

PNS analysis update for VD COldBox run

Ajib Paudel [Fermilab]

Framework (LArSoft and Lardon):

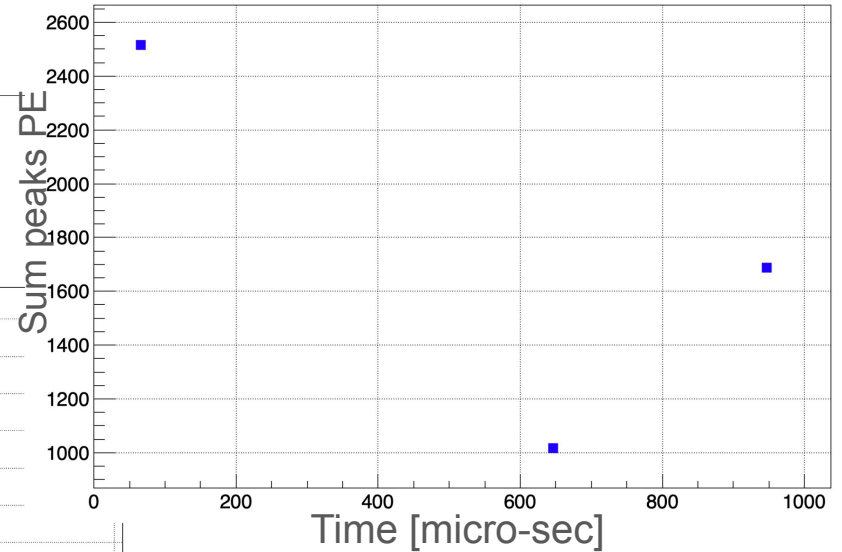
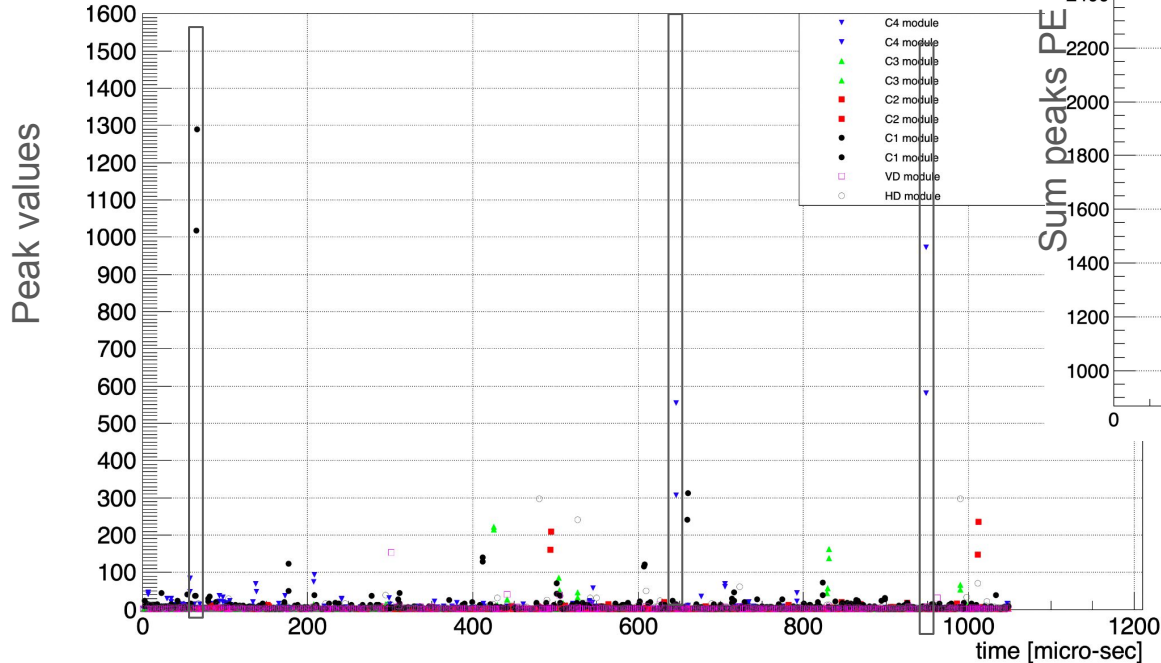
I am mainly working on LArSoft, Wei has been looking at Lardon at the moment (will present details after me).

