Monte Carlo for Combined Test

First Results

A. Kiryunin and *D. Salihagić*

December 09, 1999

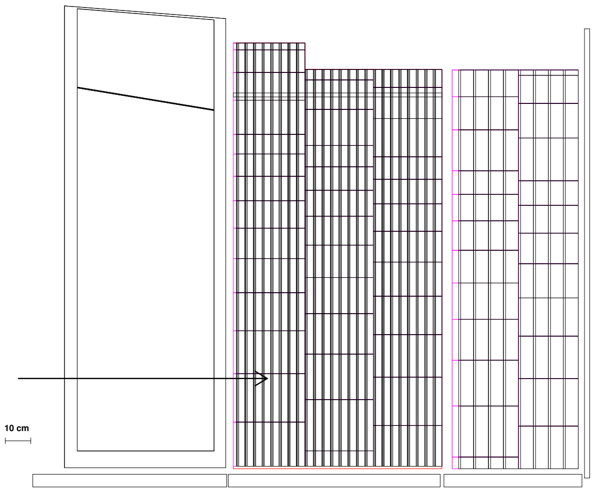
- **Status of the code**
- **Simulations done**
- **Evaluation of performance**
- **Conclusions and outlook**

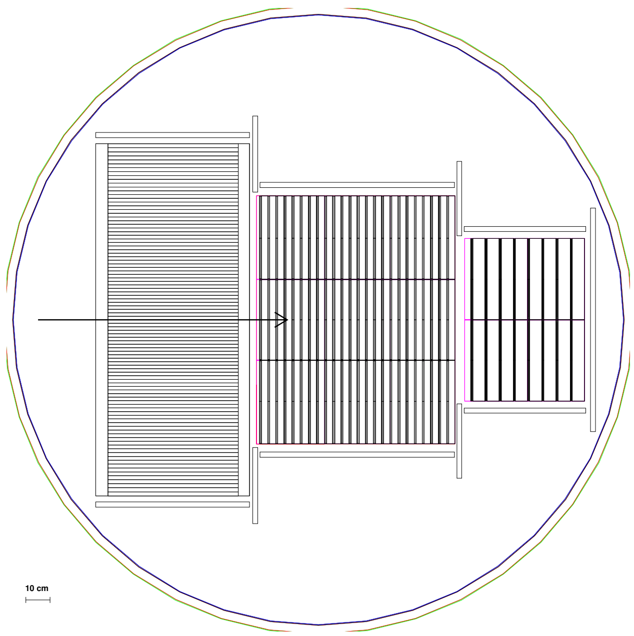
Status of the Code

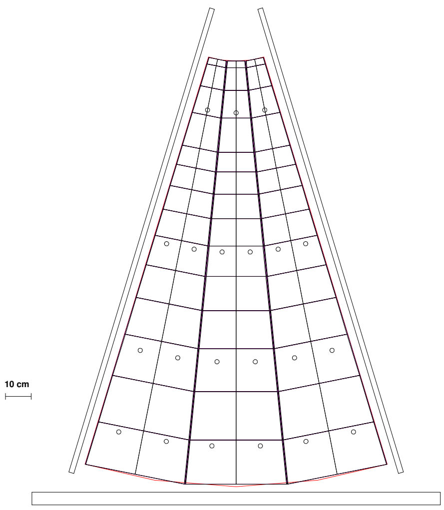
- Combined test: HEC + EMEC
- Studied configuration:
  - 3 HEC-1 modules
  - 2 HEC-2 modules
  - 1/8 of EMEC wheel
- Description:
  - HEC modules, ”leakage detectors”, cryostat, MWPCs and other H6 beam line elements — from HEC-BEAM 3.0
  - EMEC — from C. Benchouk and A.Chekhtman
- Simulation framework — Atlsim

Simulations Done

- Charged pions: 20, 40, 60, 100, 150 and 200 GeV
- Electrons: 100 GeV
- 1200 events per energy
- $X_{CRYOSTAT}$=5 cm, Y_{TABLE}=12.4 cm
- GCALOR - hadronic shower model
- No ”charge correction” in EMEC


10 cm


10 cm


10 cm

Evaluation of Performance

- **Comparison of charged pion simulations for:**
  - **combined test**
  - **ATLAS at η=2.45**
  - **HEC test beam 1999 (three full-length HEC modules)**
- **Influence of the energy leakage**
- **Energy reconstruction**
  - **Whole calorimeter volume (no cone, no tower)**
  - **EM-scale calibration**
    - **HEC-1: C = 23.1 (from HEC-BEAM 3.0)**
    - **HEC-2: C = 46.2 (from HEC-BEAM 3.0)**
    - **EMEC: C = 11.3**
  - **Pion-energy-scale calibration**
    - **energy in the i^{th} event:**

$$E_i = \sum_{j=1}^{2} C_j \cdot E_{ij},$$

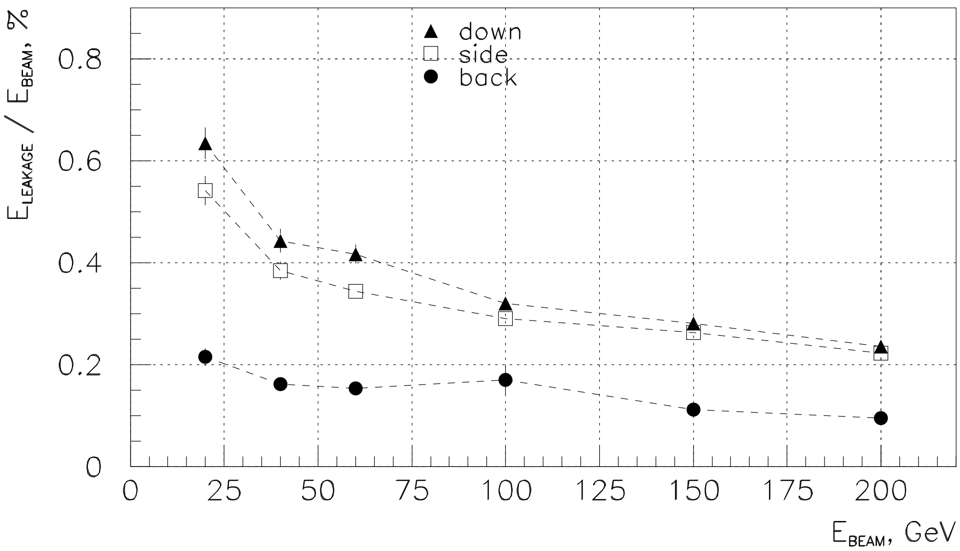
E_{ij} — energy in the j^{th} part of the calorimeter in the i^{th} event,
C_j — pion "calibration" parameters,
two part/parameters: HEC and EMEC

