Silicon detector alignment study update

TPOL analysis meeting

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Outline

- MC - data comparison
  - value of DILU
  - selection criteria
- Check polarisation dependence
- Re-measure silicon-cal angle
- Energy resolution (u+d and l+r)

Value of DILU

- In same way as before, subtract mc and data η distributions for different DILU values

- This time have more realistic cal (1.5°), si (3.1°) and P_y (0.40) values

DILU	$\Delta Abs(\eta_{mc}-\eta_{data})$
0.03	20363.3
0.04	16376.8
0.05	14639.2
0.06	15431.8
0.07	17406.6

(last time, with no rotation simulated, found DILU = 0.10)

MC - data comparison

- Apply the following selection criteria to data and mc histograms:

cut	data	mc
ncx = 1	clusx + cluschgx	clusx + cluschgx
ncy = 1	clusy + cluschgy	clusy + cluschgy
veto off	all	-
elr > 2.85 GeV	-	all

found by matching elr(data) with elr(mc)

- Then compare Aug 11th data (3.1° rotation from ellipse) with mc with:
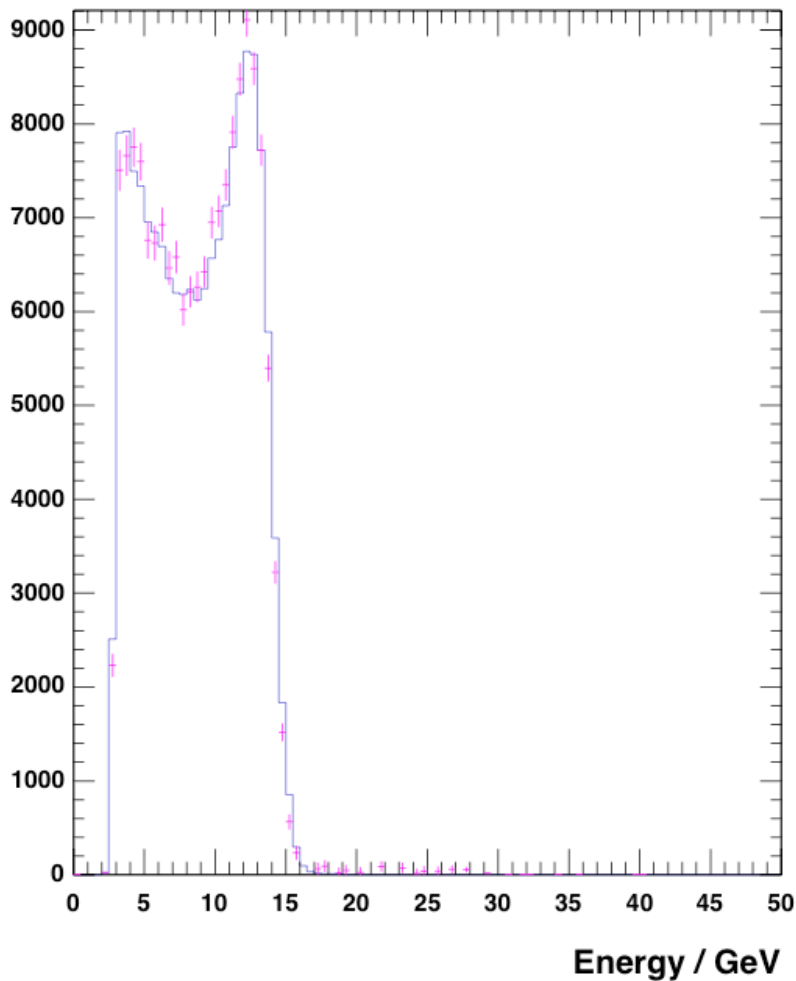
P_y = 0.40   DILU = 0.05   si = 3.1°   cal = 1.5°