Initially there was uncertainty on how long the LArSoft setting up will take, but as the framework is ready to be used for data-analysis we might mostly use LArSoft and Lardon will be used for comparison/validation.

PDS Flash reconstruction:

Looking at individual PDS channels and finding peaks above a threshold of 1 PE. Then finding a waveform above threshold (set to 500 PE in the plot below). Adding up all peaks within 5 micro-sec of maxPE hit. **Note: used SPE peaks from Henrique's slides.**

time vs peak values

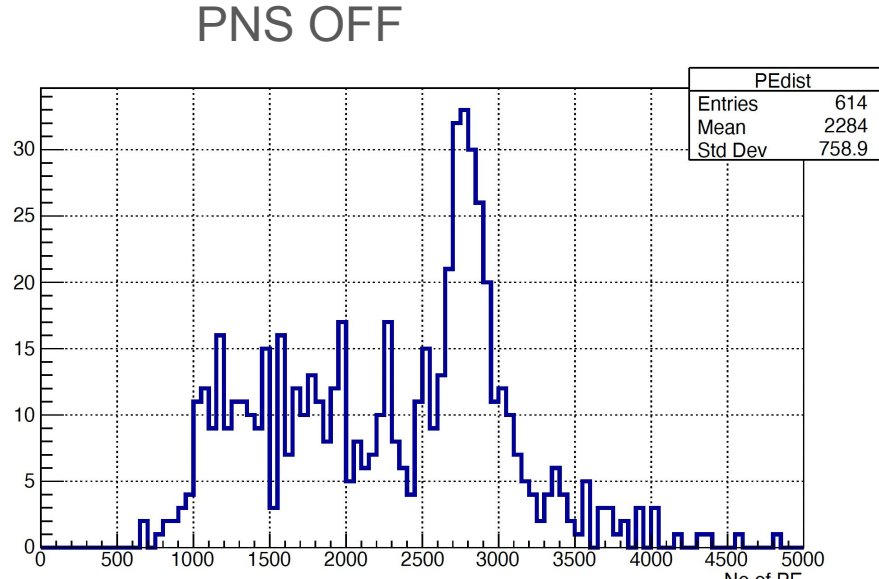
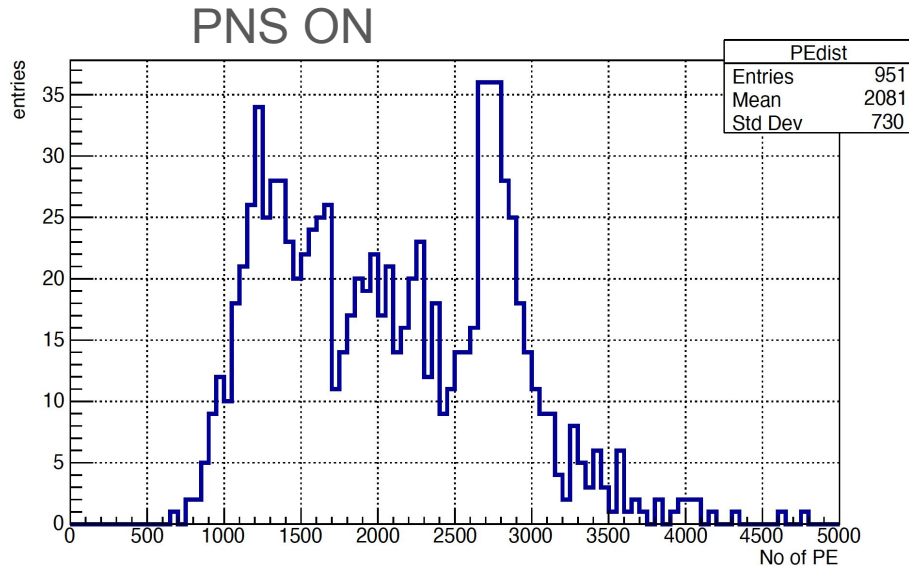


