FLUKE®

Industry 4.0 and IIoT Drive a New World of Maintenance

Accelix™

Webinar Series

Today's presenters

Martin Davis

Managing Partner
DUNELM Associates

Jim Gavigan

President and
Chief Time-Series Data Storyteller
Industrial Insight Inc.

Poll Question No. 1

How would you rate your knowledge of Industry 4.0?

- Expert
- Know the basics
- Heard of it
- Not sure

What is Industry 4.0?

Put simply:

Turning real-time data from your equipment into real-time information to make decisions and improve your processes (manual or automated).

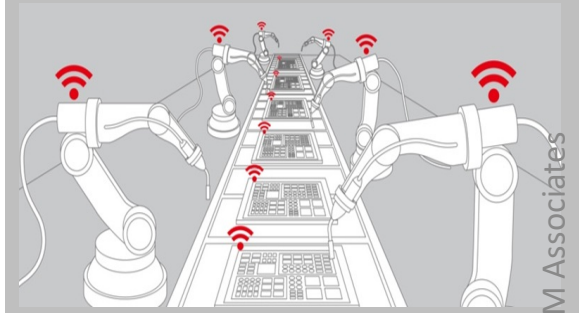
Industry 4.0 & IIoT in one slide

Industry 4.0

Corporate Strategy

- Smart / Digital Factory
- Operational Intelligence
- Lean/6-Sigma approaches
- Automation
- Trained and empowered digital workers

+



Industrial Internet

Enabling Technologies

- Everything connected (devices/machines/people)
- IIoT devices
- Existing operational data
- Analytics (incl. Big Data)
- Cloud computing
- AI/ML

=

Competitive Advantage

Improved Performance

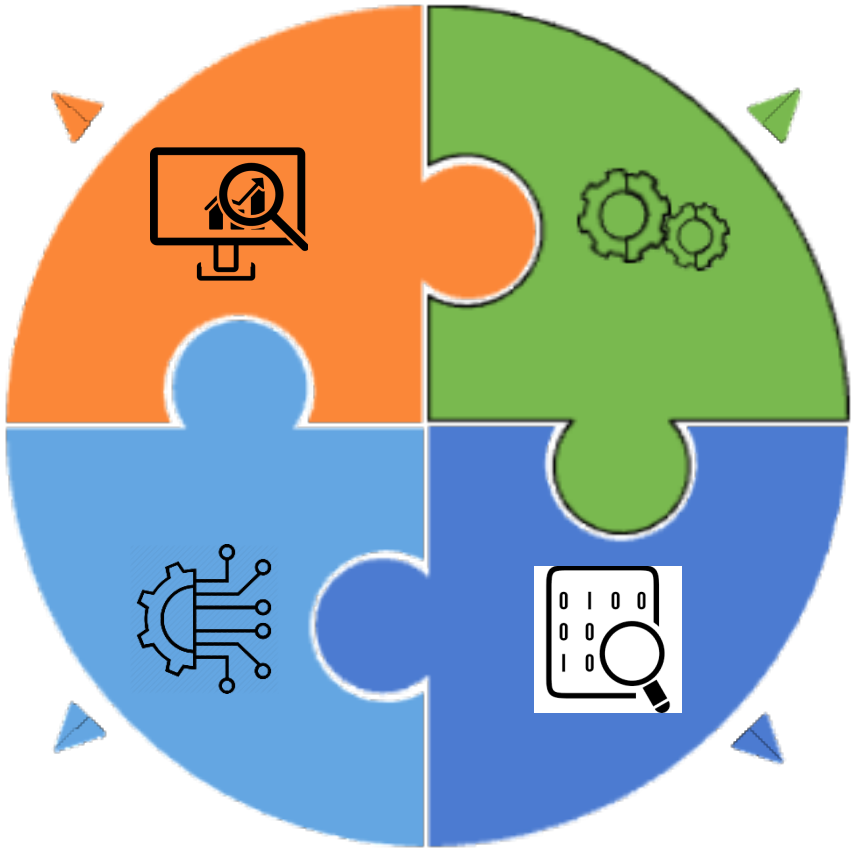
- Increased revenue & profitability
- Increased visibility
- Improved OEE
- Reduced downtime

IIoT is not a Silver Bullet

A Winning Approach

ANALYZE IT

- Get the history
- What is happening?
- What patterns?
- Predicting problems?



