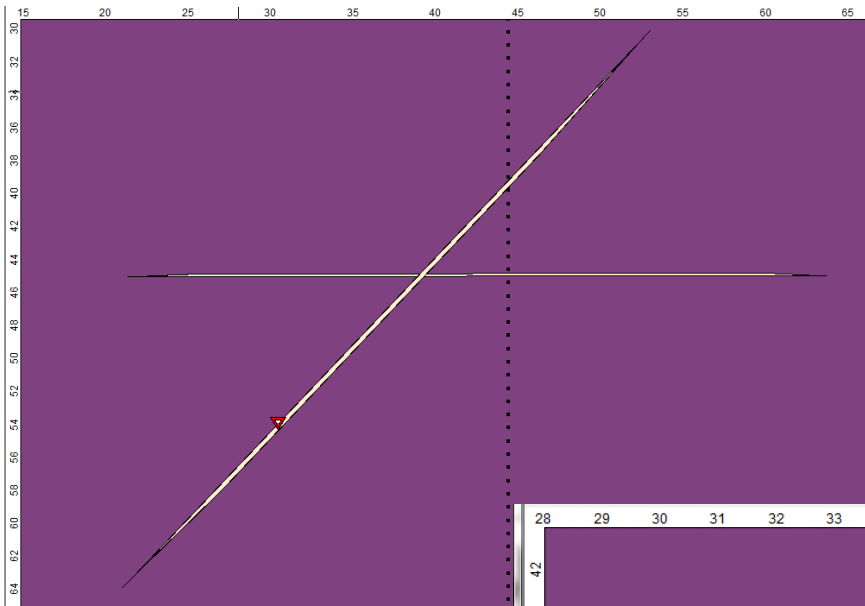


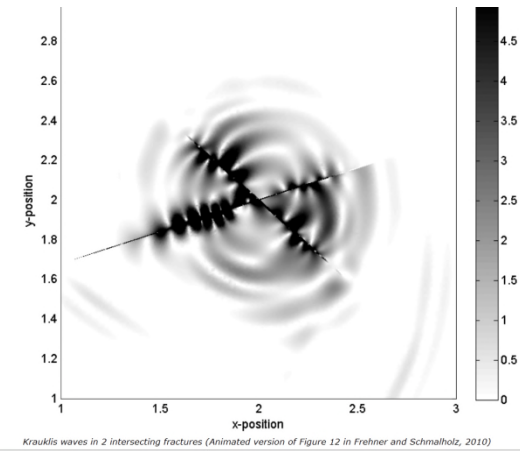
Modeling Fluid-filled Fractures



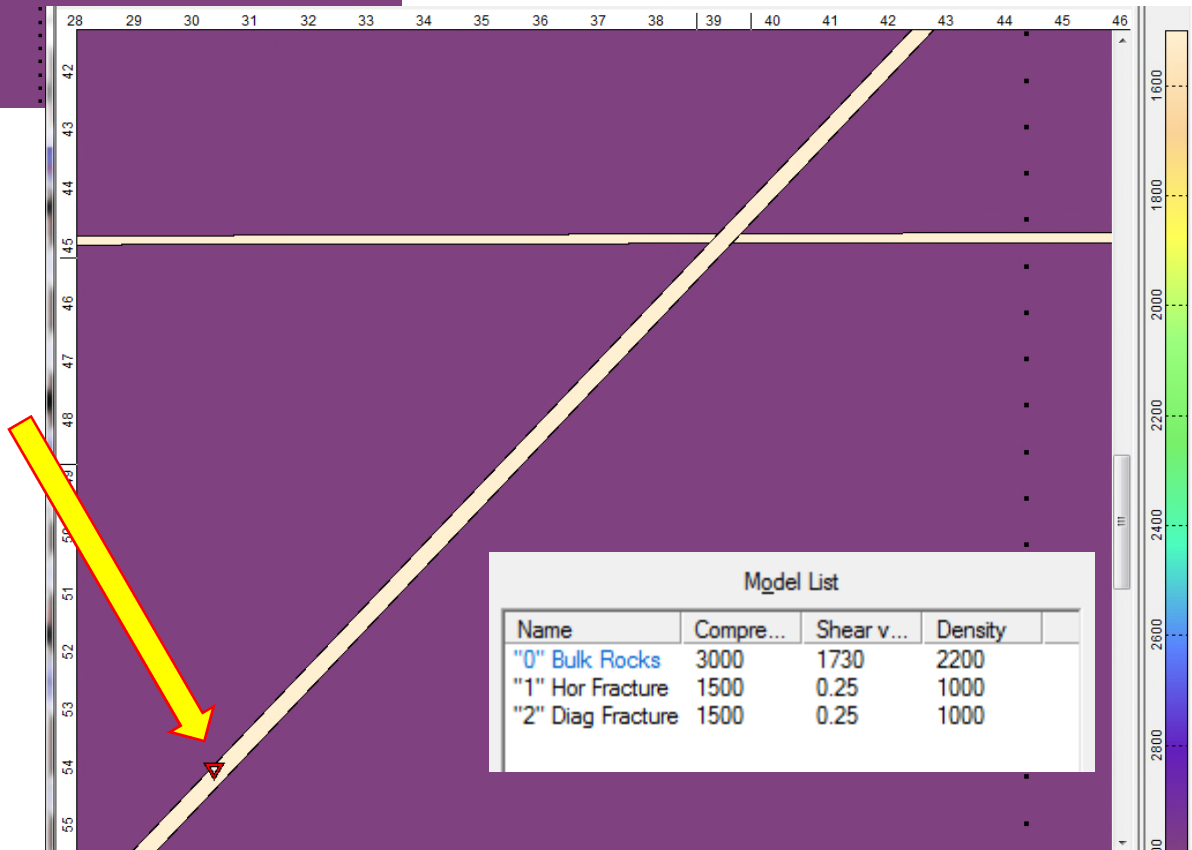
www.tesseral-geo.com

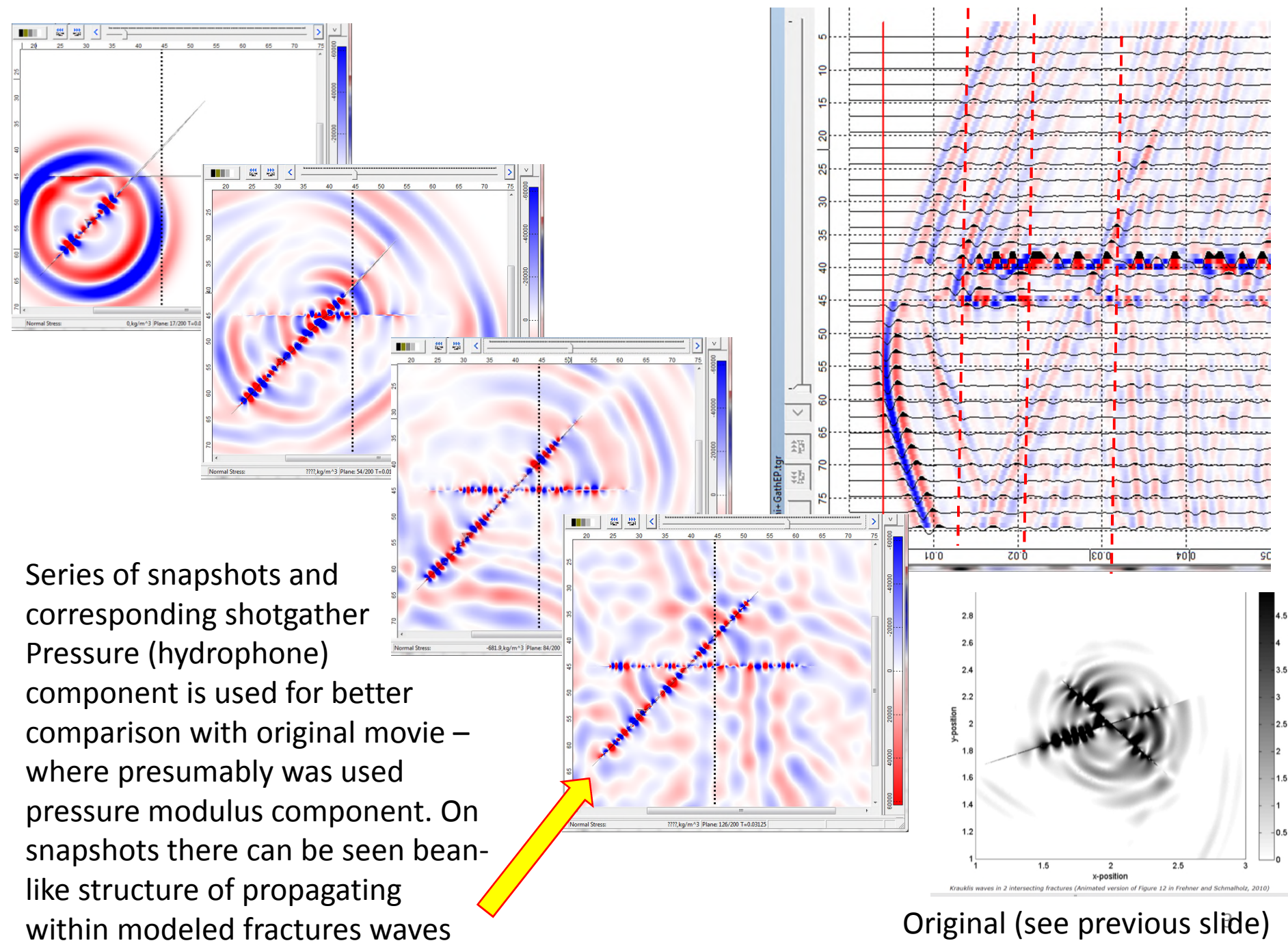


Model #1 in Tesseral
emulating
one used for Krauklis
waves modeling using
FE method in
[http://www.rockphysi
cs.ethz.ch/research/k
rauklis](http://www.rockphysi
cs.ethz.ch/research/k
rauklis)

