

23 March
2021

Robert Nyireddy

 Vysus Group

Ingenuity.
Imagination.
Insight.

Digital HAZOP Assitent- introducing a path to alarm free control rooms

Suggested Agenda

- Introduction and background
- MFM – modelling
- HAZOP assistant

Acknowledgement:

The content of this presentation is a collaboration between [Kairos Technology](#) and [Vysus Group](#)

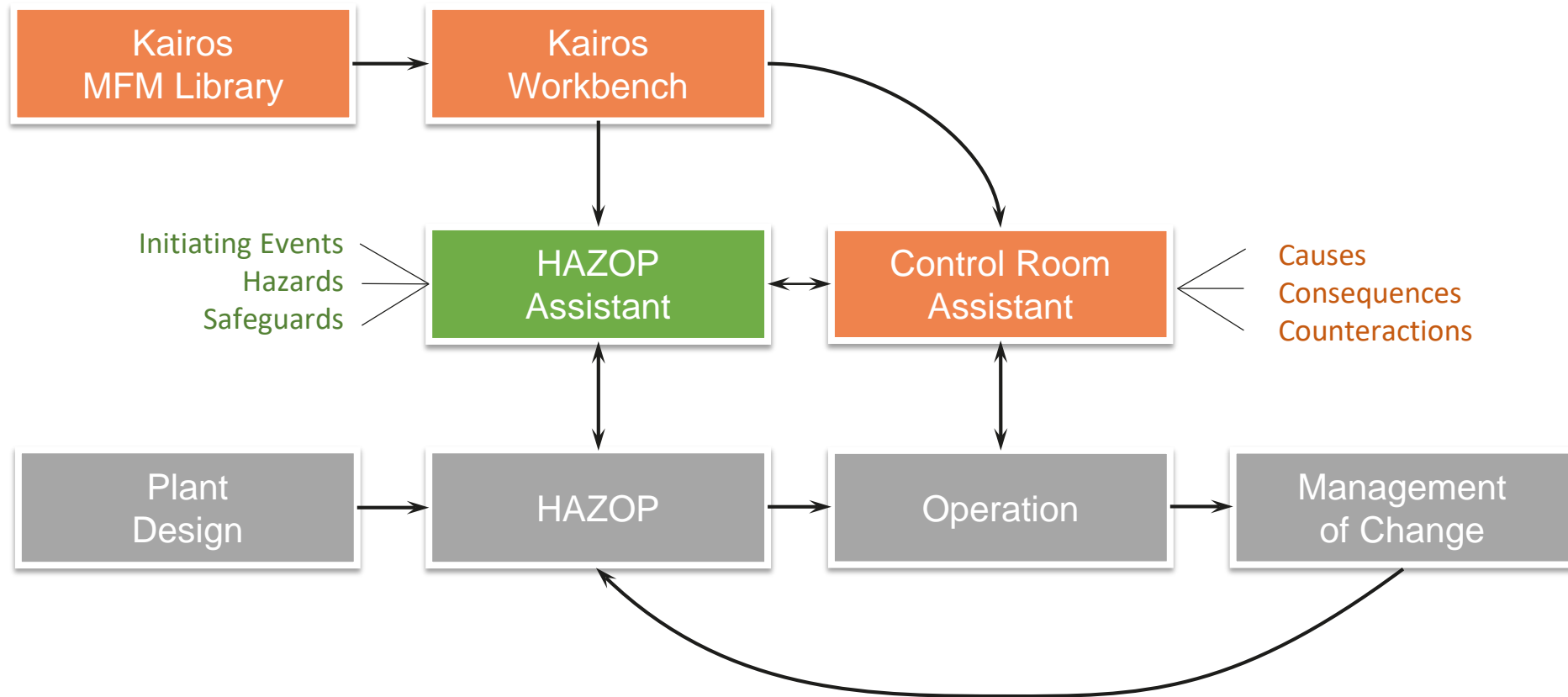


Kairos Technology and Vysus Group

Pilots and clients



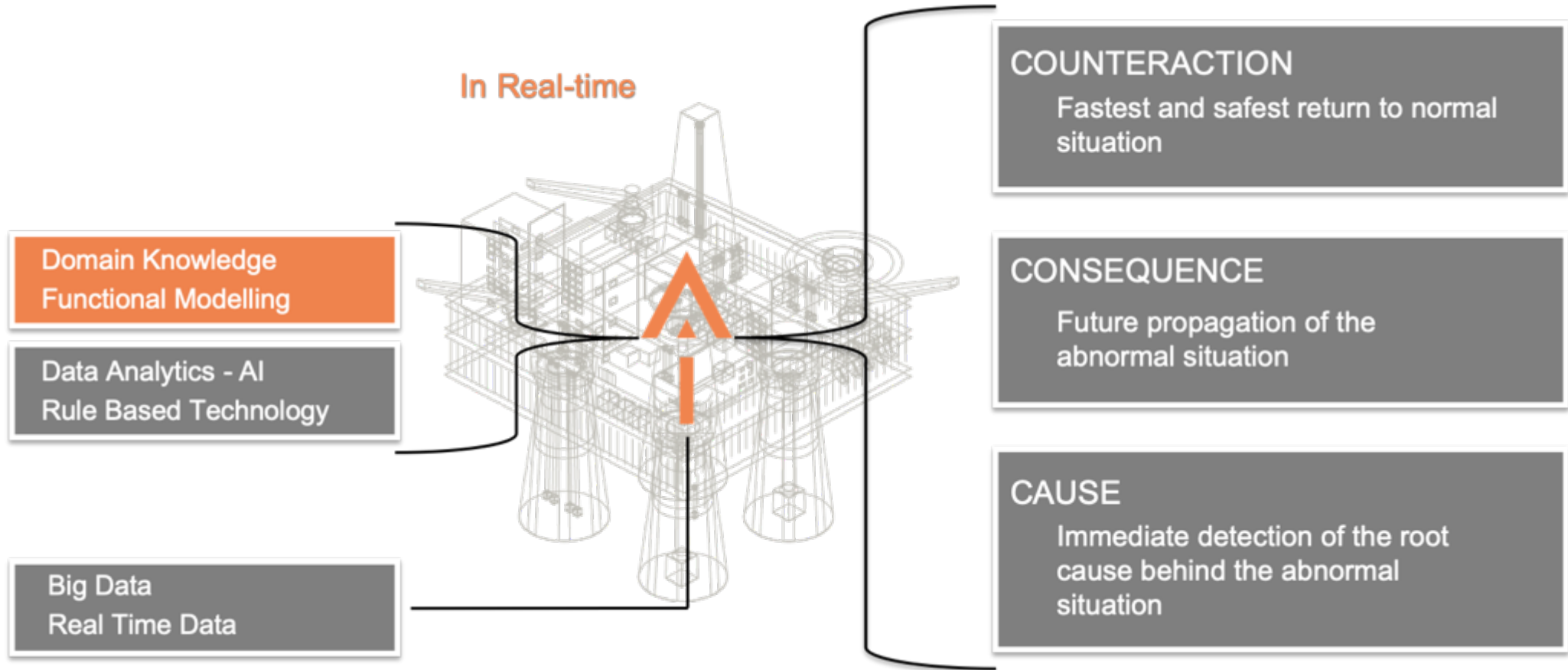
HAZOP Assitent



Control Room Challenges

Challenges	Description	Customer feedback
Overflow of alarms	<ul style="list-style-type: none">Hardware suppliers are providing an increasing amount of sensors with their equipment, causing an increasing amount of alarmsAn overload of alarms makes it harder for operators to distinguish out the critical alarm signals from unimportant anomalies	<p><i>"The amount of alarms is a clear challenge for us today – it is challenging for the operator to understand what's going on."</i></p> <p>- Sr. Advisor IOC (Equinor)</p>
Hard to identify the root cause of an alarm	<ul style="list-style-type: none">It is important for the operator to understand the root cause of alarms to be able to take the right decisionsTo be able to restart the production after a shut-down, the platform manager needs to be sure they have identified the root cause	<p><i>"We don't stop the production before an alarm with high criticality goes off, but it is sometimes hard to identify the root cause of the alarms. This extends the downtime of our production."</i></p> <p>- VP Operations Excellence (Aker BP)</p>
Outdated user interface of the control system	<ul style="list-style-type: none">Most of todays software solutions replicate old "manual" control room switchboards, on modern hardwareSome systems provides additional information about alarms in a "Help-page"	<p><i>"There is way to much information on today's screens, and the user interface is very outdated. This is a challenge for us operators today."</i></p> <p>- Experienced Operator (Aker BP)</p>
Relies to much on experienced operators	<ul style="list-style-type: none">There is currently a new, inexperienced, generation of operators exchanging retiring personnelThe inexperienced operators does not have the same knowledge or understanding of the production facilities, and are known to make more mistakes	<p><i>"Some of our processes are quite complicated. When an experienced operator observes an anomaly, he usually takes the right decision, but inexperienced operators might not understand the processes completely. "</i></p> <p>- Project Manager (Yara Porsgrunn)</p>