- **Minimize functional**
  $F = \Sigma_{i=1}^{N}(E_i - E_{0i})^2 \qquad \Rightarrow \qquad C_{HEC}$ **and** C_{EMEC}

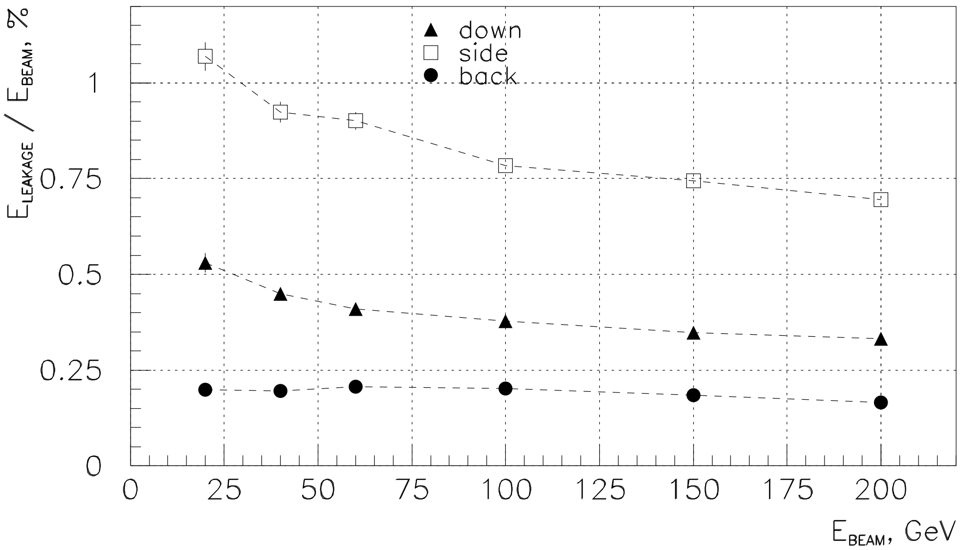
- **Energy response**
- **Energy resolution**
  energy dependence of resolution:

$$\frac{\sigma}{E}(E_0) = \frac{P_1}{\sqrt{E_0}} \oplus P_2$$

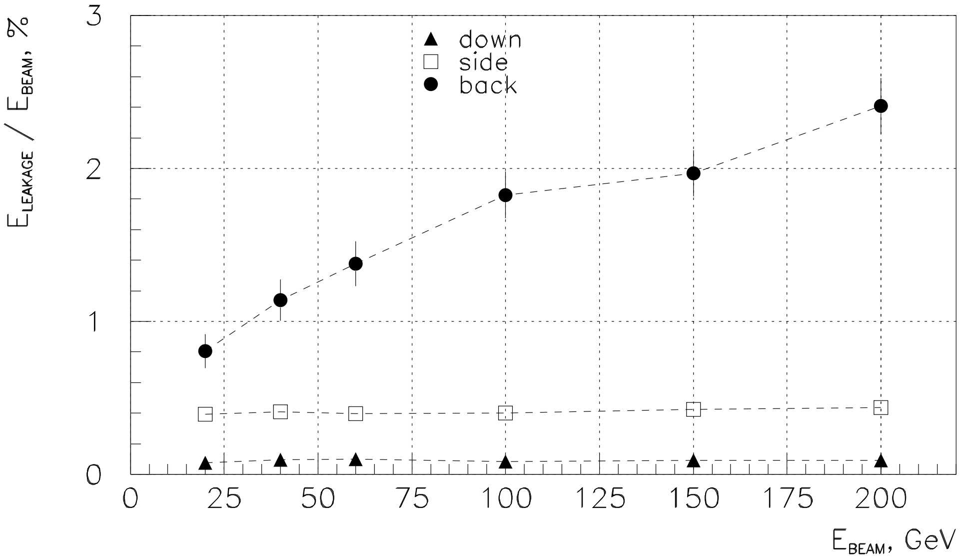
Leakage Energy for Pions in Combined Test