START SMALL

- Pick some key but problematic machine centers

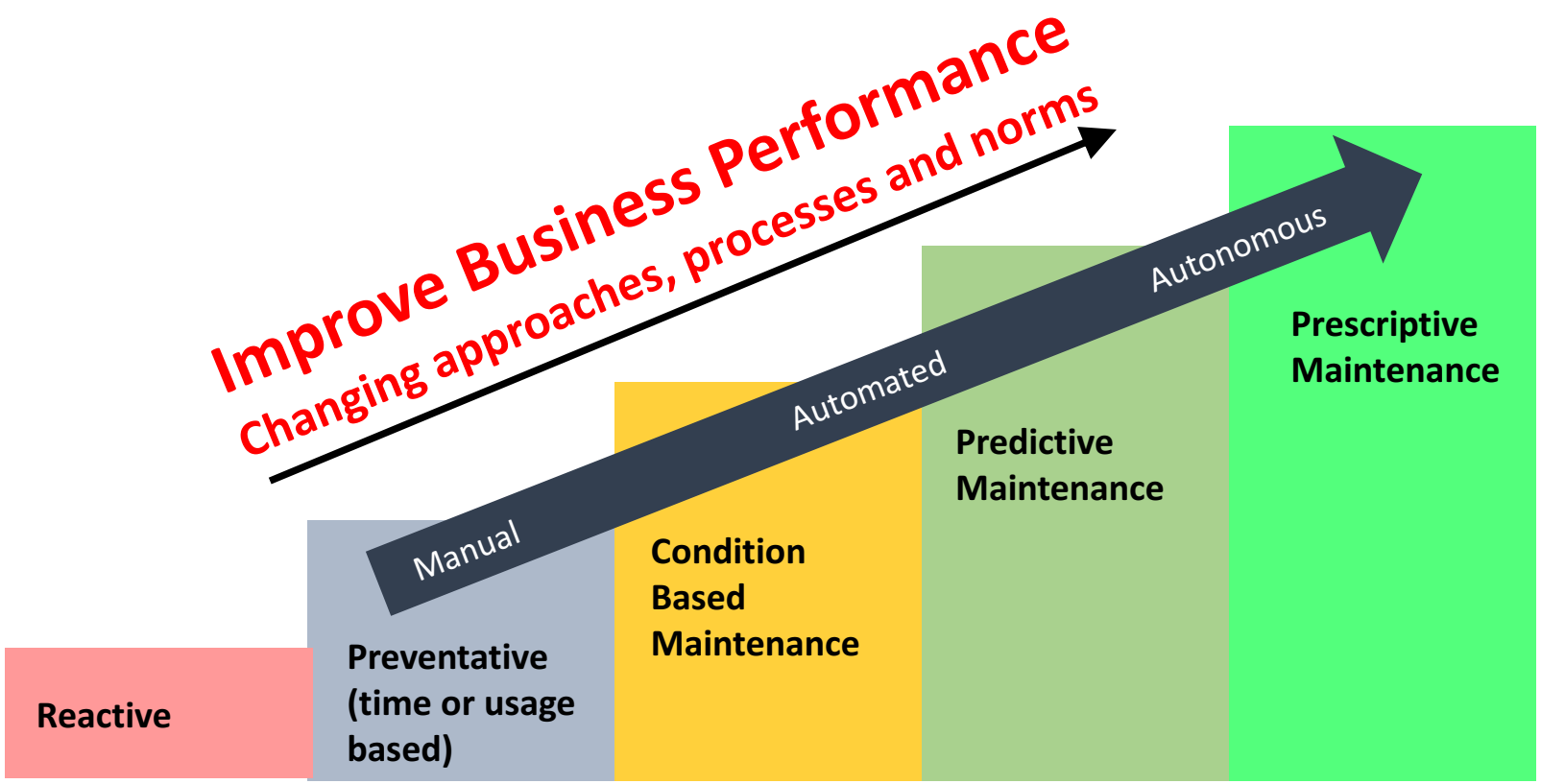
GIVE IT CONTEXT

- Location
- Product being run
- Quality data
- MES data
- Other related info

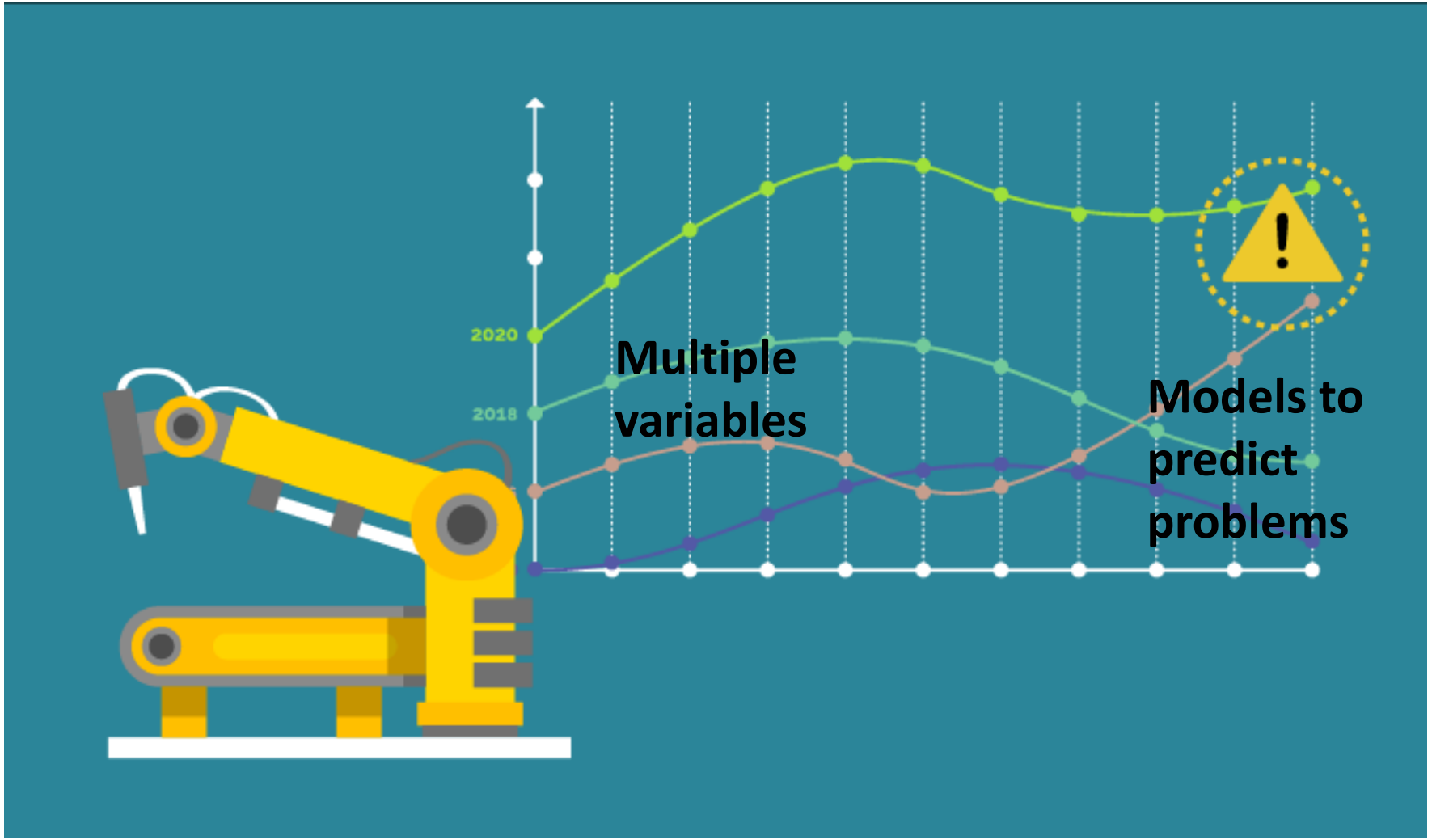
GET GOOD DATA

- Networked PLCs
- DCS
- Wireless IIoT sensors

Reducing maintenance costs using data

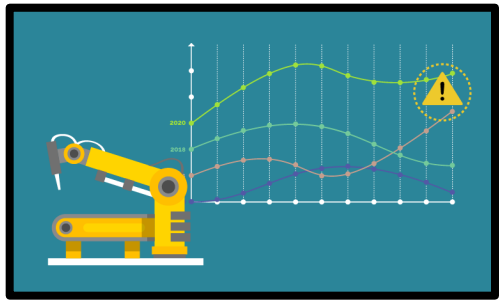


Predictive maintenance

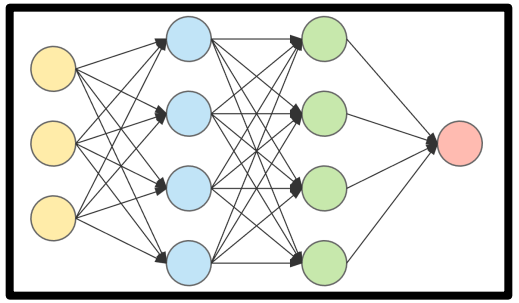


Prescriptive maintenance

Automation



Predict a developing problem



Decide corrective action

