Applied Technology and Best Practices in CEE
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Quantitative Seismic Interpretation in Reservoir Management in Pannonian basin

SPE International
Hungarian Section

Peter Zahuczki
MOL E&P
Integrated Field Applications,
Geomodel Development

Role of Seismic Data in Reservoir Management

- Goal of reservoir management:

  maximizing the economic value of a reservoir by optimizing recovery of hydrocarbons while minimizing capital investments and operating expenses

- Geological model is required to support optimal decision making in the subsurface

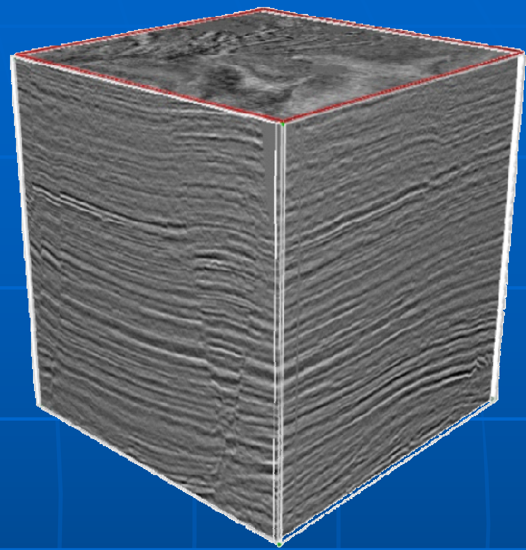
- Reservoir models need to integrate all of the available informations, and describe the associated uncertainties of the reservoir parameters

Information sources in reservoir modeling

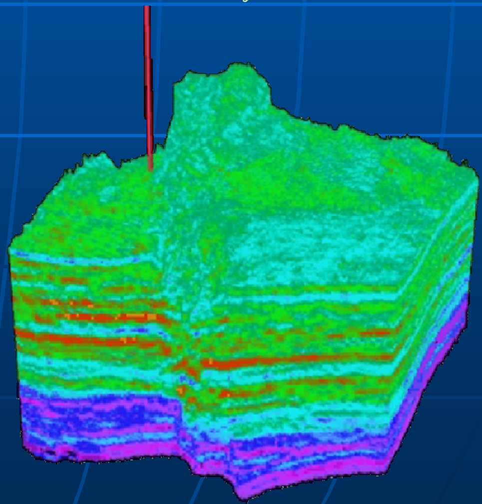
Data Type	Spatial Distribution	Scale
CORE	Point	~1 dm^3
LOG	1D	~1 m^3
3D Seismic	3D	~1000 m^3

Role of Seismic Data in Reservoir Management

- Seismic technology is the only one which can image the subsurface in 3D



- The high fidelity acquisition and modern processing technology allow of the extraction of reservoir parameters directly from seismic data



Use of seismic data can save costs by minimizing dry holes and poor producers, by contributing to the proper sizing and design of facilities via reservoir simulation

- Provide the most reliable reservoir geometry
- Constrain the reservoir parameter estimation

