

# **FRACTUREVISION: Proppant-delivered Fracture Evaluation Services**

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Fracture Evaluation Services Platform Manager

# Proppant-Delivered Technology Platforms



## CARBONRT Technology

- Chemically inert tracer technology used to identify proppant downhole

## FRACTUREVISION Services

- Interpretation and evaluation of NRT technology provides multiple deliverables and technology integration

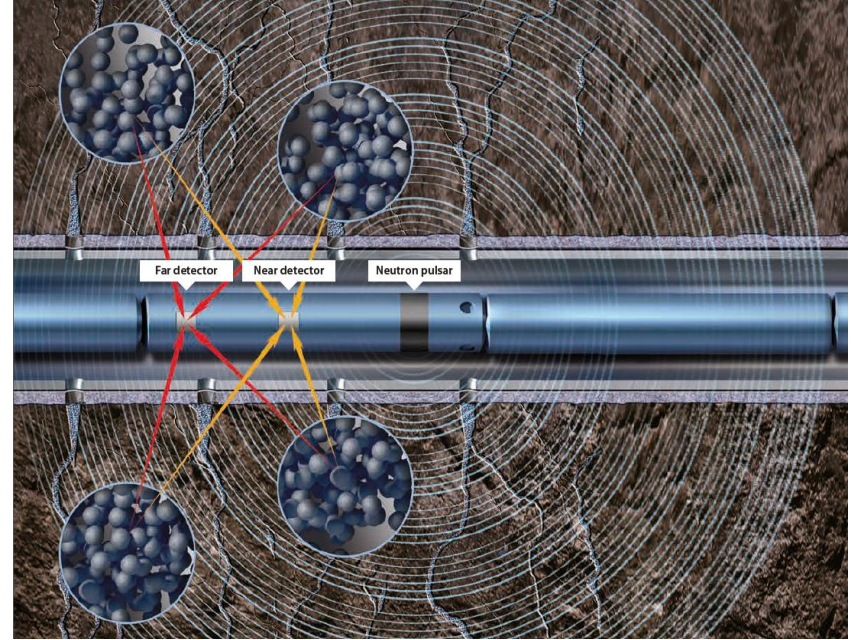
# Problem: Where Did My Proppant Go?

- Traditional methods used:
  - Radioactive tracer (measure proppant)
    - Safety and toxicity issues
    - Illegal in some countries and states
  - Microseismic (infer where proppant is)
    - Measurement of rock failure
    - Large errors

# Solution

- FRACTUREVISION

- Non-radioactive tagged/traced proppant (CARBONRT technology) that can be detected downhole using a standard pulsed neutron log
- Measures propped fracture height
- Identifies propped stage intervals and perforations in vertical and horizontal wells
- Measures near wellbore connectivity



# How is CARBONRT Proppant Made?

CARBONRT is made like any other CARBO ceramic proppant

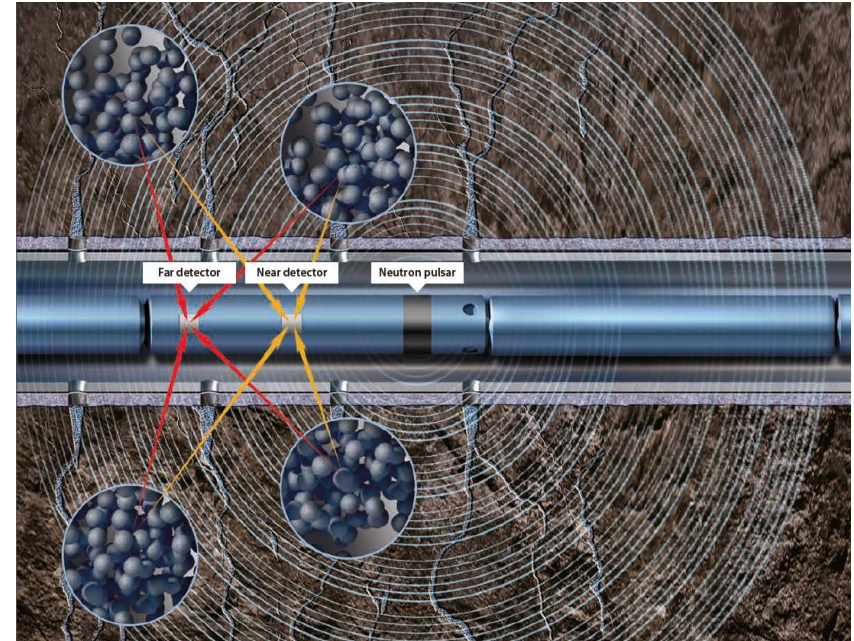
- Tracer is added during the grind process of proppant production
- Integral part of the proppant matrix
- Not a coating or fluid additive

