Getting DDC Data Into PI

Using it for FDD & EA Modeling

©2019 OSIsoft, LLC

Presenters

- Derek Drayer
- President
- RoviSys Building Technologies
- ddd@rovisysbt.com

- Craig Stevenson
- President
- Auros Group
- Craig.Stevenson@aurosgroup.com

©2019 OSIsoft, LLC

FDD Overview

©2019 OSIsoft, LLC

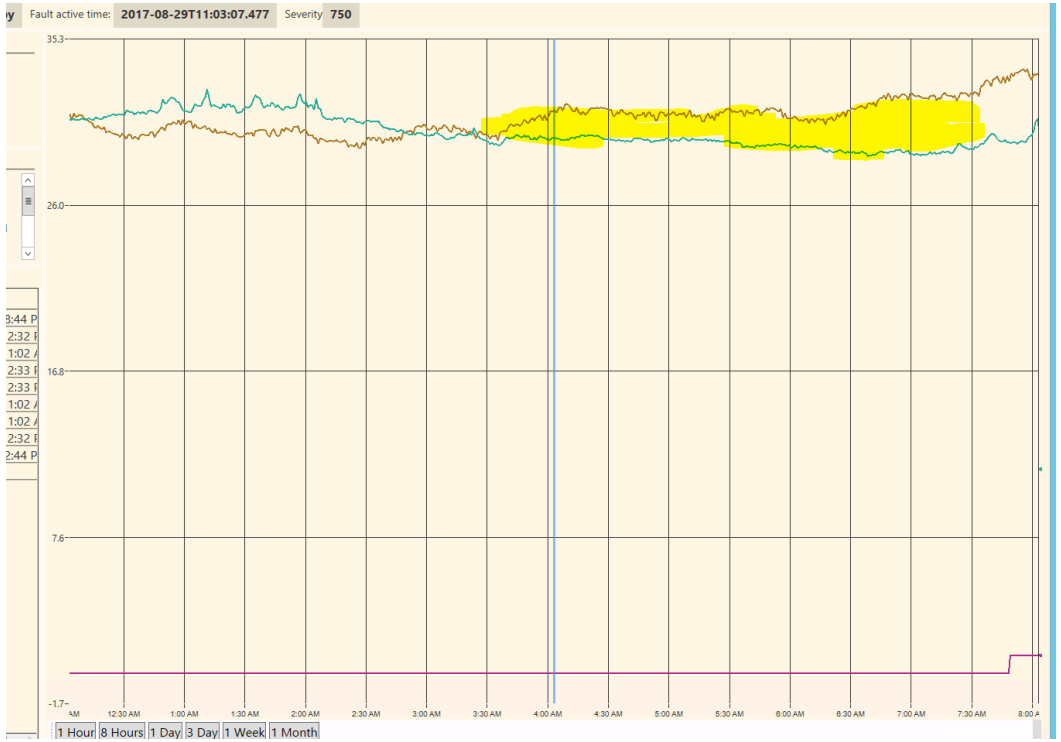
Fault #3 – AS35 Economizer Enthalpy

Observations:

1. Many Faults occur for short times

Analysis:

1. Need Dust Storm Override bit!



©2019 OSIsoft, LLC

Fault Detection & Diagnostics (FDD)

- What is FDD?
- Examples in PI
- How it can benefit you?

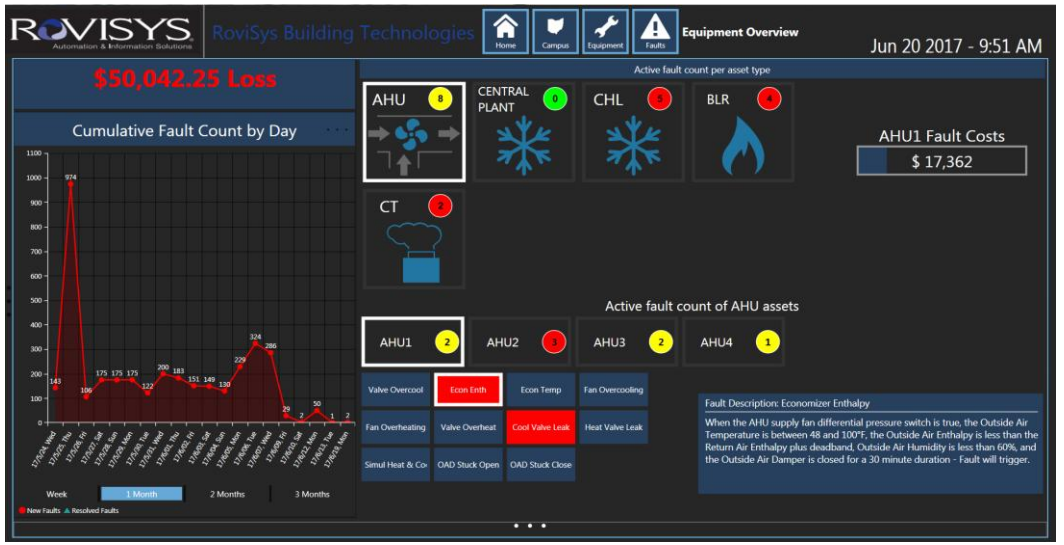
©2019 OSIsoft, LLC

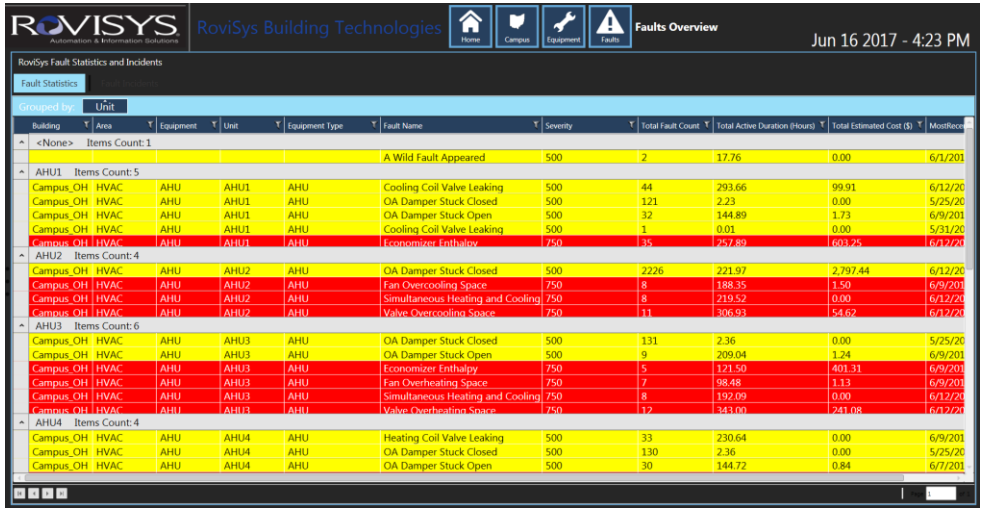
FDD Allows Continuous Cx

Analytics software that monitors actual **equipment performance**:

- Uses multivariable historical, realtime and static design data
- Evaluates the data using rules to identify equipment and process faults
- Monetizes the cost of active faults
- Guides the user in diagnosing the root problem

Continuous Commissioning: tuning, adjusting and fixing issues when they start to erode system performance rather than waiting for failure.