Control Room Assistant



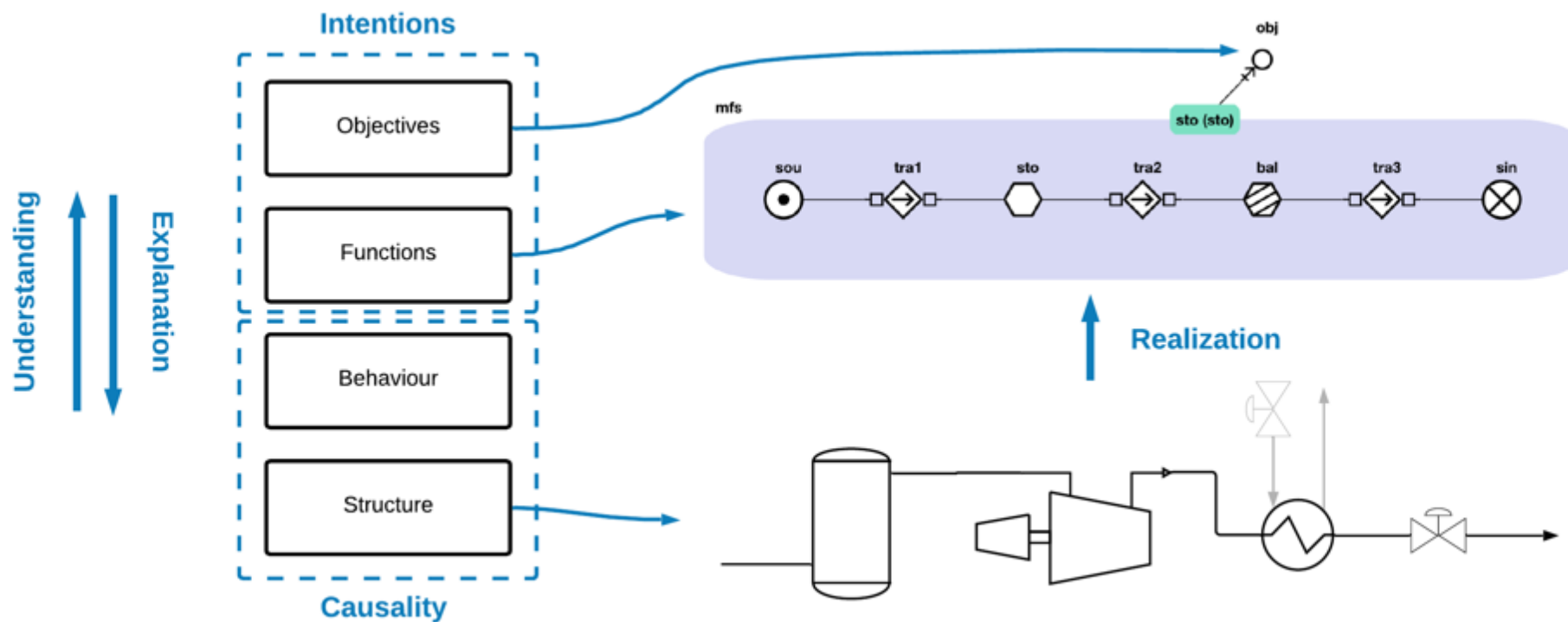
Kairos Suite

Modelling tool – HAZOP assitent

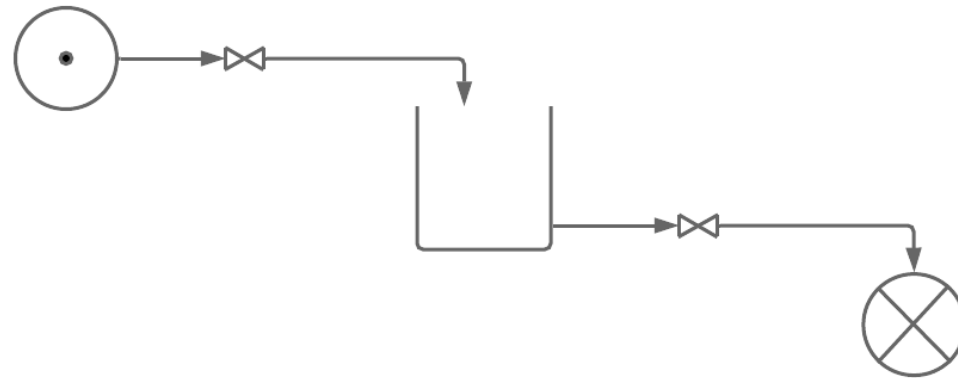
Operator User interface- Control room Assitent



Multi Flow Model (MFM) approach



MFM Model



Mass (faucet)



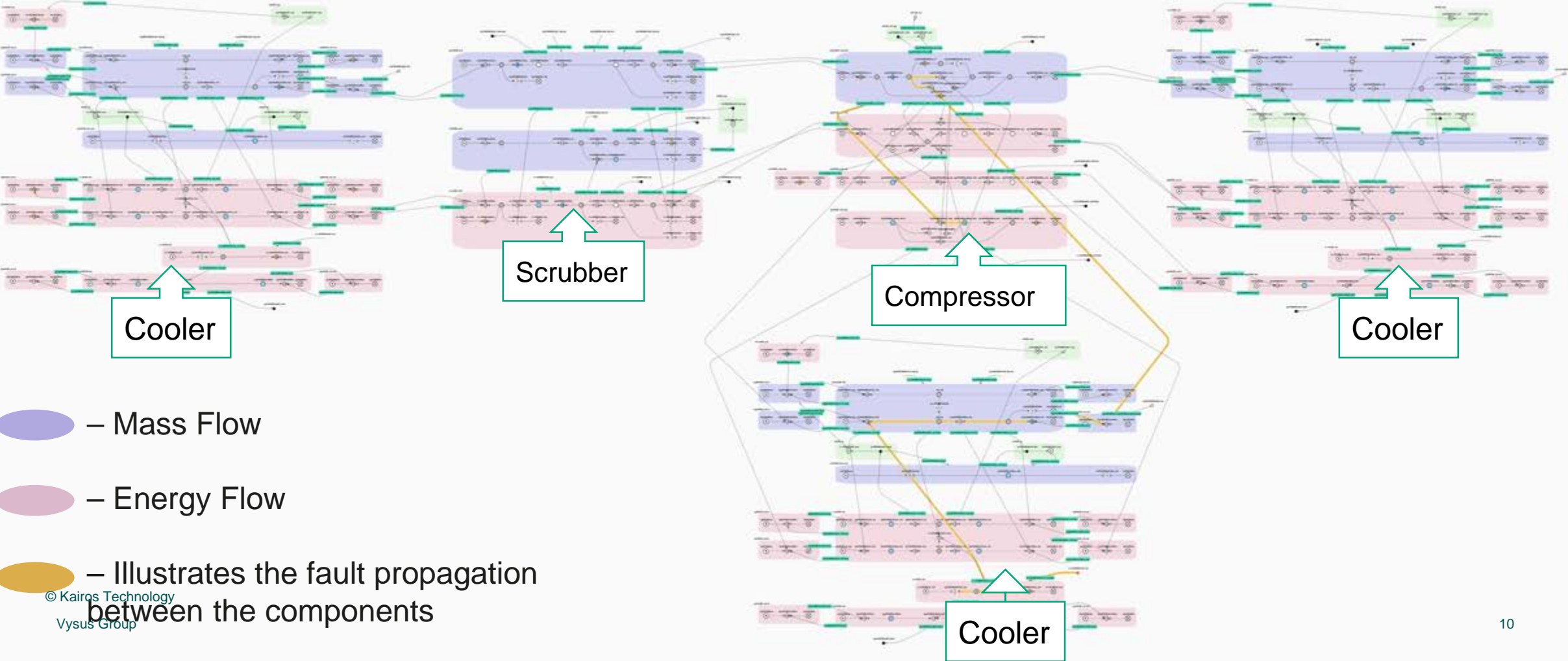
Level (sto)

Energy



Valve (tra)

MFM Model (3. stage compressor)

