



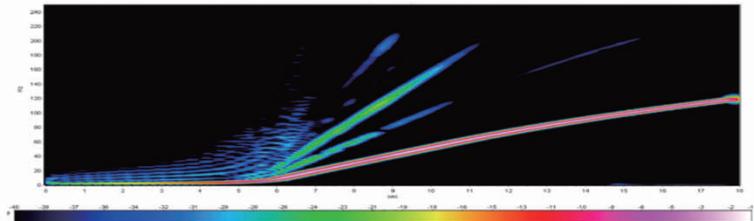
# Anti-Harmonic Sweep (AHS)

## A Robust Solution for Reducing Harmonic Distortion

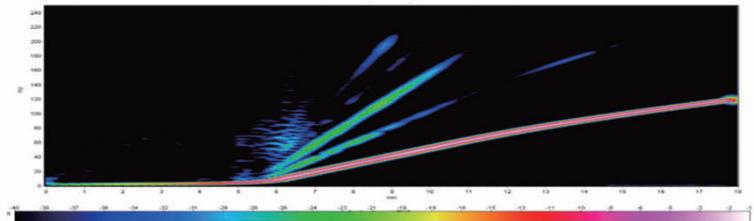
The nonlinear sweep used during vibroseis acquisition will bring harmonic distortion at low frequencies. To reduce the harmonic distortion of the vibroseis sweep, Anti-Harmonic Sweep (AHS) is proposed. AHS is a new approach to predict and prevent the low-frequency harmonic distortion in the sweep-design stage.

## Reduce harmonic noise with the designed fundamental energy

Low-dwell sweep

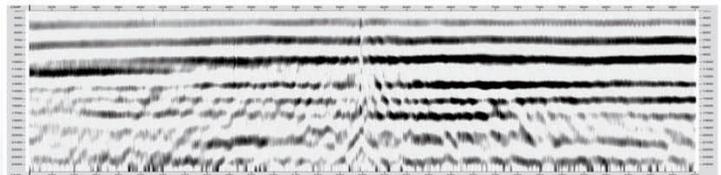


AHS sweep

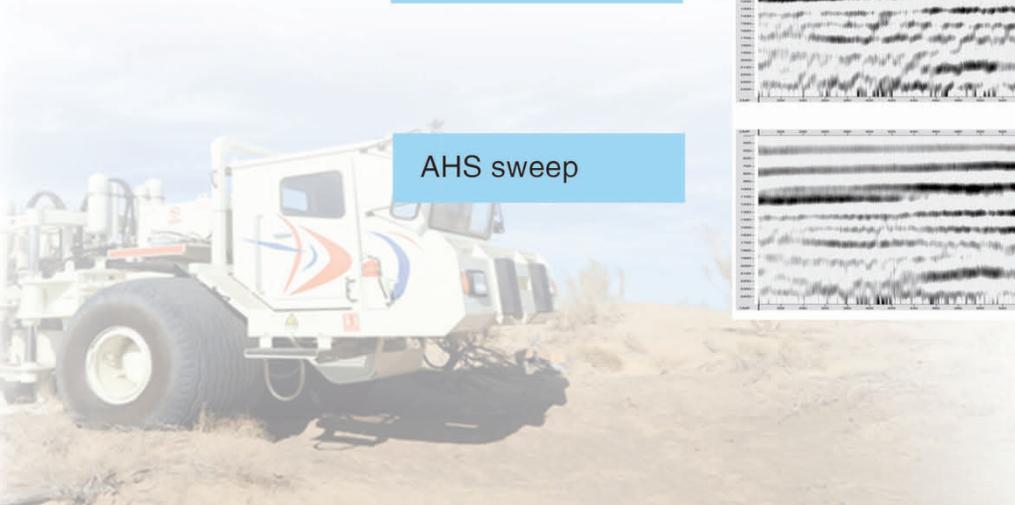
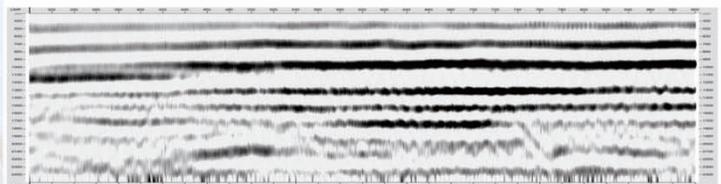


## Improve the SNR of low frequency imaging

Low-dwell sweep



AHS sweep



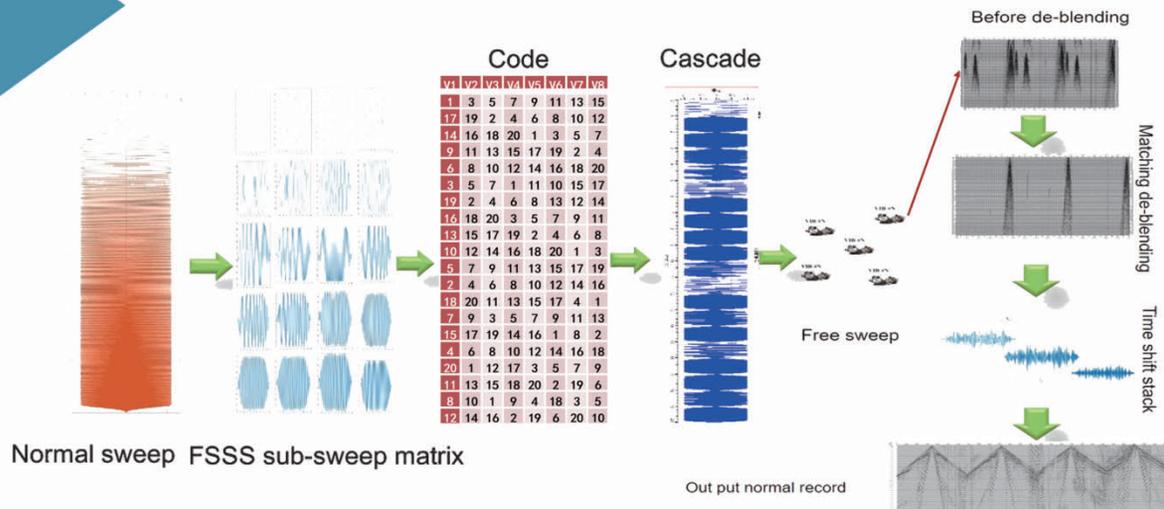


# Frequency Separated Simultaneous Sweep (FSSS)

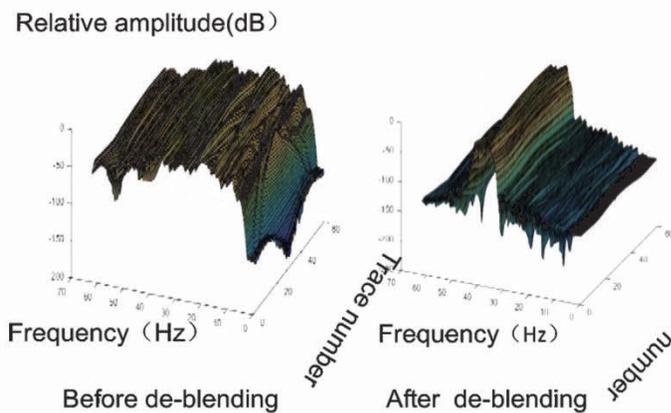
**A High fidelity and productivity vibroseis acquisition method**

Based on different frequency components being orthogonal, the Frequency Separated Simultaneous Sweep (FSSS) will eliminate the harmonic noise and solve the noise from adjoining shots, so maintaining high fidelity with high productivity.

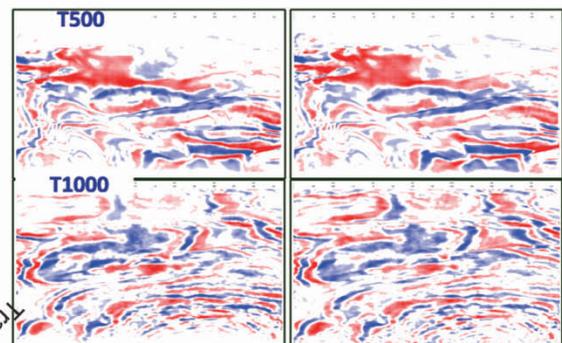
## FSSS Functional Diagram



## FSSS results



Comparison of 2D FFT spectrum



Time slices comparison with FSSS and flip-flop in the same geometry at 6 times the daily production of flip-flop



# OBN Seismic Exploration Solutions

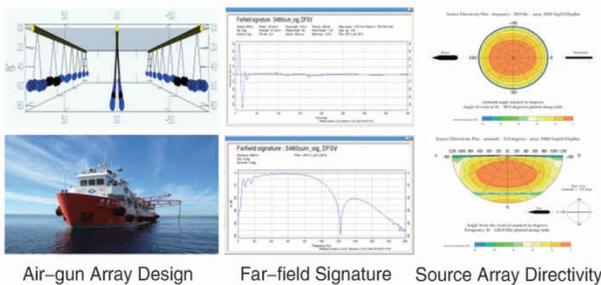


## BGP OBN Briefing

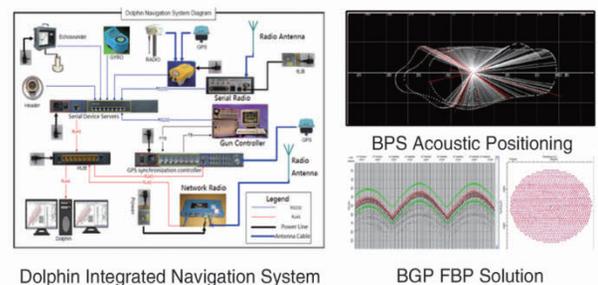
Ocean bottom node (OBN) seismic exploration service, supported by software and equipment owned by BGP, has become a focus area for BGP in the last five years, with regards to both technology and business development. This acquisition methodology requires extensive planning and integrated navigation of the seismic flotilla to achieve optimal operational efficiency for node deployment and retrieval, comprises massive data QC and on-site processing and yields superior 4-component seismic data with full azimuth, high fold, long offset and high S/N.

## BGP OBN Key Techniques

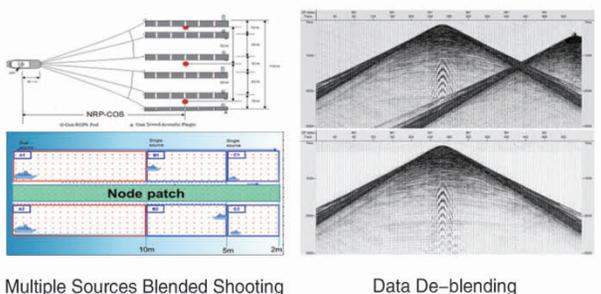
### 1. Marine Air-gun Source Modelling



### 2. Integrated Navigation & Positioning



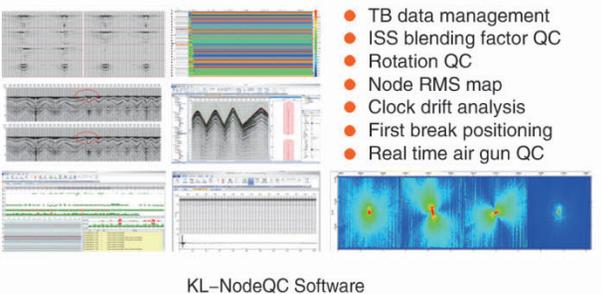
### 3. Marine Seismic High-efficiency Acquisition



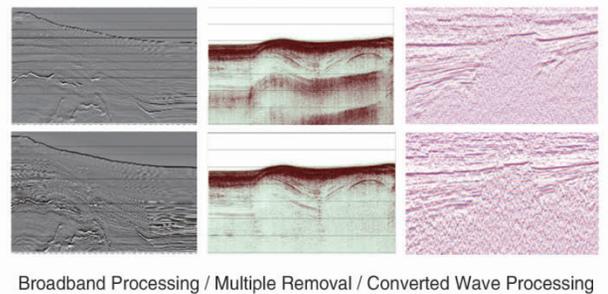
### 4. OBN Automatic Deployment & Retrieval System



### 5. OBN Data Quality Control System



### 6. OBN Data Processing





# OBN Seismic Exploration Solutions



## BGP OBN Experience

Since entering the OBN market in 2015, BGP Offshore has established itself as the major OBN service provider globally, with more than ten large scale projects to date and with the surveys in Indonesia, Abu Dhabi and Brunei being the largest OBN projects in 2017, 2018 and 2019–2021, respectively. BGP takes the lead in introducing OBN to China in 2019 in the Bohai Bay. Currently, the total OBN survey area acquired by BGP is more than 30,000 km<sup>2</sup> and there are totally over 50,000 available nodes for BGP to use in OBN acquisition, including 18,000 Sercel/BGP GPR300 and 32,000 other types of nodes.

## BP Indonesia OBN Survey Overview

- Full Azimuth design
- ISS
- Large Spread
- Large Fleet: 13 vessels
- 500+ crews
- Strong current > 4 knots
- Fishing activity
- Drifting trees
- Platforms
- Pipelines
- LNG Corridor



## Brunei Shell OBN Survey Overview

- 7 Vessels
- 8 Months
- 3 OBN surveys completed
- 140+ platforms
- Dense pipelines
- 7000+ close passes
- Sensitive coral areas
- Monsoon season
- Negligible weather standby
- No time lost to SIMOPs



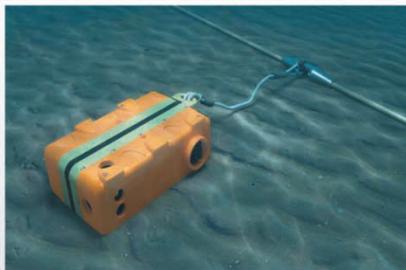


## **Transition Zone (TZ) Seismic Solutions**



BGP Offshore provides the most comprehensive transition zone seismic solutions in the industry and takes pride in being the unrivaled expert for TZ, with more than 20 years' experience including the most challenging and diverse TZ environments in the world.

Specialized and unique equipment has been designed and manufactured for a variety of TZ environments, including purpose-built shallow-draft cable deployment vessels and shallow-draft air-gun source boats allowing seamless seismic acquisition between open water and land.



