CASE STUDY

April 1, 2021
Topic: Depleted Fracture Identification

Depleted Fracture Identification (DFI) service confirms cause of rapid fracture interactions in Wolfcamp

Objective

To help understand fracture driven interactions, a Wolfcamp operator used Drill2Frac's DFI service combined with Volume to First Response (VFR) from fiber optic strain measurement in a monitor well. Analysis was performed to determine whether fracture interactions occurred more quickly when stages were pumped in the proximity of pre-existing fractures

Background

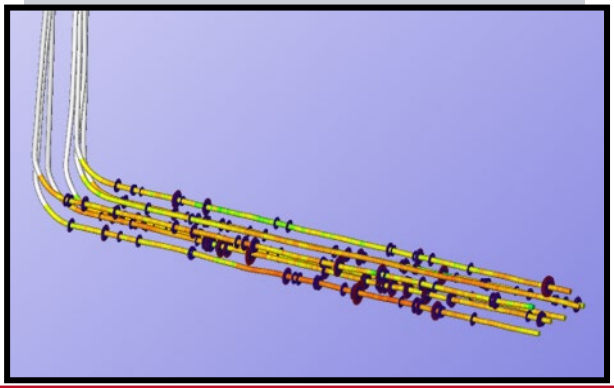
Recent studies, such as SPE 199731 (Haustveit et al), have shown that the time between start of pumping and a pressure response in the offset (volume to first response or VFR), can be related to cluster efficiency and even well productivity. In other words, the faster a fracture communicates with an offset well, the less effective the stimulation treatment is going to be.

Drill2Frac's DFI service identifies the localized depletion halo around existing fractures which usually represents a pre-existing flow path. When fracturing near these areas, a low VFR and thus a compromised stimulation treatment might be expected. Using a depleted fracture map generated by the DFI service, operators have an opportunity to reduce the VFR by avoiding placing clusters near existing fractures which will ultimately, improve well productivity and reduce negative fracture driven interactions.

Depleted Fracture Identification

A producing well that has been hydraulically fractured will gradually build a halo of depletion around the fractures connected to the wellbore. When an infill well drills through these extremely localized areas of depletion, there is a subtle change in the drilling response which can be identified using some enhanced processing.

Drill2Frac's DFI service has been mapping these features since early 2019 across over a hundred wells in almost every US basin and internationally. By mapping these features, clients have been able to not only better understand where and how fractures form, but have been using this data to reduce negative fracture driven interactions.



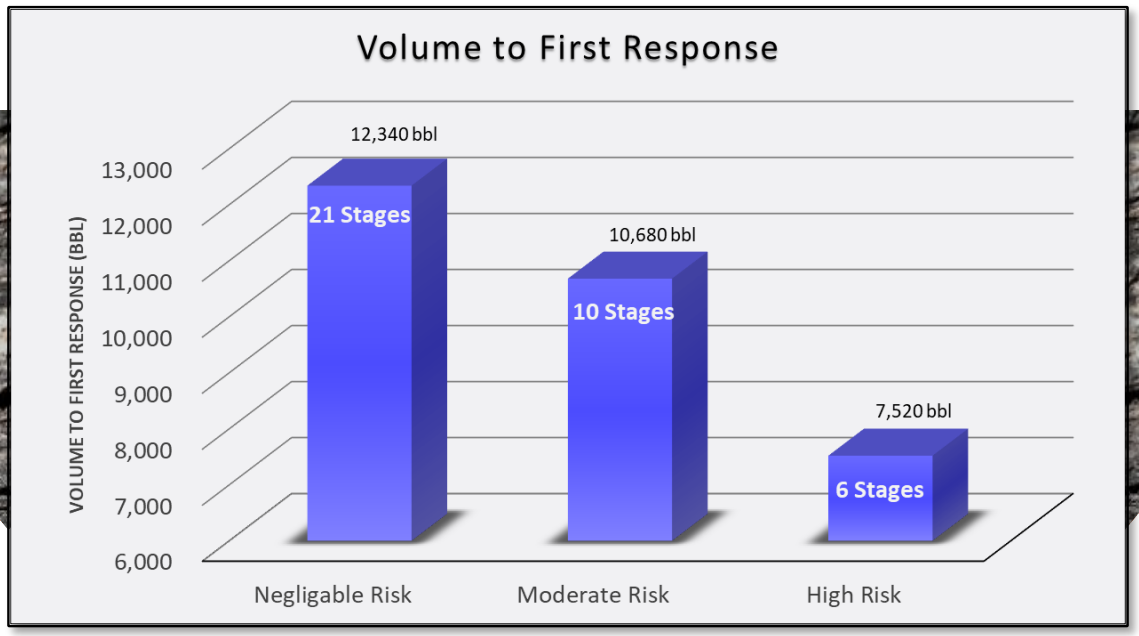
Methodology

For this study, thirty-seven fracturing stages in a Wolfcamp well were given a “fracture risk” assessment based on the lateral extent of depletion, the amount of depletion and the confidence level of the event as obtained from the DFI service. The VFR was measured using a dip-in fiber optic line in an offset monitor well and represents the amount of volume pumped in a fracturing stage before a strong strain signal was observed in the observation fiber optic line.

Results

Unsurprisingly, it was observed that where there was a significant presence of pre-existing fractures identified, the fracture interaction occurred on average 40% faster than areas where there was little to no indication of fractures. This is likely caused by the fracturing slurry travelling preferentially through and dilating the pre-existing fractures as opposed to stimulating new rock.

While this observation helps validate the presence of the identified fractures, it also highlights an opportunity to improve stimulation treatments through the avoidance of placing perforation clusters in the direct vicinity of identified pre-existing fractures.



Volume to first response in offset well measured by fiber optics compared to fracture risk as identified by Drill2Frac.