

CLAS12 TRIGGER UPDATE

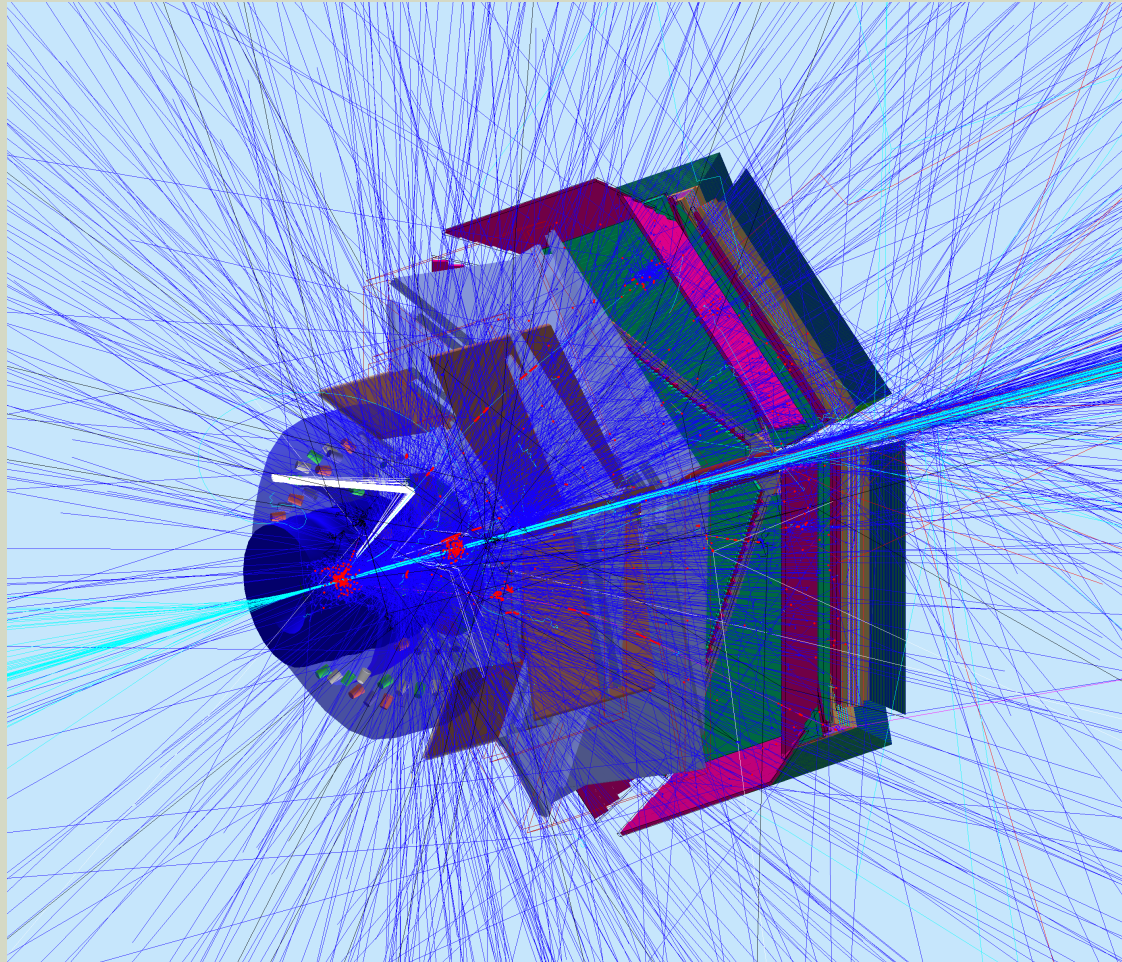
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JLAB

OUTLINE

- History of the problem
- Rate studies @ 11 GeV
- Rate studies @ 6 GeV
- Background generator
- Results
- Future plans

250 NS OF CLAS12 LIFE@ 10^{35} (GEMC)



2 GeV electron in a background environment @ 10^{35}

HISTORY OF THE TOPIC

- **Studies of the trigger rate in CLAS12:**
 - **Inclusive generator:** code developed by S. Pisano based on work by M. Sargsyan, CLAS-NOTE 90-007 (1990) used for 11 GeV and 6 GeV event generation.
 - **Background generator:** 124000 electrons in 250 ns window on 5 cm target (provides luminosity of 10^{35}) with electromagnetic, optical and hadronic processes with both 12 GeV and 6 GeV beam.

