

Status of the GEANT4 simulator & reconstruction software

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- Simulator retuning : 1KT mode results
- Reconstruction status : 8" mode
- What do we need now

Simulator status

- Removed complicated reflection model for cathode (just use Fresnel reflection)
- Increase scattering (Rayleigh but different model from skdetsim)
- Add hadronic interactions in 1KT mode as well
- Shown last time : does not improve PID discrepancy

BUT simulator working well now apart from that

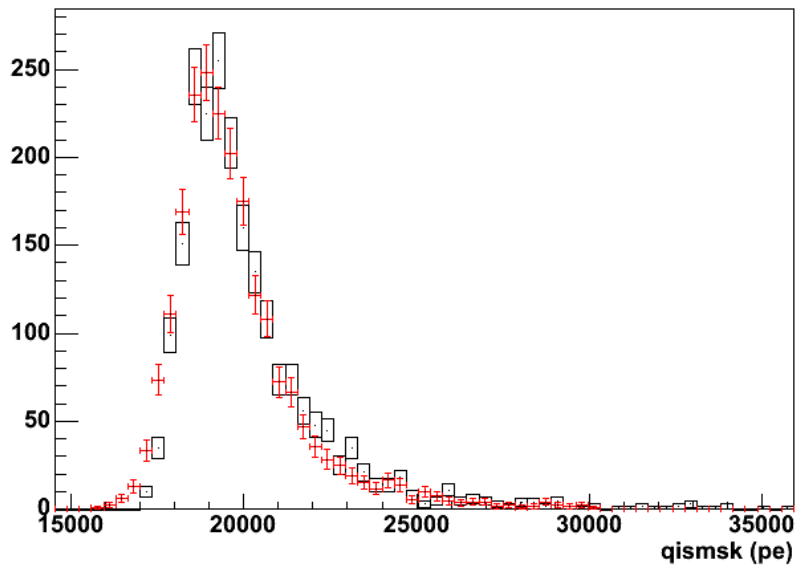
Possible future changes in the next week :

- GEANT4 propagates optical photons at phase velocity (should be group velo.) --> version 7.1 ? patch to be installed at Kashiwa by ICRR expert (I don't have the access rights...)
- PMT time jitter becomes too large at low q --> need a cutoff

