ATF Extraction Line Laser Wire

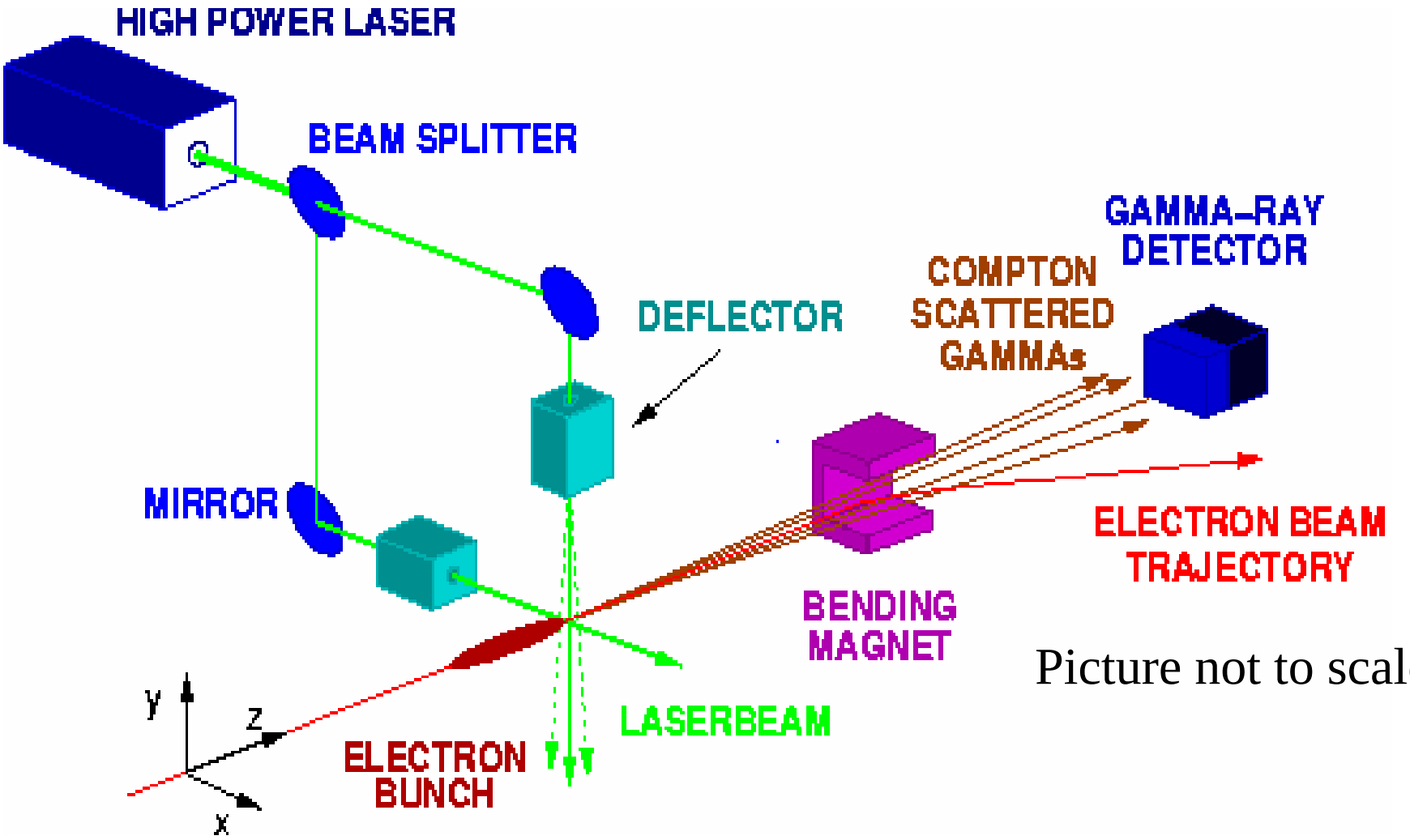
Laser Wire Mini Workshop
3rd July 2006

Lawrence Deacon

Outline

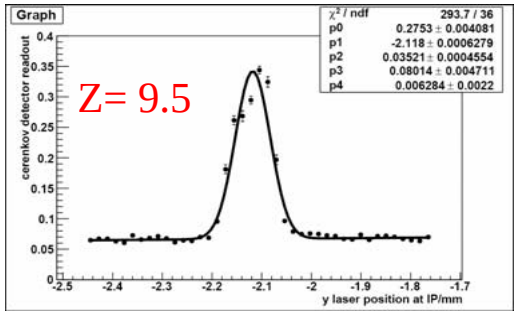
- Experimental results
- Statistics
- ATF2 simulation of laser wire photons and synchrotron radiation

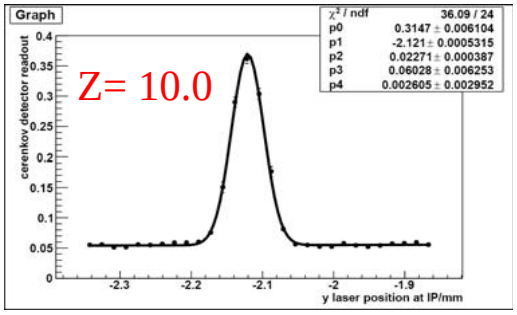
Laser Wire

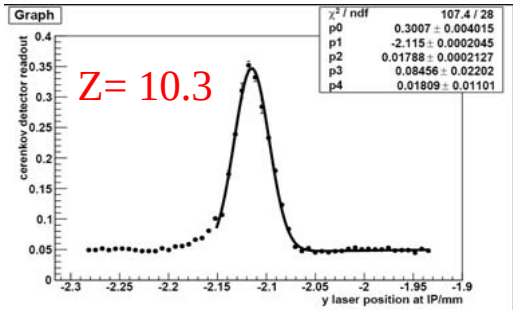


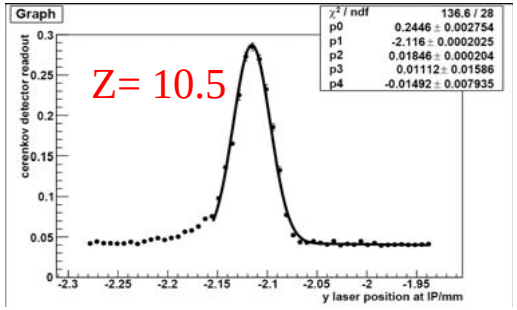
Picture not to scale.

