Production Asset Integrity and Corrosion Management: Best Practices and Innovations

29 – 30 April 2025 | BANGKOK, THAILAND

Leveraging Fiber Optic Technology For Enhanced Well Integrity Monitoring In Petroleum Development Oman

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Agenda

Introduction

Fiber Optic Technology in Well Integrity Monitoring

Implementation & Results in PDO

Conclusion & Future Outlook

Introduction

Well Integrity Monitoring:

- Essential to ensure safe and continuous operation of oil wells.
- Critical for preventing leaks, spills, and environmental damage.

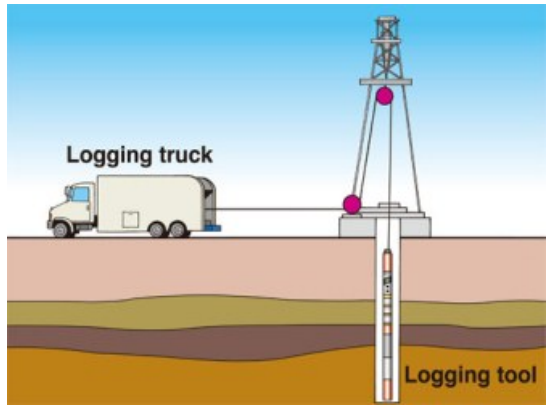
Traditional Monitoring Challenges:

- Logging tools (EMDS)
- Pressure tests from well head.

Traditional Monitoring Challenges:

- Provide periodic not continues data.
- Delayed responses, increasing operational risks.
- Oil deferment due to well intervention.

Pressure Test Unit

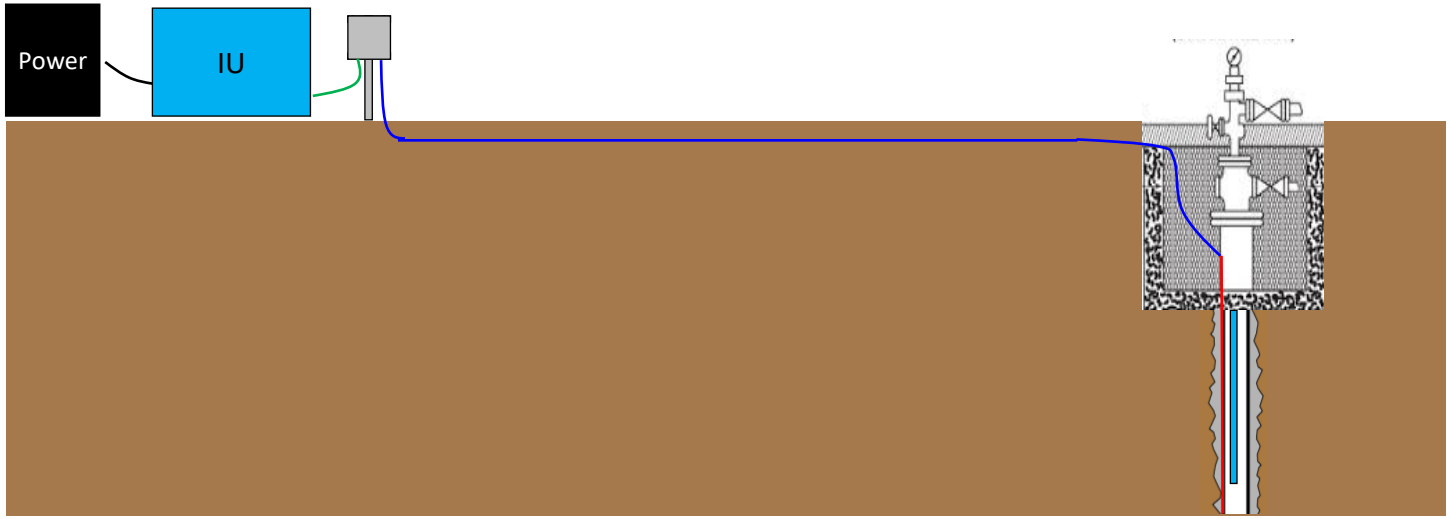


Logging Tool

Introduction

Objective of PDO's FO Well integrity check Initiative:

