CLAS12 TRIGGER UPDATE

NICK MARKOV, UCONN
VALERY KUBAROVSKY, JLAB

OUTLINE

History of the problem

Rate studies @ 11 GeV

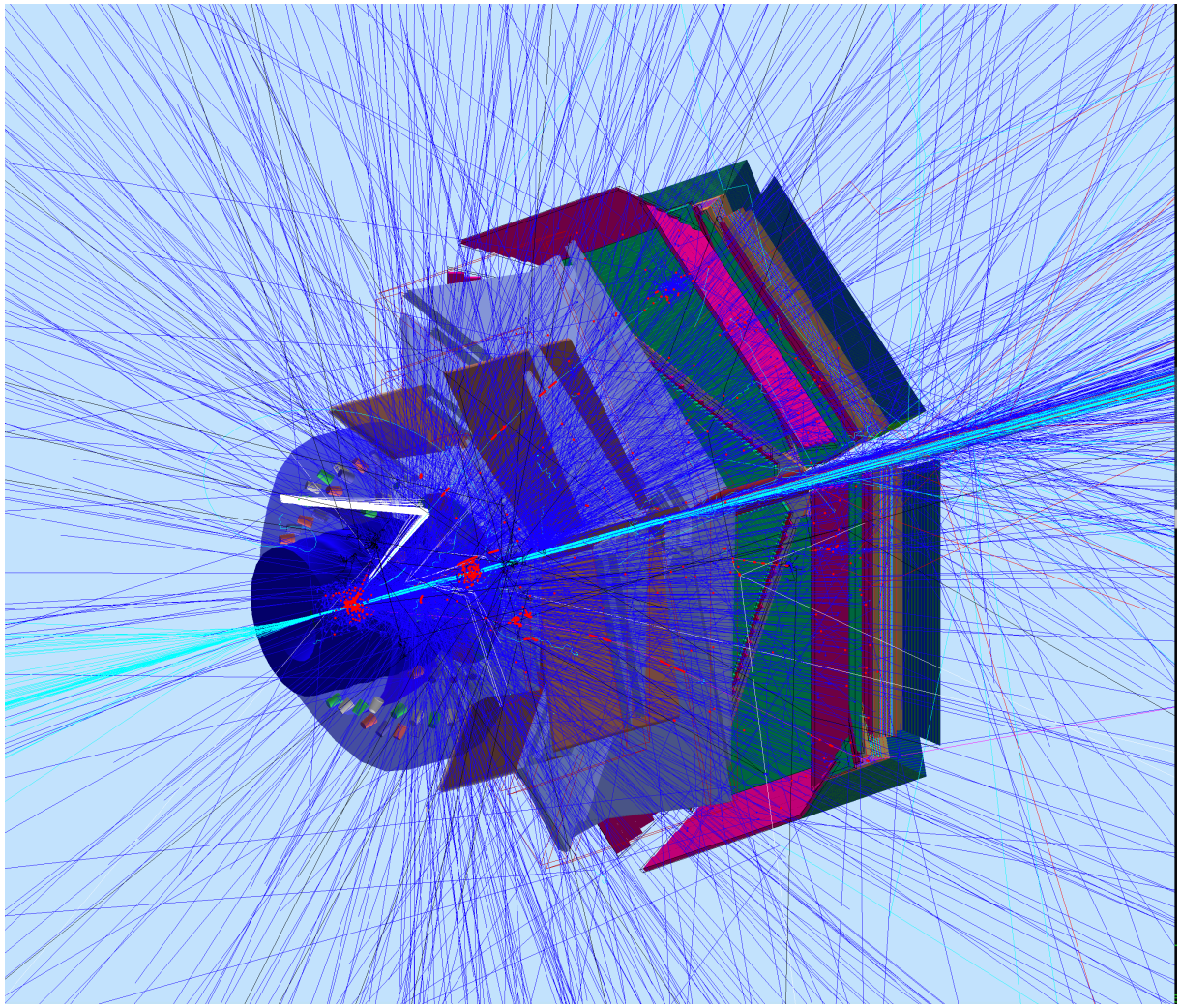
Rate studies @ 6 GeV

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 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.

HISTORY OF THE TOPIC

Electron ID procedure applied to both datasets and rates studied with different cuts

Inclusive rates @ 11 GeV

Trigger Configuration	Trigger Rate@0.5 GeV Threshold
Energy Sum	4 kHz
Energy sum + track	2.5 kHz
Clusters in PCAL+ECAL	1.3 kHz
Cluster + track	1.2 kHz
All cuts	750 Hz

Background rates @ 11 GeV

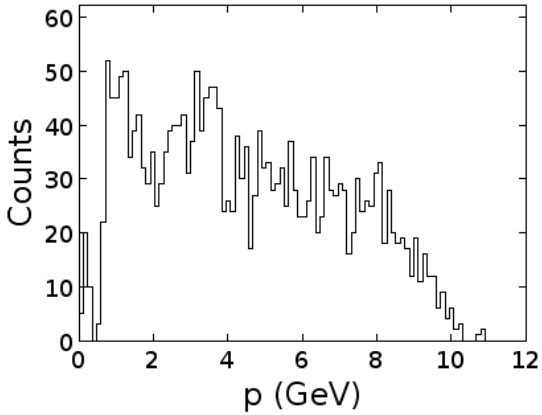
Trigger Configuration	Trigger Rate@0.5 GeV Threshold
Energy Sum	100 kHz
Energy sum + track	60 kHz
Clusters in PCAL+ECAL	40 kHz
Clusters + track	15 kHz
All cuts	9 kHz

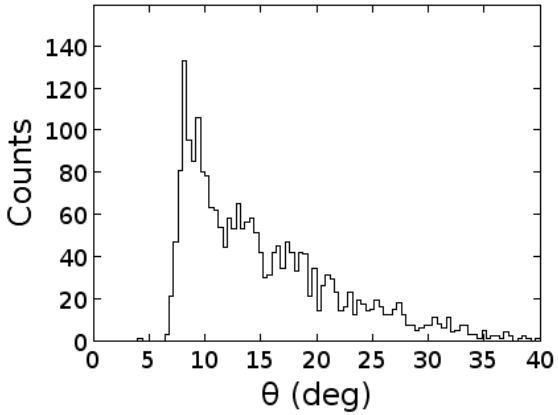
- Discrepancy ~ 12 times
- *11 GeV data only*
- *No event builder in reconstruction*

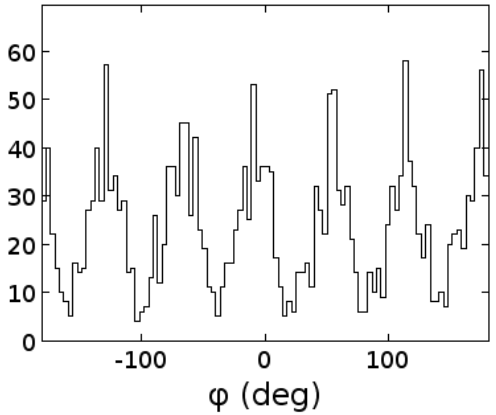
CURRENT STUDIES

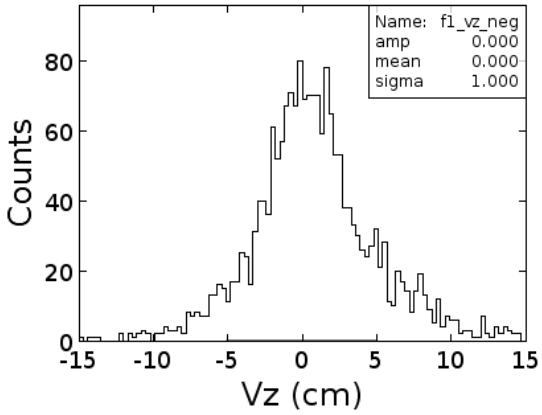
- Inclusive generator: code developed by S. Pisano based on work by M. Sargsyan, CLAS-NOTE 90-007 (1990) used for 11 GeV event generation
- Background generator: 124000 electrons in 250 ns window on 5 cm target (provides luminosity of 10^{35}) with electromagnetic, optical and hadronic processes
- **6 GeV and 11 GeV electrons are generated using both generators**
- **Event builder is used to associate track with calorimeter and ultimately select good events**