Retro vs. Continuous Commissioning

Building Efficiency (%)

100
95
90
85
80
75
70
65
60

Efficiency Loss with Retro Commissioning

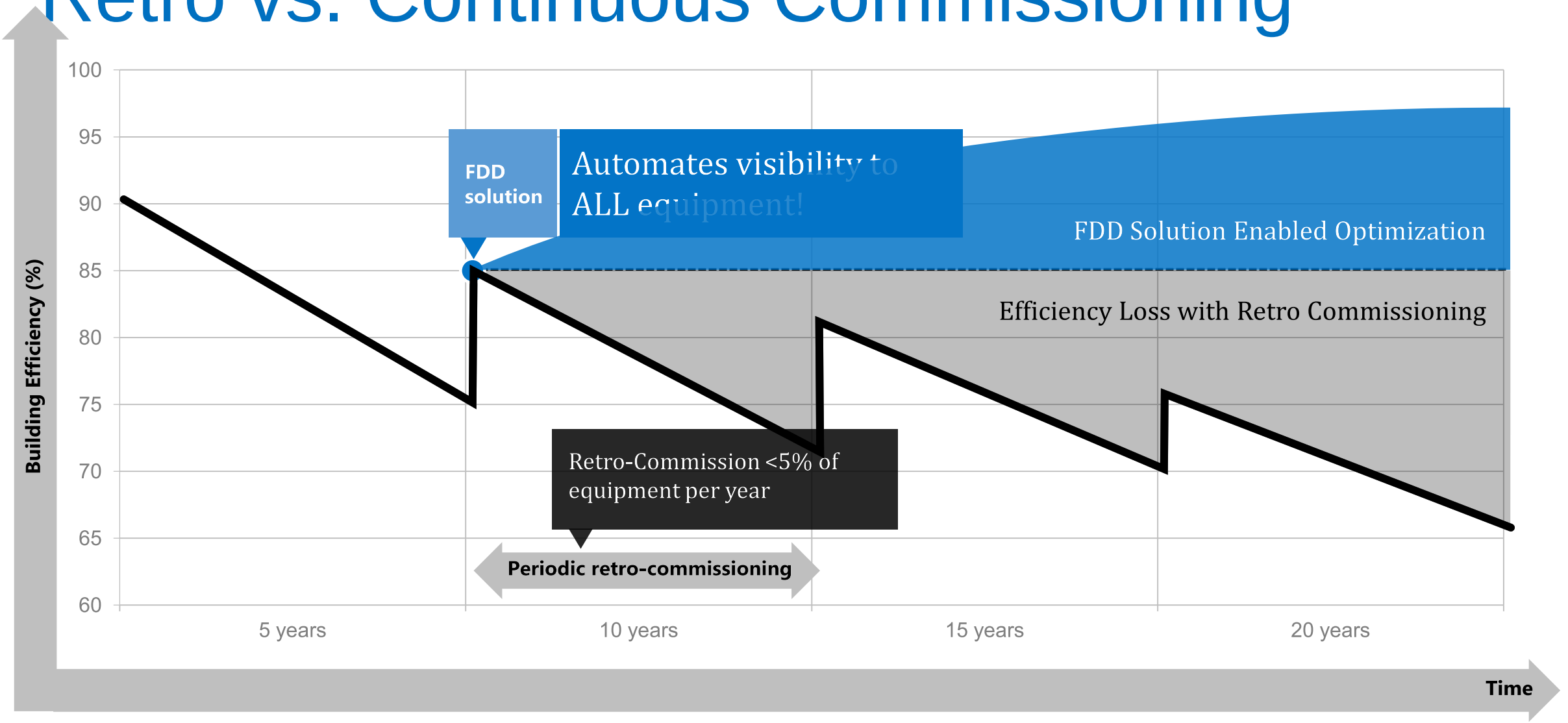
Periodic retro-commissioning

5 years
10 years
15 years
20 years

Time

©2019 OSIsoft, LLC

Retro vs. Continuous Commissioning

