Pion rejection factor in SciGlass ECal

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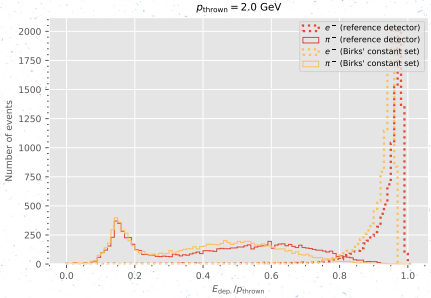
Scintillation quenching

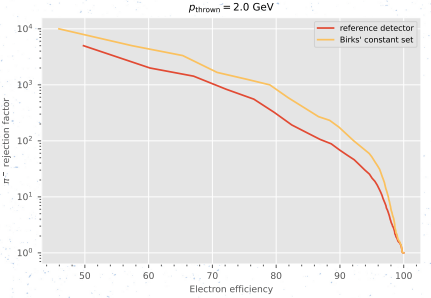
Scintillation quenching without optical simulations in G4

When measuring deposited energy one does not expect to be sensitive to scintillation effects, yet:

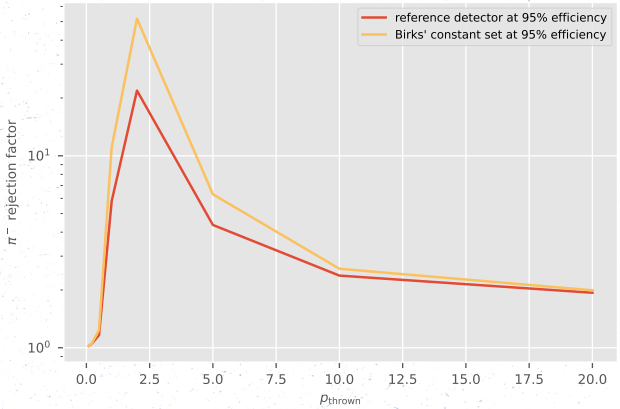
- Birks' law correction is enabled by DD4hep for detectors processed with `Geant4ScintillatorCalorimeterAction`: see Geant4SDActions.cpp of DD4hep – This uses optional Geant4 facilities
- Log message "`### Birks coefficients for Geant4 materials`" should be a good indicator that Birks' constants are applied
  see Geant4StepHandler.cpp of DD4hep, see G4EmSaturation.cc of G4
- Calorimeters are `Geant4ScintillatorCalorimeterAction` by default
  `DDG4 INFO +++ EcalBarrel type:calorimeter --> Sensitive type: Geant4ScintillatorCalorimeterAction`
- Official production log have those messages ⇒ Birks' law is applied to SciGlass!
- Constant value of 0.0333 mm/MeV is not measured, taken from PbWO4

Birks's law effect on pion rejection



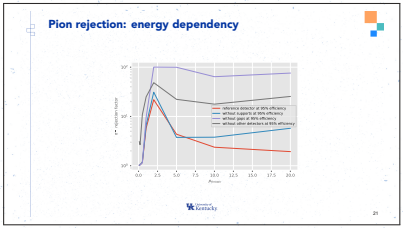


Pion rejection: energy dependency



Erratum for last presentation

Bug in previously shown results



`https://indico.bnl.gov/event/17706/`

Minor issue with the "without other detectors" curve:

- Was supposed to remove all detectors other than calorimeter and keep the magnetic field
- Configuration files from "no gaps" were used by accident with the intended "`epic_sciglass_only`" configuration
- As a result, detectors were removed, but calorimeter was simulated without gaps and without magnetic field

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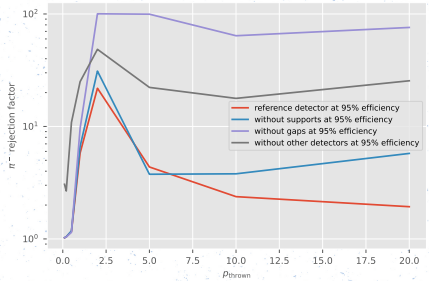
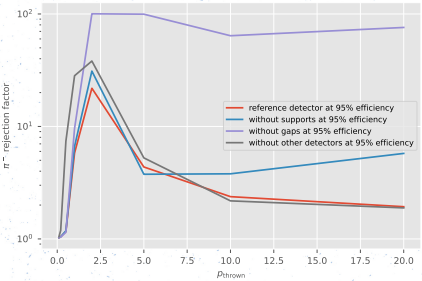
Pion rejection: energy dependency

With bug:



