

ECal updates: Bfield fixed Tunsten option

20/03/2018

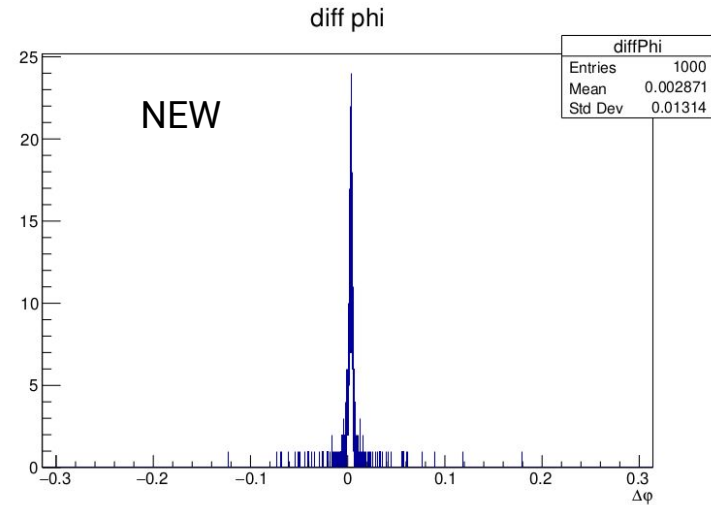
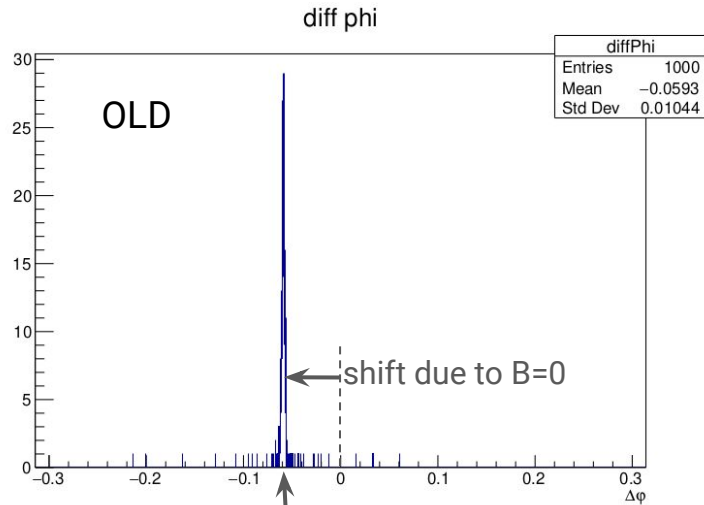
FCC calo meeting

Anna Zaborowska

FCCSimJobs: bfield

- B field not taken into account as reported by Valentin
- B field tool initialised, but not used by Geant Svc if not added
`magneticField=tool`
- BUT: same code was used in previous studies (pre-v01 production)
- Probable explanation: change in Gaudi
 - ◆ previously was using the only initialised tool
 - ◆ now (quite correctly...) is ignoring it and using default (no Bfield) unless passed directly
- V01 production has no magnetic field

B field: φ shift



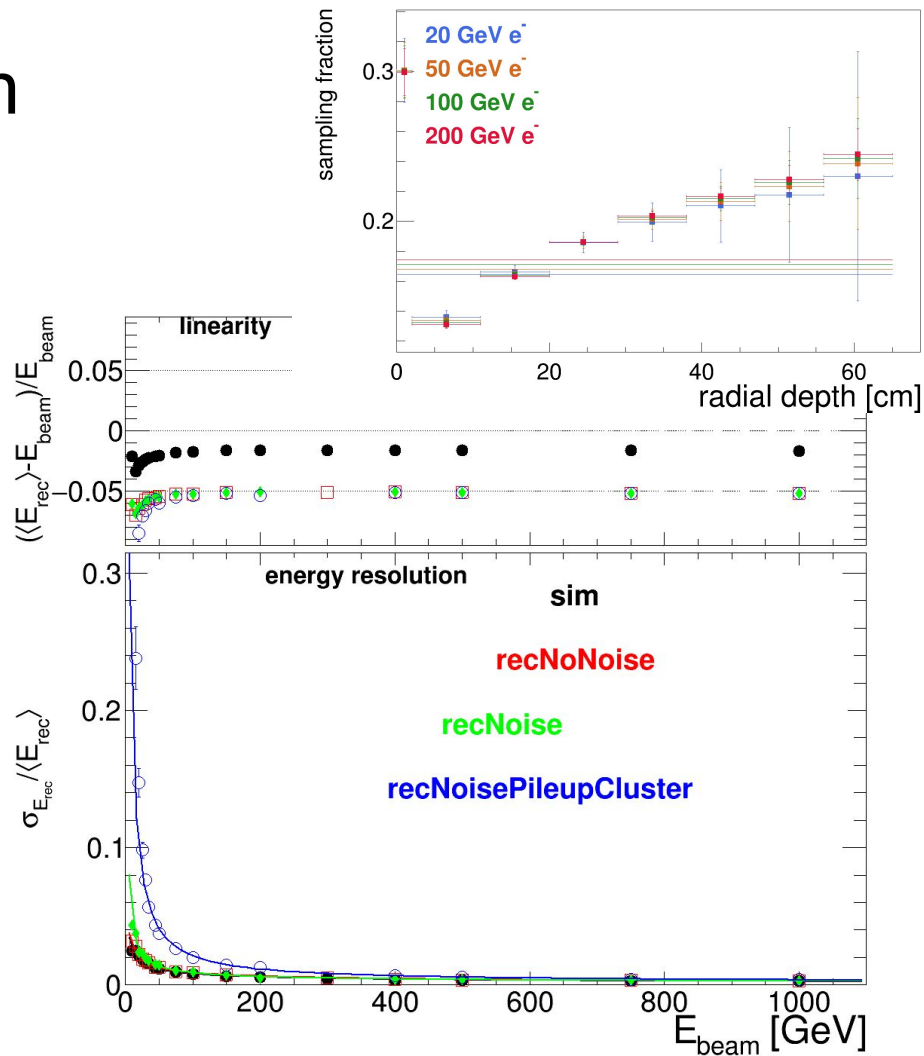
φ (extrapolated from vertex in 4T field) = $\varphi_{MC} - 0.06$ (for 20 GeV electron)

