

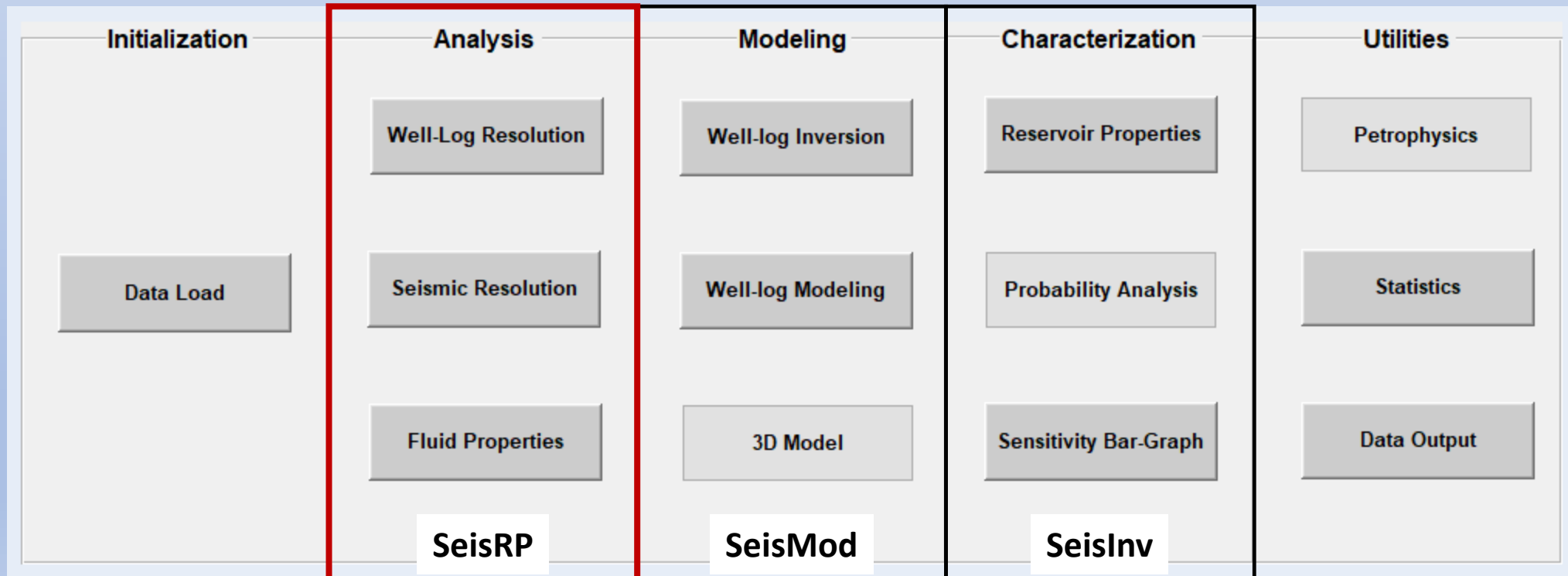
# SeisRP

[info@traceseis.com](mailto:info@traceseis.com)

# SeisTool: Seismic – Rock Physics Tool



Consists of three modules, each with three programs. The analysis and modeling modules ([SeisRp](#) and [SeisMod](#)) are based on state-of-the-art rock physics relationships. These support the reservoir characterization module ([SeisChar](#)) in which parameters to compute reservoir properties ( $\phi$ , lithology and fluids) are estimated through linear inversion of attributes computed from well-log or synthetic data



State of development to October 2019 Dark gray buttons correspond to operational programs

# SeisTool: Seismic – Rock Physics Tool



- **SeisRP**

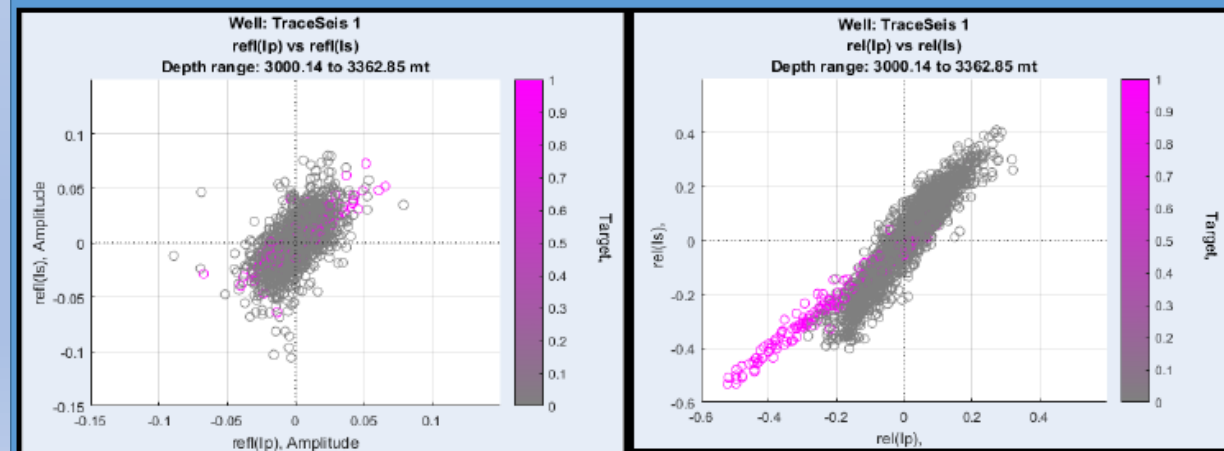
- Computes reflectivities, relative properties and absolute properties
- Generates attributes from wireline or modeled data at well-log or seismic resolutions in depth or two-way-time
- Fluid substitution. Different fluids and saturations

- SeisMod
- SeisChar

**SeisRP computes reflectivities and absolute and relative properties.**

**Some observations about relative properties**

- Measure interval properties
- Do not require a Low Frequency Model (LFM)
- Easy to compute from AVO attributes
- Better estimation of reservoir properties (SeisChar)



