Essential business agility for digital transformation

Advanced Warning of Major Equipment Failure and Production Downtime

Dr Julian Pickering, CEO Geologix Systems Integration Ltd

How to digitalise exploration and operations: November 2019

Future Production Challenges in Oil & Gas

- Extracting maximum value from declining and aging assets.
- Avoiding unplanned downtime in facilities.
- Dealing with more complex processing requirements.
- Maintaining operational knowledge and experience with a declining workforce.

In summary, we need new technology and working methods to manage the performance of production assets. We need to incorporate knowledge management into our analytical processes.

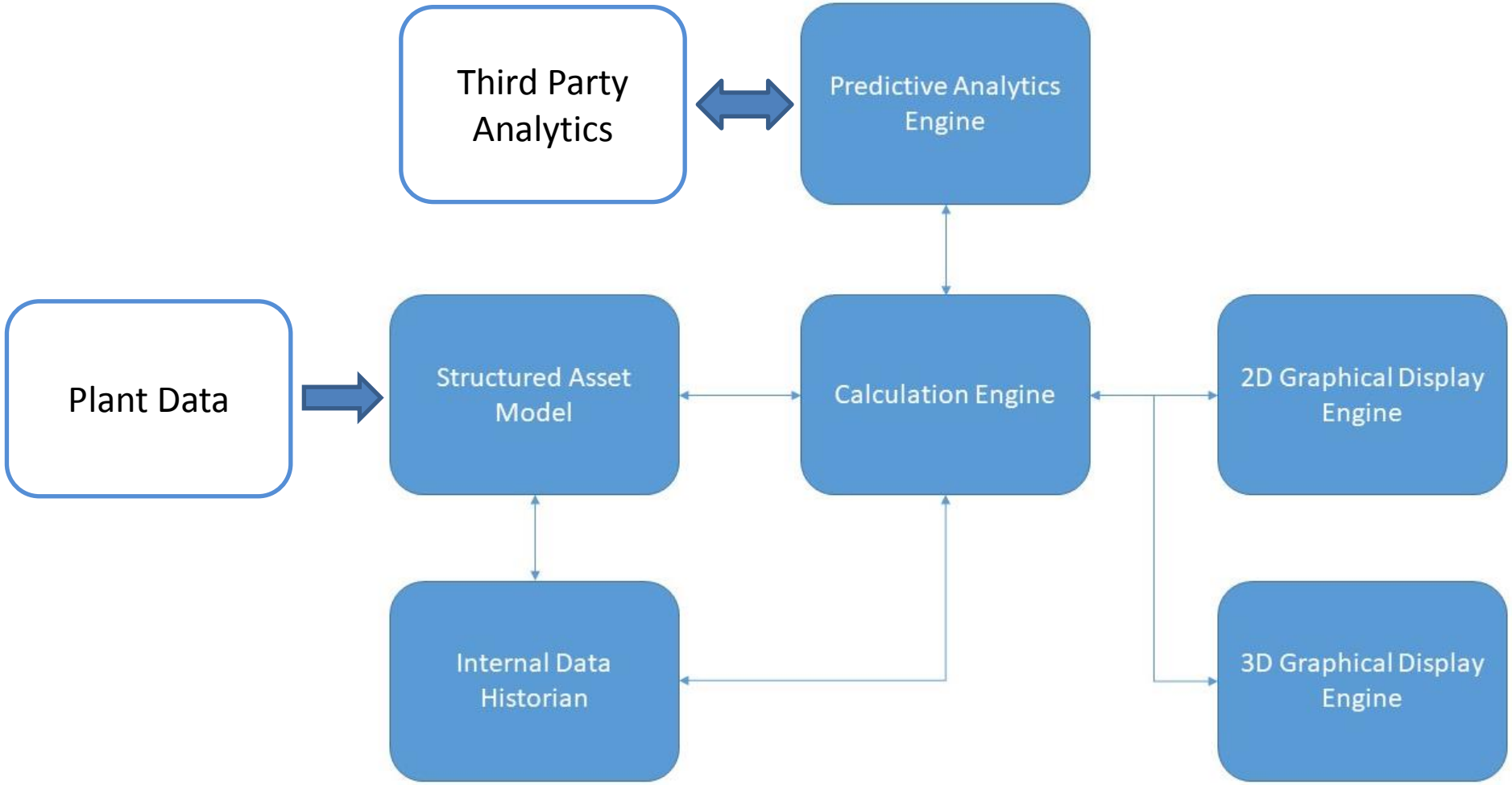
What are the requirements for a digital system to improve production performance?

- It must be available in the operations environment 24/7.
- It must be simple to use and not interfere with routine operations.
- It must operate on high quality data with an appropriate time constant.
- It must give predictions with sufficient time to take action.
- It must have a demonstrable track record of accuracy.
- It must be trusted by the operations teams.

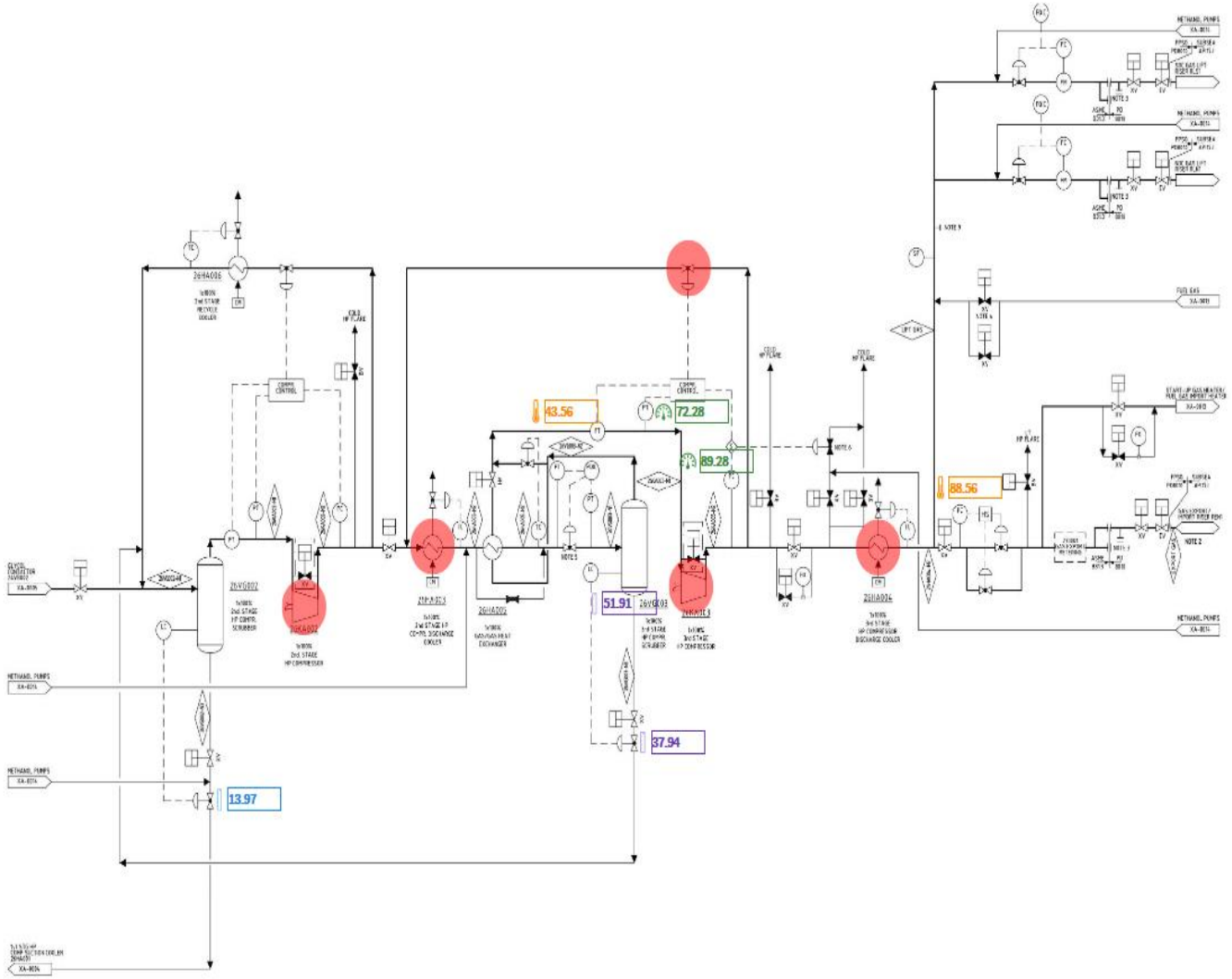
The Geologix Operations Advisor (GOA)

- GOA uses data analytics to predict decreasing performance and failure of critical process equipment (e.g. compressors, pumps, heat exchangers, control valves).
- It has a powerful graphical user interface to enable existing engineering drawings to be animated, saving a large amount of configuration compared to conventional process historians.
- It provides full 3D animations and data analysis with AR and VR.
- It includes real-time and historical trending, system alerting, knowledge management and user-entered comments.
- It performs process optimisation on the actual plant rather than a model of the plant.