EMEC

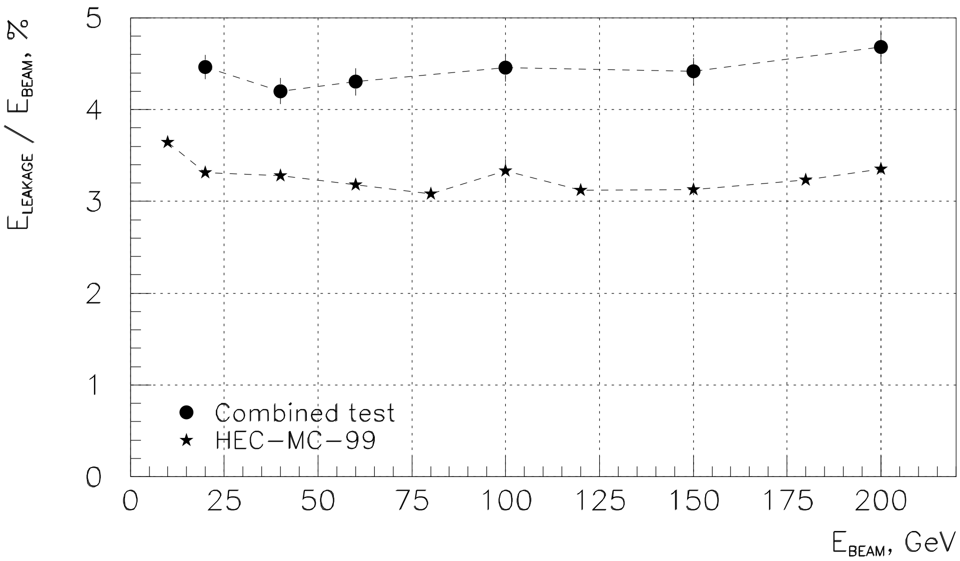


HEC-1

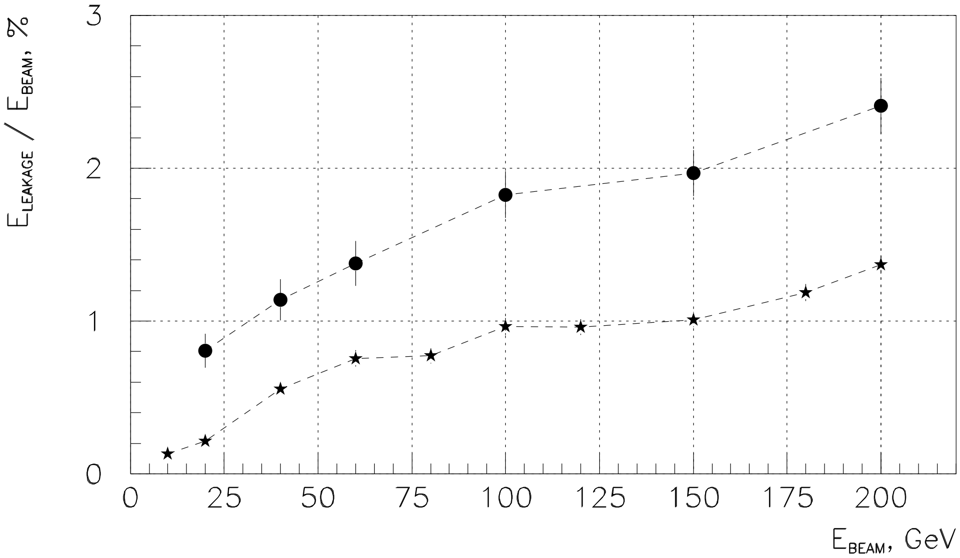


HEC-2

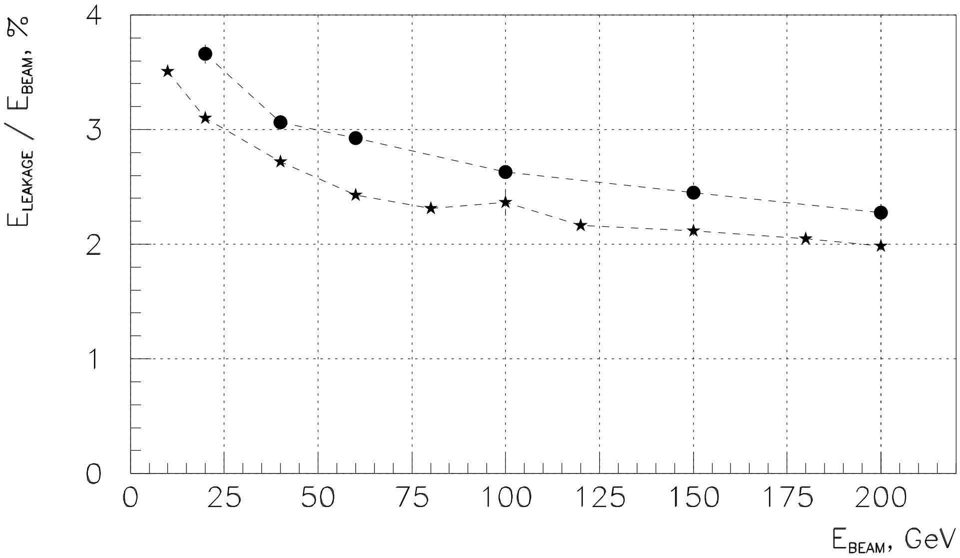
Leakage Energy for Pions



Total leakage

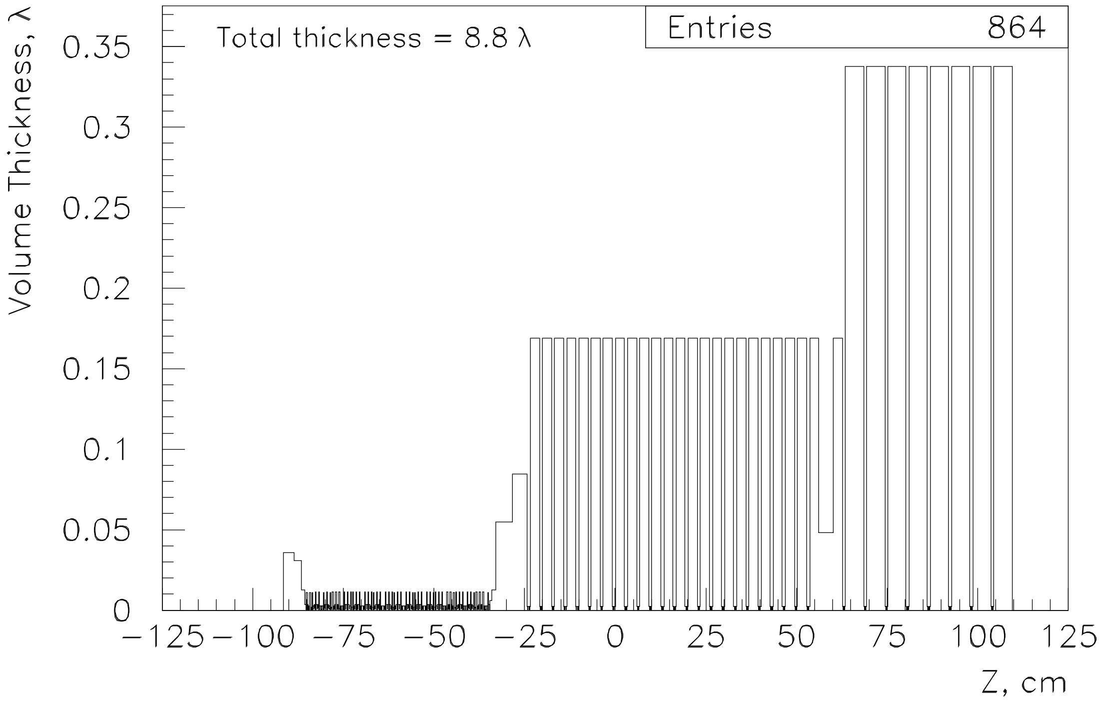


HEC-2 back leakage