ERP/ MES/CMMS

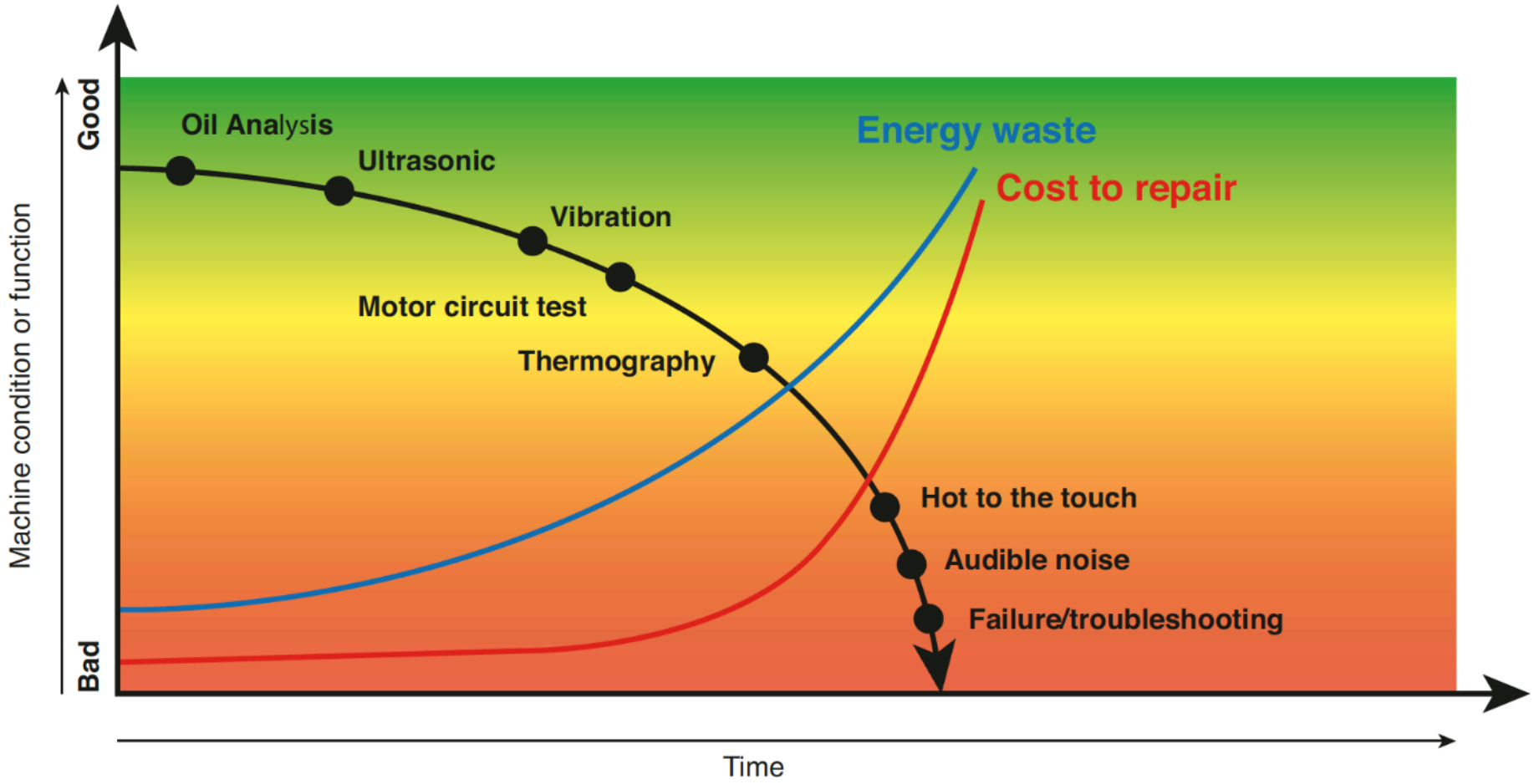
Order parts, Issue work order

Poll Question No. 2

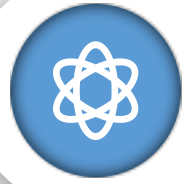
What level of maintenance does your organization use?

- Preventative (time-based)
- Condition Based (single variable)
- Predictive (multi-variable)
- Prescriptive (auto-generate work orders to fix problem)

Early detection = reduced costs



Real-time machine health



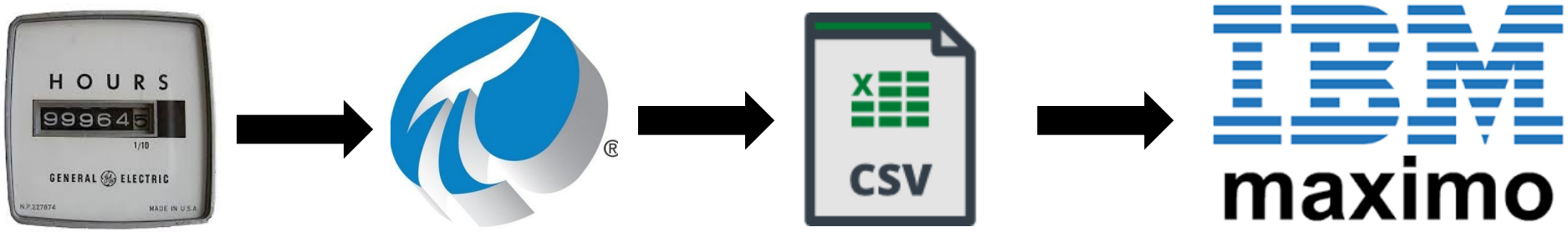
Data + Context = Information

Maintenance + Information = SAVINGS (<$$$)

