Simulation of CALICE Tile Hcal within Mokka

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ECFA Study
Physics and Detectors for a Linear Collider

- Introduction
- Features of Implementation
- Studying G4 hadronic models

Durham/UK September 2004

Introduction

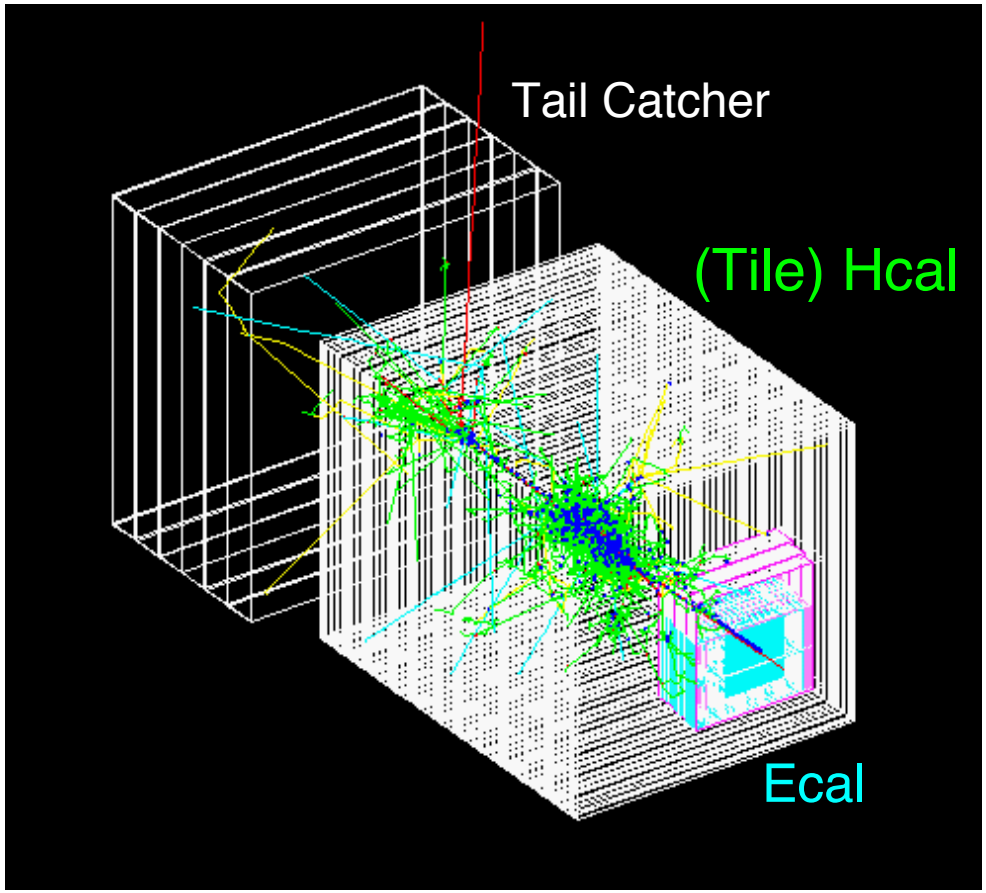
CALICE collaboration is preparing large scale testbeam (See CALO session)

Simulation studies are part of testbeam program

- Confront existing 'hadronic' models with precision data

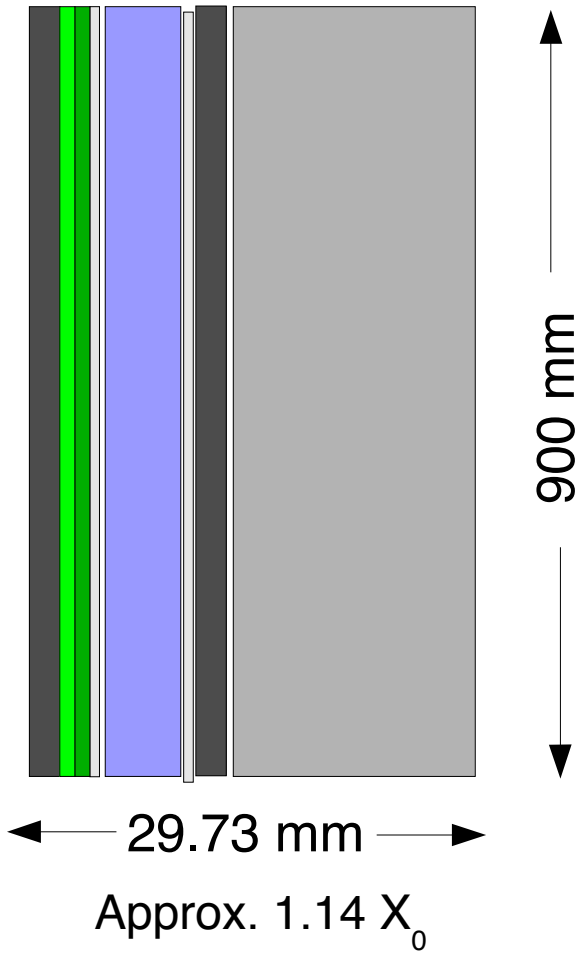
- Development of dedicated particle flow algorithms for LC physics

