



Innovative Mechanical Solutions For Scale Removal

Optimizing Pre Plug And Abandon Operation Through Robotic
Milling Solution To Achieve Multiple Milling OD'S In One Run

Agenda

The Idea

The Solution

How it Works

The First Job & Case Story

Value creation

Recap

The Idea

On one of the LWI jobs, objective was to set 2 deep plugs, however both setting areas needed to be cleared out of debris and scale before the setting

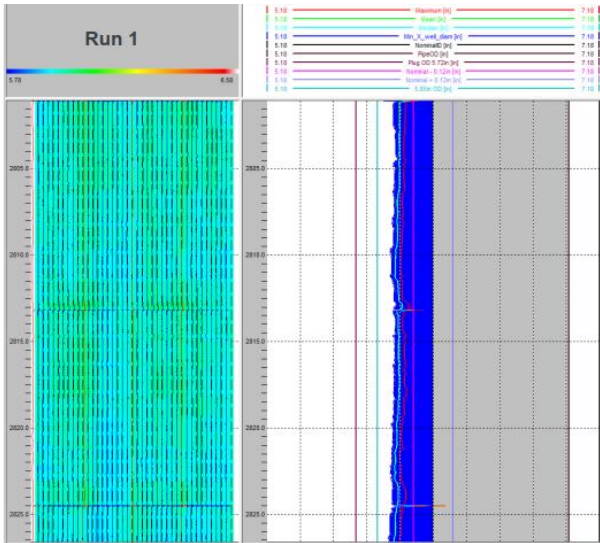
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 - Total of ten runs to complete the objectives

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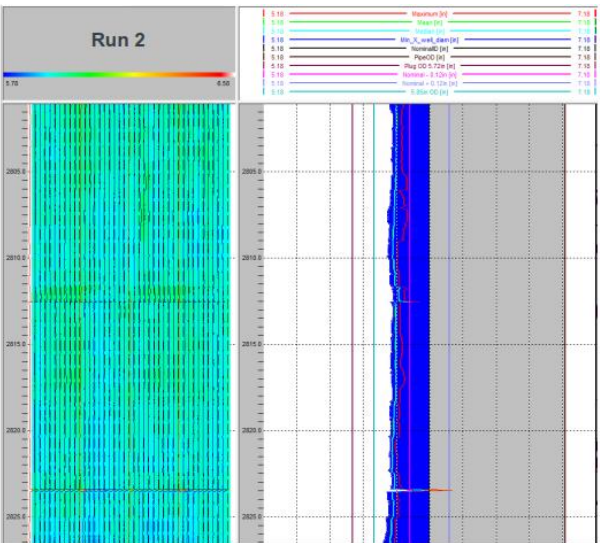
The Idea

