

## 24/7 MONITORING OF RESERVOIR MICRO-SEISMICITY

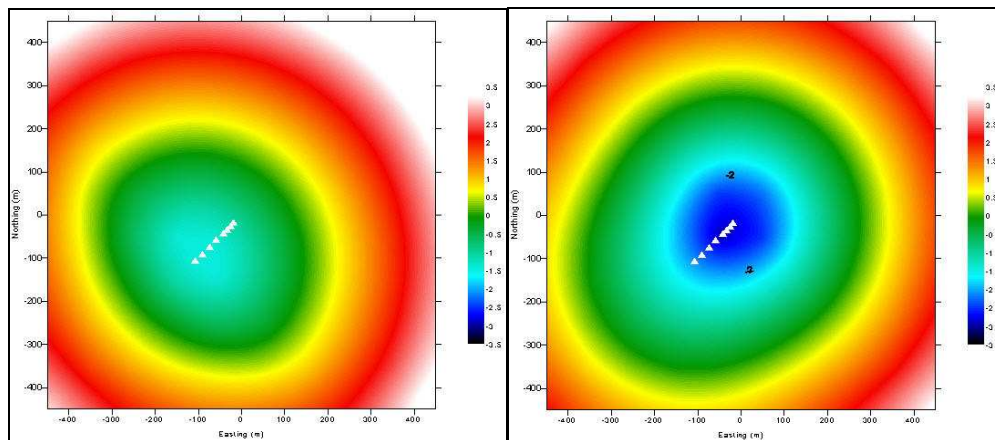
T.I. Urbancic and P. McGillivray<sup>1</sup>, Engineering Seismology Group Canada, <sup>1</sup>Shell Canada Ltd

