

FALCONEER

Technologies LLC



**MAKING PLANTS SMARTER & SAFER
& MORE PROFITABLE**

**Intelligent, Real-Time
Process Performance Solution**

ENGINEERING & PROCESS DATA *WORKING TOGETHER*

- Value of Engineering Data & Process Information
 - What Does the Customer Want?
- Benefits of Process Performance Auditing & Advising
- FALCONEER Process Performance Solution Suite
- Case Studies

*MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN*



The Value of Process Data!

- Plant Productivity
- Quality Assurance
 - Meeting Stringent Regulatory Requirements
- Safety
- Environmental
- Cost Improvements

Operations

-Reduce Energy Cost / Improve Safety

Maintenance

-Improve Reliability / Reduce Costs

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



"In all the years of accident investigation at this company, the DATA in the process control system knew what was coming ..."

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



REAL-TIME PROCESS PERFORMANCE SOLUTION

- INFORMATION MANAGEMENT
- PERFORMANCE AUDITING & ADVISING

“The process always tells on itself.”
BASF Sr. Staff Engineer.

FALCONEER Listens ...

Cuts through information
overload

“It’s not WHAT you know,
it’s WHEN you know it!”

•65% of perceived transmitter
problems are with other
equipment or the process

•75% of control valve
preventative maintenance
unnecessary

www.emersonprocess.com

Performance Auditing

- Incipient Fault Detection
- Abnormal Condition Identification
- Control & Optimization
- Enhanced Process Safety
- Improved Reliability & Uptime
- Increased Profitability / Cost Reduction



Make all your
sensors ...
"SMART
SENSORS"

at a fraction of the cost

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



Process & Instrumentation Reliability

“We all know that instruments fail and they never send e-mails before they do,” an FMC engineer says.

- FALCONEER™ real-time process performance solution on a multi-level basis
 - **Provides** up to 100% “Self-Diagnostic” Coverage
 - **Validates** instrumentation, equipment, and conditions
 - **Reconciles** failed or faulty sensor readings
 - **Identifies** incipient failures, faults, or abnormal conditions
 - **Maintains** optimal operations
 - **Creates** records for ISO, PSM, etc.

The Benefits of Better Decisions from Better Information

- Better quality control and reduction of production losses **10 to 20%**
- Reduction of the number & cost of routine analyses **20 to 50%**
- Reduction of instrumentation maintenance costs **10 to 30%**

**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



Key Performance Indicators / Soft Sensors

- Quantify Unit Operations or Process / Product Performance
 - Heat Transfer Coefficient - Exchanger Fouling
 - Reactor Selectivity - Catalyst Problems
- Create Redundant Sensors for Reliability
 - % Solids Sensor - Quality Issues
 - Dissolved O2 Sensors – Energy Savings
- **Validated** before used - **Eliminate Garbage In Garbage Out**
- Operational, Financial or ERP Examples
 - Real-Time Inventory (raw material, or product)
 - Real-Time Material Efficiencies
 - Total Energy Use or Cost (as a rate or cumulative)
 - Real-Time Cost of Operations (as a rate or cumulative)
 - Real-Time Profit or Loss (as a rate or cumulative)

**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



FALCONEER™ IV (Patent pending)

PROCESS PERFORMANCE SOLUTION

INTEGRATED FUNCTIONS

- Process State Identification
- Sensor & Data Reconciliation
- Sensor & Process Validation
- Fault & Abnormal Condition Auditing
- Virtual Continuous Statistical Process Control
- On-line Key Performance Indicators (KPI)
- Soft Sensors
- Intelligent Advice / Charts / Reports
- OPC or Proprietary Data Communication

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



Models Are the Key

- MATERIAL BALANCES
- ENERGY BALANCES
- PERFORMANCE EQUATIONS
 - SOFT SENSOR MODELS
 - SIX SIGMA TRANSFER FUNCTIONS
- HEURISTICS
- EMPIRICAL EQUATIONS / CORRELATIONS
- MULTIVARIATE STATISTICAL MODELS
- PCA MODELS

