Completion Deliverable

Boggess 5H

Geometric Design

Geometric Design Summary

Fracture ID

Limited Entry Calculator Inputs: ehd: 0.40” Cd: 0.70 Injection rate: 85 bpm Net stress: 1200 psi (regional estimate) Shots per cluster: 8 Clusters per stage: 5
Results Summary: Stages analyzed: 1-54 Predicted avg stage cluster efficiency: 61% Predicted max stage cluster efficiency: 100% Predicted min stage cluster efficiency: 60% Total clusters analyzed: 268 Total clusters effectively stimulated (predicted): 162
Problem stage indicators: Stress variability (scaled 0-300 psi) Layering (scaled 25-40% layered)

Perforation Efficiency and Problem Stage Identifier

Fracture ID

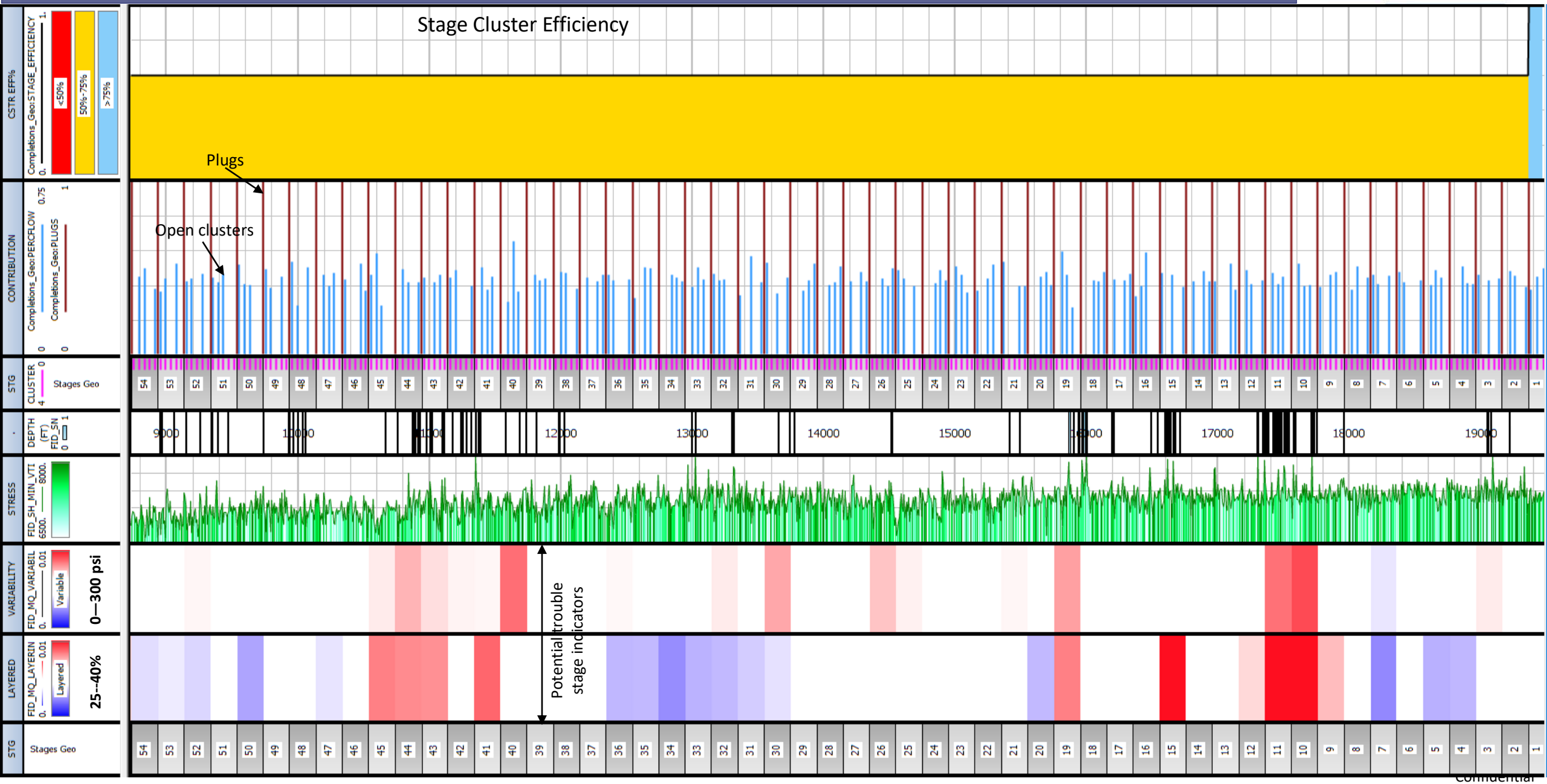
The following slides show graphical images of the completion's **predicted perforation efficiency** by stage and **potentially difficult stages**. Predicted perforation efficiency is calculated by determining if the design's perforation friction is sufficient to overcome the measured stress variability. Then, the percent flow is computed using plain strain.

Based on Fracture ID's experience, the following measurements can indicate **potentially difficult stages**:

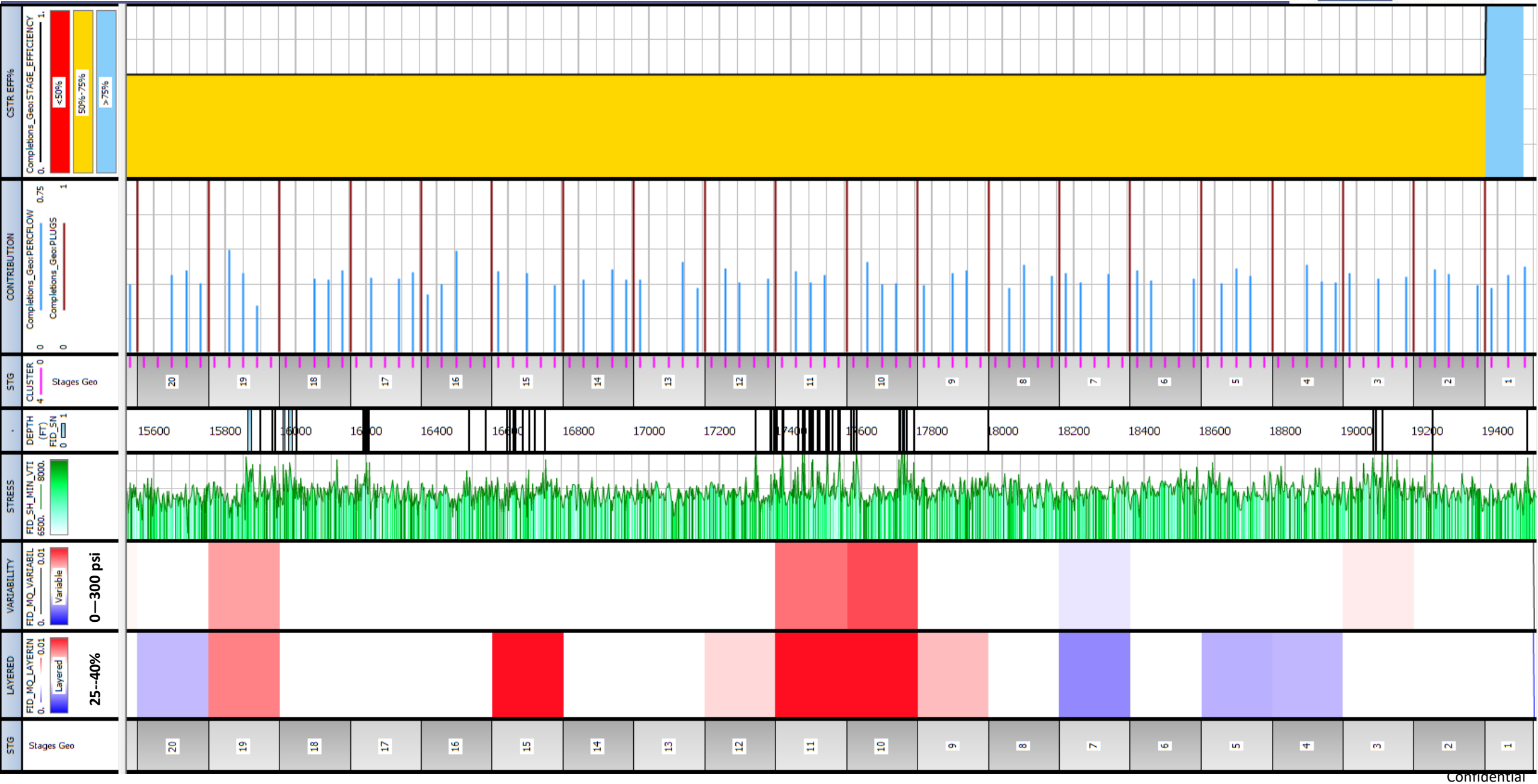
Layering: High layering can indicate higher clay content and/or more ductile rock. Thus, in highly layered stages initiating and maintaining a fracture may be more difficult. Intervals with High Layering have a higher likelihood of "screenout" events.

