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Empowering Business in **Real Time.**

PI Infrastructure for the Enterprise.

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Out-of-the-Box Thinking Beyond Time-Series Data from Rockwell Automation

Darren Riley & Jan Pingel
Rockwell Automation

Agenda

1. Living on Tradition
2. FactoryTalk® Platform Strategy
3. Enabling Effective Operations
4. Emerging Historian Solutions
5. Summary – Q&A

Traditional Thinking!

100 years of Traditional Thinking…..

….and a Strategic Partnership…..

- Technology Leadership and World-Class PI System
- Technology Provider
- Process and Data Management Expertise
- Data Historian Infrastructure

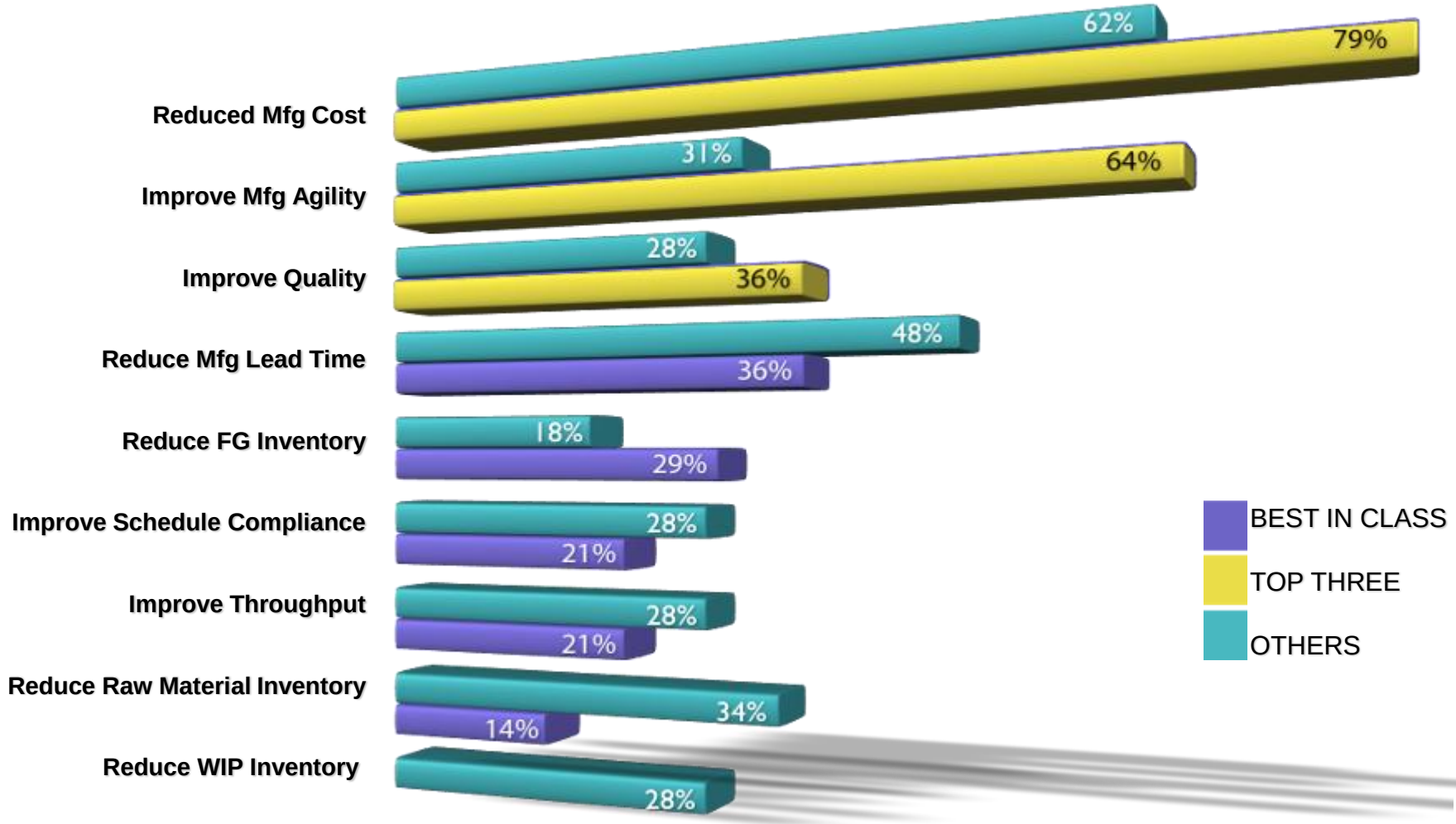
- Leadership in Automation and Information Solutions
- Solution Provider
- Automation and Controls Expertise
- Discrete and Hybrid

….to attack a “Not So Traditional” World

- Make-to-Order not Make-to-Stock
- Plant focus to Supply Chain
- Blend of all my data
- Critical-to-Quality (CTQ) Analysis for product, process and operational workflows
- Near Real Time Operations Analytics to support
  - Predictive alarming
  - Lean Workflows
  - CAPA events
  - WIP resource status

Adaptive Global Manufacturing

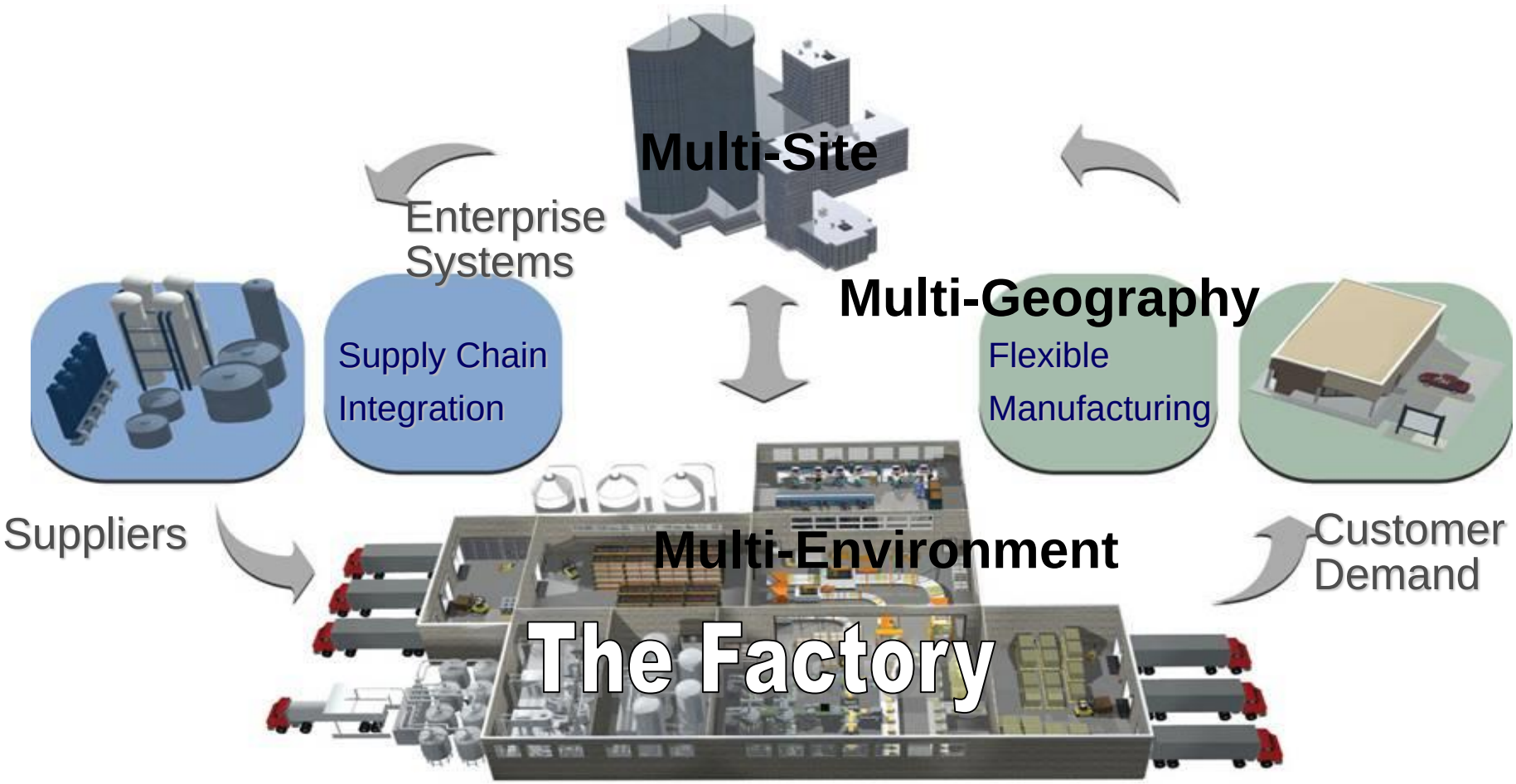
Never Short on Challenges!



SYTEMATIC EVENT DATA COLLECTION IS A MUST!