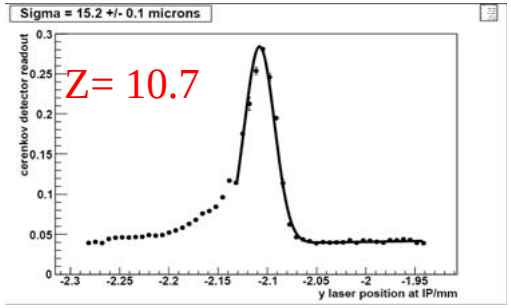
Experimental Results from May 2006

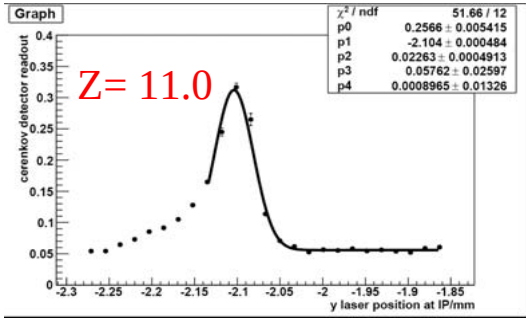


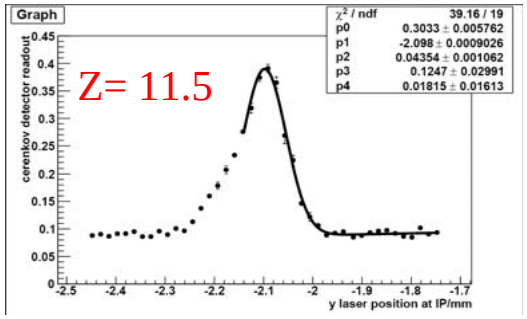


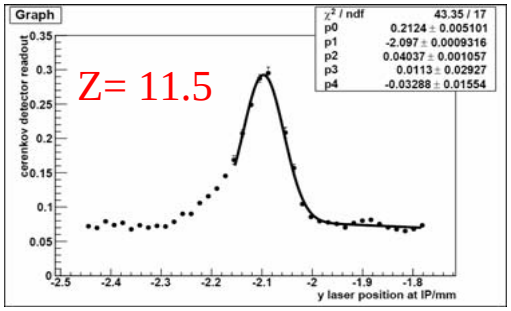


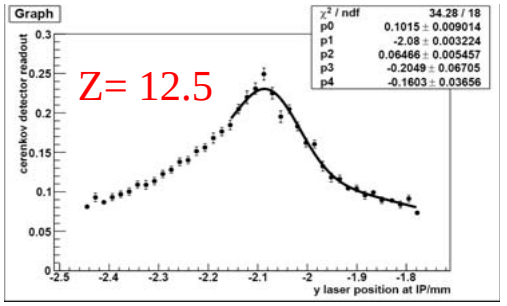




