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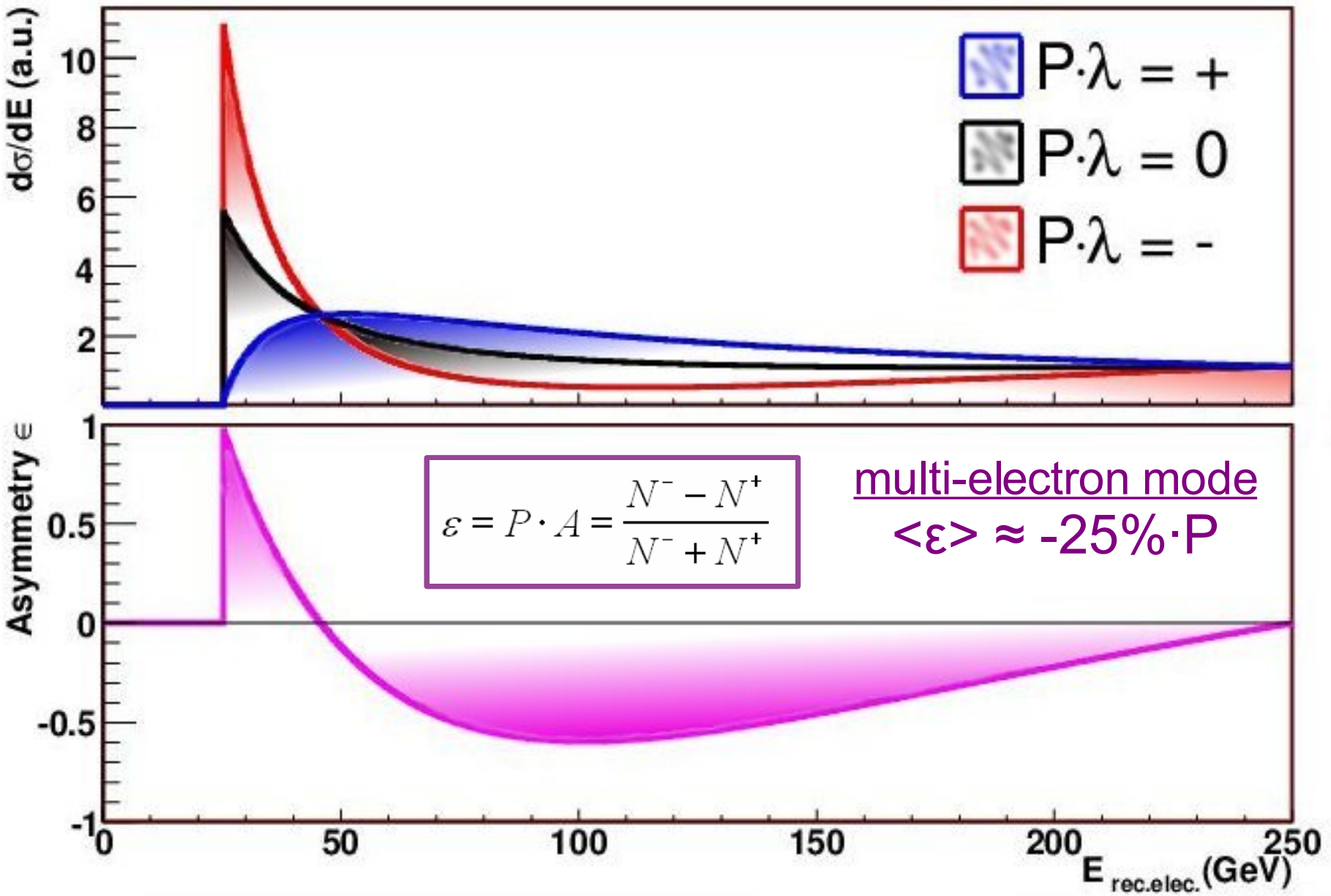
Simulation Studies
for the
Upstream Polarimeter

- Basic Considerations
- Simulation Layout
- Simulation Results
- Test Stand Updates

