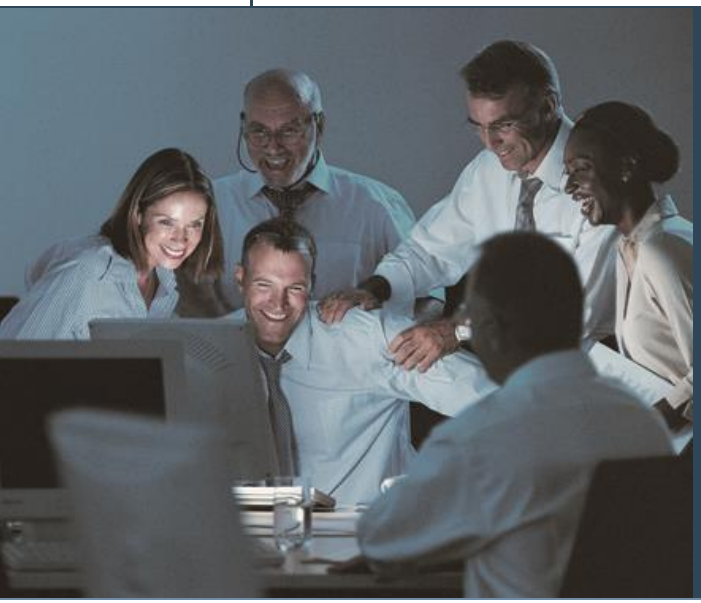
2009 Regional Seminar Series Presents:

Using PI for Reliability Centered Maintenance



Darryl Hammond, Maintenance Program Development Lead,
Alyeska Pipeline Service Company

Nick Wiley, Technology Services Director, Casne Engineering

October 28, 2009

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Presentation Overview

- About Alyeska Pipeline
- Maintenance Strategies: Mission, Goals and Challenges
- Alyeska's PI System
- Maintenance Diagnostics and Resource Center
- Development Roadmap

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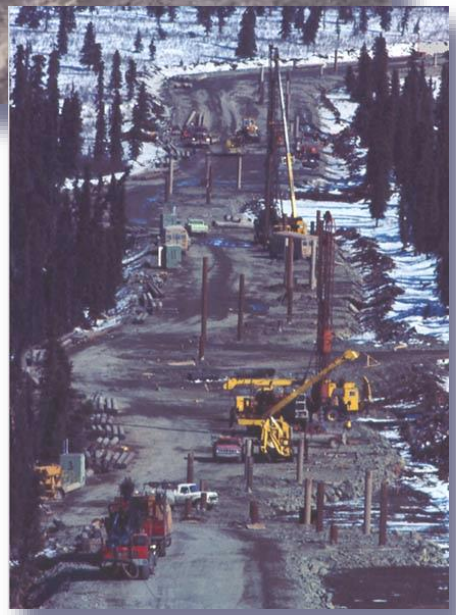

Alyeska History

- 1968 Oil discovered, Prudhoe Bay
- 1970 Alyeska Pipeline Service Company formed
- Joint venture between ARCO, BP and Humble Oil
- 1975-1977 Pipeline Construction
- largest privately financed construction project ever attempted ($8 billion)
- Consortium of BP (47%), ConocoPhillips (28%), ExxonMobile (20%) & others

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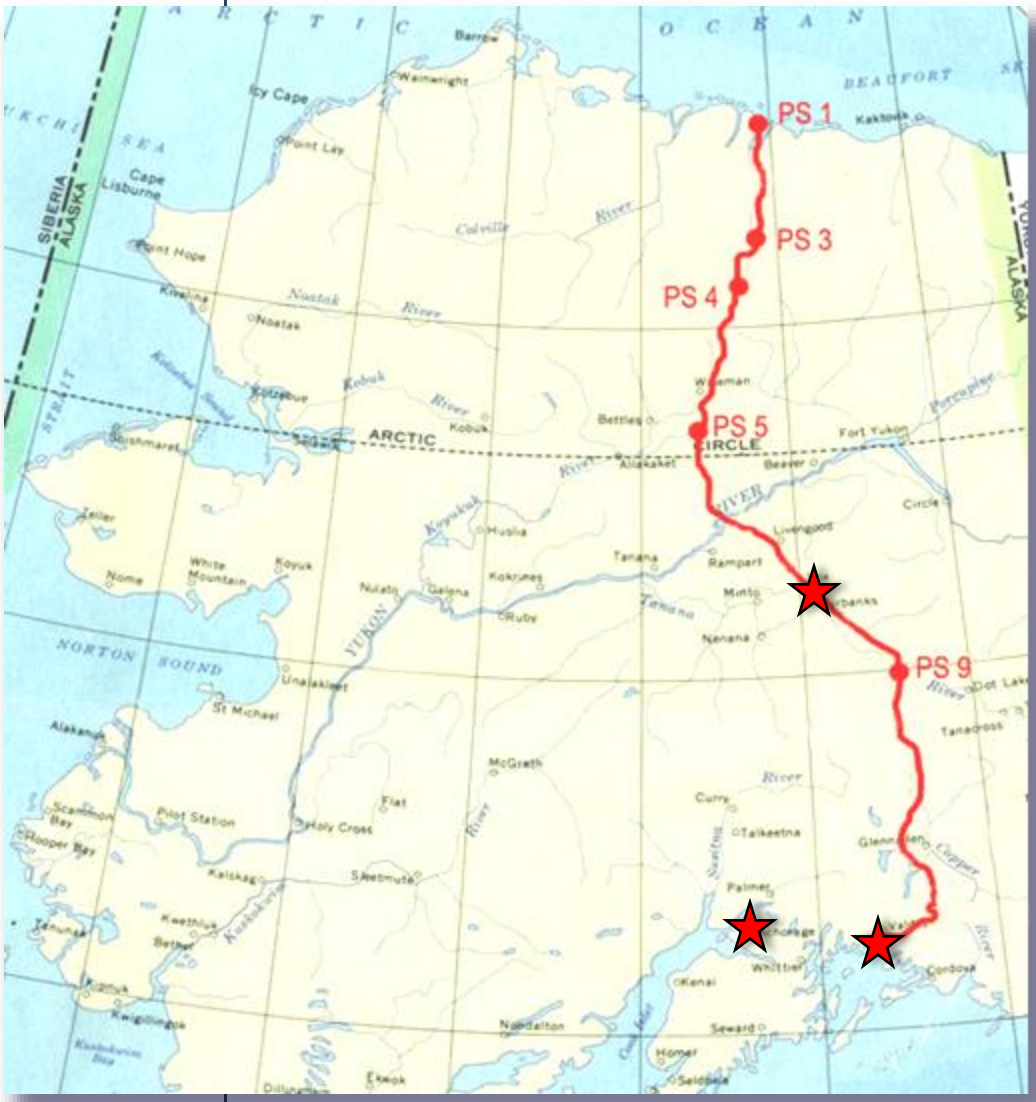

Alyeska Pipeline 2009

- 800 miles long
- 48” diameter pipe
- 5 Pump Stations
- Marine Terminal
- 1.4 Million bpd operating capacity
- Logistics & Operations centers in Valdez, Anchorage, and Fairbanks

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Prudhoe Bay

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Brooks Range

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Tanana River Bridge Crossing

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Valdez Terminal

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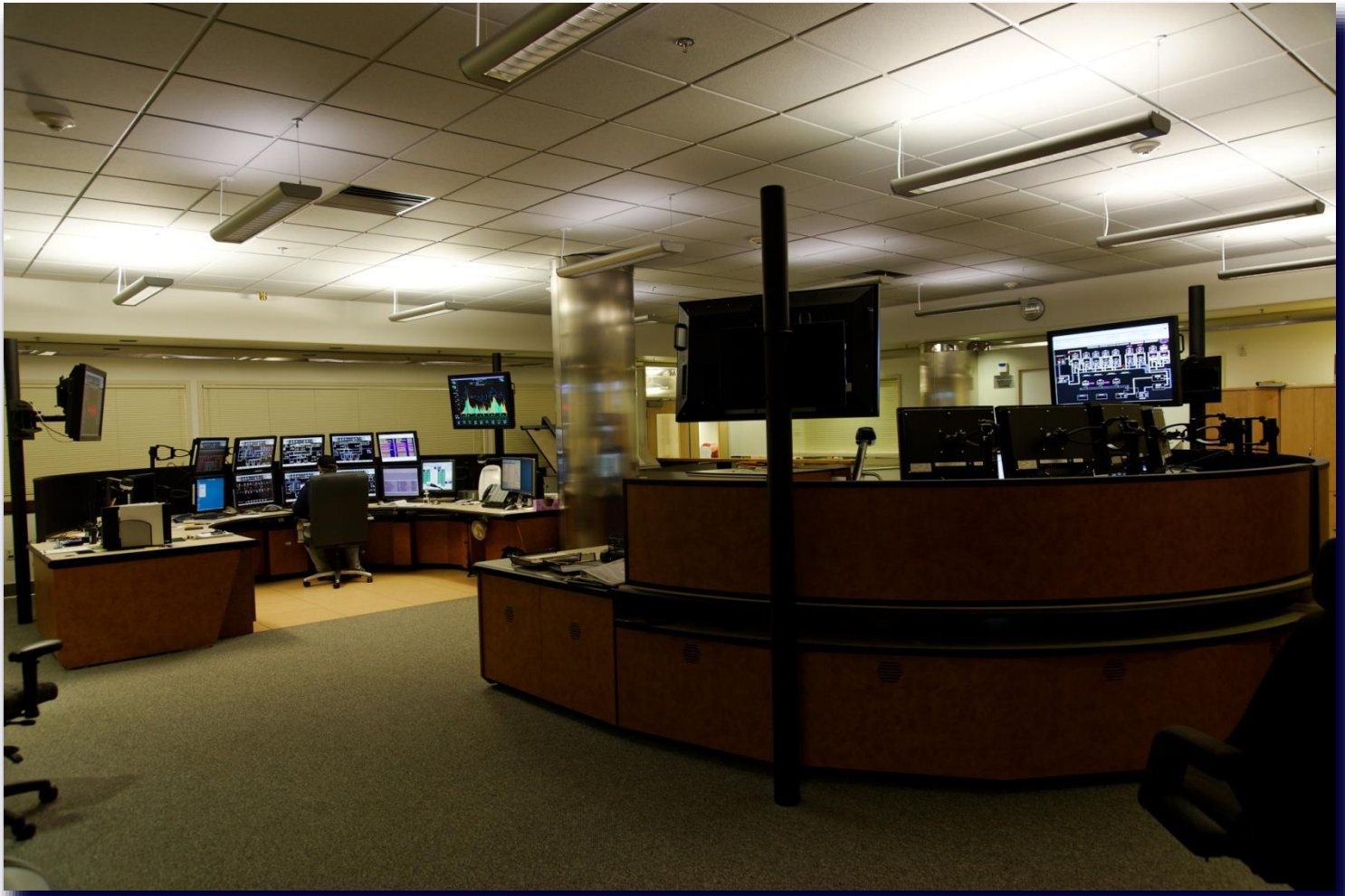

