Photon Detector Data Products

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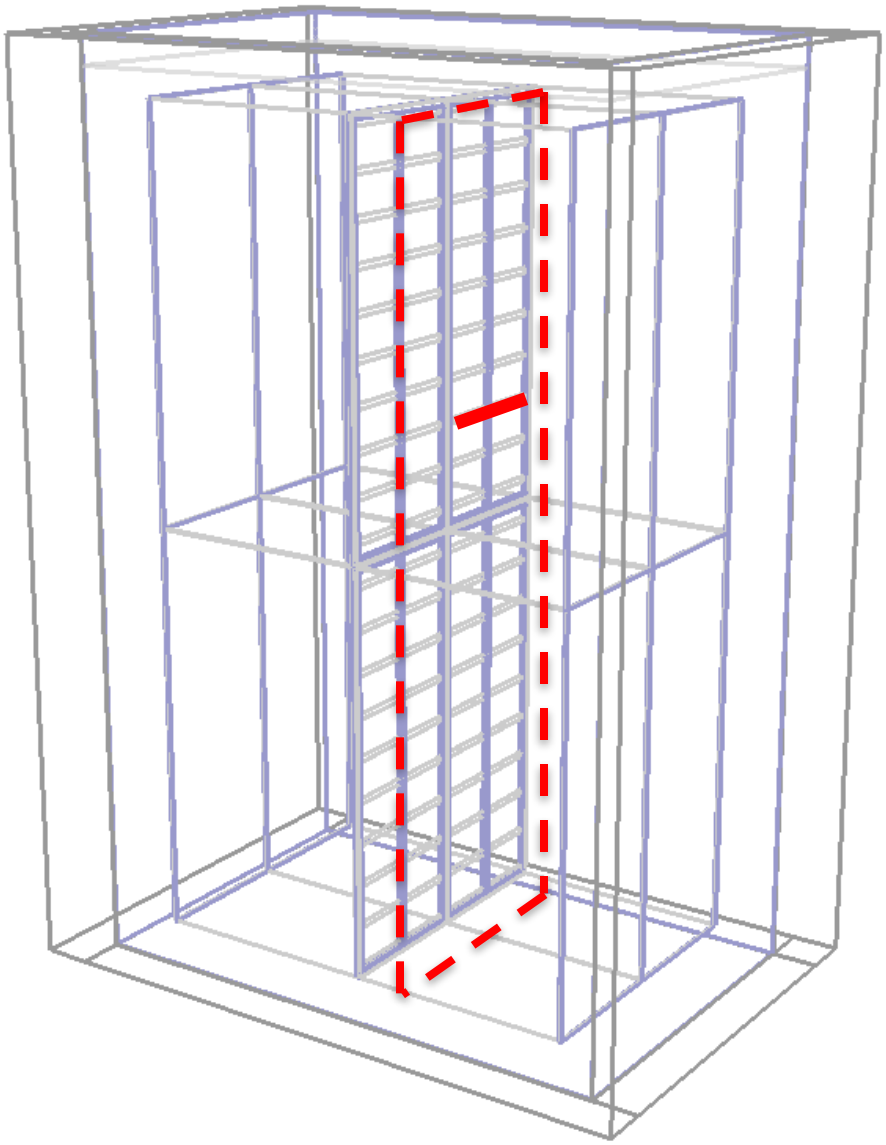
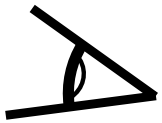
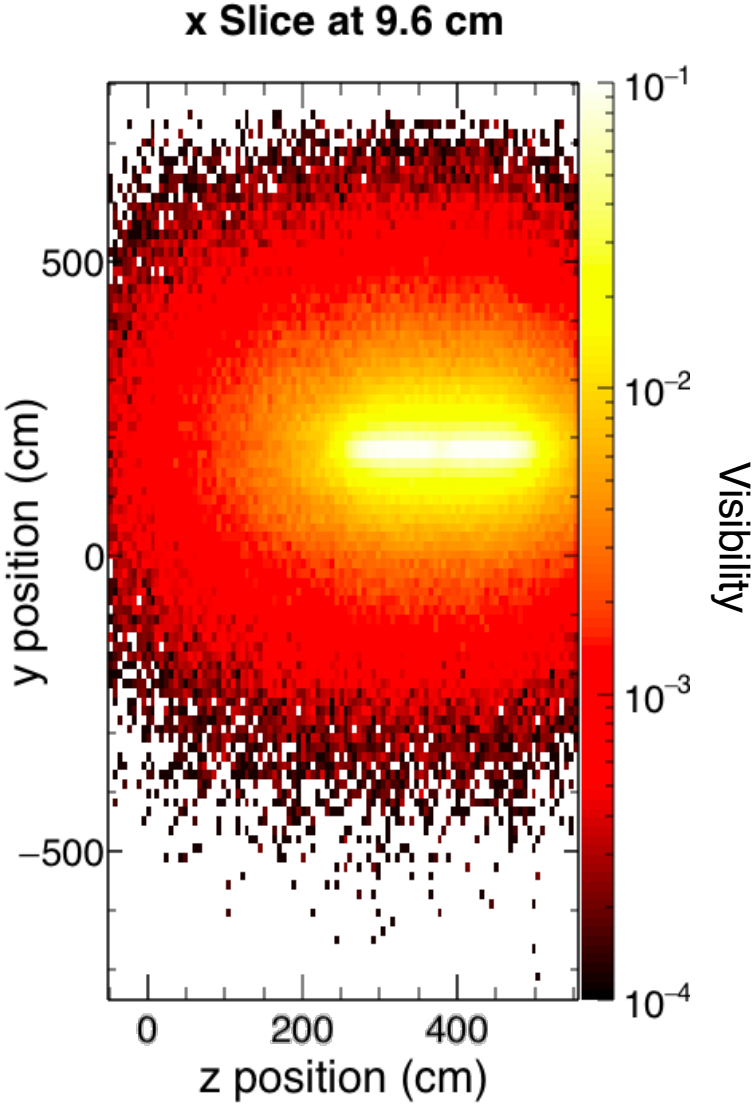
DUNE Physics Week