Plug 1 setting area

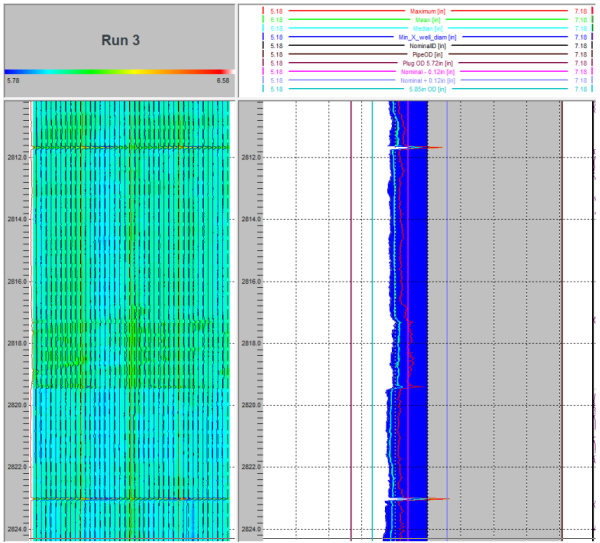
Before



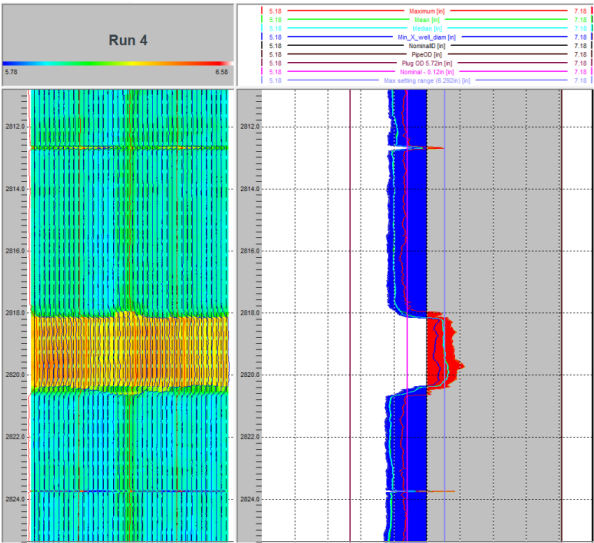
After existing tech. 1 run



After 1st run existing tech. 2



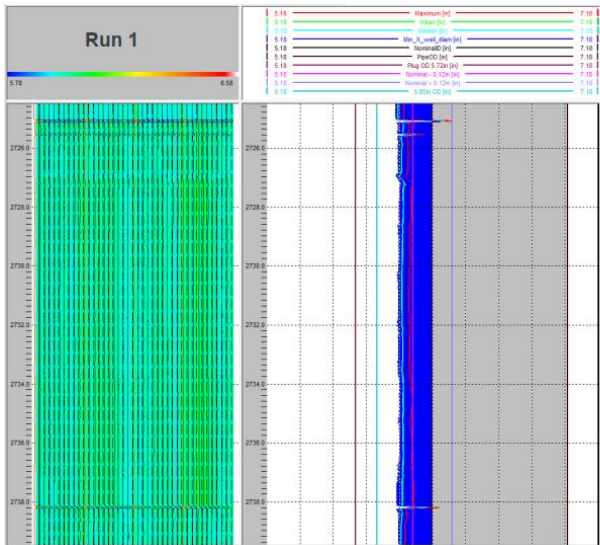
After 2nd & 3rd run existing tech. 2



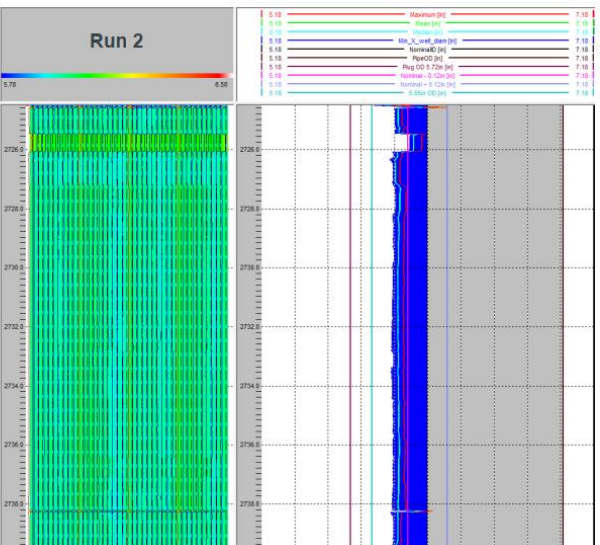
The Idea

Plug 2 setting area

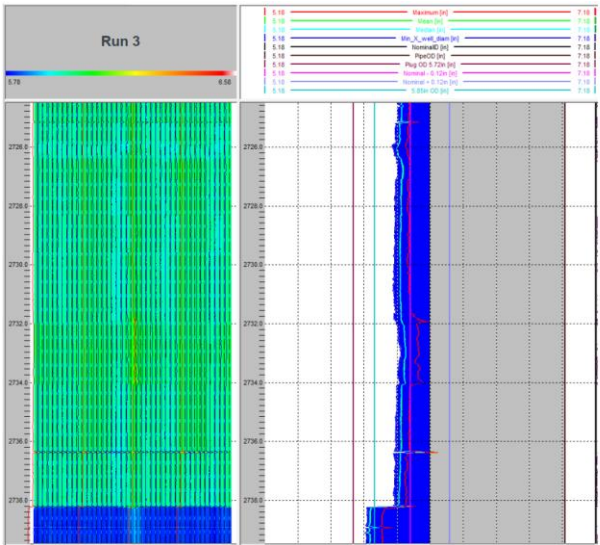
Before



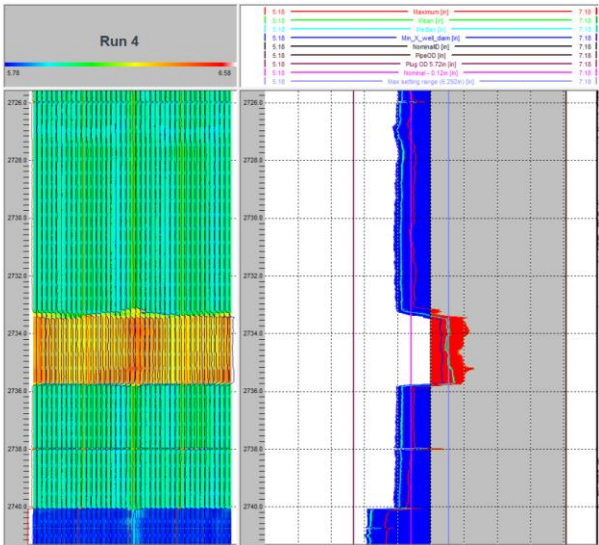
After existing tech. 1 run



After 1st run existing tech. 2



After 2nd & 3rd run existing tech. 2



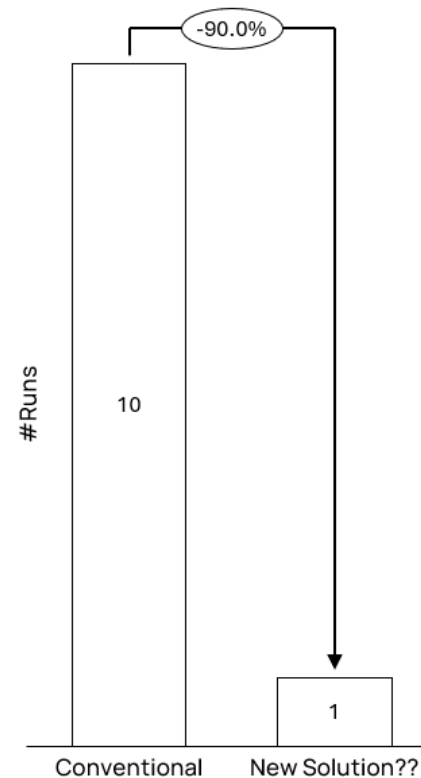
