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Traditional Diagnostics Meets Industry 4.0 to Drive Yankee Performance and Safety

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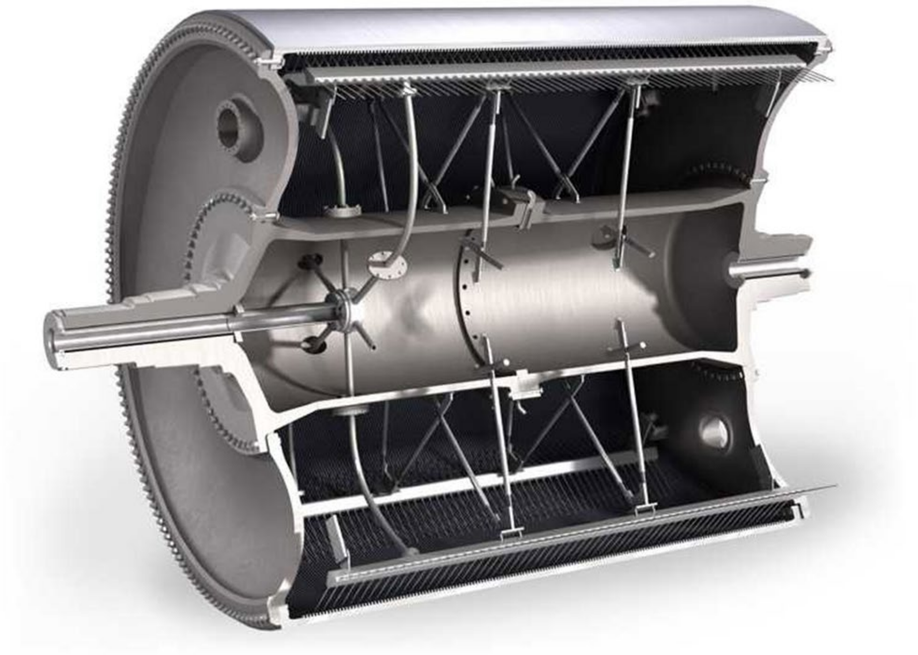
Yankee Operation Priorities



Safety:

- Annual inspection
- Fitness for service inspection
- Non-routine inspection

Performance:

- Energy cost reduction
- Productivity improvement

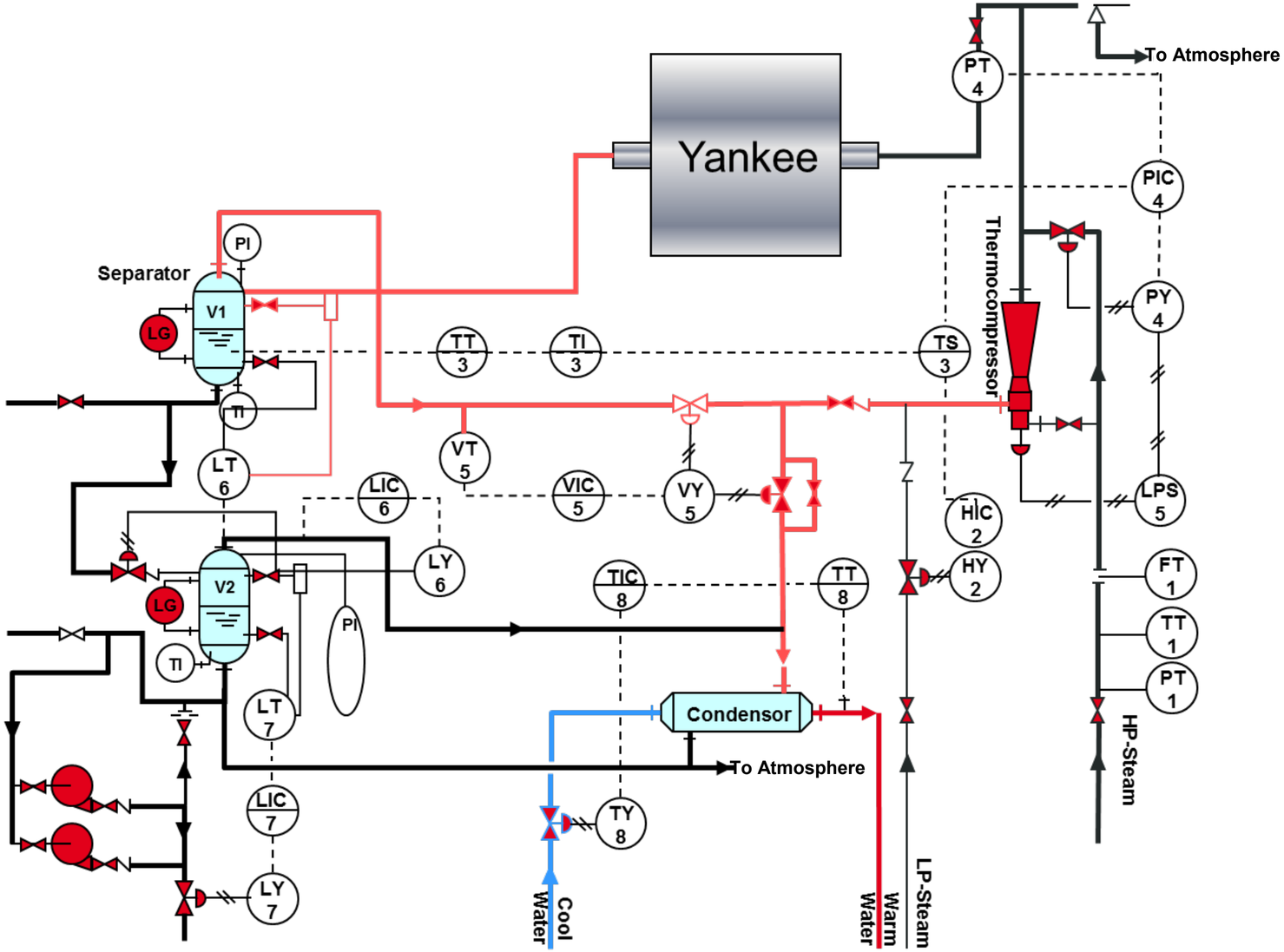
Traditional Yankee Diagnostics can help…

1. Detailed and objective steam and condensate system audit
   a) Identify opportunities for system efficiency improvement
   b) Control logic optimization
2. High speed thermal imaging of Yankee
   a) Identify internal thermal anomalies with machine running
   b) Define the most energy efficient operating configuration

….but how do we take the audit on-line?