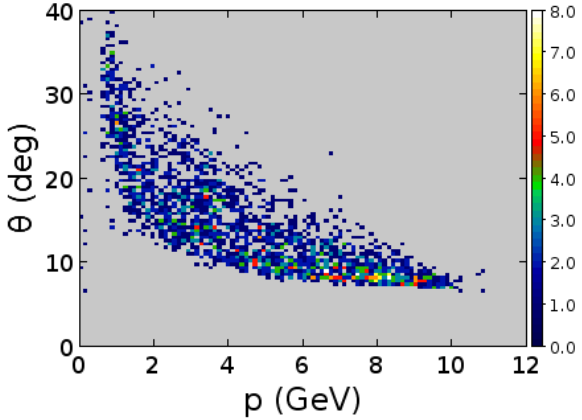
11 GEV INCLUSIVE, DC INFORMATION

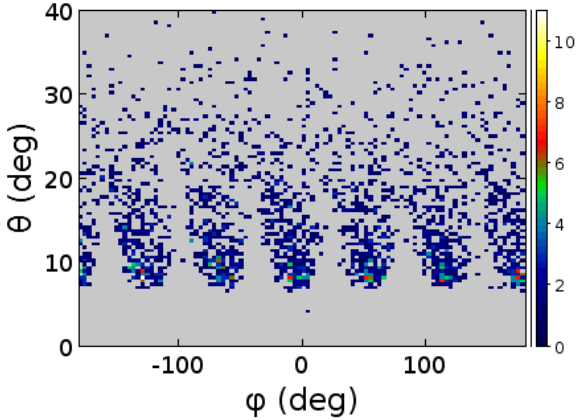






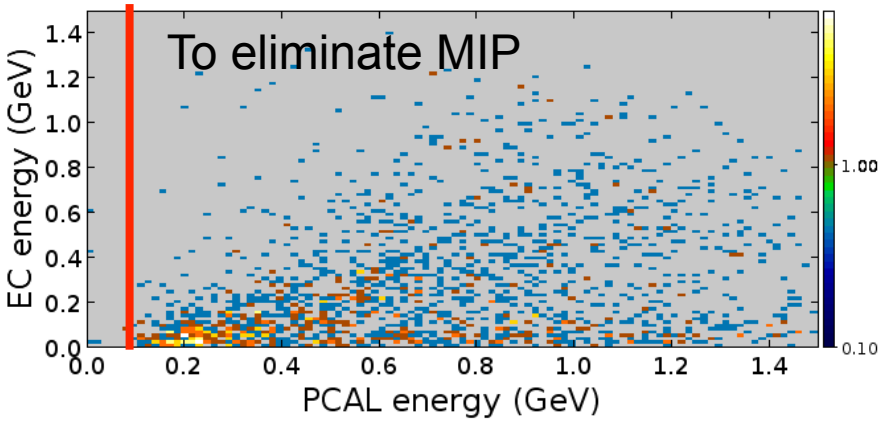


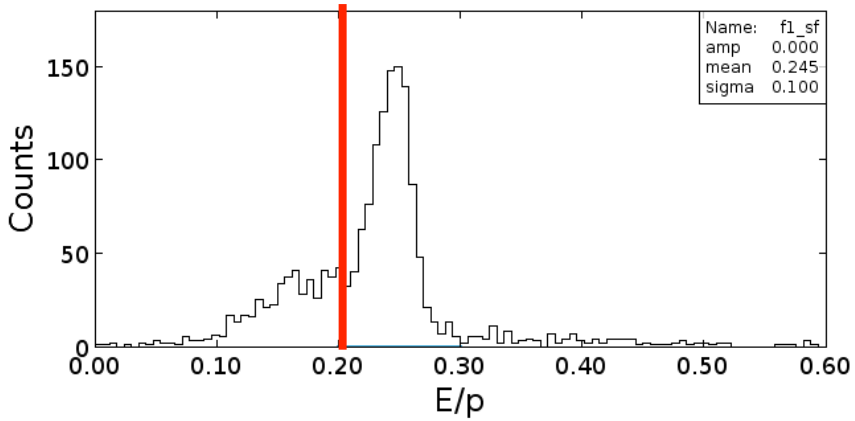


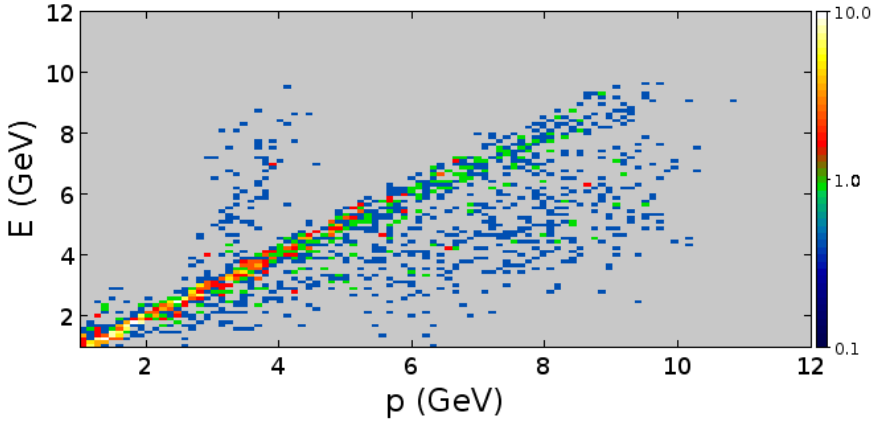


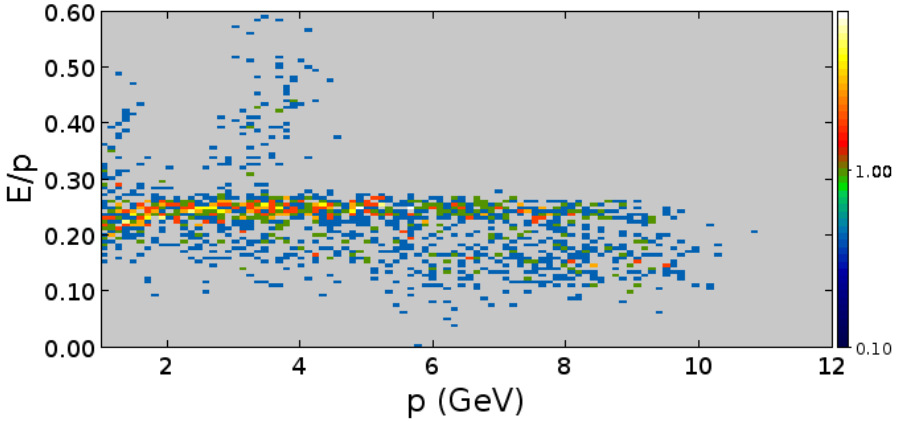
Already have a rather clean sample

11 GEV INCLUSIVE, EC INFORMATION



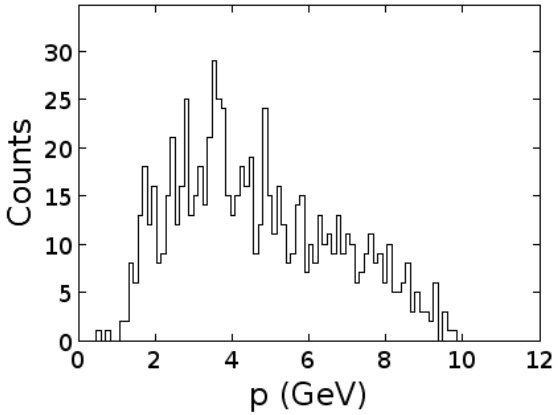


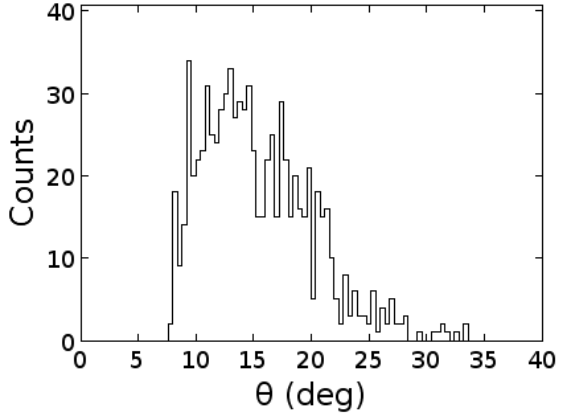