Compton Scattering

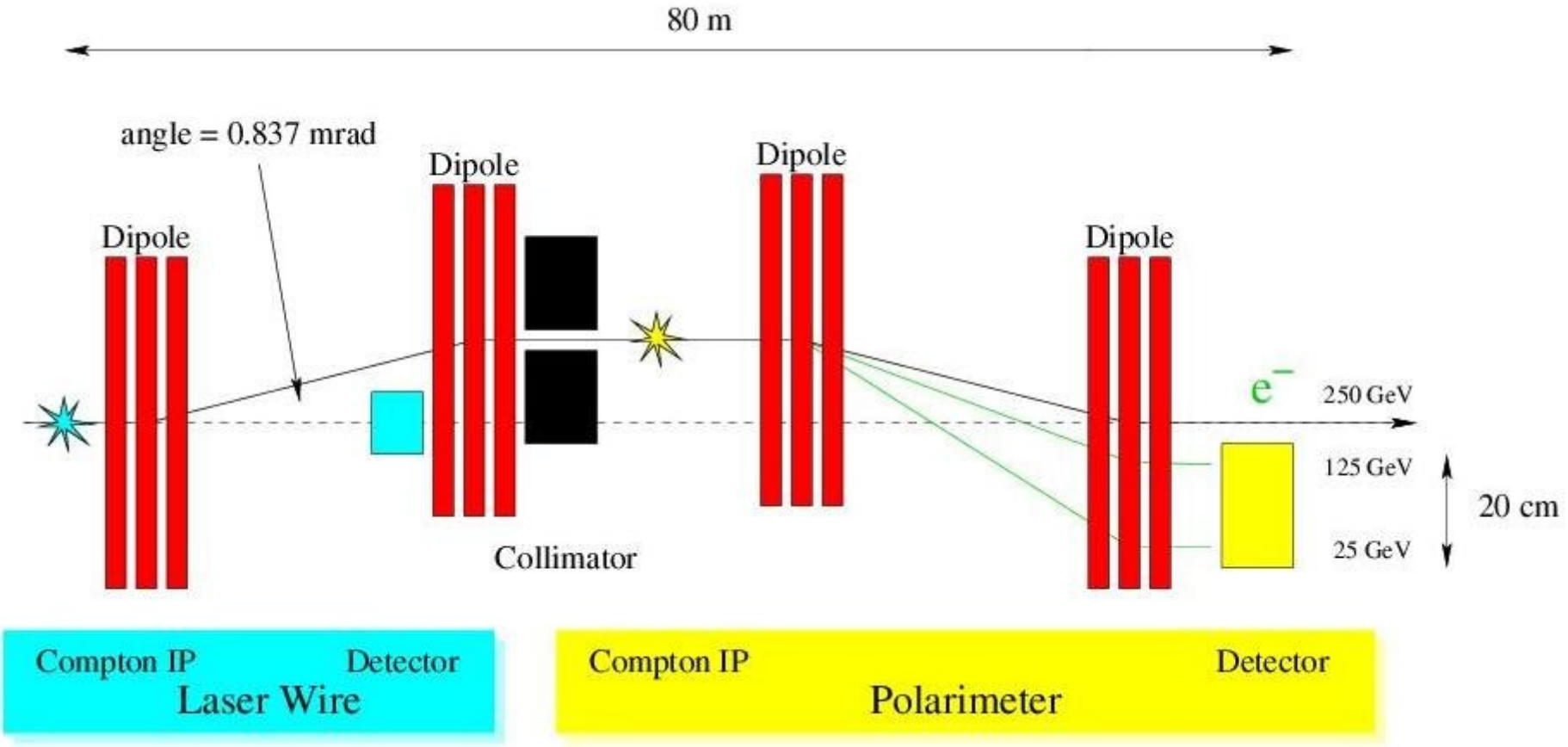


$$\varepsilon = P \cdot A = \frac{N^- - N^+}{N^- + N^+}$$

multi-electron mode

<ε> ≈ -25%·P

The *Polarimeter* Magnet Chicane



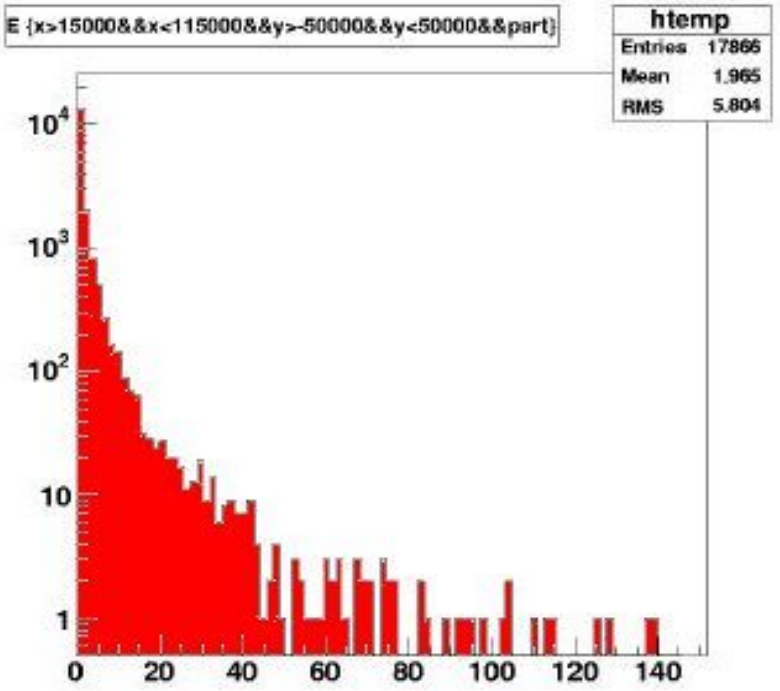
Dipoles: 0.097 T
3 x 2.4 m
0.3 m spacing

Compton spectrum < 18 cm
emittance loss < 1%
(beam displacement 2 cm)

Laser Wire Study

by Lawrence Deacon, RHUL

Background caused on polarimeter detector- spectrum



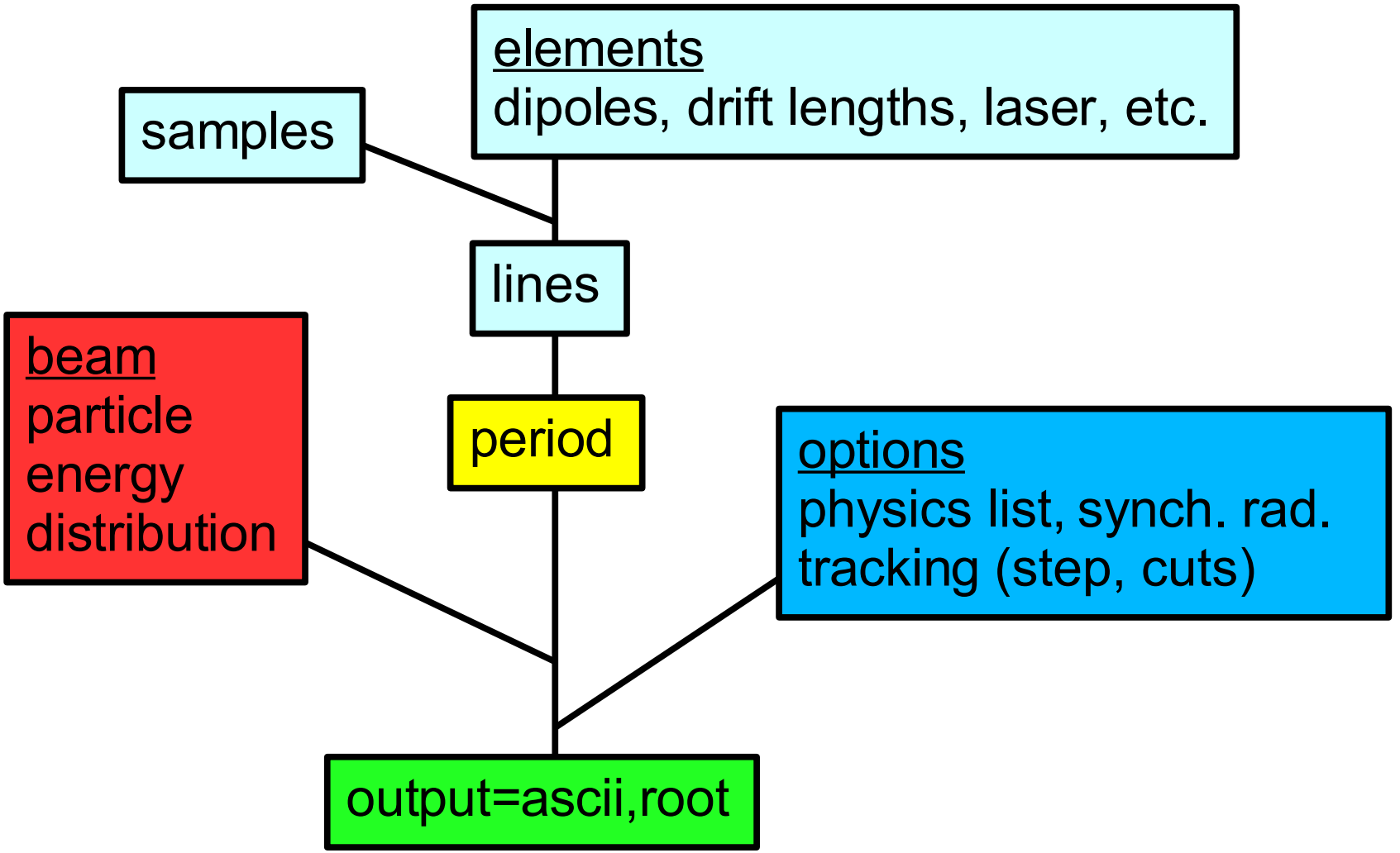
- The polarimeter detector is assumed to be 10cm by 10cm
- The background is 3.51TeV per shot, about 30% of the 12TeV polarimeter signal

30% of signal !!! asymmetry significantly reduced

BDSIM

GEANT4
Beam Delivery Simulator
complementary to fast simulation

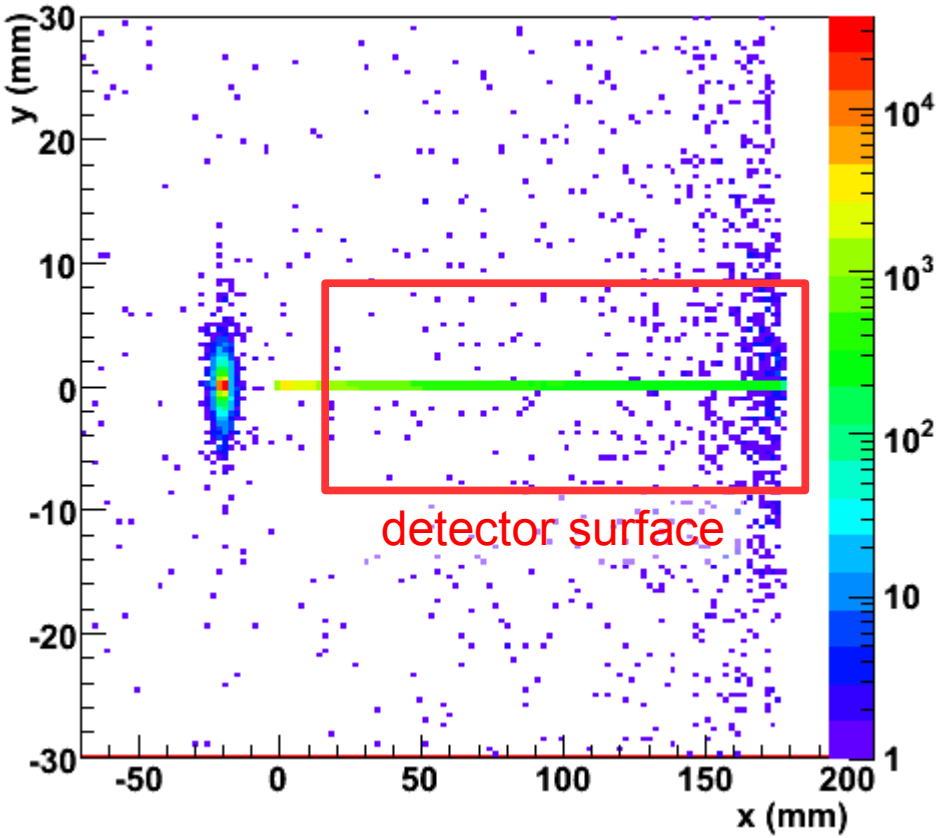
`http://cvs.pp.rhul.ac.uk/cvsweb.cgi/BDSIM/`

