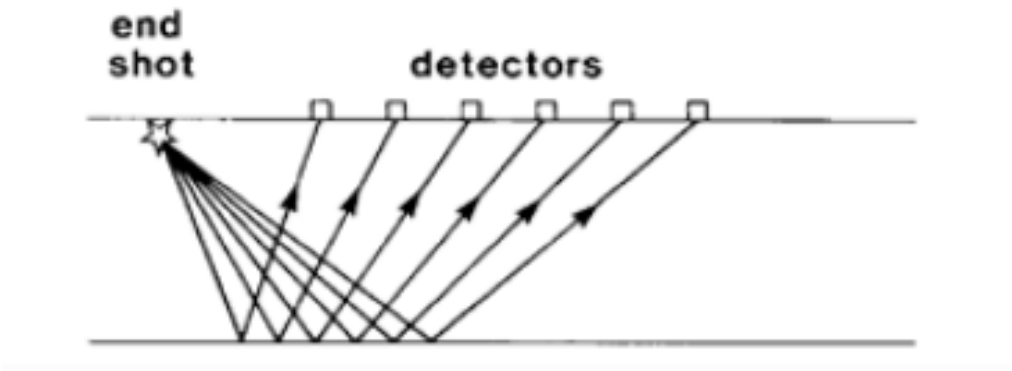
Today’s Topics: Review Lecture

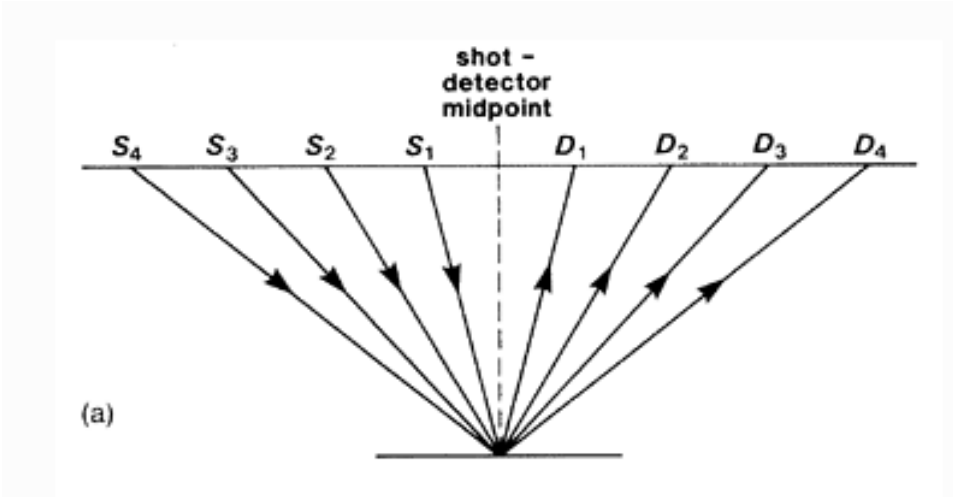
- Conditions for successful interpretation of refraction data
- Successful processing and interpretation of reflection data

Successful Interpretation of Refraction Data

Refraction Survey

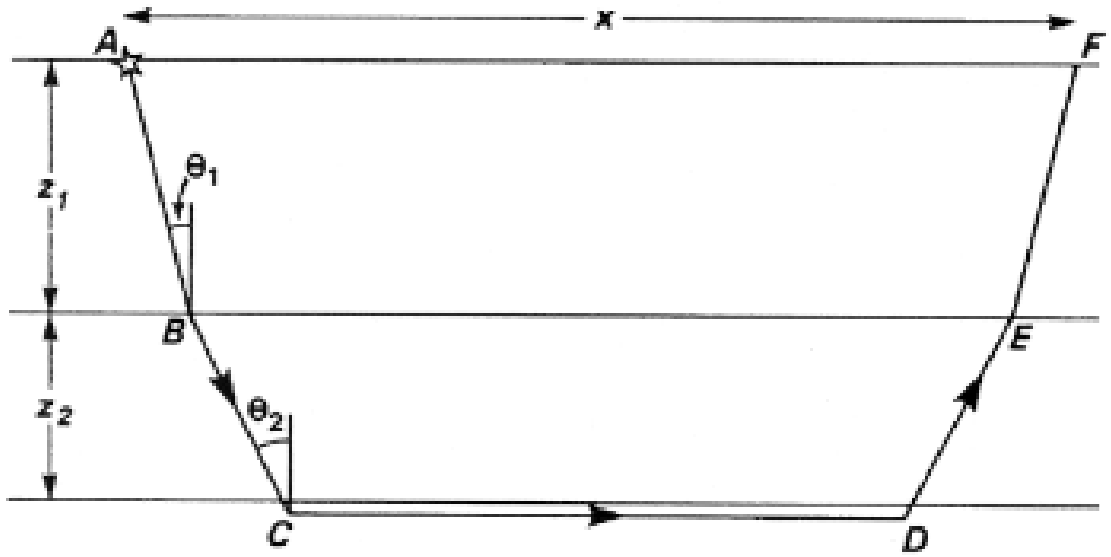
- What kind of data is most useful?

