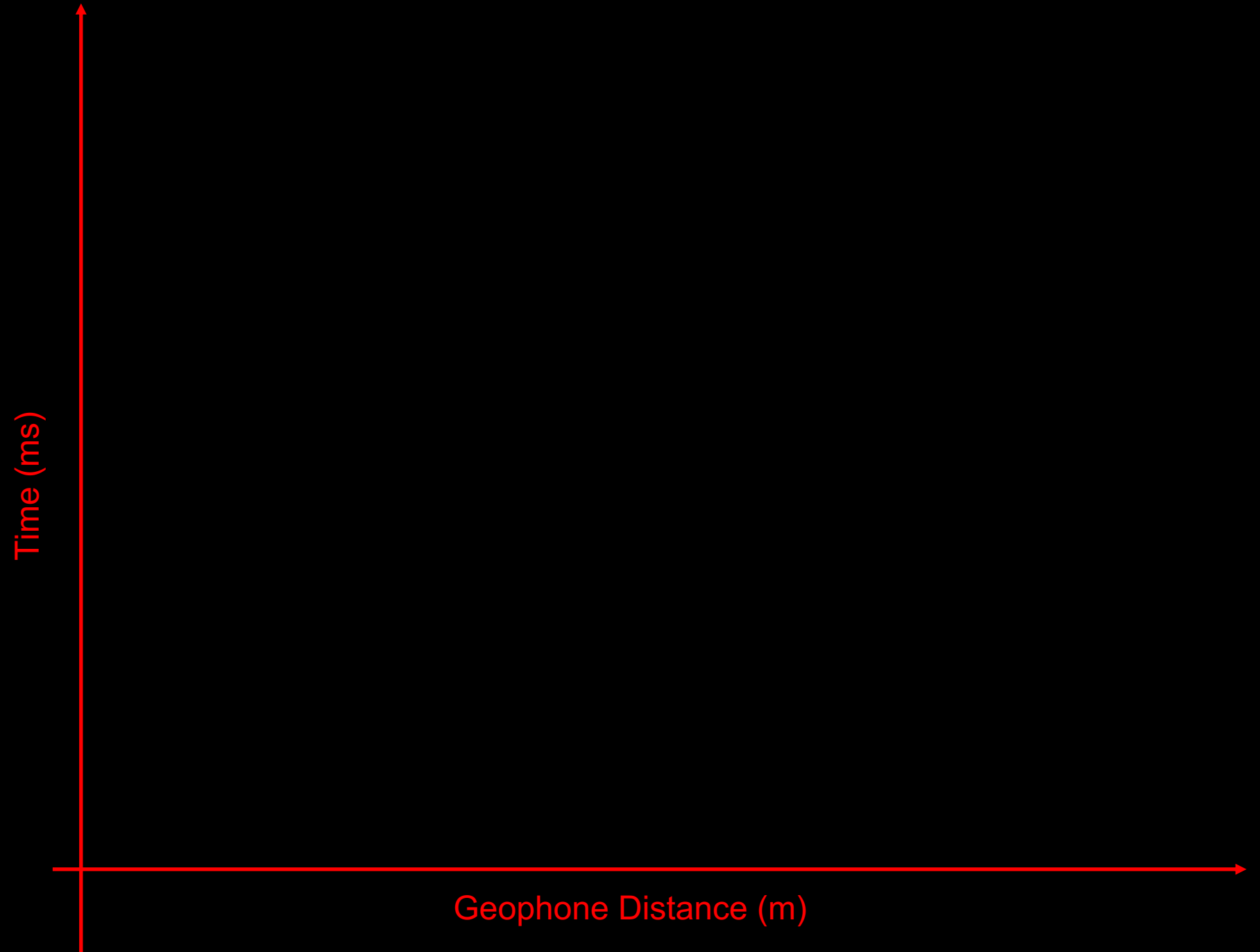
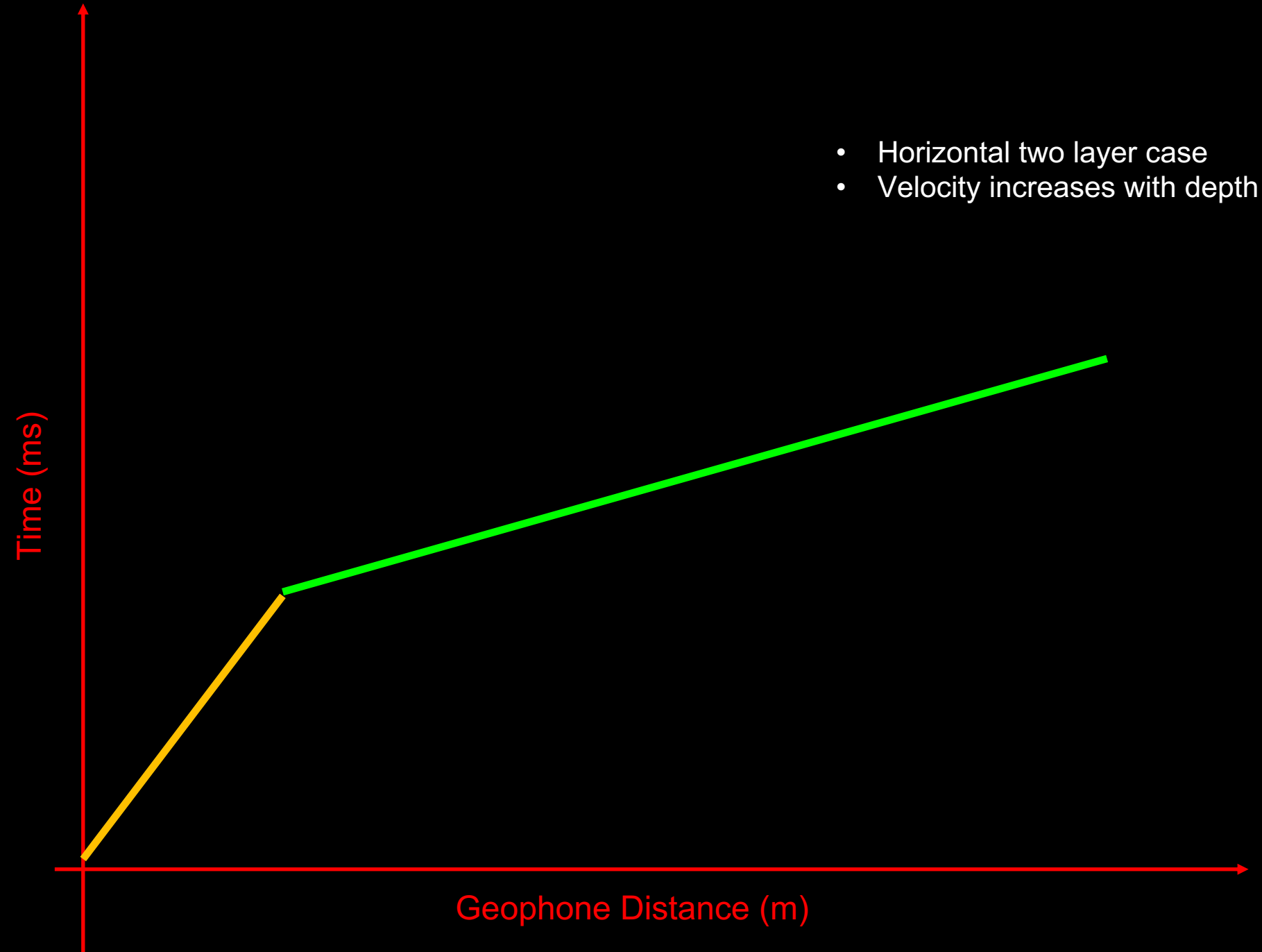
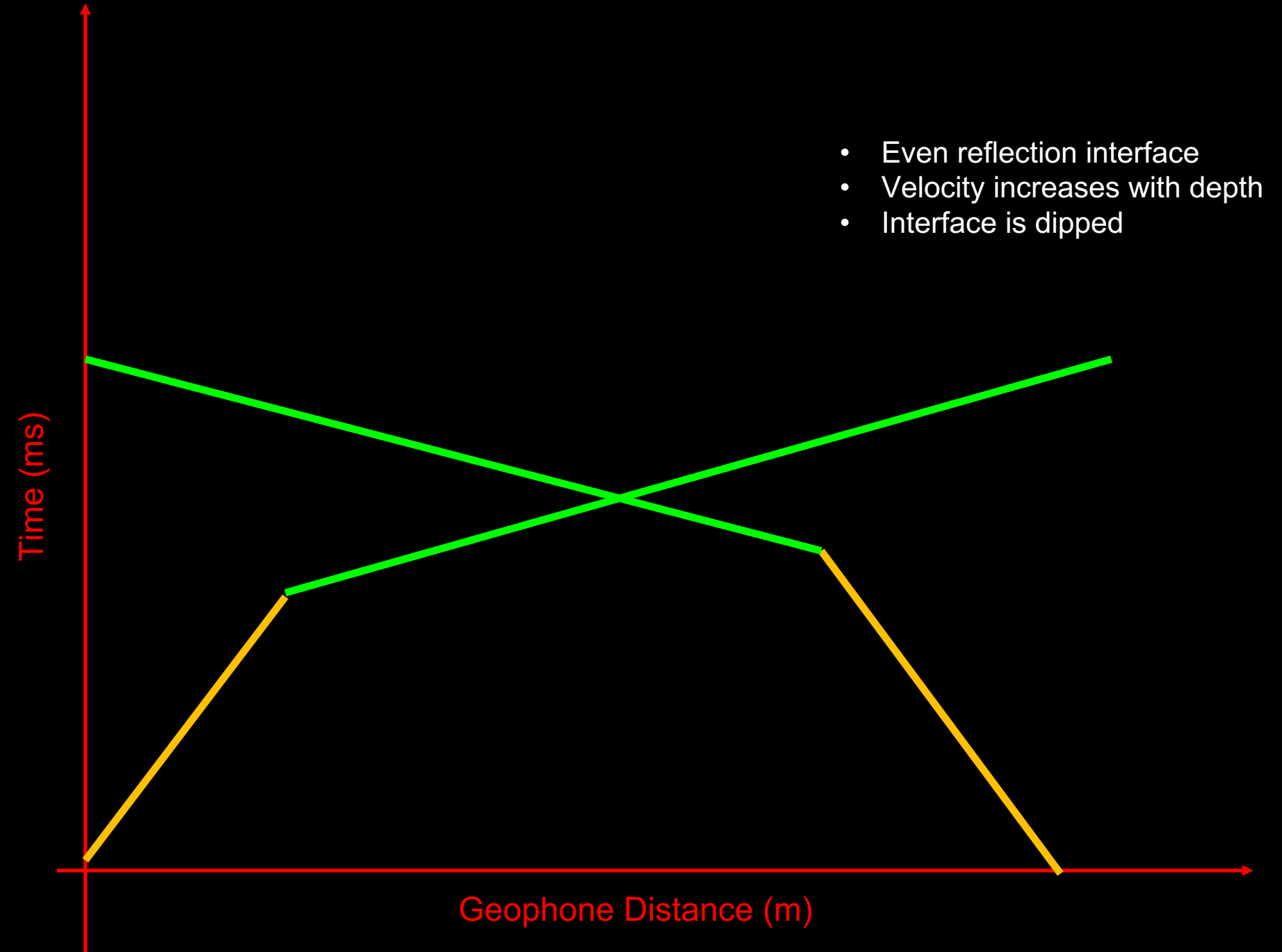




