Electron detector in the MOLLER project

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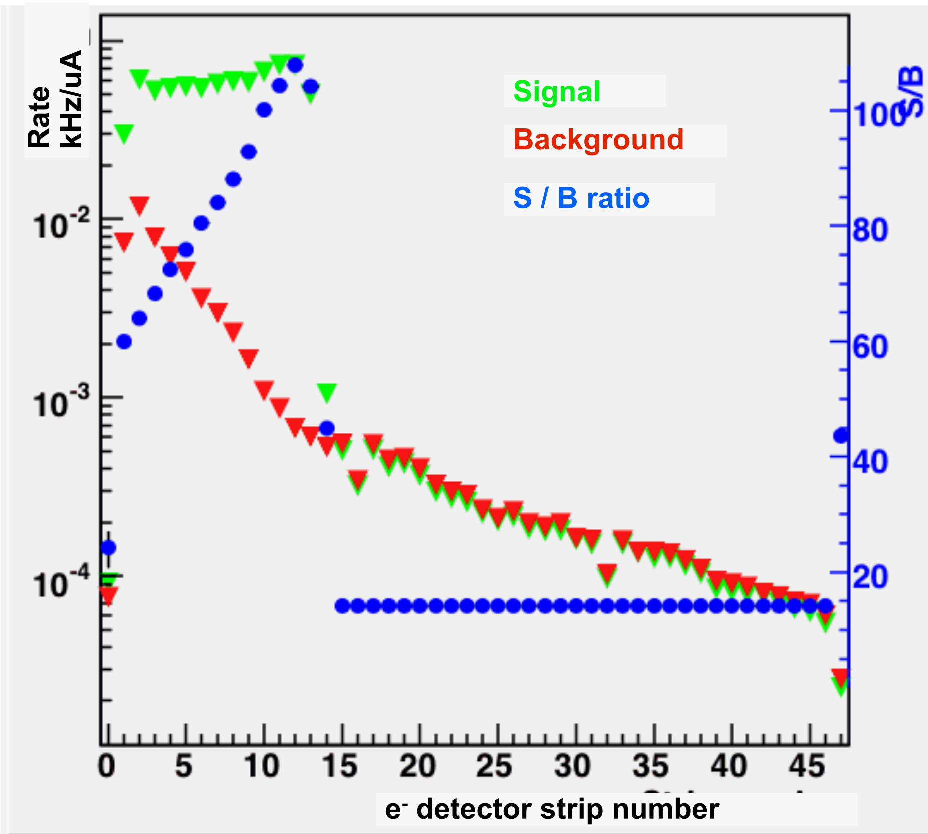
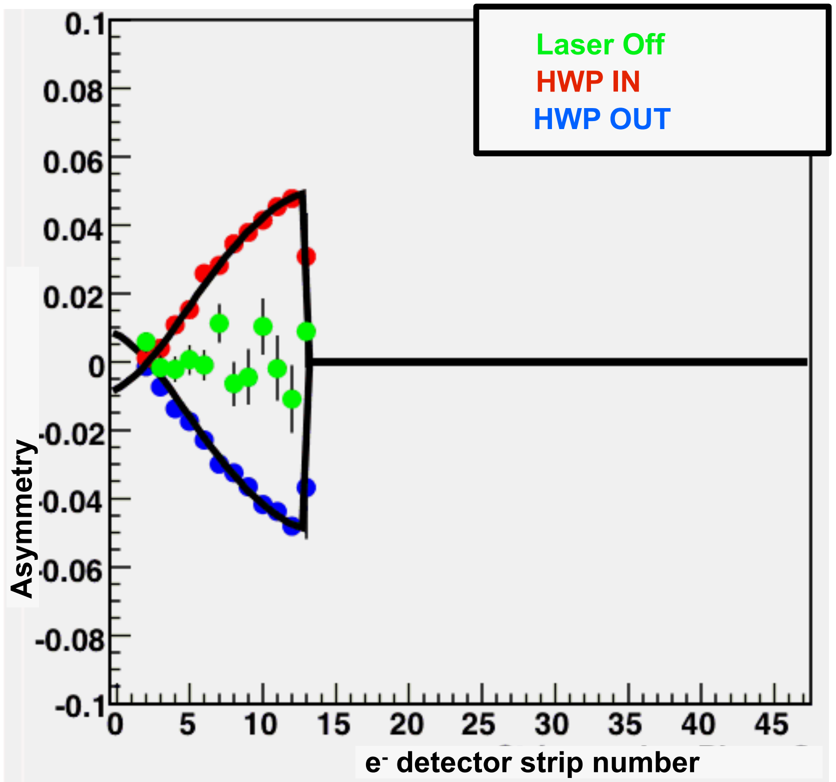
Electron Detector in Hall A (2005)