### ***New-generation OBN- GPR***

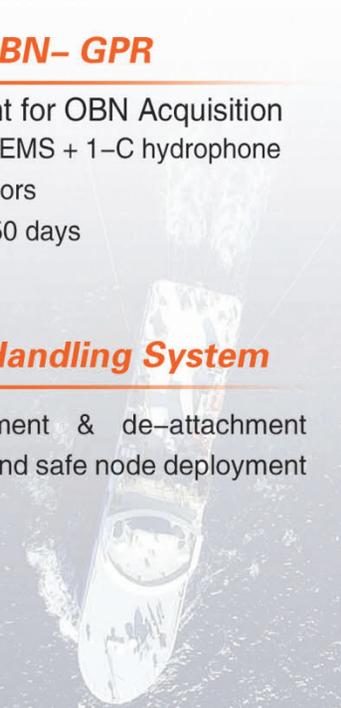
GPR is a new equipment for OBN Acquisition

- Sensor 3-C QuietSeis MEMS + 1-C hydrophone
- Internal tilt, azimuth sensors
- Battery autonomy up to 50 days
- Working depth 300m



### ***Automated Node Handling System***

Automatic rope attachment & de-attachment systems ensure efficient and safe node deployment and retrieval operation.





# Transition Zone (TZ) Seismic Solutions



## ***Node-Handling Vessel***

Equipped with a navigation system that ensures node-handling speed, safety and quality.



## ***Shallow Water Air-gun Source Vessel***

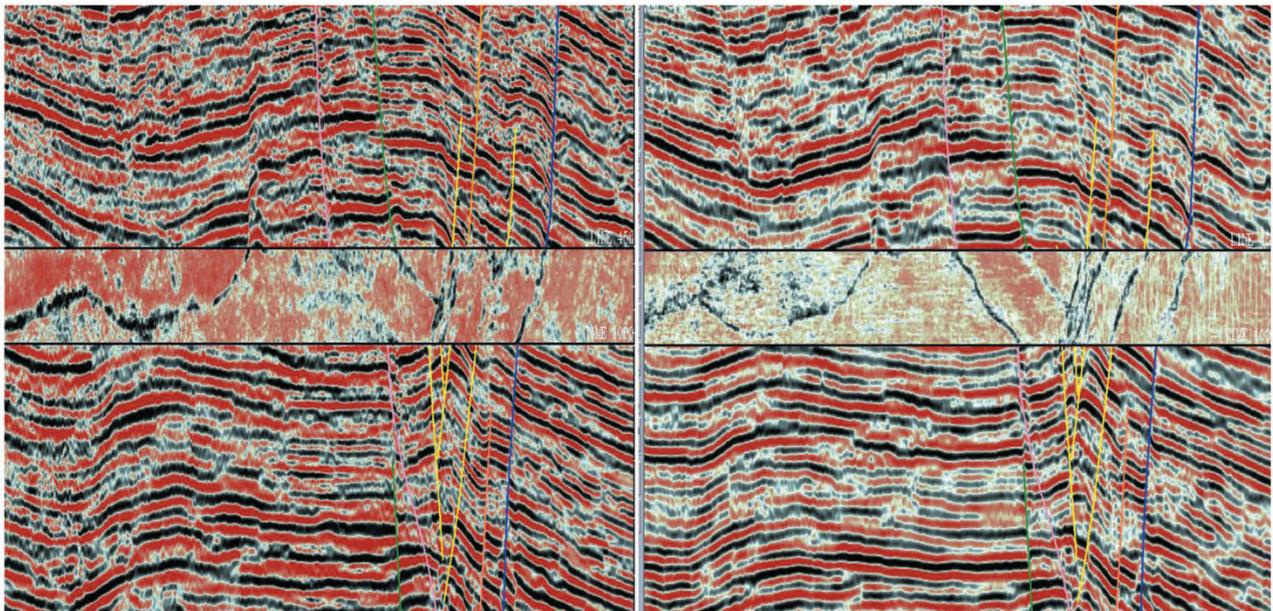
Back-towing or side-hanging air-gun array is configured on the vessel for varied shallow water areas.



## ***Multipurpose Vessel***

Multipurpose Vessels have great flexibility and great speed to be used for cable deploying, secondary positioning and logistics transportation.

In addition to the solutions for TZ seismic acquisition, BGP provides advanced seismic data processing services for high quality imaging of the subsurface using the TZ seismic data.



Migration section (Hydrophone)

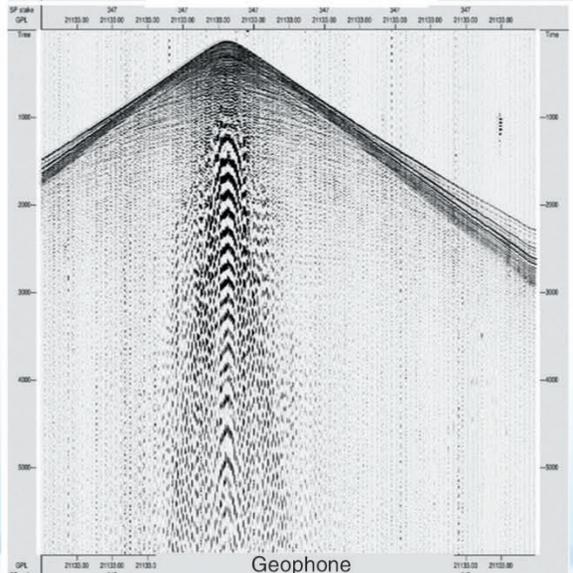
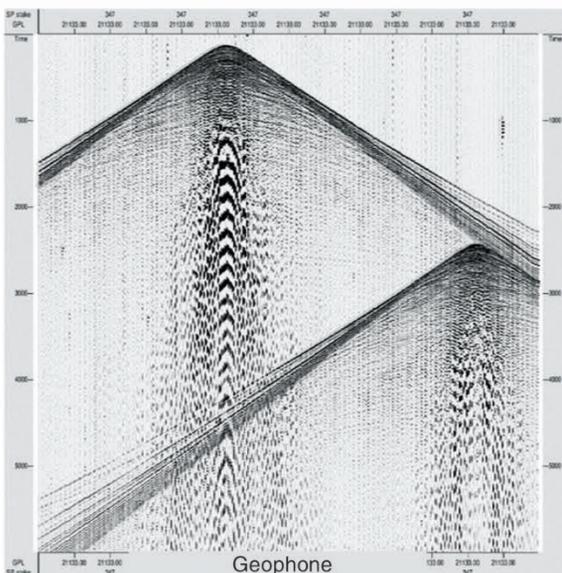
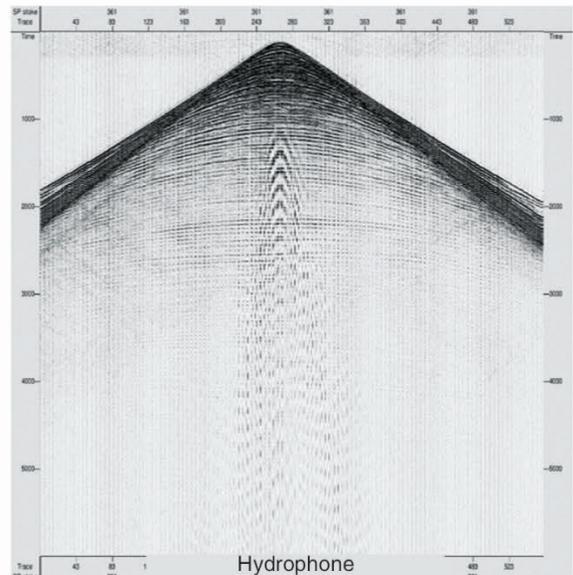
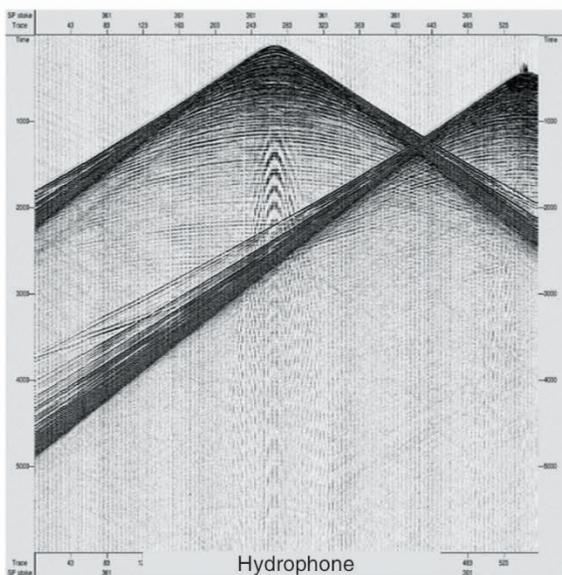
Migration section (Hydrophone & Geophone)



## Deblending

Blended acquisition and subsequent deblending is an emerging technology which dramatically improves the productivity in the field without compromising the data quality.

BGP has developed advanced technologies for highly efficient blended acquisition and subsequent deblending processing, which have been successfully implemented in many land and marine seismic surveys (towed streamer and OBS data).



Deblending of blended OBS data

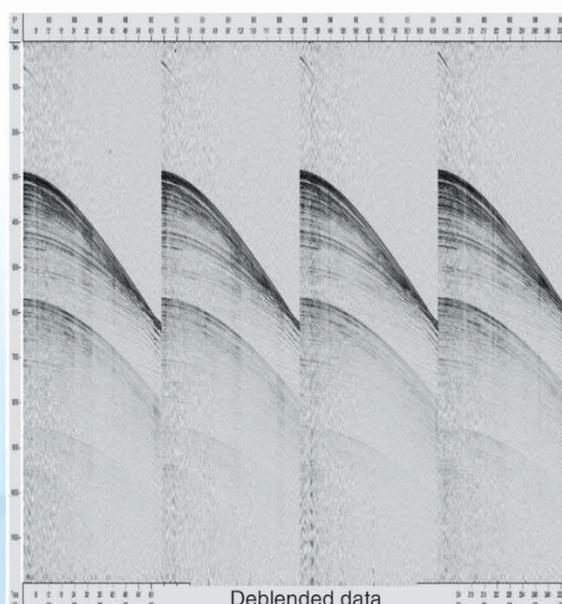
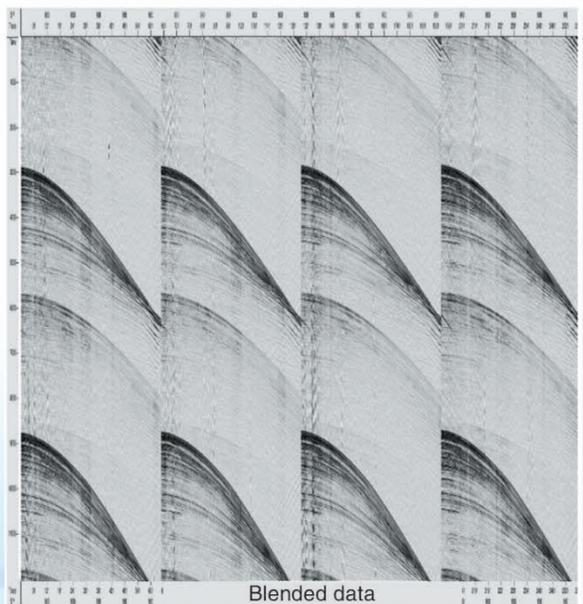
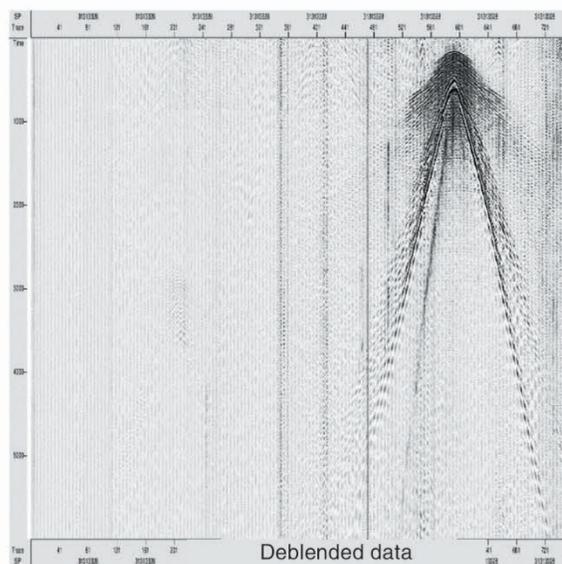
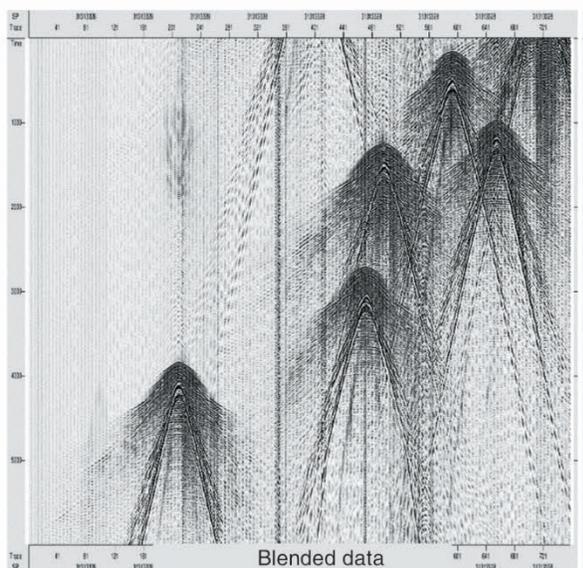
Top: Hydrophone blended data and deblended primary shot

Bottom: Geophone blended data and deblended primary shot



## Features

- Ultra-high recording efficiency in the field
- Cost effective
- High accuracy, high fidelity in deblending
- Viable for both land and marine data (streamer and OBN)



