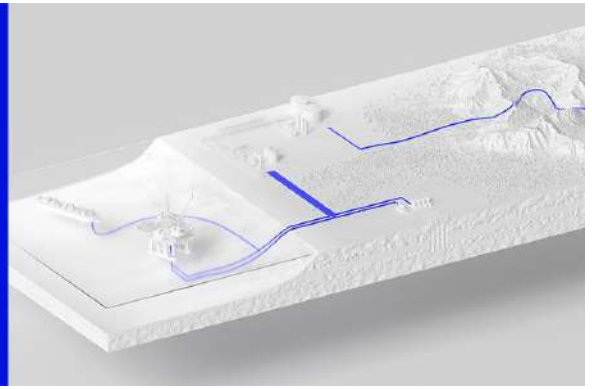
Holistic Models: Offshore Artificial Lift Training Simulator

slb

Olga and Pipesim
User Group Meetings

October 2025 – March 2026



inprocess

Inprocess in Brief

Since 2006 helping the processing industries in solving design and operational issues by applying process simulation

our **core business** is Process Simulation

enthusiastic about **sharing our knowledge** with our clients

all technologies (process simulator and control system)

2006
est. in Barcelona by domain experts

Projects in 55 countries
worldwide presence

110+
process simulation engineers

400+
executed projects

>90
OTS Projects

330+
training courses

Inprocess Solutions & Services

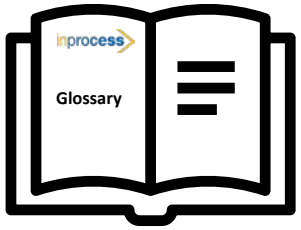
Engineering Studies

Operator Training

Digital Twins

Engineering Training

Holistic Models Introduction

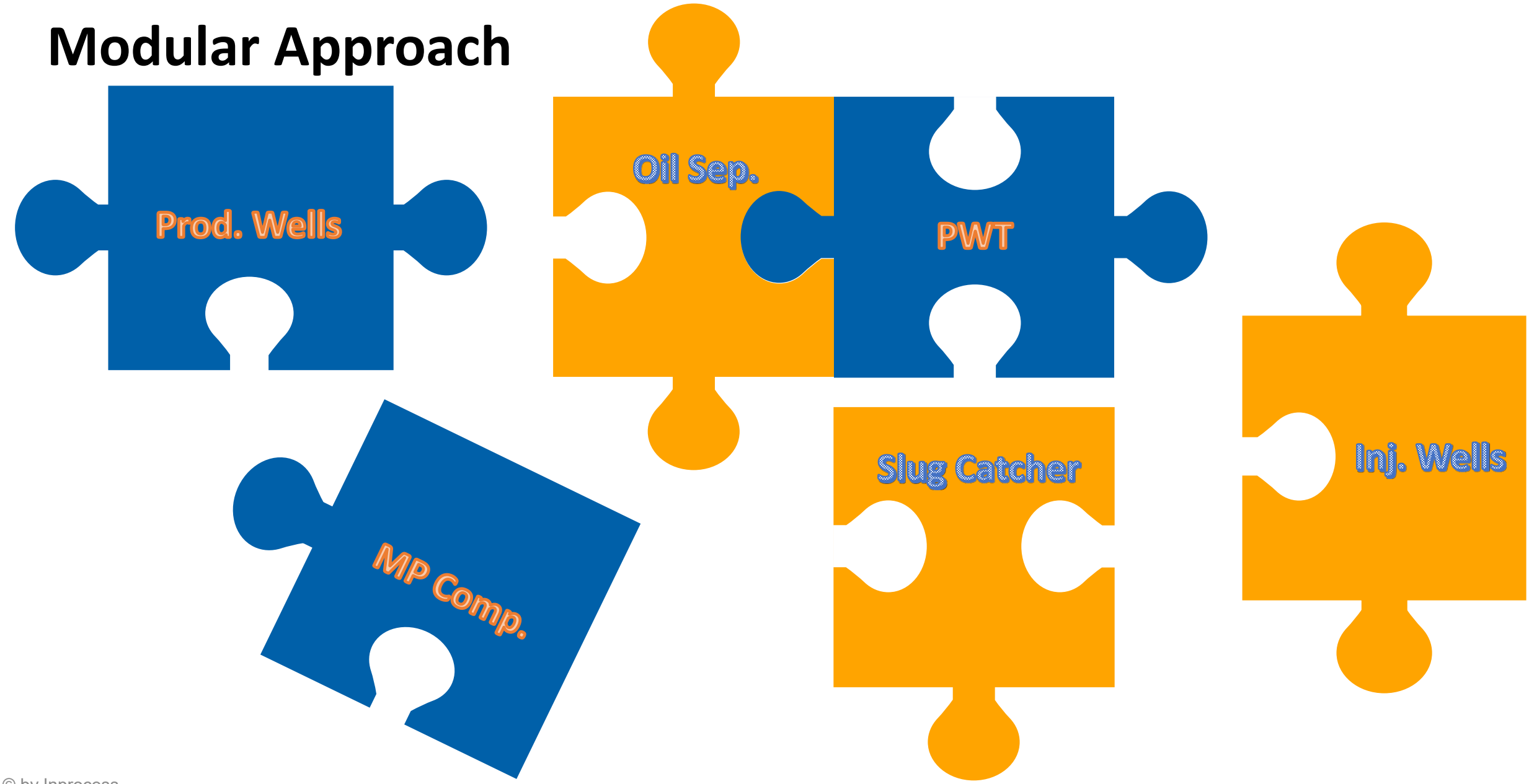


Holistic (Adjective):
Characterized by the belief that the parts of something are interconnected and can be explained only by reference to the whole.

