HCAL Energy Resolution Studies

S Schätzel, HCAL Meeting, 19 Jan 2006

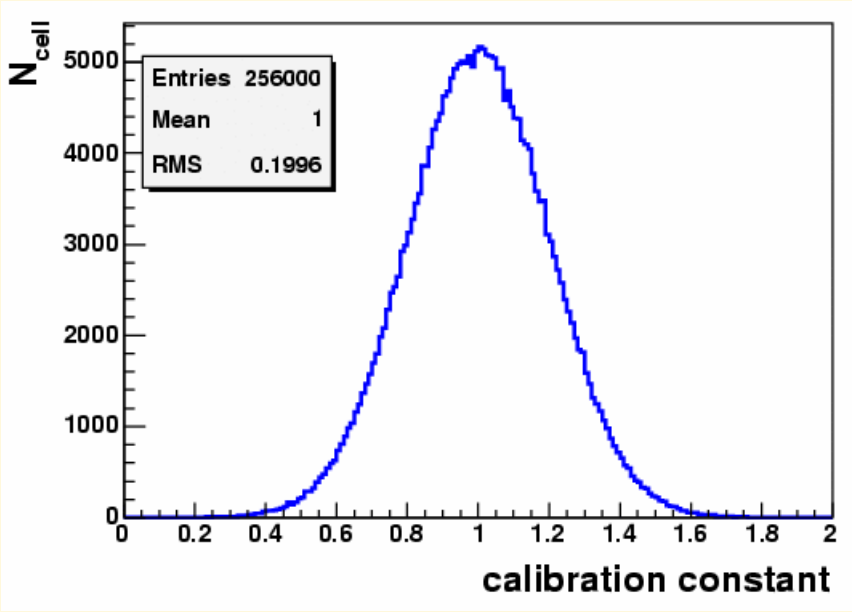
- GEANT3 simulation by Alexei Raspereza
- (Fluka hadronic interactions model)
- HCAL prototype geometry
- LCIO/ROOT analysis package by Roman Pöschl

- examine hadronic shower by π^+
- energy deposited in scintillator tiles
- energy resolution

- investigation of cell energy miscalibration on HCAL energy resolution
  ⇒ Which calibration precision is needed?

