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Supporting FLNG Design, Commissioning and Start-up with Dynamic Simulation

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Supporting FLNG Design, Commissioning and Start-up with Dynamic Simulation

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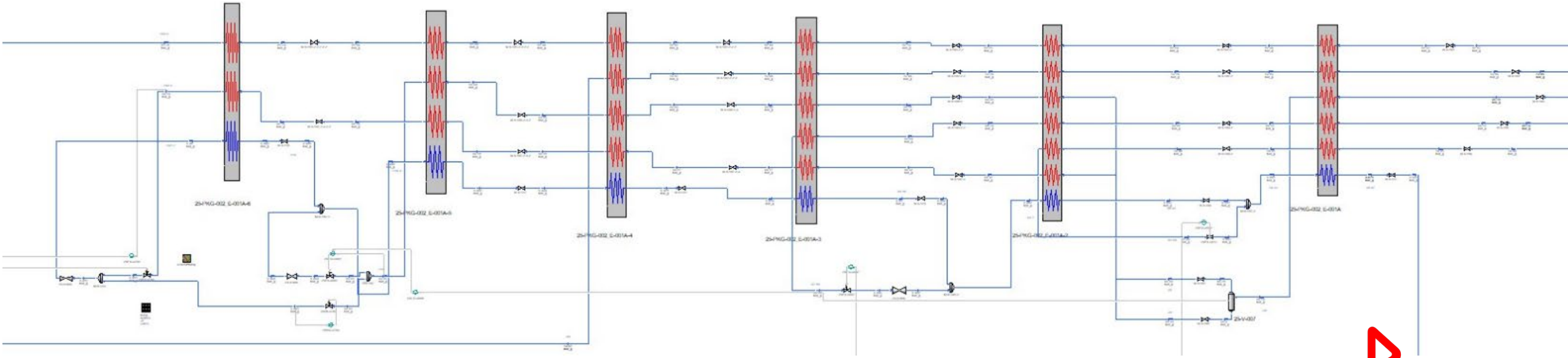
Why Dynamic Simulation for FLNG?

- FLNG = compact, offshore LNG production (2.4 Mtpa, 380 MMSCFD gas)
- Challenges: variable feed, complex transients, equipment reliability
- Dynamic simulation = test start-up, shutdown, ESD, trips before real ops