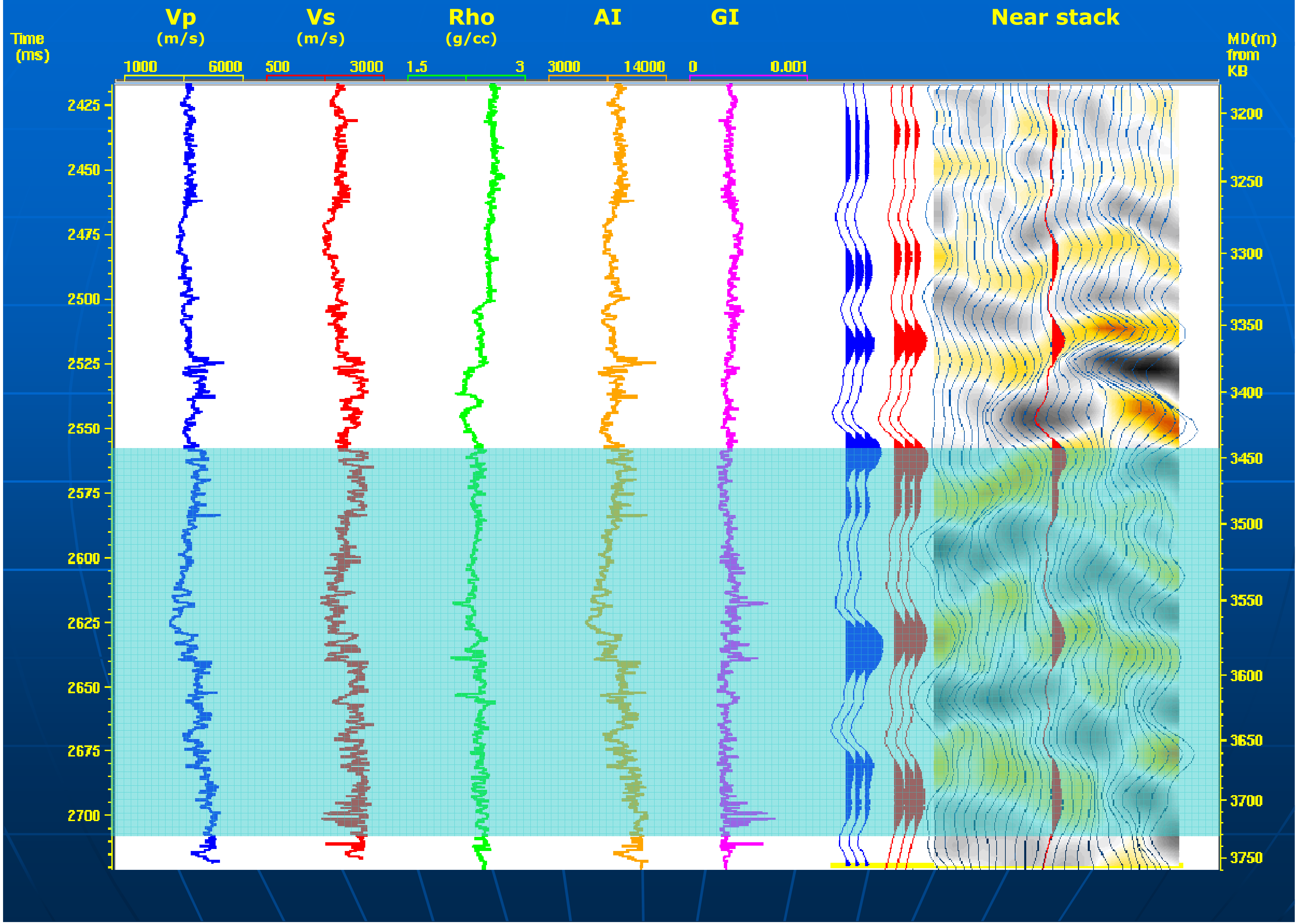
Sweet spot mapping in an unconventional tight sand by extended elastic impedance inversion