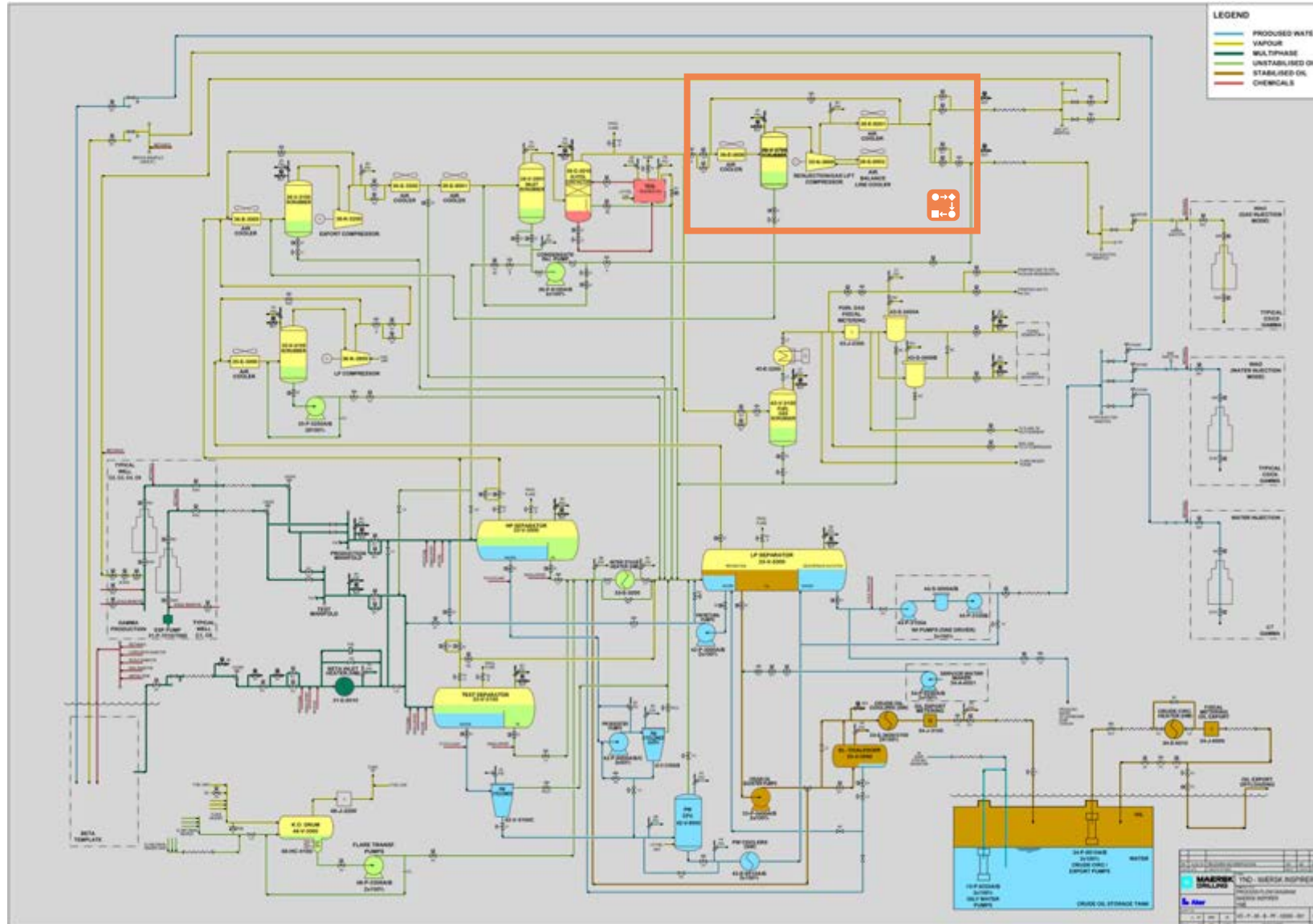




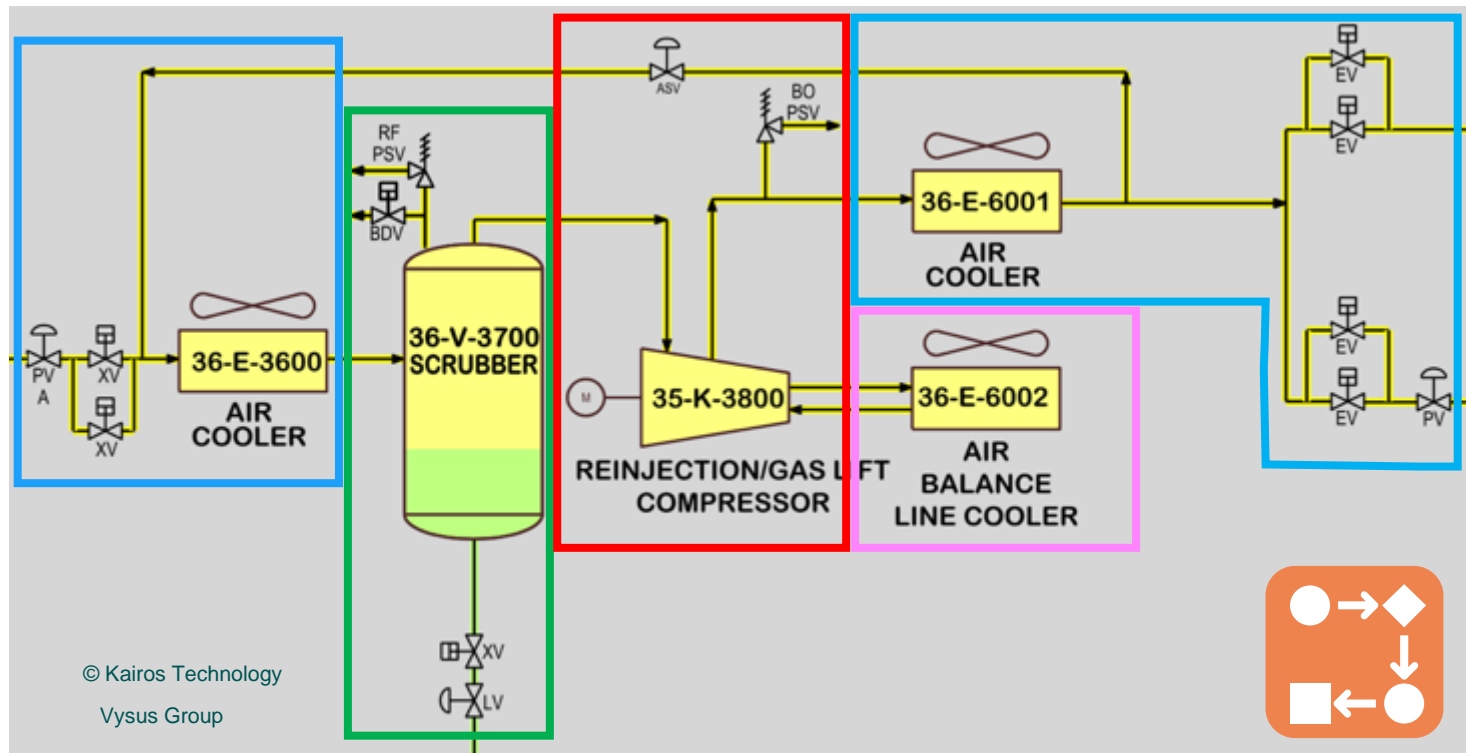
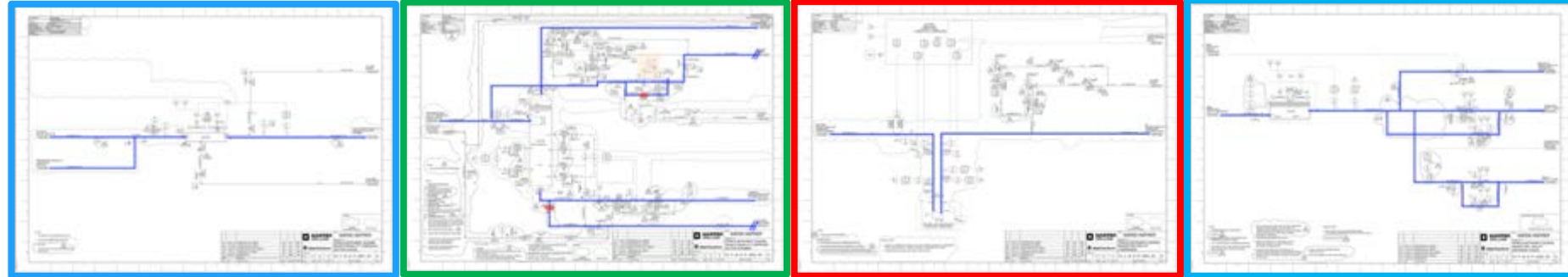
Key HAZOP Disadvantages

