

AVEVA PI WORLD 2022

Logsheets Digitalisation

Northern Star Pogo

Presented by: Daniel Qiao (MIPAC) and James Sweeney (Northern Star Resources)

AVEVA

Northern Star Resources and Mipac partner for co-development



- Northern Star Resources
 - Northern Star is a global-scale Australian gold producer with world class projects located in highly prospective and low sovereign risk regions of Australia and North America.
 - The Pogo Operations are located 145 kilometres (220 kilometres by road) southeast of Fairbanks, Alaska and is situated in the Tintina Gold Province. The operations, which commenced production in 2006, controls some 17,080ha of mining and exploration leases.



- Mipac
 - Our mission is to provide high-quality solutions to enhance operational performance and improve our clients' productivity, safety, and efficiency.
 - A global leader in operational technology, control systems and engineering services.
 - Combine our operational experience, engineering and software development capabilities to deliver tailored solutions
 - AVEVA Partner with PI Accredited Engineers



Background

AVEVA

Pogo Mine Alaska


- Located 140 miles southeast of Fairbanks, Alaska
- Production commenced in 2006, with > 4Moz produced to date
- Acquired by Northern Star Resources in 2018
- Design processing capacity of 1.0Mtpa, with recent expansion works completed to achieve stable operation of 1.3Mtpa



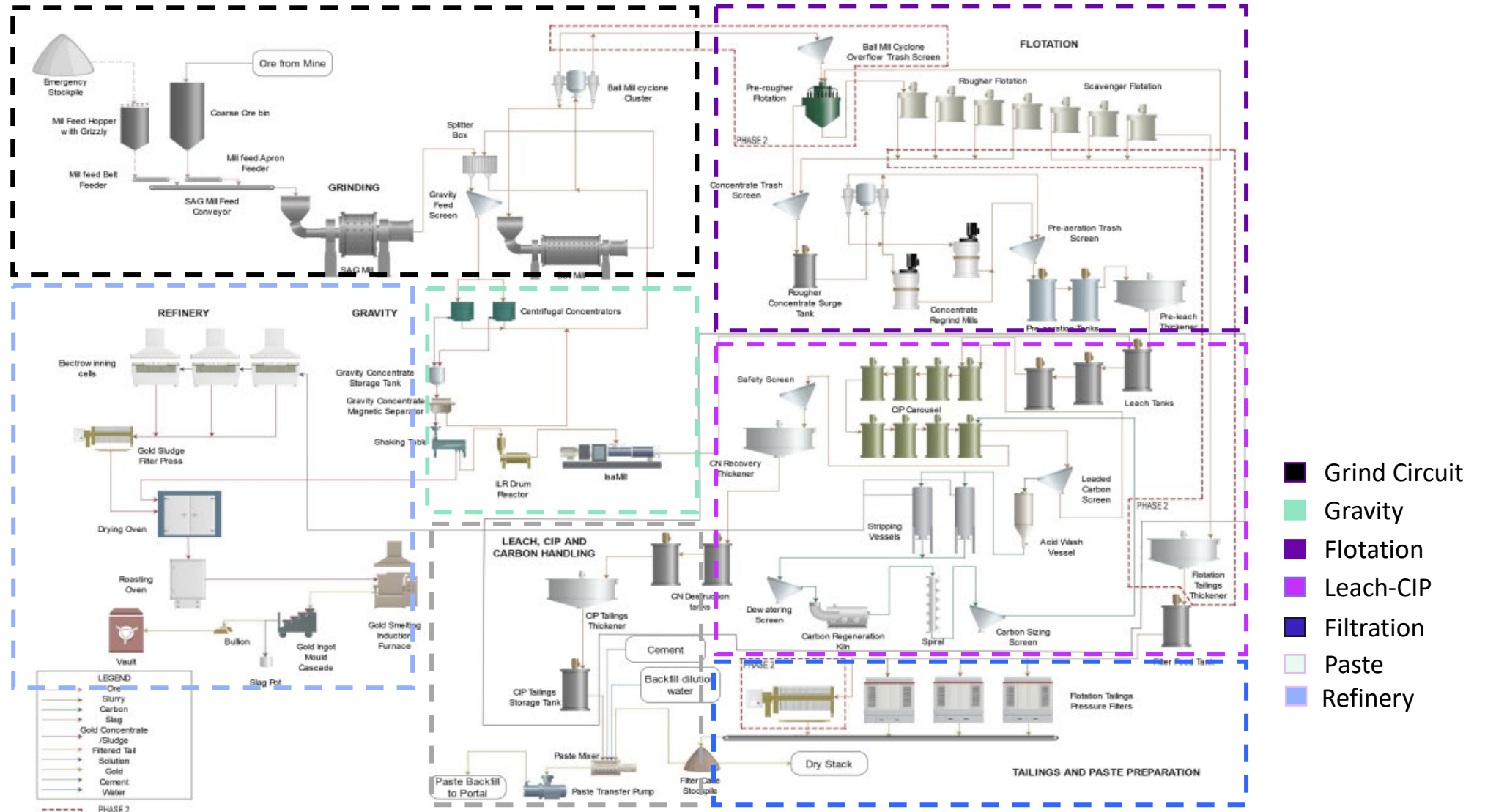
Logsheets

What are logsheets?