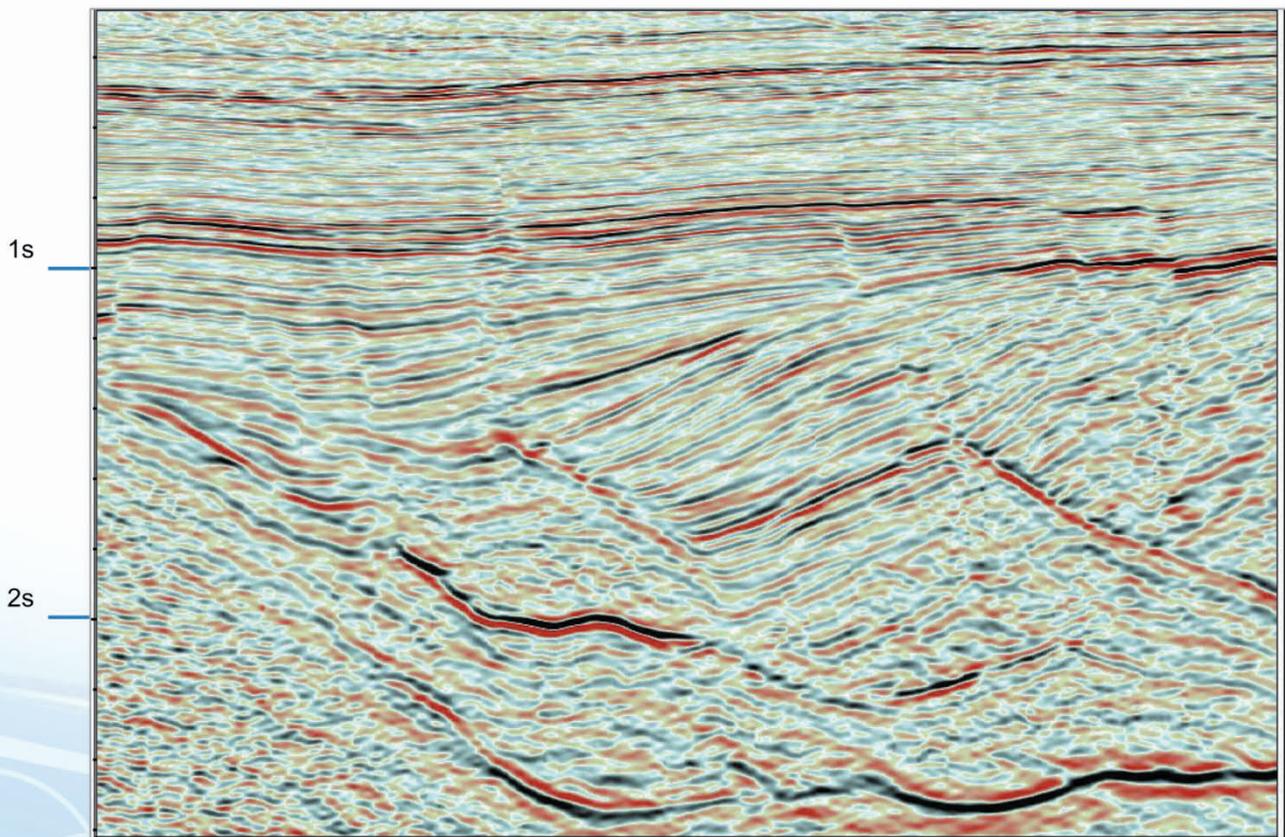
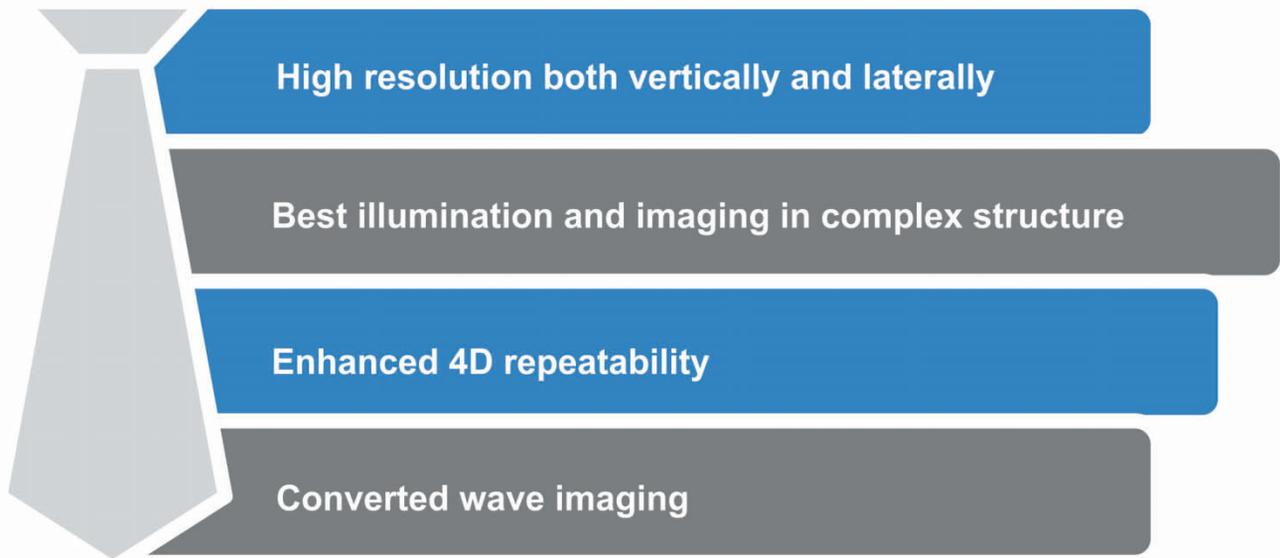
Deblending of blended land and streamer data  
Top: blended data and deblended land primary shot  
Bottom: blended data and deblended streamer primary shot



## ***OBS Data Processing***

BGP has been engaging the technologies and solutions for OBN/OBC data processing and imaging, especially for complex water bottom environments.

BGP' s OBN/OBC processing techniques can bring to you:



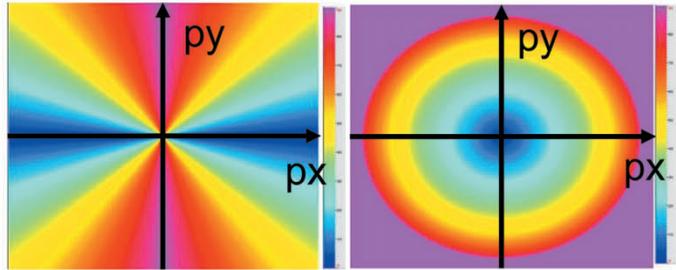
Fast track PSTM result with OBN acquisition



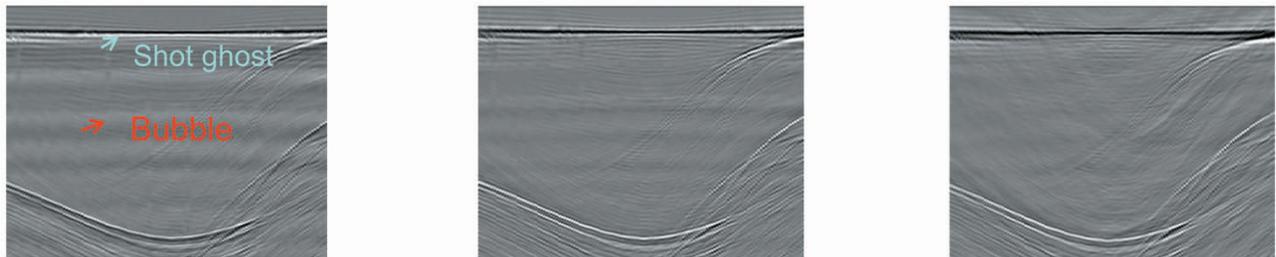
### 3D Data Driven Directional De-signature

Due to the source signature changing with direction, the directional de-signature can improve frequency bandwidth by removing the directional bubbles and shot ghosts.

- 3D signature of different azimuth and take-off angle (TOA) are easy to calculate in 3D tau-p domain.
- Shot ghost energy and the bubbles are removed more than 1D de-signature.
- Frequency bandwidth is widened.



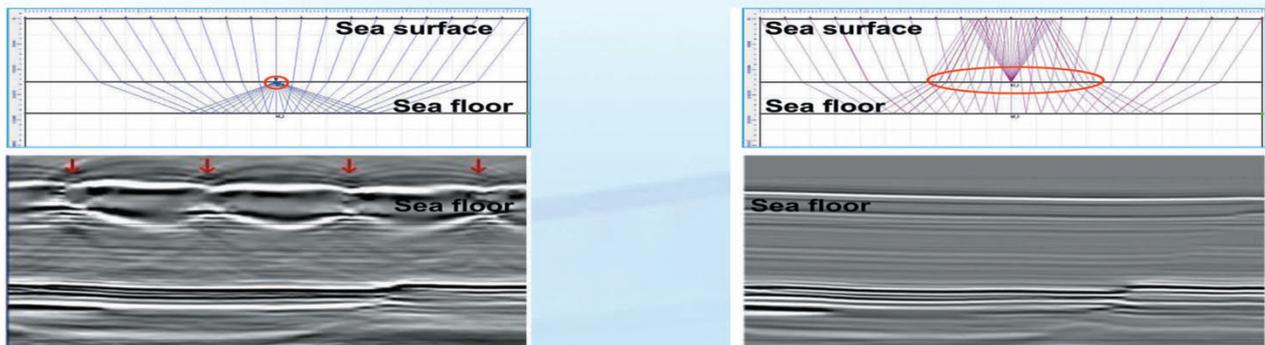
Azimuth (left) and take-off angle (right) in 3D tau-p domain



LNMO of common receiver gather with/without de-signature (left—raw gather, middle—1D de-signature, right—3D de-signature)

### Mirror Migration

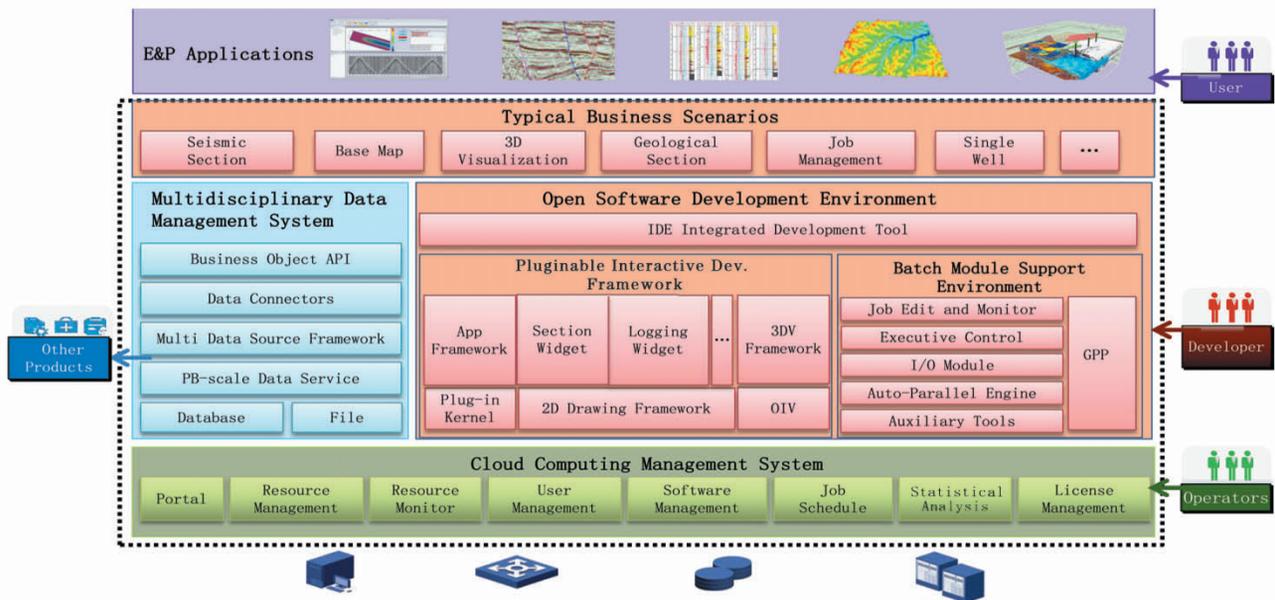
Mirror migration can improve images by migrating both up-going and down-going wave fields. Wider illumination of the subsurface from down-going wave fields, good for shallow imaging, ghosts and multiples included for imaging, improves image resolution.



Illumination of up-going wave PSTM (left) vs. down-going wave mirror PSTM (right)

## GeoEast-iEco : An Open Software Platform for E&P Applications

- Enables construction of E&P software ecosystems
- Includes three components: a cloud computing management system, a multidisciplinary data management system and an open software development framework

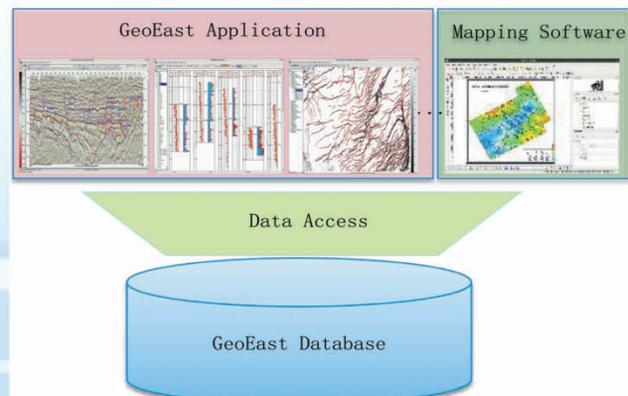
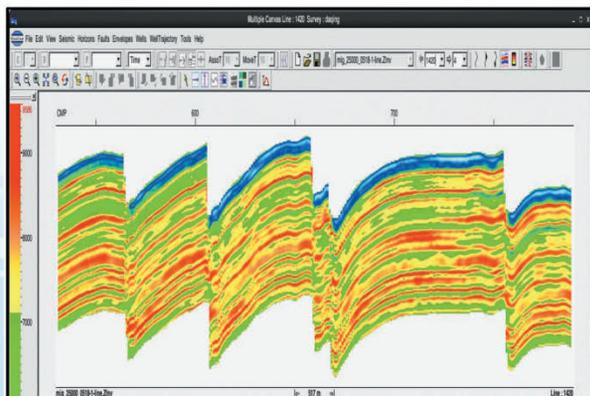


Components of GeoEast-iEco platform

## Enable Construction of E&P Software Ecosystem

Case 1: Z inversion techniques from Daqing E&P research institute integrated into GeoEast