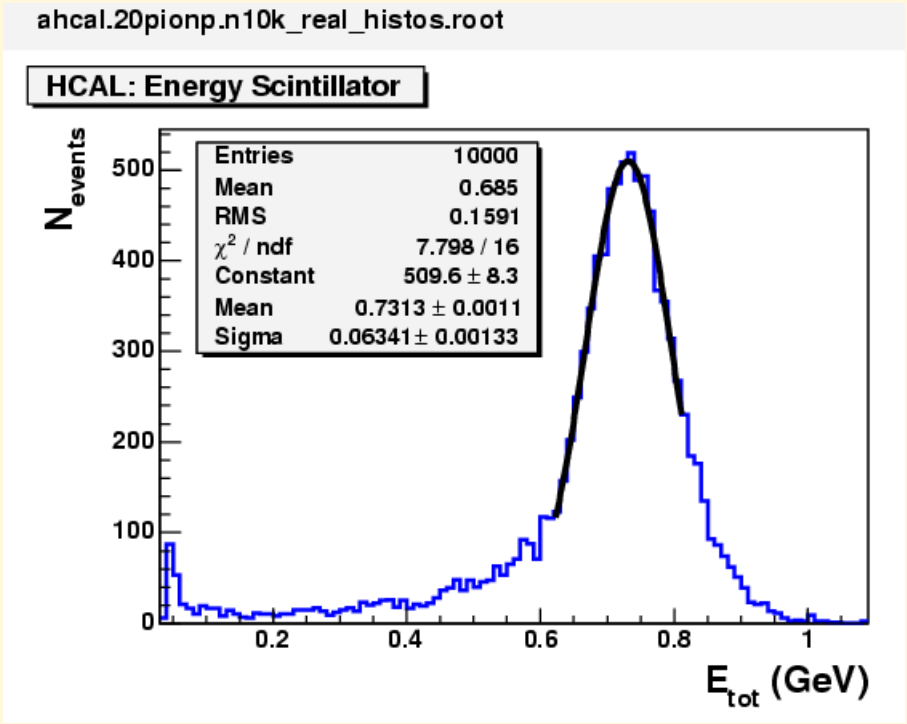
Cell energy miscalibration

- energy in cell i is multiplied by a calibration constant c_i
- ***same constant c_i for all events and all π energies***
- constants are Gaussian distributed with width σ
- nomenclature: "20% miscalibration" ⇔ σ=0.2