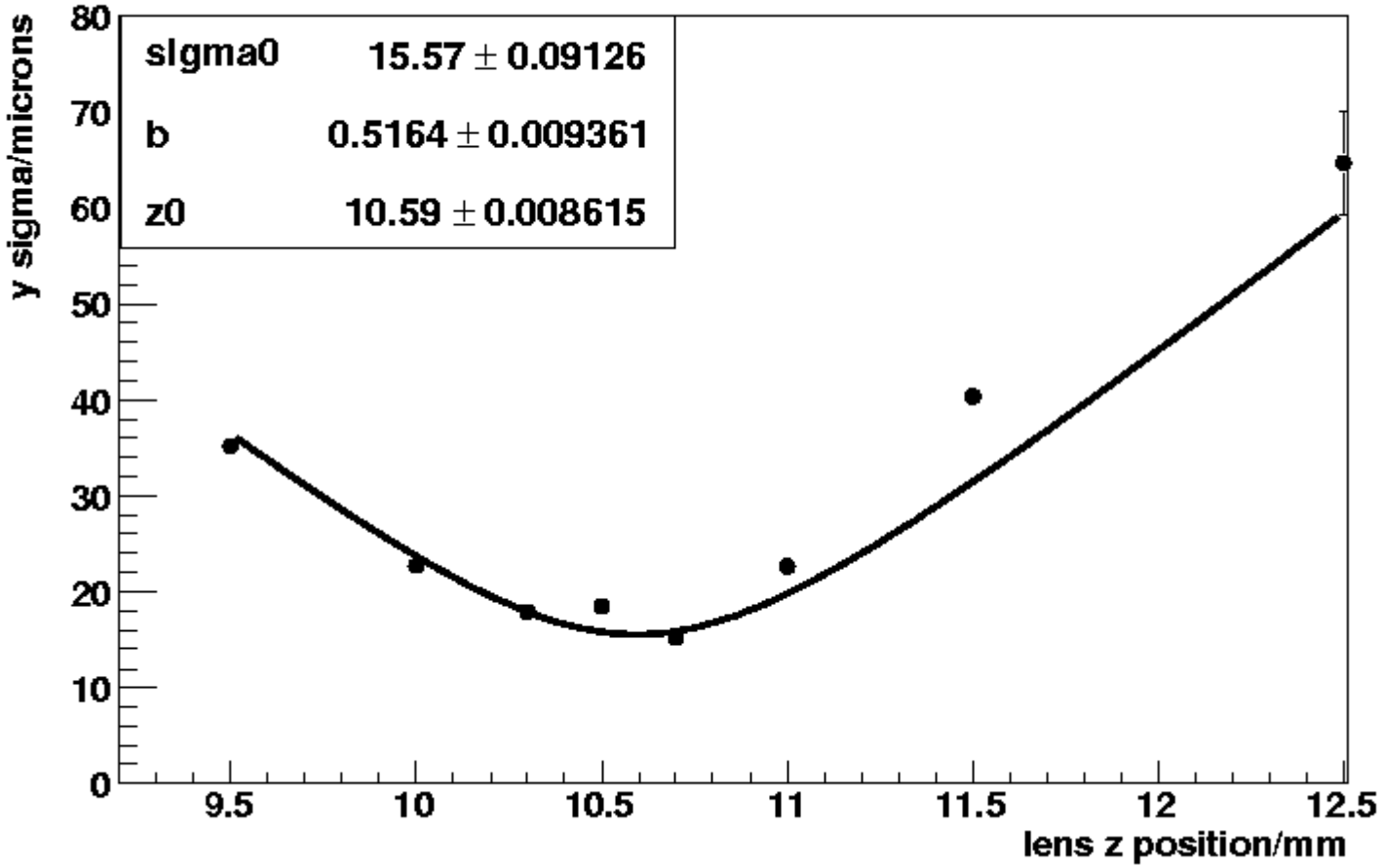




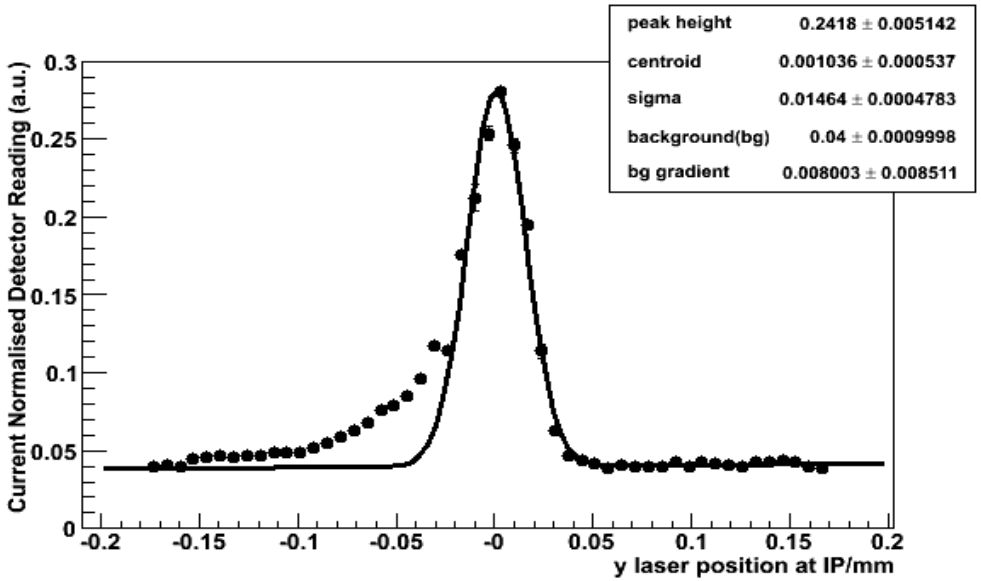


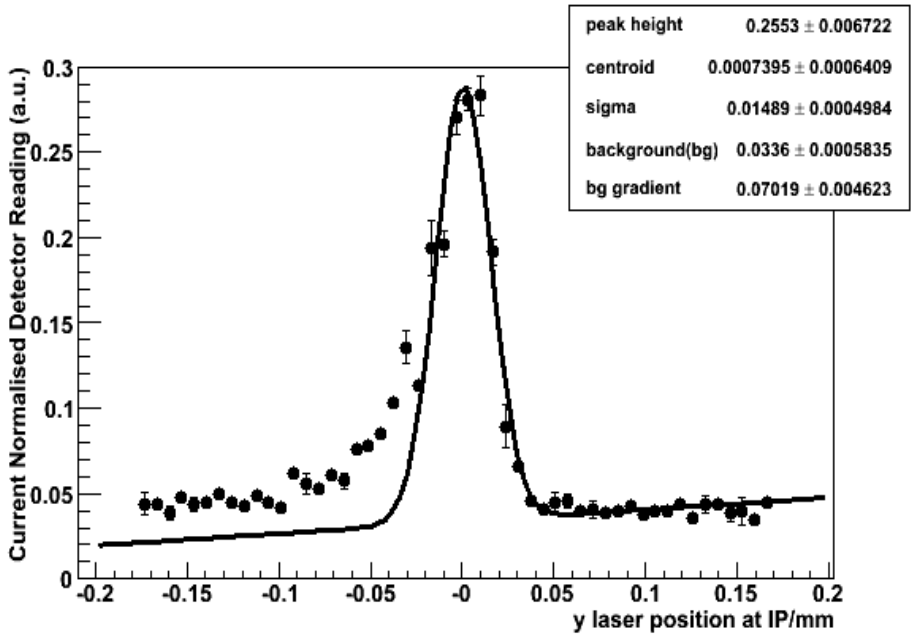


Experimental Results from May 2006



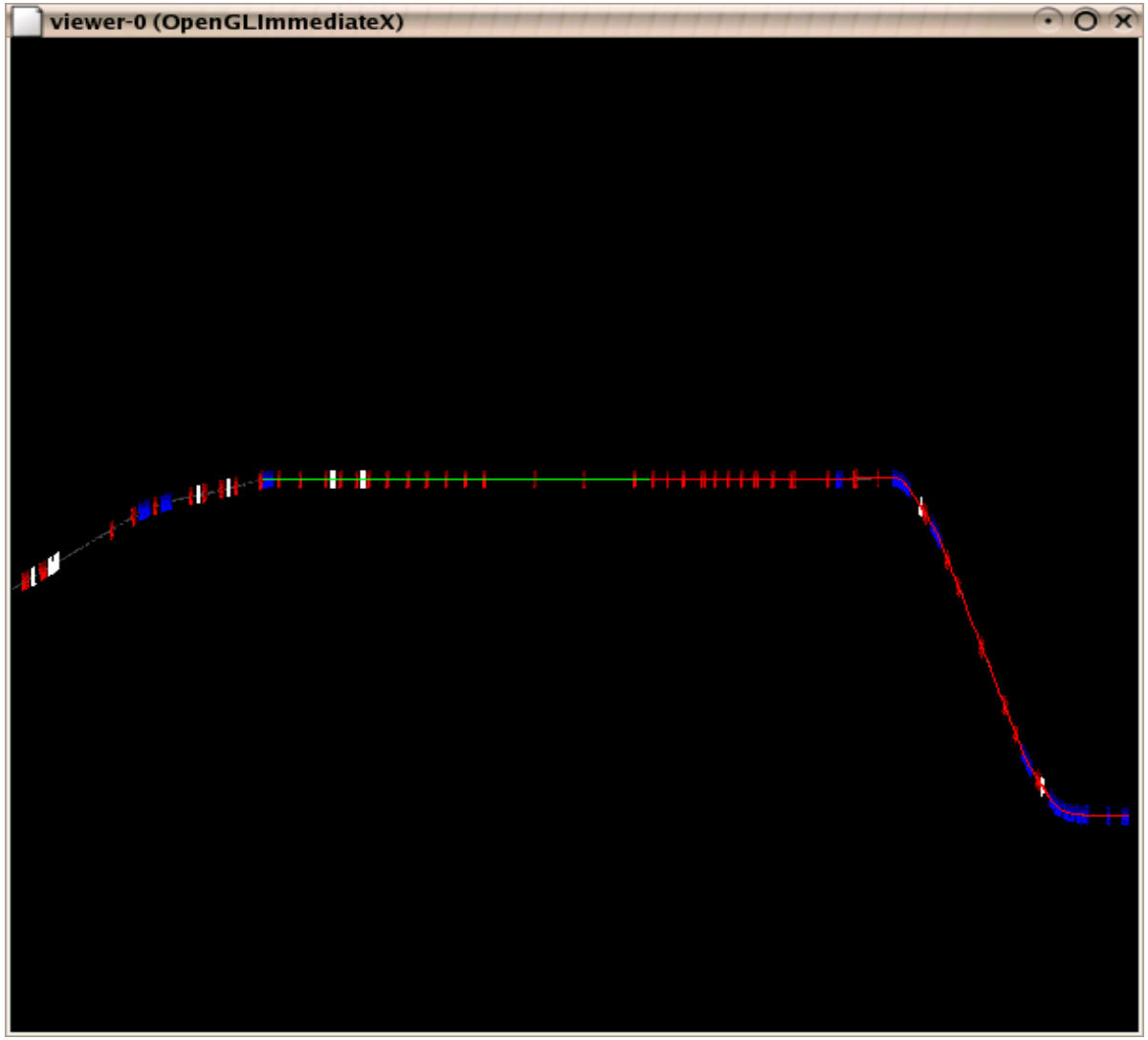
Statistics





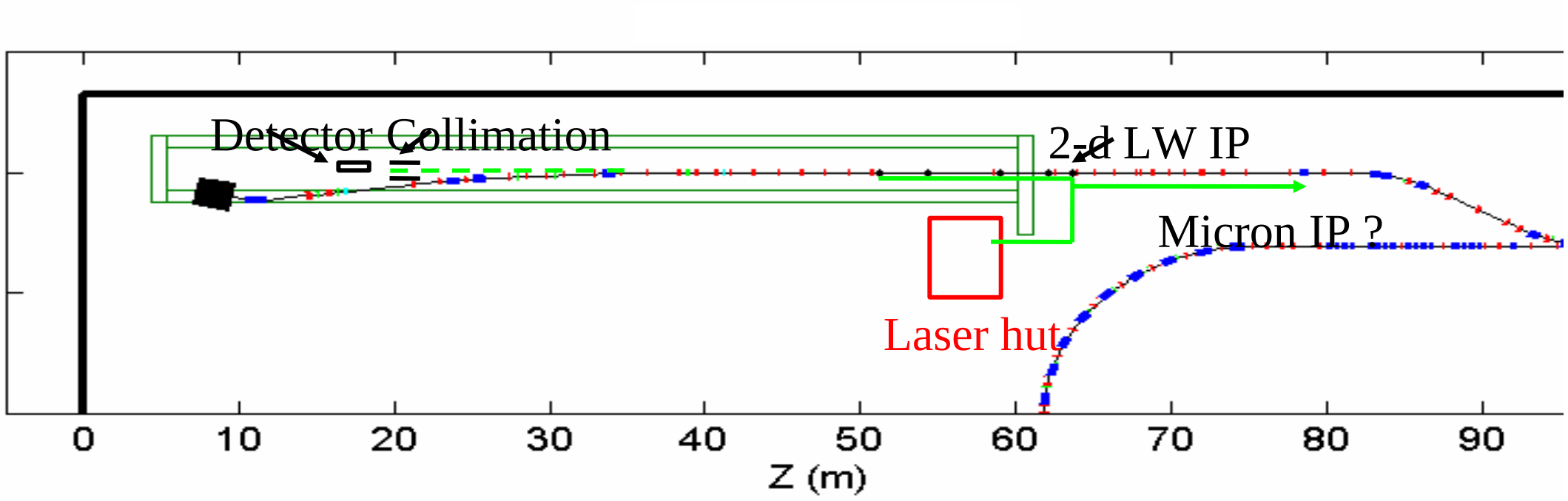