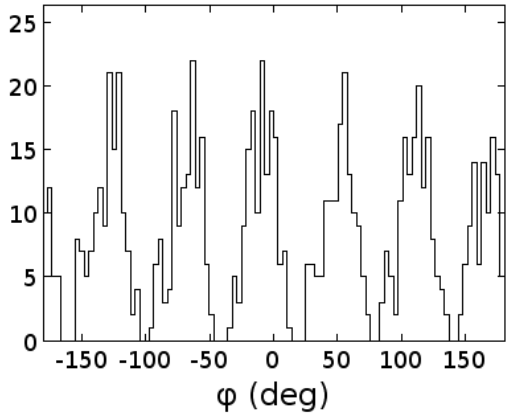


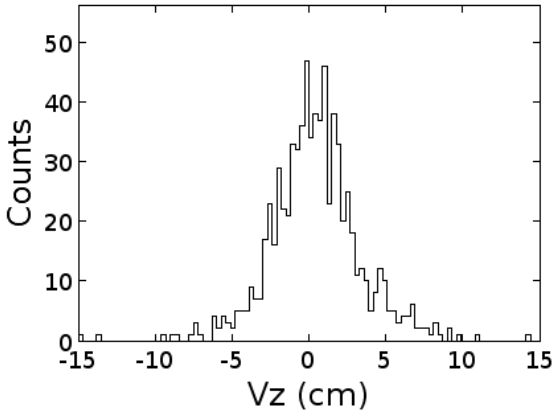
Already have a rather clean sample

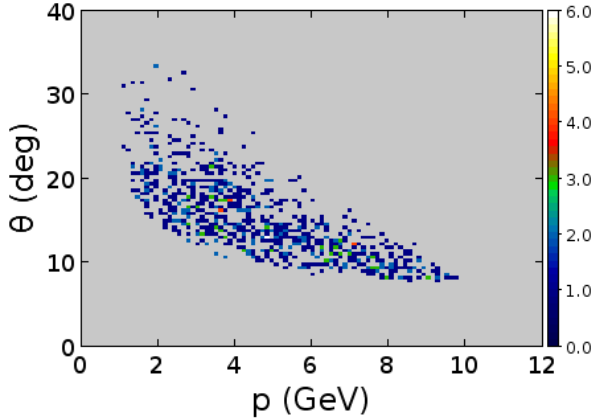
11 GEV INCLUSIVE, DC, ALL CUTS

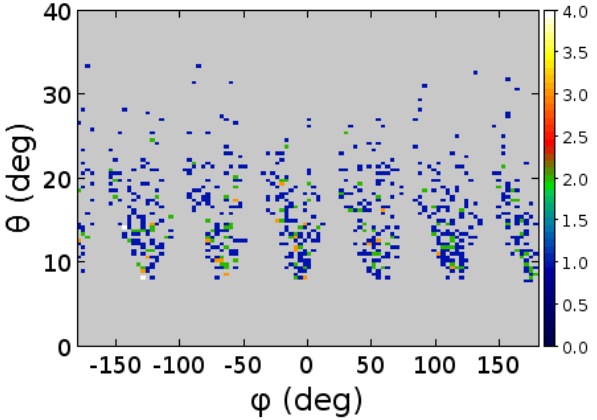




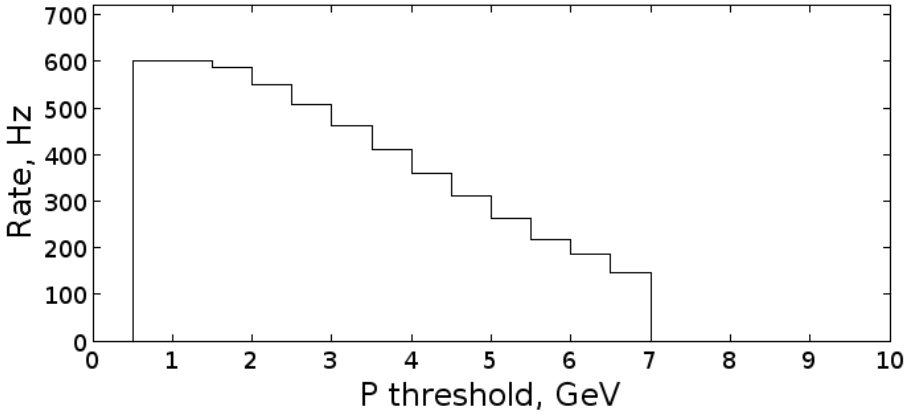


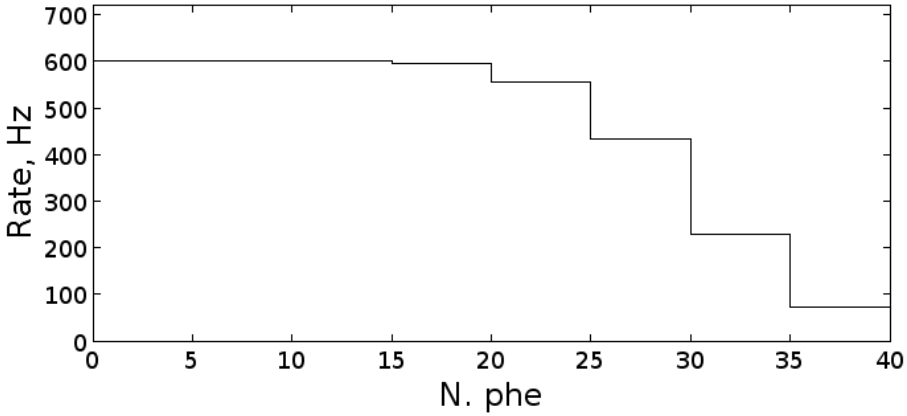






11 GEV, INCLUSIVE, RATES

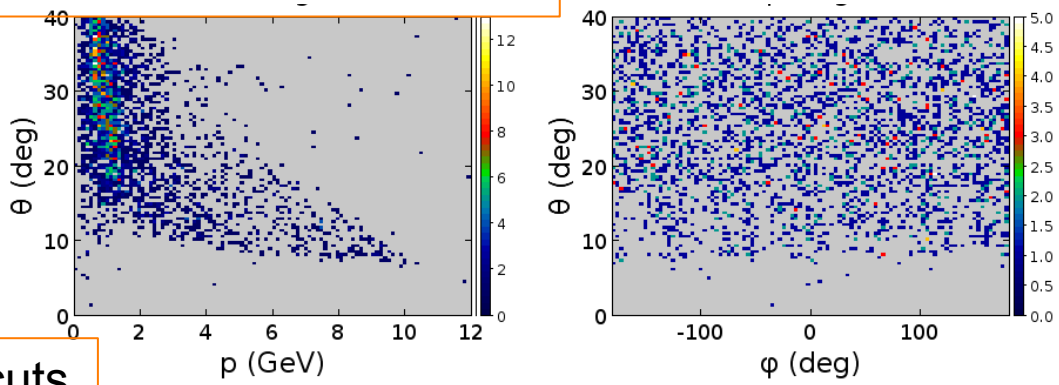




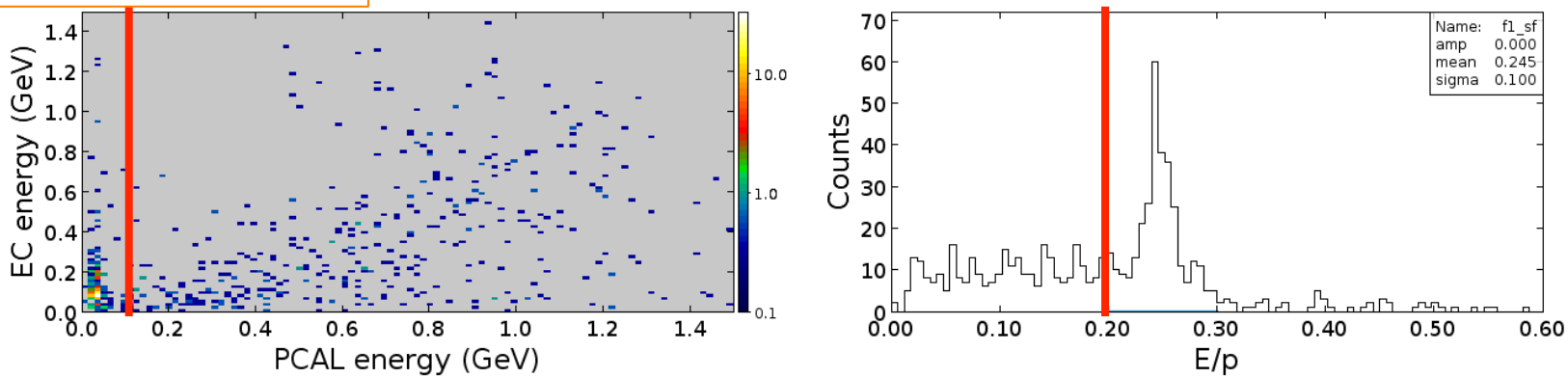
Rather flat with N.phe up to ~ 20