Use Case No. 1
Runtime hours to CMMS

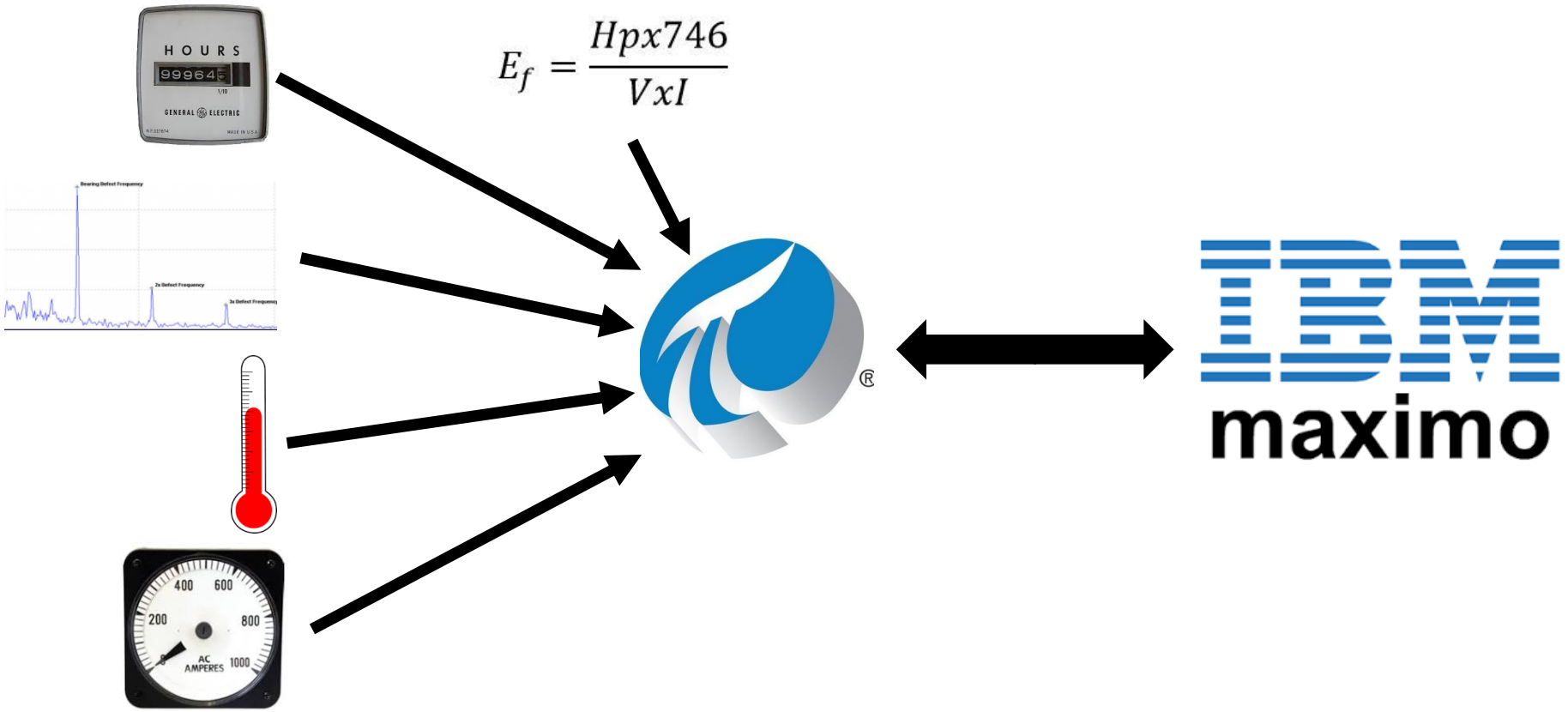
Use Case No. 1: Runtime hours to CMMS

Start Simple …



Use Case No. 1: Runtime hours to CMMS

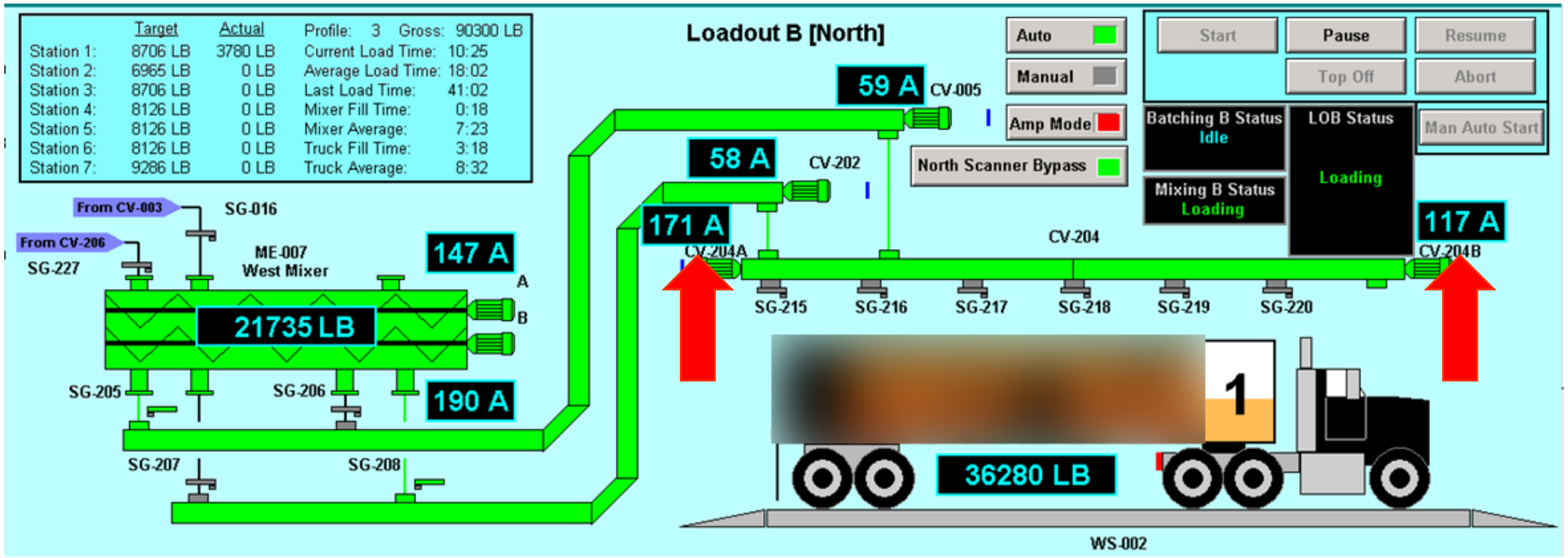
Then, Perhaps, Get More Complex …



Use Case No. 2
Overcurrent of Motor

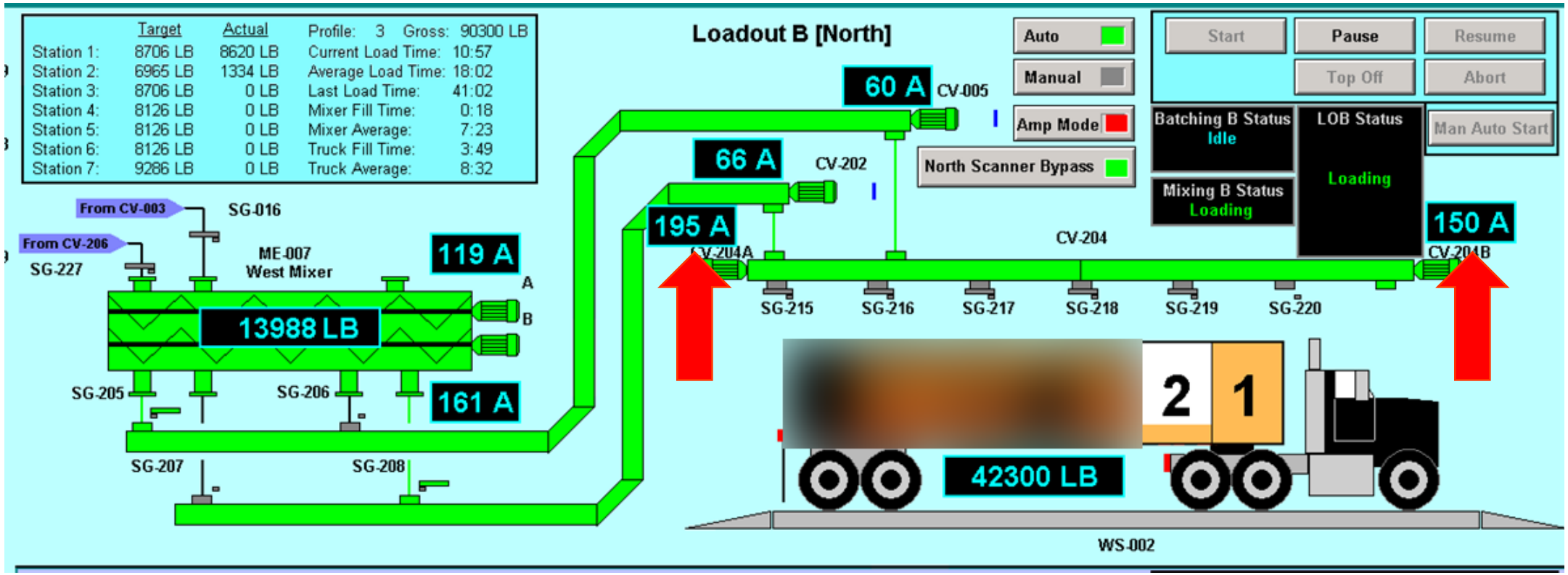
Use Case No. 2: Overcurrent of motor

Current seems high on screw conveyors!