- Top: 20 bunches per point.
- Bottom: 2 bunches per point.
- Error in fitted sigma is the same: 0.0005
- Results agree within error

Simulation Using BDSIM
ATF2



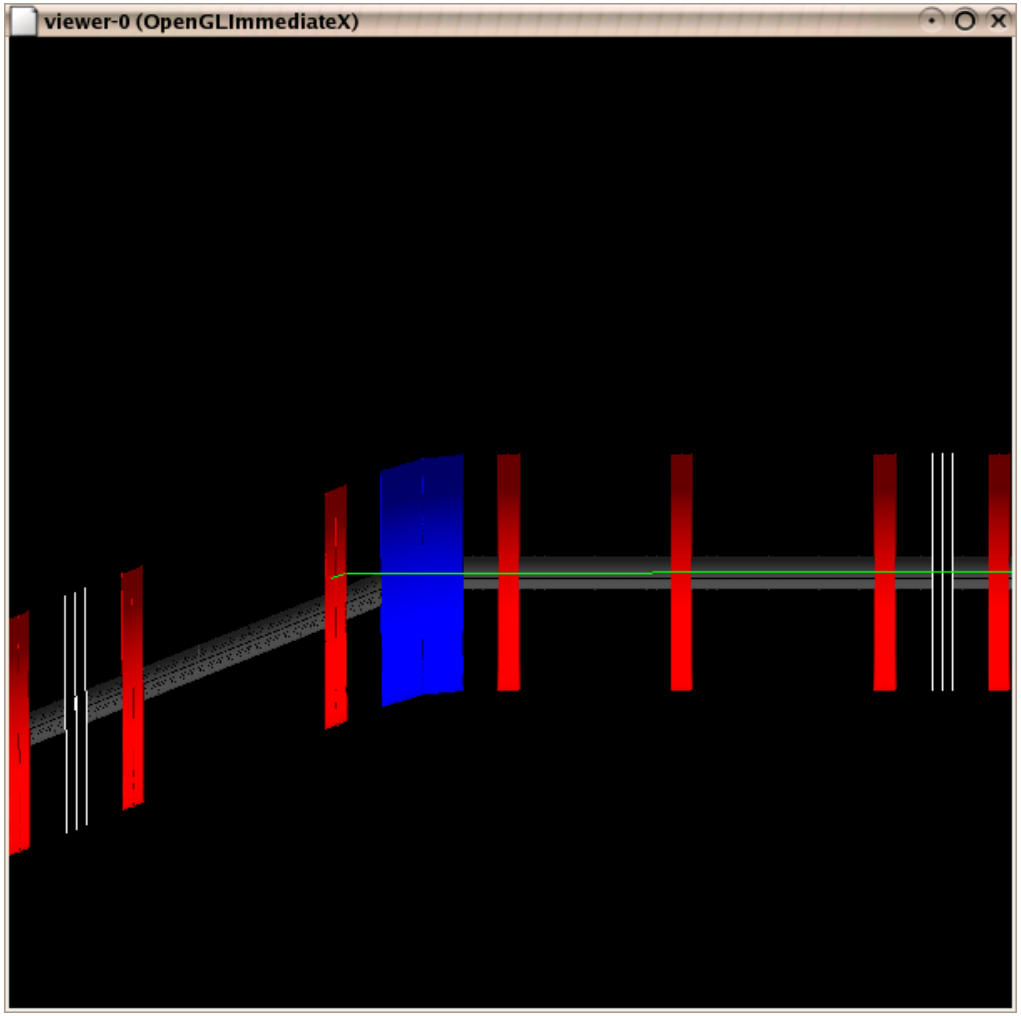
Layout comes from mad deck (Marc Woodley, SLAC)