- Empirically based
 - Difficult to identify hazards which have not been encountered before
 - Expert judgements do not guarantee completeness or consistency
- No means to assess cross node hazards
- Heavily dependent on documentation
- No risk ranking or prioritization capability
- No means to assess effectiveness of existing or proposed controls (safeguards)
- Time consuming and costly
 - Typical cost for a medium offshore greenfield project €1-2 M
 - Yearly cost of re-Hazop 10-40% of initial cost (re-Hazop every 5th year)

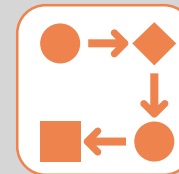
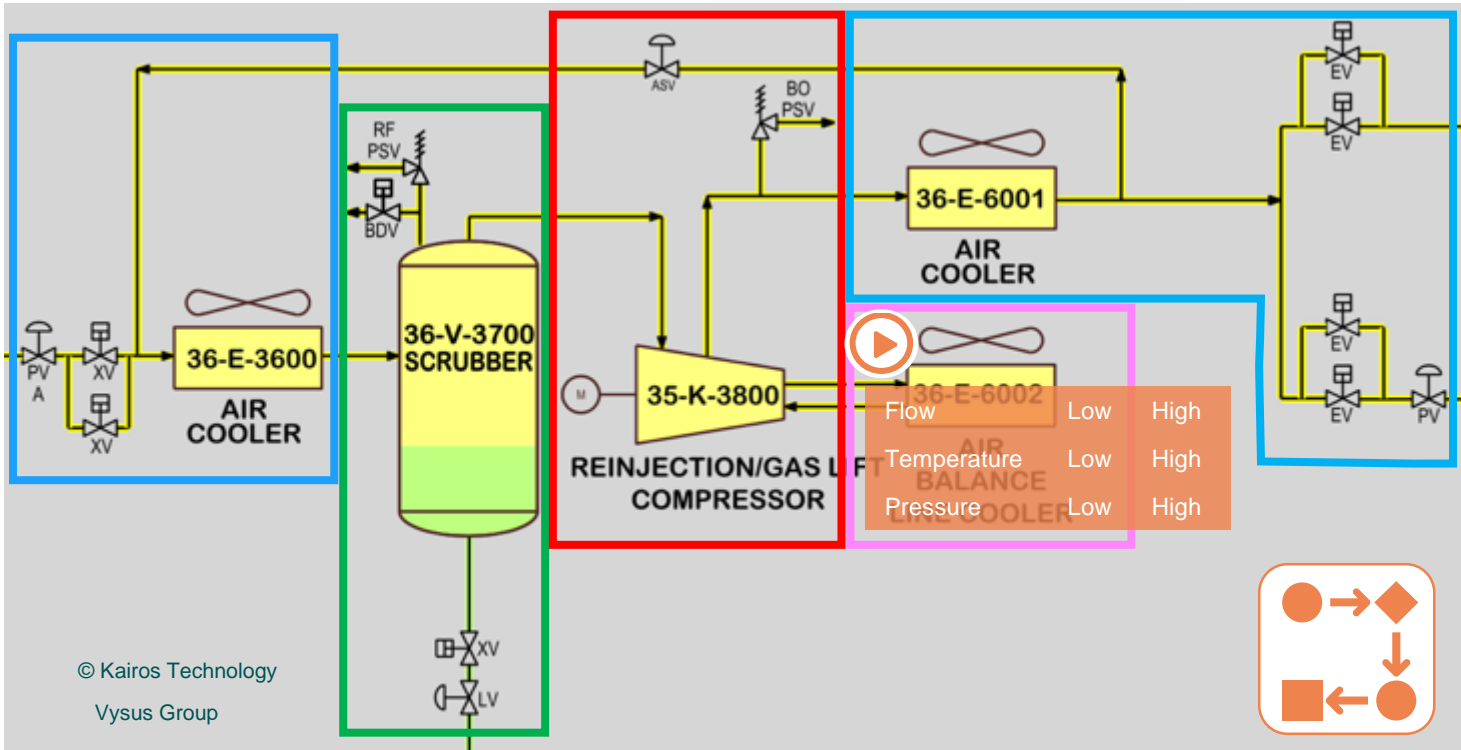
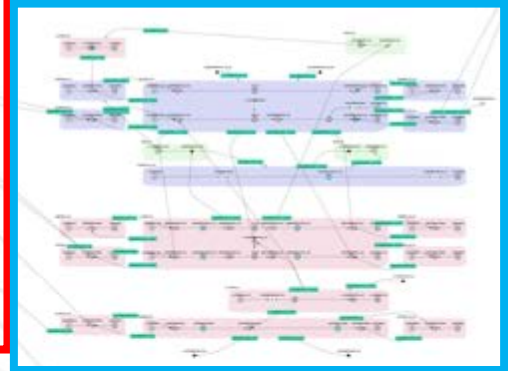
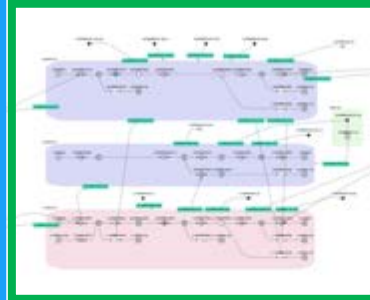
Reinjection Compression System



