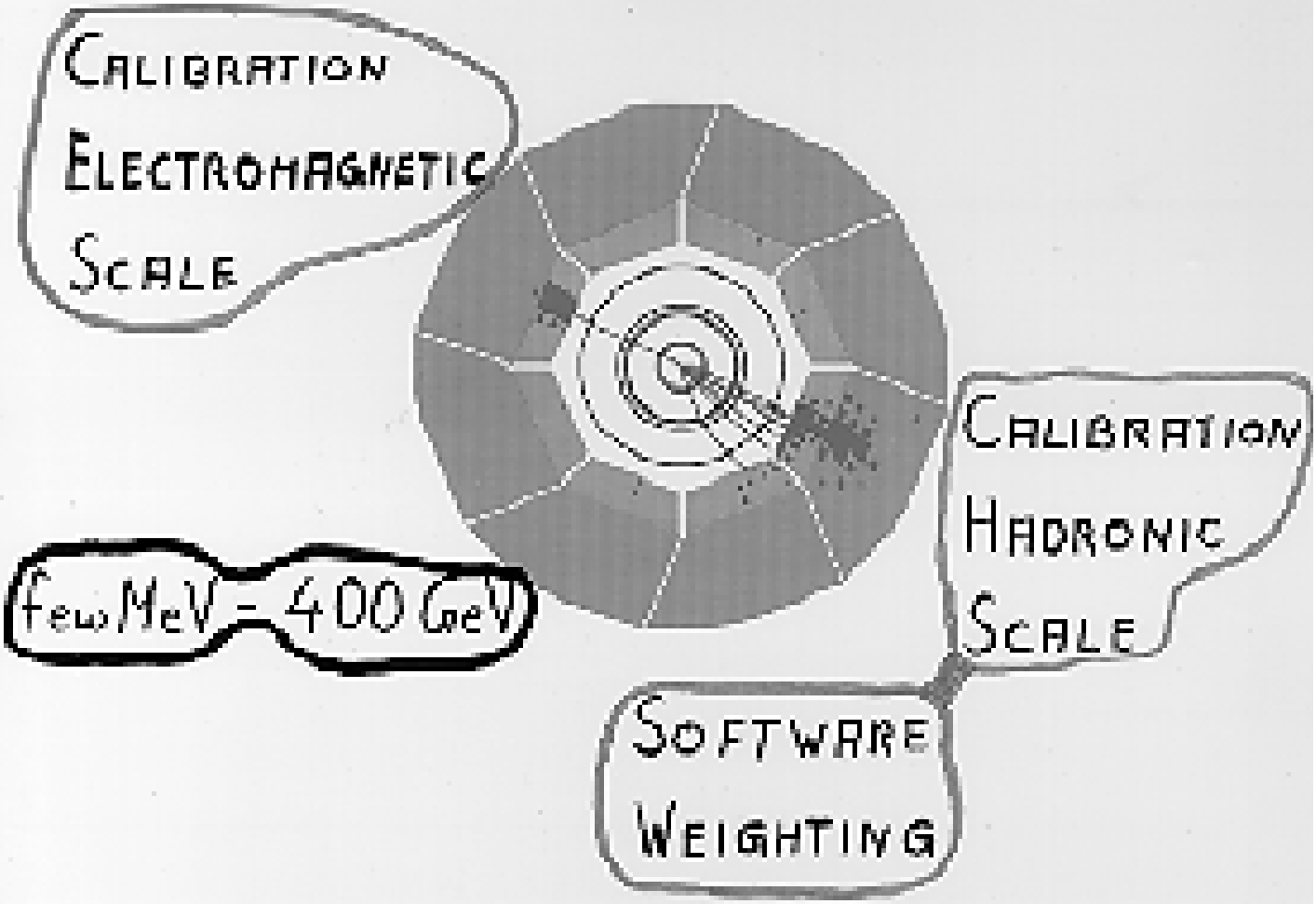
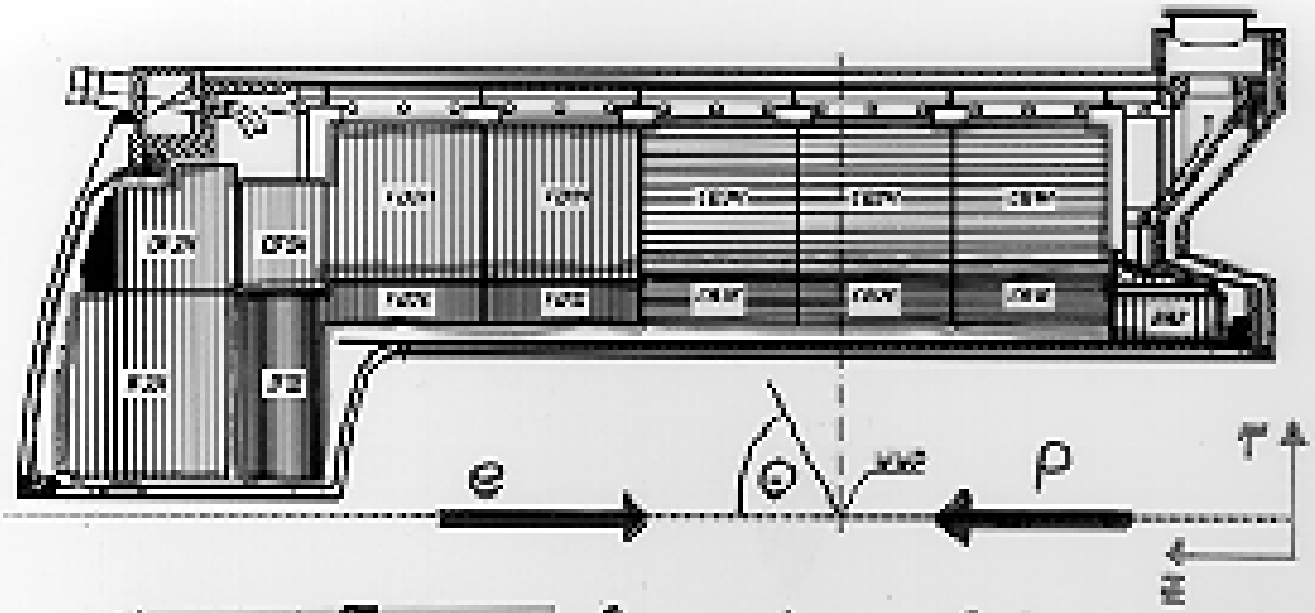
CALOR 2000
9/10 - 14/10
ANNECY

