Casing Wear evaluation through simulation

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Society of Petroleum Engineers

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Overview

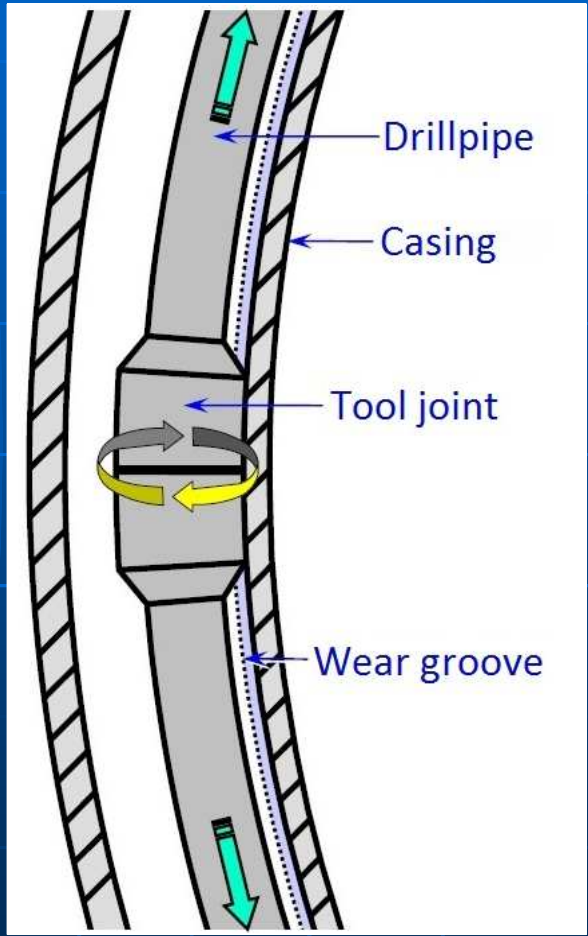
- Theoretical background
- Candidate well
- Simulation workflow
- Simulation results
- Conclusions

Theoretical background

- Well integrity
  - Reduced burst and collapse pressure
- Well life
  - Future well operations
  - Artificial lift
- Costs
  - Casing remediation
  - Well abandonment

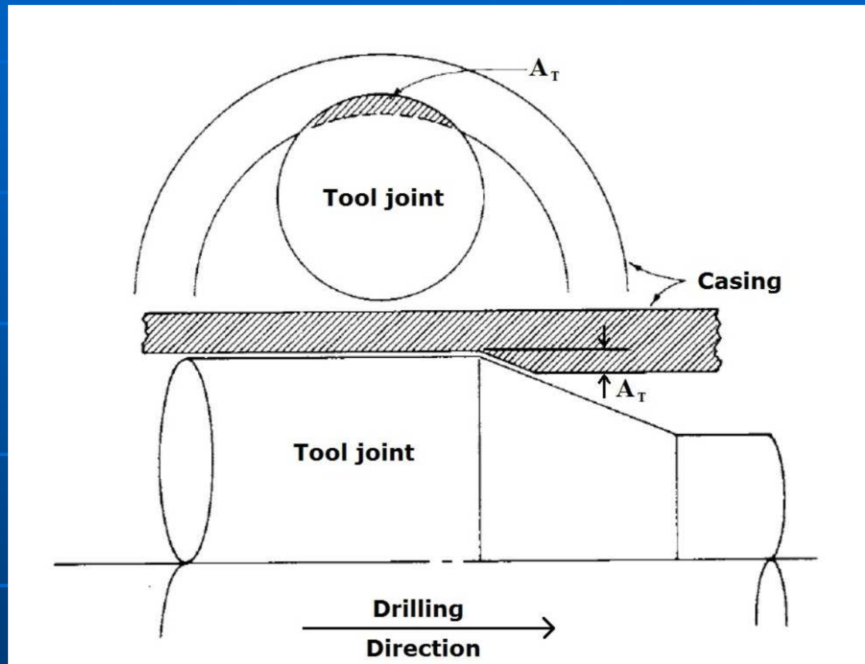
Theoretical background

- Rotating tool joint forced against the casing wall
- Contact causes friction
- Result: Crescent-shaped wear groove

