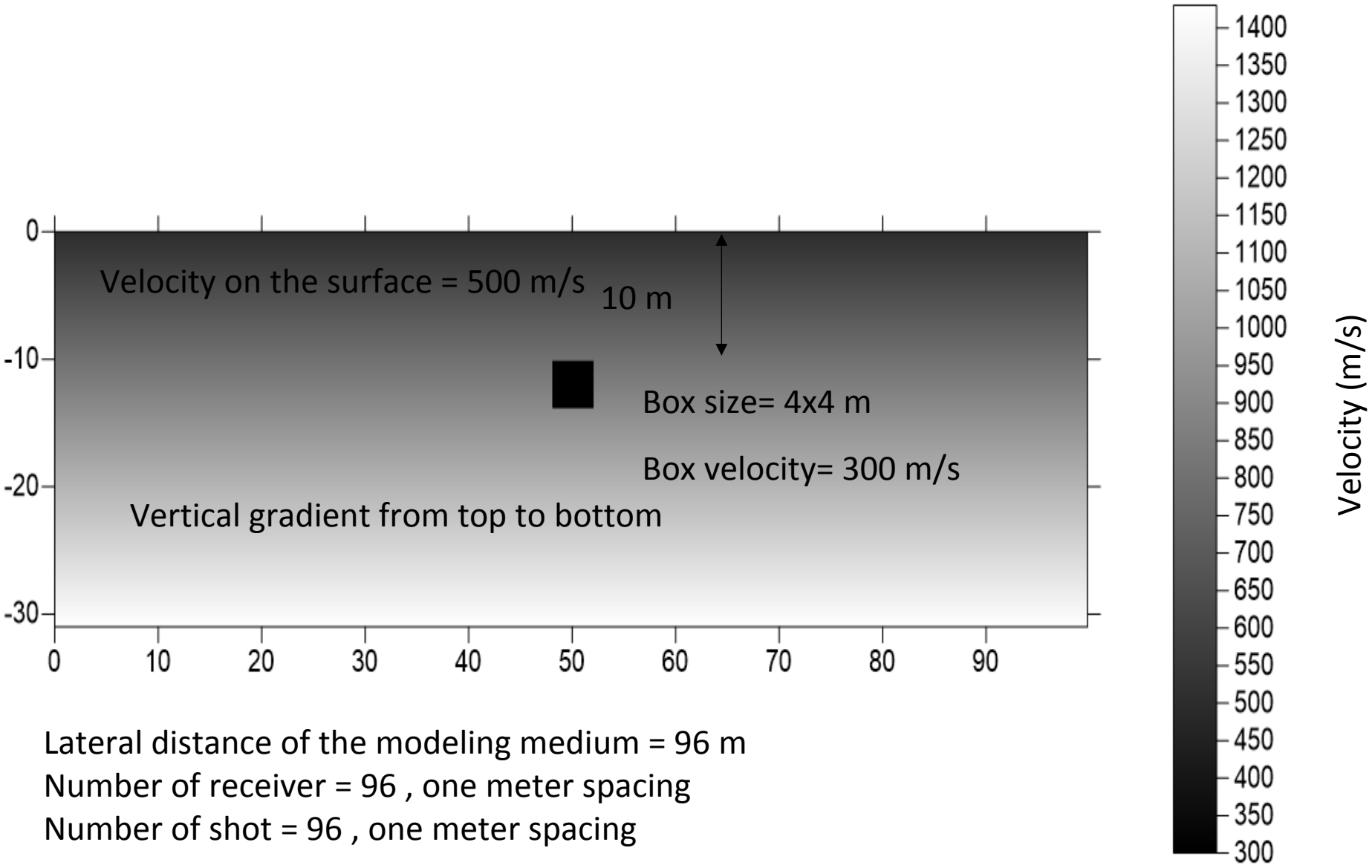
Tunnel detection using Frequency-Dependent Traveltime Tomography