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Can we complete the whole objectives in one run?



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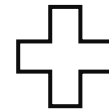
The Solution

We need a solution that could achieve multiple objectives in one run

**Efficient &
Effective**
solution

Minimize
time for scale
removal

Small
running OD –
Capable of
enlarging at
certain areas



Expandable
Bit



How It Works

We need a solution that could achieve multiple objectives in one run



How It Works

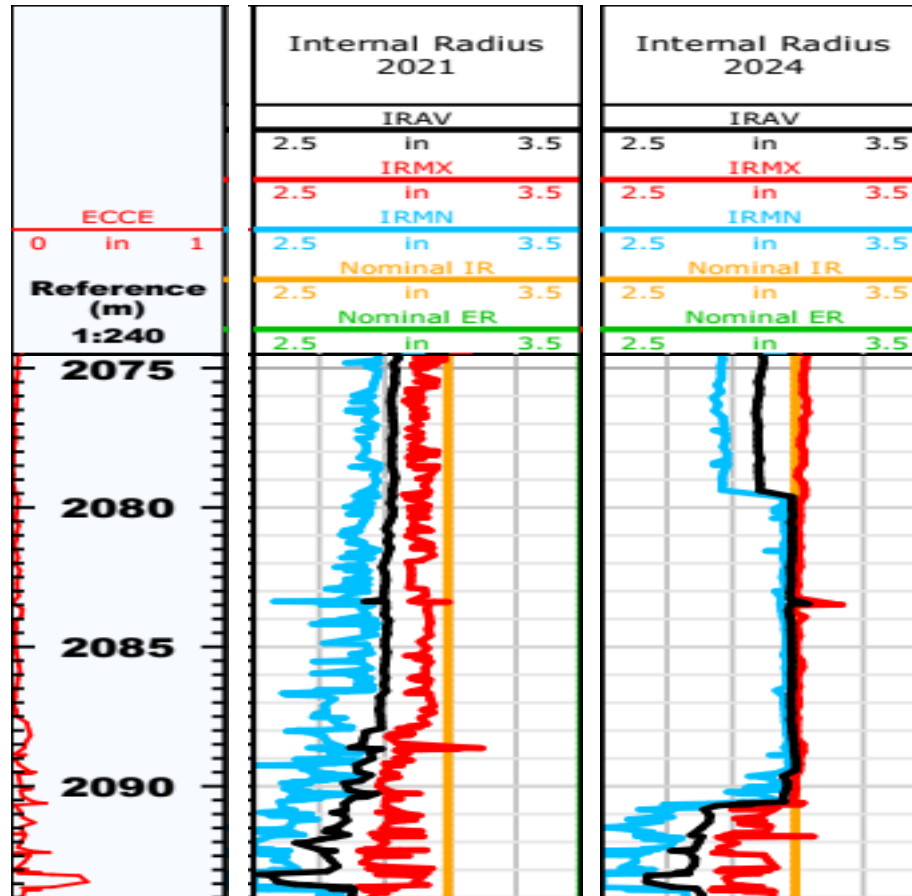
We need a solution that could achieve multiple objectives in one run