data from HAPPEX-II (2005)
E_{beam}~3 GeV, 45 uA,
P_{cavity} < 1000 W

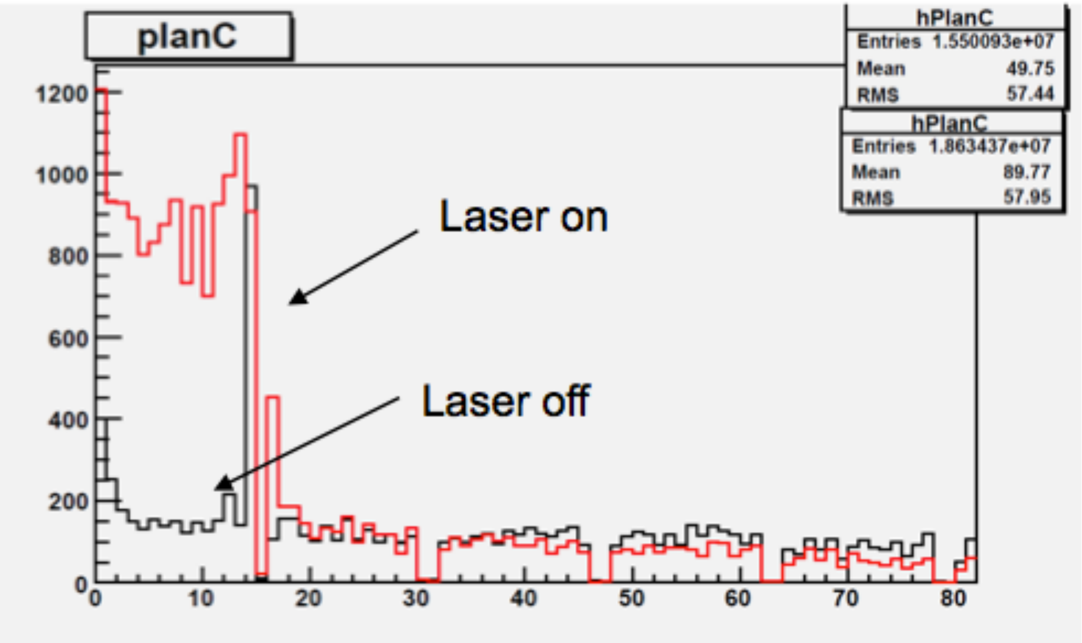


Background ~ 100 Hz / uA at Y_{det} ~ 5mm

Current Electron μstrip Detectors

Noise vs. signal, especially in Hall, makes high efficiency hard

Existing Hall A Si strip system



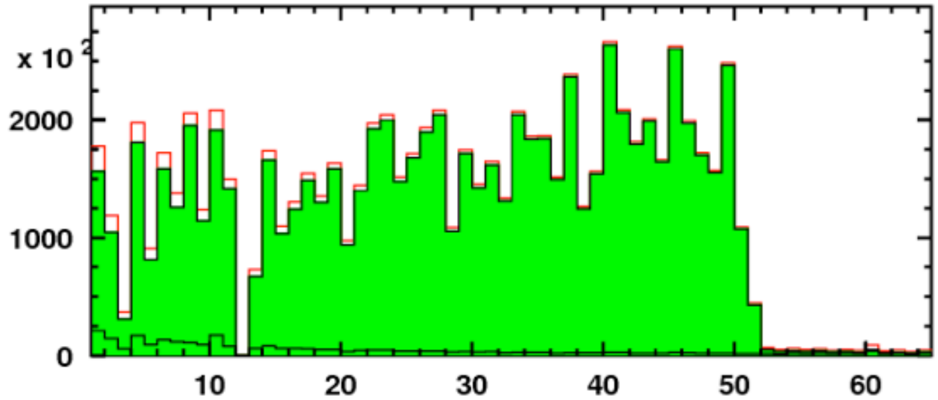
Thicker Si strips with existing electronics? (is rescattering from Si substrate an important systematic correction?)