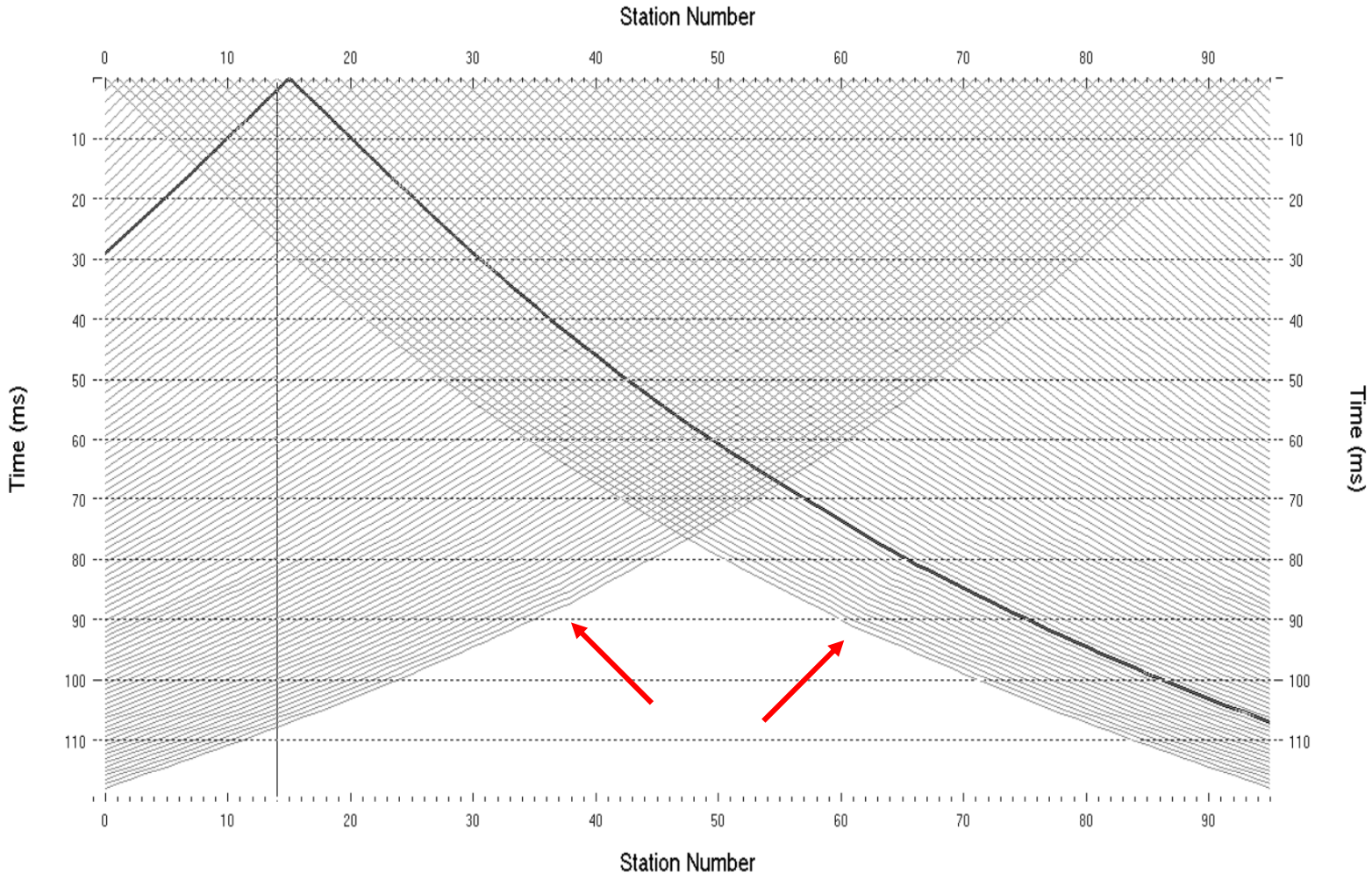
- we thank Dr. Parsa Bakhtiari Rad working at University of Mississippi, The National Center for Physical Acoustics (NCPA) for making available the following slides in Feb 2021
- the WET inversion (Wavepath Eikonal Traveltime inversion; Schuster 1993) was done with Rayfract® version 4.01 using our new Wavelength-Dependent Velocity Smoothing (Zelt and Chen, 2016)
- Golden Software Surfer was used to generate the model .GRD grid file
- synthetic traveltimes were modeled using Rayfract® version 4.01 with WDVS defaults : frequency preset to 200Hz
- both WDVS smoothing and WET smoothing were discarded after forward modeling during WET inversion for improved resolution
- WET inversion at 62.5Hz was done using our Minimal WET smoothing option, Uniform weighting with default WET smoothing settings

Test 1: 4x4 Low velocity box tomography

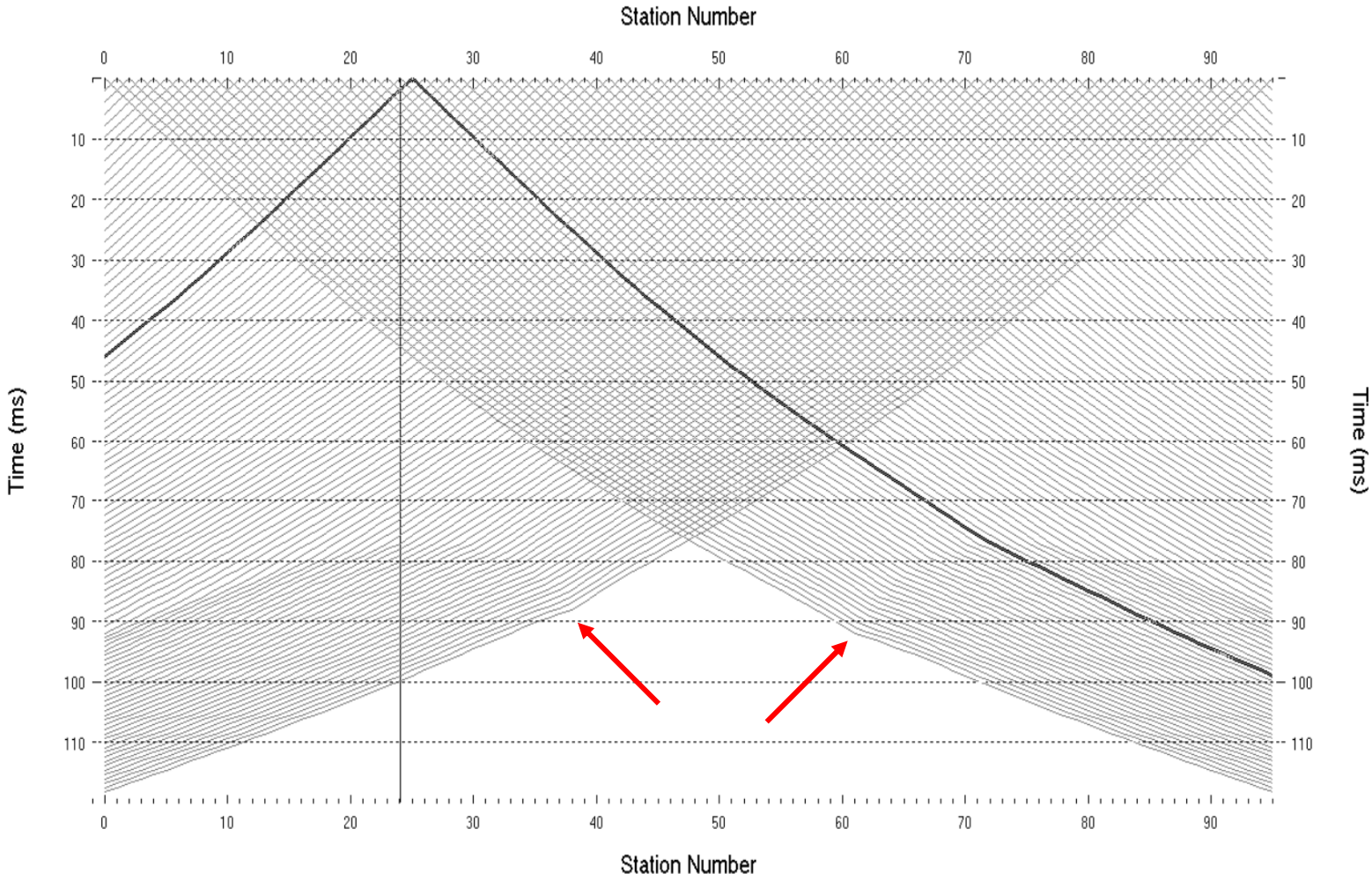


Lateral distance of the modeling medium = 96 m
Number of receiver = 96 , one meter spacing
Number of shot = 96 , one meter spacing