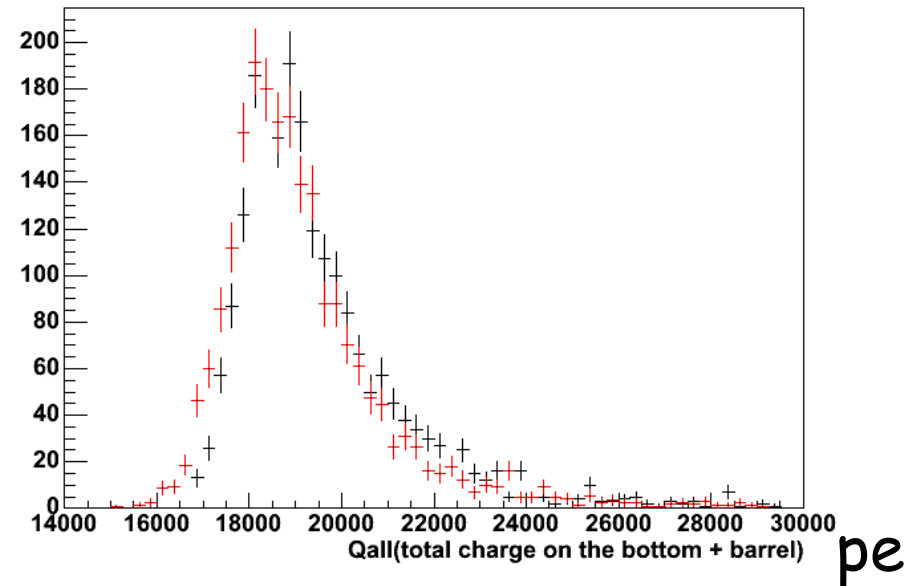
Through-going muon simulation

Data / G4

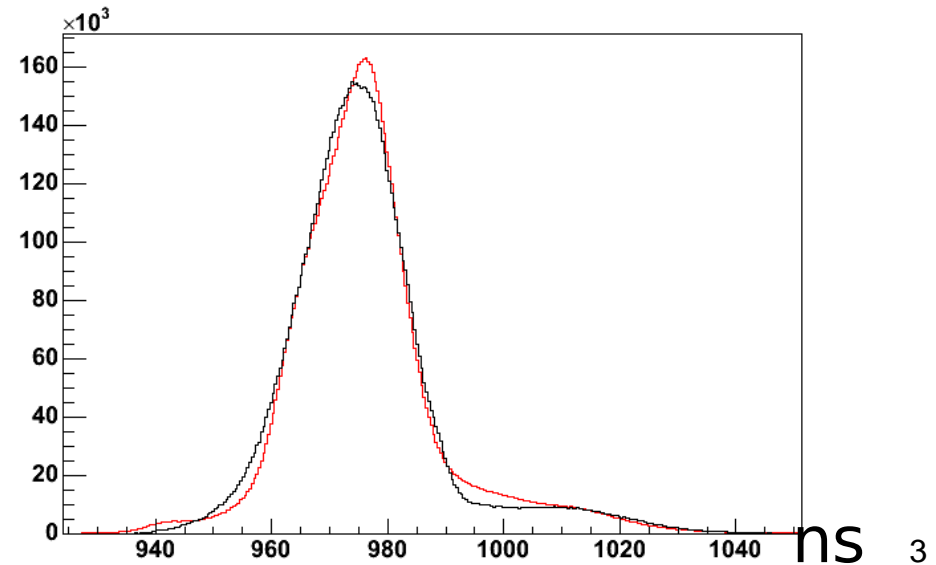
qismk, G4



Qall, G4



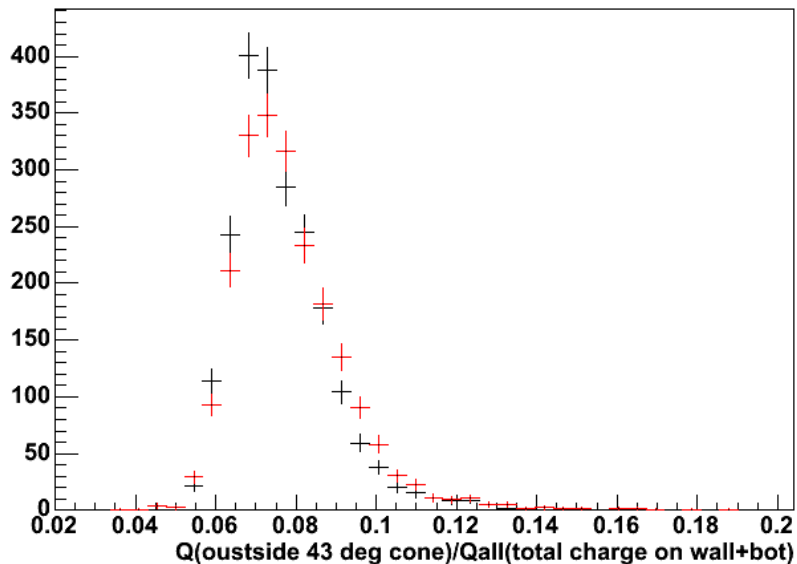
tisk



