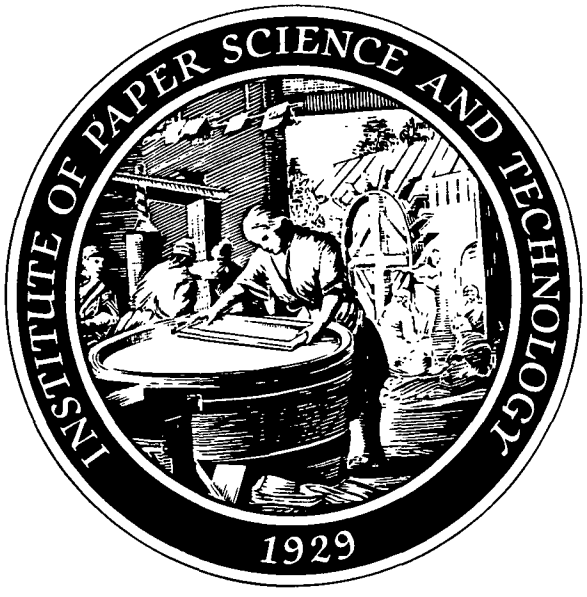


SLIDE MATERIAL

To The

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE

March 23, 1990
Institute of Paper Science and Technology
Atlanta, Georgia

MAPPS PROCESS MODEL DEVELOPMENT

TOPICS

- BACKGROUND
- OBJECTIVES
- RECENT ACCOMPLISHMENTS
- FUTURE PLANS

BACKGROUND

- TRADITIONAL APPROACH TO PROCESS SIMULATION
  - BASED ON MASS AND ENERGY BALANCES
  - WEAK IN PAPERMAKING AREAS
  - LACKS INFORMATION RELATED TO PULP AND PAPER QUALITY
- PERFORMANCE ATTRIBUTE (PAT) SIMULATION
  - ADDS NEW PULP QUALITY VARIABLES (PATS)
  - INCLUDES NEW PREDICTIVE SIMULATION MODELS
  - PROVIDES IMPROVED PAPERMAKING SIMULATION
  - PREDICTS END-USE PERFORMANCE PROPERTIES

PERFORMANCE ATTRIBUTES

FUNDAMENTAL CHARACTERISTICS OF FIBERS AND DEVELOPING NETWORK WHICH DETERMINE END-USE PERFORMANCE (I.E. SHEET PROPERTIES)

POTENTIAL USES OF PAT SIMULATION

- PREDICT END-USE PERFORMANCE OF PAPER AND PAPERBOARD
- QUANTIFY INTERACTIONS BETWEEN PROCESS CONDITIONS, FURNISH AND END-USE PERFORMANCE
- SOLVE PRODUCT QUALITY PROBLEMS
- SUPPORT PROCESS OPTIMIZATION AND CONTROL
- PROVIDE A THEORETICAL BASIS FOR UNDERSTANDING PRODUCT QUALITY RELATIONSHIPS

ORIGINS OF THE PAT SYSTEM

- IMMEDIATE NEED FOR A MECHANICAL PULPING SIMULATION CAPABILITY
- LONG RANGE NEED FOR A UNIQUE MARKETING AND DEVELOPMENT FEATURE
- EXISTENCE OF LARGE UNTAPPED POOL OF PRODUCT QUALITY EXPERTISE

SLIDE MATERIAL

To The

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE

March 23, 1990
Institute of Paper Science and Technology
Atlanta, Georgia

TABLE OF CONTENTS

MAPPS SUPPORT

SLIDE MATERIAL

FOR

PROJECT 3576

TO THE

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE

March 23, 1990

MAPPS SUPPORT

PROJECT OBJECTIVE:

TO MAINTAIN THE CONTINUED COMMERCIAL VIABILITY OF MAPPS

TOPICS

- SALES AND MARKETING
- RELEASE OF MAPPS 4.0
- MAPPS MAINTENANCE ISSUES
- USERS GROUP MEETING
- FUTURE DEVELOPMENT OF MAPPS
- DOE PROJECTS
- MISCELLANEOUS

SALES AND MARKETING

- GEORGIA-PACIFIC CORPORATION NEW COMMERCIAL USER
- FIRST CORPORATE LICENCE FOR μMIP SOLD (TO G-P)
- LICENSE AGREEMENT WITH SACDA
- MAPPS DEMONSTRATED AT THE TAPPI 90 EXHIBIT

LICENSE AGREEMENT WITH SACDA

- LICENSE AGREEMENT WILL ALLOW SACDA TO INCLUDE MAPPS MODULE LIBRARIES IN ITS PROCESS SIMULATION PRODUCTS
- NEW MAPPS MODULES DEVELOPED AT IPST WILL BE MADE AVAILABLE TO SACDA
- IPST WILL RECEIVE ROYALTY PAYMENTS FROM SACDA INC. FOR EACH LICENSED SACDA PROGRAM CONTAINING A MAPPS MODULE LIBRARY
- SACDA IS EXPECTED TO ANNOUNCE PURCHASE OPTIONS AND AVAILABILITY FOR SACDA PROGRAMS CONTAINING MAPPS MODULE LIBRARIES BY MID-1990

RELEASE OF MAPPS 4.0

- MAPPS 4.0 IS PLANNED TO BE RELEASED BY OCTOBER 1990
- PAT MODELING WILL BE FULLY INCORPORATED
- ALL MAPPS DOCUMENTATION WILL BE COMPLETELY REVISED
- ALL SOURCE CODE WILL BE REVIEWED BY PERSONNEL FROM GTRI

MAPPS 4.0 - SOURCE CODE ISSUES

- SOURCE CODE WILL INCREASE IN COMPLEXITY AND SIZE
- REASON FOR INCREASE IS ADDITION OF PAT MODELING
- SIZE OF EXECUTABLE CODE PROBLEM FOR PC VERSION OF MAPPS 4.0

WAYS TO SOLVE CODE SIZE ISSUE FOR PC VERSION OF MAPPS

- CONSTRAIN SIZE OF EXECUTABLE CODE
- CONSIDER OTHER OPERATING SYSTEMS THAN DOS; OS/2, UNIX. ETC.
- CONSIDER "EXTENDING" DOS BY USING OVERLAY OPERATING SYSTEM; LAHEY

WAYS TO CONSTRAIN THE MAPPS EXECUTABLE CODE

- CREATE AN "OVERLAID" VERSION OF EXECUTABLE CODE
- LIMIT THE SIZE OF MODULE AND STREAM MATRICES
- EXCLUDE SOME PROCESS/UTILITY MODULES FROM EXECUTABLE CODE

ONE OR MORE OF THESE CONSTRAINTS MUST BE APPLIED IN ORDER FOR THE PC-VERSION OF MAPPS 4.0 TO BE ABLE TO RUN UNDER DOS

NEW OPERATING SYSTEMS FOR PC-VERSION OF MAPPS 4.0

ADVANTAGES:

- MORE MEMORY AVAILABLE THAN WITH DOS
- NO CONSTRAINTS HAVE TO BE APPLIED TO MAPPS CODE

DISADVANTAGES:

- ADDITIONAL COSTS FOR MAPPS USERS TO UPGRADE SOFTWARE/HARDWARE
- ADDITIONAL RESEARCH ON ALTERNATIVE OPERATING SYSTEMS REQUIRED
- RELEASE OF MAPPS 4.0 IN 1990 UNLIKELY

MAPPS FOR OS/2 AND UNIX - DEVELOPMENT

- A VERSION OF MAPPS HAS BEEN DEVELOPED TO RUN ON A IBM PS/2 MACHINE WITH AN OS/2 OPERATING SYSTEM
- EXPERIENCE WITH OS/2 IS INSUFFICIENT AT THIS TIME TO RECOMMEND THIS OPERATING SYSTEM TO OTHER USERS
- A MAPPS VERSION RUNNING ON A UNISYS MACHINE, UNDER UNIX, HAS BEEN DEVELOPED
- UNIX VERSION OF MAPPS IS EXPECTED TO BE PORTABLE TO OTHER UNIX OPERATING SYSTEMS

ASSISTANCE FROM GEORGIA TECH RESEARCH INSTITUTE (GRTI)

TWO-PHASE PROPOSAL FROM DR. JAMES MAHAFFEY AT GTRI

PHASE 1: ANALYZE MAPPS CODE FOR CONSISTENCY AND EFFICIENT OPERATION AND FOR COMPATIBILITY WITH TECHNICAL DOCUMENTATION

ASSISTANCE FROM GEORGIA TECH RESEARCH INSTITUTE (GRTI)

PHASE 2: DETERMINE REQUIREMENTS FOR INTEGRATION OF μMIP CODE INTO MAPPS EXECUTIVE

IMPLEMENT INTEGRATION OF μMIP INTO MAPPS

DETERMINE SOFTWARE/HARDWARE REQUIREMENTS TO CREATE A NON-OVERLAY VERSION OF MAPPS WITH μMIP FOR PC/PC COMPATIBLES WITH DOS OPERATING SYSTEMS (LAHEY FORTRAN COMPILER AND OPERATING SYSTEM, EXTENDED MEMORY, ETC.)

IMPLEMENT CODING REQUIRED TO CREATE ABOVE NON-OVERLAY VERSIONS

MAPPS MAINTENANCE ISSUES

- MAPPS CODE CORRECTIONS
  - WASH02
  - WLIQ01
  - MATH01
- MAPPS-TALK BULLETIN BOARD
  - NOW IN OPERATION
  - LIST OF CONTACT PERSONS ADDED

MAPPS USERS GROUP MEETING

THE SPRING MAPPS USERS GROUP MEETING WAS HELD FEBRUARY 8-9, 1990

ITINERARY:

- UPDATE OF PAT MODELING DEVELOPMENT (GARY JONES)
- DEMONSTRATION OF FLOWCALC (BOB ROUDA, UNIVERSITY OF MINNESOTA)
- DEMONSTRATION OF INITIAL DEVELOPMENT OF GRAPHICAL INTERFACE FOR MAPPS (GLENN GREGG, SCIENTIFIC ATLANTA)

FEEDBACK FROM MAPPS USERS GROUP

THE USERS GROUP SHOWS A CONTINUING INTEREST FOR:

- A BETTER AND MORE USER-FRIENDLY USER INTERFACE FOR MAPPS
- PC-VERSIONS OF MAPPS FOR OTHER OPERATING SYSTEMS THAN DOS

FUTURE DEVELOPMENT OF MAPPS

- MAPPS FOR NEW OPERATING SYSTEMS
- GRAPHICAL INTERFACE
- DYNAMIC VERSION OF MAPPS

MAPPS MODEL BUILDER - GRAPHICAL INTERFACE FOR MAPPS?