First arrival times calculated for 4x4 box No WDVS

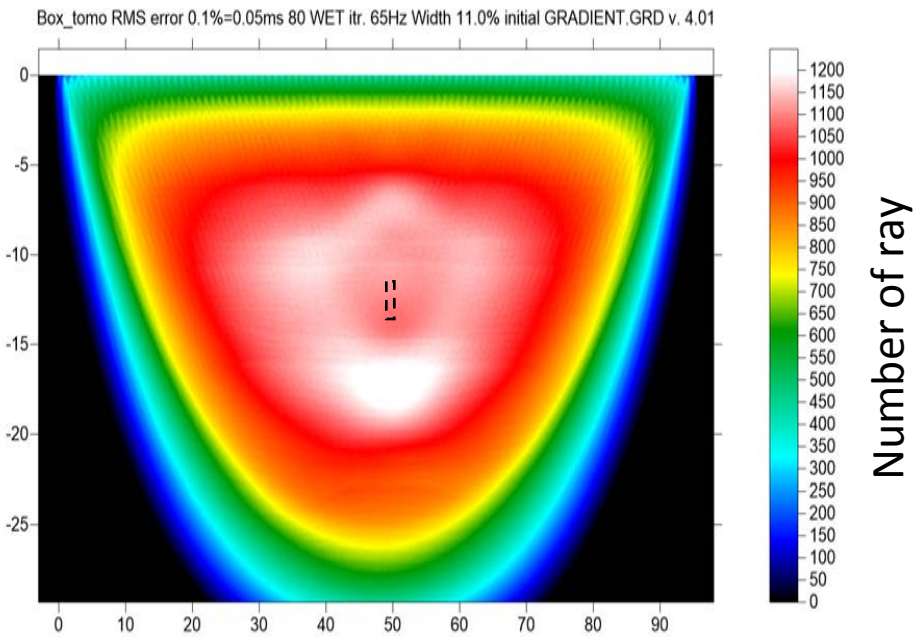


First arrival times calculated for 4x4 box with WDVS

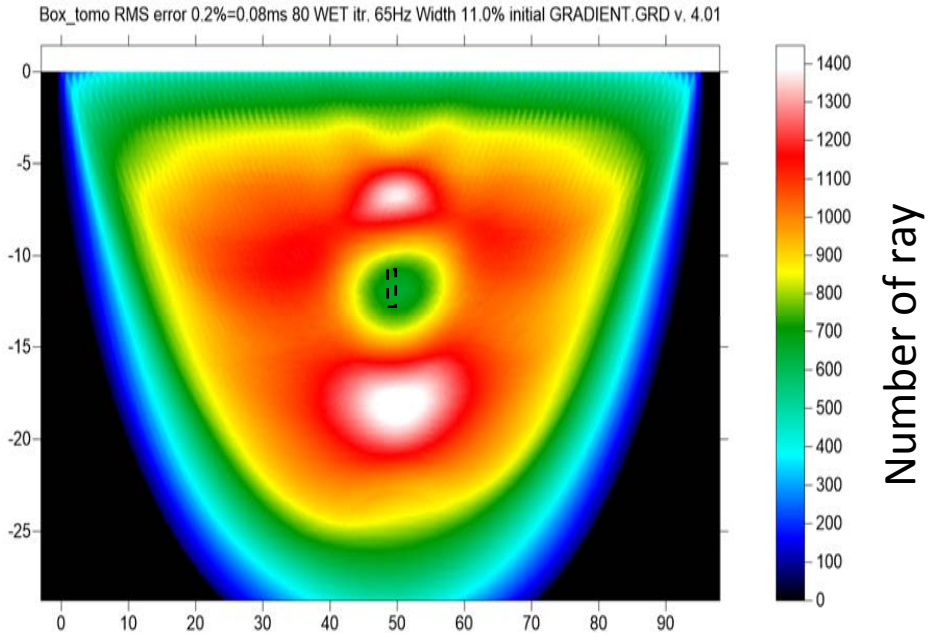


Ray coverage map for 4x4 box model :

