

USE OF A 60CM PILOT PLANT FOR SCALE-UP
OF SEMI-AUTOGENOUS GRINDING MILLS

By

DECLAN BRENDAN CORRIGAN

B.Eng., University College Dublin, Ireland, 1978

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF APPLIED SCIENCE

in

THE FACULTY OF GRADUATE STUDIES
DEPARTMENT OF MINING AND MINERAL PROCESS ENGINEERING

We accept this thesis as conforming
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April 1989

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Department of Mining and Mineral process Engineering

The University of British Columbia
Vancouver, Canada

Date April 21, 1989

ABSTRACT

Design Data for sizing full scale Autogenous or Semi-Autogenous mills is typically obtained from pilot plant tests in 1.5 to 2.0m diameter mills. These tests are expensive and time consuming. Attempts have been made to devise small-scale tests which would be faster, cost less, and require smaller samples. Some success has been achieved using a 45 cm diameter mill.

A 60 cm wet continuous SAG circuit located in the Mining and Mineral Process Engineering Department of UBC, is being used to examine the correlation between full-scale and small-scale performance. To date testwork has been conducted on samples from four operating copper mines in B.C., and one gold property in Alaska.

Equipment and test procedures are described. Data obtained to date are presented and analysed. It is concluded that the circuit can be of use in testing ores to determine SAG mill design parameters. However, additional data is required and experimentation with different circuit configurations should be attempted. The addition of a secondary ball mill to the circuit would be of benefit.

TABLE OF CONTENTS

	PAGE
ABSTRACT	ii
LIST OF TABLES	vi
LIST OF FIGURES.	vii
ACKNOWLEDGEMENT.	ix
INTRODUCTION	1
CHAPTER 1: BACKGROUND	4
1.1. Autogenous Grinding.	4
1.2. Semi-Autogenous Grinding.	5
1.3. Comparison with Conventional Systems	6
1.4. Selection Criteria.	10
1.5. Pilot Plant Testing.	11
1.5.1. Lakefield Research	13
1.5.2. MINTEK	16
1.5.3. CIMM.	18
1.5.4. University of Trondheim	22
1.5.5. Kobe Steel	23
1.5.6. Hanna Research Centre	26
1.5.7. IRSID	28
1.5.8. Kennecott Research Centre	30
1.5.9. Others	36
1.6. Small Scale Circuits.	36
1.6.1. 45cm Test Circuit	38
CHAPTER 2: 60cm PILOT PLANT AT UBC.	41
2.1. Introduction.	41
2.2. Description of Test Circuit.	43
2.2.1. Equipment.	43
2.2.2. Instrumentation and Control Elements	47
2.2.3. Circuit Control.	47
2.3. Test Procedures	48
2.3.1. Calibration of Sensors.	49
2.3.2. Feed Preparation.	49

2.3.3. Running a Test.	50
2.3.4. Sampling Circuit at Steady State..	53
2.3.5. Processing of Samples.	55
2.4. Acquisition of Full-Scale Data.	55
2.4.1. Lornex	56
2.4.2. Afton Mines.	58
2.4.3. Island Copper Mines.	60
2.4.4. Similkameen Mines.	61
2.4.5. Highland Valley Copper.	63
2.4.6. Echo Bay Mines.	64
CHAPTER 3: ANALYSIS OF DATA.	66
3.1. Data Adjustment	66
3.2. Lornex Data	72
3.2.1. Full Scale Data.	72
3.2.2. 60cm Circuit Data	75
3.2.3. Comparison of Results	77
3.2.3.1. Net Specific Power	78
3.2.3.2. Autogenous Work Indices	82
3.3. Afton	90
3.4. Island Copper Mines	91
3.5. Similco	92
3.6. Highland Valley Copper	94
3.7. Echo Bay Mines, Juneau Project	95
3.8. Discussion of Results	98
3.8.1. Energy-Size Reduction Relationship	101
CHAPTER 4. SUMMARY AND CONCLUSIONS	107
4.1. Lornex Data	107
4.2. Other Data	108
4.3. Scale-up from Results	108
4.4. Future Work	109
4.5. Conclusions	110
BIBLIOGRAPHY.	111
APPENDIX I: CALCULATION OF MILL LOAD SETPOINT FOR	
60cm MILL.	114

APPENDIX II:	LORNEX C-CIRCUIT: ADJUSTED FULL SCALE DATA	119
APPENDIX III:	LORNEX C-CIRCUIT: FULL SCALE SIZE DISTRIBUTION PLOTS.	210
APPENDIX IV:	LORNEX C-CIRCUIT: ADJUSTED 60cm DATA	240
APPENDIX V:	LORNEX C-CIRCUIT: 60cm SIZE DISTRIBUTION PLOTS	331
APPENDIX VI:	AFTON MINES: ADJUSTED FULL SCALE AND 60cm DATA; SIZE DIST. PLOTS .	362
APPENDIX VII:	ISLAND COPPER MINES: ADJUSTED FULL SCALE & 60cm DATA; SIZE DIST. PLOTS .	392
APPENDIX VIII:	SIMILCO MINES: ADJUSTED FULL SCALE & 60cm DATA; SIZE DIST. PLOTS	430
APPENDIX IX:	HIGHLAND VALLEY COPPER: ADJUSTED FULL SCALE & 60cm DATA; SIZE DIST. PLOTS .	447
APPENDIX X:	ECHO BAY JUNEAU : ADJUSTED 60cm DATA; SIZE DISTRIBUTION PLOTS	466
APPENDIX XI:	PROPOSED MODEL OF MILL WEIGHT CONTROLLER.	483

LIST OF TABLES

	PAGE
TABLE I. Comparison of Comminution Methods (Digre 1983)	8
TABLE IIa. Pilot Plant Details: Lakefield Research and Mintek	32
TABLE IIb. Pilot Plant Details: CIMM and University of Trondheim	33
TABLE IIc. Pilot Plant Details: Kobe Steel and Hanna Research.	34
TABLE IIId. Pilot Plant Details: IRSID and Kennecott.	35
TABLE III. Location, Method and Frequency of Sampling for 60 cm Circuit at Steady State	54
Table IV. Results of Data Adjustment using Simplex Program.	70
Table V. Results of Data Adjustment using Bilmat Program.	71
Table VI. Lornex C-Circuit: Full-Scale Data	74
Table VII. Lornex C-Circuit: 60cm Circuit Data	76
Table VIII. Lornex C-Circuit: Full Scale Data using K_{80} values.	86
Table IX. Lornex C-Circuit: 60cm Circuit Data using K_{80} values.	87
Table X. Full Scale Data: Various Ore Types.	99
Table XI 60cm Data: Various Ore Types.	100

LIST OF FIGURES

	PAGE
FIGURE 1.a. Golden Sunlight Mines Flowsheet.	7
FIGURE 1.b. Kidston Gold Mines Flowsheet.	7a
FIGURE 2. Schematic of Lakefield Research Test Circuit. .	14
FIGURE 3. Schematic of Mintek Test Circuit.	17
FIGURE 4. Schematic of CIMM Test Circuit..	20
FIGURE 6. Schematic of Hanna Research Test Circuit.	27
FIGURE 7. Schematic of Hazen Research Test Circuit.	38
FIGURE 8. Aerofall 45cm Test Mill.	39
FIGURE 9. UBC 60cm SAG Mill Circuit	44
FIGURE 10 60cm Mill Arrangement.	45
FIGURE 11 Schematic of Lornex C-Circuit.	57
FIGURE 12 Schematic of Afton Mines Grinding Circuit.	59
FIGURE 13 Schematic of Island Copper Mines Grinding Circuit.	61
FIGURE 14 Schematic of Similco Mines Grinding Circuit. .	62
FIGURE 15 Schematic of Highland Valley Copper, A-Line Grinding Circuit.	64

FIGURE 16	Comparison of Net Specific Power Values for Full Scale and Small Scale Lornex Runs.	77
FIGURE 17	Comparison of Autogenous Work Indices for Full Scale and Small Scale Lornex Runs using P_{80} Values.	78
FIGURE 18.	Net Specific Power (60cm) vs. Net Specific Power (Full Scale):Lornex Data	81
FIGURE 19.	Power Number vs.Volumetric Loading at 74% Critical Speed: Lornex Data.	82
FIGURE 20.	Comparison of Autogenous Work Indices for 60cm & Full Scale Ccts.:Lornex Data.	83
FIGURE 21.	Revised Work Indices vs.Run Number for Lornex Data.	85
FIGURE 22.	Comparison of Revised Work Indices.	85
FIGURE 23.	Comparison of Autogenous Work Indices with Bond Work Indices.	88
FIGURE 24.	Comparison of Autogenous Work Indices	98
FIGURE 25.	Energy-Size Reduction Relationship: Various Ores.	101
FIGURE 26.	Energy-Size Reduction Relationship in 60cm Mill: Various Ores.	102
FIGURE 27.	Energy-Size Reduction Relationship: Island Copper.	103
FIGURE 28.	Energy-Size Reduction Relationship: 60cm Island Copper Runs.	104

ACKNOWLEDGEMENT

The author wishes to acknowledge Moly-Cop Canada Ltd., The Natural Sciences and Engineering Research Council, B.C. Science Council, and the Cy and Emerald Keyes scholarship fund for financial support during this project.

Thanks are extended to the various Mining Companies who made their resources available, including:

- Highland Valley Copper Mines
- Similco Mines
- Afton Mines Ltd.
- Island Copper Mines (BHP-Utah)
- Echo Bay Mines Ltd

Sincere gratitude is extended to Professor A.L. Mular, UBC Department of Mining and Mineral Process Engineering, for his help and support during the project. Also to my colleagues, Messrs Andy Burkert, Washington Musara and Kurt Lund, I extend my thanks.

Finally, I wish to express my thanks to my greatest mentor, my wife Margaret, for her steadfast support and encouragement over the past two years.

INTRODUCTION

The application of autogenous and semi-autogenous grinding (AG/SAG), has developed rapidly in the past 25 years to the point where most new or expanding ore processing facilities consider this option for the comminution circuit. Lower capital and operating costs over conventional methods, a simpler flowsheet, and the ability to process a wide range of ore-types, are the main advantages to this type of comminution. Earlier problems with operation and control of these circuits have been substantially resolved, and a much greater level of confidence exists in the equipment. However, caution is required in selecting AG or SAG circuits, because of their greater sensitivity to ore characteristics. For non-homogenous orebodies, (as most are), wide swings in throughput and power consumption can occur, with the risk of exceeding the limitations of downstream equipment or installed motor power.

While conventional circuits can be designed confidently based on bench scale tests, (such as Bond work index determination for crushing, rod milling and ball milling), no such tests are as yet available for SAG circuits. Pilot-scale testing has invariably been required, and even then some notable

discrepancies have arisen between pilot plant predictions and full scale performance.

Existing pilot plant tests generally involve the use of a mill 1.5m - 2m in diameter, with lengths varying anywhere from 0.6m up to 5m. Running tests in these mills is expensive for a number of reasons. Firstly, a large quantity of ore is required, usually in the range of 10 to 50 tonnes of each ore type. In the case of a new orebody, this must be obtained from development drifts or adits if it is to be representative of a mined product. In addition, the samples might have to be shipped a considerable distance, with attendant costs. Secondly, it takes a long time to bring such a mill to steady state conditions, so the manpower requirements are considerable. Skilled personnel are required to conduct the tests and interpret the results.

The costs involved for such test work can be substantial and in many cases can be prohibitive. In the past, only large-scale projects with multiple grinding lines could justify the expenditure. With power costs being such a major factor in these plants, any increase in grinding efficiency arising out of pilot plant testing could pay off very quickly.

In the case of smaller projects with a single grinding line, the payback on pilot testing would be much longer, and the availability of funds at the beginning of the project, often

limited. An owner faced with such costs may be more inclined to opt for the conventional route, which requires only small samples (e.g. drill core) to determine work indices, on which the design of a conventional crushing/grinding circuit can safely be based. Time is also a consideration. With project schedules becoming more compressed nowadays, time is not available for prolonged testwork.

For these reasons, attempts have been made to develop small scale test procedures (for SAG circuits), which would require less material, shorten the duration of each test, and accordingly enable a greater variety of ore types to be tested at an early stage of the project. In this regard, some success has been achieved by MacPherson (1977, 1989) using a 450mm diameter dry Aerofall mill. This suggests that it may be possible to obtain reliable scale-up data using relatively small test samples (of the order of 50 Kg for each test)

The purpose of this thesis is to examine and compare the results obtained from a small-scale 60cm diameter SAG mill circuit located at the University of British Columbia, with those obtained in a number of full scale operating copper mines in British Columbia. The equipment and test procedures are described together with a detailed analysis of test results. Existing test methods are reviewed and compared with the UBC circuit.

CHAPTER I

BACKGROUND

1.1. Autogenous Grinding

The term autogenous grinding describes the process in which ore is ground in a tumbling mill without addition of any external grinding media. The ore particles are reduced in size by a combination of abrasion, impact and attrition. The larger ore particles are worn down gradually by abrasion. These in turn act as grinding media for the smaller particles resulting in impact and attrition action, similar to that occurring in ball mills. Primary autogenous grinding refers to the situation in which run-of mine or coarse-crushed ore is fed to the mill directly. The product from the mill may be of a size suitable for recovery of the valuable component, in which case it is termed single-stage AG, or it may require further grinding to a final product size in ball or pebble mills (two-stage AG.).

Use of primary autogenous grinding began in the 1930's, but really it was not until the late 1950's and early 1960's that the mining industry as a whole began to consider this option seriously when planning new or expanded facilities. In North America, although there have been some notable successes with primary AG, the trend has been towards semi-autogenous

grinding.

Successful application of autogenous grinding depends greatly on the nature of the ore. There must be sufficient competent material present which will act as the grinding media for the smaller fractions. This component must not wear down too quickly, or the mill will be media-deficient. On the other hand, if this component is too hard, an excess of slimes will be produced and the potential for build up of a hard fraction ("critical size") exists.

Variations in composition, structure and size distribution of the feed to autogenous mills can lead to wide swings in throughput, power consumption, and in product size distribution. In general, this is undesirable in that the downstream process may be disrupted and equipment limitations may be exceeded.

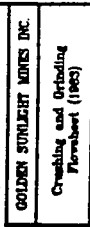
1.2 Semi-Autogenous Grinding

Where problems of the above nature arose, it was found that the addition of a steel ball charge of up to 12% by volume, gave much improved performance, hence the development of semi autogenous grinding, (SAG). Generally a coarser grind is obtained with SAG, but at a much lower power consumption, and higher throughput. Typically, a secondary ball or pebble mill is used to obtain the required finished grind.

1.3 Comparison With Conventional Systems

Whether by AG or SAG, if the ore is amenable to this type of comminution, considerable savings can be realized as compared with the conventional 2- or 3- stage crushing plant followed by Rod and Ball milling. To illustrate the difference between a plant using Autogenous or Semi Autogenous Grinding, versus one using conventional Fine Crushing followed by Rod/Ball milling, two flowsheets are presented in Figures 1a and 1b. Both are for Placer Dome Gold Milling operations. The first one is for the Golden Sunlight Project located near Butte, Montana, which was commissioned in 1983, and uses a conventional crushing/grinding circuit. The second is for the Kidston Project, Queensland, Australia, which uses a two-stage SAG circuit, and was commissioned in 1985. These examples are presented for a number of reasons. Firstly, the author was involved in the design of both operations; secondly, comparative capital and operating cost data have been published, and thirdly, and most interestingly in relation to the content of this thesis, the test work and sizing for the SAG mill used at Kidston, was done using a 450mm diameter pilot mill (see section 1.6.).

A comparison of the two flowsheets shows that the SAG mill in the Kidston plant replaces the Secondary and Tertiary Crushing and the Rod Milling Sections of the Conventional Golden Sunlight plant.



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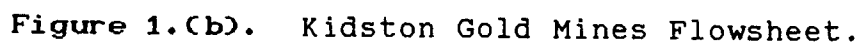


Table I. Comparison of Comminution Methods (Digre, 1988).
Ratings are from 1 to 5 in order of merit.

COMPARISON OF COMMINATION METHODS

Comminution Method	AG POSITIVE FACTORS				AG NEGATIVE FACTORS		
	Capital Cost	Steel Media Consumption	Other Materials	Labour	Demands on Mine	Operating Reliability	Energy Consumption
One Stage Straight Autogenous Grinding (AG)	2 to 3	-	1 to 2	1 to 2	5 to 3	5 to 3	5 to 1
Two-stage AG and Pebble Grinding	2 to 4	-	1 to 2	2 to 3	4 to 2	4 to 2	4 to 1
Two-stage lump and Pebble Grinding	3 to 5	-	2 to 3	2 to 4	3 to 1	2 to 1	3 to 1
One-stage AG with crushing critical-size	3 to 5	-	2 to 3	2 to 4	4 to 2	4 to 2	3 to 2
One-stage AG with separation critical size	3 to 5	-	2 to 3	2 to 4	4 to 2	4 to 2	3 to 2
One-stage Semi-Autogenous Grinding (SAG)	1 to 3	2 to 3	2 to 3	1 to 2	4 to 2	4 to 2	3 to 1
Two-stage SAG and Ball Mill Grinding	2 to 3	3 to 4	4	2 to 4	3 to 2	3 to 2	2 to 1
Conventional Multi-stage Comminution Circuit	5	5	5	5	1	1	1

Savings over the conventional circuit, arise from a number of factors, including:

- simpler flowsheet consisting of only two or three comminution stages;
- lower capital cost of equipment due to elimination of secondary and tertiary crushing, screening and associated conveying, buildings, dust collection, and services;
- reduced power consumption in many cases;
- reduced media consumption (crusher wear parts, rods, balls, liner plates);
- lower operating costs due to reduced maintenance requirements, operating personnel, and consumables.

Table I (Digre, 1988) is an attempt to summarize the relative costs for various autogenous and semi autogenous circuits versus conventional circuits. While this serves to illustrate the trends, each specific case is different and has to be evaluated on its own, taking into account the grinding characteristics of the ore and the relevant economic conditions prevailing, e.g. cost of power, steel and labour.

Comparison data for the Kidston and Golden Sunlight comminution circuits has been provided by Knight et al (1987). They conclude that a two stage SAG circuit can produce operating cost savings of up to 20% and capital cost savings of up to 40% over conventional circuits.

1.4 SELECTION CRITERIA

At the feasibility stage of a project, various processing options are normally evaluated based on testwork, historical data, and the experience of the designers involved.

In the case of a comminution circuit, the starting point is always the characteristics of the ore itself. The mineral process engineer should consult with the mining geologist prior to any sampling to determine what ore types are present, mineralogy and liberation requirements, presence of any fracturing (which may be critical to the operation of an AG Circuit), ore hardness, and any additional information deemed relevant.

Drill core samples can be used for determination of Bond Work Indices for crushing, rod milling and ball milling. Regardless of which comminution scheme is being considered, these tests should be conducted as they will give a better understanding of the breakage characteristics of the ore throughout its size range, will provide information to enable the designer to do comparative economic studies, and in the event a conventional crushing/grinding flowsheet is chosen, the information required for design purposes will be available.

Determination of power required for SAG milling can be estimated at this stage using empirical relationships

developed by Barratt (1979). However, a contingency of 25% is included and there is a high risk involved in using this method. Nonetheless, this preliminary sizing will provide a basis for comparison with the conventional circuit.

When considering Autogenous or Semi-Autogenous grinding, the presence of suitable material to act as grinding media in the ore is of utmost importance. Accordingly, some manufacturers consider this to be the starting point in the evaluation of AG or SAG. Allis Chalmers have developed what they call a "Media Competency Test" which is performed on -8"/+4" samples representing each ore type. The test is a batch test in which the products are examined, and compared to historical data to determine whether or not the ore will be suitable for AG or SAG.

1.5. PILOT-PLANT TESTS

Because the grinding action in an autogenous or semi-autogenous mill is different to that occurring in a ball mill or rod mill, standard Bond Work Indices cannot be used to determine the power consumption in the mill. To obtain this information, pilot plant tests are generally conducted. Pilot plants can also be used to assess the effects of changing such variables as feed rate, water to solids ratio, mill speed, % filling, ball charge (both % and size distribution), open or closed circuit, classifier type and classification size. Factors such as lifter height/spacing, grate opening size and

geometry, grate open area and lifter profile are not studied.

If Pilot Plant testing indicates that the ore is amenable to Autogenous or Semi-Autogenous grinding, then the most important information required from the tests is:

- Net Specific Power, (KWhr/tonne), and the variations expected from the various ore types;
- an "Autogenous Work Index" for typical mill feed to be used for design purposes;
- product size distribution;
- optimum ball charge to be used;

Once important information is available, the size of mill and the motor rating can be calculated for the throughput required. Mill manufacturers generally have their own method of sizing a mill, given the test data and design conditions. However, there appears to be some debate as to what the correct exponent to be applied to mill diameter should be. Values ranging from 2.3 to 2.84 have been used (Pena and Hopple, 1979).

Before describing the equipment and procedures used for this thesis, it seems appropriate to look at some existing testing facilities and the procedures used. The operators of these facilities have been identified by Dor and Bassarear (1982) and Barratt (1985), and include mill manufacturers, operating companies and research laboratories. The information which follows is taken from published data and represents current

practices in the field of pilot plant testing for autogenous or semi-autogenous grinding. Each plant is reviewed particularly with respect to mill dimensions, drive arrangement, feed preparation, sampling, power measurement and associated circuit equipment.

1.5.1. LAKEFIELD RESEARCH, Ontario, Canada.

Much of the testwork for AG/SAG in Canada is done at Lakefield. The facilities have been described by Wyslouzil (1982). The mill used is a Hardinge Cascade, 1.8m diameter by 0.6m long. This type of mill has proven to be very popular for pilot plant testing as can be seen from Table II. Many of the test procedures used by others have been adopted from Koppers/Hardinge (now MPSI). These have been described by Peña and Hopple (1979).

For details on the mill and associated equipment, see Table. IIa. Figure 2 is a schematic of the circuit.

(a) Feed Preparation.

Material as received is split into three fractions: +150 mm, -150/+75mm, and -75mm. Pieces larger than 250mm are broken by sledgehammer. The three fractions are recombined so as to correspond to a primary crusher discharge.

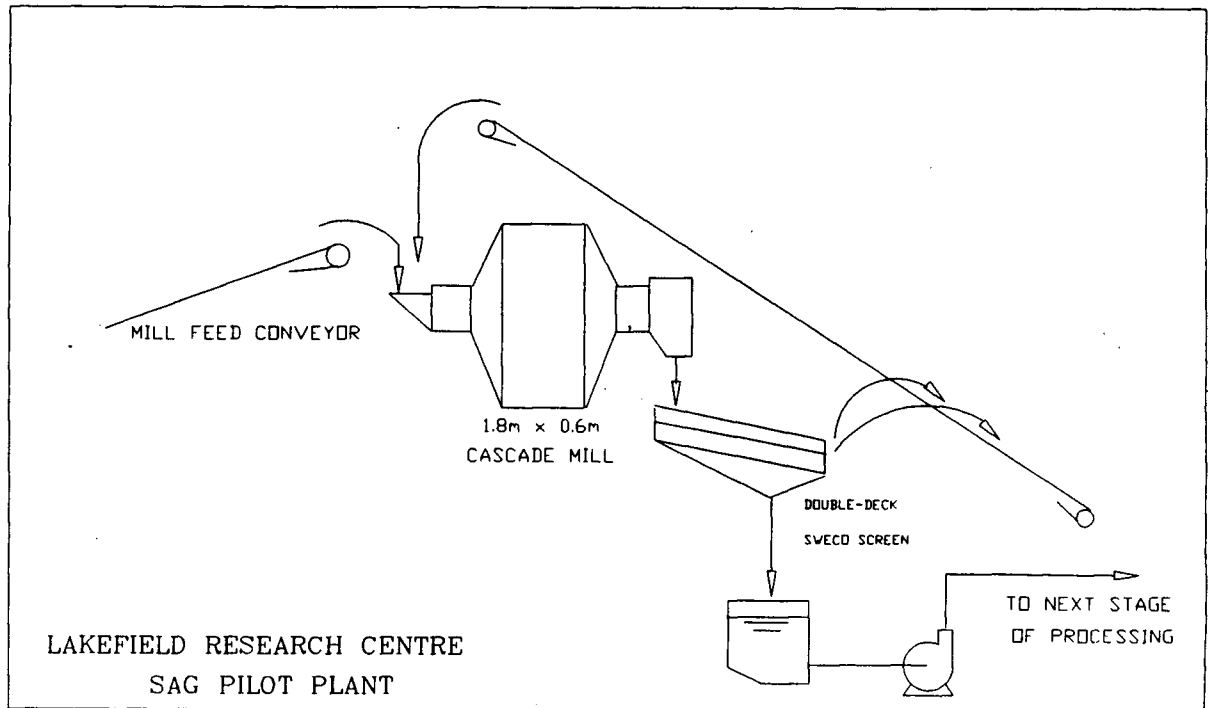


Figure 2. Lakefield Research SAG Test Circuit.

(b) Circuit Sampling

Pulp samples (mill discharge, screen oversize and screen underflow), are taken every 15 minutes, and composited during a test run. These are later analysed for percent solids and size distribution. Mill charge is dumped and analysed after a run or series of runs.

(c) Measured Variables.

1. Fresh Feed:

Batches of material are fed to the mill at intervals of 3 to 15 minutes and an average feed rate calculated over the duration of the sampling period, (1 to 2 hours).

ii. Water Addition:

A Brooks Rotameter measures water flow to the mill. During the fill-up phase the flow rate is set proportional to the fresh feed. When the mill has reached its operating load, the water addition is controlled by the pulp density of the mill discharge.

iii. Mill Load:

Load cells are used to monitor the load in the mill and the feed rate is adjusted by the operator to maintain a volume filling in the range of 25%. Visual inspection of the charge periodically during a run is used as a check, (The mill feed chute can be pulled back giving visual access to the charge).

iv. Power Draw:

A wattmeter measures the electrical power input to the motor. Gross power is the power delivered to the mill chain drive and is calculated based on the efficiencies of the motor, gearbox, and v-belt drive. The No-Load power is calculated in the same manner with the mill operating empty. Net Power Consumption is equal to Gross Power minus No Load Power.

1.5.2. MINTEK, Randburg, South Africa

The South African gold mining industry was one of the first to

adopt autogenous or run-of-mine grinding as it is known there, although they employ mills with diameter/length ratios of less than one (Pebble Mills). The test facilities of Mintek (formerly the National Institute for Metallurgy) have been described by Loveday (1978), Loveday and Moys (1979), and Hoyer (1985). Table IIa gives details of the equipment used, while Figure 3 shows the circuit configuration.

(a) Feed Preparation

The feed is classified into 8 size fractions which are then recombined as mill feed of consistent size distribution. Oversize pieces (larger than 200mm) are fed to the mill by pulling back the feed chute.

(b) Circuit Sampling

Mill Discharge, Screen Oversize, Cyclone Overflow and Underflow are all sampled and flowrates measured. Samples are analysed for % solids and size distribution.

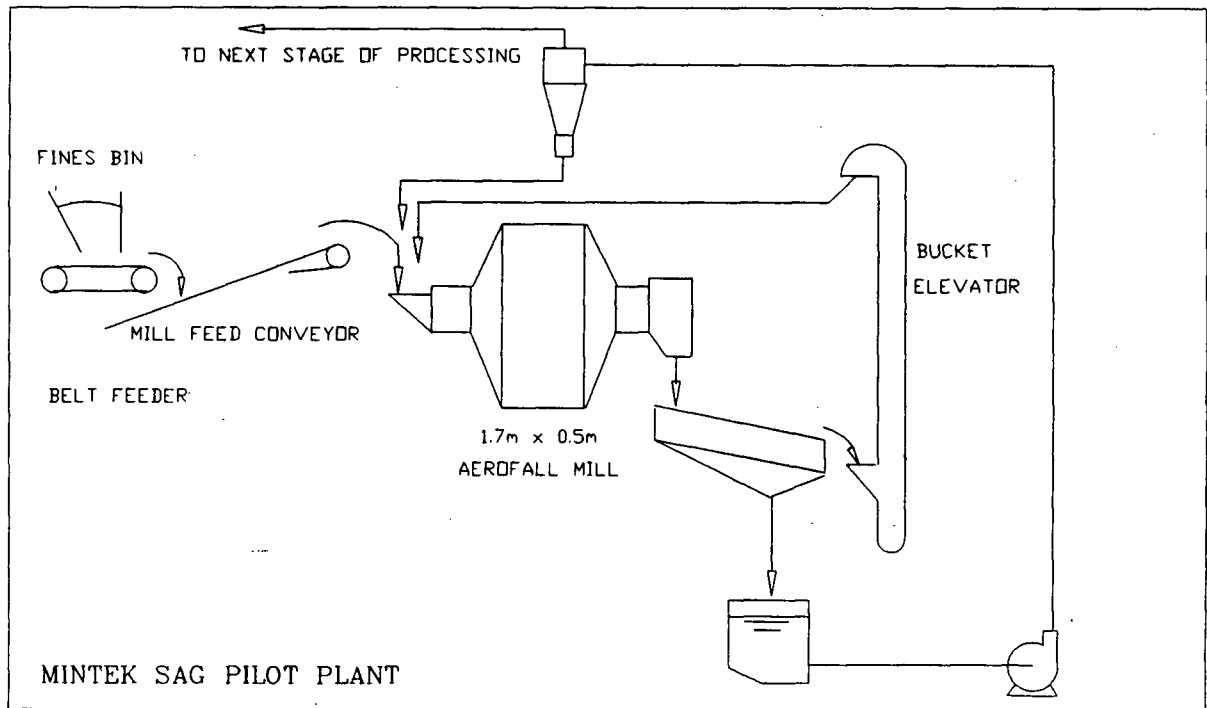


Figure 3. Mintek SAG Test Circuit.

(c) Measured Variables.

i. Fresh Feed:

The fines are metered onto a feed belt, while the coarse fractions are added manually at timed intervals to make up the required size distribution. A chart recorder is used to log the addition of each fraction. The feed rate is averaged over the duration of sampling.

ii. Water addition:

A rotameter is used for measuring water addition to the mill.

iii. Mill Load:

A visual check is used to maintain constant % filling in the mill.

iv. Power Draw:

A wattmeter is used to measure the power input to the motor. The power dissipated in the motor and mill bearings has been calibrated as a function of the gross power draw. The net power is then the difference between the gross power and the power losses.

1.5.3. CIMM, Santiago, Chile

The first semi-autogenous grinding mill in Chile was installed by Compañía Minera Disputada (CMD), at their Los Bronces mine in 1981. That same year the Chilean Mining and Metallurgical Research Centre (CIMM) decided to establish a pilot plant facility which would provide testing services to interested parties on a commercial basis. Fundamental research into the mechanism of autogenous grinding was also envisaged.

This facility has been in operation since 1983. Sepulveda et al (1983) have described the circuit and procedures used, while Urizar (1983) has described the testwork conducted by CIMM to size a 34ft diameter SAG mill at CMD's El Soldado operation. This was commissioned in 1987.

For details on the mill and associated equipment see Table I Ib. Figure 4 is a schematic of the circuit which is similar to that used by a number of other test facilities.

(a) Feed Preparation

The ore is classified on a 600mm x 1800mm Ty-Rock double deck screen to separate it into three fractions, typically +150mm, -150mm/+75mm, and -75mm. These fractions are recombined in small batches and hand-fed to the mill. This ensures a consistent size distribution to the mill and minimizes segregation. The natural size distribution of the material is maintained as closely as possible.

(b) Circuit Sampling

After the circuit has reached steady state (circa 12 hours), all process streams are sampled every 30 mins to give composite samples over a 12 hour period. The complete flows are cut for a period of 10 to 30 seconds depending on the stream. Flowrates are calculated based on the volume of the timed samples.

(c) Measured Variables

i. Feed Rate

The fresh feed is hand-fed to the mill in preweighed

i. Feed Rate

The fresh feed is hand-fed to the mill in preweighed batches on a timed basis, and an average feedrate calculated.

ii. Mill Load

The volumetric loading of the mill is checked every one or two hours by stopping the mill and measuring from the top of the charge to the centre line of the mill. The volume of the charge is obtained at the end of the test by discharging the mill contents into a graduated container.

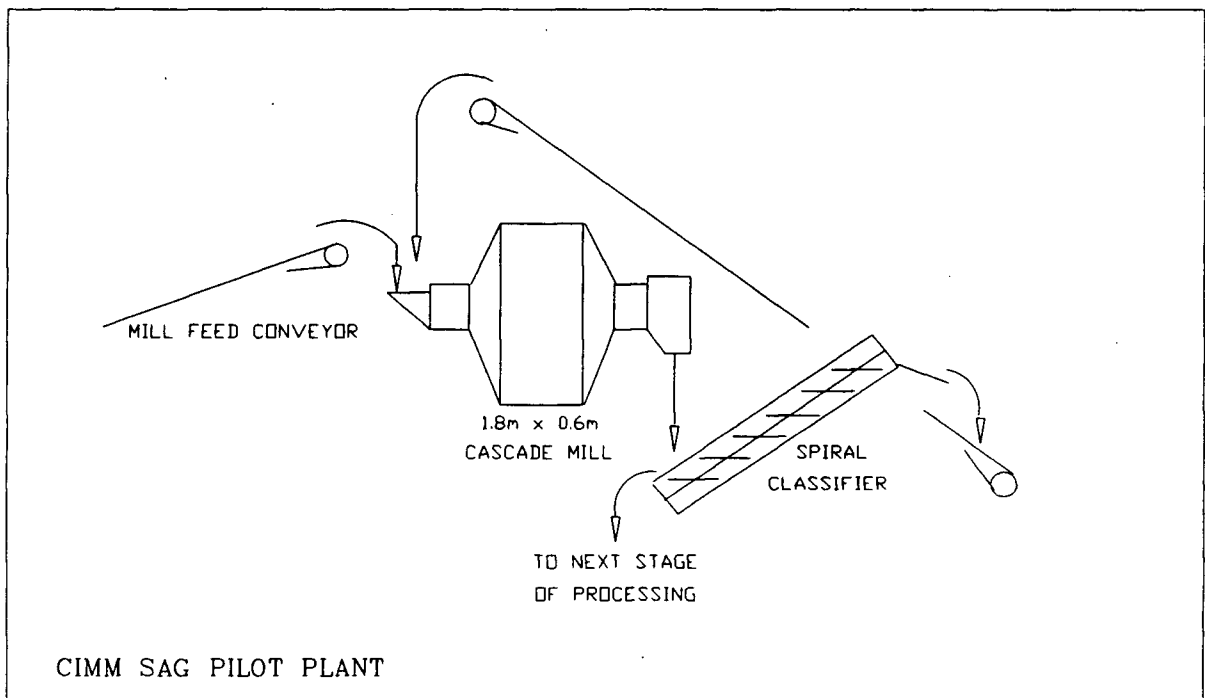


Figure 4. CIMM SAG Test Circuit.

iii. Power Draw

Gross power input to the motor is measured by Wattmeter. A prony brake (Dynamometer) on the gear reducer output shaft is used to determine drive losses. No load power is determined regularly on a mill which has warmed up. To simulate the load on the bearings when the mill is operating with charge, weights are bolted to the shell for the no-load power measurement. The difference in bearing friction losses between an empty and a loaded mill depends on the type of bearing lubrication used. It has been found to range from 30% to 60%.

(d) Data Analysis and Scale-Up

Redundant data are collected during a test. Measured values are adjusted by a least-squares mass balancing routine, the degree of adjustment depending on the estimated error of the measured values.

Two approaches have been used to scale-up from test data. The first is the "classical approach", which assumes that the net specific power (KWhr/tonne) of the full-scale mill will be the same as for the pilot mill when operated under similar conditions. The required dimensions of the full-scale mill are obtained from an equation which relates mill power consumption to its dimensions and other operating variables.

The second approach which is being developed by CIMM involves the use of a phenomenological model of the grinding process based on the population balance concept. As yet, this approach has not been fully tested.

1.5.4. UNIVERSITY OF TRONDHEIM, Norway

The Scandinavian Countries, Norway, Sweden, and Finland were the first to use autogenous grinding in base-metal mining, and a considerable amount of development work has been done there, particularly by the Boliden company. As in South Africa, mill diameter/length ratios tend to be less than one, equivalent to large scale pebble mills. Digre (1979, 1988) has described developments in autogenous grinding technology (particularly from the Scandinavian viewpoint) and the use of a pilot plant at the University of Trondheim for testing and scale-up purposes. Refer to Table IIb for details on the mill and circuit.

(a) Feed Preparation

Normally, material is used as received with maximum lump size of 150mm.

(b) Circuit Sampling

All streams are sampled and analysed for % solids, size

distribution and flowrate. The mill is emptied at the end of each run and the charge analysed.

(c) Measured Variables

i. Fresh Feed

Material is fed to the mill in batches of known weight. The feed rate is averaged over time.

ii. Water Addition

Water is fed to the mill from a constant head tank, and measured by rotameter.

iii. Mill Load

The entire mill assembly is supported by four Elliott load cells and the load signal recorded continuously. This is used to control the feed rate.

iv. Power Draw

The no-load power is determined with the mill running empty. It is not adjusted for different speeds or mill loading as it has been found to be reasonably stable. gross power is measured by wattmeter. Net power is equal to gross power minus no load power.

1.5.5. KOBE STEEL, Takasago, Japan.

Kobe Steel manufacture grinding mills in Japan, under license from Allis Chalmers. A pilot plant was constructed to provide design information for the sizing of autogenous or

semi-autogenous mills. The pilot plant and test procedures have been described by Uchida and Nakajima (1983), while the design of a 28' x 15' mill at Los Bronces (Chile) based on pilot plant data is described by Tanaka and Tanaka (1983). Table IIc gives the pilot plant details, while Figure 5 is a flowsheet of the circuit.

(a) Feed Preparation

The natural size distribution of the material is used. The percentage of three size fractions, +150mm, -150/+75mm and -75mm are determined prior to testing.

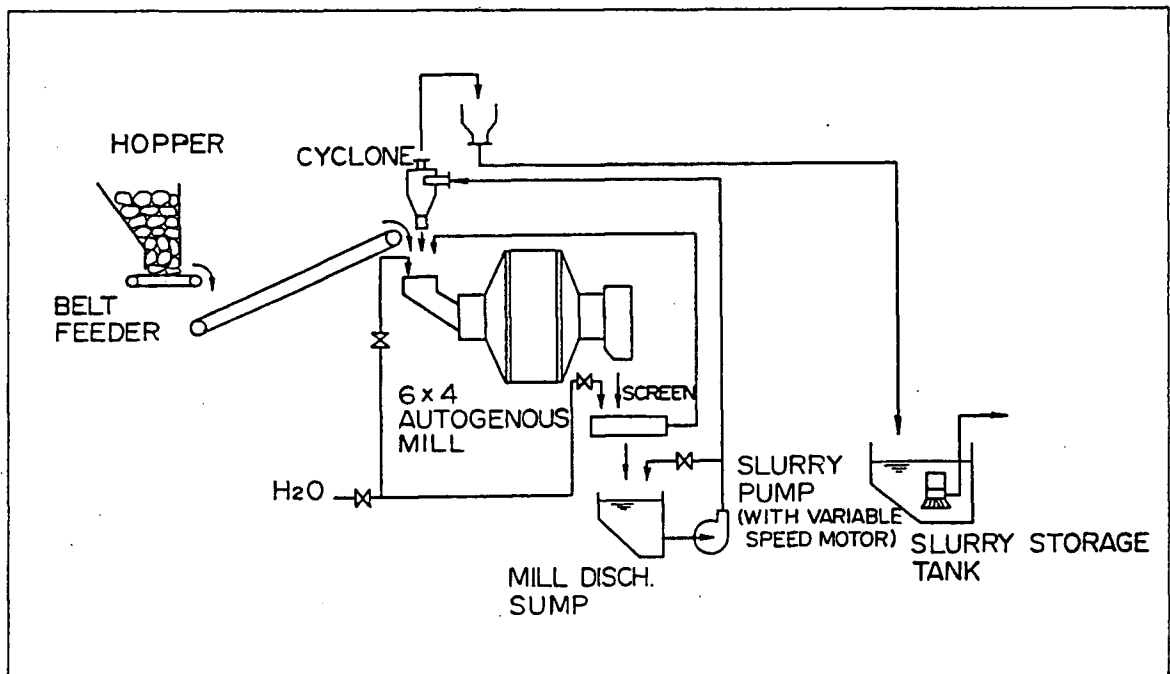


Figure 5. KOBE STEEL SAG Test Circuit.

(b) Circuit Sampling

All streams, including mill discharge, screen oversize, cyclone overflow and underflow, are sampled and analysed for % solids and size distribution.

(c) Measured Variables

i. Fresh Feed

Feed is metered to the mill by means of a vibratory feeder and belt conveyor. Feed is controlled to maintain a charge volume of between 20% and 25%.

ii. Power Draw

No-Load power is measured with the mill running empty. Net Power is the gross power minus no-load power. Gross power is measured using a wattmeter.

No details have been given on mill water addition or mill load measurements.

Tests are conducted at various product sizes by varying cyclone feed water addition. The predicted net specific power at the required product size is then obtained from a curve of net specific power vs product size.

1.5.6. HANNA RESEARCH CENTRE, Minnesota, USA.

The test facilities at Hanna Research were mainly used in the 1970's for comparative studies on ball size usage in the Taconite plants of Minnesota. In the early 1980's, Hanna began commercial testwork for outside parties on a variety of ore types. The facilities are still operational and have been described by Wakeman and Mai (1984) and Coyle (1989). For mill details see Table IIc. Figure 6 shows the circuit configuration.

(a) Feed Preparation

Material is crushed to -200mm and classified into three size fractions; +150mm, -150mm / +75mm, and -75mm. The three fractions are combined to feed the mill in 50 Kg or 100 Kg batches. The percentage of each size fraction in each batch is maintained at a constant value.

(b) Circuit Sampling

Sampling starts after the circuit has been at steady state for at least two hours. Mill discharge, trommel oversize, screen oversize and screen underflow are sampled and analysed for % solids and size distribution.

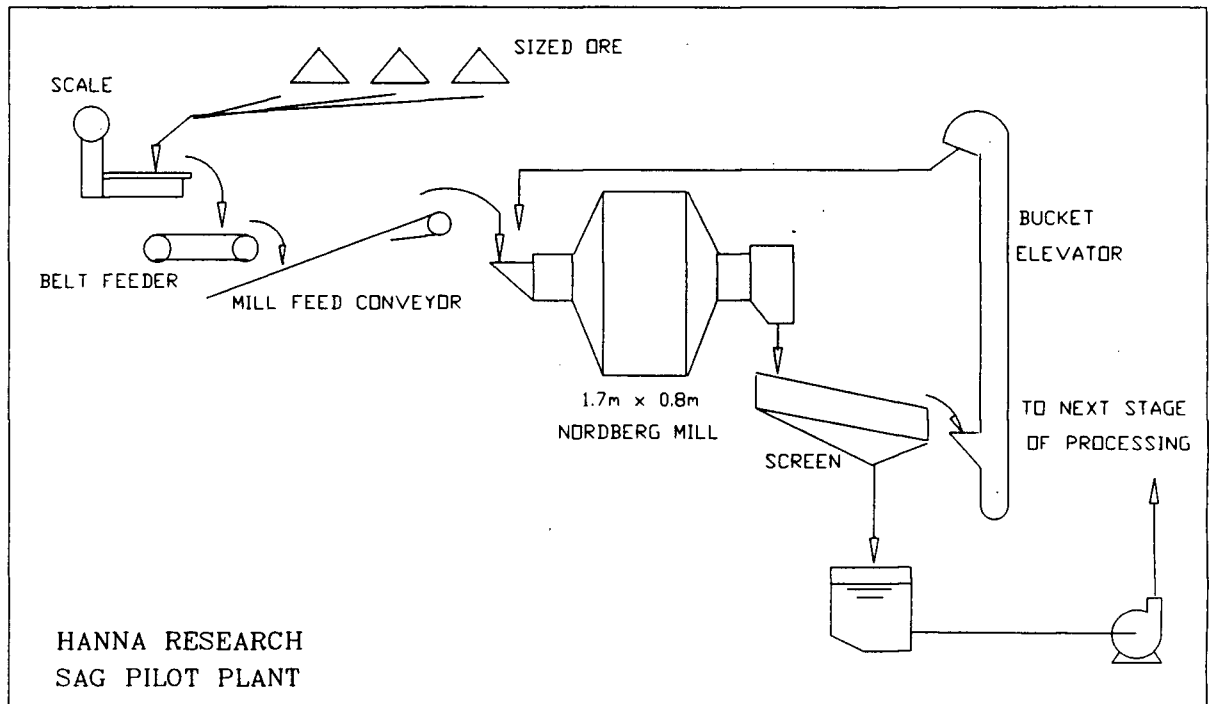


Figure 6. Hanna Research SAG Test Circuit.

(c) Measured Variables

i. Fresh Feed

Batches of known weight are fed to the mill periodically. The feed rate is averaged over time.

ii. Water Addition

A Brooks rotameter is used to measure mill water addition. A mill discharge % solids of 60-63% is maintained by manually adjusting the water addition as required.

iii. Mill Load

The entire mill and drive is supported on load cells which provide an indirect measurement of charge volume. This signal is used to control feed addition to the mill by stopping and starting the feed conveyor.

A visual check is done every hour to ensure the correct volumetric loading.

iii. Power Draw

The power drawn by the mill is measured by a wattmeter on the motor power supply and by a torquemeter installed on the pinion shaft of the drive system.

The no-load power is determined with the mill having run empty for a period of 6 to 8 hours. Net power is the Gross Power minus No-Load Power.

1.5.7. IRSID, France.

Details on this installation have been given by Javelle et al (1968). For Mill details see Table IID. The circuit arrangement is essentially the same as the CIMM circuit shown in Figure 4.

(a) Feed Preparation

The feed is split into two fractions, +60mm and -60mm. The -60mm material is fed to the mill by a constant weight feeder, while the +60mm fraction is added manually in batches to the mill feed conveyor. The % of +60mm material in the feed may be varied.

(b) Circuit Sampling

An automatic sampler is used on the screen underflow. Screen oversize and trommel oversize are sampled periodically and flowrates calculated.

(c) Measured Variables

i. Fresh Feed

The feed rate is measured by calibrating the input of the feeder for the -60mm fraction. The coarser fraction is fed in timed batches of known weight so an average feed rate can be calculated.

ii. Water Addition

Water addition to the mill is measured by rotameter, while the overall flow to the circuit is measured by a water meter.

iii. Mill Load

Checked visually.

iv. Power Draw:

Gross Power to the mill is measured by Wattmeter. No Load Power is measured with the mill operating empty. Net Power is equal to Gross Power minus No Load Power. Power Draw is recorded on a chart and used to determine when steady state has been achieved.

1.5.8 KENNECOTT RESEARCH CENTRE, UTAH, USA.

The Metal Mining Division of Kennecott Copper Corp. became involved with SAG mill pilot plant testing when the need arose for replacement and expansion of grinding facilities at the company's Ray, Chino and Utah Copper Divisions. Extensive testwork was carried out to provide design parameters for the selection of SAG circuits at Chino and Ray. The test facilities and procedures have been described by Themmelis and Last (1978), and by Jergensen and Pena (1985).

For Mill details see Table IId. The circuit is essentially the same as that used by CIMM, as shown in Figure 4.

(a) Feed Preparation

The feed material is classified into three fractions, +100mm, -100mm / +50mm, and -50mm. These fractions are combined into consistent batches which are fed to the mill by belt feeder.

(b) Circuit Sampling

When steady state operation is achieved, the feed, mill discharge, classifier sand and classifier overflow are sampled for % solids determination and size analysis.

(c) Measured Variables

i. Fresh Feed

Material is loaded in batches of known weight onto the feed conveyor. The feed rate is averaged over the duration of the sampling period.

ii. Mill Load

The fresh feed rate is adjusted to maintain a mill charge of 27% to 30% of mill volume. This is checked visually.

iii. Power Draw

The gross power is measured using an integrating kilowatt-hour meter and a recording wattmeter. Net power is the difference between gross power loaded and gross power operating empty.

Pilot Plant	LAKEFIELD RESEARCH	MINTEK
Location	Ontario, Canada	Randburg, RSA.
Mill Type	Hardinge Cascade	Aerofall
Dimensions	1.8m dia.x 0.6m	1.7m dia.x 0.5m L
Discharge Arrg't.	Grate/Trunnion	Grate/Trunnion
Drive Configuration	25hp Motor, V-Belt Drive, Reducer, Chain Drive to Mill	
Trommel Screen	Optional	Optional
Liners	Smooth	Smooth
Lifters	35-40mm Projection	
Grate Openings	6.5mm slots	12mm
Pebble Ports	50x75mm (Optional)	Optional
Classifying Device	Sweco Vib. Screen	Screen/Cyclone
Mill Bearings	Hydrodynamic	Hydrodynamic
Flowsheet Arrangements Available	Single/Two Stage AG/SAG: AG with Pebble Extraction and Crushing	Wet or Dry Autogenous or Semi-Autogenous
Average Duration of Test Run	2 to 6 Hours	3 to 8 Hours
Amount of Material required per Run	2 to 10 Tonnes	20 Tonnes for 1 series of runs

Table IIa. Pilot Plant Details: Lakefield Research & Mintek.

Pilot Plant	CIMM	UNIV. OF TRONDHEIM
Location	Santiago, Chile	Norway.
Mill Type	Hardinge Cascade	Wet or Dry
Dimensions	1.8m dia.x 0.6m	800mmdia.x1000mmL
Discharge Arrg't.	Grate/Trunnion	G/T,Rubber/Steel
Drive Configuration	30hp Motor, V-Belt Speed Reducer,Chain Drive to Mill	5 KW Motor, Belt Drive, Reducer, Chain Drive on Mill, Variable Speed 20-50 RPM.
Trommel Screen	Yes	Yes, Various Sizes
Liners	Smooth	Smooth
Lifters	No Information	70mm W x 40mm H
Grate Openings	12 mm Slots	5mm to 50mm
Pebble Ports	Optional	Yes
Classifying Device	Spiral Classifier	Screen/Cyclone
Mill Bearings	Hydrodynamic Lube	Roller Bearings
Flowsheet Arrangements Available	Single or Two Stage AG or SAG	Wet or Dry,AG/SAG Open Cct.or Closed with Screen, Cyclones and Crusher for Pebbles.
Average Duration of Test Run	24 Hours	2 to 4 hrs.
Amount of Material required per Run	5 to 40 Tonnes	1 to 2 Tonnes

Table IIb. Pilot Plant Details: CIMM and University of Trondheim

Pilot Plant	KOBE STEEL	HANNA RESEARCH
Location	Japan	Minn., USA.
Mill Type	Kobe	Nordberg
Dimensions	1.8m dia.x 0.875m L	1.7m dia x 0.8-1.7mL
Discharge Arrg't.	Grate/Trunnion	Grate/Trunnion
Drive Configuration	50HP, Speed Reducer Gear Drive, Mill Speed 25.8 RPM (78% Critical)	60 HP Motor, Speed Reducer, Chain Drive to Mill, (75% Critical)
Trommel Screen	No	Yes
Liners	No Info. Available	No Info. Available
Lifters	No Info. Available	100mm High
Grate Openings	12 mm slots	12mm & 20mm slots
Pebble Ports	No	No
Classifying Device	Screen/Cyclone	Screen
Mill Bearings	Journal	4 Roller Bearings
Flowsheet Arrangements Available	Ag or SAG, Open Circuit or Closed with Screen Cyclone	Ag or SAG. Open Cct.or Closed with Screen, Single stage or Two stage
Average Duration of Test Run	4 to 6 Hours	8 to 10 Hours
Amount of Material required per Run	5 to 10 Tonnes	10 to 50 Tonnes

Table IIc. Pilot Plant Details: Kobe Steel & Hanna Research

Pilot Plant	IRSID	KENNECOTT
Location	France	Utah, USA
Mill Type	Hardinge Cascade	Hardinge Cascade
Dimensions	1.8m dia.x 0.6m L	1.8m dia x 0.6m L
Discharge Arrg't.	Grate/Trunnion	Grate/Trunnion
Drive Configuration	30HP Motor, V-Belt Drive, Reducer, Chain Drive to Mill	Motor, V-Belt Drive, Reducer, Chain Drive to Mill. 72-76% Critical
Trommel Screen	Yes	No
Liners	Smooth	Smooth
Lifters	No Info. Available	No Info. Available
Grate Openings	10 mm Slots	N/A
Pebble Ports	N/A	No
Classifying Device	Screen	Rake Classifier
Mill Bearings	Hydrodynamic Lube	Hydrodynamic Lube
Flowsheet Arrangements Available	AG or SAG, Open Circuit or Closed With Screen	AG or SAG, Open Circuit or Closed With Screen, Single or Two Stage with 1m x 1m Ball Mill
Average Duration of Test Run	3 to 4 Hours	8 to 10 Hours
Amount of Material required per Run	2 to 5 tonnes	2 to 10 Tonnes

Table IIId. Pilot Plant Details: IRSID and Kennecott.

1.5.9. OTHERS.

A number of other test circuits are in operation around the world, but sufficient published data was not available to detail here. These include International Process Inc. (formerly the Colorado School of Mines Research Centre), MPSI (formerly Koppers/Hardinge), and Fuller Traylor.

1.6. SMALL-SCALE CIRCUITS.

The preceeding test facilities are classified as pilot plants based on the size of the equipment, duration of tests and amount of material required to do a test. While some batch tests are in use which require considerably less material, the scope of the testwork is limited, and the reliability of the results questionable. Batch tests are quite often followed by pilot plant testing.

Because of the costs involved in pilot plant testing, attempts have been made to devise "small-scale" tests. These would require less material, less time, and accordingly, enable a greater variety of ore types to be tested quickly and at reasonable cost.

The use of "small-scale" tests to predict the autogenous grinding requirements of an ore was first introduced by MacPherson (1977). He used a 45cm (18") diameter dry Aerofall

mill to grind small samples of drill core or crushed rock. The products are collected, sized, and an "Autogenous Work Index" determined. This is defined as the work required to grind ore from an infinite size to 80% passing 100 μm , i.e. similar to the Bond Work Index.

An extensive program of testwork was carried out to check the correlation between the 45cm mill and full scale results. Reasonable correlations were reported for some ores. However, as the ore became harder, the autogenous work index for the small circuit was much higher than for the full scale circuit.

Nevertheless, having collected a wide range of data for the 45cm circuit, MacPherson is able to predict with reasonable accuracy what the autogenous grinding requirements will be for an unknown ore. This service is available on a commercial basis and little information has been published on the actual techniques used. The Kidston Project in Australia uses a SAG circuit which was designed on the basis of small-scale testing using the 45cm Mill. Performance has been up to expectations and the method has been used on subsequent Placer Dome projects. However, considerable reliance is placed in the experience and judgement of the developer.

1.6.1. 45cm Test Circuit.

The Aerofall test mill used by MacPherson is now located at Hazen Research Inc., Golden, Colorado. Figure 7 shows the components of the circuit including the mill, a draught fan to supply the airflow required to remove the ground material from the mill, and a collection system to remove the ground material from the air stream.

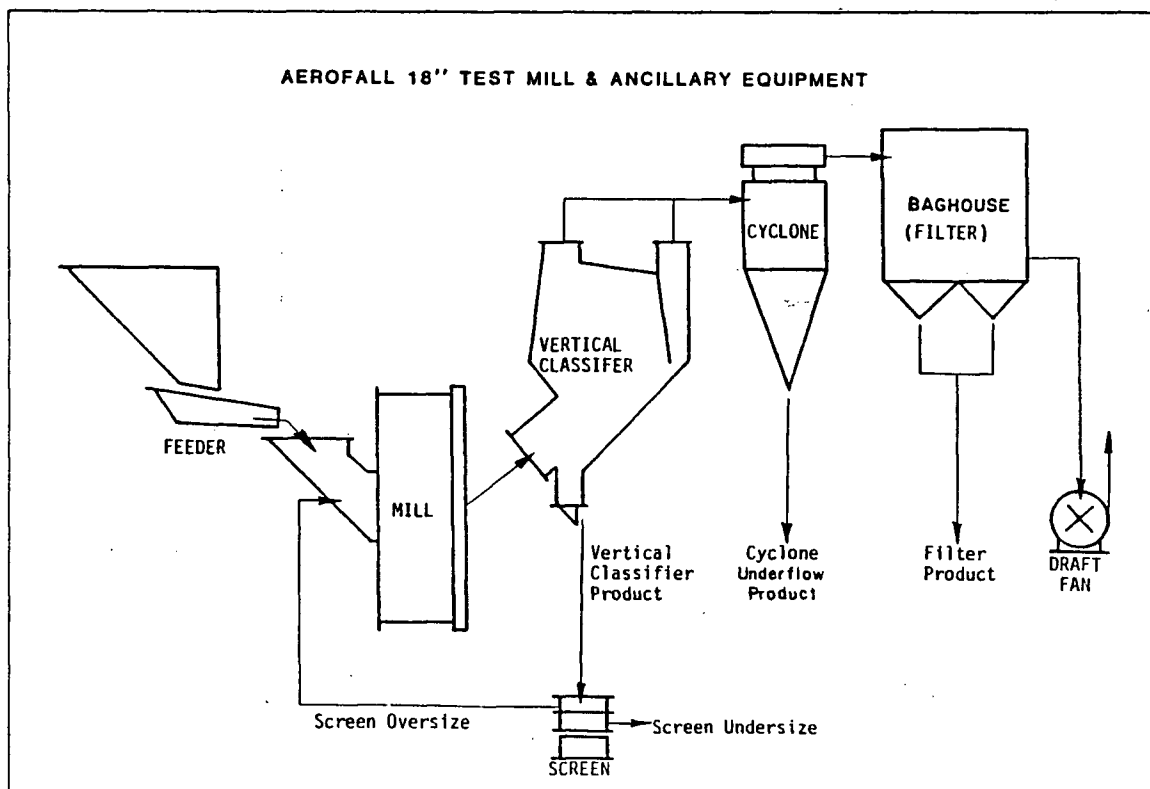


Figure 7. Hazen Research Test Circuit.

The mill itself (see Figure 8) consists of a 45cm diameter by 25cm long shell fitted with axially mounted hollow steel trunnions running on ball bearings. The mill ends have

deflector shaped steel liners, while the shell has rectangular lifters. The drive consists of a 1/2 HP motor, reducer, and v-belt drive. Speed is variable from 0% to 100%, but normal running speed is 52 RPM (87% critical).

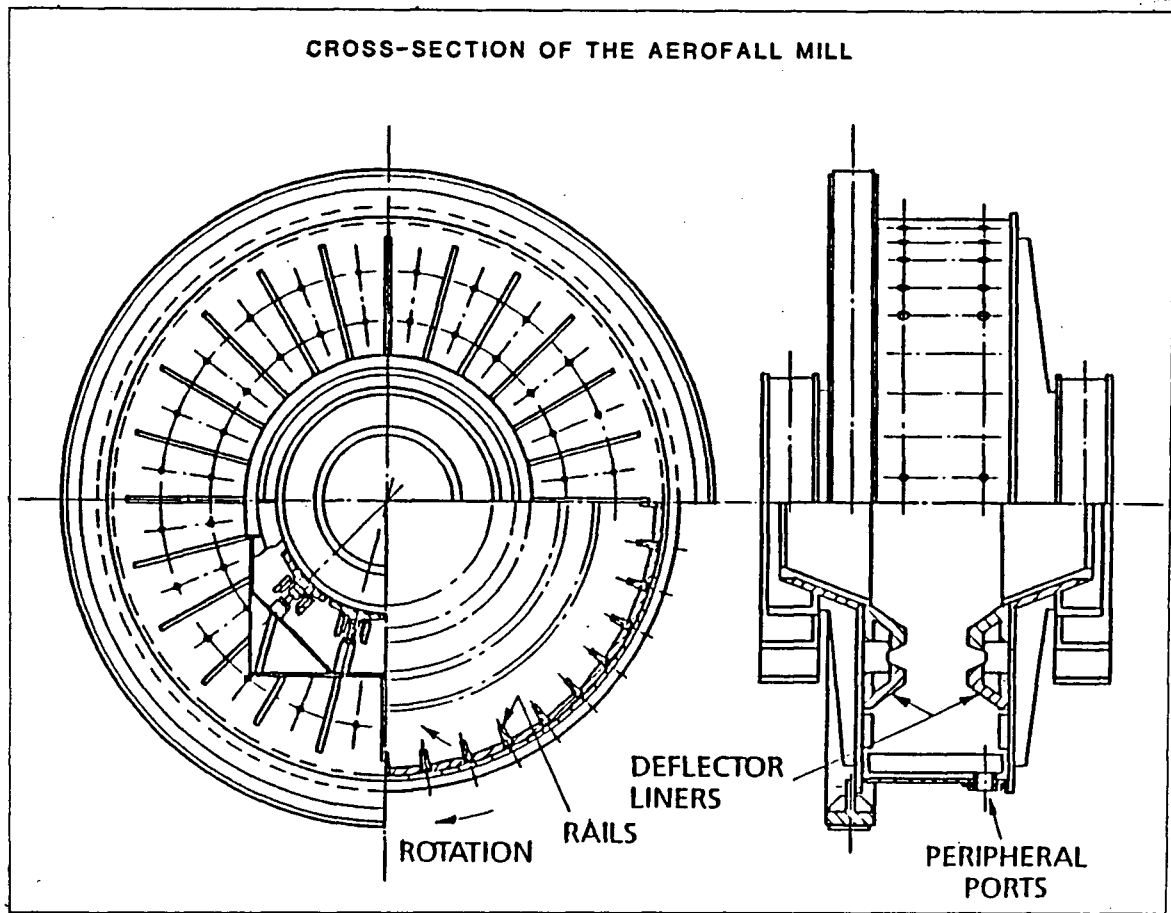


Figure 8. Aerofall 45cm SAG Test Mill.

Six peripheral discharge ports are cut into the shell below the discharge deflector liners, for the removal of a coarse product if required. Normally, the standard air-swept system is used without peripheral discharge. The product from the vertical classifier passes over a Sweco screen. Screen

opening is 1190 microns (14 mesh). This size was arrived at after considerable experimentation. Oversize is returned to the mill while undersize is collected as a product. The products from the cyclone and filter are also collected. The standard ball charge used is 40 lbs. in weight, and has a size distribution corresponding to naturally graded charge with 2.5 inch make-up balls.

Material is prepared for running in the mill by crushing in a jaw crusher with an open side set of 1 inch to produce a minus 1.25 inch feed size. The crushed material is blended and fed to the mill from a feed hopper by a Syntron feeder with an automatic feed controller. The controller regulates the feed continuously to maintain a preset mill load which is measured indirectly by means of a sound monitor.

Net power is calculated according to a formula established by Prony brake tests. Sampling of the circuit commences when steady state has been achieved. Samples are taken at timed intervals over a one to two hour period, and size distributions determined. The entire mill charge is analysed at the end of a run to check for critical size build-up.

CHAPTER 2

60cm PILOT PLANT AT UBC

2.1. Introduction

In 1982, Dominion Engineering of Montreal initiated a project in the Department of Mining and Mineral Processing at the University of British Columbia, to develop a mathematical model of a SAG mill. A pilot plant, centered around a 60cm diameter SAG mill constructed by Dominion Engineering, was assembled in the Centre for Coal and Mineral Processing Laboratory, where the circuit is housed today.

The objective of the project was to conduct small-scale tests on representative samples of ore from operating mills, under a variety of conditions. The results would be used to assess the importance of various factors such as charge volume, feed rate, ball charge, mill speed, and to develop a mathematical model representing a full scale SAG mill.

The possibility of using the circuit to evaluate the feasibility of SAG for other ores, and to scale-up to full size mills, is now being examined at UBC. At present, SAG mill selection and design is generally based on pilot plant

tests using 1.5m to 2m diameter mills. The cost of such tests can be substantial, mainly because of the quantities of material required and the duration of the tests. If the 60cm mill could provide reliable results with which to select and design full scale circuits, then considerable savings could ensue.

The subsequent sections of this thesis describe the equipment, test-procedures, and analytical methods used to establish a data base for the 60cm mill.

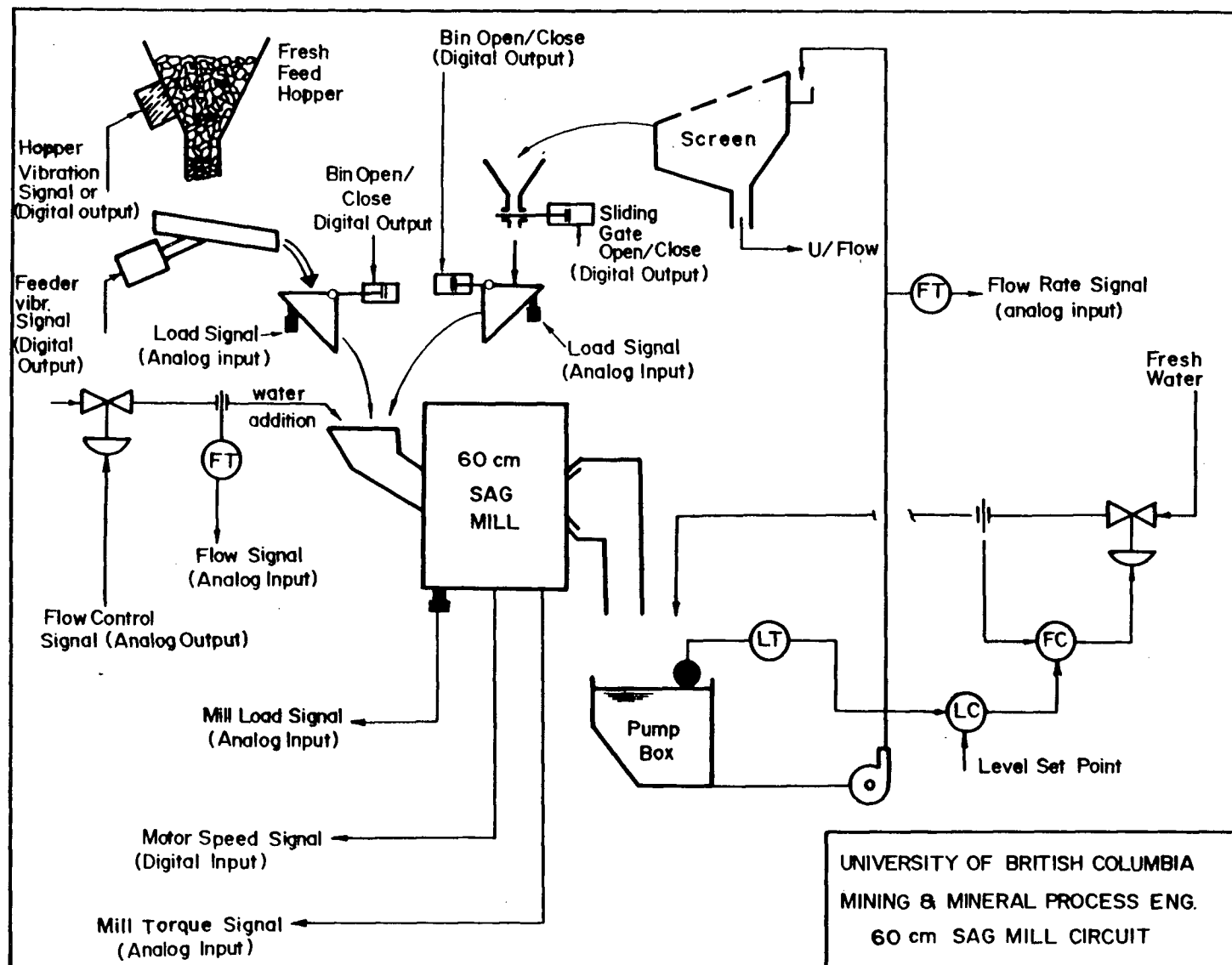
2.2. Description of Test Circuit

2.2.1 Equipment

In common with many of the test facilities described in section 1.5, the UBC circuit is essentially a scaled down version of the full-scale circuits found in industry. Figure 9 is a basic flowsheet of the system showing the main equipment items and instrumentation.

Material is fed to the mill from a hopper by means of an Eriez vibrating feeder. The level of vibration can be adjusted depending on the feedrate required during a test. A custom designed mass flowmeter, as described by Mular et al (1989), measures and controls the feedrate to the mill. Material is dispensed in batches at a fixed interval. Both batch weight and batch interval are determined by a control program depending on the feedrate required. The input to the control program may be from the operator (for fixed feedrate operation) or from a remote setpoint, e.g. to control mill weight setpoint. In either case the control program executes the following cycle. The vibrating feeder is started, dispensing material into a weighing bin. The bin is fully supported by a load cell. When the weight of material in the bin reaches a predetermined setpoint, the feeder is stopped. A final batch weight is taken, and an air cylinder is activated to open the bin gate, discharging the material into the mill. The gate is then closed and the empty bin weight

Figure 9. UBC 60cm SAG Mill Circuit.



taken to determine the net weight of material dispensed. The system then idles for the balance of the batch interval, and the cycle starts again. Flowrates in the range 0-4 Kg/min can be achieved with an accuracy of about 2%.

The mill itself was designed and fabricated by Dominion Engineering Ltd., and is shown in Figure 10. Mill inside dimensions are 60cm diameter by 25cm long. Critical speed is 54 RPM. Feed enters through a 15 cm opening while the discharge grate and trunnion are incorporated into a removable end plate which also connects to the drive mechanism.

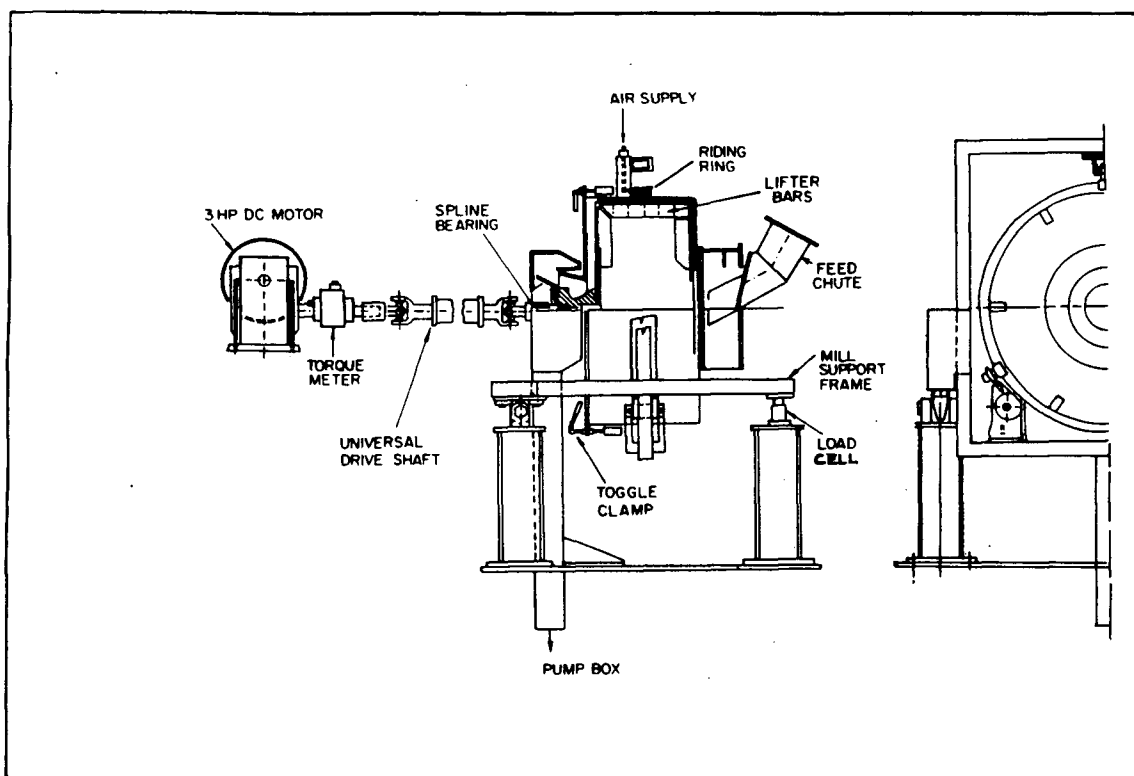


Figure 10. 60cm SAG Mill Arrangement.

A machined ring attached to the mill shell runs on 2 horizontal rollers which are fixed to a support frame. The support frame rests on a load beam which is used to monitor mill load continuously. Axial thrust is taken up by an air bearing.

The mill drive arrangement consists of a 3 HP variable speed D.C. motor, speed reducer, and universal drive shaft. A torquemeter is attached to the output shaft of the speed reducer. The drive shaft connects to a spline bearing mounted on the mill end plate. This ensures that no axial forces are transmitted between the drive and the mill. Speed may be varied from 0 to 58 rpm.

The mill shell is fitted with 8 equally spaced lifter bars, 40mm in height by 25mm wide. The feed and discharge ends are fitted with radial lifter bars of the same dimensions. The discharge grate consists of concentric slots of 10mm width at distances of 10mm and 25mm from the shell wall. This configuration was arrived at following considerable experimentation with various grate arrangements.

The mill discharges into a 75cm by 40cm pumpbox. Water addition to the pumpbox is controlled to maintain a constant level, and thus a constant head on the slurry pump feeding the vibrating screen. Pumping rate may be altered by varying the pump speed by means of a variable-pitch sheave.

The material from the pumpbox is sized on a 60cm by 70cm Universal Vibrating Screen. Screen cloth openings are 6.25mm (1/4"). The undersize passes to a drum thickener while the oversize is returned to the mill via a mass flowmeter similar to the one on the fresh feed system.

Water addition to the mill is controlled by means of a control valve downstream of a DP cell which measures the flowrate. Water addition is in proportion to the total solids feedrate to the mill (i.e. fresh feed plus oversize). The ratio is set at the beginning of a test run, but may be varied from run to run.

2.2.2. Instrumentation & Control Elements.

The circuit is fully instrumented to facilitate measurement and data logging of all important process variables. Included are mass flowmeters for fresh feed and screen oversize; load beam for mill weight monitoring; a torquemeter to measure mill power mounted on the speed reducer output shaft, which has a shaft revolution counter to detect speed; a level detector in the pumpbox; a magnetic flowmeter on the screen feed pump discharge and dp cells with orifice plates to measure mill water and pumpbox water addition. Direct measurement of torque at the output shaft of the speed reducer is considered a more accurate measurement of net mill power than measurement of electrical energy input to the motor. This is because efficiency factors applied to the motor and speed reducer are

not fixed, but change depending on the load.

2.2.3. Circuit Control

There are two separate control systems involved. The pumpbox level is controlled by a Foxboro SPEC 200 analog system which compares the level signal from the pumpbox with a level setpoint and manipulates the water flowrate setpoint so as to minimize the deviation.

The majority of the circuit control functions are performed by an ACTION Model BC2 digital control computer. Analog signals from the various instruments are converted to digital form for use in the computer by means of an A/D converter. A control program uses subroutines and interrupts to execute control algorithms, actuate control elements, and to communicate with the operator through a video display and printer.

A more detailed description of the circuit instrumentation and control has been given by Mular et al (1988).

2.3. TEST PROCEDURES

To date, 60cm circuit tests have been conducted on representative samples from operating Copper mines in B.C., and from one gold property in Alaska. These copper ore samples were acquired during sampling campaigns on the full scale circuits, while the gold ore was received from Echo Bay

Mines Ltd, via Lakefield Research, where the ore was tested.

Running tests in the small circuit involves the following steps: ensuring proper calibration of all sensors; feed preparation; running the mill under a set of predetermined conditions until steady state is achieved; sampling of the circuit at steady state over a suitable period; logging of all relevant circuit variables during the test; analysis of the collected samples; processing of the test data to determine suitable comparative parameters.

2.3.1. Calibration of Sensors

Calibration procedures have been described by Kingston (1987) and include

- fresh feed mass flowmeter, oversize flowmeter, mill water addition, torquemeter, pump discharge, pumpbox level, mill weight, and mill speed.

Prior to running a series of tests on a given ore, these are checked to ensure accuracy and consistency.

2.3.2. Feed Preparation

In order to produce reliable and reproducible results, the method of feed preparation must be consistent from test to test.

Ore samples taken at a full scale circuit are put into sealed drums for transport. On receipt at UBC, the material is weighed, dried, and the moisture content determined, A size analysis is done on the ore as received. Material larger than $1\frac{1}{2}$ " is crushed using a jaw crusher with an Open Side Set of $1\frac{3}{16}$ ". This gives a feed top size of approximately $1\frac{1}{2}$ " for the 60cm mill.

The crushed material and the balance of the ore are recombined and thoroughly blended until homogenous. A riffled sample is taken at this stage and a size analysis done. During a test run a further one or two samples are taken from the vibratory pan feeder and a size analysis done for comparison.

The prepared feed material is loaded into the feed bin in small batches, (approx. 2 Kg each) in order to minimize segregation in the hopper. This is especially important during the steady state sampling period.

2.3.3 Running a Test

Once the material has been prepared, the mill is readied by attaching the end plate, positioning the discharge chute, and connecting the drive shaft. The mill should be run for approximately half an hour empty to allow bearings to warm up and to get an accurate reading on the tare torque.

The pumpbox is filled to the operating level, the pump is

started and the flowrate adjusted to the required value. This loop stabilizes very quickly.

Empty mill torque is checked during the mill warm-up period until it has stabilized. This stable value is the tare mill torque for the run. It should remain constant from run to run. If not, the condition of the riding ring and support bearings should be examined as should the thrust bearing air pressure.

Empty mill weight is taken before the start of each run.

A number of parameters must be specified by the operator prior to starting a run. A set of Standard Conditions has been developed so that comparisons may be made between different ores. These are:

1. Mill Weight Setpoint

This is calculated to achieve a 30% charge volume in the mill. The calculation procedure takes account of the ball charge, ore, and water, and is given in Appendix I.

2. Mill Speed

Mill speed is variable from zero to 110% of Critical speed by means of a rheostat controller. The Standard Speed used is 78% of Critical or 42 RPM.

3. Water Ratio

The water is fed to the mill in proportion to the total solids feed (i.e. fresh feed plus recirculated oversize). It is desirable to maintain mill discharge % solids in the range 55-70%. A water ratio of 0.6 has been standardized upon, giving a theoretical mill discharge % solids of 62.5.

4. Ball Charge

A graded ball charge is used based on the relationship

$$p_i = [d_i/d_n]^4$$

where p_i = % by weight of ball size d_i

d_n = size of make-up balls

A ball charge of 9.9% of mill volume has been standardized on. This consists of the following sizes and distribution:

<u>Ball Size</u>	<u>Weight</u> (Kg)
2"	11.20
1.5"	10.60
1.25"	3.80
1.0"	1.85
0.875"	0.95
0.75"	<u>1.30</u>
Total	29.60 Kg.

To begin a test run, the ball charge is loaded and the control program initiated. It will prompt the operator for the various setpoints required.

Fresh feed to the mill starts off at a high rate to quickly

fill the mill. As the mill weight setpoint is approached, the feedrate is cut, and finally when mill weight setpoint is reached, the fresh feed rate is set by the mill weight control loop. This control loop has been found to be very stable. A proposed model for the controller is presented in Appendix XI. The fill-up phase normally takes about half an hour.

The mill is considered at steady state when fresh feed, oversize, mill weight and mill torque have remained stable for at least 20 minutes. At this point the sampling period begins.

2.3.4 Sampling Circuit at Steady State

Samples of all process streams are taken over a period of 64 minutes. Table III. summarizes the samples that are taken, the method used and the frequency. Note that the fresh feed and oversize streams are sampled less frequently than the others - normally at the beginning and at the end of the run. This ensures that the steady state operation of the circuit is not disturbed unduly.

At the conclusion of the sampling period, the mill is immediately stopped so that none of the steady state mill contents are lost. The drive shaft is disconnected and the mill end plate removed to collect all of the contents of the mill. Wash water used to clean out the mill is recorded.

TABLE III.

<u>SAMPLE</u>	<u>METHOD</u>	<u>FREQUENCY</u>
FRESH FEED	Scoop Sample taken from Vib. Feeder.	2 or 3 samples per Test.
MILL DISCHARGE	15 Second Bucket Sample.	8 Samples per Test.
SCREEN UNDERFLOW	5 Second Bucket Sample	8 Samples per Test.
SCREEN OVERSIZE	Batch Taken Beneath Weigh Bin.	2 or 3 Samples per Test
PUMP BOX WATER	10 Second Bucket Sample.	2 Samples per Test.

Table III. Location, method, and frequency of sampling for 60cm circuit at steady state.

During the run, the following process variables are measured, displayed on the video screen and printed on hard copy:

Fresh Feed Rate (gm/min)
 Oversize Flow Rate (gm/min)
 Mill Weight (A/O units)
 Mill Torque (A/D units)
 Screen Feed Pump Discharge (A/D units)
 Mill Water (gm/min)
 Mill Speed (RPM)

2.3.5. Processing of Samples.

Size analysis and % solids determination are performed on all samples taken during the run using a combination of wet and dry screening. The volume of the steady state mill contents is checked and compared with the setpoint.

2.4. Acquisition of Full-Scale Data

Sampling of a full scale grinding circuit requires close co-operation between the mine management and the research team. Careful planning is required in order to obtain the best possible data with the least interruption to the normal operation of the plant.

To date, four operating SAG circuits in B.C. have been sampled, and representative feed samples processed in the small scale circuit. The results of these tests are presented in Chapter 3. Section 2.4 provides a description of the sampling campaigns carried out at Lornex (1983), Afton (1986), Island Copper (1986), Similkameen (1987), and Highland Valley Copper (1987).

In addition, samples of a gold ore have been obtained from Echo Bay Mines Ltd. for processing in the 60cm mill. This ore has been tested extensively at the Lakefield Research Centre and the results of those tests have been made available for comparison purposes.

2.4.1. Lornex

During the summer of 1983, an extensive sampling campaign was conducted at the Lornex Corp. plant near Logan Lake, B.C., by Mular (1983) and co-workers. A period of 5 weeks was required including familiarization, safety training, planning, construction of sampling devices, dry runs and handling/packaging of samples.

Five ore types were identified by the Mine Geologist, and designated "Very Soft", "Soft", "Medium", "Hard", and "Very Hard". Six separate runs were conducted on each ore type for a total of thirty runs. The largest of the three SAG mills at Lornex, a 34ft. diameter by 12 ft. long mill on C-Circuit, was selected for the test runs. A schematic of the circuit is shown in Figure 11. The SAG mill discharges into a pumpbox where make-up water is added. Discharge slurry is then pumped to a stationary screen. Screen Oversize is returned to the mill. Screen Underflow is split to feed two secondary ball mills.

The procedure employed for each ore type was to first empty the coarse ore stockpile which serves as feed to C-Circuit. The mine would then send a sufficient quantity of the given ore type to last for a 24 hour period, during which the six runs were completed. The six runs were conducted under different conditions of mill speed, mill load, ball charge,

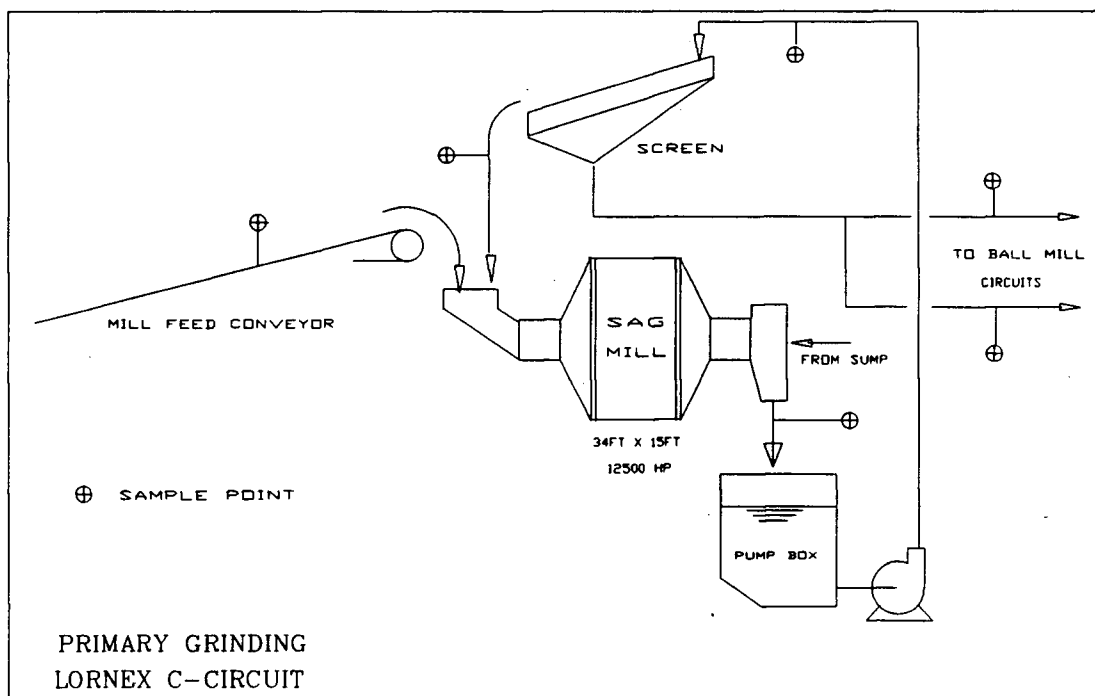


Figure 11. Lornex C-Circuit.

water ratio. The conditions for each run are given in Table VI. One repeat run was included per ore type. Facilities were available for charting and recording important process variables.

Sampling of the circuit began when steady state was deemed to have been achieved, based on the chart recordings of mill bearing pressure, feed rate, and Power Draw. At the beginning and end of each run, the feed conveyor was stopped briefly and a sample taken for processing later in the 60cm mill. Over a period of approximately one hour, the mill discharge, screen feed, screen oversize, and screen underflow were sampled at ten minute intervals, giving composite samples of approximately 25 litres each. These were weighed and dried on

site, and packaged for transport to UBC, where size analyses were conducted. Process variables were recorded every 2 minutes on hard copy, and the chart recordings of the entire run were also retained.

The samples representing the mill feed for each of the thirty runs were taken to UBC where they were firstly dried for % moisture determination, and then sized. The material was then prepared for running in the 60 cm mill, under conditions similar to those for the full-scale run, i.e. ball charge, mill load, mill speed, and water ratio. Table VII. lists the conditions under which the 60 cm tests were conducted.

The raw data from the 30 full-scale and small-scale runs was used by Dominion to develop a mathematical model of their SAG mills. These data sets have now been made available to UBC for use in scale-up investigation.

2.4.2 Afton

The Afton plant located outside Kamloops, B.C., is a Copper producer processing approximately 8500 tonnes/day of low grade ore . The grinding circuit consists of a 28'x12' SAG mill driven by a 5300 HP variable speed drive in closed circuit with a stationary screen. Secondary grinding to 65% -250 mesh is accomplished in a 16.5 'x 29' Ball mill closed with a Krebs Cyclopac. Figure 12 is a schematic of the Primary Circuit showing the sample points.

showing the sample points.

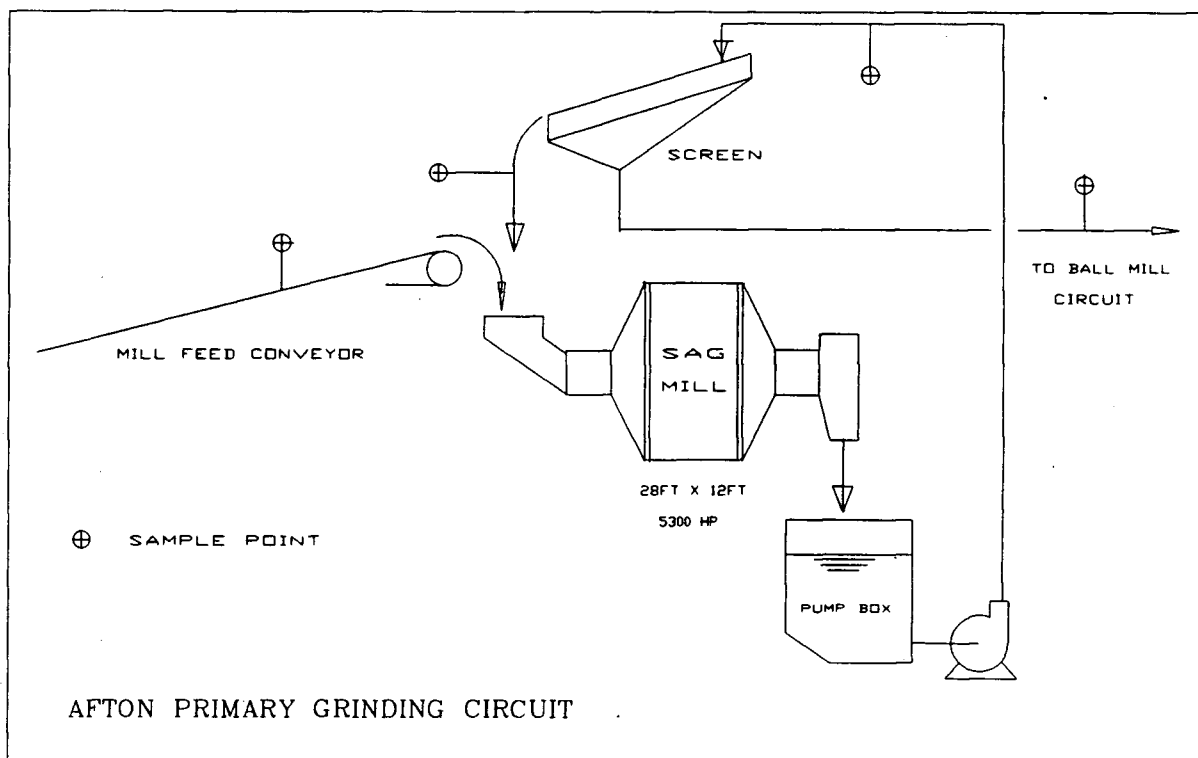


Figure 12. Afton Primary Grinding Circuit.

Sampling of the circuit was conducted in June and August of 1986, using the same procedures as at Lornex. Runs 1 and 2 were conducted on a hard ore type, with the gravity circuit inactive. The equivalent screen mesh opening for these tests was 16mm. Runs 8 and 9 were conducted on a soft ore type with the gravity circuit operating and an equivalent screen mesh opening of 9.5mm.

The fresh feed samples were processed in the 60cm mill during the Summer of 1987, under standard conditions.

2.4.3. Island Copper Mines (BHP-UTAH)

Island Copper mines, (now BHP-UTAH), is located 15 km west of Port Hardy B.C. on Vancouver Island.

Approximately 52,000 short tons/day of low grade copper ore are processed in the grinding circuit which consists of six 32' x 14' SAG mills, and three 16.5' x 22' Ball mills. Each SAG mill is driven by two 3,000 HP reversible wound rotor motors. A trommel screen returns +9.5mm material to the mill through two ports. Ball load is normally 7% to 8% by volume. Mill speed is 72% of critical.

Mill discharge is pumped from a sump to a cluster of 50cm hydrocyclones. Cyclone overflow is sent to flotation, while cyclone underflow may be recirculated entirely or in part to the SAG mill or to the ball mill discharge sump. A schematic of the circuit is shown in Figure 13.

SAG Circuit Number 4 was sampled in August 1986. Four separate runs were conducted in the same manner as described for Lornex. For runs 4 and 5, the circuit was operating in closed circuit mode, i.e. the cyclone underflow was returned to the SAG mill feed end. For runs 6 and 7, the SAG mill was operated in open circuit.

The fresh feed samples were processed in the 60cm mill during August 1987.

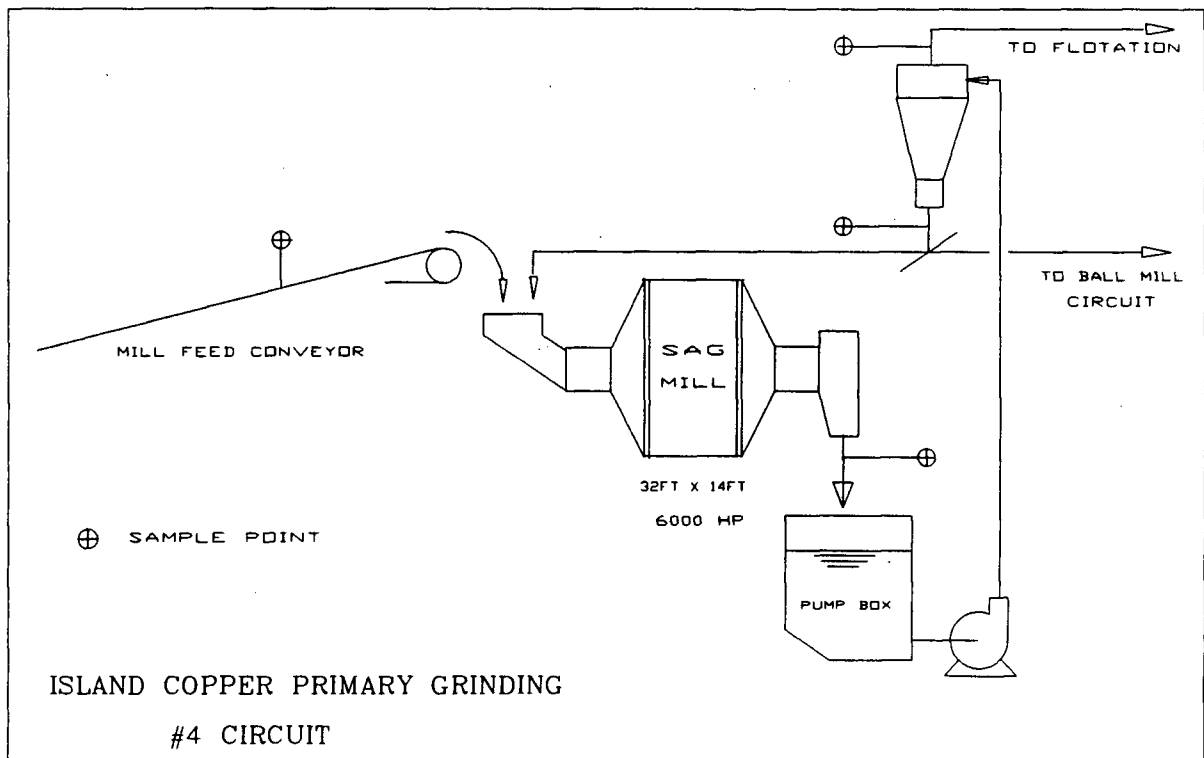


Figure 13. Island Copper Primary Grinding Circuit.

2.4.4. Similkameen, (now Similco).

Similco, (formerly Newmont Mines, Similakameen Division), is located 10km outside Princeton, B.C.. It has a nominal daily throughput of 21,000 short tons of low grade copper ore. Three 32'x14' Hardinge Cascade SAG mills are used for Primary grinding. The plant was originally designed to operate autogenously, but following start-up problems, was converted to Semi-Autogenous mode with a crusher for pebble reduction. Secondary grinding was also added at a later stage to increase throughput. The ore is known to be very tough, and the early problems experienced have been well publicised (Hazra, 1983).

The grinding circuit and sample points are shown in Figure 14.

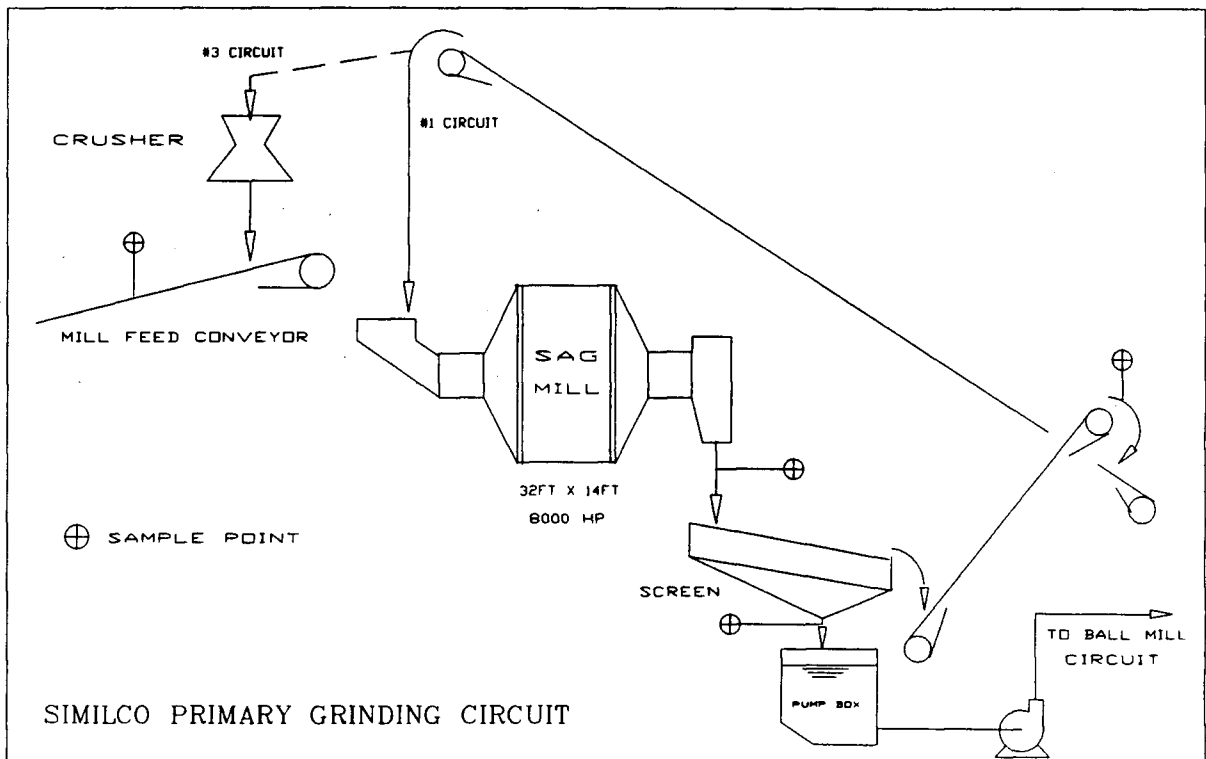


Figure 14. Similco Primary Grinding Circuit.

Two of the three circuits, #1 and #3, were sampled in August 1987. At the time the plant was conducting a test to compare performance using different size make-up balls. Circuit #1 was using 4 inch make-up, while circuit #3 was using 5 inch. Since then, 5 inch balls have been standardized upon.

At the time of sampling, the feed to the mill was quite variable in its grinding characteristics. However, following a reasonably stable period of approximately 2 hours, #1 circuit was sampled for 1 hour. #3 circuit had been down for maintenance, and was sampled about 1 1/2 hours following

start-up when conditions had stabilized.

In both cases the screen oversize was returned to the mill without crushing. Composite samples of Mill Discharge, Screen Oversize and Screen Underflow, were taken for both circuits over a 1 hour period. Fresh feed samples were taken off the mill feed conveyors. Process variables such as feed rate, water ratio, power draw, mill lift pressure, and mill speed, were recorded from the control room instruments every 2 minutes during the test runs.

2.4.5. Highland Valley Copper, (formerly Lornex)

Two of the three Primary Mills were sampled in August 1987. C-Circuit, which is the largest mill, was sampled first. This is the same circuit which had been sampled extensively in 1983 by Mular et al. The facilities used during that campaign were still available, i.e. custom cutters, data logging program etc. The same procedures were used as in 1983. A-Circuit was sampled following start up after maintenance. This circuit, shown in Figure 15., consists of a 32' x 14' Primary Mill in closed circuit with two stationary screens, followed by two 16.5' x 28' Ball Mills. Steady state conditions were achieved after approx. 1 ¹/₂ hours of running.

Composite samples of Mill Discharge, Screen Feed , Screen Oversize . and Screen Underflow, were brought back to UBC in sealed containers for processing. Fresh feed samples were

removed from the mill feed conveyors at the beginning and end of the sampling periods.. These samples were later run in the 60cm circuit under Standard Conditions.

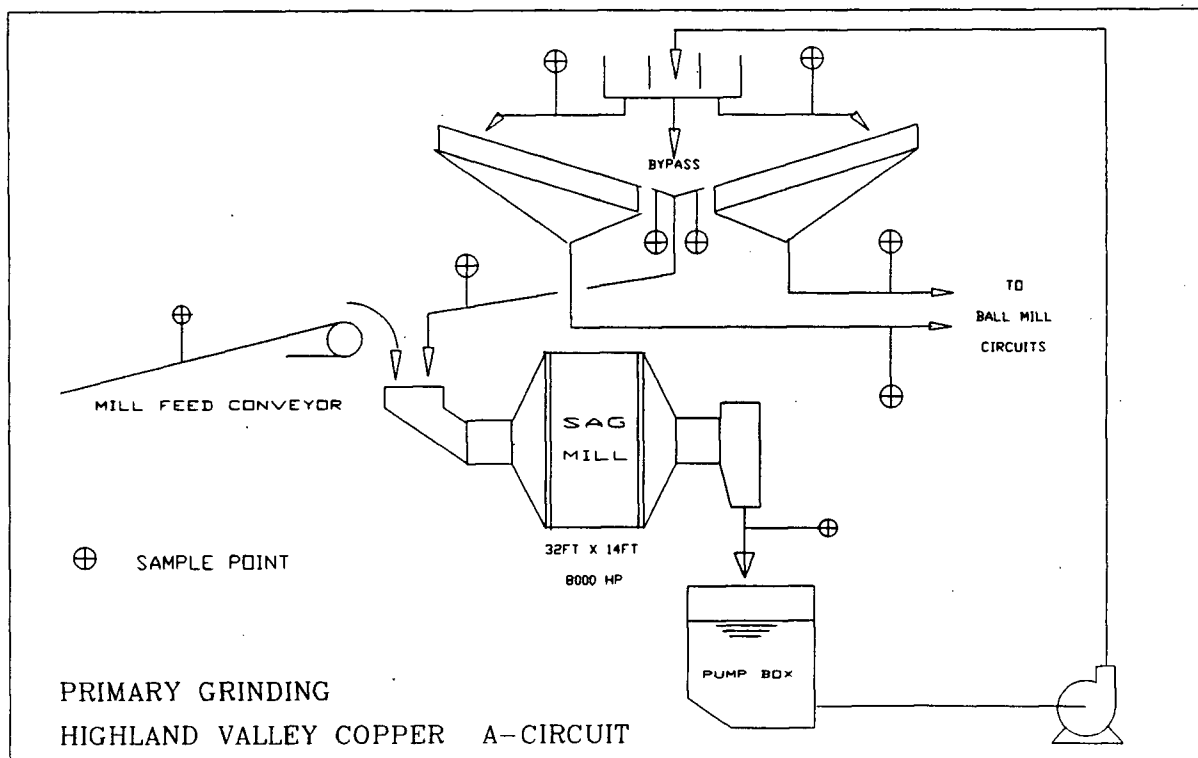


Figure 15. Highland Valley Copper A-Circuit.

2.4.6 Echo Bay, Alaska Juneau Project.

Samples of a low grade gold ore were made available for running in the 60cm mill by Echo Bay Mines Ltd. Data from SAG grinding tests conducted on this ore by Lakefield Research, were also made available for comparative purposes.

Two distinct ore types, a gabbro and a slate, were tested individually, and also in a 50/50 blend, under a set of

standard conditions. The results of the tests are presented in Chapter 3.

CHAPTER III

ANALYSIS OF DATA.

3.1. Data Adjustment.

Sections 2.2. and 2.3. describe the procedures used to acquire small scale and full scale data respectively. In theory, it is only necessary to measure the feed rate, power consumed, feed and product size distributions, in order to calculate an operating work index for a grinding circuit.

However, to rely on this data alone would be to ignore the fact that all experimental data are subject to error. Measured variables around a grinding circuit are related by the laws of mass conservation. Analysis of raw data collected around such a circuit will generally not satisfy all the mass balance relationships. This is because of random errors associated with the dynamics of the process, and random or bias measurement errors.

When conducting the subject testwork, redundant data (i.e. data over and above that required to balance the circuit),

were collected. The raw data were then statistically adjusted so that the estimated values satisfied all the mass balance equations and at the same time remained as close as possible to the measured values. This procedure upgrades the quality of the raw data and hence the reliability of the subsequent calculations. The degree of adjustment varies depending on the accuracy of the measured variable, i.e. a value which is considered to have an accuracy of $\pm 10\%$ will be adjusted more than one whose accuracy is determined to be $\pm 1\%$.

Two data adjustment procedures were examined. Firstly a customised program was written in Fortran using the Simplex direct search routine.

A set of search variables is chosen from which all measured variables can be calculated. The method uses an iterative procedure to minimize an objective function which is defined as

$$OF = \sum_{i=1}^n W_i \left(\frac{M_i - \hat{M}_i}{M_i} \right)^2$$

Where W_i is a weighing factor to be applied to M_i

M_i is a measured variable

$\hat{M}_i$ is the estimated value of M_i calculated from the search variable.

A suitable stopping criterion is selected and the $\hat{M}_i$ values calculated for minimum OF are then used as the best estimates of the measured variables.

Secondly, the mass balance program BILMAT, which is available from CANMET, was used on the same data. This program uses a weighted least squares procedure in which the sum of the squared residuals (measured minus predicted value) is minimized simultaneously for all data. Both COGGIN and BOTM routines are used in the minimization procedure. Each residual is weighted by the inverse of the standard deviation ($1/\sigma$) of the corresponding measurement. BILMAT requires the standard deviations to be input as a percentage of the measured variable.

As with the Simplex program, the weighting factors are not always known or measured and estimates must be made, based on observations, prior knowledge, experience and a certain amount of judgement. Guidelines have been provided in the SPOC Manual and also by Hodouin et al (1988). Analysis of the raw data often helps to identify poor measurements. In some cases instrument accuracies are known, or may be estimated based on vendor data or industry standards.

Errors in the data which follow arise from a number of sources including:

1. Instrumentation: Data was obtained either directly or indirectly by means of weigh scales, flowmeters, density meters, power meters, load cells, and pressure sensors. All of these devices have inherent errors associated with

them. Where repeat measurements were available, estimates could be obtained. Otherwise, values were assigned based on experience.

ii. Sampling: This is considered to be the largest source of error, particularly on the full-scale circuits where flowrates are high and streams are heterogenous. The degree of segregation occurring in the various streams was considered when assigning error values to primary sampling. For instance, the screen underflow sample was considered more reliable than the screen feed or screen oversize samples.

iii. Sample Analysis: Errors arising from percent solids determination and size analyses are not as significant as those due to primary sampling. These may be estimated by the use of repetitive analysis.

The total error is the sum of the contributions from all sources. It is most important to distinguish which data are reliable and which are not, otherwise the mass balance program may make large adjustments to "good" data while dubious measurements are left unchanged.

To compare the efficiency of the two methods, a series of comparisons were done on different data sets. Tables IV. and V. show one example of the results obtained using the Simplex

DATA ADJUSTMENT PROCEDURE USING SIMPLEX METHOD

MASS BALANCE OF 60CM CIRCUIT

LORNEX DATA RUN #6

MACRO VARIABLES

	MEASURED VALUE	ADJUSTED VALUE	% CHANGE
FRESH FEED (Qf)	0.615	0.604	1.77
MILL DISCH. (Qd)	1.438	1.548	7.64
SCREEN FEED (Qt)	52.80	53.01	0.40
SCR OVERSIZE (QO)	0.433	0.424	2.05
SCR U/FLOW (QU)	52.37	52.59	0.42
MILL WATER (Wm)	0.539	0.52	3.45
PBOX WATER (Wp)	51.24	51.47	0.44
MILL DISCH %SOLIDS (Pd)	64.08	65.17	1.71
MILL OVERSIZE %SOLIDS (Po)	92.36	95.17	3.05
SCR OVERSIZE %SOLIDS (Po)	1.16	1.15	0.72
FRESH FEED %SOLIDS (Pf)	98.79	99.25	1.48

MICRO VARIABLES

PARTICLE SIZE (microns)	MILL DISCHARGE (%RETAINED)		SCREEN OVERSIZE (%RETAINED)		SCREEN UNDERFLOW (%RETAINED)	
	MEASURED	ADJUSTED	MEASURED	ADJUSTED	MEASURED	ADJUSTED
26500	0.00	0.00	0.00	0.00	0.00	0.00
19000	0.00	0.00	0.00	0.00	0.00	0.00
13200	0.00	0.00	0.00	0.00	0.00	0.00
9500	4.89	4.08	9.34	10.21	0.00	0.00
6700	15.70	15.25	37.49	38.12	0.00	0.00
4750	13.36	14.00	35.60	34.97	0.03	0.03
3350	7.19	8.33	15.75	15.26	3.76	3.71
2360	4.10	4.27	1.72	1.73	6.00	5.97
1700	2.14	2.36	0.08	0.08	6.99	3.88
1180	1.74	1.90	0.01	0.01	3.22	3.16
850	1.64	1.69			2.84	2.81
600	1.91	2.00			3.51	3.33
425	2.37	2.26			3.75	3.77
300	2.98	3.22			5.47	5.37
212	3.33	3.16			5.28	5.27
150	4.23	4.09			6.84	6.81
106	4.15	4.08			6.85	6.80
75	4.30	4.05			6.77	6.74
53	4.23	4.33			7.28	7.22
38	3.25	2.94			4.83	4.90
-38	18.51	17.97			29.57	30.21

STOPPING CRITERION: STD ERROR=1E-8 # ITERATIONS REQ'D: 10501

Table IV. Results of Data Adjustment using Simplex Program.