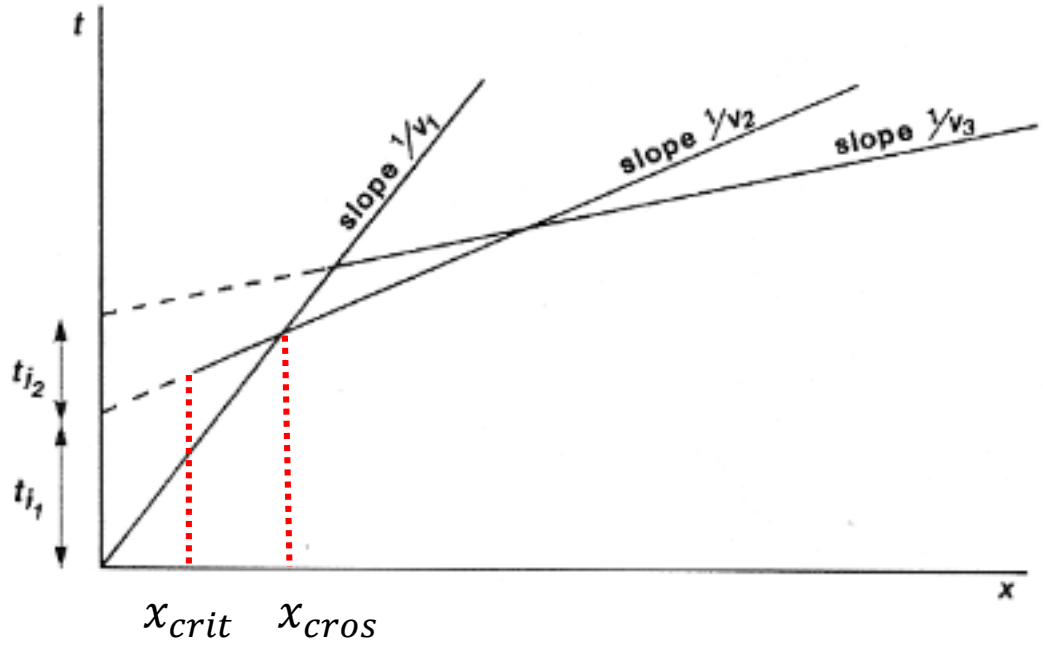




Refraction Survey

- Under what conditions would we see the plot on the right? e.g



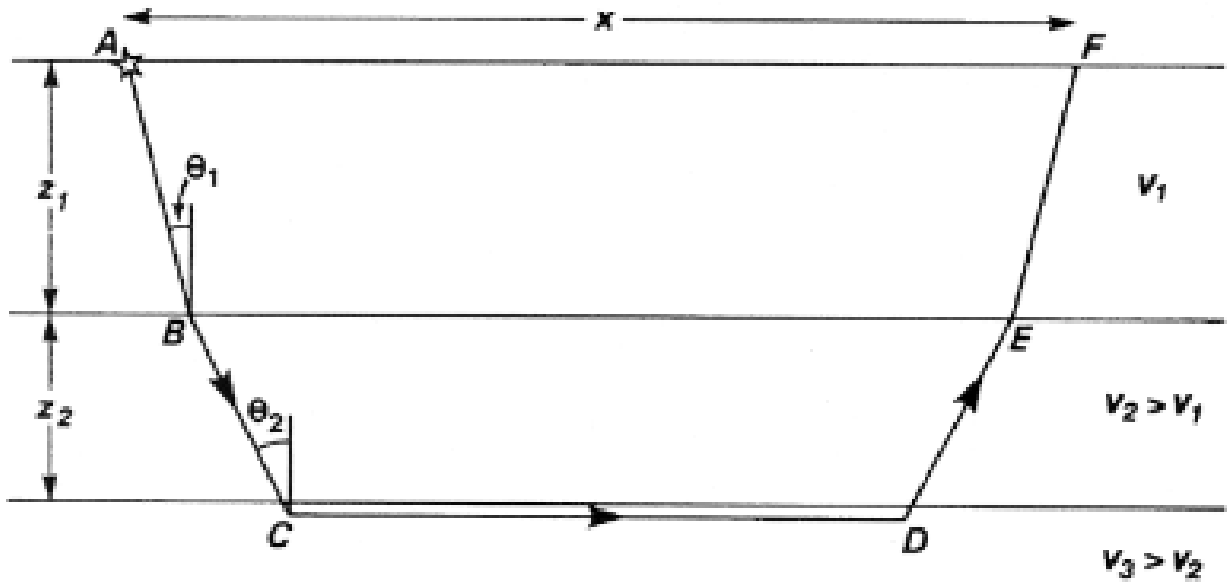


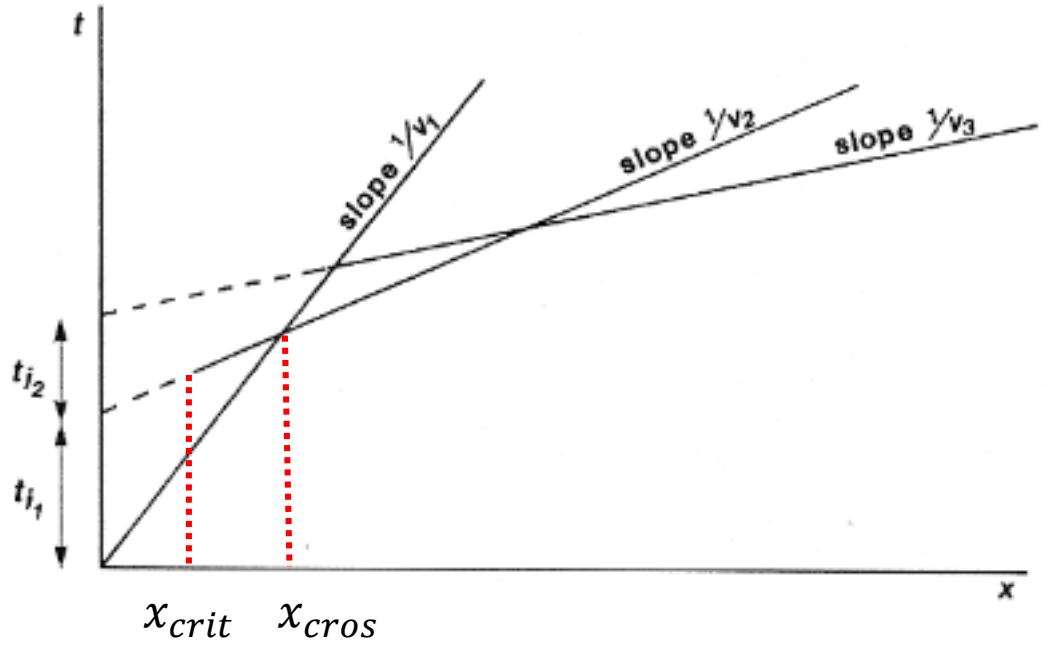
Refraction Survey

1) Must have $v_1 < v_2 < v_3$ …

2) Must have enough receivers whose distance from source is larger than x_{cross}

What else?

