smart fibres™

Pioneering Optical Fiber Sensing

Fiber Optic Sensing for Artificial Lift Pump Condition Monitoring and Optimisation

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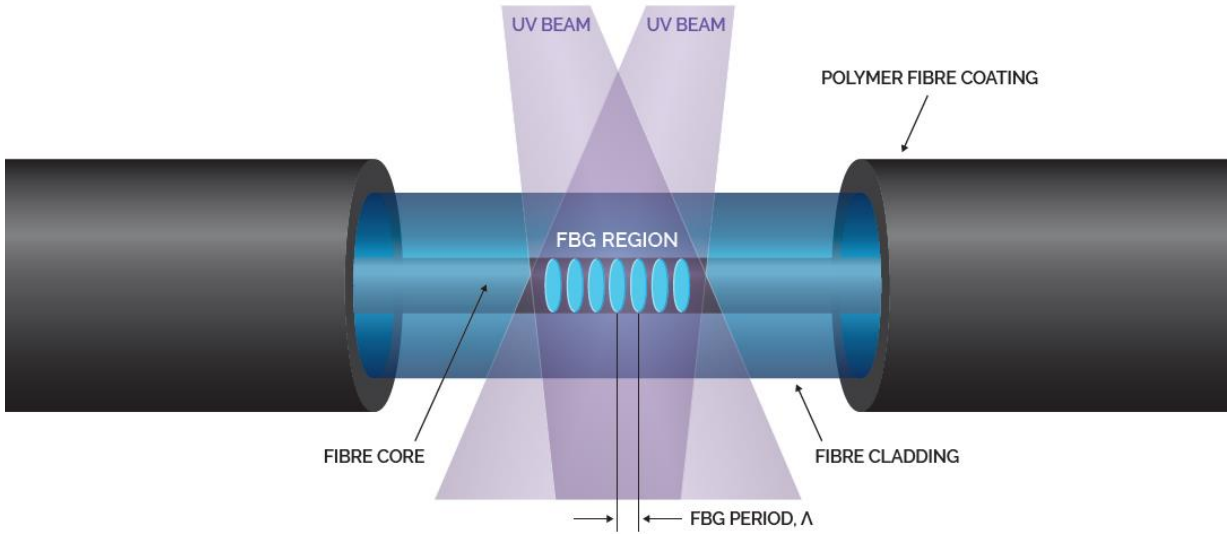
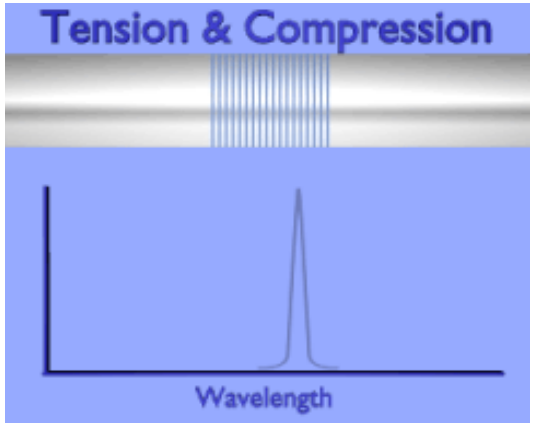
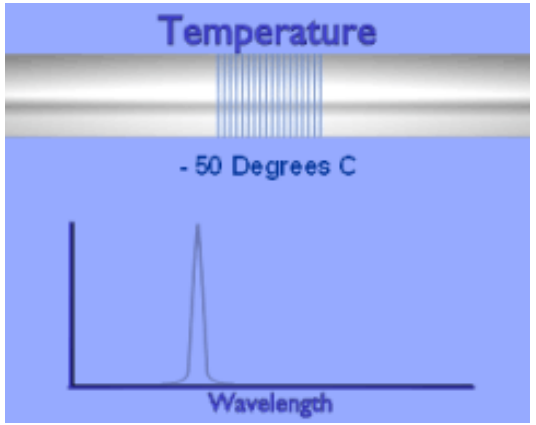
The Fibre Bragg Grating (FBG)