CASE HISTOTY

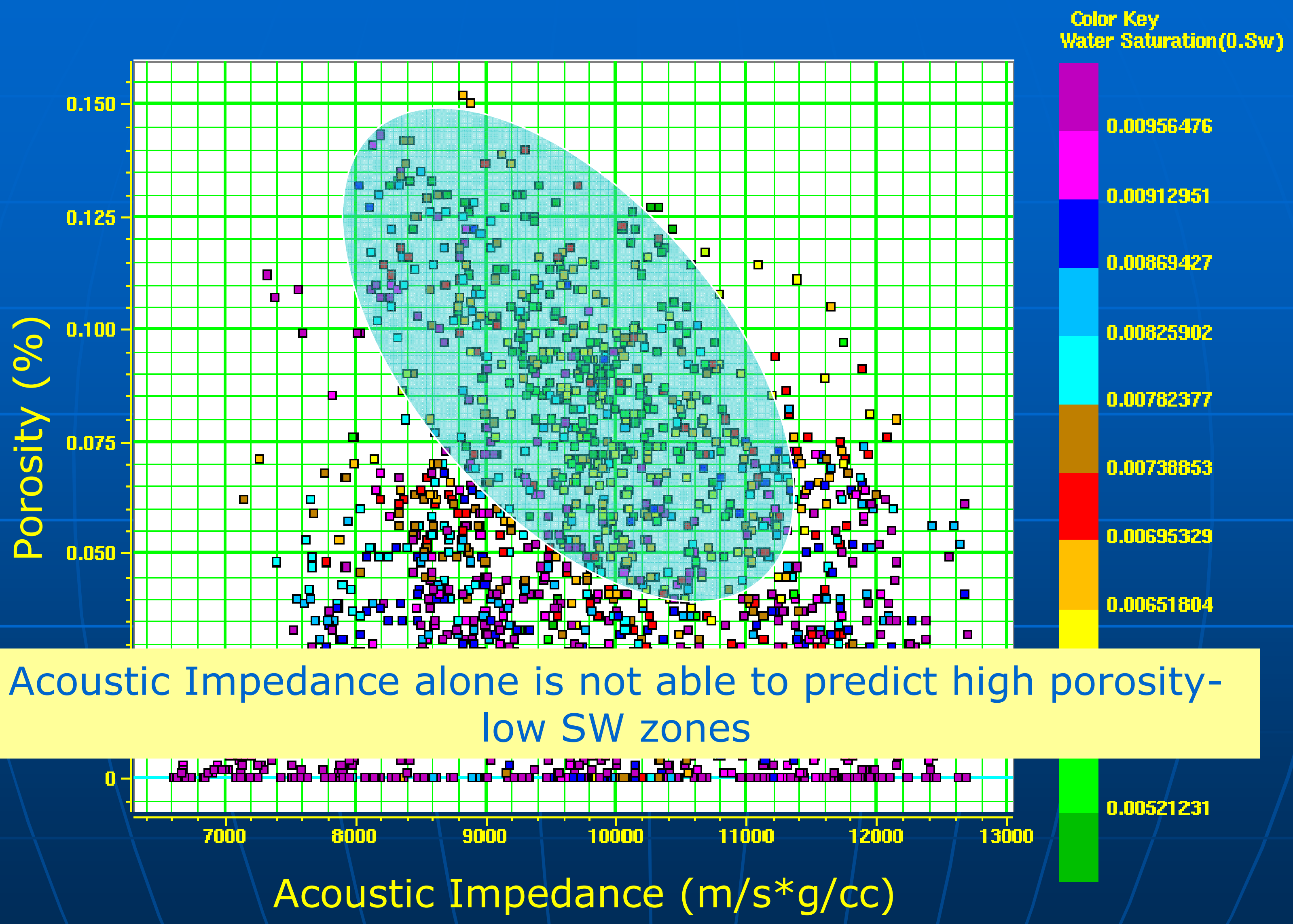
Reservoir Settings

- Miocene tight sandstones
- Deep HPHT environment
- Early development phase
  - 2 existing well
- Aim:
  - Mapping the possible „sweet spots” to identify new well locations for further development

Well Tie


Vp
(m/s)
Vs
(m/s)
Rho
(g/cc)
AI
GI
Near stack
Time
(ms)
MD(m)
from
KB
1000 6000
500 3000
1.5 3
3000 14000
0 0.001
2425
2450
2475
2500
2525
2550
2575
2600
2625
2650
2675
2700
3200
3250
3300
3350
3400
3450
3500
3550
3600
3650
3700
3750