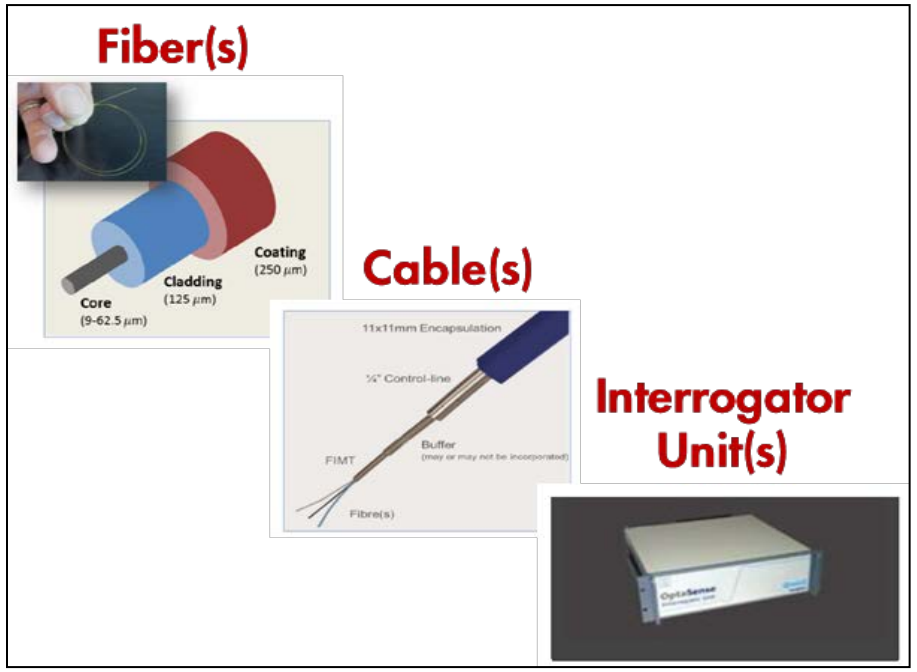
- Real-time, accurate data for proactive well integrity management
- Greater safety (no well intervention activity)
- Environmental compliance
- Improved Operational Efficiency



Fiber Optic Setup at Well-site

Introduction

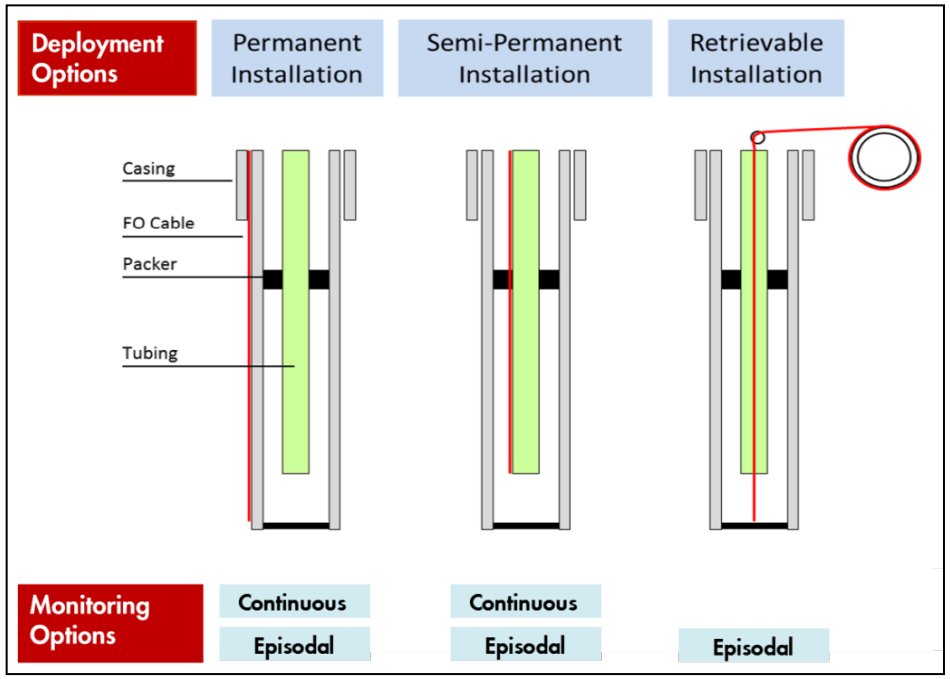
FO Systems



Components:

- Fiber(s) – Many Types (SM , MM, FBG, etc.)
- Cable(s) – Many Configurations
- Optical Interrogator – Many Unit(s)

FO Deployment Options

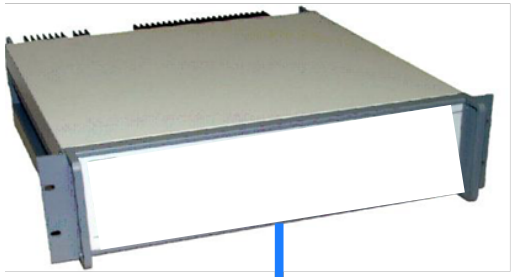


Deployment

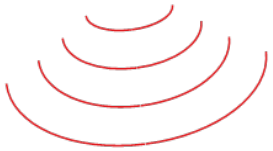
- Permanent Installation
- **Continuous** or Episodal Monitoring
- Combined with other downhole Discrete Sensors

Introduction

FO Interrogator Units

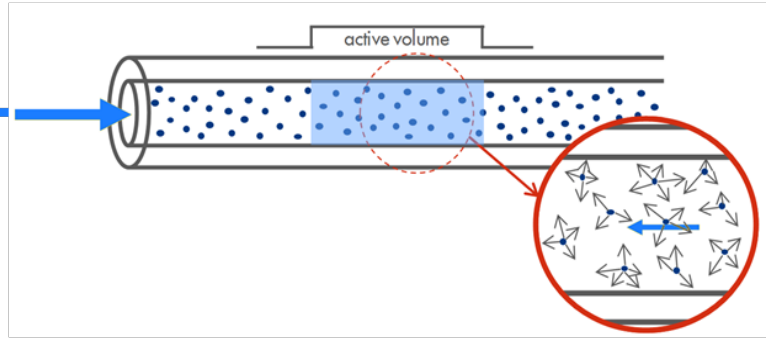


Signals



Laser Pulses

Returned Modulated signals



Light backscatter due to impurities in fibre core

- FO can generate terabytes of data (DAS)
- Depth resolution typically :1 – 8 m

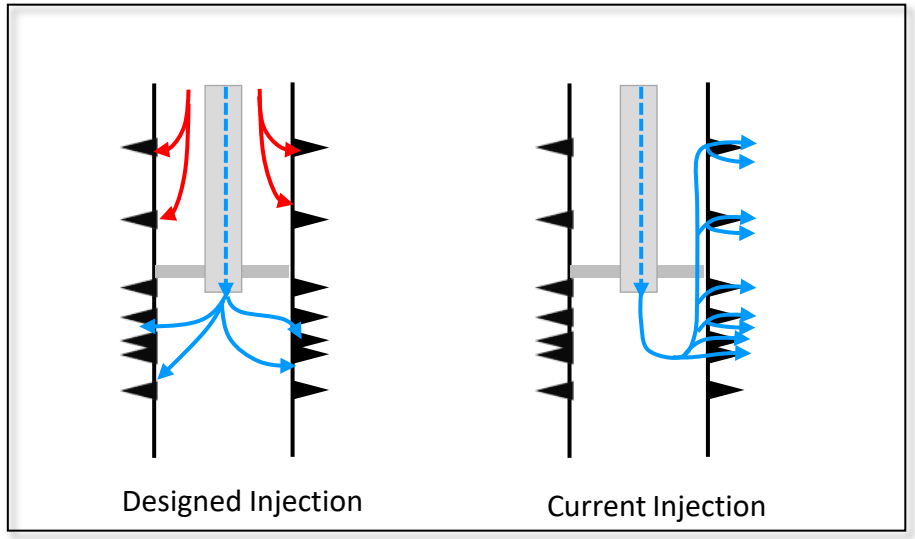
1 Channel:
The smaller the channel, the less light reflected → smaller SNR

