A new paradigm for rapid technology onboarding

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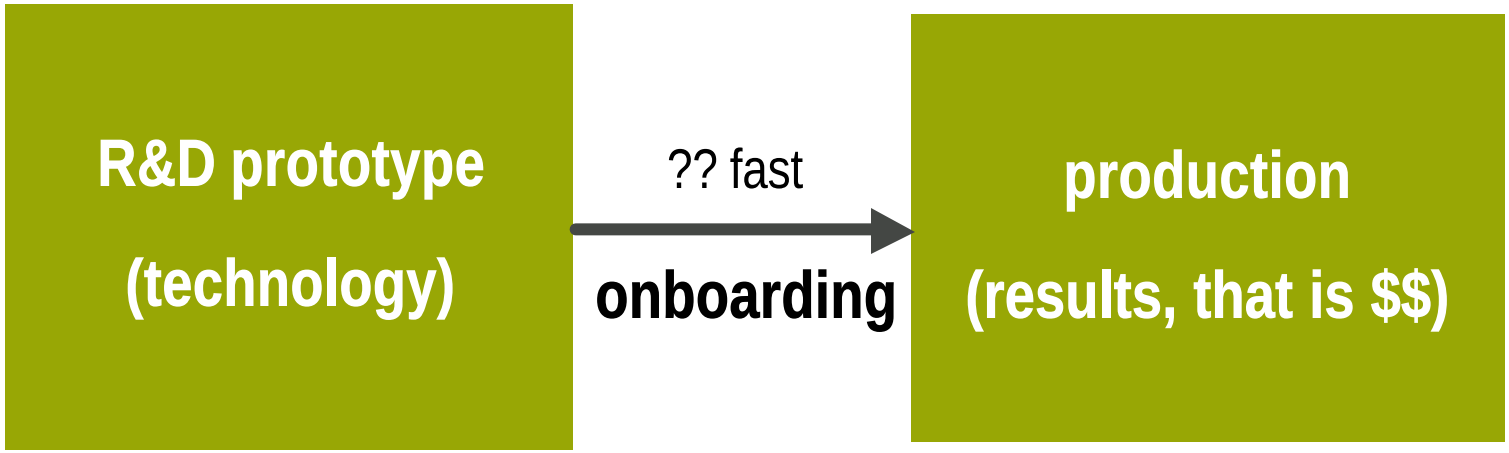
How do you get results from technology?



Outline

- Strategy
- Tactical plan
- Implementation
  - BHPviewer
  - Configurable XMLeditor
  - Wavelet based reservoir ID

Environmental changes

- Java
  - 25% to 30% development time and cost
  - Easy to port to new hardware platforms
  - Extendable (10-20x more than C or Fortran)
  - Performance rivals that of C and Fortran
    - 400 Mflop/s performance per Linux processor (Colt dense matrix benchmark), 60 Mflop/s (Linpack benchmark)
    - CERN Colt library
    - Insignificant object oriented overhead, performance determined by FFT speed (same as optimized C and Fortran program)
- OpenSource maintenance
- Linux clusters with LSF
  - Low cost
  - Robust distribution

Strategy

- Exploit superior knowhow
  - Increase the value of our assets
- Rapid technology development and onboarding
  - Maximize the rate of technology change

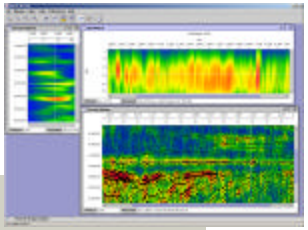
Tactical plan

- 100% Java based development
- OpenSource maintenance whenever possible
- Seismic Unix backplane
- BHPviewer
  - servlet-applet, multi-tier structure
  - Java, XML saveset of view
  - Multidimensional 2D viewer, 3D in future
- Linux cluster with LSF
- General XML editor for parameters and distribution
  - Behavior determined by xsd
  - Servlet-applet infrastructure