The First Job

Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



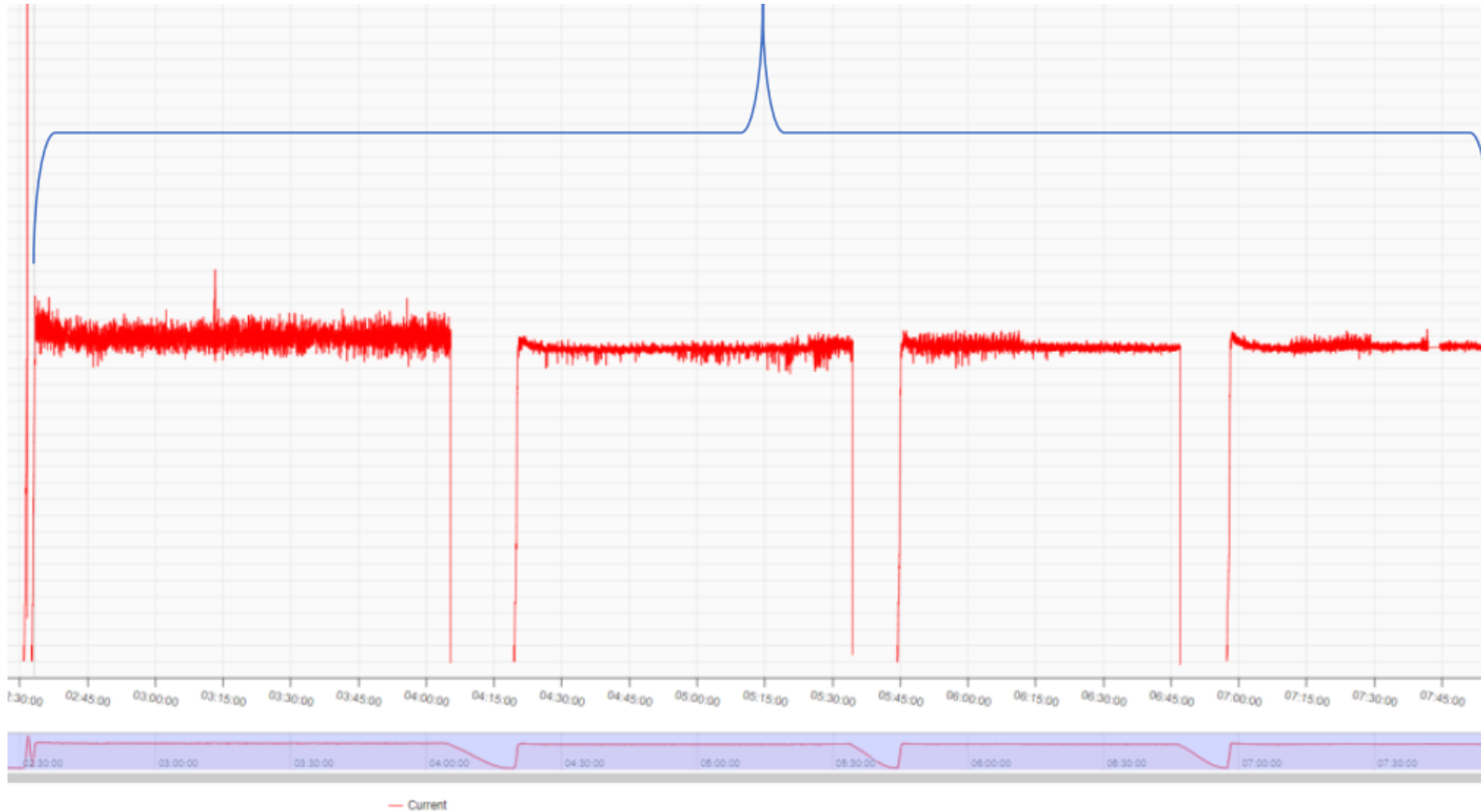
- 4.5in lead bit and 6.05in Expandable Bit
- Milled through various restrictions with lead bit
- Section milled plug setting area 10m Expandable Bit
- Post milling MFC showed successful scale removal
- High expansion plug was set and tested successfully



At least, 3 runs saved!

