GeoNeurale

announces

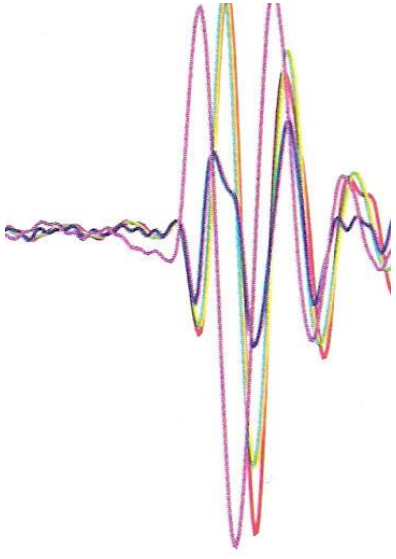
Multi-Component Seismic

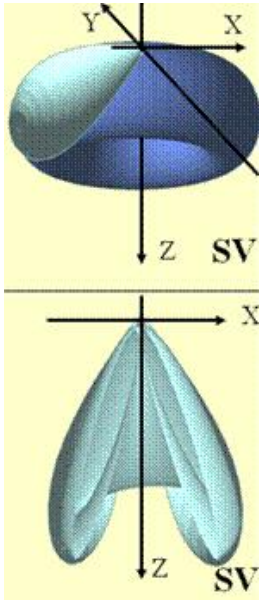
Principles and Applications

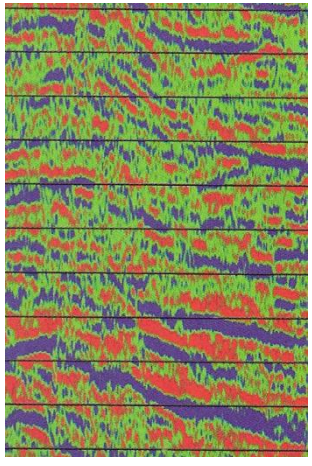
6-10 June 2016

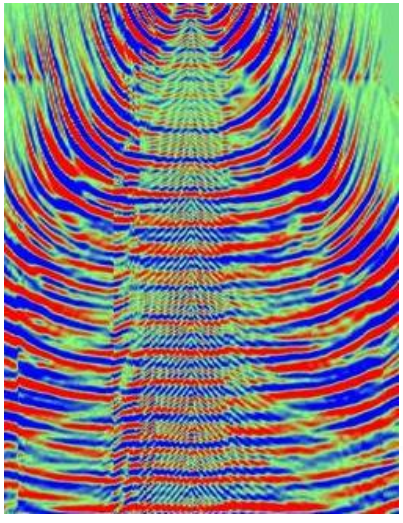
(5 Days)

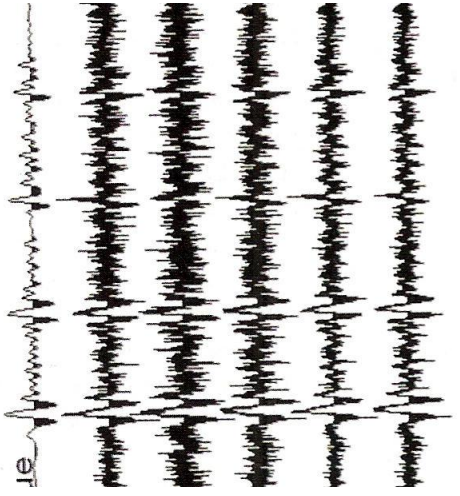
Munich











Multi-Component Seismic

Principles and Applications

(New Program)

Munich : 6-10 June 2016

Special topics:

Seismic 3D3C Theory and Applications
Seismic PP-PS Inversion, 3D3C Seismic/Petrophysical Integration.
Seismic and Petrophysical Applications, Seismic Interpretation with OpendTect