Stress Variability: Stages with the highest Variability may have lower perforation efficiency because of the additional perforation friction required to effectively distribute fluid and proppant to all clusters. Low perforation efficiency can result in increased treating pressures and proppant bridging.

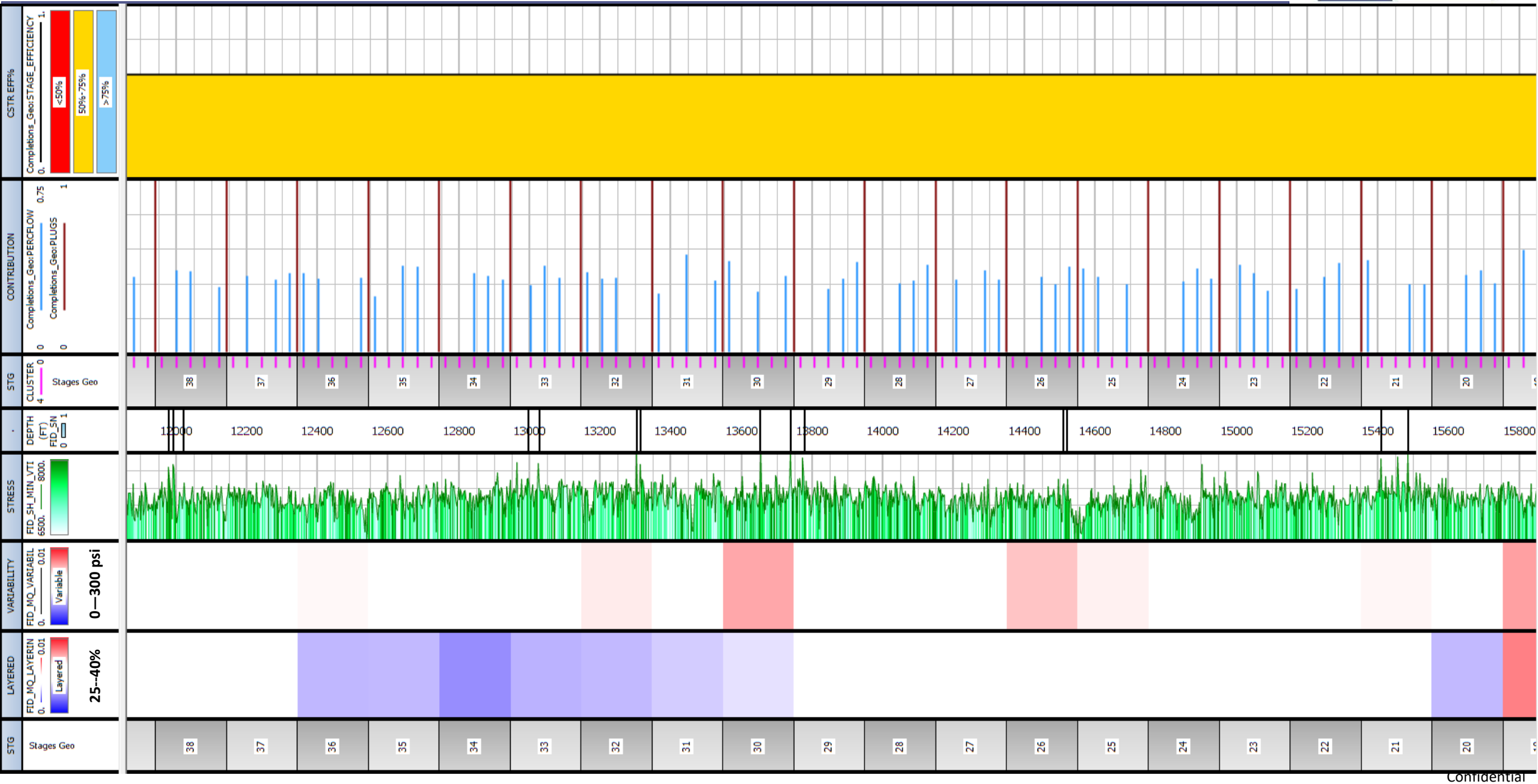
Geometric Completion: All Lateral Data



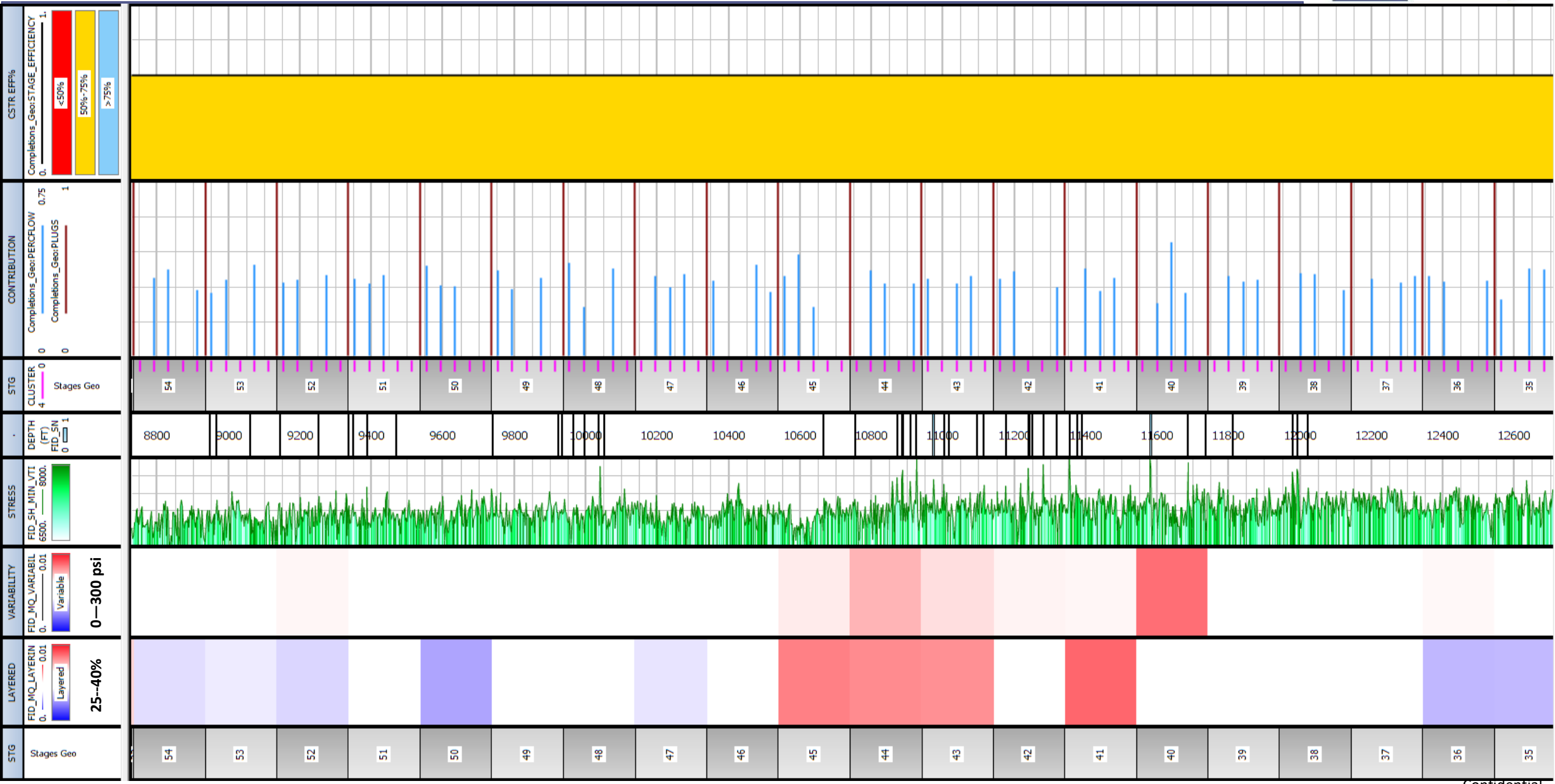
Geometric Completion: Stages 1-20



Geometric Completion: Stages 20-38



Geometric Completion: Stages 35-54



Geometric Stage Summary

Fracture ID

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
1	31%	150	100%
2	31%	162	60%
3	31%	198	60%
4	29%	147	60%
5	29%	162	60%
6	32%	157	60%
7	28%	113	60%
8	33%	143	60%
9	36%	152	60%
10	40%	272	60%
11	41%	253	60%
12	35%	180	60%
13	33%	152	60%
14	34%	130	60%
15	42%	182	60%
16	33%	144	60%
17	33%	162	60%
18	35%	189	60%
19	37%	232	60%
20	30%	162	60%
21	31%	194	60%
22	32%	179	60%
23	33%	181	60%
24	32%	188	60%

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
25	32%	196	60%
26	33%	215	60%
27	32%	170	60%
28	32%	160	60%
29	34%	180	60%
30	31%	228	60%
31	30%	191	60%
32	30%	199	60%
33	29%	189	60%
34	28%	154	60%
35	30%	182	60%
36	29%	193	60%
37	32%	150	60%
38	33%	189	60%
39	31%	185	60%
40	34%	255	60%
41	38%	193	60%
42	34%	195	60%
43	37%	204	60%
44	37%	224	60%
45	37%	199	60%
46	32%	167	60%
47	31%	157	60%
48	34%	155	60%

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
50	29%	166	60%
51	31%	155	60%
52	30%	193	60%
53	31%	177	60%
54	30%	177	60%
55*			
56*			