HISTORY OF THE TOPIC

Threshold	Rate @ 1GeV threshold	Rate @ 1GeV threshold
11 GeV Inclusive	0.6 kHz	0.75 kHz
11 GeV background	12 kHz	9 kHz
6 GeV Inclusive	1.4 kHz	n/a
6 GeV background	13 kHz	n/a

No Event builder,
old simulation and
reconstruction

CLAS6 estimation: 1.7 kHz

Consistent results between different version of simulations
6 GeV simulation is consistent with CLAS6 data

- Large discrepancy between inclusive and background simulation was observed and reported;
- GEANT4 simulation of the background is unrealistic;
- M. Ungaro provide more intrinsic details on this subject in his talk.

CURRENT STUDIES

- Inclusive generator: code developed by S. Pisano based on work by M. Sargsyan, CLAS-NOTE 90-007 (1990) used for 11 GeV event generation
- 6 GeV and 11 GeV electrons are generated using inclusive generator
- Event builder is used to associate track with calorimeter and ultimately select good events (where track is included in the trigger)
- Rates with different trigger configuration are estimated

TRIGGER CONFIGURATIONS

1. Energy sum in EC

- HTCC+PCAL+ECAL
- HTCC: Nphe cut
- Total energy sum(PCAL,ECAL)

2. Cluster Reconstruction in EC

- Reconstruction of clusters in PCAL and ECAL
- Corrections on the light attenuation
- Cut on the cluster energy sum(PCAL+ECAL)

3. Track reconstruction in DC

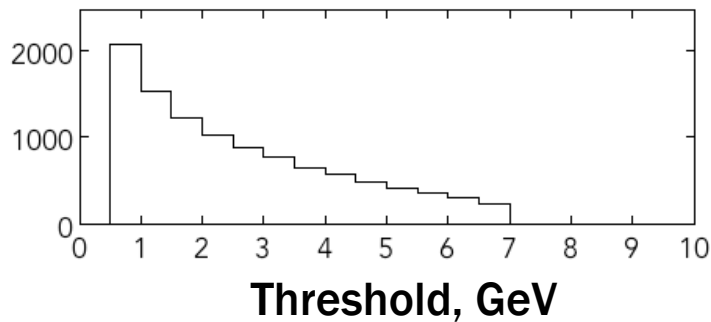
- Effect of the tracks in DC on the trigger rate

TRIGGER RATES

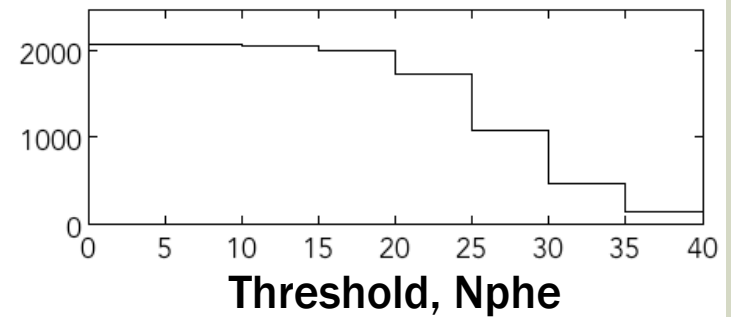
Energy sum in EC+PCAL

Threshold in calorimeter

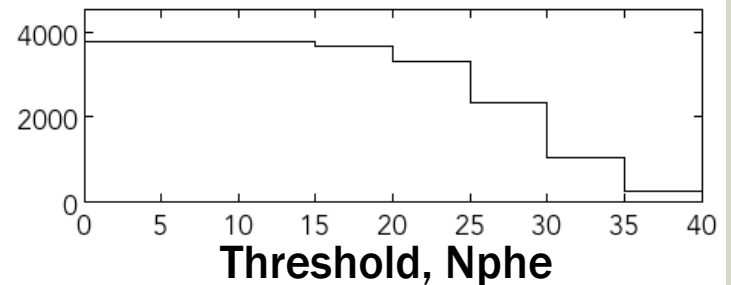
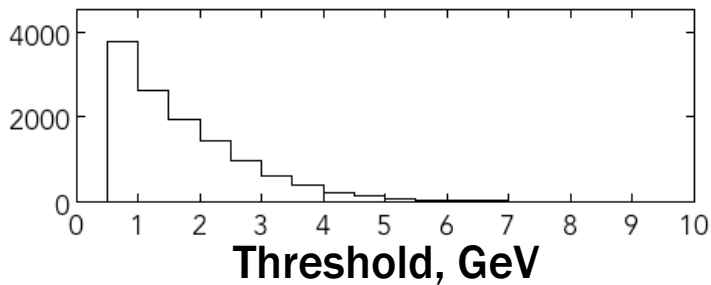
12 GeV



