Using the PI System for a Recipe-Based Data Warehousing Strategy

Presented by **Nick Dani**

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Outline

- Problem Statement
- IDM Data Warehouse Strategy
- PI System - Critical Component for Warehousing Strategy
- Where does PI System fit in this?
- Contextualizing data using PI AF and PI EF – Example
- Exporting and Accessing PI System Data
- Challenges
- Next Steps

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Problem Statement

"We've got lots of information technology. We just don't have any information."

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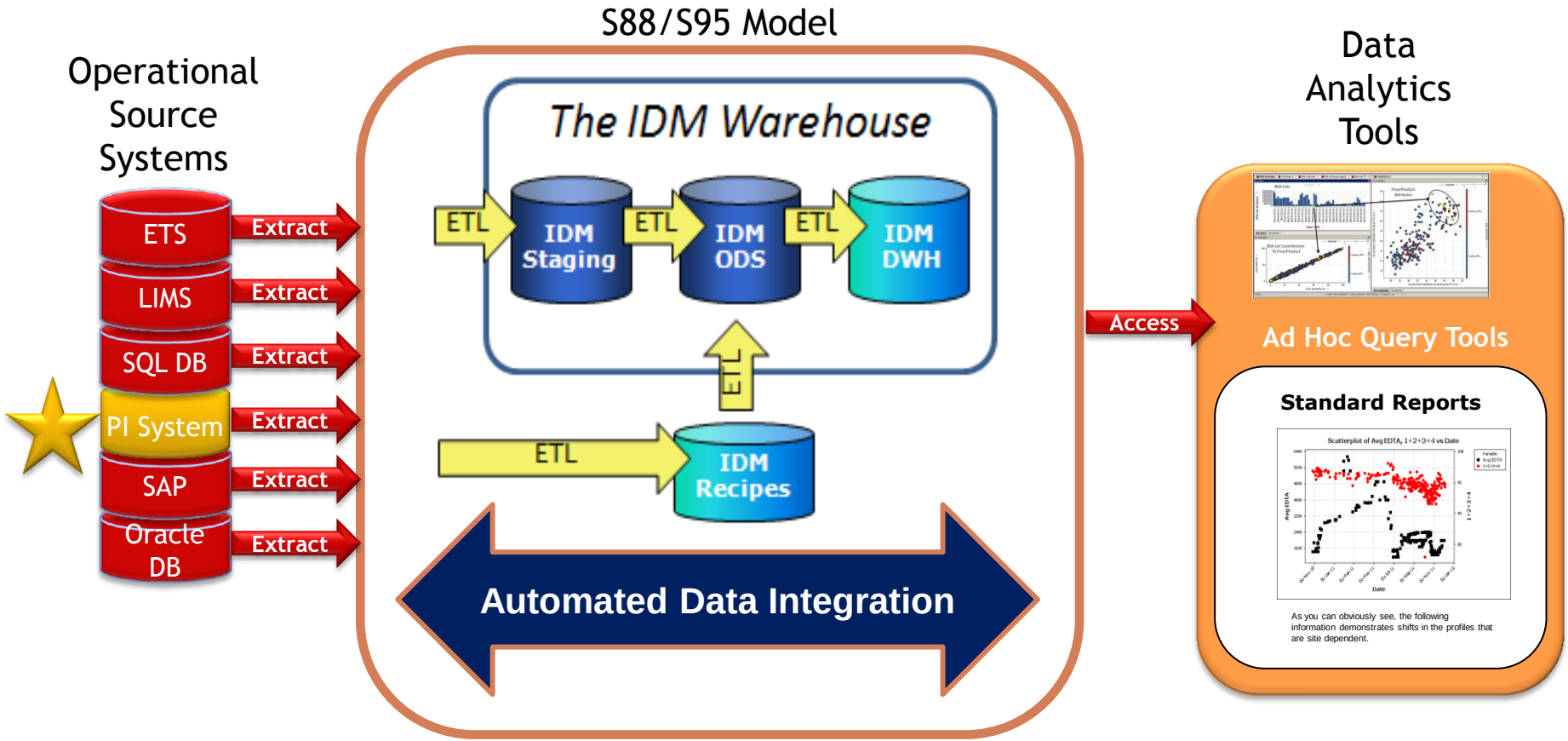
IDM Data Warehouse Strategy



