

Figure 1
Abnormal Event Detection On-Line Information Flow

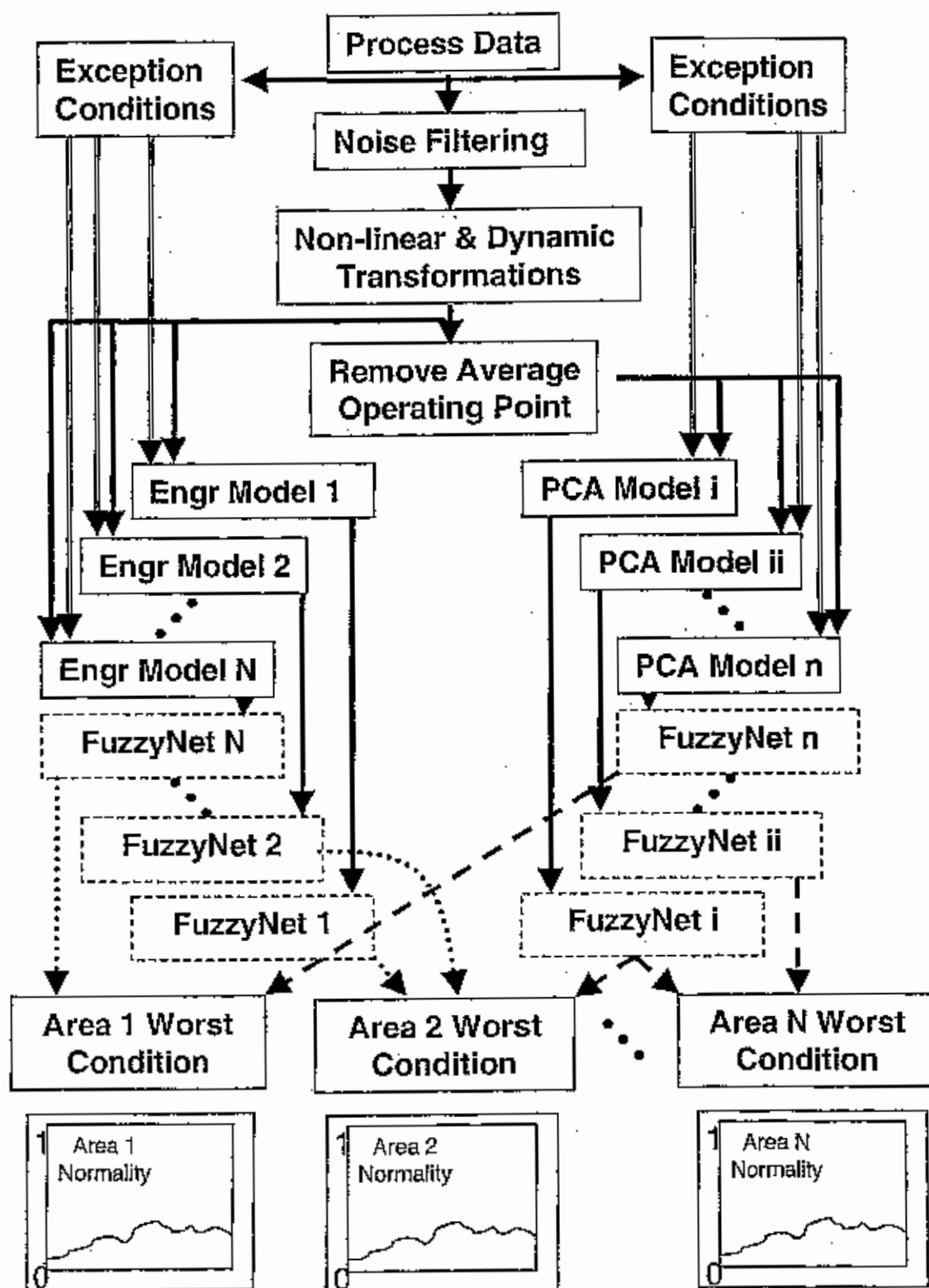


Figure 2

Valve to Flow Model

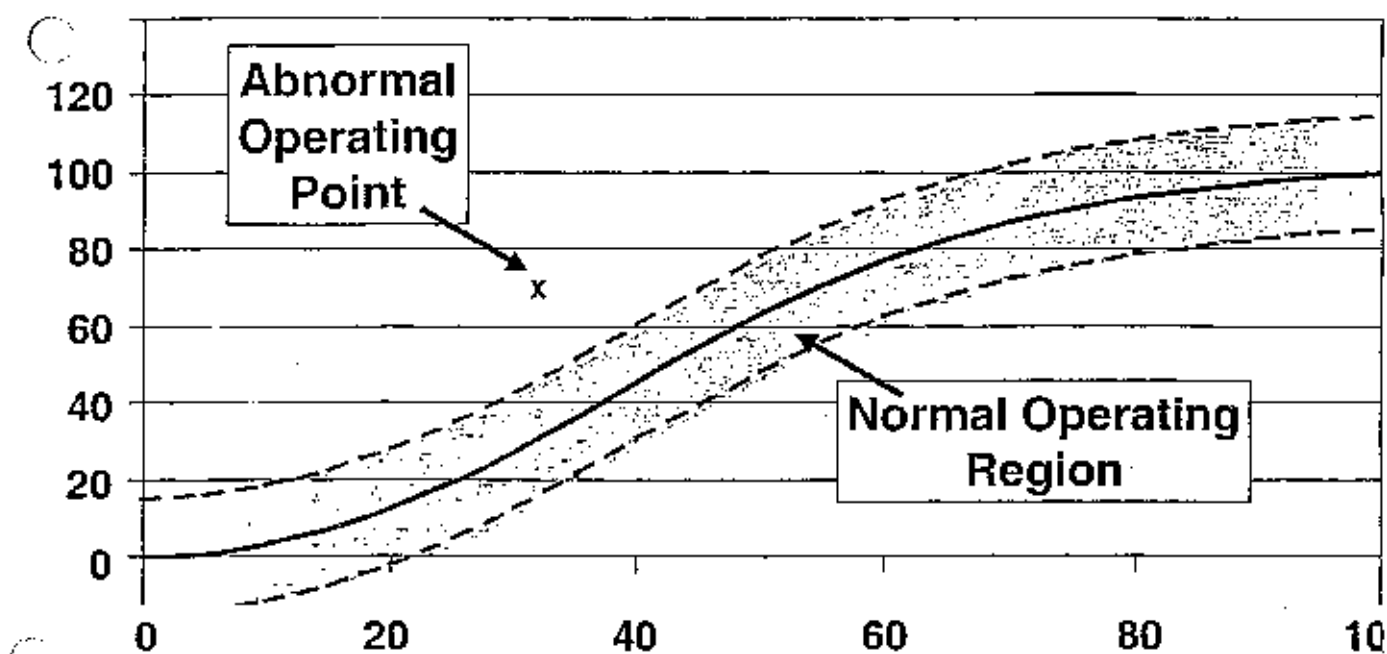


Figure 3

Three Dimensional Redundancy Expressed as a PCA Model

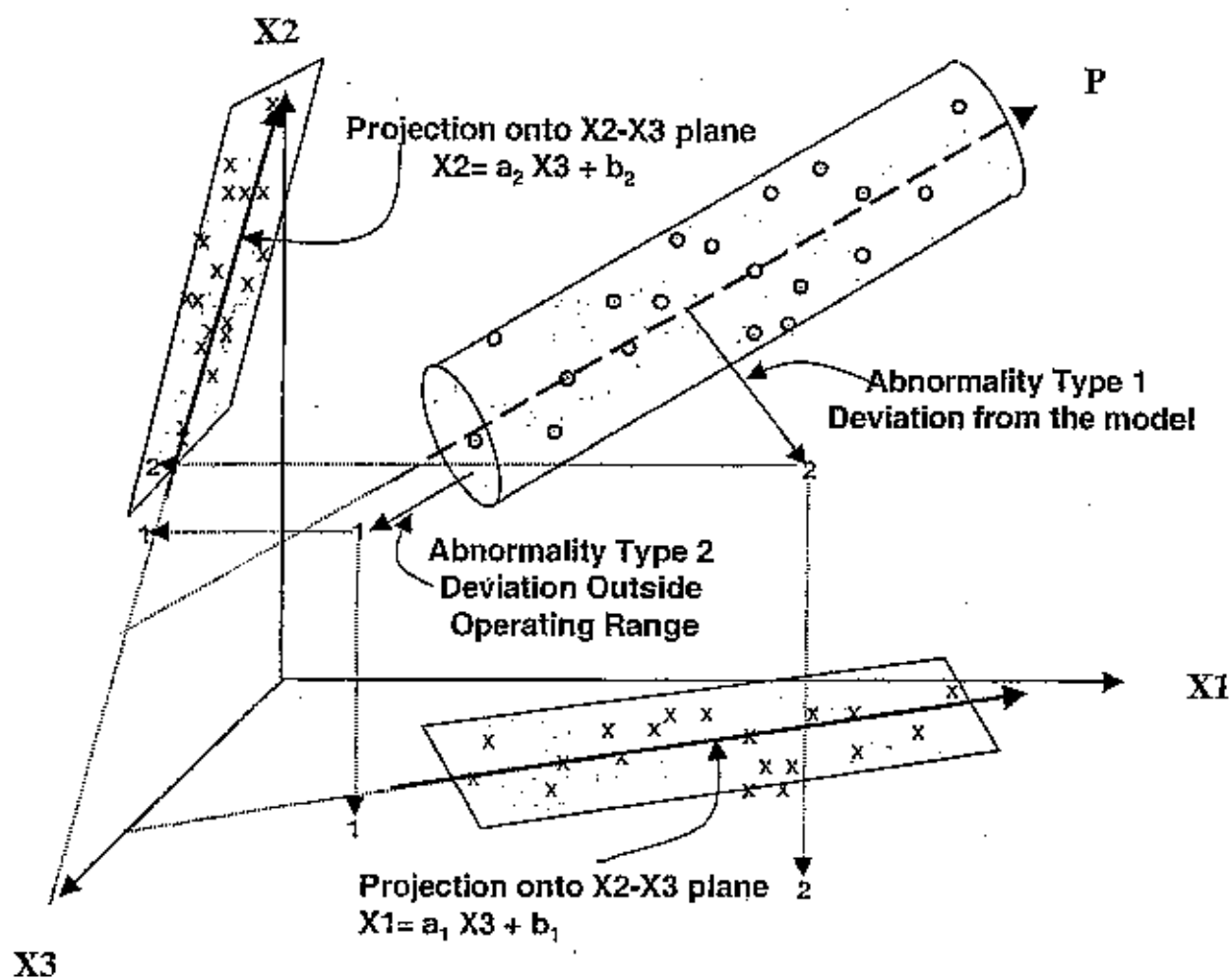


Figure 4
Fuzzy Network Setup

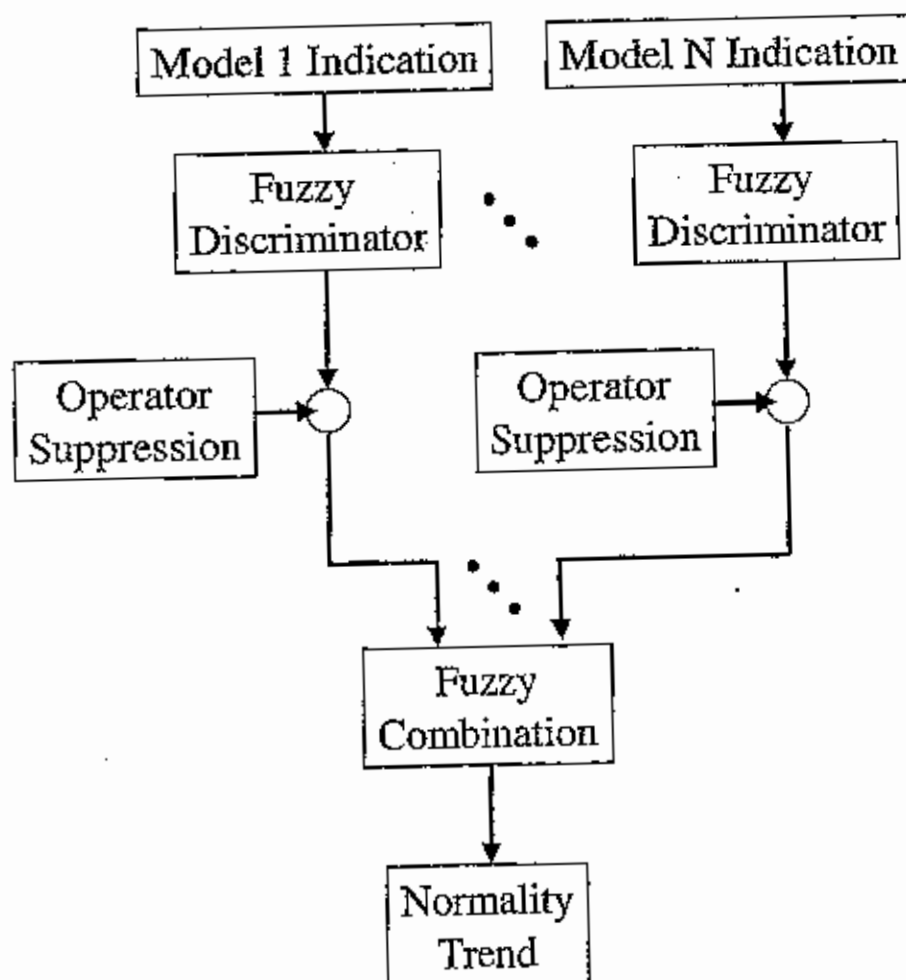


Figure 5

Process For Developing a PCA Abnormal Event Detector

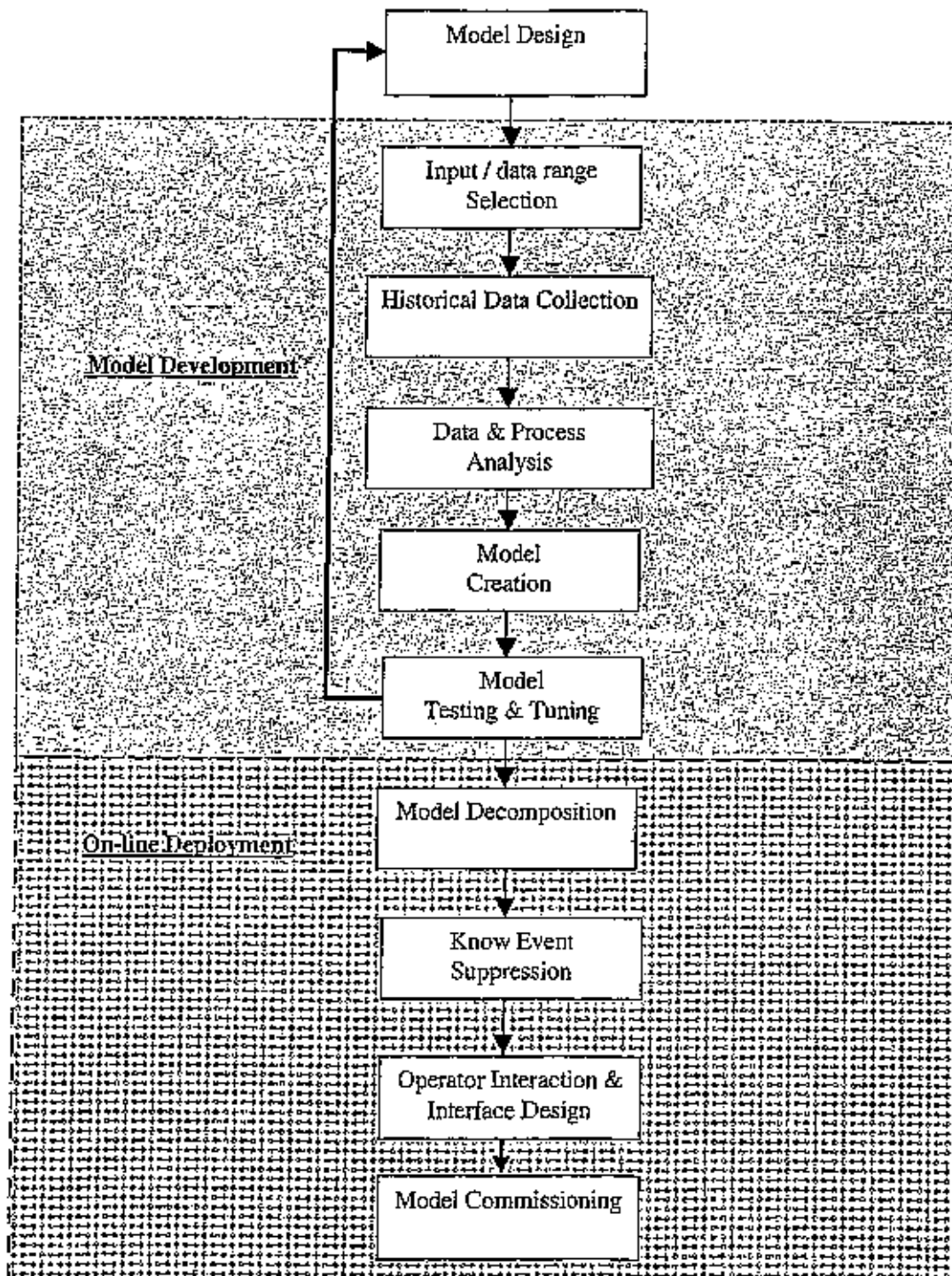


Figure 6
Anatomy of a Process Control Cascade