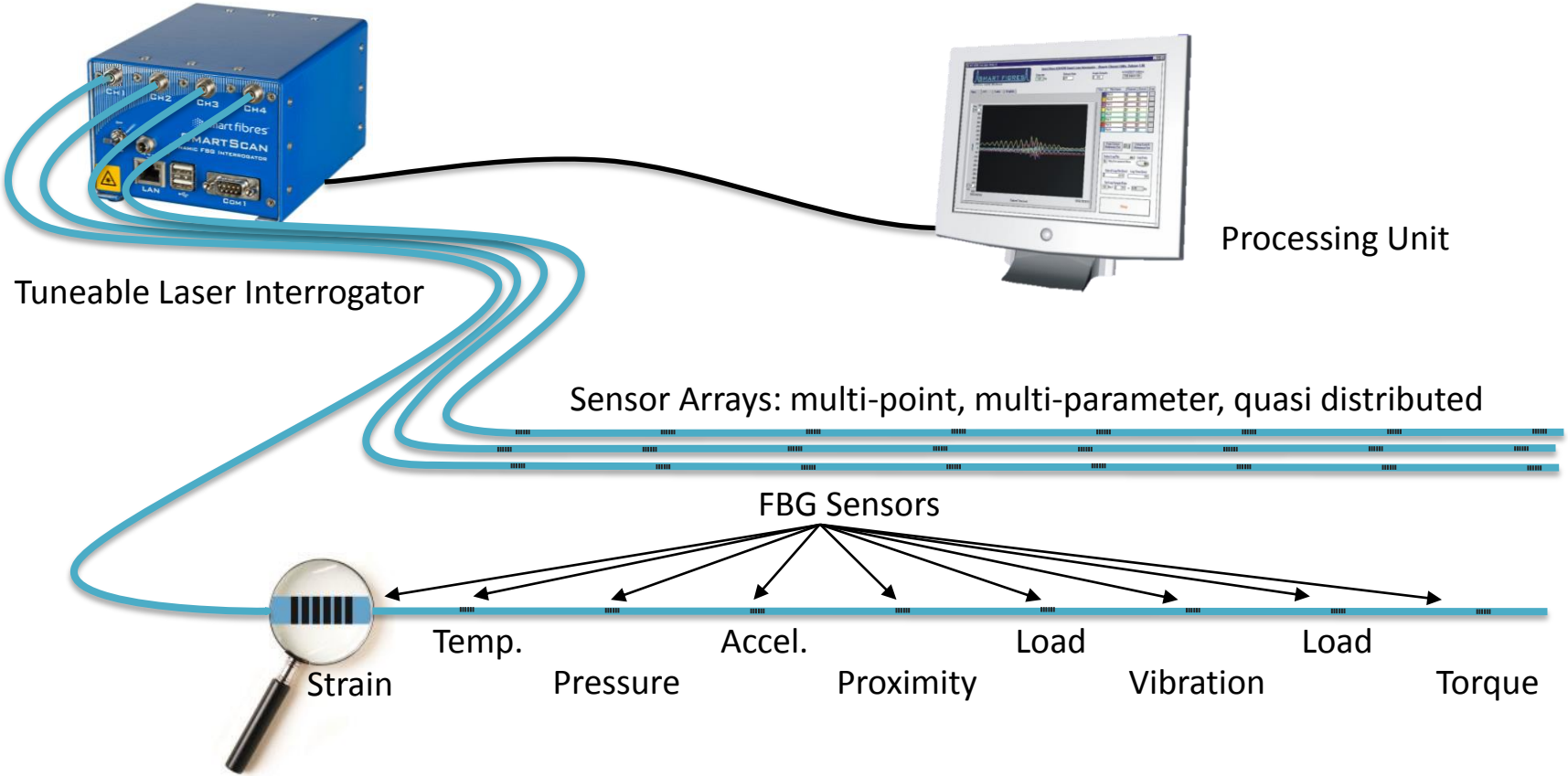
- A point fiber optic sensor that reflects light
- Recorded with UV laser light
- Reflected wavelength varies with strain and temperature