Acoustic Impedance vs. Porosity



Acoustic Impedance alone is not able to predict high porosity-low SW zones

Extended Elastic Impedance

$$EEI = V_p^{(\cos\chi + \sin\chi)} \cdot V_s^{(-8K\sin\chi)} \cdot \rho^{(\cos\chi - 4K\sin\chi)}$$

$$\tan\chi = \sin^2\theta$$

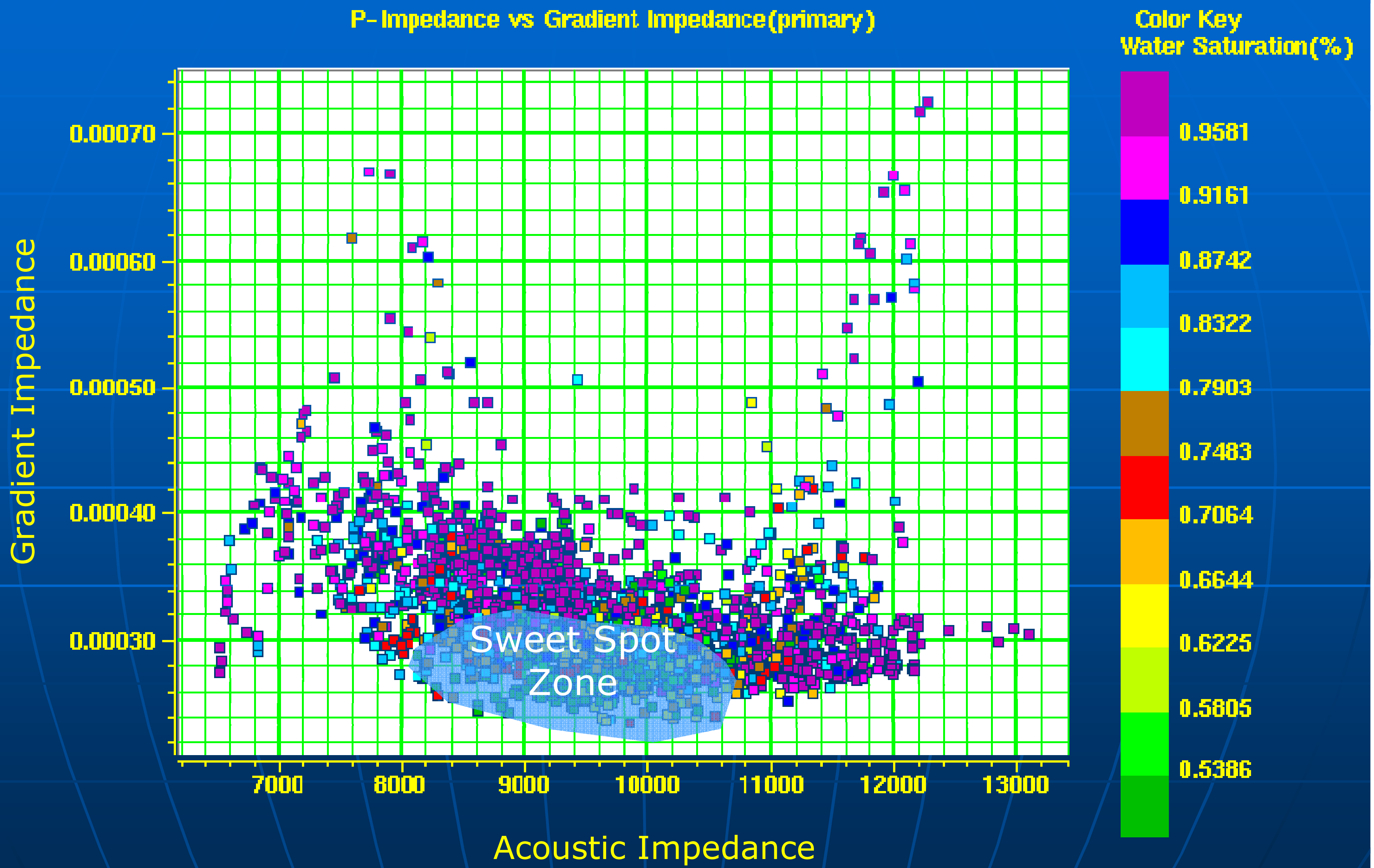
$$EEI(0^0) = V_p \cdot \rho = AI$$

$$EEI(90^0) = V_p \cdot V_s^{-8K} \cdot \rho^{-4K} = GI$$

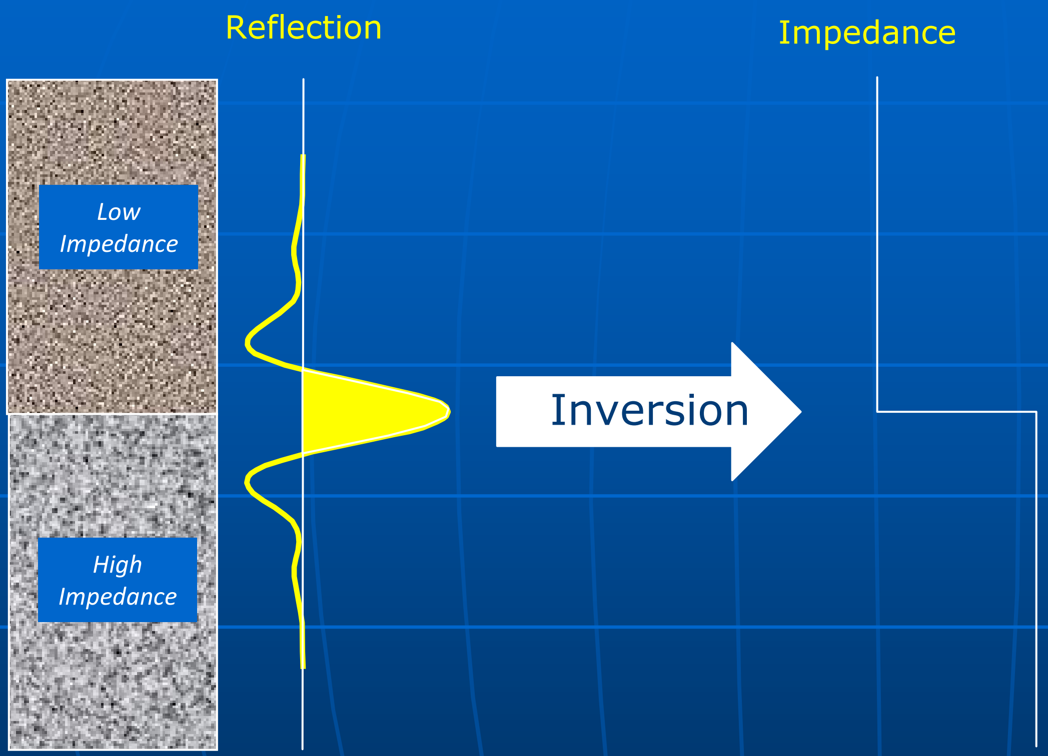
$$K = \left(\frac{V_s}{V_p}\right)^2$$

Whitcombe et al, 2002

Acoustic Impedance EEI(0) vs. Gradient Impedance EEI(90)