→ $\Delta\varphi = \varphi$ (extrapolated from vertex in 4T field) - φ (cluster)

Redoing energy resolution

What changed:

- B field properly included
- New SF recalculation (avg from 20-200 GeV)
- More data points included (previously 6 points, now 16)
- Study includes also photons (here with one exception on slide 7 only electrons shown)
- Strange drop to -5% in linearity to be investigated



Energy resolution

1 Just single electrons, no noise

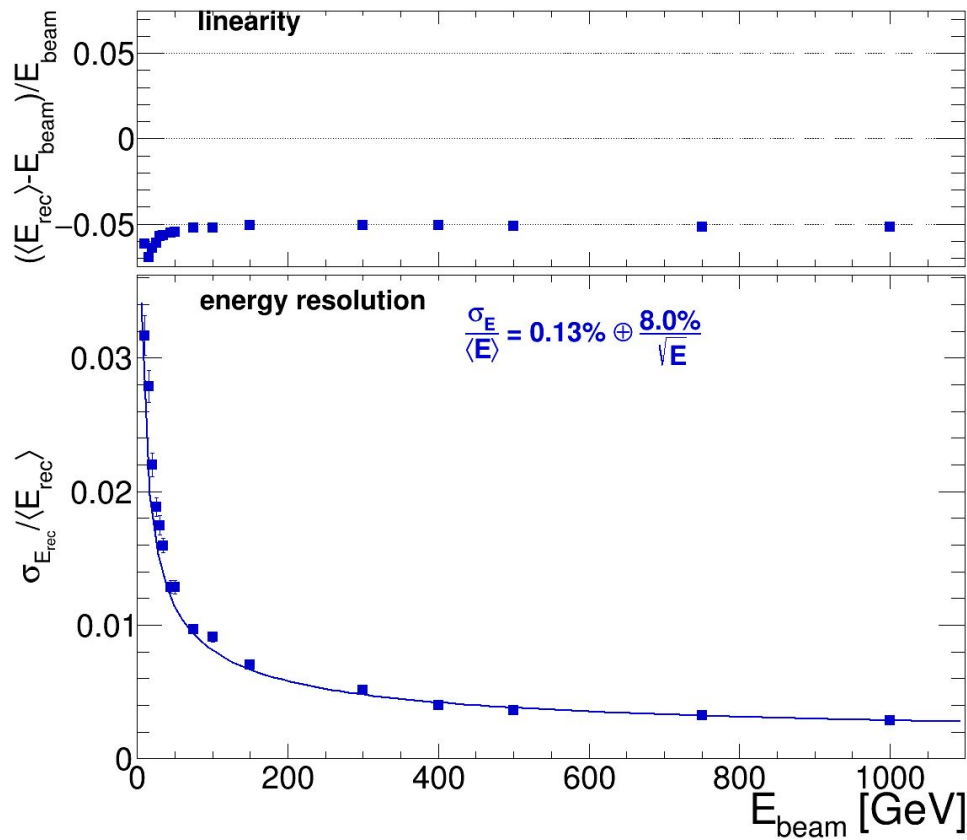
2 Electronics noise

3 Electronics noise + pile-up noise per cell: assuming uncorrelated noise

4 Electronics noise per cell + pile-up noise per cluster: correlated pile-up noise

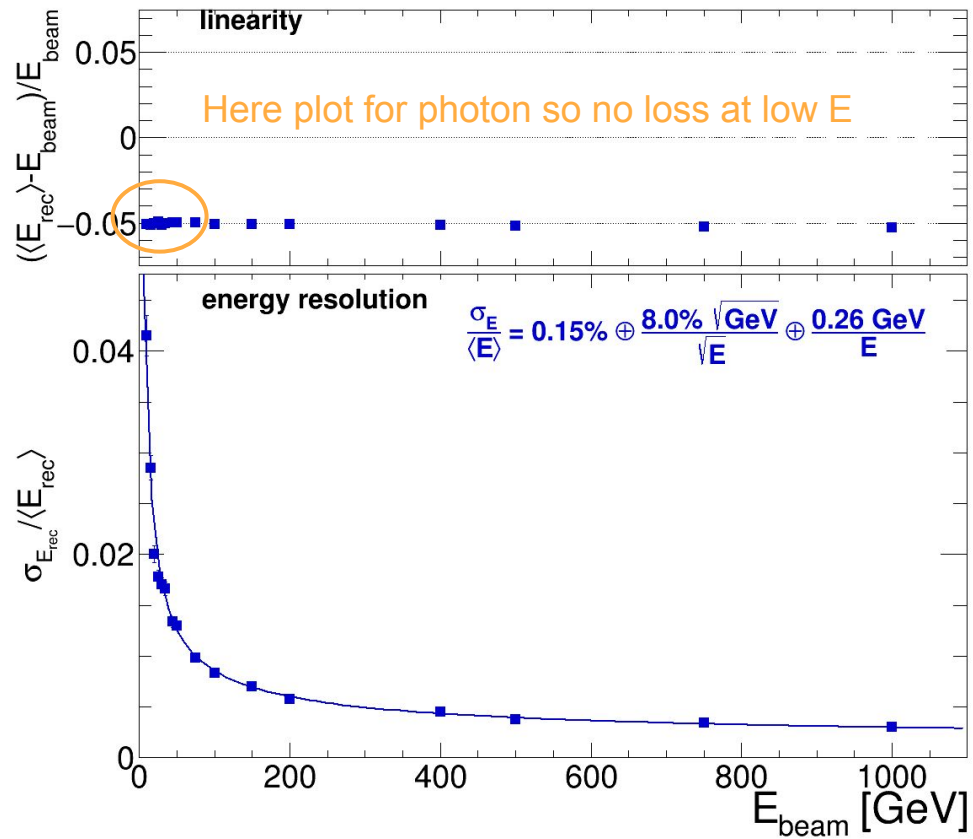
1 Energy resolution

- No noise
- Linearity should be restored with correction for upstream material (but not all)
- Constant term $c = 0.2\%$
(much smaller than 0.6% obtained before! But linearity $\sim -5\%$)
- Sampling term $a = 8\% \sqrt{\text{GeV}}$



2 Energy resolution

- Only electronics noise
- **a** fixed to 8% (otherwise it fits to 7% and **b** is overestimated)
- Noise term **b** = 0.26 GeV

