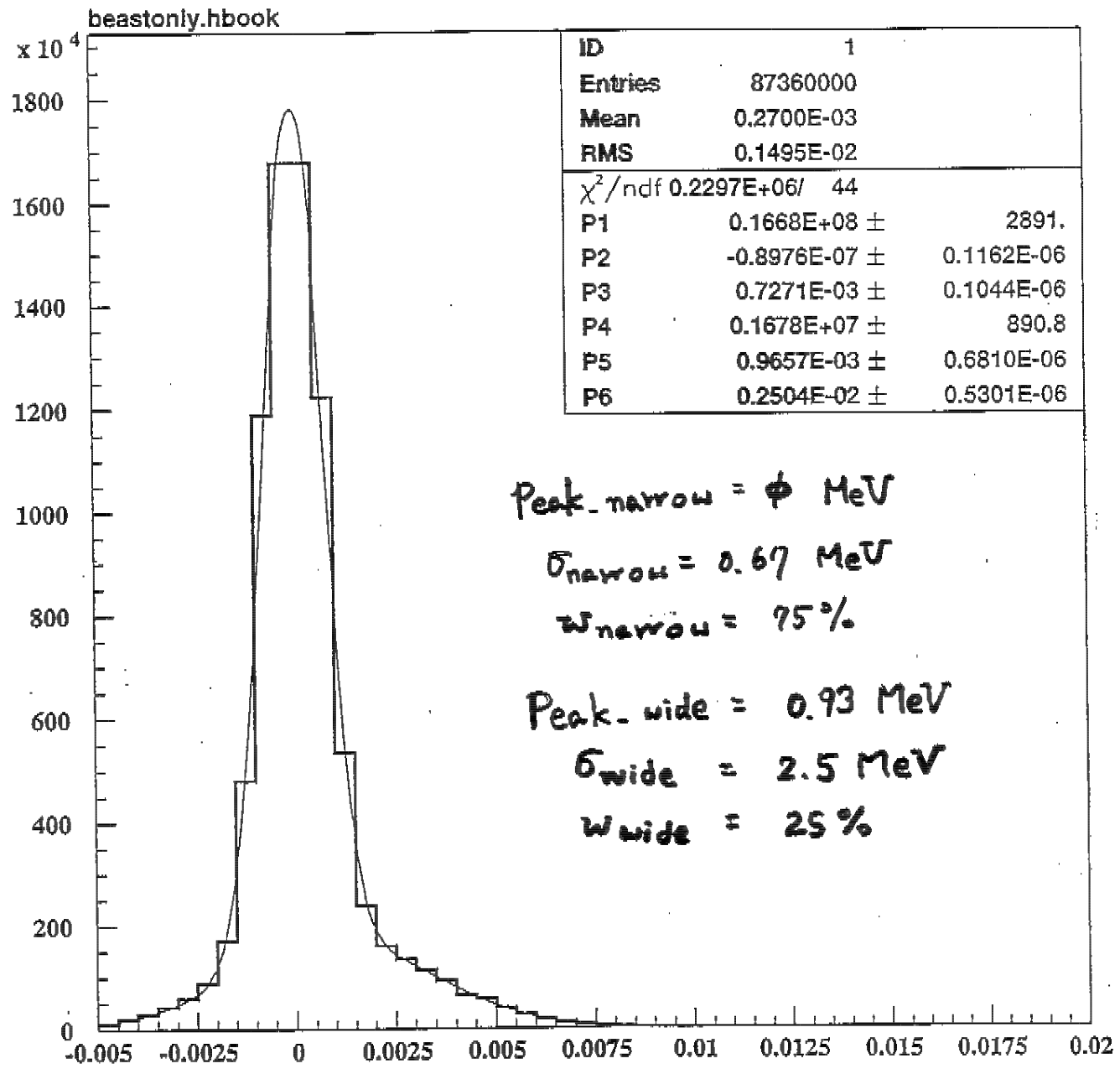
Beam background effect

Noise smearing estimated from the BEAST are studied in single π° and generic events