Source: Aberdeen Group, Mfg Perf Mgt2, 2006

But it's much larger than your plant



Climb out of the box

Convergence and the Connected Enterprise

Operations Management (OM)

Increased Profitability

Cost to Profit

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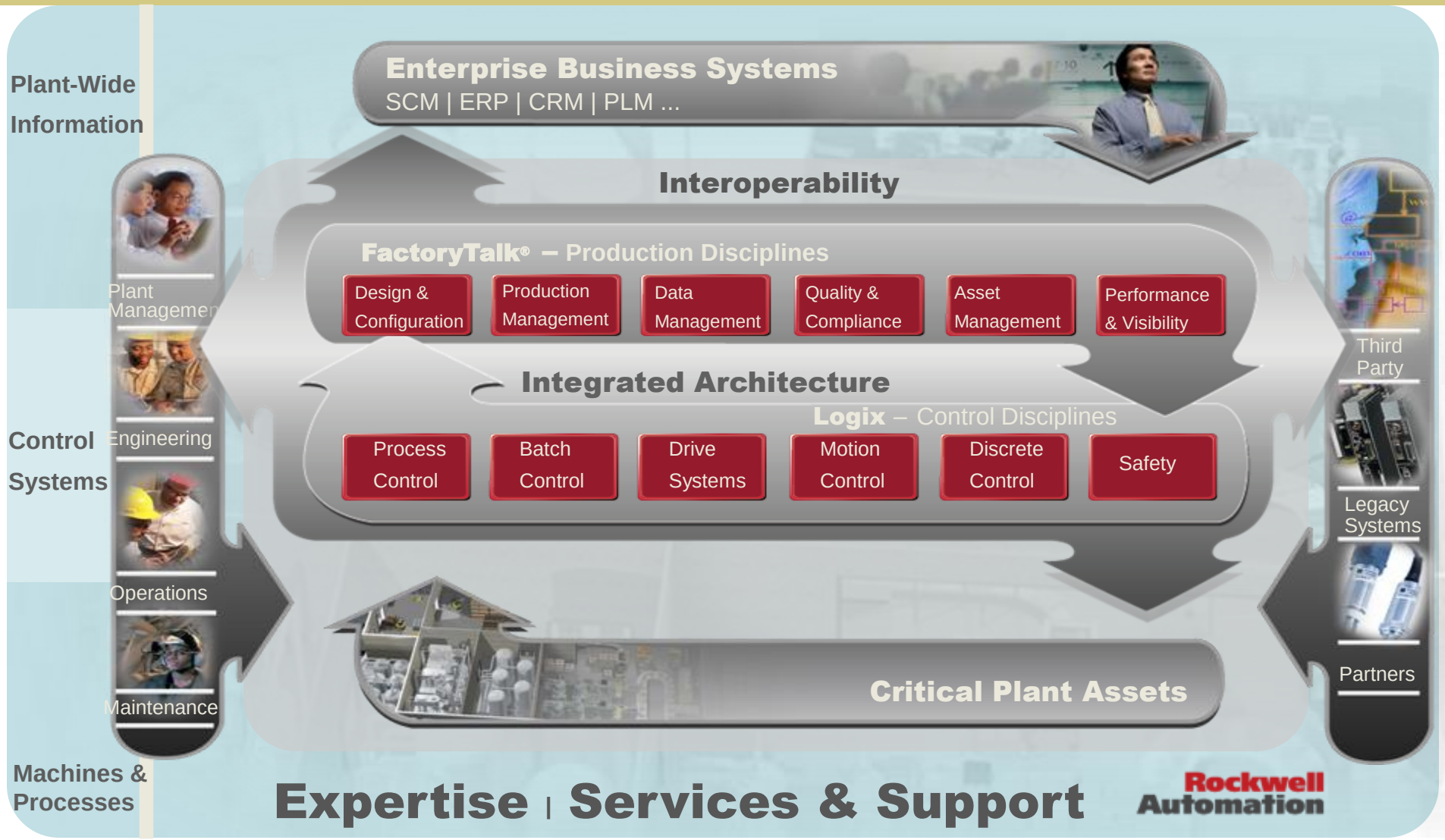
Rockwell Automation and OSIsoft

Rockwell Automation Solutions –
Integrated Architecture – The Expanded Vision

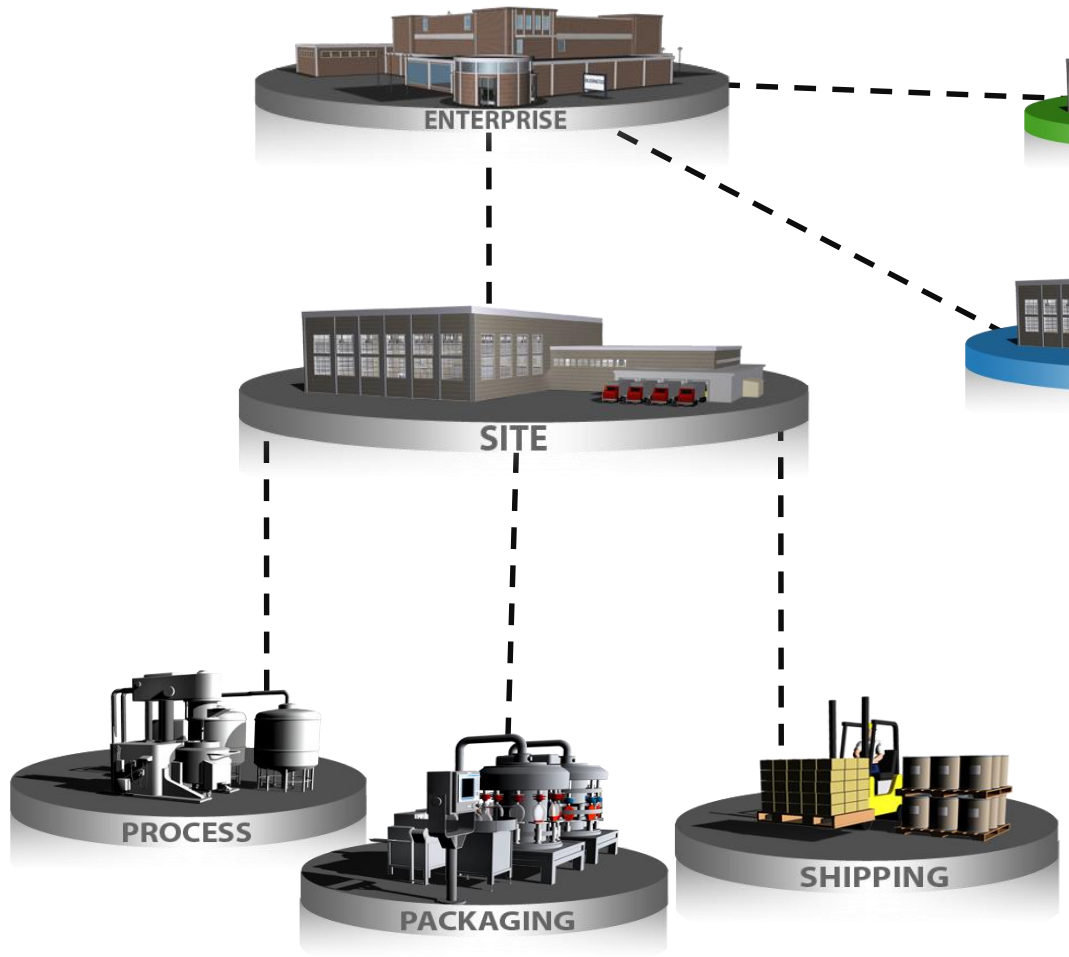


Simpler Configuration and Deployment

Rich set of Clients and Interfaces

- Utilizing existing OSIsoft Clients
  - ProcessBook
  - DataLink
- Interfacing to Rockwell Clients
  - FactoryTalk View HMI
  - Incuity EMI
- Extending the Technology into FactoryTalk
  - Control and Production Model (i.e S88/S95)
  - More capabilities for Discrete and Hybrid solutions

Distributed Historian Strategy

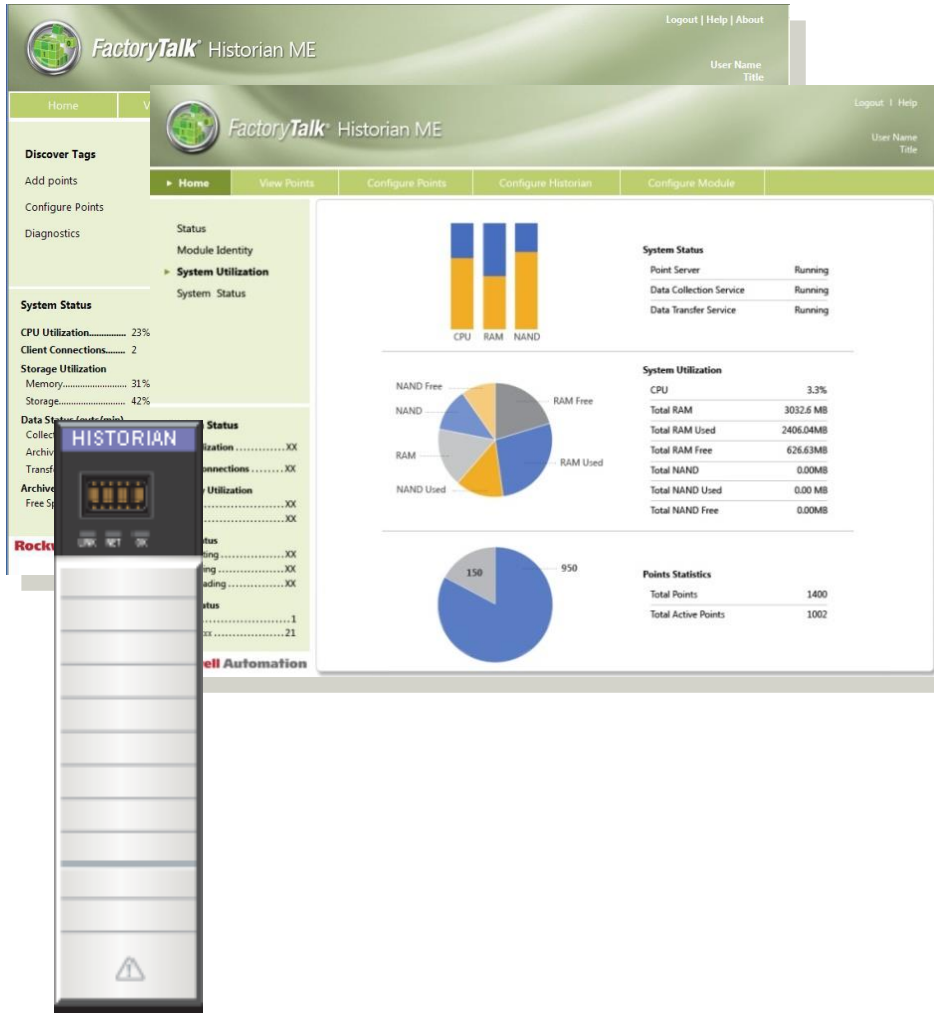


- 3 tiered historian
- Aggregating data upward
- Auto-discover sources downward
- Auto-configure tags
- Performance and Scalability
- 3rd party connectivity