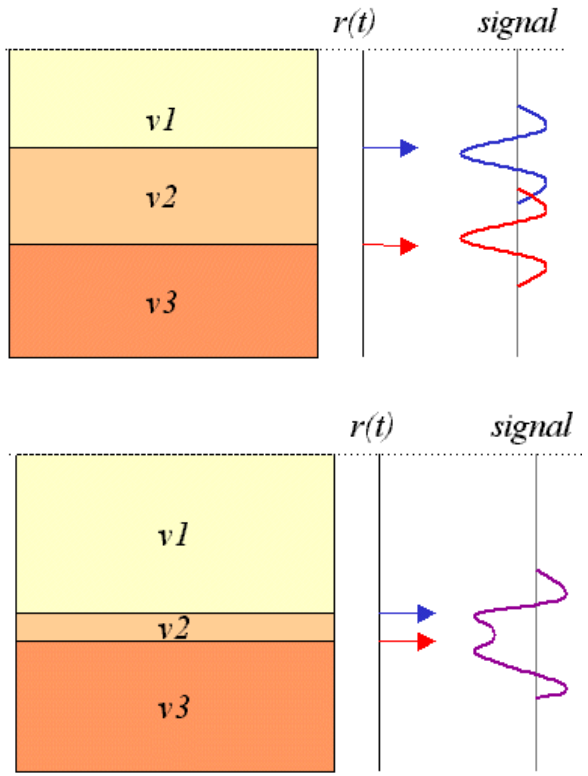




Refraction Survey

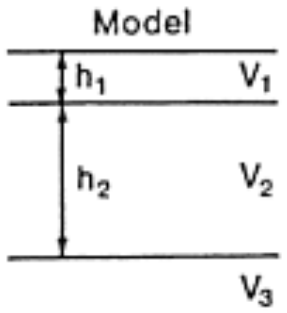
- Layers must be thicker than…

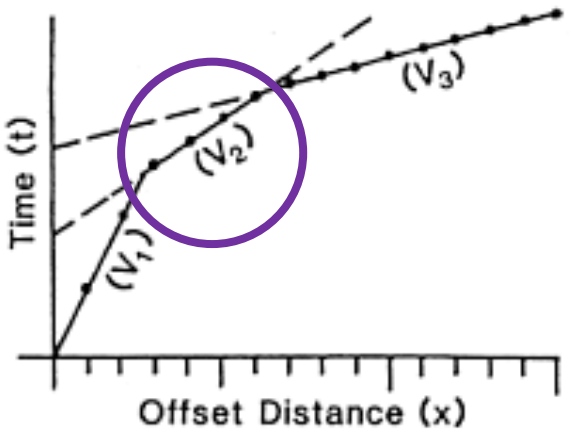
$$h > \frac{\lambda}{4}$$

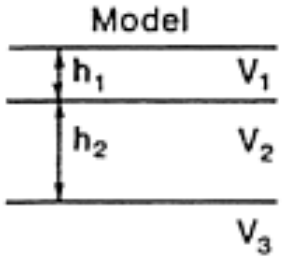


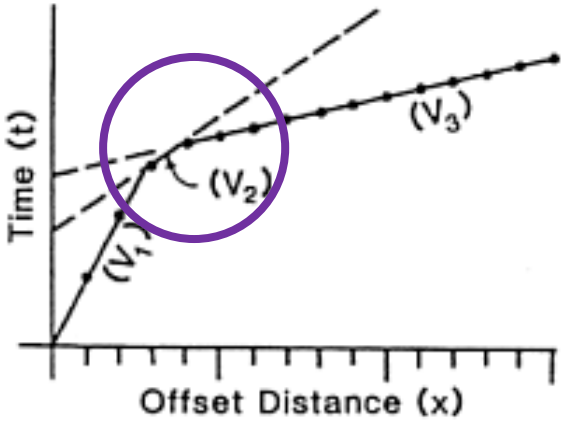
Thickness h_2 decreases

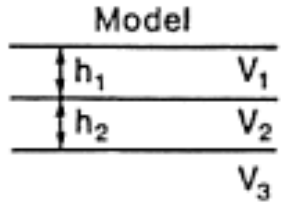
v3>v2>v1

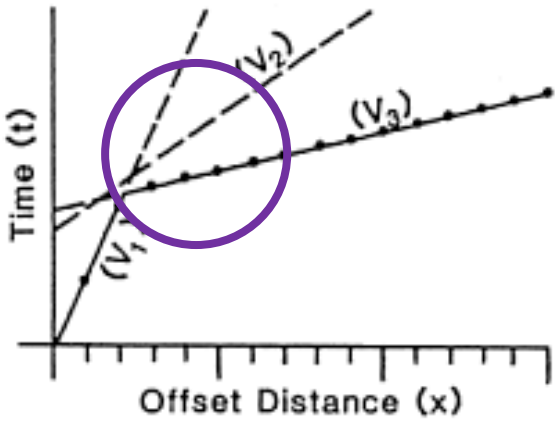






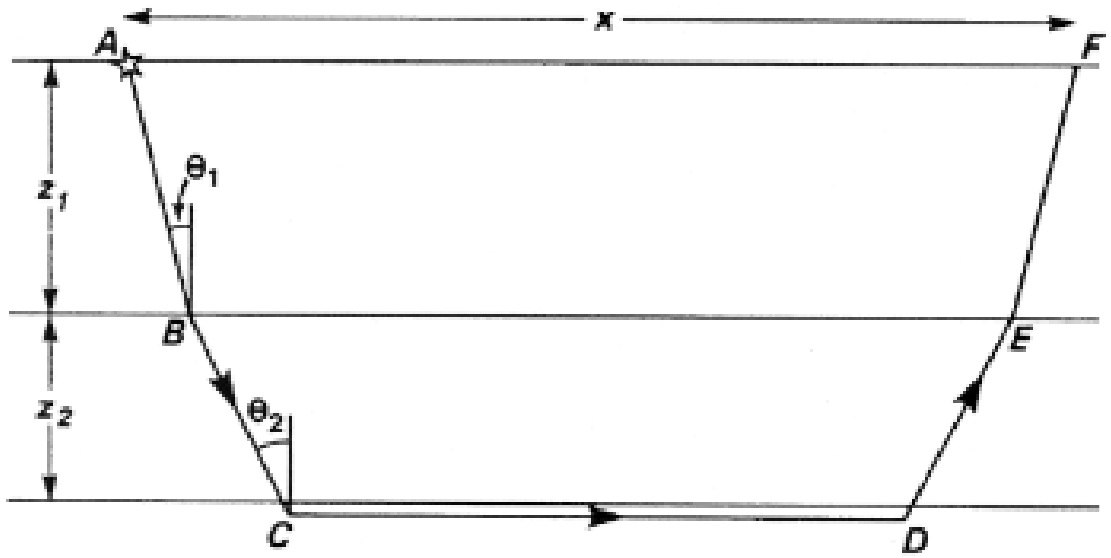


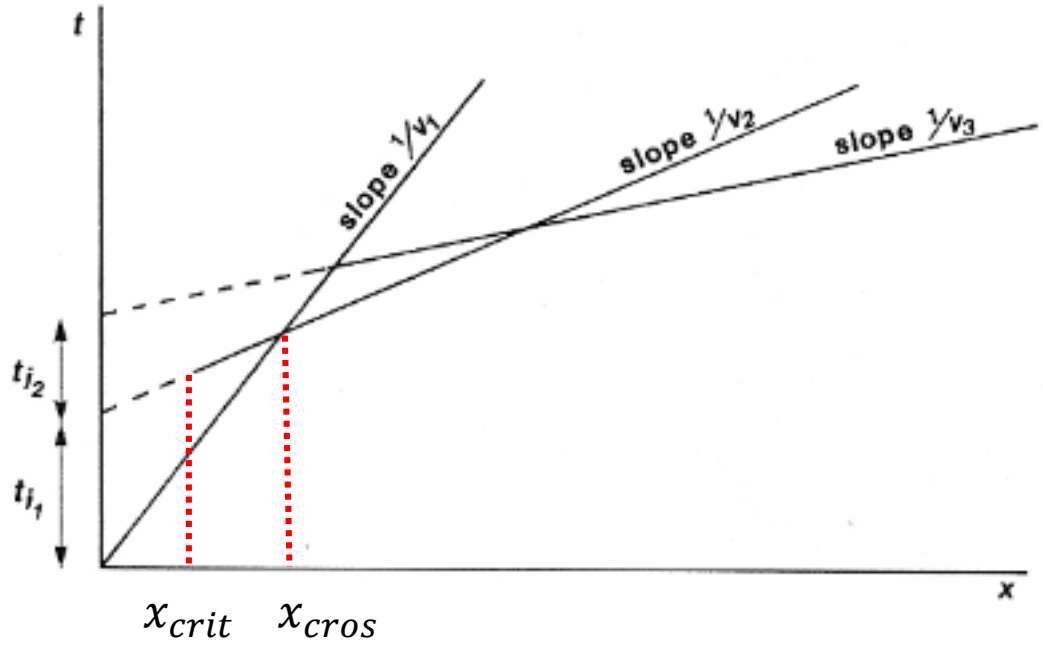




Refraction Survey

- What happens if the an interface is dipping?
- Is a single shot sufficient?
- What should you do?