New electronics for Si ustrips?

Cons: radiation hardness and synch light sensitivity

Hall C Diamond strips

Rough guess: 65% efficient?



Hall C style diamond strips?

Improved electronics? (compton edge from hit pattern is an important calibration point: high efficiency needed!)

Improved radiation hardness & synch light sensitivity

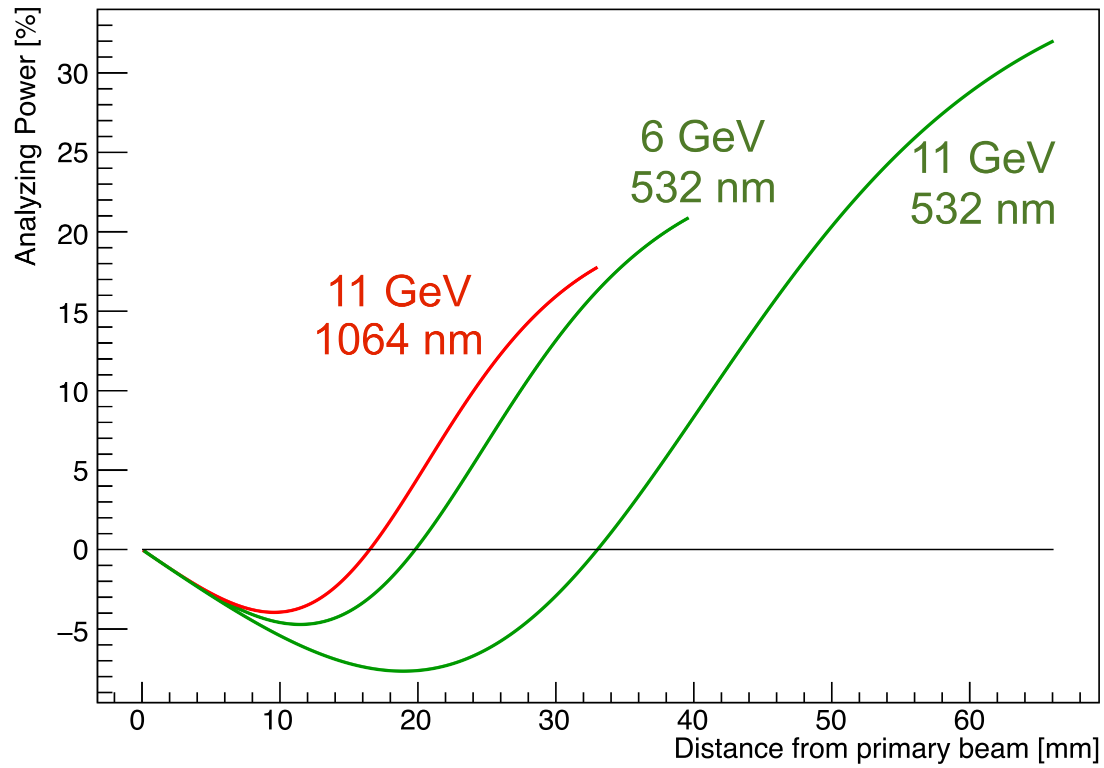
Electron analysis at 11 GeV

Multiple analysis techniques to calibrate analyzing power

- **Asymmetry Fit:** using Compton edge and 0xing to calibrate
- **Edge "single strip"**- a single microstrip, 250 micron pitch, right at the compton edge. (~1 hour to 0.4%)
- **Minimum single strip**- a single microstrip, at the asymmetry minimum (~1 day to 0.4%)