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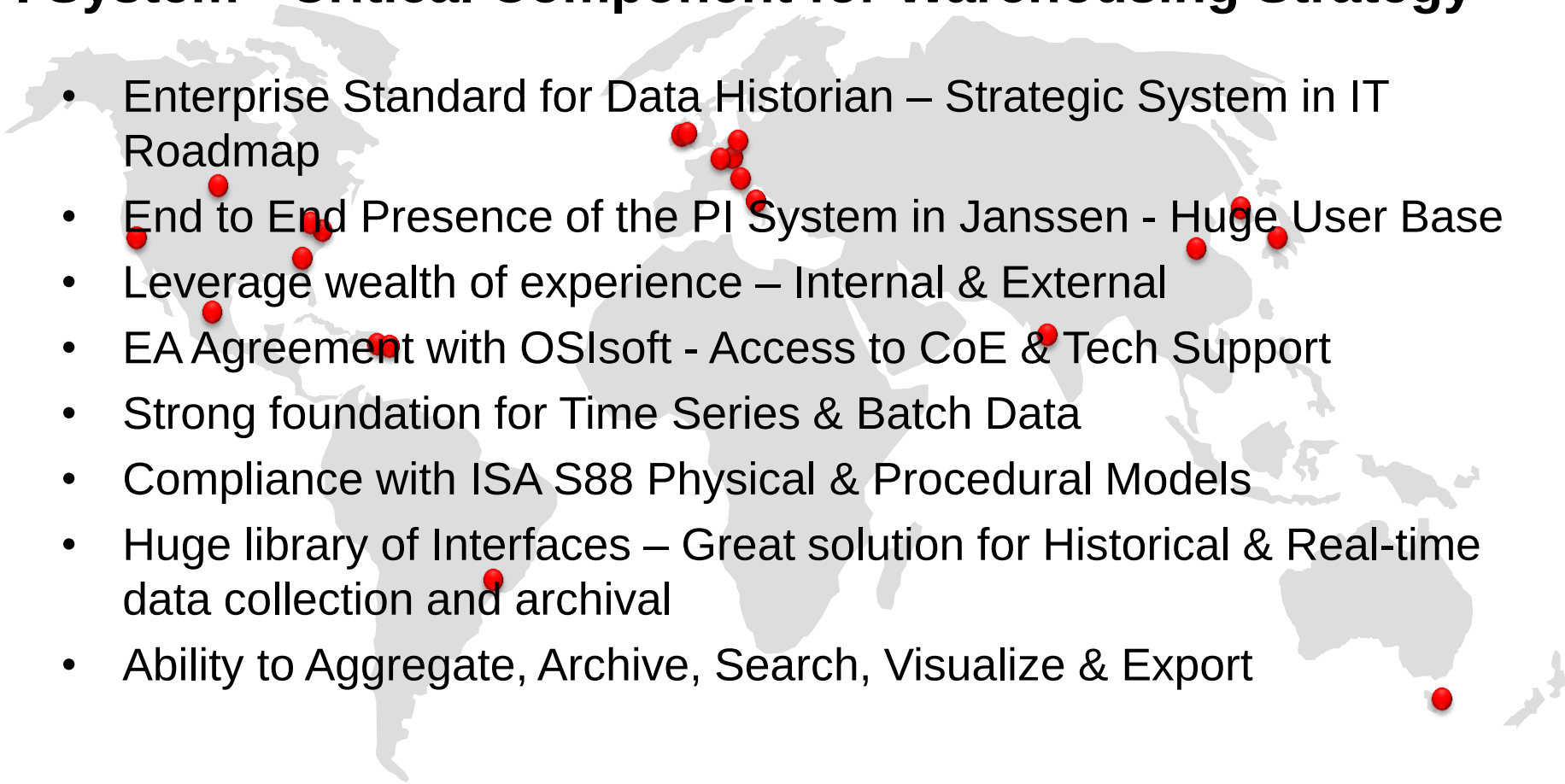
PI System - Critical Component for Warehousing Strategy



- Enterprise Standard for Data Historian – Strategic System in IT Roadmap
- End to End Presence of the PI System in Janssen - Huge User Base
- Leverage wealth of experience – Internal & External
- EA Agreement with OSIsoft - Access to CoE & Tech Support
- Strong foundation for Time Series & Batch Data
- Compliance with ISA S88 Physical & Procedural Models
- Huge library of Interfaces – Great solution for Historical & Real-time data collection and archival
- Ability to Aggregate, Archive, Search, Visualize & Export

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Where does the PI System fit in this?

EXECUTION

Real time Cont.

Discrete

Historical

PI Interface Layer

PI Server

Archives

PI AF

PI AF Server

Microsoft SQL Server

Recipes

Analysis

IDM RW OLTP
- S88 Recipe and Risk Content

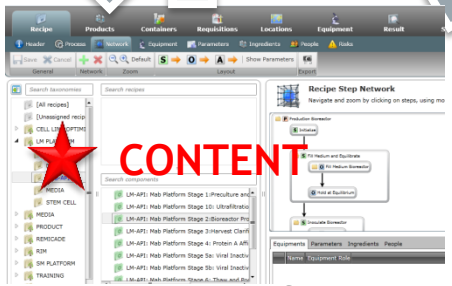
IDM RW ODS
- Linking Control Recipes

IDM RW DWH
Data Aggregation & Optimization for Reporting

PI AF SDK + PI OLE DB

Element Template Library
Global Asset Model

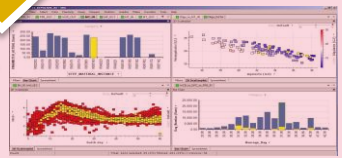
PI Event Frames



CONTENT

Recipe Mgt. System

VISUALIZATION



livepoint

ProSensus
data driven innovation

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Recipe Portal - S88 Recipe, Parameters

Recipe Step Parameters

Drag a column header and drop it here to group by that column

Name	Step	Equipment Type	Parameter
Hours elapsed	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[ELAPSED TIME_HRS]
Days elapsed	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[ELAPSED TIME_DAYS]
Total Viable Cells	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL COUNT VIABLE]
Total Total Cells	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL COUNT TOTAL]
Cumulative generations basic	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL GENERATIONS ACCUM._A]
INTEGRAL_VIABLE_CELL	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL COUNT VIABLE INTEGRAL]
INTEGRAL_VIABLE_CELL_CUM	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL COUNT VIABLE INTEGRAL ACCUM.]
CALC_PERFUSION_RATE	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PERFUSION RATE]
Reactor volume perfused per day	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PERFUSION RATE SCALED]
Specific Antibody Production Rate basic	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[CELL SPECIFIC ANTIBODY PRODUCTION RATE_A]
IgG output per Liter Media per day	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[SPECIFIC CELL-PRODUCTIVITY_PER VOLUME MEDIA]
IgG Output per day basic	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PRODUCTION RATE_A]
Cumulative IgG production in kg basic	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PRODUCT MASS ACCUM._KG_A]
Cumulative IgG Production basic	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PRODUCT MASS ACCUM._G_A]
Perfusion per cell	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[PERFUSION RATE_PER CELL]
Medium consumption per gram	Production Bioreactor\Continuous Perfusion\Daily Sampling	PI MDE	[MEDIUM CONSUMPTION_PER G]