- Hidden Layers
- Consistency Criteria
- Applied Tomography example

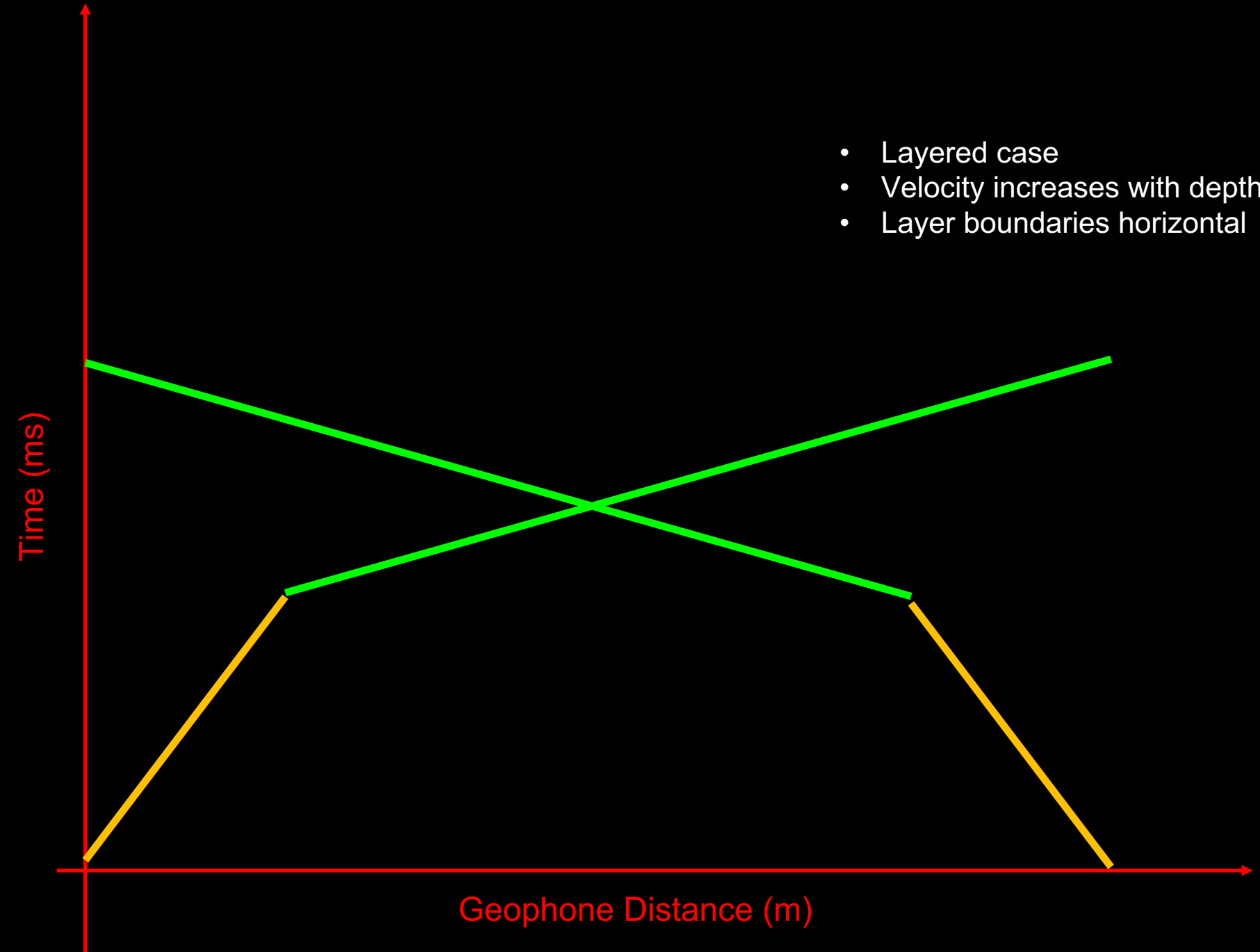






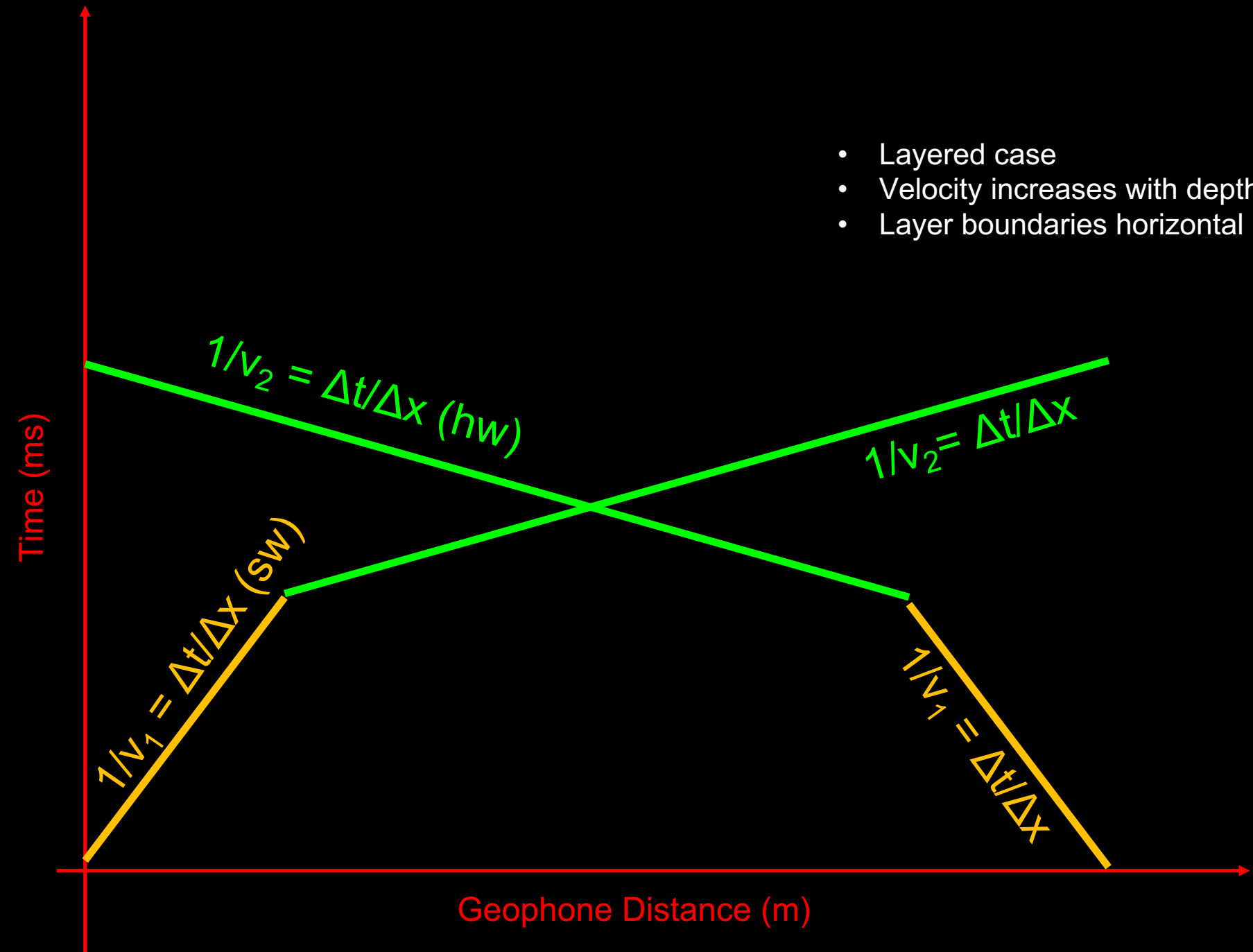


- Layered case
- Velocity increases with depth
- Layer boundaries horizontal



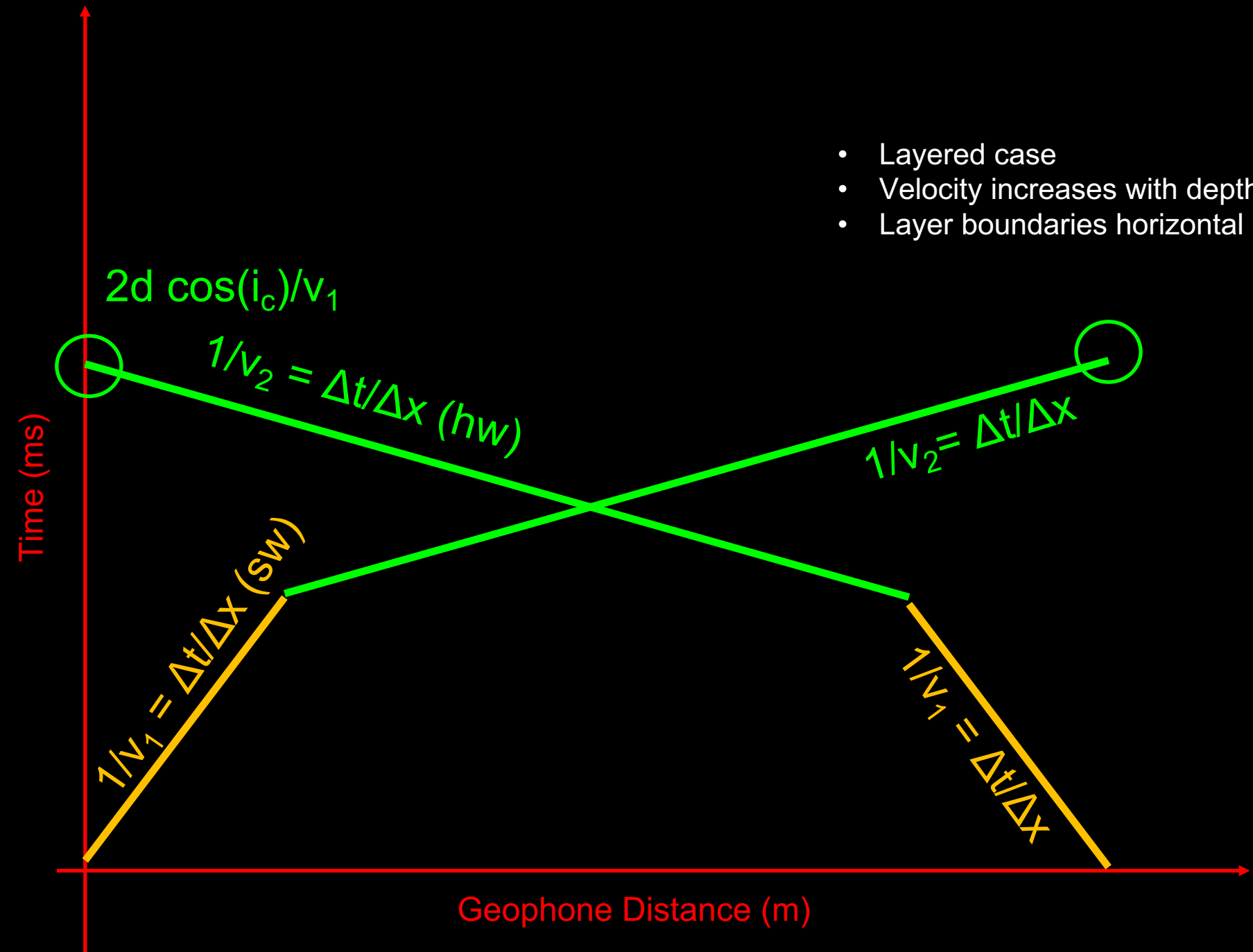


- Layered case
- Velocity increases with depth
- Layer boundaries horizontal





- Layered case
- Velocity increases with depth
- Layer boundaries horizontal

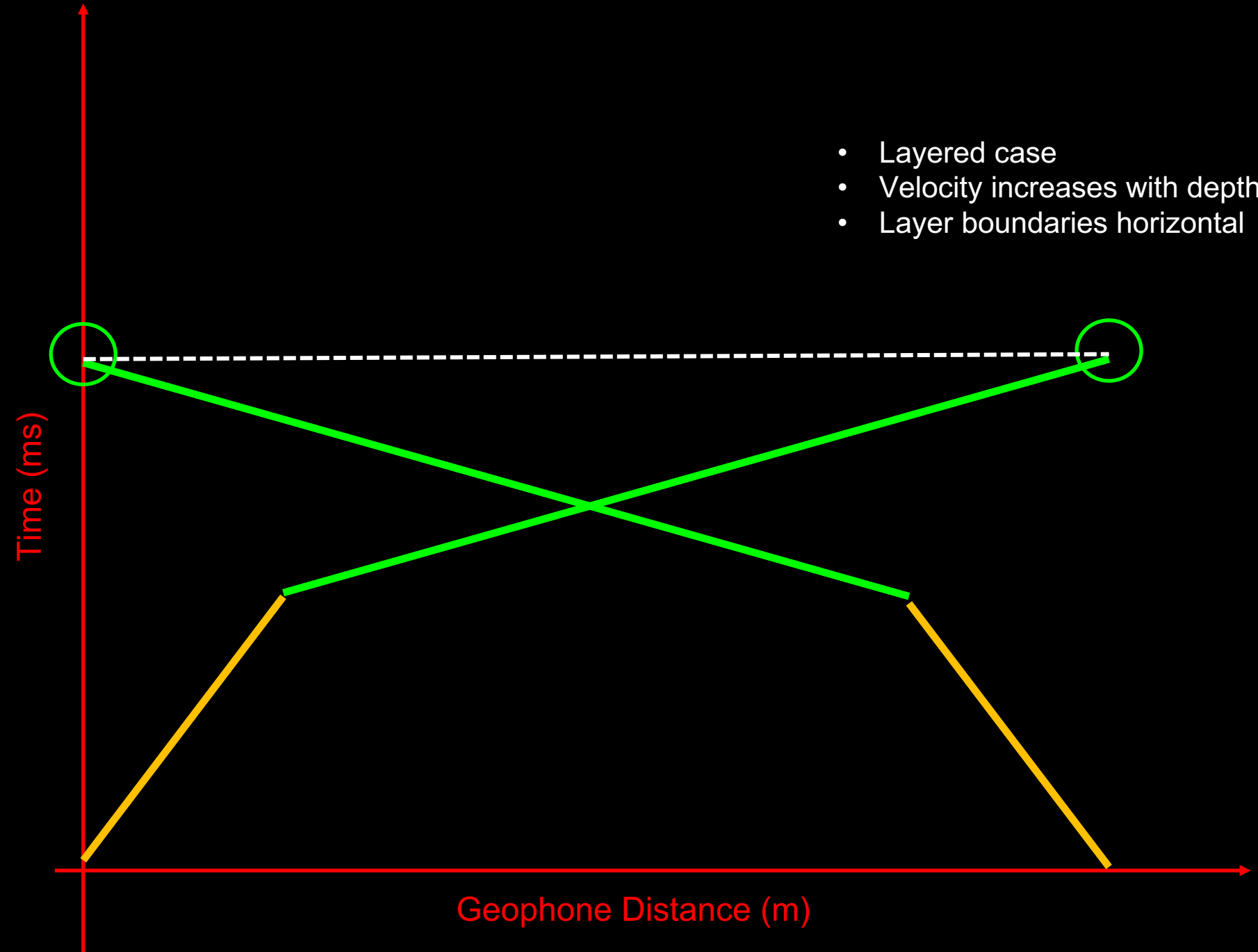




Consistency Criteria

- Layered case
- Velocity increases with depth
- Layer boundaries horizontal

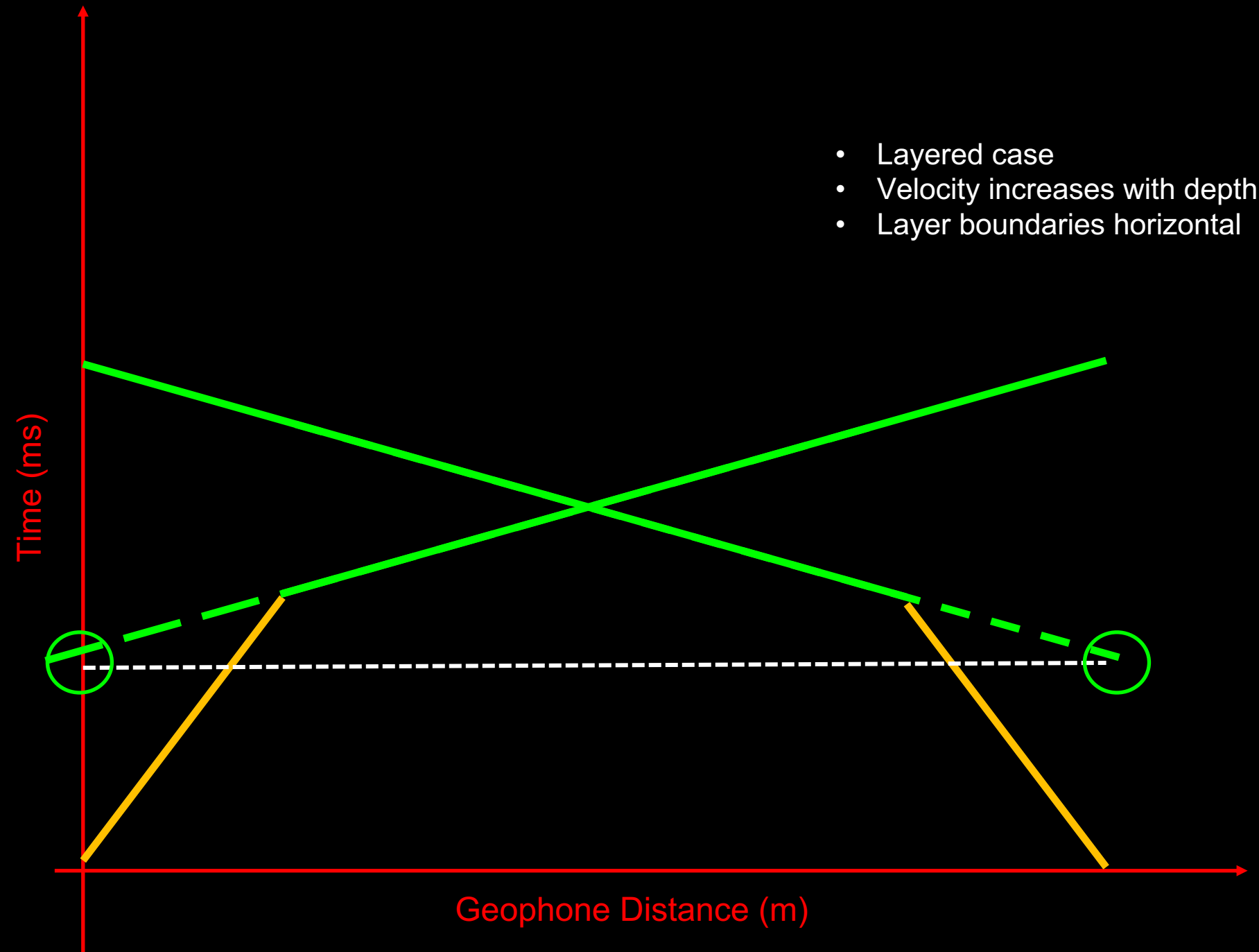
- Reciprocal times must be equal
(their interpretation may differ)





Consistency Criteria

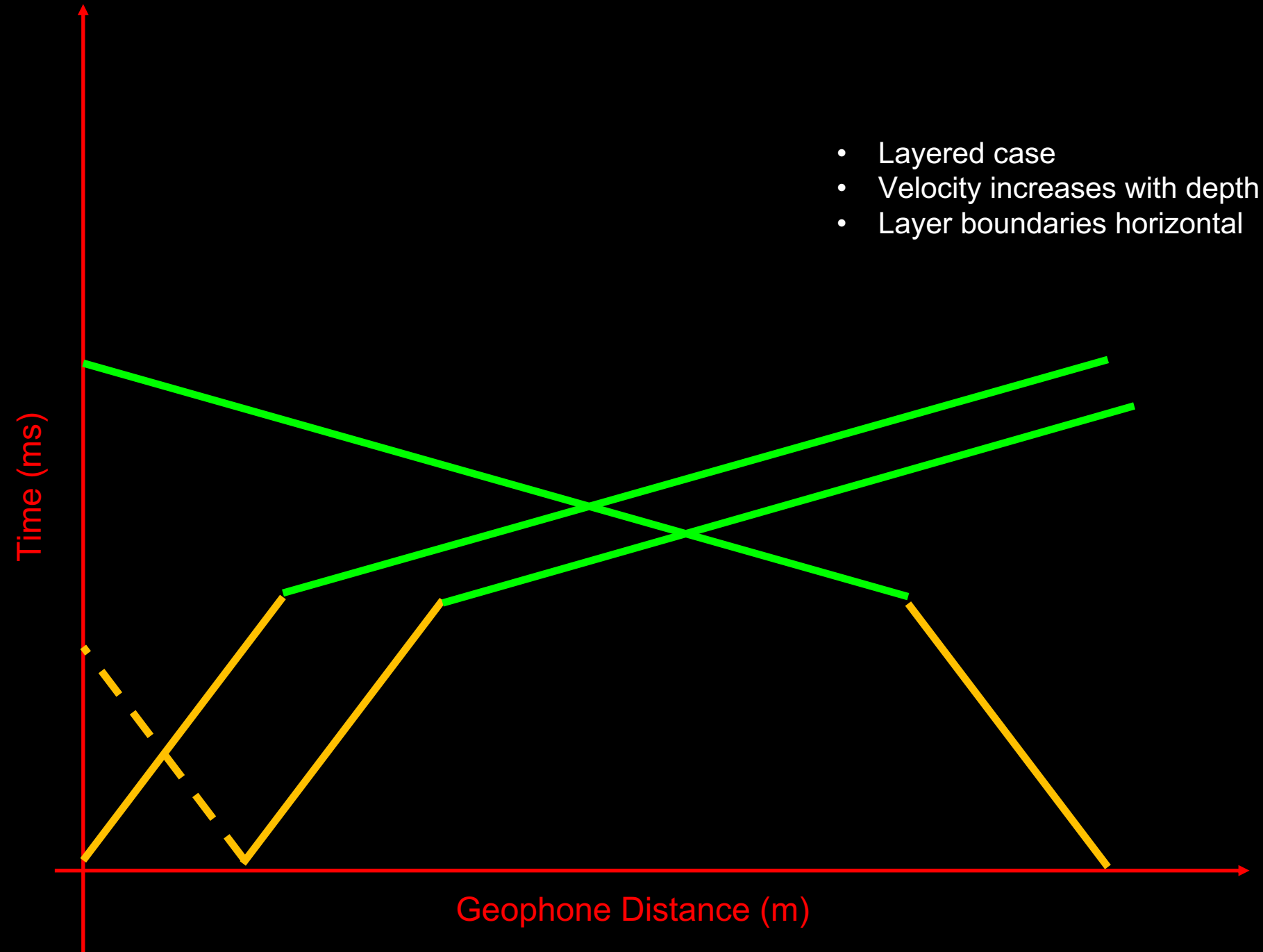
- Reciprocal times must be equal (their interpretation may differ)
- Intercept times are the same for horizontal case





Consistency Criteria

- Reciprocal times must be equal (their interpretation may differ)
- Intercept times are the same for horizontal case
- Branches of different shot points should be parallel



