Silicon Analysis Update

TPOL analysis meeting

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- Update on work since last presentation in POL2000 meeting (24 August)
  - Noise clusters
  - Silicon cluster RMS vs. calorimeter focus
  - Comparing η from Compton beams of each helicity state
  - Calculating the polarisation from Δy?

Noise clusters

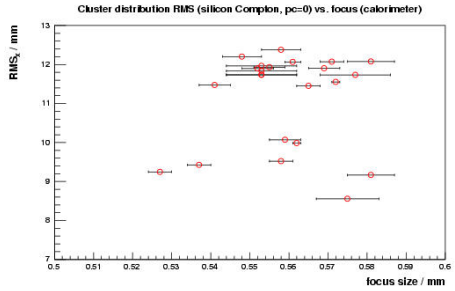
- Want to check are not identifying a significant number of noise clusters
- Look at data from 14 consecutive runs $\longrightarrow$ 1.37M events
- Make histograms of Compton cluster distribution for each laser helicity state in silicon x and y strips and get RMS of distribution
- Find percentage of clusters within 1, 2 and 3 RMS of mean:

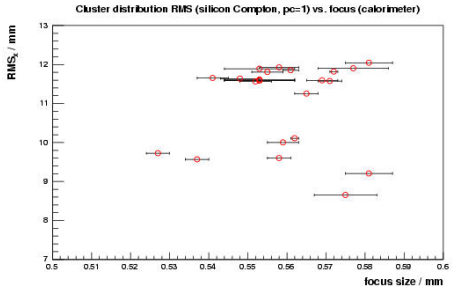
Board	Pockels cell	1 RMS	2 RMS	3 RMS
x	0	70	91	100
x	1	70	91	100
y	0	75	89	100
y	1	75	89	100

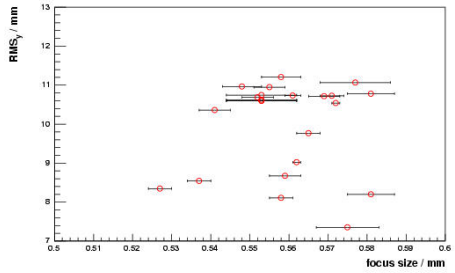
- Don't expect perfect Gaussian distribution
- But seems that reasonable percentage of clusters are within few RMS of mean
- Don't appear to have excess of noise clusters being identified

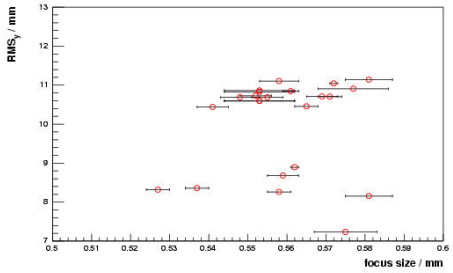
Silicon RMS vs. calorimeter focus

- Measure RMS of cluster distribution in silicon x and y strips for Compton data of each helicity with energy range: $11 < E < 14$ GeV (same as for focus)









- x pc0: correlation = 0.08
- y pc0: correlation = 0.05
- x pc1: correlation = 0.05
- y pc1: correlation = 0.10

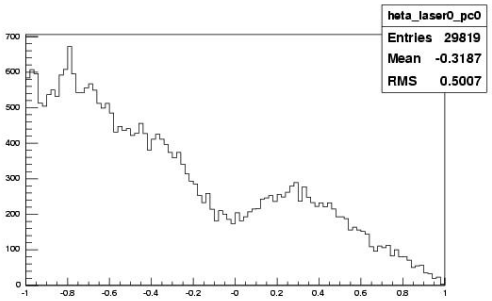
- Need more data - would like focus to be in ntuple when take a global run