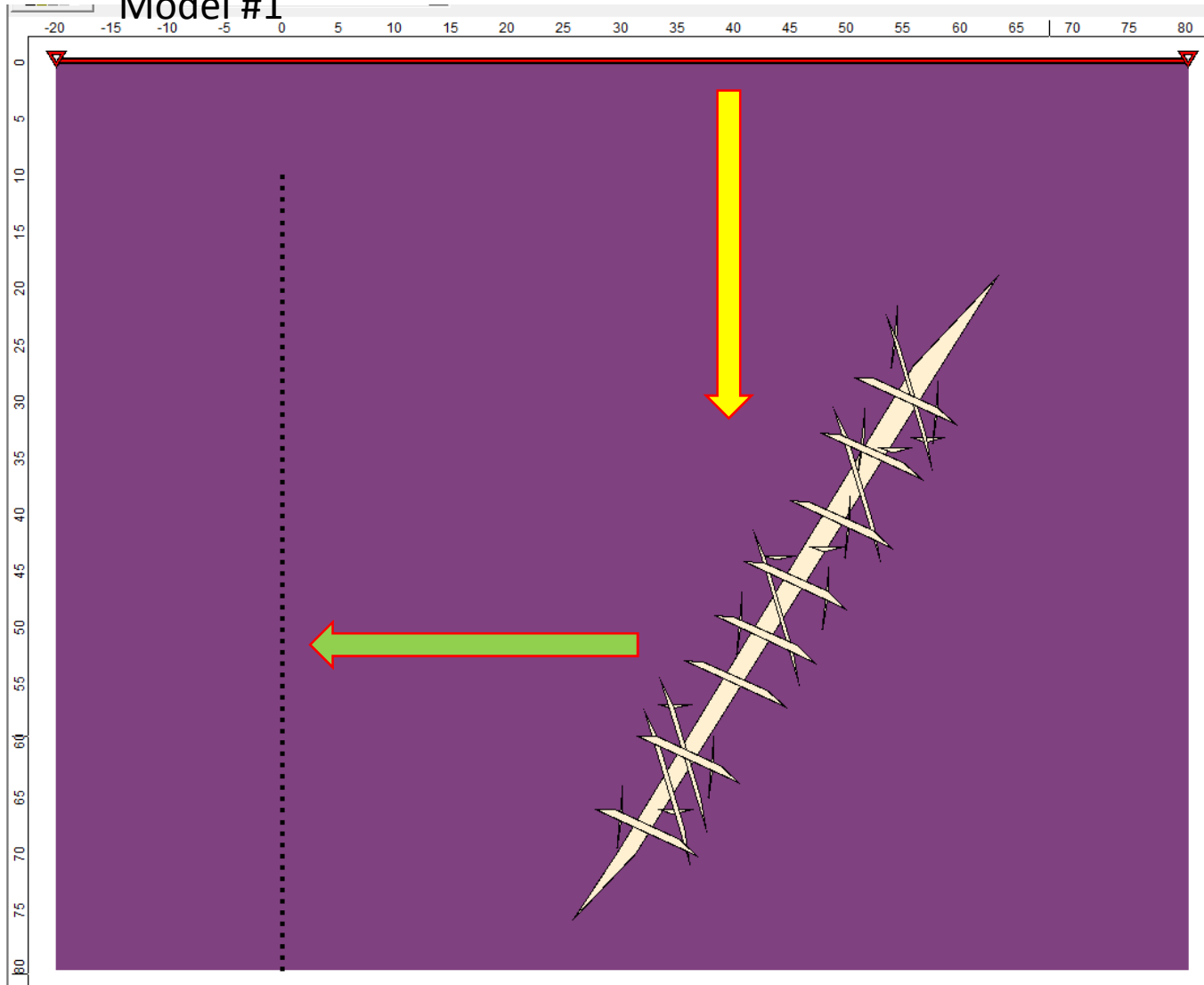


Source Rikker 500 Hz
Finite-difference
method,
Elastic equation, Grid
2.5x2.5 cm



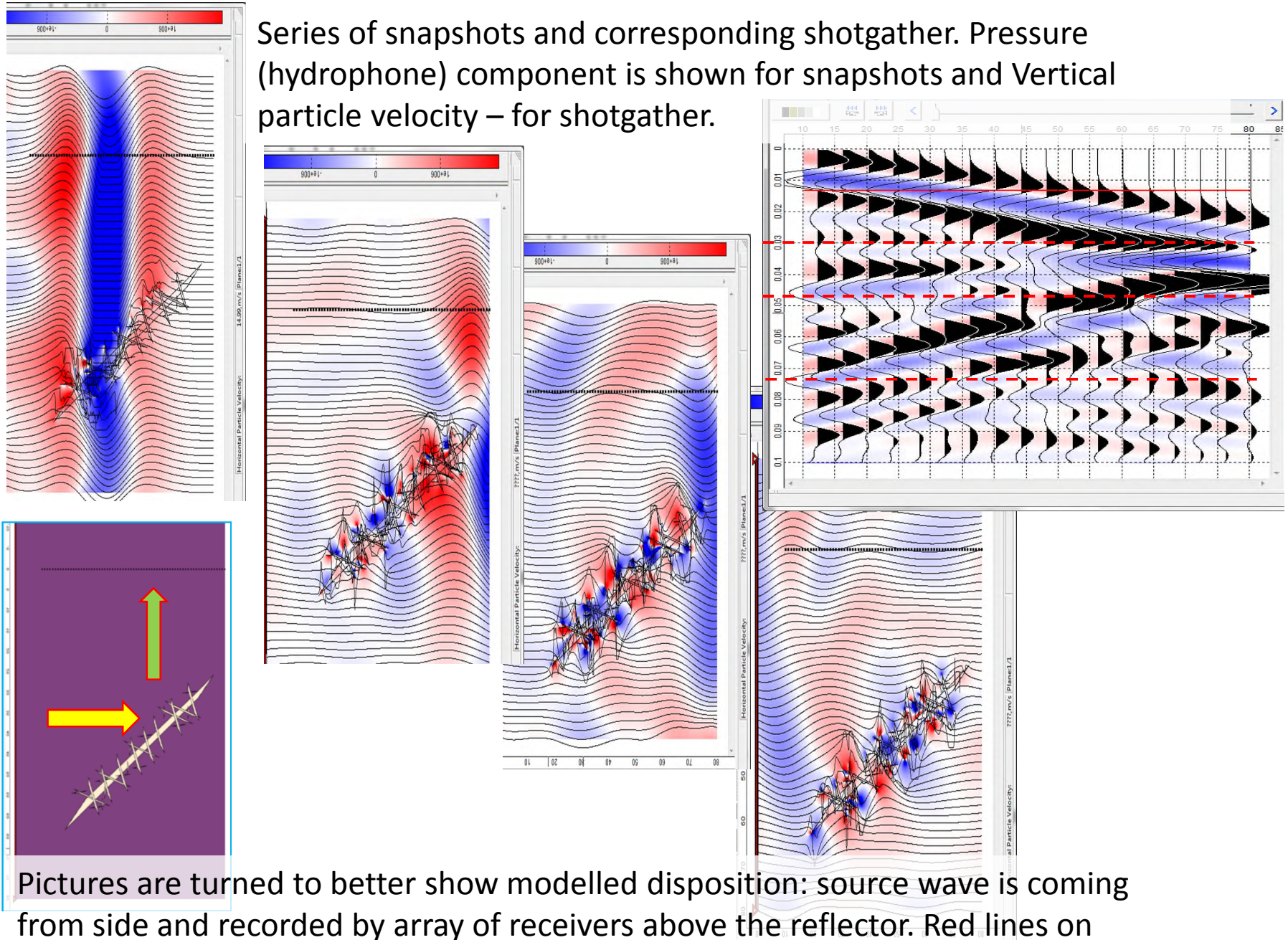


Model #2 in Tesseral is representing in schematic way “Big fracture with swarm of fledging smaller fractures”. Medium properties the same as for Model #1



Source Rikker
“Exploding
Surface” Mode
100 Hz
Finite-
difference
method,
Elastic equation,
Grid 5x5 cm