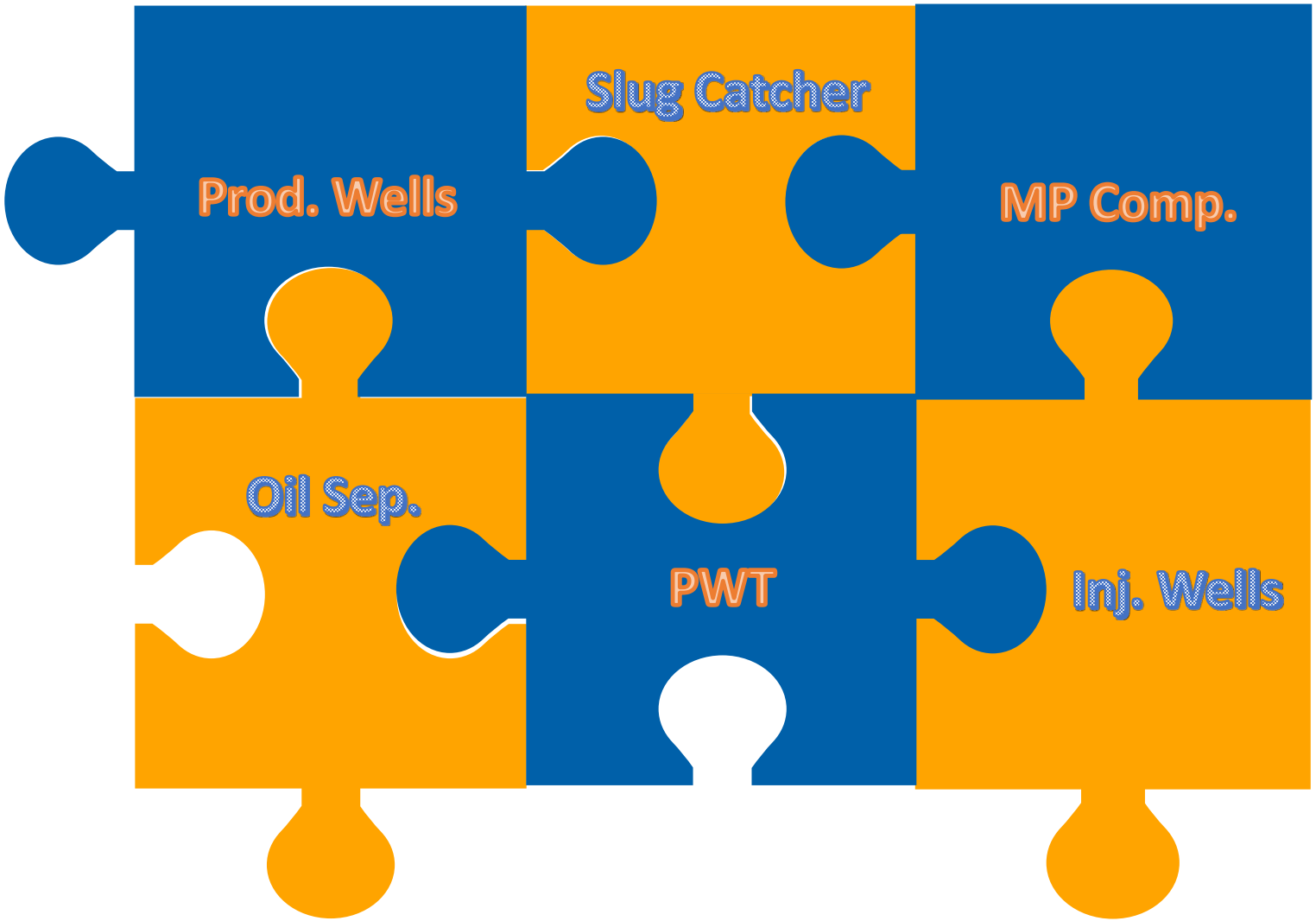
- A modular dynamic simulation approach considers each unit as an individual entity.
- A holistic dynamic simulation approach takes into account the interconnectivity between all units.
- Holistic simulations can also link **process simulator (**e.g. Symmetry**)** software with **flow assurance software** (e.g. Schlumberger **OLGA**) to take advantage of the best from both worlds.