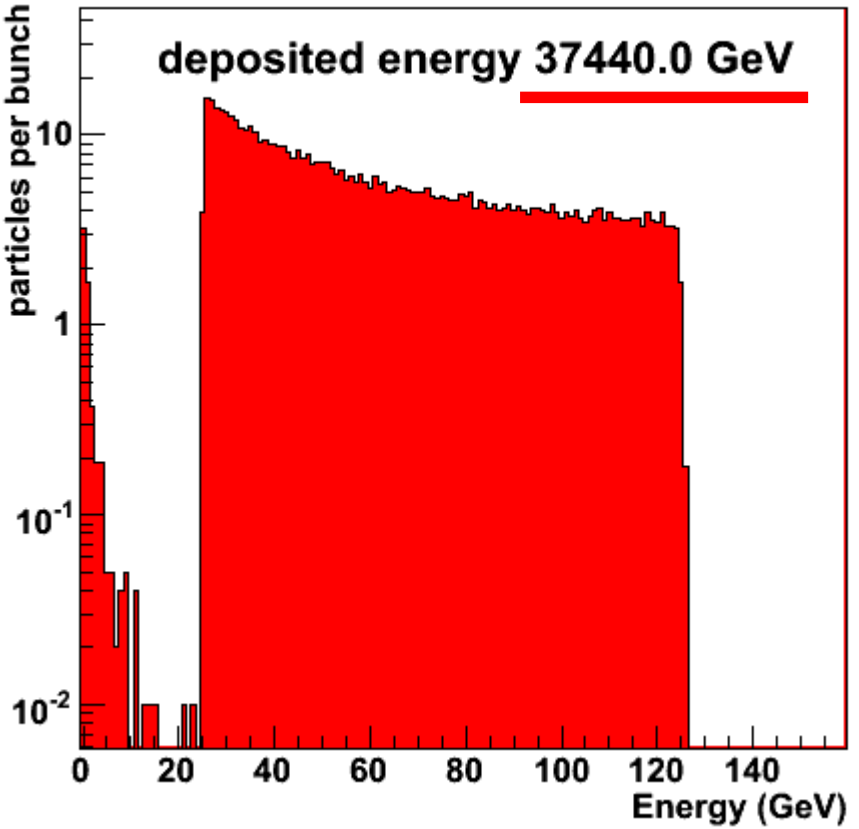


Polarimeter Signal

250 GeV electron beam (10^{-4} energy resolution, gaussian)
Laser 532 nm
10^3 Compton electrons per bunch crossing
no crossing angle
no polarization !!!