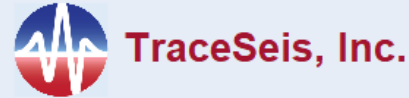
**Reflectivities Ip, Is**

**Relative Properties Ip, Is**

# SeisRP: Analysis at well-log resolution



Analysis at Well-log Resolution



Well : NMR Petrophysics #1 Pay

Initial Depth 801.929 mt Final Depth 1538.33 mt  
 Plot from 800 mt to 1538.33 mt

Attributes

**X Axis** **Y Axis** **Color**

Absolute Absolute Absolute

Vp Vs Density

Fluid Substitution

Sw -1

InSitu HC Live Oil

Subs HC Live Oil

**Matrix**

Modeled

Rock Physics Model

Solids' Model HS Average

Porosity Model Krief

mk 2.99 mMu 3.04

Finalized DISABLED

Fluids into Matrix Gassmann

Fluids' Model Wood

Plot

Templates

Empirical

Axes

-999 min X -999 max X

-999 min Y -999 max Y

-999 min Z -999 max Z

Color-fill Petrophysics

General

De-Trend Filter Length 200 m

Display Units  Metric  English

Chi Angle (deg) 0

Angles (deg) 0 Near 45 Far

Vertical Domain  Depth  Time

Resolution  Well-Log  Synth Seismic

Rock Properties  Measured  Modeled

Select Well NMR\_Petrophysics1\_Pay

Scatter and log plots of rock properties, fluid properties and reservoir properties. Byproducts of the “Well-log inversion” can be displayed for some of the rock physics models

Rock properties and derivates

Absolute Relative Reflectivities

Vp	Vp	Vp
Vs	Vs	Vs
Density	Density	Density
BritIndx	E	E
E	E*Rho	E*Rho
E*Rho	K*Rho	K*Rho
K*Rho	Ksat	Ksat
Ksat	Lambda	Lambda
Lambda	Lambda*Rho	Lambda*Rho
Lambda*Rho	MuDry	MuDry
MuDry	Mu*Rho	Mu*Rho
Mu*Rho	Ip	Ip
Ip	PModulus	P-Modulus
PModulus	Poisson	Poisson
Poisson	Is	Is
Is	vp/vs	vp/vs
vp/vs		
ELASTIC	ELASTIC	SHUEY
EI near	EI near	Ro
EI far	EI far	Go
GI	GI	C
		STACKS
		Stack
		Near Stack
		Far Stack

Some of the fluid properties available

SW
HC
Brine
FLUIDS MIX
k fluids mix
Density fluids mix
Vp fluids mix
ENVIRONMENTAL PROPERTIES
Pressure
Temperature
IN SITU FLUID PROPERTIES
k in situ Live Oil
Density in situ Live Oil
Vp in situ Live Oil
SG in situ Live Oil
API in situ Live Oil
GORin situ Live Oil

Byproducts of WLI for some of the models

KBiot
KdryExp
Kdry (Gassmann)
Kdry Fixed (Gassmann)
Kdry (Model)
Kdry/Ko (Gassmann)
Kdry/Ko (Model)
Ko
MuBiot
MuDryExp
MuDry (Gassmann)
MuDry (Model)
MuDry/Muo (Gassmann)
MuDry/Muo (Model)
Muo

# SeisTool: Seismic – Rock Physics Tool

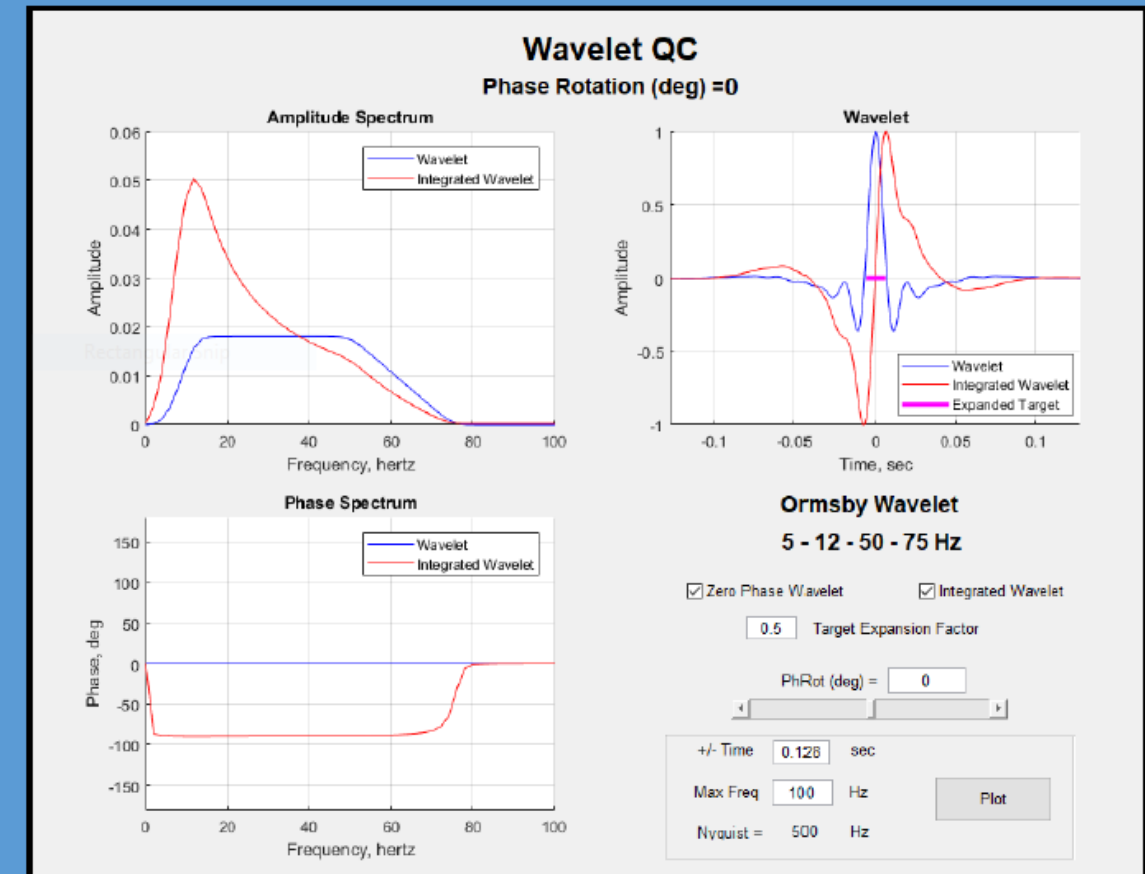


- **SeisRP**

- Computes reflectivities, relative properties and absolute properties
- **Generates attributes from wireline or modeled data at well-log or seismic resolutions in depth or two-way-time**
- Fluid substitution. Different fluids and saturations