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***

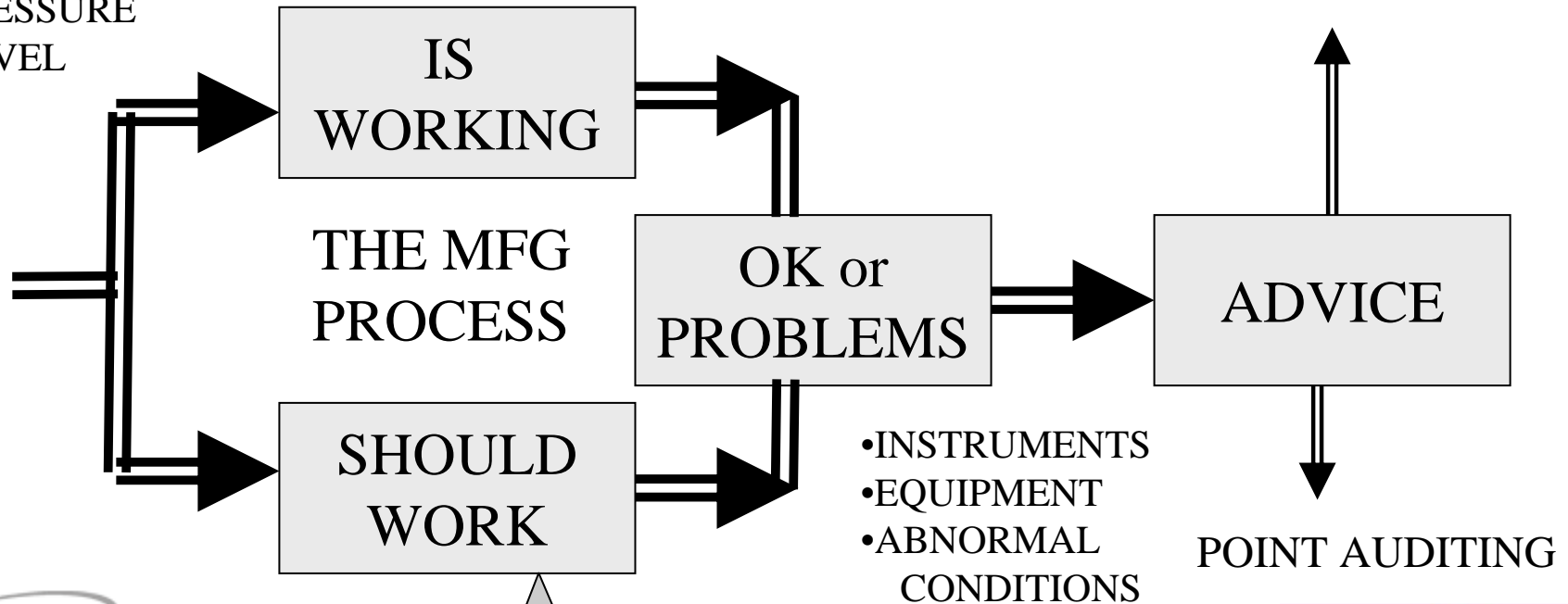


HOW DOES FALCONEER™ IV WORK?

CONTROL SYSTEM

FLOW
TEMPERATURE
PRESSURE
LEVEL
...