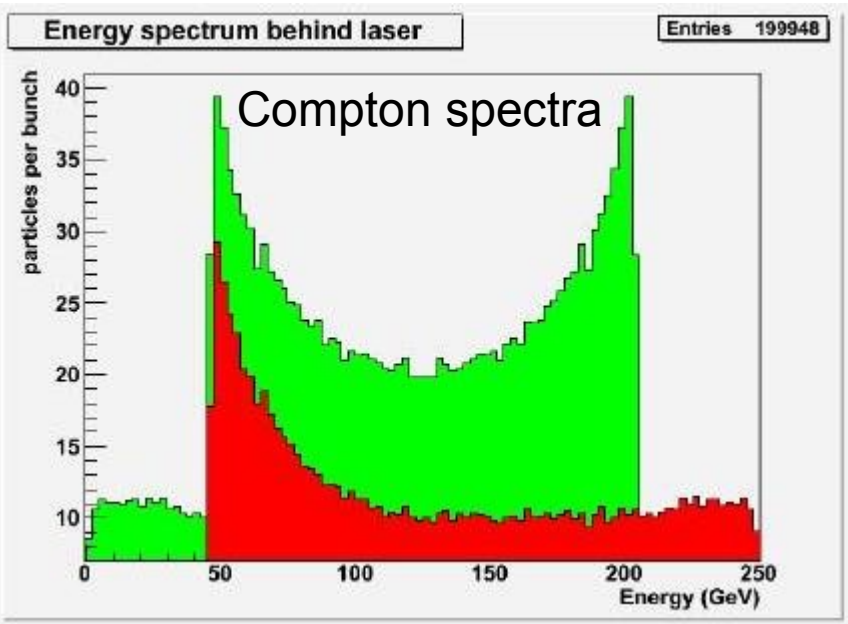
more than 12 TeV

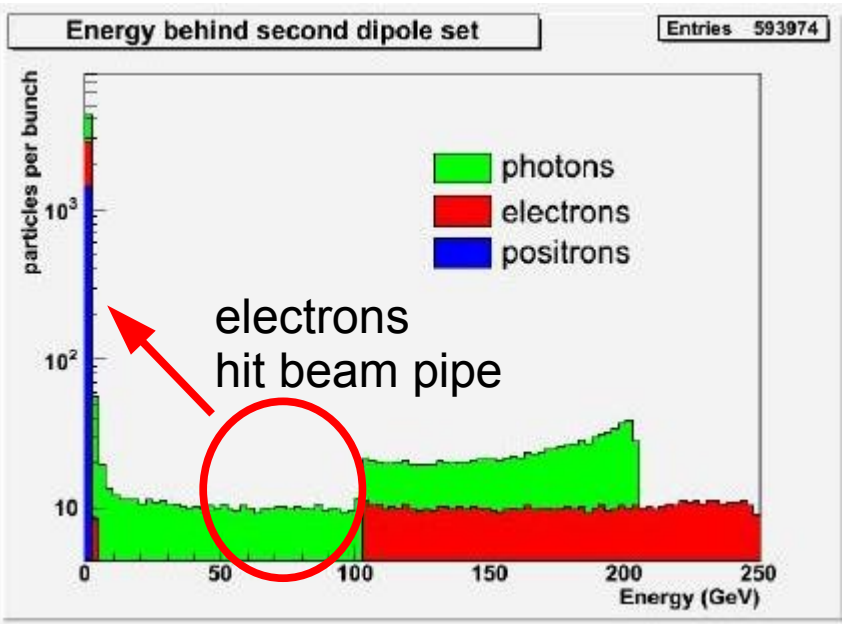


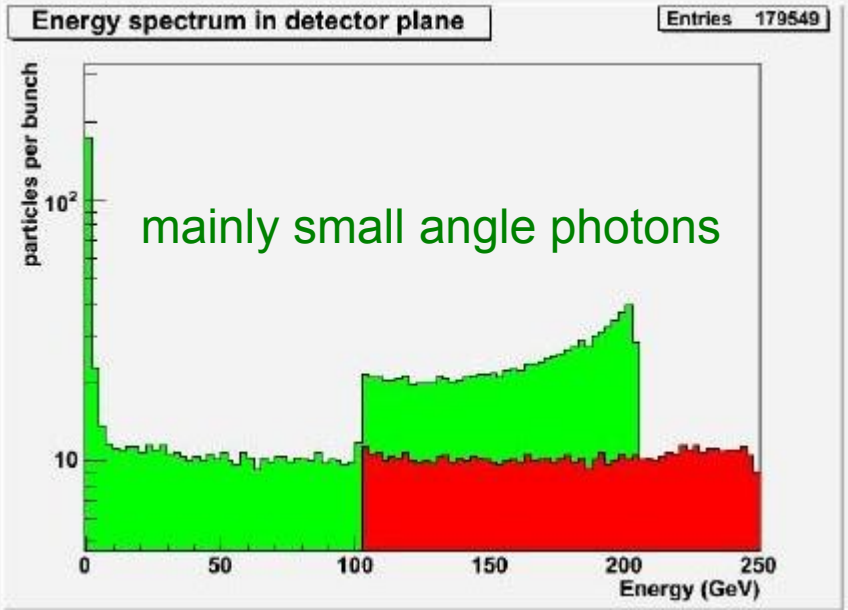


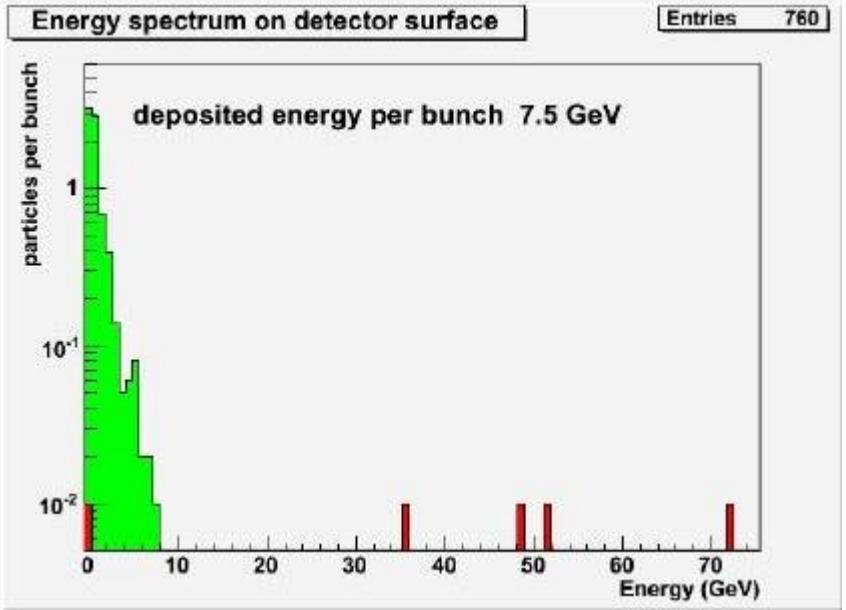
Laser Wire Background

summer student work by Moritz Beckmann





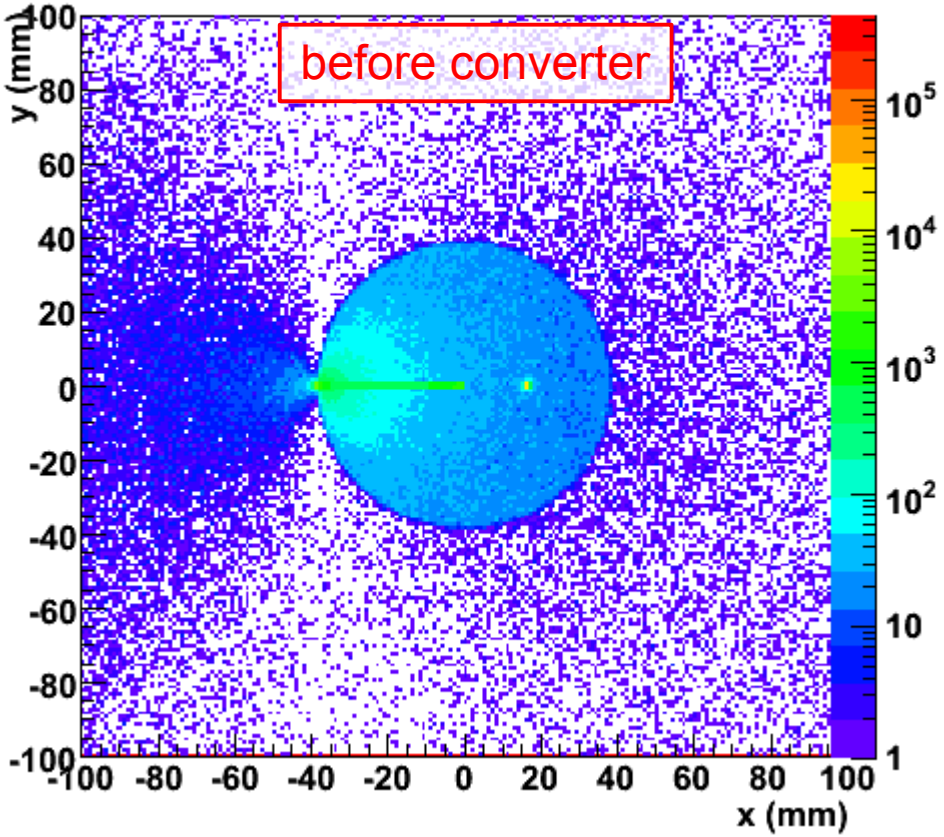


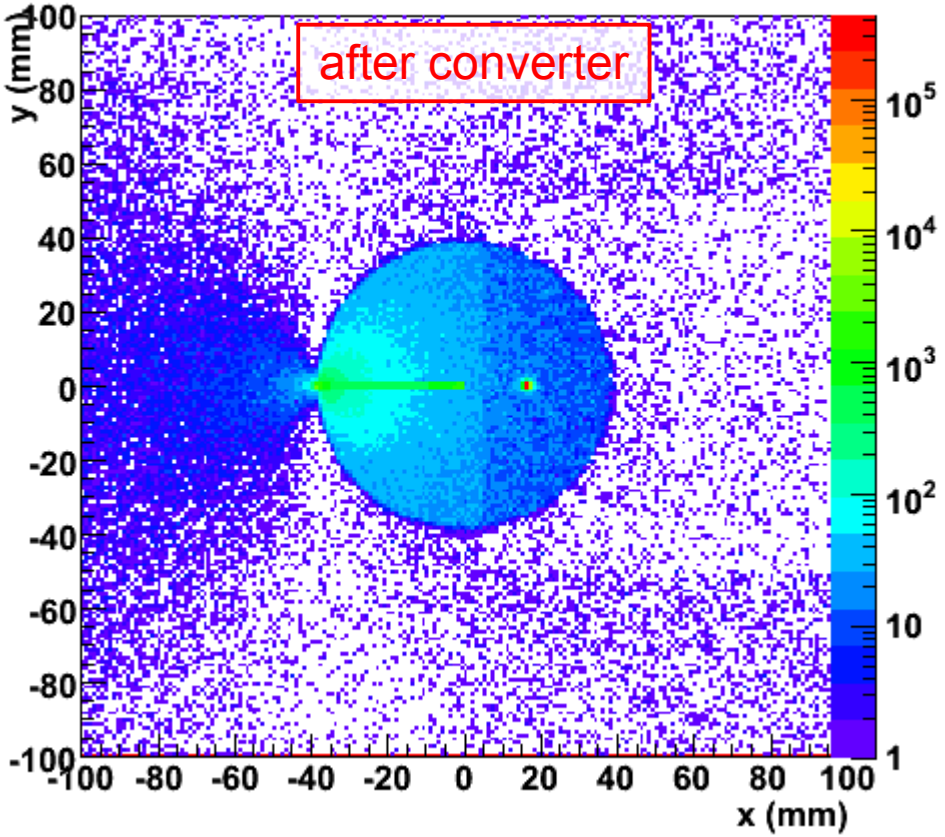


Laser Wire Converter

10 mm lead before second set of dipoles
Compton photons to conversion electrons
10 cm Cerenkov detector