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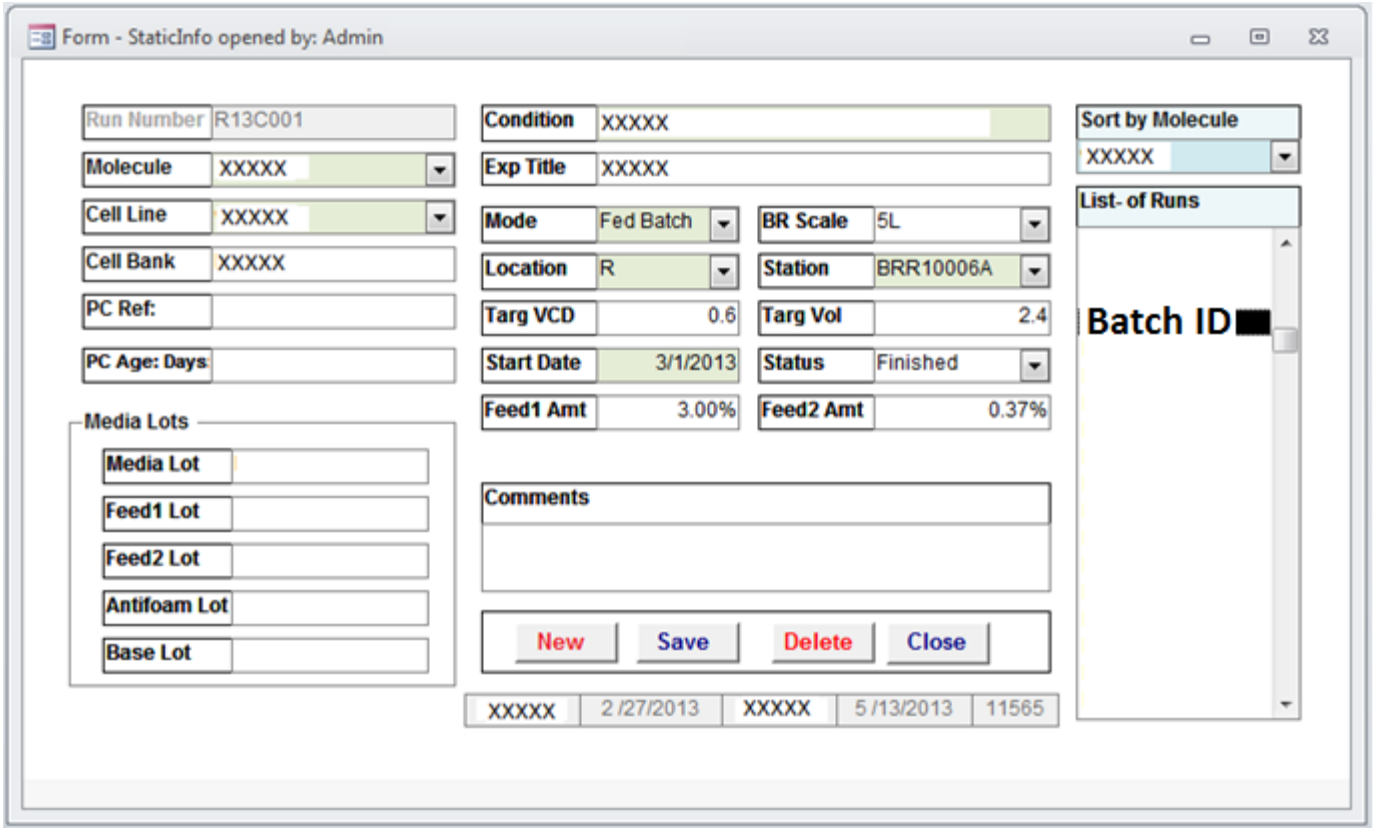
Source Data - Batch Data (Static)



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Source Data - Batch Data (Dynamic)

List of Runs | Product | Condition | Started By | Start Date | Status | Calculate Sheet | Import NOVA | Get PI Data