November 14th, 2017

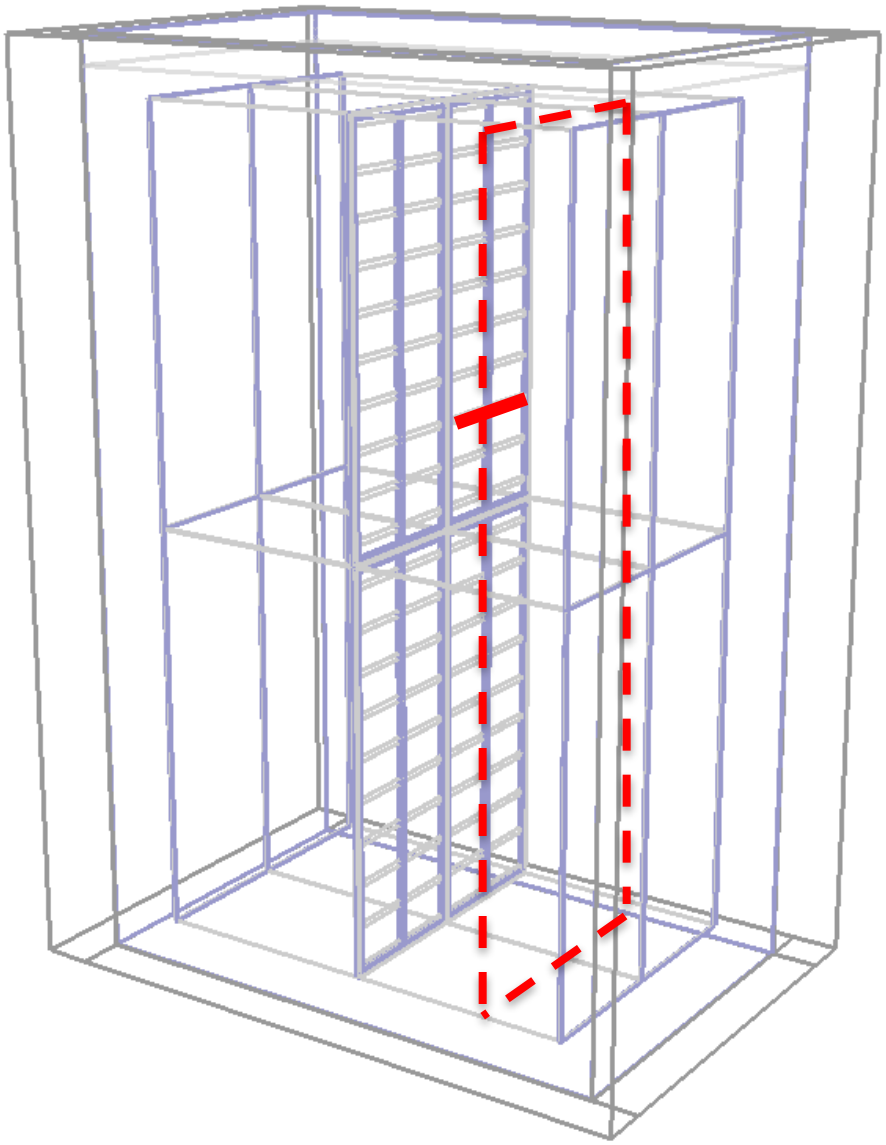
Photon Detectors

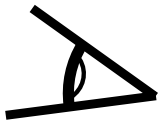