*Stages 55 and 56 are in the curve section

Engineered Design

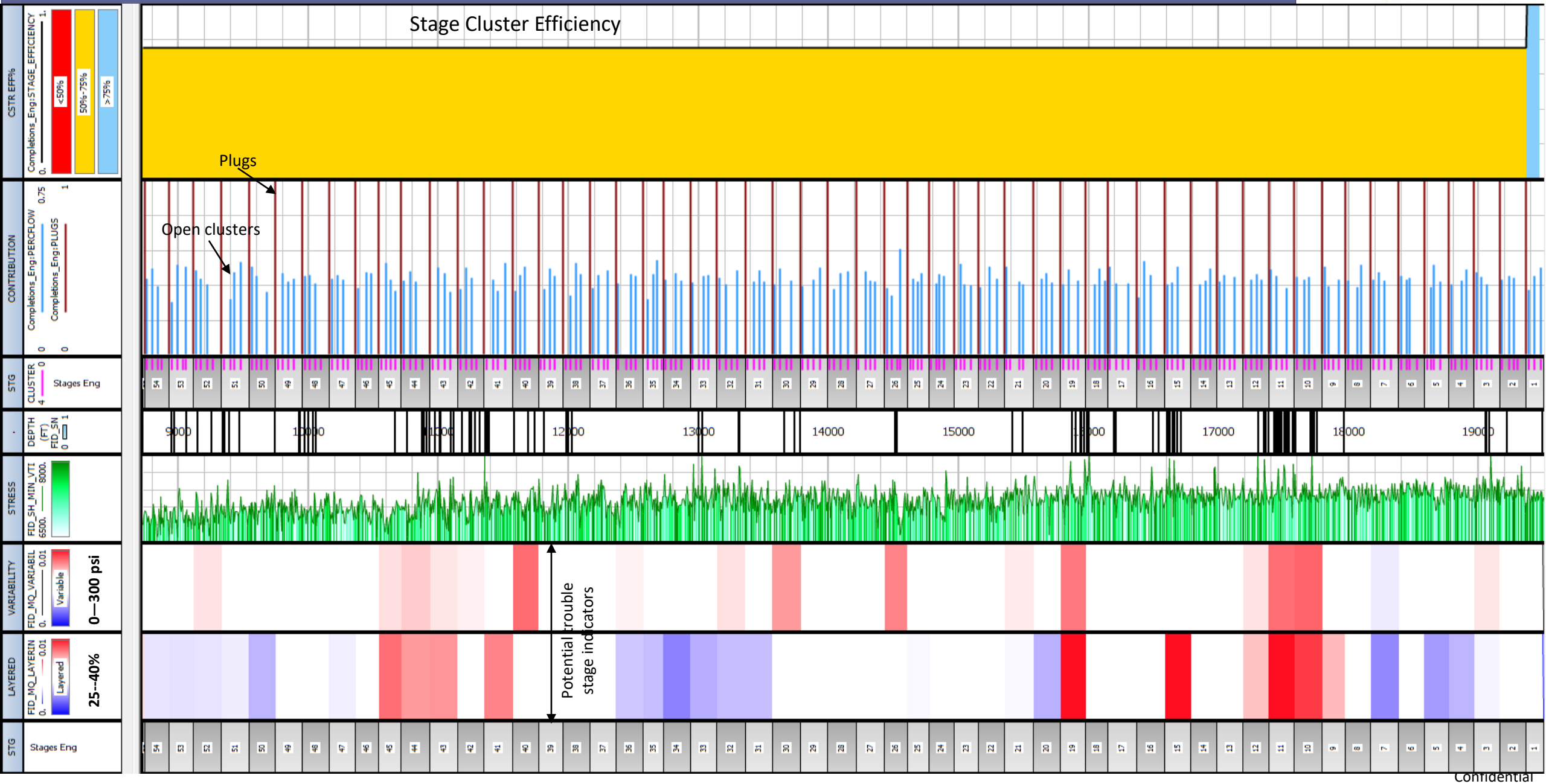
Engineered Design Summary

Fracture ID

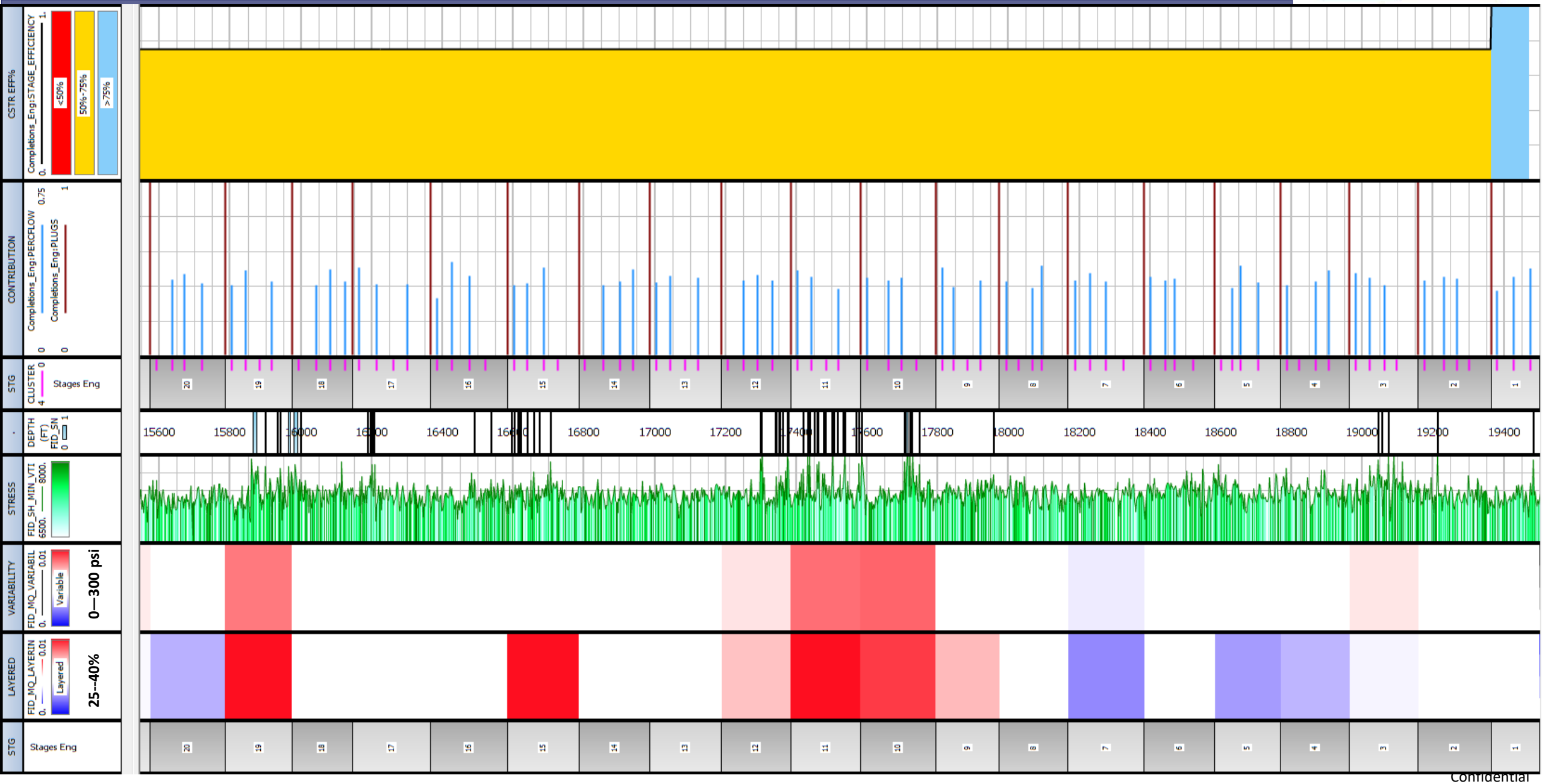
LE Calculator Inputs: ehd: 0.40” Cd: 0.70 Injection rate: 85 bpm Net stress: 1200 psi (regional estimate) Shots per cluster: 8 Clusters per stage: 4-5
Results Summary: Stages analyzed: 1-54 Predicted avg stage cluster efficiency: 61% Predicted max stage cluster efficiency: 100% Predicted min stage cluster efficiency: 60% Total clusters analyzed: 266 Total clusters effectively stimulated (predicted): 162
Problem stage indicators: Stress variability (scaled 0-300 psi) Layering (scaled 25-40% layered)