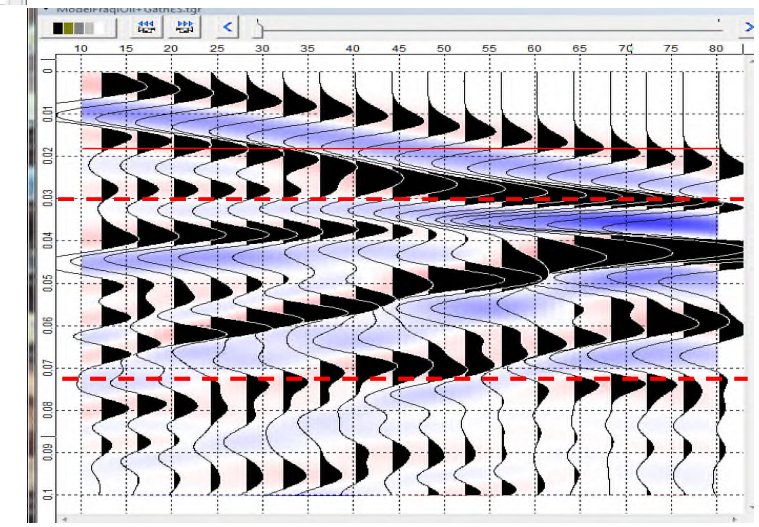
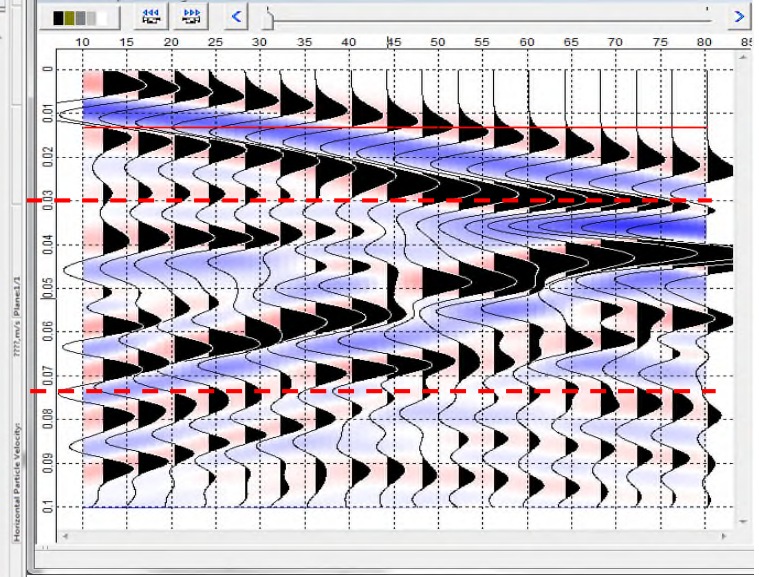
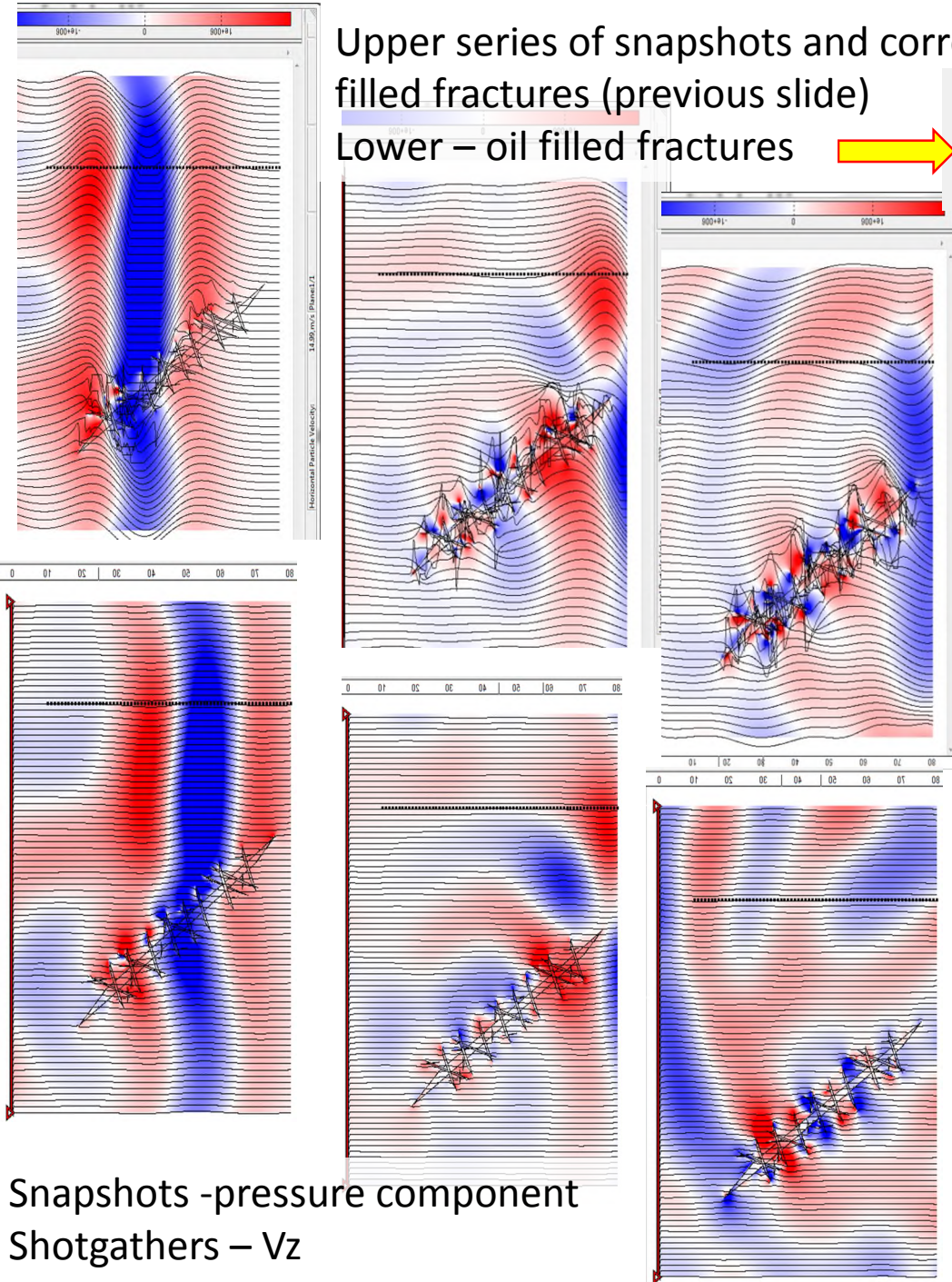
Series of snapshots and corresponding shotgather. Pressure (hydrophone) component is shown for snapshots and Vertical particle velocity – for shotgather.



