

ILD BeamCal reconstruction.

ILD software and analysis meeting

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DESY

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The ILD BeamCal

A few characteristics

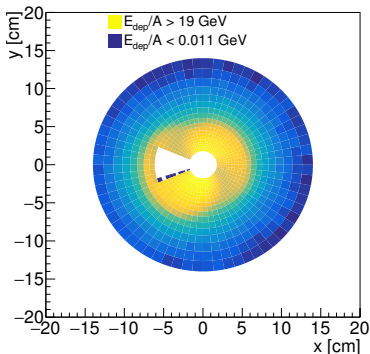
- ECal Si-W sandwich calorimeter
- Main purpose:
 - electron ($\gamma\gamma$) tagging
 - beam diagnostics from the background pattern
- Angular coverage: $\theta \sim [6, 45]$ mrad
- Crossing angle: ~ 14 mrad
- Segmentation:
 - polar grid in ϕ
 - Cell R size: from 2 to 13.7 mm
- 30 layers: total thickness ~ 20 cm

Dedicated reconstruction algorithm

- Overlay beam background (ROOT file)
- Reconstruct showers
- BeamCalClusterReco processor
→ FCALSW/FCalClusterer (mainly CLIC)

More documentation in CLIC note:

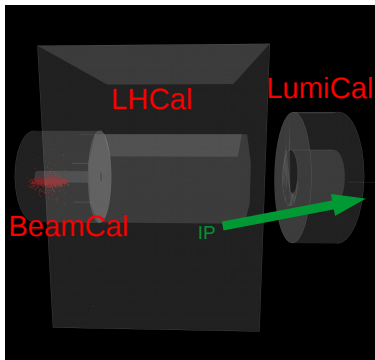
<http://cds.cern.ch/record/2227265/files/BeamCalReco-Note-2016-005.pdf>



BeamCal cluster reconstruction

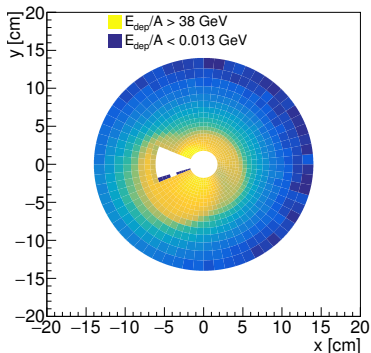
Setup

- Currently not run in ILDConfig
 - re-activating
 - re-investigating reconstruction
- iLCSoft v01-19-05
- ILD_I5_v02
- Use BeamCal background maps from previous study by S. Lukić
 - With nominal Anti DiD
 - Without Anti DiD
 - (See next slide)
- Single particle reconstruction
 - Use ddsim particle gun
 - 50 GeV electrons
 - Flat θ distribution
 - Statistics: 10000 events

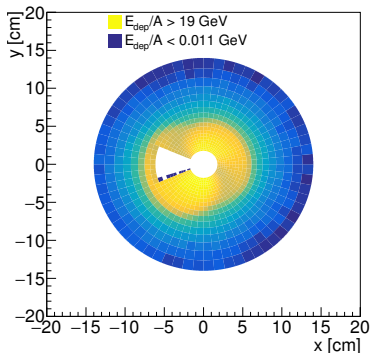


BeamCal cluster reconstruction

Background maps (S. Lukić)



NO Anti DiD



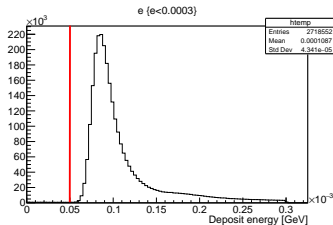
Nominal Anti DiD

Don't pay attention to numbers but to the ratio
→ Factor 2 on background in the central region !

BeamCal cluster reconstruction

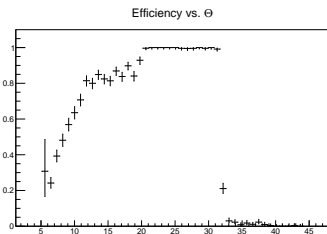
BeamCalClusterReco processor parameters

- Original settings from v01-17-11 (M. Habermehl)
 - Study done with old L*
 - Optimized for maximum efficiency
 - Never looked at energy calibration
 - Digitizer run before reco
 - Give digitizer output to BeamCal reco
 - Geometry change:
 - v01-17-11 → Fixed cell size per ring
 - v01-19-05 → Fixed ϕ segmentation
- Re-adjusted a few parameters to fit the current reco
 - No digitizer before reco
 - Give SimHits as reco input
 - Need to re-adjust energy-related parameters
 - ETPad = 5.10^{-5} GeV, from MIP scale
 - ETCluster = 0.06 GeV (non-calibrated), rescaled from v01-17-11
 - LinearCalibrationFactor = 72, same as v01-17-11
 - Shower reconstruction parameters left untouched