No WDVS

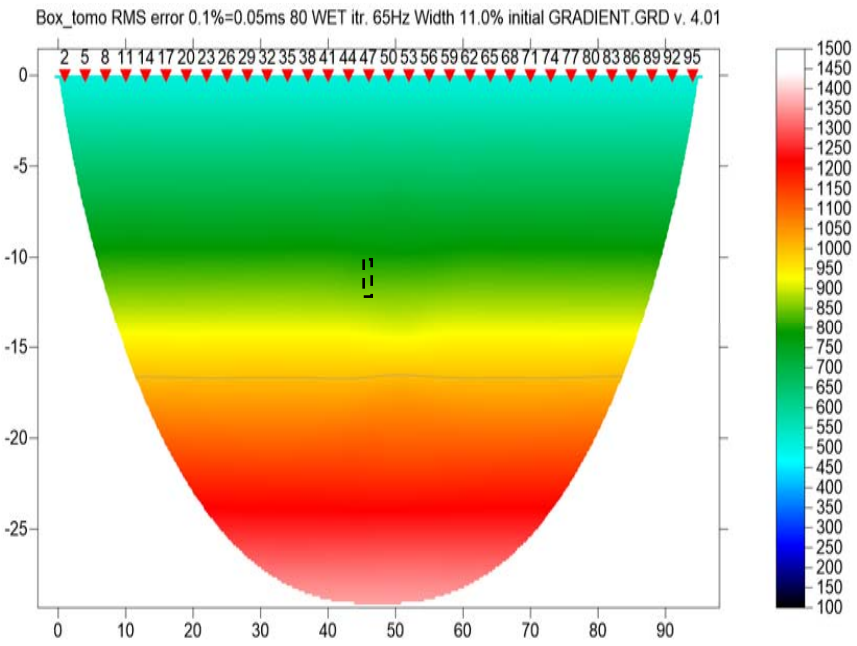


with WDVS

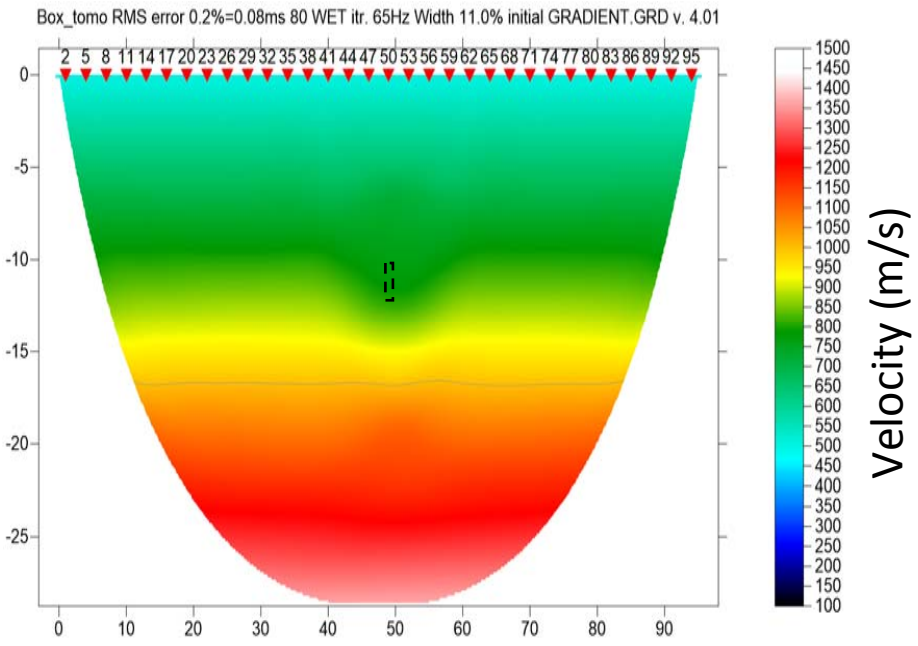


Velocity tomogram for 4x4 box model :

