Introduction
EXO-200 utilizes dual liquid xenon time projection chambers to observe the double beta decay (DB) of 130Te. Each TPC yields 37 scintillation channel waveforms and 38 each of ionization and charge induction channel waveforms; all of which are 2 ms in length and sampled at 1 MHz. Event reconstruction is a process by which raw waveform traces are analyzed to determine the time, position, and uncalibrated energy of individual localized energy deposits.

The reconstruction of an event proceeds in three stages:
1. Signal finding
2. Parameterization of signal characteristics
3. Bundling of coincident, characterized signals

Signal Models
Signal shape templates are used extensively in reconstruction in both the signal finding and parameter extraction stages and are produced for all channels. The models begin with unshaped signals: U- and V-wire response from the 2D weight potentials (eq. fig. 1); APD response is a step function.

![Image of signal models](image)

Waveform unshaping
The matched filter is ill-suited to disentangle multiple signals on a single track when these signals arrive close in time. An algorithm dedicated to isolating these signals is additionally applied to the original waveforms. This algorithm unsilenses the signal to obtain the charge signal

![Image of waveform unshaping](image)

Signal Fitting
Amplitude and timing extraction
The amplitudes of all U- and V-wire, and both APD sum signals are measured by fitting the waveforms to their respective signal models by minimizing

![Image of signal fitting](image)

Signal Clustering
Once the time and amplitude of signals on U-, V-, and APD channels have been found (and gained correctness), these signals are grouped together to form 3-D clusters.
1. Signals like channels are bundled.
2. U-wire signals identified as due to induction are ignored when constructing bundles.
3. Z-positions of bundles are then associated with APD bundles.
4. Wire bundles are grouped together to form fully 3-D reconstructed clusters.

Signal bundling
U-wire signals on adjacent channels arriving within 3.5 μs are bundled together. The bundle time is the amplitude-weighted average of associated signals. V-wire signals are bundled according

![Image of signal clustering](image)

Amplitude correlation PDF

\[
P_r(E_r, E_v, E_x) = \frac{A}{Z |Z| > 100 \text{ mm}}
\]

where \(P_r\) is a linear parameterization and

\[
\sigma_g(E_1) = \frac{1}{E_1 < 300 \text{ ADC} \mu\text{C}}
\]

All free parameters are determined from calibration data.

Time correlation PDF

![Image of time correlation](image)

Physical plausibility PDF

![Image of physical plausibility](image)