5 DAYS COURSE

INSTRUCTOR: Robert Garotta, Arnoud Huck

LEVEL: Advanced

AUDIENCE: Intermediate and advanced level geophysicists, seismic processing specialists, interpreters, exploration and production geologists

COURSE FEES: 3850 Euro + 19% VAT **(VAT Tax is 100% refunded from the German Finance Ministry)**

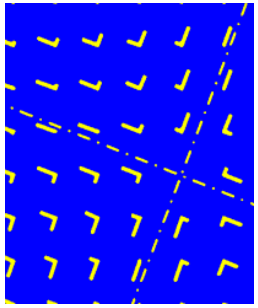
REGISTRATION DEADLINE : 15 May 2016

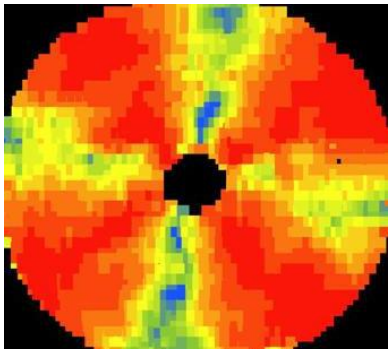
ONLINE REGISTRATION: www.GeoNeurale.com

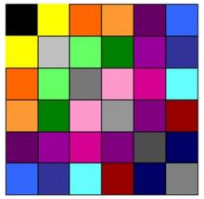
Multi-Component Seismic Principles and Applications

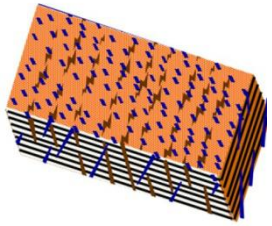
Dr Robert Garotta

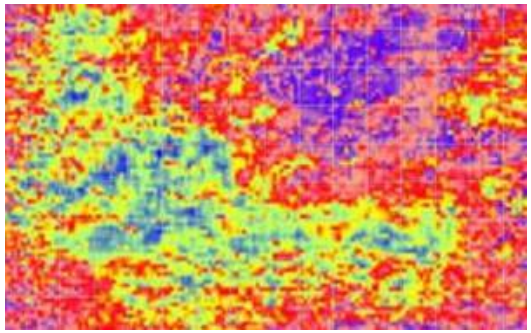
Robert Garotta, one of the fathers of the Seismic Multi-Components methods, developed this course that summarizes his more than 30 years experience by some of the major seismic companies and research institutions worldwide. The course represents an important goal for all seismologists who are interested to advanced P and Shear waves measurements, processing and interpretation.