50k events
correspond to 50 bunches

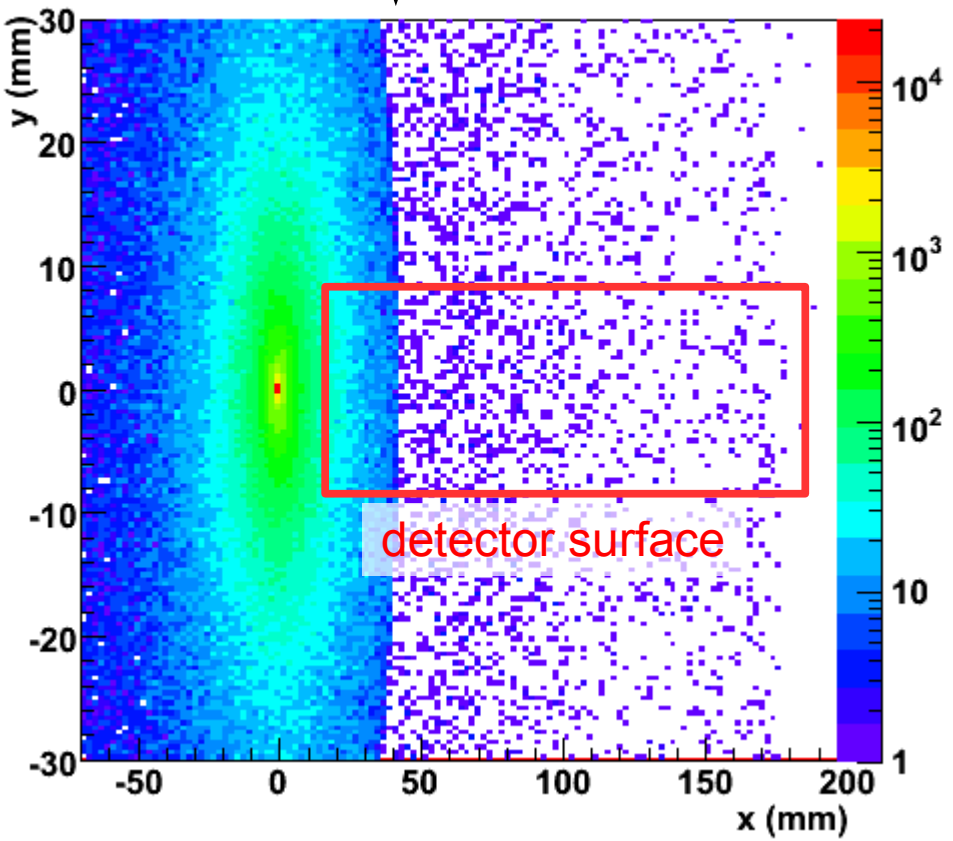




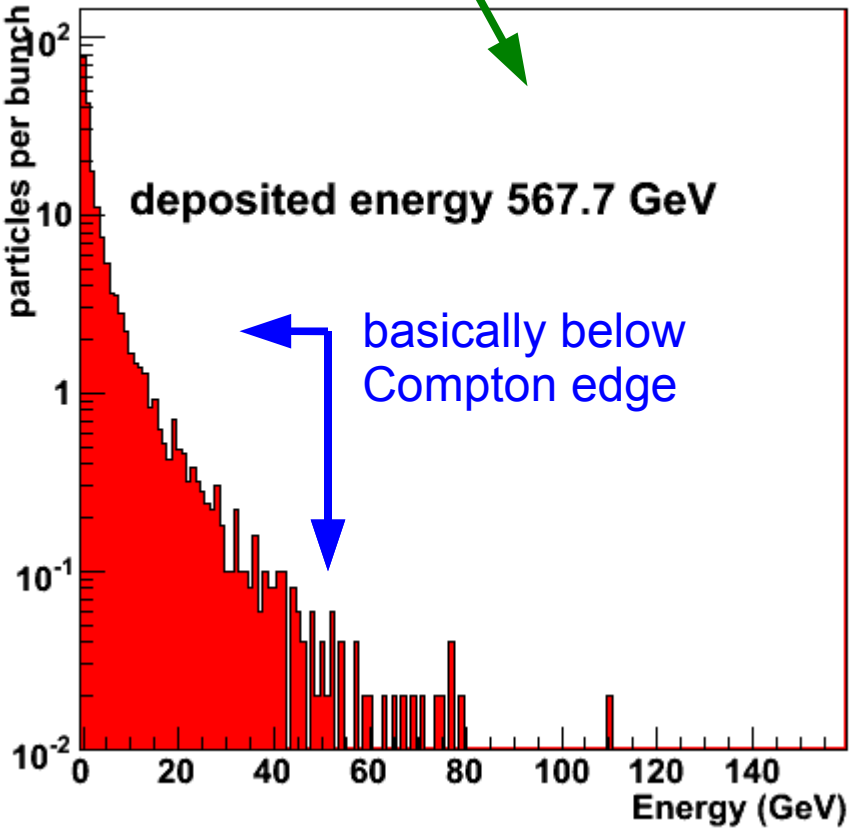
Converter Background

low energy electrons deflected by dipoles
almost exclusively photons
total energy 570 GeV

beam pipe (before dipole set #3)
after that: polarimeter vacuum chamber



1.5% of signal
but ΔP/P < 0.25% !!!