- Manual Data entry
- Data for streams without instrumentation
- Process monitoring
- Instrumentation validation / checks
- 10+ separate log sheets required
- Used daily by operators and mets

		Date: 10 July 2022																
		D/S Operator:						N/S Operator:						AVERAGES				
		Day Shift						Night Shift										
UG Ore Bin Level (ft)	0 to -40 ft							-24.00						-16.00				
Coarse Ore Bin Level (%)								92						91				91.5
SAG Mill	TARGETS	7:00	9:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	1:00	3:00	5:00					
Feed Tons Setpoint (tph)								200						200				200
Audio (dB)	93-94																	
Power Draw (kW)	1000							1362						1274				1318
Trunnion PSI Feed (psig)								1509						1492				1501
Trunnion PSI Discharge (psig)								1437						1421				1429
Feed Chute Water (gpm)								180						160				170
Feed Chute Water (ratio)																		
TrommelJet Water (gpm)								72						79				76
Discharge Density (%)	66-68%							76						77				77
TrommelJet Visual CHECK								ok										
SAG LUBE Sys CHECK								ok										
Ball Mill	TARGETS	7:00	9:00	11:00	13:00	15:00	17:00	19:00	21:00	23:00	1:00	3:00	5:00					
Power Draw (kW)	3000							3373						3349				3361
BM Dschrg Density (%)	65-70%							73						73				73
BM Cyc Fd Density (%)	53-57%							55						55				55
BM Cyc Fd (tph)								618						620				619
Number BM Cyc Open	5-6							7						7				7
BM Cyc Fd Water (gpm)								73						66				70
BM Cyc Pressure (psig)	30-35							30						31				31
BM Cyc O/F Density (%)	35%							33						35				34
BM cyclone O/F pH								8.5						7.9				8
BM Cyc U/F Density (%)	72%							74						75				75
BM Cyc O/F Size (%-270)	95%																	
CuSO4 Addition	150 g/ton							300						300				300
BM LUBE Sys CHECK								ok										

Mill Process Flow



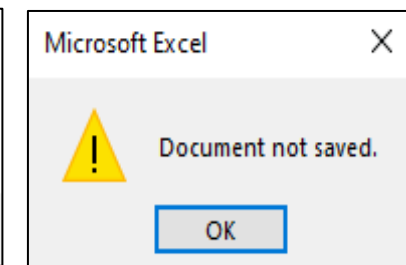
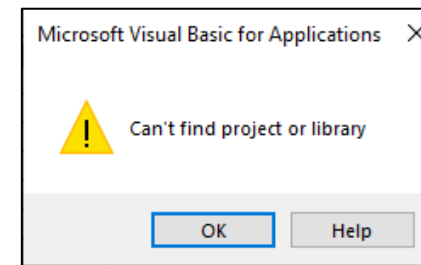
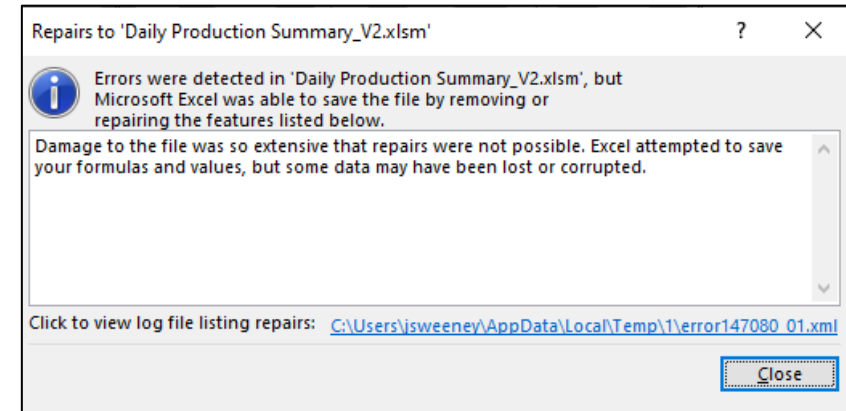
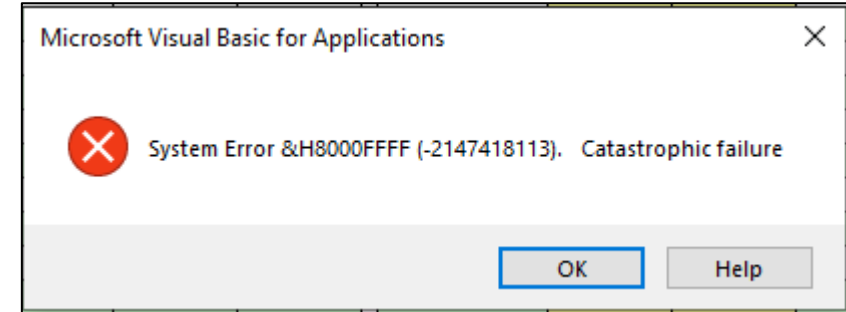
Business Case

AVEVA

Challenge

Existing issues with excel based logsheets

- Time consuming for operators
- Manual entry of DCS data
- Access control/security of excel
- Multiple copies of same excel spreadsheet
- Data lag – PI uploads confined to 24 hour period averages
- Prone to errors



Solution

Digitization of Logsheets

- Leverage existing plant data in the PI system
- Configure and template logsheets format and structure using PI Asset Framework
- Web-based data entry
- Organise data entry into set time periods and at fixed and user selectable timestamps
- Real-time data upload for improved process monitoring



Benefits

Data visualization



User selectable time period of plant performance and manual data entry pages readily available



A single source of truth derived from real time plant data and manually entered data for decision making



Key plant data readily accessible available to view and share for a wider audience

Reporting



Streamlined web-based data entry into the PI system combined with real time plant data from the PI system.