11 GEV BACKGROUND

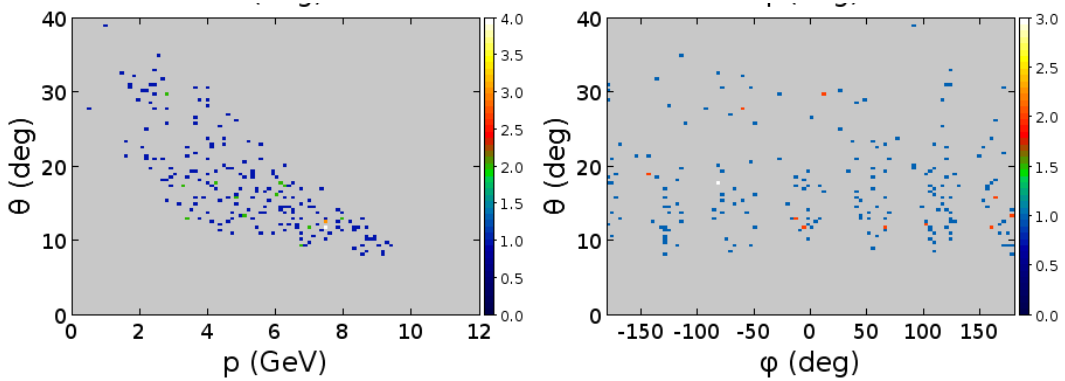
Clearly see low momentum contamination



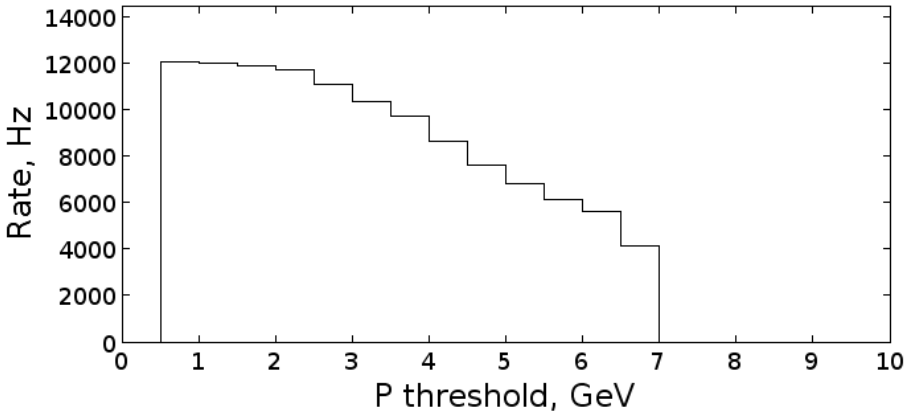
Clean it with EC cuts

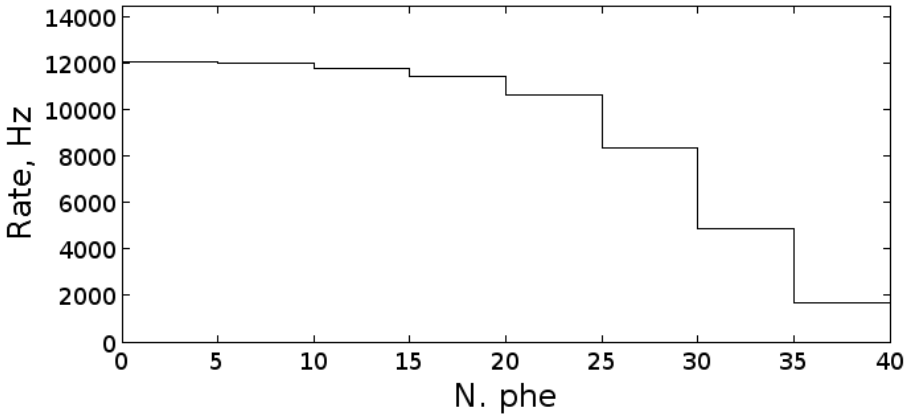


Clean sample



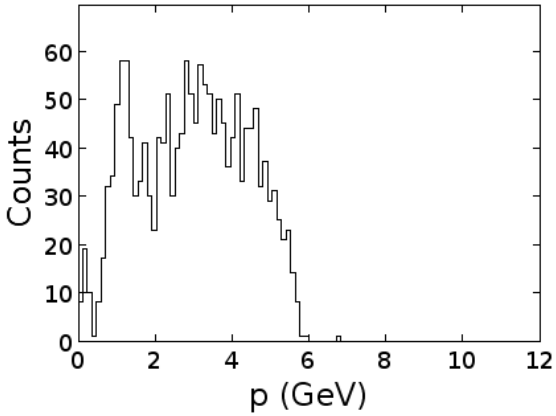
11 GEV BACKGROUND RATES

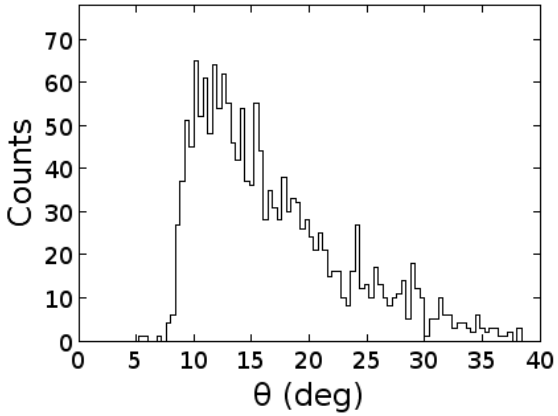


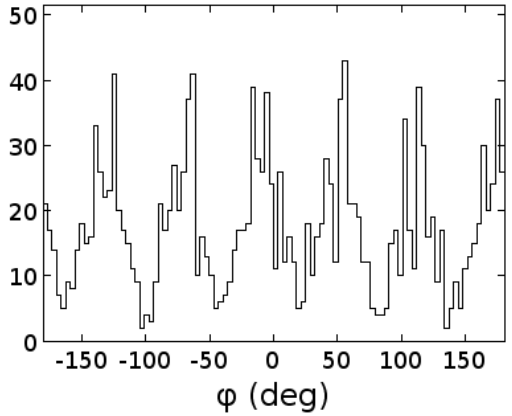


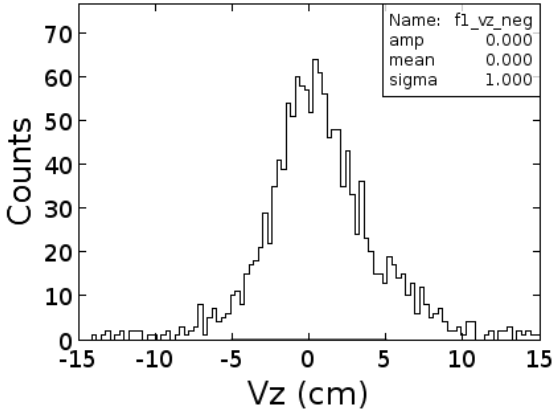
Rather flat with N.phe up to ~ 20