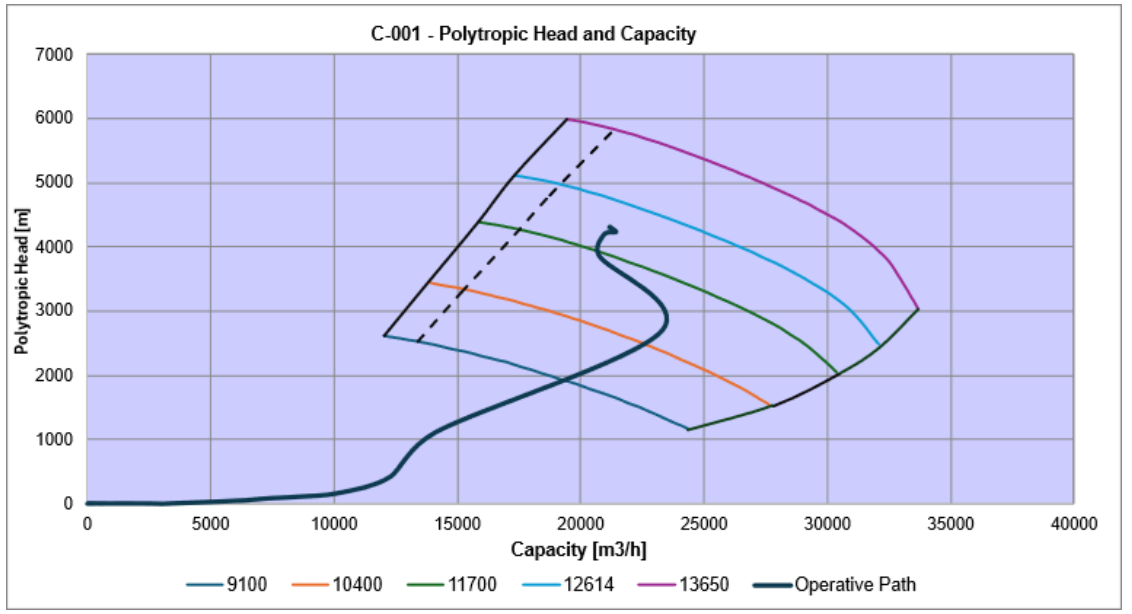


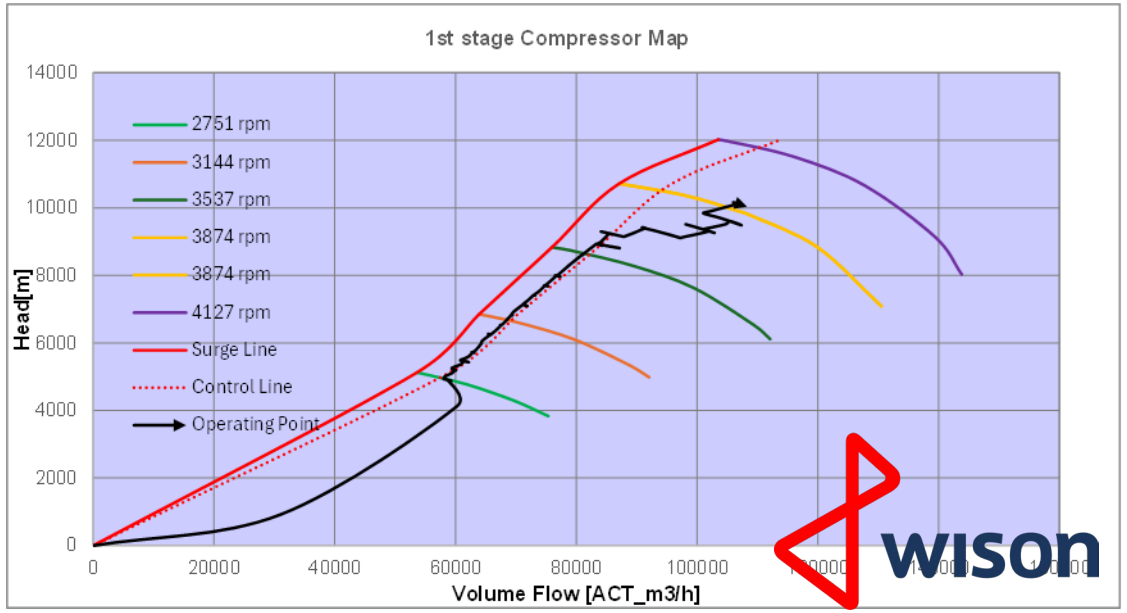
Simulation Scope

- Full topside modeled:Liquefaction trains
  - MRC, compressors, cold box
  - Utilities (cooling, hot oil, fuel gas)
  - Cargo handling & BOG system
- Aspen HYSYS® Dynamics with equipment maps & detailed control logic
- Model accuracy: >95% (critical variables within 2%)

Operational Scenarios

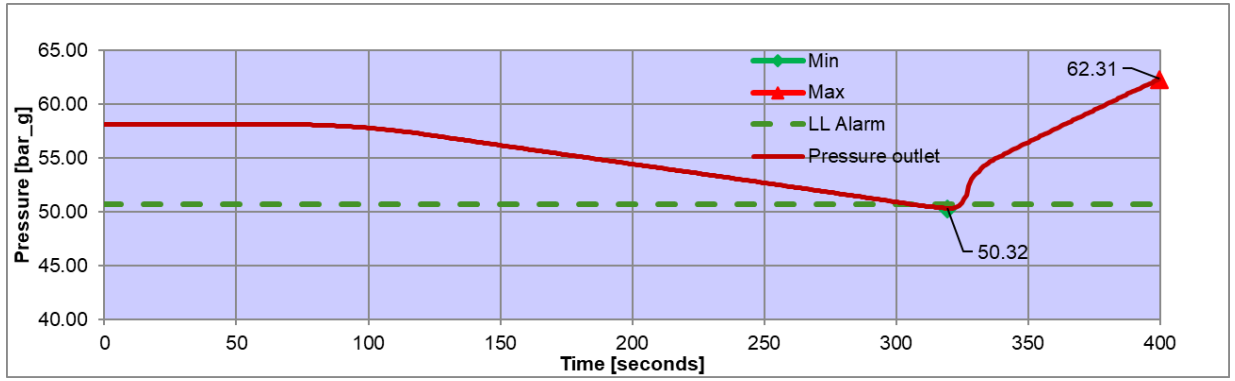
- Start-up & restart procedures
- Planned shutdown & controlled coast-down
- Emergency Shutdown (ESD) + blowdown
- Equipment trips (compressors, compander, pumps)
- Feed gas upsets & load changes

