

# Verification of P/W/C

QA/QC during operation

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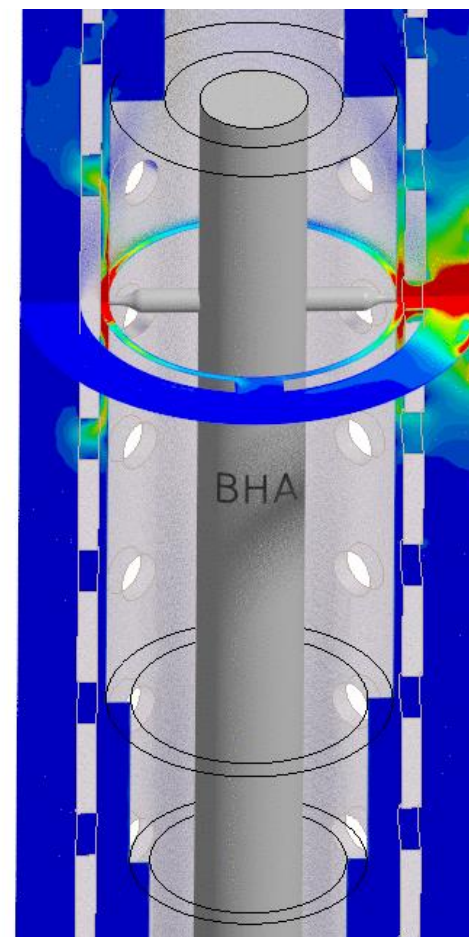
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# Agenda

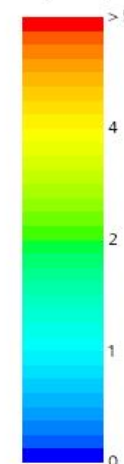
## Background

## Best practice P/W/C operation

- Planning
- Perforation
- Washing
- Cementing
- Testing

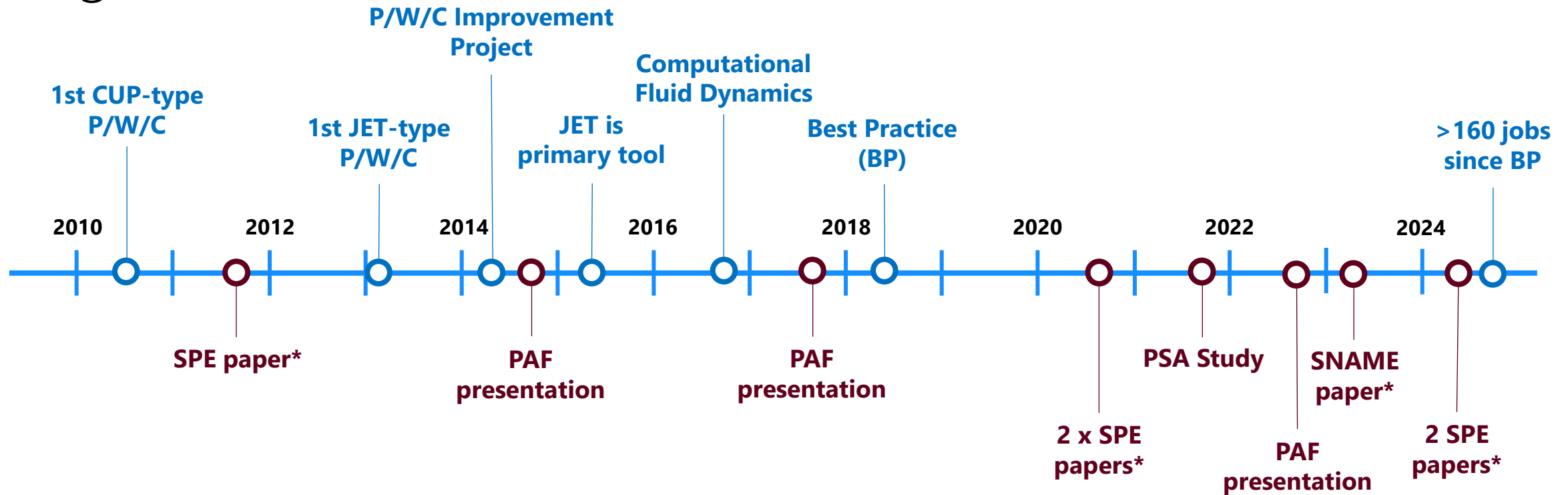


Velocity: Magnitude (m/s)