Operation Control Center

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Maintenance Strategies

- Mission
- Goals
- Challenges
- Strategies
  - Reliability Centered Maintenance 2
  - Alarm Management D&R
  - Continuous Monitoring

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Solution Stack

System Need	Solution
Real-time Data Storage	**PI Enterprise Server**
Relational/Transaction Data Storage	Microsoft SQL Server 2007
System Modeling	**Analysis Framework 2.0 (AF)**
Computations	**Advanced Computing Engine** .NET Code
Alarm & Event Notifications	**Analysis Framework 2.0, AF Notifications** Outlook & Microsoft Exchange Server
User Interaction	**RtWebParts**, Custom WebParts & Microsoft Office SharePoint Server 2007 (MOSS)

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PI Server

Operations

- Two Operations PI Servers in HA Configuration
- Test/Dev Server for prototyping
- OPC Interfaces to all data sources
- 150k tags

Enterprise

- 150k Tag PI Server
- PI-PI with Operations PI Servers

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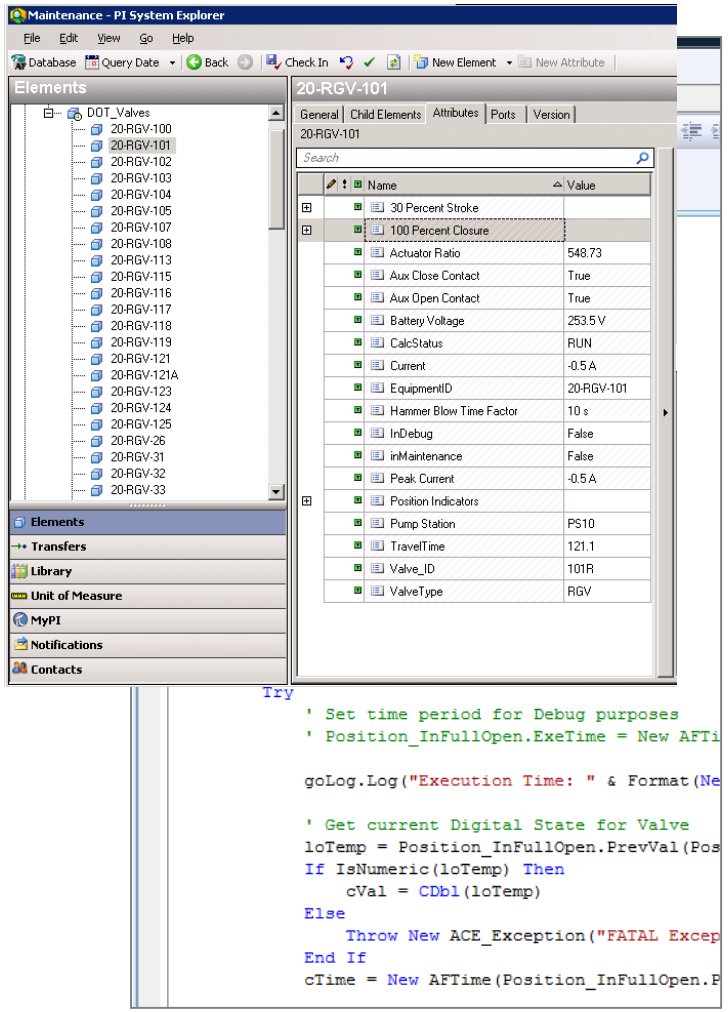
Analysis Framework & Advanced Computing Engine

- Foundational elements of our architecture
  - Model assets according to Alyeska standards for system / subsystem / component hierarchy
  - Develop re-usable structured logic around asset model
  - Integration of disparate data
  - Notifications architecture
  - Platform for continuous monitoring of like equipment



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Microsoft Office SharePoint Server & RtWebParts

- Primary Visualization for Enterprise Users
  - MOSS for team collaboration, document management, access control
  - RtGraphic WebPart for PB-developed graphics & trends
  - RtTrend WebPart for Web-based reports
  - RtTreeView WebPart for Navigation
  - Custom Silverlight WebParts as required

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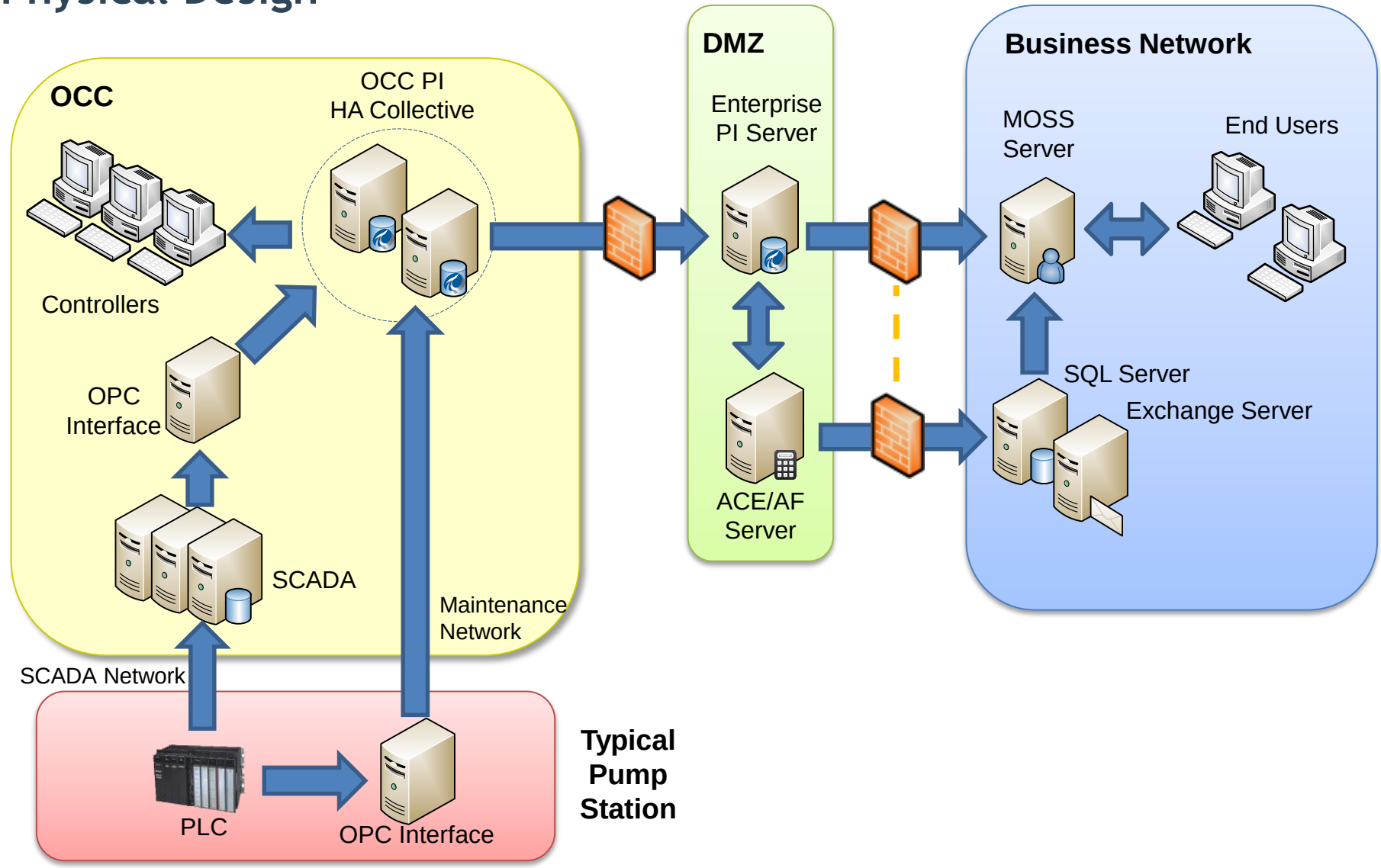
Physical Design



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Continuous Monitoring proof of concept - RGV Valves

