



LumiCal Resolutions

André Sailer

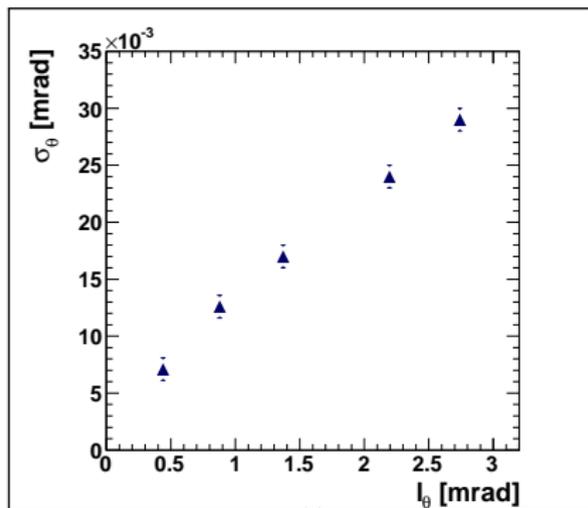
CERN-EP-LCD

FCal Software Meeting
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LumiCal Parameters, expected Performance



- Z: 2539 mm
- Inner Radius: 100 mm, 40 mrad
- Outer Radius: 340 mm, 134 mrad
- Radial cells: 64, 1.47 mrad



From LCD-Note-2009-002, 1.5 TeV electrons, optimized log constant

The Situation

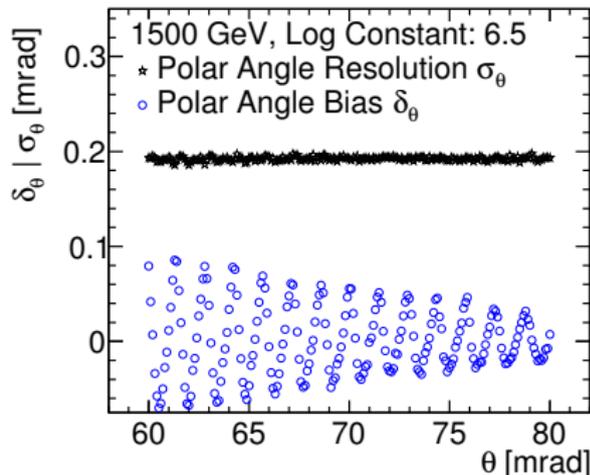


- Polar angle resolution 10 times worse than previously estimated
- Theta calculated from x/y/z average. Energy weighted by

$$\bar{x}_i = \frac{\sum_{\text{Hits}} w_{\text{Hit}} x_{\text{Hit}}}{\sum_{\text{Hits}} w_{\text{Hit}}}$$

with

$$w_{\text{Hit}} = \max\left(0.0, \log\left(C + \frac{E_{\text{Hit}}}{E_{\text{Cluster}}}\right)\right)$$

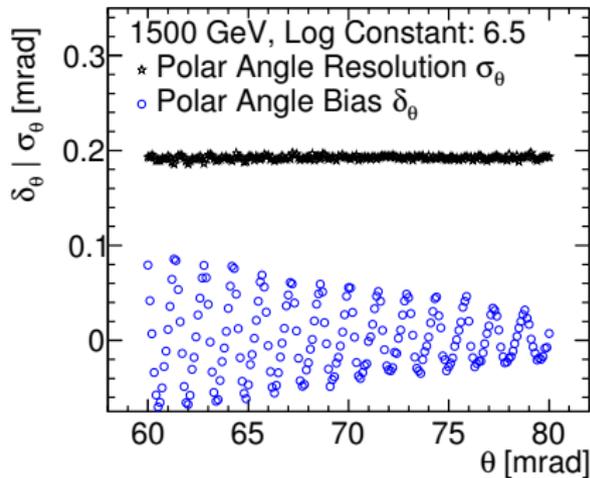


- Multiple places where cluster positions is calculated
 - ▶ Once for clusters for LCIO output: not averaging polar angle
 - ▶ Once for root trees written by processor: averaging polar angle, at least for *Theta* branch
- Re-calculating cluster position from clusters resulted in better resolutions
 - ▶ Discovered by Yorgos: wrong Z position calculated from cellID: wrong unit when reading layer thickness. Off-by-one error: starting layers at 0
 - ★ Also has impact on reconstruction performance, not just resolutions
 - ▶ segmentation offset off by half radial cell width