Batch ID: BRR10006A

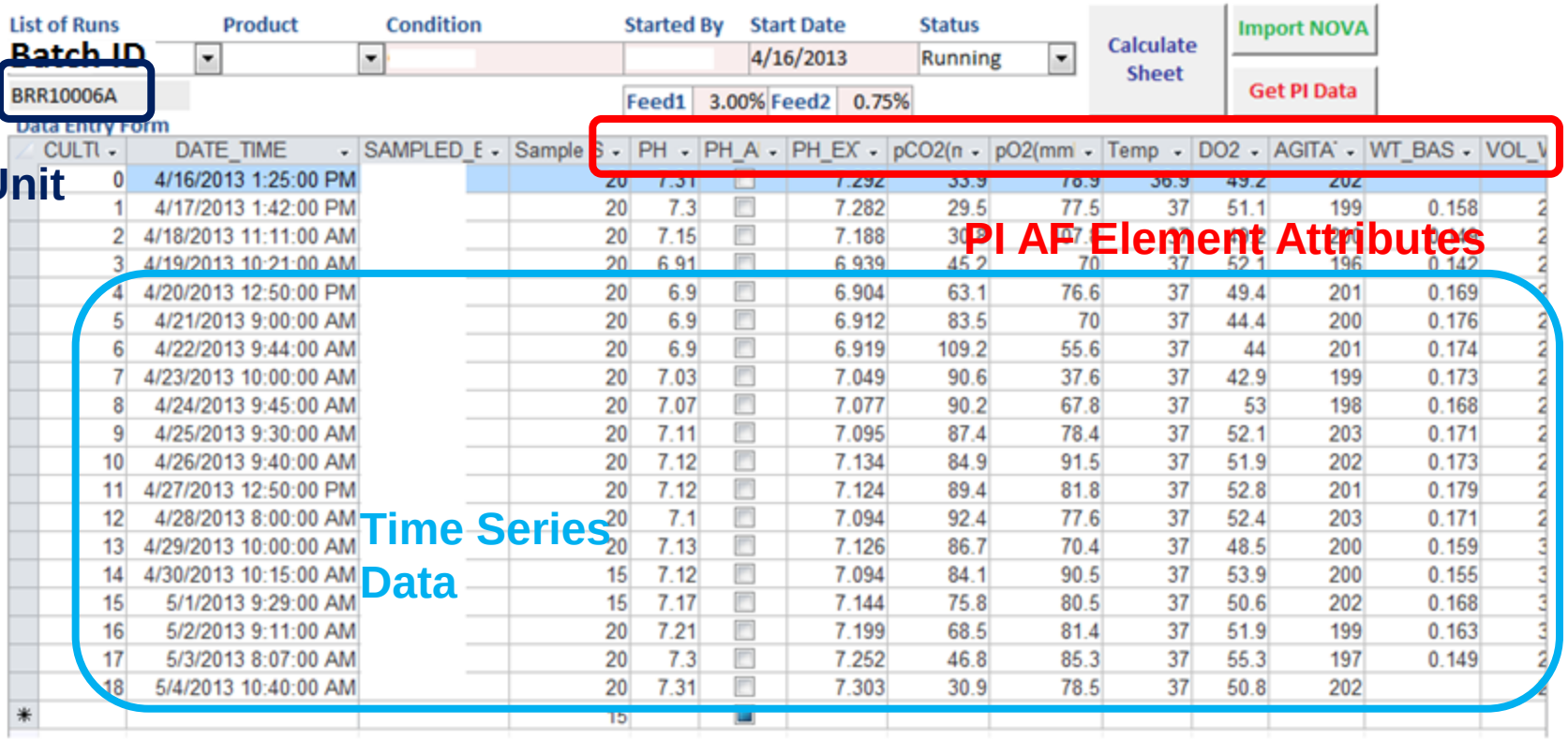
Feed1 3.00% Feed2 0.75%

Data Entry Form

PI Unit

PI AF Element Attributes

Time Series Data



CULTI	DATE_TIME	SAMPLED_E	Sample S	PH	PH_A	PH_EX	pCO2(n	pO2(mm	Temp	DO2	AGITA	WT_BAS	VOL_V
0	4/16/2013 1:25:00 PM		20	7.31		7.292	33.9	78.9	36.9	49.2	202		
1	4/17/2013 1:42:00 PM		20	7.3		7.282	29.5	77.5	37	51.1	199	0.158	2
2	4/18/2013 11:11:00 AM		20	7.15		7.188	30.[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	2
3	4/19/2013 10:21:00 AM		20	6.91		6.939	45.2	70	37	52.1	196	0.142	2
4	4/20/2013 12:50:00 PM		20	6.9		6.904	63.1	76.6	37	49.4	201	0.169	2
5	4/21/2013 9:00:00 AM		20	6.9		6.912	83.5	70	37	44.4	200	0.176	2
6	4/22/2013 9:44:00 AM		20	6.9		6.919	109.2	55.6	37	44	201	0.174	2
7	4/23/2013 10:00:00 AM		20	7.03		7.049	90.6	37.6	37	42.9	199	0.173	2
8	4/24/2013 9:45:00 AM		20	7.07		7.077	90.2	67.8	37	53	198	0.168	2
9	4/25/2013 9:30:00 AM		20	7.11		7.095	87.4	78.4	37	52.1	203	0.171	2
10	4/26/2013 9:40:00 AM		20	7.12		7.134	84.9	91.5	37	51.9	202	0.173	2
11	4/27/2013 12:50:00 PM		20	7.12		7.124	89.4	81.8	37	52.8	201	0.179	2
12	4/28/2013 8:00:00 AM		20	7.1		7.094	92.4	77.6	37	52.4	203	0.171	2
13	4/29/2013 10:00:00 AM		20	7.13		7.126	86.7	70.4	37	48.5	200	0.159	3
14	4/30/2013 10:15:00 AM		15	7.12		7.094	84.1	90.5	37	53.9	200	0.155	3
15	5/1/2013 9:29:00 AM		15	7.17		7.144	75.8	80.5	37	50.6	202	0.168	3
16	5/2/2013 9:11:00 AM		20	7.21		7.199	68.5	81.4	37	51.9	199	0.163	3
17	5/3/2013 8:07:00 AM		20	7.3		7.252	46.8	85.3	37	55.3	197	0.149	2
18	5/4/2013 10:40:00 AM		20	7.31		7.303	30.9	78.5	37	50.8	202		2
*			15										

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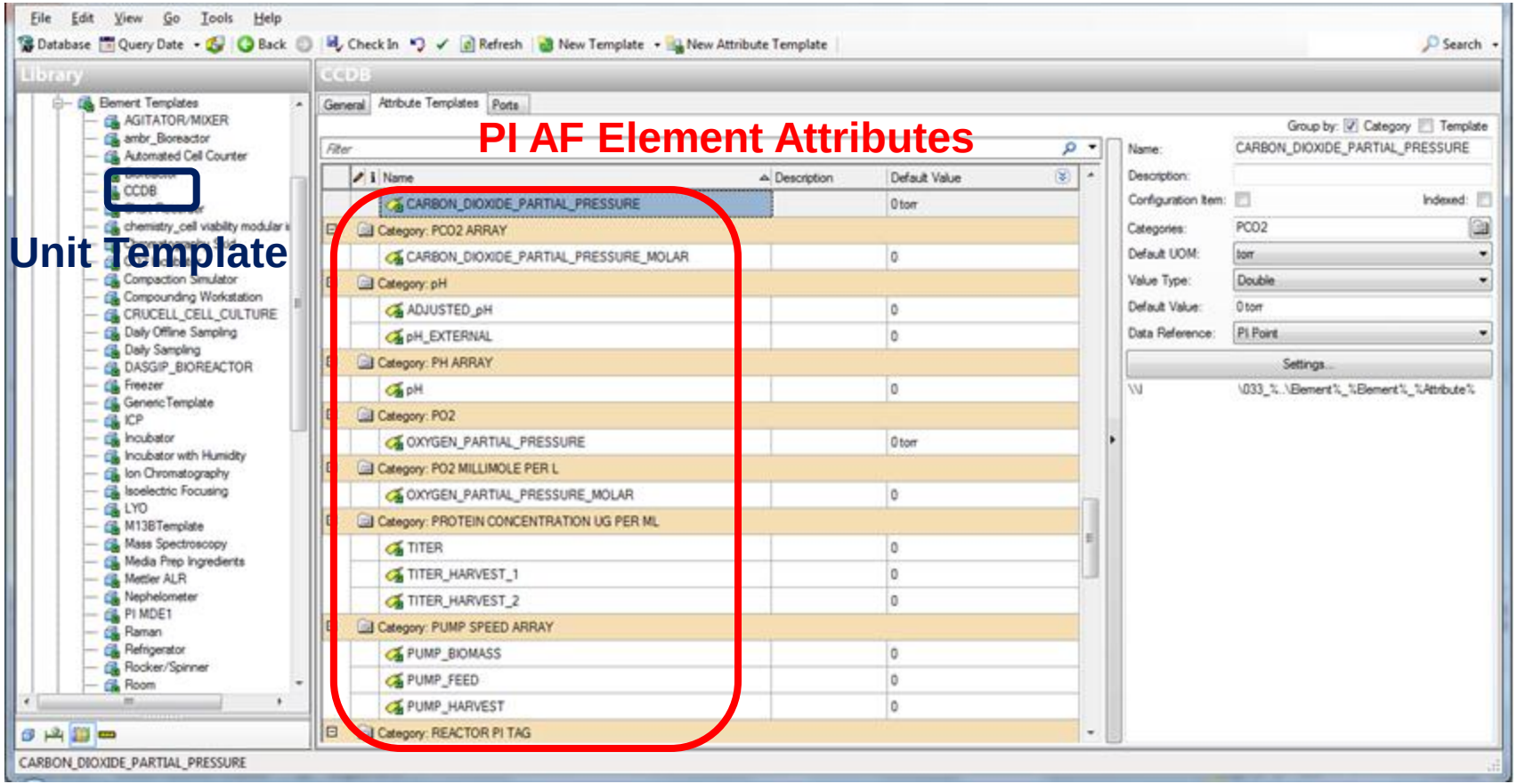
PI AF Element Template Configuration