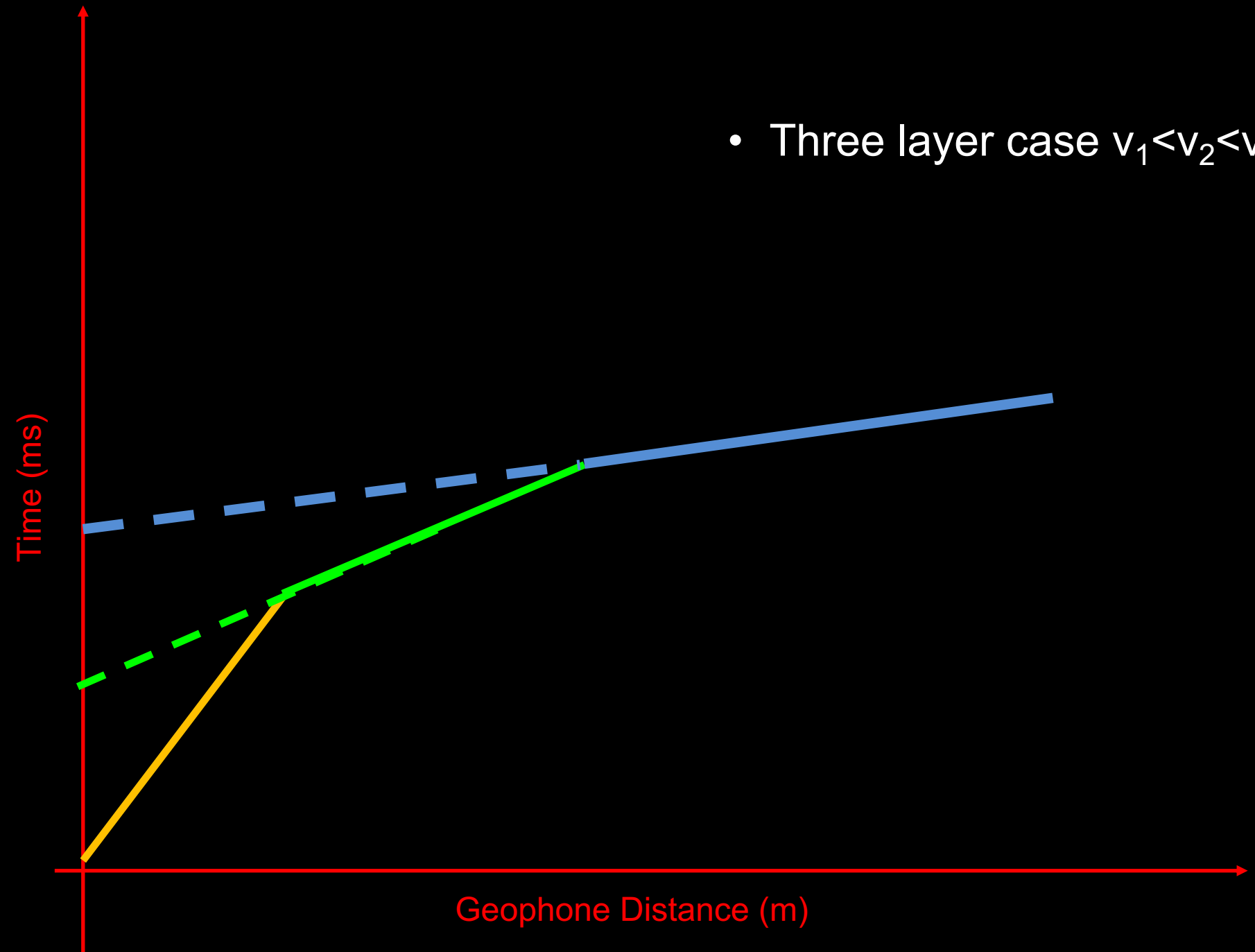


- Consistency criteria for refraction seismics
- Hidden Layers



Case : Thin Layers

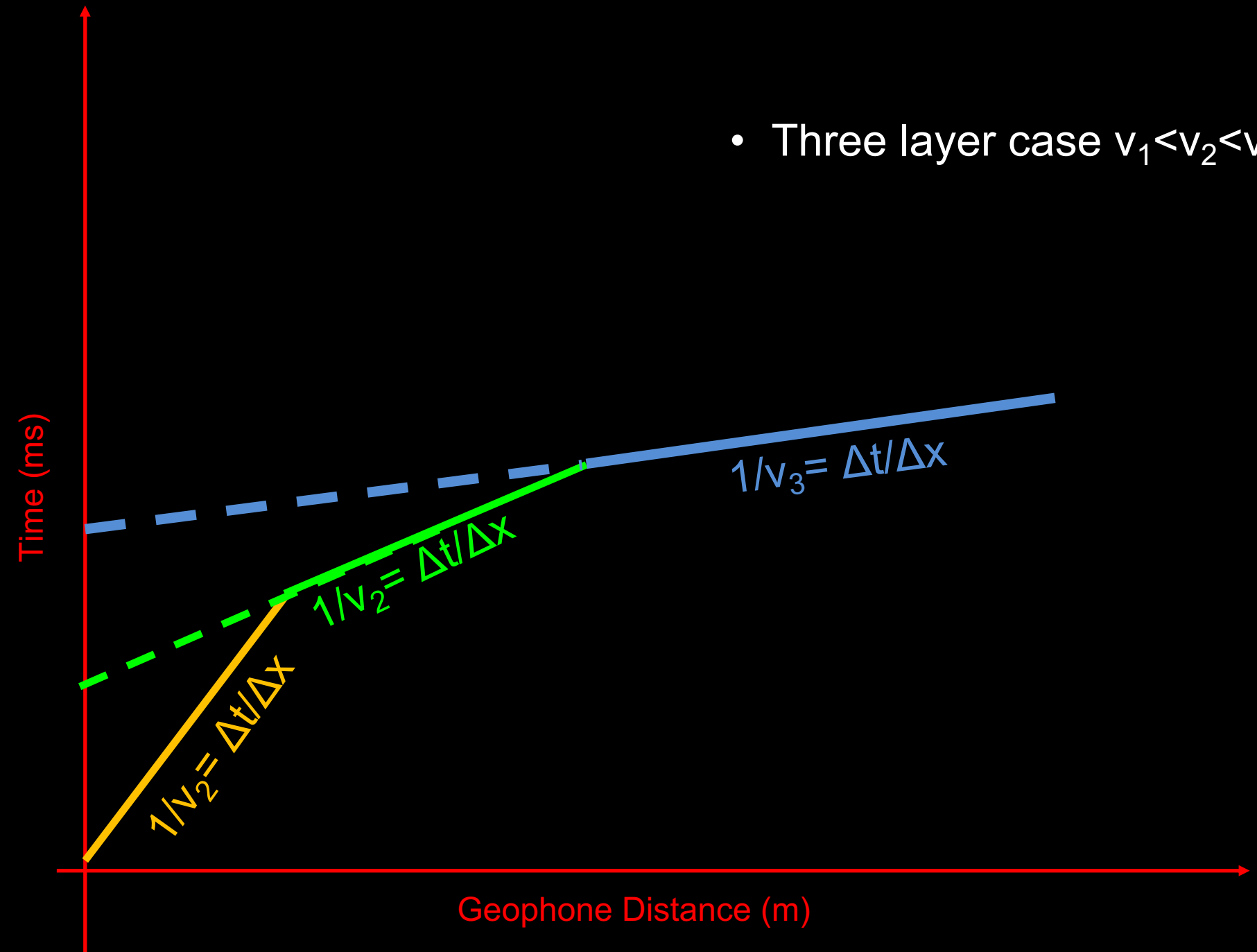
- Three layer case $v_1 < v_2 < v_3$





Case : Thin Layers

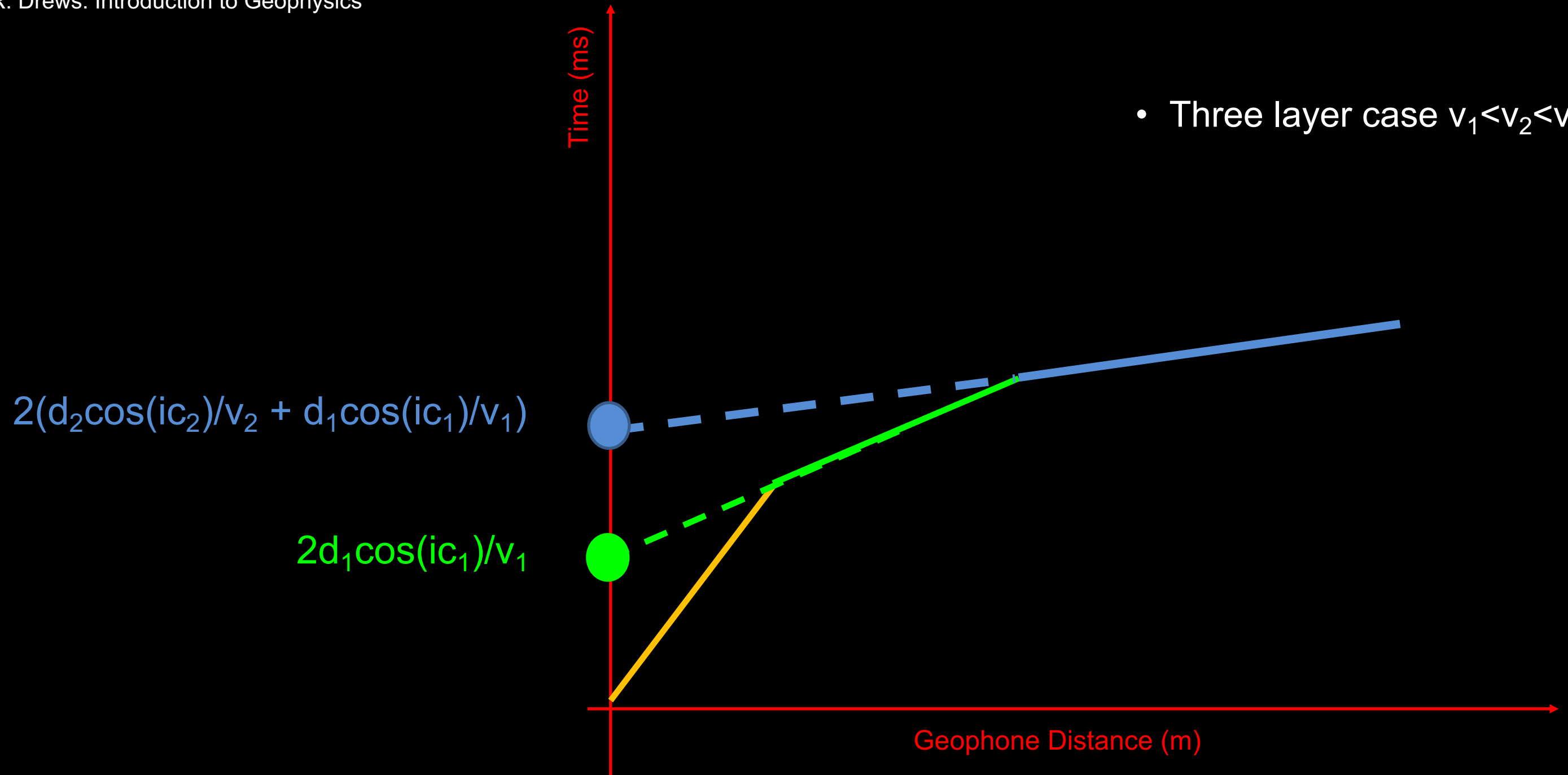
- Three layer case $v_1 < v_2 < v_3$





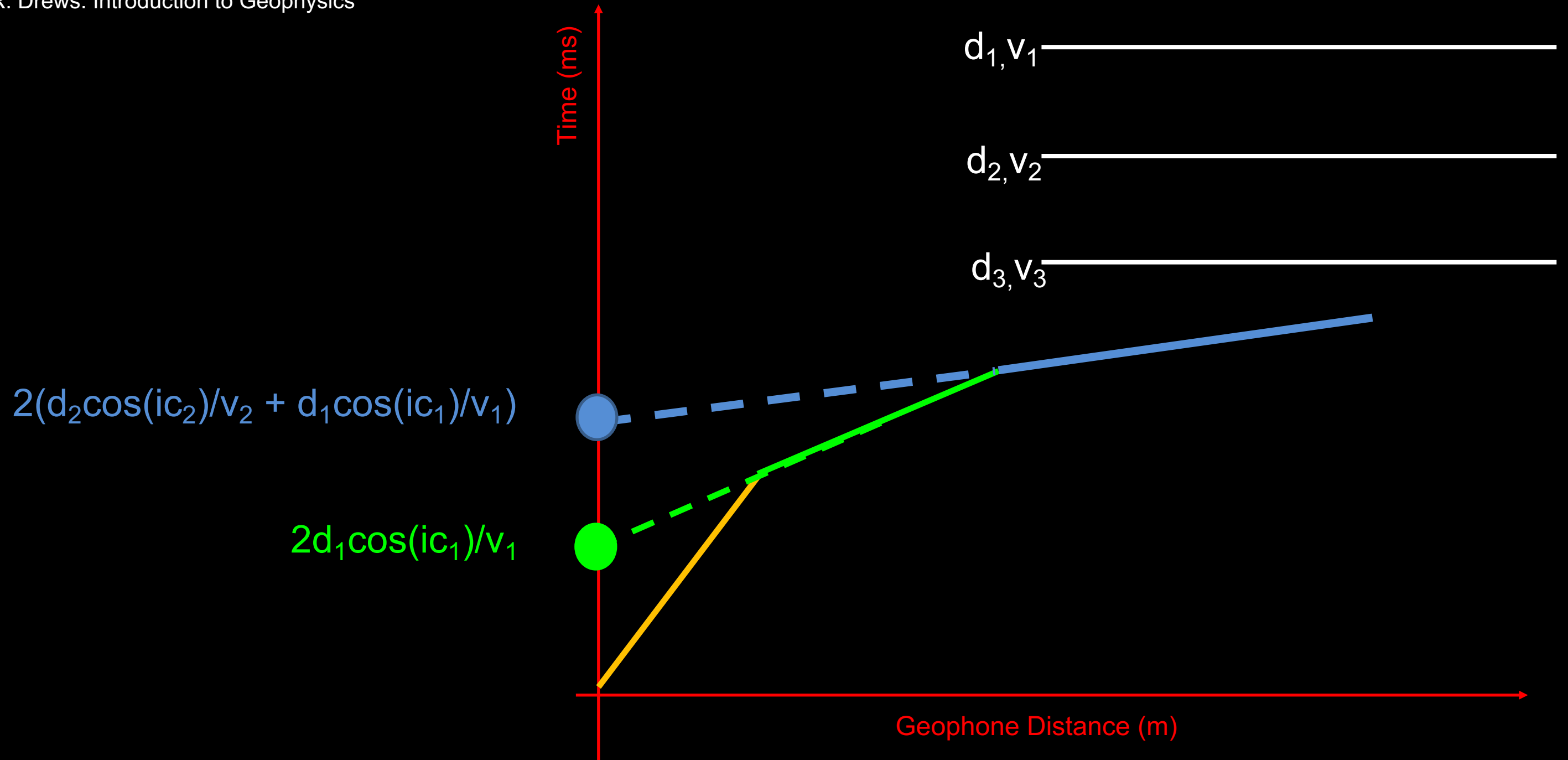
Case : Thin Layers

- Three layer case $v_1 < v_2 < v_3$



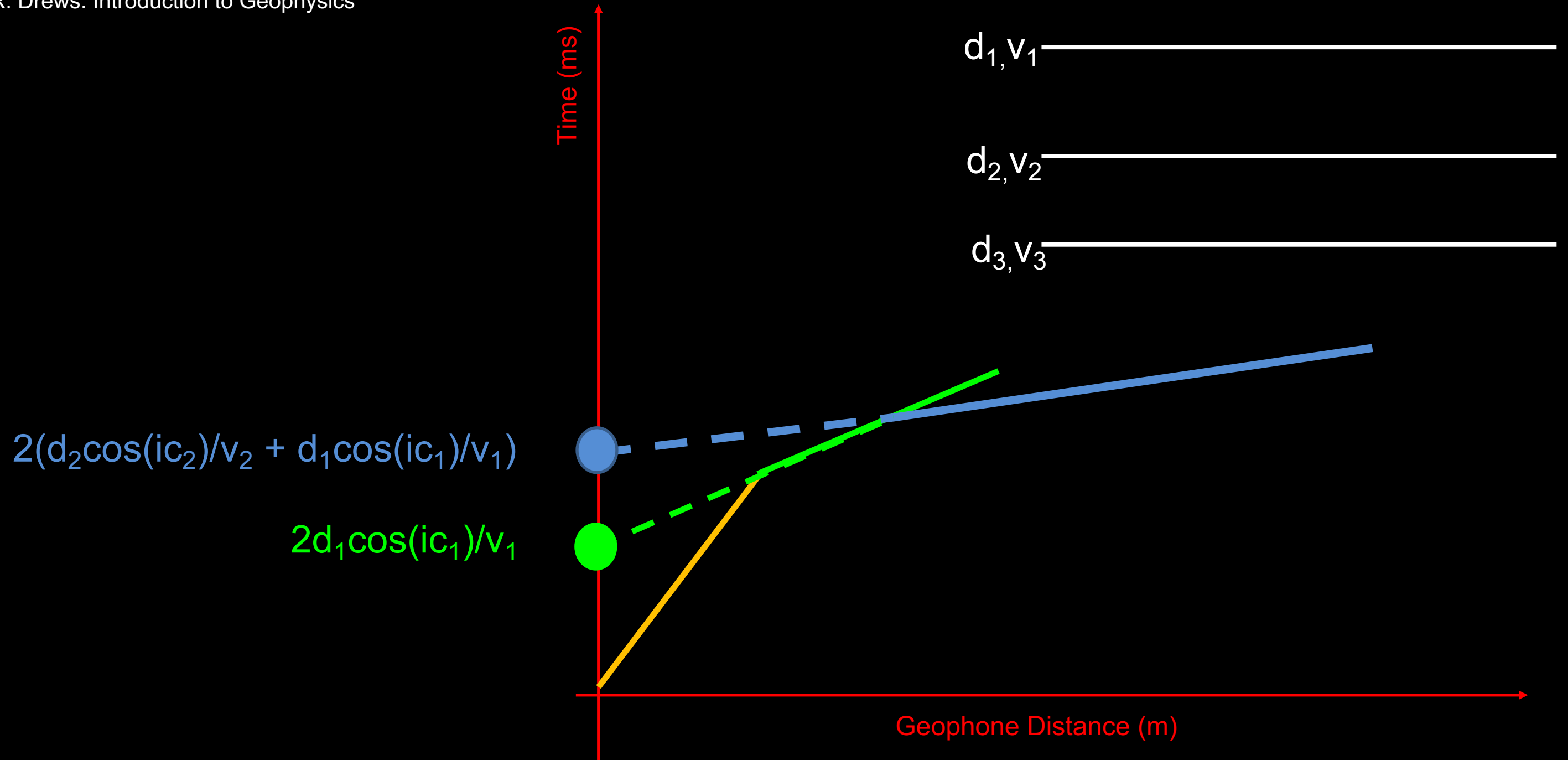


Case : Thin Layers



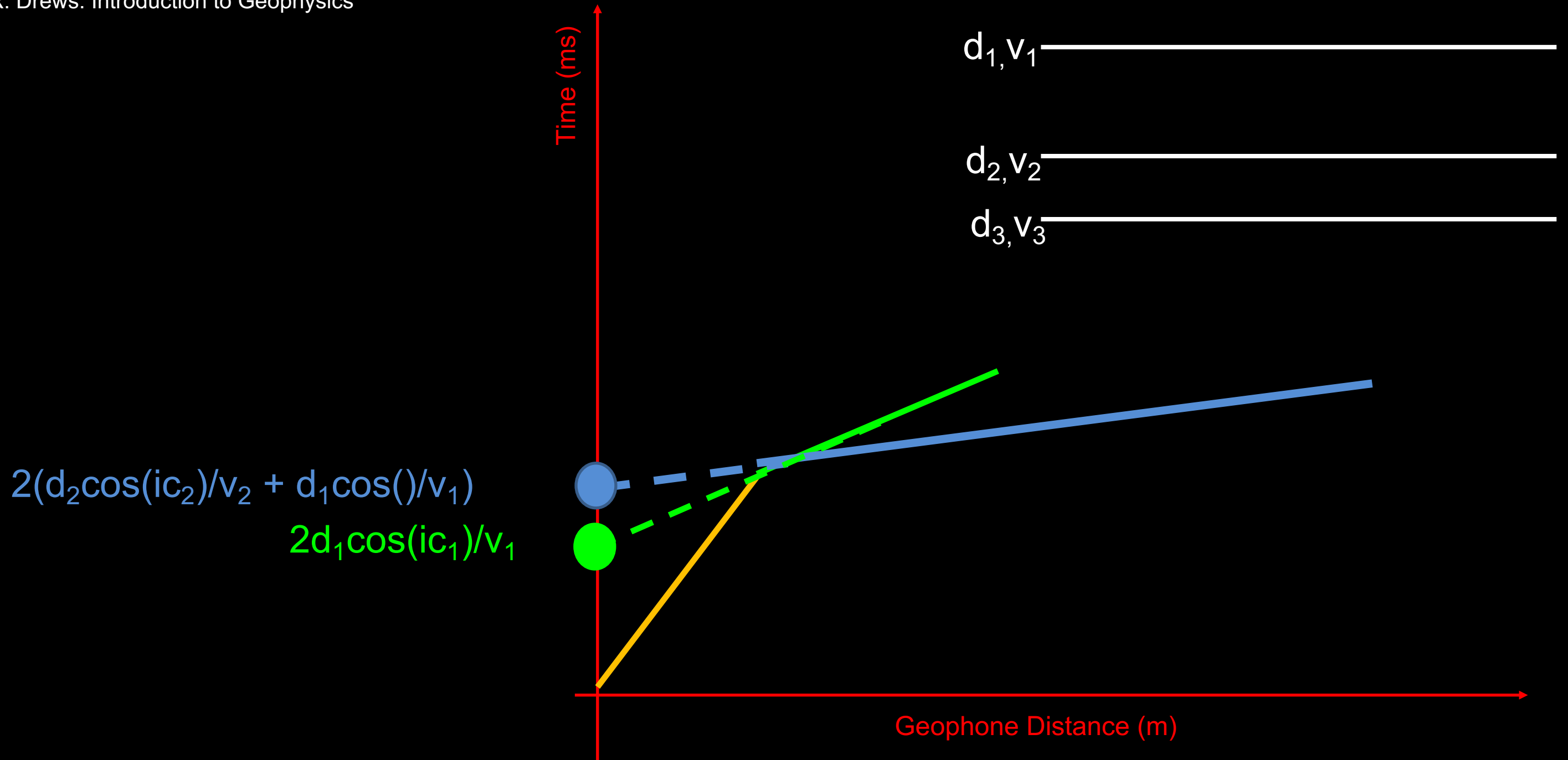


Case : Thin Layers





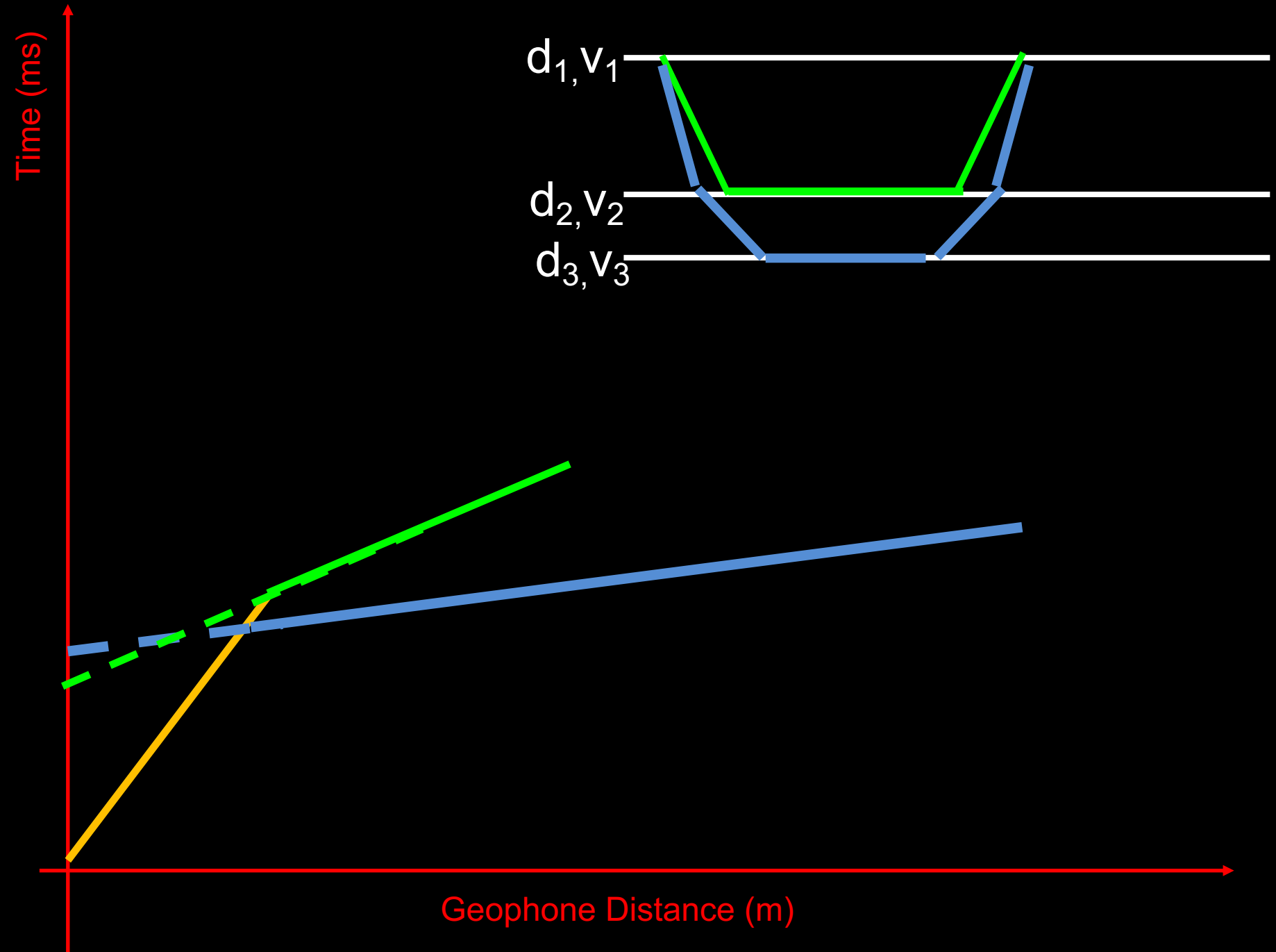
Case : Thin Layers





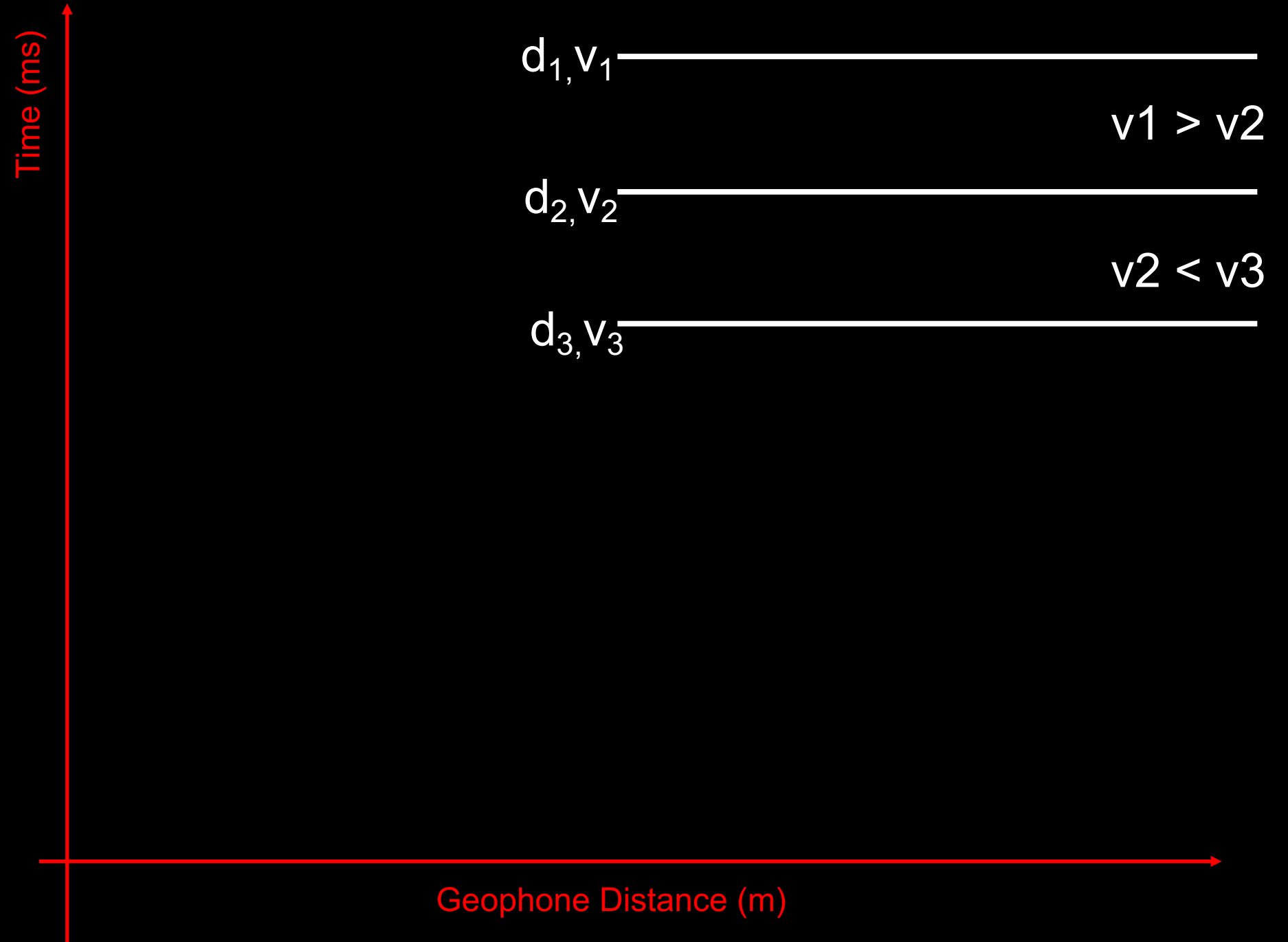
Case : Thin Layers

- Head waves are initiated at all boundaries, but headwave of thin layer does not appear as first arrival.
- Thin layers are hidden in the analysis. Effect depends on thickness and velocities.