*Solution Time 0.005 (s)*

# Background



## \*Publications:

- **SPE-148640-MS** - Novel Approach to More Effective Plug and Abandonment Cementing Techniques
- **SPE-202397-MS** – Best Practice for Cementing and Zonal Isolation Using the Jet-Type Perforate, Wash and Cement Technique
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# Planning



Pre operation planning  
and engineering



Section plan meeting



Risk and mitigations



Roles and  
responsibilities



Checklist



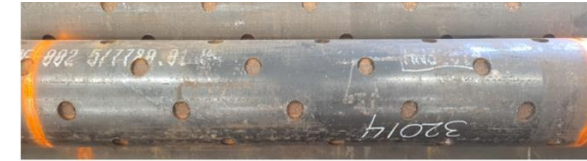
After Action Review

Customer	ConocoPhillips	Well		Casing Size	9 5/8"	Units	Oil Field
Field	Ekofisk	Plug		Parameter Set	9 5/8"		
Description				QA			
Pre-Check				Description			
<input type="checkbox"/> Pre-job meeting with DSV to go through previous incidents and experience				<input type="checkbox"/> Cement Thickening Time (TT):			
<input type="checkbox"/> Deviation at perforated interval:				<input type="checkbox"/> Prepared space-out to minimize connections during PPR			
<input type="checkbox"/> Checked all BHAs according to drawing. Checked nozzles vs. Nozzle sheet				<input type="checkbox"/> Check mud pumps stks/bbl at 97% efficiency			
Volume				Strokes			
Planned Cement Volume				Displacement Plan (Cmt)			
100.0 bbls				47.4 bbls			
841				399			
String Volume				Planned PPR volume in perforated interval			
140.4 bbls				80.8 bbls			
1180				679			
Displacement volume to BHA (Mud)				Planned additional volume on connections			
43.4 bbls				3.0 bbls			
365				25			
Safety volume ahead (prior to PPR)				Total cement volume pumped through tool			
4.0 bbls				85.5 bbls			
34				752			
Safety volume (PPR in rat hole)				Safety volume available for lubrication			
2.4 bbls				10.5 bbls			
20				88			
Wash				Cement			
Flow				Flow			
380 gpm				3.3 bpm			
Pressure				Pressure			
[Expect >2500 psi]				2500 - 3100 PSI			
2900 PSI				2550 - 3100 PSI			
RPM				RPM			
80 RPM				120 RPM			
Torque				Torque			
8 kft-lbs				9-10 kft-lbs			
Running Speed				Pulling Speed			
1.0 ft/min				7.0 ft/min			
Activation Pressure				Activation Pressure			
2300 PSI				1150 PSI			
Description				Description			
Tagged top of cement as per plan?				Any cuttings/formation observed on shakers?			
Yes <input type="checkbox"/> No <input type="checkbox"/>				Much <input type="checkbox"/> Some <input type="checkbox"/> No <input type="checkbox"/>			
Full box during connections?				Any losses observed during operation?			
Yes <input type="checkbox"/> No <input type="checkbox"/>				(wash and cement)			
Increased standpipe pressure during cement job?				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Yes <input type="checkbox"/> No <input type="checkbox"/>				Displacement according to PPR Table?			
Started PPR early (SPP cmt signature) 0 stks				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Yes <input type="checkbox"/> No <input type="checkbox"/>				Mud in cement?			
Yes <input type="checkbox"/> No <input type="checkbox"/>				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Info				Pump/Pull/Rotate Table			
Depth Cmt Valve				Info			
If 0 at cmt exit				Planned stks.			
Planned tot stks				Actual stks.			
Actual stks.							
Lubrication							
Stop Position							
7990 ft				752			
7995 ft				733			
7990 ft				752			
7995 ft				733			
7990 ft				752			
7995 ft				733			
8000 ft				713			
8005 ft				693			
8010 ft				673			
8015 ft				653			
8020 ft				634			
8025 ft				614			
8030 ft				594			
8035 ft				574			
8040 ft				554			
8045 ft				534			
8050 ft				515			
8055 ft				495			
8060 ft				475			
8065 ft				455			
8070 ft				435			
8075 ft				416			
8080 ft				396			
752				1117			
1098				1102			
1098				1102			
1098				1102			
1078				1084			
1058				1064			
1038				1044			
1018				1022			
998				1004			
979				984			
959				964			
939				944			
919				924			
899				905			
880				886			
860				866			
840				846			
820				826			
800				806			
780				787			
761				761			
Description				Description			
Planned Circulation Depth				7810 ft			
Work String Volume at circulation depth				134.3 bbls			
Expected peak from sponge ball				1129 stks			
Actual pressure peak from sponge ball				1026 stks			
Signature				Signature			
Verified by Offshore Supervisor:				Date:			
Signature:				Date:			
Tagged TOC depth				7838ft			
BHA in expected condition?				Yes <input type="checkbox"/> No <input type="checkbox"/>			
UCA Cell at 90/10 contamination				9.0 hrs			
Cement plug tested?				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Safety and > Planned vs Actual Spongeball?				Yes <input type="checkbox"/> No <input type="checkbox"/>			
Cement residue on BHA condition				Soft <input type="checkbox"/> Medium <input type="checkbox"/> Hard <input type="checkbox"/>			
Total Operational time				27.0 hrs			
Comments:							
Approved by:							
PWC™ Field Quality Assurance Matrix Rev. 3							