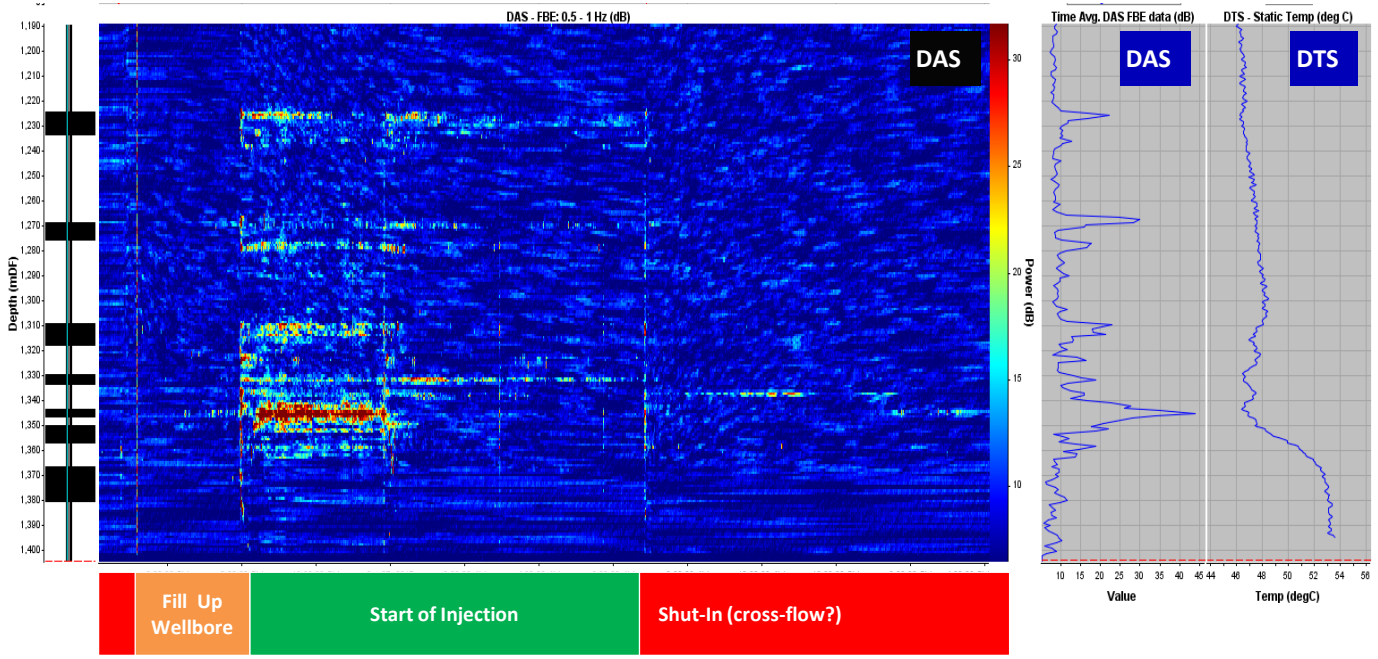
Implementation & Results

CASE-I

- Slim well with dual injection (annulus/tubing) for selective water injection in Middle and Lower Zone.

- DAS shows that there is injection above the packer (even though there is no annulus injection). Packer leak.