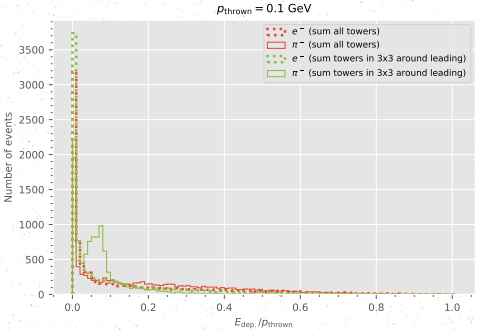
Without bug:

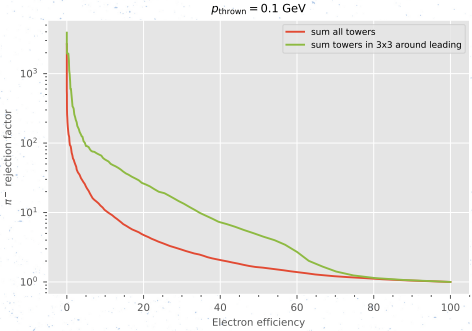


Corrected slides uploaded back to Indico.

Proto-clustering for pion rejection

Pion rejection (0.10 GeV)





» sum all towers - sum of raw $E_{dep.}$ for all 7920 towers

» sum towers in 3x3 around leading - sum of raw $E_{dep.}$ 9 towers around the one with the highest energy

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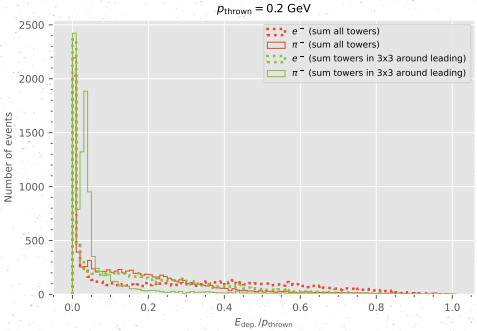
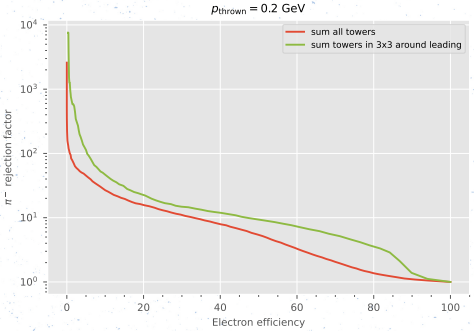
Pion rejection (0.20 GeV)





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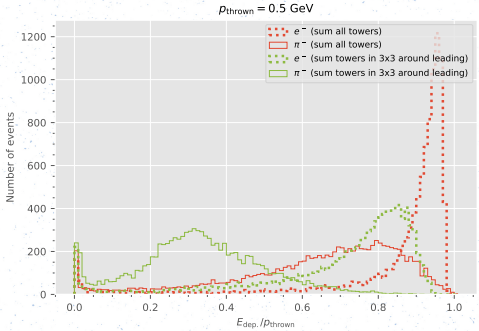
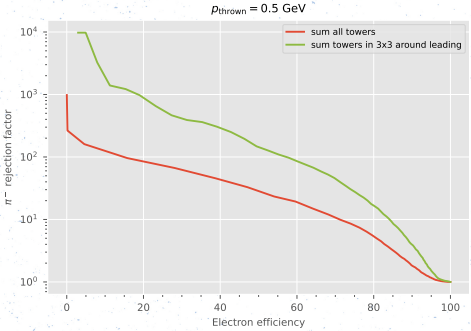
Pion rejection (0.50 GeV)





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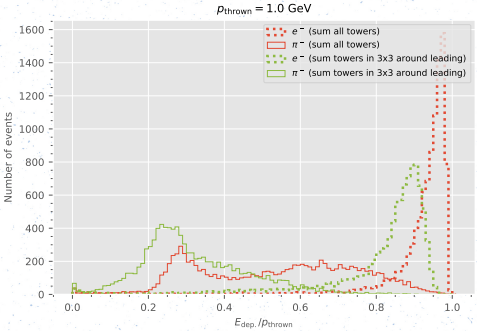
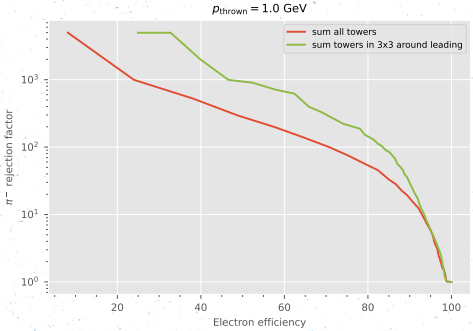
Pion rejection (1.00 GeV)