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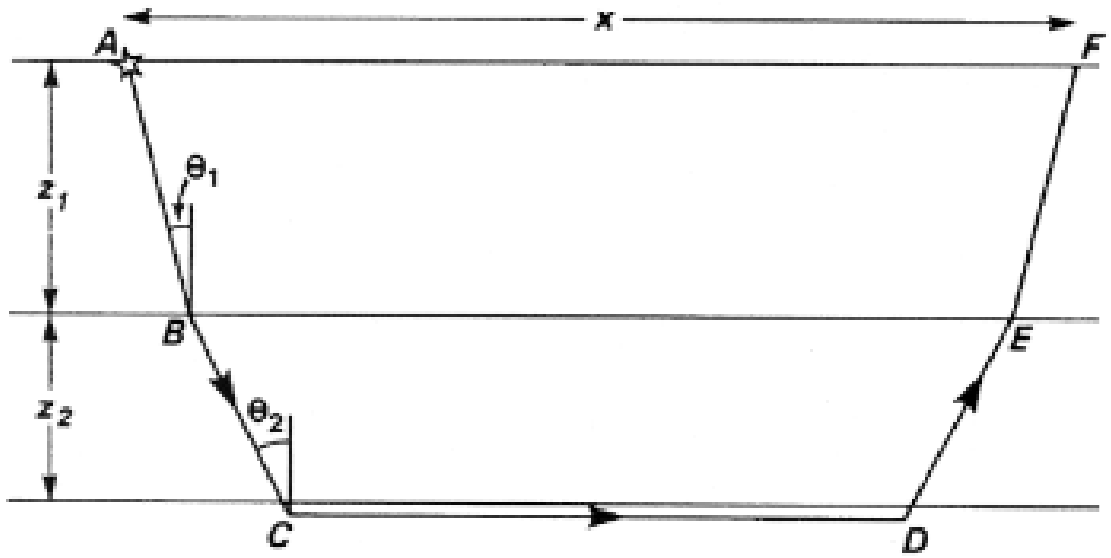
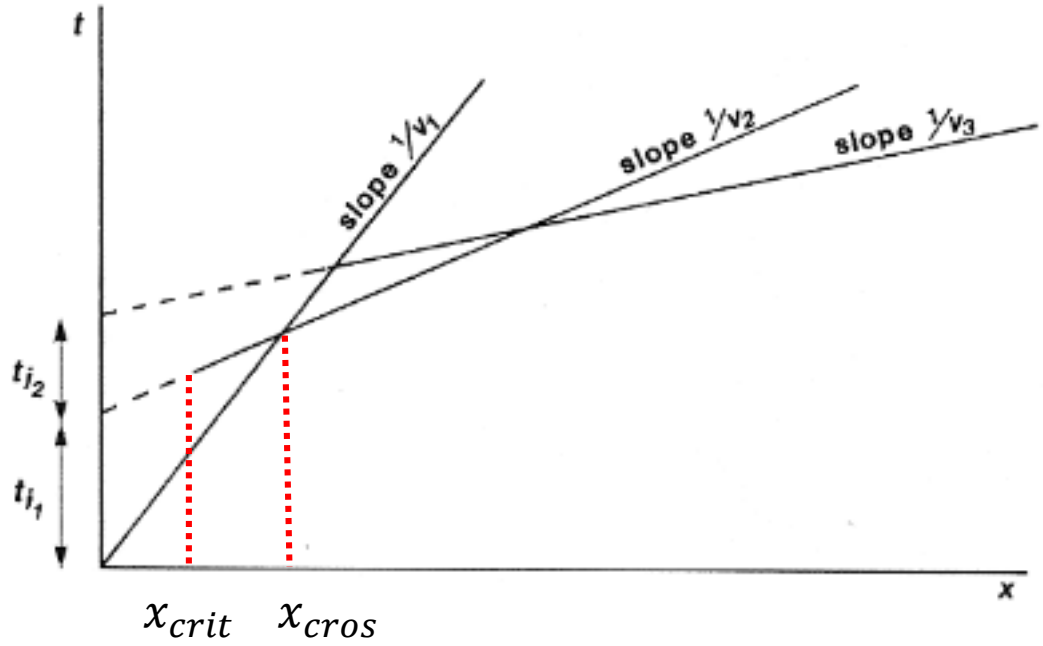
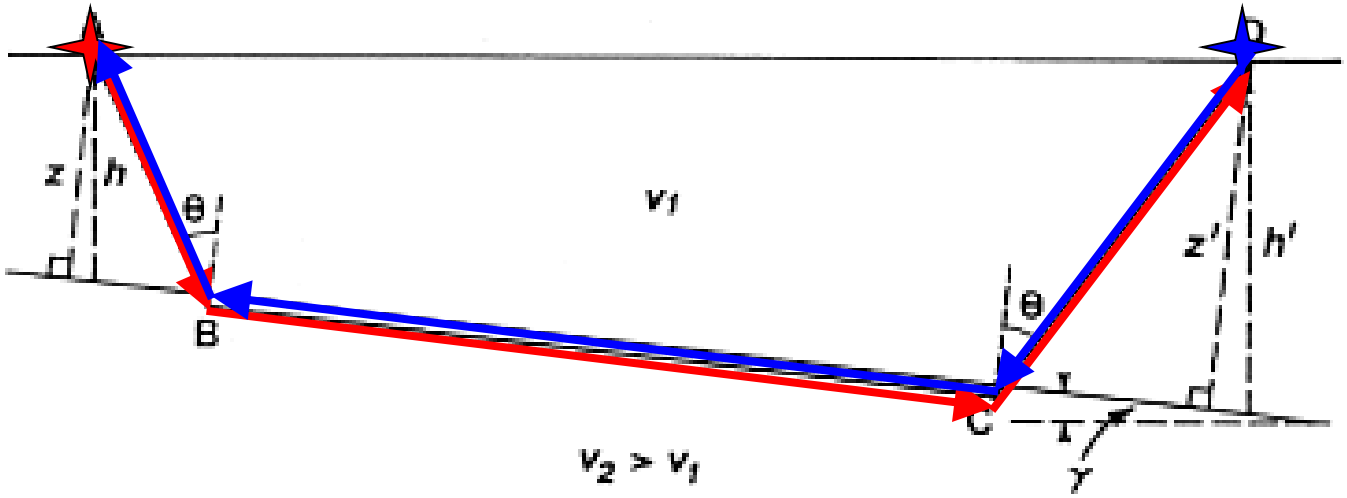
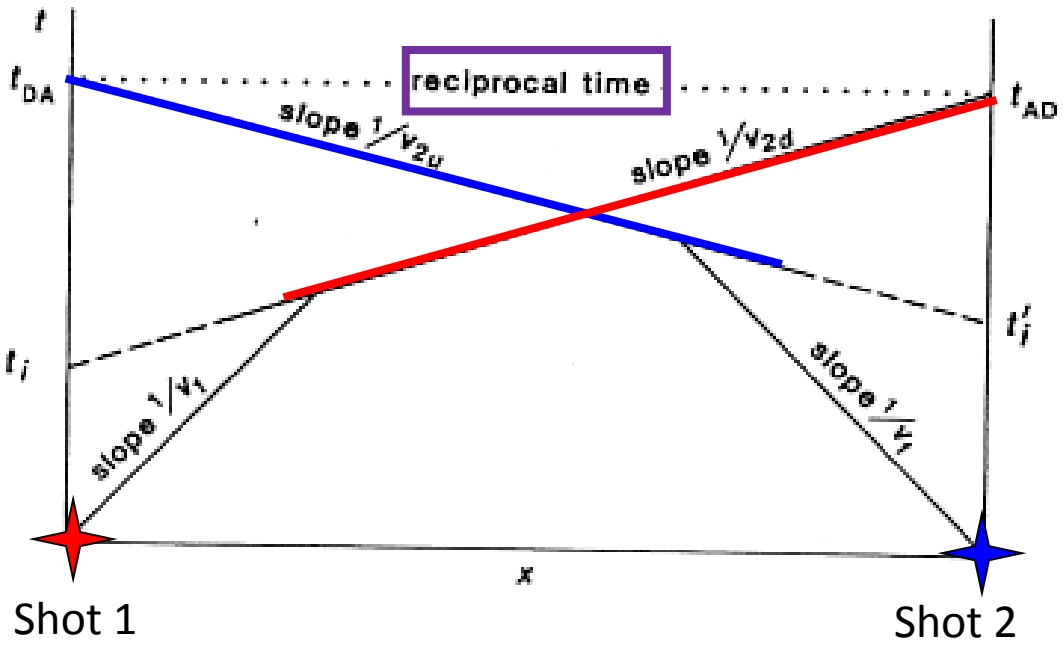




Refraction Survey

- So this requires **TWO** shots to be able to interpret





Refraction Survey

- Depth estimates
  - “Slant” depths can be obtained through the intercept times
  - True depths can be estimated using dip-angle (see GPG)

