



BY AARBAKKE INNOVATION

“On a wire” - Smart Downhole Machining and Intervention

Well Decom 2024 – Aberdeen 4 - 5th June 2024

Axter

Versatile wireline deployed tool for multiple advanced downhole operations.

- **Axter Retrieve** - Removing control line and cables outside the tubing/in A-annulus
- **Axter Cast** - A quick and economical solution to install a patch/straddle with minimum ID reduction across milled windows
- **Axter Perforation Gun Orienter** - Locate position of control lines and cables outside Tubing/Liner to allow for oriented perforation guns to be run
- **Axter DHSV Modification Tool** - Penetrate the hydraulic inlet of a TRSCSSV to install retrofit Slickline set DHSV
- **Axter Lateral Window Mill** - Create lateral window in liner/casing for CTD
- Machine various strength weak points in a tubing
- Other potential uses of the technology



Moving from Rig to Well Intervention Vessel.

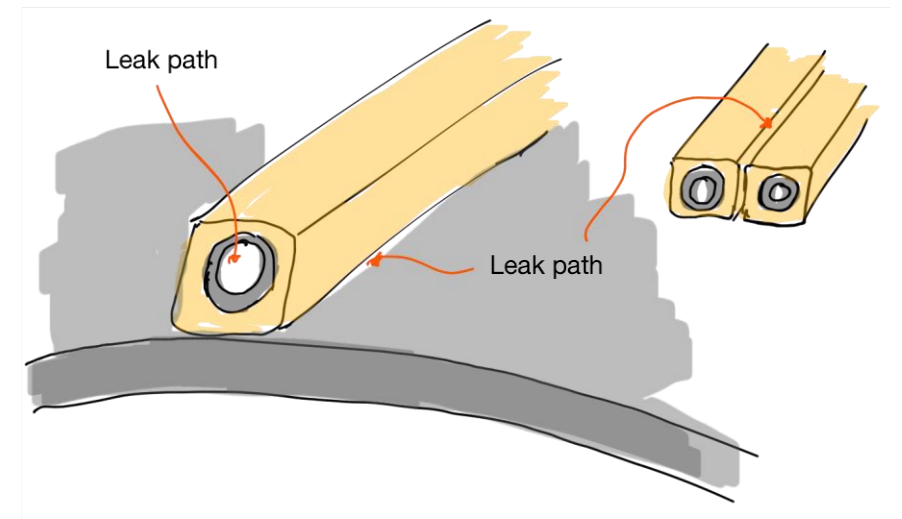
Axter Retrieve

The enabler for permanently leaving the tubing string in the wellbore by removing the cable outside the tubing string to permit cementing the tubing in place.

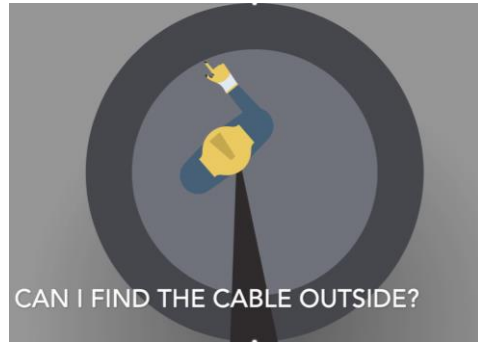
Today's Challenge: A cable or similar located in area to be sealed in the production annulus must be removed, as it will leak over time

The target: Minimize need for tubing retrieval

Why: Substantial cost savings
Step-change improvement in HSE
Legislation changes



The Axter Retrieve solution



CAN I FIND THE CABLE OUTSIDE?



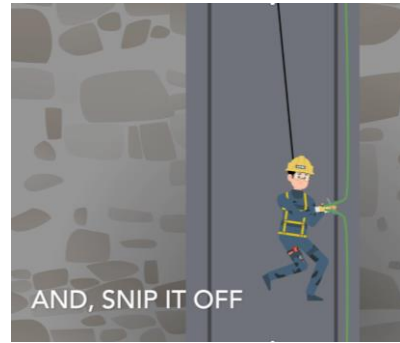
GOT IT!



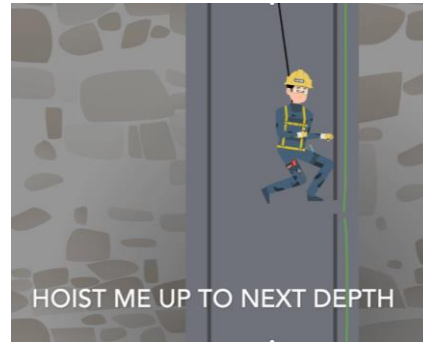
CREATE THE WINDOW TO GET TO IT



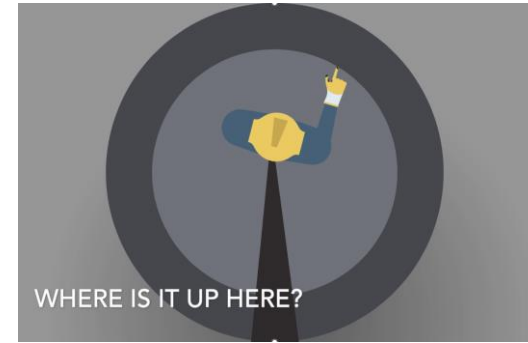
GOT IT!



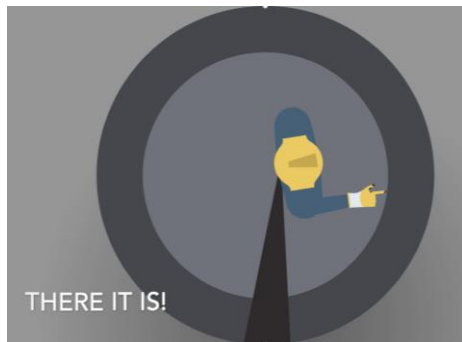
AND, SNIP IT OFF



HOIST ME UP TO NEXT DEPTH



WHERE IS IT UP HERE?