Grind Process

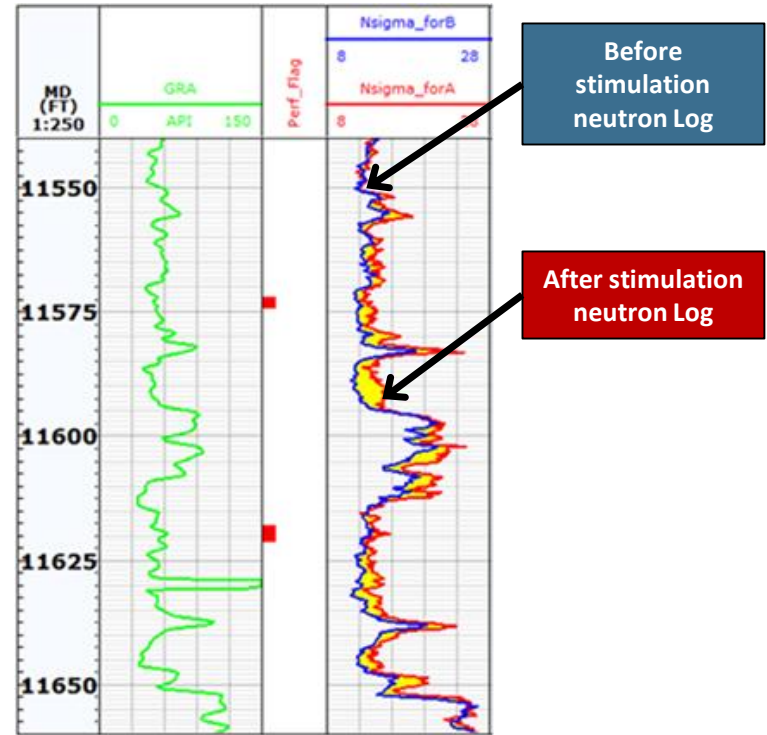
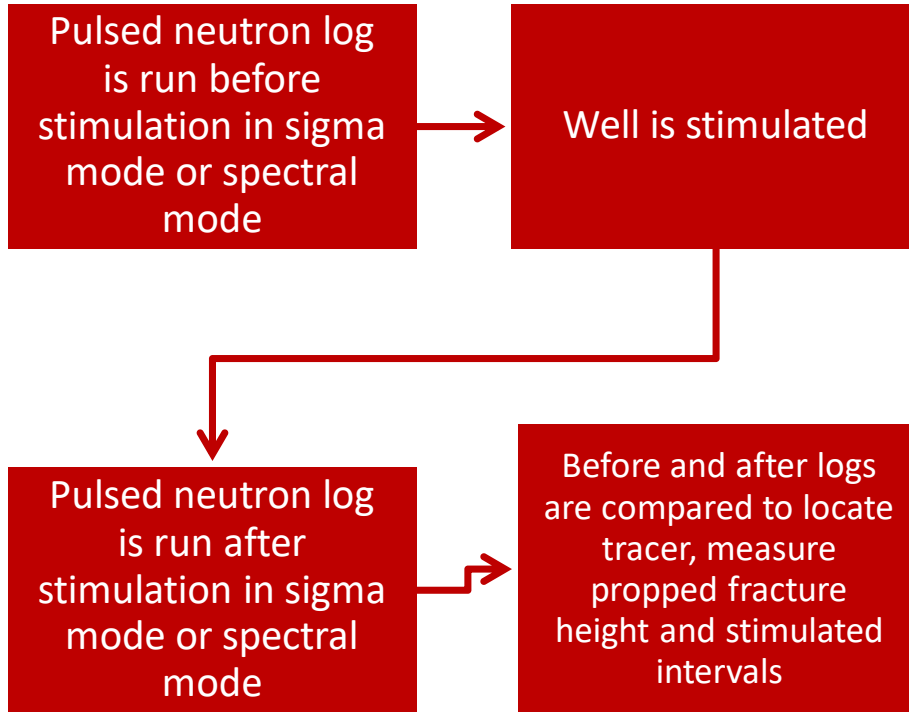


# How does CARBONRT Technology Work?

- Tracer absorbs neutrons at very high rate
- Emits small amount of Gamma rays compared to formation
- Alters response of neutron log to locate proppant



# What is the Process in the Field?





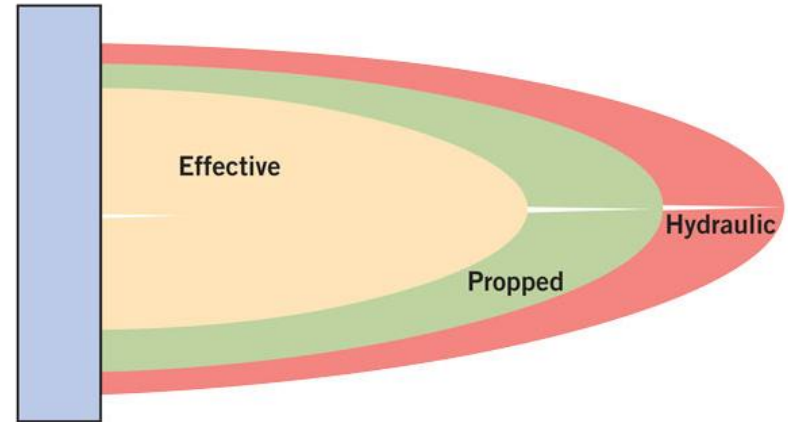
# Advantages of Using CARBONRT Technology

- Measuring Proppant
- Longevity and Repeatability
- High Resolution
- Environmentally Inert
- Field Proven Technology

➤ CARBONRT is not a fluid additive or a coating. It is an integral part of the grain matrix.

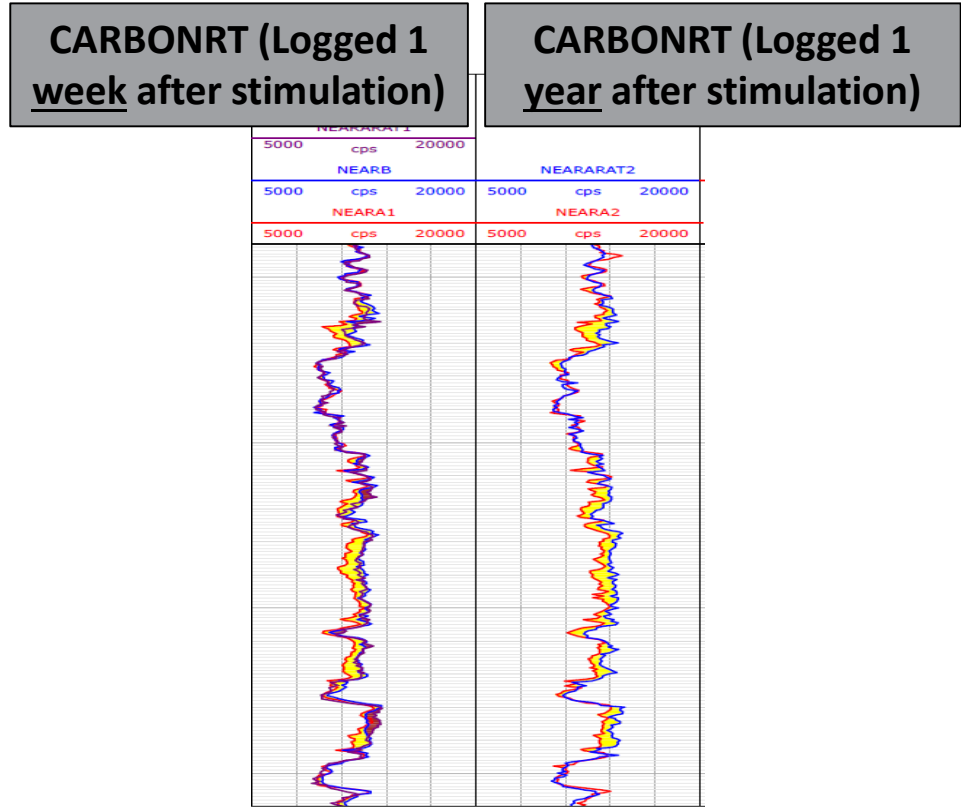
## RELATIONSHIPS OF VARIOUS FRACTURE LENGTHS

