LTCC/FMT simulation and Fall experiment configuration

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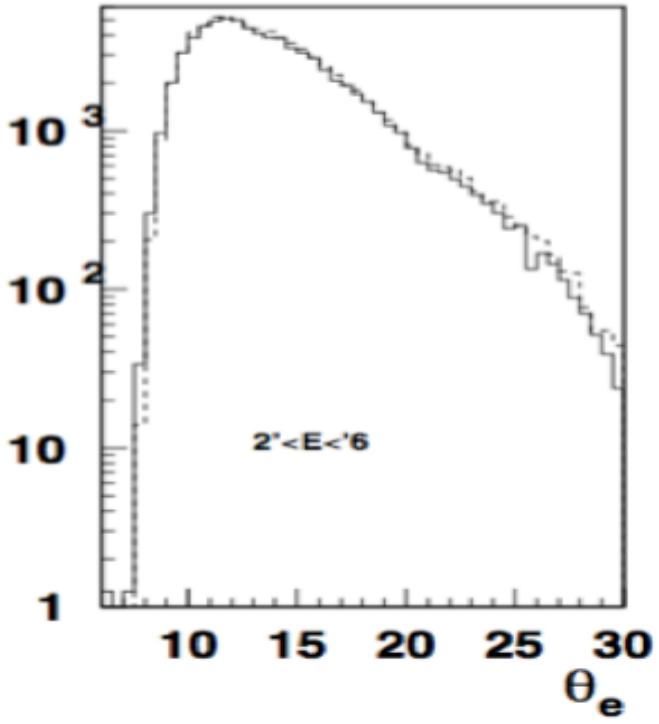
CLAS Collaboration Meeting, 11 July 2018

- Study LTCC and FMT performance using MC
- CLAS12 data MC comparison
- Physics processes
  - SIDIS
  - DVCS
- Sector dependence
- Conclusions

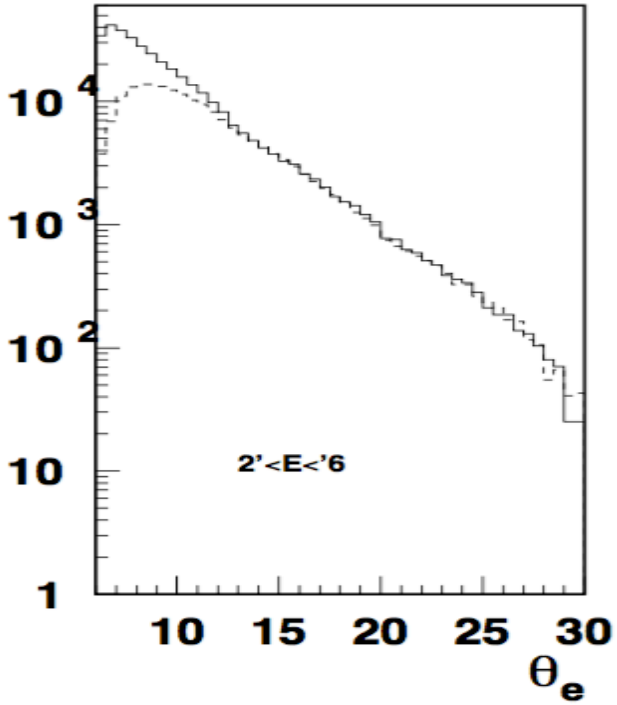
SIDIS electrons: outbending vs inbending

solid-experiment (Run-4203)
dashed clasDIS MC



solid-experiment (Run-3967)
dashed clasDIS MC

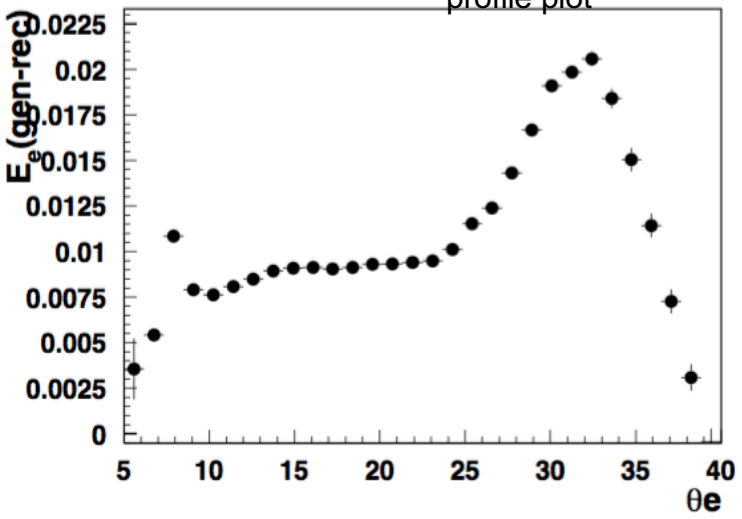
outbending:
15<θ<25



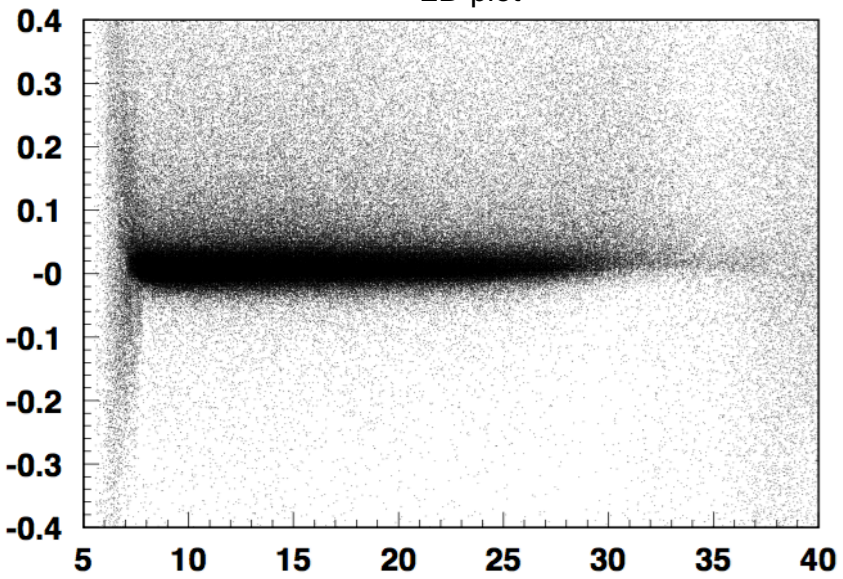
Reconstructed electrons

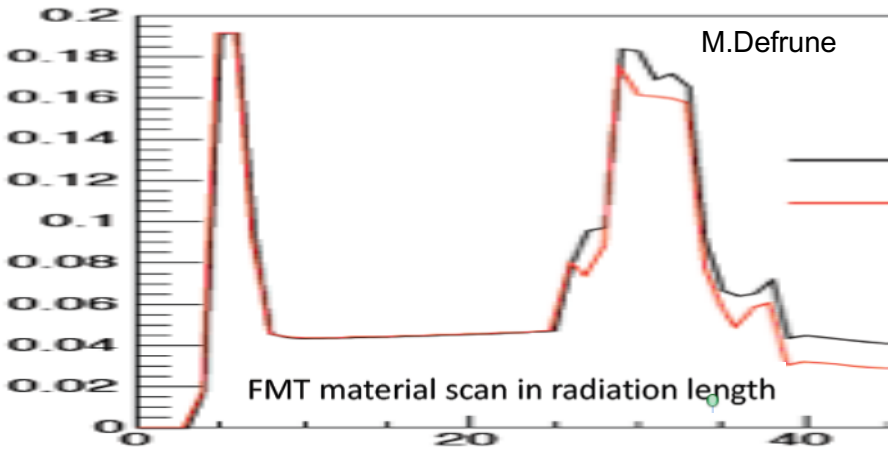
Energy loss of electrons vs their angle in the CLAS12 outbending-gemc+coatjava 5.0.11

