FT-based PID

These slides summarize a study of different FT-based PID algorithms to be used for events that do not have an electron in the FD.

Two algorithms were tested:

1. FT-only PID that simply takes the most energetic charged cluster or electron in the FT to calculate the start time;
2. FT&FD PID that looks for the best timing match between electrons in the FT and tracks in the FD to choose the trigger electron.

The study is based on a skim of events with at least one positive and one negative track in the FD, one positive track in the CD and one electron in the FT from run 4013, cooked in January (no alignment yet).

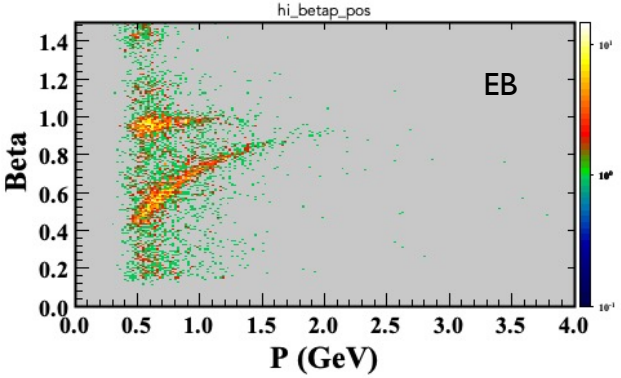
The results indicate the second algorithm is more effective.

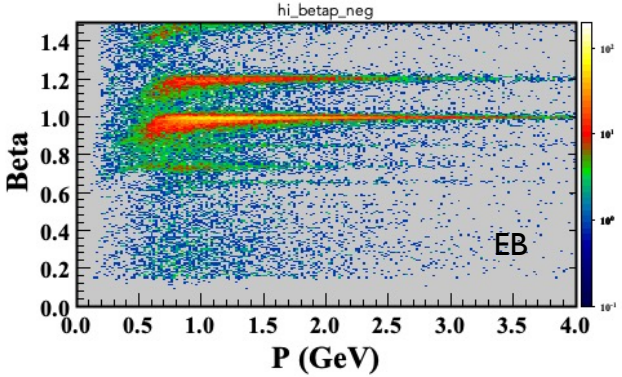
Final confirmation could come from analysis of exclusive final states.

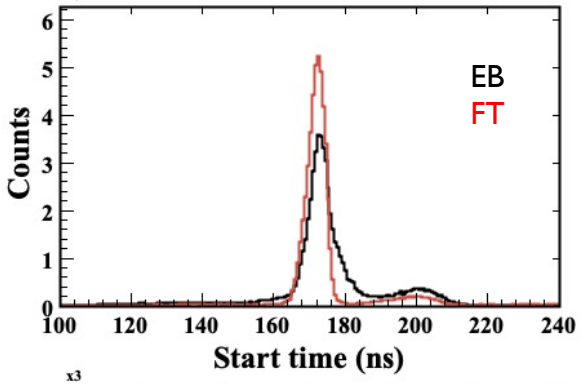
Current PID vs. FT-based PID

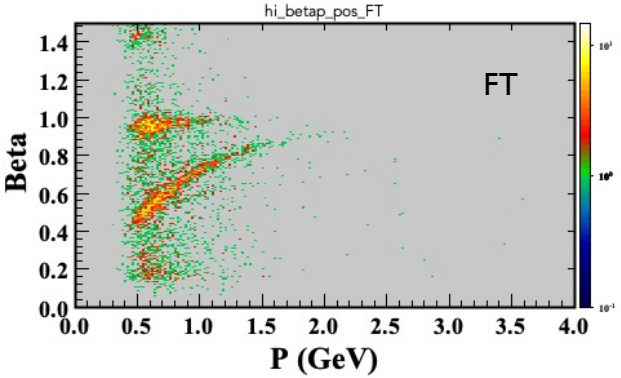
The beta vs. p and start time distributions for the PID scheme currently implemented in the EB for events with no electron in the FD was compared to what obtained using the FT information alone to get the start time.
The comparison is done for events with at least one positive and one negative track in the FD, one positive track in the CD and one electron in the FT.
(vertical scale in 2D plots is constrained to the same range)
Findings:

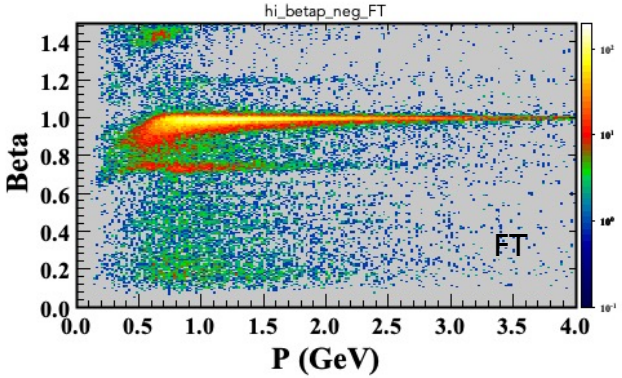
- The FT recovers events in which assuming the FD trigger particle is a pion is wrong,
- The FT pid seems to give more junk at low beta (start time is too small); this is consistent with the start time difference shown in the bottom right plot.