- PRELIMINARY VERSION OF GRAPHICAL MAPPS FILE BUILDER DEVELOPED BY SCIENTIFIC-ATLANTA
- WORKS WITH PC VERSION OF AUTOCAD
- DEMONSTRATED TO MAPPS USERS GROUP AND POSITIVELY RECEIVED
- CONSIDERABLE WORK REMAINS TO COMPLETE DEVELOPMENT OF INTERFACE

JOINT IPST/SCIENTIFIC ATLANTA PROPOSAL

- JOINT IPST/SCIENTIFIC ATLANTA PROPOSAL TO COMPLETE DEVELOPMENT OF MAPPS GRAPHICAL INTERFACE WILL BE DEVELOPED
- PROPOSAL WILL BE SENT TO MAPPS USERS GROUP MEMBERS TO DETERMINE MAPPS USERS' WILLINGNESS TO FUND DEVELOPMENT
- PROPOSAL WILL CONSIDER METHODS FOR COMPENSATING COMPANIES CONTRIBUTING TO THE INITIAL PROJECT FUNDING

JOINT IPST/SCIENTIFIC ATLANTA PROPOSAL

PROPOSAL IS DIVIDED INTO THREE PHASES:

PHASE I: COMPLETE DEVELOPMENT OF "MAPPS MODEL BUILDER", A STAND-ALONE GRAPHICAL MAPPS FILE BUILDER

PHASE II: DEVELOPMENT OF INTEGRATED PACKAGE WHICH WILL;

- BUILD FILES
- EXECUTE SIMULATIONS
- PRESENT RESULTS GRAPHICALLY ON A PROCESS FLOWSHEET

PHASE III: DEVELOPMENT OF A RESULTS EVALUATION PACKAGE

DYNAMIC VERSION OF MAPPS

- FEASIBILITY STUDY DONE BY STUDENT AS A-190 PROJECT
- INTERNATIONAL ENERGY AGENCY PROPOSAL

STUDENT RESEARCH

A-190 PROJECT BY EUGENE T. OCHALEK

PROJECT TITLE: "FEASIBILITY STUDY: THE DYNAMIC FUTURE OF MAPPS"

OBJECTIVE: TO DETERMINE TO WHAT EXTENT THE DYNAMIC CAPABILITIES OF MAPPS SHOULD BE DEVELOPED

INTERNATIONAL ENERGY AGENCY PROPOSAL

THE PSC GROUP IS WORKING WITH THE INTERNATIONAL ENERGY AGENCY ON A PROPOSAL

NAME OF PROPOSAL:

"DEVELOPMENT OF A DETAILED MODULAR DYNAMIC PULP AND PAPER PROCESS SIMULATION PROGRAM AND ITS SUBSEQUENT USE TO CREATE AND DEMONSTRATE THE USE OF A MILLWIDE SIMULATION MODEL FOR OPTIMIZATION OF PROCESS AND PROCESS CONTROL SYSTEMS TO REDUCE ENERGY CONSUMPTION"

PROPOSED PROJECT:

JOINT DEVELOPMENT WITH SACDA TO BUILD A TRAINER MODEL WITH A MAPPS MODULE LIBRARY FOR A TMP PULP MILL

PROJECT FUNDING:

WOULD COME FROM THE DOE, AND POSSIBLY CANADIAN EQUIVALENT OF DOE

DOE PROJECT

- PROPOSAL TO DOE, "OPTIMIZING FIBER PROCESSING IN THE PULP AND PAPER INDUSTRY", HAS NOT YET BEEN FUNDED
- QUESTIONS ASKED BY DOE HAS BEEN ANSWERED AND FUNDING IS EXPECTED SOON

MAPPS STUDENT PAPER CONTEST - RESULTS

- WINNING PAPER WAS AUTHORED BY PETER HART, A PH. D. CANDIDATE AT THE DEPARTMENT OF CHEMICAL ENGINEERING AT GEORGIA TECH

- TITLE OF PAPER: "PARAMETRIC STUDIES AND DEBOTTLENECKING OPPORTUNITIES THROUGH MAPPS MODELING OF A KRAFT MILL"

- PAPER WILL BE PUBLISHED IN JUNE ISSUE OF TAPPI JOURNAL

SYSTEMS ANALYSIS

SLIDE MATERIAL

FOR

PROJECT 3471

TO THE

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE

March 23, 1990

SOURCES OF INFORMATION

- THEORETICAL RELATIONSHIPS
- EXPERIMENTAL DATA
- MODIFICATIONS AND EXTENSIONS OF EXISTING THEORIES AND CONCEPTS

DEVELOPMENT HISTORY

- INITIAL DEVELOPMENT MECHANICAL PULPING SYSTEMS
  - SEPARATION OF CHIPS INTO FIBERS AND SHIVES
  - SURFACE AREA DEVELOPMENT
  - FREENESS CHANGE
  - SIMPLE HANDSHEET PROPERTY MODELS
- LATER EXTENDED SYSTEM TO INCLUDE CHEMICAL PULPING, BLEACHING REFINING OF CHEMICAL PULPS, PAPERMAKING AND CONVERTING
  - YIELD EFFECTS
  - MORE DETAILED FIBER GEOMETRY
  - FIBER SWELLING AND STIFFENING EFFECTS
  - BONDING/ DEBONDING EFFECTS
  - SHEET DENSIFICATION AND COMPRESSIBILITY EFFECTS
  - MORE FUNDAMENTAL SHEET PROPERTIES

OVERVIEW OF PAT SYSTEM IN MAPPS

PAT's

- YIELD, KAPPA, XHEMI, C_K → COMPOSITION → FIBERS → PAPER
- L, σ_L; W, σ_W; JDIST; CWT → MORPHOLOGY → FIBERS → PAPER
- TENSILE, MODULUS, FLEXIBILITY FACTOR → PHYSICAL → FIBERS → PAPER
- CSF → SURFACE AREA → FIBERS → PAPER
- S_{B1}, S_{B2} → SIDEDNESS → BONDS → NETWORK → PAPER
- S_A → AREA → BONDS → NETWORK → PAPER
- SBS → STRENGTH → BONDS → NETWORK → PAPER
- FORMATION FACTOR, WET STRAIN, ORIENTATION → ANISOTROPY → NETWORK → PAPER

PROCESS MODELS

- MATERIAL AND ENERGY BALANCES
- PAT MODELS
- PROPERTY MODELS

Interaction Between Traditional Mass and Energy Balance Models and PAT Models

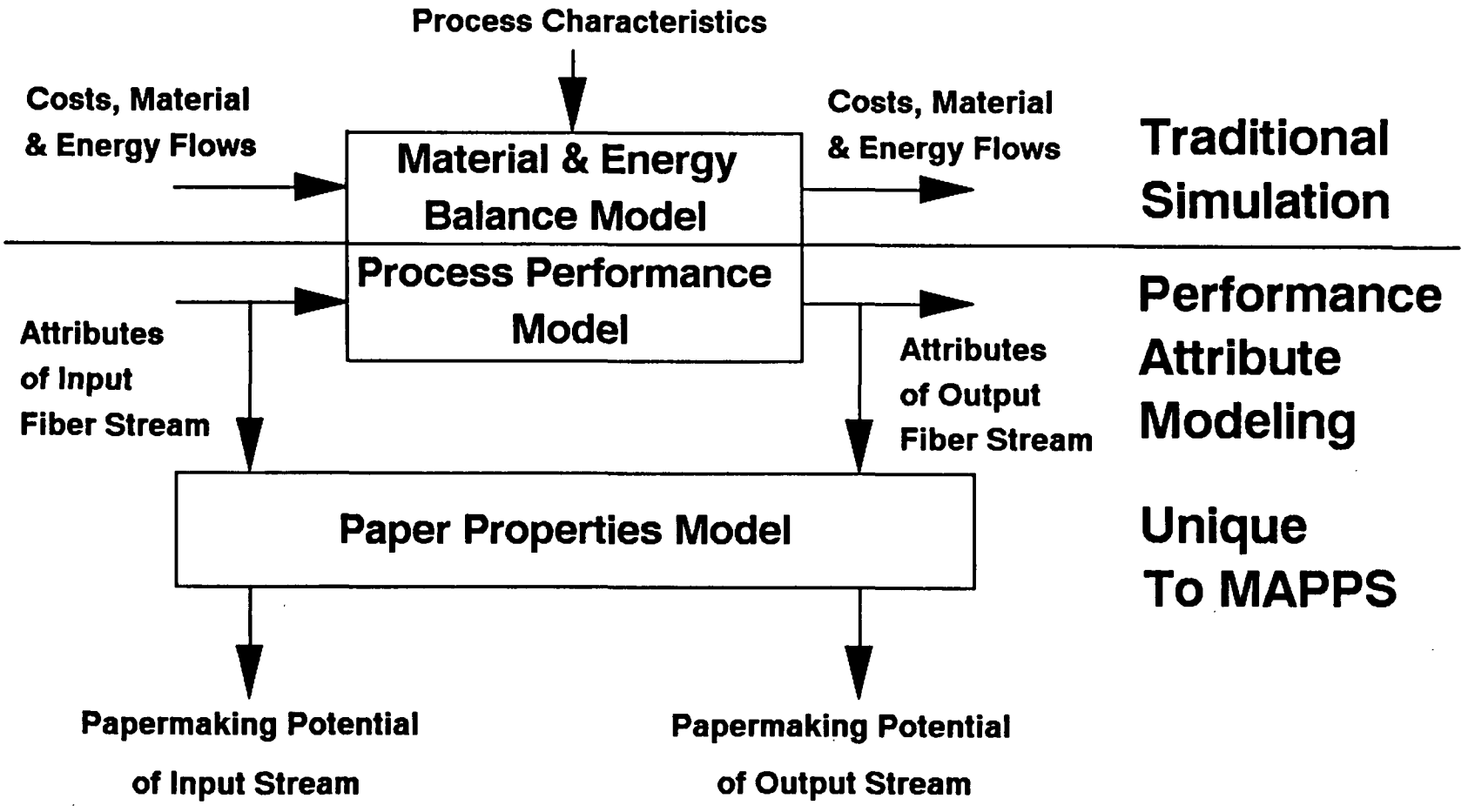


Table 2-3. Properties of North American pulpwoods[1]

Species	Fiber length, mm	Fiber diameter, microns	Wood density, lb/cu ft
Southern Region			
Longleaf Pine	4.9	35-45	41
Shortleaf Pine	4.6	35-45	36
Loblolly Pine	3.6	35-45	36
Slash Pine	4.6	35-45	43
Northeast Region			
Black Spruce	3.5	25-30	30
White Spruce	3.3	25-30	26
Jack Pine	3.5	28-40	30
Balsam Fir	3.5	30-40	25
Northwest Region			
Douglas Fir	3.9	35-45	34
Western Hemlock	4.2	30-40	29
Redwood	6.1	50-65	25
Red Cedar	3.5	30-40	23
Hardwoods			
Aspen	1.04	10-27	27
Birch	1.85	20-36	38
Beech	1.20	16-22	45
Oaks	1.40	14-22	46
Red Gum	1.70	20-40	34

[1] Isenberg, I.H. *The Pulpwoods of the United States and Canada.* Second Ed., The Institute of Paper Chemistry, Appleton, Wisconsin. 1951.

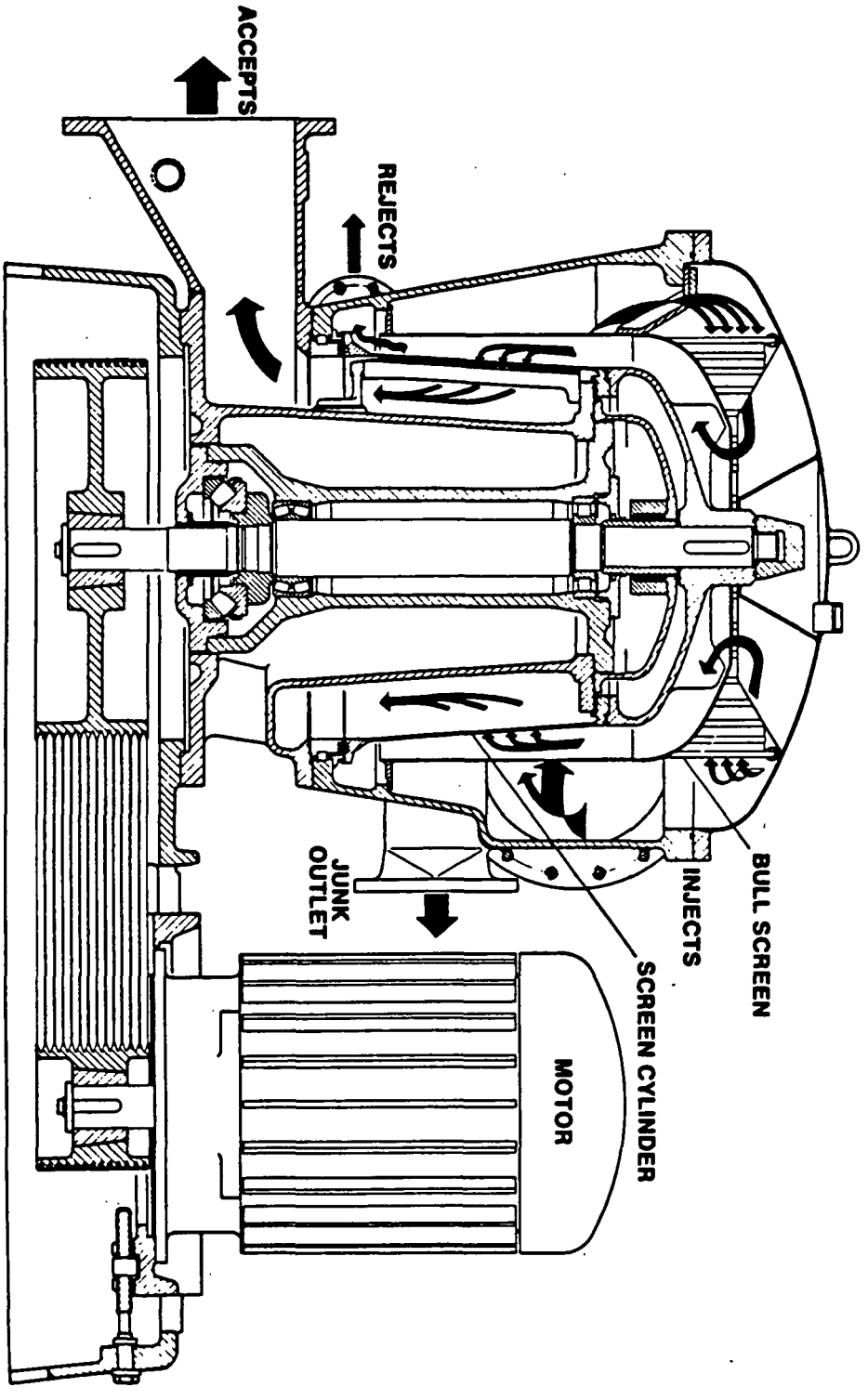


Fig. 9-23. Example of conventional pressure screen (KMW).