Case 2: a mapping software integrated into GeoEast



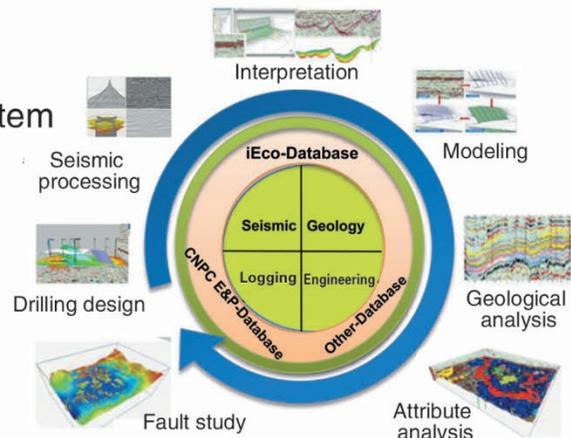
## Cloud Computing Management System



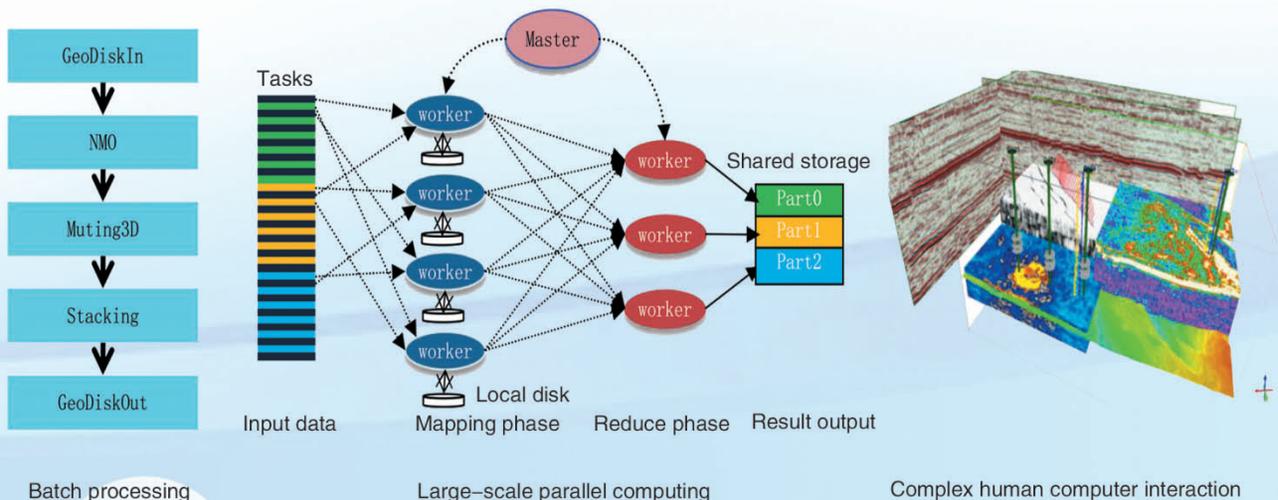
- Resource management and monitoring
- User management
- Software management
- Job scheduling
- Remote visualization
- Statistical analysis

## Multidisciplinary Data Management System

- Multidisciplinary data management
- Two-level database management
- Basin scale data management
- Support crossing zone in coordinate system
- Multi-data source access
- Efficient management techniques:
  - R&W separation
  - Tiled horizon format
  - Parallel trace sorting and indexing
- Database management & maintenance tools



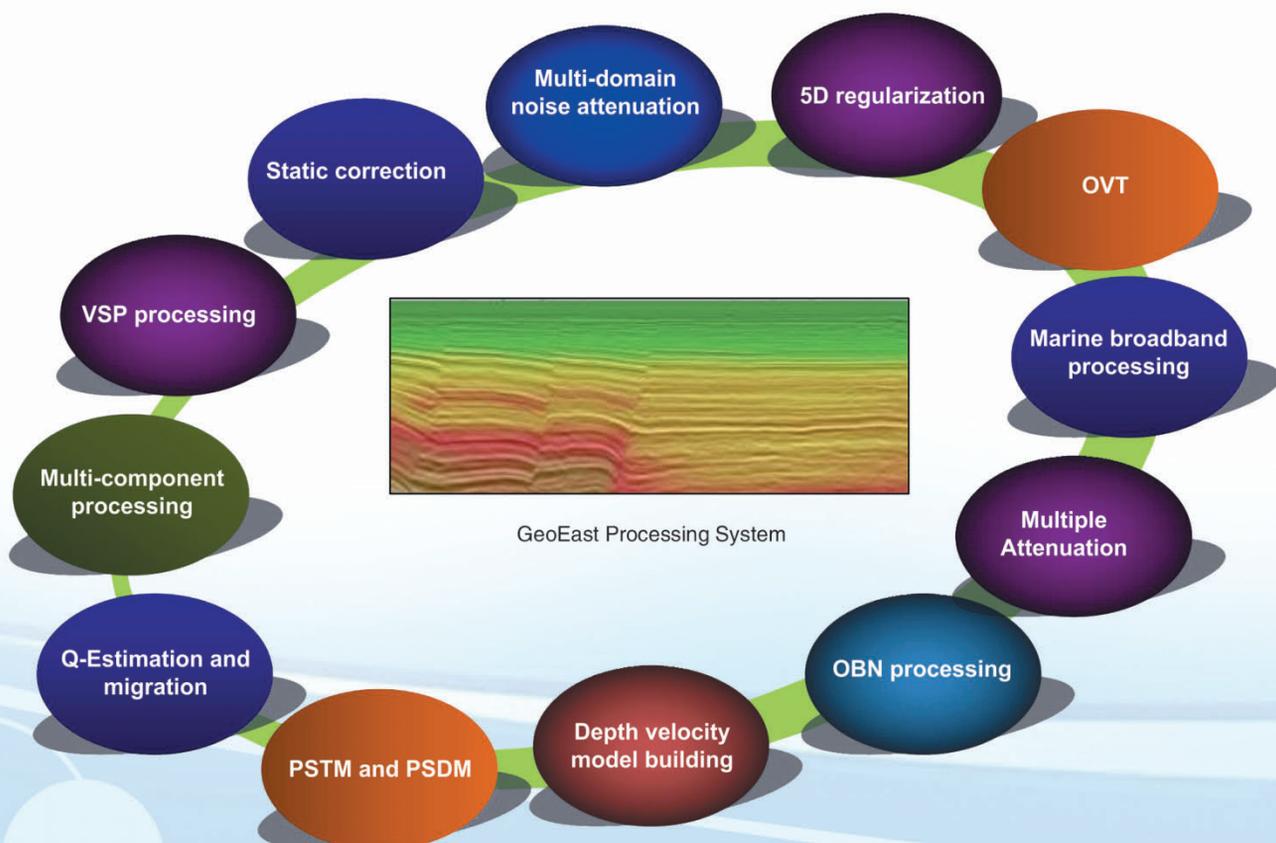
## Open Software Development Framework



GeoEast is an integrated seismic data processing & interpretation software system, a proprietary product of CNPC Geophysical Software Co. Ltd (CNPC-GS). CNPC-GS is a geophysical research institute, carrying out comprehensive R&D activities on integrated seismic data processing & interpretation, software development, as well as services for the geophysical industry.

## GeoEast Processing System

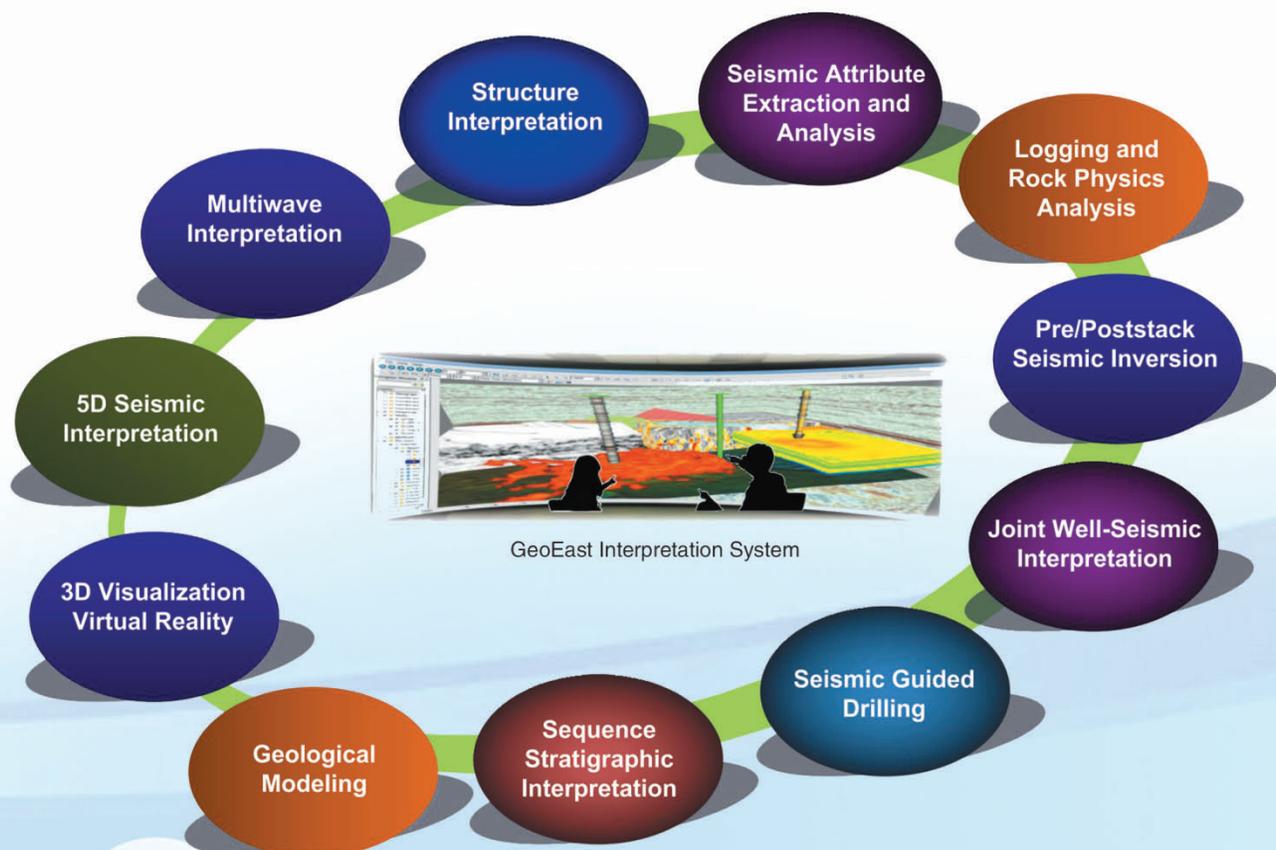
GeoEast provides a complete suite of seismic data processing functions, covering the entire process from pre-processing to depth imaging. With advanced technologies in de-noising, imaging, and multi-component processing, GeoEast is well suited for processing challenging seismic data under complex near-surface/sub-surface geology. Recent advances include sparse inversion de-blending, OBS processing, Q-tomography/Q-migration, TTI velocity model building, FWI, and least-square migrations.



## GeoEast Seismic Interpretation System

GeoEast interpretation system consists of comprehensive seismic and geological interpretation abilities, such as structure interpretation, reservoir prediction, hydrocarbon detection, fracture prediction, 3D visualization and virtual reality etc. It supports multi-survey interpretation in time and depth domains. In particular, its highlights are in structure interpretation, seismic attribute analysis and 5D seismic interpretation.

In the latest version GeoEast V4.0, the efficiency and precision of structure interpretation and reservoir predictions are further improved. Forward modeling and a frequency domain interpretation sub-system are developed, achieving an integrated seismic and geological interpretation workflow with comprehensive supporting technique series.



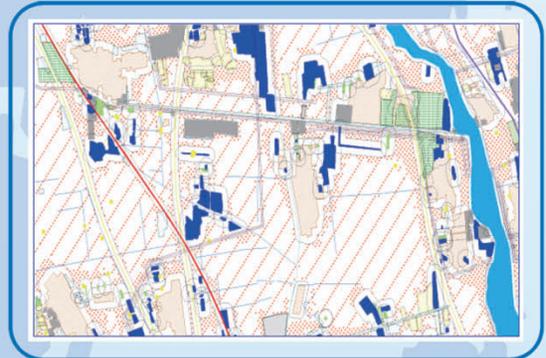


# Seismic Acquisition Design

KLSeis II seismic survey acquisition design software includes KL-LandDesign, KL-Streamer and KL-DataDriven and delivers optimized designs for land, marine and transitional zone seismic surveys.

## KL-LandDesign

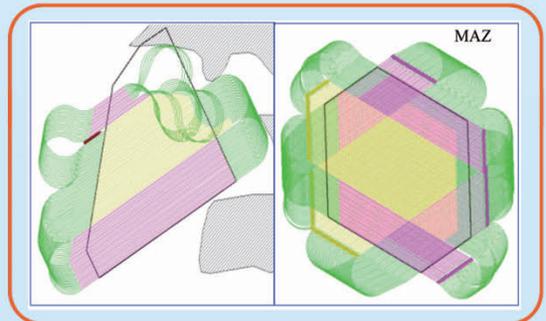
- ➔ Optimize acquisition parameters including source, receiver and source-receiver array, etc.
- ➔ Design and edit source/receiver points up to the level of 10 million
- ➔ Automatic obstacle-avoidance of source/receiver points
- ➔ Bin attributes analysis and pre-stack attribute analysis



Automatic obstacle-avoidance

## KL-Streamer

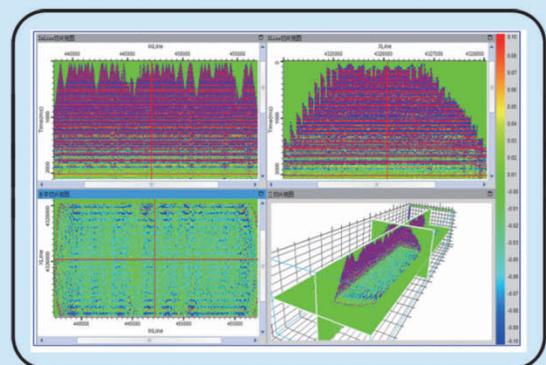
- ➔ Template design and preplot
- ➔ Sail line optimization and bin attribute analysis
- ➔ 4D seismic acquisition design and QC



Streamer acquisition design

## KL-DataDriven

- ➔ Optimize acquisition parameters based on legacy data
- ➔ Imaging analysis with different geometries for stack data volume
- ➔ Source or receiver array analysis



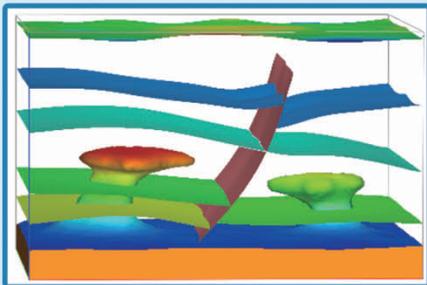
Imaging analysis  
for stack data volume





# Modeling and Illumination

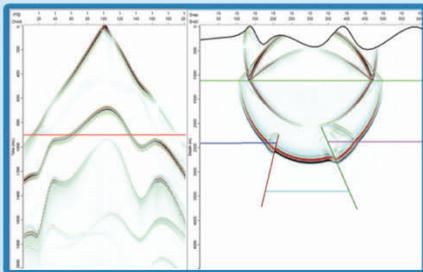
KLSeis II modeling and illumination software includes KL-2DModeling, KL-3DGeoModeler and KL-3DModeling. The software builds 2D or 3D complex models, performs seismic forward modeling and compares illumination of different geometries.