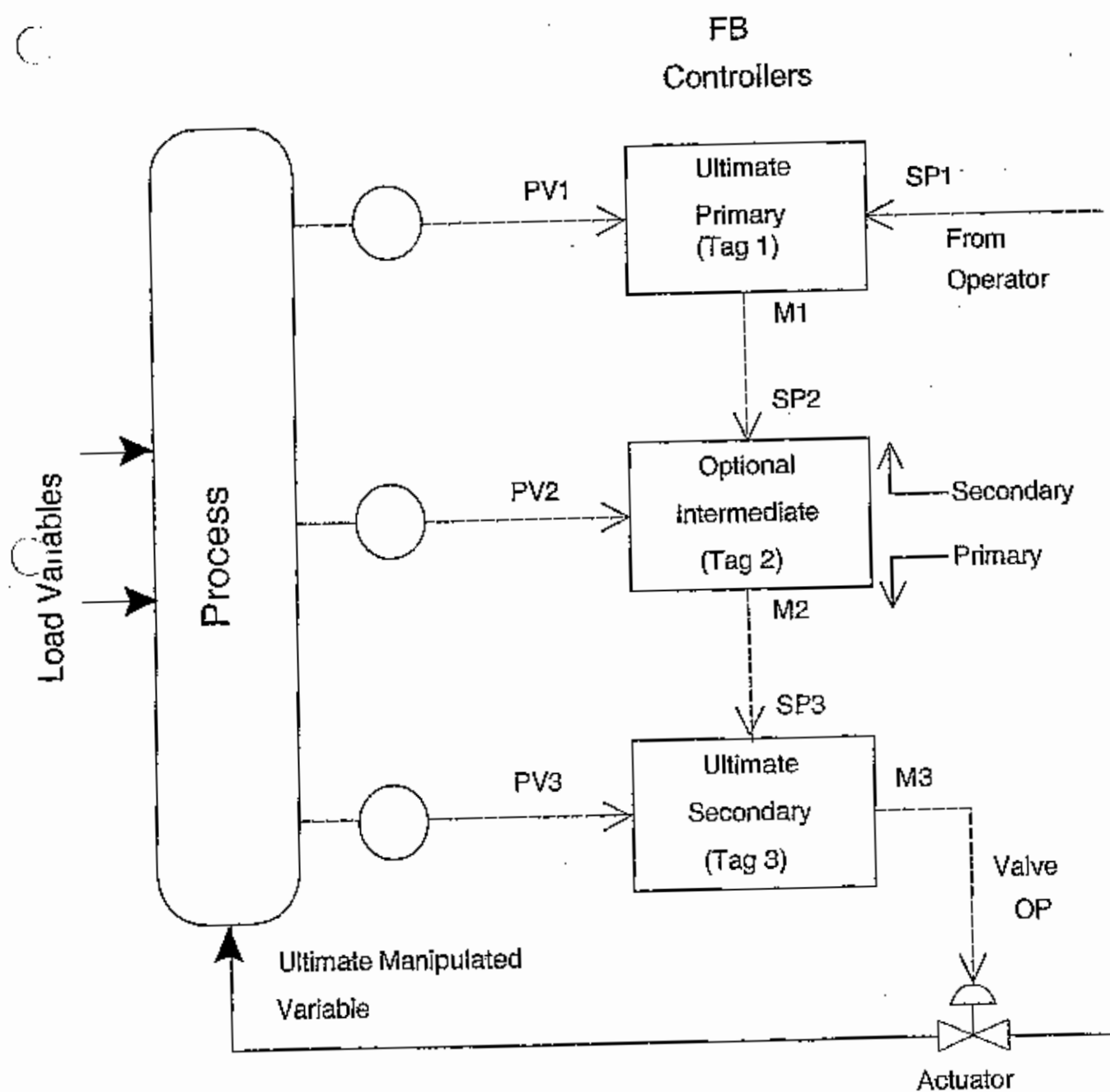


Figure 7

Anatomy of a Multivariable Constraint Controller, MVCC

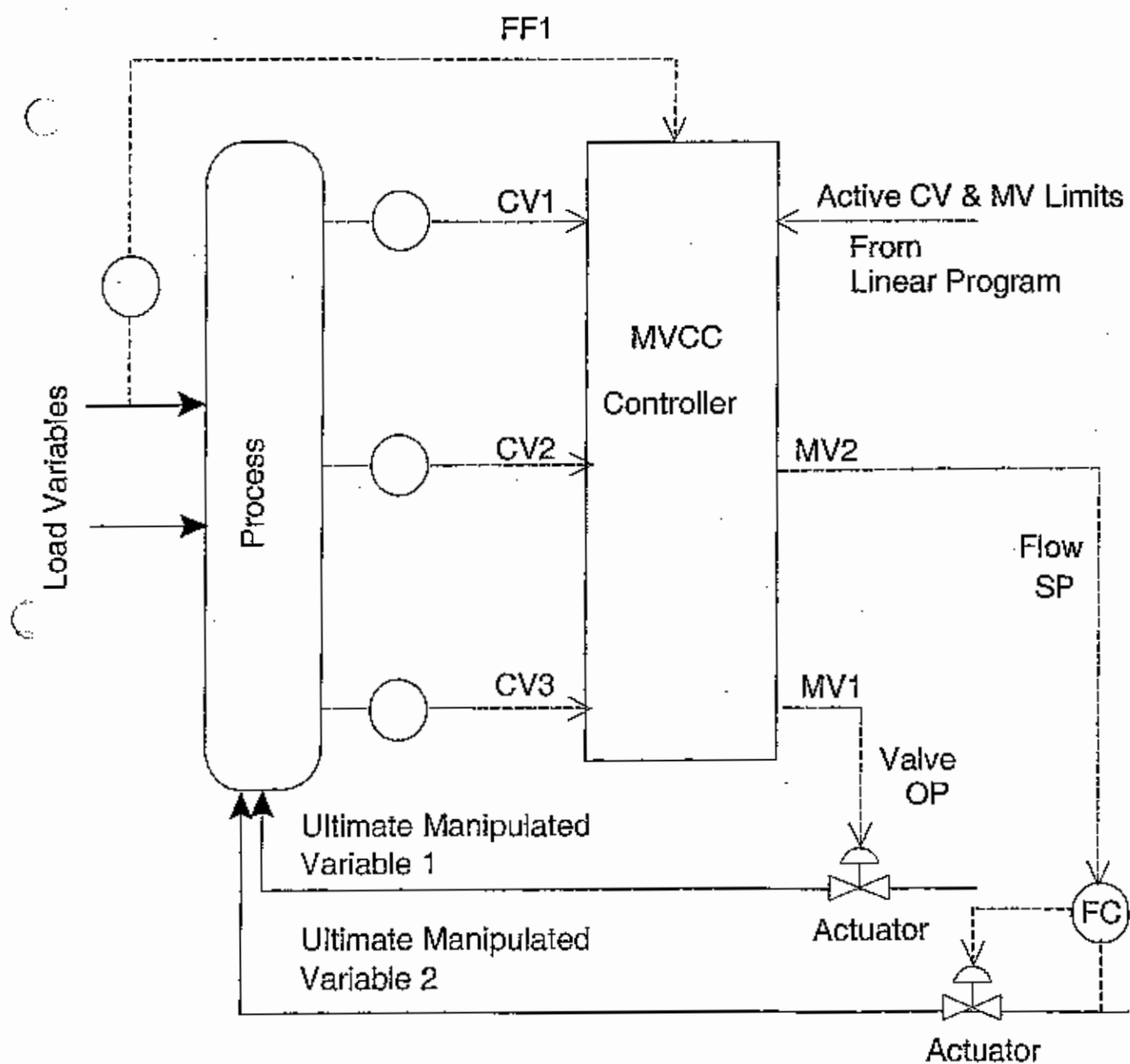


Figure 8

On-Line Inferential Estimate of Current Quality

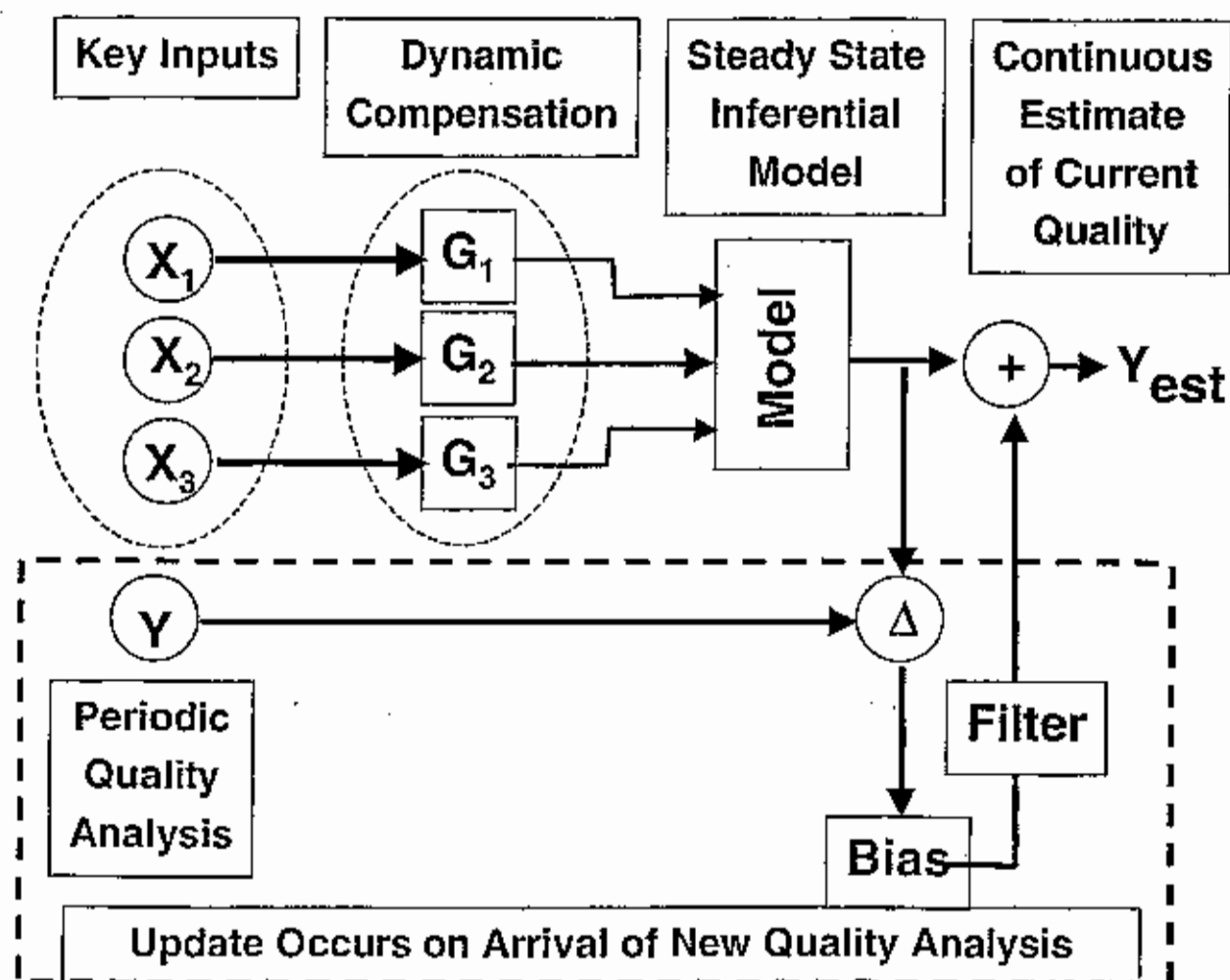


Figure 9
KPI Analysis of Historical Data

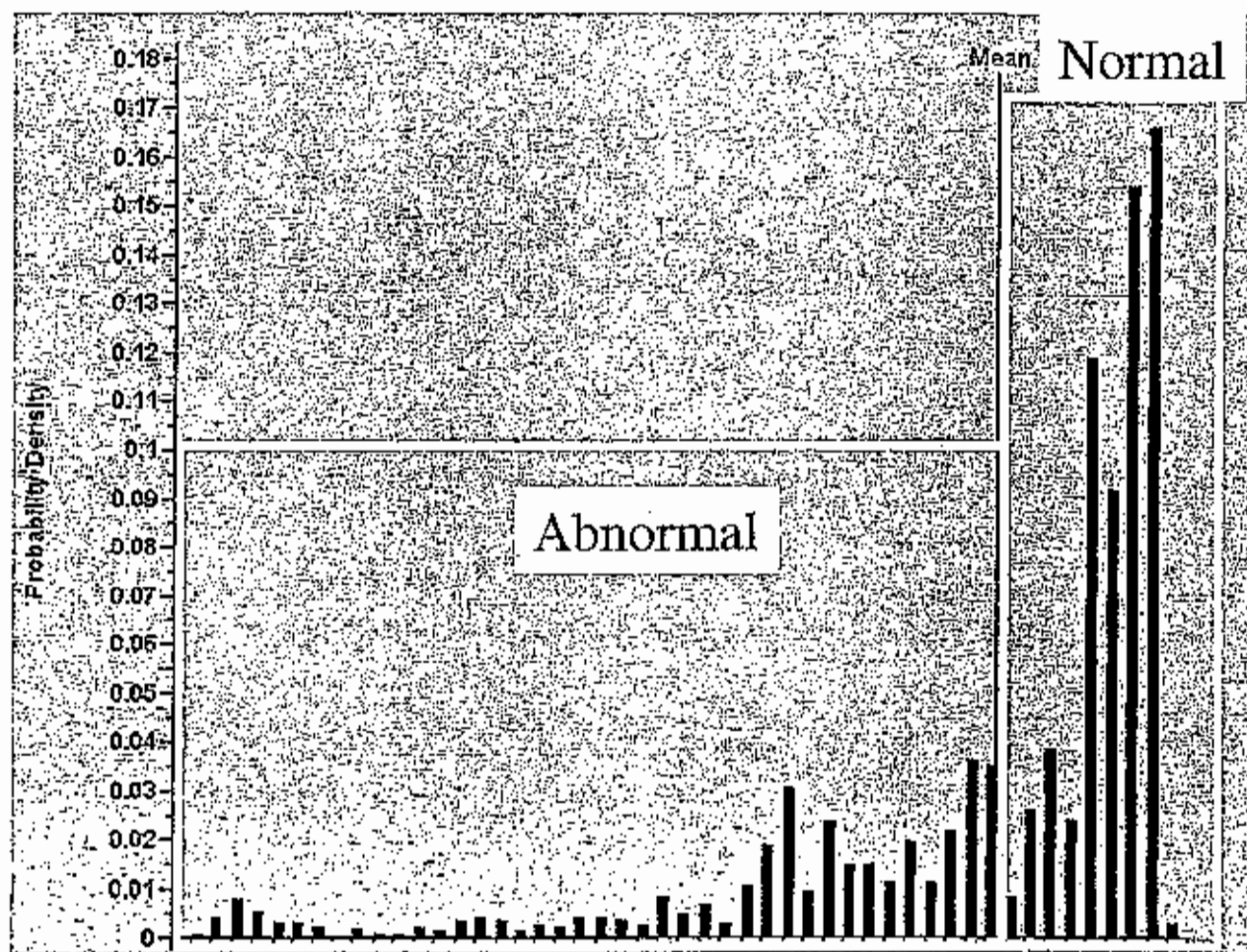


Figure 10

Signal to Noise Ratio

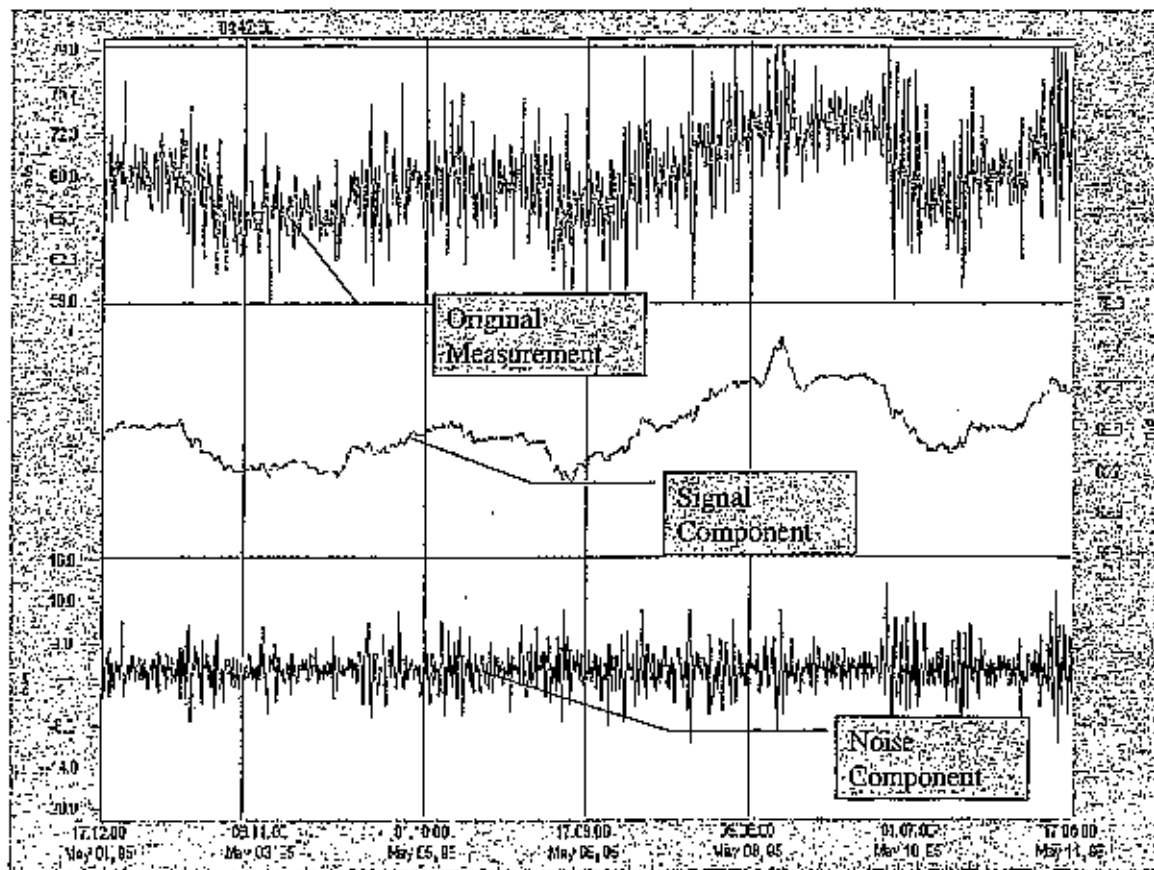
 $\text{Standard Deviation of Signal} / \text{Standard Deviation of Noise}$ 