# Perforation

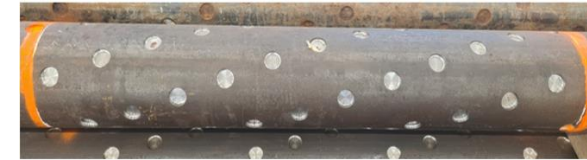
- TCP as dedicated run or combined with wash and cement BHA
  - 165 ft / 50m as per regulatory requirements
  - Ball drop activated
  - +/- no NPT
- Verification
  - Pipe movement
  - Hookload, if dropping guns
  - Volume change
  - Gas
  - LOFS

12 spf (cup type)



2009-  
2015

18 spf (jet type)



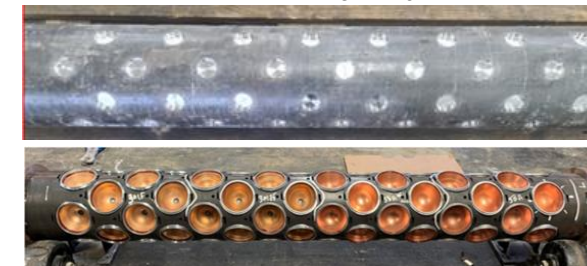
2014

20 spf (jet type)



2017

27.5 spf (jet type)