Holistic Models Introduction

Modular Approach

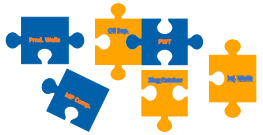


Holistic Approach



Holistic Models Introduction

Modular Approach



- Each unit is analysed independently.
- Standalone simulation models.
- OLGA outputs used as inputs.
- Less computational cost, greater RTF.

$$RTF: Real\ time\ factor \rightarrow RTF = \frac{Simulated\ time}{Real\ Time}$$

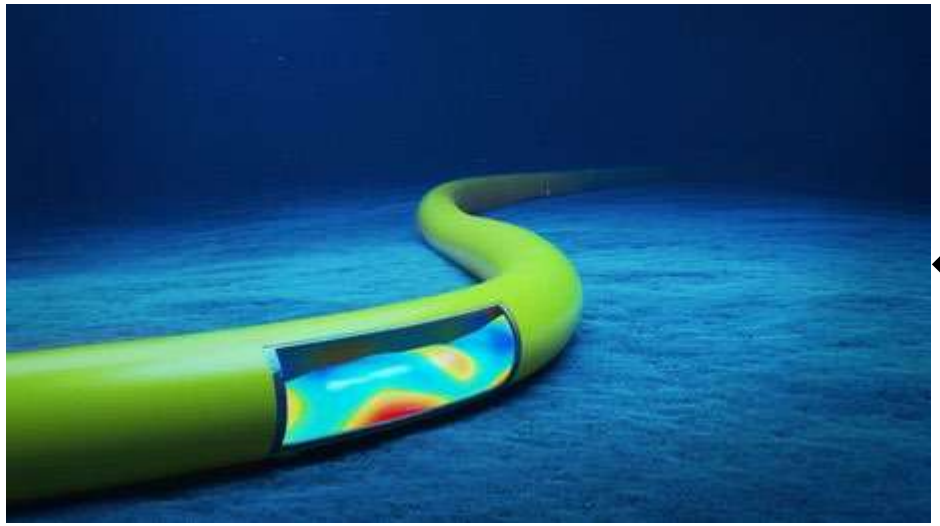
Holistic Approach

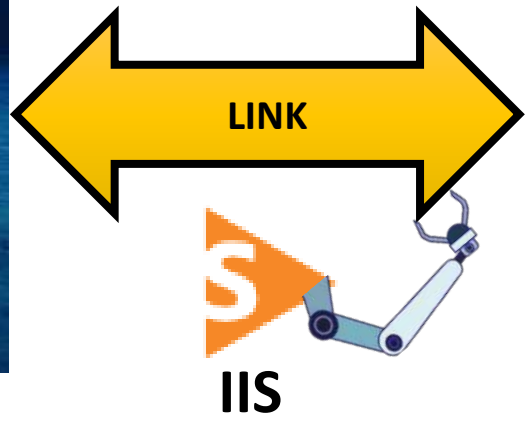
- Interaction between units is analysed.
- One integrated simulation model.
- OLGA and Process Model Linked
- More computational cost, lower RTF.

Inprocess Infrastructure Suite

- Facilities models and OLGA model share information using OPC protocol.
- Inprocess Infrastructure Suite (IIS) application manages the communication and synchronization between models.
- IIS allows starting/stopping simulation, saving/loading snapshots, plot trends, etc.

OLGA Model





Process Simulator Model

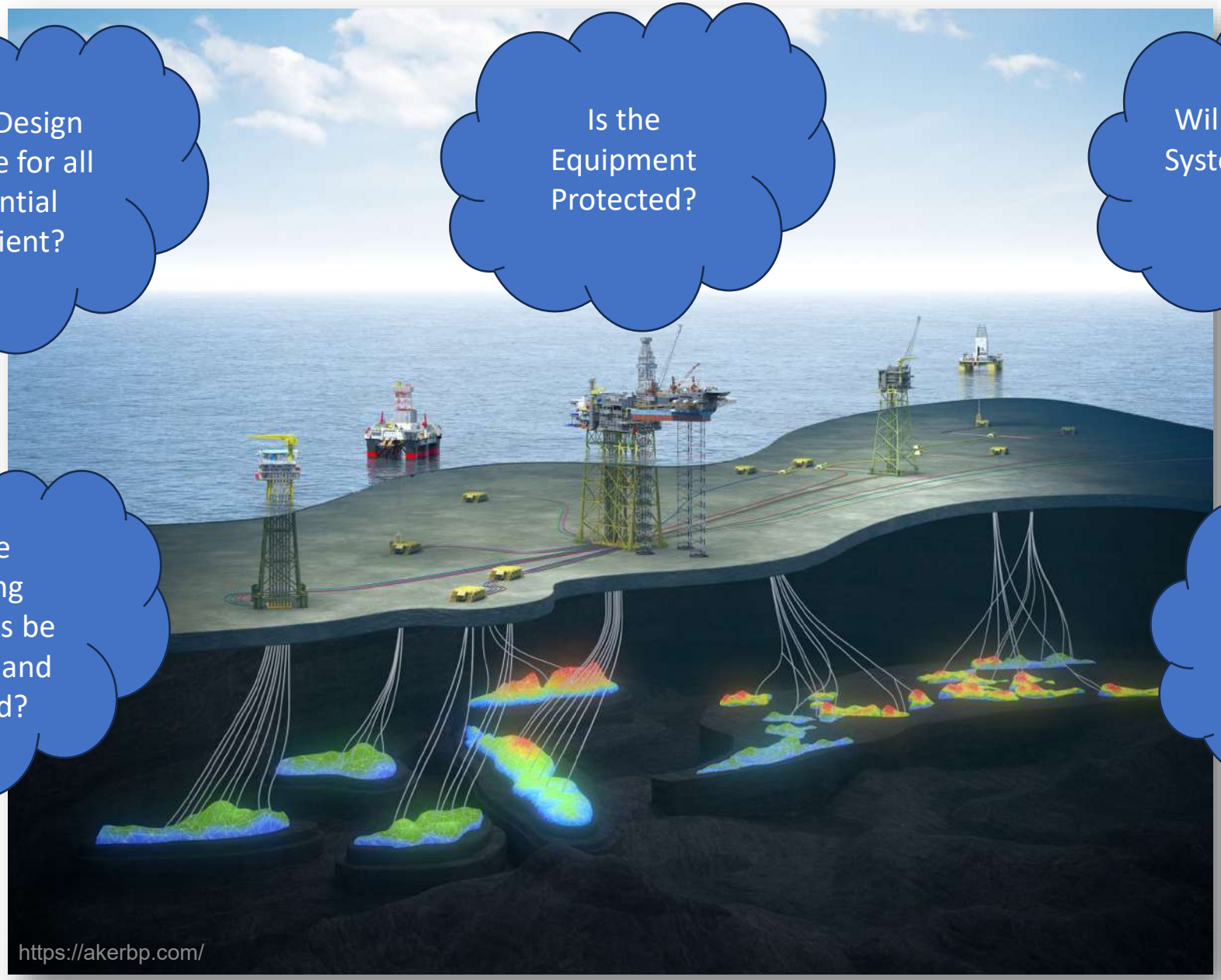
***OPC**: OLE (Object Linking and Embedding) for Process Control*