The Geologix Operations Advisor Framework



GOA Links a Standard PFD with its Digital Twin



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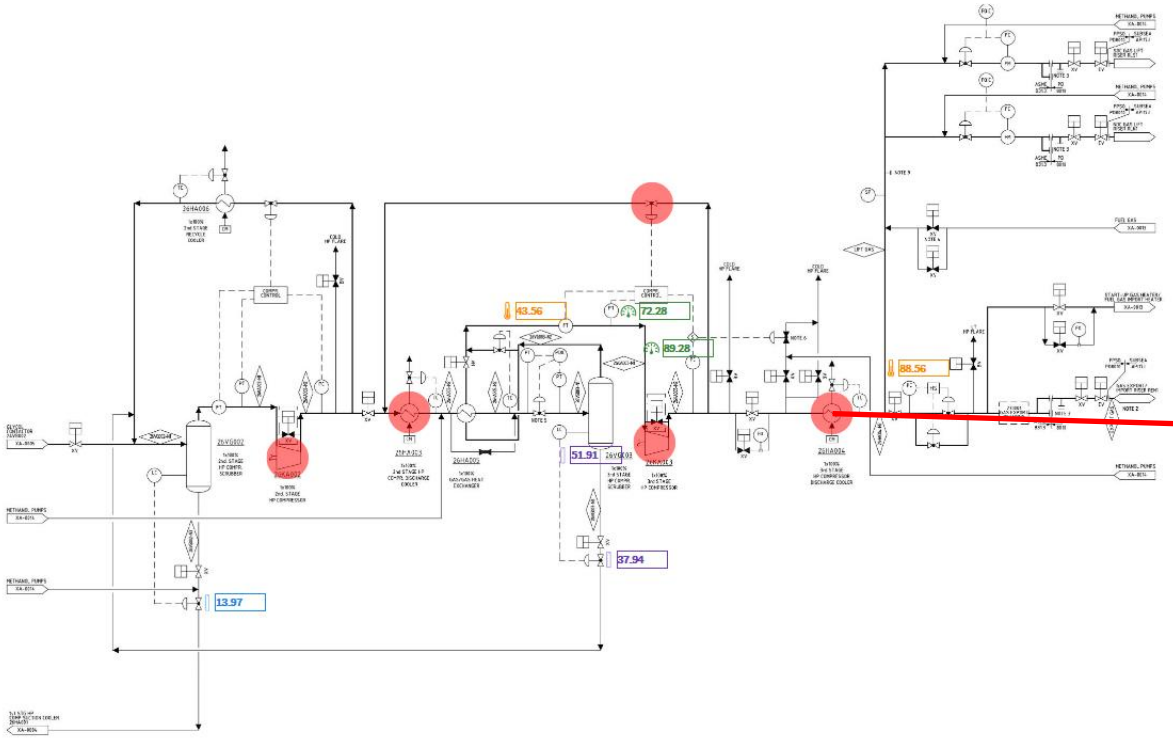
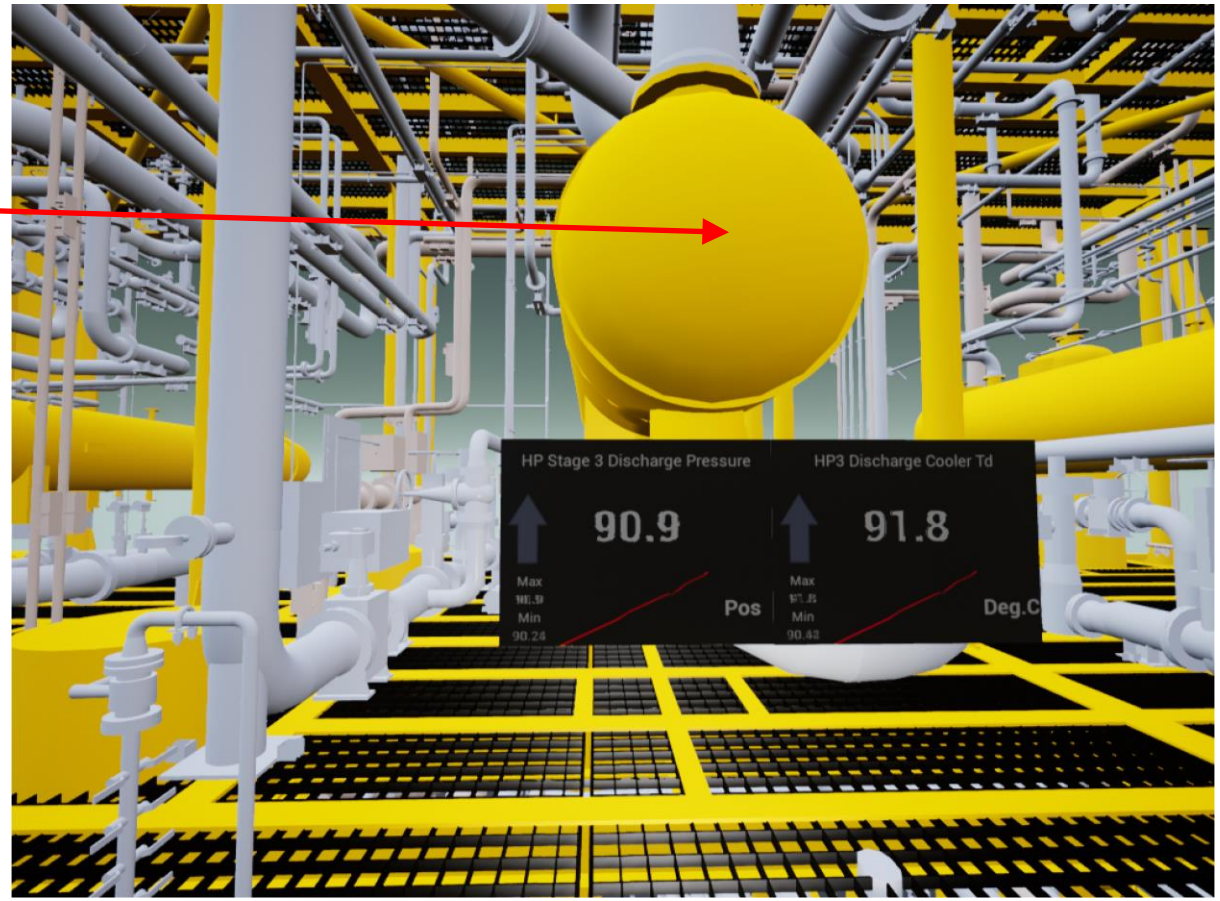
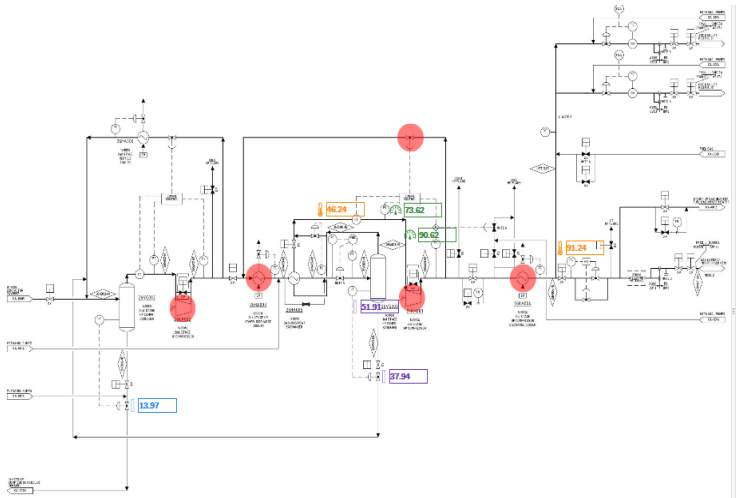
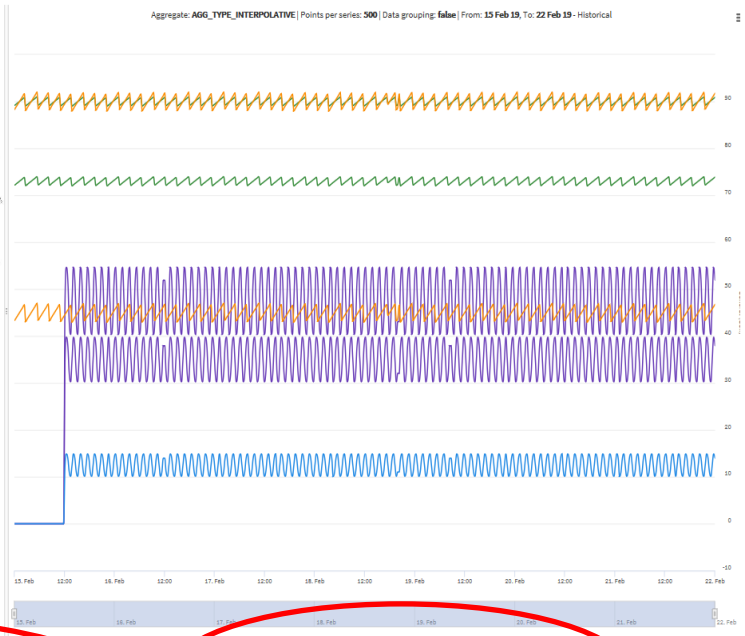