Simulation is to be developped within LC Collider software framework



Complete testbeam setup available in Mokka

Layer Composition of Tile Hcal



Approx. 1.14 X_0

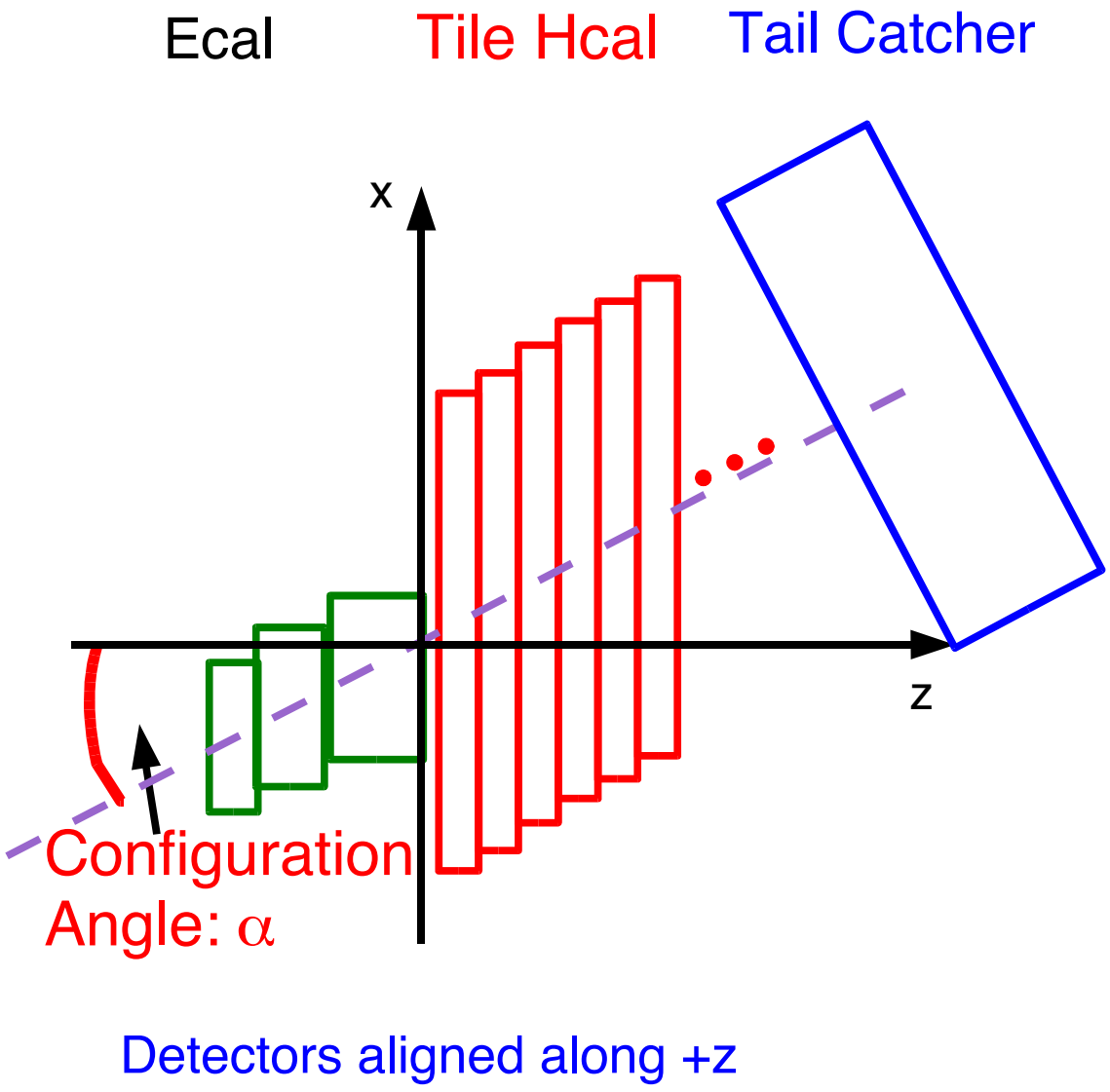
39 Layers implemented

Approx. 4.7 λ_I

- 16 mm Steel, S235 (Main Absorber)
- 1 mm Air Gap
- 2mm Scintillator Housing – Front Plate
- 0.115 mm 3M Foil
- 5 mm Scintillator
- 0.115 mm 3M Foil
- 1 mm FR4
- 1.5 mm Cable-Fibre Mixture (PVC, Fibre Air Mix)
- 2 mm Scintillator Housing – Rear Plate
- 1 mm Air Gap