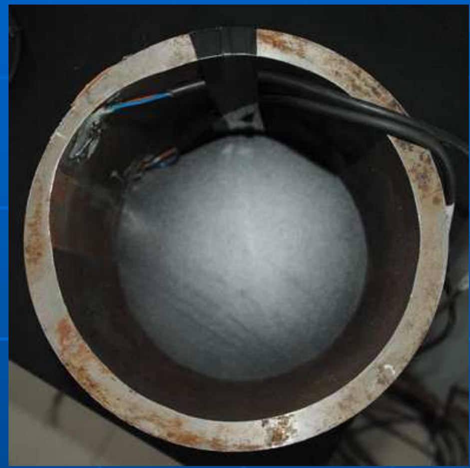


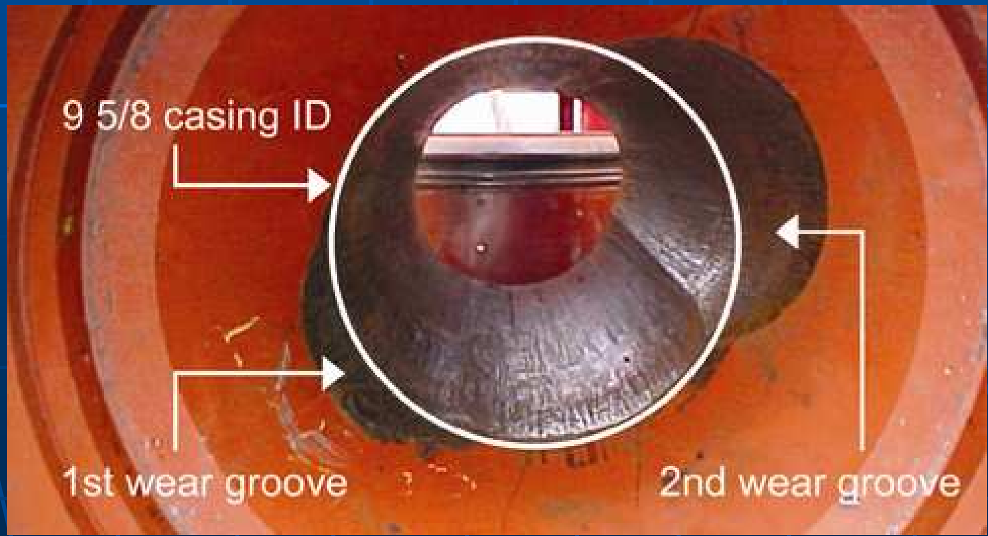
Theoretical background

- High contact pressure
- Contact area initially a line, slowly becomes a groove



Theoretical background



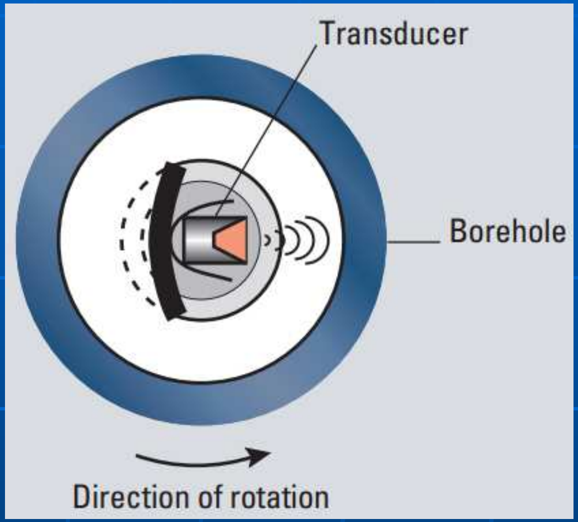


Affecting parameters

- Lateral load
- Well survey (Dogleg severity)
- Mud composition
- Tool joint hardbanding

Casing Wear logging tools

- Ultrasonic Imaging Tool
- Circumferential borehole-imaging tool



Wear mitigation

- Non-rotating drillpipe protector
- Downhole motor
- Mud additives – lubricants
- Tool-joint materials
- Internal casing coating

Remedial actions

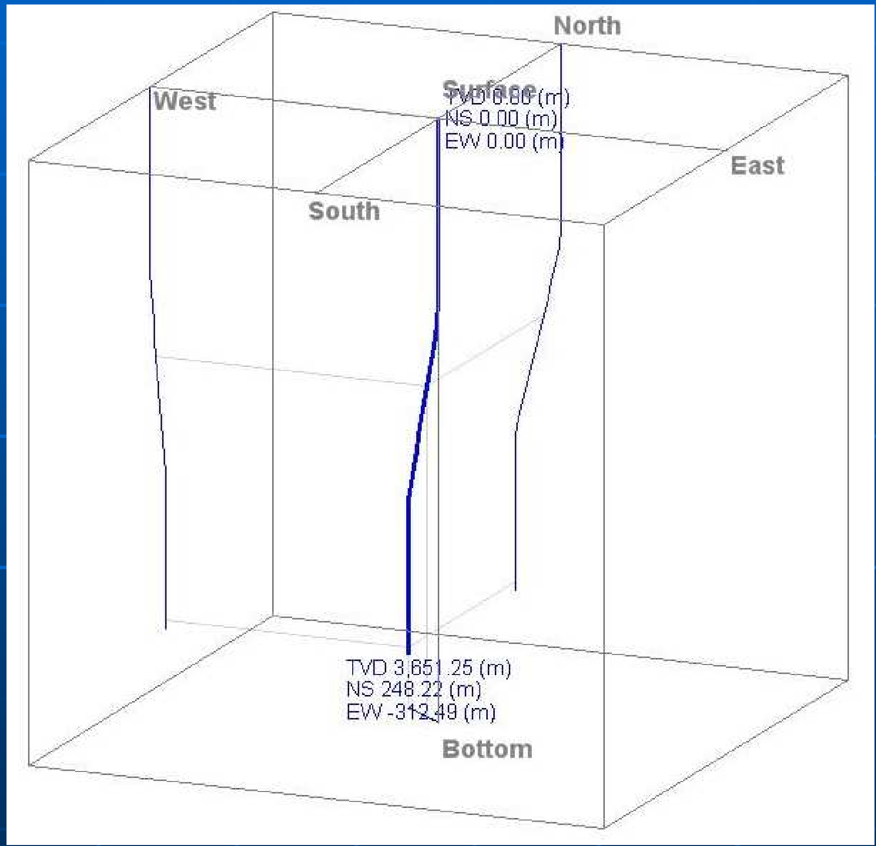
- Complete replacement
- Partial replacement
  - Rethreading
  - Overshot
- Squeeze cementing