Threshold in HTCC



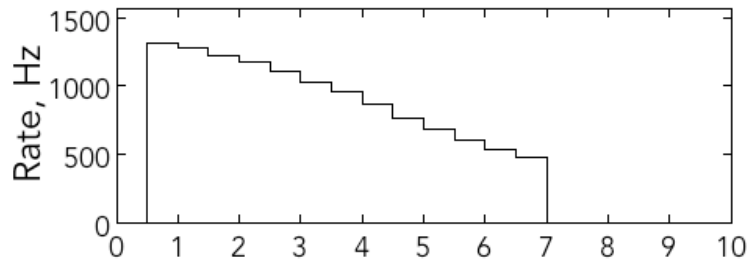
6 GeV



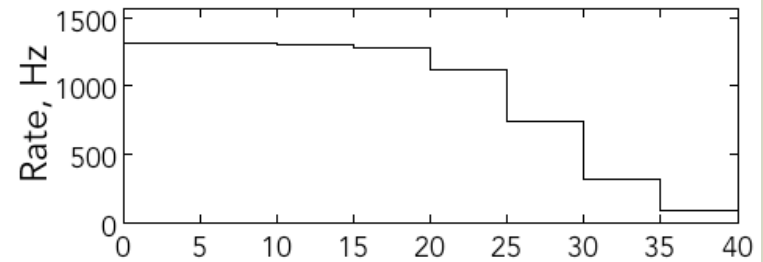
TRIGGER RATES

Cluster reconstruction in EC+PCAL

Threshold in calorimeter



Threshold in HTCC

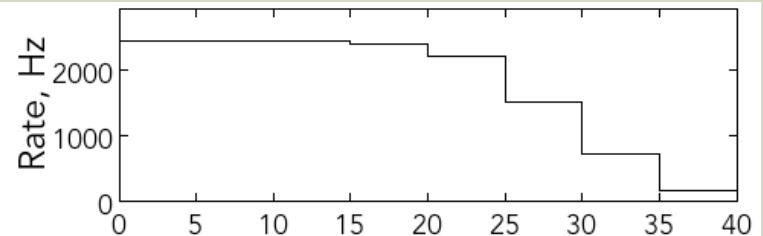
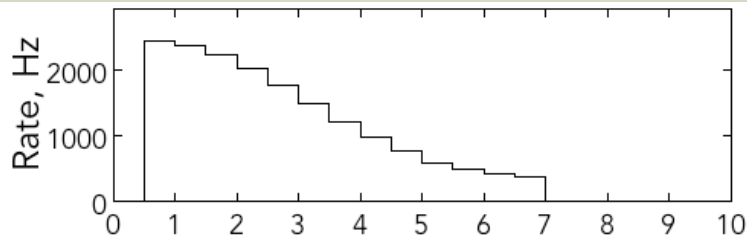