A Fiber Bragg Grating Sensing System

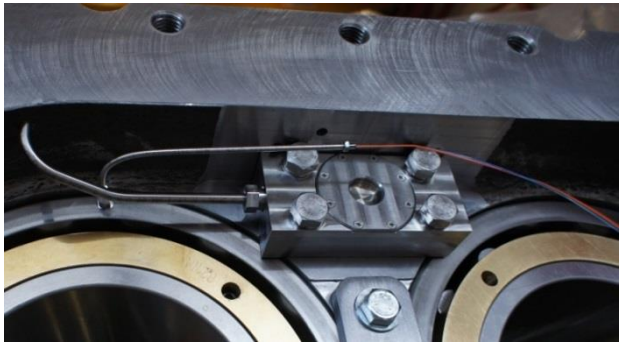


Pump condition monitoring case study

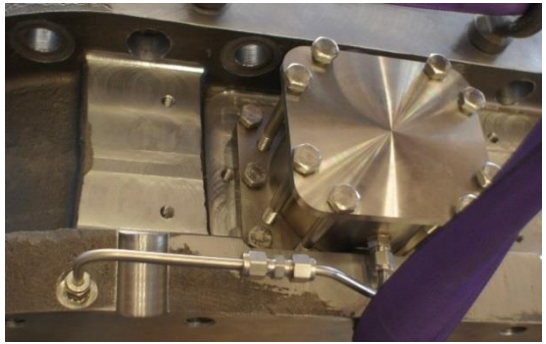
Twin screw, high boost subsea oil pump

Bearing race strain…

Motor winding temperature

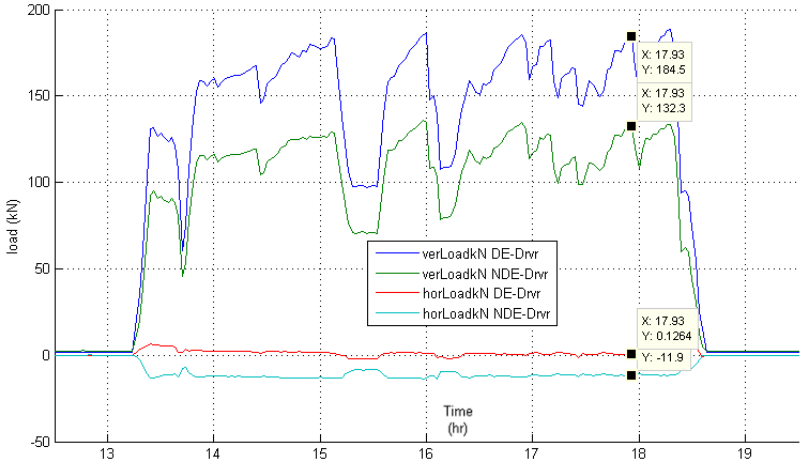


Lube oil pressure / temperature

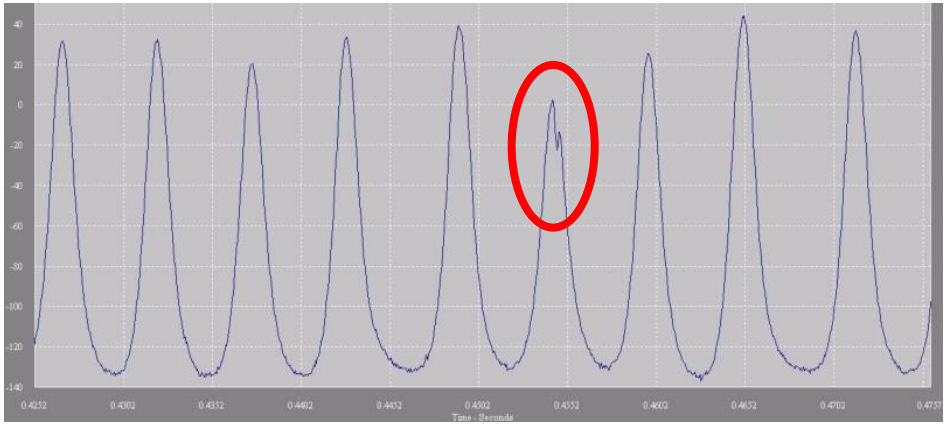


Bearing housing acceleration

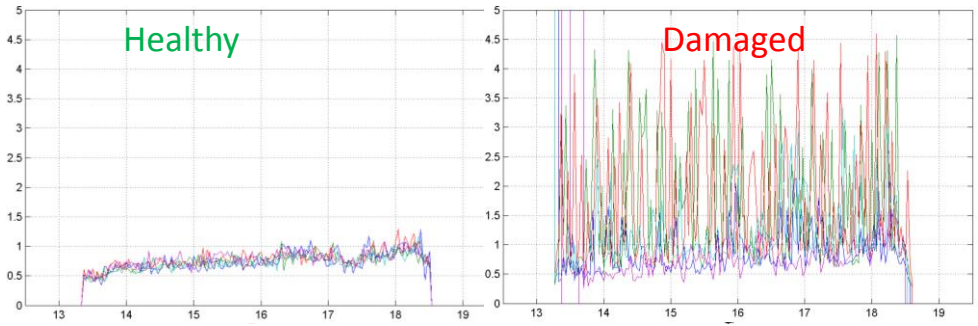
Pump condition monitoring case study



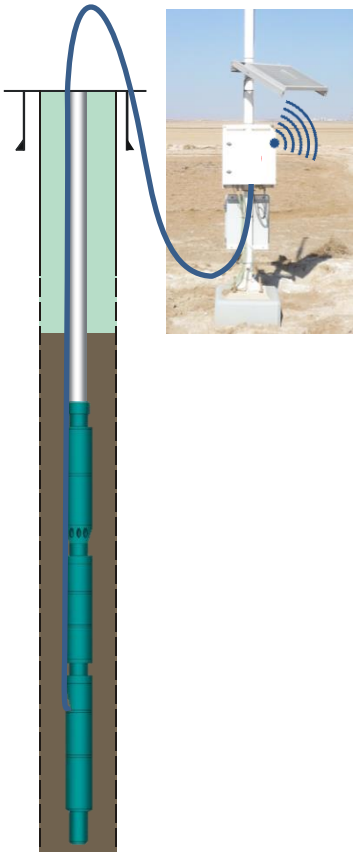
Static data: Vertical and Horizontal shaft loads match FE model



Dynamic data: signatures identify damaged roller



2 micron roller scratch detected from 10 Km



Why Monitor ESPs?

- Identify ESP faults as they develop
- Manage ESP deterioration with changes in operating parameters
- Keep ESP producing until a scheduled ESP exchange can be made

Why use an FBG monitoring System?

FBG System Feature	Benefits for ESP Monitoring
Multiple measurands, single surface instrument	Fewer connections Simpler interface Lower cost
