

An alternative approach to reservoir stimulation

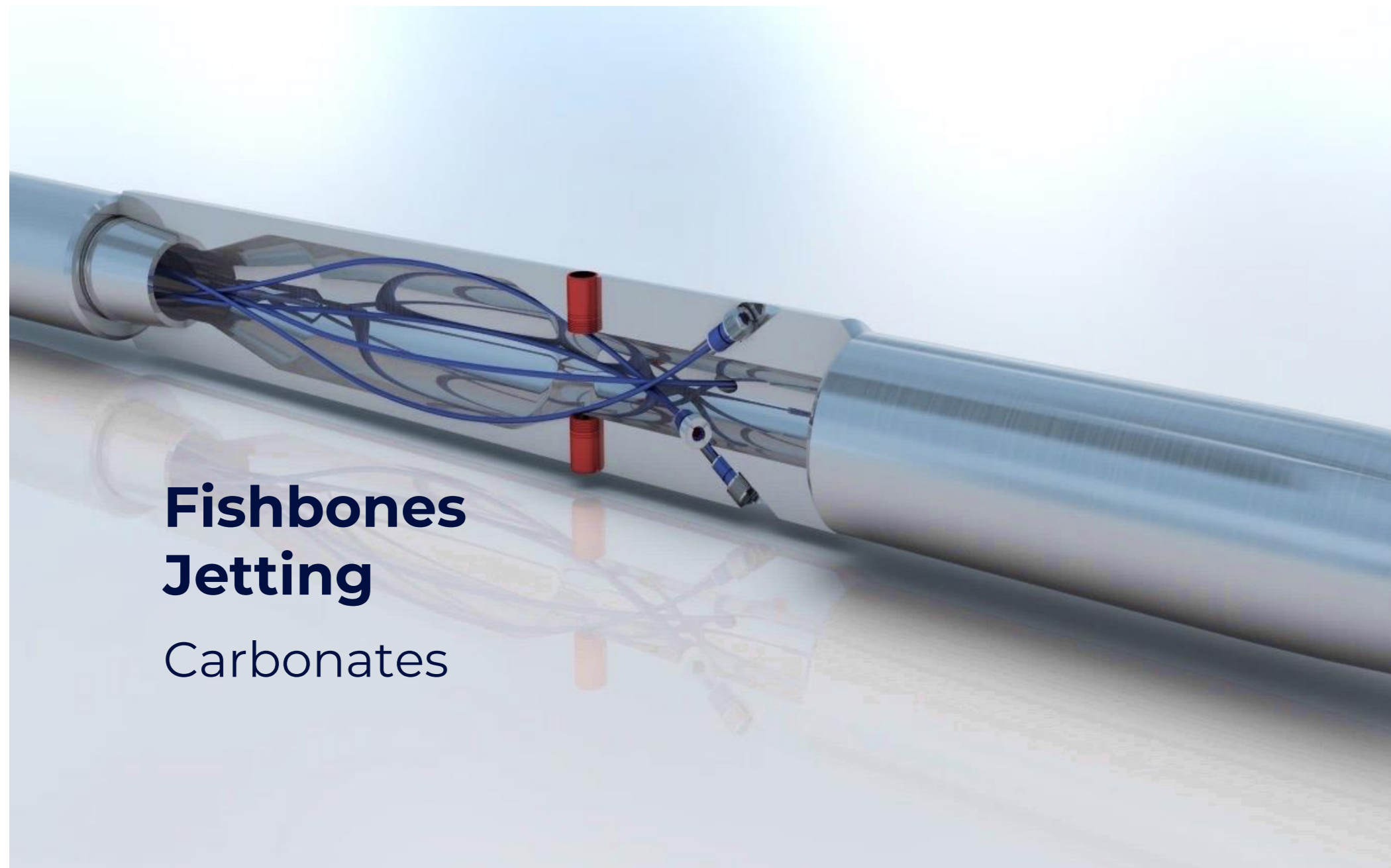
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SPE Aberdeen Geothermal

How the reservoir stimulation is done – short summary

- Deploy lower completion string fitted with fishbone subs in open hole well bore to TD and anchor the completion string in the reservoir interval
- Start the pumping job to activate the fishbones system
- Acid is pumped for the jetted system and filtered drilling mud is pumped for drilled system
- Continue pumping (2-6 hours job) to simultaneously extend long hollow Titanium needles fitted with a drill bit or jetting nozzle at the tip out of the fishbone subs and into the formation to create all the laterals
- 3 needles/sub with the drilling system and 4 needles/sub with the jetting system
- Laterals are each 10-12m long, with a ½” (drilled) to a 1-2 “ (jetted) diameter
- In a single reservoir stimulation operation creates a very large number (10’s to 100’s) laterals ~perpendicular to main well bore, spaced out all along the reservoir interval