FIG. 1



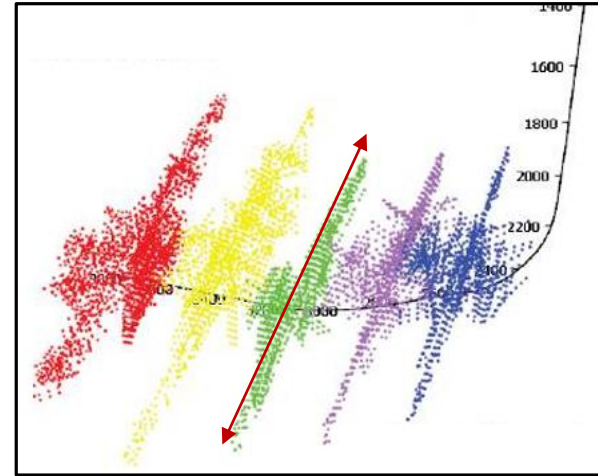
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# Advantages of Using CARBONRT Technology

- Measuring Proppant
- Longevity and Repeatability
- **High Resolution**
- Environmentally Inert
- Field Proven Technology



Microseismic resolution 25 – 500 ft  
CARBONRT Tech Resolution 1-2 ft

# Advantages of Using CARBONRT Technology

- Measuring Proppant
  - Uses CARBONRT, an inert proppant
- Longevity and Repeatability
  - There are no special handling requirements
  - Can be handled like any other proppant
- High Resolution
- Environmentally Inert
- Field Proven Technology



# Advantages of Using CARBONRT Technology

- Measuring Proppant
- Longevity and Repeatability
- High Resolution
- Environmentally inert
- **Field Proven Technology**

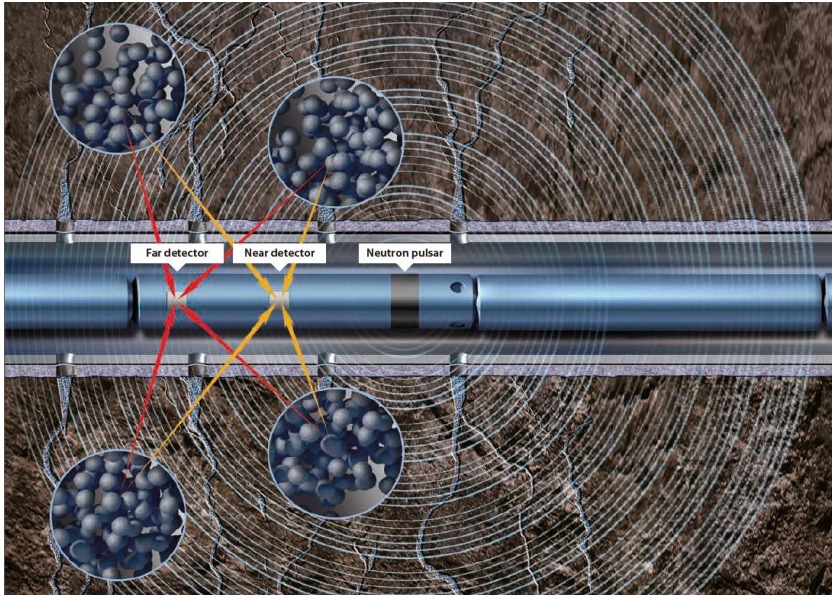


*Academic achievements: SPE 146744 (Field Trials), SPE 149102 (Middle East), SPE 151696 (Field Results), SPE 152169 (Rockies), SPE 152251 (Colombia), IPTC 14369 (China), IPTC 16581*