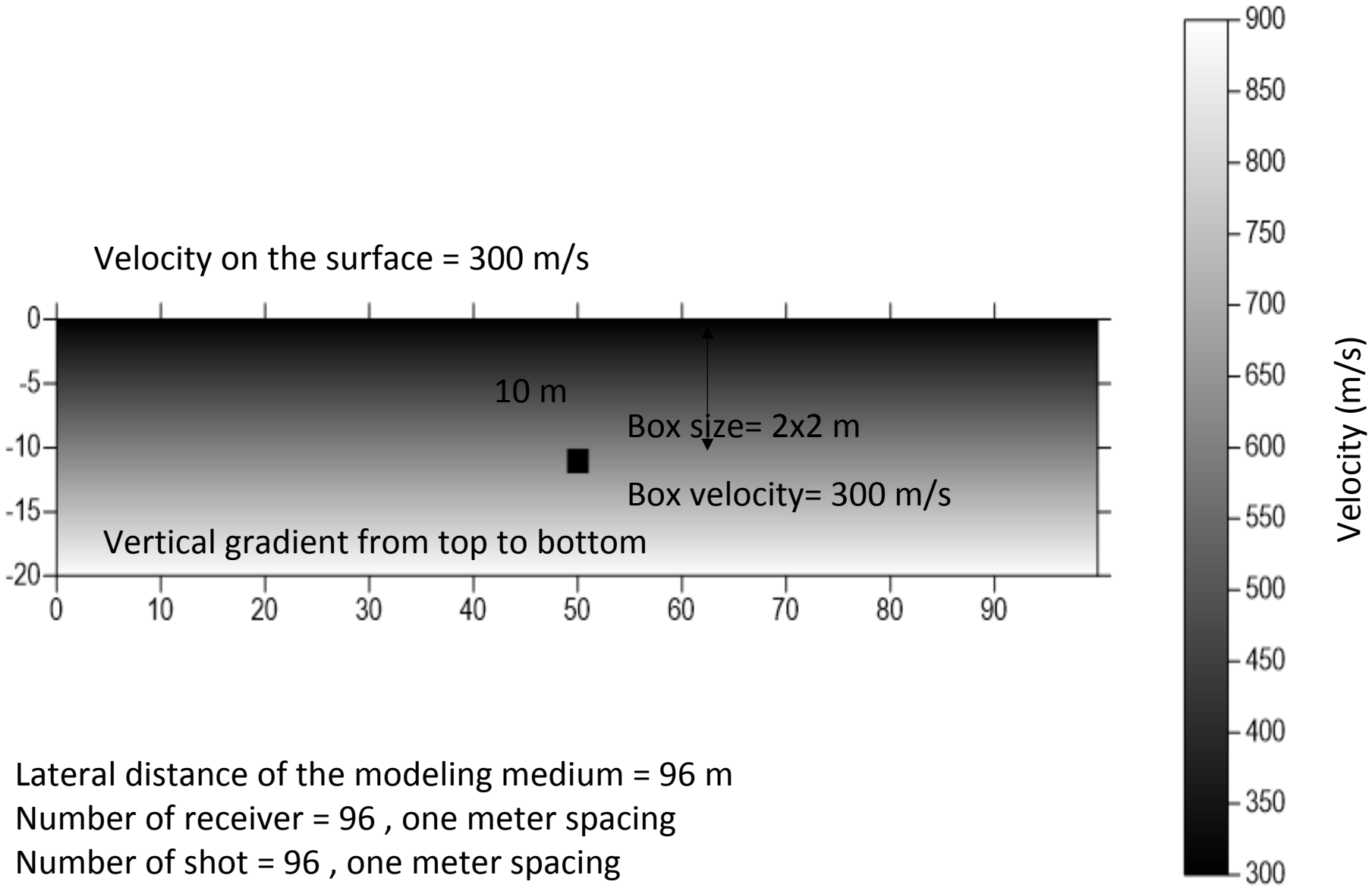
No WDVS



with WDVS



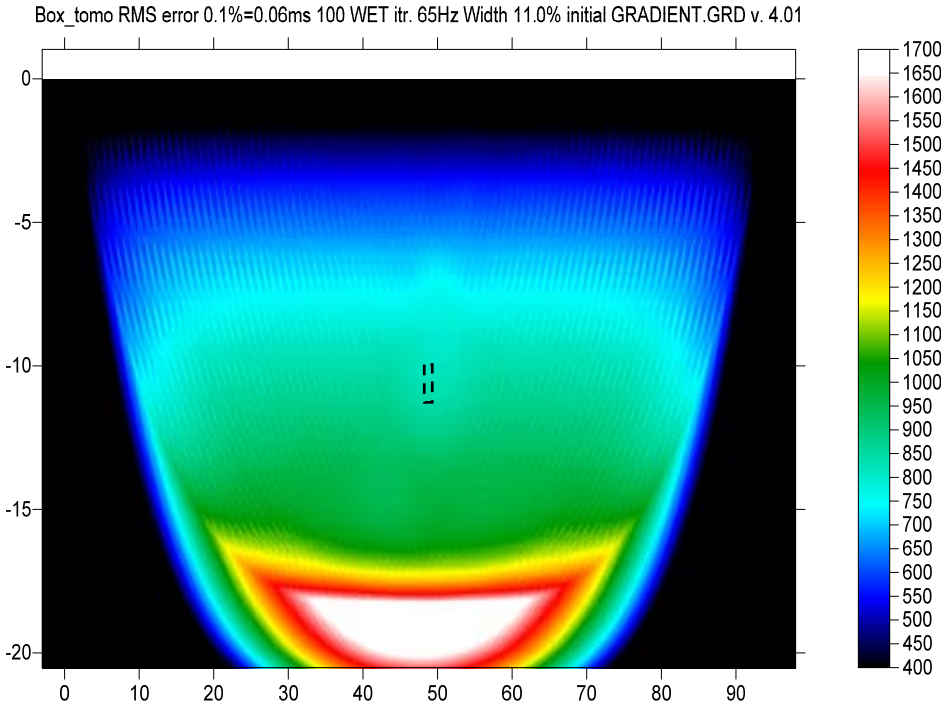
Test 2: 2x2 Low velocity box tomography



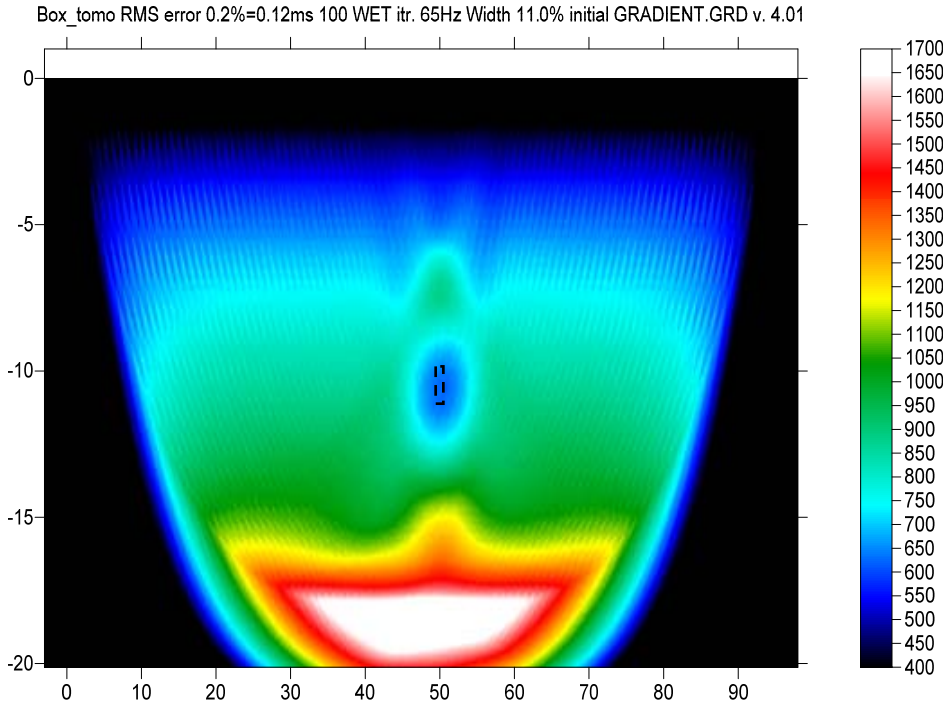
Lateral distance of the modeling medium = 96 m
Number of receiver = 96 , one meter spacing
Number of shot = 96 , one meter spacing

Ray coverage map for 2x2 box model :