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Home - Maintenance & Diagnostics Center - Windows Internet Explorer

http://aecm:5450/sites/OEM/MDC/default.aspx

Favorites | Home - Maintenance & Diagnostics Center

Page | Safety | Tools

OEM Center > Maintenance & Diagnostics Center

Welcome Wiley, Nick J | My Site | My Links

Maintenance & Diagnostics Center

All Sites | Advanced Search

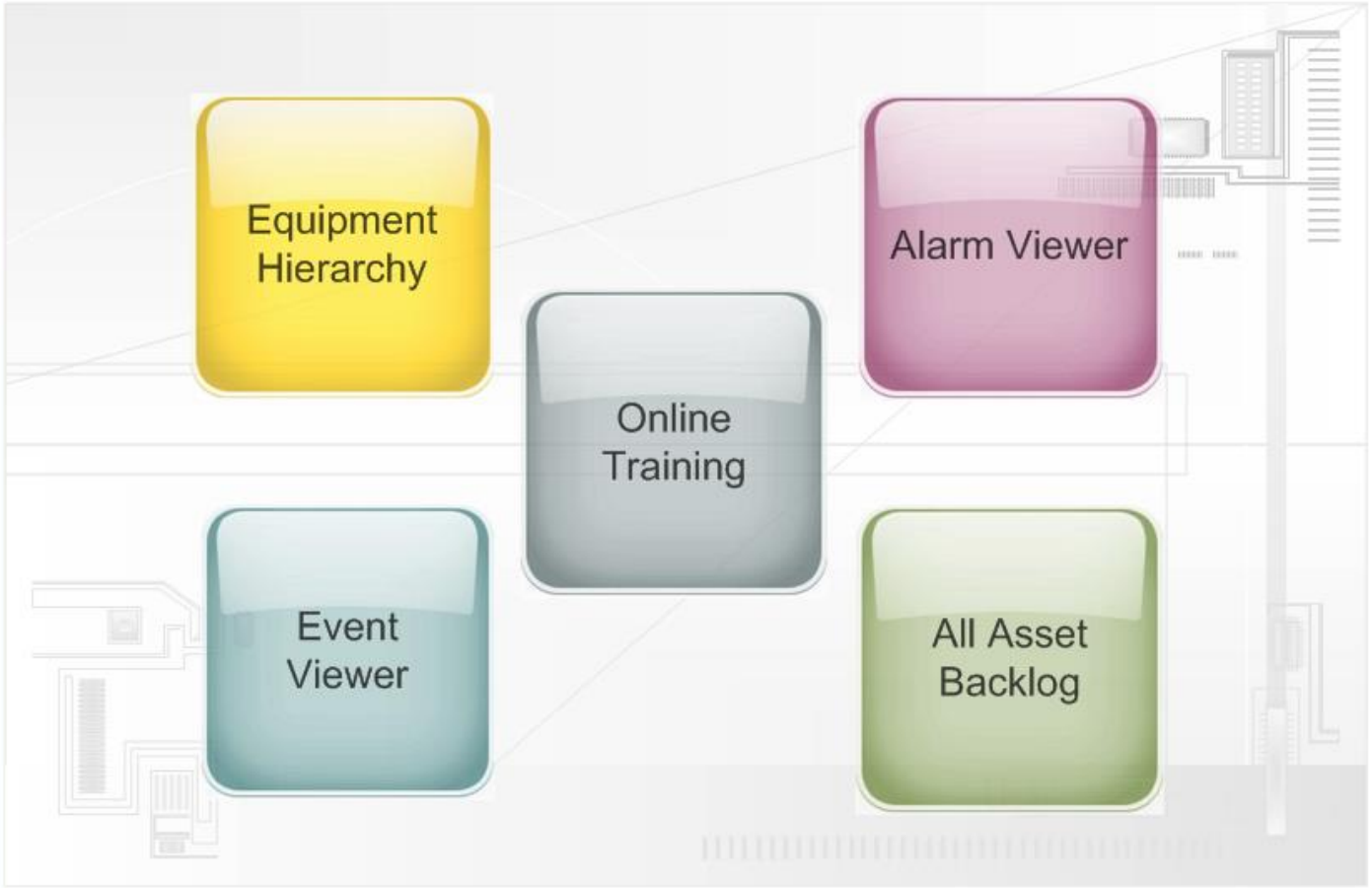
Maintenance & Diagnostics Center | Planning & Scheduling | Maintenance Strategies | Equipment Hierarchy | Site Actions

- View All Site Content
- **Oil Movements Department**
- **Engineering**
- **Maintenance & Diagnostics Center**
  - Discussions
  - Documents
  - Lists
  - People and Groups
  - Sites
  - Equipment Hierarchy
- **Environment**
- Recycle Bin

Announcements

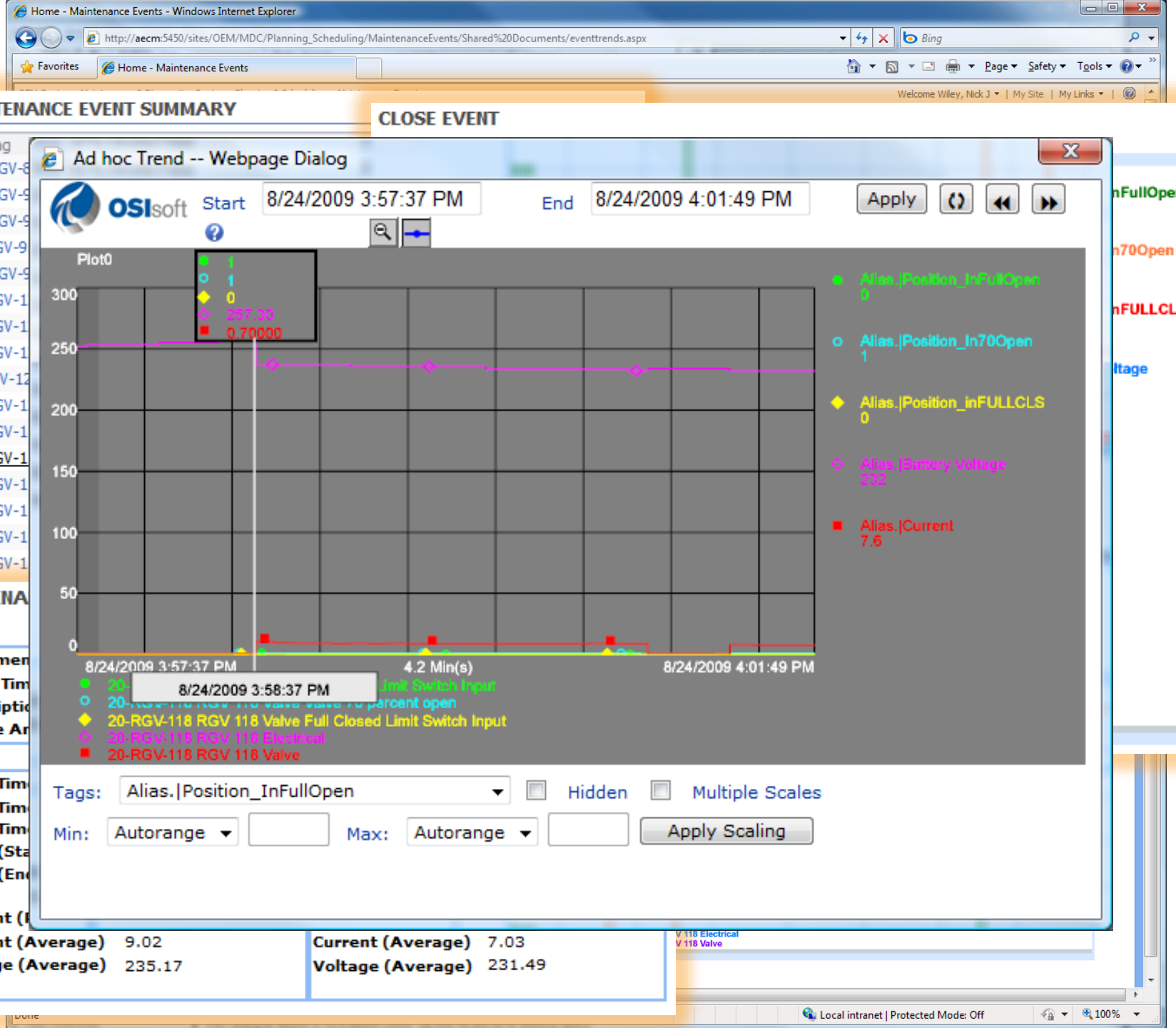
There are currently no active announcements. To add a new announcement, click "Add new announcement" below.

Add new announcement



Local intranet | Protected Mode: Off

100%


Home - Maintenance Events - Windows Internet Explorer
http://aecm:5450/sites/OEM/MDC/Planning_Scheduling/MaintenanceEvents/Shared%20Documents/eventtrends.aspx
Favorites
Home - Maintenance Events
MAINTENANCE EVENT SUMMARY
Equip Tag
CLOSE EVENT
Ad hoc Trend -- Webpage Dialog
OSIsoft
Start
8/24/2009 3:57:37 PM
End
8/24/2009 4:01:49 PM
Apply
Plot0
1
1
0
257.30
0.70000
300
250
200
150
100
50
0
Alias.|Position_InFullOpen
0
Alias.|Position_In70Open
1
Alias.|Position_inFULLCLS
0
Alias.|Battery Voltage
232
Alias.|Current
7.6
8/24/2009 3:57:37 PM
4.2 Min(s)
8/24/2009 4:01:49 PM
8/24/2009 3:58:37 PM
20-RGV-118 RGV 118 Valve Full Closed Limit Switch Input
Tags:
Alias.|Position_InFullOpen
Hidden
Multiple Scales
Min:
Autorange
Max:
Autorange
Apply Scaling
Current (Average) 9.02
Voltage (Average) 235.17
Current (Average) 7.03
Voltage (Average) 231.49
Local intranet | Protected Mode: Off
100%

All Asset Back log

Excel Web Access – AllAssetTemplate

Open | Update | Find

	A	B	C	D	E	F	G	H	I	J	
1	Ace_Calc	Event_ID	ACE_Event_Date	To Schedule	Score	Task Status	Ops Sys	Tag #	Work Group	Crew Code	
2					322	READY		OASIS #6905~AIR QUALITY SUPPC			
3					172	READY	INVC	0000005915-0	INVCTL	INV	
4					-487	READY	GMB	34-SYS-ELEC	PS#04	34M	
5					476	READY	FMB	39-BD-4701R	PMC	39CS	
6					451	READY	FMB	39-BD-2	PMC	39CS	
7					286	READY	INVC	R&R ENDUSER EQ	INVCTL	INV	
8					478	READY	FMB	20-RGV-119-BD	LWMT	LWMT	
9					322	READY		SLR #6956~2007 FISH & WILDLIFE			
10					390	READY		34-SYS-CIVIL	PL PROJ		
11					271	READY	FMB	39-SYS-ELEC	LWMT	LWMT	2
12					390	READY		34-SYS-EQUIP	PL PR(	VHF	
13					431	READY	P-EN	39-UCP-4201R	PS#09	OPS	
14					451	READY	FMB	38-BD-33	LWMT	LWMT	2
15					356	READY	FMB	39-BD-77	LWMT	LWMT	
16					365	RETURN	FMB	31-MOV-120S	LWMT	LWMT	
17					371	READY	FMB	20-RGV-31-BD	LWMT	LWMT	
18					371	READY	FMB	20-RGV-26-BD	LWMT	LWMT	
19					371	READY	FMB	20-RGV-34-BD	LWMT	LWMT	2