Technology

Product Portfolio

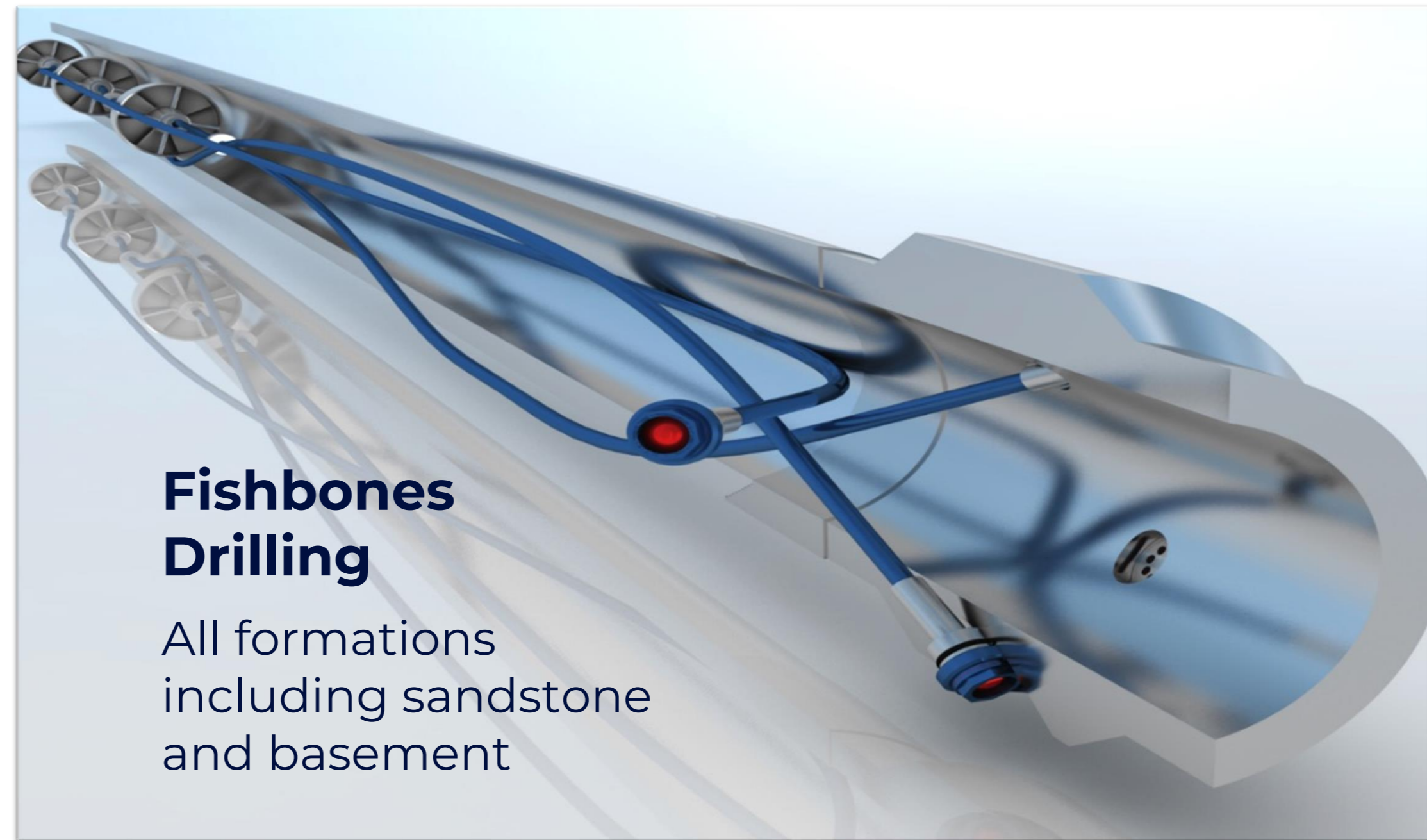


Fishbones Jetting

Carbonates

Dimensions:

- 4-1/2" liner for 6-1/4" - 6.5" open holes
- 5-1/2" liner for 8.5" open holes



Fishbones Drilling

All formations including sandstone and basement

Specifications:

- Available in all materials/threads to match liner specifications

What we do

Applications to-date worldwide (onshore & offshore)

Formations stimulated

- Fractured and layered carbonates and sandstones
- Heterolithic clastic sequences
- Conglomerates
- Fractured basement rock
- Chalk

Well types

- Oil and gas producers
- Water injectors
- Vert. / Dev. / Horiz. Wells
- Max temp. **200° C**

Combinations

with other well construction methods

- Multi-lateral wells
- Sand screens & ICDs
- Swellable packers
- Frac sleeves
- Perforations

