DYNAenergetics

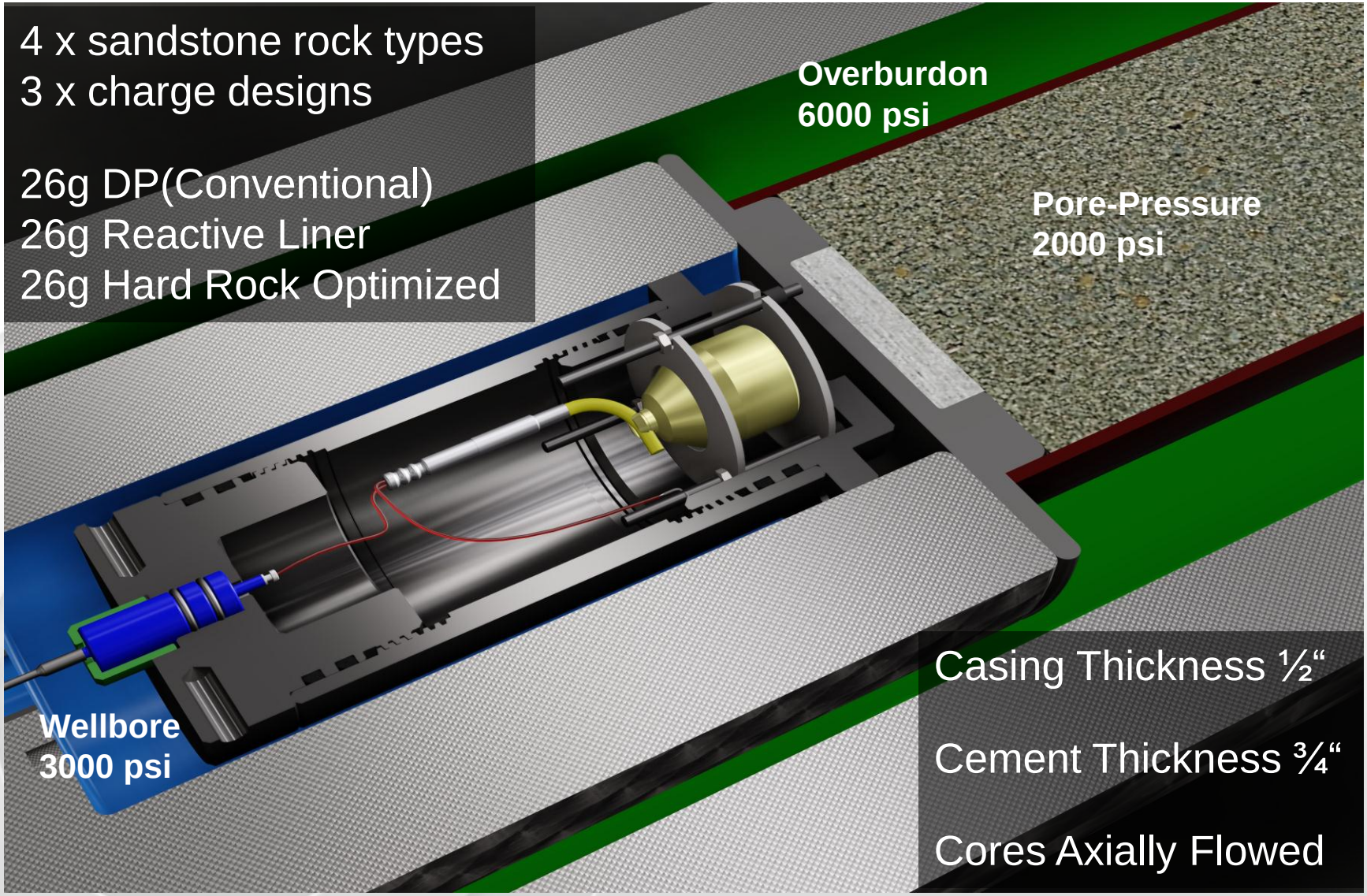
Rock optimized shaped charges and Section IV testing

Presenter: Liam McNelis.
Co-Author: Christian Eitschberger.

Introduction & Outline

- Test configuration & sandstone targets
- Test results (TTP & flow ratio)
- Analsyis of results
- Summary (way foward)