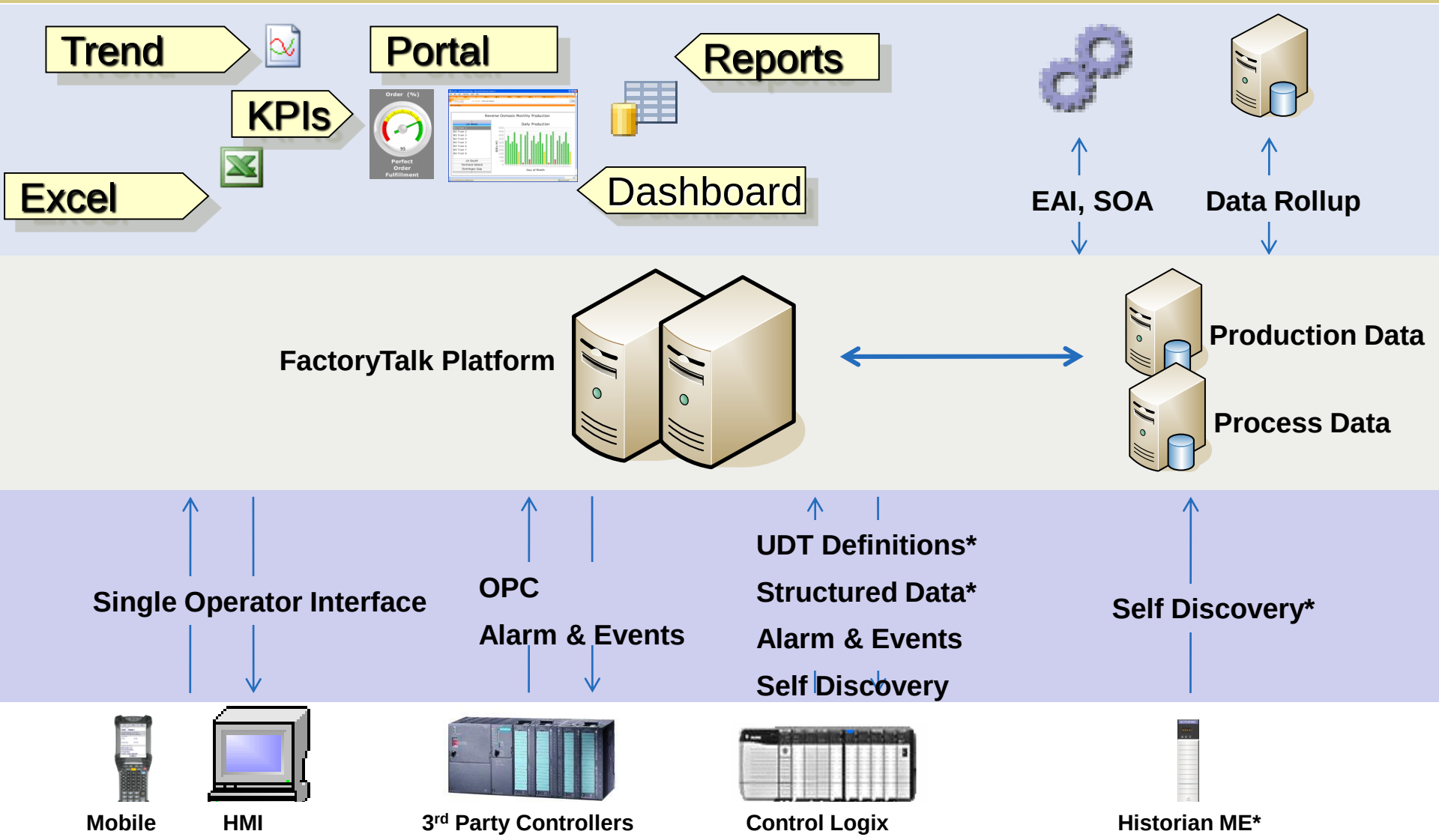
Pervasive Information Across Enterprise, Site, Machine/Device

FactoryTalk Historian Machine Edition

- Machine Edition
  - Based on “OSI PI Inside”
  - Module based Historian
  - Backplane speed data collection
  - More granular data
  - Solid State data collection on NAND Flash
  - Interfaces with existing PI installations



Platform Architecture



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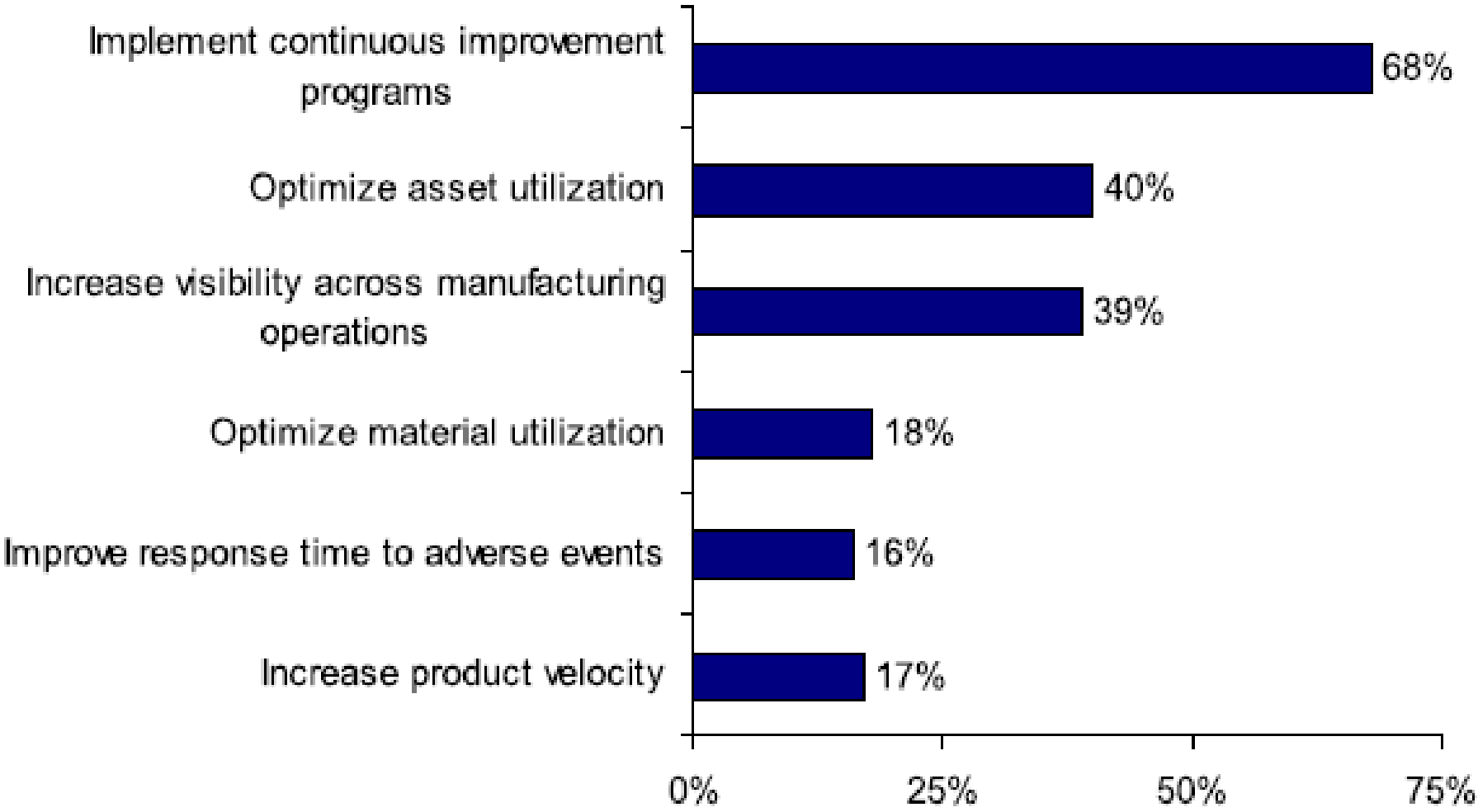
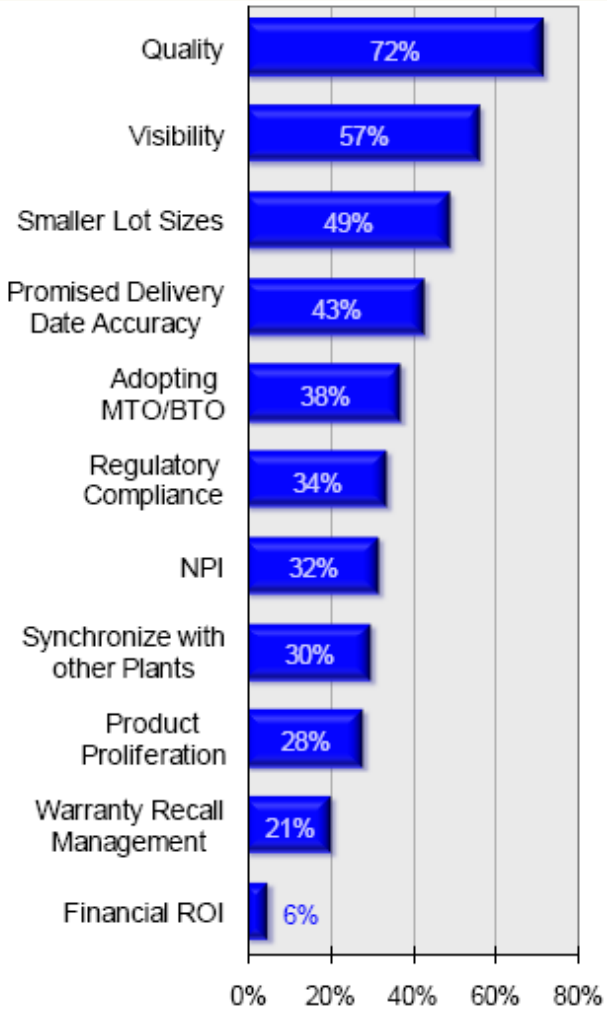
Feeling under Pressure? To reach your goals?