- Blue – dipoles
- Red - quadrupoles
- Red line- electron tranjectory
- Green line – photon trajectory
- Maximum of simulated Lasser wire energy spectrum agrees with theory



- Possible detector position (G. Blair).
- Problem getting past QD6

Photon Beam Loss



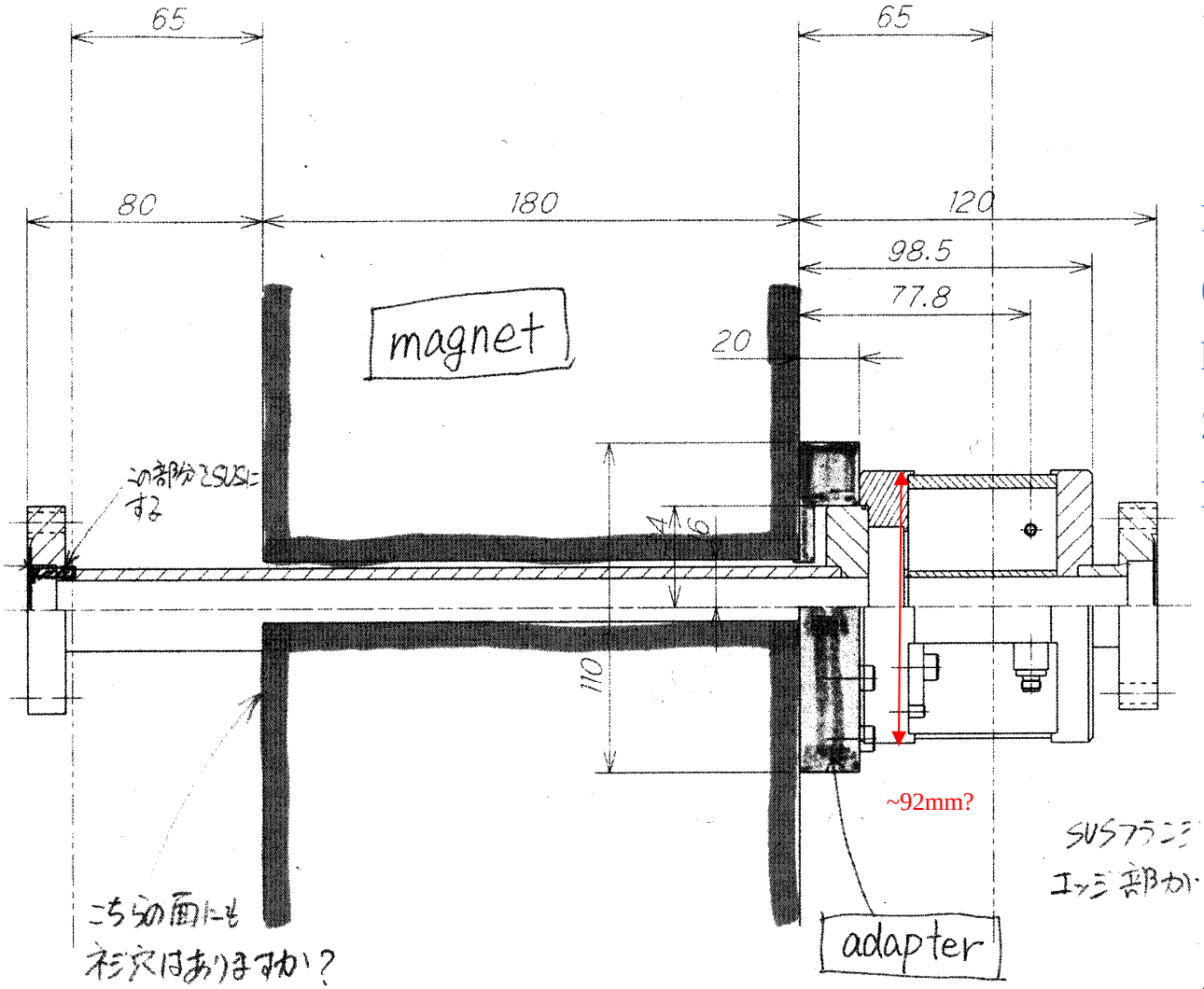
- Picture of 1 event
- Photon comes from right
- Through B5 (blue)
- Into QD6

Photon Beam Loss

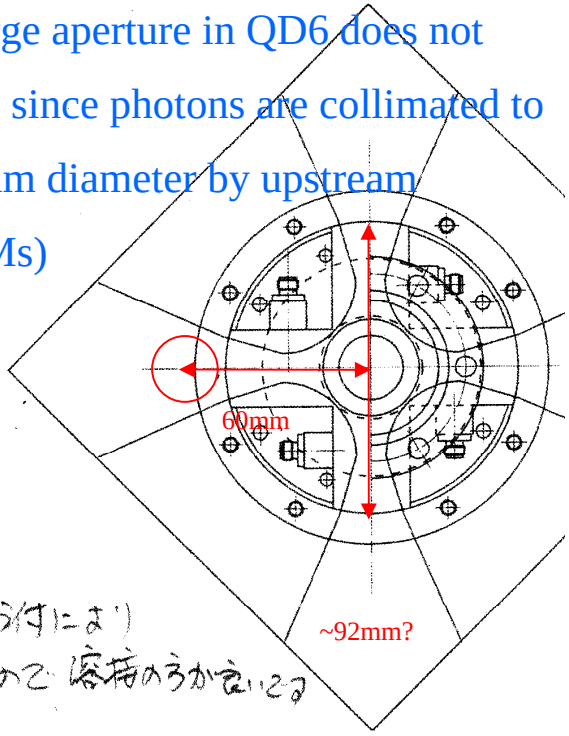
Picture by Andrei Seryi

- Possible solution (Andrei Sergei): lengthen drift between B5 and QD6 from 35cm to 50 cm.
- Makes larger aperture
- Also makes room for gamma detector between B5 and Qd6