2005 CSEG National Convention

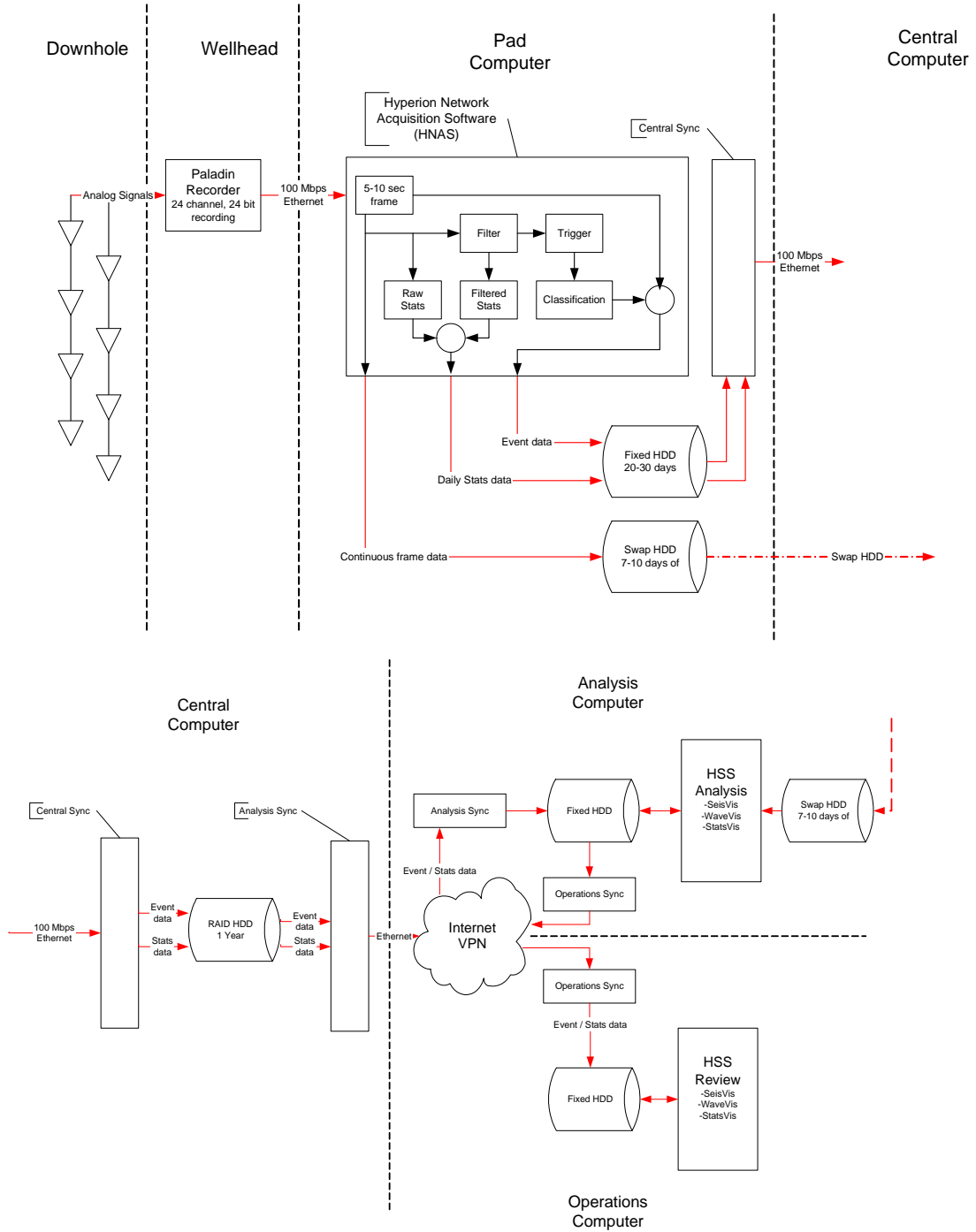


### Abstract

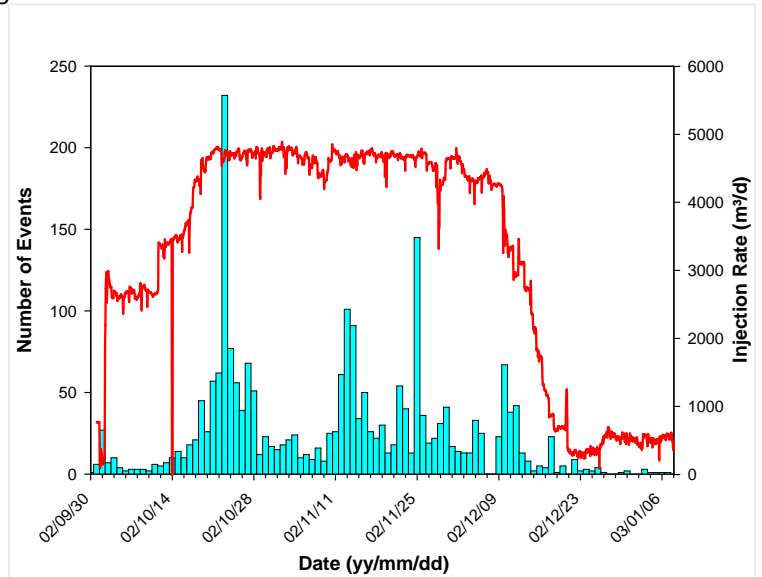
Shell Canada's heavy oil operations at Peace River, Alberta cyclically steam multi-lateral horizontal wells to produce the mobilized bitumen. However, there is uncertainty about the effectiveness of the drilling and steaming process, making it difficult to optimize drilling and operational strategies. To assess these issues, a feasibility study was carried out to ascertain if microseismic monitoring could be used to provide additional insight into reservoir behavior. Following initial field trials, a 24 bit distributed multi-pad based microseismic monitoring system has been installed and in operation over the past 2 years. Data is collected 24/7 using downhole permanently installed geophone arrays and signals are digitized at the wellhead with web-enabled recorders prior to transmission along fibre to a central site. Automated processors identify microseismic events that are then transmitted by satellite to processing offices for additional in-depth analysis and data archiving. Remote web-based access to wellhead recorders provide for system debugging and instant re-classification of recording parameters and events. In this paper, we discuss the findings of the feasibility study and the resulting field trials, including instrumentation and array expansion capabilities for field-wide monitoring, integration of microseismic data with pressure, injection and temperature data, and the benefits derived from the study, namely improved well design and operating strategies. Furthermore, our studies suggest that field-wide applications of microseismic monitoring can provide valuable information about steam conformance, pad-to-pad interaction and well and cap rock integrity.