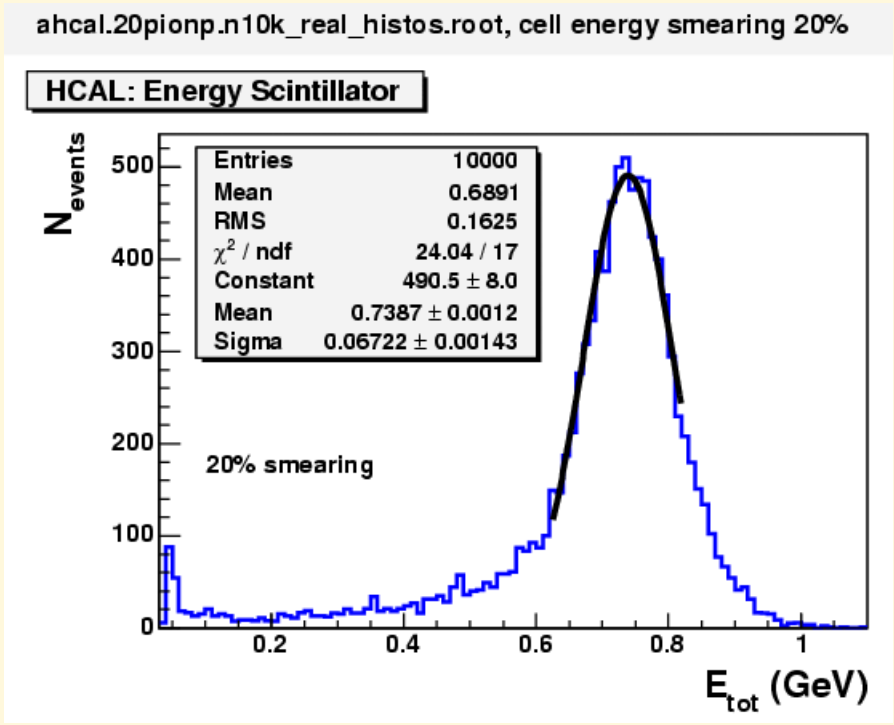


Energy resolution 20 GeV π^+

perfect calibration



20% miscalibration

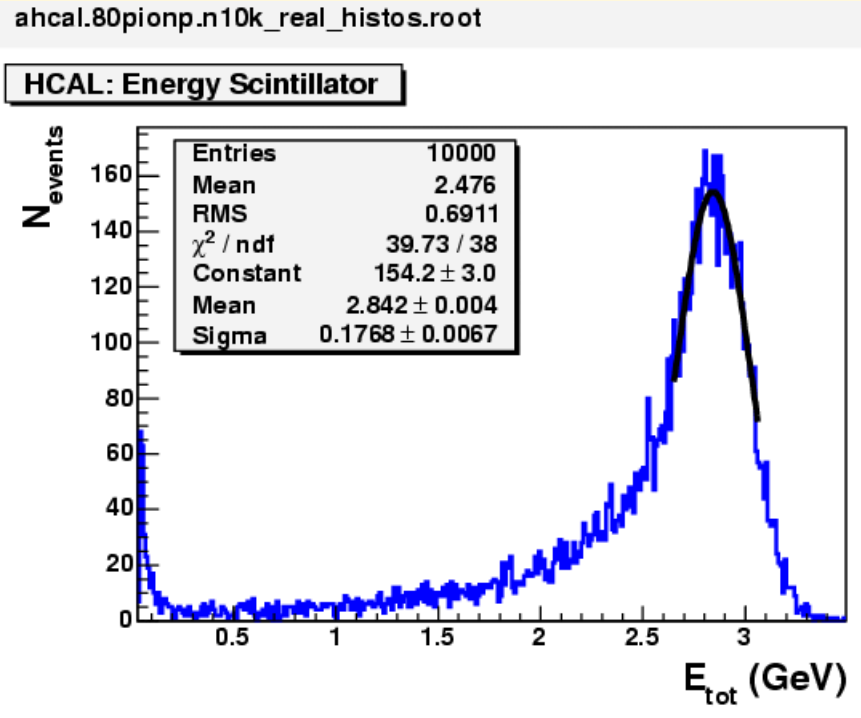


Gauss-Fit: σ/mean= 8.7(2)%

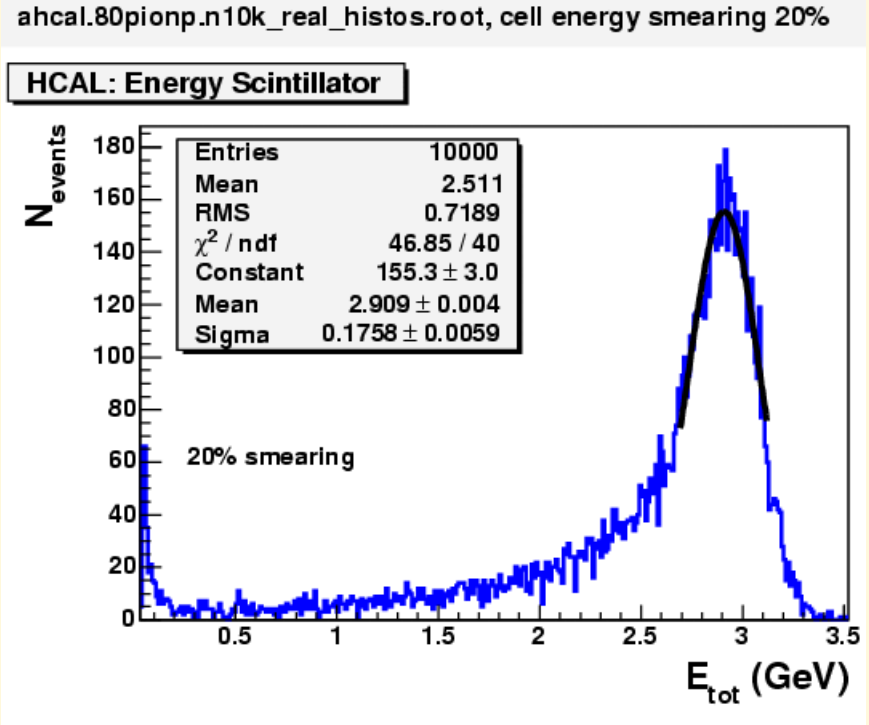
9.1(2)%

Energy resolution 80 GeV π^+