Implementation as realistic as possible

Implementation Issues



Detectors aligned along +z

- Implementation allow for different configuration angles

  The layers of the detectors are shifted and the beam is rotated

  - HCAL/Catcher will be freely rotatable

  - fixed predefined config. angles for combination with Ecal

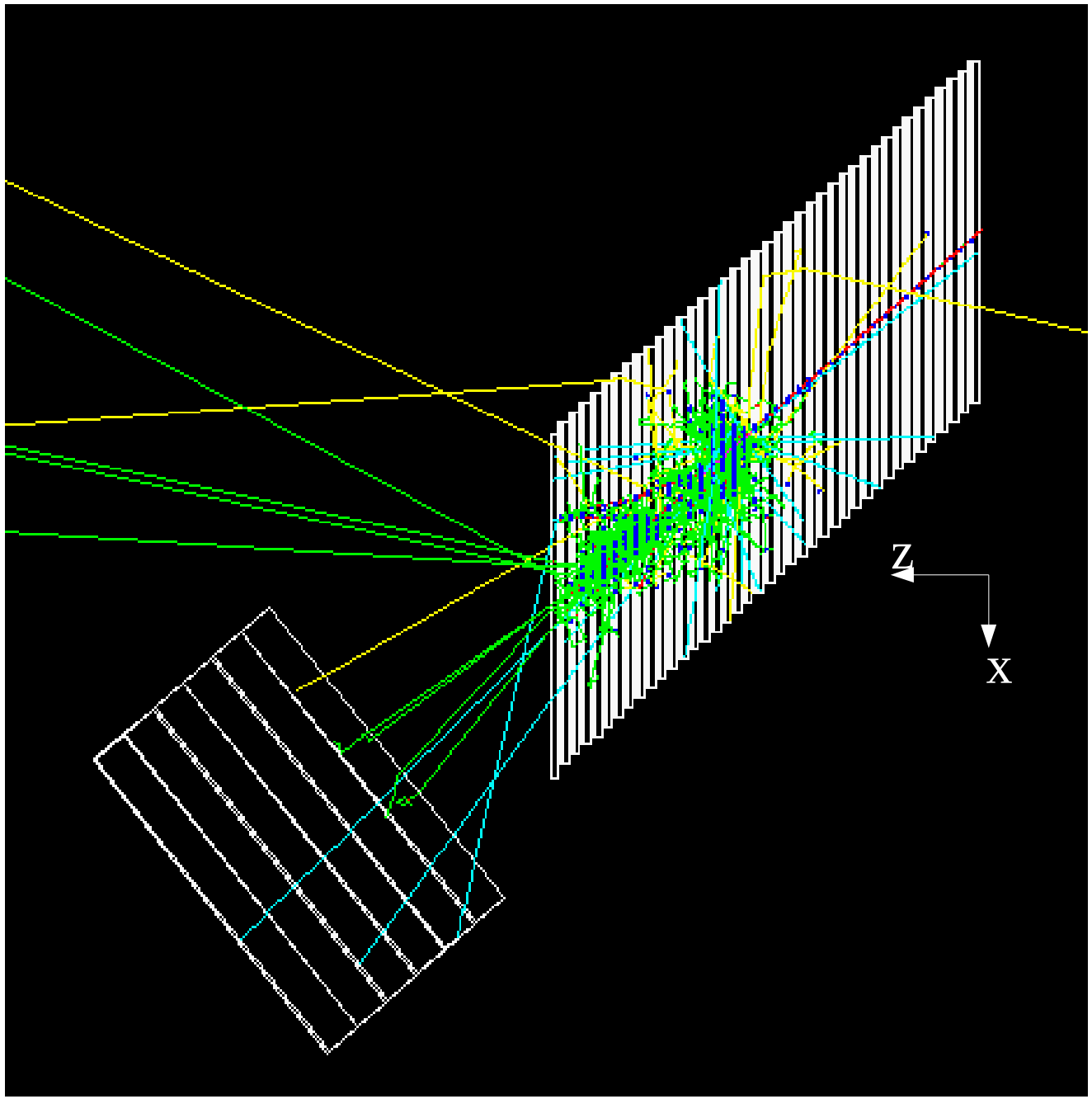
- Implementation is part of current Mokka release Mokka 03-02

  Geometry/tbeam area:
  names ...03... (e.g. Tbhcal03.cc)

- Communication of parameters between drivers ?

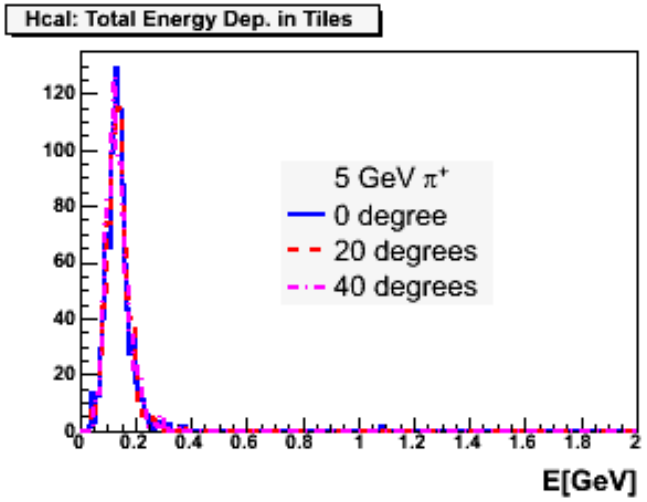
=> (careful) Revision of Mokka concept needed !?

