

## Case study: Fiber-Optic Borehole Seismic Acquisition

Location: Offshore Gulf of Mexico

Aligned with United Nations Sustainable Development Goals:  
12—Responsible consumption and production,  
13—Climate action, 14—Life below water

# Fiber Optics Simultaneously Records 3D VSPs in Four Wells, Reducing Acquisition Time by 88 Days

Optiq Seismic fiber-optic solution provides better reservoir delineation without deferred production

**Carbon Emissions:**  
Reduced ~7,536 metric tons of CO<sub>2</sub>e

An operator used the end-to-end Optiq Seismic\* fiber-optic borehole seismic solution and its unique denoising workflow to simultaneously record a 3D vertical seismic profile (VSP) in four offshore wells to better characterize the reservoir—saving 88 days in acquisition time compared with conventional geophones and reducing ~7,536 metric tons of carbon emissions. Furthermore, the improved understanding of subsurface reservoir structures leads to optimized positioning for future development wells, different completion strategy, and potentially a reduction of required wells, further decarbonizing full-field development.

## Obtain high-resolution seismic images without deferring production

The operator faced different production rates in four wells on the same platform and wanted an efficient acquisition solution that could provide high-resolution seismic images to explain the different production rates without deferring production. The next drilling campaign was planned in the upcoming 5 months, and the high-resolution images would enable the operator to plan a new well or sidetrack an existing well.

## Deploy fiber-optic borehole seismic solution and denoising workflow

The Optiq Seismic fiber-optic borehole seismic solution brings new efficiency to seismic acquisition. The solution's optical interrogator unit at surface is connected to any fiber-optic wireline cable deployed in a well, from hybrid wireline logging cable to production tubing with fiber installed or optical fiber permanently cemented behind casing. The interrogator records seismic signals, employing the downhole fiber as a vibration sensing device along the full length of the wellbore.

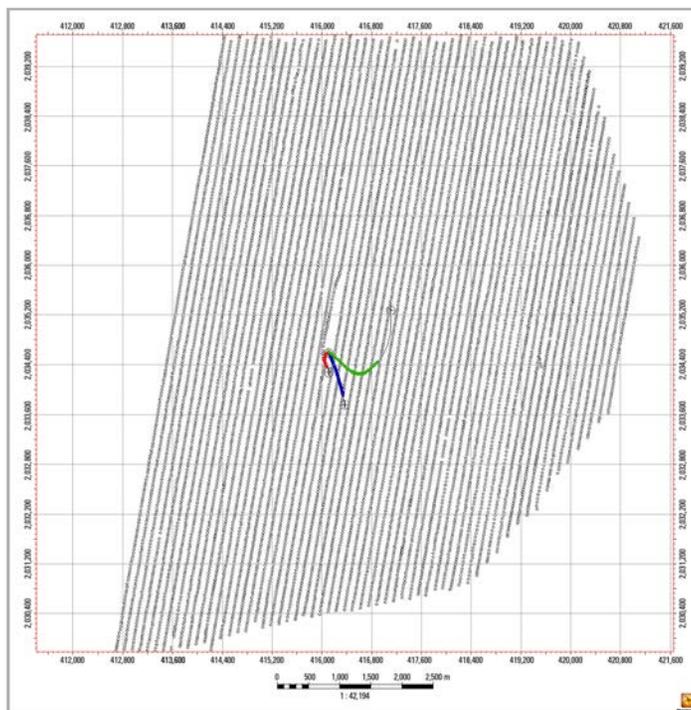


Figure 1. Source and receiver geometry.

Included in the Optiq\* Schlumberger fiber-optic solutions family, a single, hybrid fiber-optic and electrical cable was installed along the production tubing as part of the completion string, enabling joint deployment of Metris Extreme\* HPHT permanent PT gauges and distributed temperature and acoustic measurements. The survey was designed with 58 lines containing 10,425 shot positions (Fig. 1). Schlumberger simultaneously recorded a 3D VSP in all four wells while the wells were in production. And using Schlumberger's denoising workflow, the operator obtained high-resolution images in the northeastern part of the field to understand the compartmentalization of the reservoir (Fig. 2 and Fig. 3). For each well, the Optiq Seismic solution recorded more than 22 TB of raw optical data

## Case study: Fiber-optic technology reduces VSP acquisition time by 88 days, offshore Gulf of Mexico

and 133 GB of real-time processed data in SEG-Y format. Because of the solution's source-driven capability and embedded source positions within the SEG-Y headers, the operator obtained data in near-real time to the processing center to minimize turnaround time.