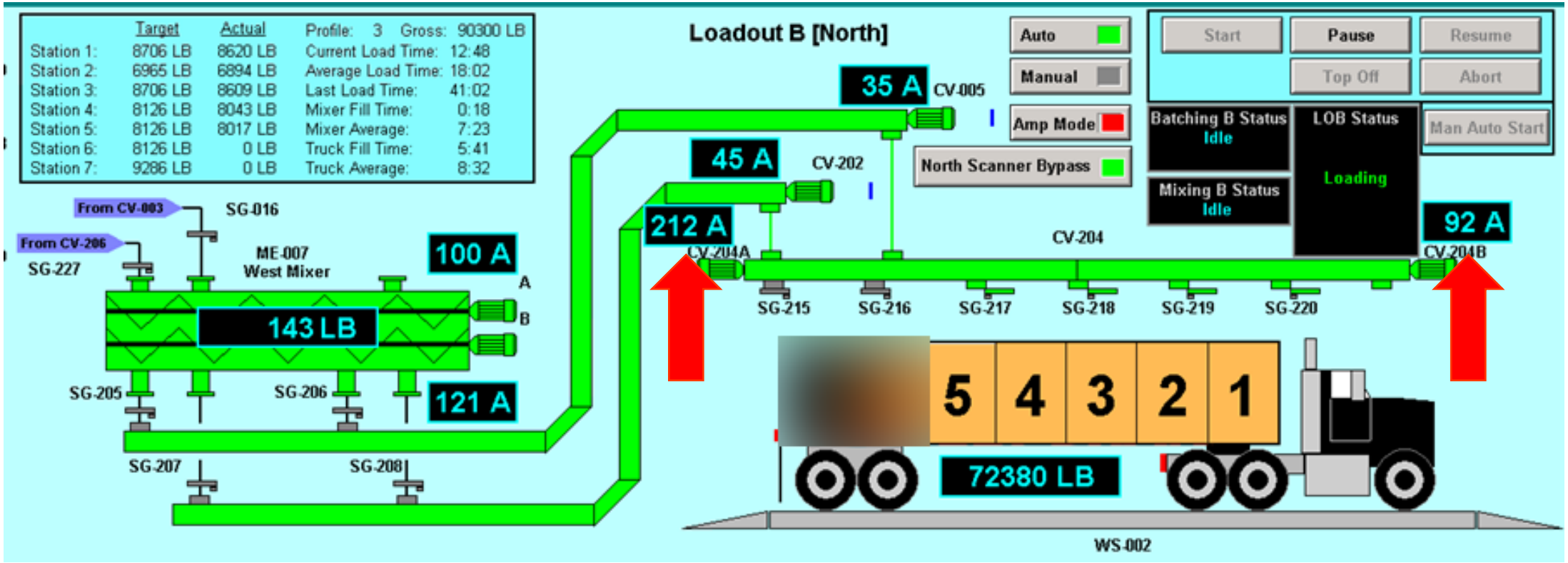
Use Case No. 2: Overcurrent of motor

Current IS high on screw conveyors!



Use Case No. 2: Overcurrent of motor

Current IS high on screw conveyors!



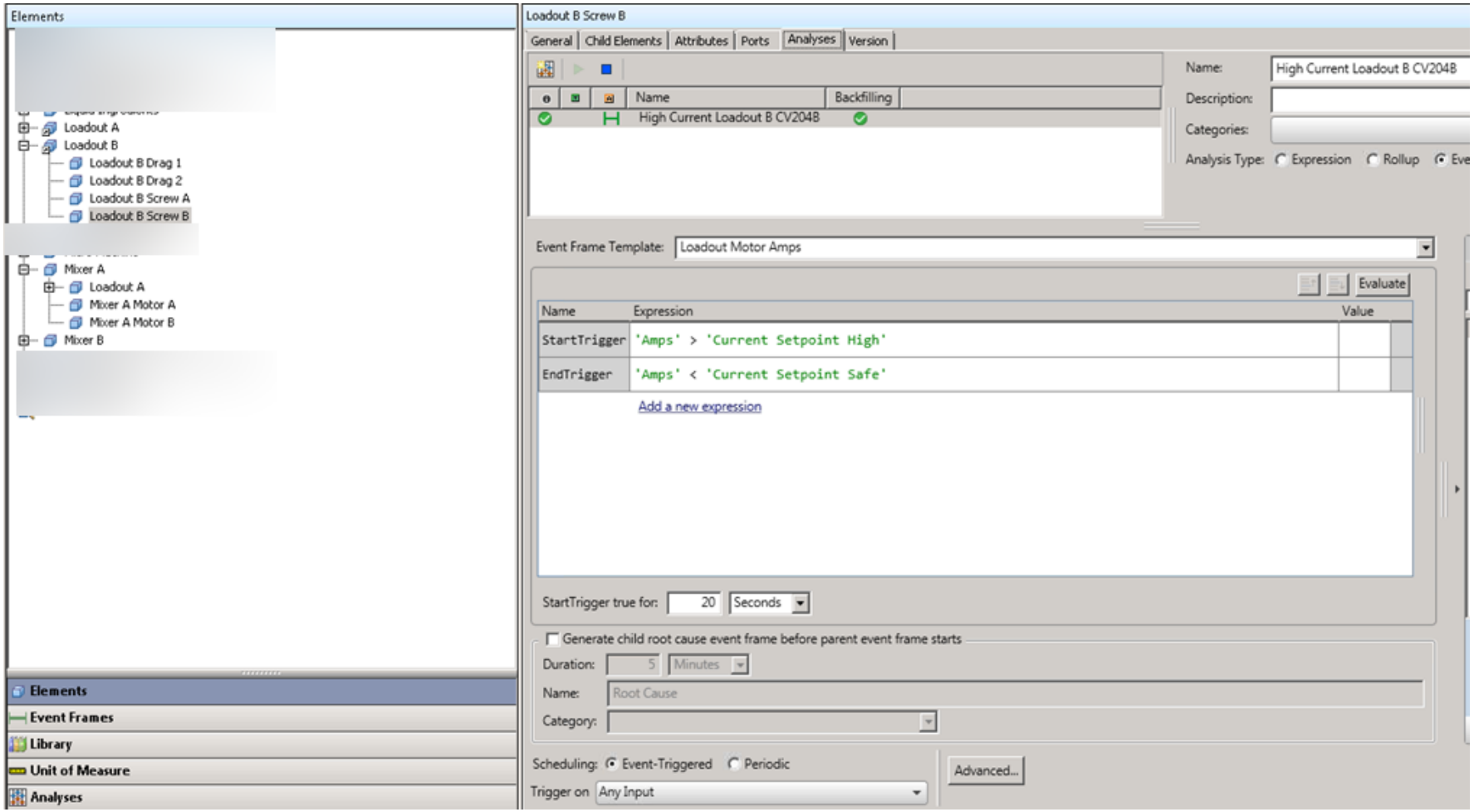
Use Case No. 2: Overcurrent of motor

Questions:

- **What is the maximum rating of the screw feeder motors in Loadout B?**
  - **155A (125HP)**
- **Feedstock from Plant "A" has caused problems in the past – were they running Plant "A" Feed on this occasion?**
  - **YES!**
- **Does this same issue happen when running Feedstock from Plant "B" and Plant "C" ?**
  - **You will see…**
- **Does this motor have a record of premature failure?**
  - **"We think so, it failed within the last year, but we need more information on its failure history"**

Use Case No. 2: Overcurrent of motor

"Event frames" – How often?