Software architecture supporting fast implementation

external consortia and vendors $$$

internal development



Delphi

Colorado School of Mines

advanced migration, model building with uncertainty

Monte Carlo driven map migration

seismic unix

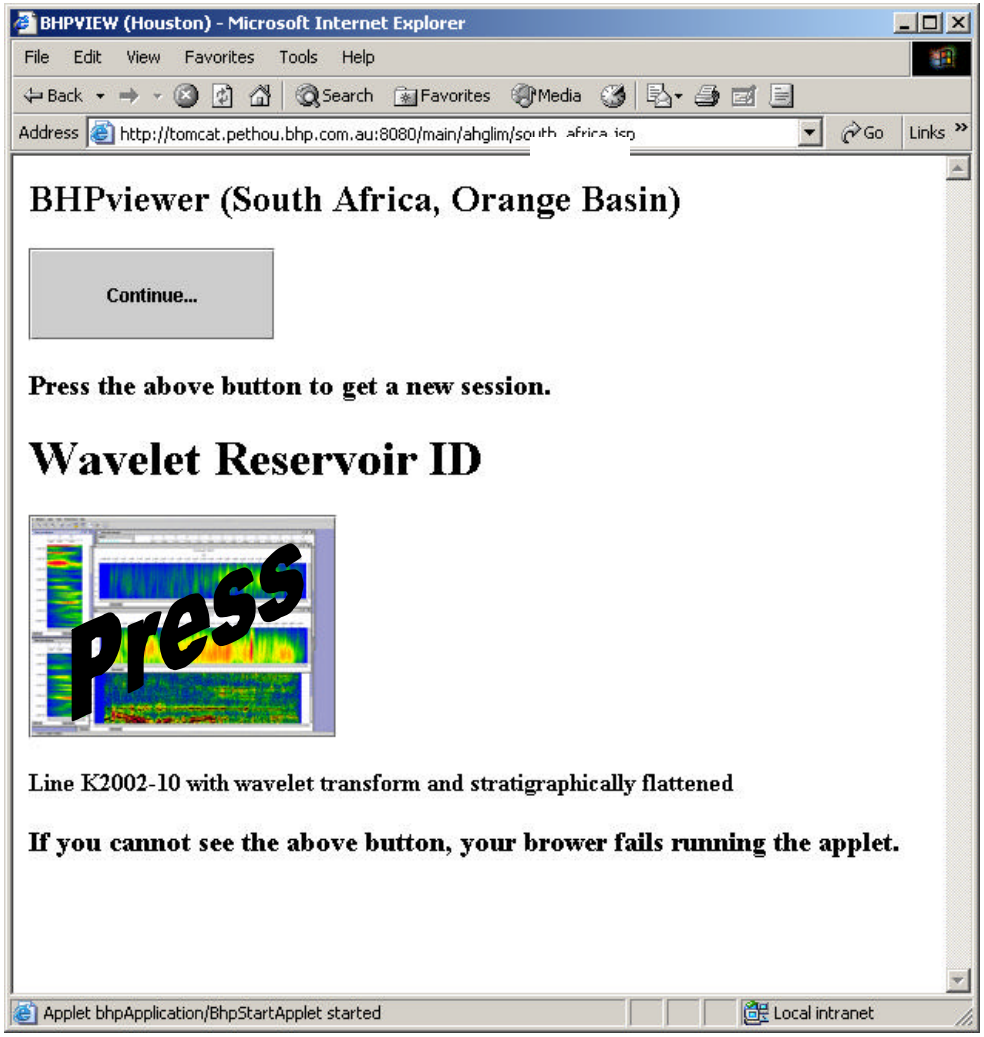
(seismic horizon, model, random access)

Java viewer

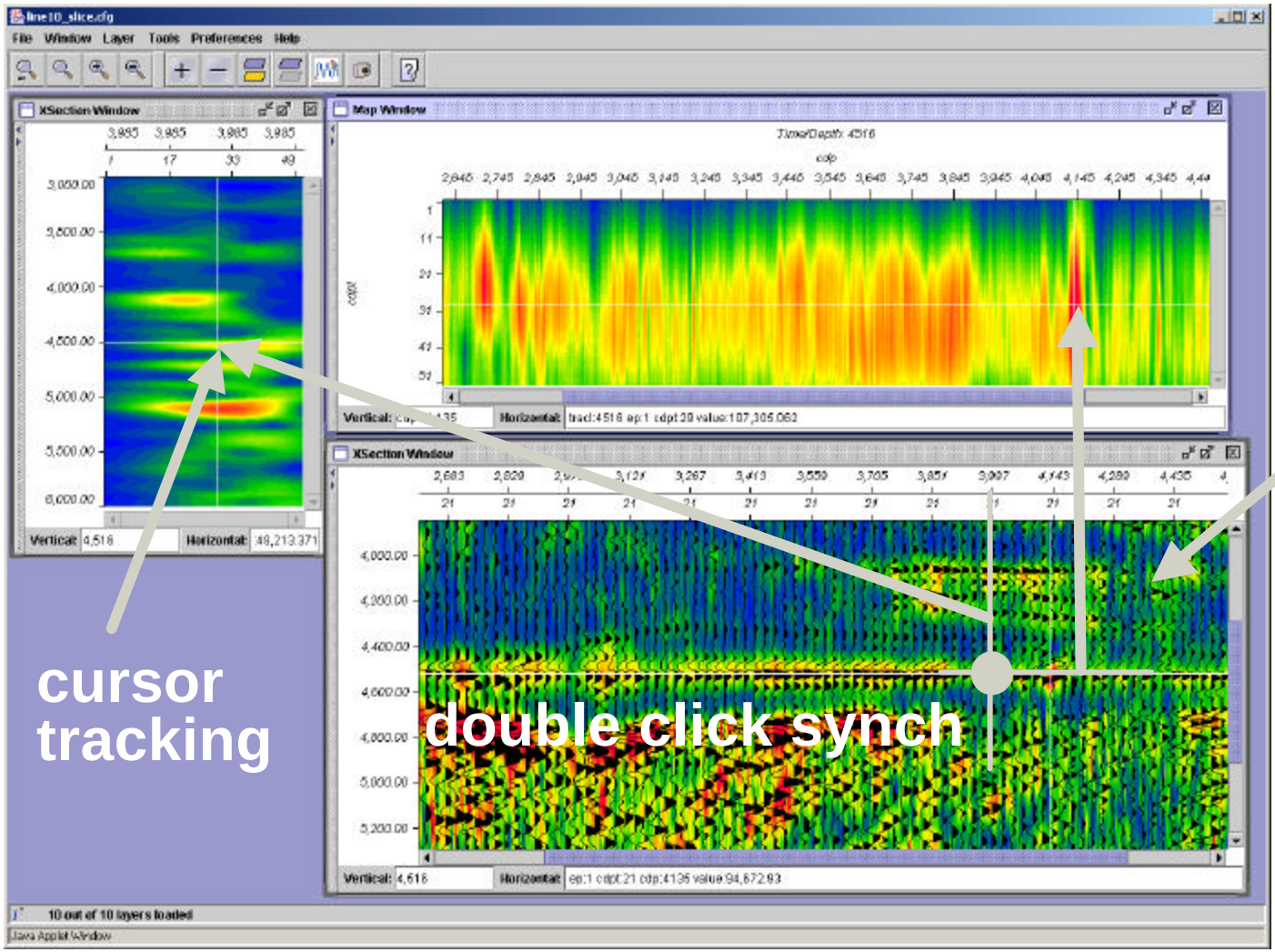
stochastic model based seismic inversion