# Two Different Products

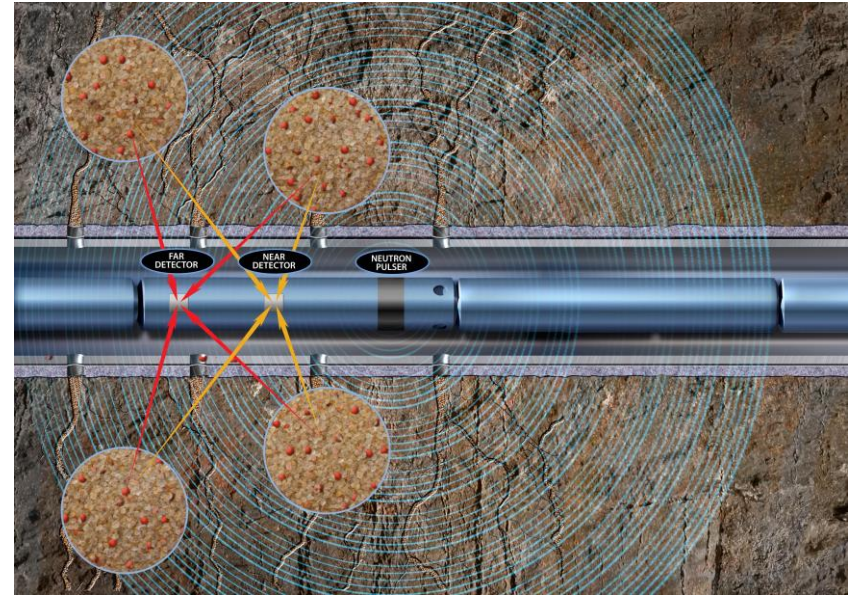
- CARBONRT

- 100% Ceramic proppant

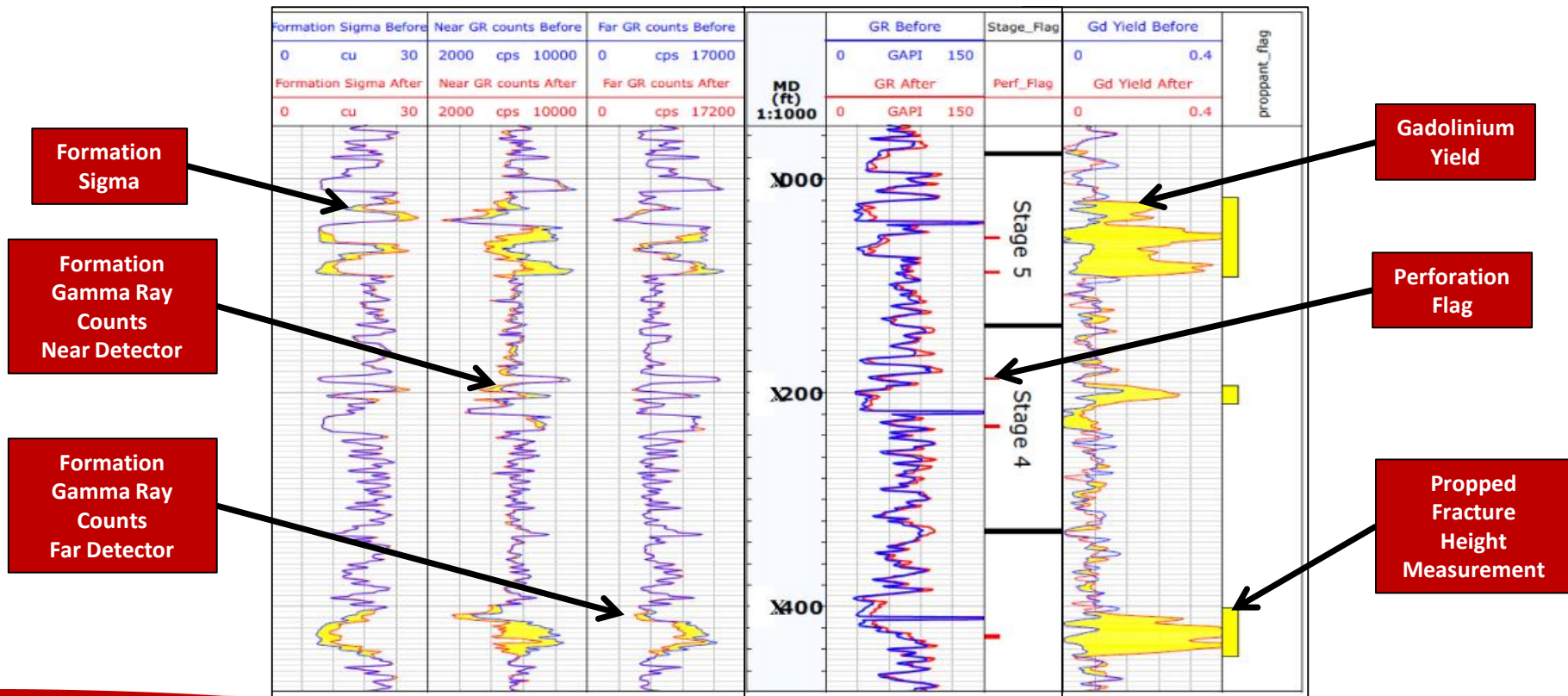


- CARBONRT ULTRA

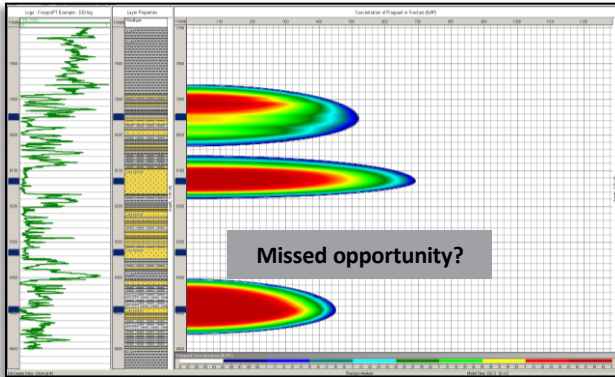
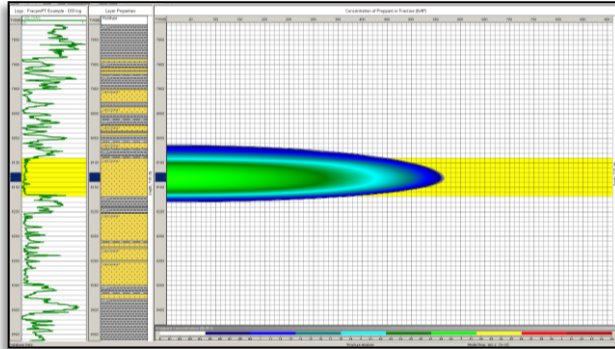
- Ceramic mixed with sand



# FRACTUREVISION Interpretation



# What Information does FRACTUREVISION Provide?



## Propped Fracture Height

- Measure fracture height in vertical wells

## Propped Zones

- Measure if perforation clusters and stages have been adequately stimulated and propped

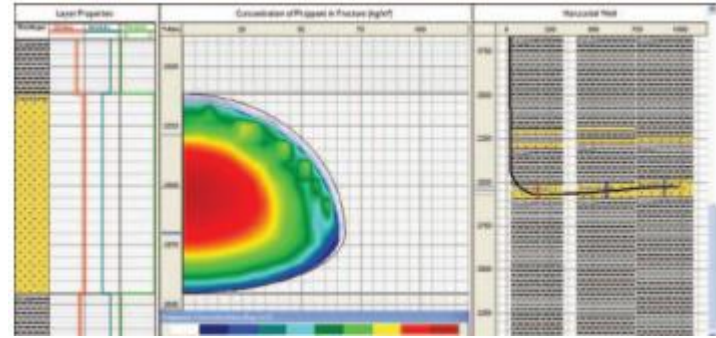
## Near Wellbore Connectivity

- Estimate the amount of proppant close to the wellbore

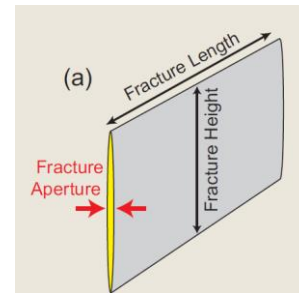


# What is the Value of this Information?

- Propped Fracture Height
- Perf Cluster and Stage Efficiency
- Near Wellbore Connectivity
- Integrated Solution