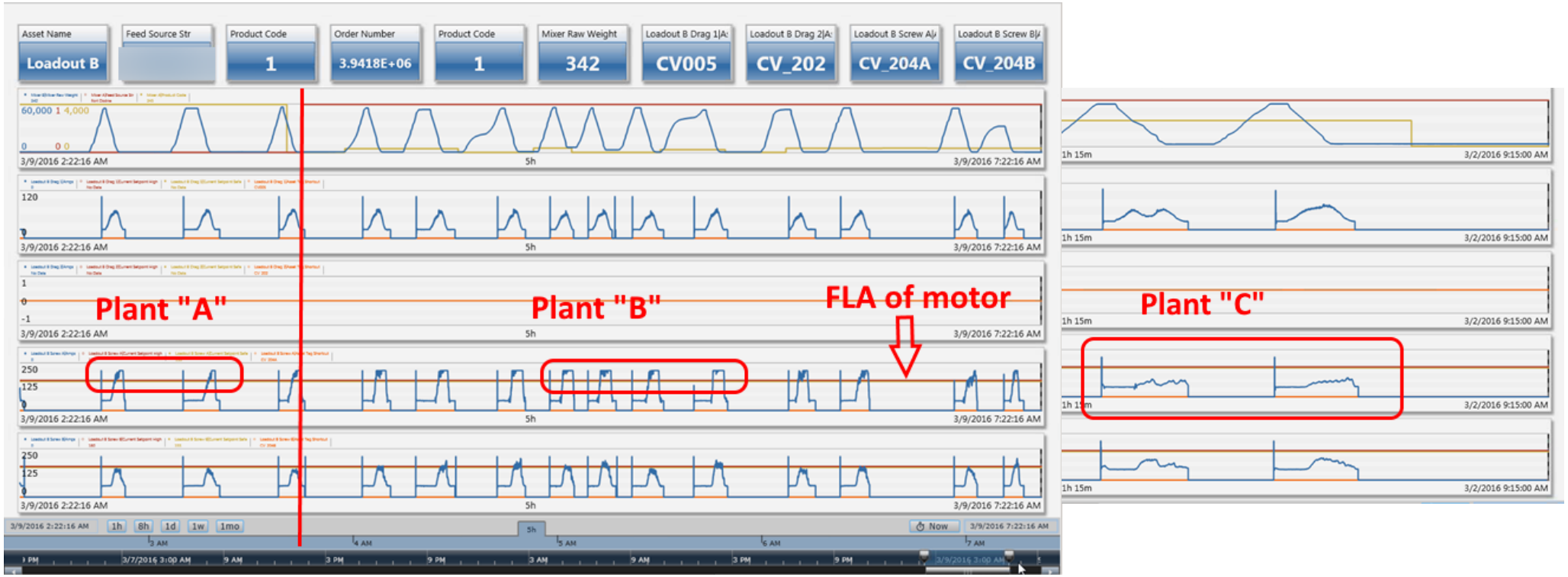
Use Case No. 2: Overcurrent of motor

Happens a LOT, with specific traits

EventFrame	Event_Start_Tim	EF_End_Tim	Duration	Asset Name	Feed Source	Mixer Weight at End	Mixer Weight At Star	Motor Current Av	Motor Current Ma	Order Numbe	Product Cod
Loadout B Screw A Loadout Motor Amps 03-30-2016 09:07:18	3/30/2016 9:07	3/30/2016 9:08	01:10	Loadout B Screw A		2878	19779.5	196.2863553	212	3965164	7070
Loadout B Screw B Loadout Motor Amps 03-30-2016 09:07:39	3/30/2016 9:07	3/30/2016 9:08	00:55	Loadout B Screw B		2294	13467.5	166.4909301	177	3965164	7070
Loadout B Screw A Loadout Motor Amps 03-30-2016 09:25:40	3/30/2016 9:25	3/30/2016 9:26	00:56	Loadout B Screw A		7583.5	22866	202.1437451	212	3965076	7002
Loadout B Screw B Loadout Motor Amps 03-30-2016 09:25:49	3/30/2016 9:25	3/30/2016 9:26	00:52	Loadout B Screw B		6574	19880	177.0386383	186	3965076	7002
Loadout B Screw A Loadout Motor Amps 03-30-2016 09:27:43	3/30/2016 9:27	3/30/2016 9:28	01:01	Loadout B Screw A		1103.5	1181.5	195.0981461	212	3965076	7002
Loadout B Screw A Loadout Motor Amps 03-30-2016 09:53:56	3/30/2016 9:53	3/30/2016 9:55	01:04	Loadout B Screw A		2666.5	16780	181.0000436	200	3968281	1
Loadout B Screw B Loadout Motor Amps 03-30-2016 12:06:58	3/30/2016 12:06	3/30/2016 12:07	00:43	Loadout B Screw B		9740.5	21259	164.6975016	176	3968450	7065
Loadout B Screw A Loadout Motor Amps 03-30-2016 14:17:47	3/30/2016 14:17	3/30/2016 14:19	01:25	Loadout B Screw A		2345.5	2466	206.4603234	212	3971262	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 14:32:34	3/30/2016 14:32	3/30/2016 14:34	01:44	Loadout B Screw A		1482.5	4288.5	204.7024061	212	3968063	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 14:42:06	3/30/2016 14:42	3/30/2016 14:44	02:02	Loadout B Screw A		1457	5960.5	199.5415119	212	3966621	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 14:52:22	3/30/2016 14:52	3/30/2016 14:53	01:16	Loadout B Screw A		1656	1690.5	196.3815937	212	3968064	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 15:01:41	3/30/2016 15:01	3/30/2016 15:04	02:38	Loadout B Screw A		1508.5	15194	200.2598097	212	3968065	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 15:12:20	3/30/2016 15:12	3/30/2016 15:14	01:54	Loadout B Screw A		1455	5425	197.4918488	212	3968065	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 15:38:51	3/30/2016 15:38	3/30/2016 15:40	01:58	Loadout B Screw A		1452.5	6559.5	186.2299561	212	3971396	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 15:49:12	3/30/2016 15:49	3/30/2016 15:50	01:34	Loadout B Screw A		760.5	1421.5	193.4135109	212	3970729	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 16:01:40	3/30/2016 16:01	3/30/2016 16:03	01:23	Loadout B Screw A		1290.5	2174.5	193.4917259	212	3970610	355
Loadout B Screw A Loadout Motor Amps 03-30-2016 16:30:21	3/30/2016 16:30	3/30/2016 16:31	01:05	Loadout B Screw A		3372	3382	185.5375566	212	3971474	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 16:42:56	3/30/2016 16:42	3/30/2016 16:44	01:47	Loadout B Screw A		1246	4765	183.8973247	212	3971474	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 17:18:49	3/30/2016 17:18	3/30/2016 17:19	00:23	Loadout B Screw A		1204	1209.5	170.4787265	180	3969627	410
Loadout B Screw A Loadout Motor Amps 03-30-2016 17:33:01	3/30/2016 17:33	3/30/2016 17:33	00:41	Loadout B Screw A		1098	1098	178.1947585	198	3970281	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 18:29:00	3/30/2016 18:29	3/30/2016 18:30	01:44	Loadout B Screw A		1268	4912.5	185.5574812	212	3971476	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 18:42:59	3/30/2016 18:42	3/30/2016 18:44	01:43	Loadout B Screw A		571.5	4014	194.7865584	212	3977021	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 18:59:40	3/30/2016 18:59	3/30/2016 19:01	01:50	Loadout B Screw A		571.5	5494	192.7007242	212	3970283	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 20:10:47	3/30/2016 20:10	3/30/2016 20:11	00:57	Loadout B Screw A		536	750.5	172.2101938	190	3977513	1
Loadout B Screw A Loadout Motor Amps 03-30-2016 20:35:53	3/30/2016 20:35	3/30/2016 20:37	01:56	Loadout B Screw A		587.5	5567	181.6718053	212	3970284	1