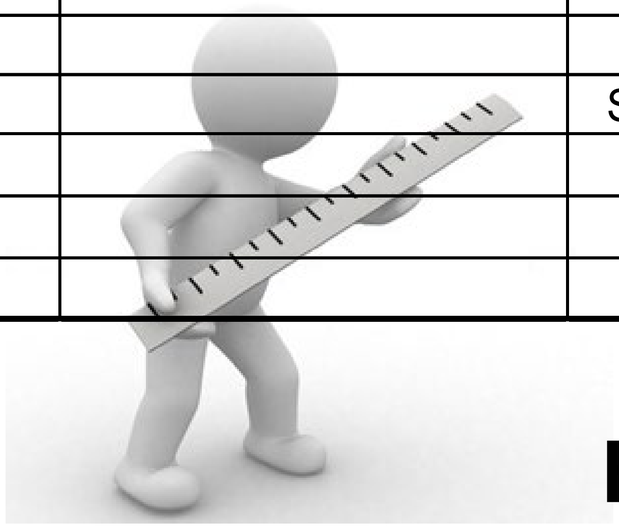
3. On-line performance monitoring
   a) “Scorecard” approach to data visualization
   b) Modular building block to Industry 4.0

Simplified Steam and Condensate Schematic



The Audit Tool

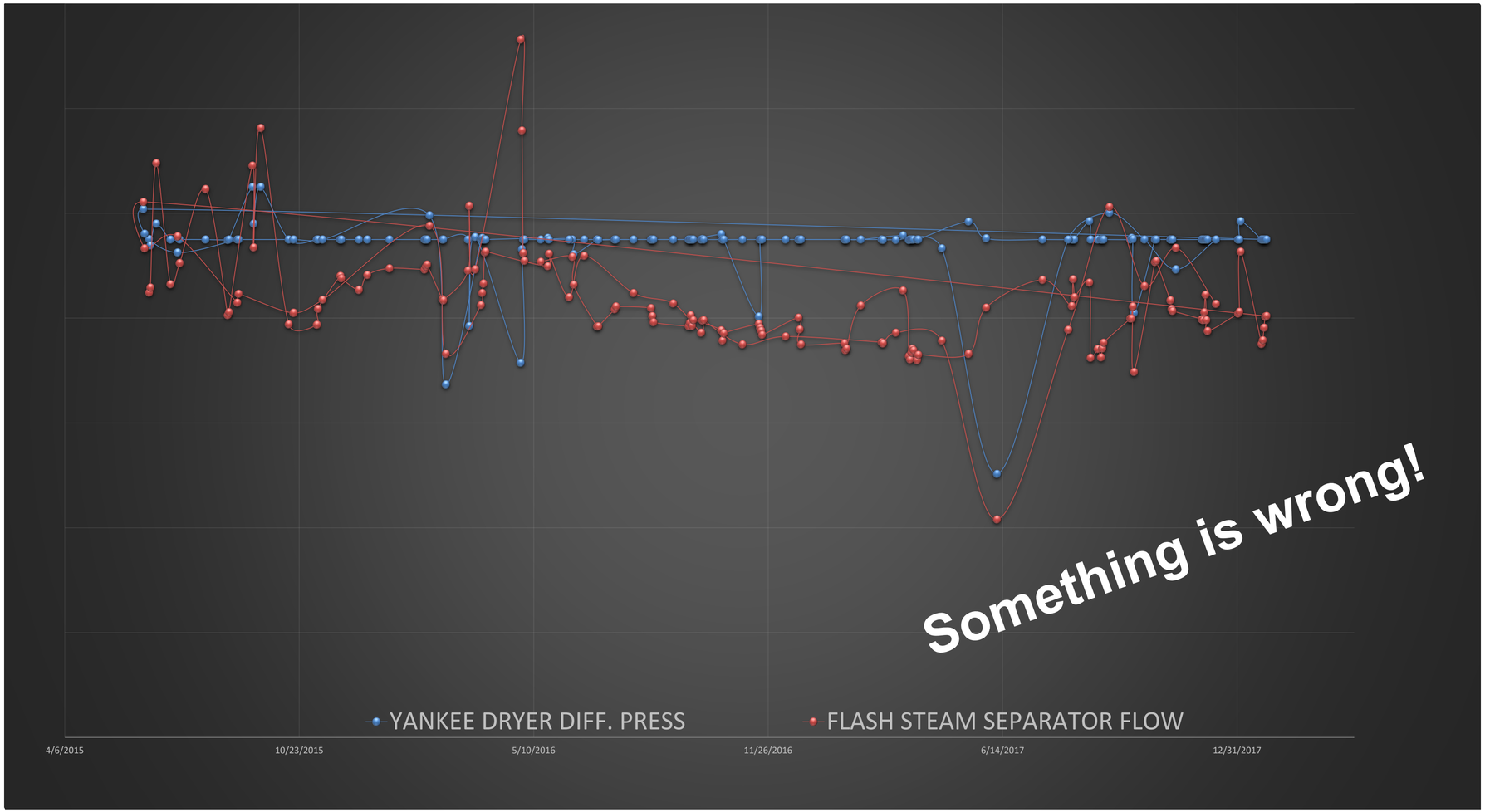
Machine Basics	Drawings	DCS	Steam Tables
Machine # & Location	Number of Straws	Make-up Pressure (Gauge)	Total Supply Density
Yankee Speed	ID Straws	Make-up Temperature (optional)	Blow Thru Density
Reel Speed	Riser ID	Make-up Flow	Condensate Density
Grade	Number of Headers	Motive Pressure (Gauge)	Make-up Density
Basis Weight	Separator Diameter	Motive Temperature (optional)	Motive Density
Reel Moisture		Motive Supply Flow	
Post Press Moisture		Supply Pressure (Gauge)	
Sheet Width		Supply Temperature (optional)	
Yankee Manufacturer		Blow Thru Pressure (Gauge)	
		Blow Thru Flow	
		Vent or Flash Tank Flow	



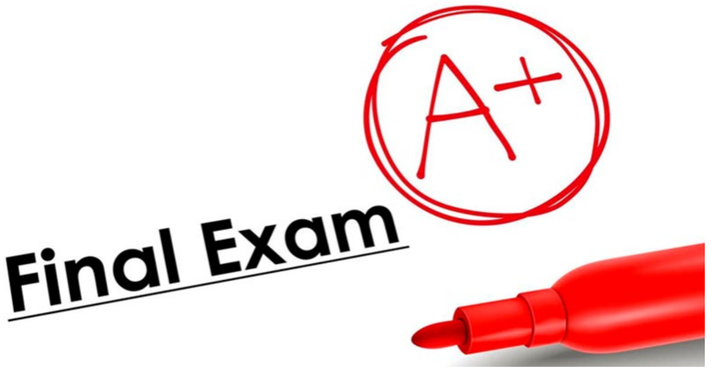
How Does it Measure Up?