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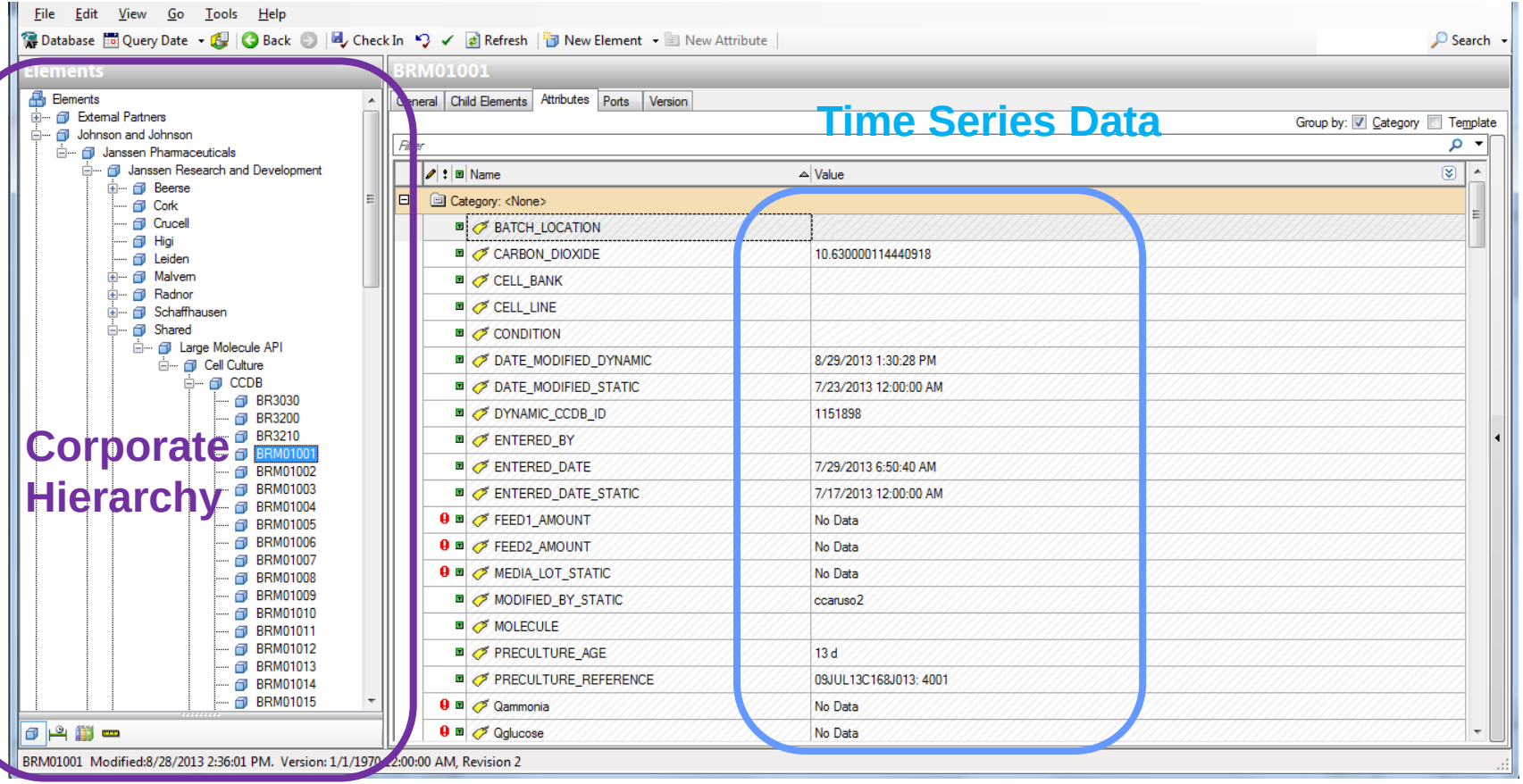
S88 Physical Model – Template tied to the PI unit