SYSTEM AUDITING



INTERGRAPH

**SmartPlant
P&ID**

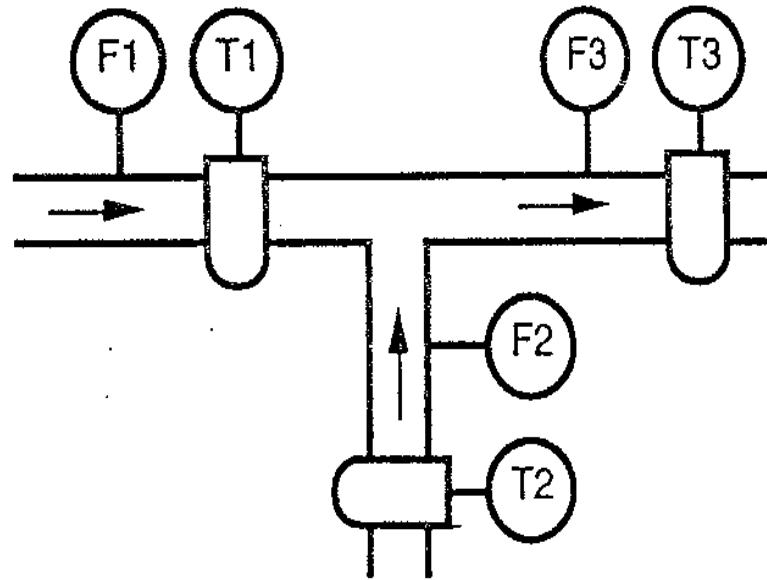
INFORMATION -
PROCESS DESIGN
PROCESS OPERATION

**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



METHOD OF MINIMAL EVIDENCE

EXAMPLE



INSTRUMENTED PROCESS MIXING TEE

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



METHOD of MINIMAL EVIDENCE

Diagnostic Models

PRIMARY INDEPENDENT MODELS

Primary Model 1 “PM₁”:
MASS BALANCE

$$0 = \text{Flow}_1 + \text{Flow}_2 - \text{Flow}_3 - \text{Leaks}$$

Primary Model 2 “PM₂”:
ENERGY BALANCE

$$\begin{aligned} 0 = & \text{Flow}_1 * \text{cp} * \text{Temperature}_1 \\ & + \text{Flow}_2 * \text{cp} * \text{Temperature}_2 \\ & - \text{Flow}_3 * \text{cp} * \text{Temperature}_3 \\ & - \text{Leaks} * \text{cp} * \text{Temperatures} \end{aligned}$$

SECONDARY DEPENDENT MODEL

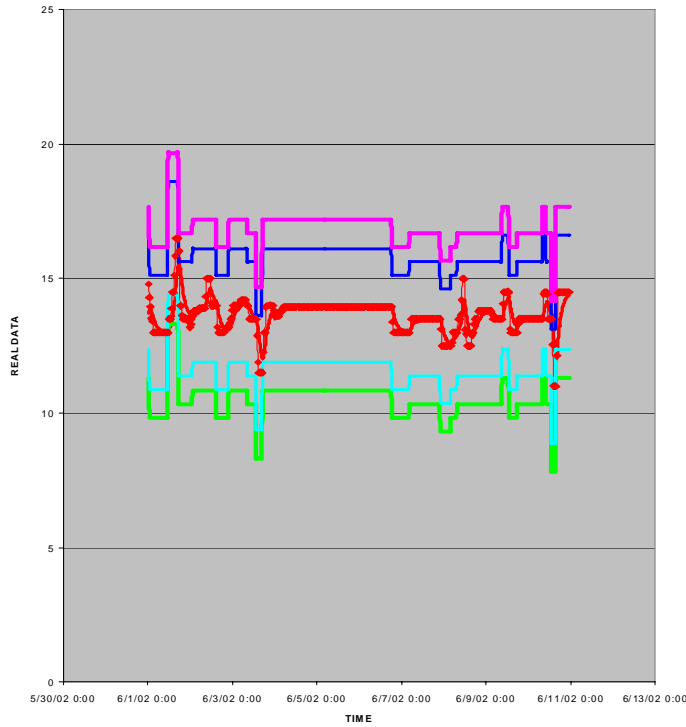
Secondary Model 1 “SM₁”: $0 = \text{Flow}_2 * \text{cp} * (\text{Temp}_2 - \text{Temp}_1) - \text{Flow}_3 * \text{cp} * (\text{Temp}_3 - \text{Temp}_1)$
Eliminate Flow₁