Mushroom-like intrusive body

## KL-2DModeling

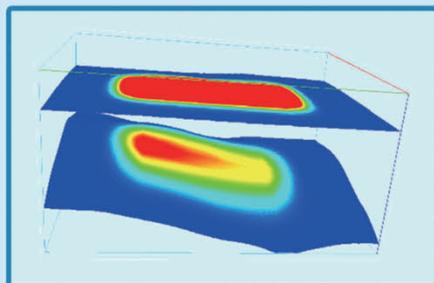
- ➔ Build 2D complex geological models
- ➔ Forward modeling includes ray tracing, Gauss beam, acoustic, elastic and viscous elastic
- ➔ Wave equation illumination



Acoustic finite difference modeling and snapshot

## KL-3DGeoModeler

- ➔ Create 3D geological models using the seismic interpretation data
- ➔ Build overthrust, pinchout, overlap, sand body, lenticular body and mushroom-like intrusive bodies, etc.
- ➔ Interactively edit complex layers and faults of 3D models



Wave equation layer illumination

## KL-3DModeling

- ➔ Input multiple formats of geological models
- ➔ Acoustic finite difference modeling based on CPU+GPU
- ➔ Output snapshots
- ➔ Fast layer illumination based on wave equations

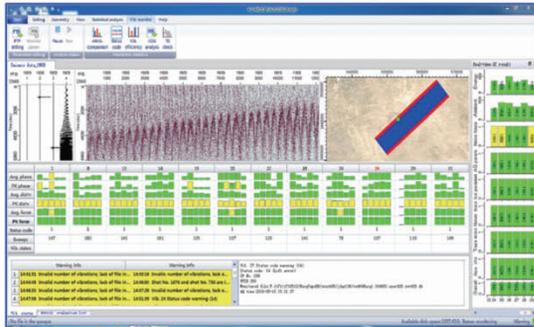




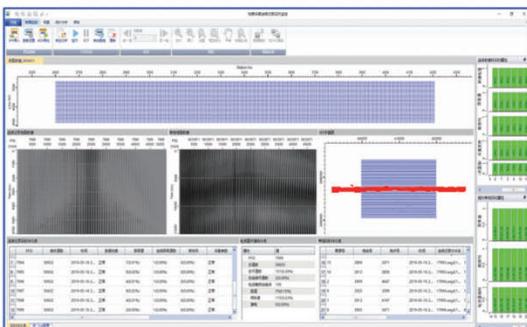
# Seismic Data QC



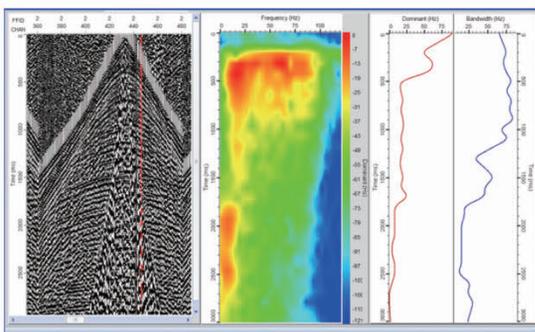
KLSeis II seismic data QC software includes KL-RtQC, KL-DataAE and KL-SeisPro and meets the QC requirements for equipment, seismic data and acquisition parameters.



Real-time monitor seismic data and the performance of vibrators



Real-time monitor continuous records based on micro-seismic mode



Interactive analysis to seismic data

## KL-RtQC

- ➔ Real-time monitor of seismic data, such as energy, ambient noise, acquisition parameters, auxiliary traces , etc.
- ➔ Monitor the performance of vibrators and receivers
- ➔ Real-time monitor of continuous records based on micro-seismic modes for UHP seismic acquisition

## KL-DataAE

- ➔ Seismic data interactive analysis such as frequency spectrum, time-frequency, F-K,energy, time-varying energy, S/N etc.
- ➔ Seismic data preprocessing such as zone filtering, frequency scanning, gain balance, mute and LMO etc.
- ➔ Comparison of spectrum, energy and signal-to-noise of different shots

## KL-SeisPro

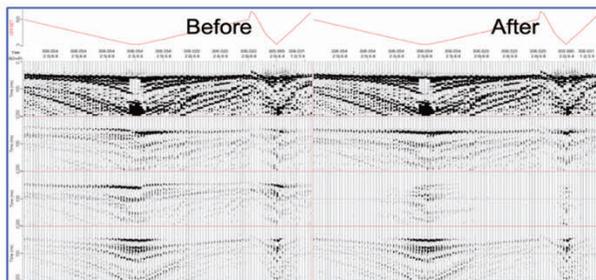
- ➔ Seismic data dump, simultaneously output to disks and tapes
- ➔ Header block information and seismic data QC
- ➔ Convert seismic data format between SEG-D and SEG-Y



# Offshore Acquisition QC



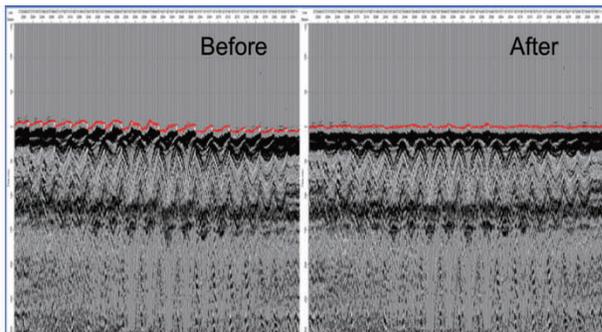
KLSeis II offshore acquisition QC software includes KL-NodeQC, KL-AGQC and KL-FBP and meets the requirements of segmentation of OBN data, QC of seismic data and airgun performance and positioning of nodes.



multi-component rotation

## KL-NodeQC

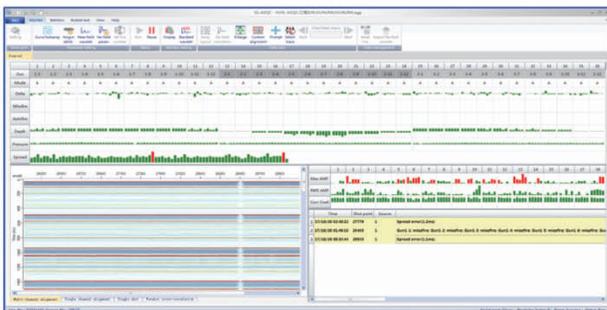
- ➔ OBN data segmentation, daily segmentation capability over 10TB
- ➔ Clock drift correction
- ➔ Multi-component rotation
- ➔ OBN attribute analysis



first break positioning

## KL-FBP

- ➔ First break high-precision picking
- ➔ Interactive positioning to OBN
- ➔ Automatic positioning
- ➔ Positioning precision analysis and evaluation, the positioning precision of less than 3 meter

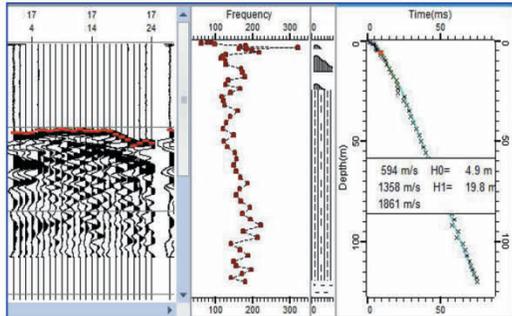


Real-time monitor of airgun performance

## KL-AGQC

- ➔ Real-time QC of airgun
- ➔ Real-time QC to near field wavelet
- ➔ Bubble test
- ➔ Far field wavelet simulation
- ➔ Attribute statistics and analysis

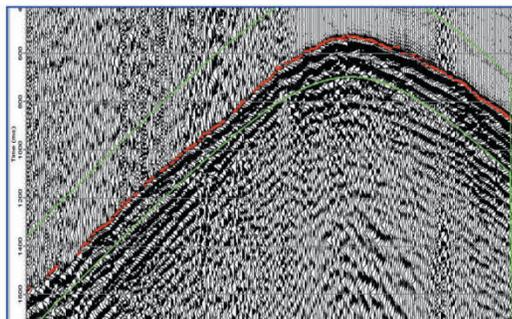
KLSeis II near surface investigation and statics software includes KL-LVL, KL-FBPicker, KL-RefraStatics and KL-TomoStatics and provides static and near surface model for seismic data processing.



Uphole interpretation

## KL-LVL

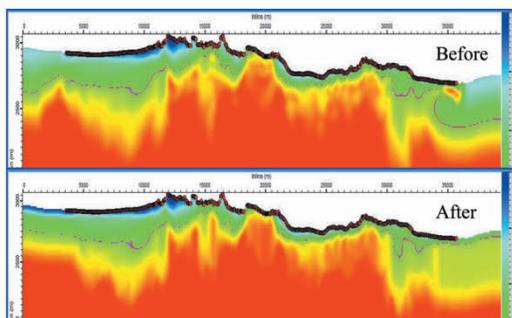
- ➔ Interpretation of shallow refraction
- ➔ Interpretation of upholes
- ➔ Kinetic curve analysis
- ➔ Q estimation of near surface



First break picking

## KL-RefraStatics

- ➔ First breaks automatic picking and QC
- ➔ Flexibly interactively branch refraction layers
- ➔ Refraction velocity and delay time calculation
- ➔ Model building constrained by near surface investigation data

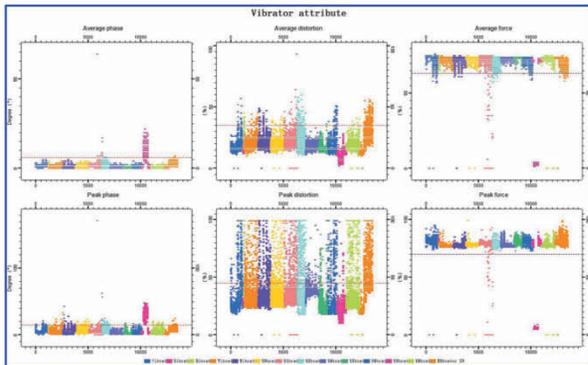


Boundary optimization of tomography model

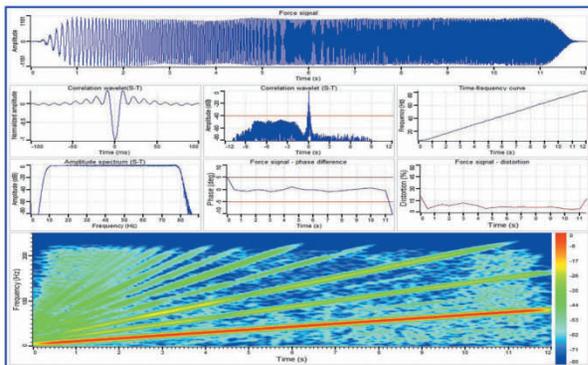
## KL-TomoStatics

- ➔ Tomography inversion and QC
- ➔ Tomography model interpretation
- ➔ Datum statics calculation
- ➔ FB-based residual statics calculation

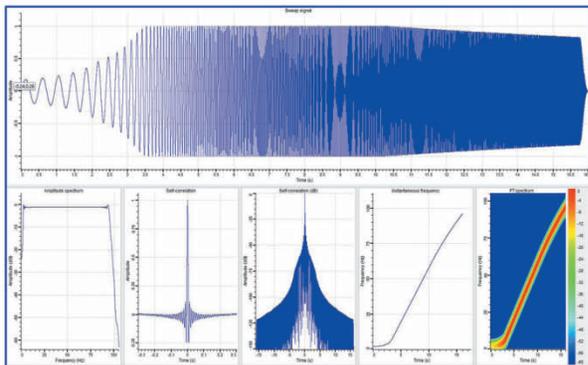
KLSeis II vibroseis software includes KL-VibEQA, KL-VibParam, KL-VibSig and KL-VibPlan and has the functions of vibrator performance QC, sweep signal design, operation parameters analysis and operation plan optimization.



Vibrator performance QC



Vibrator similarity analysis



Low-dwell sweep Design

## KL-VibEQA

- ➔ Vibrator performance, COG, similarity test and extended QC data analysis.
- ➔ FDU/BOX and geophone test QC
- ➔ Ground force analysis

## KL-VibParam

- ➔ Optimizing parameters of conventional vibroseis operation mode
- ➔ Design slip time for slip sweep
- ➔ Design simultaneous sweeping distance for DSSS
- ➔ Optimizing parameters for ISS

## KL-VibSig

- ➔ Design linear and nonlinear conventional sweeps
- ➔ Design customized sweeps, such as low-dwell, shaped and segments, etc.

## KL-VibPlan

- ➔ Productivity estimation for different vibroseis operation plans
- ➔ Optimization equipment deployment plan
- ➔ Zipper operation plan analysis



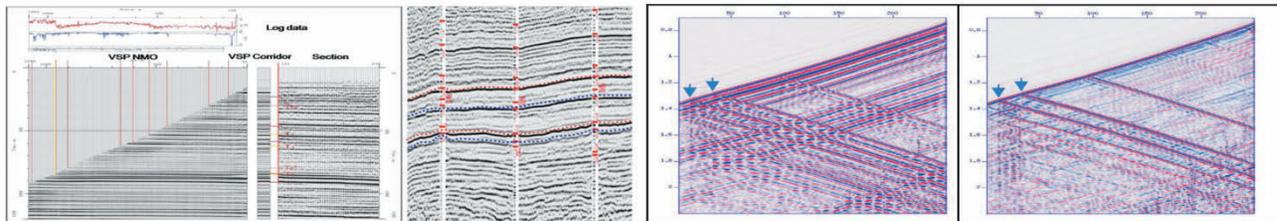
# VSP Applications

## Zero offset VSP and multi-offset VSP

The Vertical seismic profile (VSP) bridges surface seismic and well logging. With high resolution and accurate time depth relationship, zero offset VSP's are used to calibrate seismic and other applications, such as velocity estimation, depth prediction ahead of the drill bit and multiple identification, etc. Offset VSP's are used to describe the details of complex structures around wellbores.