GOA Smart Alerting and Knowledge Management





System Alerts

Date/Time	Alert Name	Recommended Action	Days to Respond	Best Practice
2019-02-18 20:29:35	H10015-Abnormal behaviour - monitor	Continue to monitor relative valve position	100	
2019-02-18 15:09:32	H10015-Abnormal behaviour - monitor	Continue to monitor relative valve position	100	
2019-02-18 13:18:07	H10015-Abnormal behaviour - monitor	Continue to monitor relative valve position	100	

Days to respond (urgency)
Best Practice (knowledge management)

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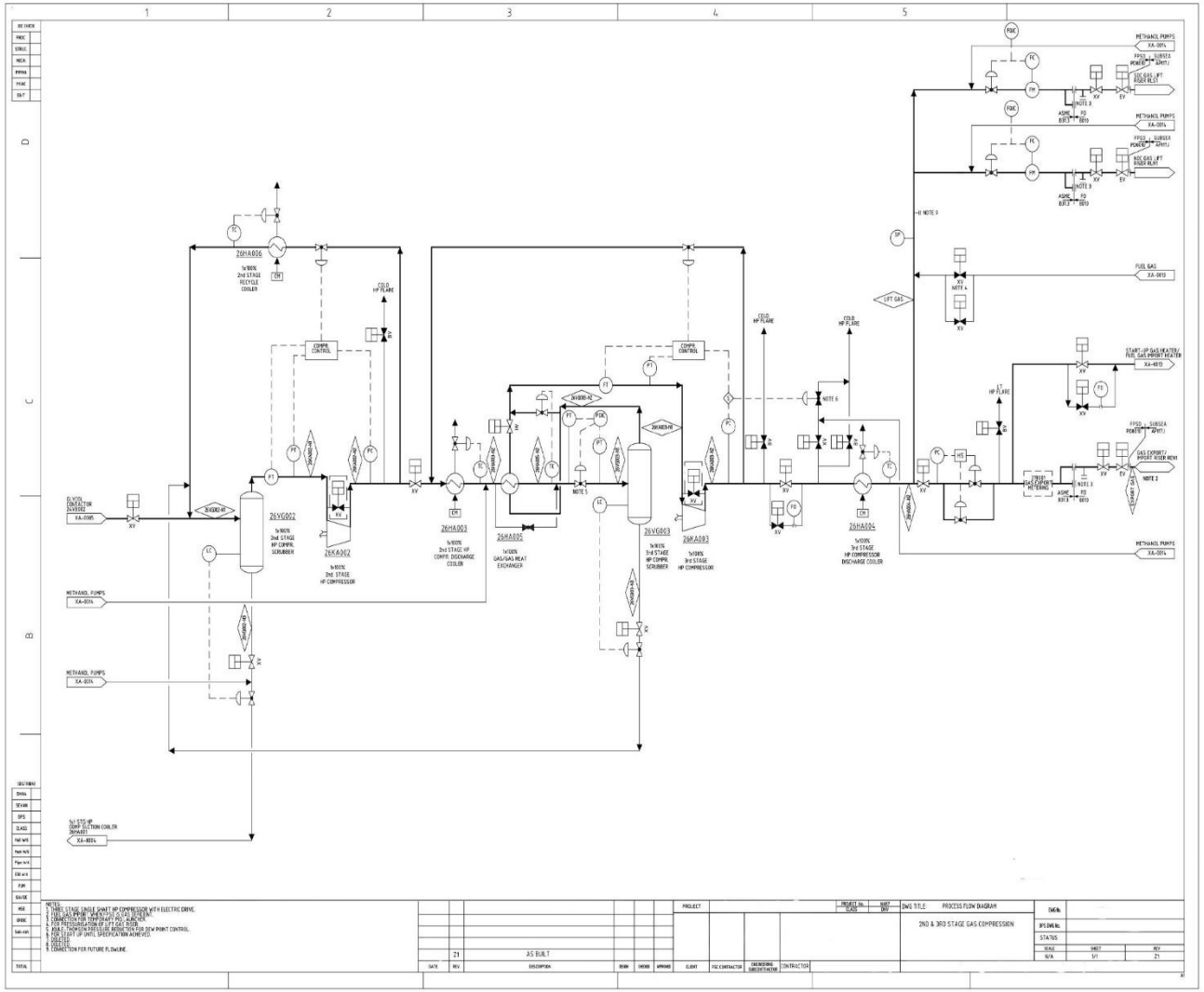
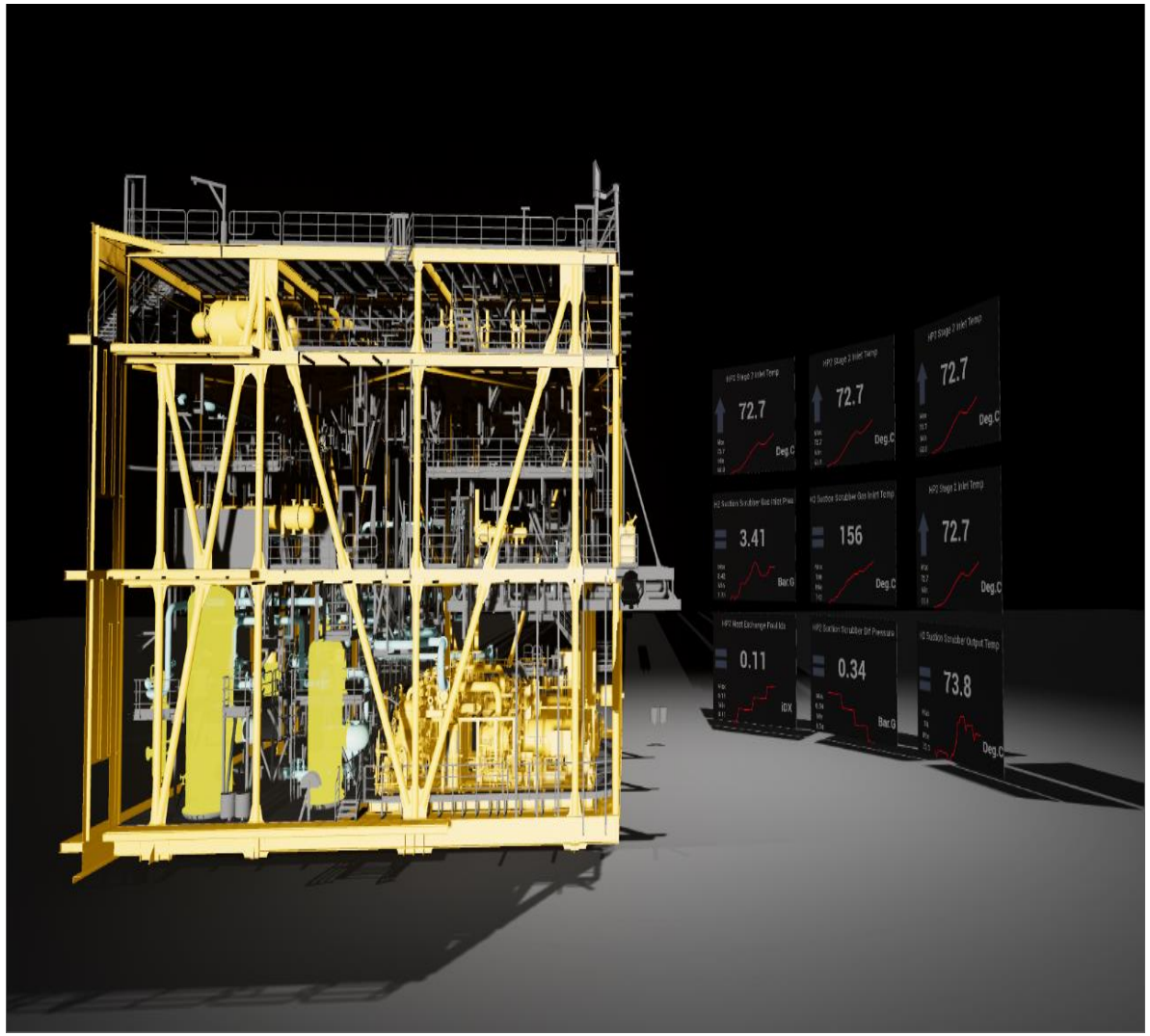
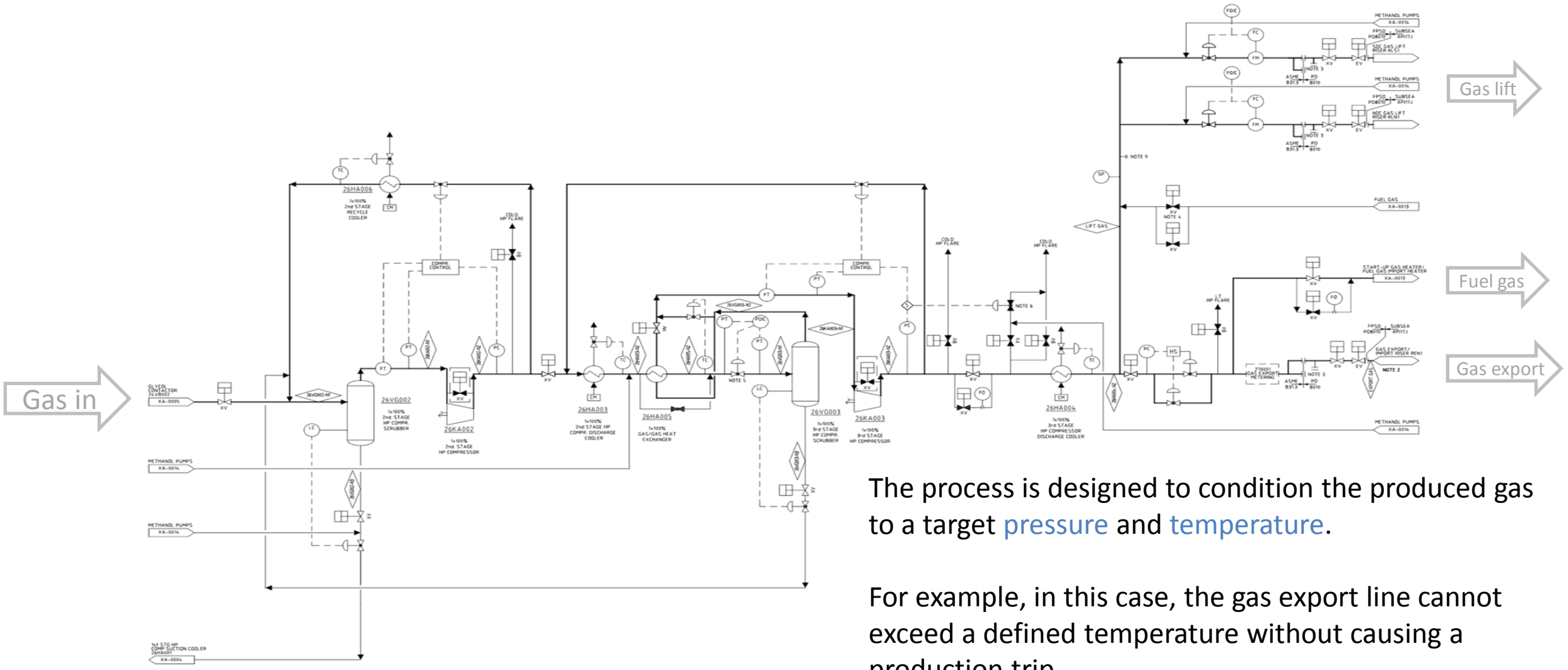
We now have total integration between 2D and 3D