DATA ADJUSTMENT PROCEDURE USING BILMAT PROGRAM

MASS BALANCE OF 60CM CIRCUIT
LORNEX DATA RUN #6

MACRO VARIABLES

	MEASURED VALUE	ADJUSTED VALUE	% CHANGE
FRESH FEED (Qf)	0.62	0.60	2.83
MILL DISCH. (Qd)	1.44	1.54	6.94
SCREEN FEED (Qt)	52.80	51.97	1.56
SCR OVERSIZE (QO)	0.43	0.41	4.16
SCR U/FLOW (QU)	52.37	51.56	1.55
MILL WATER (Wm)	0.54	0.53	2.56
PBOX WATER (Wp)	51.24	50.44	1.57
MILL DISCH %SOLIDS (Pd)	64.08	64.4	0.50
MILL OVERSIZE %SOLIDS (Po)	92.36	96.26	4.22
SCR OVERSIZE %SOLIDS (Po)	1.16	1.15	1.21
FRESH FEED %SOLIDS (Pf)	98.79	98.88	0.09

MICRO VARIABLES

PARTICLE SIZE (microns)	MILL DISCHARGE (%RETAINED)		SCREEN OVERSIZE (%RETAINED)		SCREEN UNDERFLOW (%RETAINED)	
	MEASURED	ADJUSTED	MEASURED	ADJUSTED	MEASURED	ADJUSTED
26500	0.00	0.00	0.00	0.00	0.00	0.00
19000	0.00	0.00	0.00	0.00	0.00	0.00
13200	0.00	0.00	0.00	0.00	0.00	0.00
9500	4.89	4.19	9.34	10.38	0.00	0.00
6700	15.70	15.43	37.49	38.26	0.00	0.00
4750	13.36	13.86	35.60	34.31	0.03	0.03
3350	7.19	7.94	15.75	15.24	3.76	3.63
2360	4.10	4.19	1.72	1.71	6.00	5.87
1700	2.14	2.26	0.08	0.08	6.99	3.73
1180	1.74	1.82	0.01	0.01	3.22	3.05
850	1.64	1.67			2.84	2.79
600	1.91	1.99			3.51	3.34
425	2.37	2.30			3.75	3.85
300	2.98	3.11			5.47	5.20
212	3.33	3.23			5.28	5.42
150	4.23	4.15			6.84	6.95
106	4.15	4.11			6.85	6.89
75	4.30	4.15			6.77	6.96
53	4.23	4.28			7.28	7.17
38	3.25	3.04			4.83	5.10
-38	18.51	17.94			29.57	30.02

Table V. Results of Data Adjustment using BILMAT.

and BILMAT programs respectively on the same set of data. Comparison of the results indicates good agreement, with

differences arising due to the format of the weighting factors. However, the Simplex program took about 7 seconds of CPU time on the mainframe or several hours on a PC. The BILMAT program runs on an AT Compatible with co-processor in several minutes. On this basis it was decided to proceed with BILMAT for all data adjustment.

3.2. Lornex Data.

Data from thirty runs conducted on the Lornex C-Circuit were analysed.

3.2.1. Full Scale Data.

The sample points for the C-Circuit are shown on Figure 11. A 4" line from a floor sump enters the mill discharge stream ahead of the pump box. Samples were taken with and without this sump pump running. The percent solids of both samples were determined. Analysis of the data for the 30 runs indicated that the flow from the sump pump was severely biasing the mill discharge sample. Accordingly, this sample was not used in the mass balancing of the circuit. Redundancy still existed, however, because the Screen Feed, Screen Oversize and Screen Underflow had all been sampled and size distributions determined. The Screen Underflow splits into two streams to feed two Secondary Ball Mills. Each of these streams was sampled. The data was averaged and an estimate of

error variance obtained.

The results of the data adjustment carried out on each run are presented in Appendix II.

The fresh feed and adjusted screen underflow size distributions were plotted and the 80% passing sizes determined. These plots are presented in Appendix III. The Net Power at the mill shell (KW), was calculated by applying an efficiency factor of 0.92 to the gross power input to the motor, i.e. using a motor efficiency of 96% and a gear reducer/girth gear efficiency of 96%. The Net Specific Power (KWhr/tonne) was obtained by dividing the net power by the dry feed rate in tonnes/hr. An Autogenous Work Index (W_{IA}) as defined by MacPherson (1977), was then calculated using the expression;

$$W_{IA} = \frac{W \cdot \sqrt{F} \cdot \sqrt{P}}{10(\sqrt{F} - \sqrt{P})}$$

where W = Net Sp. Power (KWhr/tonne)

F = 80% Passing Size of Feed (microns)

P = 80% Passing Size of Product (microns)

Table VI summarizes the test conditions, measured variables and calculated Work Indices for each of the thirty full-scale runs.

Table VI.: Lornex C-Circuit: Full Scale Data

LORNEX C-CIRCUIT RUNS 1 TO 30 JUNE 1983

TEST CONDITIONS, MEASURED VARIABLES (ADJUSTED) AND CALCULATED WORK INDICES

RUN NUMBER	F.FEED (STPH)	MILL H2O (STPH)	WATER RATIO	SPEED (%CRIT)	BALL LOAD (% VOL)	GRS.PWR. (KW)	NET PWR. (KW)	F80 (um)	P80 (um)	NET SP.PR (KWHR/MT)	AUTO WK. INDX	ORE TYPE
1	1116	461	0.40	68.0	6.63	6572	6046	107460	1301	5.96	24.15	V. SOFT
2	1184	479	0.40	68.0	6.59	6546	6022	84382	1366	5.60	23.69	V. SOFT
3	1447	873	0.58	80.0	8.58	7795	7171	107460	4000	5.45	42.72	SOFT
4	1311	617	0.46	77.0	7.59	8078	7432	118338	1695	6.24	29.16	MEDIUM
5	1323	854	0.64	74.0	8.87	7241	6662	124272	2261	5.54	30.44	HARD
6	1291	653	0.51	71.0	9.16	7098	6530	84747	1400	5.56	23.89	V. HARD
7	1637	965	0.58	74.0	6.77	8078	7432	115478	2875	4.99	31.79	V. SOFT
8	1255	610	0.46	71.0	8.63	6670	6136	68292	1504	5.38	24.49	SOFT
9	1199	579	0.46	71.0	8.65	6778	6236	98005	1183	5.72	22.11	SOFT
10	1124	749	0.64	68.0	7.75	7404	6812	88996	1240	6.67	26.62	MEDIUM
11	1389	732	0.52	80.0	9.04	7392	6801	182494	2000	5.39	26.90	HARD
12	1268	526	0.40	77.0	9.34	7313	6728	75205	1210	5.84	23.25	V. HARD
13	1848	879	0.46	80.0	7.35	8075	7429	107460	2551	4.42	26.40	V. SOFT
14	1410	919	0.64	77.0	8.72	7146	6574	100000	2374	5.13	29.54	SOFT
15	1226	668	0.52	74.0	7.87	7609	7000	75205	1333	6.28	26.45	MEDIUM
16	1242	687	0.52	74.0	7.90	7569	6963	75205	1433	6.17	27.09	MEDIUM
17	1154	486	0.40	71.0	9.21	7385	6794	107460	1183	6.48	24.89	HARD
18	1154	682	0.58	67.9	9.50	6684	6149	95636	1000	5.86	20.65	V. HARD
19	1603	1068	0.64	71.0	7.39	7299	6715	121269	2000	4.61	23.64	V. SOFT
20	1117	607	0.51	68.0	8.78	7315	6730	91201	900	6.63	22.08	SOFT
21	1229	511	0.40	80.0	8.03	7846	7218	136654	1822	6.46	31.18	MEDIUM
22	1461	871	0.58	77.0	9.36	7971	7333	95636	2000	5.52	28.87	HARD
23	1505	891	0.58	77.0	9.38	7944	7308	82818	2000	5.34	28.28	HARD
24	1334	629	0.46	74.0	9.67	6853	6305	107460	1539	5.20	23.17	V. HARD
25	1746	953	0.51	77.0	7.44	7537	6934	107460	2261	4.37	24.30	V. SOFT
26	1222	512	0.40	74.0	8.81	7413	6820	100000	1210	6.14	23.99	SOFT
27	1124	683	0.58	71.0	8.19	6921	6367	143507	1578	6.23	27.65	MEDIUM
28	1157	553	0.46	68.0	9.52	6860	6311	115478	1271	6.00	23.90	HARD
29	1532	973	0.64	80.0	9.81	8325	7659	136654	3747	5.50	40.34	V. HARD
30	1525	974	0.64	80.0	9.84	8311	7646	66738	3403	5.52	41.56	V. HARD

3.2.2. 60cm Circuit Data

The data for the small scale circuit was firstly adjusted using the BILMAT program. The results are presented in Appendix IV. The fresh feed and adjusted screen underflow size distributions were plotted and the 80% Passing sizes determined, (see Appendix V.). The Net Specific Power for the 60cm Mill, W, (KWhr/tonne) is obtained from the following expression

$$W = \frac{(T_G - T_{NL}) 2\pi N}{3600m}$$

Where T_G = Gross Torque (Nm)

T_{NL} = No Load Torque (Nm)

N = Mill Speed (RPM)

m = dry fresh feed rate (Kg/min)

The no-load torque is measured with the mill running empty at the speed to be used during the test (N).

The Autogenous Work Indices were then calculated for each of the thirty small-scale runs. Table VII summarizes the test conditions, measured variables and calculated Work Indices.

Table VII. Lornex C-Circuit: 60cm Circuit Data.

60cm CIRCUIT TEST RESULTS

LORNEX RUNS 1 TO 30

TEST CONDITIONS, MEASURED VARIABLES (ADJUSTED) AND CALCULATED WORK INDICES

RUN NUMBER	FEED RATE (Kg/min)	WATER RATIO	MILL SPD. % CRIT.	BALL CHARGE (% VOL)	F80 (microns)	P80 (microns)	NET PWR DRAWN (WATTS)	NET SP.PW (KWHR/T)	OP.WORK INDEX	ORE TYPE	BOND INDEX (COMP.)
1	0.44	0.40	68.00	6.63	22000	800	201.15	7.62	26.63	V.SOFT	13.1
2	0.47	0.40	68.00	6.59	22243	1164	182.52	6.47	28.63	V.SOFT	N/A
3	0.45	0.58	80.00	8.58	21203	700	210.58	7.80	25.22	SOFT	13.7
4	0.45	0.46	77.00	7.59	20919	843	246.19	9.12	33.12	MEDIUM	13.2
5	0.45	0.64	74.00	8.87	23652	475	217.98	8.07	20.50	HARD	13.4
6	0.59	0.51	71.00	9.16	20900	800	223.67	6.32	22.22	V.HARD	14.7
7	0.46	0.58	74.00	6.77	23165	745	213.37	7.73	25.71	V.SOFT	13.4
8	0.59	0.46	71.00	8.63	20000	760	215.05	6.07	20.80	SOFT	12.5
9	0.41	0.46	71.00	8.65	22685	495	211.73	8.61	22.47	SOFT	13.9
10	0.43	0.64	68.00	7.75	22245	560	241.38	9.36	26.32	MEDIUM	13.4
11	0.46	0.52	80.00	9.04	24630	645	180.19	6.53	19.78	HARD	13.8
12	0.50	0.40	77.00	9.34	21335	1000	226.06	7.54	30.41	V.HARD	14.0
13	0.54	0.46	80.00	7.35	21785	1600	188.66	5.82	31.95	V.SOFT	11.9
14	0.44	0.64	77.00	8.72	21785	675	203.38	7.70	24.29	SOFT	12.9
15	0.45	0.52	74.00	7.87	22000	700	212.68	7.88	25.37	MEDIUM	13.4
16	0.46	0.52	74.00	7.90	23650	700	238.48	8.64	27.61	MEDIUM	14.4
17	0.52	0.40	71.00	9.21	23650	645	242.90	7.79	23.68	HARD	14.0
18	0.52	0.58	67.90	9.50	23650	800	214.10	6.86	23.78	V.HARD	13.7
19	0.65	0.64	71.00	7.39	22245	1175	208.42	5.34	23.79	V.SOFT	12.0
20	0.51	0.51	68.00	8.78	23650	600	239.26	7.82	22.78	SOFT	13.5
21	0.32	0.40	80.00	8.03	23650	800	178.70	9.31	32.26	MEDIUM	14.3
22	0.54	0.58	77.00	9.36	22245	845	219.10	6.76	24.42	HARD	13.4
23	0.50	0.58	77.00	9.38	23650	800	234.69	7.82	27.11	HARD	13.9
24	0.49	0.46	74.00	9.67	21785	900	198.16	6.74	25.38	V.HARD	14.3
25	0.58	0.51	77.00	7.44	22245	1200	178.83	5.14	23.19	V.SOFT	12.3
26	0.47	0.40	74.00	8.81	23650	900	249.31	8.84	32.95	SOFT	13.7
27	0.33	0.58	71.00	8.19	24150	420	192.95	9.74	23.01	MEDIUM	15.9
28	0.50	0.46	68.00	9.52	23165	600	244.55	8.15	23.80	HARD	14.5
29	0.49	0.64	80.00	9.81	22865	840	236.98	8.06	28.90	V.HARD	14.2
30	0.52	0.64	80.00	9.84	20485	840	243.70	7.81	28.39	V.HARD	14.5

3.2.3. Comparison of Results.

The Net Specific Power and Autogenous Work Indices for the Full-Scale and Small-Scale Circuits were firstly plotted versus Run Number. Runs were conducted in random order relative to Run Number. Figure 16 shows the trend for Net Specific Power for full scale and 60cm circuits, while Figure 17 shows the trend for Work Index.

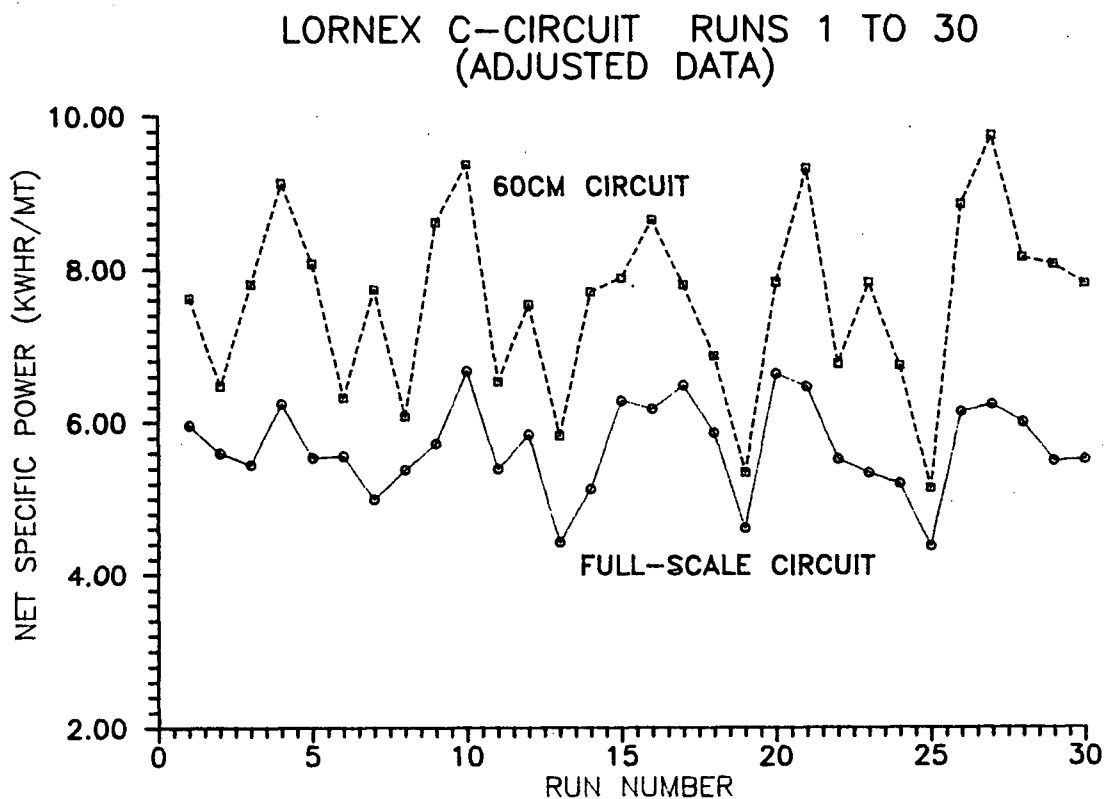


Figure 16. Comparison of Net Specific Power values for Full-Scale and 60cm circuit Lornex Runs.

3.2.3.1. Net Specific Power

The correlation between Net Specific Power appears to be quite good considering the wide variety of conditions under which the tests were conducted. Figure 18 is a plot of NSP (60cm circuit) versus NSP (Full Scale). There is obviously quite an amount of scatter, and the correlation coefficient is rather low at 0.76. However, it must be remembered that the runs were conducted under widely varying conditions which may affect the operation of the two circuits differently.

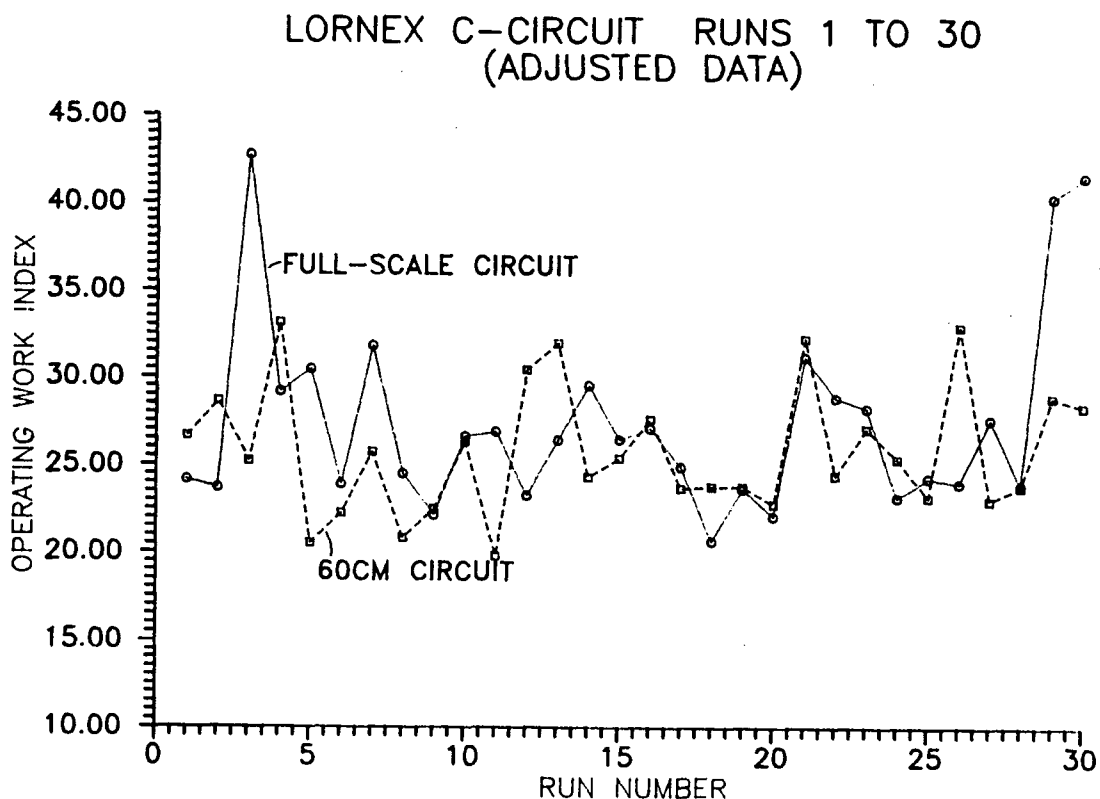


Figure 17. Comparison of Autogenous Work Indices for Full-Scale and 60cm Circuit: Lornex Runs.

A method used to compare the power draw by mills of different sizes has been proposed by Loveday (1978). He defined a proportionality factor called a Power Number P.

$$P = \frac{\text{Net Mill Power (KW)}}{\rho L D^{2.5}}$$

Where ρ is the Specific Gravity of the mill charge

L is the mill length inside liners, (m)

D is the mill diameter inside liners, (m)

P is a function of mill speed and load volume. Loveday calculated values of P for various full scale circuits, for comparison with the Mintek SAG pilot plant. He plotted P versus volume filling at a fixed speed of 73% Critical and concluded that there was good correlation between pilot plant and full scale mills. Consequently the pilot plant values could be used in scaling up to full scale mills.

A similar exercise was conducted on the Lornex data at mill speeds of 74% critical. The following results were obtained

Run Number	Volume %	P(60cm)	P(Full Scale)
24	22	0.85	1.15
5	24.5	1.05	1.38
15	27	1.09	1.54
16	27	1.25	1.56
26	29.5	1.24	1.45
7	31	1.22	1.82

A plot of these values as shown in Figure 19 indicates a significant difference between the two mills. The data for the full scale mill approaches Loveday's data reasonably well, but the Power Numbers for the small circuit are considerably lower. Also, the repeatability of the Full Scale data seems good, while the repeat runs on the 60cm mill differ by 14%.

An attempt was made to fit a simple model of the form

$$P = KN^{\alpha}R^{\beta}B^{\gamma}F^{\delta}$$

where P = Net power draw

K = a constant

N = Mill speed (% critical)

R = Water ratio

B = % Ball load

F = Mill fractional filling ($\propto$ Lift Pressure)

to the 60cm and full scale data for each of the Lornex Ore types and also collectively.

The regression portions of the statistical program SYSTAT were used. Multiple regression on the data sets produced no consistency in the variables which were significant in the equation, nor in the values of the parameters obtained from one equation to another.

A more elaborate model form may be required.

The Energy-Size Reduction relationships for each of the ore

types were examined. Log W was plotted against Log K₅₀ for each ore type. Typically, these should form a straight line of the form

$$W = AK^{\beta}$$

where W is the Net Specific Power (KWhr/Tonne)

K is the Size Modulus

β is a constant

However, it was found that the scatter on the data was too great to fit any meaningful relationship.

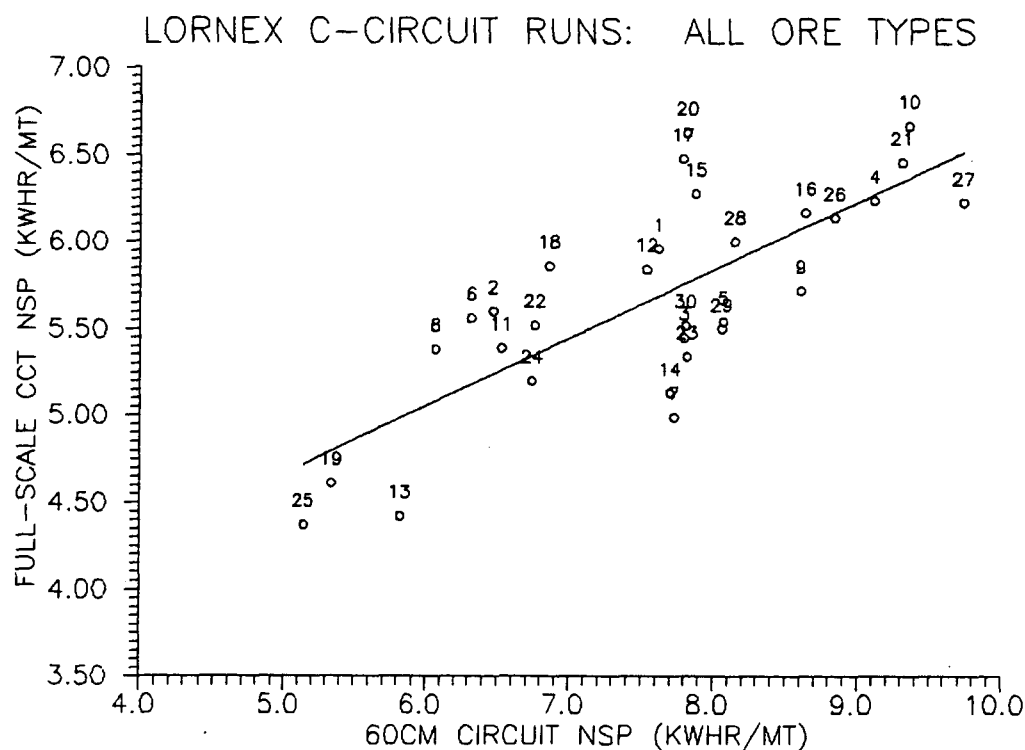


Figure 18. Comparison of Net Specific Power for 60cm and Full-Scale Circuit: Lornex Runs.

On average, the Net Specific Power for the 60cm mill is 30% higher than that for the full scale mill. It is to be

expected that a smaller mill will grind less efficiently than a large diameter mill. Digre (1979) reported that NSP values obtained in using their 0.8m diameter mill were found to be 30-35% higher than corresponding Full Scale Circuits. He now uses a correction factor on power to account for inefficient grinding in the 0.8m mill.

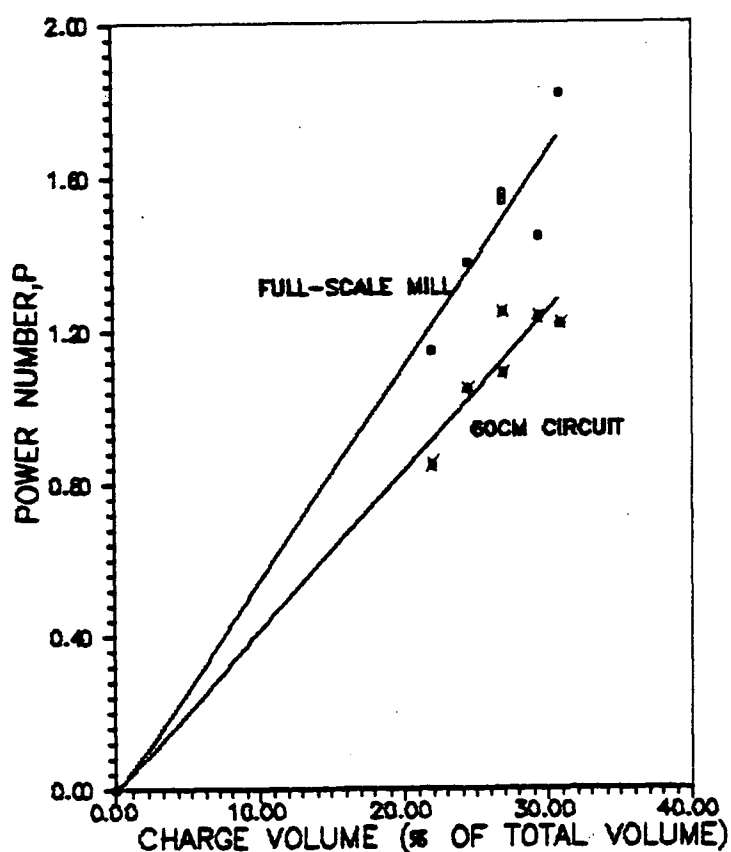


FIGURE 19. Power Number vs Volumetric Loading: Lornex Data

3.2.3.2. Autogenous Work Indices.

Comparison of the Autogenous Work Indices does not yield the

same degree of correlation. Figure 20 is a plot of work indices for the two circuits. As can be seen, there is considerable scatter and a number of obvious outliers. Examination of the P_{80} values obtained for some of the full scale runs (e.g. #3, #29, and #30) explains why such high work index values were obtained. The corresponding size distribution plots also indicate anomalies which are probably due to errors in the screening.

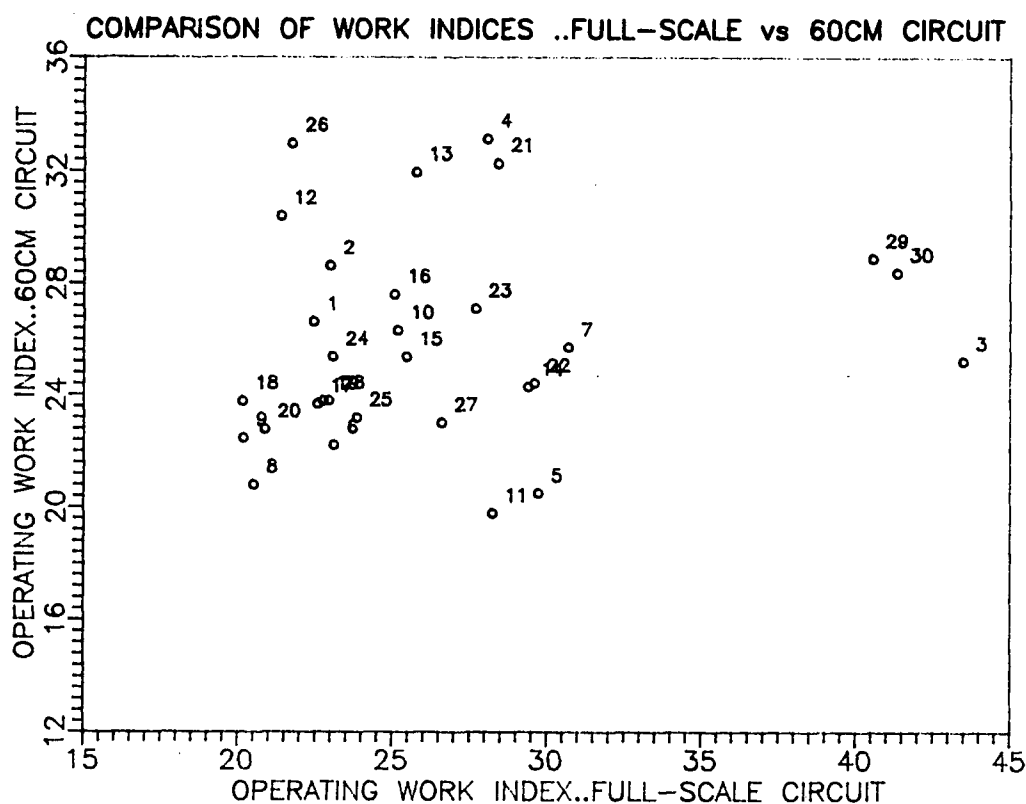


Figure 20. Comparison of autogenous work indices for 60cm and full scale circuits: Lornex Runs.

Because of the apparent inconsistencies in the P_{80} values, a second approach was used. Rather than using the 80% passing

sizes, the straight portion of the product size distribution curve was extrapolated to meet the 80% passing line. This portion of the curve represents the production of fines in the mill. This value K_{80} was then used in the calculation of the Autogenous Work Index. MacPherson (1989) uses this approach to explain the large difference between Primary Mill Work Index and overall two stage Circuit Work Index which is generally close to the Bond Ball Mill Work Index. He postulates that the Primary Mill does in fact grind at approximately the same efficiency as the Secondary Mill.

Tables VIII and IX present the revised work indices for Full-Scale and 60cm Circuits respectively, based on the K_{80} values rather than the P_{80} values used in Tables VI and VII.

Figure 21 shows the revised Work Indices versus run number for full-scale and 60cm circuits. Figure 22 presents the same work index data plotted against each other with the exception of Run 3 which is an obvious outlier. Figure 23 is a plot of 60cm autogenous work index versus Bond Work Index determined by the comparison method on the ore samples used in the 60cm tests.

The correlation between work indices as a result of using K_{80} values instead of P_{80} values is significantly improved. However, there is still a large amount of scatter, as shown in Figure 22. A possible explanation for this is the wide range

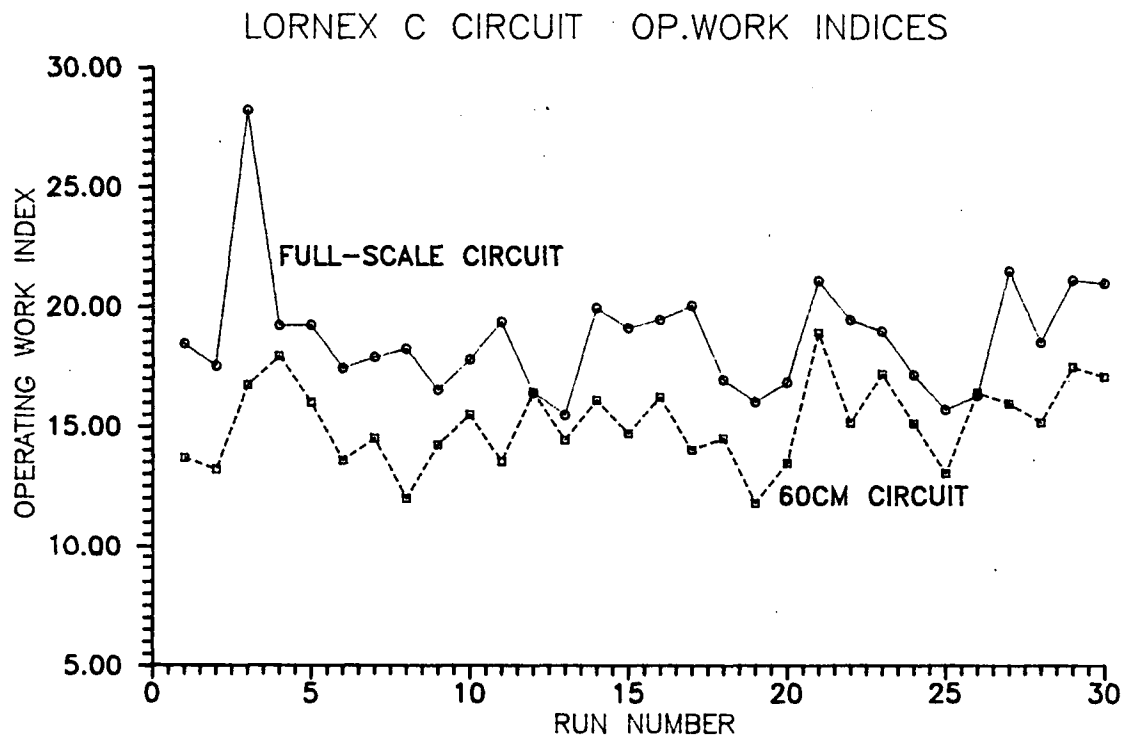


Figure 21. Revised Work Indices versus Run Number for Lornex Data.

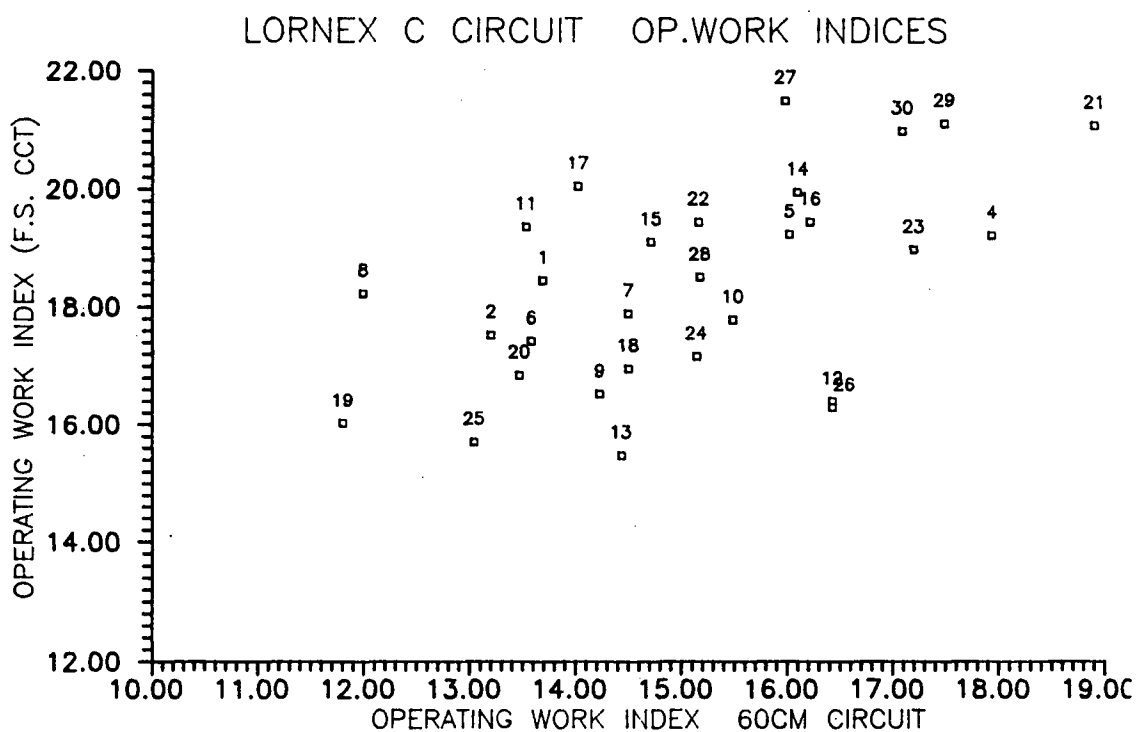


Figure 22. Comparison of Revised Work Indices.

Table VIII.

Lornex C-Circuit: Full Scale Data using Keo

LORNEC C-CIRCUIT RUNS 1 TO 30 JUNE 1983

TEST CONDITIONS, MEASURED VARIABLES (ADJUSTED) AND CALCULATED WORK INDICES

RUN NUMBER	F.FEED (STPH)	MILL H2O (STPH)	WATER RATIO	SPEED (%CRIT)	BALL LOAD (% VOL)	GRS.PWR. (KW)	NET PWR. (KW)	F80 (um)	K80 (um)	NET SP.PR (KWHR/MT)	AUTO WK. INDX	ORE TYPE
1	1116	461	0.40	68.0	6.63	6572	6046	107460	800	5.96	18.45	V. SOFT
2	1184	479	0.40	68.0	6.59	6546	6022	84382	800	5.60	17.53	V. SOFT
3	1447	873	0.58	80.0	8.58	7795	7171	107460	2000	5.45	28.23	SOFT
4	1311	617	0.46	77.0	7.59	8078	7432	118338	800	6.24	19.22	MEDIUM
5	1323	854	0.64	74.0	8.87	7241	6662	124272	1000	5.54	19.24	HARD
6	1291	653	0.51	71.0	9.16	7098	6530	84747	800	5.56	17.43	V. HARD
7	1637	965	0.58	74.0	6.77	8078	7432	115478	1050	4.99	17.89	V. SOFT
8	1255	610	0.46	71.0	8.63	6670	6136	68292	900	5.38	18.23	SOFT
9	1199	579	0.46	71.0	8.65	6778	6236	98005	700	5.72	16.53	SOFT
10	1124	749	0.64	68.0	7.75	7404	6812	88996	600	6.67	17.79	MEDIUM
11	1389	732	0.52	80.0	9.04	7392	6801	182494	1100	5.39	19.37	HARD
12	1268	526	0.40	77.0	9.34	7313	6728	75205	650	5.84	16.41	V. HARD
13	1848	879	0.46	80.0	7.35	8075	7429	107460	1000	4.42	15.48	V. SOFT
14	1410	919	0.64	77.0	8.72	7146	6574	100000	1200	5.13	19.95	SOFT
15	1226	668	0.52	74.0	7.87	7609	7000	75205	750	6.28	19.11	MEDIUM
16	1242	687	0.52	74.0	7.90	7569	6963	75205	800	6.17	19.45	MEDIUM
17	1154	486	0.40	71.0	9.21	7385	6794	107460	800	6.48	20.05	HARD
18	1154	682	0.58	67.9	9.50	6684	6149	95636	700	5.86	16.96	V. HARD
19	1603	1068	0.64	71.0	7.39	7299	6715	121269	1000	4.61	16.03	V. SOFT
20	1117	607	0.51	68.0	8.78	7315	6730	91201	550	6.63	16.85	SOFT
21	1229	511	0.40	80.0	8.03	7846	7218	136654	900	6.46	21.09	MEDIUM
22	1461	871	0.58	77.0	9.36	7971	7333	95636	1000	5.52	19.45	HARD
23	1505	891	0.58	77.0	9.38	7944	7308	82818	1000	5.34	18.98	HARD
24	1334	629	0.46	74.0	9.67	6853	6305	107460	900	5.20	17.17	V. HARD
25	1746	953	0.51	77.0	7.44	7537	6934	107460	1050	4.37	15.71	V. SOFT
26	1222	512	0.40	74.0	8.81	7413	6820	100000	600	6.14	16.30	SOFT
27	1124	683	0.58	71.0	8.19	6921	6367	143507	1000	6.23	21.50	MEDIUM
28	1157	553	0.46	68.0	9.52	6860	6311	115478	800	6.00	18.51	HARD
29	1532	973	0.64	80.0	9.81	8325	7659	136654	1210	5.50	21.12	V. HARD
30	1525	974	0.64	80.0	9.84	8311	7646	66738	1100	5.52	20.99	V. HARD

Table IX.

Lornex C-Circuit: 60cm Circuit Data using Kao

60cm CIRCUIT TEST RESULTS

LORNEX RUNS 1 TO 30

TEST CONDITIONS, MEASURED VARIABLES (ADJUSTED) AND CALCULATED WORK INDICES

RUN NUMBER	FEED RATE (Kg/min)	WATER RATIO	MILL SPD. % CRIT.	BALL CHARGE (% VOL)	F80 (microns)	K80 (microns)	NET PWR DRAWN (WATTS)	NET SP.PW (KWHR/T)	AUTO WORK INDX	ORE TYPE	BOND INDEX (COMP.)
1	0.44	0.40	68.00	6.63	22000	257	201.15	7.62	13.69	V. SOFT	13.1
2	0.47	0.40	68.00	6.59	22243	322	182.52	6.47	13.20	V. SOFT	N/A
3	0.45	0.58	80.00	8.58	21203	350	210.58	7.80	16.74	SOFT	13.7
4	0.45	0.46	77.00	7.59	20919	300	246.19	9.12	17.94	MEDIUM	13.2
5	0.45	0.64	74.00	8.87	23652	309	217.98	8.07	16.02	HARD	13.4
6	0.59	0.51	71.00	9.16	20900	350	223.67	6.32	13.58	V. HARD	14.7
7	0.46	0.58	74.00	6.77	23165	279	213.37	7.73	14.50	V. SOFT	13.4
8	0.59	0.46	71.00	8.63	20000	300	215.05	6.07	11.99	SOFT	12.5
9	0.41	0.46	71.00	8.65	22685	222	211.73	8.61	14.23	SOFT	13.9
10	0.43	0.64	68.00	7.75	22245	222	241.38	9.36	15.49	MEDIUM	13.4
11	0.46	0.52	80.00	9.04	24630	335	180.19	6.53	13.53	HARD	13.8
12	0.50	0.40	77.00	9.34	21335	360	226.06	7.54	16.43	V. HARD	14.0
13	0.54	0.46	80.00	7.35	21785	450	188.66	5.82	14.43	V. SOFT	11.9
14	0.44	0.64	77.00	8.72	21785	335	203.38	7.70	16.10	SOFT	12.9
15	0.45	0.52	74.00	7.87	22000	275	212.68	7.88	14.71	MEDIUM	13.4
16	0.46	0.52	74.00	7.90	23650	280	238.48	8.64	16.22	MEDIUM	14.4
17	0.52	0.40	71.00	9.21	23650	260	242.90	7.79	14.02	HARD	14.0
18	0.52	0.58	67.90	9.50	23650	345	214.10	6.86	14.50	V. HARD	13.7
19	0.65	0.64	71.00	7.39	22245	370	208.42	5.34	11.80	V. SOFT	12.0
20	0.51	0.51	68.00	8.78	23650	240	239.26	7.82	13.47	SOFT	13.5
21	0.32	0.40	80.00	8.03	23650	322	178.70	9.31	18.91	MEDIUM	14.3
22	0.54	0.58	77.00	9.36	22245	380	219.10	6.76	15.16	HARD	13.4
23	0.50	0.58	77.00	9.38	23650	370	234.69	7.82	17.20	HARD	13.9
24	0.49	0.46	74.00	9.67	21785	380	198.16	6.74	15.14	V. HARD	14.3
25	0.58	0.51	77.00	7.44	22245	470	178.83	5.14	13.04	V. SOFT	12.3
26	0.47	0.40	74.00	8.81	23650	275	249.31	8.84	16.43	SOFT	13.7
27	0.33	0.58	71.00	8.19	24150	220	192.95	9.74	15.98	MEDIUM	15.9
28	0.50	0.46	68.00	9.52	23165	275	244.55	8.15	15.17	HARD	14.5
29	0.49	0.64	80.00	9.81	22865	360	236.98	8.06	17.49	V. HARD	14.2
30	0.52	0.64	80.00	9.84	20485	360	243.70	7.81	17.09	V. HARD	14.5

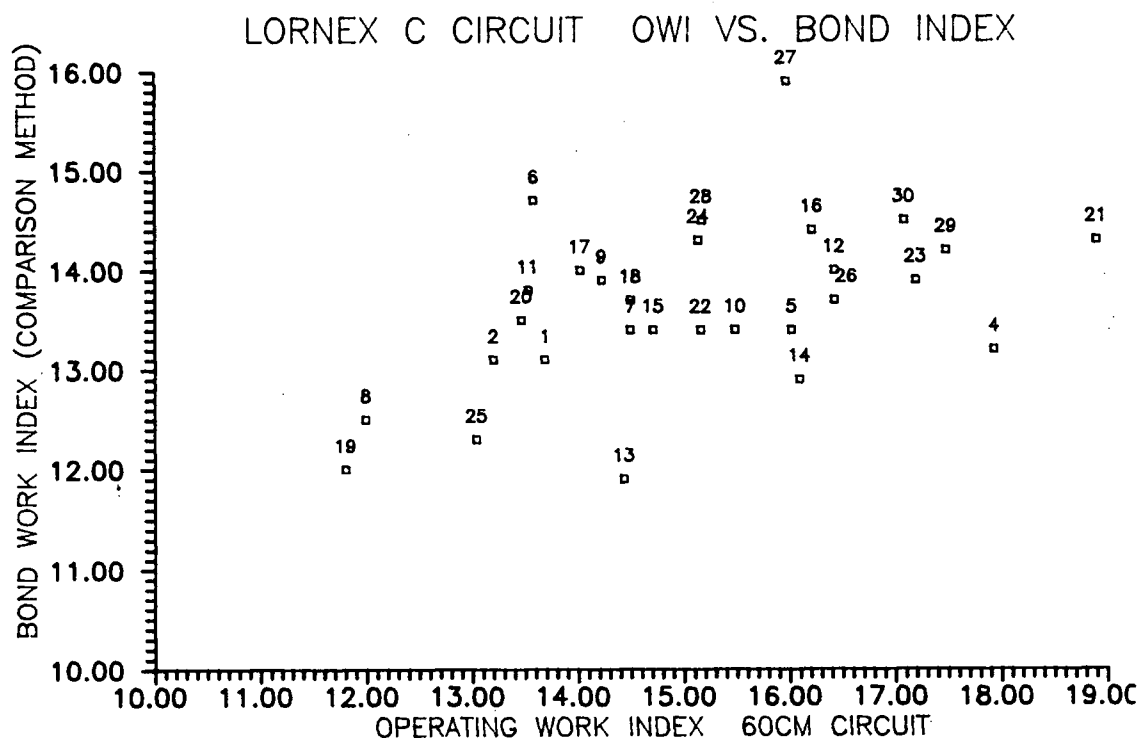


Figure 23. Comparison of Autogenous Work Indices with Bond Work Indices.

of conditions under which the tests were conducted. For the Full-Scale runs, Mill Speed, Water Ratio, and Mill Load Setpoint (Lift Pressure) were the manipulated variables. The ball charge changed from run to run and was estimated using a ball wear relationship developed by Lornex with corrections made as a result of grindouts.

For the 60cm circuit runs, the full scale conditions were simulated as closely as possible for each run. However, the effect of a change in manipulated variable may not be the same in the 60cm mill as in the full scale mill. For instance, Digre (1979) reports that the influence of mill filling on

power draw and capacity in a 0.8m diameter mill is far less than in a full scale mill. On the other hand, water ratio may have a much more significant effect in a small mill than in a large mill because of the difference in mill inventory. There is also a differential flow of water and solids through the mill as reported by Rowland and Kjos (1975) and confirmed by Rogovin and Herbst (1985). This is likely to have a greater effect on the small mill than on a full scale mill. Analysis of the charge in the 60cm mill has consistently given higher pulp densities than the mill discharge, confirming the findings of Rogovin and Herbst.

In addition, changing parameters such as mill speed and fractional filling may change the relative proportions of impact, chipping and abrasion occurring in mills of different sizes. As demonstrated by Crabtree et al (1964), the size modulus of the comminution products changes depending on the proportion of impact, chipping and abrasion present in the mill.

Consequently, for the purposes of examining scale up relationships, the Lornex data is not ideal in that the influence of the various factors cannot be examined individually.

3.3. AFTON DATA

Four runs of Afton data were analysed, two on a hard ore type (runs 1 and 2), and two on a soft ore type (runs 8 and 9). The data was firstly adjusted using the Bilmat program (see Appendix VI). The adjusted size distributions were plotted and K_{80} values determined. Using these values and the 80% passing size of the feed, the autogenous work indices (AWI) were calculated.

A comparison of the full scale and 60cm circuit results is as follows:

60cm Circuit				Full-Scale Circuit			
Run Number	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI	
AFT-1	180	15.45	22.42	500	9.92	23.56	
AFT-2	154	16.00	21.47	500	10.35	24.66	
AFT-8	500	6.73	17.56	1240	4.29	17.58	
AFT-9	700	6.31	19.97	1617	4.04	20.50	

In each case, the net specific power for the small circuit is approximately 55% greater than for the full-scale circuit. The grind however, is much finer in the small circuit which results in the Work Indices being reasonably close.

Analysis of the mill charge showed no evidence of a build up

of a hard fraction in the 60cm mill.

3.4. Island Copper Mines.

Four runs were conducted on the Island Copper full scale circuit- two in closed circuit and two in open circuit. Five runs (one repeat) were conducted in the 60cm circuit, all under standard conditions. The data from both sets of runs was adjusted and the size distributions plotted (see Appendix VII). The K_{80} values were determined and work indices calculated.

A comparison of results is as follows

Run Number	60cm Circuit			Full-Scale Circuit		
	K_{80} (μ m)	Net Sp.Pwr. (KWhr/Tonne)	AWI	K_{80} (μ m)	Net Sp.Pwr. (KWhr/Tonne)	AWI
ICM-4	160	18.47	25.28	169	15.42	20.74
ICM-5	270	13.50	24.82	200	14.16	21.75
ICM-6	250	14.51	25.17	200	13.72	20.45
ICM-6B	200	17.94	27.85			
ICM-7	400	13.20	30.60	190	13.92	20.41

These results are interesting in that although the feed sizes to the two circuits are quite different, the product sizes and net specific powers are reasonable close. The work index obtained for the full scale runs is very consistent at approximately 20.5. For the 60cm runs, there is more of a

spread in the data but a figure of 25-27 would seem reasonable. This indicates that the small circuit is grinding less efficiently than the full scale mill. The size distribution plots of the products also indicate that more abrasion grinding is occurring in the small mill than in the full scale mill, as would be expected.

3.5. Similco

The two tests conducted on the Similco Full-Scale circuits were under less than ideal conditions, as the feed to the plant had been quite variable during the day. The runs in the small circuit were under standard conditions. The data was adjusted using BILMAT and the size distributions plotted (see Appendix VIII). Using the K_{80} and F_{80} values, the autogenous work indices were calculated. The results are as follows

<u>60cm Circuit</u>				<u>Full-Scale Circuit</u>			
Run Number	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI	
SMK-1	125	24.53	29.20	500	15.04	36.08	
SMK-2	85	32.34	31.53	500	13.96	33.14	

The very fine grind obtained in the 60cm circuit is indicative of the predominance of abrasion in the mill, with little or no impact occurring

Analysis of the mill contents after the run indicated the following size distributions

Run SMK-1		
	<u>Fresh Feed</u>	<u>Mill Contents</u>
+37.5mm	12.16%	4.55%
+26.5mm/-37.5mm	19.71%	27.34%
+19.0mm/-26.5mm	15.17%	21.69%
+13.2mm/-19.0mm	9.88%	18.64%
Total	56.82%	72.21%

RUN SMK-3		
	<u>Fresh Feed</u>	<u>Mill Contents</u>
+37.5mm	2.10%	3.41%
+26.5mm/-37.5mm	27.60%	27.67%
+19.0mm/-26.5mm	12.88%	25.03%
+13.2mm/-19.0mm	11.13	12.76%
Total	53.71%	68.87%

Obviously there is a build up of a hard fraction of +13.2mm size. There is simply not enough impact in the small mill to reduce these hard pieces. Energy is being wasted tumbling this material, accounting for the high net specific power.

The results from the small circuit indicate that this is a hard ore, - the hardest of all those processed, consistent with the full scale circuit performance and also the data reported by MacPherson (1977). Results also indicate that a

problem is likely with a build up of a critical size. This may be alleviated by going to a higher ball charge and larger diameter make-up balls. or by using a crusher in the circuit, as is done at Similco.

3.6. Highland Valley Copper.

Two runs were conducted at Highland Valley Copper in 1987, one on the larger C-Circuit, and the other on A-Circuit. The samples were processed in the small circuit under standard conditions. The data were adjusted, size distributions plotted (see Appendix IX), and autogenous work indices calculated. The results are as follows:

60cm Circuit				Full-Scale Circuit		
Run Number	K ₈₀ (μ m)	Net Sp.Pwr. (KWhr/Tonne)	AWI	K ₈₀ (μ m)	Net.Sp.Pwr. (KWhr/Tonne)	AWI
HVC-A1	250	13.25	23.03	650	5.47	15.05
HVC-A2	280	6.84	12.75			
HVC-C	232	11.79	19.85	800	5.15	15.82

The results from the 60cm runs on these ore samples are not consistent with each other. Only run HVC-A2 is reasonably consistent with the data obtained for the Lornex runs previously discussed.

Examination of the data from run HVC-A1 indicates that the

mill speed was not maintained at the proper setting of 78% critical (42 RPM) but rather fell to 66% (35.67 RPM). This may have resulted in poor cascading of the charge, poor mixing, and a charge that would tend to remain near the bottom of the mill resulting in higher power consumption than normal.

There was some evidence of a build up of +13mm material particularly for Run HVC-A1 and this may be due to the poor cascading and low impact action because of the low speed. The percent solids of the mill contents was also quite high at 89% resulting in a fairly sticky charge.

For run HVC-C, the speed was also below setpoint, in this case 38 RPM corresponding to 70% of critical. For this run, there was less of a problem with build-up of the +13mm fraction in the mill and the Net Specific Power was lower.

The data from the full-scale runs is consistent with the previous Lornex data. Further tests on this ore in the 60cm circuit are required to establish consistent, repeatable results.

3.7. Echo Bay Mines, Juneau Project

Three tests were run in the 60cm circuit on the Echo Bay Juneau ore, one on each of the ore types and a third on a 50/50 blend. The data from the 60cm runs were adjusted, size

distributions plotted, and F_{80} and K_{80} values determined (see Appendix X). Using these values and the net specific power, autogenous work indices were determined.

Data from pilot plant tests conducted on these ore types by Lakefield Research (1988) were made available by Echo Bay Mines Ltd. A total of 18 tests were carried out under varying conditions of ball charge, ball size, classification size and pebble crushing. Only one test was conducted on the slate ore in semi-autogenous mode (# SAG11). The ball charge used was 8%, consisting of 3", 4", and 5" balls. The closing screen size used was 4 mesh. These conditions are similar to those used in the 60cm mill. For comparison purposes, data from two other tests were employed (SAG 9 on Gabbro and SAG 12 on Blend) because they were conducted under the same conditions as for SAG 11.

The autogenous work indices reported by Lakefield were determined using the P_{80} values from the screen underflow.

The results from SAG 9, SAG 11, and SAG 12 are as follows:

Run Number	F_{80} (μm)	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI
SAG 11 (Slate)	100000	1786	7.91	38.6
SAG 9 (Gabbro)	100000	1712	11.08	52.7
SAG 12 (50/50 Blend)	100000	1812	10.22	50.3

The screen underflow size distributions were plotted and the K_{80} values determined. The Work Indices were re-calculated using these values, and are shown below.

60cm Circuit				PILOT PLANT		
Ore Type	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI	K_{80} (μm)	Net Sp.Pwr. (KWhr/Tonne)	AWI
Slate	250	8.79	15.40	600	7.91	21.40
Gabbro	343	11.87	24.45	500	11.08	26.60
Blend (50/50)	181	13.99	20.25	450	10.22	23.23

It is interesting to note that for the Slate and Gabbro tests individually, the net specific powers are within 10% of each other for full scale and 60cm circuits. However, for the 50/50 blend, the 60cm mill NSP is 35% greater than for the pilot plant. The grind is also much finer.

In both cases, the work indices for the 50/50 blend lie between the softer shale and the harder gabbro values. The Bond Work Indices (metric) were found to be 12.0 for the Gabbro and 10.8 for the Slate.

Analysis of the mill contents after each of the three 60cm runs indicated a build-up of +13mm material similar to that

occurring on the Similco ore. Lakefield Research conducted tests including crushing of pebbles of different sizes and found that throughput increased and Net Specific Power decreased. A coarser grind was obtained, but this was desirable for intermediate gravity separation. Plant design is now proceeding on this basis. Secondary crushing will be carried out in a pebble mill.

3.8. Discussion of Results.

Tables X and XI summarize the data obtained from tests other than the Lornex thirty runs. Figure 24 shows the Work Indices for the 60cm Circuit versus those from the Full Scale Circuits.

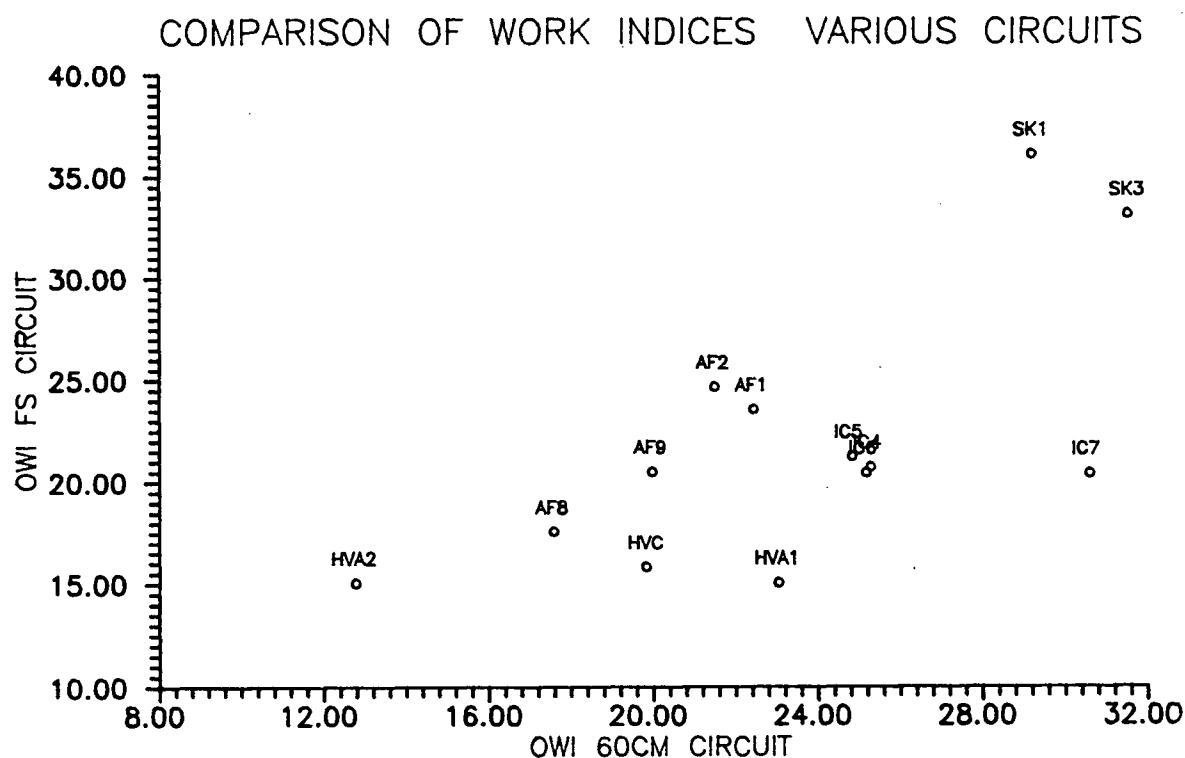


Figure 24. Comparison of Autogenous Work Indices.

TABLE X. Full Scale Data: Various Ore Types

SUMMARY OF OPERATING DAT(ADJUSTED)

HIGHLAND VALLEY COPPER A&C CIRCUITS
 SIMILKAMEEN #1 & #3 CIRCUITS
 AFTON MINES
 ISLAND COPPER #4 CIRCUIT

CIRCUIT	FEED MILL (MTPH)	H2O WATER (MTPH)	RATIO	MILL SPD (%CRIT.)	GRS.PWR (KW)	NET PWR (KW)	F80 (um)	K80 (um)	NET SP.PR (KWHR/MT)	AUTO WK.INDX	AWI 60CM MILL
HVC-A	1129	488	0.40	73.2	6707	6170	118338	650	5.47	15.05	23.03
HVC-C	1781	869	0.53	79.1	9972	9174	127167	800	5.15	15.82	19.81
SMK-1	361	125	0.40	76.3	5900	5428	107460	500	15.04	36.08	29.20
SMK-3	392	123	0.30	76.3	5950	5474	150487	500	13.96	33.14	31.53
AFT-1	306	122	0.4	78	3300	3036	146850	500	9.92	23.56	22.42
AFT-2	306	122	0.4	78	3443	3168	133544	500	10.35	24.66	21.47
AFT-8	521	291	0.56	67	2428	2234	62104	1240	4.29	17.58	17.56
AFT-9	516	278	0.54	67	2265	2084	37475	1617	4.04	20.50	19.97
IC-4	278	135	0.45	72	4660	4287	150487	169	15.42	20.74	25.28
IC-5	291	140	0.45	72	4478	4120	60000	200	14.16	21.25	24.82
IC-6	369	188	0.48	72	5502	5062	75205	200	13.72	20.45	25.17
IC-7	373	179	0.45	72	5642	5191	52481	190	13.92	20.41	30.60

TABLE XI: 60cm Data: Various Ore Types

60cm CIRCUIT TEST RESULTS

HIGHLAND VALLEY COPPER A & C CIRCUITS
 SIMILKAMEEN #1 & #3 CIRCUITS
 AFTON MINES RUNS #1,2,8,9
 ISLAND COPPER MINES 4,5,6,6B,7
 EBM JUNEAU PR RUNS 1,2,3

CIRCUIT	FEED RATE (Kg/min)	F80 (μ m)	K80 (μ m)	GROSS TORQUE (Nm)	TARE TORQUE (Nm)	MILL SPEED (RPM)	NET PWR DRAWN (WATTS)	NET SP.PW (KWHR/T)	AUT WORK INDEX 60CM	AUT WORK INDEX FULLSCALE
HVC-A1	0.31	30672	250	72.69	6.71	35.67	246.46	13.25	23.03	15.05
HVC-A2	0.48	26955	280	52.90	5.62	39.80	197.06	6.84	12.75	15.05
HVC-C	0.36	26589	232	68.00	4.00	38.00	254.68	11.79	19.81	15.82
SMK-1	0.16	33901	125	61.30	8.60	42.67	235.48	24.53	29.20	36.08
SMK-3	0.13	28855	85	71.10	7.70	38.00	252.29	32.34	31.53	33.14
AFT-1	0.29	31933	180	64.74	4.79	42.83	268.88	15.45	22.42	23.56
AFT-2	0.27	27147	154	62.12	3.60	42.30	259.22	16.00	21.47	24.66
AFT-8	0.61	24500	500	58.80	3.60	42.62	246.37	6.73	17.56	17.58
AFT-9	0.63	26043	700	57.66	3.60	42.13	238.50	6.31	19.97	20.50
ICM-4	0.22	27682	160	60.60	3.60	40.84	243.78	18.47	25.28	20.74
ICM-5	0.31	24027	270	62.51	4.79	41.55	251.15	13.50	24.82	21.25
ICM-6	0.30	31933	250	64.52	4.41	41.50	261.23	14.51	25.17	20.45
ICM-6B	0.23	25211	200	64.30	6.65	41.00	247.52	17.94	27.85	20.45
ICM-7	0.35	21239	400	67.35	4.79	42.31	277.18	13.20	30.60	20.41
EBM-1	0.47	26257	250	64.3	7.25	41.5	247.93	8.79	15.40	21.40
EBM-2	0.35	33630	343	63.3	5.96	41.5	249.19	11.87	24.45	26.60
EBM-3	0.30	36478	181	62.2	5.62	42.5	251.81	13.99	20.25	23.23

NOTE: EBM FULL-SCALE DATA IS FOR 2m PILOT PLANT

As discussed, data points for HVC and HVA1 are questionable and not consistent with the data obtained from the Lornex ore which is essentially the same. Considering the other data points, there is a general trend from soft to hard ore types. While the relationship could not be termed linear based on the data presented, there does seem to be good potential to further develop the method. Additional tests on the ores already processed under different conditions, would help to determine the repeatability of the data.

3.8.1. Energy-Size Reduction Relationships.

Figure 25 shows the relationship between net specific power

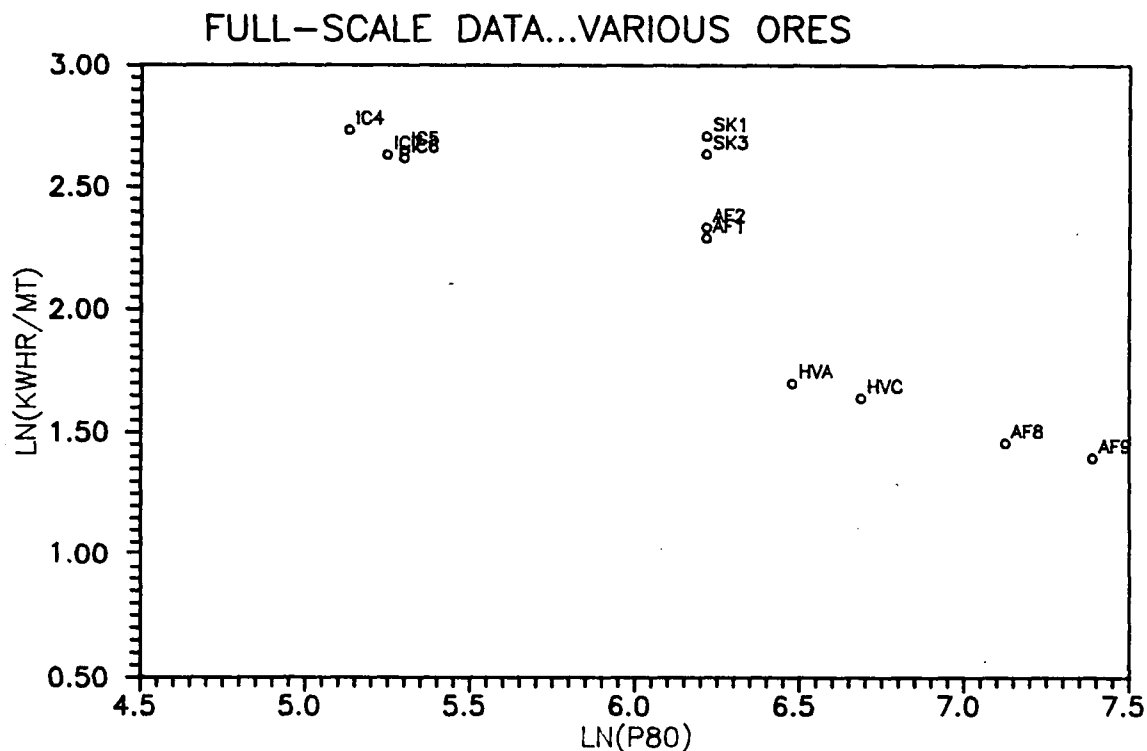


Figure 25. Energy-Size Reduction Relationship: Various Ores

and K_{80} for the full scale circuits, while Figure 26 is a similar plot for the corresponding 60cm circuit runs. It may be seen that the data points lie along approximately parallel lines. The separation between the lines is a measure of the difference in grindabilities.

The Island Copper data was found to exhibit the greatest spread in product size. Figures 27 and 28 show the relationship between Net Specific Power and K_{80} for the Island Copper Full Scale and 60cm runs respectively.

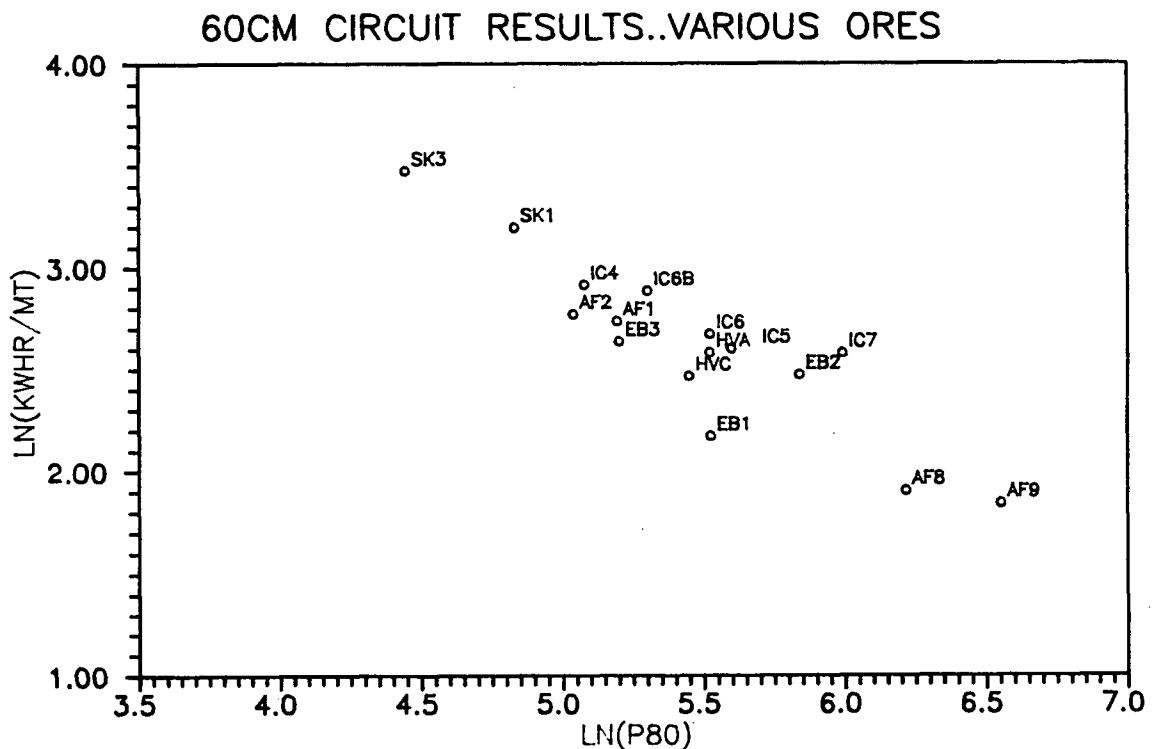


Figure 26. Energy-Size Reduction Relationship in 60cm Mill Various Ores.

Fitting the equation (Charles, 1957)

$$W = AK^{-\beta}$$

where W is the Net Specific Power

K is the size modulus, and

A and β are constants

to the above data, a β value of 0.6 is obtained for the full scale data while a value of 0.41 is obtained for the 60cm data.

According to Kinasevich et al (1964), a value of $\beta = 1$ represents comminution by impact only. In a tumbling mill

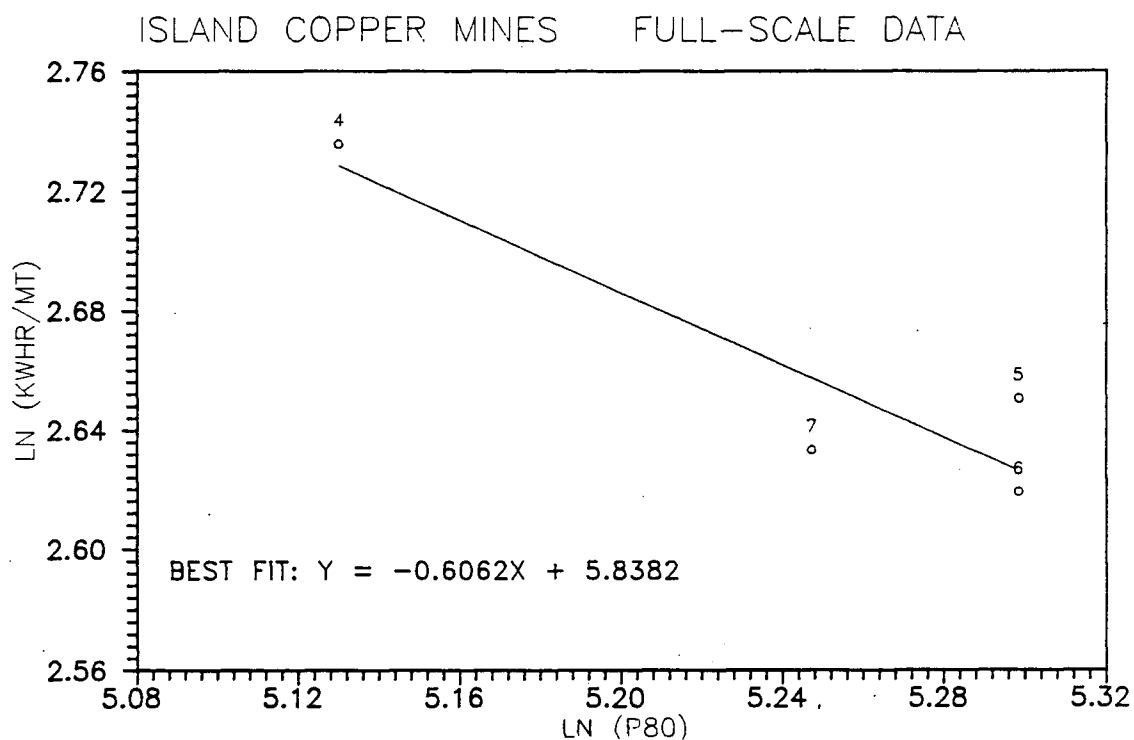


Figure 27 Energy-Size Reduction Relationship: Island Copper

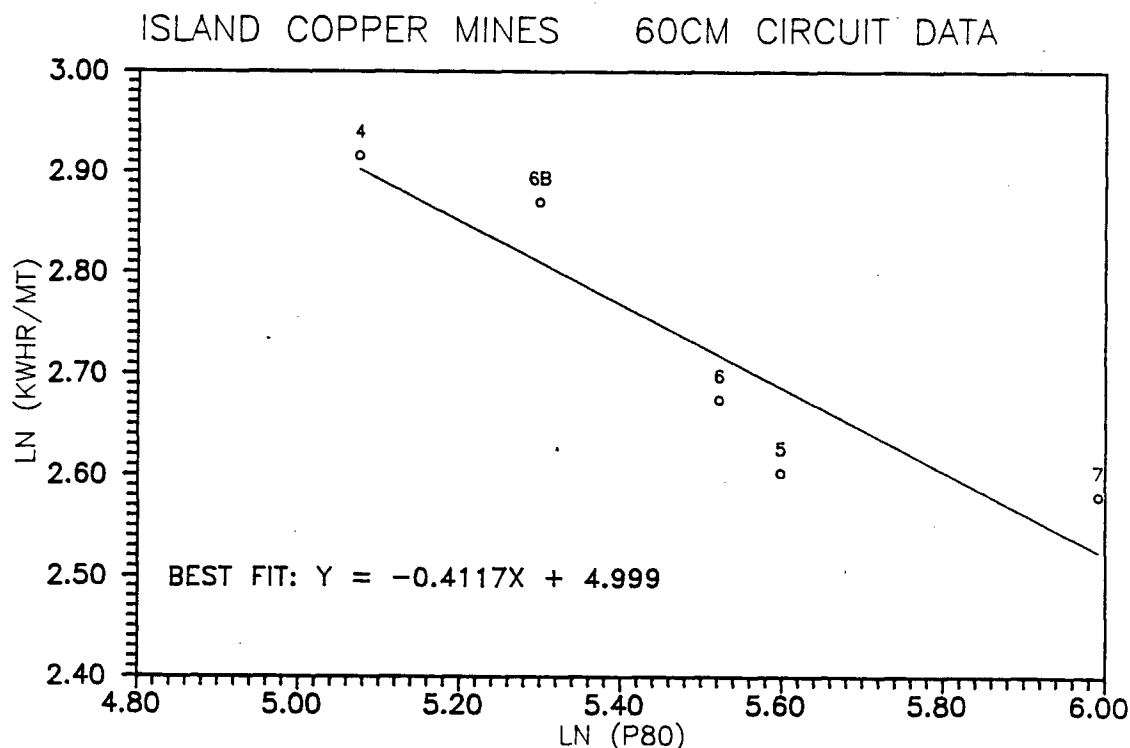


Figure 28. Energy-Size Reduction Relationship: 60cm Mill, Island Copper Ore.

where size reduction occurs as a result of impact, abrasion and chipping action, the value of β is reduced depending on the relative contributions from each of the comminution processes.

The values of β obtained above indicate that a greater amount of abrasion is occurring in the small mill. This is to be expected as the impact forces in a large mill are much more significant than in a small mill.

Agar and Somasundaran (1973) have demonstrated that this

quantity β is the same as the value α in the Schuhmann size distribution equation

$$y = (x/K)^\alpha$$

where y is the cumulative fraction finer than size x

K is the size modulus

α is the distribution modulus.

Analysis of the Island Copper size distribution, (see Appendix VII), indicates the following

	α (F.S.)	α (60cm)
ICM-4	0.69	0.50
ICM-5	0.61	0.47
ICM-6	0.54	0.57
ICM-7	0.66	0.46

(F.S.= Full Scale)

which is in fair agreement with the Energy-Size Reduction plots discussed above.

Using this Energy-Size Reduction relationship, the net specific power may be determined for different product sizes. Sufficient data is not available to determine if there is a consistent relationship between α values for small-scale and full-scale circuits processing the same ore. If this can be established, then the net specific power required in a full-scale mill could be predicted for the required product

size. Tests conducted with different % ball charges would identify the optimum ball charge required.

CHAPTER IV.

SUMMARY AND CONCLUSIONS

4.1. Lornex Data.

The thirty Lornex runs were conducted under widely varying conditions. Reasonable correlation was obtained between work indices for full scale and 60cm circuits. However, the data points displayed a considerable amount of scatter. It is believed that variation in parameters such as mill speed, water ratio, and mill filling affect the operation of the two mills differently, and that this accounts for the scatter. Work done by Digre (1979) in a 0.8m diameter mill supports this view.

Regression analysis on the full scale and small scale data did not yield any consistent relationship between power draw or product size and the manipulated variables, mill speed, water ratio and volume filling.

The net specific power for the 60cm mill was found to be 30% higher than for the full scale mill on average. Similar results have been found by Digre (1979) using a 0.8m diameter mill. A possible explanation for this is the fact that impact forces developed in the small mill are lower, and in fact

energy is wasted in tumbling material which does not develop sufficient potential energy to result in breakage.

4.2. Other Data

For the other ore types tested, i.e. Island Copper, Similco, Afton and Echo Bay Juneau, a set of standard conditions was used for the 60cm Mill. The Afton and Island Copper runs gave good correlation between autogenous work indices calculated using K_{80} values. For the Similco ore, it was found that a hard fraction had built up in the mill by the end of the run, indicating that impact forces in the mill were too low to break this hard material. A similar situation exists in the full-scale circuit and steps have been taken to deal with this problem. Material from Echo Bay Juneau gave good agreement between small-scale and pilot plant results and also identified the likelihood of a build-up of a critical size.

4.3. Scale-up from Results.

Results from the 60cm tests indicate that the method is capable of categorizing ore types as to their relative grindabilities. Problems with build-up of hard fractions were also identified by examining the mill contents after each run. Comparison of work indices, based on K_{80} values obtained by extrapolating the fines portion of the product size distributions, are reasonable. Net specific powers obtained in the 60cm mill are generally higher than full scale values

by 30-50%, but the grind obtained is finer. Where the grind from full scale and small scale mills are similar, the net specific power values have been found to be close.

Correlation between the energy-size reduction relationships appears to be worth exploring further. This technique is used by Kobe Steel in Japan to determine the net specific power at the desired grind. In their case, a number of tests are conducted at different product sizes. The energy-size reduction curve is then drawn, and the net specific power determined at the required product size. In the case of the 60cm mill, a correction would be required before using this value for scale-up.

4.4. Future Work

The existing control hardware for the 60cm circuit is in need of updating. A PC-based control system capable of data logging, trending, and manipulation is envisaged. The ability to experiment with different types of control (e.g. Expert Control) would also be possible with such a system.

Operation of the mill in open circuit or closed with various screen sizes has not been attempted to date. This would provide several points on the energy-size reduction curve, and enable the α values to be more accurately determined.

Addition of a secondary ball mill to the circuit would allow

estimation of overall power requirements for a two-stage circuit and the optimum power split between primary and secondary mills.

4.5. Conclusions

Based on the testwork carried out to date, the following general conclusions may be drawn:

1. The 60cm circuit does give reasonable correlation with results from full scale operating copper mines in British Columbia.
2. Net specific power values from the 60cm mill are higher than in full scale mills. This is believed to be due to differences in grinding efficiencies arising from differences in scale.
3. The 60cm mill is capable of identifying potential for critical size build up in a mill.
4. Energy-size reduction plots of data from the 60cm mill are in agreement with the findings of other researchers and can be used to determine the net specific power requirements of full scale mills.
5. Further experimentation with different ores and different circuit configuration will help to further define the grinding characteristics of the 60cm mill.

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APPENDIX I

DETERMINATION OF MASS LOAD SETPOINT FOR 60cm MILL.

The 60cm mill assembly is supported by a Load Cell which transmits a signal proportional to the weight of the mill plus contents.

The control strategy is to maintain a fixed volumetric loading in the mill which is expressed as a percentage of the total mill volume. For the 30 Lornex runs the volumetric loading in the small mill was varied to correspond to the loading in the full scale mill for each run.

For subsequent tests, a set of standard conditions was established. These include

- Water Ratio of 0.60 (60%).
- Volumetric loading of 30%
- Mill Speed equal to 78% Critical (42 RPM)
- Ball Charge equivalent to 9.9% by Volume

To determine the mill load setpoint the following algorithm was used. Consider the total charge in the mill. It is made up of steel balls, ore and water. The ore and water form a slurry which fills the interstices between the balls.

The Weight transmitted to the load cell is given by

$$W_t = W_m + W_c$$

Where W_m = Weight of Mill

W_c = Weight of Charge, (Balls + Ore + Water)

$$\text{Now } W_c = W_b + W_o + W_w$$

Where W_b = Weight of Steel Ball

W_o = Weight of Ore

W_w = Weight of Water

The water ratio K is maintained constant during a run, and is given by

$$K = \frac{W_w}{W_o} = \frac{\rho_w \cdot V_w}{\rho_o \cdot V_o}$$

$$\text{Therefore } W_c = W_b + W_o + kW_o$$

$$= W_b + (1+K)W_o$$

The volume of the charge is given by

$$V_c = V_b + V_o + V_w$$

$$= \frac{W_b}{\rho_b} + \frac{W_o}{\rho_o} + KW_o$$

$$= \frac{W_b}{\rho_b} + \left(\frac{1}{\rho_o} + K \right) W_o \dots\dots\dots 1$$

For a 30% Volumetric Loading

$$V_c = 0.3 V_m$$

$$\text{Therefore } W_o = \frac{0.3V_m - W_b/\rho_b}{(1/\rho_o + K)} \quad 2.$$

The Total charge weight is then

$$\begin{aligned} W_c &= W_b + (1 + K) W_o \\ &= W_b + \frac{(1+K)[0.3V_m - W_b/\rho_b]}{(1/\rho_o + K)} \\ &= W_b - \frac{(1+K)\rho_o W_b}{(1+K\rho_o)\rho_b} + \frac{(1+K)\rho_o(0.3V_m)}{(1+K\rho_o)} \end{aligned}$$

$$W_c = \frac{\rho_b - \rho_o + (\rho_b - 1)\rho_o K}{\rho_b + K\rho_b\rho_o} W_b + \frac{(1+K)\rho_o(0.3V_m)}{(1 + K\rho_o)} \quad 3.$$

For porphyry ores in B.C. $\rho_o \cong 2.8 \text{ g/cm}^3$

$$\rho_b \cong 7.71 \text{ g/cm}^3$$

The mill volume $V_m = 64310 \text{ cm}^3$

$$\text{giving } 0.3V_m = 19293 \text{ cm}^3$$

Substituting these values into Equation 3. gives

$$W_c = \frac{4.91 + 18.79K}{7.71 + 21.59K} W_b + \frac{54020(1+K)}{(1 + 2.8K)}$$

Where W_c = total charge weight (g)

W_b = ball weight (g)

This relationship was used to determine the total charge weight for the 30 Lornex runs under the various conditions of W_b and K .

Under Standard Conditions, $K = 0.6$ and

$$W_b = 29.6 \text{ Kg}$$

$$= 296000\text{g}$$

which gives

$$W_c = 55.433\text{Kg}$$

The setpoint provided to the mill control program is calculated from the calibration relationship for mill weight, which is

$$W_{sp} = 11.85 (W_c) + W_m$$

Where W_{sp} = Mill Load setpoint (A/D Units)

W_c = Required Charge Weight (Kg)

W_m = Empty mill Weight (A/D Units)

APPENDIX II.

LORNEX C-CIRCUIT: ADJUSTED FULL-SCALE DATA

MASS BALANCE OF LORNEX C-CIRCUIT RUN #1

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	11.53	11.39	1.22	5.00	.00	.23	100.00	.00
MILL DISCH.	.00	18.64	100.00	.00	.00	5.40	100.00	.00
SCREEN FEED	.00	22.92	100.00	.00	.00	9.68	100.00	.00
SCR OVERSIZE	.00	2.61	100.00	.00	.00	.53	100.00	.00
SCR U/FLOW	.00	20.31	100.00	.00	.00	9.15	100.00	.00
MILL WATER	.00	4.64	100.00	.00	4.61	4.64	.60	5.00
PBOX WATER	.00	4.28	100.00	.00	3.75	4.28	14.18	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.16	100.00	.00	98.91	97.97	.95	3.00
MILL DISCH.	.00	13.24	100.00	.00	72.40	71.03	1.89	5.00
SCREEN FEED	.00	13.24	100.00	.00	57.10	57.76	1.15	4.00
SCR OVERSIZE	.00	2.08	100.00	.00	79.45	79.69	.30	10.00
SCR U/FLOW	.00	11.16	100.00	.00	53.10	54.94	3.47	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.20	100.00	10.00	.00	1.27	100.00	10.00
26500	.00	.91	100.00	10.00	5.77	5.77	.07	10.00
19000	2.37	2.33	1.88	10.00	14.52	14.81	1.99	10.00
13200	2.98	3.13	5.18	10.00	20.86	19.75	5.43	10.00
9500	3.10	2.97	4.27	10.00	16.85	17.50	3.87	10.00
6700	3.12	3.86	23.61	10.00	9.95	8.79	11.70	10.00
4750	3.05	3.04	.17	10.00	6.17	6.18	.13	10.00
3350	3.23	2.95	8.64	10.00	3.20	3.24	1.39	10.00
2360	3.76	3.43	8.68	10.00	2.18	2.20	.82	10.00
1700	3.62	3.40	6.11	10.00	1.29	1.29	.36	10.00
1180	4.33	4.29	.90	10.00	1.17	1.17	.05	10.00
850	4.68	4.88	4.35	10.00	1.04	1.04	.14	10.00
600	6.44	5.49	14.71	10.00	1.25	1.26	.46	10.00
425	5.96	5.82	2.40	10.00	1.18	1.18	.09	10.00
300	6.70	6.81	1.59	10.00	1.45	1.45	.04	10.00
212	5.52	5.75	4.19	10.00	1.29	1.29	.14	10.00
150	5.23	5.59	6.90	10.00	1.43	1.43	.28	10.00
106	4.32	4.66	7.81	10.00	1.26	1.26	.34	10.00
75	3.90	4.24	8.76	10.00	1.21	1.21	.41	10.00
53	3.83	4.23	10.45	10.00	1.22	1.21	.51	10.00
38	2.74	3.02	10.05	10.00	.82	.82	.46	10.00
-38	21.12	19.00	10.02	10.00	5.87	5.90	.51	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					11.95
107000					8.23
75000					4.78
53000					11.42
37500	.00	.00	100.00	.00	7.57
26500	.00	.00	100.00	.00	7.88
19000	.00	.00	100.00	.00	4.51
13200	.04	.04	.01	5.00	4.61
9500	.26	.26	.08	5.00	4.28
6700	3.09	2.94	4.90	5.00	4.14
4750	2.46	2.46	.05	5.00	3.79
3350	2.85	2.90	1.63	5.00	3.07
2360	3.60	3.66	1.78	5.00	3.14
1700	3.74	3.79	1.36	5.00	2.60
1180	4.86	4.87	.25	5.00	2.12
850	5.66	5.60	1.06	5.00	2.69
600	6.10	6.28	2.98	5.00	2.10
425	6.64	6.68	.62	5.00	1.76
300	7.83	7.80	.33	5.00	1.59
212	6.65	6.58	1.01	5.00	0.76
150	6.48	6.37	1.75	5.00	0.94
106	5.40	5.29	2.02	5.00	0.80
75	4.92	4.81	2.29	5.00	0.73
53	4.93	4.79	2.80	5.00	0.70
38	3.52	3.43	2.69	5.00	0.59
-38	20.97	21.44	2.26	5.00	3.26

MASS BALANCE OF LORNEC C-CIRCUIT RUN #2

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.04	12.07	.29	5.00	.00	.23	100.00	.00
MILL DISCH.	.00	18.40	100.00	.00	.00	5.31	100.00	.00
SCREEN FEED	.00	22.83	100.00	.00	.00	9.75	100.00	.00
SCR OVERSIZE	.00	1.54	100.00	.00	.00	.30	100.00	.00
SCR U/FLOW	.00	21.29	100.00	.00	.00	9.45	100.00	.00
MILL WATER	.00	4.78	100.00	.00	4.79	4.78	.17	5.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.84	100.00	.00	97.81	98.07	.26	3.00
MILL DISCH.	.00	13.09	100.00	.00	72.40	71.12	1.76	5.00
SCREEN FEED	.00	13.09	100.00	.00	57.80	57.32	.83	4.00
SCR OVERSIZE	.00	1.25	100.00	.00	79.90	80.69	.99	10.00
SCR U/FLOW	.00	11.84	100.00	.00	54.15	55.62	2.72	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.41	.48	16.27	10.00	6.70	5.01	25.26	10.00
19000	1.28	1.29	.74	10.00	12.20	12.13	.58	10.00
13200	2.34	2.25	4.03	10.00	20.31	21.02	3.49	10.00
9500	2.93	2.74	6.64	10.00	15.54	16.08	3.48	10.00
6700	3.34	2.95	11.78	10.00	10.61	11.00	3.65	10.00
4750	3.42	3.14	8.05	10.00	5.94	6.02	1.38	10.00
3350	3.71	3.09	16.78	10.00	3.29	3.34	1.44	10.00
2360	4.25	3.66	13.90	10.00	2.42	2.44	.77	10.00
1700	3.96	3.17	19.98	10.00	1.52	1.53	.74	10.00
1130	4.22	4.74	12.30	10.00	1.54	1.53	.42	10.00
850	4.89	4.68	4.38	10.00	1.19	1.19	.11	10.00
600	6.54	6.50	.54	10.00	1.48	1.48	.02	10.00
425	5.92	5.84	1.38	10.00	1.33	1.33	.04	10.00
300	6.95	6.36	8.52	10.00	1.55	1.55	.19	10.00
212	5.81	5.90	1.63	10.00	1.41	1.41	.03	10.00
150	5.85	5.73	2.03	10.00	1.48	1.48	.06	10.00
106	4.69	5.10	8.67	10.00	1.35	1.35	.23	10.00
75	4.29	4.72	9.97	10.00	1.33	1.33	.28	10.00
53	4.38	3.42	22.03	10.00	1.43	1.44	.70	10.00
38	3.14	4.35	38.51	10.00	1.02	1.01	1.18	10.00
-38	17.66	19.90	12.66	10.00	6.33	6.31	.38	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					5.79
107000					6.10
75000					11.67
53000					12.86
37500	.00	.00	100.00	.00	1.11
26500	.00	.00	100.00	.00	6.32
19000	.00	.15	100.00	5.00	5.52
13200	.27	.27	.14	5.00	5.18
9500	1.32	1.33	.85	5.00	4.39
6700	2.06	2.10	1.92	5.00	3.40
4750	2.79	2.84	1.86	5.00	3.36
3350	2.96	3.06	3.42	5.00	3.04
2360	3.67	3.79	3.20	5.00	3.11
1700	3.21	3.34	4.09	5.00	2.49
1180	5.22	5.08	2.75	5.00	2.06
850	4.96	5.04	1.66	5.00	2.64
600	6.96	7.03	1.05	5.00	2.18
425	6.24	6.31	1.16	5.00	1.93
300	6.68	6.86	2.74	5.00	1.83
212	6.35	6.38	.44	5.00	1.29
150	6.10	6.18	1.29	5.00	1.07
106	5.58	5.49	1.59	5.00	0.64
75	5.18	5.07	2.04	5.00	0.78
53	3.47	3.62	4.41	5.00	0.78
38	5.50	4.70	14.53	5.00	0.27
-38	21.47	21.33	.63	5.00	2.98

MASS BALANCE OF LORNE C-CIRCUIT RUN #3

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	15.16	15.03	.84	5.00	.00	.57	100.00	.00
MILL DISCH.	.00	29.63	100.00	.00	.00	10.77	100.00	.00
SCREEN FEED	.00	32.20	100.00	.00	.00	13.33	100.00	.00
SCR OVERSIZE	.00	5.77	100.00	.00	.00	1.37	100.00	.00
SCR U/FLOW	.00	26.43	100.00	.00	.00	11.97	100.00	.00
MILL WATER	.00	8.83	100.00	.00	8.73	8.83	1.19	5.00
PBOX WATER	.00	2.57	100.00	.00	2.50	2.57	2.64	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	14.47	100.00	.00	97.22	96.23	1.02	3.00
MILL DISCH.	.00	18.87	100.00	.00	62.30	63.66	2.19	5.00
SCREEN FEED	.00	18.87	100.00	.00	57.50	58.59	1.89	4.00
SCR OVERSIZE	.00	4.40	100.00	.00	79.00	76.29	3.42	10.00
SCR U/FLOW	.00	14.47	100.00	.00	55.05	54.73	.59	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	1.34	100.00	10.00	5.52	5.76	4.40	10.00
19000	4.30	4.76	10.63	10.00	18.94	19.74	4.22	10.00
13200	5.97	6.29	5.38	10.00	21.87	24.69	12.88	10.00
9500	4.50	5.73	27.38	10.00	14.54	13.23	9.01	10.00
6700	3.51	5.38	53.15	10.00	8.84	6.71	24.15	10.00
4750	3.79	6.16	62.61	10.00	4.93	4.19	15.05	10.00
3350	3.71	6.16	65.94	10.00	2.71	2.46	9.07	10.00
2360	4.16	6.91	66.12	10.00	1.82	1.72	5.29	10.00
1700	3.85	6.16	59.91	10.00	1.11	1.08	3.14	10.00
1180	4.63	3.75	19.02	10.00	1.20	1.23	2.11	10.00
850	4.42	3.23	26.98	10.00	.95	.97	2.11	10.00
600	5.88	4.27	27.35	10.00	1.25	1.28	2.36	10.00
425	5.24	3.86	26.28	10.00	1.23	1.26	2.42	10.00
300	5.86	4.36	25.54	10.00	1.55	1.59	2.81	10.00
212	4.96	3.72	25.06	10.00	1.45	1.49	2.87	10.00
150	5.00	3.82	23.68	10.00	1.59	1.64	3.03	10.00
106	4.11	3.12	24.14	10.00	1.40	1.44	3.04	10.00
75	3.78	2.85	24.67	10.00	1.31	1.35	3.04	10.00
53	3.79	2.82	25.71	10.00	1.31	1.35	3.12	10.00
38	2.71	1.99	26.41	10.00	.93	.96	2.86	10.00
-38	15.86	13.36	15.76	10.00	5.54	5.86	5.71	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					9.33
107000					10.47
75000					9.18
53000					8.59
37500	.00	.00	100.00	.00	6.17
26500	.00	.00	100.00	.00	6.72
19000	.20	.20	.17	5.00	5.24
13200	.69	.70	.81	5.00	4.53
9500	3.43	3.45	.62	5.00	4.22
6700	5.43	4.97	8.45	5.00	4.20
4750	7.90	6.76	14.39	5.00	3.80
3350	8.92	7.28	18.39	5.00	3.38
2360	10.29	8.49	17.51	5.00	3.02
1700	9.04	7.70	14.80	5.00	2.58
1180	4.15	4.52	8.85	5.00	2.14
850	3.59	3.91	9.03	5.00	2.86
600	4.69	5.18	10.49	5.00	2.37
425	4.24	4.65	9.78	5.00	2.07
300	4.72	5.21	10.29	5.00	1.85
212	4.02	4.39	9.30	5.00	0.68
150	4.10	4.48	9.24	5.00	0.95
106	3.35	3.63	8.28	5.00	0.78
75	3.06	3.30	7.95	5.00	0.68
53	3.02	3.26	7.99	5.00	0.65
38	2.16	2.31	6.94	5.00	0.51
-38	13.01	15.61	19.98	5.00	3.04

MASS BALANCE OF LORNEX C-CIRCUIT RUN #4

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.44	13.44	.01	5.00	.00	.32	100.00	.00
MILL DISCH.	.00	20.65	100.00	.00	.00	6.68	100.00	.00
SCREEN FEED	.00	22.77	100.00	.00	.00	8.81	100.00	.00
SCR OVERSIZE	.00	1.03	100.00	.00	.00	.18	100.00	.00
SCR U/FLOW	.00	21.74	100.00	.00	.00	8.62	100.00	.00
MILL WATER	.00	6.18	100.00	.00	6.17	6.18	.12	5.00
PBOX WATER	.00	2.12	100.00	.00	2.00	2.12	6.01	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	13.11	100.00	.00	97.69	97.59	.10	3.00
MILL DISCH.	.00	13.97	100.00	.00	69.90	67.63	3.25	5.00
SCREEN FEED	.00	13.97	100.00	.00	59.50	61.33	3.08	5.00
SCR OVERSIZE	.00	.85	100.00	.00	82.10	82.24	.17	10.00
SCR U/FLOW	.00	13.11	100.00	.00	59.53	60.34	1.35	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.62	.17	89.80	10.00	2.48	2.71	9.31	10.00
19000	1.43	1.01	29.62	10.00	13.09	15.90	21.44	10.00
13200	1.30	1.52	16.79	10.00	23.14	20.94	9.52	10.00
9500	1.91	2.36	23.52	10.00	17.27	16.15	6.47	10.00
6700	2.58	3.05	18.05	10.00	10.33	10.28	.53	10.00
4750	3.20	3.59	12.30	10.00	6.54	6.60	.92	10.00
3350	3.41	3.57	4.74	10.00	3.01	3.04	.88	10.00
2360	4.69	4.19	10.66	10.00	1.89	1.91	.97	10.00
1700	3.79	3.60	5.05	10.00	1.06	1.07	.48	10.00
1180	4.75	4.35	8.42	10.00	.99	.99	.48	10.00
850	4.62	4.29	7.09	10.00	.86	.86	.40	10.00
600	6.25	5.92	5.32	10.00	1.22	1.23	.52	10.00
425	5.90	5.76	2.42	10.00	1.24	1.25	.50	10.00
300	6.69	6.83	2.07	10.00	1.71	1.72	.61	10.00
212	5.93	6.14	3.61	10.00	1.57	1.58	.53	10.00
150	5.68	6.19	8.89	10.00	1.77	1.78	.50	10.00
106	4.58	5.09	11.16	10.00	1.55	1.56	.35	10.00
75	4.16	4.56	9.62	10.00	1.36	1.36	.32	10.00
53	4.12	4.40	6.78	10.00	1.43	1.44	.39	10.00
38	2.95	3.14	6.42	10.00	.95	.95	.23	10.00
-38	20.44	20.29	.75	10.00	6.56	6.72	2.48	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					8.52
107000					14.01
75000					7.20
53000					6.16
37500	.00	.00	100.00	.00	5.89
26500	.00	.00	100.00	.00	7.09
19000	.04	.04	.20	5.00	6.14
13200	.26	.26	.77	5.00	5.46
9500	1.53	1.46	4.31	5.00	4.59
6700	2.69	2.58	4.22	5.00	3.71
4750	3.50	3.40	2.91	5.00	3.77
3350	3.64	3.61	.93	5.00	2.99
2360	4.23	4.34	2.56	5.00	3.19
1700	3.71	3.76	1.43	5.00	2.58
1180	4.47	4.57	2.18	5.00	2.16
850	4.43	4.51	1.92	5.00	2.76
600	6.12	6.22	1.66	5.00	2.27
425	5.99	6.05	1.01	5.00	1.95
300	7.16	7.16	.00	5.00	1.77
212	6.47	6.44	.46	5.00	0.72
150	6.60	6.47	1.95	5.00	0.95
106	5.47	5.32	2.73	5.00	0.78
75	4.88	4.77	2.30	5.00	0.70
53	4.66	4.59	1.47	5.00	0.67
38	3.33	3.28	1.46	5.00	0.53
-38	20.80	21.15	1.68	5.00	3.37

MASS BALANCE OF LORNE C-CIRCUIT RUN #5

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.37	13.45	.61	5.00	.00	.22	100.00	.00
MILL DISCH.	.00	24.33	100.00	.00	.00	9.30	100.00	.00
SCREEN FEED	.00	26.43	100.00	.00	.00	11.40	100.00	.00
SCR OVERSIZE	.00	2.31	100.00	.00	.00	.51	100.00	.00
SCR U/FLOW	.00	24.12	100.00	.00	.00	10.89	100.00	.00
MILL WATER	.00	8.57	100.00	.00	8.54	8.57	.30	5.00
PBOX WATER	.00	2.10	100.00	.00	2.25	2.10	6.59	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	13.23	100.00	.00	98.29	98.34	.05	3.00
MILL DISCH.	.00	15.03	100.00	.00	58.30	61.78	5.97	5.00
SCREEN FEED	.00	15.03	100.00	.00	59.70	56.87	4.75	5.00
SCR OVERSIZE	.00	1.80	100.00	.00	78.10	77.95	.19	10.00
SCR U/FLOW	.00	13.23	100.00	.00	54.65	54.85	.36	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.13	100.00	10.00	1.05	1.05	.35	10.00
26500	.93	.62	32.81	10.00	4.35	5.21	19.84	10.00
19000	1.48	1.63	10.28	10.00	14.18	13.18	7.08	10.00
13200	2.41	2.70	12.22	10.00	19.20	18.19	5.28	10.00
9500	3.18	3.24	1.78	10.00	15.24	15.86	4.05	10.00
6700	3.48	3.63	4.31	10.00	10.74	10.95	1.98	10.00
4750	4.11	4.32	5.17	10.00	6.90	6.99	1.26	10.00
3350	4.17	4.41	5.79	10.00	4.15	4.18	.69	10.00
2360	5.12	5.16	.72	10.00	2.85	2.88	.90	10.00
1700	4.79	4.67	2.43	10.00	1.72	1.73	.68	10.00
1180	5.64	5.15	8.73	10.00	1.51	1.52	.78	10.00
850	5.63	4.92	12.58	10.00	1.23	1.24	.74	10.00
600	7.09	6.38	9.99	10.00	1.48	1.49	.74	10.00
425	5.99	5.69	5.05	10.00	1.33	1.34	.58	10.00
300	6.46	6.44	.30	10.00	1.54	1.55	.52	10.00
212	5.14	5.34	3.96	10.00	1.34	1.34	.32	10.00
150	4.99	5.38	7.79	10.00	1.38	1.38	.20	10.00
106	3.88	4.35	12.19	10.00	1.17	1.17	.05	10.00
75	3.43	3.84	12.06	10.00	1.10	1.10	.10	10.00
53	3.30	3.58	8.59	10.00	1.10	1.10	.02	10.00
38	2.36	2.56	8.32	10.00	.78	.78	.07	10.00
-38	16.41	15.83	3.52	10.00	5.65	5.76	2.03	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST. DEV.	
215000					0.00
152000					10.94
107000					13.01
75000					14.05
53000					10.56
37500	.00	.00	100.00	.00	6.32
26500	.00	.00	100.00	.00	7.07
19000	.06	.06	.09	5.00	4.80
13200	.60	.60	.66	5.00	4.46
9500	1.52	1.52	.15	5.00	3.59
6700	2.65	2.63	.66	5.00	3.19
4750	4.00	3.96	1.01	5.00	2.87
3350	4.50	4.44	1.27	5.00	2.40
2360	5.47	5.47	.04	5.00	2.24
1700	5.04	5.07	.68	5.00	1.86
1180	5.53	5.64	2.01	5.00	1.53
850	5.28	5.42	2.72	5.00	1.93
600	6.89	7.05	2.30	5.00	1.57
425	6.20	6.28	1.29	5.00	1.32
300	7.09	7.11	.24	5.00	1.13
212	5.94	5.89	.87	5.00	0.54
150	6.04	5.92	1.94	5.00	0.69
106	4.95	4.79	3.31	5.00	0.55
75	4.36	4.22	3.27	5.00	0.48
53	4.01	3.92	2.20	5.00	0.45
38	2.86	2.80	2.15	5.00	0.37
-38	17.02	17.22	1.20	5.00	2.11

MASS BALANCE OF LORNEX C-CIRCUIT RUN #6

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.64	12.92	2.25	5.00	.00	.05	100.00	.00
MILL DISCH.	.00	23.93	100.00	.00	.00	8.94	100.00	.00
SCREEN FEED	.00	27.38	100.00	.00	.00	12.39	100.00	.00
SCR OVERSIZE	.00	2.61	100.00	.00	.00	.49	100.00	.00
SCR U/FLOW	.00	24.77	100.00	.00	.00	11.90	100.00	.00
MILL WATER	.00	8.39	100.00	.00	8.54	8.39	1.73	5.00
PBOX WATER	.00	3.45	100.00	.00	3.50	3.45	1.39	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.87	100.00	.00	97.80	99.59	1.83	3.00
MILL DISCH.	.00	14.99	100.00	.00	65.20	62.64	3.92	5.00
SCREEN FEED	.00	14.99	100.00	.00	55.50	54.75	1.35	5.00
SCR OVERSIZE	.00	2.12	100.00	.00	79.10	81.08	2.51	10.00
SCR U/FLOW	.00	12.87	100.00	.00	51.63	51.97	.65	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.49	.57	15.41	10.00	5.23	4.00	23.55	10.00
19000	3.27	2.63	19.60	10.00	16.44	18.59	13.06	10.00
13200	3.37	3.45	2.32	10.00	22.73	21.95	3.43	10.00
9500	3.47	3.50	.92	10.00	17.13	16.86	1.56	10.00
6700	3.14	3.03	3.63	10.00	8.96	9.05	.98	10.00
4750	3.47	3.12	10.19	10.00	5.10	5.19	1.85	10.00
3350	3.49	3.10	11.11	10.00	2.57	2.60	1.02	10.00
2360	4.03	3.62	10.22	10.00	1.75	1.76	.53	10.00
1700	3.76	3.27	12.92	10.00	1.02	1.02	.44	10.00
1180	4.33	3.84	11.29	10.00	.89	.89	.28	10.00
850	4.59	3.94	14.27	10.00	.73	.73	.28	10.00
600	6.26	5.51	11.92	10.00	1.00	1.00	.22	10.00
425	5.80	5.37	7.47	10.00	1.02	1.02	.13	10.00
300	6.92	6.74	2.61	10.00	1.45	1.45	.00	10.00
212	5.73	5.84	1.94	10.00	1.41	1.41	.14	10.00
150	5.70	6.04	5.89	10.00	1.63	1.62	.33	10.00
106	4.53	4.94	8.95	10.00	1.41	1.40	.47	10.00
75	4.02	4.38	9.07	10.00	1.30	1.29	.48	10.00
53	3.85	4.13	7.24	10.00	1.31	1.30	.42	10.00
38	2.75	2.95	7.42	10.00	.94	.94	.41	10.00
-38	17.04	20.05	17.68	10.00	5.98	5.91	1.20	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					8.66
107000					7.61
75000					5.97
53000					8.71
37500	.00	.00	100.00	.00	5.29
26500	.00	.00	100.00	.00	8.57
19000	.00	.00	100.00	.00	5.94
13200	.40	.40	.02	5.00	6.69
9500	1.30	1.30	.05	5.00	5.30
6700	2.02	2.03	.70	5.00	3.96
4750	2.72	2.77	1.98	5.00	4.06
3350	3.11	3.19	2.43	5.00	3.41
2360	3.83	3.92	2.46	5.00	3.48
1700	3.54	3.64	2.96	5.00	2.80
1180	4.21	4.33	2.77	5.00	2.27
850	4.32	4.46	3.31	5.00	2.90
600	6.07	6.26	3.08	5.00	2.35
425	5.95	6.08	2.23	5.00	2.01
300	7.51	7.61	1.35	5.00	1.79
212	6.56	6.57	.17	5.00	0.80
150	6.82	6.76	.84	5.00	1.02
106	5.62	5.52	1.83	5.00	0.83
75	4.99	4.89	1.93	5.00	0.75
53	4.66	4.59	1.42	5.00	0.68
38	3.34	3.29	1.60	5.00	0.55
-38	23.02	22.36	2.86	5.00	3.58