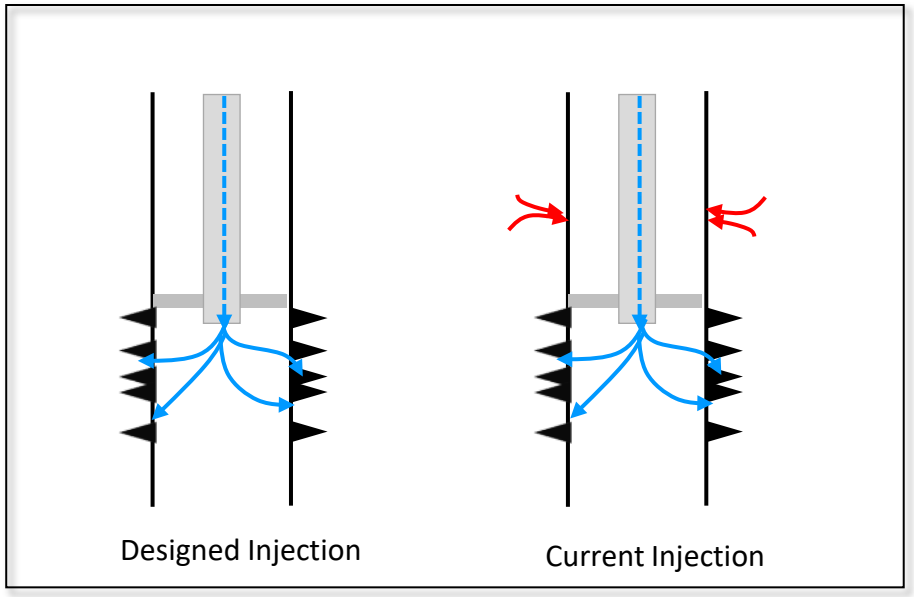


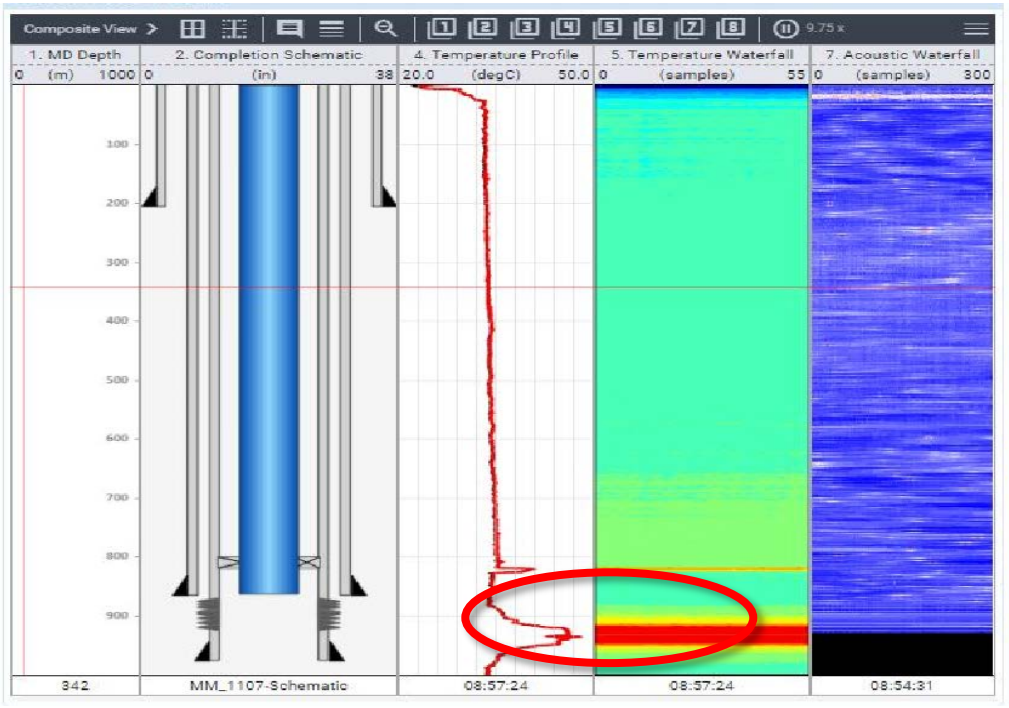
Implementation & Results

CASE-II

- Slim well with Single injection (tubing) for selective injection Zone.

- DTS shows that there is temperature anomaly at non perforated zone and above the packer (even though there is no annulus injection). Packer leak.