The First Job

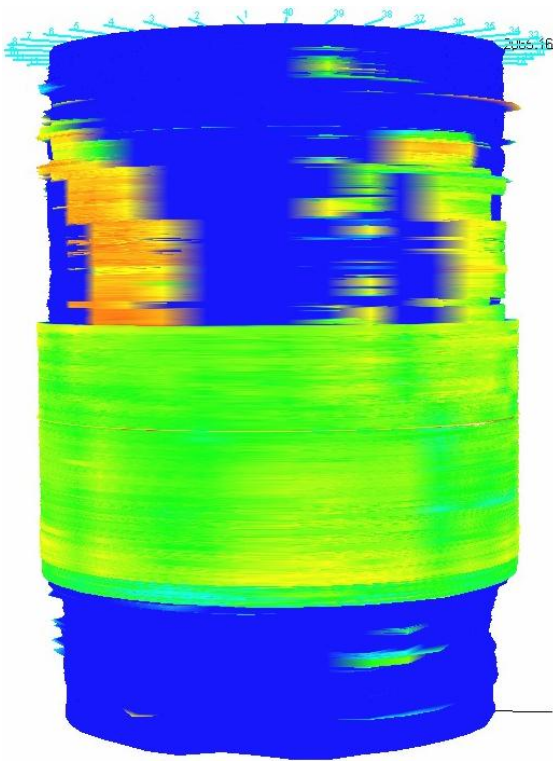
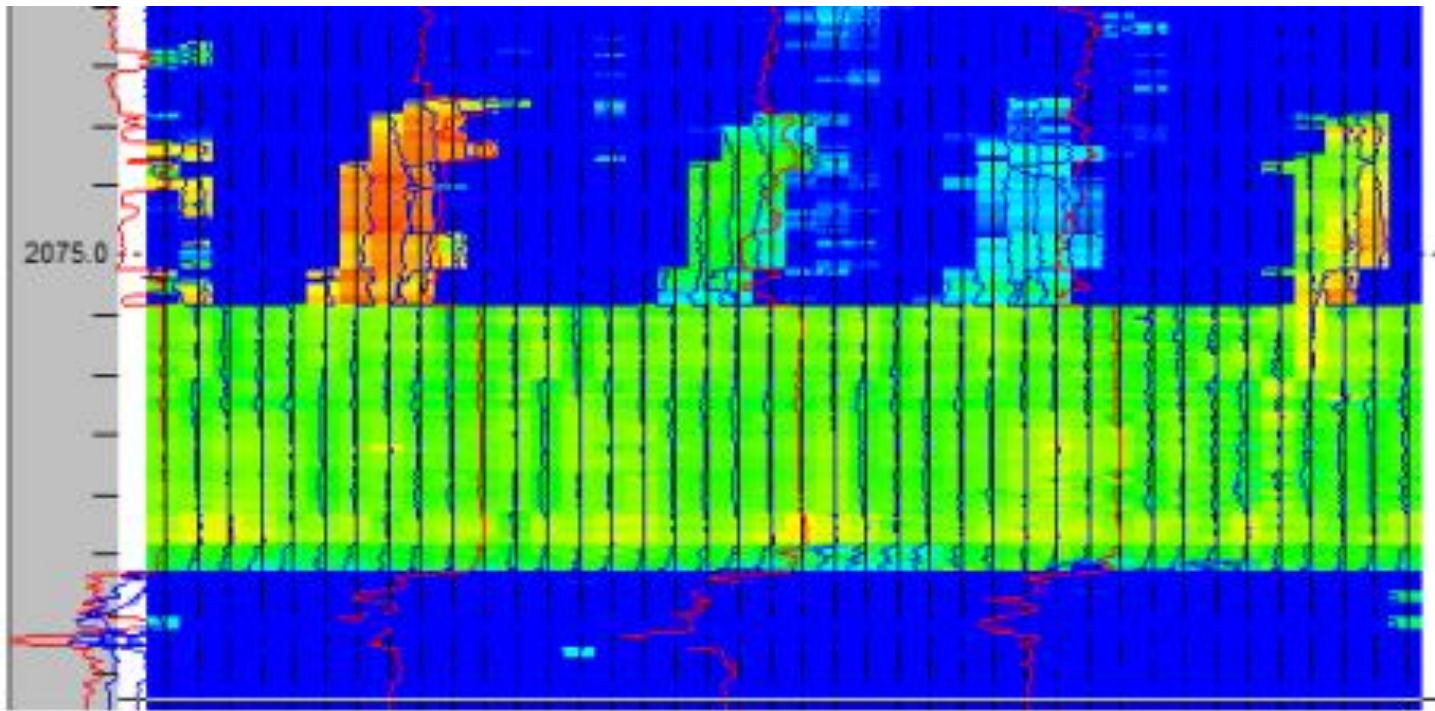
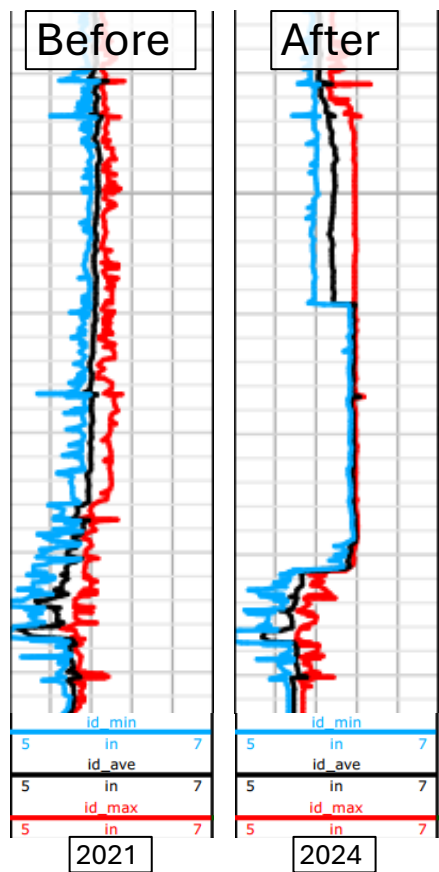
Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



- 4 Milling pass with Expandable bit
- High milling activity on the first pass
- Subsequent passes shows less milling activity
- Indicates a completion of the scale removal

The First Job

Run for an operator in the North Sea to achieve the multiple objectives of milling restriction to allow conveyance of high expansion plug, and accurately clean scale up to drift ID in the setting area



Case Story: Saving The Day!