Flashes with largest signal above 500 PE

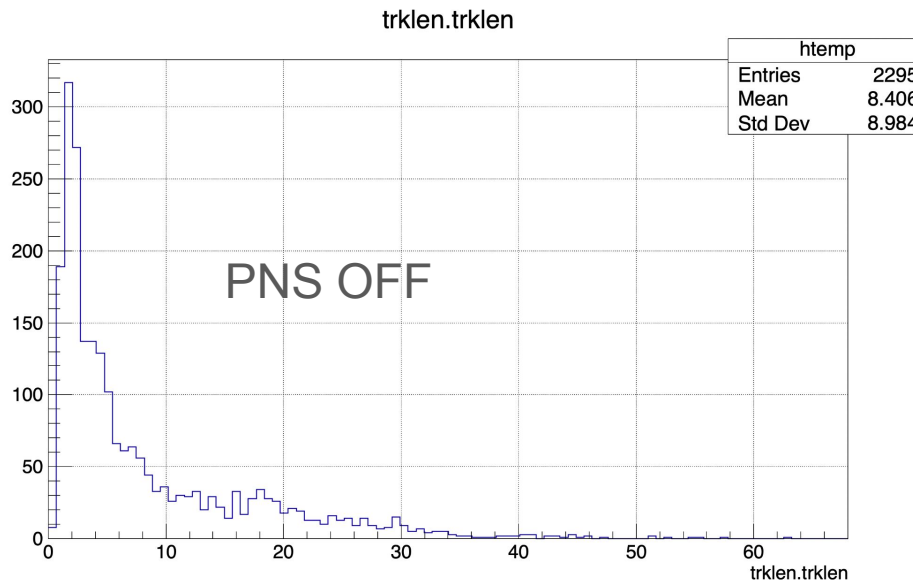
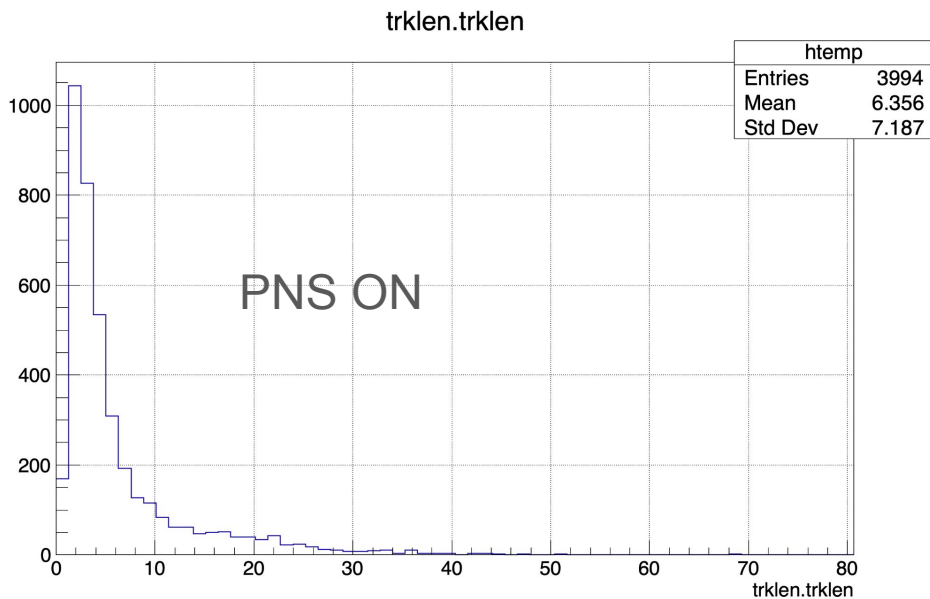
Note: At the moment we are focussing on categorizing events, so using amplitude for simplicity. For calorimetry we need integral.

Flash reconstruction :

Files with same number of events (332 events) (same time window)