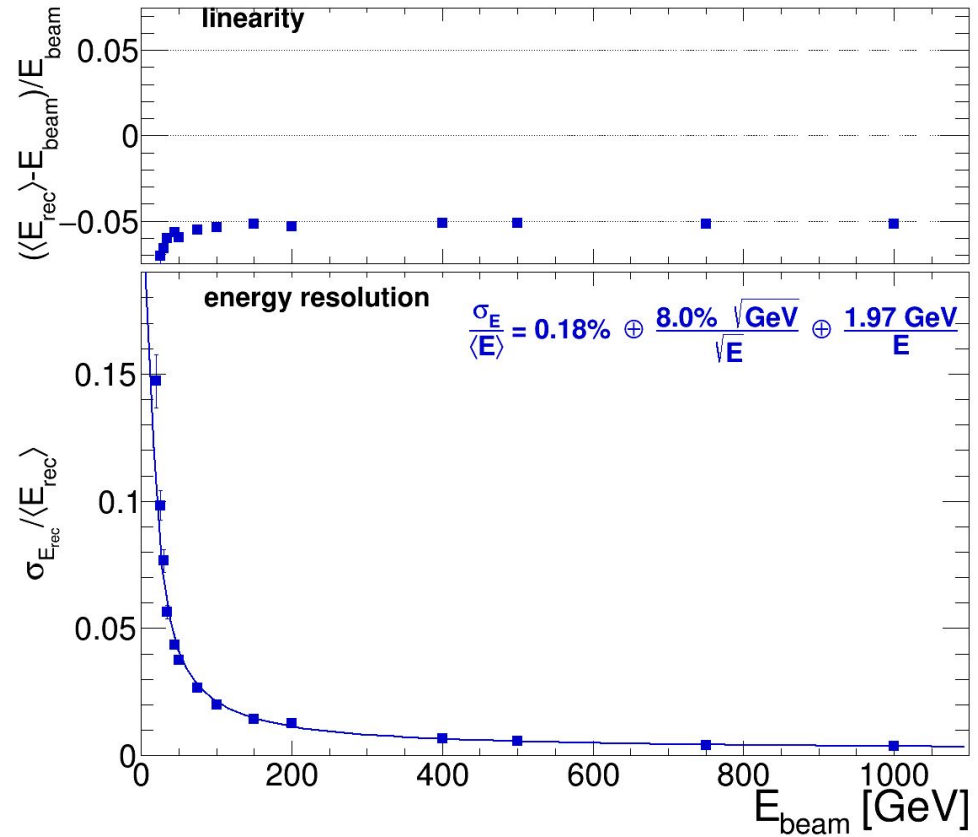


3 Energy resolution

→ Calculation ongoing

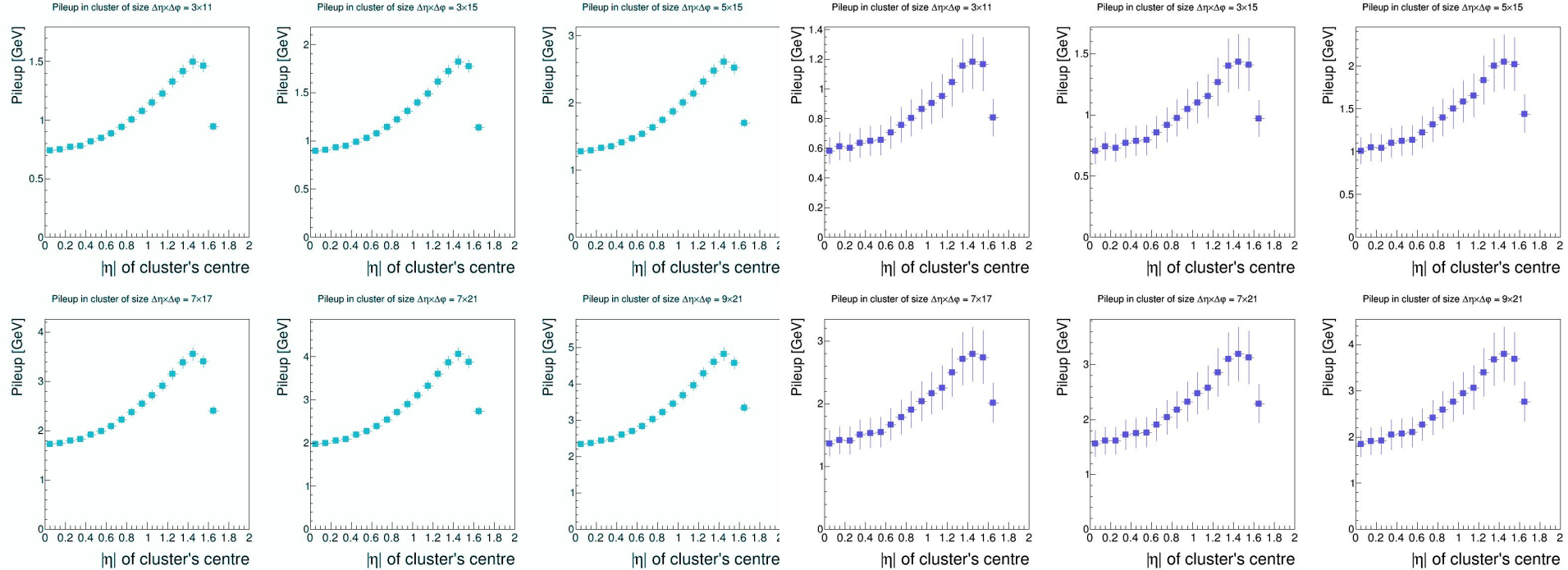
4 Energy resolution

- Electronics noise
- Pile-up noise per cluster
- **a** fixed to 8% (otherwise **b** is underestimated)