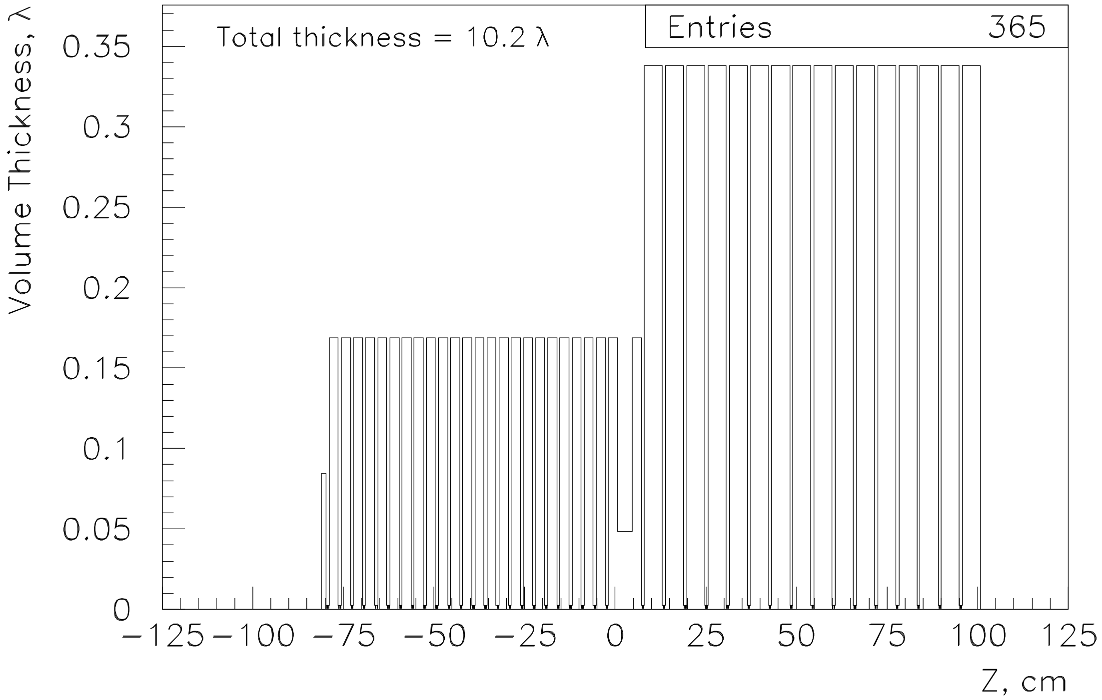


Remaining leakage

Thickness of Calorimeters in Absorption Lengths

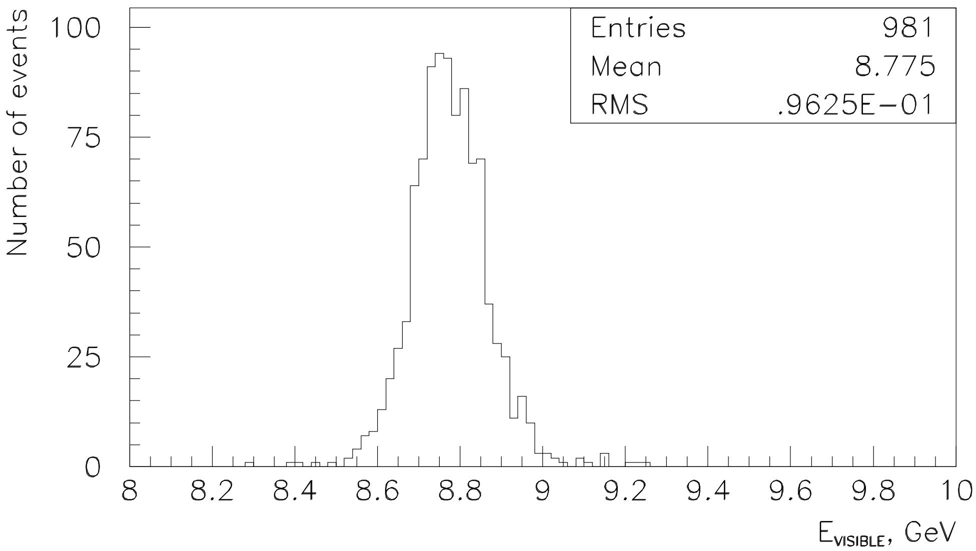


Combined Test

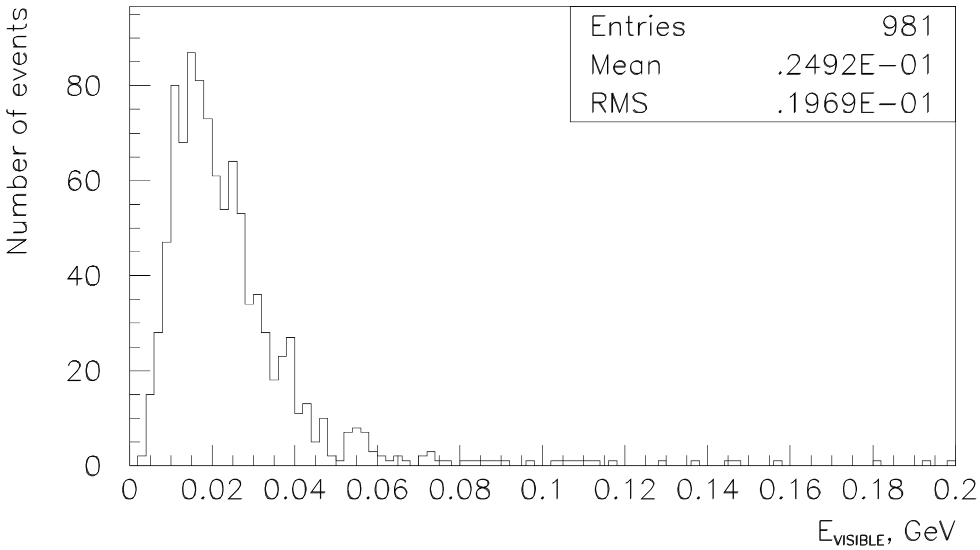


HEC-MC-99

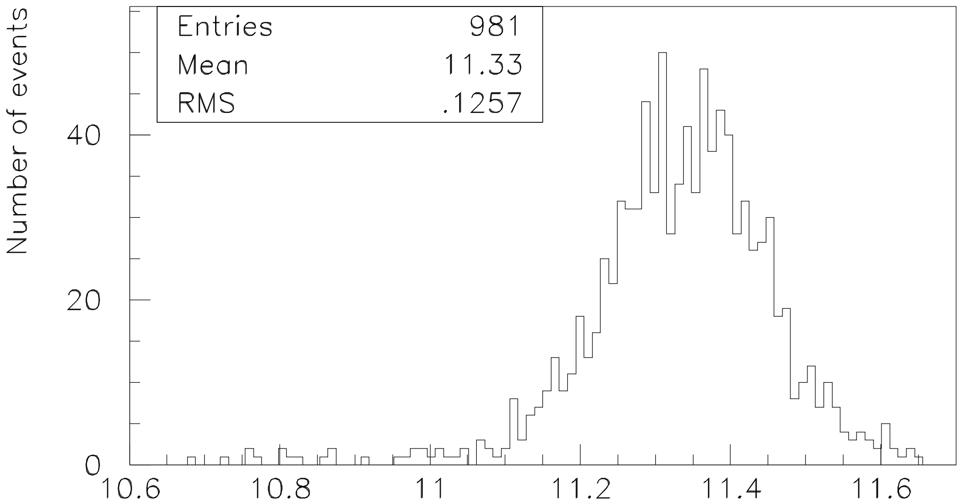
100 GeV Electrons in Combined Test