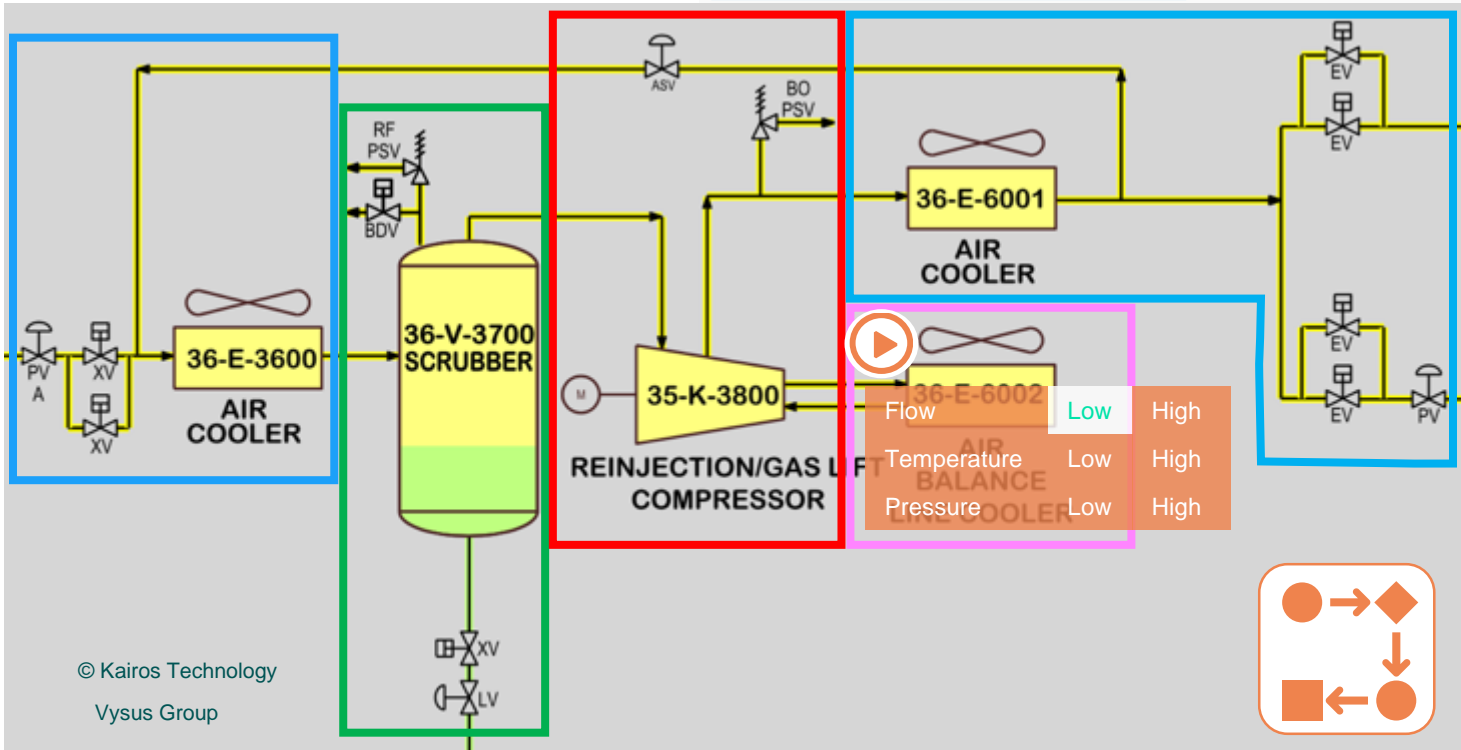
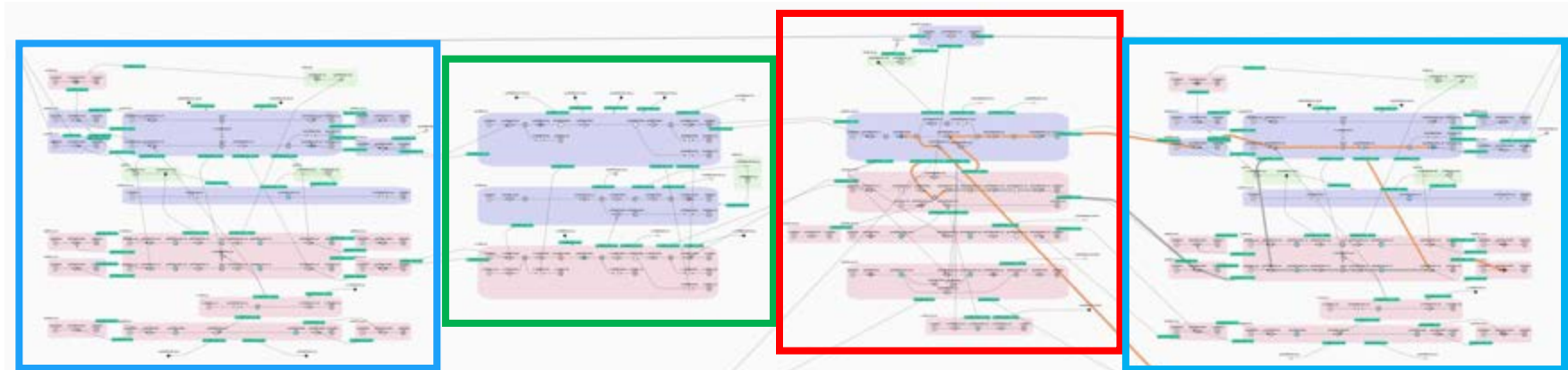
Reinjection Compressor