- Noise term $b = 2 \text{ GeV}$



Decreasing the pileup noise: W instead of Pb

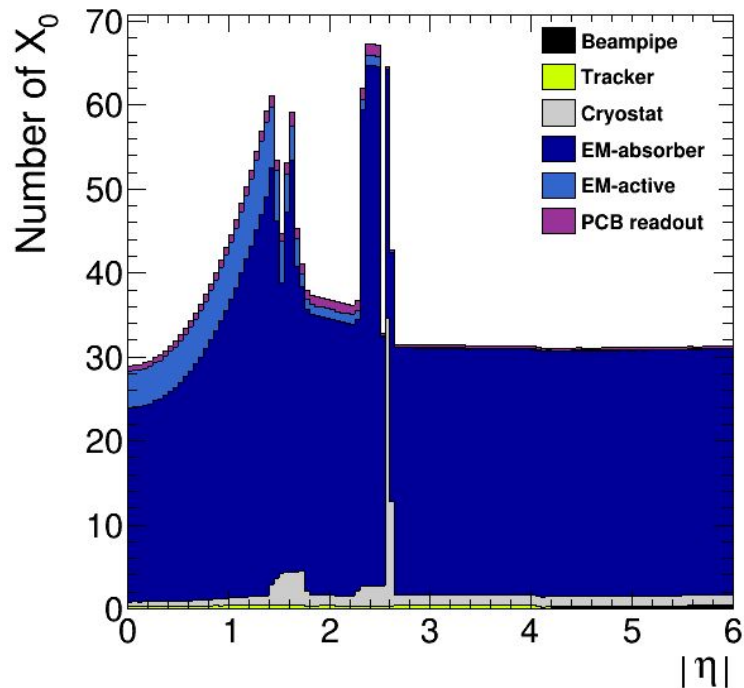
- First look into changed absorber
- ~20% decrease of noise in same cluster size (showers are more dense in W)