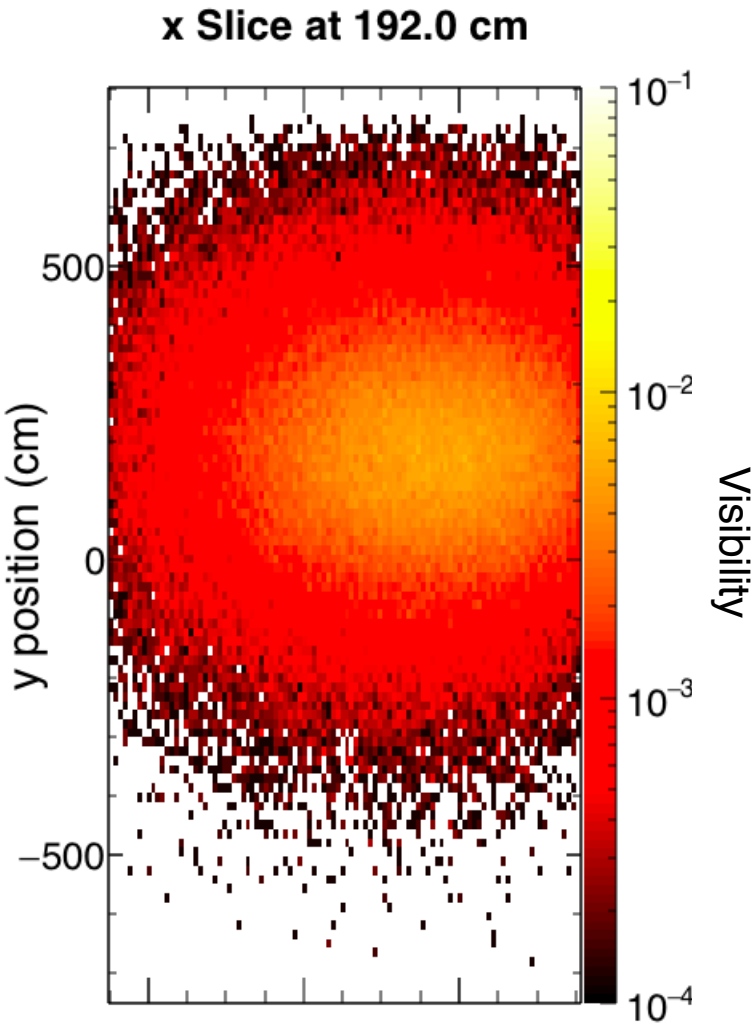




Photon Detectors







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