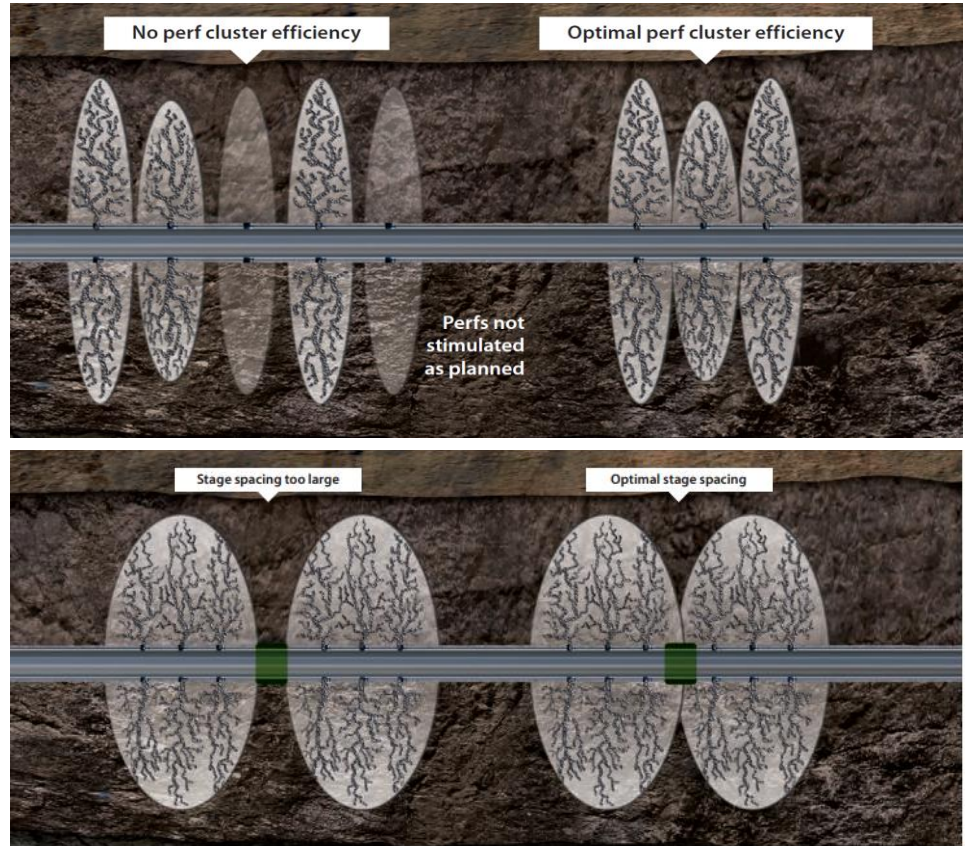
Calibrate fracture models in FRACPRO and optimize treatment of offset wells



Propped fracture length is calculated from mass balance

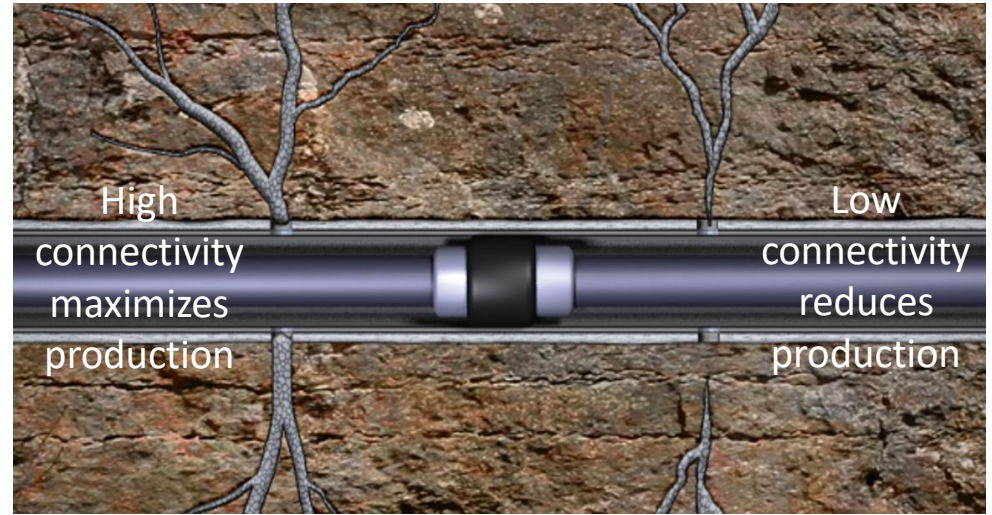
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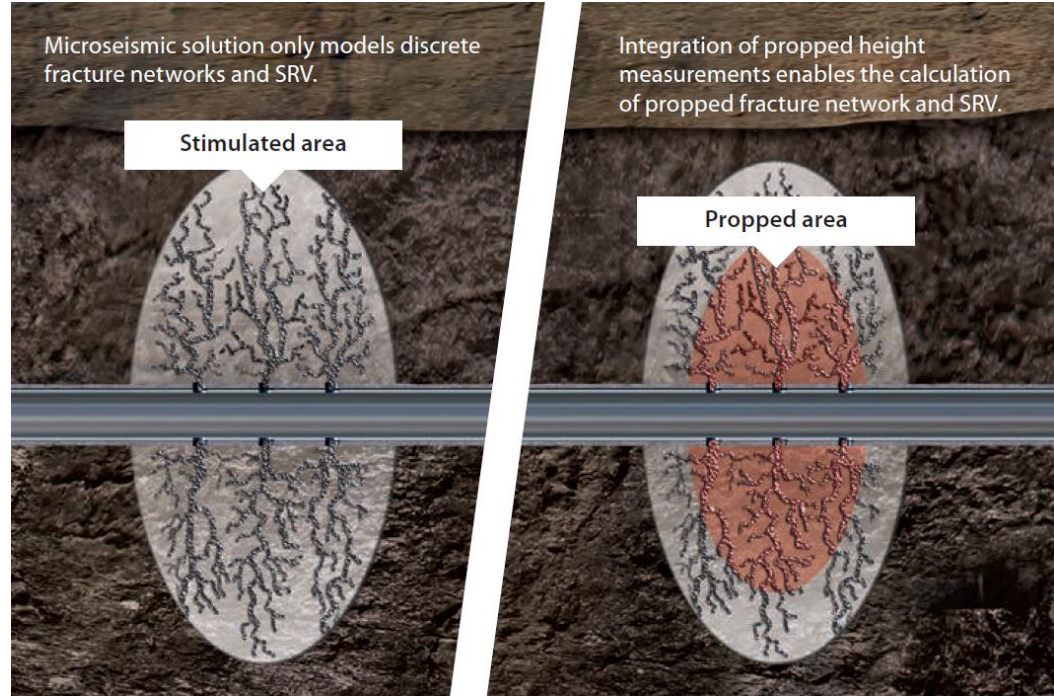
# What is the Value of this Information?