SCREEN MODEL

INPUTS:

- PROCESS:
  - TOTAL FLOW SPLIT
  - OUTLET PRESSURES
- INLET FIBER CHARACTERISTICS:
  - LENGTH DISTRIBUTION
  - WIDTH DISTRIBUTION

OUTPUTS: (OVERFLOW & UNDERFLOW)

- PROCESS:
  - FIBER SPLITS
  - CONSISTENCIES
  - INDIVIDUAL FIBER FLOWS, STREAMFLOWS
- OUTLET FIBER CHARACTERISTICS:
  - LENGTH DISTRIBUTION
  - WIDTH DISTRIBUTION
- HANDSHEET PROPERTIES: (INCLUDING FEED)
  - BULK DENSITY
  - TENSILE
  - MODULUS
  - SCATTERING, OPACITY, POROSITY, BRIGHTNESS

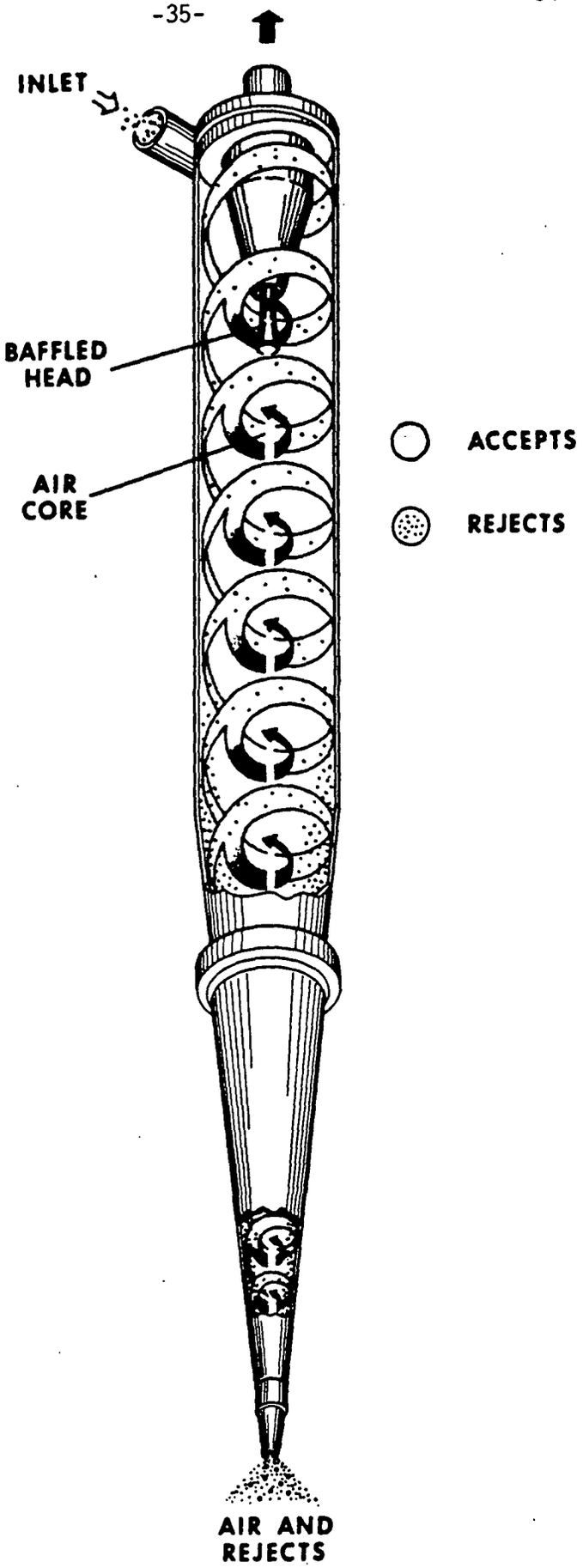


Fig. 9-30. Schematic of a centrifugal cleaner (Bird Machine Co.).

CLEANER MODEL

INPUTS:

- PROCESS:
  - TOTAL FLOW SPLIT
  - OUTLET PRESSURES
  - SPECIFIC GRAVITY OF SUSPENDED SOLIDS
- INLET FIBER CHARACTERISTICS:
  - LENGTH DISTRIBUTION
  - WIDTH DISTRIBUTION

OUTPUTS: (ACCEPTS & REJECTS)

- PROCESS:
  - FIBER SPLITS
  - CONSISTENCIES
  - STREAM & COMPONENT FLOWS
- OUTLET FIBER CHARACTERISTICS:
  - LENGTH DISTRIBUTION
  - WIDTH DISTRIBUTION
  - FREENESS
- HANDSHEET PROPERTIES:
  - BULK DENSITY
  - TENSILE
  - MODULUS
  - SCATTERING, OPACITY, POROSITY, BRIGHTNESS

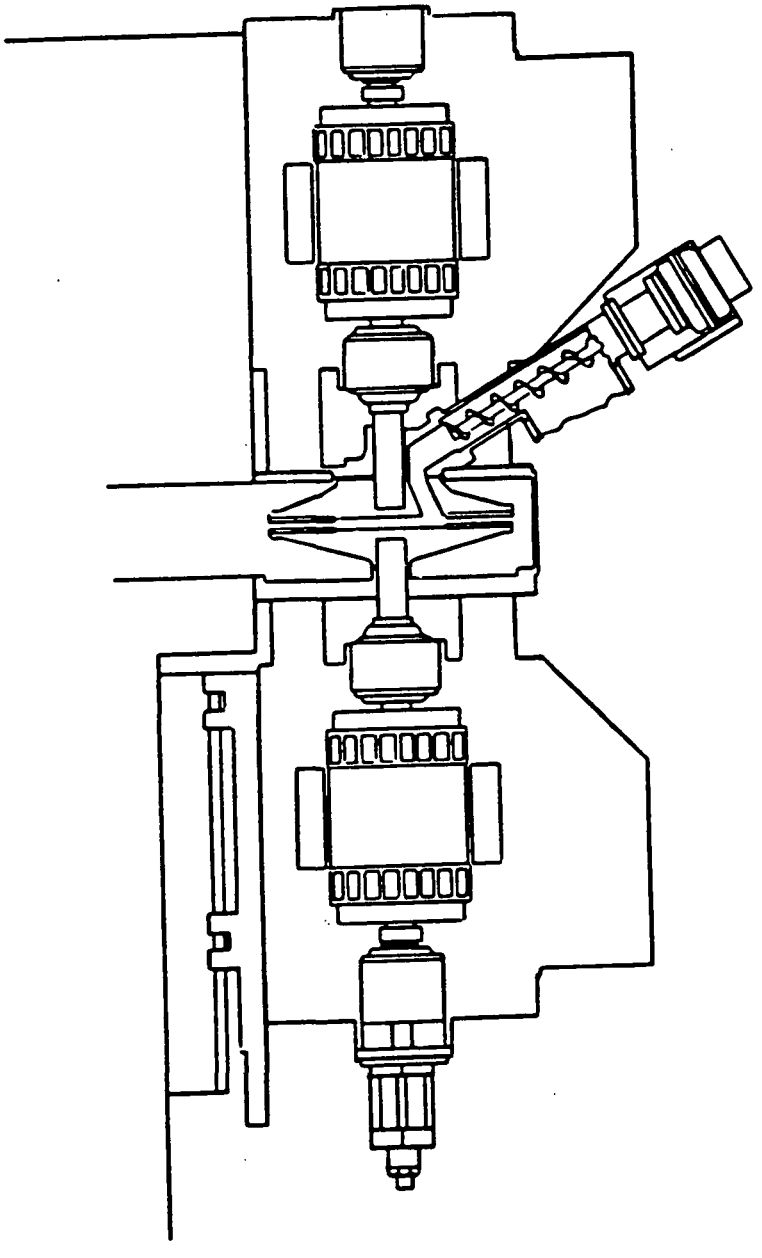


Fig. 5-16. Schematic of double-disc refiner (courtesy of Beloit Corp.).

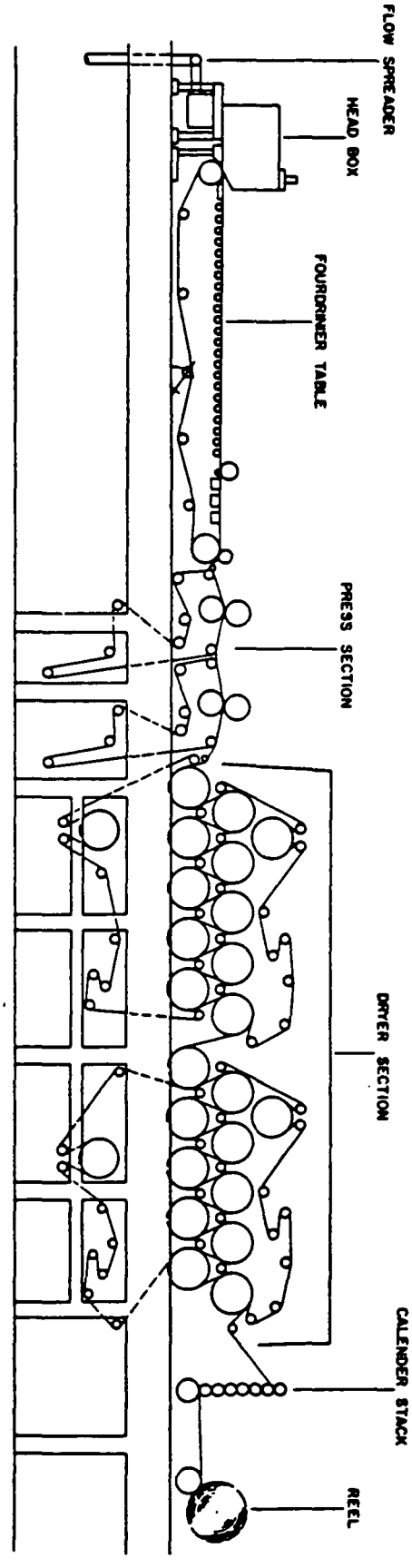


Fig. 16-1. Fourdrinier paper machine (courtesy Beloit Corp.).