Case Study – Discharge Cooler Fouling

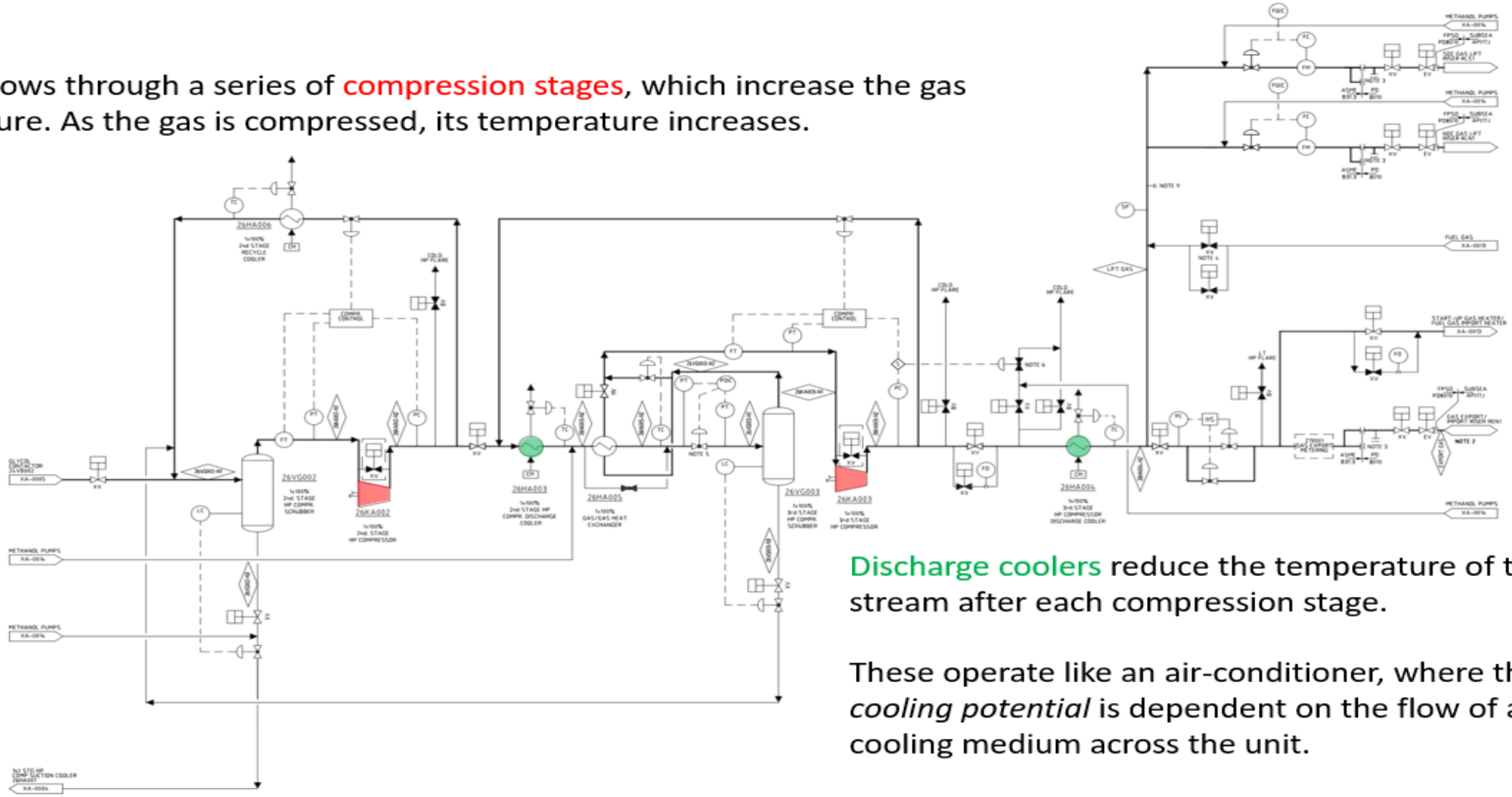


The process is designed to condition the produced gas to a target pressure and temperature.

For example, in this case, the gas export line cannot exceed a defined temperature without causing a production trip.

Case Study – Discharge Cooler Fouling

Gas flows through a series of compression stages, which increase the gas pressure. As the gas is compressed, its temperature increases.



Discharge coolers reduce the temperature of the gas stream after each compression stage.

These operate like an air-conditioner, where the *cooling potential* is dependent on the flow of a cooling medium across the unit.