Engineered Completion: All Lateral Data

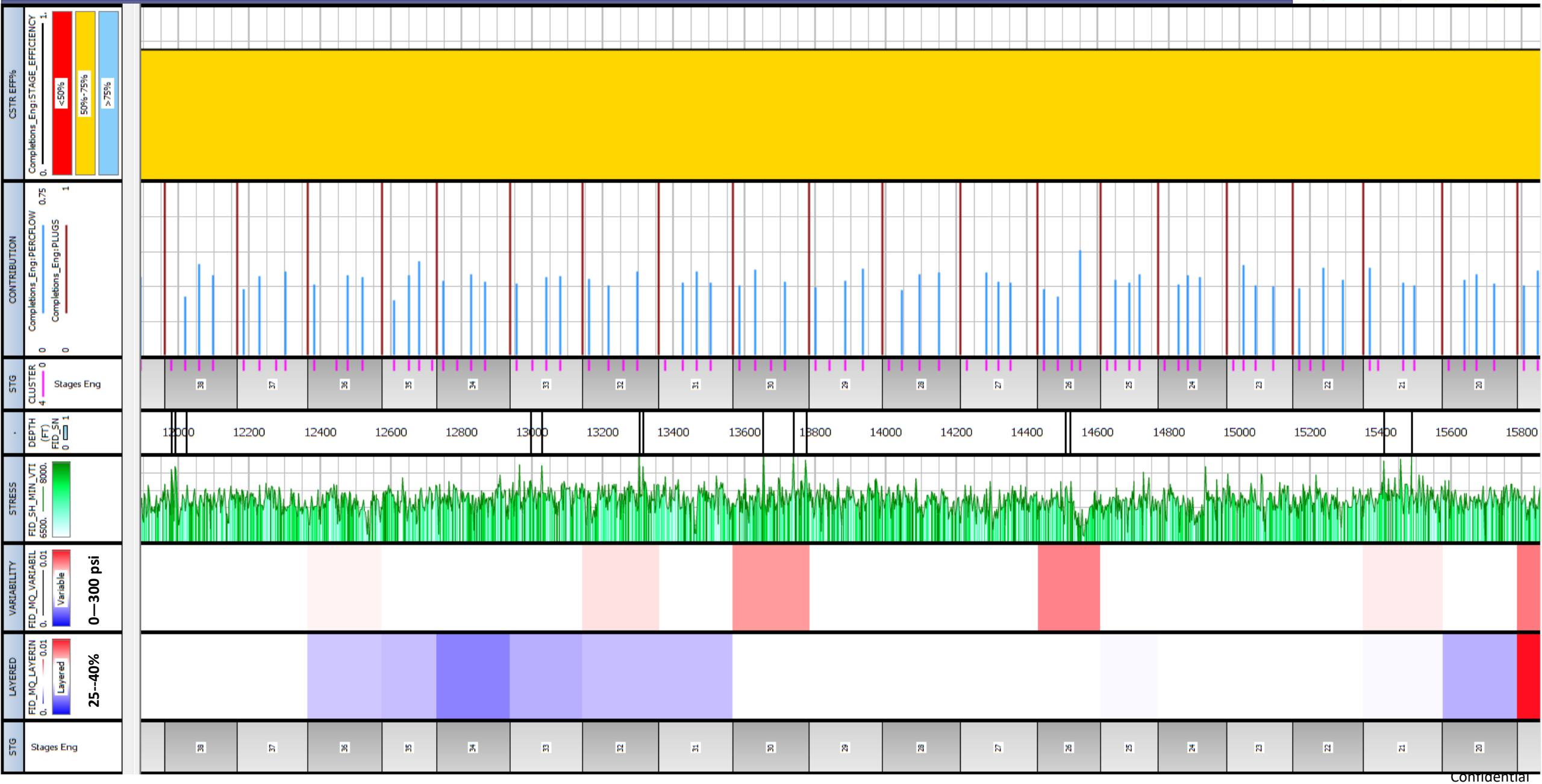
Fracture ID



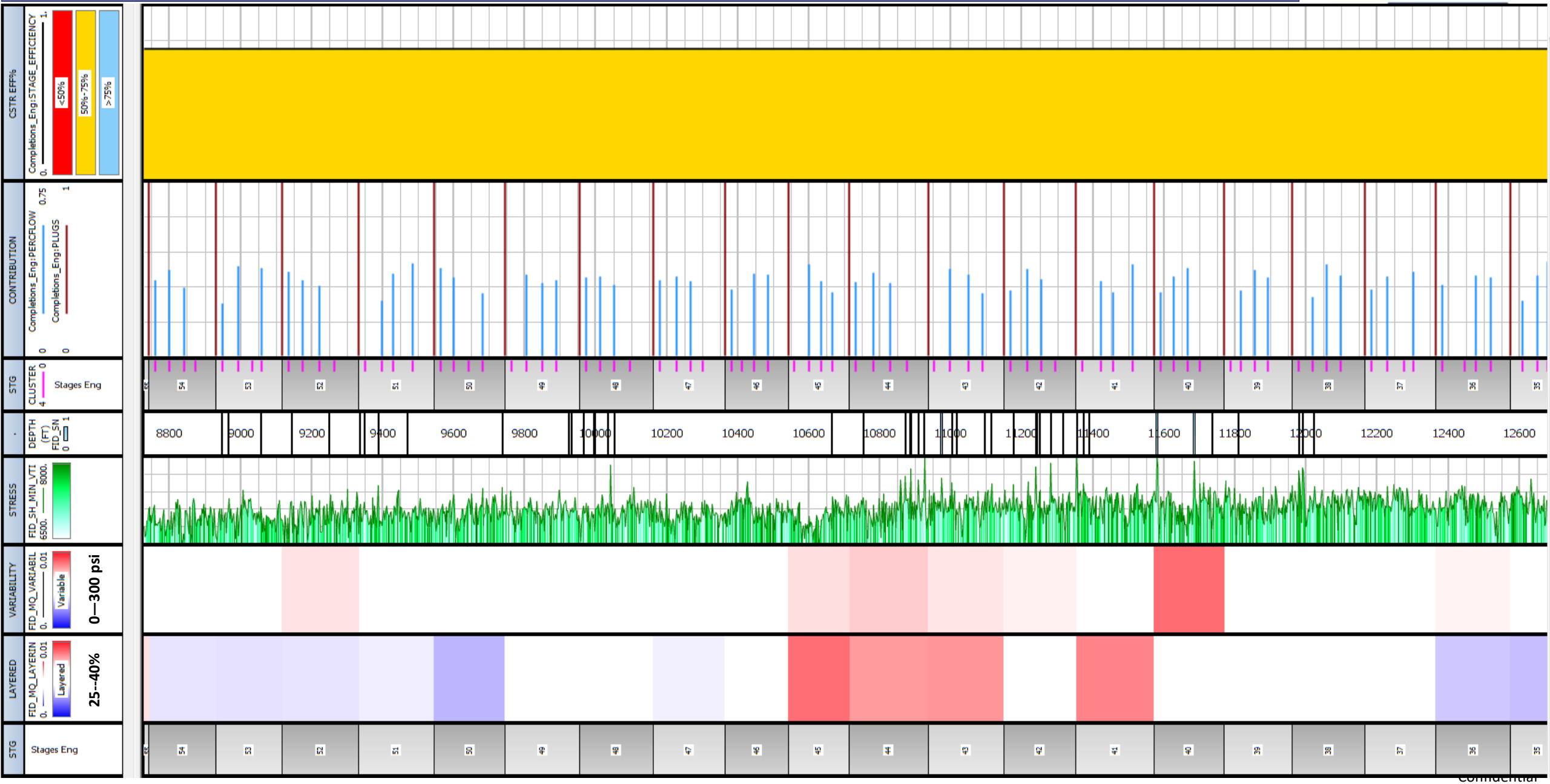
Engineered Completion: Stages 1-20



Engineered Completion: Stages 20-38



Engineered Completion: Stages 35-54



Engineered Stage Summary

Fracture ID

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
1	31%	150	100%
2	32%	162	75%
3	31%	200	75%
4	29%	146	75%
5	29%	168	75%
6	33%	152	75%
7	28%	115	75%
8	33%	144	75%
9	36%	147	75%
10	39%	259	75%
11	41%	254	75%
12	36%	202	75%
13	34%	140	75%
14	33%	146	75%
15	42%	174	75%
16	33%	145	75%
17	33%	160	75%
18	33%	179	75%
19	40%	251	75%
20	29%	156	75%
21	31%	198	75%
22	32%	179	75%
23	33%	184	75%
24	32%	191	75%