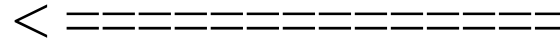
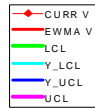
***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***

Virtual Statistical Process Control (V-SPC)

FIC6725

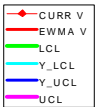
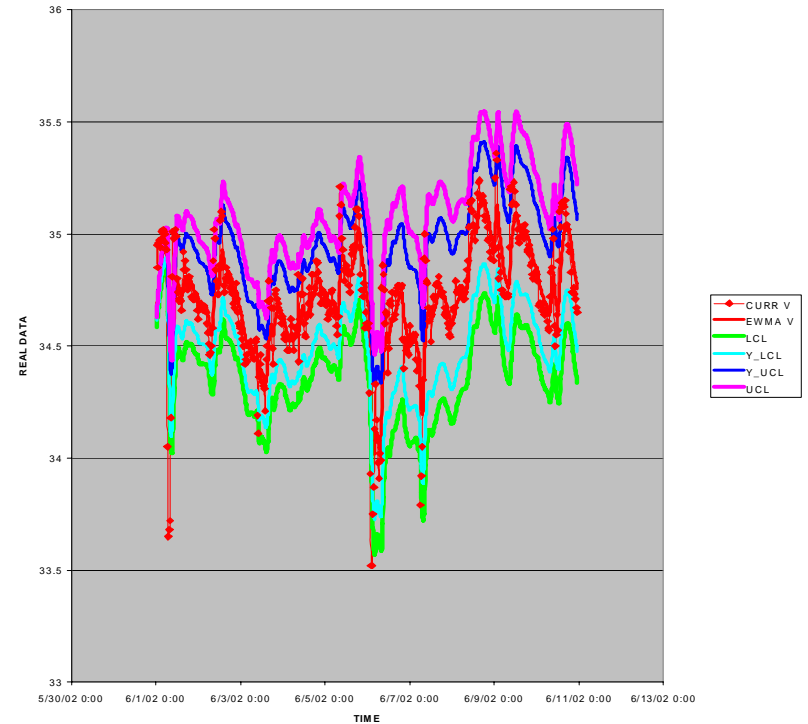
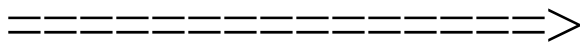


Controlled Process Variable
Virtual EWMA Chart
(Flowmeter)