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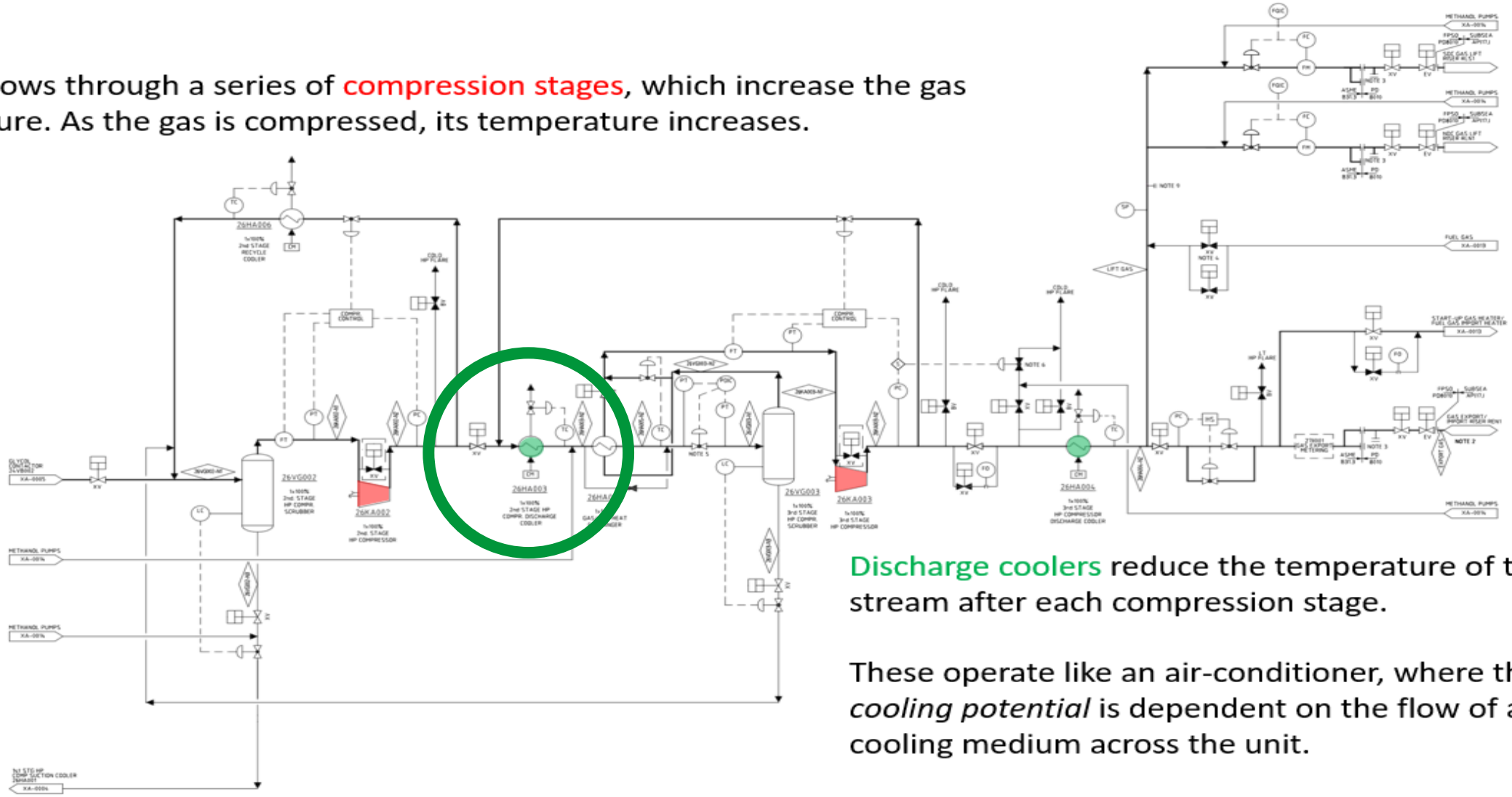

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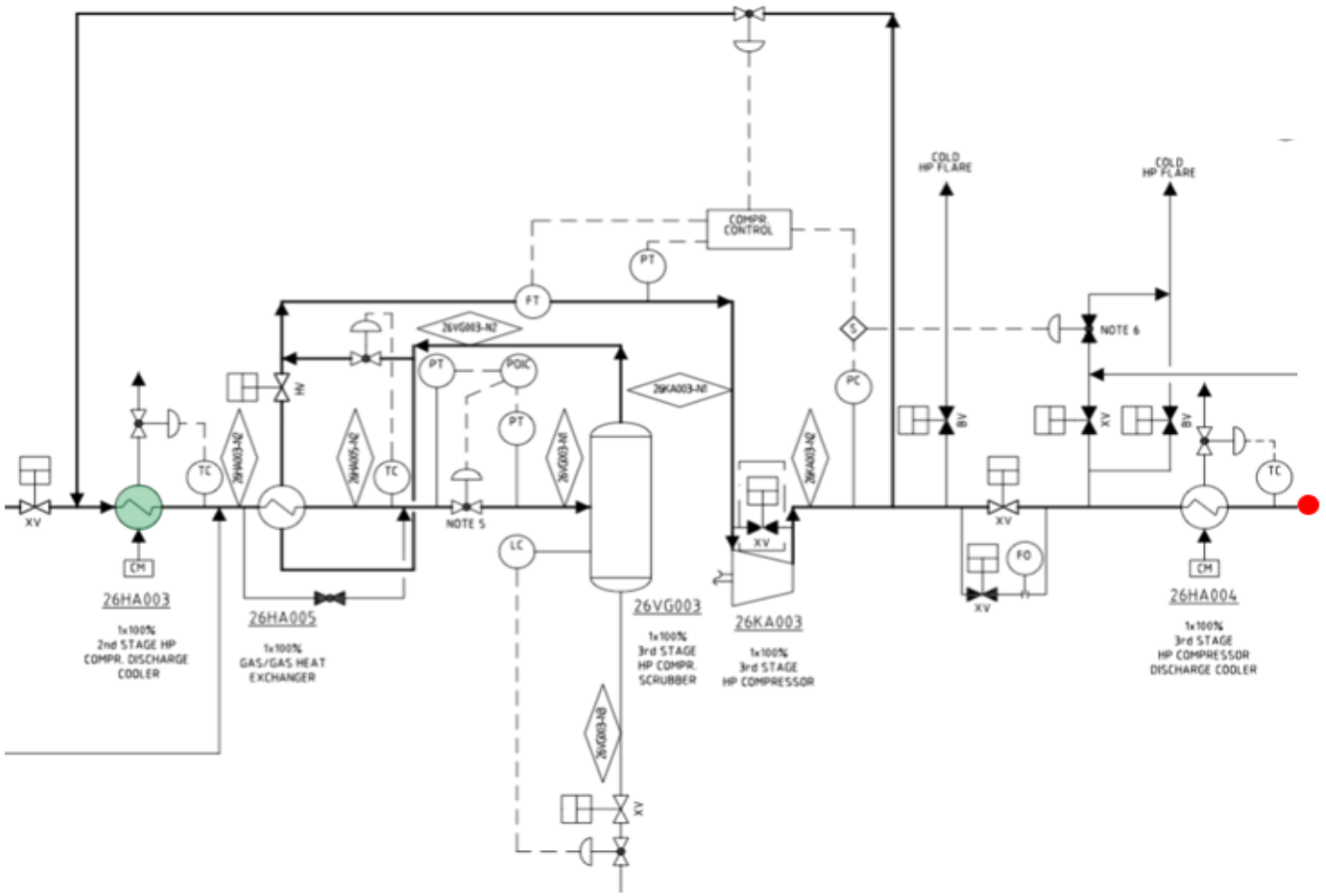
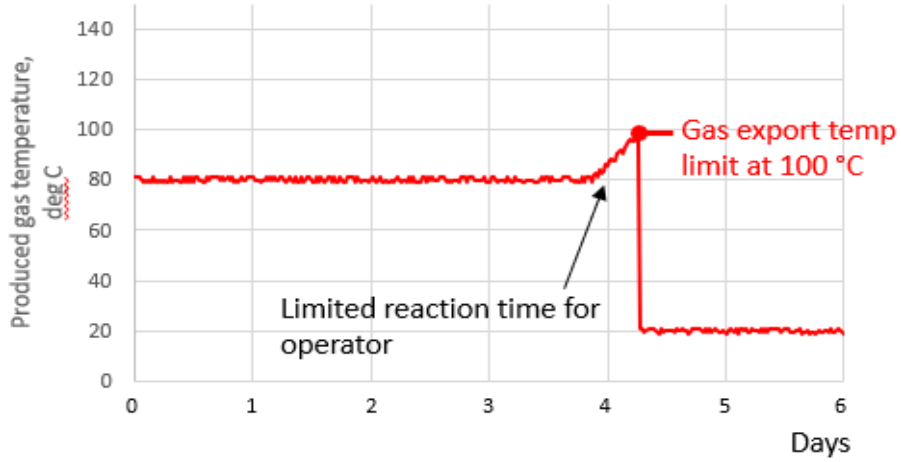
Case Study – Heat Exchanger Fouling

