



WORKSHOP

Fiber Optics Applications in Reservoir Surveillance & Operations

Chairman: M. Rampoldi, Eni E&P

Co-chairman : A. Pelliccia, SITEP

Conference Room

5th Office Building ENI E&P

San Donato Milanese, 10th May 2006

Main Drivers

■ COSTS

- New developments with high costs and high rate wells
- High or prohibitive intervention costs

■ PRODUCTION MANAGEMENT

- Improve production performance
- Foresee and prevent well problems
- Inflow/outflow profiling
- Required for “intelligent” completion

■ RESERVOIR MANAGEMENT

- Early determination of reserves
- Manage reservoir in early-life period
- Real-time reservoir management
- Optimize drainage and increase recovery

Advantages of Fiber Optics Sensors for Downhole Monitoring

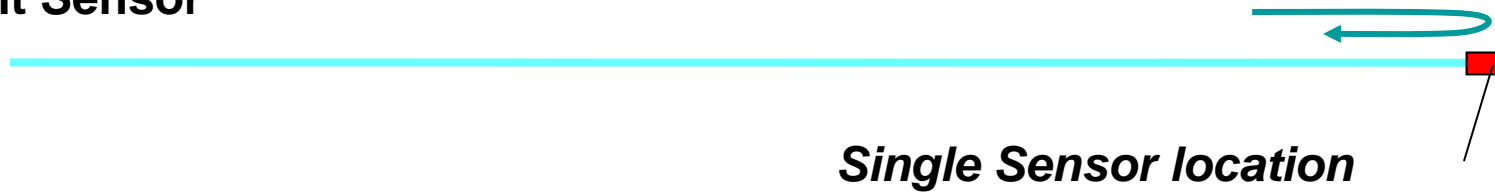
- Pressure & Temperature
- Flow rate & Liquid fraction
- Seismic
- Strain
- Density
- Chemical
- Sand
- Paraffin

Advantages of Fiber Optics Sensors

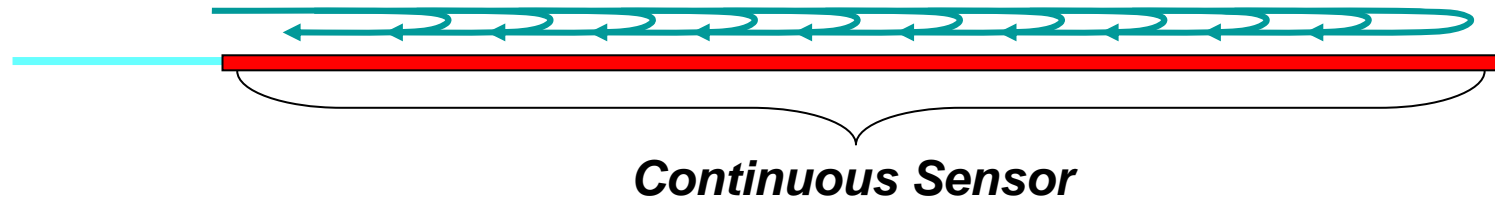
- Electrically passive (no downhole electronics)
- Operate at high temperature
- High sensitivity & wide operating range
- Low transmission loss
- High versatility – wide range of sensor types
- Provide multi-point (multi-channel) sensing capabilities
- Low-profile sensor
- Leverages off telecommunications industry

