Common-Offset 3D Physical Modeling of HTI Fractures for 3 Azimuths
Preliminary Results for Inline Perpendicular to Fractures

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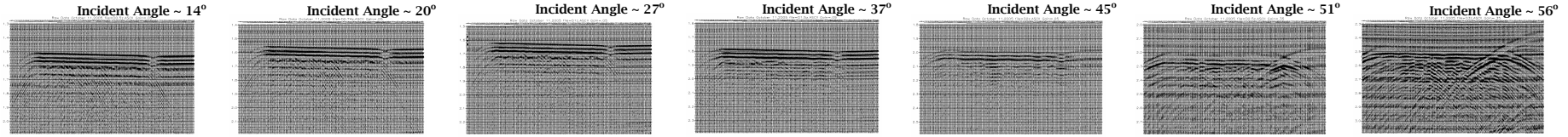
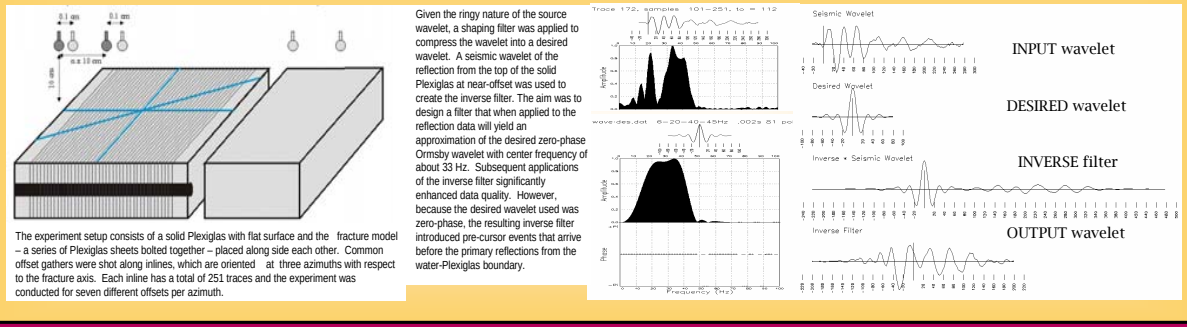


ABSTRACT

Fractures produce low-frequency scattered waves that are commonly seen beneath primary events in seismic reflection data. Numeric models and field data reveal energy scattering by fractures but much about the phenomenon is still unknown. Several factors control how fractures cause seismic wave attenuation including the mechanical and poroelastic properties of the fracture and their geometry (*e.g.* spacing and dimensions). The primary objective of this experiment is to study how fracture-generated scattering depends on extrinsic factors like the incident angle of the arriving plane waves (*i.e.* source-receiver offsets). Common-offset gathers were shot over fracture and solid Plexiglas physical models, which were laid side to side (see experimental set-up illustration). Seven sets of data were collected, corresponding to a different source-receiver offset, for three different azimuths. Only data collected for inline perpendicular to the fractures (*i.e.* azimuth = 90°) are shown. Diffractions are observed directly below the primary reflection coming off the water-Plexiglas boundary and these are more evident in the near-offset data (≤ 20°) and migrated sections. The diffractions are likely caused by minute indentions in the model surface due to the un-healed gaps between the Plexiglas sheets. Overall the reflections and diffractions lose sharpness with increasing source-receiver offset but applying a shaping filter dramatically enhanced the image quality of the data. The experiment indicates that at near-offsets, fractures scatter seismic waves just like point diffractors. At critical angle offsets however, the fractures are not as evident but instead, what is seen are periodic advance/delay in arrival times of the refractions giving the event an undulating character. We propose that this feature as another diagnostic attribute for determining fractures from seismic data.



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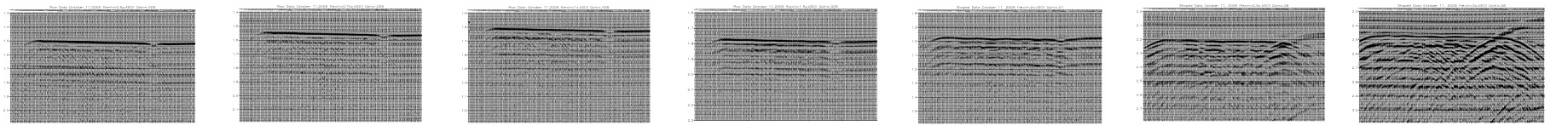

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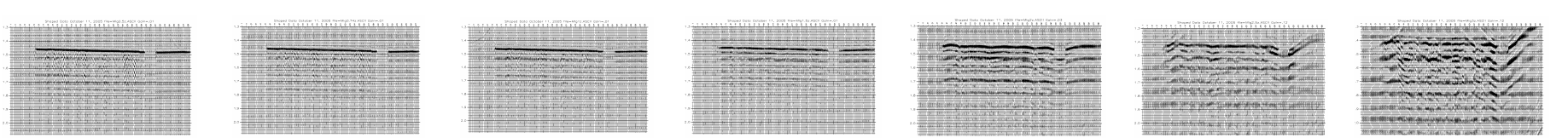

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