PetrisWinds DrillNET

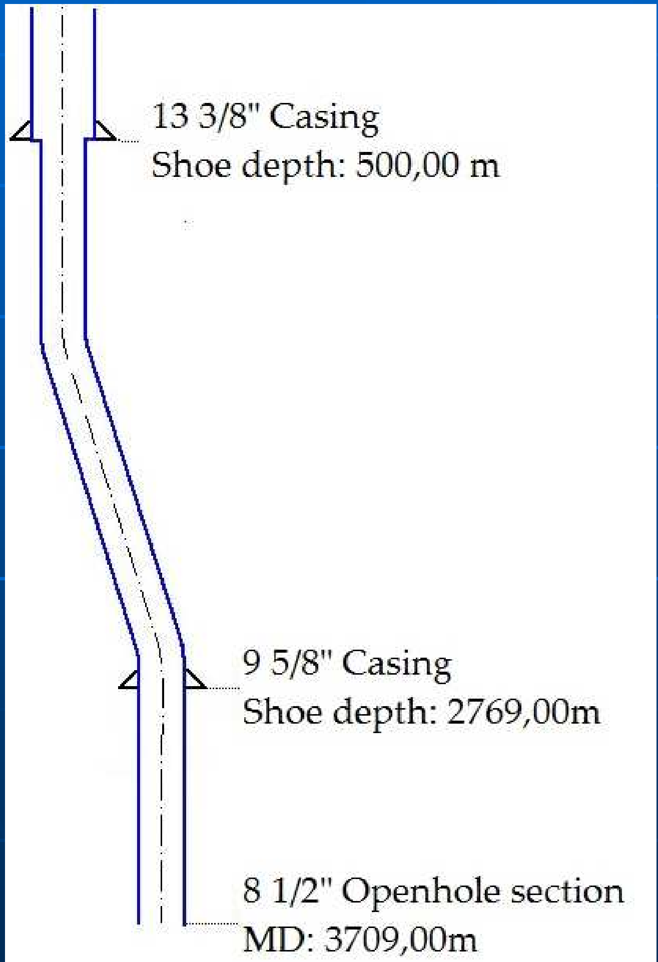
- Drilling engineering integrated analysis package
- Casing Wear module
- The model predicts the location and magnitude of casing wear in casing strings
- Calculates volumetric casing wear
- Energy based calculations

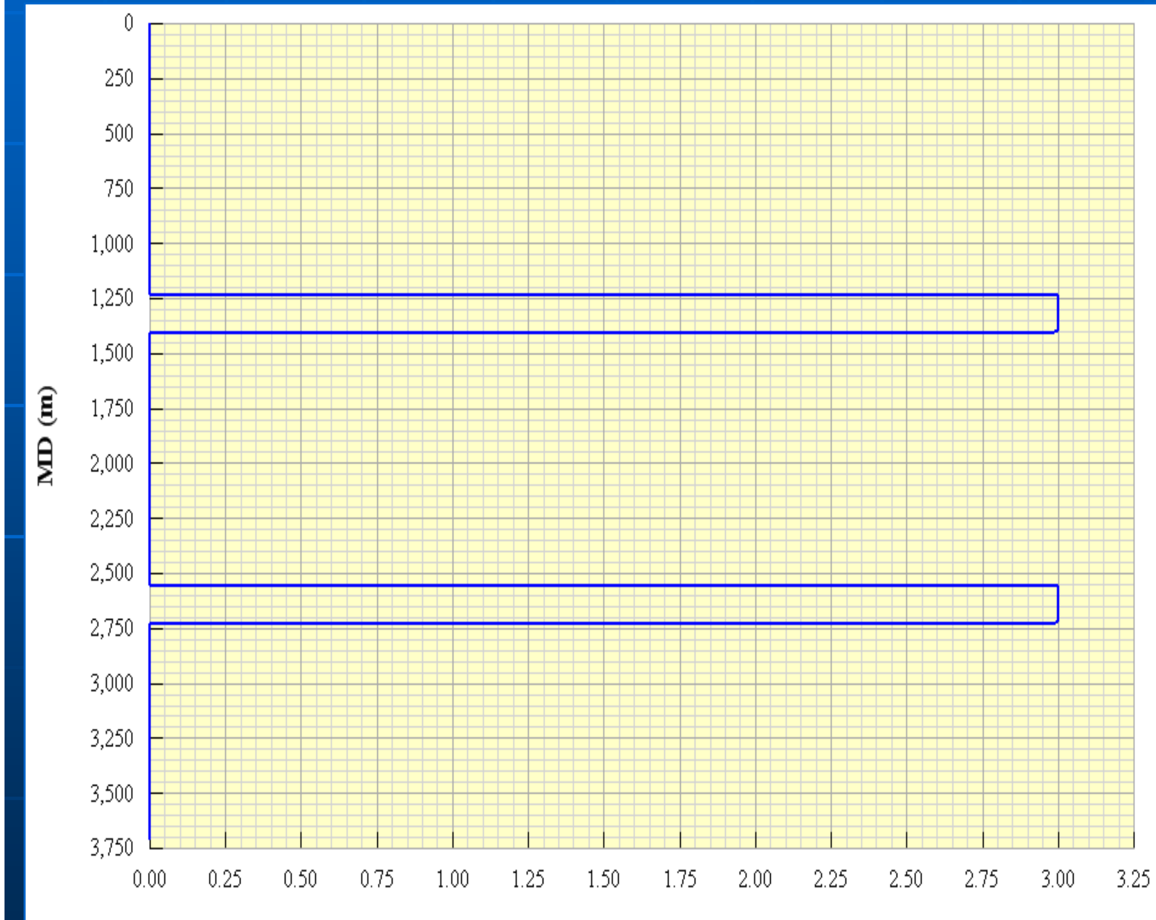
Candidate well

- S-shaped well
- Long radius build and drop section
- Build to 17,6° inclination from 1240 - 1406 m
- Hold section
- Drop to vertical from 2560-2729 m