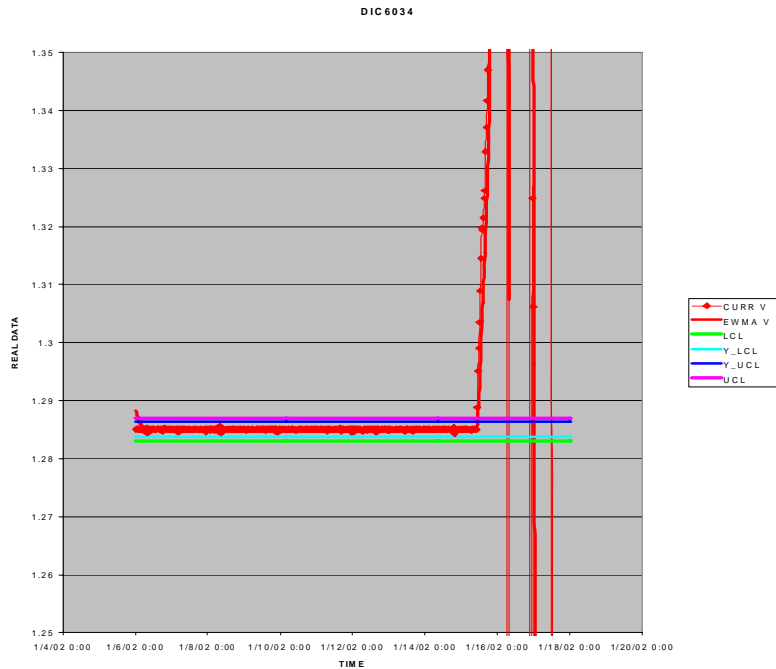


T16 037

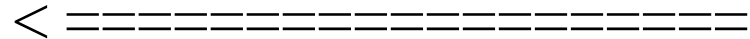
Uncontrolled Process Variable
Virtual EWMA Chart
(Temperature)



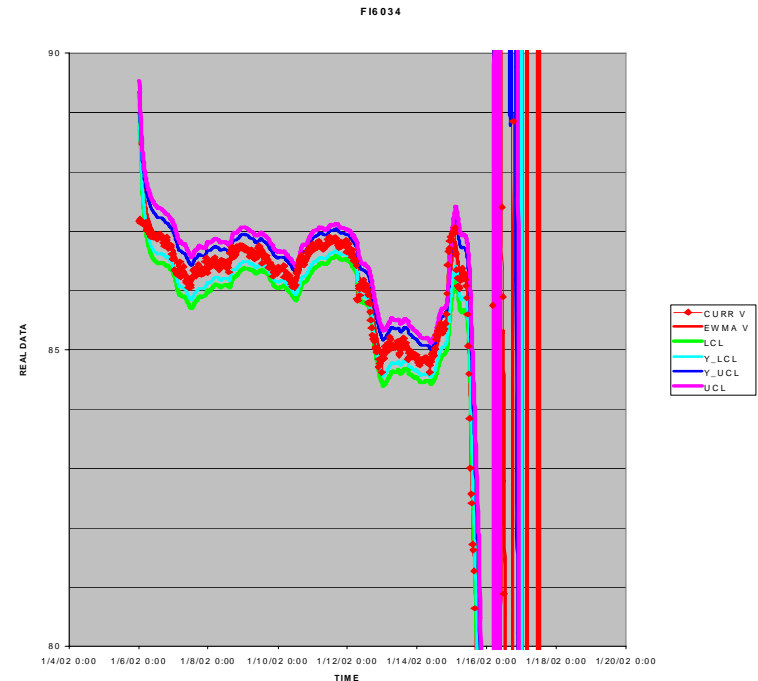
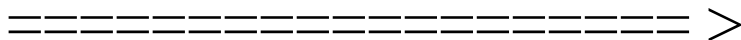
V-SPC Examples



Controlled Process Variable
Micromotion Density Meter
Failure - 12 Hours before
TDC Alarm Indication



Uncontrolled Process Variable
Micromotion Flow Meter
Failure - 18 Hours before
TDC Alarm Indication