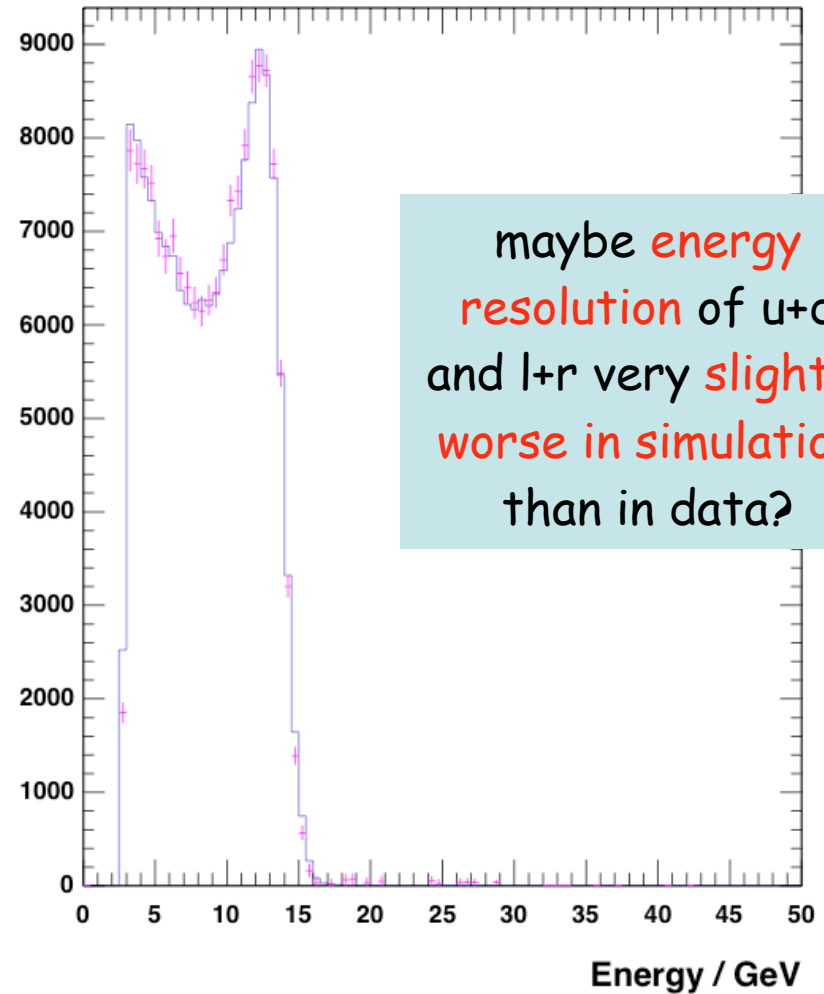# Energy (u+d and l+r)

Energy (up + down)

Energy (left + right)

maybe energy resolution of u+d and l+r very slightly worse in simulation than in data?

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Asymmetry (u/d and l/r)