ÇIĞDEM ISSEVER
UNIVERSITY OF DORTMUND
FOR THE H1 - COLLABORATION

THE H1 LIQUID ARGON CALORIMETER ENERGY SCALE



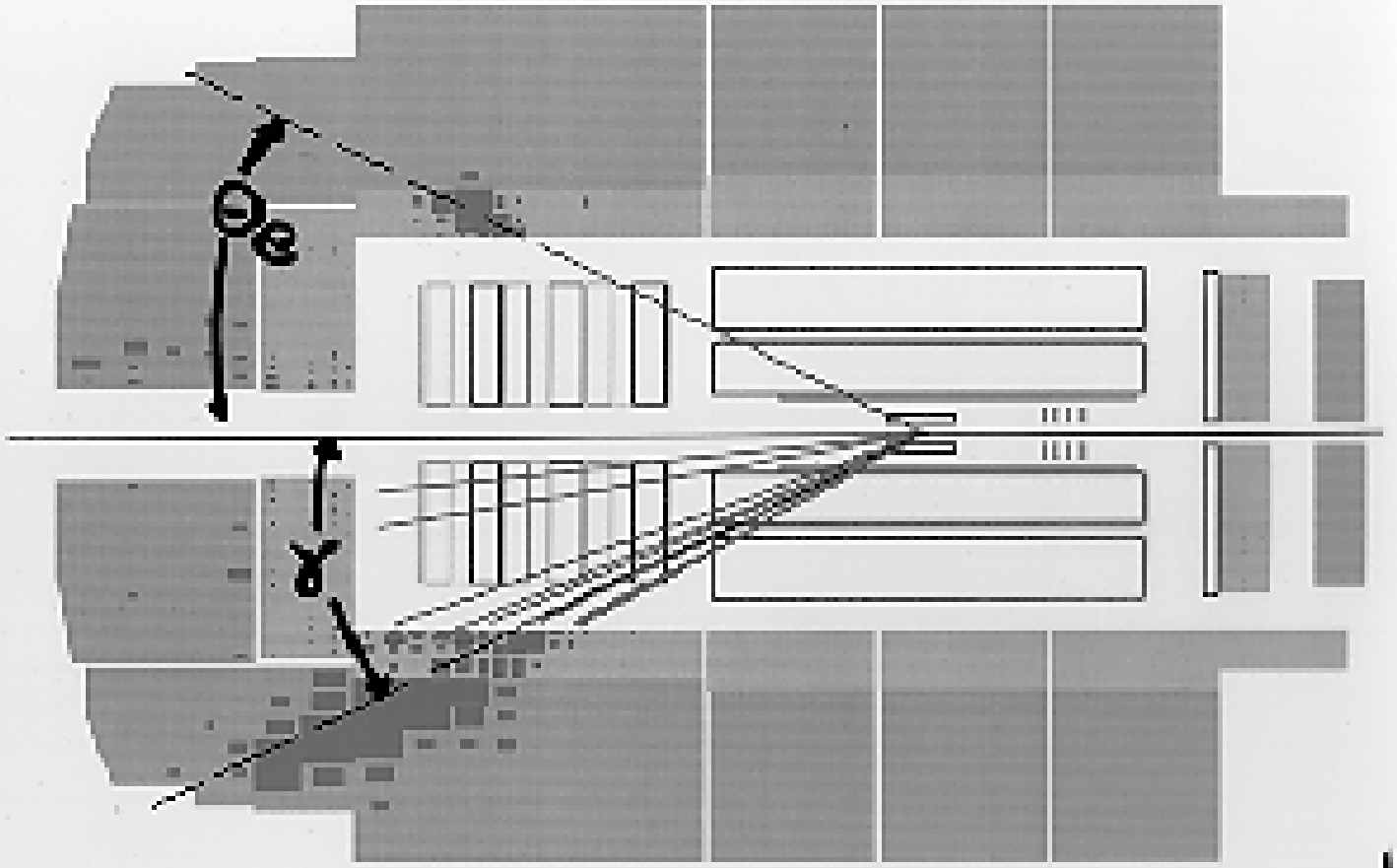
H1-Liquid Argon Calorimeter



- Liquid Argon Sampling-Calorimeter
- Lead in electromagnetic modules, 20 - 30 X_0
- Steel in hadronic modules, in total 5 - 8 λ
- High granularity 45000 cells
- Compesation ↔ Software Weighting

Electron Calibration with ep-Physics