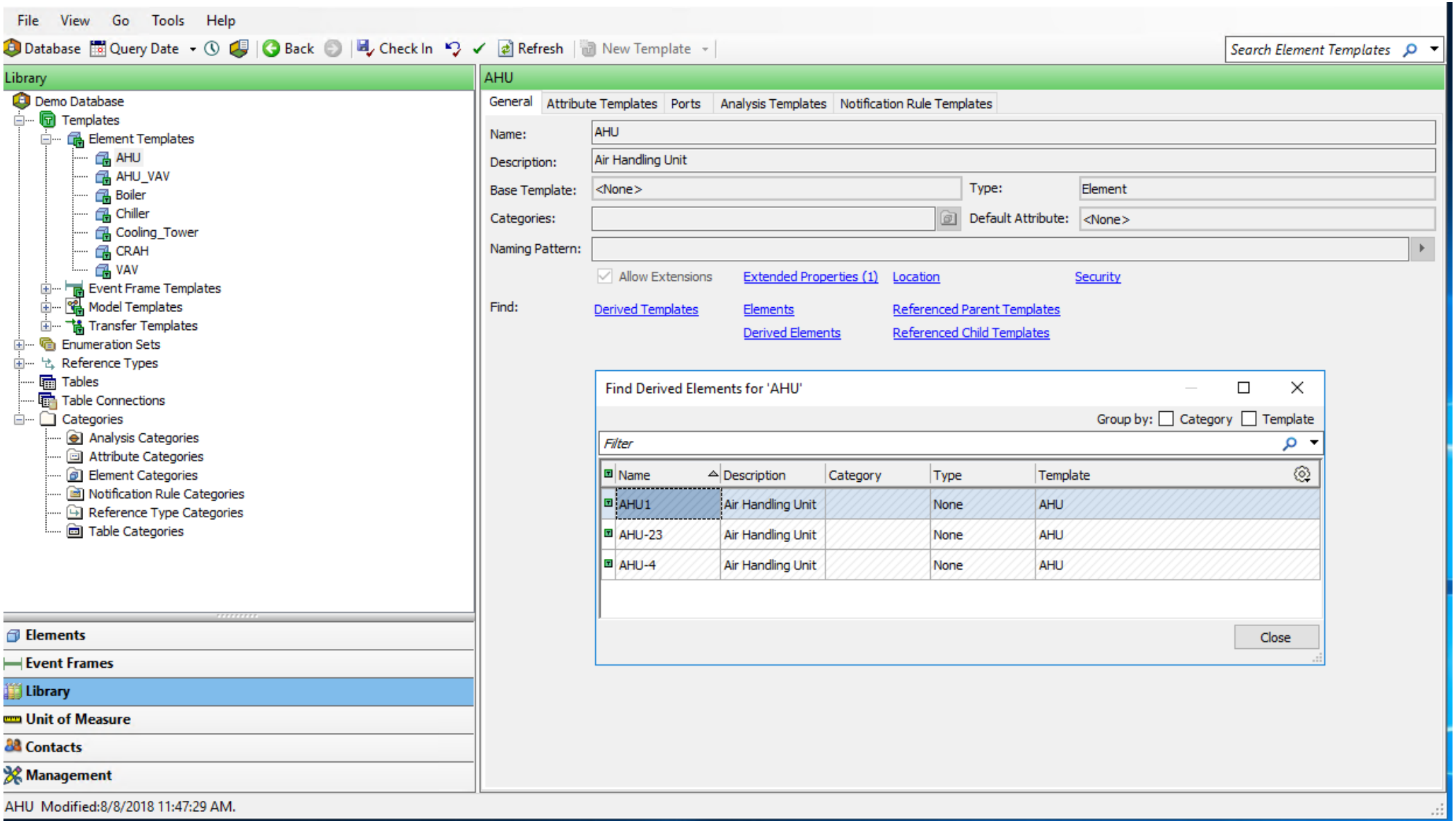


©2019 OSIsoft, LLC

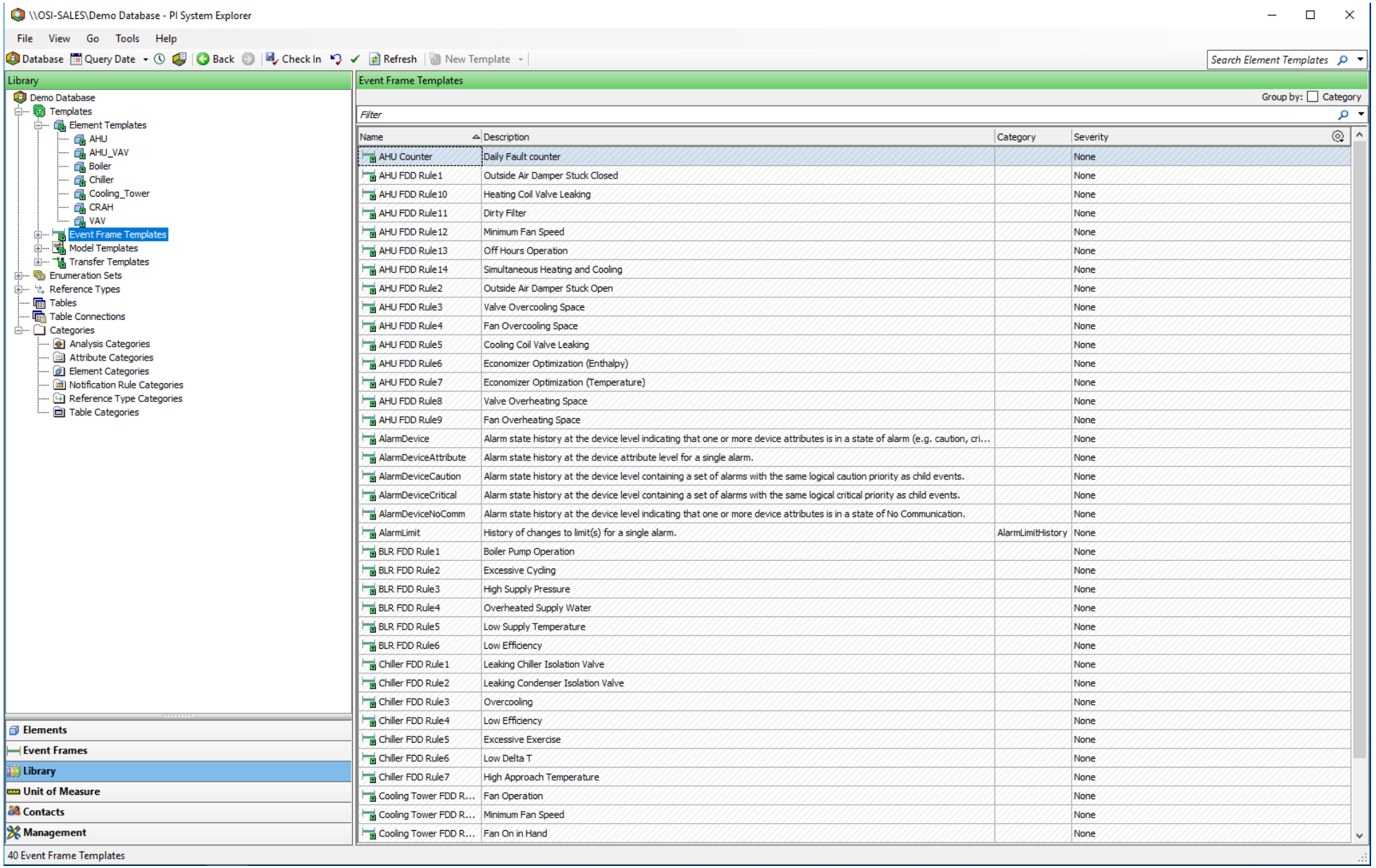
FDD – The Rules

- NISTIR 6964
  - Faults pertaining to AHUs & Terminal Units
- ASHRAE-D-7190
  - Expert Rules Set for Fault Detection in AHUs
- Our/Your own Custom Rules