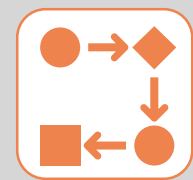
Reinjection Compressor



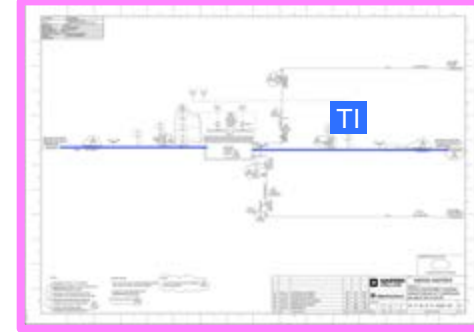
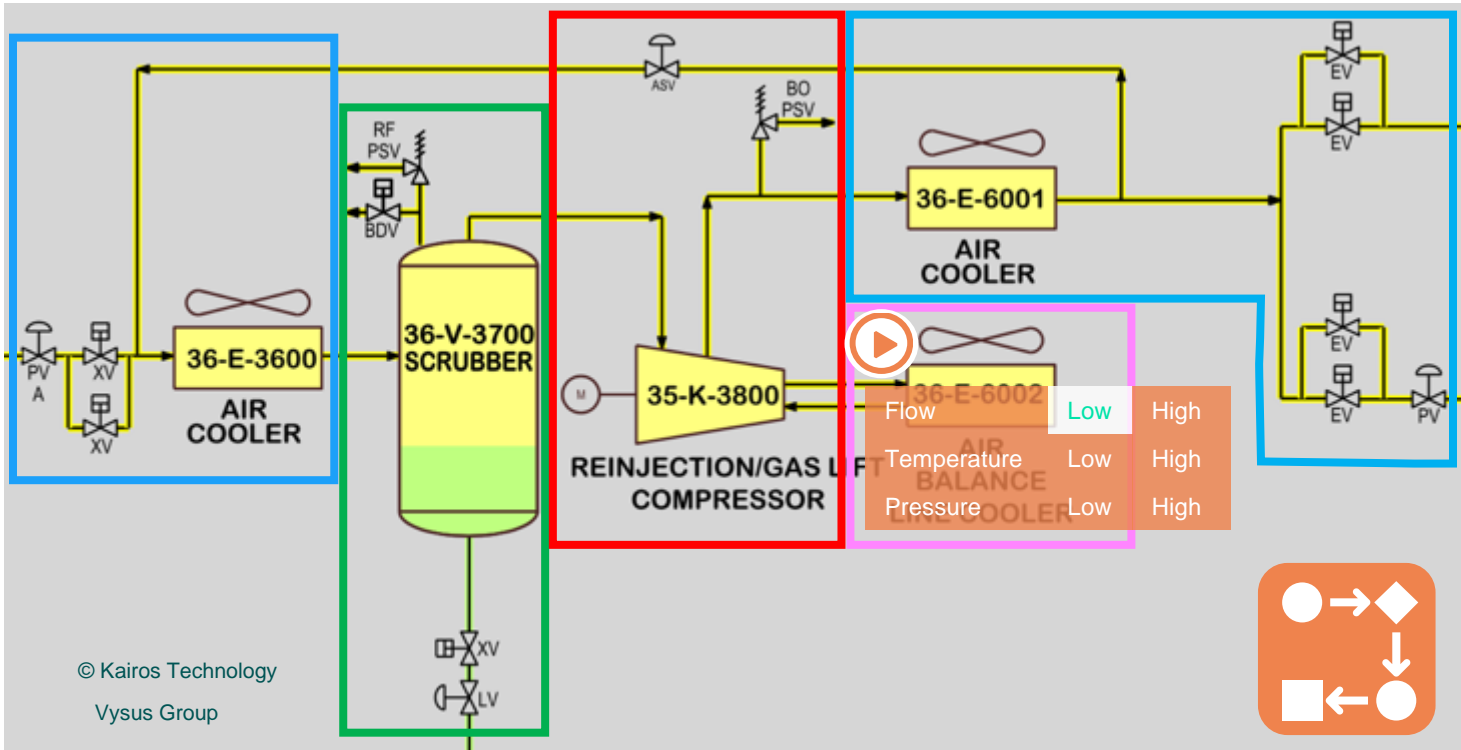
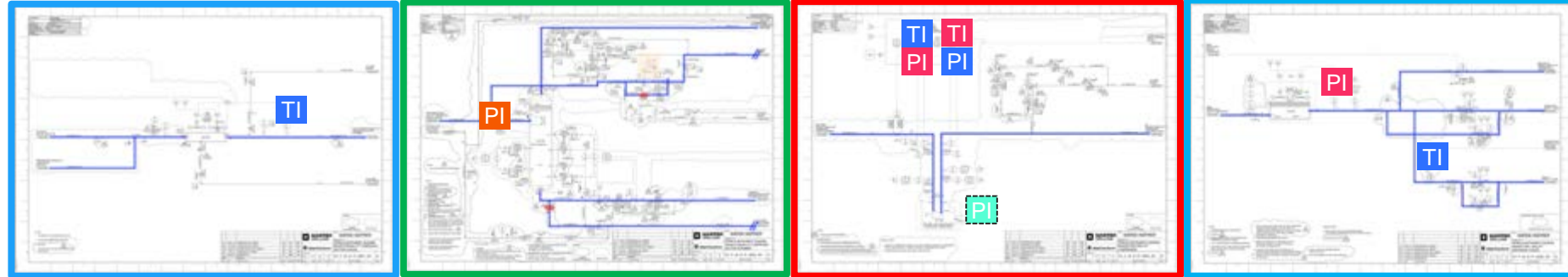
Reinjection Compressor