Stage	Layering	Stress Variability (psi)	Cluster Efficiency
25	31%	164	75%
26	34%	245	75%
27	32%	167	75%
28	32%	154	75%
29	34%	171	75%
30	32%	234	75%
31	30%	187	75%
32	30%	203	75%
33	29%	187	75%
34	28%	160	75%
35	30%	180	75%
36	30%	194	75%
37	31%	151	75%
38	33%	190	75%
39	32%	190	75%
40	34%	256	75%
41	37%	190	75%
42	34%	196	75%
43	37%	201	75%
44	37%	213	75%
45	38%	204	75%
46	32%	166	75%
47	31%	152	75%
48	34%	160	75%

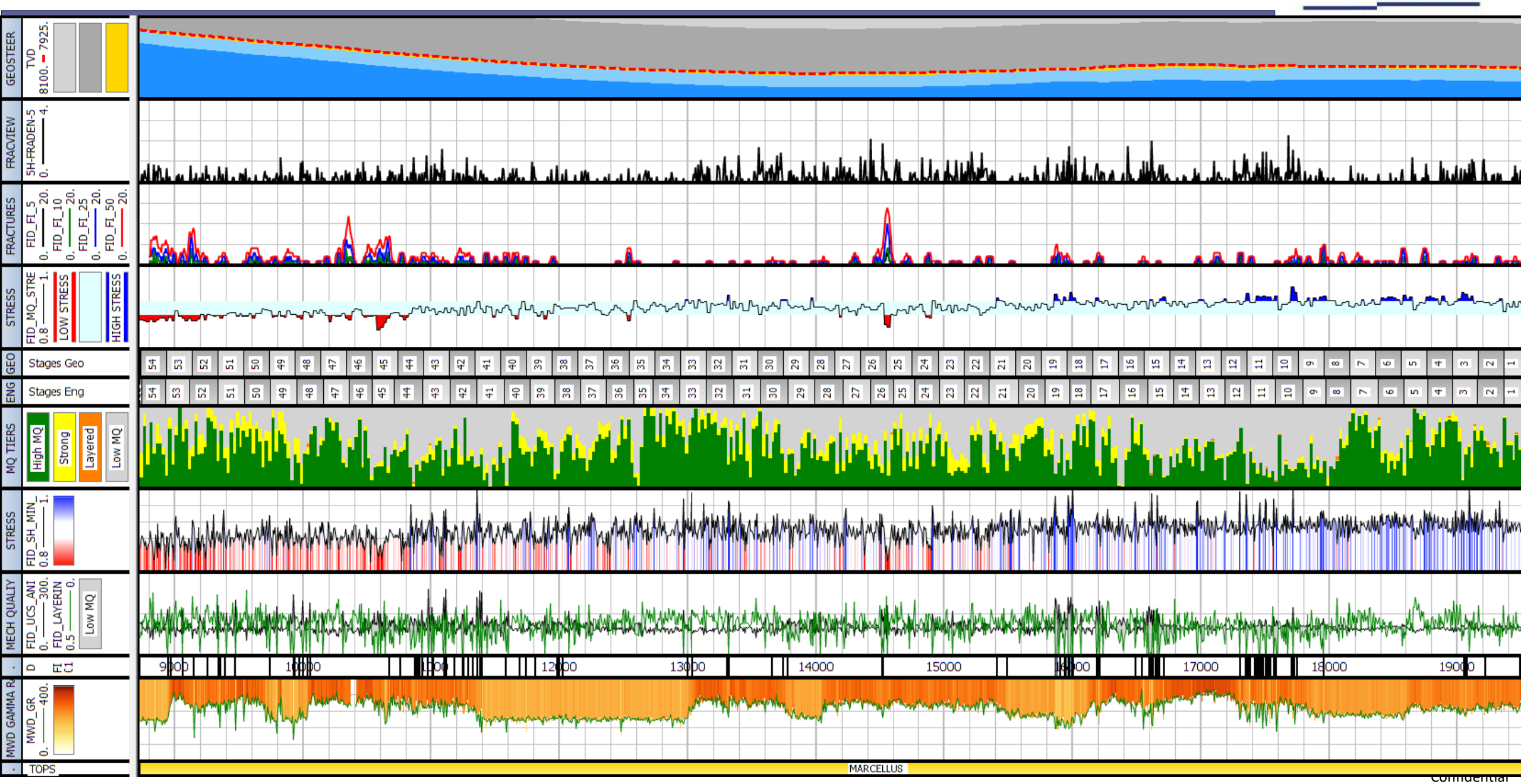
Stage	Layering	Stress Variability (psi)	Cluster Efficiency
49	32%	155	75%
50	29%	170	75%
51	31%	154	75%
52	31%	202	75%
53	31%	167	75%
55*			
56*			