Other possible complications

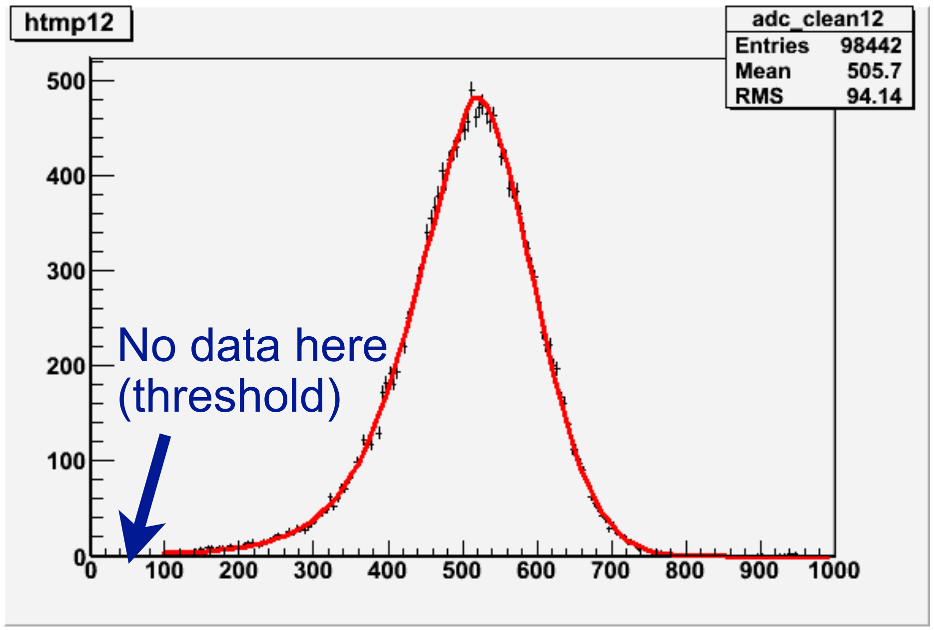
- Compton Edge location (efficiency, noise)
- δ-ray / rescattered Compton e^-
- Deadtime (noise, background)



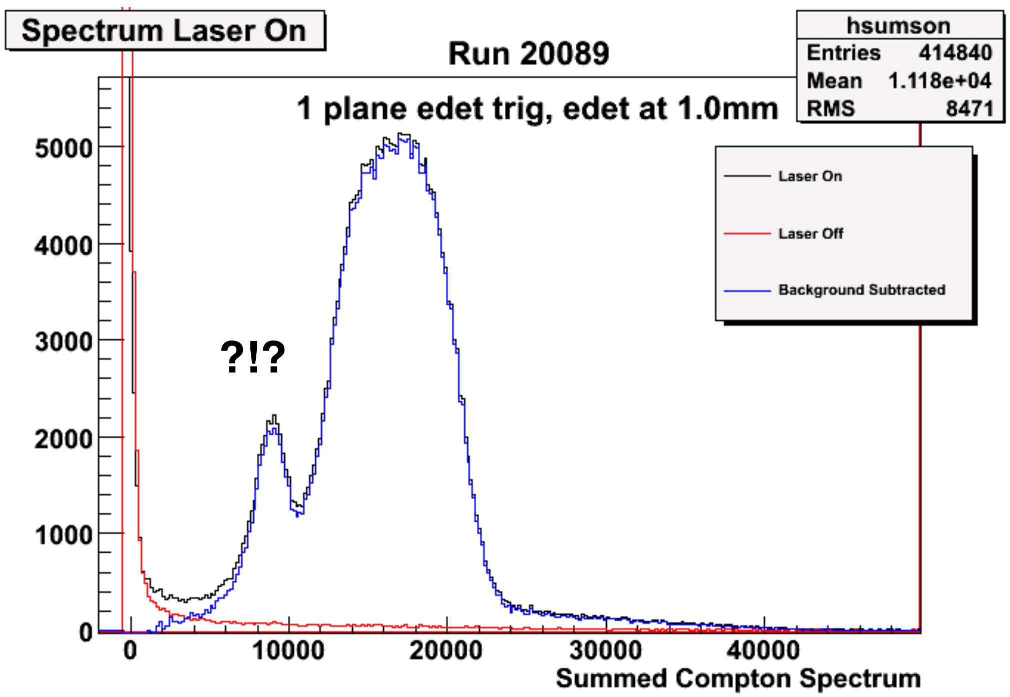
e-γ coincidence: response function calibration

- Electron-photon coincidence
- low-rate trigger (prescaled)
- Photon discriminator threshold and minimum e^- detector approach leaves some portion of the response function unmeasured....