Significant reduction in manual entry

Data security



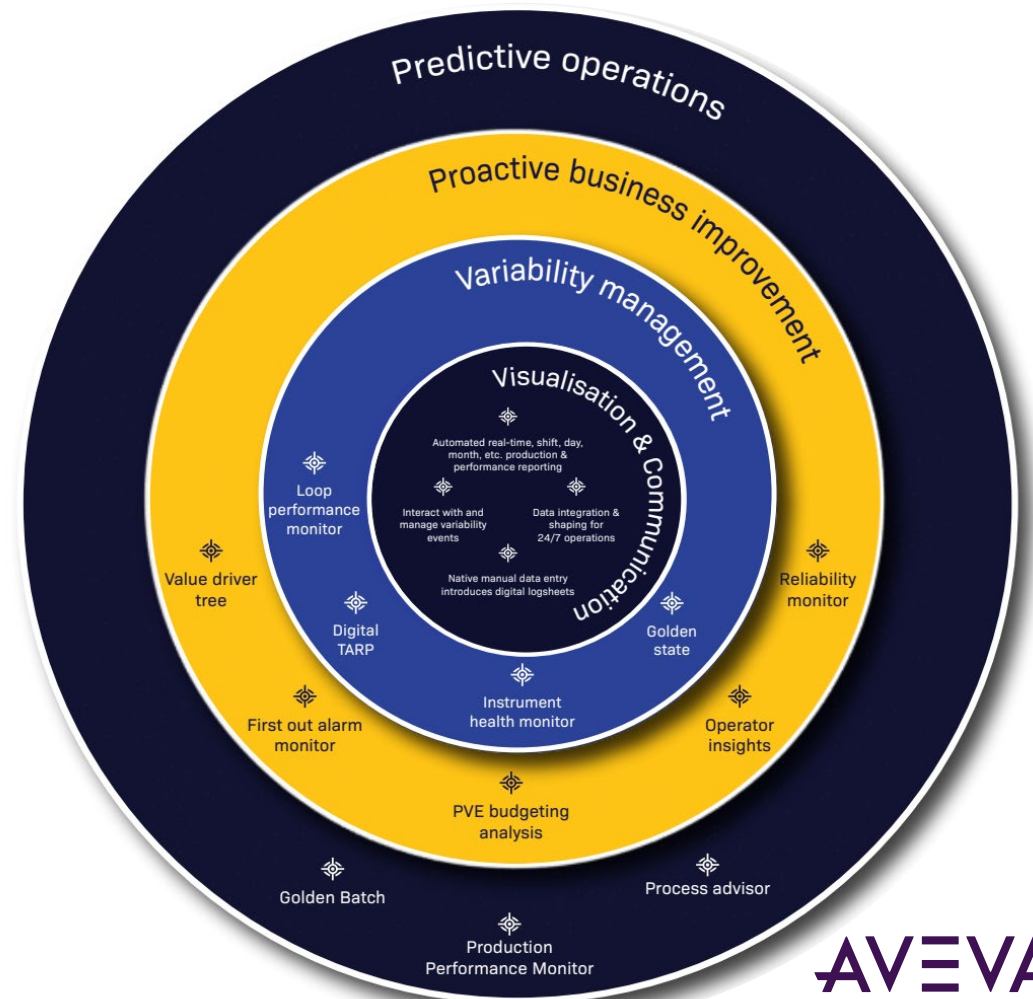
Improved security and access control of logsheets and reports

Architecture

AVEVA

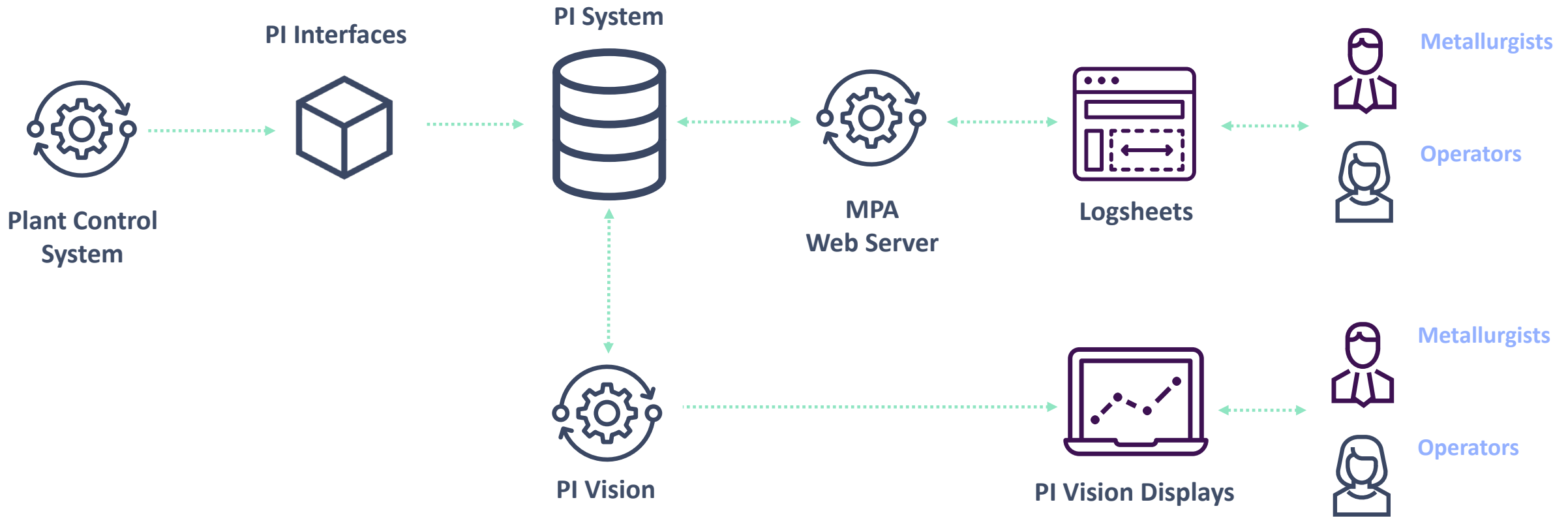
MPA is a platform to manage production, minimise variability and enable predictive operations

- Tailored applications industry build on MPA's visualisation and communication core
- Native manual data entry for digital logsheets
- Complements existing production critical systems such as PI
- MPA connects disparate data sources