Photon Beam Loss



Photon aperture is 20mm diameter.
(Large aperture in QD6 does not help since photons are collimated to 20mm diameter by upstream BPMs)

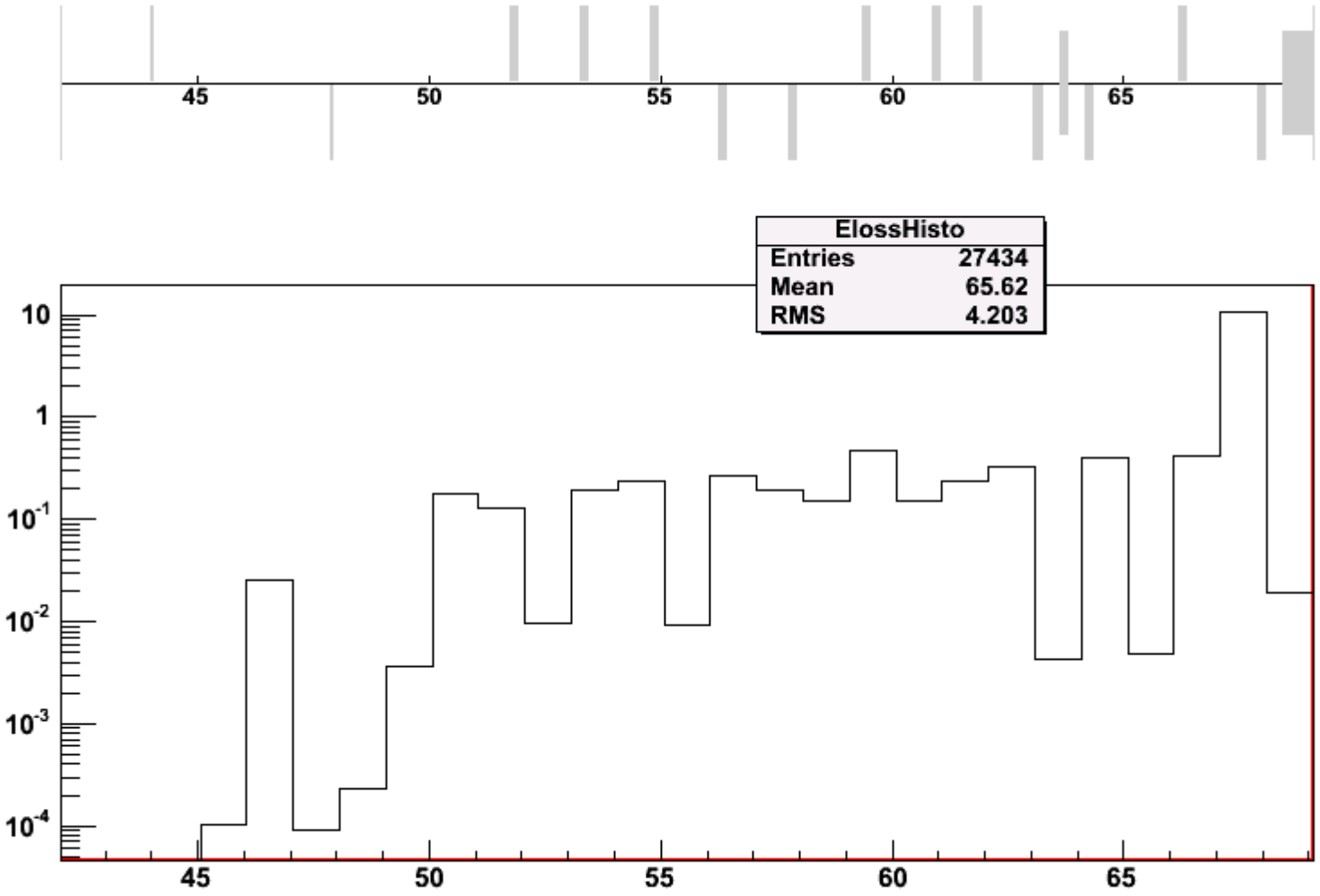


Andrei Seryi

LW Photons Energy Loss

Q21x

B5



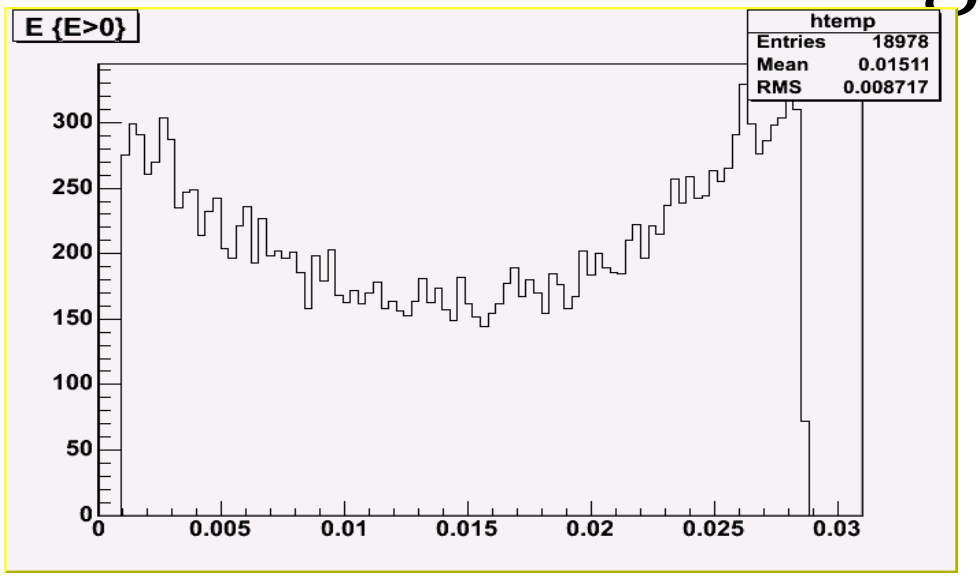
deacon, Sun Jul 2 21:23:07 BST 2006

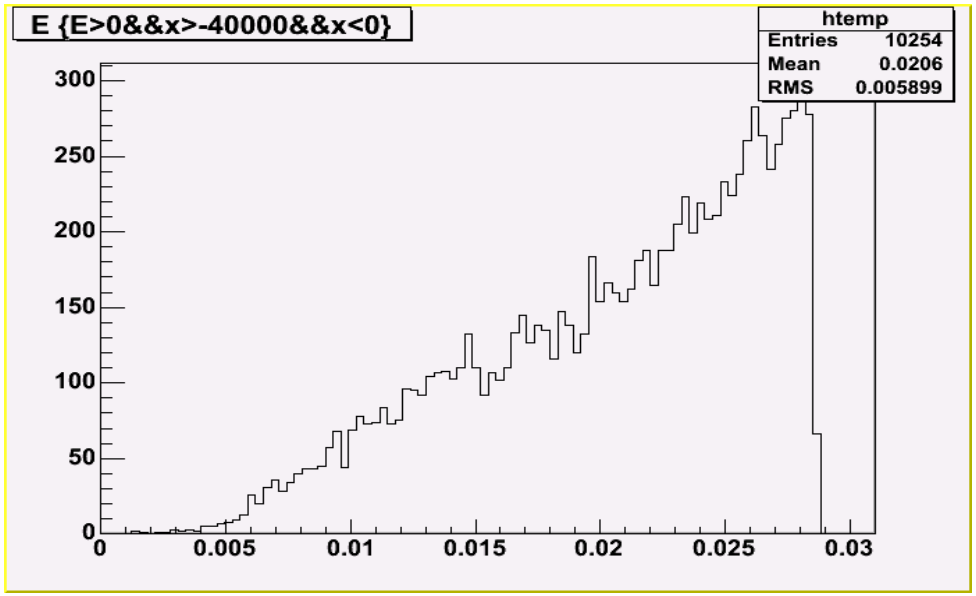
BDSIM input file : ../../ATF2/v3.3/ATF2_v3.3.gm

LW Photons Energy Loss

- Quadrupoles currently modelled as cylinders
- Accuracy will be improved by modelling the four pole pieces