PROPERTIES

- BULK PHYSICAL AND TENSILE PROPERTIES
- SURFACE, OPTICAL AND PRINTING PROPERTIES
- ELASTIC PROPERTIES
- MEDIUM GRADE SPECIFIC PROPERTIES
  - STFI
  - CD RING CRUSH
  - CONCORA

EARLY APPLICATIONS AND PARTIAL VALIDATIONS

- TMP
- NEWSPRINT
  - KRAFT
  - GROUNDWOOD
  - PAPERMACHINE
- SECONDARY FIBERS (RECYCLE PAPER)

INDUSTRY VIEW

- HIGH LEVEL OF INTEREST
- NEED FOR SYSTEMATIC MILL-WIDE VALIDATION

OBJECTIVES

- CONTINUE DEVELOPMENT OF UNIQUE PAT MODELS
- VALIDATE EXISTING SYSTEM OF MODELS

VALIDATION SCOPE

- SEVERAL IMPORTANT AND WIDELY DIFFERENT GRADES
  - NEWSPRINT (COMPLETE EARLIER STUDY)
  - CORRUGATING MEDIUM
  - LINER
  - FINE PAPERS
- EMPHASIS ON VARIABLES WHICH INFLUENCE END-USE PERFORMANCE

VALIDATION PLAN FOR MEDIUM GRADES

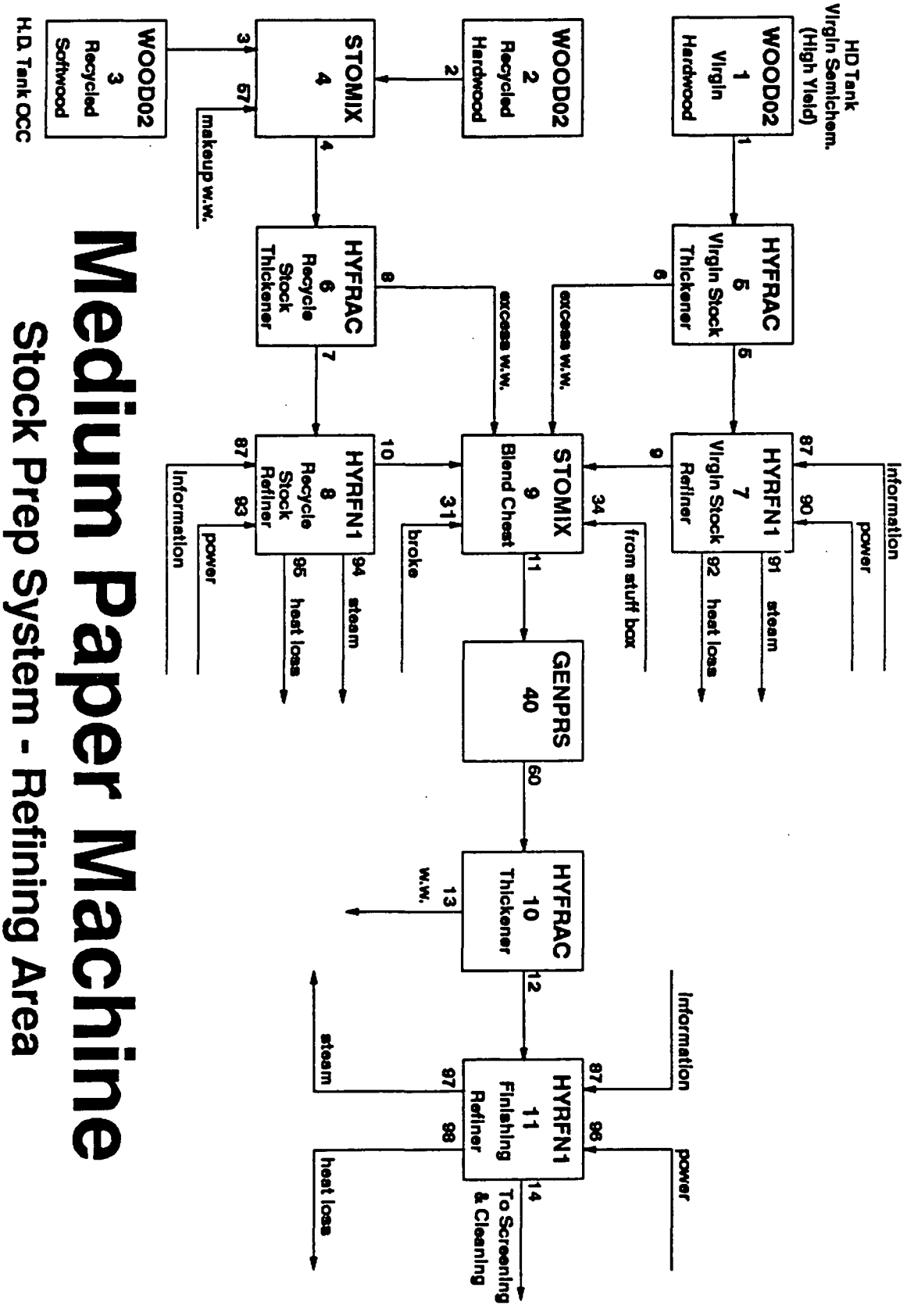
- VARIABILITY ANALYSIS
  - SHORT TERM (REEL-TO-REEL, DAY-TO-DAY)
  - ACROSS MINOR GRADE CHANGES
  - LONG TERM (SEVERAL MONTH INTERVAL)
- SENSITIVITY STUDY
  - PERTURB KEY VARIABLES ONE AT A TIME
    - FURNISH MIX
    - REFINER POWER
    - PRESS LOADING

VALIDATION PLAN FOR MEDIUM GRADES

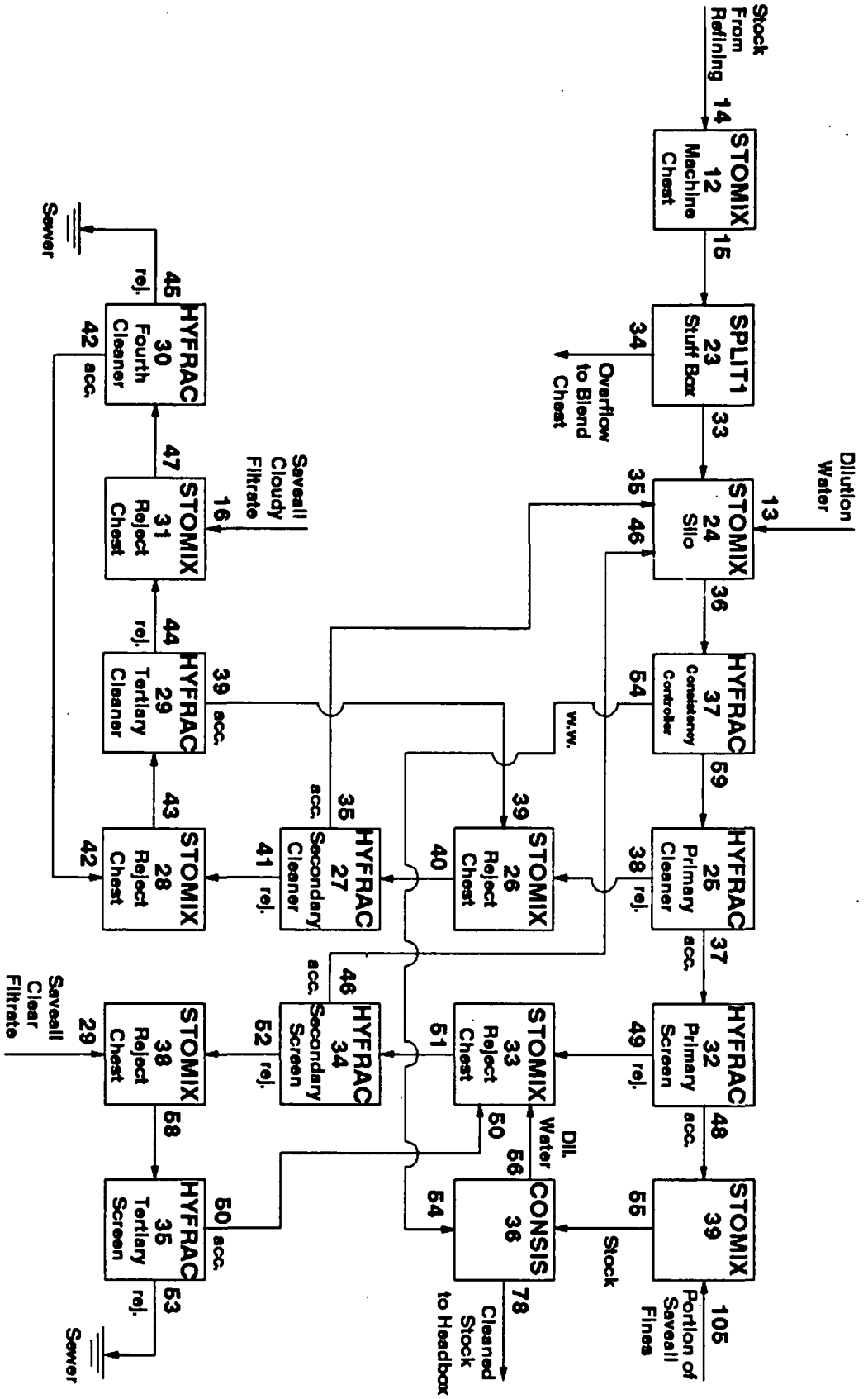
- SAMPLING
  - REEL SAMPLES
  - COMPOSITE PULP SAMPLES
  - HANDSHEETS
  - PROCESS DATA
- VALIDATION CRITERIA AND SCOPE
  - MAPPS MODEL PREDICTIONS WITHIN 1 SIGMA AT 90% CONFIDENCE
    - PULP PROPERTIES
    - CALENDERED PAPER PROPERTIES

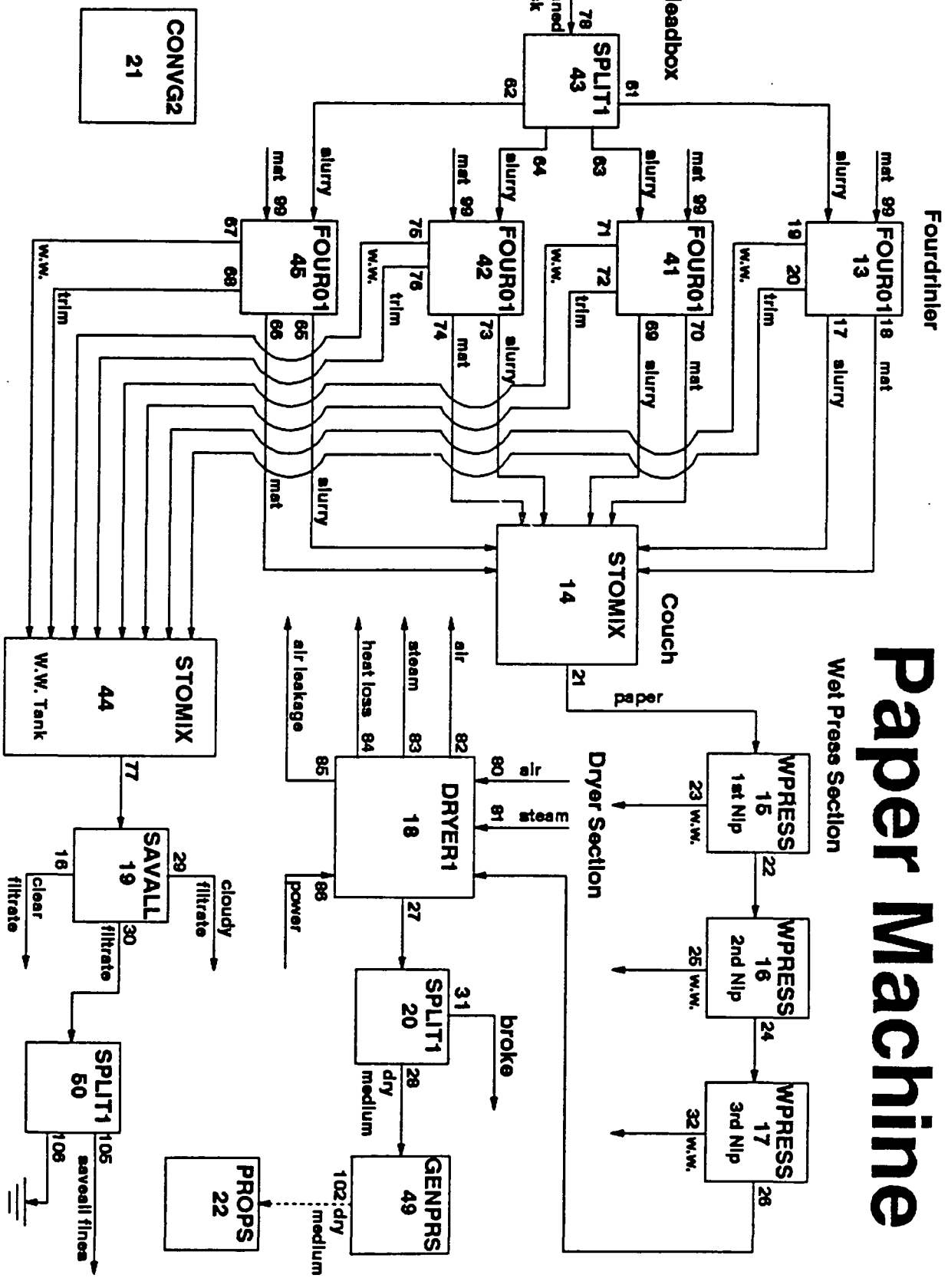
STATUS OF THE PLAN

- DETAILED MILL MODEL DEVELOPED AND REVIEWED
- PREDICTED PROPERTIES AND PROCESS CONDITIONS APPEAR REASONABLE
- KEY VARIABLES IDENTIFIED
- PLAN DEVELOPED AND REVIEWED
- PROJECTED COMPLETION DATE MID APRIL