MASS BALANCE OF LORNE C-CIRCUIT RUN #7

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	16.73	16.75	.12	5.00	.00	.38	100.00	.00
MILL DISCH.	.00	28.73	100.00	.00	.00	10.53	100.00	.00
SCREEN FEED	.00	32.17	100.00	.00	.00	13.97	100.00	.00
SCR OVERSIZE	.00	2.28	100.00	.00	.00	.46	100.00	.00
SCR U/FLOW	.00	29.89	100.00	.00	.00	13.51	100.00	.00
MILL WATER	.00	9.70	100.00	.00	9.65	9.70	.50	5.00
PBOX WATER	.00	3.44	100.00	.00	3.50	3.44	1.75	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	16.37	100.00	.00	98.01	97.75	.27	3.00
MILL DISCH.	.00	18.20	100.00	.00	61.80	63.35	2.50	5.00
SCREEN FEED	.00	18.20	100.00	.00	56.90	56.57	.57	5.00
SCR OVERSIZE	.00	1.83	100.00	.00	80.50	80.03	.59	10.00
SCR U/FLOW	.00	16.37	100.00	.00	55.00	54.78	.39	5.0

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.69	.65	5.94	10.00	6.10	6.47	5.99	10.00
19000	1.68	1.68	.08	10.00	13.44	13.66	1.66	10.00
13200	2.51	2.67	6.55	10.00	22.07	21.37	3.16	10.00
9500	4.03	3.90	3.15	10.00	18.00	18.64	3.55	10.00
6700	3.42	4.16	21.66	10.00	10.09	9.56	5.21	10.00
4750	4.48	5.08	13.40	10.00	5.97	5.91	1.08	10.00
3350	4.87	4.99	2.41	10.00	3.36	3.37	.23	10.00
2360	5.47	5.46	.16	10.00	2.24	2.25	.27	10.00
1700	4.85	4.59	5.29	10.00	1.33	1.33	.30	10.00
1180	5.85	5.13	12.27	10.00	1.23	1.23	.41	10.00
850	5.21	4.70	9.81	10.00	.97	.97	.30	10.00
600	6.46	5.72	11.47	10.00	1.18	1.18	.35	10.00
425	5.43	4.96	8.70	10.00	1.09	1.09	.30	10.00
300	6.02	5.77	4.16	10.00	1.31	1.31	.25	10.00
212	4.84	4.92	1.68	10.00	1.21	1.21	.10	10.00
150	4.79	5.07	5.76	10.00	1.32	1.32	.00	10.00
106	3.97	4.31	8.63	10.00	1.14	1.14	.11	10.00
75	3.61	3.94	9.17	10.00	1.09	1.09	.15	10.00
53	3.49	3.87	10.77	10.00	1.14	1.14	.22	10.00
38	2.50	2.76	10.52	10.00	.82	.82	.25	10.00
-38	15.82	15.65	1.05	10.00	4.90	4.93	.61	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					8.12
152000					3.04
107000					10.42
75000					9.41
53000					11.58
37500	.00	.00	100.00	.00	5.67
26500	.00	.00	100.00	.00	5.81
19000	.00	.34	100.00	5.00	4.96
13200	.59	.59	.35	5.00	4.64
9500	2.25	2.26	.38	5.00	4.01
6700	3.76	3.56	5.38	5.00	3.30
4750	5.17	4.99	3.51	5.00	3.50
3350	5.20	5.17	.61	5.00	2.93
2360	5.82	5.82	.00	5.00	3.14
1700	4.90	4.96	1.17	5.00	2.42
1180	5.43	5.57	2.52	5.00	1.98
850	5.01	5.11	2.09	5.00	2.49
600	6.08	6.23	2.39	5.00	2.05
425	5.29	5.39	1.87	5.00	1.67
300	6.21	6.27	.92	5.00	1.56
212	5.36	5.34	.46	5.00	1.07
150	5.57	5.48	1.55	5.00	0.77
106	4.78	4.67	2.37	5.00	0.74
75	4.37	4.26	2.53	5.00	0.62
53	4.30	4.17	3.01	5.00	0.71
38	3.07	2.98	2.93	5.00	0.54
-38	16.85	16.87	.13	5.00	2.84

MASS BALANCE OF LORNEX C-CIRCUIT RUN #8

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.22	13.12	.74	5.00	.00	.60	100.00	.00
MILL DISCH.	.00	23.18	100.00	.00	.00	7.59	100.00	.00
SCREEN FEED	.00	25.84	100.00	.00	.00	10.26	100.00	.00
SCR OVERSIZE	.00	3.91	100.00	.00	.00	.85	100.00	.00
SCR U/FLOW	.00	21.93	100.00	.00	.00	9.41	100.00	.00
MILL WATER	.00	6.15	100.00	.00	6.10	6.15	.81	5.00
PBOX WATER	.00	2.66	100.00	.00	2.50	2.66	6.47	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.53	100.00	.00	96.30	95.46	.87	3.00
MILL DISCH.	.00	15.59	100.00	.00	67.70	67.24	.68	5.00
SCREEN FEED	.00	15.59	100.00	.00	59.60	60.32	1.20	6.00
SCR OVERSIZE	.00	3.06	100.00	.00	78.30	78.29	.01	5.00
SCR U/FLOW	.00	12.53	100.00	.00	55.43	57.11	3.03	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.95	.95	.27	10.00	4.83	4.85	.44	10.00
19000	4.30	3.05	29.02	10.00	13.04	15.54	19.20	10.00
13200	3.83	4.21	9.98	10.00	21.94	20.19	7.99	10.00
9500	3.91	4.17	6.66	10.00	16.36	15.86	3.06	10.00
6700	3.32	3.55	7.08	10.00	9.46	9.22	2.57	10.00
4750	3.25	3.48	7.06	10.00	5.84	5.74	1.63	10.00
3350	3.13	3.14	.23	10.00	3.06	3.07	.41	10.00
2360	3.61	3.57	1.16	10.00	2.05	2.06	.43	10.00
1700	3.55	3.34	6.04	10.00	1.24	1.25	.60	10.00
1180	4.58	4.04	11.73	10.00	1.18	1.19	.77	10.00
850	4.76	4.28	10.12	10.00	1.09	1.10	.62	10.00
600	6.53	5.90	9.62	10.00	1.44	1.45	.63	10.00
425	5.95	5.44	8.53	10.00	1.38	1.39	.59	10.00
300	6.87	6.56	4.46	10.00	1.77	1.78	.49	10.00
212	5.44	5.48	.66	10.00	1.58	1.58	.19	10.00
150	5.26	5.55	5.52	10.00	1.75	1.75	.10	10.00
106	4.27	4.54	6.39	10.00	1.54	1.54	.23	10.00
75	3.87	4.06	4.78	10.00	1.44	1.44	.14	10.00
53	3.72	3.92	5.41	10.00	1.48	1.48	.21	10.00
38	2.66	2.80	5.42	10.00	1.06	1.06	.27	10.00
-36	16.25	17.97	10.57	10.00	6.48	6.49	.13	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					7.77
75000					8.05
53000					11.46
37500	.00	.00	100.00	.00	6.71
26500	.00	.00	100.00	.00	7.32
19000	.00	.00	100.00	.00	7.25
13200	.31	.31	.15	5.00	5.55
9500	1.32	1.31	.39	5.00	4.54
6700	2.19	2.17	.84	5.00	3.82
4750	2.96	2.93	1.15	5.00	4.06
3350	3.15	3.15	.10	5.00	3.66
2360	3.92	3.94	.43	5.00	3.97
1700	3.79	3.85	1.47	5.00	3.29
1180	4.62	4.74	2.53	5.00	2.61
850	4.94	5.06	2.34	5.00	3.38
600	6.83	6.99	2.34	5.00	2.83
425	6.30	6.43	2.11	5.00	2.39
300	7.63	7.73	1.35	5.00	2.17
212	6.42	6.43	.13	5.00	0.76
150	6.55	6.48	1.08	5.00	1.18
106	5.35	5.28	1.36	5.00	0.95
75	4.74	4.69	.96	5.00	0.85
53	4.57	4.52	1.13	5.00	0.81
38	3.27	3.23	1.19	5.00	0.67
-38	21.14	20.76	1.79	5.00	3.94

MASS BALANCE OF LORNEC C-CIRCUIT RUN #9

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.63	12.45	1.40	5.00	.00	.47	100.00	.00
MILL DISCH.	.00	23.16	100.00	.00	.00	7.39	100.00	.00
SCREEN FEED	.00	25.89	100.00	.00	.00	10.11	100.00	.00
SCR OVERSIZE	.00	4.85	100.00	.00	.00	1.06	100.00	.00
SCR U/FLOW	.00	21.04	100.00	.00	.00	9.06	100.00	.00
MILL WATER	.00	5.86	100.00	.00	5.79	5.86	1.24	5.00
PBOX WATER	.00	2.73	100.00	.00	2.50	2.73	9.05	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.99	100.00	.00	97.63	96.25	1.42	3.00
MILL DISCH.	.00	15.78	100.00	.00	68.30	68.11	.28	5.00
SCREEN FEED	.00	15.78	100.00	.00	59.90	60.94	1.73	6.00
SCR OVERSIZE	.00	3.79	100.00	.00	78.30	78.18	.16	5.00
SCR U/FLOW	.00	11.99	100.00	.00	54.70	56.96	4.14	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.86	1.01	17.25	10.00	5.74	4.20	26.87	10.00
19000	4.69	3.94	15.90	10.00	14.44	16.42	13.71	10.00
13200	4.06	4.48	10.30	10.00	20.08	18.17	9.52	10.00
9500	4.48	4.50	.43	10.00	15.79	16.07	1.78	10.00
6700	3.97	3.62	8.86	10.00	9.37	9.96	6.29	10.00
4750	4.04	3.28	18.83	10.00	5.79	6.21	7.27	10.00
3350	3.76	2.78	25.97	10.00	3.00	3.16	5.38	10.00
2360	4.03	3.23	19.89	10.00	1.98	2.03	2.62	10.00
1700	3.67	3.05	16.93	10.00	1.22	1.24	1.52	10.00
1180	3.77	3.76	.29	10.00	1.11	1.11	.17	10.00
850	4.16	3.65	12.21	10.00	.97	.98	.82	10.00
600	5.63	5.43	3.53	10.00	1.35	1.36	.39	10.00
425	5.31	5.62	5.87	10.00	1.39	1.39	.18	10.00
300	6.37	6.45	1.30	10.00	1.86	1.86	.16	10.00
212	5.11	5.45	6.70	10.00	1.71	1.70	.31	10.00
150	5.21	5.80	11.24	10.00	1.86	1.85	.71	10.00
106	4.23	4.60	8.63	10.00	1.61	1.60	.57	10.00
75	3.82	4.26	11.54	10.00	1.46	1.45	.86	10.00
53	3.55	4.11	15.69	10.00	1.47	1.45	1.36	10.00
38	2.54	2.84	11.94	10.00	1.05	1.04	1.04	10.00
-38	16.73	18.13	8.37	10.00	6.75	6.76	.10	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					8.03
107000					8.80
75000					9.02
53000					11.56
37500	.00	.00	100.00	.00	5.28
26500	.00	.00	100.00	.00	8.14
19000	.00	.00	100.00	.00	5.93
13200	.15	.15	.06	5.00	4.98
9500	.84	.84	.08	5.00	4.07
6700	1.60	1.61	.85	5.00	3.53
4750	2.30	2.35	2.29	5.00	3.63
3350	2.57	2.66	3.65	5.00	2.99
2360	3.48	3.61	3.64	5.00	2.99
1700	3.50	3.62	3.45	5.00	2.51
1180	4.57	4.60	.57	5.00	2.13
850	4.37	4.50	2.92	5.00	2.65
600	6.62	6.72	1.51	5.00	2.23
425	7.01	6.96	.70	5.00	1.91
300	7.86	7.90	.56	5.00	1.74
212	6.70	6.64	.93	5.00	1.22
150	7.20	7.04	2.16	5.00	1.65
106	5.63	5.54	1.57	5.00	1.20
75	5.28	5.15	2.45	5.00	0.98
53	5.14	4.95	3.75	5.00	0.85
38	3.51	3.41	2.75	5.00	0.62
-38	21.68	21.75	.32	5.00	1.36

MASS BALANCE OF LORNE C-CIRCUIT RUN #10

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	11.72	11.59	1.10	5.00	.00	.35	100.00	.00
MILL DISCH.	.00	21.44	100.00	.00	.00	8.46	100.00	.00
SCREEN FEED	.00	23.56	100.00	.00	.00	10.57	100.00	.00
SCR OVERSIZE	.00	2.27	100.00	.00	.00	.52	100.00	.00
SCR U/FLOW	.00	21.29	100.00	.00	.00	10.05	100.00	.00
MILL WATER	.00	7.58	100.00	.00	7.49	7.58	1.26	5.00
PBOX WATER	.00	2.11	100.00	.00	2.00	2.11	5.72	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.24	100.00	.00	98.05	97.00	1.07	3.00
MILL DISCH.	.00	12.99	100.00	.00	60.70	60.56	.22	5.00
SCREEN FEED	.00	12.99	100.00	.00	53.50	55.13	3.04	6.00
SCR OVERSIZE	.00	1.74	100.00	.00	77.00	76.87	.17	5.00
SCR U/FLOW	.00	11.24	100.00	.00	51.73	52.81	2.09	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.96	.62	68.29	10.00	3.87	4.63	19.67	10.00
19000	2.64	2.33	11.79	10.00	15.07	17.35	15.15	10.00
13200	2.46	2.90	17.88	10.00	22.41	19.55	12.75	10.00
9500	2.62	2.93	11.90	10.00	14.69	14.25	2.98	10.00
6700	2.48	2.67	7.46	10.00	8.87	8.87	.02	10.00
4750	2.76	3.06	10.91	10.00	5.80	5.76	.72	10.00
3350	2.87	3.04	5.79	10.00	3.59	3.61	.49	10.00
2360	3.49	3.63	3.89	10.00	2.45	2.47	.63	10.00
1700	3.49	3.27	6.18	10.00	1.51	1.52	.97	10.00
1180	4.17	3.54	15.09	10.00	1.26	1.27	1.12	10.00
850	4.58	3.88	15.23	10.00	1.06	1.07	.90	10.00
600	6.05	5.30	12.47	10.00	1.31	1.32	.89	10.00
425	5.79	5.20	10.16	10.00	1.23	1.24	.79	10.00
300	7.30	6.78	7.19	10.00	1.58	1.59	.85	10.00
212	6.15	6.00	2.41	10.00	1.49	1.50	.68	10.00
150	6.22	6.25	.49	10.00	1.68	1.69	.66	10.00
106	4.98	5.29	6.31	10.00	1.45	1.45	.34	10.00
75	4.40	4.77	8.48	10.00	1.37	1.37	.20	10.00
53	4.08	4.51	10.64	10.00	1.37	1.37	.08	10.00
38	2.92	3.23	10.51	10.00	.98	.98	.07	10.00
-38	18.56	20.77	11.90	10.00	6.95	7.10	2.23	10.00

STREAK	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					7.22
107000					4.94
75000					13.81
53000					10.18
37500	.00	.00	100.00	.00	6.88
26500	.00	.00	100.00	.00	8.00
19000	.00	.00	100.00	.00	5.96
13200	.32	.32	.48	5.00	5.80
9500	1.19	1.18	1.08	5.00	4.61
6700	1.72	1.70	.99	5.00	4.27
4750	2.70	2.64	2.11	5.00	3.49
3350	2.98	2.95	1.08	5.00	3.17
2360	3.83	3.81	.64	5.00	2.99
1700	3.49	3.55	1.60	5.00	2.43
1180	3.77	3.89	3.23	5.00	1.96
850	4.18	4.32	3.32	5.00	2.65
600	5.74	5.91	2.99	5.00	2.01
425	5.67	5.82	2.57	5.00	1.65
300	7.42	7.58	2.13	5.00	0.45
212	6.63	6.70	1.05	5.00	1.65
150	6.93	6.96	.40	5.00	0.78
106	5.96	5.89	1.19	5.00	0.56
75	5.40	5.30	1.85	5.00	0.58
53	5.13	5.00	2.51	5.00	0.55
38	3.67	3.58	2.59	5.00	0.44
-38	23.28	22.93	1.50	5.00	2.86

MASS BALANCE OF LORNEX C-CIRCUIT RUN #11

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	14.18	14.14	.26	5.00	.00	.26	100.00	.00
MILL DISCH.	.00	22.60	100.00	.00	.00	7.84	100.00	.00
SCREEN FEED	.00	24.93	100.00	.00	.00	10.17	100.00	.00
SCR OVERSIZE	.00	1.10	100.00	.00	.00	.22	100.00	.00
SCR U/FLOW	.00	23.83	100.00	.00	.00	9.94	100.00	.00
MILL WATER	.00	7.36	100.00	.00	7.32	7.36	.52	5.00
PBOX WATER	.00	2.33	100.00	.00	2.25	2.33	3.48	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	13.89	100.00	.00	98.63	98.19	.45	3.00
MILL DISCH.	.00	14.76	100.00	.00	65.70	65.32	.58	5.00
SCREEN FEED	.00	14.76	100.00	.00	58.10	59.22	1.92	7.00
SCR OVERSIZE	.00	.88	100.00	.00	79.60	79.59	.01	5.00
SCR U/FLOW	.00	13.89	100.00	.00	57.98	58.28	.51	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.09	.32	71.06	10.00	4.46	5.31	19.11	10.00
19000	.88	.79	10.23	10.00	11.14	12.51	12.31	10.00
13200	1.40	1.62	15.82	10.00	18.69	17.80	4.79	10.00
9500	2.16	2.74	27.06	10.00	19.26	18.04	6.34	10.00
6700	2.47	3.16	27.75	10.00	11.19	10.87	2.83	10.00
4750	3.11	3.97	27.62	10.00	6.88	6.83	.78	10.00
3350	3.35	4.09	22.10	10.00	3.53	3.53	.08	10.00
2360	4.28	4.86	13.47	10.00	2.34	2.35	.53	10.00
1700	4.13	4.37	5.73	10.00	1.46	1.47	.49	10.00
1180	5.00	5.23	4.54	10.00	1.34	1.35	.48	10.00
850	5.21	5.23	.33	10.00	1.19	1.20	.49	10.00
600	7.26	6.88	5.29	10.00	1.57	1.58	.72	10.00
425	6.58	6.08	7.59	10.00	1.50	1.51	.72	10.00
300	7.55	6.61	12.43	10.00	1.81	1.83	.93	10.00
212	6.07	5.42	10.69	10.00	1.59	1.60	.83	10.00
150	5.59	5.05	9.63	10.00	1.58	1.59	.82	10.00
106	4.37	4.03	7.82	10.00	1.36	1.37	.71	10.00
75	3.86	3.49	9.47	10.00	1.28	1.29	.72	10.00
53	3.54	3.36	5.18	10.00	1.22	1.23	.61	10.00
38	2.71	2.46	9.32	10.00	.69	.89	.55	10.00
-38	19.39	20.26	4.48	10.00	5.72	5.85	2.29	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					13.94
152000					14.12
107000					13.85
75000					7.24
53000					7.97
37500	.00	.00	100.00	.00	5.07
26500	.00	.00	100.00	.00	5.70
19000	.05	.05	.14	5.00	3.71
13200	.61	.60	1.57	5.00	3.67
9500	1.88	1.78	5.37	5.00	3.13
6700	2.88	2.67	7.36	5.00	2.09
4750	4.13	3.79	8.26	5.00	2.19
3350	4.41	4.13	6.45	5.00	2.10
2360	5.19	5.01	3.38	5.00	2.05
1700	4.60	4.55	1.10	5.00	1.64
1180	5.51	5.47	.69	5.00	1.34
850	5.46	5.48	.40	5.00	1.71
600	7.08	7.21	1.84	5.00	1.45
425	6.23	6.37	2.24	5.00	1.22
300	6.70	6.91	3.18	5.00	1.07
212	5.51	5.66	2.77	5.00	0.48
150	5.14	5.27	2.53	5.00	0.63
106	4.11	4.20	2.09	5.00	0.47
75	3.55	3.63	2.36	5.00	0.41
53	3.44	3.49	1.49	5.00	0.41
38	2.50	2.56	2.24	5.00	0.34
-38	21.02	21.17	.71	5.00	2.01

MASS BALANCE OF LORNEC C-CIRCUIT RUN #12

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.24	13.11	1.01	5.00	.00	.43	100.00	.00
MILL DISCH.	.00	22.03	100.00	.00	.00	6.42	100.00	.00
SCREEN FEED	.00	25.93	100.00	.00	.00	10.32	100.00	.00
SCR OVERSIZE	.00	3.63	100.00	.00	.00	.70	100.00	.00
SCR U/FLOW	.00	22.30	100.00	.00	.00	9.62	100.00	.00
MILL WATER	.00	5.29	100.00	.00	5.26	5.29	.65	5.00
PBOX WATER	.00	3.90	100.00	.00	3.50	3.90	11.45	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.68	100.00	.00	97.64	96.74	.92	3.00
MILL DISCH.	.00	15.61	100.00	.00	72.10	70.85	1.74	5.00
SCREEN FEED	.00	15.61	100.00	.00	59.80	60.19	.65	5.00
SCR OVERSIZE	.00	2.93	100.00	.00	80.50	80.67	.21	5.00
SCR U/FLOW	.00	12.68	100.00	.00	54.48	56.86	4.36	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.59	.69	17.56	10.00	5.21	3.70	29.08	10.00
19000	2.26	2.24	1.04	10.00	11.53	11.65	1.08	10.00
13200	4.51	4.60	1.88	10.00	23.13	22.75	1.65	10.00
9500	4.69	4.41	5.93	10.00	18.26	19.07	4.46	10.00
6700	3.94	3.45	12.43	10.00	10.10	10.71	6.05	10.00
4750	4.17	3.39	18.71	10.00	5.86	6.15	4.98	10.00
3350	3.49	2.86	18.19	10.00	2.90	2.98	2.86	10.00
2360	3.68	3.19	13.24	10.00	1.82	1.84	1.24	10.00
1700	3.34	2.96	11.33	10.00	1.08	1.09	.70	10.00
1180	3.96	3.44	13.16	10.00	1.03	1.04	.65	10.00
850	4.03	3.73	7.51	10.00	.92	.92	.33	10.00
600	5.46	5.30	2.92	10.00	1.22	1.22	.13	10.00
425	5.25	5.20	.95	10.00	1.20	1.20	.05	10.00
300	6.29	6.53	3.82	10.00	1.57	1.57	.17	10.00
212	5.53	5.70	3.04	10.00	1.46	1.46	.14	10.00
150	5.50	6.04	9.81	10.00	1.61	1.60	.53	10.00
106	4.51	5.03	11.48	10.00	1.38	1.37	.65	10.00
75	4.03	4.48	11.07	10.00	1.29	1.28	.66	10.00
53	3.86	4.38	13.40	10.00	1.27	1.26	.82	10.00
38	2.68	2.94	9.77	10.00	.88	.87	.60	10.00
-38	18.23	19.46	6.72	10.00	6.27	6.25	.39	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					11.30
75000					9.40
53000					10.80
37500	.00	.00	100.00	.00	5.63
26500	.00	.00	100.00	.00	7.89
19000	.06	.06	.01	5.00	8.23
13200	.40	.40	.00	5.00	6.71
9500	1.02	1.02	.35	5.00	6.23
6700	1.75	1.77	1.27	5.00	4.47
4750	2.68	2.75	2.67	5.00	4.32
3350	2.74	2.83	3.13	5.00	3.22
2360	3.41	3.50	2.78	5.00	3.19
1700	3.31	3.39	2.56	5.00	2.51
1180	3.88	3.99	2.94	5.00	1.97
850	4.29	4.38	1.99	5.00	2.48
600	6.17	6.24	1.19	5.00	1.92
425	6.08	6.12	.73	5.00	1.62
300	7.70	7.68	.30	5.00	1.49
212	6.69	6.68	.18	5.00	0.60
150	7.21	7.07	2.01	5.00	0.88
106	6.03	5.87	2.61	5.00	0.71
75	5.35	5.21	2.53	5.00	0.60
53	5.27	5.10	3.27	5.00	0.59
38	3.50	3.42	2.30	5.00	0.48
-38	22.47	22.52	.21	5.00	2.78

MASS BALANCE OF LORNEC C-CIRCUIT RUN #13

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	19.20	19.05	.80	5.00	.00	.56	100.00	.00
MILL DISCH.	.00	29.65	100.00	.00	.00	9.76	100.00	.00
SCREEN FEED	.00	32.57	100.00	.00	.00	12.68	100.00	.00
SCR OVERSIZE	.00	1.74	100.00	.00	.00	.33	100.00	.00
SCR U/FLOW	.00	30.83	100.00	.00	.00	12.35	100.00	.00
MILL WATER	.00	8.87	100.00	.00	8.79	8.87	.89	5.00
PBOX WATER	.00	2.92	100.00	.00	2.75	2.92	6.07	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	18.48	100.00	.00	97.98	97.04	.96	3.00
MILL DISCH.	.00	19.89	100.00	.00	67.80	67.08	1.07	5.00
SCREEN FEED	.00	19.89	100.00	.00	60.00	61.07	1.78	5.00
SCR OVERSIZE	.00	1.41	100.00	.00	81.00	80.98	.03	5.00
SCR U/FLOW	.00	18.48	100.00	.00	58.33	59.95	2.77	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.80	.30	62.73	10.00	3.47	4.21	21.28	10.00
19000	.52	.65	24.31	10.00	17.39	9.12	47.53	10.00
13200	3.15	2.53	19.60	10.00	25.02	31.40	25.49	10.00
9500	2.74	3.16	15.42	10.00	17.16	17.69	3.08	10.00
6700	3.28	3.75	14.21	10.00	8.64	8.84	2.34	10.00
4750	4.04	4.78	18.41	10.00	4.88	4.94	1.25	10.00
3350	4.37	4.69	7.29	10.00	2.37	2.40	1.09	10.00
2360	5.07	5.24	3.35	10.00	1.48	1.49	.79	10.00
1700	4.67	4.55	2.59	10.00	.91	.92	.56	10.00
1180	5.48	4.87	11.21	10.00	.88	.89	.64	10.00
850	5.33	4.54	14.87	10.00	.73	.73	.57	10.00
600	6.63	5.82	12.19	10.00	.97	.98	.69	10.00
425	5.59	5.26	5.96	10.00	.92	.93	.60	10.00
300	6.33	5.91	6.60	10.00	1.22	1.23	.80	10.00
212	5.12	4.99	2.51	10.00	1.18	1.19	.72	10.00
150	5.01	5.03	.37	10.00	1.38	1.39	.79	10.00
106	4.14	4.21	1.59	10.00	1.30	1.31	.72	10.00
75	3.78	3.99	5.43	10.00	1.25	1.26	.60	10.00
53	3.66	4.06	10.95	10.00	1.31	1.32	.48	10.00
38	2.64	2.90	9.99	10.00	.97	.97	.30	10.00
-38	17.64	18.77	6.43	10.00	6.57	6.81	3.63	10.00

STREAM	SCR W/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					23.00
107000					9.73
75000					10.76
53000					8.87
37500	.00	.00	100.00	.00	4.65
26500	.00	.00	100.00	.00	6.11
19000	.00	.00	100.00	.00	5.06
13200	.33	.33	.50	5.00	3.84
9500	2.11	2.06	2.60	5.00	3.47
6700	3.47	3.36	3.24	5.00	3.37
4750	5.02	4.77	4.94	5.00	3.66
3350	4.94	4.86	1.55	5.00	3.12
2360	5.55	5.53	.44	5.00	3.30
1700	4.78	4.83	.97	5.00	2.82
1180	5.03	5.17	2.76	5.00	2.36
850	4.67	4.83	3.37	5.00	2.93
600	6.01	6.19	3.01	5.00	2.44
425	5.49	5.59	1.76	5.00	2.05
300	6.15	6.27	1.94	5.00	1.83
212	5.23	5.28	.98	5.00	0.86
150	5.29	5.31	.30	5.00	1.09
106	4.43	4.43	.07	5.00	0.94
75	4.24	4.19	1.10	5.00	0.87
53	4.39	4.27	2.73	5.00	0.85
38	3.13	3.05	2.52	5.00	0.65
-38	19.75	19.71	.22	5.00	4.00

MASS BALANCE OF LORNEC C-CIRCUIT RUN #14

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	14.37	14.43	.40	5.00	.00	.32	100.00	.00
MILL DISCH.	.00	26.22	100.00	.00	.00	10.14	100.00	.00
SCREEN FEED	.00	28.60	100.00	.00	.00	12.53	100.00	.00
SCR OVERSIZE	.00	2.56	100.00	.00	.00	.59	100.00	.00
SCR U/FLOW	.00	26.04	100.00	.00	.00	11.94	100.00	.00
MILL WATER	.00	9.23	100.00	.00	9.19	9.23	.42	5.00
PBOX WATER	.00	2.38	100.00	.00	2.50	2.38	4.66	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	14.10	100.00	.00	97.84	97.75	.09	3.00
MILL DISCH.	.00	16.08	100.00	.00	58.60	61.32	4.64	5.00
SCREEN FEED	.00	16.08	100.00	.00	57.60	56.21	2.41	5.00
SCR OVERSIZE	.00	1.97	100.00	.00	77.15	77.01	.19	5.00
SCR U/FLOW	.00	14.10	100.00	.00	54.55	54.16	.71	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.42	.51	20.76	10.00	7.46	4.13	44.64	10.00
19000	4.04	2.00	50.42	10.00	13.40	16.31	21.72	10.00
13200	2.78	2.74	1.33	10.00	18.27	18.76	2.68	10.00
9500	3.68	3.76	2.15	10.00	15.37	15.41	.25	10.00
6700	3.94	4.02	2.15	10.00	10.42	10.44	.22	10.00
4750	3.94	4.47	13.40	10.00	6.20	6.07	2.04	10.00
3350	3.92	4.38	11.64	10.00	3.40	3.37	.94	10.00
2360	4.47	4.92	10.05	10.00	2.49	2.48	.47	10.00
1700	4.27	4.46	4.33	10.00	1.66	1.66	.06	10.00
1180	4.88	4.64	4.96	10.00	1.50	1.50	.32	10.00
850	4.96	4.72	4.91	10.00	1.27	1.27	.27	10.00
600	6.47	6.18	4.46	10.00	1.58	1.58	.27	10.00
425	5.56	5.35	3.77	10.00	1.36	1.36	.23	10.00
300	6.51	6.27	3.65	10.00	1.60	1.60	.25	10.00
212	5.15	5.01	2.72	10.00	1.37	1.37	.21	10.00
150	5.09	5.13	.87	10.00	1.49	1.49	.10	10.00
106	4.08	4.17	2.27	10.00	1.25	1.25	.02	10.00
75	3.66	3.82	4.37	10.00	1.19	1.19	.07	10.00
53	3.60	3.66	1.58	10.00	1.22	1.22	.04	10.00
38	2.30	2.43	5.44	10.00	.83	.83	.17	10.00
-38	16.28	17.37	6.68	10.00	6.67	6.69	.25	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					3.24
107000					13.35
75000					9.35
53000					11.25
37500	.00	.00	100.00	.00	6.01
26500	.00	.00	100.00	.00	7.15
19000	.00	.00	100.00	.00	5.62
13200	.50	.50	.09	5.00	5.49
9500	2.13	2.13	.10	5.00	4.54
6700	3.13	3.13	.12	5.00	3.56
4750	4.37	4.24	2.90	5.00	3.40
3350	4.64	4.52	2.64	5.00	3.11
2360	5.38	5.26	2.21	5.00	3.15
1700	4.88	4.85	.68	5.00	2.61
1180	5.00	5.08	1.53	5.00	2.09
850	5.12	5.20	1.53	5.00	2.71
600	6.72	6.83	1.57	5.00	2.16
425	5.83	5.91	1.35	5.00	1.85
300	6.83	6.93	1.40	5.00	1.65
212	5.46	5.52	1.08	5.00	0.69
150	5.63	5.64	.25	5.00	0.98
106	4.59	4.58	.18	5.00	0.78
75	4.22	4.19	.76	5.00	0.72
53	4.00	4.00	.05	5.00	0.67
38	2.68	2.65	1.17	5.00	0.56
-38	18.85	18.82	.14	5.00	3.31

MASS BALANCE OF LORNEC C-CIRCUIT RUN #15

8

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.93	12.76	1.34	5.00	.00	.50	100.00	.00
MILL DISCH.	.00	25.50	100.00	.00	.00	8.70	100.00	.00
SCREEN FEED	.00	27.61	100.00	.00	.00	10.81	100.00	.00
SCR OVERSIZE	.00	5.97	100.00	.00	.00	1.42	100.00	.00
SCR U/FLOW	.00	21.64	100.00	.00	.00	9.39	100.00	.00
MILL WATER	.00	6.78	100.00	.00	6.68	6.78	1.46	5.00
PBOX WATER	.00	2.11	100.00	.00	2.00	2.11	5.51	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.26	100.00	.00	97.50	96.10	1.44	3.00
MILL DISCH.	.00	16.81	100.00	.00	65.10	65.89	1.22	5.00
SCREEN FEED	.00	16.81	100.00	.00	60.20	60.86	1.09	5.00
SCR OVERSIZE	.00	4.55	100.00	.00	76.55	76.16	.50	5.00
SCR U/FLOW	.00	12.26	100.00	.00	54.95	56.64	3.07	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.18	100.00	10.00	.66	.66	.32	10.00
26500	1.75	1.42	18.68	10.00	4.56	5.26	15.36	10.00
19000	5.61	3.90	30.49	10.00	11.73	14.41	22.87	10.00
13200	3.21	3.83	19.43	10.00	16.92	13.61	19.59	10.00
9500	4.35	4.85	11.42	10.00	15.52	14.96	3.58	10.00
6700	3.51	3.82	8.90	10.00	9.97	9.76	2.06	10.00
4750	3.81	3.91	2.55	10.00	6.98	7.13	2.08	10.00
3350	3.65	3.45	5.43	10.00	3.91	4.04	3.45	10.00
2360	4.09	3.79	7.41	10.00	2.81	2.89	2.72	10.00
1700	3.77	3.41	9.48	10.00	1.72	1.75	1.99	10.00
1180	4.19	3.83	8.66	10.00	1.70	1.73	1.77	10.00
850	4.22	3.94	6.60	10.00	1.38	1.40	1.25	10.00
600	5.48	5.29	3.38	10.00	1.66	1.68	1.07	10.00
425	5.08	4.98	2.04	10.00	1.60	1.62	.94	10.00
300	6.14	5.99	2.51	10.00	1.98	2.00	1.17	10.00
212	5.21	5.23	.41	10.00	1.82	1.84	.83	10.00
150	5.33	5.35	.46	10.00	1.95	1.97	.89	10.00
106	4.27	4.57	6.92	10.00	1.73	1.73	.07	10.00
75	3.82	4.09	6.99	10.00	1.64	1.64	.02	10.00
53	3.66	3.98	8.74	10.00	1.63	1.63	.27	10.00
38	2.45	2.75	12.33	10.00	1.19	1.18	1.65	10.00
-38	16.40	17.44	6.35	10.00	6.92	7.10	2.59	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					3.85
107000					5.85
75000					10.78
53000					9.65
37500	.00	.00	100.00	.00	6.62
26500	.00	.00	100.00	.00	8.57
19000	.00	.00	100.00	.00	5.93
13200	.21	.21	.22	5.00	6.07
9500	1.10	1.09	.48	5.00	5.02
6700	1.63	1.62	.69	5.00	4.45
4750	2.72	2.71	.22	5.00	4.08
3350	3.20	3.23	1.00	5.00	3.72
2360	4.06	4.12	1.50	5.00	3.68
1700	3.95	4.03	1.97	5.00	2.96
1180	4.52	4.61	1.88	5.00	2.32
850	4.81	4.89	1.56	5.00	2.92
600	6.57	6.64	1.00	5.00	2.39
425	6.18	6.22	.70	5.00	2.01
300	7.40	7.46	.85	5.00	1.82
212	6.48	6.49	.17	5.00	0.70
150	6.60	6.61	.16	5.00	0.91
106	5.70	5.62	1.46	5.00	0.75
75	5.07	4.99	1.49	5.00	0.66
53	4.95	4.85	1.96	5.00	0.61
38	3.44	3.34	3.02	5.00	0.50
-38	21.40	21.26	.66	5.00	3.15

MASS BALANCE OF LORNEC C-CIRCUIT RUN #16

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.25	12.95	2.25	5.00	.00	.54	100.00	.00
MILL DISCH.	.00	22.96	100.00	.00	.00	8.19	100.00	.00
SCREEN FEED	.00	25.18	100.00	.00	.00	10.41	100.00	.00
SCR OVERSIZE	.00	3.01	100.00	.00	.00	.65	100.00	.00
SCR U/FLOW	.00	22.17	100.00	.00	.00	9.75	100.00	.00
MILL WATER	.00	7.00	100.00	.00	6.87	7.00	1.91	5.00
PBOX WATER	.00	2.22	100.00	.00	2.00	2.22	10.81	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.42	100.00	.00	97.82	95.86	2.01	3.00
MILL DISCH.	.00	14.77	100.00	.00	65.20	64.33	1.33	5.00
SCREEN FEED	.00	14.77	100.00	.00	58.10	58.67	.98	4.00
SCR OVERSIZE	.00	2.36	100.00	.00	78.35	78.35	.00	5.00
SCR U/FLOW	.00	12.42	100.00	.00	54.73	56.00	2.32	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.66	.75	13.46	10.00	5.75	4.70	18.32	10.00
19000	3.06	2.06	32.63	10.00	10.85	12.93	19.16	10.00
13200	3.32	3.51	5.79	10.00	21.42	20.45	4.55	10.00
9500	3.72	3.64	2.06	10.00	17.42	17.89	2.68	10.00
6700	2.92	3.12	6.89	10.00	10.56	10.21	3.26	10.00
4750	3.12	3.41	9.27	10.00	6.20	6.04	2.53	10.00
3350	3.06	3.31	8.20	10.00	3.14	3.10	1.14	10.00
2360	3.90	3.92	.50	10.00	2.10	2.10	.10	10.00
1700	3.69	3.64	1.32	10.00	1.27	1.27	.16	10.00
1180	4.58	3.87	15.61	10.00	1.10	1.11	.67	10.00
850	4.50	4.08	9.27	10.00	.98	.98	.39	10.00
600	6.01	5.34	11.20	10.00	1.33	1.34	.48	10.00
425	5.51	5.10	7.42	10.00	1.26	1.26	.35	10.00
300	6.44	6.16	4.39	10.00	1.70	1.71	.30	10.00
212	5.36	5.33	.62	10.00	1.53	1.53	.13	10.00
150	5.37	5.62	4.59	10.00	1.77	1.77	.13	10.00
106	4.39	4.92	12.03	10.00	1.46	1.45	.54	10.00
75	3.94	4.38	11.07	10.00	1.31	1.30	.50	10.00
53	4.03	4.25	5.49	10.00	1.34	1.34	.20	10.00
38	2.79	2.59	7.24	10.00	.84	.84	.40	10.00
-38	19.65	21.03	7.03	10.00	6.66	6.66	.06	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					4.39
107000					6.89
75000					9.40
53000					11.02
37500	.00	.00	100.00	.00	5.64
26500	.00	.00	100.00	.00	8.67
19000	.00	.00	100.00	.00	6.15
13200	.30	.30	.10	5.00	5.79
9500	.94	.94	.16	5.00	5.04
6700	1.79	1.78	.80	5.00	3.72
4750	2.96	2.91	1.70	5.00	4.44
3350	3.41	3.35	1.75	5.00	3.06
2360	4.26	4.26	.10	5.00	3.35
1700	4.07	4.09	.51	5.00	2.89
1180	4.25	4.39	3.25	5.00	2.33
850	4.57	4.67	2.20	5.00	2.90
600	5.94	6.10	2.62	5.00	2.39
425	5.72	5.83	1.90	5.00	2.05
300	6.91	7.00	1.33	5.00	1.87
212	6.02	6.05	.44	5.00	0.72
150	6.40	6.35	.83	5.00	0.99
106	5.75	5.58	3.03	5.00	0.80
75	5.10	4.96	2.76	5.00	0.73
53	4.86	4.80	1.15	5.00	0.68
38	2.87	2.92	1.71	5.00	0.55
-38	23.87	23.72	.62	5.00	3.55

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.23	11.97	2.09	5.00	.00	.44	100.00	.00
MILL DISCH.	.00	20.45	100.00	.00	.00	6.08	100.00	.00
SCREEN FEED	.00	23.01	100.00	.00	.00	8.64	100.00	.00
SCR OVERSIZE	.00	3.54	100.00	.00	.00	.70	100.00	.00
SCR U/FLOW	.00	19.47	100.00	.00	.00	7.93	100.00	.00
MILL WATER	.00	4.93	100.00	.00	4.66	4.93	1.47	5.00
PBOX WATER	.00	2.56	100.00	.00	2.25	2.56	13.96	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.54	100.00	.00	98.26	96.34	1.96	3.00
MILL DISCH.	.00	14.37	100.00	.00	71.50	70.29	1.70	5.00
SCREEN FEED	.00	14.37	100.00	.00	61.70	62.46	1.22	6.00
SCR OVERSIZE	.00	2.84	100.00	.00	79.95	80.09	.18	5.00
SCR U/FLOW	.00	11.54	100.00	.00	57.75	59.25	2.59	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.69	.65	5.54	10.00	3.14	3.30	5.20	10.00
19000	2.78	2.62	5.76	10.00	12.52	13.28	6.05	10.00
13200	3.33	3.59	7.66	10.00	18.59	17.28	7.07	10.00
9500	4.83	4.63	4.22	10.00	17.36	18.10	4.27	10.00
6700	3.56	3.80	6.61	10.00	11.76	11.36	3.44	10.00
4750	3.34	3.43	2.80	10.00	7.15	7.10	.65	10.00
3350	3.07	2.88	6.11	10.00	3.40	3.45	1.59	10.00
2360	3.49	3.11	10.89	10.00	2.14	2.17	1.48	10.00
1700	3.46	2.91	15.95	10.00	1.22	1.23	1.20	10.00
1180	4.29	3.52	17.97	10.00	1.07	1.08	.96	10.00
850	4.56	4.07	10.69	10.00	1.02	1.03	.55	10.00
600	5.94	5.91	.47	10.00	1.43	1.43	.13	10.00
425	5.68	5.83	2.57	10.00	1.45	1.45	.02	10.00
300	7.19	7.21	.31	10.00	1.90	1.90	.12	10.00
212	5.91	5.87	.69	10.00	1.73	1.73	.17	10.00
150	5.82	5.78	.75	10.00	1.95	1.95	.19	10.00
106	4.55	4.69	3.06	10.00	1.68	1.68	.10	10.00
75	3.84	3.96	3.12	10.00	1.55	1.55	.13	10.00
53	3.74	3.92	4.76	10.00	1.46	1.46	.26	10.00
38	2.42	2.57	6.38	10.00	.95	.95	.42	10.00
-38	17.51	19.06	8.85	10.00	6.53	6.52	.17	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					18.42
75000					16.02
53000					12.95
37500	.00	.00	100.00	.00	6.14
26500	.00	.00	100.00	.00	5.85
19000	.00	.00	100.00	.00	4.95
13200	.22	.22	.09	5.00	3.92
9500	1.31	1.31	.27	5.00	4.10
6700	1.95	1.94	.66	5.00	3.48
4750	2.54	2.53	.34	5.00	3.27
3350	2.71	2.74	1.17	5.00	2.77
2360	3.27	3.34	2.15	5.00	2.72
1700	3.22	3.32	3.08	5.00	2.09
1180	3.98	4.12	3.48	5.00	1.72
850	4.71	4.82	2.37	5.00	2.11
600	6.99	7.01	.34	5.00	1.67
425	6.93	6.90	.40	5.00	1.39
300	8.50	8.52	.20	5.00	1.19
212	6.86	6.89	.38	5.00	0.53
150	6.63	6.72	.39	5.00	0.67
106	5.46	5.43	.56	5.00	0.54
75	4.58	4.55	.60	5.00	0.46
53	4.57	4.52	1.02	5.00	0.43
38	3.02	2.97	1.50	5.00	0.36
-38	22.48	22.13	1.55	5.00	2.27

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	11.83	11.81	.15	5.00	.00	.28	100.00	.00
MILL DISCH.	.00	20.46	100.00	.00	.00	7.49	100.00	.00
SCREEN FEED	.00	24.07	100.00	.00	.00	11.09	100.00	.00
SCR OVERSIZE	.00	1.80	100.00	.00	.00	.36	100.00	.00
SCR U/FLOW	.00	22.27	100.00	.00	.00	10.73	100.00	.00
MILL WATER	.00	6.85	100.00	.00	6.82	6.85	.42	5.00
PBOX WATER	.00	3.61	100.00	.00	3.50	3.61	3.01	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.54	100.00	.00	97.97	97.66	.32	3.00
MILL DISCH.	.00	12.97	100.00	.00	63.30	63.41	.17	5.00
SCREEN FEED	.00	12.97	100.00	.00	54.60	53.91	1.27	5.00
SCR OVERSIZE	.00	1.44	100.00	.00	79.80	79.87	.08	5.00
SCR U/FLOW	.00	11.54	100.00	.00	51.00	51.81	1.59	4.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.44	.53	20.94	10.00	10.67	4.80	55.01	10.00
19000	3.41	2.81	17.57	10.00	22.01	25.36	15.21	10.00
13200	3.17	3.12	1.72	10.00	24.46	25.54	4.40	10.00
9500	2.93	2.34	20.12	10.00	11.68	12.88	10.29	10.00
6700	2.17	2.08	4.21	10.00	6.02	6.14	2.01	10.00
4750	2.54	2.20	13.50	10.00	3.38	3.46	2.40	10.00
3350	2.52	2.36	6.45	10.00	1.79	1.80	.72	10.00
2360	3.14	3.06	2.60	10.00	1.30	1.30	.27	10.00
1700	3.22	3.05	5.27	10.00	.83	.83	.25	10.00
1180	4.10	3.74	8.83	10.00	.76	.76	.27	10.00
850	4.38	4.07	7.05	10.00	.68	.68	.20	10.00
600	6.05	5.58	7.77	10.00	.92	.92	.24	10.00
425	5.87	5.46	7.02	10.00	.96	.96	.24	10.00
300	7.43	7.04	5.29	10.00	1.36	1.36	.27	10.00
212	6.21	6.15	.96	10.00	1.35	1.35	.18	10.00
150	6.19	6.42	3.75	10.00	1.55	1.55	.08	10.00
106	5.04	5.42	7.47	10.00	1.40	1.40	.06	10.00
75	4.33	4.62	6.78	10.00	1.30	1.30	.07	10.00
53	4.22	4.81	14.02	10.00	1.28	1.28	.32	10.00
38	2.85	3.15	10.38	10.00	.88	.88	.25	10.00
-38	19.81	22.02	11.18	10.00	5.43	5.45	.31	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					13.28
75000					16.03
53000					2.33
37500	.00	.00	100.00	.00	6.12
26500	.00	.00	100.00	.00	8.51
19000	.00	.00	100.00	.00	7.10
13200	.32	.32	.06	5.00	5.89
9500	1.01	1.03	1.62	5.00	5.19
6700	1.56	1.57	.79	5.00	4.09
4750	1.99	2.04	2.50	5.00	4.16
3350	2.39	2.43	1.53	5.00	3.49
2360	3.25	3.28	.84	5.00	3.40
1700	3.28	3.33	1.43	5.00	2.65
1180	4.02	4.11	2.22	5.00	2.10
850	4.41	4.49	1.90	5.00	2.69
600	6.03	6.16	2.16	5.00	2.13
425	5.90	6.02	2.00	5.00	1.85
300	7.61	7.74	1.76	5.00	1.67
212	6.70	6.75	.72	5.00	1.23
150	7.06	7.03	.43	5.00	0.91
106	6.01	5.92	1.54	5.00	0.67
75	5.11	5.04	1.40	5.00	0.73
53	5.45	5.25	3.63	5.00	0.68
38	3.52	3.43	2.59	5.00	0.51
-38	24.38	24.07	1.27	5.00	2.59

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	16.65	16.53	.73	5.00	.00	.49	100.00	.00
MILL DISCH.	.00	29.13	100.00	.00	.00	11.70	100.00	.00
SCREEN FEED	.00	30.14	100.00	.00	.00	12.71	100.00	.00
SCR OVERSIZE	.00	1.79	100.00	.00	.00	.40	100.00	.00
SCR U/FLOW	.00	28.35	100.00	.00	.00	12.31	100.00	.00
MILL WATER	.00	10.81	100.00	.00	10.68	10.81	1.24	5.00
PBOX WATER	.00	1.01	100.00	.00	1.00	1.01	.84	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	16.03	100.00	.00	97.93	97.02	.93	3.00
MILL DISCH.	.00	17.43	100.00	.00	58.70	59.82	1.92	5.00
SCREEN FEED	.00	17.43	100.00	.00	58.30	57.82	.82	5.00
SCR OVERSIZE	.00	1.39	100.00	.00	77.80	77.75	.06	5.00
SCR U/FLOW	.00	16.03	100.00	.00	55.25	56.56	2.38	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.23	.28	20.29	10.00	6.02	3.46	42.52	10.00
19000	1.99	1.40	29.56	10.00	14.91	17.53	17.59	10.00
13200	2.30	1.99	13.47	10.00	19.94	21.77	9.19	10.00
9500	2.27	2.65	16.68	10.00	15.02	13.68	8.94	10.00
6700	2.68	3.17	18.44	10.00	9.12	8.66	5.09	10.00
4750	3.49	3.84	10.06	10.00	5.75	5.67	1.37	10.00
3350	3.98	4.00	.56	10.00	3.33	3.33	.06	10.00
2360	5.11	4.78	6.48	10.00	2.45	2.46	.23	10.00
1700	4.84	4.39	9.37	10.00	1.57	1.57	.23	10.00
1180	5.70	4.95	13.22	10.00	1.44	1.44	.26	10.00
850	5.39	4.89	9.32	10.00	1.24	1.24	.16	10.00
600	6.69	6.30	5.87	10.00	1.57	1.57	.10	10.00
425	5.59	5.55	.75	10.00	1.43	1.43	.00	10.00
300	6.25	6.28	.53	10.00	1.70	1.70	.02	10.00
212	4.97	5.10	2.68	10.00	1.50	1.50	.08	10.00
150	4.89	5.15	5.38	10.00	1.55	1.55	.15	10.00
106	4.19	4.37	4.35	10.00	1.32	1.32	.12	10.00
75	3.97	4.03	1.49	10.00	1.23	1.23	.05	10.00
53	4.09	4.20	2.65	10.00	1.31	1.31	.08	10.00
38	2.77	2.86	3.09	10.00	.96	.96	.09	10.00
-38	18.61	19.82	6.53	10.00	6.63	6.61	.24	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					12.45
107000					10.93
75000					10.48
53000					8.38
37500	.00	.00	100.00	.00	6.63
26500	.00	.00	100.00	.00	5.64
19000	.00	.00	100.00	.00	4.52
13200	.27	.27	.38	5.00	3.66
9500	1.74	1.69	2.86	5.00	3.78
6700	2.82	2.70	4.34	5.00	2.94
4750	3.77	3.68	2.33	5.00	3.54
3350	4.06	4.06	.05	5.00	3.13
2360	4.90	4.98	1.65	5.00	2.99
1700	4.53	4.63	2.22	5.00	2.47
1180	5.10	5.25	2.95	5.00	2.06
850	5.09	5.20	2.25	5.00	2.63
600	6.60	6.71	1.63	5.00	2.13
425	5.88	5.91	.45	5.00	1.81
300	6.67	6.68	.17	5.00	1.62
212	5.44	5.42	.43	5.00	0.76
150	5.53	5.47	1.15	5.00	1.04
106	4.68	4.64	.91	5.00	0.87
75	4.28	4.27	.18	5.00	0.81
53	4.47	4.45	.46	5.00	0.80
38	3.04	3.02	.64	5.00	0.62
-38	21.14	20.98	.75	5.00	3.30

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	11.82	11.59	1.92	5.00	.00	.43	100.00	.00
MILL DISCH.	.00	19.41	100.00	.00	.00	6.91	100.00	.00
SCREEN FEED	.00	22.33	100.00	.00	.00	9.83	100.00	.00
SCR OVERSIZE	.00	1.68	100.00	.00	.00	.35	100.00	.00
SCR U/FLOW	.00	20.65	100.00	.00	.00	9.48	100.00	.00
MILL WATER	.00	6.14	100.00	.00	6.07	6.14	1.13	5.00
PBOX WATER	.00	2.92	100.00	.00	2.50	2.92	16.84	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.17	100.00	.00	97.71	96.33	1.41	3.00
MILL DISCH.	.00	12.50	100.00	.00	67.20	64.39	4.19	5.00
SCREEN FEED	.00	12.50	100.00	.00	55.80	55.96	.29	5.00
SCR OVERSIZE	.00	1.33	100.00	.00	78.95	79.25	.38	5.00
SCR U/FLOW	.00	11.17	100.00	.00	52.38	54.07	3.23	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.39	.47	20.25	10.00	8.02	4.41	44.98	10.00
19000	2.36	2.12	10.29	10.00	18.62	19.92	6.97	10.00
13200	3.13	2.79	10.79	10.00	21.98	23.32	6.09	10.00
9500	2.46	2.20	10.75	10.00	14.07	14.81	5.28	10.00
6700	2.31	2.11	8.53	10.00	7.86	8.05	2.38	10.00
4750	2.89	2.45	15.37	10.00	4.61	4.71	2.19	10.00
3350	2.72	2.45	9.78	10.00	2.47	2.49	.72	10.00
2360	3.26	2.99	8.17	10.00	1.59	1.59	.28	10.00
1700	3.09	2.91	5.91	10.00	.89	.89	.10	10.00
1180	3.73	3.40	8.91	10.00	.82	.82	.13	10.00
850	3.93	3.56	9.49	10.00	.69	.69	.12	10.00
600	5.35	5.08	5.02	10.00	.95	.95	.01	10.00
425	5.44	5.25	3.57	10.00	1.02	1.02	.02	10.00
300	7.26	6.86	5.45	10.00	1.46	1.46	.01	10.00
212	6.44	6.39	.74	10.00	1.50	1.50	.12	10.00
150	6.62	6.79	2.54	10.00	1.74	1.74	.23	10.00
106	5.53	5.82	5.21	10.00	1.59	1.59	.30	10.00
75	4.76	5.39	13.19	10.00	1.45	1.44	.56	10.00
53	4.69	5.18	10.54	10.00	1.49	1.48	.49	10.00
38	2.96	3.46	16.83	10.00	.91	.90	.63	10.00
-38	20.69	22.34	7.99	10.00	6.28	6.23	.82	10.00

STREAM	SCR U/FLOW				FRESH FEED
	NEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					8.67
107000					7.65
75000					7.14
53000					13.62
37500	.00	.00	100.00	.00	7.40
26500	.00	.00	100.00	.00	8.06
19000	.00	.00	100.00	.00	7.11
13200	.35	.35	.29	5.00	4.56
9500	.69	.69	.72	5.00	4.22
6700	1.39	1.41	1.24	5.00	3.64
4750	2.12	2.18	2.66	5.00	3.31
3350	2.40	2.45	2.09	5.00	2.60
2360	3.10	3.16	1.94	5.00	2.67
1700	3.10	3.15	1.53	5.00	2.22
1180	3.63	3.71	2.16	5.00	1.86
850	3.81	3.90	2.31	5.00	2.48
600	5.49	5.57	1.51	5.00	2.06
425	5.68	5.75	1.21	5.00	1.75
300	7.38	7.51	1.72	5.00	1.63
212	6.93	6.97	.64	5.00	0.66
150	7.40	7.39	.15	5.00	0.93
106	6.38	6.32	.92	5.00	0.77
75	6.06	5.86	3.35	5.00	0.72
53	5.77	5.62	2.52	5.00	0.67
38	3.95	3.76	4.76	5.00	0.52
-38	24.34	24.22	.49	5.00	3.09

MASS BALANCE OF LORNEC C-CIRCUIT RUN #21

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.95	12.73	1.70	5.00	.00	.44	100.00	.00
MILL DISCH.	.00	21.87	100.00	.00	.00	6.39	100.00	.00
SCREEN FEED	.00	24.10	100.00	.00	.00	8.62	100.00	.00
SCR OVERSIZE	.00	3.96	100.00	.00	.00	.77	100.00	.00
SCR U/FLOW	.00	20.13	100.00	.00	.00	7.85	100.00	.00
MILL WATER	.00	5.18	100.00	.00	5.11	5.18	1.33	5.00
PBOX WATER	.00	2.23	100.00	.00	2.00	2.23	11.32	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.29	100.00	.00	98.23	96.53	1.73	3.00
MILL DISCH.	.00	15.48	100.00	.00	72.20	70.79	1.96	5.00
SCREEN FEED	.00	15.48	100.00	.00	62.20	64.25	3.29	5.00
SCR OVERSIZE	.00	3.19	100.00	.00	80.70	80.59	.14	5.00
SCR U/FLOW	.00	12.29	100.00	.00	59.20	61.03	3.09	4.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.36	.87	35.89	10.00	3.52	4.23	20.03	10.00
19000	3.30	2.98	9.66	10.00	13.01	14.45	11.05	10.00
13200	3.82	4.21	10.10	10.00	20.71	19.42	6.22	10.00
9500	4.63	4.94	5.31	10.00	17.88	17.92	.21	10.00
6700	3.65	4.22	15.52	10.00	10.21	9.55	6.46	10.00
4750	3.38	4.05	19.90	10.00	6.22	5.84	6.03	10.00
3350	3.22	3.54	9.82	10.00	3.15	3.11	1.21	10.00
2360	3.73	3.89	4.16	10.00	2.14	2.14	.03	10.00
1700	3.44	3.39	1.56	10.00	1.31	1.32	.44	10.00
1180	3.96	3.78	4.48	10.00	1.19	1.20	.57	10.00
850	4.19	3.92	6.50	10.00	1.11	1.12	.63	10.00
600	5.64	5.35	5.09	10.00	1.38	1.39	.59	10.00
425	5.39	5.12	4.93	10.00	1.33	1.34	.58	10.00
300	6.52	6.03	7.47	10.00	1.66	1.67	.80	10.00
212	5.26	4.98	5.38	10.00	1.53	1.54	.70	10.00
150	5.25	5.13	2.30	10.00	1.64	1.65	.55	10.00
106	4.49	4.35	3.14	10.00	1.50	1.51	.58	10.00
75	4.06	3.86	4.94	10.00	1.39	1.40	.69	10.00
53	4.12	3.89	5.48	10.00	1.46	1.47	.76	10.00
38	2.62	2.60	.68	10.00	1.01	1.01	.30	10.00
-38	17.92	18.31	5.55	10.00	6.66	6.74	1.21	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					10.15
152000					4.61
107000					14.02
75000					6.04
53000					10.38
37500	.00	.00	100.00	.00	6.13
26500	.00	.00	100.00	.00	8.03
19000	.00	.00	100.00	.00	4.74
13200	.25	.25	.13	5.00	4.55
9500	1.57	1.56	.34	5.00	4.28
6700	2.90	2.83	2.43	5.00	3.21
4750	3.75	3.59	4.35	5.00	3.22
3350	3.73	3.65	2.23	5.00	2.49
2360	4.38	4.34	.94	5.00	2.40
1700	3.91	3.92	.36	5.00	2.02
1180	4.41	4.45	1.02	5.00	1.62
850	4.58	4.65	1.44	5.00	2.04
600	6.31	6.38	1.17	5.00	1.68
425	6.04	6.11	1.14	5.00	1.46
300	7.05	7.17	1.65	5.00	1.32
212	5.80	5.87	1.22	5.00	0.54
150	6.00	6.03	.56	5.00	0.71
106	5.05	5.09	.74	5.00	0.59
75	4.45	4.50	-1.10	5.00	0.53
53	4.47	4.52	1.21	5.00	0.48
38	3.01	3.02	.18	5.00	0.39
-38	22.31	22.04	1.22	5.00	2.38

MASS BALANCE OF LORNEX C-CIRCUIT RUN #22

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	15.11	15.03	.55	5.00	.00	.42	100.00	.00
MILL DISCH.	.00	26.52	100.00	.00	.00	9.79	100.00	.00
SCREEN FEED	.00	28.72	100.00	.00	.00	12.00	100.00	.00
SCR OVERSIZE	.00	2.68	100.00	.00	.00	.56	100.00	.00
SCR U/FLOW	.00	26.04	100.00	.00	.00	11.44	100.00	.00
MILL WATER	.00	8.81	100.00	.00	8.71	8.81	1.16	5.00
PBOX WATER	.00	2.21	100.00	.00	2.25	2.21	1.91	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	14.61	100.00	.00	98.09	97.21	.90	3.00
MILL DISCH.	.00	16.73	100.00	.00	53.80	63.08	5.49	5.00
SCREEN FEED	.00	16.73	100.00	.00	57.50	58.24	1.28	8.00
SCR OVERSIZE	.00	2.12	100.00	.00	79.60	79.17	.54	5.00
SCR U/FLOW	.00	14.61	100.00	.00	56.45	56.08	.65	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.10	100.00	10.00	.79	.79	.39	10.00
26500	1.78	.66	62.81	10.00	4.30	5.22	21.38	10.00
19000	2.59	2.04	21.30	10.00	13.09	15.73	20.14	10.00
13200	2.57	3.02	17.36	10.00	21.89	20.16	7.90	10.00
9500	3.00	3.66	22.12	10.00	16.26	15.10	7.14	10.00
6700	2.79	3.59	28.55	10.00	10.39	9.52	8.33	10.00
4750	3.45	4.24	23.00	10.00	6.03	5.90	2.11	10.00
3350	3.73	4.08	9.34	10.00	3.38	3.40	.60	10.00
2360	4.41	4.62	4.84	10.00	2.23	2.25	.79	10.00
1700	4.07	4.02	1.32	10.00	1.36	1.37	.73	10.00
1180	4.84	4.57	5.59	10.00	1.24	1.25	.80	10.00
850	4.88	4.54	6.93	10.00	1.07	1.08	.72	10.00
600	6.31	6.01	4.78	10.00	1.39	1.40	.82	10.00
425	5.63	5.41	3.84	10.00	1.33	1.34	.77	10.00
300	6.66	6.44	3.35	10.00	1.70	1.72	.95	10.00
212	5.46	5.22	4.37	10.00	1.51	1.52	.90	10.00
150	5.28	5.18	1.89	10.00	1.61	1.62	.87	10.00
106	4.24	4.23	.25	10.00	1.32	1.33	.66	10.00
75	3.68	3.73	1.47	10.00	1.20	1.21	.53	10.00
53	3.68	3.75	1.99	10.00	1.25	1.26	.53	10.00
38	2.53	2.49	1.44	10.00	.85	.85	.48	10.00
-38	18.38	18.35	.16	10.00	5.81	5.98	2.89	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					16.25
75000					9.22
32000					9.56
37500	.00	.00	100.00	.00	6.04
26500	.00	.00	100.00	.00	7.53
19000	.05	.05	.09	5.00	5.77
13200	.53	.53	.76	5.00	5.76
9500	2.07	2.00	3.26	5.00	4.95
6700	2.91	2.72	6.39	5.00	4.38
4750	4.26	4.00	6.05	5.00	3.99
3350	4.27	4.18	2.18	5.00	3.20
2360	5.02	4.97	1.02	5.00	3.19
1700	4.38	4.40	.47	5.00	2.51
1180	4.98	5.05	1.44	5.00	2.12
850	4.96	5.05	1.72	5.00	2.67
600	6.59	6.68	1.33	5.00	2.16
425	5.94	6.01	1.10	5.00	1.86
300	7.05	7.12	1.03	5.00	1.64
212	5.69	5.76	1.20	5.00	0.73
150	5.66	5.70	.65	5.00	0.92
106	4.64	4.65	.23	5.00	0.73
75	4.11	4.10	.21	5.00	0.64
53	4.13	4.12	.34	5.00	0.58
38	2.72	2.73	.43	5.00	0.47
-38	20.04	20.19	.76	5.00	3.13

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	15.38	15.36	.14	5.00	.00	.31	100.00	.00
MILL DISCH.	.00	26.84	100.00	.00	.00	9.75	100.00	.00
SCREEN FEED	.00	29.09	100.00	.00	.00	12.01	100.00	.00
SCR OVERSIZE	.00	2.52	100.00	.00	.00	.48	100.00	.00
SCR U/FLOW	.00	26.58	100.00	.00	.00	11.53	100.00	.00
MILL WATER	.00	8.97	100.00	.00	8.91	8.97	.62	5.00
PBOX WATER	.00	2.25	100.00	.00	2.25	2.25	.12	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	15.05	100.00	.00	98.40	97.97	.43	3.00
MILL DISCH.	.00	17.09	100.00	.00	62.50	63.66	1.85	5.00
SCREEN FEED	.00	17.09	100.00	.00	59.20	58.73	.79	5.00
SCR OVERSIZE	.00	2.04	100.00	.00	81.10	81.02	.10	5.00
SCR U/FLOW	.00	15.05	100.00	.00	56.45	56.62	.30	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.75	.81	8.22	10.00	7.41	6.60	8.24	10.00
19000	2.60	1.78	31.50	10.00	12.08	14.48	19.83	10.00
13200	2.46	2.84	15.62	10.00	21.54	18.93	12.12	10.00
9500	3.49	3.56	1.87	10.00	16.53	16.89	2.17	10.00
6700	3.54	3.40	4.01	10.00	9.16	9.44	3.03	10.00
4750	4.09	4.10	.15	10.00	5.73	5.79	1.09	10.00
3350	4.03	3.97	1.49	10.00	3.27	3.30	.78	10.00
2360	4.83	4.59	5.01	10.00	2.38	2.40	.76	10.00
1700	4.38	4.06	7.36	10.00	1.46	1.47	.58	10.00
1180	4.96	4.49	9.47	10.00	1.32	1.33	.56	10.00
850	4.96	4.53	8.73	10.00	1.15	1.16	.47	10.00
600	6.73	6.19	8.09	10.00	1.42	1.43	.48	10.00
425	5.84	5.55	5.05	10.00	1.32	1.33	.39	10.00
300	6.83	6.67	2.31	10.00	1.62	1.63	.38	10.00
212	5.31	5.57	4.90	10.00	1.43	1.43	.12	10.00
150	5.29	5.61	6.01	10.00	1.59	1.59	.10	10.00
106	4.27	4.59	7.49	10.00	1.40	1.40	.02	10.00
75	3.71	3.98	7.39	10.00	1.26	1.26	.05	10.00
53	3.41	3.85	12.91	10.00	1.33	1.33	.34	10.00
38	2.22	2.53	14.02	10.00	.85	.85	.47	10.00
-38	16.32	17.36	6.39	10.00	5.74	5.79	.85	10.00

STREAM	SCR U/FLOW.				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					0.00
107000					12.00
75000					11.03
53000					14.91
37500	.00	.00	100.00	.00	7.05
26500	.00	.00	100.00	.00	6.84
19000	.06	.06	.16	5.00	5.93
13200	.67	.66	.90	5.00	4.09
9500	1.75	1.75	.12	5.00	4.41
6700	2.56	2.58	.77	5.00	3.74
4750	3.86	3.87	.16	5.00	3.65
3350	4.04	4.06	.53	5.00	3.28
2360	4.92	4.88	1.34	5.00	3.16
1700	4.33	4.41	1.82	5.00	2.58
1180	4.81	4.92	2.26	5.00	2.10
850	4.88	4.98	2.13	5.00	2.65
600	6.69	6.83	2.10	5.00	2.12
425	6.03	6.12	1.45	5.00	1.75
300	7.29	7.36	.91	5.00	1.53
212	6.19	6.13	.95	5.00	0.74
150	6.23	6.15	1.25	5.00	0.92
106	5.11	5.02	1.72	5.00	0.73
75	4.43	4.35	1.72	5.00	0.64
53	4.34	4.19	3.40	5.00	0.57
38	2.87	2.76	3.85	5.00	0.48
-38	19.05	18.92	.69	5.00	3.14

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	13.79	13.72	.54	5.00	.00	.38	100.00	.00
MILL DISCH.	.00	22.78	100.00	.00	.00	7.24	100.00	.00
SCREEN FEED	.00	26.36	100.00	.00	.00	10.82	100.00	.00
SCR OVERSIZE	.00	2.73	100.00	.00	.00	.53	100.00	.00
SCR U/FLOW	.00	23.64	100.00	.00	.00	10.30	100.00	.00
MILL WATER	.00	6.34	100.00	.00	6.29	6.34	.78	5.00
PBOX WATER	.00	3.58	100.00	.00	3.50	3.58	2.31	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	13.34	100.00	.00	98.04	97.26	.79	3.00
MILL DISCH.	.00	15.54	100.00	.00	66.90	68.21	1.96	5.00
SCREEN FEED	.00	15.54	100.00	.00	59.00	58.95	.09	6.00
SCR OVERSIZE	.00	2.20	100.00	.00	80.85	80.67	.22	5.00
SCR U/FLOW	.00	13.34	100.00	.00	56.23	56.44	.37	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.54	.80	48.22	10.00	4.62	5.63	21.89	10.00
19000	2.84	2.68	5.70	10.00	16.57	18.18	9.73	10.00
13200	3.01	3.30	9.50	10.00	21.07	20.43	3.02	10.00
9500	3.15	3.52	11.61	10.00	16.30	15.72	3.56	10.00
6700	2.32	3.02	30.02	10.00	9.75	8.30	14.91	10.00
4750	2.95	3.33	12.85	10.00	5.34	5.25	1.67	10.00
3350	2.87	3.30	14.92	10.00	2.87	2.83	1.24	10.00
2360	3.67	3.90	6.26	10.00	1.98	1.98	.12	10.00
1700	3.56	3.58	.44	10.00	1.25	1.25	.36	10.00
1180	4.25	4.23	.44	10.00	1.27	1.28	.40	10.00
850	4.71	4.45	5.44	10.00	1.11	1.12	.52	10.00
600	6.77	6.28	7.28	10.00	1.40	1.41	.64	10.00
425	6.20	5.71	7.95	10.00	1.34	1.35	.65	10.00
300	7.34	6.93	5.58	10.00	1.67	1.68	.69	10.00
212	5.79	5.55	4.13	10.00	1.46	1.47	.59	10.00
150	5.51	5.48	.60	10.00	1.54	1.55	.49	10.00
106	4.35	4.61	5.90	10.00	1.34	1.34	.15	10.00
75	3.90	3.94	.99	10.00	1.24	1.24	.33	10.00
53	3.84	3.98	3.58	10.00	1.33	1.33	.23	10.00
38	2.61	2.68	2.55	10.00	.88	.88	.15	10.00
-38	18.82	18.77	.29	10.00	5.63	5.79	1.74	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					7.51
107000					12.81
75000					10.91
53000					6.41
37500	.00	.00	100.00	.00	5.76
26500	.00	.00	100.00	.00	7.11
19000	.12	.12	.05	5.00	5.86
13200	.47	.47	.31	5.00	5.52
9500	1.52	1.50	1.18	5.00	4.81
6700	2.29	2.15	6.32	5.00	4.46
4750	3.10	3.01	2.84	5.00	3.73
3350	3.51	3.37	3.85	5.00	2.98
2360	4.28	4.22	1.49	5.00	3.05
1700	3.96	3.96	.04	5.00	2.47
1180	4.71	4.72	.19	5.00	1.93
850	4.94	5.00	1.31	5.00	2.45
600	6.96	7.08	1.73	5.00	2.00
425	6.31	6.43	1.85	5.00	1.73
300	7.69	7.80	1.39	5.00	1.57
212	6.16	6.22	1.05	5.00	1.34
150	6.11	6.13	.25	5.00	0.67
106	5.22	5.15	1.43	5.00	0.72
75	4.39	4.38	.16	5.00	0.62
53	4.45	4.41	.81	5.00	0.60
38	2.99	2.97	.57	5.00	0.46
-38	20.80	20.89	.43	5.00	2.53

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	18.32	18.10	1.20	5.00	.00	.65	100.00	.00
MILL DISCH.	.00	30.10	100.00	.00	.00	10.76	100.00	.00
SCREEN FEED	.00	31.40	100.00	.00	.00	12.06	100.00	.00
SCR OVERSIZE	.00	2.34	100.00	.00	.00	.45	100.00	.00
SCR U/FLOW	.00	29.07	100.00	.00	.00	11.61	100.00	.00
MILL WATER	.00	9.67	100.00	.00	9.53	9.67	1.43	5.00
PBOX WATER	.00	1.30	100.00	.00	1.25	1.30	4.09	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	17.46	100.00	.00	97.77	96.43	1.37	3.00
MILL DISCH.	.00	19.34	100.00	.00	65.30	64.26	1.59	5.00
SCREEN FEED	.00	19.34	100.00	.00	61.70	61.60	.17	5.00
SCR OVERSIZE	.00	1.89	100.00	.00	80.75	80.86	.14	5.00
SCR U/FLOW	.00	17.46	100.00	.00	58.70	60.05	2.30	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.17	.65	44.66	10.00	5.40	6.63	22.83	10.00
19000	1.89	1.58	16.48	10.00	13.65	16.17	18.46	10.00
13200	1.80	2.19	21.65	10.00	20.90	17.96	14.06	10.00
9500	2.49	3.07	23.48	10.00	16.95	15.75	7.10	10.00
6700	3.08	3.63	17.87	10.00	9.66	9.60	.63	10.00
4750	3.94	4.32	9.74	10.00	5.57	5.65	1.45	10.00
3350	4.25	4.49	5.70	10.00	3.13	3.17	1.16	10.00
2360	5.18	5.17	.20	10.00	2.22	2.24	1.12	10.00
1700	4.78	4.52	5.50	10.00	1.50	1.51	.92	10.00
1180	5.32	4.95	6.36	10.00	1.38	1.39	.87	10.00
850	5.41	5.04	6.82	10.00	1.20	1.21	.75	10.00
600	6.48	6.26	3.44	10.00	1.51	1.52	.84	10.00
425	5.54	5.33	3.73	10.00	1.35	1.36	.77	10.00
300	6.28	6.07	3.29	10.00	1.61	1.62	.89	10.00
212	4.94	4.86	1.65	10.00	1.38	1.39	.74	10.00
150	4.94	4.88	1.12	10.00	1.52	1.53	.80	10.00
106	4.01	4.21	4.86	10.00	1.33	1.34	.51	10.00
75	3.72	3.93	5.63	10.00	1.24	1.25	.44	10.00
53	3.87	3.98	2.87	10.00	1.38	1.39	.53	10.00
38	2.70	2.74	1.43	10.00	.96	.96	.43	10.00
-38	18.17	18.08	.47	10.00	6.15	6.34	3.10	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					11.82
107000					7.75
75000					6.88
53000					14.43
37500	.00	.00	100.00	.00	6.15
26500	.00	.00	100.00	.00	6.44
19000	.00	.00	100.00	.00	5.18
13200	.49	.48	1.32	5.00	3.92
9500	1.77	1.70	3.74	5.00	4.18
6700	3.11	2.98	4.03	5.00	3.66
4750	4.28	4.18	2.33	5.00	3.72
3350	4.70	4.64	1.37	5.00	2.98
2360	5.48	5.49	.11	5.00	2.99
1700	4.78	4.84	1.30	5.00	2.50
1180	5.25	5.33	1.61	5.00	2.03
850	5.37	5.46	1.59	5.00	2.56
600	6.71	6.77	.88	5.00	2.04
425	5.71	5.76	.94	5.00	1.74
300	6.50	6.56	.85	5.00	1.55
212	5.21	5.23	.46	5.00	1.09
150	5.23	5.25	.33	5.00	0.87
106	4.57	4.52	1.20	5.00	0.69
75	4.28	4.22	1.41	5.00	0.82
53	4.29	4.26	.66	5.00	0.63
38	2.94	2.93	.32	5.00	0.49
-38	19.34	19.41	.35	5.00	2.90

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.96	12.71	1.92	5.00	.00	.49	100.00	.00
MILL DISCH.	.00	23.47	100.00	.00	.00	6.88	100.00	.00
SCREEN FEED	.00	26.59	100.00	.00	.00	10.01	100.00	.00
SCR OVERSIZE	.00	5.57	100.00	.00	.00	1.20	100.00	.00
SCR U/FLOW	.00	21.02	100.00	.00	.00	8.90	100.00	.00
MILL WATER	.00	5.19	100.00	.00	5.12	5.19	1.30	5.00
PBOX WATER	.00	3.13	100.00	.00	2.75	3.13	13.67	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	12.22	100.00	.00	97.88	96.14	1.78	3.00
MILL DISCH.	.00	16.59	100.00	.00	71.60	70.69	1.27	5.00
SCREEN FEED	.00	16.59	100.00	.00	62.30	62.38	.13	5.00
SCR OVERSIZE	.00	4.37	100.00	.00	78.20	78.42	.29	5.00
SCR U/FLOW	.00	12.22	100.00	.00	56.75	58.13	2.43	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.73	.78	6.89	10.00	3.22	2.96	7.98	10.00
19000	4.17	3.41	18.20	10.00	11.44	12.95	13.23	10.00
13200	5.76	5.29	8.10	10.00	18.01	19.23	6.80	10.00
9500	4.77	5.01	5.06	10.00	16.20	15.49	4.41	10.00
6700	3.70	4.26	15.18	10.00	12.00	10.45	12.88	10.00
4750	3.40	3.64	6.94	10.00	6.85	6.60	3.63	10.00
3350	3.08	3.03	1.60	10.00	3.52	3.54	.51	10.00
2360	3.38	3.15	6.90	10.00	2.31	2.34	1.26	10.00
1700	2.93	2.79	4.82	10.00	1.31	1.32	.58	10.00
1180	3.37	3.17	5.92	10.00	1.15	1.16	.54	10.00
850	3.60	3.38	6.12	10.00	1.03	1.03	.47	10.00
600	5.06	4.95	2.24	10.00	1.47	1.47	.18	10.00
425	4.91	4.90	.23	10.00	1.48	1.48	.03	10.00
300	6.32	6.31	.18	10.00	2.01	2.01	.03	10.00
212	5.47	5.54	1.32	10.00	1.89	1.89	.11	10.00
150	5.64	5.92	5.01	10.00	2.13	2.12	.48	10.00
106	4.75	5.03	5.82	10.00	1.84	1.83	.58	10.00
75	4.23	4.30	1.58	10.00	1.67	1.67	.15	10.00
53	4.14	4.32	4.27	10.00	1.79	1.78	.47	10.00
38	2.79	2.74	1.91	10.00	1.17	1.17	.22	10.00
-38	17.81	18.10	1.66	10.00	7.50	7.49	.13	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					6.80
107000					12.13
75000					7.54
53000					9.57
37500	.00	.00	100.00	.00	5.57
26500	.00	.00	100.00	.00	8.09
19000	.00	.00	100.00	.00	6.94
13200	.31	.31	.09	5.00	5.01
9500	1.27	1.27	.22	5.00	4.26
6700	2.08	2.05	1.53	5.00	4.24
4750	2.60	2.58	.93	5.00	3.42
3350	2.84	2.85	.33	5.00	2.86
2360	3.39	3.44	1.34	5.00	3.19
1700	3.28	3.31	1.06	5.00	2.52
1180	3.84	3.89	1.32	5.00	2.01
850	4.16	4.22	1.39	5.00	2.65
600	6.15	6.19	.62	5.00	2.12
425	6.11	6.12	.17	5.00	1.81
300	7.83	7.85	.19	5.00	1.66
212	6.86	6.85	.17	5.00	0.77
150	7.36	7.28	1.06	5.00	0.98
106	6.25	6.17	1.29	5.00	0.78
75	5.25	5.24	.26	5.00	0.71
53	5.27	5.22	.90	5.00	0.65
38	3.28	3.30	.48	5.00	0.45
-38	21.88	21.89	.05	5.00	3.25

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	11.85	11.61	2.02	5.00	.00	.37	100.00	.00
MILL DISCH.	.00	20.69	100.00	.00	.00	7.36	100.00	.00
SCREEN FEED	.00	22.81	100.00	.00	.00	9.98	100.00	.00
SCR OVERSIZE	.00	2.10	100.00	.00	.00	.51	100.00	.00
SCR U/FLOW	.00	20.71	100.00	.00	.00	9.47	100.00	.00
MILL WATER	.00	6.97	100.00	.00	6.83	6.97	2.05	5.00
PBOX WATER	.00	2.13	100.00	.00	2.00	2.13	6.40	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.24	100.00	.00	98.64	96.77	1.89	3.00
MILL DISCH.	.00	12.83	100.00	.00	60.70	62.02	2.18	5.00
SCREEN FEED	.00	12.83	100.00	.00	54.90	56.24	2.44	5.00
SCR OVERSIZE	.00	1.59	100.00	.00	76.05	75.73	.42	5.00
SCR U/FLOW	.00	11.24	100.00	.00	53.13	54.26	2.12	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.35	.31	11.79	10.00	2.25	2.49	10.46	10.00
19000	3.17	1.73	45.42	10.00	10.81	13.43	24.28	10.00
13200	2.01	2.24	11.43	10.00	17.27	16.55	4.15	10.00
9500	2.47	2.91	17.97	10.00	16.72	15.50	7.32	10.00
6700	2.57	3.11	20.95	10.00	12.31	11.48	6.73	10.00
4750	2.82	3.46	22.63	10.00	8.06	7.72	4.28	10.00
3350	2.92	3.57	22.17	10.00	4.35	4.26	2.08	10.00
2360	3.82	4.42	15.73	10.00	3.15	3.15	.14	10.00
1700	3.97	4.14	4.28	10.00	1.87	1.88	.62	10.00
1180	4.79	4.78	.17	10.00	1.66	1.67	.78	10.00
850	5.26	5.11	2.76	10.00	1.41	1.42	.75	10.00
600	7.09	6.77	4.50	10.00	1.70	1.72	.93	10.00
425	6.34	6.04	4.71	10.00	1.54	1.55	.86	10.00
300	7.31	6.98	4.46	10.00	1.84	1.86	1.00	10.00
212	5.76	5.59	2.93	10.00	1.59	1.60	.84	10.00
150	5.62	5.56	1.15	10.00	1.69	1.70	.83	10.00
106	4.35	4.53	4.06	10.00	1.47	1.48	.51	10.00
75	3.84	3.86	.52	10.00	1.37	1.38	.62	10.00
53	3.87	4.00	3.42	10.00	1.40	1.41	.50	10.00
38	2.68	2.71	1.14	10.00	.98	.98	.40	10.00
-38	19.02	18.20	4.29	10.00	6.56	6.77	3.24	10.00

STREAM	SCR U/FLOW				FRESH FEED
	NEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					6.42
152000					8.29
107000					18.64
75000					10.83
53000					8.16
37500	.00	.00	100.00	.00	4.15
26500	.00	.00	100.00	.00	6.46
19000	.07	.07	.22	5.00	4.62
13200	.21	.21	.25	5.00	4.58
9500	1.15	1.13	1.79	5.00	3.69
6700	1.99	1.92	3.47	5.00	2.71
4750	3.01	2.85	5.17	5.00	3.07
3350	3.69	3.47	5.98	5.00	2.35
2360	4.80	4.60	4.13	5.00	2.16
1700	4.50	4.46	.88	5.00	1.81
1180	5.21	5.22	.25	5.00	1.39
850	5.59	5.64	.87	5.00	1.64
600	7.39	7.49	1.33	5.00	1.38
425	6.59	6.68	1.34	5.00	1.22
300	7.61	7.71	1.33	5.00	1.12
212	6.10	6.16	.93	5.00	0.52
150	6.07	6.10	.52	5.00	0.64
106	5.00	4.96	.82	5.00	0.54
75	4.21	4.21	.05	5.00	0.48
53	4.40	4.37	.67	5.00	0.46
38	2.96	2.96	.16	5.00	0.36
-38	19.45	19.79	1.75	5.00	2.31

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.06	11.90	1.32	5.00	.00	.33	100.00	.00
MILL DISCH.	.00	20.05	100.00	.00	.00	6.48	100.00	.00
SCREEN FEED	.00	22.55	100.00	.00	.00	8.98	100.00	.00
SCR OVERSIZE	.00	2.56	100.00	.00	.00	.57	100.00	.00
SCR U/FLOW	.00	19.98	100.00	.00	.00	8.41	100.00	.00
MILL WATER	.00	5.58	100.00	.00	5.53	5.58	.99	5.00
PBOX WATER	.00	2.50	100.00	.00	2.25	2.50	10.93	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.57	100.00	.00	98.42	97.23	1.21	3.00
MILL DISCH.	.00	13.57	100.00	.00	69.30	67.66	2.37	5.00
SCREEN FEED	.00	13.57	100.00	.00	60.10	60.17	.12	6.00
SCR OVERSIZE	.00	1.99	100.00	.00	77.35	77.79	.31	5.00
SCR U/FLOW	.00	11.57	100.00	.00	56.63	57.91	2.26	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.62	.50	68.90	10.00	2.88	3.43	18.98	10.00
19000	1.28	1.29	1.05	10.00	8.30	8.45	1.81	10.00
13200	2.80	2.59	7.64	10.00	14.95	16.60	11.06	10.00
9500	2.88	3.33	15.57	10.00	17.04	15.71	7.78	10.00
6700	2.88	3.32	15.38	10.00	12.26	11.59	5.48	10.00
4750	2.88	3.50	21.41	10.00	8.65	8.09	6.52	10.00
3350	2.91	3.30	13.55	10.00	5.06	4.97	1.75	10.00
2360	3.64	3.74	2.79	10.00	3.43	3.46	.77	10.00
1700	3.53	3.46	2.12	10.00	1.95	1.97	.83	10.00
1180	4.19	3.85	8.14	10.00	1.70	1.72	1.06	10.00
850	4.67	4.30	7.93	10.00	1.52	1.53	.89	10.00
600	6.69	6.11	8.72	10.00	1.96	1.98	1.04	10.00
425	6.41	5.86	8.57	10.00	1.84	1.86	.98	10.00
300	7.53	7.21	4.31	10.00	2.24	2.26	.95	10.00
212	6.01	5.95	.92	10.00	1.92	1.93	.69	10.00
150	5.97	6.09	1.96	10.00	2.04	2.05	.59	10.00
106	4.92	5.01	1.85	10.00	1.79	1.80	.51	10.00
75	4.02	4.24	5.39	10.00	1.53	1.53	.22	10.00
53	4.02	4.10	2.07	10.00	1.54	1.55	.40	10.00
38	2.66	2.71	1.79	10.00	1.01	1.01	.24	10.00
-38	18.50	19.56	5.71	10.00	6.37	6.49	1.87	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					5.59
107000					17.23
75000					13.63
53000					9.09
37500	.00	.00	100.00	.00	5.87
26500	.00	.00	100.00	.00	6.86
19000	.06	.06	.01	5.00	4.93
13200	.17	.17	.10	5.00	3.53
9500	1.21	1.19	1.36	5.00	4.10
6700	1.94	1.90	2.15	5.00	3.82
4750	2.83	2.71	4.40	5.00	3.46
3350	3.11	3.02	2.99	5.00	2.79
2360	3.81	3.79	.50	5.00	2.78
1700	3.69	3.71	.59	5.00	2.18
1180	4.14	4.22	1.84	5.00	1.75
850	4.69	4.78	1.84	5.00	2.18
600	6.68	6.82	2.07	5.00	1.71
425	6.42	6.55	2.03	5.00	1.46
300	7.96	8.06	1.22	5.00	1.25
212	6.62	6.63	.42	5.00	0.57
150	6.80	6.78	.26	5.00	0.73
106	5.58	5.56	.27	5.00	0.58
75	4.76	4.70	1.21	5.00	0.51
53	4.56	4.54	.36	5.00	0.47
38	3.01	3.00	.34	5.00	0.38
-38	21.96	21.79	.76	5.00	2.55

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	15.24	15.48	1.57	5.00	.00	.16	100.00	.00
MILL DISCH.	.00	32.78	100.00	.00	.00	11.43	100.00	.00
SCREEN FEED	.00	35.70	100.00	.00	.00	14.35	100.00	.00
SCR OVERSIZE	.00	7.61	100.00	.00	.00	1.57	100.00	.00
SCR U/FLOW	.00	28.09	100.00	.00	.00	12.77	100.00	.00
MILL WATER	.00	9.70	100.00	.00	9.73	9.70	.32	5.00
PBOX WATER	.00	2.91	100.00	.00	3.50	2.91	16.80	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	15.32	100.00	.00	98.19	98.94	.77	3.00
MILL DISCH.	.00	21.35	100.00	.00	58.80	65.12	10.76	5.00
SCREEN FEED	.00	21.35	100.00	.00	62.70	59.81	4.61	5.00
SCR OVERSIZE	.00	6.04	100.00	.00	80.10	79.35	.94	5.00
SCR U/FLOW	.00	15.32	100.00	.00	55.38	54.52	1.55	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.94	1.04	10.99	10.00	4.31	3.69	14.37	10.00
19000	4.70	4.22	10.25	10.00	13.80	14.92	8.13	10.00
13200	8.48	8.56	.89	10.00	28.83	28.36	1.63	10.00
9500	8.24	8.11	1.63	10.00	19.36	19.47	.56	10.00
6700	6.57	6.66	1.31	10.00	9.93	9.85	.83	10.00
4750	5.75	5.78	.45	10.00	4.44	4.43	.22	10.00
3350	4.59	4.65	1.26	10.00	2.10	2.10	.22	10.00
2360	4.53	4.49	.93	10.00	1.28	1.28	.04	10.00
1700	3.42	3.29	3.85	10.00	.74	.74	.22	10.00
1180	3.32	3.16	4.67	10.00	.67	.67	.25	10.00
850	3.06	3.04	.59	10.00	.56	.56	.02	10.00
600	3.82	3.74	2.20	10.00	.70	.70	.10	10.00
425	3.57	3.53	1.10	10.00	.72	.72	.04	10.00
300	4.60	4.56	.80	10.00	1.04	1.04	.02	10.00
212	4.16	4.19	.75	10.00	1.05	1.05	.08	10.00
150	4.35	4.45	2.35	10.00	1.27	1.27	.23	10.00
106	3.80	3.79	.27	10.00	1.15	1.15	.01	10.00
75	3.31	3.23	2.42	10.00	1.08	1.08	.19	10.00
53	3.35	3.25	2.93	10.00	1.12	1.12	.25	10.00
38	1.54	1.94	26.20	10.00	.76	.73	3.68	10.00
-38	13.90	14.33	3.07	10.00	5.09	5.07	.46	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIM.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					16.60
107000					6.30
75000					9.07
53000					8.40
37500	.00	.00	100.00	.00	5.48
26500	.00	.00	100.00	.00	7.43
19000	.00	.00	100.00	.00	6.15
13200	.75	.75	.01	5.00	5.09
9500	3.62	3.63	.23	5.00	4.52
6700	5.40	5.40	.03	5.00	3.78
4750	6.30	6.31	.10	5.00	2.92
3350	5.66	5.65	.11	5.00	2.64
2360	5.73	5.75	.38	5.00	2.63
1700	4.25	4.29	.98	5.00	2.14
1180	4.10	4.15	1.16	5.00	1.71
850	4.01	4.02	.26	5.00	2.41
600	4.90	4.93	.65	5.00	1.71
425	4.62	4.64	.39	5.00	1.51
300	5.93	5.95	.36	5.00	1.35
212	5.43	5.43	.02	5.00	0.63
150	5.73	5.71	.39	5.00	0.75
106	4.82	4.83	.20	5.00	0.63
75	4.05	4.08	.65	5.00	0.55
53	4.06	4.09	.76	5.00	0.51
38	2.63	2.42	7.95	5.00	0.41
-38	18.02	17.99	.19	5.00	2.59

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	15.33	15.48	1.00	5.00	.00	.24	100.00	.00
MILL DISCH.	.00	33.85	100.00	.00	.00	11.81	100.00	.00
SCREEN FEED	.00	36.84	100.00	.00	.00	14.80	100.00	.00
SCR OVERSIZE	.00	8.61	100.00	.00	.00	1.81	100.00	.00
SCR U/FLOW	.00	28.23	100.00	.00	.00	12.98	100.00	.00
MILL WATER	.00	9.76	100.00	.00	9.74	9.76	.18	5.00
PBOX WATER	.00	2.99	100.00	.00	3.50	2.99	14.68	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	15.25	100.00	.00	98.20	98.46	.27	3.00
MILL DISCH.	.00	22.04	100.00	.00	58.20	65.11	11.88	5.00
SCREEN FEED	.00	22.04	100.00	.00	63.60	59.84	5.92	5.00
SCR OVERSIZE	.00	6.80	100.00	.00	79.60	78.93	.84	5.00
SCR U/FLOW	.00	15.25	100.00	.00	54.45	54.01	.81	3.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

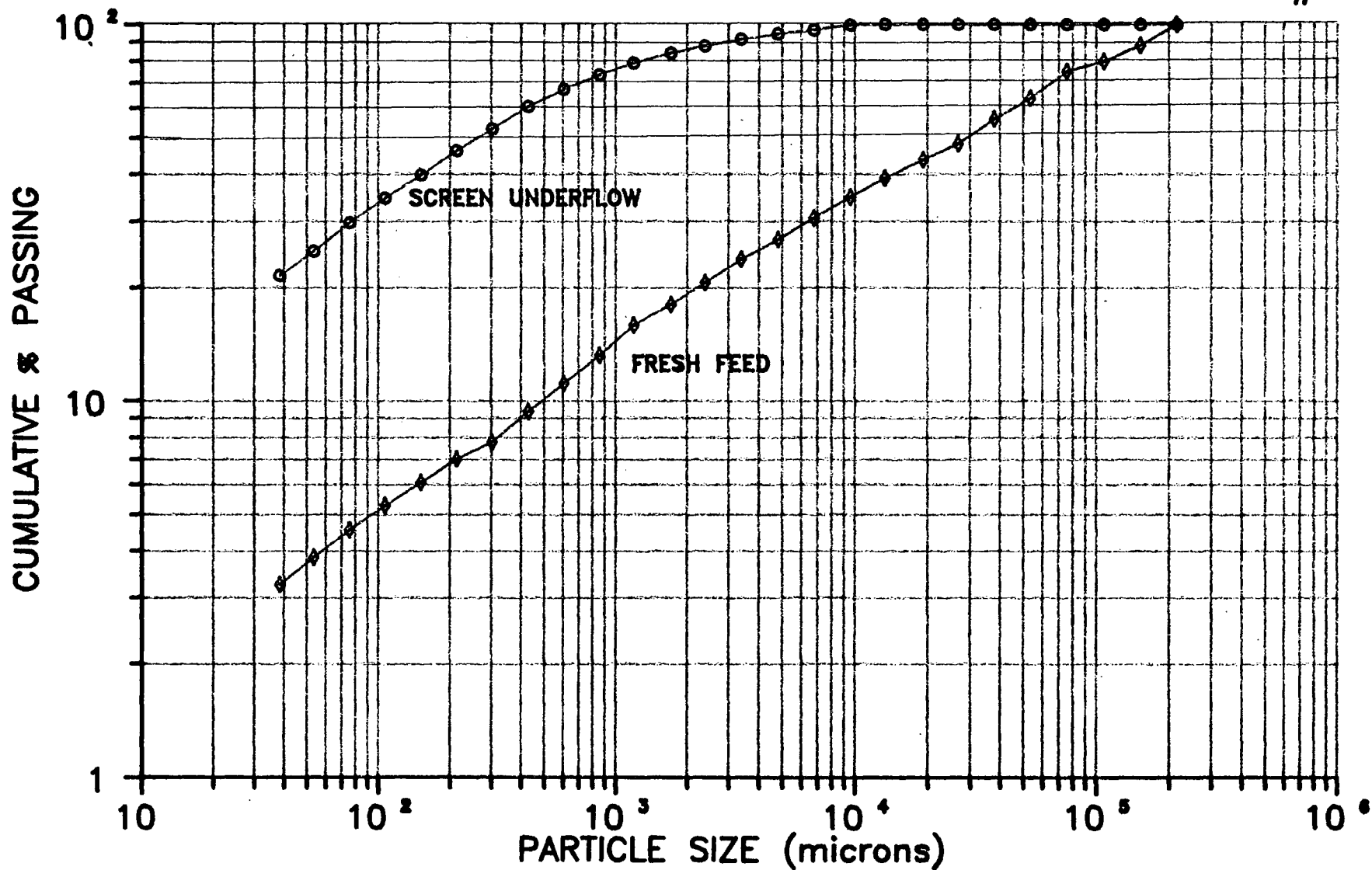
STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	1.52	1.23	19.36	10.00	3.48	3.58	14.24	10.00
19000	3.63	3.92	6.27	10.00	13.36	12.72	4.80	10.00
13200	7.64	8.12	6.24	10.00	25.64	25.07	2.22	10.00
9500	8.55	8.76	2.51	10.00	20.51	20.82	1.53	10.00
6700	6.83	6.72	1.61	10.00	10.69	10.96	2.54	10.00
4750	5.31	5.59	3.74	10.00	4.99	5.08	1.81	10.00
3350	4.79	4.51	5.76	10.00	2.58	2.62	1.38	10.00
2360	4.87	4.48	8.09	10.00	1.68	1.70	1.14	10.00
1700	3.61	3.33	7.81	10.00	.99	1.00	.82	10.00
1180	3.54	3.03	14.41	10.00	.86	.87	1.22	10.00
850	3.38	2.92	13.47	10.00	.74	.75	1.03	10.00
600	4.21	3.78	10.24	10.00	.89	.90	.81	10.00
425	3.80	3.58	5.77	10.00	.89	.90	.56	10.00
300	4.88	4.62	5.33	10.00	1.26	1.27	.63	10.00
212	4.25	4.14	2.58	10.00	1.19	1.19	.42	10.00
150	4.60	4.56	.84	10.00	1.45	1.45	.32	10.00
106	3.73	3.87	3.72	10.00	1.14	1.14	.16	10.00
75	3.07	3.25	5.77	10.00	1.05	1.05	.43	10.00
53	2.99	3.37	12.73	10.00	1.06	1.05	1.22	10.00
38	1.47	1.80	22.15	10.00	.59	.57	2.64	10.00
-38	12.76	14.41	12.94	10.00	4.95	4.91	.73	10.00

STREAM	SCR U/FLOW				FRESH FEED
	MEAS.	ESTIN.	RESID.	RELAT.	NOT ADJUSTED
	VALUES	VALUES	VALUES	ST.DEV.	
215000					0.00
152000					4.15
107000					7.29
75000					8.70
53000					7.58
37500	.00	.00	100.00	.00	7.58
26500	.00	.00	100.00	.00	9.28
19000	.00	.00	100.00	.00	6.67
13200	.56	.56	.05	5.00	7.35
9500	3.39	3.39	.03	5.00	6.20
6700	4.81	4.83	.40	5.00	4.38
4750	5.77	5.82	.89	5.00	4.53
3350	5.29	5.36	1.33	5.00	3.69
2360	5.61	5.71	1.85	5.00	3.63
1700	4.29	4.37	1.79	5.00	2.78
1180	3.88	3.99	2.90	5.00	2.15
850	3.79	3.90	2.78	5.00	2.59
600	4.95	5.06	2.30	5.00	2.05
425	4.71	4.78	1.44	5.00	1.79
300	6.03	6.11	1.40	5.00	1.62
212	5.41	5.45	.80	5.00	0.60
150	5.92	5.95	.44	5.00	0.93
106	5.12	5.09	.66	5.00	0.79
75	4.28	4.23	1.20	5.00	0.69
53	4.55	4.41	3.15	5.00	0.64
38	2.50	2.34	6.40	5.00	0.53
-38	19.16	18.68	2.53	5.00	3.30

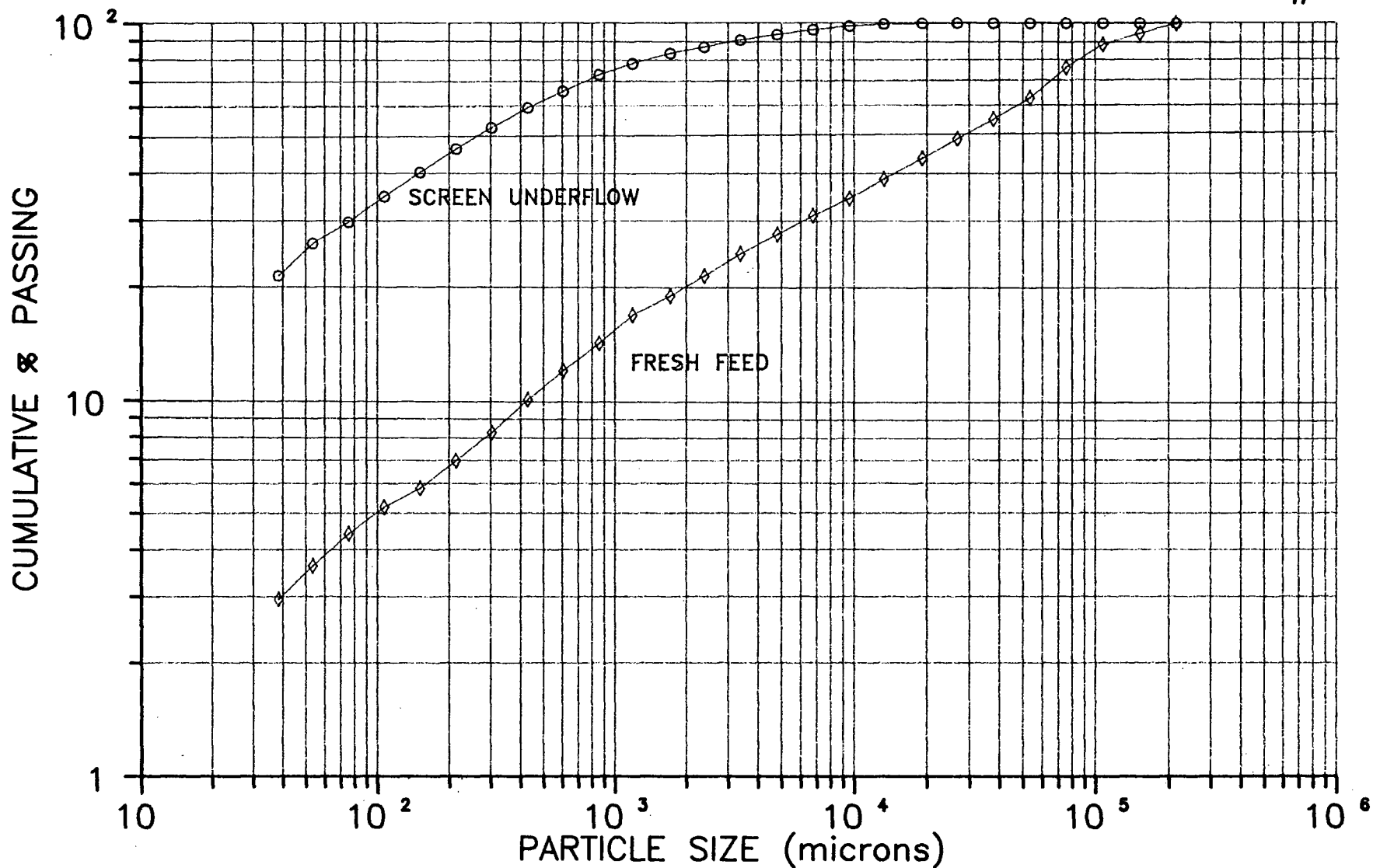
APPENDIX III.

