NExT
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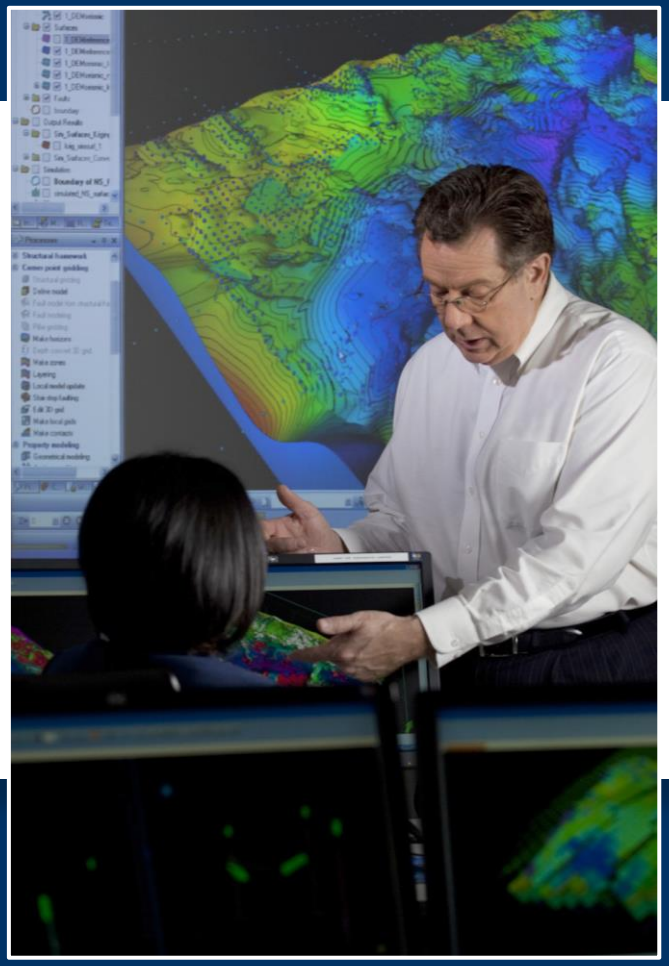
Petrel Geophysics
Module 8: Wavelet generation

Schlumberger-Private

Lesson 1: Wavelet toolbox



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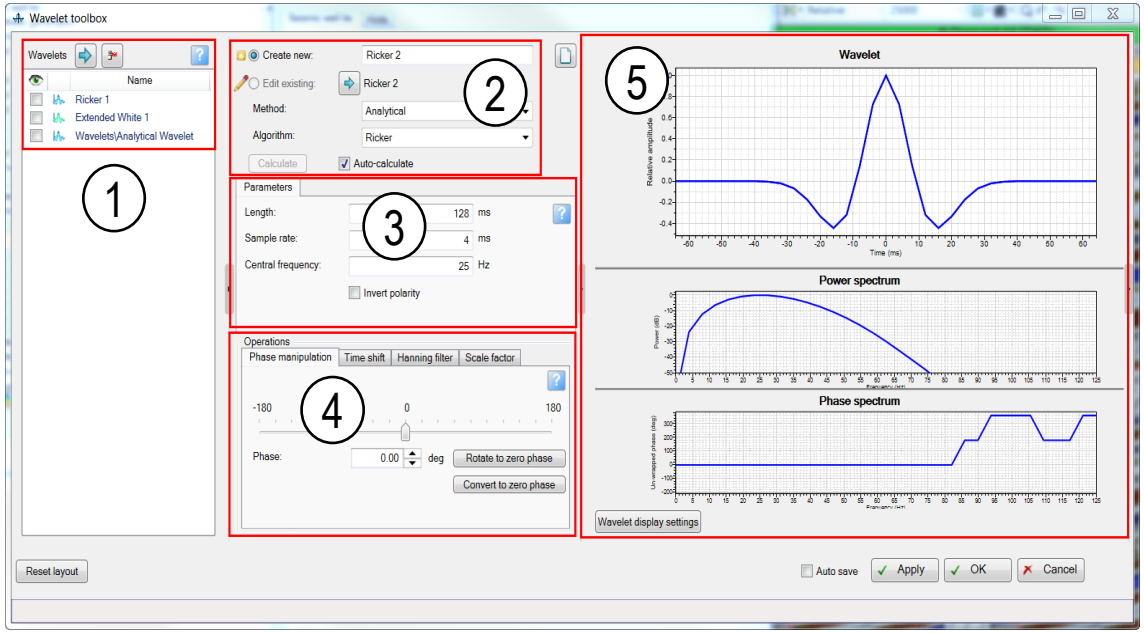
Wavelet toolbox

