Ovintiv™

CRAFT FRAC'ING *THE* CUBE

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April 2025

Designing for Efficiency

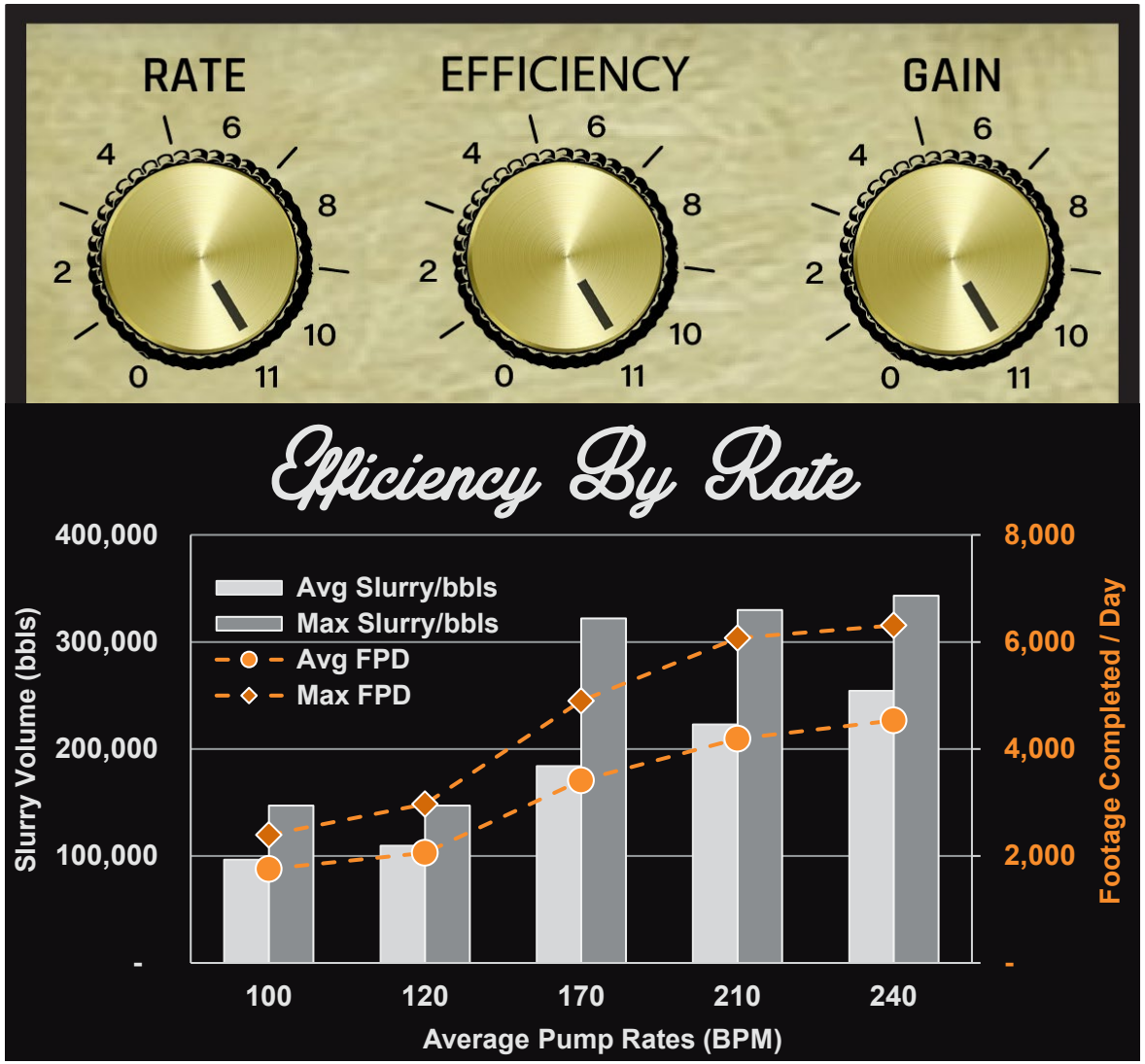
Maximize Value

- Improve Capital / production efficiency
- Don't sacrifice value for savings
- Reduce NPT / Overcome limiters

Design for Efficiency

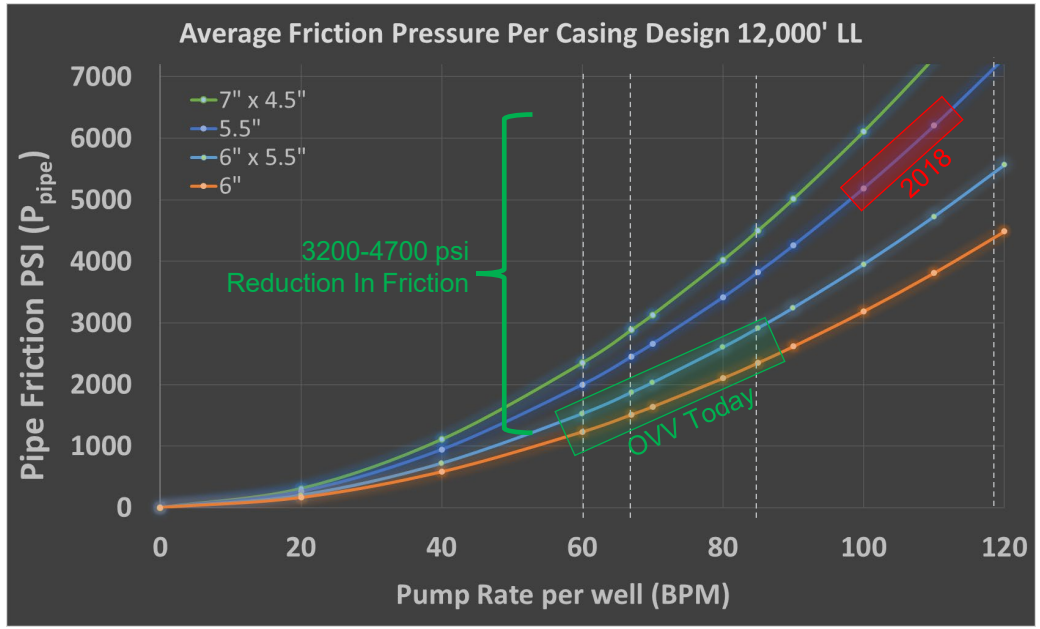
- Cluster efficiency matters
  - Confidently execute what is designed
- Eliminate wasted energy

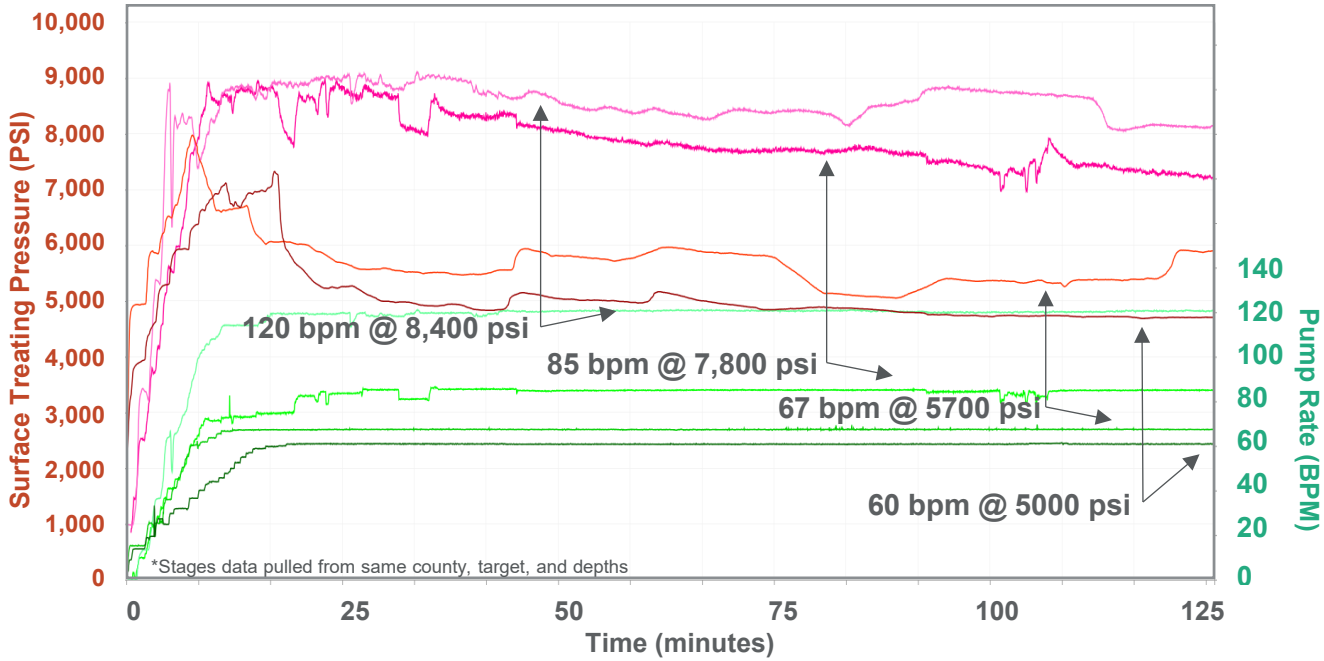
… "Because this one goes to 11"