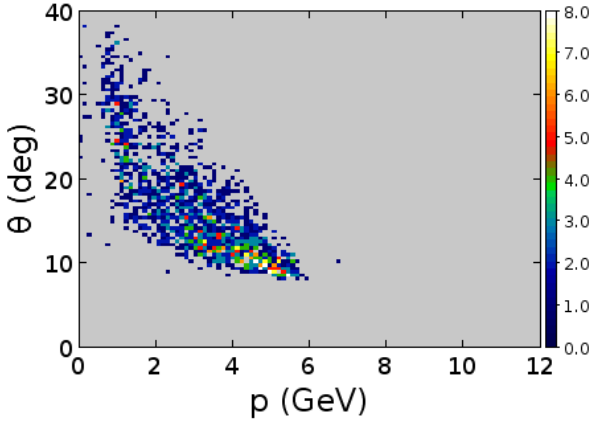
6 GEV INCLUSIVE, DC

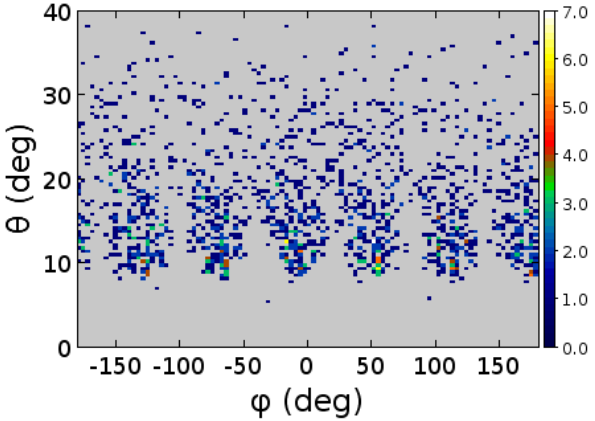




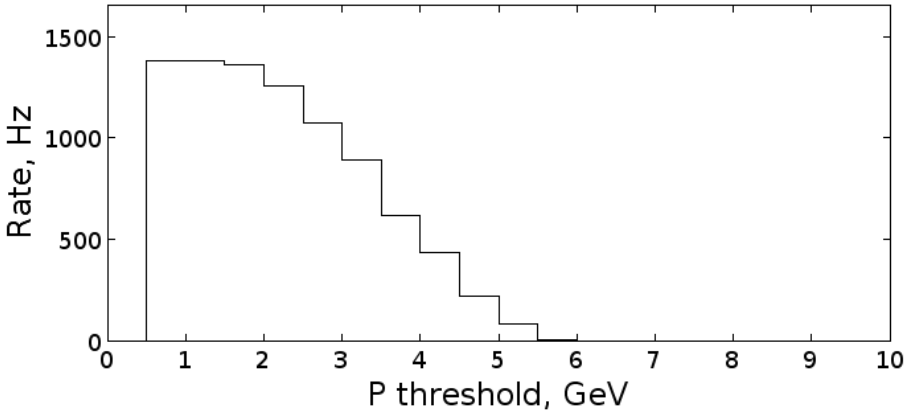


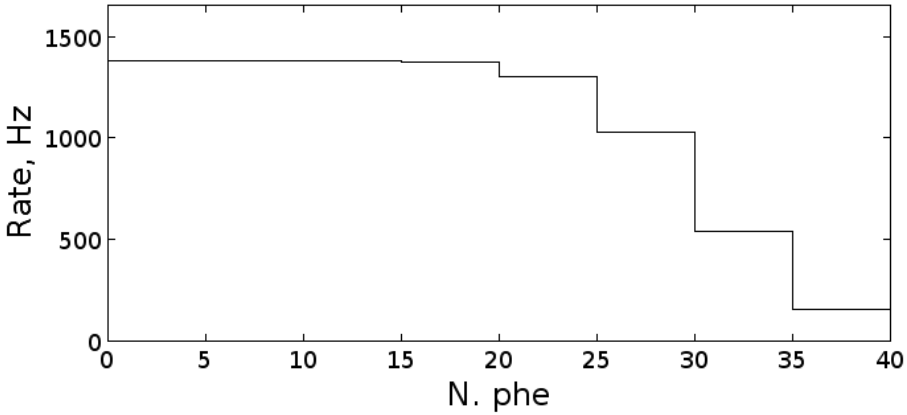






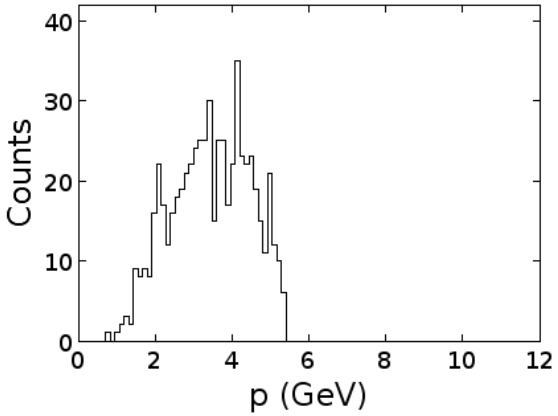
6 GEV INCLUSIVE RATES

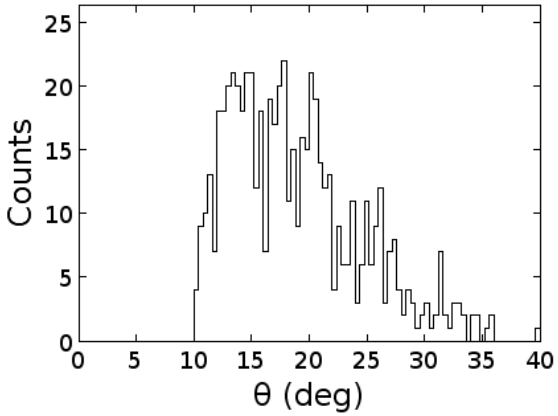


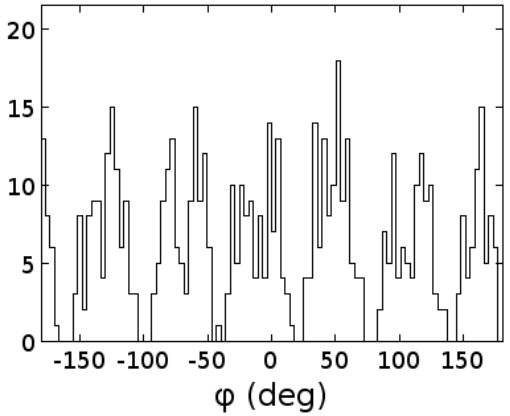


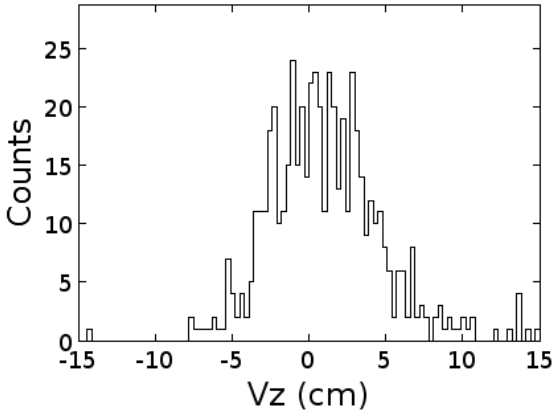
Rather flat with N.phe up to ~ 20

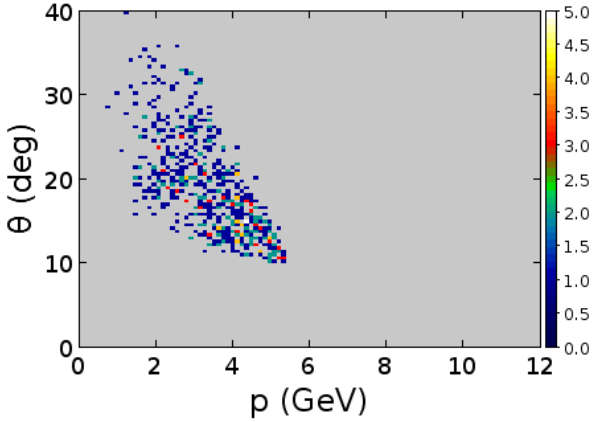