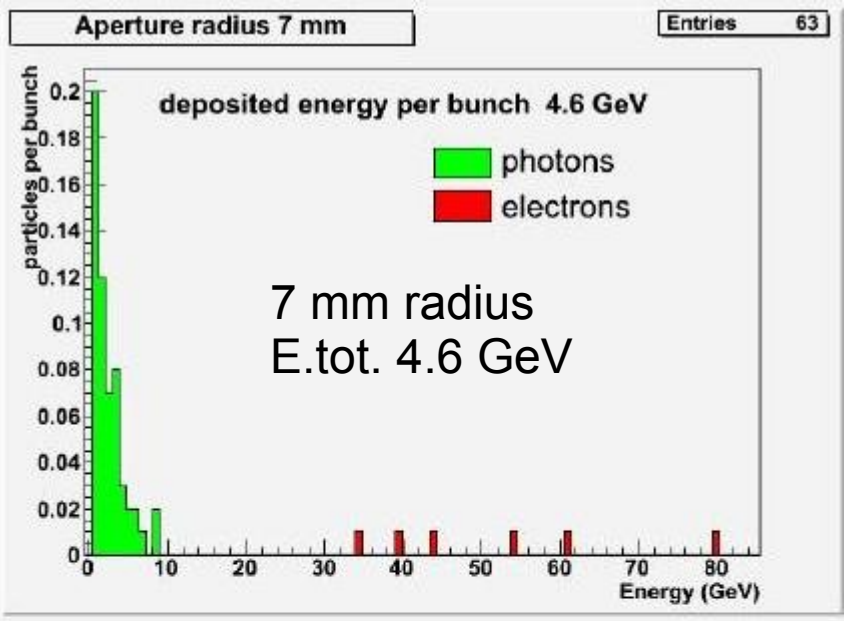


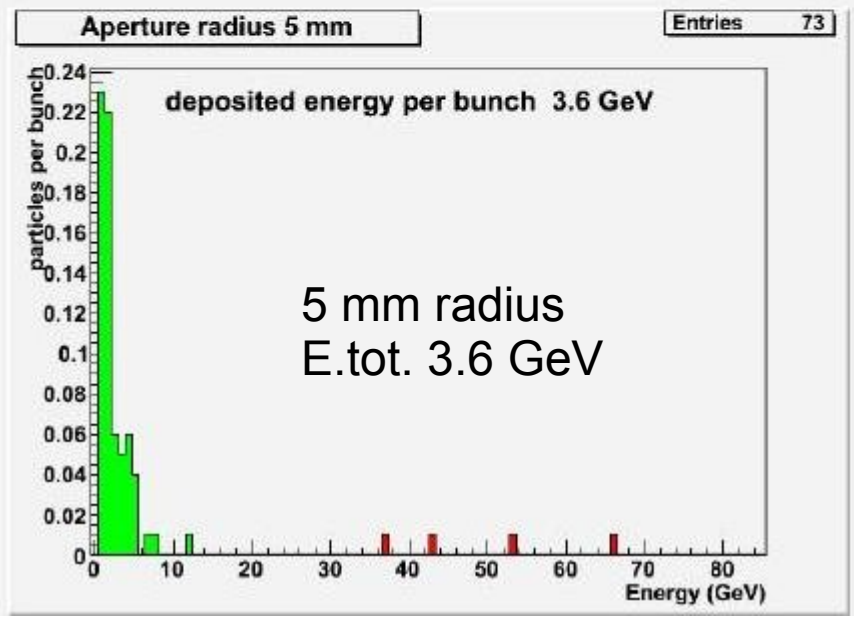
Collimator

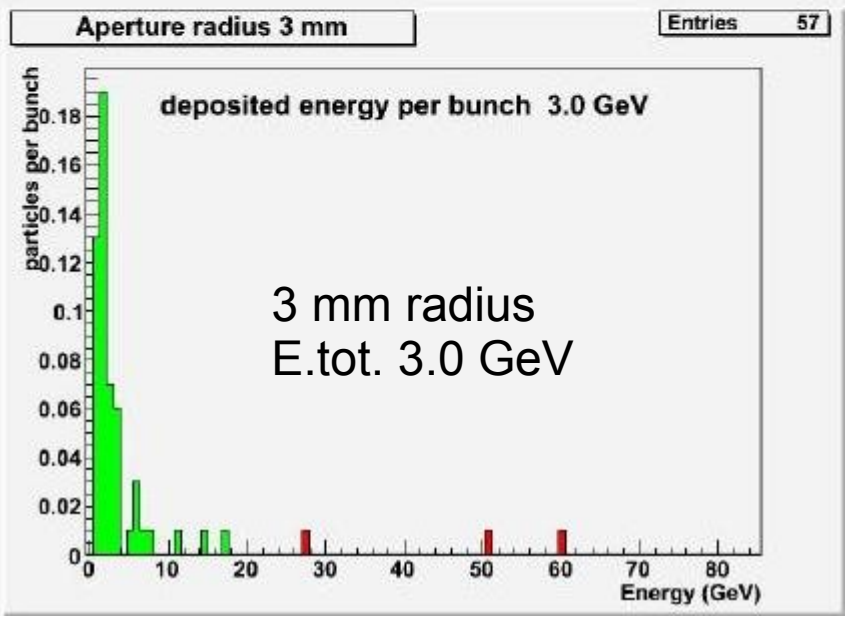
Laser Wire only, NO converter
3m Carbon Steel collimator
circular

cleans up incident electron beam
small effect on polarimeter

some high energetic secondary electrons







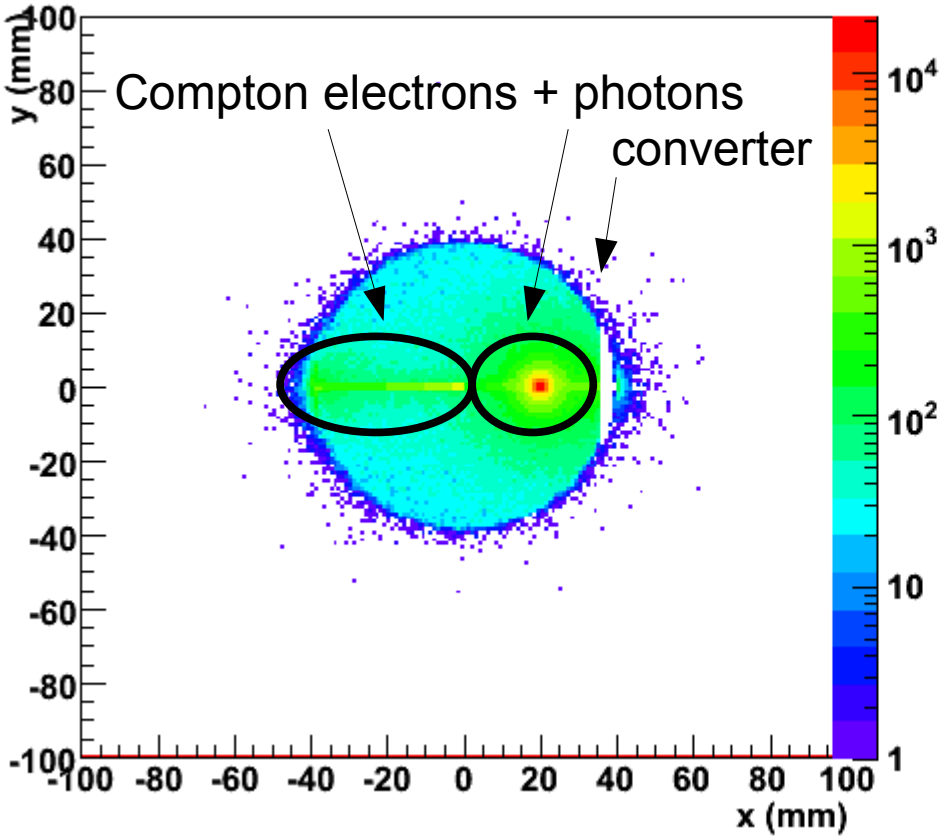
Collimator

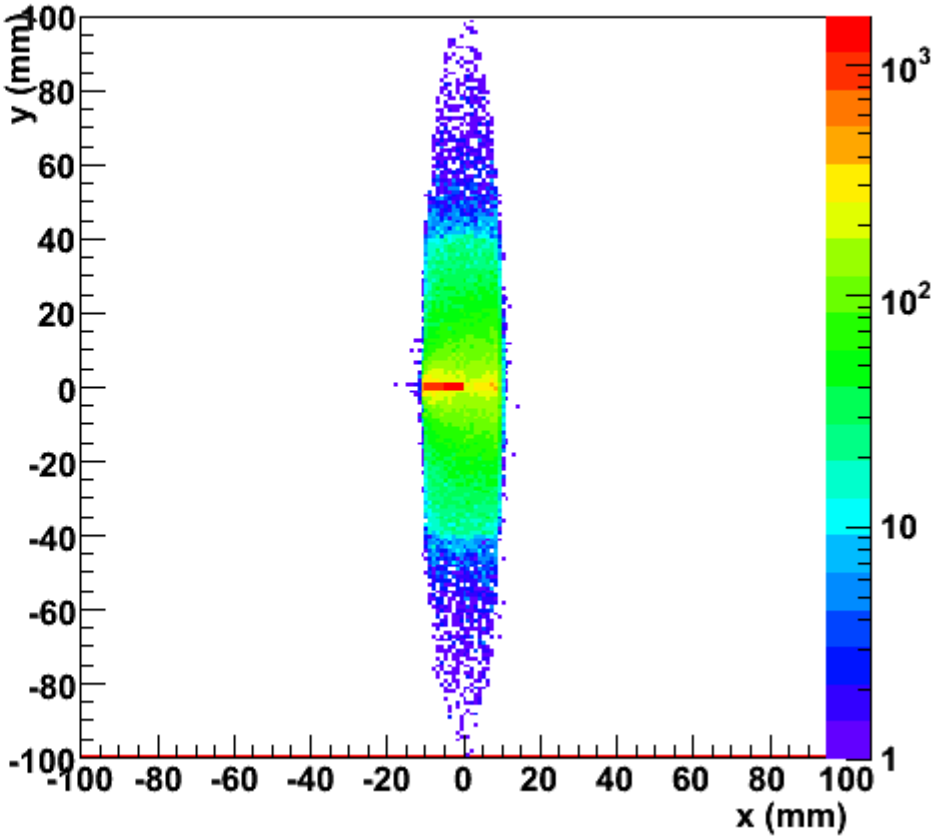
Secondary particles from converter
50 cm Tungsten collimator (slit)

Wake fields not considered !!!
Scraper might be ok.

[background reduced to few GeV]