LORNEX C-CIRCUIT: FULL-SCALE SIZE DISTRIBUTION PLOTS

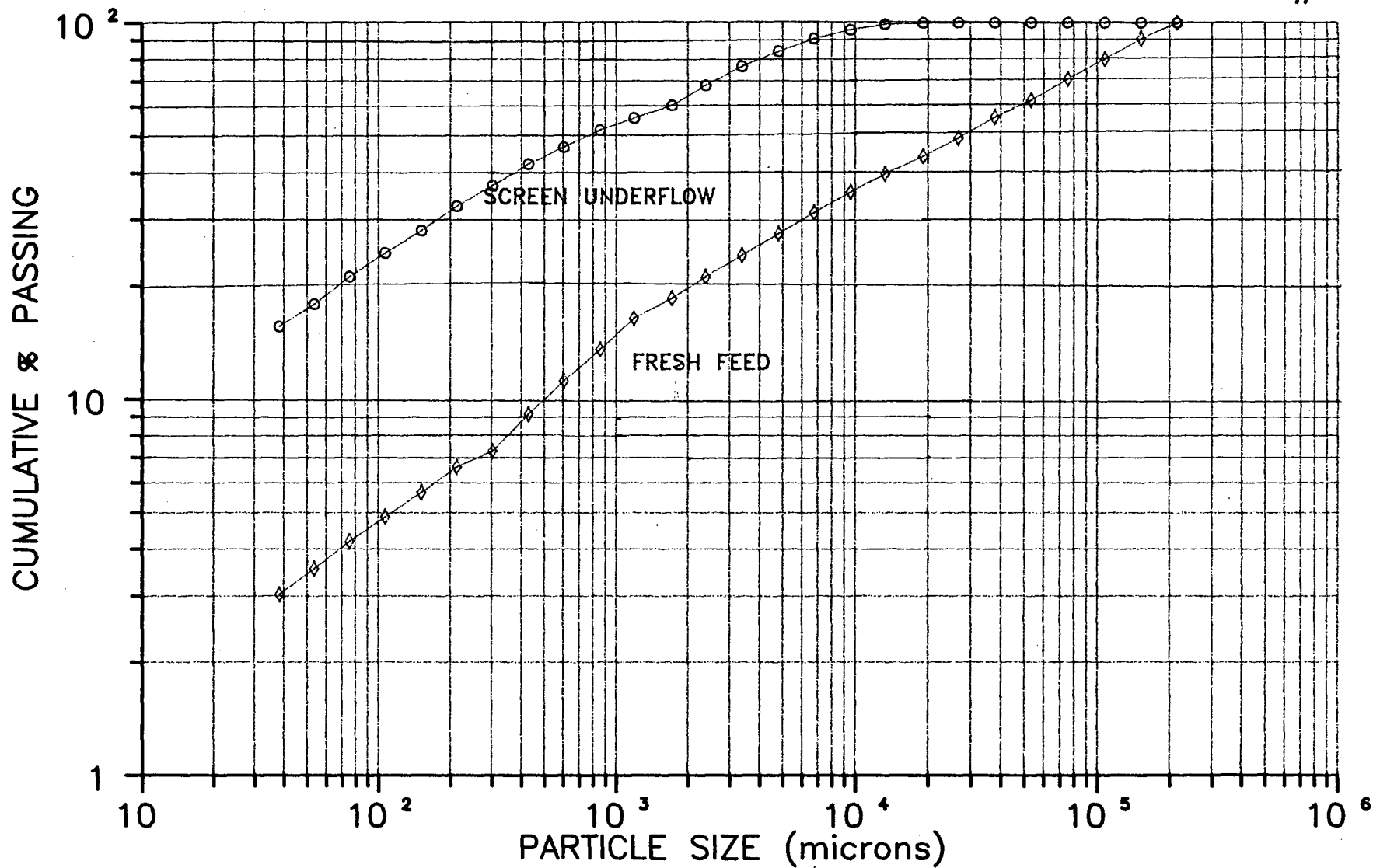
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #1



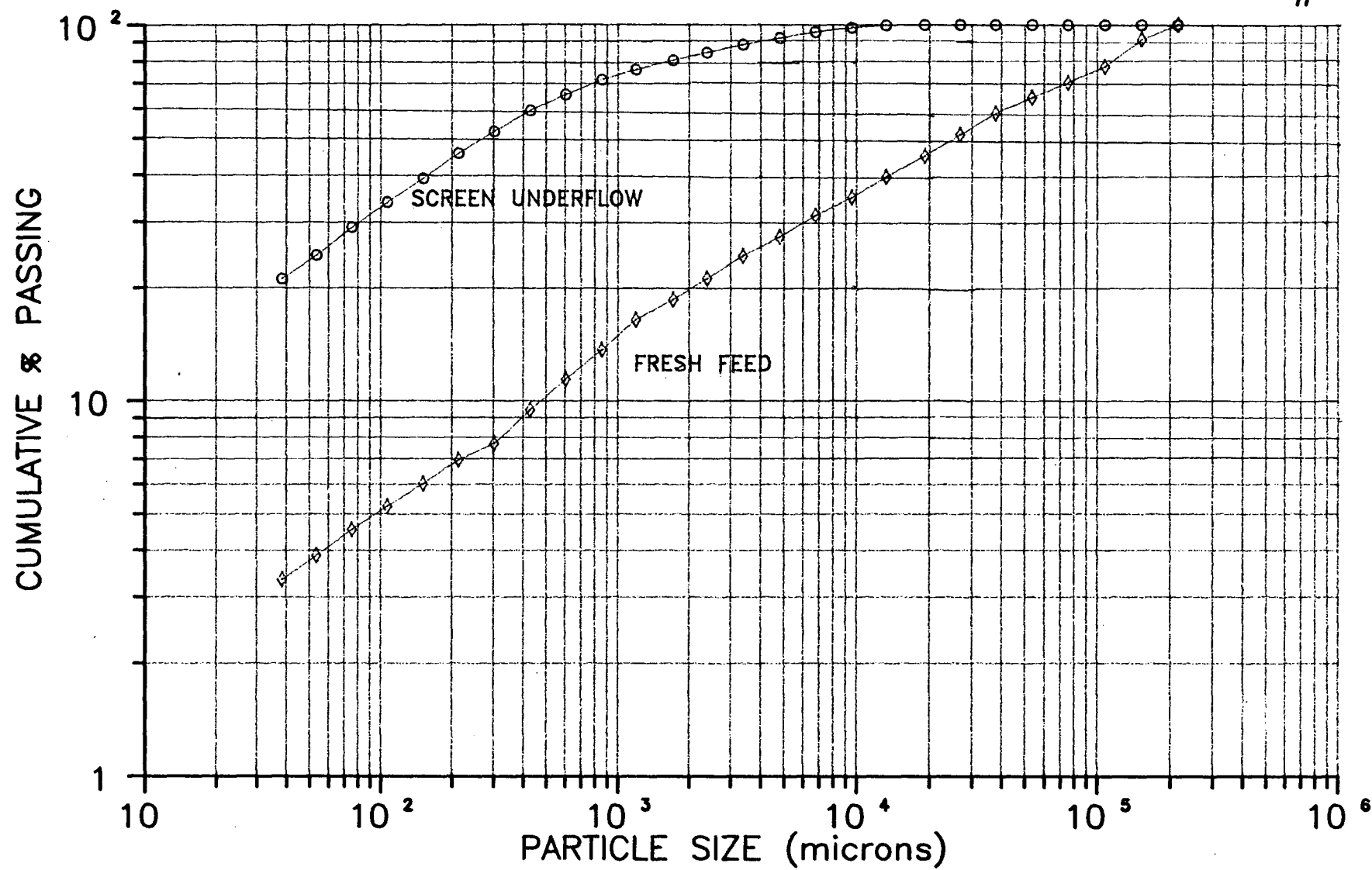
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #2



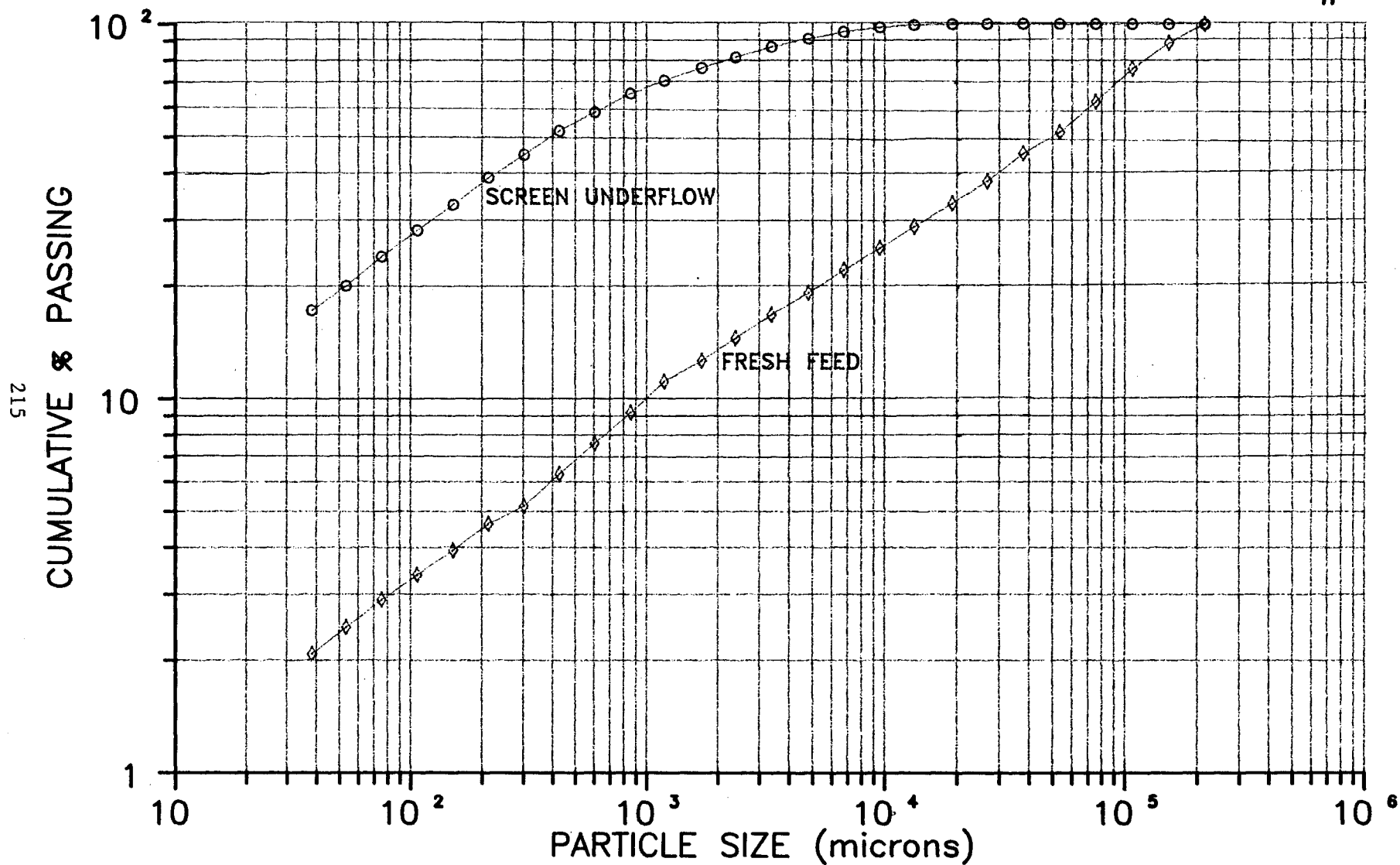
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #3



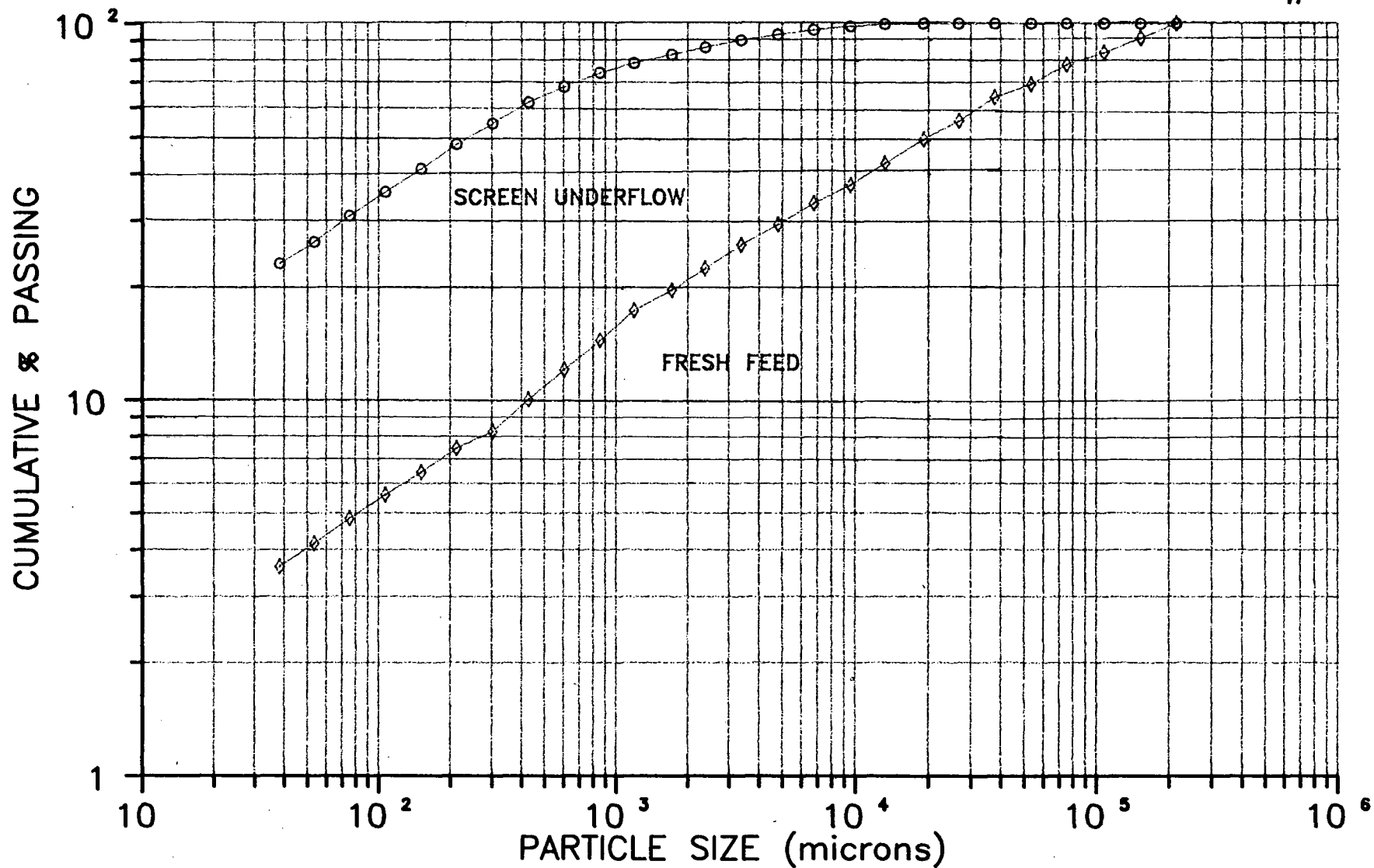
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #4



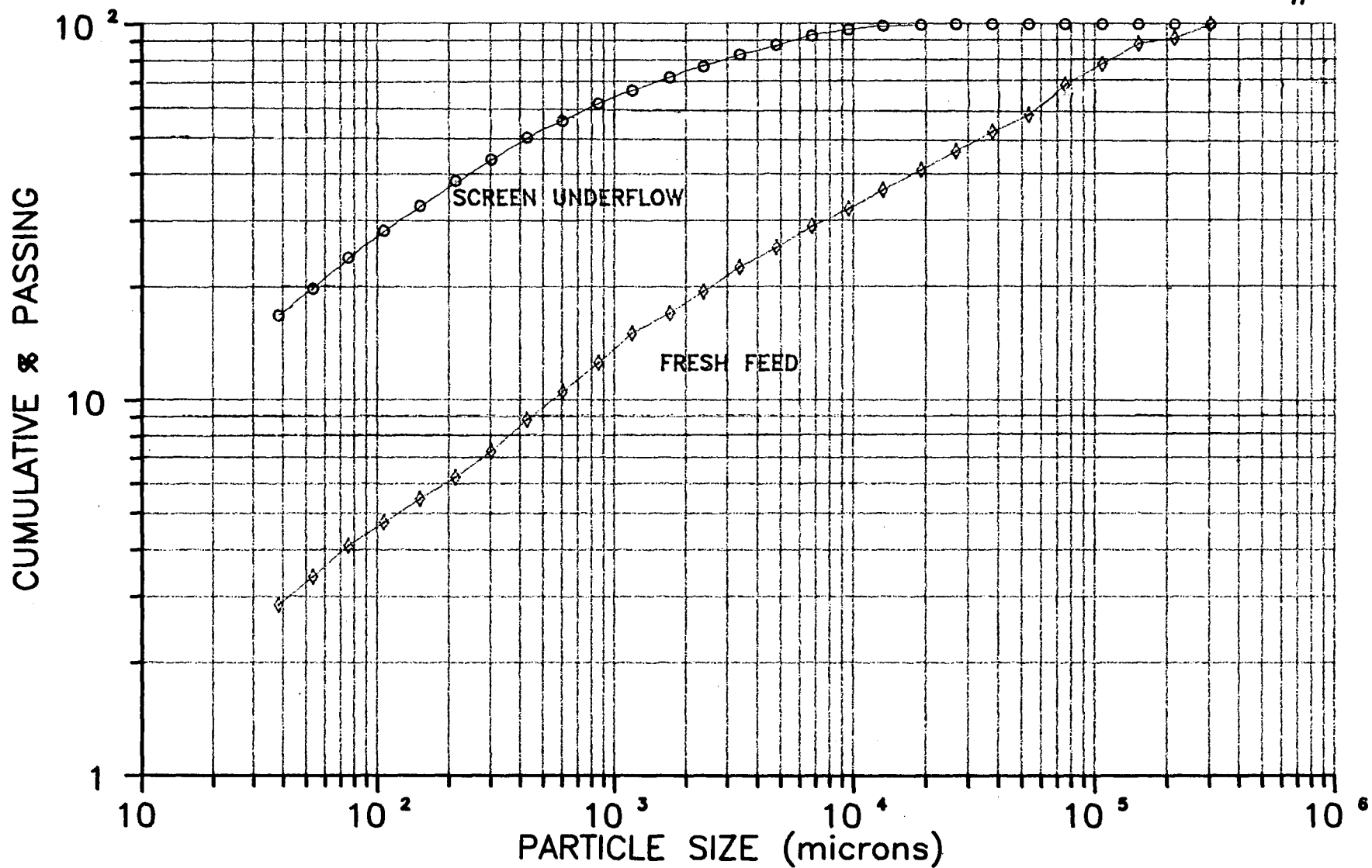
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #5



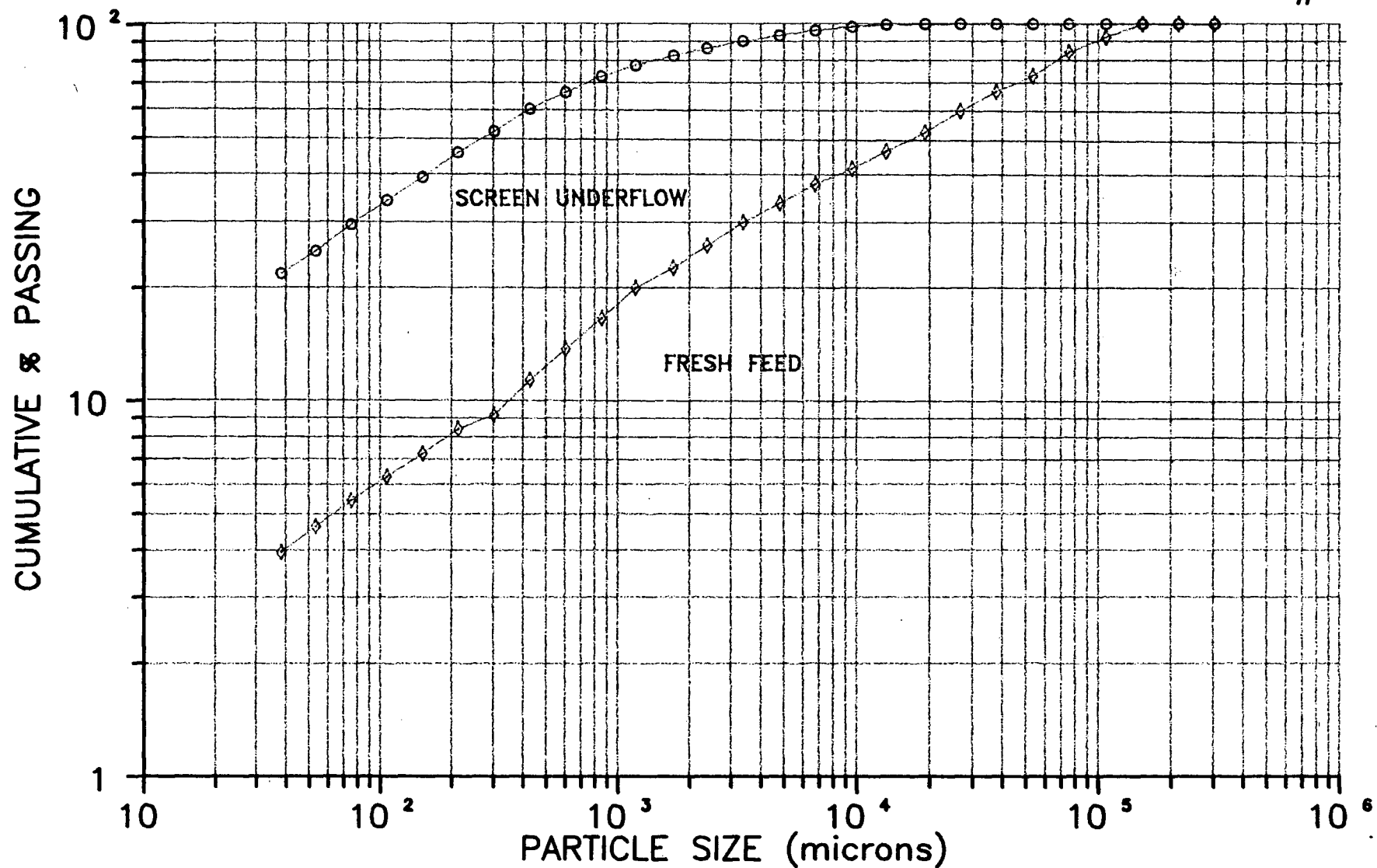
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #6



LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #7

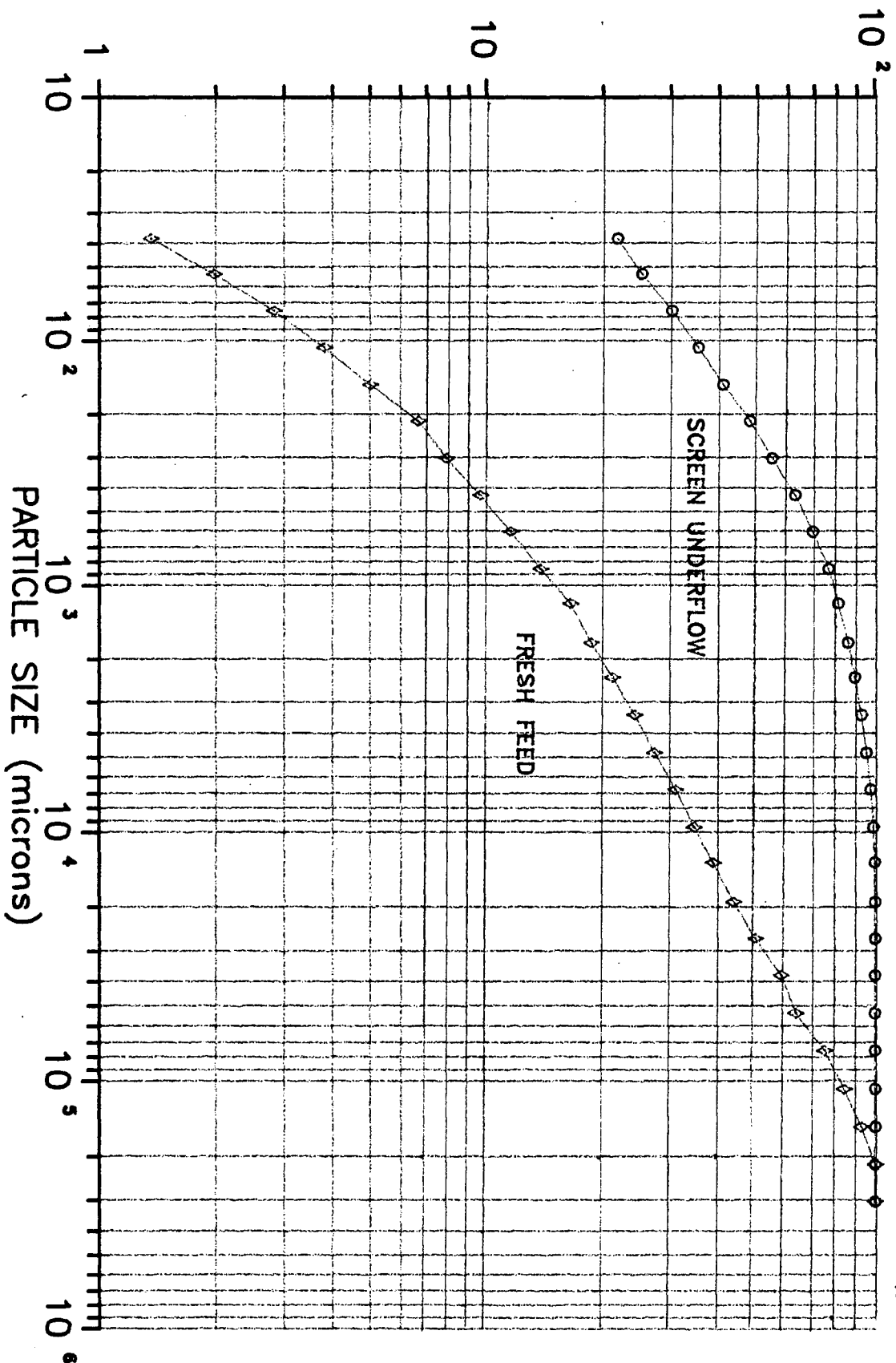


LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #8



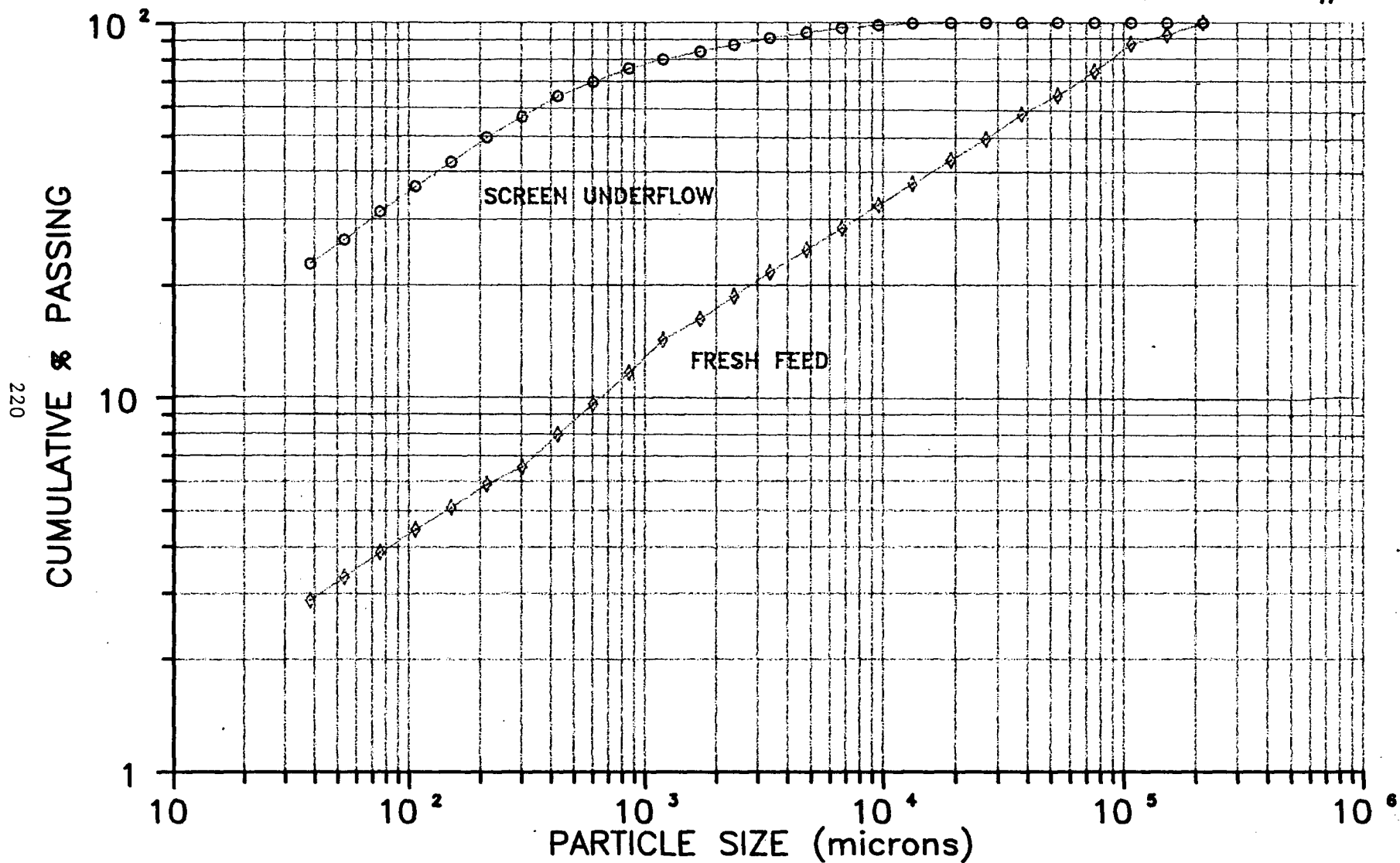
CUMULATIVE % PASSING

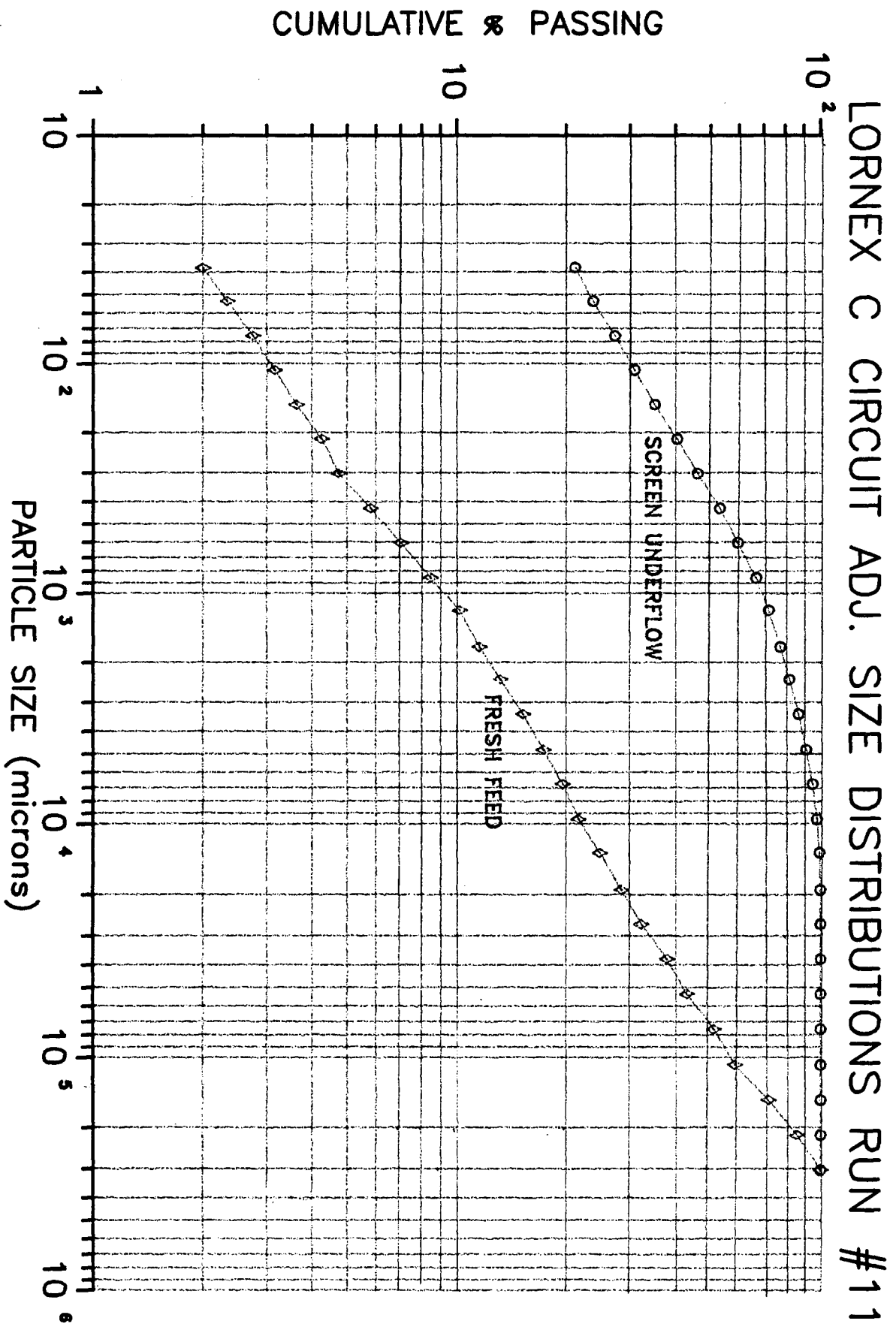
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #9



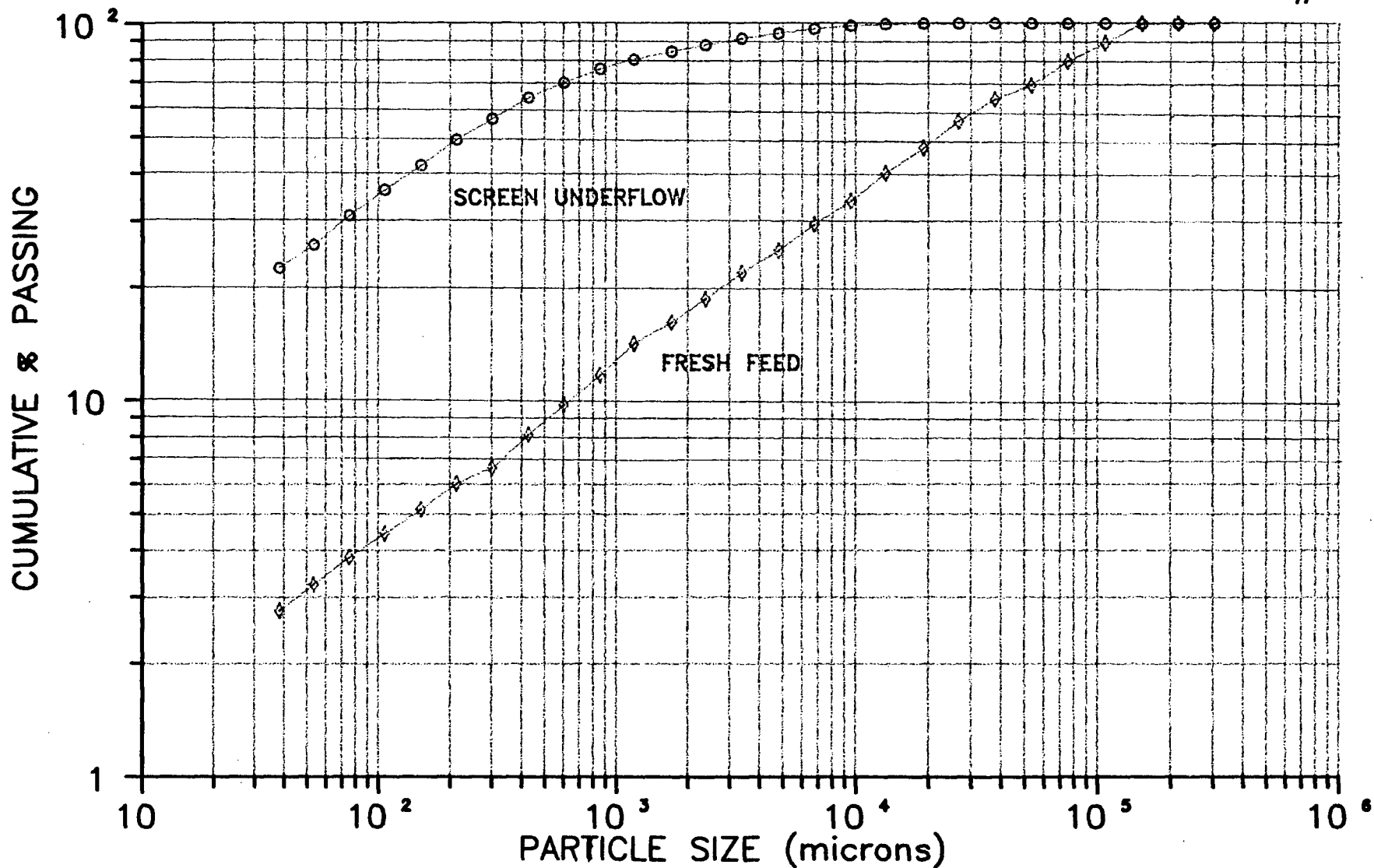
PARTICLE SIZE (microns)

LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #10

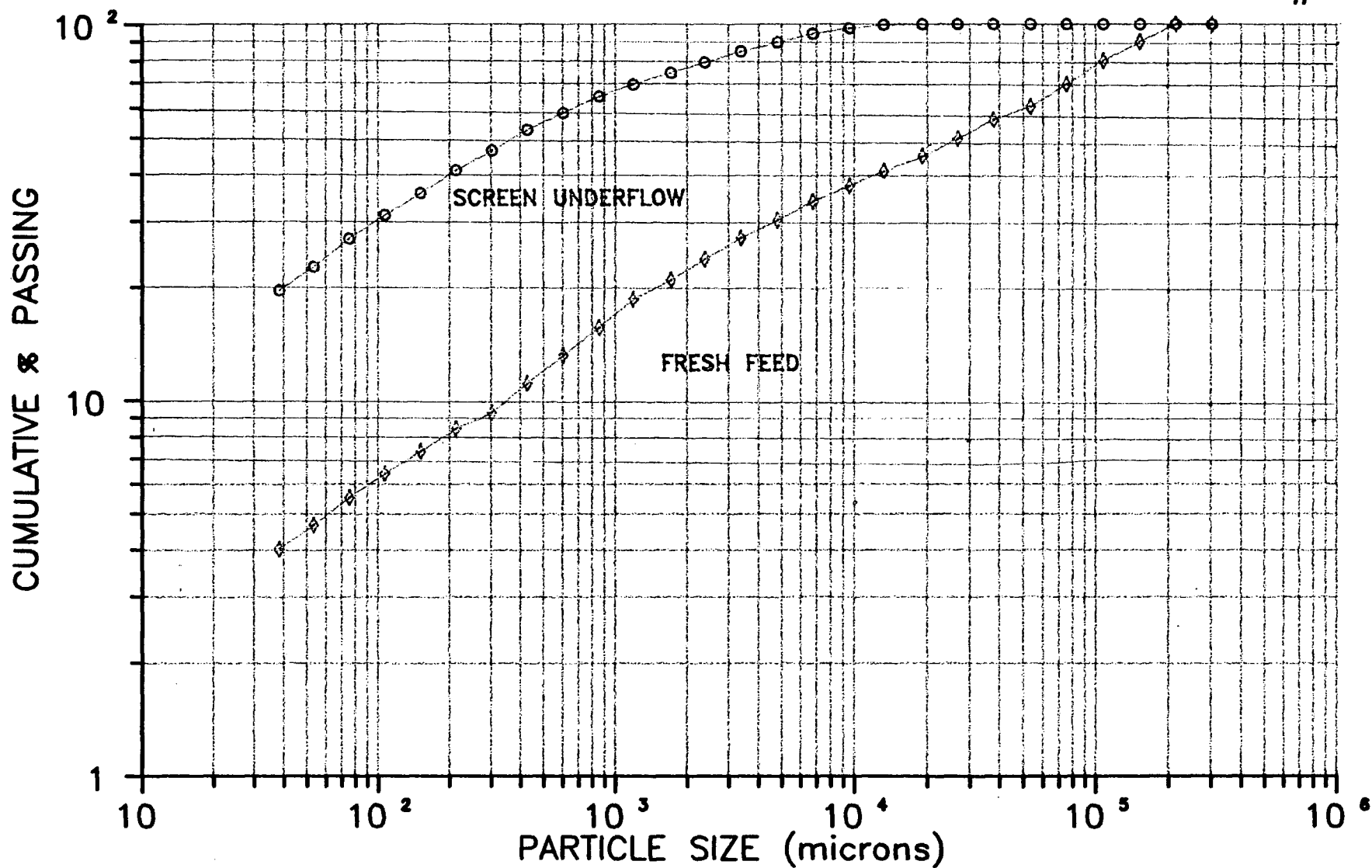




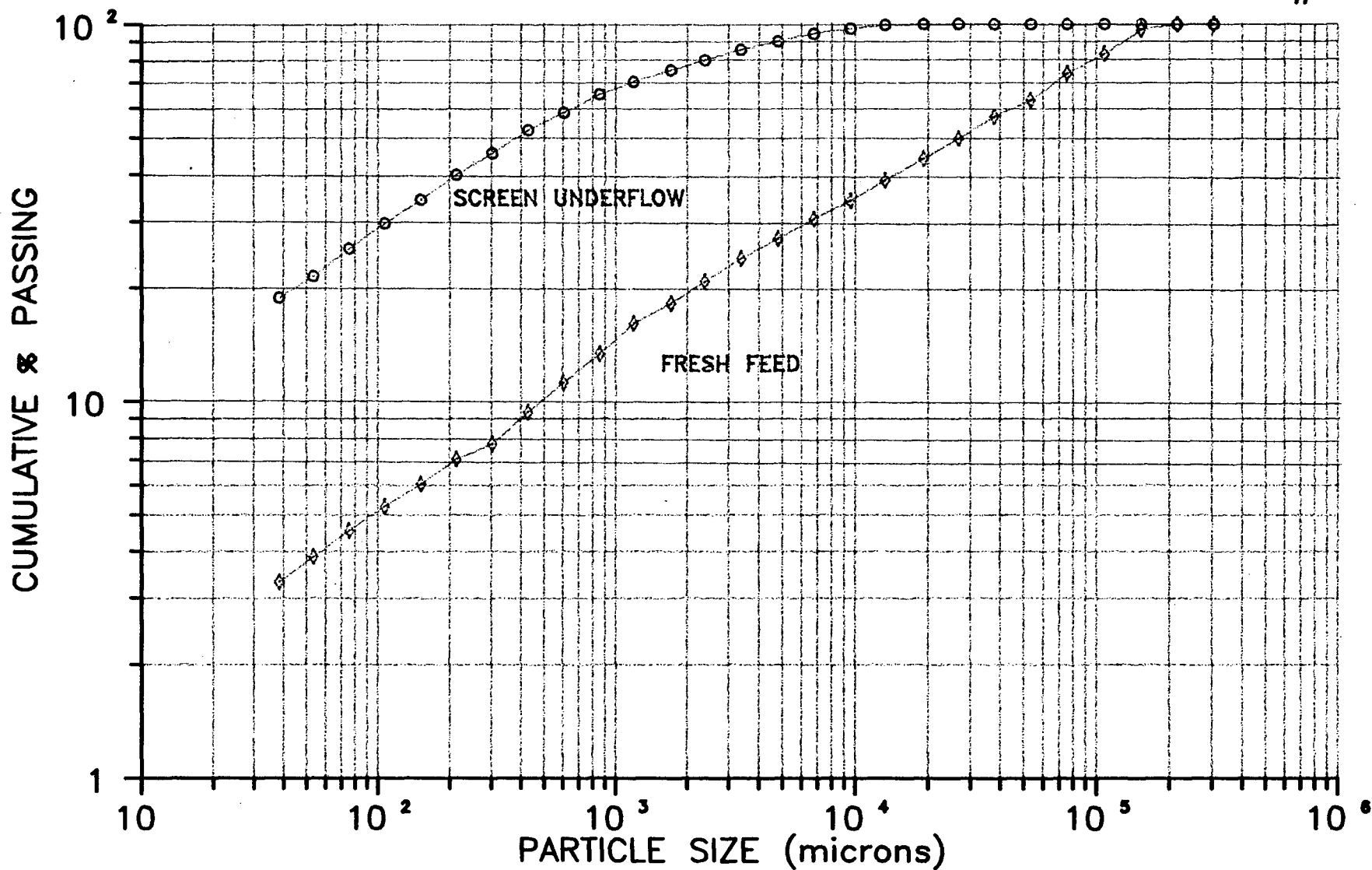
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #12



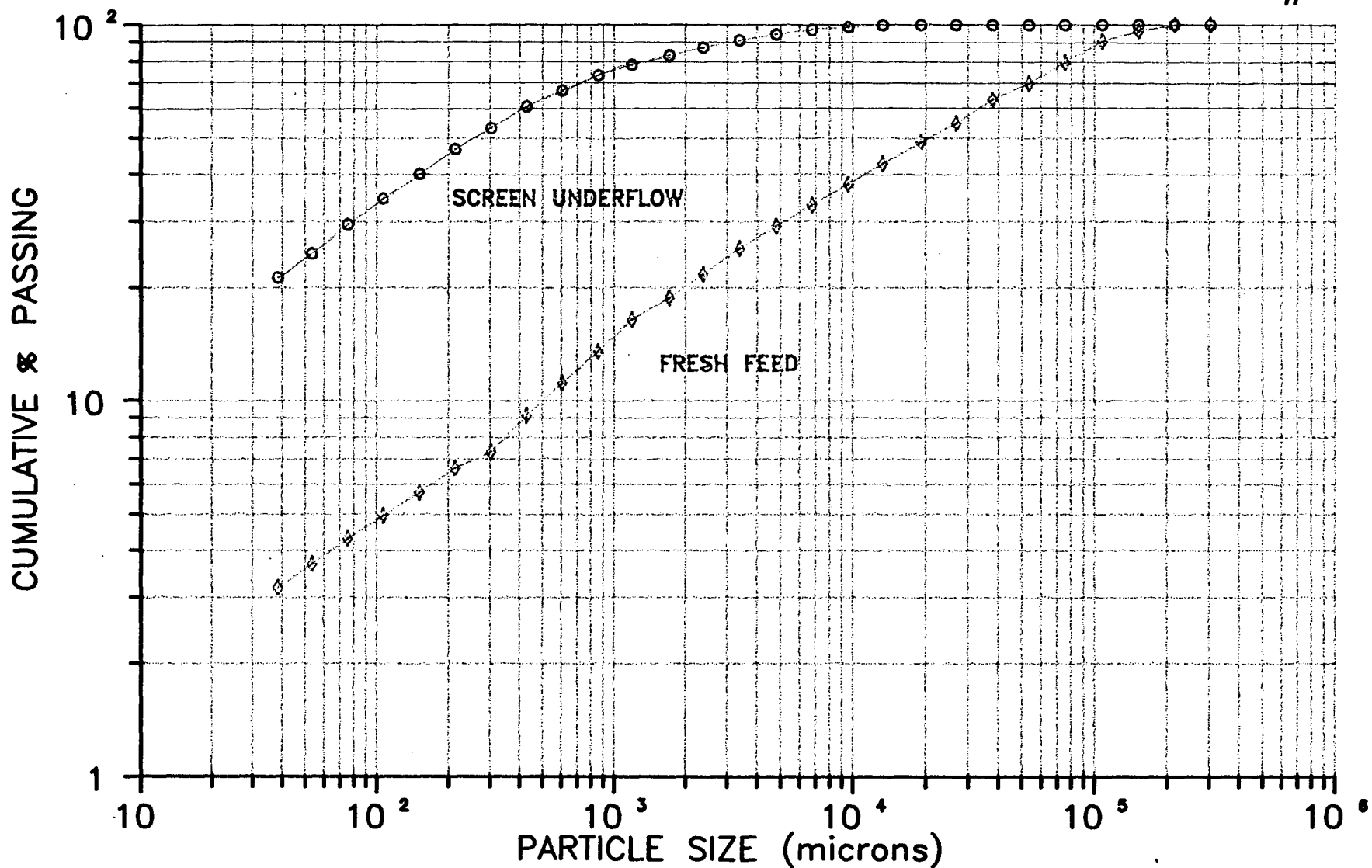
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #13



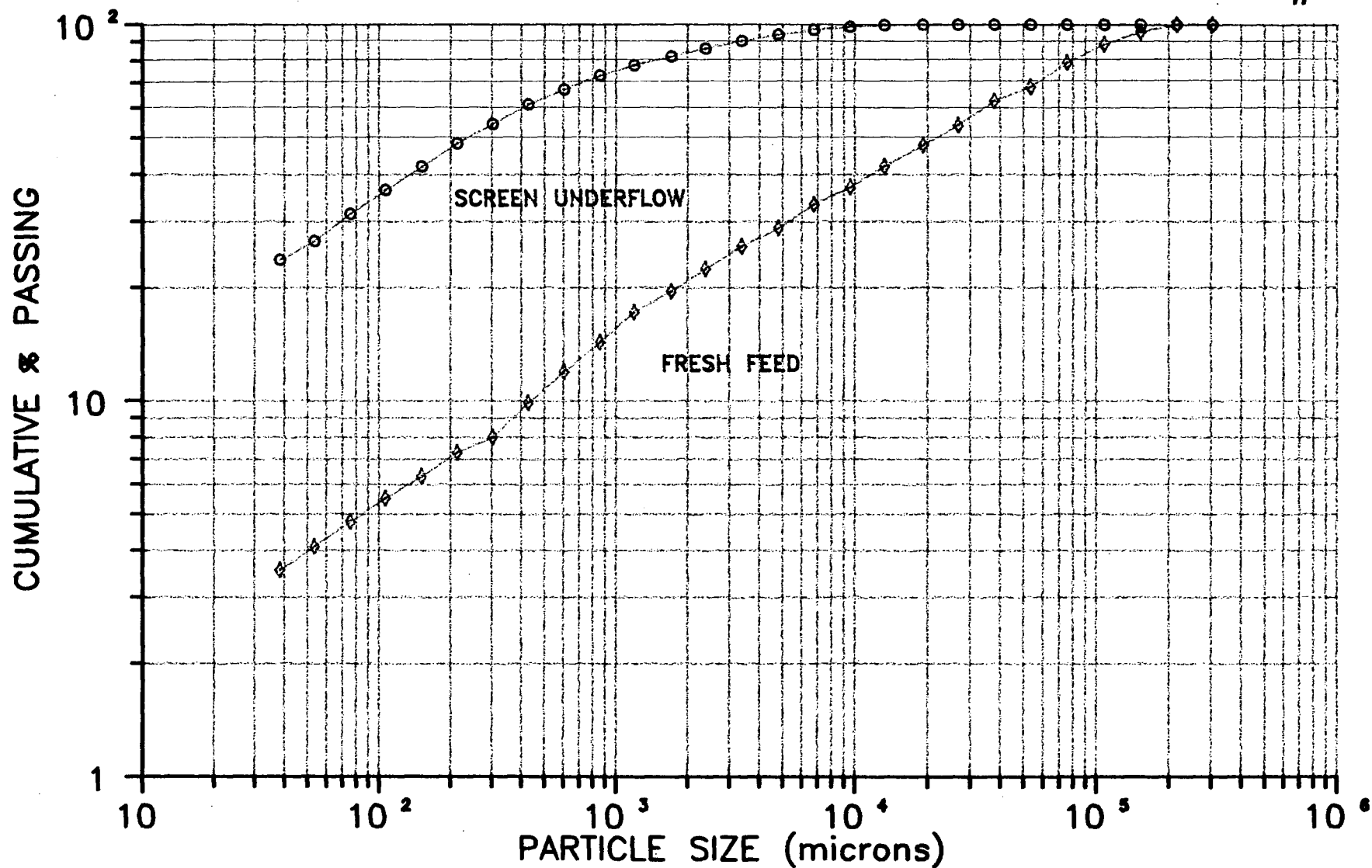
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #14



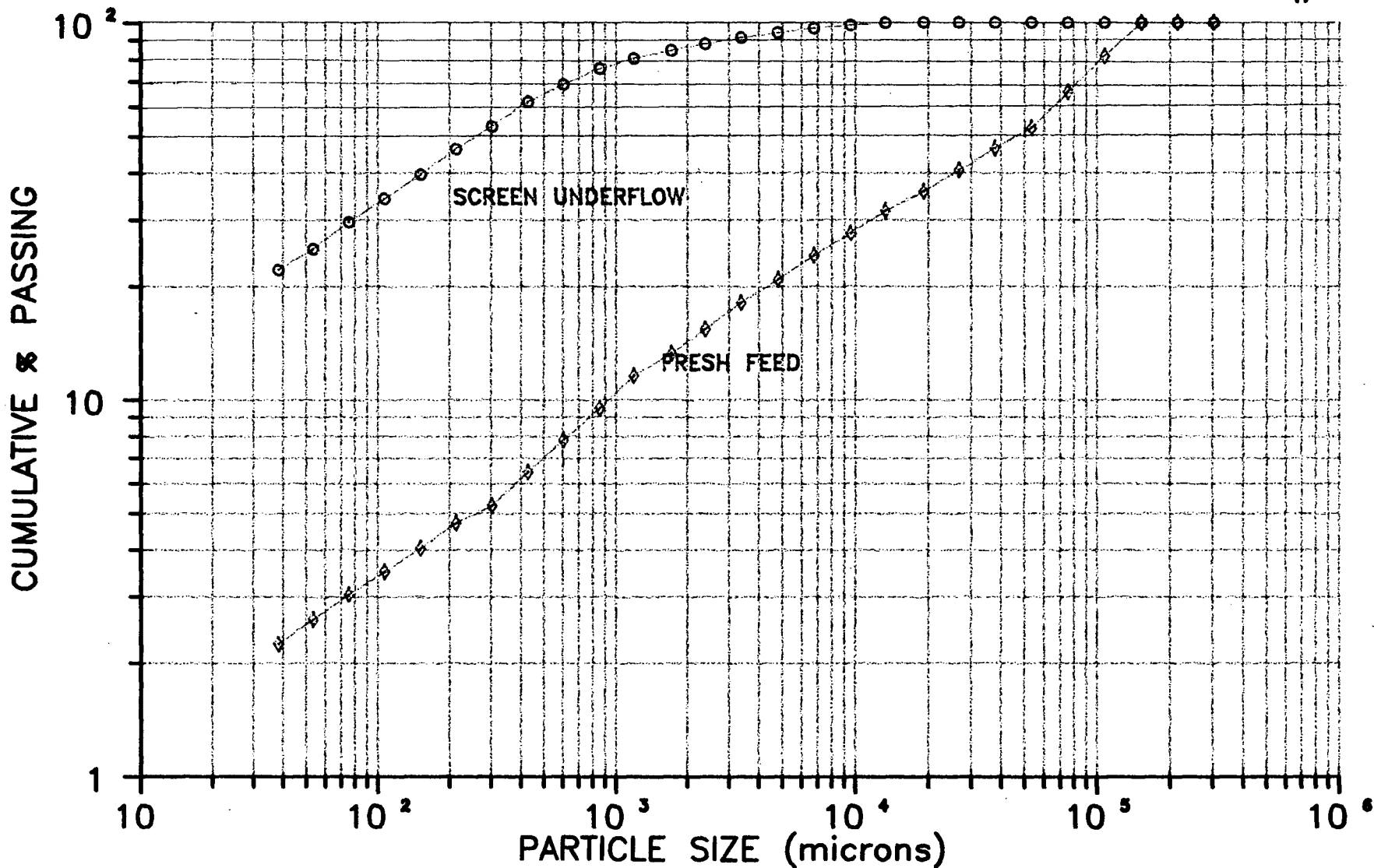
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #15



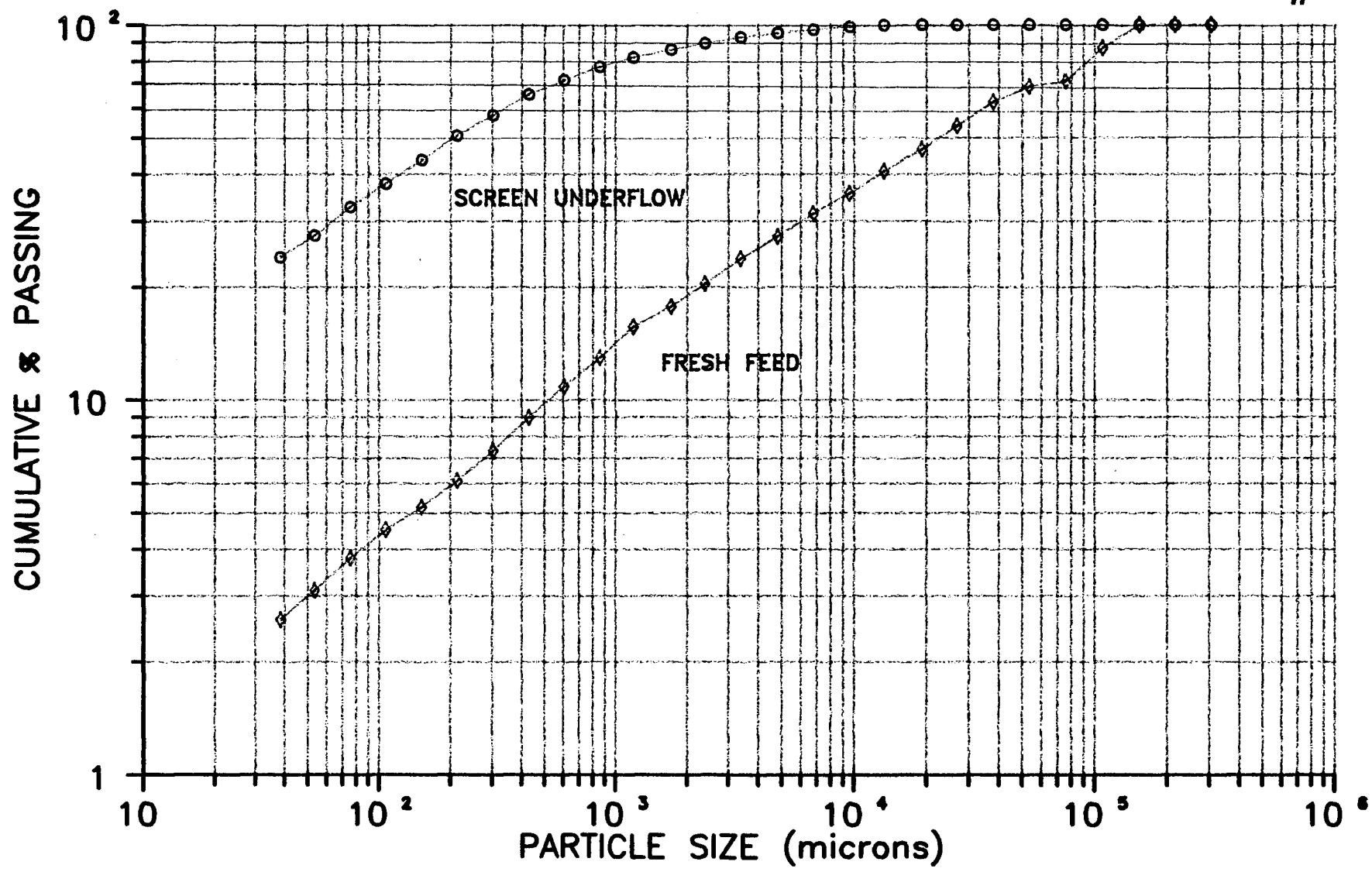
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #16



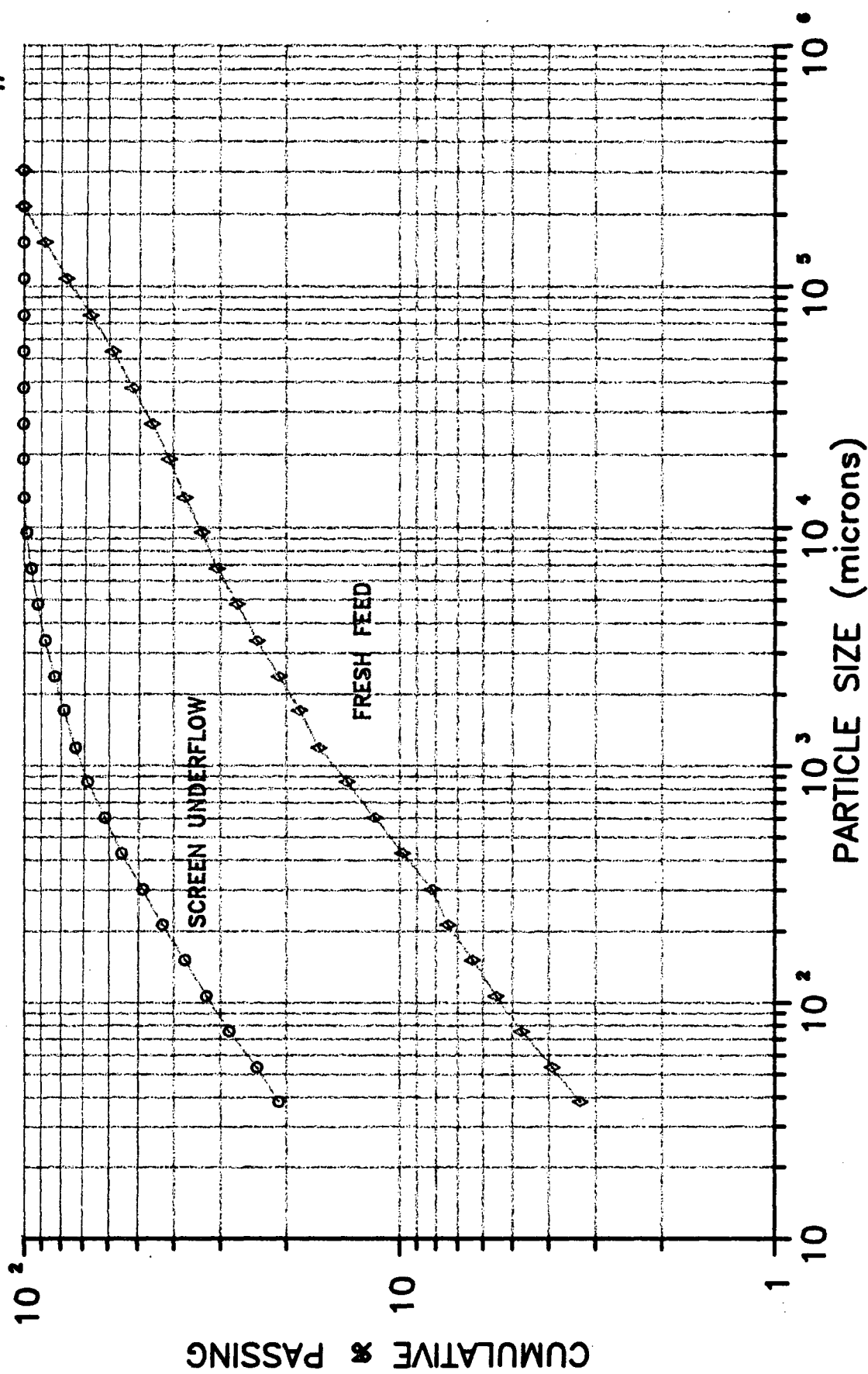
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #17



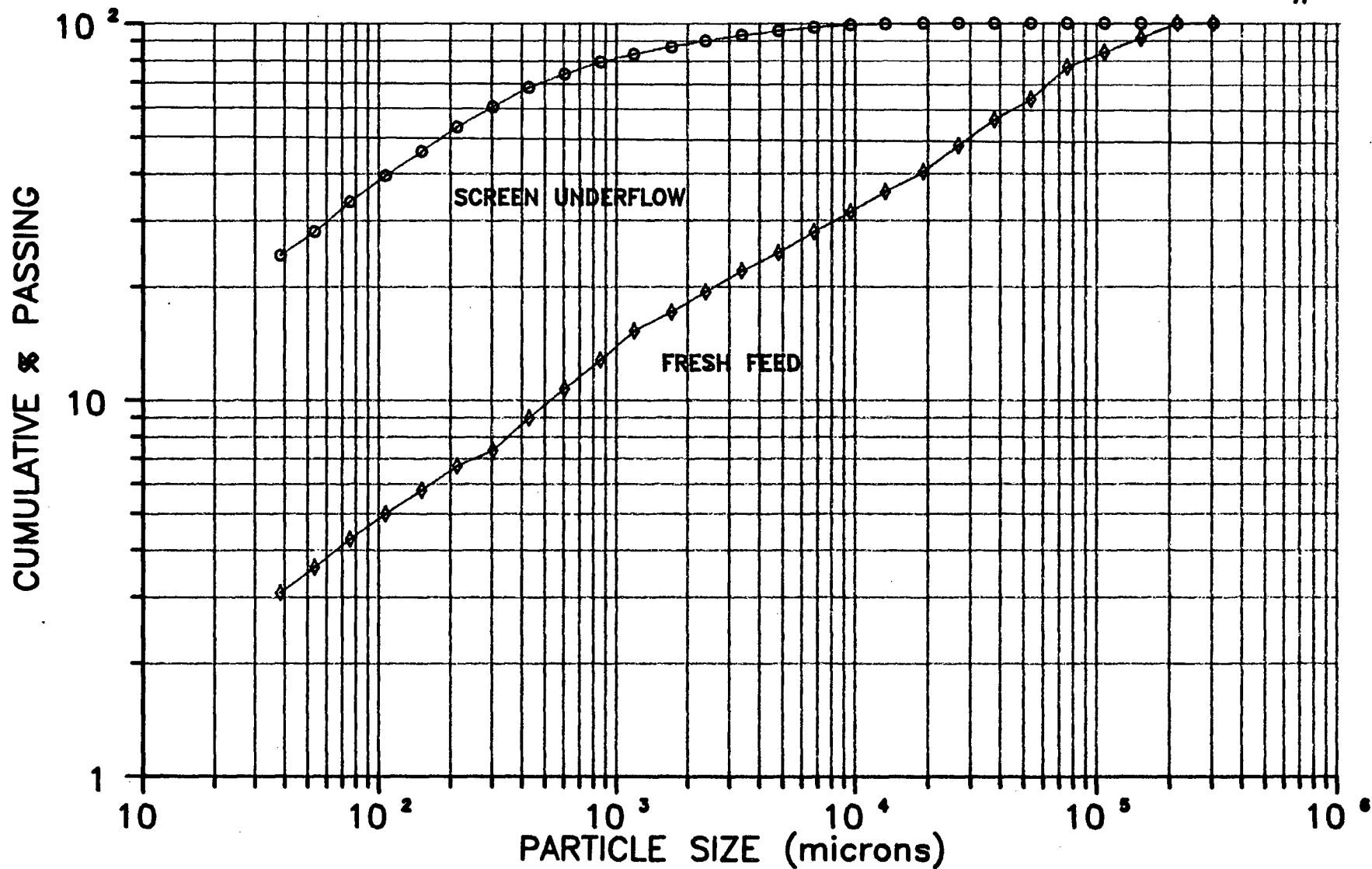
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #18



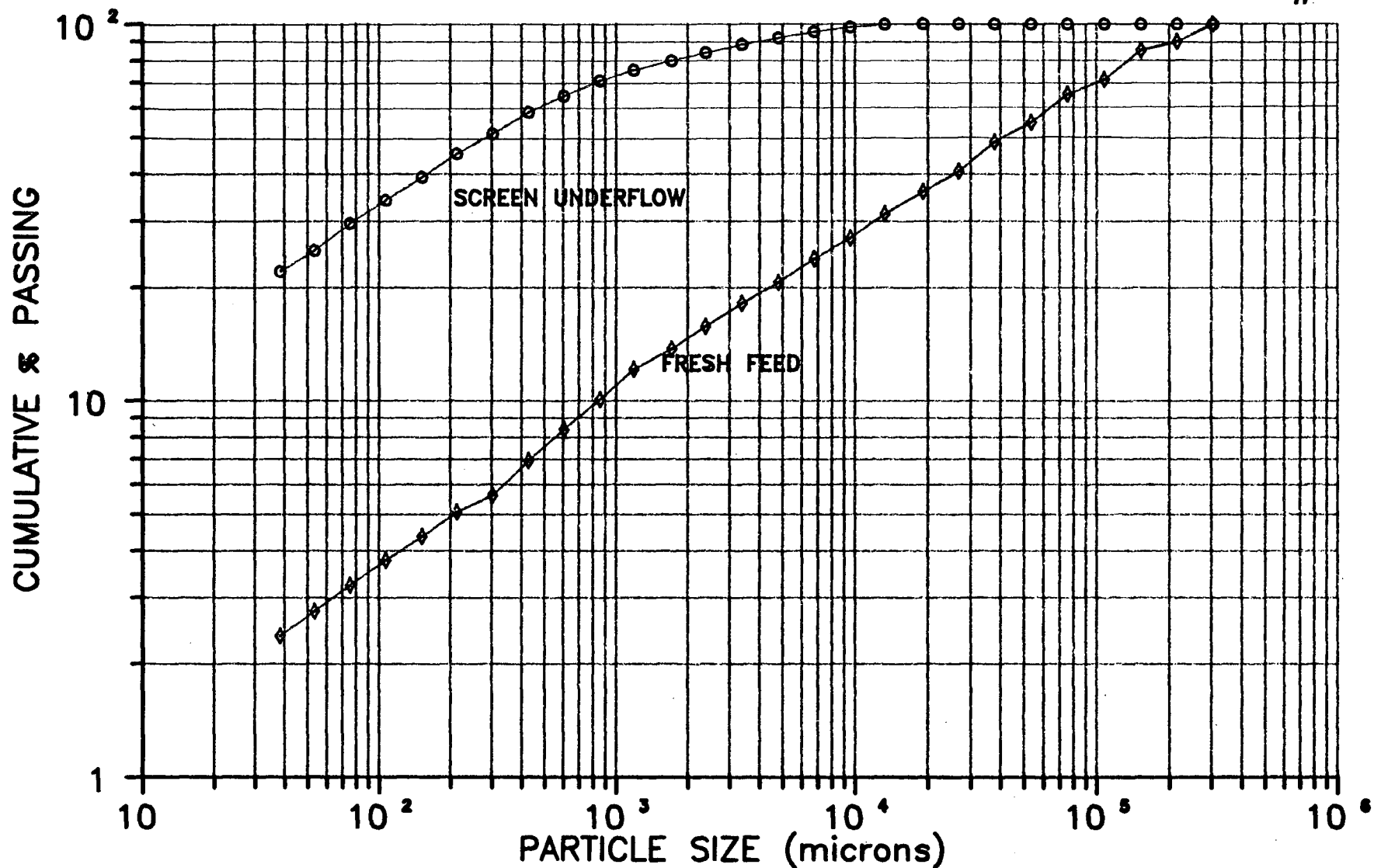
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #19

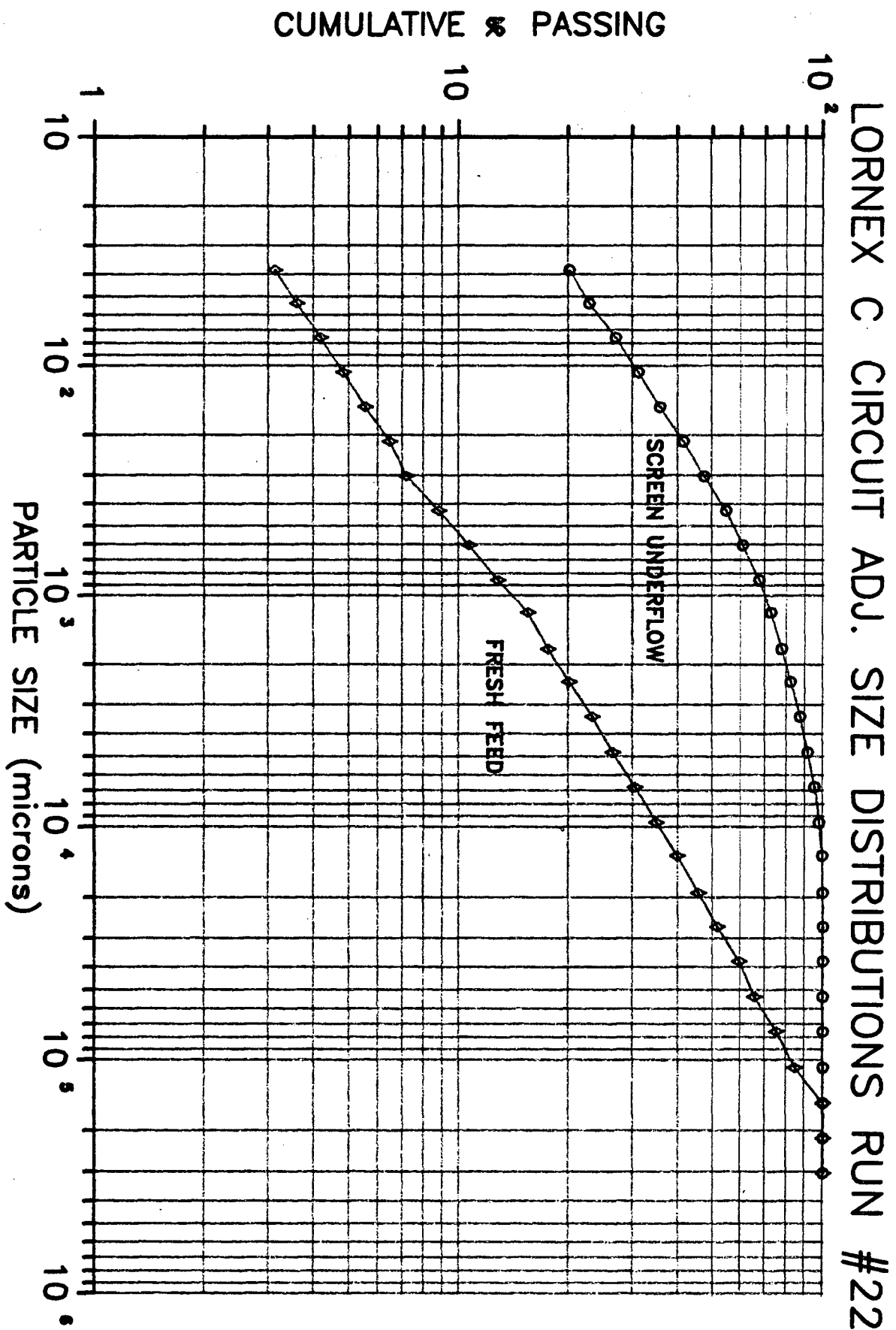


LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #20

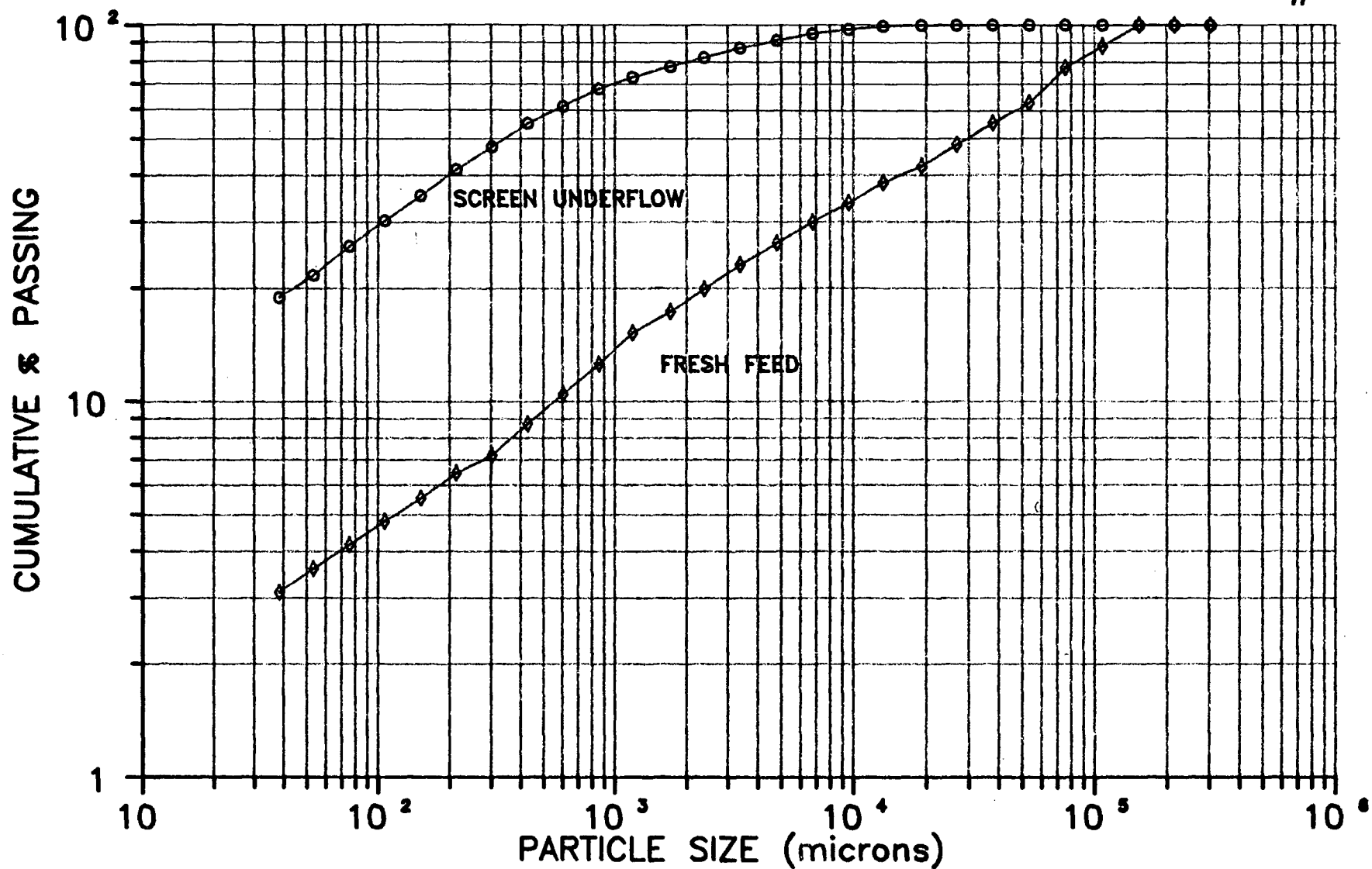


LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #21



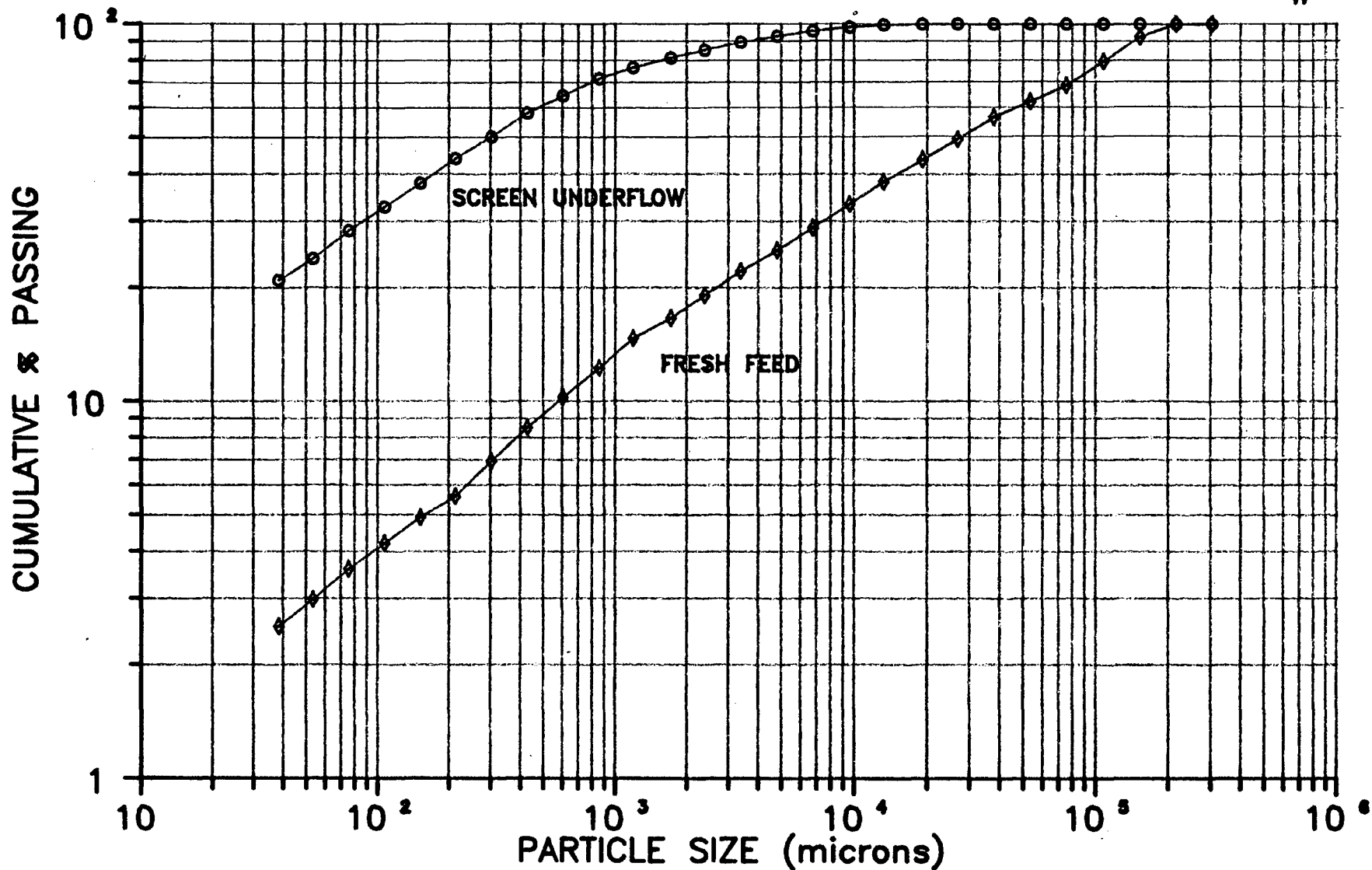


LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #23

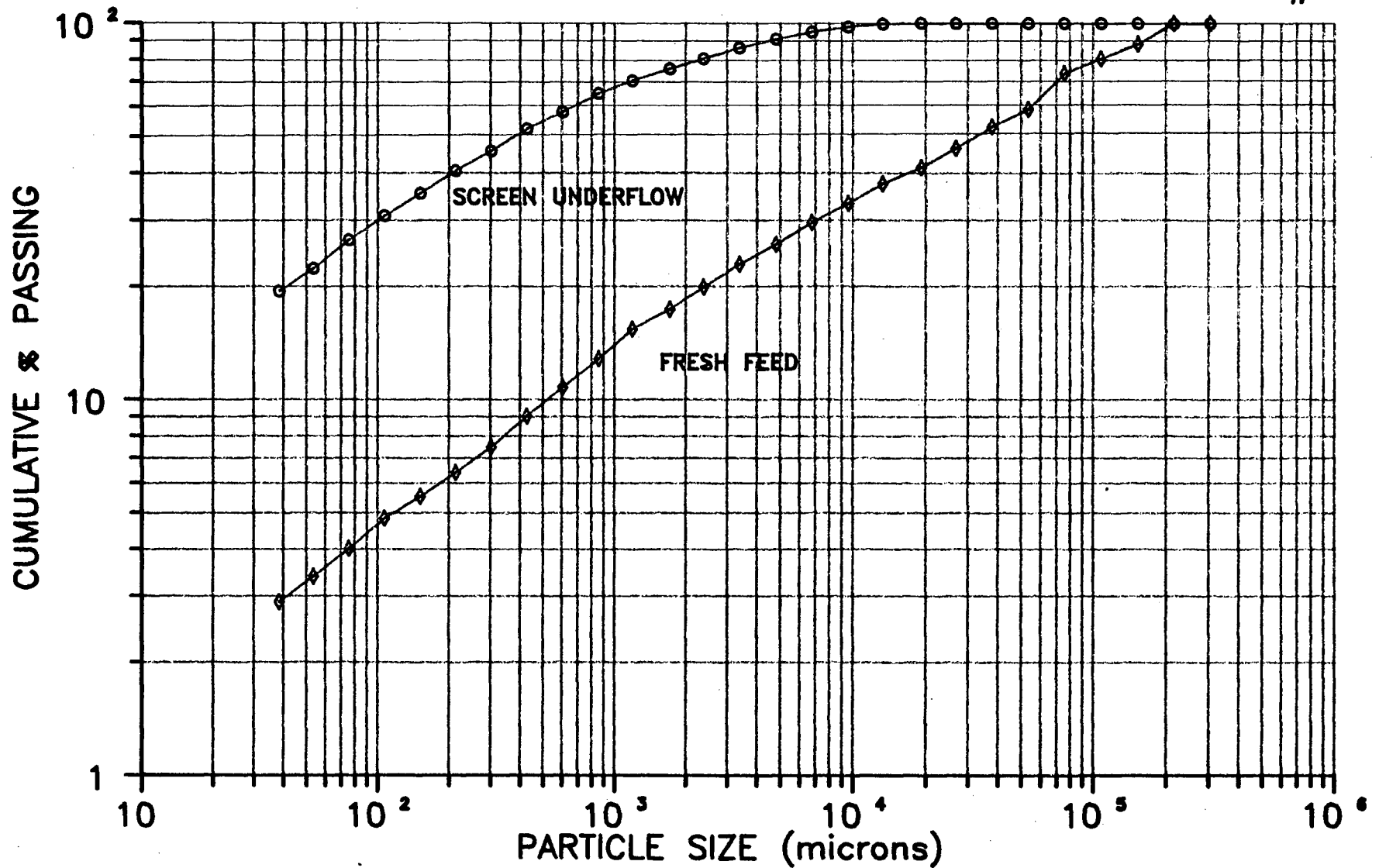


LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #24

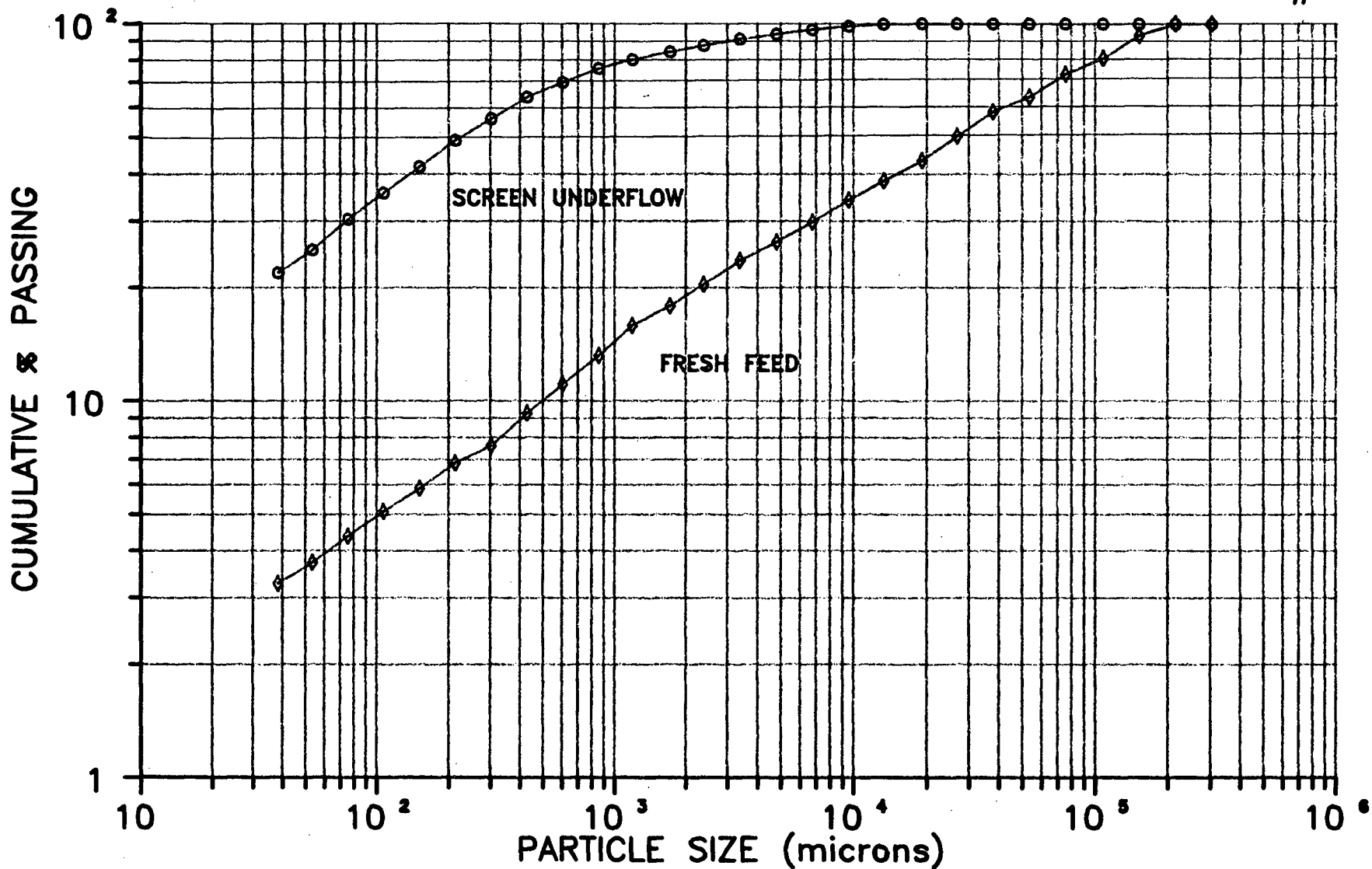
233



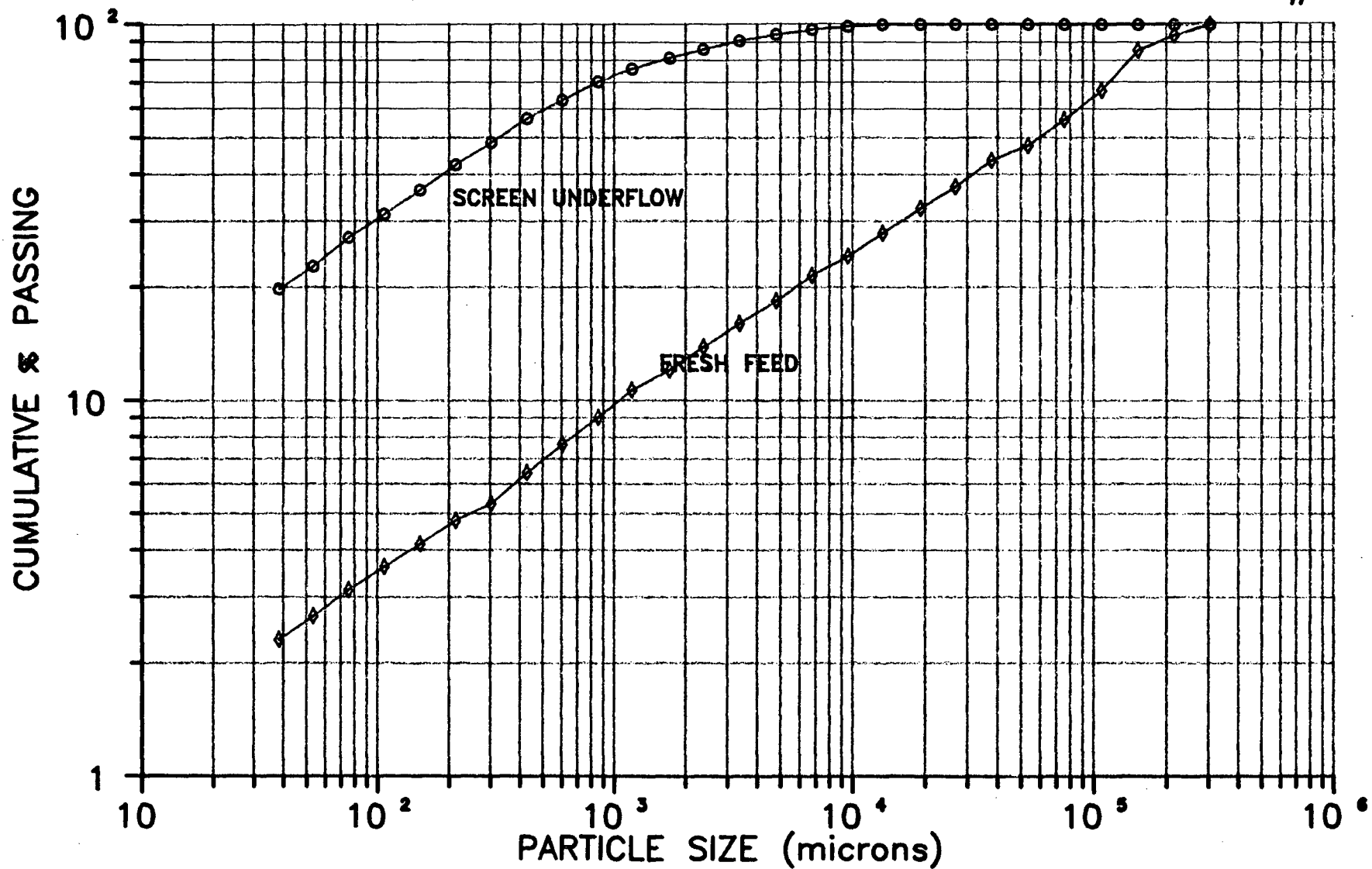
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #25



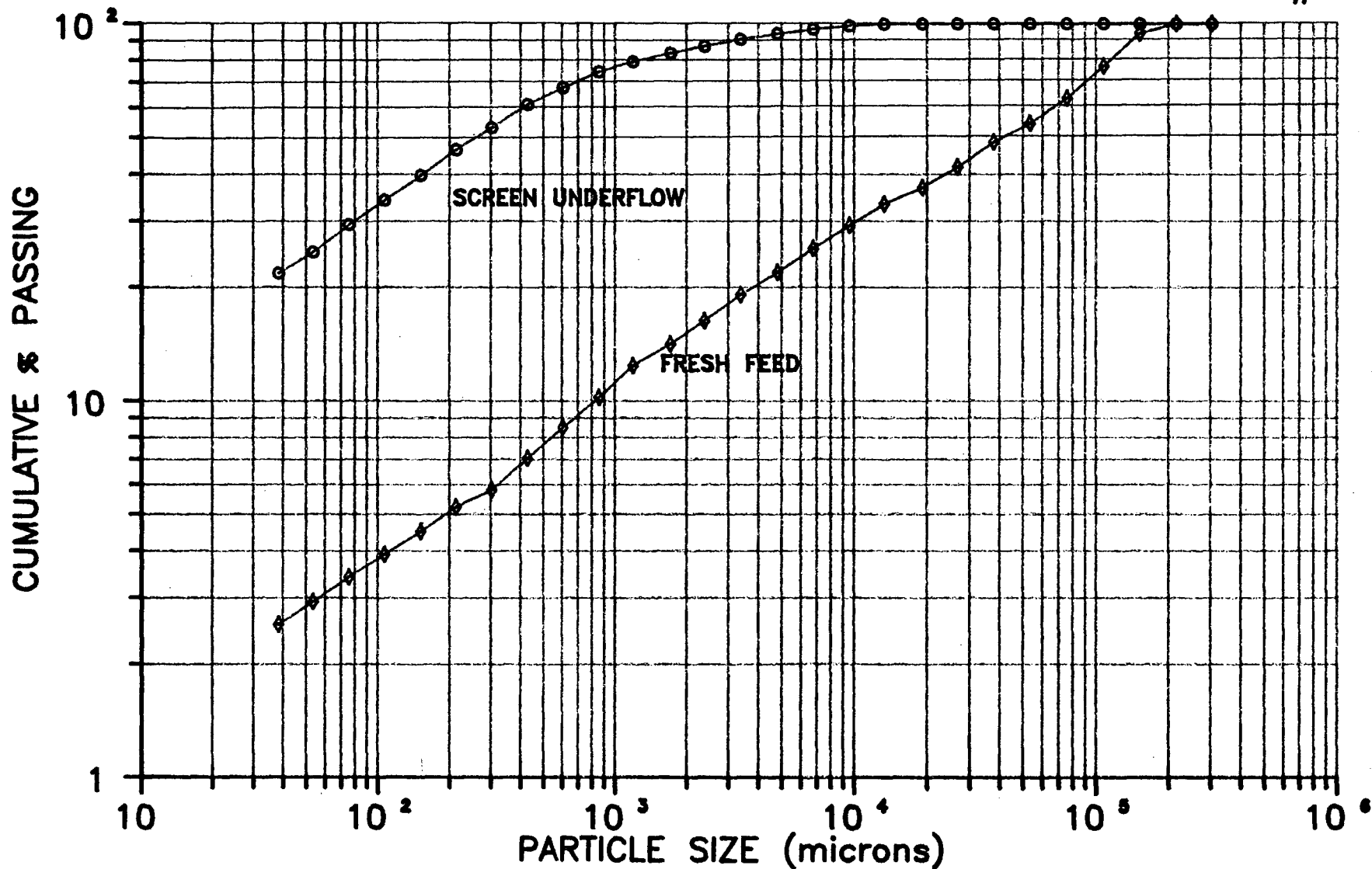
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #26



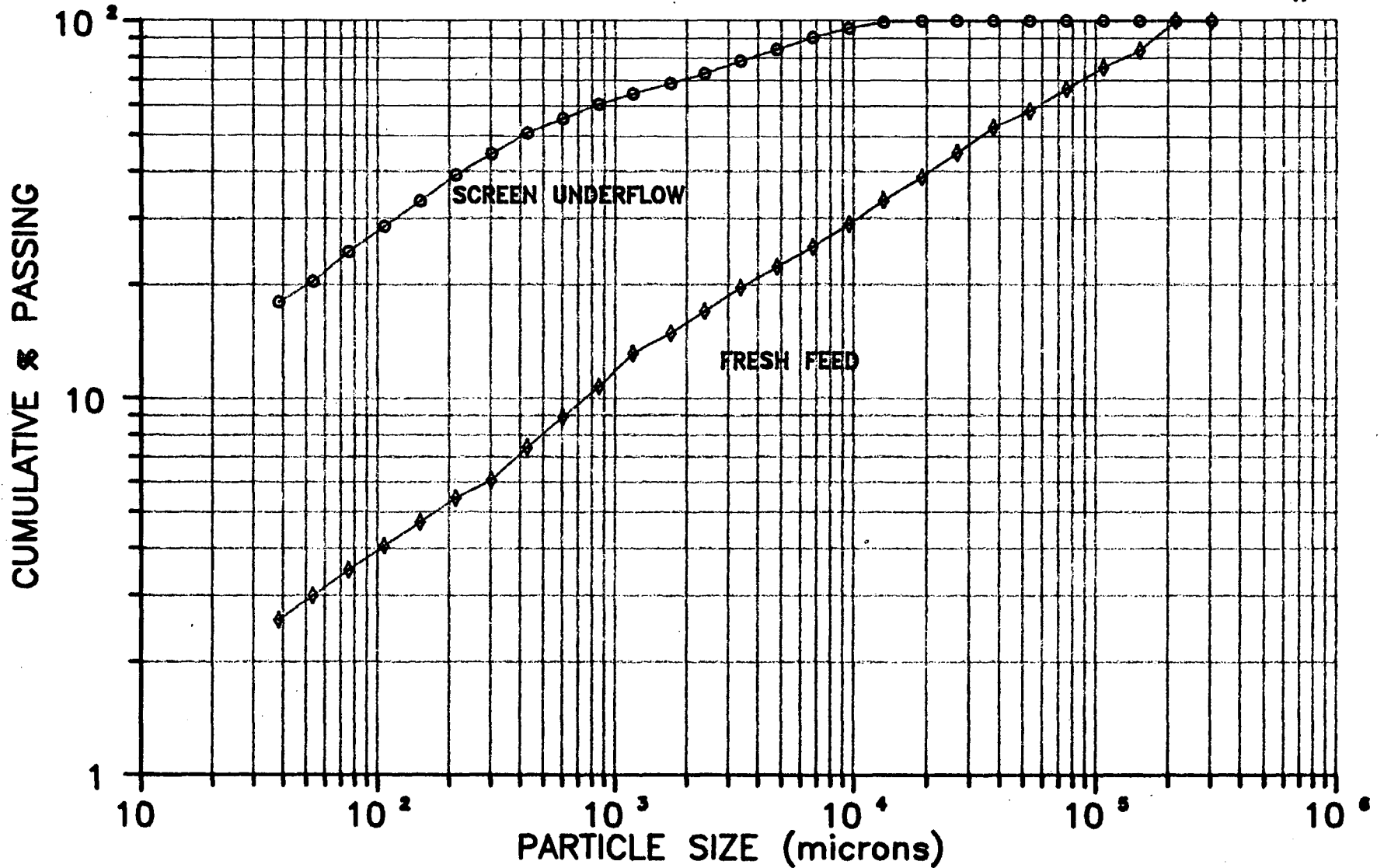
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #27



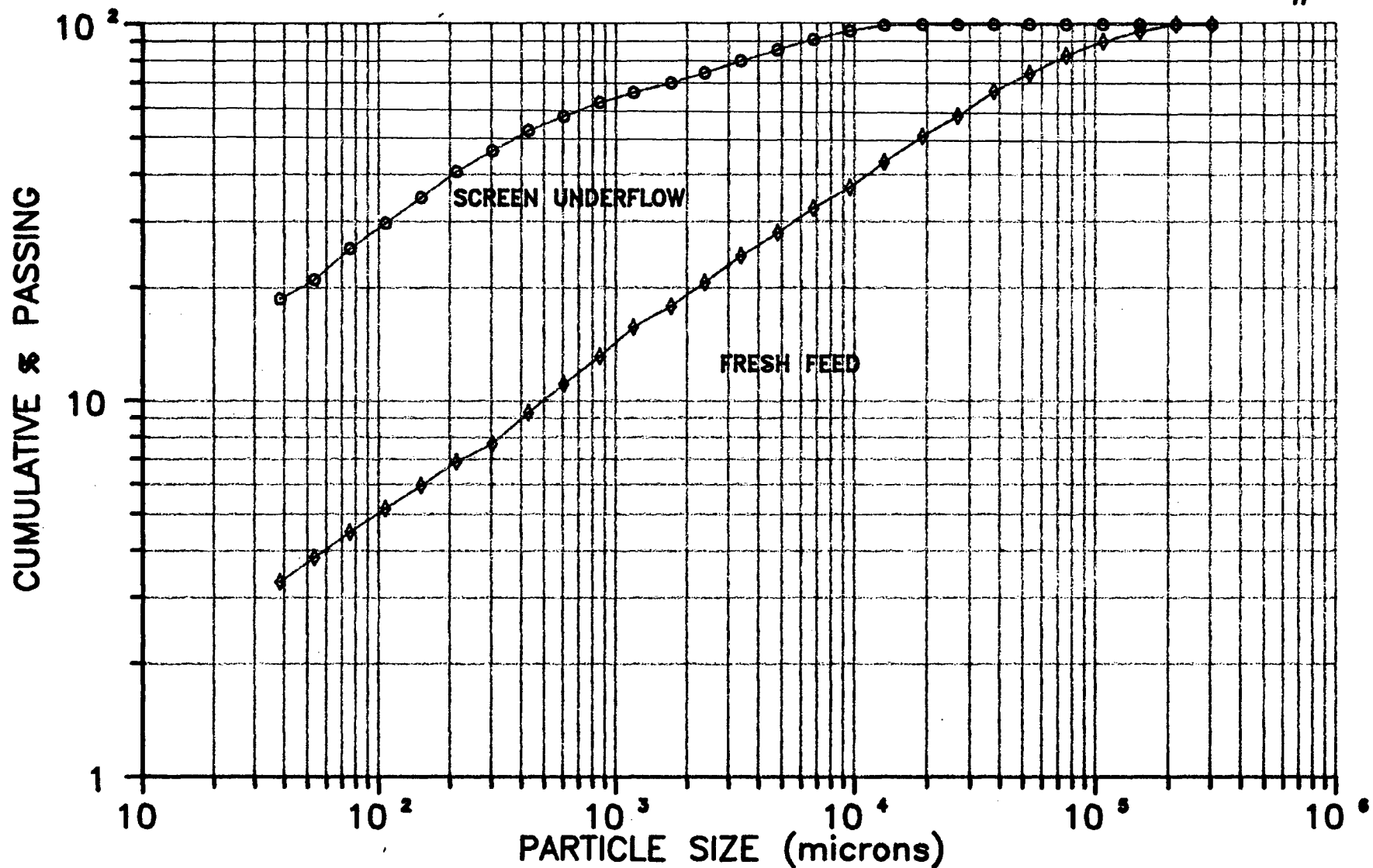
LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #28



LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #29



LORNEX C CIRCUIT ADJ. SIZE DISTRIBUTIONS RUN #30



APPENDIX IV.