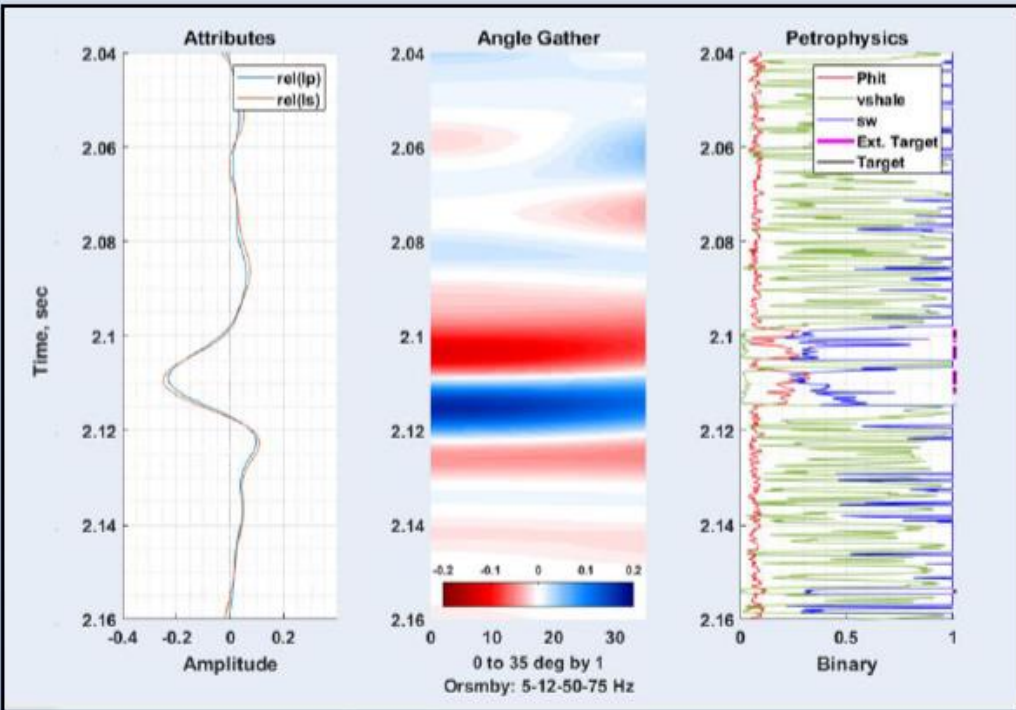
- SeisMod

- SeisChar



Analysis at seismic resolution  
Wavelet QC

# SeisRP: Analysis at well-log and seismic resolution

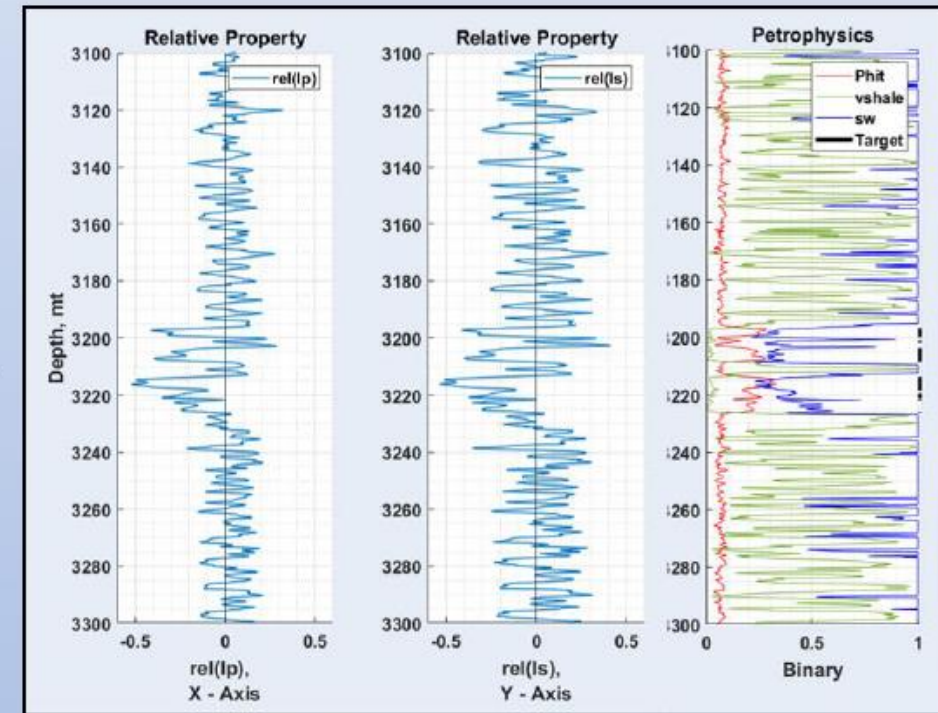


## Relative P-impedance and Relative S-impedance

In depth at well-log resolution