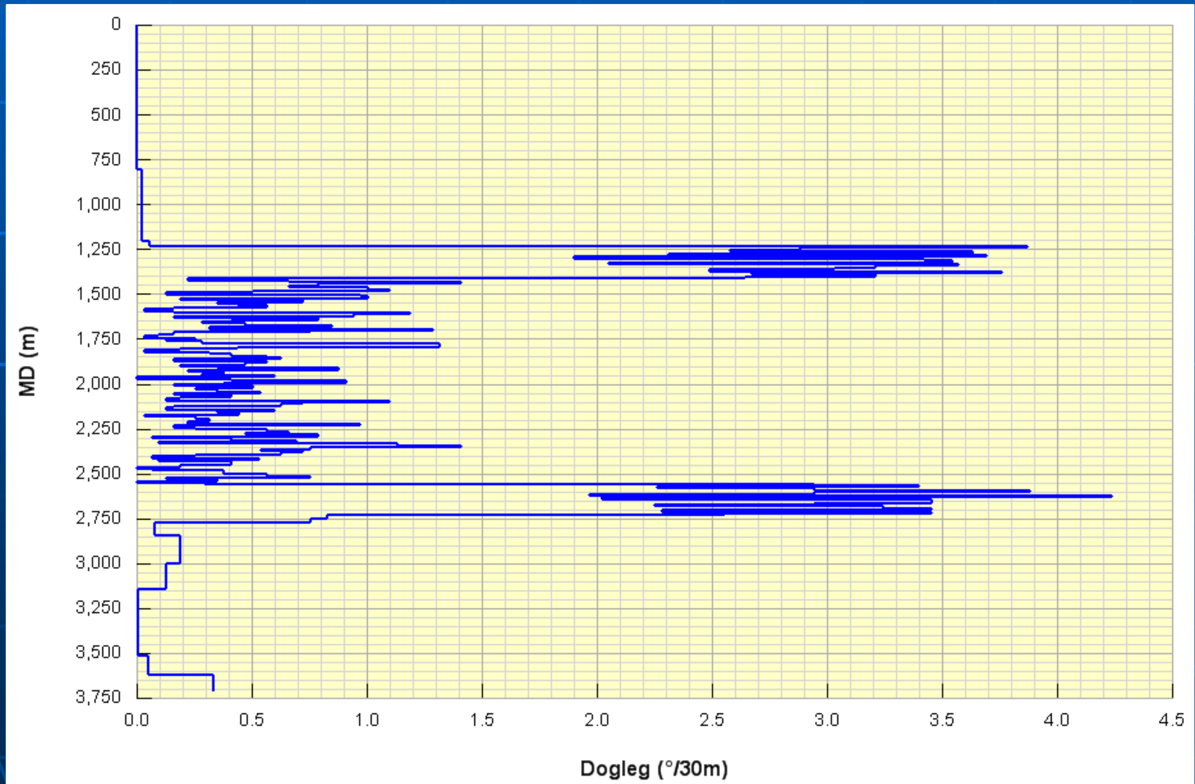
Candidate well





Pre-simulation work

- Adding tortuosity, adjusting inclination and dogleg values



Simulation workflow

Survey data

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Wellbore data

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Operation data

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Wear factor assumption

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Simulation preferences

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Result evaluation

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New simulation

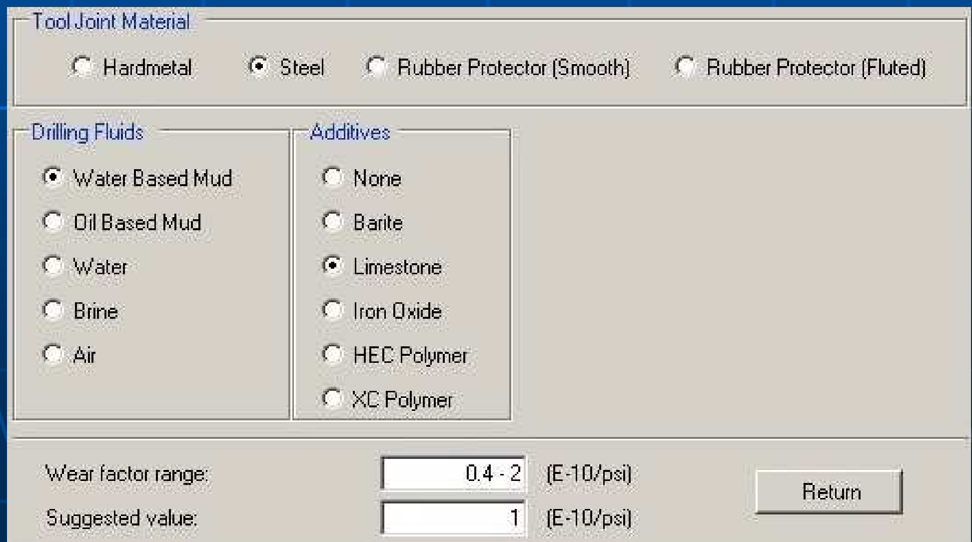
Simulation preferences

Model Options	
Wear factor input:	Single wear factor
Single wear factor input:	5.00
Wear from Drill pipe body/casing contact:	Not considered
Buckling criteria:	Dawson and Paslay
Burst and collapse:	API equation
Buckling frictional force:	Helical frictional force not considered
Bending stiffness:	Considered
Operation General Data	
Tool joint OD	6.500 (in)
Tool joint contact length	20.079 (in)
Drill pipe joint length	9.600 (m)
Drill pipe type/grade	NC50 (XH)

Drilling parameters			
Mud weight		1,1 g/cm^3	
Rotating RPM	Drilling	80 RPM	Average of rotating and sliding
	Reaming	80 RPM	After every stand
	Wiper trip	1 RPM	Every 300 m, 50 m overlap
Rate of penetration		4,5 m/h	
Weight on bit	Vertical section	4 t	
	Directional section	8 t	