LORNEX C-CIRCUIT: ADJUSTED 60CM DATA

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 1

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.46	.45	.49	5.00	.00	.01	100.00	.00
MILL DISCH.	1.25	1.23	1.93	5.00	.00	.34	100.00	.00
SCREEN FEED	53.37	53.72	.65	15.00	.00	52.83	100.00	.00
SCR OVERSIZE	.40	.44	9.30	10.00	.00	-.01	100.00	.00
SCR U/FLOW	52.97	53.28	.58	20.00	.00	52.83	100.00	.00
MILL WATER	.00	.34	100.00	.00	.34	.34	.58	5.00
SUMP WATER	.00	52.49	100.00	.00	52.17	52.49	.61	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.44	100.00	.00	99.19	97.96	1.24	5.00
MILL DISCH.	.00	.89	100.00	.00	71.63	72.40	.99	10.00
SCREEN FEED	.00	.89	100.00	.00	2.00	1.65	17.25	1000.00
SCR OVERSIZE	.00	.44	100.00	.00	93.81	101.67	8.38	10.00
SCR U/FLOW	.00	.44	100.00	.00	.83	.83	.51	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.45	.46	3.19	5.00	.96	.93	3.26	5.00
9500	4.70	3.22	31.43	5.00	5.42	6.45	18.93	5.00
6700	18.84	20.87	10.75	5.00	44.41	41.73	6.03	5.00
4570	17.47	16.67	4.59	5.00	30.69	33.34	8.62	5.00
3350	8.80	9.56	8.59	5.00	16.98	16.00	5.74	5.00
2360	4.28	4.12	3.71	5.00	1.44	1.45	.84	5.00
1700	2.00	1.92	3.75	5.00	.07	.07	.08	5.00
1180	1.63	1.60	1.66	5.00	.02	.02	.01	5.00
850	1.33	1.30	2.01	5.00	.01	.01	.01	5.00
600	1.41	1.43	1.65	5.00	.00	.00	100.00	.00
425	1.63	1.54	5.48	5.00	.00	.00	100.00	.00
300	1.95	2.05	5.15	5.00	.00	.00	100.00	.00
212	2.29	2.36	3.15	5.00	.00	.00	100.00	.00
150	3.33	3.25	2.49	5.00	.00	.00	100.00	.00
106	3.51	3.50	.37	5.00	.00	.00	100.00	.00
75	3.58	3.63	1.26	5.00	.00	.00	100.00	.00
53	3.98	4.02	.99	5.00	.00	.00	100.00	.00
38	3.23	3.01	6.93	5.00	.00	.00	100.00	.00
-38	15.56	15.46	.65	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS. VALUES	ESTIM. VALUES	RESID. VALUES	RELAT. ST.DEV.	NOT ADJUSTED	NOT ADJUSTED
37500					0.54	0.40
26500					10.94	5.17
19000					16.26	27.47
13200	.00	.00	100.00	.00	12.17	19.42
9500	.00	.00	100.00	.00	9.13	15.08
6700	.00	.00	100.00	.00	6.67	5.70
4750	.00	.00	100.00	.00	6.41	5.09
3350	3.16	3.11	1.68	5.00	4.58	2.16
2360	6.62	6.79	2.58	5.00	4.62	1.63
1700	3.66	3.78	3.27	5.00	3.74	0.94
1180	3.14	3.19	1.46	5.00	3.33	0.77
850	2.55	2.60	1.82	5.00	2.71	0.65
600	2.92	2.87	1.83	5.00	2.49	0.67
425	2.94	3.08	4.81	5.00	2.02	0.62
300	4.36	4.10	5.95	5.00	1.78	0.86
212	4.90	4.72	3.59	5.00	1.39	0.94
150	6.36	6.49	2.10	5.00	1.43	1.23
106	6.99	6.99	.06	5.00	1.17	1.33
75	7.37	7.25	1.62	5.00	1.11	1.28
53	8.15	8.04	1.37	5.00	1.07	1.68
38	5.68	6.01	5.85	5.00	0.77	1.11
-38	31.21	30.99	.71	5.00	5.68	5.78

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 2

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.47	.47	.07	5.00	.00	.00	100.00	.00
MILL DISCH.	1.17	1.18	.27	5.00	.00	.34	100.00	.00
SCREEN FEED	55.50	55.24	.47	15.00	.00	54.41	100.00	.00
SCR OVERSIZE	.36	.37	2.89	10.00	.00	.01	100.00	.00
SCR U/FLOW	55.14	54.87	.49	20.00	.00	54.40	100.00	.00
MILL WATER	.00	.33	100.00	.00	.34	.33	.14	5.00
SUMP WATER	.00	54.06	100.00	.00	54.33	54.06	.49	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.47	100.00	.00	99.26	99.53	.27	5.00
MILL DISCH.	.00	.83	100.00	.00	71.50	70.84	.92	10.00
SCREEN FEED	.00	.83	100.00	.00	2.00	1.51	24.58	1000.00
SCR OVERSIZE	.00	.36	100.00	.00	94.64	98.32	3.89	10.00
SCR U/FLOW	.00	.47	100.00	.00	.86	.86	.38	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.10	100.00	5.00	.00	.23	100.00	5.00
9500	3.58	4.04	12.95	5.00	11.28	9.28	17.75	5.00
6700	18.25	18.04	1.14	5.00	40.90	41.40	1.22	5.00
4750	17.51	17.06	2.59	5.00	38.00	38.97	2.55	5.00
3350	8.31	7.72	7.10	5.00	9.06	9.37	3.40	5.00
2360	4.38	4.36	.51	5.00	.67	.67	.04	5.00
1700	2.20	2.23	1.28	5.00	.07	.07	.02	5.00
1180	1.68	1.68	.15	5.00	.01	.01	.00	5.00
850	1.40	1.40	.15	5.00	.01	.01	.00	5.00
600	1.48	1.54	4.11	5.00	.00	.00	100.00	.00
425	1.67	1.62	2.71	5.00	.00	.00	100.00	.00
300	2.06	2.22	7.66	5.00	.00	.00	100.00	.00
212	2.49	2.61	4.64	5.00	.00	.00	100.00	.00
150	3.49	3.48	.30	5.00	.00	.00	100.00	.00
106	3.70	3.74	1.18	5.00	.00	.00	100.00	.00
75	4.03	3.99	1.03	5.00	.00	.00	100.00	.00
53	4.11	4.25	3.46	5.00	.00	.00	100.00	.00
38	3.18	3.03	4.86	5.00	.00	.00	100.00	.00
-38	16.48	16.89	2.51	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.14	6.14
19000					20.01	27.72
13200	.00	.00	100.00	.00	14.78	22.20
9500	.00	.00	100.00	.00	11.74	13.33
6700	.00	.00	100.00	.00	6.69	5.92
4750	.13	.13	.00	.00	6.73	5.22
3350	6.22	6.45	3.65	5.00	5.33	1.58
2360	7.12	7.21	1.21	5.00	4.55	1.24
1700	3.93	3.90	.88	5.00	3.35	0.74
1180	2.97	2.97	.16	5.00	2.78	0.62
850	2.46	2.47	.41	5.00	2.17	0.53
600	2.85	2.73	4.17	5.00	1.92	0.55
425	2.80	2.88	2.85	5.00	1.36	0.52
300	4.30	3.93	8.58	5.00	1.38	0.74
212	4.84	4.62	4.58	5.00	0.97	0.81
150	6.11	6.17	.94	5.00	1.02	1.15
106	6.67	6.64	.51	5.00	0.84	1.29
75	6.95	7.07	1.72	5.00	0.84	1.35
53	7.76	7.54	2.87	5.00	0.81	1.56
38	5.11	5.36	4.94	5.00	0.54	1.05
-38	29.78	29.94	.55	5.00	4.05	5.72

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 3

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.46	.46	.05	5.00	.00	.01	100.00	.00
MILL DISCH.	.94	.91	2.76	5.00	.00	.34	100.00	.00
SCREEN FEED	51.04	51.69	1.27	15.00	.00	51.12	100.00	.00
SCR OVERSIZE	.10	.11	8.64	10.00	.00	.00	100.00	.00
SCR U/FLOW	50.94	51.57	1.25	20.00	.00	51.12	100.00	.00
MILL WATER	.00	.34	100.00	.00	.33	.34	.90	5.00
SUMP WATER	.00	50.78	100.00	.00	50.15	50.78	1.25	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.45	100.00	.00	99.06	97.90	1.18	5.00
MILL DISCH.	.00	.57	100.00	.00	62.83	62.27	.89	10.00
SCREEN FEED	.00	.57	100.00	.00	2.00	1.10	45.11	1000.00
SCR OVERSIZE	.00	.11	100.00	.00	92.64	101.79	9.87	10.00
SCR U/FLOW	.00	.45	100.00	.00	.87	.88	1.06	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	2.83	3.09	9.24	5.00	16.94	15.40	9.09	5.00
6700	5.92	5.67	4.28	5.00	26.39	28.23	6.97	5.00
4750	6.21	6.66	7.19	5.00	34.51	33.16	3.92	5.00
3350	5.48	5.23	4.60	5.00	18.79	19.81	5.40	5.00
2360	4.22	3.95	6.38	5.00	3.03	3.07	1.28	5.00
1700	2.97	3.00	1.11	5.00	.27	.27	.01	5.00
1180	3.25	3.31	1.87	5.00	.05	.05	.00	5.00
850	3.21	3.23	.70	5.00	.01	.01	.00	5.00
600	3.62	3.73	3.03	5.00	.00	.00	100.00	.00
425	4.04	3.77	6.60	5.00	.00	.00	100.00	.00
300	4.42	4.52	2.34	5.00	.00	.00	100.00	.00
212	4.58	4.49	1.98	5.00	.00	.00	100.00	.00
150	5.62	5.46	2.76	5.00	.00	.00	100.00	.00
106	5.30	5.34	.68	5.00	.00	.00	100.00	.00
75	5.57	5.52	.92	5.00	.00	.00	100.00	.00
53	5.44	5.67	4.20	5.00	.00	.00	100.00	.00
38	4.09	4.04	1.16	5.00	.00	.00	100.00	.00
-38	23.24	23.32	.36	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.71	0.00
26500					7.92	5.63
19000					16.61	23.43
13200	.00	.00	100.00	.00	13.07	17.49
9500	.00	.00	100.00	.00	10.05	15.40
6700	.00	.00	100.00	.00	6.60	6.19
4750	.00	.00	100.00	.00	6.30	5.67
3350	1.55	1.57	1.05	5.00	4.27	2.58
2360	3.98	4.17	4.83	5.00	4.73	2.78
1700	3.73	3.69	1.09	5.00	3.72	1.80
1180	4.21	4.13	1.91	5.00	3.31	1.58
850	4.07	4.04	.69	5.00	2.88	1.24
600	4.82	4.67	3.19	5.00	2.71	1.18
425	4.46	4.72	5.85	5.00	2.02	0.93
300	5.80	5.66	2.42	5.00	2.04	1.14
212	5.51	5.62	1.94	5.00	1.45	1.08
150	6.66	6.84	2.66	5.00	1.47	1.29
106	6.72	6.68	.65	5.00	1.15	1.32
75	6.84	6.90	.95	5.00	1.14	1.37
53	7.43	7.09	4.54	5.00	1.09	1.48
38	5.00	5.06	1.16	5.00	0.68	0.99
-38	29.21	29.16	.18	5.00	6.07	5.44

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 4

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.47	.47	1.67	5.00	.00	.01	100.00	.00
MILL DISCH.	1.28	1.26	1.39	5.00	.00	.39	100.00	.00
SCREEN FEED	54.49	55.54	1.92	15.00	.00	54.66	100.00	.00
SCR OVERSIZE	.35	.39	11.18	10.00	.00	-.03	100.00	.00
SCR U/FLOW	54.14	55.14	1.85	20.00	.00	54.69	100.00	.00
MILL WATER	.00	.40	100.00	.00	.40	.40	.40	5.00
SUMP WATER	.00	54.28	100.00	.00	53.31	54.28	1.81	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.45	100.00	.00	99.17	97.16	2.03	5.00
MILL DISCH.	.00	.87	100.00	.00	69.59	69.32	.39	10.00
SCREEN FEED	.00	.87	100.00	.00	2.00	1.57	21.35	1000.00
SCR OVERSIZE	.00	.42	100.00	.00	93.46	106.67	14.13	10.00
SCR U/FLOW	.00	.45	100.00	.00	.81	.82	1.60	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.32	.31	2.02	5.00	.64	.65	1.94	5.00
9500	4.10	4.05	1.30	5.00	8.31	8.42	1.33	5.00
6700	19.97	19.63	1.68	5.00	40.08	40.86	1.94	5.00
4750	16.43	16.66	1.39	5.00	35.01	34.61	1.15	5.00
3350	8.05	8.44	4.85	5.00	13.99	13.44	3.94	5.00
2360	5.10	4.25	16.72	5.00	1.84	1.89	2.91	5.00
1700	2.51	2.30	8.33	5.00	.09	.09	.14	5.00
1180	2.00	1.88	6.00	5.00	.02	.02	.03	5.00
850	1.74	1.69	3.08	5.00	.02	.02	.02	5.00
600	1.82	1.85	1.48	5.00	.00	.00	100.00	.00
425	1.80	1.79	.82	5.00	.00	.00	100.00	.00
300	1.88	2.03	8.06	5.00	.00	.00	100.00	.00
212	1.99	2.08	4.33	5.00	.00	.00	100.00	.00
150	2.63	2.62	.33	5.00	.00	.00	100.00	.00
106	2.70	2.77	2.62	5.00	.00	.00	100.00	.00
75	2.83	2.99	5.63	5.00	.00	.00	100.00	.00
53	3.47	3.62	4.34	5.00	.00	.00	100.00	.00
38	3.07	2.97	3.11	5.00	.00	.00	100.00	.00
-38	17.59	18.08	2.77	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.93	0.00
26500					7.12	6.09
19000					16.29	23.78
13200	.00	.00	100.00	.00	11.81	18.57
9500	.00	.00	100.00	.00	10.83	16.93
6700	.00	.00	100.00	.00	6.61	6.94
4750	.05	.05	.00	5.00	6.96	6.68
3350	3.85	3.82	.89	5.00	5.13	3.01
2350	5.82	6.42	10.39	5.00	4.93	2.39
1700	4.05	4.35	7.31	5.00	3.67	1.48
1180	3.41	3.60	5.59	5.00	3.38	1.12
850	3.13	3.23	3.13	5.00	2.74	0.79
600	3.60	3.56	1.23	5.00	2.57	0.69
425	3.40	3.44	1.08	5.00	1.90	0.53
300	4.31	3.91	9.25	5.00	1.90	0.63
212	4.18	4.00	4.38	5.00	1.37	0.62
150	5.01	5.05	.73	5.00	1.49	0.75
106	5.46	5.33	2.31	5.00	1.21	0.84
75	6.11	5.75	5.81	5.00	1.11	0.85
53	7.27	6.97	4.13	5.00	1.15	1.26
38	5.54	5.73	3.37	5.00	0.71	0.86
-38	34.81	34.80	.02	5.00	6.18	5.19

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 5

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.46	.45	.84	5.00	.00	.01	100.00	.00
MILL DISCH.	1.01	1.01	.18	5.00	.00	.41	100.00	.00
SCREEN FEED	58.53	59.26	1.25	15.00	.00	58.65	100.00	.00
SCR OVERSIZE	.16	.16	5.10	10.00	.00	.00	100.00	.00
SCR U/FLOW	58.37	59.10	1.24	20.00	.00	58.65	100.00	.00
MILL WATER	.00	.40	100.00	.00	.40	.40	.08	5.00
SUMP WATER	.00	58.25	100.00	.00	57.53	58.25	1.24	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.45	100.00	.00	99.35	98.63	.73	5.00
MILL DISCH.	.00	.61	100.00	.00	60.16	60.08	.14	10.00
SCREEN FEED	.00	.61	100.00	.00	2.00	1.03	48.56	1000.00
SCR OVERSIZE	.00	.16	100.00	.00	92.90	98.66	6.20	10.00
SCR U/FLOW	.00	.45	100.00	.00	.75	.76	1.06	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	1.25	1.29	3.25	5.00	5.03	4.86	3.29	5.00
9500	3.09	2.99	3.36	5.00	10.87	11.25	3.54	5.00
6700	10.12	10.70	5.70	5.00	42.34	40.32	4.77	5.00
4750	7.79	7.41	4.91	5.00	26.49	27.92	5.40	5.00
3350	4.94	4.78	3.27	5.00	12.80	13.15	2.72	5.00
2360	3.34	3.18	4.75	5.00	2.33	2.35	.96	5.00
1700	2.25	2.25	.17	5.00	.11	.11	.01	5.00
1180	2.18	2.14	1.95	5.00	.01	.01	.00	5.00
850	2.15	2.10	2.22	5.00	.00	.00	100.00	.00
600	2.75	2.77	.67	5.00	.00	.00	100.00	.00
425	3.15	3.07	2.49	5.00	.00	.00	100.00	.00
300	3.97	4.15	4.65	5.00	.00	.00	100.00	.00
212	4.44	4.43	.28	5.00	.00	.00	100.00	.00
150	5.73	5.58	2.66	5.00	.00	.00	100.00	.00
106	5.65	5.56	1.65	5.00	.00	.00	100.00	.00
75	5.64	5.48	2.91	5.00	.00	.00	100.00	.00
53	5.24	5.43	3.54	5.00	.00	.00	100.00	.00
38	4.02	3.88	3.57	5.00	.00	.00	100.00	.00
-38	22.32	22.86	2.41	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.57
26500					11.34	7.23
19000					20.40	28.31
13200	.00	.00	100.00	.00	13.46	19.30
9500	.00	.00	100.00	.00	10.18	13.40
6700	.00	.00	100.00	.00	6.26	5.63
4750	.00	.00	100.00	.00	6.30	4.82
3350	1.74	1.76	.89	5.00	4.22	2.42
2360	3.36	3.48	3.60	5.00	4.22	1.97
1700	3.01	3.02	.25	5.00	3.32	1.40
1180	2.85	2.91	1.95	5.00	3.00	1.13
850	2.80	2.86	2.20	5.00	2.40	0.88
600	3.79	3.77	.58	5.00	2.16	0.88
425	4.08	4.18	2.48	5.00	1.75	0.74
300	5.95	5.65	4.96	5.00	1.48	0.92
212	6.00	6.03	.44	5.00	1.16	0.87
150	7.39	7.59	2.73	5.00	1.16	1.05
106	7.43	7.56	1.80	5.00	0.91	1.07
75	7.24	7.45	2.94	5.00	0.81	1.05
53	7.66	7.38	3.59	5.00	0.74	1.10
38	5.10	5.28	3.46	5.00	0.50	0.75
-38	31.58	31.06	1.65	5.00	4.24	4.52

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 6

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.62	.60	2.83	5.00	.00	.01	100.00	.00
MILL DISCH.	1.44	1.54	6.94	5.00	.00	.55	100.00	.00
SCREEN FEED	52.80	51.97	1.56	15.00	.00	50.98	100.00	.00
SCR OVERSIZE	.43	.41	4.16	10.00	.00	.02	100.00	.00
SCR U/FLOW	52.37	51.56	1.55	20.00	.00	50.97	100.00	.00
MILL WATER	.00	.53	100.00	.00	.54	.53	2.56	5.00
SUMP WATER	.00	50.44	100.00	.00	51.24	50.44	1.57	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.59	100.00	.00	98.79	98.88	.09	5.00
MILL DISCH.	.00	.99	100.00	.00	64.08	64.40	.50	10.00
SCREEN FEED	.00	.99	100.00	.00	2.00	1.91	4.73	1000.00
SCR OVERSIZE	.00	.40	100.00	.00	92.36	96.26	4.22	10.00
SCR U/FLOW	.00	.59	100.00	.00	1.16	1.15	1.21	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.37	100.00	5.00	.00	.92	100.00	5.00
9500	4.89	4.19	14.36	5.00	9.34	10.38	11.16	5.00
6700	15.70	15.43	1.71	5.00	37.49	38.26	2.05	5.00
4750	13.36	13.86	3.72	5.00	35.60	34.31	3.62	5.00
3350	7.19	7.94	10.46	5.00	15.75	14.32	9.08	5.00
2360	4.10	4.19	2.22	5.00	1.72	1.71	.36	5.00
1700	2.14	2.26	5.60	5.00	.08	.08	.08	5.00
1180	1.74	1.82	4.72	5.00	.01	.01	.01	5.00
850	1.64	1.67	1.54	5.00	.00	.00	100.00	.00
600	1.91	1.99	4.29	5.00	.00	.00	100.00	.00
425	2.37	2.30	3.05	5.00	.00	.00	100.00	.00
300	2.98	3.11	4.19	5.00	.00	.00	100.00	.00
212	3.33	3.23	2.98	5.00	.00	.00	100.00	.00
150	4.23	4.15	1.99	5.00	.00	.00	100.00	.00
106	4.15	4.11	.94	5.00	.00	.00	100.00	.00
75	4.30	4.15	3.39	5.00	.00	.00	100.00	.00
53	4.23	4.28	1.13	5.00	.00	.00	100.00	.00
38	3.25	3.04	6.46	5.00	.00	.00	100.00	.00
-38	18.51	17.94	3.09	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.30	0.00
26500					7.28	6.43
19000					16.74	26.84
13200	.00	.00	100.00	.00	15.07	19.03
9500	.00	.00	100.00	.00	11.95	17.14
6700	.00	.00	100.00	.00	7.55	6.84
4750	.03	.03	.01	5.00	7.18	5.93
3350	3.76	3.63	3.45	5.00	4.46	2.90
2360	6.00	5.87	2.23	5.00	4.58	2.22
1700	3.99	3.73	6.43	5.00	3.24	1.26
1180	3.22	3.05	5.37	5.00	2.98	0.90
850	2.84	2.79	1.73	5.00	2.38	0.69
600	3.51	3.34	4.88	5.00	2.21	0.69
425	3.75	3.85	2.70	5.00	1.64	0.58
300	5.47	5.20	4.86	5.00	1.62	0.68
212	5.28	5.42	2.56	5.00	1.13	0.62
150	6.84	6.95	1.59	5.00	1.21	0.68
106	6.85	6.89	.59	5.00	0.98	0.69
75	6.77	6.96	2.85	5.00	0.87	0.73
53	7.28	7.17	1.51	5.00	0.94	0.83
38	4.83	5.10	5.49	5.00	0.54	0.60
-38	29.57	30.02	1.51	5.00	5.14	3.71

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 7

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.47	.47	.59	5.00	.00	.01	100.00	.00
MILL DISCH.	1.38	1.34	2.83	5.00	.00	.47	100.00	.00
SCREEN FEED	54.88	54.54	.62	15.00	.00	53.67	100.00	.00
SCR OVERSIZE	.34	.38	10.80	10.00	.00	-.03	100.00	.00
SCR U/FLOW	54.54	54.16	.70	20.00	.00	53.70	100.00	.00
MILL WATER	.00	.49	100.00	.00	.48	.49	1.31	5.00
SUMP WATER	.00	53.20	100.00	.00	53.55	53.20	.66	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.46	100.00	.00	99.38	97.60	1.79	5.00
MILL DISCH.	.00	.87	100.00	.00	62.42	64.82	3.85	10.00
SCREEN FEED	.00	.87	100.00	.00	2.00	1.59	20.26	1000.00
SCR OVERSIZE	.00	.41	100.00	.00	98.54	107.74	9.33	10.00
SCR U/FLOW	.00	.46	100.00	.00	.85	.85	.51	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	1.71	100.00	5.00	.00	3.62	100.00	5.00
9500	5.50	4.05	26.33	5.00	7.32	8.56	16.91	5.00
6700	18.06	18.37	1.73	5.00	38.82	38.80	.04	5.00
4750	15.03	16.83	12.00	5.00	41.22	35.55	13.75	5.00
3350	8.62	7.65	11.21	5.00	11.19	12.02	7.38	5.00
2360	3.95	3.98	.82	5.00	1.35	1.35	.07	5.00
1700	1.96	1.93	1.70	5.00	.09	.09	.04	5.00
1180	1.36	1.38	1.59	5.00	.01	.01	.01	5.00
850	1.14	1.13	.52	5.00	.00	.00	100.00	.00
600	1.32	1.38	4.83	5.00	.00	.00	100.00	.00
425	1.66	1.62	2.25	5.00	.00	.00	100.00	.00
300	2.08	2.22	6.63	5.00	.00	.00	100.00	.00
212	2.48	2.51	1.27	5.00	.00	.00	100.00	.00
150	3.35	3.21	4.18	5.00	.00	.00	100.00	.00
106	3.46	3.42	1.12	5.00	.00	.00	100.00	.00
75	3.89	3.75	3.60	5.00	.00	.00	100.00	.00
53	4.14	4.15	.31	5.00	.00	.00	100.00	.00
38	3.29	3.08	6.38	5.00	.00	.00	100.00	.00
-38	18.71	17.60	5.93	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.19	7.00
19000					23.17	25.34
13200	.00	.00	100.00	.00	14.79	21.59
9500	.00	.00	100.00	.00	11.40	15.36
6700	.00	.00	100.00	.00	6.24	6.97
4750	.00	.00	100.00	.00	6.39	6.73
3350	3.66	3.73	1.95	5.00	4.42	2.81
2360	6.46	6.35	1.70	5.00	4.17	2.33
1700	3.54	3.58	1.08	5.00	2.97	1.34
1180	2.67	2.62	2.06	5.00	2.62	0.91
850	2.15	2.15	.18	5.00	2.17	0.72
600	2.79	2.63	5.80	5.00	1.89	0.66
425	3.03	3.08	1.70	5.00	1.39	0.52
300	4.60	4.21	8.43	5.00	1.37	0.59
212	4.87	4.77	2.06	5.00	0.99	0.53
150	5.92	6.10	2.98	5.00	1.04	0.62
106	6.49	6.50	.12	5.00	0.88	0.64
75	6.96	7.12	2.33	5.00	0.84	0.68
53	8.01	7.89	1.54	5.00	0.88	0.84
38	5.58	5.85	4.84	5.00	0.55	0.56
-38	33.27	33.43	.47	5.00	3.62	3.27

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 8

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.60	.59	.84	5.00	.00	.01	100.00	.00
MILL DISCH.	1.41	1.43	1.31	5.00	.00	.48	100.00	.00
SCREEN FEED	48.46	48.83	.77	15.00	.00	47.88	100.00	.00
SCR OVERSIZE	.37	.38	2.63	10.00	.00	.01	100.00	.00
SCR U/FLOW	48.09	48.45	.75	20.00	.00	47.87	100.00	.00
MILL WATER	.00	.46	100.00	.00	.46	.46	.45	5.00
SUMP WATER	.00	47.40	100.00	.00	47.04	47.40	.76	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.59	100.00	.00	98.92	98.67	.25	5.00
MILL DISCH.	.00	.95	100.00	.00	66.65	66.46	.29	10.00
SCREEN FEED	.00	.95	100.00	.00	2.00	1.95	2.51	1000.00
SCR OVERSIZE	.00	.37	100.00	.00	92.67	96.91	4.58	10.00
SCR U/FLOW	.00	.59	100.00	.00	1.20	1.21	.63	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	-.09	100.00	5.00	.00	-.25	100.00	5.00
9500	2.81	2.90	3.31	5.00	7.81	7.53	3.57	5.00
6700	16.01	15.45	3.47	5.00	38.87	40.09	3.14	5.00
4750	13.99	14.16	1.24	5.00	37.19	36.68	1.37	5.00
3350	7.71	7.84	1.71	5.00	14.54	14.35	1.23	5.00
2360	4.12	4.07	1.21	5.00	1.53	1.53	.17	5.00
1700	2.22	2.33	4.75	5.00	.05	.05	.04	5.00
1180	1.92	1.92	.05	5.00	.01	.01	.00	5.00
850	1.75	1.75	.24	5.00	.00	.00	100.00	.00
600	2.02	2.08	3.12	5.00	.00	.00	100.00	.00
425	2.21	2.20	.56	5.00	.00	.00	100.00	.00
300	2.91	3.01	3.33	5.00	.00	.00	100.00	.00
212	3.27	3.26	.16	5.00	.00	.00	100.00	.00
150	4.48	4.29	4.14	5.00	.00	.00	100.00	.00
106	4.32	4.28	.99	5.00	.00	.00	100.00	.00
75	4.58	4.42	3.51	5.00	.00	.00	100.00	.00
53	4.40	4.51	2.45	5.00	.00	.00	100.00	.00
38	3.12	3.12	.04	5.00	.00	.00	100.00	.00
-38	18.15	18.49	1.88	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLO				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM	RESID	RELAT	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					5.71	4.99
19000					16.13	27.54
13200	.00	.00	100.00	.00	13.29	21.20
9500	.00	.00	100.00	.00	10.81	14.51
6700	.00	.00	100.00	.00	6.58	5.90
4750	.04	.04	.00	5.00	6.73	5.27
3350	3.77	3.76	.32	5.00	4.54	2.27
2360	5.59	5.66	1.29	5.00	4.98	1.50
1700	3.95	3.75	4.99	5.00	3.69	0.97
1180	3.11	3.12	.21	5.00	3.37	0.80
850	2.83	2.84	.38	5.00	2.85	0.66
600	3.50	3.39	3.15	5.00	2.72	0.69
425	3.55	3.58	.73	5.00	2.07	0.61
300	5.06	4.89	3.30	5.00	2.10	0.82
212	5.29	5.31	.43	5.00	1.47	0.89
150	6.71	6.99	4.15	5.00	1.55	1.16
106	6.87	6.96	1.31	5.00	1.30	1.24
75	6.94	7.19	3.62	5.00	1.20	1.33
53	7.50	7.34	2.19	5.00	1.25	1.41
38	5.06	5.08	.30	5.00	0.79	0.89
-38	30.24	30.12	.40	5.00	6.89	5.34

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 9.

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.40	.41	1.88	5.00	.00	.00	100.00	.00
MILL DISCH.	1.13	1.06	6.43	5.00	.00	.35	100.00	.00
SCREEN FEED	51.98	53.66	3.24	15.00	.00	52.96	100.00	.00
SCR OVERSIZE	.29	.31	8.94	10.00	.00	.01	100.00	.00
SCR U/FLOW	51.69	53.35	3.21	20.00	.00	52.94	100.00	.00
MILL WATER	.00	.33	100.00	.00	.33	.33	1.78	5.00
SUMP WATER	.00	52.61	100.00	.00	50.91	52.61	3.33	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.41	100.00	.00	99.21	98.91	.30	5.00
MILL DISCH.	.00	.71	100.00	.00	67.65	66.87	1.16	10.00
SCREEN FEED	.00	.71	100.00	.00	2.00	1.32	34.01	1000.00
SCR OVERSIZE	.00	.30	100.00	.00	93.35	96.30	3.16	10.00
SCR U/FLOW	.00	.41	100.00	.00	.74	.76	2.86	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	1.01	1.01	.01	5.00	2.37	2.37	.10	5.00
9500	4.10	4.23	3.13	5.00	10.30	9.91	3.78	5.00
6700	18.75	18.43	1.71	5.00	43.23	43.20	.08	5.00
4750	13.91	13.38	3.84	5.00	30.55	31.27	2.36	5.00
3350	6.59	6.76	2.51	5.00	12.06	11.76	2.45	5.00
2360	3.49	3.49	.06	5.00	1.37	1.37	.05	5.00
1700	1.87	1.90	1.56	5.00	.10	.10	.04	5.00
1180	1.51	1.46	3.26	5.00	.01	.01	.01	5.00
850	1.27	1.26	.48	5.00	.00	.00	100.00	.00
600	1.44	1.48	3.08	5.00	.00	.00	100.00	.00
425	1.71	1.68	1.65	5.00	.00	.00	100.00	.00
300	2.16	2.30	6.62	5.00	.00	.00	100.00	.00
212	2.64	2.67	1.11	5.00	.00	.00	100.00	.00
150	3.80	3.66	3.61	5.00	.00	.00	100.00	.00
106	4.09	4.07	.58	5.00	.00	.00	100.00	.00
75	4.63	4.47	3.36	5.00	.00	.00	100.00	.00
53	4.63	4.77	3.03	5.00	.00	.00	100.00	.00
38	3.47	3.37	2.74	5.00	.00	.00	100.00	.00
-38	18.93	19.60	3.55	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					9.86	8.16
19000					20.38	26.05
13200	.00	.00	100.00	.00	14.27	22.22
9500	.00	.00	100.00	.00	11.84	15.29
6700	.00	.00	100.00	.00	6.14	5.45
4750	.06	.06	.01	5.00	5.86	4.61
3350	3.04	3.03	.40	5.00	3.59	1.93
2360	5.04	5.06	.48	5.00	3.96	1.57
1700	3.28	3.24	1.28	5.00	2.95	0.89
1180	2.46	2.54	3.26	5.00	2.80	0.67
850	2.19	2.20	.66	5.00	2.29	0.50
600	2.67	2.59	3.04	5.00	2.14	0.50
425	2.88	2.93	1.84	5.00	1.70	0.45
300	4.33	4.02	7.24	5.00	1.52	0.60
212	4.69	4.66	.73	5.00	1.18	0.63
150	6.15	6.39	3.88	5.00	1.22	0.90
106	7.01	7.09	1.17	5.00	0.99	1.07
75	7.52	7.80	3.77	5.00	0.94	1.19
53	8.53	8.32	2.47	5.00	0.91	1.36
38	5.71	5.89	3.08	5.00	0.61	0.91
-38	34.44	34.18	.75	5.00	4.86	5.07

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.44	.44	.68	5.00	.00	.01	100.00	.00
MILL DISCH.	1.62	1.51	7.14	5.00	.00	.59	100.00	.00
SCREEN FEED	55.17	56.59	2.58	15.00	.00	55.67	100.00	.00
SCR OVERSIZE	.43	.49	13.28	10.00	.00	.00	100.00	.00
SCR U/FLOW	54.74	56.11	2.50	20.00	.00	55.68	100.00	.00
MILL WATER	.00	.58	100.00	.00	.57	.58	2.46	5.00
SUMP WATER	.00	55.09	100.00	.00	53.70	55.09	2.58	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.43	100.00	.00	98.94	97.75	1.20	5.00
MILL DISCH.	.00	.92	100.00	.00	61.30	61.13	.29	10.00
SCREEN FEED	.00	.92	100.00	.00	2.00	1.63	18.56	1000.00
SCR OVERSIZE	.00	.49	100.00	.00	93.61	100.72	7.60	10.00
SCR U/FLOW	.00	.43	100.00	.00	.75	.77	2.20	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.77	.73	5.45	5.00	1.30	1.36	4.98	5.00
9500	4.46	4.97	11.39	5.00	10.86	9.31	14.25	5.00
6700	22.30	20.12	9.77	5.00	34.36	37.72	9.77	5.00
4750	18.40	19.63	6.67	5.00	38.89	36.73	5.55	5.00
3350	9.10	8.94	1.73	5.00	13.51	13.79	2.05	5.00
2360	3.78	3.55	6.07	5.00	.99	1.00	.90	5.00
1700	1.62	1.65	1.77	5.00	.08	.08	.04	5.00
1180	1.15	1.10	4.38	5.00	.00	.00	100.00	.00
850	.91	.90	.95	5.00	.00	.00	100.00	.00
600	.98	1.02	3.65	5.00	.00	.00	100.00	.00
425	1.21	1.17	3.43	5.00	.00	.00	100.00	.00
300	1.65	1.70	3.19	5.00	.00	.00	100.00	.00
212	1.97	2.03	3.03	5.00	.00	.00	100.00	.00
150	2.93	2.86	2.23	5.00	.00	.00	100.00	.00
106	3.14	3.19	1.51	5.00	.00	.00	100.00	.00
75	3.19	3.34	4.79	5.00	.00	.00	100.00	.00
53	3.69	3.85	4.25	5.00	.00	.00	100.00	.00
38	3.12	3.02	3.20	5.00	.00	.00	100.00	.00
-38	15.62	16.22	3.87	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.28
26500					9.33	8.68
19000					18.28	30.43
13200	.00	.00	100.00	.00	13.72	24.34
9500	.00	.00	100.00	.00	10.86	14.86
6700	.00	.00	100.00	.00	6.73	5.53
4750	.07	.07	.00	5.00	6.70	4.58
3350	3.38	3.40	.71	5.00	4.33	1.66
2360	6.14	6.47	5.35	5.00	4.77	1.11
1700	3.49	3.44	1.36	5.00	3.32	0.59
1180	2.26	2.36	4.29	5.00	2.94	0.37
850	1.91	1.93	1.16	5.00	2.45	0.28
600	2.26	2.18	3.66	5.00	2.25	0.29
425	2.42	2.50	3.50	5.00	1.69	0.26
300	3.76	3.65	2.94	5.00	1.68	0.36
212	4.47	4.35	2.67	5.00	1.24	0.38
150	5.97	6.14	2.85	5.00	1.19	0.50
106	6.88	6.83	.70	5.00	0.96	0.56
75	7.49	7.17	4.34	5.00	0.89	0.61
53	8.55	8.25	3.56	5.00	0.95	0.73
38	6.24	6.47	3.75	5.00	0.56	0.54
-38	34.70	34.78	.22	5.00	5.15	3.06

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.46	.46	.13	5.00	.00	.00	100.00	.00
MILL DISCH.	.89	.88	.75	5.00	.00	.31	100.00	.00
SCREEN FEED	49.48	48.41	2.17	15.00	.00	47.83	100.00	.00
SCR OVERSIZE	.11	.12	6.24	10.00	.00	.00	100.00	.00
SCR U/FLOW	49.37	48.29	2.19	20.00	.00	47.83	100.00	.00
MILL WATER	.00	.30	100.00	.00	.30	.30	.22	5.00
SUMP WATER	.00	47.52	100.00	.00	48.58	47.52	2.18	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.46	100.00	.00	99.40	99.20	.20	5.00
MILL DISCH.	.00	.57	100.00	.00	65.08	64.79	.44	10.00
SCREEN FEED	.00	.57	100.00	.00	2.00	1.18	40.82	1000.00
SCR OVERSIZE	.00	.12	100.00	.00	90.14	96.66	7.23	10.00
SCR U/FLOW	.00	.46	100.00	.00	.96	.94	1.65	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.39	.40	3.07	5.00	2.03	1.97	3.08	5.00
9500	1.77	1.91	7.96	5.00	10.22	9.35	8.48	5.00
6700	6.58	6.79	3.24	5.00	33.38	33.25	.39	5.00
4750	6.92	7.05	1.87	5.00	34.11	34.50	1.15	5.00
3350	5.12	4.95	3.42	5.00	17.14	17.80	3.86	5.00
2360	3.89	3.89	.10	5.00	2.84	2.85	.27	5.00
1700	2.60	2.69	3.35	5.00	.23	.23	.04	5.00
1180	2.80	2.84	1.39	5.00	.04	.04	.00	5.00
850	3.04	2.96	2.71	5.00	.02	.02	.01	5.00
600	3.24	3.44	6.15	5.00	.00	.00	100.00	.00
425	3.96	3.83	3.41	5.00	.00	.00	100.00	.00
300	4.61	4.89	5.97	5.00	.00	.00	100.00	.00
212	5.36	5.21	2.89	5.00	.00	.00	100.00	.00
150	6.46	6.29	2.60	5.00	.00	.00	100.00	.00
106	5.87	5.83	.76	5.00	.00	.00	100.00	.00
75	5.70	5.56	2.54	5.00	.00	.00	100.00	.00
53	5.27	5.39	2.26	5.00	.00	.00	100.00	.00
38	3.95	3.77	4.67	5.00	.00	.00	100.00	.00
-38	22.45	22.33	.54	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					12.25	6.09
19000					23.95	29.30
13200	.00	.00	100.00	.00	15.87	16.24
9500	.00	.00	100.00	.00	10.82	12.36
6700	.00	.00	100.00	.00	6.83	4.49
4750	.00	.00	100.00	.00	5.79	4.14
3350	1.63	1.64	.85	5.00	3.64	2.56
2360	4.15	4.15	.06	5.00	3.49	2.19
1700	3.44	3.32	3.55	5.00	2.53	1.55
1180	3.61	3.56	1.45	5.00	2.17	1.37
850	3.62	3.71	2.54	5.00	1.71	1.18
600	4.65	4.32	7.05	5.00	1.58	1.20
425	4.66	4.81	3.16	5.00	1.15	1.09
300	6.59	6.14	6.83	5.00	1.15	1.44
212	6.37	6.54	2.69	5.00	0.86	1.38
150	7.72	7.91	2.43	5.00	0.84	1.62
106	7.27	7.32	.70	5.00	0.66	1.56
75	6.82	6.98	2.37	5.00	0.60	1.51
53	6.94	6.77	2.41	5.00	0.61	1.56
38	4.54	4.73	4.24	5.00	0.36	1.01
-38	27.99	28.09	.36	5.00	3.15	6.16

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 12

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.50	.51	1.68	5.00	.00	.01	100.00	.00
MILL DISCH.	1.13	1.06	5.60	5.00	.00	.32	100.00	.00
SCREEN FEED	55.61	57.61	3.60	15.00	.00	56.86	100.00	.00
SCR OVERSIZE	.24	.26	8.54	10.00	.00	.01	100.00	.00
SCR U/FLOW	55.37	57.35	3.57	20.00	.00	56.85	100.00	.00
MILL WATER	.00	.30	100.00	.00	.29	.30	1.33	5.00
SUMP WATER	.00	56.55	100.00	.00	54.57	56.55	3.62	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.50	100.00	.00	98.96	98.37	.59	5.00
MILL DISCH.	.00	.75	100.00	.00	71.28	70.08	1.68	10.00
SCREEN FEED	.00	.75	100.00	.00	2.00	1.29	35.29	1000.00
SCR OVERSIZE	.00	.25	100.00	.00	90.15	94.61	4.94	10.00
SCR U/FLOW	.00	.50	100.00	.00	.84	.87	3.20	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.31	.30	2.25	5.00	.89	.91	2.16	5.00
9500	3.24	3.33	2.88	5.00	10.30	10.00	2.90	5.00
6700	11.53	11.15	3.26	5.00	32.33	33.47	3.51	5.00
4750	11.99	12.36	3.06	5.00	37.89	36.88	2.68	5.00
3350	7.61	7.53	1.06	5.00	16.05	16.21	.98	5.00
2360	4.95	4.96	.20	5.00	2.35	2.35	.00	5.00
1700	3.15	3.20	1.70	5.00	.17	.17	.03	5.00
1180	2.73	2.73	.09	5.00	.00	.00	100.00	.00
850	2.37	2.39	.65	5.00	.00	.00	100.00	.00
600	2.39	2.51	4.85	5.00	.00	.00	100.00	.00
425	2.55	2.47	3.09	5.00	.00	.00	100.00	.00
300	2.94	3.07	4.55	5.00	.00	.00	100.00	.00
212	3.27	3.28	.29	5.00	.00	.00	100.00	.00
150	4.26	4.25	.35	5.00	.00	.00	100.00	.00
106	4.28	4.35	1.56	5.00	.00	.00	100.00	.00
75	4.55	4.50	1.19	5.00	.00	.00	100.00	.00
53	4.50	4.62	2.71	5.00	.00	.00	100.00	.00
38	3.40	3.27	3.86	5.00	.00	.00	100.00	.00
-38	19.99	19.74	1.23	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					1.07	0.00
26500					8.86	4.38
19000					16.29	21.92
13200	.00	.00	100.00	.00	14.00	18.00
9500	.00	.00	100.00	.00	10.54	15.57
6700	.00	.00	100.00	.00	6.88	6.70
4750	.10	.10	.02	5.00	6.58	6.13
3350	3.18	3.19	.34	5.00	4.69	2.68
2360	6.27	6.26	.08	5.00	4.99	2.64
1700	4.80	4.72	1.66	5.00	3.63	1.62
1180	4.10	4.10	.04	5.00	3.29	1.32
850	3.60	3.58	.61	5.00	2.60	1.10
600	3.97	3.76	5.32	5.00	2.30	1.06
425	3.60	3.71	2.96	5.00	1.82	0.88
300	4.85	4.61	4.94	5.00	1.53	1.21
212	4.93	4.92	.22	5.00	1.19	1.14
150	6.34	6.37	.43	5.00	1.20	1.40
106	6.62	6.52	1.52	5.00	0.98	1.45
75	6.66	6.74	1.25	5.00	0.93	1.51
53	7.13	6.93	2.77	5.00	0.87	1.65
38	4.73	4.90	3.65	5.00	0.64	1.09
-38	29.13	29.60	1.60	5.00	5.10	6.55

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 13

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.56	.55	2.76	5.00	.00	.01	100.00	.00
MILL DISCH.	1.29	1.35	4.77	5.00	.00	.43	100.00	.00
SCREEN FEED	55.89	55.80	.15	15.00	.00	54.88	100.00	.00
SCR OVERSIZE	.37	.38	.85	10.00	.00	-.01	100.00	.00
SCR U/FLOW	55.52	55.43	.16	20.00	.00	54.89	100.00	.00
MILL WATER	.00	.43	100.00	.00	.43	.43	1.63	5.00
SUMP WATER	.00	54.45	100.00	.00	54.57	54.45	.21	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.54	100.00	.00	99.35	98.74	.61	5.00
MILL DISCH.	.00	.93	100.00	.00	68.74	68.50	.35	10.00
SCREEN FEED	.00	.93	100.00	.00	2.00	1.66	17.05	1000.00
SCR OVERSIZE	.00	.38	100.00	.00	94.75	101.89	7.54	10.00
SCR U/FLOW	.00	.54	100.00	.00	.98	.98	.13	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	-.09	100.00	5.00	.00	-.22	100.00	5.00
9500	3.77	3.71	1.69	5.00	8.81	8.95	1.61	5.00
6700	15.30	14.91	2.53	5.00	35.20	36.02	2.32	5.00
4750	15.63	15.60	.20	5.00	37.58	37.62	.10	5.00
3350	8.49	9.04	6.48	5.00	15.76	14.97	5.02	5.00
2360	5.74	5.62	2.01	5.00	2.45	2.46	.35	5.00
1700	3.73	3.55	4.74	5.00	.18	.18	.09	5.00
1180	3.21	3.11	3.09	5.00	.01	.01	.00	5.00
850	2.67	2.67	.15	5.00	.00	.00	100.00	.00
600	2.76	2.85	3.11	5.00	.00	.00	100.00	.00
425	2.58	2.54	1.69	5.00	.00	.00	100.00	.00
300	2.58	2.72	5.52	5.00	.00	.00	100.00	.00
212	2.50	2.49	.45	5.00	.00	.00	100.00	.00
150	3.04	3.01	1.04	5.00	.00	.00	100.00	.00
106	2.91	2.95	1.53	5.00	.00	.00	100.00	.00
75	3.28	3.25	.84	5.00	.00	.00	100.00	.00
53	3.24	3.47	7.21	5.00	.00	.00	100.00	.00
38	2.58	2.61	1.08	5.00	.00	.00	100.00	.00
-38	15.98	15.97	.07	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.77	2.70
19000					16.99	17.39
13200	.00	.00	100.00	.00	13.56	16.18
9500	.00	.00	100.00	.00	9.63	15.05
6700	.00	.00	100.00	.00	7.14	8.22
4750	.04	.04	.00	5.00	6.78	8.70
3350	4.95	4.85	1.97	5.00	4.54	5.67
2360	7.71	7.86	1.96	5.00	4.95	4.54
1700	5.68	5.94	4.51	5.00	3.76	3.00
1180	5.14	5.30	3.15	5.00	3.51	2.43
850	4.56	4.56	.07	5.00	2.74	1.89
600	5.01	4.86	3.06	5.00	2.47	1.68
425	4.25	4.33	1.84	5.00	1.81	1.22
300	4.94	4.65	5.95	5.00	1.81	1.24
212	4.22	4.25	.65	5.00	1.28	0.92
150	5.07	5.13	1.26	5.00	1.29	1.05
106	5.11	5.04	1.33	5.00	1.08	0.92
75	5.49	5.55	1.10	5.00	0.98	0.97
53	6.45	5.93	8.10	5.00	1.05	1.09
38	4.49	4.45	.88	5.00	0.46	0.73
-38	26.89	27.26	1.38	5.00	5.38	4.42

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 14

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.44	.45	1.64	5.00	.00	.01	100.00	.00
MILL DISCH.	1.03	.96	6.97	5.00	.00	.37	100.00	.00
SCREEN FEED	54.90	55.21	.57	15.00	.00	54.63	100.00	.00
SCR OVERSIZE	.13	.14	11.15	10.00	.00	-.01	100.00	.00
SCR U/FLOW	54.77	55.07	.55	20.00	.00	54.63	100.00	.00
MILL WATER	.00	.37	100.00	.00	.36	.37	2.39	5.00
SUMP WATER	.00	54.26	100.00	.00	53.94	54.26	.59	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.44	100.00	.00	99.02	97.75	1.28	5.00
MILL DISCH.	.00	.59	100.00	.00	61.68	61.43	.40	10.00
SCREEN FEED	.00	.59	100.00	.00	2.00	1.07	46.70	1000.00
SCR OVERSIZE	.00	.15	100.00	.00	95.63	105.64	10.47	10.00
SCR U/FLOW	.00	.44	100.00	.00	.79	.79	.48	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	3.99	3.76	5.87	5.00	13.83	14.59	5.53	5.00
6700	9.05	9.15	1.09	5.00	35.68	35.55	.36	5.00
4750	8.51	8.44	.85	5.00	32.30	32.79	1.51	5.00
3350	4.98	5.46	9.60	5.00	15.16	14.07	7.20	5.00
2360	3.72	3.96	6.35	5.00	2.86	2.83	1.20	5.00
1700	2.51	2.55	1.57	5.00	.14	.14	.02	5.00
1180	2.54	2.53	.50	5.00	.02	.02	.00	5.00
850	2.64	2.60	1.48	5.00	.01	.01	.00	5.00
600	3.17	3.18	.24	5.00	.00	.00	100.00	.00
425	3.64	3.41	6.30	5.00	.00	.00	100.00	.00
300	4.15	4.32	4.16	5.00	.00	.00	100.00	.00
212	4.58	4.55	.73	5.00	.00	.00	100.00	.00
150	5.77	5.60	2.87	5.00	.00	.00	100.00	.00
106	5.29	5.36	1.33	5.00	.00	.00	100.00	.00
75	5.02	5.15	2.64	5.00	.00	.00	100.00	.00
53	5.27	5.40	2.54	5.00	.00	.00	100.00	.00
38	4.10	3.96	3.50	5.00	.00	.00	100.00	.00
-38	21.07	20.63	2.09	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.83	0.00
26500					8.14	6.80
19000					17.76	27.00
13200	.00	.00	100.00	.00	11.60	18.32
9500	.00	.00	100.00	.00	10.97	14.26
6700	.00	.00	100.00	.00	6.04	5.40
4750	.00	.00	100.00	.00	6.14	4.64
3350	2.57	2.48	3.69	5.00	3.69	2.16
2360	4.62	4.35	5.89	5.00	4.15	1.93
1700	3.44	3.38	1.62	5.00	3.54	1.42
1180	3.38	3.40	.48	5.00	3.20	1.17
850	3.45	3.50	1.41	5.00	2.71	0.96
600	4.29	4.28	.26	5.00	2.59	1.03
425	4.35	4.59	5.57	5.00	2.17	0.96
300	6.10	5.82	4.58	5.00	1.92	1.28
212	6.08	6.12	.69	5.00	1.52	1.22
150	7.35	7.55	2.67	5.00	1.62	1.40
106	7.32	7.22	1.40	5.00	1.36	1.35
75	7.14	6.94	2.83	5.00	1.31	1.18
53	7.48	7.28	2.72	5.00	1.24	1.47
38	5.16	5.33	3.24	5.00	0.87	0.92
-38	27.29	27.80	1.86	5.00	6.62	5.14

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 15

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.44	.45	1.66	5.00	.00	.00	100.00	.00
MILL DISCH.	1.24	1.20	3.09	5.00	.00	.43	100.00	.00
SCREEN FEED	59.60	60.34	1.24	15.00	.00	59.56	100.00	.00
SCR OVERSIZE	.33	.35	3.43	10.00	.00	.02	100.00	.00
SCR U/FLOW	59.27	60.00	1.23	20.00	.00	59.55	100.00	.00
MILL WATER	.00	.41	100.00	.00	.41	.41	.95	5.00
SUMP WATER	.00	59.14	100.00	.00	58.39	59.14	1.28	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.45	100.00	.00	98.97	99.61	.64	5.00
MILL DISCH.	.00	.78	100.00	.00	65.08	64.65	.67	10.00
SCREEN FEED	.00	.78	100.00	.00	2.00	1.29	35.47	1000.00
SCR OVERSIZE	.00	.33	100.00	.00	95.28	95.58	.31	10.00
SCR U/FLOW	.00	.45	100.00	.00	.74	.75	1.04	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.66	.67	1.35	5.00	1.60	1.58	1.39	5.00
9500	3.75	4.06	8.37	5.00	10.66	9.59	10.08	5.00
6700	18.63	18.61	.09	5.00	43.86	43.90	.10	5.00
4750	14.35	14.15	1.41	5.00	32.92	33.37	1.37	5.00
3350	7.39	6.63	10.31	5.00	10.11	10.71	5.98	5.00
2360	3.83	3.87	1.09	5.00	.79	.79	.10	5.00
1700	2.00	2.01	.51	5.00	.05	.05	.01	5.00
1180	1.56	1.52	2.43	5.00	.01	.01	.01	5.00
850	1.41	1.37	2.49	5.00	.01	.01	.01	5.00
600	1.63	1.68	3.27	5.00	.00	.00	100.00	.00
425	1.94	1.86	4.00	5.00	.00	.00	100.00	.00
300	2.32	2.45	5.70	5.00	.00	.00	100.00	.00
212	2.80	2.81	.30	5.00	.00	.00	100.00	.00
150	3.63	3.62	.39	5.00	.00	.00	100.00	.00
106	3.68	3.75	1.81	5.00	.00	.00	100.00	.00
75	4.03	4.04	.26	5.00	.00	.00	100.00	.00
53	3.99	4.23	5.95	5.00	.00	.00	100.00	.00
38	3.21	3.16	1.46	5.00	.00	.00	100.00	.00
-38	19.18	19.49	1.62	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.18	6.55
19000					19.03	24.28
13200	.00	.00	100.00	.00	15.82	19.95
9500	.00	.00	100.00	.00	13.24	16.87
6700	.00	.00	100.00	.00	7.69	7.19
4750	.00	.00	100.00	.00	6.65	6.14
3350	3.51	3.62	3.12	5.00	4.50	3.09
2360	6.17	6.14	.48	5.00	4.29	2.10
1700	3.46	3.45	.21	5.00	2.95	1.26
1180	2.57	2.63	2.53	5.00	2.51	0.98
850	2.32	2.38	2.56	5.00	1.98	0.76
600	3.02	2.92	3.23	5.00	1.75	0.73
425	3.11	3.23	3.96	5.00	1.34	0.60
300	4.53	4.26	6.02	5.00	1.18	0.72
212	4.87	4.88	.11	5.00	0.93	0.67
150	6.22	6.28	.92	5.00	0.92	0.83
106	6.59	6.50	1.30	5.00	0.77	0.85
75	6.99	7.01	.34	5.00	0.72	0.84
53	7.81	7.34	6.04	5.00	0.71	0.98
38	5.39	5.49	1.88	5.00	0.53	0.67
-38	33.44	33.86	1.25	5.00	4.31	3.96

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 16

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.47	.47	.64	5.00	.00	.01	100.00	.00
MILL DISCH.	1.49	1.40	5.81	5.00	.00	.48	100.00	.00
SCREEN FEED	54.88	56.44	2.84	15.00	.00	55.52	100.00	.00
SCR OVERSIZE	.41	.46	11.87	10.00	.00	.00	100.00	.00
SCR U/FLOW	54.47	55.98	2.77	20.00	.00	55.52	100.00	.00
MILL WATER	.00	.47	100.00	.00	.47	.47	1.75	5.00
SUMP WATER	.00	55.04	100.00	.00	53.53	55.04	2.82	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.46	100.00	.00	98.91	97.82	1.10	5.00
MILL DISCH.	.00	.92	100.00	.00	66.10	65.56	.82	10.00
SCREEN FEED	.00	.92	100.00	.00	2.00	1.63	18.71	1000.00
SCR OVERSIZE	.00	.46	100.00	.00	93.58	100.51	7.41	10.00
SCR U/FLOW	.00	.46	100.00	.00	.80	.82	2.44	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.78	.78	.33	5.00	1.57	1.57	.31	5.00
9500	5.72	6.34	10.88	5.00	14.72	12.68	13.82	5.00
6700	19.62	18.87	3.82	5.00	36.30	37.74	3.97	5.00
4750	16.87	16.70	1.02	5.00	32.87	33.33	1.39	5.00
3350	7.59	7.52	.87	5.00	12.63	12.74	.87	5.00
2360	4.26	3.88	8.88	5.00	1.72	1.75	1.81	5.00
1700	1.96	1.97	.70	5.00	.16	.16	.03	5.00
1180	1.61	1.61	.01	5.00	.02	.02	.00	5.00
850	1.36	1.35	1.00	5.00	.00	.00	100.00	.00
600	1.53	1.57	2.48	5.00	.00	.00	100.00	.00
425	1.83	1.75	4.29	5.00	.00	.00	100.00	.00
300	2.22	2.32	4.62	5.00	.00	.00	100.00	.00
212	2.50	2.51	.23	5.00	.00	.00	100.00	.00
150	3.21	3.21	.06	5.00	.00	.00	100.00	.00
106	3.20	3.27	2.19	5.00	.00	.00	100.00	.00
75	3.41	3.44	.90	5.00	.00	.00	100.00	.00
53	3.49	3.66	5.01	5.00	.00	.00	100.00	.00
38	2.74	2.69	1.65	5.00	.00	.00	100.00	.00
-38	16.11	16.55	2.73	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL DISCHARGE
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJSUTED	ADJUSTED
37500					0.37	0.00
26500					10.15	4.74
19000					20.55	23.09
13200	.00	.00	100.00	.00	13.95.....	18.48
9500	.00	.00	100.00	.00	11.11	17.44
6700	.00	.00	100.00	.00	6.45	7.18
4750	.07	.07	.01	5.00	6.06	6.59
3350	2.30	2.31	.35	5.00	4.36	3.41
2360	5.65	6.01	6.42	5.00	3.96	2.93
1700	3.80	3.79	.33	5.00	3.10	1.61
1180	3.19	3.20	.31	5.00	2.78	1.30
850	2.66	2.69	1.23	5.00	2.23	0.98
600	3.21	3.14	2.31	5.00	1.98	0.91
425	3.36	3.50	4.25	5.00	1.59	0.73
300	4.87	4.65	4.61	5.00	1.35	0.84
212	5.00	5.01	.23	5.00	1.09	0.73
150	6.39	6.42	.53	5.00	1.04	0.81
106	6.65	6.54	1.65	5.00	0.85	0.86
75	6.90	6.88	.27	5.00	0.80	0.89
53	7.70	7.33	4.81	5.00	0.78	1.03
38	5.28	5.39	2.08	5.00	0.60	0.71
-38	33.01	33.11	.30	5.00	4.85	4.74

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 17

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.51	.53	3.47	5.00	.00	.00	100.00	.00
MILL DISCH.	1.40	1.29	8.02	5.00	.00	.38	100.00	.00
SCREEN FEED	55.14	55.75	1.10	15.00	.00	54.84	100.00	.00
SCR OVERSIZE	.37	.40	8.45	10.00	.00	.02	100.00	.00
SCR U/FLOW	54.77	55.34	1.05	20.00	.00	54.82	100.00	.00
MILL WATER	.00	.36	100.00	.00	.35	.36	2.03	5.00
SUMP WATER	.00	54.46	100.00	.00	53.83	54.46	1.16	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.52	100.00	.00	99.28	99.87	.60	5.00
MILL DISCH.	.00	.91	100.00	.00	70.24	70.25	.01	10.00
SCREEN FEED	.00	.91	100.00	.00	2.00	1.63	18.58	1000.00
SCR OVERSIZE	.00	.38	100.00	.00	94.71	94.65	.06	10.00
SCR U/FLOW	.00	.52	100.00	.00	.94	.95	.91	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	4.63	4.63	.01	5.00	10.97	10.98	.08	5.00
6700	15.60	15.99	2.52	5.00	38.82	37.92	2.32	5.00
4750	14.64	14.46	1.22	5.00	33.79	34.29	1.47	5.00
3350	8.64	8.34	3.44	5.00	14.51	14.88	2.56	5.00
2360	4.45	4.15	6.71	5.00	1.83	1.85	1.18	5.00
1700	2.15	2.10	2.43	5.00	.06	.06	.03	5.00
1180	1.61	1.62	.46	5.00	.01	.01	.00	5.00
850	1.41	1.39	1.19	5.00	.00	.00	100.00	.00
600	1.47	1.53	3.81	5.00	.00	.00	100.00	.00
425	1.56	1.54	1.24	5.00	.00	.00	100.00	.00
300	1.92	2.04	6.32	5.00	.00	.00	100.00	.00
212	2.38	2.36	.74	5.00	.00	.00	100.00	.00
150	3.43	3.39	1.30	5.00	.00	.00	100.00	.00
106	3.78	3.82	1.18	5.00	.00	.00	100.00	.00
75	4.27	4.22	1.09	5.00	.00	.00	100.00	.00
53	4.42	4.55	3.01	5.00	.00	.00	100.00	.00
38	3.48	3.38	2.88	5.00	.00	.00	100.00	.00
-38	20.16	20.48	1.57	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					9.54	6.25
19000					23.56	30.60
13200	.00	.00	100.00	.00	15.23	21.67
9500	.00	.00	100.00	.00	9.75	13.62
6700	.00	.00	100.00	.00	6.11	5.31
4750	.00	.00	100.00	.00	5.88	4.60
3350	3.54	3.57	.94	5.00	4.03	1.47
2360	5.55	5.83	5.02	5.00	4.02	1.49
1700	3.50	3.58	2.40	5.00	3.25	0.79
1180	2.80	2.79	.37	5.00	2.82	0.59
850	2.38	2.41	1.24	5.00	2.28	0.45
600	2.75	2.64	4.03	5.00	2.05	0.46
425	2.63	2.66	1.30	5.00	1.62	0.40
300	3.80	3.53	7.10	5.00	1.37	0.55
212	4.05	4.09	.87	5.00	1.04	0.62
150	5.77	5.85	1.46	5.00	1.03	0.86
106	6.68	6.61	.98	5.00	0.81	1.04
75	7.21	7.30	1.30	5.00	0.72	1.16
53	8.11	7.87	2.92	5.00	0.65	1.37
38	5.68	5.85	2.91	5.00	0.46	0.95
-38	35.54	35.39	.41	5.00	3.79	5.75

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 18

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.52	.53	2.02	5.00	.00	.00	100.00	.00
MILL DISCH.	1.50	1.44	4.20	5.00	.00	.56	100.00	.00
SCREEN FEED	55.95	56.69	1.33	15.00	.00	55.81	100.00	.00
SCR OVERSIZE	.37	.38	3.69	10.00	.00	.02	100.00	.00
SCR U/FLOW	55.59	56.31	1.30	20.00	.00	55.79	100.00	.00
MILL WATER	.00	.53	100.00	.00	.52	.53	1.53	5.00
SUMP WATER	.00	55.25	100.00	.00	54.48	55.25	1.42	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.52	100.00	.00	98.80	99.32	.53	5.00
MILL DISCH.	.00	.88	100.00	.00	60.71	61.14	.70	10.00
SCREEN FEED	.00	.88	100.00	.00	2.00	1.55	22.41	1000.00
SCR OVERSIZE	.00	.36	100.00	.00	94.58	94.03	.58	10.00
SCR U/FLOW	.00	.52	100.00	.00	.92	.93	1.11	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.59	.56	4.65	5.00	1.33	1.39	4.57	5.00
9500	5.59	2.51	55.12	5.00	5.10	6.20	21.62	5.00
6700	15.78	17.33	9.81	5.00	42.85	42.84	.03	5.00
4750	13.52	14.93	10.43	5.00	37.49	36.63	2.29	5.00
3350	6.74	7.24	7.43	5.00	12.11	11.82	2.36	5.00
2360	3.54	3.78	6.88	5.00	1.05	1.04	.56	5.00
1700	2.02	2.02	.04	5.00	.04	.04	.01	5.00
1180	1.62	1.67	2.90	5.00	.00	.00	100.00	.00
850	1.41	1.45	2.61	5.00	.00	.00	100.00	.00
600	1.72	1.77	3.07	5.00	.00	.00	100.00	.00
425	2.12	2.04	3.80	5.00	.00	.00	100.00	.00
300	2.86	2.94	2.67	5.00	.00	.00	100.00	.00
212	3.29	3.27	.56	5.00	.00	.00	100.00	.00
150	4.51	4.45	1.32	5.00	.00	.00	100.00	.00
106	4.50	4.42	1.76	5.00	.00	.00	100.00	.00
75	4.58	4.41	3.63	5.00	.00	.00	100.00	.00
53	4.37	4.42	1.26	5.00	.00	.00	100.00	.00
38	3.22	3.07	4.55	5.00	.00	.00	100.00	.00
-38	18.02	17.71	1.74	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					10.94	8.61
19000					20.61	29.61
13200	.00	.00	100.00	.00	12.06	21.73
9500	.00	.00	100.00	.00	11.59	13.27
6700	.00	.00	100.00	.00	6.23	5.72
4750	.19	.19	.09	5.00	6.08	4.30
3350	4.25	4.13	2.88	5.00	4.18	1.73
2360	6.08	5.64	7.16	5.00	3.88	1.36
1700	3.37	3.37	.11	5.00	3.01	0.87
1180	2.89	2.80	3.14	5.00	2.60	0.68
850	2.50	2.43	2.81	5.00	2.29	0.55
600	3.08	2.98	3.34	5.00	2.13	0.60
425	3.31	3.42	3.47	5.00	1.62	0.57
300	5.08	4.93	2.93	5.00	1.64	0.78
212	5.47	5.49	.44	5.00	1.20	0.78
150	7.39	7.47	1.13	5.00	1.24	0.91
106	7.31	7.42	1.55	5.00	1.03	0.88
75	7.18	7.41	3.23	5.00	0.98	0.89
53	7.54	7.43	1.45	5.00	0.99	0.99
38	4.96	5.16	4.06	5.00	0.63	0.71
-38	29.40	29.71	1.07	5.00	5.07	4.45

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 19

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.63	.65	2.62	5.00	.00	.00	100.00	.00
MILL DISCH.	1.91	1.79	6.39	5.00	.00	.73	100.00	.00
SCREEN FEED	55.20	56.52	2.39	15.00	.00	55.46	100.00	.00
SCR OVERSIZE	.43	.45	5.23	10.00	.00	.04	100.00	.00
SCR U/FLOW	54.77	56.07	2.38	20.00	.00	55.43	100.00	.00
MILL WATER	.00	.69	100.00	.00	.68	.69	2.18	5.00
SUMP WATER	.00	54.73	100.00	.00	53.38	54.73	2.53	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.65	100.00	.00	99.40	100.03	.63	5.00
MILL DISCH.	.00	1.06	100.00	.00	59.82	59.22	1.00	10.00
SCREEN FEED	.00	1.06	100.00	.00	2.00	1.88	6.19	1000.00
SCR OVERSIZE	.00	.41	100.00	.00	92.29	92.07	.24	10.00
SCR U/FLOW	.00	.65	100.00	.00	1.13	1.15	2.07	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	3.97	4.41	10.99	5.00	13.23	11.29	14.63	5.00
6700	15.69	13.77	12.27	5.00	32.36	35.28	9.04	5.00
4570	15.25	15.34	.61	5.00	39.68	39.03	1.64	5.00
3350	8.26	8.55	3.46	5.00	13.13	12.80	2.48	5.00
2360	4.40	4.66	5.90	5.00	1.48	1.47	.81	5.00
1700	2.54	2.54	.08	5.00	.11	.11	.00	5.00
1180	1.85	1.81	2.30	5.00	.01	.01	.00	5.00
850	1.54	1.55	.71	5.00	.00	.00	100.00	.00
600	1.84	1.86	1.29	5.00	.00	.00	100.00	.00
425	2.18	2.11	3.38	5.00	.00	.00	100.00	.00
300	2.84	2.93	3.19	5.00	.00	.00	100.00	.00
212	3.16	3.07	2.99	5.00	.00	.00	100.00	.00
150	4.01	3.93	1.89	5.00	.00	.00	100.00	.00
106	3.74	3.86	3.16	5.00	.00	.00	100.00	.00
75	4.02	4.05	.86	5.00	.00	.00	100.00	.00
53	3.99	4.25	6.44	5.00	.00	.00	100.00	.00
38	3.15	3.09	1.96	5.00	.00	.00	100.00	.00
-38	17.56	18.23	3.79	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.68	5.43
19000					17.62	25.43
13200	.00	.00	100.00	.00	15.57	19.87
9500	.00	.00	100.00	.00	10.93	15.98
6700	.00	.00	100.00	.00	7.49	7.13
4750	.19	.19	.03	5.00	6.42	6.86
3350	5.85	5.82	.49	5.00	4.97	2.68
2360	7.02	6.70	4.54	5.00	4.96	2.19
1700	4.06	4.09	.77	5.00	3.53	1.37
1180	2.88	2.96	2.68	5.00	2.90	1.11
850	2.55	2.54	.28	5.00	2.25	0.90
600	3.08	3.06	.78	5.00	2.03	0.92
425	3.33	3.45	3.72	5.00	1.43	0.75
300	4.93	4.81	2.53	5.00	1.44	0.90
212	4.85	5.03	3.64	5.00	1.01	0.79
150	6.27	6.45	2.88	5.00	1.06	0.86
106	6.47	6.33	2.22	5.00	0.92	0.81
75	6.63	6.65	.28	5.00	0.84	0.80
53	7.41	6.96	6.02	5.00	0.91	0.89
38	4.93	5.06	2.72	5.00	0.54	0.61
-38	29.53	29.88	1.19	5.00	4.50	3.72

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 20

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.50	.51	1.06	5.00	.00	.00	100.00	.00
MILL DISCH.	1.50	1.45	3.35	5.00	.00	.52	100.00	.00
SCREEN FEED	53.33	55.97	4.95	15.00	.00	55.04	100.00	.00
SCR OVERSIZE	.44	.45	3.49	10.00	.00	.03	100.00	.00
SCR U/FLOW	52.89	55.52	4.97	20.00	.00	55.01	100.00	.00
MILL WATER	.00	.49	100.00	.00	.49	.49	1.04	5.00
SUMP WATER	.00	54.52	100.00	.00	51.90	54.52	5.04	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.51	100.00	.00	99.21	99.19	.02	5.00
MILL DISCH.	.00	.93	100.00	.00	64.35	64.04	.49	10.00
SCREEN FEED	.00	.93	100.00	.00	2.00	1.66	16.85	1000.00
SCR OVERSIZE	.00	.43	100.00	.00	94.15	93.91	.25	10.00
SCR U/FLOW	.00	.51	100.00	.00	.87	.91	4.59	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.47	.47	.60	5.00	1.04	1.03	.58	5.00
9500	4.86	4.58	5.76	5.00	9.51	10.02	5.32	5.00
6700	16.88	17.29	2.43	5.00	38.53	37.81	1.87	5.00
4750	17.44	17.71	1.57	5.00	39.10	38.74	.93	5.00
3350	7.80	7.14	8.52	5.00	10.58	11.16	5.47	5.00
2360	3.84	3.76	2.17	5.00	1.15	1.15	.32	5.00
1700	1.71	1.76	2.94	5.00	.07	.07	.05	5.00
1180	1.36	1.26	7.42	5.00	.01	.01	.03	5.00
850	1.12	1.09	2.65	5.00	.01	.01	.01	5.00
600	1.27	1.29	1.30	5.00	.00	.00	100.00	.00
425	1.54	1.43	7.31	5.00	.00	.00	100.00	.00
300	1.98	2.00	1.18	5.00	.00	.00	100.00	.00
212	2.34	2.31	1.48	5.00	.00	.00	100.00	.00
150	3.39	3.27	3.52	5.00	.00	.00	100.00	.00
106	3.64	3.62	.43	5.00	.00	.00	100.00	.00
75	4.24	4.24	.04	5.00	.00	.00	100.00	.00
53	4.30	4.53	5.26	5.00	.00	.00	100.00	.00
38	3.24	3.23	.20	5.00	.00	.00	100.00	.00
-38	18.57	19.01	2.38	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					10.45	6.64
19000					23.47	31.23
13200	.00	.00	100.00	.00	14.56	22.45
9500	.00	.00	100.00	.00	10.91	15.12
6700	.00	.00	100.00	.00	6.29	6.02
4750	.00	.00	100.00	.00	5.63	4.92
3350	3.66	3.75	2.34	5.00	2.96	2.07
2360	5.83	5.95	2.06	5.00	3.42	1.32
1700	3.28	3.18	2.91	5.00	2.84	0.64
1180	2.17	2.31	6.52	5.00	2.66	0.47
850	1.95	2.00	2.59	5.00	2.18	0.35
600	2.40	2.37	1.23	5.00	1.95	0.35
425	2.47	2.63	6.48	5.00	1.59	0.31
300	3.73	3.69	1.03	5.00	1.36	0.39
212	4.18	4.25	1.63	5.00	1.11	0.39
150	5.82	6.03	3.55	5.00	1.10	0.53
106	6.63	6.68	.73	5.00	0.90	0.61
75	7.79	7.82	.33	5.00	0.83	0.72
53	8.82	8.34	5.44	5.00	0.79	0.89
38	5.93	5.96	.47	5.00	0.58	0.67
-38	35.43	35.14	.82	5.00	4.40	3.90

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 21

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.32	.32	.70	5.00	.00	.00	100.00	.00
MILL DISCH.	.65	.68	4.15	5.00	.00	.20	100.00	.00
SCREEN FEED	56.69	53.97	4.80	15.00	.00	53.49	100.00	.00
SCR OVERSIZE	.15	.15	4.20	10.00	.00	.00	100.00	.00
SCR U/FLOW	56.54	53.81	4.82	20.00	.00	53.50	100.00	.00
MILL WATER	.00	.21	100.00	.00	.21	.21	1.37	5.00
SUMP WATER	.00	53.29	100.00	.00	55.99	53.29	4.82	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.32	100.00	.00	99.05	100.41	1.37	5.00
MILL DISCH.	.00	.48	100.00	.00	70.05	69.95	.15	10.00
SCREEN FEED	.00	.48	100.00	.00	2.00	.88	55.93	1000.00
SCR OVERSIZE	.00	.16	100.00	.00	93.45	102.87	10.08	10.00
SCR U/FLOW	.00	.32	100.00	.00	.61	.59	3.41	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	5.13	4.67	8.94	5.00	12.87	14.01	8.84	5.00
6700	13.24	14.09	6.44	5.00	43.32	42.26	2.45	5.00
4750	7.87	8.38	6.45	5.00	26.28	25.12	4.41	5.00
3350	6.94	6.36	8.32	5.00	14.76	15.86	7.46	5.00
2360	4.19	4.40	4.97	5.00	2.52	2.50	.73	5.00
1700	3.16	2.88	8.93	5.00	.22	.22	.23	5.00
1180	2.66	2.62	1.39	5.00	.01	.01	.00	5.00
850	2.42	2.44	.64	5.00	.02	.02	.00	5.00
600	2.59	2.71	4.66	5.00	.00	.00	100.00	.00
425	2.74	2.66	3.00	5.00	.00	.00	100.00	.00
300	3.09	3.22	4.32	5.00	.00	.00	100.00	.00
212	3.34	3.42	2.42	5.00	.00	.00	100.00	.00
150	4.37	4.14	5.30	5.00	.00	.00	100.00	.00
106	4.36	4.23	2.88	5.00	.00	.00	100.00	.00
75	4.51	4.40	2.50	5.00	.00	.00	100.00	.00
53	4.64	4.71	1.60	5.00	.00	.00	100.00	.00
38	3.62	3.49	3.69	5.00	.00	.00	100.00	.00
-38	21.14	21.19	.23	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					11.60	3.04
19000					20.14	16.84
13200	.00	.00	100.00	.00	14.03	16.90
9500	.00	.00	100.00	.00	11.61	12.76
6700	.00	.00	100.00	.00	6.68	5.44
4750	.00	.00	100.00	.00	6.21	5.51
3350	1.59	1.61	1.25	5.00	4.33	2.35
2360	5.60	5.35	4.51	5.00	3.95	2.82
1700	3.92	4.21	7.33	5.00	3.04	1.92
1180	3.88	3.93	1.30	5.00	2.54	1.64
850	3.67	3.64	.70	5.00	2.08	1.32
600	4.29	4.07	5.20	5.00	1.92	1.43
425	3.88	3.99	2.78	5.00	1.42	1.31
300	5.08	4.84	4.80	5.00	1.42	1.80
212	5.27	5.13	2.61	5.00	1.03	1.82
150	5.93	6.21	4.71	5.00	1.03	2.28
106	6.19	6.35	2.64	5.00	0.85	2.32
75	6.45	6.60	2.29	5.00	0.77	2.48
53	7.20	7.07	1.76	5.00	0.77	2.66
38	5.06	5.23	3.37	5.00	0.16	1.77
-38	32.00	31.78	.68	5.00	4.42	11.58

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 22

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.55	.55	.67	5.00	.00	.01	100.00	.00
MILL DISCH.	1.37	1.33	2.87	5.00	.00	.51	100.00	.00
SCREEN FEED	55.79	56.12	.59	15.00	.00	55.29	100.00	.00
SCR OVERSIZE	.27	.29	6.36	10.00	.00	.01	100.00	.00
SCR U/FLOW	55.52	55.83	.55	20.00	.00	55.28	100.00	.00
MILL WATER	.00	.49	100.00	.00	.49	.49	1.12	5.00
SUMP WATER	.00	54.78	100.00	.00	54.44	54.78	.63	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.54	100.00	.00	99.40	98.82	.59	5.00
MILL DISCH.	.00	.83	100.00	.00	61.37	62.05	1.11	10.00
SCREEN FEED	.00	.83	100.00	.00	2.00	1.48	26.22	1000.00
SCR OVERSIZE	.00	.28	100.00	.00	93.28	97.44	4.46	10.00
SCR U/FLOW	.00	.54	100.00	.00	.97	.97	.48	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	4.21	2.79	33.64	5.00	6.79	8.15	19.99	5.00
6700	12.90	14.40	11.66	5.00	44.07	42.00	4.69	5.00
4750	11.88	12.58	5.86	5.00	35.98	36.43	1.24	5.00
3350	6.18	6.20	.35	5.00	11.87	12.13	2.18	5.00
2360	4.05	4.01	1.03	5.00	1.23	1.23	.36	5.00
1700	2.43	2.48	1.91	5.00	.05	.05	.00	5.00
1180	2.28	2.32	1.80	5.00	.00	.00	100.00	.00
850	2.28	2.30	.99	5.00	.00	.00	100.00	.00
600	2.79	2.85	2.22	5.00	.00	.00	100.00	.00
425	3.20	3.03	5.24	5.00	.00	.00	100.00	.00
300	3.64	3.75	2.89	5.00	.00	.00	100.00	.00
212	3.71	3.70	.19	5.00	.00	.00	100.00	.00
150	4.47	4.32	3.39	5.00	.00	.00	100.00	.00
106	4.15	4.14	.14	5.00	.00	.00	100.00	.00
75	4.27	4.15	2.82	5.00	.00	.00	100.00	.00
53	4.12	4.18	1.51	5.00	.00	.00	100.00	.00
38	3.20	3.07	3.92	5.00	.00	.00	100.00	.00
-38	20.25	19.72	2.60	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.68	4.52
19000					17.43	23.23
13200	.00	.00	100.00	.00	14.46	19.54
9500	.00	.00	100.00	.00	10.72	16.09
6700	.00	.00	100.00	.00	8.03	6.44
4750	.13	.13	.05	5.00	7.38	6.59
3350	3.12	3.11	.36	5.00	4.57	2.99
2360	5.43	5.46	.48	5.00	4.49	2.90
1700	3.83	3.74	2.28	5.00	3.51	2.01
1180	3.61	3.53	2.15	5.00	3.00	1.66
850	3.55	3.50	1.29	5.00	2.52	1.27
600	4.46	4.34	2.68	5.00	2.38	1.14
425	4.42	4.61	4.41	5.00	1.80	0.87
300	5.91	5.70	3.55	5.00	1.81	1.00
212	5.65	5.64	.26	5.00	1.24	0.84
150	6.40	6.57	2.69	5.00	1.16	1.08
106	6.33	6.31	.36	5.00	0.86	0.98
75	6.18	6.32	2.19	5.00	0.69	1.00
53	6.50	6.36	2.08	5.00	0.68	1.02
38	4.53	4.68	3.29	5.00	0.42	0.66
-38	29.95	30.00	.16	5.00	4.17	4.18

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 23

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.52	.51	.71	5.00	.00	.01	100.00	.00
MILL DISCH.	1.16	1.16	.46	5.00	.00	.43	100.00	.00
SCREEN FEED	53.17	52.63	1.02	15.00	.00	51.89	100.00	.00
SCR OVERSIZE	.20	.22	7.62	10.00	.00	-.01	100.00	.00
SCR U/FLOW	52.97	52.41	1.06	20.00	.00	51.90	100.00	.00
MILL WATER	.00	.43	100.00	.00	.43	.43	.15	5.00
SUMP WATER	.00	51.47	100.00	.00	52.02	51.47	1.06	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.50	100.00	.00	99.27	98.41	.86	5.00
MILL DISCH.	.00	.73	100.00	.00	63.43	63.28	.23	10.00
SCREEN FEED	.00	.73	100.00	.00	2.00	1.39	30.34	1000.00
SCR OVERSIZE	.00	.23	100.00	.00	94.82	103.79	9.46	10.00
SCR U/FLOW	.00	.50	100.00	.00	.97	.96	.81	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	5.52	5.60	1.45	5.00	18.14	17.93	1.15	5.00
6700	11.15	11.62	4.23	5.00	38.71	37.21	3.87	5.00
4750	9.19	8.49	7.60	5.00	25.29	27.06	6.99	5.00
3350	5.95	6.00	.86	5.00	15.10	15.04	.41	5.00
2360	4.19	4.18	.14	5.00	2.56	2.56	.07	5.00
1700	2.69	2.69	.11	5.00	.19	.19	.00	5.00
1180	2.63	2.64	.31	5.00	.01	.01	.00	5.00
850	2.51	2.56	1.89	5.00	.00	.00	100.00	.00
600	2.85	2.95	3.37	5.00	.00	.00	100.00	.00
425	3.24	3.09	4.59	5.00	.00	.00	100.00	.00
300	3.63	3.78	4.07	5.00	.00	.00	100.00	.00
212	3.77	3.68	2.45	5.00	.00	.00	100.00	.00
150	4.53	4.51	.44	5.00	.00	.00	100.00	.00
106	4.33	4.38	1.12	5.00	.00	.00	100.00	.00
75	4.60	4.53	1.61	5.00	.00	.00	100.00	.00
53	4.46	4.62	3.68	5.00	.00	.00	100.00	.00
38	3.40	3.34	1.77	5.00	.00	.00	100.00	.00
-38	21.34	21.32	.09	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					11.45	4.98
19000					19.38	26.24
13200	.00	.00	100.00	.00	13.89	18.68
9500	.00	.00	100.00	.00	10.65	14.74
6700	.00	.00	100.00	.00	6.54	6.15
4750	.06	.06	.04	5.00	6.22	5.89
3350	1.90	1.90	.14	5.00	4.71	3.22
2360	4.91	4.92	.23	5.00	4.39	2.75
1700	3.83	3.83	.01	5.00	3.28	1.82
1180	3.84	3.83	.22	5.00	2.88	1.37
850	3.79	3.72	1.87	5.00	2.35	1.08
600	4.44	4.28	3.51	5.00	2.15	0.96
425	4.31	4.50	4.30	5.00	1.53	0.73
300	5.74	5.49	4.29	5.00	1.51	0.83
212	5.22	5.35	2.45	5.00	1.08	0.78
150	6.52	6.56	.59	5.00	1.03	0.90
106	6.43	6.37	.99	5.00	0.81	0.93
75	6.47	6.58	1.72	5.00	0.74	0.95
53	6.99	6.72	3.80	5.00	0.76	1.11
38	4.77	4.86	1.82	5.00	0.46	0.77
-38	30.77	31.02	.82	5.00	4.18	5.10

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 24

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.49	.50	2.18	5.00	.00	.01	100.00	.00
MILL DISCH.	1.10	1.05	4.69	5.00	.00	.33	100.00	.00
SCREEN FEED	57.75	56.73	1.77	15.00	.00	56.01	100.00	.00
SCR OVERSIZE	.21	.23	8.83	10.00	.00	.00	100.00	.00
SCR U/FLOW	57.54	56.51	1.80	10.00	.00	56.02	100.00	.00
MILL WATER	.00	.33	100.00	.00	.32	.33	1.39	5.00
SUMP WATER	.00	55.68	100.00	.00	56.67	55.68	1.75	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.49	100.00	.00	98.76	98.86	.10	5.00
MILL DISCH.	.00	.72	100.00	.00	68.40	68.51	.16	10.00
SCREEN FEED	.00	.72	100.00	.00	2.00	1.27	36.64	1000.00
SCR OVERSIZE	.00	.23	100.00	.00	95.44	101.65	6.50	10.00
SCR U/FLOW	.00	.49	100.00	.00	.89	.87	2.58	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	4.49	4.49	.06	5.00	13.96	14.09	.92	5.00
6700	11.58	11.95	3.21	5.00	37.91	37.52	1.02	5.00
4750	10.73	11.09	3.36	5.00	35.30	34.82	1.36	5.00
3350	6.83	6.09	10.79	5.00	11.48	12.22	6.48	5.00
2360	4.32	4.46	3.31	5.00	1.30	1.30	.24	5.00
1700	2.63	2.79	5.96	5.00	.04	.04	.03	5.00
1180	2.51	2.51	.07	5.00	.01	.01	.00	5.00
850	2.31	2.34	1.20	5.00	.00	.00	100.00	.00
600	2.67	2.76	3.51	5.00	.00	.00	100.00	.00
425	3.05	2.90	4.78	5.00	.00	.00	100.00	.00
300	3.64	3.76	3.37	5.00	.00	.00	100.00	.00
212	3.92	3.98	1.56	5.00	.00	.00	100.00	.00
150	5.12	5.03	1.73	5.00	.00	.00	100.00	.00
106	4.64	4.74	2.13	5.00	.00	.00	100.00	.00
75	4.65	4.54	2.41	5.00	.00	.00	100.00	.00
53	4.29	4.49	4.70	5.00	.00	.00	100.00	.00
38	3.20	2.98	6.88	5.00	.00	.00	100.00	.00
-38	19.41	19.08	1.69	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					7.53	5.32
19000					18.09	24.03
13200	.00	.00	100.00	.00	12.99	19.56
9500	.00	.00	100.00	.00	12.02	14.29
6700	.00	.00	100.00	.00	7.03	6.07
4750	.00	.00	100.00	.00	7.06	5.30
3350	3.12	3.23	3.43	5.00	4.86	2.69
2360	6.13	5.94	3.06	5.00	4.40	2.58
1700	4.36	4.07	6.64	5.00	3.56	1.61
1180	3.67	3.68	.16	5.00	3.02	1.36
850	3.47	3.43	1.15	5.00	2.49	1.08
600	4.21	4.06	3.67	5.00	2.31	1.11
425	4.08	4.26	4.45	5.00	1.77	0.96
300	5.72	5.52	3.48	5.00	1.76	1.20
212	5.93	5.84	1.48	5.00	1.22	1.08
150	7.25	7.38	1.83	5.00	1.28	1.32
106	7.10	6.95	2.06	5.00	1.01	1.28
75	6.50	6.66	2.44	5.00	0.97	1.24
53	6.94	6.59	5.03	5.00	0.96	1.32
38	4.12	4.37	6.13	5.00	0.60	0.88
-38	27.41	28.02	2.24	5.00	5.08	5.41

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 25

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.59	.59	.62	5.00	.00	.01	100.00	.00
MILL DISCH.	1.29	1.29	.02	5.00	.00	.44	100.00	.00
SCREEN FEED	46.69	46.90	.45	15.00	.00	46.06	100.00	.00
SCR OVERSIZE	.25	.26	5.40	10.00	.00	.00	100.00	.00
SCR U/FLOW	46.44	46.64	.42	10.00	.00	46.05	100.00	.00
MILL WATER	.00	.43	100.00	.00	.43	.43	.03	5.00
SUMP WATER	.00	45.62	100.00	.00	45.42	45.62	.43	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.58	100.00	.00	99.38	98.81	.58	5.00
MILL DISCH.	.00	.85	100.00	.00	66.06	65.81	.38	10.00
SCREEN FEED	.00	.85	100.00	.00	2.00	1.80	9.80	1000.00
SCR OVERSIZE	.00	.26	100.00	.00	93.62	99.74	6.54	10.00
SCR U/FLOW	.00	.58	100.00	.00	1.24	1.25	.69	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	FEED DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	3.02	3.22	6.72	5.00	11.19	10.33	7.64	5.00
6700	12.95	12.86	.71	5.00	40.76	41.23	1.16	5.00
4750	9.34	9.52	1.98	5.00	30.91	30.39	1.69	5.00
3350	7.91	7.05	10.86	5.00	14.32	15.22	6.29	5.00
2360	5.56	5.41	2.64	5.00	1.97	1.98	.31	5.00
1700	3.62	3.65	.84	5.00	.12	.12	.01	5.00
1180	3.32	3.34	.62	5.00	.01	.01	.00	5.00
850	3.10	3.12	.80	5.00	.00	.00	100.00	.00
600	3.26	3.33	2.27	5.00	.00	.00	100.00	.00
425	3.27	3.15	3.55	5.00	.00	.00	100.00	.00
300	3.52	3.61	2.61	5.00	.00	.00	100.00	.00
212	3.63	3.45	4.94	5.00	.00	.00	100.00	.00
150	4.06	4.02	.87	5.00	.00	.00	100.00	.00
106	3.65	3.80	4.20	5.00	.00	.00	100.00	.00
75	3.80	3.88	2.15	5.00	.00	.00	100.00	.00
53	3.84	4.06	5.67	5.00	.00	.00	100.00	.00
38	3.12	3.11	.18	5.00	.00	.00	100.00	.00
-38	19.03	19.38	1.85	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.00	0.00
26500					8.61	6.11
19000					18.20	19.06
13200	.00	.00	100.00	.00	13.61	17.39
9500	.00	.00	100.00	.00	10.30	14.24
6700	.00	.00	100.00	.00	6.44	6.86
4750	.07	.07	.00	5.00	6.16	7.24
3350	3.24	3.35	3.35	5.00	4.11	3.73
2360	6.78	6.97	2.81	5.00	4.12	3.21
1700	5.27	5.25	.38	5.00	3.29	2.26
1180	4.86	4.85	.20	5.00	2.94	1.94
850	4.56	4.54	.41	5.00	2.24	1.54
600	4.94	4.84	1.93	5.00	2.39	1.42
425	4.42	4.58	3.69	5.00	1.97	1.12
300	5.37	5.25	2.26	5.00	1.74	1.25
212	4.78	5.01	4.90	5.00	1.44	1.07
150	5.77	5.85	1.36	5.00	1.48	1.25
106	5.76	5.53	4.05	5.00	1.30	1.22
75	5.74	5.64	1.73	5.00	1.28	1.22
53	6.26	5.90	5.81	5.00	1.26	1.33
38	4.50	4.53	.57	5.00	0.88	0.88
-38	27.67	27.83	.58	5.00	6.00	5.67

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 26

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.45	.47	3.89	5.00	.00	.00	100.00	.00
MILL DISCH.	1.23	1.13	8.01	5.00	.00	.33	100.00	.00
SCREEN FEED	54.11	54.47	.66	15.00	.00	53.67	100.00	.00
SCR OVERSIZE	.32	.34	6.38	10.00	.00	.01	100.00	.00
SCR U/FLOW	53.79	54.13	.63	20.00	.00	53.66	100.00	.00
MILL WATER	.00	.32	100.00	.00	.31	.32	2.21	5.00
SUMP WATER	.00	53.34	100.00	.00	52.94	53.34	.75	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.47	100.00	.00	99.13	99.89	.77	5.00
MILL DISCH.	.00	.80	100.00	.00	69.11	70.72	2.33	10.00
SCREEN FEED	.00	.80	100.00	.00	2.00	1.46	26.78	1000.00
SCR OVERSIZE	.00	.33	100.00	.00	100.00	97.42	2.58	10.00
SCR U/FLOW	.00	.47	100.00	.00	.86	.86	.55	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.49	.50	2.93	5.00	1.26	1.22	3.13	5.00
9500	5.18	5.74	10.90	5.00	16.22	13.90	14.28	5.00
6700	17.04	17.03	.07	5.00	41.37	41.21	.38	5.00
4750	14.81	13.46	9.13	5.00	30.28	32.51	7.38	5.00
3350	7.28	6.87	5.59	5.00	9.54	9.82	2.92	5.00
2360	4.16	4.11	1.27	5.00	1.26	1.26	.14	5.00
1700	2.30	2.36	2.63	5.00	.06	.06	.03	5.00
1180	1.90	1.86	2.16	5.00	.01	.01	.00	5.00
850	1.58	1.58	.21	5.00	.00	.00	100.00	.00
600	1.72	1.77	2.70	5.00	.00	.00	100.00	.00
425	1.79	1.75	1.96	5.00	.00	.00	100.00	.00
300	2.06	2.21	7.28	5.00	.00	.00	100.00	.00
212	2.44	2.49	1.94	5.00	.00	.00	100.00	.00
150	3.38	3.41	.89	5.00	.00	.00	100.00	.00
106	3.80	3.82	.64	5.00	.00	.00	100.00	.00
75	4.28	4.21	1.67	5.00	.00	.00	100.00	.00
53	4.59	4.62	.59	5.00	.00	.00	100.00	.00
38	3.61	3.30	8.54	5.00	.00	.00	100.00	.00
-38	17.60	18.91	7.45	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.88	0.00
26500					11.80	8.67
19000					17.82	25.25
13200	.00	.00	100.00	.00	12.06	19.82
9500	.00	.00	100.00	.00	9.43	13.96
6700	.00	.00	100.00	.00	6.37	5.80
4750	.04	.04	.02	5.00	6.05	4.83
3350	4.66	4.80	2.97	5.00	4.19	2.62
2360	5.98	6.11	2.19	5.00	4.75	1.77
1700	4.06	3.98	1.96	5.00	3.53	1.01
1180	3.08	3.16	2.63	5.00	3.11	0.81
850	2.69	2.70	.30	5.00	2.54	0.86
600	3.08	3.01	2.26	5.00	2.43	0.54
425	2.92	2.99	2.42	5.00	1.77	0.47
300	4.08	3.77	7.70	5.00	1.78	0.62
212	4.29	4.24	1.20	5.00	1.29	0.66
150	5.80	5.81	.19	5.00	1.33	0.93
106	6.48	6.52	.57	5.00	1.06	1.16
75	6.97	7.17	2.90	5.00	1.02	1.39
53	7.80	7.87	.87	5.00	1.01	1.50
38	5.20	5.63	8.20	5.00	0.59	1.20
-38	32.87	32.21	2.01	5.00	5.17	6.43

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 27

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.34	.33	2.21	5.00	.00	.00	100.00	.00
MILL DISCH.	.78	.81	4.26	5.00	.00	.31	100.00	.00
SCREEN FEED	47.67	48.20	1.11	15.00	.00	47.69	100.00	.00
SCR OVERSIZE	.18	.18	.22	10.00	.00	.00	100.00	.00
SCR U/FLOW	47.49	48.02	1.12	20.00	.00	47.69	100.00	.00
MILL WATER	.00	.30	100.00	.00	.31	.30	1.60	5.00
SUMP WATER	.00	47.39	100.00	.00	46.86	47.39	1.13	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.33	100.00	.00	98.96	98.56	.40	5.00
MILL DISCH.	.00	.50	100.00	.00	61.65	62.12	.77	10.00
SCREEN FEED	.00	.50	100.00	.00	2.00	1.05	47.72	1000.00
SCR OVERSIZE	.00	.17	100.00	.00	95.11	98.69	3.76	10.00
SCR U/FLOW	.00	.33	100.00	.00	.68	.69	.94	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.85	.85	.07	5.00	2.46	2.46	.03	5.00
9500	4.08	4.58	12.21	5.00	15.78	13.24	16.12	5.00
6700	14.95	14.21	4.95	5.00	39.12	41.08	5.02	5.00
4750	11.12	11.01	.95	5.00	31.42	31.85	1.36	5.00
3350	5.12	5.00	2.35	5.00	9.77	9.93	1.69	5.00
2360	3.17	3.32	4.63	5.00	1.38	1.37	.68	5.00
1700	1.81	1.83	.89	5.00	.06	.06	.01	5.00
1180	1.57	1.56	.57	5.00	.00	.00	100.00	.00
850	1.41	1.43	1.08	5.00	.00	.00	100.00	.00
600	1.63	1.70	4.42	5.00	.00	.00	100.00	.00
425	2.00	1.96	2.09	5.00	.00	.00	100.00	.00
300	2.53	2.70	6.80	5.00	.00	.00	100.00	.00
212	3.33	3.35	.53	5.00	.00	.00	100.00	.00
150	4.75	4.62	2.72	5.00	.00	.00	100.00	.00
106	5.09	5.07	.37	5.00	.00	.00	100.00	.00
75	5.53	5.42	2.01	5.00	.00	.00	100.00	.00
53	5.49	5.60	2.02	5.00	.00	.00	100.00	.00
38	4.10	3.94	3.94	5.00	.00	.00	100.00	.00
-38	21.48	21.87	1.80	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.67	0.00
26500					11.98	8.81
19000					22.09	33.04
13200	.00	.00	100.00	.00	15.51	21.41
9500	.00	.00	100.00	.00	11.97	13.11
6700	.00	.00	100.00	.00	6.99	4.57
4750	.00	.00	100.00	.00	5.78	3.68
3350	2.37	2.39	.85	5.00	3.63	1.31
2360	4.53	4.35	4.06	5.00	3.60	1.08
1700	2.78	2.76	.73	5.00	2.75	0.72
1180	2.37	2.39	.70	5.00	2.31	0.50
850	2.20	2.18	.97	5.00	1.86	0.42
600	2.73	2.60	4.68	5.00	1.65	0.44
425	2.93	2.99	2.17	5.00	1.21	0.41
300	4.47	4.13	7.59	5.00	1.19	0.56
212	5.13	5.12	.23	5.00	0.85	0.58
150	6.86	7.06	2.98	5.00	0.79	0.78
106	7.69	7.75	.82	5.00	0.62	0.91
75	8.09	8.28	2.40	5.00	0.57	1.04
53	8.70	8.56	1.58	5.00	0.59	1.98
38	5.79	6.02	3.99	5.00	0.36	0.81
-38	33.37	33.42	.15	5.00	3.06	4.63

MASS BALANCE OF 60CM CIRCUIT LORNEX RUN 28

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.50	.50	.10	5.00	.00	.00	100.00	.00
MILL DISCH.	1.28	1.29	.93	5.00	.00	.40	100.00	.00
SCREEN FEED	58.95	55.18	6.39	15.00	.00	54.30	100.00	.00
SCR OVERSIZE	.36	.38	5.31	10.00	.00	.00	100.00	.00
SCR U/FLOW	58.59	54.80	6.46	20.00	.00	54.30	100.00	.00
MILL WATER	.00	.41	100.00	.00	.41	.41	.20	5.00
SUMP WATER	.00	53.90	100.00	.00	57.62	53.90	6.46	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.50	100.00	.00	99.28	99.43	.15	5.00
MILL DISCH.	.00	.88	100.00	.00	67.68	68.58	1.33	10.00
SCREEN FEED	.00	.88	100.00	.00	2.00	1.60	19.97	1000.00
SCR OVERSIZE	.00	.39	100.00	.00	94.33	101.17	7.25	10.00
SCR U/FLOW	.00	.50	100.00	.00	.95	.91	4.41	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	2.96	3.40	14.78	5.00	9.85	7.78	21.00	5.00
6700	18.18	18.14	.22	5.00	40.65	41.55	2.20	5.00
4750	15.43	15.01	2.74	5.00	32.89	34.26	4.15	5.00
3350	8.02	8.22	2.47	5.00	14.59	14.41	1.25	5.00
2360	3.63	3.75	3.28	5.00	1.88	1.87	.65	5.00
1700	1.94	1.95	.31	5.00	.12	.12	.00	5.00
1180	1.54	1.52	1.41	5.00	.01	.01	.00	5.00
850	1.30	1.36	4.37	5.00	.01	.01	.01	5.00
600	1.42	1.55	8.92	5.00	.00	.00	100.00	.00
425	1.75	1.80	2.66	5.00	.00	.00	100.00	.00
300	2.33	2.49	6.78	5.00	.00	.00	100.00	.00
212	2.64	2.78	5.20	5.00	.00	.00	100.00	.00
150	4.02	3.91	2.74	5.00	.00	.00	100.00	.00
106	4.21	4.17	.94	5.00	.00	.00	100.00	.00
75	4.54	4.32	4.76	5.00	.00	.00	100.00	.00
53	4.33	4.41	1.88	5.00	.00	.00	100.00	.00
38	3.14	3.02	3.87	5.00	.00	.00	100.00	.00
-38	18.62	18.22	2.12	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.26	0.39
26500					9.59	10.36
19000					20.36	30.40
13200	.00	.00	100.00	.00	14.39	19.99
9500	.00	.00	100.00	.00	11.54	13.63
6700	.00	.00	100.00	.00	7.44	4.81
4750	.09	.09	.01	5.00	6.89	3.96
3350	3.44	3.42	.56	5.00	3.72	1.60
2360	5.35	5.21	2.67	5.00	4.91	1.06
1700	3.37	3.36	.27	5.00	3.18	0.64
1180	2.65	2.69	1.40	5.00	2.76	0.44
850	2.52	2.40	4.74	5.00	2.12	0.38
600	3.08	2.75	10.87	5.00	1.96	0.40
425	3.28	3.19	2.78	5.00	1.39	0.39
300	4.79	4.42	7.81	5.00	1.37	0.56
212	5.23	4.93	5.75	5.00	1.03	0.66
150	6.76	6.94	2.66	5.00	0.96	0.92
106	7.33	7.40	.99	5.00	0.77	1.03
75	7.35	7.67	4.42	5.00	0.66	1.12
53	7.98	7.83	1.88	5.00	0.70	1.24
38	5.17	5.36	3.64	5.00	0.40	0.86
-38	31.60	32.34	2.34	5.00	3.61	5.16

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 29

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.48	.49	1.82	5.00	.00	.00	100.00	.00
MILL DISCH.	1.20	1.16	2.99	5.00	.00	.48	100.00	.00
SCREEN FEED	55.14	58.01	5.20	15.00	.00	57.32	100.00	.00
SCR OVERSIZE	.22	.22	1.74	10.00	.00	.02	100.00	.00
SCR U/FLOW	54.92	57.79	5.22	20.00	.00	57.30	100.00	.00
MILL WATER	.00	.45	100.00	.00	.45	.45	1.15	5.00
SUMP WATER	.00	56.84	100.00	.00	53.98	56.84	5.30	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.49	100.00	.00	99.02	99.62	.60	5.00
MILL DISCH.	.00	.69	100.00	.00	58.88	59.04	.27	10.00
SCREEN FEED	.00	.69	100.00	.00	2.00	1.18	40.75	1000.00
SCR OVERSIZE	.00	.20	100.00	.00	93.84	90.43	3.63	10.00
SCR U/FLOW	.00	.49	100.00	.00	.81	.85	4.88	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	3.02	3.51	16.30	5.00	15.43	12.29	20.33	5.00
6700	9.53	10.89	14.27	5.00	41.63	38.11	8.45	5.00
4570	10.28	7.98	22.36	5.00	23.33	27.94	19.74	5.00
3350	5.97	5.15	13.77	5.00	14.45	16.30	12.77	5.00
2360	4.94	4.30	12.88	5.00	4.55	4.75	4.41	5.00
1700	3.42	3.35	2.00	5.00	.55	.55	.22	5.00
1180	3.30	3.24	1.70	5.00	.04	.04	.01	5.00
850	3.11	3.20	2.86	5.00	.02	.02	.00	5.00
600	3.61	3.71	2.64	5.00	.00	.00	100.00	.00
425	3.69	3.66	.89	5.00	.00	.00	100.00	.00
300	3.83	4.12	7.52	5.00	.00	.00	100.00	.00
212	3.88	3.96	2.05	5.00	.00	.00	100.00	.00
150	4.62	4.58	.78	5.00	.00	.00	100.00	.00
106	4.23	4.35	2.86	5.00	.00	.00	100.00	.00
75	4.08	4.06	.46	5.00	.00	.00	100.00	.00
53	4.50	4.81	6.94	5.00	.00	.00	100.00	.00
38	3.57	3.56	.34	5.00	.00	.00	100.00	.00
-38	20.39	21.53	5.61	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.59	0.00
26500					10.50	4.38
19000					18.60	21.68
13200	.00	.00	100.00	.00	13.93	16.99
9500	.00	.00	100.00	.00	10.37	14.97
6700	.00	.00	100.00	.00	6.73	6.50
4750	.00	.00	100.00	.00	6.32	6.24
3350	.68	.69	1.27	5.00	3.86	4.16
2360	3.82	4.12	7.98	5.00	4.16	3.85
1700	4.35	4.47	2.80	5.00	3.27	2.49
1180	4.41	4.53	2.62	5.00	2.85	2.08
850	4.56	4.47	1.96	5.00	2.38	1.69
600	5.27	5.19	1.56	5.00	2.27	1.72
425	5.02	5.12	2.00	5.00	1.84	1.35
300	6.22	5.77	7.31	5.00	1.56	1.44
212	5.59	5.54	.84	5.00	1.24	1.20
150	6.28	6.42	2.19	5.00	1.23	1.25
106	6.19	6.09	1.59	5.00	1.00	1.11
75	5.59	5.69	1.71	5.00	0.91	1.03
53	7.19	6.74	6.29	5.00	0.83	1.07
38	4.91	4.98	1.45	5.00	0.59	0.69
-38	29.92	30.19	.90	5.00	4.95	4.10

MASS BALANCE OF 60CM CIRCUIT LORNEK RUN 30

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.51	.52	1.20	5.00	.00	.01	100.00	.00
MILL DISCH.	1.31	1.27	2.99	5.00	.00	.51	100.00	.00
SCREEN FEED	51.48	53.33	3.60	15.00	.00	52.58	100.00	.00
SCR OVERSIZE	.24	.25	2.78	10.00	.00	.01	100.00	.00
SCR U/FLOW	51.24	53.08	3.60	20.00	.00	52.57	100.00	.00
MILL WATER	.00	.50	100.00	.00	.49	.50	1.03	5.00
SUMP WATER	.00	52.07	100.00	.00	50.23	52.07	3.66	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.52	100.00	.00	98.70	98.82	.12	5.00
MILL DISCH.	.00	.76	100.00	.00	60.22	59.62	.99	10.00
SCREEN FEED	.00	.76	100.00	.00	2.00	1.42	29.18	1000.00
SCR OVERSIZE	.00	.24	100.00	.00	95.48	96.23	.79	10.00
SCR U/FLOW	.00	.52	100.00	.00	.94	.97	3.21	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

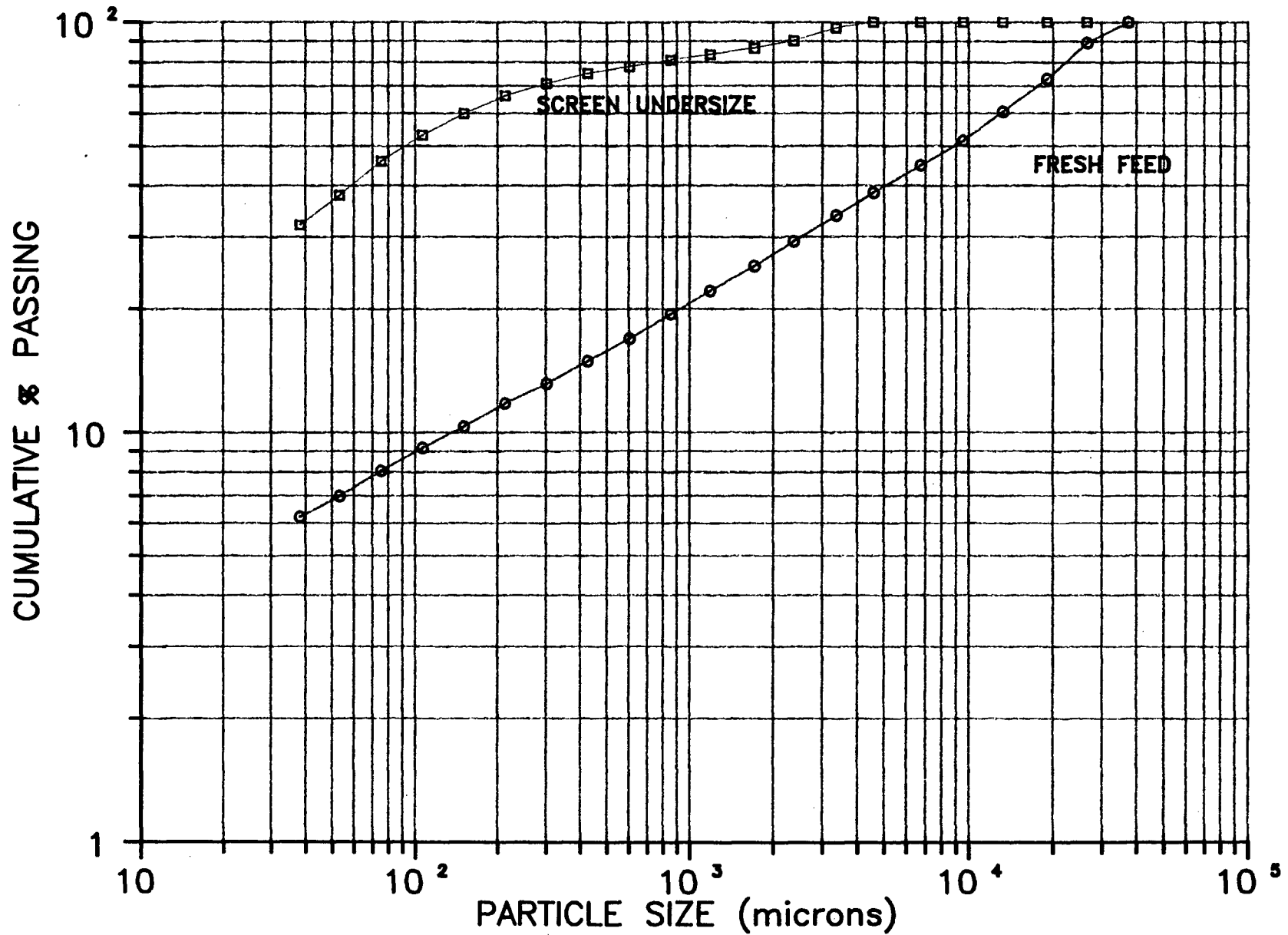
STREAMS	MILL DISCHARGE				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	2.73	2.36	13.62	5.00	6.66	7.41	11.28	5.00
6700	11.65	12.32	5.71	5.00	39.47	38.70	1.94	5.00
4570	10.82	11.53	6.54	5.00	37.43	36.23	3.20	5.00
3350	7.17	6.39	10.86	5.00	14.11	15.28	8.31	5.00
2360	5.12	4.48	12.49	5.00	2.16	2.20	1.91	5.00
1700	3.21	3.00	6.68	5.00	.15	.15	.12	5.00
1180	3.12	2.95	5.35	5.00	.01	.01	.01	5.00
850	2.88	2.83	1.80	5.00	.00	.00	100.00	.00
600	3.21	3.24	.86	5.00	.00	.00	100.00	.00
425	3.42	3.27	4.28	5.00	.00	.00	100.00	.00
300	3.66	3.80	3.76	5.00	.00	.00	100.00	.00
212	3.69	3.64	1.42	5.00	.00	.00	100.00	.00
150	4.37	4.27	2.31	5.00	.00	.00	100.00	.00
106	4.07	4.12	1.13	5.00	.00	.00	100.00	.00
75	4.34	4.31	.78	5.00	.00	.00	100.00	.00
53	4.16	4.38	5.39	5.00	.00	.00	100.00	.00
38	3.24	3.26	.51	5.00	.00	.00	100.00	.00
-38	19.17	19.90	3.82	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW				FRESH FEED	MILL CONTENTS
	MEAS.	ESTIM.	RESID.	RELAT.	NOT	NOT
	VALUES	VALUES	VALUES	ST.DEV.	ADJUSTED	ADJUSTED
37500					0.41	0.00
26500					7.13	6.26
19000					14.93	22.31
13200	.00	.00	100.00	.00	11.95	17.18
9500	.00	.00	100.00	.00	11.37	14.58
6700	.00	.00	100.00	.00	7.23	7.25
4750	.00	.00	100.00	.00	7.22	6.79
3350	2.19	2.24	2.36	5.00	5.11	2.82
2360	5.10	5.54	8.71	5.00	5.14	2.52
1700	4.08	4.32	5.97	5.00	3.76	2.06
1180	4.12	4.33	5.01	5.00	3.33	1.86
850	4.07	4.15	1.92	5.00	2.76	1.63
600	4.78	4.75	.66	5.00	2.59	1.57
425	4.61	4.80	4.15	5.00	1.96	1.23
300	5.79	5.57	3.80	5.00	1.94	1.32
212	5.25	5.34	1.62	5.00	1.41	1.10
150	6.11	6.26	2.48	5.00	1.47	1.14
106	6.09	6.04	.87	5.00	1.20	1.08
75	6.25	6.32	1.05	5.00	1.07	1.03
53	6.82	6.43	5.71	5.00	1.06	1.13
38	4.79	4.78	.29	5.00	0.66	0.77
-38	29.94	29.13	2.70	5.00	6.28	4.39

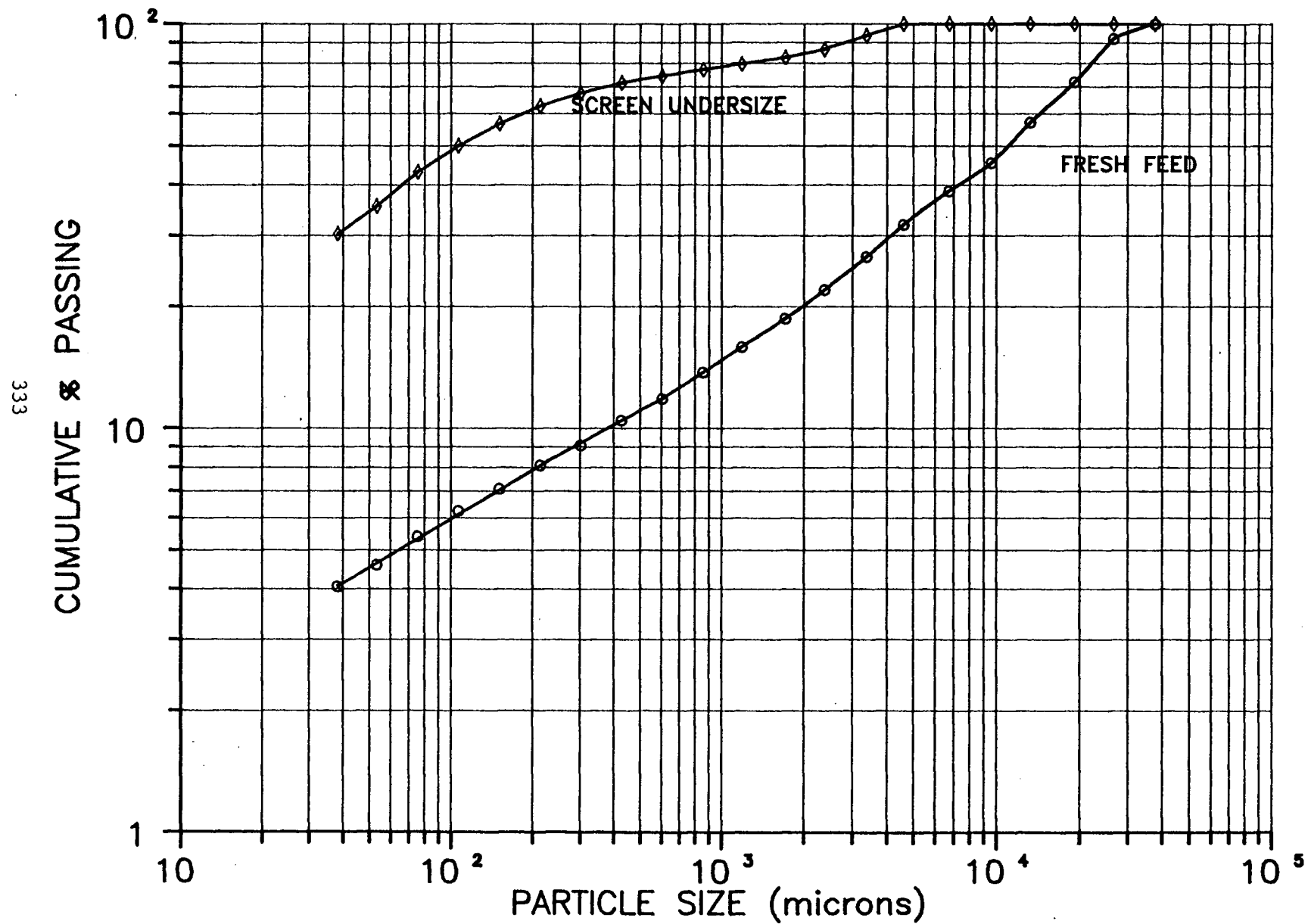
APPENDIX V.