- The **Wavelet toolbox** integrates all related processes (Wavelet extraction, Wavelet Builder, and Wavelet viewer) in a single canvas.
- It provides an easy interactive tool for wavelet extraction.



1. Displayed Wavelet list
2. Method and algorithm
3. Parameters of extraction/generation
4. Operations
5. Visualizations

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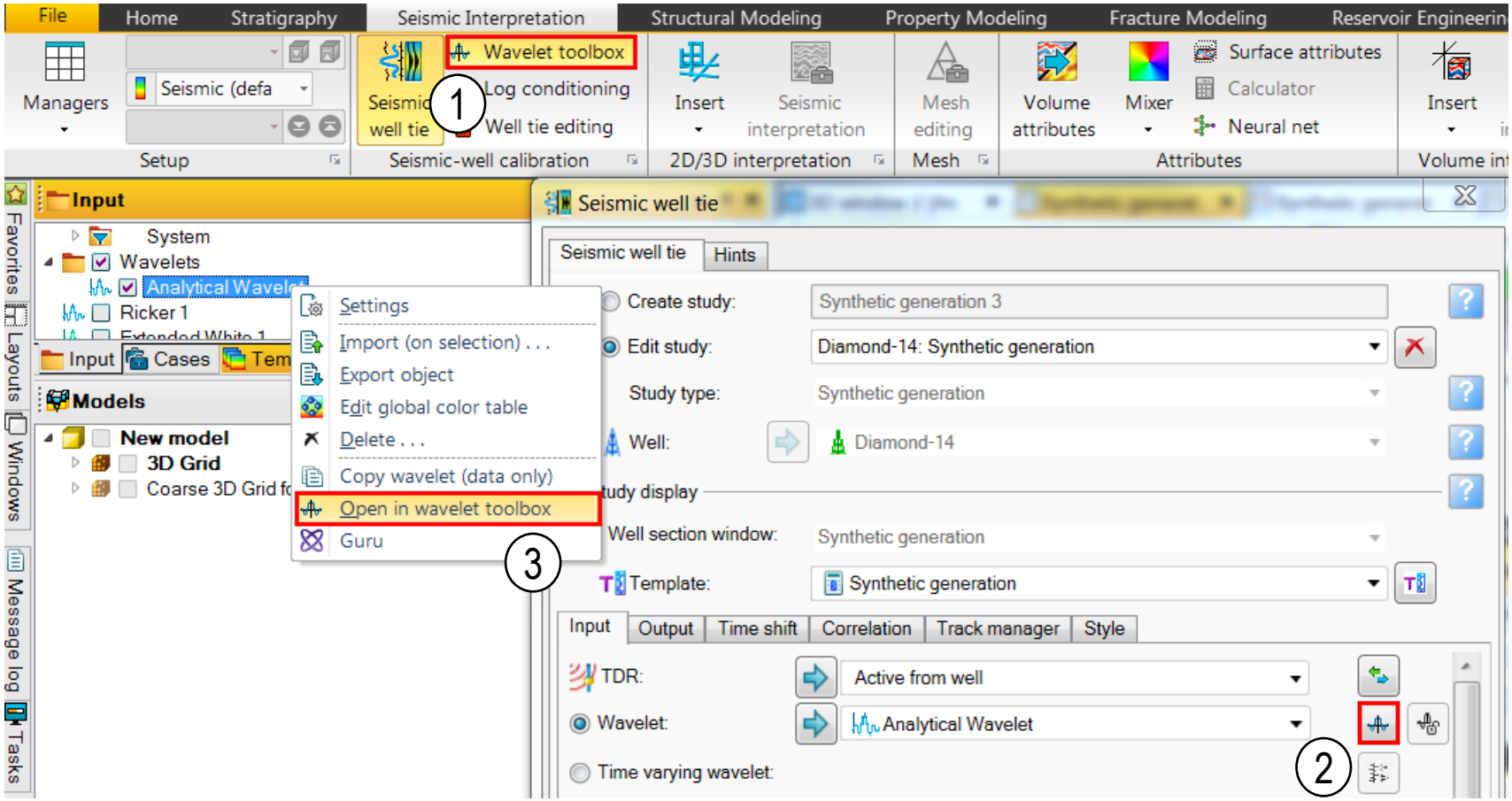
Access the Wavelet toolbox