3%



$$\delta = 2\,\mathrm{atan}\left(\frac{\sum_i (E_i^H - p_{z,i}^H)}{p_T^H}\right)$$

Electron Calibration

Double Angle Method: $\Theta_e, \gamma \rightarrow E^e_{DA} - E^e_{LAR}$

$$E^e_{DA} = \frac{2 E_0 \sin\gamma}{\sin\gamma + \sin\Theta_e - \sin(\gamma + \Theta_e)}$$

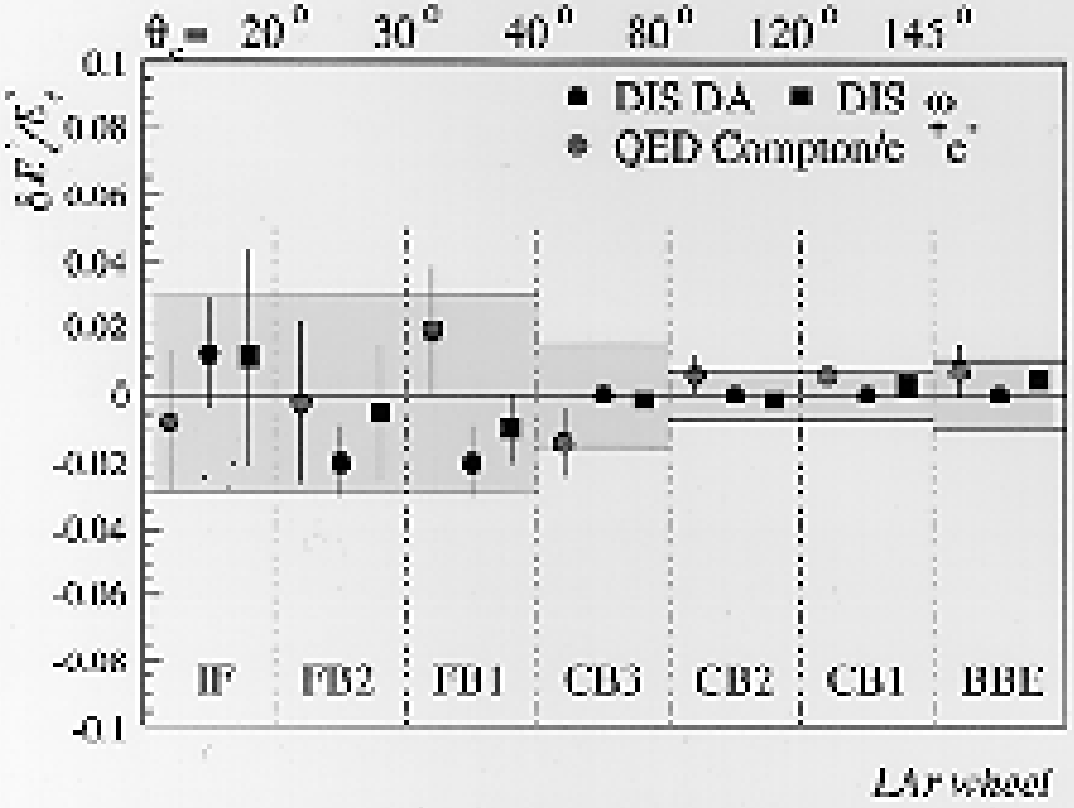
- Absolute Calibration
- $F(z, f) = \frac{E^e_{LAr}}{E^e_{DA}}$