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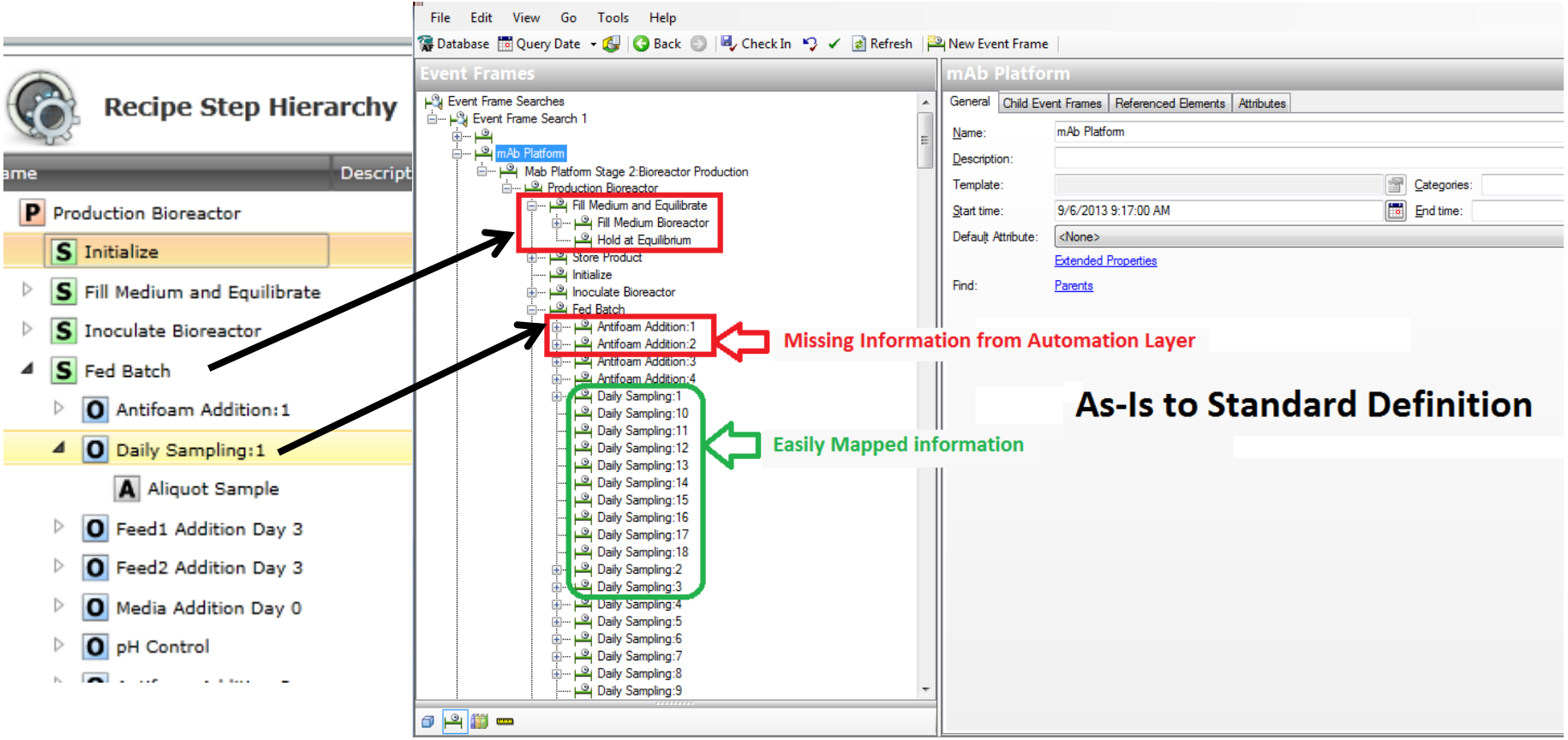
S88 Process Model with PI EF



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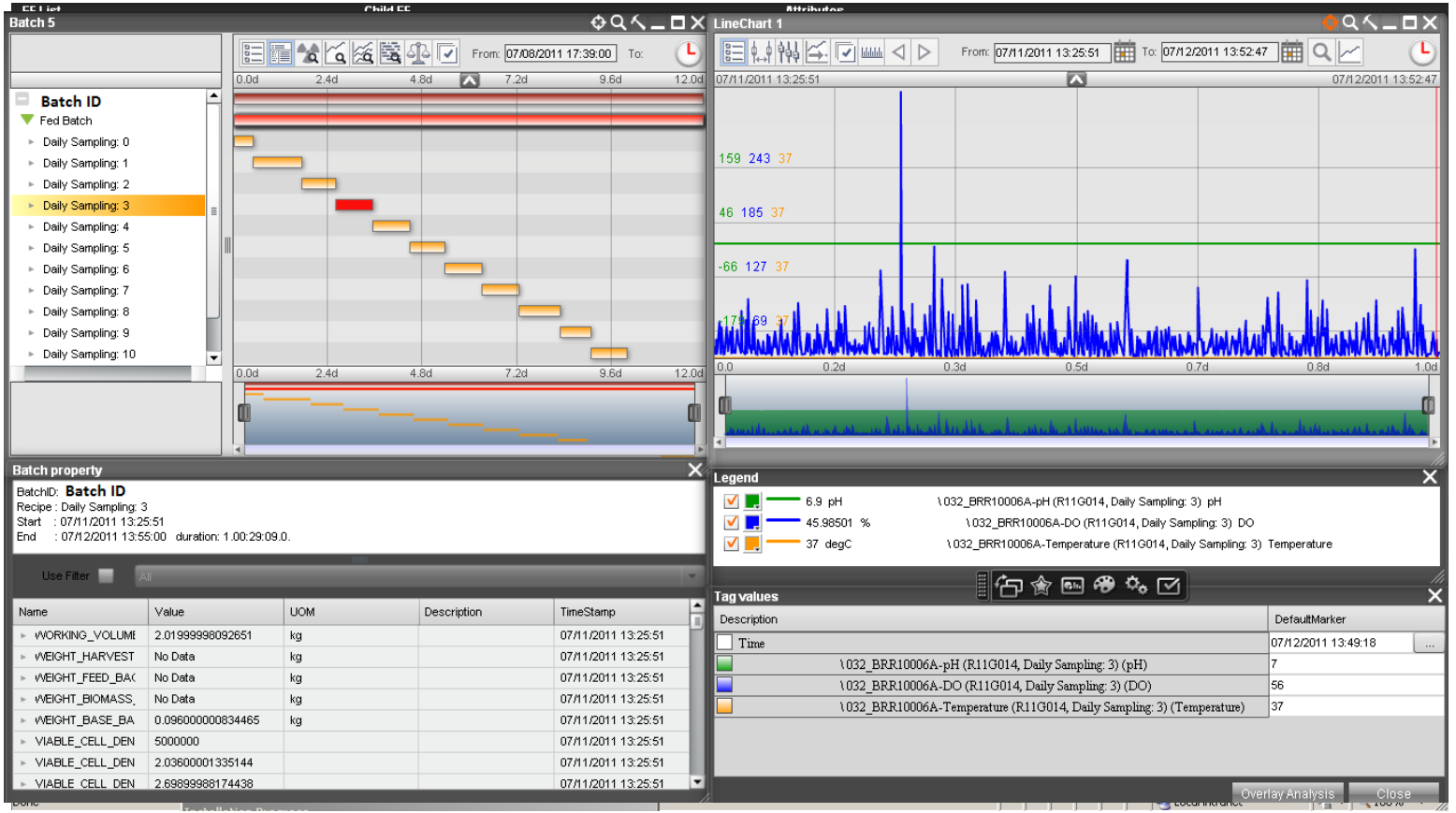
Visualization