- Noise function from the BEAST CsI pedestal spectrum :
  Double Gaussian with
  $\text{peak}_{narrow} = 0$ MeV, $\sigma_{narrow} = 0.67$ MeV, $w_{narrow} = 75\%$
  $\text{peak}_{wide} = 0.93$ MeV, $\sigma_{wide} = 2.5$ MeV, $w_{wide} = 25\%$
- Momentum of single π° :
  0.1, 0.2, 0.5 and 2 GeV/c
- Sparsification(zero suppression) values of 0.8(current default), 2 and 5 MeV are tested. 2 MeV found to be the best in the π° mass peak value.
- In generic events with optimal cuts.
  $\epsilon = 35.4$ %, S/N = 0.41 (0.8 MeV spars.)
  $\epsilon = 42.1$ %, S/N = 0.37 (2 MeV spars.)
  ($\epsilon = 49.1$ %, S/N = 0.64 w/o BKG)

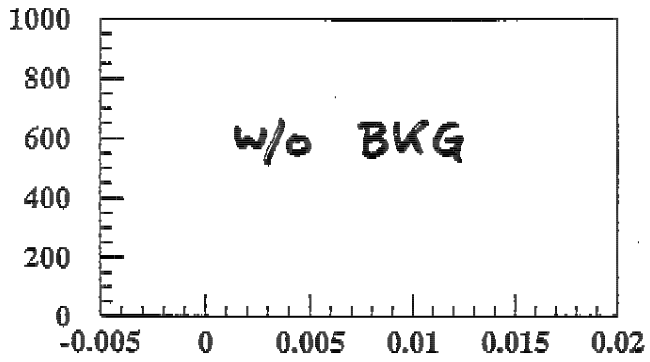
99/05/20 02.46

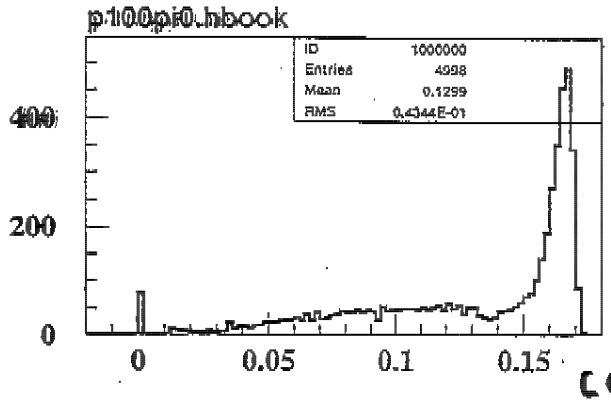


double-Gaussian noise

100 MeV pi0

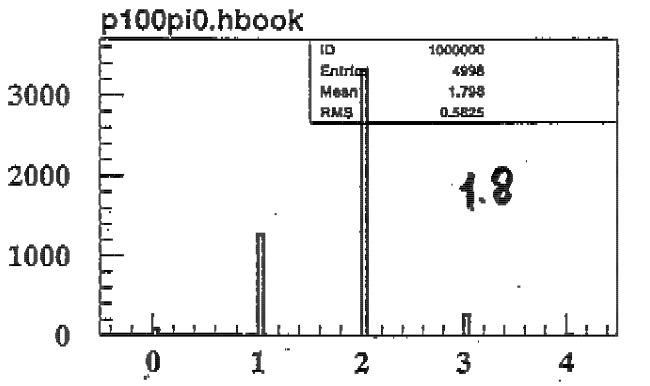
99/05/20 17.05



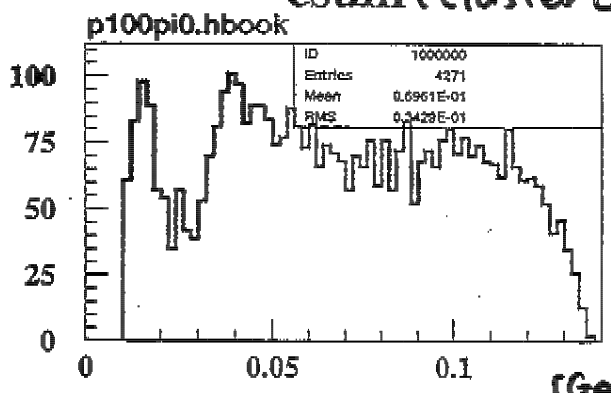


[GeV]

csum (cluster E sum)