Visible energy in EMEC

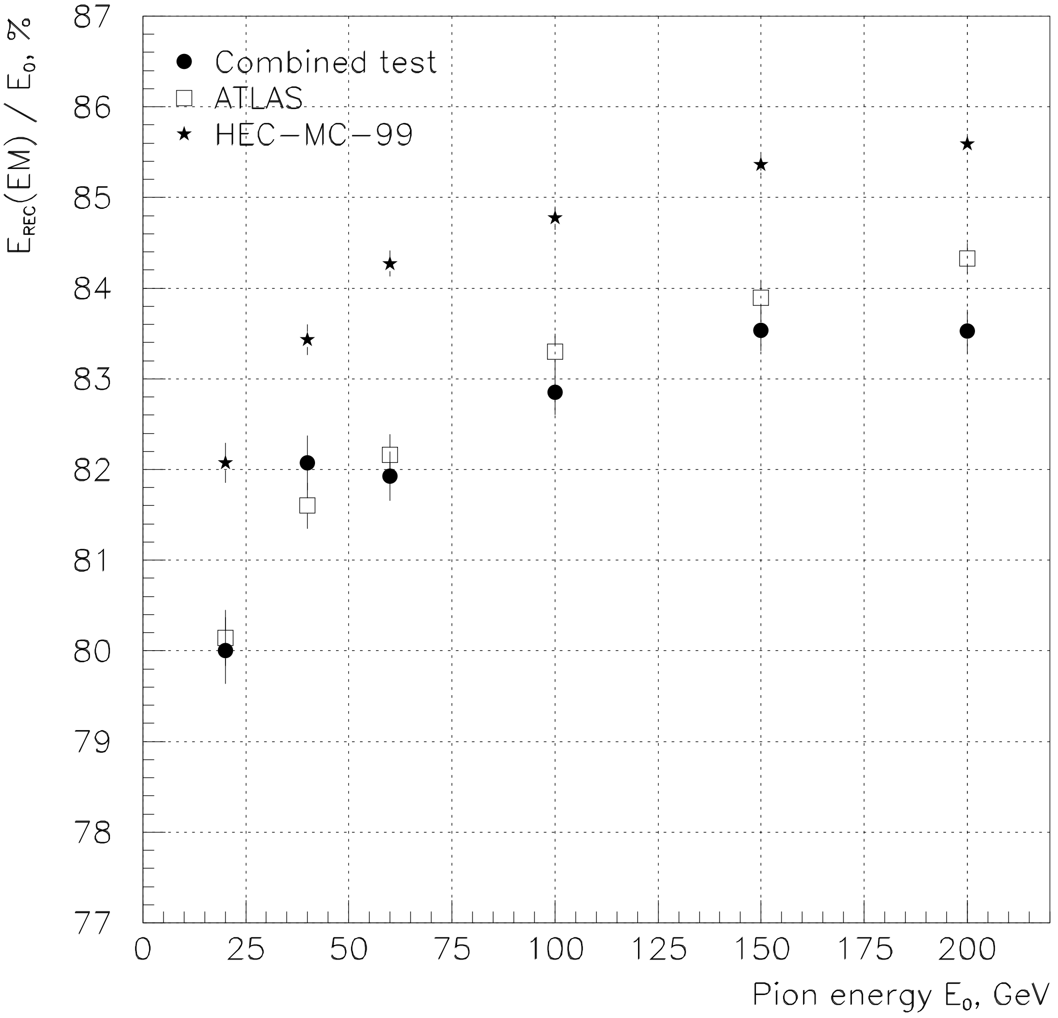


Visible energy in HEC-1

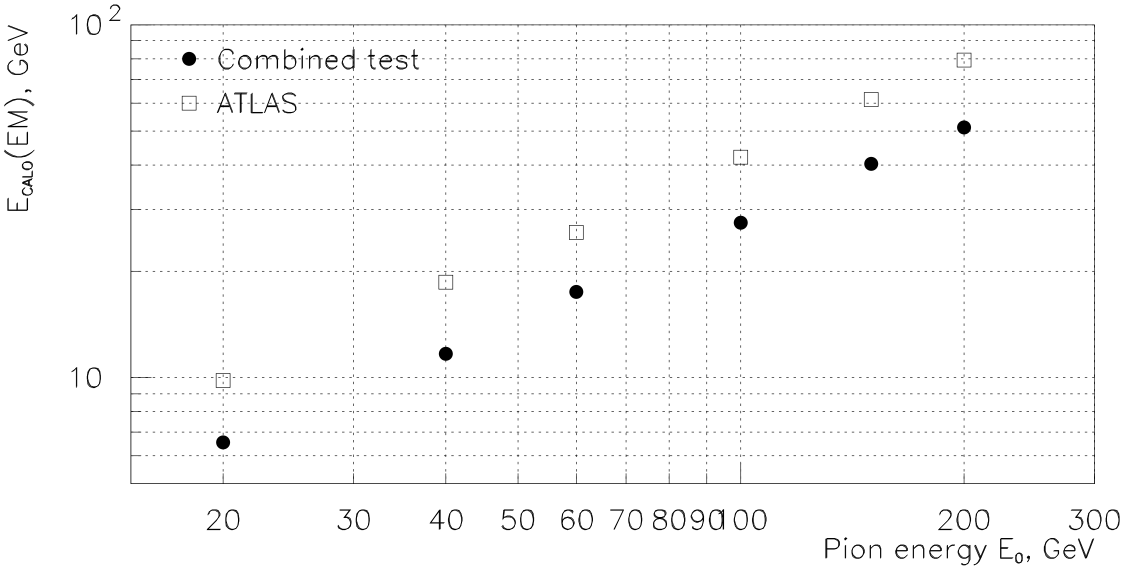


$(100 - E_{HEC-1} * 23.1) / E_{EMEC}$

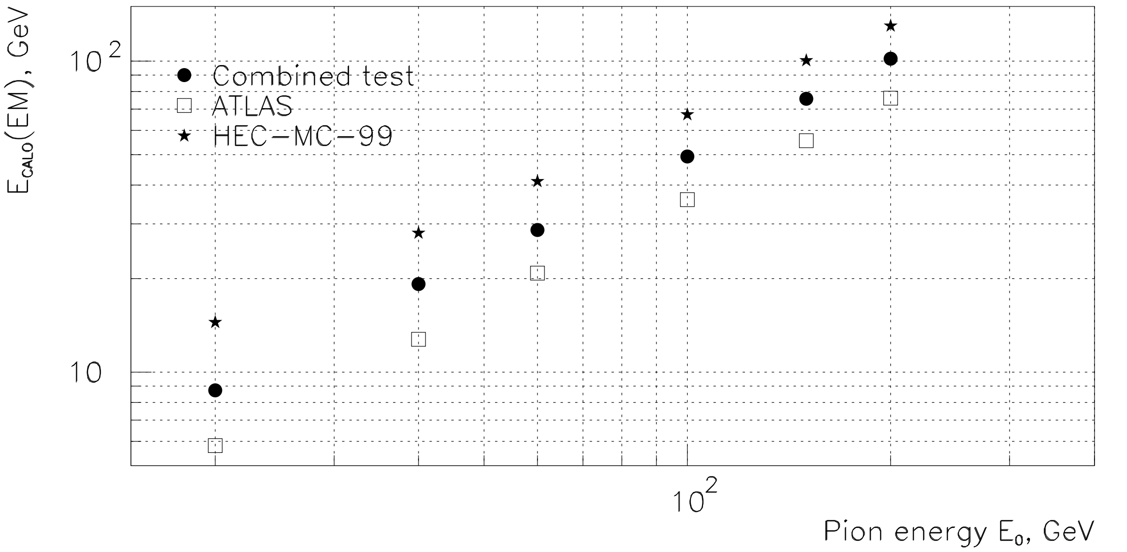
Reconstructed Pion Energy (EM-Scale)