Medium Paper Machine
Stock Prep System - Refining Area
WOOD02 1 Virgin Hardwood
HD Tank Virgin Semichem. (High Yield)
WOOD02 2 Recycled Hardwood
WOOD02 3 Recycled Softwood
H.D. Tank OCC
STOMIX 4
HYFRAC 5 Virgin Stock Thickener
HYFRAC 6 Recycle Stock Thickener
HYRFN1 7 Virgin Stock Refiner
HYRFN1 8 Recycle Stock Refiner
STOMIX 9 Blend Chest
HYFRAC 10 Thickener
HYRFN1 11 Finishing Refiner
GENPRS 40
makeup w.w.
excess w.w.
excess w.w.
broke
from stuff box
w.w.
steam
heat loss
power
Information
steam
heat loss
power
Information
To Screening & Cleaning

Medium Paper Machine Screening & Cleaning




Paper Machine
Fourdrinier
Headbox
Wet Press Section
Dryer Section
Couch
CONVG2 21
Cleaned Stock
78
SPLIT1 43
61
62
FOUR01 13
FOUR01 41
FOUR01 42
FOUR01 45
mat 99
slurry
19
20
18 mat
17 slurry
71
72
70 mat
69 slurry
75
76
73 slurry
74 mat
67
68
65
66
w.w.
trim
STOMIX 14
21
paper
STOMIX 44
W.W. Tank
77
WPRESS 15 1st Nip
23 w.w.
22
WPRESS 16 2nd Nip
25 w.w.
24
WPRESS 17 3rd Nip
32 w.w.
26
DRYER1 18
air
steam
heat loss 84
air leakage
85
82
83
80
81
86
power
SAVALL 19
16 clear filtrate
28 cloudy filtrate
30 filtrate
SPLIT1 20
31 broke
28 dry medium
SPLIT1 50
105 saveall fines
106
GENPRS 49
102: dry medium
PROPS 22

BASE CASE MACHINE PAPER PROPERTIES

26lb/100ft²

	PREDICTED	TYPICAL RANGE
CALIPER mils	8.8	8.0 - 10.0
TENSILE lb/in	40.0 (6.5km)	40.0
MD/CD RATIO	2.2	2.2 - 3.1
STRETCH	1.8	1.2 - 1.8
GURLEY POROSITY sec/100ml	23.0	7.0 - 41.0
STFI lb/in	19.5	15.0 - 30.0
FLAT CRUSH	34.2	30.0 - 55.0
CONCORA lb/in	61.5	55.0 - 70.0
RING CRUSH MD	56.4	40.0 - 80.0
BURST FACTOR psi	20.0	23.0
TEAR FACTOR	256.0	----

Moisture Removal Sensitivity

Effect of Refined Freeness, Fines Retention, and OCC Content

	Refiner		Headbox	Couch	Press Section			Dryer		
OCC %	Power hspd/t	CSF	CSF	%	%	1 %	2 %	3 %	Consis %	Steam Cnsmptn M lb/hr	Comments
19.0	5.5	584	284	0.65	13.2	26.1	31.7	39.3	92.7	53.5	Base case
19.0	30.0	537	228	0.65	10.6	21.5	26.5	33.4	93.3	70.0	Increase retention
19.0	36.0	500	400	0.65	17.0	33.0	39.6	47.6	91.5	35.0	Decrease fines retention
19.0	28.0	550	500	0.65	19.2	35.1	41.4	50.0	92.9	32.0	Decrease refining
31.6	30.0	444	264	0.65	9.2	19.1	23.6	30.1	95.5	83.5	Increase OCC

ADDITIONAL MODULE LIBRARY ENHANCEMENTS

- BLEACHING
  - CHLORINE OR ClO_2 SUBSTITUTION
  - MULTIPLE INJECTION POINTS
- CHEMICAL PRETREATMENT - DISCUSSED LATER
- FLOWSHEET CONVERGENCE ROUTINE

STATUS ON LINER BOARD VALIDATION

- MULTIPLY FORMING MODEL UNDER DEVELOPMENT
  - MULTIPLE HEADBOXES
  - SEQUENCE OF HEADBOXES
  - SEPARATE SHEETS FORMED AND COUCHED
- MULTIPLY PROPERTY SYSTEM UNDER DEVELOPMENT
  - BASED ON SINGLE SHEET MODELS
  - PATS'S FOR EACH PLY
  - INTERPLY MIXING LEVELS

STATUS OF FINE PAPER VALIDATION

- DEVELOPING CONCEPTS AND VARIABLES
- NEED TO ACCOUNT FOR:
  - FILLERS
  - RETENTION AIDS, POLYMERS
  - BOND FORMING & DEBONDING EFFECTS
  - BOND STRENGTH EFFECTS
  - INTERACTION BETWEEN OPTICAL AND STRENGTH PROPERTIES

MILLWIDE MAPPS

SLIDE MATERIAL

FOR

PROJECT 3683

TO THE

SYSTEMS ANALYSIS PROJECT ADVISORY COMMITTEE

March 23, 1990

MILL-WIDE INFORMATION AND CONTROL

TOPICS

- BACKGROUND
- OBJECTIVES
- ACCOMPLISHMENTS
- FUTURE WORK

BACKGROUND

- TECHNOLOGY
  - TREMENDOUS POTENTIAL FOR MILL LEVEL SIMULATION
  - NEED TO EXPAND EXISTING CONTROL FUNCTIONS
  - INFORMATION MANAGEMENT TECHNOLOGY HIGHLY DEVELOPED
- DEVELOPMENT ENVIRONMENT
  - CTMP PILOT UNIT
  - CONTROL AND INFORMATION COMPONENTS
  - ABB-TAYLOR MODEL 300 CONTROL SYSTEM
  - IBM RPMIS (REAL-TIME PLANT MANAGEMENT INFORMATION SYSTEM)
  - AND ACS (ADVANCED CONTROL SYSTEM)

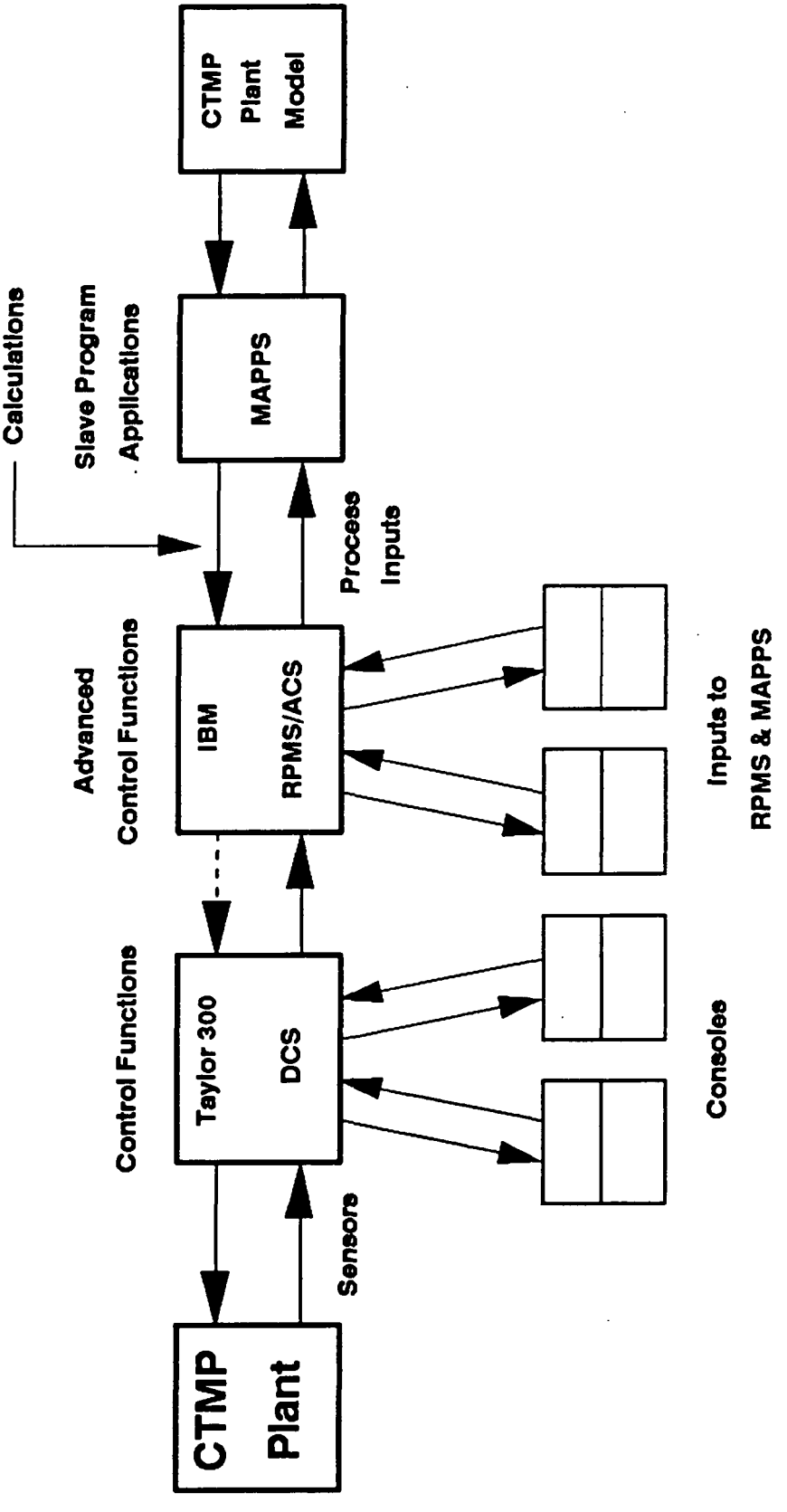
OBJECTIVES

- DEMONSTRATE FEASIBILITY OF INTEGRATION OF PROCESS SIMULATION WITH MILL-WIDE INFORMATION AND CONTROL SYSTEMS
- INTEGRATE MAPPS WITH RPMIS SYSTEM ON PILOT UNIT