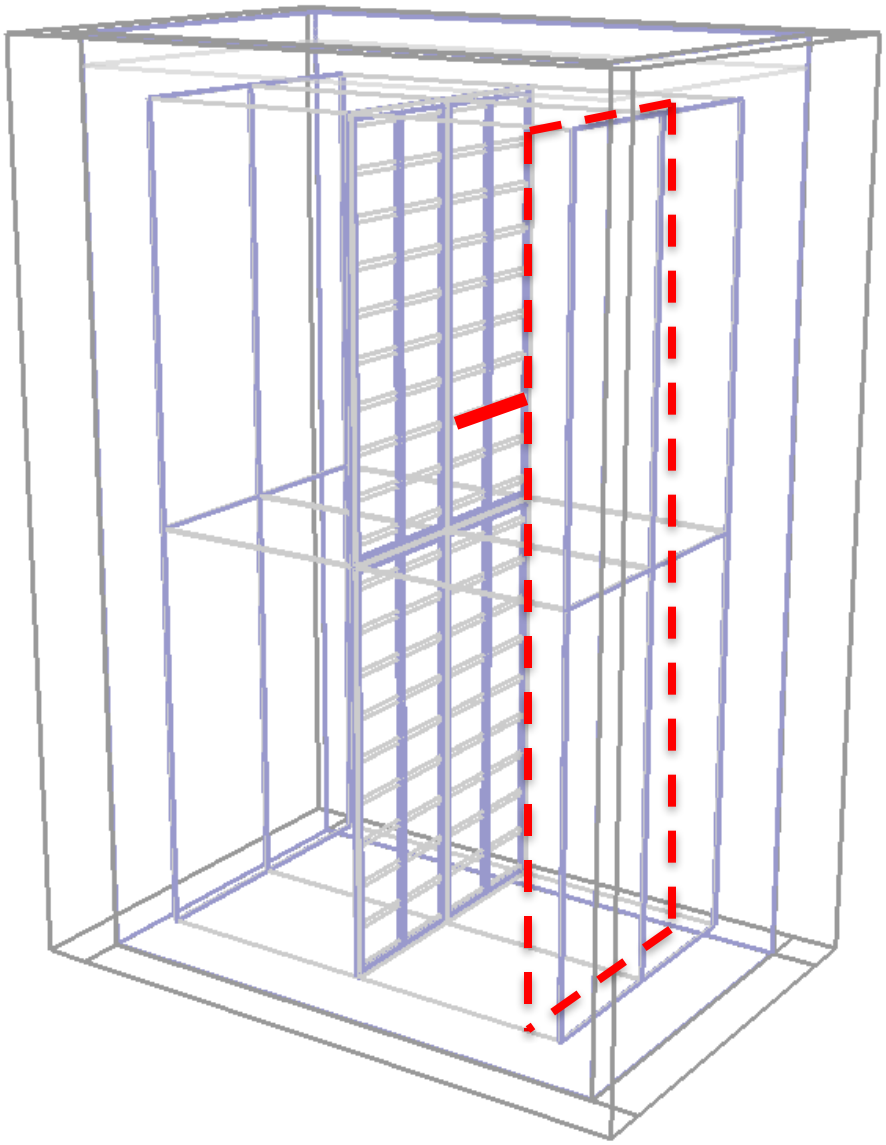
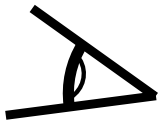