Section IV Test Configuration



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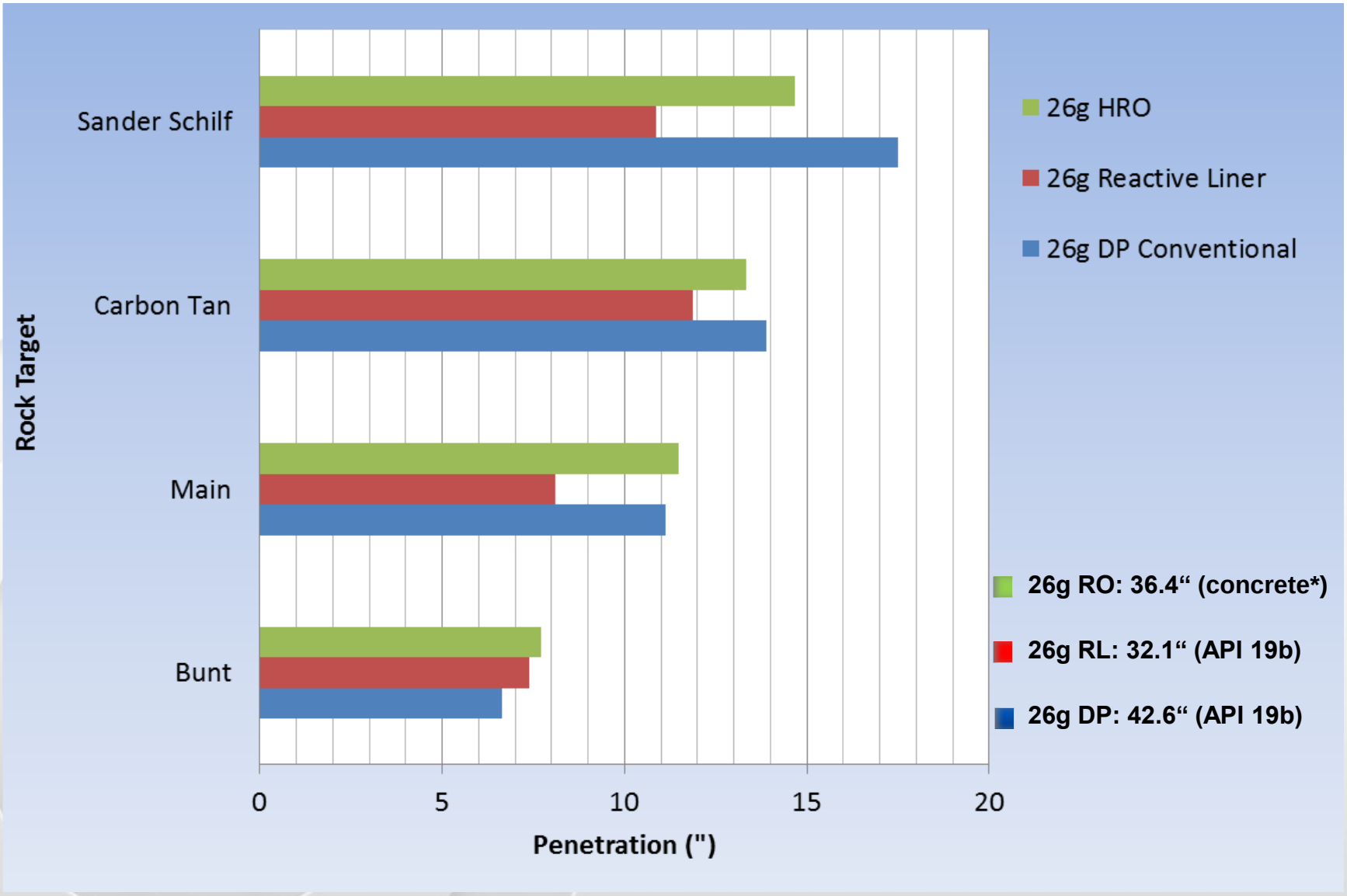
Sandstone Targets (7“ x 30“)

Sander Schilf	Carbon Tan	Main	Bunt
UCS 6200psi	UCS 8900psi	UCS 10150psi	UCS 11312psi
Porosity 19.4 – 20.6%	Porosity 14.9 – 15.6%	Porosity 11.6 – 11.8%	Porosity 12.4 – 13.6%
Perm. 120 – 150 mD	Perm. 25 – 30 mD	Perm. 2 – 6 mD	Perm. 40 – 50 mD