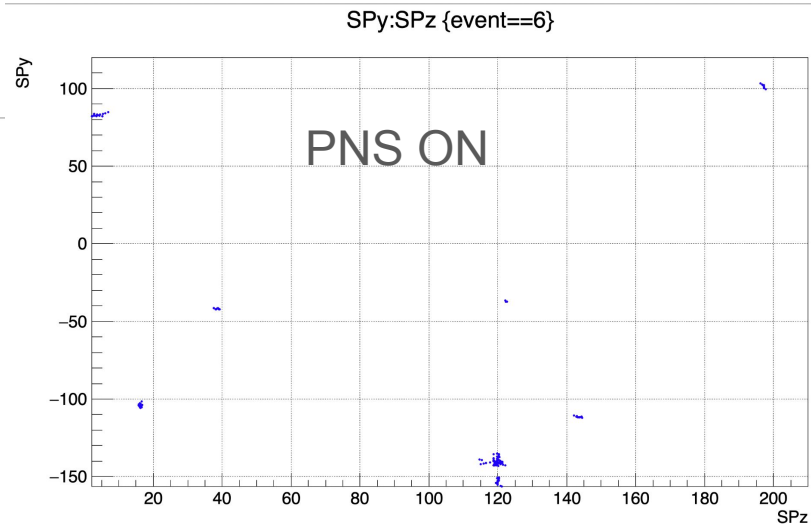
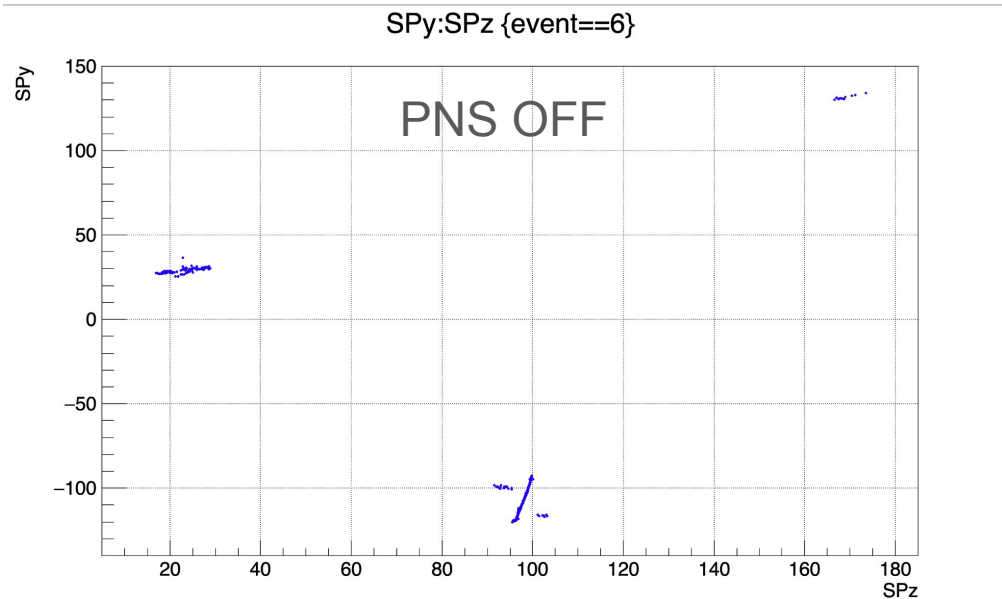


Track reconstruction:



PNS ON sample has more tracks and the average track-length is smaller as the neutron capture activity is reconstructed as short tracks or hits lasting over a few channels

PNS OFF and PNS ON events (SpacePoints):



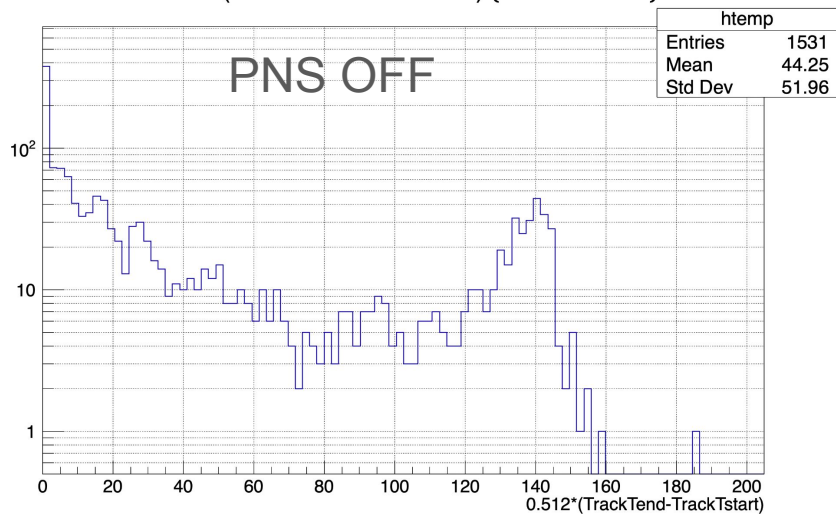
PNS ON have isolated clusters of few hits spanning over a few wires; which are candidates for neutron capture.