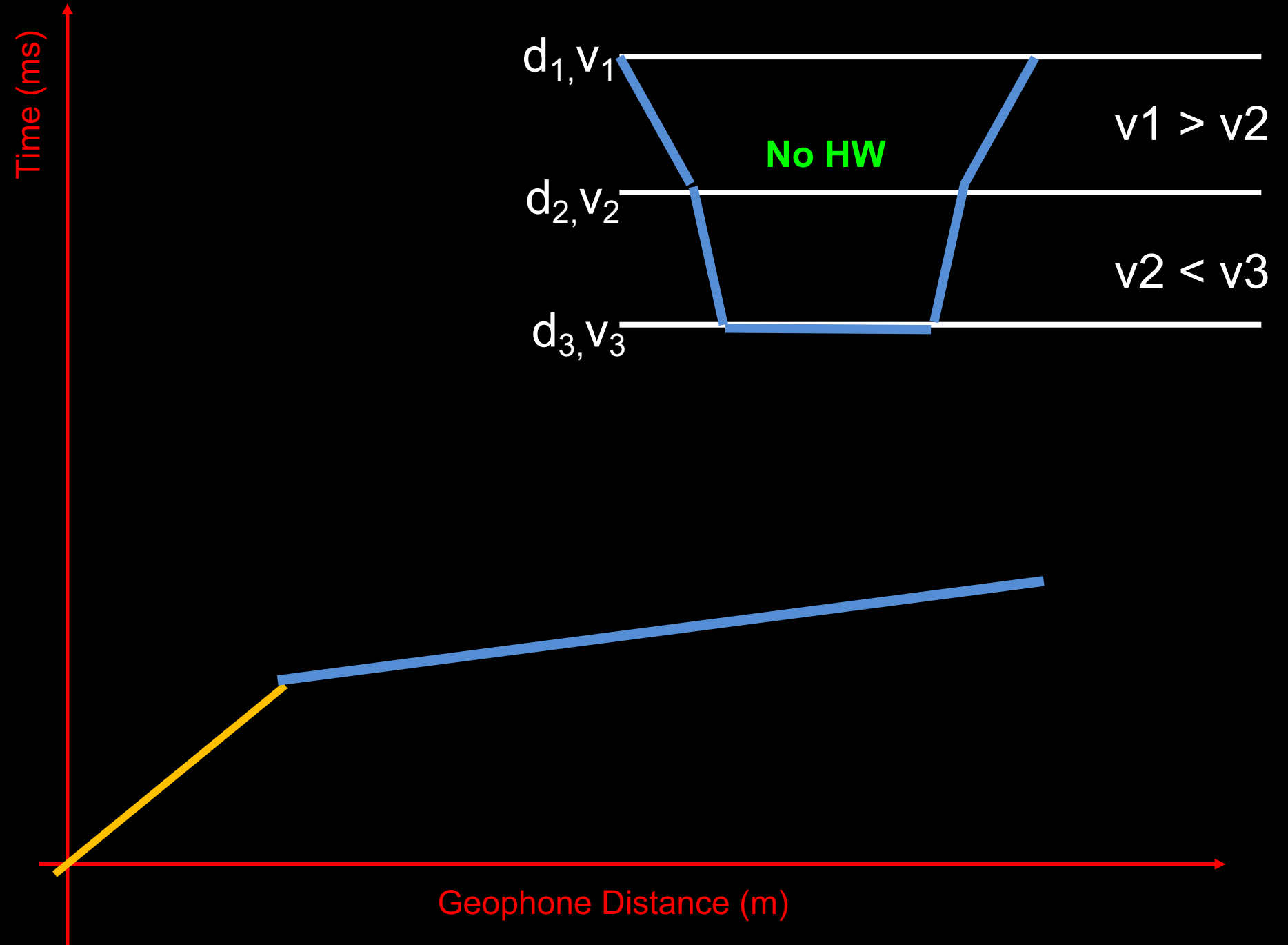


Case 2: Sandwich velocities

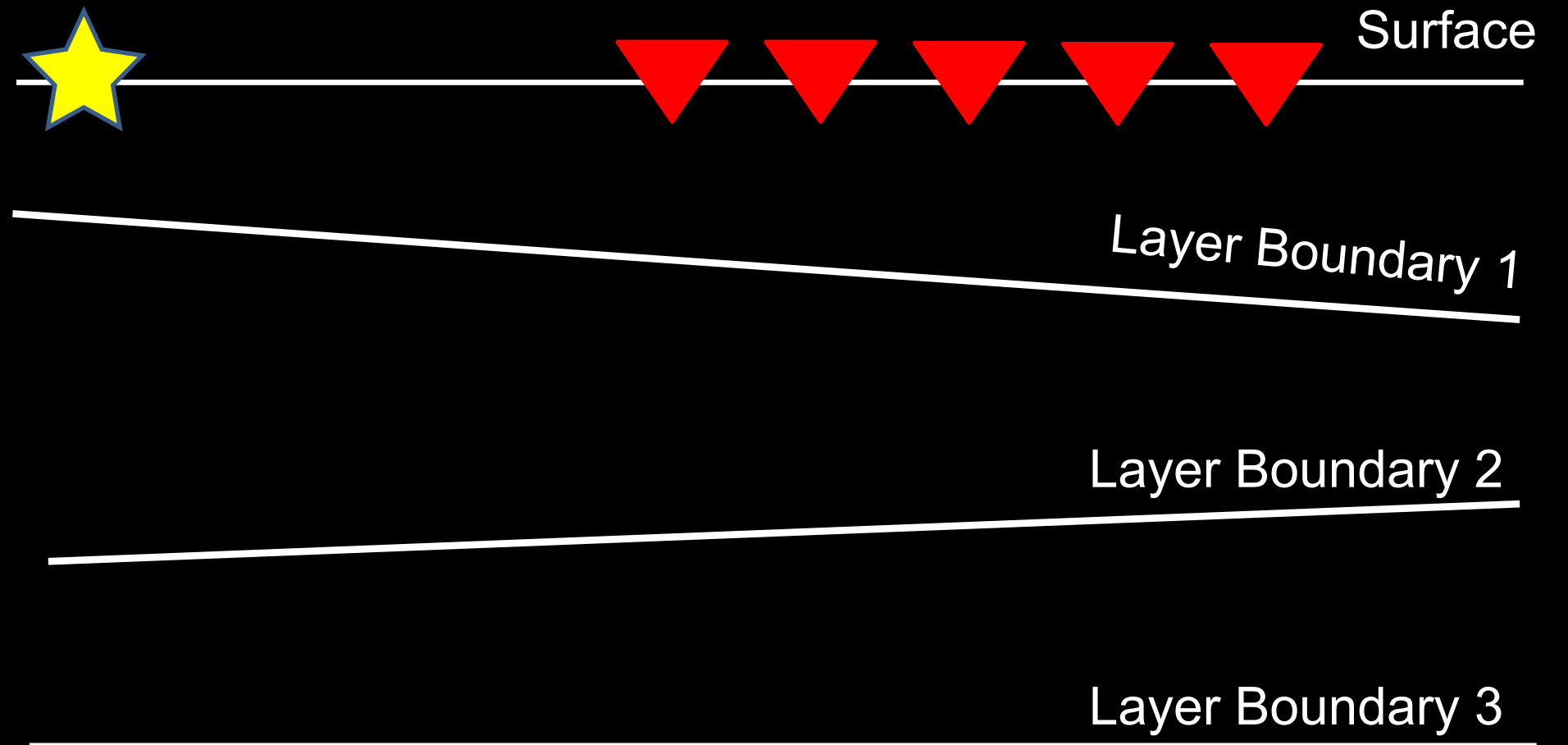


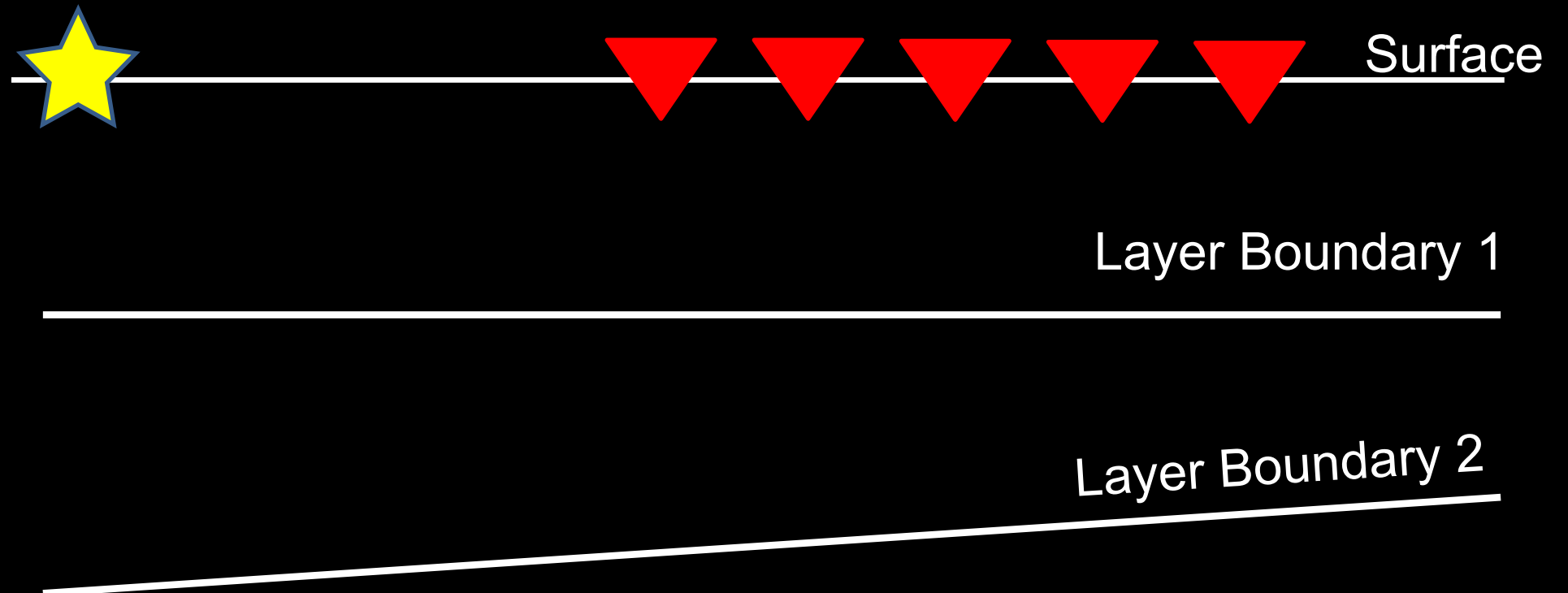


Case 2: Sandwich velocities



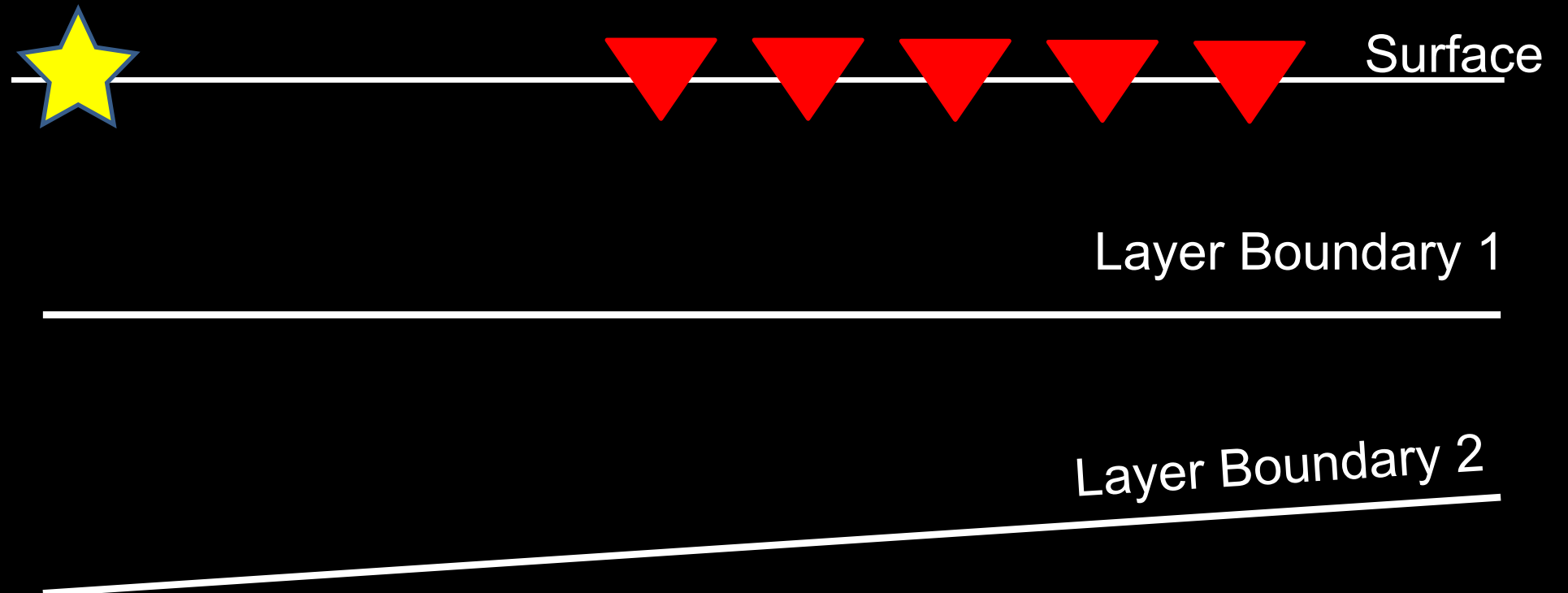
- A high velocity layer prevents formation of HW.
- Intermediate interface remains hidden
- Inferred depth to third interface will be too deep (b/c high-velocity zone above).





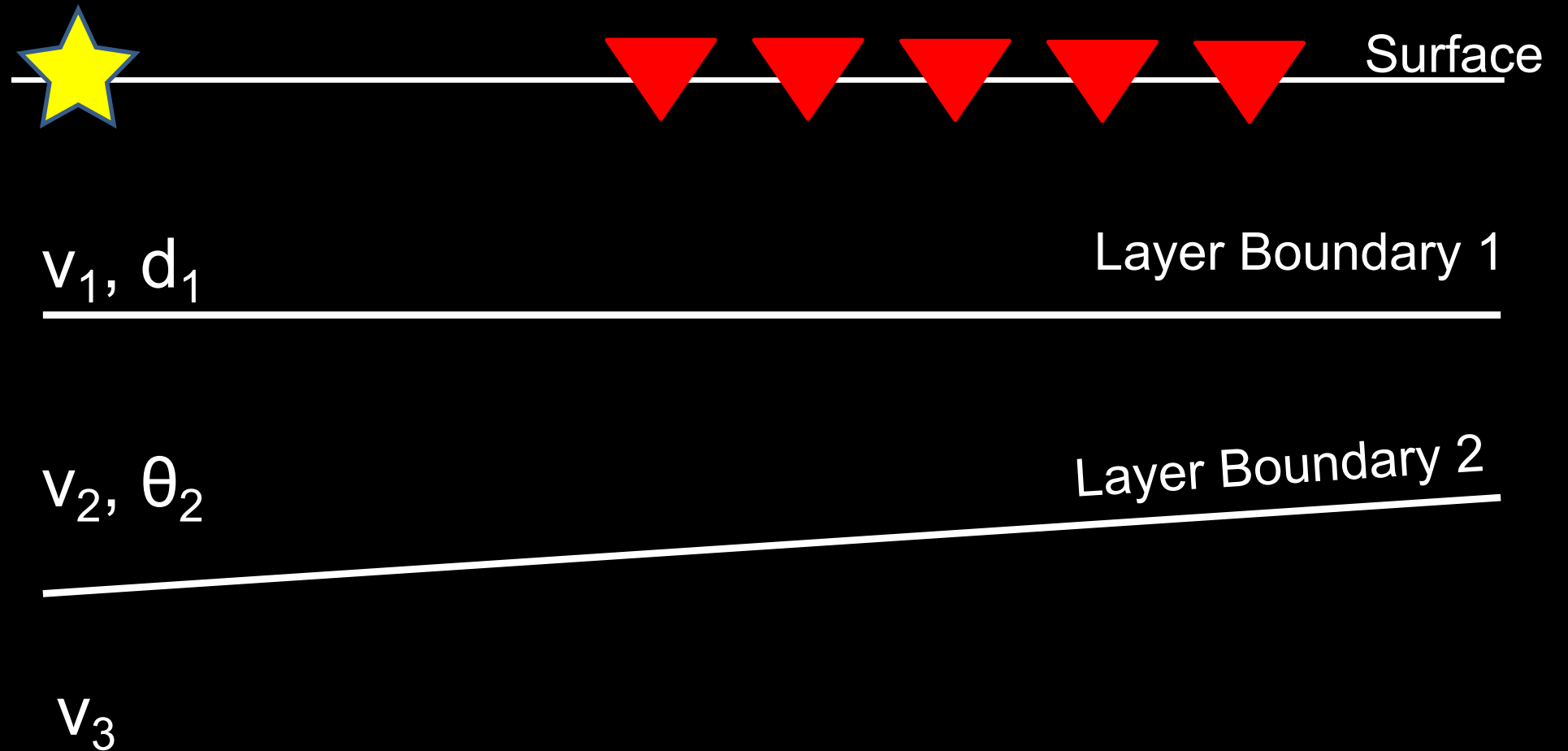


How many and which parameters are needed to predict traveltimes at geophones?



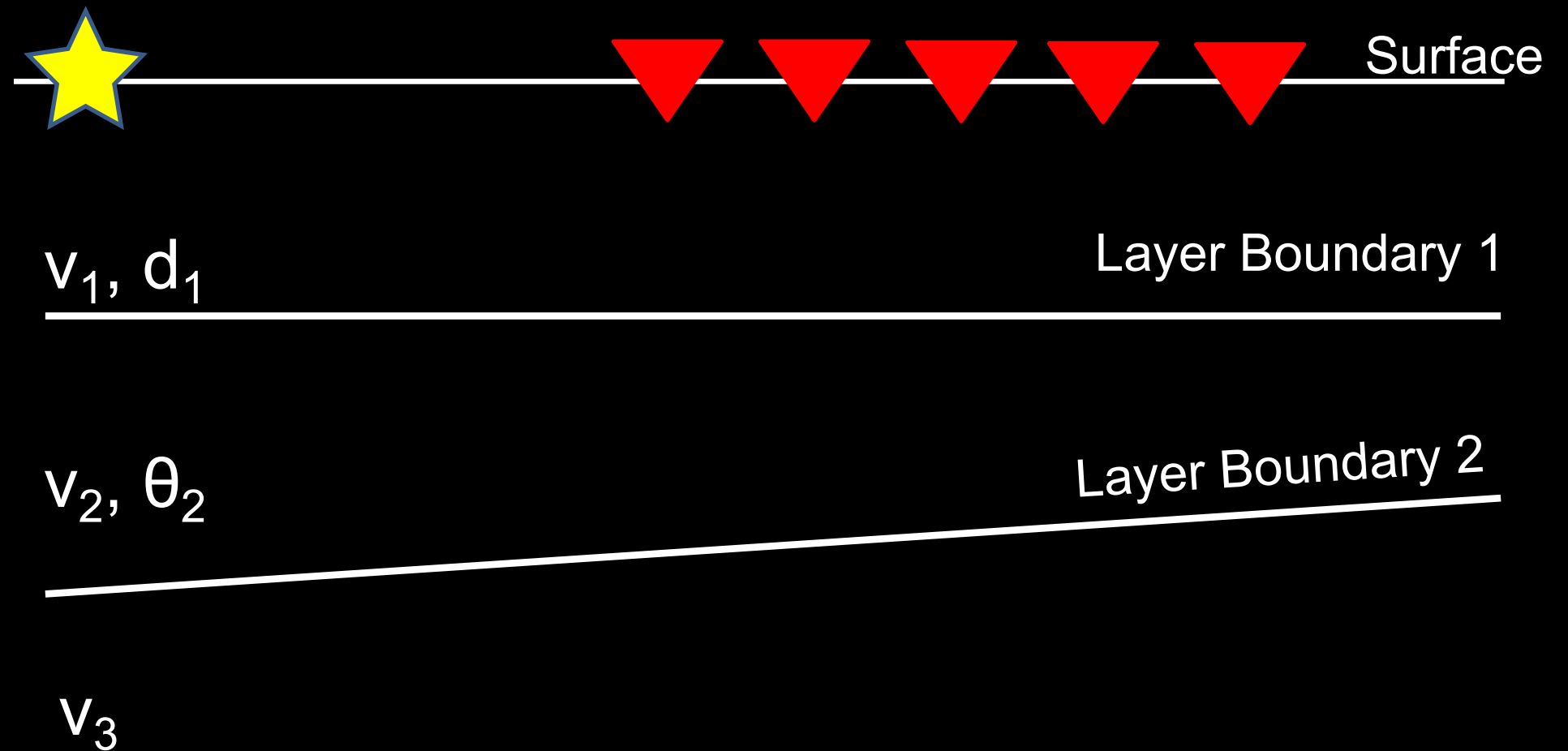


5 parameters are needed.



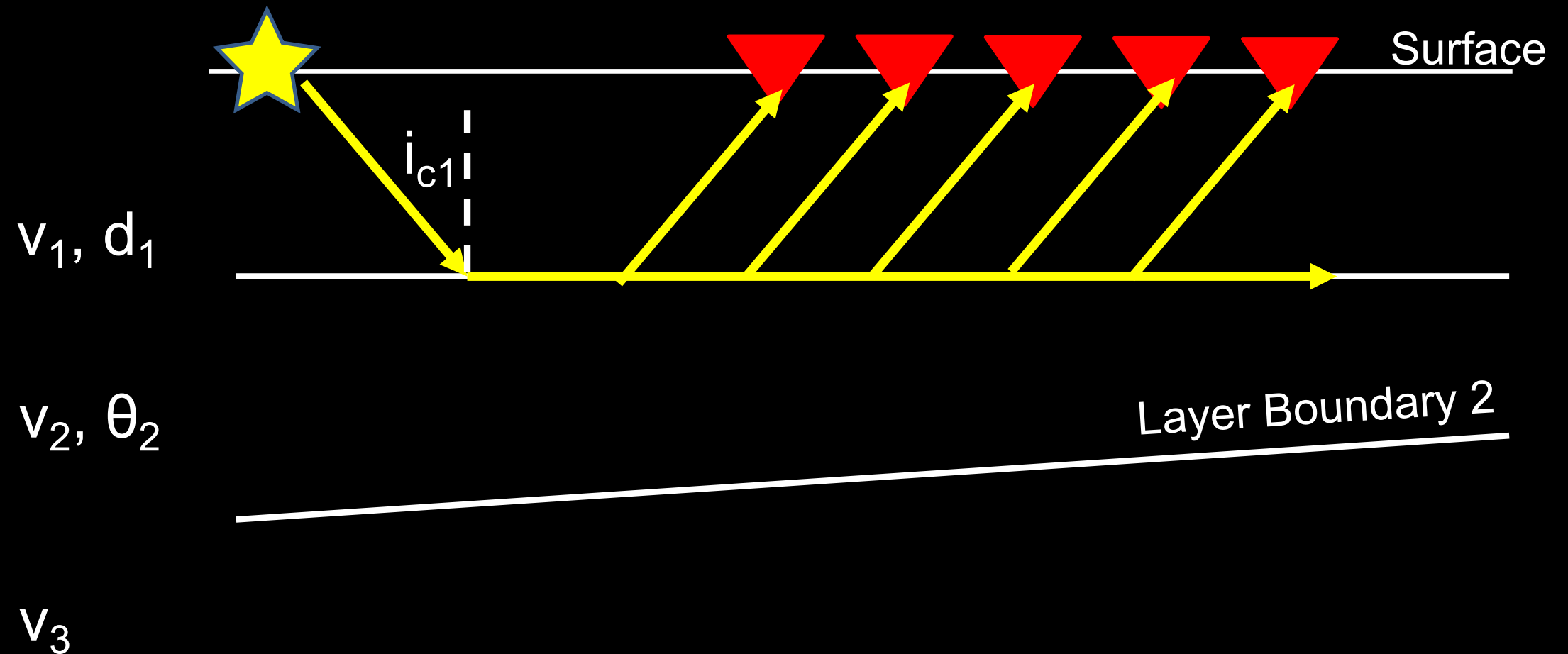


What would the forward model look like?



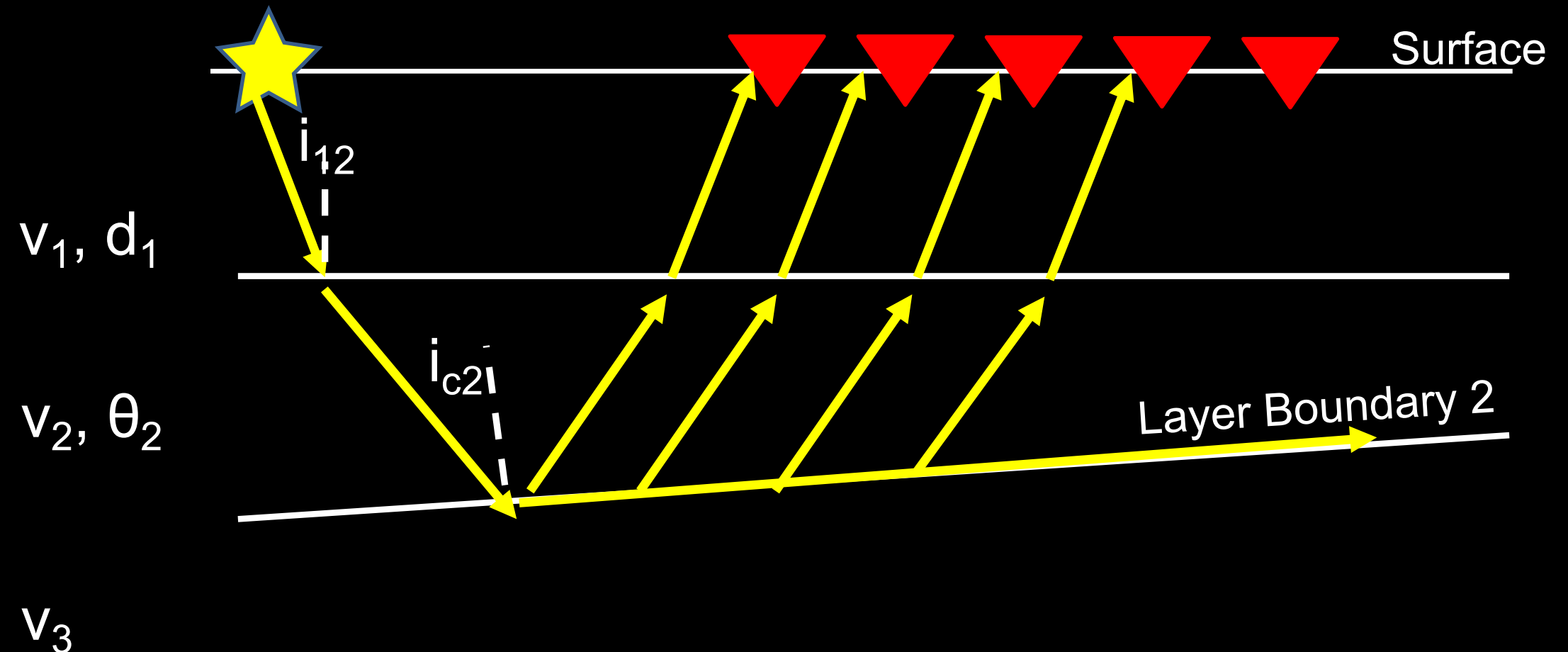


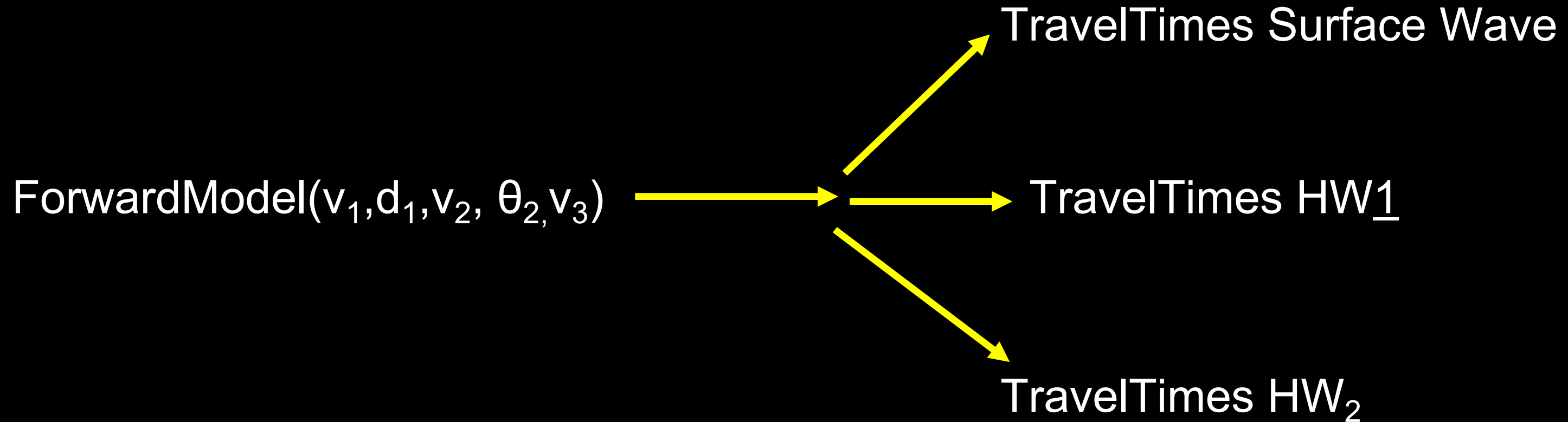
Use Snell's law for raypath geometry. Calculate traveltimes.