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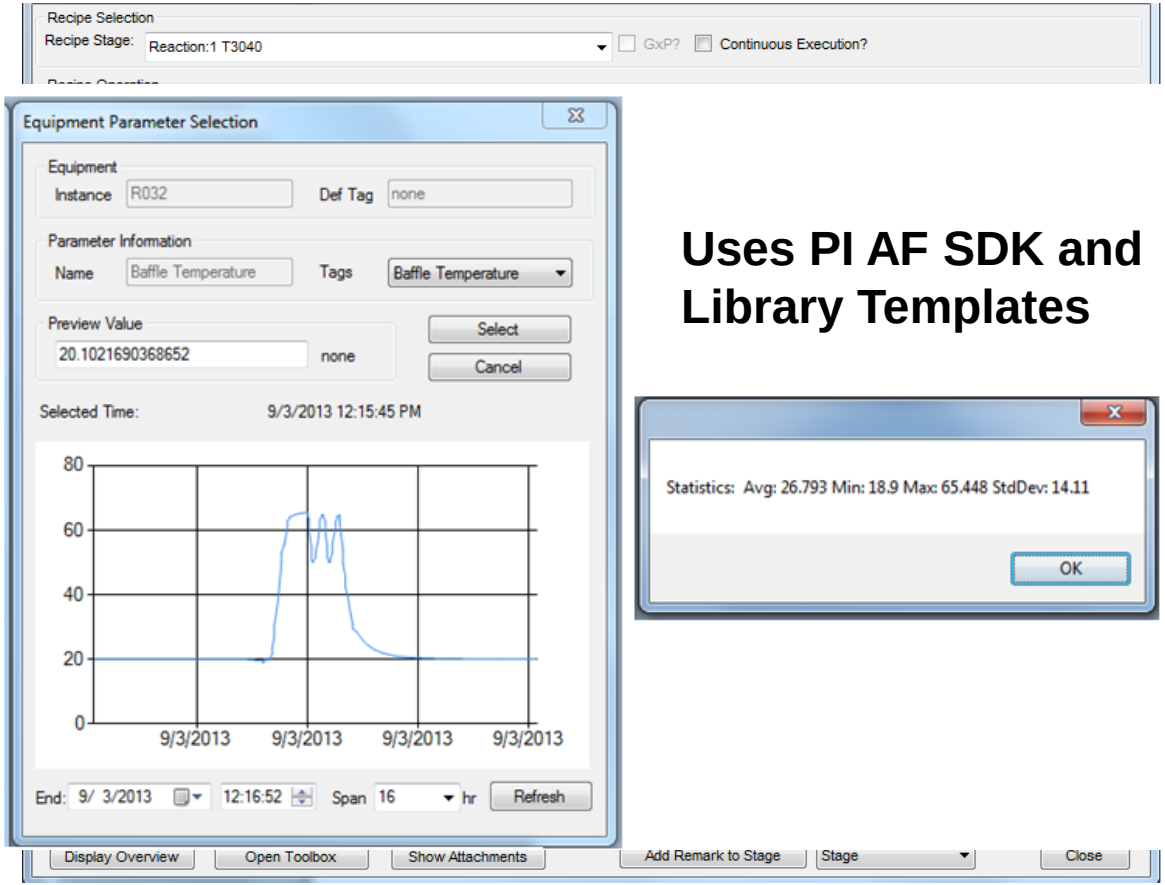
Accessing real-time PI System Data during ELN Execution



Uses PI AF SDK and Library Templates

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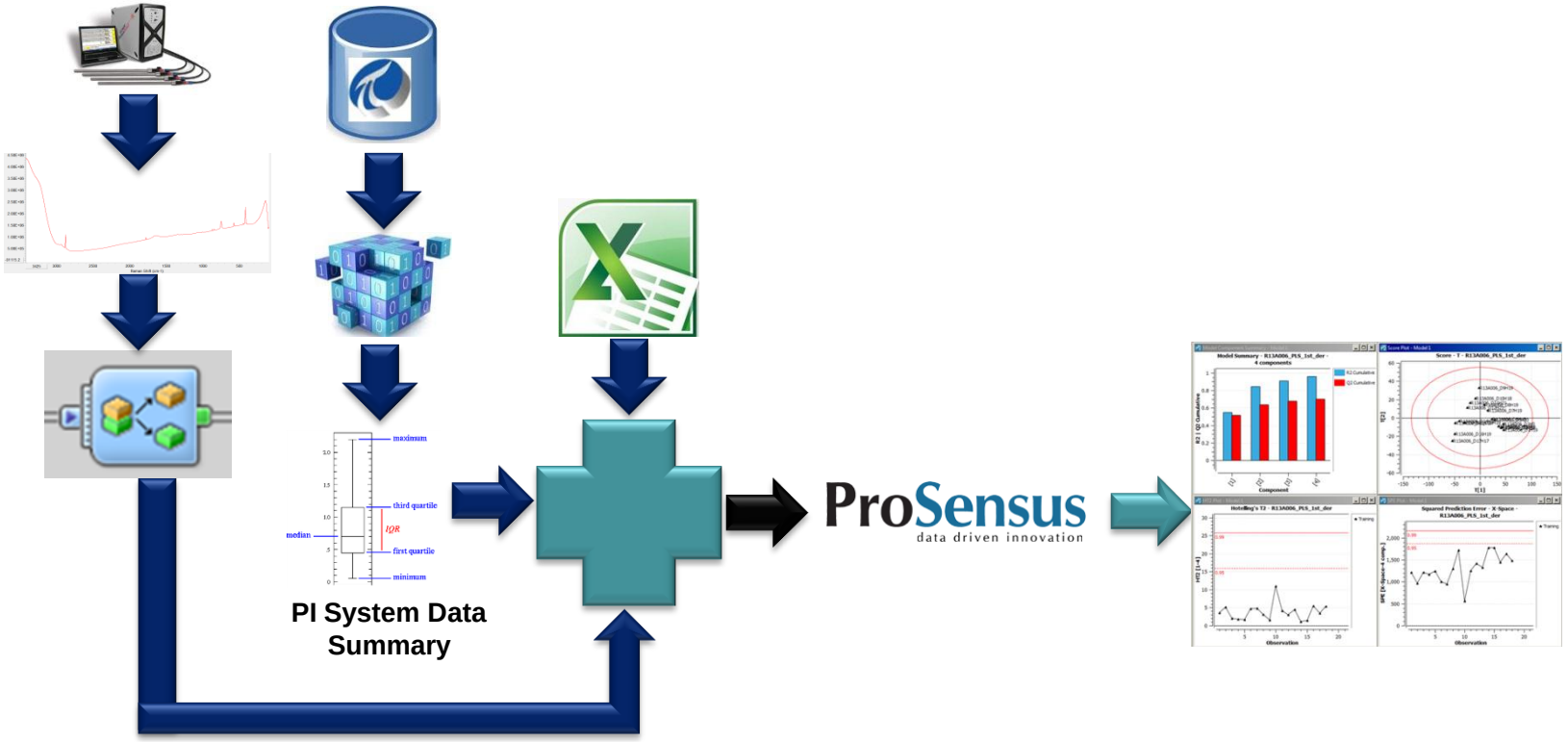
Exporting PI System Data Summary – Today