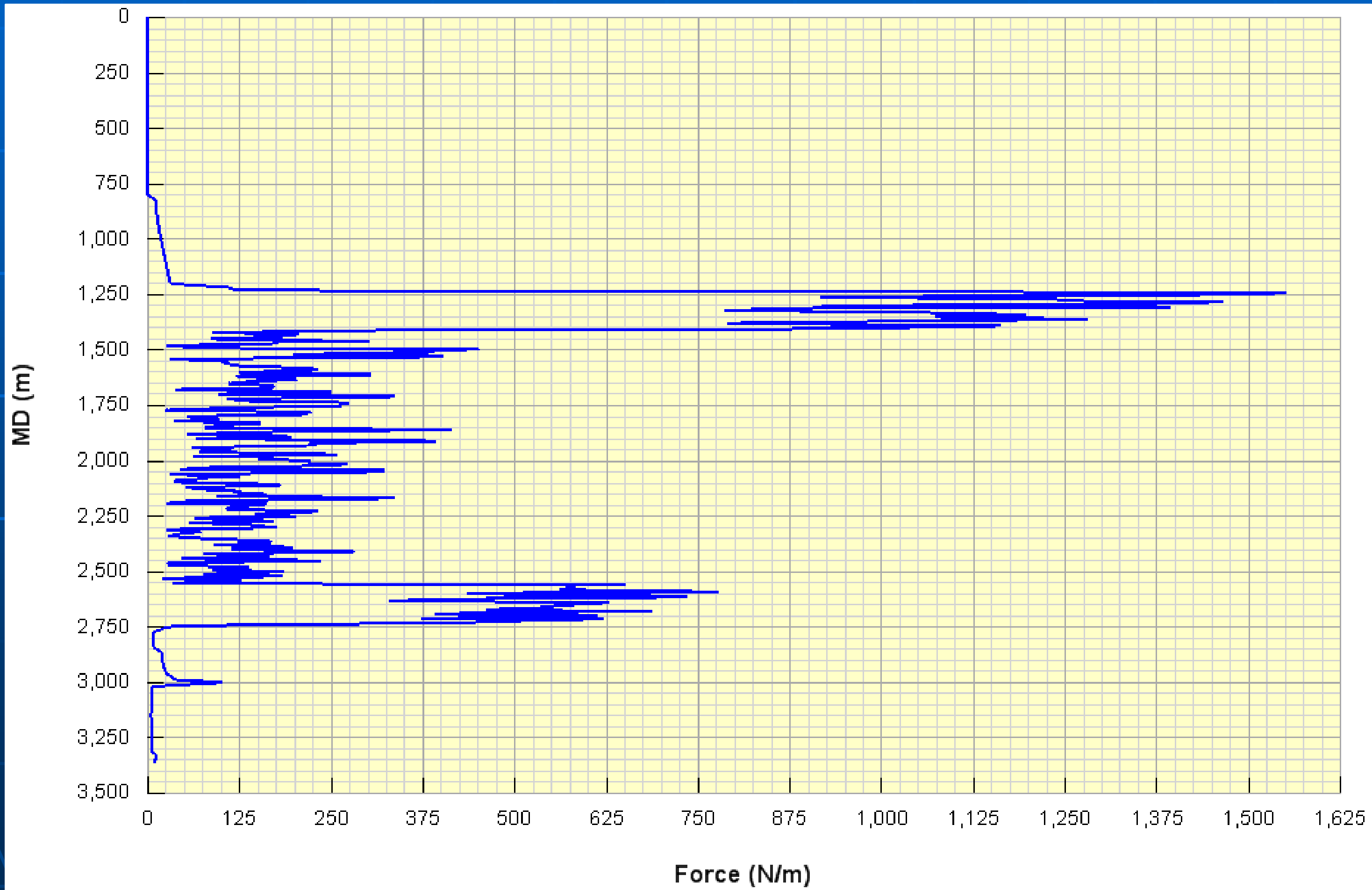
Wear factor

- Represents the energy required to remove a unit volume of casing material for a given set of conditions, function of:
  - Casing and tool joint materials
  - Drilling fluid composition