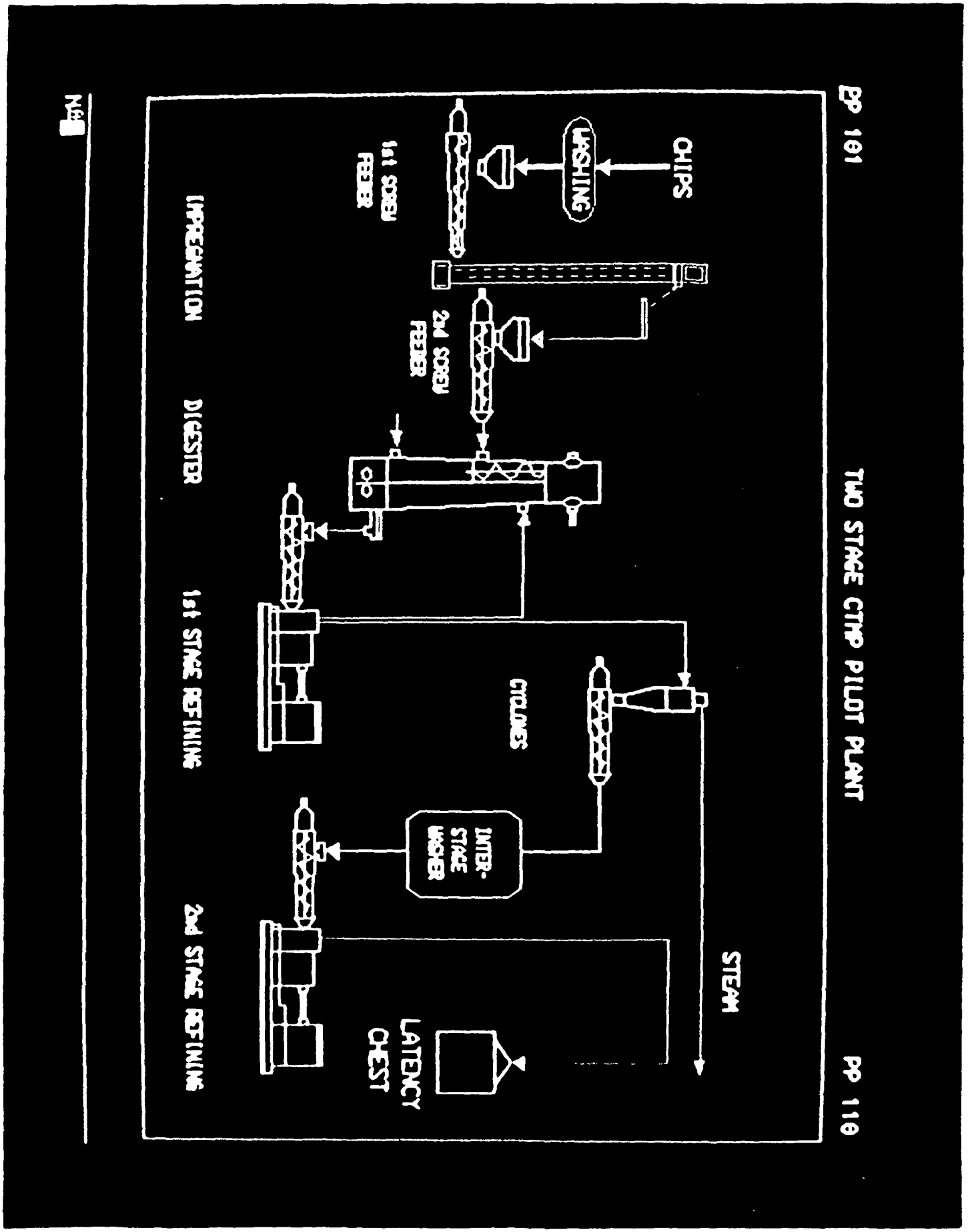
ACCOMPLISHMENTS

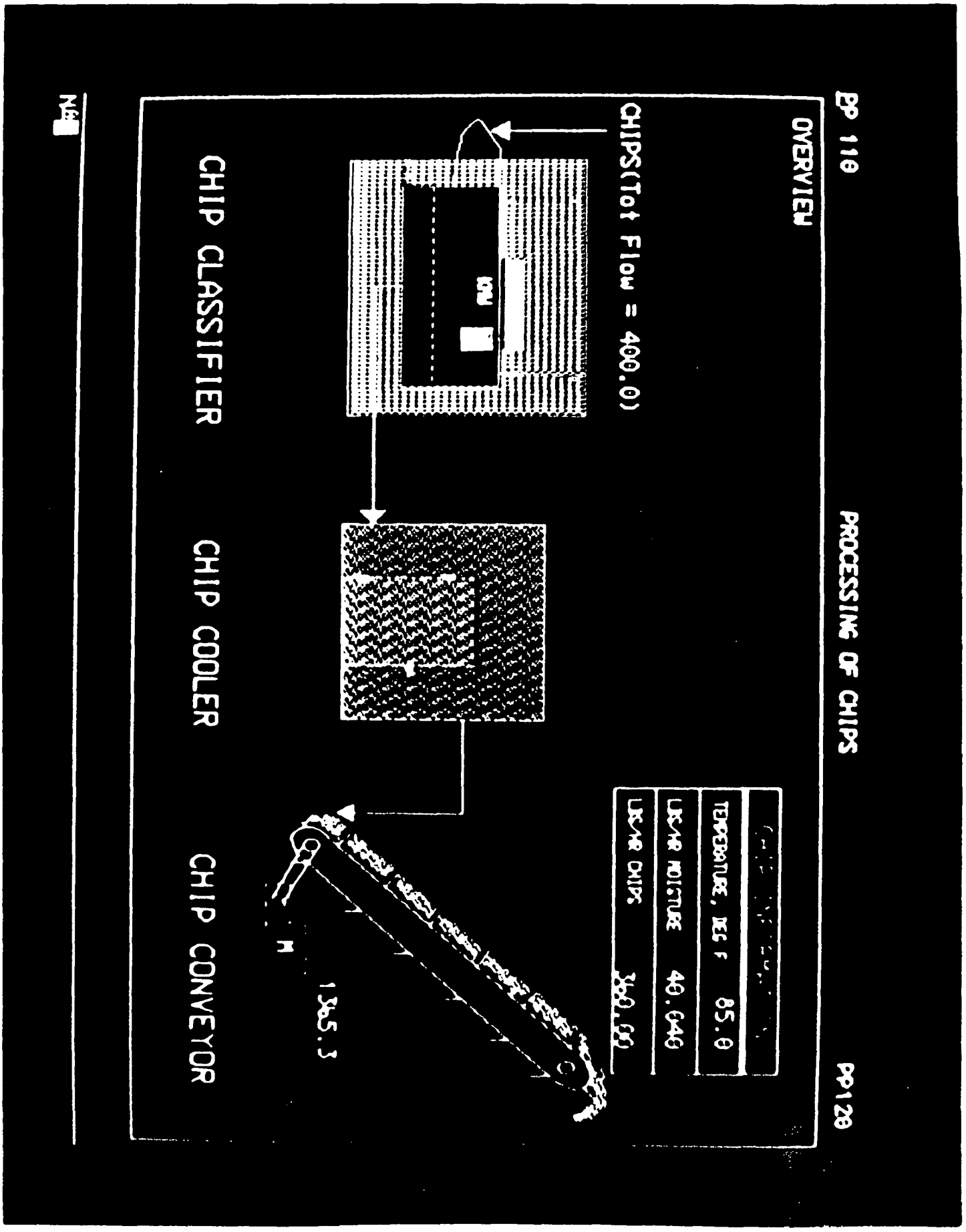
- MAPPS
  - NEW PRETREATMENT MODEL
  - INTERACTIONS BETWEEN PRETREATMENT AND REFINING
  - CTMP FLOWSHEET MODEL
  - MODIFICATIONS TO COMMUNICATE WITH RPMS (IMB AND IPST)
- RPMIS
  - DEVELOPED SCHEMATICS (3X DEVELOPED TAGS AND VARIABLES
- TAPPI DEMONSTRATION