Holistic Dynamic Simulation Studies - Purpose

Is the Design Suitable for all potential transient?

Is the Equipment Protected?

Will the Safety System perform well?



Can the operating procedures be improved and validated?

Can we increase production, reduce flaring and improve controllability?

Holistic Dynamic Simulation Studies - Purpose

Is the Design Suitable for all potential transient?

Is the Equipment Protected?

Will the Safety System perform well?

How will the operators be trained?

Can the operating procedures be improved and

Can we increase production, reduce flaring and improve controllability?

Case Study #1 - Offshore Artificial Lift Training Simulator

Background & Motivation

- Offshore operator facing production decline in **aging subsea wells**.
- Decision made to install subsea **Electrical Submersible Pumps** (ESPs) — a first for their offshore team, though ESPs are common in their onshore assets.

- Operators had **no prior experience** with ESP operations, start-up, or shutdown procedures.

- ESPs project to extend field life expectancy beyond 2050, **recovering billions** in potential production value.

Inprocess Approach

- Holistic Simulation:
  - Topside process modelled in dynamic simulation process simulator.
  - Subsea network modelled in OLGA.
  - Integration achieved through Inprocess' proprietary linking interface for seamless dynamic data exchange.

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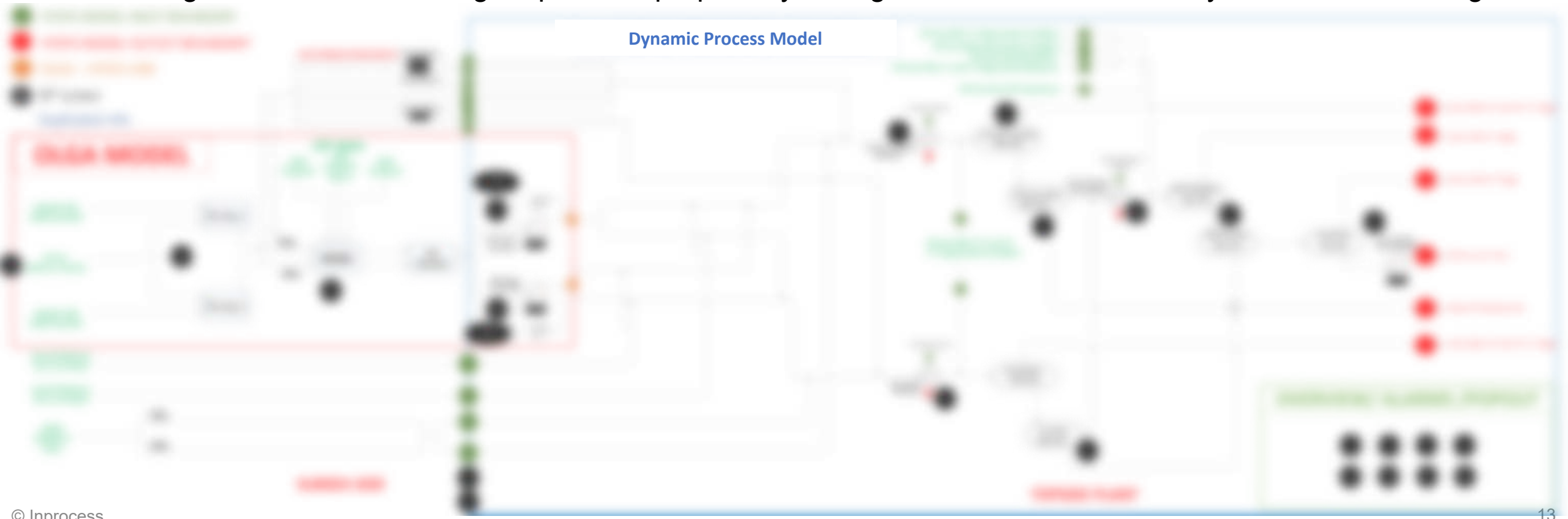
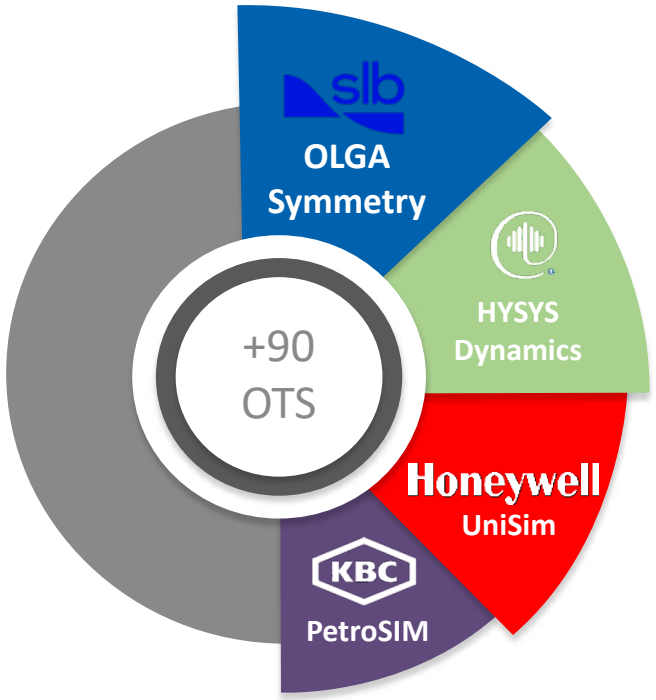