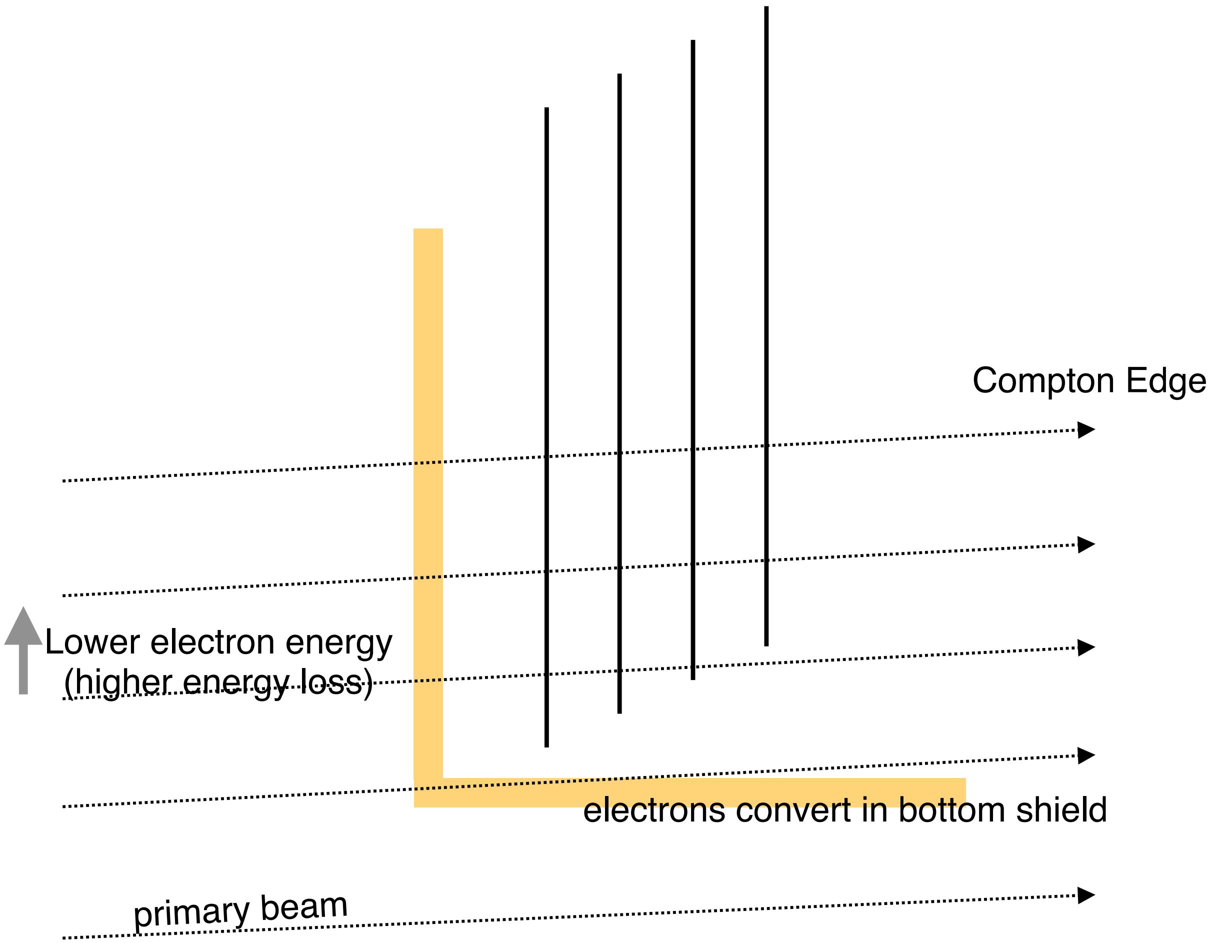
Photon detector response in coincidence with single e-det strip