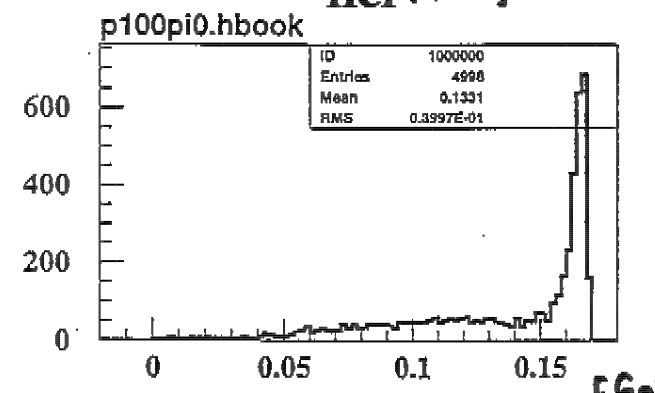


ncl (# of clusters)



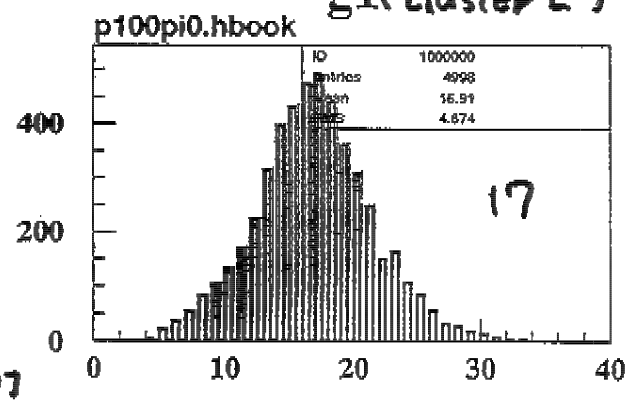
[GeV]

gl (cluster E)



[GeV]

dsum (Crystal E sum)

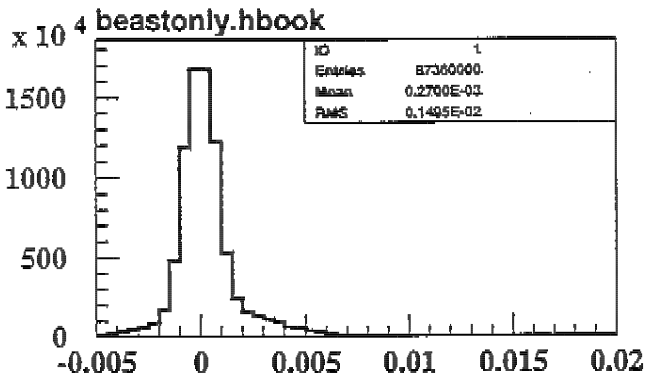


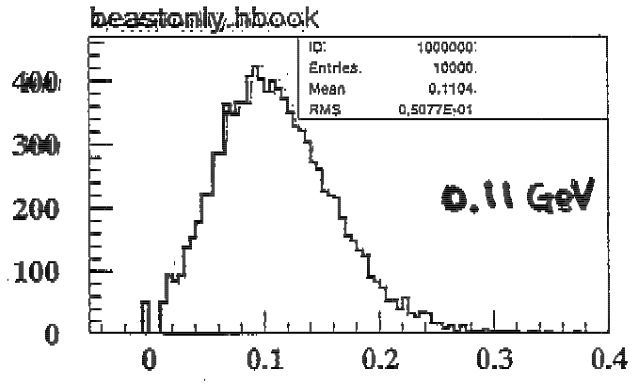
nhits (# of crystal hits)

(Only BKG noise) <0.8MeV spars?