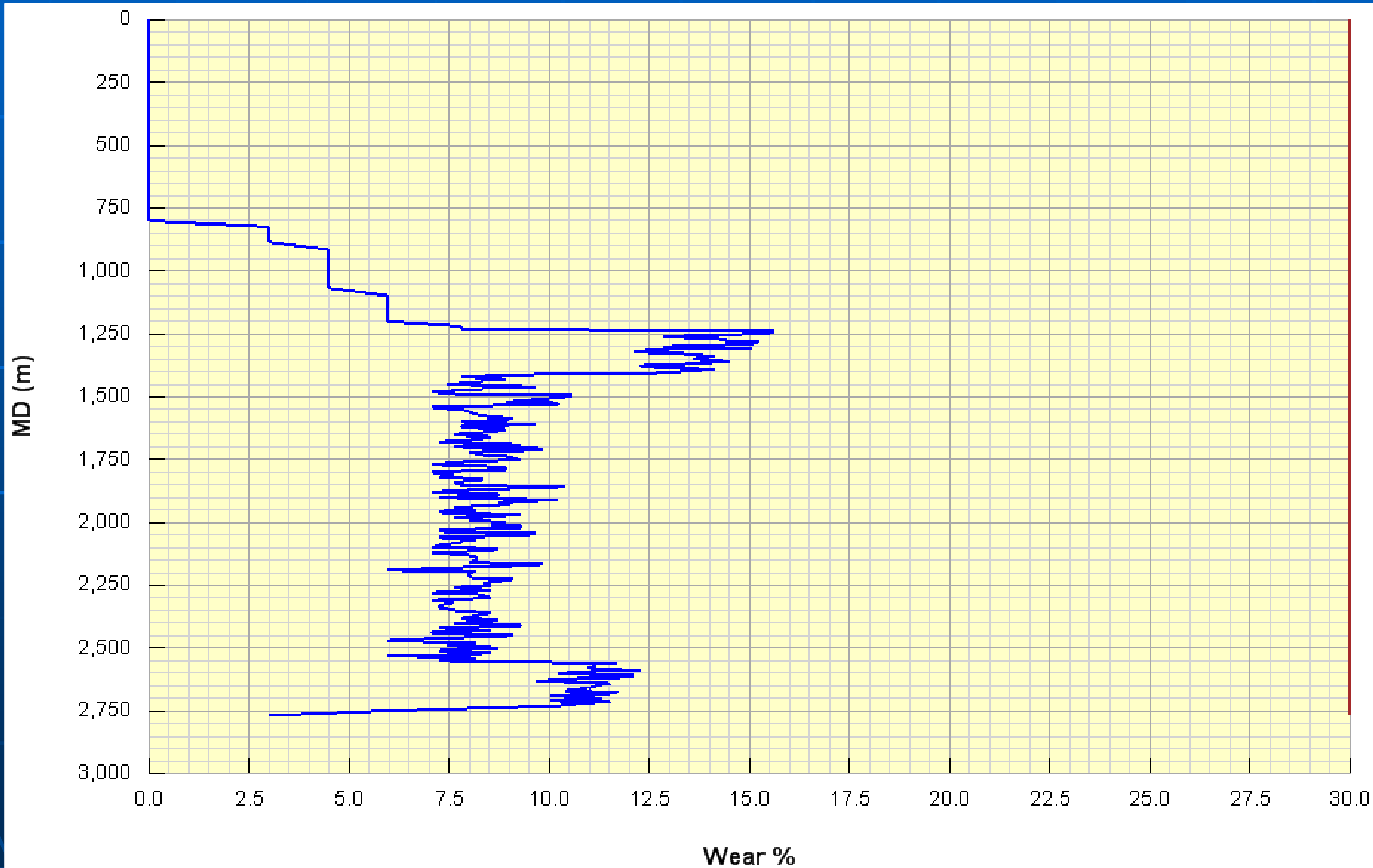
Simulation results

Normal force



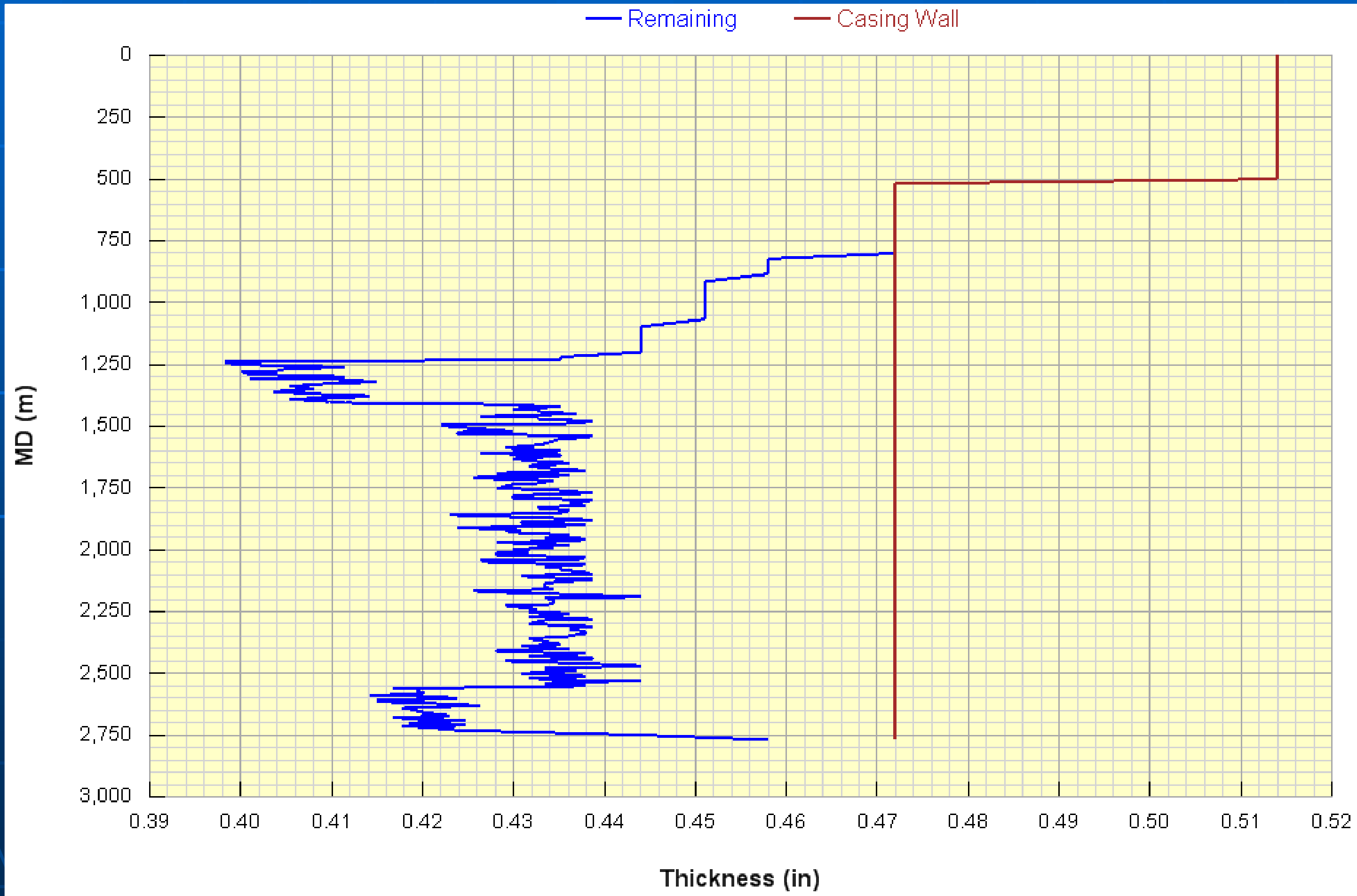
Simulation results

Wear percentage



Simulation results