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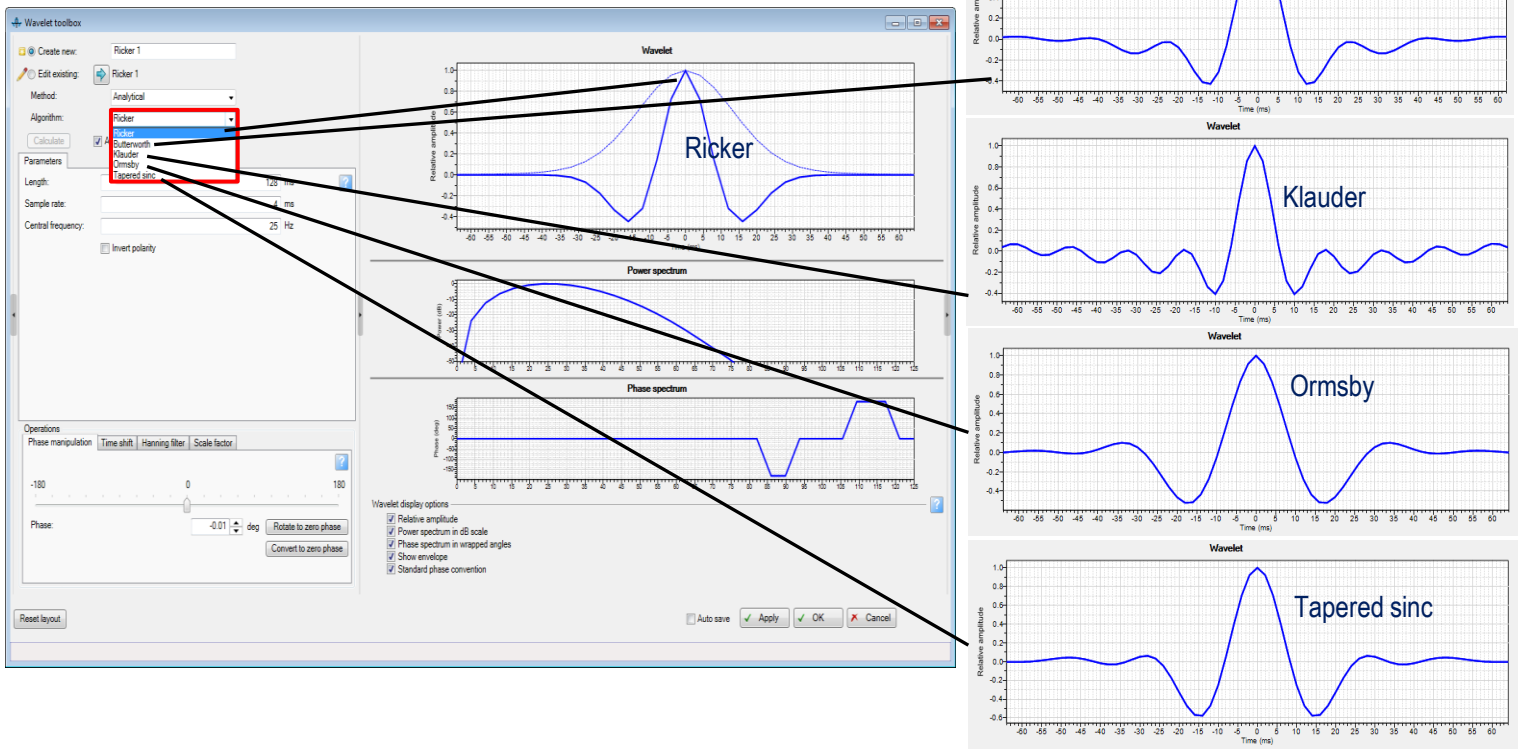
Types of wavelet extraction methods

- Analytical:
  - Ricker
  - Butterworth
  - Klauder
  - Ormsby
  - Tapered Sinc
- Statistical: Extraction
- Deterministic:
  - Extended White
  - Isis Frequency
  - Isis Time
- Multi wavelet: Wavelet Average
- Multi well

Analytical method

Analytical wavelets are standard model wavelets.