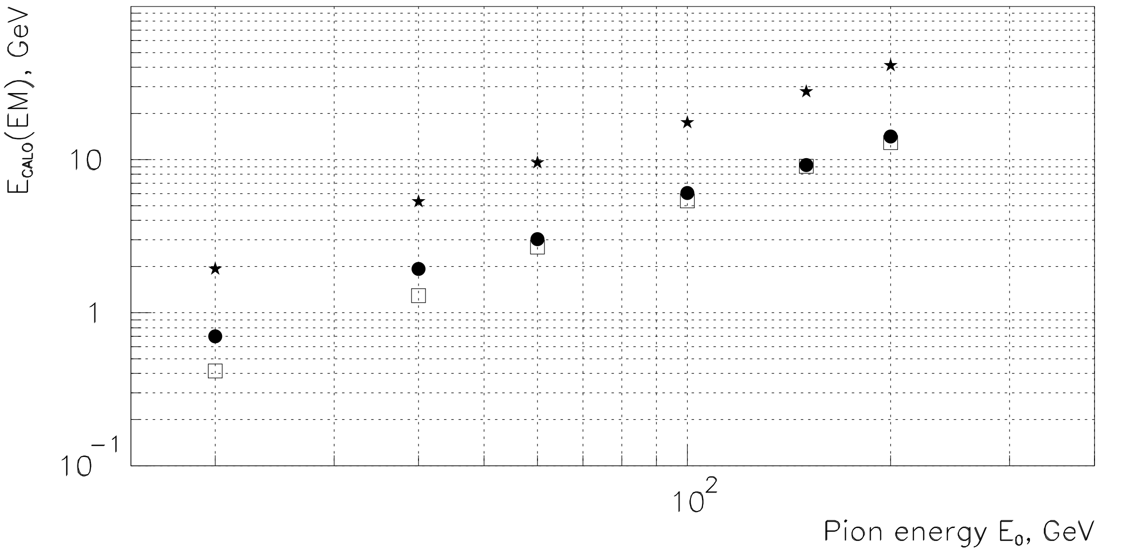
Pion Energy (EM-Scale) in Calorimeters



EMEC

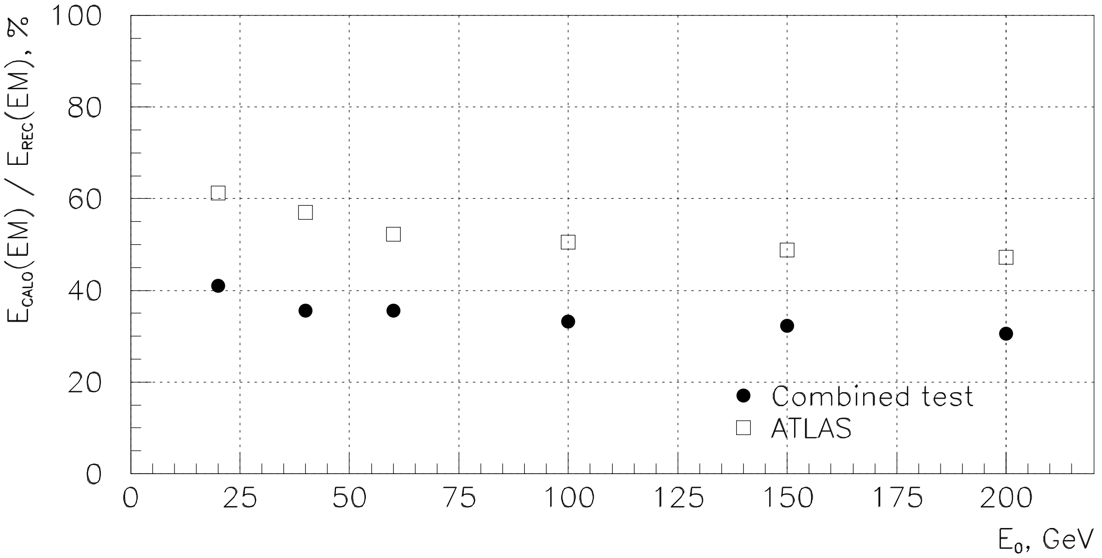


HEC-1

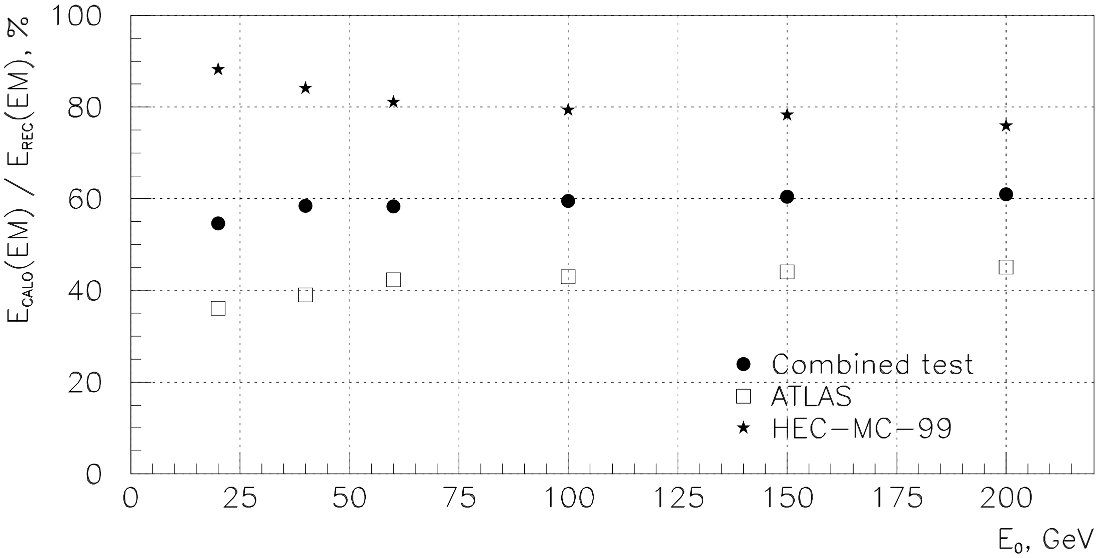


HEC-2

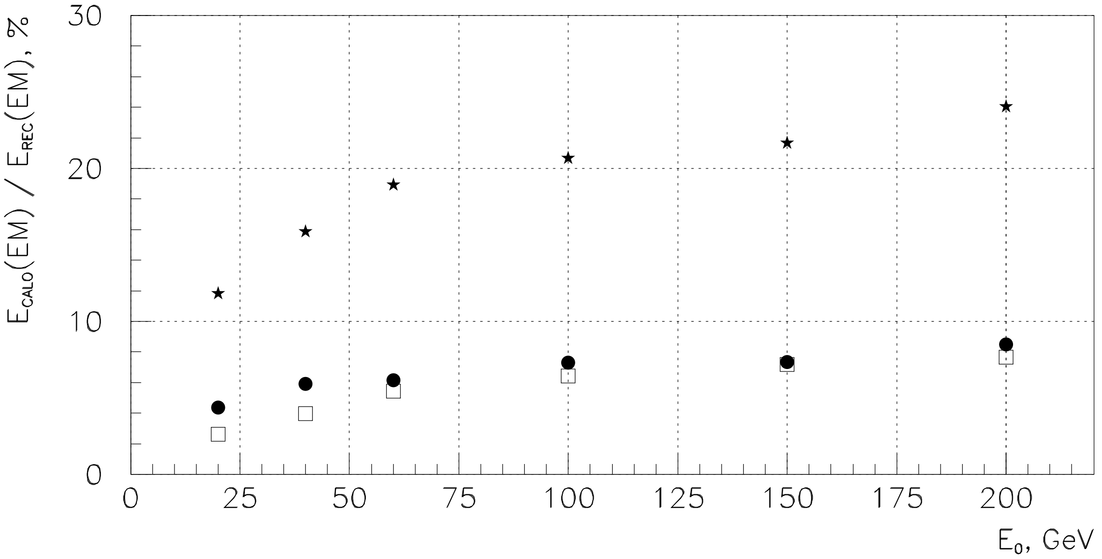
