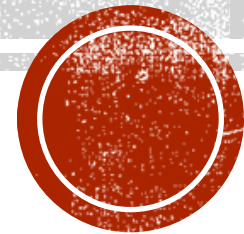


bHCAL Meeting — Neutron Calibration Update

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04/10/2026



OVERVIEW

- Updated bHCAL geometry
 - Removed chimney tiles from current geometry
- Background studies status

CHIMNEY SECTOR GEOMETRY

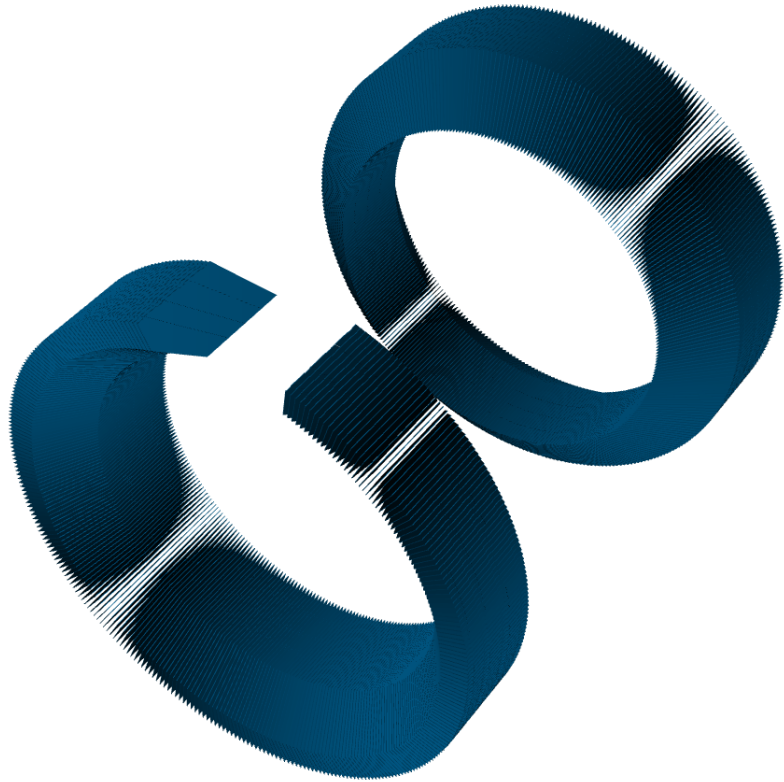
FULL bHCAL GEOMETRY

- Full bHCAL geometry
- No changes to the sectors yet
 - New gdlm files for new chimney sectors should be available soon