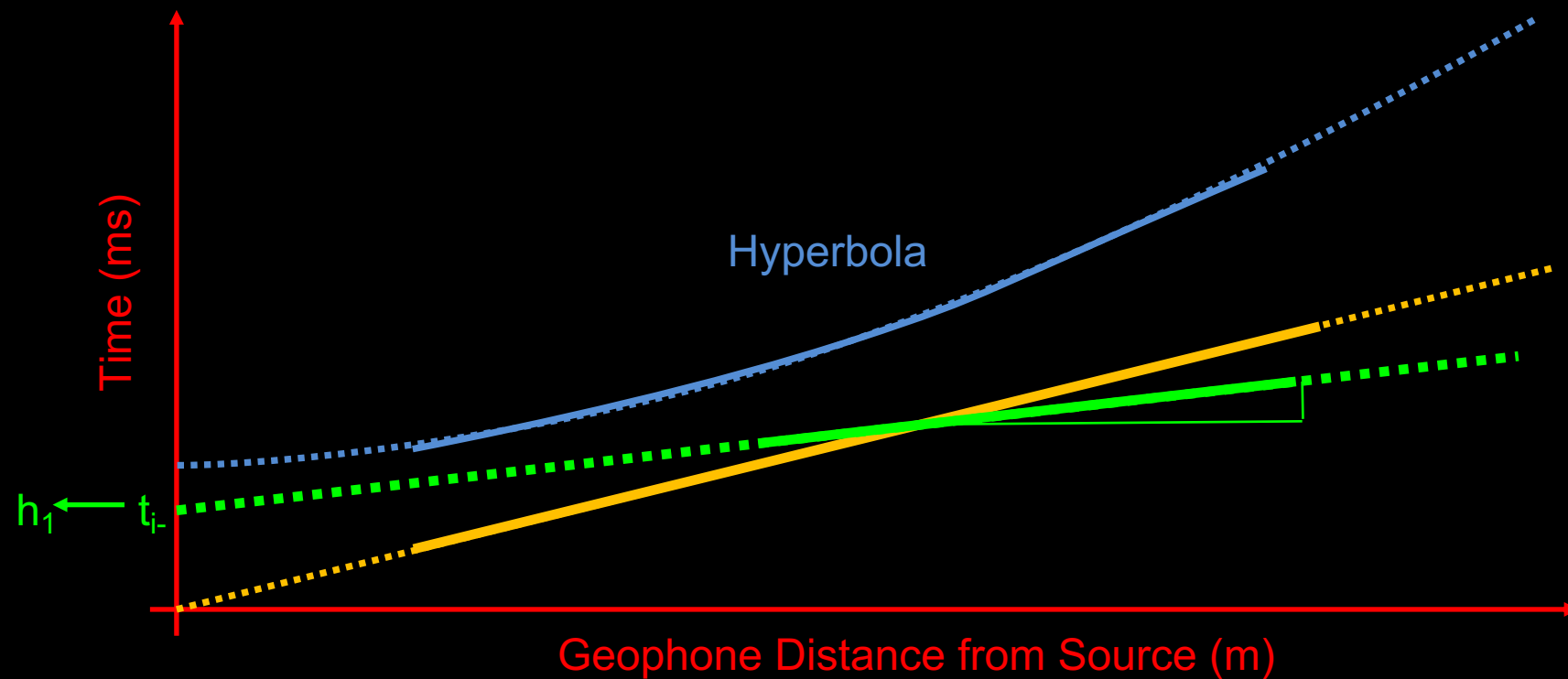
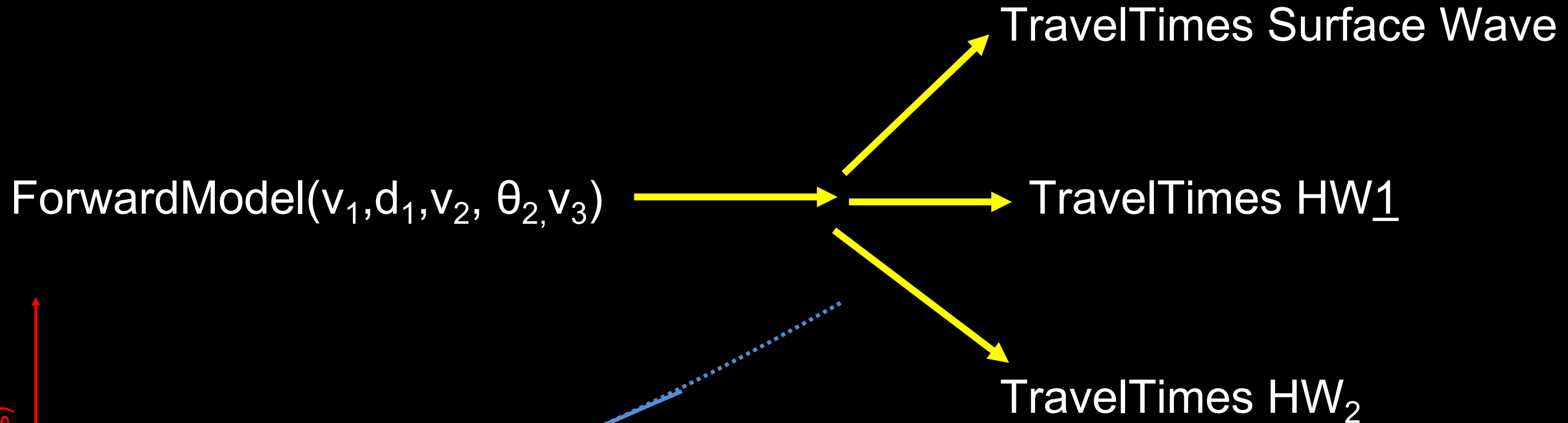




Use Snell's law for raypath geometry. Calculate traveltimes.

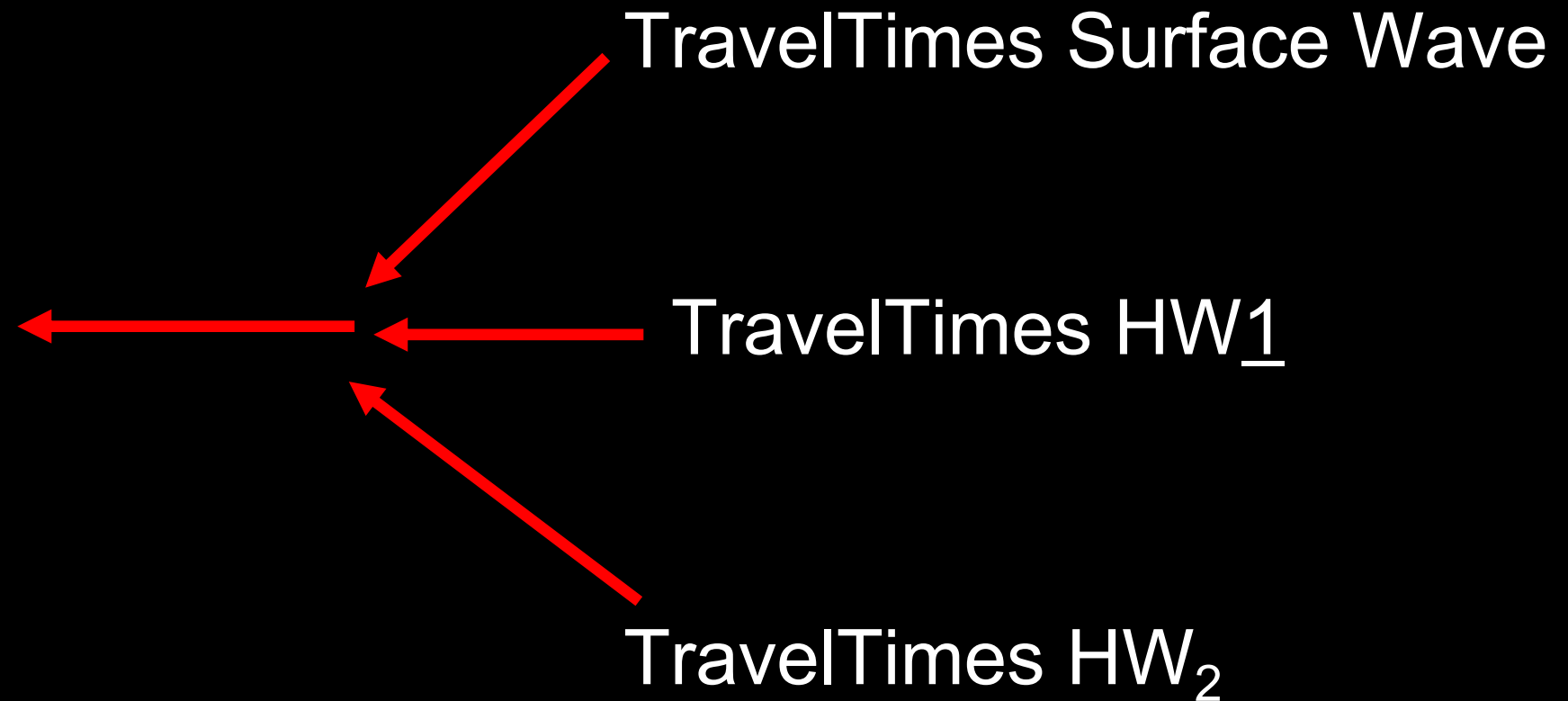


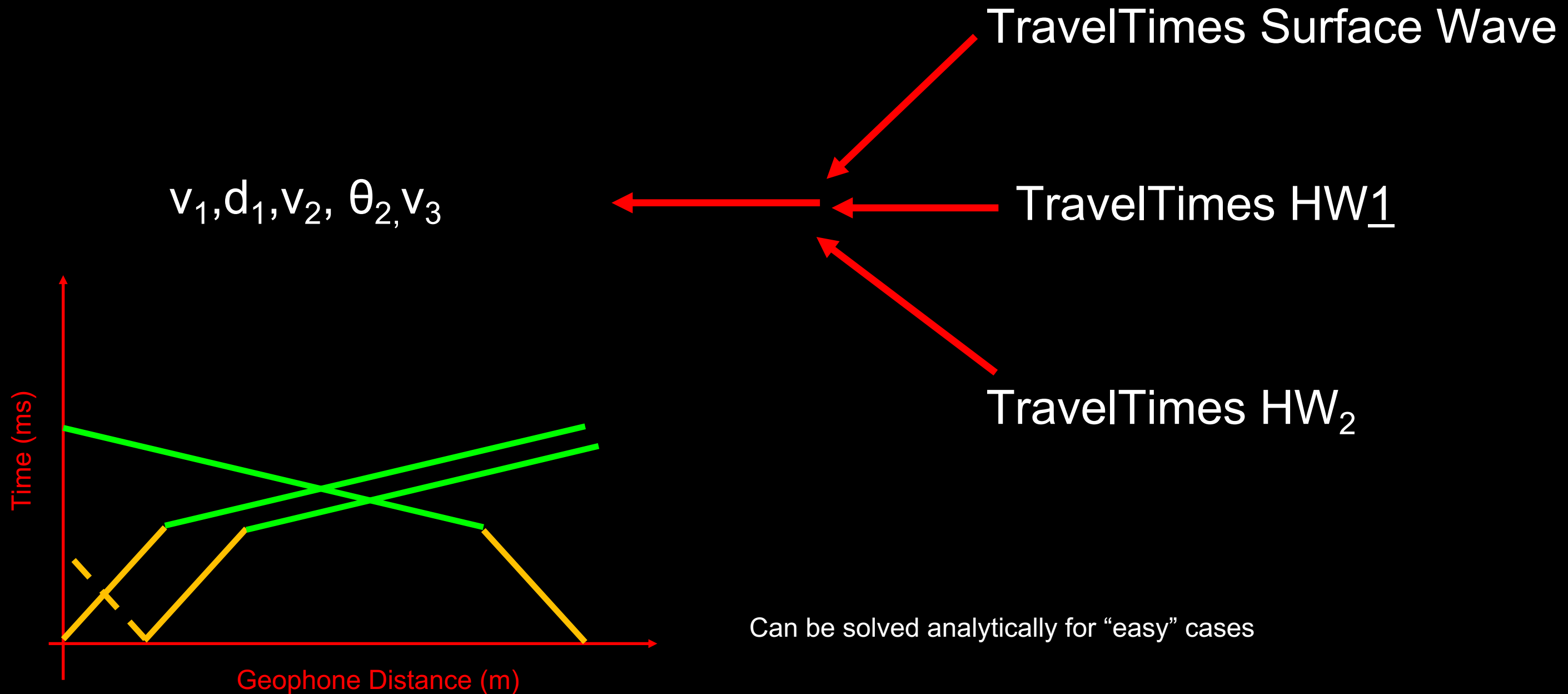






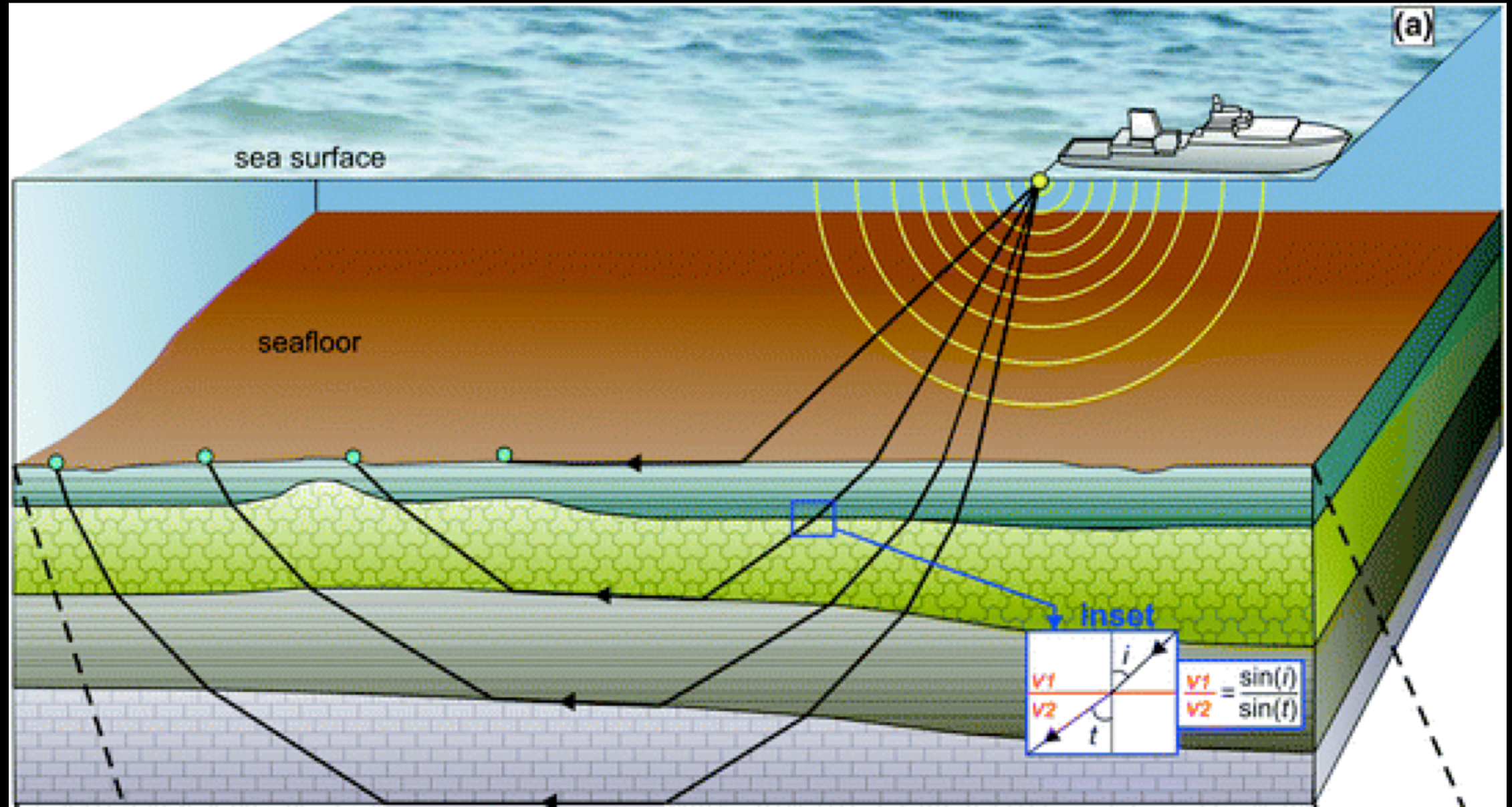
$v_1, d_1, v_2, \theta_2, v_3$







- More complicated geometries

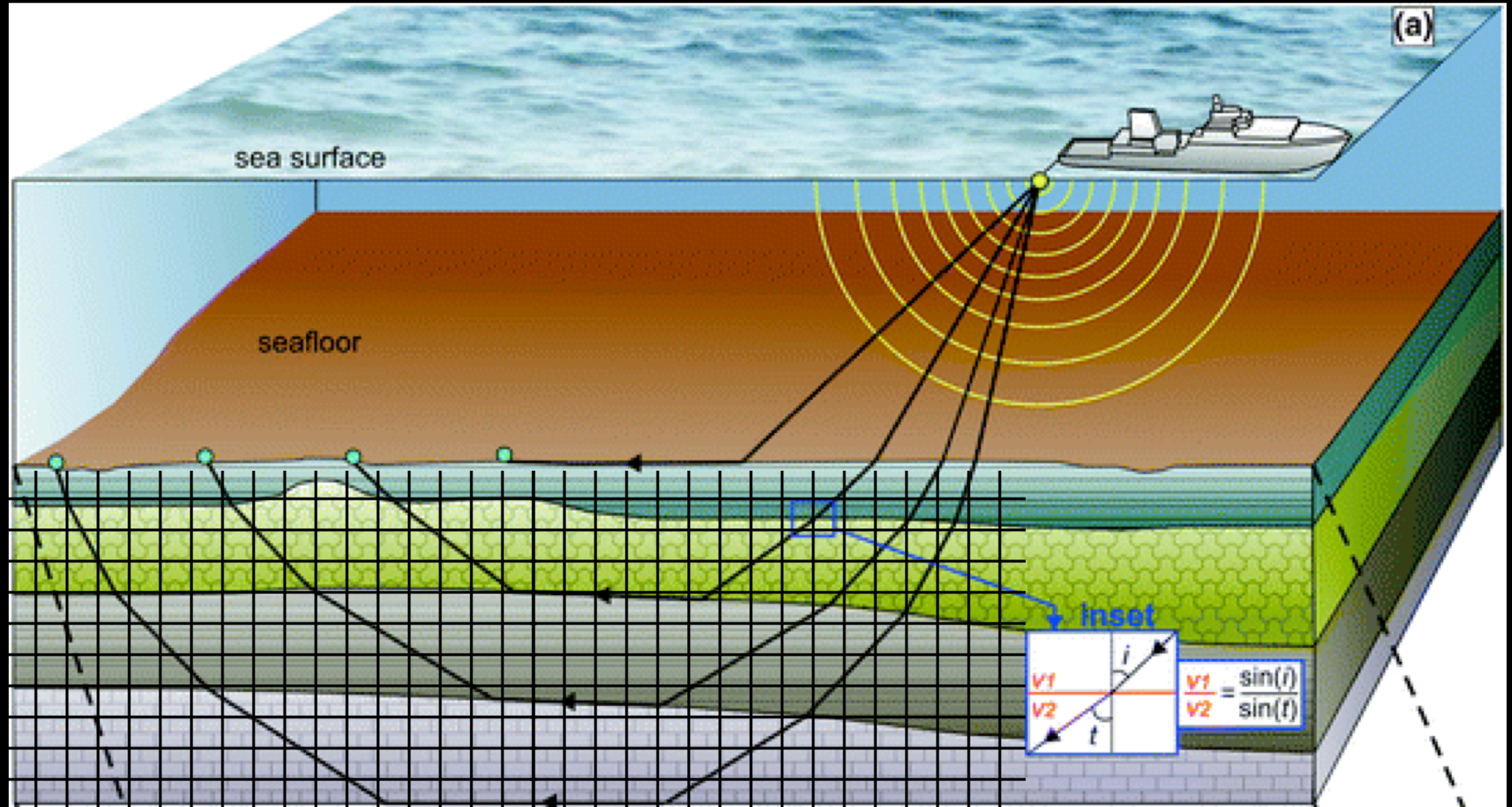


What are the
model
parameters?