Depth of Penetration



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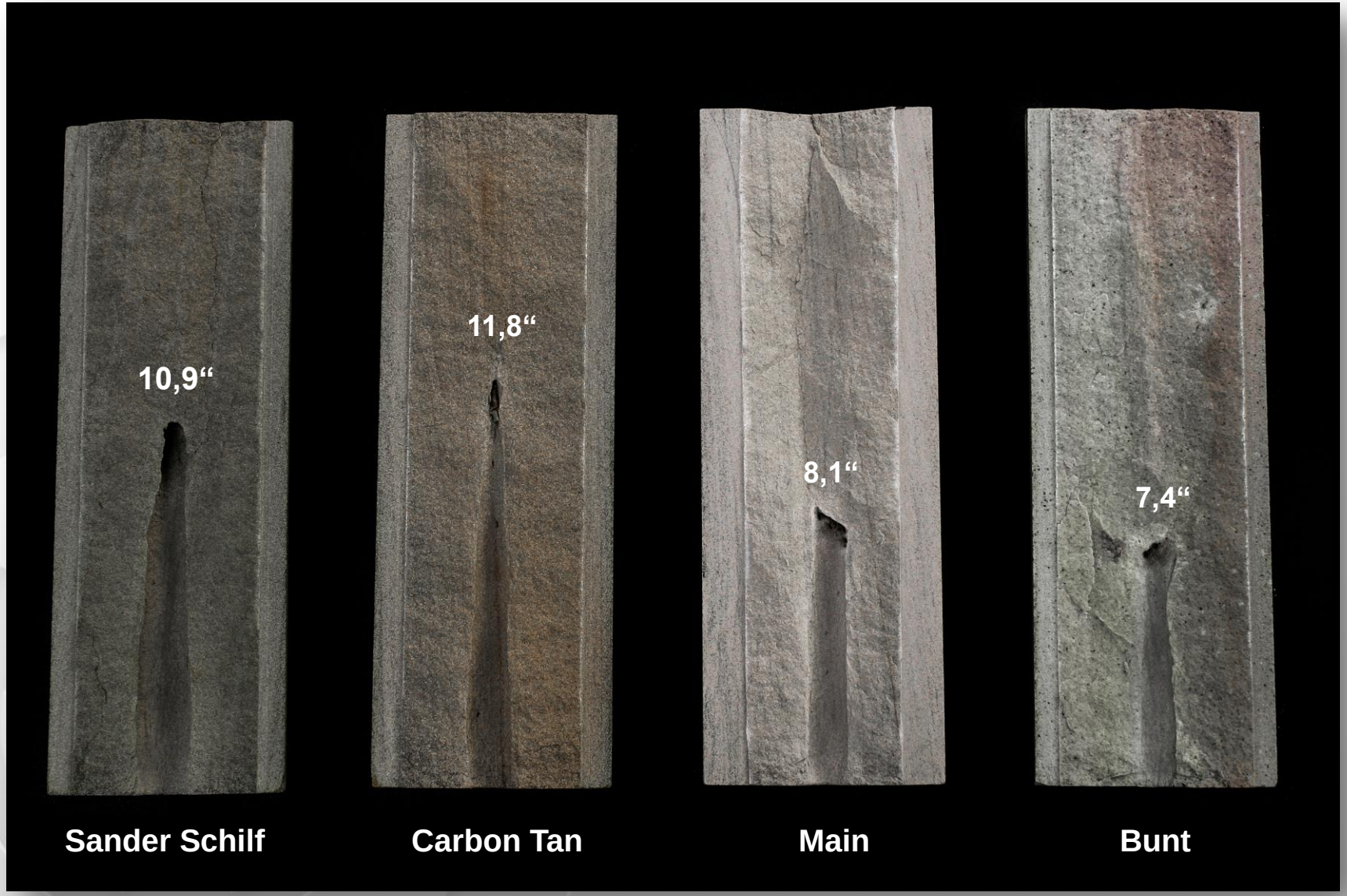
26g Reactive Liner - 4 different rocks