Eliminating Wasted Energy (P_{pipe})

Eliminating Wasted Energy (P_{pipe}) **Surface Treating Pressure = $P_{near\ wellbore} + P_{formation} + P_{perf} + P_{pipe} - P_{hydrostatic}$**





Larger Production Casing

- Increased flow area **reduces P_{pipe}**
- Historic simul-frac data with **5.5" vs**…
  - Tapered **6"x 5.5": +7 bpm** & **~450 psi** lower
  - Full string **6": +12.5 bpm** & **~230 psi** lower

Higher Total Pump Rate over Multiple Wells

- Increasing total rate improves effiency
- Decreasing rate/well **reduces P_{pipe}**
  - Stage architecture needs to be adjusted

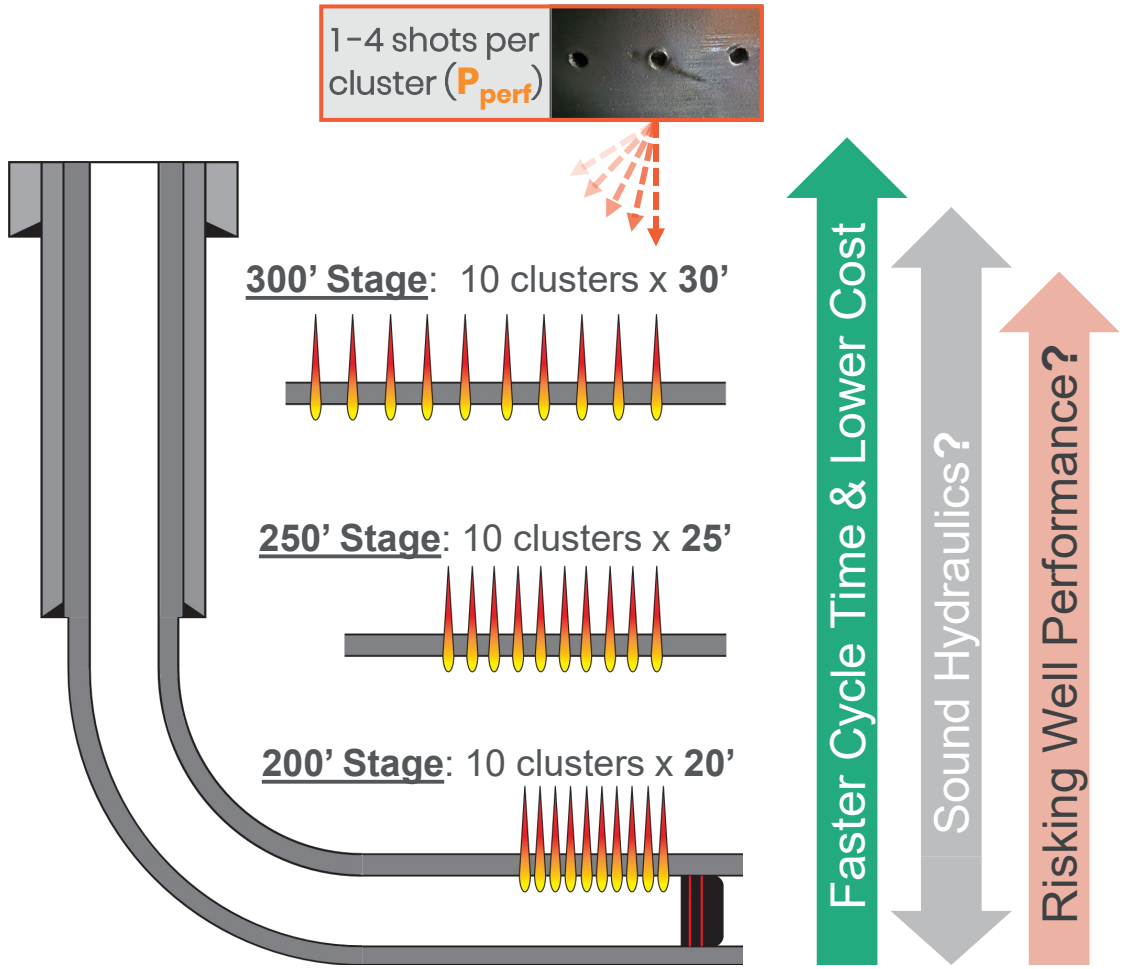
What is GOOD Stage Architecture

Stage length is important…

- If there is good isolation between stages during frac
- If geologic hazards (i.e. faults) are present
- If you have good hydraulics
- If it fits your capital budget

Cluster spacing is important…

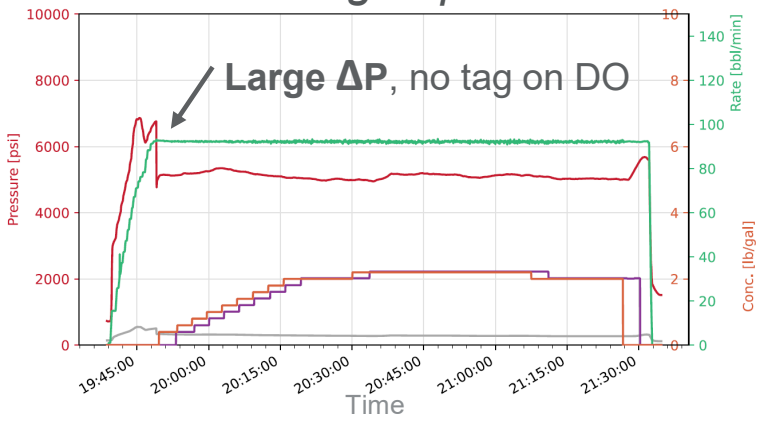
- When geology matters
- If you care about cluster efficiency
- If you have cluster isolation



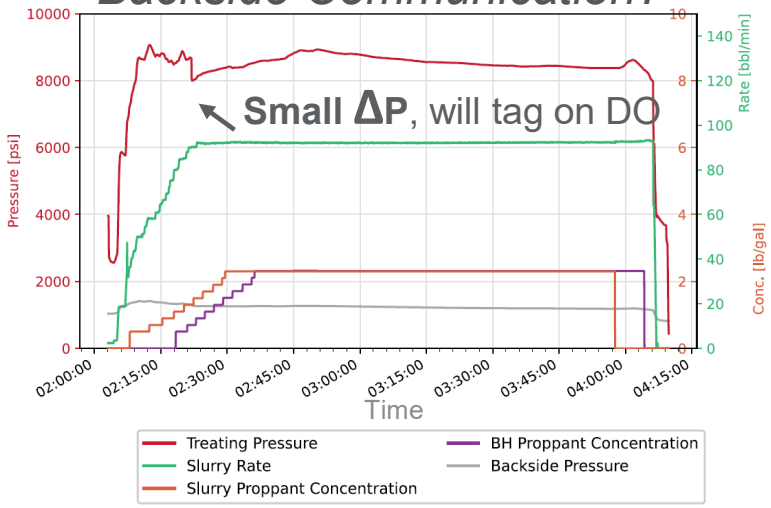
How do you balance **rate/cluster**, **perf friction**, and **cluster spacing** relative to stage length?

What Makes Stages Ineffective?