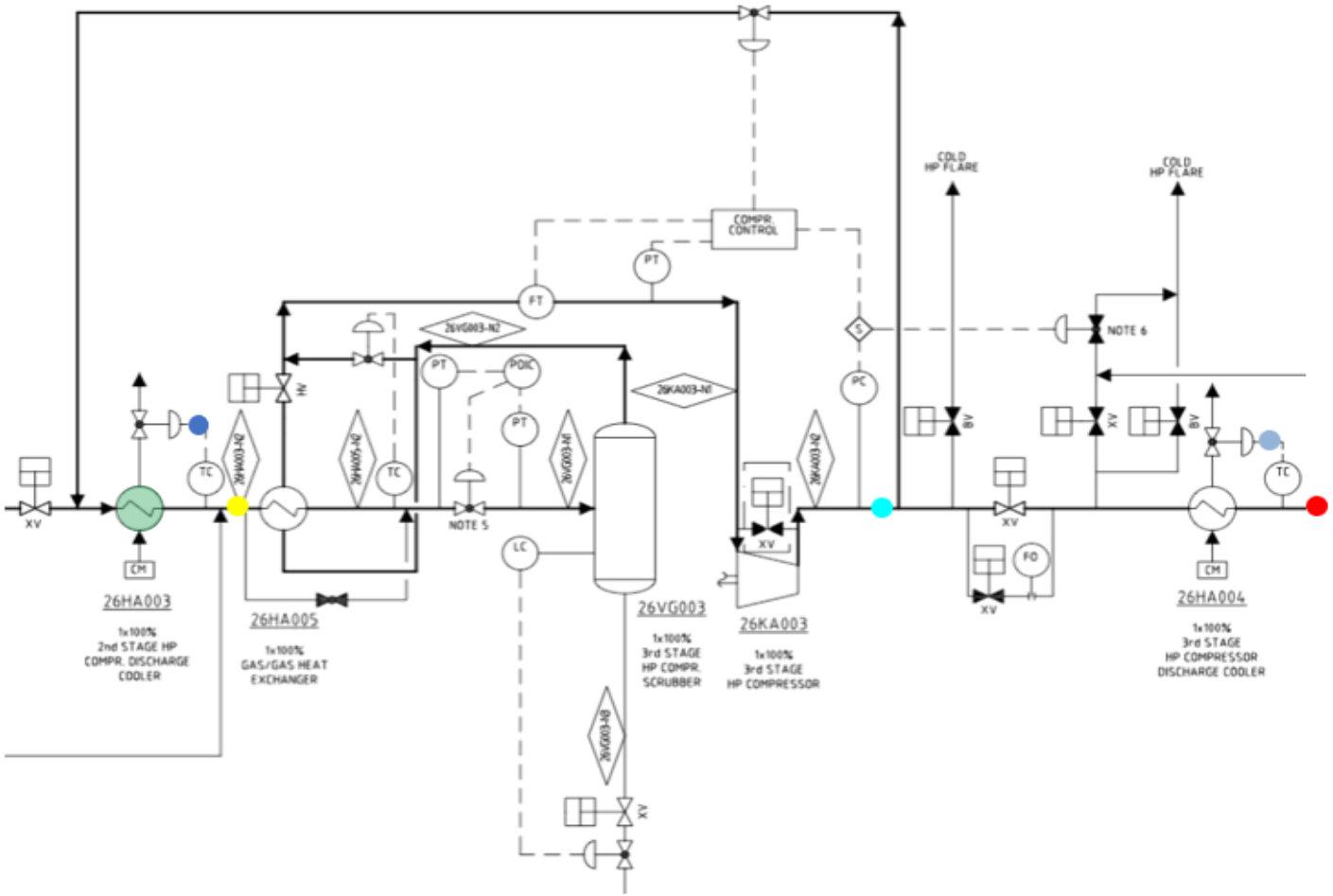
In this example, a platform trip occurs when gas export temperature exceeds the platform trip limit of 100 °C.
For the operator, the time to react can be as little as 4 hours, and the root cause is not immediately apparent.

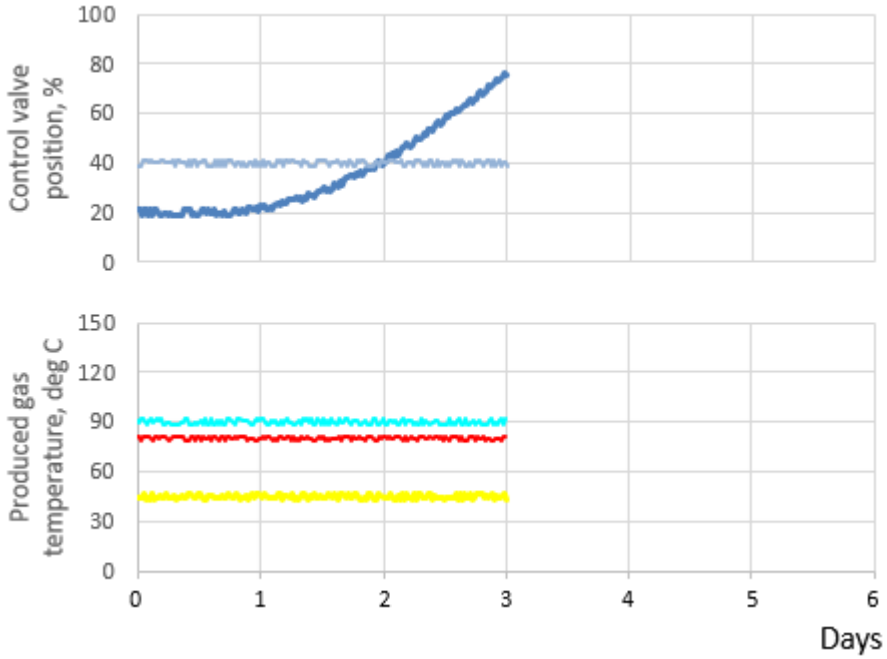




Case Study – Heat Exchanger Fouling

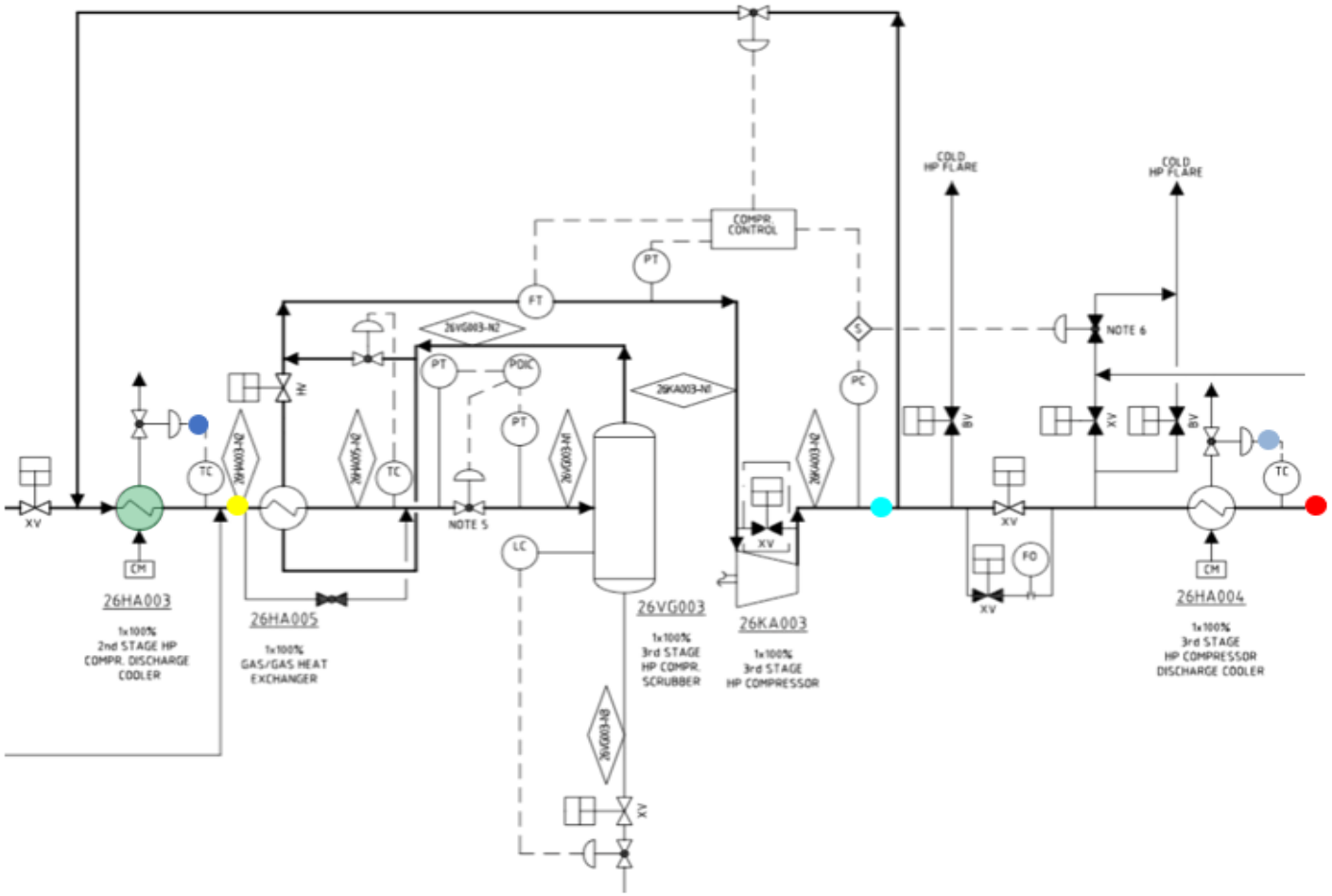
Fouling reduces the thermal efficiency of the 2nd stage Discharge Cooler. To offset this, the control valve opens, increasing the flow of coolant to maintain the same target gas temperature (~45°C).