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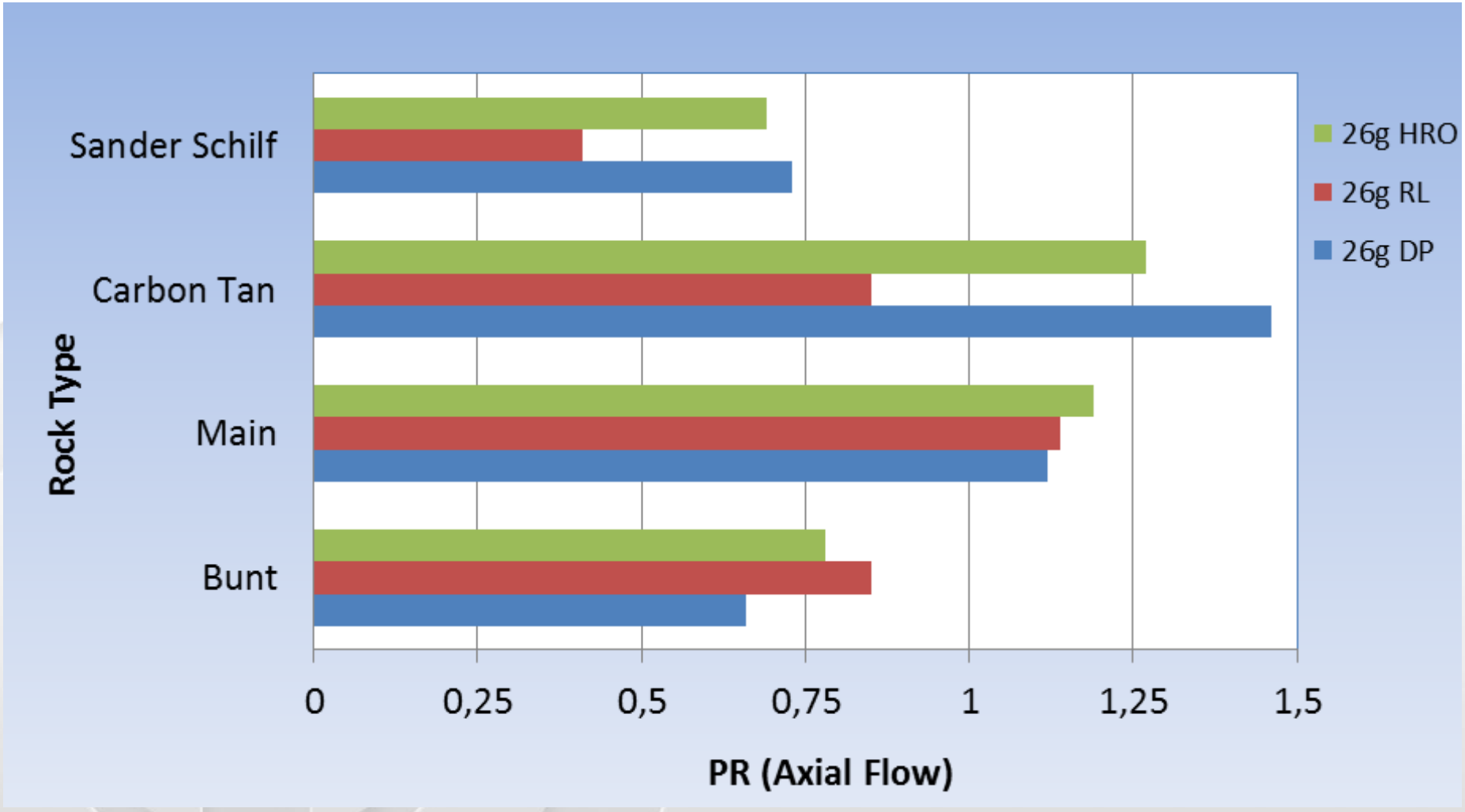
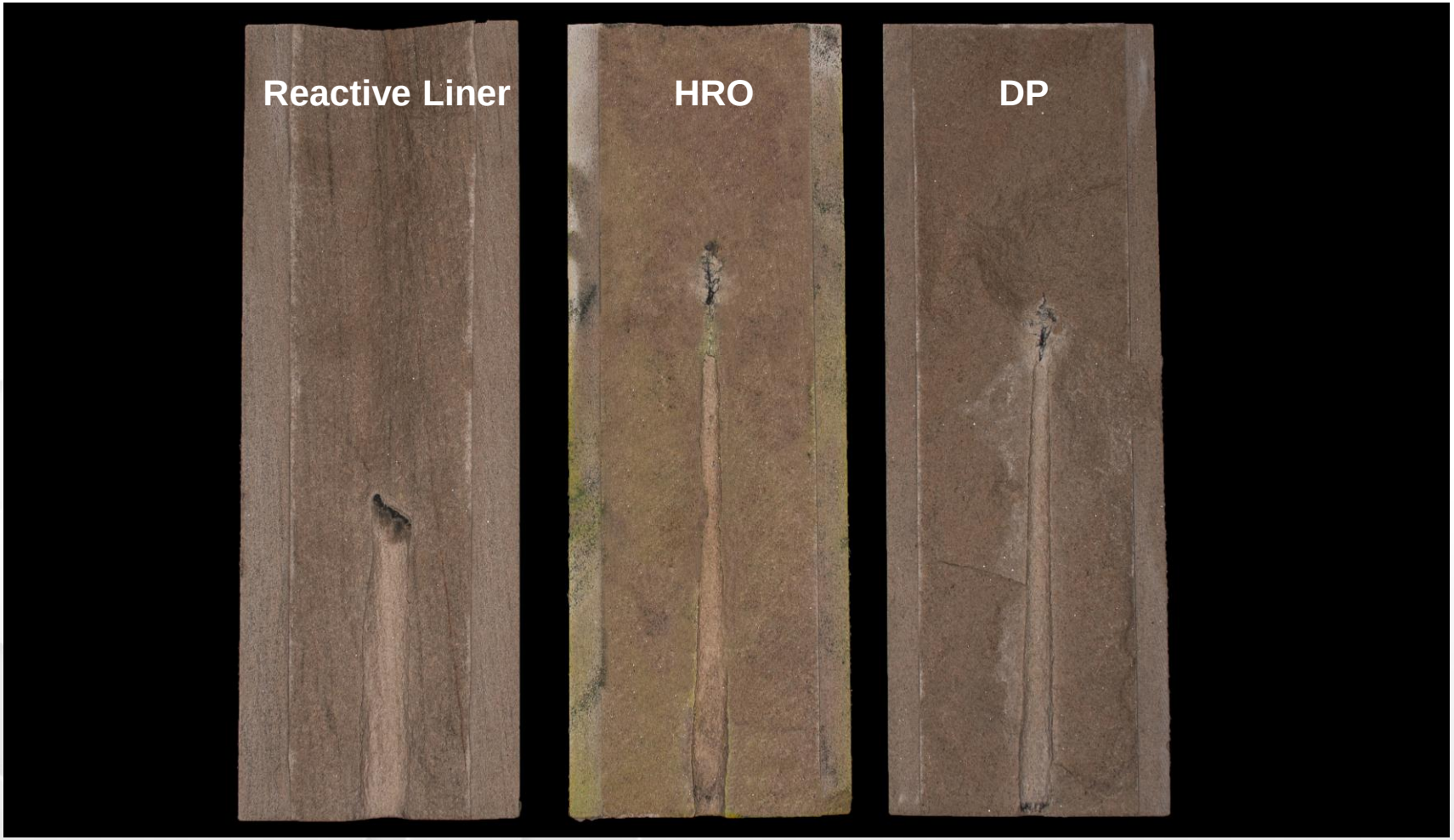
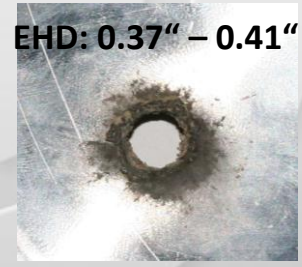
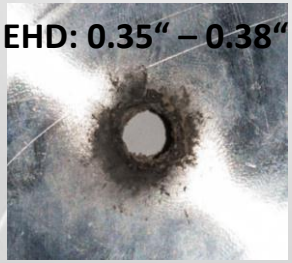
Pre/Post Shot Permeability Ratio