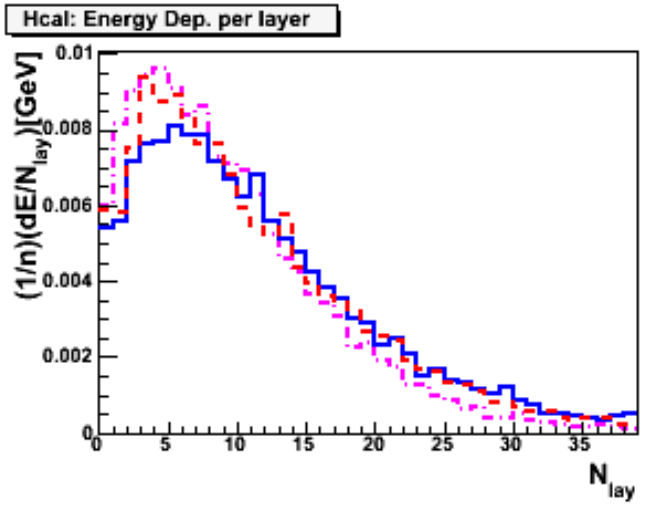
A Simulated Event



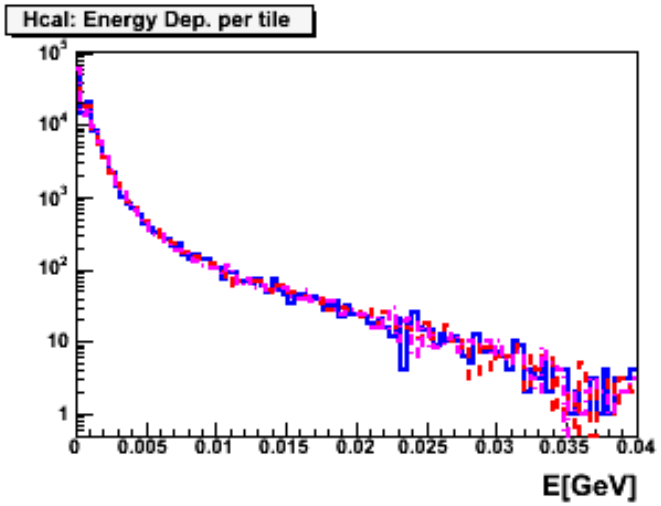
First Look at results with rotated detectors

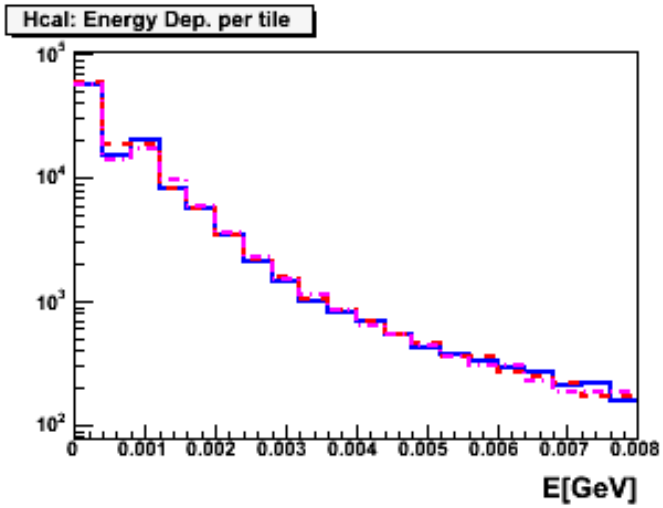
Energy deposition in Hcal





Longit. Shower Max. vary with impact angle





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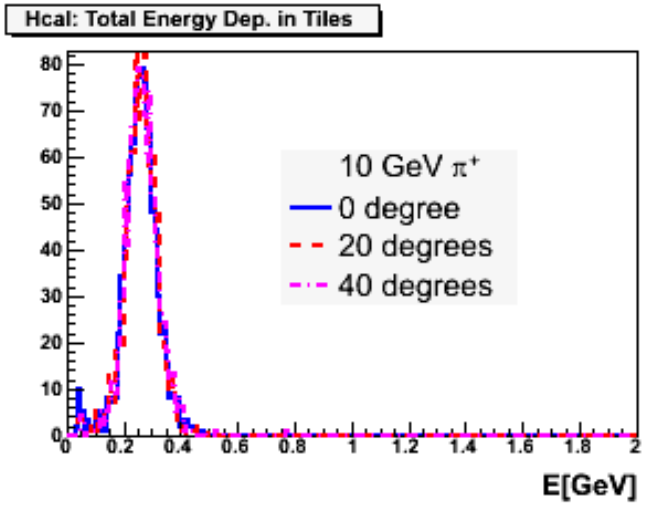