Historical Review of KPI

dP vs BT

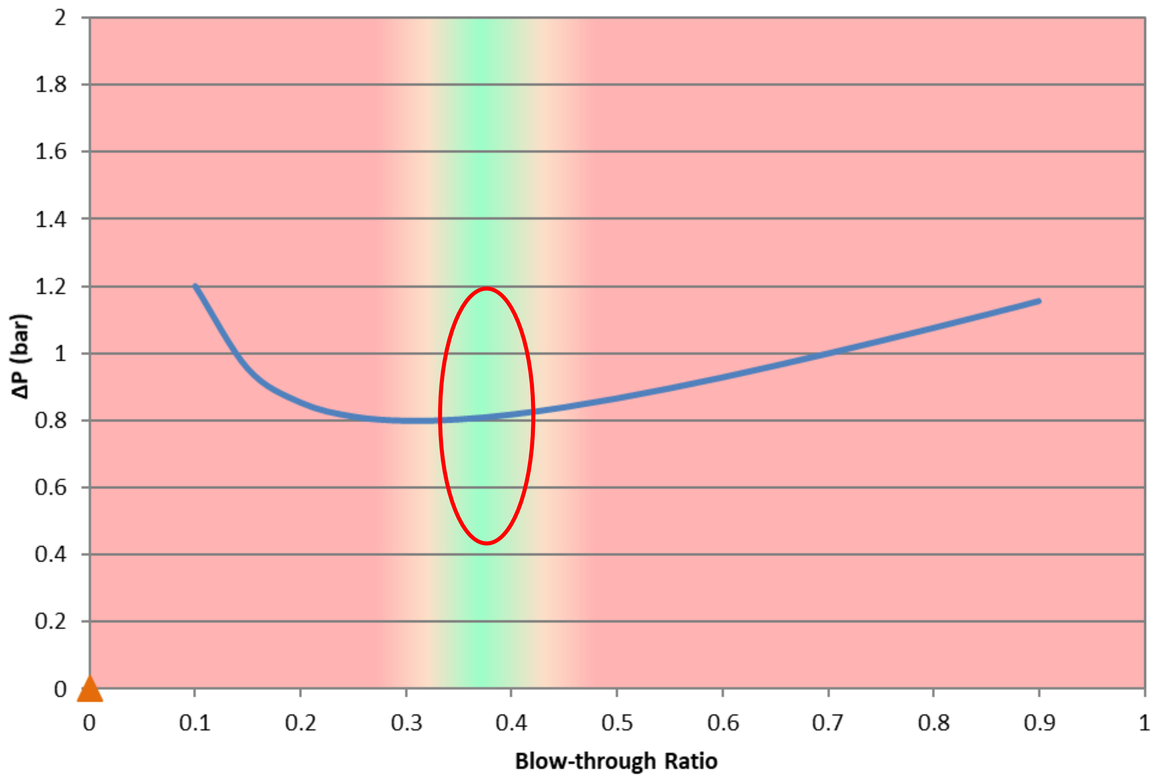


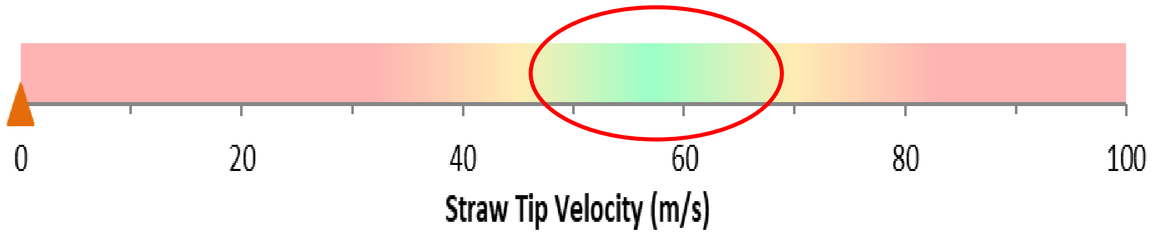
Results vs Recommended Values



- Riser Pipe / Straw Tip Area Ratio
  - ✓ Ratio in range of 1.1 - 1.3
- Blow-Through / Supply Steam Ratio
  - ✓ Ratio in range of 35% - 40%
- Straw Tip Blow-Through Velocity
  - ✓ Velocity in range of 45 - 70 m/s