### Leverage Schlumberger's end-to-end workflow to reduce acquisition time and minimize the carbon footprint

The Optiq Seismic solution enabled the operator to record the 3D VSPs within 12 days without any deferred production; in contrast, the conventional downhole geophone method would have taken 100 days with deferred production. This drastic reduction in acquisition time reduced CO<sub>2</sub>e emissions by 7,536 metric tons.

Despite the challenging turnaround time, the end-to-end Optiq Seismic solution managed to acquire, process, and deliver an answer product within the 5-month window, obtaining high-resolution 3D images to enable the operator to define the spatial resolution of fault planes and better interpret subsurface reservoir structures (Fig. 4 and Fig. 5).

As a result, the operator improved understanding of the reservoir framework, reducing uncertainty to further optimize the field development plan.

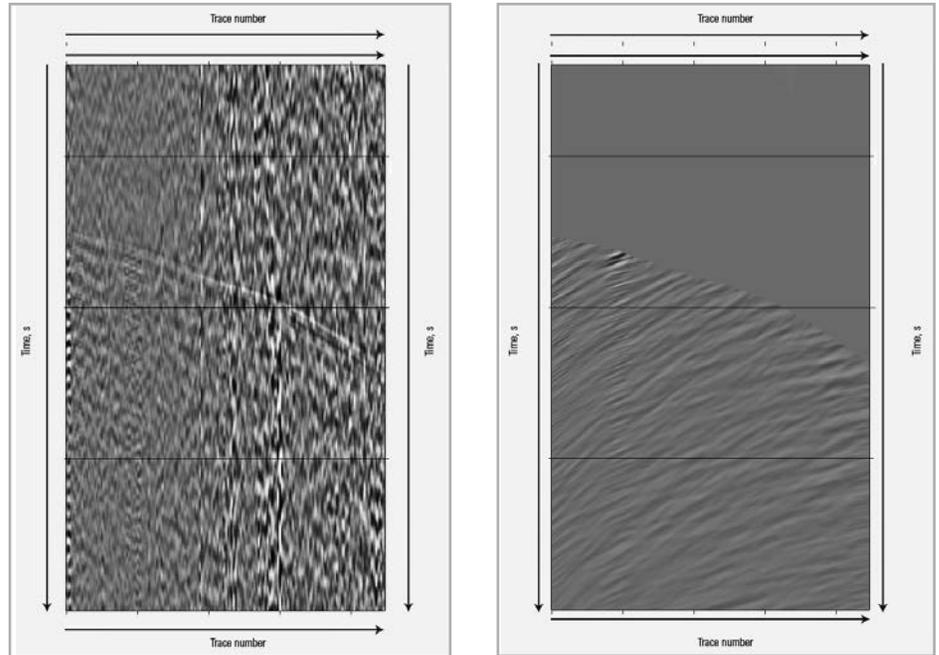


Figure 2. Midoffset shot of raw and processed upgoing P-waves.

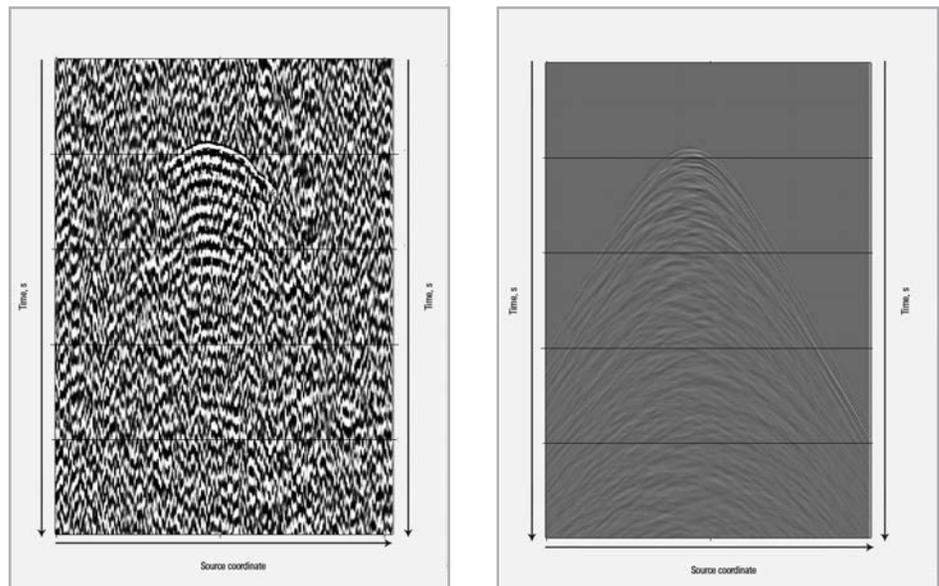


Figure 3. Near-well line common receiver raw and processed wavefield after production denoising.

