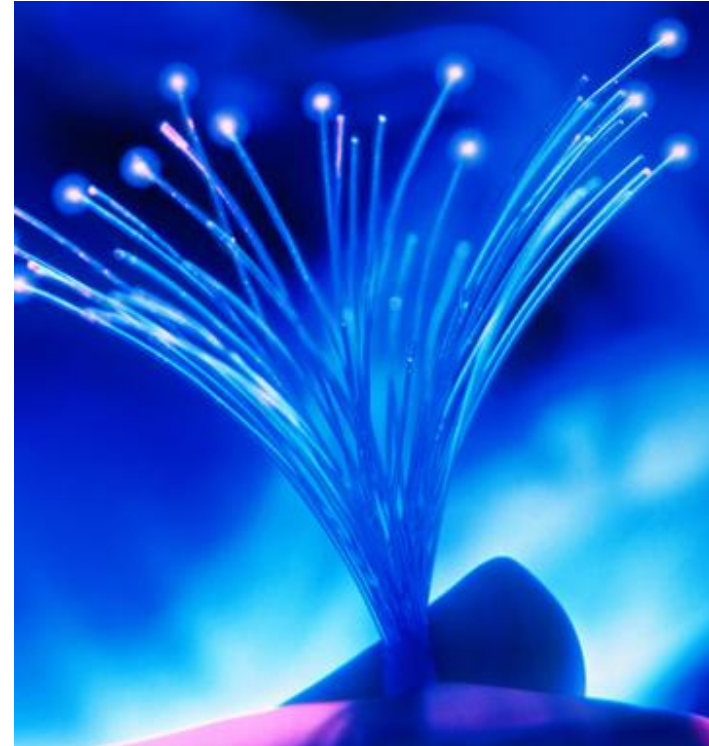


Benefits of Improved Wellbore Acoustic & Strain Monitoring using Fiber Optic Technology

Criteria For Improved Wellbore Monitoring

- **Distributed**
- **24/7 monitoring capabilities**
- **Preventative**
 - Heaving, strain, deformations
- **Reactive**
 - Ability to detect pinhole leaks
 - Real time
- **Reliable – stable – trustworthy**
 - No false alarms
- **Needs to be economical / scalable**



Key Criteria Can Be Met Using Fiber Optic Distributed Sensors

Data Transmission AND a Sensor

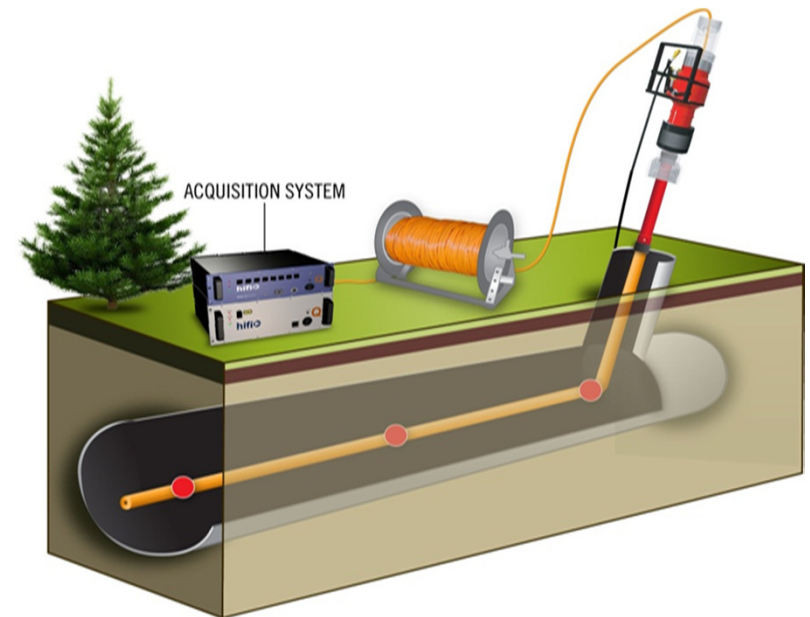
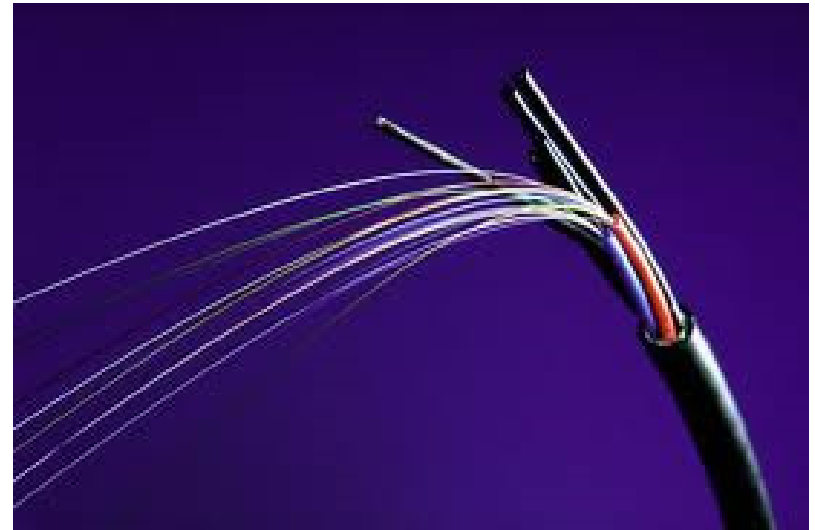
- Strain, vibration, and acoustics