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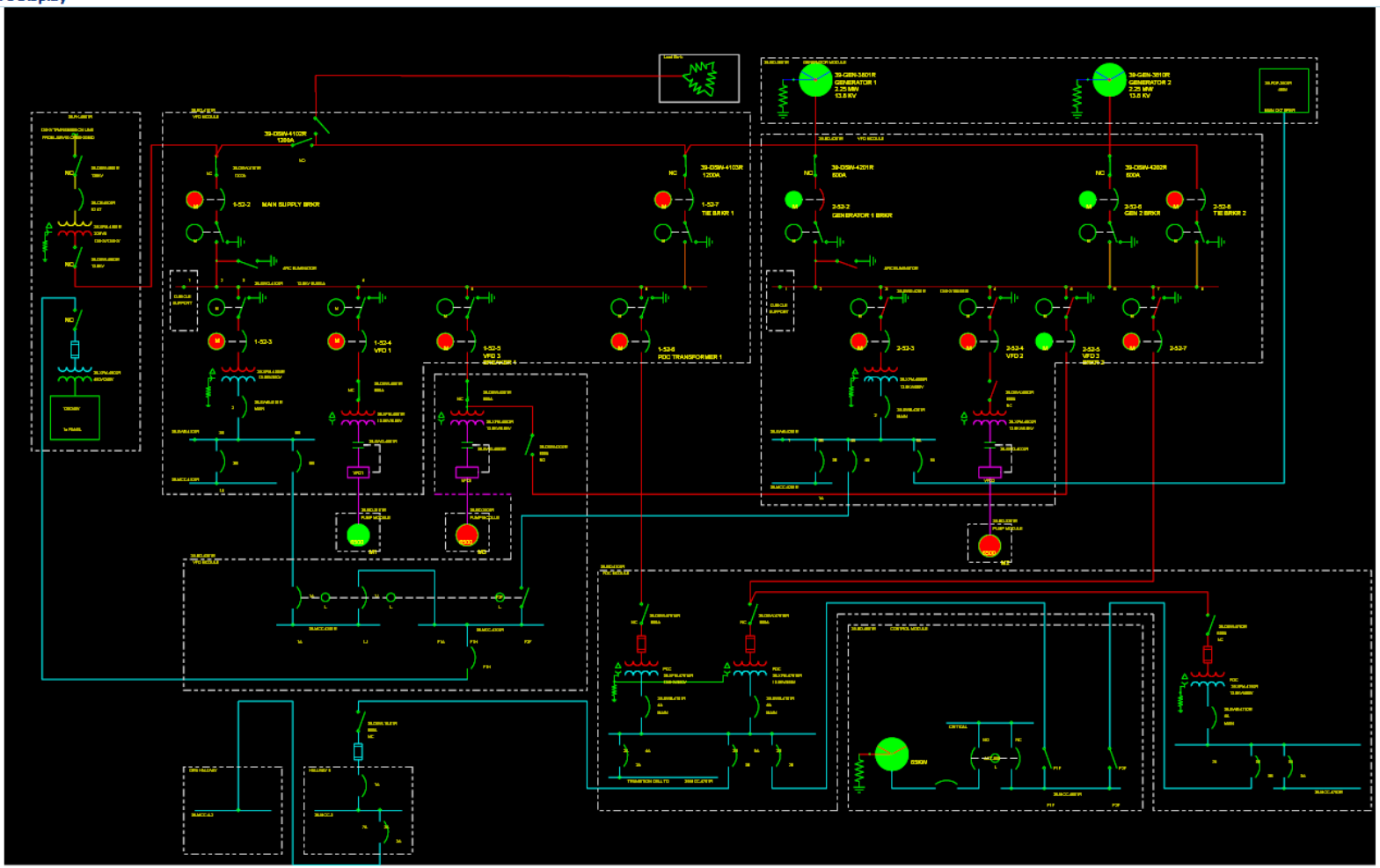
Start Time *-2d End Time * Apply

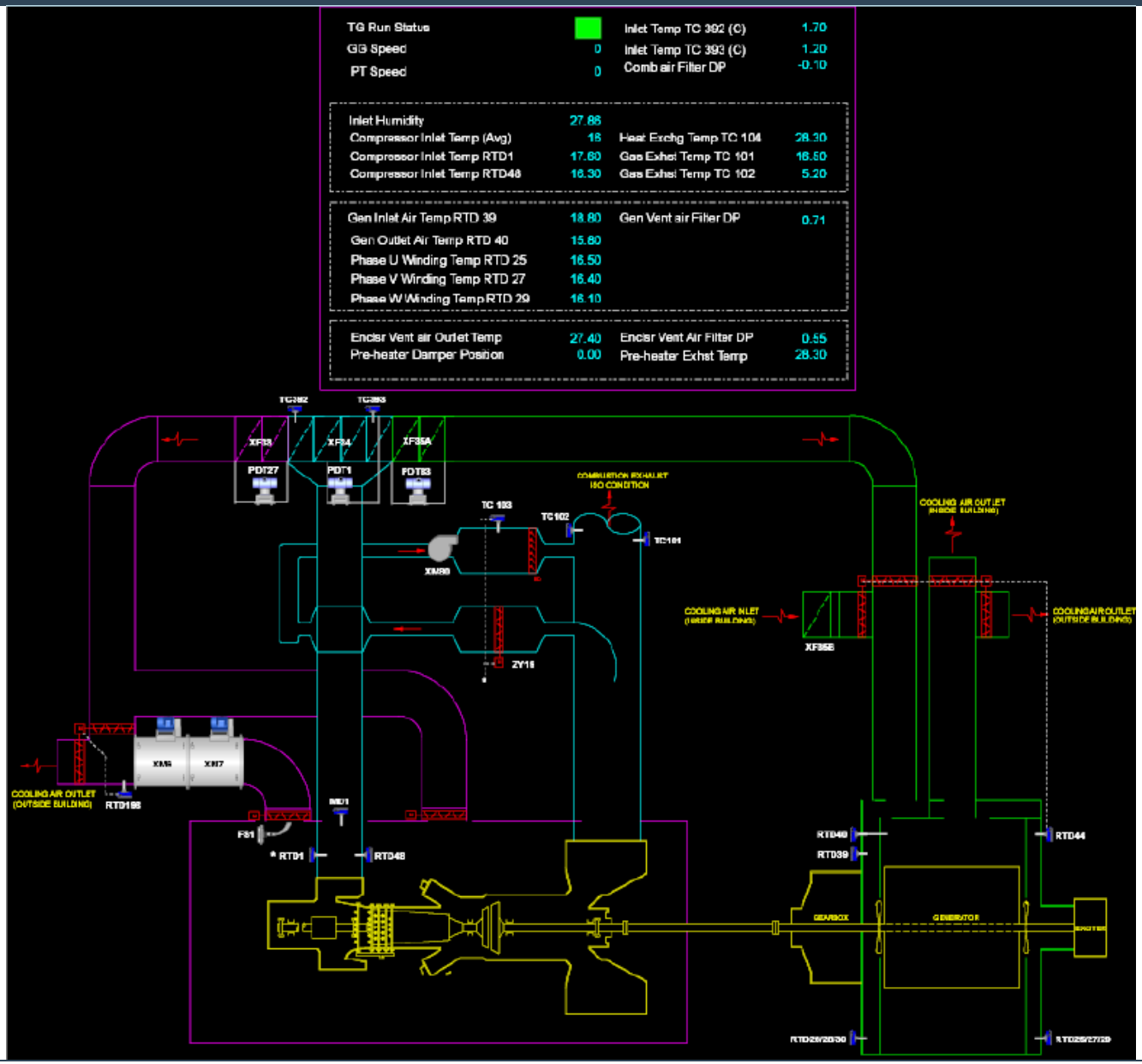
Trends
PS04
PS05
PS09
Diesel Fuel Systems
DRA
Fire Detection
Fuel Gas Systems
Gas Detection
PS03
MLU
PS04
PS05
PS09
Heat and Vent Systems
LEFM
M/L Relief
PS01
PS03
Discharge
305AR
305BR
Suction
304AR
304BR
304CR
PS04
PS05
PS09
M-L Pipe
MLU
MOS
Power Distribution
PS01
PS03
PS04
PS05
PS09
PDC Module
Sub Station
Switch Board
Switch Gear
Transformers
VFD 1 Module