©2019 OSIsoft, LLC



©2019 OSIsoft, LLC



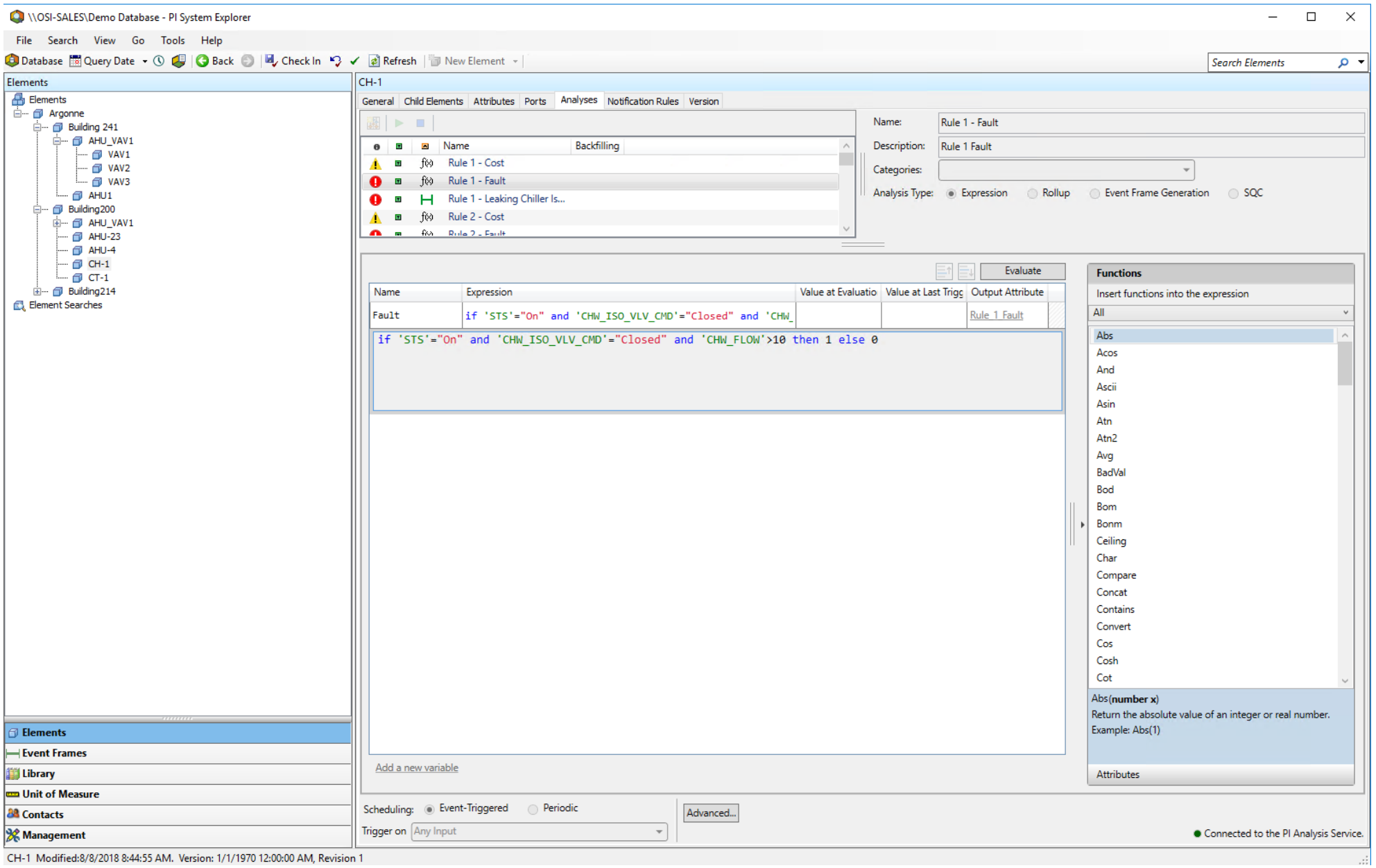
©2019 OSIsoft, LLC

Why This Matters

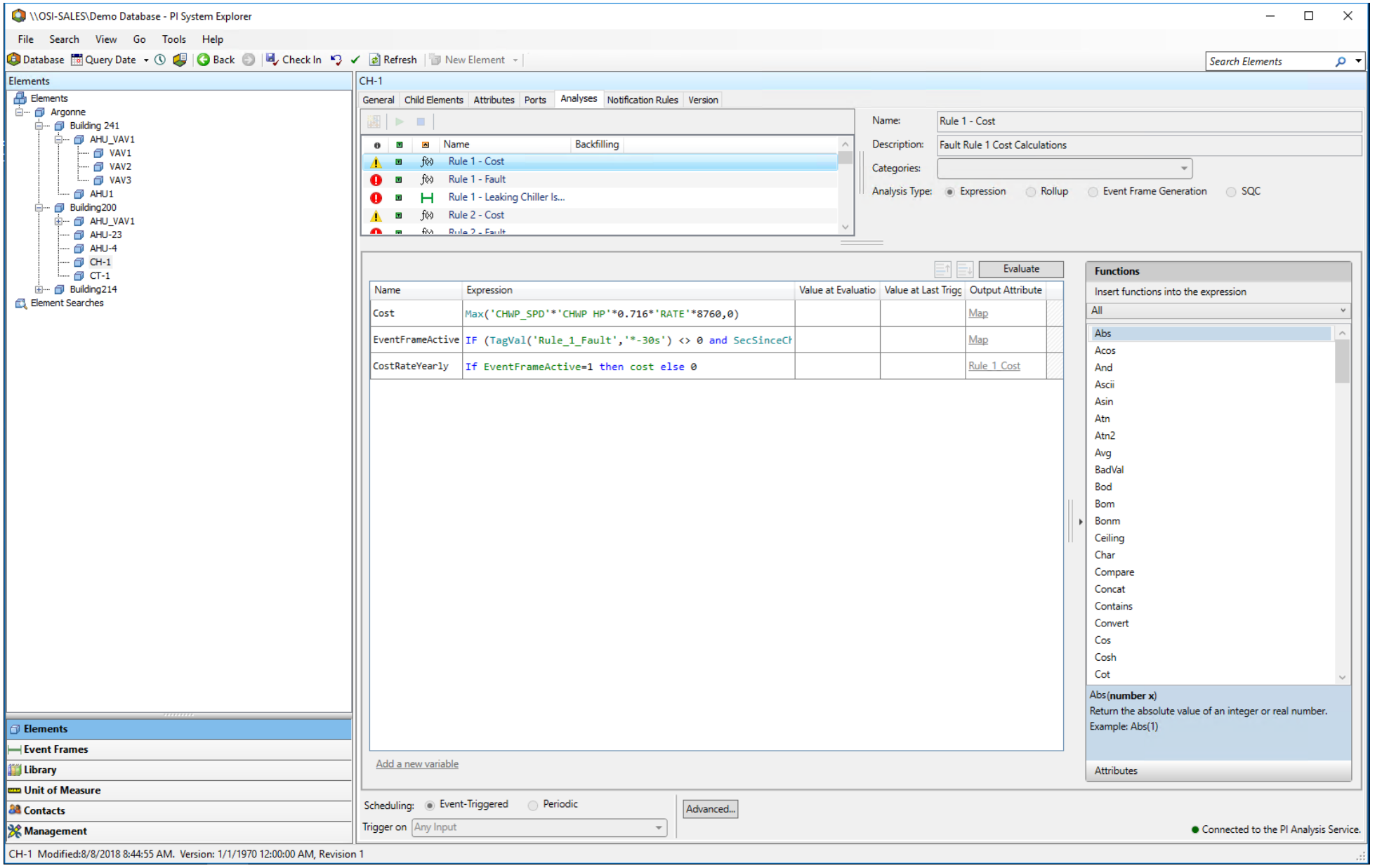
Acknowledged Faults

Equipment	Fault	Most Recent Ack Time	ACK Fault Count	ACK Total Duration (hr)	ACK Fault Cost	ACK Fault Cost per hr	Most Recent Comment
CHL4	Chiller Overcooling	10/25/2017 12:35	99	16.85	$59.60	$5.48	N/A
CHL4	Low Efficiency	10/25/2017 12:34	2	0.25	$0.11	$0.85	N/A
AS19	Cooling Coil Valve Leaking	10/18/2017 19:57	7512	1411.33	$13,302.32	$26.70	N/A
AS19	Economizer Enthalpy	10/18/2017 19:57	6540	6812.2	$35,032.71	$13.07	N/A
AS19	OA Damper Stuck Open	10/18/2017 19:56	2590	2797.78	$734.97	$3.56	N/A
AS16	Cooling Coil Valve Leaking	10/18/2017 18:08	65492	36795.09	$521,443.64	$52.85	N/A
AS46	OA Damper Stuck Open	10/12/2017 18:02	78	41.01	$3.60	$1.24	N/A
AS46	Economizer Enthalpy	10/12/2017 18:02	1515	7114.53	$160,339.28	$79.54	valve commanded close by hmi button
AS46	OA Damper Stuck Closed	10/12/2017 18:02	1968	6005.47	$0.00	$0.00	N/A
AS43	Cooling Coil Valve Leaking	10/12/2017 18:01	30	0.09	$0.41	$7.28	N/A
AS43	Economizer Enthalpy	10/12/2017 18:01	2853	10059.81	$64,374.89	$46.94	N/A
AS43	OA Damper Stuck Closed	10/12/2017 18:01	230	74.07	$0.00	$0.00	N/A
AS41	OA Damper Stuck Open	10/12/2017 18:00	888	2095.77	$1,076.61	$2.73	N/A
AS41	Economizer Enthalpy	10/12/2017 18:00	210	330.13	$840.92	$11.15	N/A
AS41	OA Damper Stuck Closed	10/12/2017 18:00	16	1.73	$0.00	$0.00	N/A
AS40	Economizer Enthalpy	10/12/2017 18:00	22	31.31	$274.04	$19.53	N/A
AS39	OA Damper Stuck Closed	10/12/2017 17:59	108	97.73	$0.00	$0.00	N/A
AS39	Economizer Enthalpy	10/12/2017 17:59	1746	1693.47	$1,860.39	$3.77	N/A
AS39	OA Damper Stuck Open	10/12/2017 17:59	1111	1208.31	$193.78	$1.20	N/A
AS38	Economizer Enthalpy	10/12/2017 17:59	120	216.97	$191.16	$2.98	N/A
AS36	Economizer Enthalpy	10/12/2017 17:58	256	452.8	$3,583.59	$25.83	N/A
AS36	OA Damper Stuck Closed	10/12/2017 17:58	234	57.84	$0.00	$0.00	N/A
AS35	Economizer Enthalpy	10/12/2017 17:58	1316	6429.14	$124,078.14	$67.78	N/A
AS35	OA Damper Stuck Closed	10/12/2017 17:58	310	53.71	$0.00	$0.00	N/A