2022



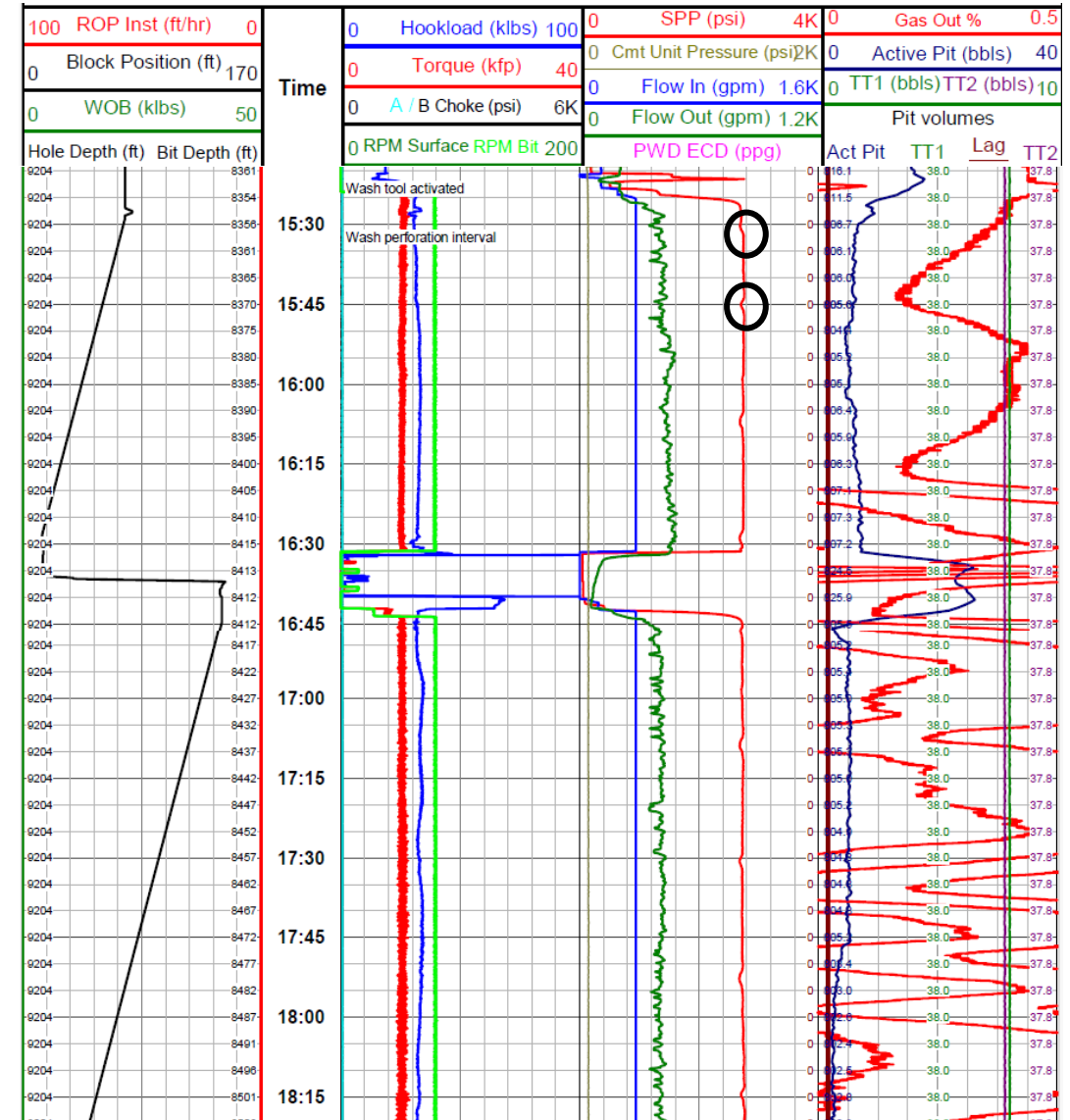
# Survival test – 7" Benchmark Gun



Survival test of 7" OD, 20 shot per foot TCP in 9 5/8" casing - YouTube

# Washing

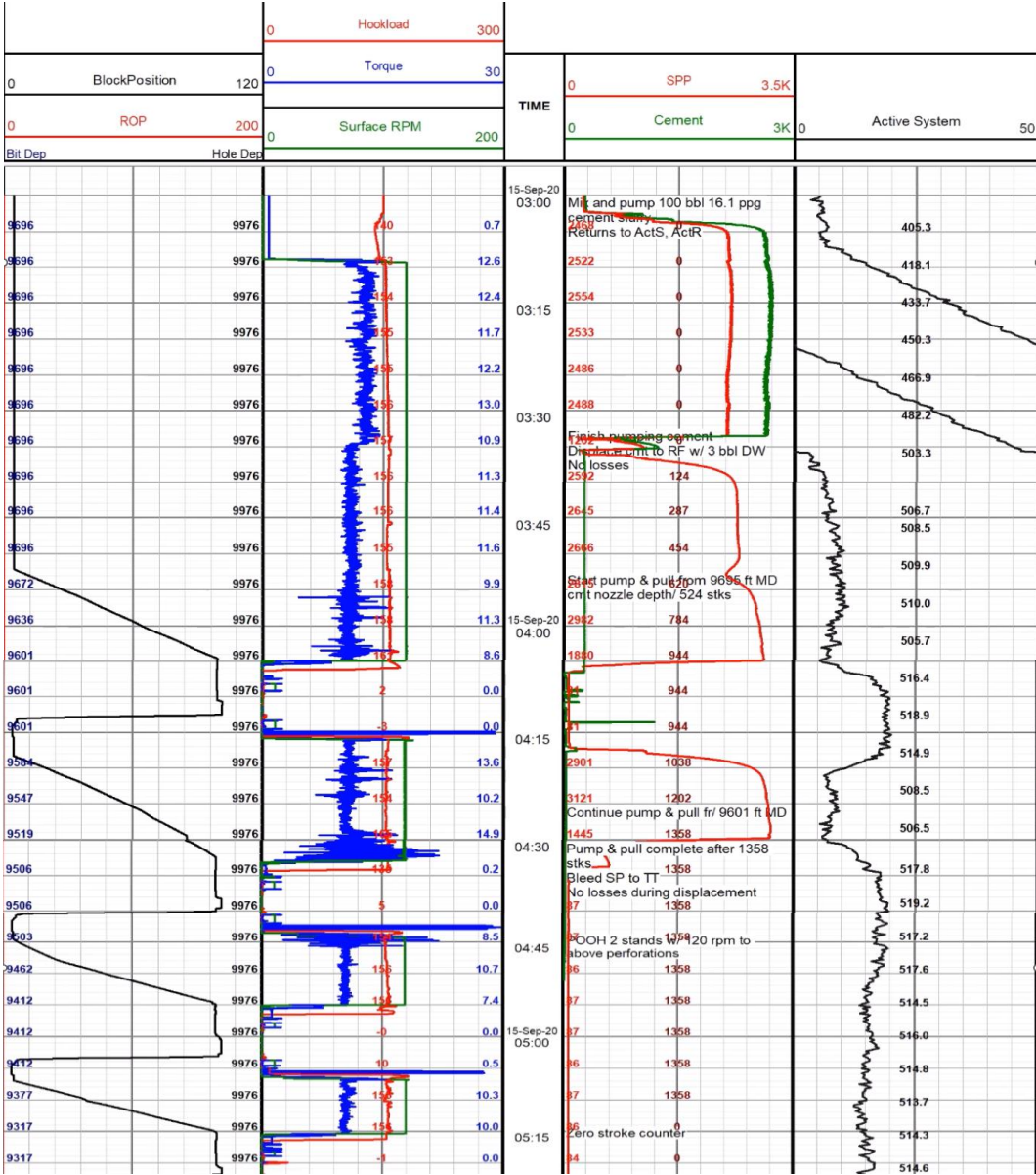
- Remove 'debris fluid' from annulus
  - Nozzle selection from CFD work
  - Total flow governed by ECD
- Water wet formation
- Cuttings on shaker verifies perforations
- SPP verifies perforations/blanks (volume 7)