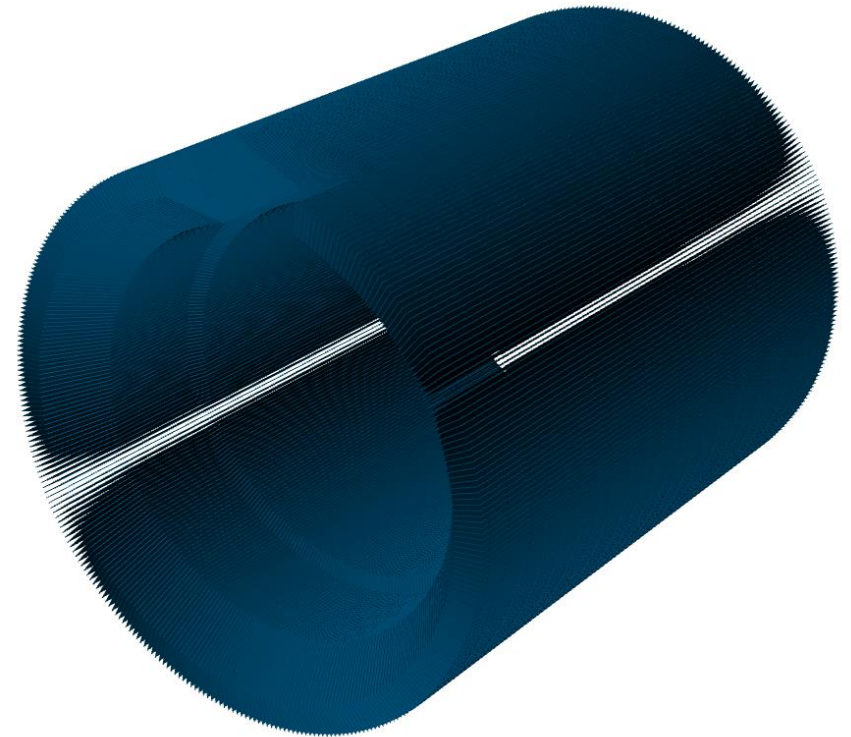


CHIMNEY TILES

Four outer tile rings

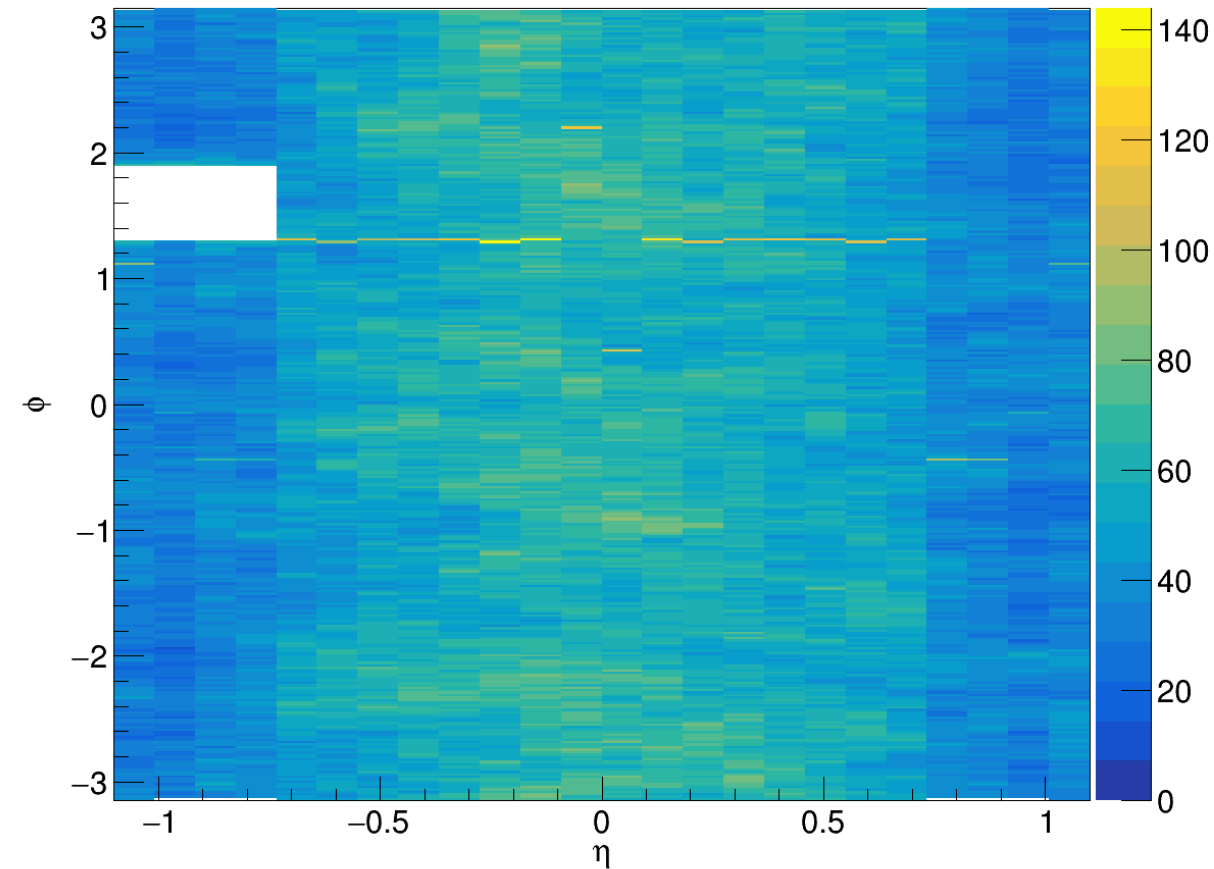


All bHCAL tiles



NEW η VS. ϕ MAP

- Tile-by-tile hits in bHCAL with new geometry
 - Chimney tiles removed
- Simulation setup
 - bHCAL only geometry
 - 10k Single neutrons at 2 GeV/c
 - $\cos \theta$ distribution, $33.5 < \theta < 146$ deg
- New geometry in separate branch of epic
 - Pull request after we get new sectors
 - https://github.com/eic/epic/tree/bHCAL_new_geometry



BACKGROUND STUDY

BACKGROUND OVERVIEW

- Energy resolution vs. E and η
 - **Challenge:** Do not have calibration, so determination of resolution in physics events challenging
- Efficiency vs. E and η
 - Standard efficiency, using MC information?
- Efficiency in neutron detection/identification vs. E
 - **Challenge:** Do not have neutron identification algorithm
- Spatial resolution
 - Should be possible from MC matching and comparing true MC η vs. ϕ and RC η vs. ϕ from clusters
 - **Challenge:** MC to RC matching mainly for clusters and clustering may not be reliable.
 - Probably see more clusters associated with one MC particle. Currently investigating.

BACKGROUND OUTLOOK

- Energy resolution vs. E and η
 - **Temporary solution:** Try implementing MC based framework in bins of energy, rather than for specific MC energy?
 - Use tracking for charged particles, MC info for neutrons
 - Bins with central value at current MC neutron momenta: (1, 2, 5) GeV/c
- Efficiency vs. E and η
 - Efficiency definition: $\varepsilon = \frac{N_{bHCAL,match}}{N_{MC}}$
- Efficiency in neutron detection/identification vs. E
 - **Temporary solution:** Use MC matching to estimate the detection efficiency, put identification as future prospect.
- Spatial resolution
 - **Temporary solution:** Use current implementation in EIC recon
 - Resolution width of following distribution: $R_\eta = \frac{\eta_{MC} - \eta_{clust}}{\eta_{MC}}$ (and same for ϕ)

SUMMARY

- Updated bHCAL geometry
 - Removed chimney tiles
 - Waiting for new chimney sector gdml files
 - Pull request after we get new sectors
 - Current version available at github:
 - https://github.com/eic/epic/tree/bHCAL_new_geometry
- Working on background studies using central DIS files with and without background

THANK YOU FOR ATTENTION