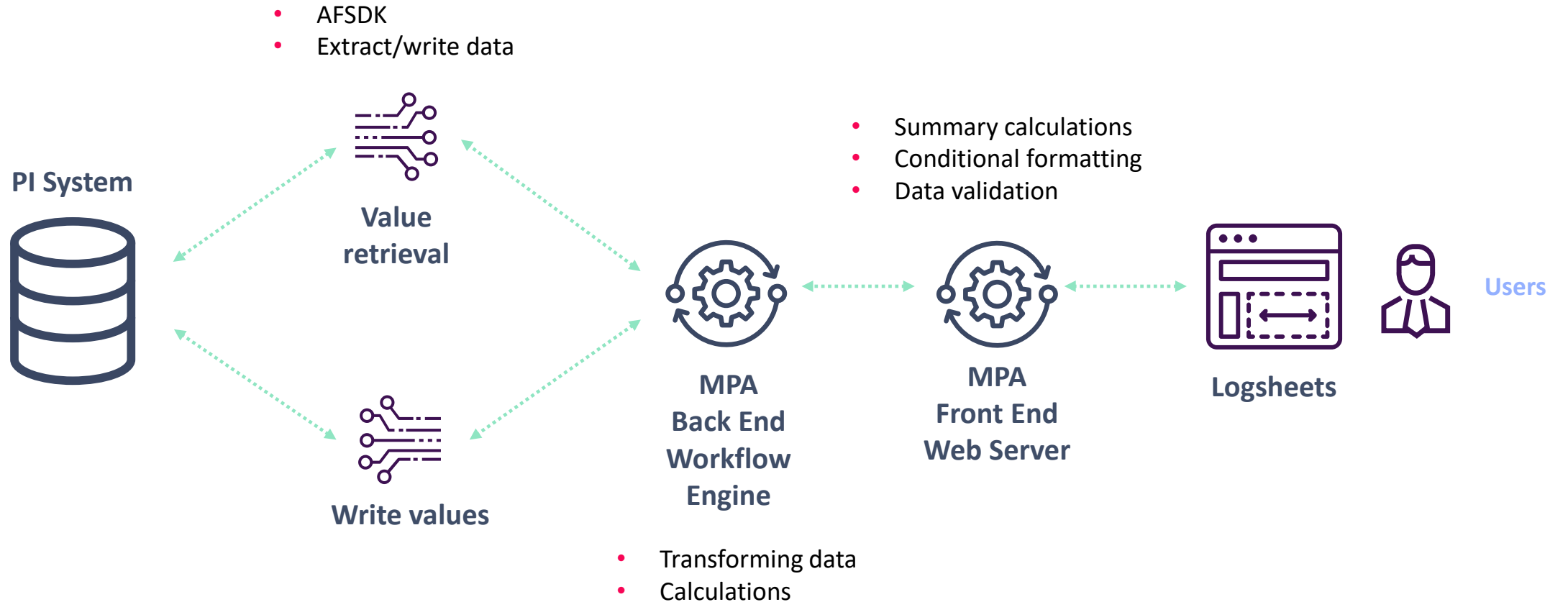
PI Vision and MPA leverage the same infrastructure and complement existing production systems.

Entire Architecture



MPA's tailored digital logsheet application can write and retrieve values to/from PI

MPA Subsystem





Implementation

AVEVA

MPA and PI Vision work together to provide a complete digital logsheet and reporting solution

- PI vision used to displaying trending and dashboarding
- MPA used for logsheet data entry
 - PI tags used to store manually entered logsheet data
 - Leverages PI Asset Framework structure
 - Uses meta data from PI Asset Framework such as AF element templates, attribute categories to construct the digital logsheets
 - Uses value retrieval methods and summaries to display data in PI tags

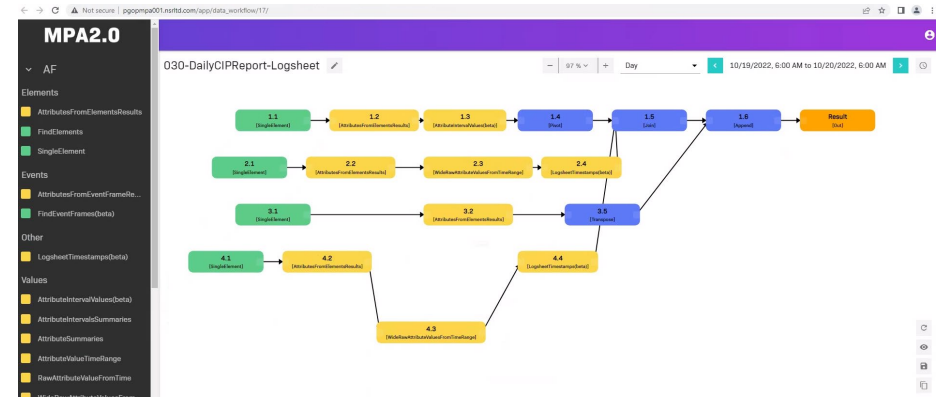


MPA's workflow engine can combine data from PI AF and other systems

- Uses a workflow to retrieve data from the PI AF using AFSDK
- Allows data entry at specific timestamps and data validation
- Writes data back to the PI AF using AFSDK

030 Daily CIP Report

Name	Value	Manual Data Entry
00 PRE AER 1 - pH : Online	8.278152	False
08 LEACH 1 - pH : Online	10.582	False
12 LEACH 1 - CN - (ppm) : Online	405.97	False
14 LEACH 1 - NaCN addition rate (gpm)	0.30907 gpm	False
15 LEACH 2 - pH : Online	10.74353	False
18 LEACH 2 - CN - (ppm) : Online	396.96	False
20 LEACH 2 - NaCN addition rate (gpm)	0.15541 gpm	False
24 LEACH 3 - CN - (ppm) : Online	323.46	False
29 CN REC TANK - Flocculant (LPM)	3.9995 lpm	False
33 CHD #1 - Air (acfm)	258.4535 acfm	False
36 CHD #2 - Air (acfm)	153.8529 acfm	False
38 CHD #2 - Standpipe WAD (ppm)	0.840 ppm	True
Category: 01 Manual Entry		
00 PRE AER 1 - pH (hand)	8.9	True
01 PRE AER 1 - Marcy scale density (% Solids)	15 %	True
02 PRE AER 1 - O2 addition rate (scfm)	31 SCFM	True
03 PRE AER 1 - Dissolved O2 (mg/L)	25 mg/L	True
04 PRE AER 2 - pH (hand)	8.9	True
05 PRE AER 2 - Marcy scale density (% Solids)	15 %	True
06 PRE AER 2 - O2 addition rate (scfm)	38 SCFM	True
07 PRE AER 2 - Dissolved O2 (mg/L)	24 mg/L	True
08 LEACH 1 - pH (hand)	10.9	True
09 LEACH 1 - Marcy scale density (% Solids)	20 %	True



Paste Pour

Paste Pour

Time Stamp	Paste (% Sol)	CIP Feed - Dry Tons (tph)	CIP Feed % Solids - DCS (%)	CIP Feed % Solids - Paste Cylinder (%)	OFFSET (%)
17:00		0.00			1.60
18:00		0.00			1.60
19:00		0.00			1.60
20:00		0.00			1.60
21:00		0.00			1.60
22:00		0.00			1.60
23:00		25.90			1.60
00:00		27.13			1.60
01:00	63.2	27.61	47.2	48.2	2.00
02:00		26.22			2.00
03:00		0.00			2.00
04:00		0.00			2.00
05:00		0.00			2.00
Average	63.78	12.35	47.33	48.90	1.66

+ ADD ROW

MPA's simple to use UI facilitates quick navigation around logsheets and time period

Digital logsheets

MPA2.0

Search...