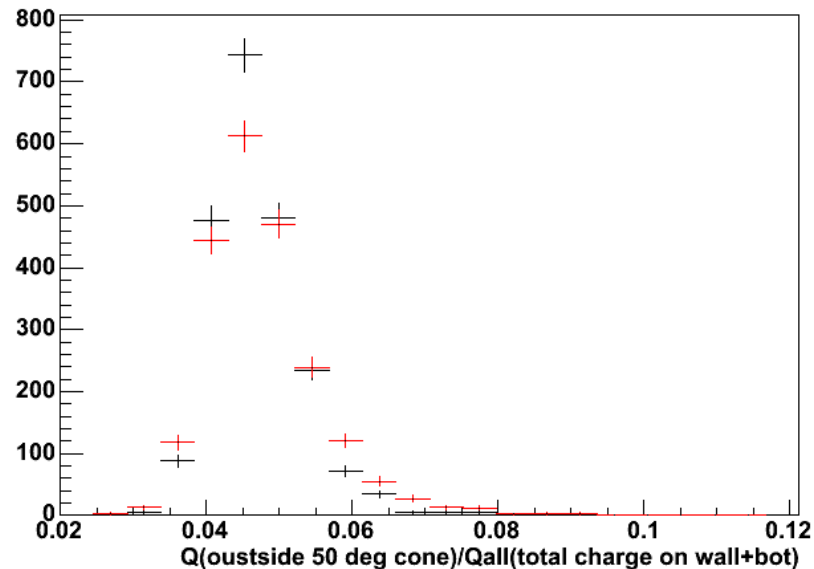
- Qismk (MC-DATA)/DATA = $1.67\% \pm 0.25\%$
- QOUT43 DIFFERENCES :
G4 : 0.076 DATA : 0.078
G4-DATA/DATA = -0.026
- QOUT50 DIFFERENCES :
G4 : 0.047 DATA : 0.048
G4-DATA/DATA = -0.022