All optical data	Measurements immune to EMI Measurements insensitive to cable impedance
Zero Power on fiber	ATEX certified for explosive environment use
No downhole electronics	Long survival in harsh environments i.e. monitoring system outlasts the pump

ESP Monitoring Potential

Internal to ESP

- Motor winding temperature
- Motor oil temperature
- Motor oil pressure
- Radial bearing temperatures and loads
- Thrust bearing loads
- Pressure drops across pump stages
- Shaft angle and speed
- Shaft torque and orbit
- Vibration at key locations
- Acoustic noise

External to ESP

- Wellbore fluid level
- Intake and discharge pressures and temperatures

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With loose tube FBG temperature sensors

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With diaphragm pressure transducer

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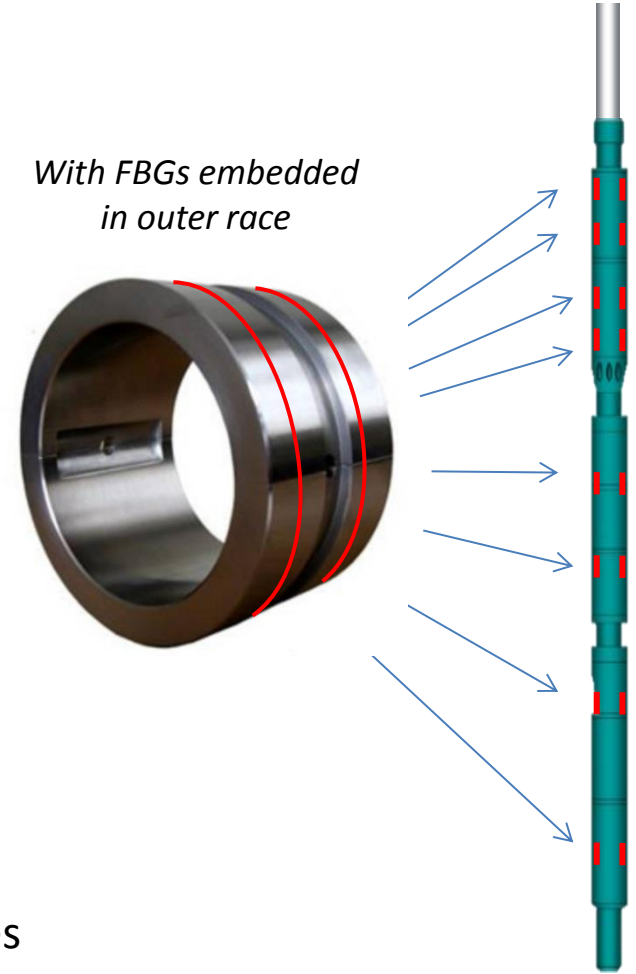
With FBGs embedded in outer race