profile plot



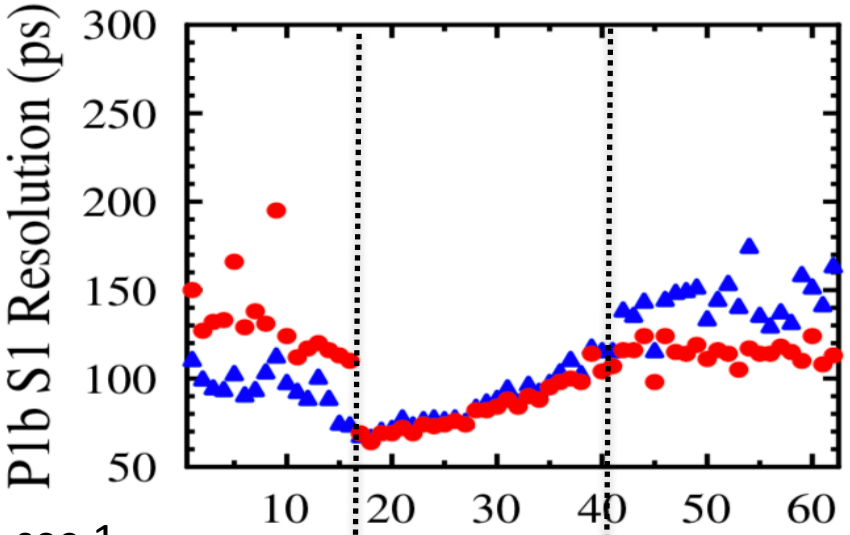
2D plot

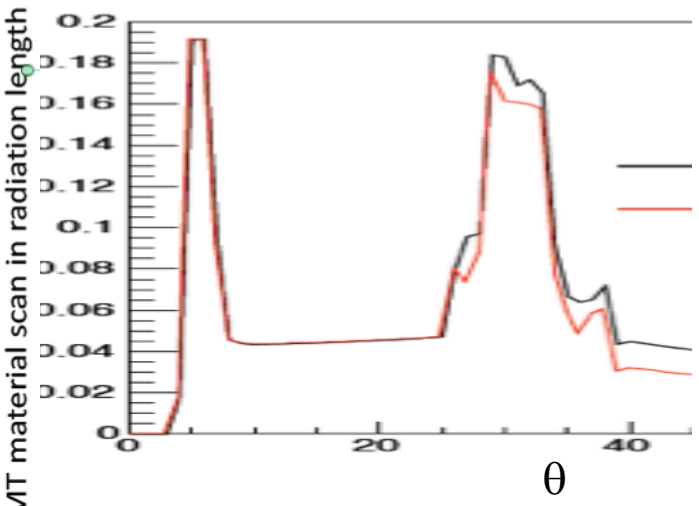




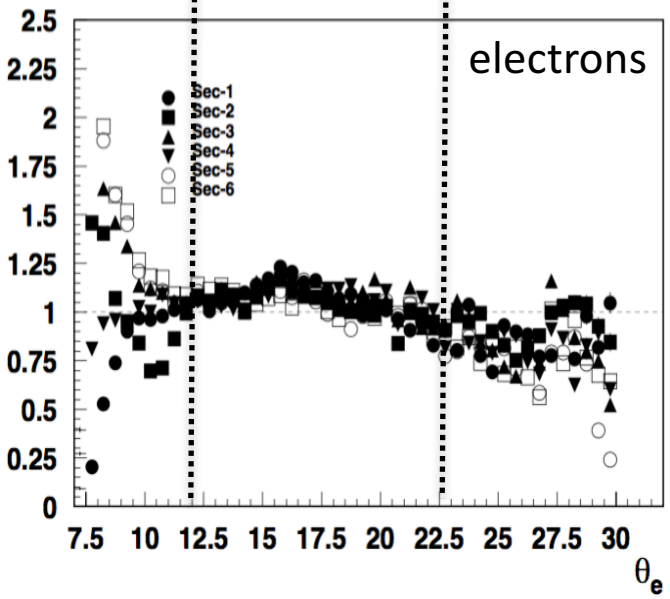
The energy loss shape consistent with FMT angular coverage

FTOF& DIS electrons



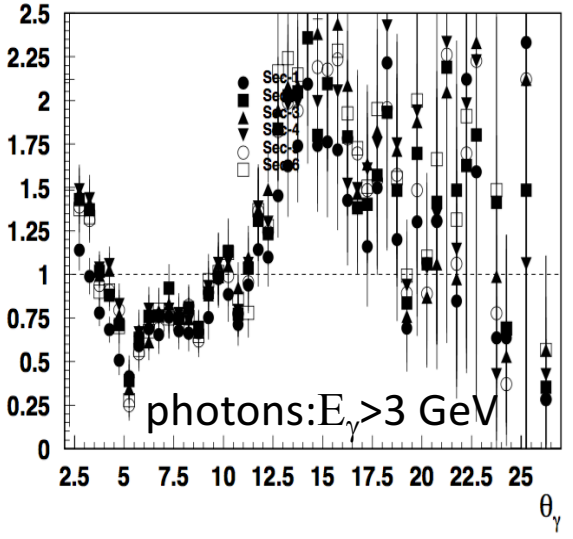


No LTCC box in sec-1



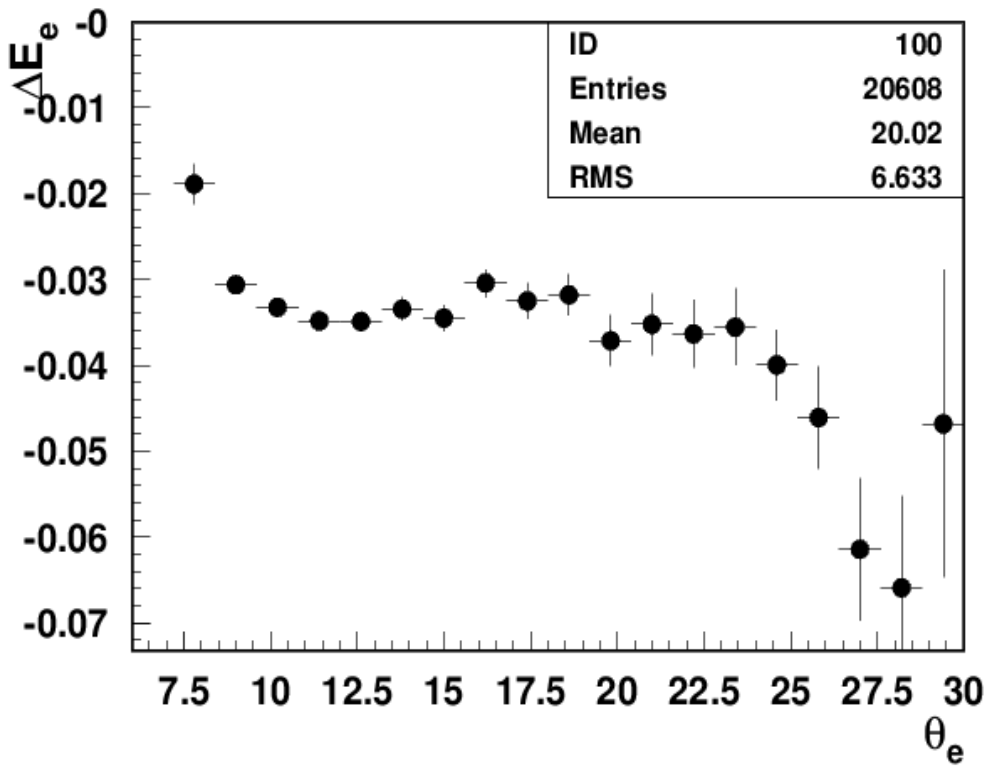
No significant difference between Sec-1 and others