wavelet based reservoir ID

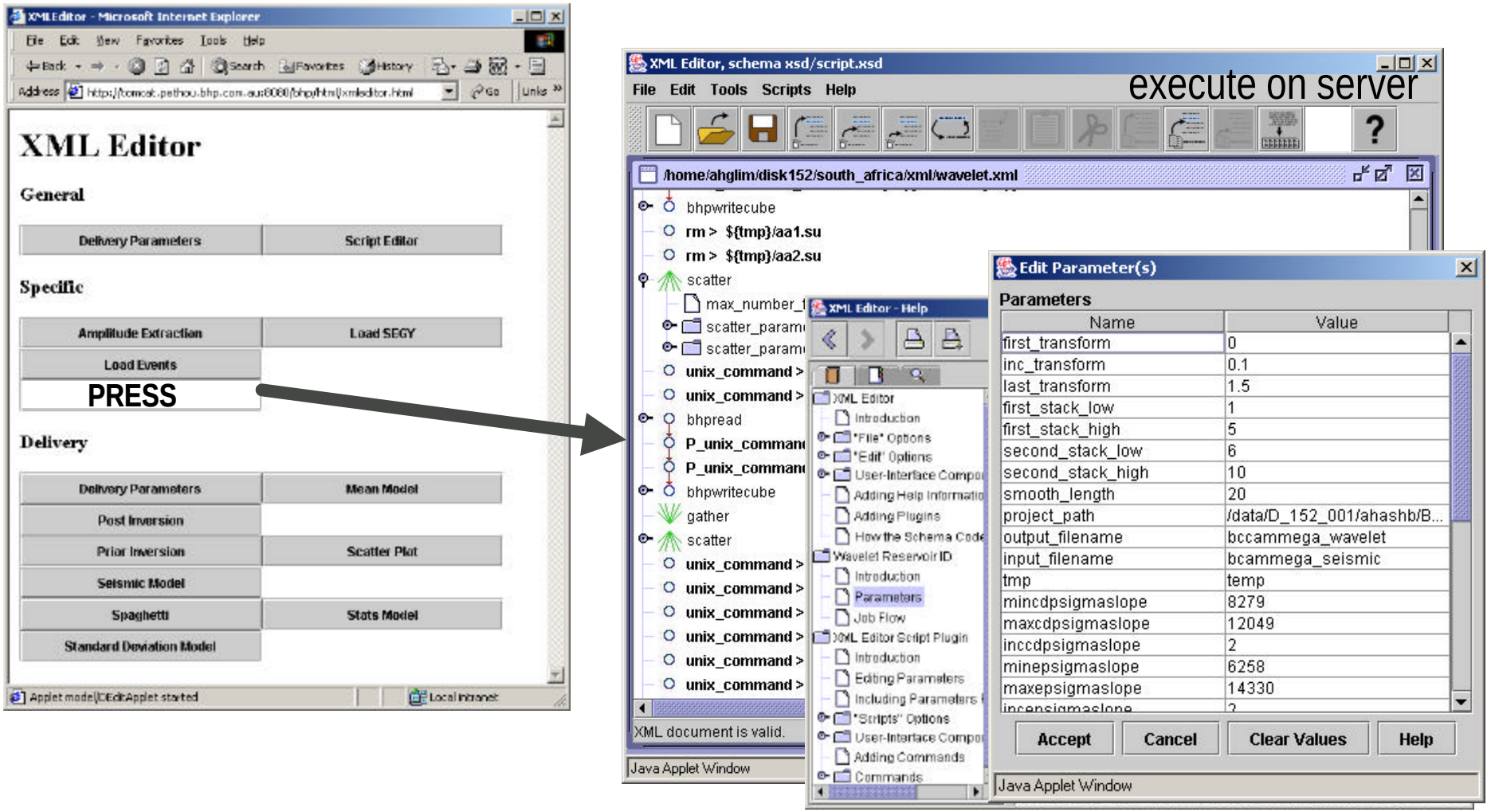
Web page access to results – a picture that can be browsed