- Propped Fracture Height
- Perf Cluster & Stage Efficiency
- **Near Wellbore Connectivity**
- Integrated Solution



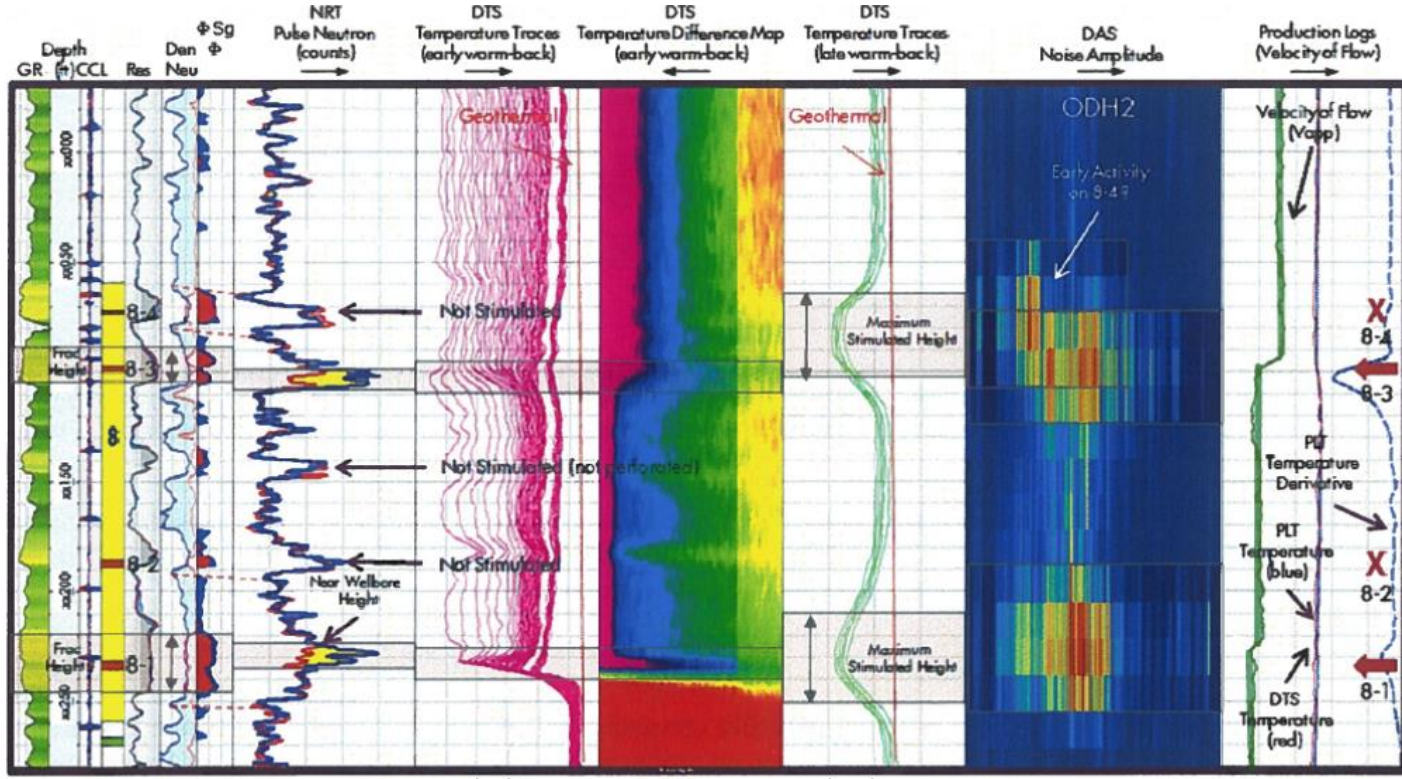
# What is the Value of this Information?

- Propped fracture height
- Perf cluster & stage efficiency
- Near wellbore connectivity
- Integrated solution



# Case Study #1 with Detection Technologies

- 4
- 3
- 2
- 1



SPE-168603

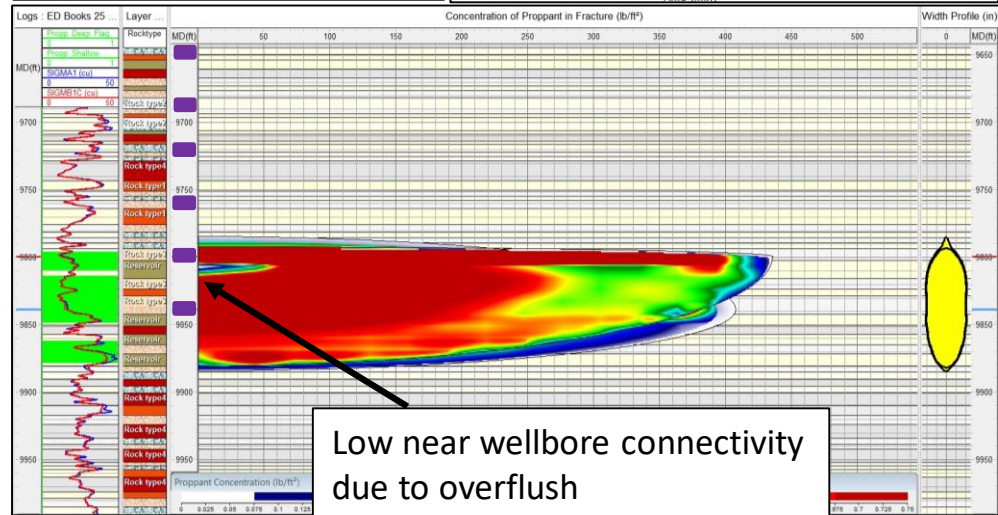
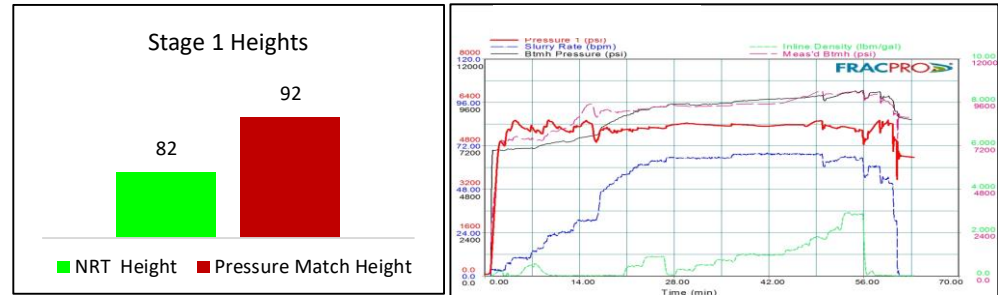
# Case Study #2 Permian

- Project goals:
  - To evaluate propped fracture height using FRACTUREVISION
  - To evaluate the effects of overflushing on near wellbore connectivity and fracture height using pressure matching

# Stage 1 Results

- Stage 1 has low overall perf near wellbore connectivity per perforation and short propped fracture height and 2 out of 6 perforations showing proppant with 2 distinct fractures.
- Consider avoiding over-flushing by any amount.
- Consider using viscous fluid systems (crosslinked or linear) for the entire treatments to ensure a uniform proppant distribution is achieved in near wellbore area.
- Consider decreasing the phase angle on perforations and shot density on stage 1.