Five types are available.



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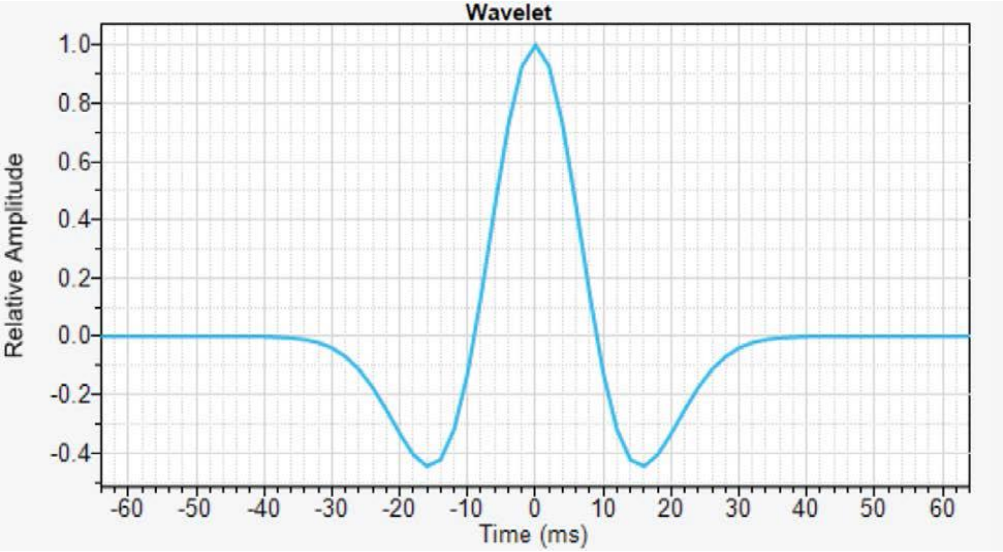
Ricker

- A Ricker filter requires only the peak frequency.
- This filter commonly is used for synthetic modeling.
- No bandpass filter is involved; the frequency and phase spectrums are purely a function of the peak frequency input.



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Ormsby

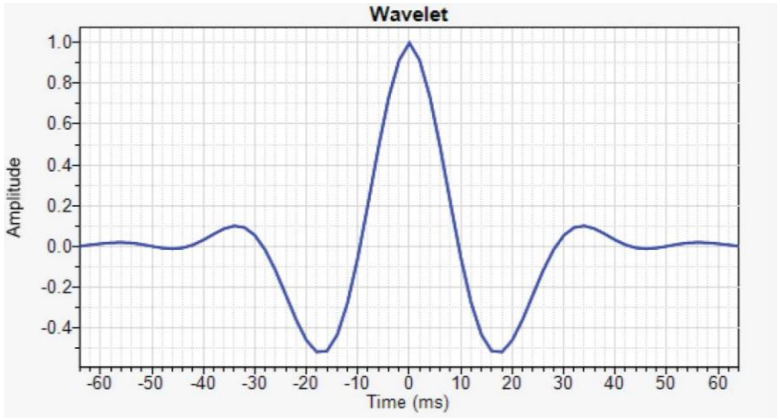
The bandpass of an Ormsby filter can be described by using as many as four corner frequencies.