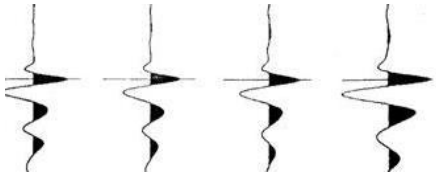


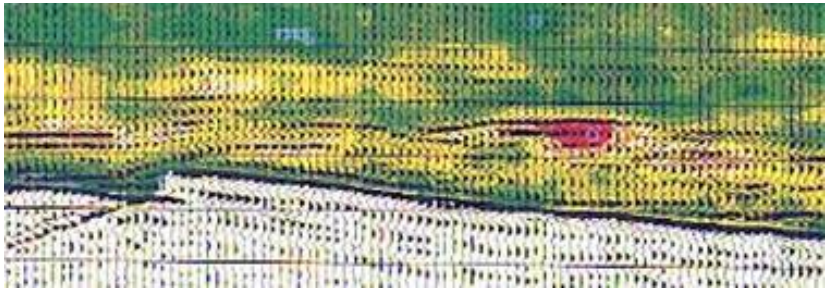


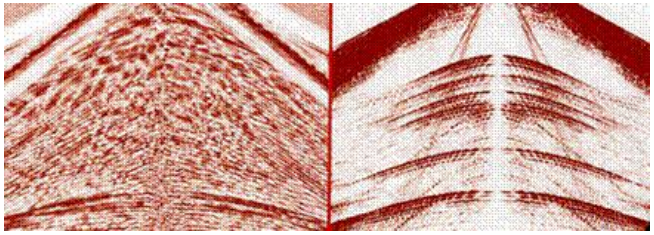


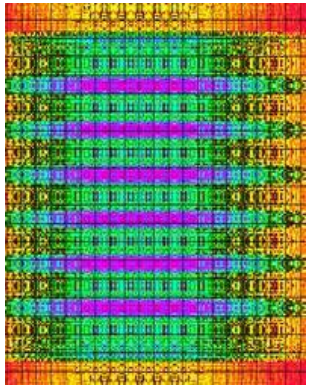
21 elastic constants
1 symmetry center

$$t_c = \sqrt{\frac{t_{c0}^2}{(1+\gamma_0)^2} + \frac{x_p^2}{v_{p2}^2} - 2\eta_e \Delta t_p^2} + \sqrt{\frac{t_{c0}^2 \gamma_0^2}{(1+\gamma_0)^2} + \frac{(x - x_p)^2}{v_{s2}^2} + 2\zeta_e \Delta t_s^2}$$









ONLINE COURSE PREPARATION

PROPEDEUTICAL PHASE

We offer an optional online preparation to the course, to review some useful fundamental mathematical applications and smoothly enter into the logic of the course.
The preparation phase will start 2-3 weeks before the course.

GENERAL PROPEDEUTICALS

Linear Algebra
Matrix and Tensors (The Stiffness Tensor)
Complex Numbers and Functions
Fourier Transform
Hilbert Transform
Convolution, Deconvolution
Filters
Ricker Wavelet and Spectrum
Function Shift / Spectral Changes
Spectrum Shift / Function Changes
Spatial Statistics

SPECIFIC PROPEDEUTICALS

Petrophysical Applications
Sonic and Density Logs, Synthetic Seismograms
Seismic Inversion
AVO / AVA Analysis
Geostatistical Applications links in Seismic and Petrophysics