12 GeV

Threshold, GeV

Threshold, Nphe

6 GeV



Threshold, GeV

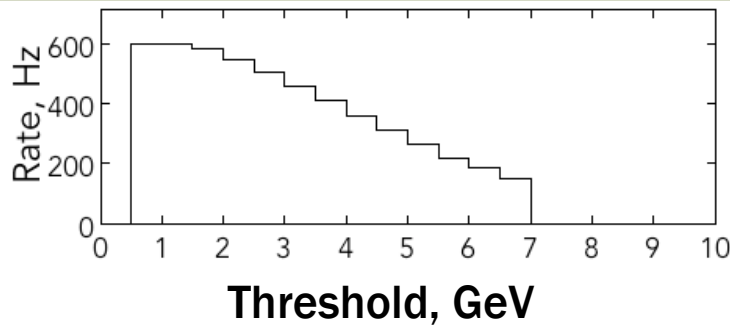
Threshold, Nphe

TRIGGER RATES

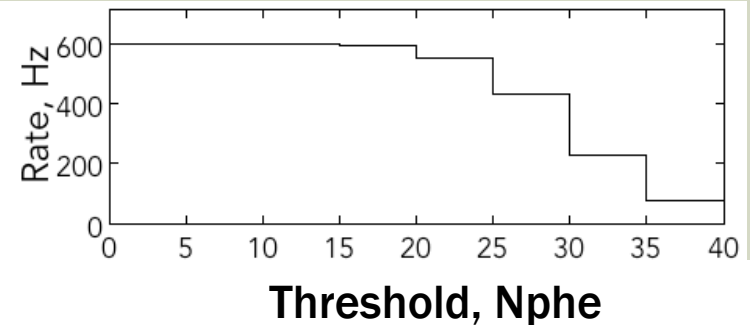
Cluster reconstruction in EC+PCAL + track in DC

Threshold in calorimeter

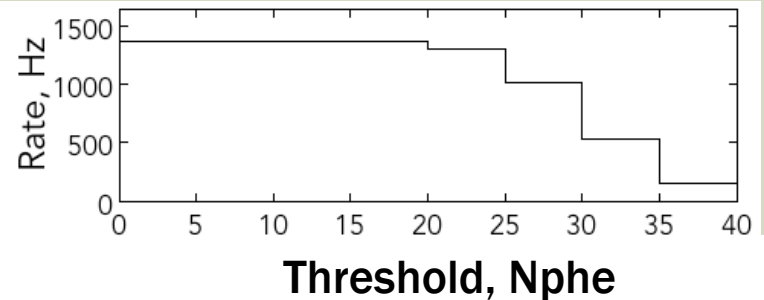
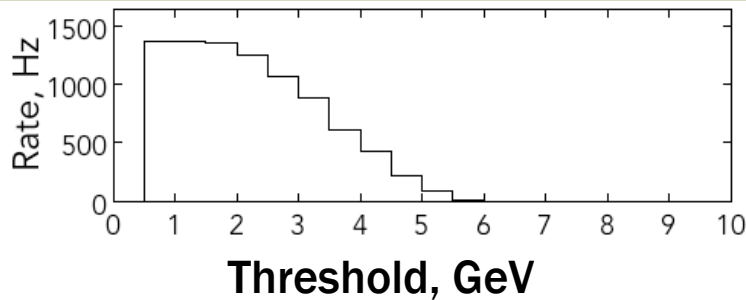
12 GeV