Reduction of casing wall thickness



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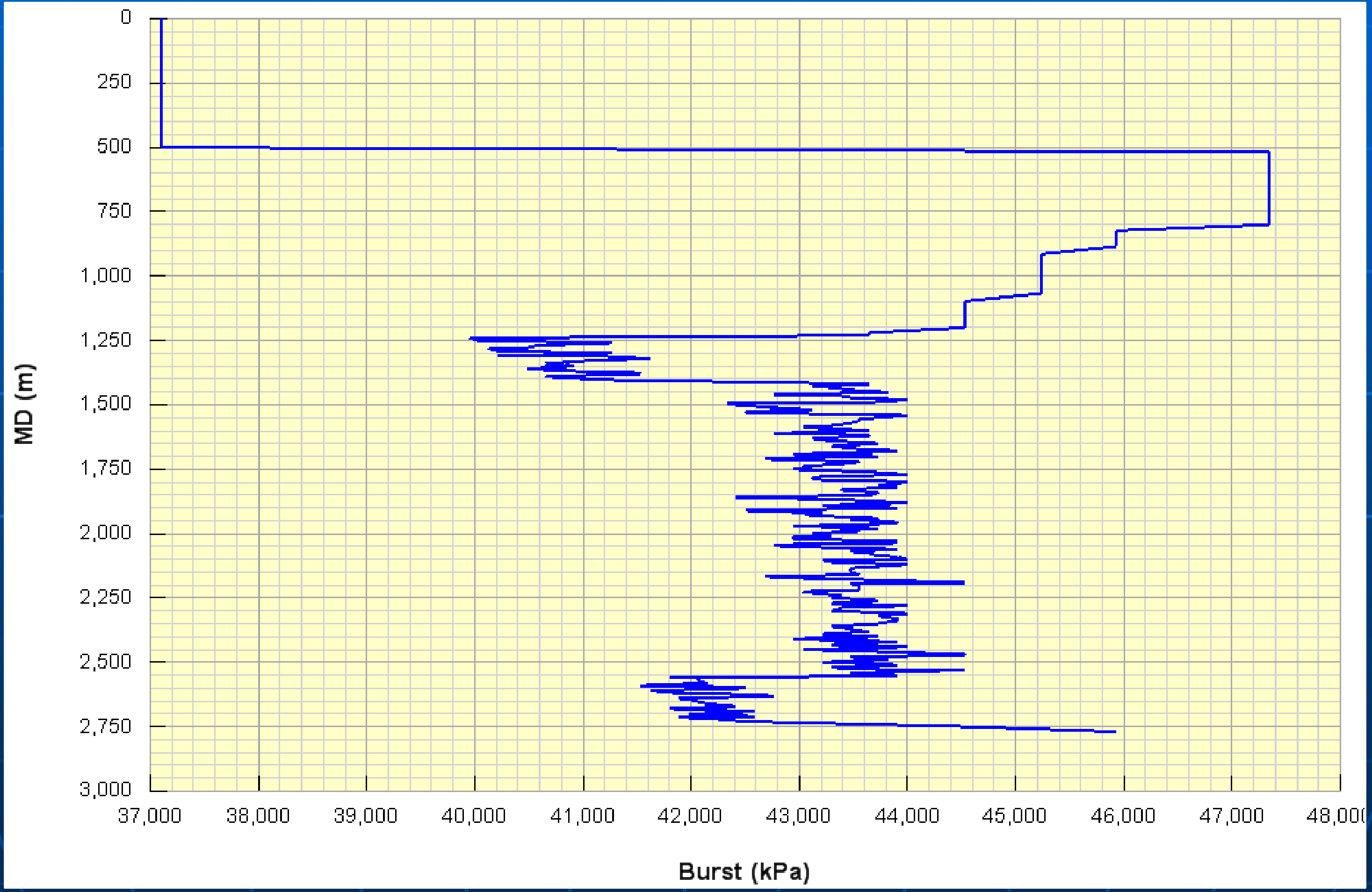
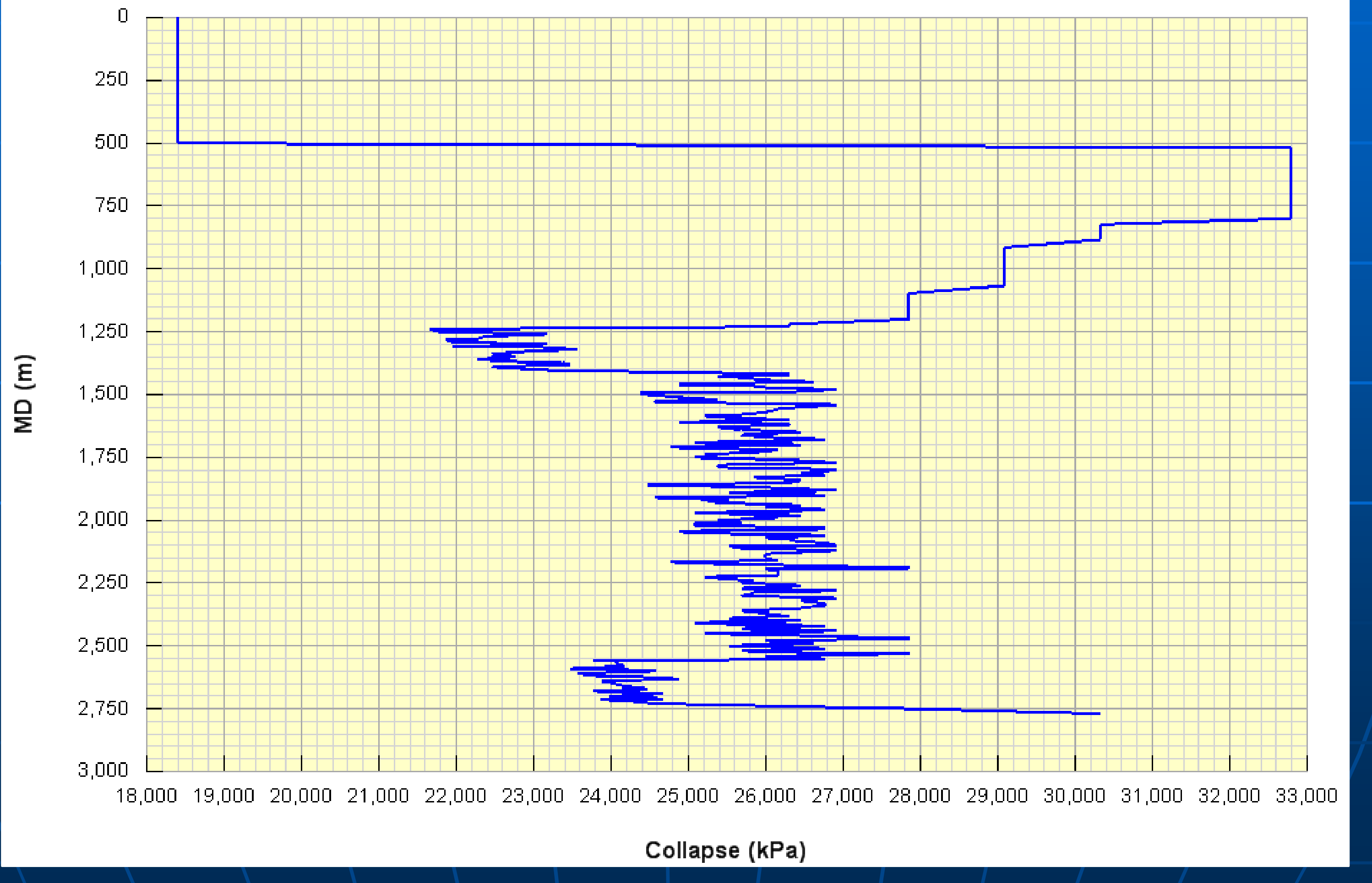
Simulation results