Source: Aberdeen Group, January 2008

Manufacturing Operations Drivers

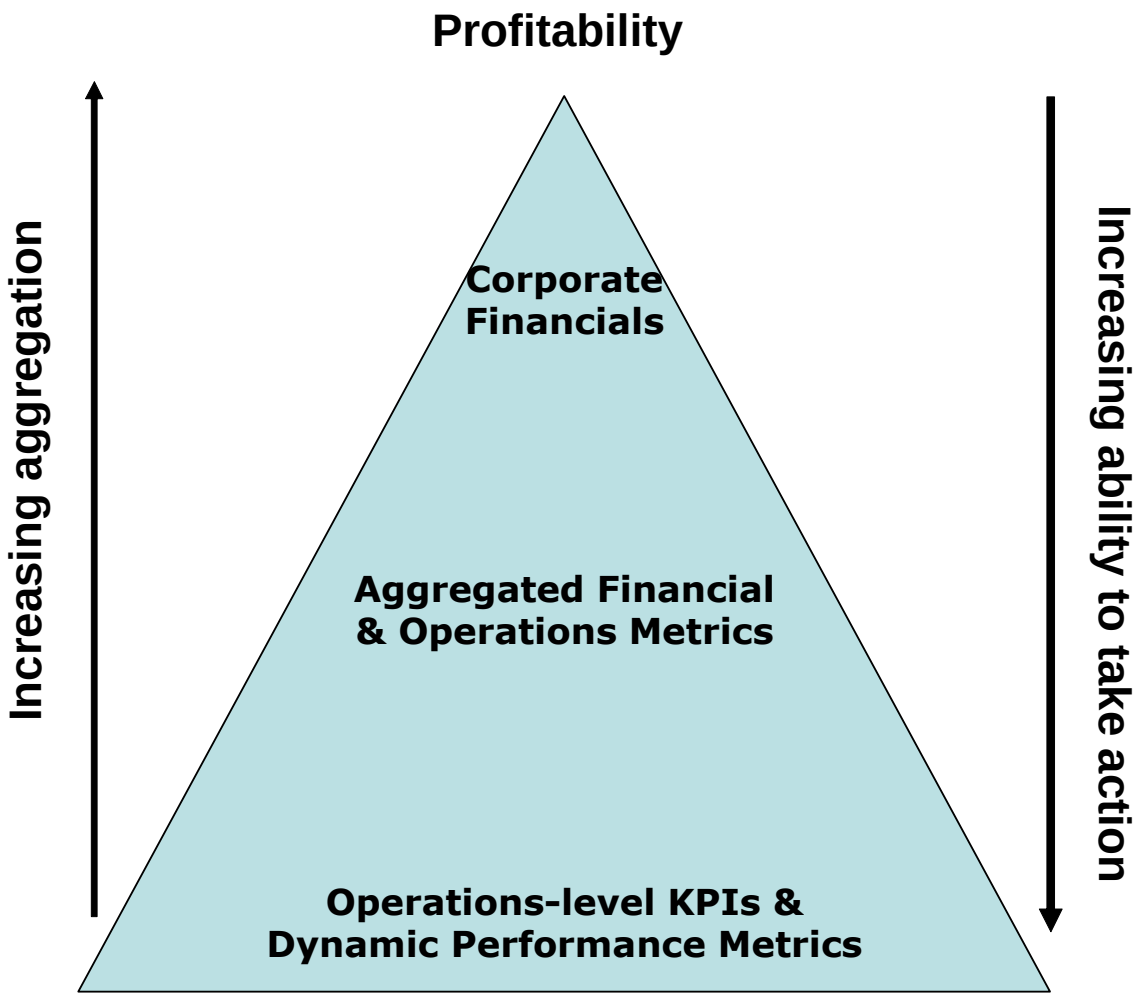
- The look of Today's Hybrid plants
  - Explosion of SKUs - high mix - MTO
  - Brand and margin protection
  - Regulation across the supply chain
  - Balancing execution with utilization
- And today's Discrete factories
  - Continuing the "pull" move with MTO/BTO
  - Quality, Visibility, Delivery
  - Small lot sizes
  - Compliance



Strategic Reasons for CPM Acquisition

Source: ARC Survey of Manufacturers, Discrete/Hybrid Industries

What Metrics are Actionable vs. Status?



Audience:

CFO, CEO

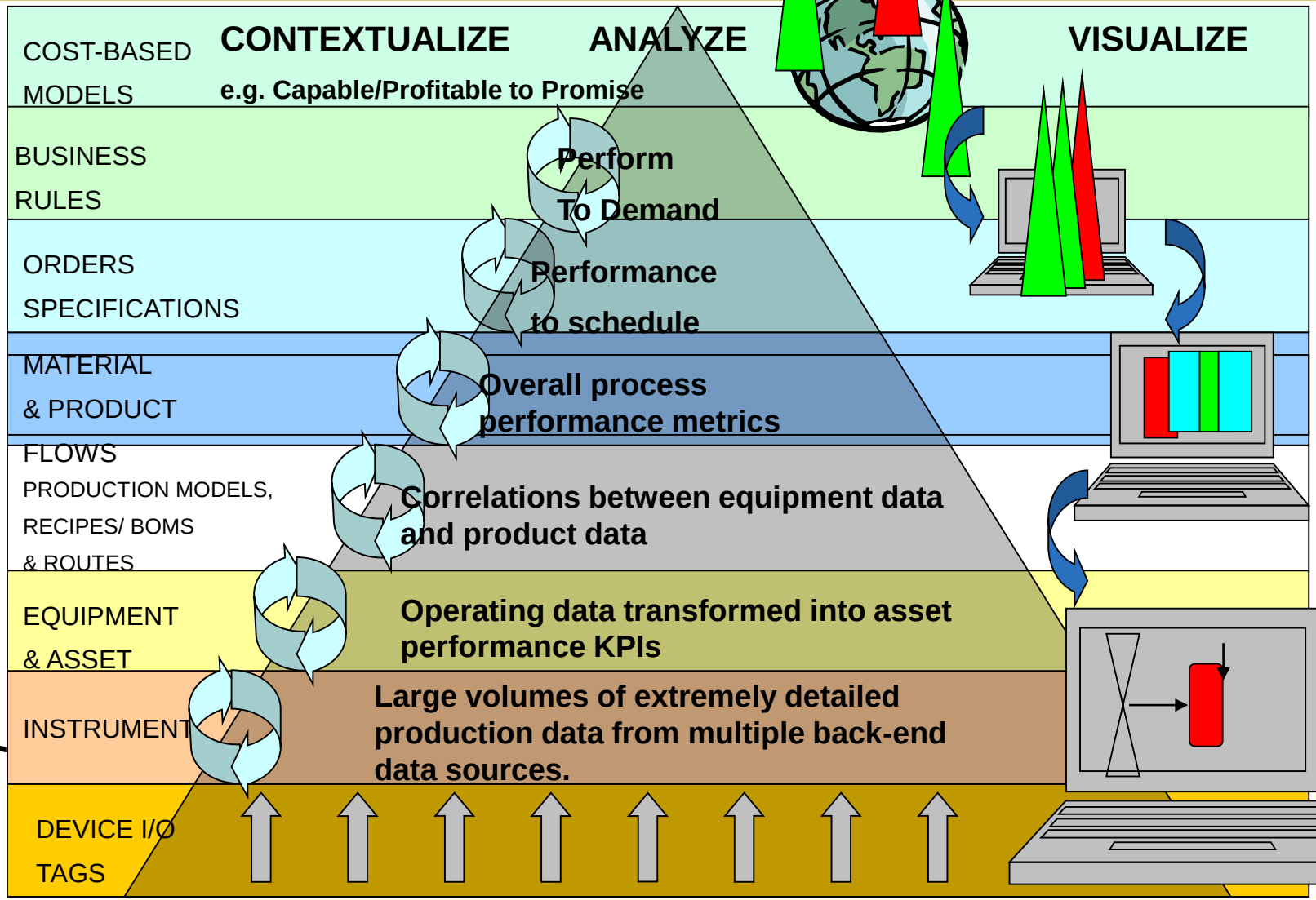
Plant Accounting, Finance

Plant Management, Operations Management

Operators, Supervisors, Quality, Engineers, Technicians

Source: MESA Metrics that Matter Guidebook & Framework © 2006 MESA International

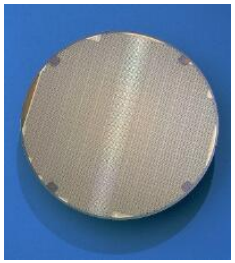
Enterprise Manufacturing Intelligence



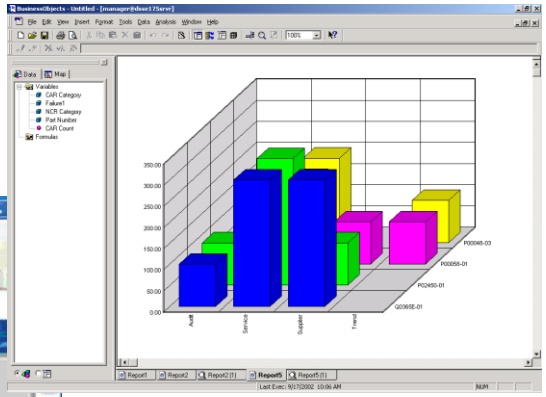
Source: AMR Research Benchmark Analytix

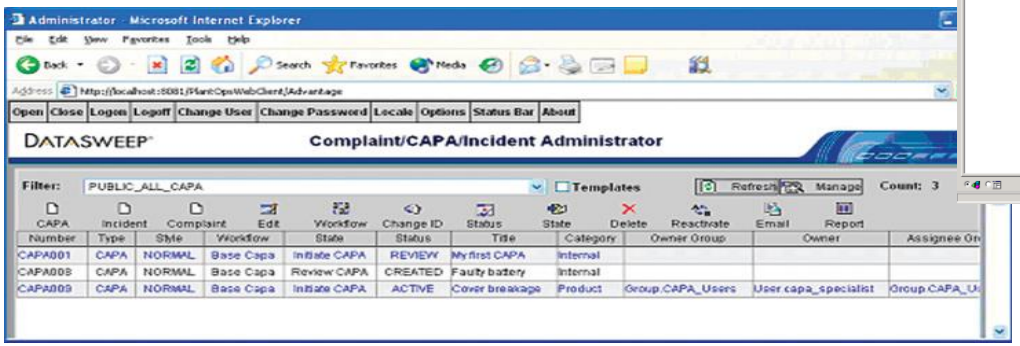
Traditional Solutions
Discrete and Hybrid Processes

- Immediate view of compound KPI's
  Yield, CpK or OEE
- KPI Aggregation across multiple sites
  (Cycle Times, Energy, OTDs Missed)
- Rapid calculation of complex KPI's
  Real-time CTQ
- Predictive impact/deviation detection
- Manufacturing plant today require both types of data storage systems



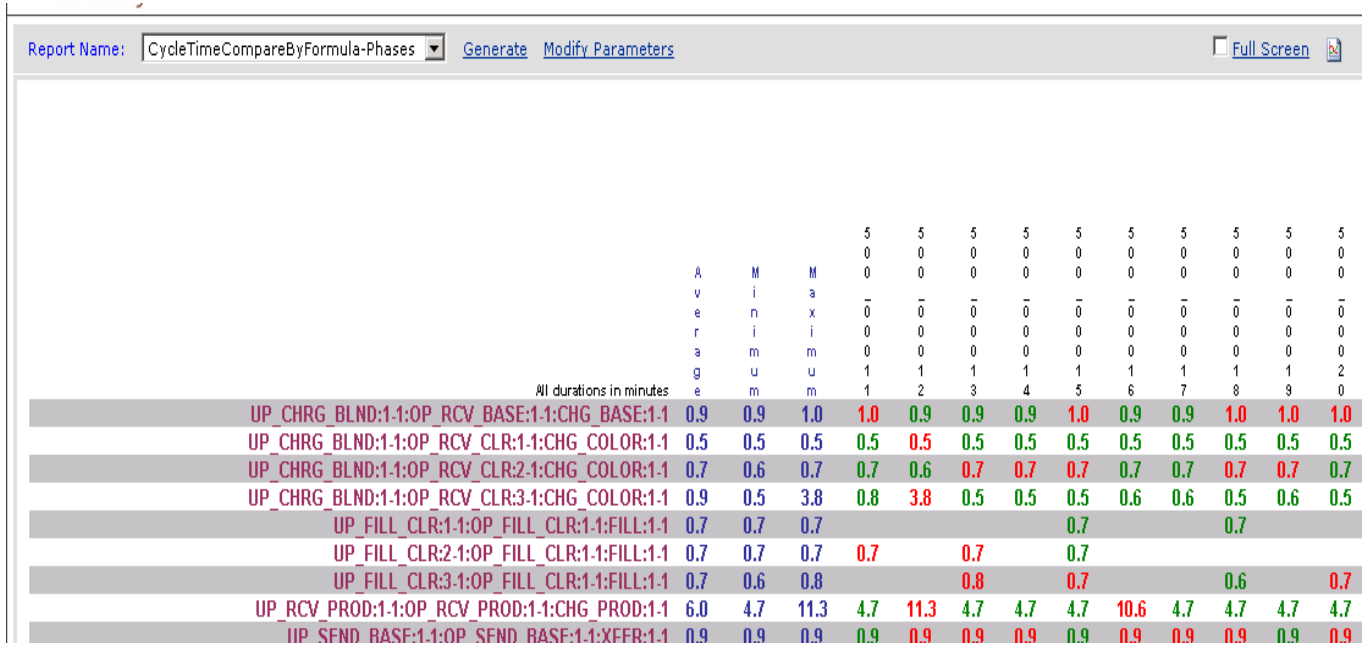
$$P_r = P_t \int \frac{\lambda^2 g_t g_r}{(4\pi)^2 r_1^{\,2} r_2^{\,2}} \sigma \, dV$$





Cycle Time Analysis

- Breakout of batches is the same as the chart (Unit Procedures, Operations or Phases)
- Average, Minimum and Maximum times are based on the batches included for the given filter criteria
- For each Batch ID, times below the average appear in Red and times above the average in Green


Report Name: CycleTimeCompareByFormula-Phases Generate Modify Parameters Full Screen

All durations in minutes	Average	Minimum	Maximum	500_0_0_0_0_0_0_0_0_0_0_1_1_1	500_0_0_0_0_0_0_0_0_0_0_1_1_2	500_0_0_0_0_0_0_0_0_0_0_1_1_3	500_0_0_0_0_0_0_0_0_0_0_1_1_4	500_0_0_0_0_0_0_0_0_0_0_1_1_5	500_0_0_0_0_0_0_0_0_0_0_1_1_6	500_0_0_0_0_0_0_0_0_0_0_1_1_7	500_0_0_0_0_0_0_0_0_0_0_1_1_8	500_0_0_0_0_0_0_0_0_0_0_1_1_9	500_0_0_0_0_0_0_0_0_0_0_1_2_0
UP_CHRG_BLND:1-1:OP_RCV_BASE:1-1:CHG_BASE:1-1	0.9	0.9	1.0	1.0	0.9	0.9	0.9	1.0	0.9	0.9	1.0	1.0	1.0
UP_CHRG_BLND:1-1:OP_RCV_CLR:1-1:CHG_COLOR:1-1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
UP_CHRG_BLND:1-1:OP_RCV_CLR:2-1:CHG_COLOR:1-1	0.7	0.6	0.7	0.7	0.6	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
UP_CHRG_BLND:1-1:OP_RCV_CLR:3-1:CHG_COLOR:1-1	0.9	0.5	3.8	0.8	3.8	0.5	0.5	0.5	0.6	0.6	0.5	0.6	0.5
UP_FILL_CLR:1-1:OP_FILL_CLR:1-1:FILL:1-1	0.7	0.7	0.7					0.7			0.7		
UP_FILL_CLR:2-1:OP_FILL_CLR:1-1:FILL:1-1	0.7	0.7	0.7	0.7		0.7		0.7					
UP_FILL_CLR:3-1:OP_FILL_CLR:1-1:FILL:1-1	0.7	0.6	0.8			0.8		0.7			0.6		0.7
UP_RCV_PROD:1-1:OP_RCV_PROD:1-1:CHG_PROD:1-1	6.0	4.7	11.3	4.7	11.3	4.7	4.7	4.7	10.6	4.7	4.7	4.7	4.7
UP_SEND_BASE:1-1:OP_SEND_BASE:1-1:XFER:1-1	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9

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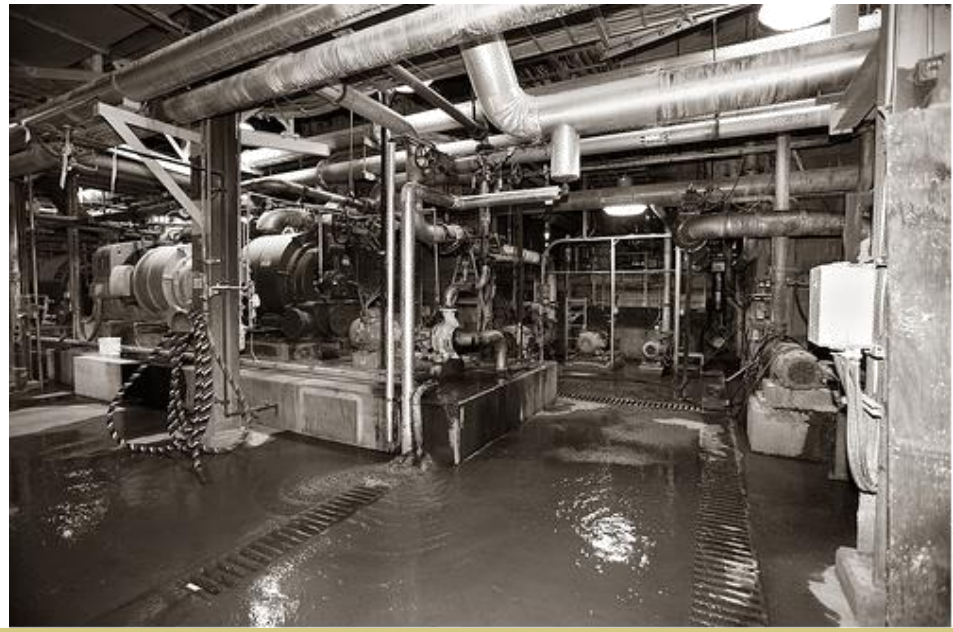
Enabling Incident Management

"**Incidents**" are unexpected events related to maintaining plant operations, safety, regulatory compliance, or security.