24/7 Continuous REAL TIME

- High Bandwidth
- 40km, every meter of the fiber is sensing

Efficient & Versatile

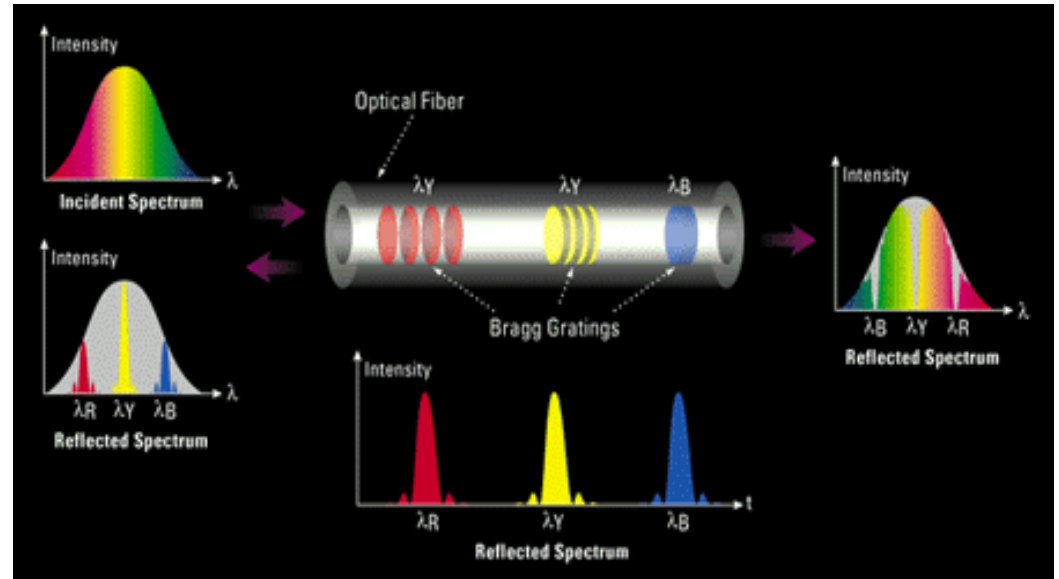
- Fiber is very cost effective
- Internal or external deployment
- Extreme environments, 300degC



