**TECHNICAL SPECIFICATIONS**

**Software Presentation**

InterWell is Beicip-Franlab’s seismic inversion and reservoir characterization software. Available on Windows and Linux platforms.

InterWell unified workflow offers the following key stages:
- Seismic data conditioning and QC
- Multi-well wavelet estimation and multi-cube well-to-seismic calibration
- Prior impedance modeling for elastic parameters
- Deterministic acoustic/elastic inversion
- VTI deterministic elastic inversion
- Acoustic/elastic geostatistical inversion
- Multi-component, azimuthal and 4D inversion workflows
- Lithology prediction and trend modeling

**Functionality & Algorithms**

**Seismic Data Conditioning and QC**
- NMO correction and stacking of migrated gathers
- Residual NMO Misalignment correction between angle stacks using a volumetric analysis and optimization method
- Generation of cube-to-cube cross-correlation, noise maps, and more QCs

**Multi-Trace Coherence Analysis**
- Estimation of seismic signal, noise and seismic bandwidth
- Statistical estimation of wavelet amplitude spectrum
- Performed in constant time window or along an horizon

**Well-to-Seismic Calibration**
- Hybrid approach for wavelet estimation (statistical and deterministic)
- Multi-well wavelet extraction and optimization
- Time shift estimation through envelop of intercorrelation
- Wavelet phase & energy determination via multi-trace & multi-well analysis
- Variable phase and amplitude wavelet estimation using a least square optimization method
- Inter-bed multiple modeling option to detect multiple generator and maximize calibration accuracy
- Flexible editing of calibrated wells location and time-shift
- Energy normalization map from wells using several interpolation methods

**Multi-Cube Calibration**
- Well-to-seismic calibration and determination of optimal well position taking into account different single-volume calibration sessions

**Prior Impedance Modeling**
- Structural framework
  - Building a geological framework for guiding the prior model and the inversion
  - Integration of horizons and deposit modes
  - Definition of macro-units for parameter mapping
- 3D dip analysis from seismic data to define the inversion correlation lines
- Prior model for elastic parameters
  - Creation of an a priori distribution of impedance and density
  - Well data interpolation along structural and stratigraphic features
  - Modeling of low frequency component using seismic velocity data
  - Possibility to use an external prior model or to derive a new prior model from a previous inversion result

**Deterministic Inversion**

**Acoustic and Elastic Seismic Inversion with Bayesian Approach**
- Inversion products: IP, IS, RHO, synthetic seismic, reflection coefficients and residuals seismic for each angle stack
- Additional available elastic parameters: Poisson Ratio, Vp/Vs Ratio, LamdbaRho, MhuRho, Intercept and Gradient
- Taking into account data quality and influence by tuning inversion parameters:
  - Parameterization of inversion algorithm using prior uncertainty assessments
  - Balancing the influence of input seismic data volumes
  - Optimization through a multi-channel conjugated gradient method
  - Monitoring of inversion cost function
  - Inversion on full-cube, sub-cube or around a surface
  - Fast full-seismic option available

**Advanced Inversion Capabilities**
- HPC capabilities to minimize computing time
- Inter-Bed Multiple Modeling (IBMM) technology to attenuate the impact of multiples from a contaminated dataset on the inversion results
- Laterally variable wavelet energy
- Integration of VTI (Rüger) anisotropy model for enhanced inversion results

**Azimuthal Inversion**
- Complete sequential multi-azimuth inversion workflow
- Determination of isotropic and anisotropic contributions
- Assessment of horizontal anisotropy parameters via statistical ellipse fitting

**Time-Lapse 4D Joint Inversion**
- A priori warping using a multi-channel correlations method
- Physical warping process integrating both P-waves cinematic and impedance variations
- Multi-vintage acoustic and/or elastic post- and/or pre-stack inversion

**Multicomponent Joint Inversion**
- Complete workflow for multicomponent (Pp, Ps, SV, SH) inversion
- Scaling law computation for the different domains
- Multicomponent post- or pre-stack inversion

**Global Stochastic Inversion**
- Use of direct stochastic sequential simulations
- Global optimization technique based on the trace-to-trace mismatch between real and synthetic seismic
- Possibility to use deterministic inversion results as secondary variable
- Possibility to use external distributions to constrain the simulations
- Uncertainty analysis through the analysis of several simulations
**Results Analysis**