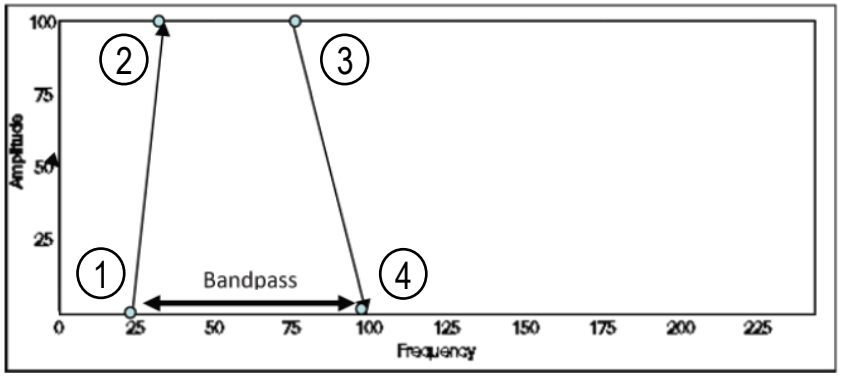
1 Low cut frequency

2 Low pass frequency

3 High pass frequency

4 High cut frequency





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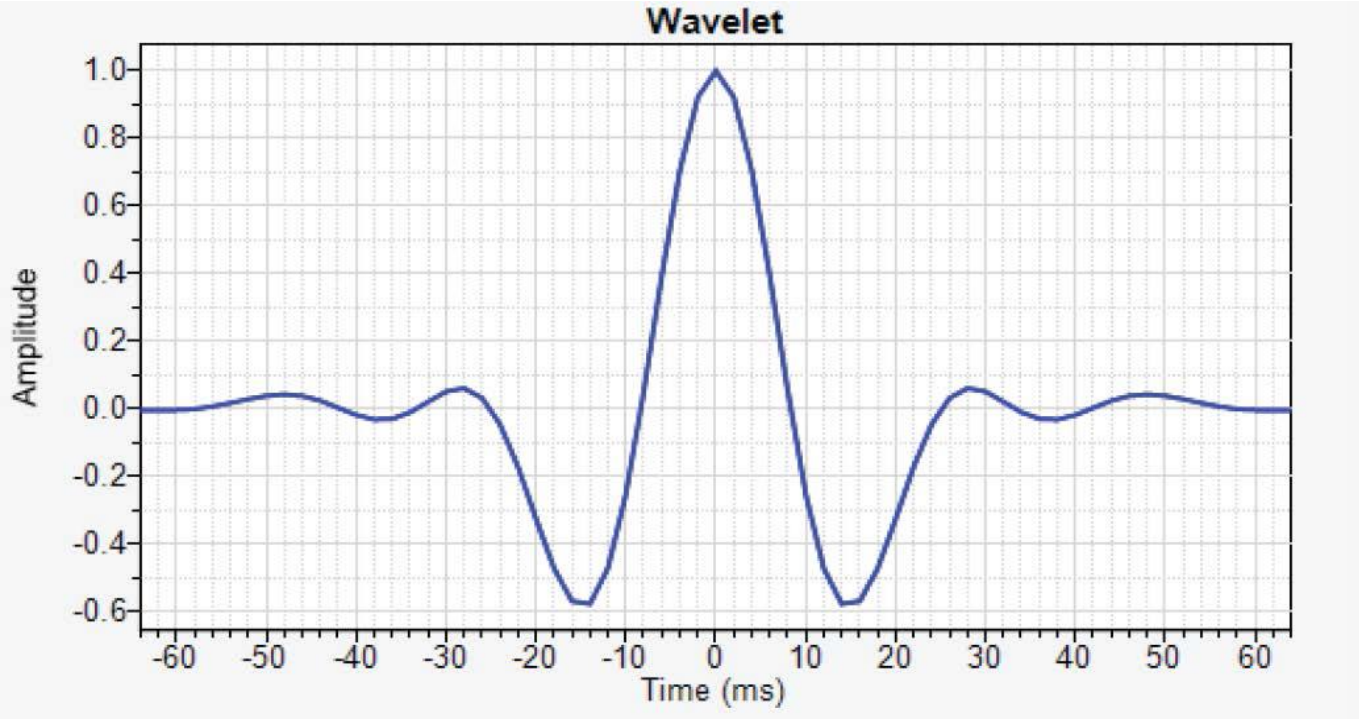
Tapered sinc

A tapered sinc filter is defined by a low and a high cutoff similar to a Butterworth filter but applies no further filters. A Butterworth filter applies two slopes.