"**Incident management**" determines root causes, a short-term corrective action, and preventive actions necessary to prevent future incidents.

Incident KPIs related to equipment/materials:

- Unexpected process releases
- Production events that contaminate product
- Equipment incidents
- Material incidents



Example:
Effective KPIs for Deviation Management

“Production Impact – Deviations”

- A measured differences between an observed value and an expected or normal value for a process or product condition
- An anomalous event from a documented standard or process.

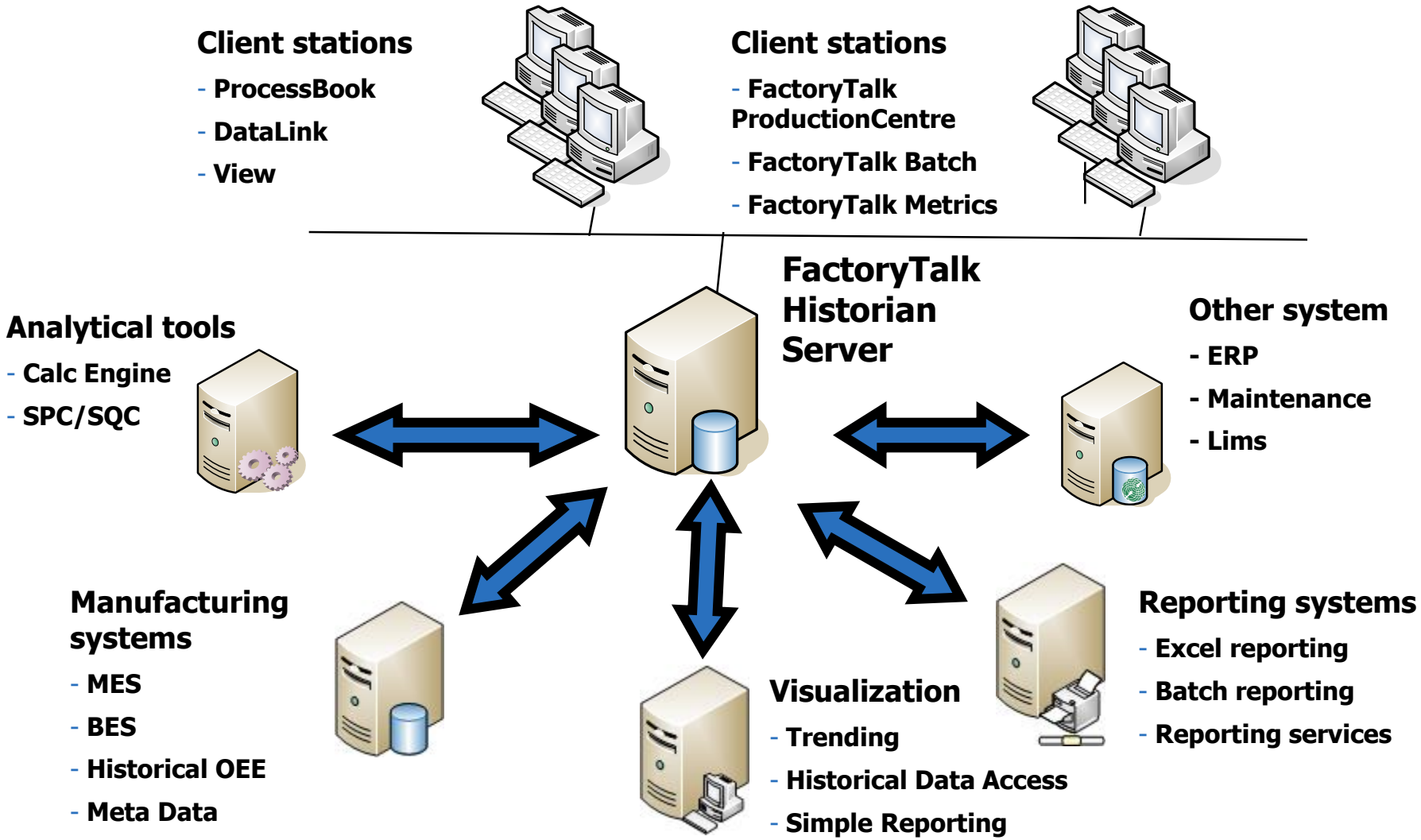
Product deviations examples:

- Crystal Specification too large after a crystallization operation
- Tablets have too high a friability after a compression operation
- Active ingredient percentage in blend or mix is below specification

Equipment deviations examples:

- A temperature setting spiking in a dryer
- Temperature profile curves not being followed in a lyopholizer
- Pressures in a reaction vessel trending out of a normal setting.

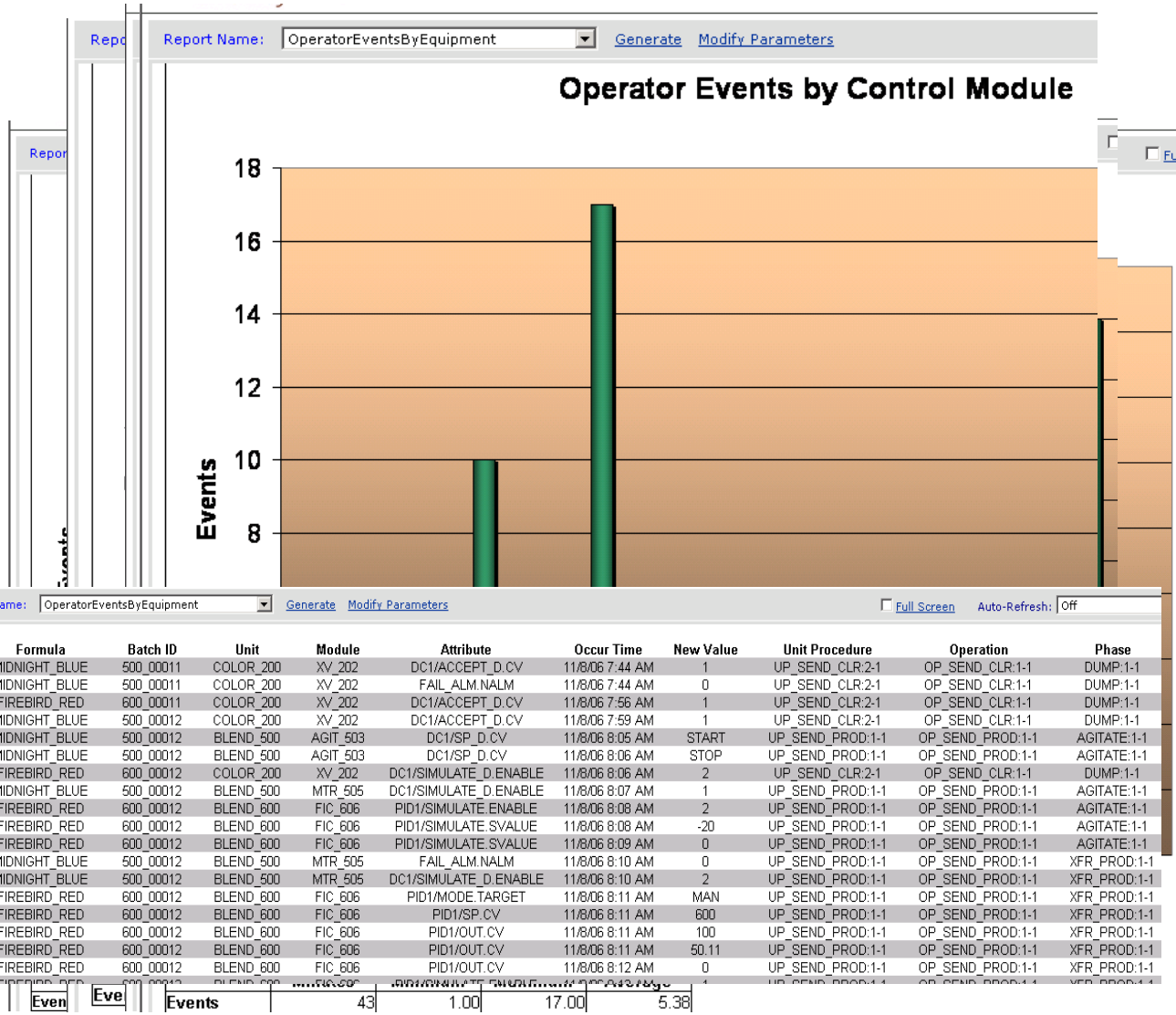
Example:
Incident and Deviation Management



Visibility and Calculation Across Multiple Systems … NOW!