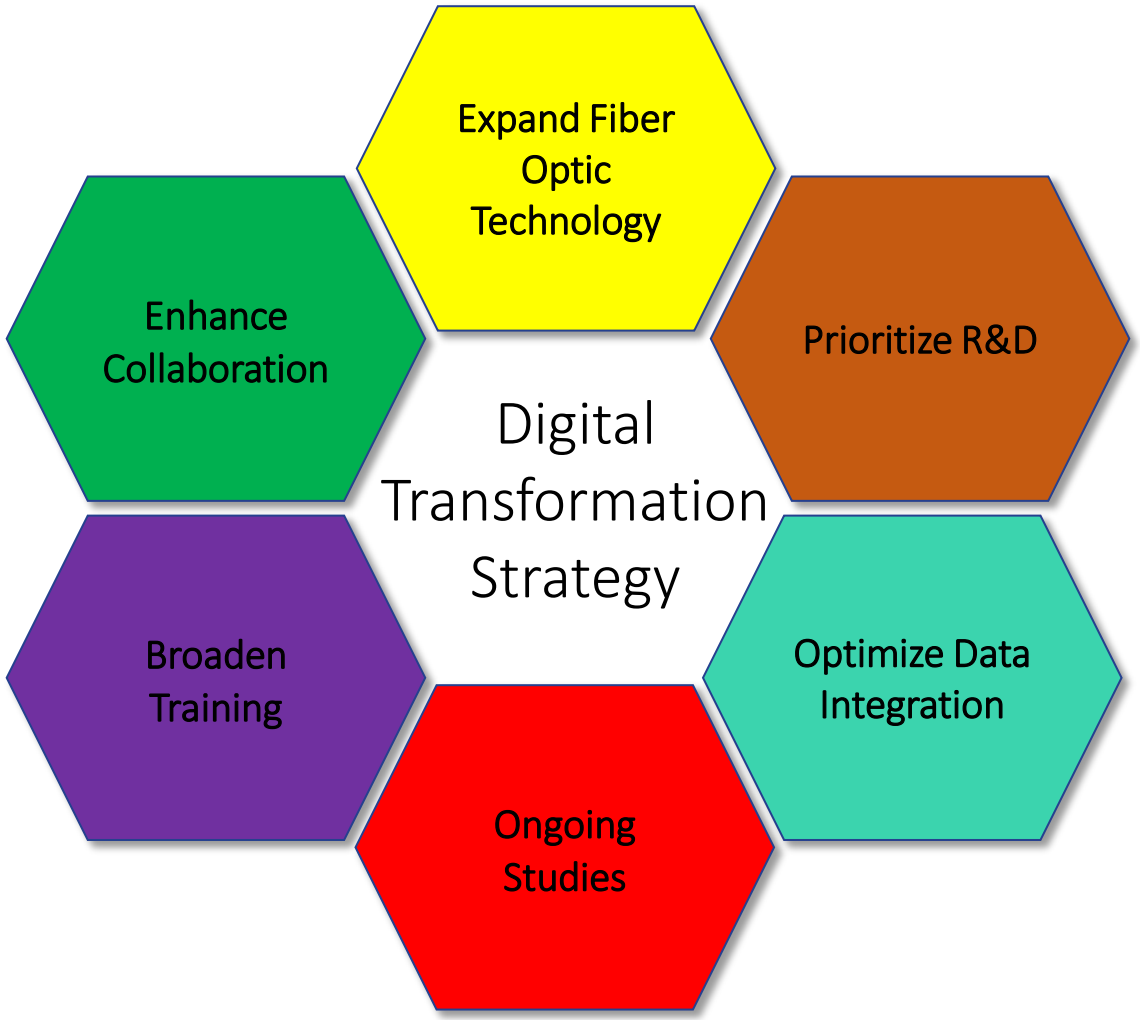
FO Data Interpolated

Annulus Pressure Containment Tests

Task	Description	Annulus Volume [m³]	Fitted	Start Pr. [kPa]	Finish Pr. [kPa]	Volume [m³]	Fluid type added	No. of tests
APS	Completion integrity test (above packer)			0	0		No Fluid	1
APT	Pressure containment test A Annulus	19.887		4000	3998	0.050	R1	1
APF	Is 'A' annulus being charged from formation?							
BPT	Pressure containment test B Annulus	0.000		1000	584	0.460	R1	3
BPF	Is 'B' annulus being charged from formation?							
CPT	Pressure containment test C Annulus			800	0	0.460	R1	3

Pressure Test Result

Conclusion & Future Outlook



Thank you