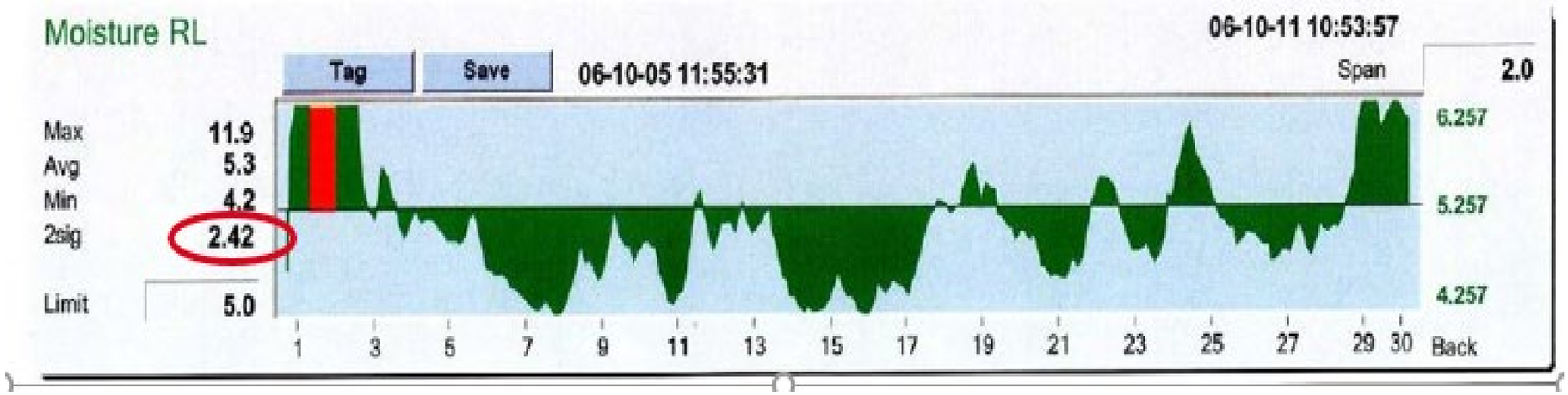
System Resistance "J" Curve





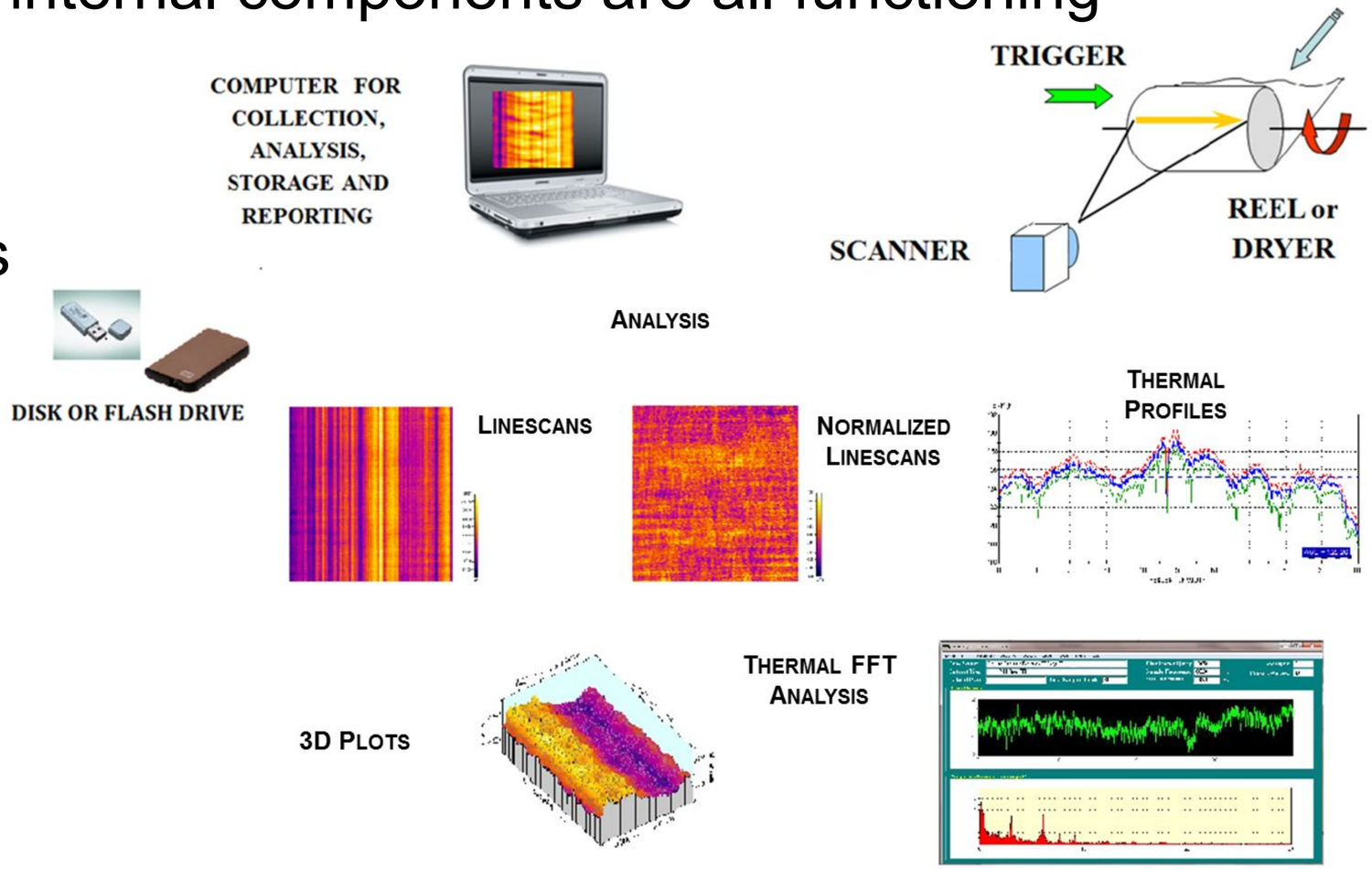
When to Consider High Speed Thermal IR

- Moisture 2-sigma more than 0.75
- Venting steam to avoid flooding
- Yankee floods occasionally
- Higher blow-through now needed to maintain dP
- Higher dP at the same BT flow
- **High steam use or high blow-through rate based on the steam and condensate audit**

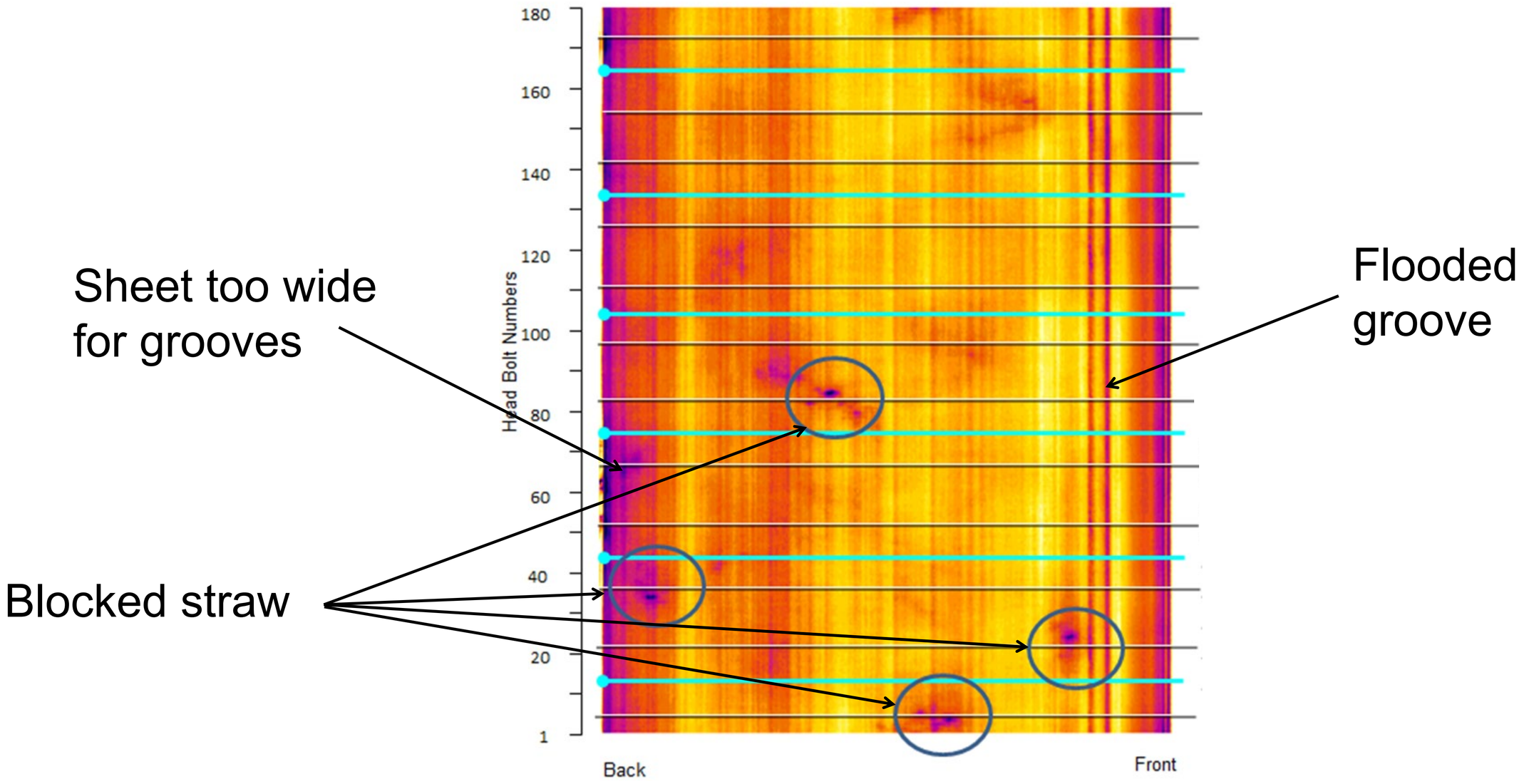


A Solid Partner for Steam and Condensate A

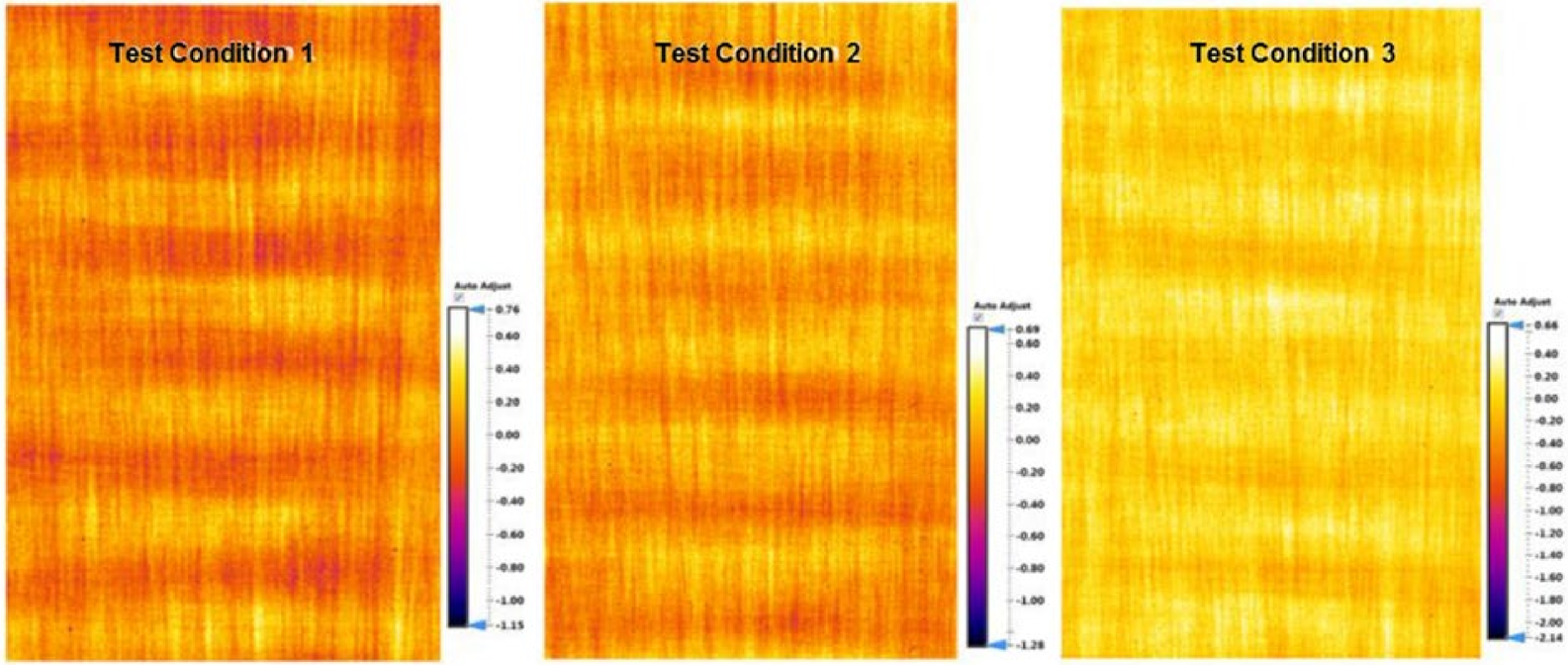
- Optimize Yankee differential pressure or blow-through rates
- Determine if the internal components are all functioning properly:
  - Gaskets
  - Collection pots
  - Headers
  - Risers
  - Straws