LORNEX C-CIRCUIT: 60CM SIZE DISTRIBUTION PLOTS

SIZE DISTRIBUTIONS LORNEX RUN 1

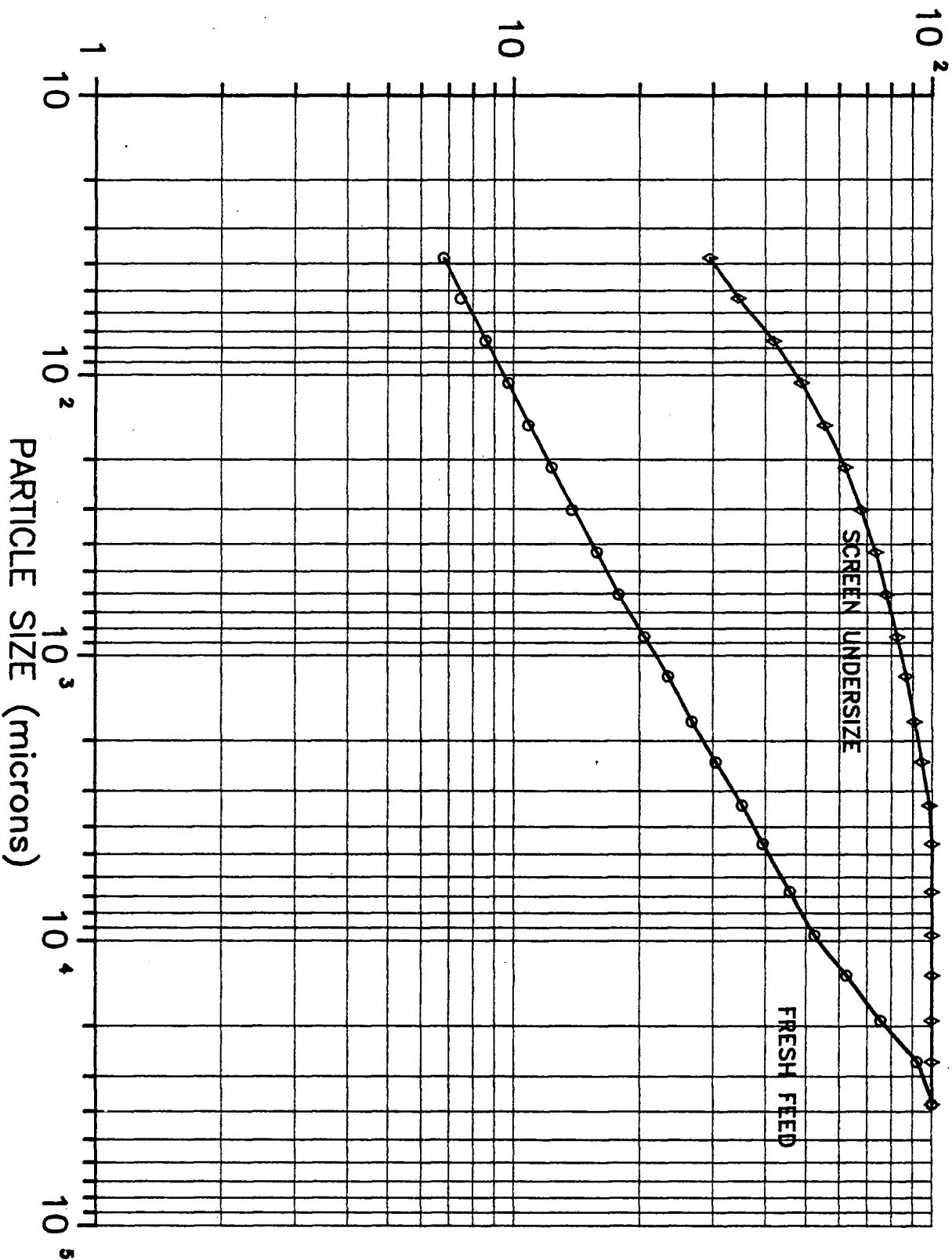


SIZE DISTRIBUTIONS LORNEK RUN 2

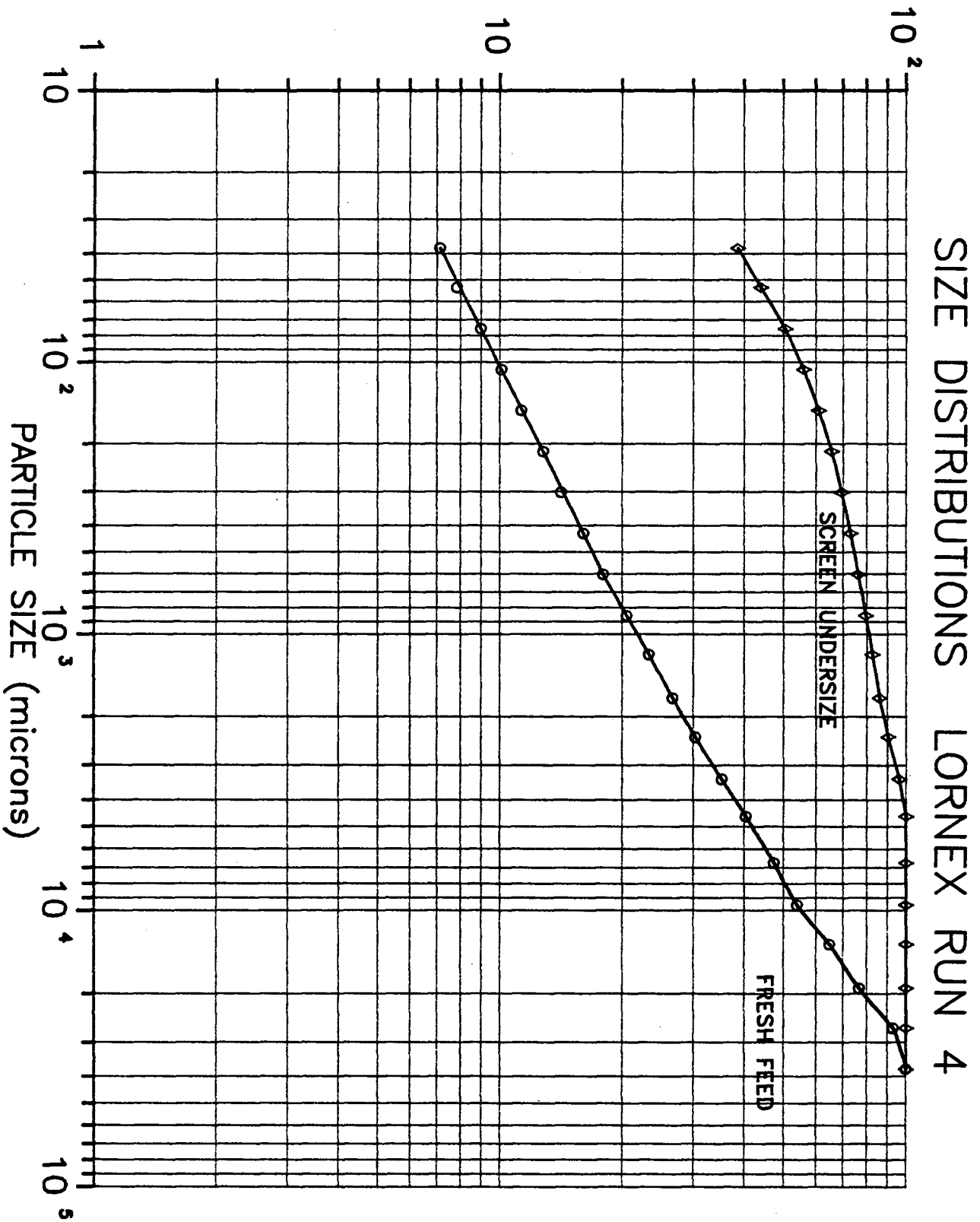


CUMULATIVE % PASSING

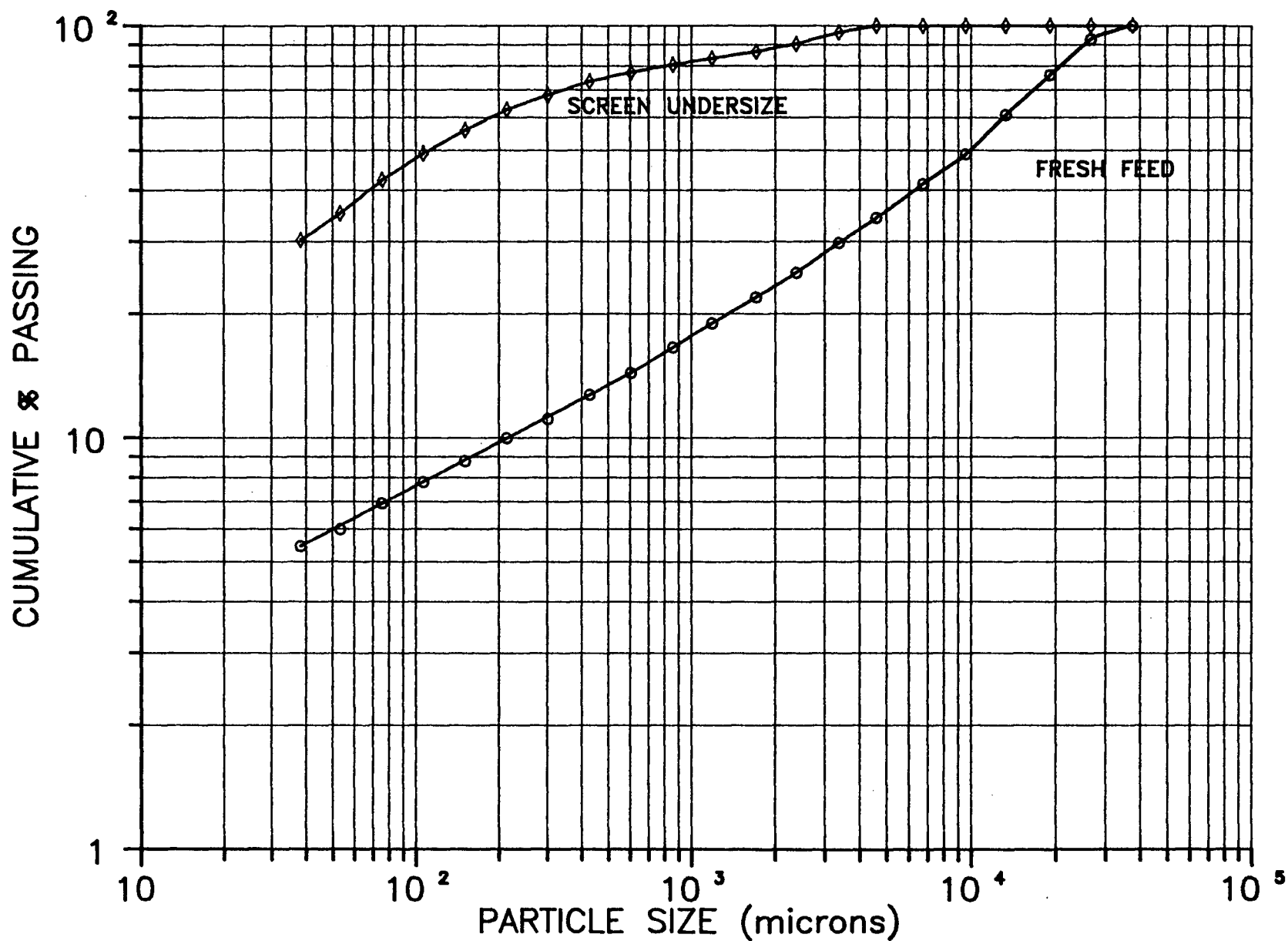
SIZE DISTRIBUTIONS LORNEX RUN 3



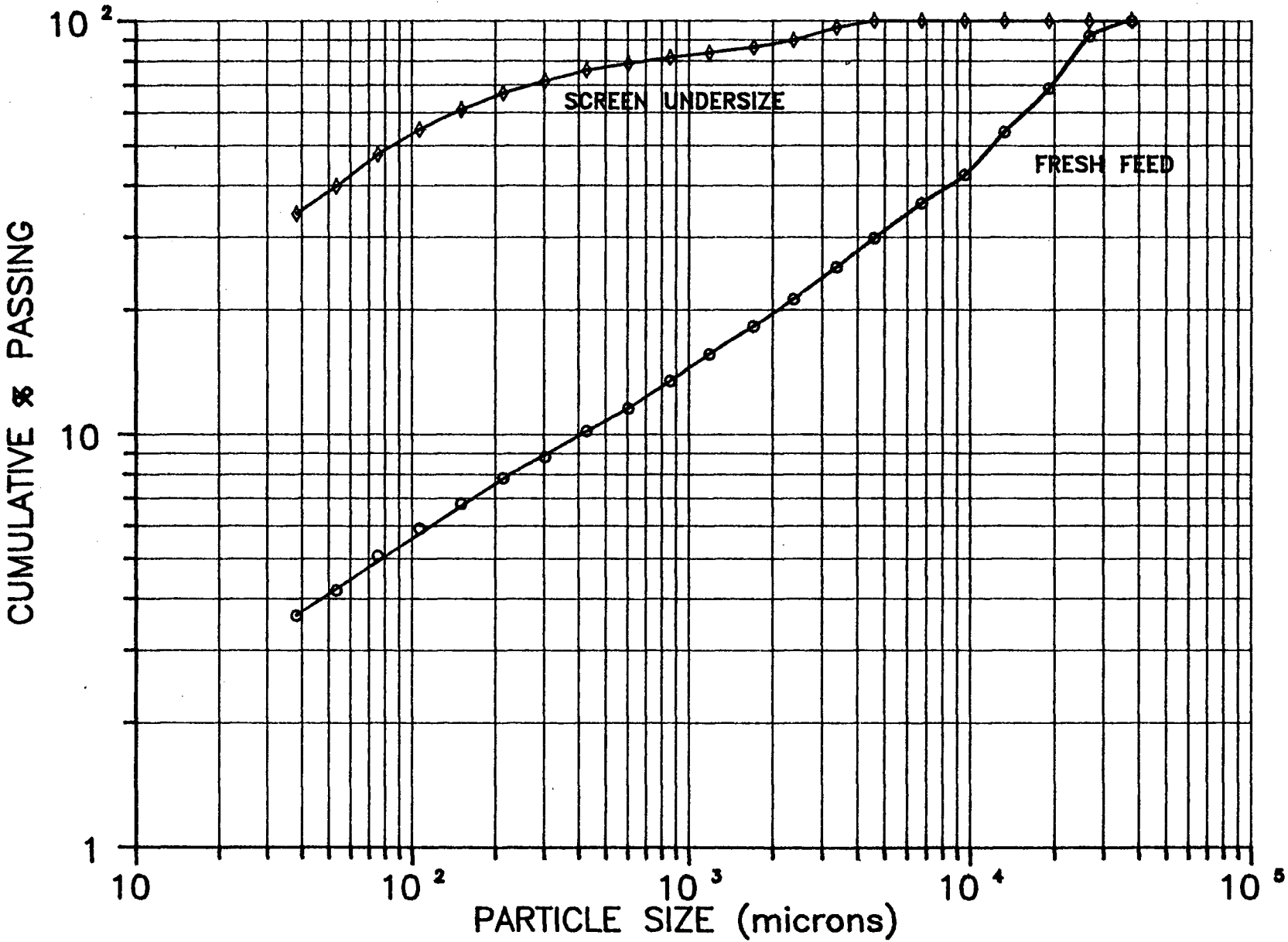
CUMULATIVE % PASSING



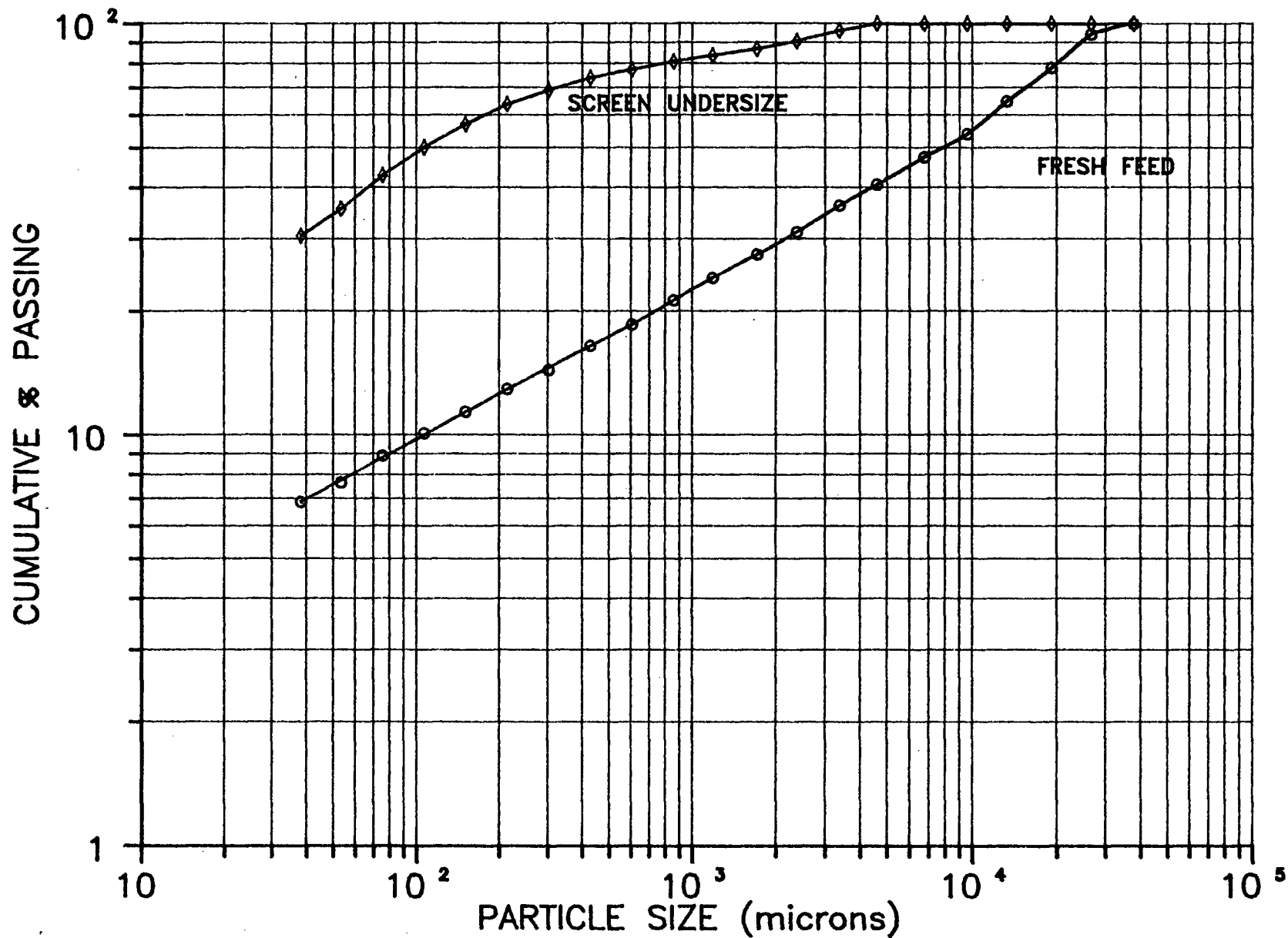
SIZE DISTRIBUTIONS LORNEX RUN 6



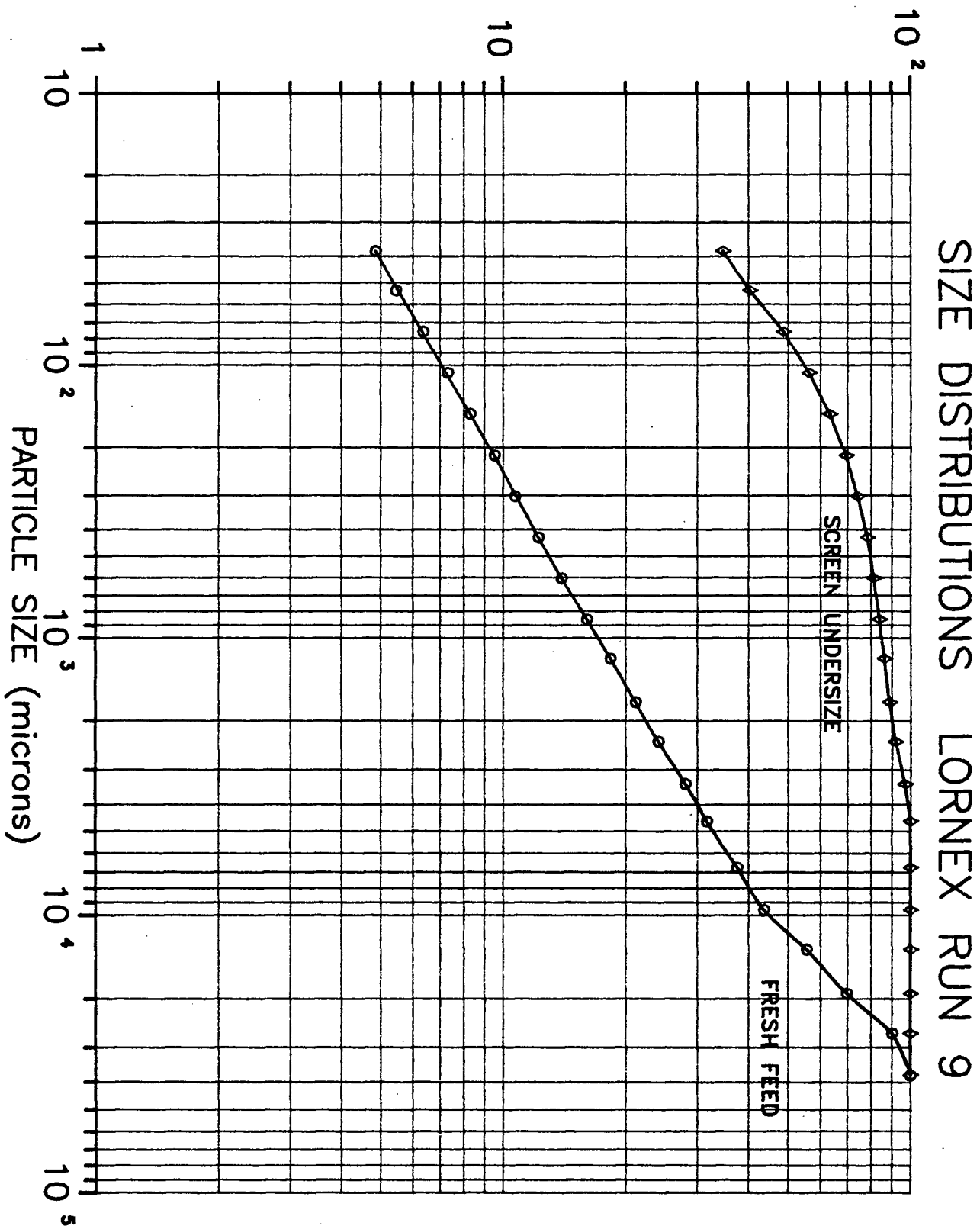
SIZE DISTRIBUTIONS LORNEX RUN 7



SIZE DISTRIBUTIONS LORNEK RUN 8

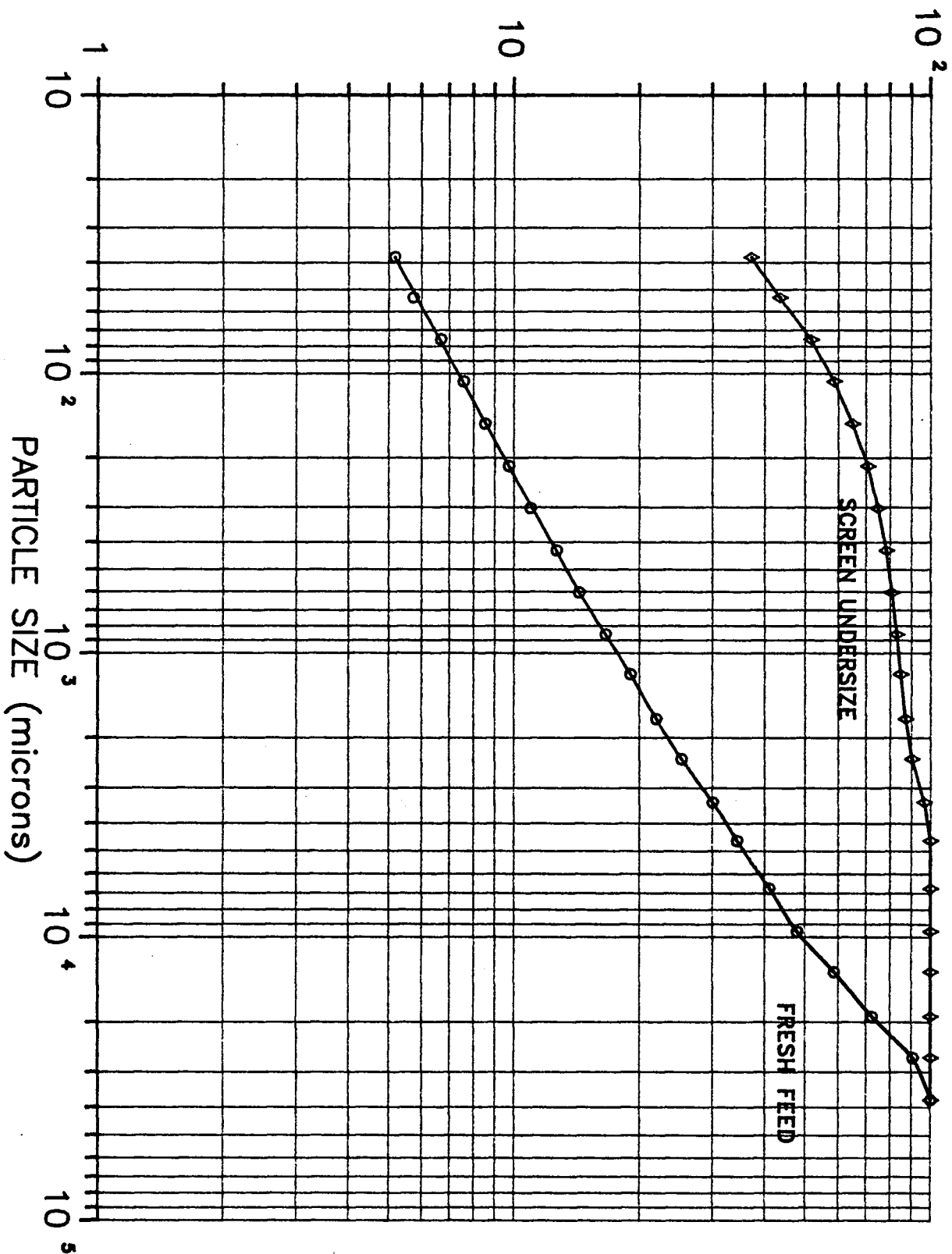


CUMULATIVE % PASSING



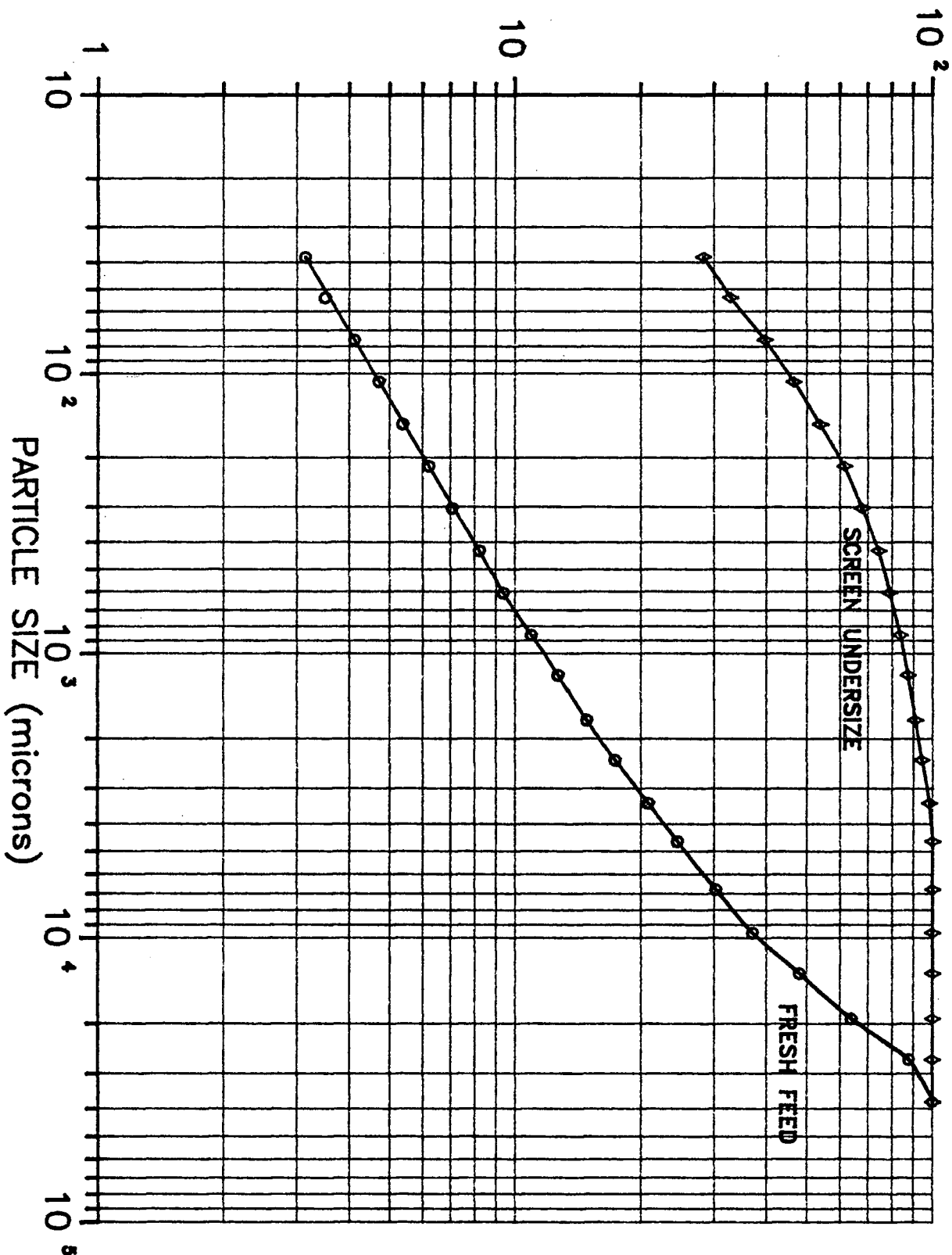
SIZE DISTRIBUTIONS LORNEX RUN 10

CUMULATIVE % PASSING



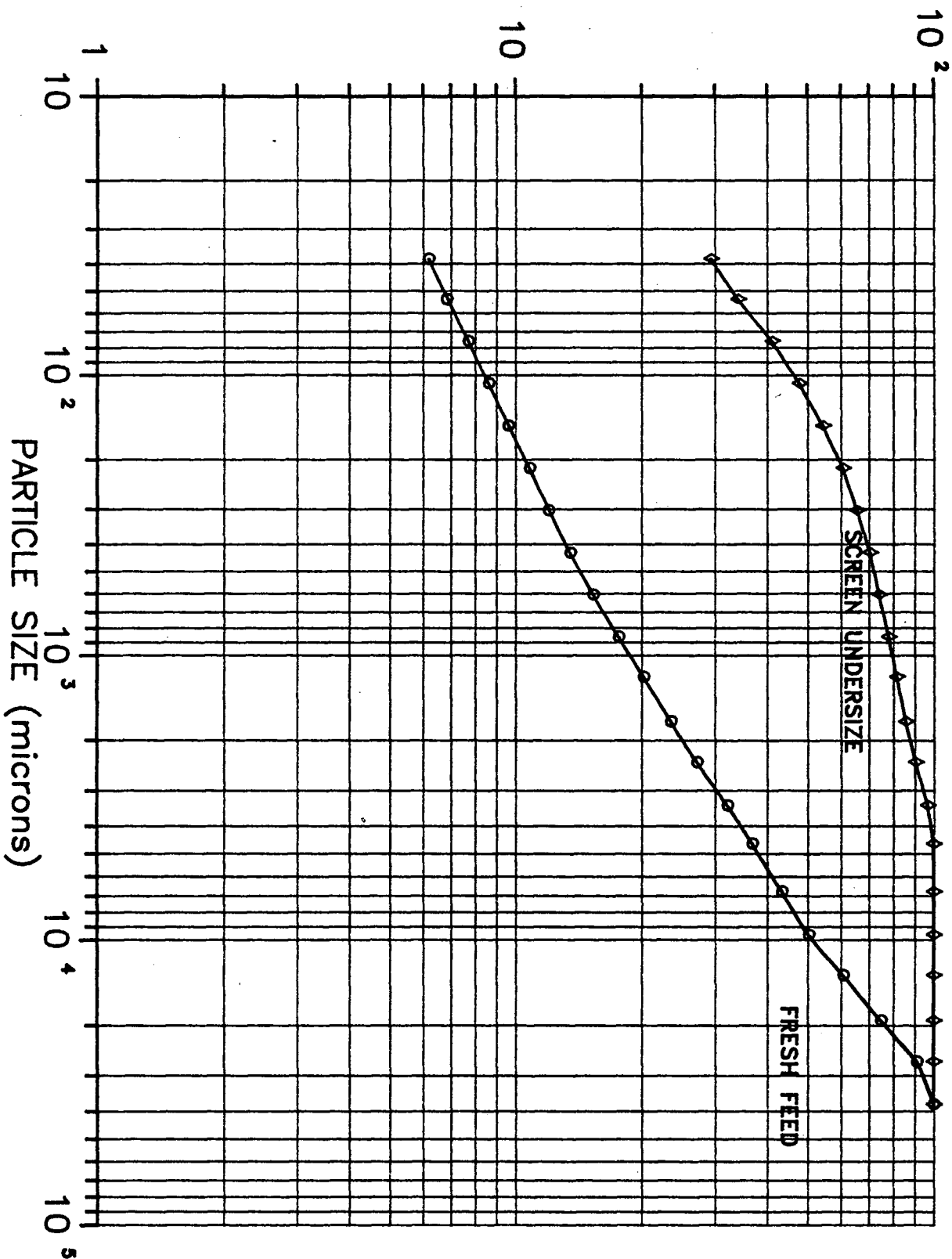
CUMULATIVE % PASSING

SIZE DISTRIBUTIONS LORNEX RUN 11

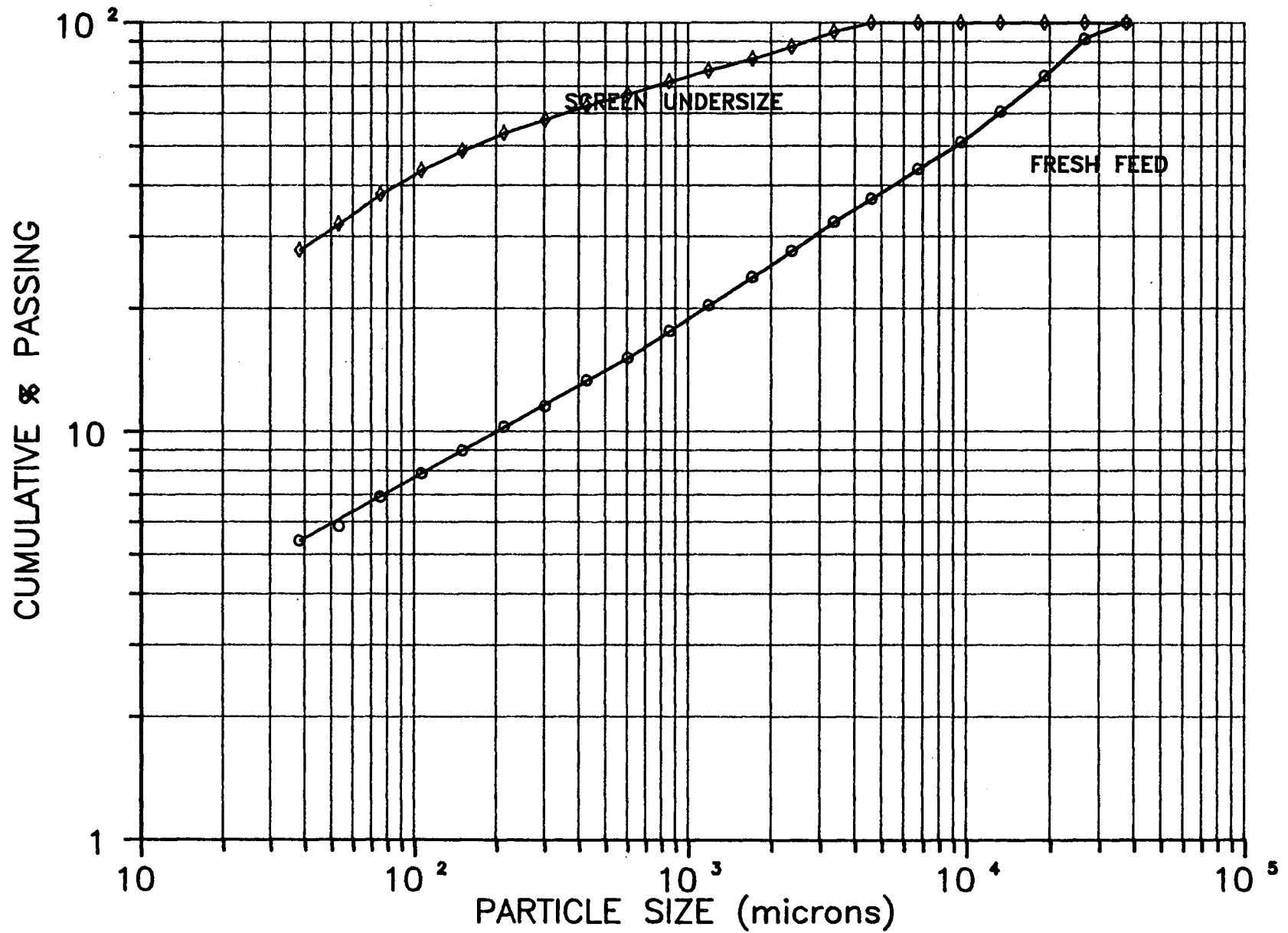


SIZE DISTRIBUTIONS LORNEX RUN 12

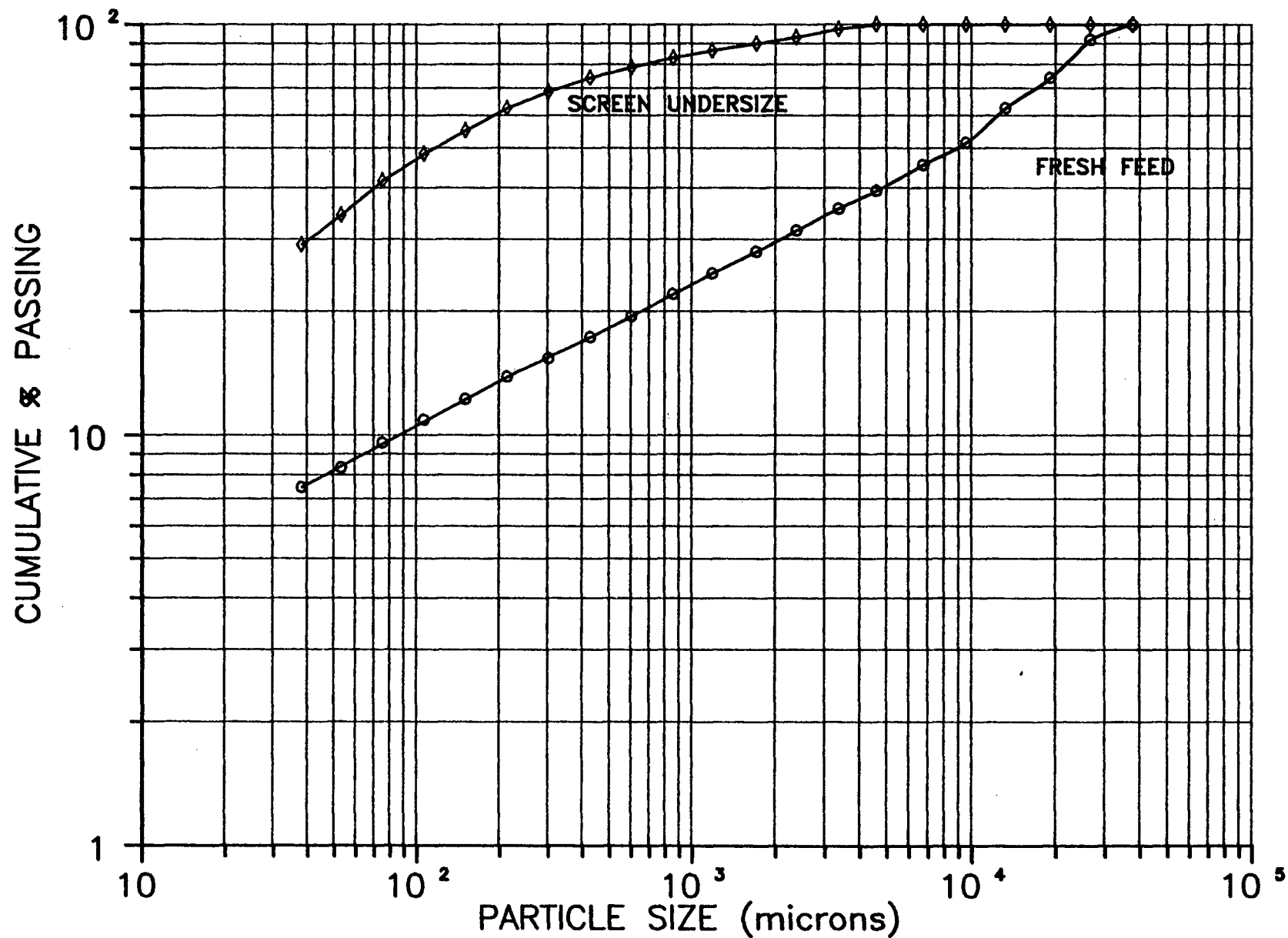
CUMULATIVE % PASSING



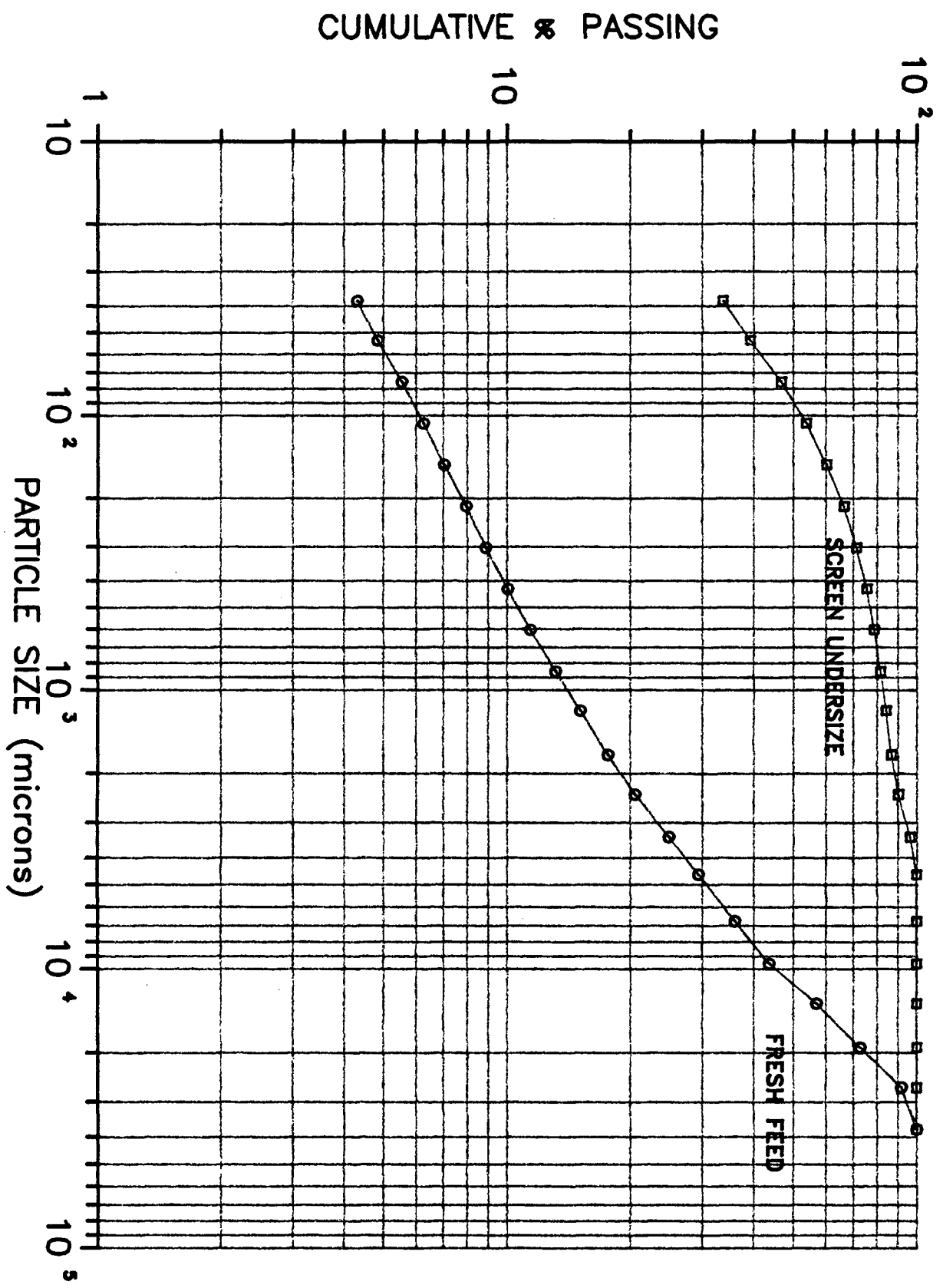
SIZE DISTRIBUTIONS LORNEK RUN 13



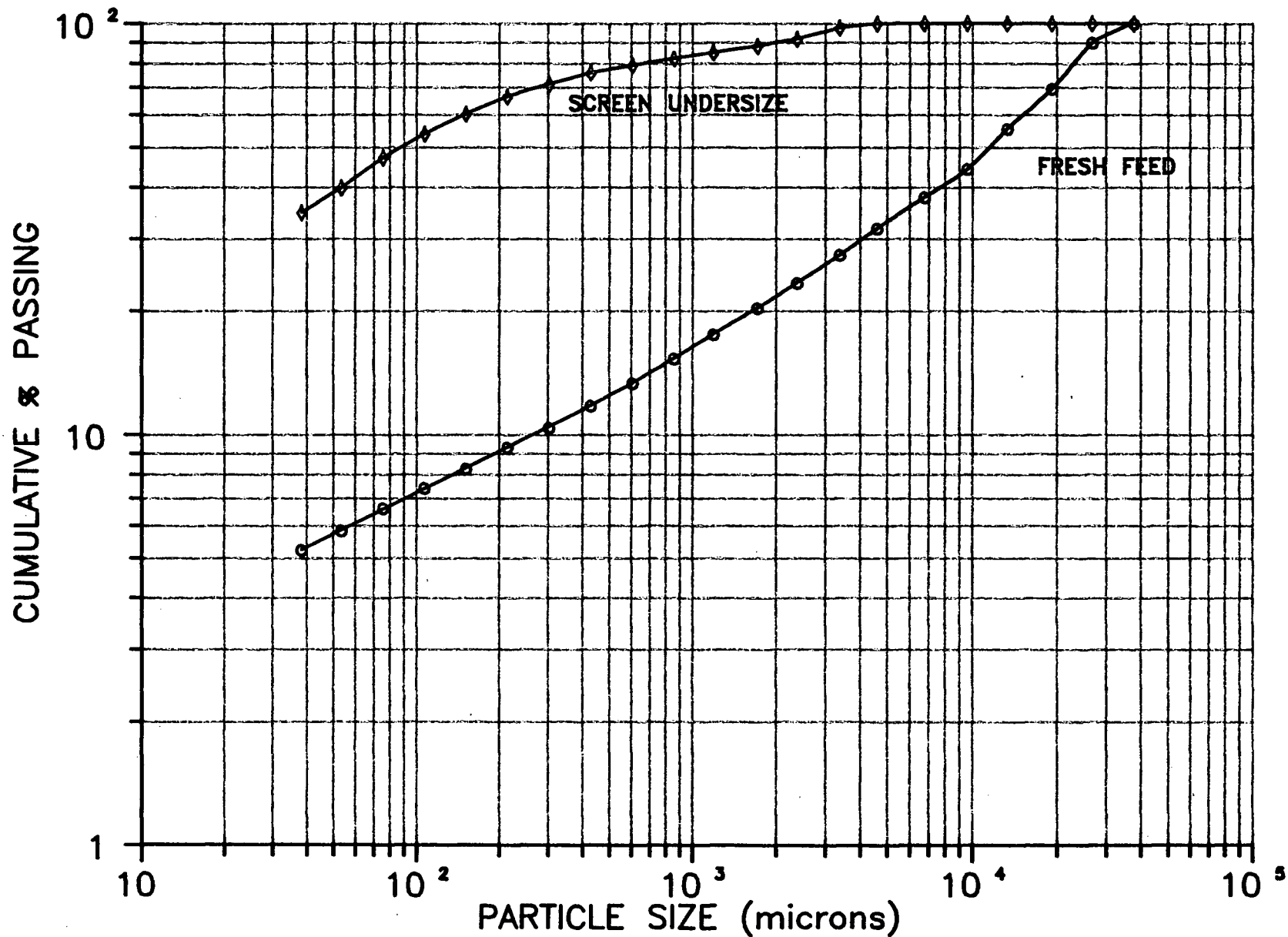
SIZE DISTRIBUTIONS LORNEX RUN 14



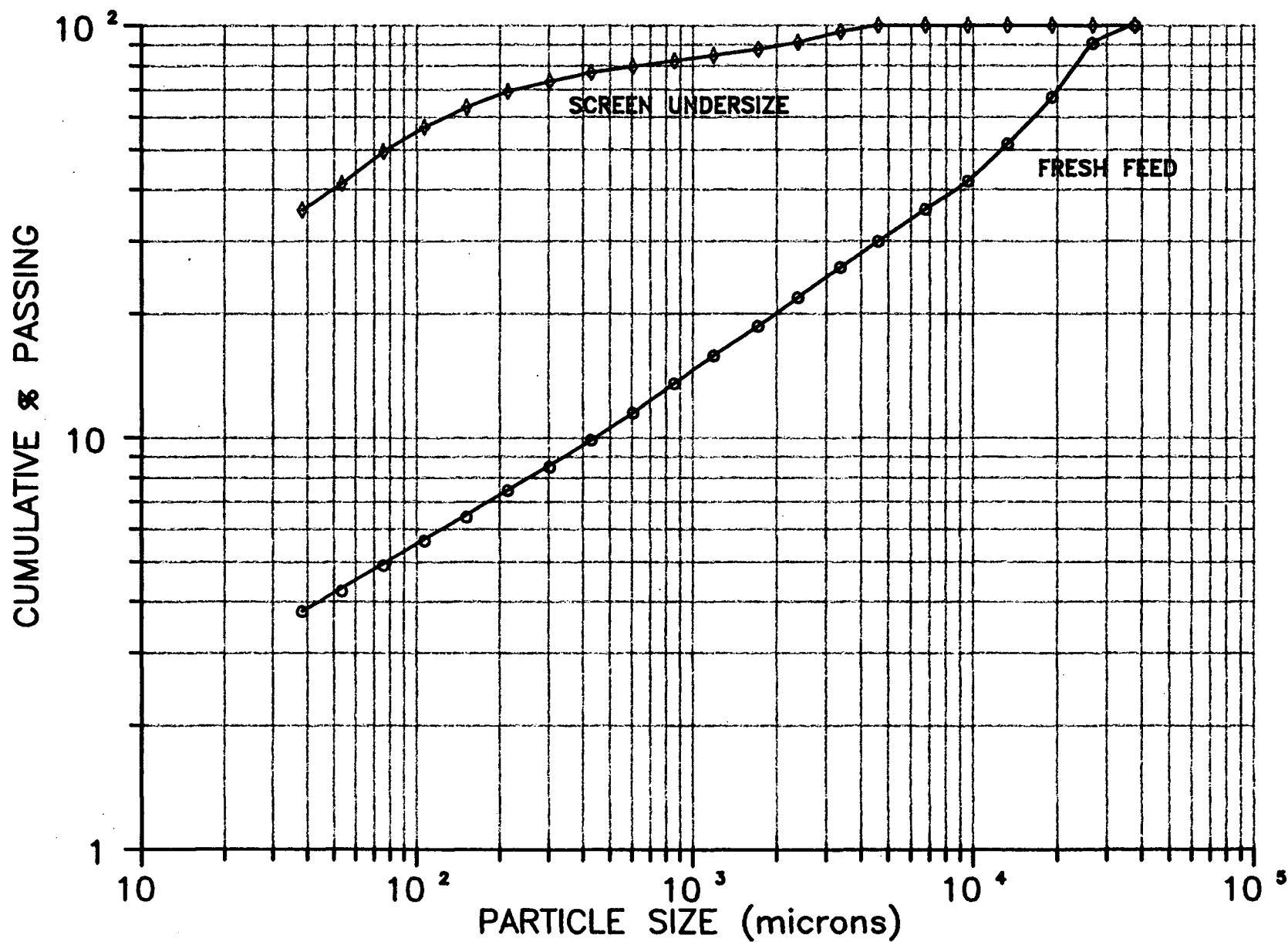
SIZE DISTRIBUTIONS LORNEX RUN 15



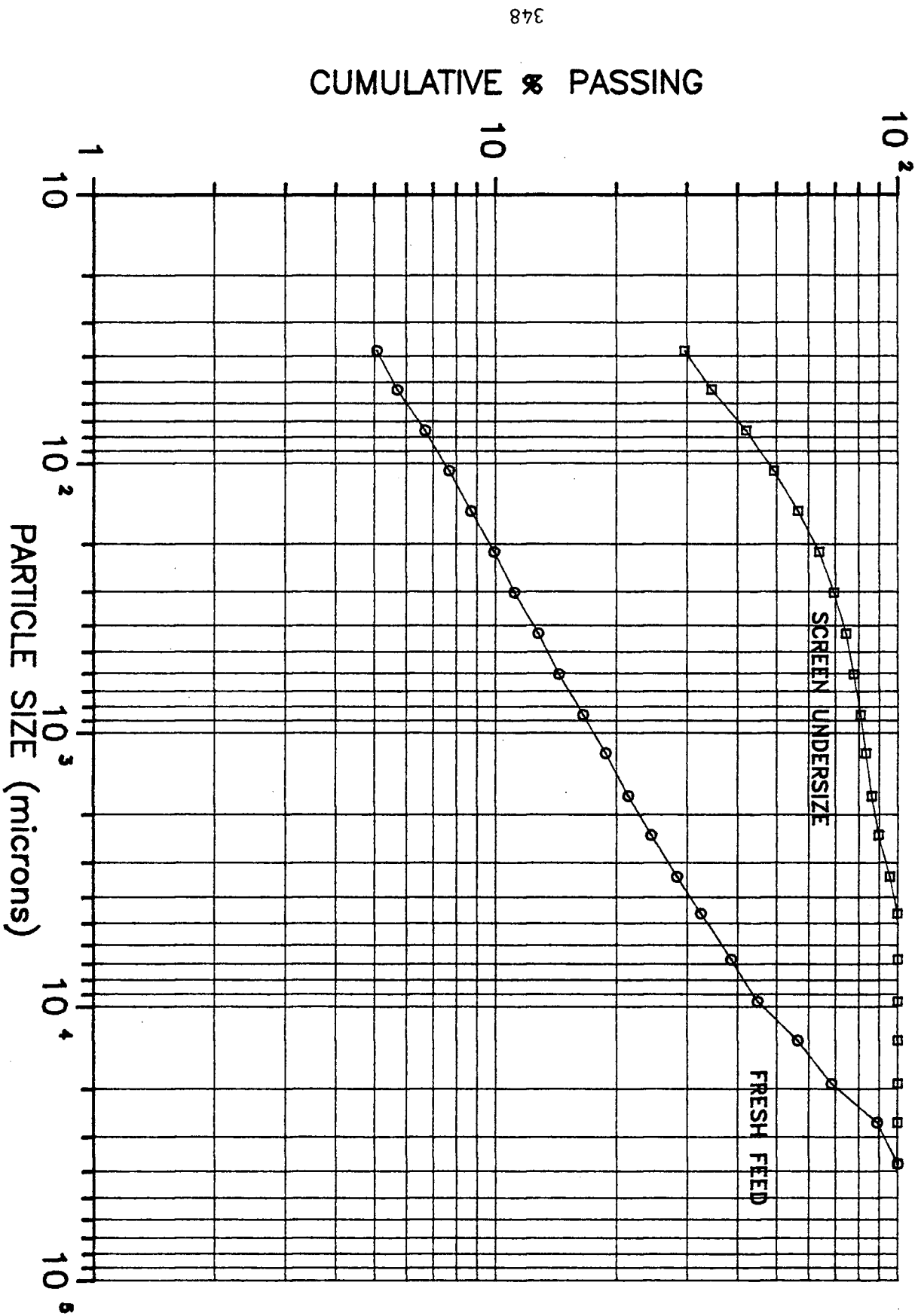
SIZE DISTRIBUTIONS LORNEK RUN 16



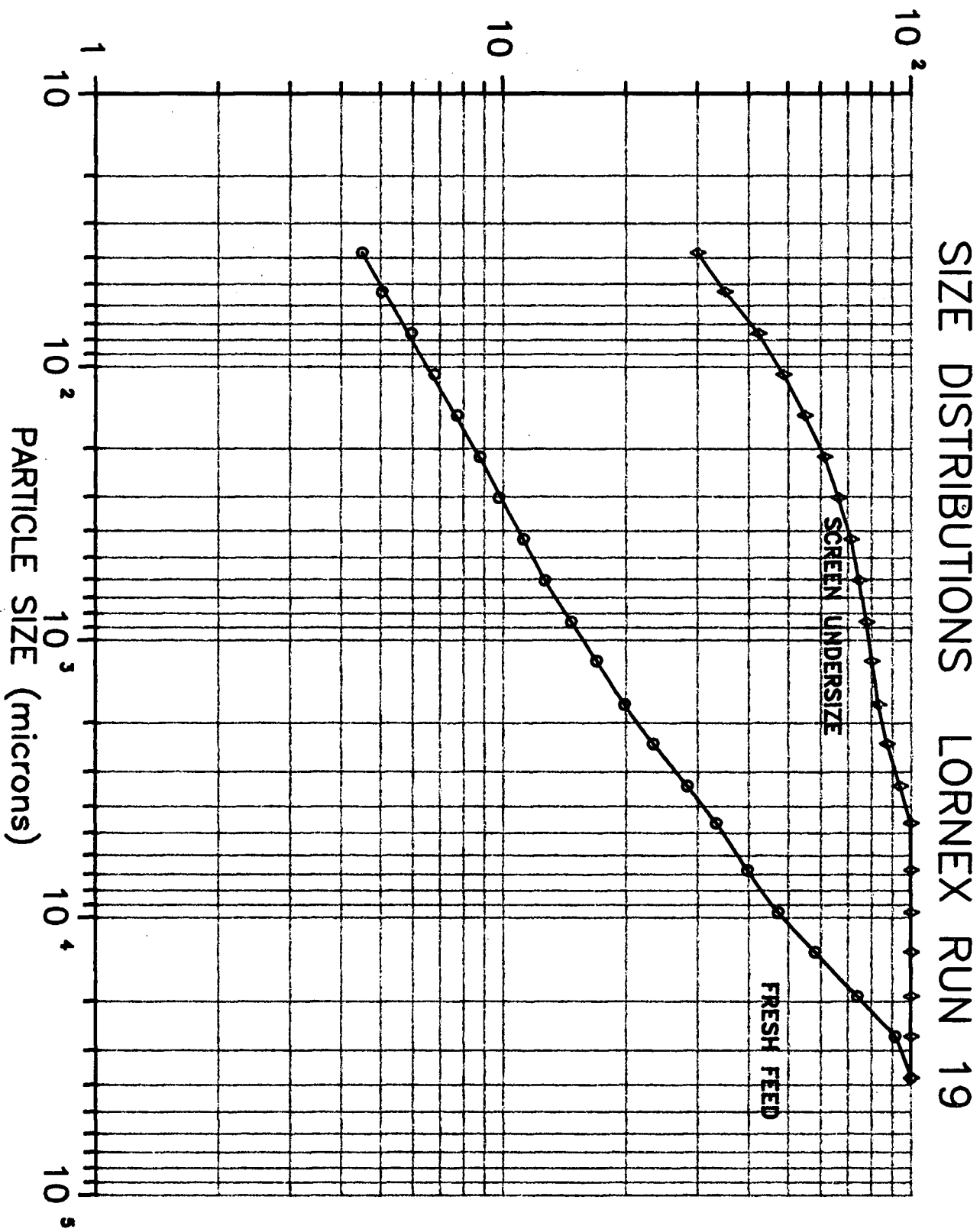
SIZE DISTRIBUTIONS LORNEKX RUN 17



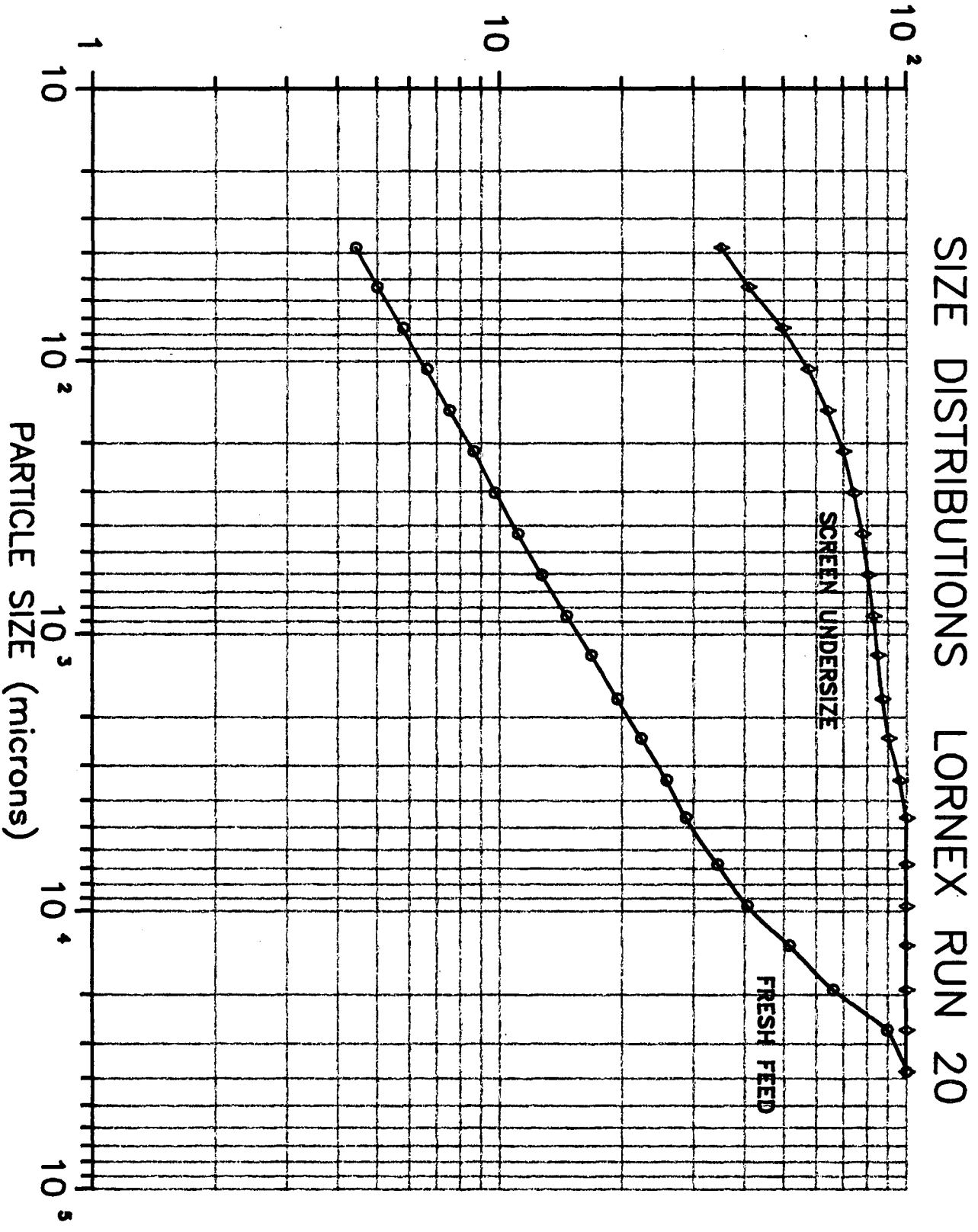
SIZE DISTRIBUTIONS LORNEX RUN 18



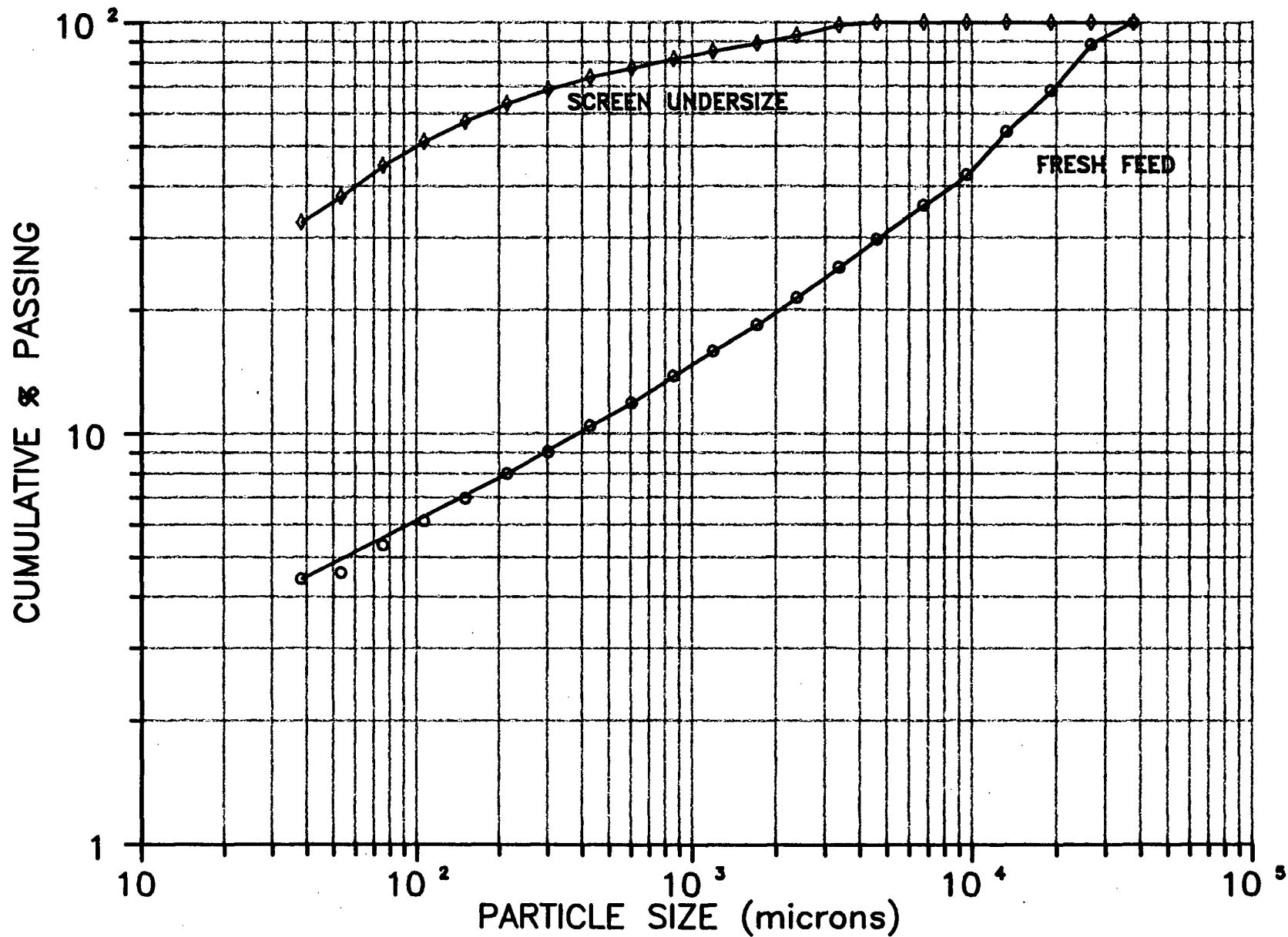
CUMULATIVE % PASSING



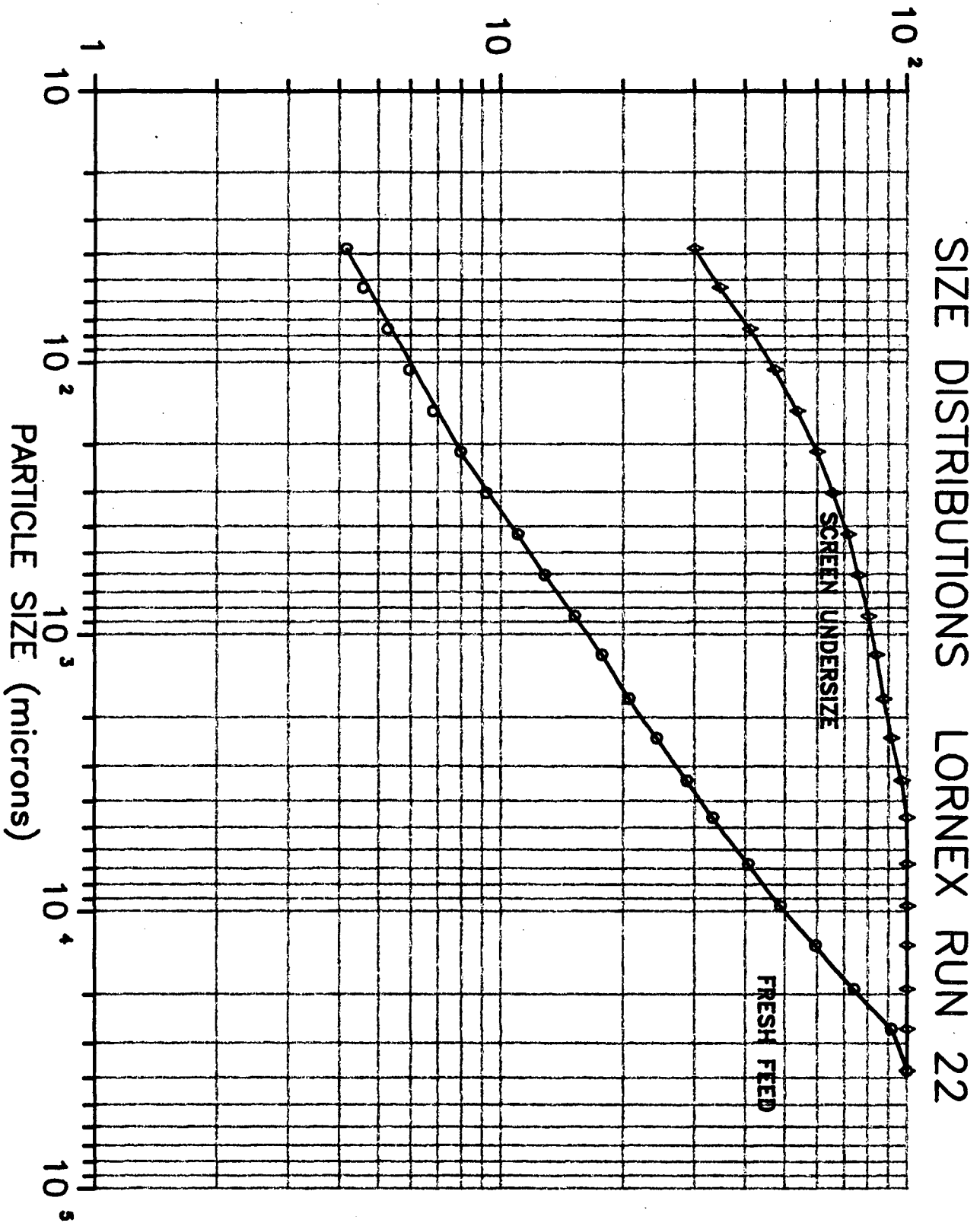
CUMULATIVE % PASSING



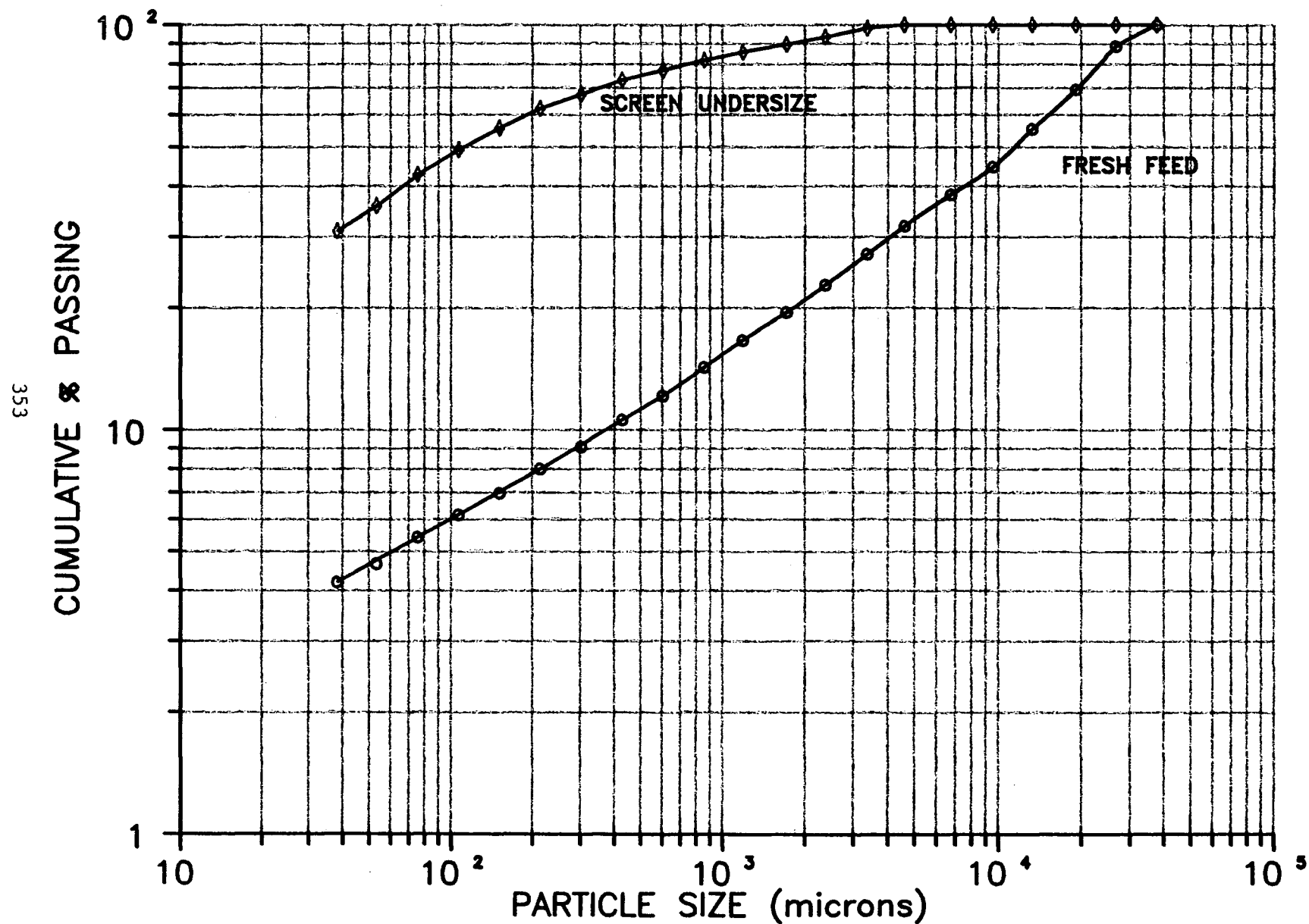
SIZE DISTRIBUTIONS LORNEK RUN 21



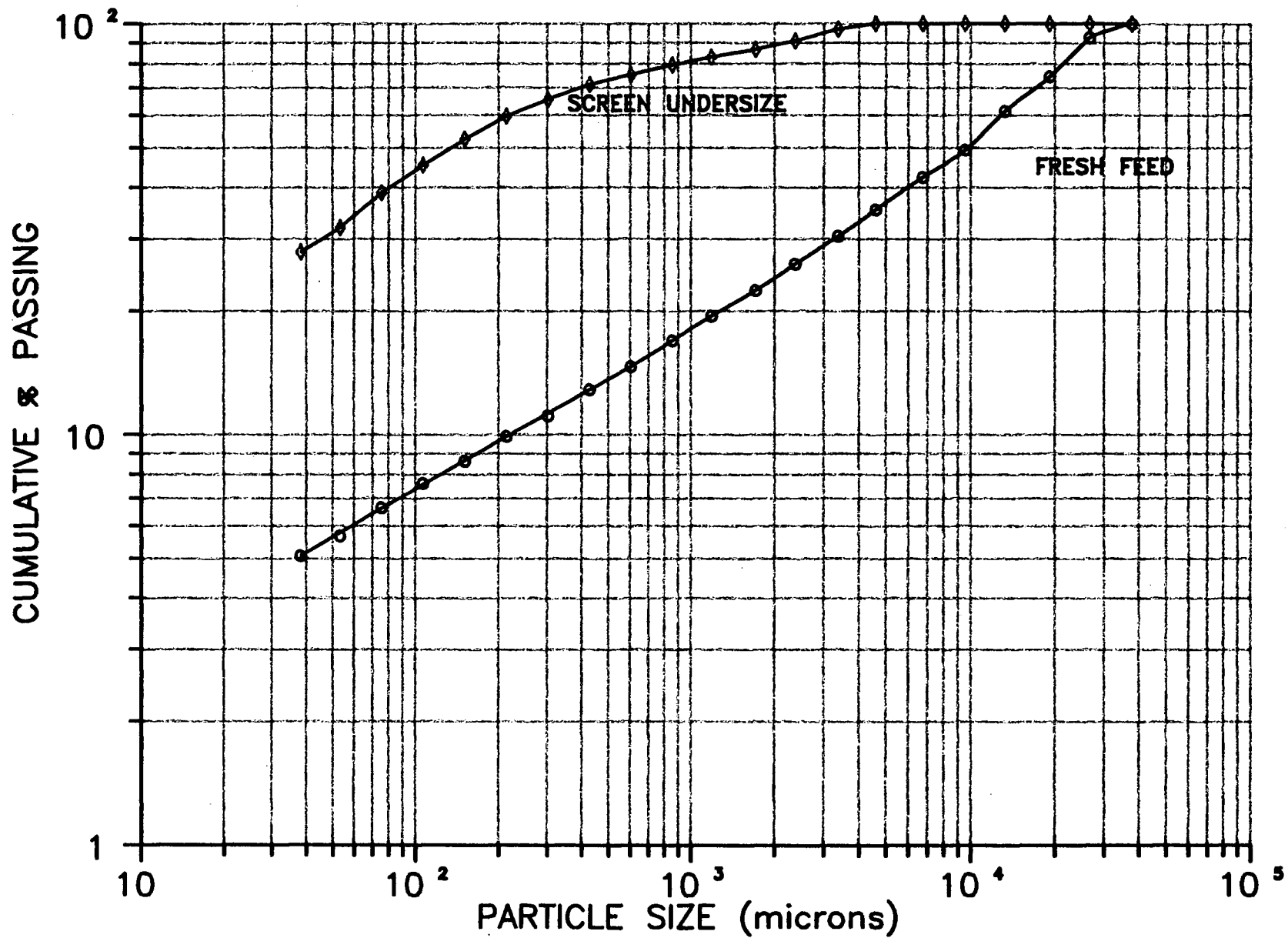
CUMULATIVE % PASSING



SIZE DISTRIBUTIONS LORNEX RUN 23

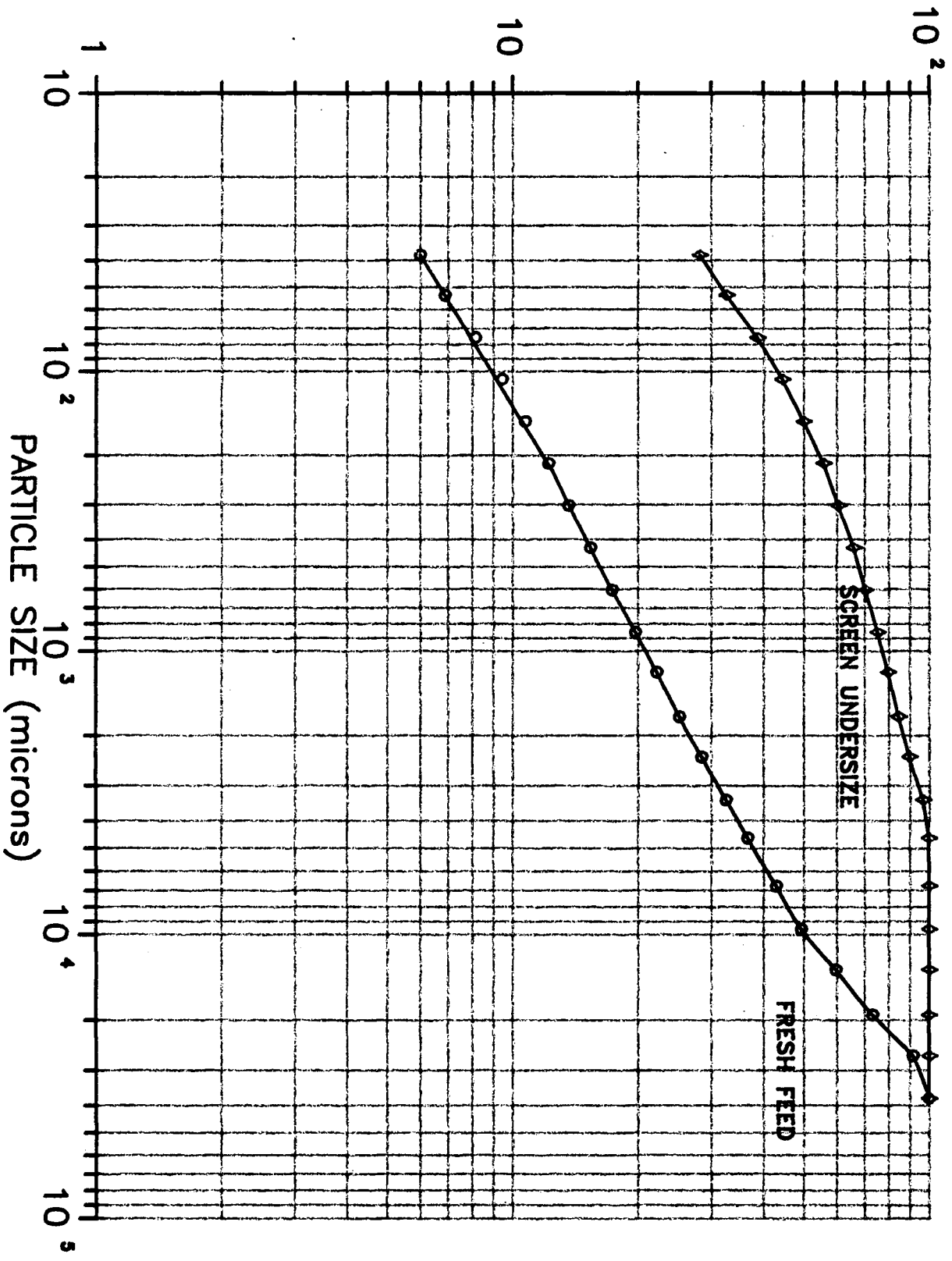


SIZE DISTRIBUTIONS LORNEK RUN 24

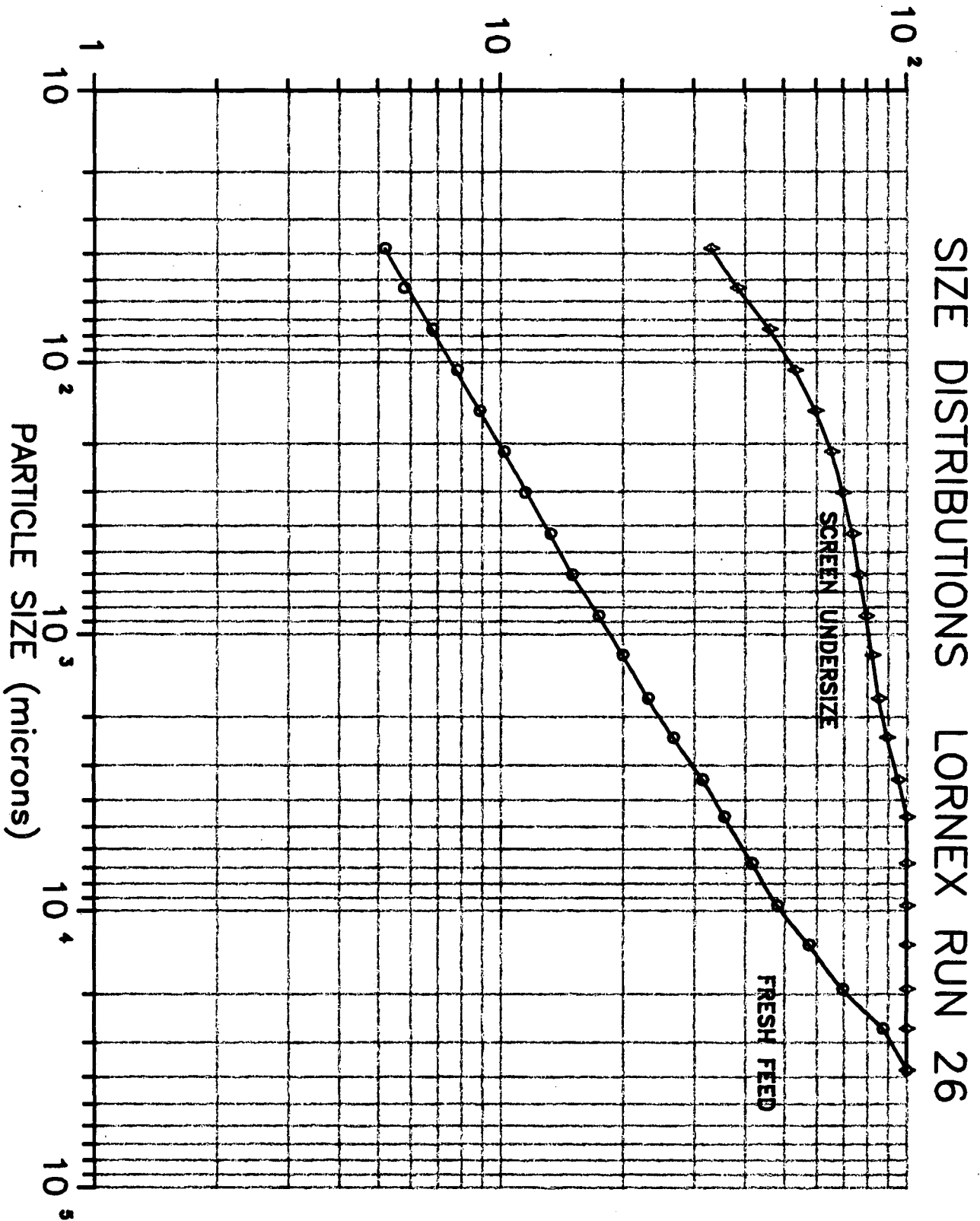


CUMULATIVE % PASSING

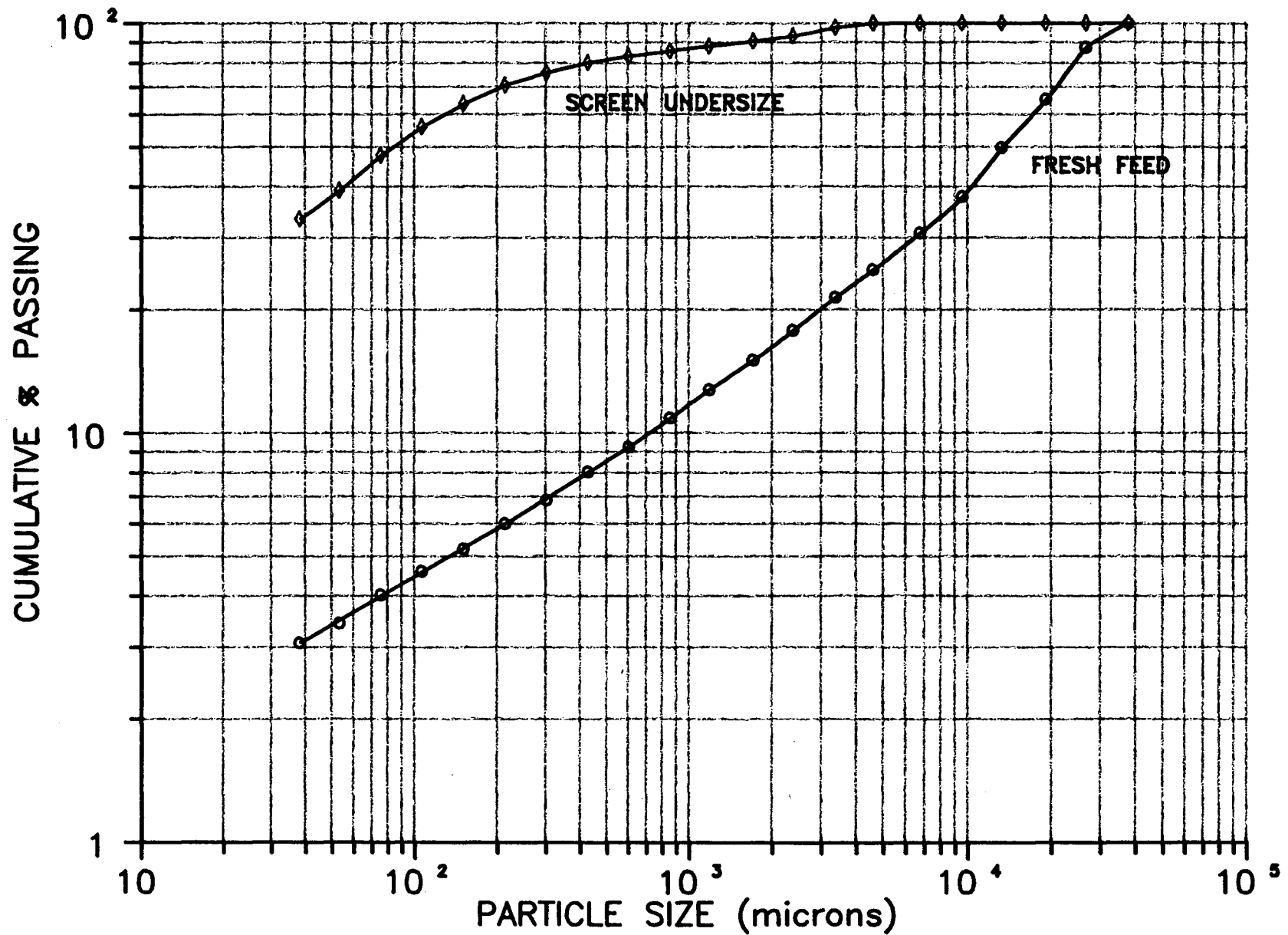
SIZE DISTRIBUTIONS LORNEX RUN 25



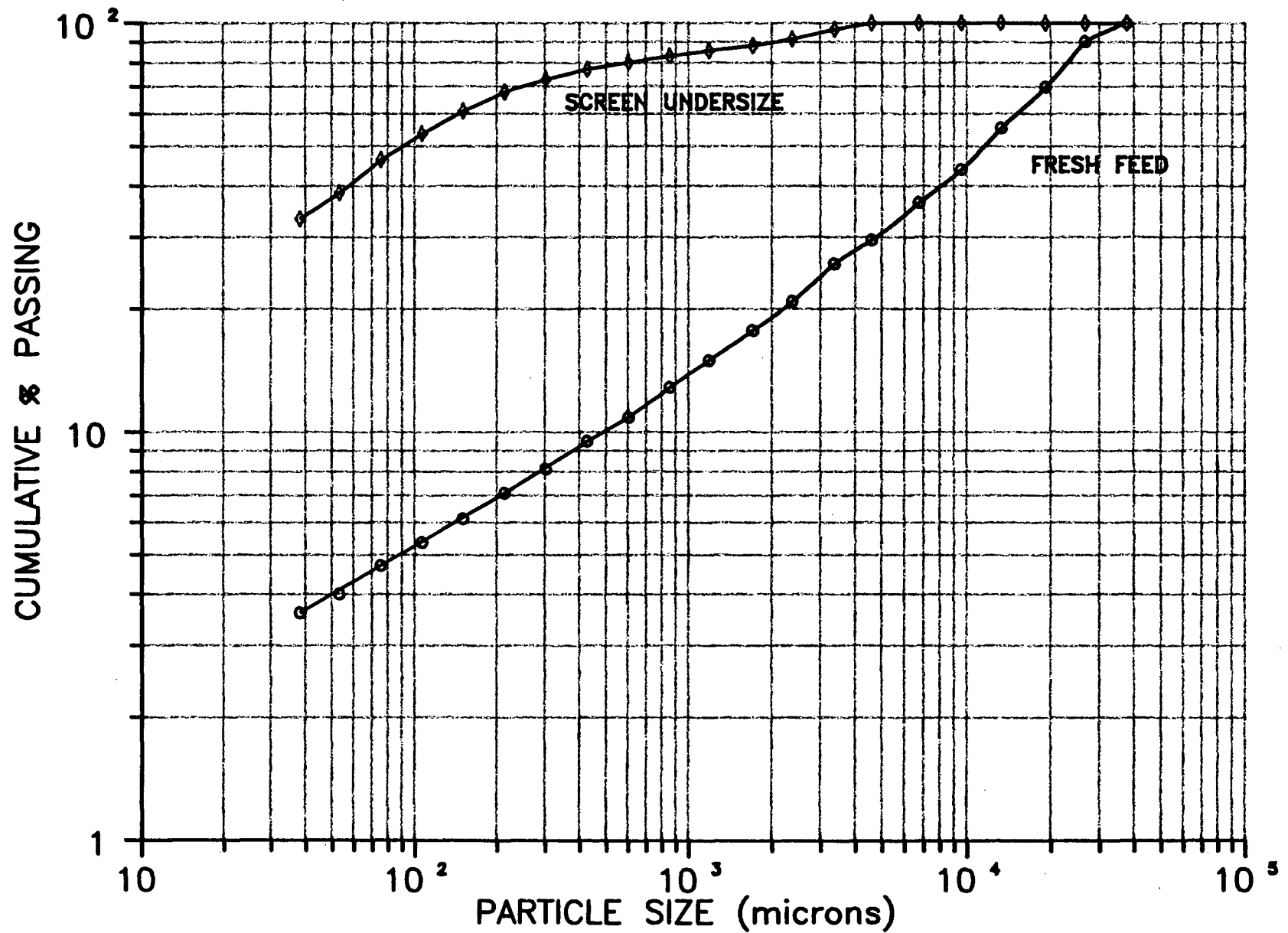
CUMULATIVE % PASSING



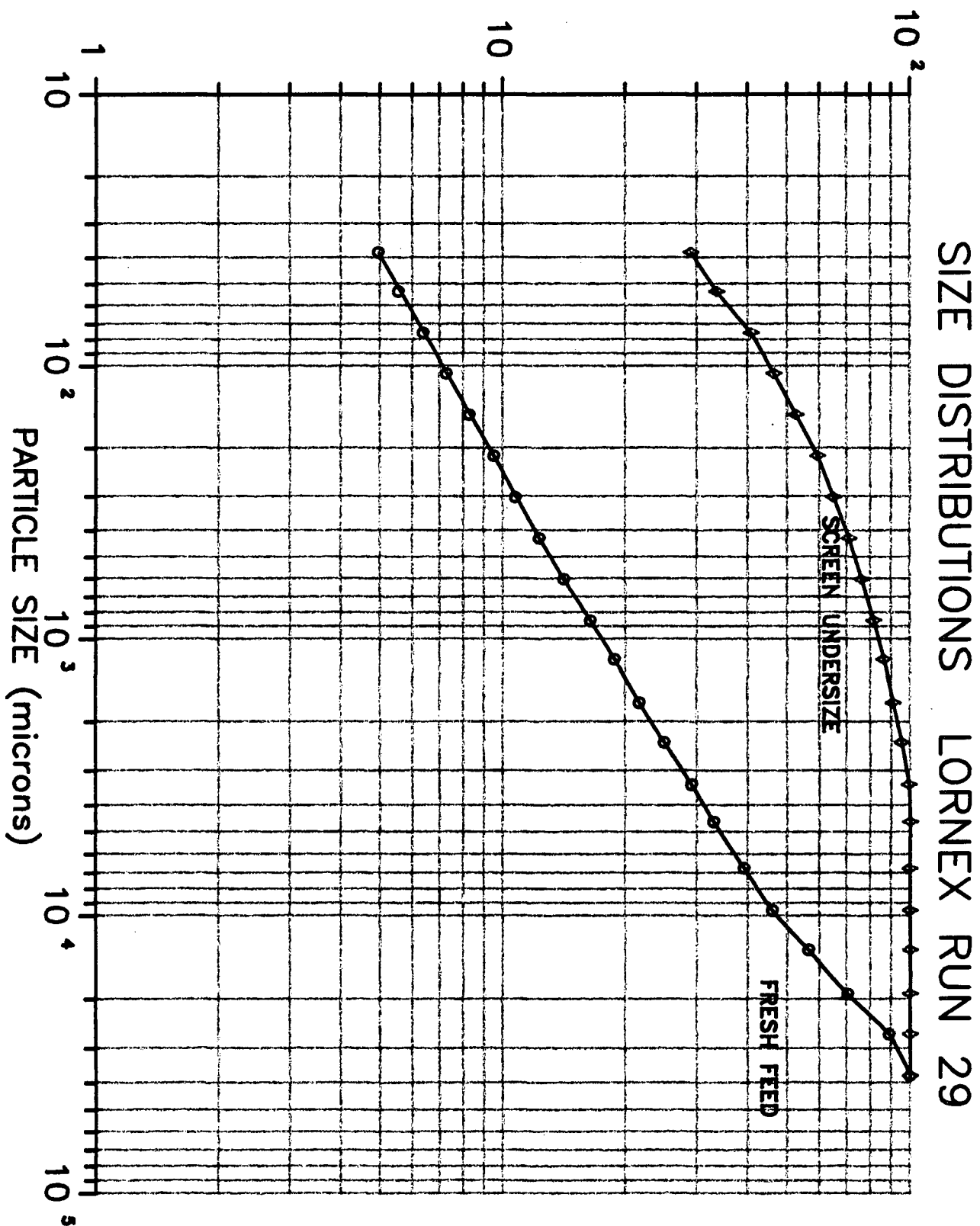
SIZE DISTRIBUTIONS LORNEK RUN 27



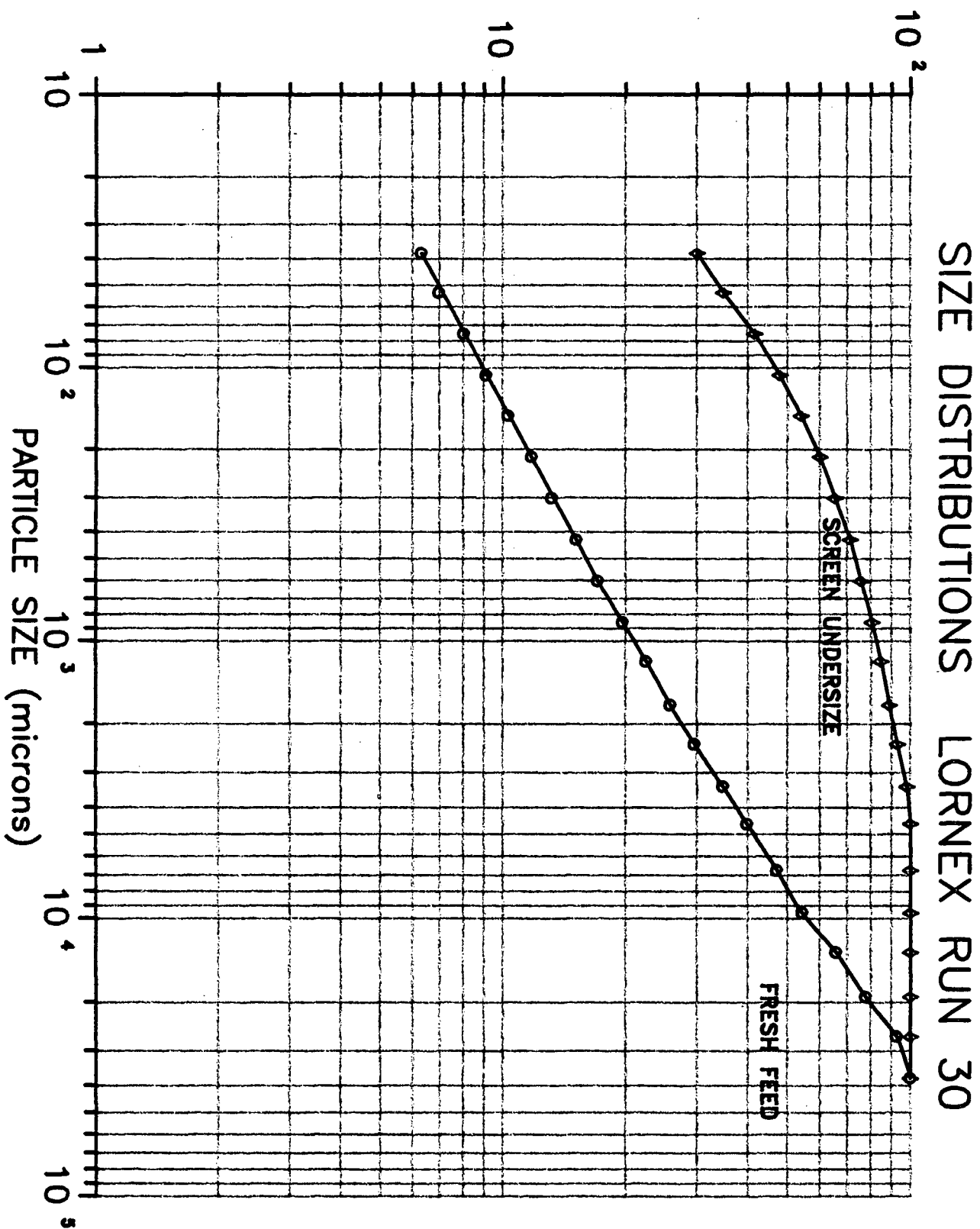
SIZE DISTRIBUTIONS LORNEX RUN 28



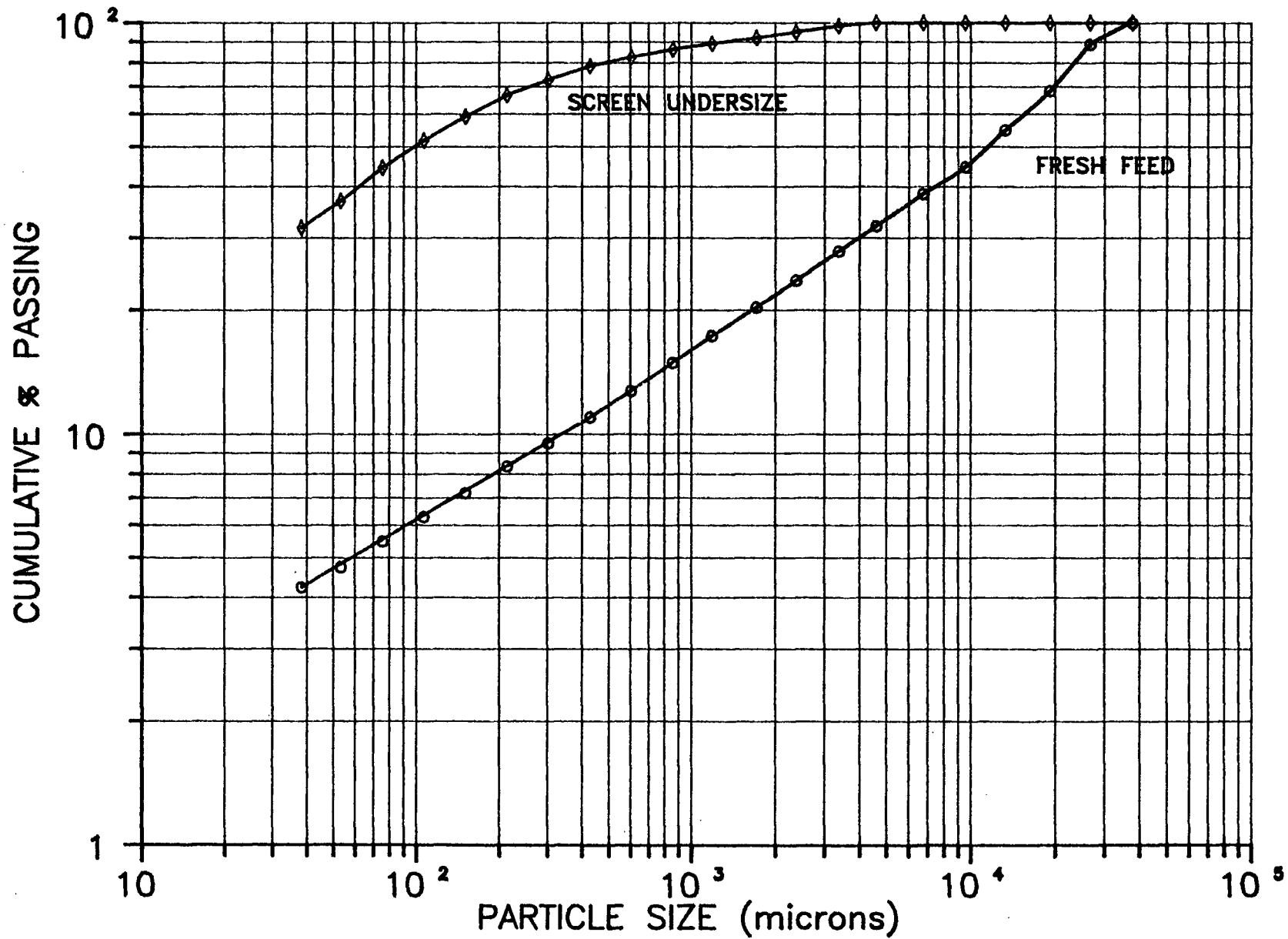
CUMULATIVE % PASSING



CUMULATIVE % PASSING



SIZE DISTRIBUTIONS LORNEK RUN 5



APPENDIX VI.