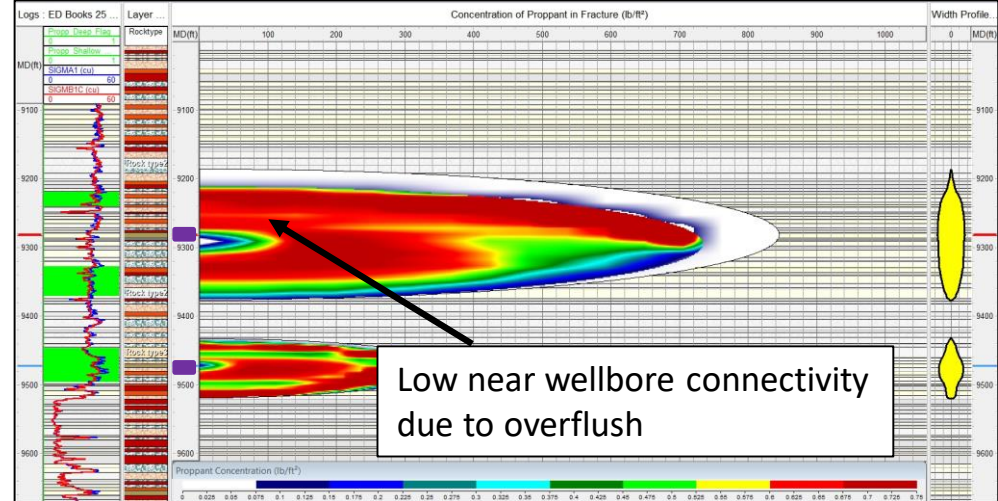
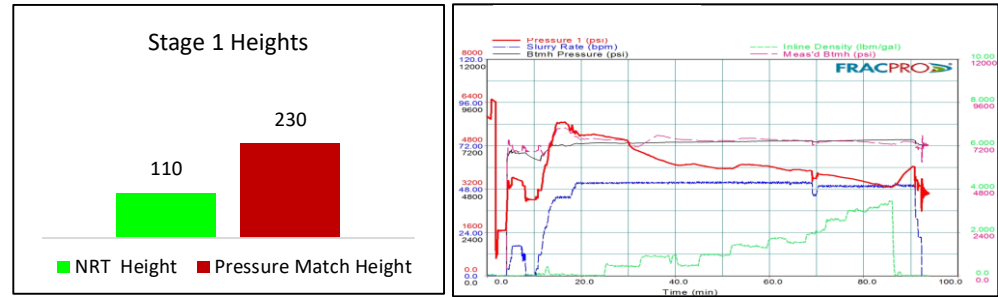
Total Fluid	2,857 bbls	6 clusters, 39 shots
Total Proppant	108,000 lb	31 bbl overflush + 24 bbl 15% HCL
Rate	65 bpm	



# Stage 2 Results

- Stage 2 has high near wellbore connectivity per perforation but low perf efficiency with 1 out of 2 perforations showing proppant.
- A zone above the stage interval shows propped fracturing.
- Consider avoiding over-flushing by any amount
- Consider using viscous fluid systems (crosslinked or linear) for the entire treatments to ensure a uniform proppant distribution is achieved in near wellbore area.

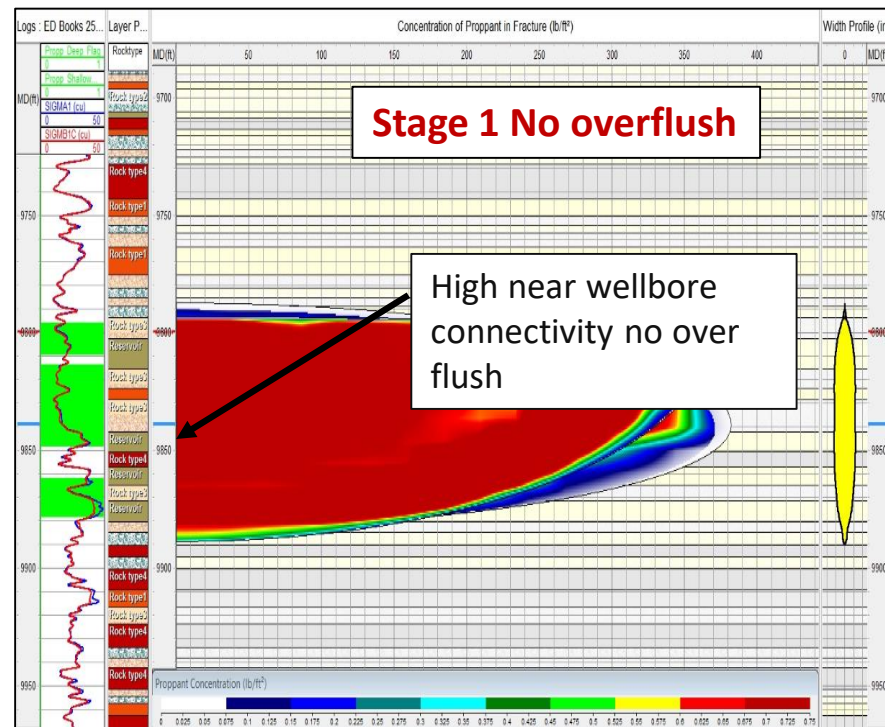
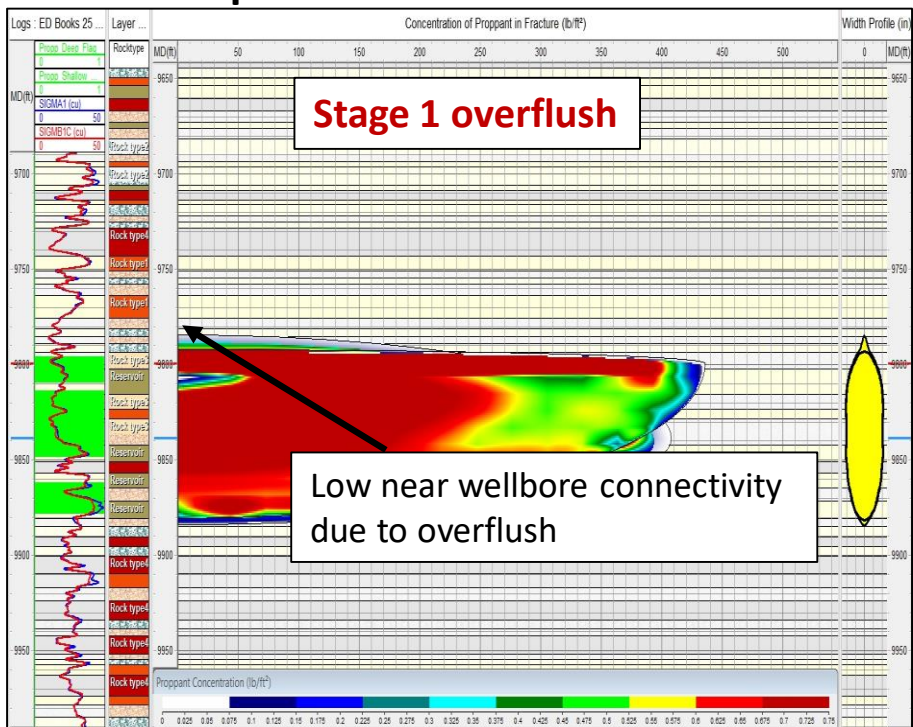
Total Fluid	3,759 bbls	2 clusters, 24 shots
Total Proppant	218,000 lb	9 bbl overflush + 12 bbl 15% HCL
Rate	51 bpm	