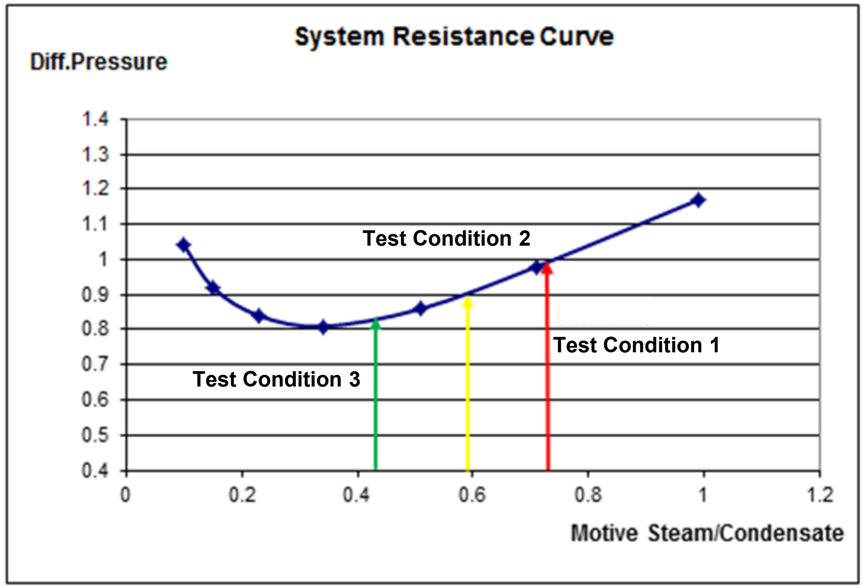


Detect Internal Deficiencies on the Run

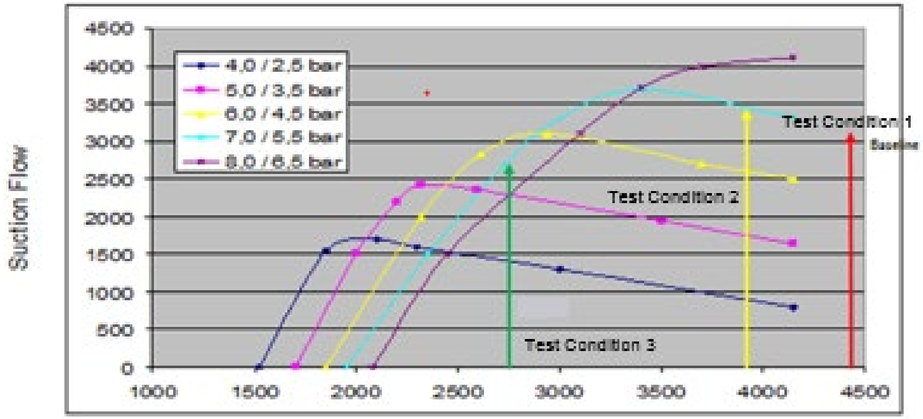


Establish Best System Performance





Thermocompressor Operating Curves



Use IR imaging to establish the best S&C KPI settings for the optimum Yankee thermal performance.

Now use on-line system to maintain resilient Yankee performance in real-time

Taking the Audit On-line

Step 1.
Aggregate data from multiple sources

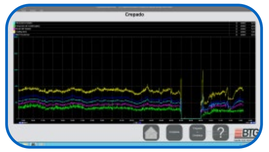
Step 2.
Add domain expertise
Calculate KPI