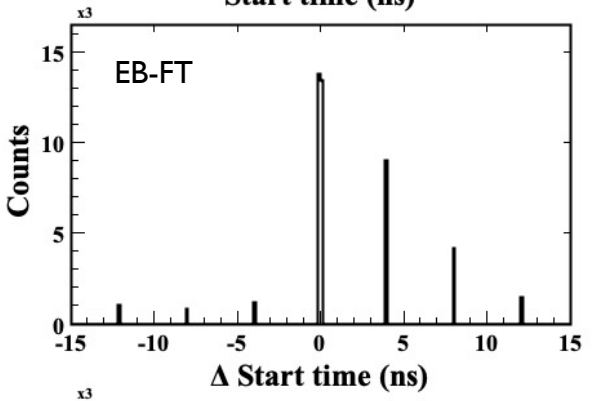












FT&FD algorithm

Using the FT time alone could be too loose due to accidentals or events with multiple clusters.

As alternative, the combined information of FD tracks and FT electrons could be used as follows:

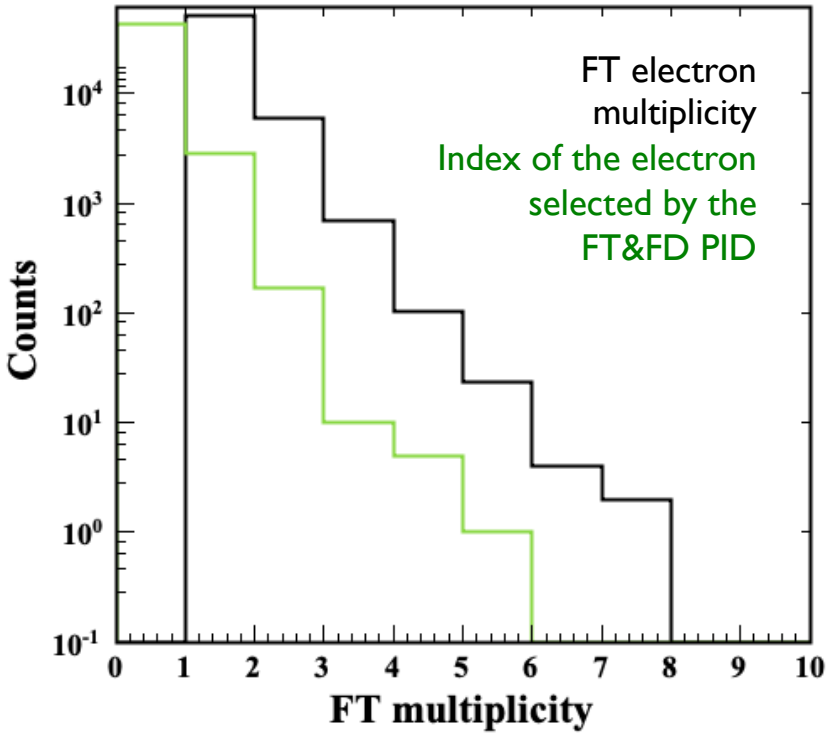
- Loop over all FT electrons (
- Loop over all FD tracks (using only panel 1B time for now), looping over all possible mass assignments
- Choose the FT electron that gives the best match in vertex time with the FD track
- Assign the start time based on that electron

This is very similar to what was used in CLAS for photon runs.

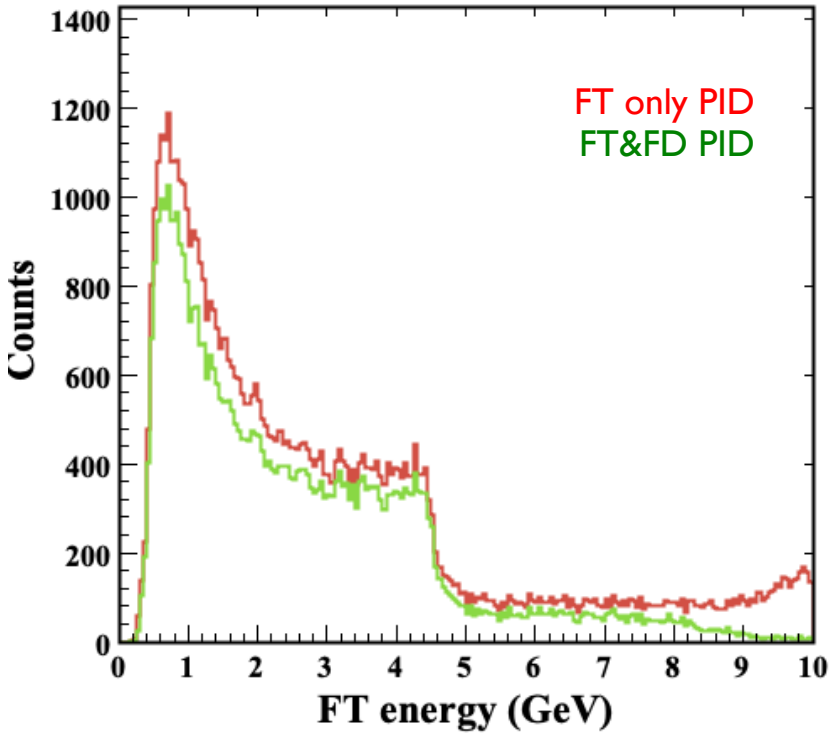
RF vertex corrections can be applied using the track vertex.