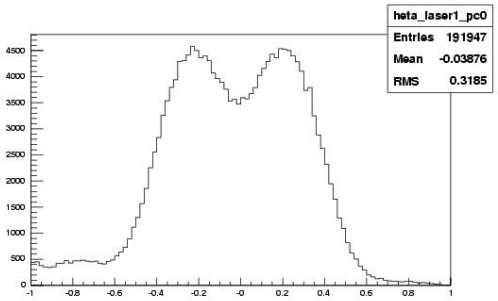
Comparing η from Compton beams of each helicity state I

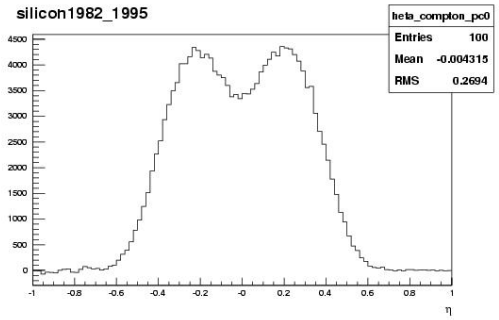
- Previously only saw a very small difference in y_0 for the Compton beam between the two laser helicity states:
  - $y_0(pc = 0) = 31.76 \pm 0.00$ mm
  - $y_0(pc = 1) = 31.79 \pm 0.00$ mm
  - $\Delta y_0 = 0.03 \pm 0.00$ mm

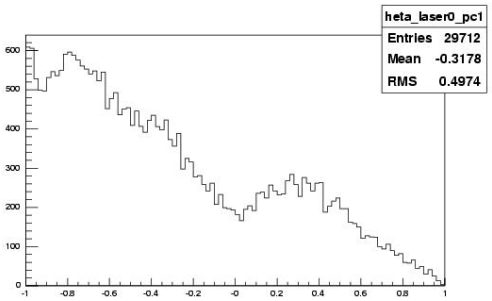
- Plot η distribution for laser off (Bremsstrahlung), laser on and Compton beams for each laser helicity state and in the energy range $10 < \mathrm{E} < 16$ GeV and see what asymmetry is observed

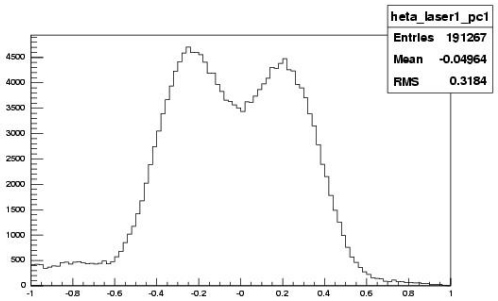
Comparing η from Compton beams of each helicity state II