- Travel time in down-dip direction

$$t_2 = \frac{x\sin(\theta+\gamma)}{v_1} + \frac{2z\cos\theta}{v_1} = \frac{x}{v_{2d}} + t_i$$

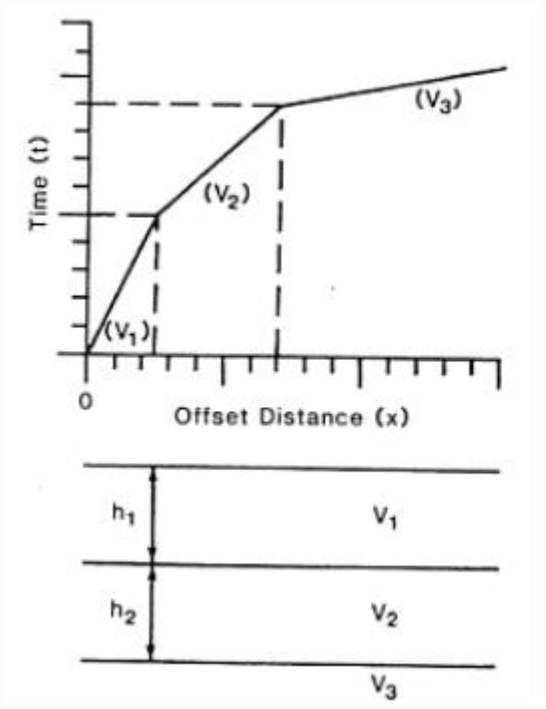
- Travel time in up-dip direction

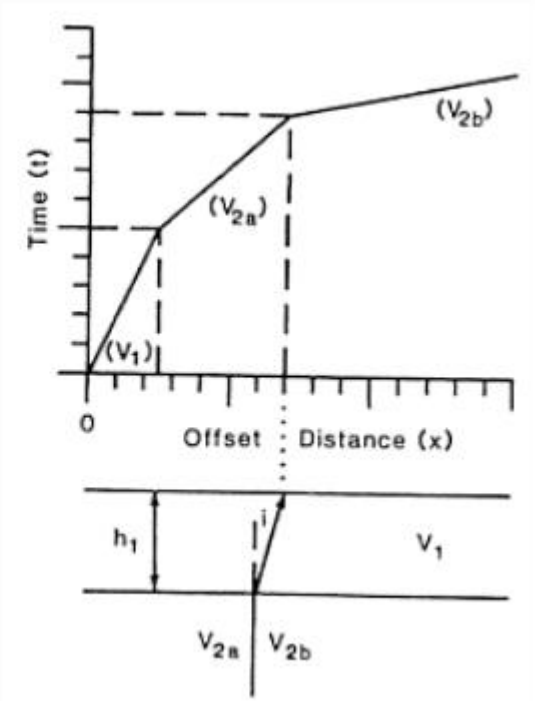
$$t_2' = \frac{x\sin(\theta-\gamma)}{v_1} + \frac{2z'\cos\theta}{v_1} = \frac{x}{v_{2u}} + t_i'$$

Refraction Survey

- How would you determine if additional layer or lateral velocity change?