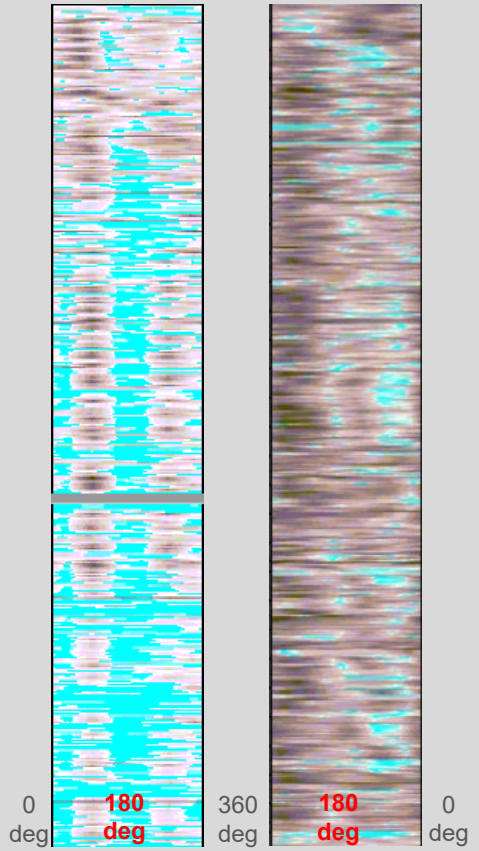
Plug Slips



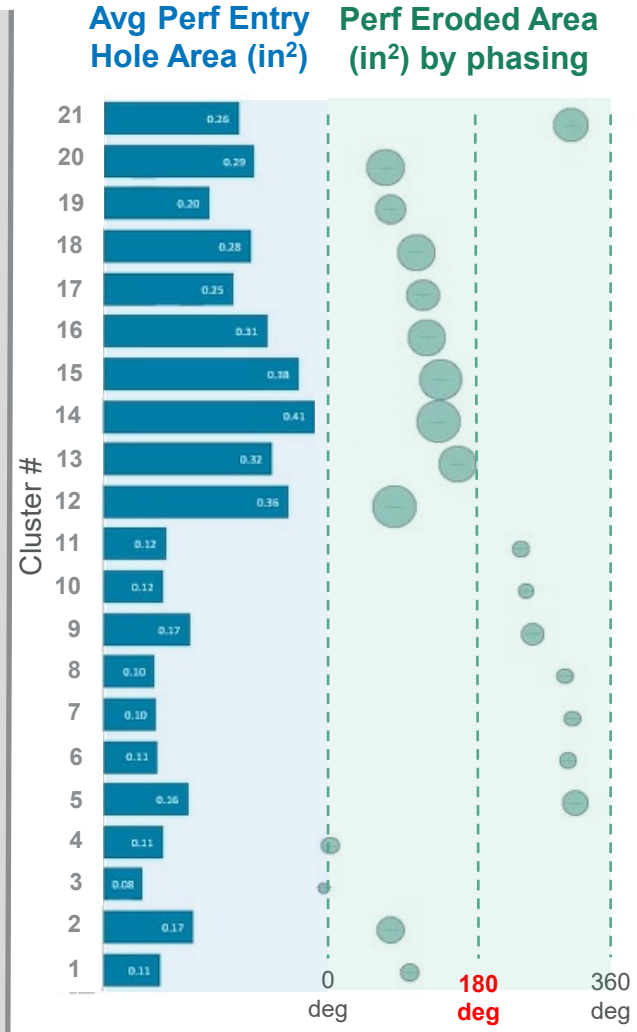
Backside Communication?