Resolutions



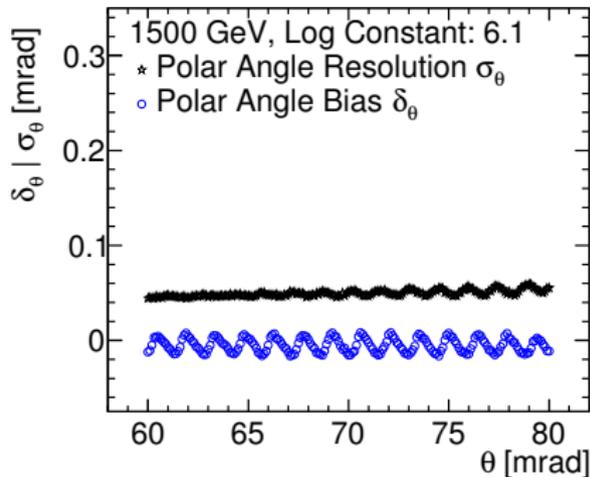
■ Previously



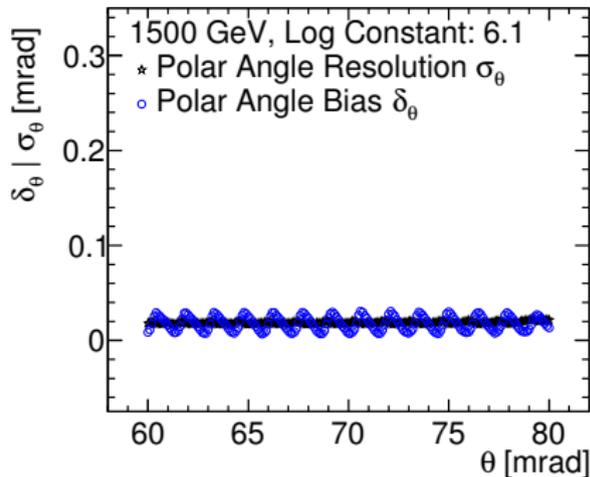
Resolutions



- Previously
- Fix Z-position of layers, fix layer starting with 0, place hit in middle of sensitive



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- Average over polar angle instead of cartesian coordinates



Weighting Cells by cell Area



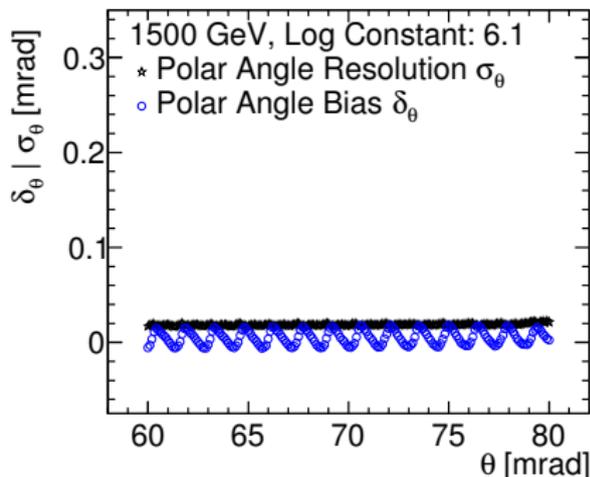
- Cell area grows by radius, larger cells receive larger energy deposit

$$A = R_{\text{cell}} \Delta\phi \Delta R \quad (1)$$

ΔR and $\Delta\phi$ are constant, area only scales by R .

- Scale cell weights with $R_{\text{min}}/R_{\text{cell}}$

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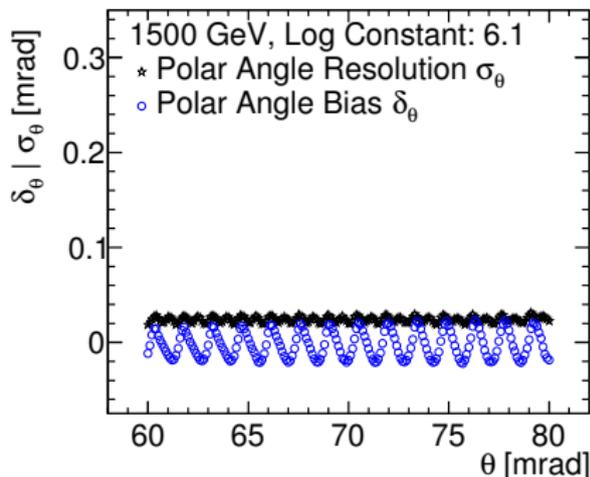
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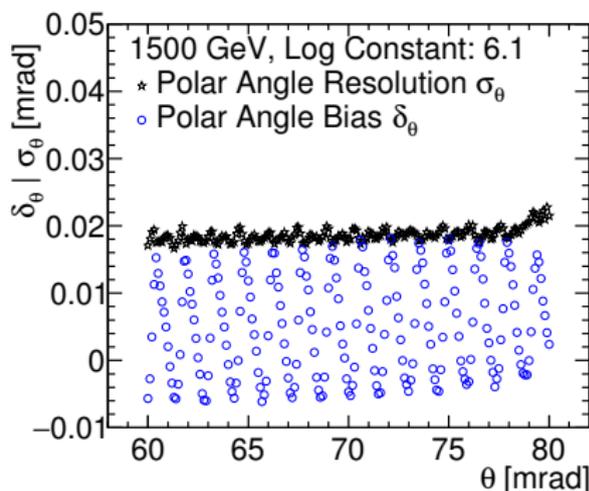
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