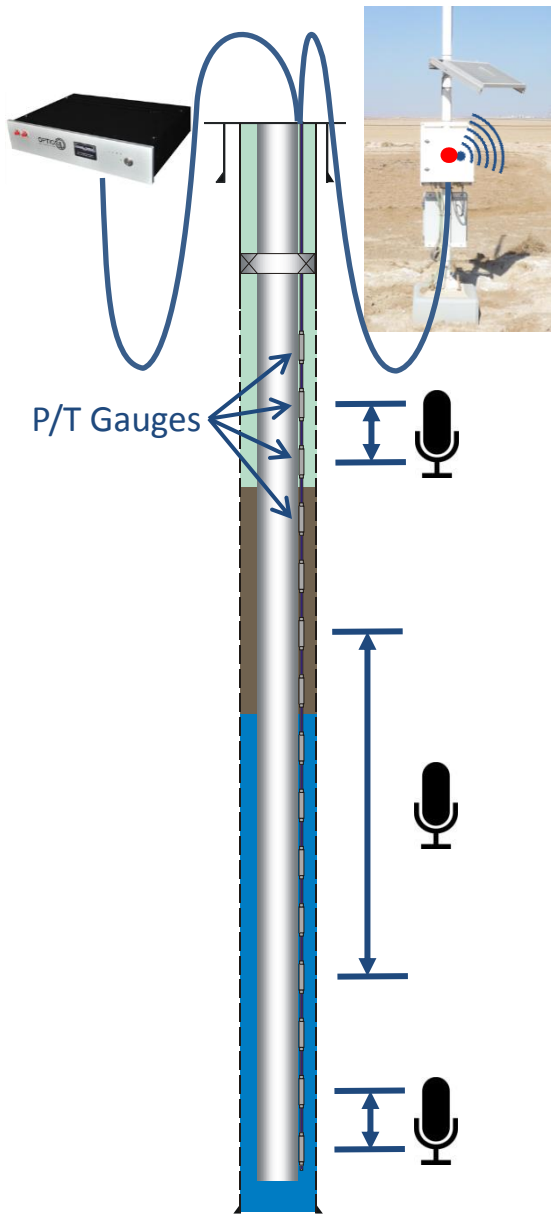
smart fibres™

Pioneering Optical Fibre Sensing

Quasi-Distributed Acoustic Sensing System for Fiber Bragg Gratings

December 2016



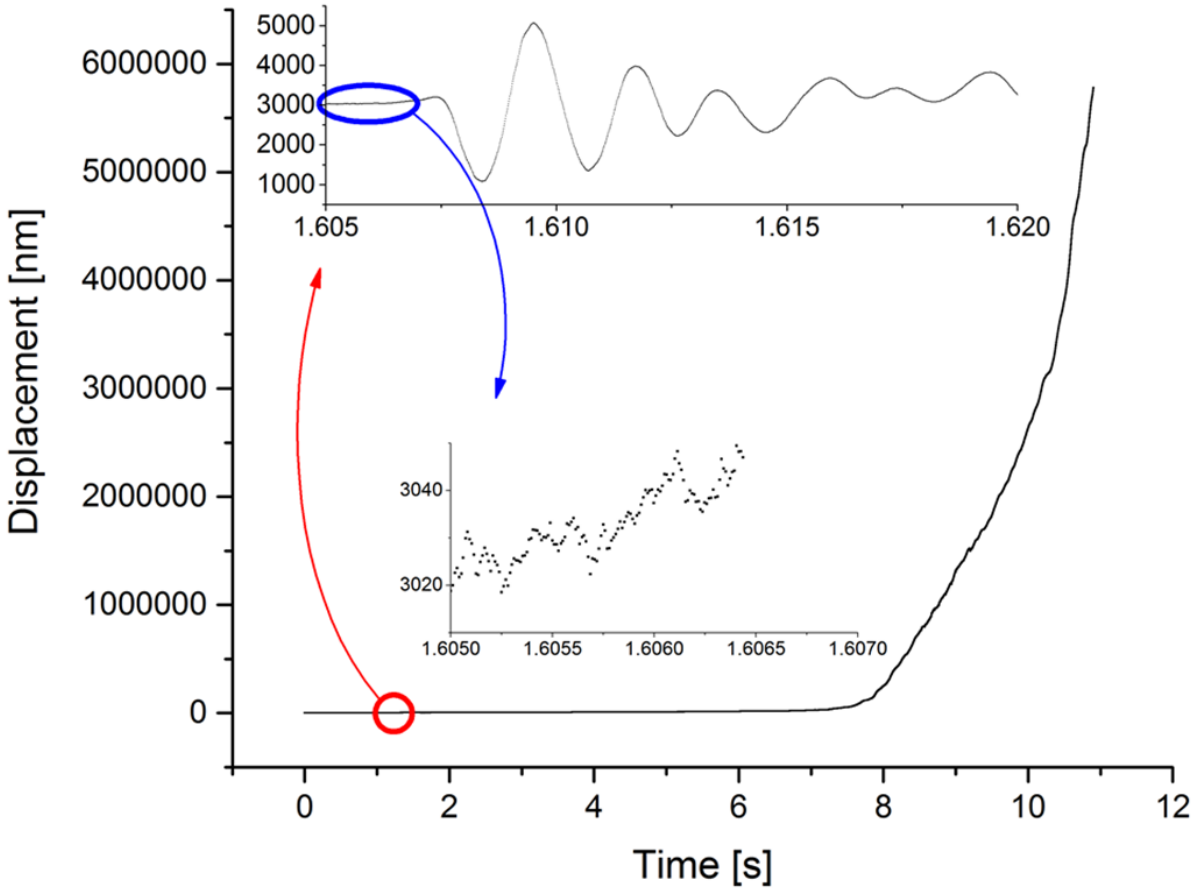
Introducing the Concept

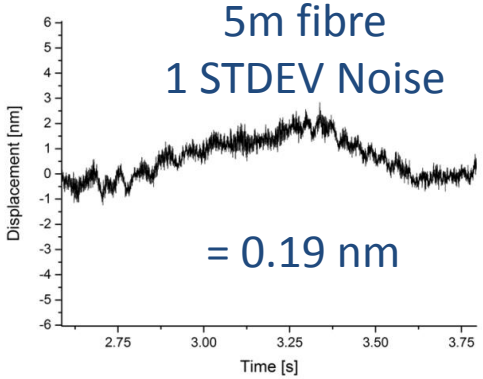
- Take an array of installed FBGs
- FBG wavelengths all different
- Add an additional surface instrument:
  - Compares change in fibre length between pairs of FBGs selected by wavelength
  - Each FBG pair defines the ends of an in-fibre downhole microphone

The Surface Instrument: SmartSonic

Item	Value
Components	Tuneable lasers High speed interferometer Signal detection & processing
Bandwidth	DC to 600 kHz
Dynamic Range	Up to 160 dB…
Signal Loss Tolerated	More than 20 dB
Noise level (5 cm fibre, 2 kHz)	<100 femtometer/√Hz (100fm/5cm = 2 picostrain/√Hz)