small shift between mc and data
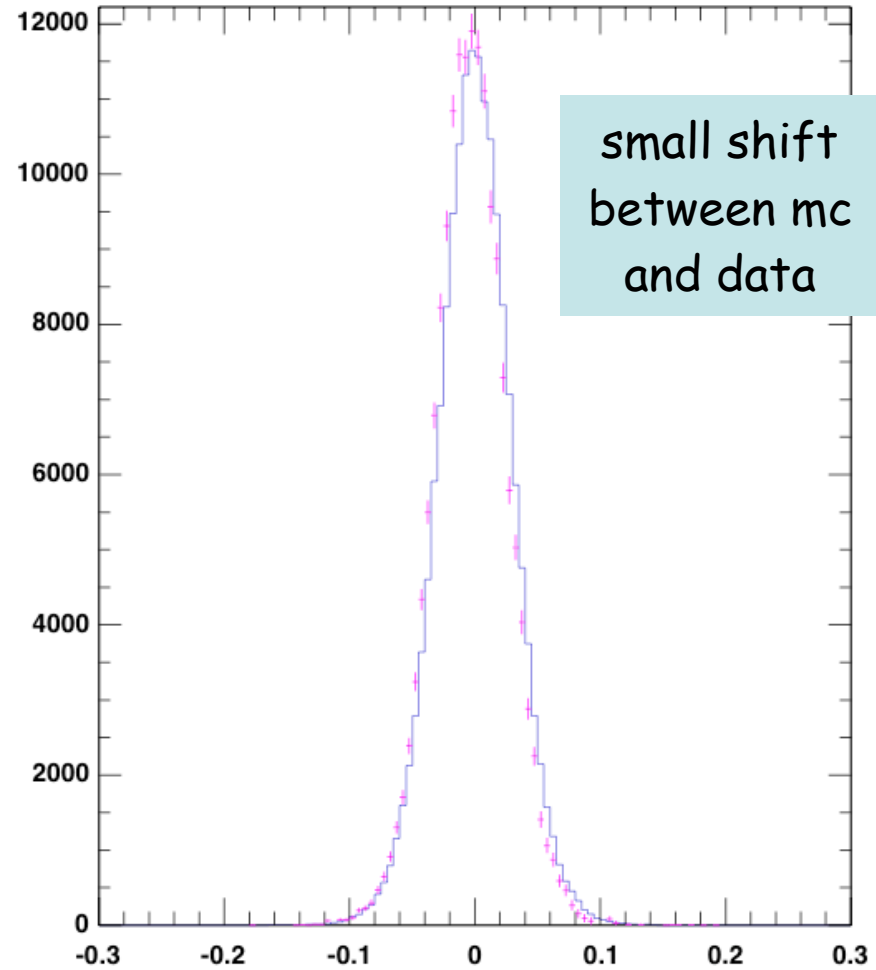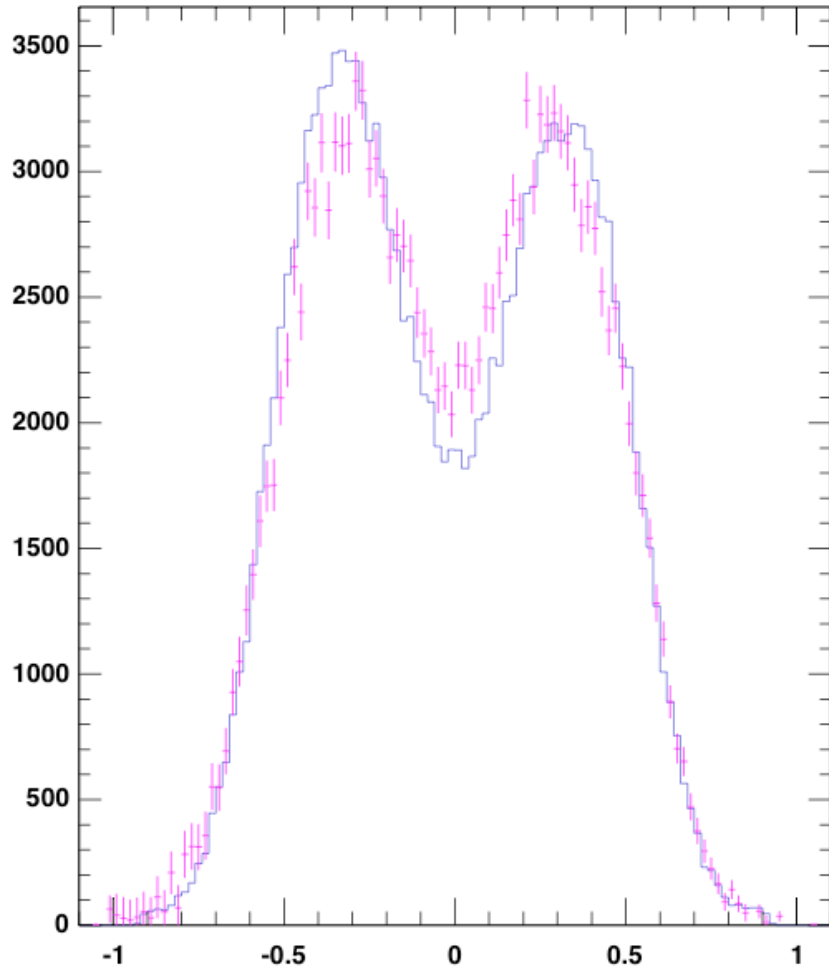