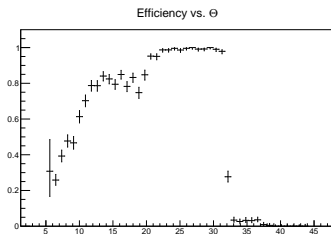


BeamCal cluster reconstruction

Reconstruction efficiency



NO Anti DiD



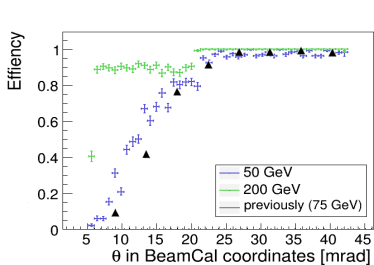
Nominal Anti DiD

- Nice efficiency
- Looks better without Anti DiD ...



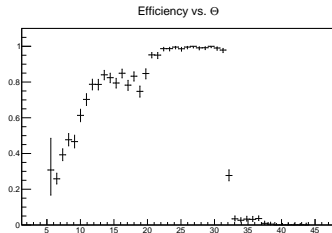
BeamCal cluster reconstruction

Reconstruction efficiency



Mokka world (old L*)

M. Habermehl



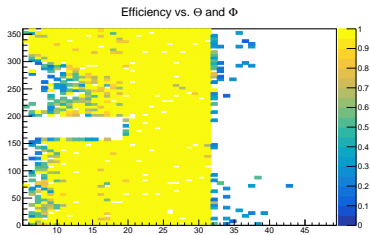
Nominal Anti DiD

- Efficiency comparable to previous studies

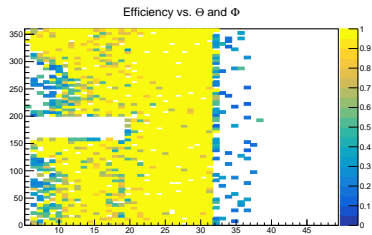


BeamCal cluster reconstruction

Reconstruction efficiency (2)



NO Anti DiD

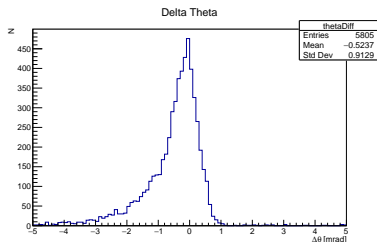


Nominal Anti DiD

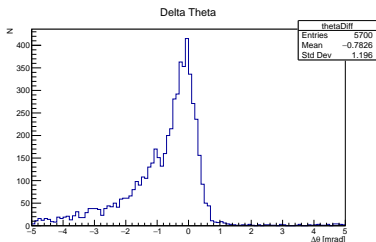


BeamCal cluster reconstruction

MC / Reco θ angle



NO Anti DiD



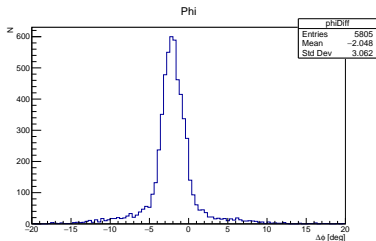
Nominal Anti DiD

- Nominal Anti DiD
 - additional BField adds curvature to particle
→ $\Delta\theta$ distribution wider

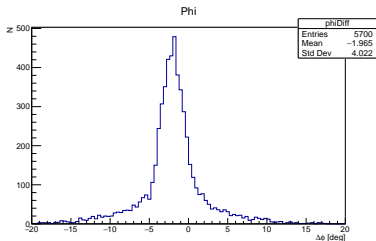


BeamCal cluster reconstruction

MC / Reco ϕ angle



NO Anti DiD



Nominal Anti DiD

- Nominal Anti DiD
 - additional BField adds curvature to particle
→ $\Delta\phi$ distribution wider



BeamCal cluster reconstruction

Conclusion

- BeamCal reconstruction (re-)investigated
- Will be (re-)activated soon in ILDConfig (PR pending)
- Shown today:
 - Nice reconstruction efficiency (efficiency VS θ)
 - No fake showers ($< 10^{-3}$)
 - (A bit) better results without Anti DID
 - Results comparable to Mokka world
- Not shown/studied:
 - Reconstructed energy
 - Need to tune `LinearCalibrationFactor`
 - ILD_s5_v02 reconstruction
 - No realistic BField map yet