No WDVS

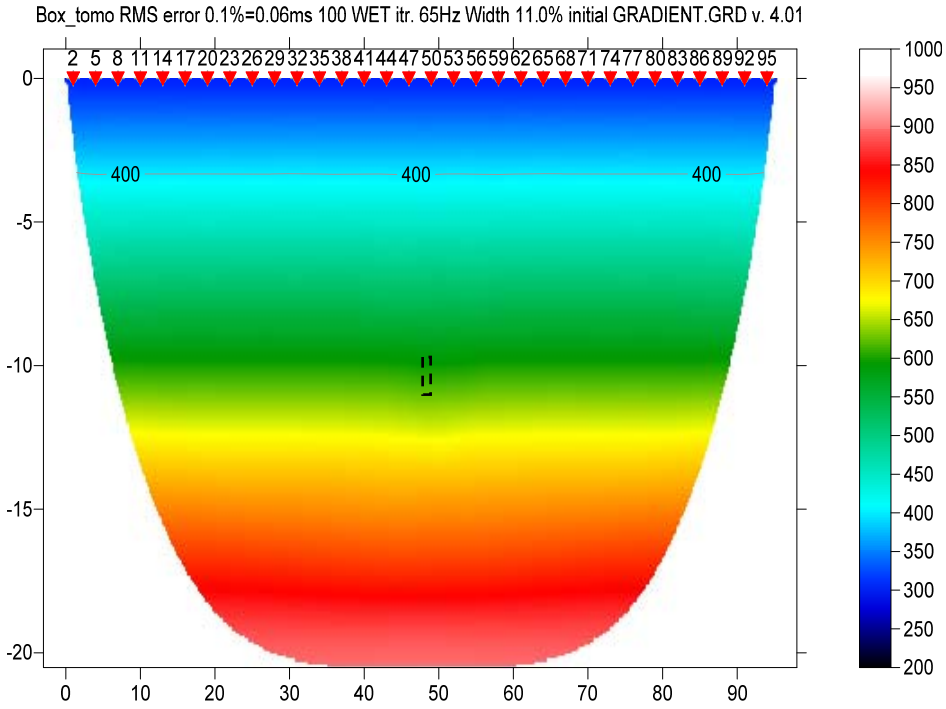


with WDVS

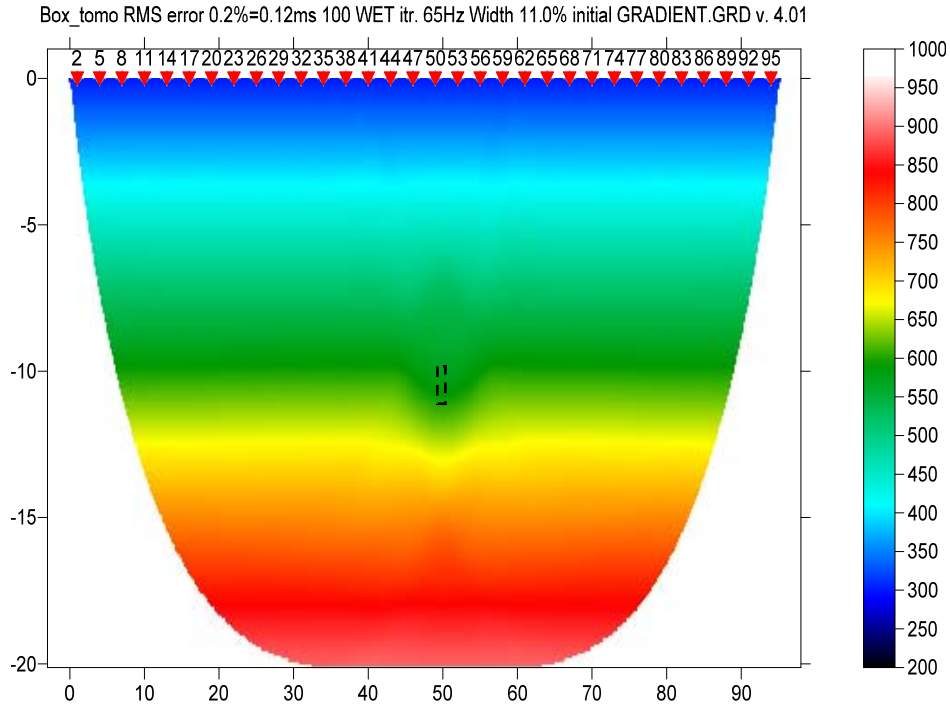


Velocity tomogram for 2x2 box model :