Number of silicon clusters
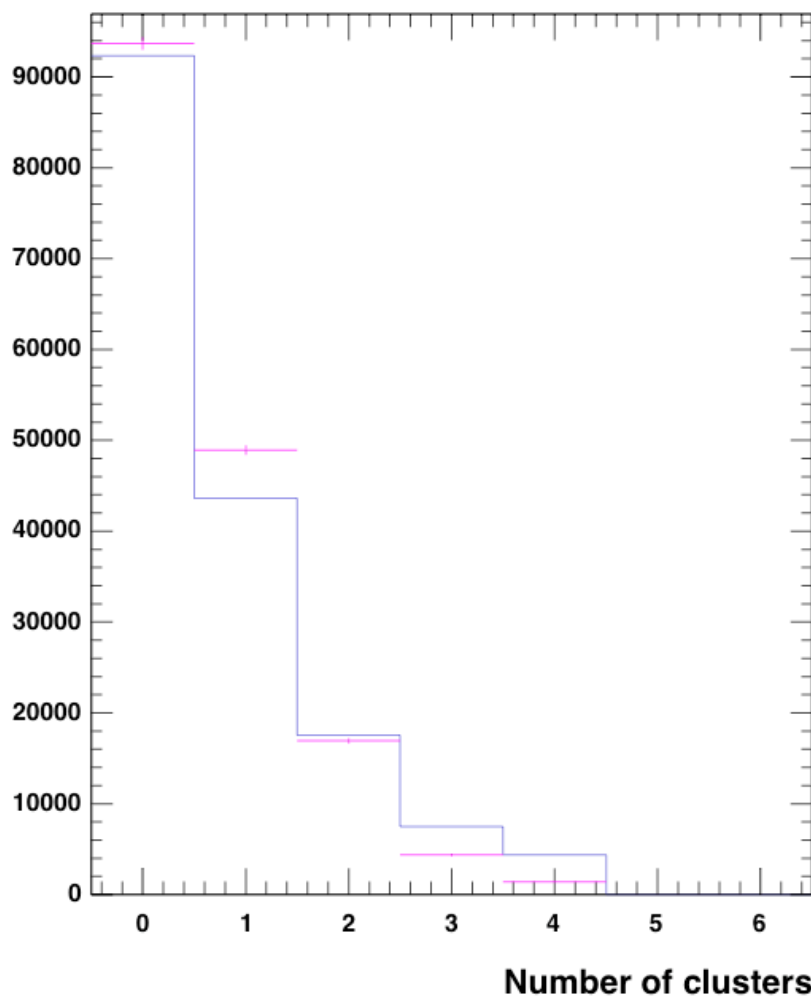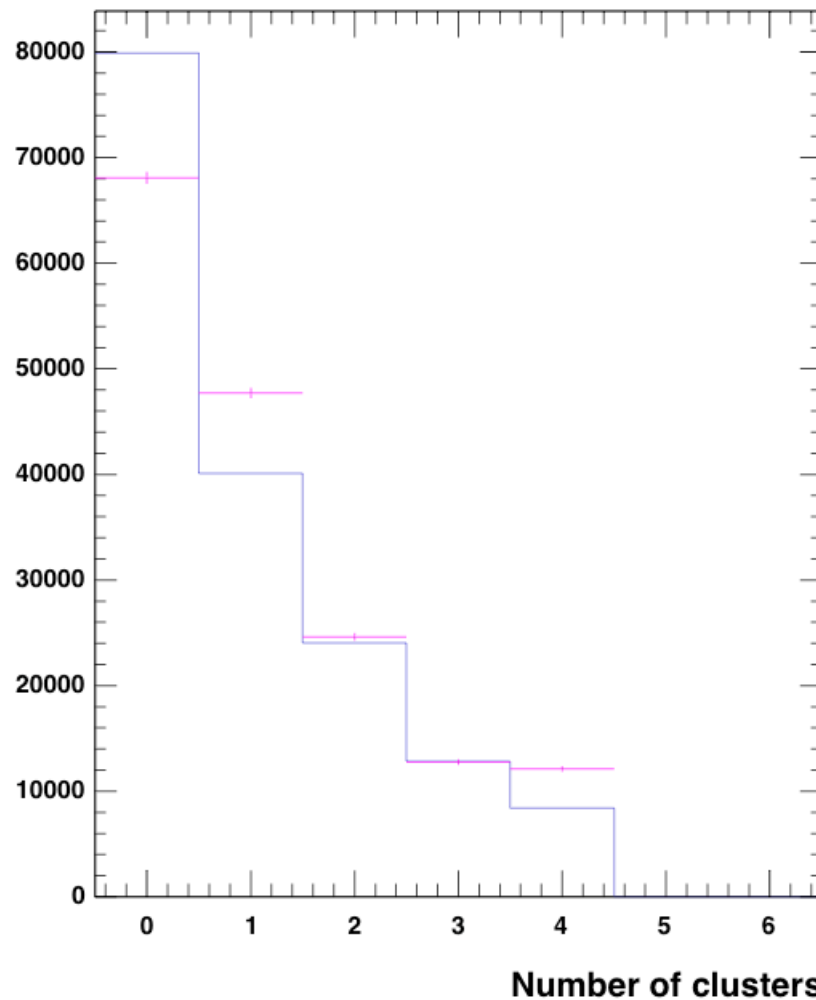