THERE IT IS!



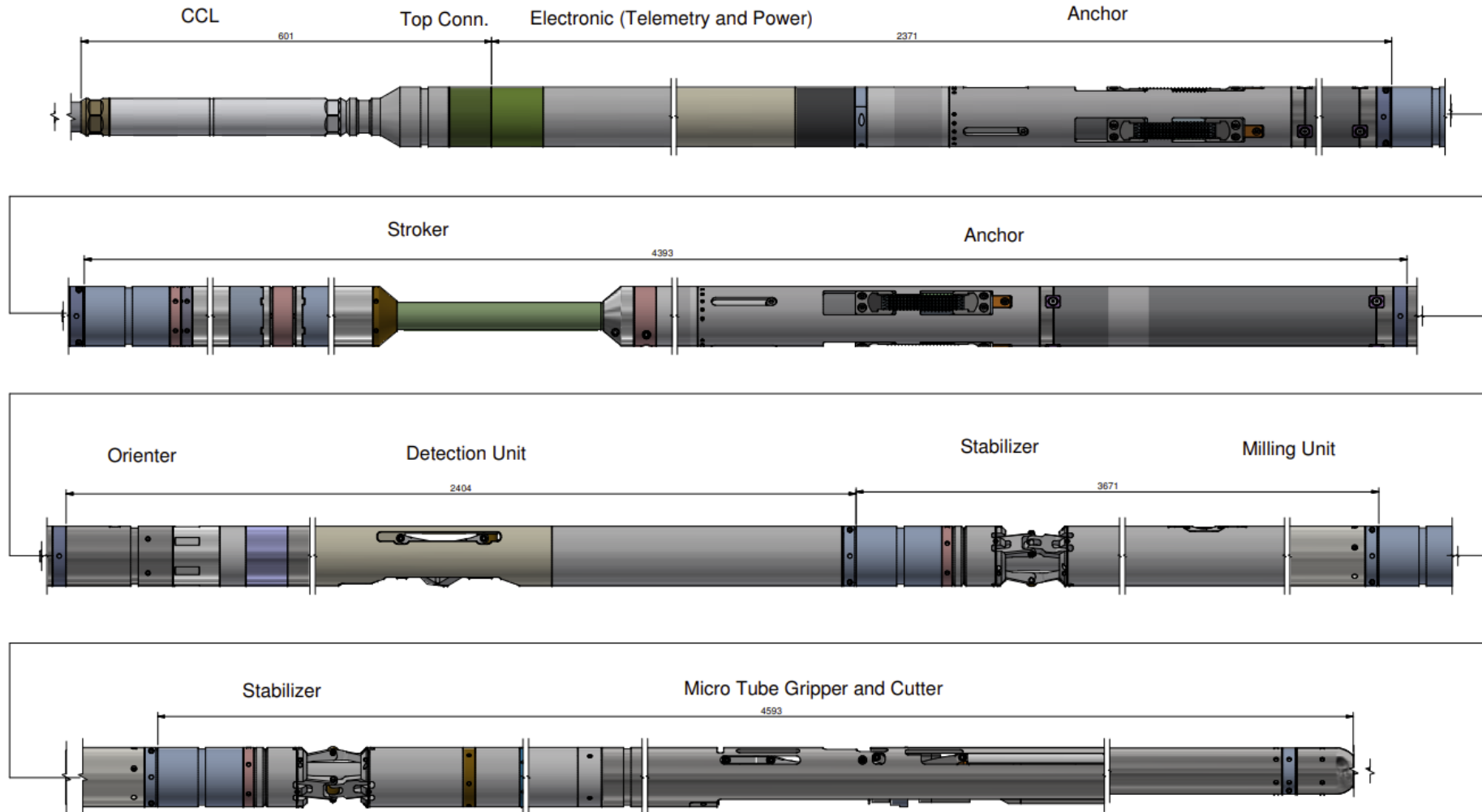
I'LL GET IT THIS TIME ALSO



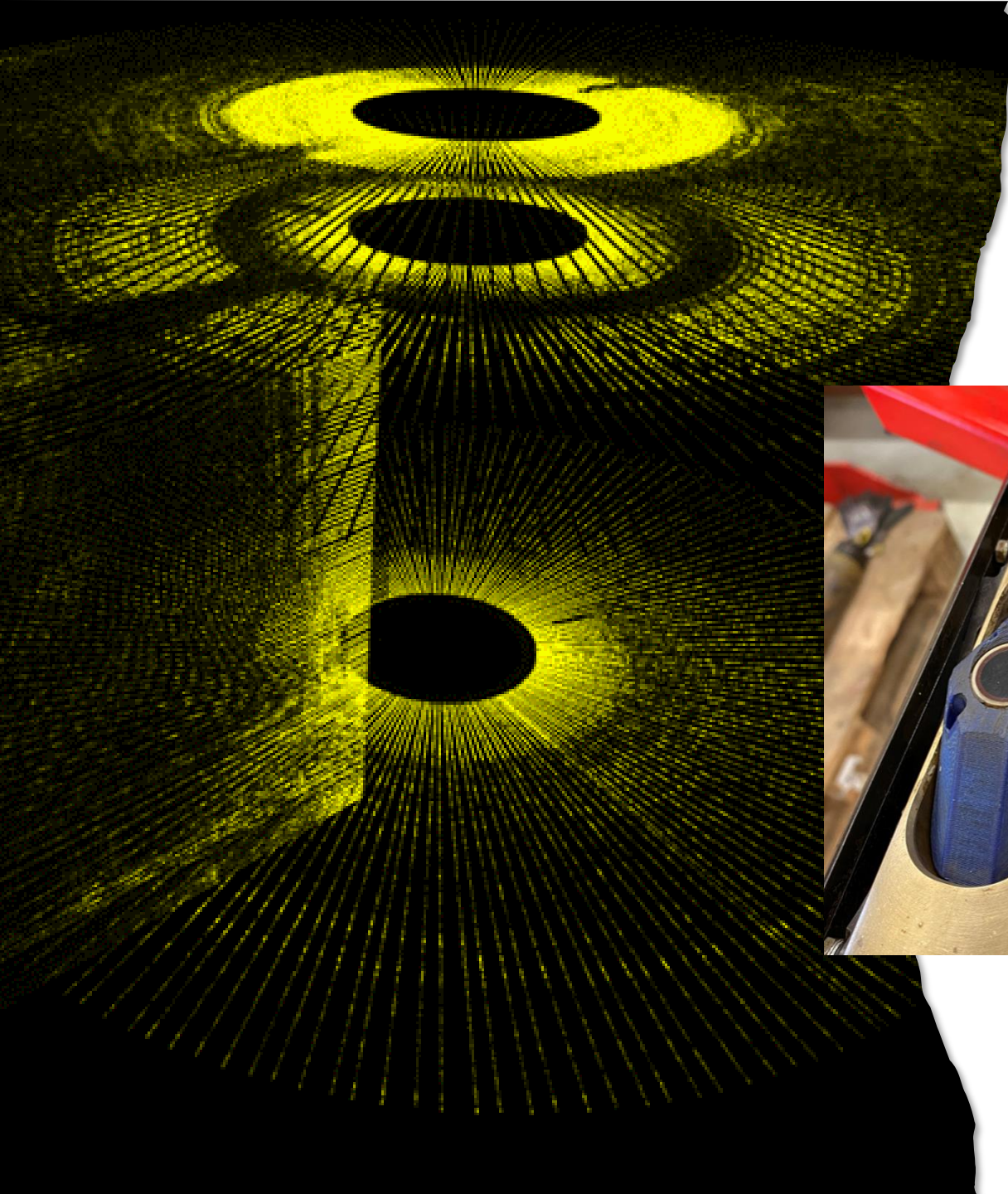
GOT IT. NOW GET ME OUT OF HERE! PLEASE...

The Axter Retrieve tool string for 4-1/2" tubing

To be run on 5/16" Mono-conductor and larger Multi-conductor cables



MUL ~ 18m (709")



Detection Unit



The Axter Detect Ultrasonic Through Tubing Imaging Tool.

- Capable of detecting external cable position along a tubing string (outside cable clamps).
- Measures Tubing within Casing Eccentricity and detects Casing Deformation.
- Detect position of hydraulic channel in DHSV.

Milling Unit

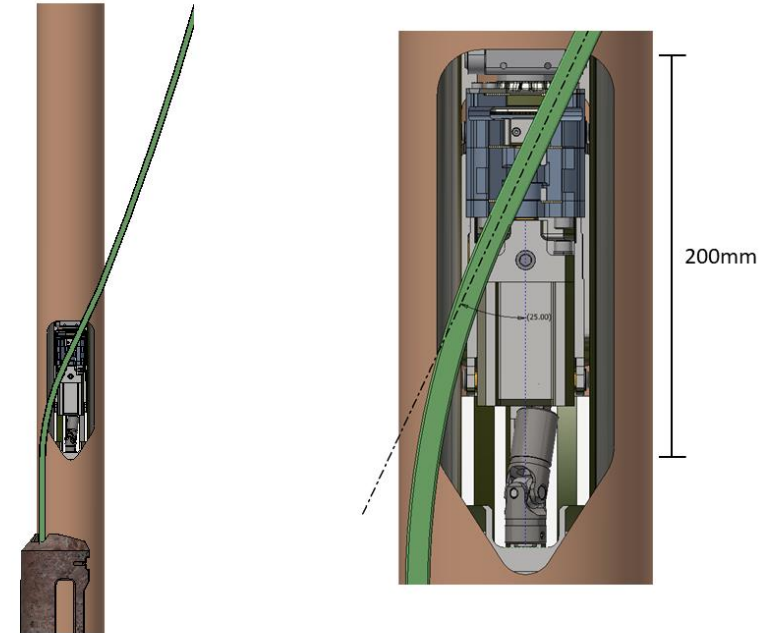
- Powerful and stable milling unit, high cutting rate.
- 3-4 mm Swarf size.
- Special designed mill bits for different applications.
- Mill designed to extend to max. 5mm outside tubing OD (Fully controllable from operator panel).



Gripper/cutter Unit

New and improved gripper claw design

- Requires a smaller window to be milled
- Firmer grip on the control line.



Gripper able to grab control line where line is positioned at an angle of up to 25° in relation to tubing.



In-house testing

Testing functionality of Anchors, Stabilizers, Mill and Gripper Cutter where increased amounts of cutting swarf are packed under and around the modules – No issues!

