



Event Display Tool + (Very Quick) ECAL Hit Studies

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Introduction to Problem

- Observe significant degradation in photon/neutron reconstruction performance with new v0.8 (EU24) lattice:
 - High fake rate (e.g. BIB reco higher than no BIB reco)
 - Poor BIB resolution (salvaged by "truth assisted" which indicates we can do better!)
- We need to re-think calorimeter object clustering: I started with a low-level, event-by-event approach...



Event Display Tool

https://gitlab.cern.ch/kikenned/EventDisplay



Event Display Tool: Adapted for MAIA + BIB

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Inputs:

- Two input ROOT files with1:1 event mapping:
 - With BIB
 - Without BIB
 - Made via <u>lcio2root.py</u>
- Config json











Photon Gun: ECAL Hit Distributions

- Hit energy spectrum without BIB softer than with BIB, with mode of BIB energy ~ 0.2 GeV
 - This almost looks like an artifact of pre-processing, clearly noBIB samples have a cell threshold of ~ 0.1 GeV
- Hit times without BIB very close to 0 with width ~ 10-15 ps is this a realistic timing resolution?



Neutron Gun: <u>ECAL</u> Hit Distributions

- No-BIB hit distribution for neutrons slightly softer than for photons (as expected)
 - This almost looks like an artifact of pre-processing? Clearly noBIB samples have a cell threshold of ~ 0.1 GeV
- Hit times without BIB have a much broader tails, but with similar core timing distribution width ~10-15 ps



Impact of Timing Cuts on Total ECAL Event Energy

Photon Gun

 (No BIB) Hard cell timing cuts for photon energies as low as ~10 GeV have minimal impact on energy scale/resolution → good!

Neutron Gun

 (No BIB) ECAL energy contributions from hadronic objects not as robust against hard timing cuts, moderate expected impact on energy/scale resolution (from ECAL) → OK



Conclusions + Open Questions

- If you're interested in using the Event Display tool and have questions/issues please let me know :)
- We **must** start implementing timing cuts into our object reconstruction (...towards 5D calorimetry!)
 - For photons/ECAL, expect minimal impact on energy scale and resolution for no BIB samples
 - I propose starting with 0.2 ns symmetric cuts on ECAL hits and re-running photon clustering + perf plots
 - Analogous plan for neutrons see results from Rose

• Additional considerations:

- Shorter term:
 - How easy is it to re-run reco/clustering step for existing samples? E.g. repeatedly for different reco algos
 - Is the 200 ps timing cut realistic? I would say anything O(50-500 ps) is probably reasonable
 - May need to re-run energy calibration(s) with timing cuts, at least for ECAL contributions to hadronic activity
- Longer term:
 - Does our MC reasonably match "realistic" timing, or do we need to apply smearing?
 - How does OOT BIB impact cell timing?
 - Symmetric vs asymmetric timing cuts, global cut vs cluster-seed based cut
- Other thoughts/ideas very welcome!