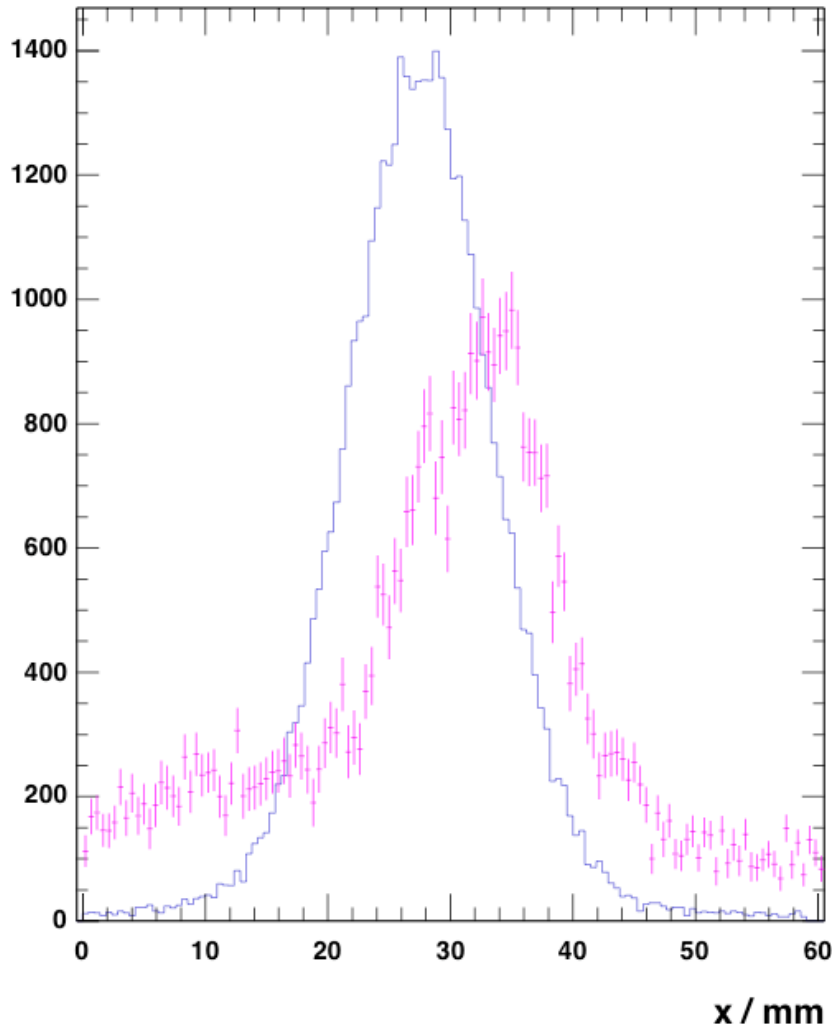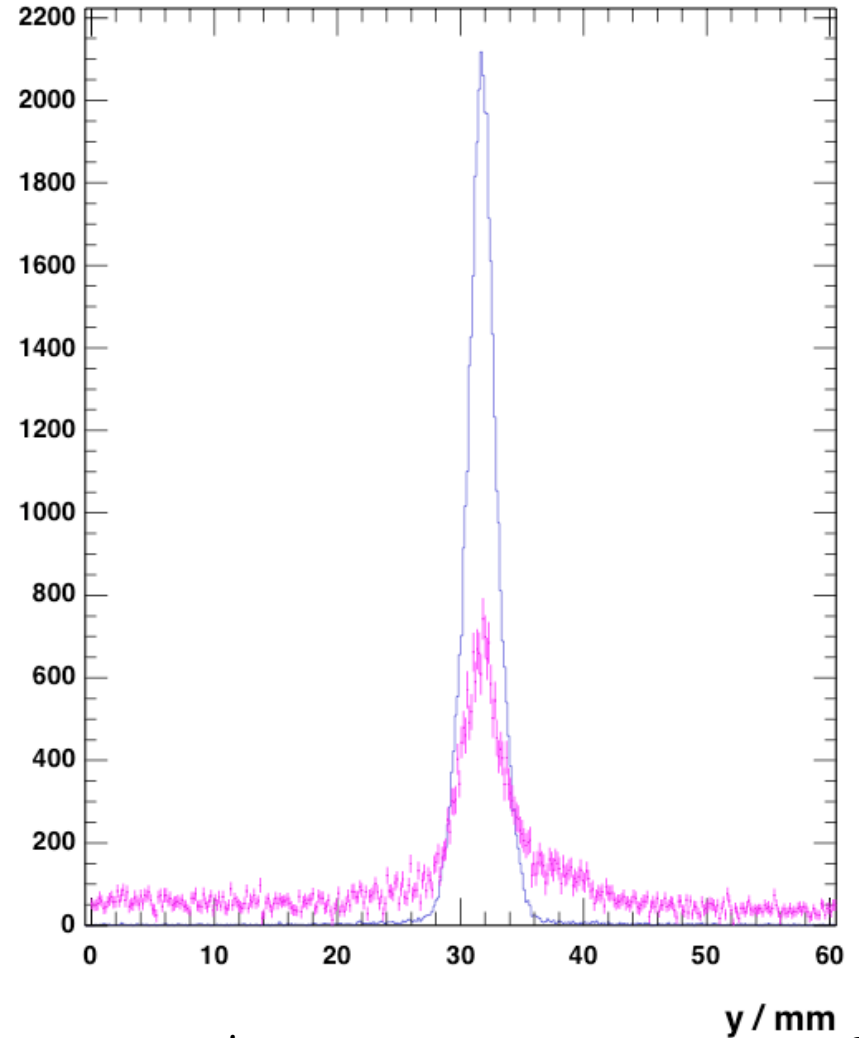
Silicon cluster position