6 GEV BACKGROUND DC, ALL CUTS

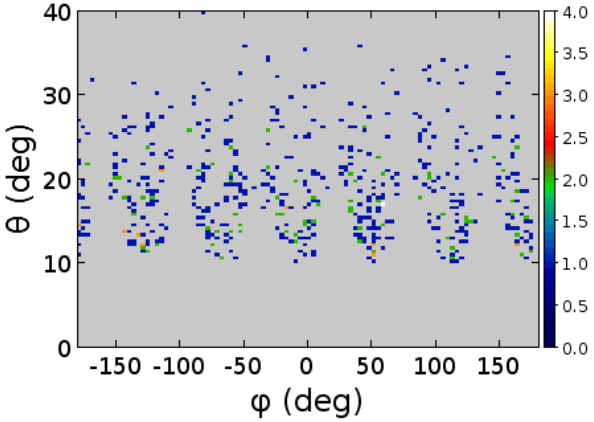




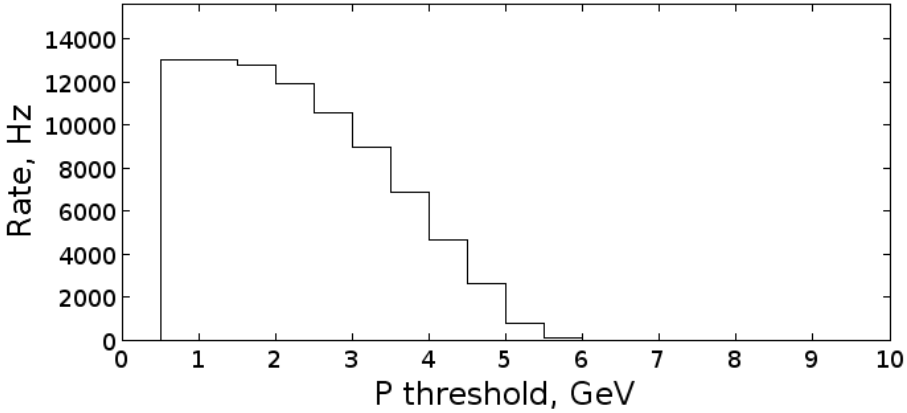


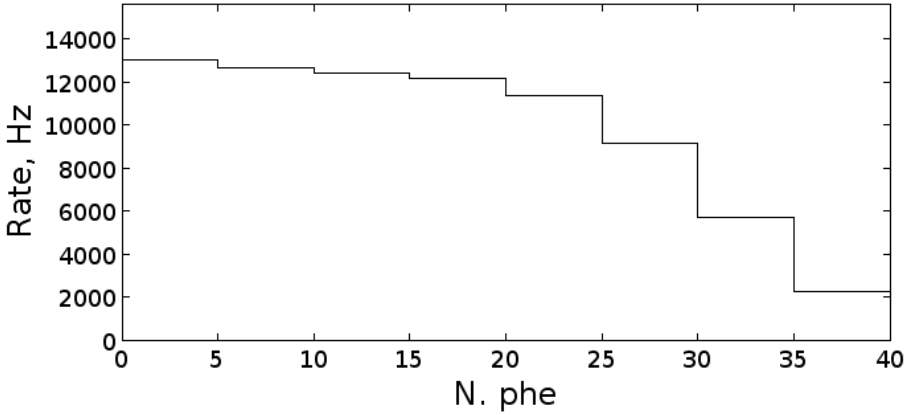






6 GEV BACKGROUND RATES





Rather flat with N.phe up to ~ 20

SUMMARY

Threshold	1 GeV	2 GeV	3 GeV	Previous @ 1GeV
11 GeV Inclusive	0.6 kHz	0.55 kHz	0.5 kHz	0.75 kHz
11 GeV background	12 kHz	11.5 kHz	11 kHz	9 kHz
6 GeV Inclusive	1.4 kHz	1.3 kHz	0.9 kHz	n/a
6 GeV background	13 kHz	12 kHz	9 kHz	n/a