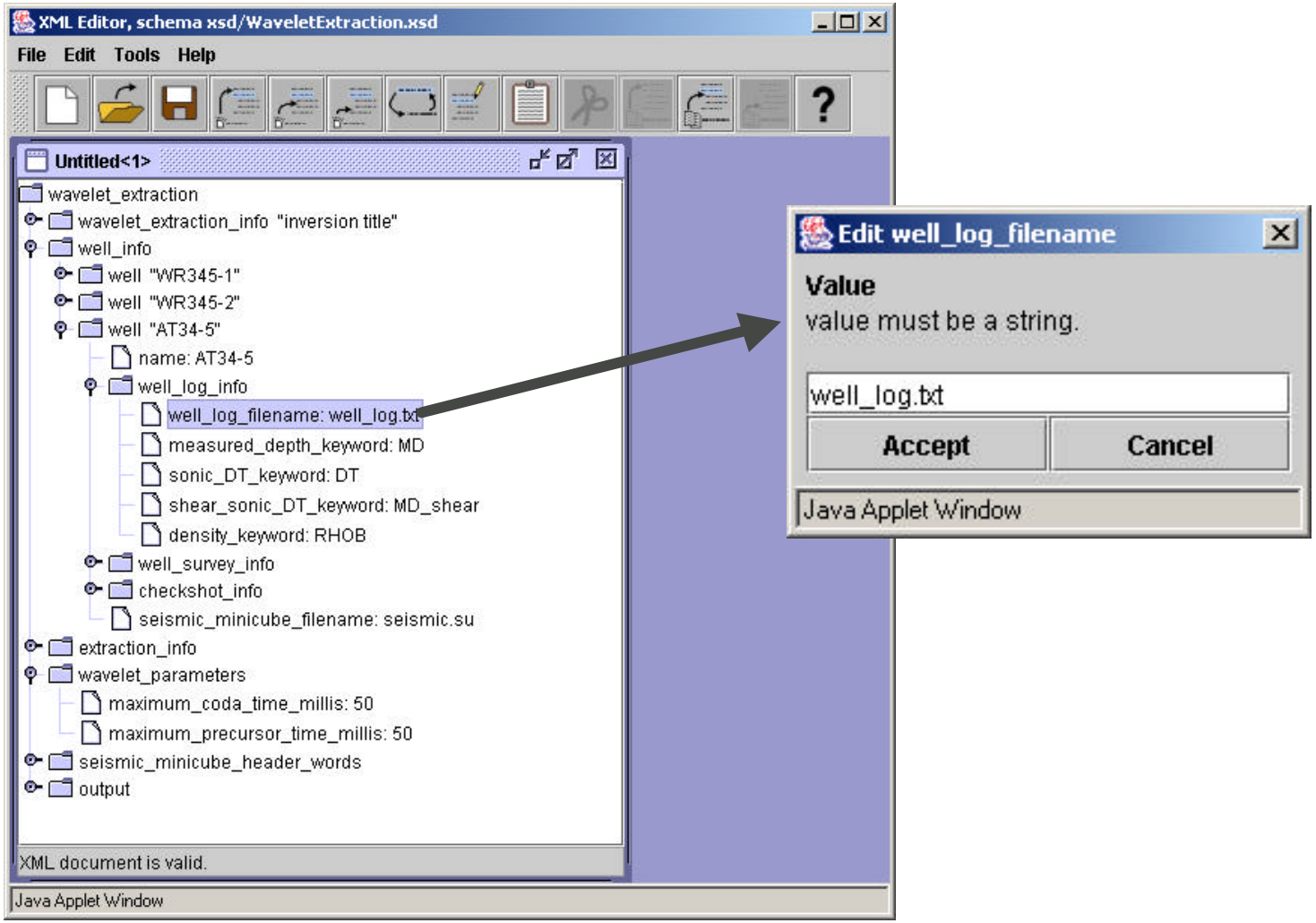
Synchronized viewer



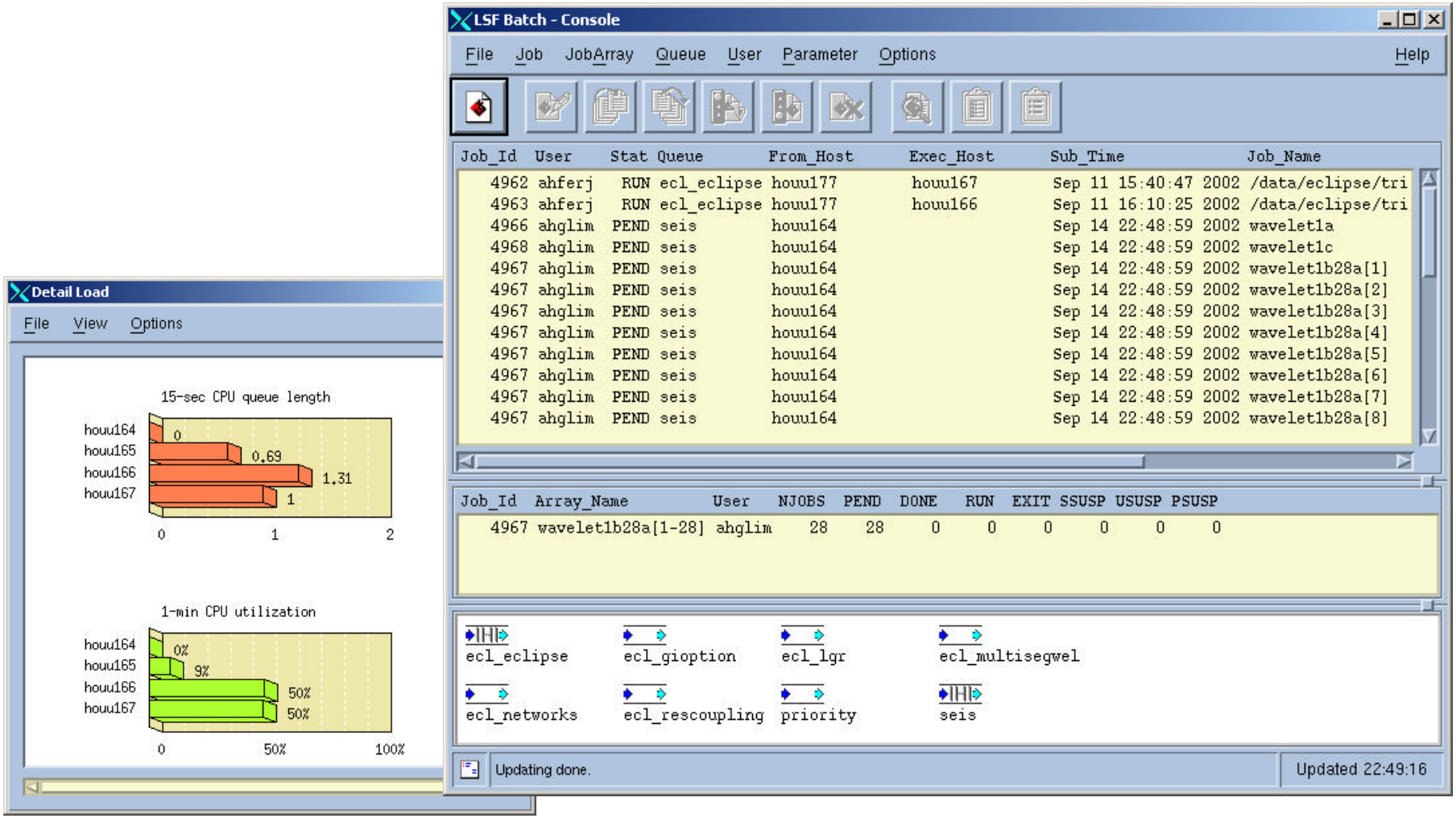
XML distribution via the web interface with application specific Java help