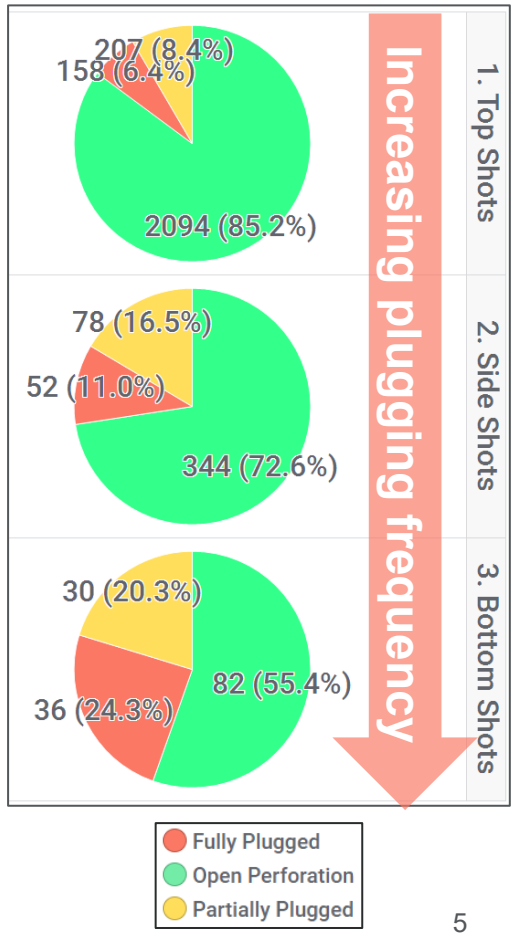
Poor Cement Quality



Poor Cluster Design

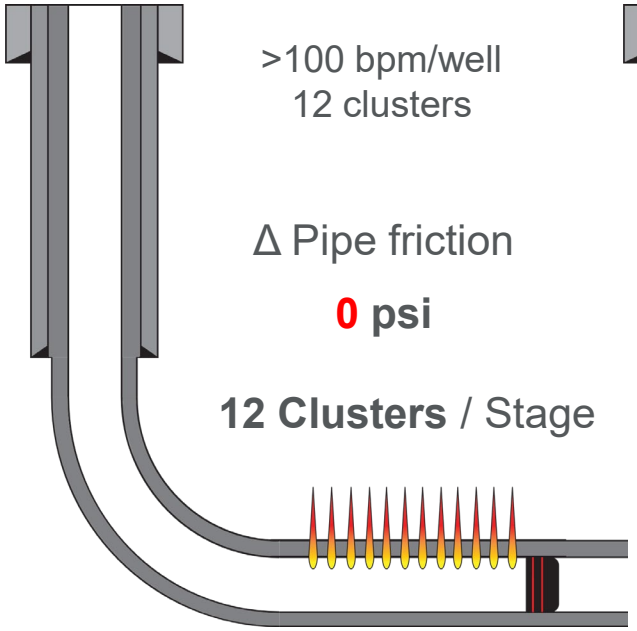


Perf Plugging vs. Orientation
SPE-217769-MS



Stage Design by Rate

Treating Pressure / Fuel Consumption / FR Usage

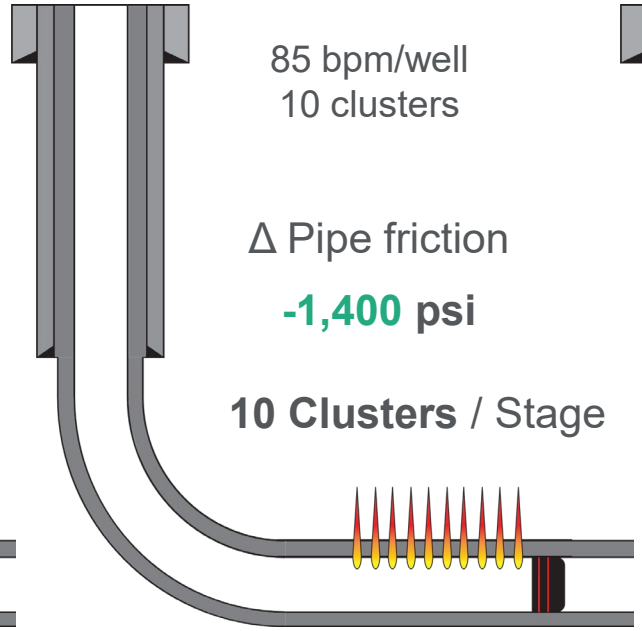


>100 bpm/well
12 clusters

Δ Pipe friction

0 psi

12 Clusters / Stage

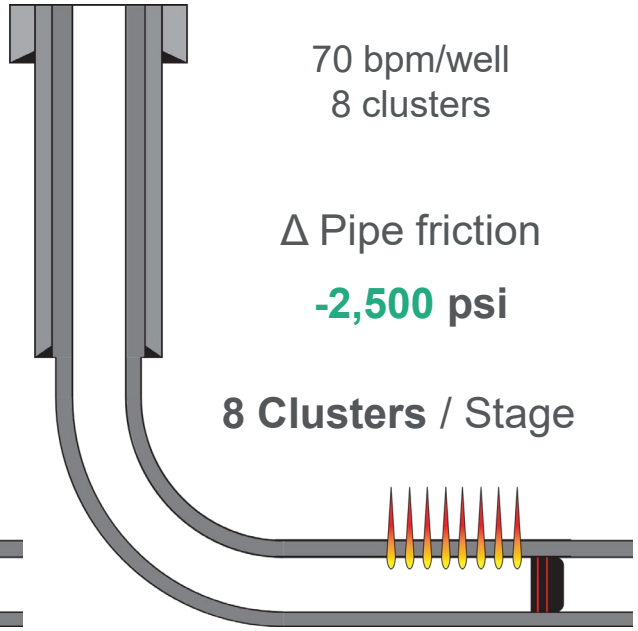


85 bpm/well
10 clusters

Δ Pipe friction

-1,400 psi

10 Clusters / Stage

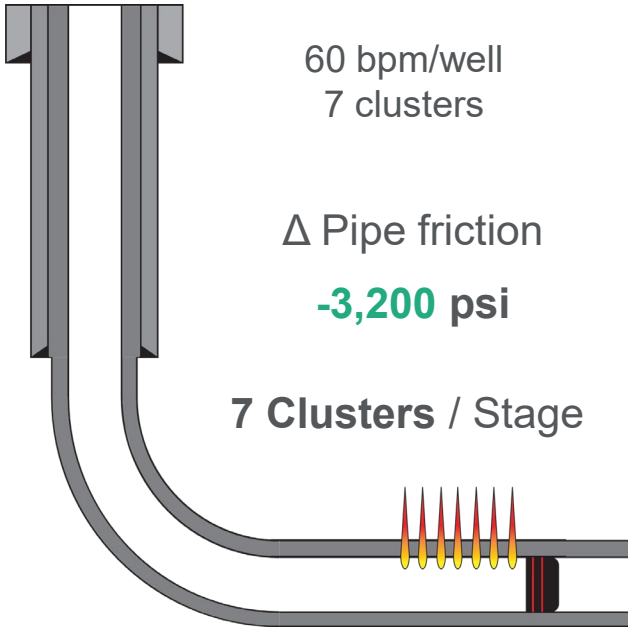


70 bpm/well
8 clusters

Δ Pipe friction

-2,500 psi

8 Clusters / Stage



60 bpm/well
7 clusters

Δ Pipe friction

-3,200 psi

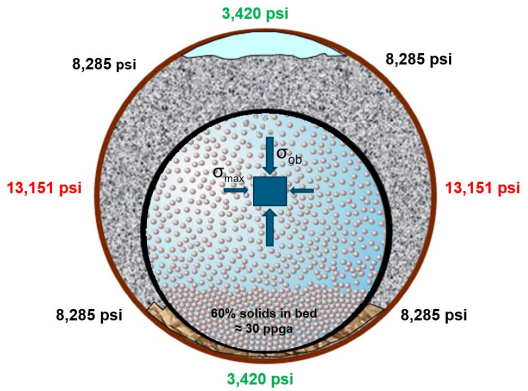
7 Clusters / Stage

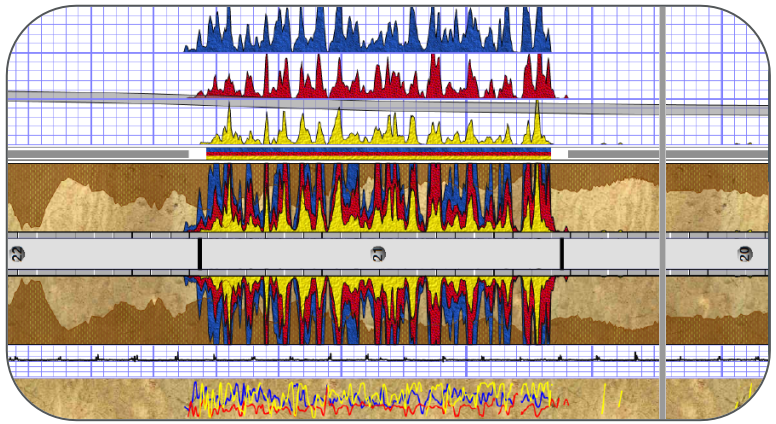
Hydraulics drives stage architecture

- Cluster efficiency / uniformity drives how many clusters we design per stage
- Stage Length = **Desired** cluster spacing (X) **Effective** number of clusters

$$STP = P_{near\ wellbore} + P_{formation} + P_{perf} + P_{pipe} - P_{hydrostatic}$$

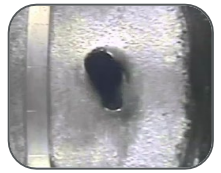
Ovintiv

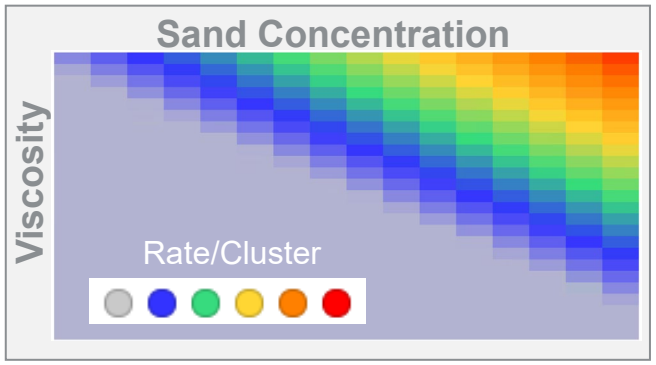


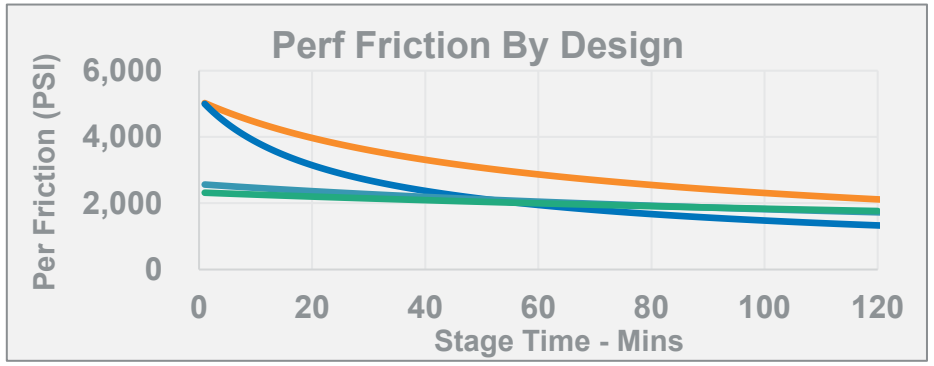


Pre-Frac

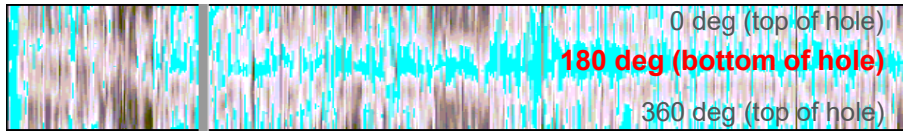
Post-Frac



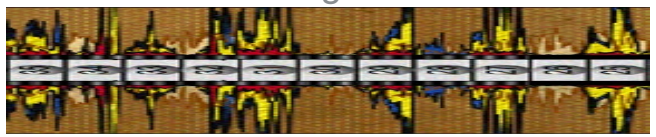




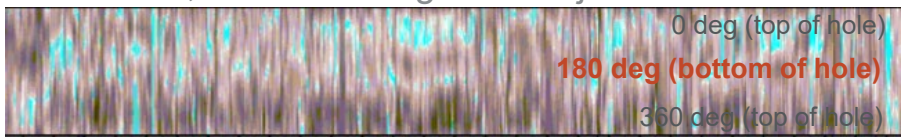
Un-centralized, no rotation during cement job



