ATLAS Tilecal: pion – proton comparison

C. Alexa, S. Constantinescu, S. Dita

- 2002 test-beam data
- QGSP 2.7
- LHEP 3.6
- Groom predictions

2002 test-beam data:

- the energy interval imposed by Cerenkov counter
- electrons beam: 50, 100 and 180 GeV
- pion beams: 50, 100 and 180 GeV

QGSP 2.7 and LHEP 3.6

D. E. Groom: (SDC Collaboration Note SDC-93-559(1993))

- Geant3 simulations predict a difference between pion and proton response in a non-compensating hadronic calorimeter
- explained by a smaller pure hadronic fraction of pions due to leading π^0 produced by charge exchange mechanism

$$\frac{e}{\pi} = \frac{e/h}{1+(e/h-1)F_{\pi^0}^{\pi}} = \frac{e/h}{e/h-(e/h-1)F_{h}^{\pi}}$$

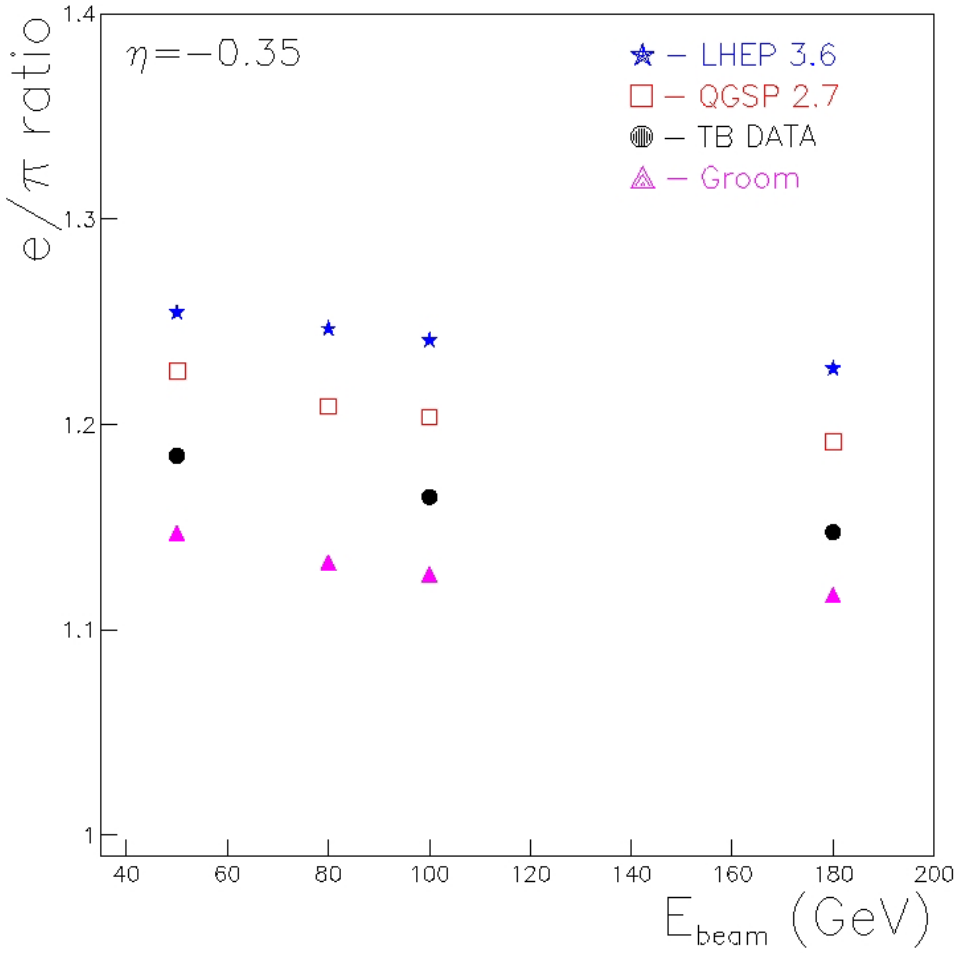
$$\frac{e}{p} = \frac{e/h}{1+(e/h-1)F_{\pi^0}^{p}} = \frac{eh}{e/h-(e/h-1)F_{h}^{p}}$$