**AUTOMATED DEDICATED QC**
- **Wells**
  - Sections with customizable well projection
  - Automatic display for comparison between initial logs and inversion results
  - Available for blind wells testing
- **Wavelets**
  - Display of the envelop of inter-correlation functions between observed and synthetic traces (time-shift detection)
  - Cross-plots and histograms integrating all wells or sub-sets of wells for optimizing the time shift, the phase and the energy
  - Mapping of estimated parameters and corresponding correlations of observed vs. synthetic trace, to check the accuracy of the estimated parameters in the vicinity of the wells / intersections
  - Correlation coefficient, Phase, Time Shift and Energy maps around wells
  - Average calibration attribute maps (multi-cube calibration)
  - Wavelet and corresponding phase & amplitude spectrum
  - Display of multiple wavelets, comparison of amplitudes spectra, available for multi-cube stability analysis or input versus inversion results QC

**Sections**
- Automatic combined sections display showing a user-defined selection among inversion results, input seismic and prior models
- Cross-plots
  - Cross-plots between inverted parameters such as IP vs. IS (or calculated Vp/Vs or PR), and between inverted traces and well logs.
- Maps
  - Fast and accurate extractions of various attributes along/between horizon(s)
  - Display of isolines over any map view
  - Design of arbitrary lines stored as a survey data

**SEISMIC CHARACTERIZATION TOOLS**
Comprehensive set of functionalities and attributes
- **Filters**
  - Available for horizons and seismic data
- **Advanced calculator**
  - Available for horizon and seismic data
- **Seismic data QC**
  - Noise maps and energy maps
  - Using a constant time window or around an horizon
- **Inversion QC**
  - Cross-correlation maps between two sections/volumes
  - Energy ratio maps between two sections/volumes
  - Noise maps before/after inversion
- **Frequency analysis on maps**
  - Minimum, maximum, dominant frequency, analysis at -6dB or -10dB
  - Spectral decomposition
- **Statistics maps extraction**
  - Average, minimum, maximum, variance, standard deviation, RMS
  - Available around one horizon or in an interval defined by two horizons
  - Possible use of threshold to derive proportion maps in an interval
- **Fast-track AVO analysis**
  - R0-G cross-plots and direct highlight on seismic data

**LITHO SEISMIC CHARACTERIZATION AND SEISMIC CONSTRAINTS GENERATION**
Complete workflow for litho-seismic characterization from inversion results
- Dominant lithology prediction using discriminant analysis
- Generation of volumes of dominant lithology and associated probabilities of good assignment
- Trend modeling to derive maps of key reservoir properties combining inversion results and well data

**DEDICATED CHARACTERIZATION OPTIONS FOR ADVANCED WORKFLOWS**
- Ellipse fitting for anisotropy intensity and orientation quantification in azimuthal workflows
- 4D effects quantification modules
- Discriminant analysis using 3 variables in multi-component workflows

**Data Management**
InterWell integrated survey migrator automatically ensures compatibility with databases and runs from previous versions.

**DATA IMPORT/EXPORT**
- 2D/3D seismic, velocity, and anisotropy data in SEG-Y and binary files format
- 2D/3D seismic gather in SEG-Y format
- Well data in LAS format (3.0), automatic projection on 2D lines
- Horizons, maps, tables, and pointsets in ASCII format
- Wavelet in ASCII format
- 2D/3D anisotropy parameters and attribute data
- Direct connection with EasyTrace database for transfer of input well logs / results extracted at wells / tables for Discriminant Analysis training data / external distributions for geostatistical inversion

**DATA EDITING AND QC**
- Horizon edition through various gridding, smoothing, merge options
- Data extraction and calculators for wells, maps, sections and volumes
- Automated QC displays on wells, maps, sections and volumes

**Extensions & Customization**
Based on the open Java™-based INT platform (http://intviewer.net/products/intviewer.html) allowing a high level of customization and extensions
- Powerful and flexible GUI
- Based on the open source Netbeans Rich Client Platform (RCP) for creating and managing plugin functionality
- Existing plug-ins available among spherical divergence correction, Butterworth filter, binning 4D.
- Interoperability with Python and the Seismic Workbench

**System Requirements**
- PC Windows 7 and Windows 10
- PC Linux 64 bits RedHat6 or RedHat 7 or compatible
- RAM: 16 GB or more (minimum: 8 GB)
- CPU: x86 and x86-64 processors
- Graphics board: NVIDIA recommended (or any graphic card compatible with OpenGL)

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Beicip-Franlab Headquarters
232, avenue Napoléon Bonaparte
92500 Rueil-Malmaison - France
Tel: 33 1 47 08 80 00
Email: info@beicip.com

An IFP group company