In-house 24m horizontal test cell for function testing under elevated pressure and temperature conditions





SIT at Ullrigg / AAI test well

- Tool tested in 4-1/2" tubing
- Up to 365m / 1200ft depth
- Up to 60° inclination
- 18 windows milled



Axter Retrieve tool system TRL status and development timeline

The TRL scale used is from API RP17N / API 17Q

TRL 0	Basic Research	Basic R&D paper concept
TRL 1	Concept Selection	Proof of concept as a paper study or R&D experiments
TRL 2	Concept Demonstration	Experimental proof of concept using physical model tests
TRL 3	Prototype Development	System function, performance, and reliability tested
TRL 4	Product Validation	Pre-production system validated and environment tested
TRL 5	System Integration Testing	Production system interface tested
TRL 6	System Installed	Production system installed and tested
TRL 7	System Operation	Production system field proven



Successful SIT at Ullrigg and AAI test well



Gripper locked onto control line



Gripper biting into steel tube



Cut surface



- Axter Retrieve
- Pilot scheduled for Summer 2024
- Katy Field
- 4-1/2" tubing @ 8200ft

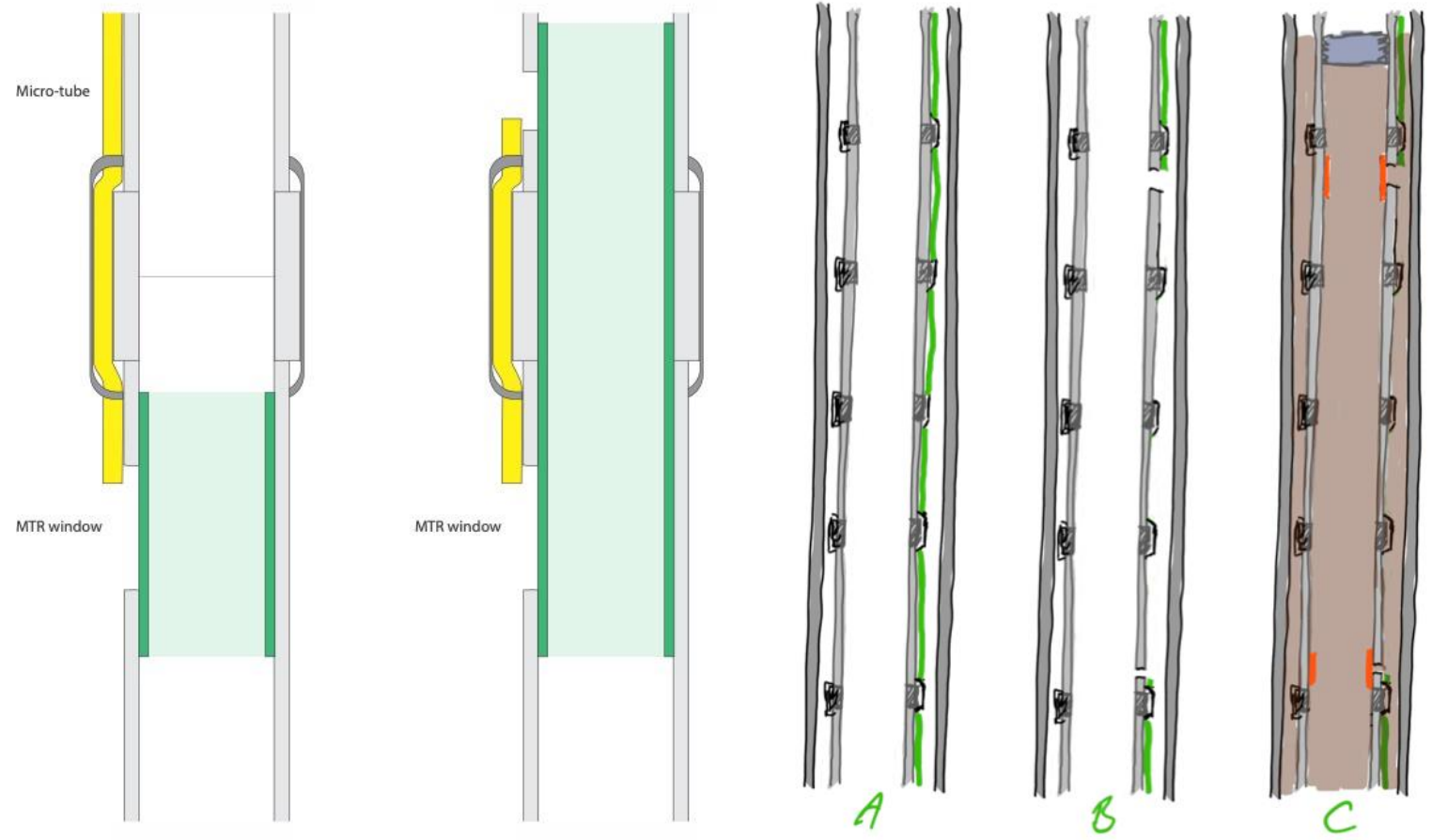


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**Axter Cast – Low cost and rapid installation
of sleeves for cementing purposes**