*Stages 55 and 56 are in the curve section

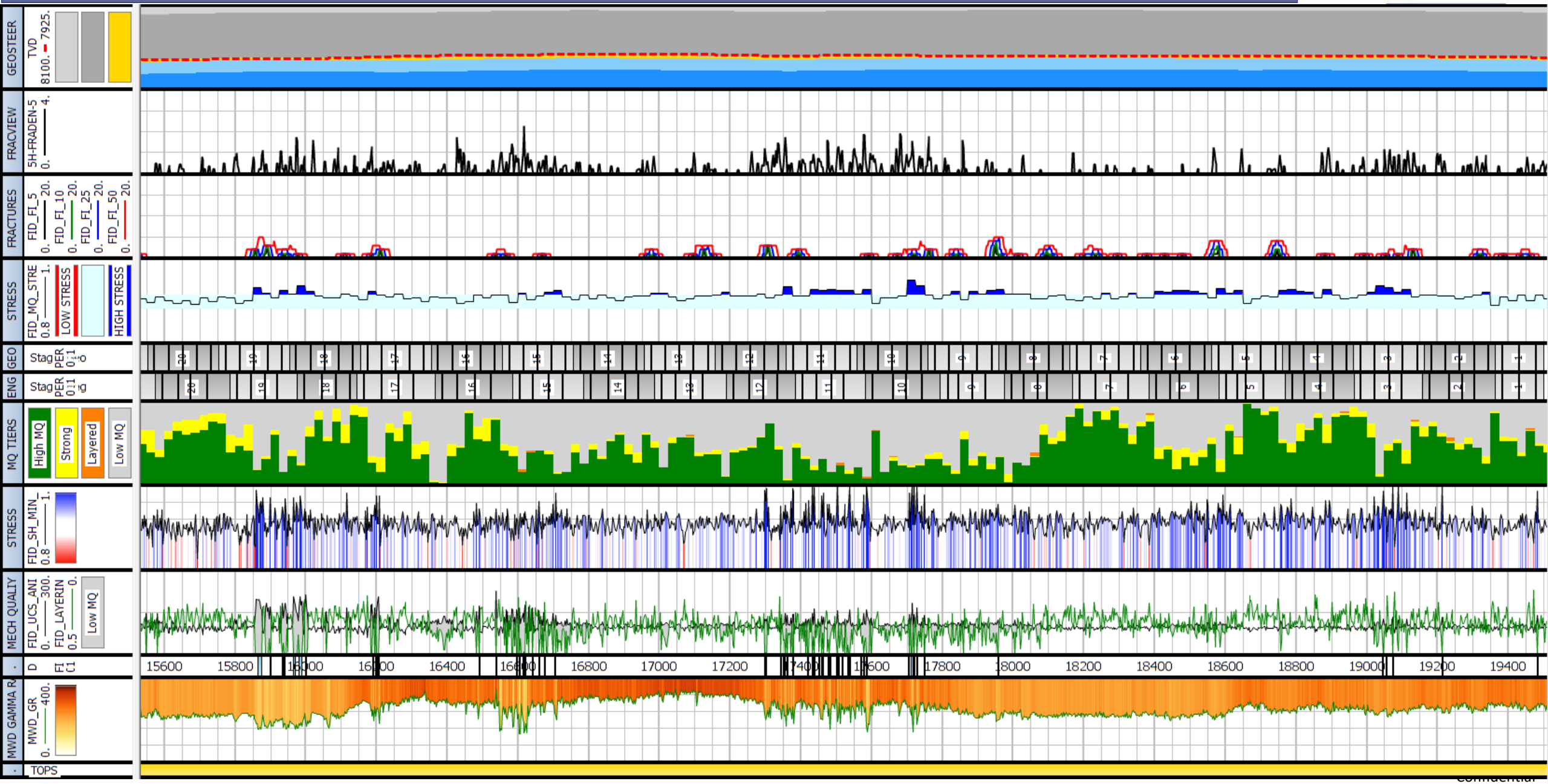
Design Comparison with Log

All Data

Fracture ID

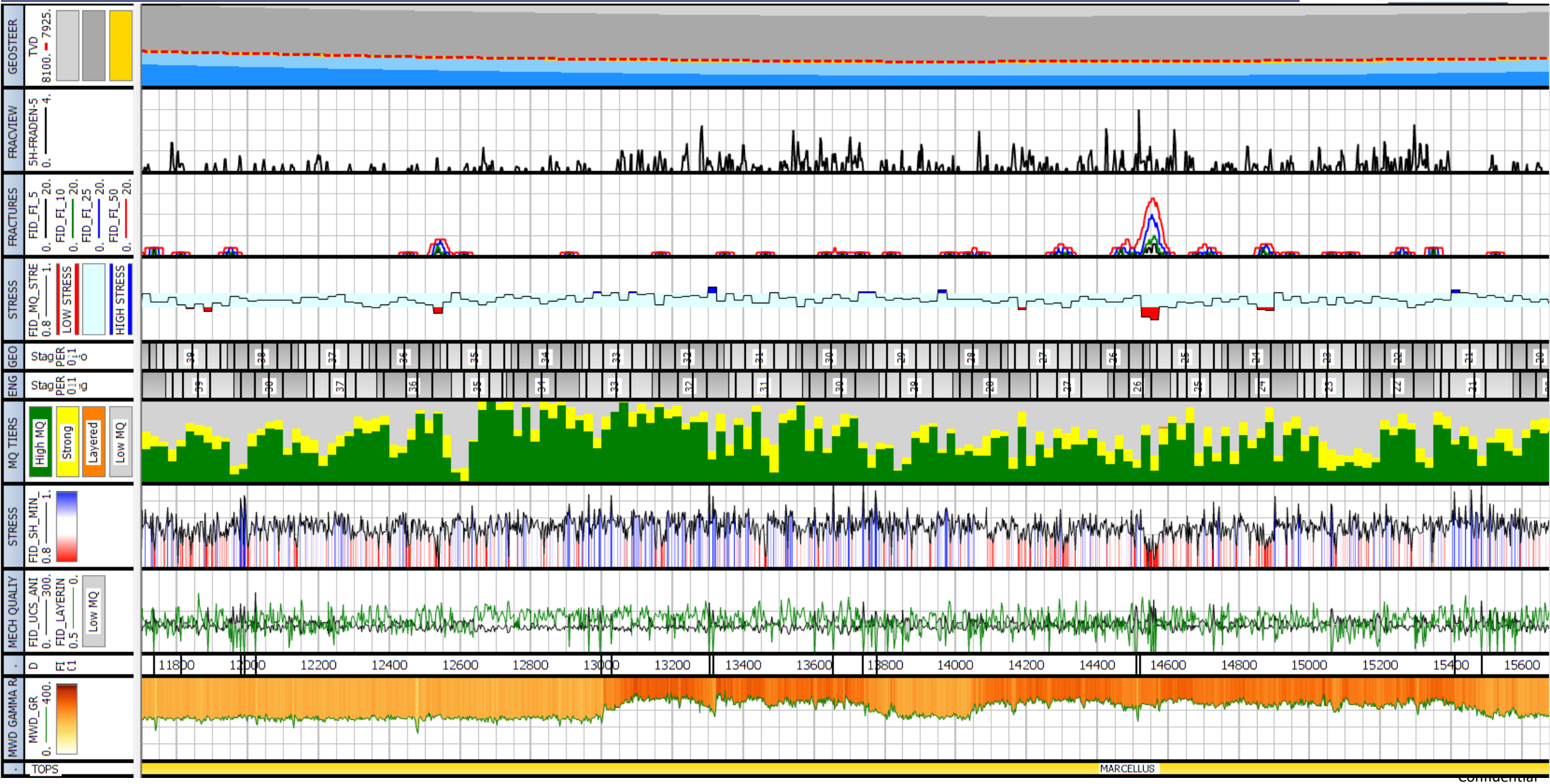


Stages 1-20

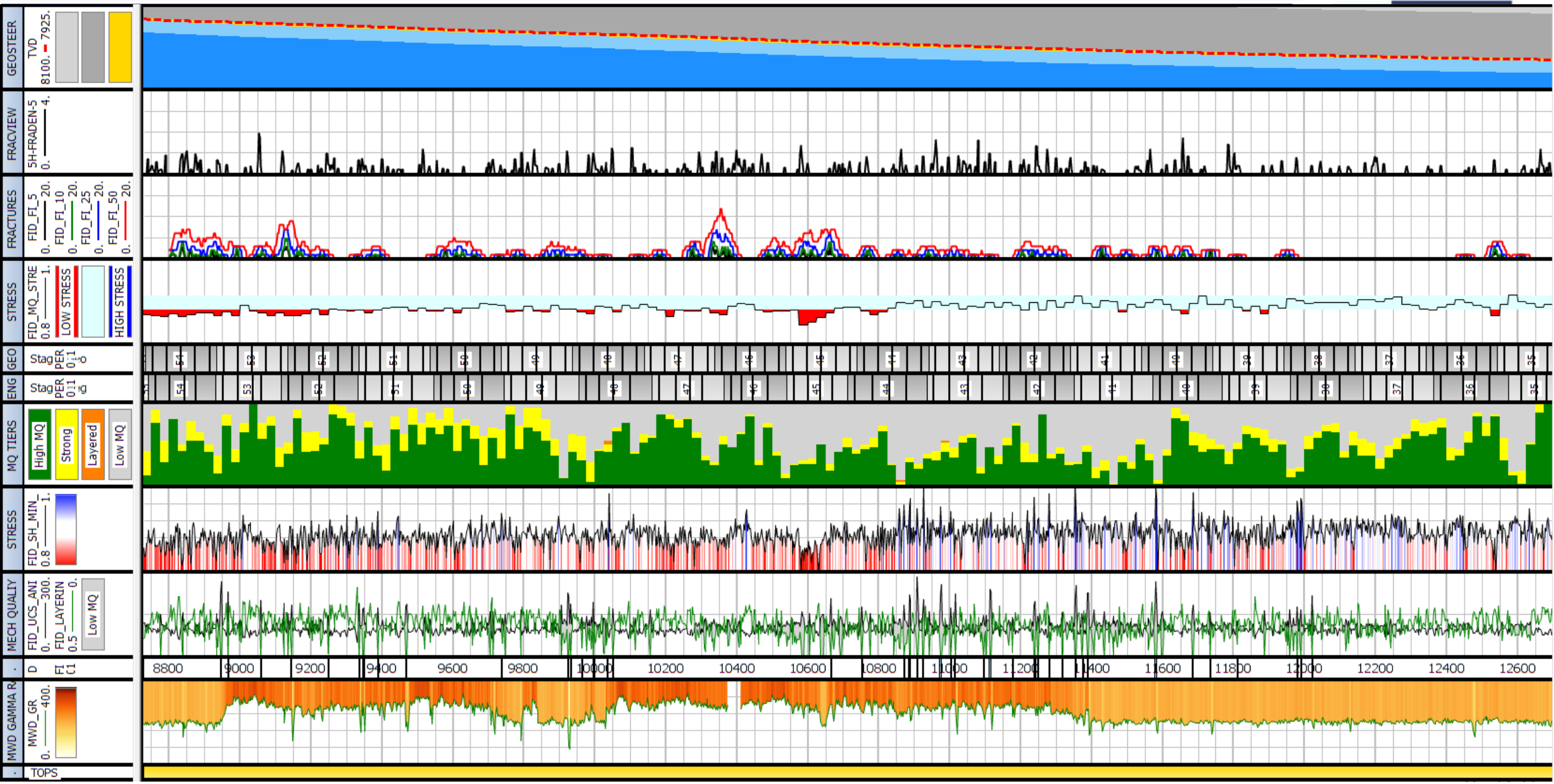

GEOSTEER
TVD
8100.
7925.
FRACVIEW
5H-FRADEN-5
4.
0.
FRACTURES
FID_FI_5
FID_FI_10
FID_FI_25
FID_FI_50
20.
STRESS
FID_MQ_STRE
1.
0.8
LOW STRESS
HIGH STRESS
GEO
ENG
Stag
PER
MQ TIERS
High MQ
Strong
Layered
Low MQ
STRESS
FID_SH_MIN_
MECH QUALITY
FID_UCS_ANI
300.
FID_LAYERIN
0.5
Low MQ
D
FI
C1
15600
15800
16000
16200
16400
16600
16800
17000
17200
17400
17600
17800
18000
18200
18400
18600
18800
19000
19200
19400
MWD GAMMA R
MWD_GR
400.
TOPS

Stages 20-39

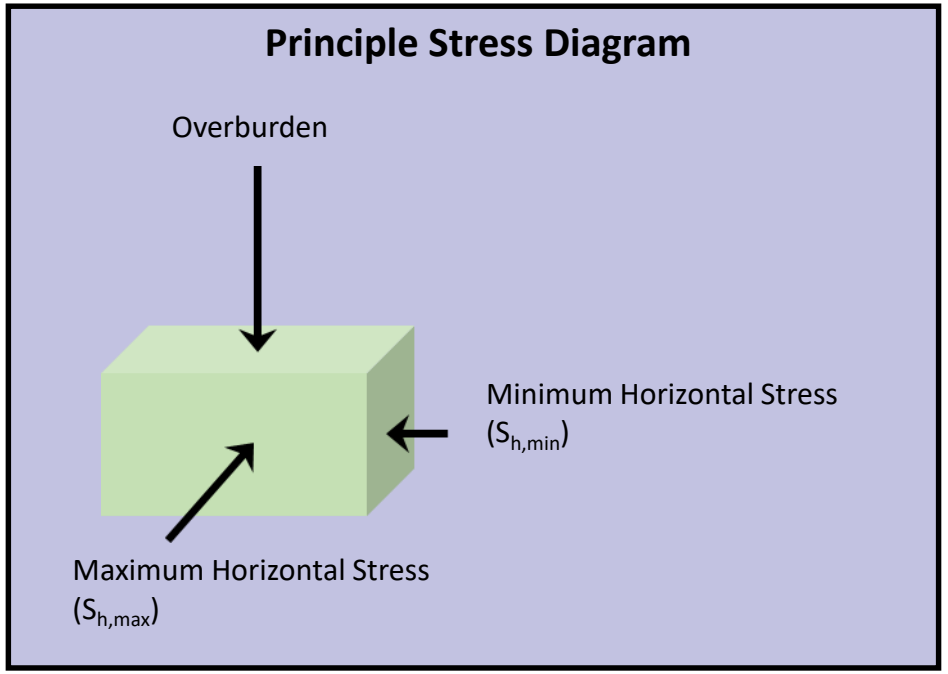
Fracture ID



Stages 36-54


GEOSTEER
TVD
8100.
7925.
FRACVIEW
5H-FRADEN-5
4.
0.
FRACTURES
FID_FI_5
FID_FI_10
FID_FI_25
FID_FI_50
20.
STRESS
FID_MQ_STRE