Motivations

About 11.5% of the events have more than one electron in the FT
The FT-only PID selects the most energetic one
The FT&FD PID can select electrons other than the most energetic

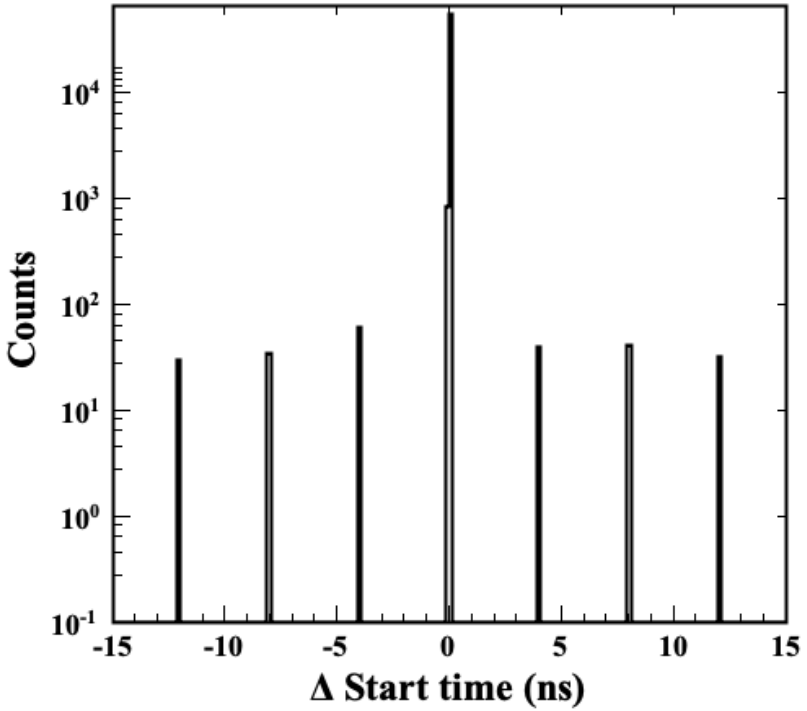


The energy spectrum of the "trigger" electron for the FT-only PID, shows contribution from elastic scattering (the rise at 10 GeV) that is a symptom of accidentals since elastic is incompatible with the selected event topology
This contribution disappears with the FT&FD PID (loss of overall statistics due to timing cuts as explained in the next slide

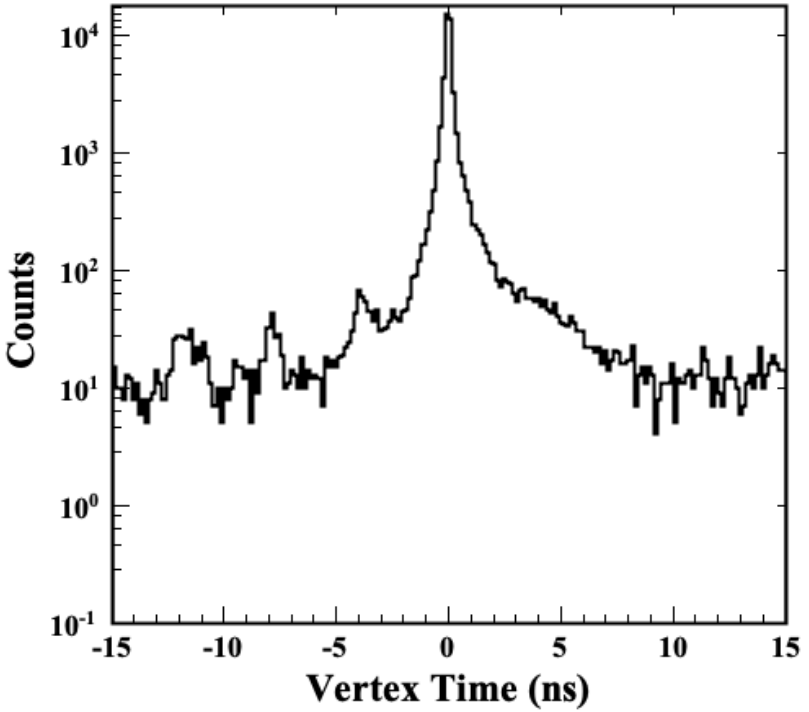


FT-only vs. FT&FD PID

The start time of the two algorithms can differ by multiple RF periods



In the FT&FD PI, the vertex time difference between the FT electron and the track can be used as quality parameter.
A +/-2ns window is used in the current analysis



FT-only vs. FT&FD PID

The final comparison between the two algorithms shows that, even if fewer events are reconstructed with the FT&FD PID because of the timing cut, the events that are lost are not in the mass peaks but in the out-of-time tails, consistently with the improvement observed in the beta vs. p plots