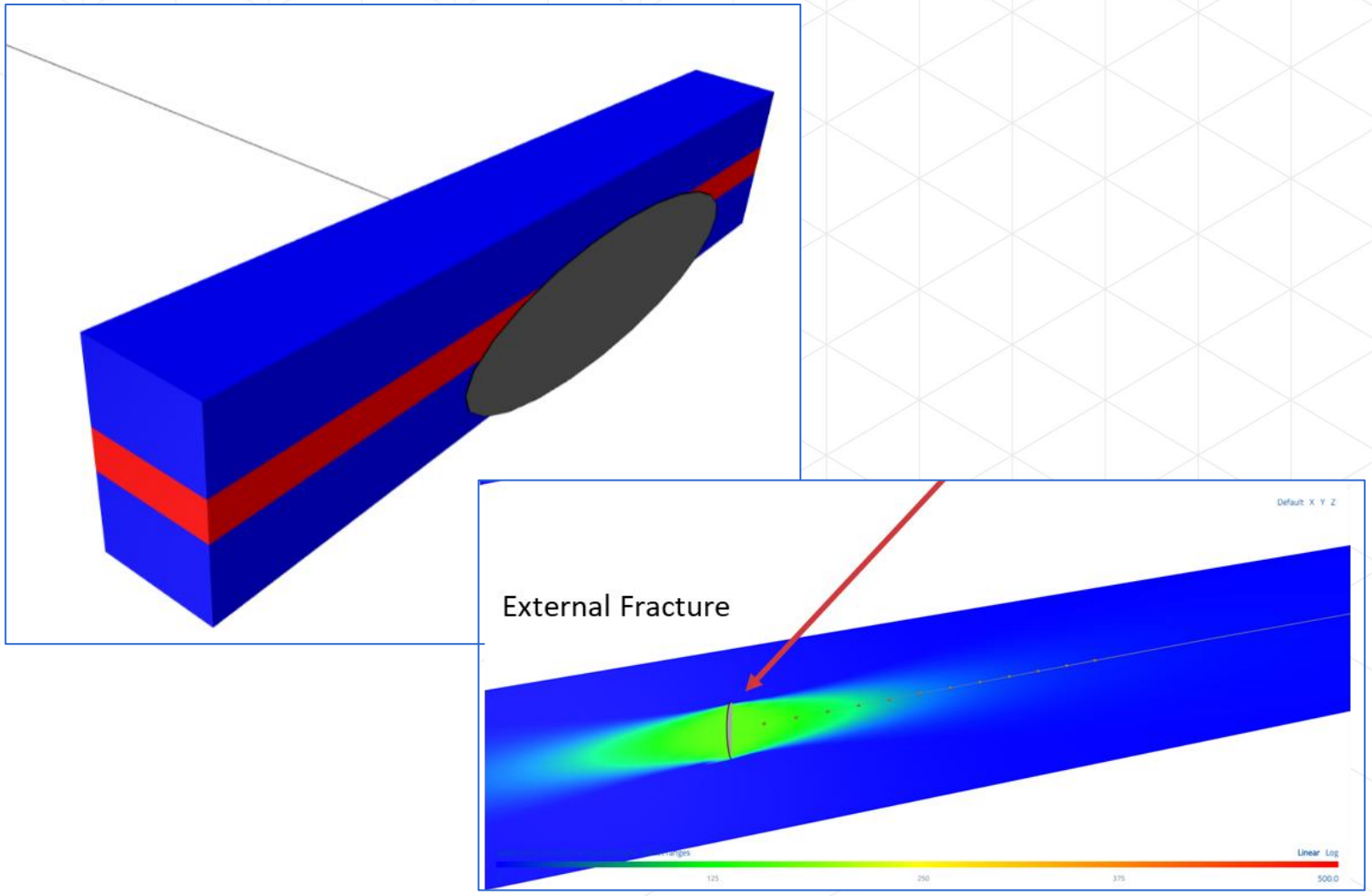
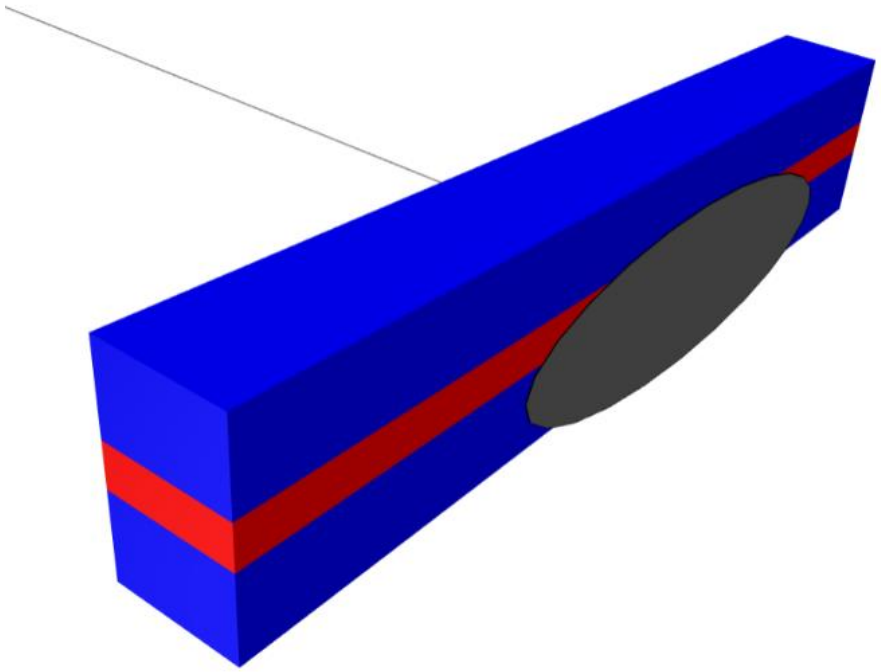
ResFrac