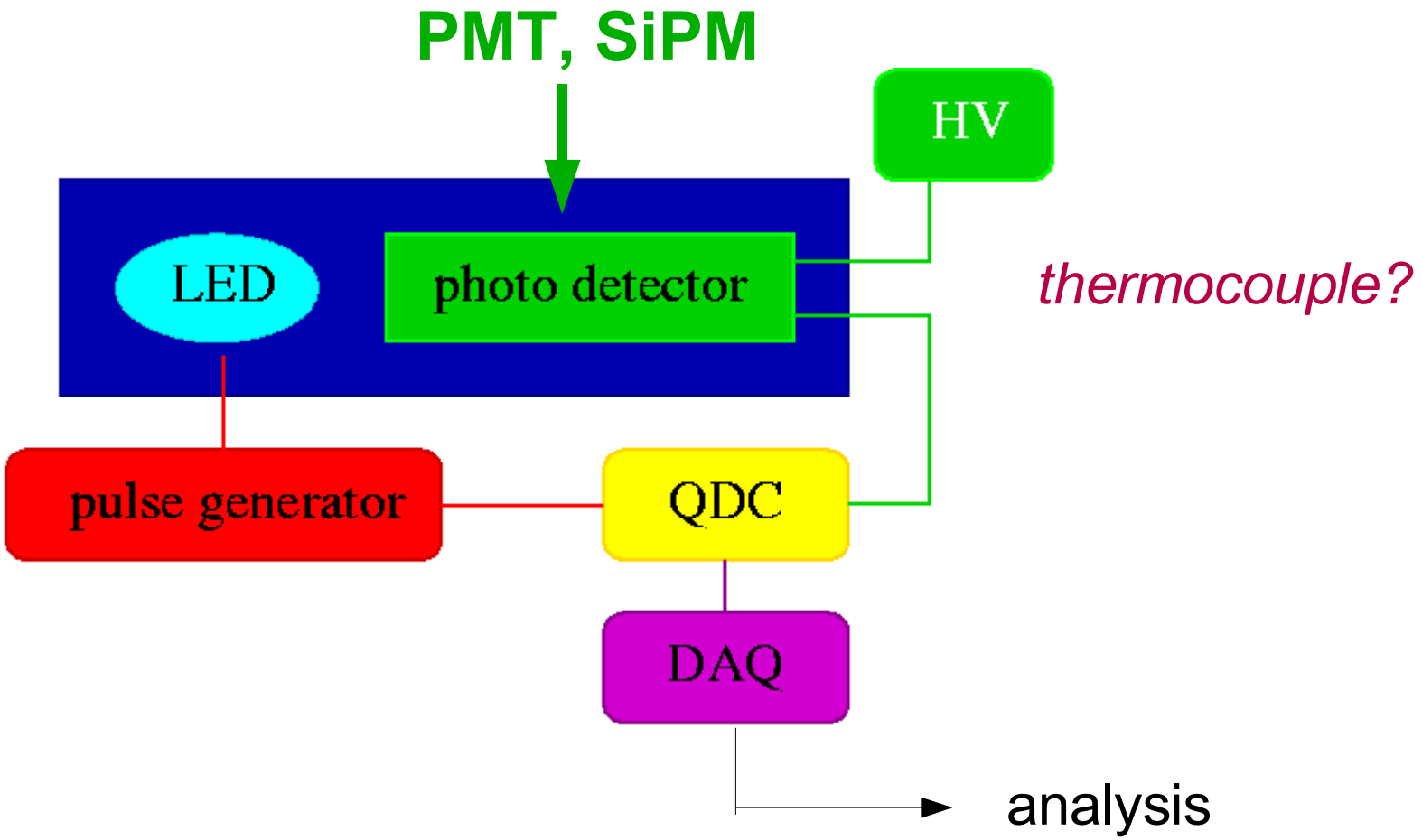
50 bunches



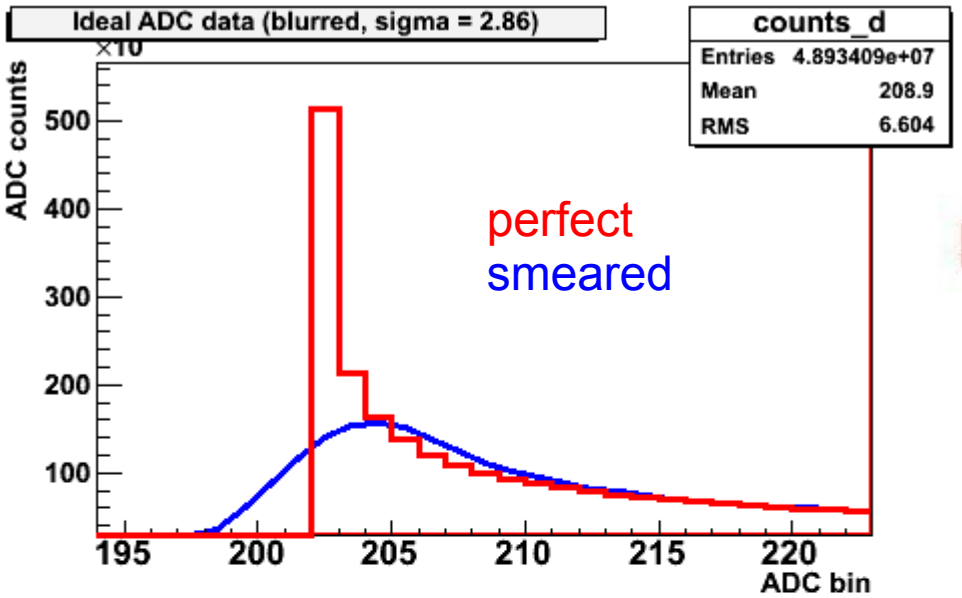


Test Stand Update 1

Homogenizer for LEDs
fibers for light output
w pedestal for scan of dynamic range

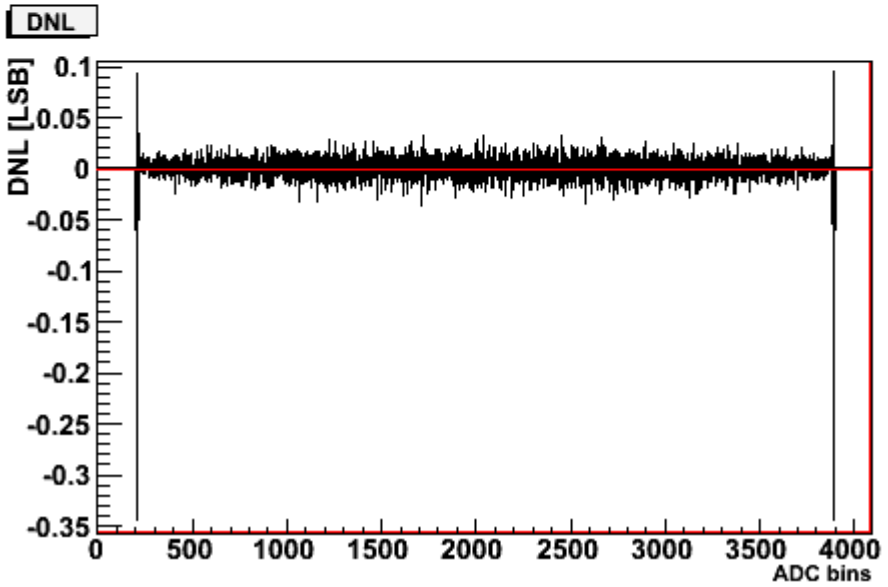


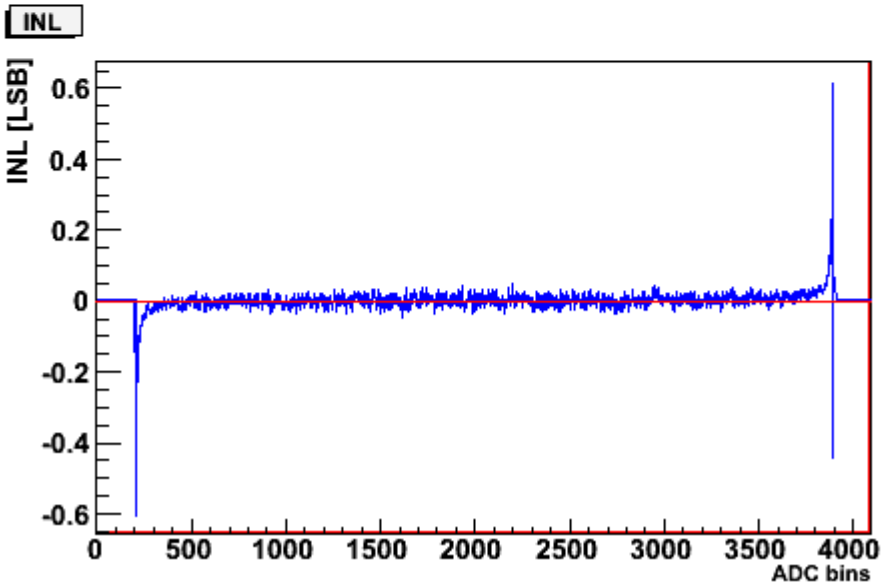
Smeared Self-Test 1



$$P(code) = \frac{N_{meas}}{\pi \cdot \sqrt{\frac{A^2}{2} - (code - offset)^2}}$$