©2019 OSIsoft, LLC

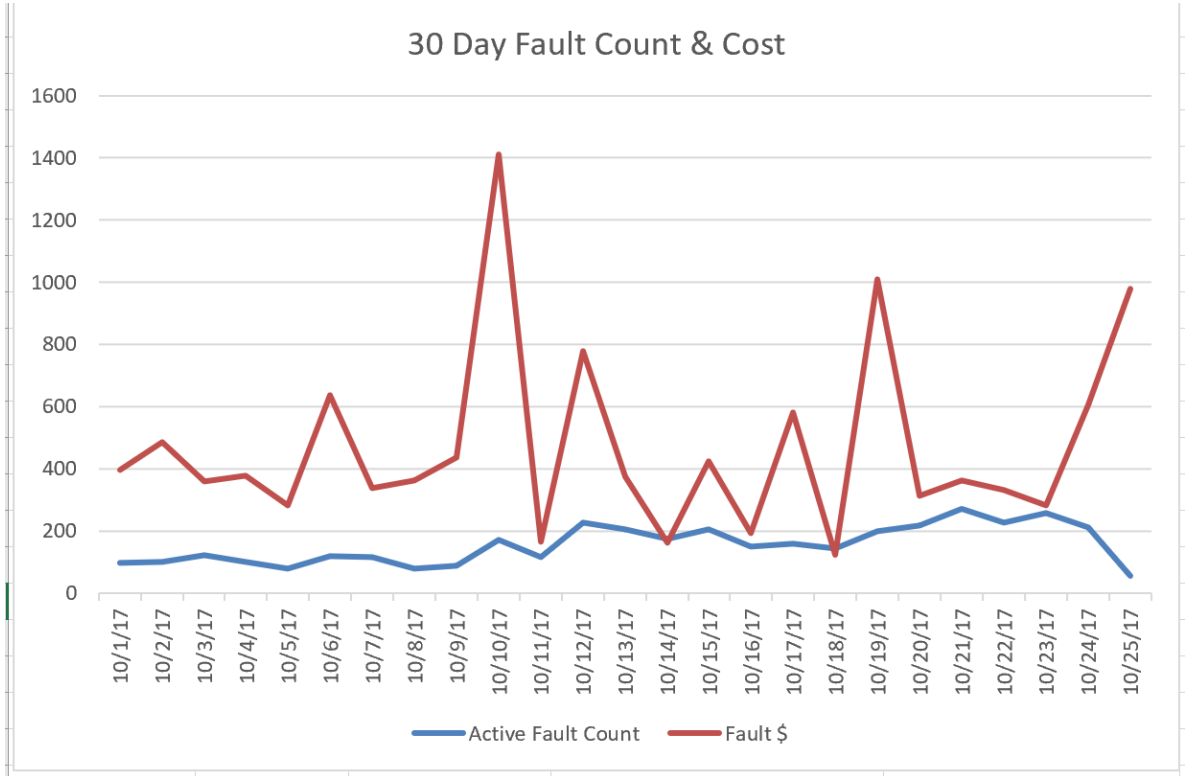


©2019 OSIsoft, LLC



©2019 OSIsoft, LLC

Prioritize What You Pay Attention To

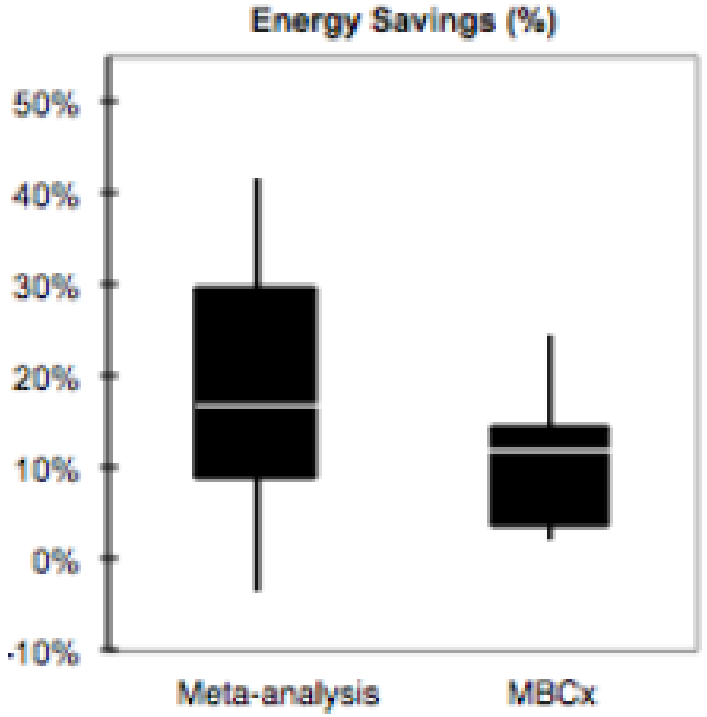


Aggregates			
Avg faults/day	80	$73,445	Total Fault Cost
Days active	221		

©2019 OSIsoft, LLC

Berkeley Lab Study of 154 Buildings

- Half of commercial lab buildings waste 16% - 30% of total energy consumed
- Waste increases with the size and complexity of the facility
- Median cost $.46/sqft per year = $46,000/yr wasted for a 100,000 sqft facility

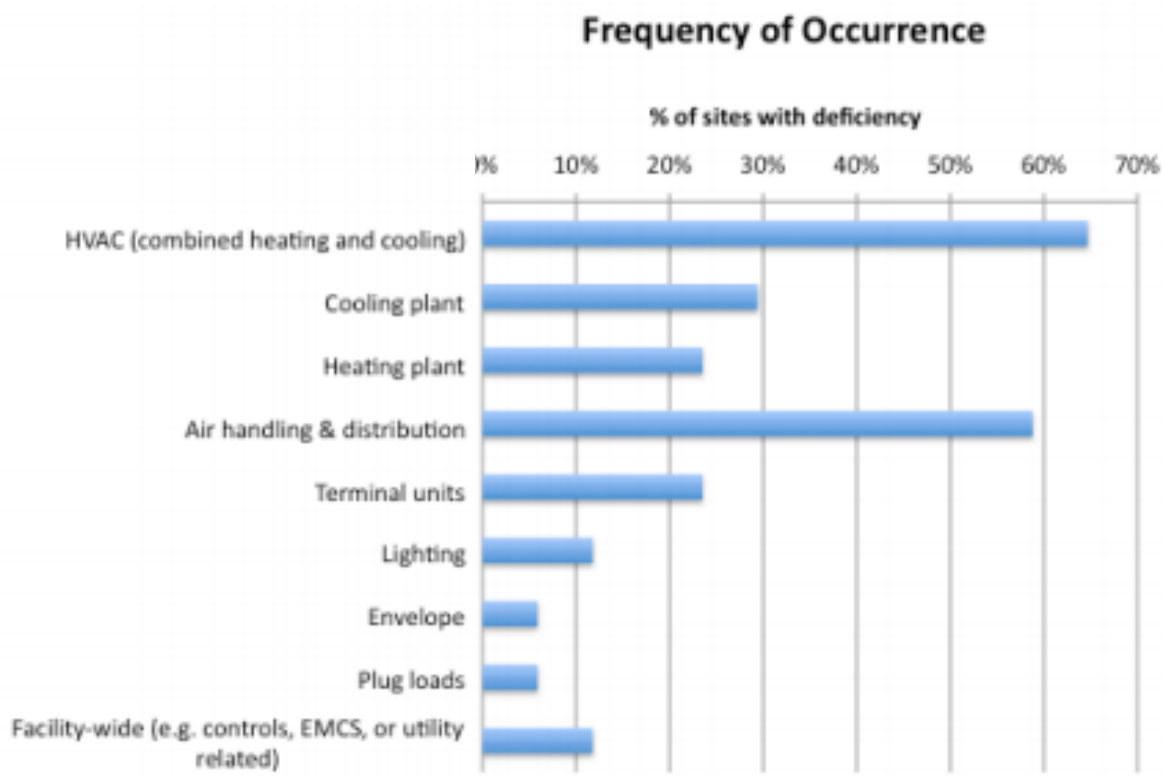


Evan Mills, Paul A Mathew (2012) *Monitoring-based Commissioning: Benchmarking Analysis of 24 University, Buildings in California*

©2019 OSIsoft, LLC

Berkeley Lab Study of 154 Buildings

- 98% of issues are easy fixes:
  - 2% Design or Installation Deficiencies
  - 56% Controls & Operations Errors
  - 42% Overlooked Maintenance
- 1.9 yr simple payback to correct issues with monitoring based continuous commissioning

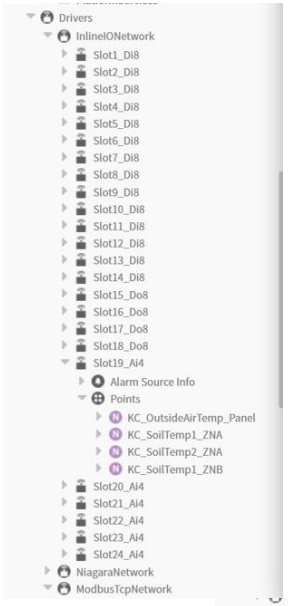


Evan Mills, Paul A Mathew (2012) *Monitoring-based Commissioning: Benchmarking Analysis of 24 University, Buildings in California*

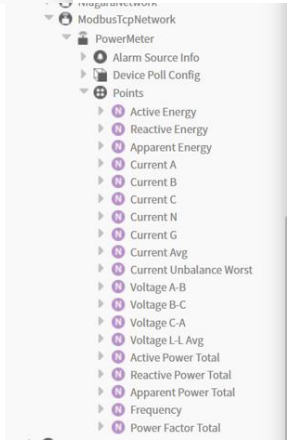
RoviSys Building Technologies 2017 Confidential