External Fractures

Modification of the local stress state used for sector modeling

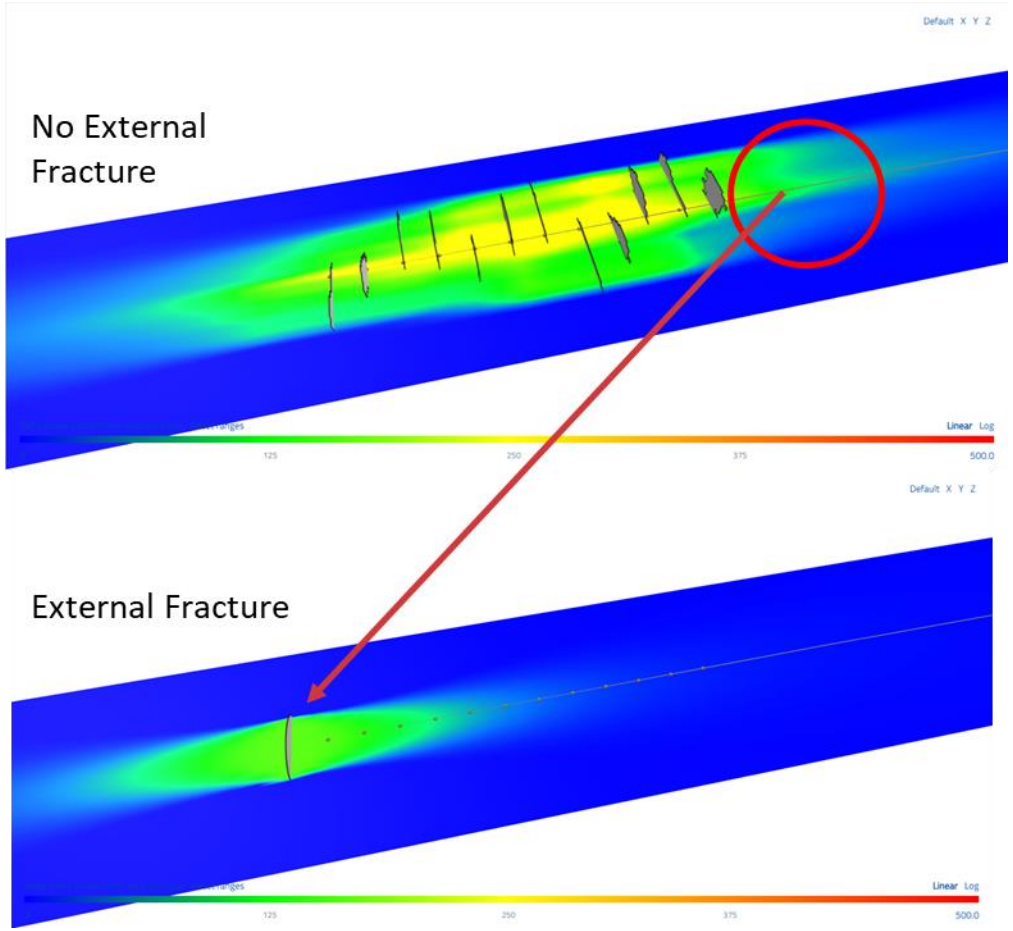
External Fractures



A list of hydraulic fractures from previous stages that are not directly included in the simulation model. Their purpose is to approximately capture the effect of stress shadow from previous stages. The Sneddon solution is used to calculate the stresses around them, and these stresses are included in the simulation model.

These external fractures should be located in places that are NOT within the simulation grid. They represent the stress shadow from previous stages that are outside the simulation grid.

External Fractures – Stress Shadowing



External fractures can be used to approximate the intital stress state, due to stress shadowing, of the stage being simulated.

Initial stress state at the start of a fracturing stage can be approximated by looking at the stress build up over multiple stages and using an external fracture to mimic that stress.

The stress build up is akin to ISIP build ups seen in actual data. We will use the magnitude of the external fracture to simulate this response without having to run multiple stages.

External Fractures - Wells and Perforations Tab

	Well name	Approx distance from edge of matrix region [ft]	Center x-coordinate [ft]	Center y-coordinate [ft]	Center z-coordinate [ft]	Total volume [bbl]	Net pressure [psi]
1	Well_High Noon	15					300
2	Well_Sunset	15					300
3	Well_Sunrise	15					300

External fractures can only be located outside of the matrix. It is customary to place the external fracture along the wellbore at ½ the cluster spacing away from the matrix, which is equivalent to the cluster spacing. This parameter will do this automatically.

Alternatively, you could specify the x, y and z locations of the external fracture.

Specify the total volume or net pressure of the external fracture. Use the delta stress plot in the UI to confirm this value. Stress observation planes can be set up in the output options.

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External Fractures