- 000 Logsheets
- 010 Daily Grind Report Report
- 020 Daily Flotation Report
- 030 Daily CIP Report
- 040 Daily Gravity Report
- 050 Daily Paste Operating Report
- 051 Tail Thickeners and Filters Logsheets
- 060 Daily Reagents Report

Day
10/19/2022, 6:00 AM to 10/20/2022, 6:00 AM

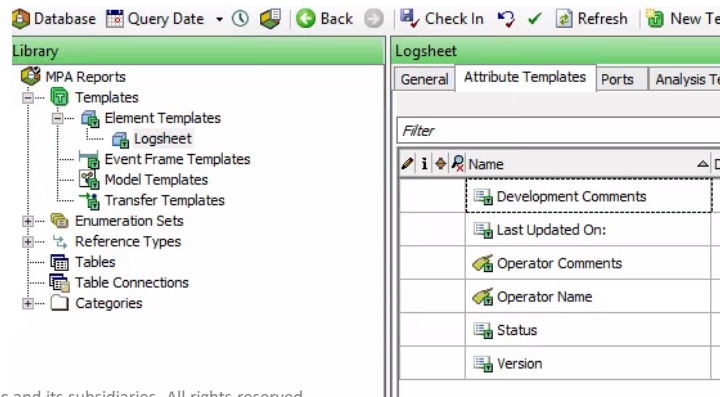
Paste Pump & Pressure Transducers

Time Stamp	Filter Cake - Dry Tph (tph)	Hydraulic Press (bar)	Pump Strokes	Speed (%)	Surface Pump (psig)	Sump #1 - 1690 Portal (psig)	Sump #2- 1690 Decline (psig)	Sump #3 - 1400 Stope (psig)	2150 Portal - 1350 Stope (psig)	1807 Raise - 1650 Ore Bin (psig)	1875 Haulage (psig)	BFD Water Tank (%)	CIP Tails Stock Tank (%)
13:00	81.94	41.87	6713.89	44.00	16.97	6.29	-9.97	-8.98	255.00	4.76	-74.98	30.84	48.03
14:00	82.00	40.16	0.00	0.00	81.27	126.91	80.14	78.36	255.00	4.63	-74.98	28.83	48.54
15:00	81.73	1.48	0.00	0.00	0.28	16.09	8.23	3.99	255.00	4.63	-74.98	29.36	49.04
16:00	81.45	1.33	0.00	0.00	-1.08	10.74	5.73	2.38	255.00	4.63	-74.98	30.69	49.54
17:00	81.19	1.17	0.00	0.00	-2.43	5.40	3.22	0.77	255.00	4.63	-74.98	32.03	50.02
18:00	81.25	1.02	0.28	0.00	-3.78	1.31	0.72	-0.83	255.00	4.89	-74.98	33.36	50.39
19:00	81.31	41.00	0.02	0.00	-4.09	1.12	0.08	-1.36	255.00	5.22	-74.98	34.74	50.77
20:00	81.36	40.88	0.28	0.00	-4.04	0.92	0.17	-1.33	255.00	5.55	-74.98	36.14	51.14
21:00	81.33	40.76	0.55	0.00	-3.99	0.73	0.26	-1.31	255.00	5.88	-74.98	37.55	51.52
22:00	81.08	40.64	0.81	0.00	-3.94	1.95	0.35	-1.28	255.00	6.01	-74.98	39.84	51.90
23:00	80.83	36.30	13.89	30.00	13.97	5.60	12.49	3.52	255.00	6.10	-74.98	42.28	52.29
00:00	49.53	52.65	534.66	73.04	49.91	80.31	75.93	61.23	255.00	6.18	-74.98	40.62	52.38
01:00	51.44	79.95	1040.97	66.75	219.81	316.39	200.28	164.54	255.00	6.26	-74.98	38.47	52.08
02:00	61.46	118.81	1482.13	74.63	482.24	589.17	374.91	298.98	255.00	6.32	-74.98	36.31	51.79
03:00	29.28	62.49	32.81	41.25	70.49	108.43	79.09	77.17	255.00	6.37	-74.98	37.50	51.72
04:00	29.55	40.62	95.00	0.00	0.12	15.77	1.52	8.67	255.00	6.42	-74.98	40.00	52.32
05:00	29.83	40.46	95.00	0.00	-0.77	9.93	1.35	5.98	255.00	6.48	-74.98	41.20	52.92
Average	64.43	54.89	1858.96	34.98	120.44	163.20	104.80	85.94	255.00	5.58	-74.98	36.74	50.68

PI Asset Framework Element Templates was used for consistency

AF elements

- AF Element templates used for logsheets for consistent visualisation
- Leverages AF meta data for visualisation
 - Same attribute names
 - Different element names



The screenshot shows the '030 Daily CIP Report' element with tabs for 'General', 'Child Elements', 'Attributes', 'Ports', 'Analyses', 'Notification Rules', and 'Version'. A table below shows data for the '030 Daily CIP Report' element:

Name	Value	Manual Data Entry
00 PRE AER 1 - pH : Online	8.278152	False
08 LEACH 1 - pH : Online	10.582	False
12 LEACH 1 - CN- (ppm) : Online	405.97	False
14 LEACH 1 - NaCN addition rate (gpm)	0.30907 gpm	False
15 LEACH 2 - pH : Online	10.74353	False
18 LEACH 2 - CN- (ppm) : Online	396.96	False
20 LEACH 2 - NaCN addition rate (gpm)	0.15541 gpm	False
24 LEACH 3 - CN- (ppm) : Online	323.46	False
29 CN REC TANK - Flocculant (LPM)	3.9995 lpm	False
33 CND #1 - Air (acfm)	258.4535 acfm	False
36 CND #2 - Air (acfm)	153.8529 acfm	False
38 CND #2 - Standpipe WAD (ppm)	0.840 ppm	True
Category: 01 Manual Entry		
00 PRE AER 1 - pH (hand)	8.9	True
01 PRE AER 1 - Marcy scale density (% Solids)	15 %	True
02 PRE AER 1 - O2 addition rate (scfm)	31 SCFM	True
03 PRE AER 1 - Dissolved O2 (mg/L)	25 mg/L	True
04 PRE AER 2 - pH (hand)	8.9	True
05 PRE AER 2 - Marcy scale density (% Solids)	15 %	True
06 PRE AER 2 - O2 addition rate (scfm)	38 SCFM	True
07 PRE AER 2 - Dissolved O2 (mg/L)	24 mg/L	True
08 LEACH 1 - pH (hand)	10.9	True
09 LEACH 1 - Marcy scale density (% Solids)	20 %	True

PI Asset Framework

AF attribute categories

- AF attribute categories used to group PI attributes
- Leverages AF meta data for visualisation
 - Use attribute categories for display
 - Filtering
 - Value retrieval methods

Name	Value	Data Reference	Settings...
Category: 02 Targets			
00 PRE AER 1 - pH (hand)	8.2	PI Point	\\PGOPCIP01\POG_MET_PreAerationTank_pH_Target
00 PRE AER 1 - pH : Online	+/- 0.5 Hand Sample	<None>	
01 PRE AER 1 - Marcy scale density (% Solids)		<None>	
02 PRE AER 1 - O2 addition rate (scfm)	> 10	<None>	
03 PRE AER 1 - Dissolved O2 (mg/L)	20-30	String Builder	'03 PRE AER 1 - Dissolved O2 (mg/L)-Min';';'03 PRE AER 1 - Dissolved O2 (mg/L)-Max';
04 PRE AER 2 - pH (hand)	8.2	PI Point	\\PGOPCIP01\POG_MET_PreAerationTank_pH_Target
05 PRE AER 2 - Marcy scale density (% Solids)		<None>	
06 PRE AER 2 - O2 addition rate (scfm)	> 10	<None>	
07 PRE AER 2 - Dissolved O2 (mg/L)	20-30	String Builder	'07 PRE AER 2 - Dissolved O2 (mg/L)-Min';';'07 PRE AER 2 - Dissolved O2 (mg/L)-Max';
08 LEACH 1 - pH (hand)	10.5	PI Point	\\PGOPCIP01\POG_MET_LeachTank1_pH_Target
08 LEACH 1 - pH : Online	+/- 0.5 Hand Sample	<None>	
09 LEACH 1 - Marcy scale density (% Solids)	30-35	String Builder	'09 LEACH 1 - Marcy scale density (% Solids)-Min';';'09 LEACH 1 - Marcy scale density (% Solids)-Max';
10 LEACH 1 - O2 addition rate (scfm)	> 10	<None>	
11 LEACH 1 - Dissolved O2 (mg/L)	20-30	String Builder	'11 LEACH 1 - Dissolved O2 (mg/L)-Min';';'11 LEACH 1 - Dissolved O2 (mg/L)-Max';
12 LEACH 1 - CN- (ppm) : Online	380	PI Point	\\PGOPCIP01\240TAC1000_CAL\SP.CV
13 LEACH 1 - CN- (ppm) : Hand	380	PI Point	\\PGOPCIP01\240TAC1000_CAL\SP.CV
14 LEACH 1 - NaCN addition rate (gpm)	< 1.5	<None>	
15 LEACH 2 - pH (hand sample)	10.7	PI Point	\\PGOPCIP01\POG_MET_LeachTank2_pH_Target

Name	Description
00 Information	DCS Data to display. No input from operator required
01 Manual Entry	Used when a data entry field for the input from operator is required
02 Targets	Used for attributes that are targets
03 Headings	Attributes that are used as headings for logsheet section
04 Manual Entry - Custom Interval	

Digital Logsheets

MPA2.0

- 000 Logsheets
- 010 Daily Grind Report Report
- 020 Daily Flotation Report
- 030 Daily CIP Report
- 040 Daily Gravity Report
- 050 Daily Paste Operating Report
- 051 Tail Thickeners and Filters Logsheet
- 060 Daily Reagents Report

Day
10/20/2022, 6:00 AM to 10/21/2022, 6:00 AM

Logsheets

Editing enabled

You might be entering data into the wrong time period

Time Stamp	Target	07:00	11:00	15:00	19:00	23:00	03:00	Average
PRE AERATION 1								
pH (hand)	8.2	8.9	8.9	8.9				8.90
pH : Online	+/- 0.5 Hand Sample	8.23	8.22	8.18	8.20			8.21
Temp (deg F)		115	116	116				115.67
Marcy Scale Density (% Solids)		15	15	15				15.00
O2 Addition Rate (scfm)	>10	24	31	31				28.67
Dissolved O2 (mg/l)	20-30	20	22	25				22.33
PRE AERATION 2								
pH (hand)	8.2	9.3	9.1	8.9				9.10
Temp (deg F)		116	116	116				116.00
Marcy Scale Density (% Solids)		15	15	15				15.00
O2 Addition Rate (scfm)	>10	33	38	38				36.33
Dissolved O2 (mg/l)	20-30	18	21	24				21.00
LEACH TANK 1								
pH (hand)	10.5	10.9	10.7	10.9				10.83
pH : Online	+/- 0.5 Hand Sample	10.89	10.68	10.55	10.72			10.71

MPA's conditional formatting reduces entry error and surfaces issues quickly

- Handled in the front end of MPA
- Uses AF attribute values
 - Retrieve attribute value at start of time range
 - Check if numeric
 - Apply a deadband for conditional formatting
 - Try to parse the either range of values or limits
- Order the conditional formatting
 - Prioritisation of which would apply