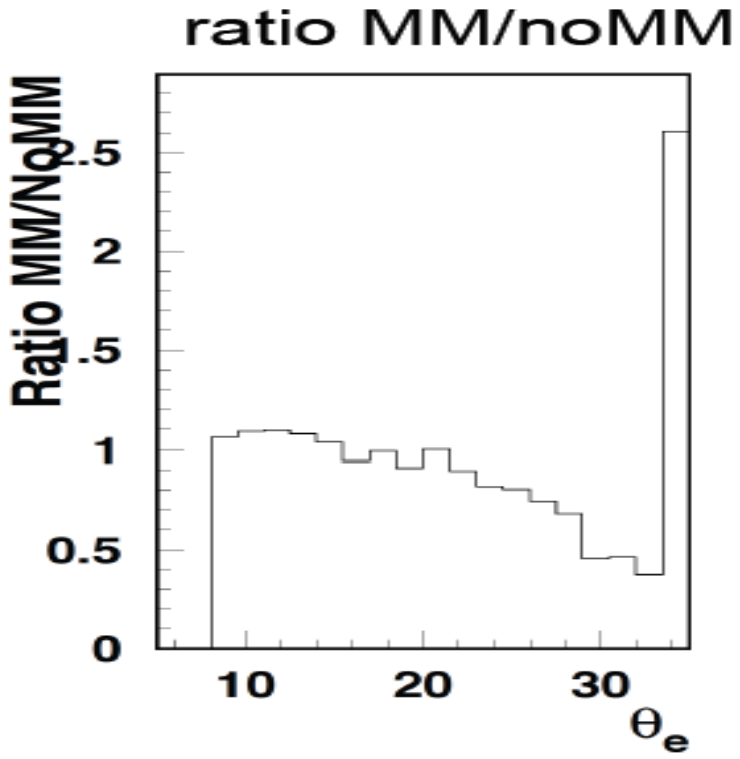
photons



π

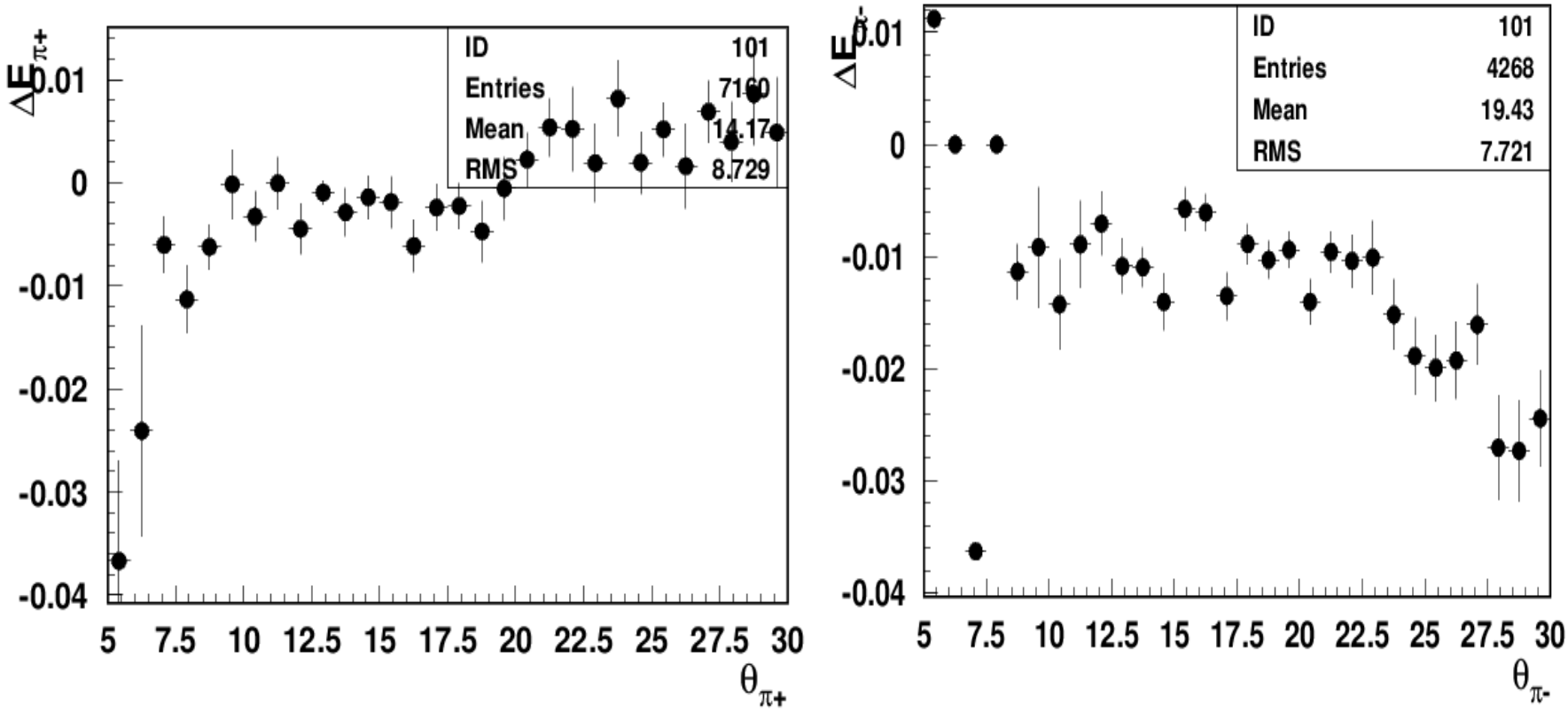
energy loss and efficiency





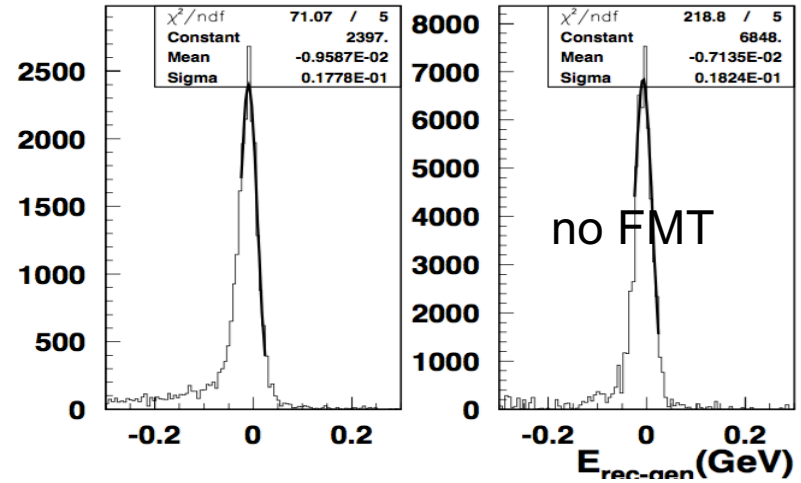
Material in the detector ~25-30 degrees significantly deteriorates electron detection

energy loss



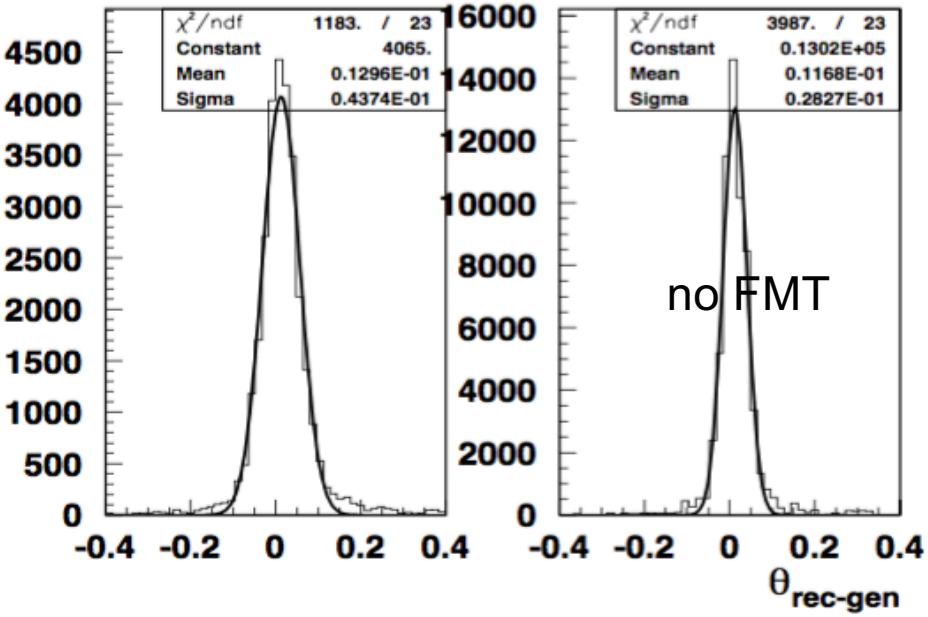
Effect is smaller for pions, but may still affect the reconstructed momenta

FMT effects in MC:angular bins



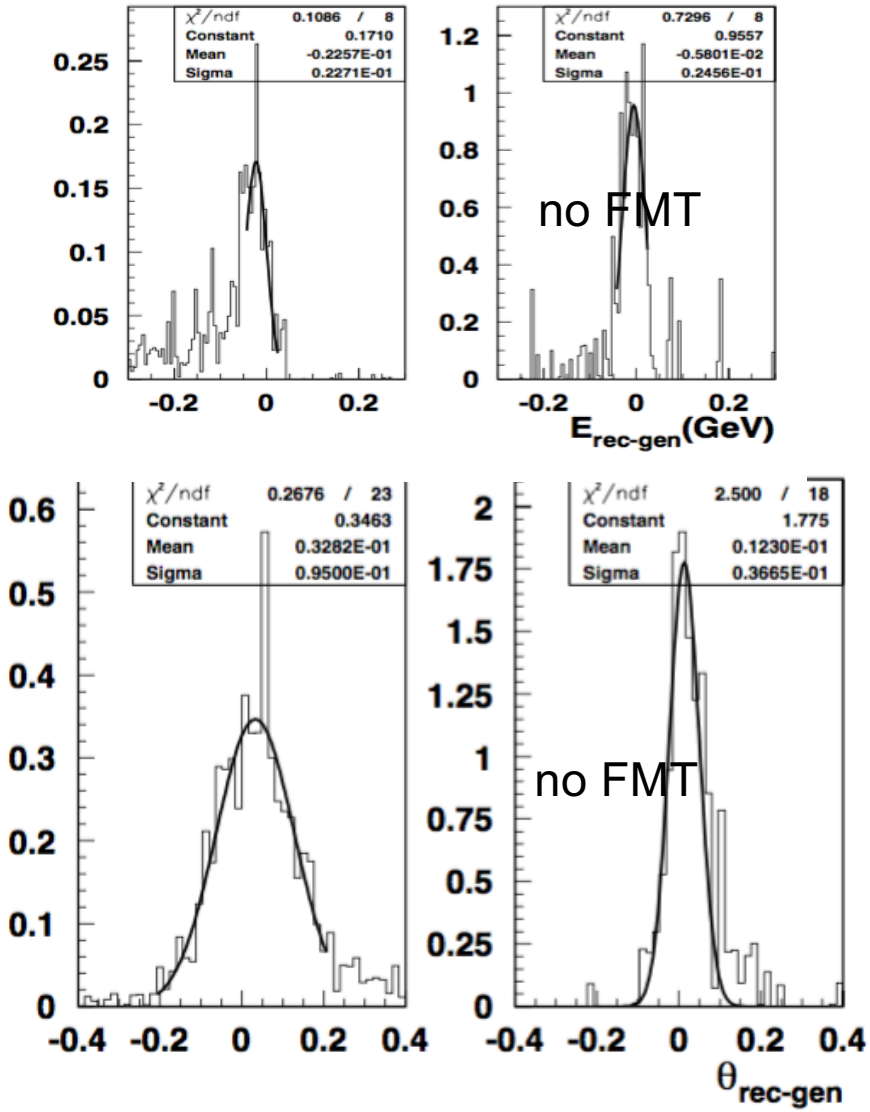
5<E<6GeV,17<θ<19

Significant energy loss from MM ~2-3 MeV



- Worse angular resolutions even in the range of low density

FMT effects in MC:fixed angular bin



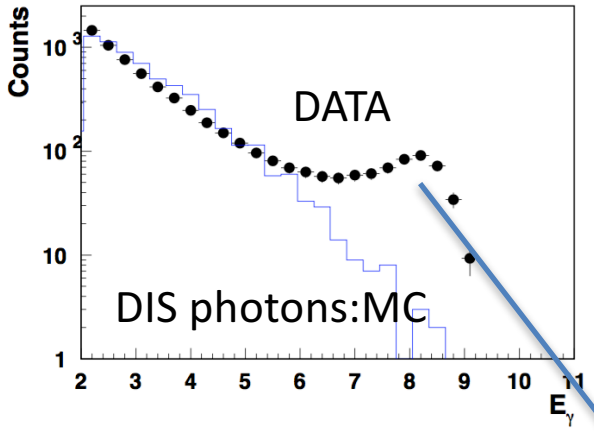
4<E<5GeV,29<θ<31

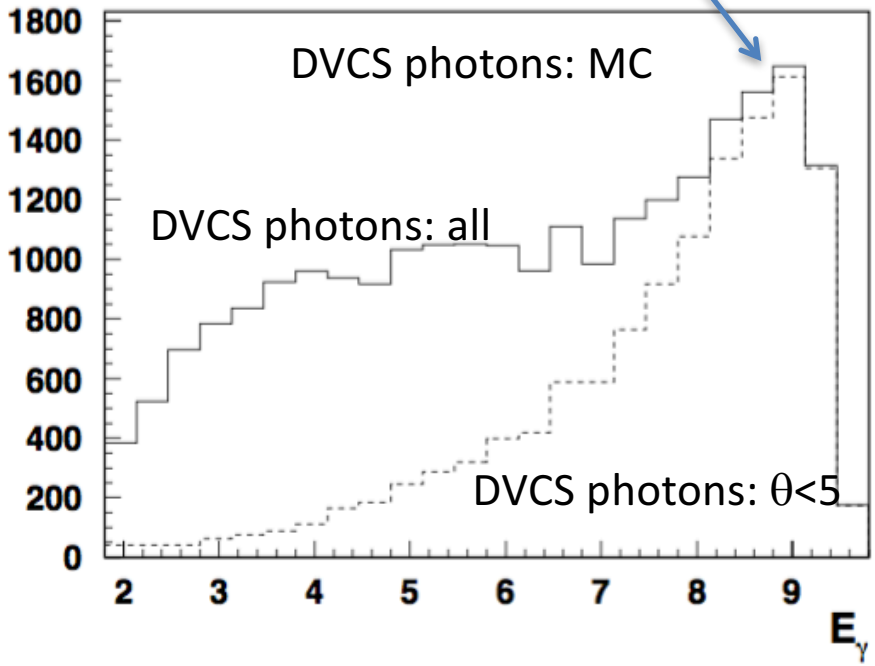
Significant energy loss from FMT >15 MeV