Noise Floor and Dynamic Range



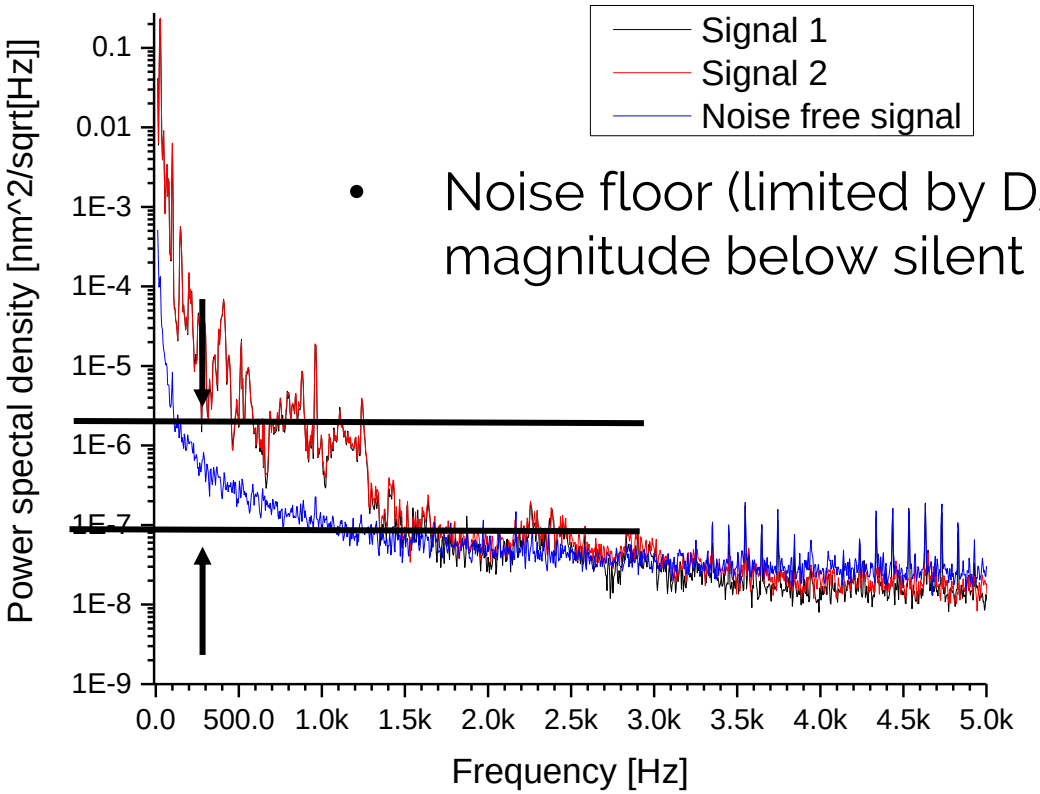


Max fibre strain
= (say) 1%
= 5 cm

- Using 3 STDEV resolution,
- Dynamic range = 20 Log (5cm/0.57nm) = 158 dB

Noise Floor Tests

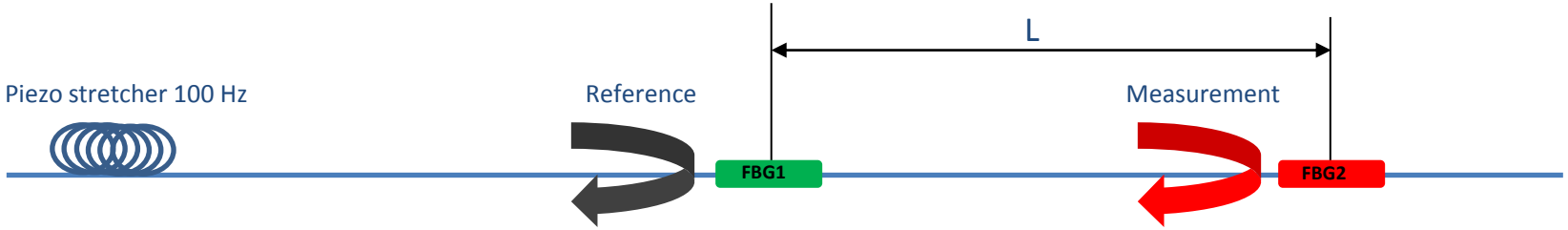
- Test in “silent” laboratory, 2 measures of ambient noise - red and black (underneath)
- Difference (blue) is noise floor