Paste Pour

Time Stamp	Paste (% Sol)	CIP Feed - Dry Tons (tph)	CIP Feed % Solids - DCS (%)	CIP Feed % Solids - Paste Cylinder (%)	OFFSET (%)
17:00		0.00			1.60
18:00		0.00			1.60
19:00		0.00			1.60
20:00		0.00			1.60
21:00		0.00			1.60
22:00		0.00			1.60
23:00		25.90			1.60
00:00		27.13			1.60
01:00	63.2	27.61	47.2	48.2	2.00
02:00		26.22			2.00
03:00		0.00			2.00
04:00		0.00			2.00
05:00		0.00			2.00
Average	63.78	12.35	47.33	48.90	1.66

+ ADD ROW

Conditional Formatting

Condition Formula Format

`isNumeric(val) ? (val < number(dat` Example Text

`isNumeric(val) | val == null ? fals` Example Text

+ CANCEL APPLY

Database Query Date Back Check In Refresh New Element New Attribute

Elements

- 000 Logsheets
 - 010 Daily Grind Report
 - 020 Daily Filtration Report
 - 030 Daily CIP Report
 - Target
 - 040 Daily Gravity Report
 - 050 Daily Paste Operating Report
 - 051 Tall Thickeners and Filters Logsheet
 - 060 Daily Reagents Report
- Element Searches

Target

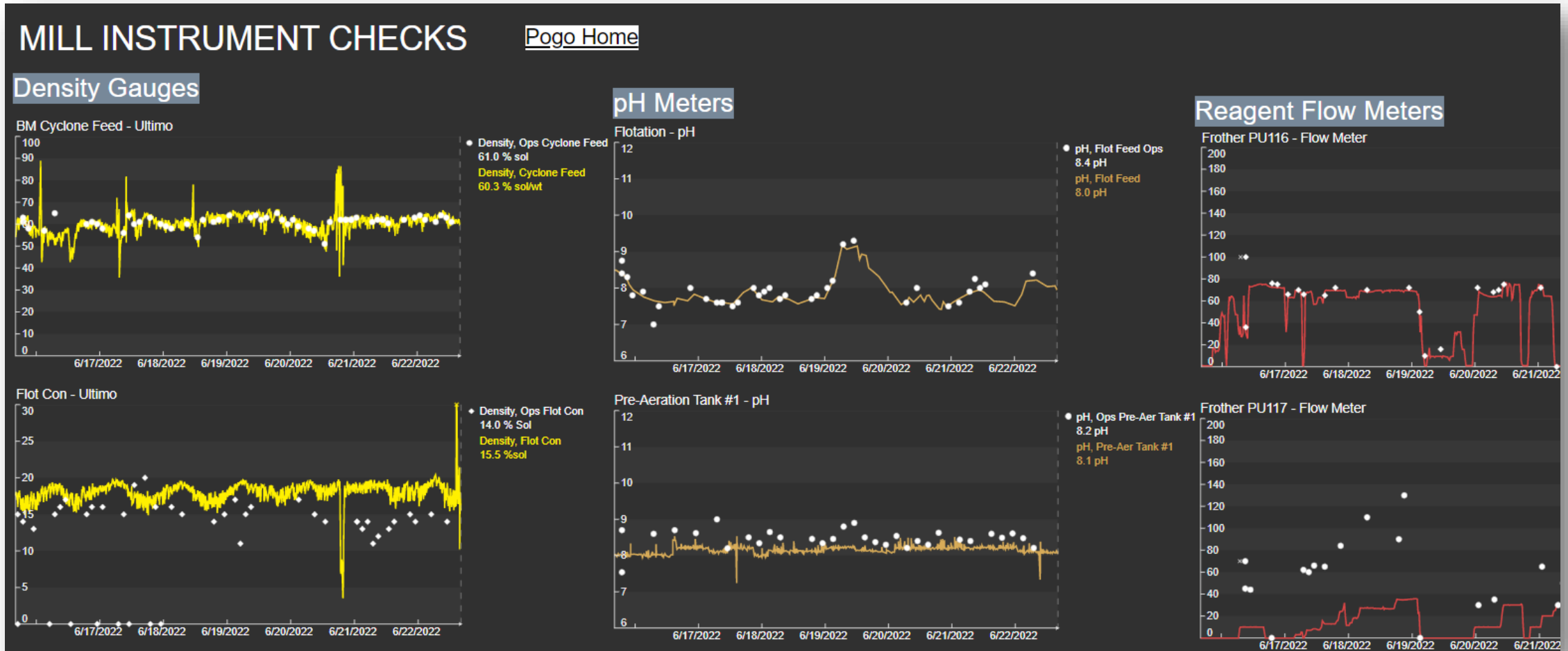
General Child Elements Attributes Ports Analyses Notification Rules Version

Filter

Name	Value	Data Reference	Settings...
Category: 02 Targets			
00 PRE AER 1 - pH (hand)	8.2	PI Point	VPGOPCIP01 POG_MET_PreAerationTank_pH_Target
00 PRE AER 1 - pH : Online	+/- 0.5 Hand Sample	<None>	
01 PRE AER 1 - Marcy scale density (% Solids)		<None>	
02 PRE AER 1 - O2 addition rate (scfm)	> 10	<None>	
03 PRE AER 1 - Dissolved O2 (mg/L)	20-30	String Builder	'03 PRE AER 1 - Dissolved O2 (mg/L)-Min';';'03 PRE AER 1 - Dissolved O2 (mg/L)-Max';
04 PRE AER 2 - pH (hand)	8.2	PI Point	VPGOPCIP01 POG_MET_PreAerationTank_pH_Target
05 PRE AER 2 - Marcy scale density (% Solids)		<None>	
06 PRE AER 2 - O2 addition rate (scfm)	> 10	<None>	
07 PRE AER 2 - Dissolved O2 (mg/L)	20-30	String Builder	'07 PRE AER 2 - Dissolved O2 (mg/L)-Min';';'07 PRE AER 2 - Dissolved O2 (mg/L)-Max';
08 LEACH 1 - pH (hand)	10.5	PI Point	VPGOPCIP01 POG_MET_LeachTank1_pH_Target
08 LEACH 1 - pH : Online	+/- 0.5 Hand Sample	<None>	
09 LEACH 1 - Marcy scale density (% Solids)	30-35	String Builder	'09 LEACH 1 - Marcy scale density (% Solids)-Min';';'09 LEACH 1 - Marcy scale density (% Solids)-Max'
10 LEACH 1 - O2 addition rate (scfm)	> 10	<None>	
11 LEACH 1 - Dissolved O2 (mg/L)	20-30	String Builder	'11 LEACH 1 - Dissolved O2 (mg/L)-Min';';'11 LEACH 1 - Dissolved O2 (mg/L)-Max';
12 LEACH 1 - CN (ppm) : Online	380	PI Point	VPGOPCIP01 240TAC1000_CAL/SP_CV