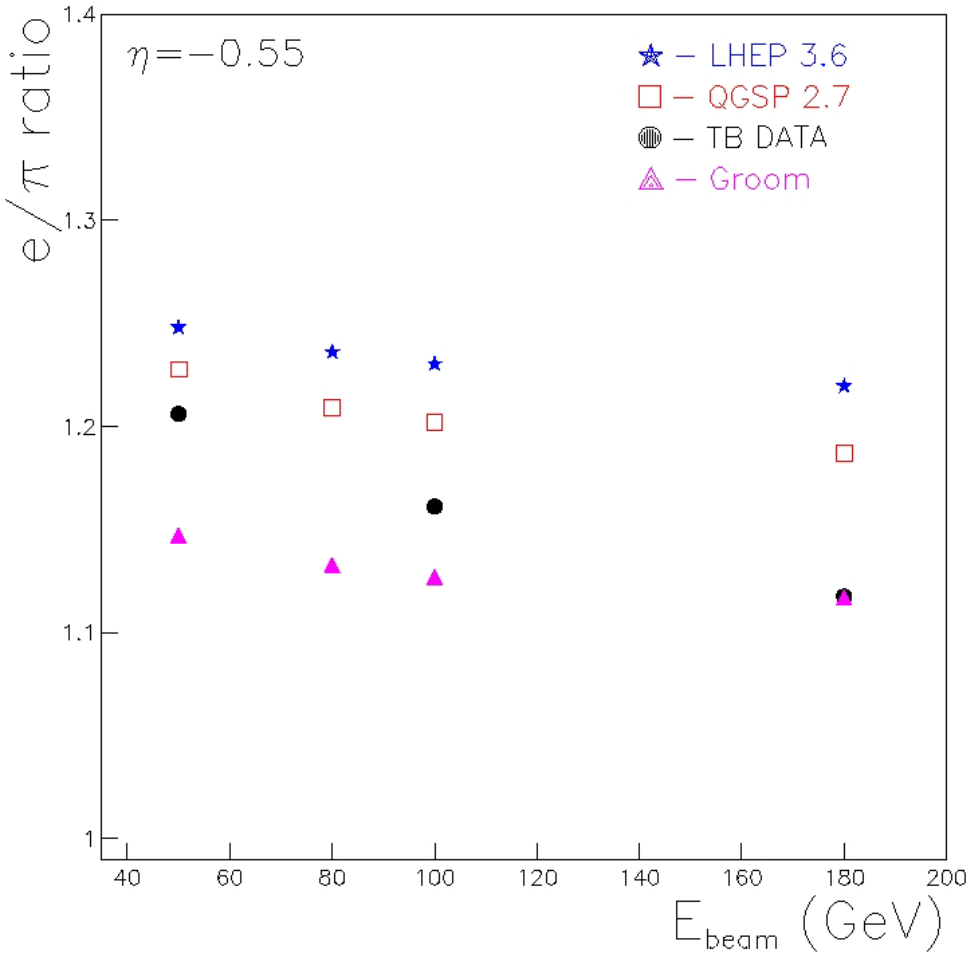
$$F_h = (E/E_0)^{m-1}$$

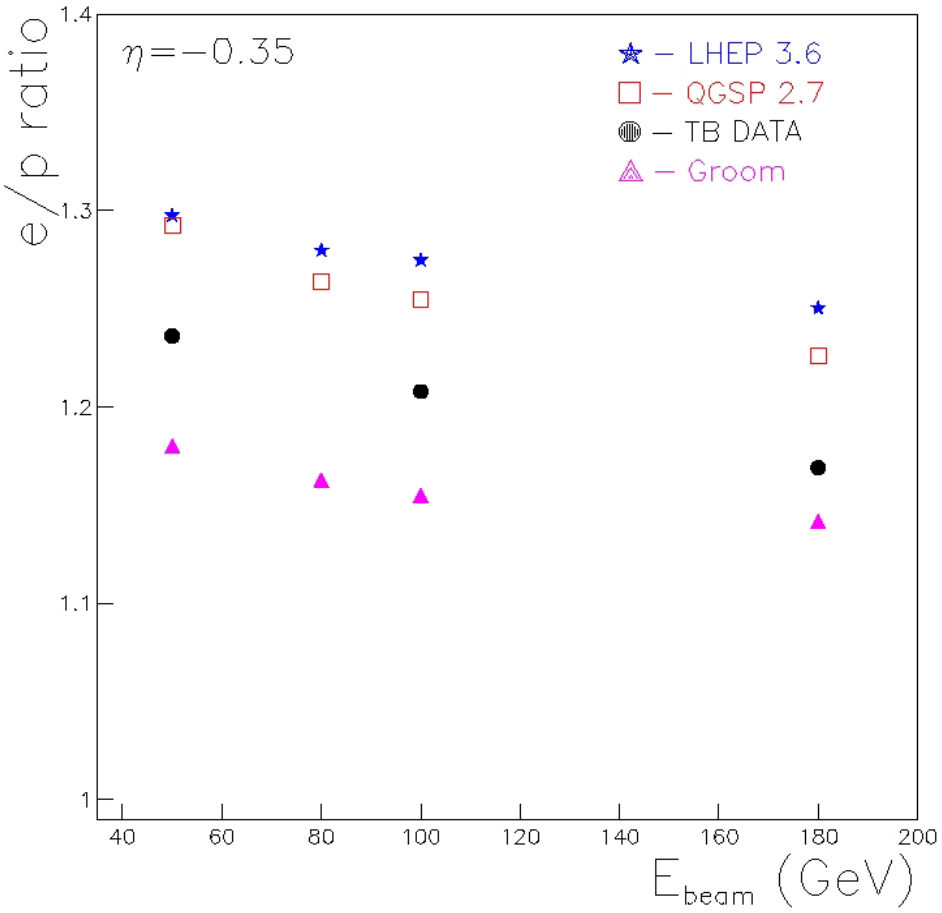
- for iron absorbant and scintillator Groom predictions are:
  - E_0=0.96 for pions and E_0=2.62 for protons
  - m=0.816 for pions and m=0.814 for protons