# Project Goal Effects of Overflushing

Avoiding overflush would lead to **30% increase** in near wellbore connectivity and **10% increase** in production



# Project Goals



- To evaluate propped fracture height using FRACTUREVISION
- To evaluate the effects of overflushing on near wellbore connectivity and fracture height using pressure matching
  - Over flushing has a negative impact on near wellbore connectivity and production

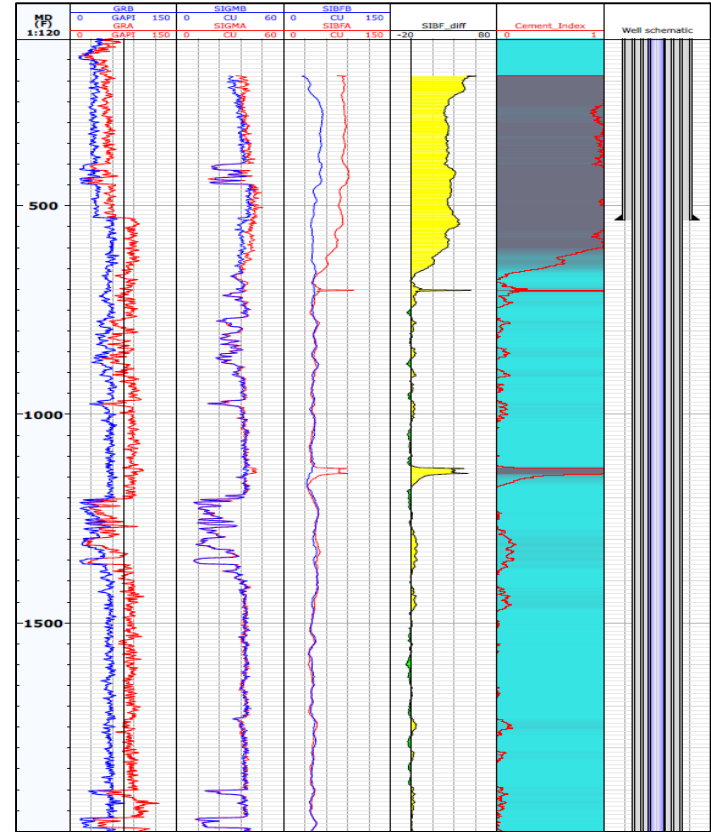
# Cement Evaluation Published Field Test

## Objective

- Determine final location of cement by logging through production tubing

## Results

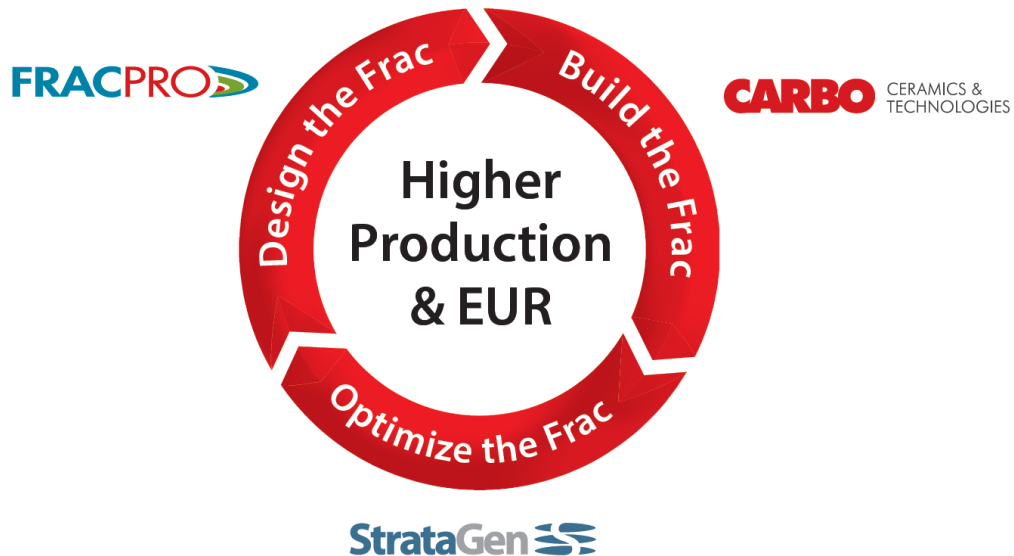
- Cement was detected to 680 feet through multiple casings



# Summary

- CARBONRT is a traceable proppant that can be detected downhole with standard pulsed neutron log
- No shelf life and no safety or handling requirements
- Direct measurement of the proppant near the wellbore
- Using FRACTUREVISION you can measure propped fracture height, propped stages and zones, and near wellbore connectivity
- FRACTUREVISION enables a high resolution perf spacing and stage spacing analysis

# Thank You!



## Questions?