Threshold in HTCC

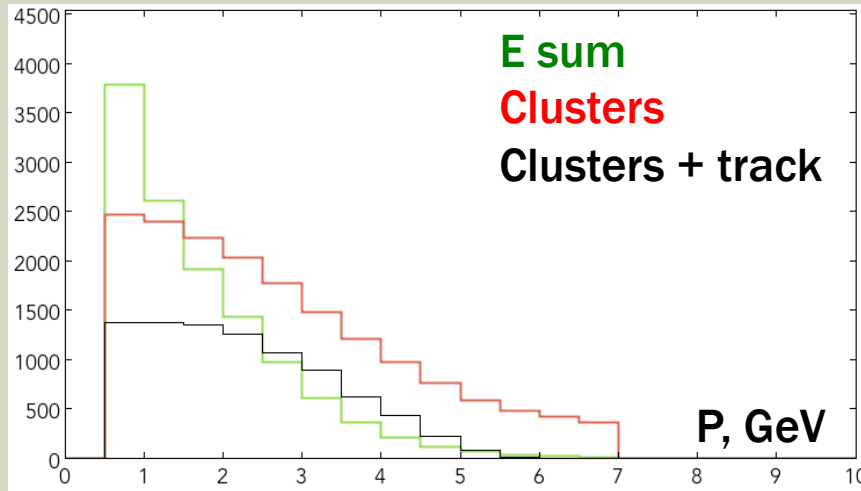


6 GeV

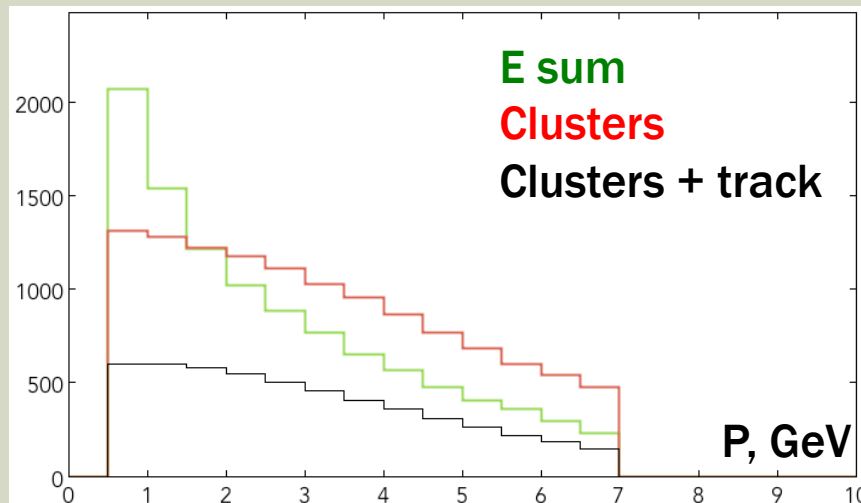


DISCUSSION

6 GeV



12 GeV

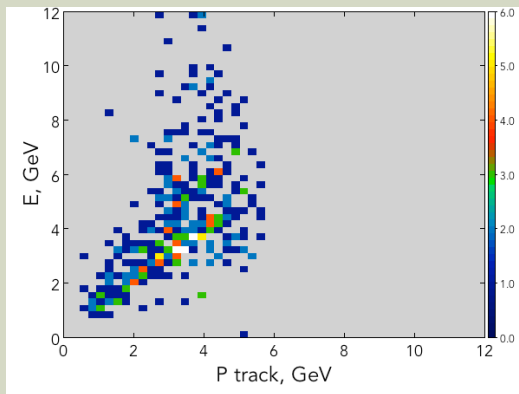


- PCAL is not designed to work well with the energy sum
- Sharp drop off of the rate with energy sum trigger with threshold
- Around 2 GeV rate with energy sum and clusters in calorimeter become practically the same in both 6 GeV and 12 GeV case
- Adding tracking to the trigger cuts the rate in about half in 6 GeV and 12 GeV cases. One possibility is different geometrical acceptance between DC and EC/PCAL.

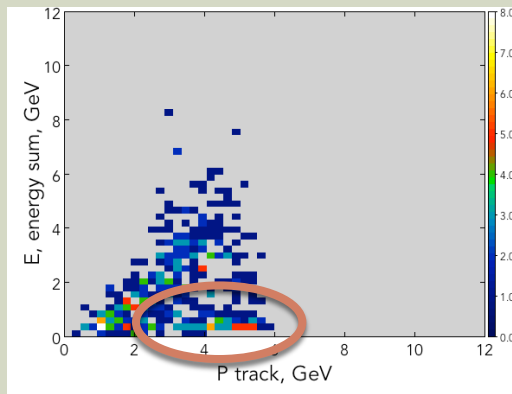
DISCUSSION

6 GeV

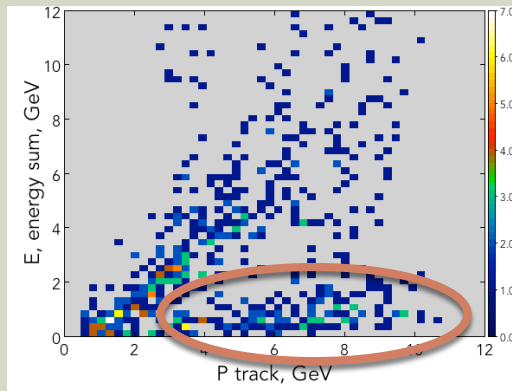
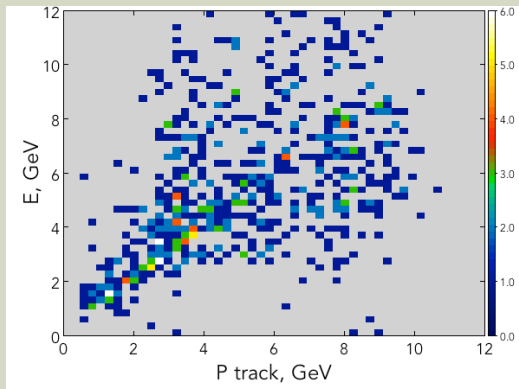
Cluster + DC