deltaT distribution:

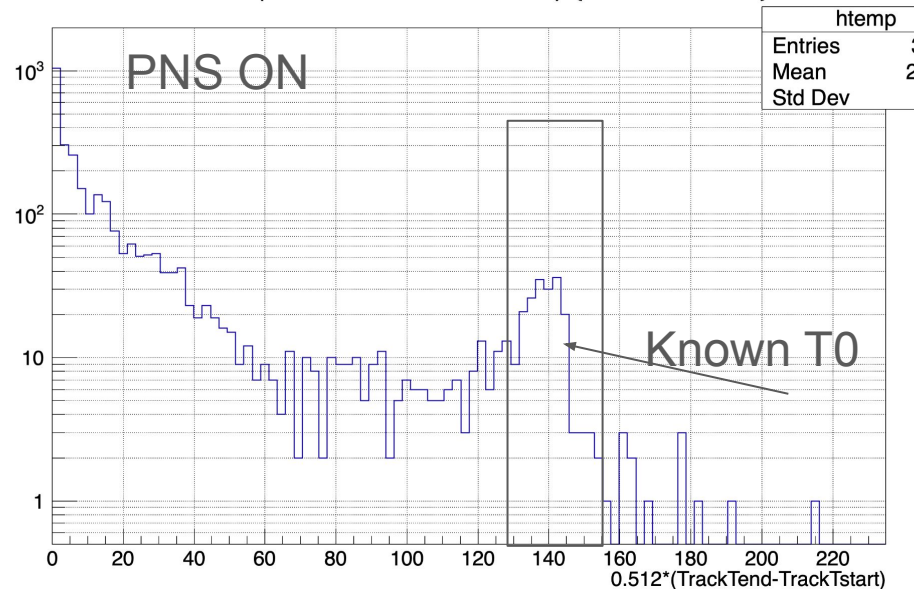
Look at all the collection hits associated with a track and find the difference between the minimum and maximum hit time.

This will help eliminate cosmics crossing cathode-anode (which might be a major background, considering small drift volume).

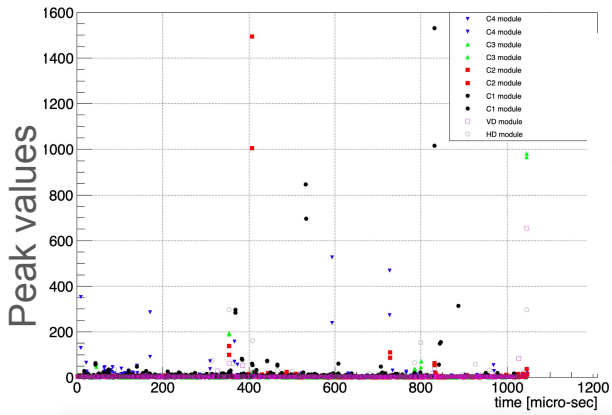
$0.512 * (\text{TrackTend} - \text{TrackTstart}) \{ \text{TrackTstart} > 0 \}$



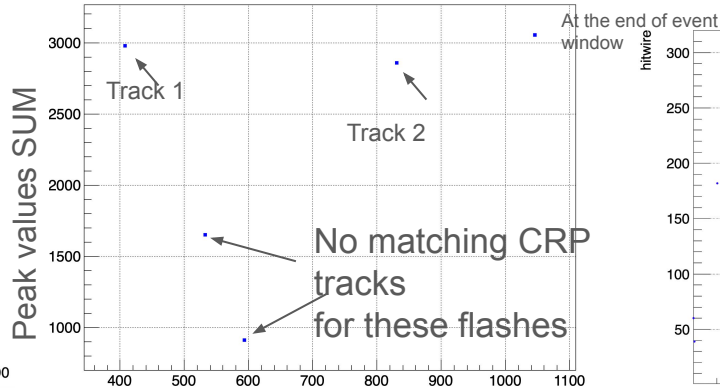
$0.512 * (\text{TrackTend} - \text{TrackTstart}) \{ \text{TrackTstart} > 0 \}$