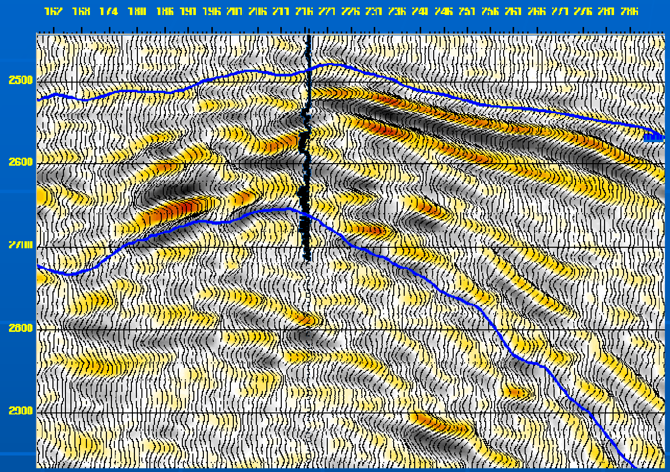


Impedance Inversion



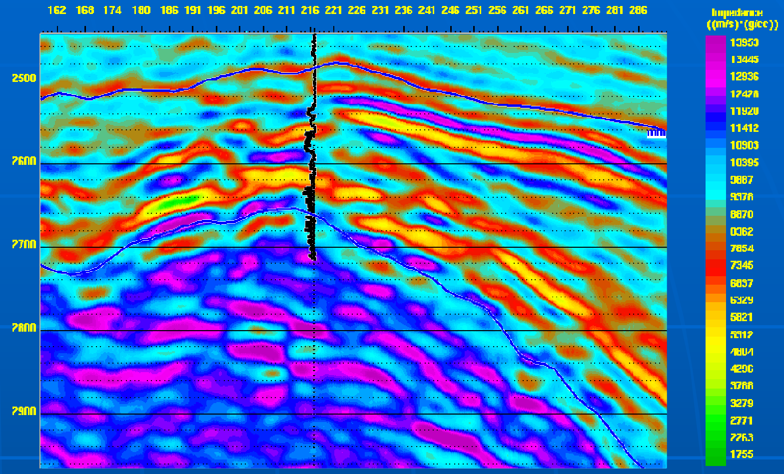
Inversion technology convert the relative amplitudes to absolute impredance values

Intercept

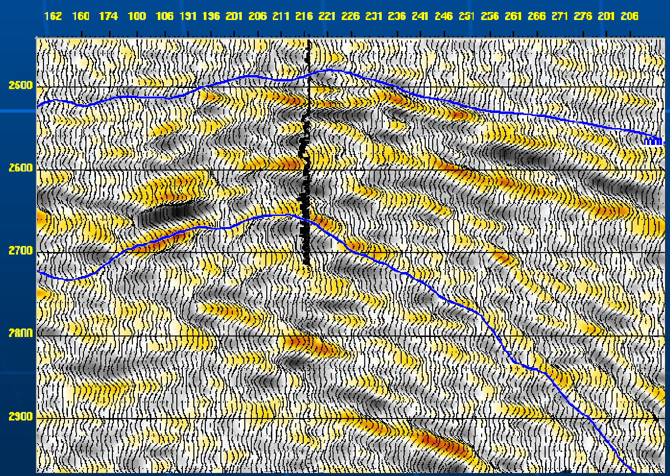


Inversion

Acoustic Impedance EEI(0)