- Logistically simple – fishbones completion system is delivered to wellsite ready to deploy
- Fast and operationally straight forward deployment as open hole liner system.
- Small spatial and environmental stimulation footprint

Started in geothermal market in mid 2023

Case Study: North Sea Fishbones Drilling

10 times increased productivity in conglomerate formation (2021)

Challenge

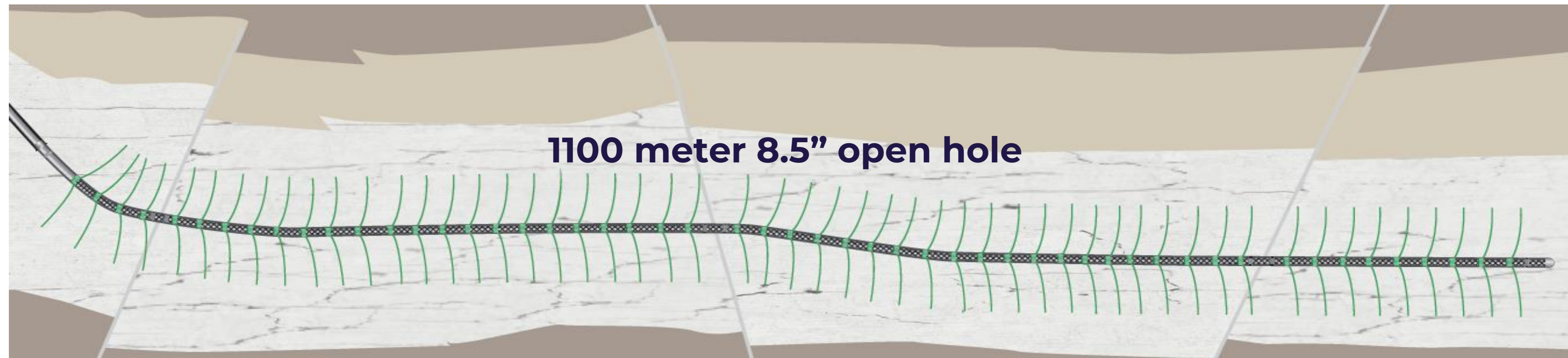
- Basement infill project
- New well in fractured conglomerate formation
- Sand control requirement
- Risk for losses

Solution

- 5 ½" Fishbones Drilling system with 53 subs / 159 laterals
- Fishbones in combination with standalone ICD screens
- Swell packers run to isolate loss zones

Results

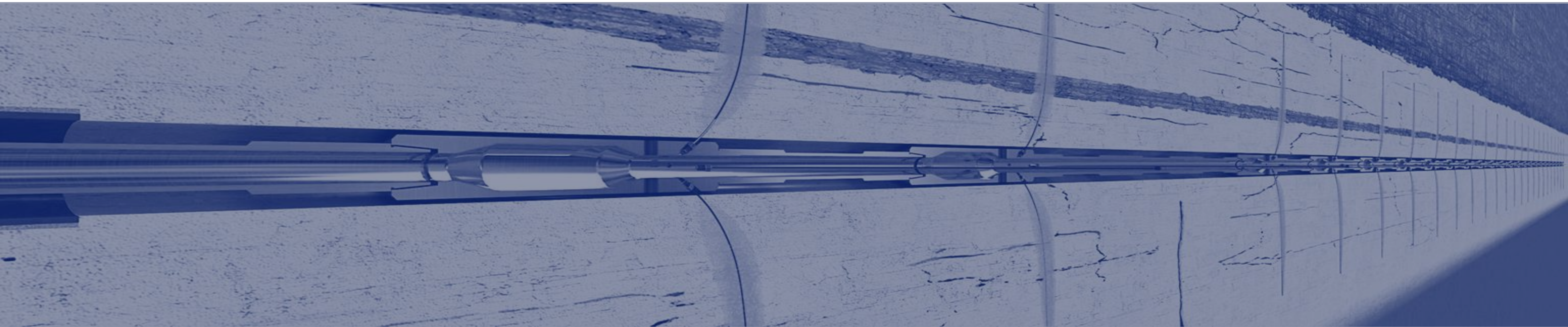
- Excellent production results
- **10x** better productivity than original prognosis.
- SPE-209953-MS
- 2nd well 2022 with 183 laterals
- 3rd well 2023 with 180 laterals



Benefits

The value of Fishbones stimulation technology

- ✓ Bypass damaged zone
- ✓ Increase reservoir exposure
- ✓ Connect layered reservoirs
- ✓ Connect to open natural fractures
- ✓ Connect with sweet spots and lenses
- ✓ Accurately stimulate zones
- ✓ Reduced drawdown and lower injection pressure
- ✓ Improve distribution of injection & production flow
- ✓ Rapid and operationally robust stimulation
- ✓ Reduced HSE exposure



Thank You

www.fishbones.as

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