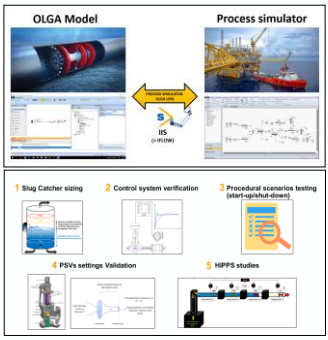
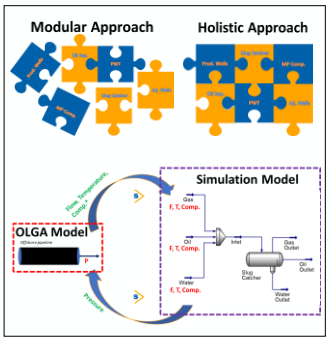
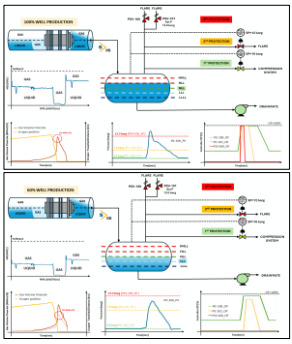
Relief Avoidance During Pigging

Coral Paramio & Michael Brodkorb







BACKGROUND / CHALLENGES

In the oil and gas industry, scrapers (or "pigs") are used for pipeline maintenance to remove solid deposits or accumulated liquids along the pipelines, ensuring a proper flow.

Scraping operations are especially important in **multiphase pipelines** to avoid overpressures in the pipes due to the formation of condensates or precipitates that could cause them to break

These multiphase pipelines normally discharge in devices known as slug catchers that receive gas, oil, and water mixtures and absorb upstream flow disturbances.

Key factors to consider during pig launches include:

- **Gas Flowrate Management:** Ensuring adequate pig velocity to prevent it from getting stuck.
- **Slug Catcher Design:** Properly size the vessel to handle the liquid discharge by the pig device, preventing downstream issues – like emergency shutdowns.

However, one of the issues that is not usually considered in flow assurance studies is the **gas pocket accumulated behind the pig**, which can excessively pressurize the vessel, leading to a potential opening of the relief valves.

Dynamic simulation tools like **Schlumberger's OLGA** is essential for modeling these operations in a realistic way, making possible not only to calculate the liquid accumulated on the front side of the pig but also the gas pocket buildup on the back.

SOLUTIONS / WORKFLOWS

At Inprocess, we have a vast experience in carrying out holistic dynamic studies (integrated studies of upstream & downstream facilities). These studies are based on the communication between downstream process simulators (e.g. Symmetry, or Aspen Hysys) with flow assurance/upstream simulators (i.e. Schlumberger OLGA), by using the Inprocess Instructor (IIS), as a unique software interconnecting tool, allowing to take advantage of the best from both worlds.

It is important to distinguish between modular and holistic studies, in order to clarify the main differences of both approaches and select the best one to fulfil the project requirements.

In a modular approach:

- Each unit is analyzed independently
- Standalone simulation models
- OLGA outputs used as Hysys inputs
- Less computational cost, greater RTF(*)

While for the Holistic Model:

- Interaction between units is analyzed
- One integrated simulation model.
- OLGA and Process Simulator link (IFLOW)
- More computational cost, lower RTF(*)

(*)Real time factor (RFT)=$\frac{Simulation\ time}{Real\ time}$

RESULTS / CONCLUSIONS

In one specific case, the dynamic simulation analysis performed by Inprocess revealed that the opening of the relief valves during pigging operations was unavoidable, since in the flow assurance study provided by the contractor previously, the pocket of gas accumulated behind the scrapper was not considered and therefore the slug catcher was not sized accordingly

To address this issue, Inprocess proposed and tested, using a holistic dynamic simulation model, several mitigation measures to prevent the relief valves from opening:

- First, a parametric study to understand what is the minimum production to ensure a stable and positive flow pattern, avoiding the pig from getting trapped in the pipeline.
- A much more aggressive control strategy was required than what was predicted for normal operation.
- Before starting the pigging operation, it was suggested to reset the Slug Catcher level from the NLL to the LLL. This increases the volume available for the accumulated gas behind the pig, avoiding trip levels to be reached and the PSVs to open.

Additionally, the live link between Process and Flow-line models provides a complex floating boundary node and not a fixed backpressure value. This allows to predict a realistic behavior and flow regime in the pipeline (slugs, bubble, annular, stratified, etc.)

Presented at

SLB Digital Forum 2024

Navigating new frontiers