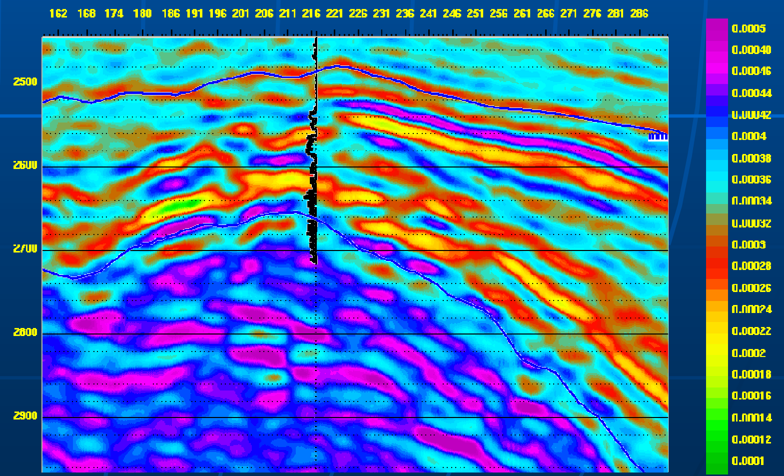


Gradient

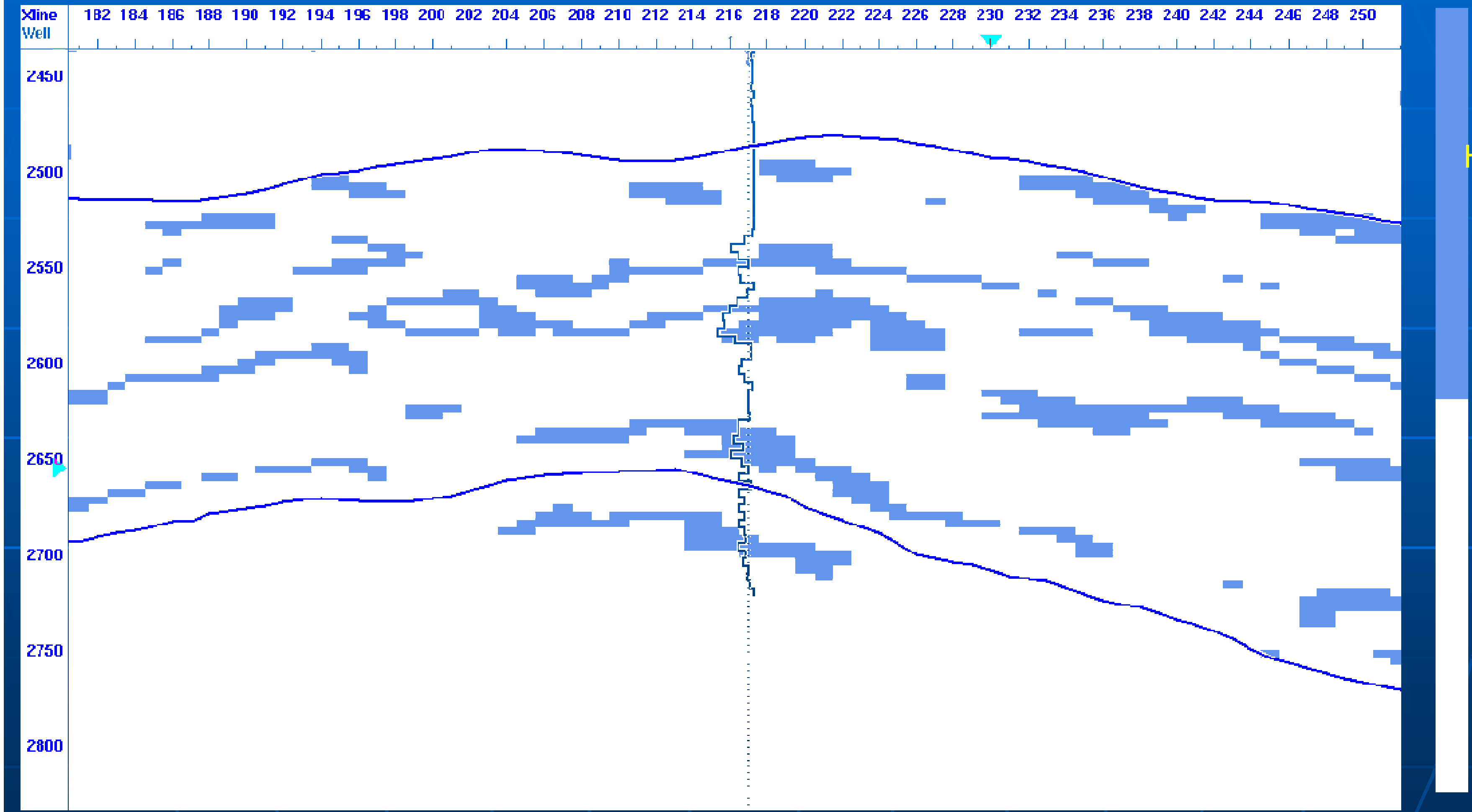


Inversion

Gradient Impedance EEI(90)



Application of „sweet spot” zone from AI-GI cross-plot



High por.
Low SW
Zone

Back-
ground

THANK YOU FOR YOUR ATTENTION