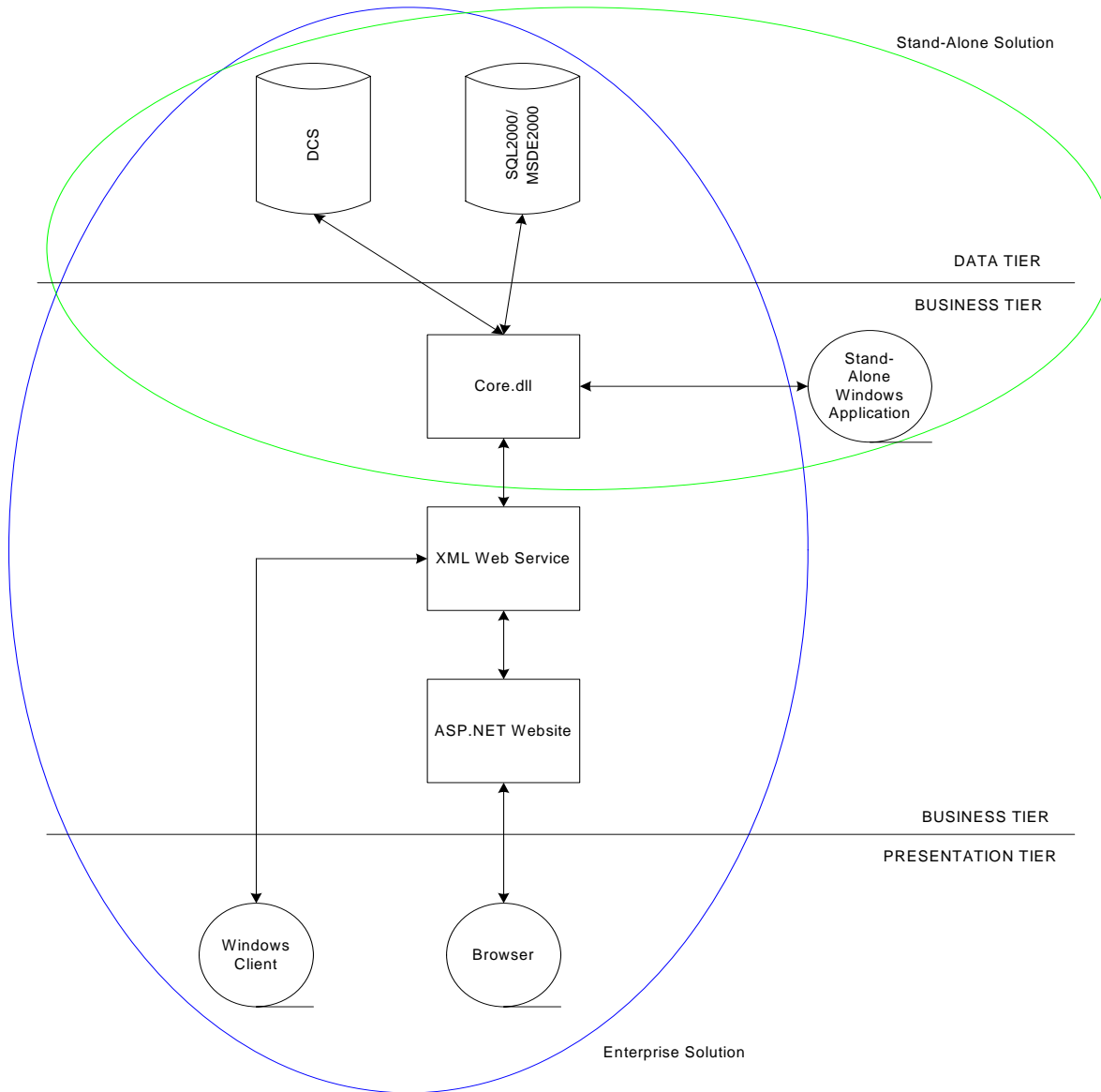
WHY CAN'T OUR DCS / SCADA DO THIS?

- Patent Pending Method and System
 - Adds “wisdom” or intelligence to the raw information.
 - Secondary model generation for enhanced cross-checking
- High Level Auditing & Advising
 - Accounts for ALL Information from Process
 - More than just Individual High/Low Alarm Limits and Trending
 - Real-time Continuous vs. Manual or Scheduled
- Predictive and Preemptive versus After-The-Fact
 - WHAT & WHEN & WHY
- Certain Functions Possible (SPC, KPI, HART)
 - Requires Significantly More Time, Effort, Term Support to Configure & Maintain
 - Older systems may not even be possible

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



FALCONEER SUITE ARCHITECTURE



SUPPORTED INTERFACES

- OPC
- DCS
- SCADA
- PLC
- XML

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



FALCONEER CASE STUDIES

A former Foxboro manager appreciates our approach as: *“being rigorous enough to identify the problems without being too complex or expensive, combined with being easy enough to configure and maintain.”*