Enhanced Fiber Sensitivity

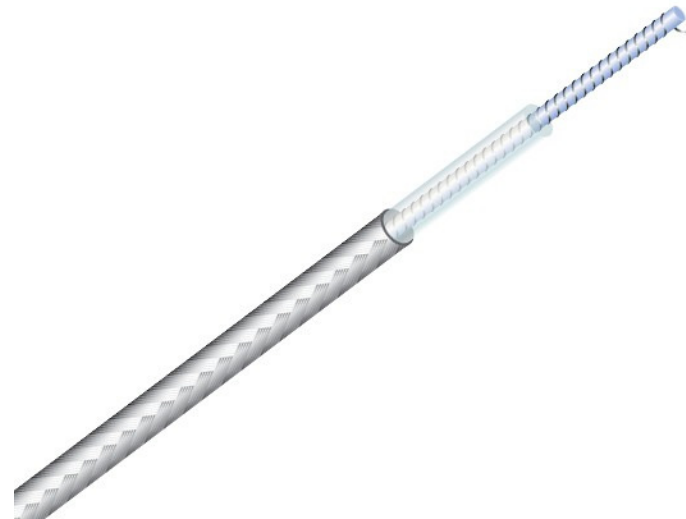
Fiber Bragg Grating

- Accurately control wavelengths and location of reflected light
- >1% wasted light through scattering pure core fiber, and efficient reflection
- Stable, linear, real time signals