Precision: 0.7 - 3 %

Limited by statistics

Design: 1%

Electron Calibration



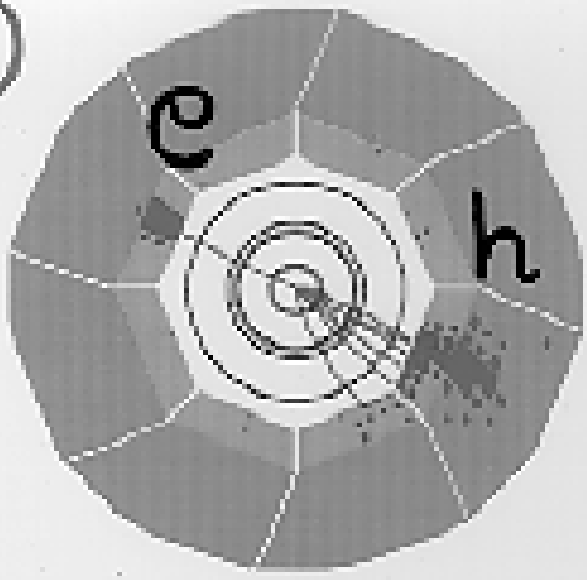
Improvement of $F_2(x, Q^2)$ System.:

low x, Q^2 7% → 4%

high x, Q^2 20% → 15%

Hadron Calibration P_T-Balance