1.
0.8
LOW STRESS
HIGH STRESS
GEO
ENG
Stag
PER
MQ TIERS
High MQ
Strong
Layered
Low MQ
STRESS
FID_SH_MIN_
MECH QUALITY
FID_UCS_ANI
300.
FID_LAYERIN
0.5
Low MQ
D
FI
C1
8800
9000
9200
9400
9600
9800
10000
10200
10400
10600
10800
11000
11200
11400
11600
11800
12000
12200
12400
12600
MWD GAMMA R
MWD_GR
400.
TOPS

Minimum Horizontal Stress Calculation and Assumptions



$$\sigma_{h,min} = \frac{\upsilon_{13}}{(1-\upsilon_{12})}(\sigma_{obg} - \alpha \cdot P_{ppg}) + P_{ppg}$$

- υ_{13} = Fracture ID Horizontal-Vertical Poisson's Ratio, unitless
- υ_{12} = Fracture ID Horizontal-Horizontal Poisson's Ratio, unitless
- σ_{obg} = Overburden Gradient, psi/ft
- P_{ppg} = Pore Pressure Gradient, psi/ft
- α = Biot's Poroelastic Constant, unitless
- TVD = True Vertical Depth, ft

Overburden Gradient (psi/ft):	1.166
Pore Pressure Gradient (psi/ft):	0.68
Biot's Poroelastic Constant:	0.9