Figure 11

Example of the Need for Dynamic Reconciliation

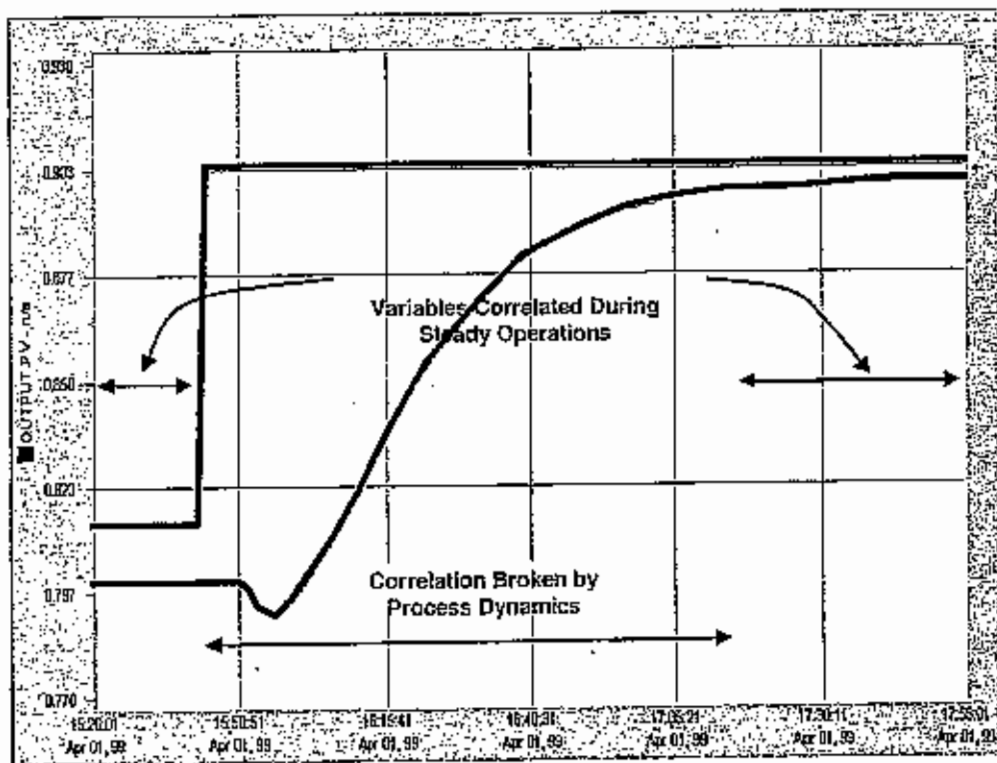


Figure 12

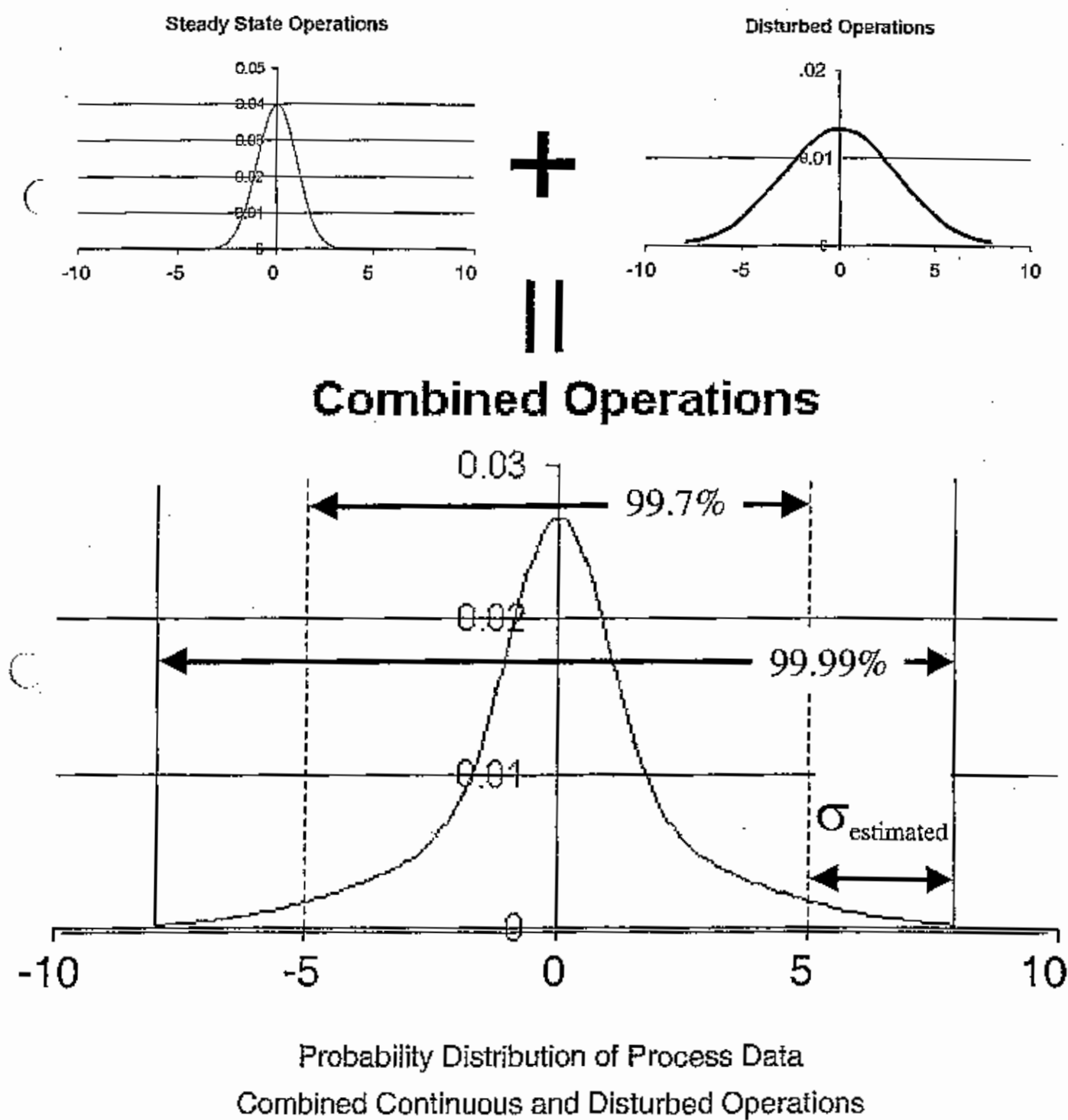


Figure 13
An Illustration of the Press Statistic

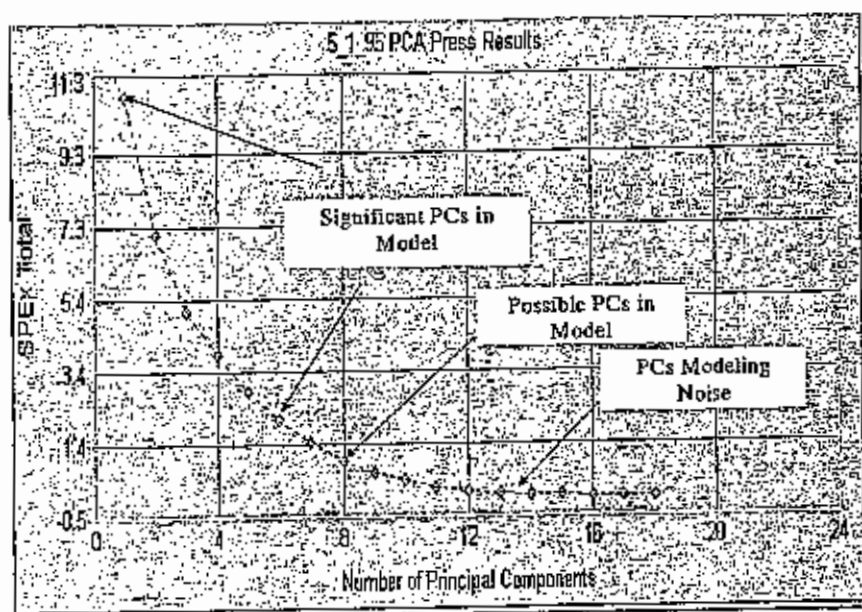


Figure 14

Two Dimensional Energy Balance Model

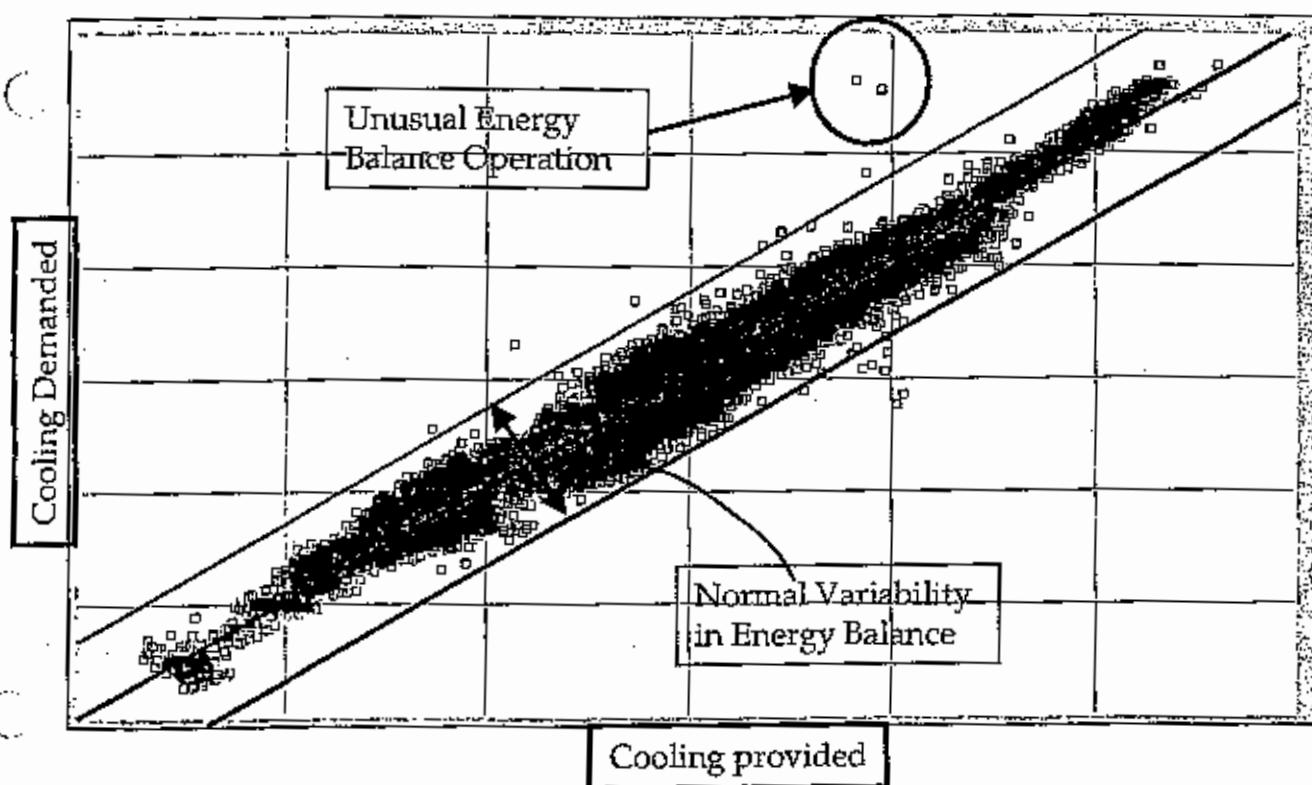


Figure 15
Valve to Flow Data

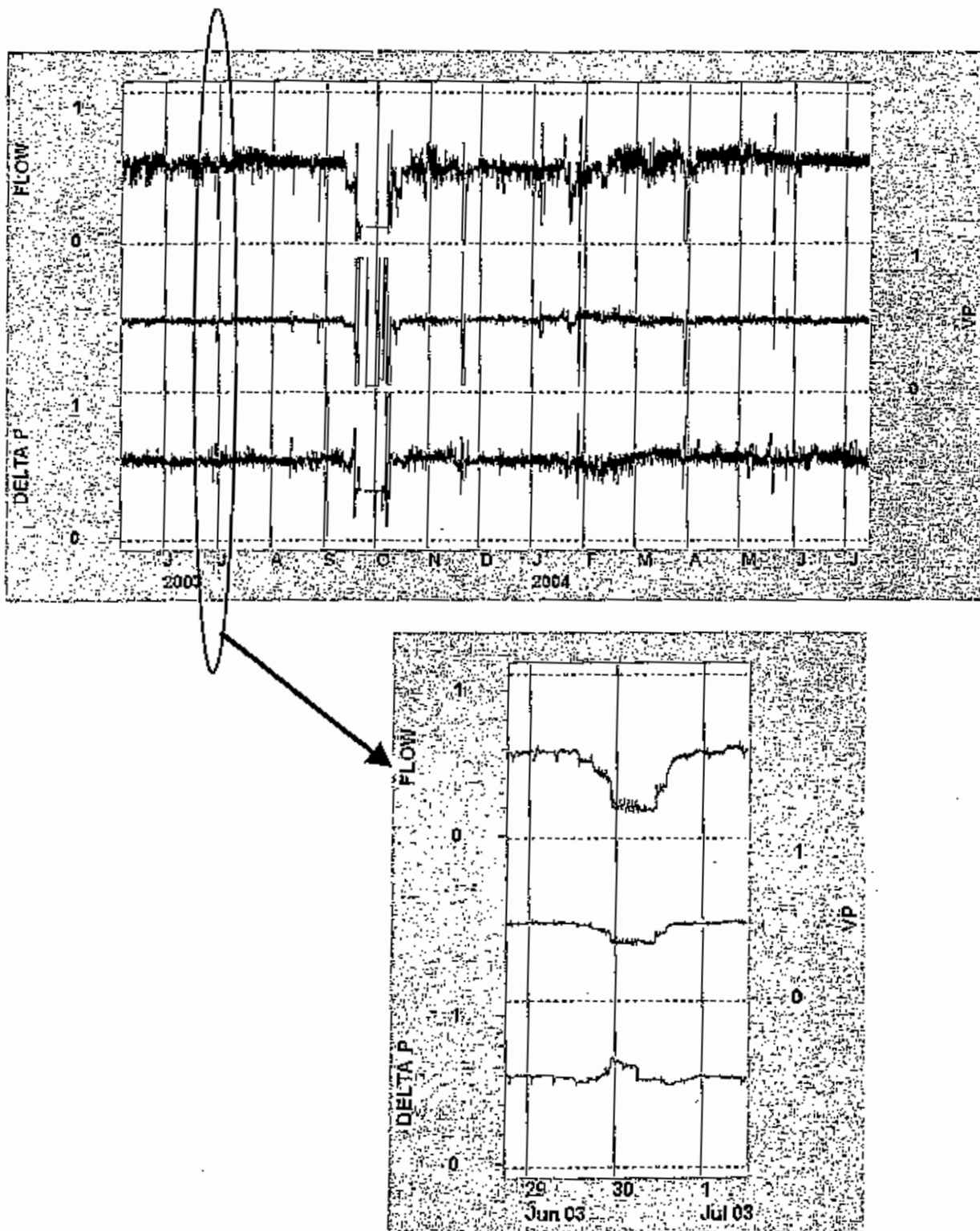


Figure 16
Fuzzy Discriminators

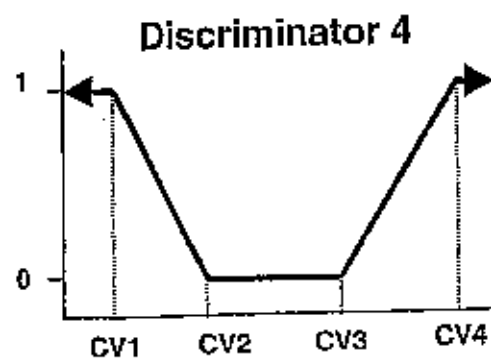
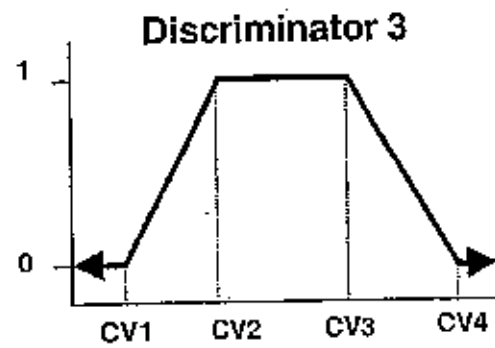
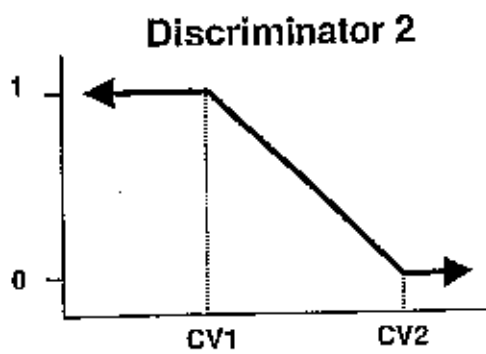
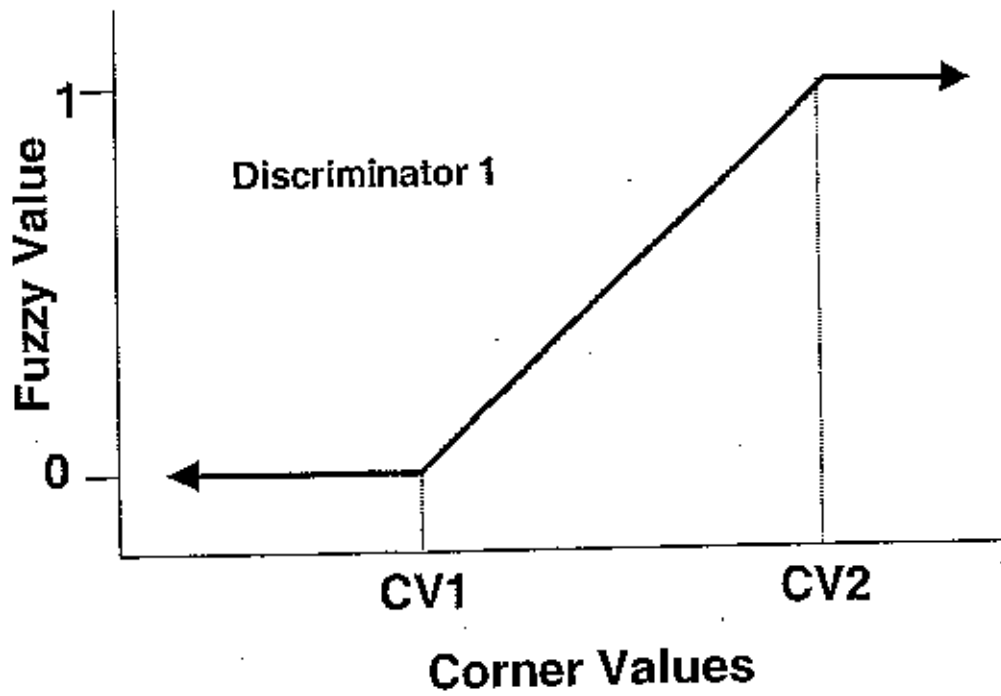