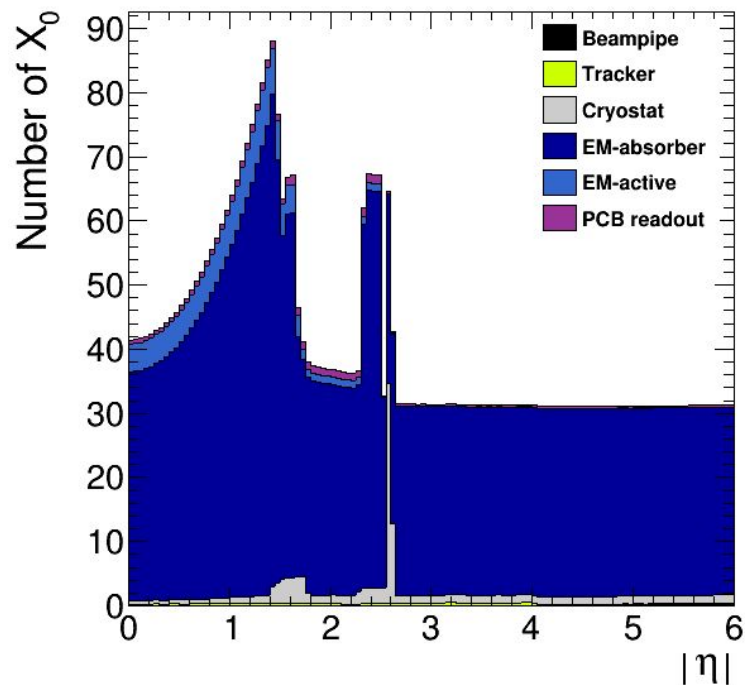
Pb

W

Lead -> Tungsten



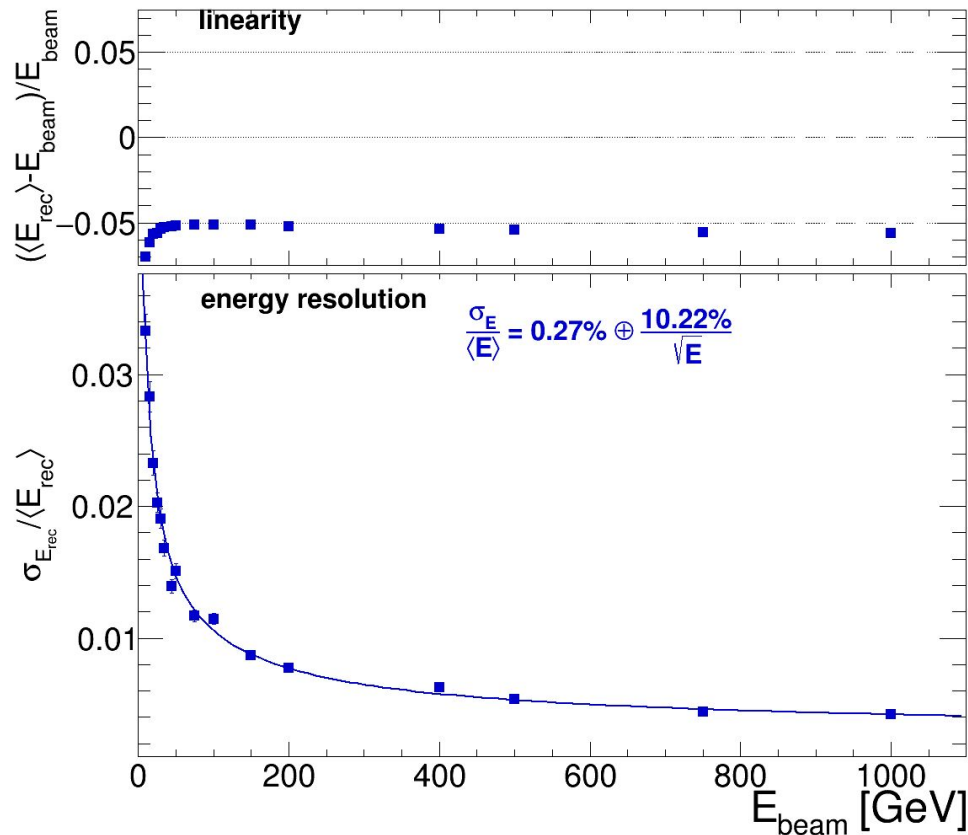
Pb



W

Tungsten: energy resolution

- Same reco window as for Pb
- Pileup noise per cluster decreases from 1.8 to 14 GeV
- Energy resolution would improve if better division of detector in layers