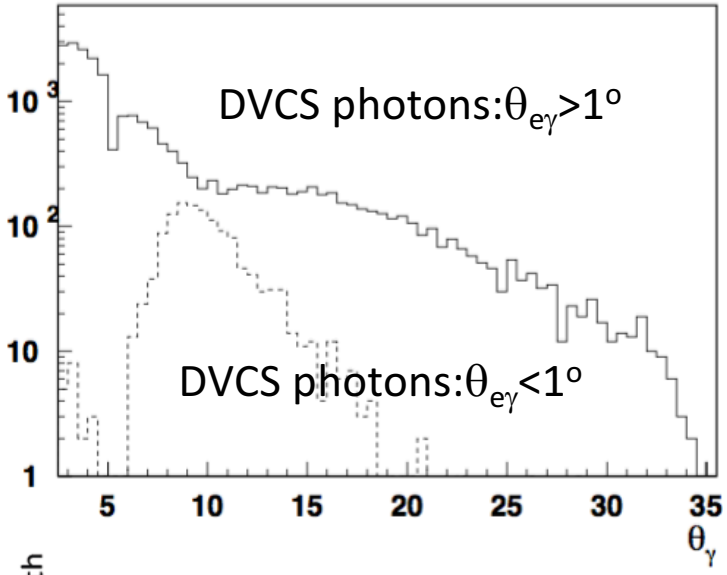
- Much worse angular resolutions in the critical for high Q^2 kinematics

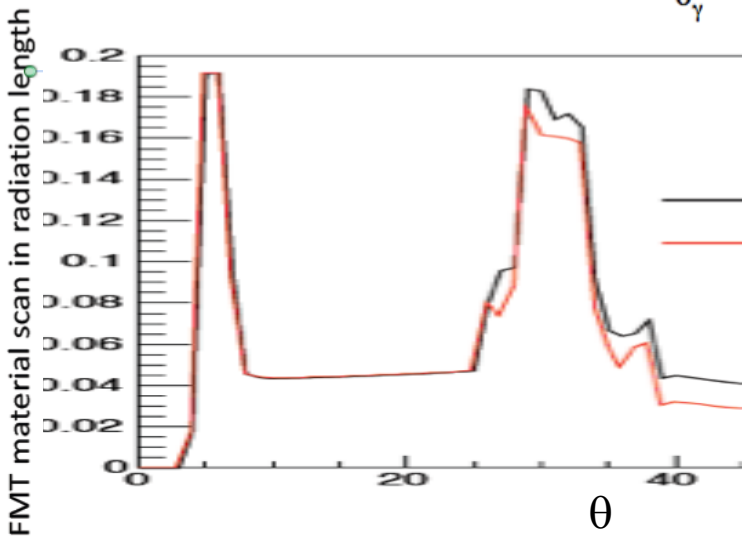
Note:
When assessing FMT performance comparison should be done
FMT used in tracking vs FMT removed from clas12

DVCS photons: MC





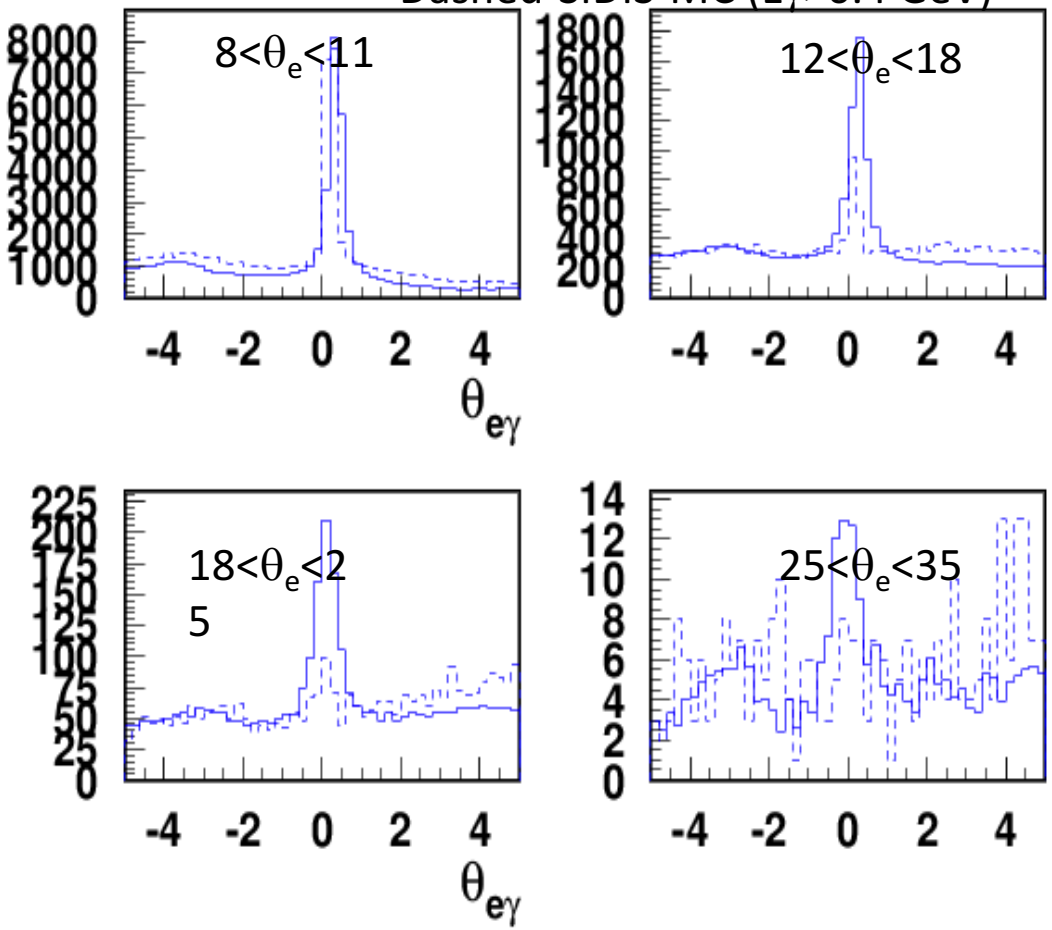


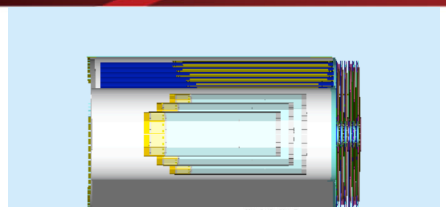


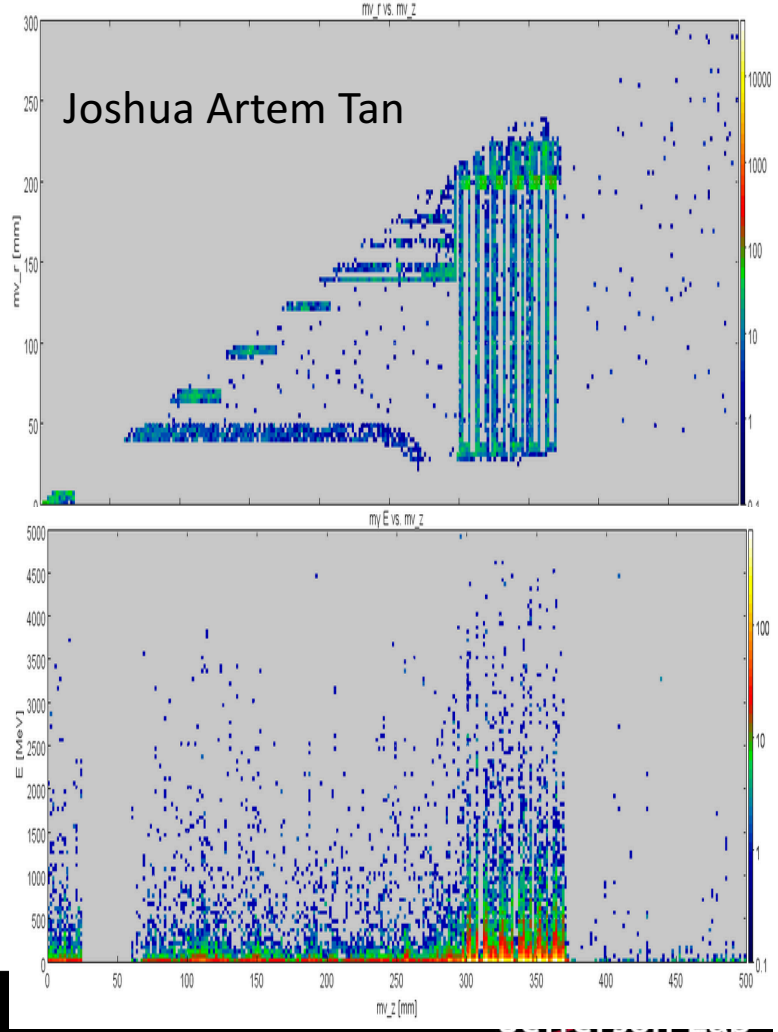
Photons along the e' in CLAS12

Solid-Data

Dashed-SIDIS-MC (Eγ>0.4 GeV)