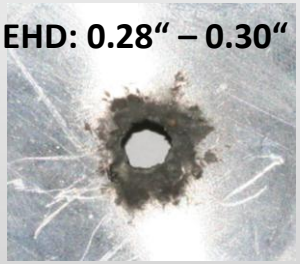


Main Sandstone – 3 different charges









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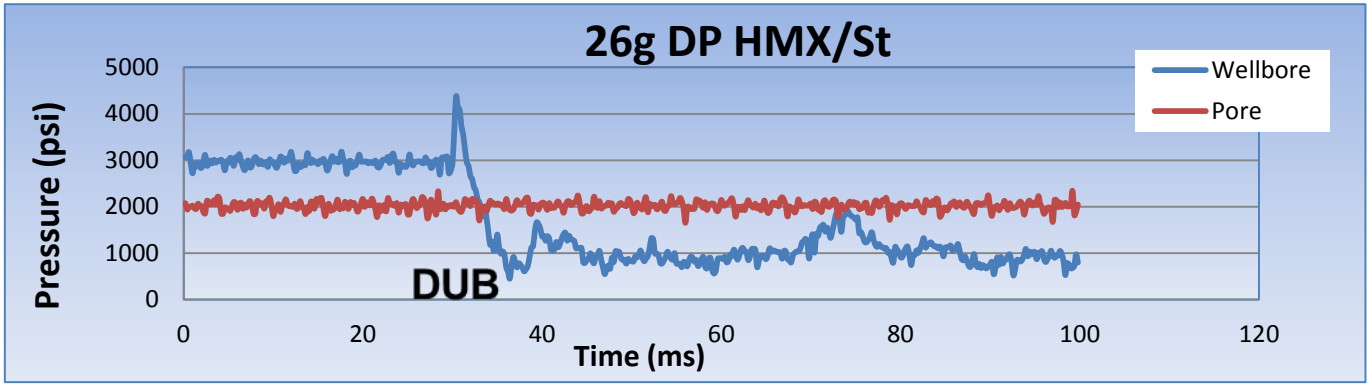
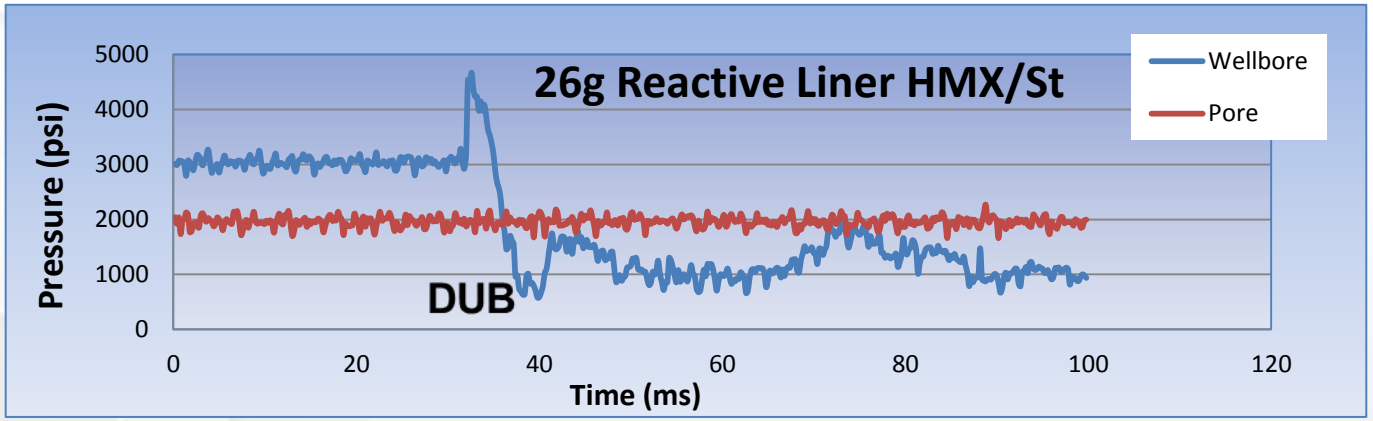
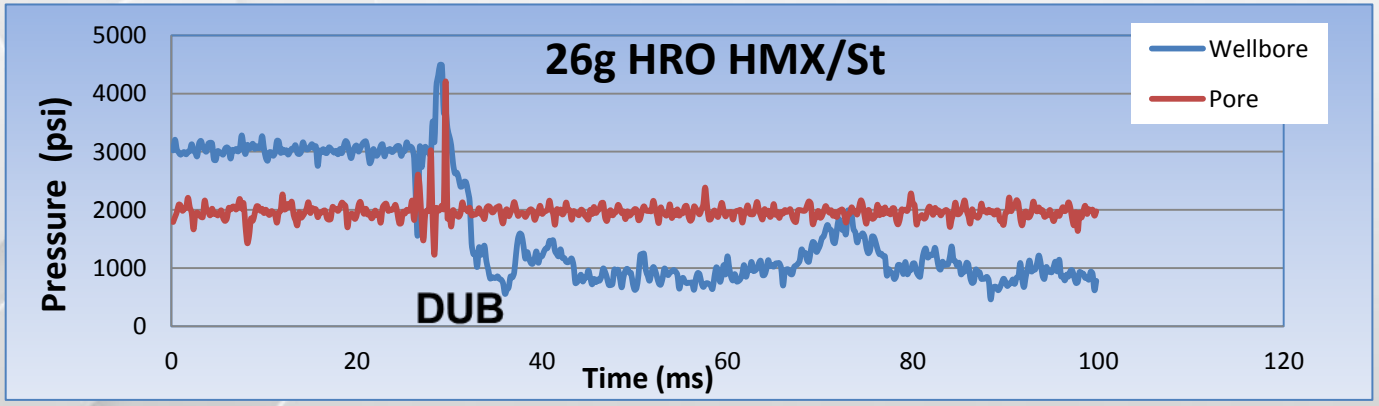
High Speed Recording (5 KHz) x 3 Main Sandstone