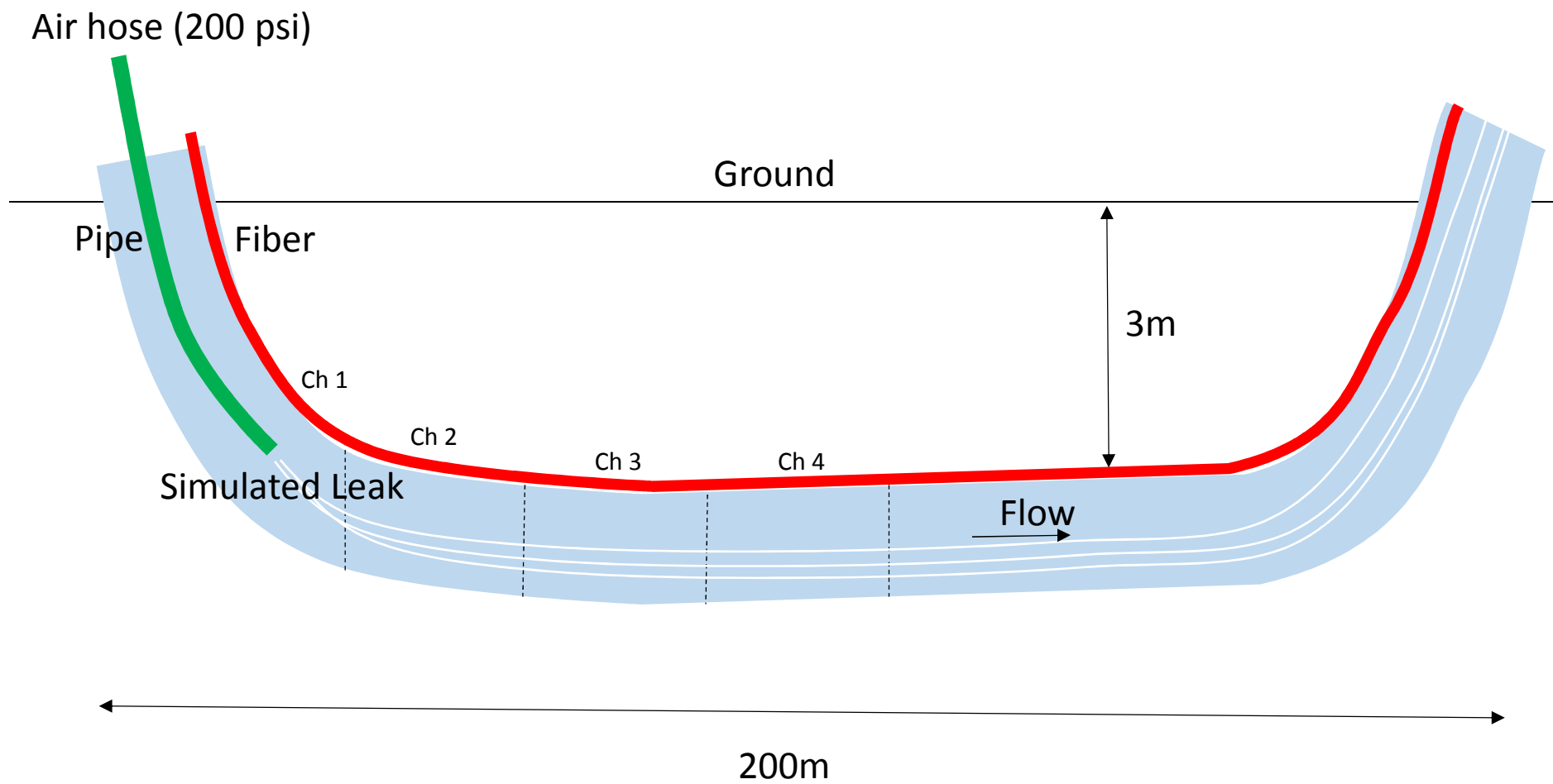


Acoustically enhanced fiber

- Coated with special polymers to enhance acoustic sensitivity
- Coating reinforces structural integrity
- High resistance against extreme temperatures