**AFTON MINES: ADJUSTED FULL-SCALE & 60CM DATA
SIZE DISTRIBUTION PLOTS**

MASS BALANCE OF 60CM CIRCUIT AFTON MINES RUN #1

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.31	.30	.77	2.00	.00	.02	100.00	.00
MILL DISCH.	.83	.80	3.02	15.00	.00	.27	100.00	.00
SCREEN FEED	70.90	65.22	8.01	20.00	.00	64.69	100.00	.00
SCR OVERSIZE	.17	.18	5.45	5.00	.00	-.06	100.00	.00
SCR U/FLOW	61.20	65.04	6.27	20.00	.00	64.75	100.00	.00
MILL WATER	.00	.32	100.00	.00	.32	.32	.99	5.00
SUMP WATER	.00	64.42	100.00	.00	58.80	64.42	9.55	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.29	100.00	.00	99.00	93.90	5.15	5.00
MILL DISCH.	.00	.53	100.00	.00	59.54	65.93	10.73	10.00
SCREEN FEED	.00	.53	100.00	.00	1.00	.81	18.92	1000.00
SCR OVERSIZE	.00	.24	100.00	.00	96.00	135.92	41.58	10.00
SCR U/FLOW	.00	.29	100.00	.00	.42	.44	4.38	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	10.81	10.27	5.00	5.00	21.53	22.29	3.51	5.00
6700	22.08	20.64	6.52	5.00	43.19	44.79	3.72	5.00
4570	12.28	12.23	.40	5.00	26.33	26.09	.92	5.00
3350	2.72	3.41	25.46	5.00	6.96	4.85	30.37	5.00
2360	2.73	2.77	1.46	5.00	1.43	1.42	.42	5.00
1700	1.58	1.51	4.16	5.00	.32	.32	.37	5.00
1180	.98	.96	1.81	5.00	.06	.06	.05	5.00
850	1.09	1.03	5.36	5.00	.00	.00	100.00	.00
600	1.31	1.18	9.81	5.00	.00	.00	100.00	.00
425	1.50	1.25	16.60	5.00	.00	.00	100.00	.00
300	1.35	1.41	4.18	5.00	.00	.00	100.00	.00
212	1.75	1.76	.63	5.00	.00	.00	100.00	.00
150	2.26	2.24	.67	5.00	.00	.00	100.00	.00
106	2.46	2.66	8.22	5.00	.00	.00	100.00	.00
75	2.93	3.16	7.94	5.00	.00	.00	100.00	.00
53	3.42	3.75	9.65	5.00	.00	.00	100.00	.00
38	3.20	3.41	6.64	5.00	.00	.00	100.00	.00
-38	25.55	26.34	3.07	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.39	.39	.07	5.00
3350	2.49	2.19	12.17	5.00
2360	3.94	3.92	.51	5.00
1700	2.44	2.53	3.85	5.00
1180	1.70	1.73	1.96	5.00
850	1.82	1.91	5.11	5.00
600	2.02	2.19	8.47	5.00
425	2.06	2.32	12.62	5.00
300	2.72	2.61	4.11	5.00
212	3.27	3.27	.12	5.00
150	4.11	4.16	1.30	5.00
106	5.42	4.94	8.91	5.00
75	6.40	5.87	8.35	5.00
53	7.78	6.95	10.61	5.00
38	6.77	6.33	6.51	5.00
-38	46.67	48.69	4.32	5.00

MASS BALANCE OF 60CM CIRCUIT AFTON MINES RUN #2

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.29	.28	2.70	5.00	.00	.01	100.00	.00
MILL DISCH.	.77	.78	2.20	15.00	.00	.30	100.00	.00
SCREEN FEED	66.69	62.18	6.76	20.00	.00	61.70	100.00	.00
SCR OVERSIZE	.19	.20	2.93	5.00	.00	-.01	100.00	.00
SCR U/FLOW	58.50	61.98	5.95	20.00	.00	61.71	100.00	.00
MILL WATER	.00	.30	100.00	.00	.30	.30	.31	5.00
SUMP WATER	.00	61.40	100.00	.00	63.60	61.40	3.46	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.27	100.00	.00	99.00	96.27	2.75	5.00
MILL DISCH.	.00	.48	100.00	.00	58.72	61.43	4.62	10.00
SCREEN FEED	.00	.48	100.00	.00	1.00	.77	22.66	1000.00
SCR OVERSIZE	.00	.21	100.00	.00	93.00	106.75	14.79	10.00
SCR U/FLOW	.00	.27	100.00	.00	.44	.43	1.42	20.00

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	10.55	9.58	9.22	5.00	20.30	21.72	6.99	5.00
6700	19.16	18.89	1.41	5.00	43.00	42.84	.37	5.00
4570	11.63	11.48	1.26	5.00	26.00	26.04	.17	5.00
3350	3.91	4.62	18.04	5.00	7.90	6.60	16.40	5.00
2360	2.43	2.44	.58	5.00	2.13	2.12	.31	5.00
1700	1.31	1.33	1.50	5.00	.21	.21	.11	5.00
1180	1.15	1.04	9.97	5.00	.10	.10	.38	5.00
850	.87	.92	5.83	5.00	.00	.00	100.00	.00
600	1.02	1.03	.78	5.00	.00	.00	100.00	.00
425	1.55	1.32	14.75	5.00	.00	.00	100.00	.00
300	1.46	1.55	5.84	5.00	.00	.00	100.00	.00
212	1.81	1.77	2.41	5.00	.00	.00	100.00	.00
150	2.77	2.69	2.93	5.00	.00	.00	100.00	.00
106	3.12	3.09	1.03	5.00	.00	.00	100.00	.00
75	3.61	4.00	10.67	5.00	.00	.00	100.00	.00
53	4.34	4.34	.10	5.00	.00	.00	100.00	.00
38	4.05	4.04	.17	5.00	.00	.00	100.00	.00
-38	25.26	25.89	2.51	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	3.32	3.05	8.24	5.00
2360	2.70	2.70	.10	5.00
1700	2.24	2.21	1.21	5.00
1180	1.64	1.77	8.10	5.00
850	1.76	1.65	6.42	5.00
600	1.85	1.84	.61	5.00
425	2.12	2.36	11.49	5.00
300	2.95	2.76	6.31	5.00
212	3.08	3.16	2.59	5.00
150	4.66	4.81	3.21	5.00
106	5.44	5.52	1.53	5.00
75	8.19	7.15	12.74	5.00
53	7.69	7.76	.85	5.00
38	7.17	7.23	.86	5.00
-38	45.19	46.03	1.86	5.00

MASS BALANCE OF 60CM CIRCUIT AFTON MINES RUN #8

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.68	.63	7.78	5.00	.00	.01	100.00	.00
MILL DISCH.	2.04	1.95	4.37	10.00	.00	.50	100.00	.00
SCREEN FEED	61.70	56.41	8.57	20.00	.00	54.96	100.00	.00
SCR OVERSIZE	.54	.58	6.84	5.00	.00	-.27	100.00	.00
SCR U/FLOW	57.30	55.83	2.56	20.00	.00	55.22	100.00	.00
MILL WATER	.00	.75	100.00	.00	.73	.75	2.12	5.00
SUMP WATER	.00	54.46	100.00	.00	60.00	54.46	9.23	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.61	100.00	.00	99.00	97.62	1.40	2.00
MILL DISCH.	.00	1.45	100.00	.00	56.23	74.56	32.60	10.00
SCREEN FEED	.00	1.45	100.00	.00	1.00	2.58	157.86	1000.00
SCR OVERSIZE	.00	.84	100.00	.00	96.00	145.79	51.86	10.00
SCR U/FLOW	.00	.61	100.00	.00	1.23	1.09	11.12	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	5.10	4.04	20.77	5.00	6.05	6.96	15.07	5.00
6700	21.56	22.47	4.21	5.00	38.50	38.71	.55	5.00
4570	20.85	22.33	7.12	5.00	38.85	37.79	2.74	5.00
3350	10.49	10.88	3.69	5.00	13.37	13.23	1.02	5.00
2360	5.26	4.88	7.15	5.00	2.76	2.83	2.53	5.00
1700	2.65	2.38	10.30	5.00	.47	.48	1.12	5.00
1180	1.64	1.33	18.93	5.00	.00	.00	100.00	.00
850	1.95	1.61	17.62	5.00	.00	.00	100.00	.00
600	2.10	1.74	17.30	5.00	.00	.00	100.00	.00
425	1.34	1.43	7.04	5.00	.00	.00	100.00	.00
300	1.61	1.77	10.07	5.00	.00	.00	100.00	.00
212	1.43	1.58	10.15	5.00	.00	.00	100.00	.00
150	1.79	1.93	7.63	5.00	.00	.00	100.00	.00
106	1.57	1.74	10.52	5.00	.00	.00	100.00	.00
75	1.75	1.99	13.98	5.00	.00	.00	100.00	.00
53	2.22	2.25	1.52	5.00	.00	.00	100.00	.00
38	1.97	2.08	5.73	5.00	.00	.00	100.00	.00
-38	14.72	13.57	7.79	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.96	.96	.12	5.00
3350	7.69	7.62	.96	5.00
2360	7.40	7.73	4.39	5.00
1700	4.65	5.01	7.69	5.00
1180	2.79	3.17	13.57	5.00
850	3.39	3.83	12.93	5.00
600	3.67	4.14	12.77	5.00
425	3.72	3.42	8.11	5.00
300	4.83	4.22	12.56	5.00
212	4.30	3.75	12.70	5.00
150	5.04	4.59	8.90	5.00
106	4.77	4.14	13.31	5.00
75	5.92	4.75	19.70	5.00
53	5.45	5.37	1.44	5.00
38	5.30	4.96	6.34	5.00
-38	30.12	32.35	7.39	5.00

MASS BALANCE OF 60CM CIRCUIT AFTON MINES RUN #9

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.64	.63	.90	5.00	.00	.01	100.00	.00
MILL DISCH.	1.98	1.89	4.63	15.00	.00	.60	100.00	.00
SCREEN FEED	64.35	64.37	.03	20.00	.00	63.08	100.00	.00
SCR OVERSIZE	.54	.56	2.98	5.00	.00	-.10	100.00	.00
SCR U/FLOW	64.50	63.81	1.07	20.00	.00	63.18	100.00	.00
MILL WATER	.00	.70	100.00	.00	.71	.70	1.28	5.00
SUMP WATER	.00	62.48	100.00	.00	58.80	62.48	6.26	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.63	100.00	.00	99.00	99.04	.04	2.00
MILL DISCH.	.00	1.29	100.00	.00	87.00	68.15	21.67	15.00
SCREEN FEED	.00	1.29	100.00	.00	1.00	2.00	99.93	1000.00
SCR OVERSIZE	.00	.66	100.00	.00	94.00	118.33	25.89	10.00
SCR U/FLOW	.00	.63	100.00	.00	.96	.98	2.06	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	3.22	3.33	3.38	5.00	5.16	6.47	25.46	10.00
6700	15.97	24.53	53.59	5.00	44.02	47.70	8.37	10.00
4570	13.49	19.95	47.87	5.00	41.72	38.12	8.63	10.00
3350	6.23	7.96	27.75	5.00	8.21	6.82	16.98	10.00
2360	3.46	3.89	12.56	5.00	.67	.67	.25	10.00
1700	1.87	2.01	7.38	5.00	.22	.22	.23	10.00
1180	1.22	1.30	6.38	5.00	.00	.00	100.00	.00
850	.98	1.14	16.35	5.00	.00	.00	100.00	.00
600	.11	.12	6.72	5.00	.00	.00	100.00	.00
425	1.42	1.56	10.15	5.00	.00	.00	100.00	.00
300	2.77	2.67	3.64	5.00	.00	.00	100.00	.00
212	1.58	1.89	19.74	5.00	.00	.00	100.00	.00
150	1.76	1.99	13.25	5.00	.00	.00	100.00	.00
106	1.80	2.08	15.53	5.00	.00	.00	100.00	.00
75	1.68	1.94	15.62	5.00	.00	.00	100.00	.00
53	1.83	2.11	15.28	5.00	.00	.00	100.00	.00
38	1.40	1.62	15.71	5.00	.00	.00	100.00	.00
-38	39.21	19.91	49.22	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.72	.72	.67	5.00
3350	10.76	9.17	14.79	5.00
2360	7.92	7.31	7.72	5.00
1700	4.09	3.90	4.62	5.00
1180	2.81	2.67	4.93	5.00
850	3.01	2.35	22.03	5.00
600	3.20	.24	92.45	5.00
425	3.56	3.22	9.56	5.00
300	5.12	5.49	7.31	5.00
212	5.48	3.89	28.94	5.00
150	4.75	4.10	13.63	5.00
106	5.20	4.28	17.69	5.00
75	4.89	4.00	18.24	5.00
53	5.24	4.34	17.13	5.00
38	4.13	3.33	19.26	5.00
-38	29.12	40.98	40.73	5.00

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	2.97	3.04	2.27	5.00	.00	-.02	100.00	.00
MILL DISCH.	.00	4.40	100.00	.00	.00	1.19	100.00	.00
SCREEN FEED	.00	5.18	100.00	.00	.00	1.97	100.00	.00
SCR OVERSIZE	.00	.19	100.00	.00	.00	.04	100.00	.00
SCR U/FLOW	.00	4.99	100.00	.00	.00	1.94	100.00	.00
MILL WATER	.00	1.17	100.00	.00	1.18	1.17	.92	5.00
PBOX WATER	.00	.79	100.00	.00	1.00	.79	21.46	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	3.06	100.00	.00	98.85	100.58	1.75	3.00
MILL DISCH.	.00	3.21	100.00	.00	71.13	72.98	2.60	5.00
SCREEN FEED	.00	3.21	100.00	.00	63.48	61.92	2.46	5.00
SCR OVERSIZE	.00	.15	100.00	.00	80.91	80.87	.05	10.00
SCR U/FLOW	.00	3.06	100.00	.00	63.67	61.20	3.88	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCREEN FEED			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.08	100.00	20.00	.08	.08	4.81	20.00
13200	.10	.17	72.91	20.00	.28	.17	38.25	20.00
9500	.50	1.30	159.93	20.00	1.27	1.30	2.34	20.00
6700	.60	1.42	136.29	20.00	1.13	1.42	25.46	20.00
4750	1.29	2.27	75.91	20.00	1.92	2.27	18.19	20.00
3350	1.61	2.14	33.11	20.00	1.92	2.14	11.62	20.00
2360	2.39	2.50	4.54	5.00	2.50	2.50	.06	5.00
1700	2.50	2.55	2.10	5.00	2.53	2.55	.89	5.00
1180	3.36	3.26	3.10	5.00	3.13	3.26	4.02	5.00
850	3.90	3.83	1.77	5.00	3.77	3.83	1.61	5.00
600	4.94	4.73	4.15	5.00	4.57	4.73	3.61	5.00
425	4.74	4.63	2.26	5.00	4.42	4.63	4.82	5.00
300	7.52	7.20	4.21	5.00	7.22	7.20	.23	5.00
212	5.04	4.90	2.70	5.00	4.93	4.90	.53	5.00
150	6.68	6.60	1.17	5.00	6.52	6.60	1.26	5.00
106	5.88	5.64	4.01	5.00	5.82	5.64	3.02	5.00
75	5.29	5.17	2.19	5.00	5.22	5.17	.88	5.00
53	7.15	6.69	6.45	5.00	6.97	6.69	4.03	5.00
38	3.88	3.88	.08	5.00	3.85	3.88	.86	5.00
-38	32.63	31.01	4.97	5.00	31.95	31.01	2.95	5.00

STREAMS	SCR OVERSIZE				SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	1.63	1.76	8.02	15.00	.00	.00	100.00	.00
13200	7.45	2.27	69.59	15.00	.07	.07	2.48	5.00
9500	17.26	11.04	36.01	15.00	1.01	.81	19.56	5.00
6700	12.48	12.24	1.96	15.00	1.04	.88	15.69	5.00
4750	11.81	18.37	55.52	15.00	1.57	1.46	6.73	5.00
3350	7.38	10.55	42.93	15.00	1.78	1.72	3.21	5.00
2360	5.00	5.16	3.18	5.00	2.49	2.37	5.00	5.00
1700	2.64	2.69	1.77	5.00	2.64	2.55	3.57	5.00
1180	2.04	2.07	1.44	5.00	3.38	3.32	1.92	5.00
850	1.64	1.66	1.19	5.00	3.97	3.94	.77	5.00
600	1.65	1.67	1.20	5.00	4.93	4.89	.85	5.00
425	1.49	1.51	1.04	5.00	4.99	4.79	4.02	5.00
300	2.39	2.43	1.80	5.00	7.26	7.44	2.50	5.00
212	1.61	1.63	1.22	5.00	4.97	5.07	1.96	5.00
150	2.10	2.13	1.52	5.00	6.94	6.83	1.65	5.00
106	2.02	2.05	1.58	5.00	5.54	5.82	5.12	5.00
75	1.99	2.02	1.50	5.00	5.24	5.33	1.75	5.00
53	2.66	2.72	2.12	5.00	6.40	6.89	7.62	5.00
38	1.62	1.64	1.16	5.00	4.07	4.00	1.84	5.00
-38	13.11	14.38	9.67	5.00	31.68	31.81	.41	5.00

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	4.92	5.09	3.51	5.00	.00	-.11	100.00	.00
MILL DISCH.	.00	8.50	100.00	.00	.00	2.69	100.00	.00
SCREEN FEED	.00	9.37	100.00	.00	.00	3.57	100.00	.00
SCR OVERSIZE	.00	.72	100.00	.00	.00	.12	100.00	.00
SCR U/FLOW	.00	8.65	100.00	.00	.00	3.45	100.00	.00
MILL WATER	.00	2.68	100.00	.00	2.75	2.68	2.59	5.00
PBOX WATER	.00	.88	100.00	.00	1.00	.88	12.02	20.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	5.21	100.00	.00	99.02	102.22	3.23	3.00
MILL DISCH.	.00	5.81	100.00	.00	72.55	68.37	5.76	10.00
SCREEN FEED	.00	5.81	100.00	.00	63.74	61.95	2.80	5.00
SCR OVERSIZE	.00	.60	100.00	.00	82.93	83.24	.37	5.00
SCR U/FLOW	.00	5.21	100.00	.00	62.36	60.17	3.51	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCREEN FEED			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.52	100.00	20.00	.00	.52	100.00	20.00
13200	2.94	1.10	62.73	20.00	.73	1.10	50.08	20.00
9500	3.52	2.81	20.08	20.00	2.05	2.81	37.22	20.00
6700	2.81	2.58	8.36	20.00	2.52	2.58	2.18	20.00
4750	4.66	3.41	26.72	20.00	3.52	3.41	2.99	20.00
3350	4.09	3.45	15.68	20.00	3.56	3.45	3.13	20.00
2360	4.85	4.86	.29	5.00	4.94	4.86	1.54	5.00
1700	4.93	4.99	1.16	5.00	5.06	4.99	1.44	5.00
1180	5.92	6.07	2.51	5.00	6.31	6.07	3.82	5.00
850	5.06	5.41	6.87	5.00	6.08	5.41	11.06	5.00
600	6.28	6.32	.64	5.00	6.04	6.32	4.64	5.00
425	5.95	6.00	.90	5.00	5.69	6.00	5.51	5.00
300	5.57	5.88	5.60	5.00	6.11	5.88	3.73	5.00
212	4.39	4.61	5.03	5.00	4.63	4.61	.41	5.00
150	4.43	4.76	7.49	5.00	4.72	4.76	.88	5.00
106	3.49	3.48	.41	5.00	3.35	3.48	3.76	5.00
75	3.15	3.25	3.26	5.00	3.58	3.25	9.14	5.00
53	4.25	4.14	2.57	5.00	4.03	4.14	2.75	5.00
38	2.21	2.35	6.38	5.00	2.38	2.35	1.21	5.00
-38	18.54	21.04	13.50	5.00	20.76	20.06	3.36	5.00

STREAMS	SCR OVERSIZE				SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	4.84	5.04	-4.12	15.00	.00	.00	100.00	.00
13200	14.66	10.56	27.96	15.00	.00	.00	100.00	.00
9500	26.26	27.12	3.27	15.00	.00	.00	100.00	.00
6700	13.97	15.87	13.61	15.00	1.03	1.04	.60	5.00
4750	8.75	9.70	10.81	15.00	2.63	2.69	2.19	5.00
3350	3.71	3.86	4.18	15.00	3.32	3.40	2.42	5.00
2360	2.74	2.75	.33	5.00	4.94	5.11	3.41	5.00
1700	1.68	1.68	.17	5.00	5.23	5.37	2.67	5.00
1180	1.64	1.64	.19	5.00	6.33	6.58	3.97	5.00
850	1.27	1.27	.18	5.00	5.61	5.89	4.92	5.00
600	1.62	1.62	.01	5.00	7.02	6.86	2.22	5.00
425	1.60	1.60	.03	5.00	6.76	6.51	3.65	5.00
300	1.63	1.63	.09	5.00	6.33	6.37	.70	5.00
212	1.31	1.31	.02	5.00	5.12	4.99	2.48	5.00
150	1.49	1.49	.15	5.00	5.51	5.14	6.71	5.00
106	1.22	1.22	.01	5.00	3.80	3.74	1.66	5.00
75	1.03	1.03	.26	5.00	3.31	3.51	6.04	5.00
53	1.60	1.60	.14	5.00	4.36	4.43	1.72	5.00
38	.86	.86	.13	5.00	2.64	2.52	4.40	5.00
-38	7.47	7.49	.27	5.00	22.60	22.38	.98	5.00

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	4.97	5.11	2.87	5.00	.00	-.05	100.00	.00
MILL DISCH.	.00	8.73	100.00	.00	.00	2.77	100.00	.00
SCREEN FEED	.00	9.59	100.00	.00	.00	3.62	100.00	.00
SCR OVERSIZE	.00	.99	100.00	.00	.00	.19	100.00	.00
SCR U/FLOW	.00	8.59	100.00	.00	.00	3.43	100.00	.00
MILL WATER	.00	2.62	100.00	.00	2.68	2.62	2.10	5.00
PBOX WATER	.00	.86	100.00	.00	1.00	.86	14.36	25.00

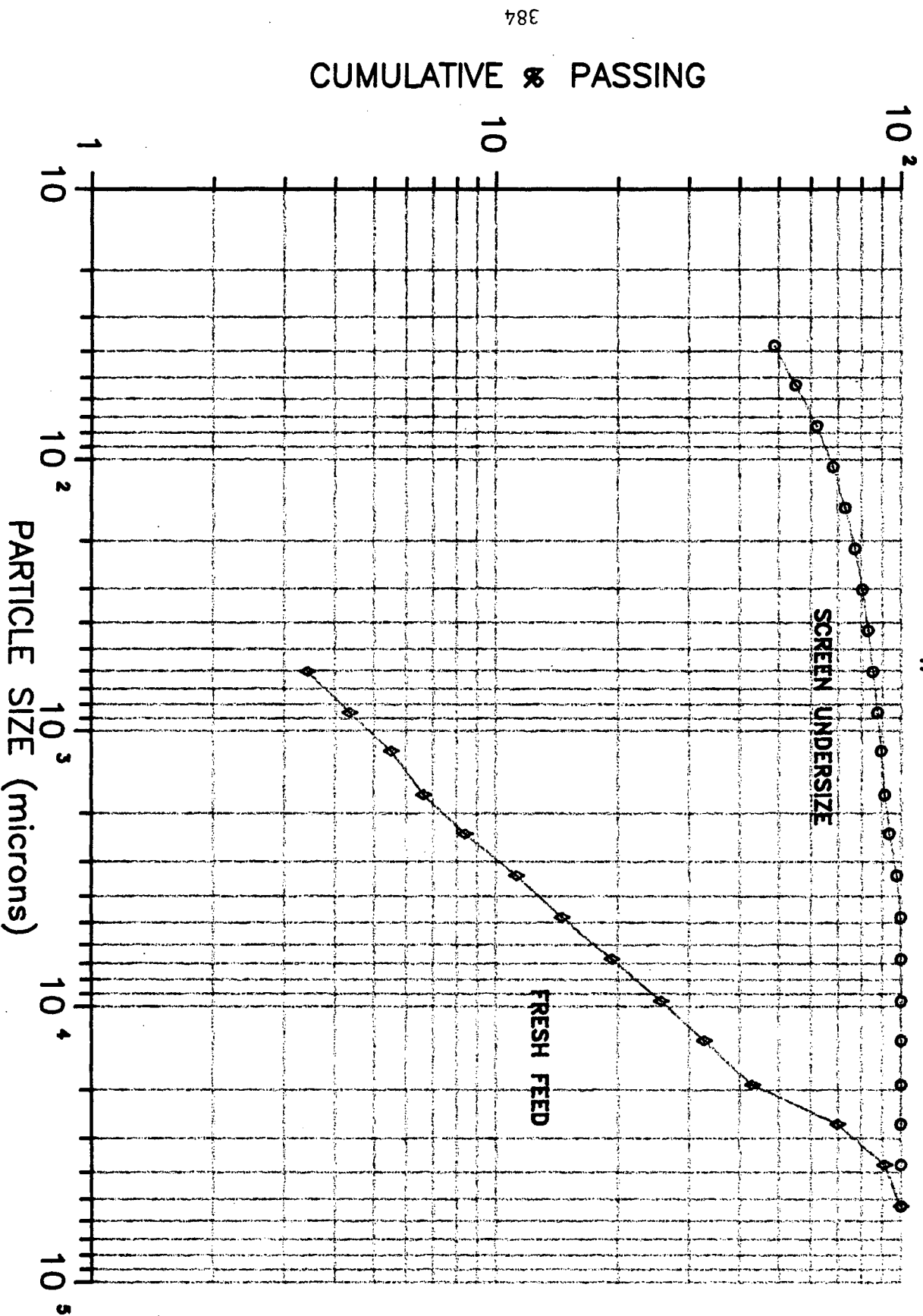
STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	5.16	100.00	.00	98.40	100.99	2.63	3.00
MILL DISCH.	.00	5.96	100.00	.00	72.94	68.30	6.36	10.00
SCREEN FEED	.00	5.96	100.00	.00	63.41	62.20	1.91	5.00
SCR OVERSIZE	.00	.80	100.00	.00	80.14	80.47	.42	5.00
SCR U/FLOW	.00	5.16	100.00	.00	61.93	60.09	2.98	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCREEN FEED			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.49	.42	13.97	20.00	.00	11.44	100.00	20.00
13200	1.87	1.40	25.08	20.00	1.12	1.40	25.10	20.00
9500	3.47	3.16	8.93	20.00	2.57	3.16	22.97	20.00
6700	3.75	3.08	17.78	20.00	2.56	3.08	20.44	20.00
4750	4.54	3.67	19.26	20.00	3.69	3.67	.66	20.00
3350	3.96	3.51	11.33	20.00	3.79	3.51	7.35	20.00
2360	5.24	5.09	2.83	5.00	4.99	5.09	2.04	5.00
1700	5.25	5.00	4.73	5.00	5.11	5.00	2.12	5.00
1180	6.25	6.13	1.85	5.00	6.52	6.13	5.91	5.00
850	5.27	5.46	3.59	5.00	5.92	5.46	7.78	5.00
600	6.43	5.93	7.76	5.00	6.04	5.93	1.80	5.00
425	5.90	5.48	7.08	5.00	5.56	5.48	1.40	5.00
300	5.49	5.61	2.24	5.00	5.95	5.61	5.66	5.00
212	4.20	4.28	1.81	5.00	4.45	4.28	3.91	5.00
150	4.25	4.42	3.89	5.00	4.39	4.42	.57	5.00
106	3.32	3.27	1.50	5.00	3.41	3.27	4.10	5.00
75	2.66	2.83	6.35	5.00	3.10	2.83	8.75	5.00
53	3.93	3.96	.75	5.00	4.19	3.96	5.50	5.00
38	2.14	2.16	1.16	5.00	2.32	2.16	6.69	5.00
-38	18.28	21.82	19.36	5.00	20.03	9.82	50.98	5.00

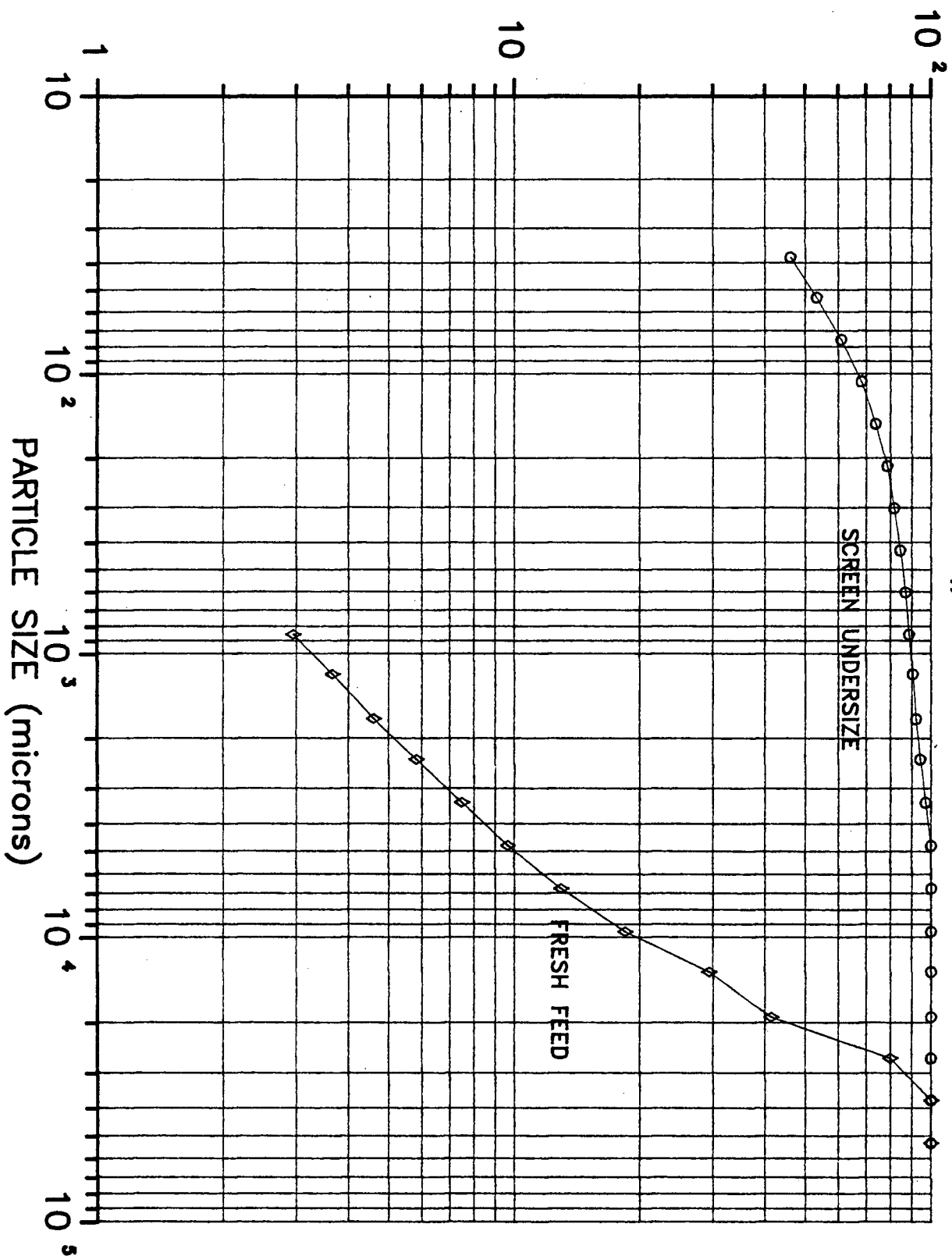
STREAMS	SCR OVERSIZE				SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	2.93	3.14	7.15	15.00	.00	.00	100.00	.00
13200	10.88	10.44	4.04	15.00	.00	.00	100.00	.00
9500	23.33	22.39	4.03	15.00	.18	.18	.24	5.00
6700	14.89	15.03	.94	15.00	1.25	1.23	1.48	5.00
4750	9.88	10.51	6.34	15.00	2.66	2.61	2.05	5.00
3350	4.76	4.91	3.19	15.00	3.38	3.29	2.54	5.00
2360	3.33	3.34	.17	5.00	5.65	5.36	5.07	5.00
1700	2.12	2.13	.45	5.00	5.41	5.45	.69	5.00
1180	2.00	2.01	.39	5.00	6.76	6.77	.21	5.00
850	1.58	1.58	.19	5.00	6.24	6.06	2.88	5.00
600	1.99	2.00	.47	5.00	6.42	6.54	1.88	5.00
425	1.96	1.97	.45	5.00	5.94	6.03	1.46	5.00
300	1.96	1.96	.21	5.00	6.40	6.18	3.46	5.00
212	1.58	1.58	.15	5.00	4.84	4.69	3.02	5.00
150	1.72	1.72	.18	5.00	5.39	4.83	10.33	5.00
106	1.32	1.32	.34	5.00	3.52	3.57	1.48	5.00
75	1.47	1.47	.14	5.00	3.10	3.04	1.96	5.00
53	1.61	1.61	.30	5.00	4.33	4.32	.17	5.00
38	1.01	1.01	.35	5.00	2.29	2.34	2.33	5.00
-38	9.01	9.20	2.11	5.00	21.32	22.57	5.88	5.00

AFTON MINES RUN #1 ADJ. 60CM CCT. DATA

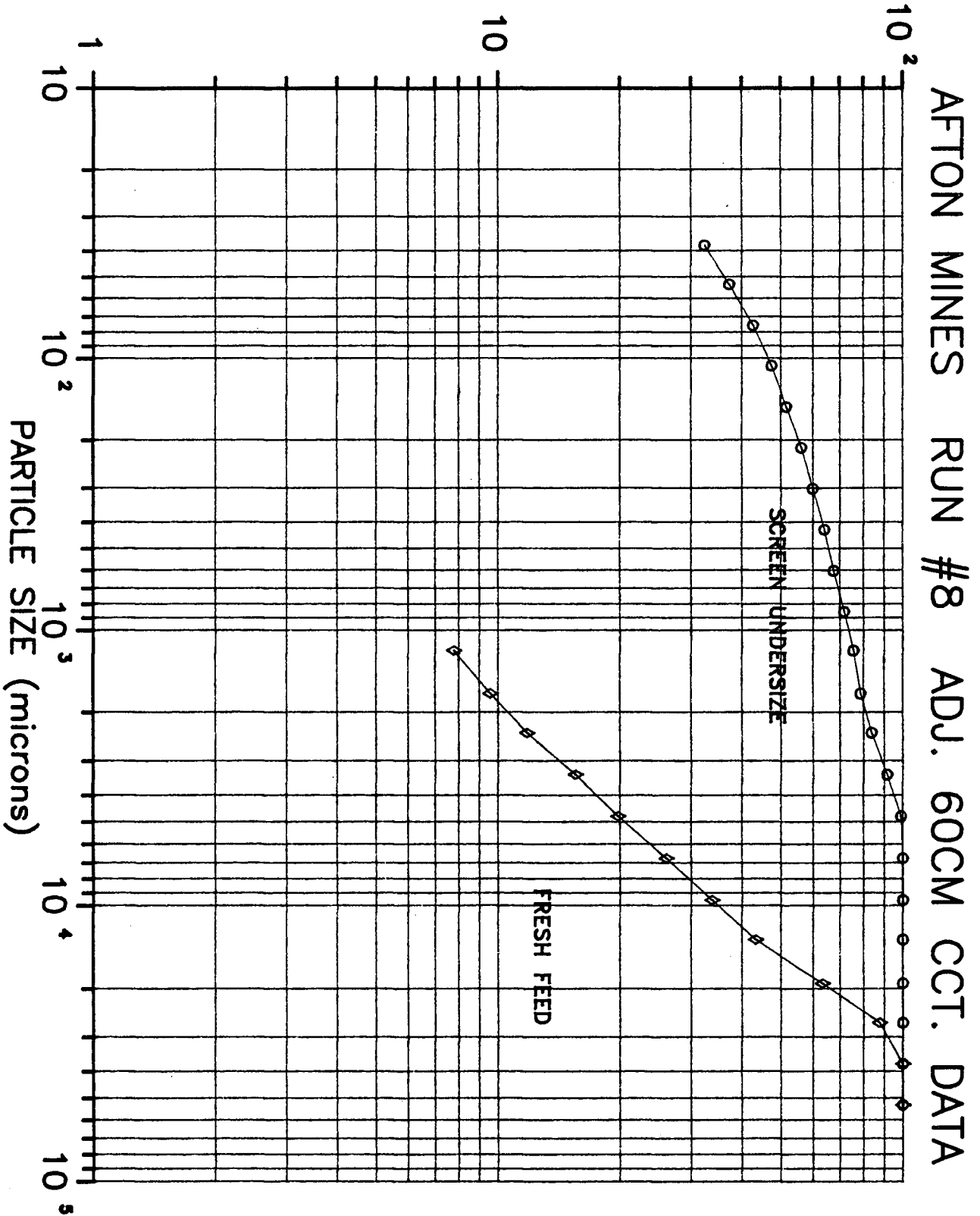


CUMULATIVE % PASSING

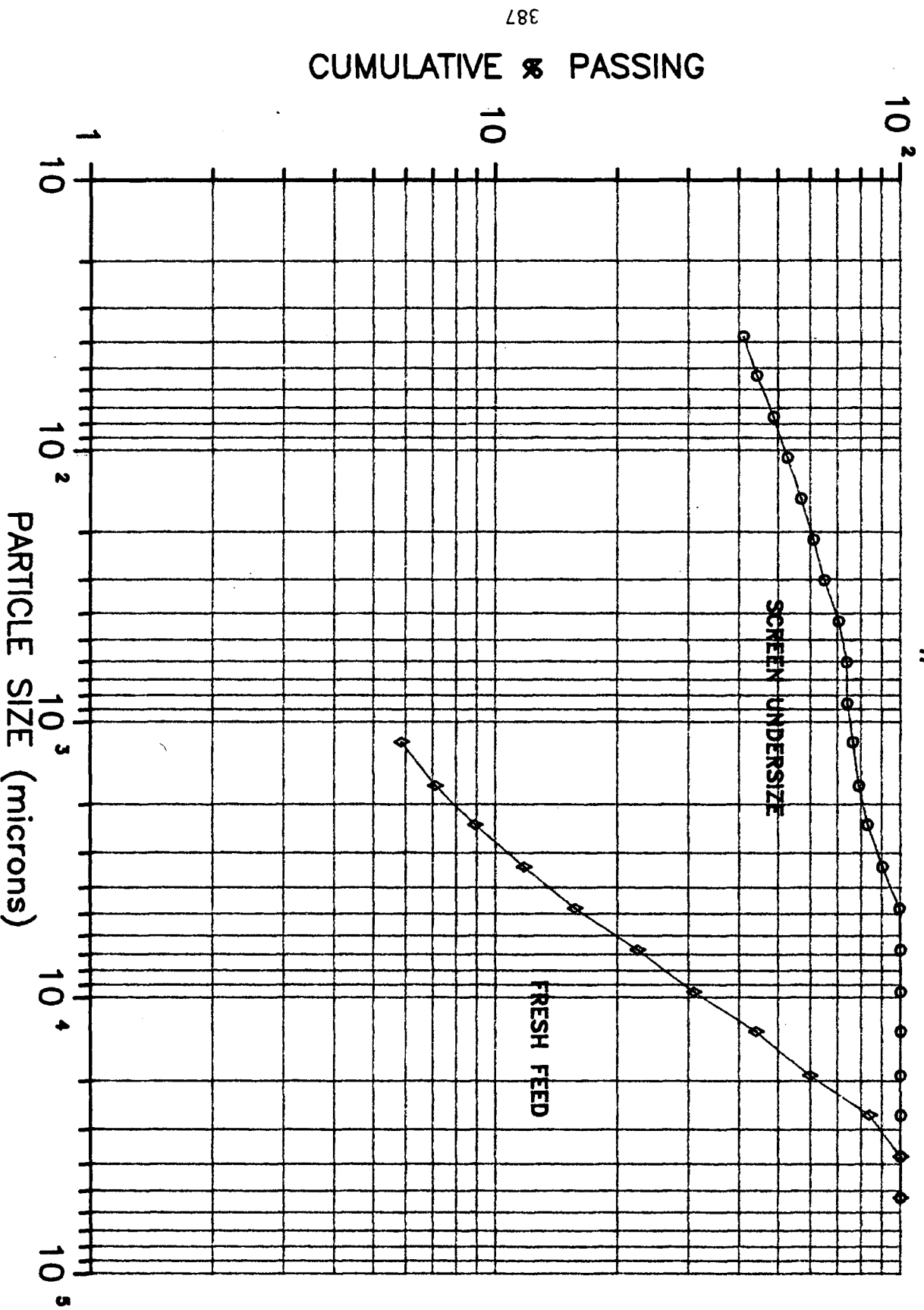
AFTON MINES RUN #2 ADJ. 60CM CCT. DATA



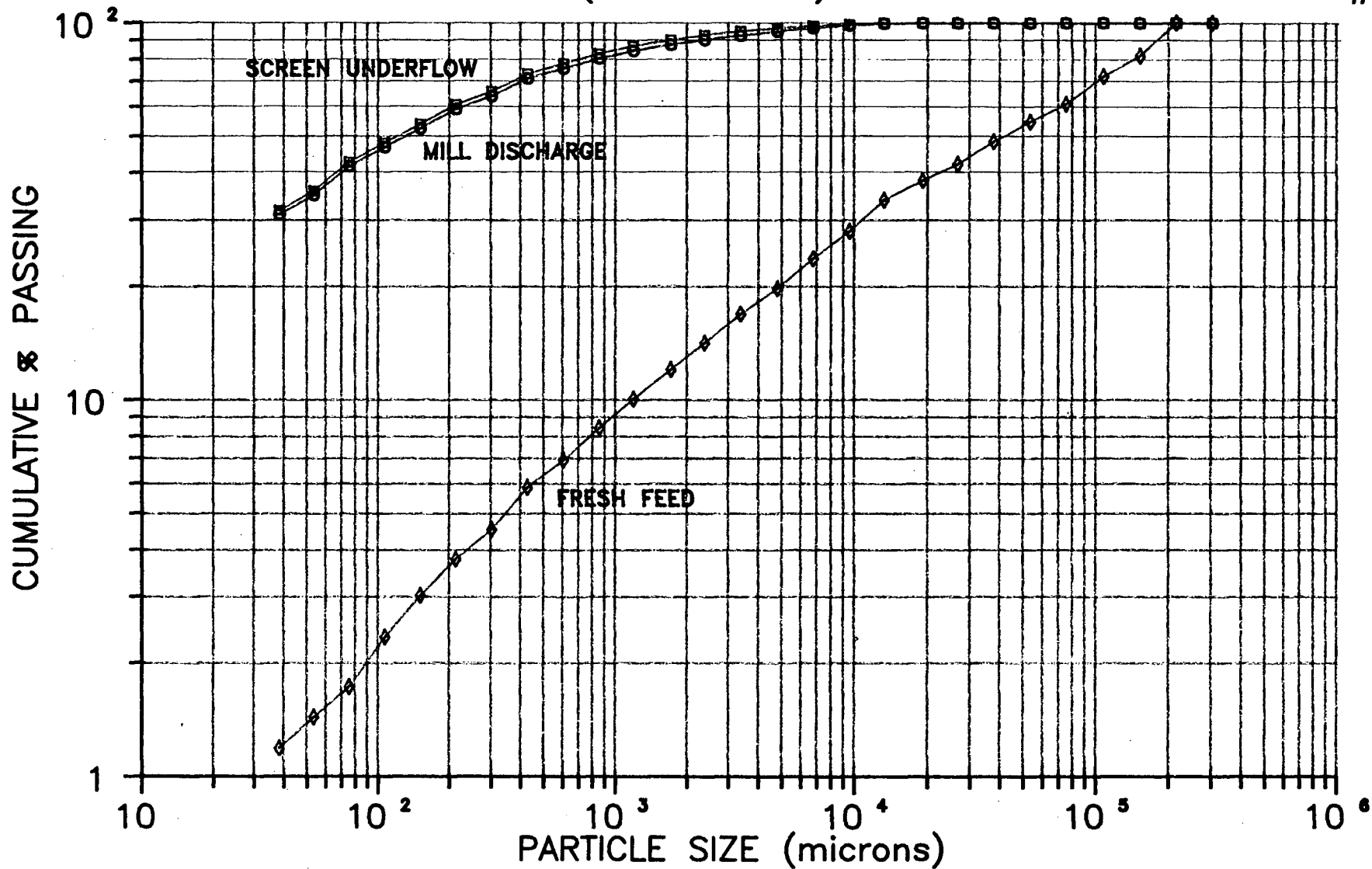
CUMULATIVE % PASSING



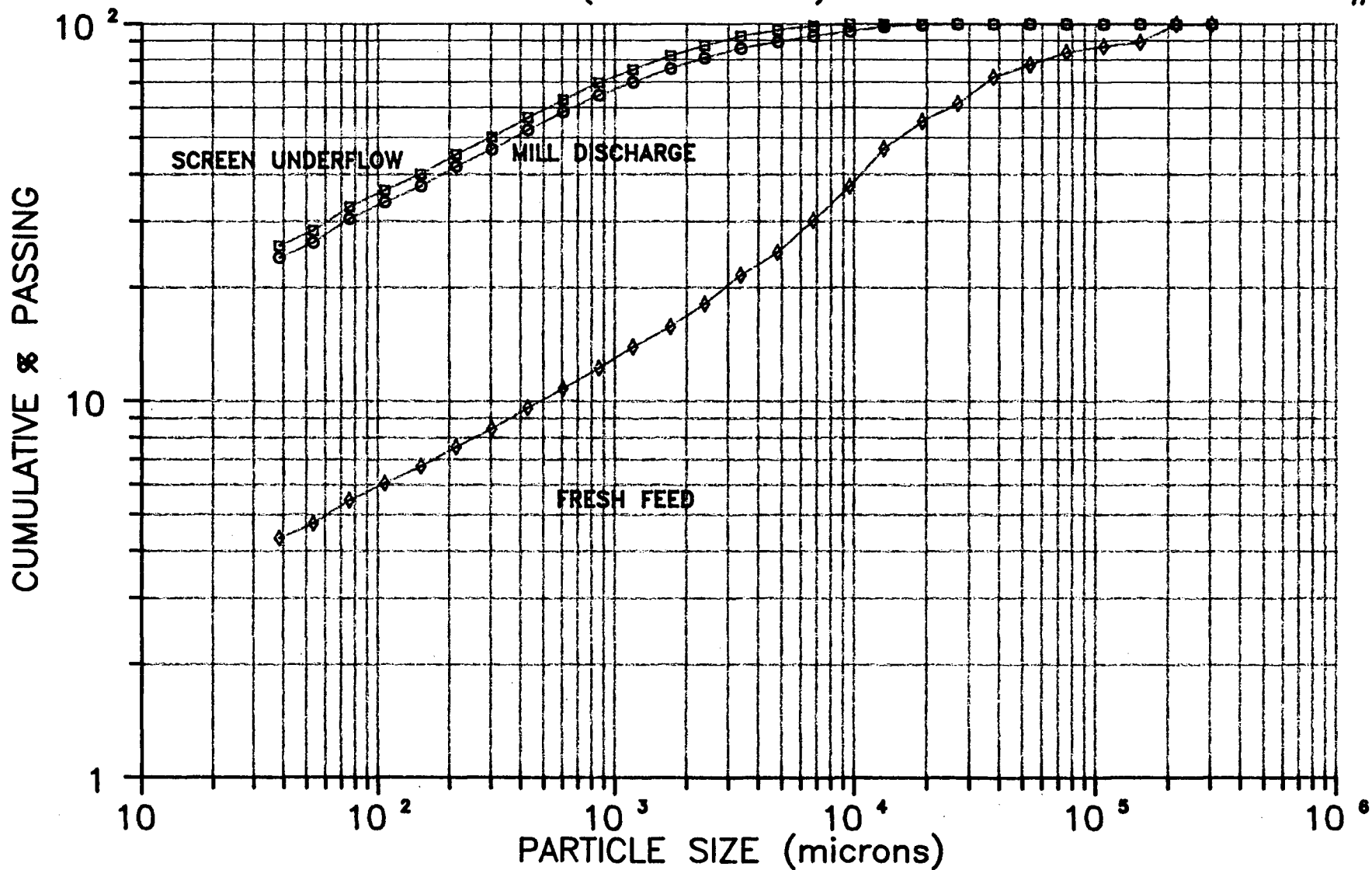
AFTON MINES RUN #9 ADJ. 60CM CCT. DATA



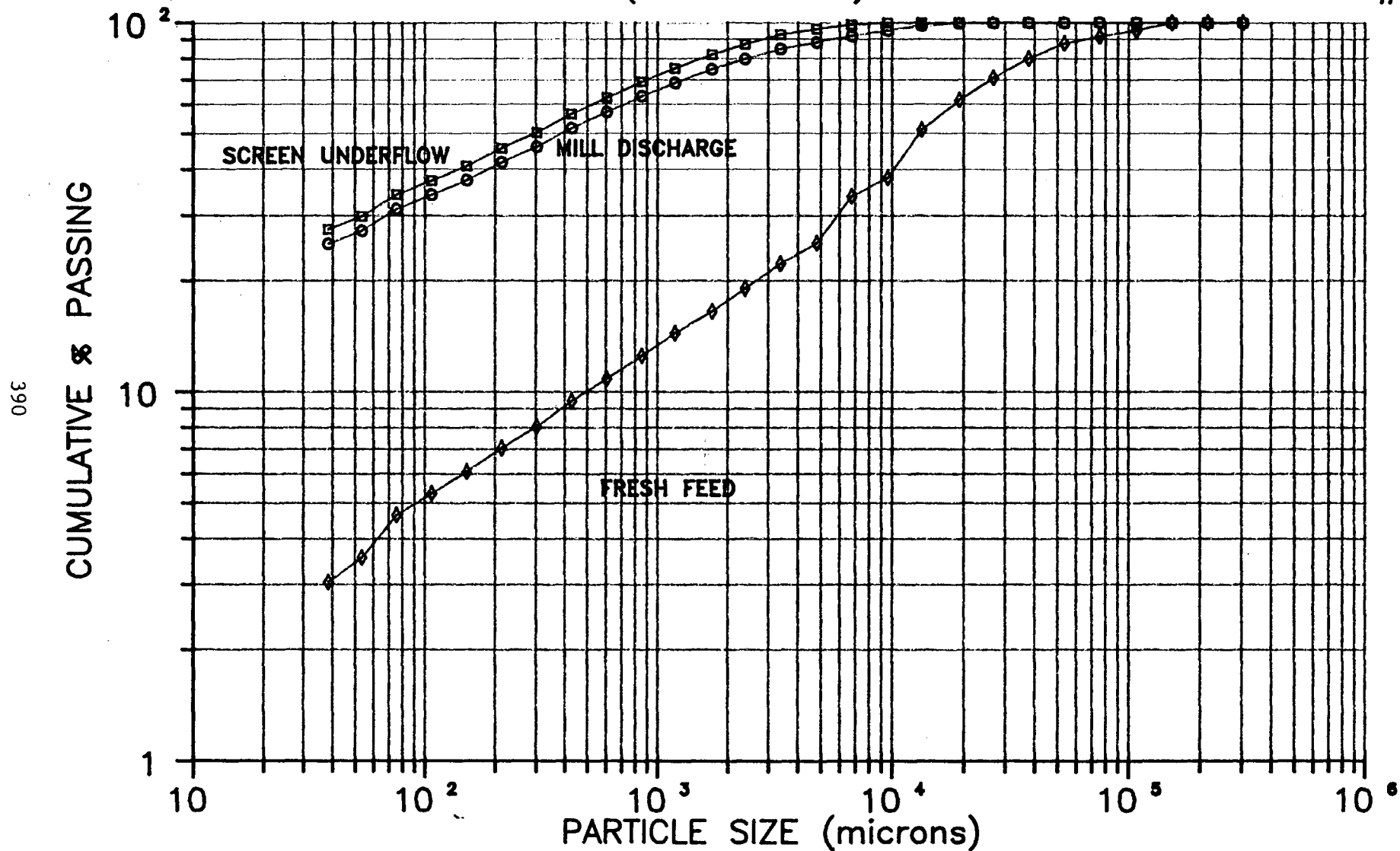
SIZE DISTRIBUTIONS (ADJUSTED) AFTON MINES RUN #1



SIZE DISTRIBUTIONS (ADJUSTED) AFTON MINES RUN #8



SIZE DISTRIBUTIONS (ADJUSTED) AFTON MINES RUN #9



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APPENDIX VII

**ISLAND COPPER MINES: ADJUSTED FULL SCALE AND 60CM DATA; SIZE
DISTRIBUTION PLOTS**

MASS BALANCE OF 60CM CIRCUIT ISLAND COPPER RUN #4

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.22	.22	.80	5.00	.00	.00	100.00	.00
MILL DISCH.	.66	.60	9.59	15.00	.00	.24	100.00	.00
SCREEN FEED	69.70	61.52	11.73	20.00	.00	61.17	100.00	.00
SCR OVERSIZE	.14	.14	.83	5.00	.00	.00	100.00	.00
SCR U/FLOW	58.20	61.39	5.48	20.00	.00	61.16	100.00	.00
MILL WATER	.00	.23	100.00	.00	.23	.23	1.64	10.00
SUMP WATER	.00	60.93	100.00	.00	67.92	60.93	10.29	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.22	100.00	.00	99.00	99.06	.06	2.00
MILL DISCH.	.00	.36	100.00	.00	59.14	59.69	.93	15.00
SCREEN FEED	.00	.36	100.00	.00	1.00	.58	42.11	1000.00

SCR OVERSIZE	.00	.13	100.00	.00	95.00	97.36	2.49	10.00
SCR U/FLOW	.00	.22	100.00	.00	.39	.36	7.41	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	8.89	9.00	1.24	5.00	25.00	23.83	4.67	10.00
6700	16.82	16.99	.98	5.00	46.37	44.98	3.00	10.00
4570	10.32	9.95	3.56	5.00	23.38	26.36	12.73	10.00
3350	4.37	4.62	5.63	5.00	4.74	4.31	9.12	10.00
2360	2.70	2.26	16.13	5.00	.36	.37	3.26	10.00
1700	1.34	1.31	1.99	5.00	.10	.10	.23	10.00
1180	1.21	1.16	4.30	5.00	.05	.05	.27	10.00
850	1.03	1.12	8.91	5.00	.00	.00	100.00	.00
600	1.24	1.30	4.95	5.00	.00	.00	100.00	.00
425	1.85	1.83	1.00	5.00	.00	.00	100.00	.00
300	1.50	1.69	12.45	5.00	.00	.00	100.00	.00
212	1.71	1.67	2.36	5.00	.00	.00	100.00	.00
150	2.44	2.44	.10	5.00	.00	.00	100.00	.00
106	3.63	3.29	10.90	5.00	.00	.00	100.00	.00
75	3.94	3.96	.55	5.00	.00	.00	100.00	.00
53	5.56	5.11	8.02	5.00	.00	.00	100.00	.00
38	4.00	4.17	4.13	5.00	.00	.00	100.00	.00
-38	27.39	28.13	2.69	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	4.99	4.80	3.74	5.00
2360	3.06	3.41	11.53	5.00
1700	2.01	2.05	1.96	5.00
1180	1.76	1.83	3.98	5.00
850	2.02	1.80	10.77	5.00
600	2.21	2.09	5.38	5.00
425	2.91	2.94	1.13	5.00
300	3.25	2.71	16.61	5.00
212	2.62	2.68	2.39	5.00
150	3.92	3.92	.11	5.00
106	4.84	5.28	9.15	5.00
75	6.38	6.37	.23	5.00
53	7.66	8.22	7.27	5.00
38	6.98	6.69	4.12	5.00
-38	45.39	45.19	.43	5.00

MASS BALANCE OF 60CM CIRCUIT ISLAND COPPER RUN #5

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.31	.31	1.40	5.00	.00	.00	100.00	.00
MILL DISCH.	.95	.95	.26	15.00	.00	.35	100.00	.00
SCREEN FEED	71.89	62.53	13.02	20.00	.00	61.94	100.00	.00
SCR OVERSIZE	.27	.27	2.20	5.00	.00	-.02	100.00	.00
SCR U/FLOW	60.30	62.26	3.25	20.00	.00	61.95	100.00	.00
MILL WATER	.00	.37	100.00	.00	.37	.37	.30	10.00
SUMP WATER	.00	61.58	100.00	.00	59.40	61.58	3.67	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.31	100.00	.00	99.00	98.77	.23	2.00
MILL DISCH.	.00	.59	100.00	.00	61.78	62.70	1.49	15.00
SCREEN FEED	.00	.59	100.00	.00	1.00	.95	4.89	1000.00
SCR OVERSIZE	.00	.29	100.00	.00	96.00	106.29	10.72	10.00
SCR U/FLOW	.00	.31	100.00	.00	.52	.49	5.54	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	10.01	9.38	6.25	5.00	17.41	19.32	10.96	10.00
6700	22.10	21.02	4.89	5.00	46.59	43.27	7.14	10.00
4570	14.81	14.04	5.22	5.00	28.09	28.89	2.86	10.00
3350	6.34	5.98	5.65	5.00	6.38	6.85	7.34	10.00
2360	3.60	2.87	20.28	5.00	1.15	1.29	11.92	10.00
1700	2.03	1.71	15.91	5.00	.17	.17	2.49	10.00
1180	1.12	1.05	5.92	5.00	.07	.07	.68	10.00
850	1.13	.99	12.63	5.00	.14	.14	2.96	10.00
600	1.39	1.21	13.13	5.00	.00	.00	100.00	.00
425	1.23	1.24	1.18	5.00	.00	.00	100.00	.00
300	1.51	1.56	3.09	5.00	.00	.00	100.00	.00
212	1.73	1.75	1.37	5.00	.00	.00	100.00	.00
150	2.35	2.12	9.65	5.00	.00	.00	100.00	.00
106	2.66	2.88	8.44	5.00	.00	.00	100.00	.00
75	2.57	2.59	.64	5.00	.00	.00	100.00	.00
53	3.35	3.24	3.16	5.00	.00	.00	100.00	.00
38	2.85	2.93	2.97	5.00	.00	.00	100.00	.00
-38	19.22	23.42	21.88	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	4.93	5.16	4.72	5.00
2360	3.86	4.37	13.10	5.00
1700	2.80	3.16	12.68	5.00
1180	1.87	1.98	6.02	5.00
850	1.62	1.78	10.12	5.00
600	2.11	2.35	11.30	5.00
425	2.42	2.42	.01	5.00
300	3.08	3.03	1.71	5.00
212	3.40	3.41	.31	5.00
150	3.76	4.13	9.82	5.00
106	6.02	5.61	6.82	5.00
75	4.94	5.03	1.83	5.00
53	5.96	6.31	5.86	5.00
38	5.72	5.71	.22	5.00
-38	47.51	45.56	4.11	5.00

MASS BALANCE OF 60CH CIRCUIT ISLAND COPPER RUN #6

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.32	.30	5.59	5.00	.00	.01	100.00	.00
MILL DISCH.	1.27	1.15	9.69	15.00	.00	.35	100.00	.00
SCREEN FEED	62.80	57.83	7.92	20.00	.00	57.03	100.00	.00
SCR OVERSIZE	.38	.40	5.97	5.00	.00	-.10	100.00	.00
SCR U/FLOW	56.40	57.42	1.81	20.00	.00	57.13	100.00	.00
MILL WATER	.00	.44	100.00	.00	.43	.44	2.49	10.00
SUMP WATER	.00	56.68	100.00	.00	56.40	56.68	.49	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.30	100.00	.00	99.00	98.11	.90	2.00
MILL DISCH.	.00	.80	100.00	.00	64.95	69.53	7.06	15.00
SCREEN FEED	.00	.80	100.00	.00	1.00	1.38	38.13	1000.00
SCR OVERSIZE	.00	.50	100.00	.00	80.00	124.33	55.41	10.00
SCR U/FLOW	.00	.30	100.00	.00	.54	.51	4.71	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	8.66	8.71	.57	5.00	13.29	13.82	4.01	10.00
6700	32.31	33.29	3.04	5.00	47.60	52.84	11.00	10.00
4570	14.38	15.30	6.40	5.00	29.51	23.83	19.26	10.00
3350	7.53	7.79	3.44	5.00	8.11	7.66	5.55	10.00
2360 °	3.69	1.81	51.00	5.00	1.02	1.39	36.01	10.00
1700	1.90	2.26	18.74	5.00	.24	.23	5.85	10.00
1180	1.09	1.00	8.25	5.00	.23	.24	4.49	10.00
850	.76	.79	4.01	5.00	.00	.00	100.00	.00
600	.87	.84	2.88	5.00	.00	.00	100.00	.00
425	.81	.86	6.59	5.00	.00	.00	100.00	.00
300	1.17	1.06	9.00	5.00	.00	.00	100.00	.00
212	1.21	1.25	3.66	5.00	.00	.00	100.00	.00
150	1.73	1.65	4.45	5.00	.00	.00	100.00	.00
106	1.85	1.84	.33	5.00	.00	.00	100.00	.00
75	2.03	2.07	2.08	5.00	.00	.00	100.00	.00
53	2.57	2.62	1.82	5.00	.00	.00	100.00	.00
38	2.11	2.28	7.83	5.00	.00	.00	100.00	.00
-38	15.33	14.57	4.98	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.78	.78	.07	5.00
3350	8.07	8.01	.75	5.00
2360	2.26	2.53	11.73	5.00
1700	8.00	5.71	28.58	5.00
1180	2.16	2.29	6.21	5.00
850	2.23	2.14	4.18	5.00
600	2.22	2.28	2.89	5.00
425	2.52	2.33	7.39	5.00
300	2.67	2.88	7.80	5.00
212	3.52	3.39	3.67	5.00
150	4.28	4.47	4.40	5.00
106	4.95	4.98	.70	5.00
75	5.70	5.60	1.73	5.00
53	7.17	7.07	1.34	5.00
38	6.74	6.15	8.75	5.00
-38	36.73	39.38	7.20	5.00

MASS BALANCE OF 60CM CIRCUIT ISLAND COPPER RUN #7

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.37	.36	3.49	5.00	.00	.01	100.00	.00
MILL DISCH.	1.35	1.29	4.21	15.00	.00	.41	100.00	.00
SCREEN FEED	69.70	61.42	11.88	20.00	.00	60.53	100.00	.00
SCR OVERSIZE	.42	.44	4.18	5.00	.00	-.10	100.00	.00
SCR U/FLOW	58.80	60.98	3.71	20.00	.00	60.63	100.00	.00
MILL WATER	.00	.50	100.00	.00	.49	.50	1.73	10.00
SUMP WATER	.00	60.12	100.00	.00	62.40	60.12	3.65	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.35	100.00	.00	99.00	98.42	.58	2.00
MILL DISCH.	.00	.89	100.00	.00	63.90	68.49	7.19	15.00
SCREEN FEED	.00	.89	100.00	.00	1.00	1.44	44.21	1000.00
SCR OVERSIZE	.00	.53	100.00	.00	98.00	122.10	24.59	10.00
SCR U/FLOW	.00	.35	100.00	.00	.62	.58	7.04	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	.00	7.33	100.00	5.00	14.31	12.16	15.05	10.00
6700	35.84	29.99	16.31	5.00	45.17	49.73	10.09	10.00
4570	18.54	17.58	5.16	5.00	31.12	29.15	6.33	10.00
3350	8.18	8.13	.60	5.00	8.06	7.61	5.64	10.00
2360	4.16	3.97	4.60	5.00	1.05	1.07	1.88	10.00
1700	1.95	1.96	.38	5.00	.08	.08	.11	10.00
1180	1.04	1.03	1.39	5.00	.00	.00	100.00	.00
850	1.00	.95	4.53	5.00	.00	.00	100.00	.00
600	.90	.93	3.32	5.00	.00	.00	100.00	.00
425	1.33	1.08	18.52	5.00	.00	.00	100.00	.00
300	1.24	1.22	1.57	5.00	.00	.00	100.00	.00
212	1.24	1.31	5.32	5.00	.00	.00	100.00	.00
150	1.55	1.59	2.81	5.00	.00	.00	100.00	.00
106	2.41	2.18	9.74	5.00	.00	.00	100.00	.00
75	1.83	1.95	6.66	5.00	.00	.00	100.00	.00
53	2.00	2.18	9.15	5.00	.00	.00	100.00	.00
38	2.11	2.18	3.34	5.00	.00	.00	100.00	.00
-38	14.88	14.43	1.72	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	8.91	8.93	.23	5.00
2360	8.09	8.37	3.52	5.00
1700	4.83	4.81	.39	5.00
1180	2.55	2.58	1.35	5.00
850	2.31	2.41	4.15	5.00
600	2.43	2.34	3.57	5.00
425	2.41	2.73	13.31	5.00
300	3.03	3.08	1.51	5.00
212	3.50	3.29	5.97	5.00
150	4.14	4.02	3.00	5.00
106	5.07	5.48	8.12	5.00
75	5.33	4.92	7.71	5.00
53	6.20	5.50	11.27	5.00
38	5.70	5.49	3.60	5.00
-38	35.50	36.04	1.52	5.00

MASS BALANCE OF 60CM CIRCUIT ISLAND COPPER RUN #68

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.26	.25	7.17	5.00	.00	.01	100.00	.00
MILL DISCH.	.88	.73	16.63	10.00	.00	.14	100.00	.00
SCREEN FEED	73.80	51.25	30.55	15.00	.00	50.66	100.00	.00
SCR OVERSIZE	.17	.22	27.93	10.00	.00	-.14	100.00	.00
SCR U/FLOW	47.70	51.04	6.99	15.00	.00	50.80	100.00	.00
MILL WATER	.00	.27	100.00	.00	.26	.27	3.25	5.00
SUMP WATER	.00	50.52	100.00	.00	55.50	50.52	8.98	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.23	100.00	.00	99.00	95.77	3.26	3.00
MILL DISCH.	.00	.60	100.00	.00	53.64	81.19	51.37	10.00
SCREEN FEED	.00	.60	100.00	.00	1.00	1.16	16.09	1000.00
SCR OVERSIZE	.00	.36	100.00	.00	85.00	166.65	96.06	10.00
SCR U/FLOW	.00	.23	100.00	.00	.49	.46	6.15	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	7.77	8.62	10.97	5.00	16.04	14.24	11.23	5.00
6700	26.77	29.42	9.92	5.00	50.34	48.59	3.48	5.00
4570	17.26	16.01	7.24	5.00	24.07	26.44	9.85	5.00
3350	7.09	5.81	18.11	5.00	8.39	9.59	14.28	5.00
2360	4.01	4.49	12.02	5.00	1.03	1.01	1.71	5.00
1700	1.42	1.51	6.02	5.00	.11	.11	.27	5.00
1180	1.08	1.09	1.26	5.00	.04	.04	.02	5.00
850	.83	.82	1.50	5.00	.00	.00	100.00	.00
600	1.07	1.02	4.36	5.00	.00	.00	100.00	.00
425	.92	.90	2.21	5.00	.00	.00	100.00	.00
300	1.47	1.41	4.03	5.00	.00	.00	100.00	.00
212	1.13	1.33	17.59	5.00	.00	.00	100.00	.00
150	1.80	1.52	15.57	5.00	.00	.00	100.00	.00
106	1.80	1.76	2.41	5.00	.00	.00	100.00	.00
75	2.35	2.69	14.29	5.00	.00	.00	100.00	.00
53	2.83	2.94	3.81	5.00	.00	.00	100.00	.00
38	3.07	2.85	7.32	5.00	.00	.00	100.00	.00
-38	17.34	15.83	8.71	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST. DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	11.23	9.83	12.43	5.00
1700	3.89	3.65	6.21	5.00
1180	2.74	2.71	1.05	5.00
850	2.04	2.07	1.61	5.00
600	2.49	2.59	4.19	5.00
425	2.23	2.28	2.28	5.00
300	3.44	3.58	3.98	5.00
212	4.72	3.37	28.63	5.00
150	3.44	3.85	12.00	5.00
106	4.34	4.45	2.62	5.00
75	8.48	6.81	19.70	5.00
53	7.72	7.45	3.52	5.00
38	6.75	7.21	6.86	5.00
-38	36.48	40.13	9.99	5.00

MASS BALANCE OF ISLAND COPPER #4 CIRCUIT RUN #4

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	295.00	287.92	2.40	5.00	.00	9.36	100.00	.00
MILL DISCH.	.00	904.55	100.00	.00	.00	258.00	100.00	.00
CYCLONE FD.	.00	980.36	100.00	.00	.00	333.81	100.00	.00
CYCLONE U/F	.00	481.49	100.00	.00	.00	113.49	100.00	.00
CYCLONE O/F	.00	499.14	100.00	.00	.00	220.58	100.00	.00
MILL WATER	.00	135.15	100.00	.00	132.75	135.15	1.80	5.00
PBOX WATER	.00	75.75	100.00	.00	70.00	75.75	8.22	15.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	278.56	100.00	.00	98.88	96.75	2.16	3.00
MILL DISCH.	.00	646.55	100.00	.00	71.12	71.48	.50	5.00
CYCLONE FD.	.00	646.55	100.00	.00	65.00	65.95	1.46	1000.00
CYCLONE U/F	.00	367.99	100.00	.00	76.63	76.43	.26	5.00
CYCLONE O/F	.00	278.56	100.00	.00	51.90	55.81	7.53	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	CYCLONE FD.				CYCLONE U/F			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.00	100.00	.00	.00	.00	100.00	.00
13200	.07	.02	71.36	10.00	.03	.04	17.41	10.00
9500	1.06	1.04	1.62	10.00	1.80	1.83	1.79	10.00
6700	1.09	1.20	9.85	10.00	2.39	2.10	11.98	10.00
4750	1.92	2.04	6.38	10.00	3.85	3.59	6.79	10.00
3350	2.07	2.16	4.43	10.00	3.97	3.80	4.33	10.00
2360	2.49	2.54	2.11	10.00	4.54	4.47	1.60	10.00
1700	2.40	2.42	.67	10.00	4.25	4.24	.12	10.00
1180	3.04	3.06	.52	10.00	5.36	5.37	.17	10.00
850	2.96	2.92	1.49	10.00	4.96	5.06	2.07	10.00
600	4.52	4.59	1.56	10.00	7.98	7.94	.54	10.00
425	5.70	5.67	.58	10.00	9.28	9.44	1.74	10.00
300	8.12	8.23	1.38	10.00	11.56	11.60	.38	10.00
212	7.54	7.59	.62	10.00	7.46	7.51	.62	10.00
150	9.20	8.71	5.37	10.00	6.70	6.91	3.09	10.00
106	6.24	6.44	3.22	10.00	4.35	4.32	.71	10.00
75	5.18	5.41	4.45	10.00	2.95	2.92	1.06	10.00
53	6.42	6.14	4.40	10.00	3.03	3.08	1.57	10.00
38	4.00	4.08	2.03	10.00	1.97	1.96	.32	10.00
-38	25.93	25.70	.88	10.00	13.08	13.33	1.94	10.00

STREAM	CYCLONE O/F			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4750	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	.00	.00	100.00	.00
1700	.00	.00	100.00	.00
1180	.00	.00	100.00	.00
850	.08	.08	.02	10.00
600	.17	.17	.03	10.00
425	.68	.68	.02	10.00
300	3.79	3.78	.31	10.00
212	7.72	7.69	.34	10.00
150	10.80	11.08	2.62	10.00
106	9.45	9.24	2.18	10.00
75	9.01	8.70	3.41	10.00
53	9.90	10.18	2.83	10.00
38	6.99	6.88	1.59	10.00
-38	41.38	41.48	.24	10.00

MASS BALANCE OF ISLAND COPPER #4 CIRCUIT RUN #5

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	308.00	300.81	2.33	5.00	.00	9.49	100.00	.00
MILL DISCH.	.00	873.17	100.00	.00	.00	245.75	100.00	.00
CYCLONE FD.	.00	949.07	100.00	.00	.00	321.65	100.00	.00
CYCLONE U/F	.00	431.42	100.00	.00	.00	95.32	100.00	.00
CYCLONE O/F	.00	517.90	100.00	.00	.00	226.58	100.00	.00
MILL WATER	.00	140.93	100.00	.00	138.60	140.93	1.68	5.00
PBOX WATER	.00	75.88	100.00	.00	70.00	75.88	8.40	15.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	291.32	100.00	.00	98.87	96.84	2.05	3.00
MILL DISCH.	.00	627.42	100.00	.00	72.60	71.86	1.03	5.00
CYCLONE FD.	.00	627.42	100.00	.00	65.00	66.11	1.71	1000.00
CYCLONE U/F	.00	336.10	100.00	.00	77.50	77.91	.52	5.00
CYCLONE O/F	.00	291.32	100.00	.00	52.05	56.25	8.07	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	CYCLONE FD.				CYCLONE U/F			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.00	100.00	.00	.00	.00	100.00	.00
13200	.00	.05	100.00	10.00	.09	.09	.01	10.00
9500	.89	.92	2.99	10.00	1.77	1.71	3.32	10.00
6700	.92	1.04	13.12	10.00	2.38	1.94	18.37	10.00
4750	1.76	1.84	4.83	10.00	3.65	3.44	5.64	10.00
3350	1.85	1.88	1.76	10.00	3.59	3.51	2.11	10.00
2360	2.36	2.28	3.23	10.00	4.15	4.26	2.73	10.00
1700	2.41	2.29	5.00	10.00	4.10	4.27	4.24	10.00
1180	3.27	3.25	.55	10.00	5.57	5.57	.08	10.00
850	3.38	3.15	6.84	10.00	5.48	5.78	5.52	10.00
600	5.76	5.46	5.23	10.00	9.54	9.91	3.91	10.00
425	7.65	7.18	6.11	10.00	11.30	11.75	3.98	10.00
300	9.29	9.27	.23	10.00	11.67	11.59	.73	10.00
212	7.72	7.81	1.14	10.00	7.31	7.23	1.13	10.00
150	8.14	8.88	9.09	10.00	6.68	6.38	4.50	10.00
106	6.14	6.22	1.38	10.00	3.79	3.76	.75	10.00
75	5.24	5.30	1.19	10.00	2.76	2.74	.54	10.00
53	5.53	4.89	11.54	10.00	2.38	2.44	2.48	10.00
38	3.65	3.67	.59	10.00	1.85	1.84	.30	10.00
-38	24.01	24.58	2.36	10.00	11.89	11.71	1.53	10.00

STREAM	CYCLONE O/F			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4750	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	.00	.00	100.00	.00
1700	.00	.00	100.00	.00
1180	.00	.57	100.00	5.00
850	.11	.11	.02	5.00
600	.32	.32	.03	5.00
425	1.91	1.91	.15	5.00
300	6.60	6.60	.07	5.00
212	8.50	8.48	.26	5.00
150	11.97	11.76	1.72	5.00
106	9.10	9.07	.37	5.00
75	8.28	8.25	.33	5.00
53	7.59	7.72	1.73	5.00
38	5.79	5.78	.19	5.00
-38	39.82	39.42	1.01	5.00

MASS BALANCE OF ISLAND COPPER #4 CIRCUIT RUN #6

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	387.00	380.08	1.79	5.00	.00	10.97	100.00	.00
MILL DISCH.	.00	568.45	100.00	.00	.00	199.34	100.00	.00
CYCLONE FD.	.00	646.40	100.00	.00	.00	277.28	100.00	.00
CYCLONE U/F	.00	312.44	100.00	.00	.00	114.71	100.00	.00
CYCLONE O/F	.00	333.94	100.00	.00	.00	162.55	100.00	.00
MILL WATER	.00	188.37	100.00	.00	185.00	188.37	1.82	5.00
PBOX WATER	.00	77.93	100.00	.00	75.00	77.93	3.91	15.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	369.11	100.00	.00	99.00	97.11	1.90	3.00
MILL DISCH.	.00	369.11	100.00	.00	63.40	64.93	2.42	5.00
CYCLONE FD.	.00	369.11	100.00	.00	65.00	57.10	12.15	1000.00
CYCLONE U/F	.00	197.73	100.00	.00	62.12	63.29	1.88	5.00
CYCLONE O/F	.00	171.38	100.00	.00	50.31	51.32	2.01	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	CYCLONE FD.				CYCLONE U/F			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.00	100.00	.00	.00	.00	100.00	.00
13200	.00	.00	100.00	.00	.00	.00	100.00	.00
9500	.22	.27	20.60	10.00	.91	.50	45.57	10.00
6700	.28	.34	20.14	10.00	1.54	.63	59.22	10.00
4750	.54	.65	20.75	10.00	2.34	1.22	47.98	10.00
3350	.98	1.11	13.36	10.00	2.54	2.07	18.35	10.00
2360	1.82	1.81	.28	10.00	3.37	3.39	.54	10.00
1700	2.18	1.88	13.82	10.00	3.16	3.51	10.98	10.00
1180	2.82	2.30	18.30	10.00	3.79	4.30	13.47	10.00
850	2.45	1.99	18.84	10.00	3.21	3.64	13.47	10.00
600	3.20	2.73	14.77	10.00	4.34	4.82	11.07	10.00
425	3.40	3.04	10.47	10.00	4.49	4.84	7.76	10.00
300	4.59	3.80	17.29	10.00	5.38	5.99	11.28	10.00
212	4.77	3.63	23.93	10.00	4.82	5.46	13.33	10.00
150	6.13	6.36	3.71	10.00	5.56	5.48	1.37	10.00
106	6.52	6.93	6.29	10.00	5.19	5.07	2.28	10.00
75	6.88	7.09	3.10	10.00	5.43	5.38	.89	10.00
53	8.94	8.08	9.67	10.00	7.01	7.33	4.61	10.00
38	5.64	5.94	5.35	10.00	4.39	4.31	1.89	10.00
-38	38.60	42.01	8.85	10.00	32.53	32.06	1.44	10.00

STREAM	CYCLONE O/F			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4750	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	.00	.00	100.00	.00
1700	.00	.00	100.00	.00
1180	.00	.00	100.00	.00
850	.08	.08	.29	10.00
600	.31	.31	.70	10.00
425	.96	.97	1.48	10.00
300	1.24	1.27	2.31	10.00
212	1.46	1.51	3.56	10.00
150	7.46	7.37	1.27	10.00
106	9.37	9.07	3.15	10.00
75	9.15	9.07	.90	10.00
53	8.49	8.93	5.21	10.00
38	8.04	7.83	2.64	10.00
-38	53.44	53.58	.27	10.00

MASS BALANCE OF ISLAND COPPER #4 CIRCUIT RUN #7

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	393.00	386.12	1.75	5.00	.00	12.32	100.00	.00
MILL DISCH.	.00	565.97	100.00	.00	.00	192.17	100.00	.00
CYCLONE FD.	.00	644.83	100.00	.00	.00	271.03	100.00	.00
CYCLONE U/F	.00	289.62	100.00	.00	.00	102.72	100.00	.00
CYCLONE O/F	.00	355.25	100.00	.00	.00	168.35	100.00	.00
MILL WATER	.00	179.85	100.00	.00	177.00	179.85	1.61	5.00
PBOX WATER	.00	78.95	100.00	.00	75.00	78.95	5.27	15.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	373.81	100.00	.00	98.60	96.81	1.82	3.00
MILL DISCH.	.00	373.81	100.00	.00	65.56	66.05	.74	5.00
CYCLONE FD.	.00	373.81	100.00	.00	65.00	57.97	10.82	1000.00
CYCLONE U/F	.00	186.90	100.00	.00	63.04	64.53	2.37	5.00
CYCLONE O/F	.00	186.90	100.00	.00	51.11	52.61	2.94	5.00

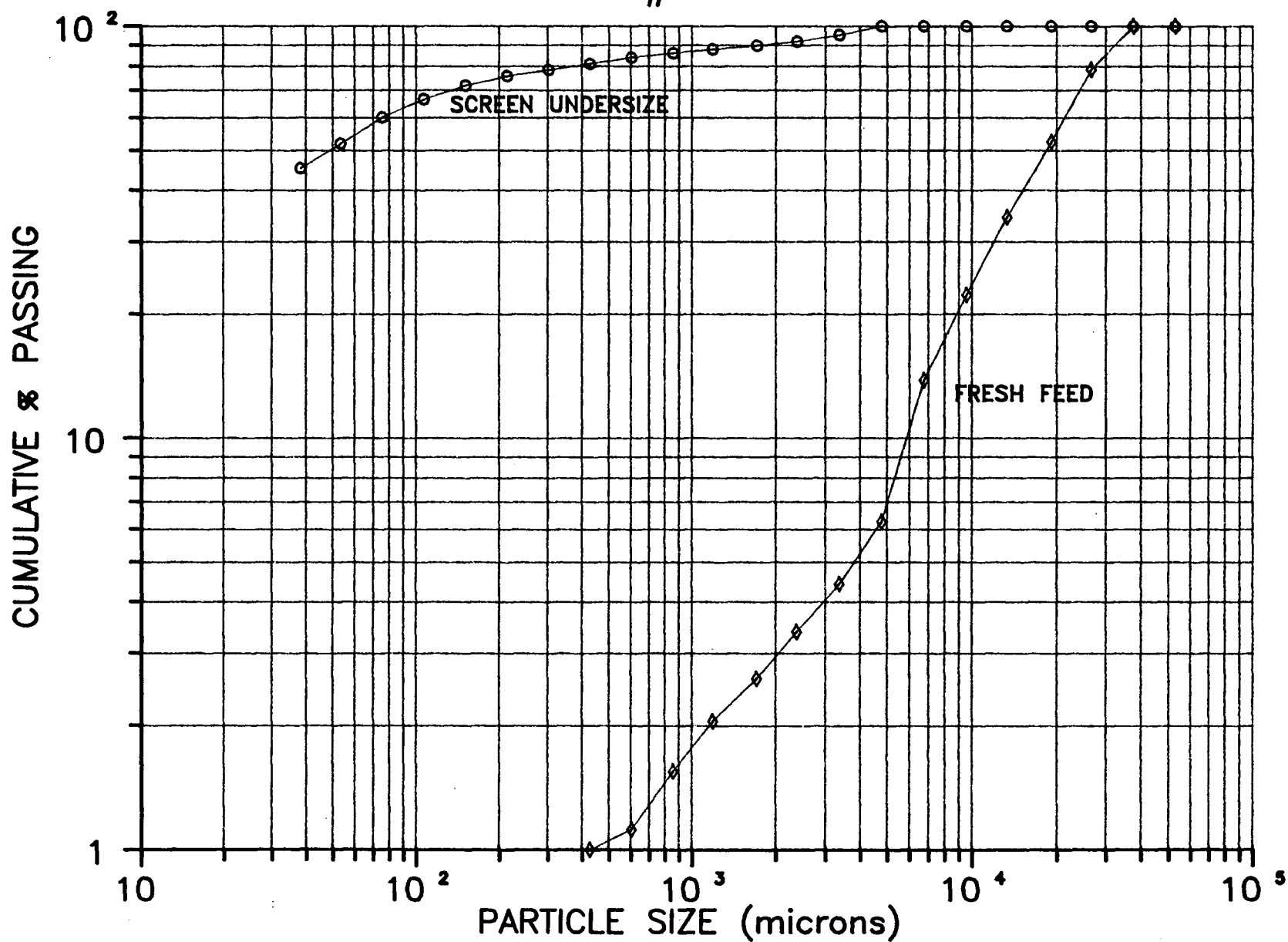
ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	CYCLONE FD.				CYCLONE U/F			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.00	100.00	.00	.00	.00	100.00	.00
19000	.00	.00	100.00	.00	.00	.00	100.00	.00
13200	.00	.04	100.00	10.00	.07	.07	.01	10.00
9500	.06	.07	12.87	10.00	.77	.14	82.41	10.00
6700	.13	.15	14.74	10.00	1.39	.30	78.54	10.00
4750	.40	.48	19.46	10.00	2.65	.96	63.94	10.00
3350	.86	1.02	18.50	10.00	2.97	2.04	31.37	10.00
2360	1.77	1.86	4.85	10.00	3.89	3.71	4.58	10.00
1700	2.12	1.94	8.59	10.00	3.59	3.88	7.96	10.00
1180	2.87	2.41	16.09	10.00	4.27	4.82	12.79	10.00
850	2.48	2.01	18.88	10.00	3.44	3.91	13.75	10.00
600	3.52	2.76	21.65	10.00	4.61	5.30	15.06	10.00
425	3.66	2.87	21.50	10.00	4.59	5.25	14.36	10.00
300	4.50	3.74	16.87	10.00	5.26	5.83	10.87	10.00
212	4.34	4.06	6.34	10.00	4.50	4.69	4.15	10.00
150	6.27	6.01	4.13	10.00	5.38	5.53	2.80	10.00
106	6.44	6.45	.19	10.00	4.96	5.00	.88	10.00
75	6.84	7.05	3.02	10.00	5.23	5.22	.15	10.00
53	8.38	8.59	2.56	10.00	6.32	6.34	.24	10.00
38	5.78	6.43	11.25	10.00	4.81	4.63	3.76	10.00
-38	39.56	42.05	6.28	10.00	31.23	32.32	3.50	10.00

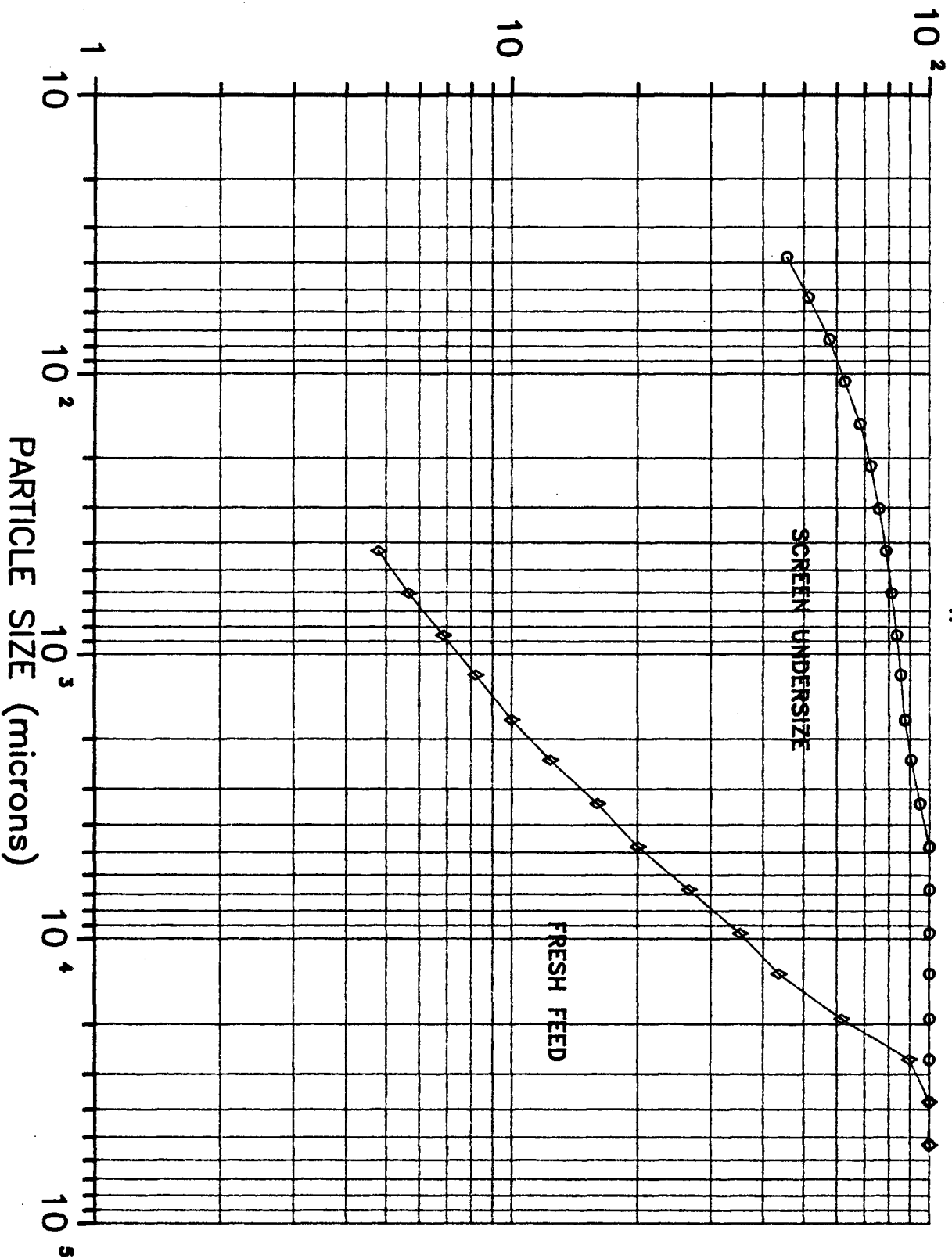
STREAM	CYCLONE O/F			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4750	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	.00	.00	100.00	.00
1700	.00	.00	100.00	.00
1180	.00	.00	100.00	.00
850	.11	.11	.43	10.00
600	.21	.21	.67	10.00
425	.49	.50	1.49	10.00
300	1.60	1.65	3.16	10.00
212	3.35	3.44	2.78	10.00
150	6.32	6.49	2.70	10.00
106	7.85	7.90	.65	10.00
75	8.97	8.87	1.10	10.00
53	10.92	10.85	.60	10.00
38	8.93	8.23	7.82	10.00
-38	51.05	51.54	.96	10.00

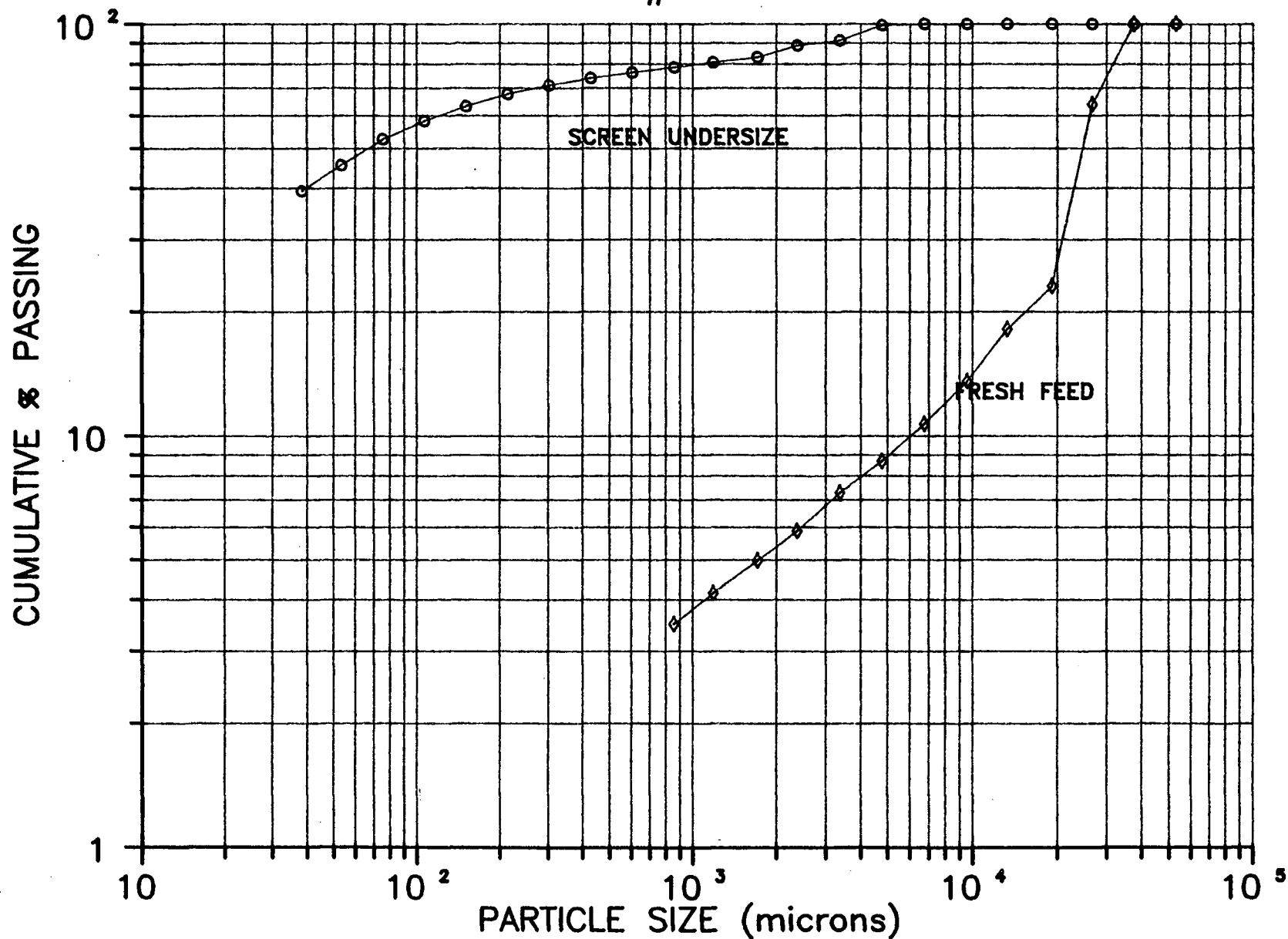
ISLAND COPPER RUN #4 ADJ. 60CM CCT. DATA



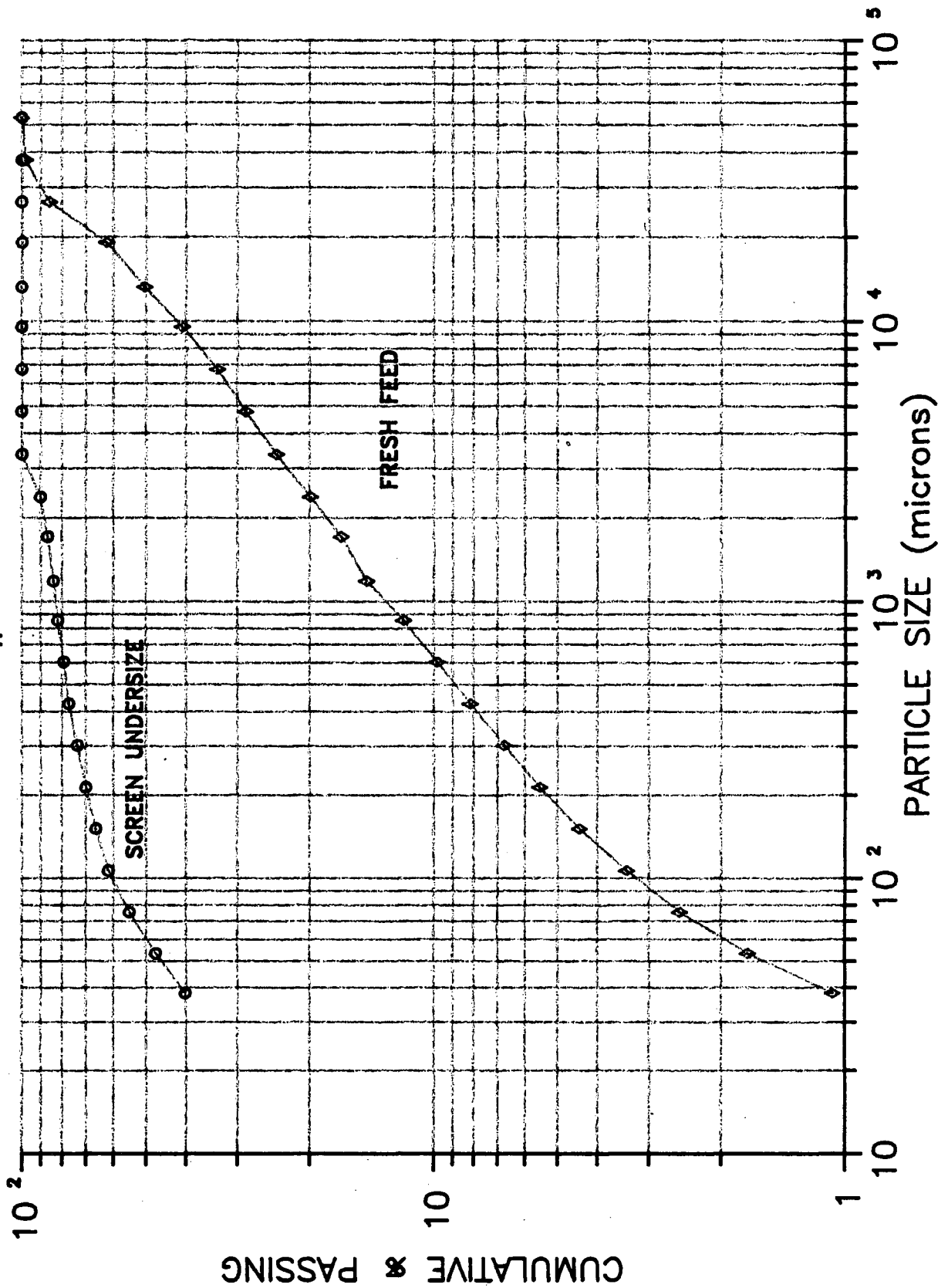
ISLAND COPPER RUN #5 ADJ. 60CM CCT. DATA



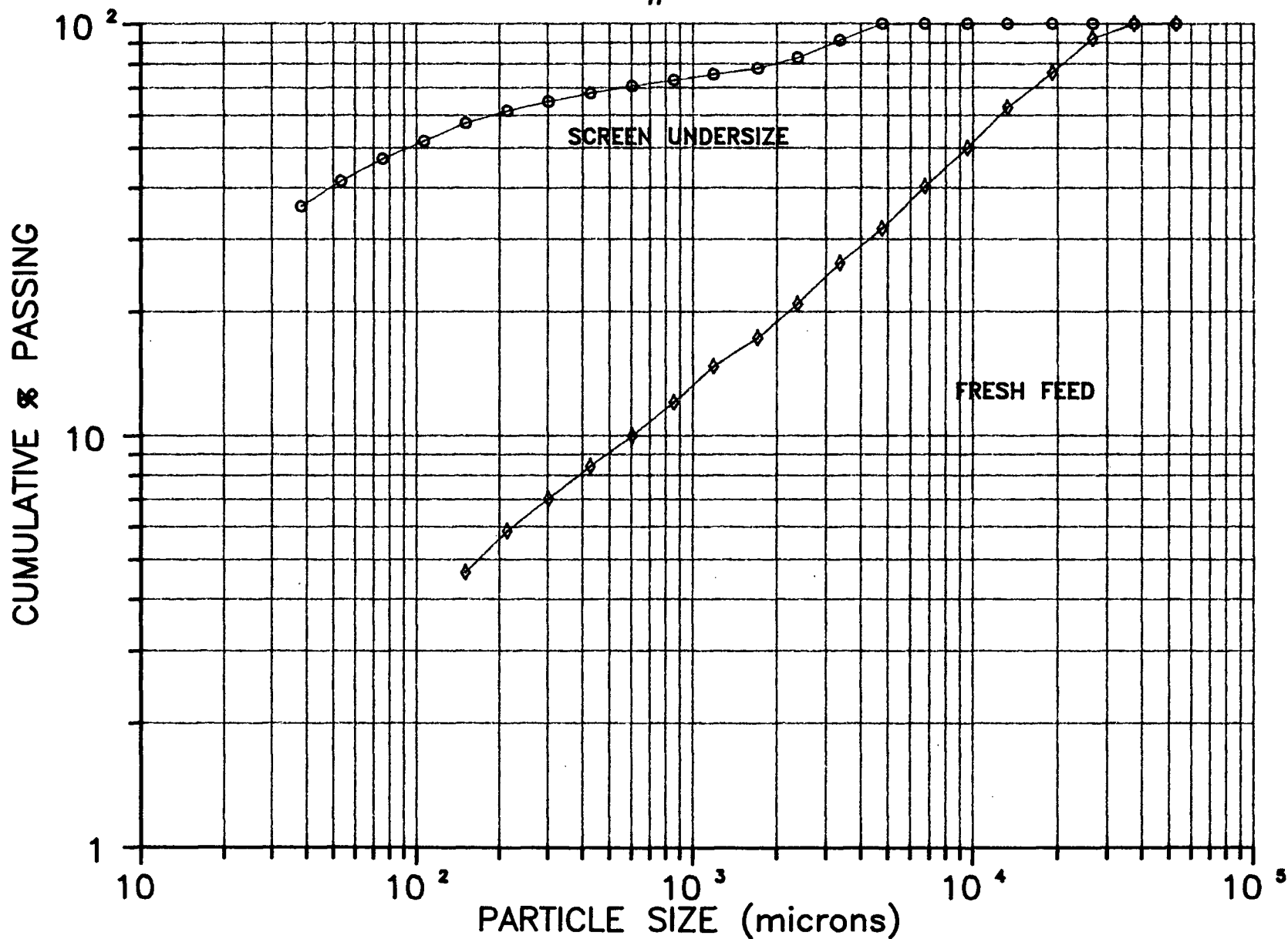
ISLAND COPPER RUN #6 ADJ. 60CM CCT. DATA



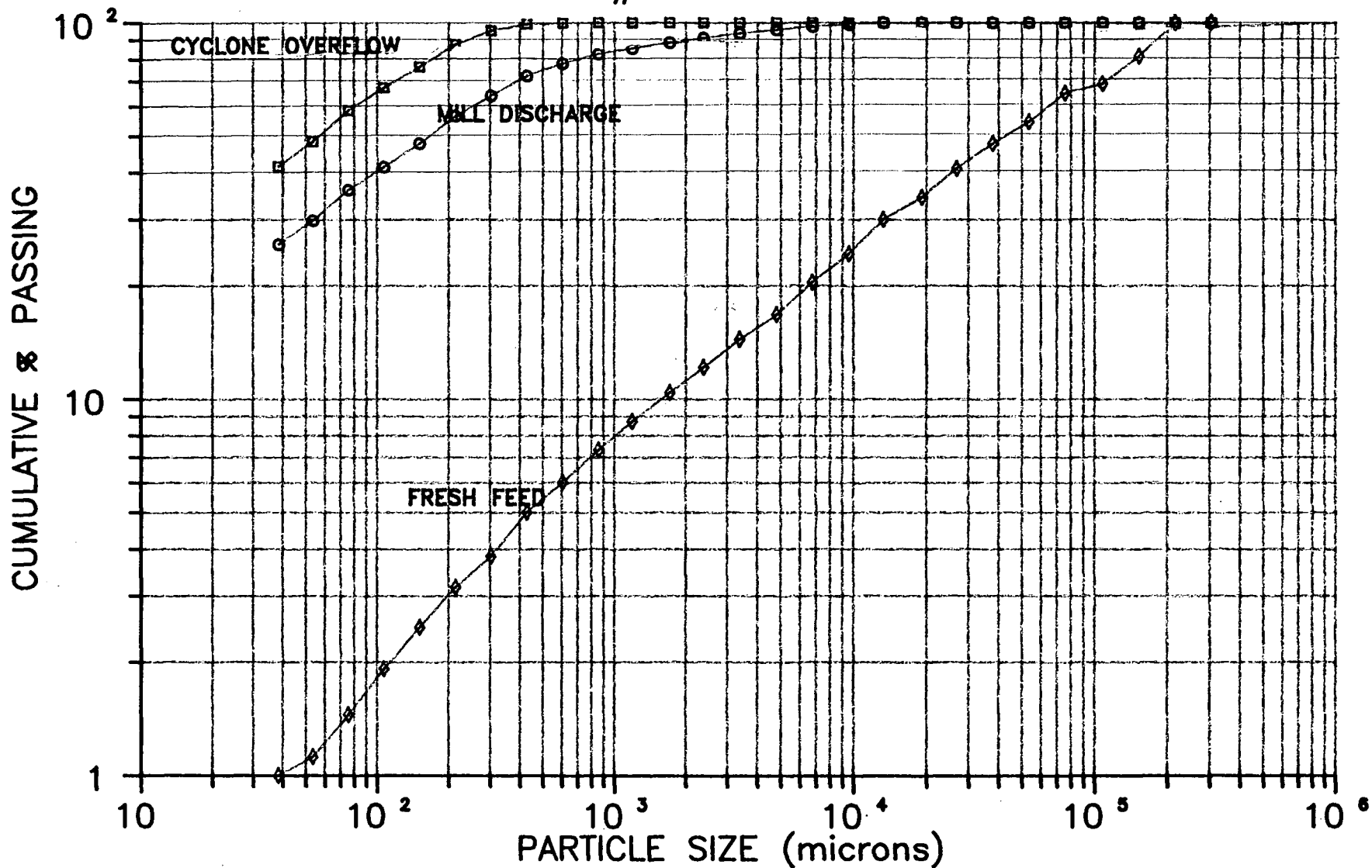
ISLAND COPPER RUN #6B ADJ. 60CM CCT. DATA



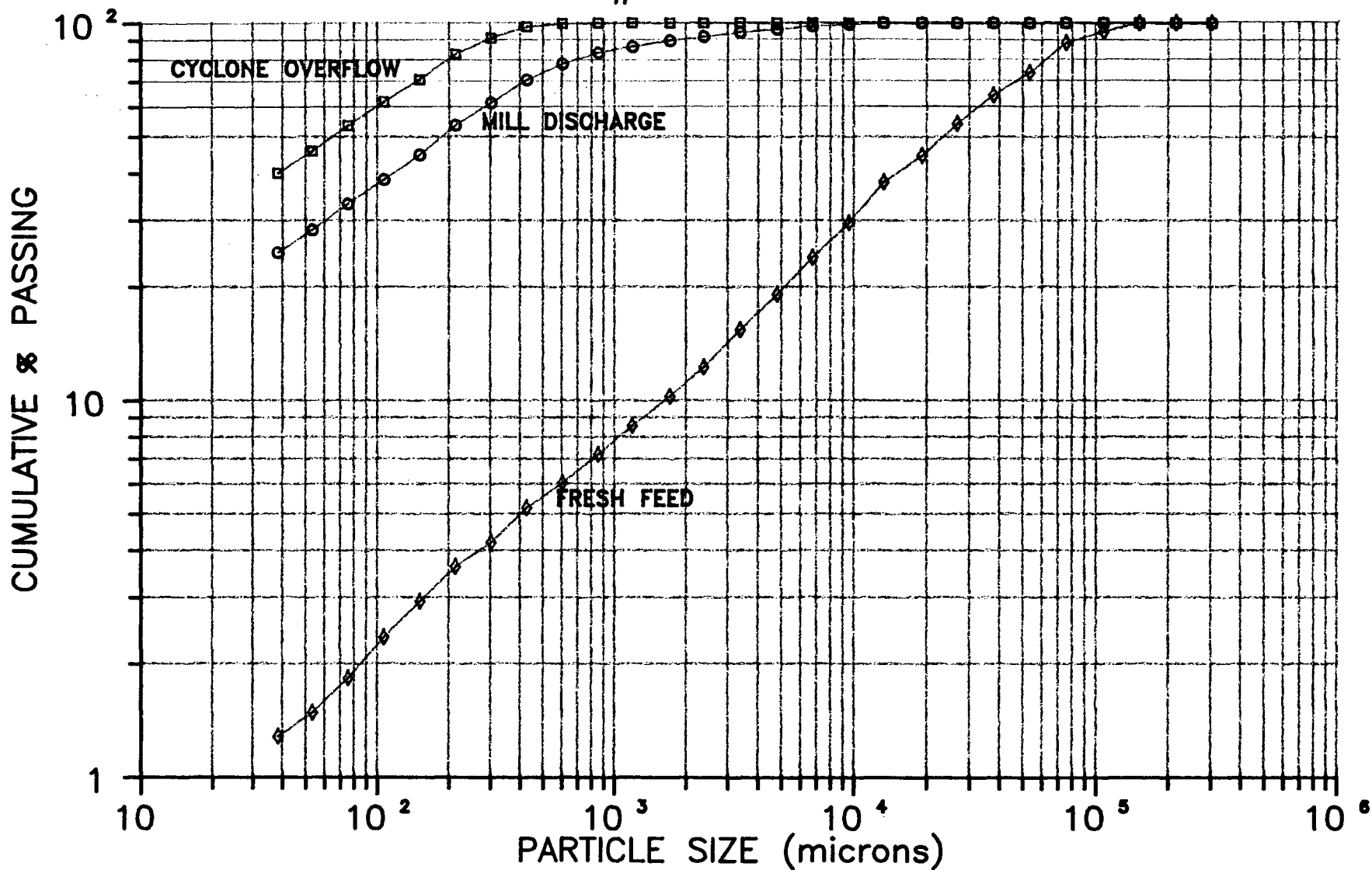
ISLAND COPPER RUN #7 ADJ. 60CM CCT. DATA



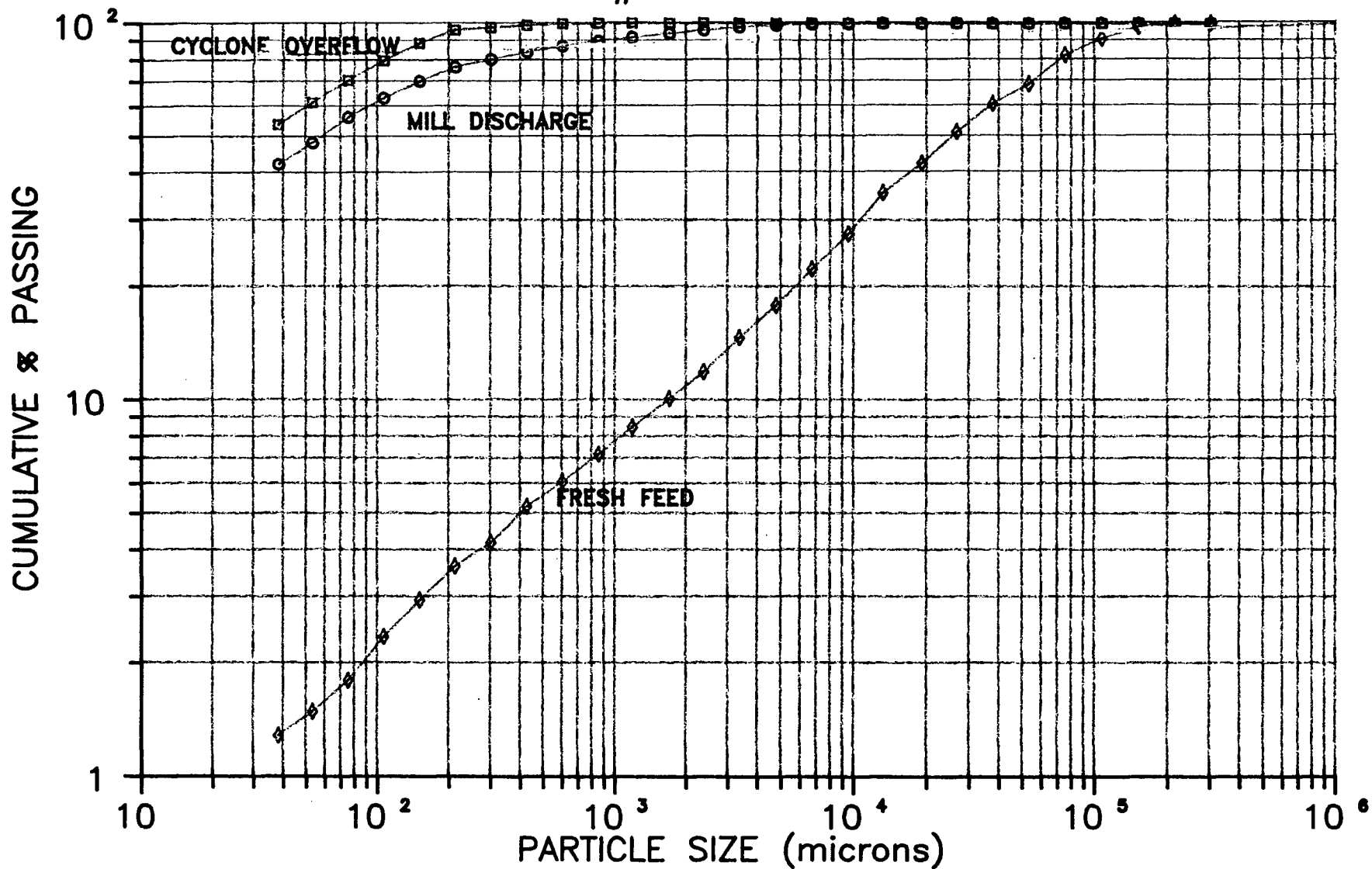
ISLAND COPPER RUN #4 ADJUSTED FULL-SCALE DATA



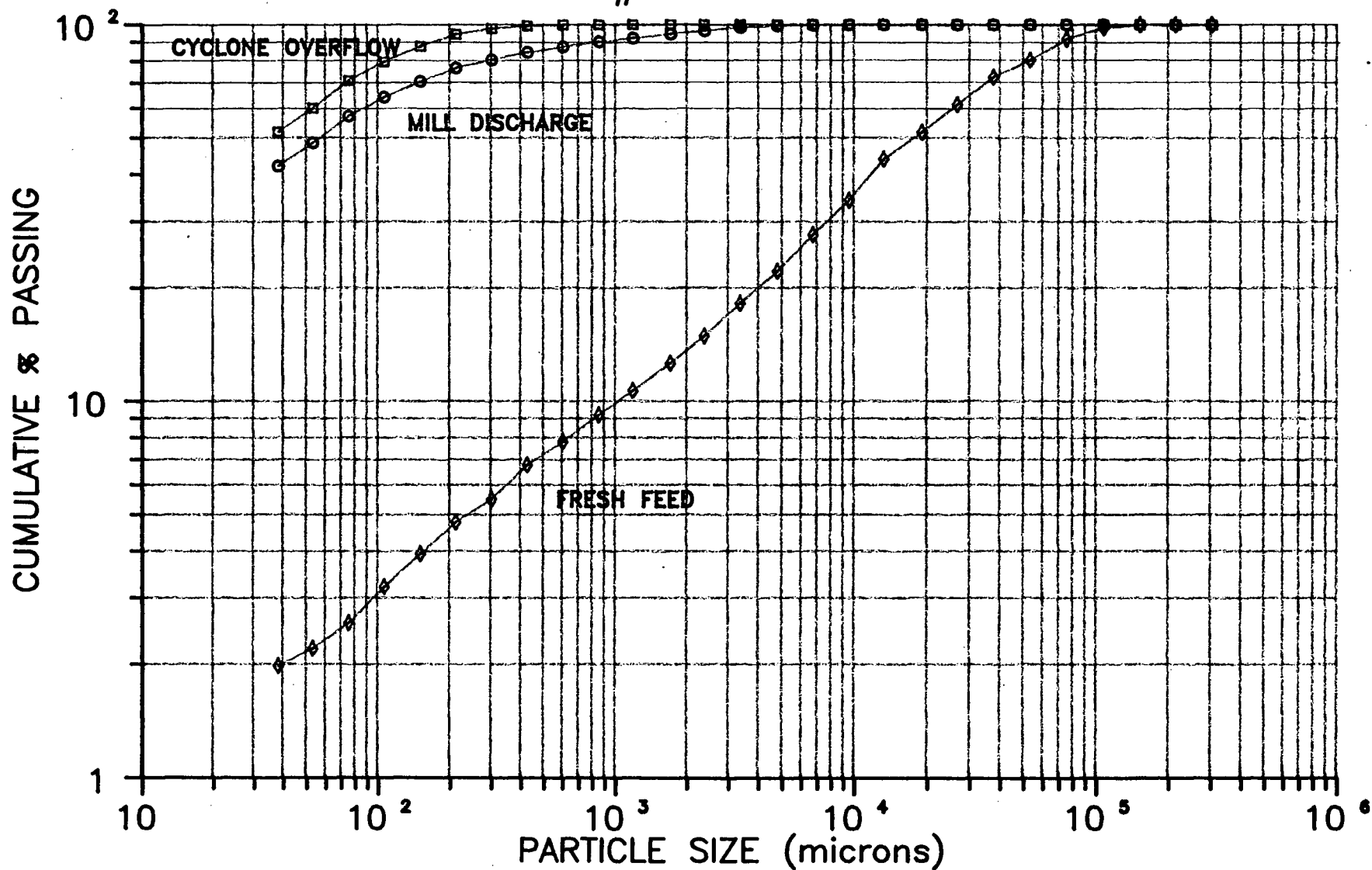
ISLAND COPPER RUN #5 ADJUSTED FULL-SCALE DATA



ISLAND COPPER RUN #6 ADJUSTED FULL-SCALE DATA



ISLAND COPPER RUN #7 ADJUSTED FULL-SCALE DATA



APPENDIX VIII.