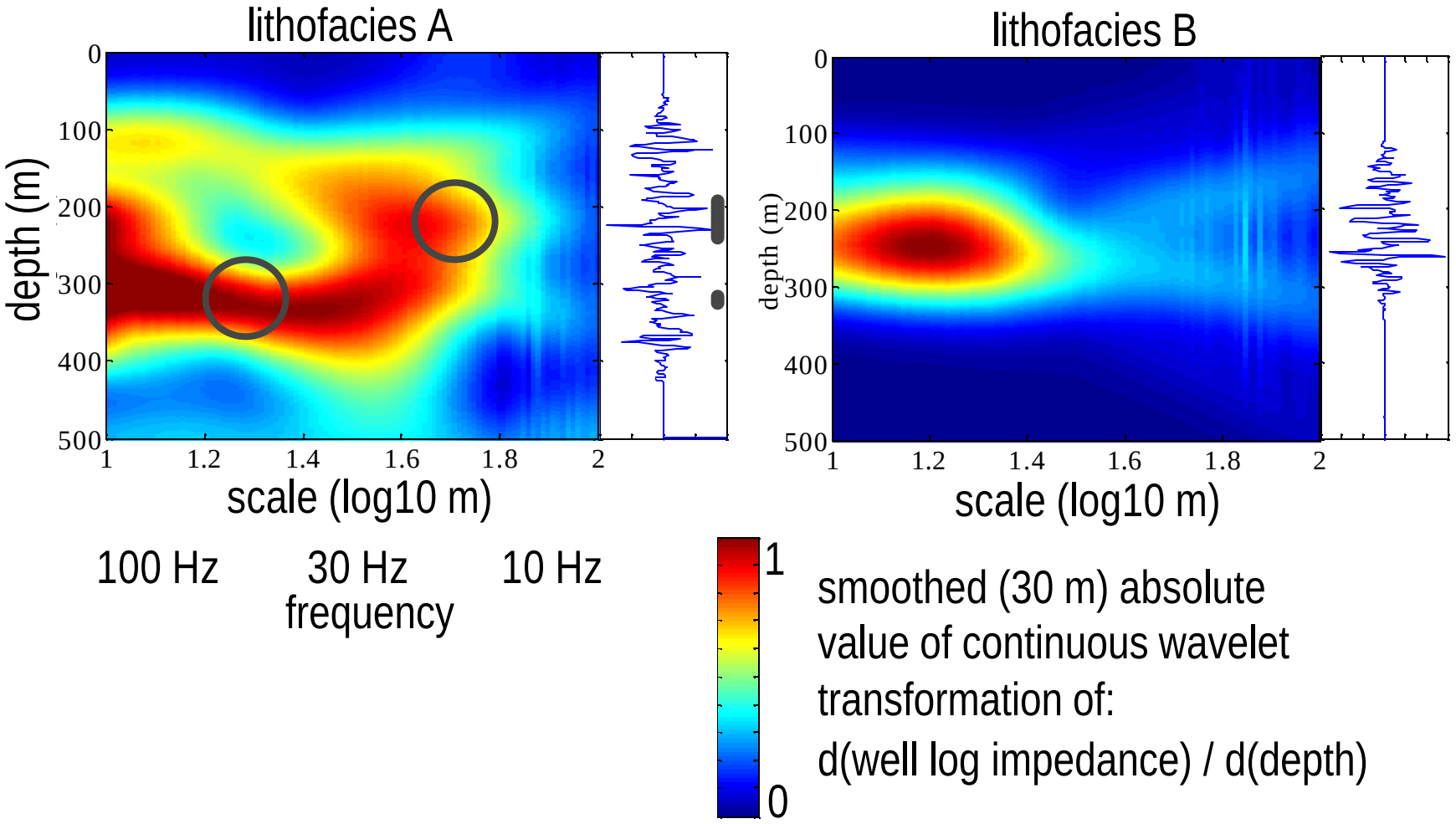
XML explorer of parameter file



Distributed on Linux cluster using LSF



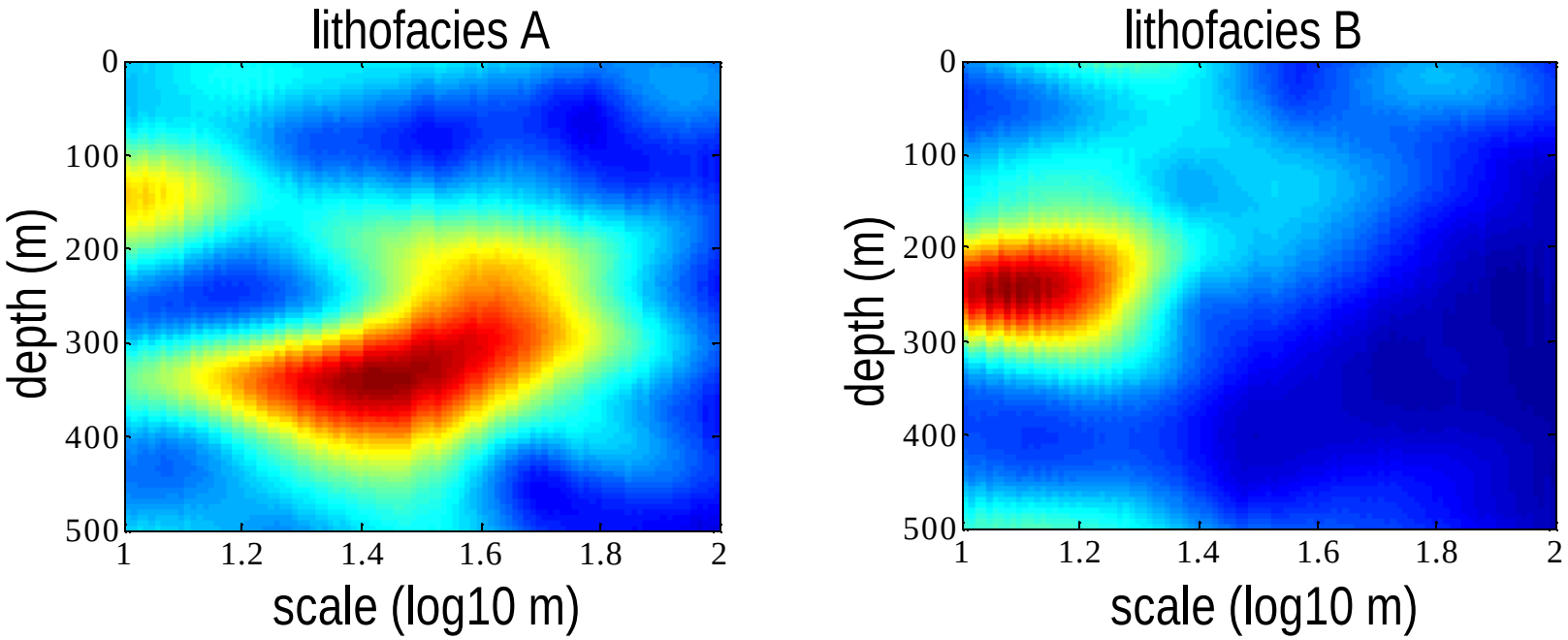
There is multiscale structure in seismic reflectors, can we detect it?



smoothed (30 m) absolute value of continuous wavelet transformation of:

d(well log impedance) / d(depth)