Field Test Diagram



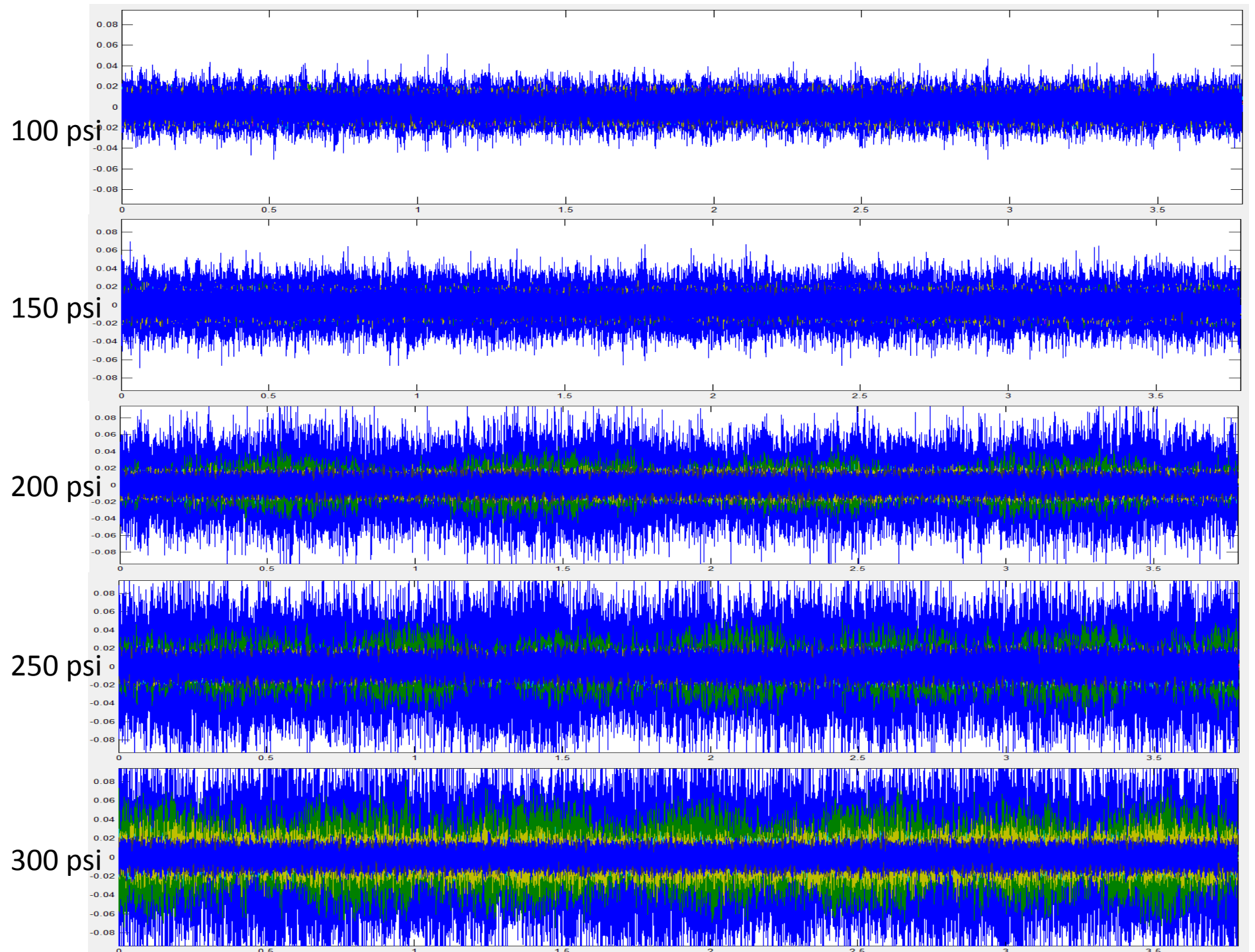
Securing to the pipe



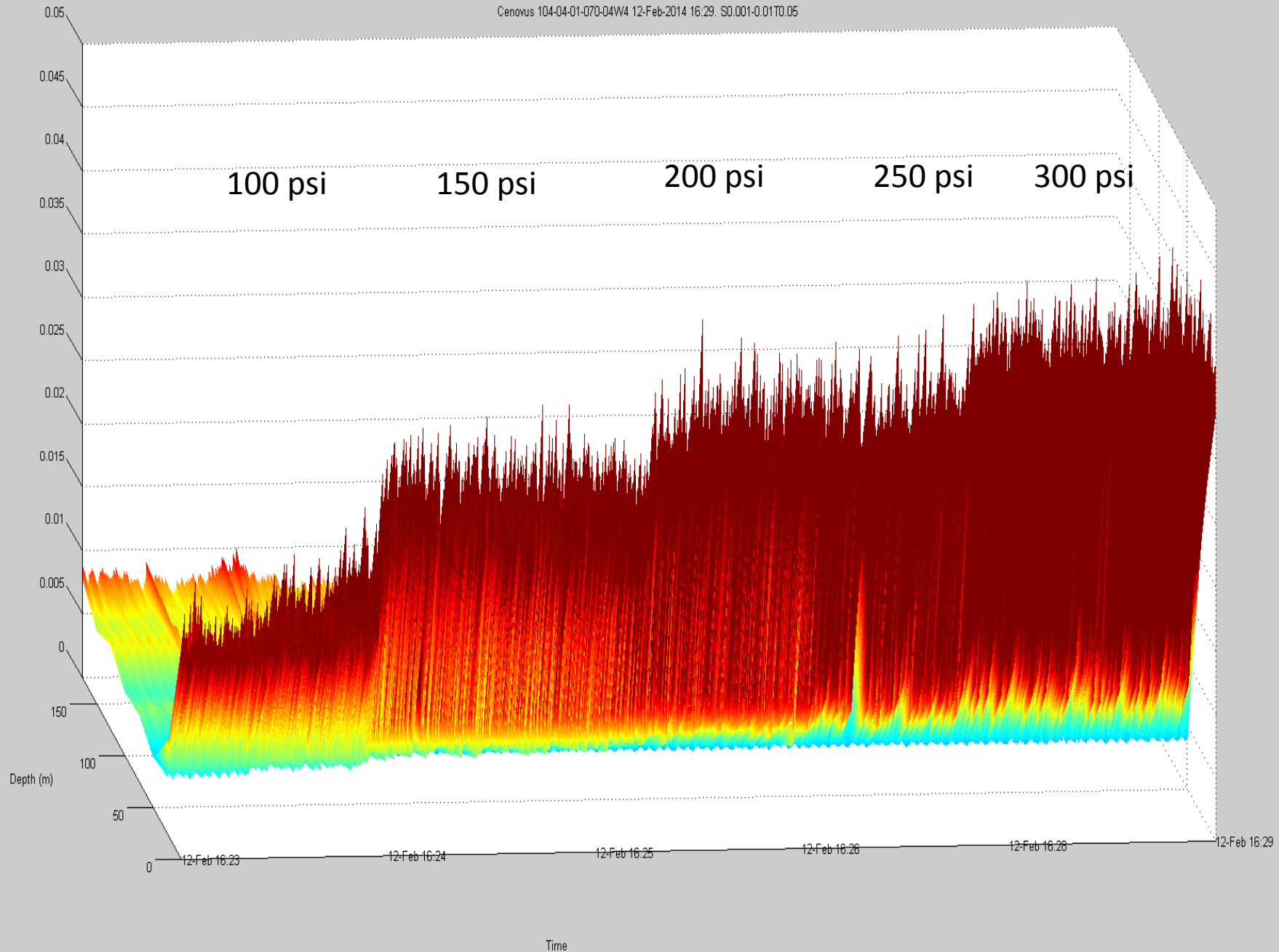
Leak Simulation Testing

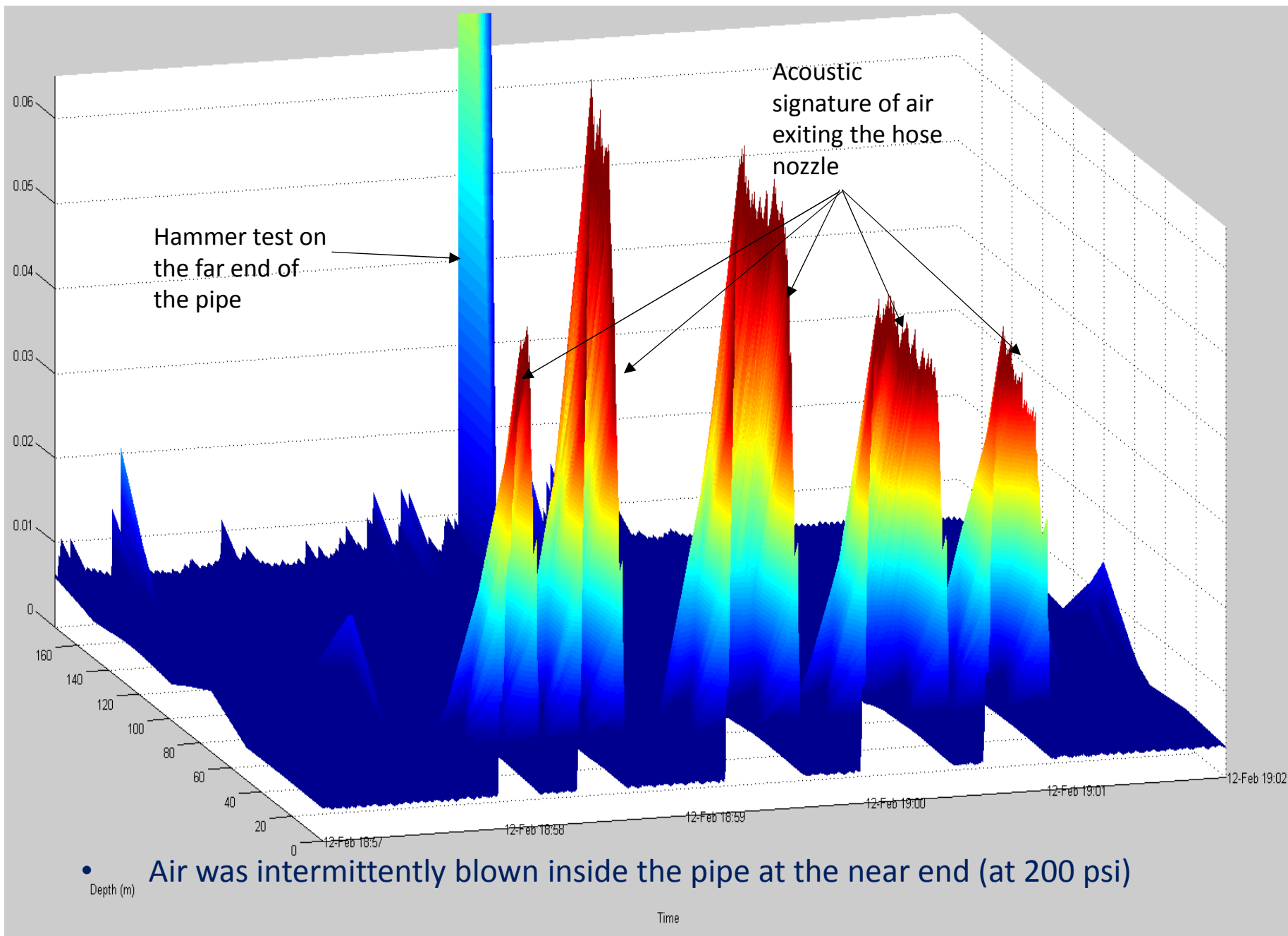
- ½” hose inserted into the pipe and pushed in by 10m
- Pipe entry point sealed
- Injecting air from a ¼” nozzle near the fiber
- Pressure ranged from 100 to 300 psi