Pictures are turned to better show modelled disposition: source wave is coming from side and recorded by array of receivers above the reflector. Red lines on shotrather – correspond to time of snapshot.

Upper series of snapshots and corresponding shotgather –water filled fractures (previous slide)
 Lower – oil filled fractures

Name	Compre...	Shear v...	Density
"0" Bulk Rocks	3000	1730	2200
"1" Fracture Oil...	1500	300	800
"2"	1500	300	800
"3"	1500	300	800
"4"	1500	300	800

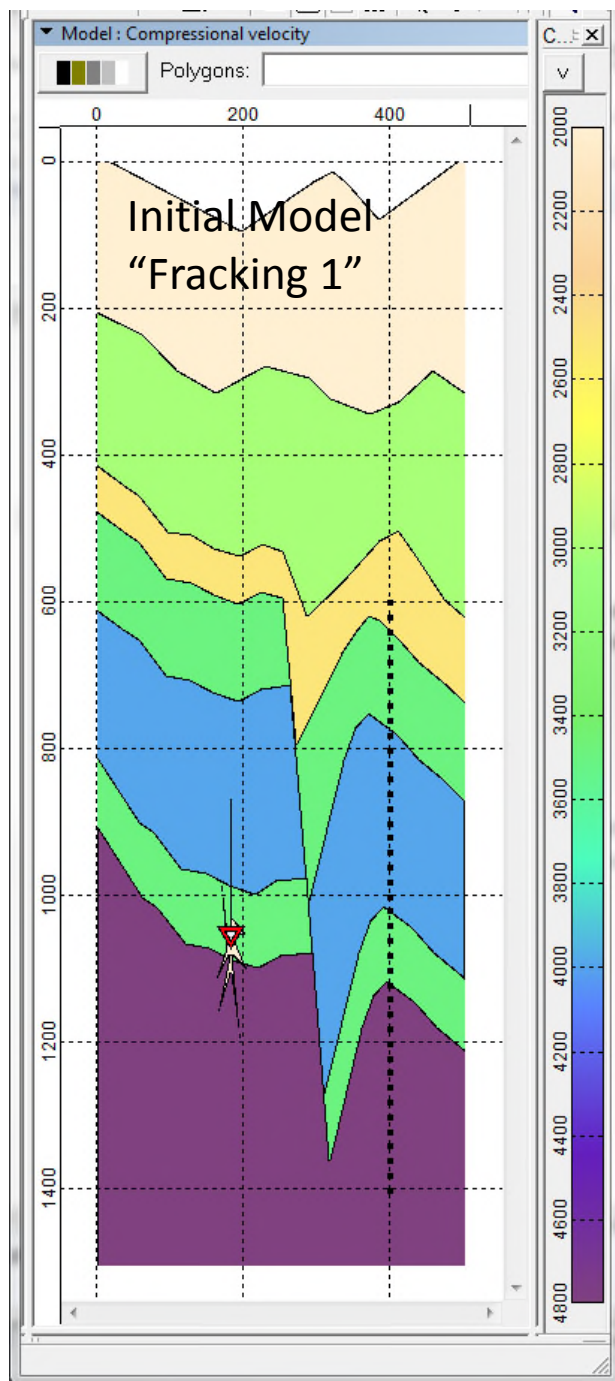


Snapshots -pressure component