# Cementing

- Verification
  - iCem data (cmt unit)
  - SPP & U-tube
  - SPP Signature
  - Volume balance
  - Cement on BHA
  - UCA
  - Tag & Test

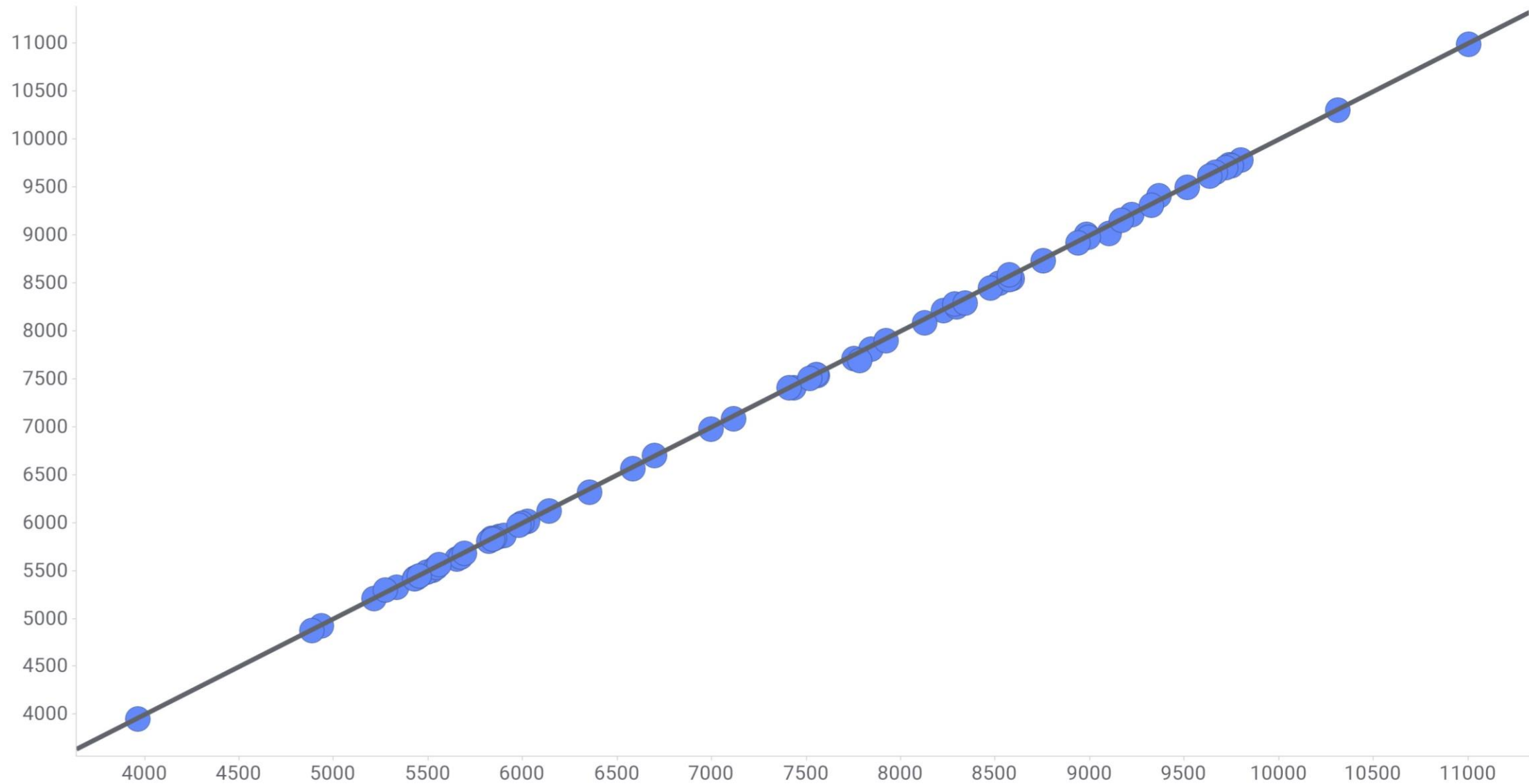


# Cementing

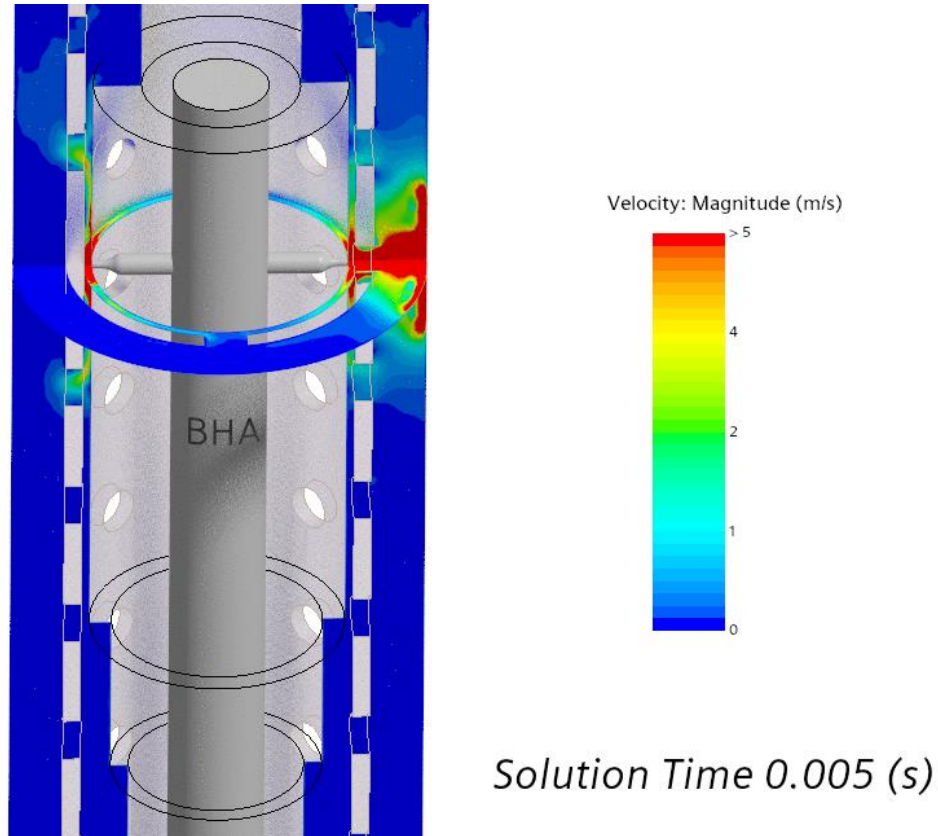


			0 Hookload 300								
0	BlockPosition	120	0 Torque 30		TIME	0 SPP 3.5K		0 Active System 50			
0	ROP	200	0 Surface RPM 200			0	Cement 3K				
Bit Dep		Hole Dep									
					15-Sep-20						
					03:00	Mix and pump 100 bbl 16.1 ppg cement slurry Returns to ActS, ActR					
					03:15						
					03:30	Finish pumping cement Displace cmt to RF w/ 3 bbl DW No losses					
					03:45						

# Circ depth vs Tag depth



# Q/A?



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# Acknowledgements – PL018 Partners



**ConocoPhillips**