Step 3.
Visualize indexed KPI data

DCS/historian

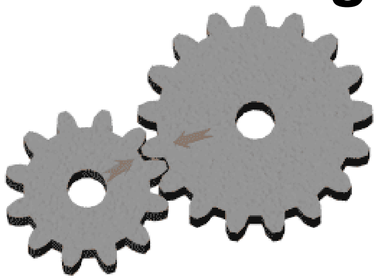
QCS

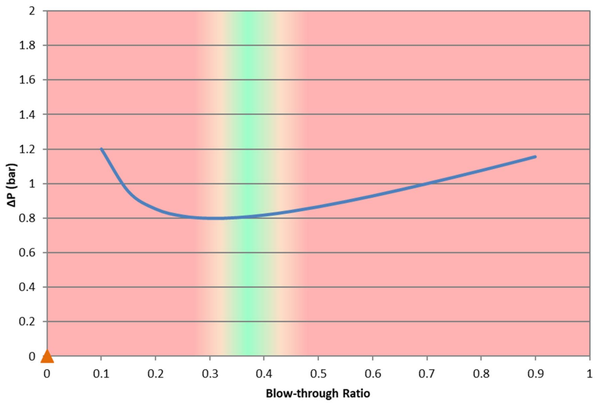
Paper Lab/LIMS

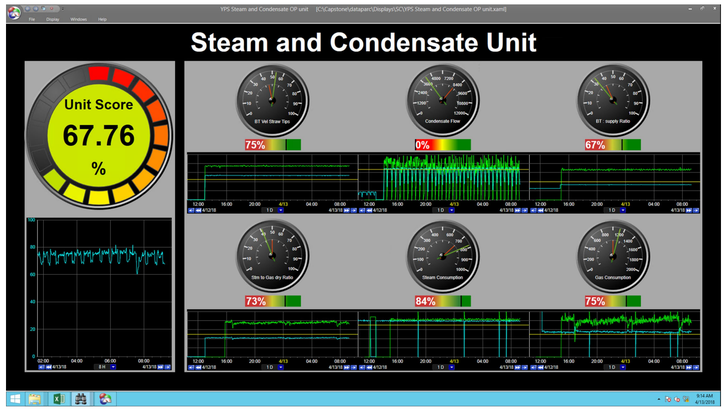


Blade Vibration

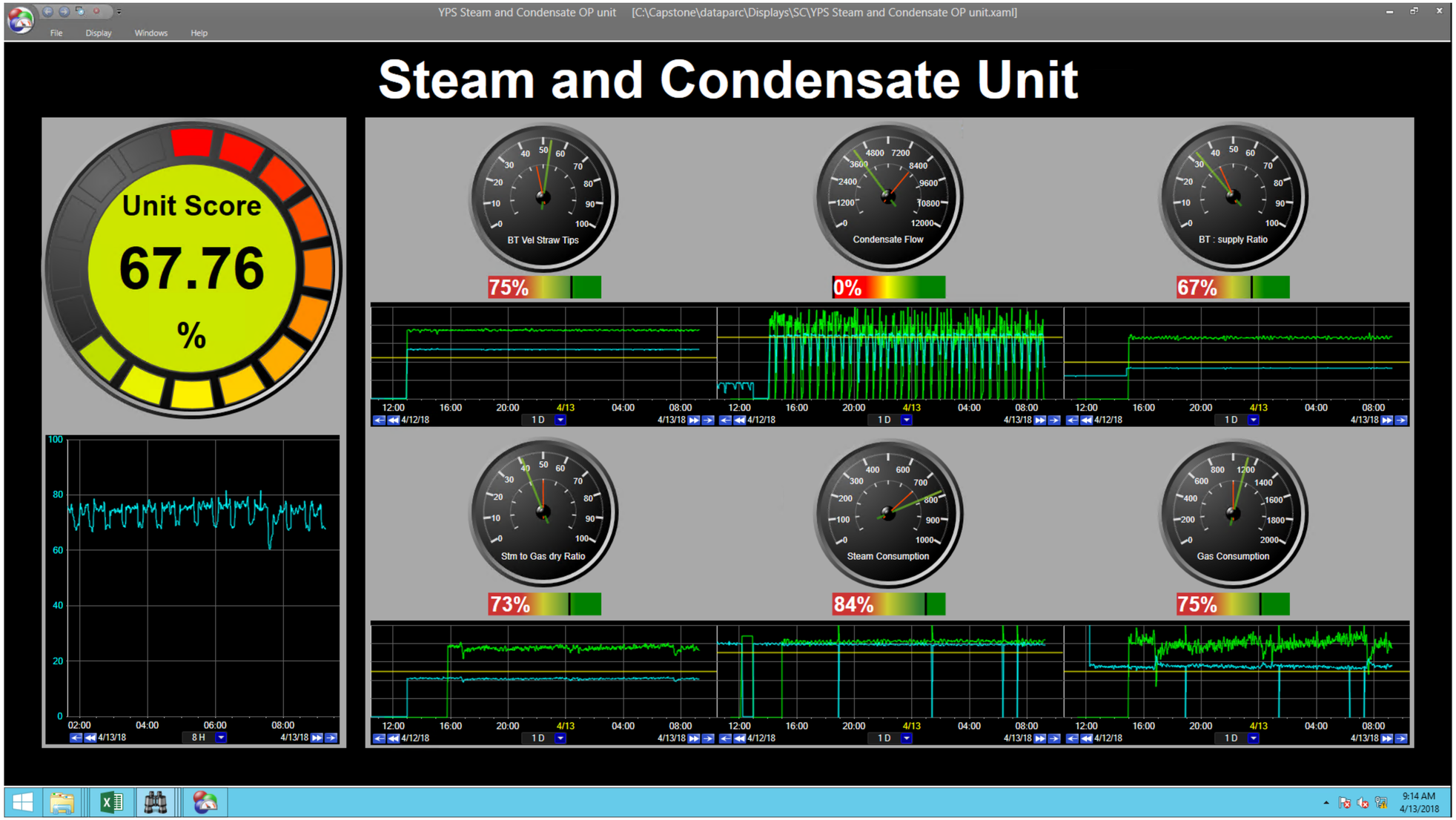
Calculation Engine



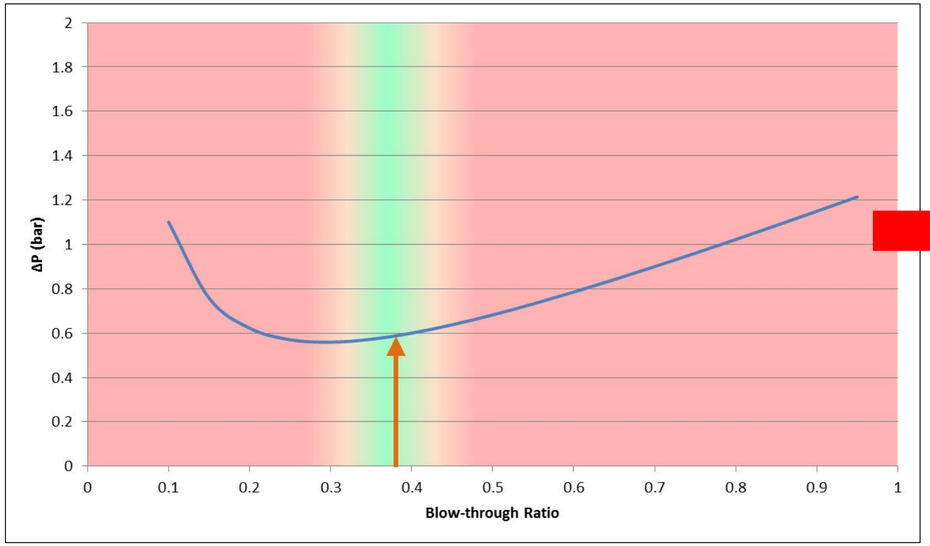


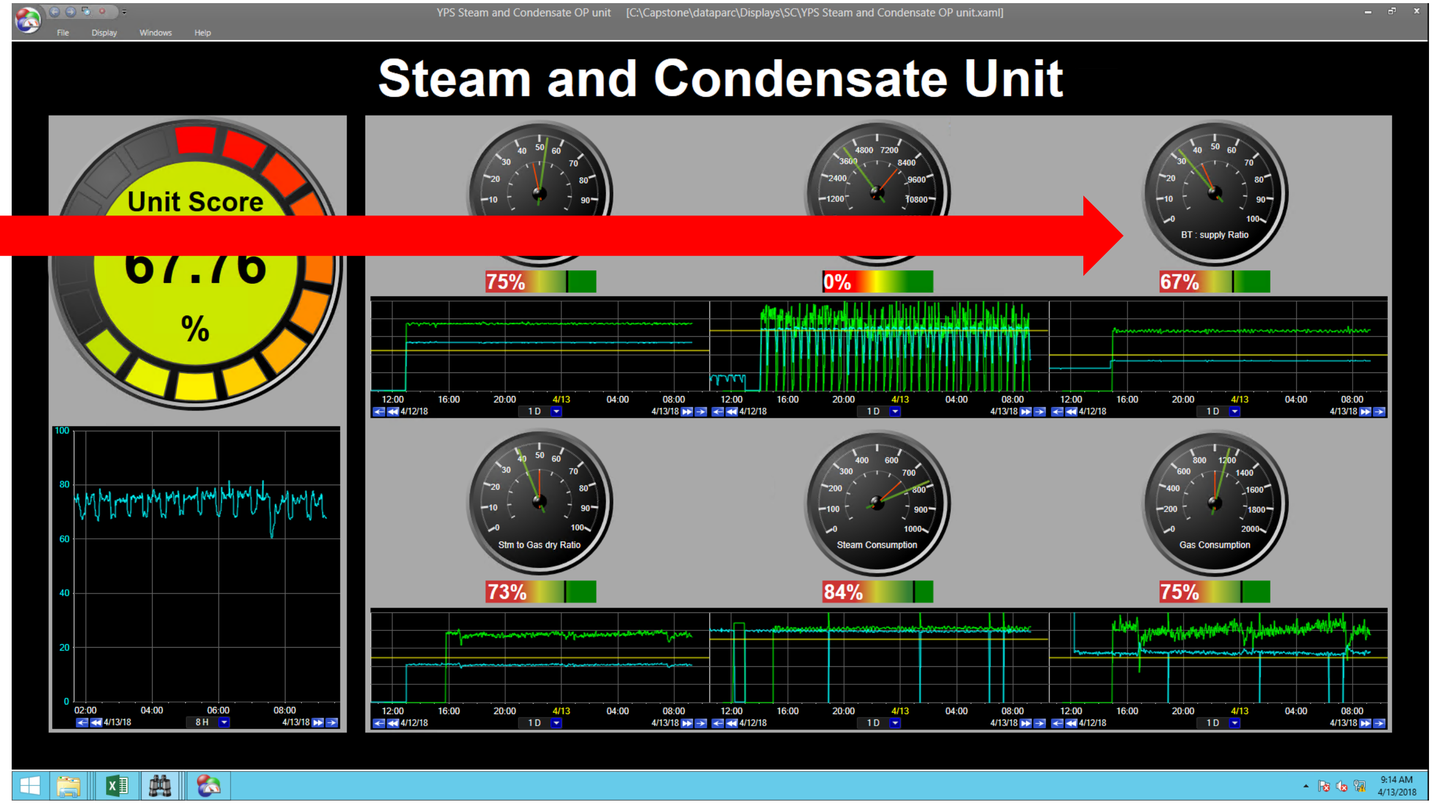


Example: Steam and Condensate Scorecard



How Does It Work?