**SIMILCO MINES: ADJUSTED FULL-SCALE & 60CM DATA
SIZE DISTRIBUTION PLOTS**

MASS BALANCE OF 60CM CIRCUIT SINILKAMEEN #1 LINE

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.18	.17	5.24	5.00	.00	.01	100.00	.00
MILL DISCH.	.47	.46	1.81	10.00	.00	.19	100.00	.00
SCREEN FEED	70.70	59.42	15.95	20.00	.00	59.16	100.00	.00
SCR OVERSIZE	.08	.09	18.78	10.00	.00	-.02	100.00	.00
SCR U/FLOW	54.60	59.33	8.67	20.00	.00	59.17	100.00	.00
MILL WATER	.00	.20	100.00	.00	.20	.20	.89	5.00
SUMP WATER	.00	58.96	100.00	.00	60.70	58.96	2.86	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.16	100.00	.00	99.00	93.91	5.14	5.00
MILL DISCH.	.00	.26	100.00	.00	53.64	57.62	7.41	10.00
SCREEN FEED	.00	.26	100.00	.00	2.00	.45	77.72	1000.00
SCR OVERSIZE	.00	.11	100.00	.00	84.44	119.40	41.41	10.00
SCR U/FLOW	.00	.16	100.00	.00	.27	.27	1.12	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	1.79	1.13	37.11	5.00	2.33	2.80	20.26	5.00
9500	10.77	12.21	13.37	5.00	31.73	30.39	4.22	5.00
6700	16.38	17.17	4.82	5.00	38.98	42.74	9.64	5.00
4570	6.01	6.93	15.35	5.00	19.86	17.26	13.11	5.00
3350	3.56	3.92	10.14	5.00	5.83	5.57	4.54	5.00
2360	1.91	2.11	10.52	5.00	1.17	1.14	2.16	5.00
1700	1.25	1.24	.98	5.00	.11	.11	.07	5.00
1180	.90	1.04	15.61	5.00	.00	.00	100.00	.00
850	1.04	1.05	1.05	5.00	.00	.00	100.00	.00
600	.70	.79	12.34	5.00	.00	.00	100.00	.00
425	.72	.77	6.46	5.00	.00	.00	100.00	.00
300	1.79	1.47	18.10	5.00	.00	.00	100.00	.00
212	1.23	1.29	4.69	5.00	.00	.00	100.00	.00
150	2.23	2.48	11.38	5.00	.00	.00	100.00	.00
106	3.30	3.08	6.73	5.00	.00	.00	100.00	.00
75	8.88	5.61	36.83	5.00	.00	.00	100.00	.00
53	4.42	5.23	18.26	5.00	.00	.00	100.00	.00
38	5.18	5.72	10.33	5.00	.00	.00	100.00	.00
-38	27.93	26.77	4.15	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	2.95	2.82	4.50	5.00
2360	3.05	2.76	9.51	5.00
1700	1.97	2.00	1.27	5.00
1180	2.26	1.74	23.05	5.00
850	1.77	1.76	.76	5.00
600	1.57	1.31	16.28	5.00
425	1.38	1.28	7.16	5.00
300	2.16	2.45	13.45	5.00
212	2.26	2.15	4.76	5.00
150	4.82	4.15	13.86	5.00
106	4.82	5.14	6.74	5.00
75	7.77	9.38	20.67	5.00
53	12.09	8.74	27.73	5.00
38	10.72	9.55	10.89	5.00
-38	40.41	44.77	10.79	5.00

MASS BALANCE OF 60CM CIRCUIT SIMILKAMEEN #3 LINE

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.16	.15	9.11	5.00	.00	.01	100.00	.00
MILL DISCH.	.56	.48	13.14	10.00	.00	.10	100.00	.00
SCREEN FEED	60.50	58.02	4.09	20.00	.00	57.64	100.00	.00
SCR OVERSIZE	.10	.13	25.48	10.00	.00	-.12	100.00	.00
SCR U/FLOW	56.60	57.89	2.29	20.00	.00	57.76	100.00	.00
MILL WATER	.00	.21	100.00	.00	.20	.21	2.78	5.00
SUMP WATER	.00	57.54	100.00	.00	45.00	57.54	27.87	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.13	100.00	.00	99.00	90.47	8.62	5.00
MILL DISCH.	.00	.39	100.00	.00	65.01	80.18	23.33	10.00
SCREEN FEED	.00	.39	100.00	.00	1.00	.67	33.39	1000.00
SCR OVERSIZE	.00	.25	100.00	.00	89.10	195.97	119.94	10.00
SCR U/FLOW	.00	.13	100.00	.00	.19	.23	21.10	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	4.69	5.16	10.10	5.00	9.14	7.88	13.79	5.00
9500	18.36	16.69	9.12	5.00	24.13	25.46	5.52	5.00
6700	25.78	25.67	.45	5.00	40.57	39.16	3.47	5.00
4570	14.48	13.55	6.44	5.00	19.90	20.67	3.88	5.00
3350	4.78	4.11	13.94	5.00	5.69	6.28	10.32	5.00
2360	1.51	1.87	23.78	5.00	.47	.45	4.90	5.00
1700	.58	.61	4.51	5.00	.10	.10	.52	5.00
1180	.40	.43	6.58	5.00	.00	.00	100.00	.00
850	.26	.26	.82	5.00	.00	.00	100.00	.00
600	.83	.24	71.17	5.00	.00	.00	100.00	.00
425	.25	.18	28.68	5.00	.00	.00	100.00	.00
300	.37	.33	9.95	5.00	.00	.00	100.00	.00
212	.40	.41	1.48	5.00	.00	.00	100.00	.00
150	1.12	1.13	.83	5.00	.00	.00	100.00	.00
106	1.02	.97	4.85	5.00	.00	.00	100.00	.00
75	1.80	1.63	9.66	5.00	.00	.00	100.00	.00
53	2.78	2.87	3.11	5.00	.00	.00	100.00	.00
38	2.91	3.12	7.37	5.00	.00	.00	100.00	.00
-38	17.67	20.78	17.61	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	7.11	4.57	35.68	5.00
1700	1.63	1.57	3.70	5.00
1180	1.33	1.24	7.00	5.00
850	.74	.75	1.11	5.00
600	.59	.69	17.68	5.00
425	.44	.52	17.58	5.00
300	.89	.97	8.62	5.00
212	1.19	1.18	1.03	5.00
150	3.26	3.28	.51	5.00
106	2.67	2.82	5.47	5.00
75	4.30	4.72	9.72	5.00
53	8.30	8.32	.20	5.00
38	9.48	9.06	4.38	5.00
-38	58.07	60.32	3.88	5.00

MASS BALANCE OF SIMILKAMEEN #1 CIRCUIT AUG 1987

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	372.00	370.38	.44	5.00	.00	9.25	100.00	.00
MILL DISCH.	.00	521.23	100.00	.00	.00	134.83	100.00	.00
SCR O/SIZE	.00	25.84	100.00	.00	.00	.56	100.00	.00
SCR U/FLOW	.00	545.25	100.00	.00	.00	184.12	100.00	.00
MILL WATER	.00	125.01	100.00	.00	124.00	125.01	.82	5.00
SCREEN WASH	.00	49.86	100.00	.00	50.00	49.86	.28	25.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	361.13	100.00	.00	98.50	97.50	1.01	3.00
MILL DISCH.	.00	386.40	100.00	.00	71.40	74.13	3.83	5.00
SCR O/SIZE	.00	25.28	100.00	.00	98.00	97.83	.18	5.00
SCR U/FLOW	.00	361.13	100.00	.00	67.52	66.23	1.91	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCR D/SIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	.00	.14	100.00	15.00	2.12	2.12	.06	10.00
19000	.00	.22	100.00	15.00	3.37	3.37	.09	10.00
13200	.00	1.13	100.00	15.00	17.12	17.20	.47	10.00
9500	5.00	4.82	3.53	15.00	55.13	56.60	2.67	10.00
6700	2.24	2.97	32.81	15.00	19.69	18.15	7.84	10.00
4750	2.51	3.09	23.26	15.00	2.40	2.39	.58	10.00
3350	2.07	2.51	21.41	15.00	.17	.17	.05	10.00
2360	2.64	3.12	18.16	15.00	.00	.00	100.00	.00
1700	2.28	2.55	12.00	15.00	.00	.00	100.00	.00
1180	2.62	2.72	3.69	15.00	.00	.00	100.00	.00
850	2.82	2.78	1.36	15.00	.00	.00	100.00	.00
600	3.72	3.51	5.57	15.00	.00	.00	100.00	.00
425	5.13	5.15	.41	15.00	.00	.00	100.00	.00
300	5.93	5.42	8.64	15.00	.00	.00	100.00	.00
212	6.17	5.34	13.46	15.00	.00	.00	100.00	.00
150	8.04	6.92	13.91	15.00	.00	.00	100.00	.00
106	5.74	5.81	1.22	15.00	.00	.00	100.00	.00
75	5.45	5.31	2.58	15.00	.00	.00	100.00	.00
53	6.02	5.23	13.10	15.00	.00	.00	100.00	.00
38	4.23	4.16	1.73	15.00	.00	.00	100.00	.00
-38	27.42	27.12	1.10	15.00	.00	.00	100.00	.00

STREAM

SCR. U/FLOW

	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	1.18	1.20	1.62	15.00
6700	4.18	1.91	54.24	15.00
4750	6.16	3.14	48.97	15.00
3350	4.45	2.68	39.84	15.00
2360	4.49	3.34	25.66	15.00
1700	3.15	2.73	13.26	15.00
1180	2.96	2.91	1.79	15.00
850	2.88	2.98	3.35	15.00
600	3.50	3.76	7.39	15.00
425	5.33	5.51	3.40	15.00
300	5.23	5.80	10.84	15.00
212	5.02	5.71	13.81	15.00
150	6.44	7.41	15.00	15.00
106	6.03	6.22	3.10	15.00
75	5.35	5.68	6.18	15.00
53	4.93	5.60	13.54	15.00
38	4.25	4.45	4.65	15.00
-38	24.53	29.04	18.40	15.00

MASS BALANCE OF SIMILKAMEEN #3 CIRCUIT AUG 1987

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	407.00	402.46	1.11	5.00	.00	10.19	100.00	.00
MILL DISCH.	.00	597.77	100.00	.00	.00	135.55	100.00	.00
SCR O/SIZE	.00	71.75	100.00	.00	.00	1.80	100.00	.00
SCR U/FLOW	.00	578.02	100.00	.00	.00	185.75	100.00	.00
MILL WATER	.00	123.56	100.00	.00	122.00	123.56	1.28	5.00
SCREEN WASH	.00	52.00	100.00	.00	50.00	52.00	4.00	25.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	392.27	100.00	.00	99.30	97.47	1.85	3.00
MILL DISCH.	.00	462.22	100.00	.00	73.80	77.32	4.78	5.00
SCR O/SIZE	.00	69.95	100.00	.00	98.00	97.49	.52	5.00
SCR U/FLOW	.00	392.27	100.00	.00	62.40	67.86	8.76	10.00

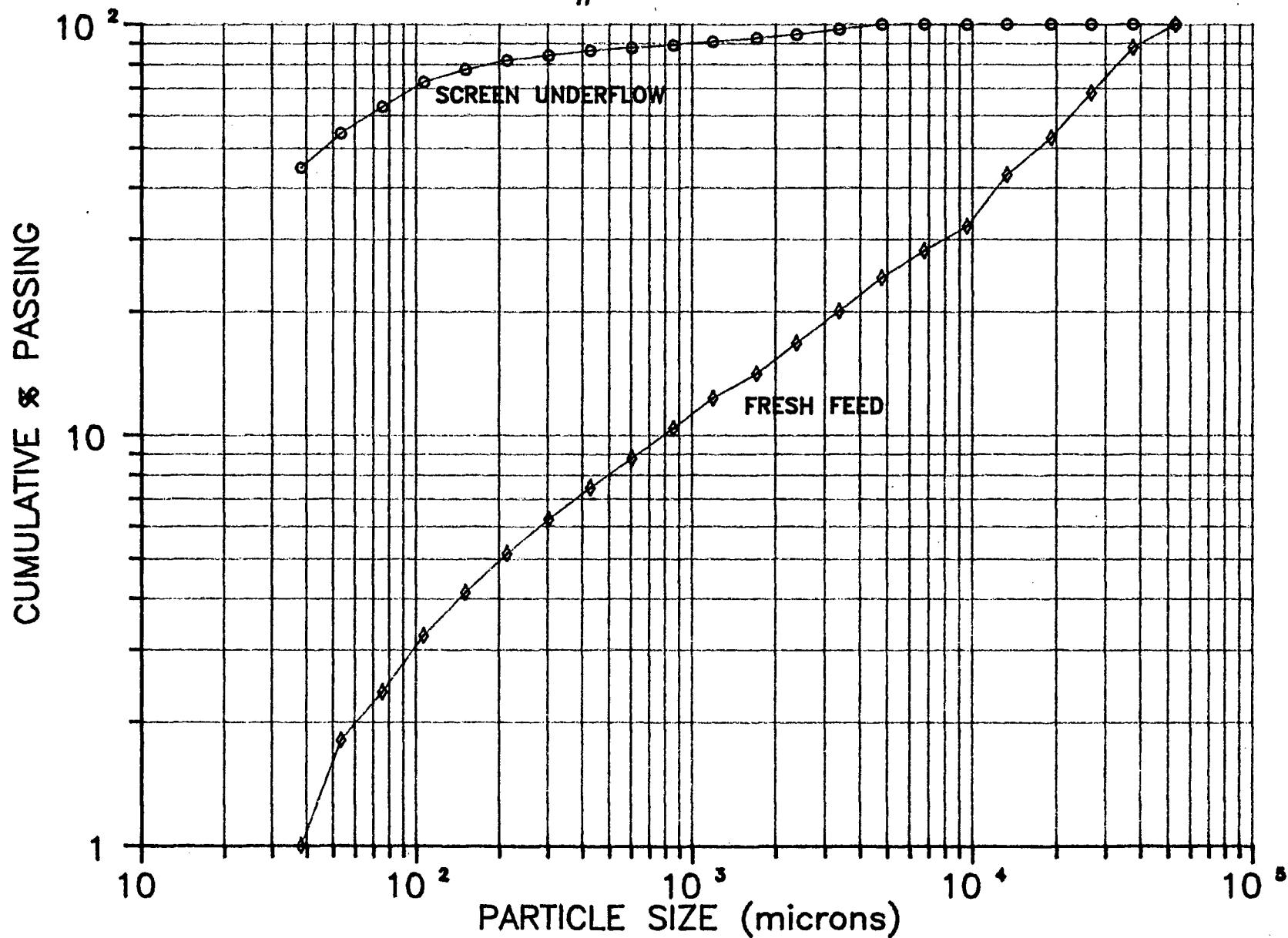
ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCR O/SIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.00	100.00	.00	.00	.00	100.00	.00
26500	13.24	2.06	84.48	15.00	12.46	13.58	9.00	10.00
19000	5.51	3.94	28.45	15.00	22.74	26.05	14.56	10.00
13200	2.91	3.80	30.65	15.00	28.50	25.12	11.85	10.00
9500	3.29	3.97	20.81	15.00	27.25	26.27	3.61	10.00
6700	2.74	3.17	15.77	15.00	8.60	8.53	.81	10.00
4750	2.99	3.36	12.30	15.00	.36	.36	.01	10.00
3350	2.79	3.09	10.87	15.00	.09	.09	.00	10.00
2360	3.13	3.58	14.33	15.00	.00	.00	100.00	.00
1700	2.52	2.78	10.16	15.00	.00	.00	100.00	.00
1180	2.50	2.81	12.35	15.00	.00	.00	100.00	.00
850	2.53	2.81	10.98	15.00	.00	.00	100.00	.00
600	2.98	3.28	10.21	15.00	.00	.00	100.00	.00
425	4.03	4.49	11.46	15.00	.00	.00	100.00	.00
300	4.41	4.75	7.70	15.00	.00	.00	100.00	.00
212	3.99	4.40	10.25	15.00	.00	.00	100.00	.00
150	5.70	6.18	8.42	15.00	.00	.00	100.00	.00
106	4.12	4.58	11.05	15.00	.00	.00	100.00	.00
75	4.01	4.37	8.94	15.00	.00	.00	100.00	.00
53	4.95	5.63	13.66	15.00	.00	.00	100.00	.00
38	2.99	3.22	7.73	15.00	.00	.00	100.00	.00
-38	18.65	23.72	27.16	15.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

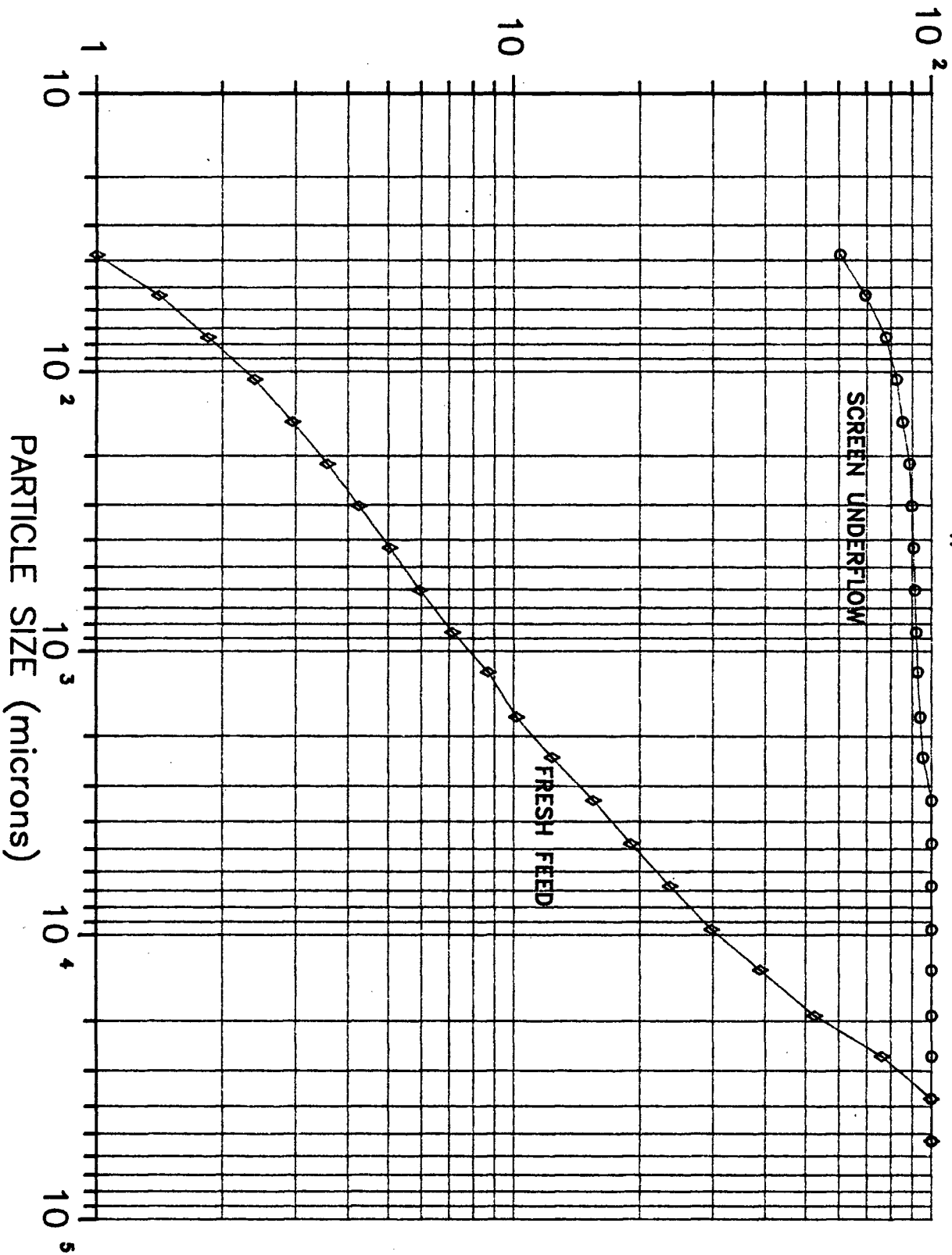
37500	.00	.00	100.00	.00
26500	.00	.00	100.00	.00
19000	.00	.00	100.00	.00
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	2.40	2.22	7.64	15.00
4750	4.21	3.89	7.55	15.00
3350	3.87	3.63	6.23	15.00
2350	4.70	4.22	10.28	15.00
1700	3.48	3.27	6.00	15.00
1180	3.64	3.31	9.08	15.00
850	3.56	3.31	7.07	15.00
600	4.07	3.87	4.92	15.00
425	5.51	5.29	3.94	15.00
300	5.53	5.60	1.20	15.00
212	5.32	5.18	2.57	15.00
150	7.06	7.28	3.14	15.00
106	5.57	5.39	3.22	15.00
75	5.20	5.15	1.01	15.00
53	6.94	6.63	4.47	15.00
38	3.87	3.80	1.92	15.00
-38	25.05	27.95	11.57	15.00

SIMILKAMEEN LINE #1 ADJUSTED 60CM CCT DATA



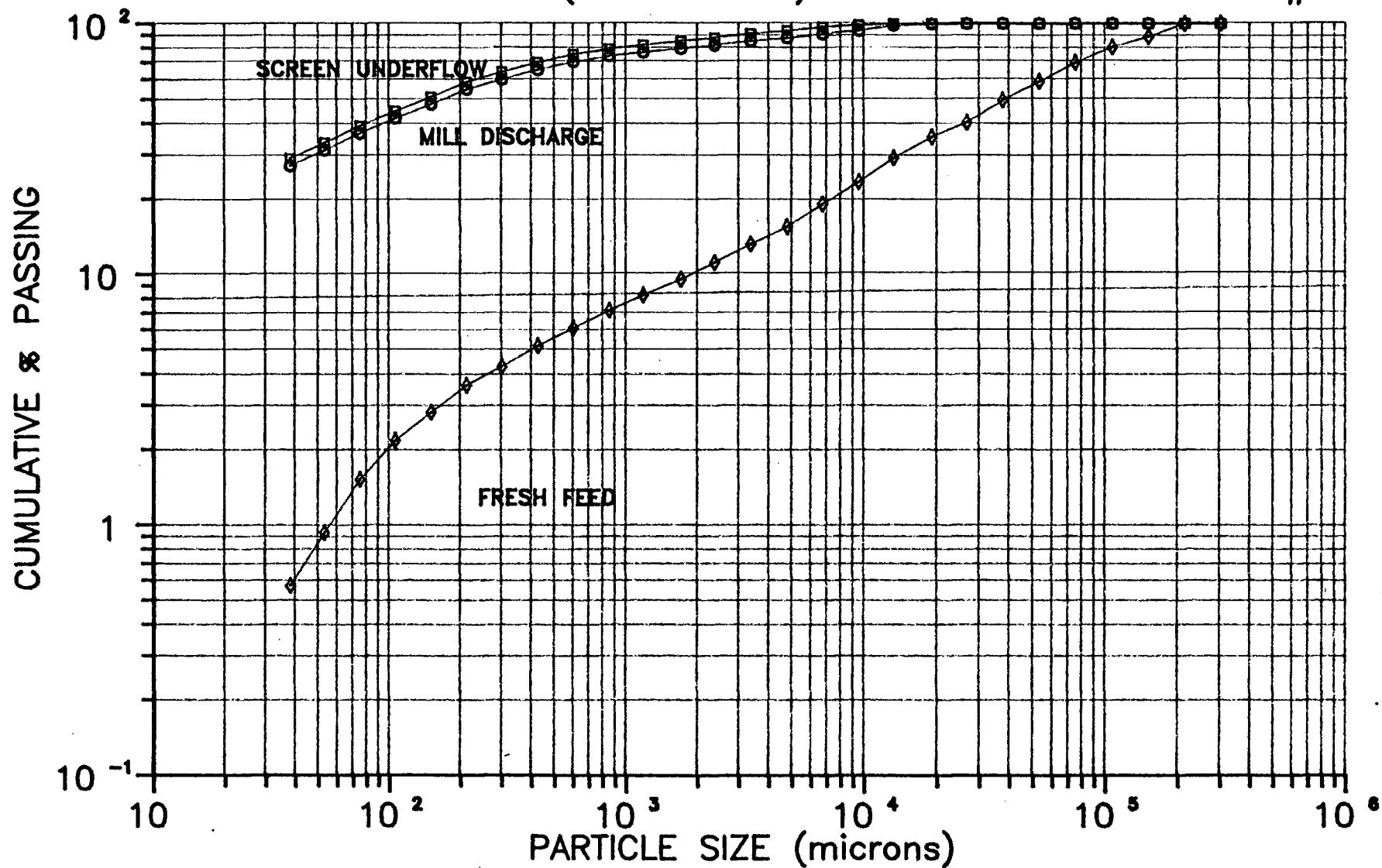
CUMULATIVE % PASSING

SIMILKAMEEN LINE #3 ADJUSTED 60CM CCT DATA



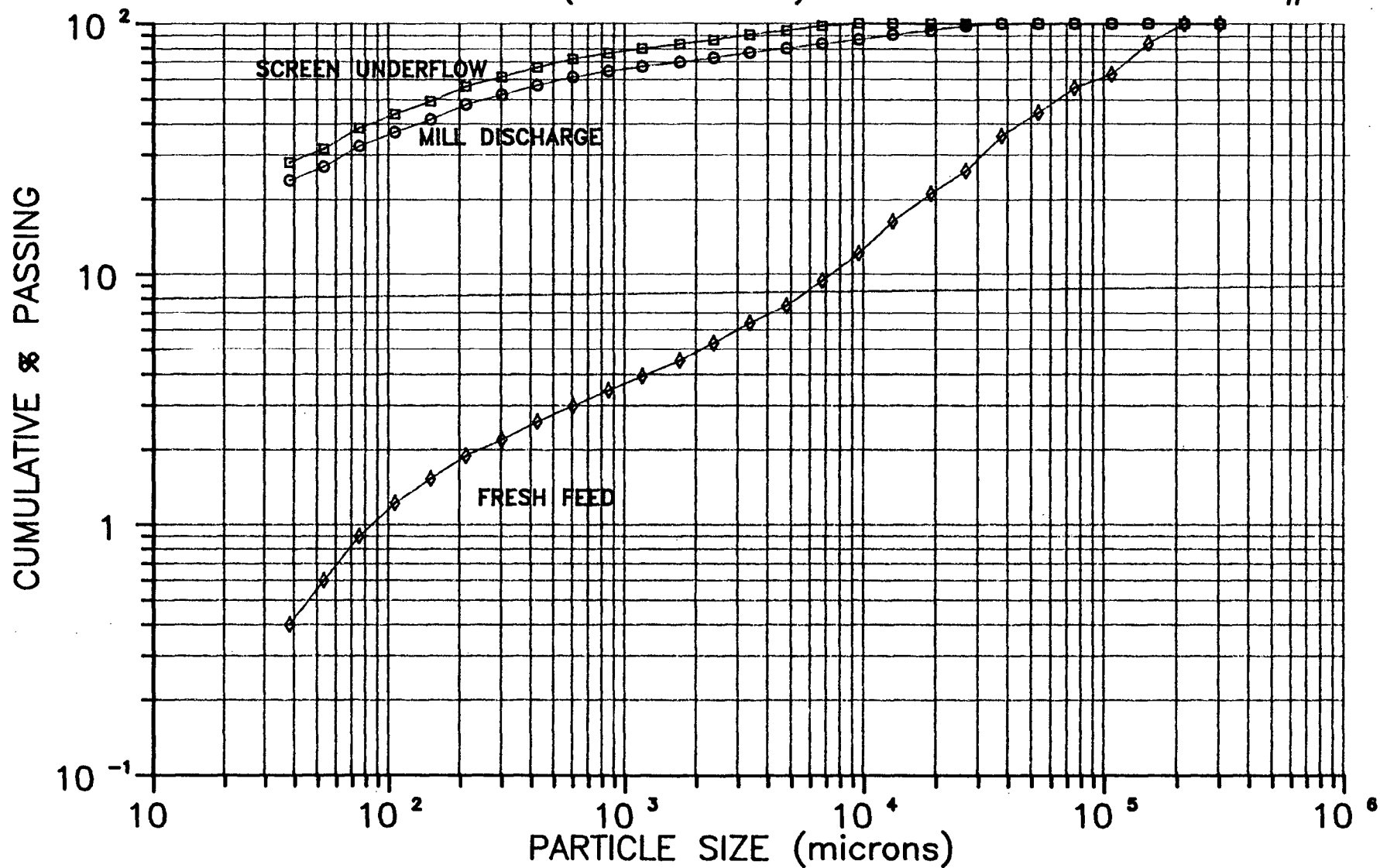
SIZE DISTRIBUTIONS(ADJUSTED) SIMILKAMEEN LINE #1

445



SIZE DISTRIBUTIONS(ADJUSTED) SIMILKAMEEN LINE #3

977



APPENDIX IX.

HIGHLAND VALLEY COPPER: ADJUSTED FULL-SCALE & 60CM DATA

SIZE DISTRIBUTION PLOTS

MASS BALANCE OF 60CN CIRCUIT HIGHLAND VALLEY COPPER A-CIRCUIT

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.34	.33	1.26	5.00	.00	.02	100.00	.00
MILL DISCH.	.75	.68	8.38	5.00	.00	.16	100.00	.00
SCREEN FEED	69.20	63.01	8.94	15.00	.00	62.49	100.00	.00
SCR OVERSIZE	.12	.14	25.74	10.00	.00	-.07	100.00	.00
SCR U/FLOW	72.60	62.87	13.40	20.00	.00	62.56	100.00	.00
MILL WATER	.00	.21	100.00	.00	.20	.21	3.04	5.00
SUMP WATER	.00	62.33	100.00	.00	60.00	62.33	3.88	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.31	100.00	.00	99.00	93.51	5.55	5.00
MILL DISCH.	.00	.53	100.00	.00	68.18	77.29	13.36	10.00
SCREEN FEED	.00	.53	100.00	.00	2.00	.84	58.08	1000.00
SCR OVERSIZE	.00	.22	100.00	.00	93.20	151.44	62.49	10.00
SCR U/FLOW	.00	.31	100.00	.00	.52	.49	5.39	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.35	.00	100.00	5.00	.00	.00	100.00	.00
9500	6.12	6.82	11.45	5.00	18.27	16.45	9.94	5.00
6700	19.07	20.06	5.18	5.00	45.89	48.39	5.44	5.00
4570	11.17	11.51	3.03	5.00	26.90	27.76	3.20	5.00
3350	2.87	3.49	21.54	5.00	7.25	5.74	20.91	5.00
2360	1.94	2.07	6.75	5.00	1.43	1.41	1.73	5.00
1700	.99	1.03	4.48	5.00	.18	.18	.30	5.00
1180	.95	.95	.51	5.00	.06	.06	.00	5.00
850	.87	.84	3.27	5.00	.00	.00	100.00	.00
600	.66	.79	19.34	5.00	.00	.00	100.00	.00
425	1.60	1.52	4.99	5.00	.00	.00	100.00	.00
300	2.22	2.56	15.54	5.00	.00	.00	100.00	.00
212	3.66	3.68	.51	5.00	.00	.00	100.00	.00
150	5.01	5.52	10.25	5.00	.00	.00	100.00	.00
106	16.64	12.88	22.61	5.00	.00	.00	100.00	.00
75	3.53	3.53	.02	5.00	.00	.00	100.00	.00
53	2.48	2.87	15.68	5.00	.00	.00	100.00	.00
38	2.57	2.98	16.08	5.00	.00	.00	100.00	.00
-38	17.27	16.86	2.38	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLGW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	2.07	1.89	8.59	5.00
2360	2.67	2.54	4.78	5.00
1700	1.71	1.64	4.11	5.00
1180	1.59	1.59	.10	5.00
850	1.39	1.44	3.41	5.00
600	2.07	1.35	35.01	5.00
425	2.47	2.60	5.12	5.00
300	5.58	4.38	21.49	5.00
212	6.22	6.28	1.02	5.00
150	10.48	9.43	9.98	5.00
106	18.45	22.00	19.22	5.00
75	5.94	6.03	1.48	5.00
53	6.25	4.90	21.60	5.00
38	6.57	5.10	22.44	5.00
-38	26.53	28.83	8.67	5.00

MASS BALANCE OF 60CM CIRCUIT HIGHLAND VALLEY COPPER C-CIRCUIT

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.35	.37	5.40	5.00	.00	.00	100.00	.00
MILL DISCH.	1.02	.84	17.70	5.00	.00	.25	100.00	.00
SCREEN FEED	69.50	59.74	14.05	15.00	.00	59.15	100.00	.00
SCR OVERSIZE	.16	.20	22.82	10.00	.00	-.03	100.00	.00
SCR U/FLOW	65.70	59.54	9.38	20.00	.00	59.18	100.00	.00
MILL WATER	.00	.28	100.00	.00	.26	.28	4.67	5.00
SUMP WATER	.00	58.90	100.00	.00	73.20	58.90	19.54	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.36	100.00	.00	99.50	98.75	.76	5.00
MILL DISCH.	.00	.59	100.00	.00	69.16	69.93	1.11	10.00
SCREEN FEED	.00	.59	100.00	.00	2.00	.99	50.72	1000.00
SCR OVERSIZE	.00	.23	100.00	.00	95.15	114.56	20.40	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	5.59	.22	96.06	5.00	.55	.57	4.14	5.00
9500	2.19	2.74	25.21	5.00	13.91	7.13	48.77	5.00
6700	12.12	15.40	27.05	5.00	39.02	40.02	2.56	5.00
4570	11.11	13.20	18.80	5.00	31.58	34.30	8.62	5.00
3350	13.55	7.32	46.01	5.00	11.62	14.63	25.92	5.00
2360	2.86	2.92	2.25	5.00	2.12	2.15	1.32	5.00
1700	1.65	1.65	.18	5.00	.42	.42	.37	5.00
1180	.89	.99	11.51	5.00	.25	.25	1.01	5.00
850	1.19	1.30	9.55	5.00	.16	.16	.35	5.00
600	1.54	1.56	1.02	5.00	.38	.38	.25	5.00
425	1.35	1.48	9.39	5.00	.00	.00	100.00	.00
300	2.69	2.91	8.18	5.00	.00	.00	100.00	.00
212	3.03	3.35	10.50	5.00	.00	.00	100.00	.00
150	7.89	8.53	8.05	5.00	.00	.00	100.00	.00
106	5.54	5.87	5.93	5.00	.00	.00	100.00	.00
75	4.50	5.09	13.10	5.00	.00	.00	100.00	.00
53	4.55	5.22	14.75	5.00	.00	.00	100.00	.00
38	5.48	4.73	13.62	5.00	.00	.00	100.00	.00
-38	12.28	15.52	26.40	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	2.53	2.74	8.33	5.00
2360	3.33	3.41	2.40	5.00
1700	2.36	2.42	2.68	5.00
1180	1.64	1.46	11.08	5.00
850	2.20	2.02	8.22	5.00
600	2.25	2.29	1.79	5.00
425	2.61	2.40	8.03	5.00
300	4.89	4.73	3.27	5.00
212	5.75	5.44	5.35	5.00
150	12.90	13.86	7.42	5.00
106	9.09	9.54	4.94	5.00
75	8.72	8.27	5.13	5.00
53	9.15	8.49	7.25	5.00
38	6.53	7.69	17.83	5.00
-38	26.05	25.24	3.13	5.00

MASS BALANCE OF HIGHLAND VALLEY A-CIRCUIT AUG 1987

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	12.28	11.84	3.56	5.00	.00	.55	100.00	.00
MILL DISCH.	.00	23.44	100.00	.00	.00	7.06	100.00	.00
SCREEN FEED	.00	27.36	100.00	.00	.00	10.98	100.00	.00
SCR OVERSIZE	.00	6.71	100.00	.00	.00	1.62	100.00	.00
SCR U/FLOW	.00	20.65	100.00	.00	.00	9.35	100.00	.00
MILL WATER	.00	4.88	100.00	.00	4.78	4.88	2.17	5.00
PBOX WATER	.00	3.92	100.00	.00	3.00	3.92	30.75	25.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	11.29	100.00	.00	98.30	95.37	2.98	3.00
MILL DISCH.	.00	16.38	100.00	.00	66.90	69.89	4.47	10.00
SCREEN FEED	.00	16.38	100.00	.00	57.35	59.87	4.40	5.00
SCR OVERSIZE	.00	5.09	100.00	.00	79.50	75.79	4.66	10.00
SCR U/FLOW	.00	11.29	100.00	.00	51.55	54.70	6.10	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	MILL DISCH.				SCREEN FEED			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	1.60	100.00	50.00	.00	1.60	100.00	10.00
26500	8.00	3.46	56.77	50.00	.00	3.12	100.00	100.00
19000	7.37	5.16	30.04	50.00	2.27	5.16	127.13	100.00
13200	3.88	7.55	94.71	50.00	5.03	7.55	50.20	100.00
9500	1.71	3.92	129.47	50.00	5.88	3.92	33.27	100.00
6700	3.15	3.13	.64	30.00	4.32	3.13	27.55	30.00
4750	3.51	2.69	23.36	30.00	4.71	2.69	42.89	30.00
3350	2.54	1.88	26.09	30.00	3.65	1.88	48.57	30.00
2360	3.14	3.05	2.88	30.00	4.43	3.05	31.16	30.00
1700	3.29	3.22	2.18	30.00	4.11	3.22	21.70	30.00
1180	3.82	3.96	3.56	20.00	4.57	3.96	13.43	20.00
850	4.04	4.44	9.80	20.00	4.78	4.44	7.20	20.00
600	5.06	5.53	9.26	20.00	5.78	5.53	4.35	20.00
425	5.89	6.41	8.84	10.00	6.72	6.41	4.61	10.00
300	5.98	6.43	7.58	10.00	6.38	6.43	.83	10.00
212	4.83	5.42	12.31	10.00	4.91	5.42	10.48	10.00
150	5.64	5.69	.89	10.00	5.42	5.69	4.99	10.00
106	5.56	6.03	8.43	10.00	6.16	6.03	2.13	10.00
75	3.13	3.10	1.06	10.00	3.00	3.10	3.23	10.00
53	3.54	3.83	8.12	10.00	3.54	3.83	8.12	10.00
38	2.52	2.63	4.48	10.00	2.40	2.63	9.70	10.00
-38	13.40	10.88	18.81	10.00	11.96	11.24	6.01	10.00

STREAMS	SCR OVERSIZE				SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	4.95	5.15	3.95	15.00	.00	.00	100.00	.00
26500	10.10	11.13	10.17	15.00	.00	.00	100.00	.00
19000	15.35	16.60	8.16	15.00	.00	.00	100.00	.00
13200	24.00	24.33	1.36	15.00	.00	.00	100.00	.00
9500	15.80	12.63	20.03	15.00	.00	.00	100.00	.00
6700	6.14	6.36	3.60	10.00	1.63	1.67	2.72	15.00
4750	3.40	3.50	3.07	10.00	2.17	2.32	7.05	15.00
3350	1.61	1.64	1.89	10.00	1.83	1.98	8.41	15.00
2360	1.27	1.28	.80	10.00	3.60	3.85	6.85	15.00
1700	.90	.90	.51	10.00	4.01	4.26	6.24	15.00
1180	.75	.75	.10	5.00	5.24	5.40	3.05	10.00
850	.90	.90	.06	5.00	6.00	6.03	.47	10.00
600	1.20	1.20	.08	5.00	7.45	7.48	.38	10.00
425	1.33	1.33	.04	5.00	8.96	8.70	2.91	10.00
300	1.58	1.58	.03	5.00	9.24	8.62	6.72	10.00
212	1.64	1.63	.45	5.00	7.56	7.13	5.65	5.00
150	1.57	1.57	.01	5.00	7.62	7.55	.97	5.00
106	1.53	1.53	.00	5.00	8.15	8.06	1.16	5.00
75	1.38	1.38	.05	5.00	3.88	3.87	.26	5.00
53	1.43	1.42	.38	5.00	5.10	4.91	3.73	5.00
38	1.24	1.23	.45	5.00	3.37	3.26	3.18	5.00
-38	1.98	1.99	.47	5.00	13.63	14.35	5.29	5.00

MASS BALANCE OF HIGHLAND VALLEY C-CIRCUIT AUG 1987

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	17.02	17.57	3.25	5.00	.00	-.23	100.00	.00
MILL DISCH.	.00	31.92	100.00	.00	.00	9.66	100.00	.00
SCREEN FEED	.00	34.17	100.00	.00	.00	11.91	100.00	.00
SCR OVERSIZE	.00	5.66	100.00	.00	.00	1.21	100.00	.00
SCR U/FLOW	.00	28.51	100.00	.00	.00	10.70	100.00	.00
MILL WATER	.00	8.69	100.00	.00	8.90	8.69	2.38	5.00
PBOX WATER	.00	2.25	100.00	.00	2.50	2.25	10.09	20.00

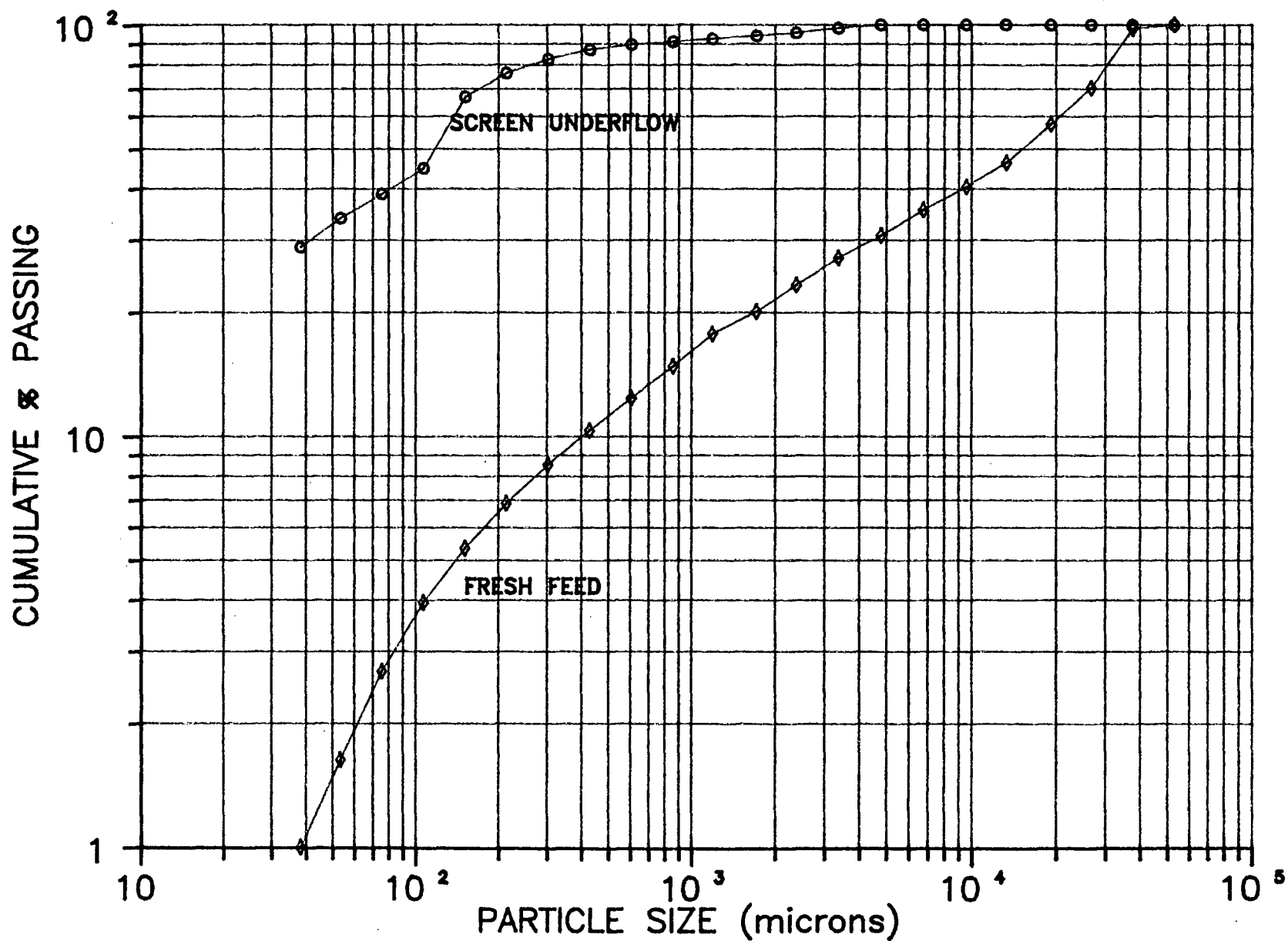
STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	17.81	100.00	.00	98.30	101.33	3.08	3.00
MILL DISCH.	.00	22.26	100.00	.00	71.00	69.73	1.79	10.00
SCREEN FEED	.00	22.26	100.00	.00	68.00	65.14	4.20	5.00
SCR OVERSIZE	.00	4.45	100.00	.00	78.00	78.67	.85	5.00
SCR U/FLOW	.00	17.81	100.00	.00	64.50	62.46	3.16	5.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

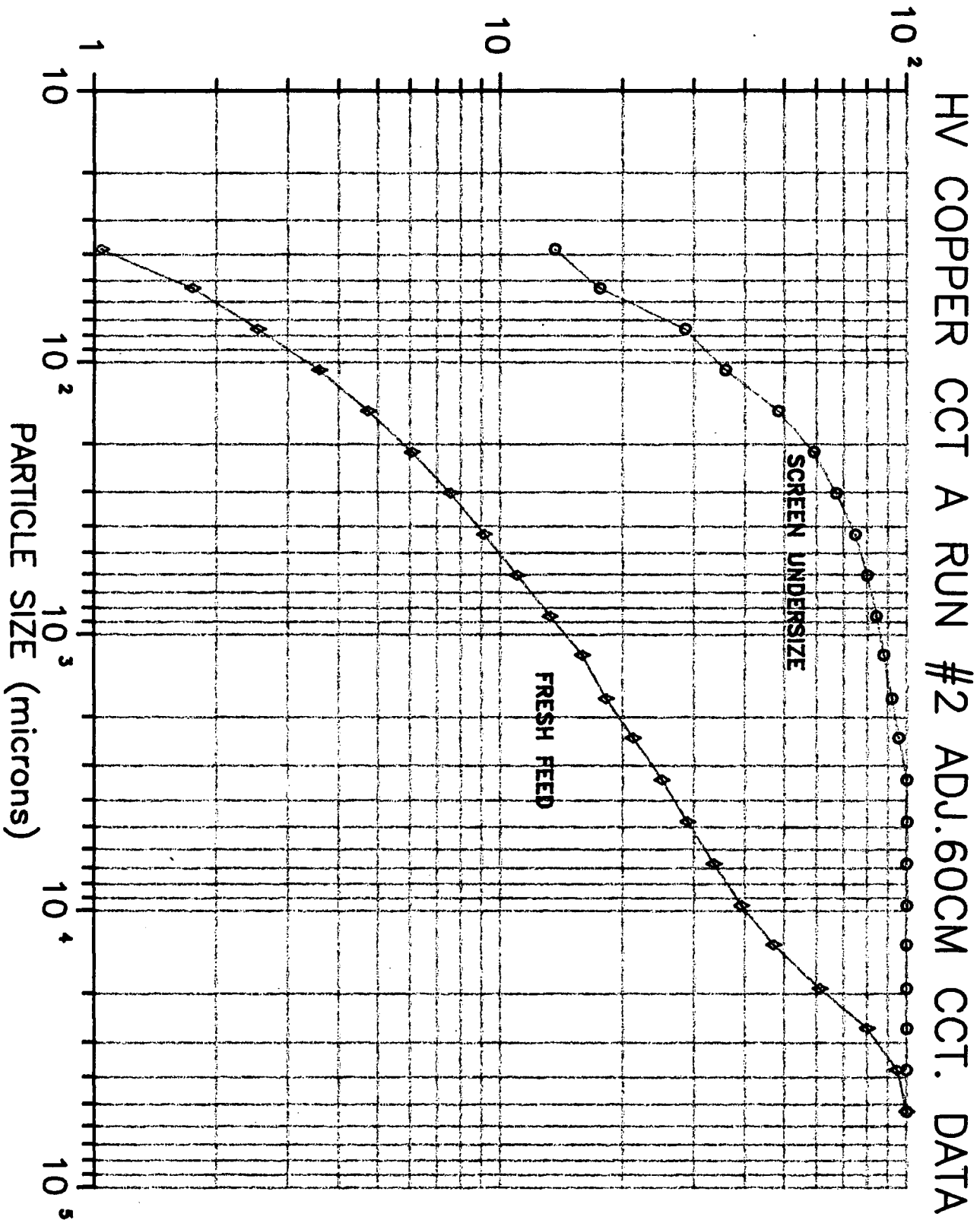
STREAMS	MILL DISCH.				SCREEN FEED			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	.00	.35	100.00	15.00	.00	.35	100.00	10.00
26500	.00	1.54	100.00	15.00	.00	1.54	100.00	10.00
19000	.00	4.98	100.00	15.00	.00	4.98	100.00	10.00
13200	5.51	7.67	39.21	15.00	11.87	7.67	35.38	10.00
9500	2.21	3.56	61.00	15.00	7.01	3.56	49.24	10.00
6700	2.38	4.29	80.27	15.00	4.77	4.29	10.05	10.00
4750	1.96	3.60	83.44	15.00	3.23	3.60	11.32	10.00
3350	2.73	3.50	28.26	15.00	3.73	3.50	6.13	10.00
2360	3.39	3.47	2.25	15.00	3.80	3.47	8.78	10.00
1700	3.48	3.53	1.53	15.00	3.44	3.53	2.71	10.00
1180	4.39	4.00	8.94	15.00	3.63	4.00	10.12	10.00
850	4.95	4.34	12.30	15.00	4.02	4.34	7.98	10.00
600	6.26	5.38	14.02	15.00	4.93	5.38	9.17	10.00
425	11.11	6.63	40.33	15.00	7.14	6.63	7.15	10.00
300	6.17	6.06	1.71	15.00	5.39	6.06	12.51	10.00
212	5.80	4.83	16.80	15.00	4.30	4.83	12.23	10.00
150	6.16	5.25	14.73	15.00	4.72	5.25	11.28	10.00
106	7.11	6.77	4.74	15.00	6.41	6.77	5.67	10.00
75	3.37	2.47	26.80	15.00	2.14	2.47	15.28	10.00
53	4.47	3.43	23.30	15.00	3.08	3.43	11.31	10.00
38	2.99	2.41	19.37	15.00	2.08	2.41	15.91	10.00
-38	15.55	11.93	23.29	15.00	14.31	11.94	16.57	10.00

STREAMS	SCR OVERSIZE				SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
37500	1.72	1.73	.34	10.00	.00	.00	100.00	.00
26500	7.61	7.72	1.47	10.00	.00	.00	100.00	.00
19000	23.88	24.92	4.37	10.00	.00	.00	100.00	.00
13200	33.90	35.75	5.46	10.00	.65	.65	.15	5.00
9500	15.68	13.59	13.34	10.00	1.06	1.05	.84	5.00
6700	5.14	4.51	12.23	10.00	4.76	4.24	11.03	5.00
4750	2.61	2.32	11.19	10.00	4.95	3.91	20.91	5.00
3350	1.14	1.13	.45	10.00	4.15	4.09	1.37	5.00
2360	.61	.61	.37	10.00	4.07	4.18	2.70	5.00
1700	.50	.50	.00	10.00	4.28	4.29	.27	5.00
1180	.46	.46	.08	10.00	4.91	4.88	.57	5.00
850	.45	.45	.01	10.00	5.29	5.31	.44	5.00
600	.60	.60	.01	10.00	6.54	6.58	.57	5.00
425	.71	.71	.51	10.00	7.65	8.11	5.99	5.00
300	.57	.57	.14	10.00	7.54	7.44	1.35	5.00
212	.68	.68	.08	10.00	5.88	5.86	.30	5.00
150	.67	.67	.05	10.00	6.40	6.40	.03	5.00
106	.60	.60	.05	10.00	8.22	8.32	1.17	5.00
75	.58	.58	.30	10.00	2.98	2.94	1.37	5.00
53	.51	.51	.04	10.00	4.16	4.16	.05	5.00
38	.42	.42	.32	10.00	2.97	2.91	2.06	5.00
-38	.88	.88	.49	10.00	13.52	14.66	8.45	5.00

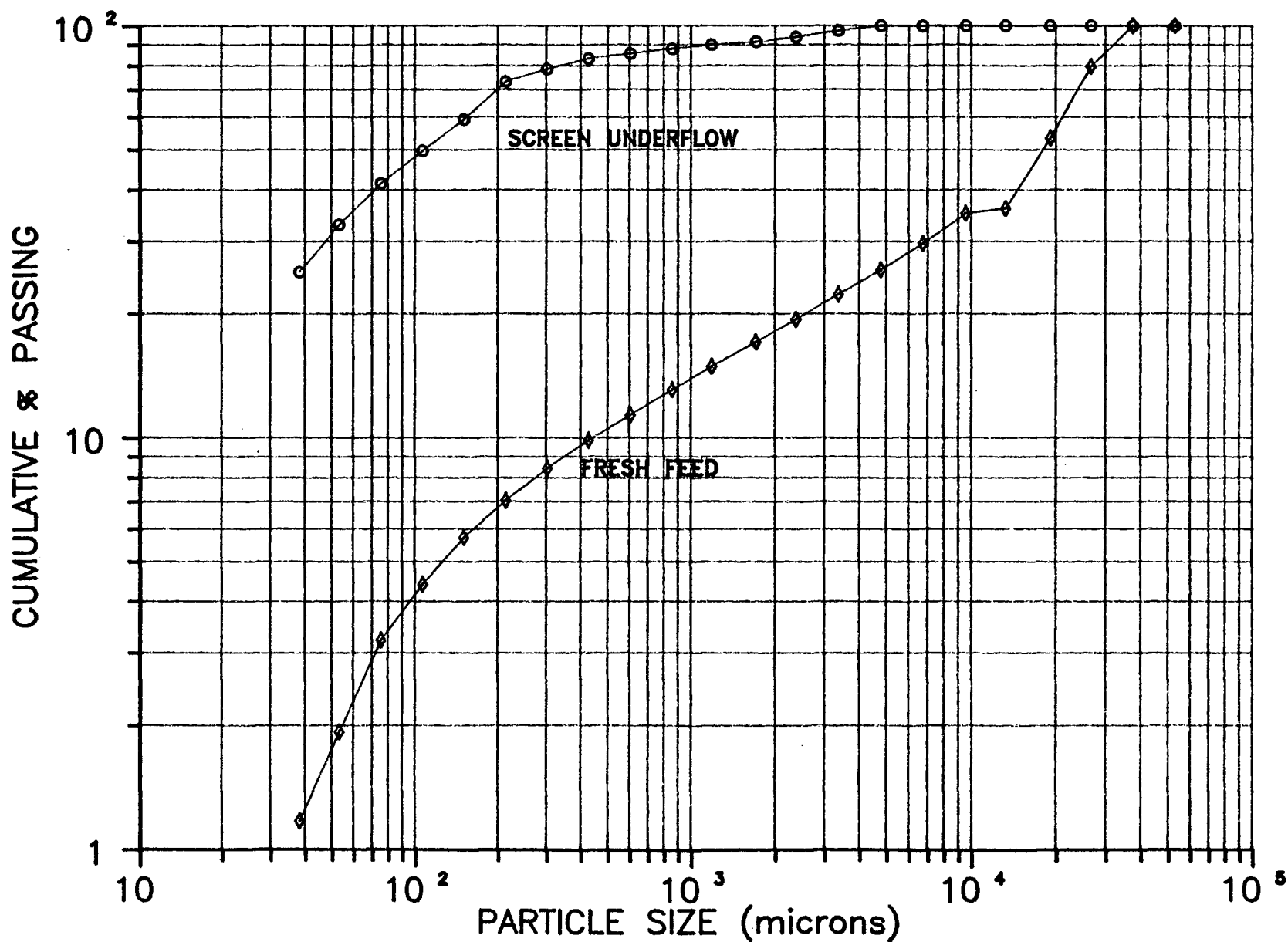
HVC A-CIRCUIT ADJUSTED 60CM CIRCUIT DATA



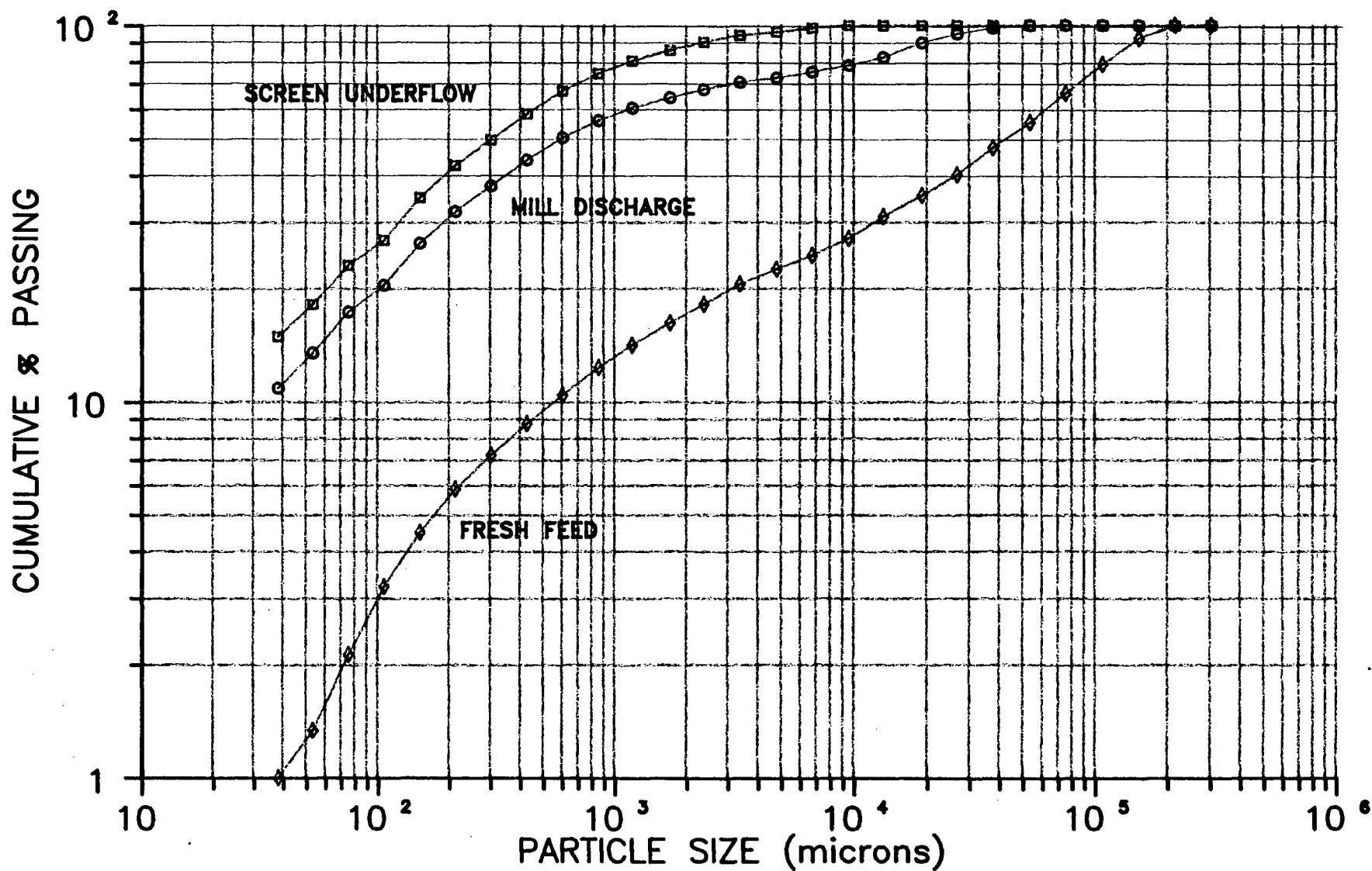
CUMULATIVE % PASSING



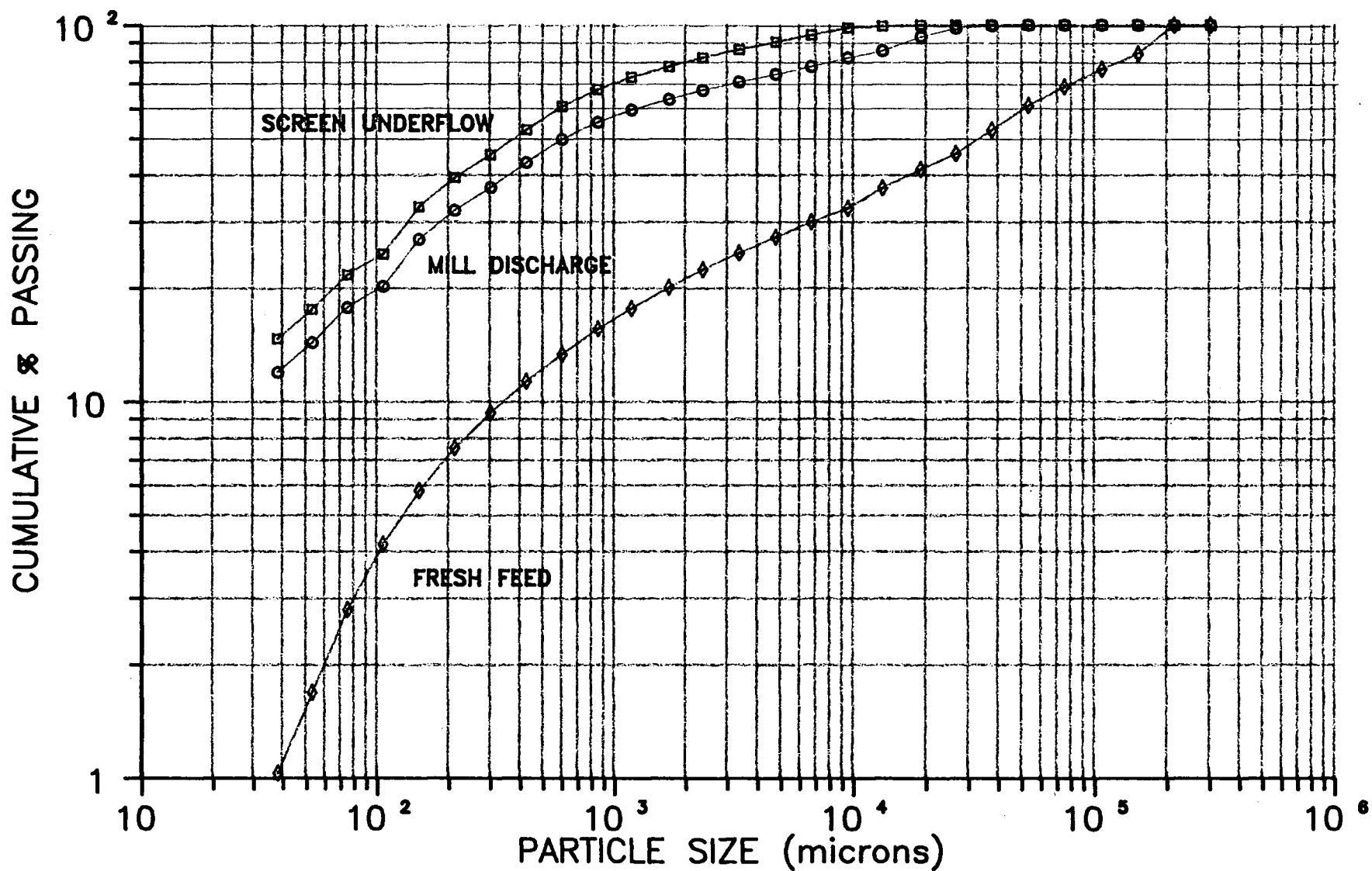
HVC C-CIRCUIT ADJUSTED 60CM CIRCUIT DATA



HIGHLAND VALLEY COPPER A-CIRCUIT ADJUSTED DATA



HIGHLAND VALLEY COPPER C-CIRCUIT ADJUSTED DATA



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APPENDIX X.

ECHO BAY JUNEAU: ADJUSTED 60CM DATA & SIZE DISTRIBUTION DATA

MASS BALANCE OF 60CM CIRCUIT ECHO BAY JUNEAU #1 SLATE

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.50	.48	3.04	5.00	.00	.01	100.00	.00
MILL DISCH.	1.46	1.20	17.93	20.00	.00	.18	100.00	.00
SCREEN FEED	76.50	79.26	3.61	15.00	.00	78.25	100.00	.00
SCR OVERSIZE	.23	.25	9.35	10.00	.00	-.29	100.00	.00
SCR U/FLOW	86.10	79.01	8.24	20.00	.00	78.54	100.00	.00
MILL WATER	.00	.46	100.00	.00	.45	.46	1.94	5.00
SUMP WATER	.00	78.06	100.00	.00	83.70	78.06	6.73	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.47	100.00	.00	99.00	97.27	1.75	3.00
MILL DISCH.	.00	1.01	100.00	.00	66.50	84.76	27.46	10.00
SCREEN FEED	.00	1.01	100.00	.00	1.00	1.28	28.04	1000.00
SCR OVERSIZE	.00	.55	100.00	.00	80.00	213.98	167.48	20.00
SCR U/FLOW	.00	.47	100.00	.00	.60	.59	.92	10.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	1.51	1.52	.37	5.00	.00	2.82	100.00	5.00
9500	9.76	9.03	7.43	5.00	15.46	16.82	8.78	5.00
6700	17.82	19.97	12.06	5.00	40.54	37.17	8.31	5.00
4570	14.98	16.20	8.12	5.00	31.46	30.15	4.17	5.00
3350	8.27	7.93	4.13	5.00	11.14	11.67	4.76	5.00
2360	4.18	4.81	15.16	5.00	1.30	1.27	2.33	5.00
1700	2.66	2.09	21.40	5.00	.11	.11	.49	5.00
1180	1.43	1.38	3.68	5.00	.00	.00	100.00	.00
850	1.07	1.07	.43	5.00	.00	.00	100.00	.00
600	1.48	1.36	8.03	5.00	.00	.00	100.00	.00
425	1.48	1.64	10.74	5.00	.00	.00	100.00	.00
300	1.76	1.75	.50	5.00	.00	.00	100.00	.00
212	1.90	2.11	11.19	5.00	.00	.00	100.00	.00
150	4.77	2.55	46.51	5.00	.00	.00	100.00	.00
106	2.52	3.10	23.12	5.00	.00	.00	100.00	.00
75	2.44	2.88	17.98	5.00	.00	.00	100.00	.00
53	6.24	5.01	19.78	5.00	.00	.00	100.00	.00
38	1.88	1.86	1.11	5.00	.00	.00	100.00	.00
-38	14.62	14.52	.71	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	3.48	3.59	3.03	5.00
2360	9.96	8.93	10.36	5.00
1700	3.77	4.39	16.44	5.00
1180	2.83	2.98	5.17	5.00
850	2.26	2.30	1.86	5.00
600	2.71	2.94	8.53	5.00
425	3.97	3.54	10.80	5.00
300	3.68	3.78	2.83	5.00
212	5.11	4.56	10.67	5.00
150	4.48	5.51	23.07	5.00
106	11.36	6.70	40.98	5.00
75	7.99	6.22	22.15	5.00
53	9.08	10.82	19.12	5.00
38	3.88	4.02	3.54	5.00
-38	25.44	29.72	16.81	5.00

MASS BALANCE OF 60CM CIRCUIT ECHO BAY JUNEAU RUN #2 (GABBRO)

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.37	.36	4.49	5.00	.00	.01	100.00	.00
MILL DISCH.	1.12	.91	18.95	10.00	.00	.24	100.00	.00
SCREEN FEED	72.60	57.75	20.46	15.00	.00	57.08	100.00	.00
SCR OVERSIZE	.17	.21	24.39	10.00	.00	-.12	100.00	.00
SCR U/FLOW	51.00	57.54	12.82	20.00	.00	57.19	100.00	.00
MILL WATER	.00	.34	100.00	.00	.33	.34	2.21	5.00
SUMP WATER	.00	56.84	100.00	.00	65.00	56.84	12.55	30.00

STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.35	100.00	.00	99.00	96.73	2.29	3.00
MILL DISCH.	.00	.67	100.00	.00	66.80	73.93	10.67	10.00
SCREEN FEED	.00	.67	100.00	.00	1.00	1.16	15.90	1000.00
SCR OVERSIZE	.00	.32	100.00	.00	85.00	155.84	83.34	10.00
SCR U/FLOW	.00	.35	100.00	.00	.70	.60	14.21	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	1.91	1.90	.74	5.00	.00	3.92	100.00	5.00
9500	9.13	7.06	22.70	5.00	12.85	14.59	13.54	5.00
6700	20.27	20.10	.86	5.00	44.03	41.54	5.65	5.00
4570	13.24	13.69	3.43	5.00	30.93	28.31	8.47	5.00
3350	6.05	6.31	4.30	5.00	10.38	9.85	5.11	5.00
2360	3.44	3.62	5.33	5.00	1.65	1.63	1.48	5.00
1700	2.12	1.28	39.55	5.00	.13	.13	1.15	5.00
1180	1.07	1.01	6.05	5.00	.03	.03	.08	5.00
850	.88	.84	4.74	5.00	.00	.00	100.00	.00
600	1.04	1.10	6.04	5.00	.00	.00	100.00	.00
425	1.22	1.02	16.13	5.00	.00	.00	100.00	.00
300	1.59	1.31	17.86	5.00	.00	.00	100.00	.00
212	1.66	1.43	13.93	5.00	.00	.00	100.00	.00
150	1.77	2.02	14.07	5.00	.00	.00	100.00	.00
106	2.10	2.59	23.27	5.00	.00	.00	100.00	.00
75	4.91	3.24	33.95	5.00	.00	.00	100.00	.00
53	4.85	4.89	.81	5.00	.00	.00	100.00	.00
38	3.19	3.72	16.54	5.00	.00	.00	100.00	.00
-38	19.56	22.88	16.98	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.

13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	2.96	2.99	1.13	5.00
2360	5.51	5.49	.28	5.00
1700	1.96	2.36	20.35	5.00
1180	1.80	1.92	6.61	5.00
850	1.54	1.62	5.44	5.00
600	2.25	2.14	5.06	5.00
425	1.75	1.98	13.25	5.00
300	2.21	2.53	14.47	5.00
212	2.46	2.77	12.50	5.00
150	4.63	3.91	15.53	5.00
106	10.61	5.01	52.74	5.00
75	5.14	6.28	22.20	5.00
53	8.94	9.47	5.93	5.00
38	8.64	7.20	16.66	5.00
-38	39.58	44.30	11.92	5.00

MASS BALANCE OF 60CM CIRCUIT ECHO BAY JUNEAU RUN #3 (50/50 BLEND)

MASS BALANCE RESULTS

ESTIMATES OF NETWORKS 1 & 2 VARIABLES

STREAMS	PULP FLOW RATES				WATER FLOW RATES			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.33	.31	5.68	5.00	.00	.01	100.00	.00
MILL DISCH.	.66	.61	7.66	10.00	.00	.18	100.00	.00
SCREEN FEED	80.50	66.41	17.50	15.00	.00	65.98	100.00	.00
SCR OVERSIZE	.05	.07	21.57	10.00	.00	-.06	100.00	.00
SCR U/FLOW	59.10	66.35	12.26	20.00	.00	66.05	100.00	.00
MILL WATER	.00	.23	100.00	.00	.23	.23	1.44	5.00
SUMP WATER	.00	65.80	100.00	.00	60.00	65.80	9.67	30.00

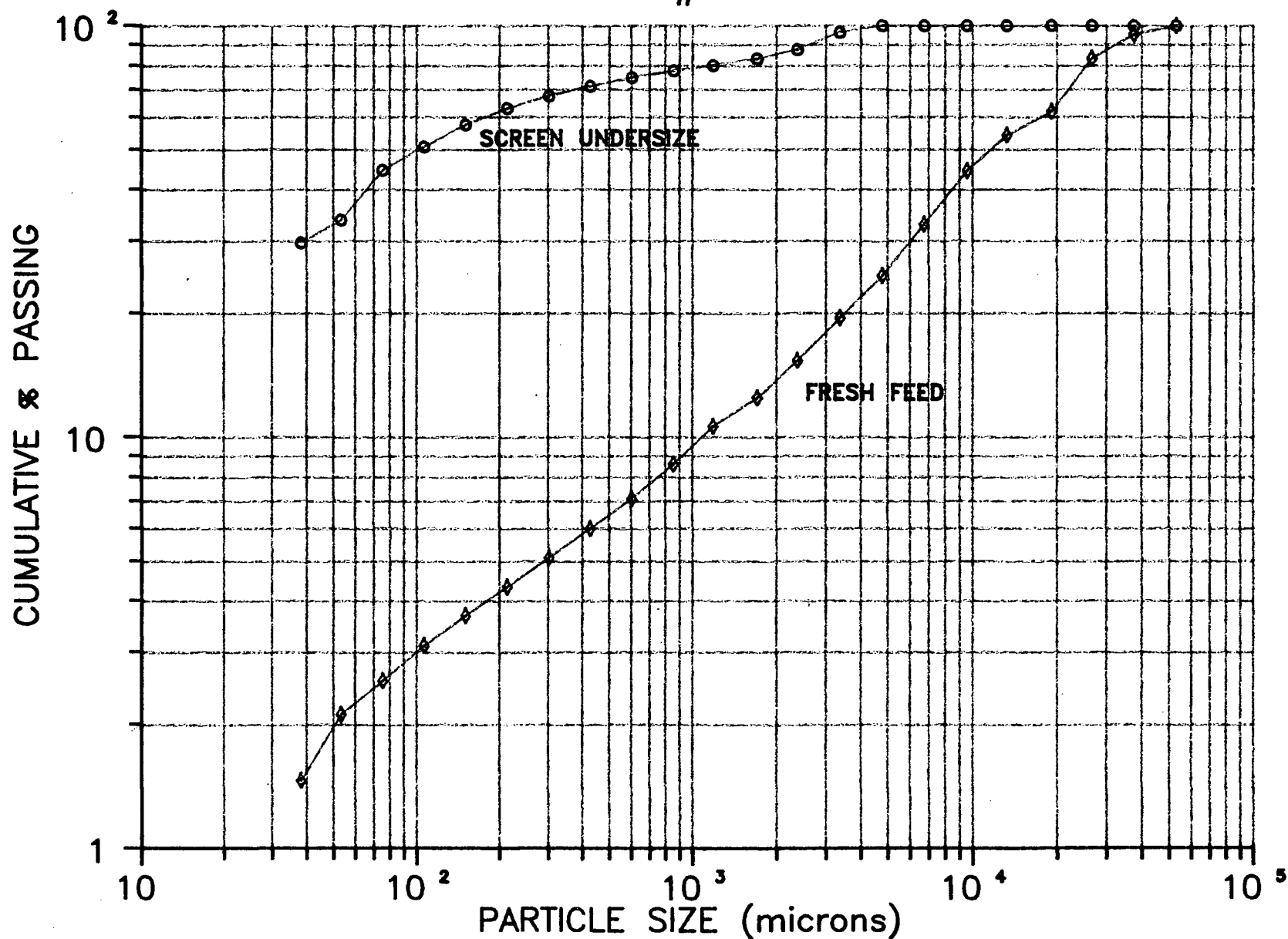
STREAMS	SOLID FLOW RATES				PULP PERCENT SOLIDS			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV	VALUES	VALUES	VALUES	ST.DEV
FRESH FEED	.00	.30	100.00	.00	99.00	96.52	2.50	3.00
MILL DISCH.	.00	.43	100.00	.00	64.30	70.74	10.01	10.00
SCREEN FEED	.00	.43	100.00	.00	1.00	.65	35.19	1000.00
SCR OVERSIZE	.00	.13	100.00	.00	85.00	197.19	131.99	10.00
SCR U/FLOW	.00	.30	100.00	.00	.48	.45	6.23	20.00

ESTIMATES OF NETWORK 3 MASS FRACTIONS

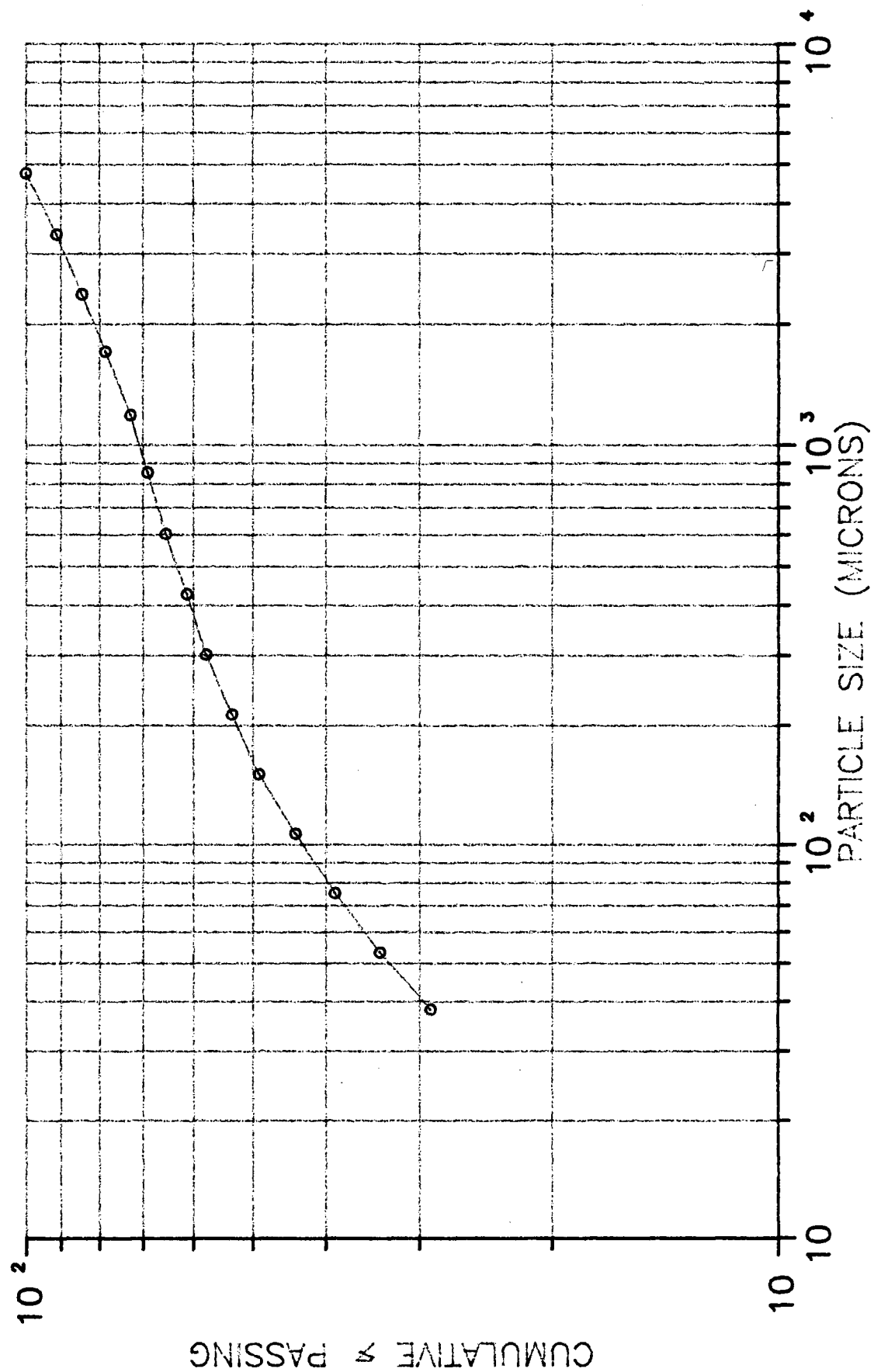
STREAMS	SCREEN FEED				SCR OVERSIZE			
	MEAS.	ESTIM.	RESID.	RELAT.	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.	VALUES	VALUES	VALUES	ST.DEV.
13200	.93	1.00	7.13	5.00	5.33	3.25	38.97	10.00
9500	7.90	9.07	14.80	5.00	31.79	29.61	6.86	10.00
6700	10.34	11.76	13.70	5.00	33.32	38.38	15.20	10.00
4570	5.07	5.65	11.43	5.00	21.64	18.44	14.77	10.00
3350	3.13	2.89	7.77	5.00	6.95	9.42	35.60	10.00
2360	2.01	2.50	24.23	5.00	.83	.74	10.53	10.00
1700	1.63	1.30	19.99	5.00	.09	.09	1.54	10.00
1180	1.00	1.10	9.86	5.00	.04	.04	.40	10.00
850	.89	.94	6.08	5.00	.00	.00	100.00	.00
600	1.04	1.12	8.02	5.00	.00	.00	100.00	.00
425	1.02	1.10	7.58	5.00	.00	.00	100.00	.00
300	1.47	1.71	16.44	5.00	.00	.00	100.00	.00
212	4.08	2.83	30.72	5.00	.00	.00	100.00	.00
150	2.96	2.86	3.53	5.00	.00	.00	100.00	.00
106	1.19	1.41	18.38	5.00	.00	.00	100.00	.00
75	3.69	4.46	20.86	5.00	.00	.00	100.00	.00
53	1.31	1.52	16.23	5.00	.00	.00	100.00	.00
38	2.32	2.88	24.31	5.00	.00	.00	100.00	.00
-38	48.03	43.92	8.56	5.00	.00	.00	100.00	.00

STREAM	SCR U/FLOW			
	MEAS.	ESTIM.	RESID.	RELAT.
	VALUES	VALUES	VALUES	ST.DEV.
13200	.00	.00	100.00	.00
9500	.00	.00	100.00	.00
6700	.00	.00	100.00	.00
4570	.00	.00	100.00	.00
3350	.00	.00	100.00	.00
2360	5.07	3.27	35.47	5.00
1700	1.59	1.84	15.70	5.00
1180	1.73	1.57	9.47	5.00
850	1.43	1.36	4.83	5.00
600	1.74	1.62	6.93	5.00
425	1.69	1.58	6.40	5.00
300	3.07	2.47	19.63	5.00
212	3.34	4.07	22.00	5.00
150	3.80	4.12	8.33	5.00
106	7.97	2.03	74.52	5.00
75	8.11	6.43	20.73	5.00
53	11.10	2.19	80.23	5.00
38	9.60	4.16	56.69	5.00
-38	39.76	63.29	59.18	5.00

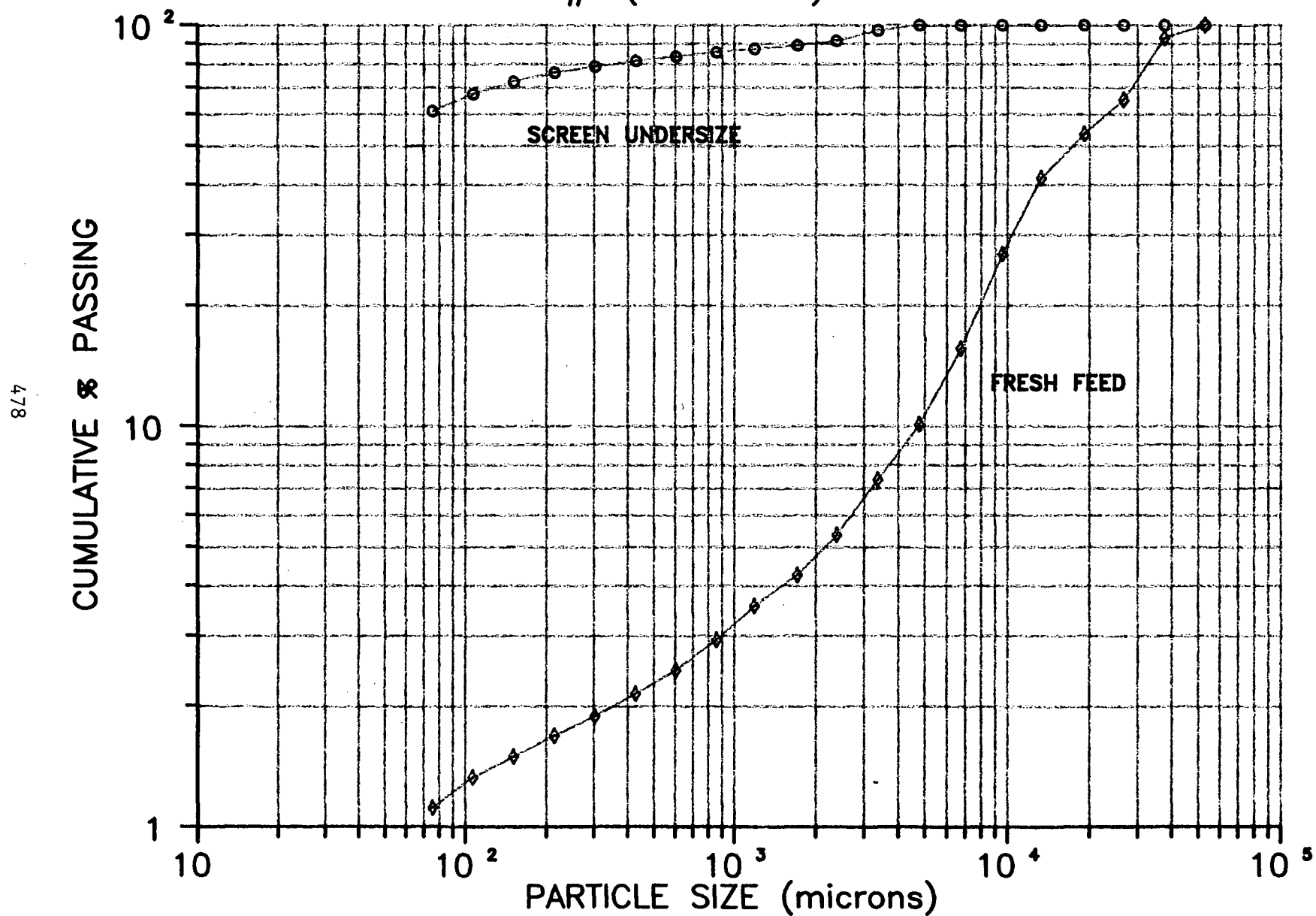
ECHO BAY SLATE RUN #1 ADJ. 60CM CCT. DATA



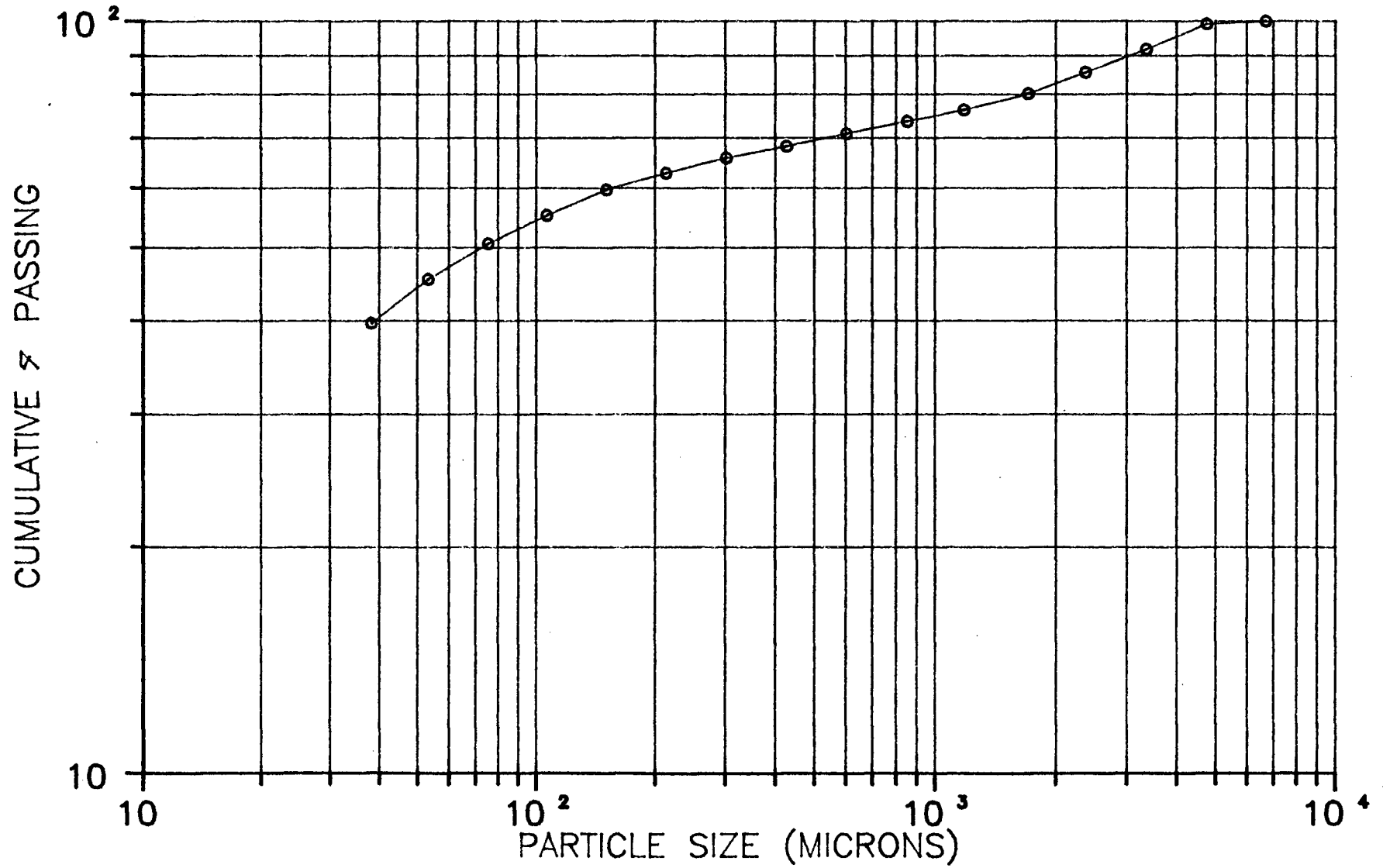
ECHO BAY JUNEAU TEST SAG11 SCR. U/FLOW



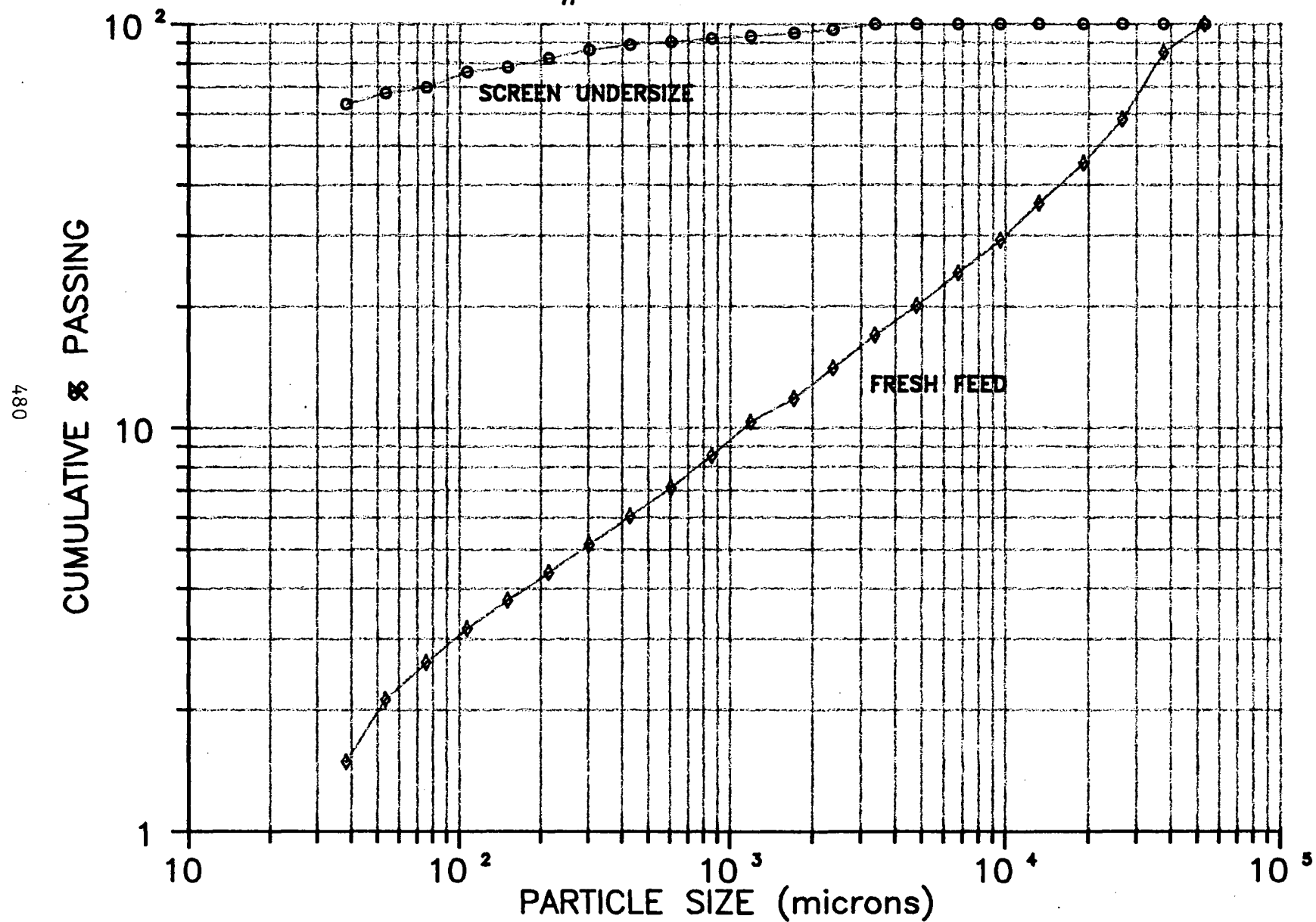
ECHO BAY RUN #2(GABBRO) ADJ.60CM CCT DATA



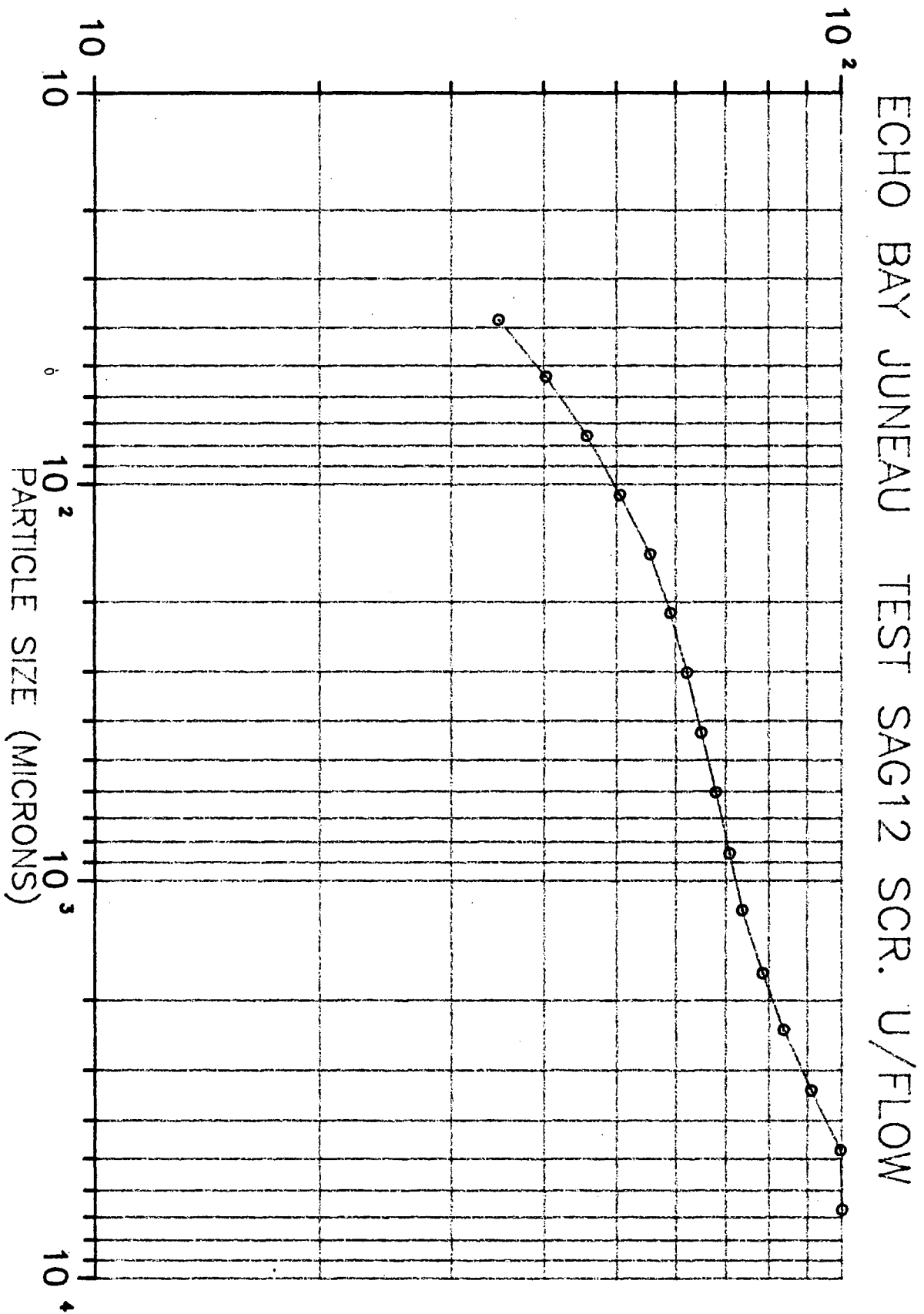
ECHO BAY JUNEAU TEST SAG9 SCR. U/FLOW



ECHO BAY RUN #3 ADJUSTED 60CM CCT DATA



CUMULATIVE % PASSING



APPENDIX XI

PROPOSED MODEL OF MILL WEIGHT CONTROLLER.

If the mill is modelled as a First Order Lag System, i.e.

$$\frac{W}{F} = \frac{1}{s+k} = \frac{1/k}{s/k + 1}$$

Where W = Mill Weight

F = Feed Rate.

then the discrete model would be

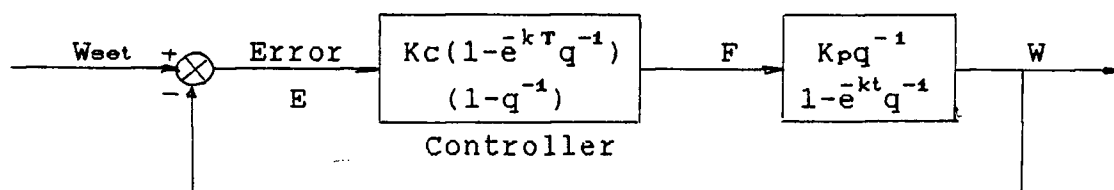
$$\frac{W}{F} = \frac{1/k(1-e^{-kT})q^{-1}}{(1-e^{-kT}q^{-1})} = \frac{k_P q^{-1}}{1-e^{-kT}q^{-1}}$$

Where T = Sampling Period

q^{-1} = Backwards Shift Operator

$$k_P = 1/k (1-e^{-kT})$$

Choosing the following integrating controller (where the denominator of the process is cancelled)



We obtain the following closed loop transfer function

$$\begin{aligned} \frac{W}{W_{set}} &= \frac{K_c K_P q^{-1}}{1-q^{-1} + K_c K_P q^{-1}} \\ &= \frac{K_c K_P q^{-1}}{1-(1+K_c K_P)q^{-1}} \end{aligned}$$

If the desired closed-loop time constant is for example $2T$, then

$$\text{set } 1 + K_c k_p = e^{-T/2T} = 0.606 \text{ and solve for } K_c$$

The controller is therefore

$$F_k - F_{k-1} = K_c (E_k - e^{-kT} E_{k-1})$$

or

$$F_k - F_{k-1} = K_c (E_k - (1 - kT) E_{k-1})$$