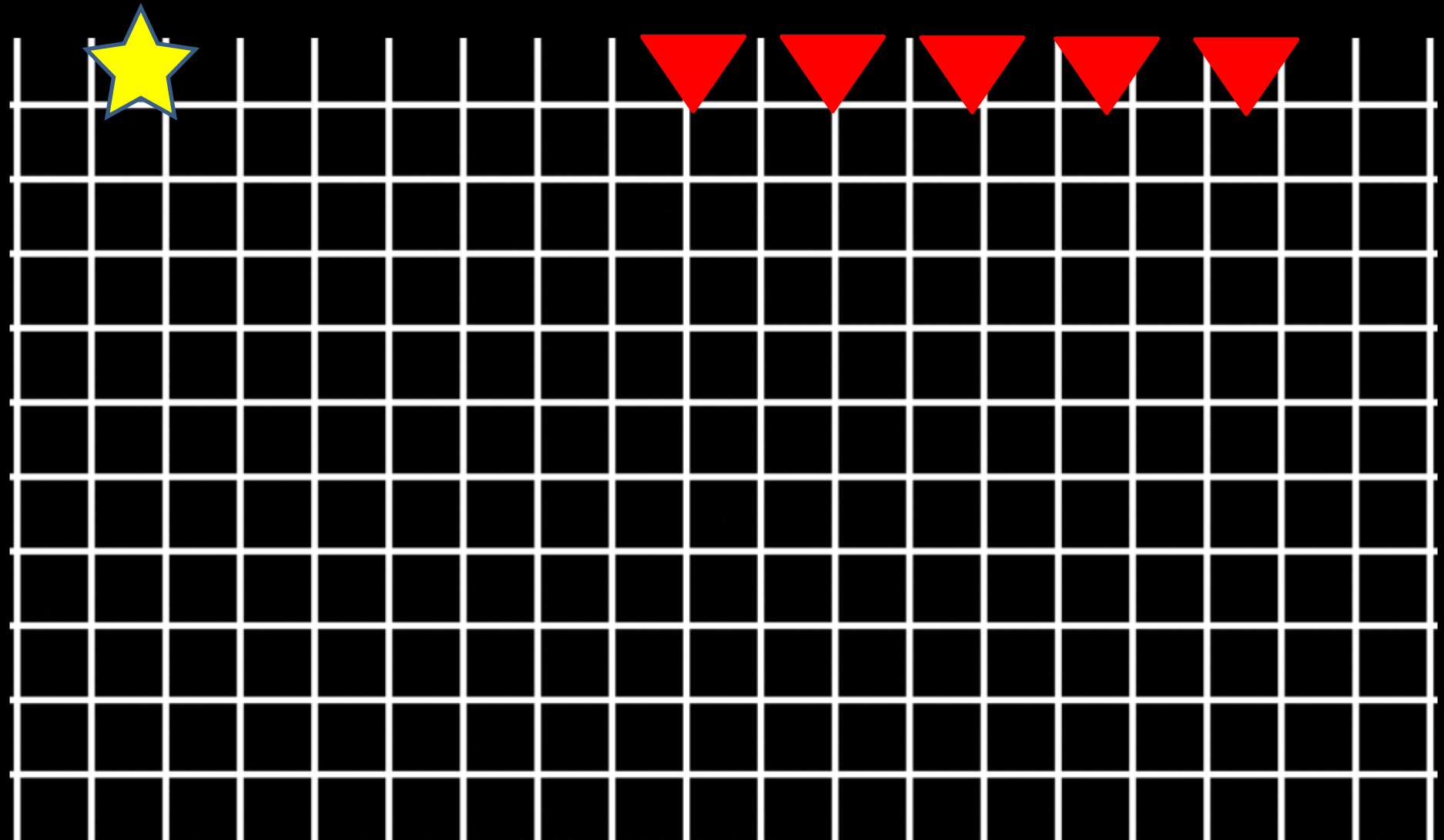
- More complicated geometries

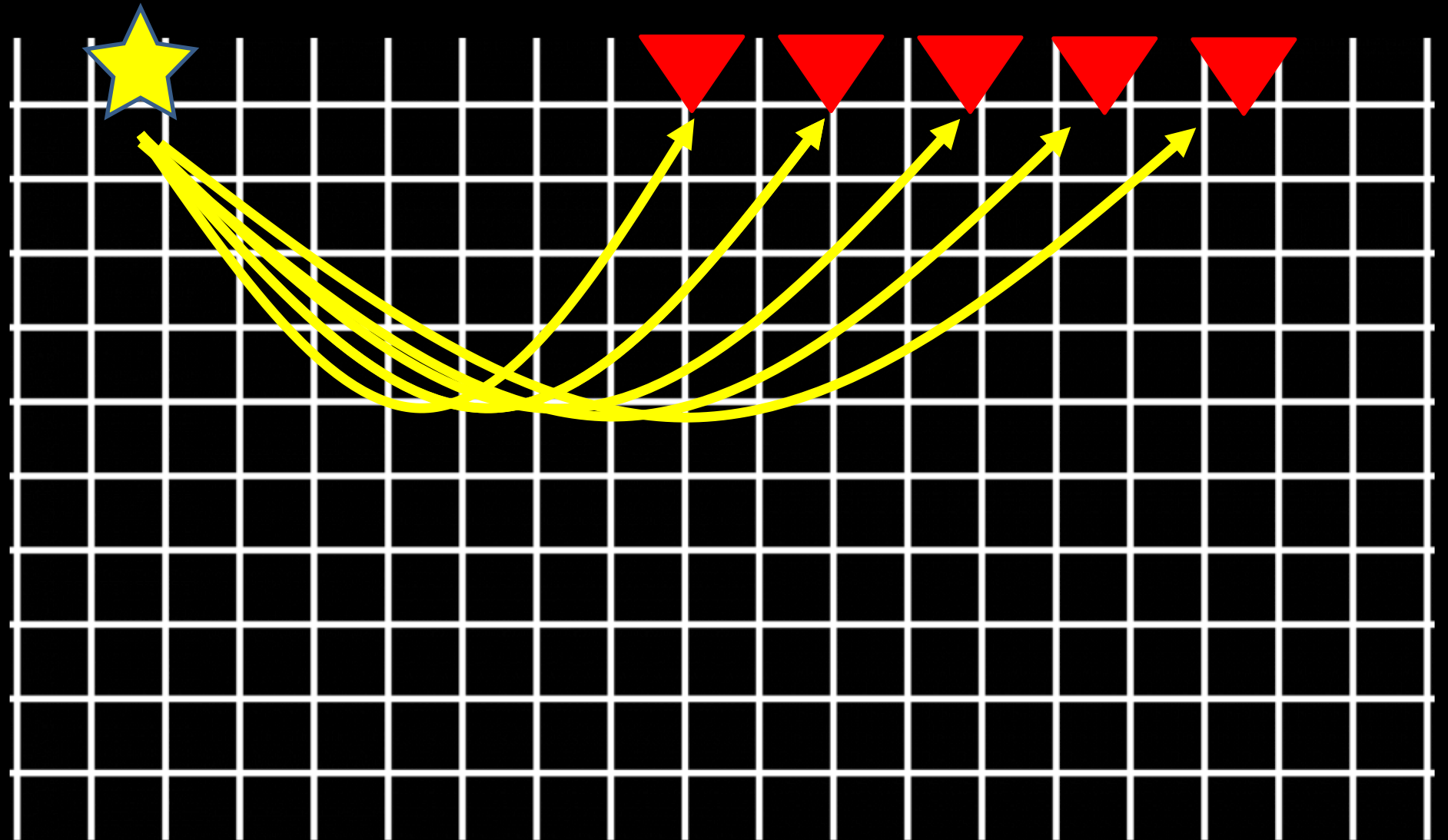
Subdivision into
 $N \times M$ cells of
unknown
velocities.



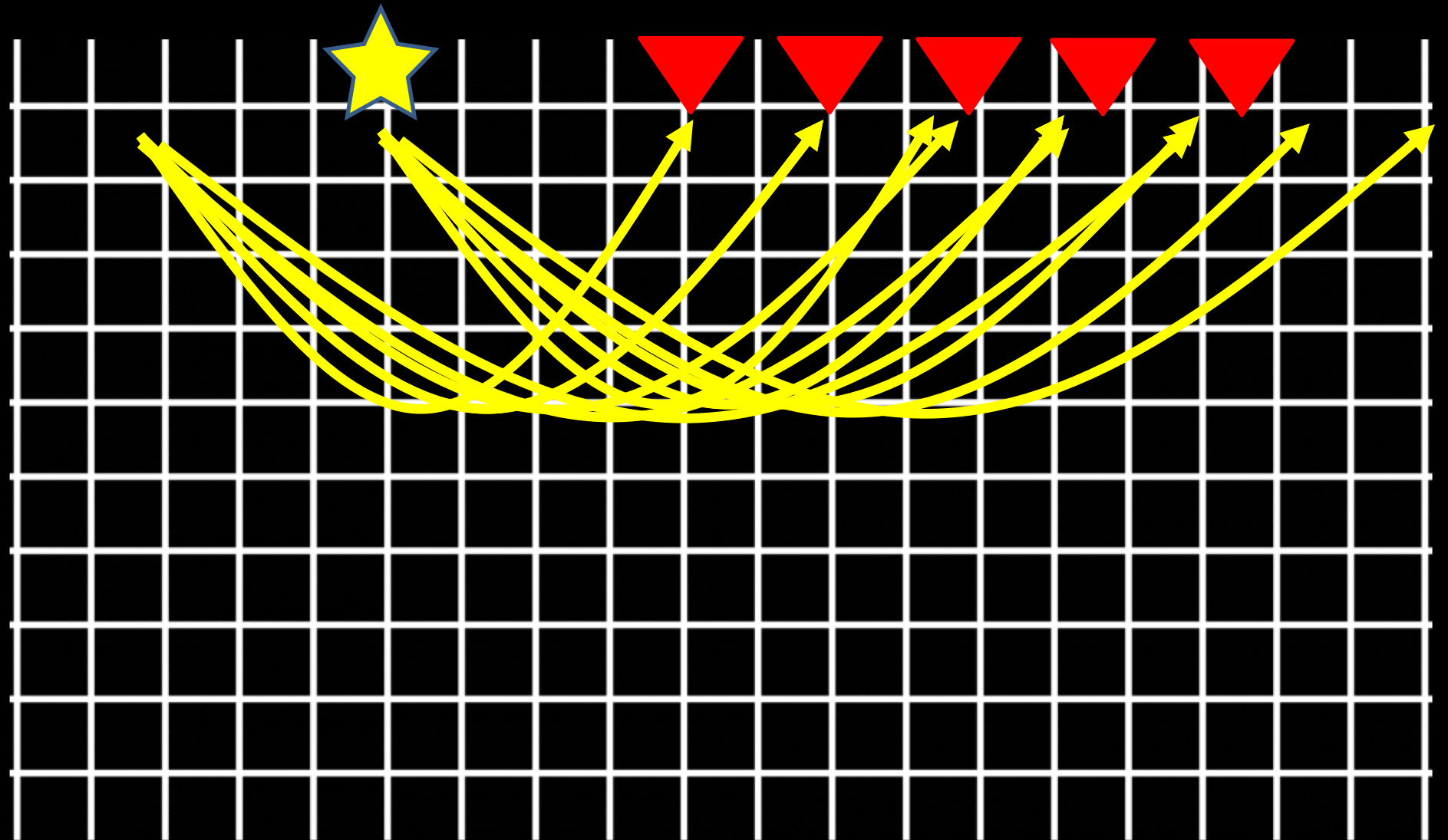


V increases
continuously with
depth. Fastest
raypath ?





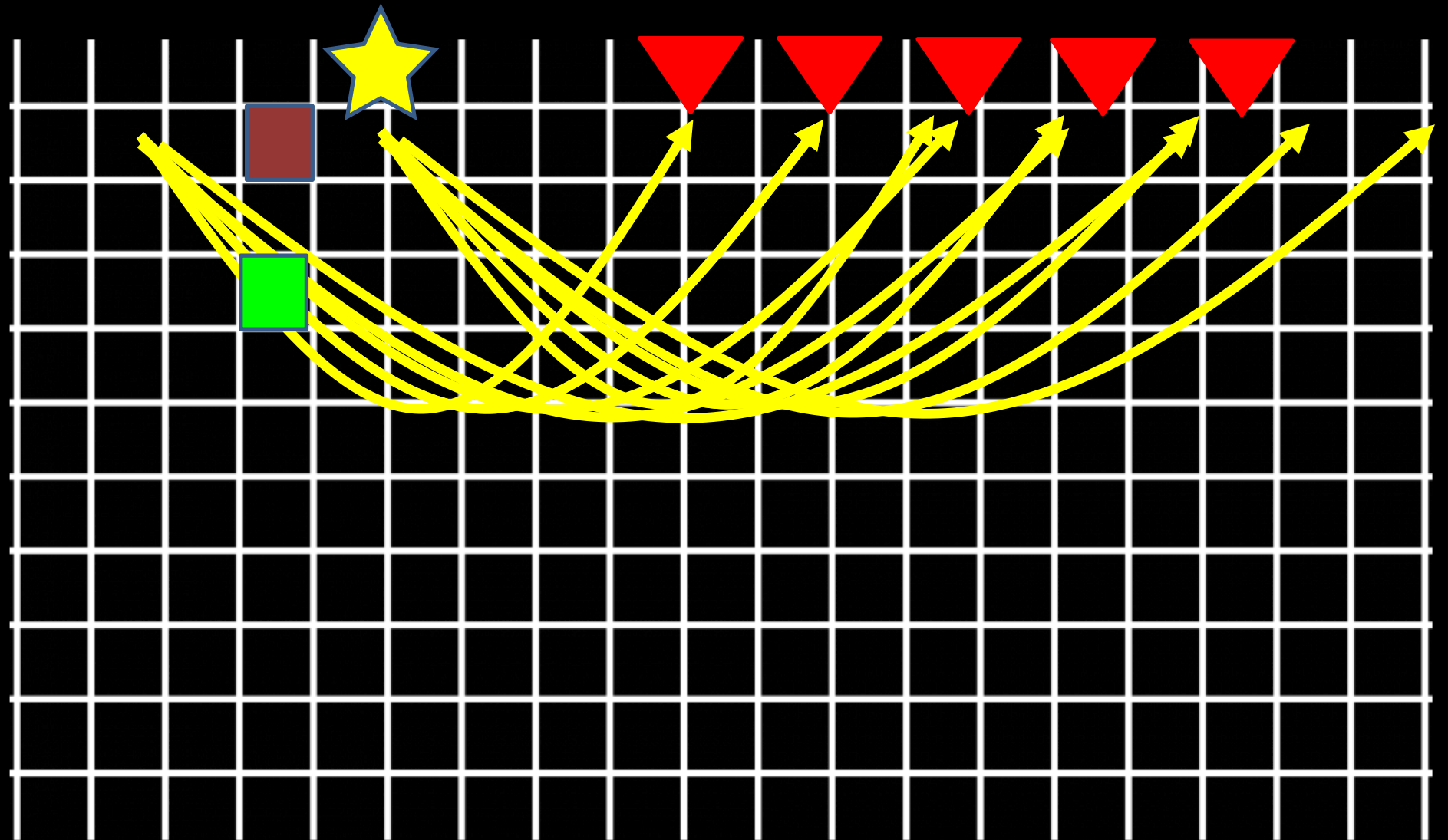
e.g., diving waves



e.g., diving waves

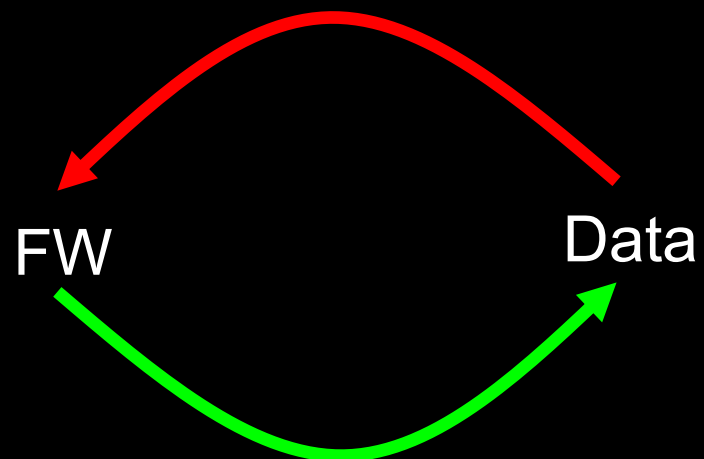


This leads to a (non-linear)
system of equations where
some areas are better resolved
then others.