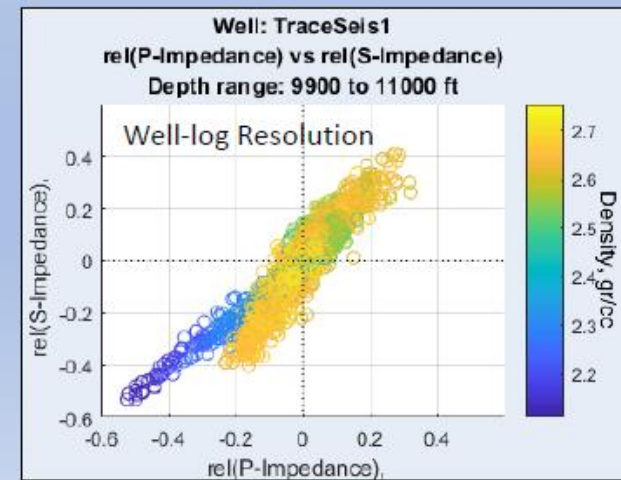
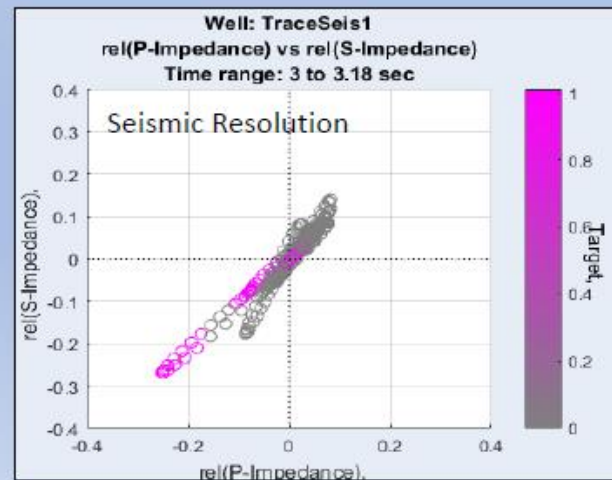


In time at seismic resolution ( $\Delta t = 1\text{msec}$ )

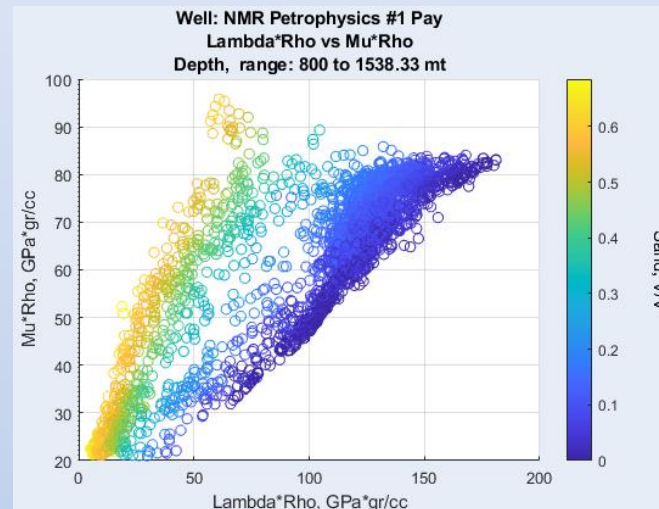
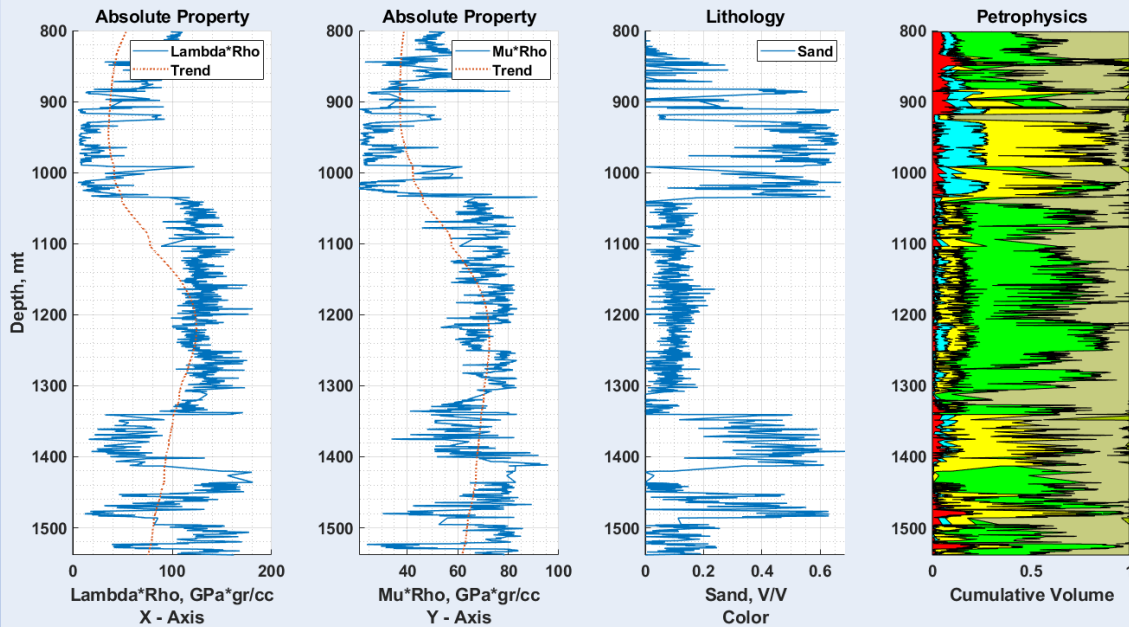


Reflectivity in the angle gather shows a trough and a peak in top and base reservoir respectively.