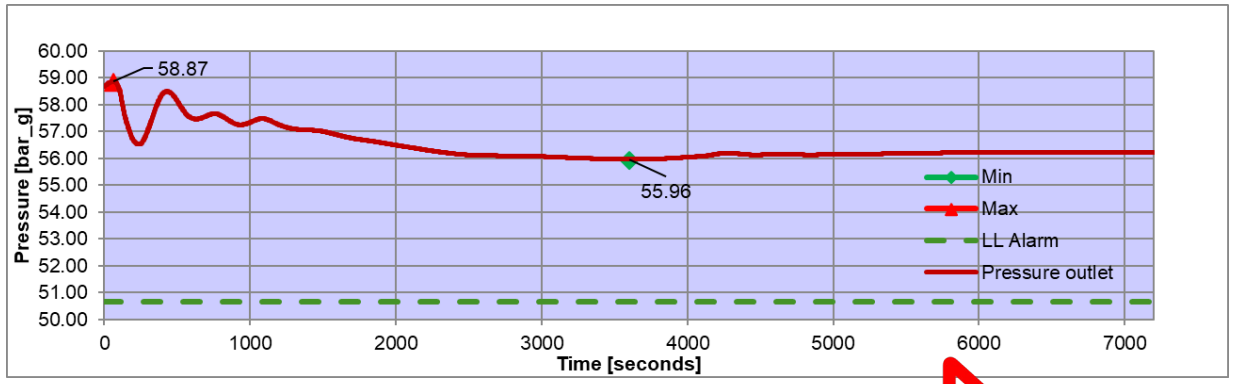




Results - Procedures & Safety

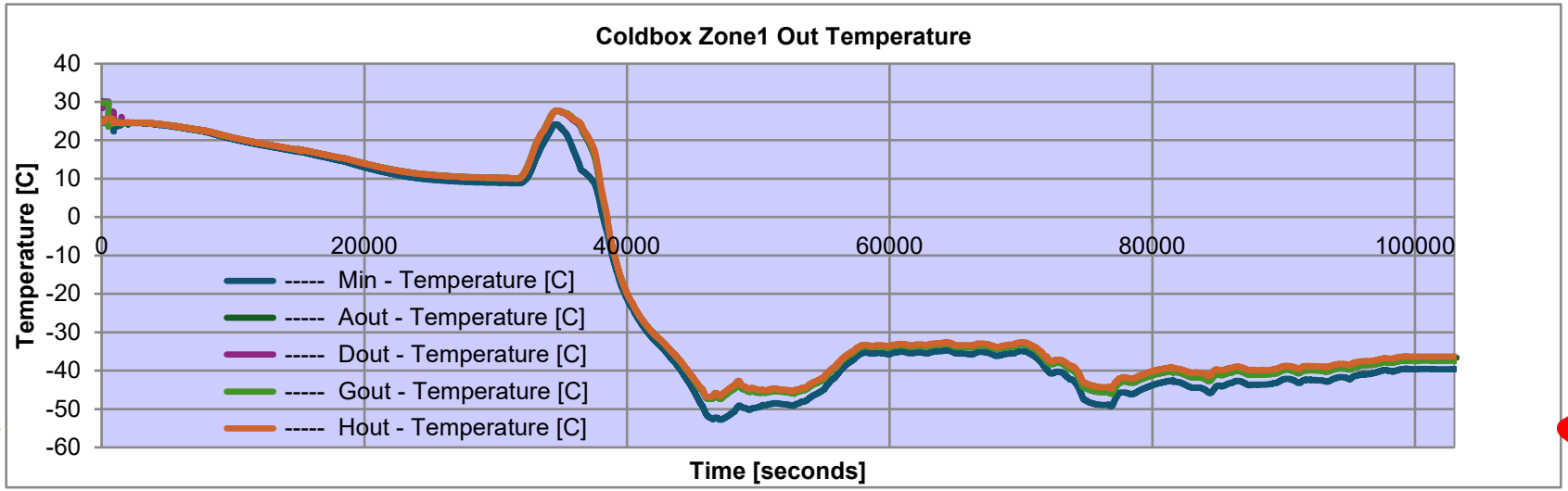
- Start-up: avoided surge & stonewall via ASV tuning and step adjustments
- ESD: plant reached safe no-flow without exceeding limits
- Safety system delays identified → confirmed response windows
- Equipment integrity verified for several upset scenarios.
- Control logic enhanced and operator actions aligned in front of different upset situations to improve plant control and overall plant survivability





Results - Equipment & Survivability

- Cold box: temperature change rates within material limits (no thermal stress)
- Feed gas loss (50%): defined mitigation actions to stabilize plant at new turndown
- Verification of Start-up and Normal shutdown procedures
- Holistic view of impact of changes in operation within all the units
- Elaboration and check of mitigation actions to improve plant operability in front of non-common operating conditions (partial trip, turndown condition, equipment failure…)
- Basis for OTS training scenarios



Business Impact & Benefits

- Enabled faster, safer start-up by pre-validating procedures and setpoints, reducing commissioning time and offshore interventions.
- Improved decision-making and collaboration, minimizing friction between EPC, Manufacturers and end-user.
- Delivered a safer, more reliable design – significantly reducing emergency shutdowns and enabling faster operator training.

Conclusions

- Dynamic simulation validated procedures, safety systems, and equipment integrity
- Delivered enhanced procedures by identification of the right steps in time and priority
- Provided design basis for setpoints & operational limits
- Reduced commissioning risks, improved operation readiness, supported OTS
- Increases confidence in design and minimizes commissioning doubts by pretesting of sequences and procedures
- Essential tool for FLNG lifecycle: design → commissioning → operation

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Any questions?

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