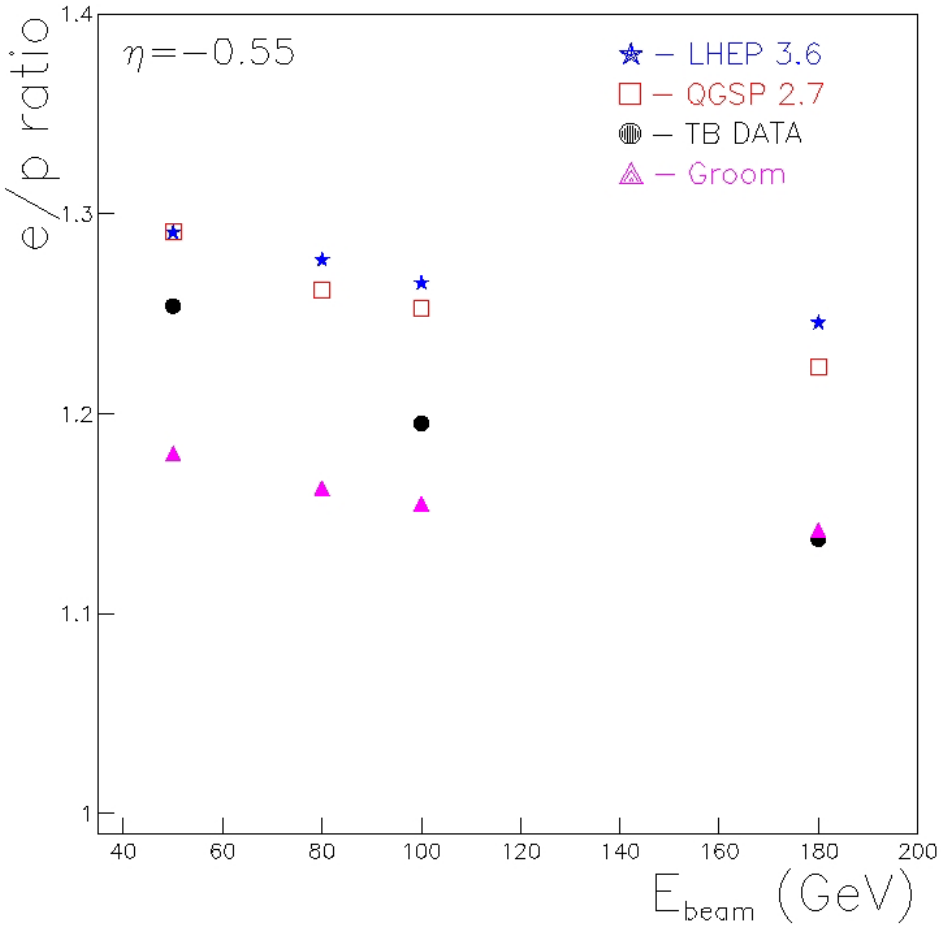
- e/h = 1.36 $\pm$ 0.11 was determined in ATLAS Tilecal (CERN/LHCC 95-44)