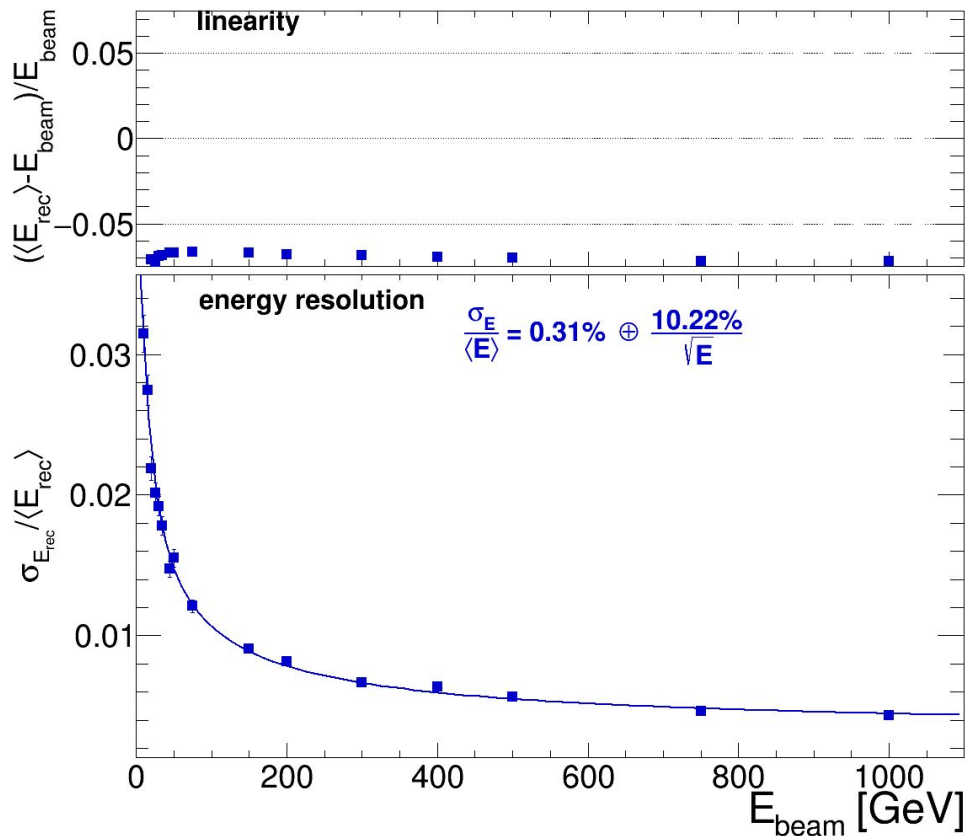
Tungsten: energy resolution

Window size decreases from
7x17 to 5x15

1-2 % of reconstructed energy
within window

Similar en resolution

Further decrease of pileup
noise per cluster to 1 GeV



BACKUP, old data

1 Energy resolution

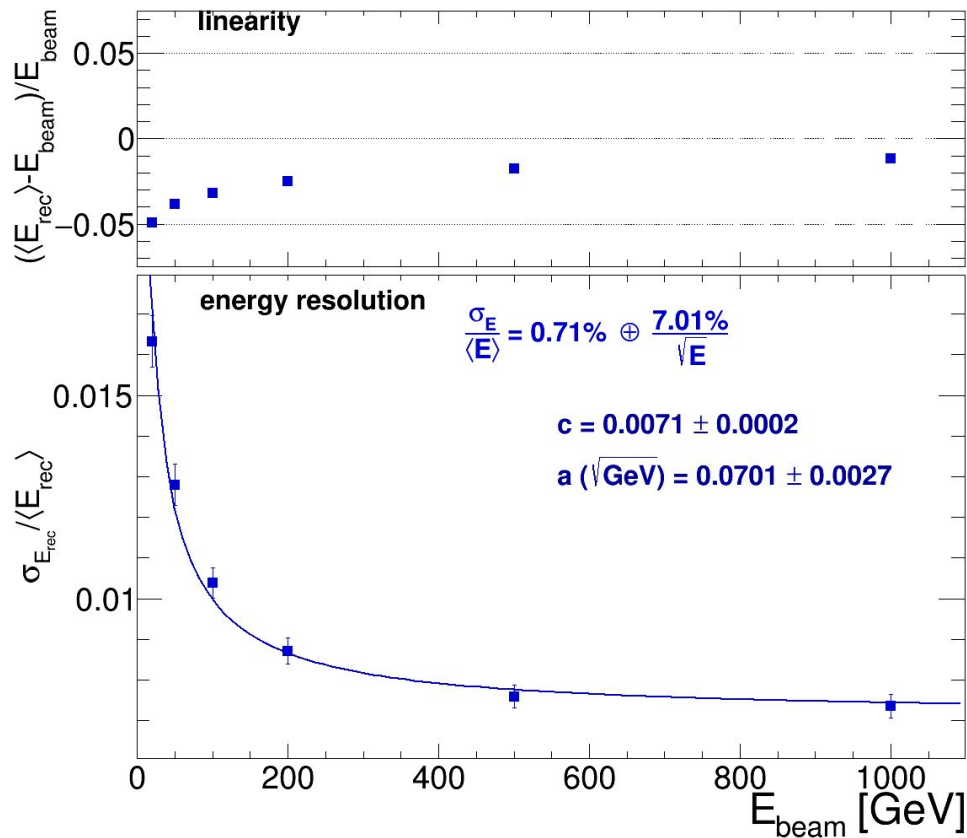
- No noise
- Linearity will be restored with correction for upstream material