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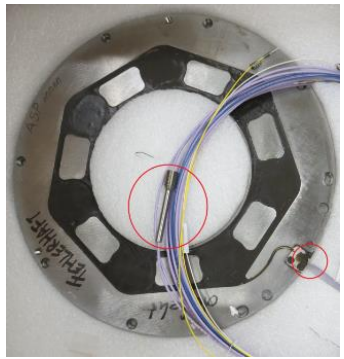
With strain FBGs on load bearing plate



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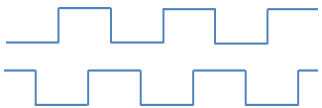
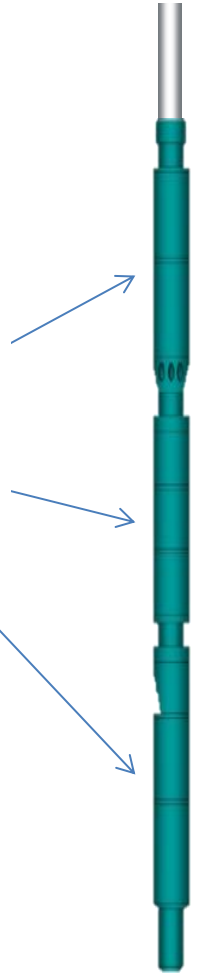
With magnetostrictive FBG proximity sensor





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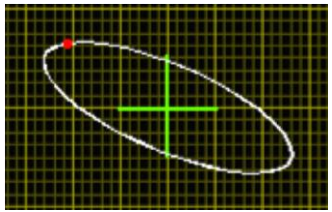

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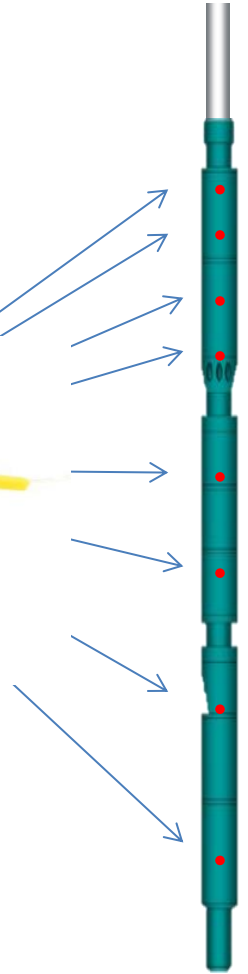
With FBG acceleration transducer



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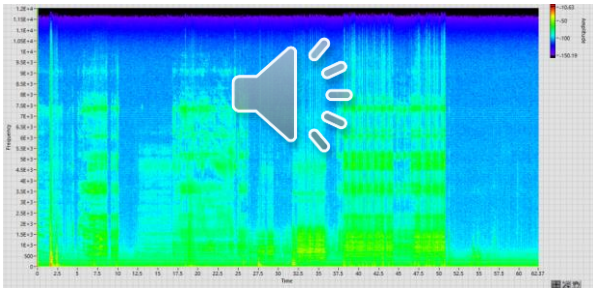
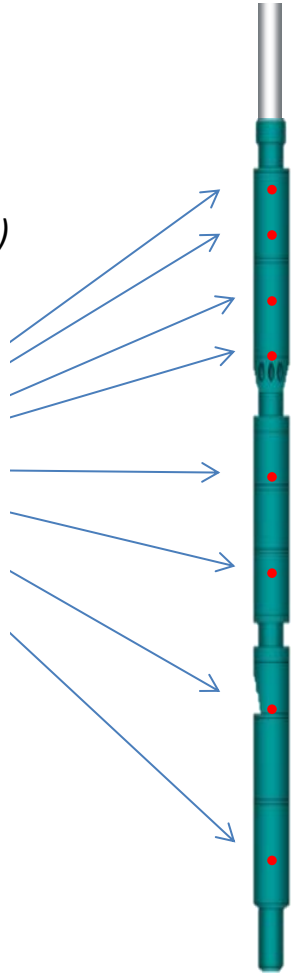
With quasi-distributed acoustic sensing (QDAS)