Single cluster distribution in x

Single cluster distribution in y

x / mm

y / mm

Silicon cluster charge
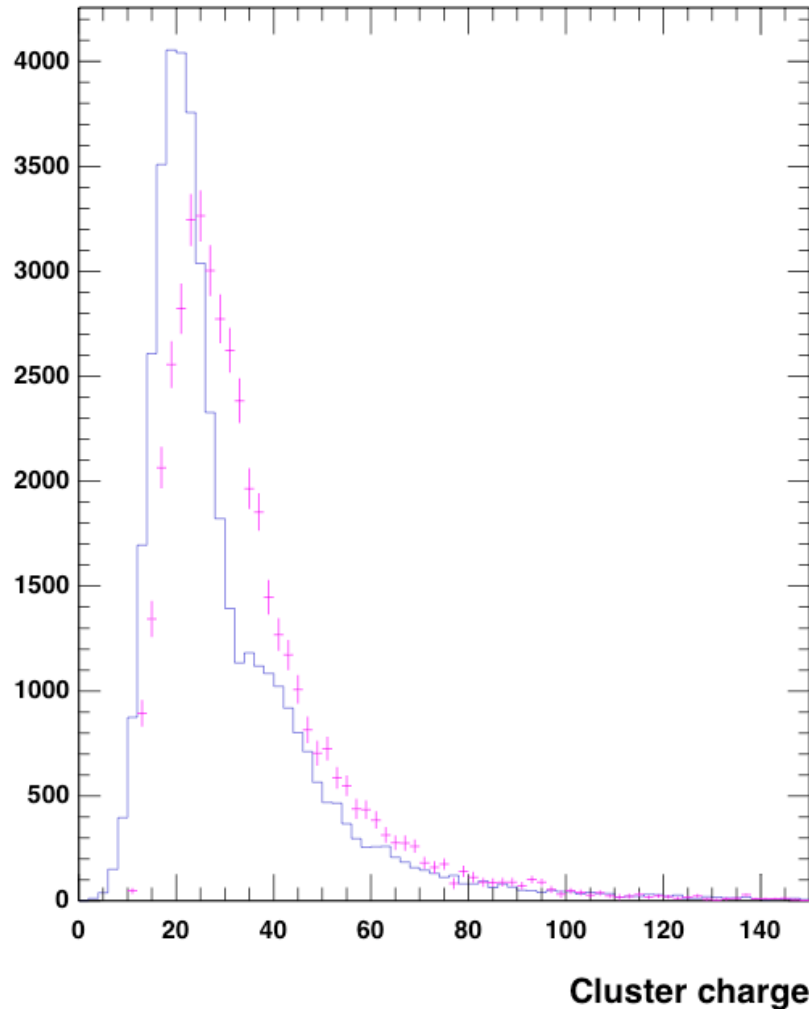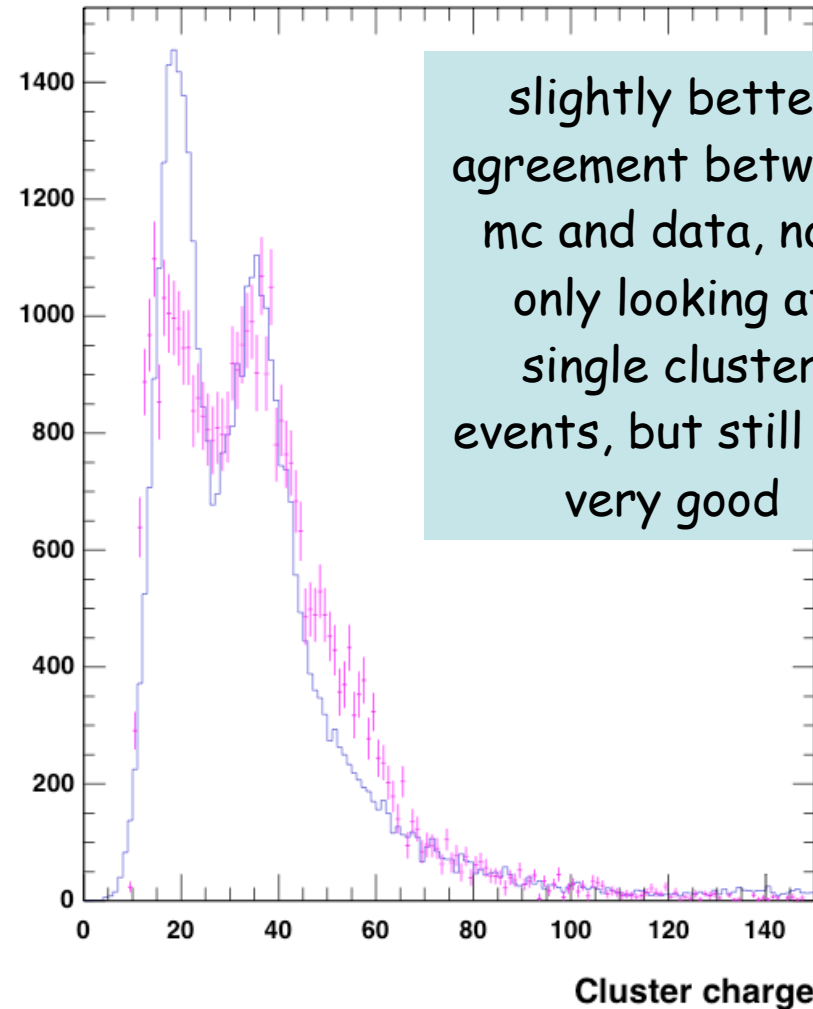
slightly better agreement between mc and data, now only looking at single cluster events, but still not very good