Indirect light in much better shape

Qout43/Qall , G4

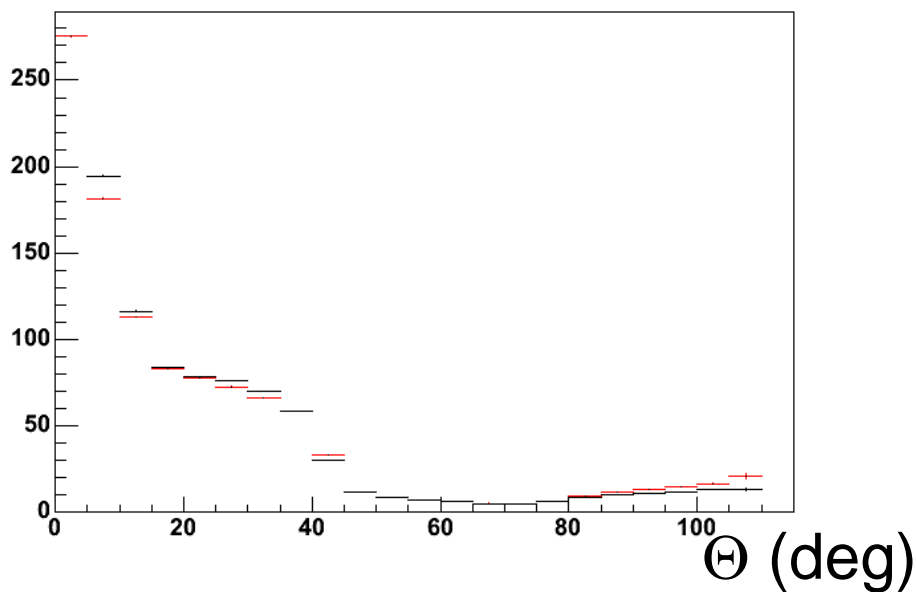


Qout50/Qall, G4

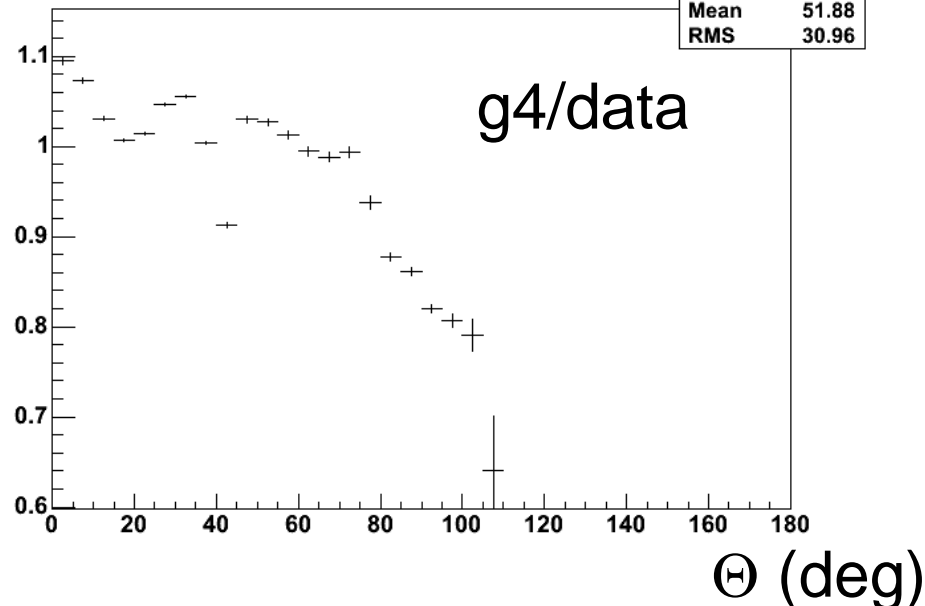


Data / G4

q profile, reconstructed direction



| ratioprof | |
|-----------|---------|
| Entries | 1460640 |
| Mean | 51.88 |
| RMS | 30.96 |



Good agreement of the charge profiles up to 80°

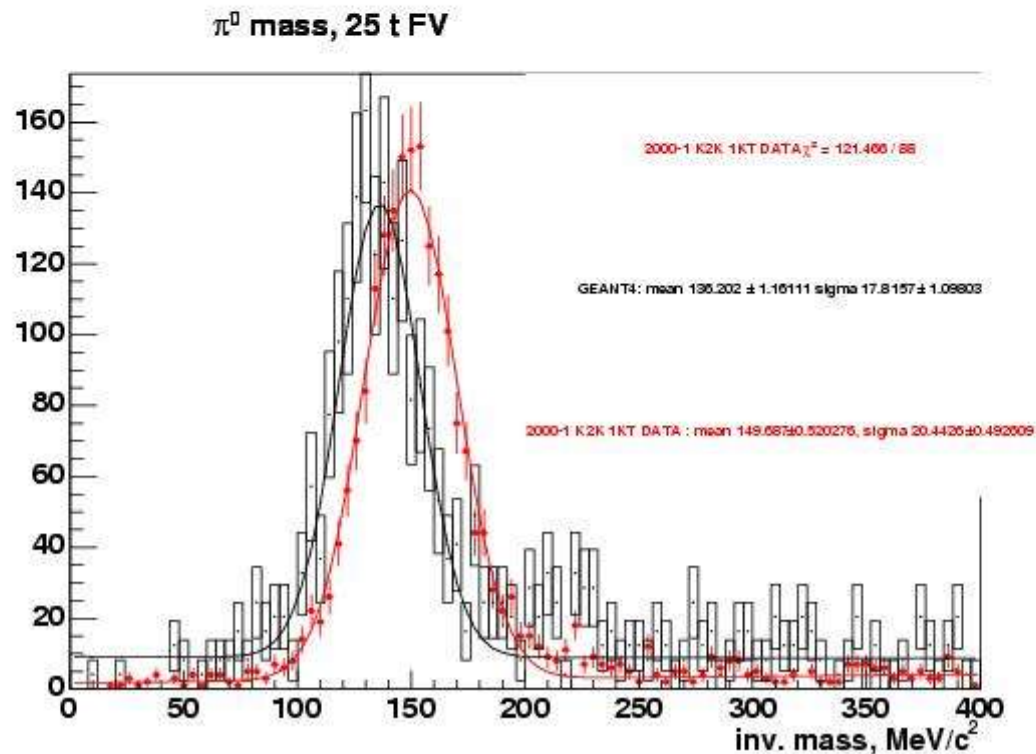
ν Beam simulation

Usual method...