11 GeV Results are consistent with previous studies

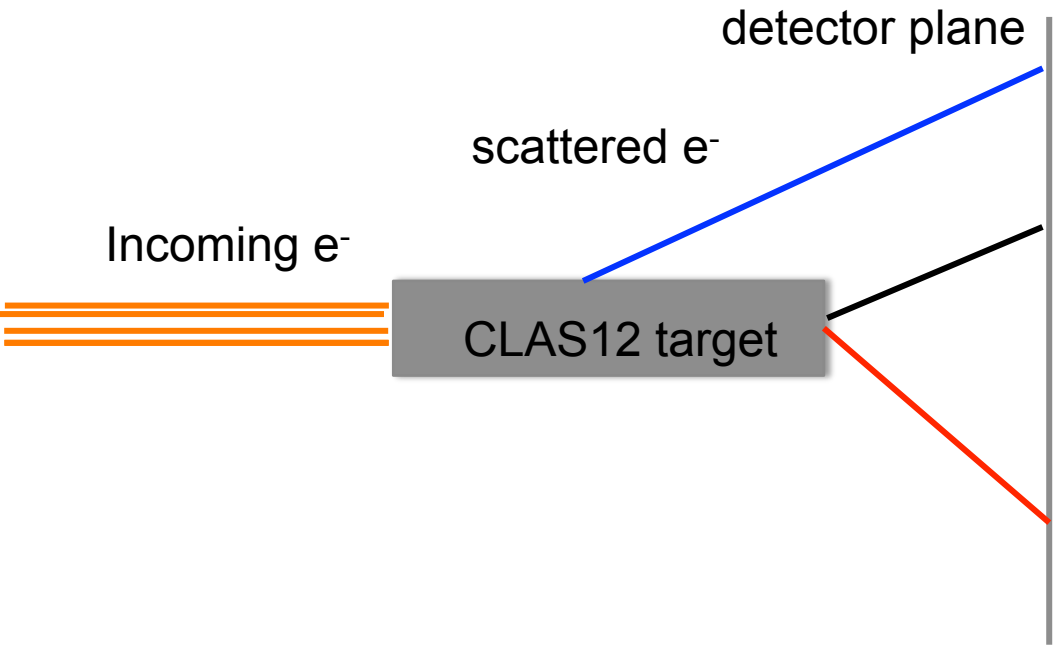
CLAS6 had a different geometry, but it is the best experimental comparison we can have:

- run 38353 (e1f run period)
- target: 5 cm liquid H_2
- trigger rate 2.4kHz
- Beam current 7.5 nA
- luminosity 10^{34}
- Expected ***electron*** rate at 10^{35} (corrected for the percentage of good electrons and different luminosity) 1.7 kHz. Consistent with 1.4 kHz from out estimation

BACKGROUND GENERATOR

Where are the electrons are coming from?

Set up an empty detector which registers electrons
Print tag associated with each electron crossing the detector plane

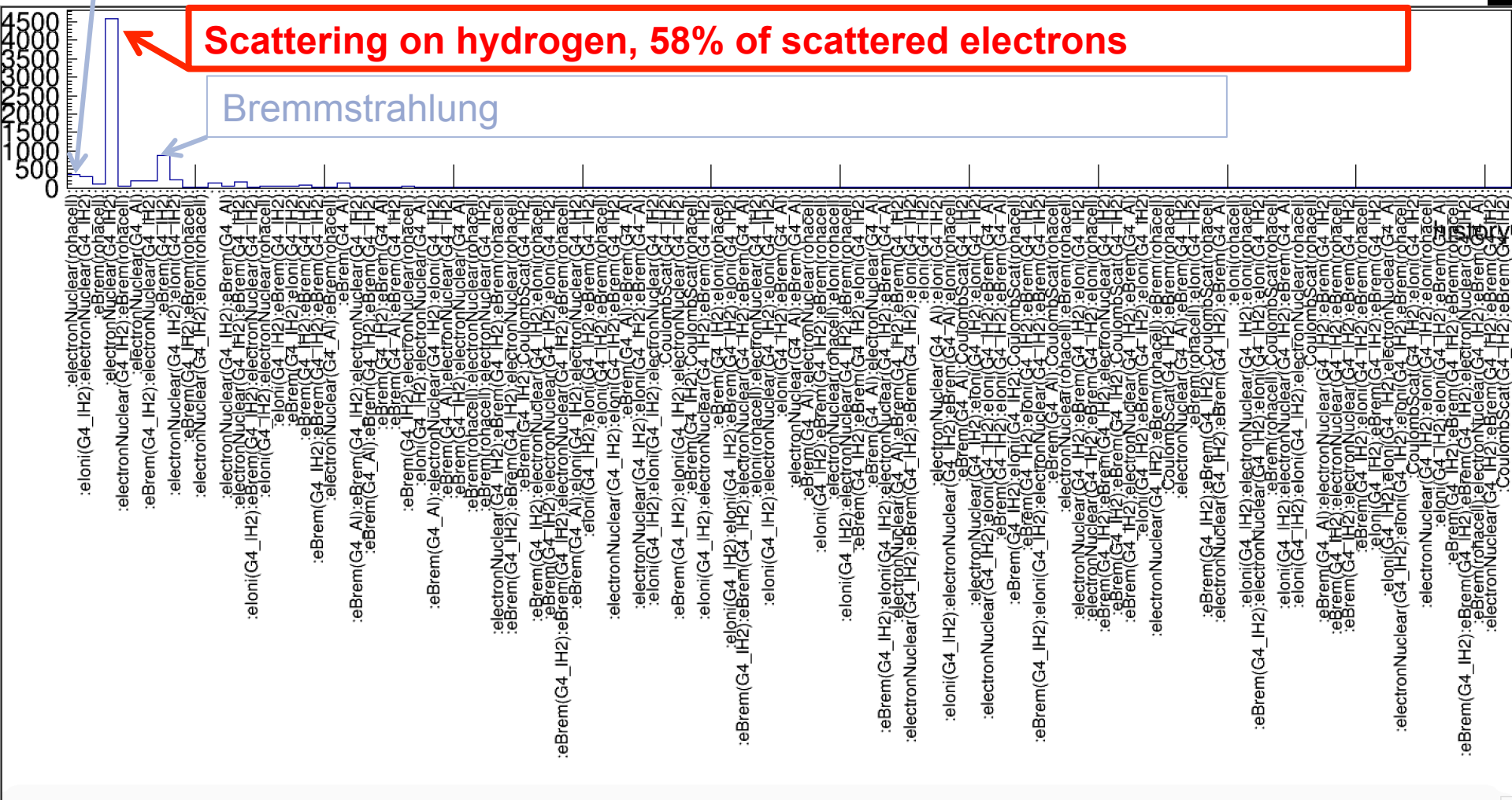


Possibilities are

- Interaction with rohacell foam in target chamber
- Interaction with aluminum windows
- Interaction with hydrogen in target chamber

BACKGROUND GENERATOR

Scattering on rohacell from target cell



BACKGROUND GENERATOR

From events scattered off the target we select *electronNuclear(G4_lH2)* which are electrons scattered on hydrogen;