 Shotgathers – Vz

Modeling for Fracking Passive Micro-Seismic



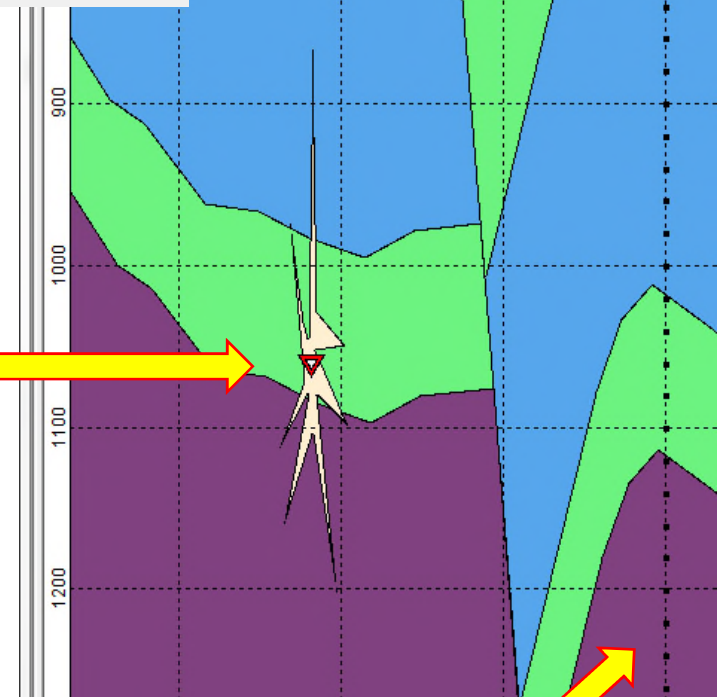
www.tesseral-geo.com



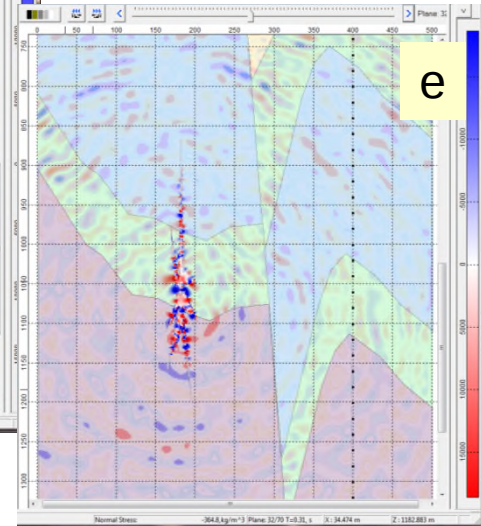
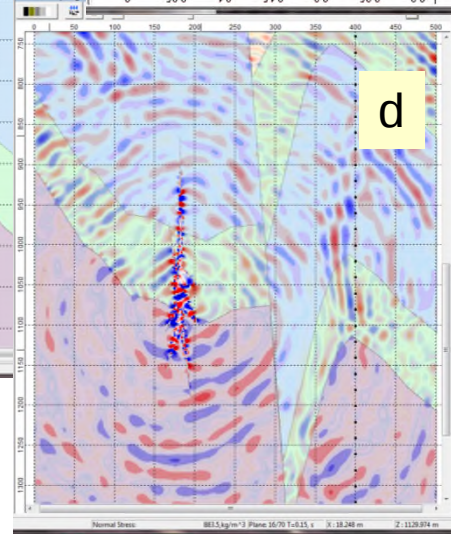
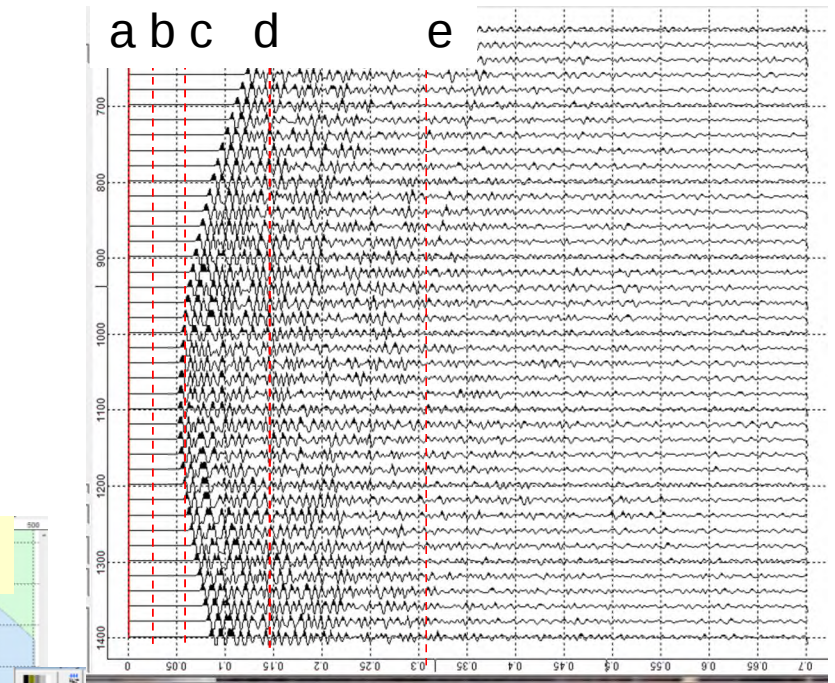
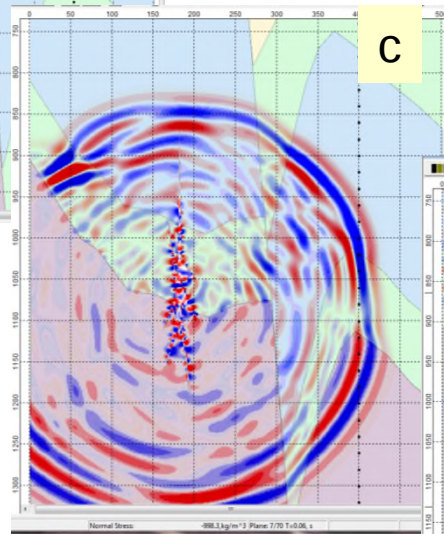
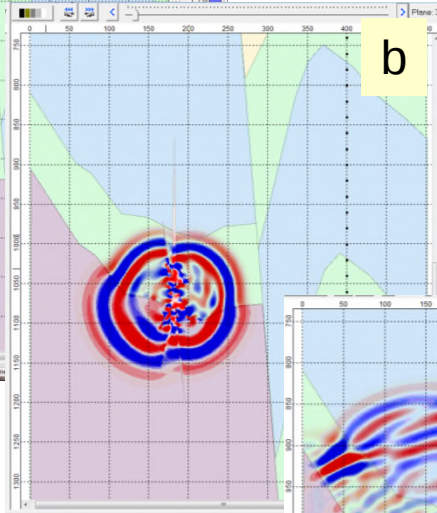
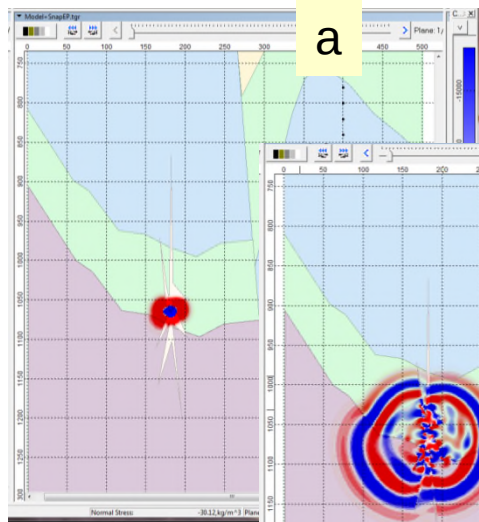
Model List

Name	Compre...	Shear v...	Density
"0" Clay 1	2000	--	--
"1" Clay 2	3000	--	--
"2" Clay 3	2500	--	--
"3" Shale 1	3500	--	--
"4" Shale 2	4000	--	--
"5" Shale 3	3500	--	--
"6" Sandstone 1	4800	--	--
"7" Fracture mud f...	2000	1	1800

Source Rikker
150 Hz
Finite-difference
method,
Elastic equation,
Grid 0.5x0.5 m
Source is inside
of "Fracture filled
with drilling
mud"



Receiver line in vertical well
600-1400 m, interval 20m,
41 receivers



Series of snapshots and corresponding shotgather Pressure (hydrophone) component is shown.

On snapshots there can be seen bean-like structure of propagating within modeled fractures waves, which create “ringing” energy dissipation pattern.