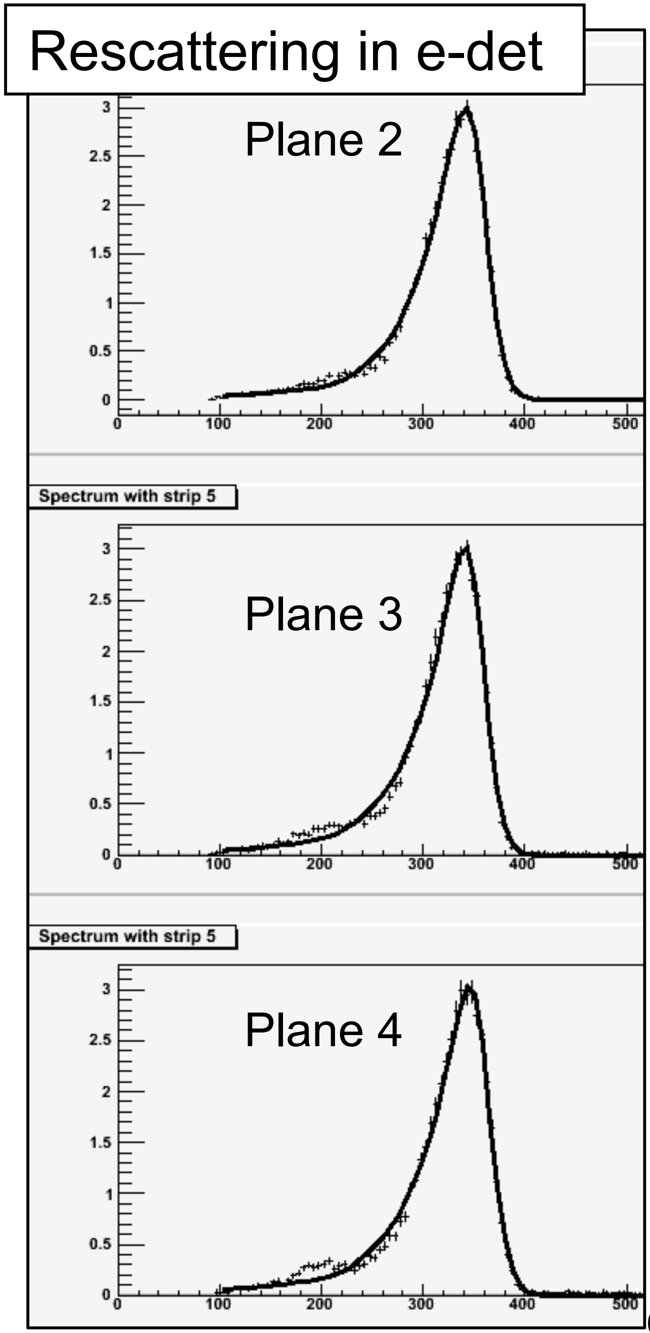


HAPPEX-3 2009 (3 GeV)



HAPPEX-3 “bump”





e-det challenges

MOLLER requires a credible path to electron detector to meet 0.4% polarimetry goal

The options we have before us:

- keep C-F electronics but with thicker planes
- try Qwad electronics with existing Silicone planes
- Drop in Hall C detector
- HVMAPS detector

Thick planes - more delta-ray background

First three options are too small to contain full spectrum

- IR laser?
- New staggered plane geometry?

Give up on asymmetry minimum?

- IR laser?
- New staggered plane geometry?

Compton in the MOLLER project

Presently, listed as dependency:

- Laser (5kW Green and high precision polarimetry determination)
- Photon detector (capable of 0.5%)
- Electron detector (capable of 0.5%)

Hall A isn't (at this point) committed to further upgrades

- Laser - if IR is needed, should add budget for this?
- Photon detector - probably ok at this point?
- Electron detector - Not even fully clear that a functional detector is in the hall plans. Is more needed for high precision?

Options for project

- Specify a budget for IR laser
- Specify a budget
  - for HVMAPS detector,
  - OR Qwad adapt / Si thick plane purchase
  - Include language about other funding for these components possible
- OR declare Silicone planes possible, and hint at possible outside funding for future detector upgrade