- CHEMICAL
 - Solid Oxidizer Plant
 - Polymerization Plants

- POWER GENERATION
 - Boiler Feed System

- PULP & PAPER
 - Paper Machine
 - Pulp Mill

- WASTE WATER
 - Municipal

**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



CASE STUDY

- SAFETY
 - PSM
 - Validation
 - Fault Analysis
- ASSET MGT
 - Increase Automation / Reduce Headcount
 - Instrumentation Reliability
 - Uptime
- COST IMPROVEMENT

- CHEMICAL
 - Solid Oxidizer Plant
 - Honeywell TDC

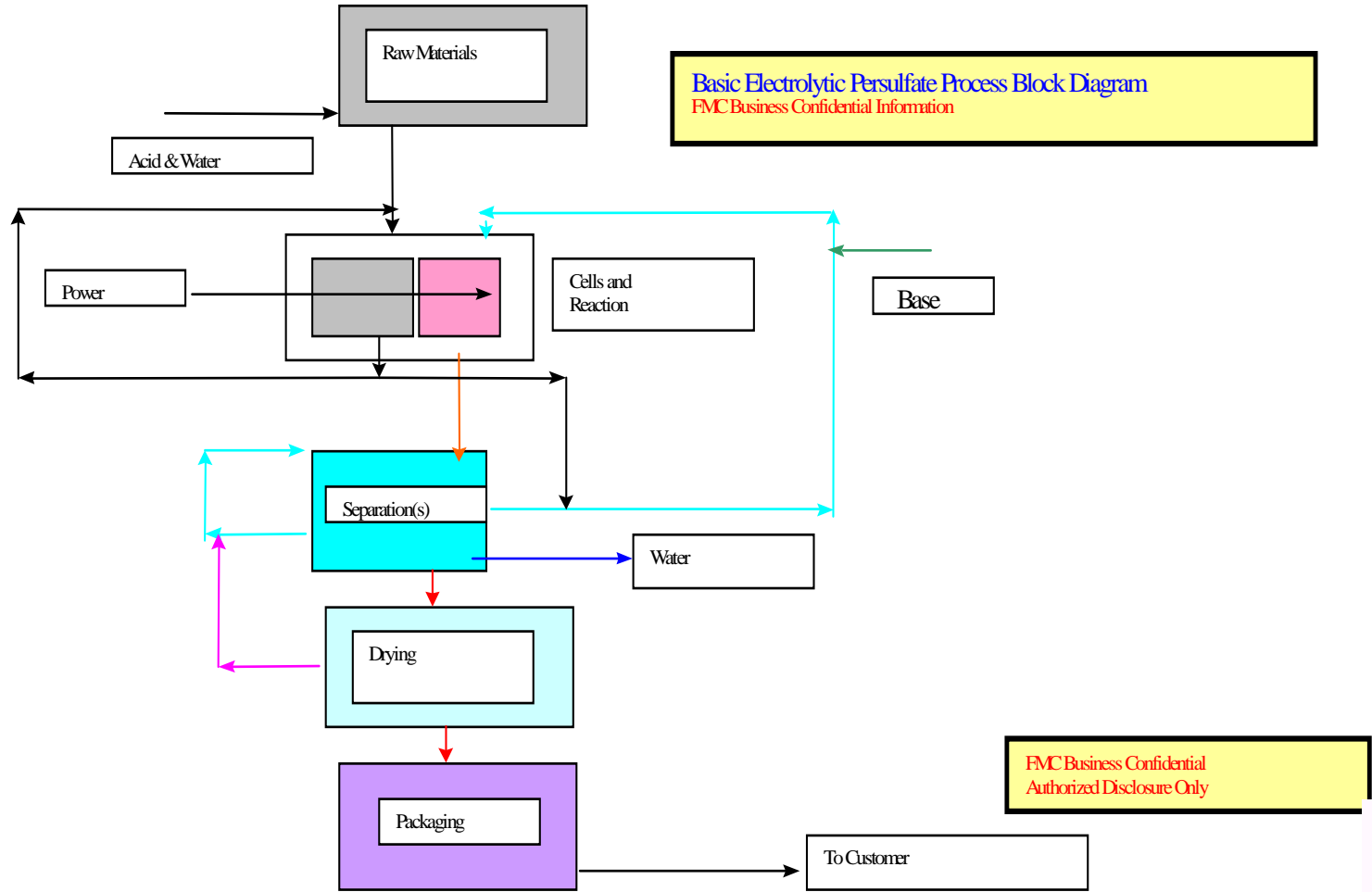
Inputs: 80 Measured Variables (PHD), 41 Unmeasured Variables, 24 Primary Models, ~1,400 SQL Database Entries