Fiber Optics Sensing

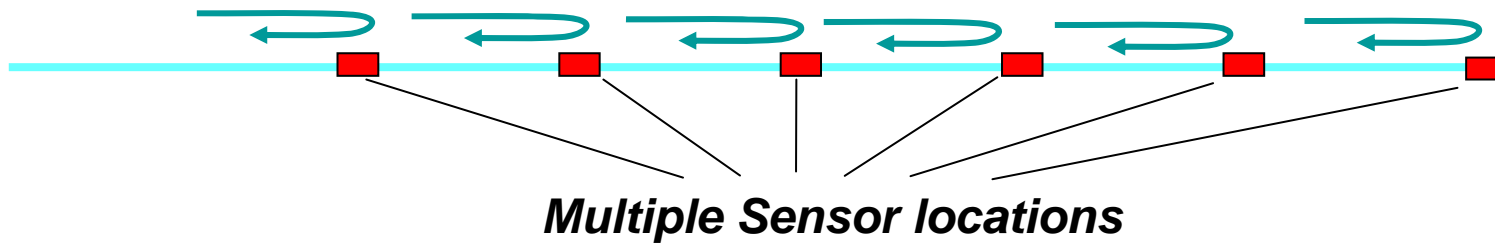
Point Sensor



Distributed Sensor



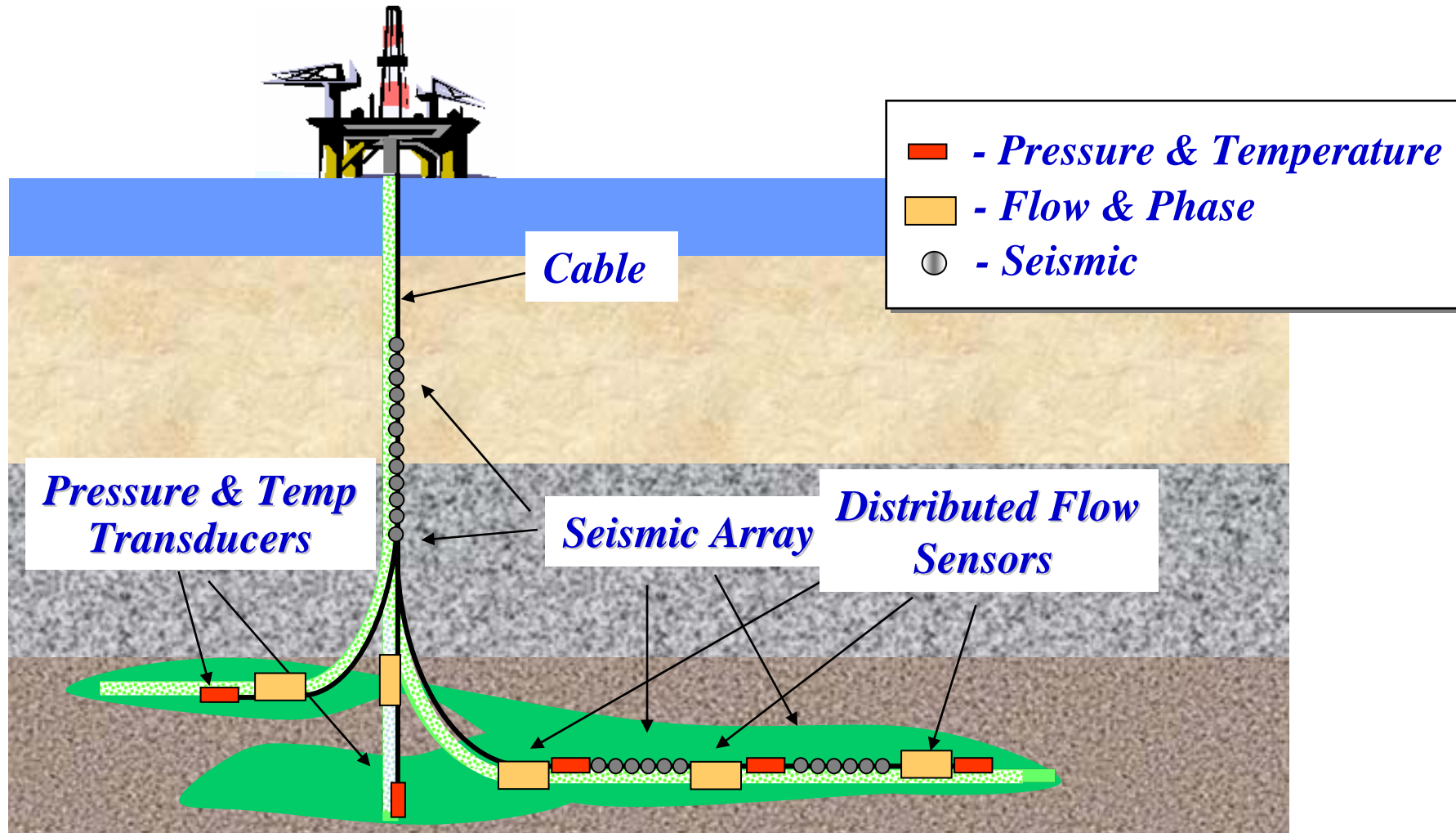
Quasi-Distributed Sensor



Potential of Technology

- **Complete Reservoir Monitoring**
(e.g. P&T, Flow, Phase Fraction, Seismic, Strain,)
- **Distributed Monitoring**
(e.g. multi-zone measurements)
- **Building block flexibility**
(e.g. Plug & play capability, Fit-for-purpose installation)
- **Enabling technology for Smart Completions**
(e.g. flow control, water injection, artificial lift)
- **Real-Time production & reservoir management**
(e.g. production optimisation, time-lapse fluid imaging)

Potential of Technology



Complete Sensor Suite For Reservoir Monitoring

Benefits to the Industry

- **Permanent Installed Sensors**
(e.g. Real-time data,)
- **High reliability, HP-HT Operations**
- **Multi-parameter/Multi-zone Capability**
(e.g. whole solution, Plug & play capability)
- **Provides Data required for Improved Field Management**
(e.g. improved field yield, lower overall production costs)

The Workshop

- Explore the application of fiber optics technology in the oil industry with particular care to reservoir and well monitoring, and operations.
- Presentation and discussion of economic advantages of current applications as well as limitations, criticalities, future developments and opportunities.

Agenda

- 9:00 - 9:30 Opening Session
- 9:30 – 10:00 **Integrated Optical Sensing Solutions for Complex Wells**
by Tor Kragas, Weatherford
- 10:00 – 10:30 **Real Time Monitoring of Acid Stimulation Using a Fiber Optic DTS System** - *by Dan Gualtieri, Halliburton*
- 10:30 – 11:00 *Coffee break*
- 11:00 – 11:30 **Fiber Optics High Data Rate Communications for Reservoir Evaluation** - *by Frederique Kalb, Schlumberger*
- 11:30 – 12:00 **A view of On-going Fiber Optics Developments**
by Stephen Poland, Baker Hughes
- 12:00 – 12:45 **Panel Discussion**
- 12:45 – 13:00 Closing Session