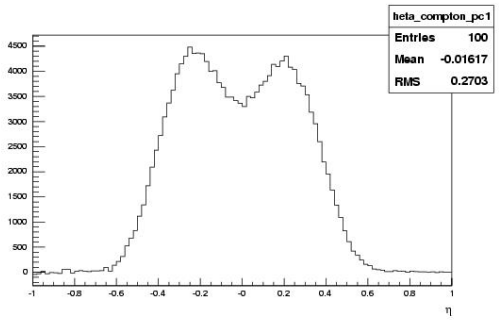








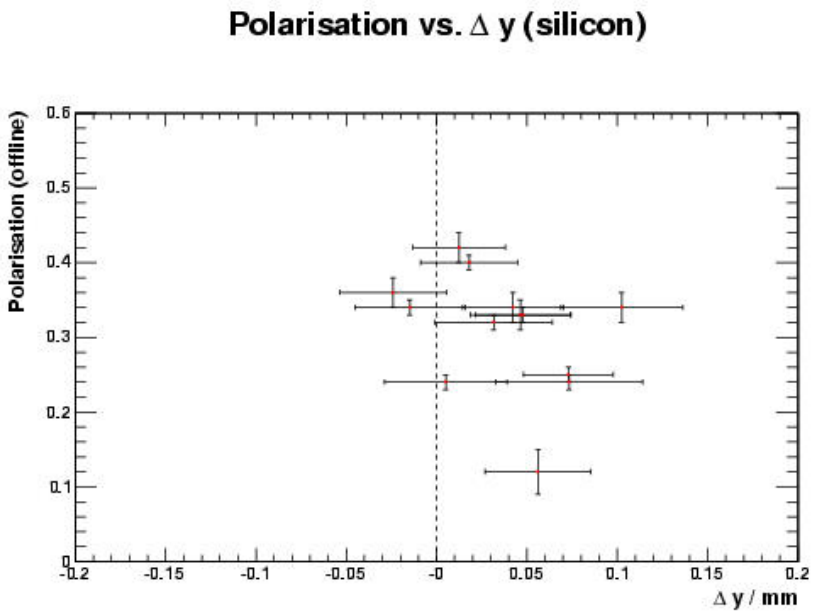




- See $\Delta\eta = 0.012$ between the two helicity states
- This gives reasonable estimate of polarisation $= 24\%$ (calculated by Vahagn)
- Quick look at $\eta - y$ curve suggests that order of magnitude of Δy_0 is as expected

Calculating the polarisation from Δy? I

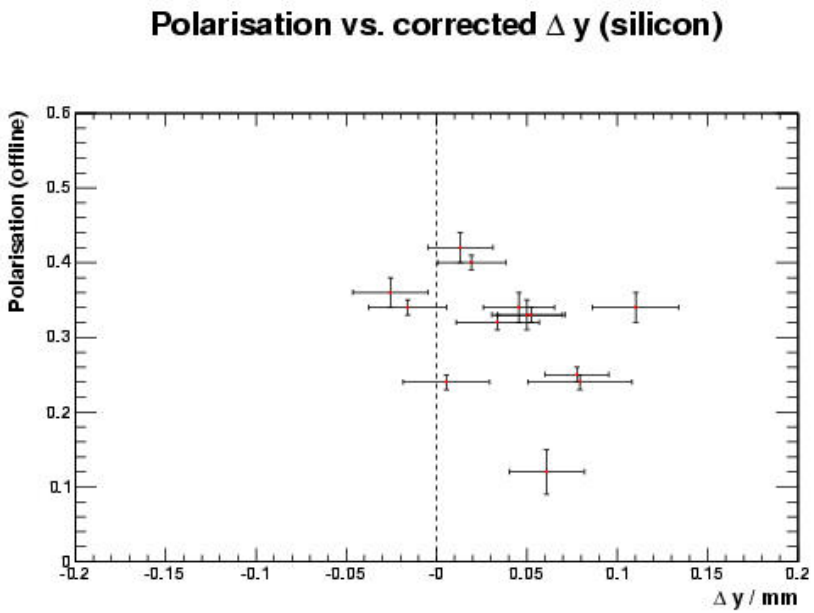
- Since the Δy asymmetry seems reasonable - is it possible to measure the polarisation from the silicon detector?
- Since $P_y = \Pi \frac{\eta_R - \eta_L}{2} \rightarrow P_y = f \times \Delta y$
- Plot polarisation vs. Δy and see if it's a straight line...



- Not really...

Calculating the polarisation from Δy? II

- Try applying focus correction to Δy and see if this improves correlation:
- $\Delta y \rightarrow \Delta y \times (1 + 0.6649(focus - 0.44358))$



- No obvious improvement in correlation, although the fact that most values of Δy are positive suggests that the difference in y_0 between the two Pockels cell states is not merely statistical

Future work

- Would like to take much more data with the focus and polarisation read out to the ntuple (also the time, so it's easier to look up other variables from oracle database later if need them) so can plot:
  - Focus vs. beam size from silicon
  - Polarisation vs Δy
- Will then be able to make these plots with:
  - More points
  - More data per point so have more accurate beam size and Δy measurement from silicon
- If these plots show that there is a 'reasonable' correlation or straight line relationship between polarisation and Δy, then could try using fitting code to calculate polarisation from Δy and see what this gives