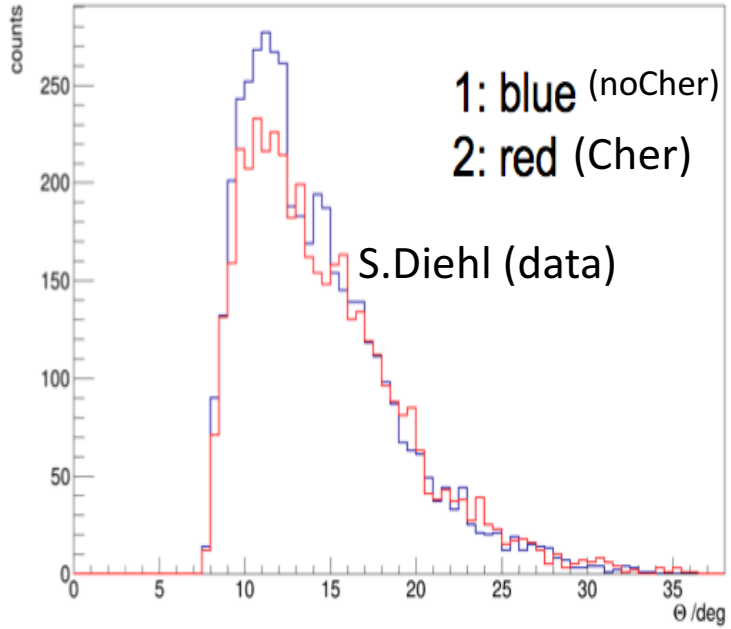




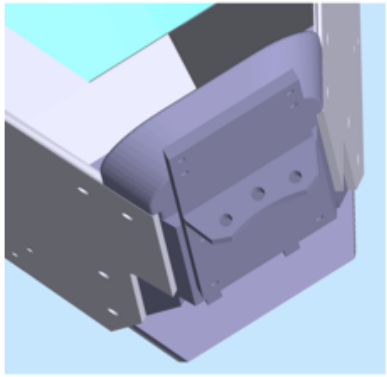


In data we have much more high energy photons along the e' (within 1 degree) than in MC

LTCC: acceptance effects

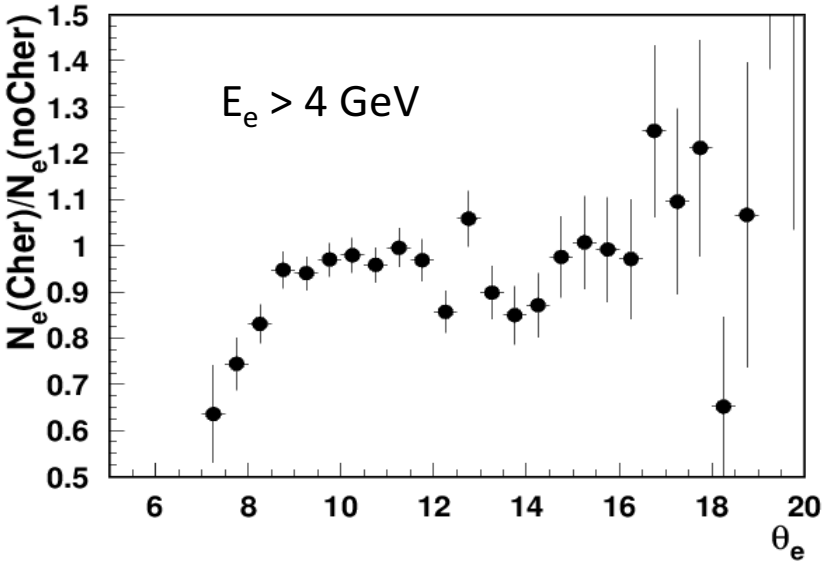


Some reduction of electrons observed at small angles



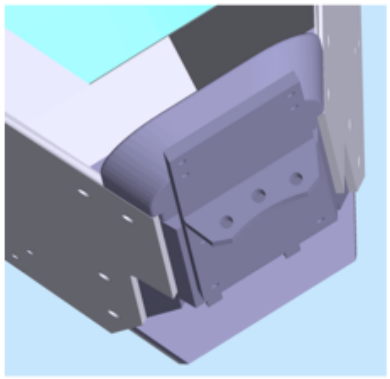
GEMC Nose Implementation

Latest GEMC (4a.2.4)+
Coatjava 5b.5.1



LTCC nose implemented in the latest version.
Reduction of electrons observed at small angles in MC (need more statistics)

Acceptance effects



GEMC Nose Implementation

Latest GEMC (4a.2.4)+
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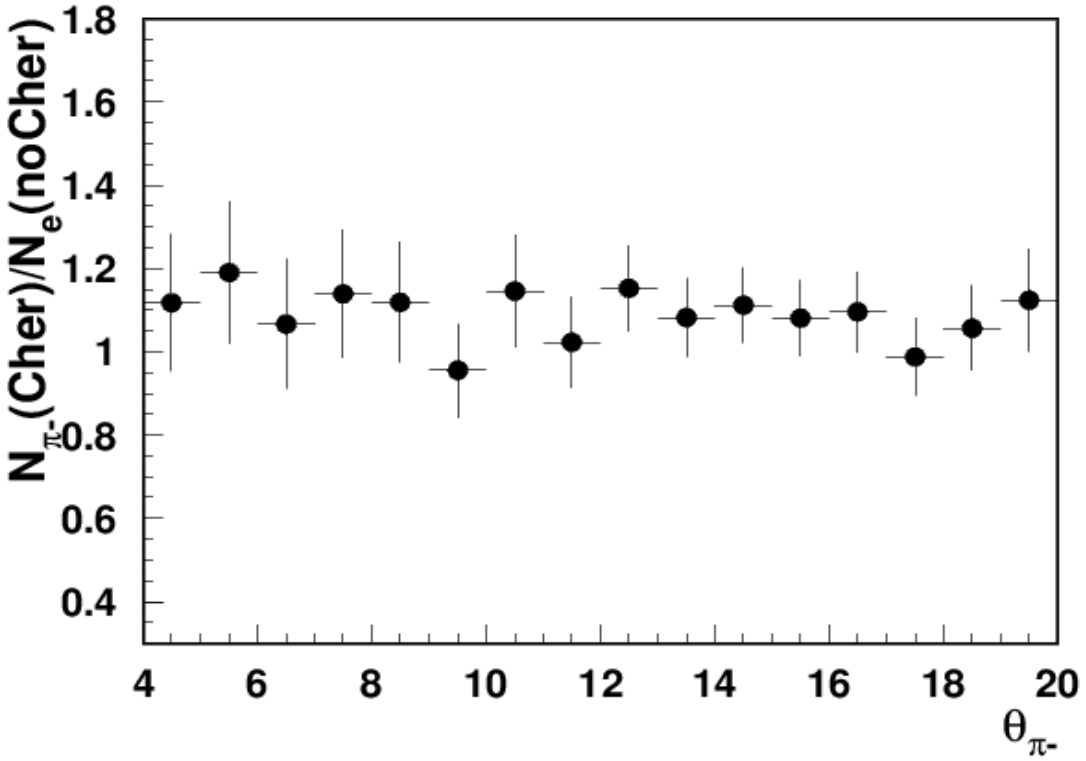
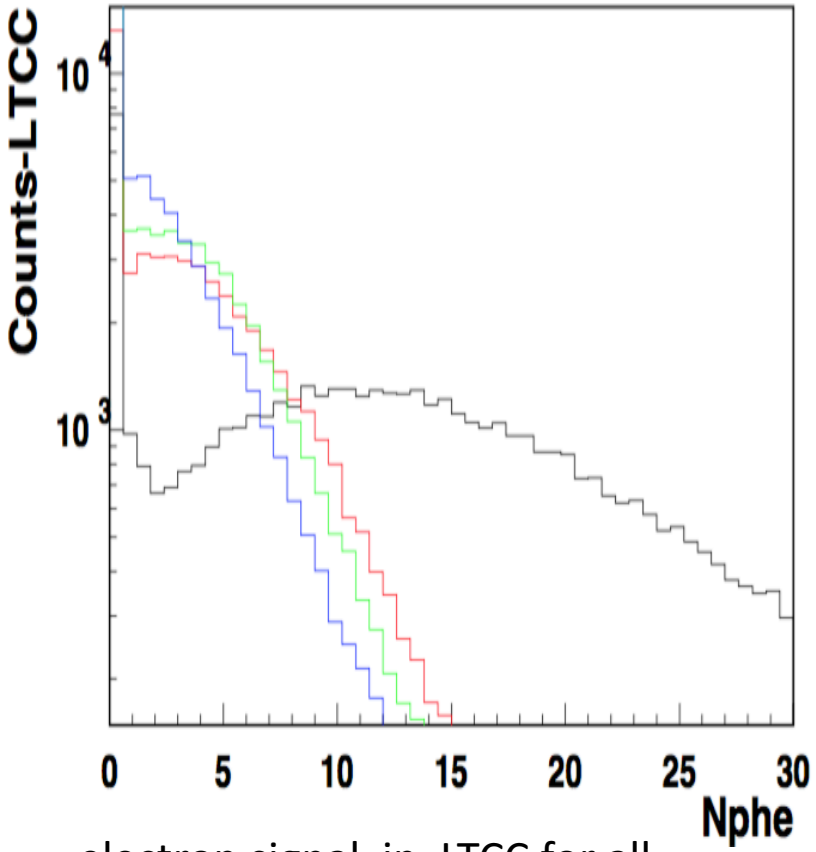


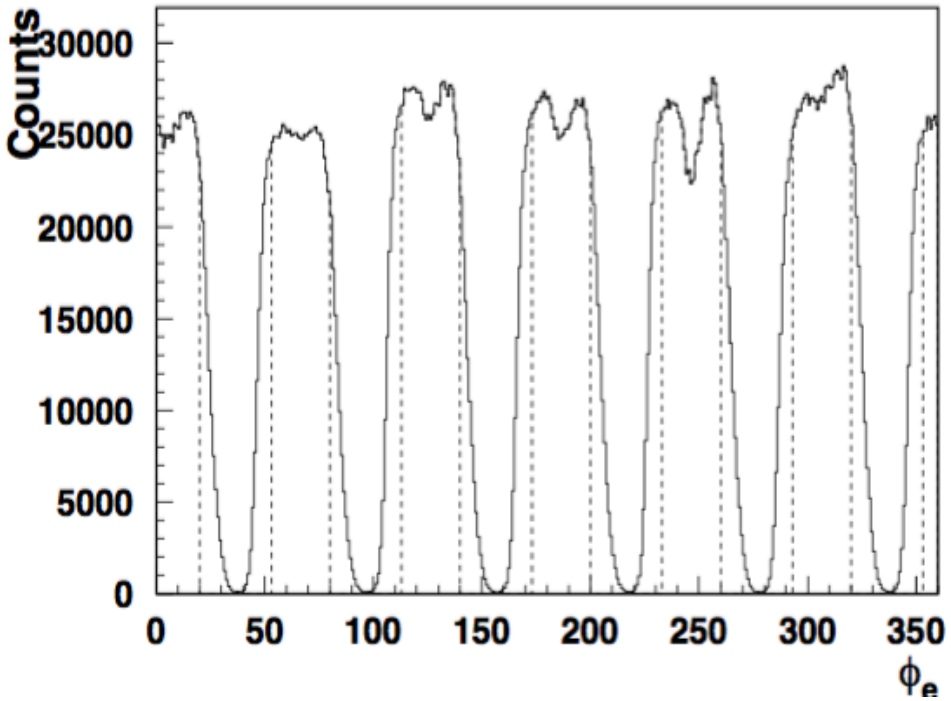
No significant effect from LTCC nose on pions observed at small angles in MC (need more statistics)