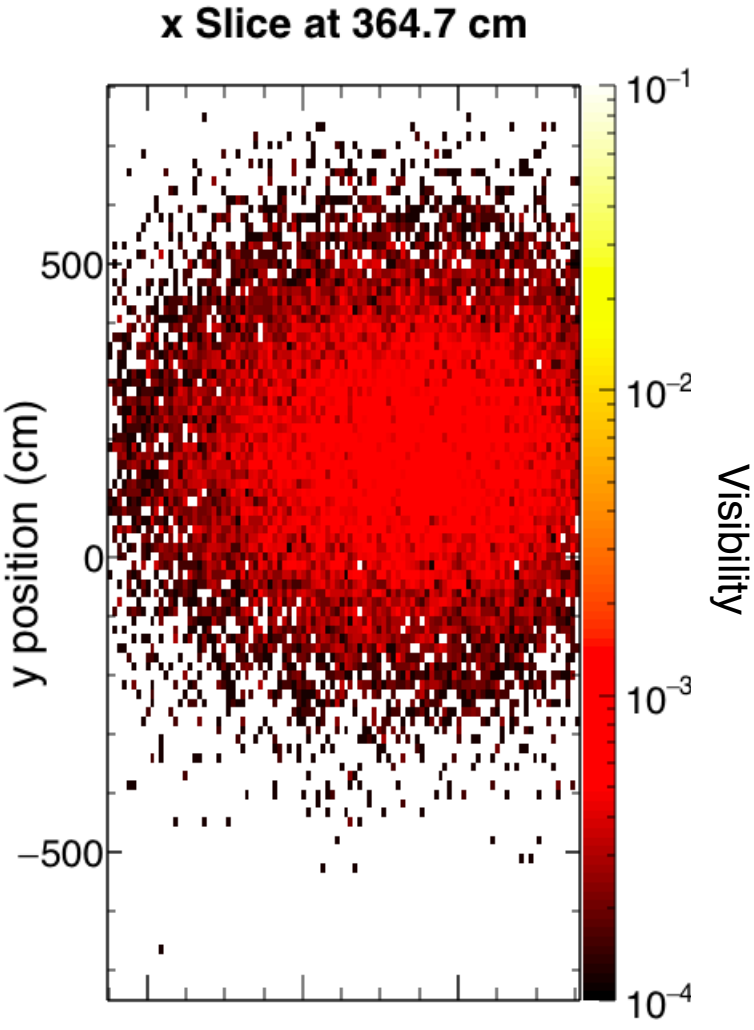
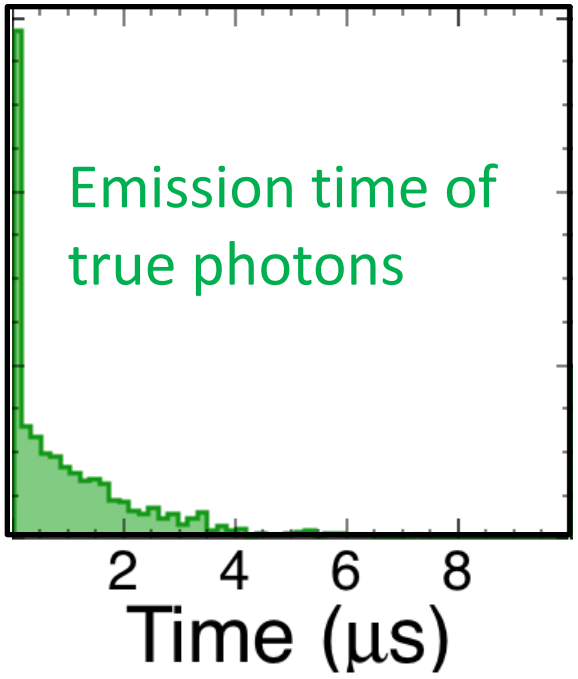
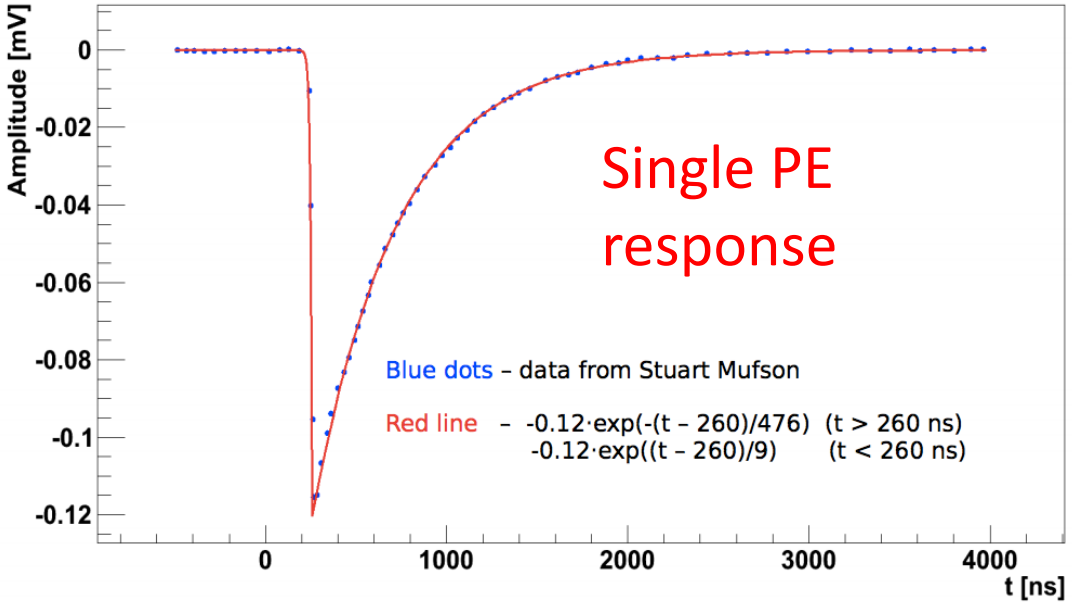