Operator Change Events Analysis.. By

- Batches
- Production Unit
- Operation
- Phase
- Control Module
- Graphically or tabular for externally delivery

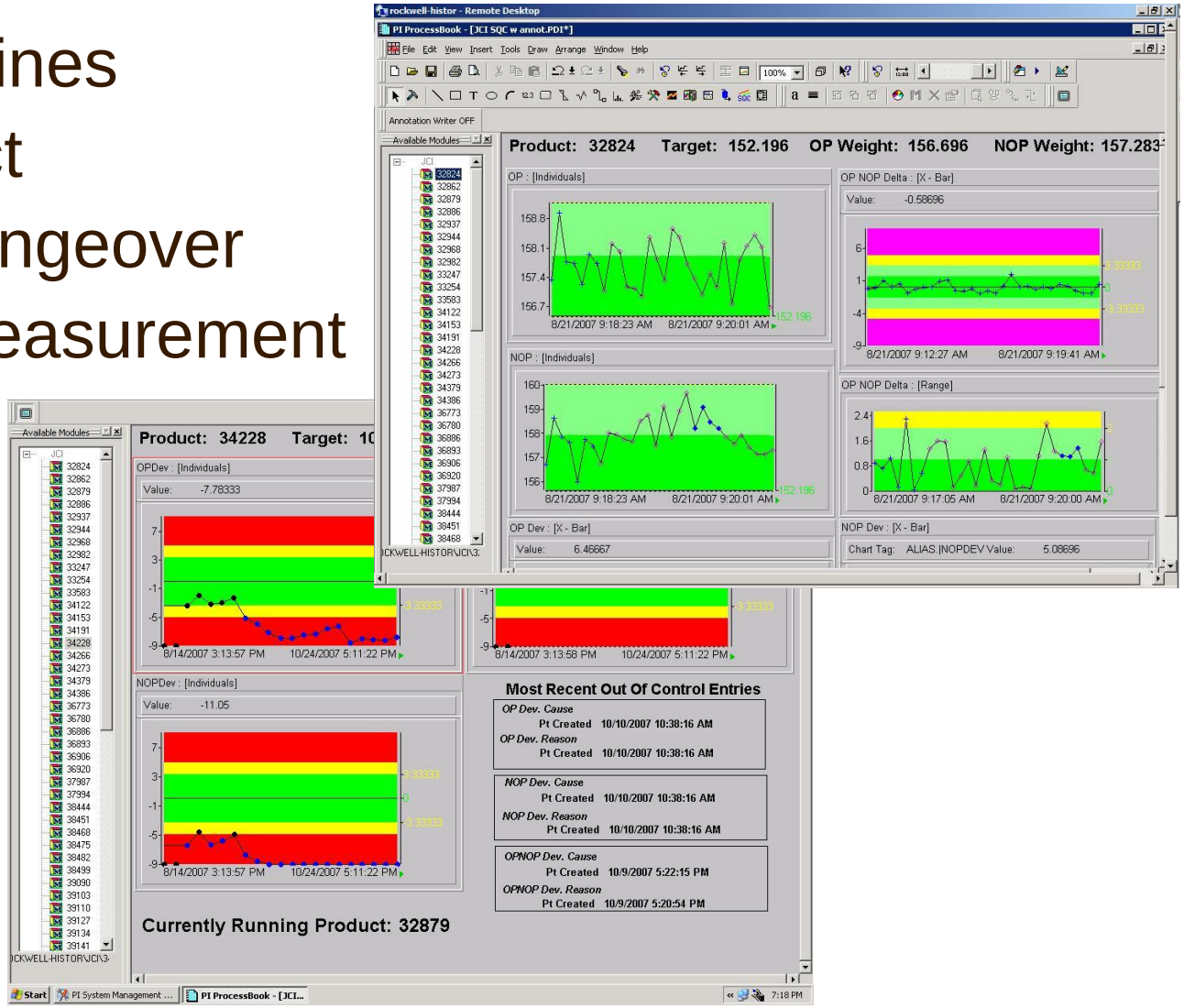


Formula	Batch ID	Unit	Module	Attribute	Occur Time	New Value	Unit Procedure	Operation	Phase
MIDNIGHT_BLUE	500_00011	COLOR_200	XV_202	DC1/ACCEPT_D.CV	11/8/06 7:44 AM	1	UP_SEND_CLR:2-1	OP_SEND_CLR:1-1	DUMP:1-1
MIDNIGHT_BLUE	500_00011	COLOR_200	XV_202	FAIL_ALM.NALM	11/8/06 7:44 AM	0	UP_SEND_CLR:2-1	OP_SEND_CLR:1-1	DUMP:1-1
FIREBIRD_RED	600_00011	COLOR_200	XV_202	DC1/ACCEPT_D.CV	11/8/06 7:56 AM	1	UP_SEND_CLR:2-1	OP_SEND_CLR:1-1	DUMP:1-1
MIDNIGHT_BLUE	500_00012	COLOR_200	XV_202	DC1/ACCEPT_D.CV	11/8/06 7:59 AM	1	UP_SEND_CLR:2-1	OP_SEND_CLR:1-1	DUMP:1-1
MIDNIGHT_BLUE	500_00012	BLEND_500	AGIT_503	DC1/SP_D.CV	11/8/06 8:05 AM	START	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
MIDNIGHT_BLUE	500_00012	BLEND_500	AGIT_503	DC1/SP_D.CV	11/8/06 8:06 AM	STOP	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
FIREBIRD_RED	600_00012	COLOR_200	XV_202	DC1/SIMULATE_D.ENABLE	11/8/06 8:06 AM	2	UP_SEND_CLR:2-1	OP_SEND_CLR:1-1	DUMP:1-1
MIDNIGHT_BLUE	500_00012	BLEND_500	MTR_505	DC1/SIMULATE_D.ENABLE	11/8/06 8:07 AM	1	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/SIMULATE.ENABLE	11/8/06 8:08 AM	2	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/SIMULATE.SVALUE	11/8/06 8:08 AM	-20	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/SIMULATE.SVALUE	11/8/06 8:09 AM	0	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	AGITATE:1-1
MIDNIGHT_BLUE	500_00012	BLEND_500	MTR_505	FAIL_ALM.NALM	11/8/06 8:10 AM	0	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
MIDNIGHT_BLUE	500_00012	BLEND_500	MTR_505	DC1/SIMULATE_D.ENABLE	11/8/06 8:10 AM	2	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/MODE.TARGET	11/8/06 8:11 AM	MAN	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/SP.CV	11/8/06 8:11 AM	600	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/OUT.CV	11/8/06 8:11 AM	100	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/OUT.CV	11/8/06 8:11 AM	50.11	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1
FIREBIRD_RED	600_00012	BLEND_600	FIC_606	PID1/OUT.CV	11/8/06 8:12 AM	0	UP_SEND_PROD:1-1	OP_SEND_PROD:1-1	XFR_PROD:1-1

Even	Eve	Events	43	1.00	17.00	5.38

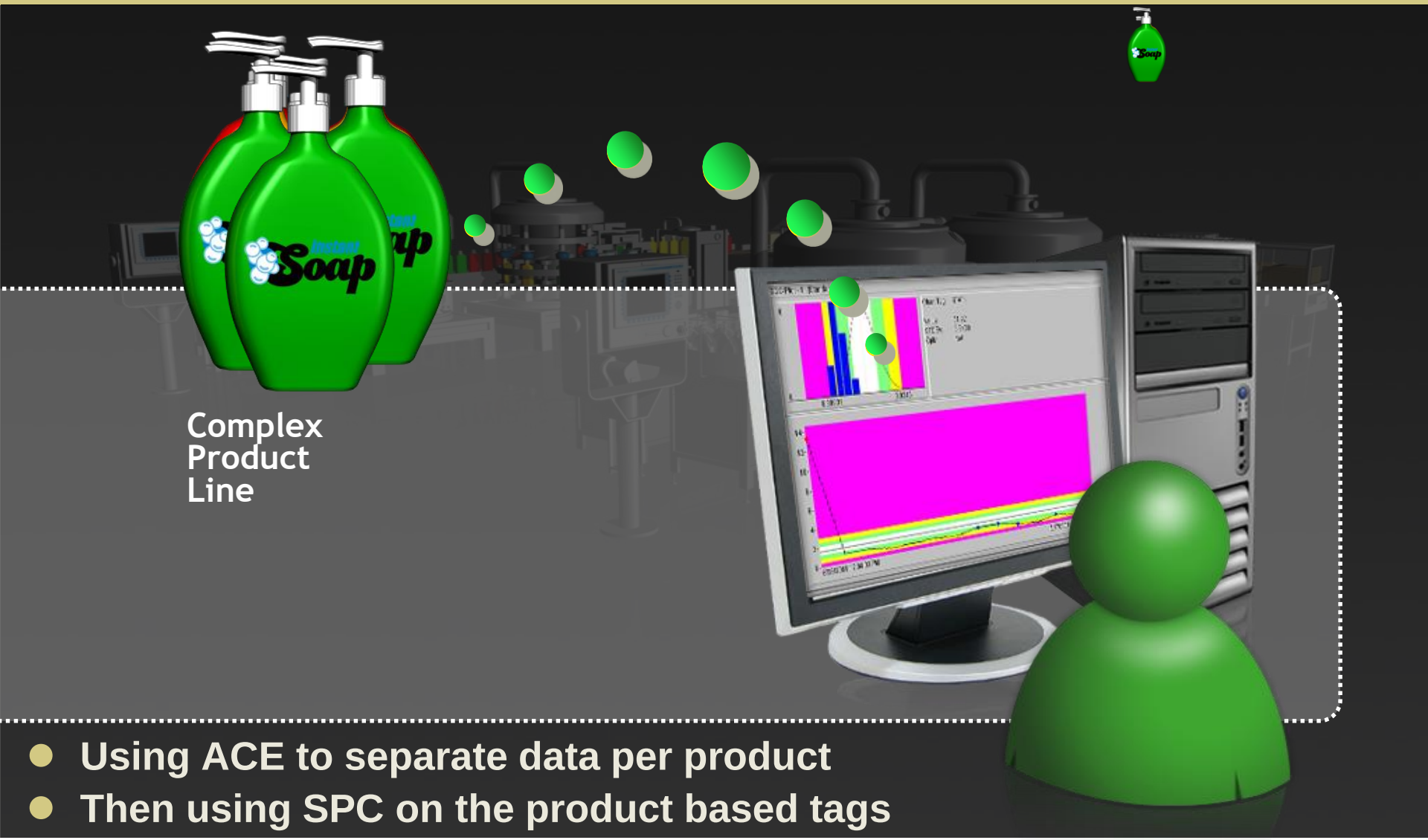
Product-based SPC for Discrete

- High Speed Lines
- Hi Mix Product
- Frequent Changeover
- Automated Measurement