- Will photon beam be collimated enough? Need info about 20mm diameter aperture BPMs
- Could affect results if edge of beam hits pole pieces and position correlated with energy due to e.g converging/diverging electron beam at IP

Energy Loss

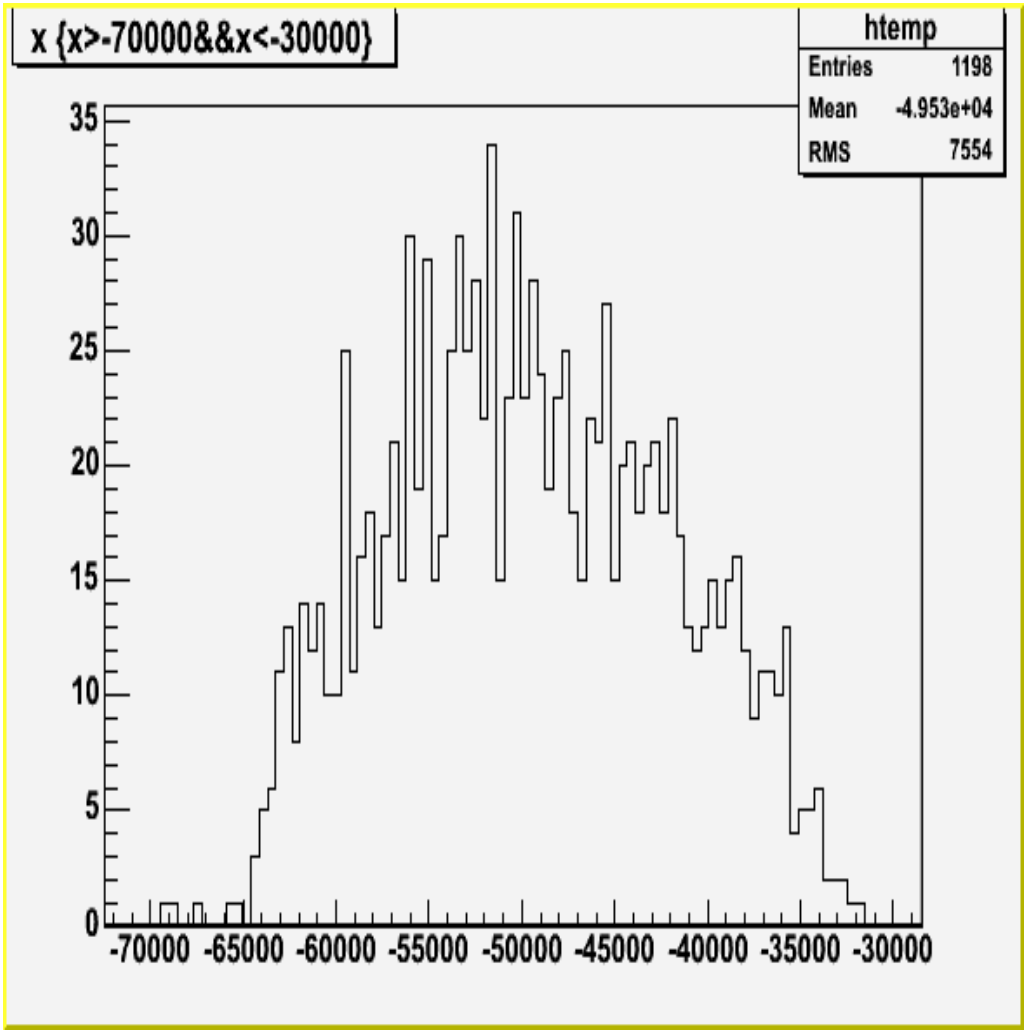




- Could put gamma detector between B5 and QD6
- Energy spectrum at LWIP (above) and E spectrum at front of QD6 (below)
- Summary: 74% of beam energy reaches detector, assuming none gets lost in the air (similar to ATF)
- BPM apertures (20mm diameter) not included