System View\Power Distribution\PS09

Legend

PI Display





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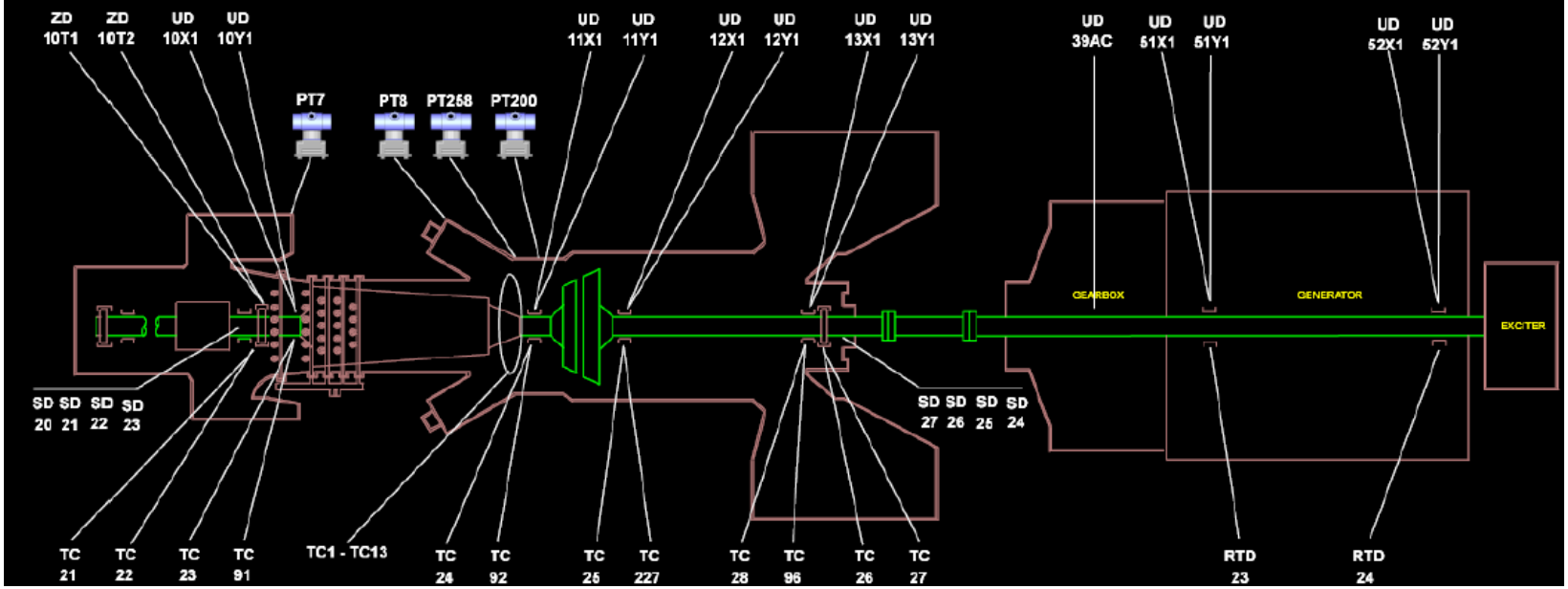
TG Run Status		CT DE Journal Radial Vib UD10X1	1.16	Compressor Inlet Temp	16	CT Thrust Brg Temp TC 21	20.90
GG Speed	0.00	CT DE Journal Radial Vib UD10Y1	2.47	Comp Inlet Temp RTD1	17.70	CT Thrust Brg Temp TC 22	21.20
PT Speed	0.00	CT NDE Journal Radial Vib UD11X1	0.86	Comp Inlet Temp RTD48	16.30	CT DE Journal Brg Temp TC 23	20.30
Comb Inlet PSI PT 7	0.95	CT NDE Journal Radial Vib UD11Y1	0.86	Interduct Temp Avg	19.08	CT DE Journal Brg Temp TC 91	20.60
Comb Inlet PSI PT 8	0.97	PT DE Journal Radial Vib UD12X1	0.96	Interduct Temp 01	22.60	CT NDE Journal Brg Temp TC 24	24.40
Interduct PSI PT 258	0.92	PT DE Journal Radial Vib UD12Y1	1.01	Interduct Temp 02	20.80	CT NDE Journal Brg Temp TC 92	24.50
		PT NDE Journal Radial Vib UD13X1	1.16	Interduct Temp 03	17.80	PT DE Journal Brg Temp TC 25	20.90
		PT NDE Journal Radial Vib UD13Y1	0.96	Interduct Temp 04	17.70	PT DE Journal Brg Temp TC 227	21.20
		CT Axial Displacement ZD10T1	-278.48	Interduct Temp 05	13.50	PT NDE Journal Brg Temp TC 28	26.60
		CT Axial Displacement ZD10T2	-271.22	Interduct Temp 06	14.50	PT NDE Journal Brg Temp TC 96	26.60
		Gen Gear Box Acceleration UD39AC	0.00	Interduct Temp 07	11.00	PT Thrust Brg Temp TC 26	27.60
		Gen Gear Box Velocity UD39AC	0.15	Interduct Temp 08	15.40	PT Thrust Brg Temp TC 27	27.80
		Gen DE Journal Radial Vib UD51X1	1.11	Interduct Temp 09	20.40	Gen DE Brg Temp RTD 23	23.20
		Gen DE Journal Radial Vib UD51Y1	1.11	Interduct Temp 10	21.10	Gen NDE Brg Temp RTD 24	20.20
		Gen NDE Journal Radial Vib UD52X1	1.11	Interduct Temp 11	22.90		
		Gen NDE Journal Radial Vib UD52Y1	0.91	Interduct Temp 12	24.50		
				Interduct Temp 13	23.90		
				Gas Exhst Temp TC 101	16.50		
				Gas Exhst Temp TC 102	5.20		



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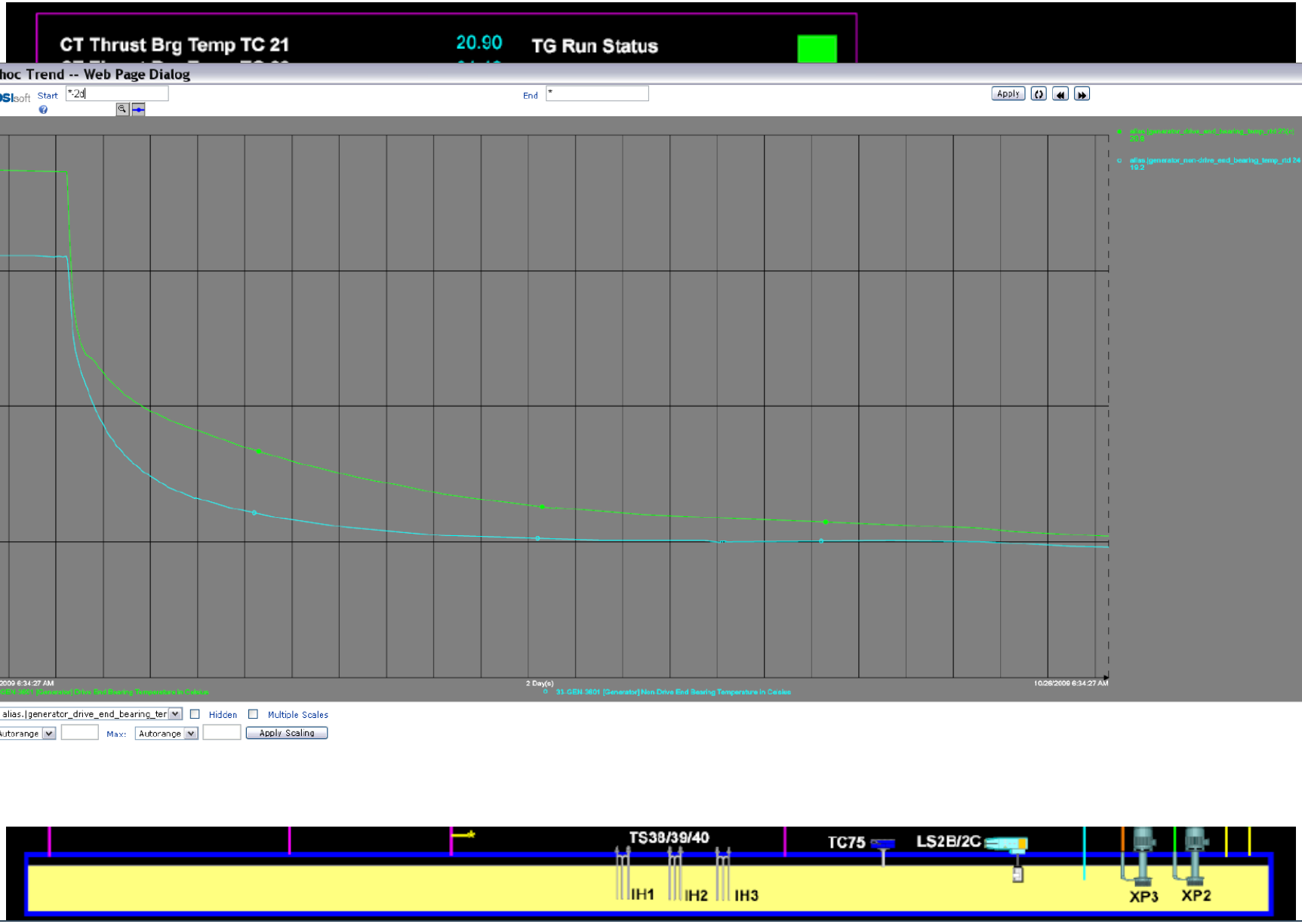

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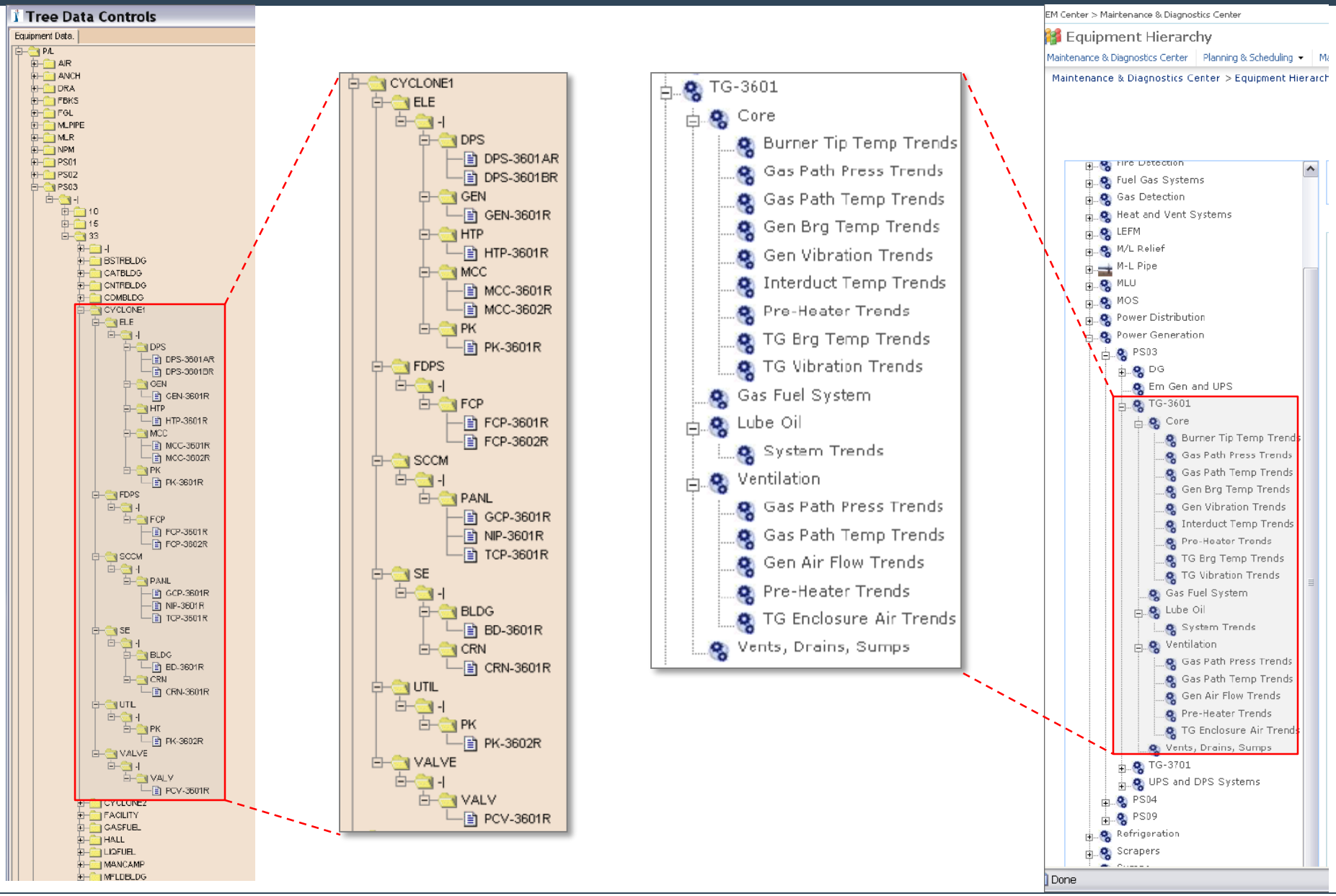