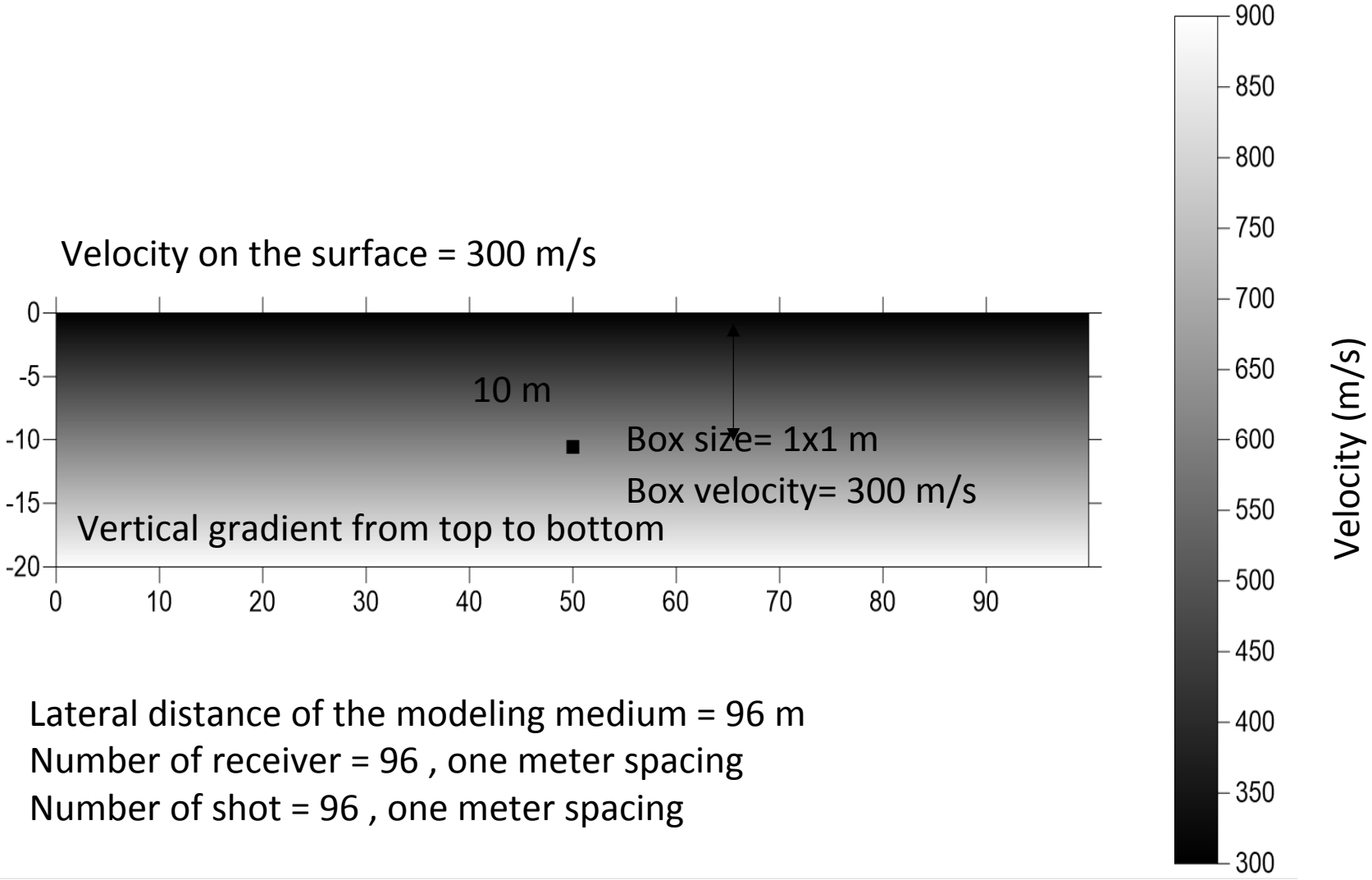
No WDVS



with WDVS



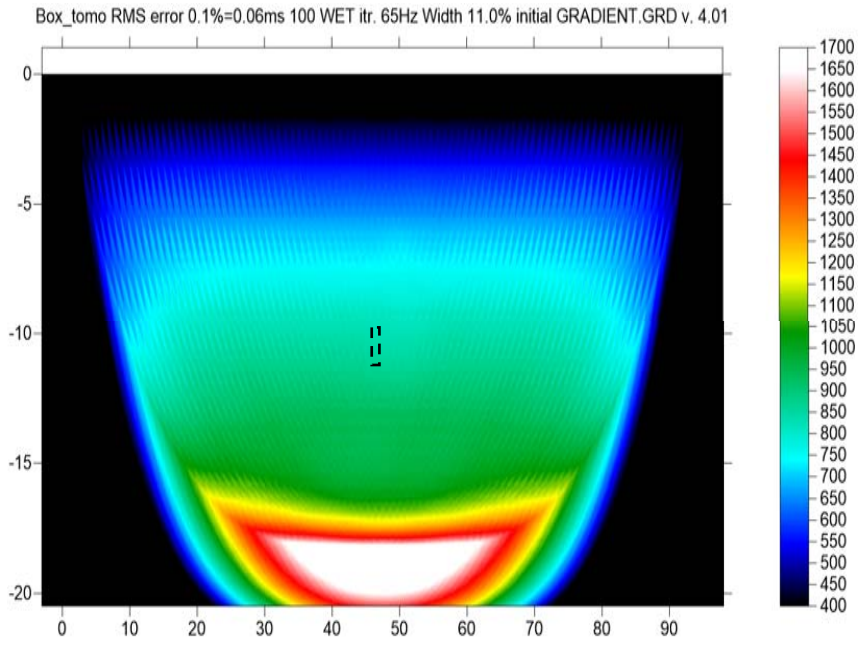
Test 3: 1x1 Low velocity box tomography



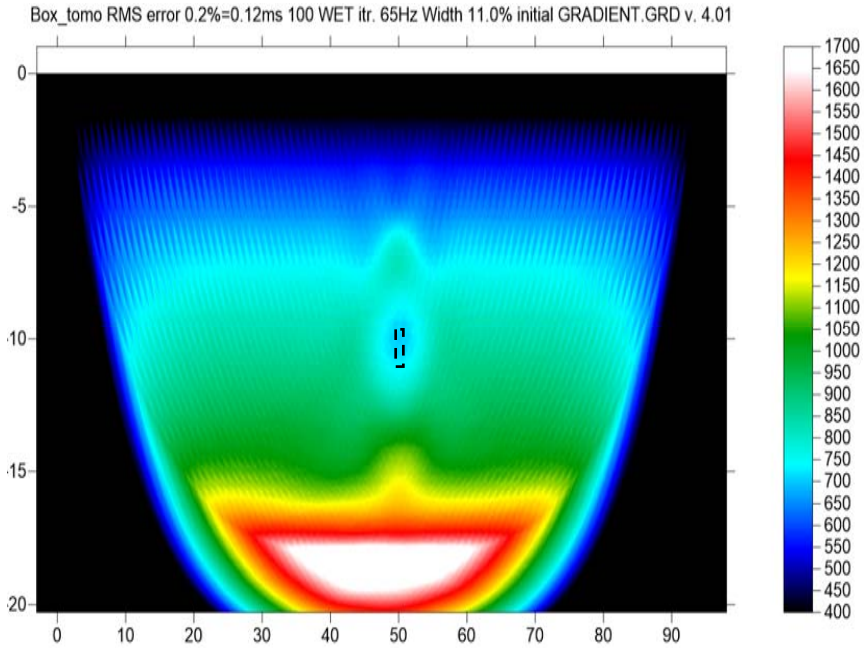
Lateral distance of the modeling medium = 96 m
Number of receiver = 96 , one meter spacing
Number of shot = 96 , one meter spacing

Ray coverage map for 1x1 box model :