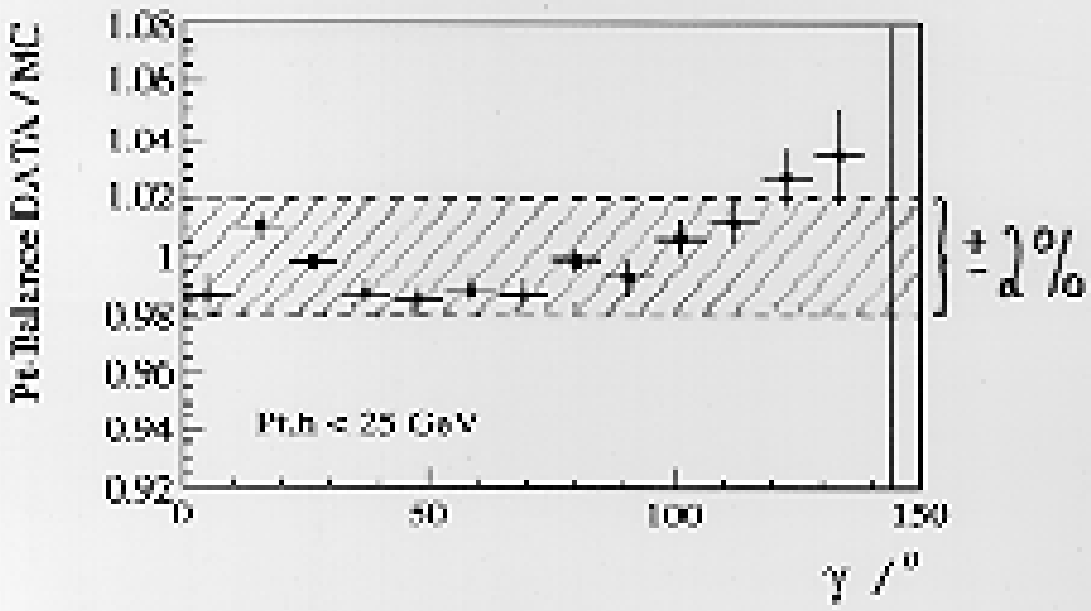
4 - 7 %

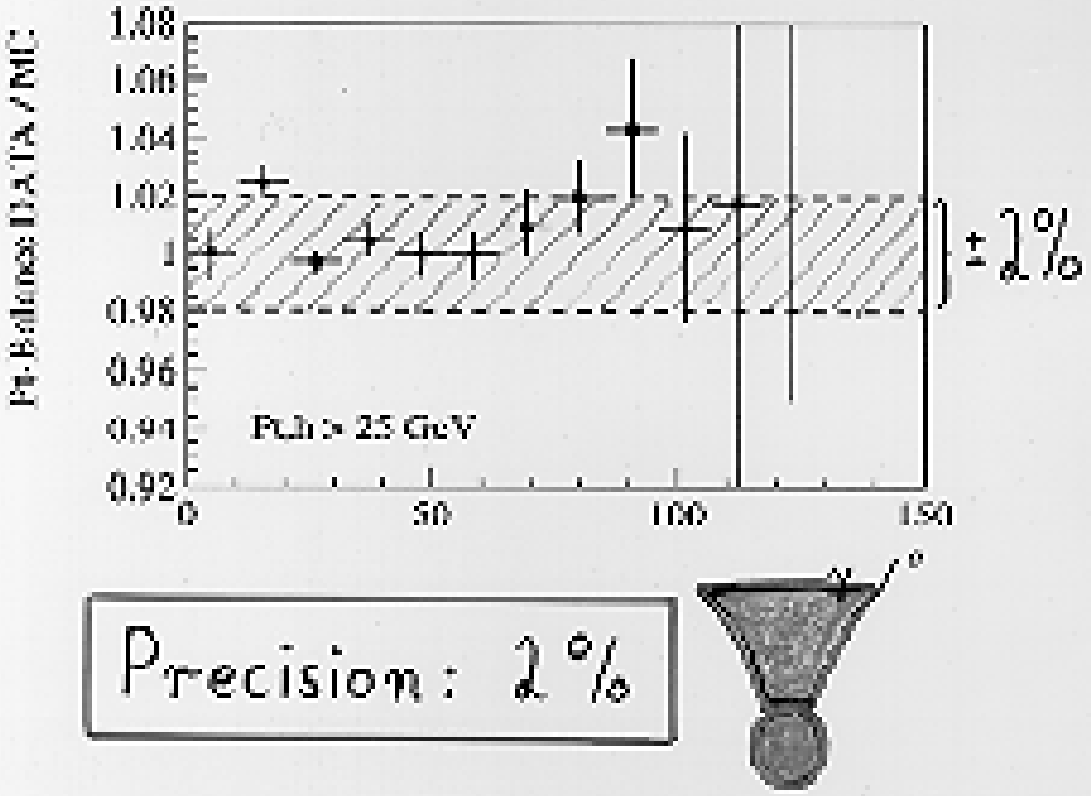


- P_T of e balanced by P_T of h
- unknown hadr. scale ↔ known e-scale
- $$F^H(\text{wheel}) = \left.\frac{(P_T^H / P_T^e)^{DATA}}{(P_T^H / P_T^e)^{MC}}\right|_{EMC,\,HAC}$$