Inprocess Approach

- Holistic Simulation:
  - Topside process modelled in dynamic simulation process simulator.
  - Subsea network modelled in OLGA.
  - Integration achieved through Inprocess' proprietary linking interface for seamless dynamic data exchange.
- The OTS was configured to simulate all operational modes:
  - Normal and abnormal start-up sequences.
  - Subsea equipment malfunctions.
  - ESP trips and shutdown recovery scenarios.

Inprocess Infrastructure Suite (IIS)

Dynamic Process Simulation Technology



Inprocess Infrastructure Suite (IIS)

Through,

DCOM (i.e. commands)
OPC DA
OPC UA
CORBA
Propietary Protocols (i.e. ExaTIF)
Windows Fundation
(i.e. SIEMENS SIMIT commands)

ICSS Technology

- EMERSON Delta V
- SIEMENS PCS7 and APACS/Quadlog
- Yokogawa Centum VP
- ABB 800xA
- Honeywell Experion PKS and TPS
- Kongsberg Maritime K-Chief 700
- Schneider-INVENSYS Foxboro I/A
- Rockwell
- CCC
- GE Mark
- Generic ICSS emulators

PLANT HISTORIANS

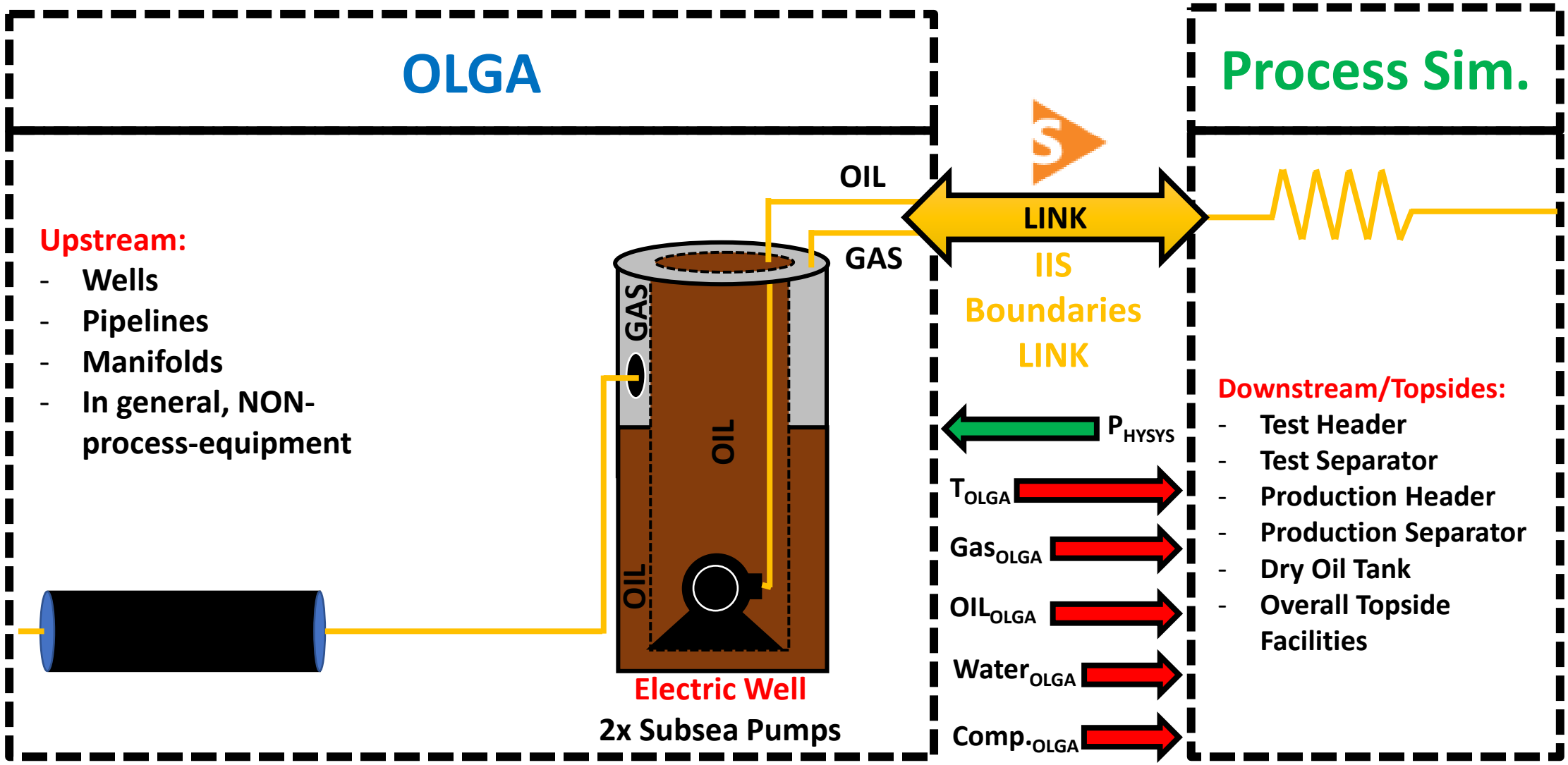
- OSI PI, Honeywell's PHD, Azure's IoT Hub, OPC server, etc.