## Calibration and multiples analysis

With the accurate time–depth relationship and VSP NMO result, well information and the surface seismic section can be tied in the time and depth domain. Zero offset VSP and offset VSP also can be used to identify multiples, diffractions, fault reflections and some other special wavefields.



Calibration seismic data with VSP and logging

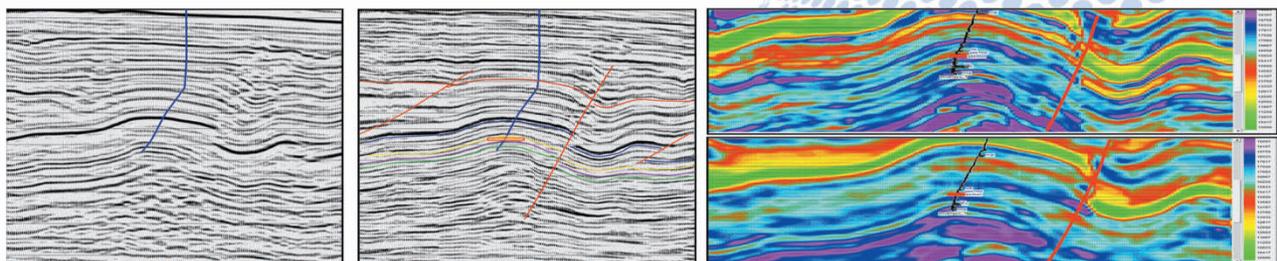
Multiples identification and attenuation

## Walkaway VSP

Compared with surface seismic, the Walkaway VSP has the advantages of high resolution and accurate depth position. It has been widely used for borehole vicinity structure imaging, high–precision reservoir prediction and time–lapse reservoir monitoring.

## Walkaway VSP imaging and inversion

The key data processing techniques of Walkaway VSP's mainly include high–precision static correction, amplitude preserved wave field separation, velocity field building, primary and multiple reflection migration and various parameters inversion for interpretation.



Surface seismic imaging

Walkaway VSP imaging

Comparison of wave impedance inversion between walkaway VSP (above) and surface seismic (below)



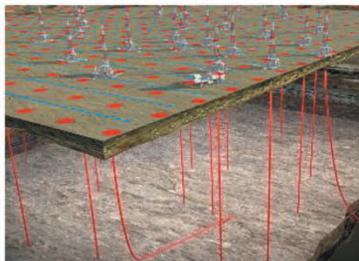
# VSP Applications

## Joint exploration of VSP and surface seismic

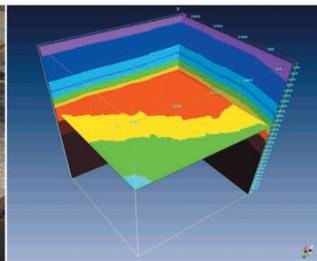
By using a DAS system, VSP data for the whole well range can be acquired with one shot. VSP and surface seismic joint exploration is more cost-effective. VSP-driven surface seismic processing with high fidelity and high resolution is achieved by the integration application of geophysical parameters which are extracted from the VSP data.

## Parameter estimation and parameter field building

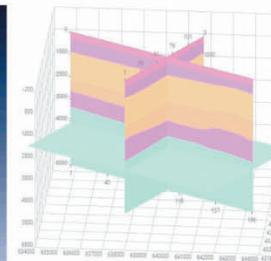
The velocity, anisotropic parameter, quality factor, seismic wavelet and other geophysical parameters are extracted from the VSP data. The 3D VSP and surface seismic data are integrated to establish a 3D Q field and anisotropic velocity field, which can provide support for high fidelity and high resolution processing of surface seismic Q-PSDM.



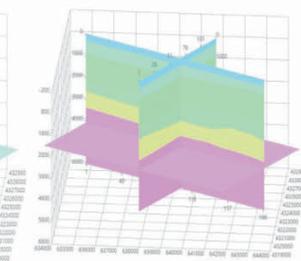
multiple wells DAS VSP and surface seismic joint acquisition



Q model building



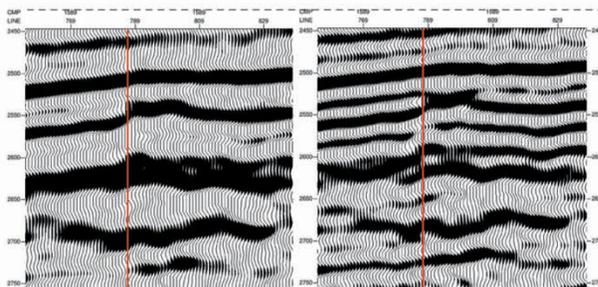
Anisotropic parameter (epsilon)



Anisotropic parameter (delta)

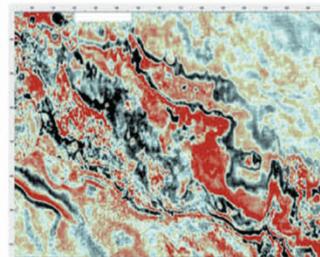
## VSP-driven surface seismic Q-PSDM/PSDM

High-fidelity and high-resolution surface seismic data processing are obtained by using VSP and surface co-constrained static corrections, deterministic wavelet deconvolution, VSP and surface seismic combined depth domain velocity model building and updating, VSP-driven Q migration technique, etc., which improves the geological characterization capability of seismic results for small fault and thin sand reservoirs.

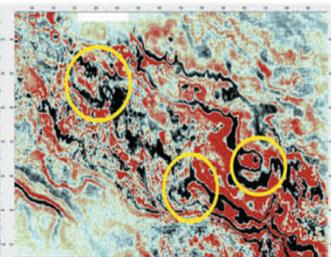


Conventional PSTM

VSP-driven PSTM



PSTM time slice of conventional process



PSTM time slice of VSP driven result



# **BSEM Technique for Oil and Gas Exploration**

The BSEM (Borehole-to-surface EM) technique is a high precision electromagnetic prospecting method for reservoir boundary delineation. The method can reduce the number of exploration and evaluation wells, provide a reliable basis for the deployment of development wells, and improve the drilling success rate. The method has been successfully applied for more than 10 years in China and become a very attractive technique for the oilfield development process. Field tests and commercial surveys have been carried out in more than 10 oilfields in China, and have achieved very good results.

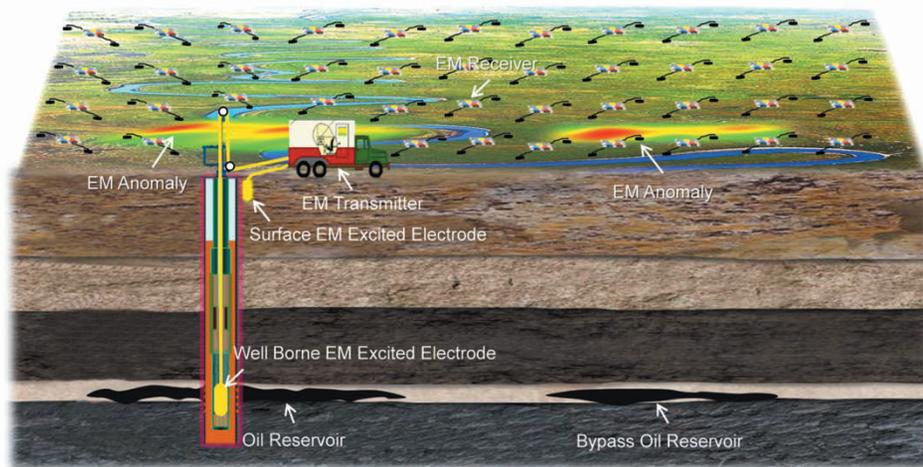


Figure 1 Schematic of BSEM layout

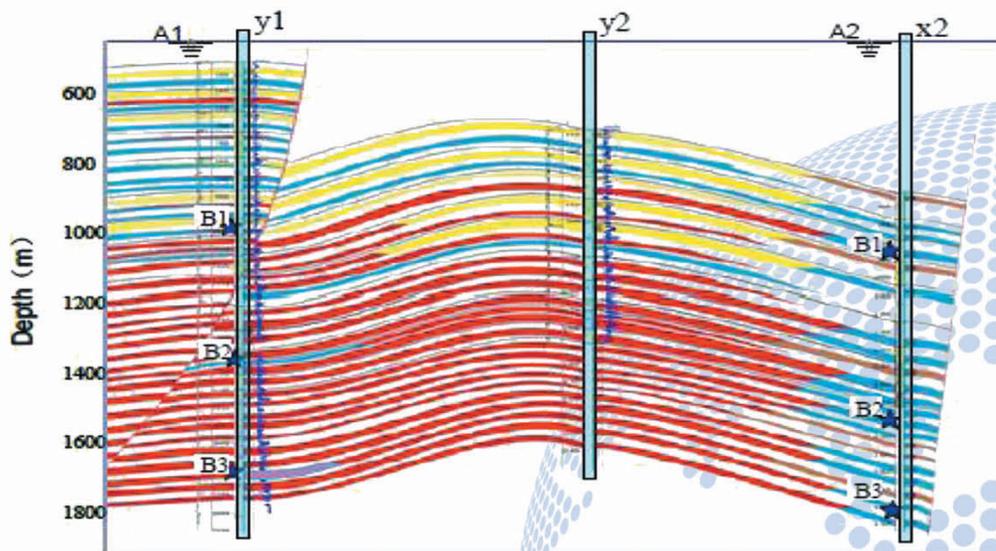


Figure 2 BSEM downhole source layout diagram.



## **BSEM Technique for Oil and Gas Exploration**

Favorable hydrocarbon zones are predicted and evaluated in two structural layers in the survey area as shown in Figure 3 and Figure 4. Seven confirmation wells were drilled to verify the shallow hydrocarbon trap, six wells have commercial oil and gas flows.

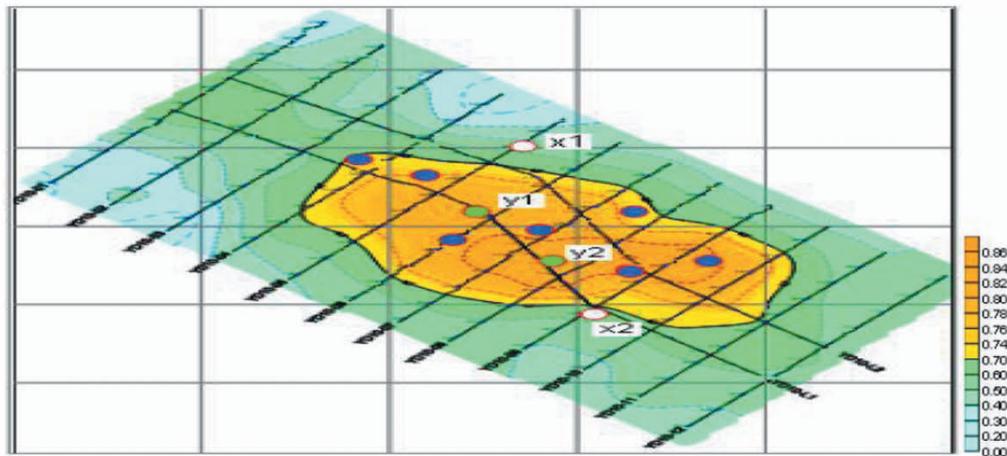


Figure 3 Comprehensive evaluation map of shallow hydrocarbon favorable area distribution.

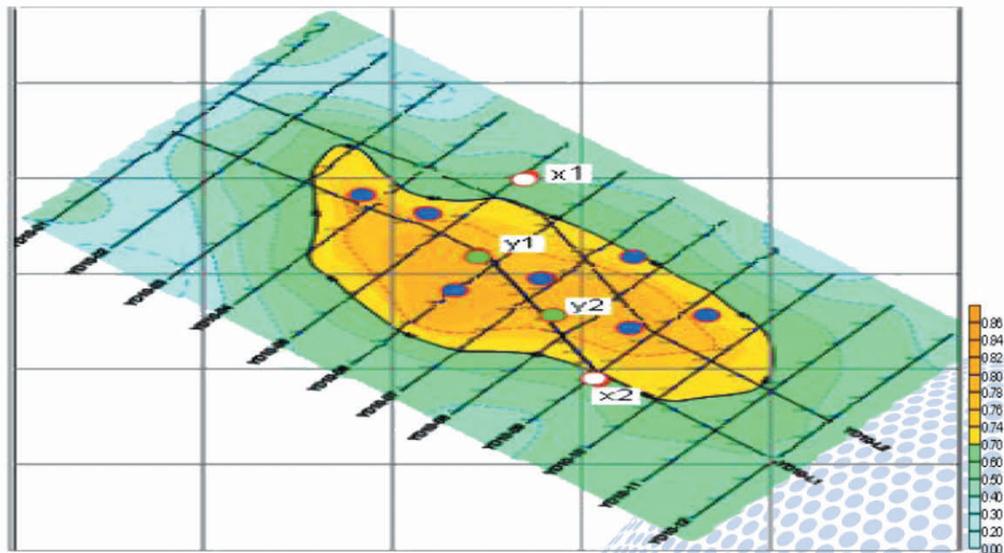


Figure 4 Comprehensive evaluation map of deep hydrocarbon favorable area distribution.

Drilling results have confirmed the validity of the BSEM method and this technique provides an effective means for the delineation of hydrocarbon boundaries and evaluation of well deployment in newly developing oilfields.