Relative Ip and relative Is are interval properties



Well: NMR Petrophysics #1 Pay  
Analysis at Well-log Resolution

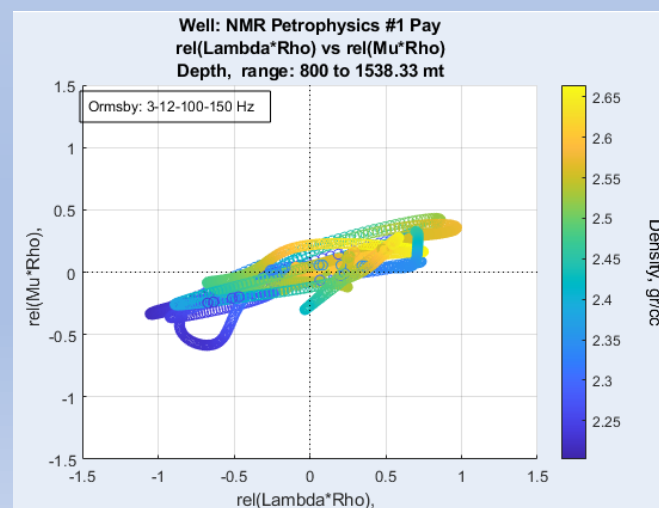
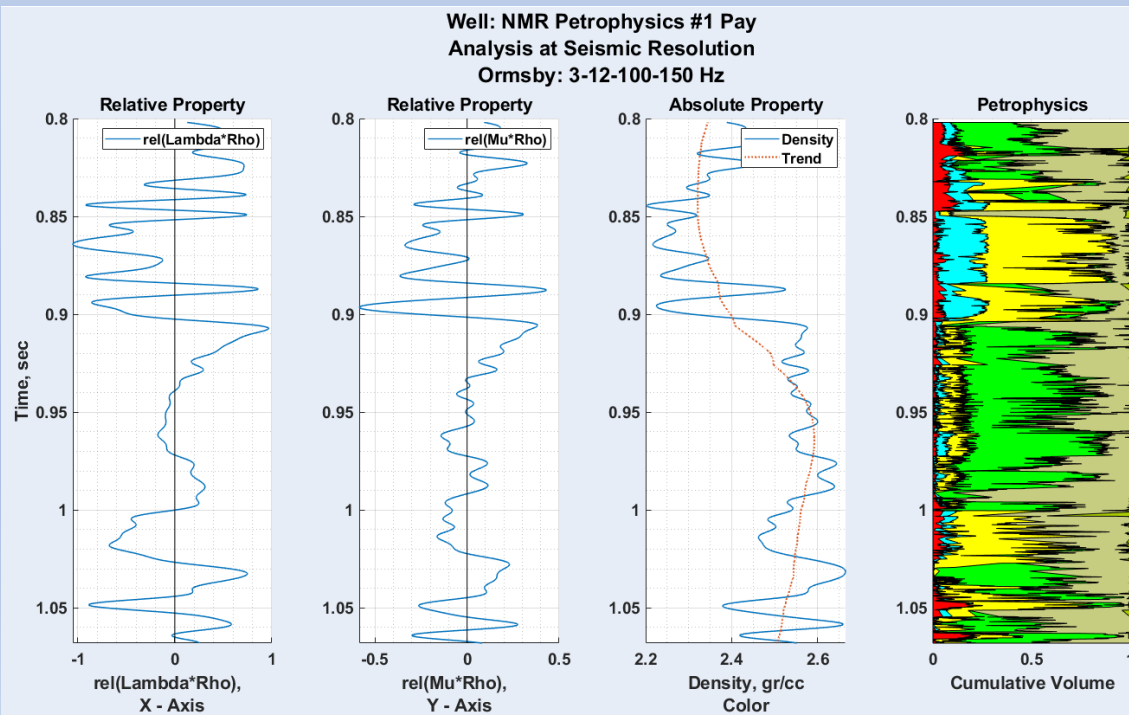


Upper two images show log and scatter plots of  $\lambda\rho$ ,  $\mu\rho$  and Sand V/V.

Depth domain and well-log resolution.

# SeisRP: Analysis at well-log and seismic resolution

- HC
- Brine
- Sand
- Lime
- Anhydrite
- Calcite
- Dolomite



Lower two images show log and scatter plots of  $rel(\lambda\rho)$ ,  $rel(\mu\rho)$  and density.

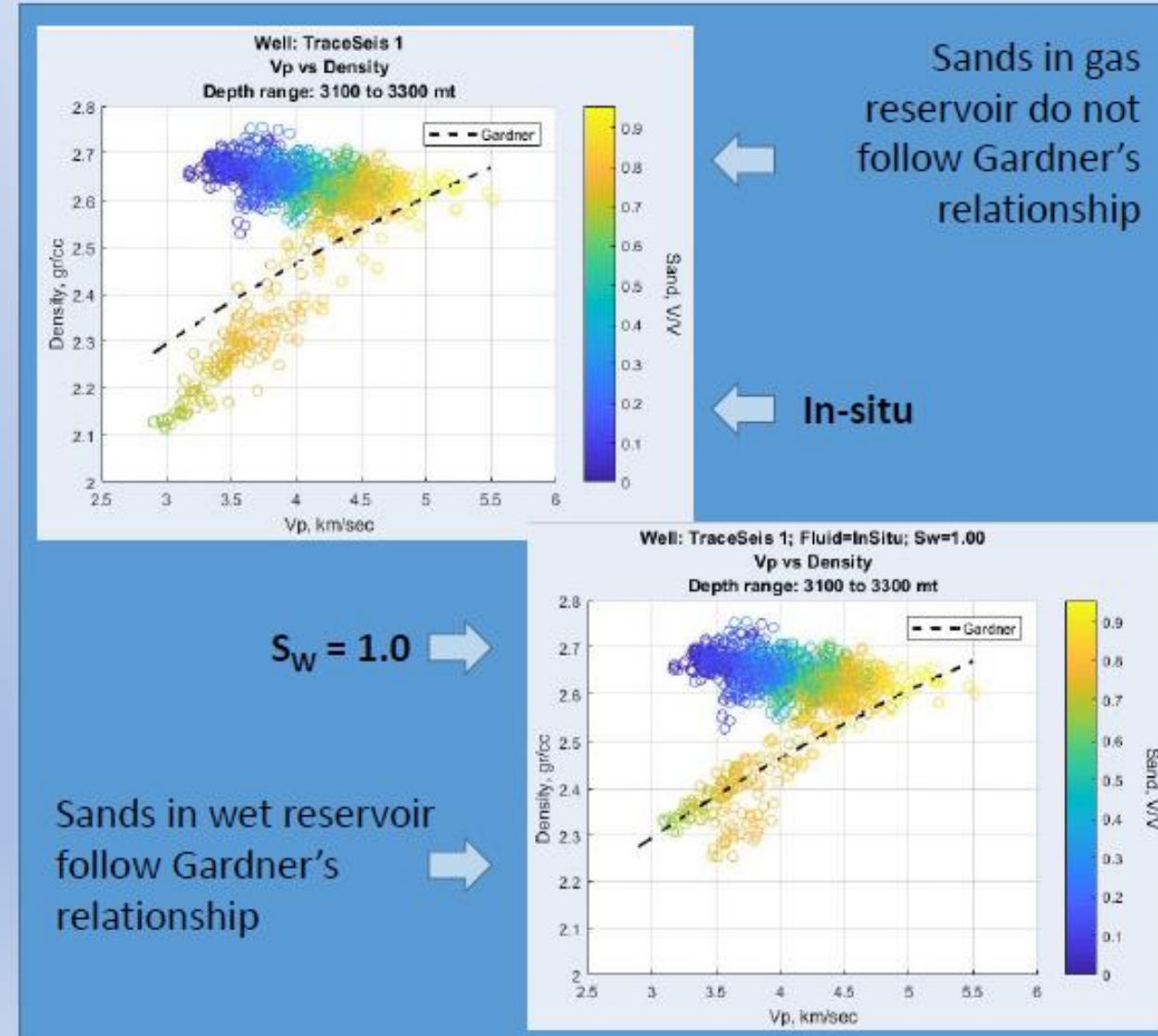
Time domain and seismic resolution.