- Seismograms could be same in either case



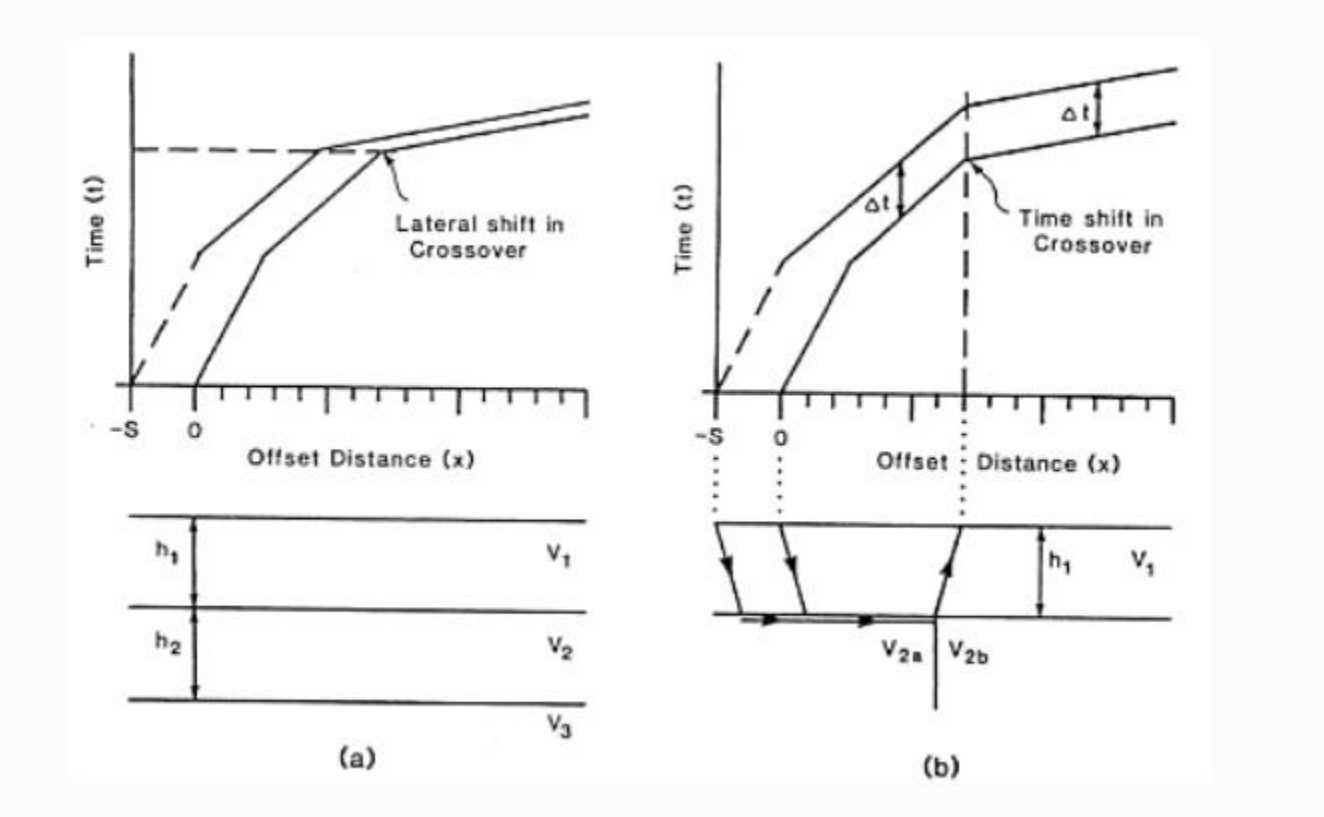


Refraction Survey

- Examine seismogram from shifted common shot gather

- If layer
  → Horizontal shift

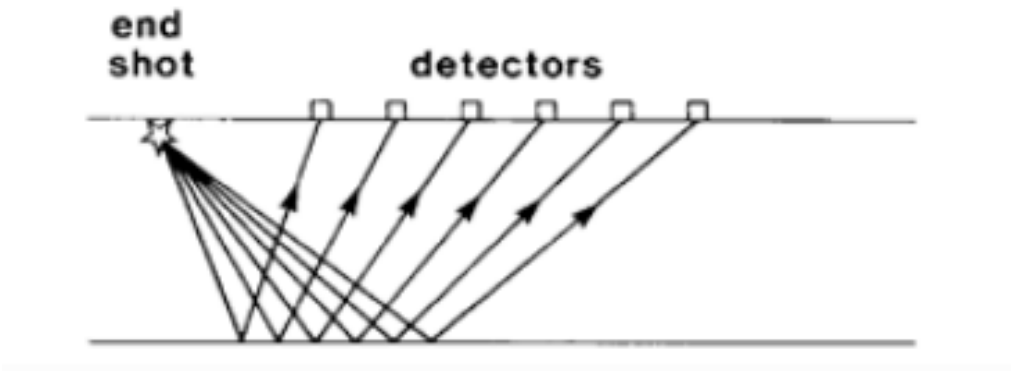
- If lateral change
  → Vertical shift

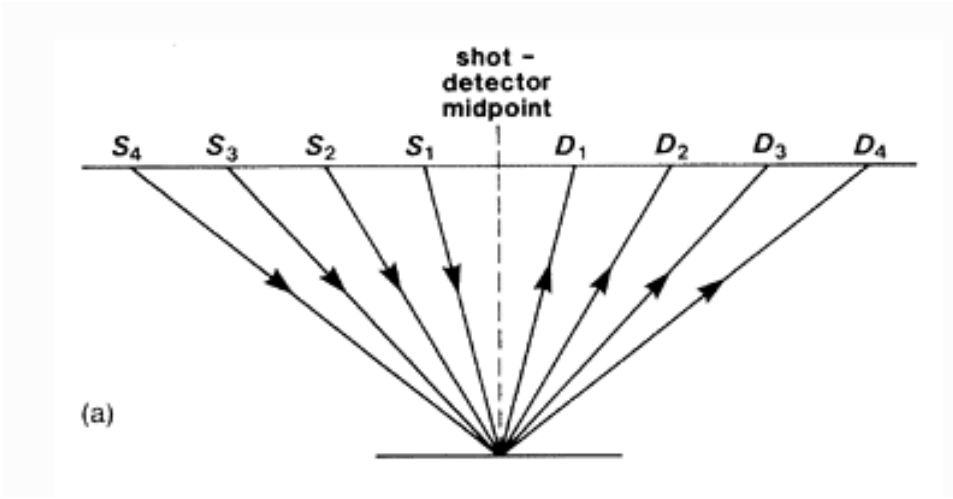


Successful Processing and Interpretation of Reflection Data

Reflection Survey

- Collected a bunch of data. How should I organize it?
- Then what?





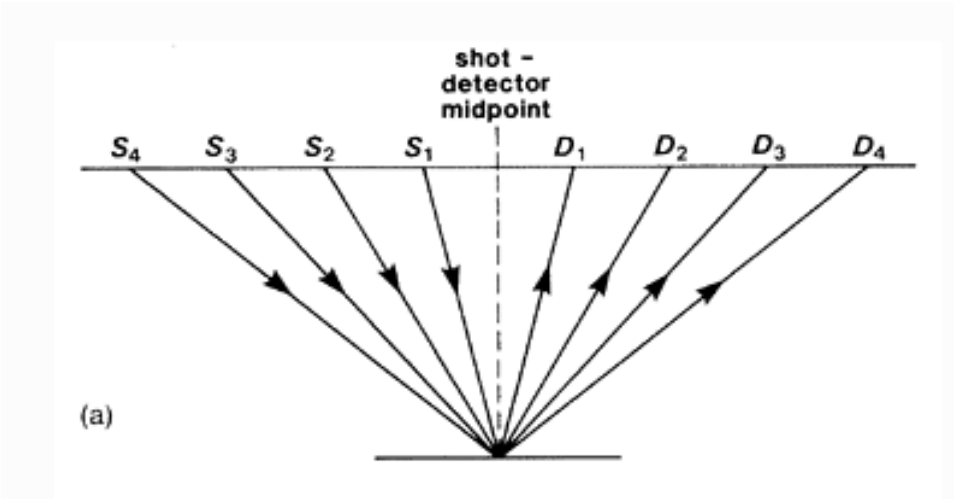
Examining CMP Gathers

- What if adjacent CMP gathers results in same parabolic feature?
- What if adjacent CMP gathers results in parabolic feature that shifts?

Examining CMP Gathers

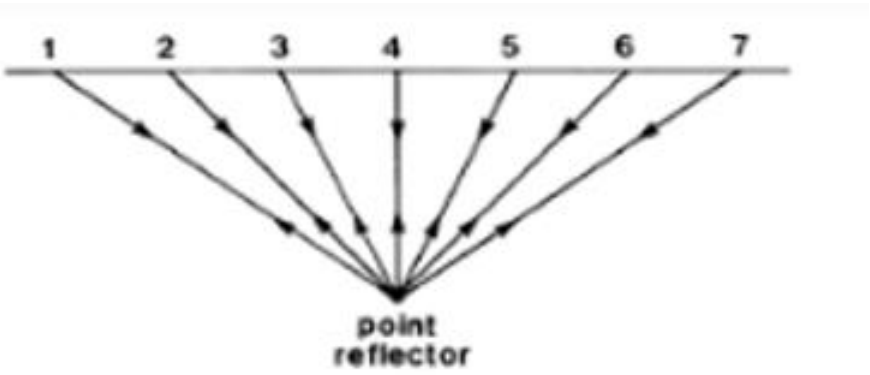
- What if adjacent CMP gathers results in same parabolic feature?

Layer



- What if adjacent CMP gathers results in parabolic feature that shifts?

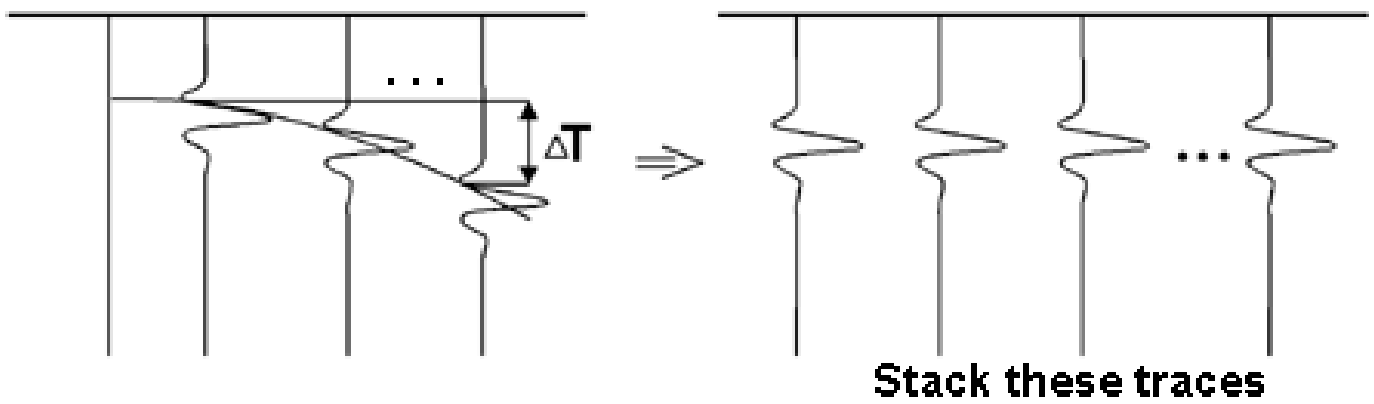
Point reflector



Remove point reflector feature from all CMP gathers **except** the one(s) with midpoint over the point reflector.

Normal Move Out Correction and Stack

- For each common mid point gather and for each reflective event.