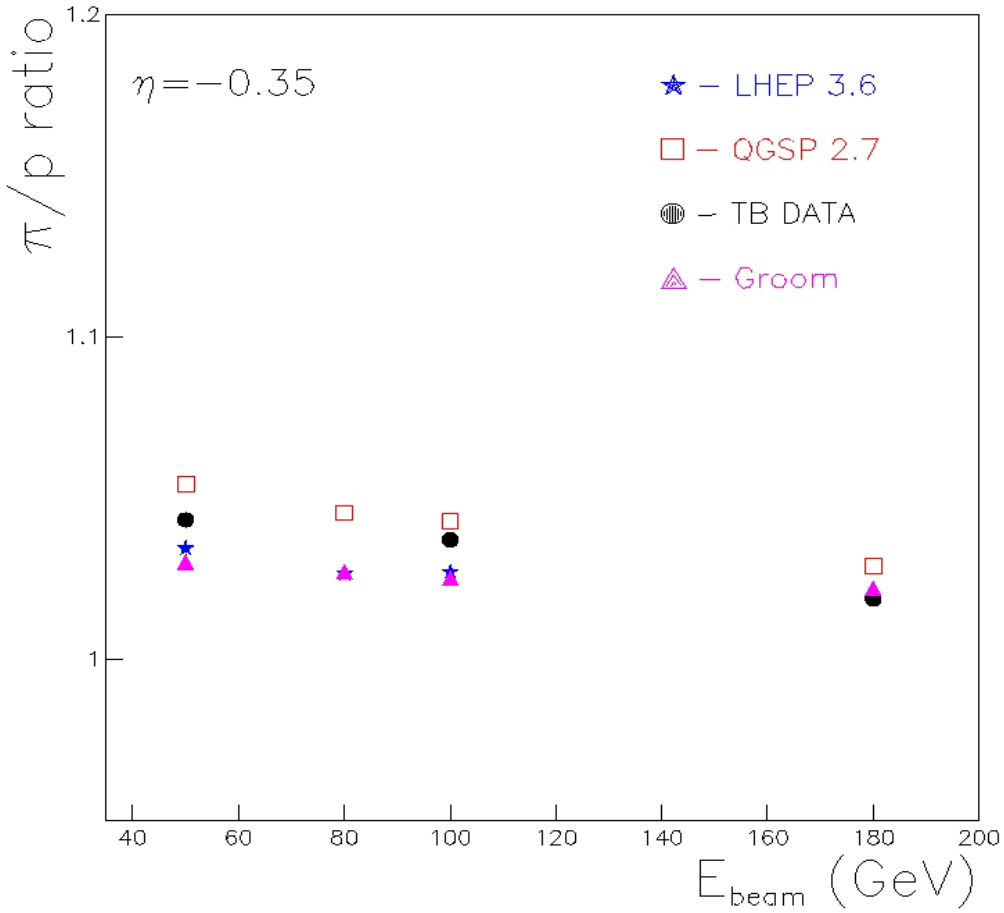
- e/π, e/p and π/p obtained using the above formula and the experimental e/h value will be shown as Groom predictions