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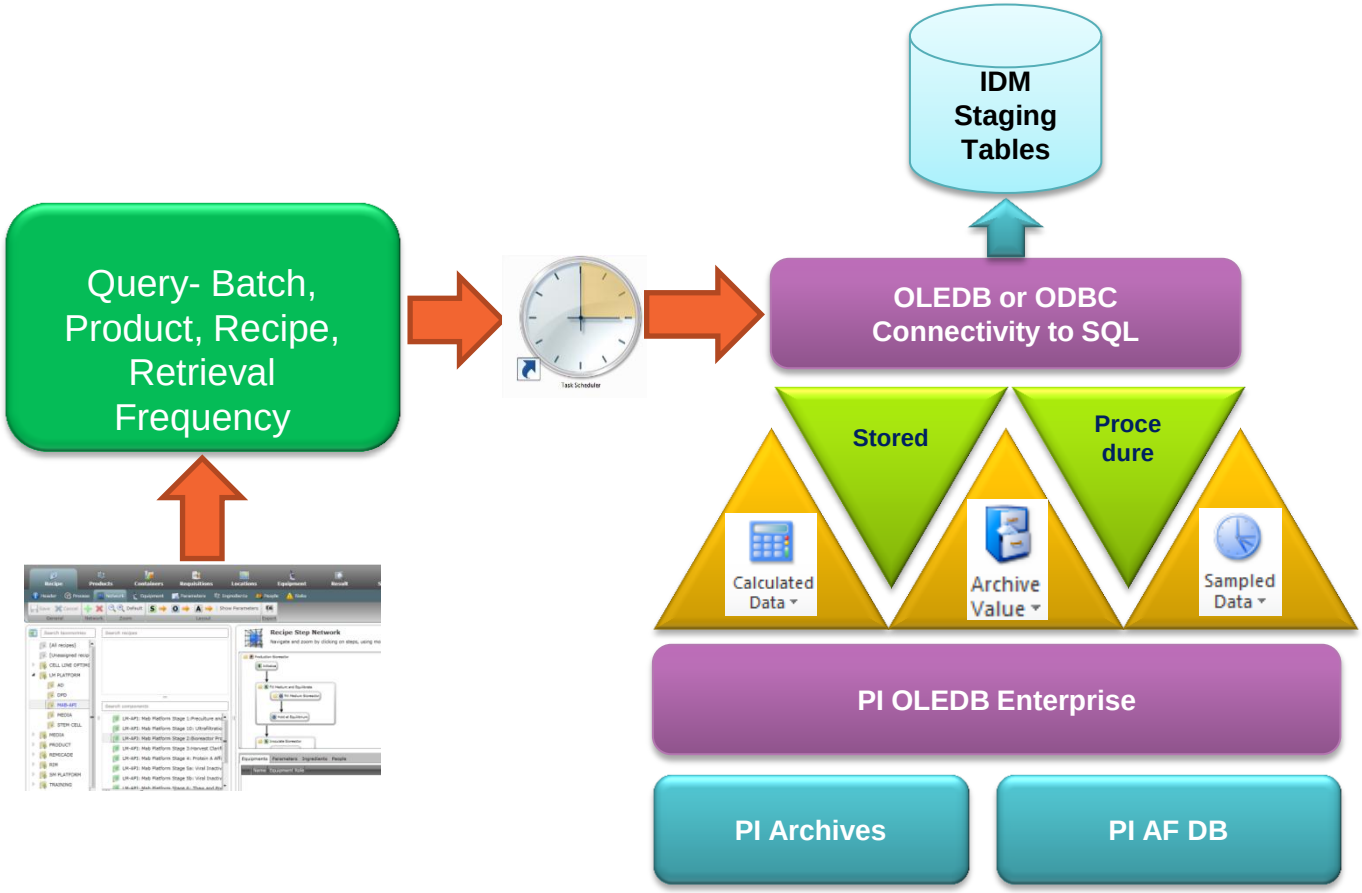
Accessing PI System Summary – Future



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Challenges

- Data Quality – Especially manual data entries
- Missing Information
  - New approach record (almost) EVERYTHING in PI that makes sense
- Batch context alignment for legacy data
  - Aligning as-is context to platform context
- Need more Flexibility & configurable settings in PI AF & PI EF
  - Using PI ACE today
- Need Improvements to PI EF Interface Generator for complex start and end trigger definitions
- Need PI ACE access in PI EF Interface Generator
- Need parent-child relationships in PI AF and PI EF Templates configuration

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Next Steps

- PI AF configuration for all equipment and instruments in Janssen
  - Corporate Unit Class Definitions
  - Pre-Requisite for all systems to reference these classes (ELN, MES)
- PI EF prototype effort and rollout plan to implement across all platforms
  - Context transformation – AS-IS to Platform
  - PI EF Context becomes the MASTER Context for Data References
- Fix data source layer and address data quality issues
  - lack of controls for data (pH = 7.023 or 70.23?)
- Continue working with OSIsoft and other strategic partners to get more COTS features & modules

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