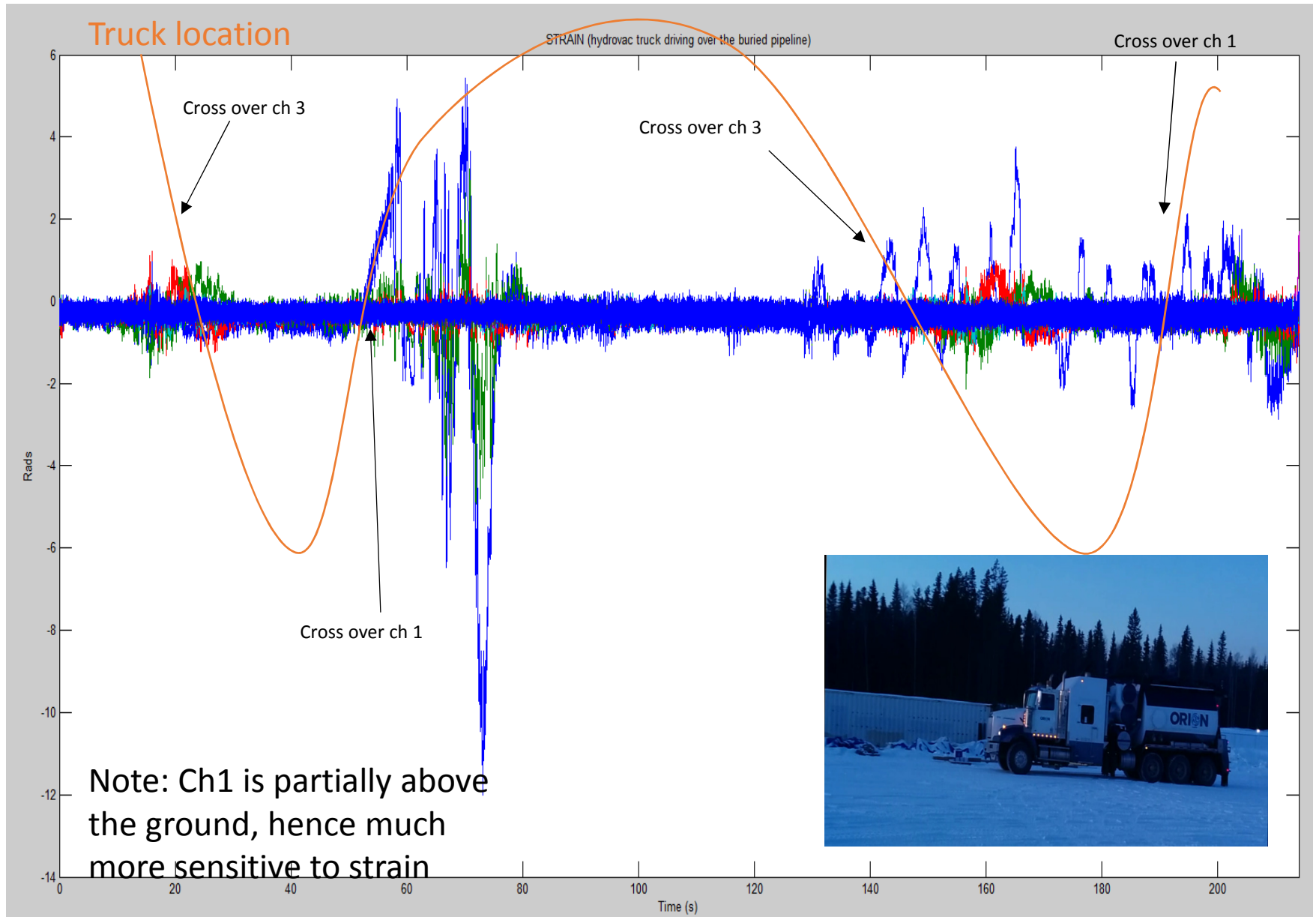
Cenovus 104-04-01-070-04W4 12-Feb-2014 16:29. S0.001-0.01T0.05