©2019 OSIsoft, LLC

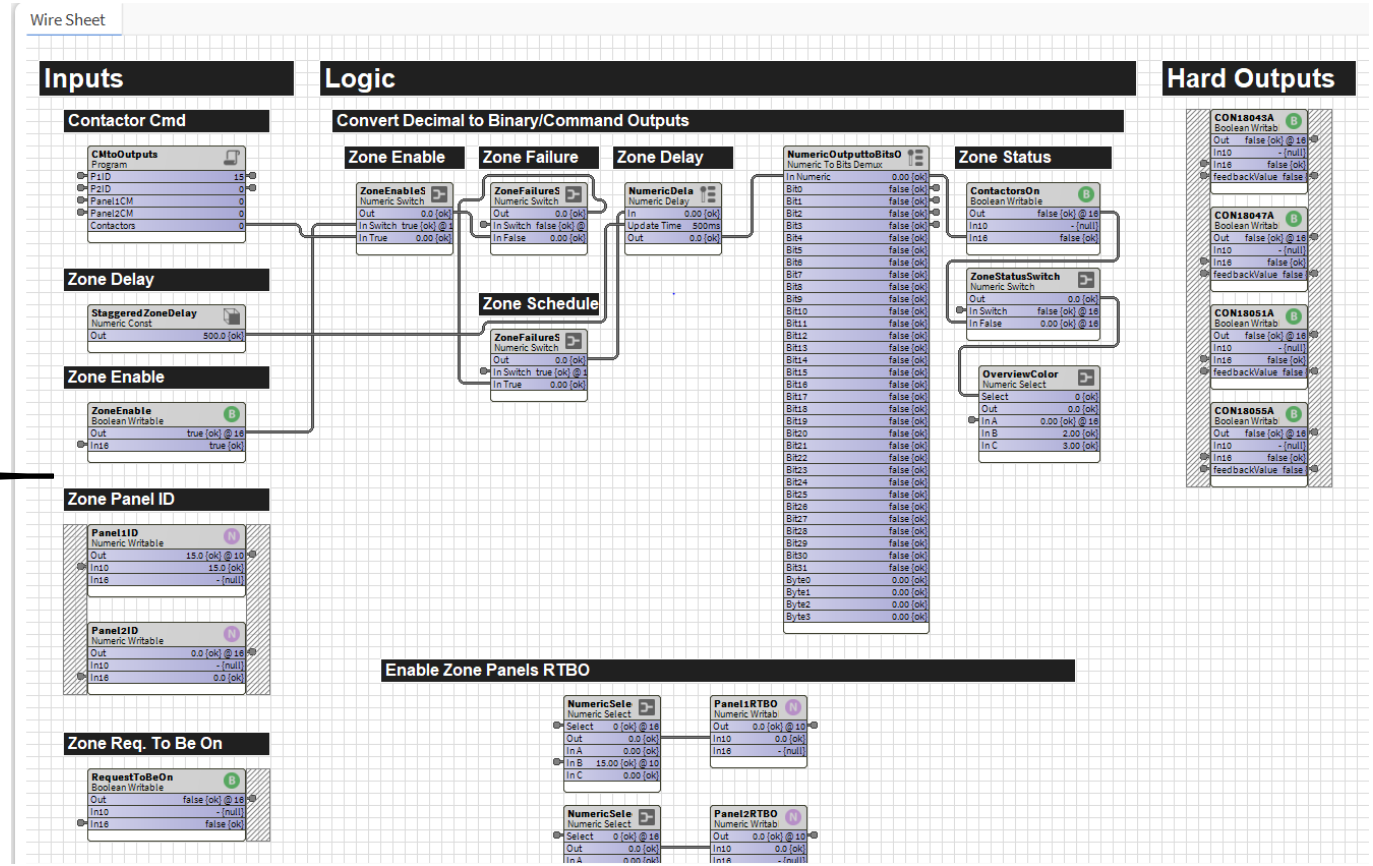
Direct Digital Control (DDC) Systems



Hard-wired I/O



ModBus (and other) “softcomms” I/O

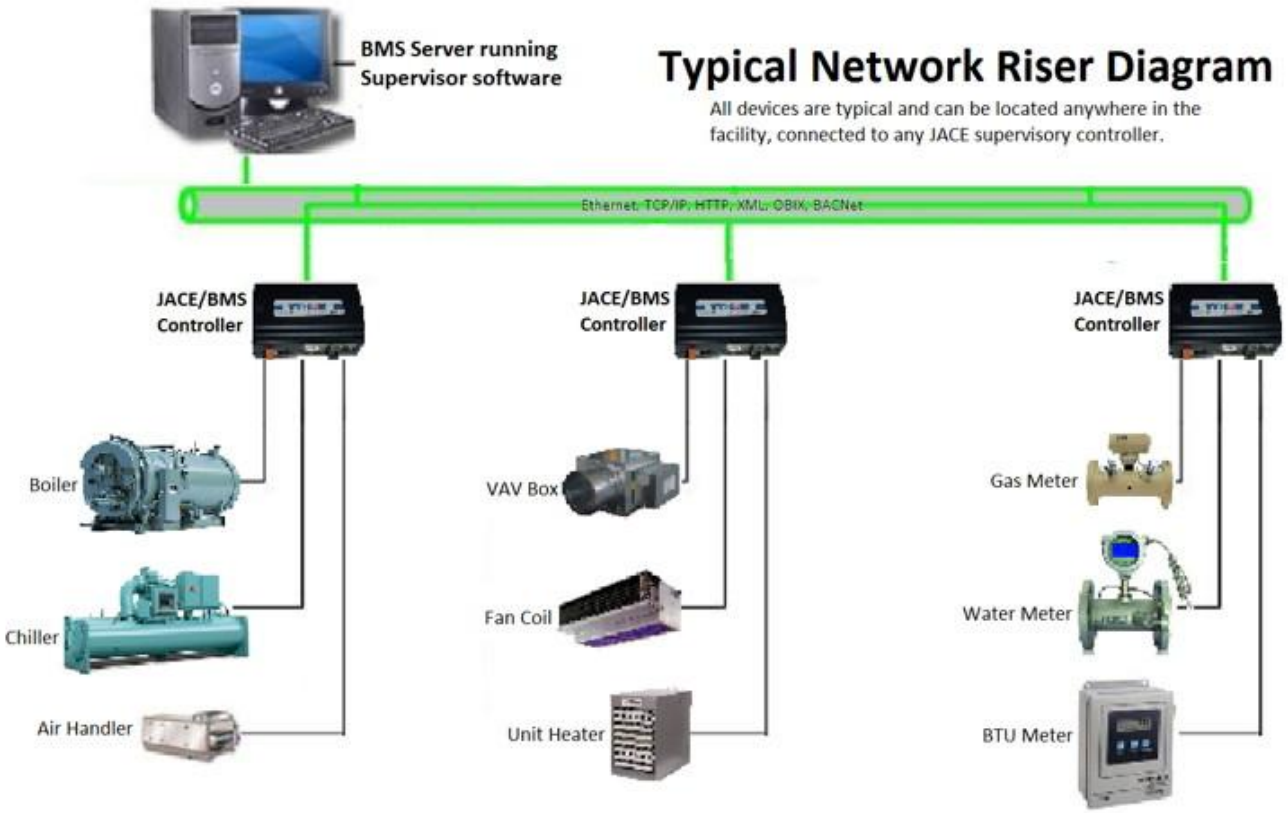


Direct Digital Control (DDC) Systems

©2019 OSIsoft, LLC

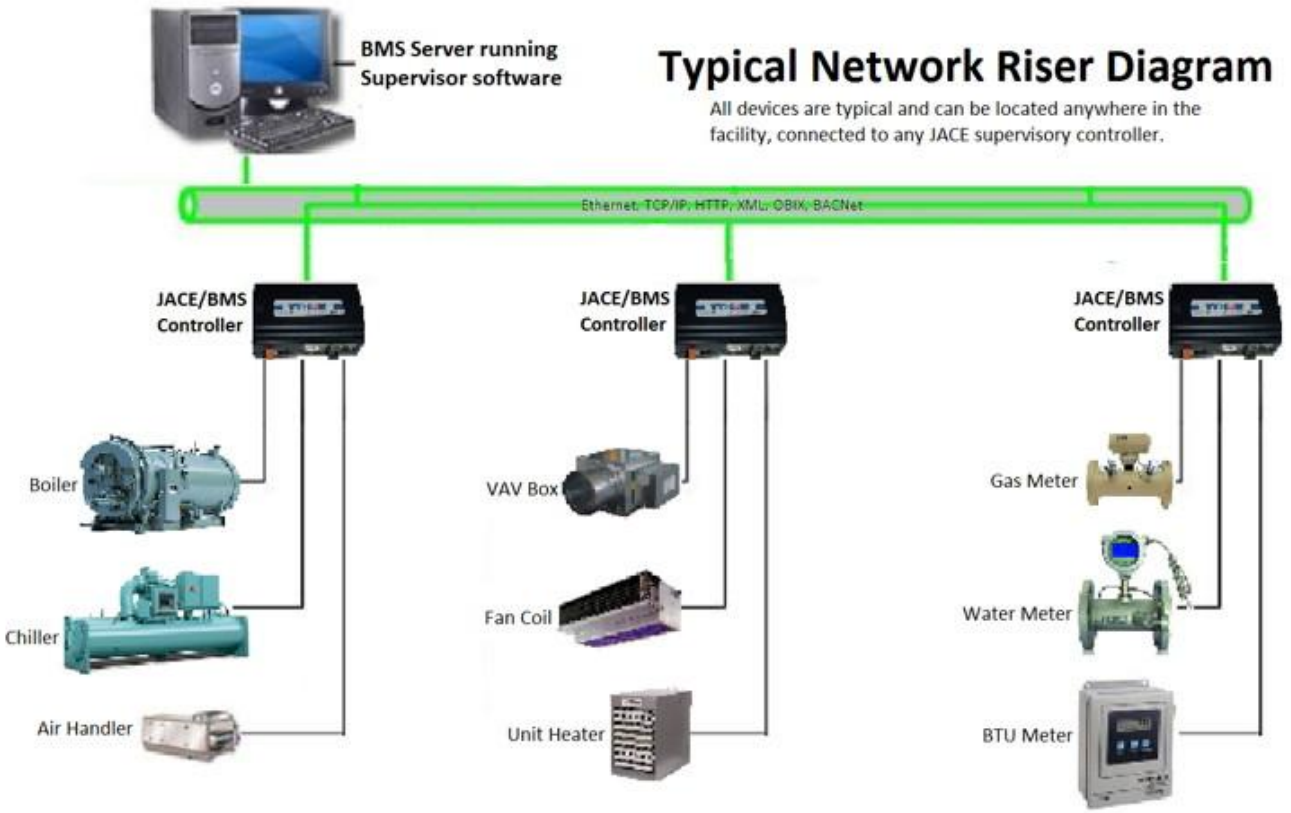
DDC HVAC Control & WAGES Monitoring

- Examples of DDC systems
  - Open Protocol
    - Johnson Controls
    - Siemens
    - Alerton
    - Automated Logic
  - Open Integration
    - Tridium
    - Distech
    - Phoenix Contact



