

Pipelines & Flow Assurance

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Using CFD To Predict Pig Behaviour

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Agenda

- 1. Introduction
- 2. CFD Modeling
- 3. Output and results
- 4. Conclusions & Way Forward



1. Introduction – About pigging

- Pigging is necessary for various reasons:
 - Cleaning
 - Inspection
 - Pre-commissioning
- Pigs can be made of different materials
- The main risk with pigging is the pig getting stuck



1. Introduction – Tie in location

- Added problem 10" pig passing through 24" then 34" pipeline
- CFD can be used to assist pig manufacturer during design to confirm passage of pig





1. Introduction – Design requirements – Weak link





1. Introduction – Design requirements – Density





1. Introduction – Design requirements – Onset velocity

MINIMUM FLOW RATE TO DISPLACE PIG?





1. Introduction – Design requirements – Wye pieces



1. Introduction – Design requirements – Wye pieces





2. CFD models – Individual pigs





2. CFD models – Wye







3. Results – Individual pigs

FIXED VELOCITY INLET



VELOCITY MAGNITUDE



3. Results – Individual pigs



3. Results – Friction Theory





3. Results – Frictions Theory



 $f_{normal} = mg - \rho_{fluid} V_{displaced}$



3. Results – Onset velocity





3. Results – Onset velocity





3. Results – Wye

LOCAL COORDINATES ATTACHED TO PIG COG



3. Results – Wye





4. Conclusions & Way forward

- CFD was successfully used to improve knowledge on how the pig behaved when going through various piping elements
- Such study can be done in a cost efficient manner and identify potential "stuck pig" risks during pigging operations
- Testing rigs and procedures should be adapted to improve the accuracy of friction factors estimates which will improve onset velocity predictions



Thanks for listening... Any question ?