Linear inversion of real seismic data also recovers well log spectrum



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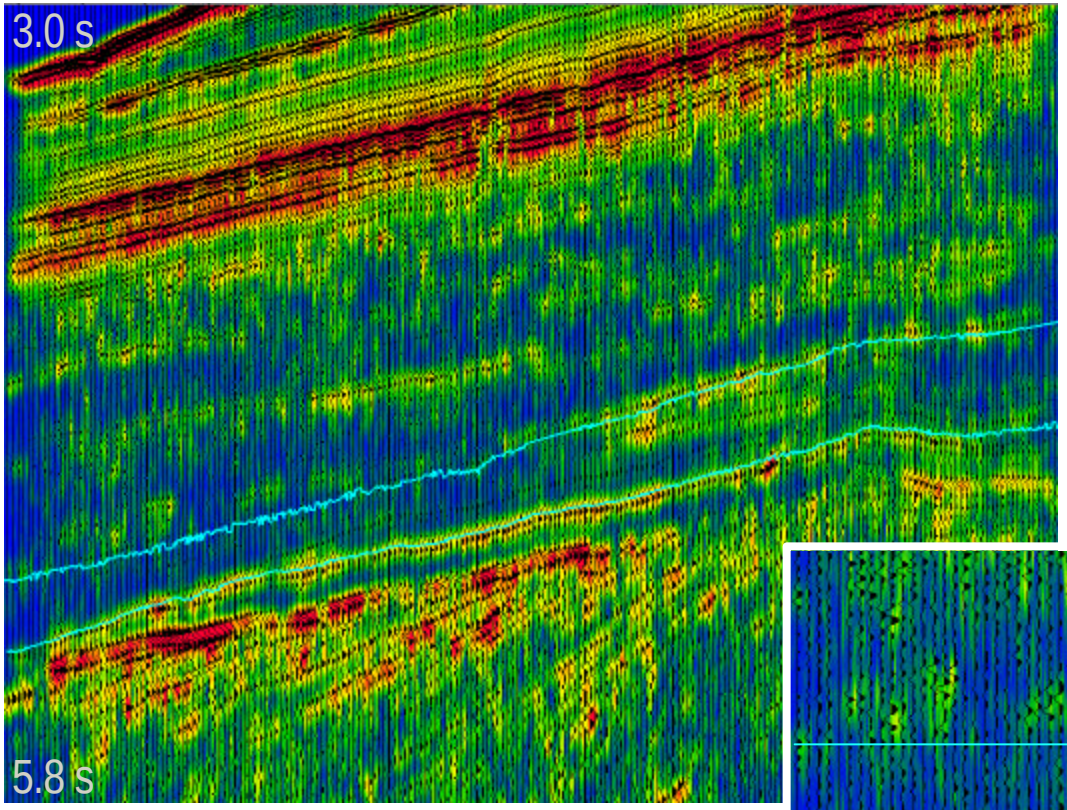
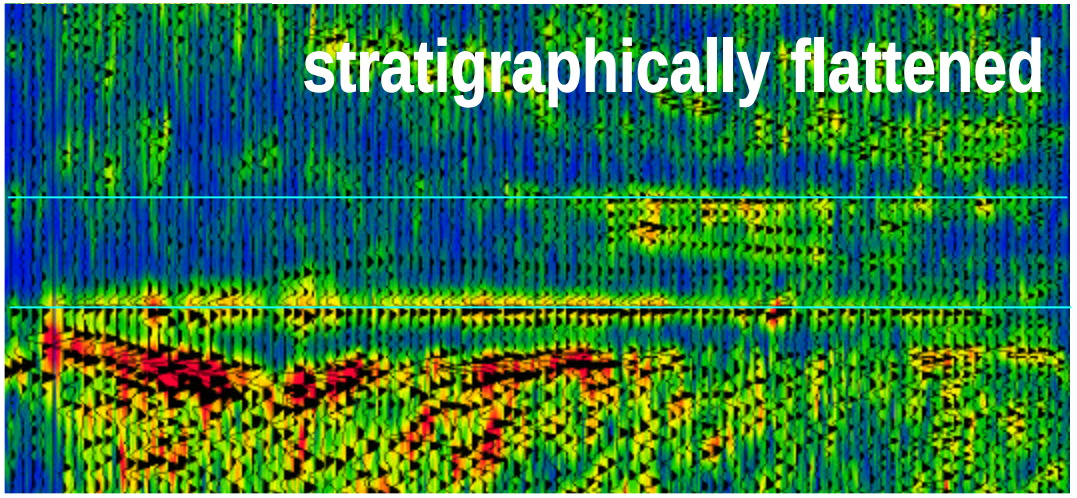
Stratigraphic slice with wavelet transform and movie