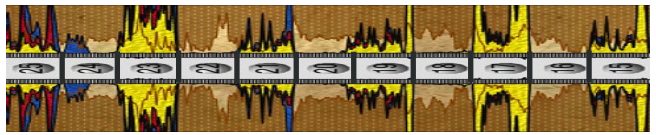
Poor Stage Isolation



Centralized, rotated during cement job



Good Stage Isolation



Our Approach for Success

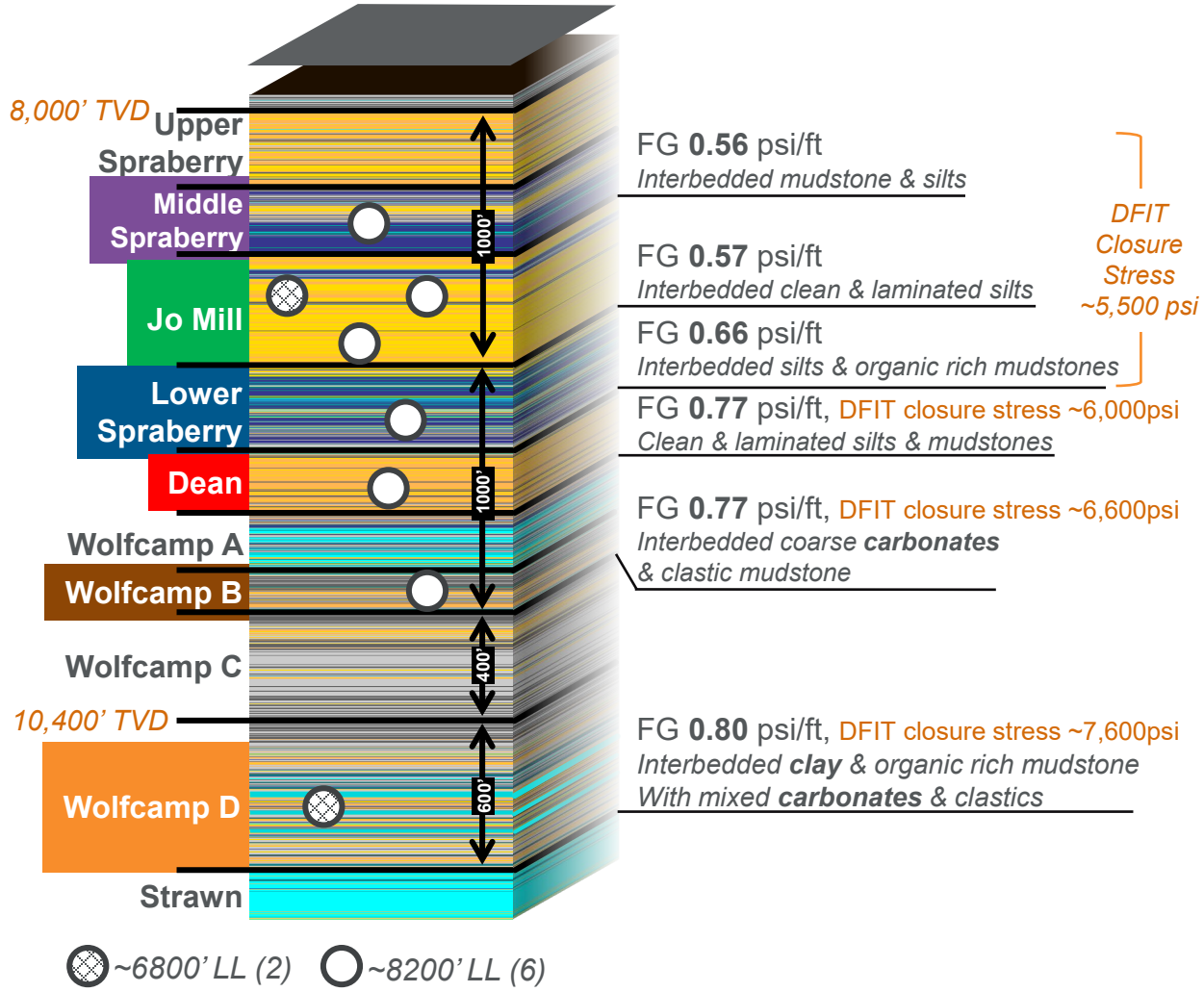
Effective cluster spacing is driven by high cluster efficiency

- **Orienting perfs** in the same plane can help reduce NWB tortuosity
- **Perf friction** should be designed to overcome NWB tortuosity, Sh min, and stress shadowing
- **Rate cluster/hole**, viscosity, mesh size, and sand ramp in pump schedule are also factors
- RA tracer, fiber, & down hole cameras are great **diagnostics** for measuring cluster efficiency

Cluster efficiency matters if you…

- care about cluster spacing
- want uniform proppant/fluid distribution inside pipe

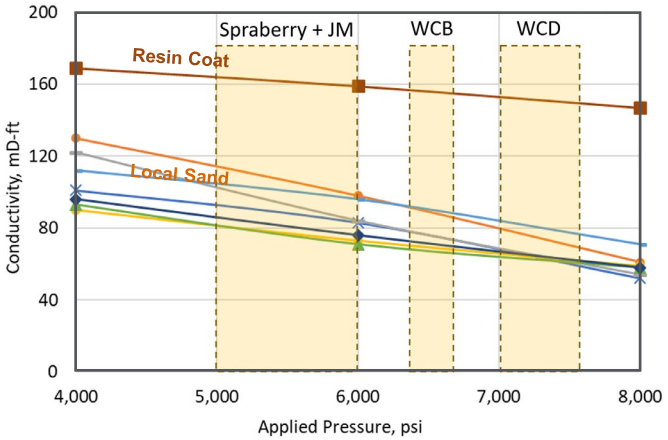
The Cube

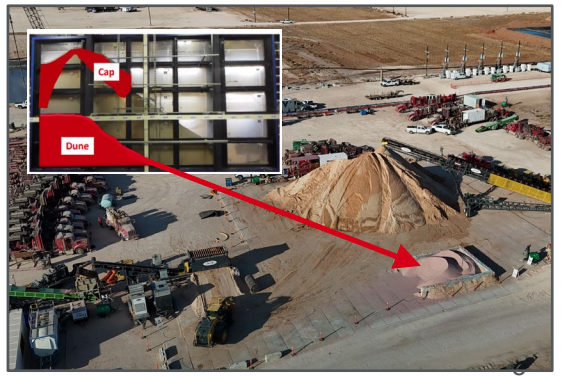


Martin County Infill last development

- The challenge: different lateral lengths and job sizes
  - Shallow stack 3000 lbs / 2000 gal/ft
  - WCB targeting minimum 2600 gal/ft
  - WCD targeting minimum 2800 gal/ft

  Ideally want tighter cluster spacing due to tighter rock
  - *Carbonates and clays limit frac growth within zone (dip in fiber, OPM, micro seismic, tracers, revochem)*
  - *Faster declines associated with higher closure stress / embedment*
- Improve **fracture conductivity** with resin coated sand in WCD
  - **2X** improvement and **3X** in permeability than local sand



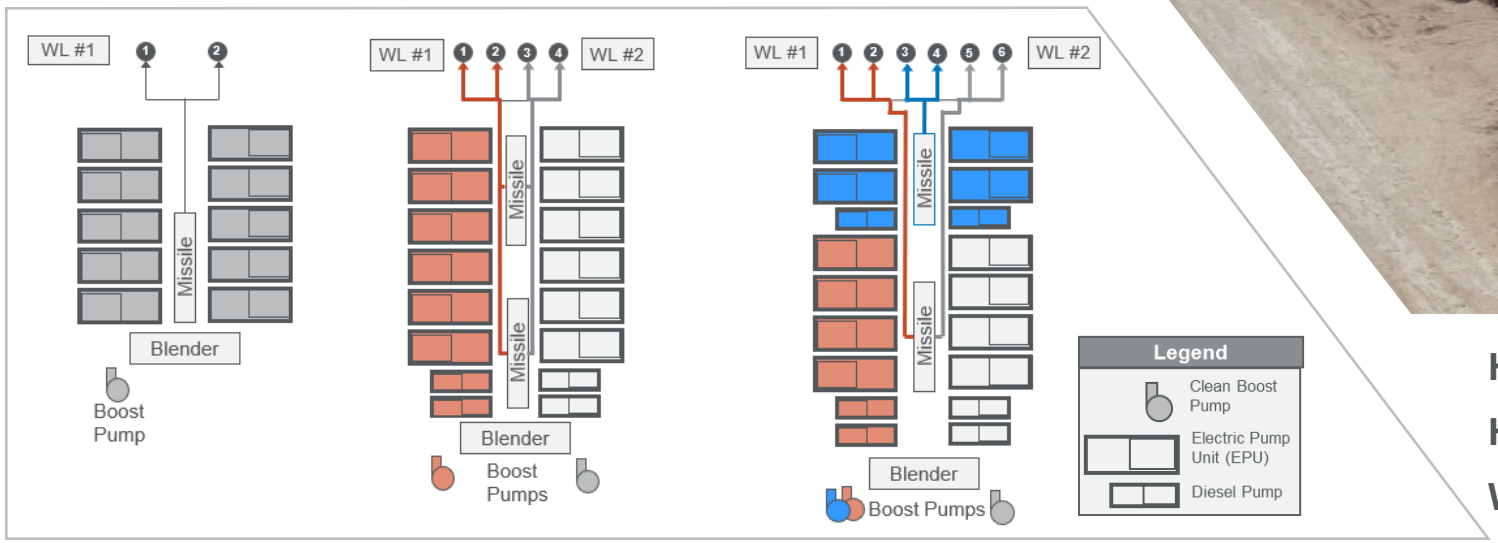


Lead & Tail with resin coat ~100 lbs/ft

Craft Frac Execution

Myths of Execution

- Blindly pumping into all wells
- Lower SRV due to less pump rate/well
- Multiple blenders needed
- Even number of wells/pad
- Same design on all well pairs
  - Gal/ft, lbs/ft, stage architecture, same pump rates
- FR and chems are the same in all wells



How far can we push total pump rate?