Pi0 mass peak difference larger than before (-5.8% \rightarrow -8.7%)

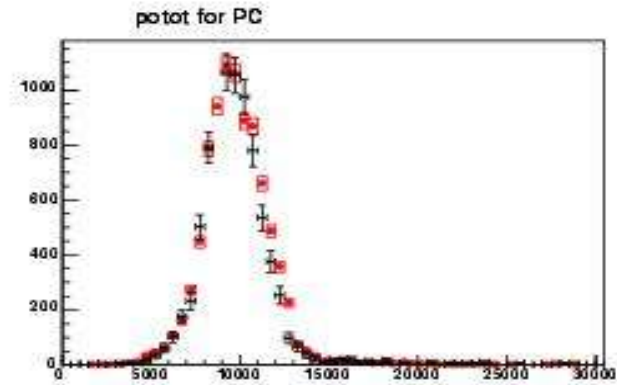
Most likely because I would need to make new 'asmo' tables
(light \leftrightarrow energy conversion)

+ discrepancies with data in 2 ring PID...



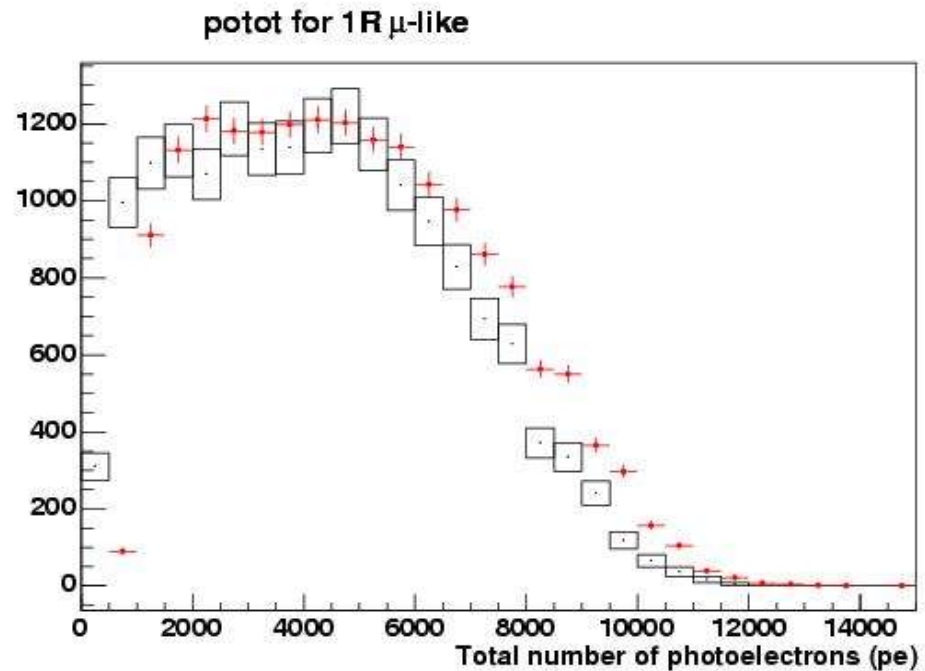
Other cross checks : total charge for 1ring PC events
MC-DATA/DATA $\sim -1.5\% \pm 0.3\%$