# GeoSNAP-GISeis

## Introduction

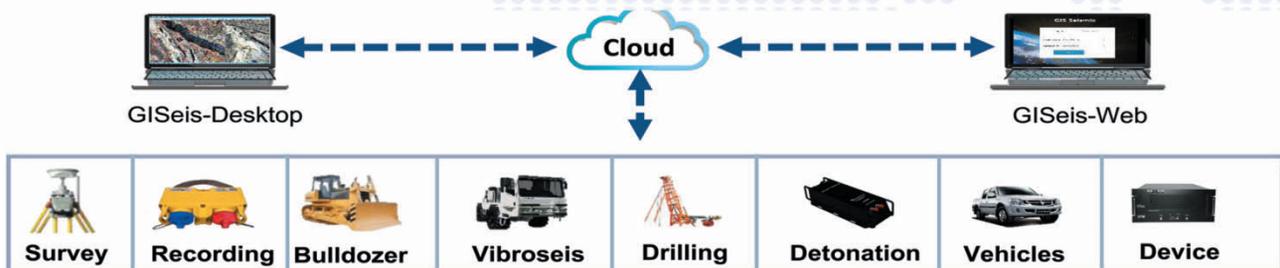
GeoSNAP-GISeis integrates many advanced technologies. Users can carry out platform management for the whole process of a surveying project. It can help users to carry out seismic surveying with high efficiency and intelligence.



GeoSNAP-GISeis

## Architecture

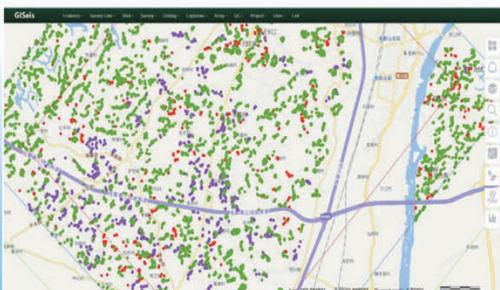
GeoSNAP-GISeis covers the whole process of survey, drilling, explosive laying, arrangement and excitation in seismic surveying. It has the functions of information collection, data display, safety warning, quality control, remote monitoring, task distribution and data sharing.



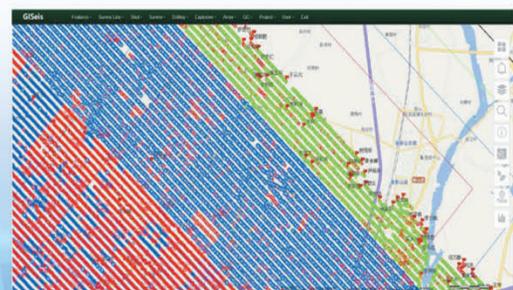
GISeis Architecture

## Application

Up to now, the GeoSNAP-GISeis system has been applied in more than 40 projects in China. The system can improve the efficiency of seismic surveying acquisition by more than 25% and reduce the operation cost by 15%. It has played a significant role in improving the speed and efficiency of surveying, reducing costs, quality control and safety management.



GISeis Application





# GeoSNAP-GISeis

GeoSNAP-GISeis consists of three parts: GISeis-Web, GISeis-App and GISeis-Desktop. It has played a significant role in increasing speed and efficiency, reducing cost, controlling quality and safety management of the seismic acquisition operation.

## GISeis-Web

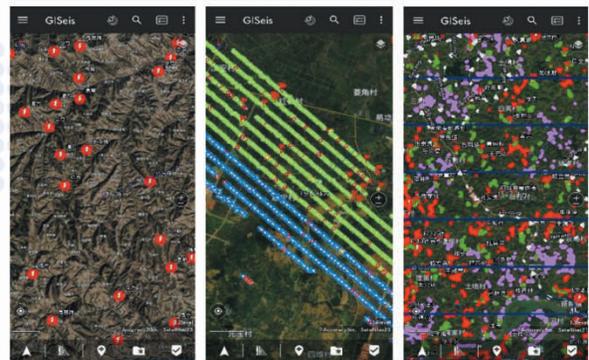
- ◆ Realize the intelligent display and statistics of the production progress of key operation processes.
- ◆ Display the production progress information in a variety of ways.
- ◆ Obtain the position of personnel and in real equipment time.
- ◆ Provide technical guarantee for safe production.



GISeis-Web

## GISeis-App

- ◆ Feature acquisition
- ◆ Basic data management
- ◆ Map management
- ◆ Bluetooth navigation
- ◆ Range radar
- ◆ Task upload
- ◆ Quality inspection



GISeis-App

## GISeis-Desktop

- ◆ Integrates geographic information, artificial intelligence and big data set technology.
- ◆ Realize the fusion and visualization of multi-source data.
- ◆ The functions of terrain feature analysis, object classification and route design.
- ◆ Automatically inspect drilling video by artificial intelligence algorithm.



GISeis-Desktop



# eSeis<sup>®</sup> Land Nodal Acquisition System

eSeis is a land seismic nodal acquisition system, independently developed by BGP. The node consist of a high-precision geophone, acquisition module and battery. Its characteristics include stability, adaptability, reliability, low consumption, convenient function expansion etc. eSeis supports up to 30 days continuous recording at 24hr./day. Various terrain applications show that eSeis has reached the same level as similar mainstream products and some specifications are leading edge.

## Node Specifications

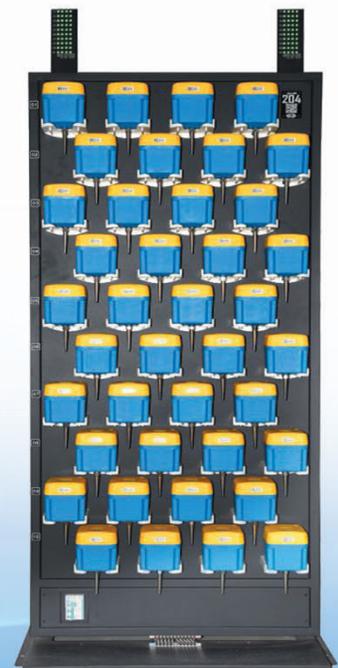


eSeis node

Weight	1.2kg(Internal) 0.8kg(External)
Size	(120 × 98 × 98) mm (Internal) (122 × 119 × 89) mm (External)
Operating Temperature	-40°C~+70°C
ADC Resolution	32-bits
Consumption	<200mW
Charging Time	<3hrs.
Channel Capacity	Unlimited

## Smart Harvest and Charge Integrated Rack

- ◆ Harvest, charging, test and configuration integrated rack
- ◆ High speed data harvest by fiber optic switch
- ◆ Fast charging(3hours)
- ◆ Built-in instrument test signal generator
- ◆ Modular parallel download and charging mode
- ◆ LED indicator for each channel status





# eSeis<sup>®</sup> Land Nodal Acquisition System

## QC Unit

- ◆ 3D quality control
- ◆ Activate the node and harvest QC data using LoRa module
- ◆ Support stake-less navigation operation
- ◆ Support more format map layers
- ◆ Observe deployment progress



Drone QC



Vehicle QC



Portable QC

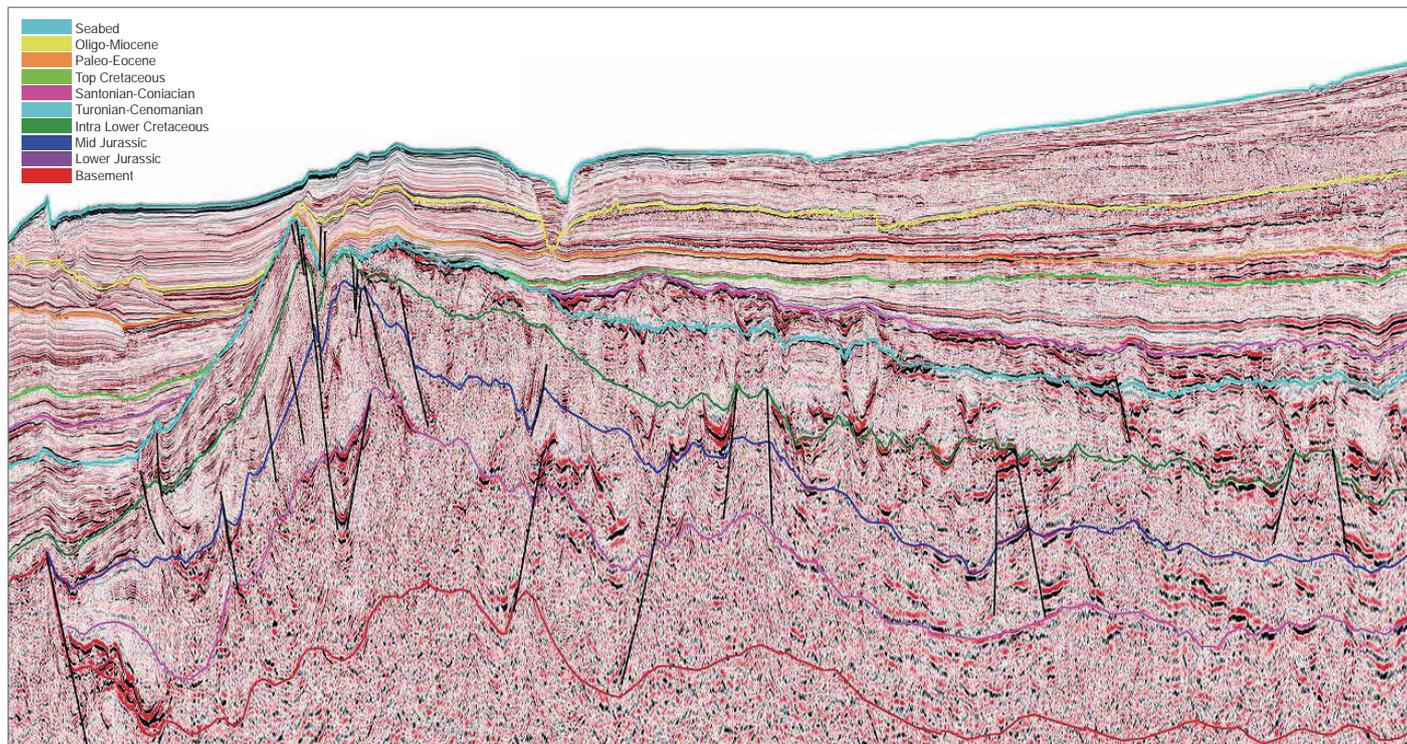
## Data Management System

- ◆ Node data download, cut and combine by Harvester Manger & Data Manger software
- ◆ Massive seismic data processing capacity by high performance server
- ◆ Supports common shot gathers or receiver gathers in SEG-D or SEG-Y format
- ◆ Supports cable and node system data fusion
- ◆ Parameter configuration, firmware upgrade and system test management functions



# OFFSHORE MADAGASCAR 2D MULTI-CLIENT SURVEY

West and South Morondava Basin, Majunga basin 20,652km



Exploration in Madagascar began in the early 20th century with the discovery of hydrocarbon-rich sedimentary basins in the west, including the Tsimiroro heavy oil field and the Bemolanga tar sands. Studies conducted by BGP in collaboration with TGS have resulted in PSTM & PSDM datasets that suggest there is a significant potential for future discoveries, both on and offshore.

The multi-client survey areas have good hydrocarbon exploration prospectivity with two exploration targets and two hydrocarbon plays identified. The targets are structural traps in the Jurassic and lower-middle Cretaceous, and stratigraphic-lithologic traps in upper Cretaceous and Cenozoic. The plays are Karoo and Jurassic structural traps sourced from Karoo and Jurassic source rocks, and Jurassic to lower-middle Cretaceous structural traps and upper Cretaceous stratigraphic-lithologic traps sourced from Jurassic and Cretaceous source rocks.

Source	5100 Cubic Inches
Shot Interval	37.5m
Gun Depth	6m
Streamer Depth	7/9+ -1m
Streamer Length	10km
Record Length	13s



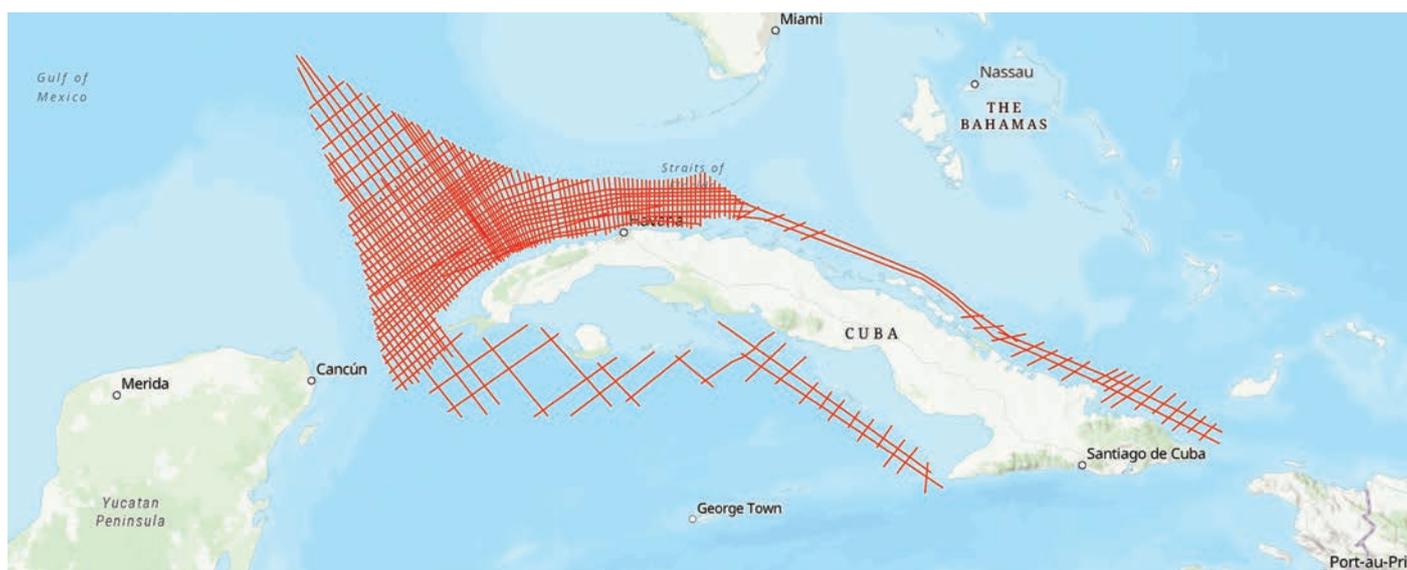
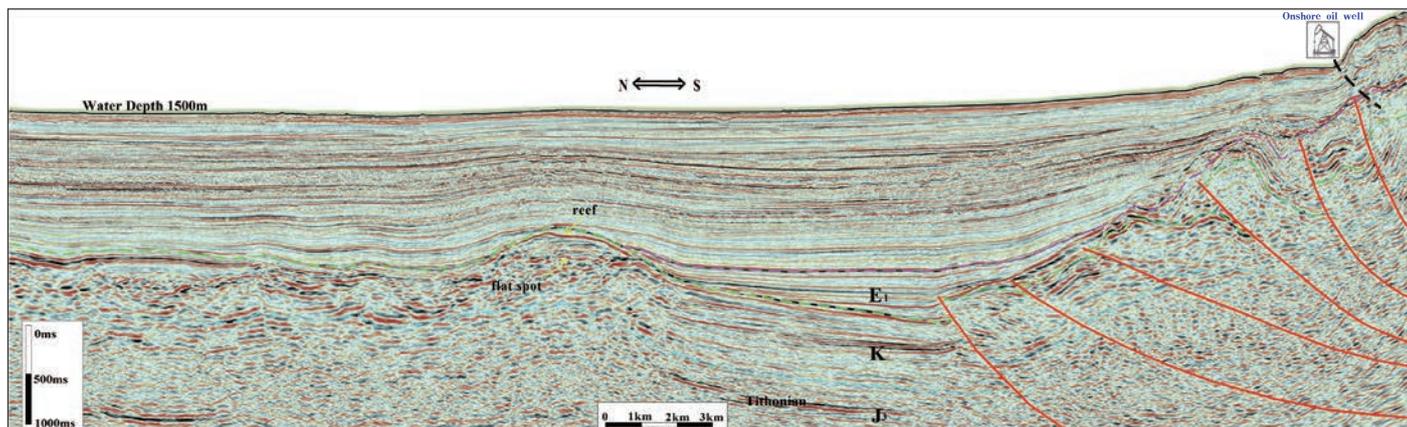
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# CARIBBEAN 2D MULTI-CLIENT SURVEY