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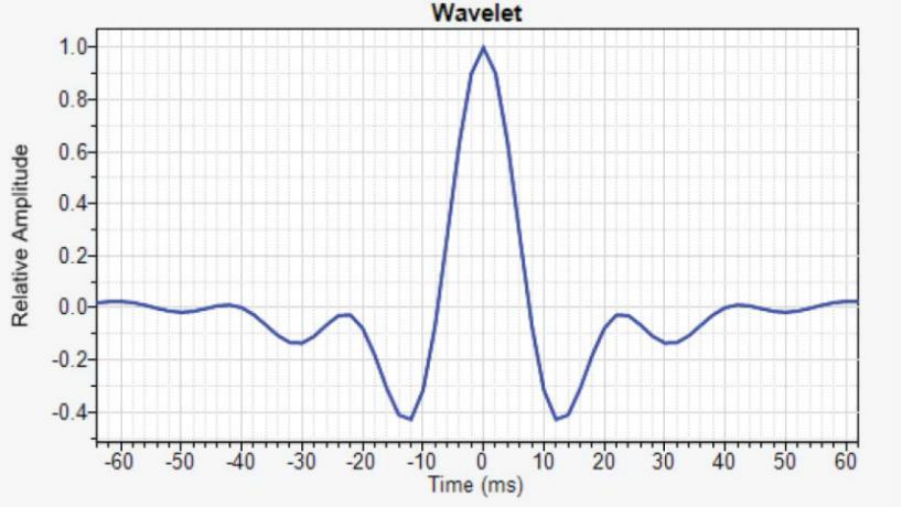
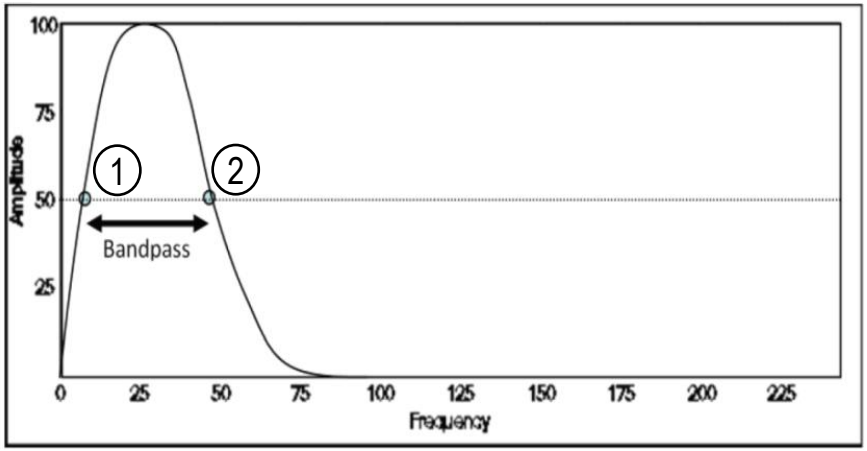
Butterworth

The Butterworth bandpass consists of two cutoff frequencies taken at 3dB down from maximum power, or approximately half power (~50% on the amplitude scale). In the figure, frequencies are at 10Hz and 50Hz. The Butterworth filter also requires two slopes.





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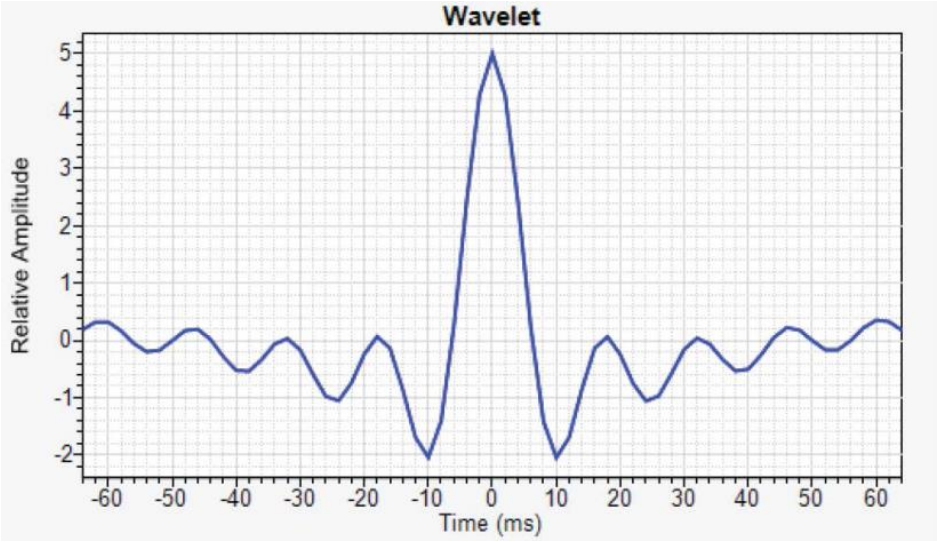
Klauder