- Constant term

$$c = 0.7\%$$

- Sampling term

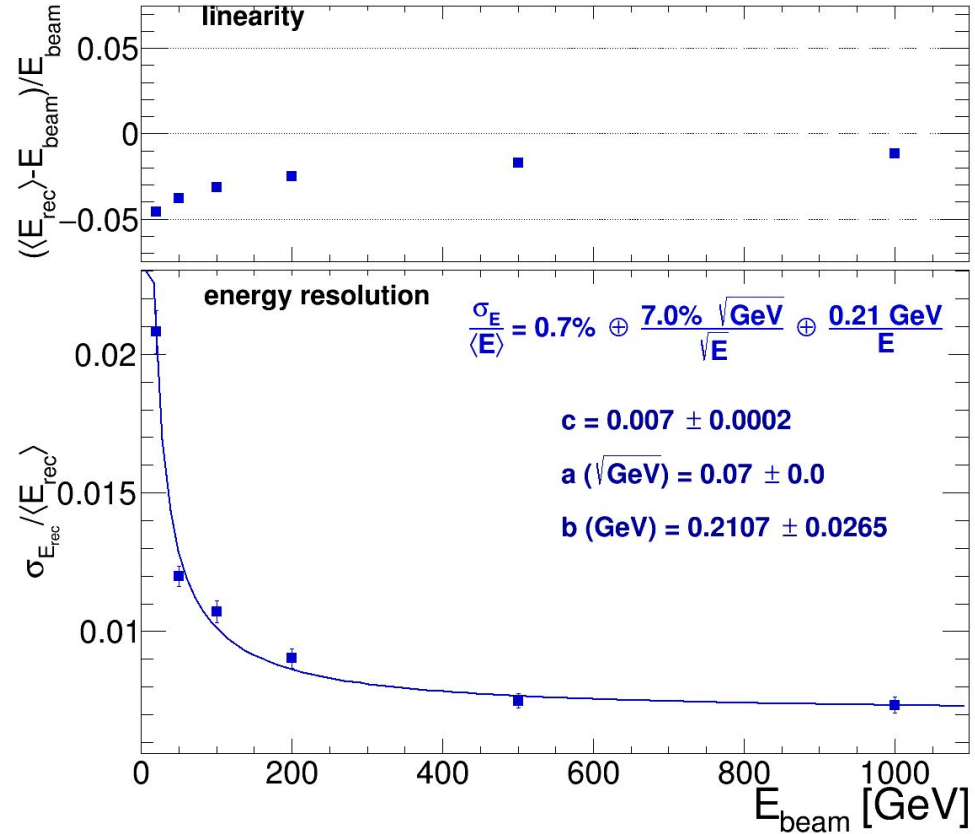
$$a = 7\% \sqrt{\text{GeV}} / \sqrt{E}$$



2 Energy resolution

- Only electronics noise
- **a** fixed to 7% (otherwise it fits to 6.5% and **b** is overestimated)
- Noise term