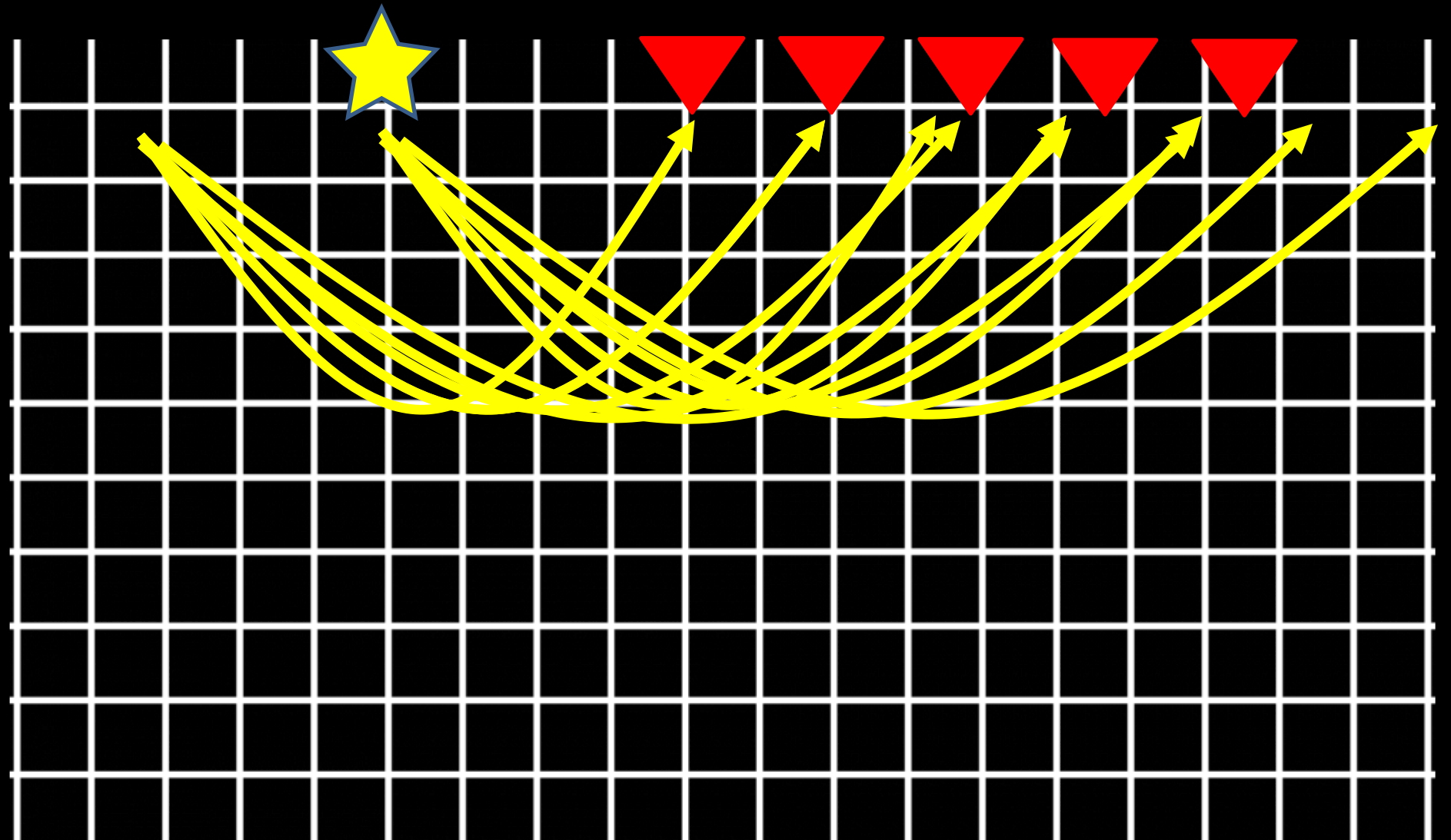


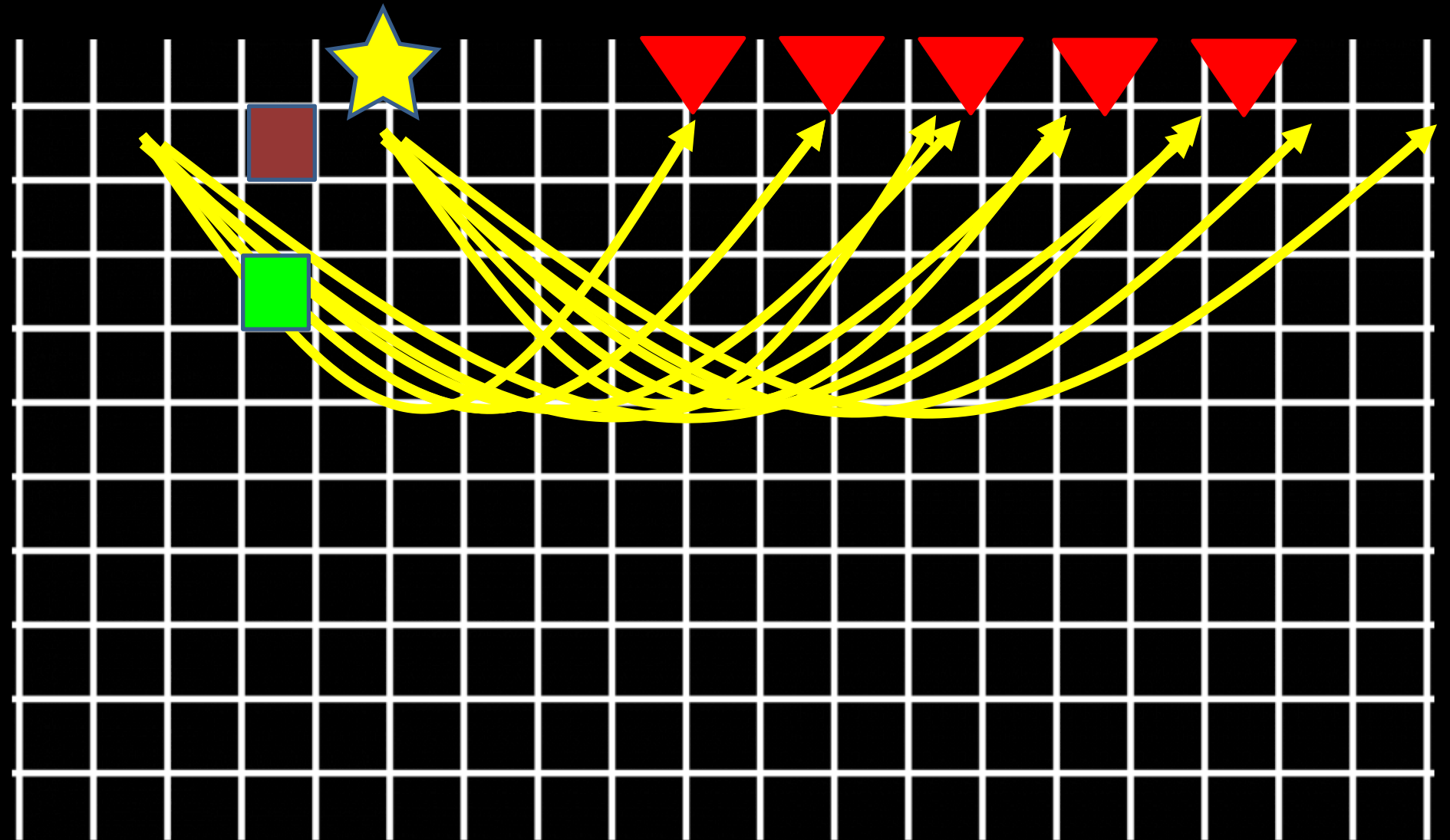


Misfit, Parameter Adjustment



Raytracing for given Parameter Set

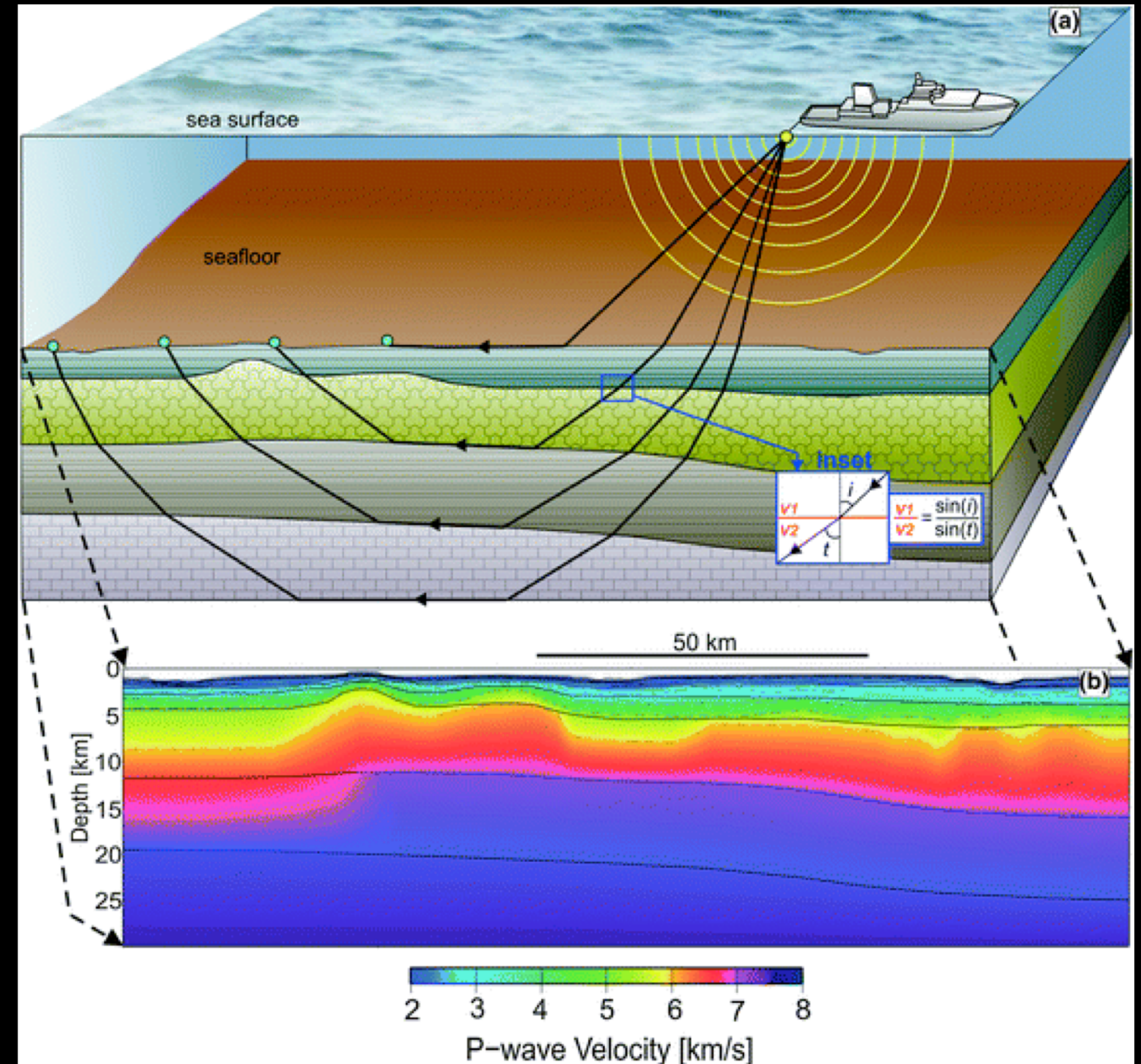




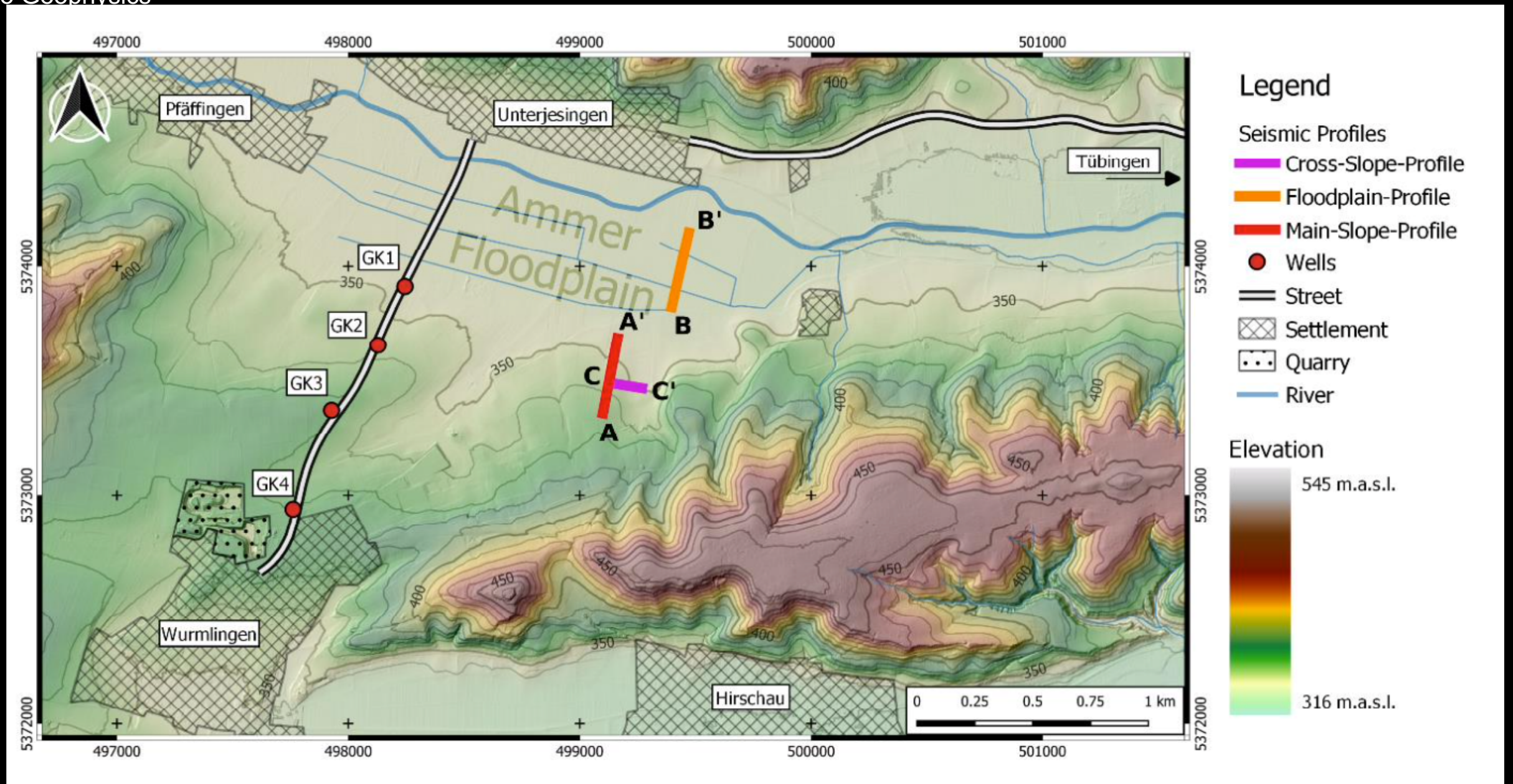
This approach is called
tomography.



- More complicated geometries

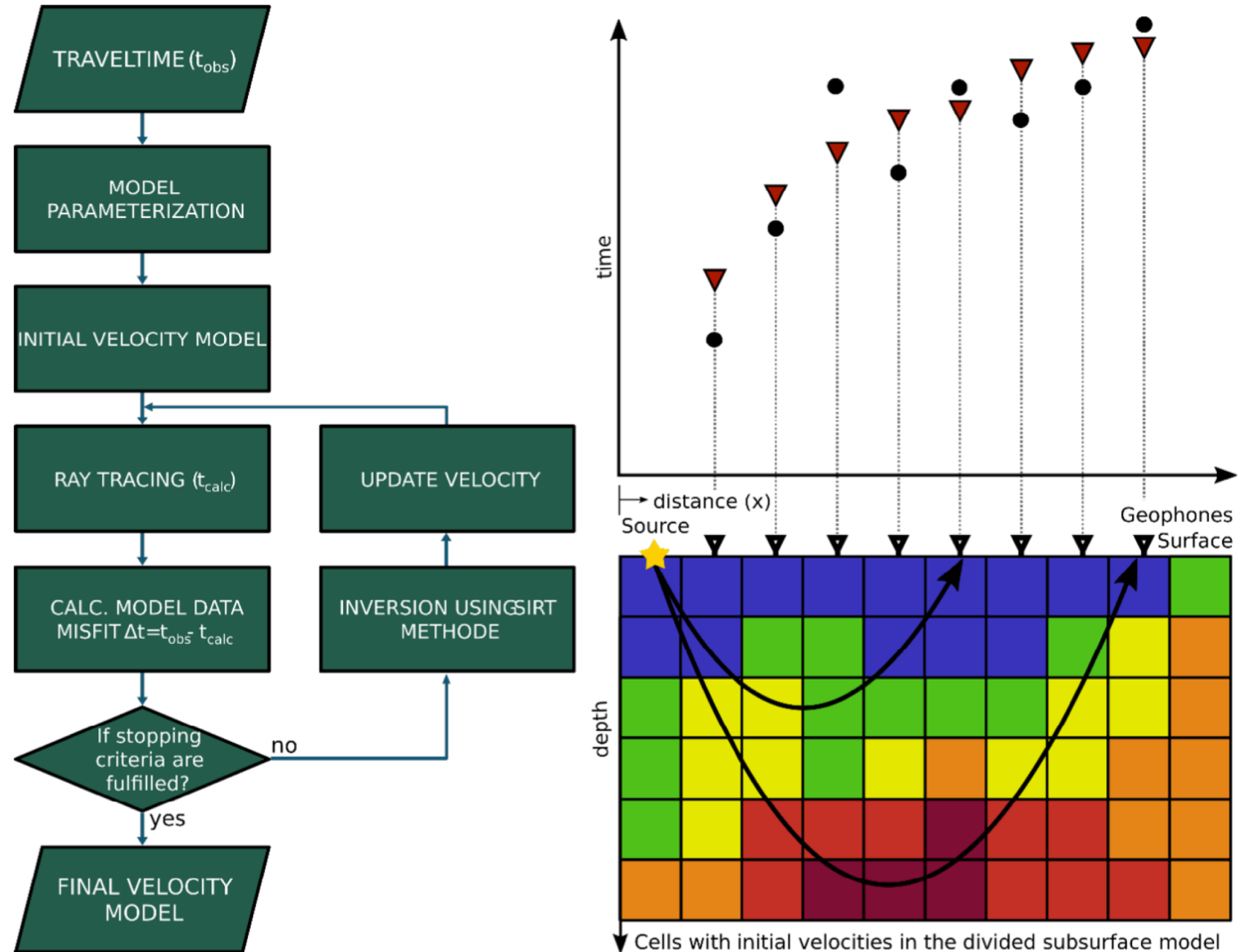


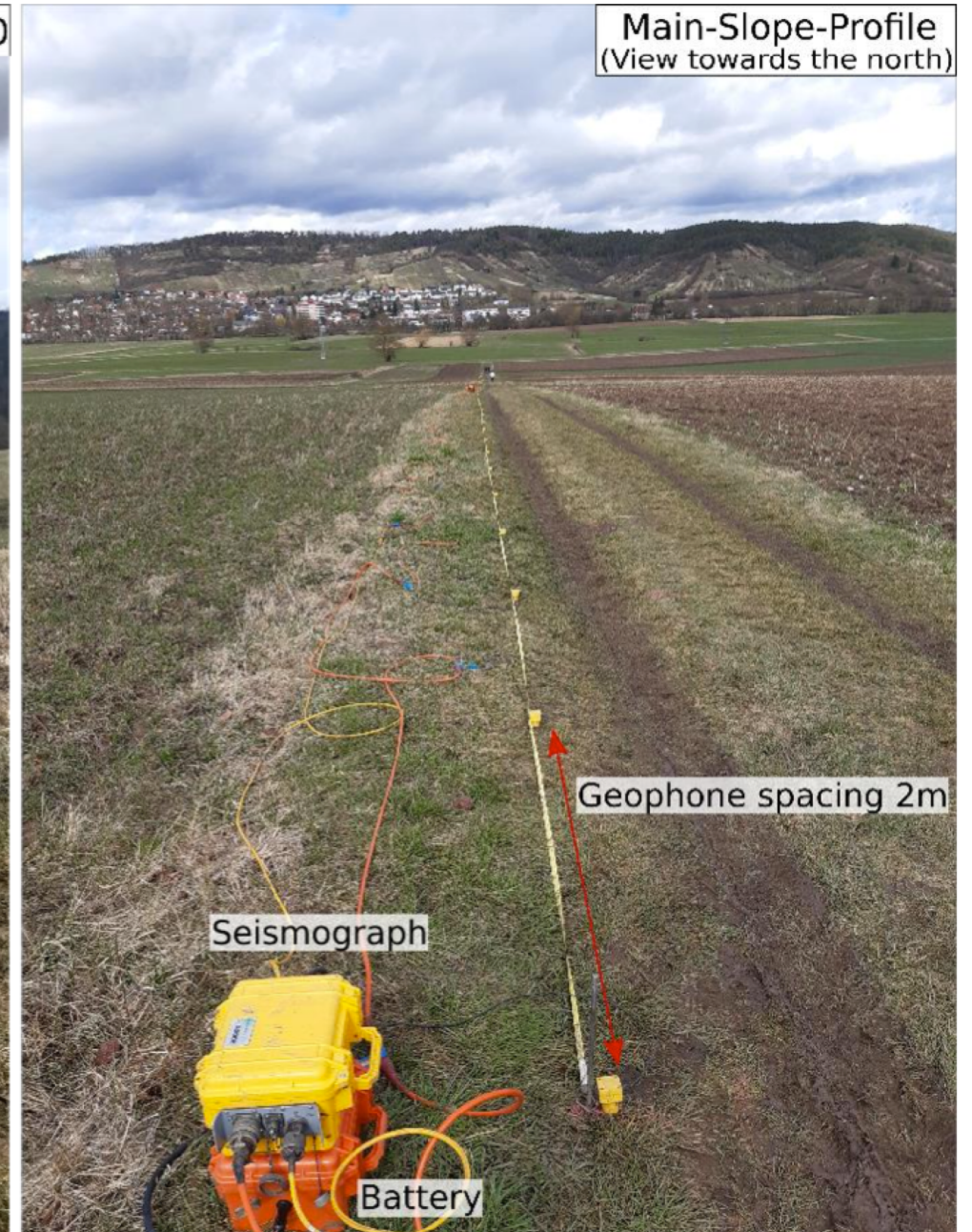
Cf. Michael Erb's thesis in our group.





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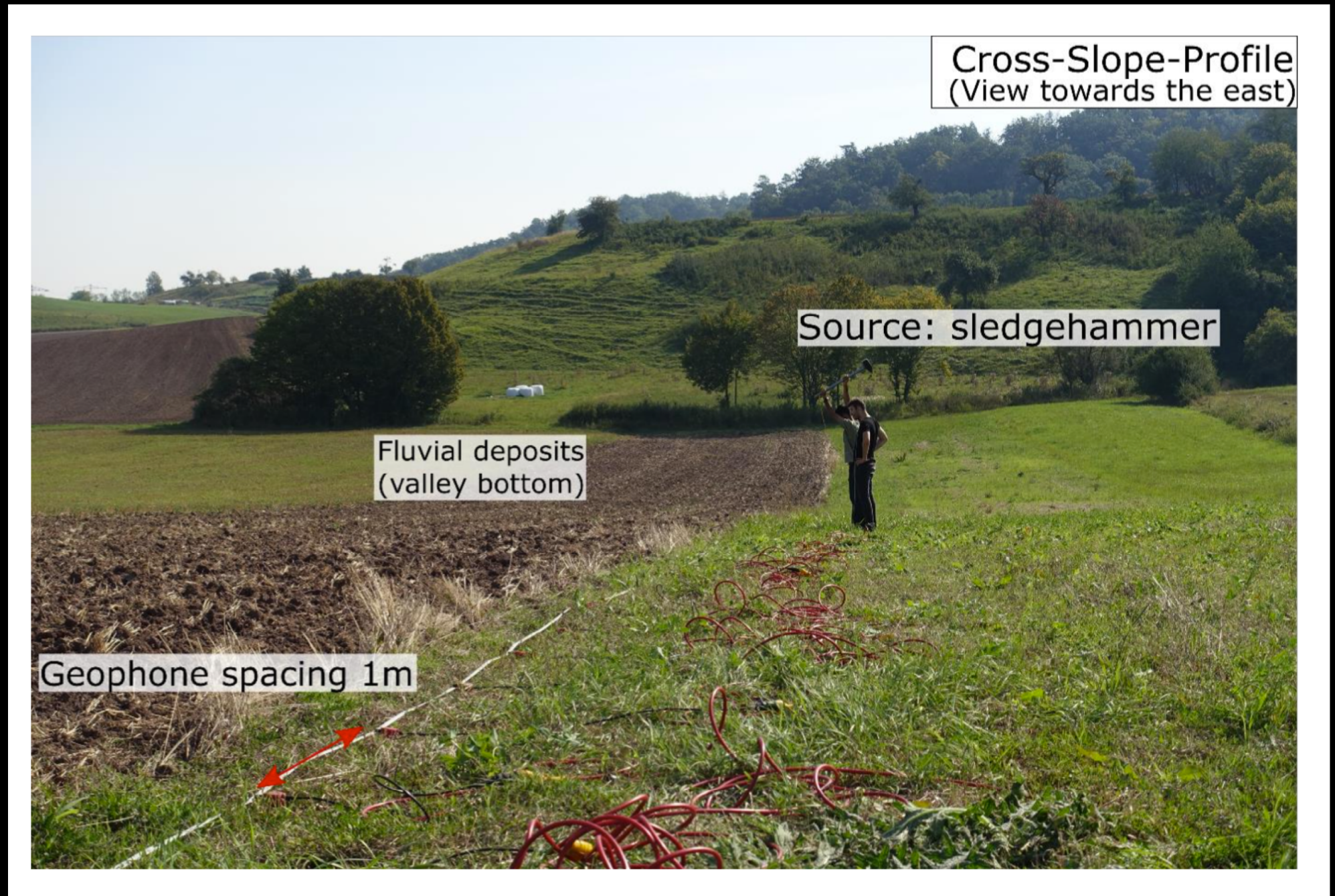
- MSc Michael Erb

Floodplain-Profile
(View towards the south)





- MSc Michael Erb



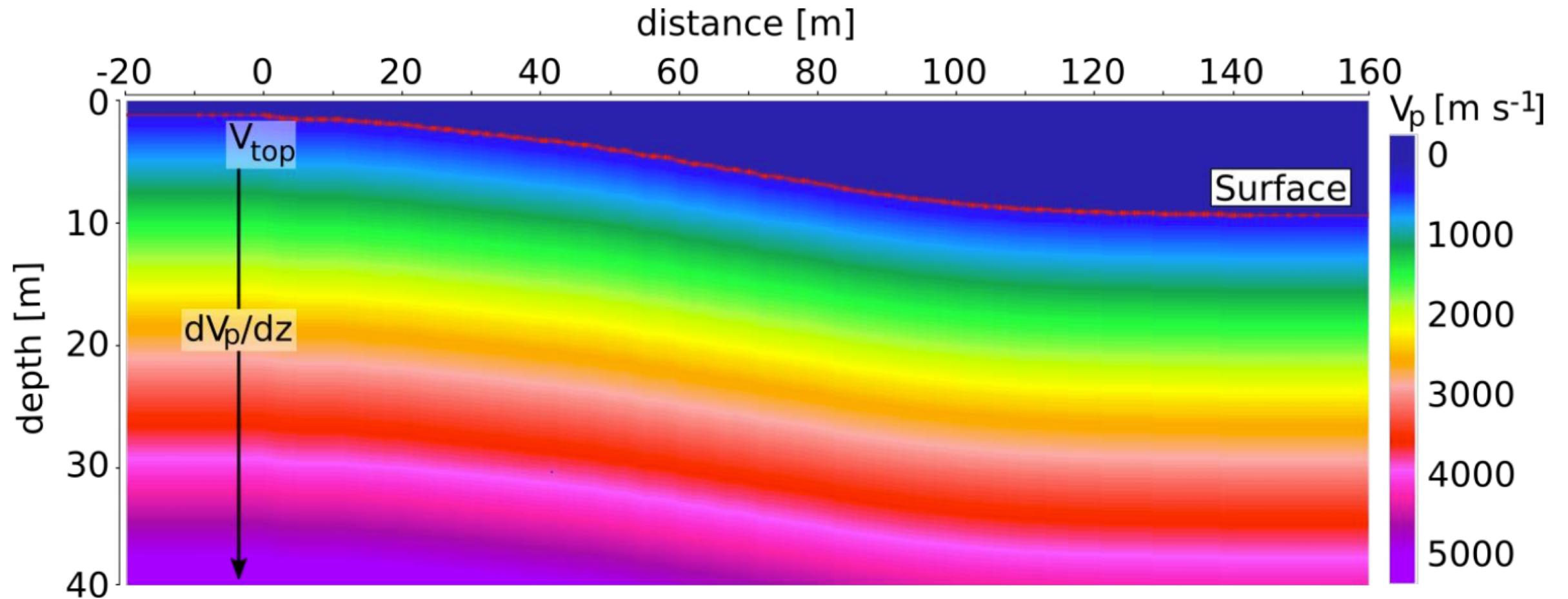


Figure 12. An initial model in Reflexw (top-velocity 575 and gradient 125), where the tomography was considered, is shown on the left. On the right, a schematic initial model with the two parameters, the top-velocity (V_p) and the velocity gradient (dv_p/dz).