How many wells can we pair together to meet design?

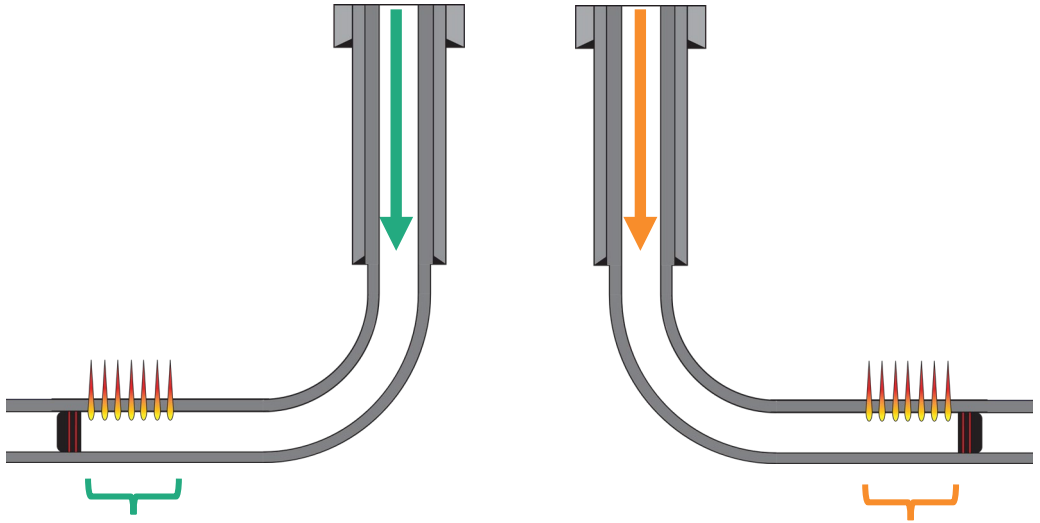
What is the best way to maximize effiency for the Cube?

Craft Frac Execution

Wells 1,2,4,5,6,7: 60 bpm
525,000 lbs / 8,250 bbls

=

Well 3,8: 60 bpm
525,000 lbs / 8,250 bbls



175' = 3000 lbs / 2000 gal/ft
7 CL x **25'** = 75 Klbs & 50 Kgal / cluster

$$\frac{\textit{Same Volume}}{\textit{Smaller Stage}} = \textit{Higher intensity}$$

145' = 3600 lbs / 2400 gal/ft
7 CL x **20.7'** = 75 Klbs & 50 Kgal / cluster

124' = 4200 lbs / 2800 gal/ft
7 CL x **17.7'** = 75 Klbs & 50 Kgal / cluster

Always Honor you Hydraulics!

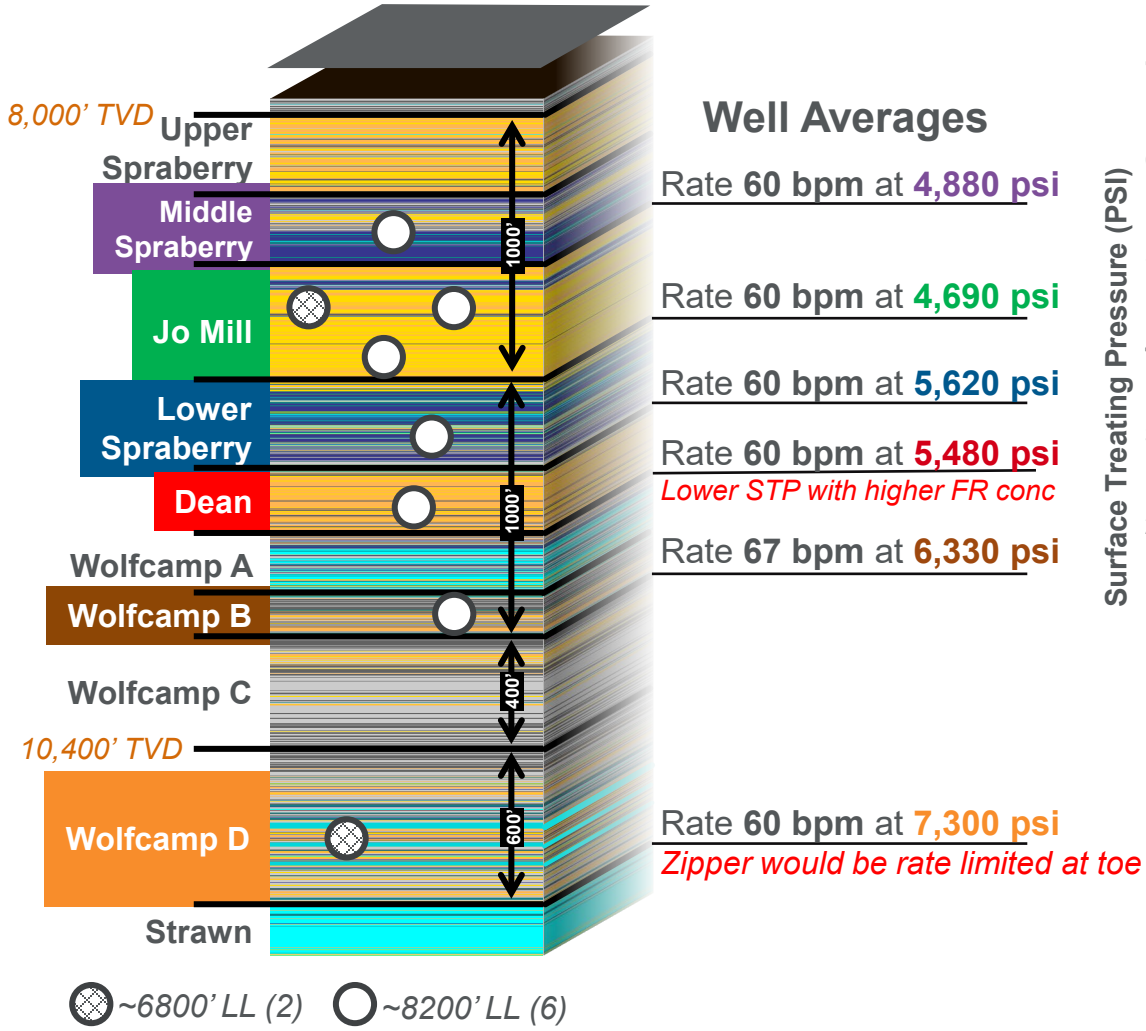
Method 1: Increase job size at the same PPG

- Increase intensity/foot by tightening cluster spacing

Method 2: Increase the fluid volume

- Increase fluid volume by adding **clean** rate to one bank
- +10 bpm over 2 hours = +350 gal/ft