Burst pressure

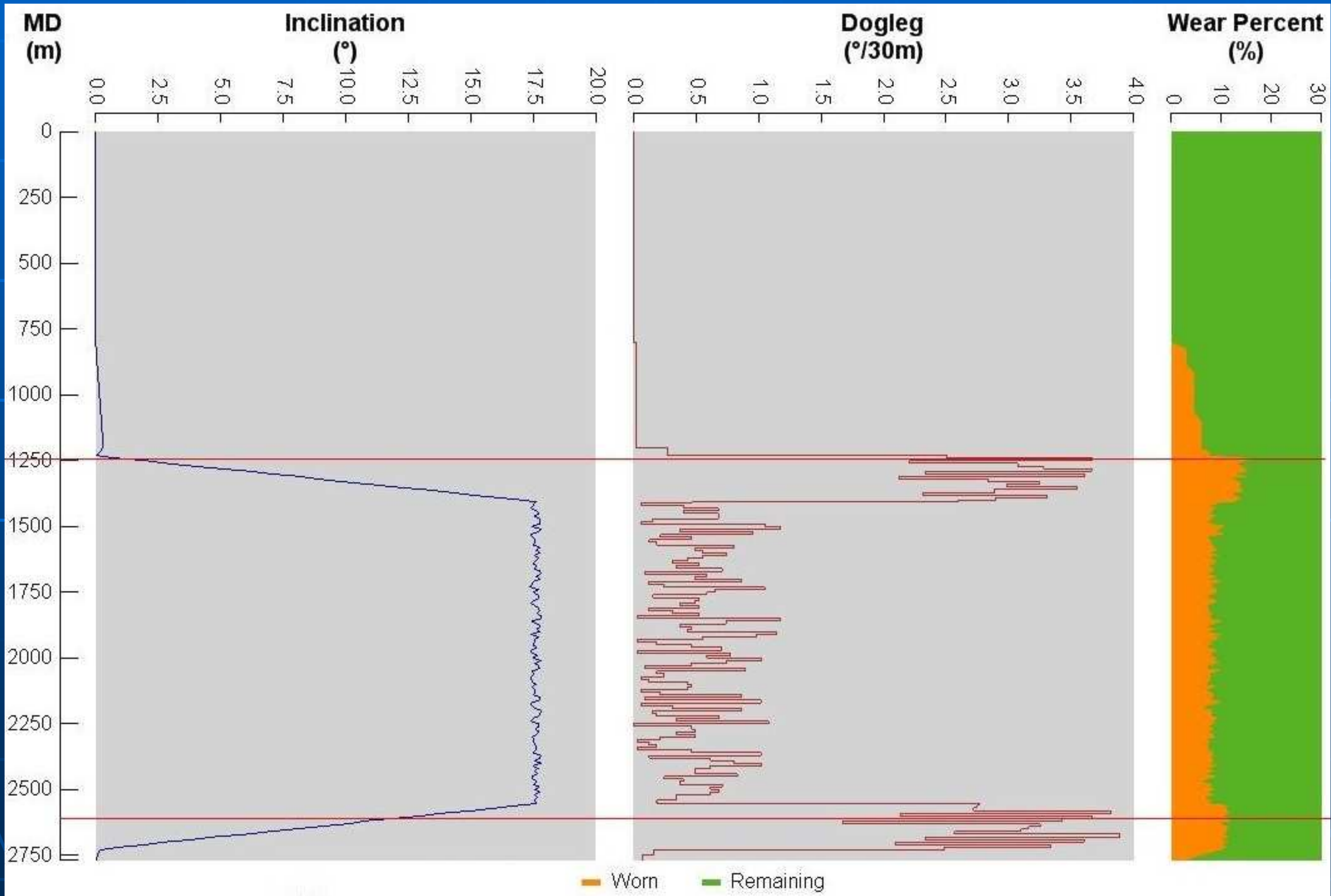


Simulation results

Collapse pressure



Simulation results



Conclusions

- Highest amount of wear at the highest dogleg values, where the inclination/azimuth starts to change
- Considerable reduction in casing strength even with small doglegs
- Simulations can predict the amount of casing wear during the well design process
- Casing wear can be tracked during the drilling process
- State of casing can forecast future remedial operations necessary to maintain well integrity

Thank You for your attention!

Questions?