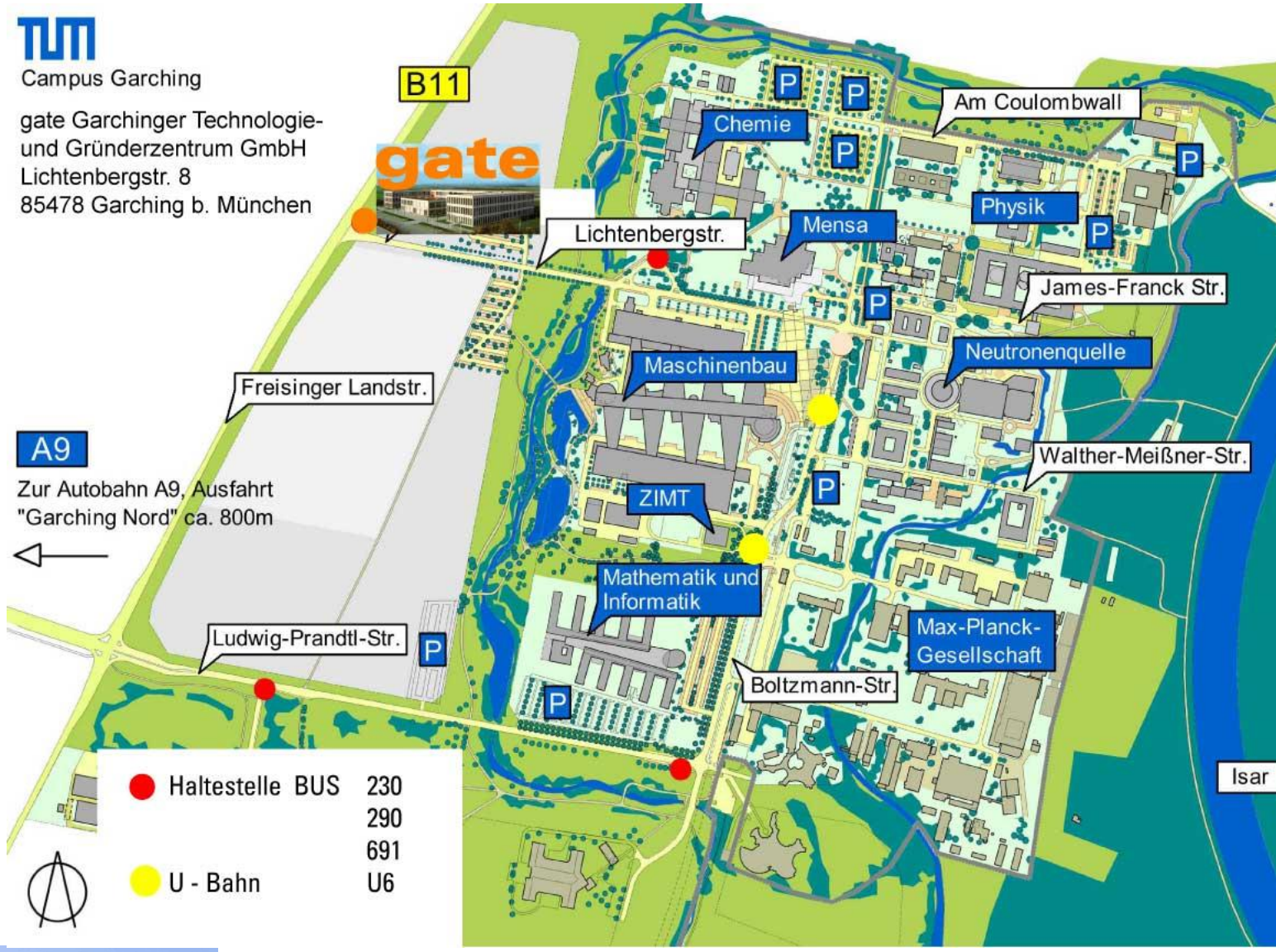
gate

GeoNeurale

Office

and

Training Location



Multi-Component Seismic

Principles and Applications

Participants will expand their understanding of significant techniques and developments in exploration geophysics, and gain a greater appreciation of the use of the attributes derived from multi-component seismic in interpretation.

This course is designed for:

-Geologically based seismic interpreters who wish to expand their understanding of significant techniques and developments in exploration geophysics.

- Processing geophysicists wishing to handle multi-component data and to derive the most significant attributes.

-The course topics, listed below, are presented by means of lectures, examples and particular developments about advanced techniques.

-Enrollment in this course is limited to 25.

Multi-Component Seismic Principles and Applications

Course description:

A brief historical overview describes the sources of motivation and subsequent advances in theory and techniques used to apply multi-component seismic.
A reminder of the elastic wave propagation theory fixes the terminology used in this course to classify the different situations appearing in seismic exploration: quasi-isotropic or anisotropic environments can be investigated by different wavefields.
Multi-component seismic has multiple fields of interest. It is sometimes seen as an additional tool to optimize the final acoustic image while particular applications use pure shear wave propagation. More widely used, the converted mode proposes additional information in different ways.
Multi-component acquisition has to satisfy more conditions than conventional acquisition: seismic sources, seismic receivers, and survey designs have to be adapted to the specifics of pure shear mode or converted mode propagations.
In the same way, multi-component processing requires additional quality controls and analyses; the differences between conventional or multi-component processing occur from static corrections up to final imaging.
Finally, the merge of consistently processed data issued from different wave modes delivers seismic attributes and opens ways of getting closer to the rock physics.

PROGRAM

The first two days of the course will be devoted to the presentation of the basic theory of elastic propagation and its consequences about the acquisition and the processing of multi-component data, then to the presentation of 2D and 3D examples of results.

During the third day more details will be given to particular topics:

- shear mode static corrections,
- derivation and use of the Vp/Vs ratios,
- simultaneous combined PP and PS mode inversion,
- detection and compensation of azimuthal anisotropy.