- All tests were shot under identical condtions.
- DUB 2500psi
- Dynamic Underbalance almost idenitcal regardless of charge type & rock type.
- Pore Pressure Peak on HRO charge.







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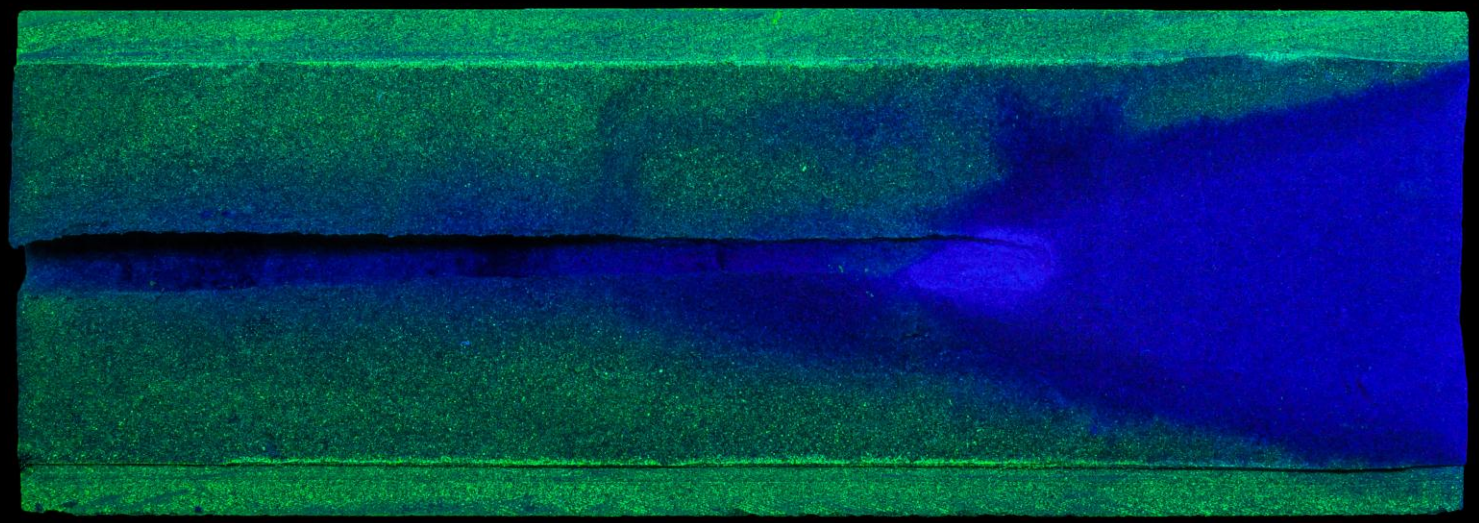
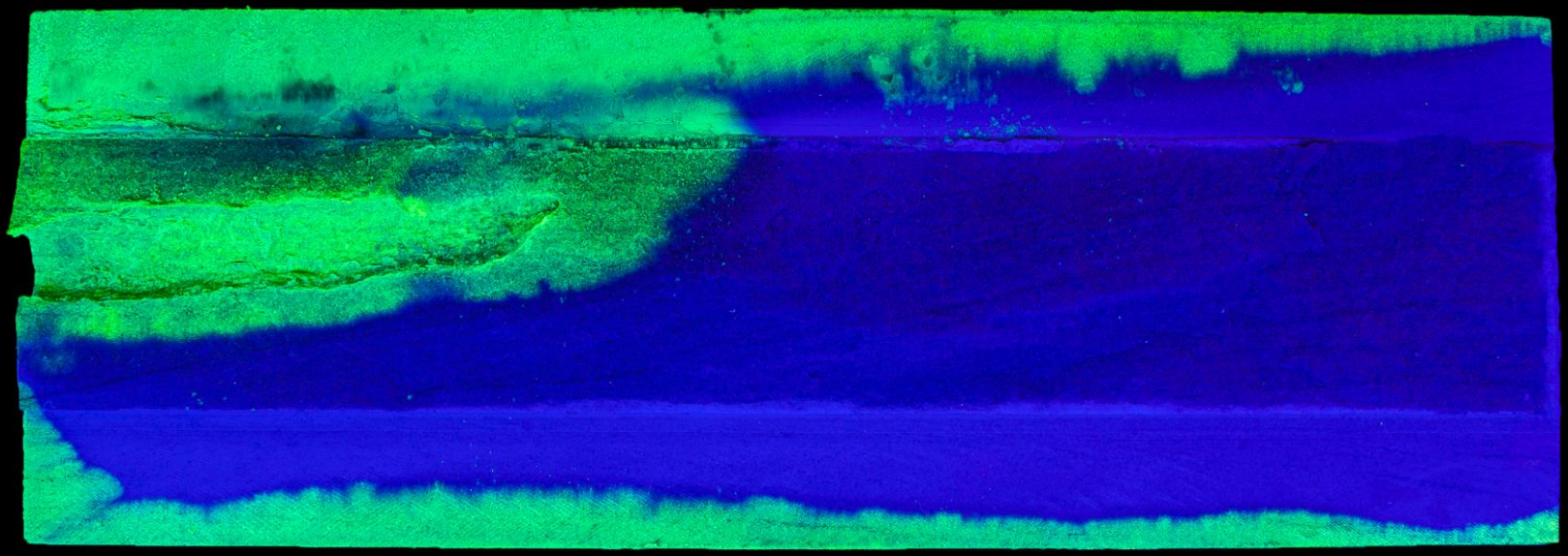
Fluorescent Dye Radial Flow