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Polarisation dependence

- Want to check whether P_y has any effect on x-η slope

seems P_y has no effect on x-η slope (as expected) so no need to simulate exact data value for rotation study

dilu = 0.05 si = 3.1 deg cal = 1.5 deg

χ^2 / ndf	5.627 / 7
Prob	0.5839
p0	-1.594 ± 0.06906
p1	-0.03301 ± 0.1077

Slope of x_{si} - η

Lepton polarisation
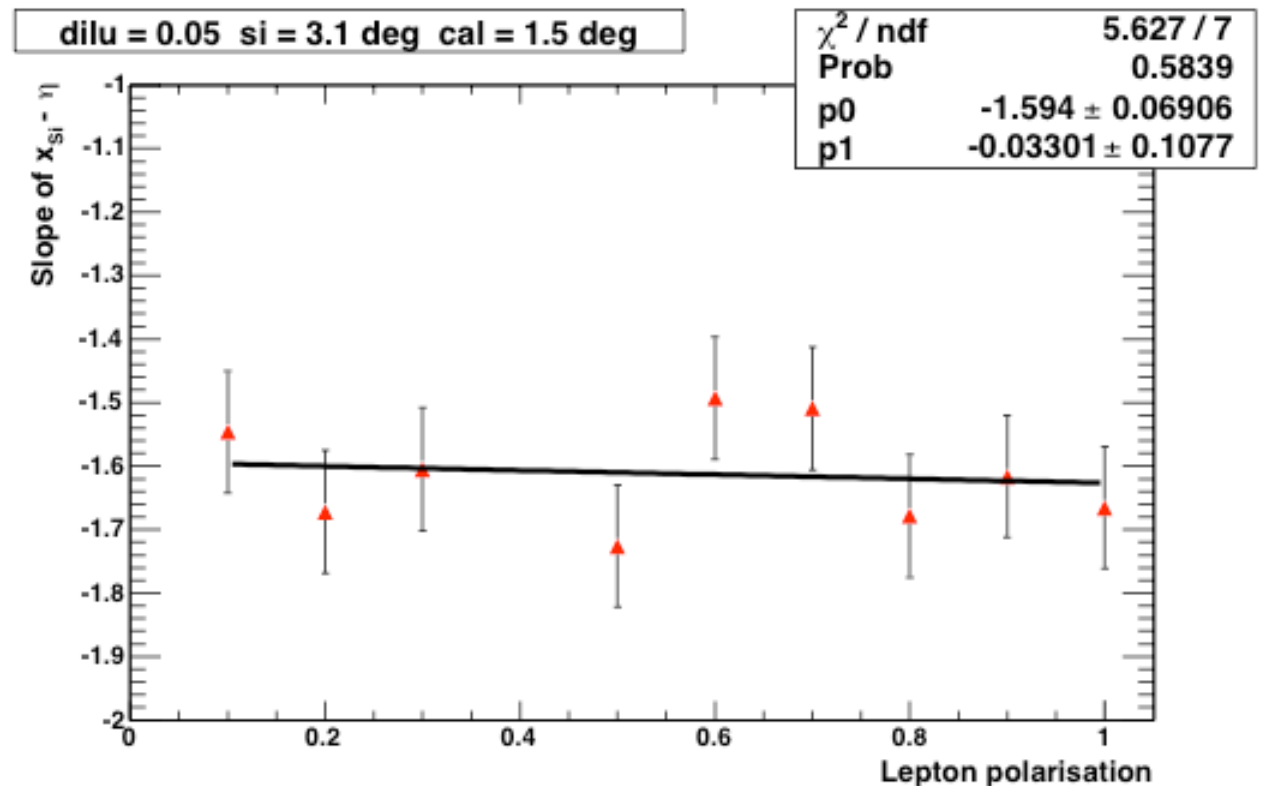
Silicon-cal angle - I

- In same way as in last talk, simulate mc over range of cal angles with si angle set to angle from ellipse fit

- Now set DILU to 0.05 (last time was 0.10) and P_y to 0.40 (last time was 1.0)