J Curve Data Input

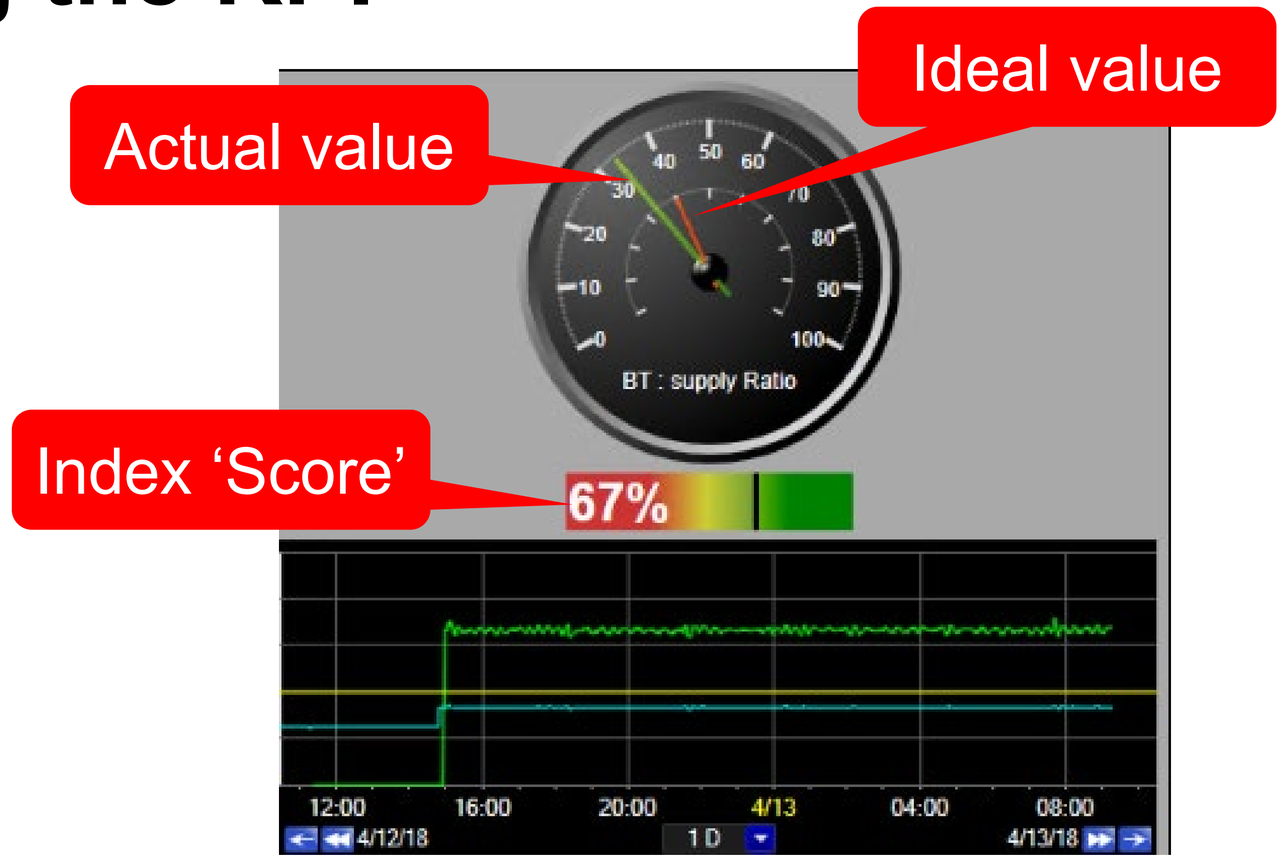
- Differential pressure
- Motive steam flow
- Blow-through flow

For example: Lets look at the ‘blow-through: supply steam ratio’, a critical parameter of the J curve

Indexing the KPI

- We can take a calculated KPI value, in this case BT: Supply steam ratio and compare it with best practice: 0.4 in this case

- From the deviation from best practice, we calculate and index where 100% always = good



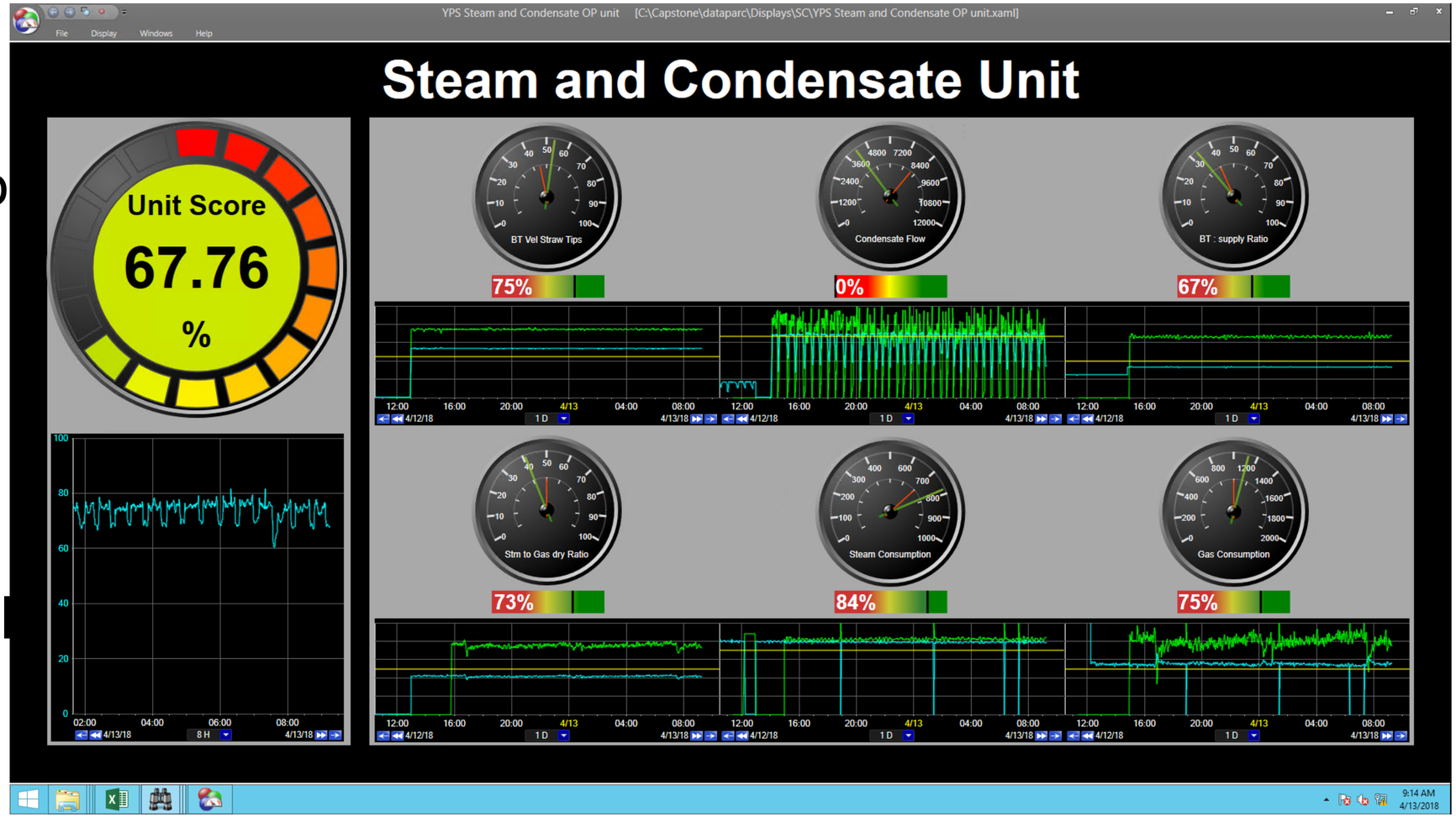
In our example, we deviate from the preferred 0.4 ratio, so we show an indexed value of 67%