Increased (~10-15%) number of pions due to additional PID

CLAS12: LTCC studies with run 3985

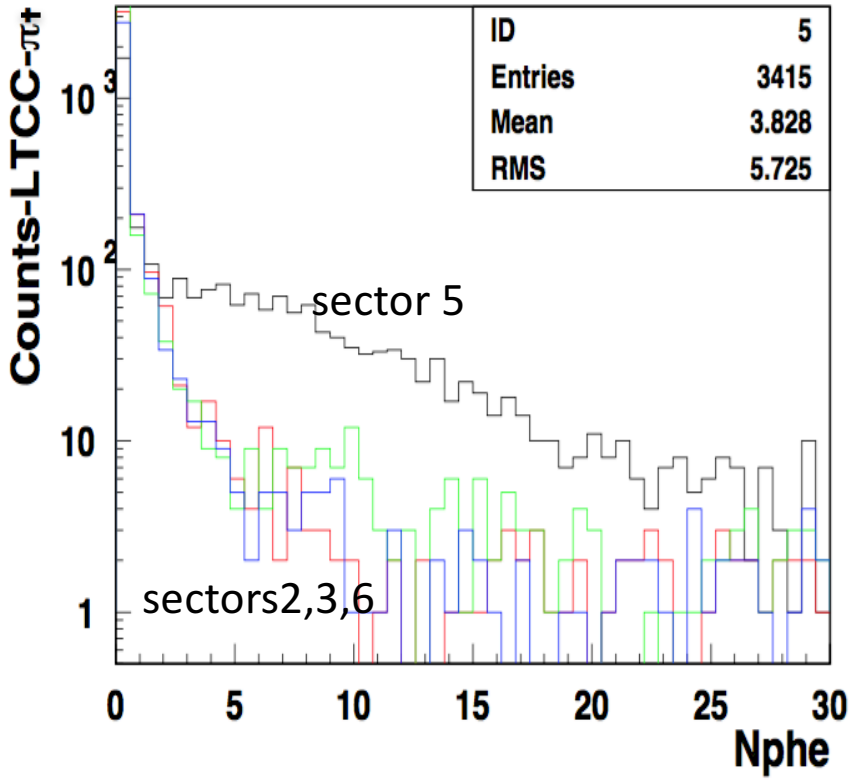


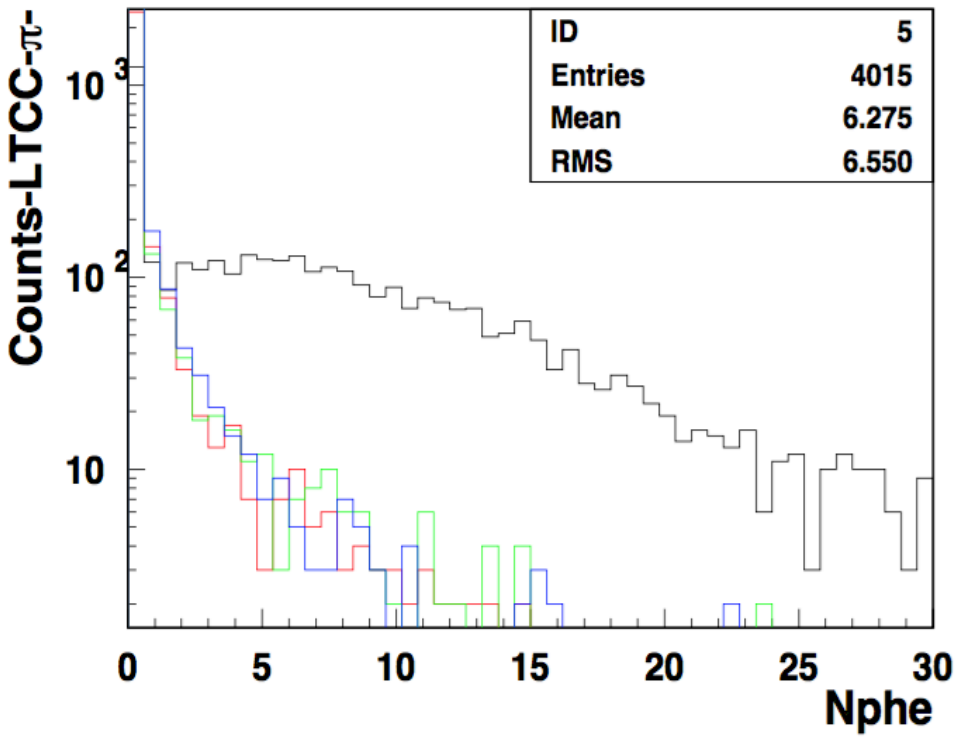
electron signal in LTCC for all sectors black→ sector-5



Both for electrons and pions the edges were cut out

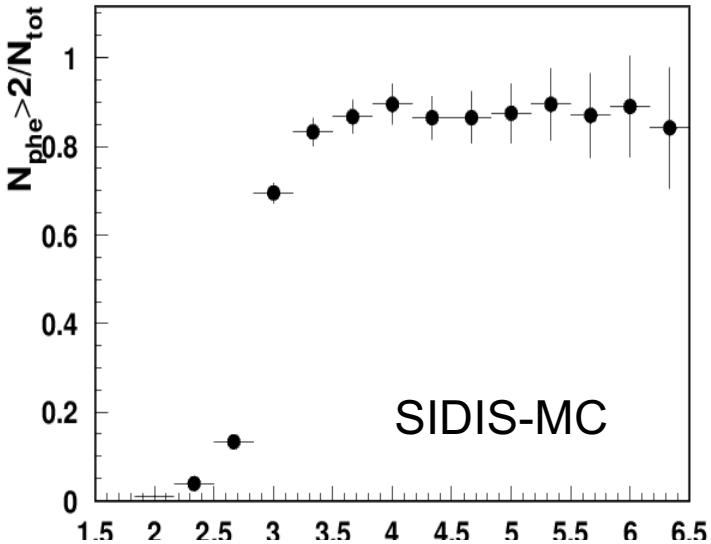
LTCC: response to pions from run 3985

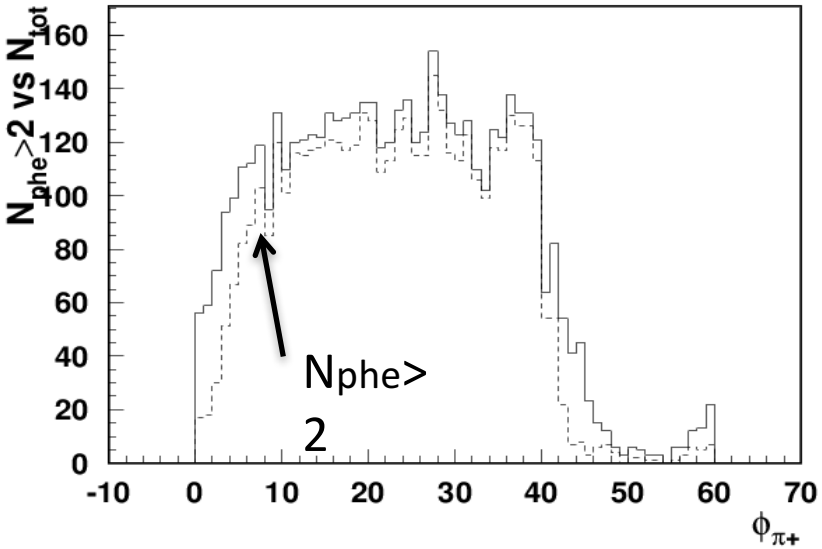


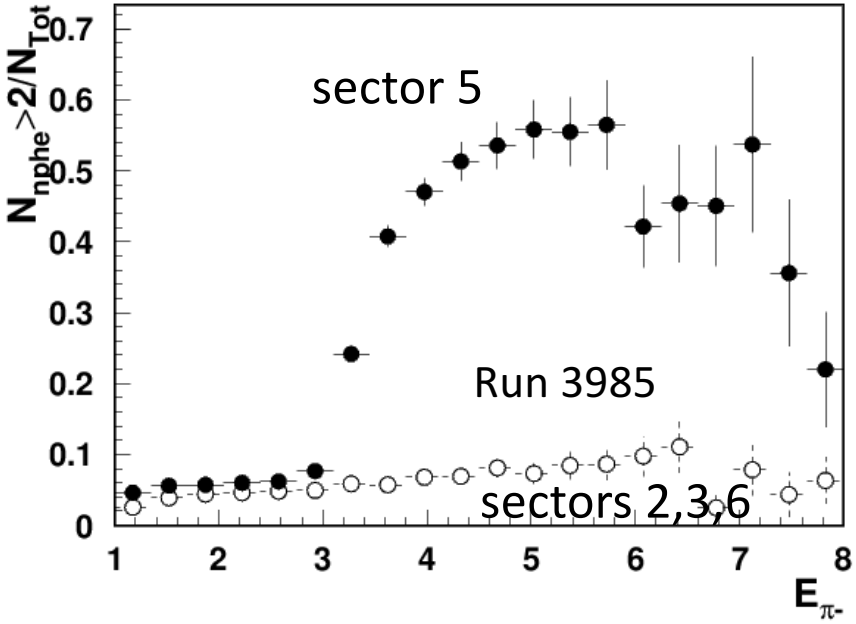


Sector 5 signal (black line) very different from other sectors both for pi+ and pi-