Timing



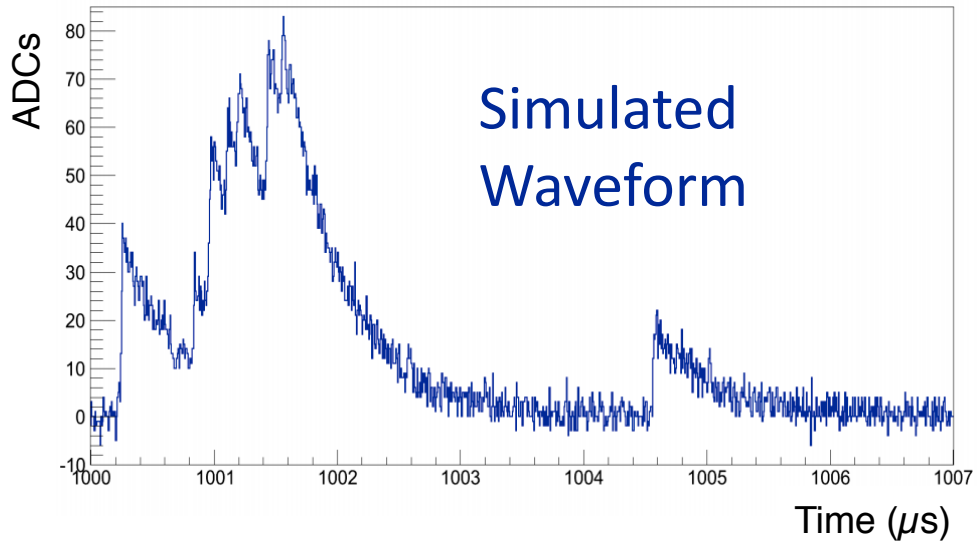


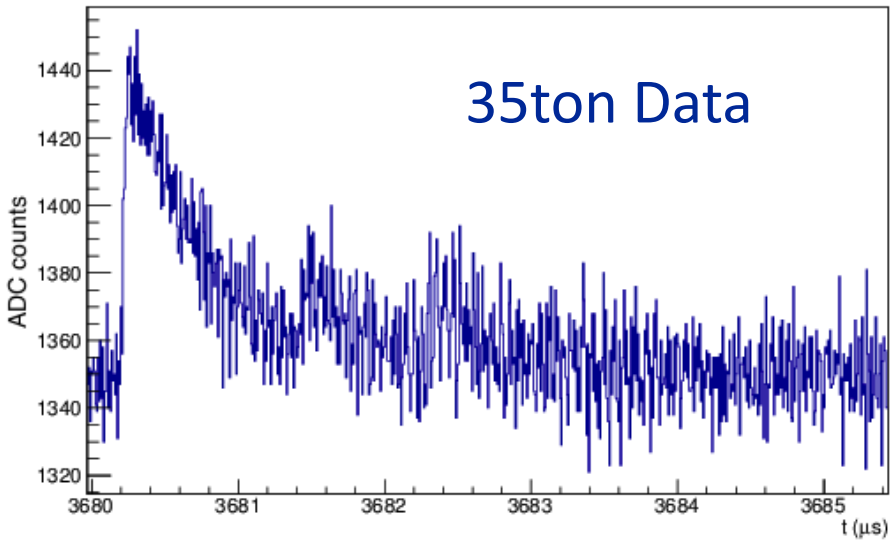
- Light emitted with two different time constants
  - ~1/4 emitted promptly (τ = 6 ns)
  - ~3/4 emitted late (τ = ~5 μs)
- Note that even the "slow" light is much faster than the drift time (ms)
- The SiPMs also have a time constant of ~0.5 μs, so each photon signal lasts a couple μs.

Waveforms

- The lowest-level object you're likely to run into.
  - Raw waveform data unpacked into this object.
  - Electronics simulation produces this object