Sander Schilf Sandstone: (UCS 6200psi) , 26g DP HMX/St



Fluorescent dye indicates path of fluid flow

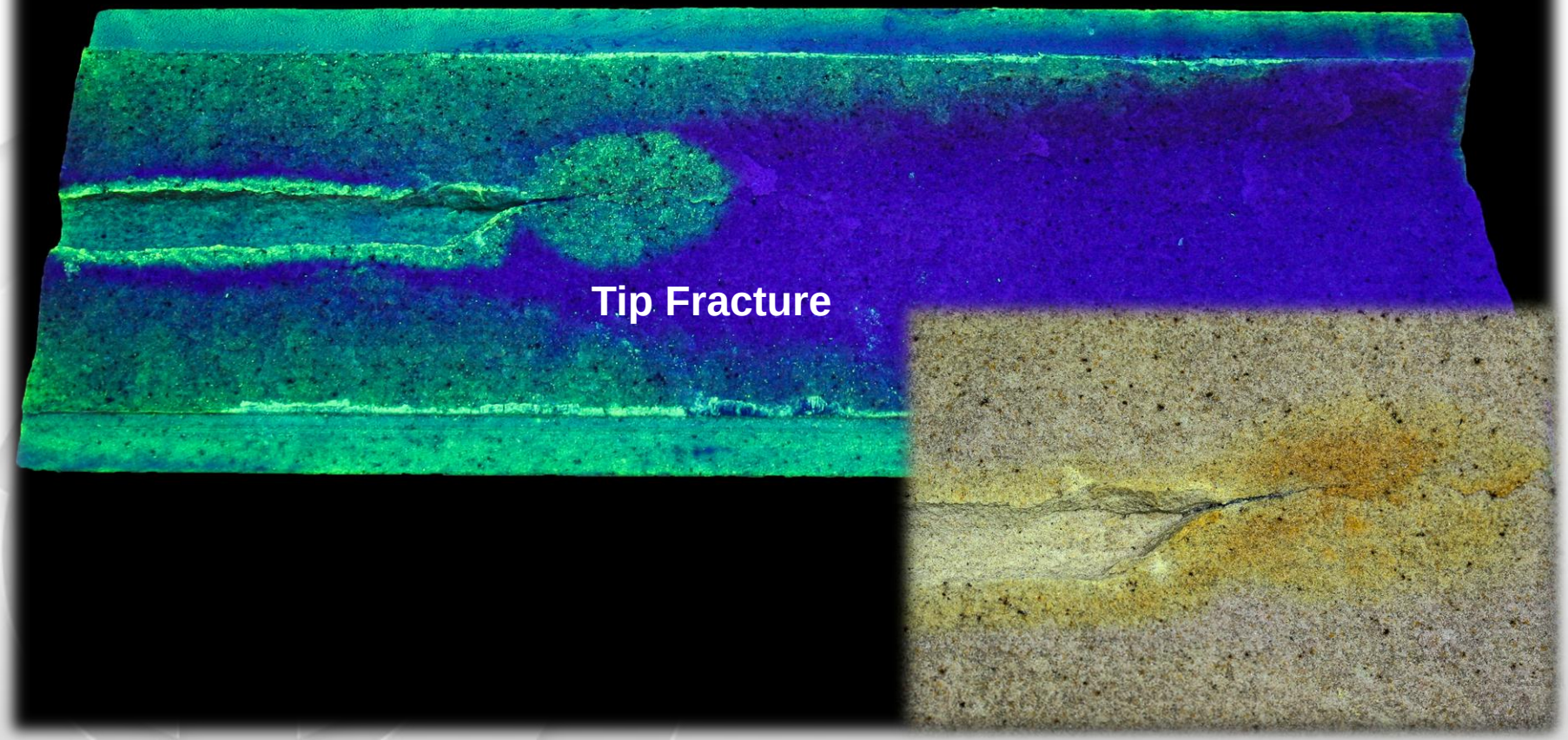
Main Sandstone: (UCS 10150psi), 26g Reactive Liner HMX/St