No WDVS



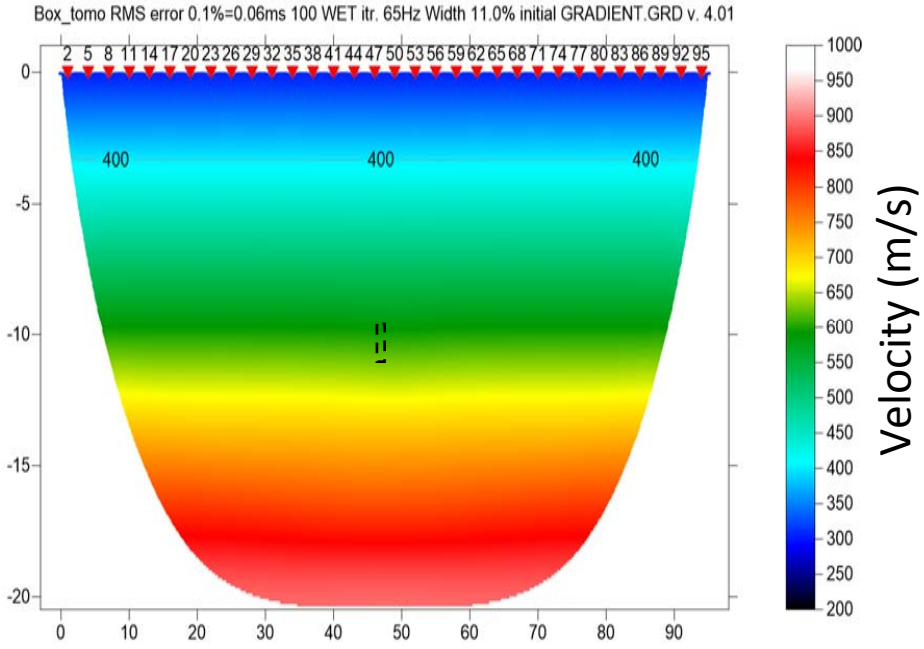
with WDVS



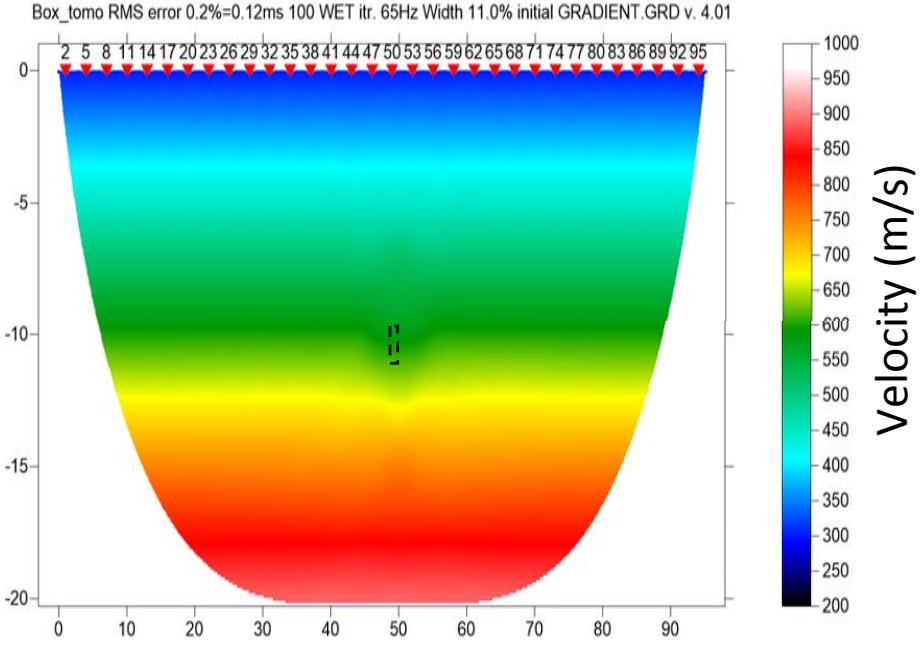
Number of ray

Velocity tomogram for 1x1 box model :

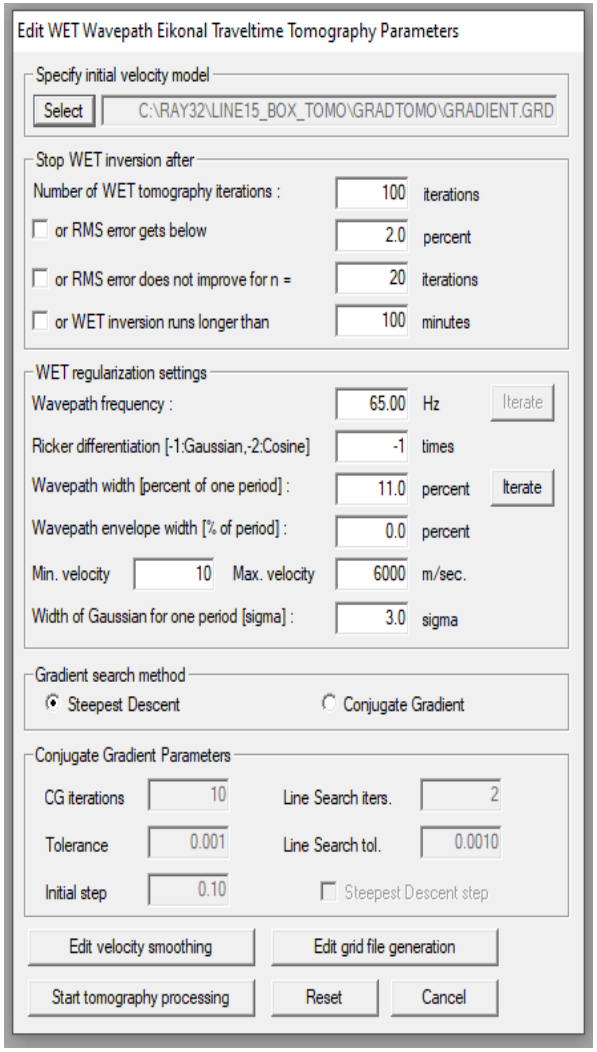
No WDVS

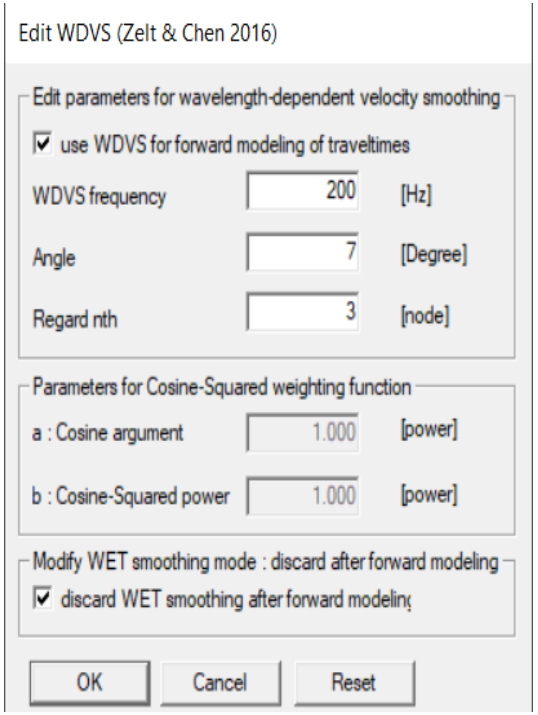


with WDVS



WDVS parameters used for box tomography:





*Unchecked the boxes for non-WDVS case

WET parameters used for box tomography: