Location of seismicity recorded at SAFOD

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We present the principles of a novel event location procedure and its application to seismicity recorded in the main borehole of the San-Andreas-Fault-Observatory-at-Depth (SAFOD). The basic idea of the location approach is the back-propagation of the recorded wavefield along rays using a Gaussian-beam-type weighting factor. In the case of a sufficient number of receivers the intersection of these rays results in a distinct maximum at the corresponding hypocenter location. We have applied this technique to data recorded with an 80-level-3C-receiver array in the SAFOD main hole and we have located a number of events in the vicinity of the fault system. A modification of the location algorithm also allowed the precise location of one of the so called target events, which are the subject of the ongoing drilling activities at SAFOD. Figure 1 shows the result for this target event of May 5, 2005.

![Graph and Diagram](image)

Fig. 1: Resulting image for the target event of May 5, 2005 (yellow diamonds indicate the used 3C-receivers). Red/white colors in the center correspond to large stacked values and mark the event location.

We will summarize the principles of the location method and the performed processing steps, provide estimates of the uncertainties for the target event location and test the robustness of the location using six different 3D velocity models. Furthermore we will discuss the event locations in comparison with borehole logging data and coincident seismic reflection images and we will also show identified events with highly correlated waveforms.