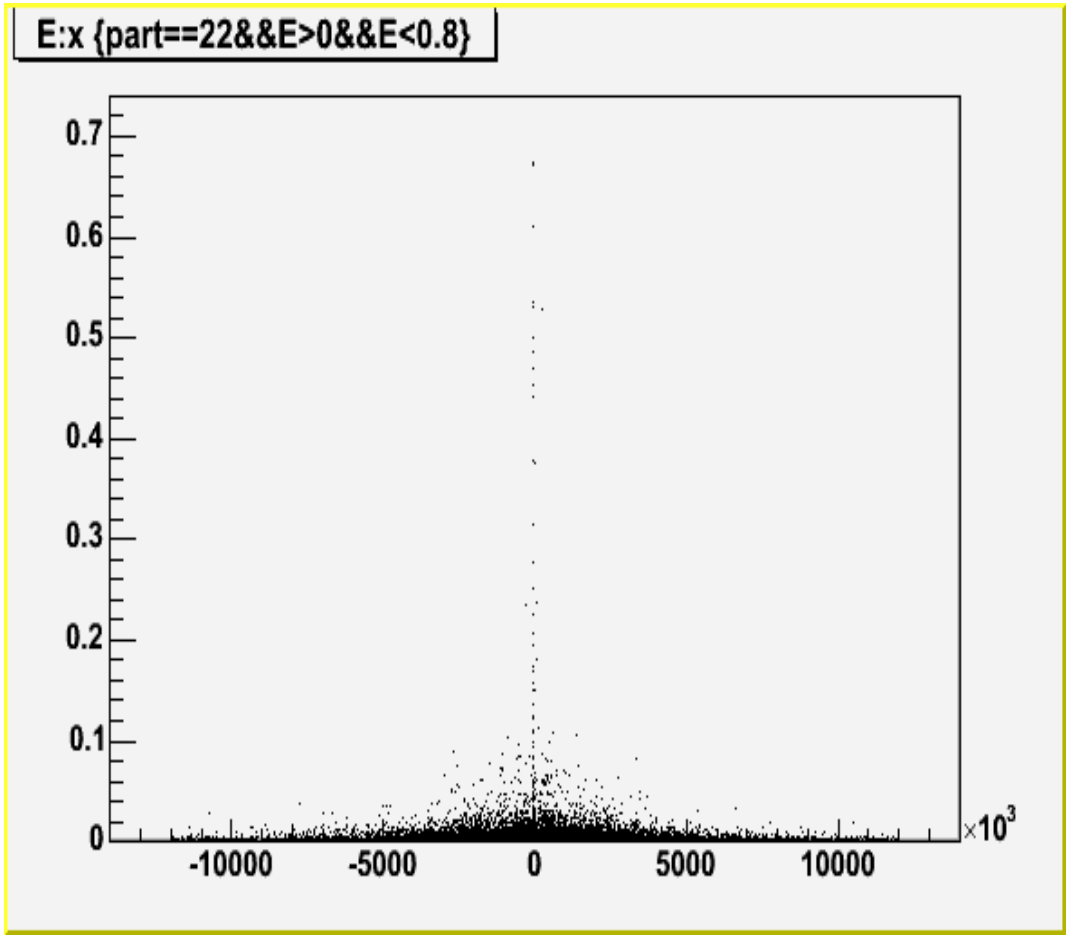
Information on BPMs ?

Photon Distribution at QD6



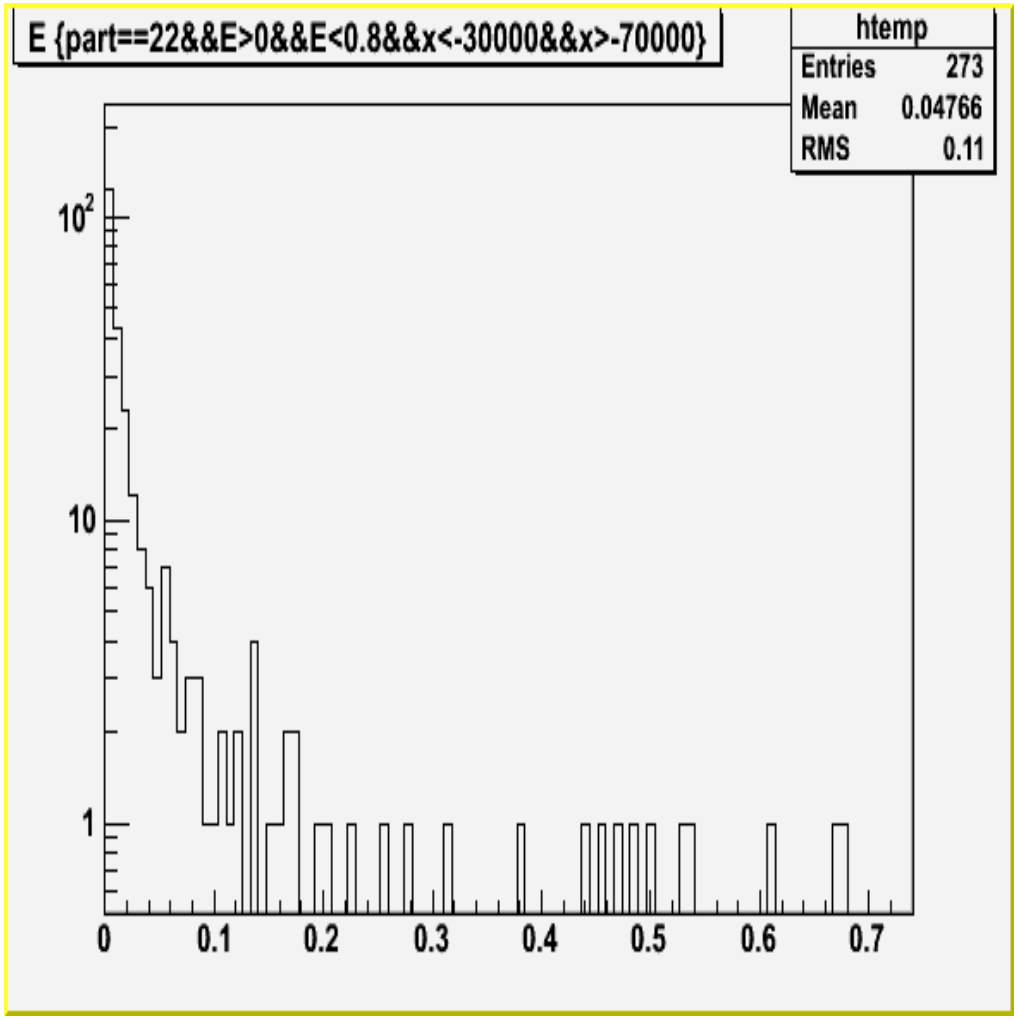
- 5mm from centre of beam pipe
- Large amount of synchrotron radiation (next slide)

Synchrtron Radiation Energy vs Position



- Highest energy SR near centre (Cerenkhov Threshold currently 2.7 MeV)
- Detector must be near centre at this position
- SR will be detected

Synchrotron Radiation between B5 and QD6



- SR energy in detector between B5 and QD6
- Threshold of Cerenkhov detector 2.98 MeV
- Mean a few million GeV per bunch
- Larger than LW signal (10 GeV)
- Collimation seems impossible (too close to beam

Conclusion

- Best to go through qd6 and add collimation (detector at ATF is behind a steel wall).
- Scans could be done more quickly (1 or 2 points instead of 20)
- Need information about BPMs to find out if the beam really will be collimated enough to fit through qd6 aperture and to model energy loss
- Need to compare simulation more thoroughly with current ATF experiment
- Simulation consistent with theoretical tests (maximum energy and beam sizes).