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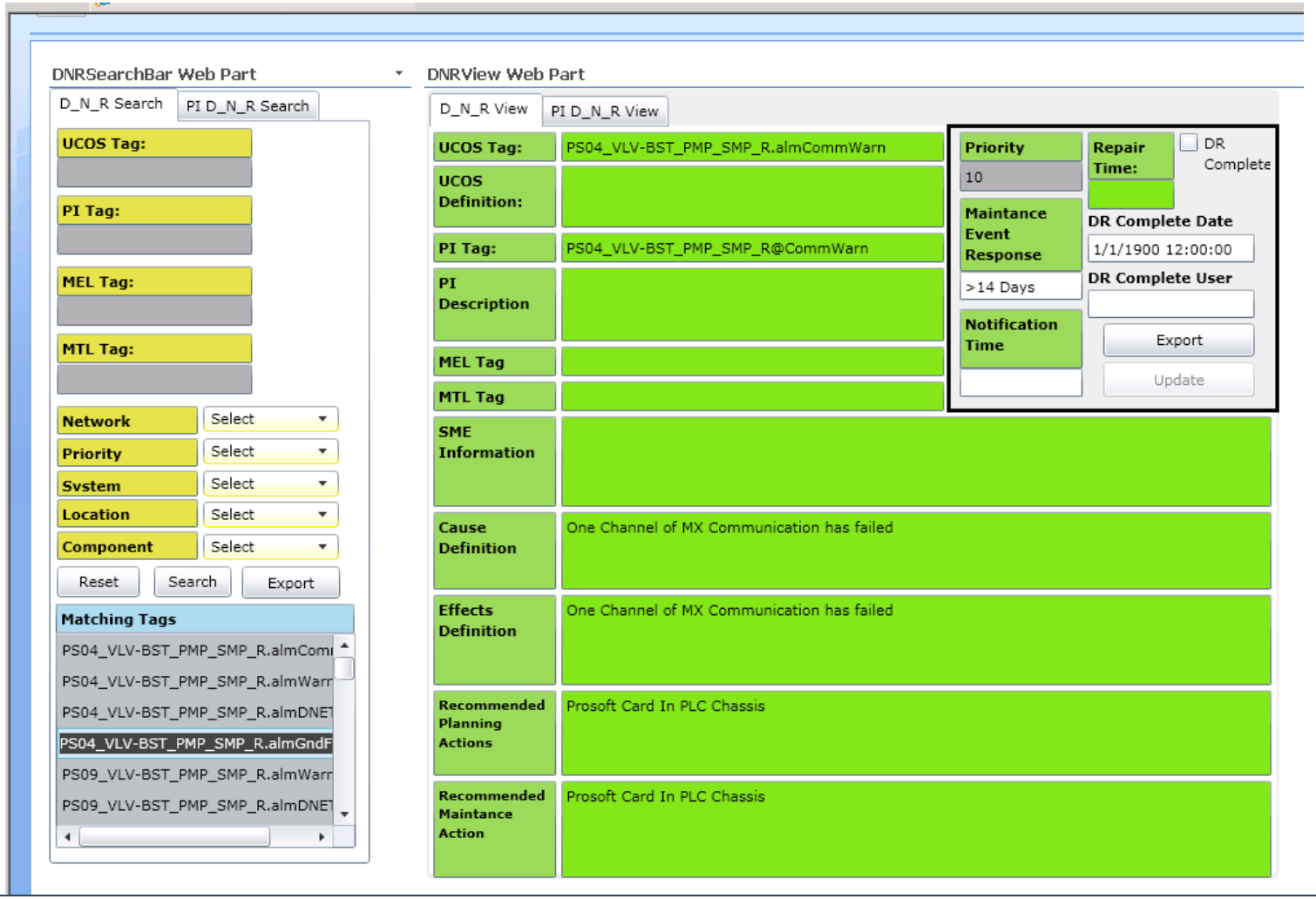
Documentation and Rationalization



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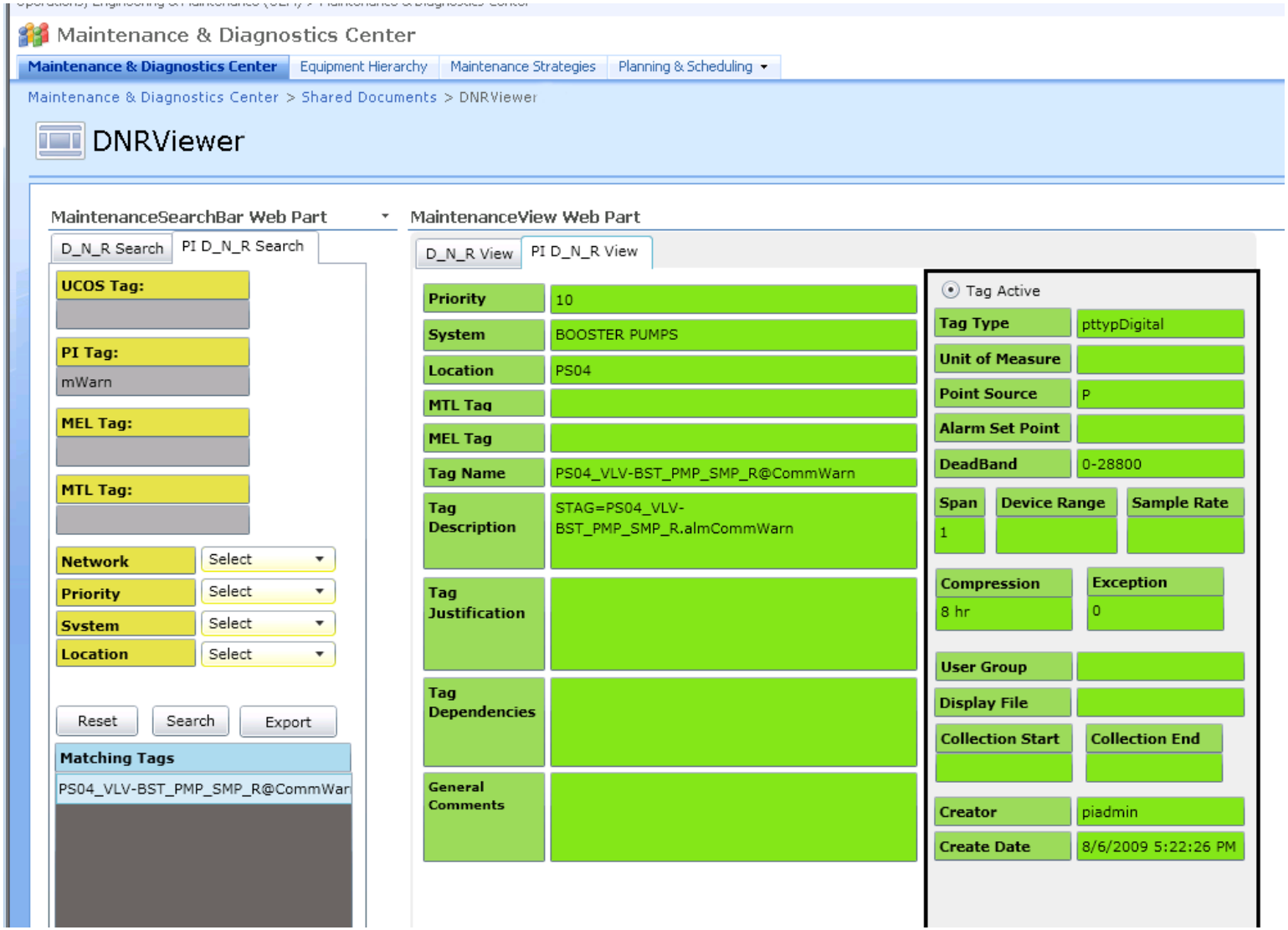