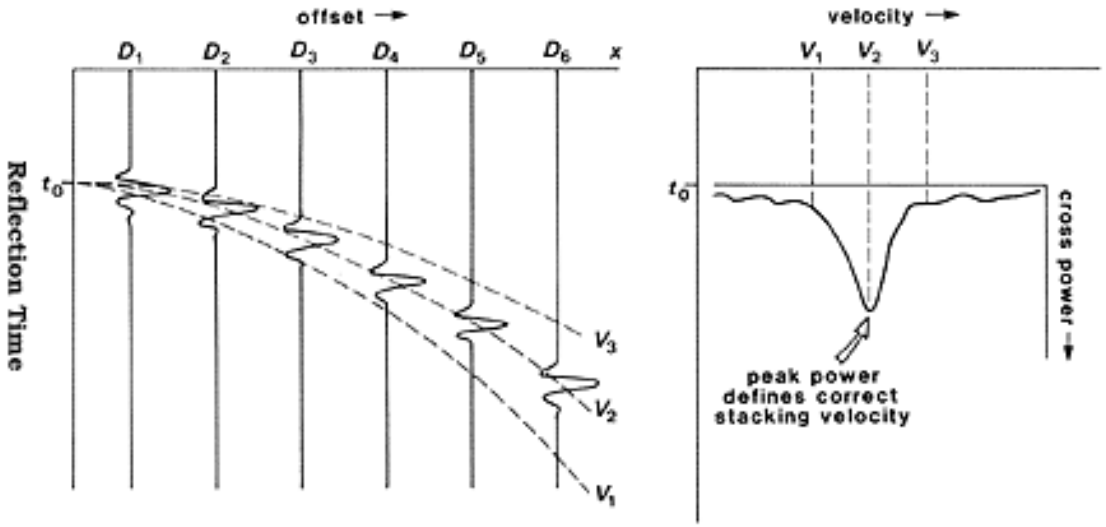


→ apply NMO correction

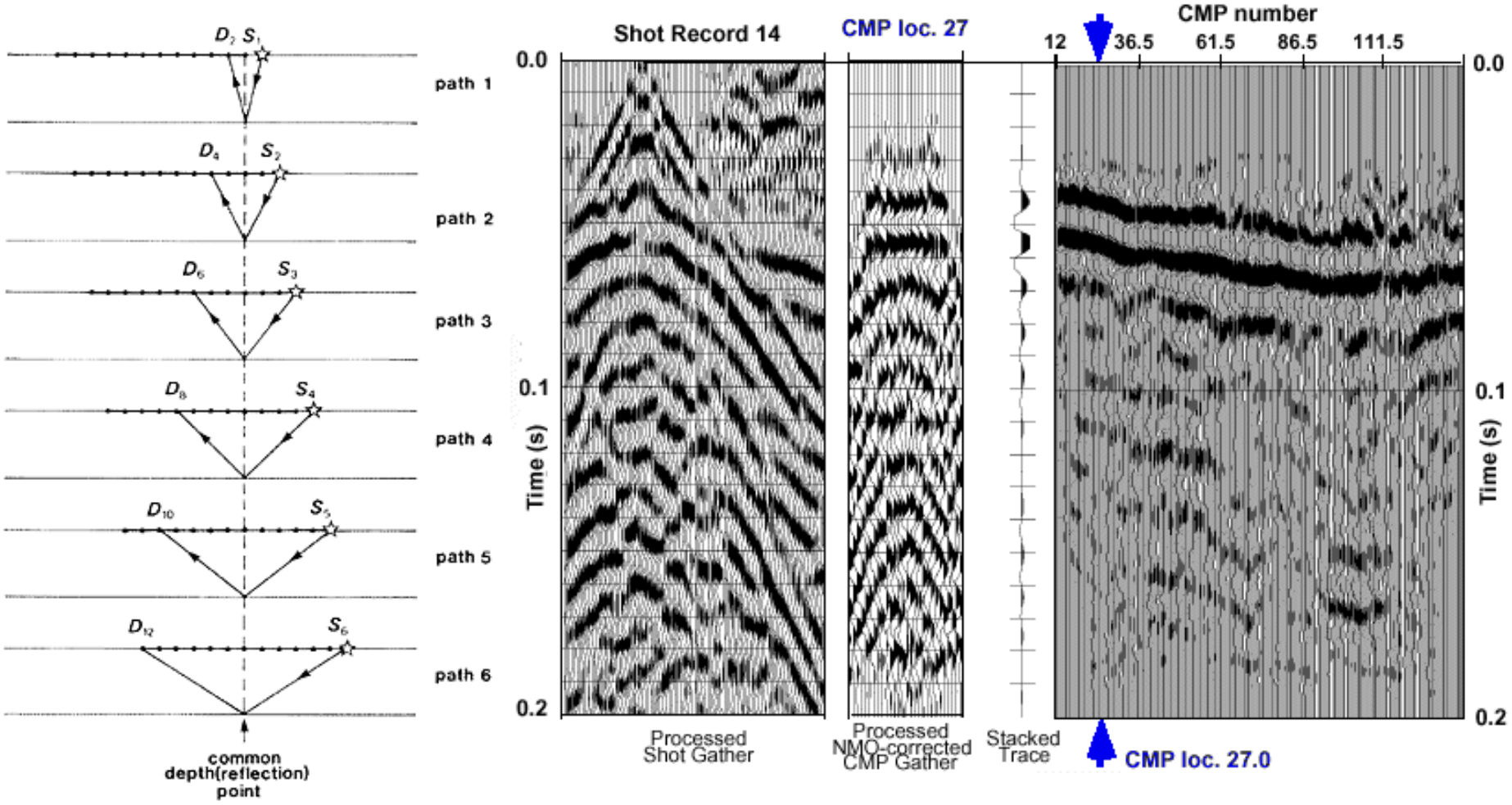
$$\triangle t = t - t_0$$

→ Verify by summing energy

→ Stack all the traces



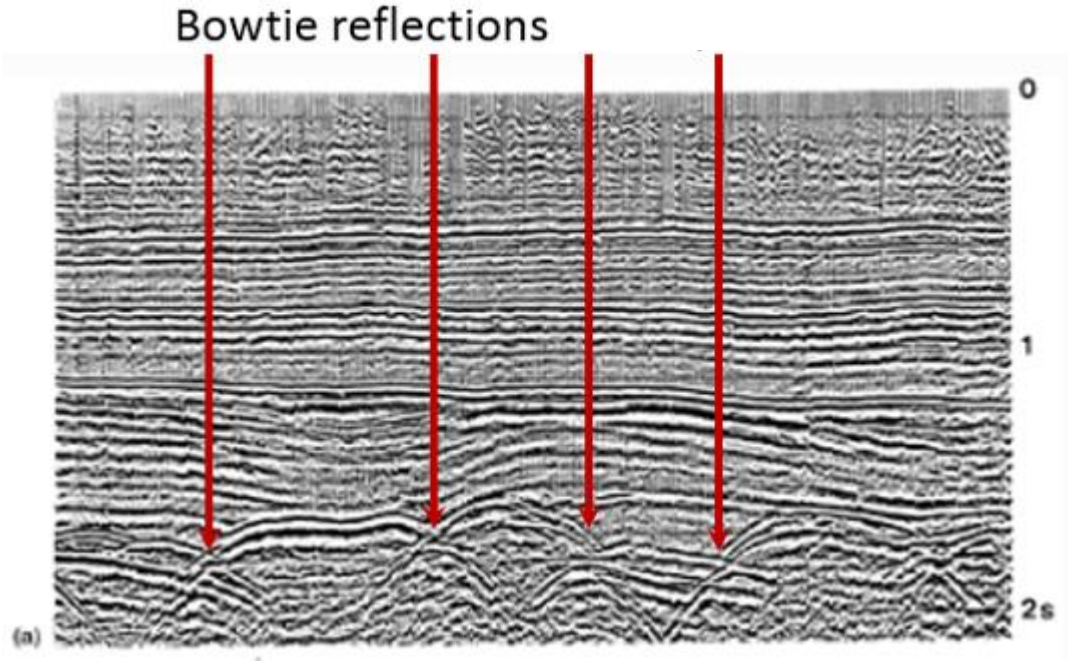
Interpolate Stacks for 2d or 3d Section



CSG = common shot gather
CMP = common midpoint gather

Migration: Bow-tie features

- What causes bow-tie features?
- Why is this?
- What can we do?