# SeisTool: Seismic – Rock Physics Tool

- **SeisRP**


- Computes reflectivities, relative properties and absolute properties
- Generates attributes from wireline or modeled data at well-log or seismic resolutions in depth or two-way-time
- **Fluid substitution. Different fluids and saturations**

- SeisMod
- SeisChar





# SeisRP: Fluid Properties


TraceSeis, Inc.

**Fluids Analysis**

Well: **NMR Petrophysics #1 Pay**

---

**Hydrocarbons**

**In-Situ**

Hydrocarbons

Gas

Dead Oil

Live Oil

Live Oil Properties

API:

GOR:

Gas SG:

**Replacement**

Hydrocarbons

Gas

Dead Oil

Live Oil

Live Oil Properties

API:

GOR:

Gas SG:

**Non-hydrocarbon**

Brine

Water

---

**Environment (P and T) and Brine Salinity**

**Depth-variant**

	At Surface		Gradient	
Pressure	<input type="text" value="0.101325"/>	MPa	<input type="text" value="0.0098"/>	MPa/mt
Temperature	<input type="text" value="14"/>	oC	<input type="text" value="0.027"/>	oC/mt
Brine Salinity	<input type="text" value="0"/>	ppm	<input type="text" value="40"/>	ppm/mt

**Constant**

Pressure:  MPa

Temperature:  oC

Brine:  ppm

**Execute/Save**

Color-Fill Petrophysics

---

**Fluids' Mixing Law :**

Wood  Brie

**Physical Properties of Fluids**

**InSitu Hydrocarbon**

rho:  gr/cc

k:  GPa

Vp:  km/se

**Replacement Hydrocarbon**

rho:  gr/cc

k:  GPa

Vp:  km/se

**Brine / Water**

rho:  gr/cc

k:  GPa

Vp:  km/se

**Plot**

Fluid Properties

Depth Variant Environment

QC Graphs

Rock Properties

---

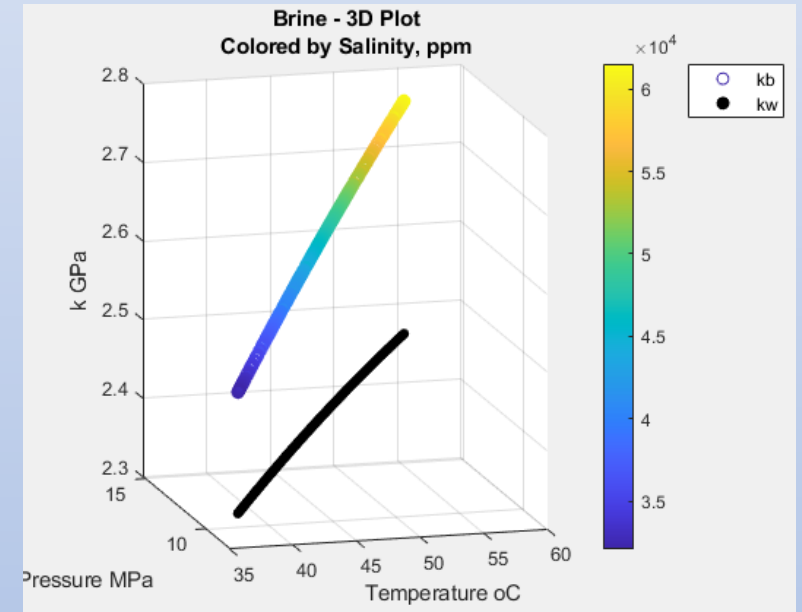
**General**

Display Units

Metric

English

Select Well:

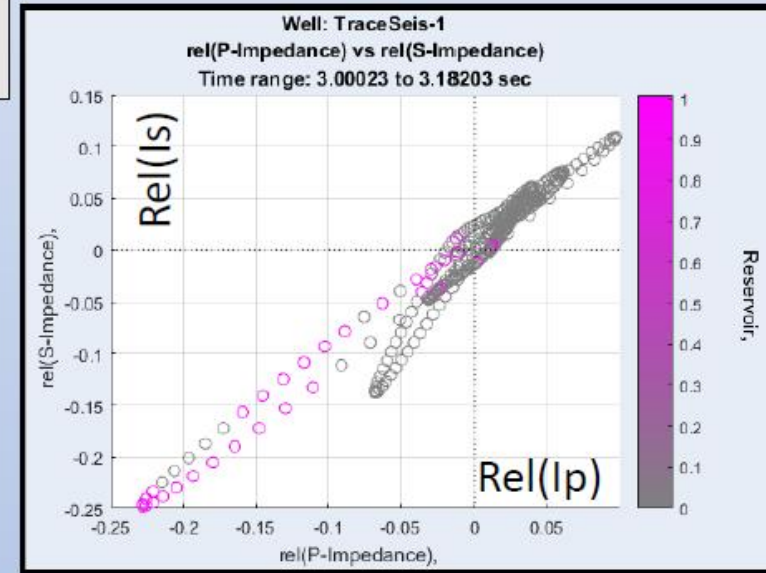
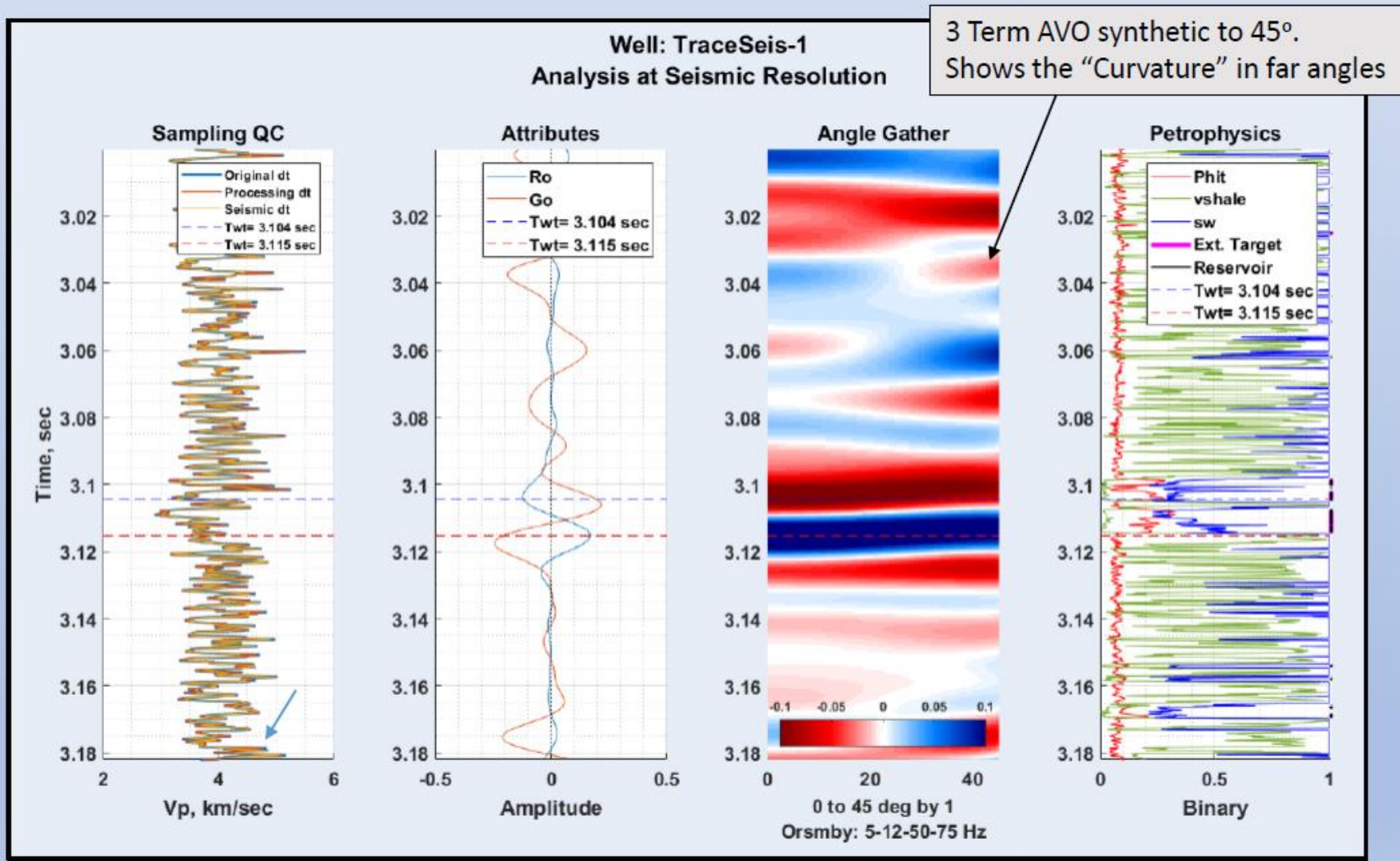


Reservoir fluids' composition (GOR, API, SG, salinity) and environmental variables (pressure and temperature) are used to compute bulk moduli and density of fluids.

Properties for three fluids are computed: in-situ hydrocarbons, replacement hydrocarbons, and brine.

