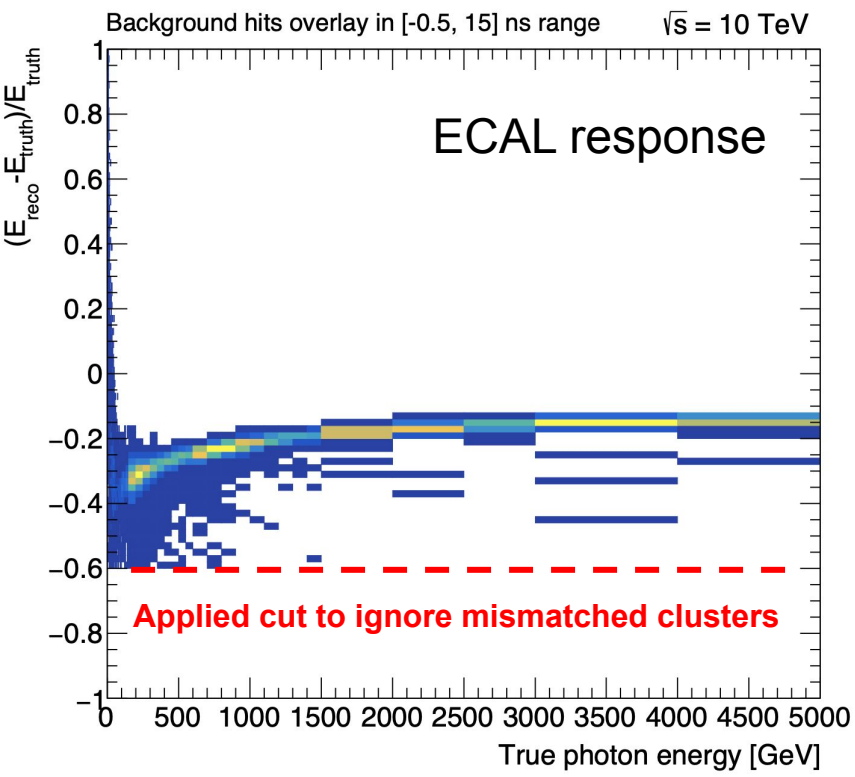
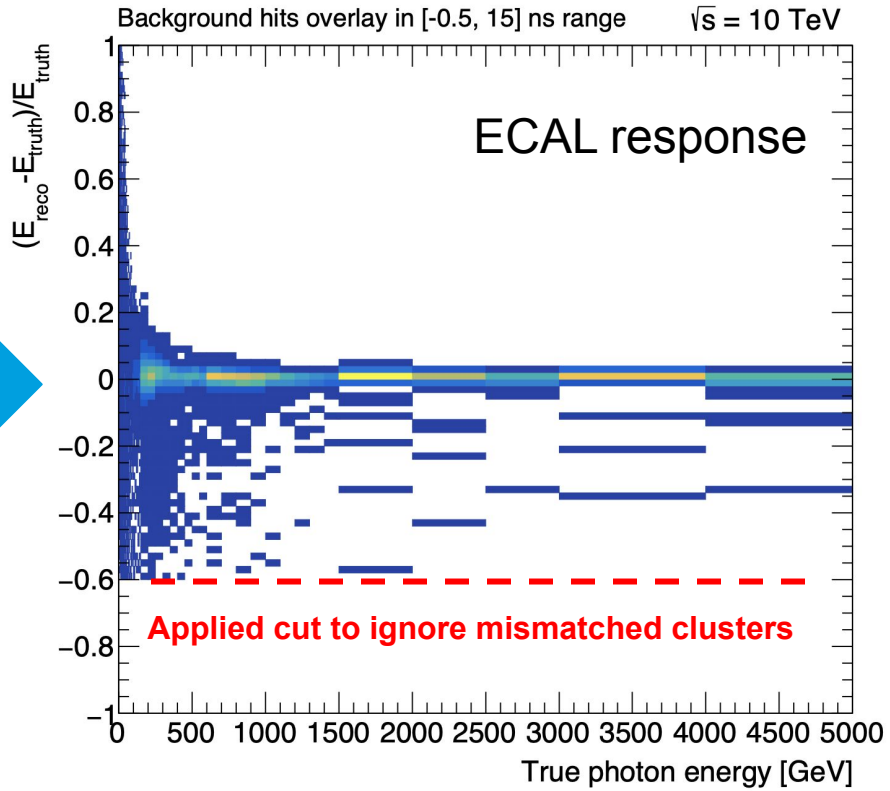
Intro and miscellanea

Federico Meloni (DESY)
Ben Rosser (University of Chicago)