Auto-Generated: 101 Secondary Models, ~ 200 Fault Hypothesis, ~ 30,000 Validation / Fault Diagnostic Rules, 80 Virtual SPC Charts

**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



INDUSTRIAL CHEMICAL PROCESS



**MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN**



Gain Value from “Lost” Information

“Compared to other approaches, FALCONEER is more fundamental with easily configurable and understandable equations and logic”, according to FMC

- During Configuration, ID’s unanticipated control issues
- ID sensor failures coupled with & w/o process condition changes
- ID sensor failures 12 - 18 hrs before DCS alarms
- ID periodically malfunctioning sensors
- ID poorly tuned control loops
- ID control loops operating in manual mode instead of automatic mode
- ID general location of leaks, line plugs
- ID significant process changes
 - Heat Exchanger Tube Plugging
 - pH meter drift
- “Measure” & monitor process performance parameters
- ID pump failures

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



BENEFITS!!

Savings per Cost of Production	Low (cents / \$)	High (cents / \$)
Operating Costs Reduction	0.1	2.0
Maintenance Cost Reduction	0.1	0.5
Improved Safety	0.1	0.5
Addl Product Sales	1.0	2.0
Reduced Energy	0.5	1.0
OVERALL ANNUAL COST SAVINGS POTENTIAL	1.6	6.0
% UNIT COST Improvement	1.6%	6.0%

\$30,000 Savings with One Alert !!

Projected

- Energy & Raw Material Savings up to \$500,000 at Waste Water
- Steam
- Reconciliation
- \$100,000 at Chemical Plant

MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE BY DESIGN



PROCESS PERFORMANCE **SOLUTIONS**

- **Powerful performance functionalities**
 - Monitor key performance indicators (KPI) and metrics in real time
 - Receive predictive notifications of under-performing assets before they impact the bottom line
 - Ensure designed plant performance and assure data quality to Asset Management software
 - Optimize plant design and instrumentation by performance and costs before it is built

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



PROCESS PERFORMANCE **SOLUTIONS**

- **Tools to Aid the Decision-Making Process**
 - Enhance existing DCS and SCADA systems by validating settings & increased real-time diagnostics
 - Take advantage of comprehensive diagnostic coverage at both process level and point level
 - Help prevent inaccurate data and validate information used in asset management systems
 - Automatically generate P&ID-based engineering models coming from SmartPlant P&ID

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



PROCESS PERFORMANCE *SOLUTIONS*

- **Improved profitability, safety, and efficiency**
 - Identify energy saving opportunities
 - Reduce operating costs by finding potential operational issues before they actually occur
 - Improve process and instrumentation reliability
 - Prevent safety incidents and environmental releases
 - Leverage process data & knowledge to provide critical solutions in a timely and cost-effective way

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***



Capturing the Opportunities Together

Path Forward

- On-site Demonstration & Project Opportunities Discussions
- Pilot Evaluation Option
- Project Scope Development
- Configuration, Implementation & Start-up
- Technology Transfer

***MAKING PLANTS SMARTER, SAFER & MORE PROFITABLE
BY DESIGN***