- Apply energy and number of cluster cuts to mc

- Plot mc x-η slope vs. cal angle, fit straight line

- Use value of data x-η slope to read off cal rotation w.r.t. beam

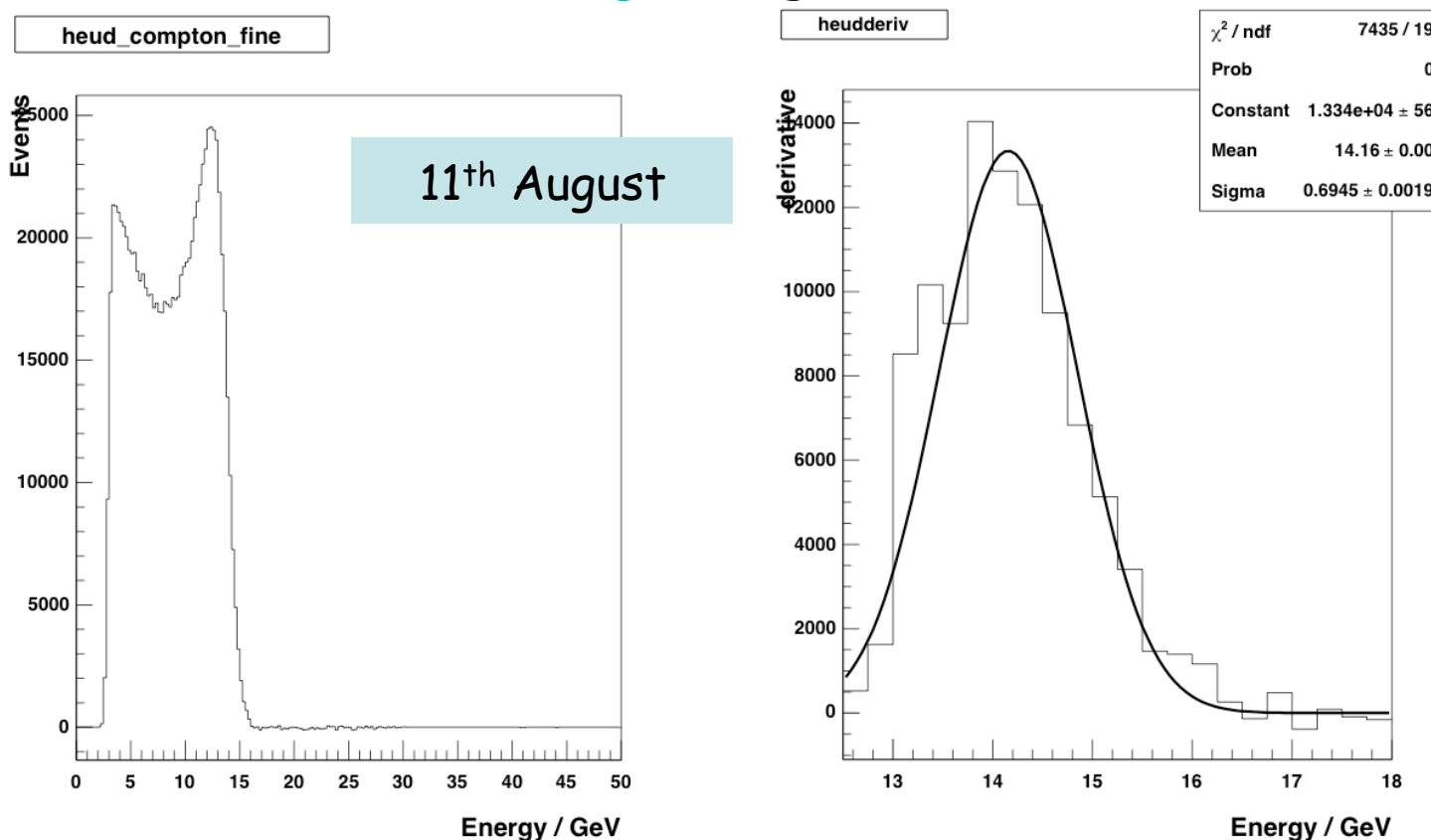- Calculate angle between si and cal for same four data sets

Silicon-cal angle - II

Date	Si tilt (ellipse fit) / °	Cal tilt / °	Si-cal angle / °	Previous si-cal angle / °
01 Mar	6.8 ± 0.4	2.4 ± 0.3	4.4 ± 0.5	5.1 ± 0.4
07 Mar	4.6 ± 0.2	1.9 ± 0.2	2.7 ± 0.3	2.7 ± 0.2
24 May	3.0 ± 0.2	1.2 ± 0.2	1.8 ± 0.2	1.6 ± 0.2
11 Aug	3.1 ± 0.2	1.3 ± 0.2	1.8 ± 0.2	1.6 ± 0.2

Agreement of four data sets now slightly better than last time, but still not great

Energy resolution - I

- Plot derivative of Compton edge vs. energy for eud and elr background-subtracted distributions

- Fit Gaussian and extract sigma, e.g.:

11th August

χ^2 / ndf	7435 / 19
Prob	0
Constant	1.334e+04 ± 56
Mean	14.16 ± 0.00
Sigma	0.6945 ± 0.0019

Energy resolution - II

- Repeat same procedure for elr and eud from four data sets:

Date	σ_{ud} / GeV	σ_{lr} / GeV
01 Mar	0.722 ± 0.003	0.683 ± 0.002
07 Mar	0.727 ± 0.001	0.715 ± 0.001
24 May	0.748 ± 0.002	0.673 ± 0.001
11 Aug	0.695 ± 0.002	0.724 ± 0.002

- Seems both eud and elr have resolution of ~0.7 GeV

- What value is used in simulation?

Summary

- DILU = 0.05 gives best match with η from data

- Applying energy cut (elr > 2.85 GeV) to mc gives better match for energy distributions

- Using single cluster events improves cluster charge distributions, but still not great

- Using new cuts on mc gives slightly closer si-cal angles from the four data sets compared with before, but still not quite in agreement

- P_y has practically no effect on mc x-η slope, as expected

- Si-cal angle now measured to be in range: 1.8 to 4.4 $^\circ$

- Measure energy resolution 0.7 GeV for both eud and elr