Informal detector team meeting 14/12/2023

Photon calibration





Applying these thresholds induces a non linearity that can be corrected

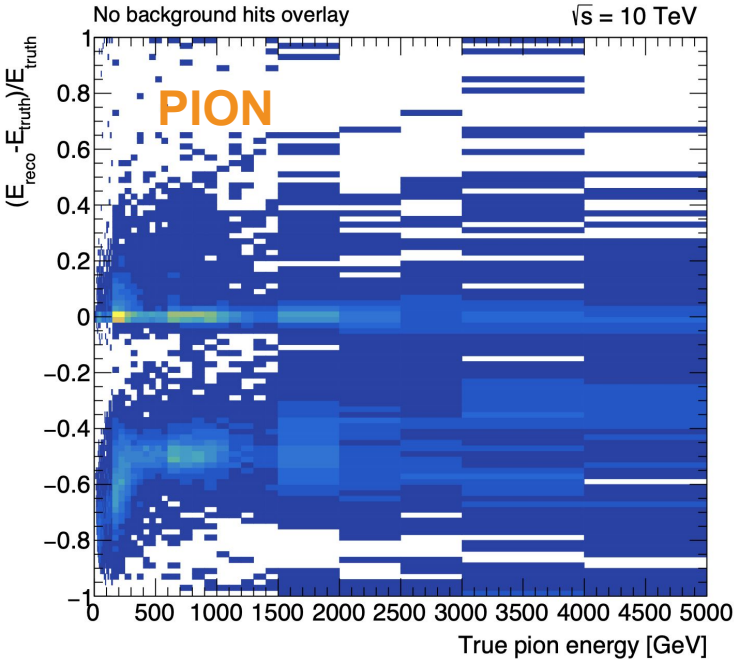
- Implemented custom pandora plugin in key4hep for ECAL calibration
- **Important to reduce BIB flux in calorimetry to minimise fluctuations at low energy**

HCAL calibration

We can follow the same strategy

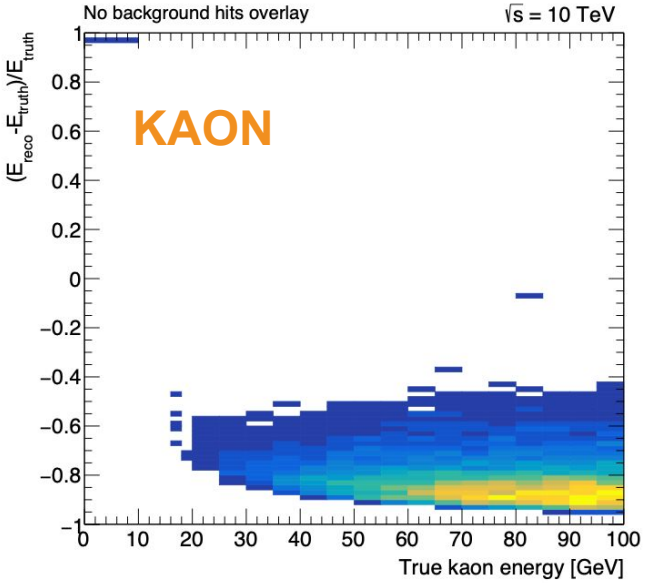
Pion gun (top) need some care:

- PFO energy taken from track when matched



Produced k_L sample - still a bit challenging

- ECAL and HCAL clusters are assigned to separate PFOs
- Used anti kt 4 jets to group the clusters → response on the right



Possible bug in HCAL cell calibrator plugin

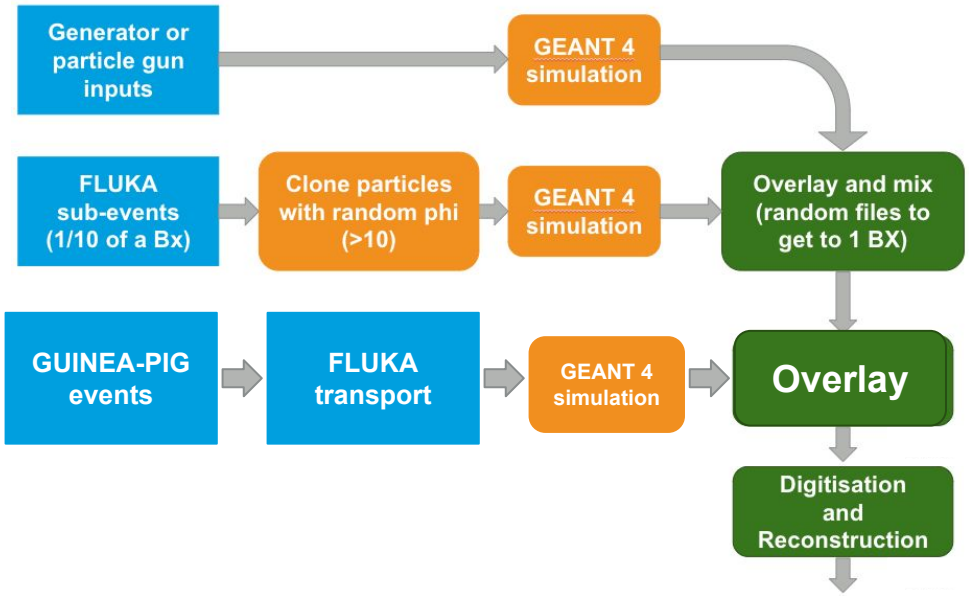
- Thomas on the case - though he disagrees with me