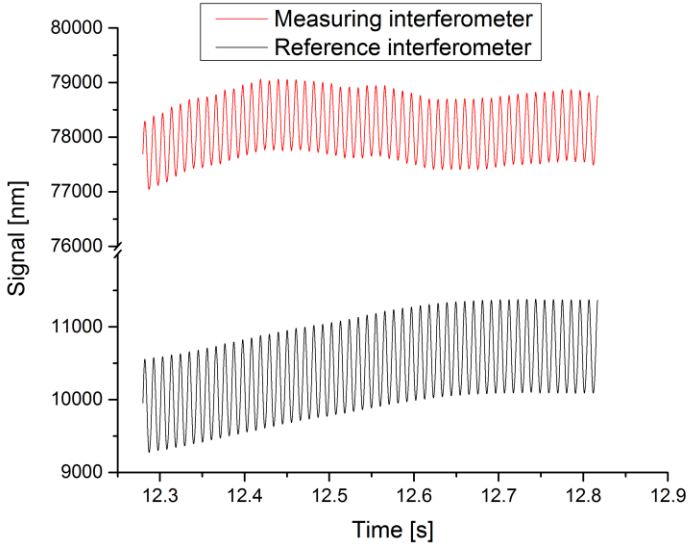
- Noise floor (limited by DAQ) is 1 order of magnitude below silent ambient

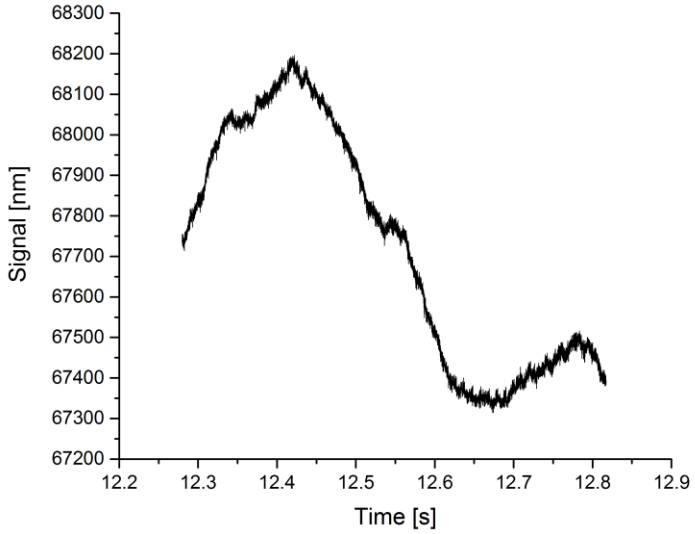
The Technology Benefits

- Amplitude noise removed via novel processing



- 100 Hz 'noise' from piezo swamps measurement signal
- Subtracting reference from measurement deletes the noise



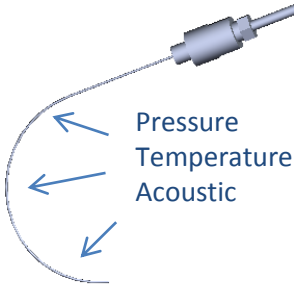


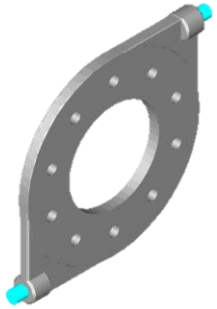
The Technology Benefits, cont'd

- Tolerant of large attenuation: high performance at long range
- Polarization effects minimized by demodulation scheme
- Good bandwidth, dynamic range and noise floor
- Not limited to a single fibre: branched fibre topologies become possible
- Selectable sensing regions = absolute spatial accuracy
- Directional sensitivity possible (2 or 3 fibres / multicore)
- Retrofittable to existing FBG P or T sensor installations
- Low optical power (<35 mW) –ATEX compatible
- Relatively low cost instrumentation

Potential Oil & Gas Applications

- Monitoring downhole valves
- Multi-point downhole seismic
- Rotating machine condition monitoring
- Pipeline Leak detection
- Pipeline flow assurance via new multi-function pressure / temperature / acoustic probe





Thank You
for your interest

For more information, please CONTACT US

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