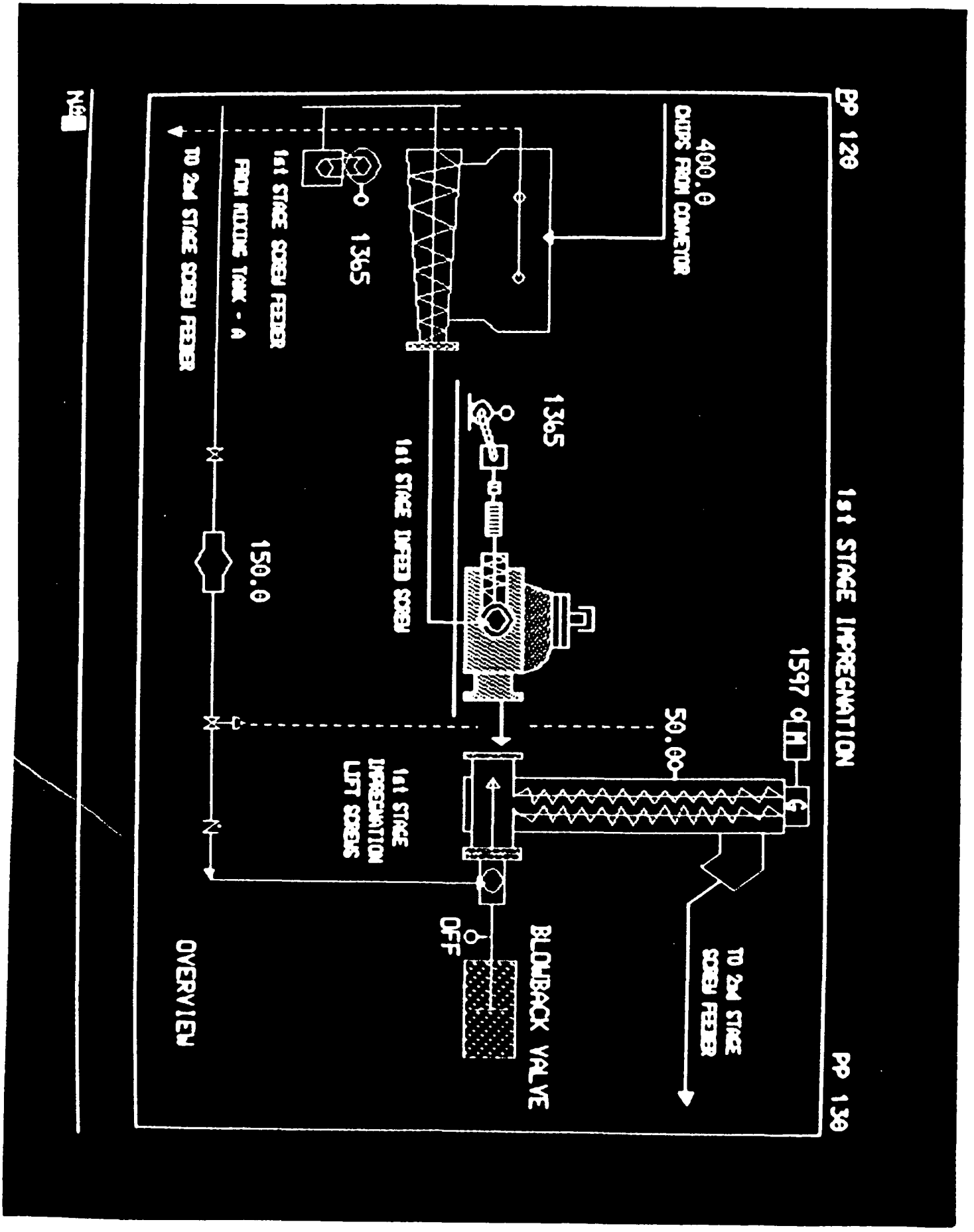
Pilot System Integration

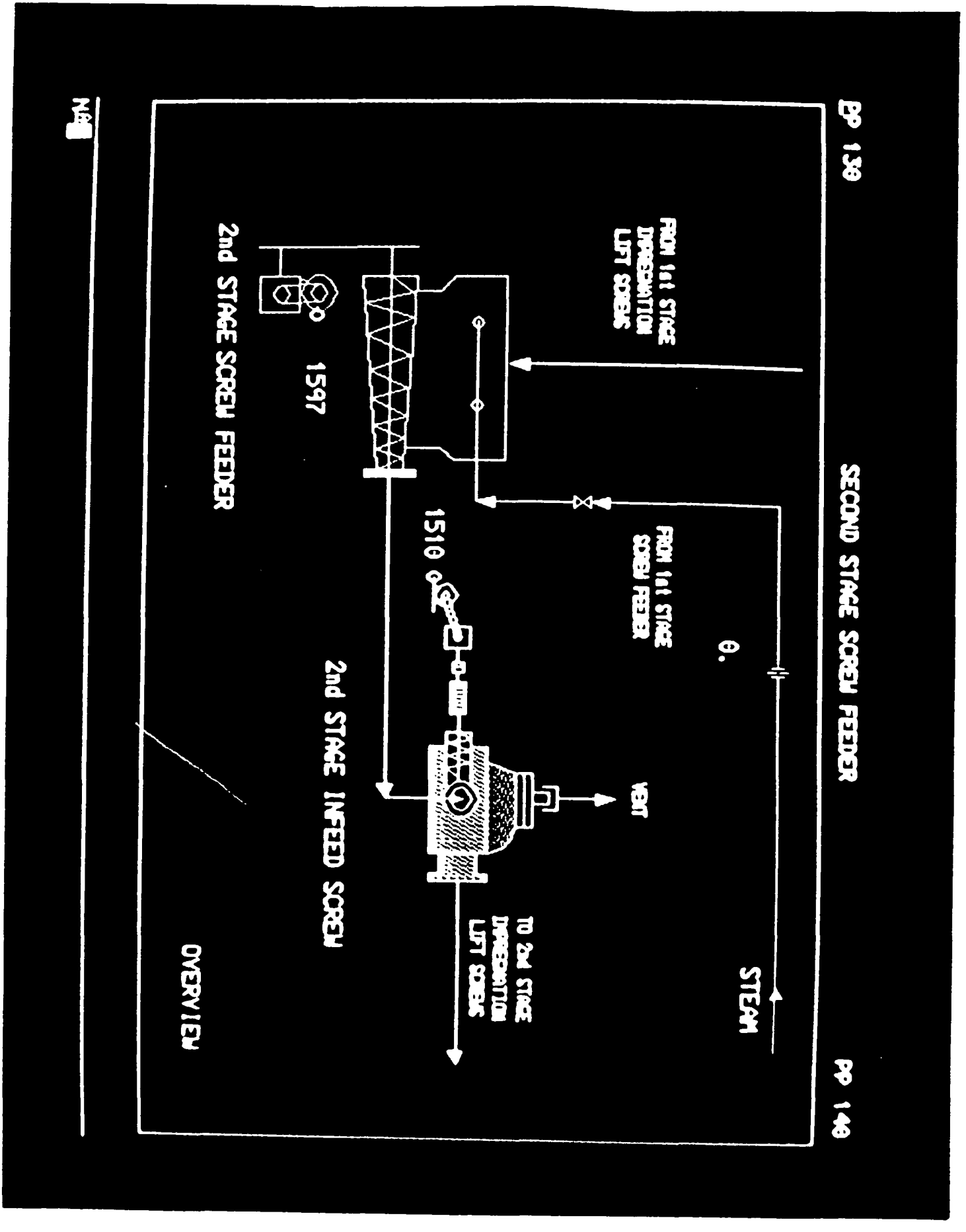


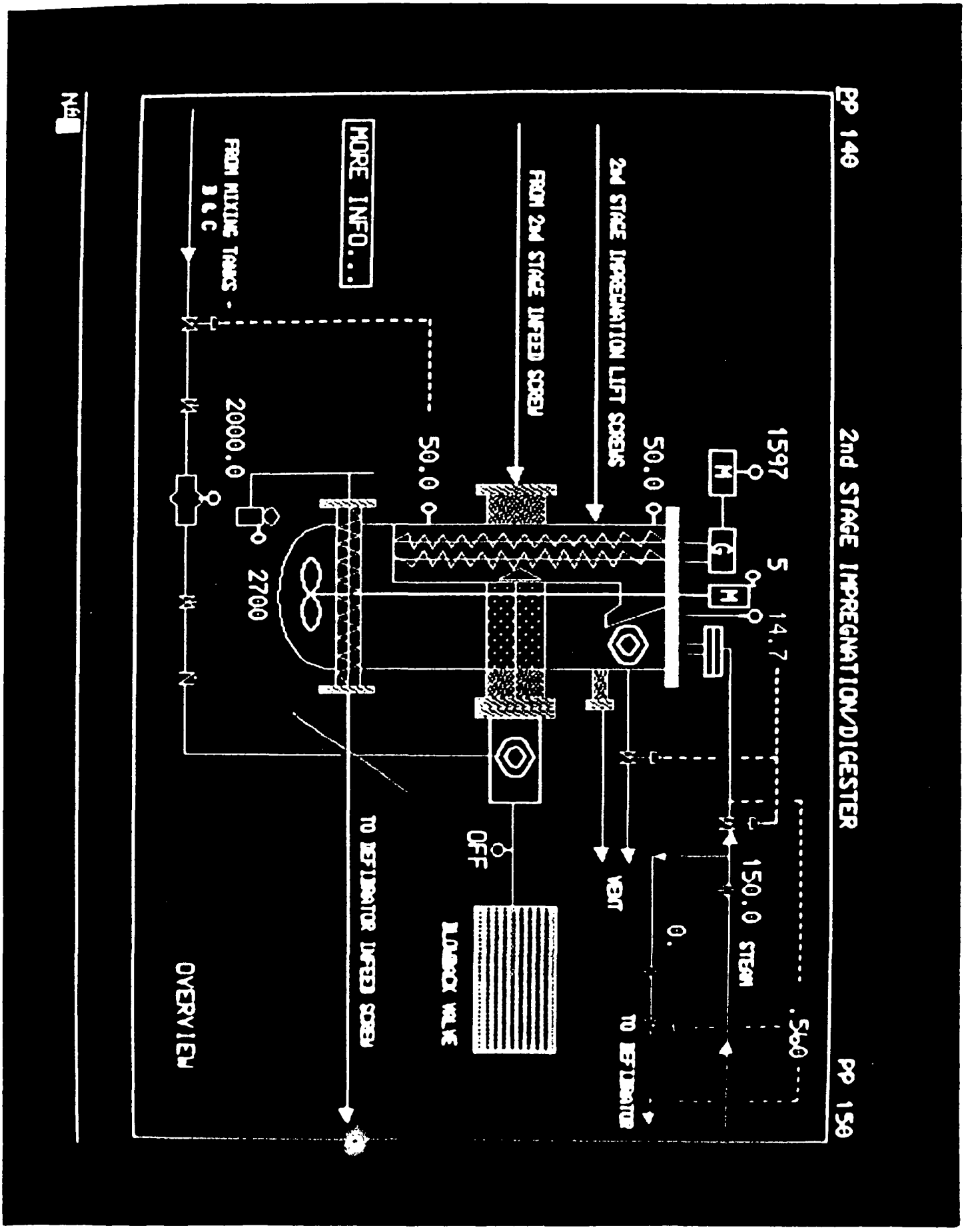

WELCOME
TO THE
CTMP CONSORTIUM
PRESENTATION
TAPPI EXHIBITION - 1990


BP 101
TWO STAGE CTMP PILOT PLANT
BP 110
CHIPS
WASHING
1st SCREW FEEDER
2nd SCREW FEEDER
IMPREGNATION
DIGESTER
1st STAGE REFINING
CYCLONES
INTER-STAGE WASHER
2nd STAGE REFINING
LATENCY CHEST
STEAM


BP 110
OVERVIEW
PROCESSING OF CHIPS
PP120
CHIPS(Tot Flow = 400.0)
CHIP CLASSIFIER
CHIP COOLER
CHIP CONVEYOR
TEMPERATURE, DEG F 85.0
LBS/HR MOISTURE 40.0AG
LBS/HR CHIPS 360.00
185.3


PP 120
1st STAGE IMPREGNATION
PP 130
400.0
CHIPS FROM CONVEYOR
1365
1st STAGE SCREW FEEDER
FROM MIXING TANK - A
TO 2nd STAGE SCREW FEEDER
1365
1st STAGE INFEED SCREW
150.0
1597
50.00
1st STAGE IMPREGNATION LIFT SCREWS
BLOWBACK VALVE
OFF
TO 2nd STAGE SCREW FEEDER
OVERVIEW


BP 130
SECOND STAGE SCREW FEEDER
BP 140
FROM 1st STAGE DEWATERING LIFT SCREWS
2nd STAGE SCREW FEEDER
1507
1510
FROM 1st STAGE SCREW FEEDER
0.
STEAM
VENT
2nd STAGE INFEED SCREW
TO 2nd STAGE DEWATERING LIFT SCREWS
OVERVIEW

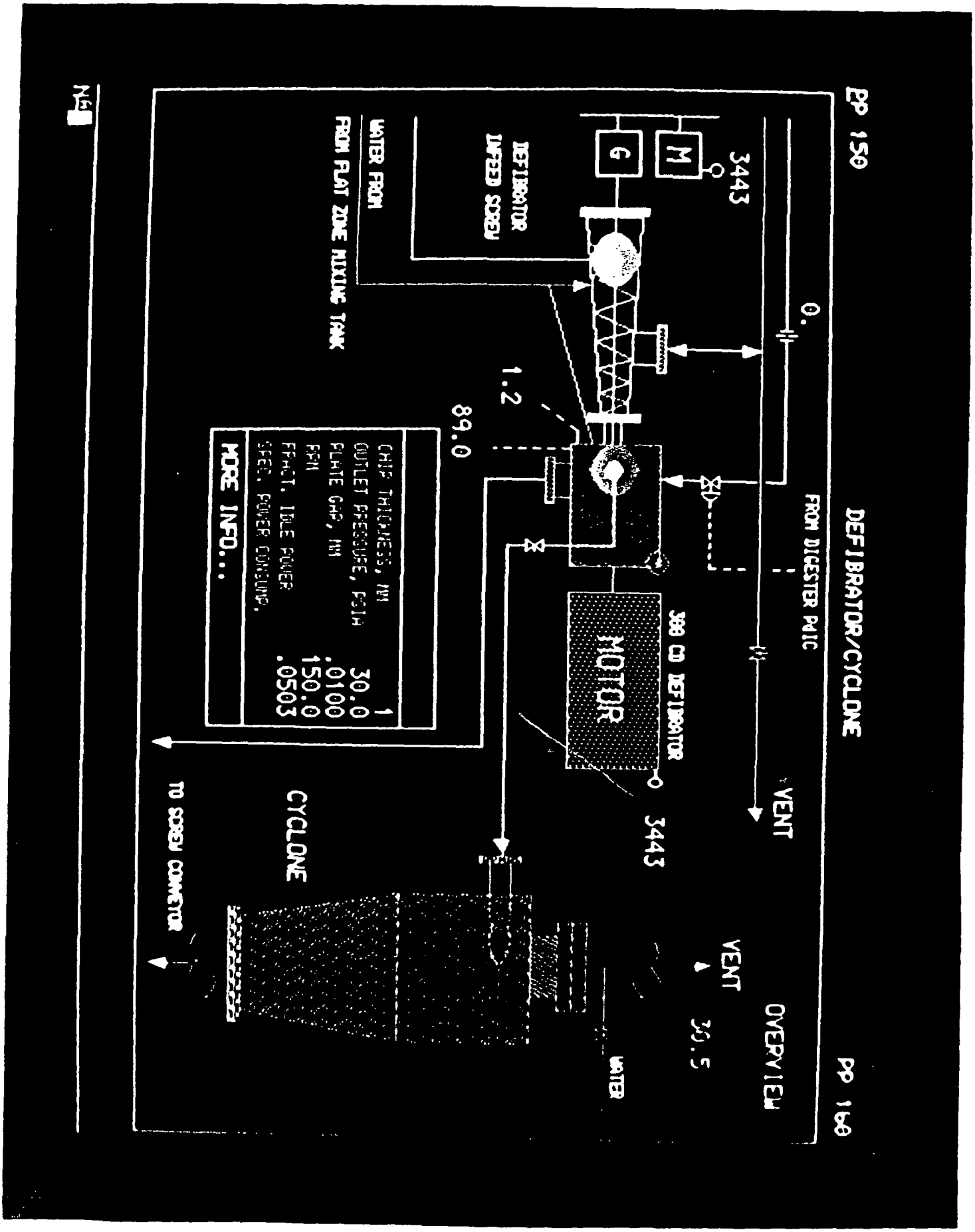

PP 140
2nd STAGE IMPREGNATION/DIGESTER
PP 150
2nd STAGE IMPREGNATION LIFT SCREW
FROM 2nd STAGE INFEED SCREW
FROM MIXING TANKS - B & C
MORE INFO...
2000.0
2700
50.0
50.0
1597
5
14.7
150.0 STEAM
560
0.
VENT
TO BLOWTANK
OFF
TO DEFIBRATOR INFEED SCREW
OVERVIEW

PP 142 DIGESTER INFORMATION PP 140

DESCRIPTION	TAG	VALUE	UNIT
CHIP THICKNESS	PPX9006	1.0	MM
RES. TIME IN LIQUOR	PPQ9007	.0499	HR
RES. TIME IN STEAM	PPQ9008	.0499	HR
YIELD LOSS	PPQ9009	10.0	%
OUTLET PRESSURE	PPP9010	30.0	PSIA
TEMP. AT CEN. OF CHIP	PPT9011	212	DEG-F
GLASS TRANSMIT TEMP.	PPX9012	232.4	DEG-F
MASS FRACT. ABOVE GTT	PPT9013	0.	DEG-F
MASS FRACT. NEAR GTT	PPT9014	1.0	DEG-F
MASS FRACT. BELOW GTT	PPT9015	0.	DEG-F
FRACT. MOIST. IN LUMENS	PPX9016	.9254	FRACN.
FRACT. MST. CELL WALL	PPX9017	.0745	FRACN.