Rush mobilization required to set a plug below a CMU sleeve for Pre P&A purposes. It was encountered scale above and at the plug setting area. Explosive removal was run multiple times without success.

Before mobilized :

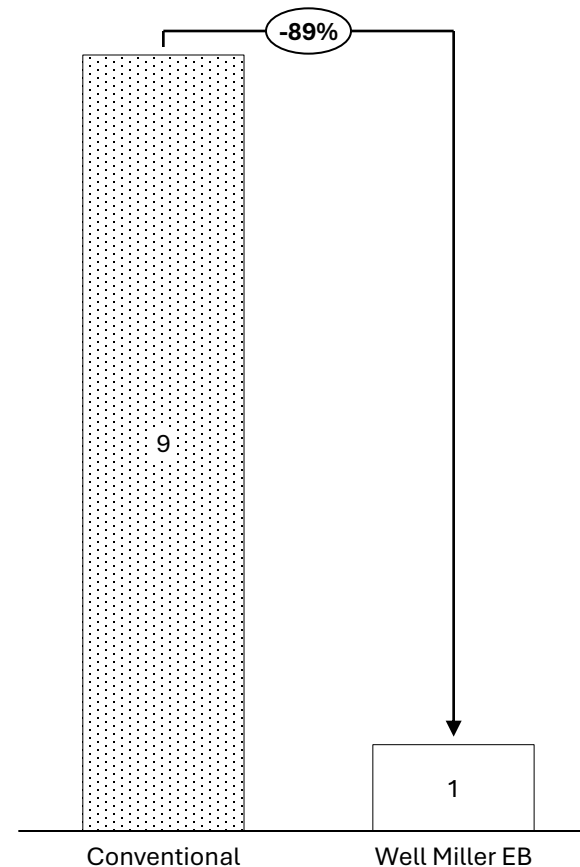
- 3 MFC runs
- 3 stringshot runs
- 3 milling runs

Operation Success:

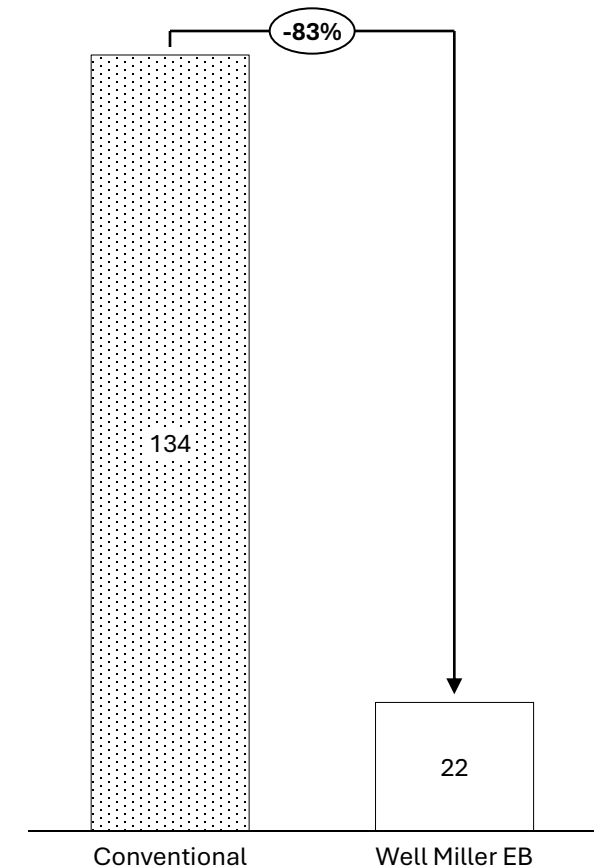
- One run combo to clear scale debris path
- Expandable arms scale cleaning in plug area

Well Miller EB could have potentially saved more than 100 hours in the well

of Runs



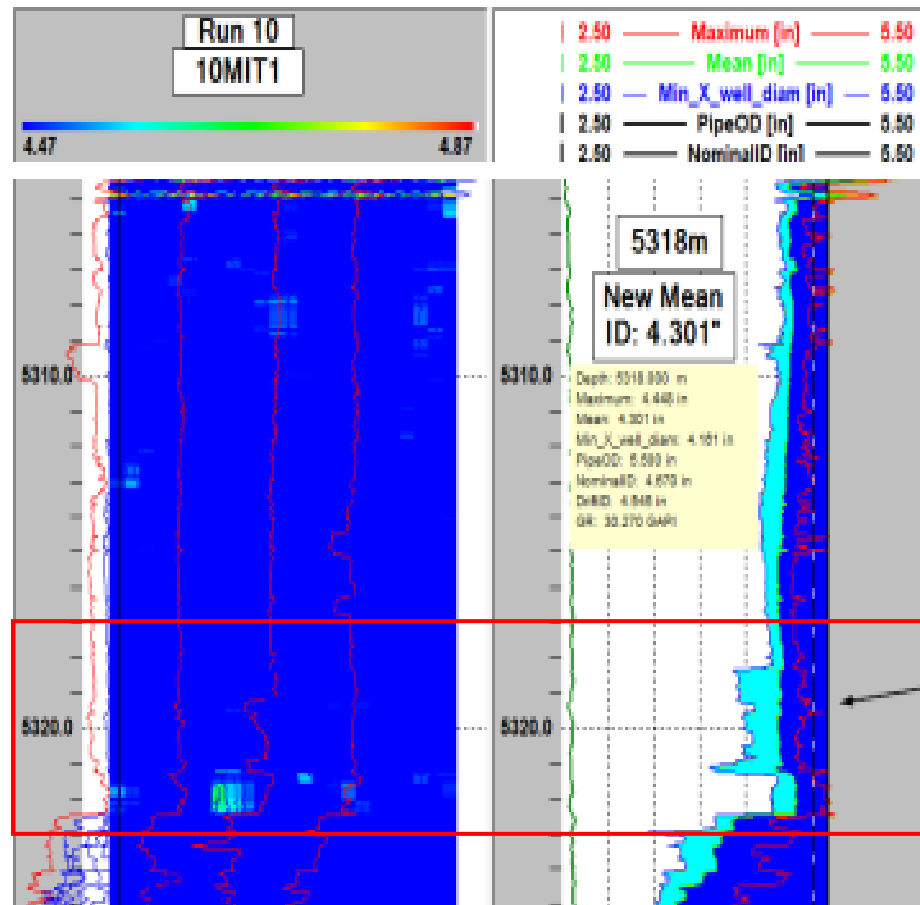
Time in the well



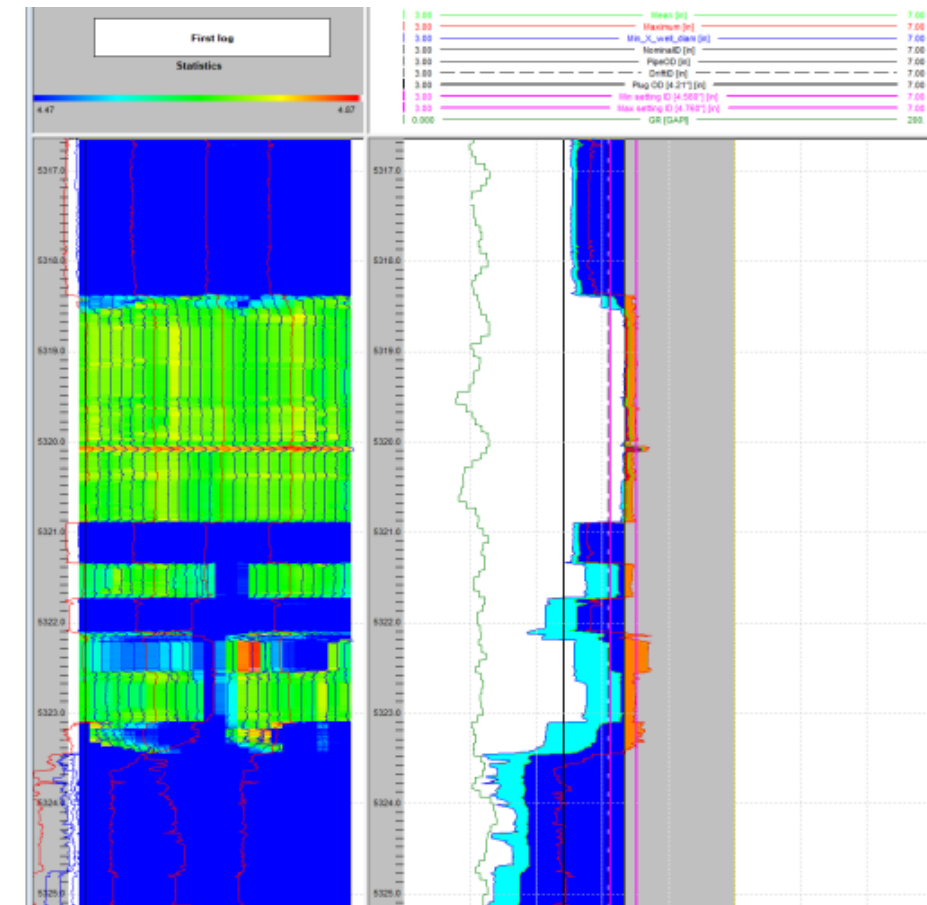
Case Story: Results From Operation

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Caliper Results Before

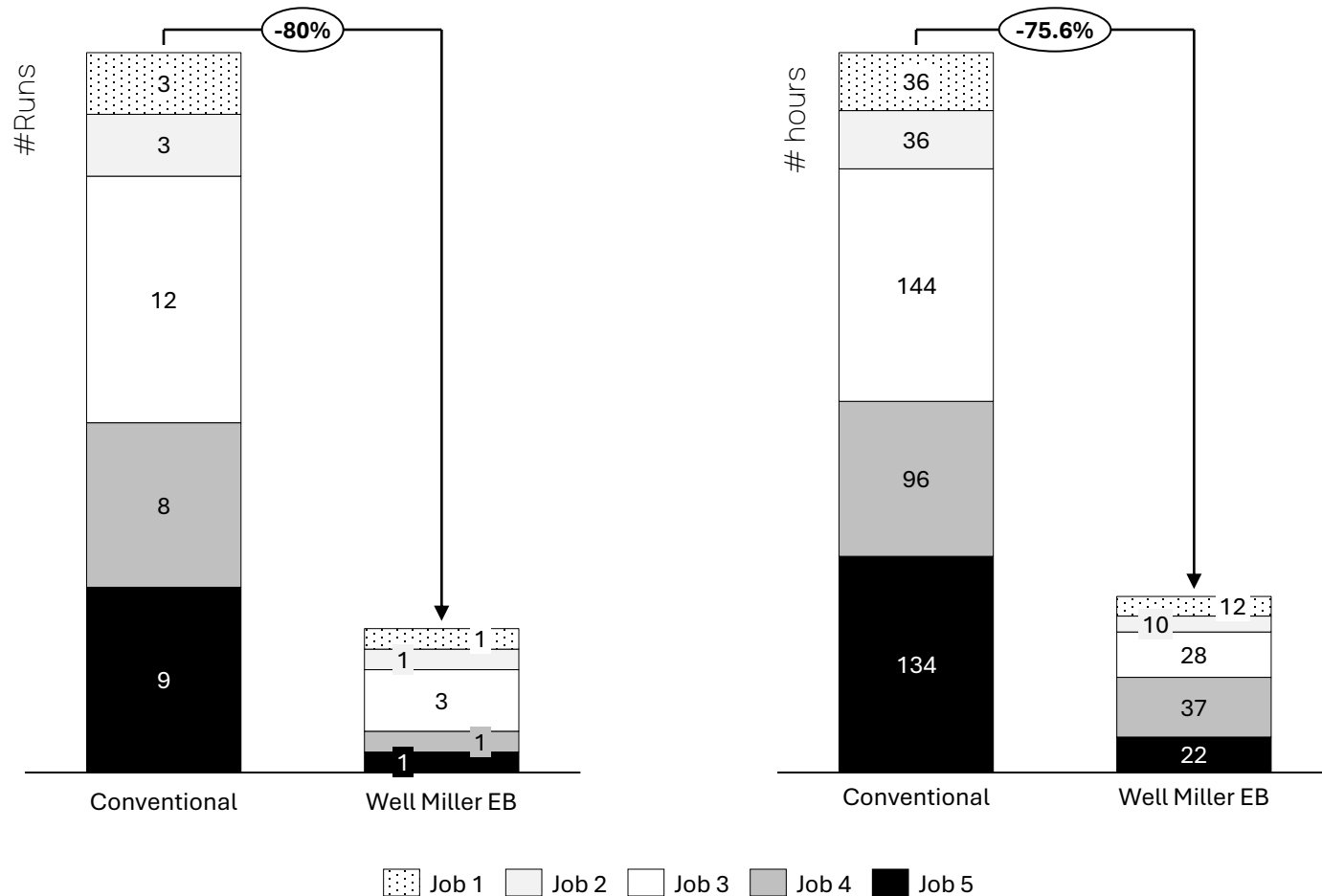


Caliper Results After



Value Creation

5 successful jobs been performed leading to reduced number of runs per job and rig time savings



More than 330 hrs. saved in 5 operation

Average time saving is 66 hrs. per job

Less Cost

Less Exposure

Recap

Technology is key to achieving effective solution for our challenges while reducing cost and exposure

Identify Challenge

Local scale removal

Think and create

One run solution

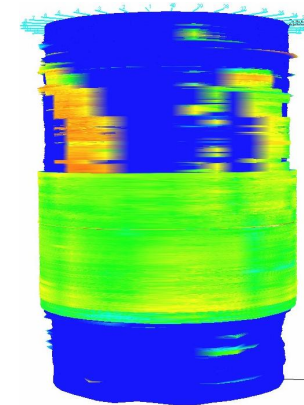
Execute

5 jobs successfully completed

Measure value

75%-time reduction

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Questions?

Thank you for your time