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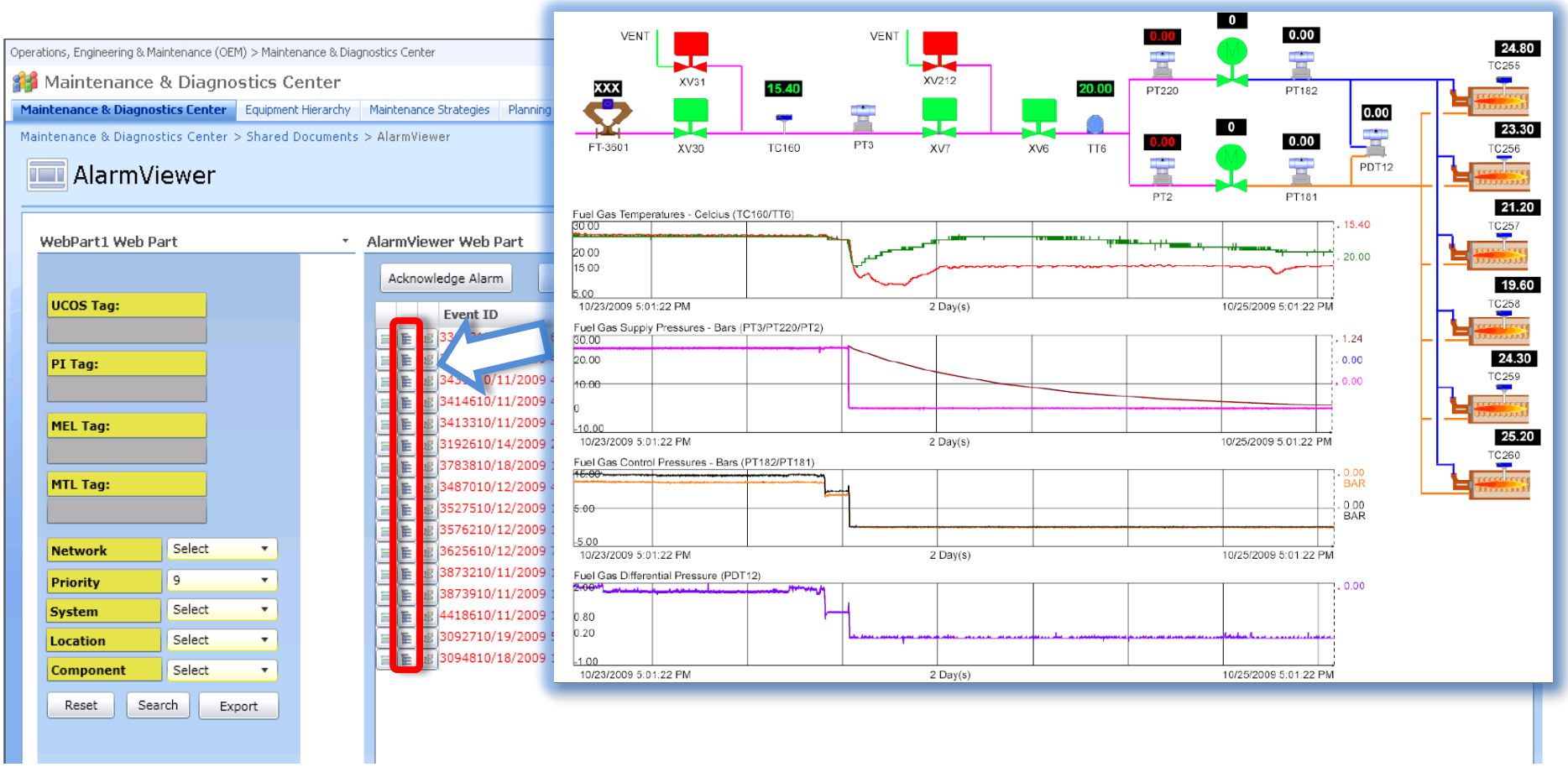
Alarm Management



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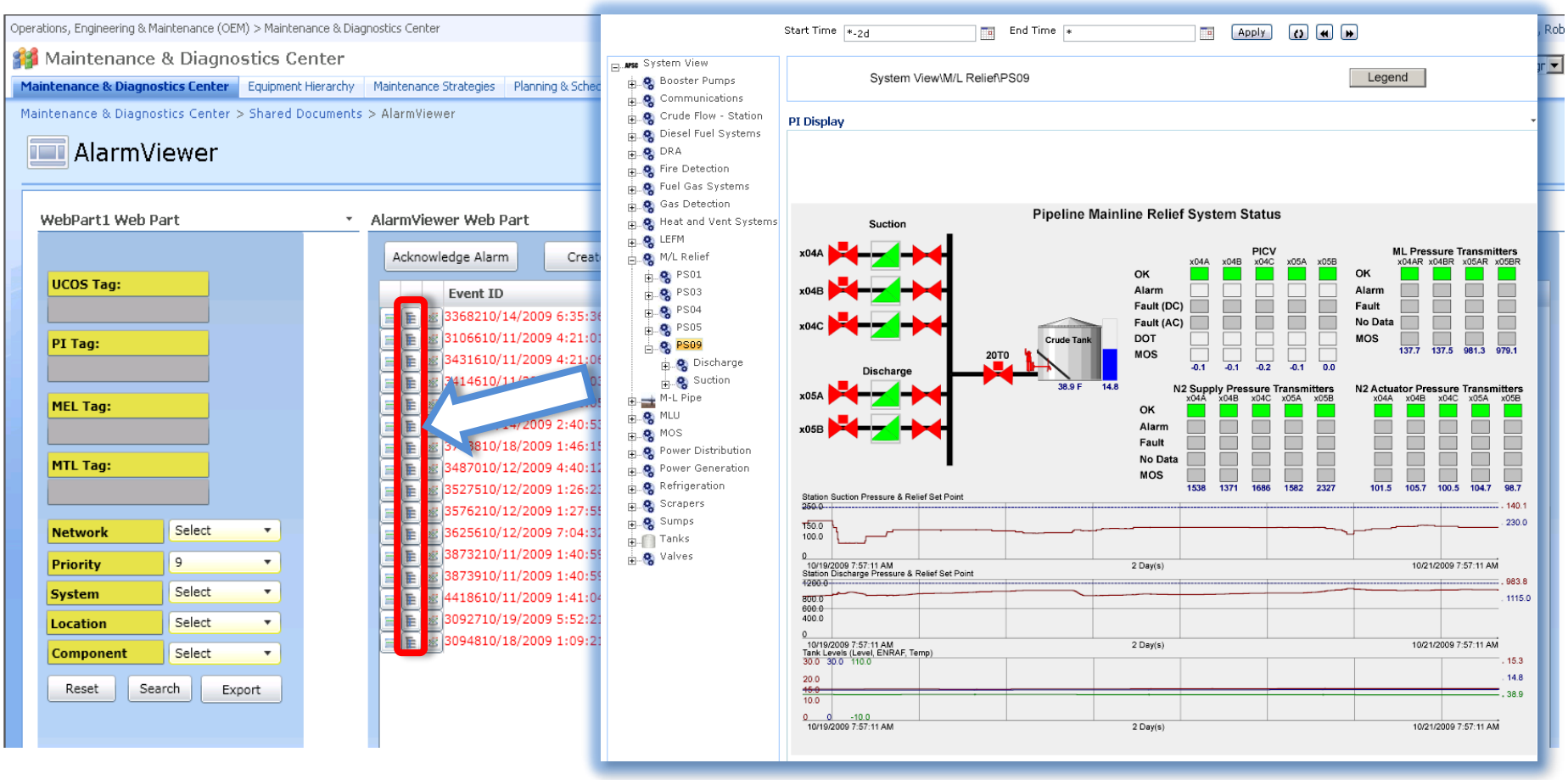

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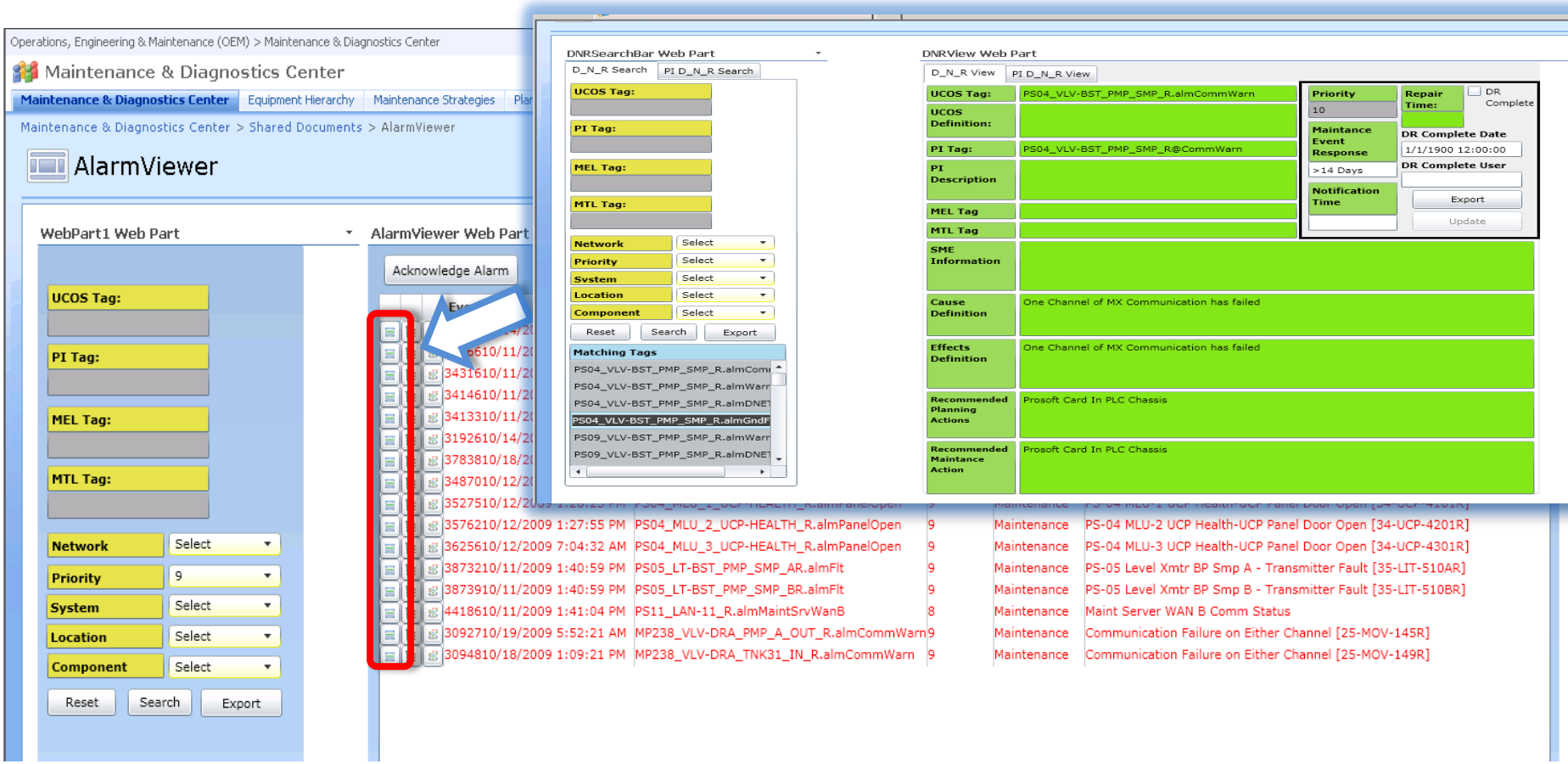
Alarm Management