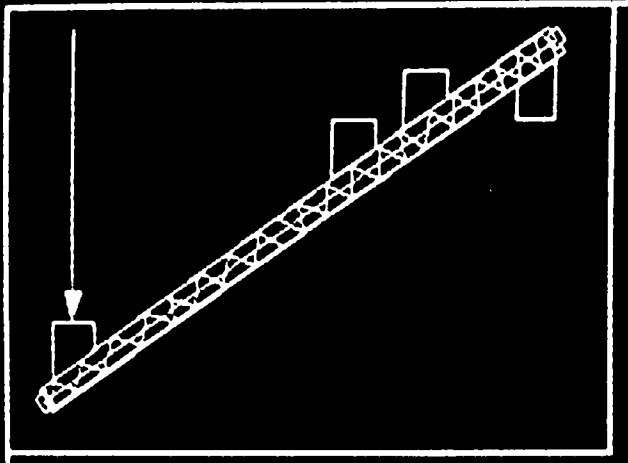
BACK...

N4


DEFIBRATOR/CYCLONE
BP 150
BP 160
OVERVIEW
M
G
3443
0.
1.2
89.0
DEFIBRATOR INFEED SCREW
WATER FROM FLAT ZONE MIXING TANK
FROM DIGESTER P4IC
VENT
MOTOR
388 CD DEFIBRATOR
3443
CYCLONE
TO SCREW CONVEYOR
VENT
WATER
CHIP THICKNESS, MM 30.0
OUTLET PRESSURE, PSIA .0100
PLATE GAP, MM 150.0
RPM .0503
EFFICT. IDLE POWER
SPEC. POWER CONSUMP.
MORE INFO...

PP 152

PP 150

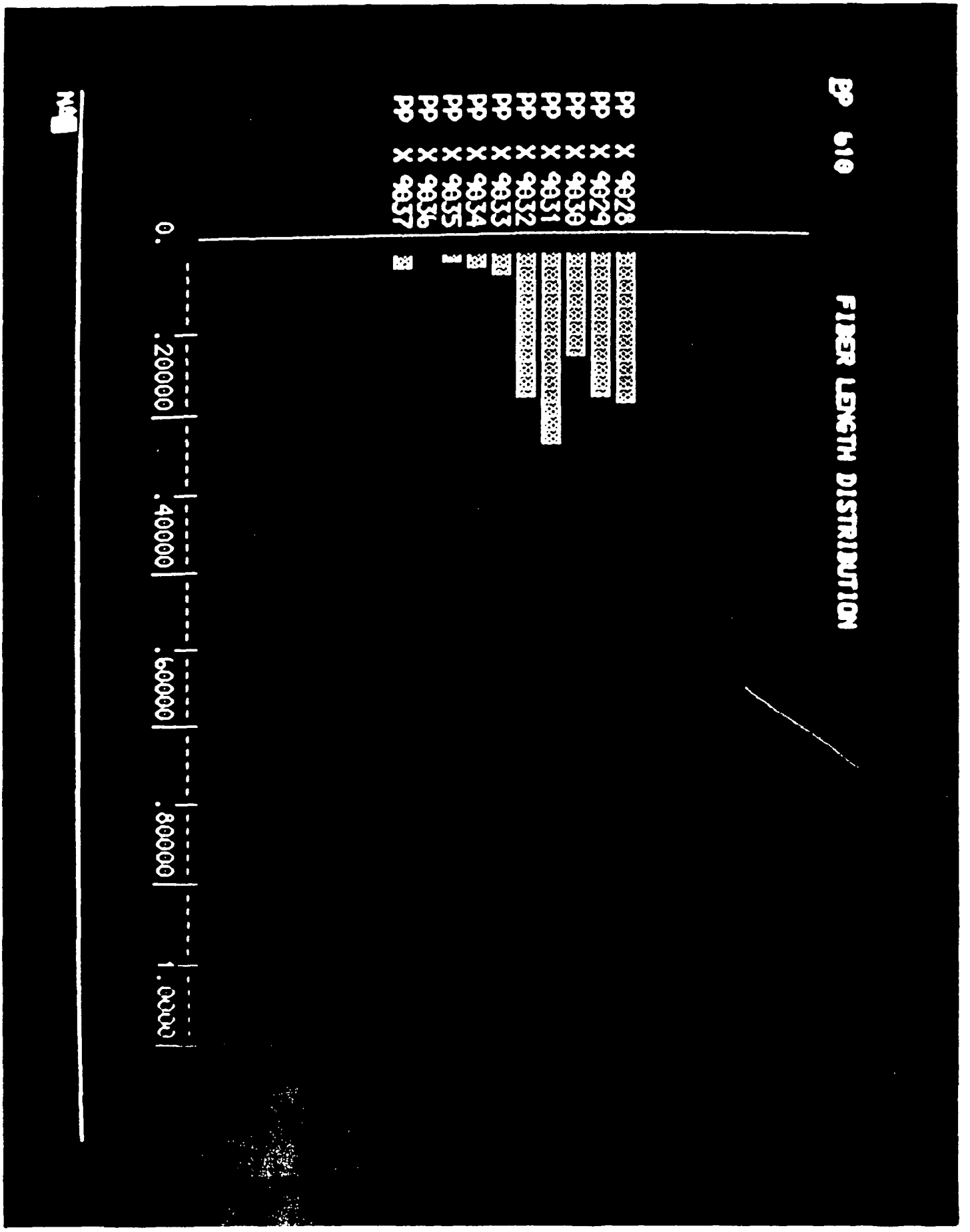


OUTLET CONSISTENCY, %	27.4
CHIP LENGTH, MM	25.00
AVG. FIBER LENGTH OUT, MM	1
CHIP WIDTH IN, MM	5.00
AVG. FIBER WIDTH OUT, MM	0
FREENESS, ML	218.3

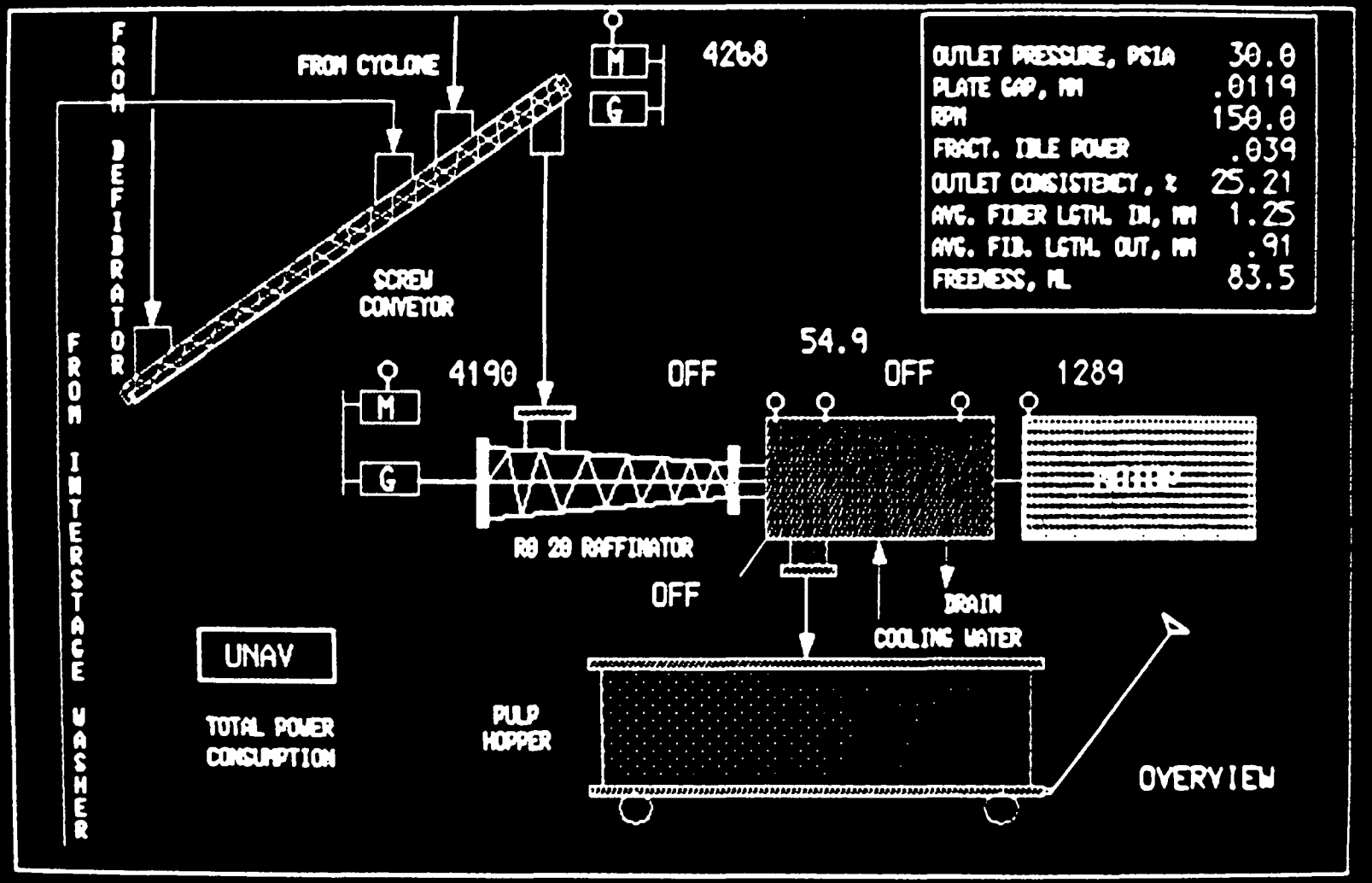
FIBER LENGTH DIST., MM	.1
IN WEIGHT FRACTIONS, %	.0

BACK...

NA


FIBER LENGTH DISTRIBUTION
BP 610
WT%
0.
20000
40000
60000
80000
1.0000
0827
0836
0835
0834
0833
0832
0831
0830
0829
0828

PP 160 RAFFINATOR/FINAL STAGE PP 170



NB:

PP 162 PULP PROPERTIES PP 160

DESCRIPTION	TAG	VALUE	UNIT
DENSITY	PPXC9001	.648	G/CC
WET WEB STRENGTH	PPXC9002	3.214	KM
TEAR FACTOR	PPXC9003	1.4	UNITS
BURST FACTOR	PPXC9004	24.8	UNITS
MD BREAK LENGTH	PPXC9005	3.803	KM
CD BREAK LENGTH	PPXC9006	2.717	KM
SCATTTERING COEFF.	PPXC9007	546.8	FRAC
POROSITY	PPXC9008	100.0	FRAC
OPACITY	PPXC9009	91.46	FRAC
RUPTURE ENERGY	PPXC9010	100.0	UNITS
STRETCH	PPXC9011	2.411	UNITS
MODULUS	PPXC9012	3.772	UNITS
BRIGHTNESS	PPXC9013	45.35	PERC
CALIPER, MM	PPXC9014	5.9	MM
BASIS WEIGHT	PPXC9015	20.0	UNITS
CONCORA	PPXC9016	58.8	UNITS
STFI	PPXC9017	18.7	UNITS
CD RING CRUSH	PPXC9018	41.7	UNITS

BACK...

N&

FUTURE WORK

- CONNECT RPMS TO DCS
- RUN MAPPS WITH REAL-TIME PROCESS INPUTS
- CHECK AND TUNE PROCESS MODEL
- DEVELOP AND TEST ADVANCED CONTROL APPLICATIONS
  - SUPERVISORY
  - PROCESS
- MIGRATE FROM PILOT TO ACTUAL MILL