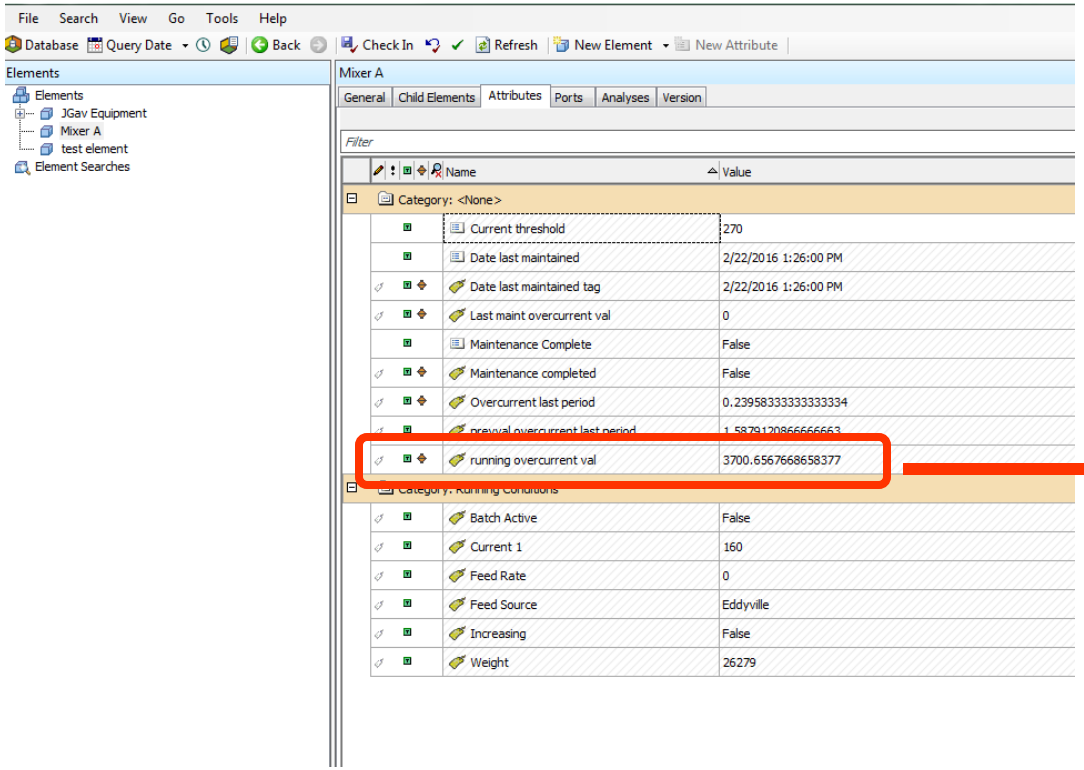
Use Case No. 2: Overcurrent of motor

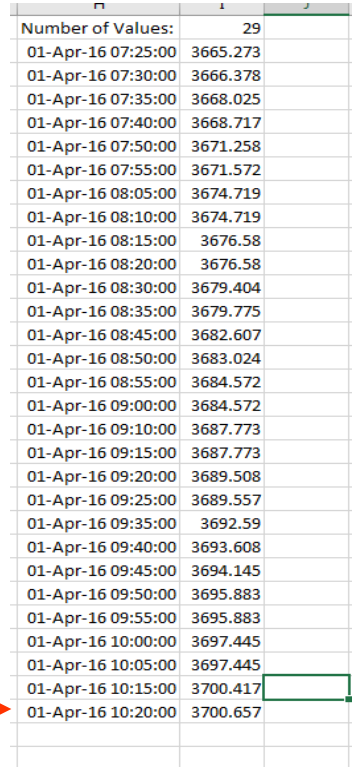
Trends



Use Case No. 2: Overcurrent of motor

Calculations – How Long In Overcurrent?





Number of Values:	29
01-Apr-16 07:25:00	3665.273
01-Apr-16 07:30:00	3666.378
01-Apr-16 07:35:00	3668.025
01-Apr-16 07:40:00	3668.717
01-Apr-16 07:50:00	3671.258
01-Apr-16 07:55:00	3671.572
01-Apr-16 08:05:00	3674.719
01-Apr-16 08:10:00	3674.719
01-Apr-16 08:15:00	3676.58
01-Apr-16 08:20:00	3676.58
01-Apr-16 08:30:00	3679.404
01-Apr-16 08:35:00	3679.775
01-Apr-16 08:45:00	3682.607
01-Apr-16 08:50:00	3683.024
01-Apr-16 08:55:00	3684.572
01-Apr-16 09:00:00	3684.572
01-Apr-16 09:10:00	3687.773
01-Apr-16 09:15:00	3687.773
01-Apr-16 09:20:00	3689.508
01-Apr-16 09:25:00	3689.557
01-Apr-16 09:35:00	3692.59
01-Apr-16 09:40:00	3693.608
01-Apr-16 09:45:00	3694.145
01-Apr-16 09:50:00	3695.883
01-Apr-16 09:55:00	3695.883
01-Apr-16 10:00:00	3697.445
01-Apr-16 10:05:00	3697.445
01-Apr-16 10:15:00	3700.417
01-Apr-16 10:20:00	3700.657