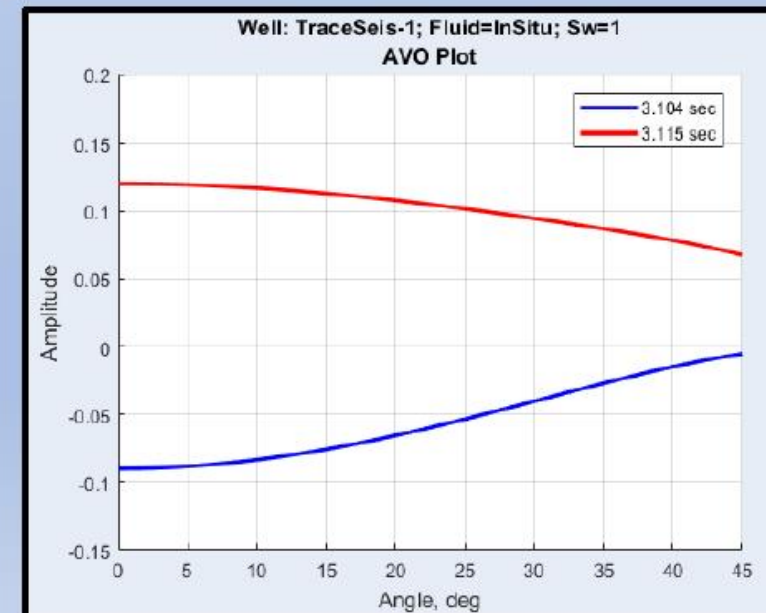
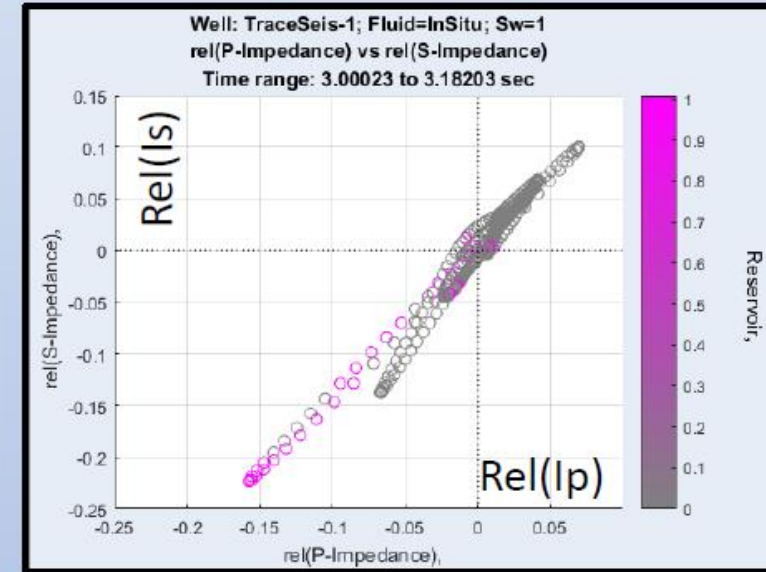
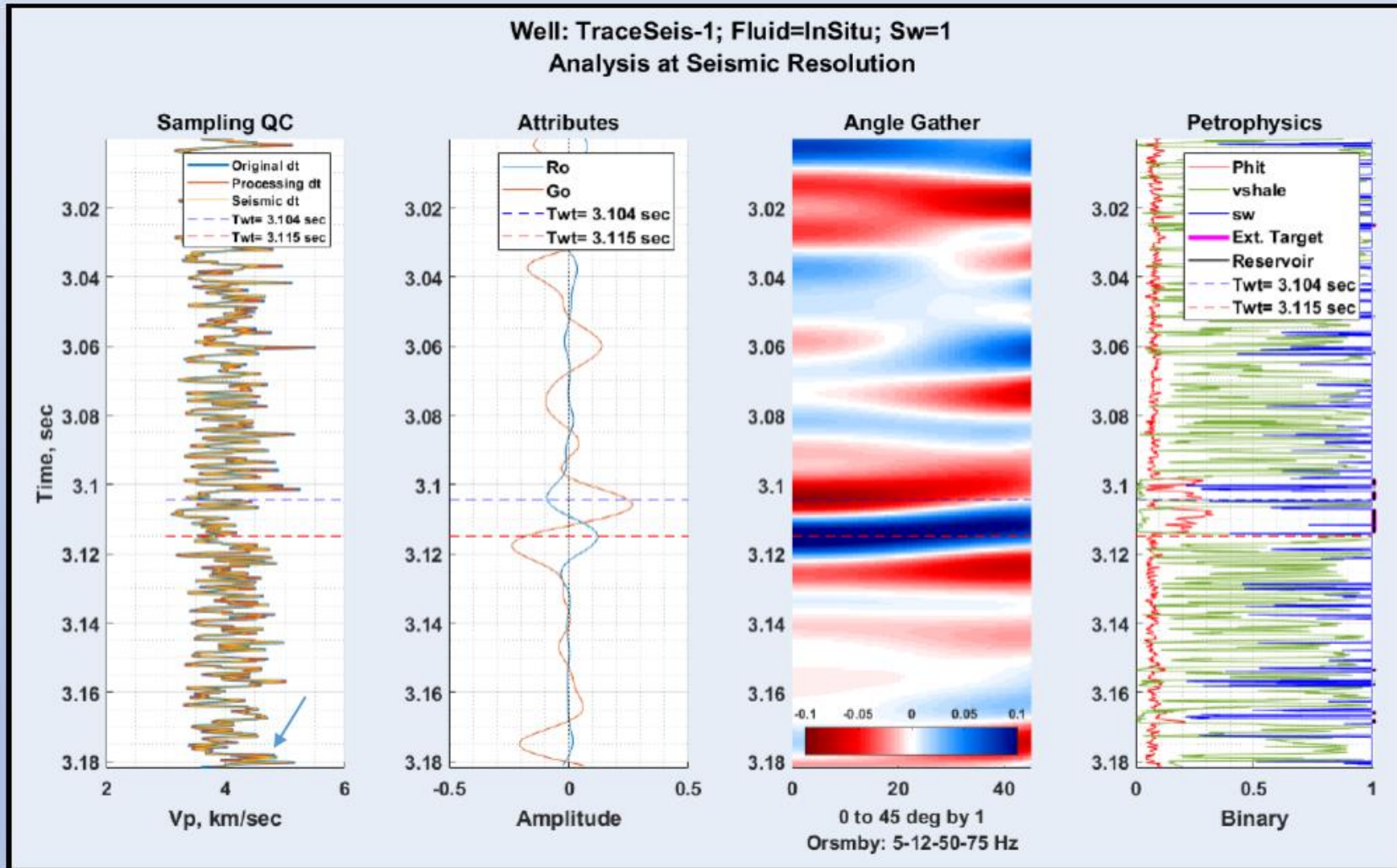
Depth variant or constant fluid properties can be computed

# SeisRP – Fluid substitution. In-situ



In-situ fluids. The AVO extracted at the red and blue horizontal lines in tracks 1 and 2 correspond to a class 4 anomaly, as observed in the plot at right

# SeisRP – Fluid substitution. $Sw = 1.0$



Water saturation = 1.0. Compare with the previous slide. The light-blue arrow in the lower part of track 1 shows the slight time difference between the in-situ (previous slide) and wet reservoir (this slide) associated to fluids with different velocities