Identification of pions

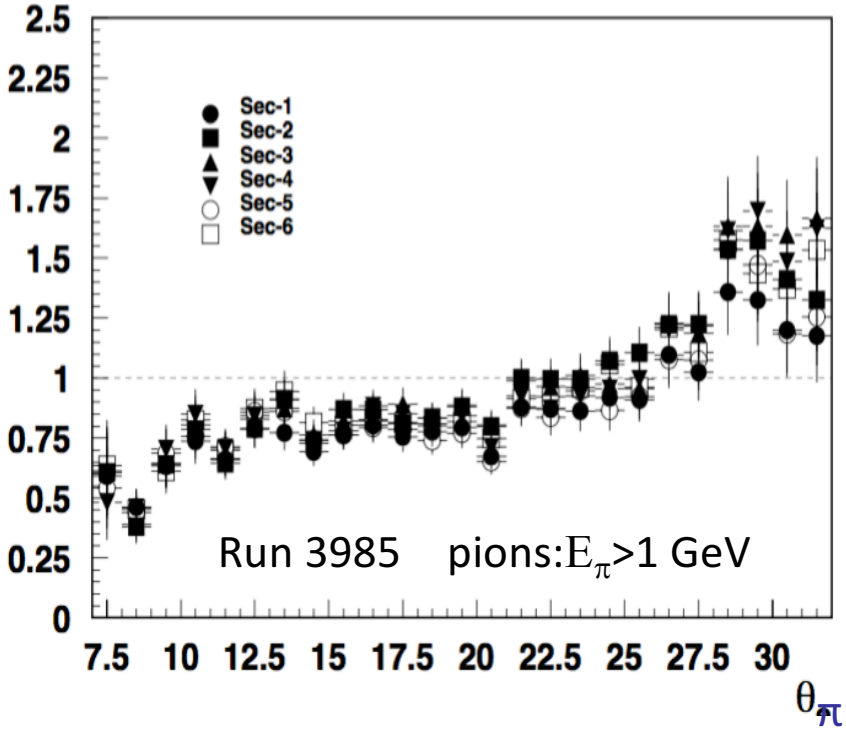


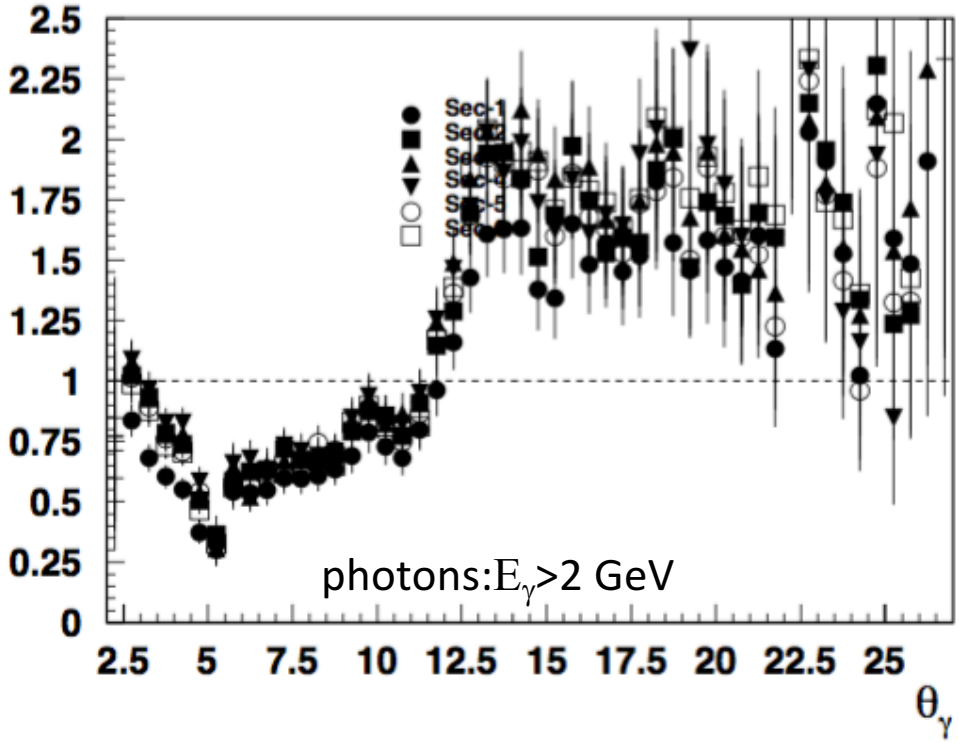




- LTCC efficient ~90% starting from ~3-3.5 GeV (with $N_{phe}>2$) mainly inefficient at edges

DATA/MC: sector dependence





No significant difference in photon or pions counts between Sec-1 and others at angles fro 5-12

SUMMARY

- SIDIS and DVCS were used to study the CLAS12 response
- LTCC ID efficiency studied
- Possible impact of LTCC and FMT studied on acceptance of electrons, pions and photons.
- FMT introducing additional radiation in CLAS12
- LTCC may be responsible for acceptance reduction at small angles (nose effect)

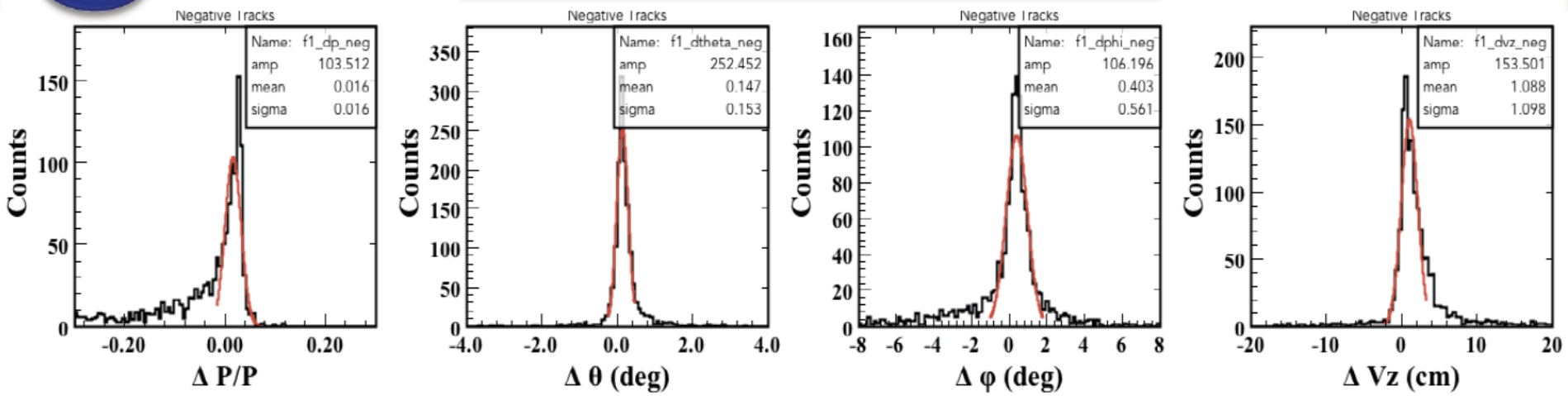
Need more detailed studies for both detectors, FMT & LTCC to justify their presence in second part of RG-A run

Current suggestion: collect some data with no FMT and 2 back to back sectors of LTCC fully operational