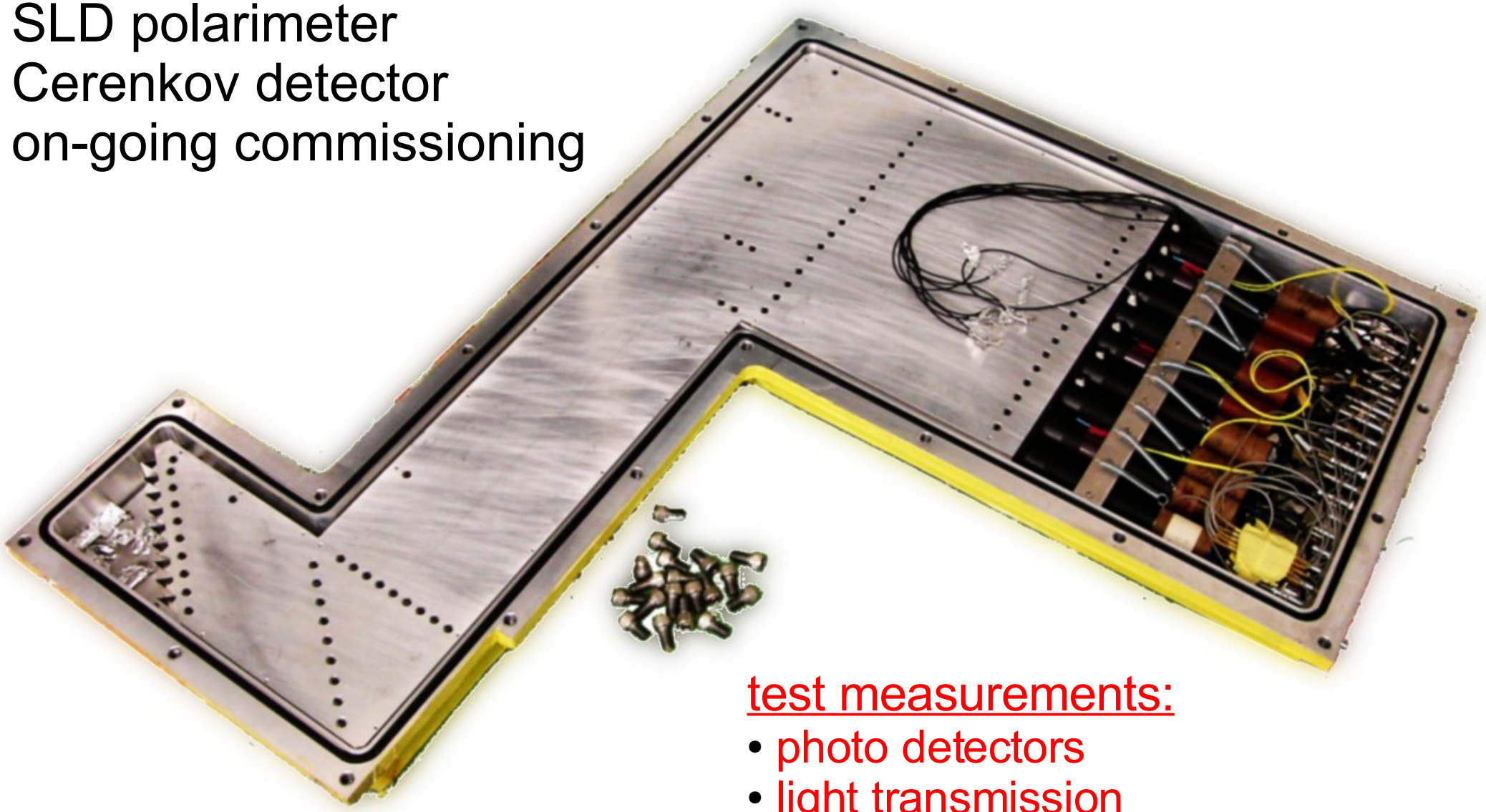
A – charge at full range





Test Stand Update 2

SLD polarimeter
Cerenkov detector
on-going commissioning

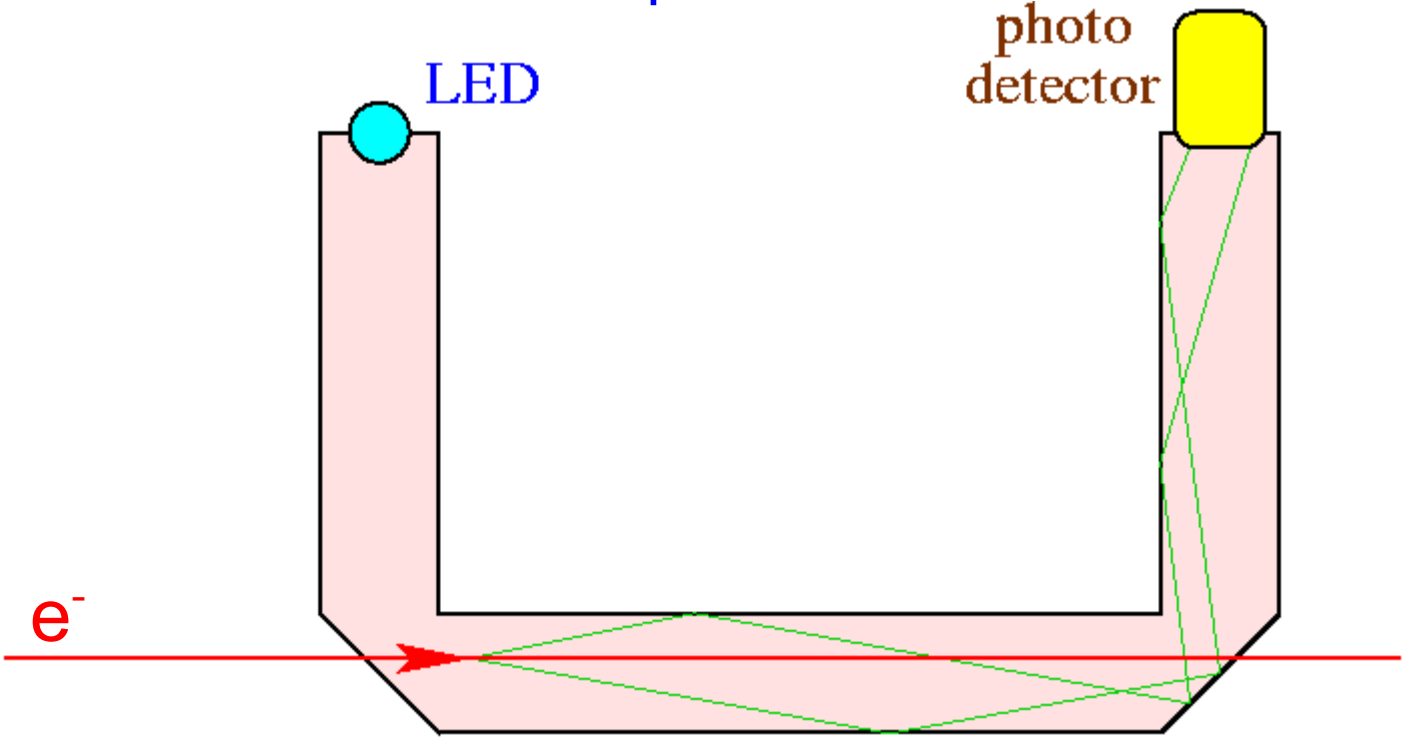


test measurements:

- photo detectors
- light transmission
- Cerenkov light production

Test Stand Update 3

- Design of ILC polarimeter Cerenkov tubes
  - geometry and mechanical structure
  - material and surfaces for light transmission
  - light read-out
  - gas enclosing
  - LED / Laser calibration integration
  - Optical simulation needed for comparison



Summary

- Upsetting background in first Laser Wire studies
- **BDSIM toolkit** (complementary to fast simulation)
- Proper Cerenkov detector positioning
  - small background contribution
- Converter background
  - mainly photons below Compton edge
  - significantly reduced by collimator
- Collimator or scraper
  - wake fields not considered
- **Full simulation**
  - complete detector
  - polarized Compton process
- **Test stand measurements**
  - photo detectors
  - SLD Cerenkov detector
- Design of Cerenkov test tubes started