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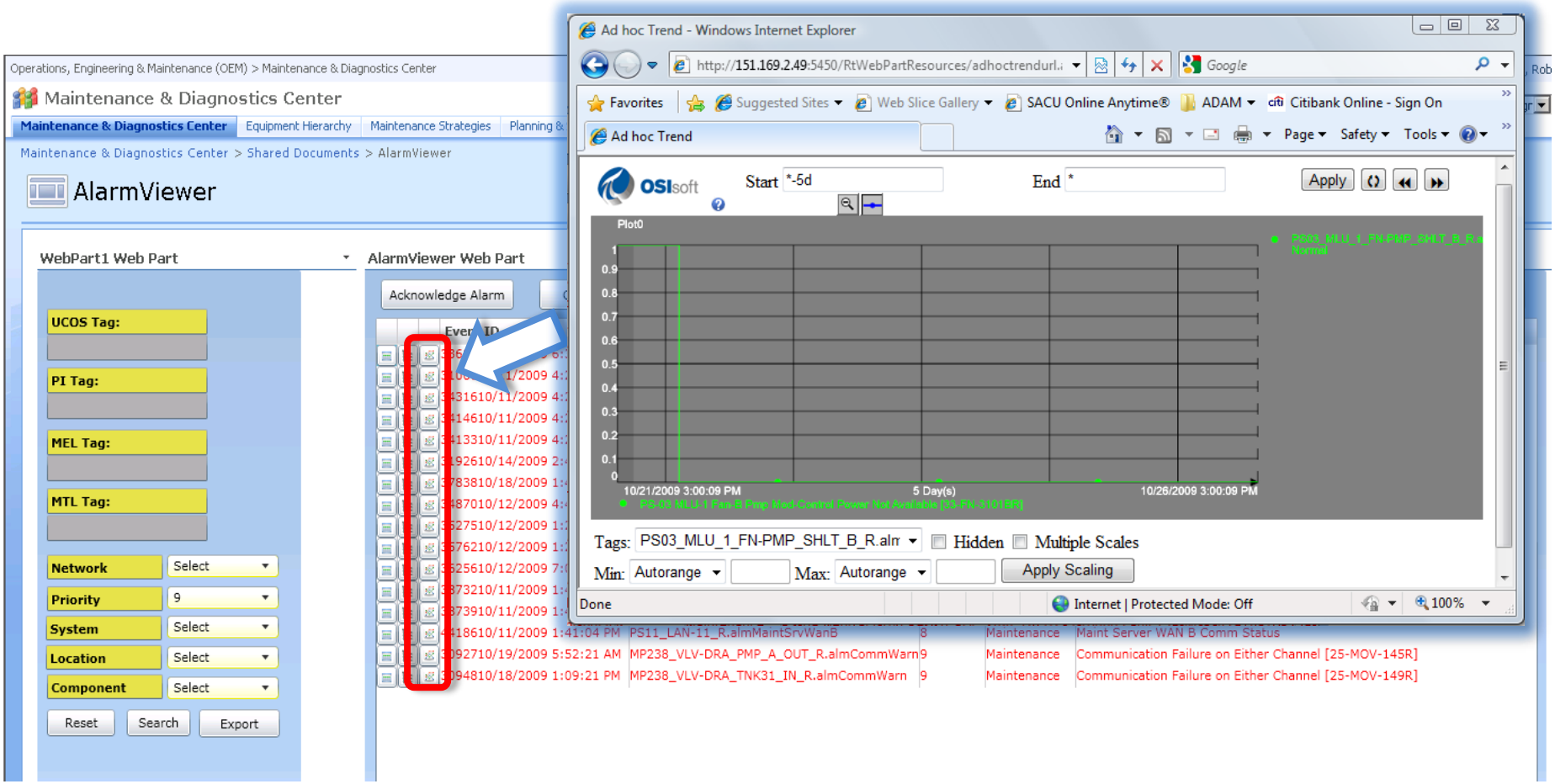
Alarm Management



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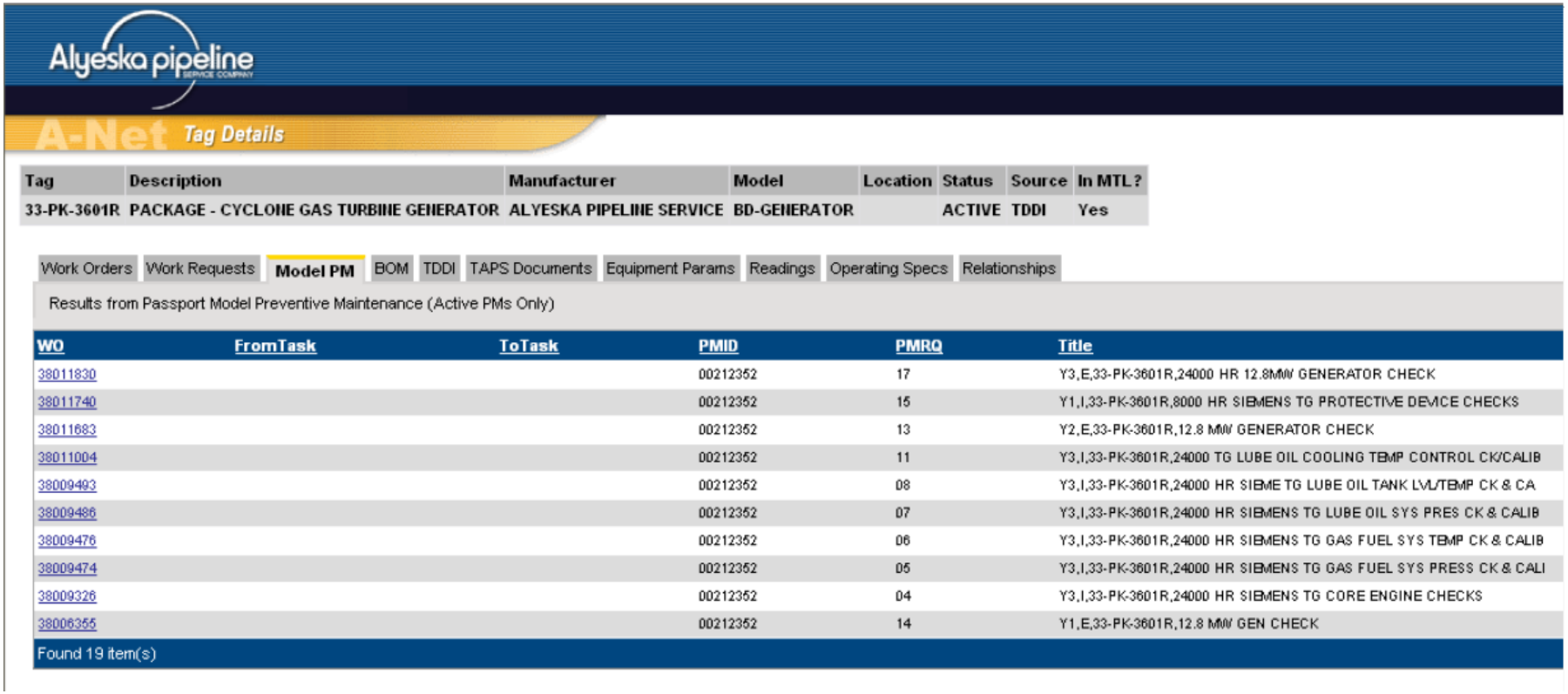

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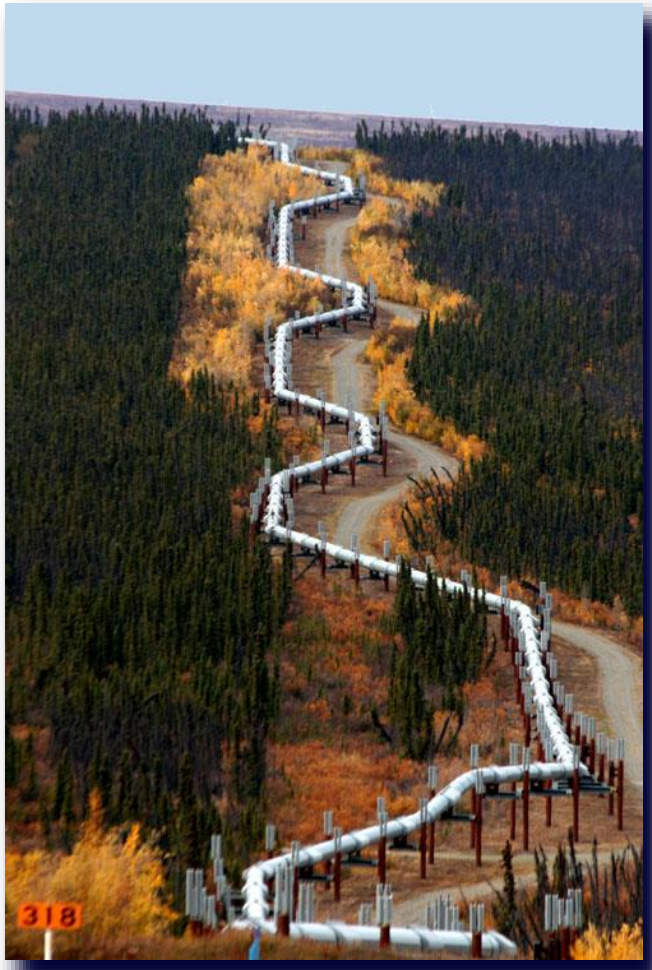
Next Steps

- Additional Asset Modeling in AF
- Develop additional CM and RCM calculations to plug into Event Viewer
- Integrate predictive failure analysis tools
- Automation Genome
- Expand Diagnostics and Resource Center
- Explore Work Management Systems that will allow for tighter integration



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