time vs peak values

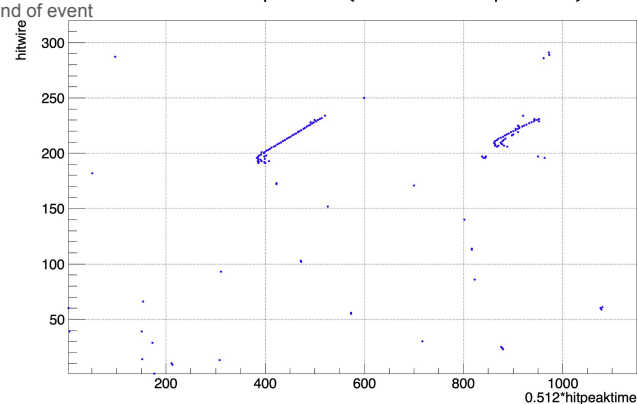


Flash PE vs time



Collection hit vs time

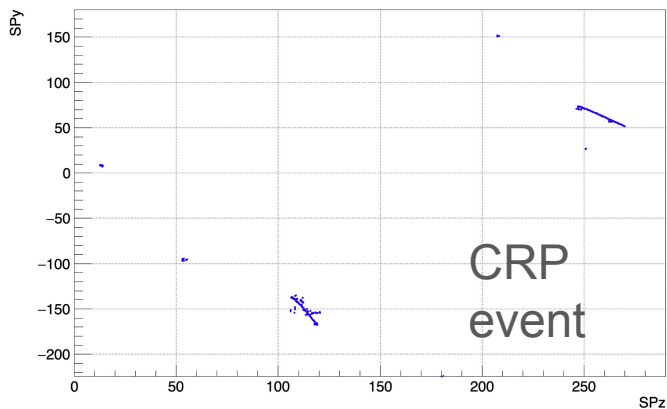
hitwire:0.512*hitpeaktime {event==1 && hitplane==2}



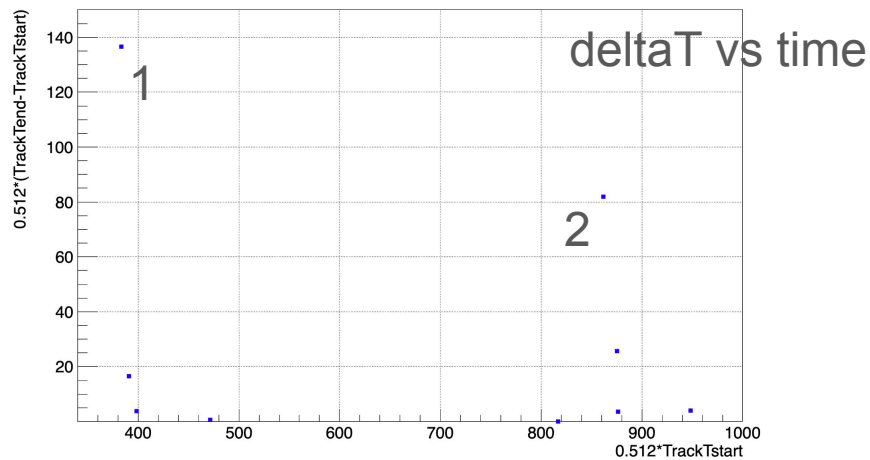
PDS+CRP [same event, looking at different parameters]

Space points

SPy:SPz {event==1}



$0.512 \cdot (\text{TrackTend} - \text{TrackTstart}) : 0.512 \cdot \text{TrackTstart}$ {TrackTstart=0 && event==1}



Summary:

1. LArSoft framework ready from the analysis point of view.
2. LArSoft reconstruction for VD coldbox needs to be tuned, current reconstruction has many issues to list a few:
 - a. Induction planes have a lot more hits than collection plane. Most of the induction hits are presumably noise.
 - b. Many tracks has very few or no collection hits
 - c. Space points have only one hit associated with them; in principle at least 2 hits is needed to find the Space point which is a 3D object
3. For the PDS data we are looking at the raw waveforms and trying to reconstruct PE for neutron capture identification; for more advanced studies we will need to reconstruct the PDS charge by integrating the waveform.