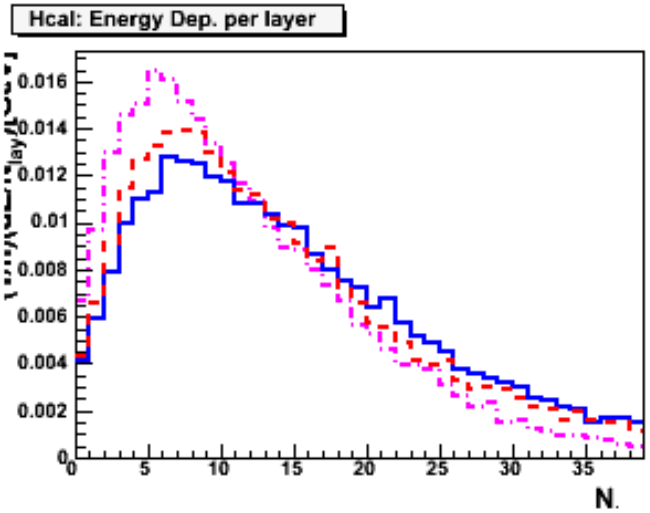

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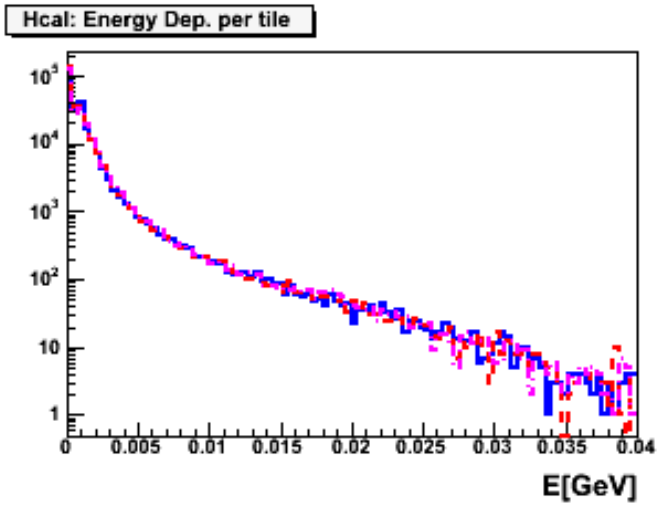

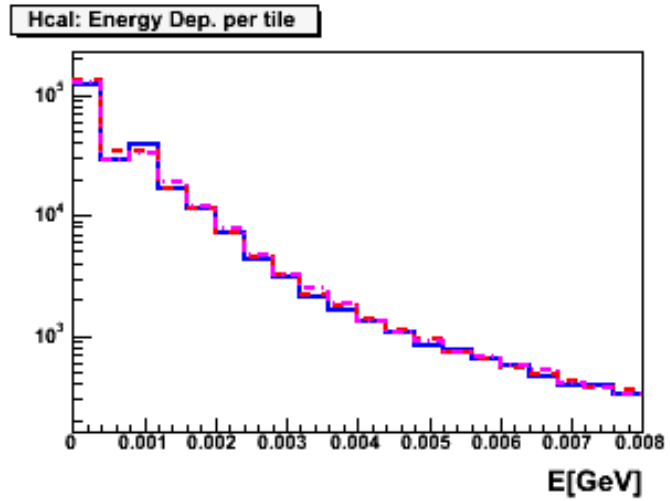

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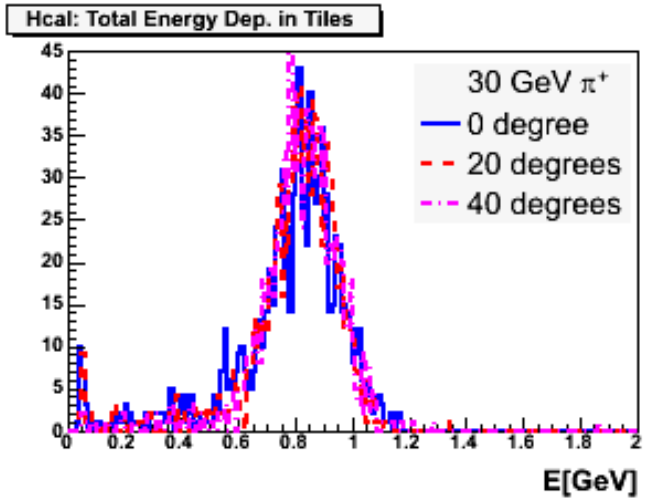