Survey	Caribbean 2D
Survey Size	26,880km
Shot Interval	37.5m
Source Depth	9m
Streamer Length	12,000m
Streamer Depth	12m
Source Volume	4,780 Cu ins
Record Length	13050ms
Key Deliverables	PSTM,PSDM,Gather

BGP has acquired a 26,880 km 2D Multi-Client in the Caribbean. The project performed by the BGP Pioneer and Challenger seismic vessels provides a long offset, high resolution broadband dataset as well as gravity data. The data has been processed to provide both PSTM and PSDM deliverables which are ready for delivery. Data viewing is highly recommended and can be arranged upon request.

This largely underexplored region of the Caribbean contains large areas of open acreage. The presence of an active hydrocarbon system is indicated by oil and gas shows in previously drilled wells. This high quality data will be fundamental in assisting the interpretation of the geology in this part of the Caribbean, and the identification of prospective structural and stratigraphic trends can be used for regional evaluation and future detailed seismic survey designs.

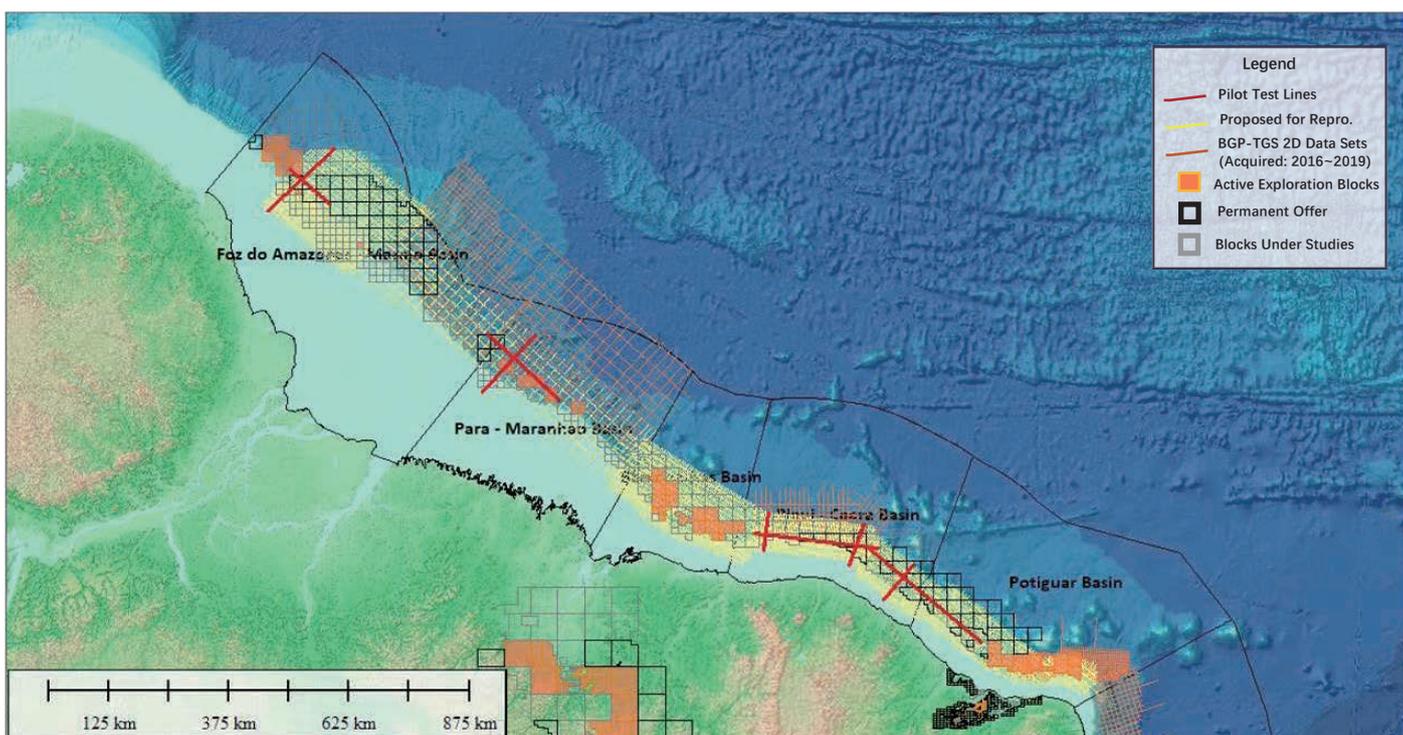
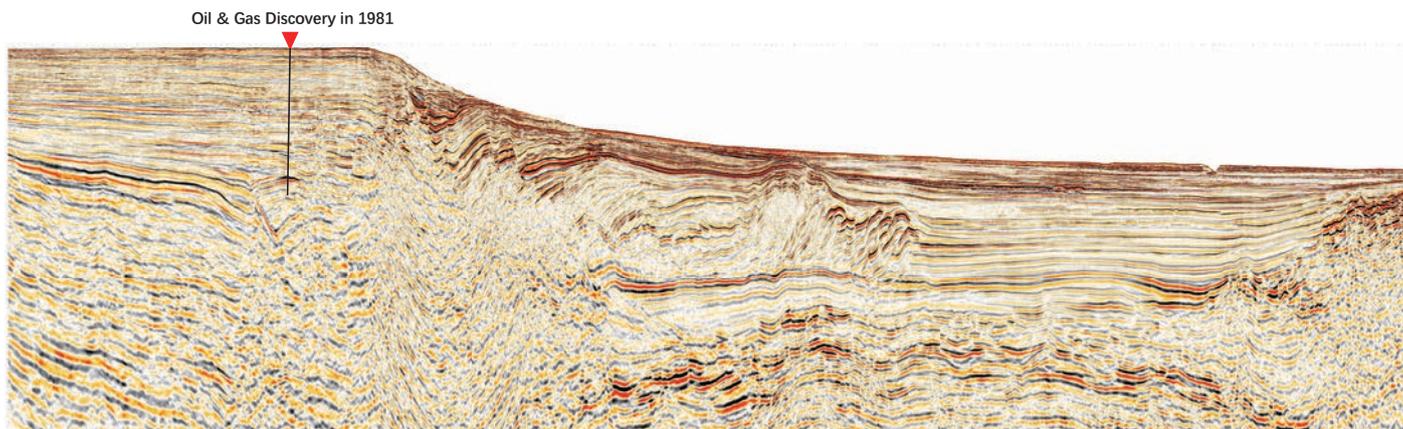


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# Brazil Equatorial Margin Reprocessing 2D



BGP proposes to reprocess the legacy regional 2D seismic data along the margin with state-of-art technology, and provide the industry with new insight on the geology and plays. 9 lines have initially been reprocessed, indicating significant improvement compared with the publically available data. Data viewing is now available.



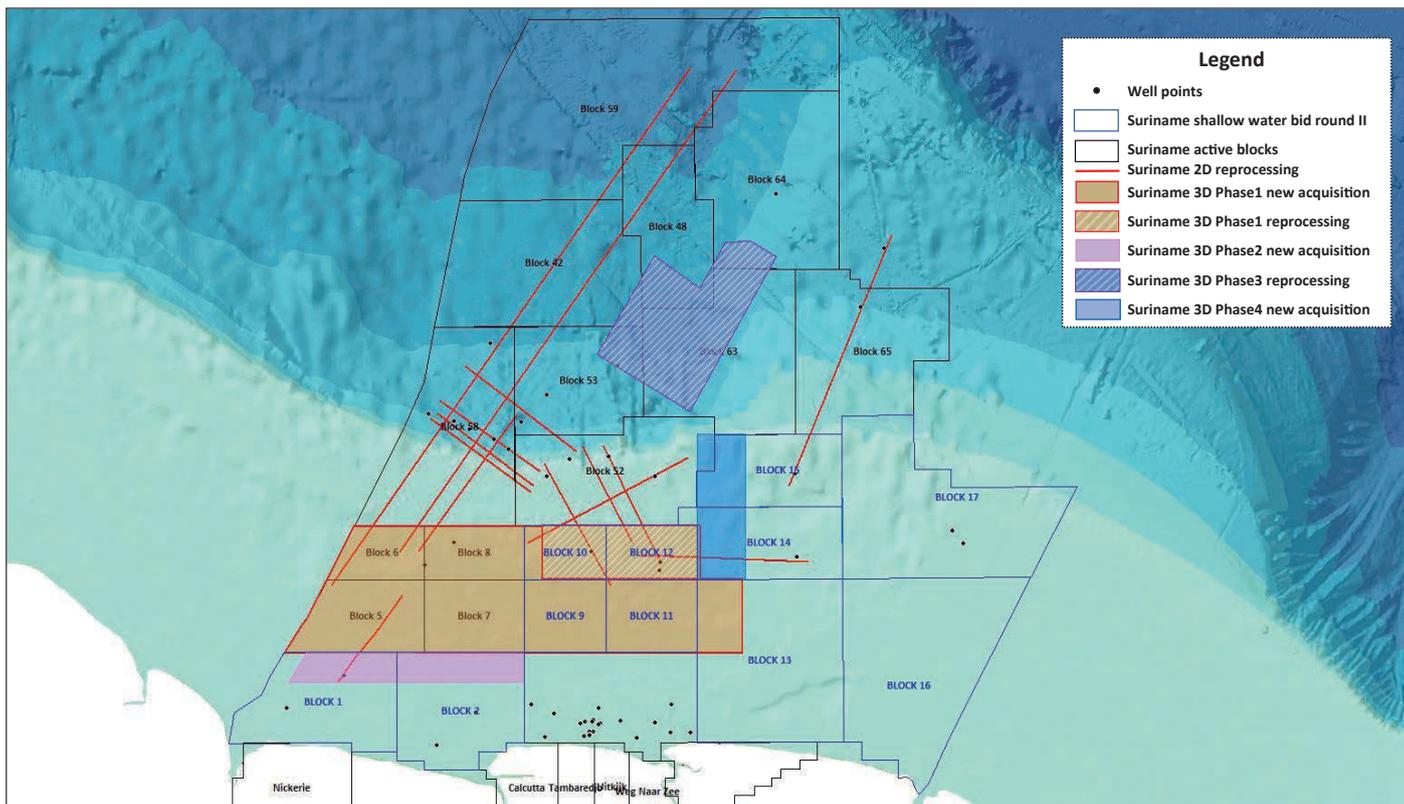
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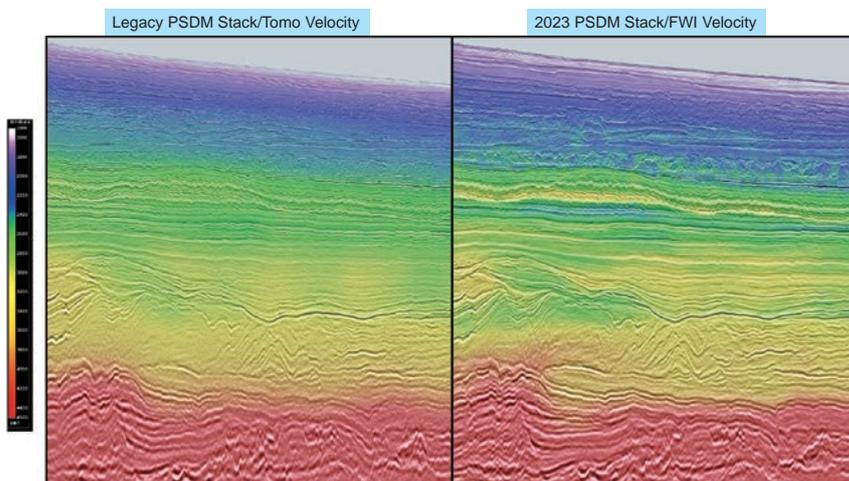
# OFFSHORE SURINAME 3D MULTI-CLIENT SURVEY

BGP in a consortium with CGG and TGS has conducted new multi-client 3D acquisition and legacy data reprocessing, in the shallow water acreage offshore Suriname. The new seismic data from the consortium's multi-client programs will be instrumental in accurately delineating the prospectivity and potential of this underexplored area.



## Highlights:

- Dense sampled 3D acquisition
- Better imaging and accurate velocity model building with Time Lag FWI and TTI anisotropic parameter estimation
- Better S/N ratio and AVO metrics
- Better resolution and frequency bandwidth through broadband processing
- Supporting the 2nd Shallow Water Bid Round



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