## Case study: Fiber-optic technology reduces VSP acquisition time by 88 days, offshore Gulf of Mexico

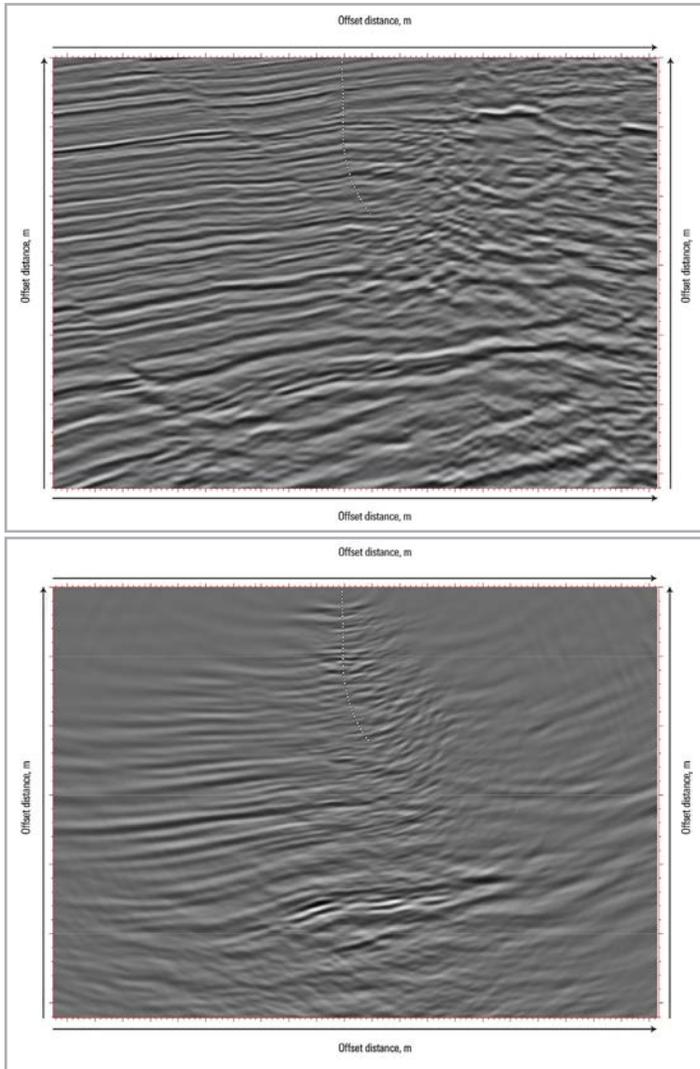


Figure 4. Surface seismic data (top) and Optiq Seismic solution 3D VSP data (bottom).

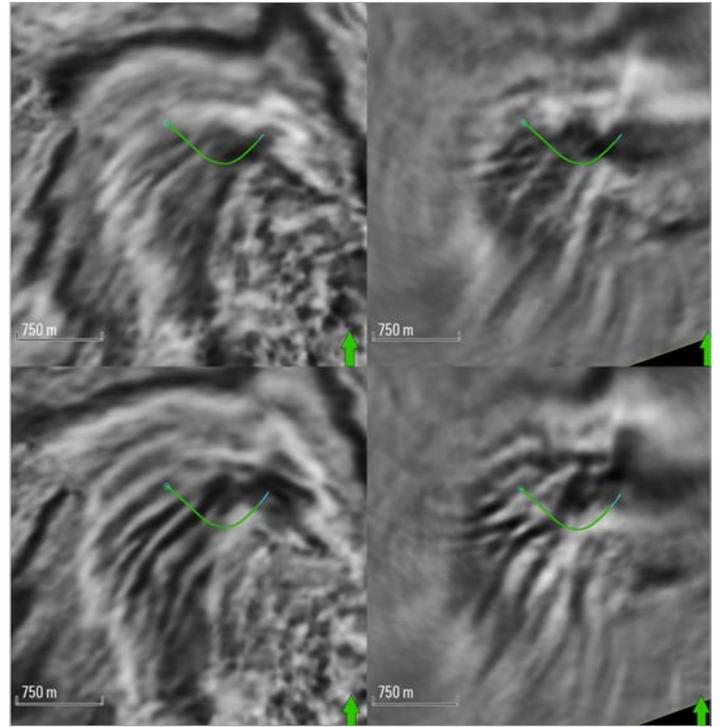


Figure 5. Two depth slices near the reservoir interval: surface seismic data (left) and Optiq Seismic solution data (right). Optiq Seismic solution data shows higher spatial resolution of fault planes to better understand compartmentalization.

[slb.com/OptiqSeismic](https://slb.com/OptiqSeismic)

**Schlumberger**