Craft Frac Execution



Well Averages

Rate **60 bpm** at **4,880 psi**

Rate **60 bpm** at **4,690 psi**

Rate **60 bpm** at **5,620 psi**

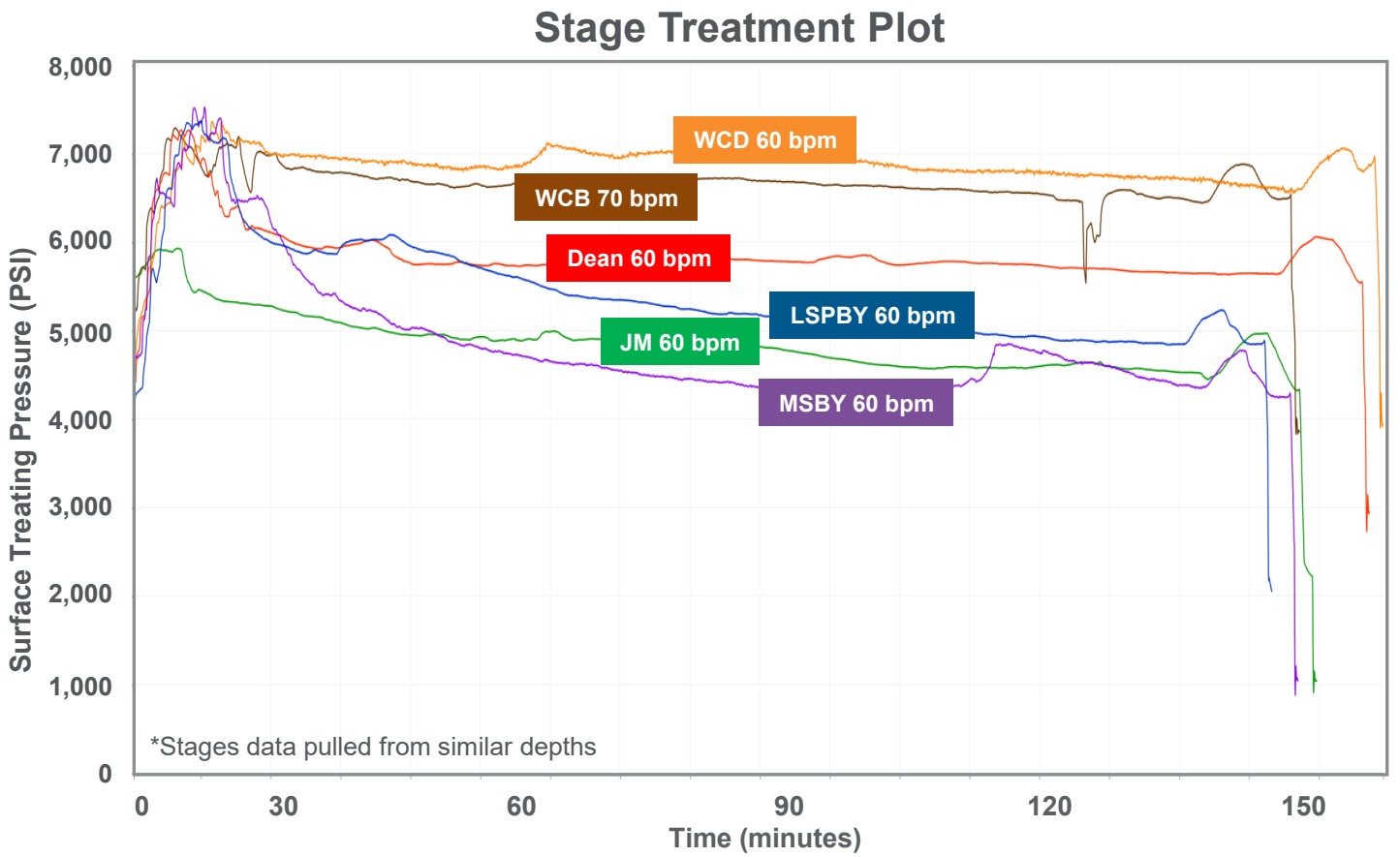
Rate **60 bpm** at **5,480 psi**

Lower STP with higher FR conc

Rate **67 bpm** at **6,330 psi**

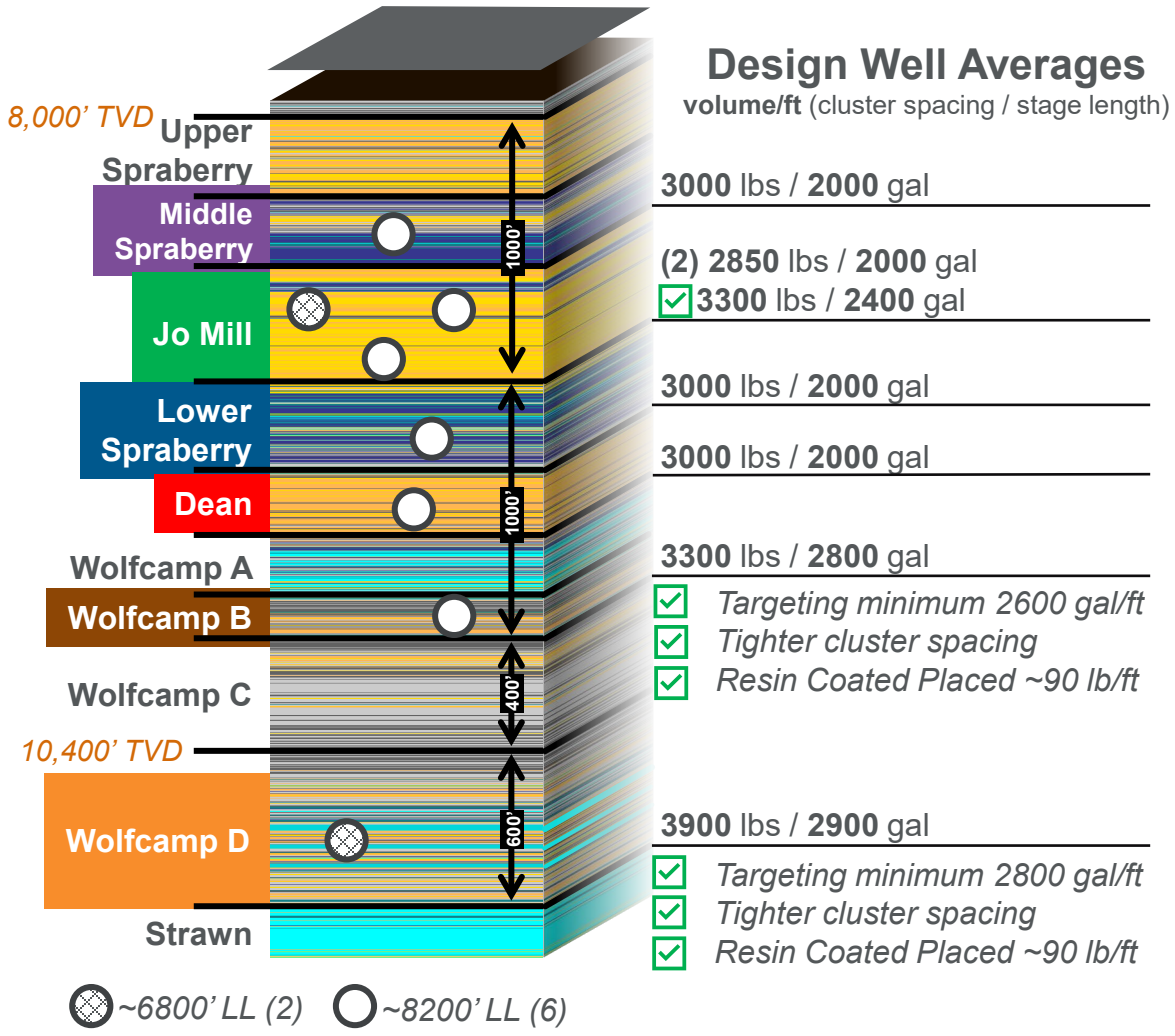
Rate **60 bpm** at **7,300 psi**

Zipper would be rate limited at toe



- Wells treated **~2,800 psi lower** than historic zipper fracs
  - All wells would be pressure limited with traditional 5.5" casing and longer laterals
- Dean and JM ran slightly less FR (0.11 gpt)
- The WCB was designed with higher pump rate/well

Craft Frac Execution



Design Well Averages

volume/ft (cluster spacing / stage length)

3000 lbs / **2000** gal

(2) **2850** lbs / **2000** gal

☑ **3300** lbs / **2400** gal

3000 lbs / **2000** gal

3000 lbs / **2000** gal

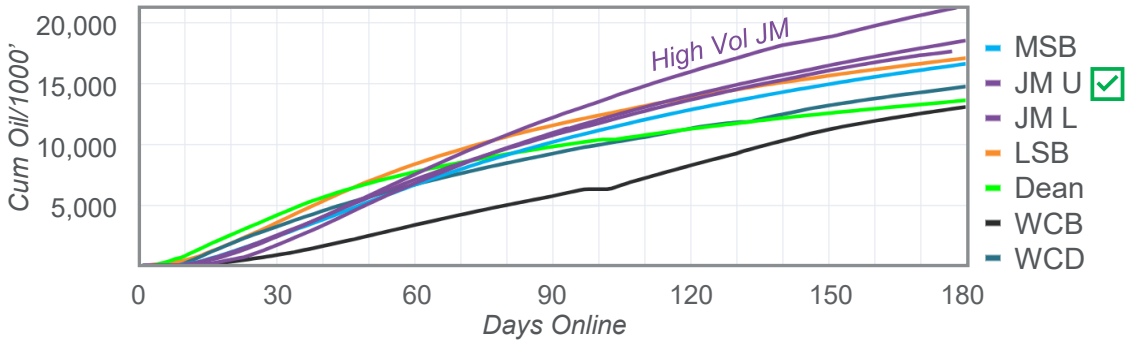
3300 lbs / **2800** gal

- ☑ *Targeting minimum 2600 gal/ft*
- ☑ *Tighter cluster spacing*
- ☑ *Resin Coated Placed ~90 lb/ft*