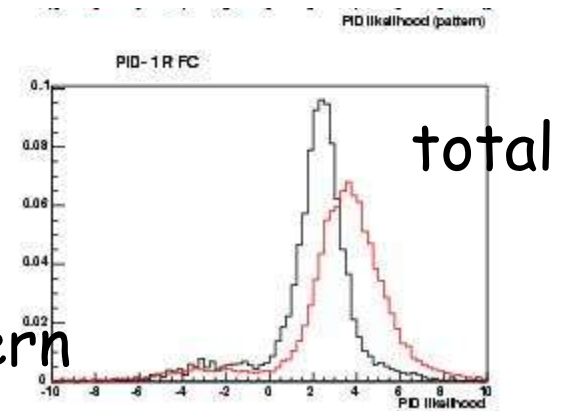
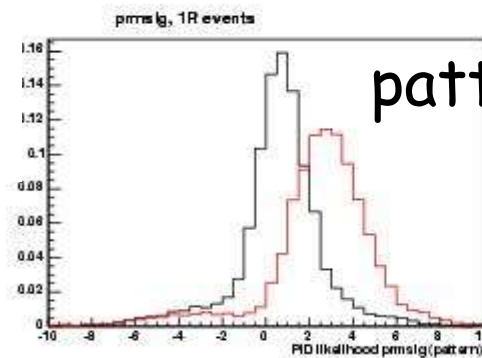
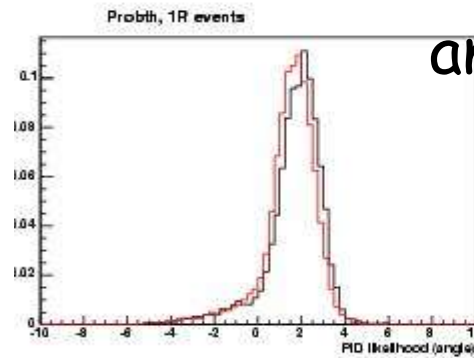
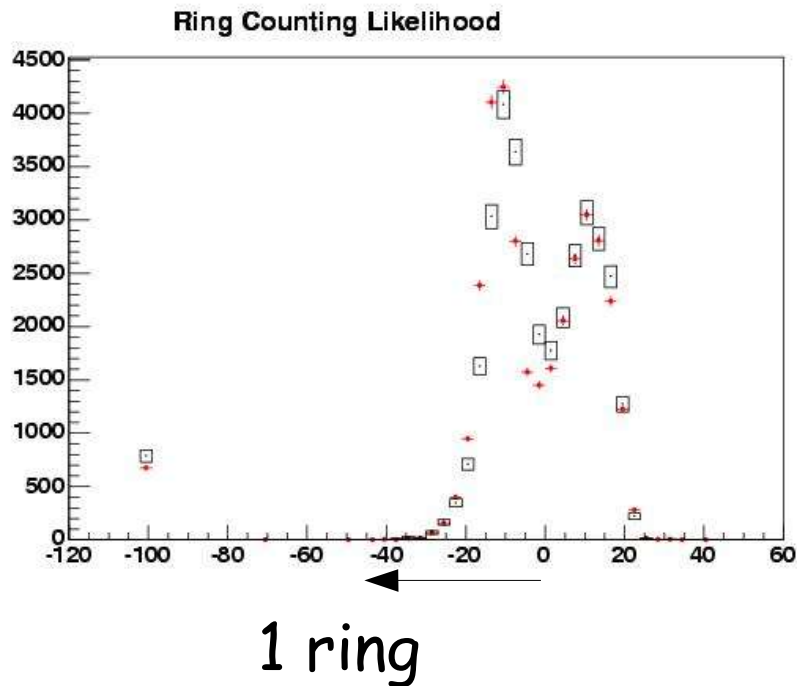
Good agreement



Total charge for 1R μ like events

Visible shift
by 1 bin





1 ring PID

- Changed 1 pe distribution from modified Poisson to 'Skryn1pe'
- Changed threshold from sharp cutoff to sk function

PID & ring counting likelihoods are obtained after complicated light pattern calculations --> very difficult to get likelihood distributions to agree perfectly...