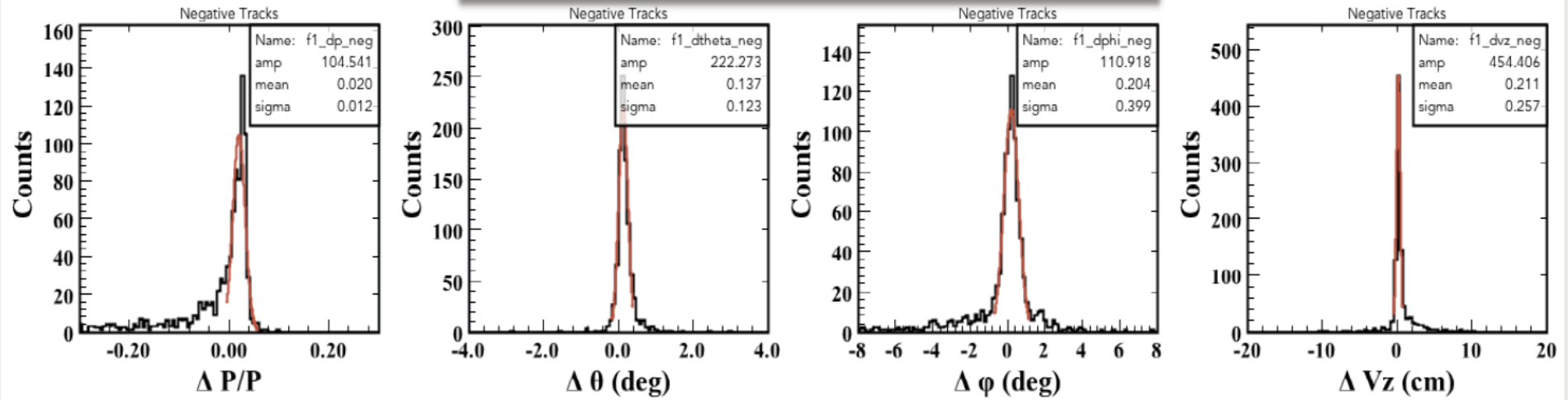
- support slides

e-

DC Stand-alone reconstruction

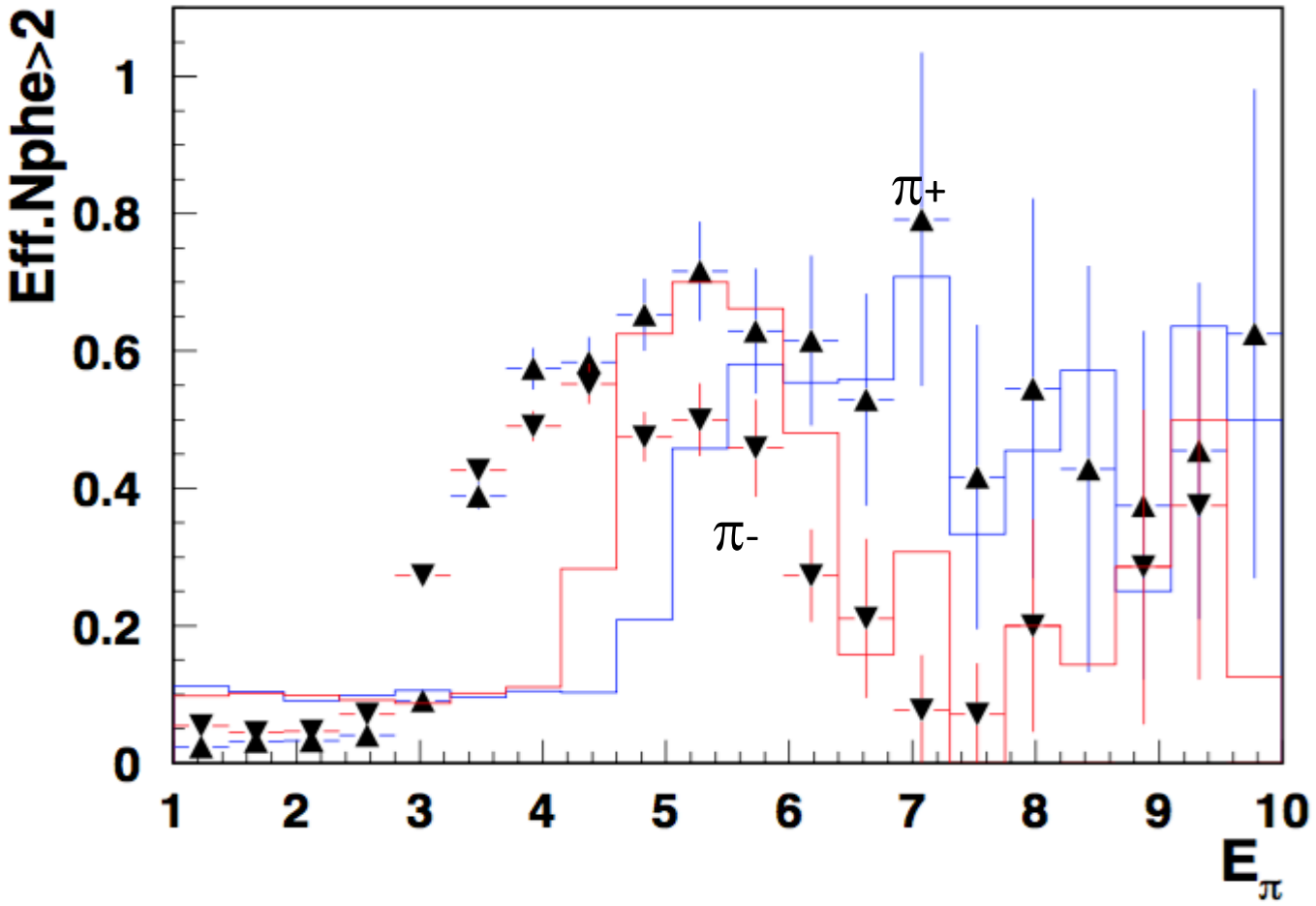


Using FMT clusters in reconstruction



- CAVEAT : The *with-FMT-reconstruction sample* has ghosts. This validation picks 1st track.
- Code not yet ready for data

LTCC: ID-efficiency with a cut Nphe>2 (outbending)

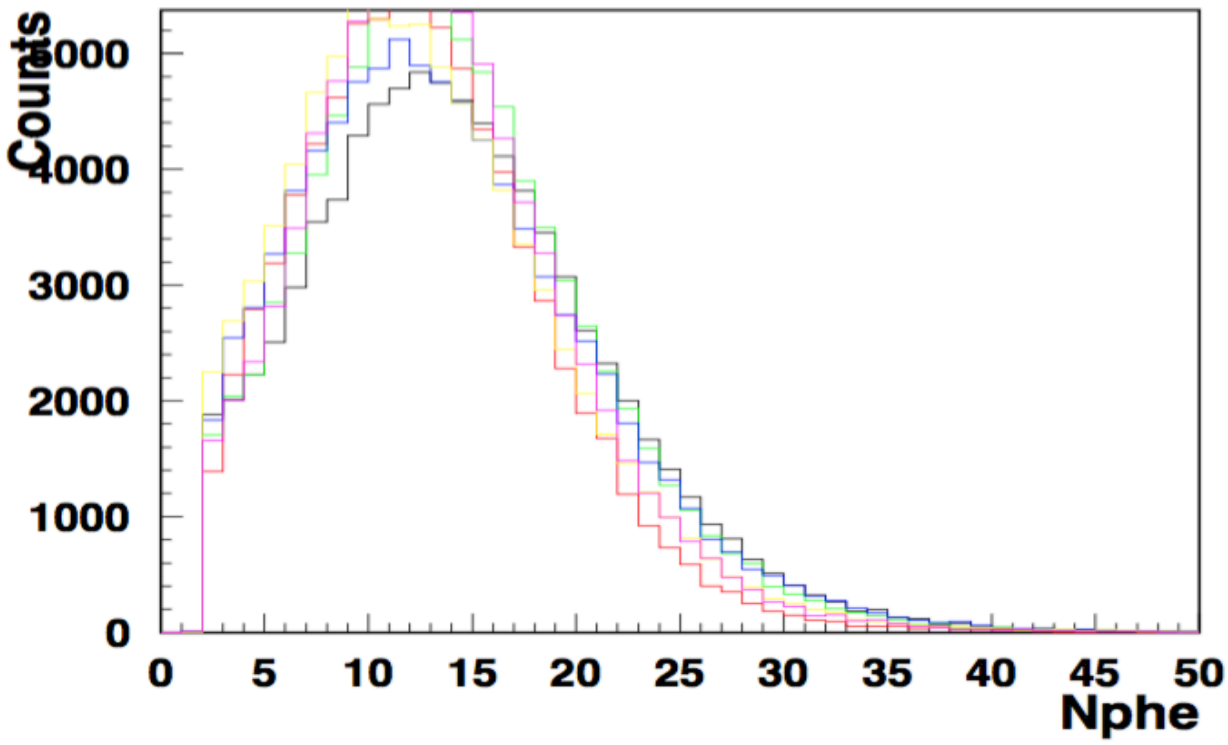


LTCC: triangles up (blue) pi+
down (red) pi-

Lines-HTCC Nphe>2
weird: low energies constant fraction (not for LTCC!)

HTCC response to electrons

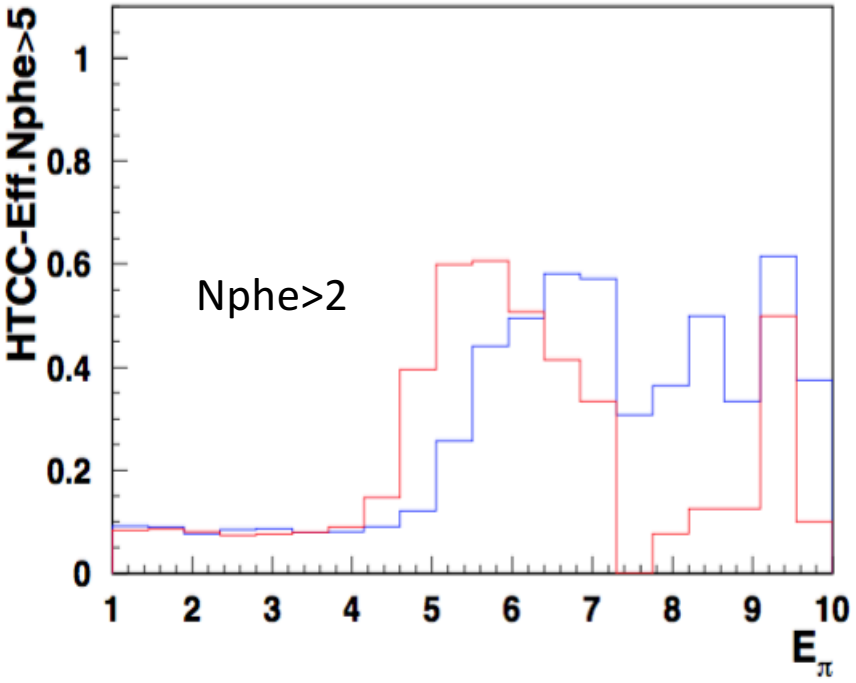
6 Lines-HTCC for 6 sectors

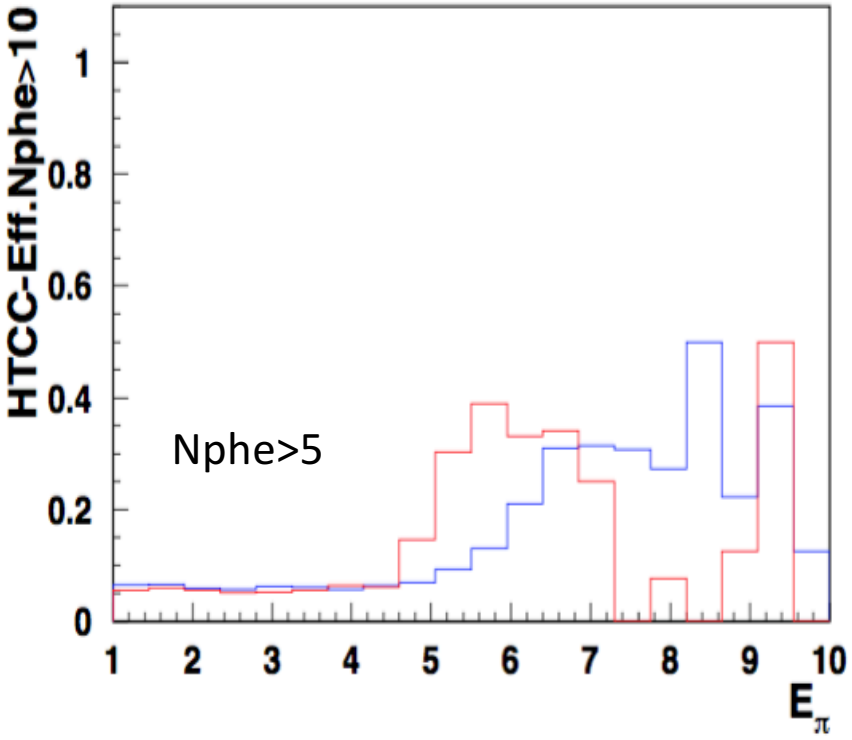


HTCC for all sectors roughly consistent for electrons

HTCC response to pions

Weird plato in HTCC for E<5 GeV decreases with a cut on Nphe





Need to clarify the source of signal