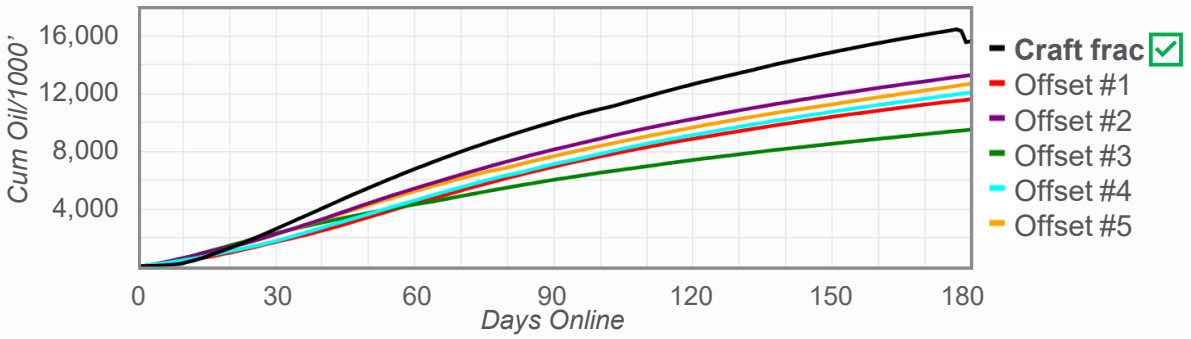
3900 lbs / **2900** gal

- ☑ *Targeting minimum 2800 gal/ft*
- ☑ *Tighter cluster spacing*
- ☑ *Resin Coated Placed ~90 lb/ft*

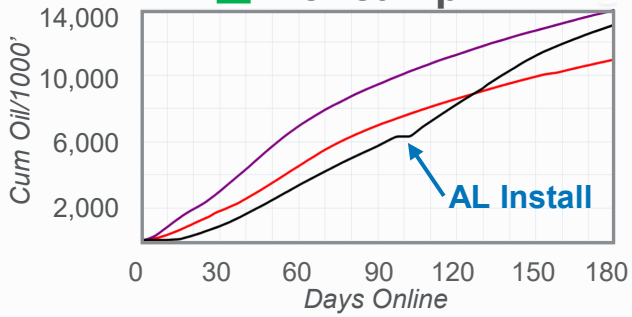
Pad Production



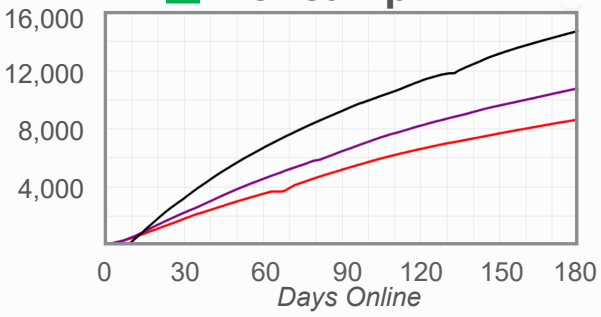
☑ Pad Production vs. Offset



☑ Wolfcamp B



☑ Wolfcamp D



Craft Frac'ing the Cube

Turned it up to 11!

Maximized Total Rate

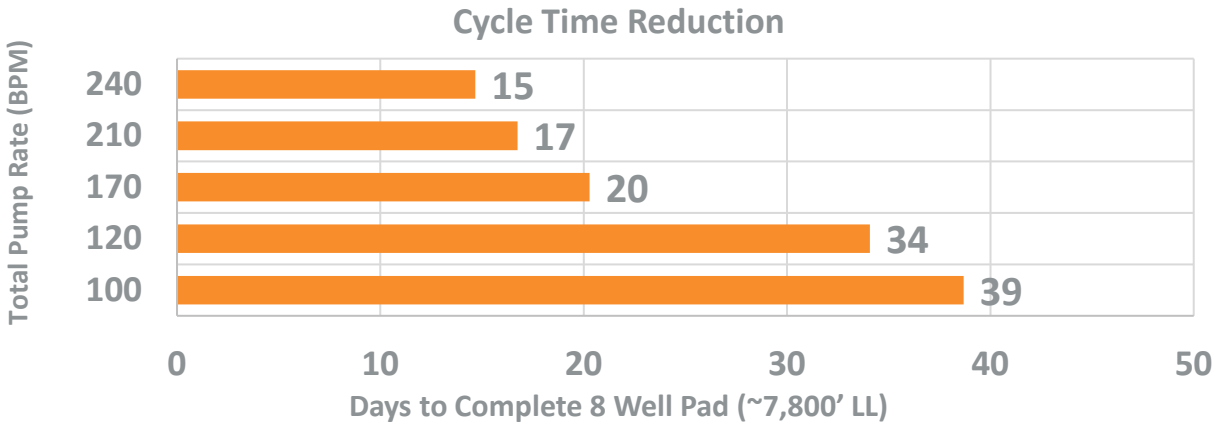
- Reduce cycle time

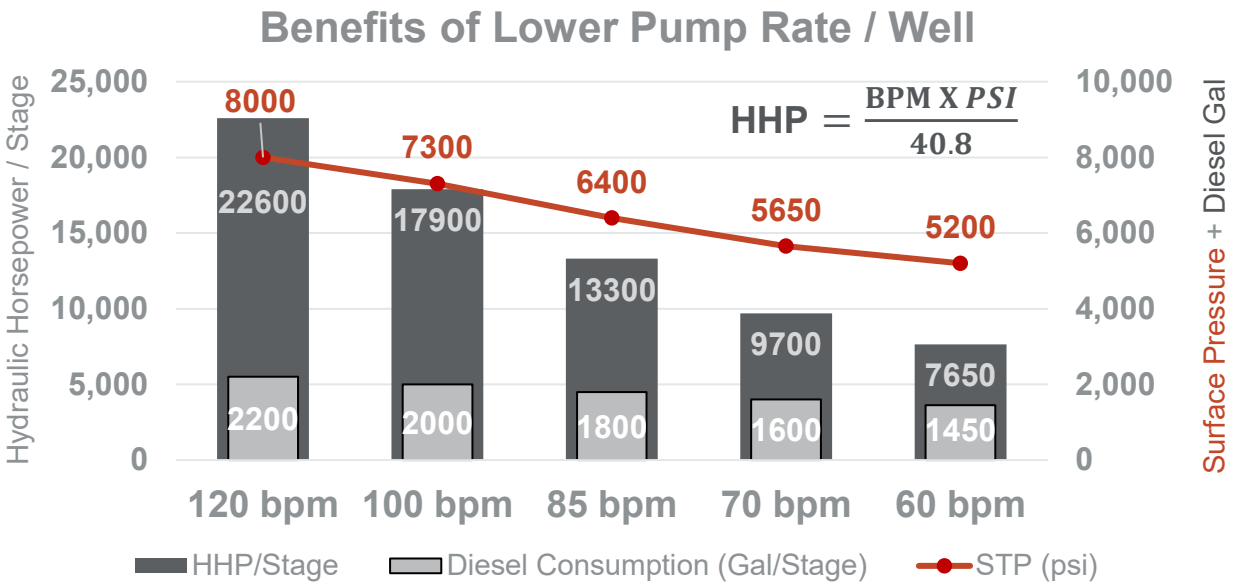
Eliminated Wasted Energy P_{pipe}

- Optimized casing design
- Reduced total rate/well
  - Lower chem usage + fuel consumption
- Shortened stages
- Reduced proppant inertia

Craft Frac'd the Cube

- Honored hydraulics
- Tailored completion design by bench
- Didn't sacrifice value for savings!
- Maximized efficiency!





*HHP/Fuel consumption based on 200' stage and 2000 gal/ft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