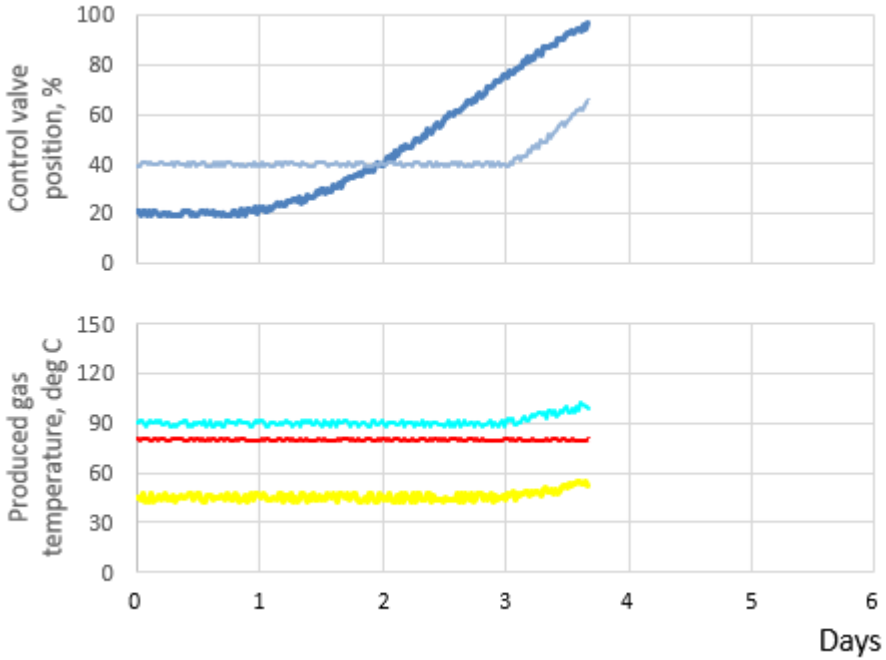




Case Study – Heat Exchanger Fouling

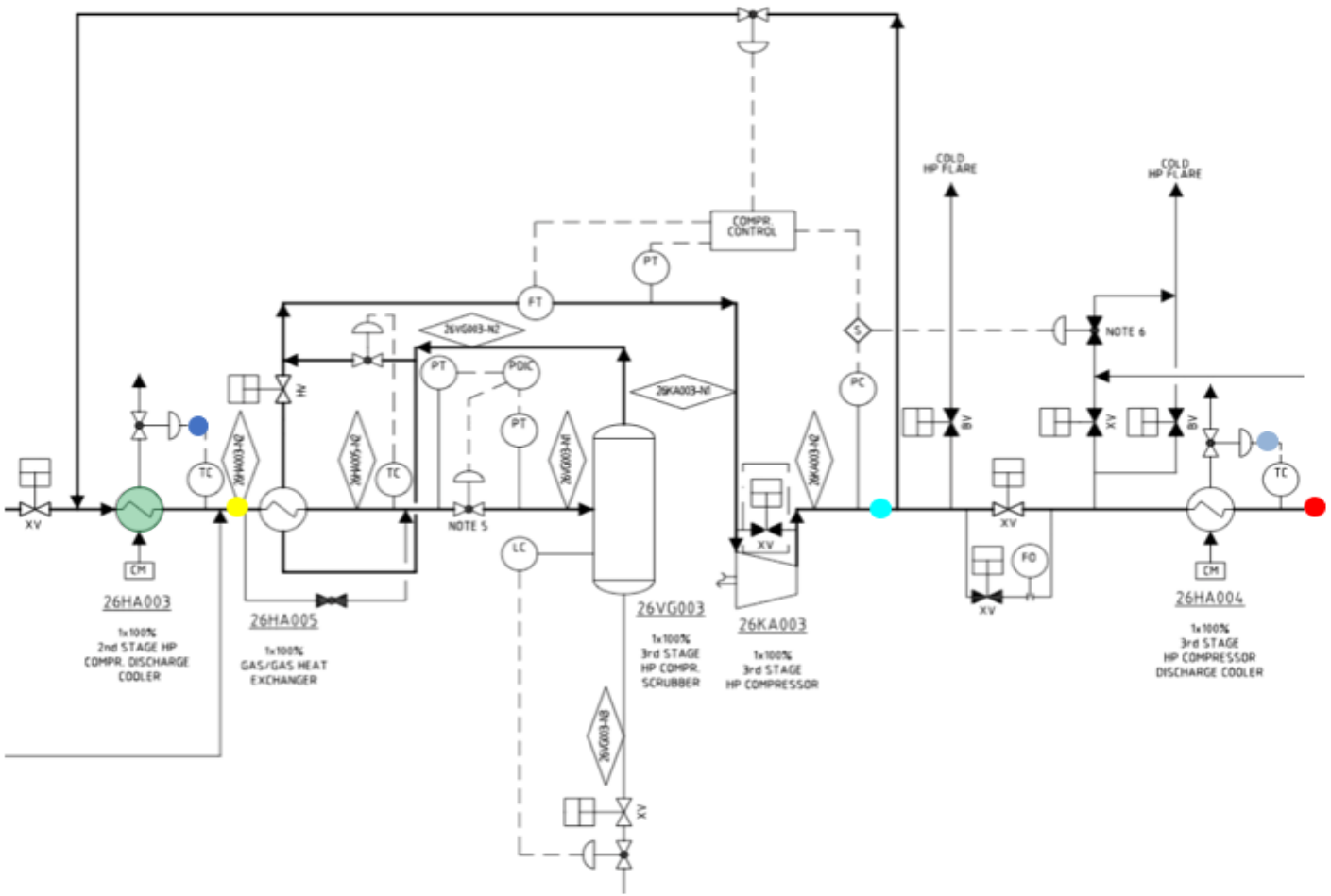
At ~75% open, cooling medium flow across the control valve is maximised, and further valve movement cannot offset continued fouling. The 3rd stage Discharge Cooler control valve starts to open to maintain export gas at 80°C.

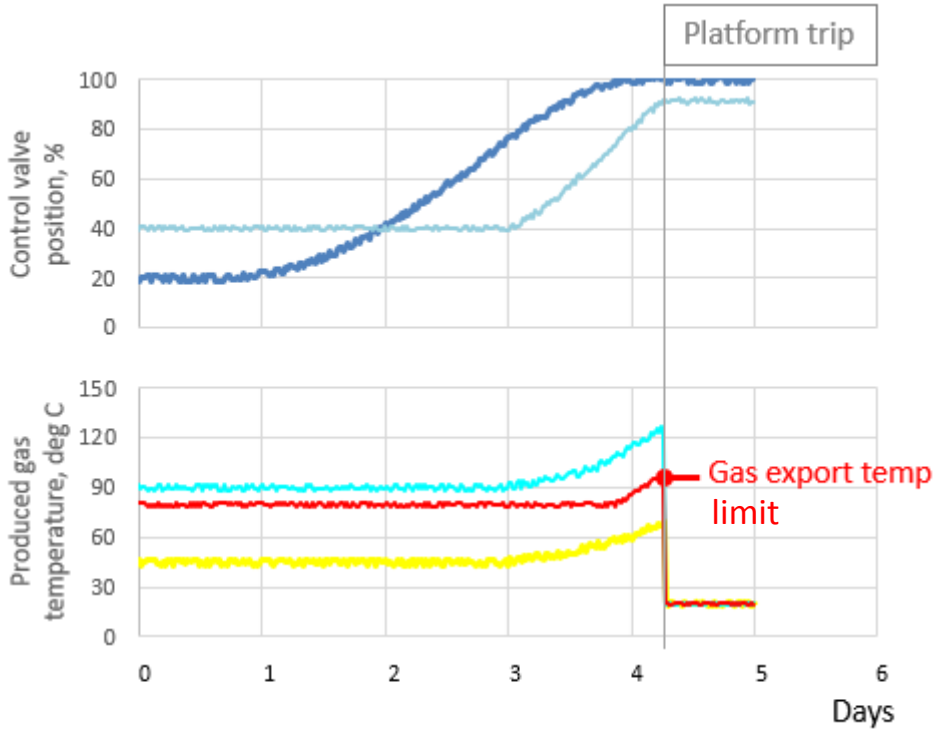




Case Study – Heat Exchanger Fouling

After its control valve reaches ~75% open, the 3rd stage Discharge Cooler cannot cool the produced gas further, and export gas temperature begins to rise. When the export gas reaches 100°C, the platform trips.