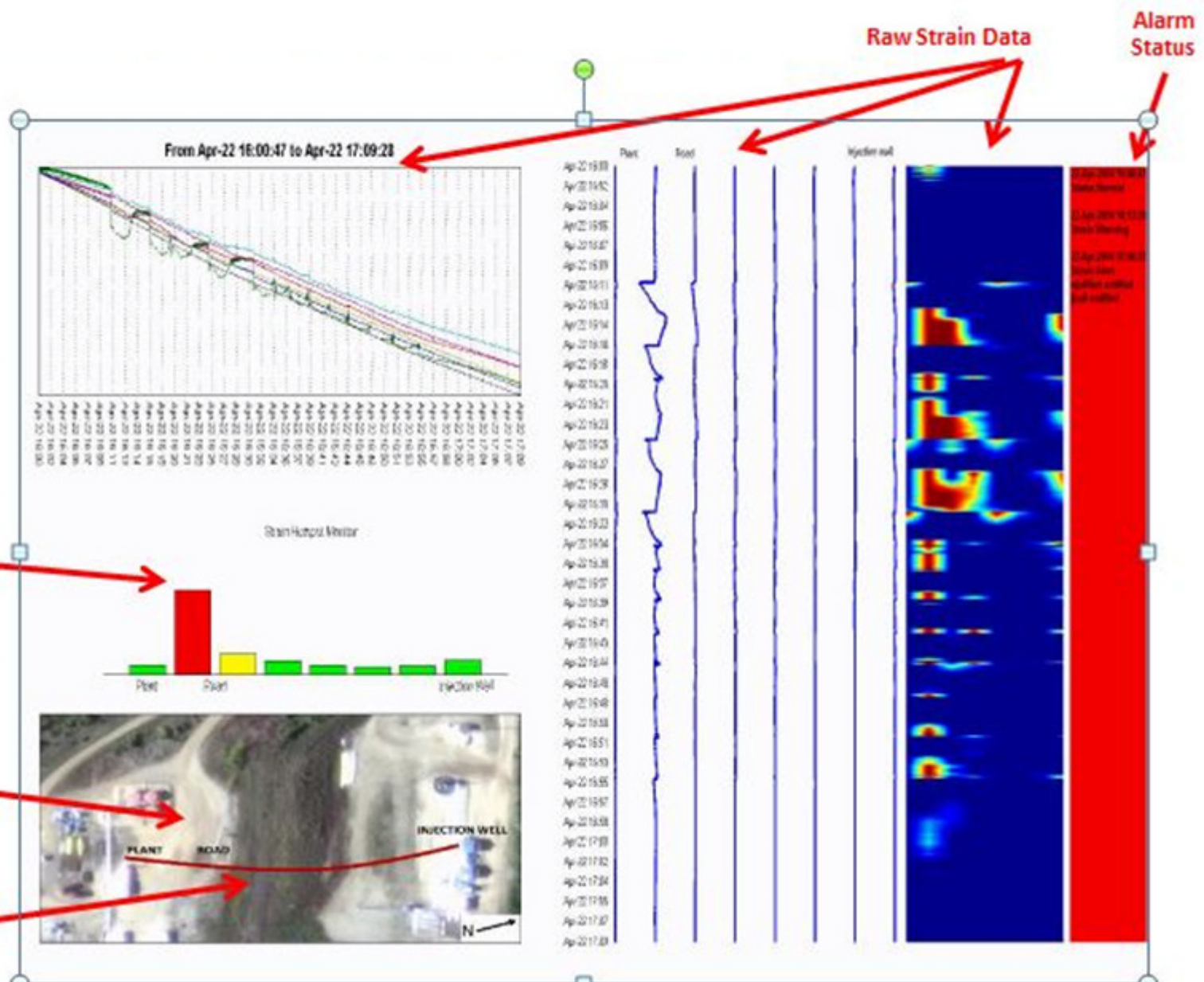




- Air was intermittently blown inside the pipe at the near end (at 200 psi)

Hydro Vac Truck Induced Strain





Conclusions and Remarks

- All data was real time, conclusive, provided instant feedback, and required very little 'interpretation'.
- With accurate Acoustics and Strain measurements. Preventative measures can be made – passes on large cost savings to operators
- New technology / gathering more data can make a significant difference in information provided.

Thank You

Q&A