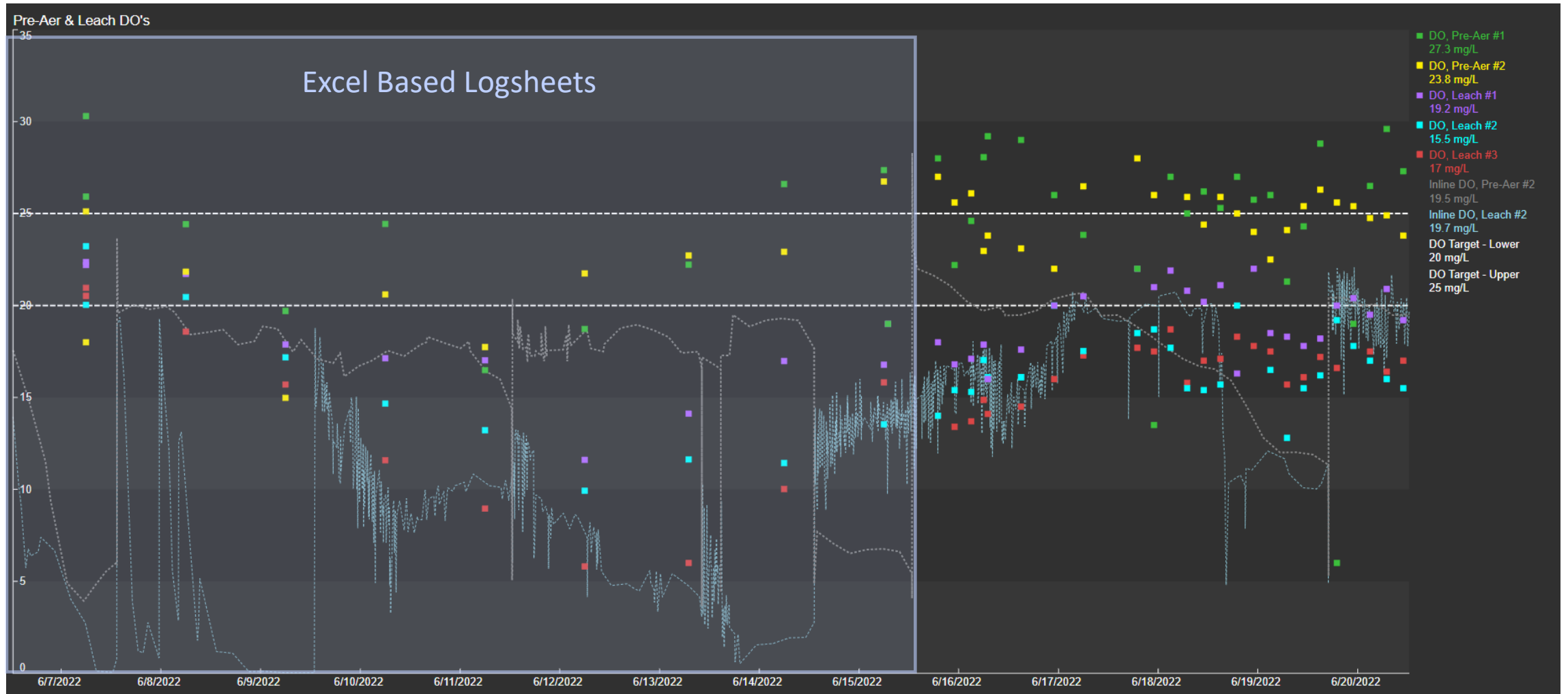
PI Vision

Data Visualization



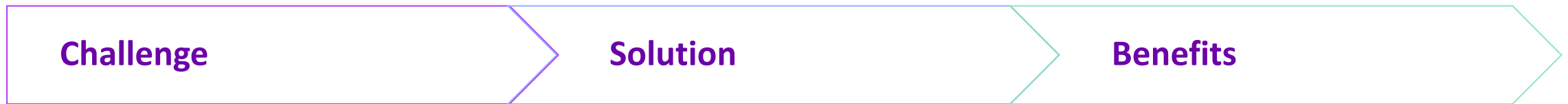
PI Vision

Data Visualization



Summary

Summary – Digital Logsheets



Resource intensive manual data entry using excel

Deployed the latest AVEVA PI System technology including PI AF as an advanced foundation to integrate both process data and manually entered data.

Deployed MIPAC's MPA software to leverage the AVEVA PI System and provide a frontend of data entry.

Improved consistency and reliability of data

Improved efficiency

Integrated systems



Daniel Qiao

Lead Systems Specialist (OSISoft Infrastructure Accredited)

- MIPAC (OSISoft by AVEVA - PI Systems Integrator)
- Daniel.Qiao@MIPAC.com



James Sweeney

Project Metallurgist

- Northern Star Resources
- jsweeney@nsrltd.com

Questions?

Please wait for the microphone.
State your name and company.



Please remember to...


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AVEVA is a global leader in industrial software, sparking ingenuity to drive responsible use of the world's resources. The company's secure industrial cloud platform and applications enable businesses to harness the power of their information and improve collaboration with customers, suppliers and partners.

Over 20,000 enterprises in over 100 countries rely on AVEVA to help them deliver life's essentials: safe and reliable energy, food, medicines, infrastructure and more. By connecting people with trusted information and AI-enriched insights, AVEVA enables teams to engineer efficiently and optimize operations, driving growth and sustainability.

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