-

Section 1 Historical overview

- Scientists
- Earthquake seismologists
- Civil engineers
- Exploration geophysicists

Section 2 Why use shear waves

-
- When compressional mode fails
- When lithological information is required
- When fluid contend is important
- When confirmation is needed
- When shallow to medium depth resolution is required

Logs P/S discrimination , PS Converted Mode Propagation through Gas , Imaging below Velocity Layers , Lithology Discrimination , Azimuthal Anisotropy , Amplitude Anomaly , 3D-3C Attributes

Section 3 Theoretical basis

- Elastic wave propagation in homogeneous media
- Reflection, transmission and conversion of elastic waves
- Boundary and surface waves
- Wave attenuation
- Modelling

Elastic Materials and Parameters , Anisotropy and Heterogeneity , Compressional wave Equation and Solutions ,Stress/Strain relations , wave Propagation in Isotropic and Anisotropic media , wave Polarization in Anisotropic media , Hooke´s law in Anisotropic media , Stiffness Matrix and Models: Isotropic to Triclinic , Thomsen Parameters and Elastic constants , Wavefronts and AVO parameters in VTI , the linearized Zoeppritz equation, Anisotropy concepts in seismic processing , Raileigh and Love wave characters , wave Attenuation , multiple contributions , Quality Factors , P and PS Raytracing , P, S and P+S Seismic Attributes

Section 4 Shear wave acquisition

- Shear wave sources
- Land multi-component receivers
- Shear wave land acquisition
- PS mode land acquisition specifics
- Shear wave marine and shallow water acquisition

Directivity Functions , Pure Shear sources , Y+ and Y- Records , Field Station Anisotropy , Multicomponent sources and receivers , wave Mode Separation , wave Modes VTI to Orthorombic , P S and PS wave land acquisition , Target Illumination and compared 3D Folds , P and PS Amplitude, P to S Conversion , Frequency Spectrum Preservation , Effects of Absorption , Filtered Records , Marine Acquisition and design , OBS

Section 5 Processing of shear wave data

- Generalities about Shear mode processing in VTI environment
- Static corrections
- Normal moveout corrections
- Generalities about PSv mode processing in VTI environment
- Processing sequence of PSv mode in VTI environment
- Particulars of marine processing
- S and PSV mode processing in an orthorhombic environment
- Correlation of P and S data

Compared P and S Statics , NMO Velocities, P and Sh time differences, equivalent Raypaths, S wave fronts, P and S Velocities versus angle of incidence, Velocity Analysis, Lithology Indicator parameters, Wavefronts in VTI , Shear waves CMP Gathers, ΨS-wave data, PSv Mode CRP Gather and NMO, CMP Binning vs. CCP Binning, Radial component Stack, PSv Mode Asymptotic Gathering, PSv Mode Hybrid Average Velocity, PSv Mode RMS Velocity, PSv Mode NMO Velocity, Effective Velocity Ratio, PSv Processing Sequences, first breack Hodogram, Orientation QC, Spectral Ratios horizontal-vertical-total, synthetic data, surface Consistent Deconvolution, Asymmetrical Response of Converted waves, CCP Binning. Processing Schemes: PSv, 2D P-S DMO, 2D PSTM. Gamma Zero definition, Vp/Vs Velocity Analysis, Migrations, Pre-Stack Kirchhoff time and depth Migration, Shear wave Splitting, Birefringence

Section 6 Results of shear waves surveys

- Poisson's ratio derivation from P and SH surveys
- Poisson's ratio derivation from P and PSV surveys
- Example of gas detection
- Wave mode comparisons
- Improving the seismic image
- 3Dx3C and 2Dx3C azimuthal anisotropy surveys

Conclusions

Robert Garotta

BIOGRAPHY

Robert Garotta, graduated of the Faculté des Sciences in Paris (DES), began his career at the geophysical department of the French National Centre of Scientific Research (CNRS).

