

# SIMFRAC

## Hydraulic Fracture Mapping and Fluid Injection Monitoring



The SIMFRAC system developed by IFP is an acoustic tool designed to determine the orientation and extension of fractures induced by hydraulic stimulation or existing fractures worked on by fluid injection.

The SIMFRAC system can be used to:

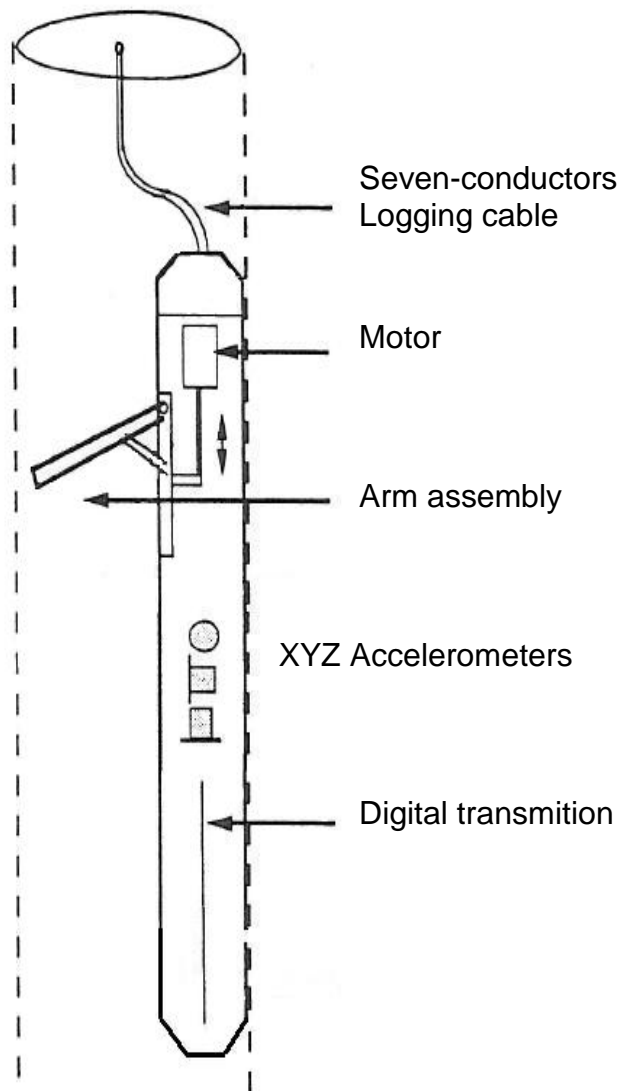
- Assess the development of the hydraulic fracture during a minifrac test.
- Determine the main direction of fluid injection paths in anisotropic reservoirs.

### SYSTEM PRINCIPLE

The SIMFRAC sonde is fitted with a triaxial accelerometer, pressure and temperature gauges.

The sonde is attached to a standard seven conductors logging cable and lowered either down the well to be fractured or down the injection well. Digital signals are high-speed transmitted from the sonde to the surface acquisition system. During falloffs following hydraulic fracturing, the SIMFRAC tool records, via the accelerometers, the seismic activity associated with the closure of the fracture. Fracture mapping is performed by locating the different microseismic events, their location being based on the interpretation of the P/S-wave succession, assuming the velocity model is known.

Thereby these data are interpreted in term of azimuth and expression of the fracture taking into account the layer properties.



## OPERATING PROCEDURE

The surface pressure control equipment is installed at the surface, including BOP, tubing riser, wireline stuffing box and grease injector.

The SIMFRAC tool is lowered by wireline into the well, below the perforations or the injection zone. The Mini-Frac injection can then start. It consists of a sequence of pumping and shut-in periods. The seismicity is recorded only during shut-in periods (the noise level being too high during pumping).

The seismicity acoustic “events” induced by the closure of fractures is recorded during a few hours (after the end of pumping).

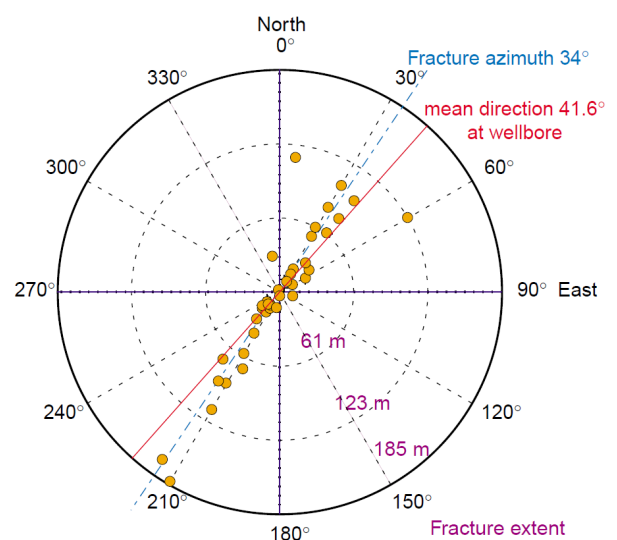
## DATA PROCESSING & INTERPRETATION

The SIMFRAC-MAP interactive interpretation software has been developed to visualize and process the data after or during the job. This software includes a series of modules to sort and characterize the microseismic data in order to map the fracture (azimuth and extent) and estimate the minimal stress direction.