Fluorescent dye indicates path of fluid flow

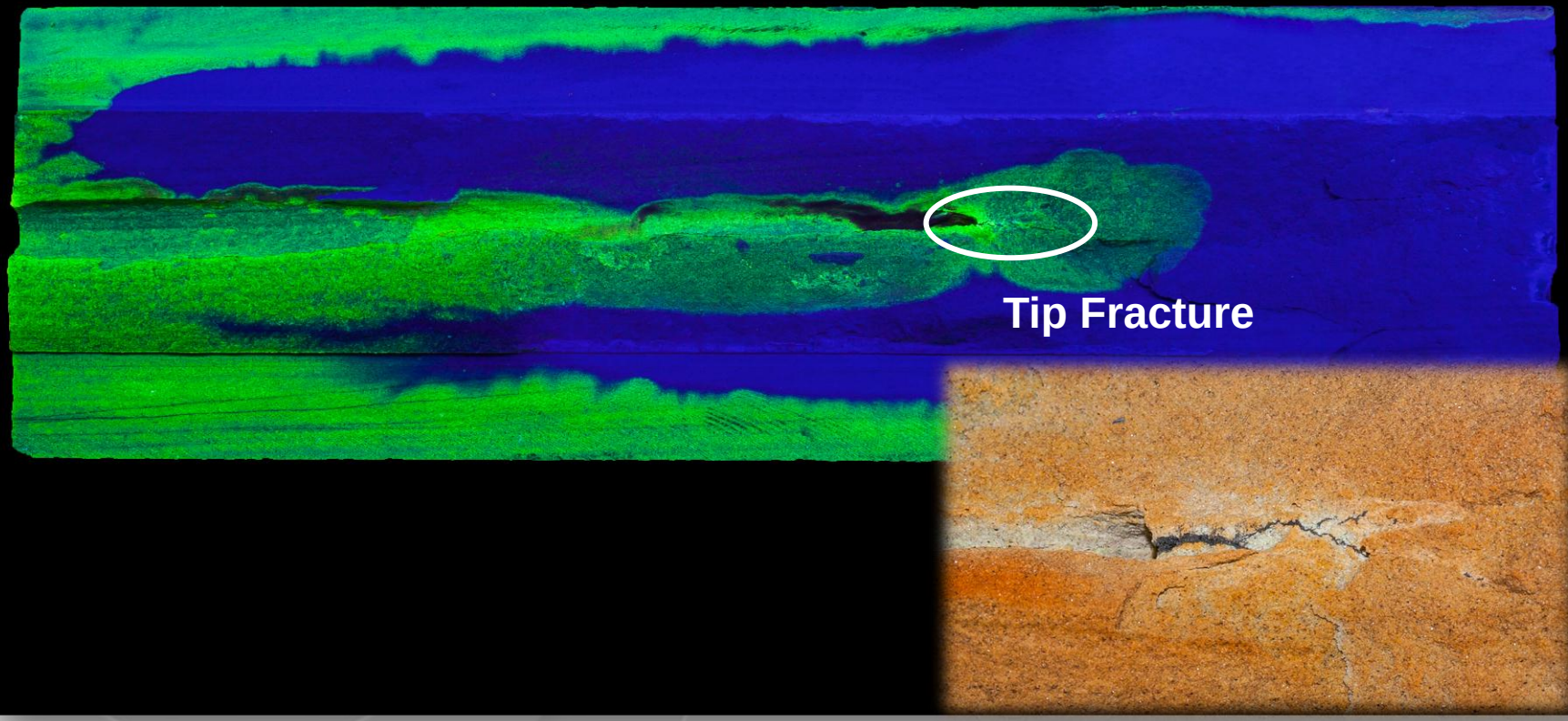
Bunt Sandstone: (UCS 11300psi), 26g DP HMX/St

Fluorescent dye indicates path of fluid flow



Main Sandstone: UCS 10150psi, 26g DP HMX/St

Fluorescent dye indicates path of fluid flow



Summary

- Sufficient and good penetration is desirable but highest DoP, especially in concrete targets, does not automatically mean best downhole performance
- Best performance can be achieved by developing a charge specifically for the rock type
  (not always feasible – time/cost/availablity of rock)
- Reactive Liner charges appear to be more suited to harder tighter sandstone rocks
- Results indicate that sandstone rocks with medium-high porosity are more susceptable to skin effect and crushed zone than the harder rocks, particularly with OB perforating
- Need to repeat more tests with other test configurations to confirm the effect of Overbalance and DUB on the results.

Thank you for your attention.