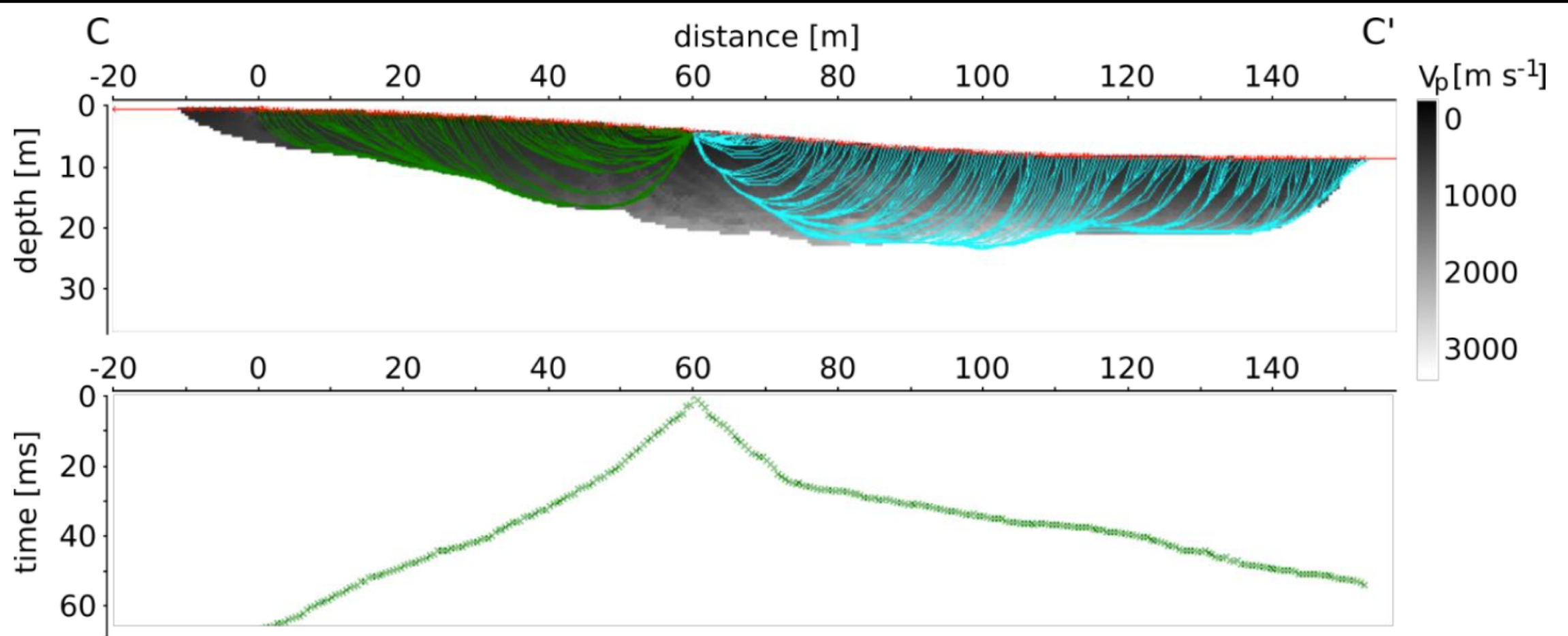
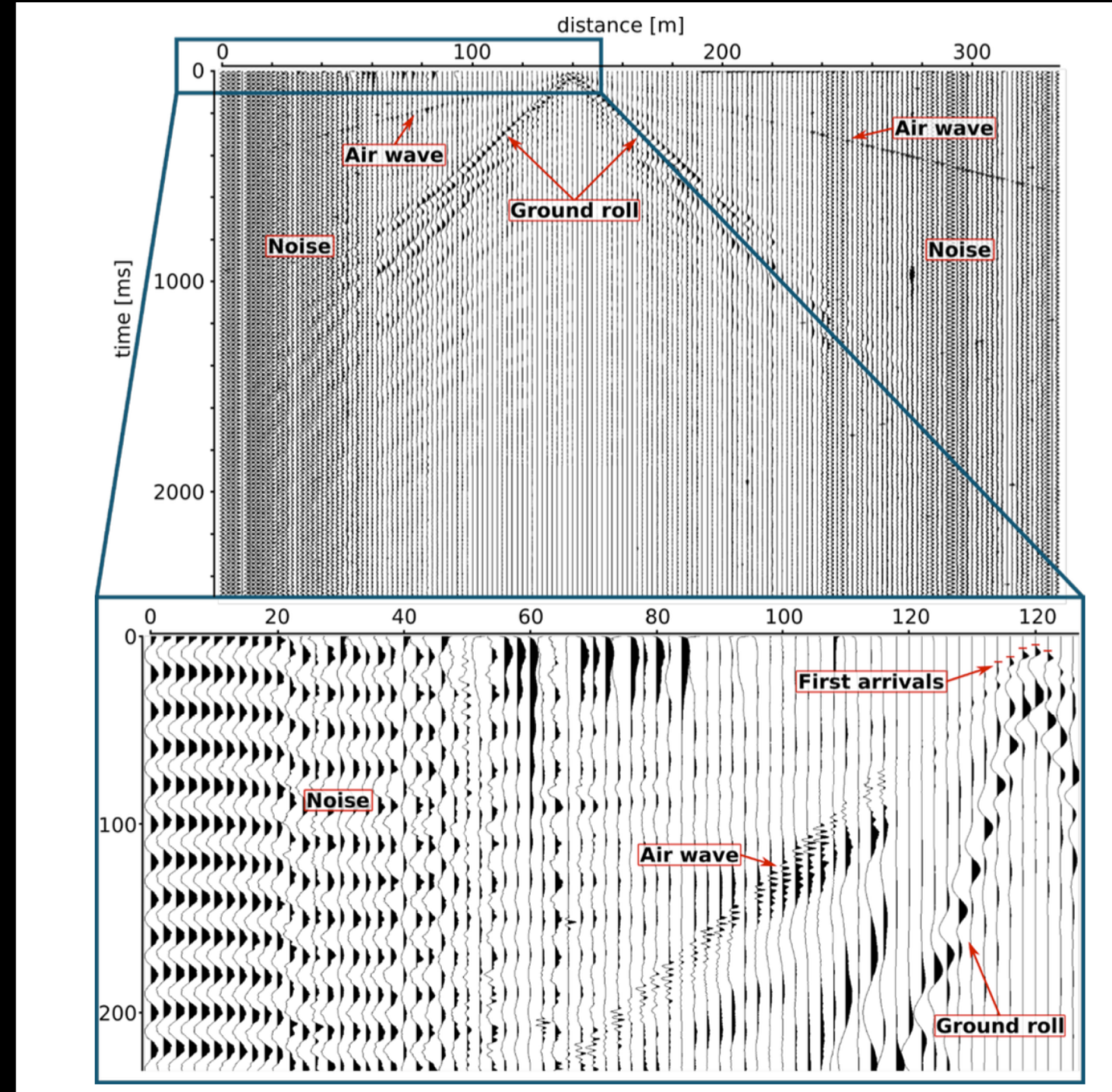
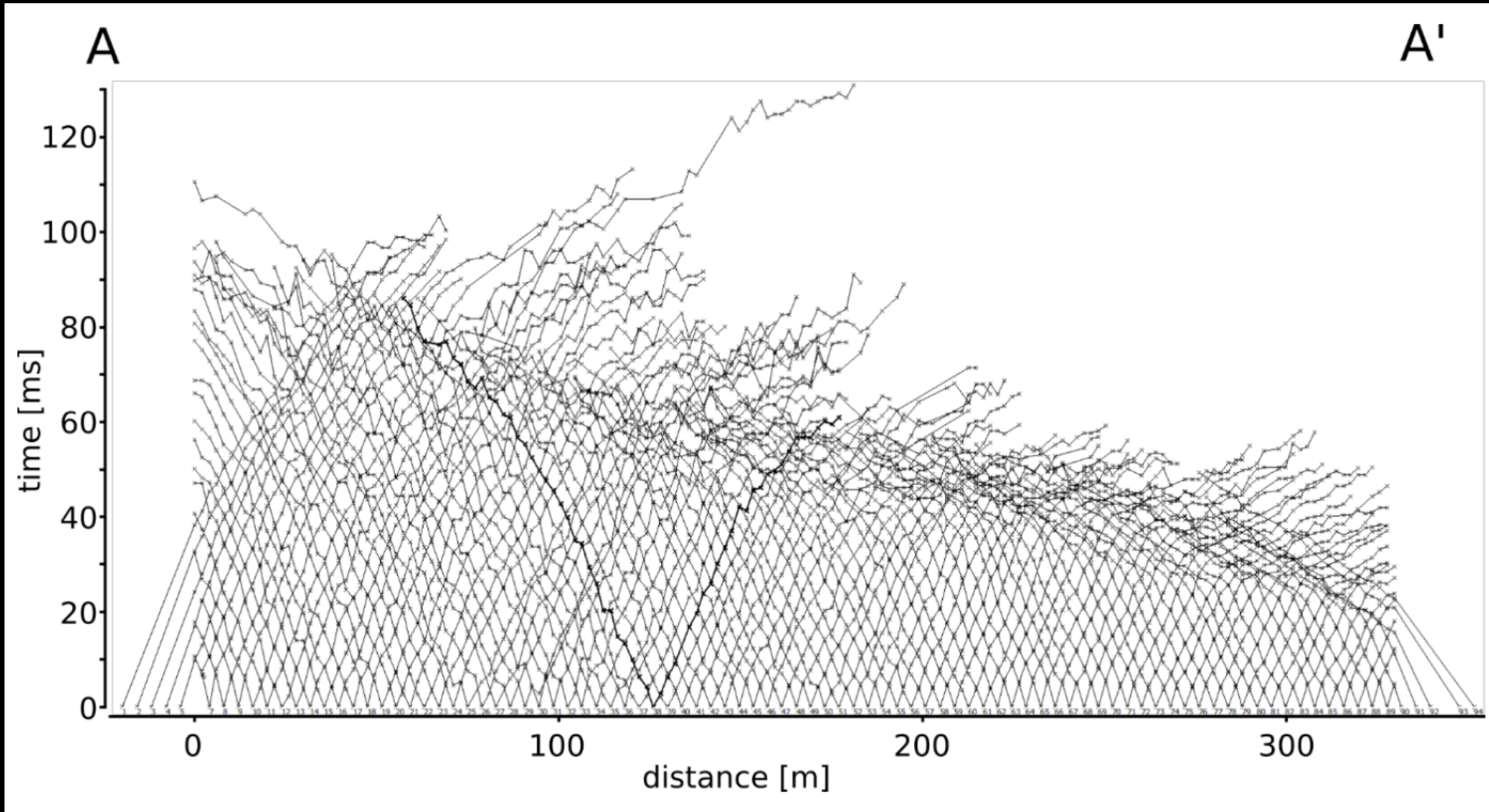


Figure 13. Forward raytracing of one shot. The upper image illustrates the raypaths from a source to each receiver (increment 0.5 m) through a subsurface model. The image beneath shows the corresponding traveltimes curve.



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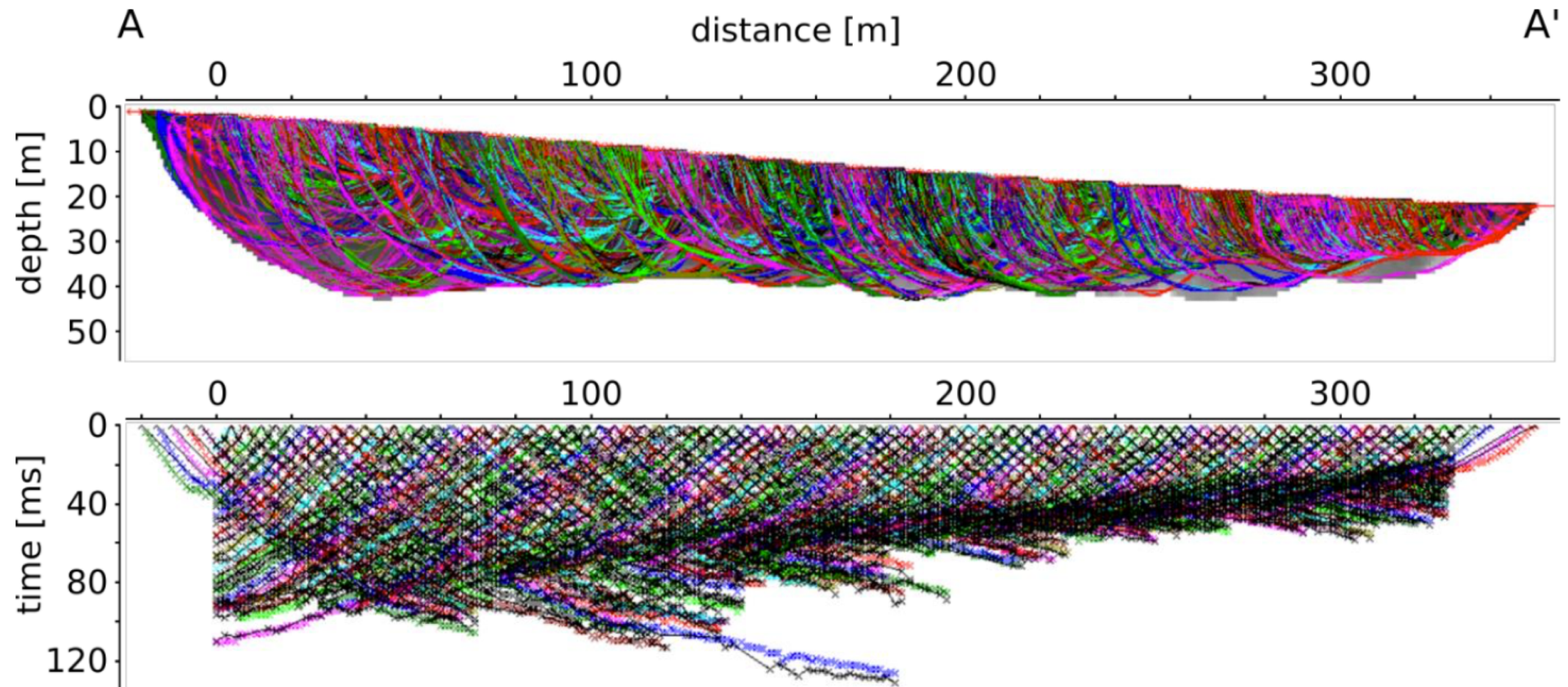
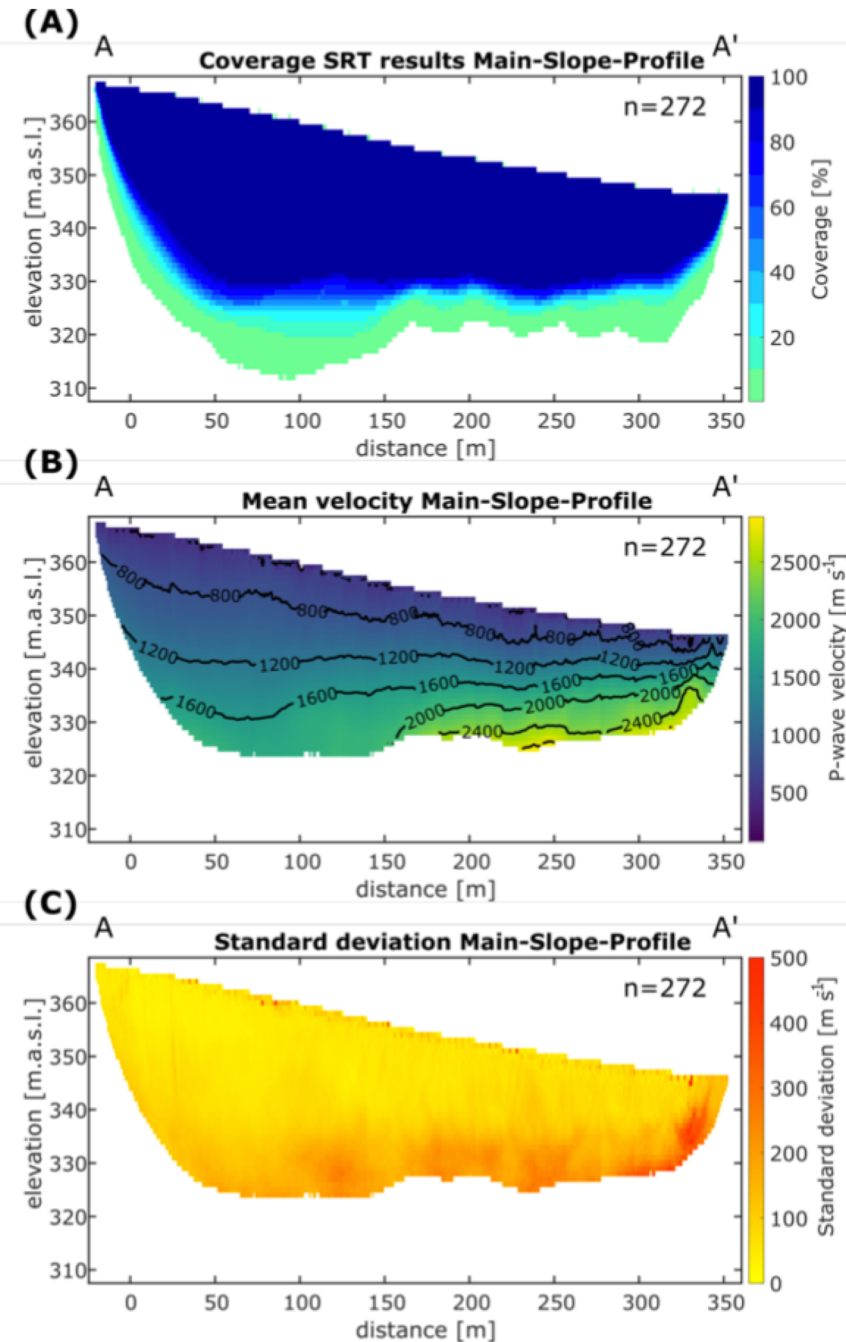


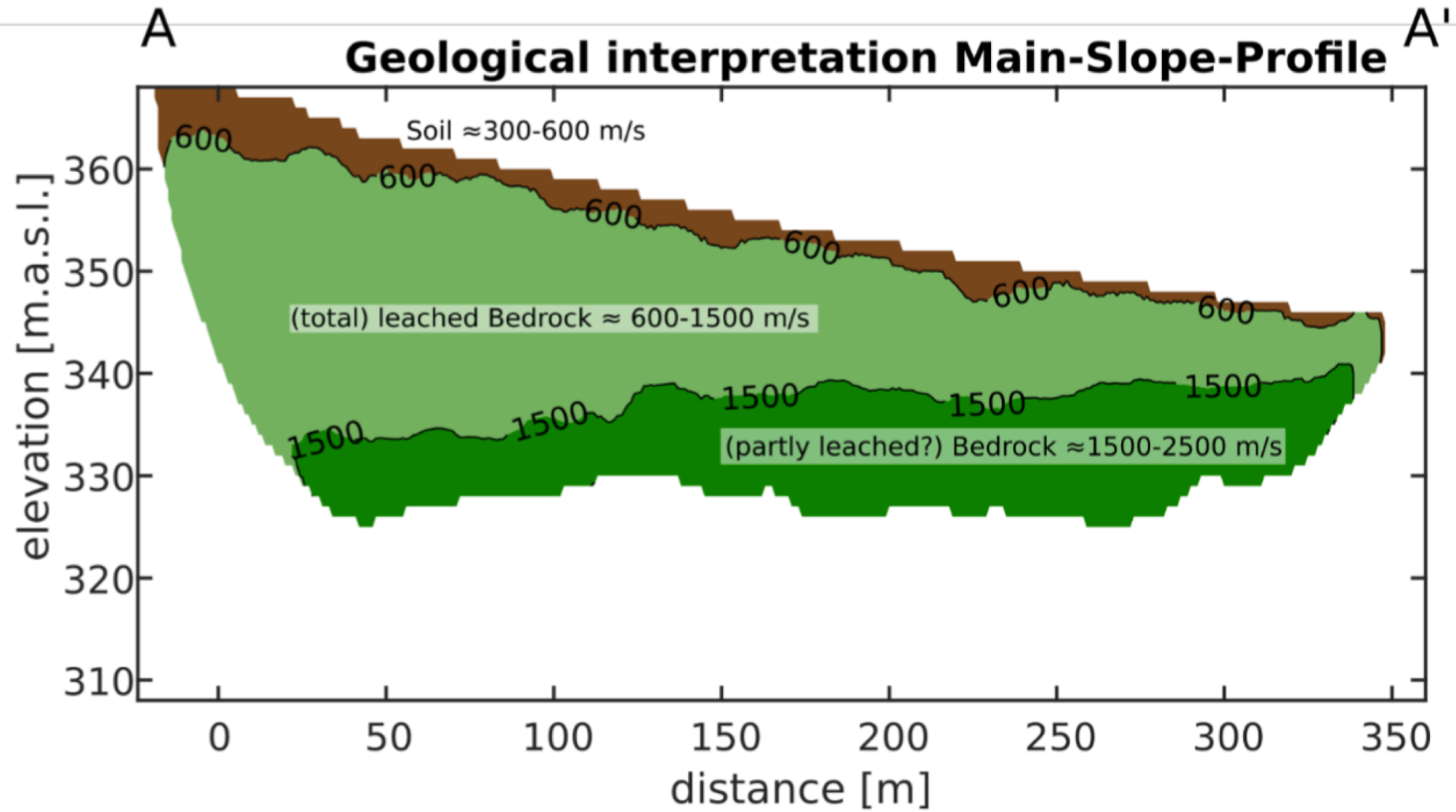
Figure 21. Forward Raytracing of an SRT result from the Main-Slope-Profile (V_p : 200; dV_p/dz : 125). The upper figure illustrates the rays paths through the model. The lower one shows the corresponding forward modelled traveltimes (colourful) and the observed traveltimes (black). For each receiver position, the difference between the modelled and the observed traveltime is calculated. Subsequently, from all these the RMS is calculated for the entire profile.

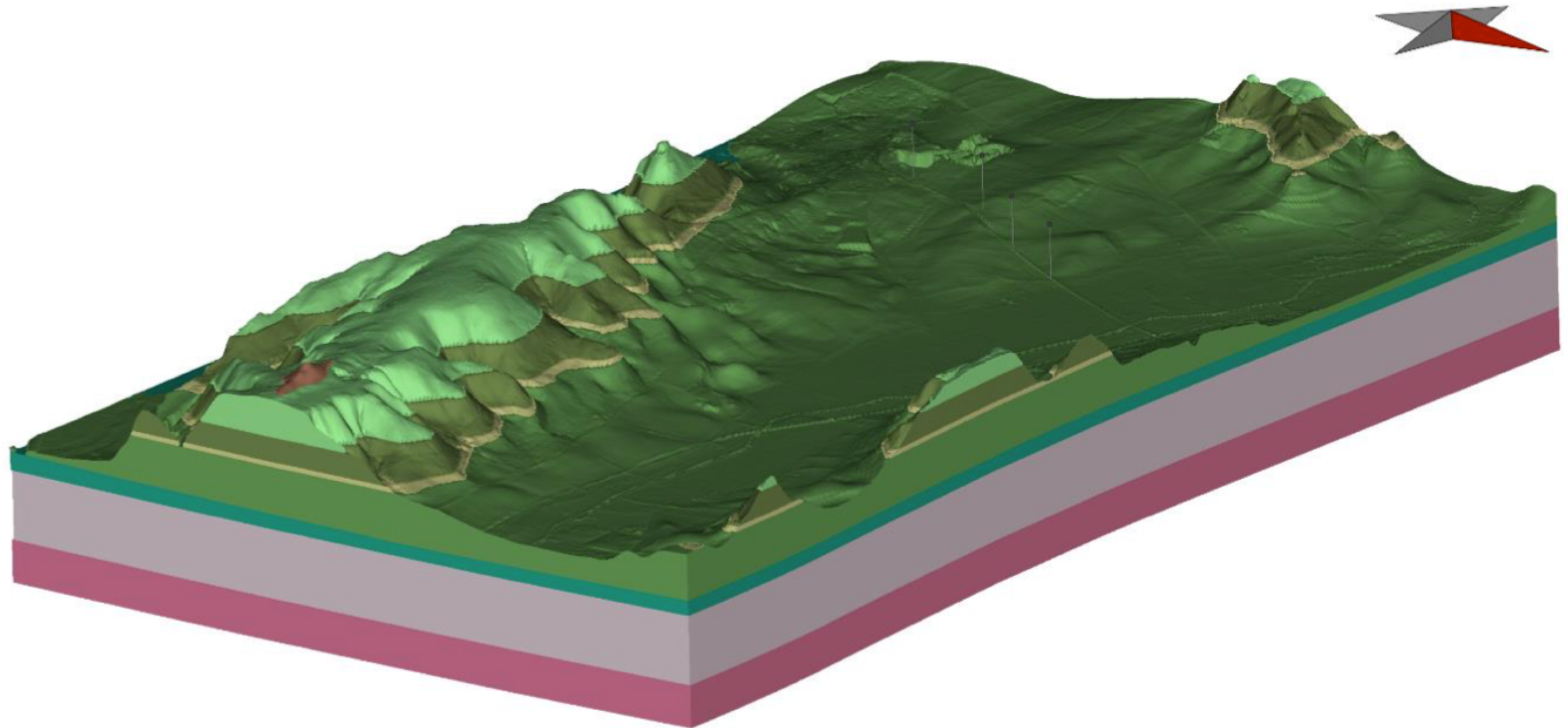


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R. Drews: Introduction to Geophysics