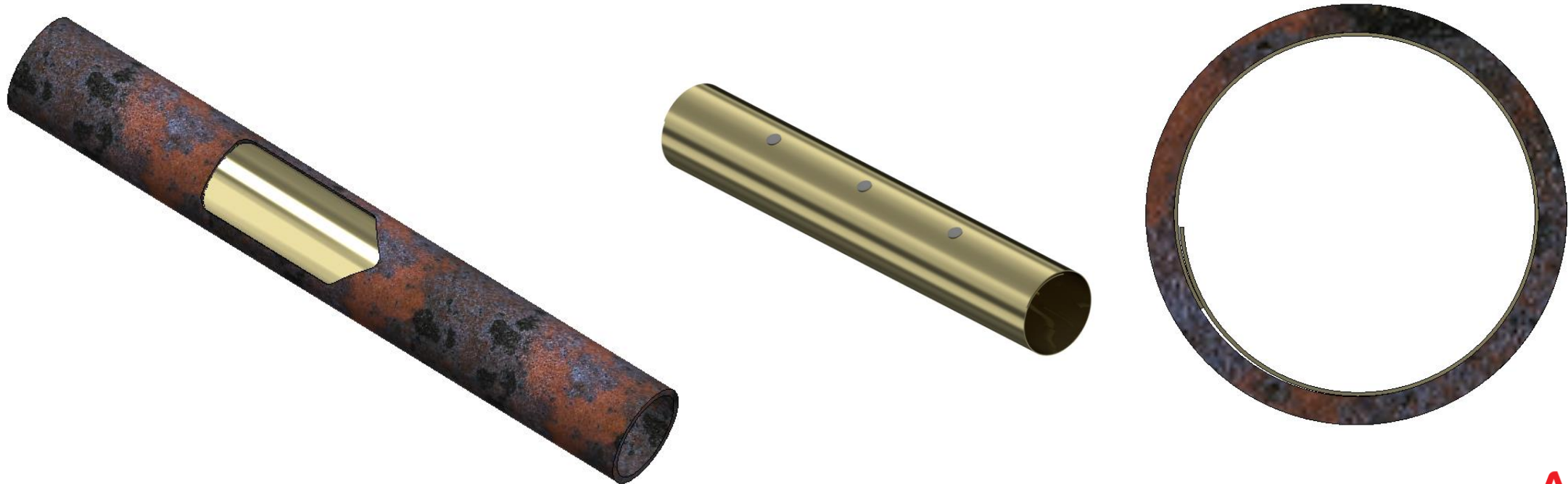
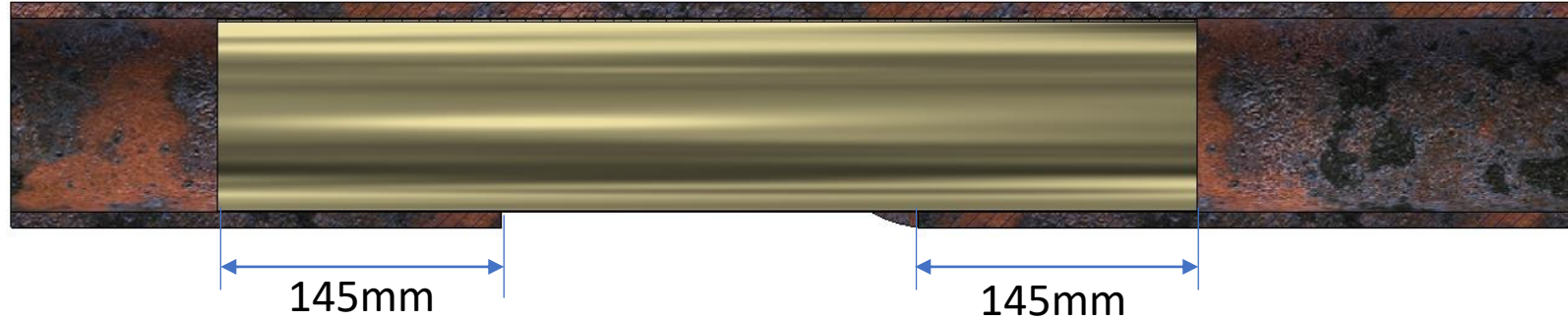
Axter Cast



- A patch/straddle with minimum ID reduction, can be placed across milled windows
- Allows cement darts to easily pass through

The Axter Cast tool string for 4-1/2" tubing

To be run on 5/16" Mono-conductor and larger Multi-conductor cables



Axter Cast – In house testing

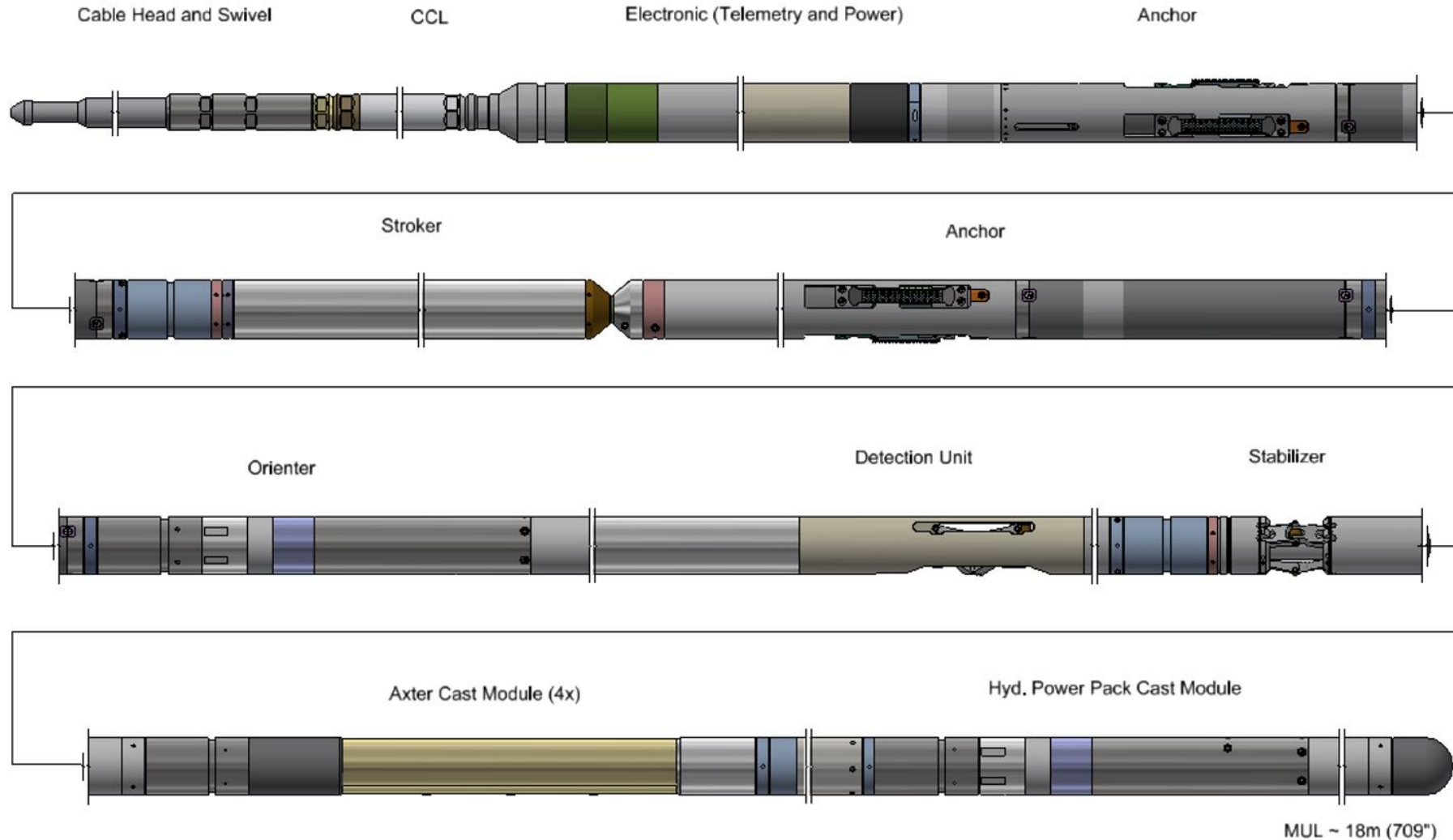


Successful testing

- Pull test to confirm sufficient lateral holding force
- Dart pumping test
- Pressure testing – Internal and external

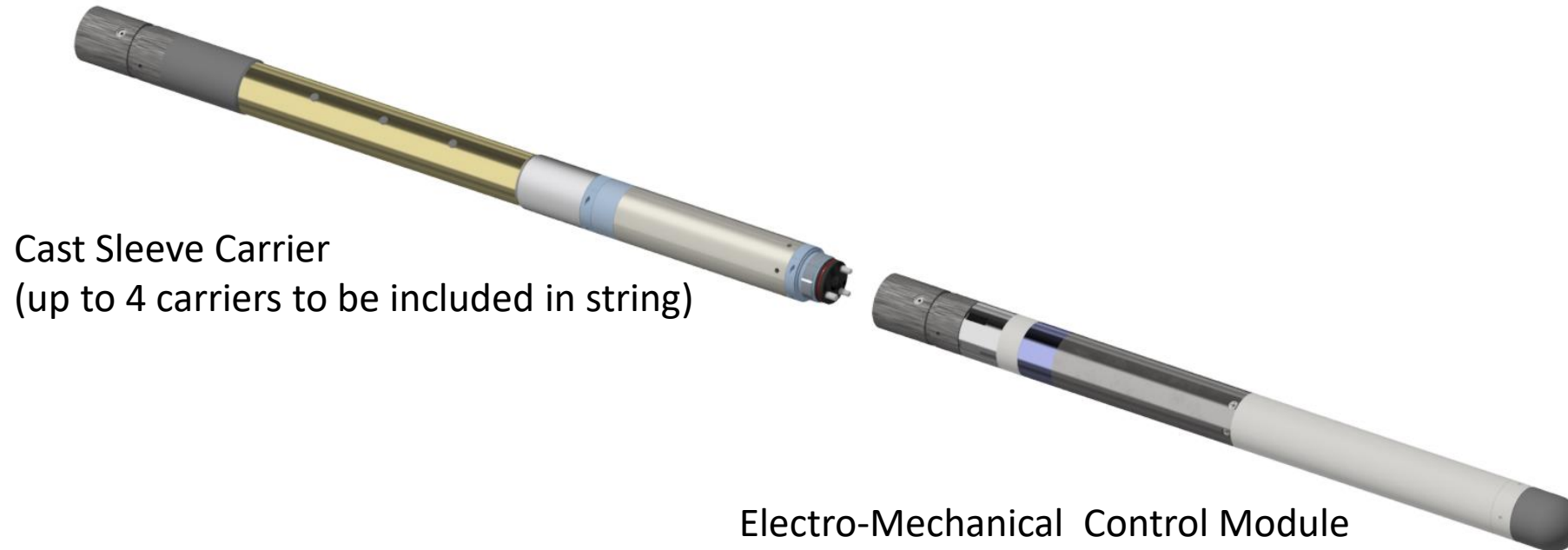
The Axter Cast tool string for 4-1/2" tubing

To be run on 5/16" Mono-conductor and larger Multi-conductor cables



Make up length, with 4 ea. Cast sleeve carriers ~ 18m - Same length as Axter Retrieve

The Axter Cast tool string for 4-1/2" tubing



Cast Sleeve Carrier
(up to 4 carriers to be included in string)

Electro-Mechanical Control Module

Tool scheduled to be ready for SIT at Ullrigg in Q4-2024



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Non P&A applications

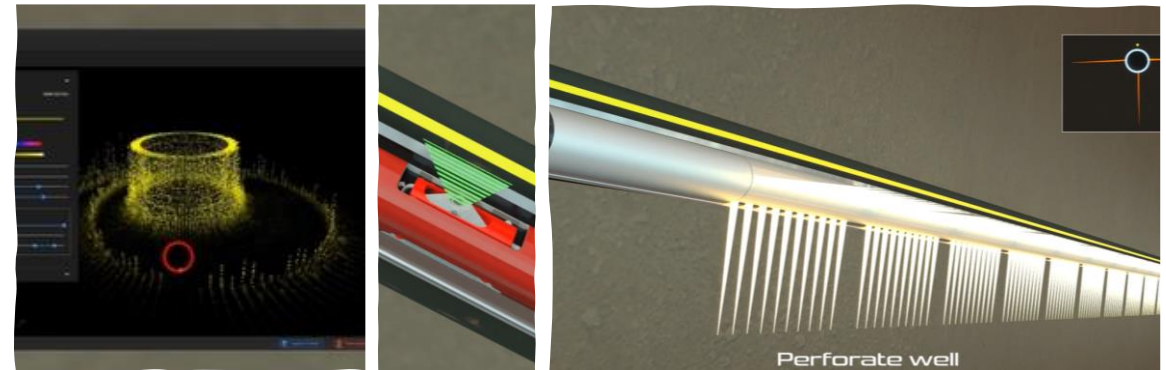
Detection of control lines and cables to avoid cable damage prior to running oriented perforating guns

Axter Retrieve modified and tested for operations in 5-1/2" Tubing

Operations scheduled to Q3 -2024



Island Wellserver



Optimizing Coiled Tubing Drilling

Machining lateral window for Liner Exit / Sidetrack and installing Whipstock. Offline

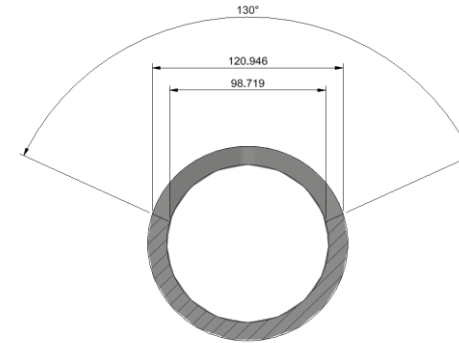
Operation done offline on pipe deck

Mill window 60" long by 3,8" wide

5" Liner #23 ppf, Q-125

Initial workshop milling tests successfully performed

Feasibility study submitted, awaiting go-ahead for next phase



Includes milling of nipple to allow for entry of 3.8" CTD Drillbit

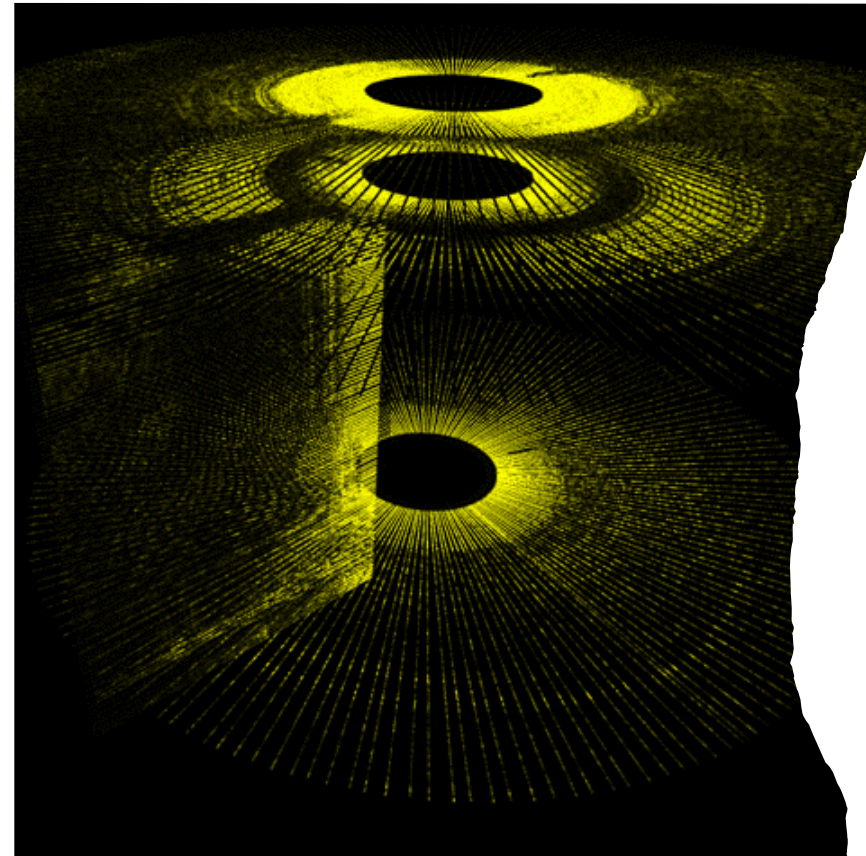


Penetrate the hydraulic inlet of a TRSCSSV to install retrofit Slickline set DHSV

When one of the two hydraulic supply
lines down to the valve connection is
ok, but the TRSCSSV will not cooperate

Accurately locate hydraulic bore,
penetrate and create communication
to slickline retrievable DHSV.

Potential work offshore West Africa
and Brazil

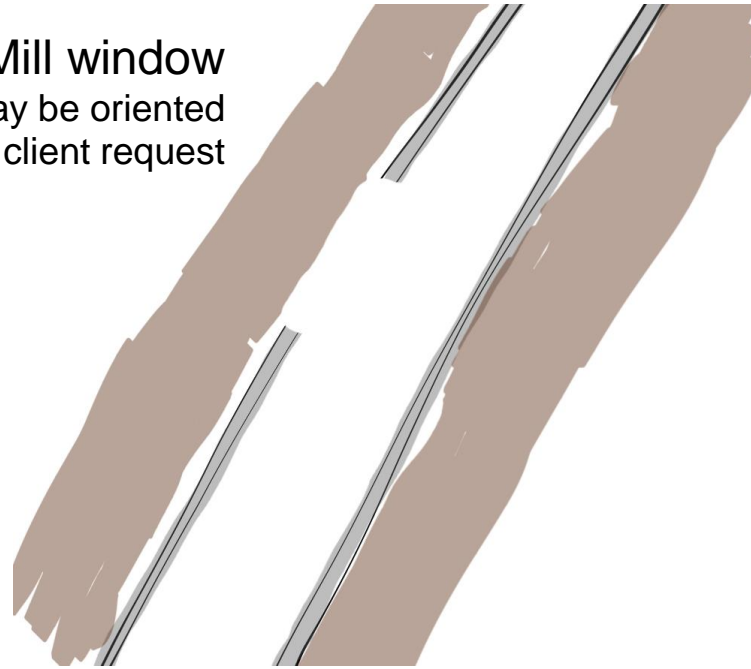


Retrofit sand control

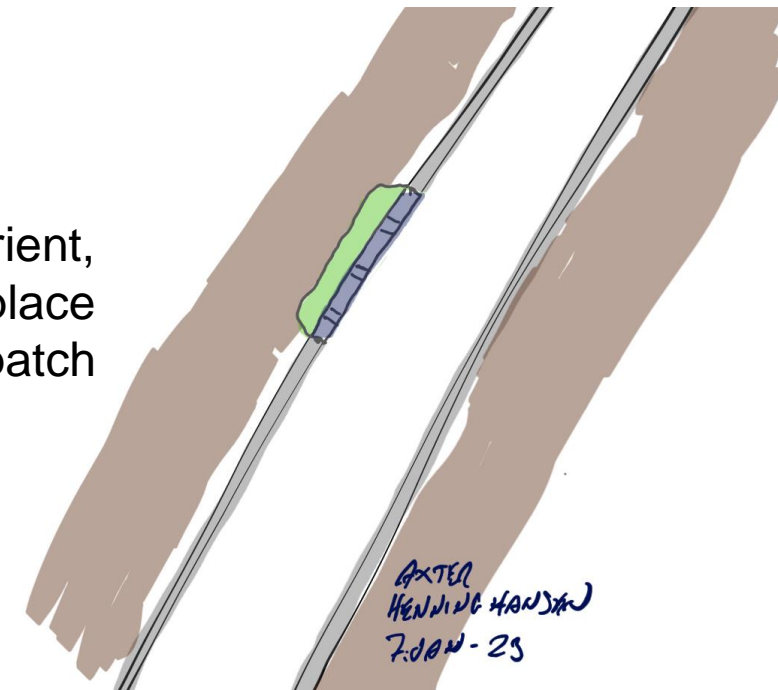
When sand control is needed to produce from new formations

The Axter tool can mill a window. Detect it and insert a sand control patch

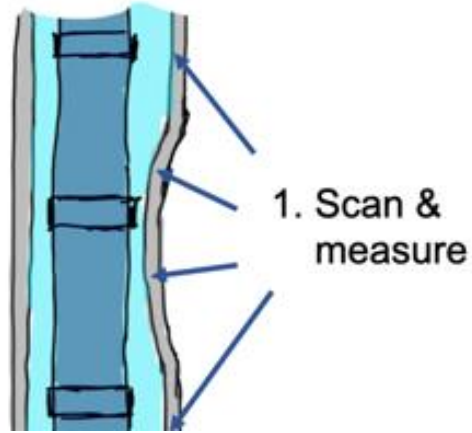
Mill window
May be oriented upon client request



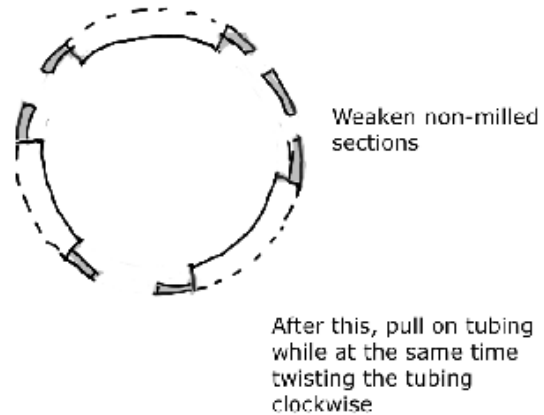
Detect window, orient, insert and secure in place a sand control patch



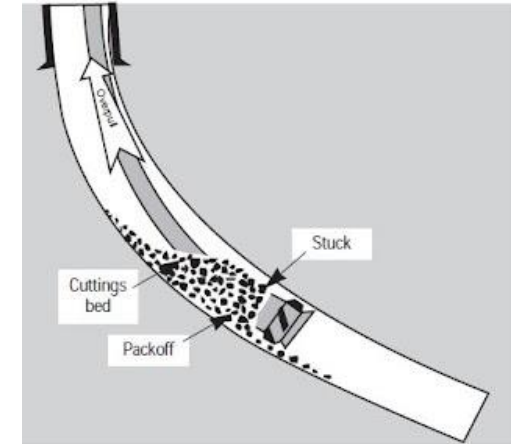
Other application for use of the Axter Scanner & Miller



Scan through the tubing to identify possible casing collapse/deformation



Enable safe tubing disconnect at required depth.



Enable safe drill pipe disconnect at required depth

AOTER

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