Figure 17

Flow versus Valve Paraeto Chart

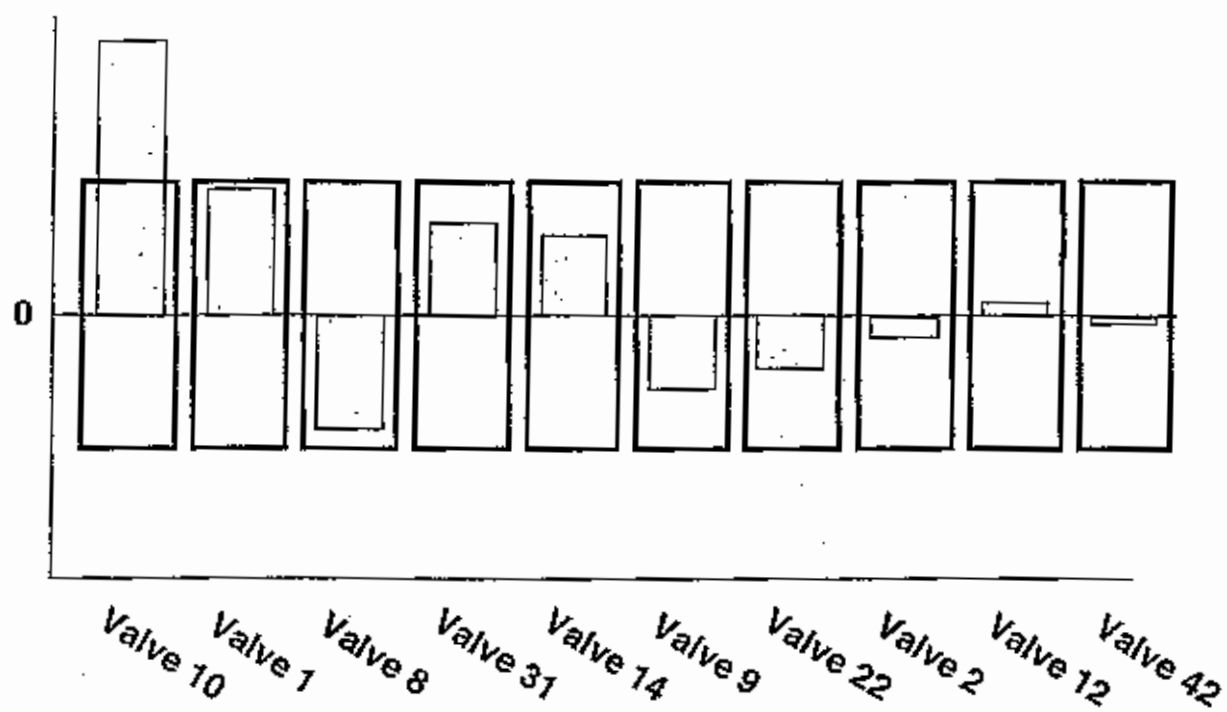


Figure 18
Operator Suppression Logic

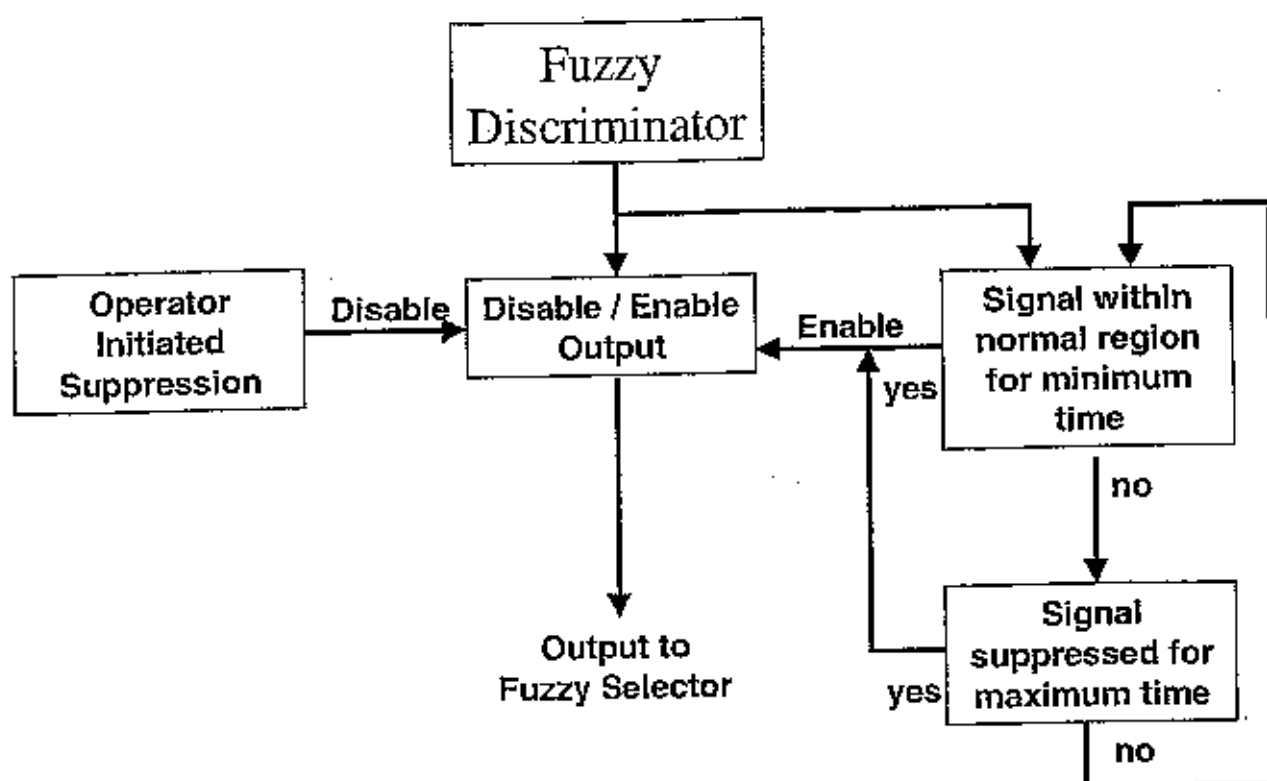


Figure 19
Event Suppression Logic

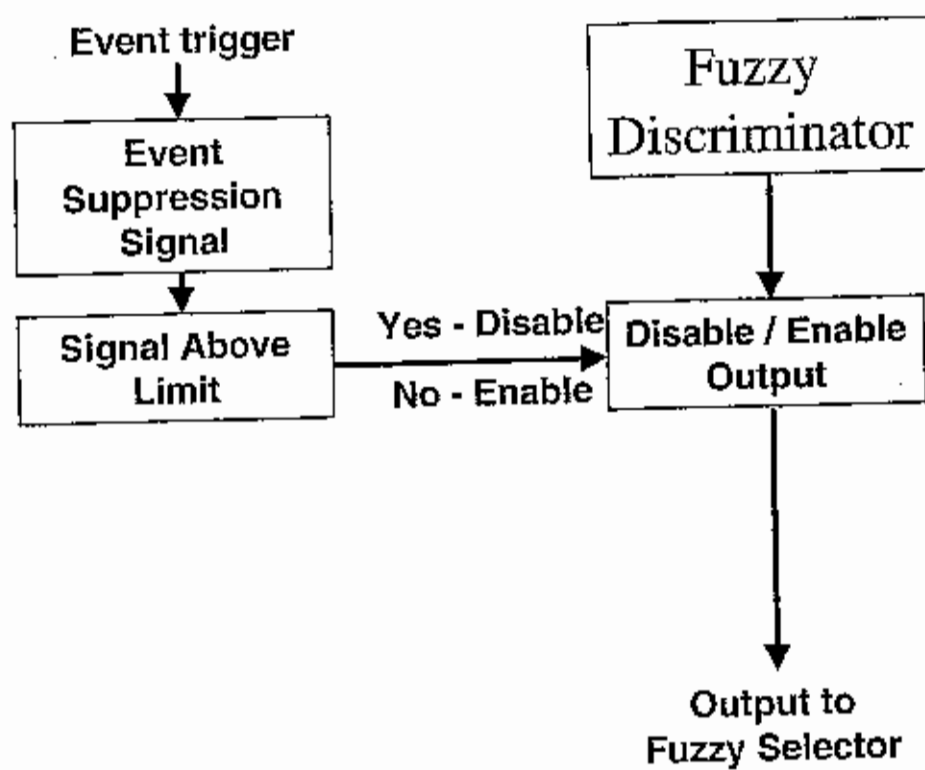


Figure 20

Setting the Duration of Event Suppression

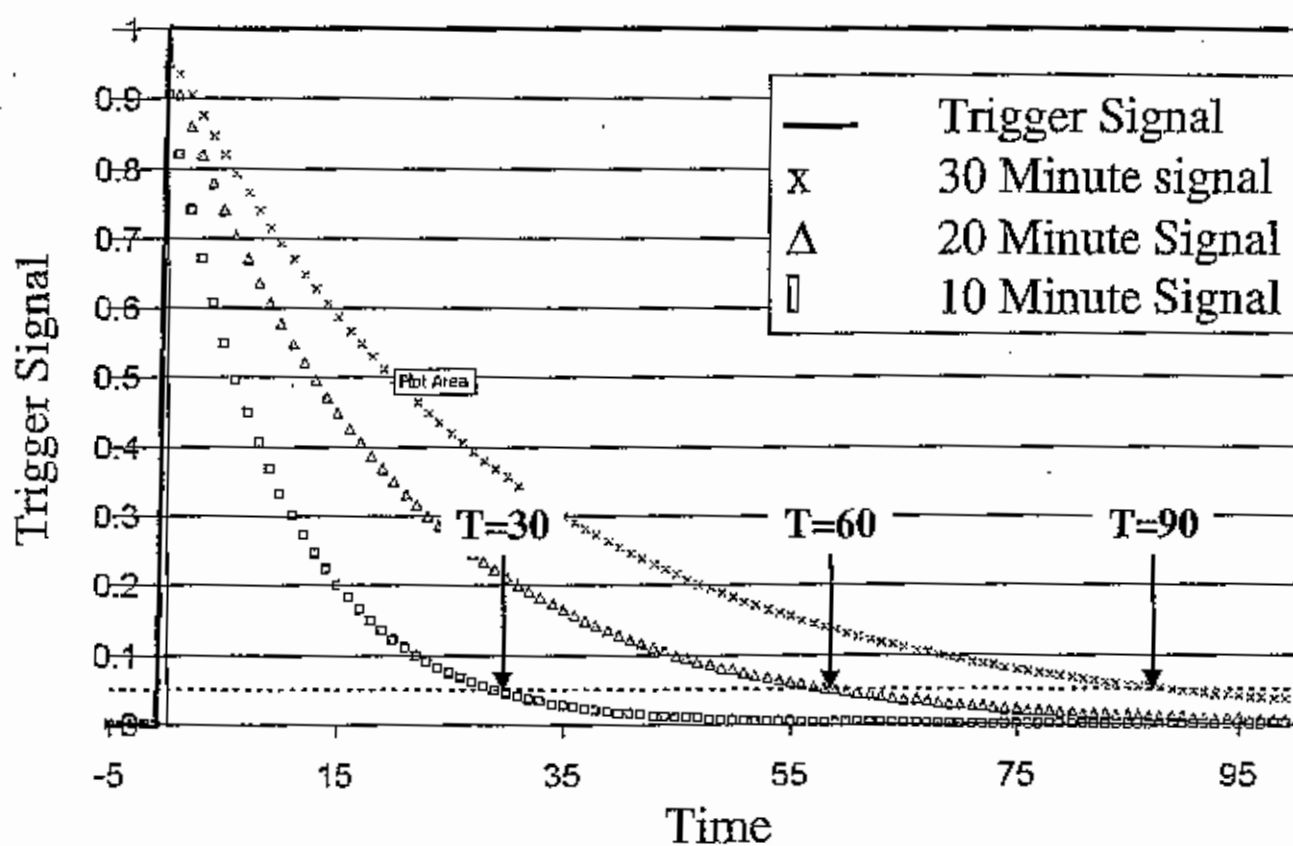


Figure 21

PCA Model Suppression

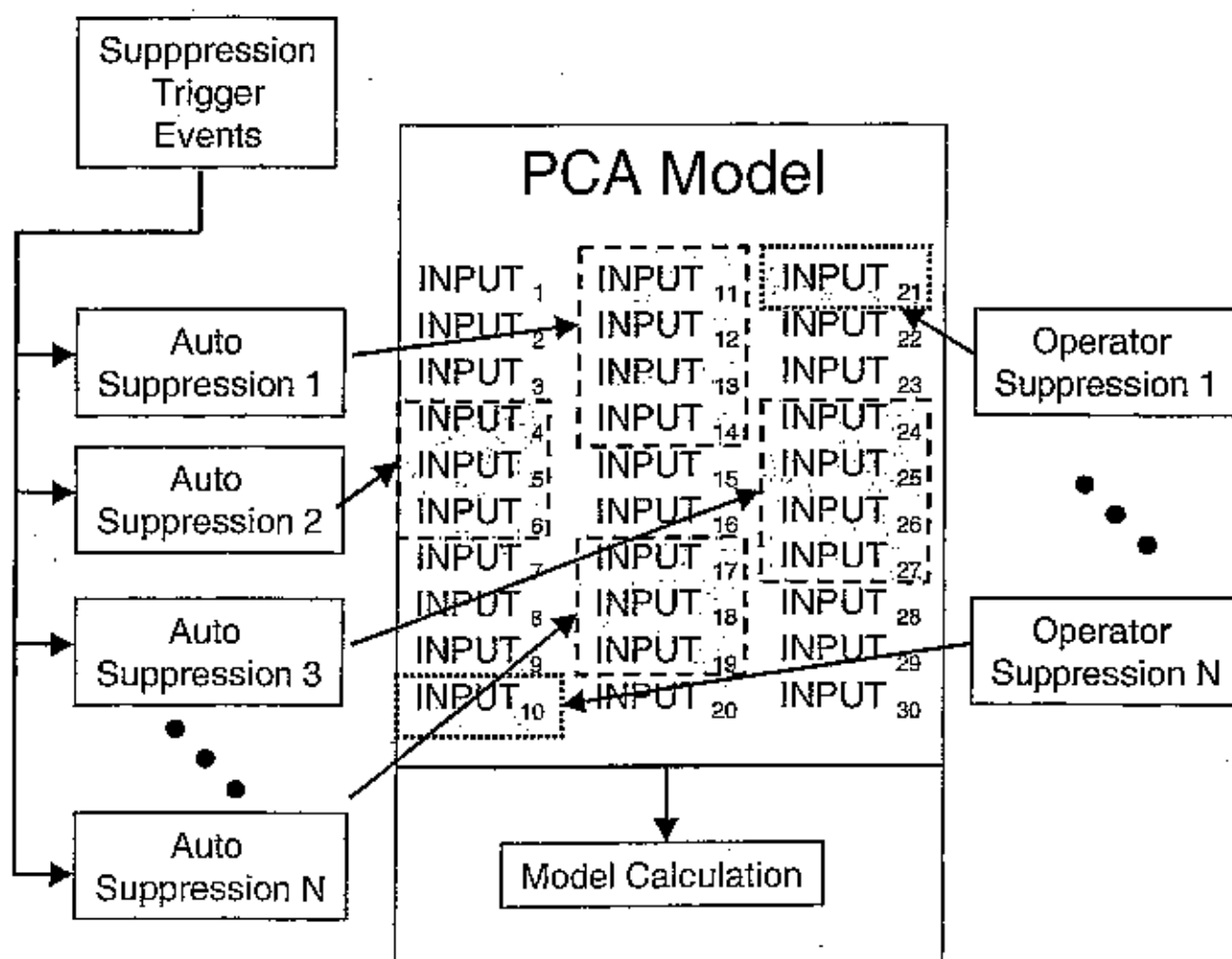


Figure 22
Primary Operator Interface Design

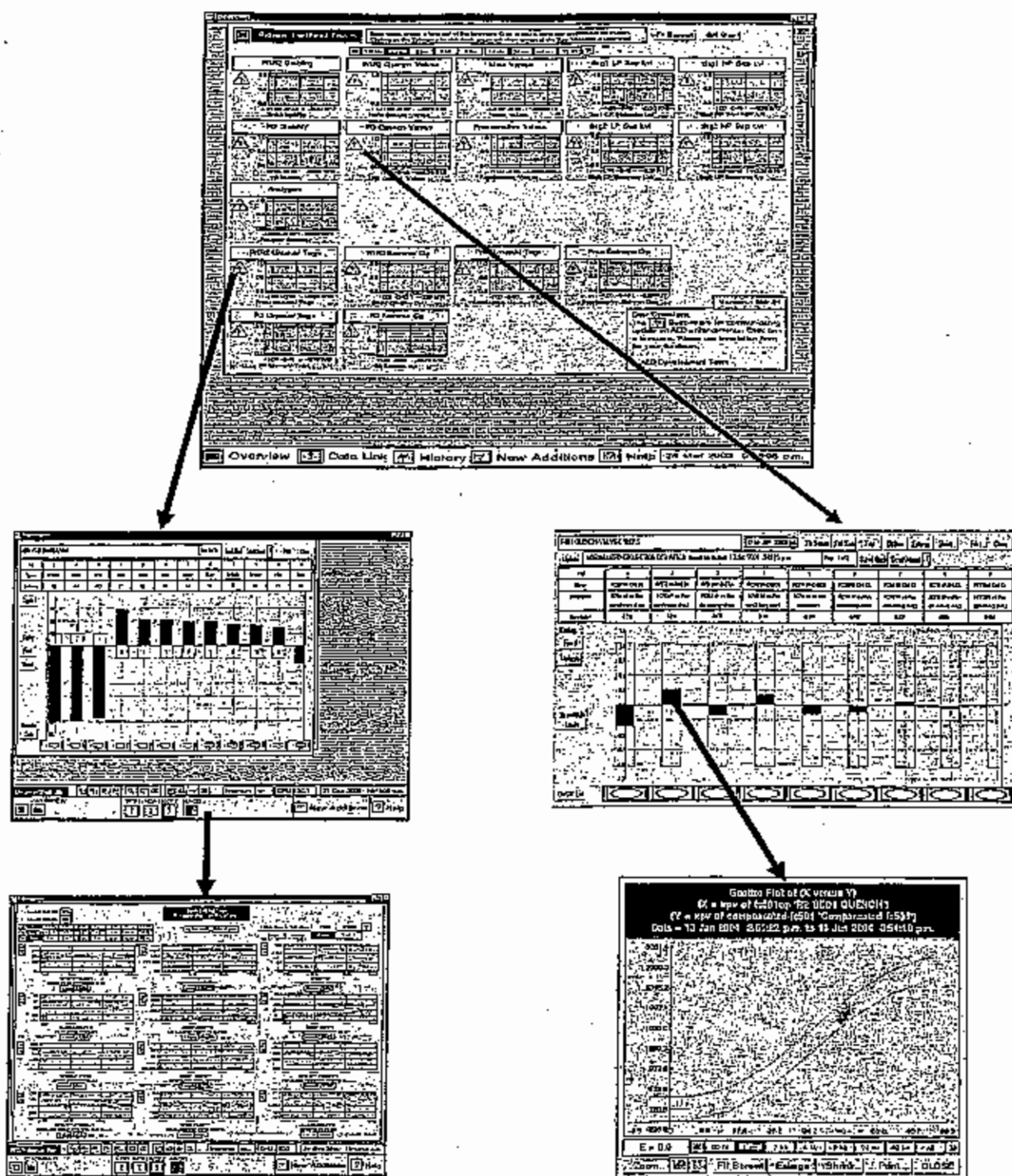


FIGURE 24

FCCU and Light Ends Processing Units

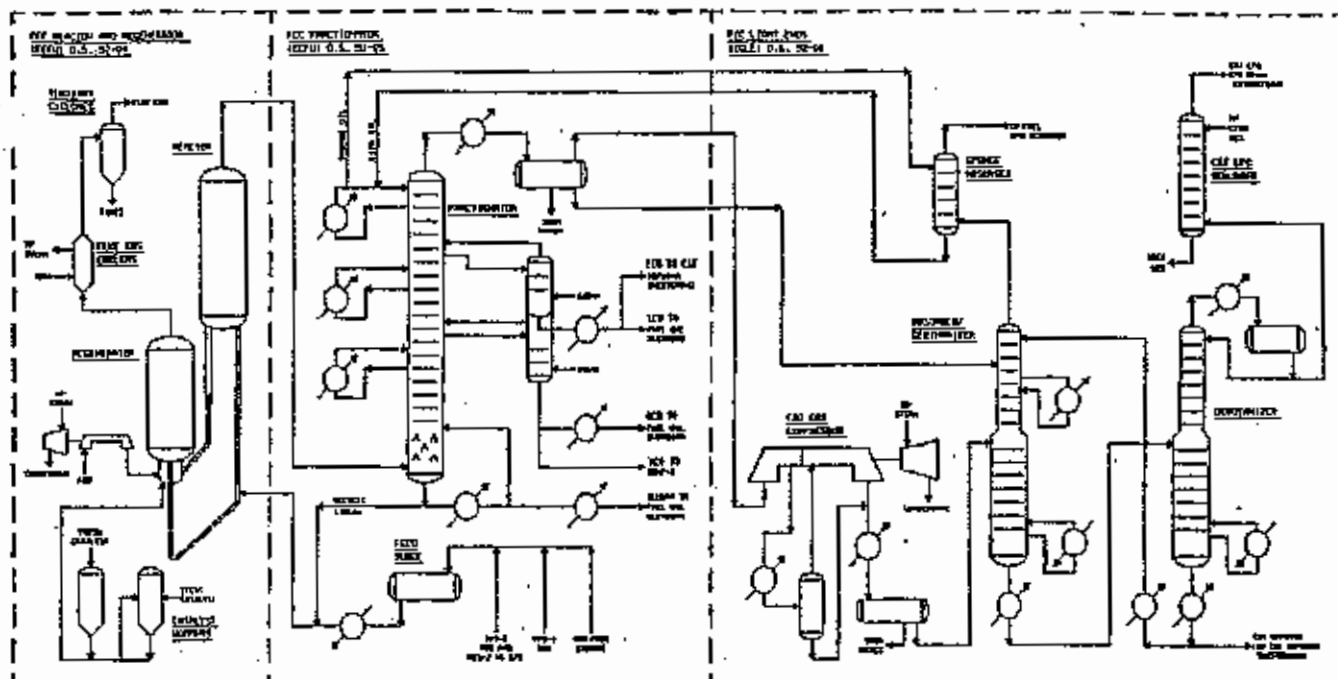


FIGURE 25

AED Overview of FCCU Process

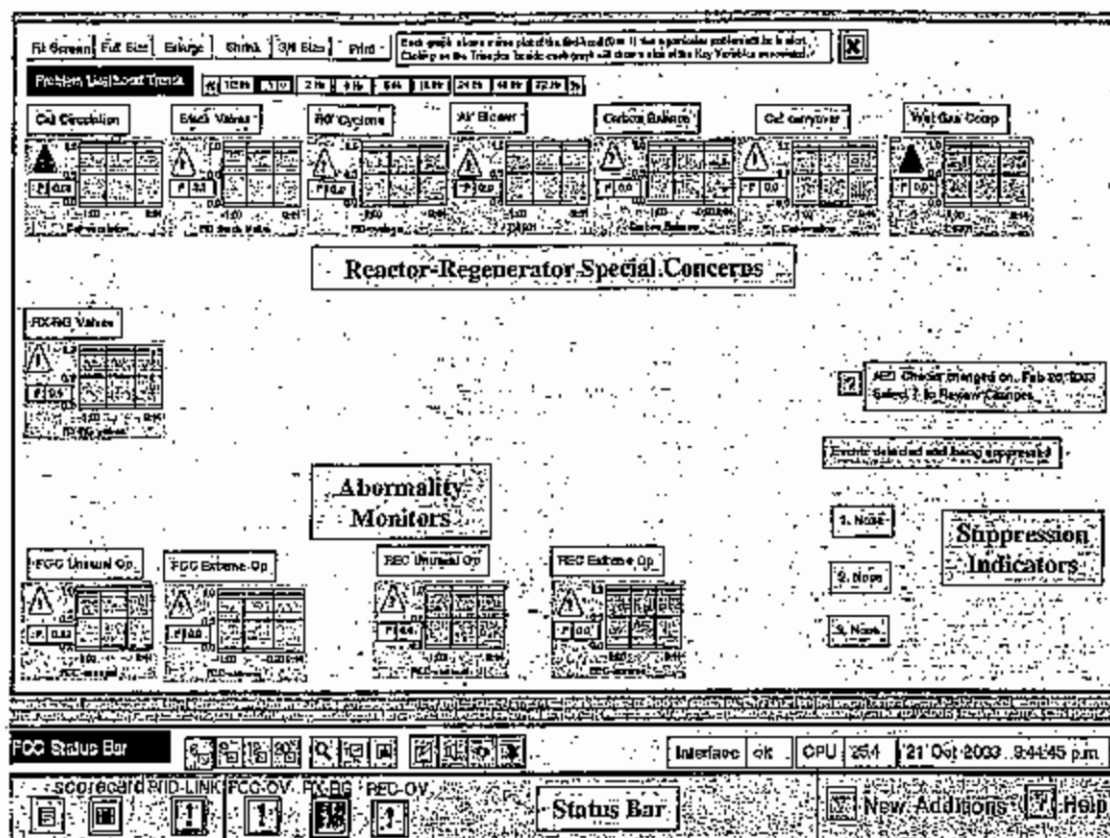


FIGURE 26
Fuzzy Logic based continuous abnormality indicators

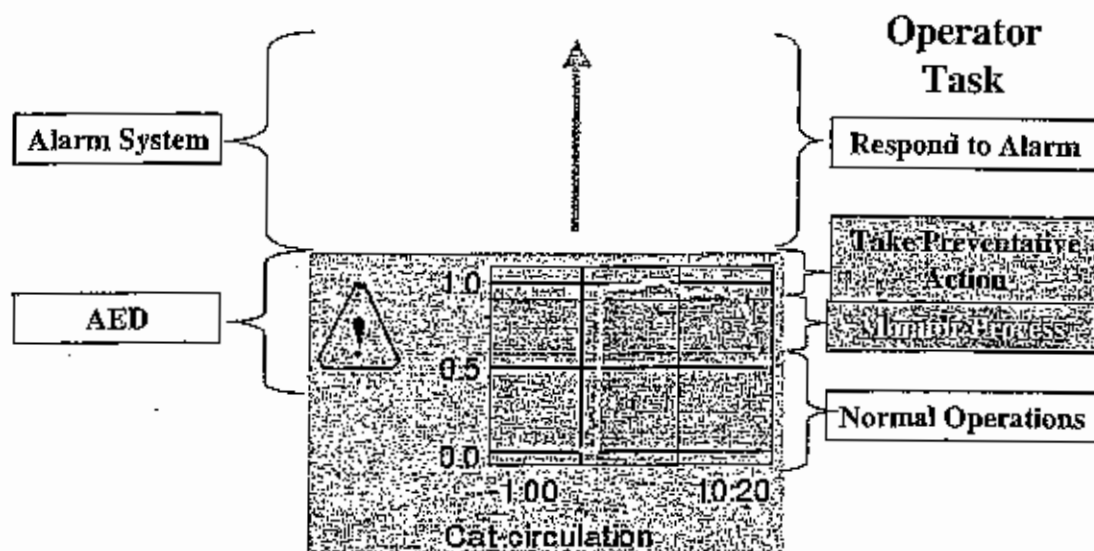


FIGURE 27

Complete drill down of the Catalyst Circulation problem in AED

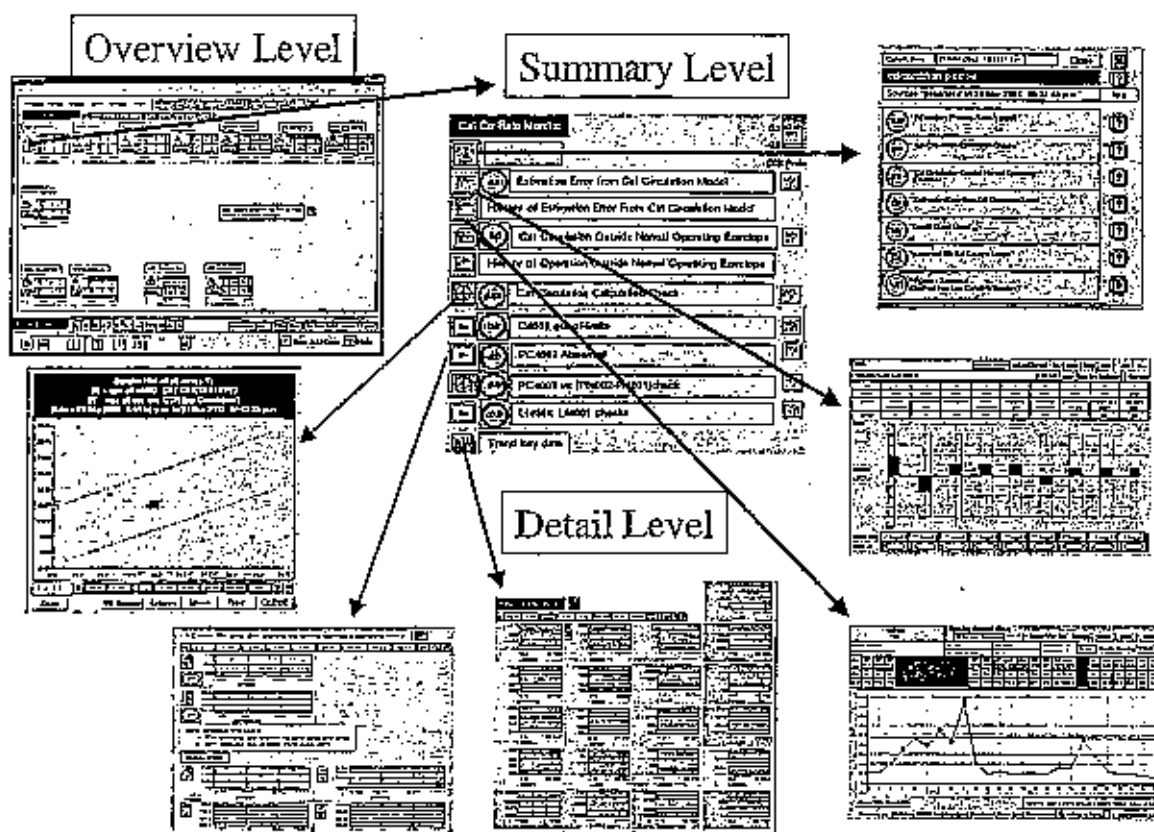


FIGURE 29

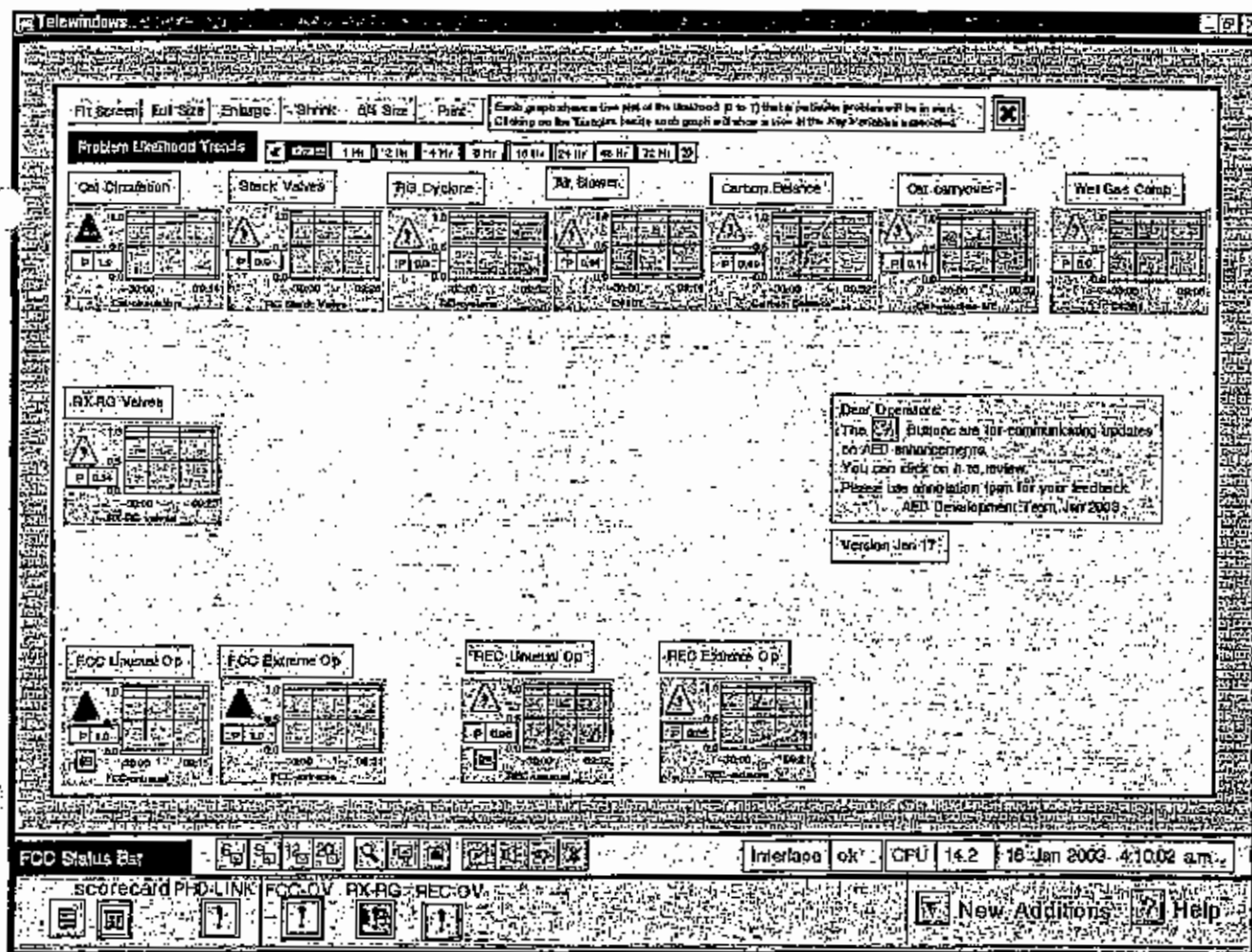


FIGURE 30

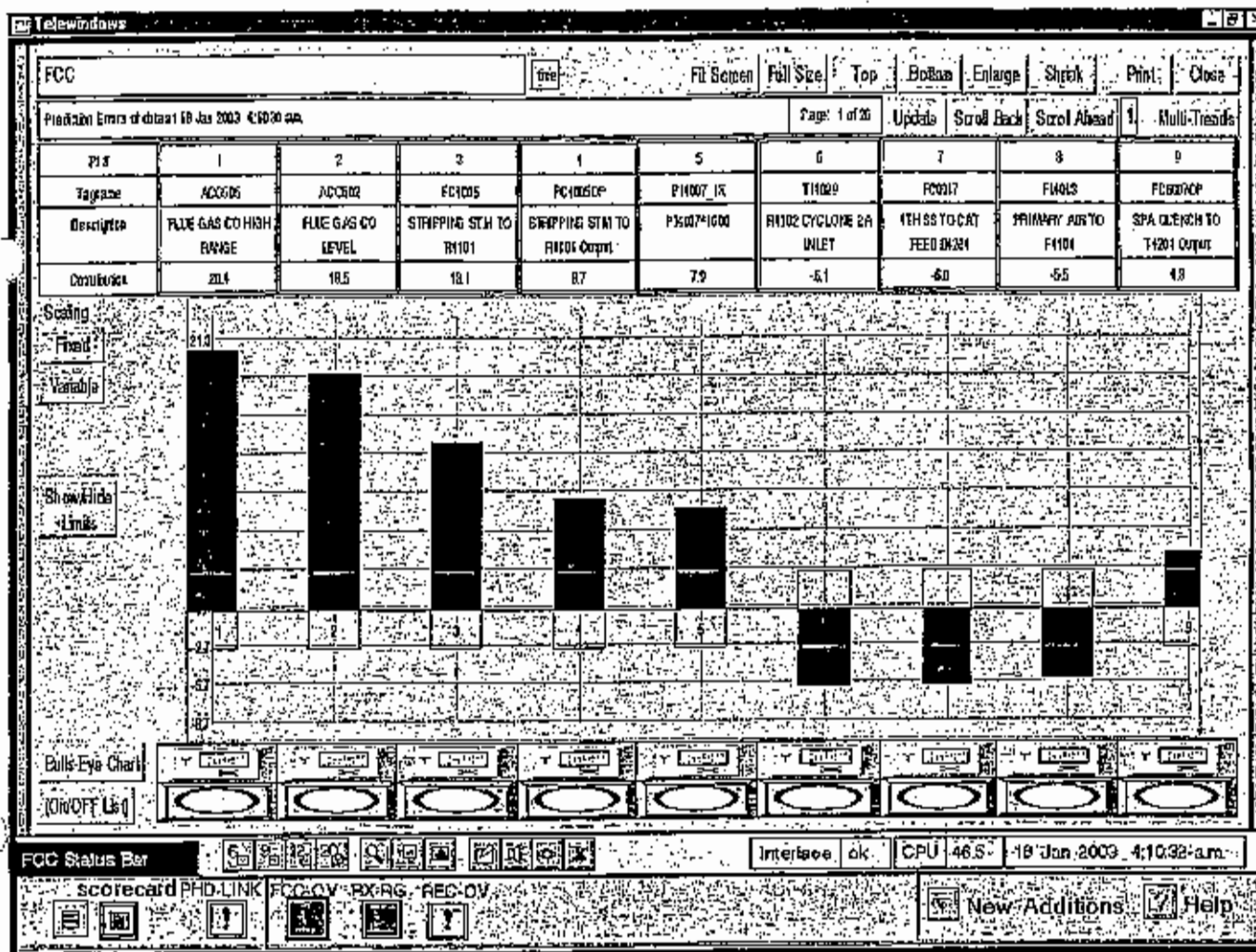


FIGURE 31

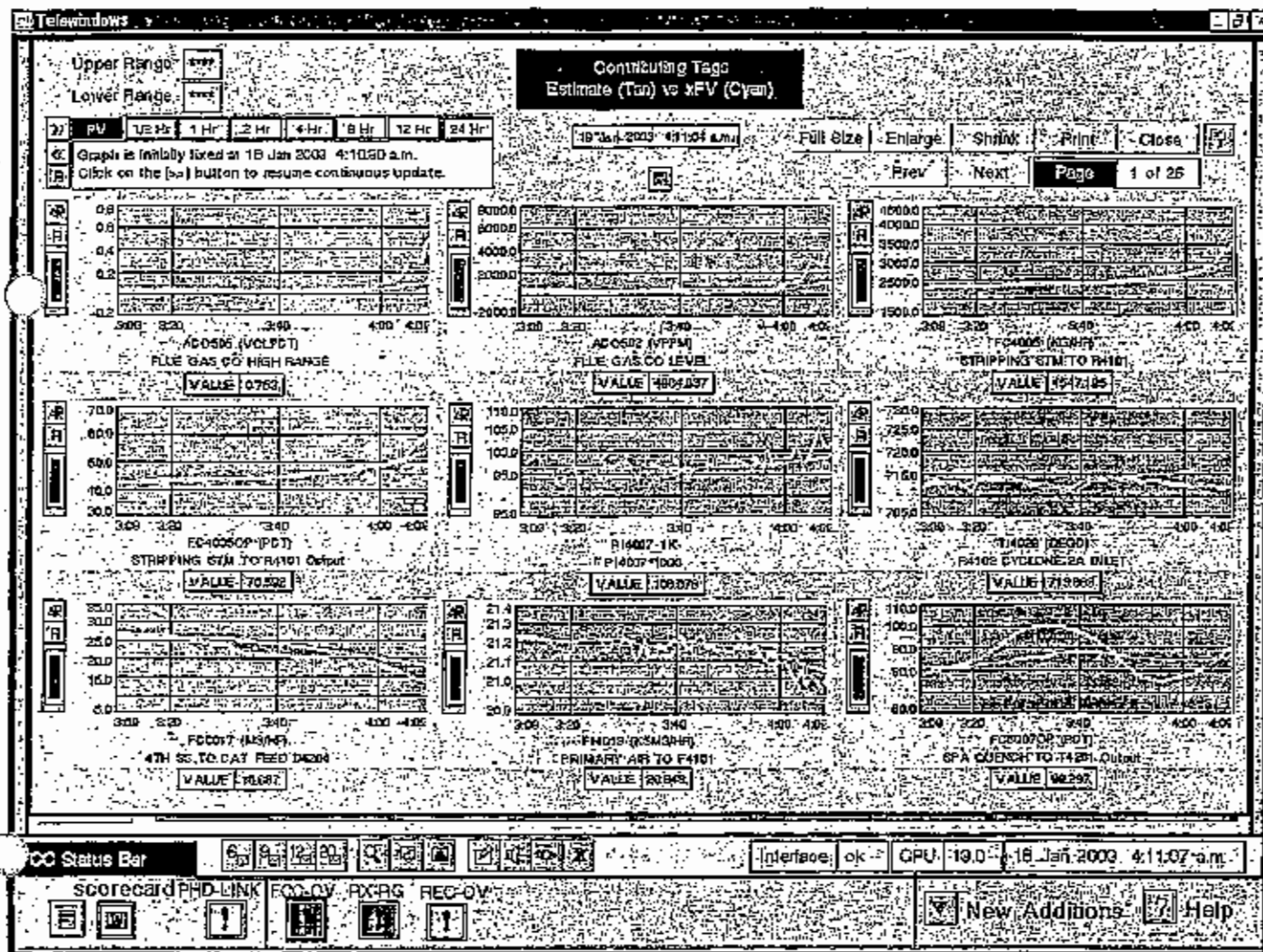


FIGURE 32

Valve Flow Pareto Chart

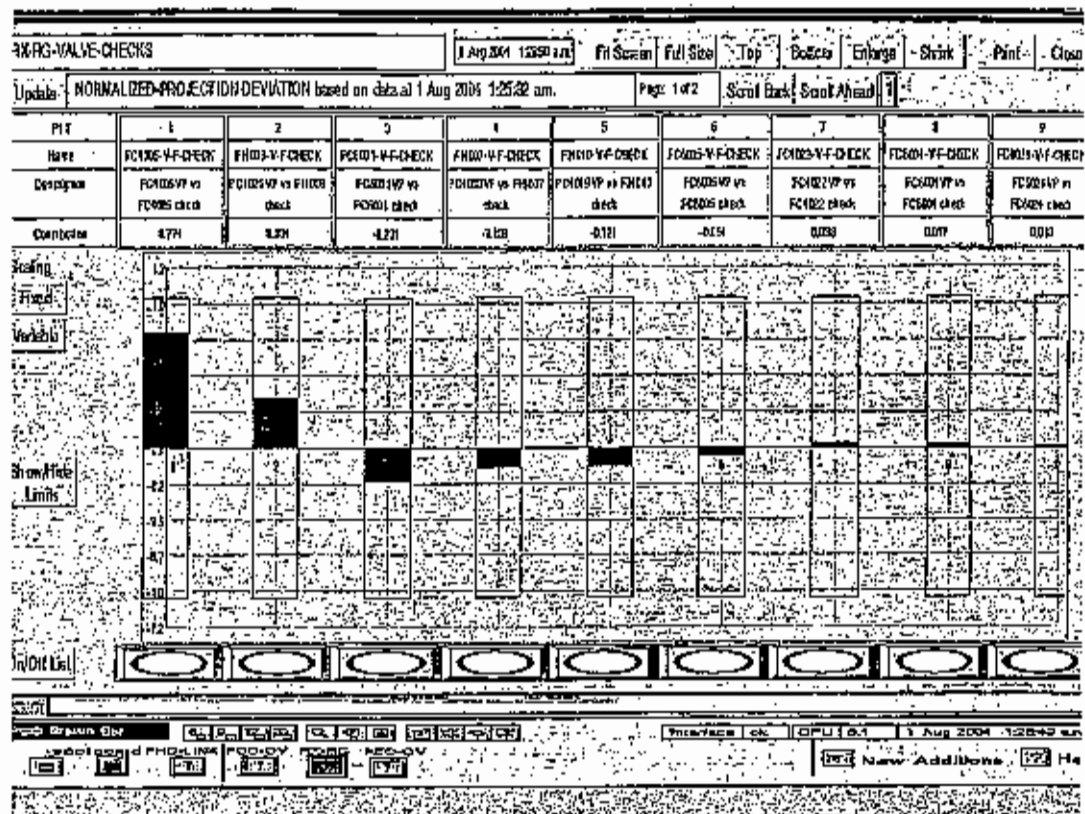


FIGURE 33

Valve-Flow model X-Y plot

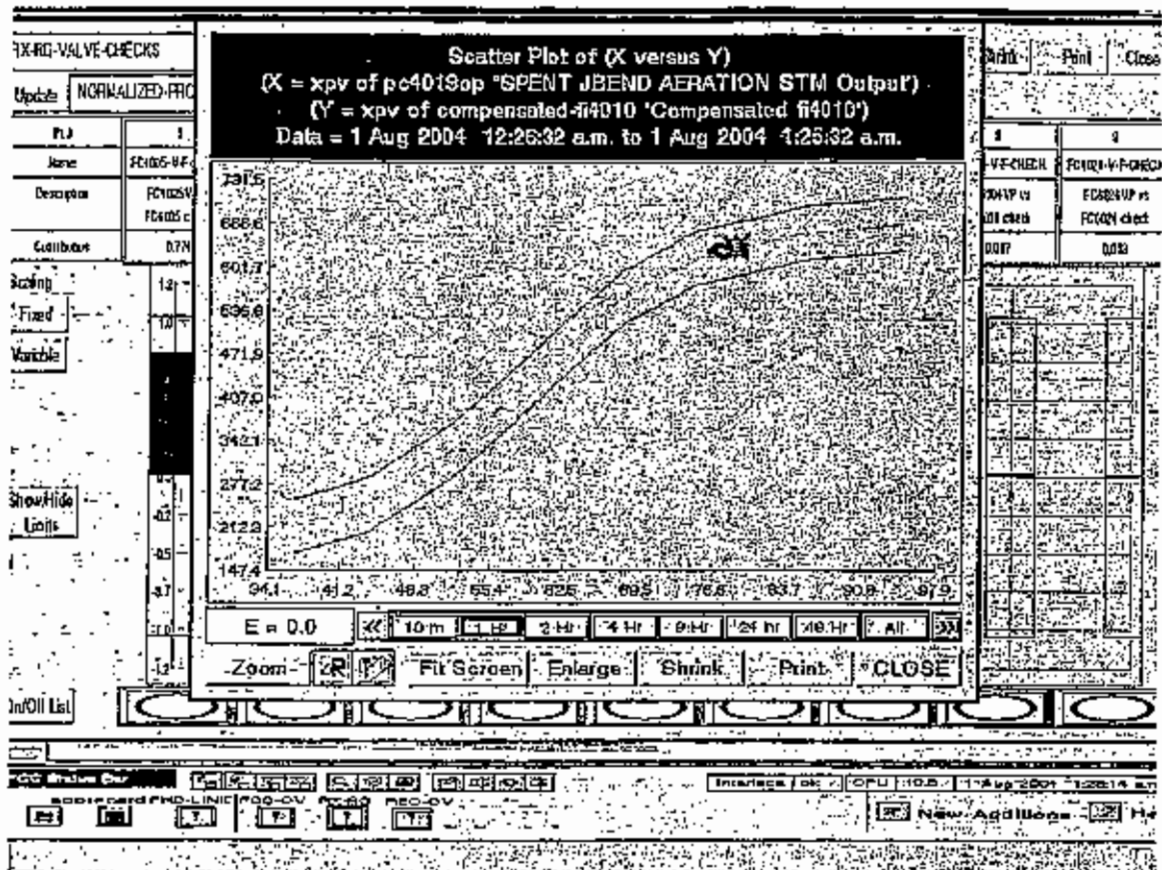


FIGURE 35

Regenerator Stack Valve Monitor Drill Down

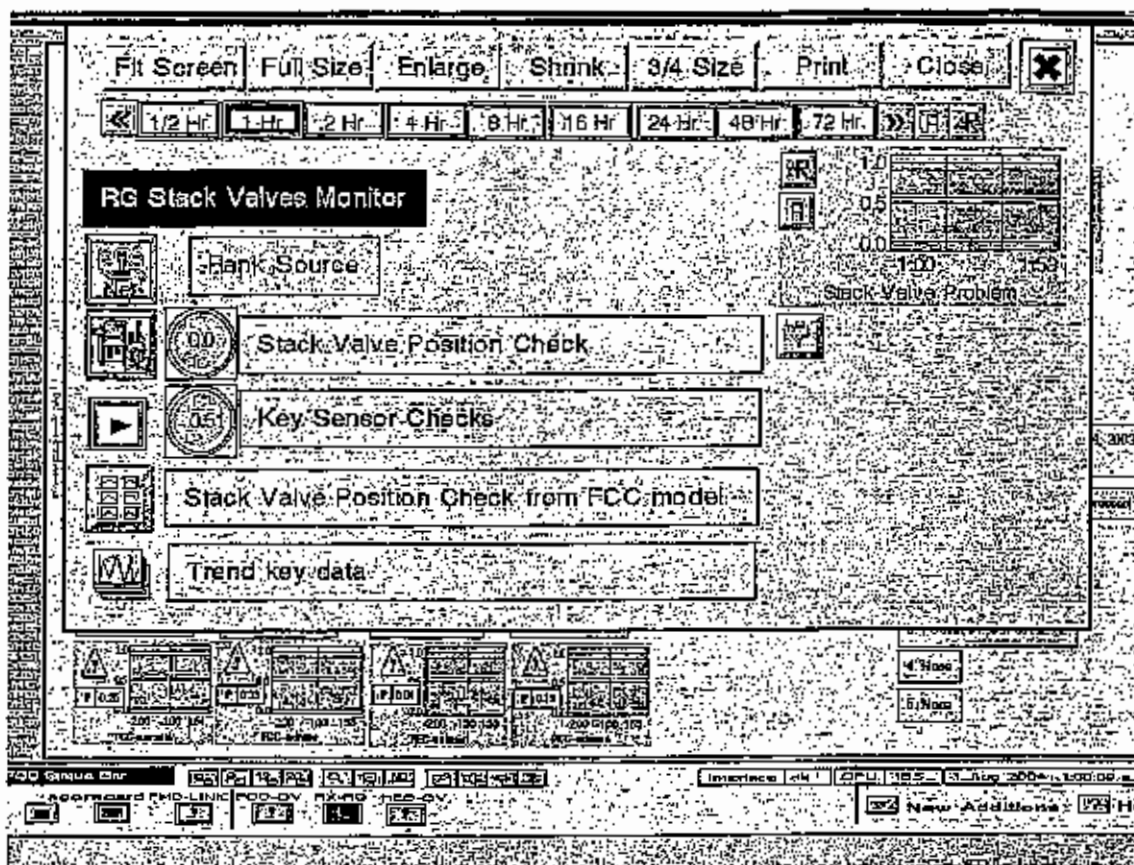


FIGURE 36

Regenerator Cyclones Monitor Drill Down

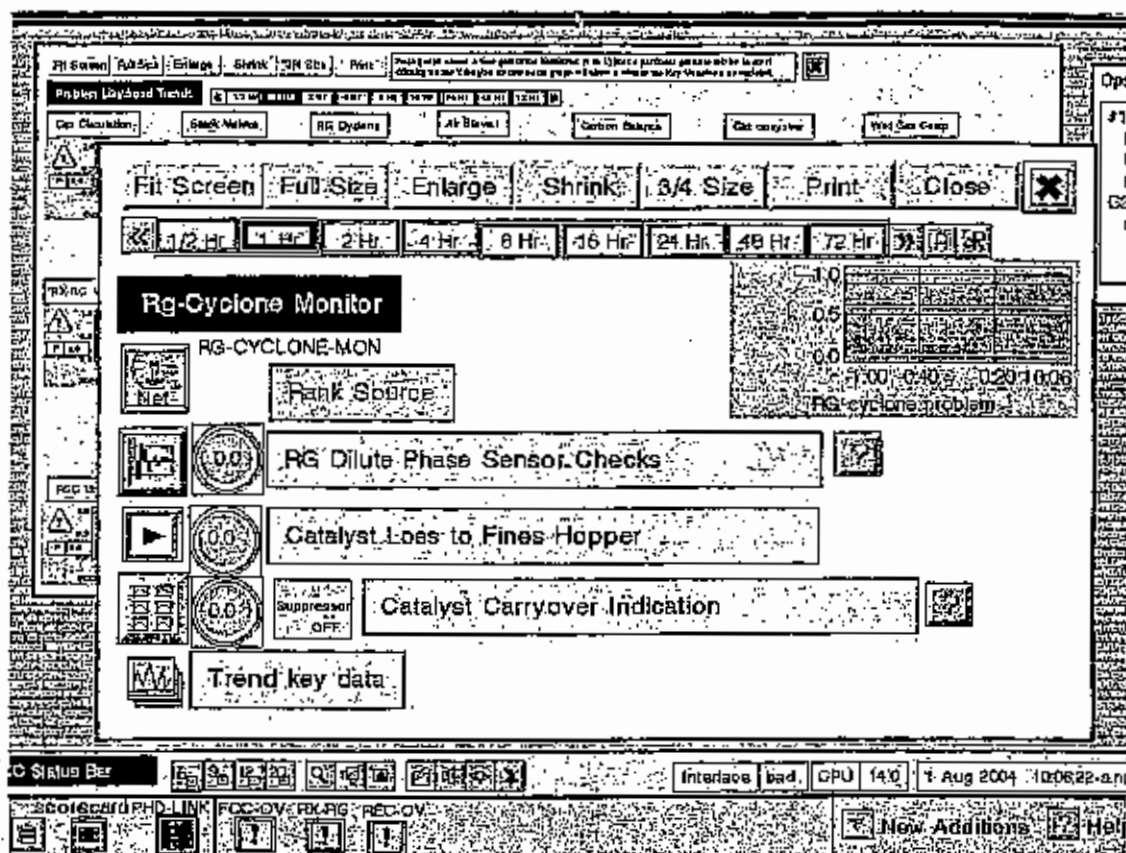


FIGURE 38

Carbon Balance Monitor Drill Down

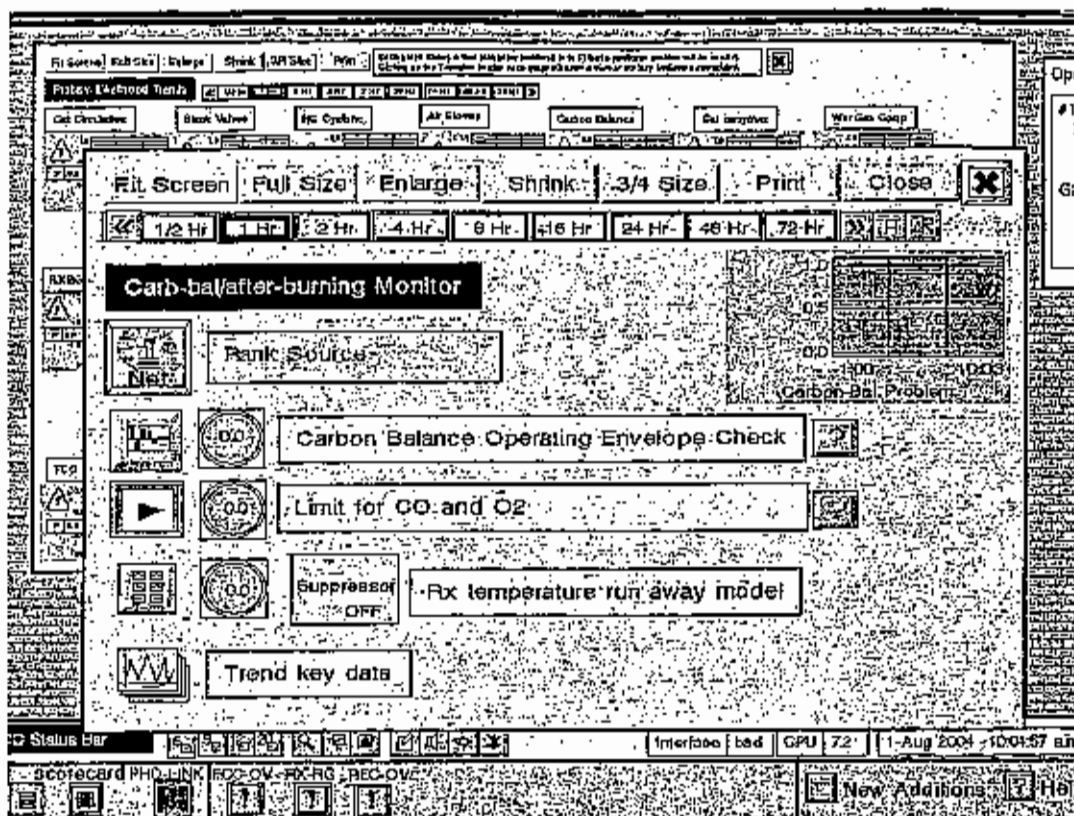


FIGURE 39

Catalyst Carryover to Main Fractionator Monitor Drill Down

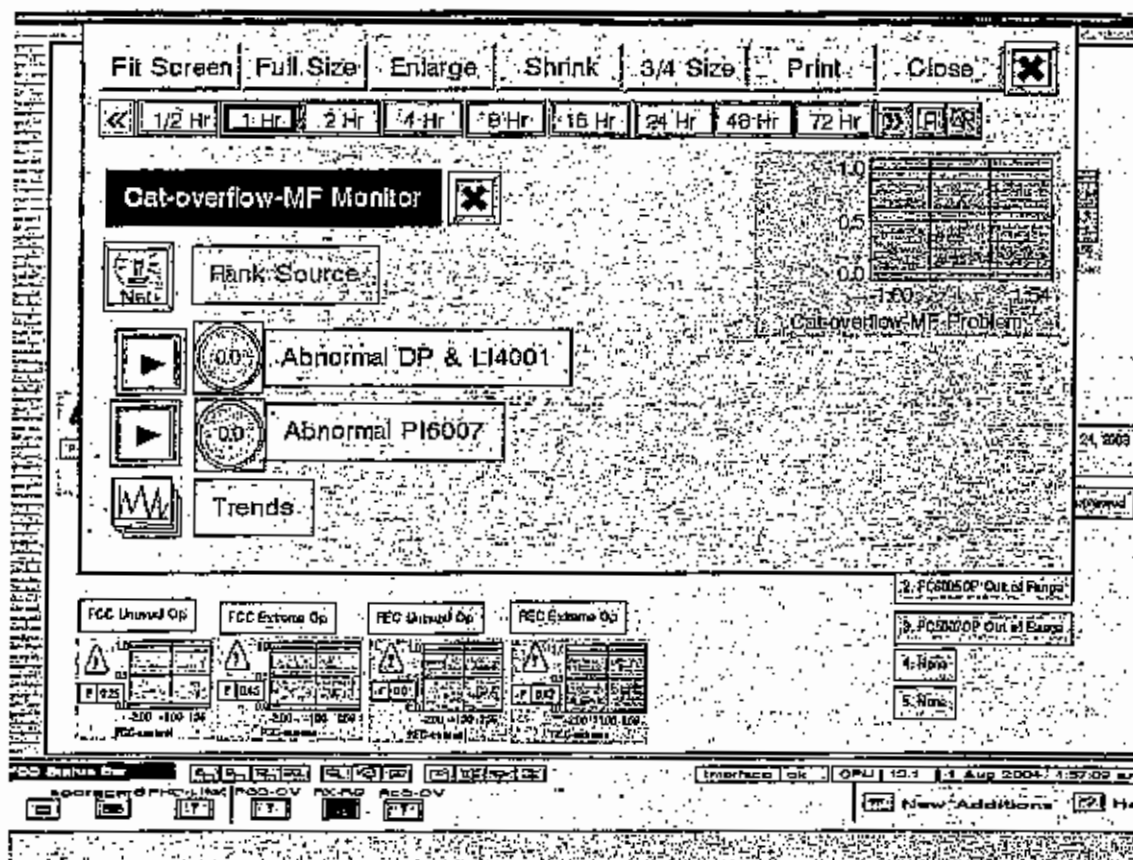


FIGURE 40

Wet Gas Compressor (WGC) Monitor Drill Down

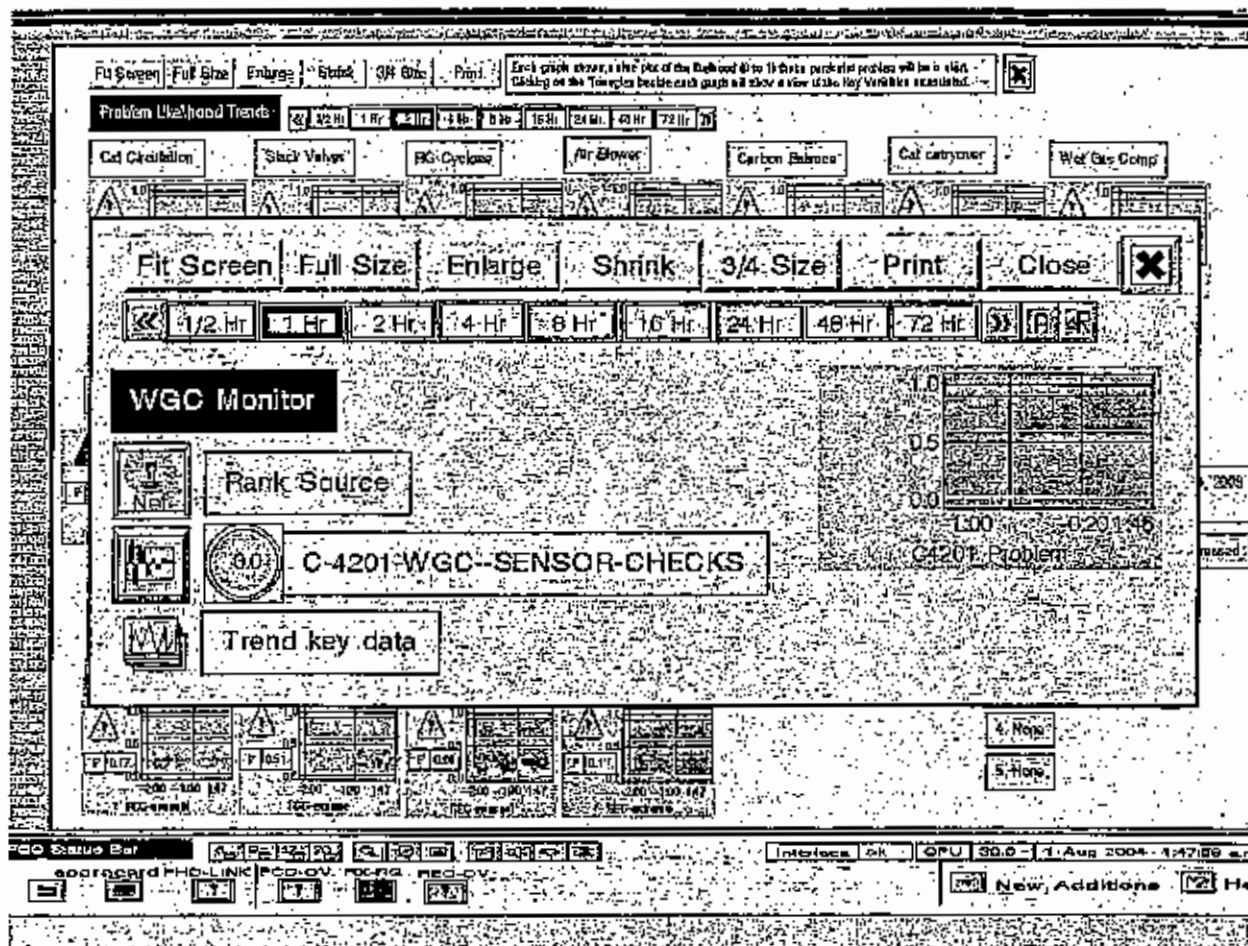


FIGURE 41

Valve-Flow Fuzzy Network

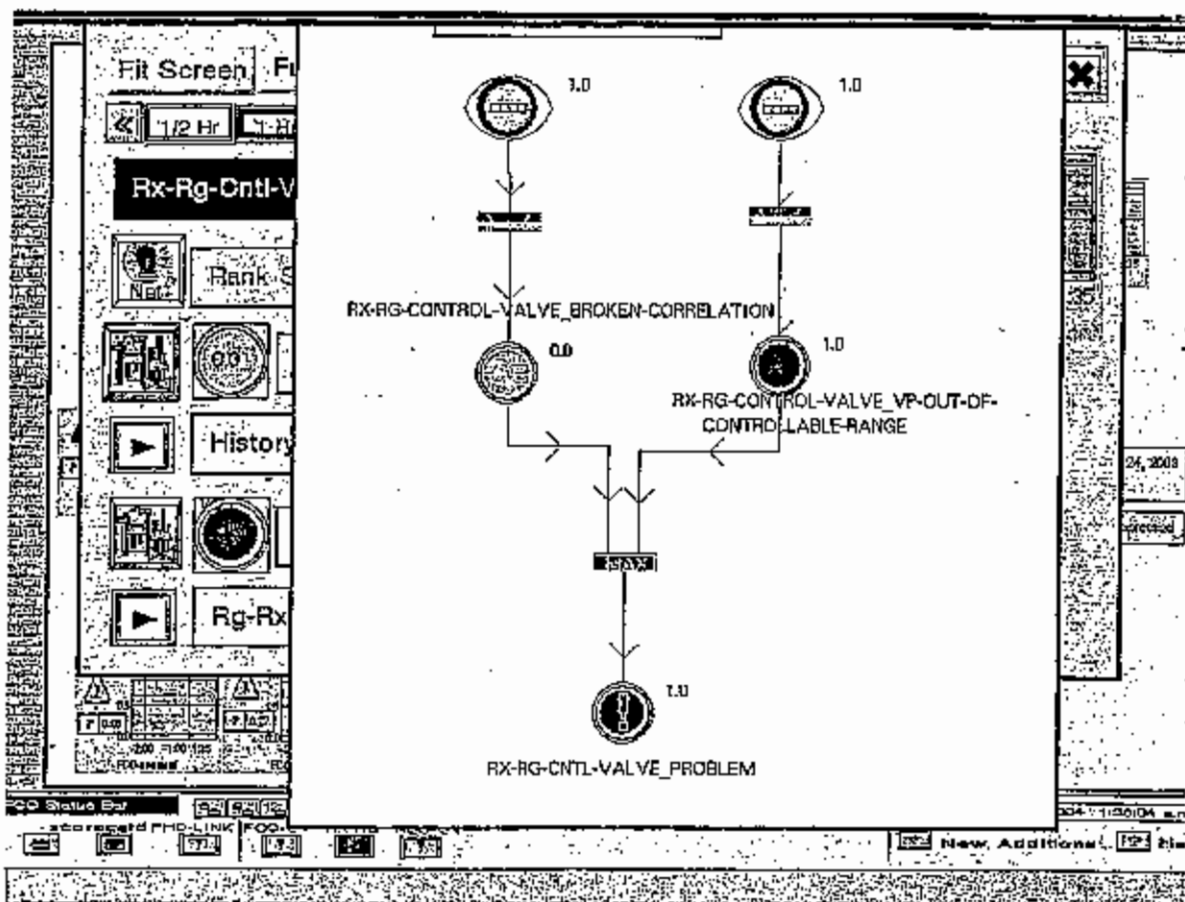


FIGURE 42

Example of Valve Out of Controllable Range

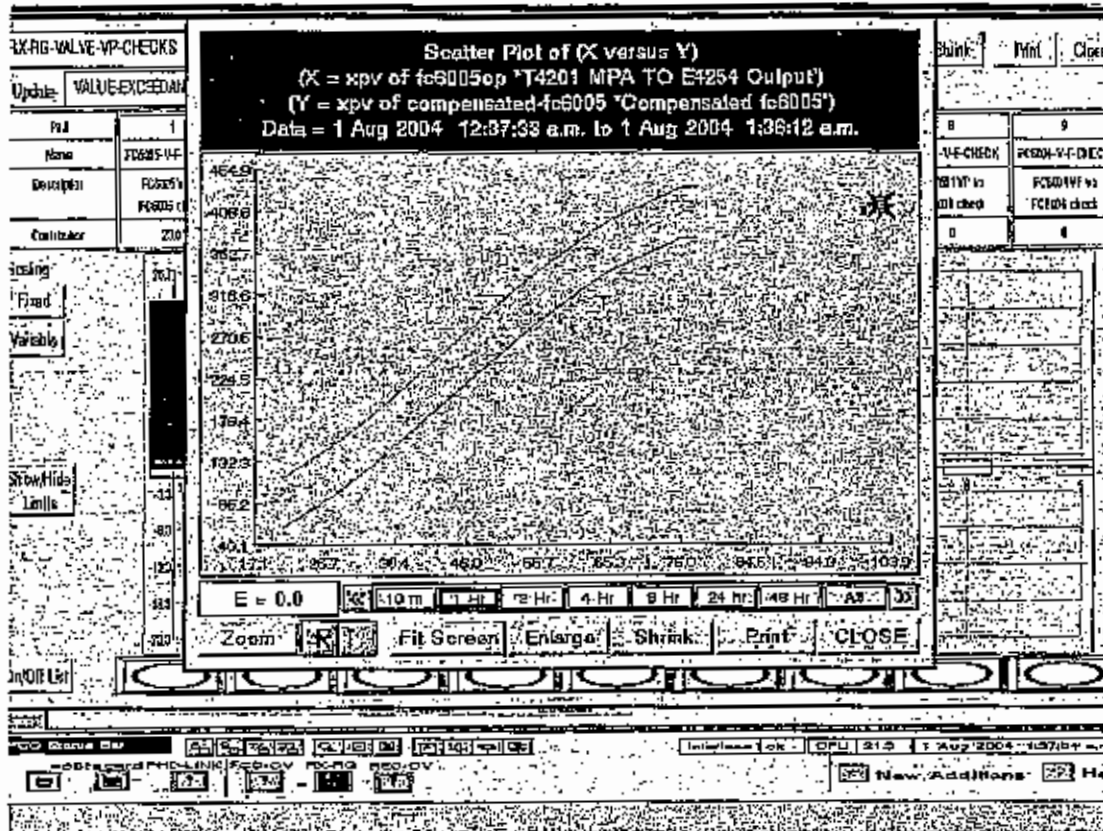


FIGURE 43

Event Suppression Display

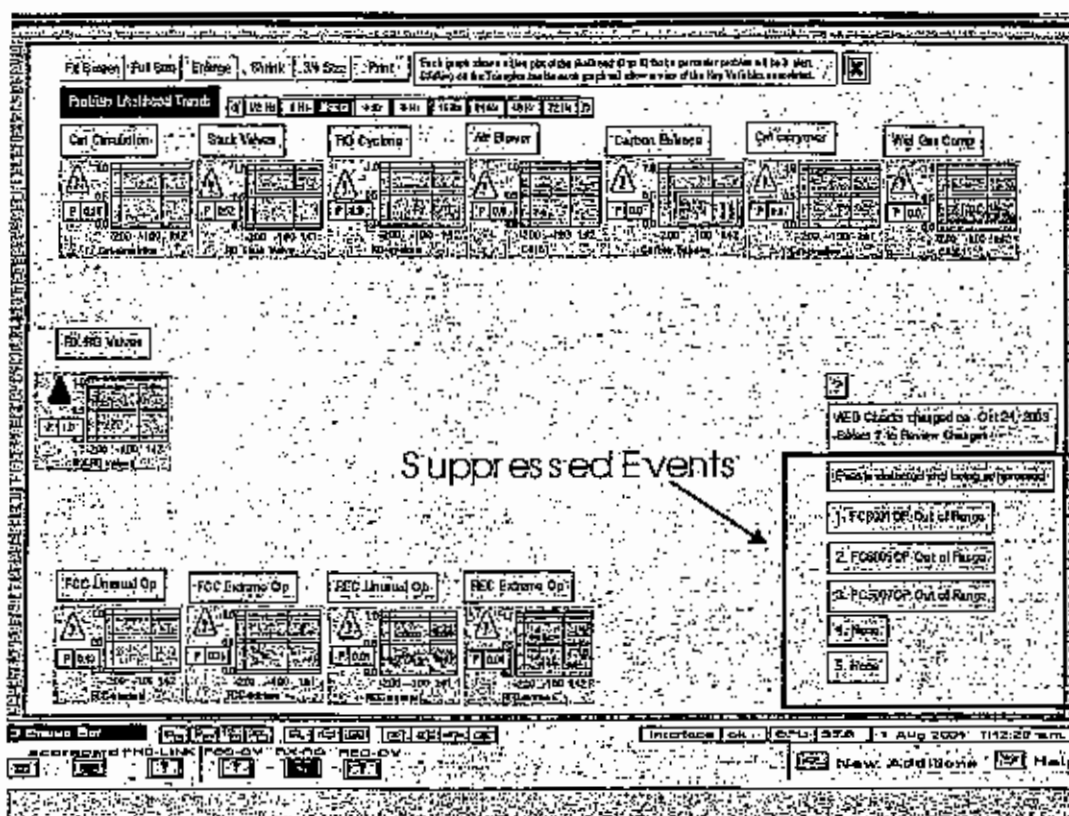


FIGURE 44

AED Event Form

AED Event Description

Date _____ Time: _____ (Please indicate appr

Indicator Event Severity - Check One ☐ Yellow ☒ RedYour opinion of the Event Indication ☐ Redundant ☐ Useful ☐ Important

Initial Event Indication - Check Once

☐ FCCU Special Concern	☐ Carbon Balance	☐ FCC Unusual Operations
☐ Cat Circulation	☐ Cat Overflow to MF	☐ FCC Extreme Operations
☐ Slack Valve	☐ Reactor Regenerator Flow/Valve	☐ REC Unusual Operations
☐ RG-Cyclone	☐ Wet Gas Compressor	☐ REC Extreme Operations
☐ Air Blower		

Do You Agree with the Initial Indication ☐ Yes ☐ No IF No where? _____Did This Provide You with an Early Warning ☐ Yes ☐ NoWrite a brief description of the process / instrument condition causing the event indication:Any operator actions taken following the indication:Which were the key logs / measurements you used to diagnose the processAny suggested improvements to help you better diagnose this event

Your Name: _____

FIGURE 45

Building PCA model - Distribution of Principal Components