Design: 2 %

Hadron Calibration



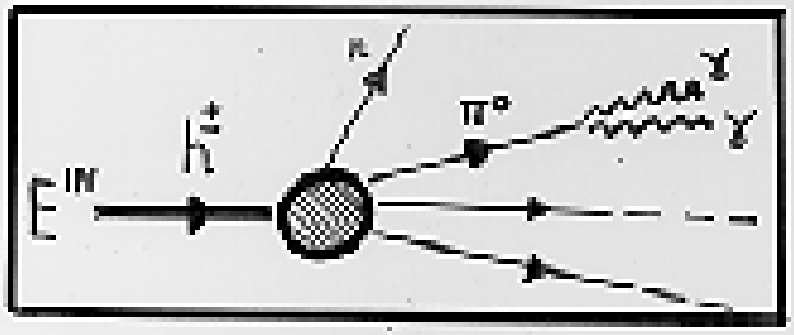


Precision : 2 %

Software Weighting

$$E^{h}_{dep} = E_{elm}(E^{IN}) + E_{had}(E^{IN}) + E_{inv}(E^{IN})$$

$E^{IN}\uparrow$: $\uparrow$ $\downarrow$ $\downarrow$



$$\frac{e}{\pi}(10\,GeV) = 1.35$$

① Weighting must „recognize" elm. and had. deposited energy
▶ Energy density

② Weighting must „grasp" global shower development ▶ Cones

Software Weighting Actually Used in H1

$$E^i_{rec} = E^i_0 \cdot \omega$$

reconstructed cell energy — signal in cell — weighting factor

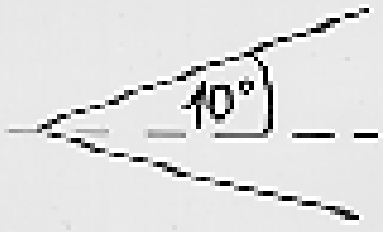
▶ hadr. Object $\lesssim$ 7 GeV:

$$\omega = \begin{cases} 1.353 & \text{in EMC} \\ 1.608 & \text{in HAC} \end{cases}$$

constant

▶ hadr. Object > 10 GeV:

$$\omega = C_1 \cdot e^{-C_2 \frac{E^i_0}{Vol^i}} + C_3$$



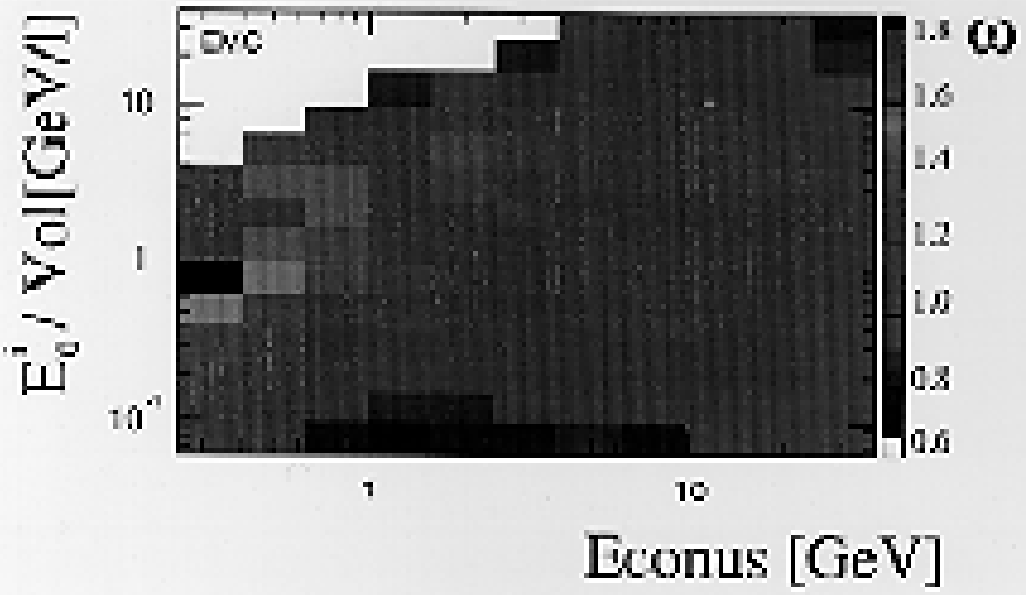
$C_1 \propto E_{conus}$ $C_2 \propto E_{conus}$ $C_3 \propto E_{conus}, \theta_{conus}$

optimized rec. event level

New Weighting Method

- $\omega\left(\frac{E_0^i}{Vol_i}, E_{conus}\right)$ for **low energies**

0.5 - 25 GeV



- Reconstruction of energy on **cell Level** + event level

CERN TEST

Improvements of new Weighting

- Linearity $\frac{E_{dep} - E_{rec}}{E_{dep}}$:

old	3 - 12 %
new	1 - 3 %

E_{conus} : 1 - 25 GeV

- $\sigma(E_{rec})/E_{rec}$:

old	16 % - 46 %
new	15 % - 40 %

"

- less aberration from gaussian of rec. energy distributions

- rec. on cell level

Summary

- Using ep-Physics to calibrated
- Electromagnetic Scale:

  DA - Method

  Precision: 0.7 - 3 %
- Hadronic Scale:

  P_T - Balance

  Precion: 2 %
- New promising weighting

THANK YOU !