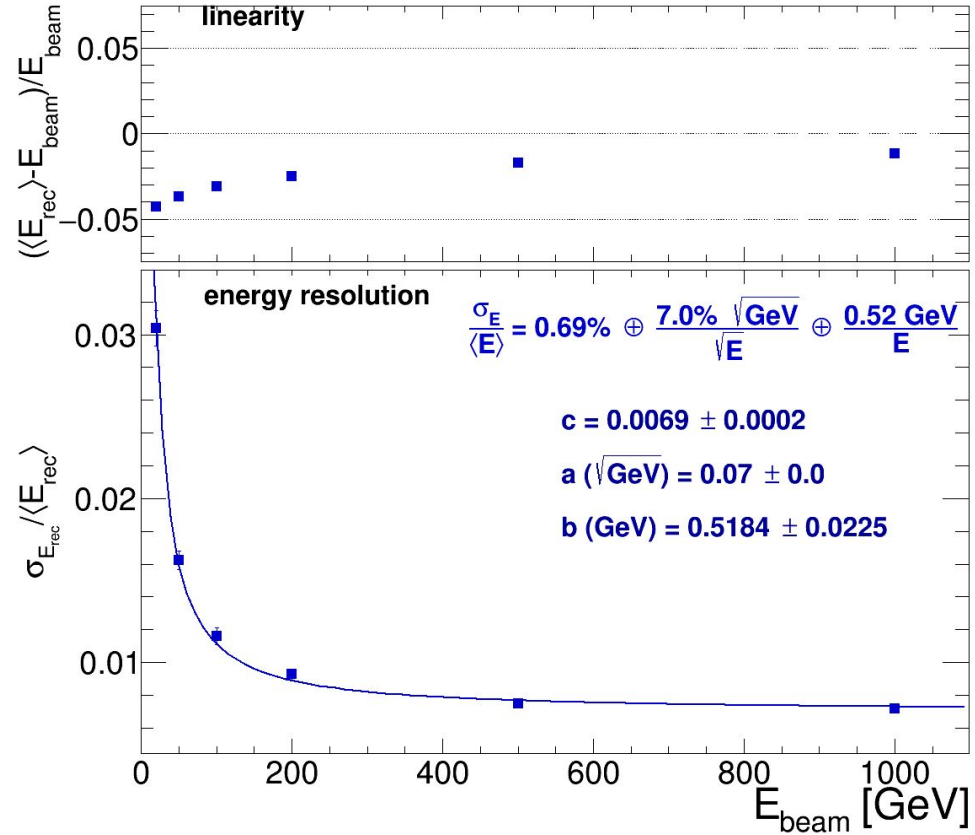
$$b = 0.21 \text{ GeV}/E$$



3 Energy resolution

- Electronics noise
- Pile-up noise per cell
- **a** fixed to 7% (otherwise it fits to 8.4% and **b** is underestimated)
- Noise term

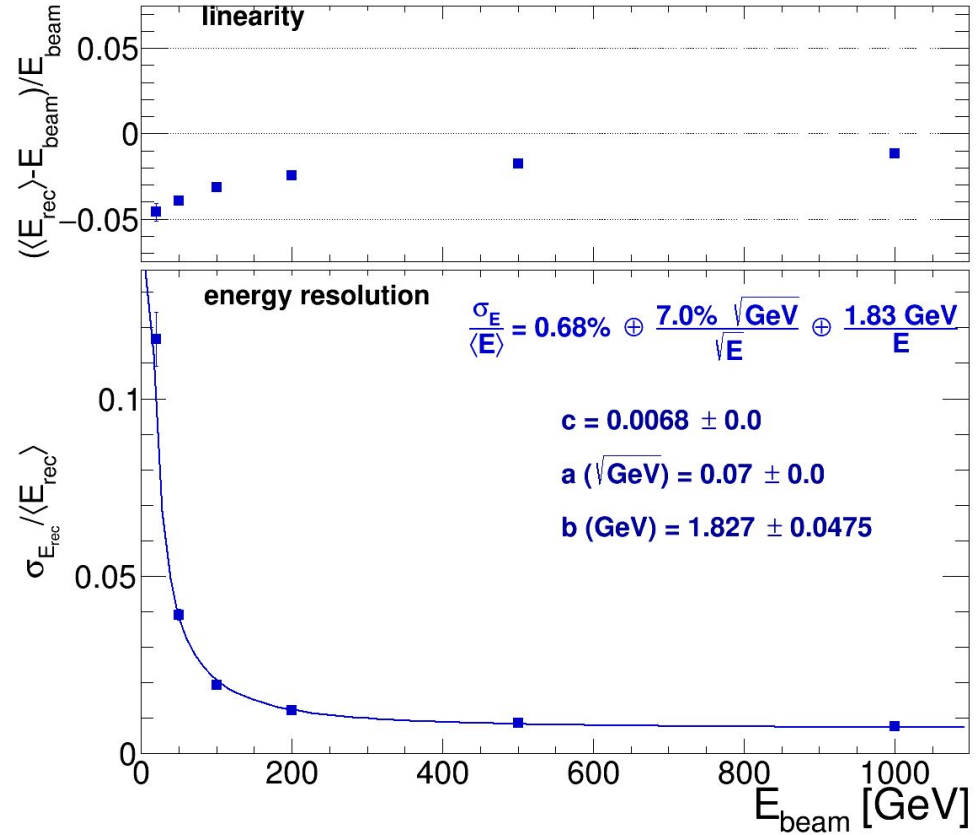
$$b = 0.52 \text{ GeV}/E$$



4 Energy resolution

- Electronics noise
- Pile-up noise per cluster
- **a** fixed to 7% (otherwise it fits to 8.4% and **b** is underestimated)
- Noise term

$$b = 1.83 \text{ GeV}/E$$



New photon energy resolution