Data processing can be performed as soon as the data are recorded; the main steps are:

- Automatic detection of first wave arrival time;
- Polarization analysis for source location based on the identification of the P/S-wave succession;
- Source characterisation.

At each step, different plots are available to control the data processing and to edit reports. Utility modules are also included to manage the application, to take into account calibration shots (if required) and to manage the data. Data interpretation can be delivered with minimum delay after the job if the required filed data have already been inserted into the database.

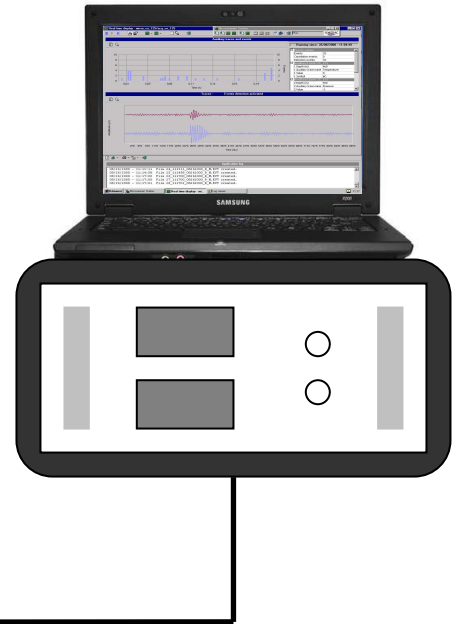


*SIMFRAC-MAP™ hydraulic fracture mapping*

# SYSTEM PERFORMANCE

## Surface Acquisition System « NAS »

- Power requirement 100/230VAC – 47/60Hz
- Output files SEG2, SEG2, SEG2
- Operating T° 50°C
- Synchronisation Better than 50µs
- Standard 19" rack mounting
- Digital/analogical transformation
- Data storage

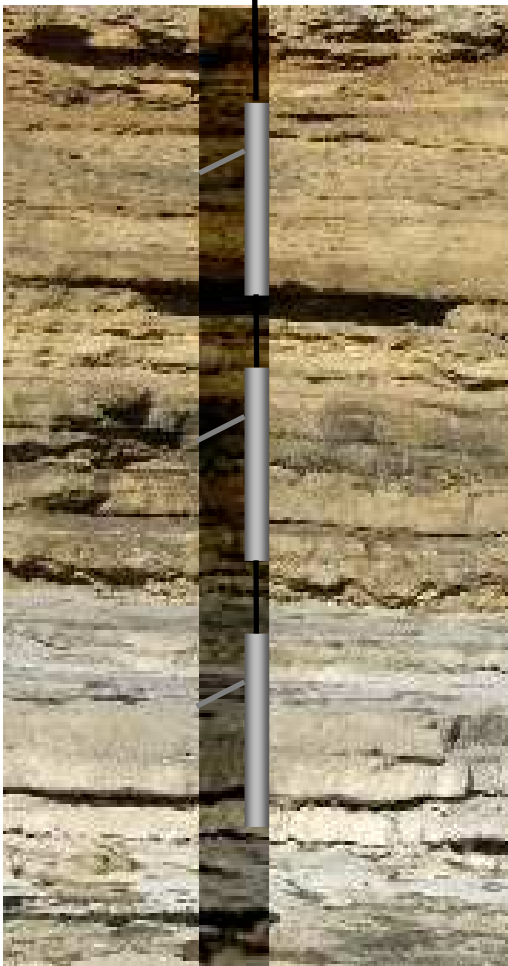


## Winch unit

- Digital transmission on standard seven conductors logging cable

## SIMFRAC Downhole Tool

- OD 50mm (2")
- Length 1,100mm (43")
- Temperature 150°C (302°F)
- Pressure 1,500bar (21,500psi)
- Cased hole 2"7/8 mini  
13" maxi
- Digitalisation 24bits
- Dynamic range 105dB
- Data rates 1.5Mbits/s
- Sampling rates 0.25ms  
0.5ms  
1.2ms



## CONTACT

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