2KM geometry

- Retuned 'asmo' (light->energy) tables using mono energetic MC e-/μ- events

- PID discrepancy in 1KT mode was also visible in 2KM geometry

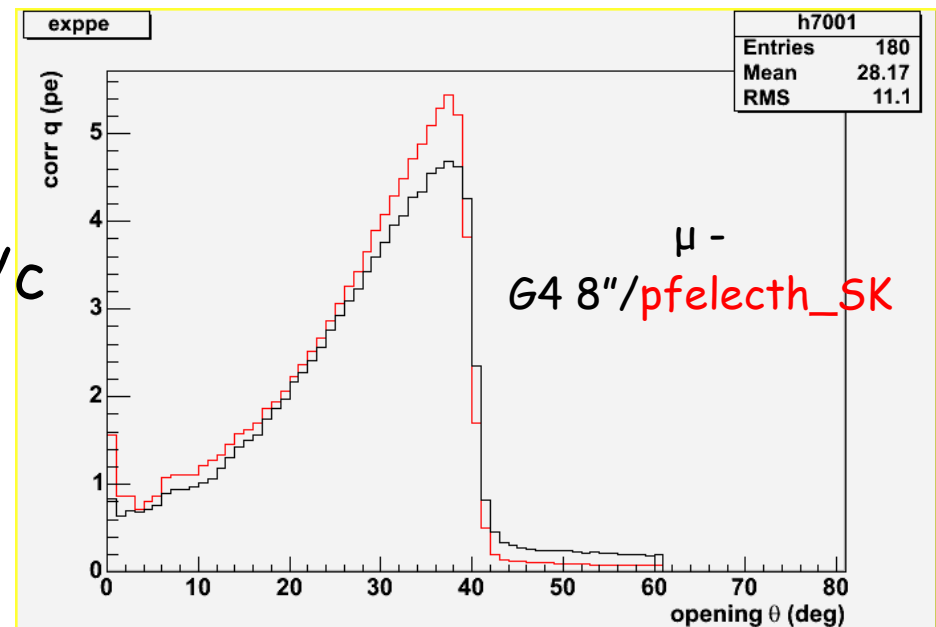
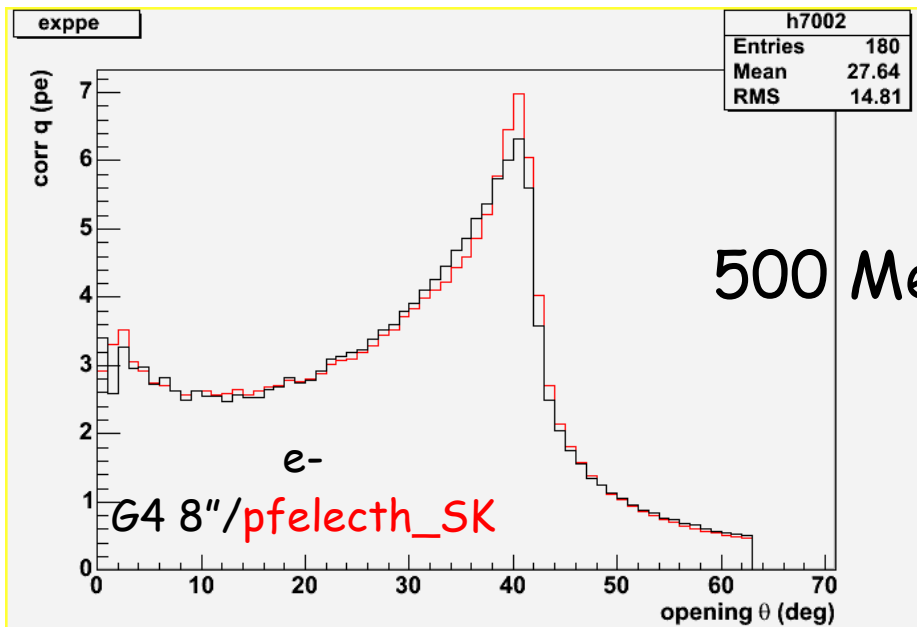
1 possibility : 'wrong' light patterns (1KT 20" instead of 8")

In 1KT geometry the 'pfmmonth' & 'pfelecth' patterns are the best

→ Use the SK version of pfmmonth/pfelecth to do PID calculations for 8" tubes

problems with AFIT & angle PID remain

→ Will probably have to keep the 56t reduced FV for my analysis



Conclusion

- Simulator was re-tuned to thru-mu data
- Increase scattering, reduce reflections, new 1pe dist., etc.
- Better agreement with thru-mu ; seems to be slight pe deficit (due to scattering ?) when comparing with ν data
- Possible future changes :
 - 1) phase velocity \rightarrow group velocity (v7.1 ?)
 - 2) PMT time jitter too large at very low q
- Reconstruction software : under study...
re-made pe \leftrightarrow energy tables for 2KM geometry
changed PID patterns to get better agreement
- Hopefully finished by end of this week

Need to start generating **vectors** ASAP for mass production