Use Case No. 3
Dynamic Displays

Use Case No. 3: Dynamic displays based on rules

Use Case No. 3: Dynamic displays based on rules

Heads up displays

Use Case No. 4
Spare Run Compliance

Use Case No. 4: Spare run compliance

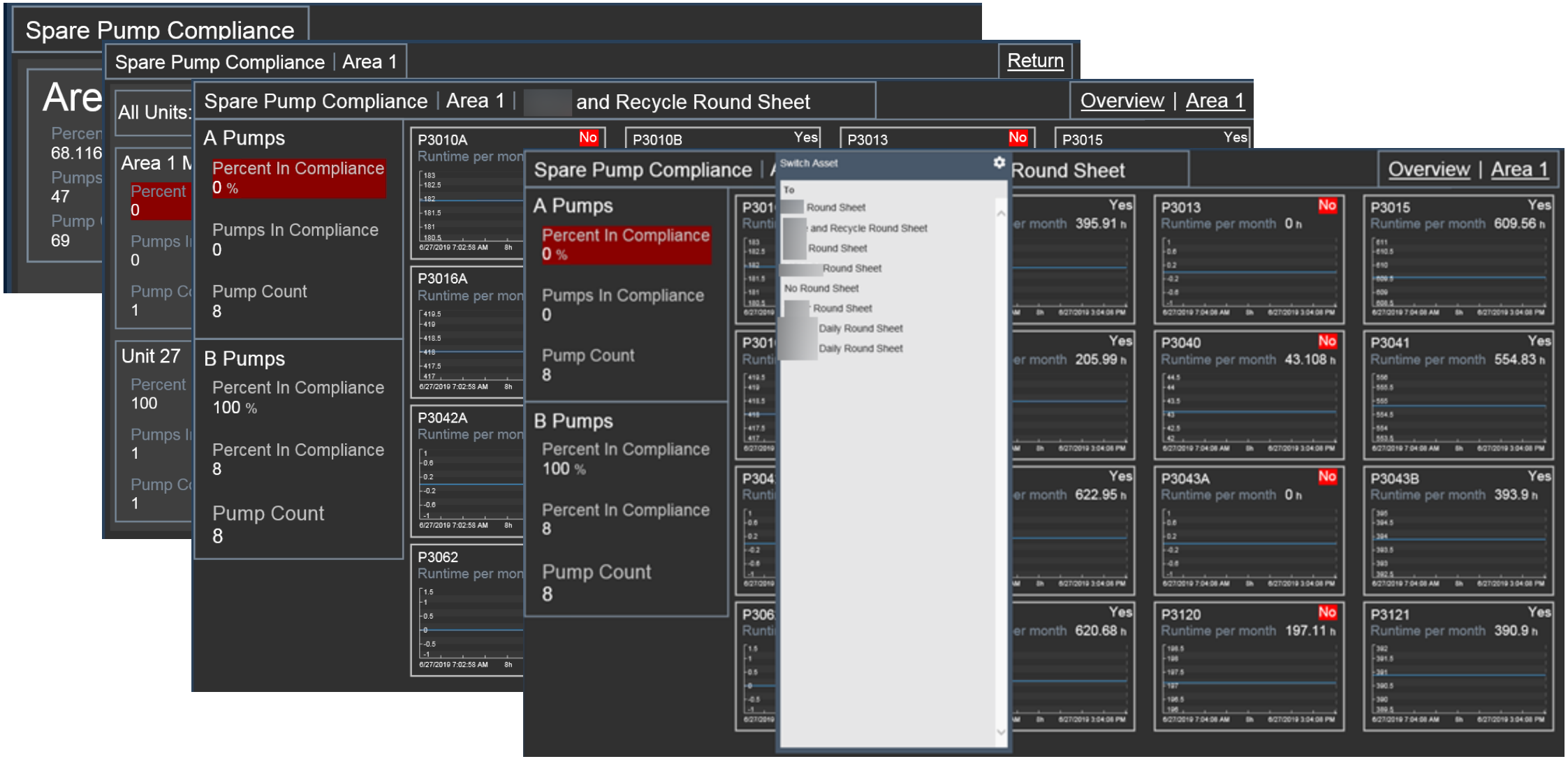
Used to take a full day to compile manually

Area 5 Spares Management Report

Plan	Pump #	January	Febuary	March	April	May	June	July	August	September	October	November	December
B	P8604B	Off	Off	Off	Off	Off	On	On	On	Off	On		
A	B8651	On	On	On	On	On	On	On	On	On	On		
B	B8652	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off		
A	B8656	On	On	On	On	On	Off	On	On	Off	On		
B	B8659	Off	Off	Off	Off	Off	On	Off	Off	On	Off		
Monthly	A	13	6	6	5	14	5	7	5	14	4	0	0
Totals	B	4	11	11	11	3	12	10	13	3	13	0	0
Percent on Plan		76%	65%	35%	65%	82%	71%	41%	76%	82%	76%	0%	0%
Unit 6- B1093W Round Sheet													
A	P3491	On	Off	On	Off	Off	Off	Off	Off	Off	Off		
B	P3492	On	On	On	On	On	On	On	On	Off	On		
A	P3493	Off	Off	Off	Off	Off	Off	Off	Off	Off	Off		
B	P3494	On	On	On	On	On	On	On	On	On	On		
A	P9368A	Off	Off	On	On	Off	Off	Off	Off	On	On		
B	P9368B	On	On	Off	Off	On	On	On	On	Off	Off		
A	P9395A	Off	Off	Off	Off	Off	Off	Off	Off	On	On		
B	P9395B	On	On	On	On	On	On	On	On	Off	Off		
A	P3440	On	On	On	On	On	On	On	On	On	Off		
B	P3441	Off	Off	Off	Off	Off	Off	Off	Off	Off	On		
Monthly	A	2	1	3	2	1	1	1	1	3	2	0	0
Totals	B	4	4	3	3	4	4	4	4	1	3	0	0

Plant | Area1 | Area 2 | Area 3 | Area 5 | Lookup sheet | Master List | Sheet2 | Variations on "running"

Use Case No. 4: Spare run compliance



In closing

Thoughts from the trenches

- You need **HIGH QUALITY** (reliable, and at the right frequency or fidelity) data from the **RIGHT** sensors that stay **CALIBRATED**
- Your data historian is likely a **Gold** Mine of information, don't just use it **REACTIVELY**
- Your data historian isn't just a "bunch of trends"
- The integration options with CMMS, augmented reality, machine learning and AI are endless, but if you don't have **HIGH QUALITY** data from the **RIGHT** sensors, don't waste your money on this technology until you do
- If you aren't historizing condition data from your equipment, or don't have a plan to, plan for **EXTINCTION or IRRELEVANCY**
- Reliability and CBM is the LARGEST single opportunity in the IIoT/Industry 4.0 realm. Get on the train or get **RUN OVER.**

DUNELM Associates

industrial insight

FLUKE®

The end result / getting started

- Up to 30% less in maintenance costs
- Considerably reduced unplanned downtime

→ Why are you not doing this right now?

Getting Started

- Put down the firehose
- Get good data from one problem area
- Prove to yourself that this approach works
- Repeat on another area
- Use the firehose less often

Q&A

Martin Davis

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