- An analytical approximation of the Klauder wavelet is computed through autocorrelation of an actual vibroseis sweep signal.
- A Klauder wavelet is defined by two frequency cutoff values: a low cutoff and a high cutoff. The figure shows these frequencies set at 10Hz and 70Hz.



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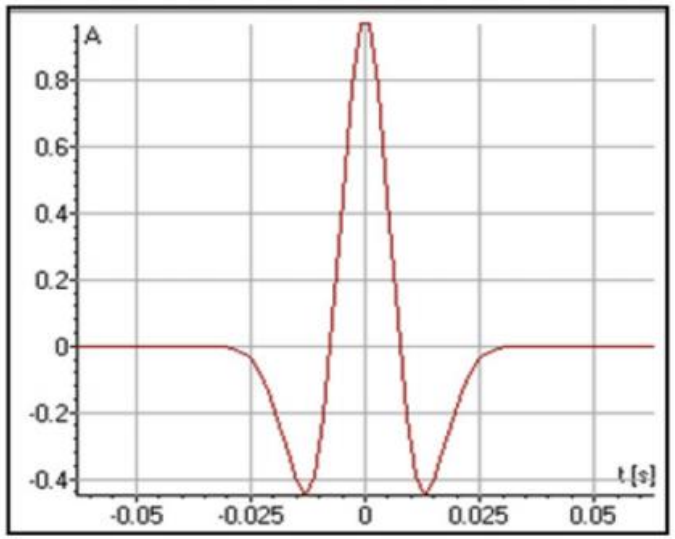
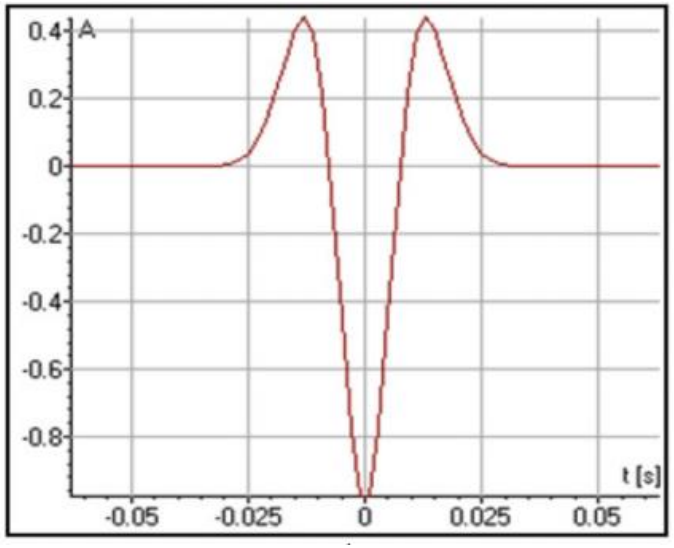
Wavelet phase

Convention for a zero-phase wavelet for the USA and Europe are opposite in phase.