- High compressor thrust bearing load
- High thrust bearing temperature
- High compressor discharge temperature
- Risk of undetected surge
- High scrubber pressure
- Low suction cooler temperature

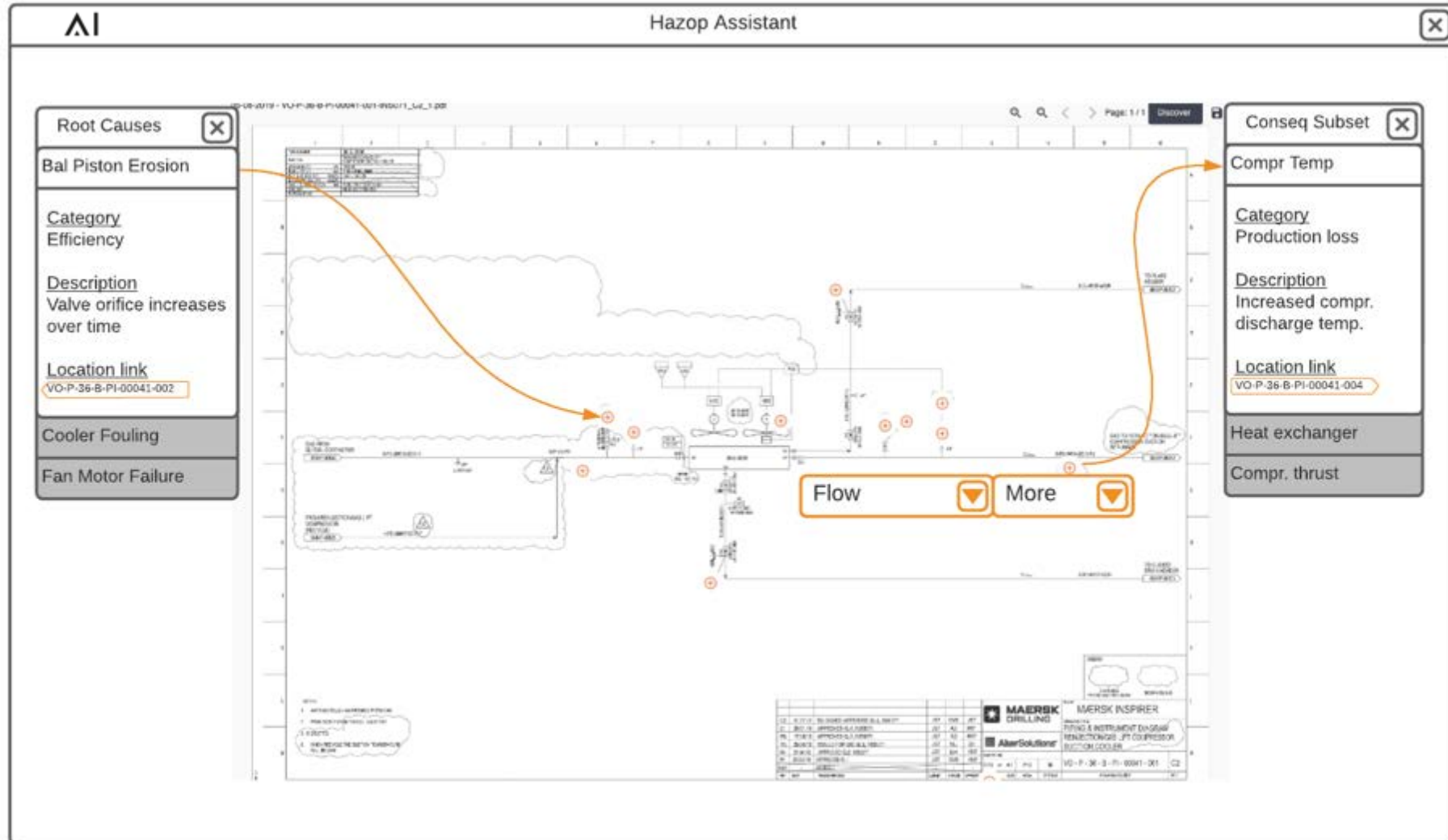


Reinjection Compressor – Sensor signature



- High compressor thrust bearing load
- High thrust bearing temperature
- High compressor discharge temperature
- Risk of undetected surge
- High scrubber pressure
- Low suction cooler temperature

Automated Guideword Analysis





HAZOP Assistant Objectives

- Assist the quality and cost of MoC
 - Improve efficacy and quality
 - Documentation always available
 - Verify adequate safeguards are in place
 - Cross site learning
 - Increase safety
 - Reduce cost by 50%
- Ensure best possible models in Kairos Control Room Assistant
 - Limit impact on production, avoid production loss
 - Minimize flaring and other emissions



Robert Nyiredy

Managing Director

+47 40 64 32 32

Robert.Nyiredy@vysusgroup.com