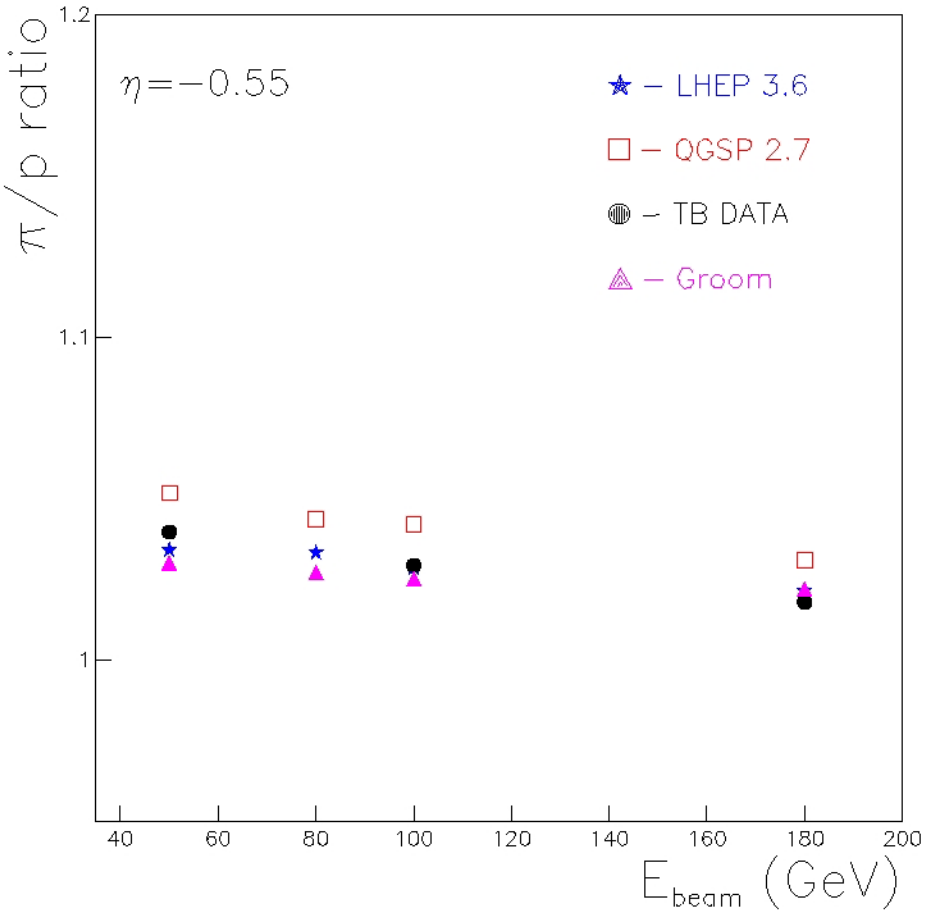

$\eta = -0.35$
★ – LHEP 3.6
□ – QGSP 2.7
◍ – TB DATA
◬ – Groom
e/π ratio
1.4
1.3
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E_{beam} (GeV)


$\eta = -0.55$
★ – LHEP 3.6
□ – QGSP 2.7
◍ – TB DATA
◬ – Groom
e/π ratio
1.4
1.3
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E_{beam} (GeV)

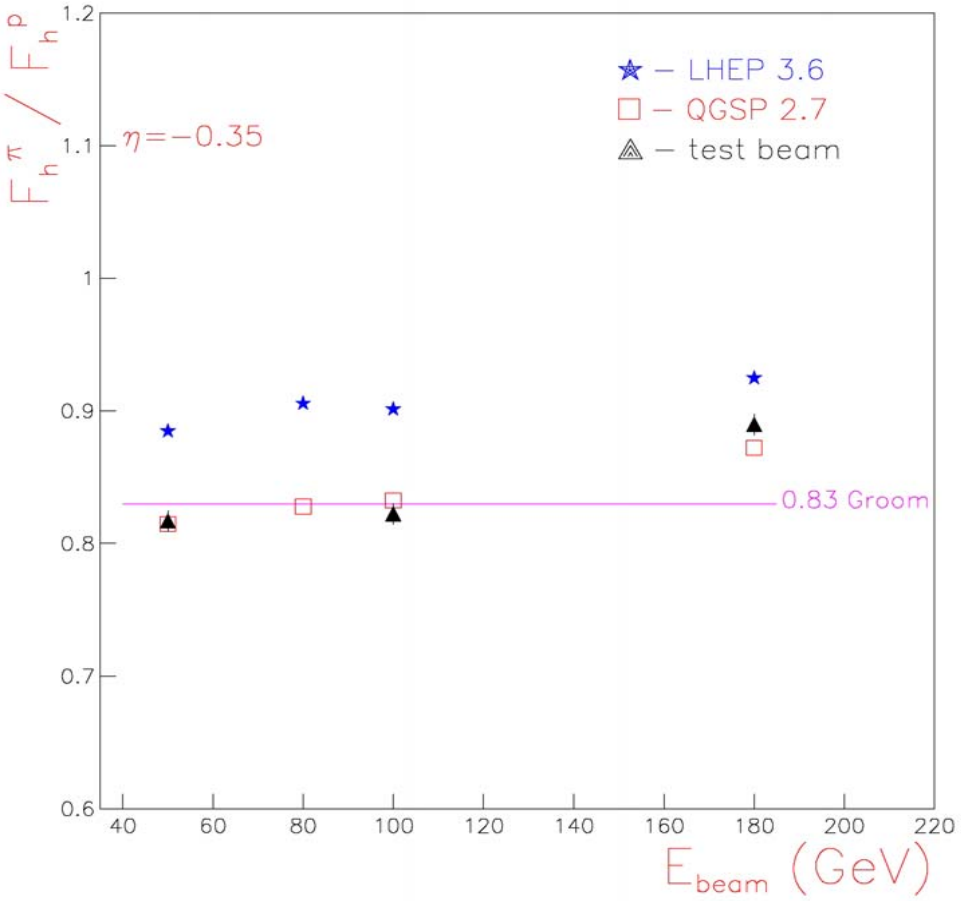

η=−0.35
★ – LHEP 3.6
□ – QGSP 2.7
◍ – TB DATA
△ – Groom
e/p ratio
1.4
1.3
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E_beam (GeV)

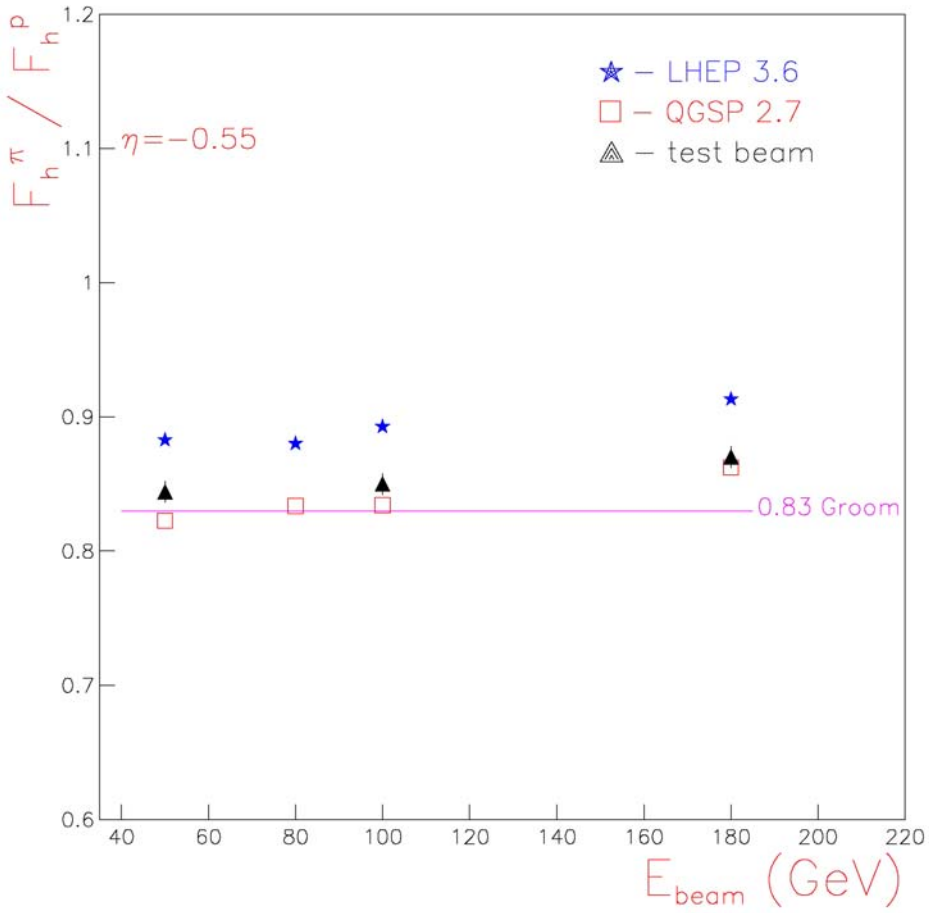

η=−0.55
★ – LHEP 3.6
□ – QGSP 2.7
◍ – TB DATA
△ – Groom
e/p ratio
1.4
1.3
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E_beam (GeV)


π/p ratio
η=−0.35
– LHEP 3.6
– QGSP 2.7
– TB DATA
– Groom
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E beam (GeV)


π/p ratio
η=−0.55
– LHEP 3.6
– QGSP 2.7
– TB DATA
– Groom
1.2
1.1
1
40
60
80
100
120
140
160
180
200
E beam (GeV)

ratio between pion and proton pure hadronic fractions





Summary and conclusions

e/π and e/p ratio:

- a small decrease with beam energy for data and simulations
- a better description of the data by QGSP 3.6
- no η dependence

π /p ratio:

- a good description of the test-beam data by the MC

F_{π}^{h} / F_{p}^{h} ratio:

- e/pi and e/p test-beam data were used to obtain this ratio
- good agreement between test-beam data and simulations (QGSP better then LHEP)
- data, QGSP and LHEP predictions are showing a small increase with the energy in contrast to the constant behavior predicted by Groom