Example – Product Based SPC

Quality Data From Complex Product Line



- Using ACE to separate data per product
- Then using SPC on the product based tags

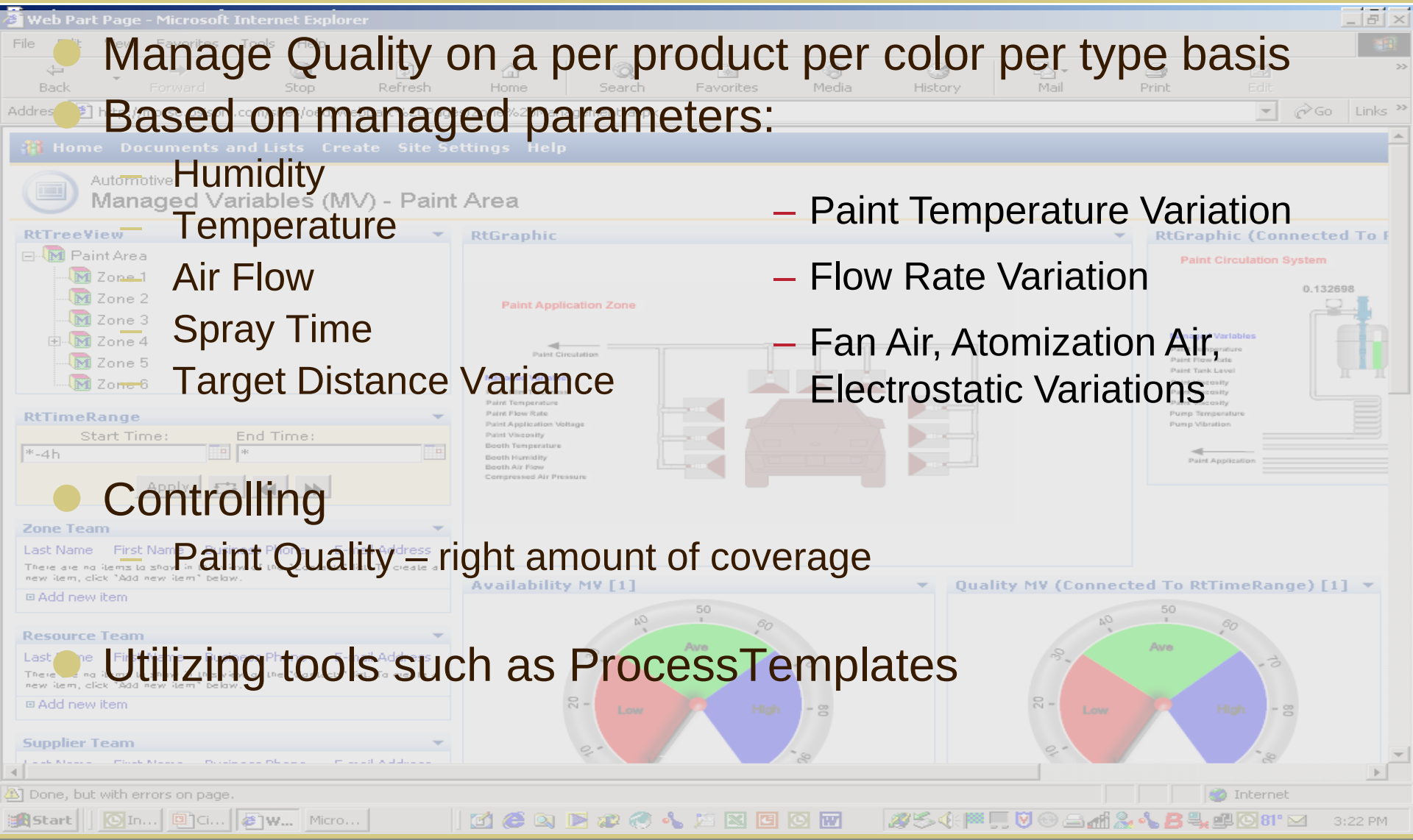
Example – Visual Inspection System

- High speed data capture
  - Visual quality indicator
  - Serial Number Barcode
- Buffering that data to Historian
- Using Tools to store the data points together in Quality system

Example – Automotive Paint Shop

Create Zone Level Visibility - Managed Variables

- Manage Quality on a per product per color per type basis
- Based on managed parameters:
  - Humidity
  - Temperature
  - Air Flow
  - Spray Time
  - Target Distance Variance
  - Paint Temperature Variation
  - Flow Rate Variation
  - Fan Air, Atomization Air, Electrostatic Variations
- Controlling
  - Paint Quality – right amount of coverage
- Utilizing tools such as ProcessTemplates



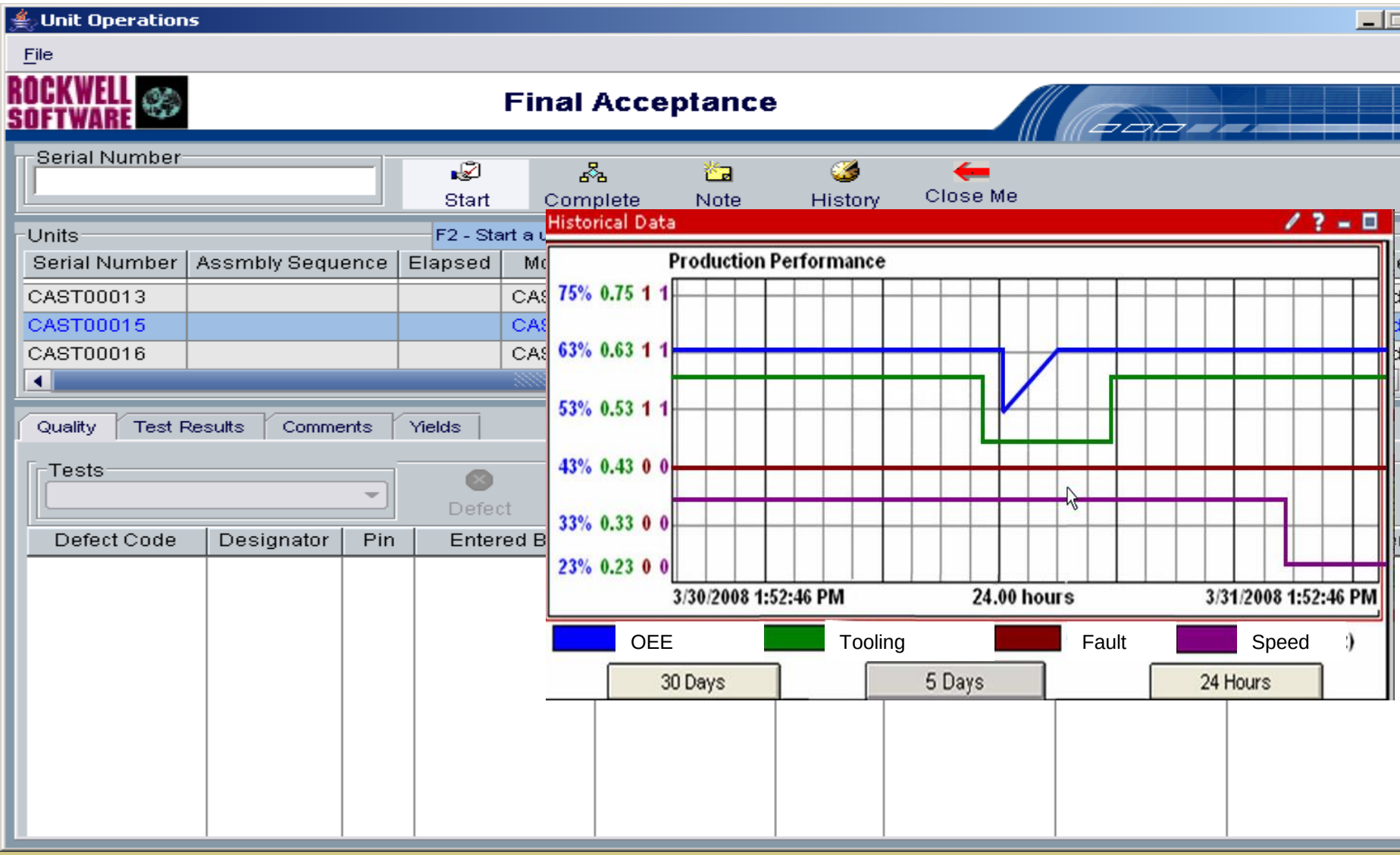
Optimized Discrete Workflows
Hybrid Manufacturing

"**Operations Events**" (Production, Maintenance, Inventory ,Quality) are stored events……**Not stored** in time series data store, but used as "fence posting" for the process data in the Historian

Examples:

- High speed data capture in a high speed, high mix production lines
  - Labeling, filling, bottling, vision system inspections, packaging, bar coding, palletizing, electronic Kanban counts and triggers, etc.
- Near real-time calculations based on events for predictive alarming
  - Batch statistics, product characteristics, predictive bottlenecks and starvations etc, when run or batch begins/ends, equipment available/unavailable, WIP levels in and out queues, status change of committed resources, critical deviations and changeover events (dispatching, staging begin/end, CIP begin/end)

Contextual Quality for Discrete Assembly



Rockwell Automation's Application

- 8,000 insertions per hour
- 128 K per day
- 3 lines
- In one facility

Enables tracking, genealogy, and RoHS compliance!

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Operational Agility Demands New Capabilities

Questions

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Darren Riley - dkriley@ra.rockwell.com
Jan Pingel - jpingel@ra.rockwell.com

THANK YOU