OTHERS

- Excel
- Other communication protocols can be developed on demand.

Link OLGA + Topsides – Explanation Scheme

- **Simulation speed of both Software's is controlled and synchronized by IIS link.**
- **Data transfer between software's is performed via OPC protocol.**



Project Challenges & Solutions

- Operators provided hands-on feedback that led to:
  - Major revisions in start-up and shutdown procedures. Engineering assumptions proved unrealistic under real conditions and operator experience.
- OTS caught an error for ESP control. Narrative stated it should be based on discharge pressure. Walking through the scenario with the ESP consultants highlighted that this should be on suction pressure.

OTS Architecture - Explanation

Ethernet Connections

Management Network

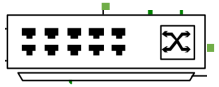
- Network for remote management purposes

Instructor & Simulation Station -1

Where the HYSYS, OLGA and IIS (HMI Inprocess emulator) are to be installed.

Models will be only able to be manipulated from emulated HMI via IIS.

Where MODELS RUNTIME will be executed.



Ethernet Switch - 1

Operation Station - 1

Operation Station - 2

Do not contain process simulation software's installed.

The main and only purpose is to visualize/manipulate the system via HMI screens.

Only software installed for OTS purpose is the Inprocess IIS (HMI emulator).

Signals are shared between the ISS-1 and the OS-1/2.

OTS Olga Scope Screen

Cold Start-up of the ESP OTS

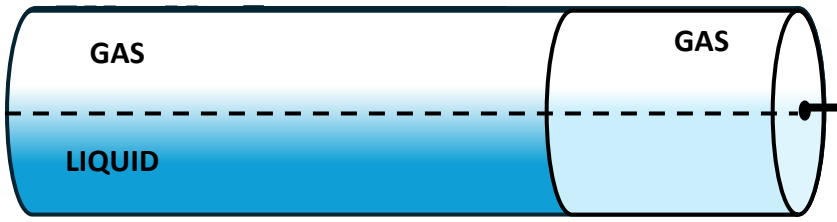
Project Benefits

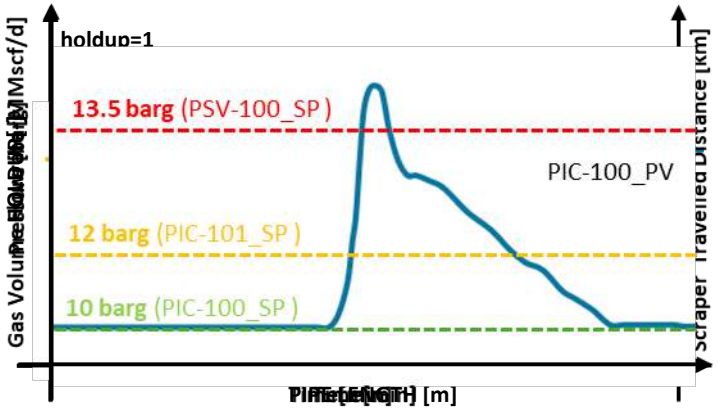
- Conducted 10+ **training sessions** across operating shifts to ensure broad engagement.
- OTS became a **procedure validation** tool, not just a training platform.
- OTS was able to adjust **tuning parameters** for ESPs in advance of startup.
- OTS caught an error for ESP control. **Narrative** stated it should be based on discharge pressure. Walking through the scenario with the ESP consultants highlighted that this should be on suction pressure.
- **Developed HMI** screens in parallel with control system supplier (ahead of schedule) and were tested within the simulator environment to capture operator feedback before final deployment.
- Facilitated **cross-discipline collaboration** between engineering, operations, and control system teams.
- Validated that **dead oil** circulation is only required during initial startup, not for every restart which significantly reducing offshore operational effort.
- **The actual start-up went flawlessly, and production has increased by 5,000 BPD with only one pump online.**