Fraction of Pion Energy in Calorimeters



EMEC

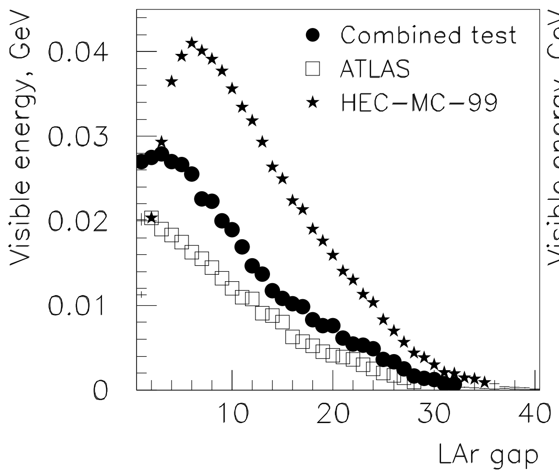


HEC-1

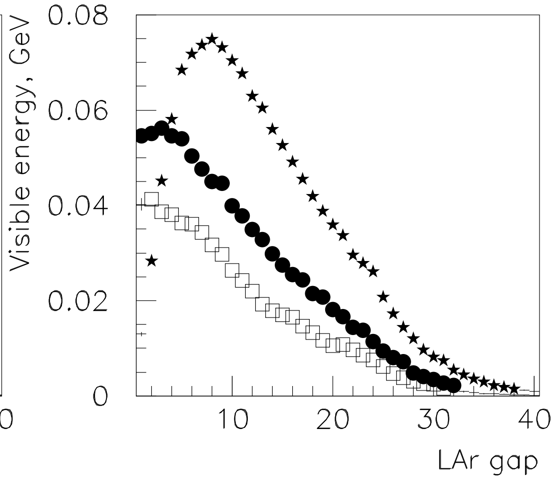


HEC-2

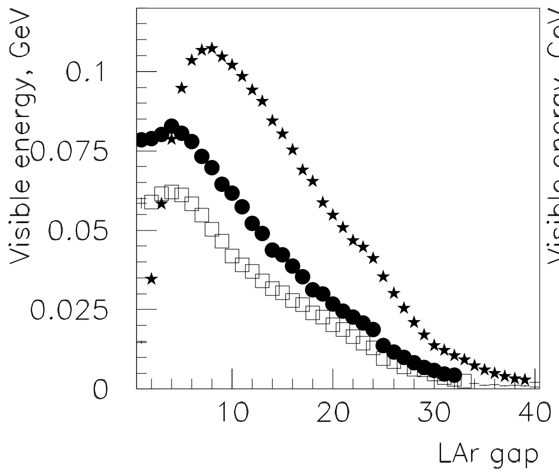
Longitudinal Energy Profiles in HEC for Pions