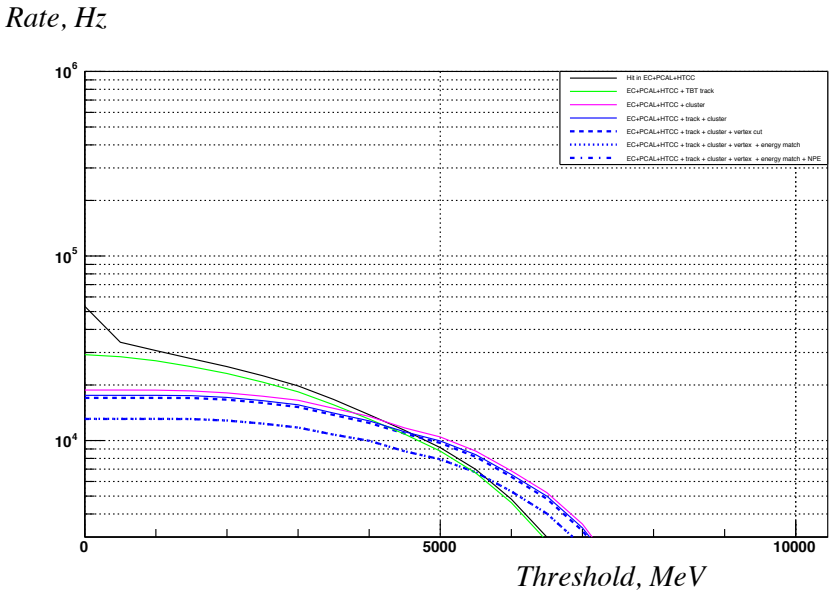
Record them into LUND file;

Use this LUND file as an input to GEMC;

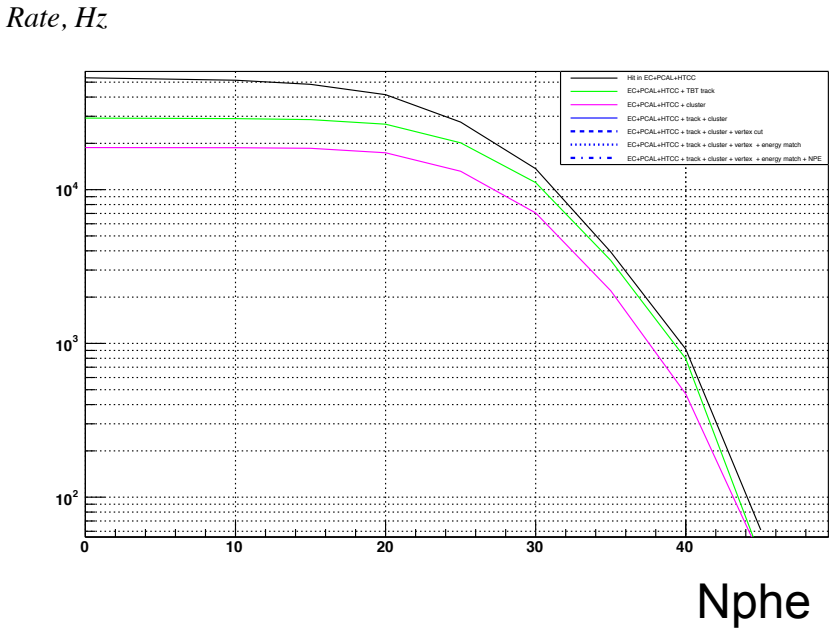
Put them through the same electron ID chain.

BACKGROUND GENERATOR

Rate of selected good electrons as a function threshold in calorimeter



Rate of selected good electrons as a function of Nphe in HTCC



Rate with threhold @ 1 GeV (~ 10kHz) is consistent with previous results

SUMMARY

Event rates for both inclusive and background events were estimated with 11 and 6 GeV electron beam;

Results @ 11 GeV are consistent with previous estimation;

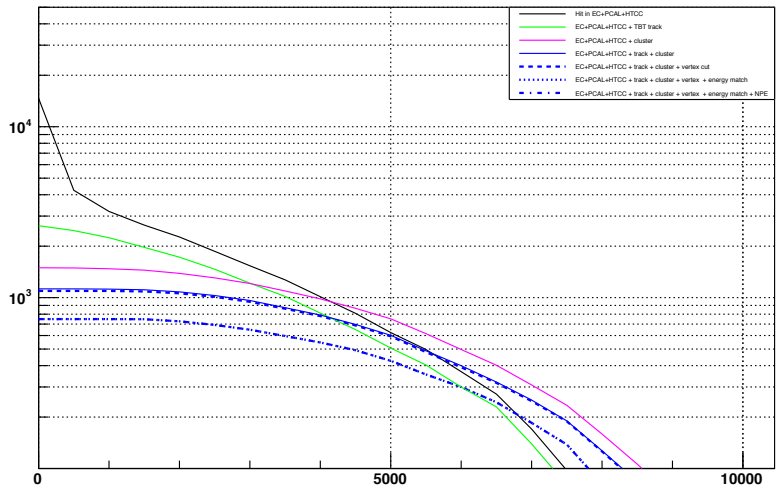
Results @ 6 GeV are consistent with CLAS6 data;

Electron selection was performed on the level of *gemc* and results obtained with a clean sample are consistent with the results of our electron ID procedure;

There is a significant discrepancy between results obtained with inclusive generator and GEANT.

BACKUP

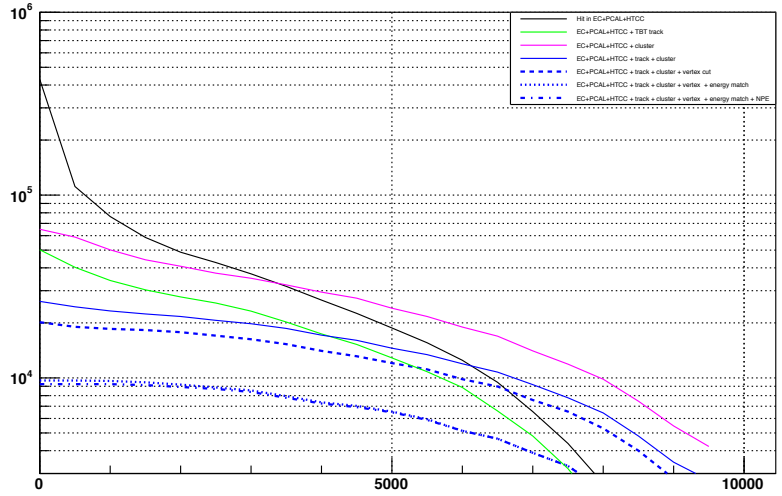
Rate, Hz



Threshold, MeV

Trigger Configuration	Trigger Rate@0.5 GeV Threshold
Energy Sum	4 kHz
Energy sum + track	2.5 kHz
Clusters in PCAL+ECAL	1.3 kHz
Cluster + track	1.2 kHz
All cuts	750 Hz

Rate, Hz



Threshold, MeV

Trigger Configuration	Trigger Rate@0.5 GeV Threshold
Energy Sum	100 kHz
Energy sum + track	60 kHz
Clusters in PCAL+ECAL	40 kHz
Clusters + track	15 kHz
All cuts	9 kHz

Background rate is suppressed by a factor of 2, but ratio of background/inclusive is roughly the same