Half-length [ft]	Half-height [ft]	Closure time [hours]	Residual fraction	Activation time [hours]	Second activation time [hours]	Third activation time [hours]	Fourth activation time [hours]
600	250	20	0.3	0			
600	250	20	0.3	3			
600	250	20	0.3	7			

The length and width of the fracture are specified to create the size of the stress state. Use the stress plane to determine this based on the fracturing times, and the amount that fracture has closed (Eopen).

Specifies how long it takes for the closure to happen and the residual fraction of stress shadowing that is left. Once again, use the stress plane in combination with UI parameter ‘open part of the aperture’ (Eopen) to understand the best way to set these values.

Multiple activation times can be set. The down time between fracs can be used to set this value e.g., the frac ends one hour before the next one starts so set this value to be 1 hour before the well fracs in your well controls.

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External Fractures – Typical Procedure

1. Set up one well with 3 to 5 stages.
2. Create an observation plane (Observation Planes Presentation) in the output options at the depth of the well.
3. Place the fracture ½ of the cluster spacing away from the matrix.
4. Observe the stress at the end of the fracturing and use this for a starting net pressure.
5. Observe the ‘average’ width and heights of the fracture.
6. Observe how long it takes for the stress plane to stabilize after frac’ing and use this for the closure time.
7. Observe the residual stress after fracture closing and calculate the residual fraction i.e., Residual stress ÷ Starting stress
8. Use the frac job report to determine when the last stage was frac’d and use this to activate the external fracture appropriately.
9. Use the stress plane in the UI to ensure that the external fracture achieved the appropriate stress when the stage begins to frac.
10. Use ISIP data to help confirm that the pressure in the external fracture is correct.
    1. ISIP = Net Pressure + Shmin + Stress Shadowing
11. Create an external fracture for each well being frac’d.
12. As history matching proceeds, iterations may be required.

Thank You!

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Last updated Feb 2026