Energy sum + DC



12 GeV

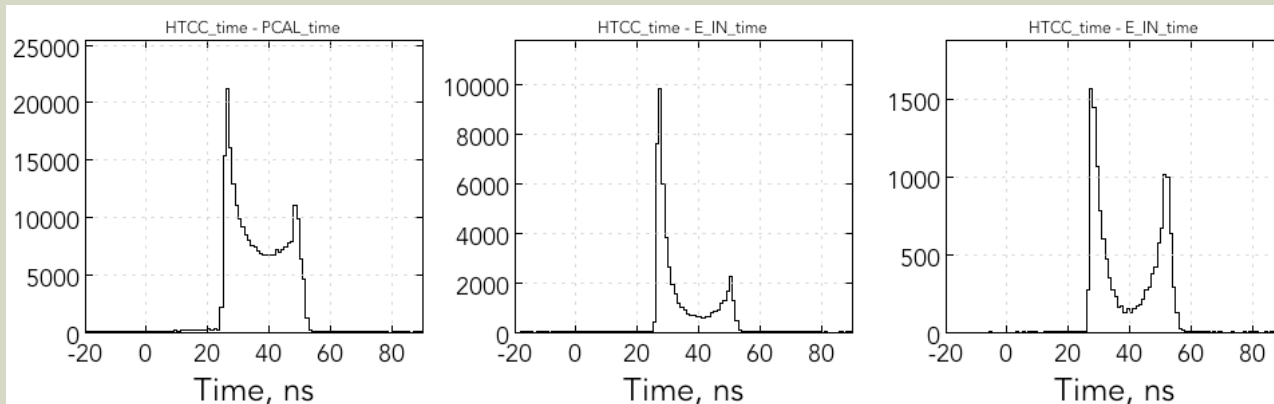
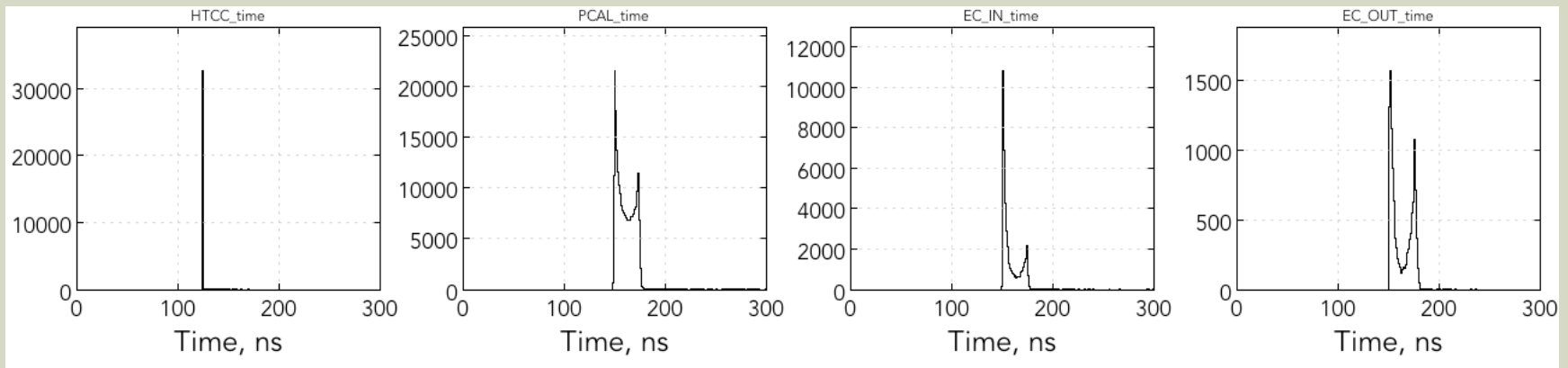


- Proportionality between energy deposition in calorimeters and track momentum seem to break at low electron momentum with energy sum;
- Setting threshold with energy sum will cut out significant amount of good high momentum events

SIGNAL TIMING

Very sharp peak in HTCC timing

Complicated structure of EC/PCAL timing due to location of PMT readout



- **Window size between HTCC and PCAL ~ 40 ns**
- **Window size between HTCC and PCAL ~ 40 ns**

SUMMARY

- Event rates for inclusive events were estimated with 11 and 6 GeV electron beam with different trigger configuration;
- Timing of the signals in different detectors is studied;
- Estimated trigger rate is within the DAQ capabilities;
- Trigger CLAS12 note is in preparation.