Pipeline for incoherent pair production

Mostly a technical check of the workflow

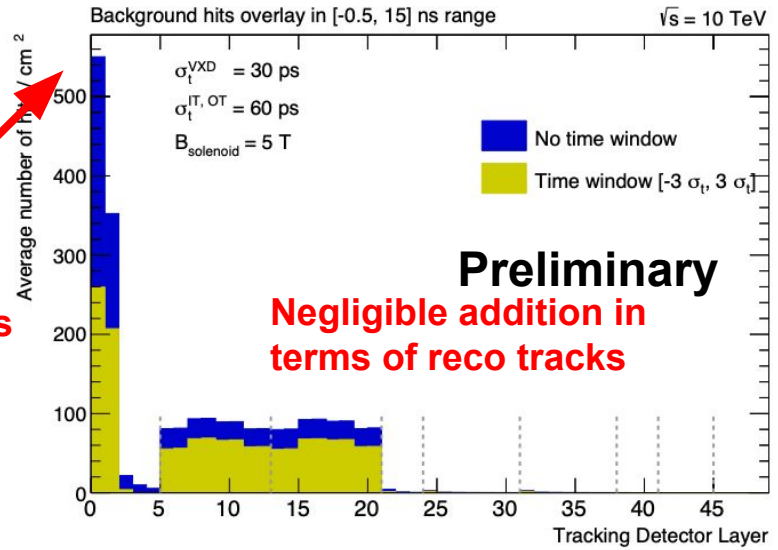
Daniele / Daniel shared a very preliminary set of predictions from GUINEA-PIG+FLUKA (4 full BXs)

- Very similar format as BIB files (minus the information on the muon decays)



Prepared:

- Conversion scripts
- Overlay machinery
- Processing pipeline



This would bring us ~30% above target occupancy.
Not a disaster

Key4hep-based image

https://hub.docker.com/r/madbaron/k4test-ubuntu

docker pull madbaron/k4test-ubuntu

docker run -it -e DISPLAY=$IP:0 -v /path/to/local/data:/data --rm madbaron/k4test-ubuntu

source setup.sh

Added ECAL energy corrections

- **HCAL technically too**

Make sure you grab the latest version!

Updated detailed instructions at https://docs.google.com/document/d/1YBCttRKfxUpVErEqADR5hXOZUmc6VIaH2huvRIcrOjo/edit?usp=sharing

Activities status - quick roundtable

Occupancies:

- trackers **DONE**
- calorimeters **DONE**
- Source of calorimeter hits in cell vs E, time

Tracks: - UChicago WIP

- reco efficiency vs pT, eta
- fake rate vs pT, theta
- Track momentum resolution
- impact parameters resolution

Electrons:

- reco efficiency vs pT, eta [Adam Vendrasco is having a look at this]
- energy resolution vs E, eta

Photons:

- reco efficiency vs E, theta **DONE - to be updated with fixed BIB**
- energy resolution vs E, eta **DONE - to be updated with fixed BIB**

Muons:

- reco efficiency vs pT, eta
- pT resolution vs pT, eta

Jet:

- multiplicity [Ben Johnson is having a look at this]
- selection efficiency vs pT, eta
- energy resolution vs pT, eta

Taus:

- reco efficiency vs pT, theta [Rose and Sergo]

Thank you!

BIB overlay updates

Got new set of high-statistics BIB files from Daniele (Thanks!!)

- Now 1/10 of BX (up from 1/100). “Ordered” another 2x for the other beam

Opportunity to implement better treatment of overlay

Previous scheme:

- Generate ~100x particle clones per incoming particle, randomizing phi
- Overlay the same 1060 pseudo-events (i.e., all) to all events
- Trust the digitisation smearing to make things independent enough (sub-optimal for Calorimeters, where position is fixed by the cell)

New scheme:

- Generate ~40x particle clones per incoming particle, randomizing phi
- Overlay a random subset of 260 pseudo-events (i.e. ~¼ of the total)
- Digitisation-related smearing is the same

Seems to be working well:

- average number of “BIB jets” per event went from 67 to 11

Links

Documentation
Google doc with notes, list of tasks
Muon Collider Software Tutorial
Shared Overleaf
Key4Hep Documentation
LCIO Documentation

Snowmass Connect Documentation

Data files: /tank/data/snowmass21/muonc/fmeloni

Communication channels:

#10tev-simulations channel on SCHEMA slack.

muoncollider-detector-physics@cern.ch IMCC egroup for physics and detector