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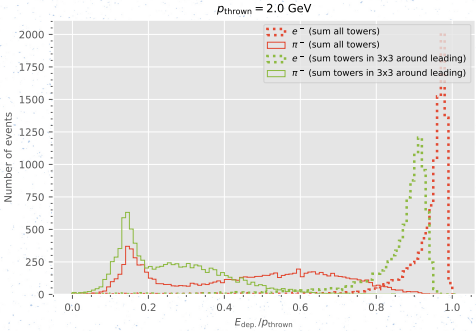
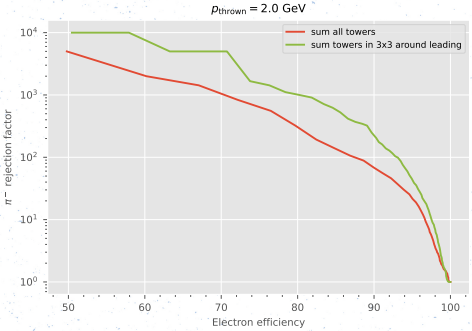
Pion rejection (2.00 GeV)





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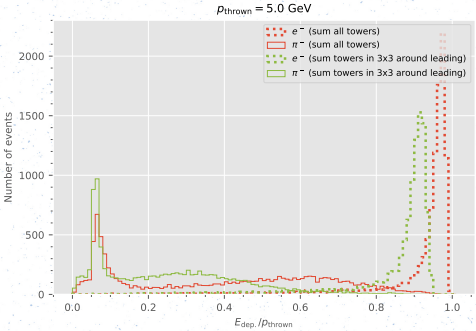
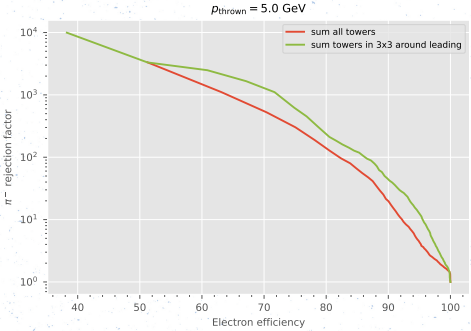
Pion rejection (5.00 GeV)





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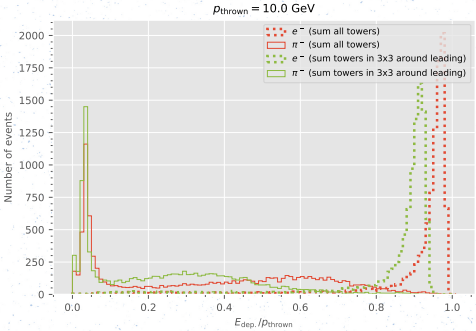
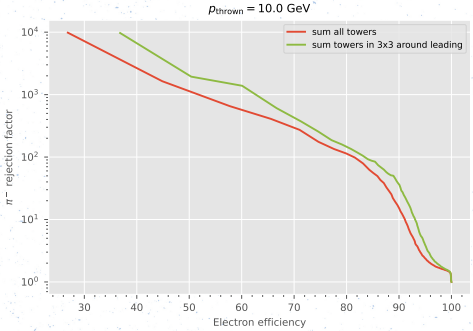
Pion rejection (10.00 GeV)





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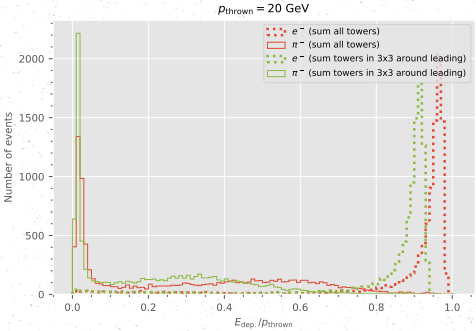
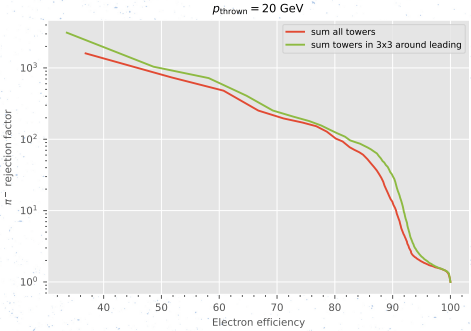
Pion rejection (20.00 GeV)





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Pion rejection: energy dependency