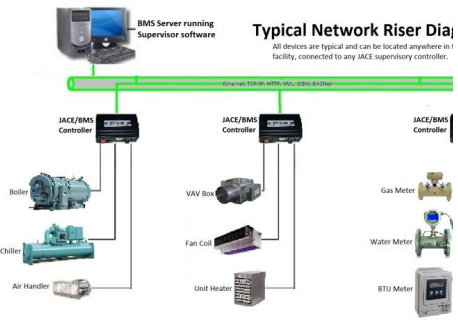
©2019 OSIsoft, LLC

DDC HVAC Control & WAGES Monitoring



©2019 OSIsoft, LLC

DDC Data Into PI



PI INTERFACES & PI CONNECTORS

Notifications

Event Frames

Asset Analytics

Asset Framework

Data Archive

PI SERVER

CLOUD SERVICES

PI Cloud Connect

PI INTEGRATORS

ArcGIS

Azure

Business Analytics

SAP HANA

VISUALIZATION

PI Vision

PI DataLink

PI Manual Logger

PI ProcessBook

PI WebParts

PI SYSTEM ACCESS

Custom applications
Business systems

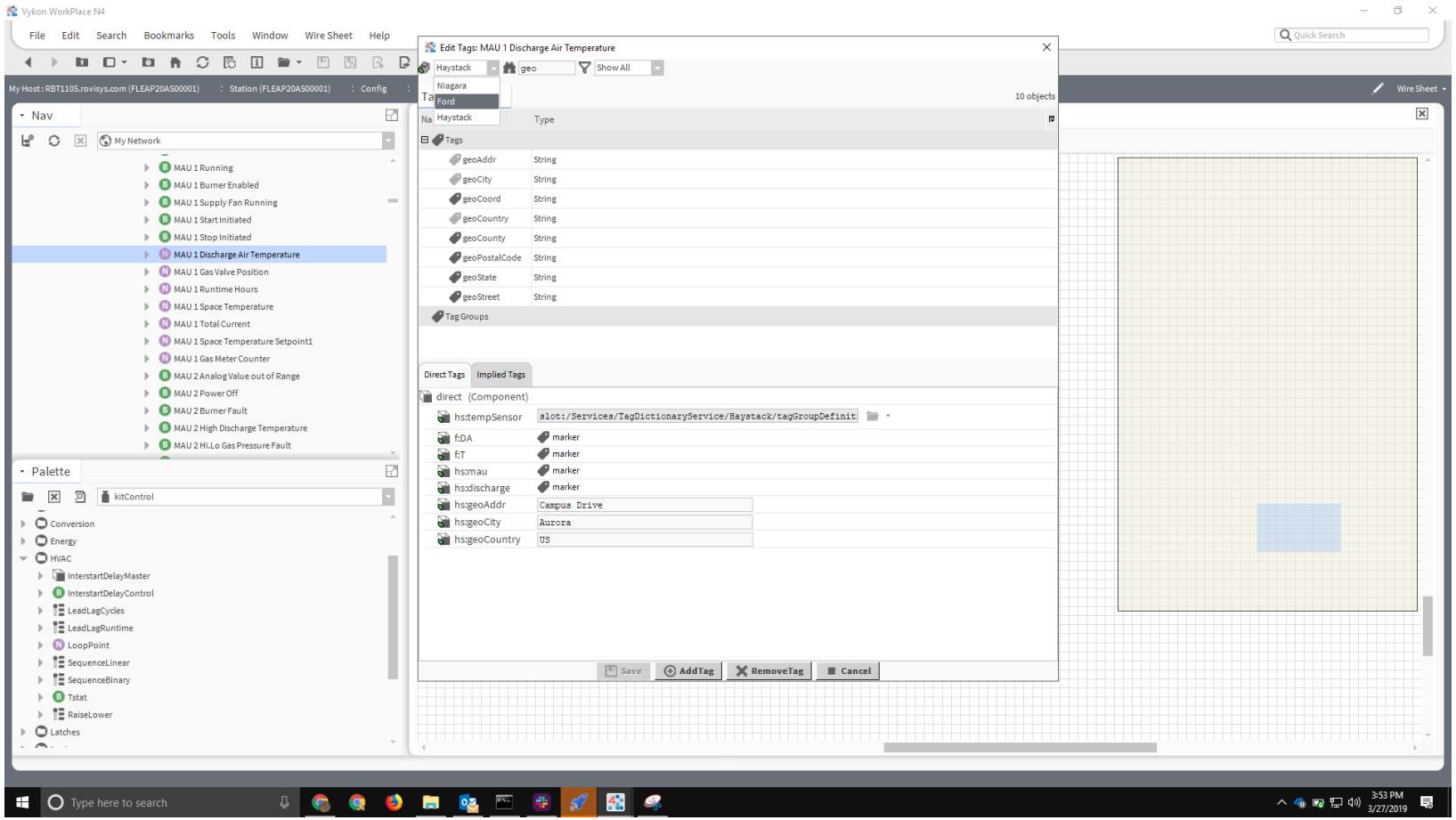
©2019 OSIsoft, LLC

Tridium Niagara → OSIsoft PI Connector

- Automatically build PI-AF hierarchy
- Poll all device meta-data, values, and hierarchies from Niagara
- Write data from PI → Niagara

©2019 OSIsoft, LLC

#Tagging



©2019 OSIsoft, LLC

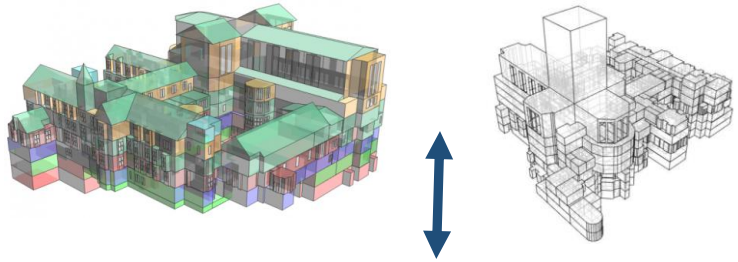
Building Performance Against Target/Design