perfect calibration



20% miscalibration

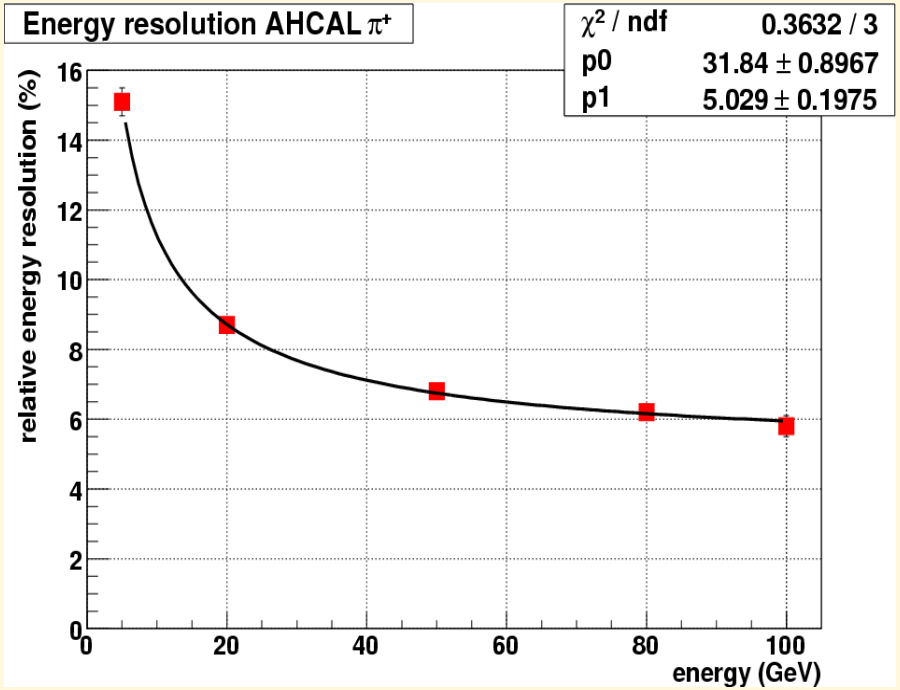


Gauss-Fit: σ/mean= 6.2(2)%

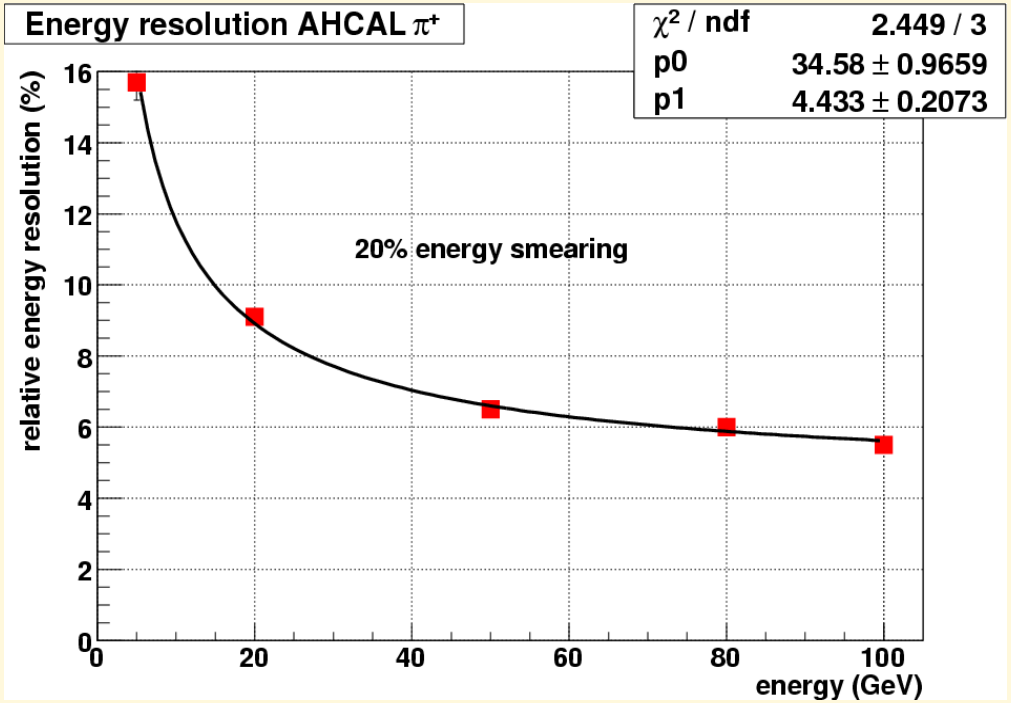
6.0(2)%

Energy resolution

perfect calibration

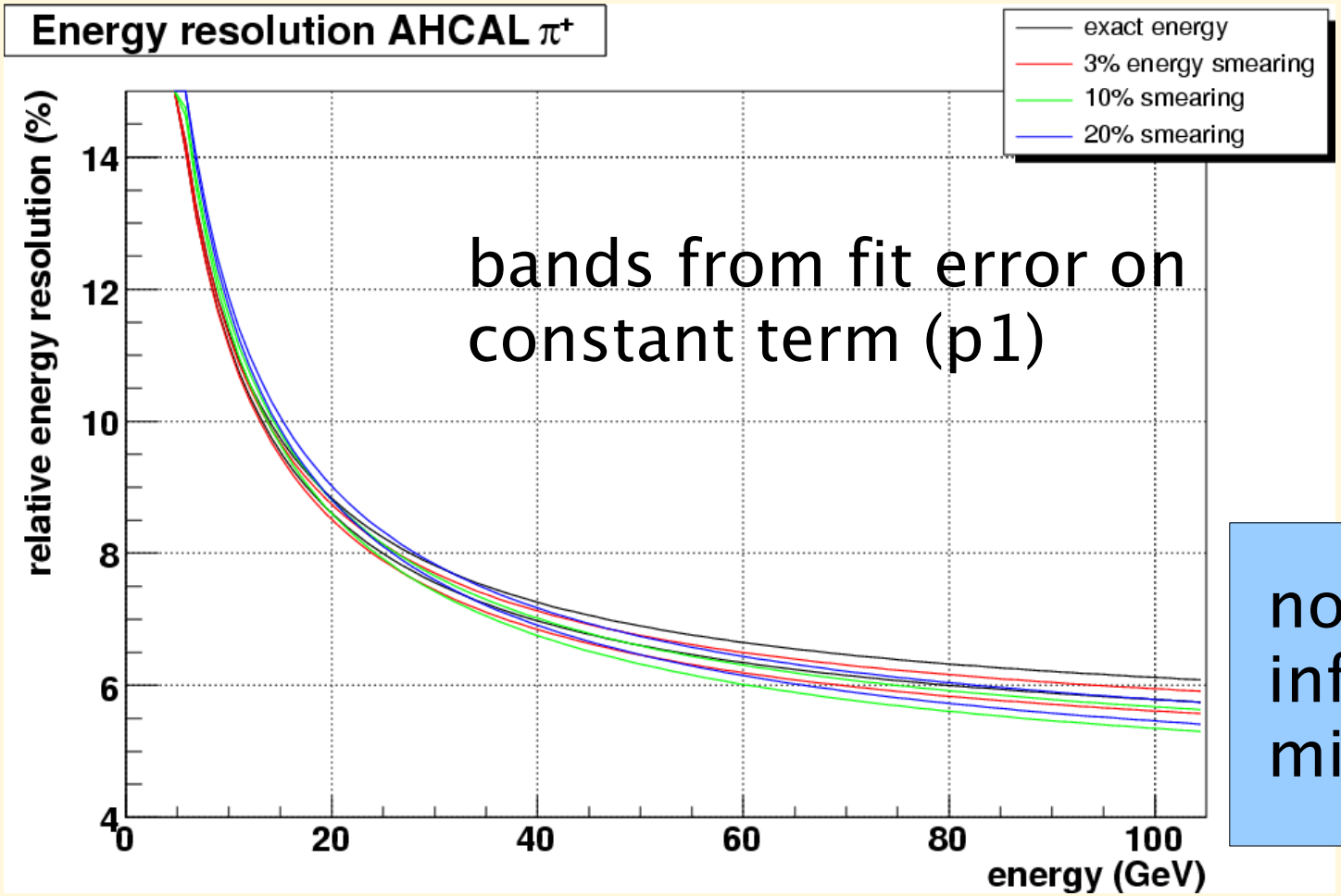


20% miscalibration



Fit: $\frac{\Delta E}{E} = \sqrt{\left(\frac{p0}{\sqrt{E}}\right)^2 + (p1)^2}$

Energy Resolution



no significant influence of miscalibration

Conclusions

- 20% cell energy calibration enough

To be investigated:

⇒ duration of calibration runs
⇒ photo-electrons/MIP requirement

To come:

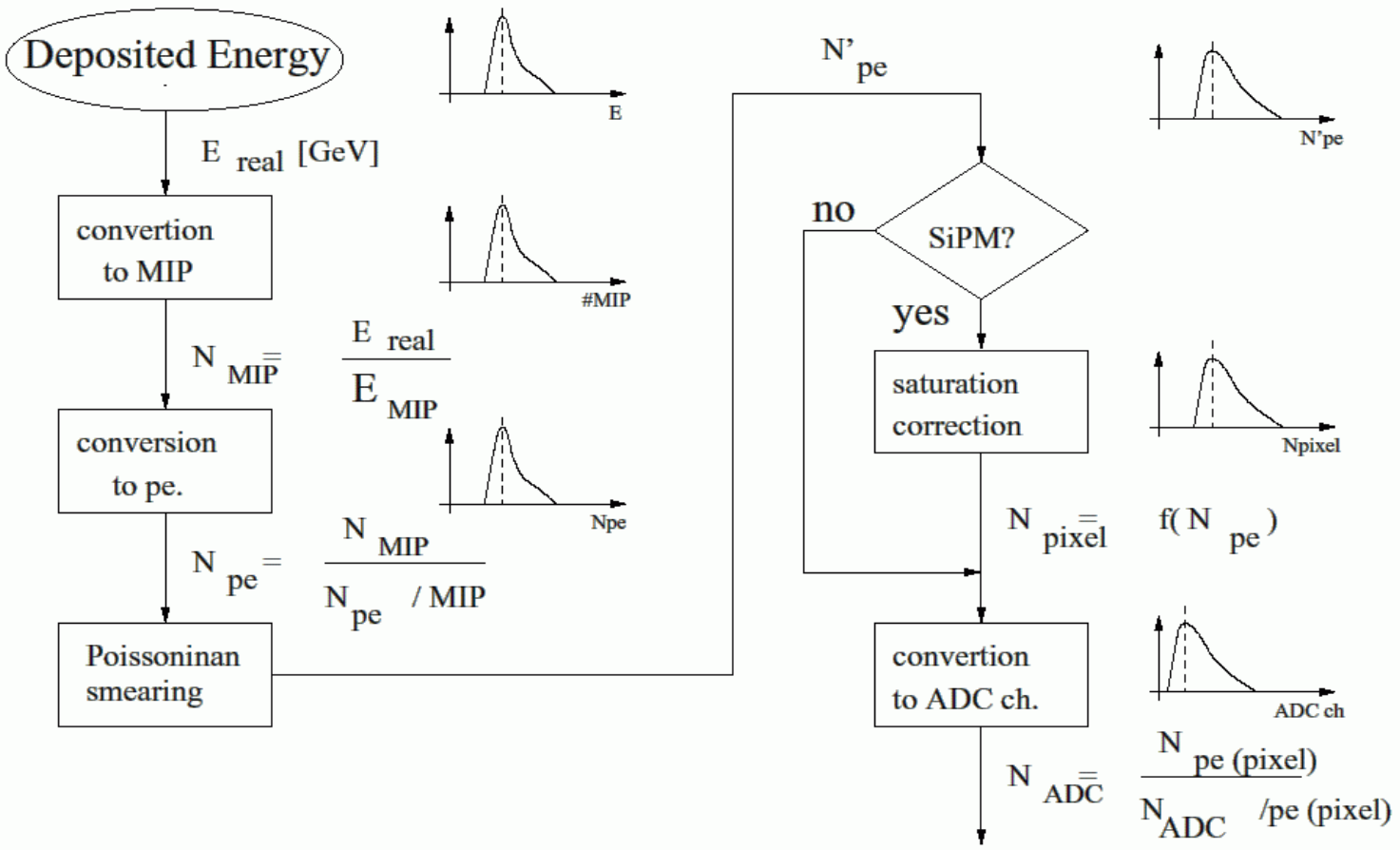


Fig. 9. Flowchart of Monte Carlo implementation of photodetector physics.