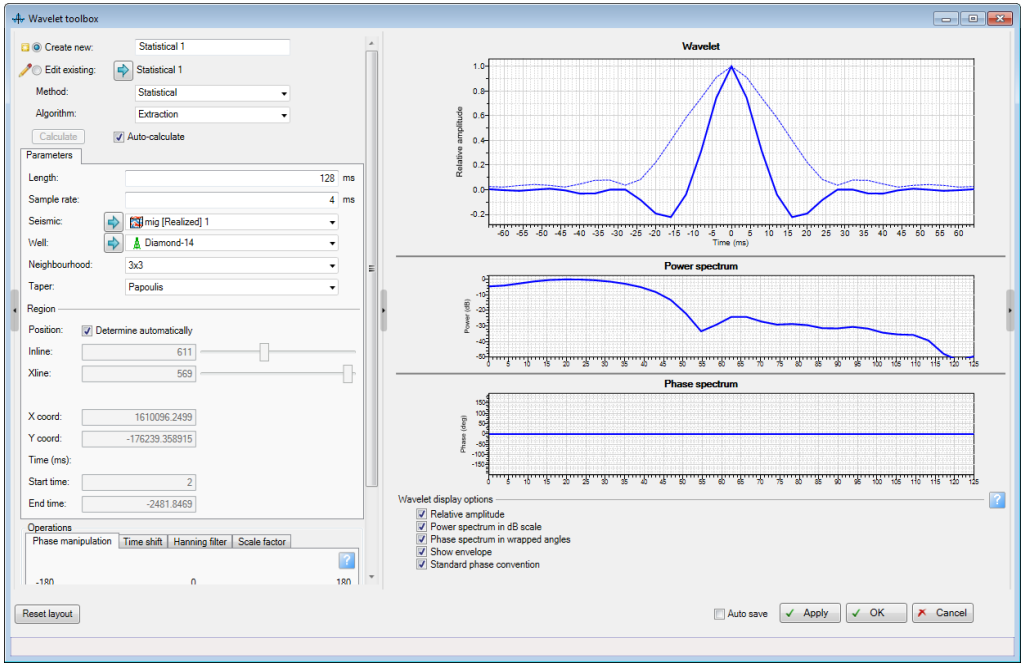
USA zero-phase wavelet



European zero-phase wavelet

Statistical method

- It is possible to access statistical extraction even if no sonic log exists for the borehole.
- This method assumes that the embedded wavelet is the same as the truncated autocorrelation of the seismic trace.



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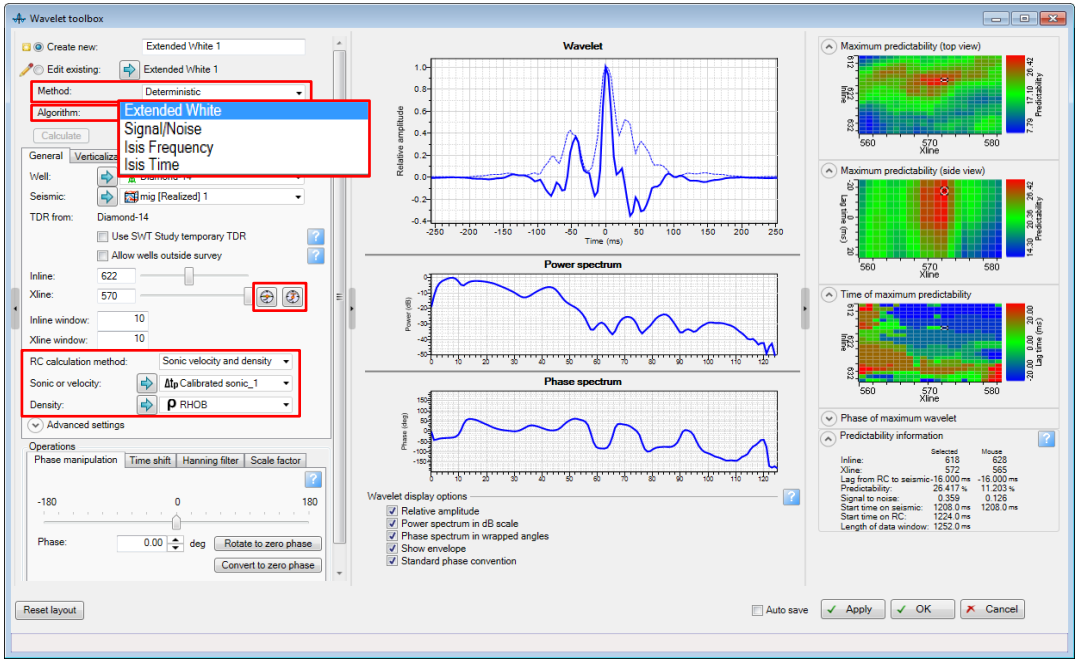
Deterministic method

For this method, a seismic volume and input logs of interest are required. You can change the position of the extraction location interactively, based on predictability, to optimize the wavelet to use.



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Exercises