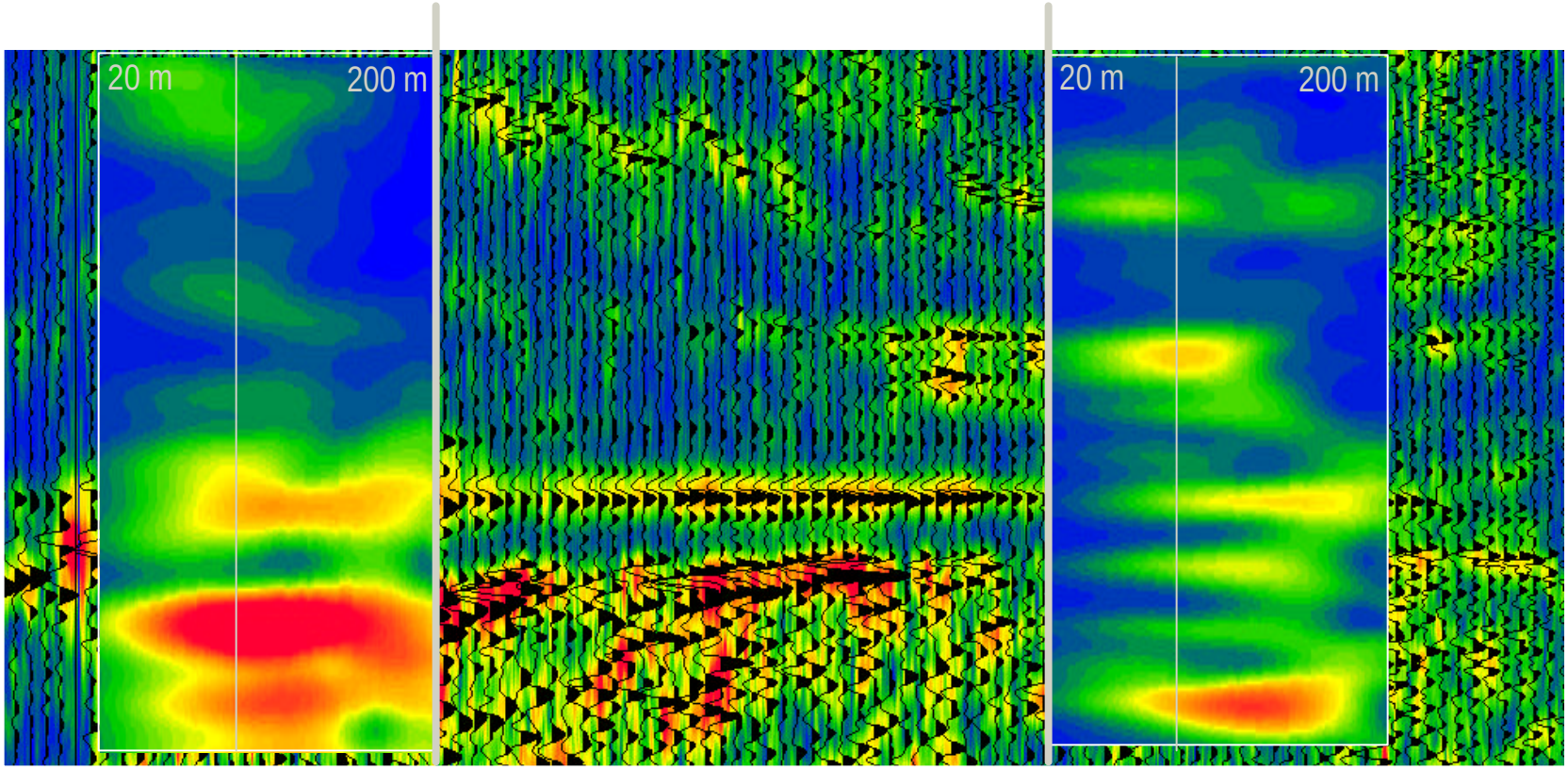




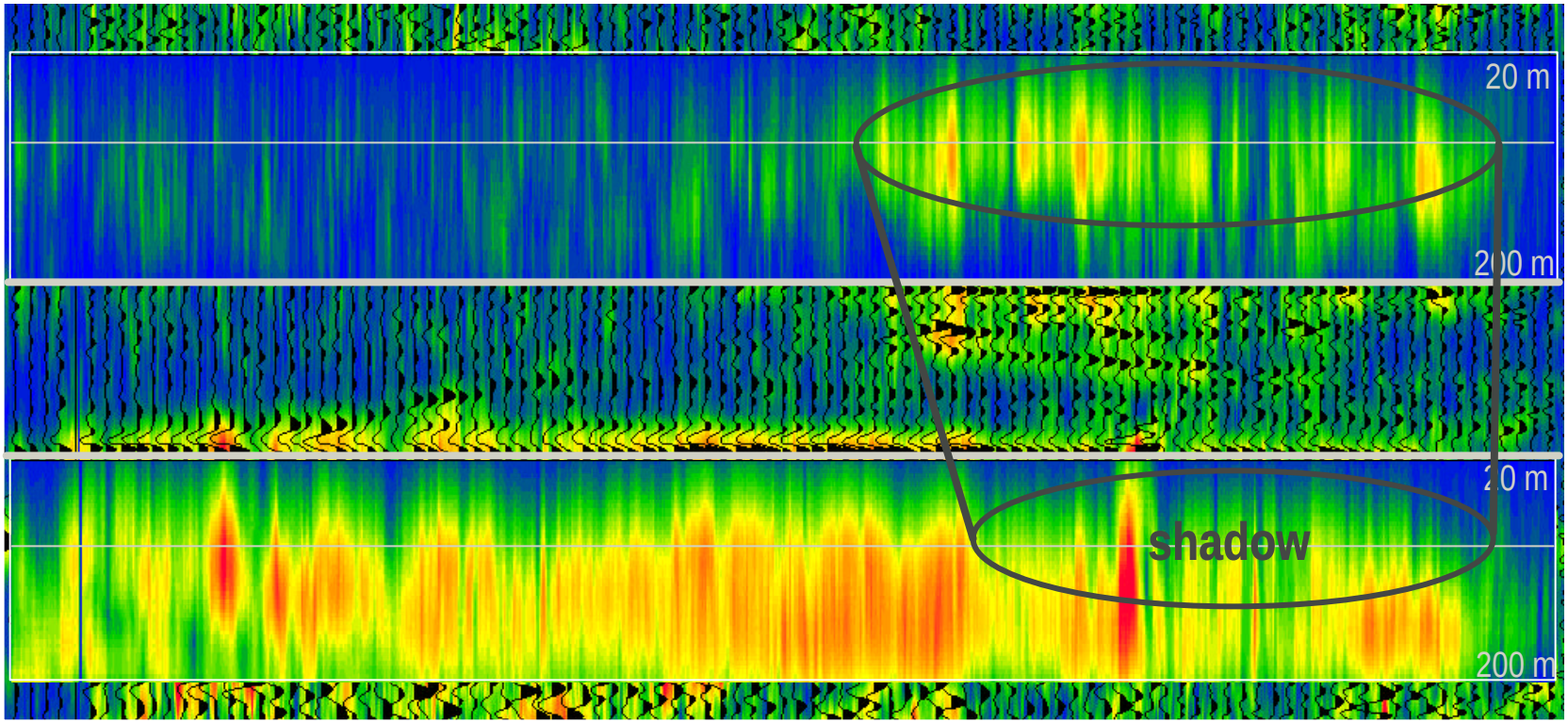
Wiggle trace = rfc seismic

= density of 50 m beds

Full wavelet spectrums for two traces



Wavelet spectrums for two times show spectral shadow



Conclusion

- New paradigm has enabled rapid reduction of the cycle time from concept to business value
  - Wavelet based reservoir ID (12 months)
  - Advanced horizon amplitude extraction (2 months)
  - Stratigraphic flattening (2 months)
  - Bayesian imaging velocity tomography (9 months)
  - Stochastic model based inversion (24 months)
  - Bayesian wavelet extraction (8 months, in progress)
  - Stochastic inversion to COUGAR reservoir simulation (18 months, in progress)