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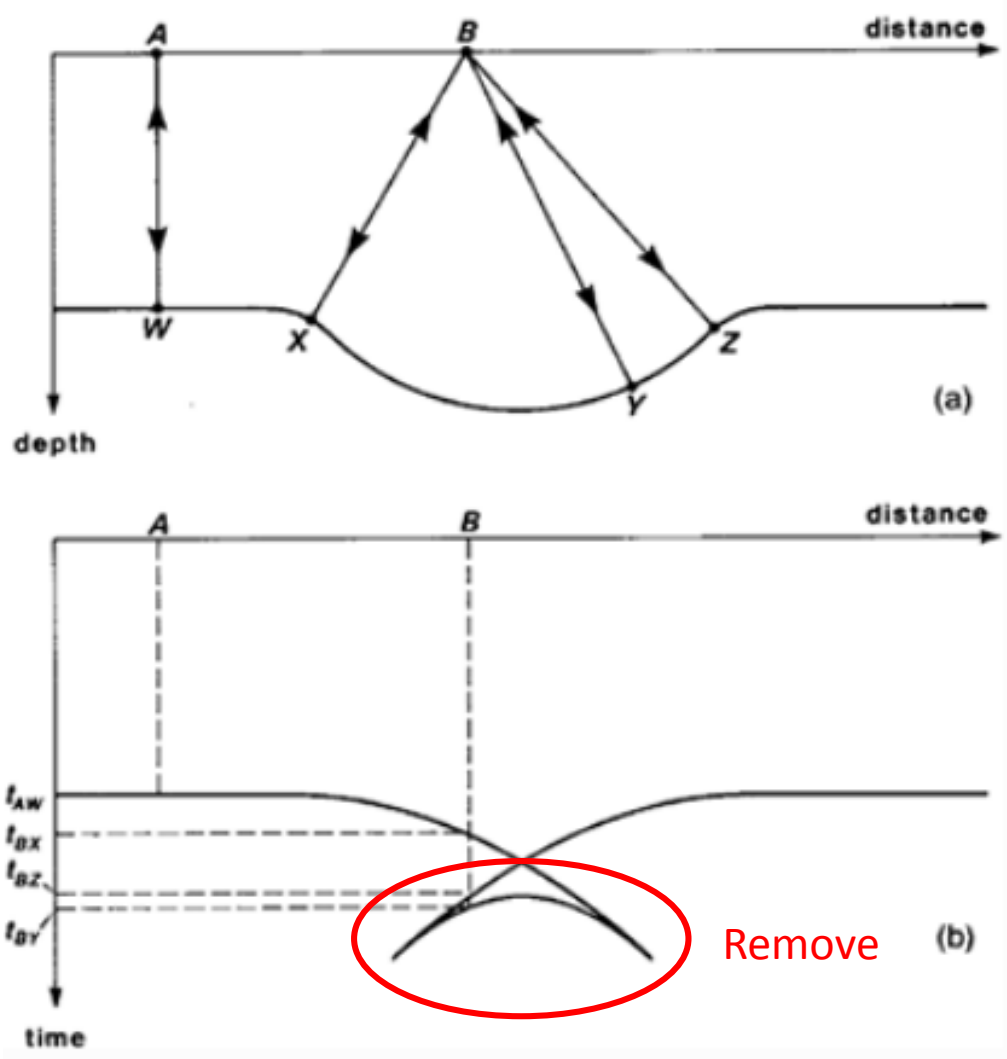

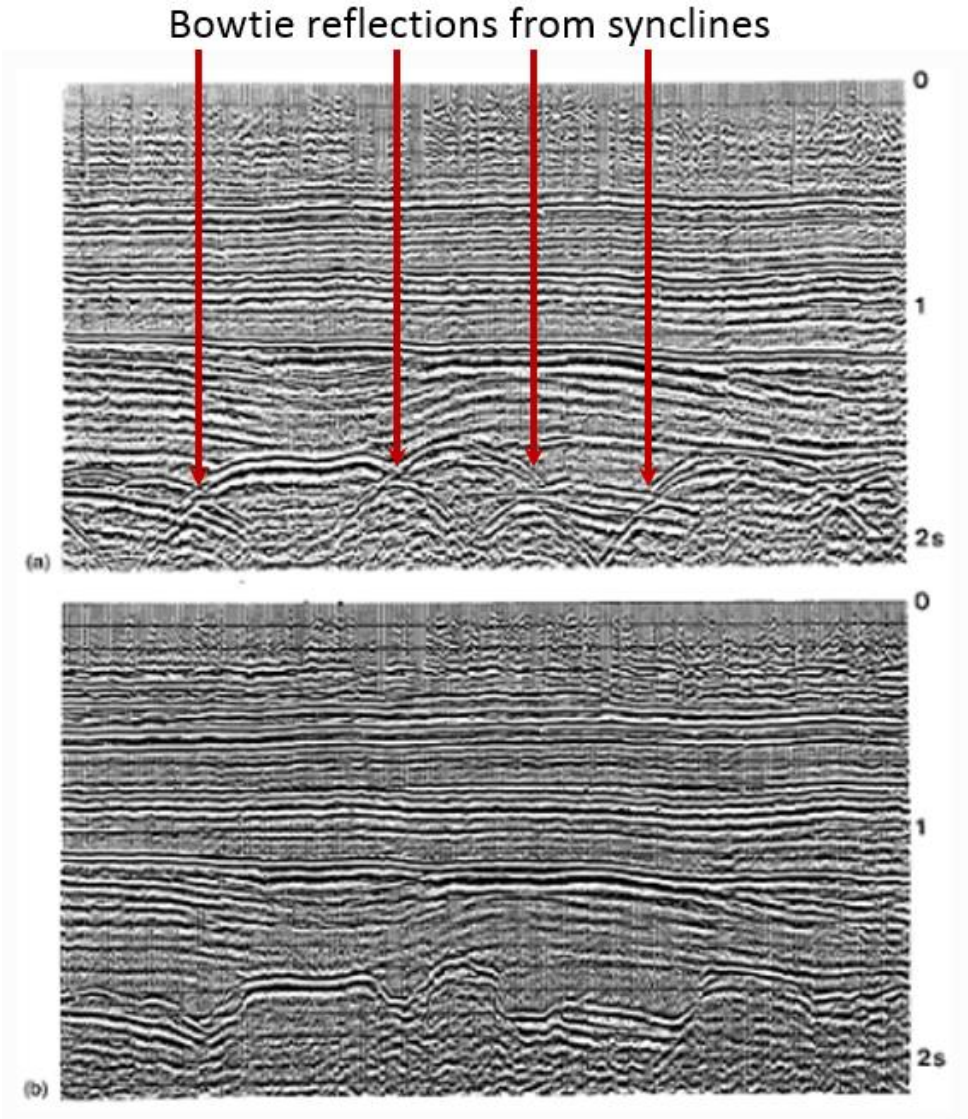

End of Seismology

Unit Activities

- **Labs: (Seismic I)**
  - Monday, September 30th
  - Tuesday, October 1st
- **Labs: (Seismic II)**
  - Monday, October 7th
  - Tuesday, October 8th
- **TBL:**
  - Monday, October 7th
- **Quiz:**
  - Monday, October 7th