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Beam Request for the Calibration of H1 Calorimeter Modules in 1992

H 1 Calorimeter Group

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I. Beam Request for the Calibration of H1 Calorimeter Modules in 1992

The H1 liquid argon calorimeter is structured in eight separate rings, with eight modules of identical type (i.e. identical detailed substructure) forming one ring (see Fig.1). With lead and stainless steel as absorber materials for the electromagnetic and hadronic section respectively, it is non-compensating, i.e. $e/\pi \neq 1$. Applying the π° - weighting technique, one can obtain an effective e/π - ratio of one [1], [2], [3] , [4]. This software weighting technique requires a detailed understanding of the relevant weighting parameters. They depend primarily on the particle energy, but to some extent also on the angle of impact. In addition, the module crack zones and the critical transition zones between modules of different absorber plate orientation require a rather detailed study of these parameters. So far Monte Carlo results do not reproduce the data at the level of accuracy required, in particular in the crack zones.

In 1989 / 90 year the H1-calorimeter group has calibrated production modules of each module type (see Fig.1):

a) IF1/IF2 (particle impact direction A)

b) FB2/OF (particle impact direction B)

c) FB1/FB2 (particle impact direction C)

d) CB3/FB1 (particle impact direction D)

e) CB2/CB3 (particle impact direction E)

f) CB1/BBE (particle impact direction F)

d) test of the backward warm calorimeter (BWE)

The Figs. 2 and 3 show results of the test (c): the energy resolution and linearity for electrons (Figs. 2a and b), the energy resolution for pions (Fig.3a) and the measured e/π - ratio in the electromagnetic section of the calorimeter (Fig.3b). The dramatic improvement in the energy resolution for pions using the π° - weighting technique is evident.

The physics at HERA requires an absolute energy calibration at the 1% level.

The consequence of this requirement is a detailed calibration program to obtain correct weighting parameters not only for the various types of calorimeter modules, but also the variation across a module and crack zone.

For 1992 we plan to do these calibration runs of the LAr system with special emphasis on the azimuthal crack regions between 2 modules in 2 run periods, each period covering one set up. The 2 angular regions and the different module types involved are shown in Fig.1 : particle impact C, E. Horizontally and vertically a region of ± 30 cm can be scanned, which we foresee to do in steps of 10 cm (7 points horizontally, 7 points vertically). In addition, runs at a specific particle impact point are necessary, to calibrate the calorimeter response in the region of a special substructure (e.g. supporting rods, dead regions around spacers, etc.) At each point the energy dependence has to be studied. We plan to take data at 12 points: E = 10, 15, 20, 25, 30, 40, 50, 60, 70, 80, 120 and 170 GeV. The estimated time for each set up is $\sim$ 15 days.

A further running period in 1992 is necessary for a stand alone calibration of the tail catcher calorimeter (10 days).)

In summary, we request a total of 40 days of beam time in the H6 beam line for 1992.

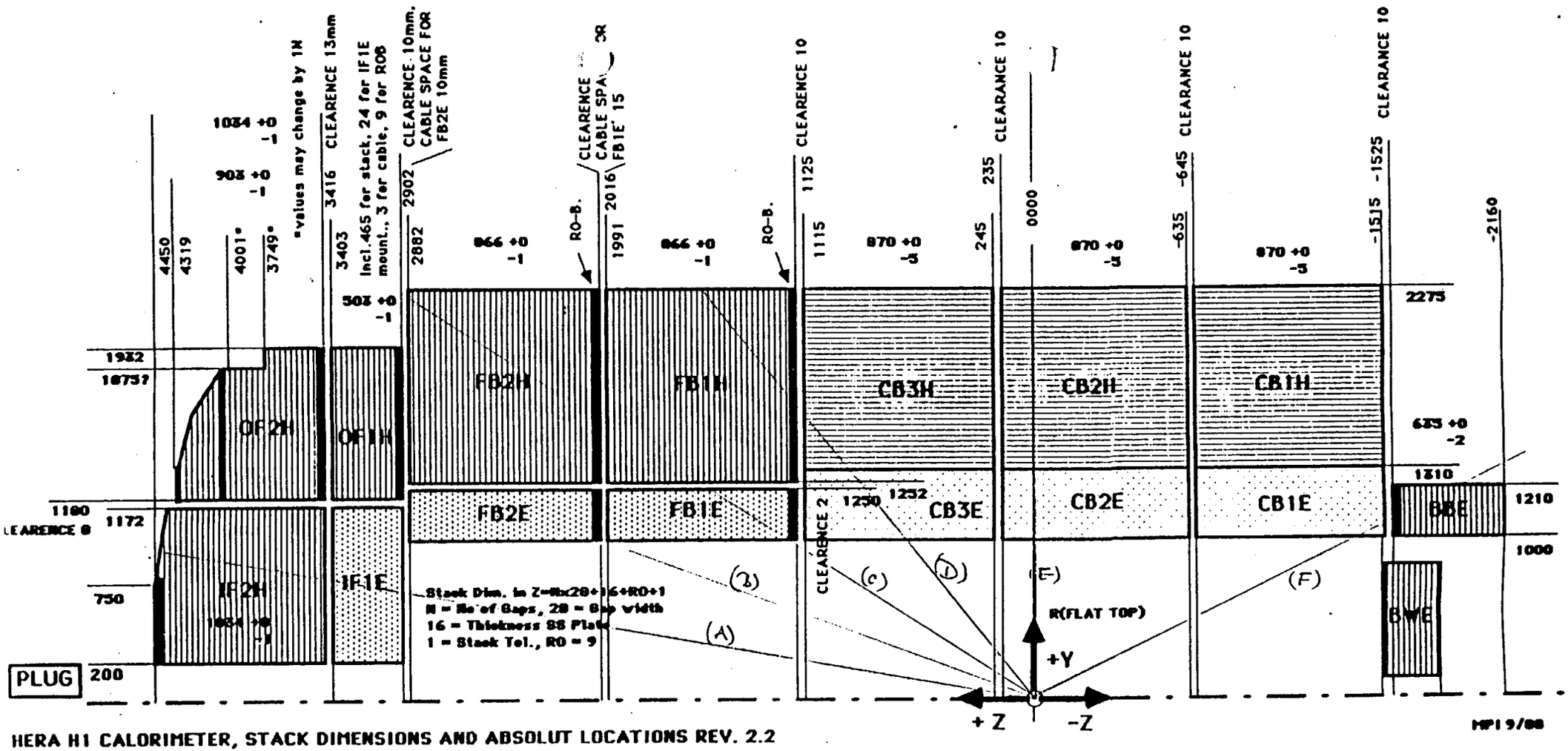
REFERENCES

[1] W. Braunschweig et al., Nucl.Inst. & Meth. **A265** (1988), 419.

[2] W. Braunschweig et al., DESY 87-172 and Nucl.Inst. & Meth. **A270** (1988), 334.

[3] W. Braunschweig et al., DESY 88-073, submitted to Nucl.Inst. & Meth.

[4] W. Braunschweig et al., **Results from a Test of a Pb-Fe Liquid Argon Calorimeter** (Submitted to Nucl.Inst. & Meth.



HERA H1 CALORIMETER, STACK DIMENSIONS AND ABSOLUT LOCATIONS REV. 2.2

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Fig. 1

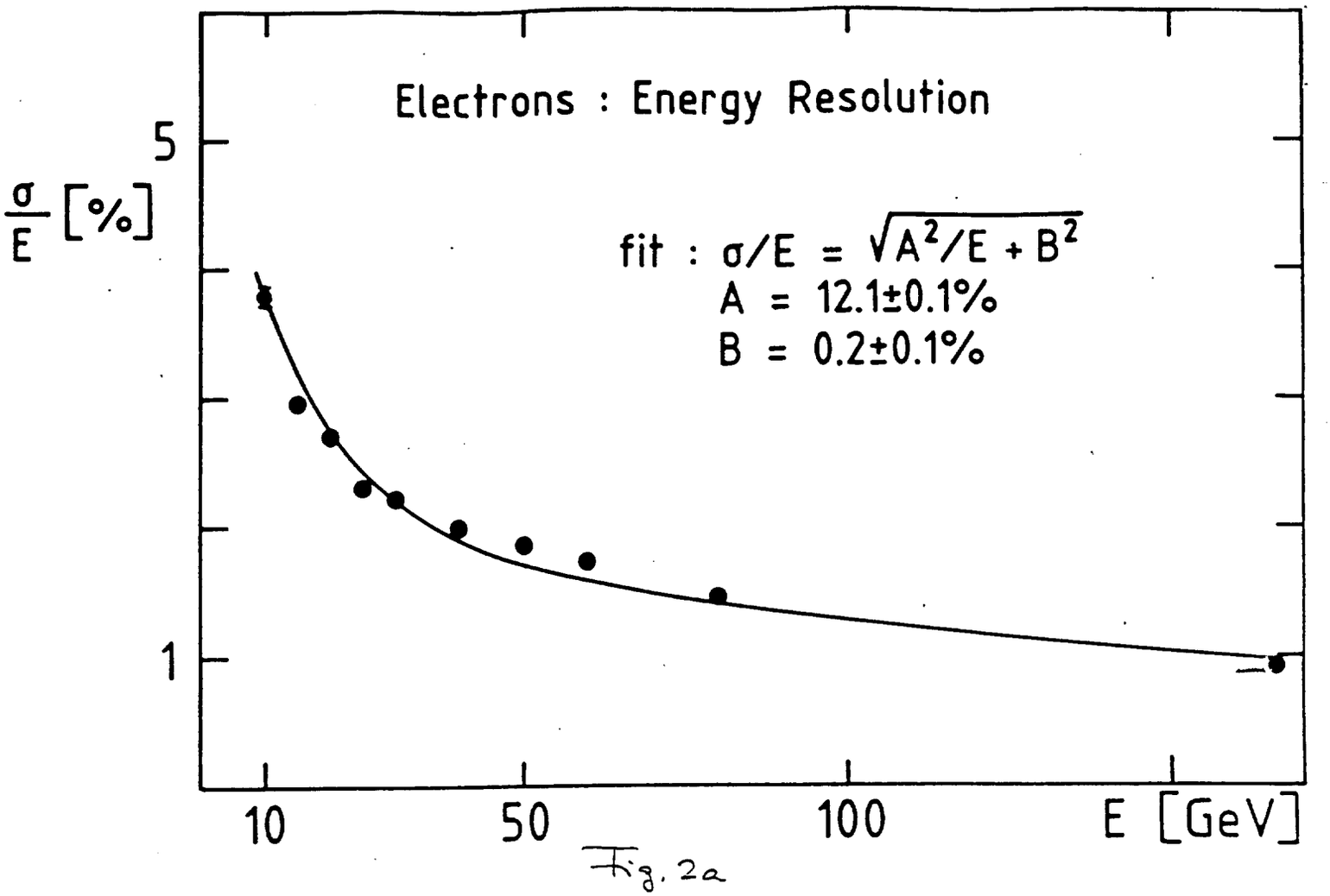
Electrons : Energy Resolution
σ/E [%]
5
1
fit : σ/E = √(A²/E + B²)
A = 12.1±0.1%
B = 0.2±0.1%
10
50
100
E [GeV]

Fig. 2a

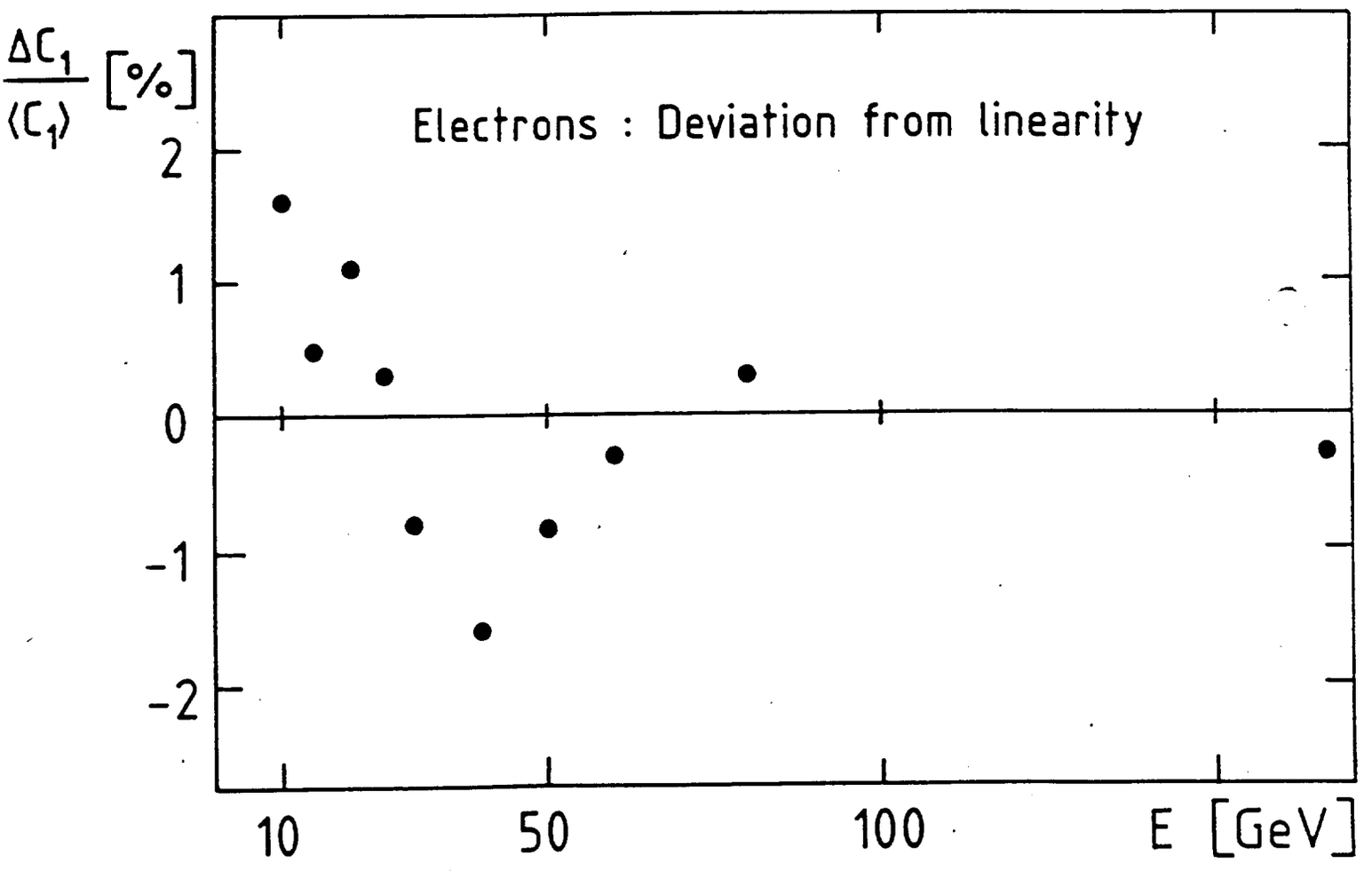
ΔC₁/⟨C₁⟩ [%]
Electrons : Deviation from linearity
2
1
0
-1
-2
10
50
100
E [GeV]

Fig 2b

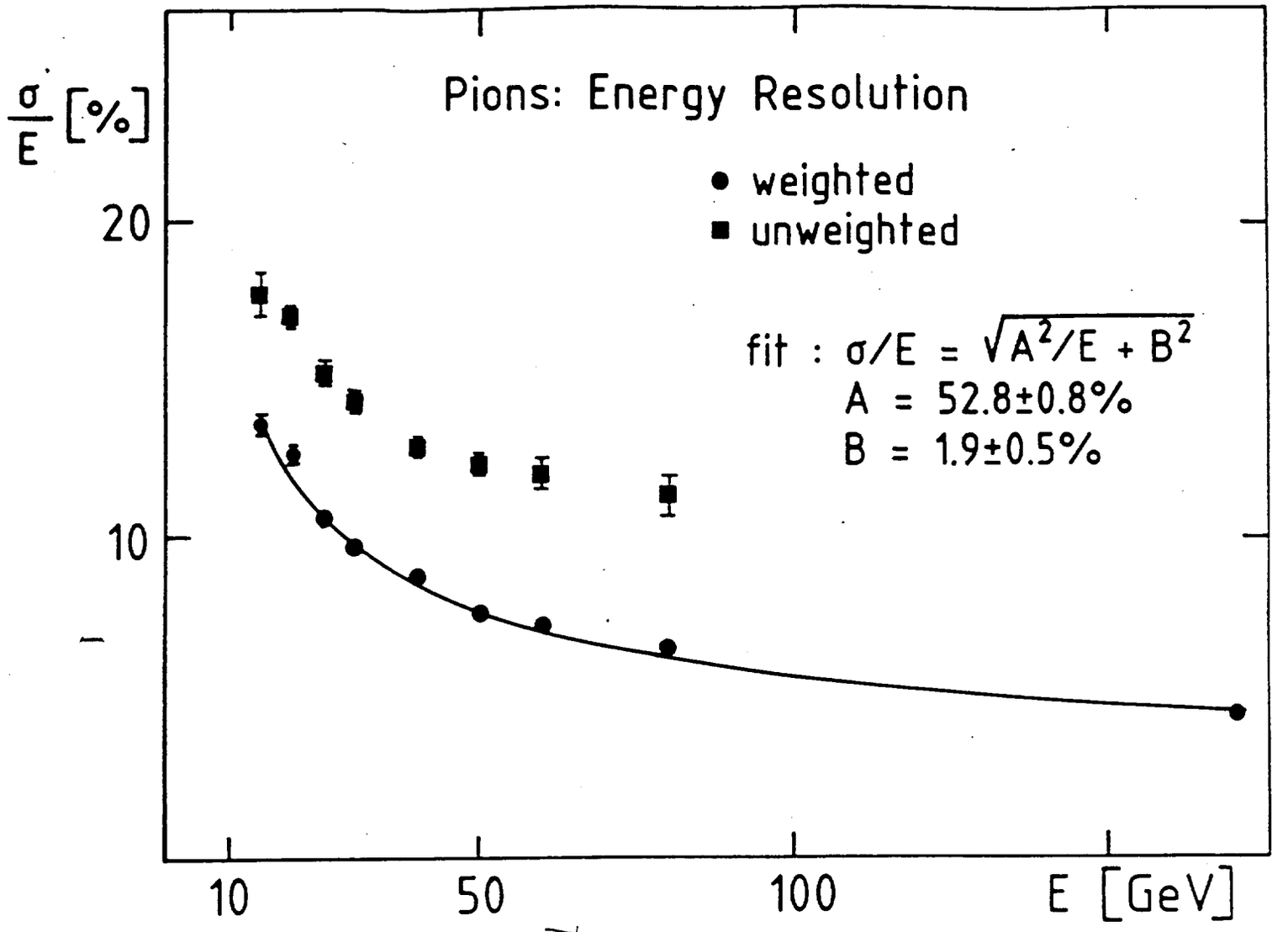
Pions: Energy Resolution
σ/E [%]
● weighted
■ unweighted
fit : σ/E = √(A²/E + B²)
A = 52.8±0.8%
B = 1.9±0.5%
20
10
10
50
100
E [GeV]

Fig. 3a

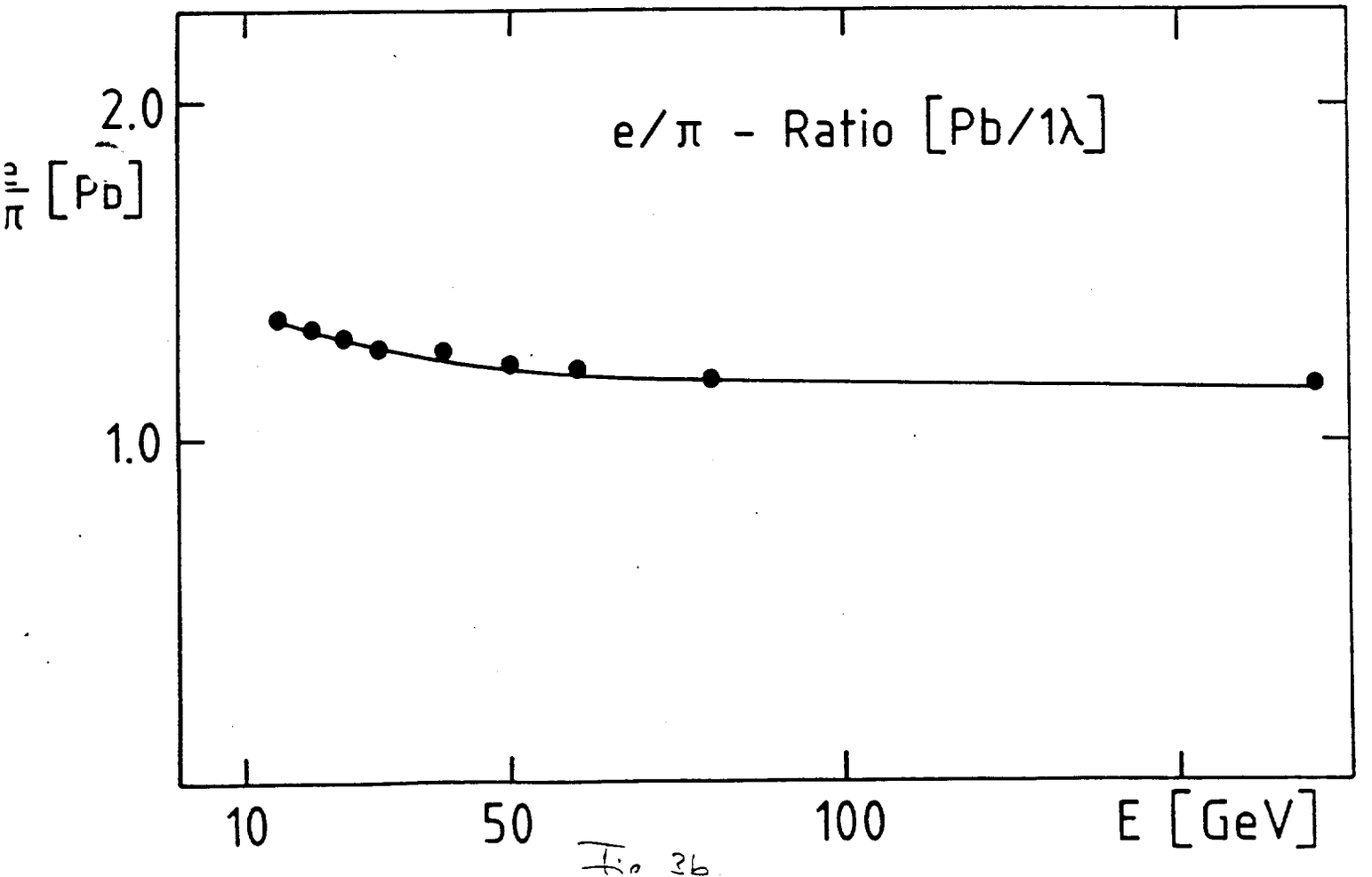
e/π - Ratio [Pb/1λ]
e/π [Pb]
2.0
1.0
10
50
100
E [GeV]

Fig. 3b