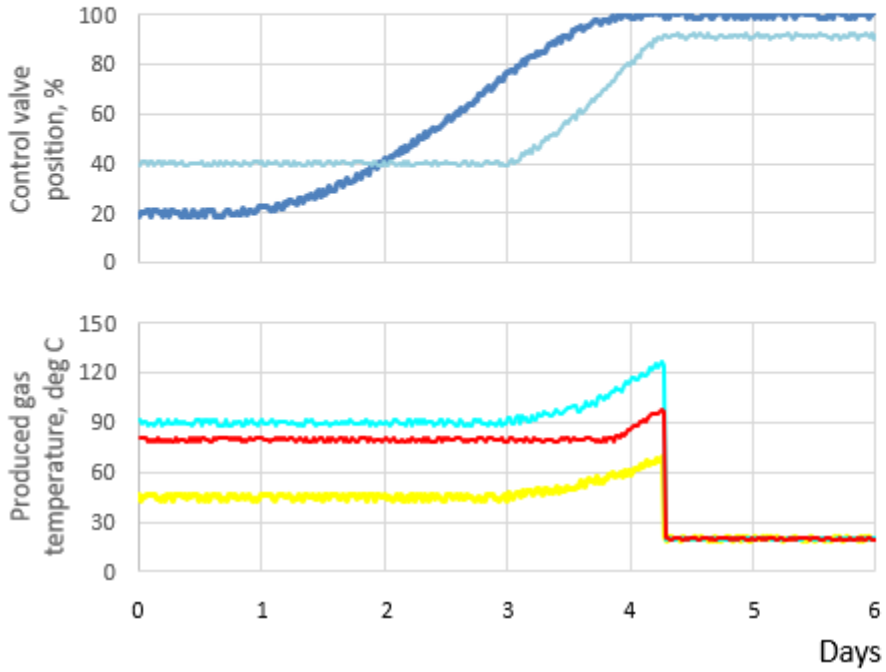




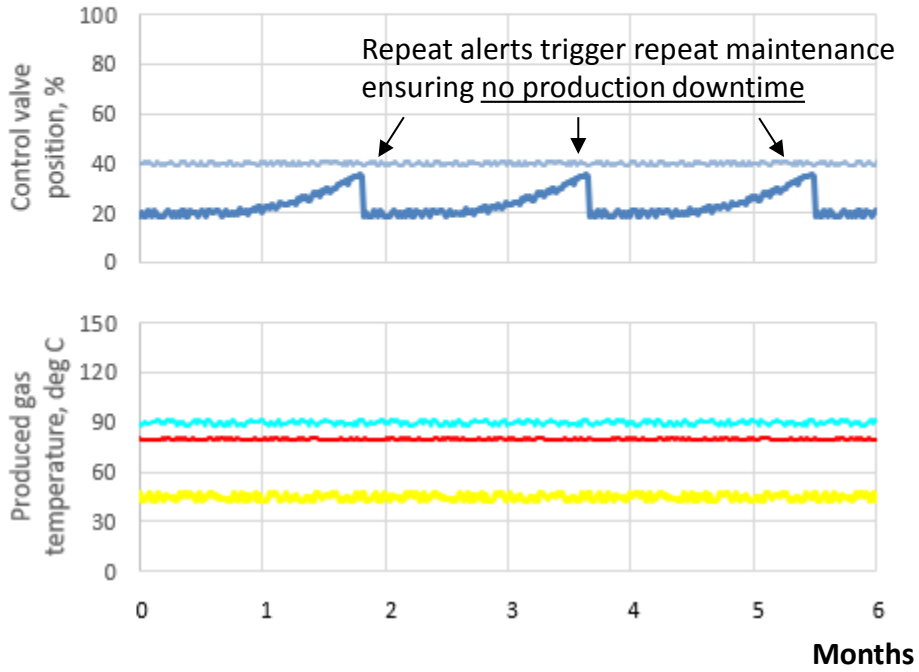
Stabilising the Heat Exchanger Operation with GOA

System analysis and use of rule based alerts can help prevent production downtime and improve efficiency.

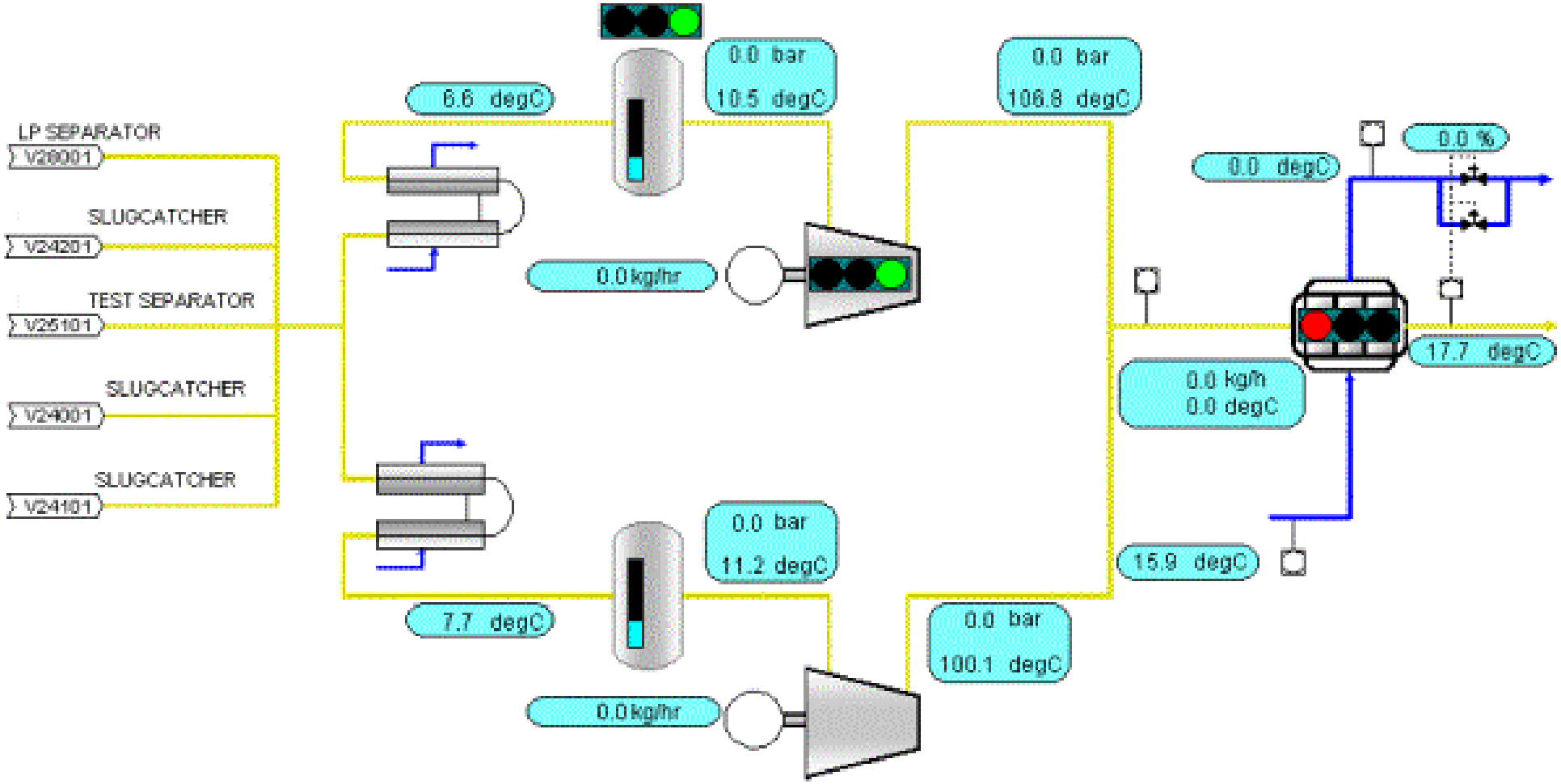
Without GOA



With GOA



North Sea Gas Export Display with Analytics



Thank you for your attention. Any Questions?