Modeling of, and considerations in cross-well and VSP (pre-) survey design

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Cross-well and VSP surveys are usually performed to image certain reflectors more accurately in a previously imaged part of the sub-surface. By employing modeling of wave propagation in a preliminary estimated Earth model, it is possible to determine the appropriate positions of sources and receivers to successfully image the reflector of interest. Using novel techniques based on eikonal equation solvers we show that modestly complicated Earth models commonly produce several illumination points on a reflector in typical cross-well geometries. Thus, proper source and receiver positions may yield more information about a certain reflector than poorly chosen positions. The techniques used will yield reflection points, which may be missed using standard ray-tracing techniques, while maintaining the computational efficiency of ray-based calculations in complex Earth models.