Weight and Aggregate the KPI

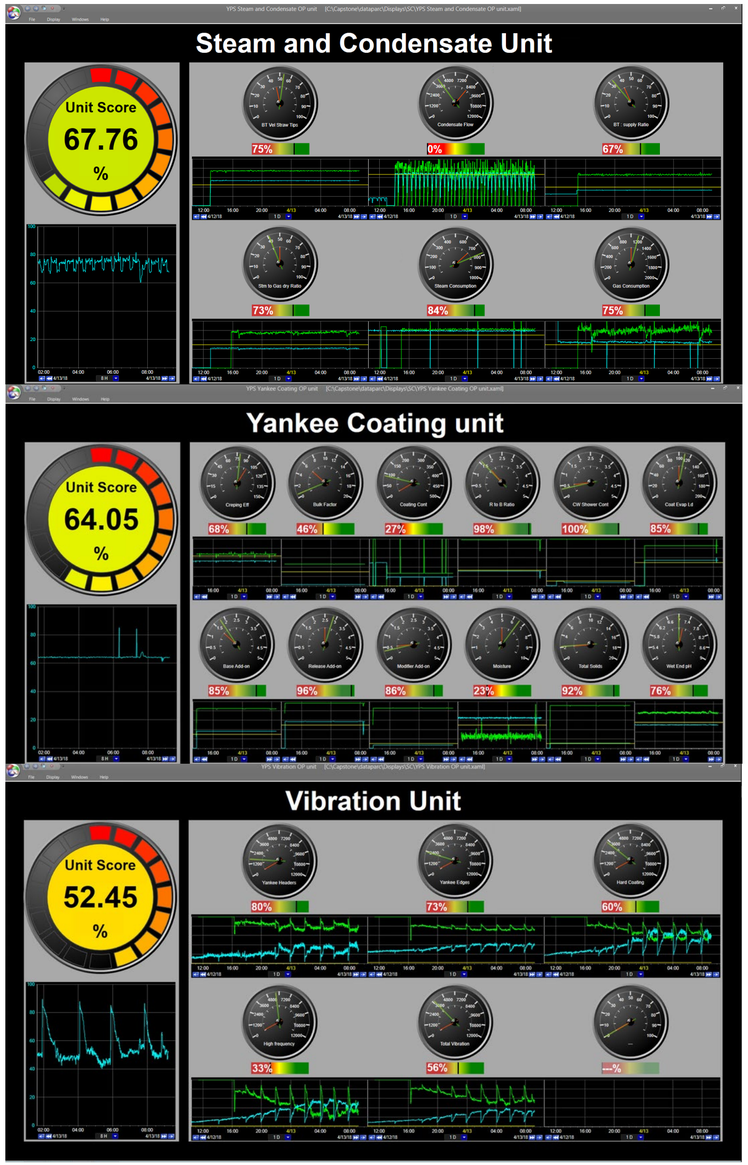
- We can weight and aggregate all KPI for the unit operation into a score for the whole unit op.

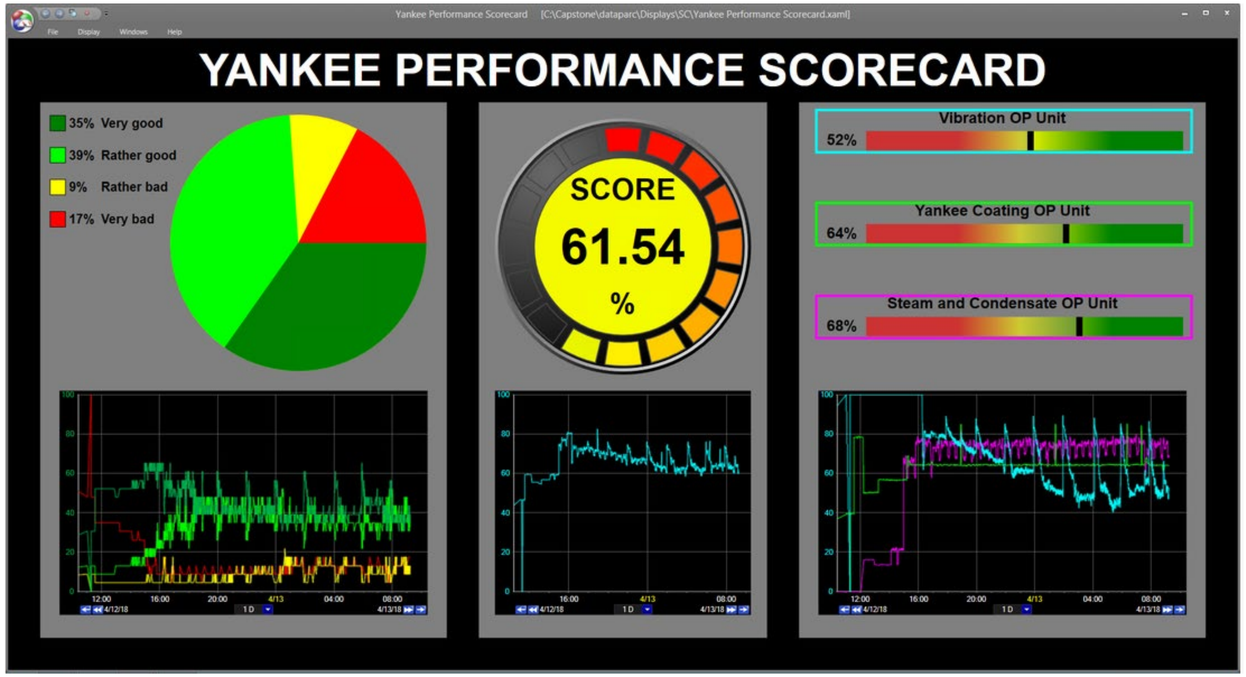
  Again 100% =

- A trend display is available for each KPI as well as the whole unit operation



Aggregate the Unit Ops for a Complete System





Summary

- A straightforward Yankee steam and condensate audit focused on specific KPI can help set up the best performance
- Fine tune or troubleshoot this with precision IR imaging
- Transfer the KPI monitoring to a real time on-line Yankee diagnostics system for sustainable performance and troubleshooting
  - **A small, modular, impactful step on the journey to Industry 4.0**

Thank you

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