He joined CGG as a field geophysicist, first in the gravity method then as a seismologist.

He was involved in various fields of research and development such as vibroseismic, velocity analysis, static corrections, 3D survey design, shear wave experimentation and processing.

He concluded his career at CGG as Senior Vice President of the Geophysical methods.

Robert is still advising the CGGVeritas group in the area of Multi-Component seismic.

Awards:

- Conrad Schlumberger Award from EAEG
- Prix Charles Bihoreau
- SEG Distinguished Instructor
- SEG Honorary Member

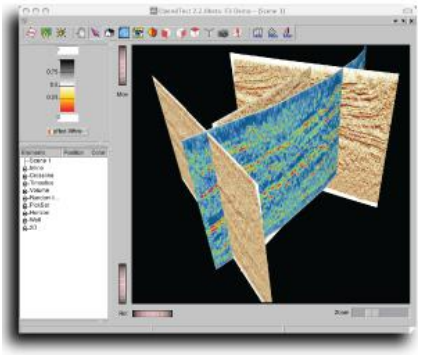
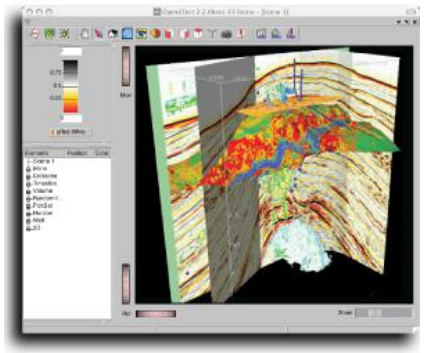
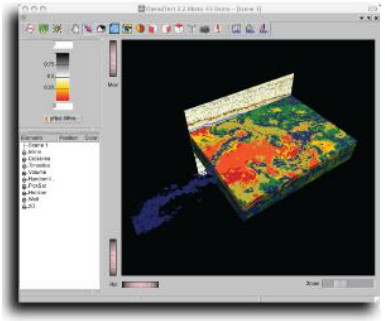
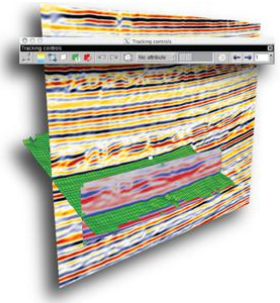
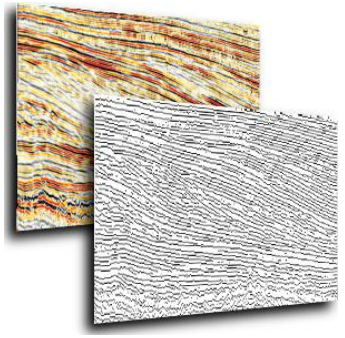
1 DAY SEISMIC INTERPRETATION PRESENTATION
with