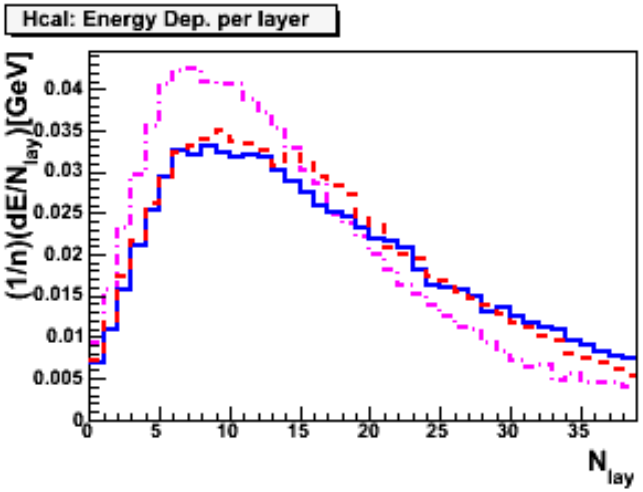

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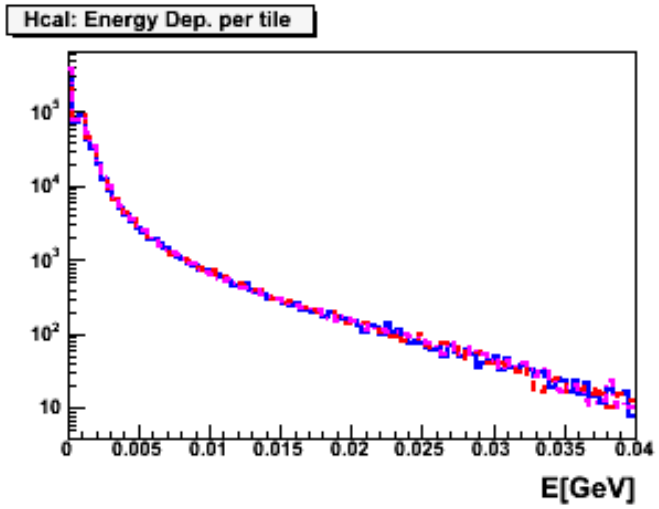
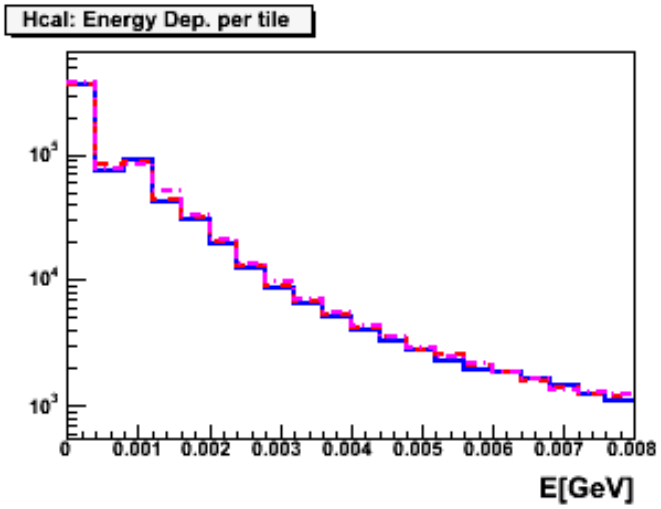




Conclusion and Outlook

- Updated simulation of Tile Hcal/Catcher implemented in Mokka

  Common effort of CALICE collaboration

  New implementation allows for arbitrary configuration angles
  First tests showed no obvious problem