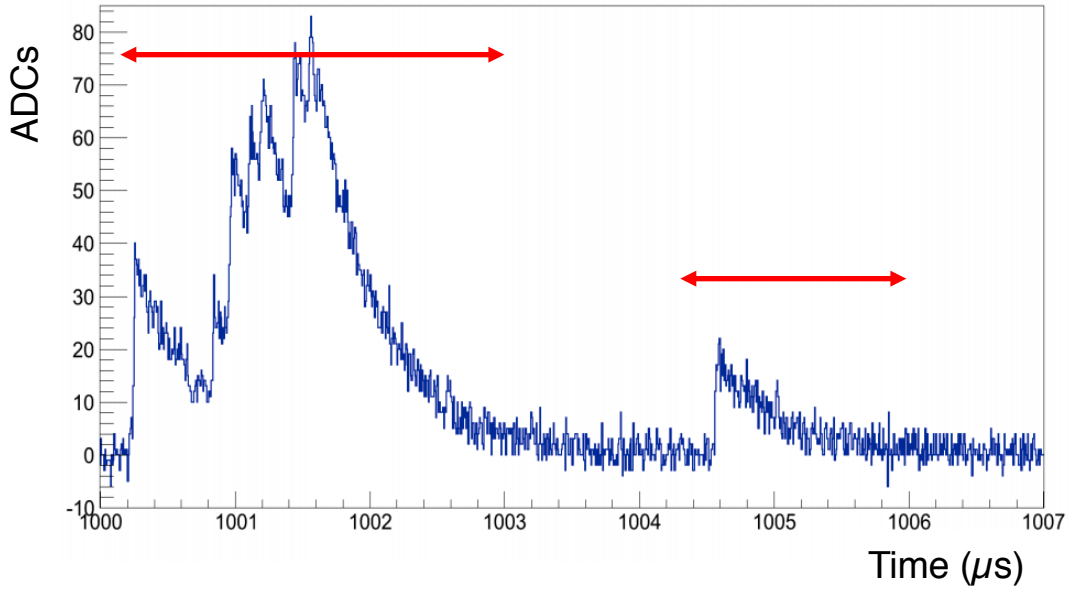
- `raw::OpDetWaveform`
  - A vector of shorts
  - Timestamp of first sample
  - Channel #
    - Note that there are 4 channels/photon detector bar





Optical Hits

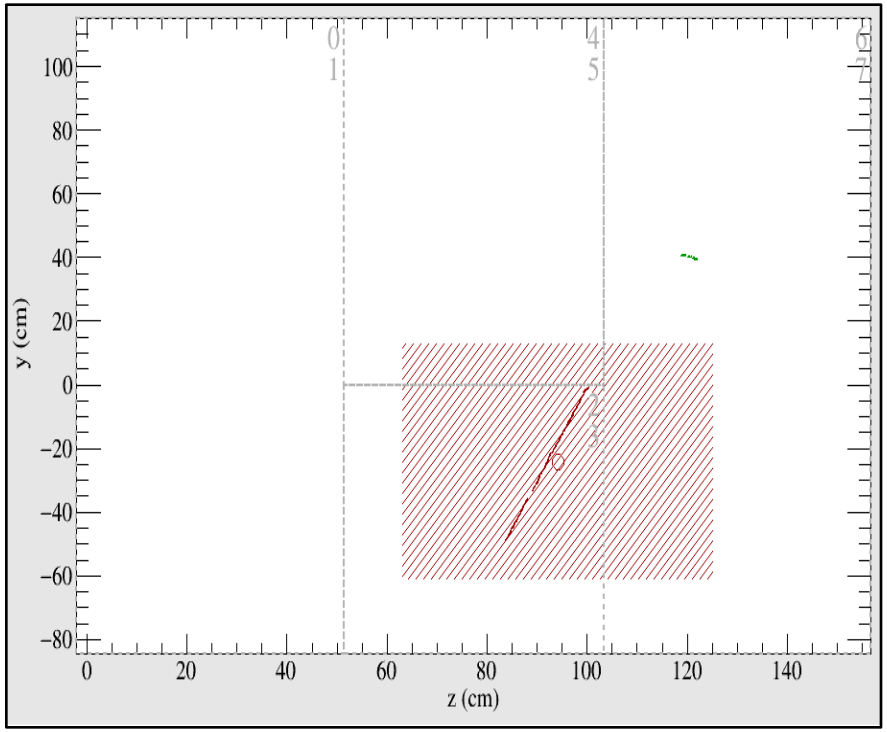
- A hit is a signal at a particular time on a particular channel.
  - Often not a single photon.
  - It will merge several photons which come close in time to one another.



- `recob::OpHit`
  - Time of the peak, relative and absolute
  - Width, Area, Height of peak
  - PE
    - Converted from Area for DUNE

Flashes

- A “Flash” is intended to correspond to physics in the detector producing light.
  - Like a track, but you expect only 1 per interaction.
  - Made up of hits coincident in time.
- `recob::OpFlash`
  - Time, width in time
  - Position, width in Y and Z
    - Weighted average of PDs with hits
  - TotalPE
  - PE on each channel



Caveat about Positions in ProtoDUNE

- In protoDUNE, there are only 3 bins of photon detectors in the Z-direction.
- We do not get the Z-position right for entering events since we don't have the resolution in that direction.