OpendTect

Presented by Arnoud Huck

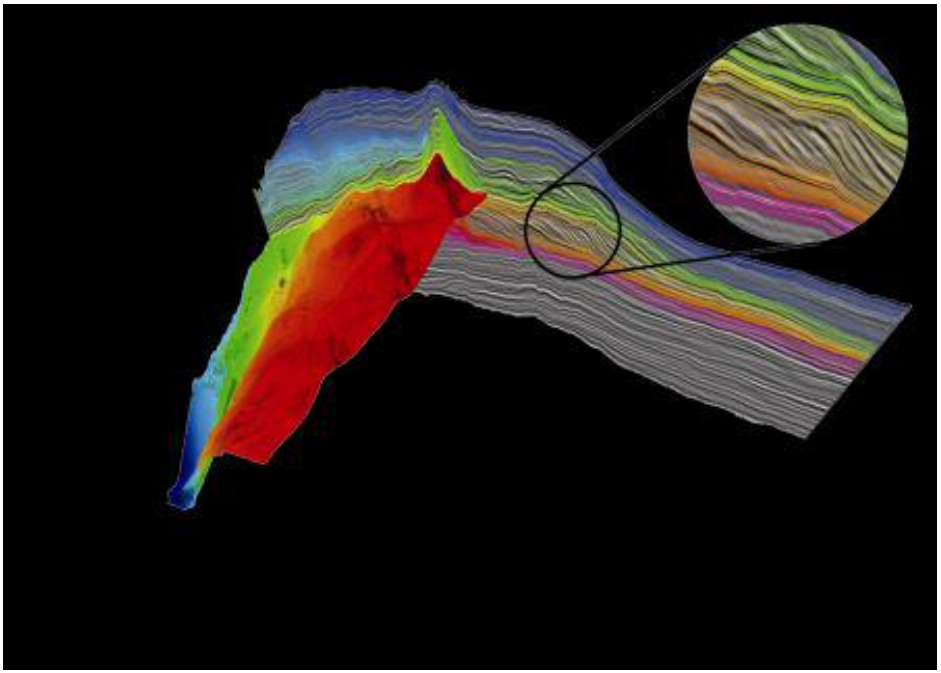
Data loading, creation of a steering cube and horizon cube, well-tie, visualization of horizons slices, inline , crossline, transverse, horizontal sections, autotracking, anttracking, attributes generation, attributes analysis, volume rendering, spectral decomposition, crossplotting, velocity analysis, sequence stratigraphy.

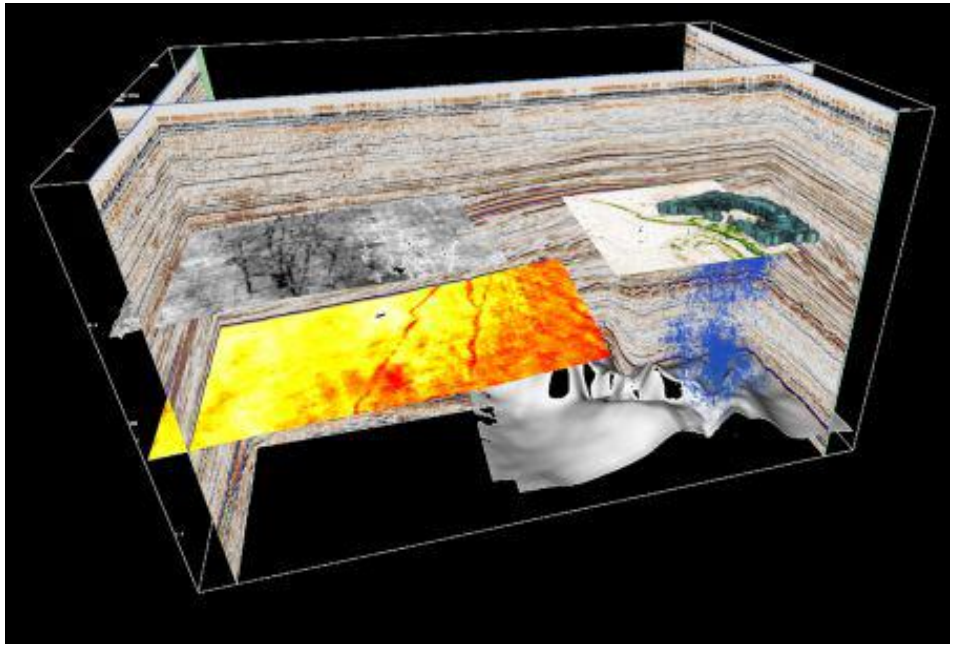
The participants will obtain a test license to install in their computer to follow interactively the software presentation and continue the software evaluation and training after the course.