- (Supposed to be) Working horse to prepare TB program

  Combination with Ecal provided
  => Realistic testbeam setup available

  Please use implementation and help to improve it

- Implementation may point to additional capabilities needed in Mokka

GEANT4 Physics List Comparison for the HCAL PPT

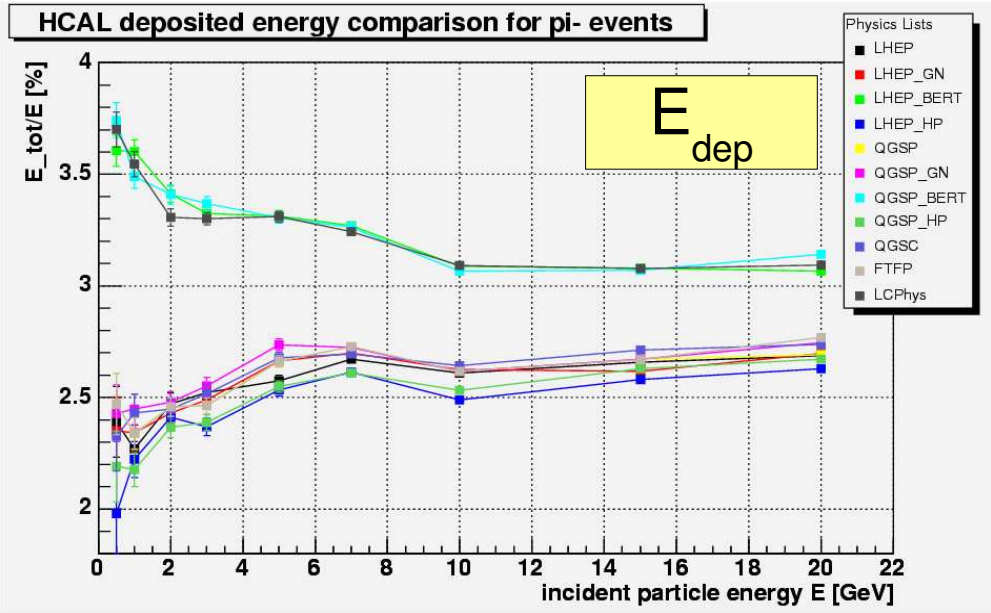
Studies by F. Gaede, P. Melchior

DESY/Hamburg

based on earlier work by S. Crooks

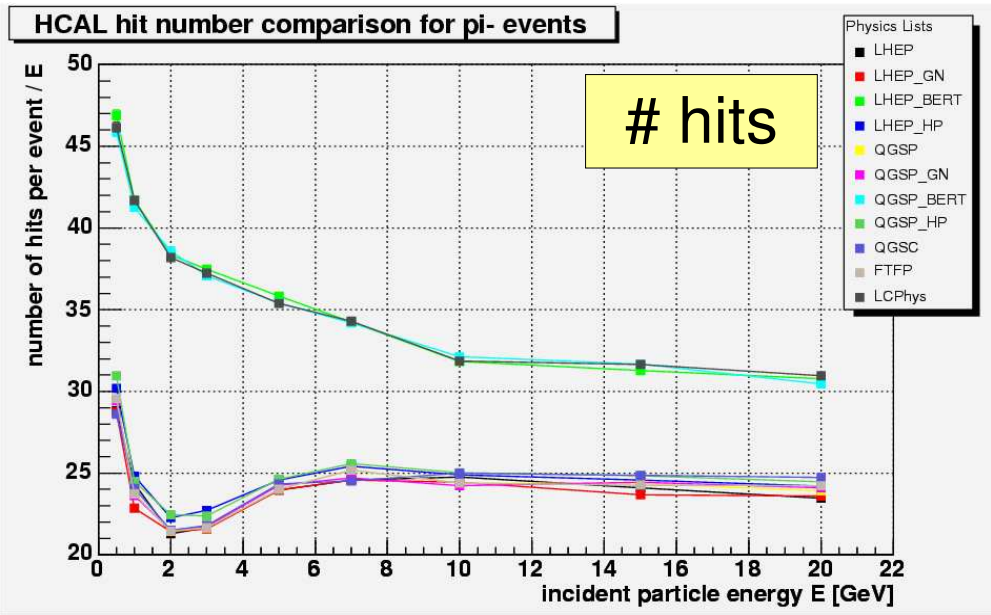
- Search for observables that reveal differences between the physics lists
- Geant4.6.1 (Cross-checked with Geant4.6.0)
- Mokka_03_01 with model TB02_hcal
- Simulated 1000 pi- events for 10 energies between
  0.5 – 20 GeV for 11 physics lists from GEANT4 release

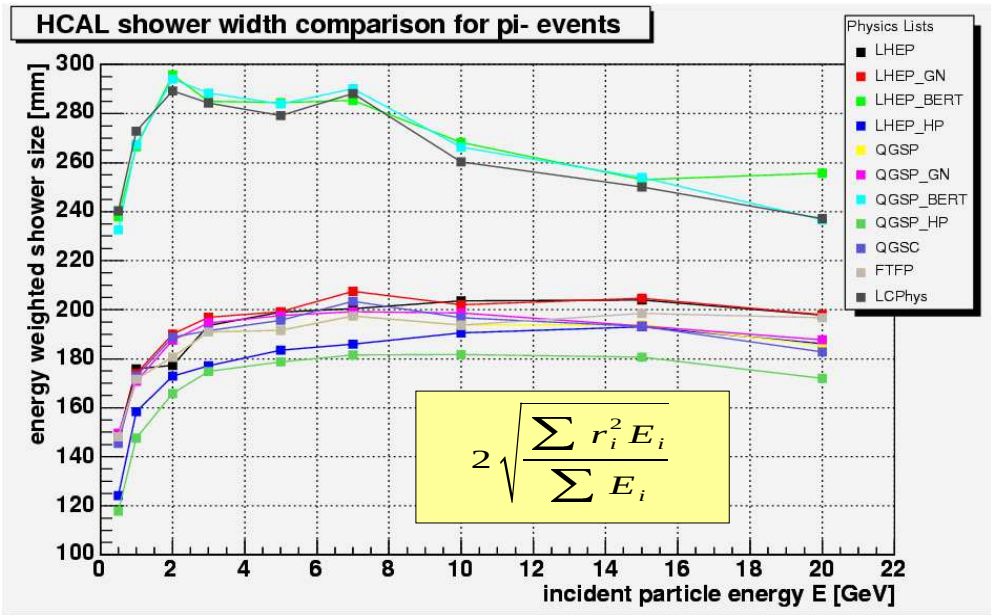
GEANT4.6.1



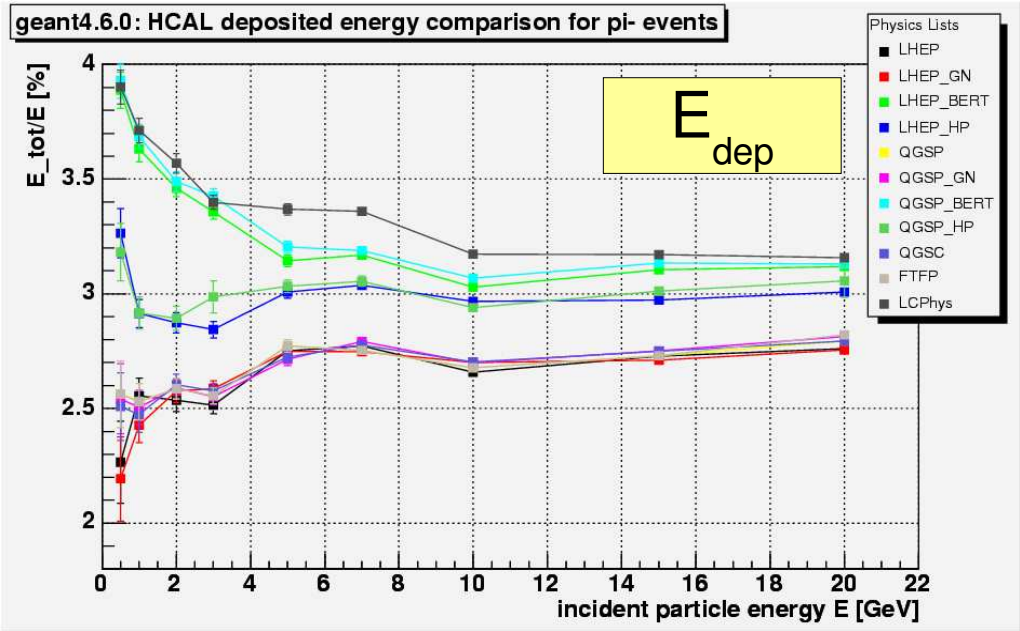
=> only two classes of physics lists in given energy domain:

- LEP like parameterization
- Bertini cascade

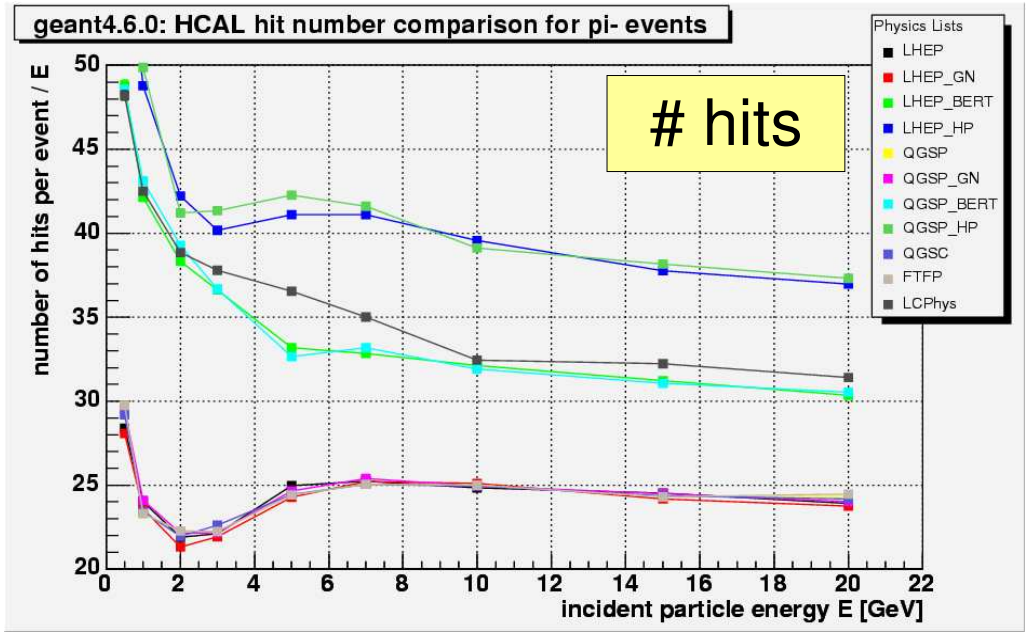


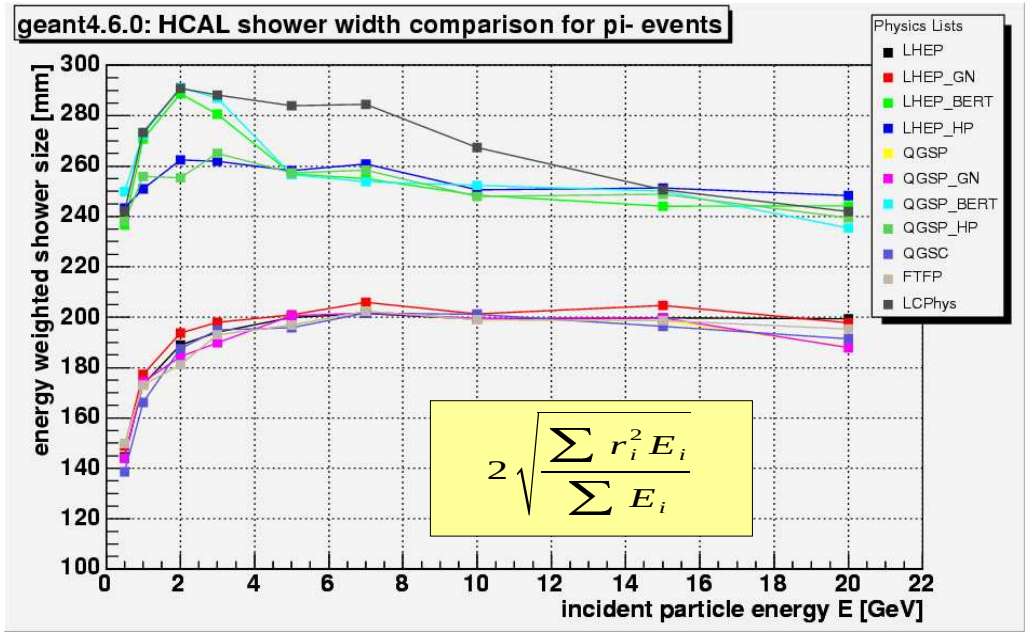


GEANT4.6.0



- BUG in neutron_hp (announced in forum)
  => increased number of low energetic hits for *_HP lists
- change in Bertini code





Results

- Two classes of physics lists:
  LEP and Bertini cascade
- Effects from theoretical models (e.g. QGSP)
  not observed in given energy range
- Only O(30%) CPU time differences between lists
- Hadronics lists still in flow
  -> need to check every new version
  -> software chain at hand
  -> handle with care (for predictions)
  -> need testbeam data