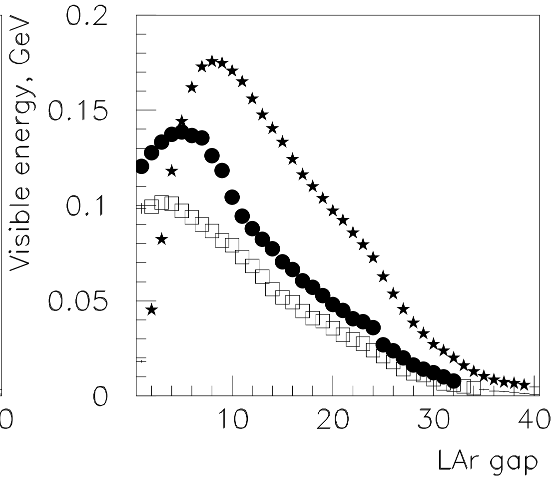
20 GeV



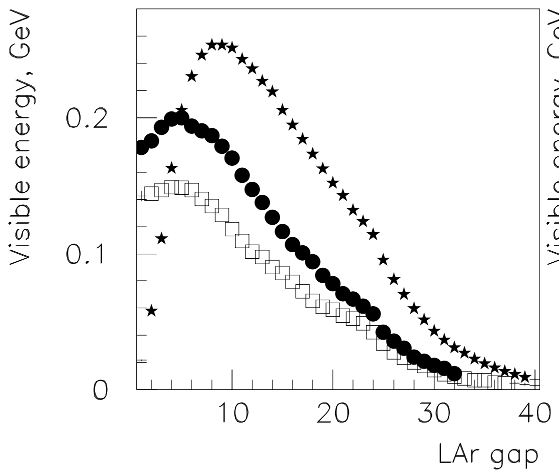
40 GeV



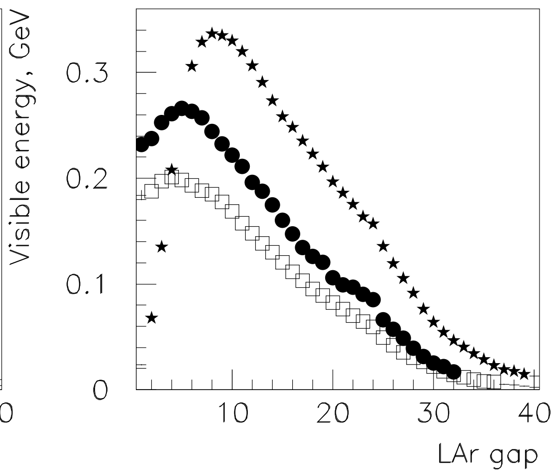
60 GeV



100 GeV

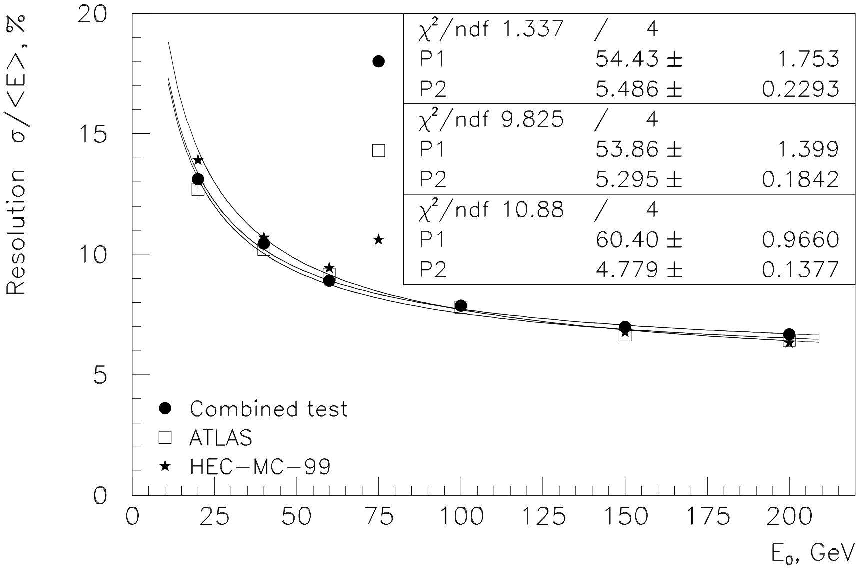


150 GeV

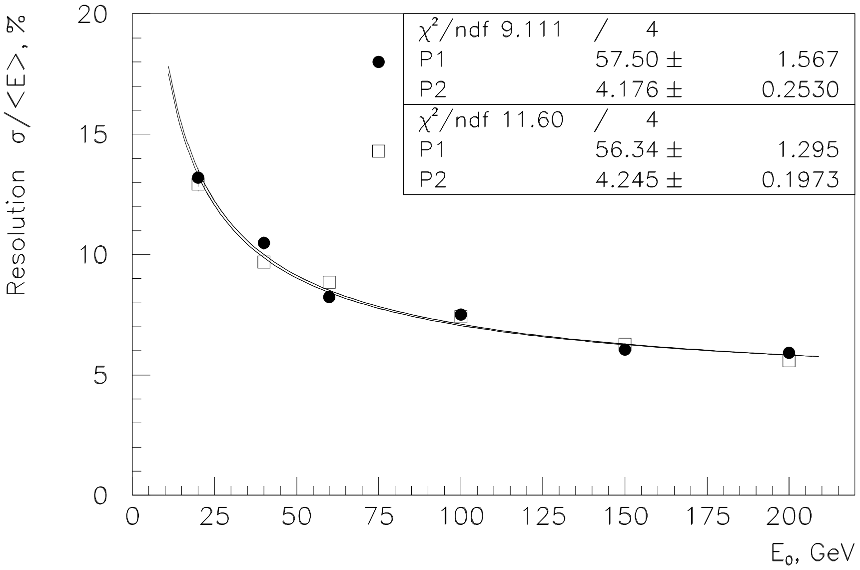


200 GeV

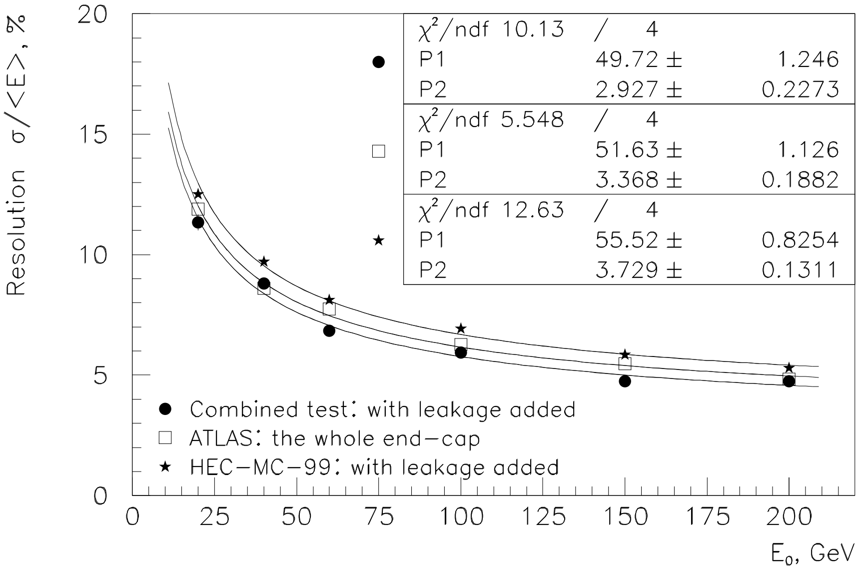
Resolution for Pions (GCALOR)



EM-scale calibration



Pion-energy-scale calibration



Leakage correction

Conclusions

- **Difference in energy longitudinal profiles**
- **Comparable values of resolution**
- **Resolution worsening because of leakage**

Outlook

- **EMEC: digitisation routine, energy calibration?**
- **Code and simulation for another configuration of HEC modules**