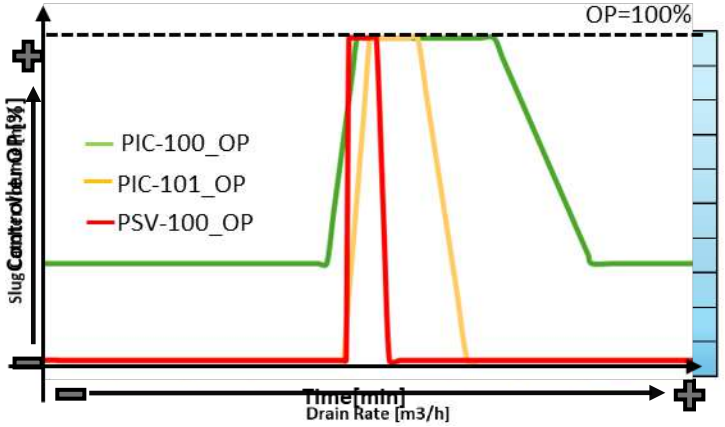
Case Study #2 - Slug Catcher analysis during scraping operation

Real Example – Scraping with Link – 100% Wells production

100% WELL PRODUCTION

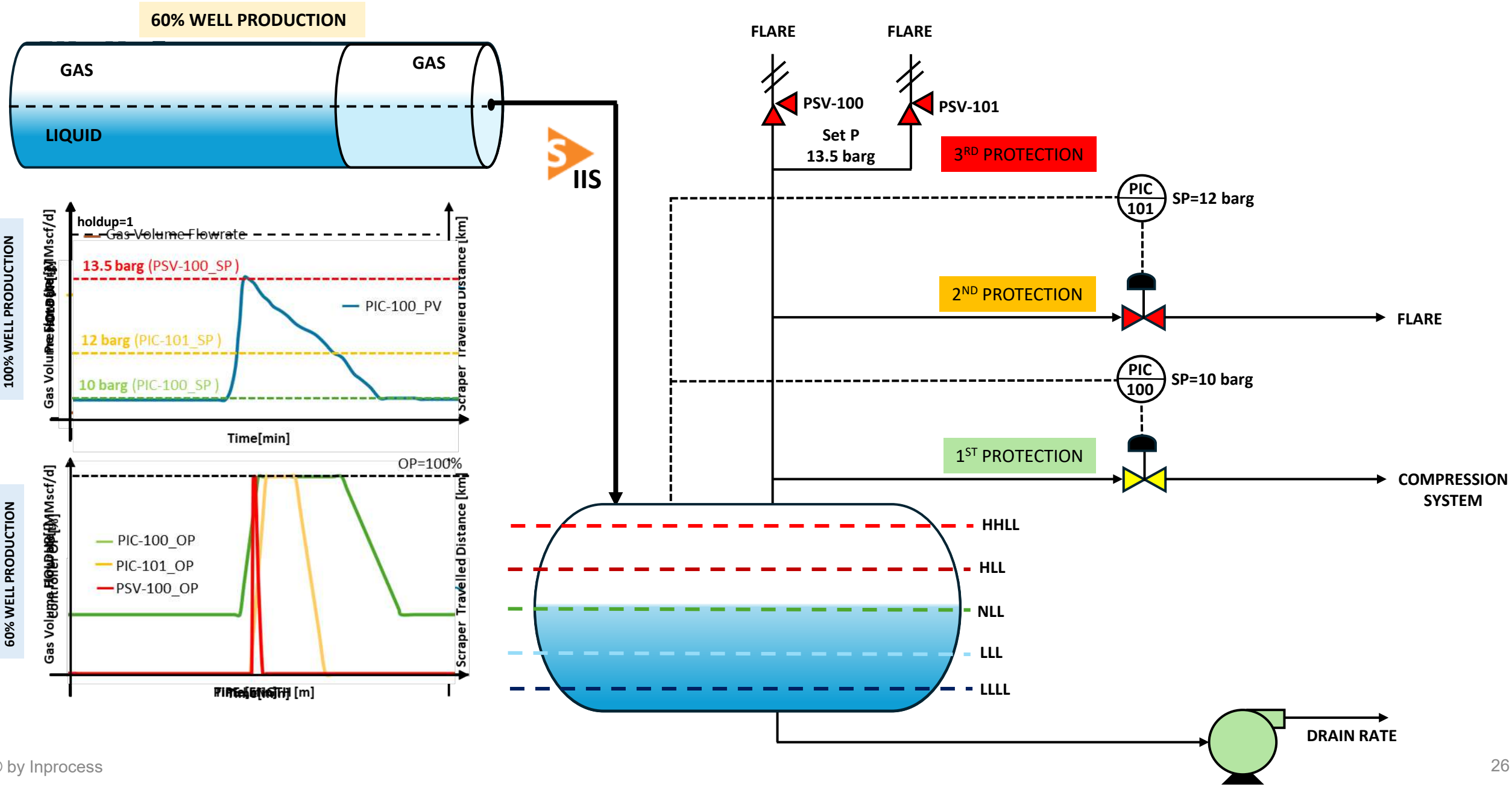




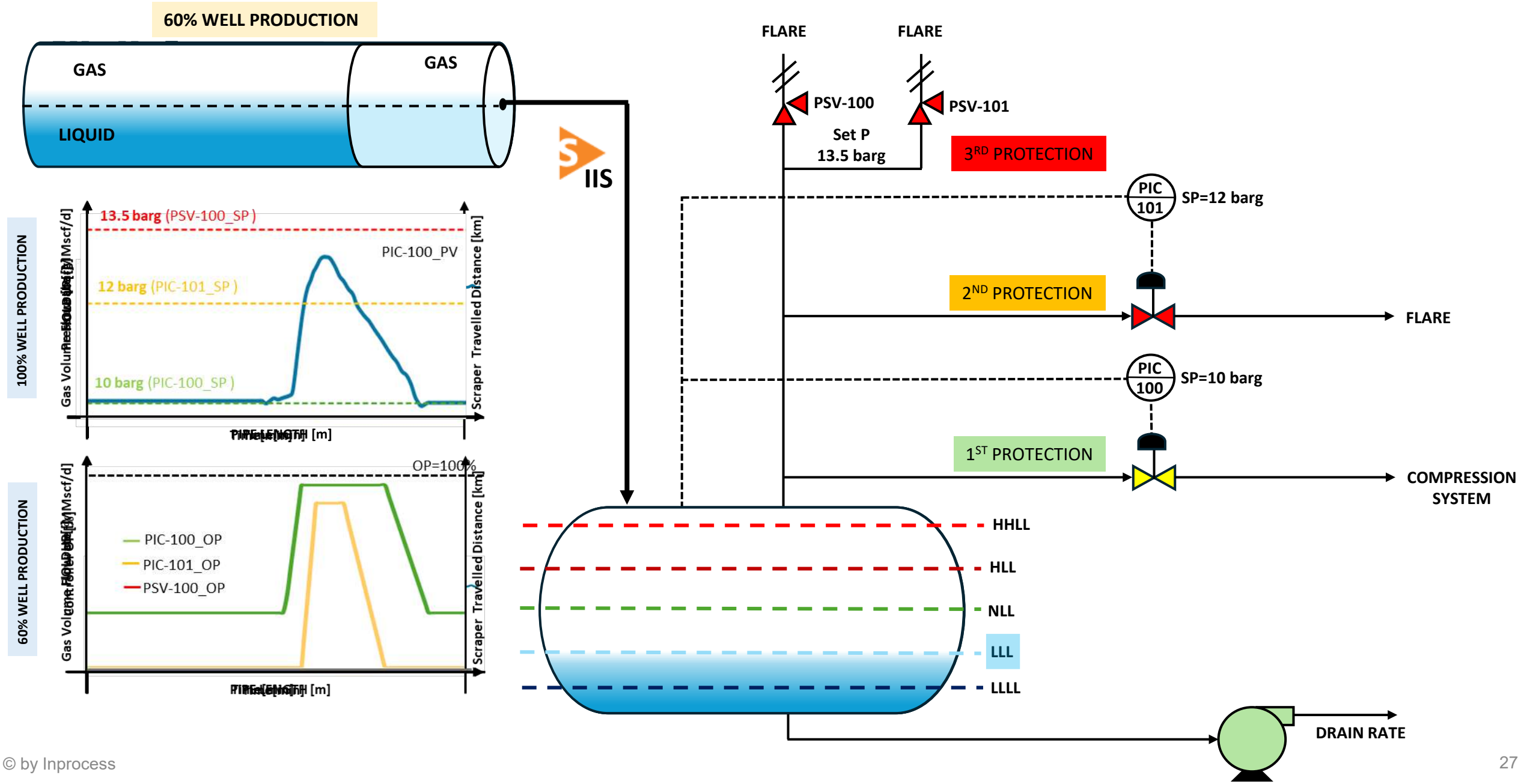


Only the drain rate was considered to size the Slug Catcher according to a previous flow assurance study*

Real Example – Scraping with Link – 60% Wells production



Real Example – Scraping with Link – Agresive SC pressure control



Real Example – Scraping Operation with Holistic Approach

General conclusions

✓ Avoided the opening of PSVs.

✓ Avoided trips in the Slug catcher and downstream facilities during scraping operations.

Holistic Approach benefits for scrapping operations

✓ Analyzing controller response during scraping operations.

✓ Validate Slug Catcher dimensions during scraping operations.

- Only the drain rate was considered to size the Slug Catcher according to the flow assurance study. However, the holistic dynamic simulation study proves that the dimensions of the Slug Catcher were not enough to prevent the opening of the PSVs due to the accumulated gas in the pipeline during the scrapping operation.

✓ Parametric study of the well production

✓ The reduction of the wells production was crucial to decrease the amount of gas accumulated behind the scrapper. However, it is important to keep enough flowrate to guarantee that the scraper is not trapped in the pipeline.

Thank you!

Q&A

Luis Imaz MSc, Chem.Eng.

Luis.Imaz@Inprocessgroup.com

+34 691 073 902

www.inprocessgroup.com