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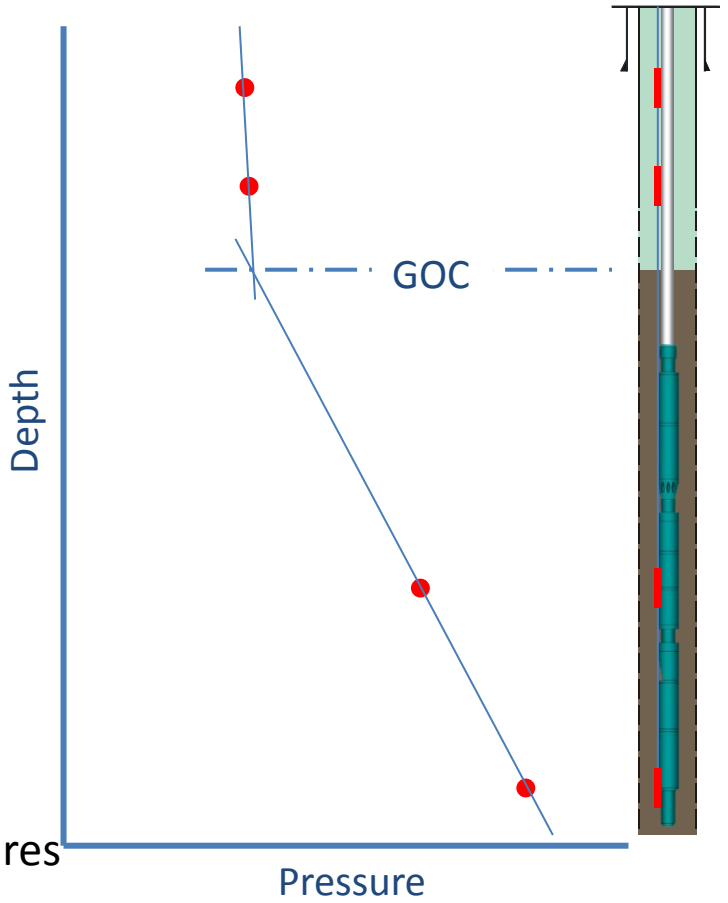
With FBG pressure transducers in wellbore



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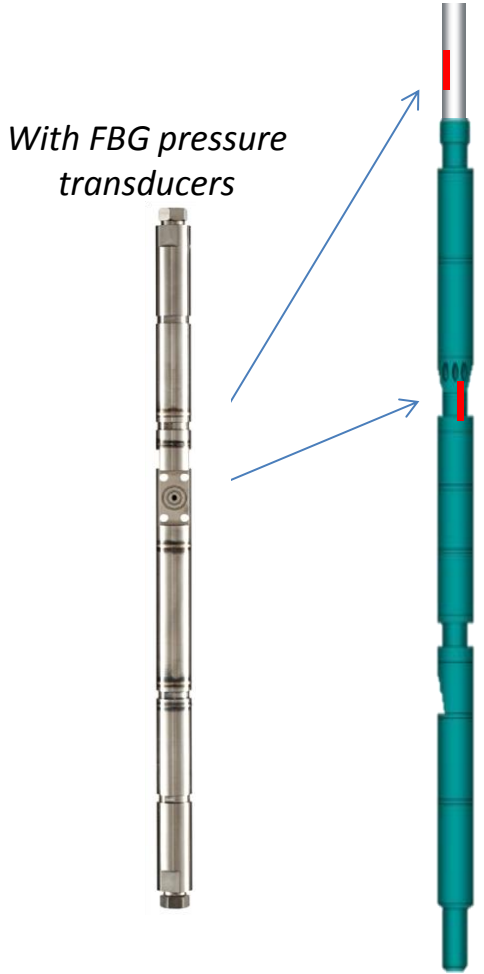

Conclusion

All the component parts exists to develop a fully integrated, multi-parameter ESP condition monitoring system using optical fiber Bragg grating technology

Thank You

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