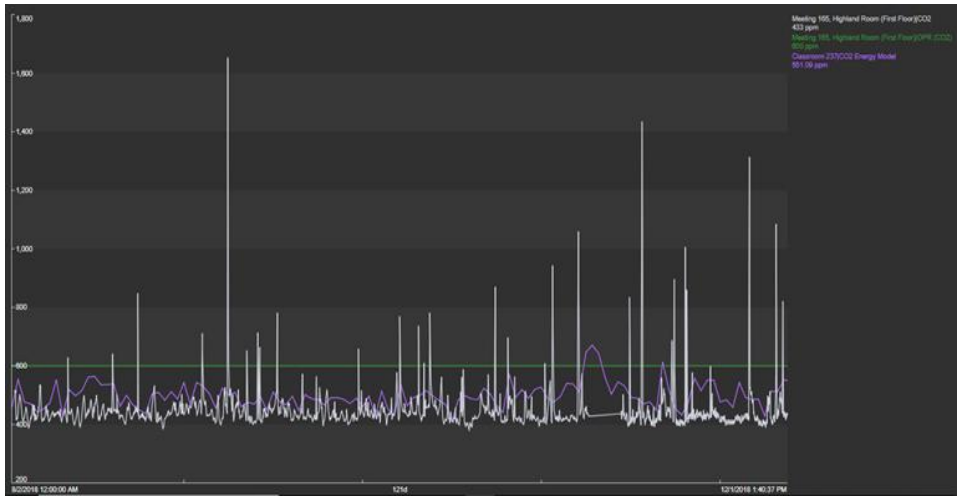
©2019 OSIsoft, LLC

AUROS360™ TECHNOLOGY SOLUTION

EVIDENCE-BASED PERFORMANCE

DIGITAL SIMULATION





Monitoring-based Commissioning & Interrogation-based Commissioning

BUILDING PERFORMANCE

Smart Building Infrastructure
Data Source

Primary Source Digital Utility Meters

BAS-BMS Integration

Indoor Air Quality Sensors

Outdoor Climate Station and Weather Station

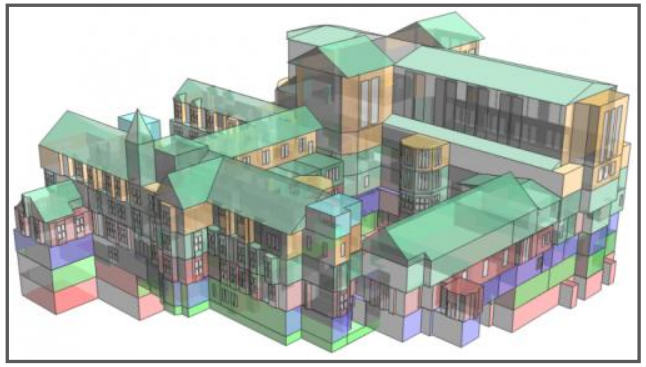
Niagara N4, JACE 8000 Controller

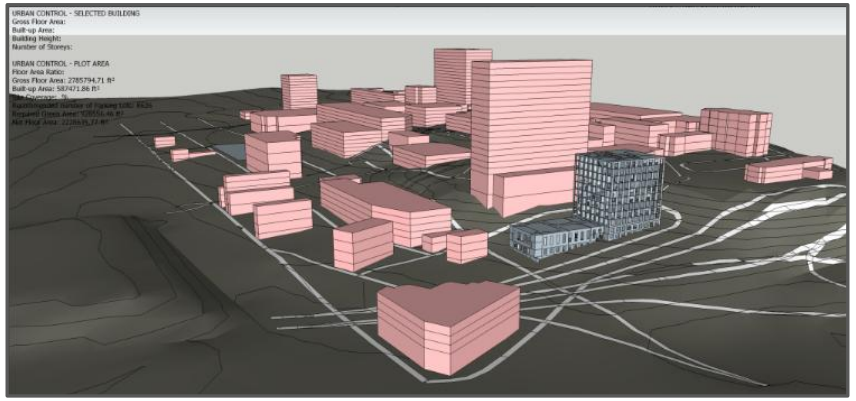
CLOSING PERFORMANCE GAPS DURING OPERATIONS

AUROS360 Data Flow Diagram

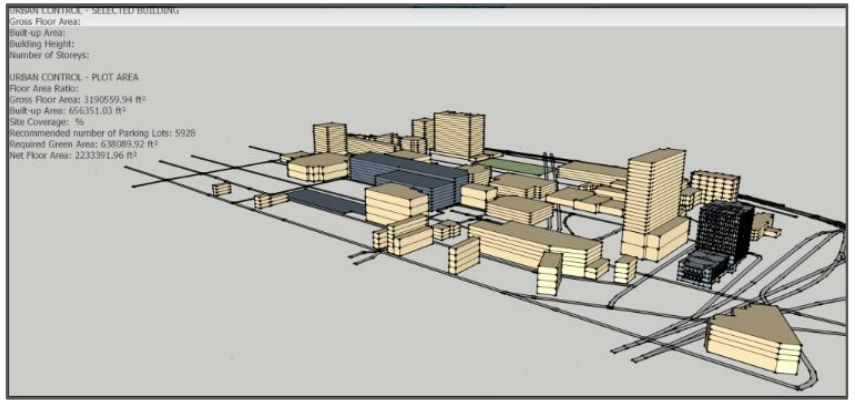
©2019 OSIsoft, LLC

CONNECTING DESIGN TO OPERATIONS





Single Buildings, Groups of Buildings, and Groups of Campuses

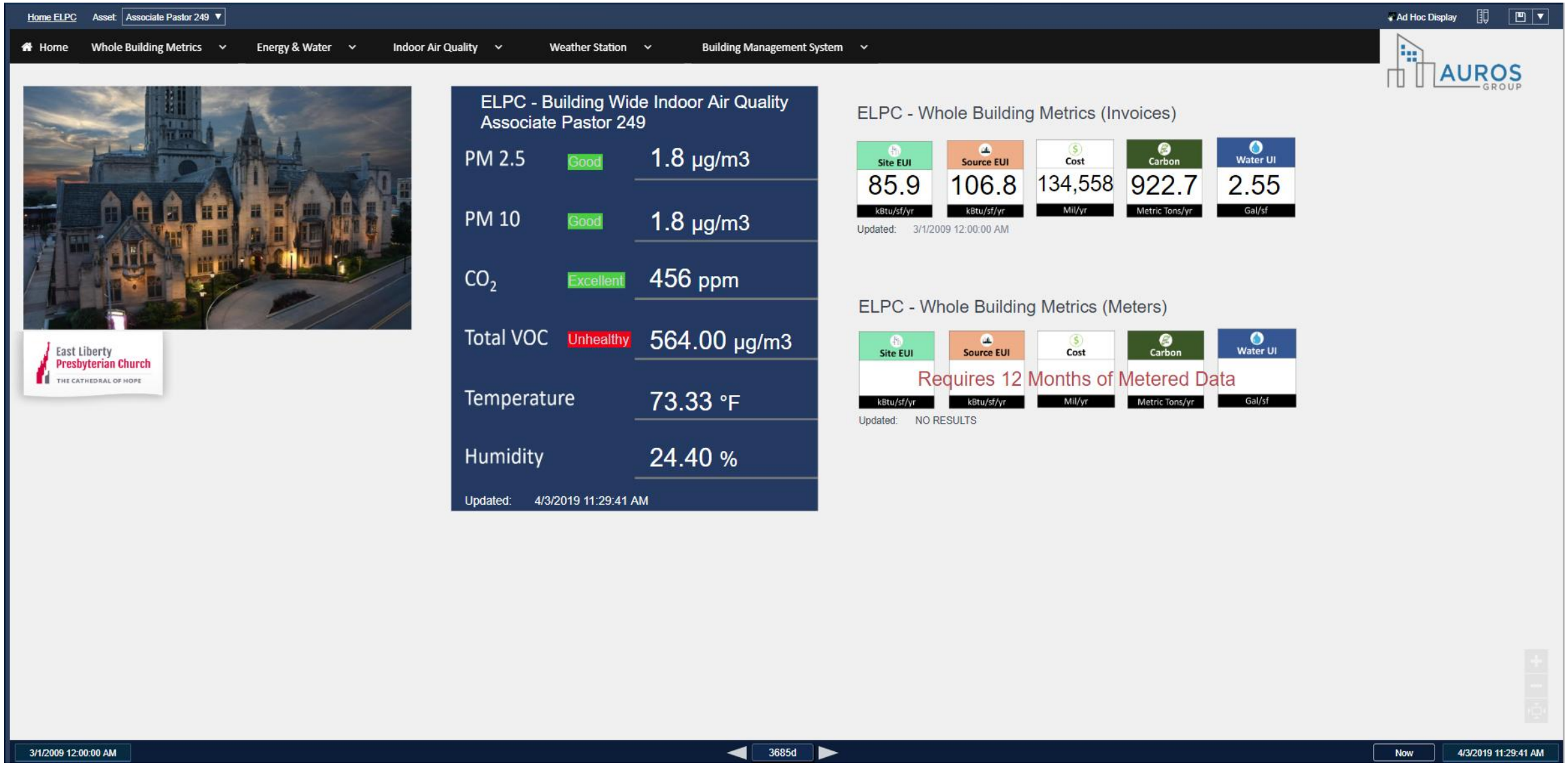


Early goal setting for buildings connected to building operations

©2019 OSIsoft, LLC

©2019 OSIsoft, LLC

©2019 OSIsoft, LLC



©2019 OSIsoft, LLC

Take Aways

- Getting PLC data into PI is well established
- Getting DDC data is also important!
- Connector will make it easy to get DDC data
- This data can be used to:
  - Optimize existing underperforming systems (FDD)
  - Determine if building is performing to design (advanced modeling)

©2019 OSIsoft, LLC