OpendTect: more Applications

create 3D volumes from 2D seismic
interpolate seismic to a new survey geometry
simple wedge modeling
SEGY header manipulation
3D pre-stack event visualization
Log math & Rock physics library
Checkshot and well log editing
Anisotropic variograms





Registration Details

- Course fee: 3850 Euro + 19% VAT (VAT optional for non German private owned companies)
- Registration deadline : 15 May 2016

Payment and Registration

Tuition fees are due and payable in Euro upon enrollment in the course by bank transfer to the bank account given below unless another payment form is agreed

Unless otherwise indicated, the payment should be received before the date specified in the invoice as payment term to make the enrollment effective.

To register to the course please fill in the registration form and fax or email it along with the confirmation of your bank transfer to:

GeoNeurale
Lichtenbergstrasse 8
D-85748 Munich
T +49 89 8969 1118
F +49 89 8969 1117

ONLINE REGISTRATION: www.GeoNeurale.com

Please indicate your name and the purpose: “Multi-Component Seismic course fee".

Provisions

Tuition fees are due and payable in Euro upon enrollment in the course. Unless otherwise indicated, fees do not include student travel costs and living expenses.

Payments are also accepted via personal or company check, traveler's check, credit card, and Company Purchase Orders.

Cancellations by Participant:

All cancellation are subject to a 100 Euro non-refundable cancellation fee.

Cancellation have to be notified to our office, at least 30 days prior to the course start date to receive a refund (less the 100 Euro cancellation fee).

If the participants are unable to cancel prior to the 32 days notification date, they may substitute another person at their place in a course by notifying us prior to the course start date.

Course Cancellations:

GeoNeurale reserves the right to cancel the courses if necessary. The decision to cancel a course is made at least two weeks prior to the course start date. If a course is cancelled, the participant will receive a full reimbursement of the tuition fees (but not of the plane ticket or hotel expenses or any other costs), or will be enrolled in another course upon his decision (the cost of the original course will be applied to the cost of the replacement course).

GeoNeurale can not be responsible for any penalties incurred for cancellation or change of airline or hotel reservations .

Refunds:

GeoNeurale will promptly remit all refunds of tuition fees due to cancellations or annullment (less any appropriate non-refundable cancellation fee) within 30 days of the course cancellation.

Force Majeure:

GeoNeurale can not be responsible for cancellations due to “force majeure” events : airplane or airport strikes, emergency situations, natural catastrophes and all situations and incidents independent or outside the human control that can delay or cancel the course. In case of such events related cancellations the course tuition fees will be refunded to the client .

Geoneurale is not responsible for any delay or absence caused by the training instructor or training instructor company for reasons which are independent or out of the control of GeoNeurale´s decisions.

AGREEMENT: Upon enrollment all parts accept the above mentioned provisions. The above specified provisions shall regulate the agreement between GeoNeurale and the participant and the participant company and will enter into force upon enrollment.

REGISTRATION FORM

Please fill out this form and Fax to +49 89 8969 1117

or Email to Courses@GeoNeurale.com

3D Seismic Multi-Component

Munich 6-10 June 2016

Course Fee: 3850 Euro + 19 % VAT **(VAT optional for non German private owned companies)**

Name:

Company:

Address:

Job Title:

Phone:

Fax:

Email:

www.GeoNeurale.com

INFORMATIONS, HOTELS, MAPS, LINKS

TRAINING LOCATION – RESEARCH CENTER

http://www.geoneurale.com/documents/GATE-Y7.pdf

GATE GARCHING

http://www.geoneurale.com/documents/GATE-Y6.pdf

MAP MUNICH-GARCHING

http://www.muenchen.city-map.de/city/db/130208000001/14269/Garching.html

MUNICH INFO and MAP MUNICH CENTRAL

http://www.muenchen.de/home/60093/Homepage.html

MAP MUNICH UNDERGROUND

http://www.mvv-muenchen.de/web4archiv/objects/download/3/netz1207englisch.pdf

HOTELS NEAR GeoNeurale

http://www.geoneurale.com/documents/HOTELS-GARCHING.pdf

BAVARIA INFO

http://www.geoneurale.com/documents/Around-Munich-Info.pdf