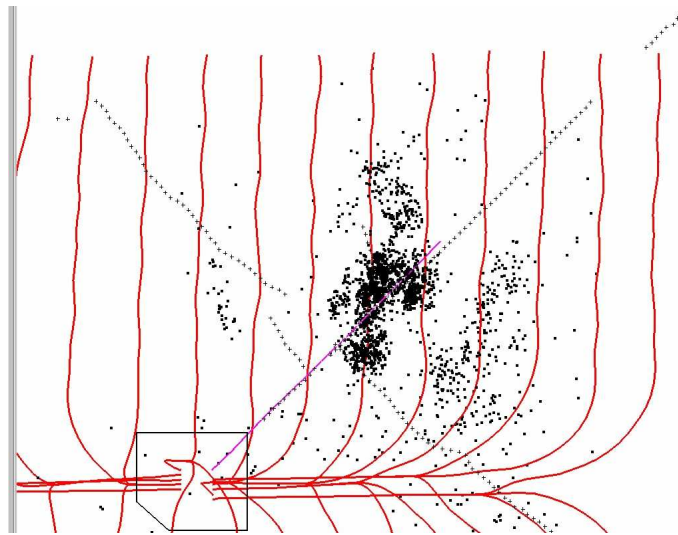
Microseismic modeling results showing the detection sensitivity (plan view) for the recommended array geometry with  $q=10$ . The left figure shows results for an event detected on all sensors, while the right shows results for events detected on at least 1 sensor.



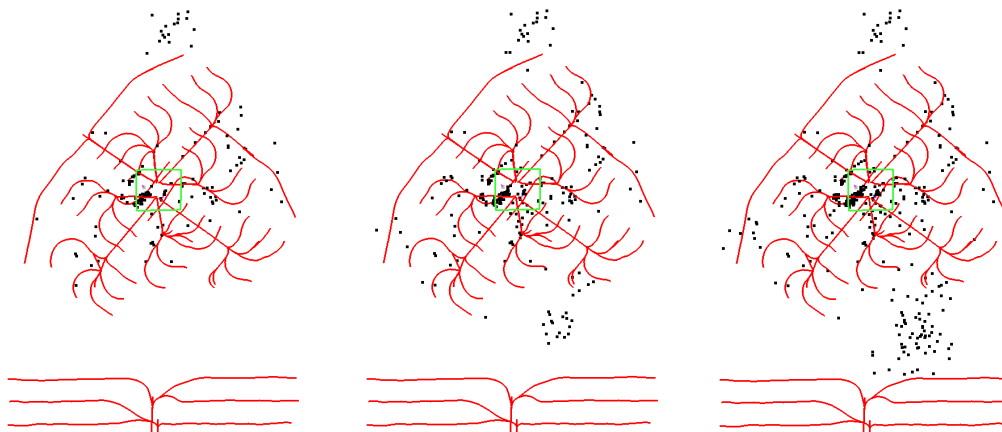
Distributed microseismic system as installed at Peace River. Connection between the central and analysis computers is by Satellite.



Relationship between steam injection and microseismic activity rates.



Microseismic activity recorded for a single steam cycle over the NE quad-rant of a pad of wells.



Space-time slice of microseismic activity in the buffer zone between two pads of wells. The upper pad is on steam, while the lower pad is on production.