



## A Comparison of Microseismic response and hydraulic fracture monitoring through DAS: A case Study from Montney

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### Summary

Since the 2014 oil price downturn, the tight gas operators from North America need to initiate cost reduction measures. The biggest portion of expense is well completion in tight gas development. Understanding of stimulated fracture area and optimizing the hydraulic fracture design (i.e. well spacing, landing zone, cluster spacing/numbers) early in the development of a field can have a strong impact on both cost reduction and maximizing net present value. We will show a case study of combining new and common monitoring technologies to quantify the propped area. In this paper, we focus on comparing both microseismic response through borehole 3C and hydraulic fracture profile monitoring through DAS on a fibre optic cable.

Encana cooperation conducted a multi-well stimulation science pad monitoring program in North-East British Columbia targeting the Montney Formation. Four horizontal wells were drilled 200 m apart laterally in the same stratigraphic interval. One well had a permanently installed fibre optic cable which monitored the completion while cluster spacing and cluster count were varied along the wellbore. The goal for this project was to determine what well spacing, cluster spacing, and cluster count are appropriate.

Technology of fiber optic sensor for oil and gas industry is relatively new technique and is still in the development phase. DAS has been considered a robust method to observe initiation of each perforation cluster and cluster efficiency in a real time basis.

Both outside wells were stimulated first in a zipper fracture manner before the inside two wells were completed. Figure 1 (left) shows that microseismic distribution for the first two pair well extended across all wells. Approximately 10 days later, the second pair of wells were stimulated. Figure 1 (middle) shows Microseismic (red) occurred in an area already fractured from the first well pair. Comparison of microseismic distribution (red and blue dots) from two sequential stages on the inside pair shows that the second stimulation (blue dots) grew away from the area already fractured from the first stimulation (red dots). Microseismic distribution (blue dots) propagate in a south-west direction.

Distribution of microseismic along the wellbore length agreed with DAS calculated fluid and proppant distribution (Paul et al 2014).

Figure 2 shows a DAS waterfall plot which is used to show fluid placement per cluster during one hydraulic fracture stage. This is compared to the distribution of microseismic events. Three different diverters are tested in this stage. During phase A, initially all clusters are initiated evenly while at later time there is little acoustic energy detected on most clusters, indicating that these clusters stopped taking fracture fluid. After the first diverter is applied, only three distinct clusters continue to take fluid (#5, 8, and 9). The second diverter trial is applied but results are unsuccessful based on the waterfall plot. Microseismic also support that no clusters were successfully diverted from the second diverter.

DAS waterfall plots alone tell us about near wellbore activities while 3C microseismic is able to indicate both the direction and extent of the hydraulic fracture growth. Therefore, a combination of both

technologies is essential for fully understanding the hydraulic fracture behaviour, both near and farther from the wellbore.

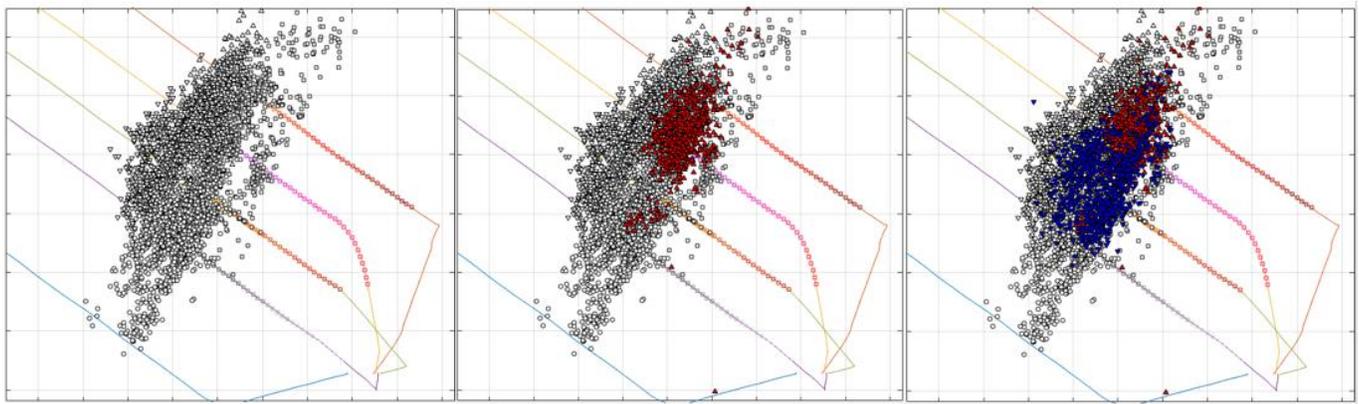


Figure 1 Distribution of microseismic from first pair (left), Microseismic distribution of sequential stages from second pair: Red (middle) and blue (right) are first and second.

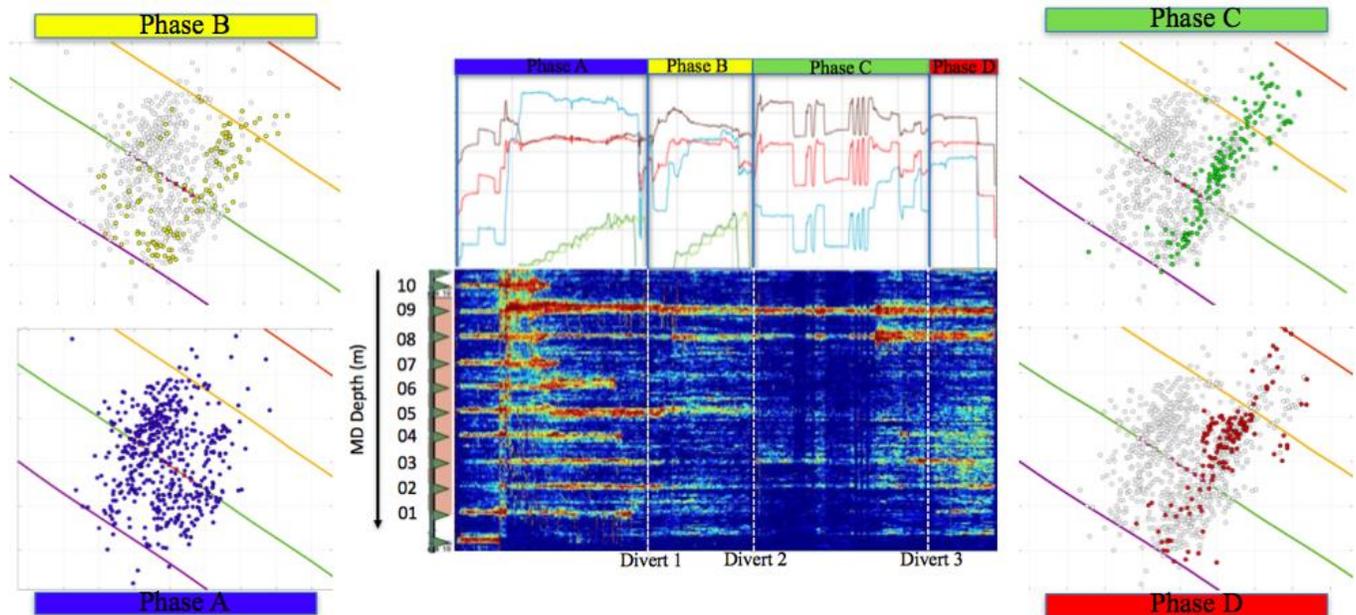


Figure 2 Fiber optic results, DAS, pumping data, showing diversion and corresponding microseismic distribution with each phase of the treatment.

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## References

Reference Style (use Arial 9pt normal)

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