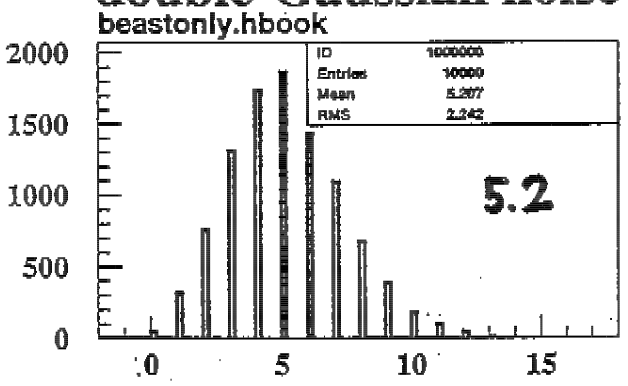
Beast(BKG) default

99/05/20 17.12

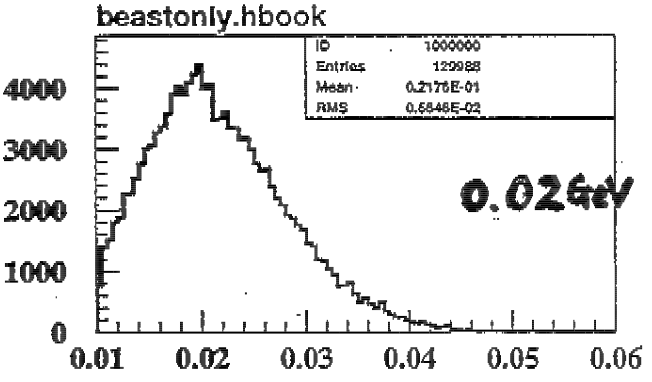




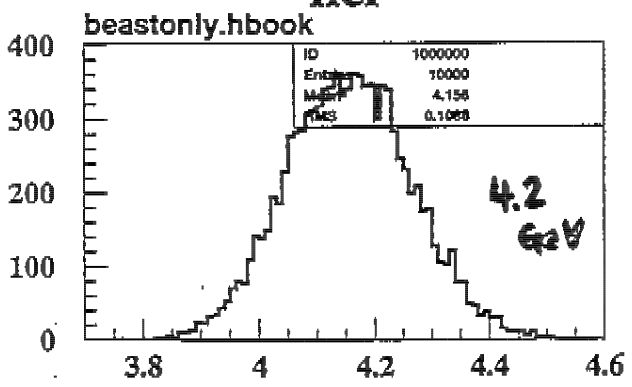
double-Gaussian noise



csum

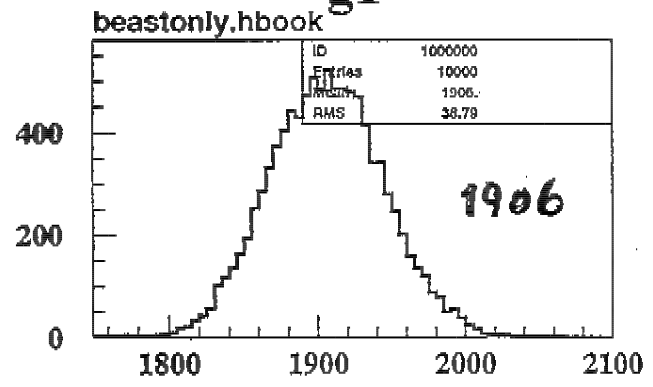


ncl



dsum

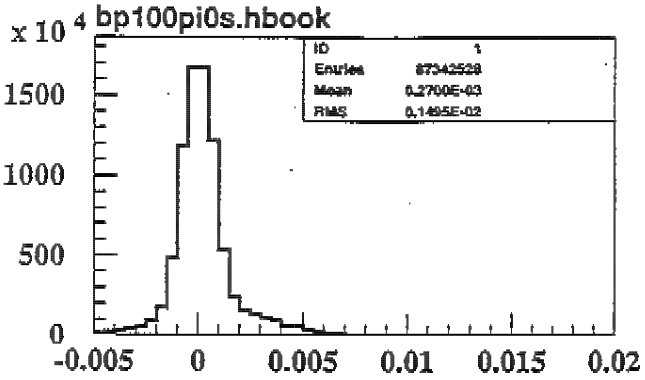
g1

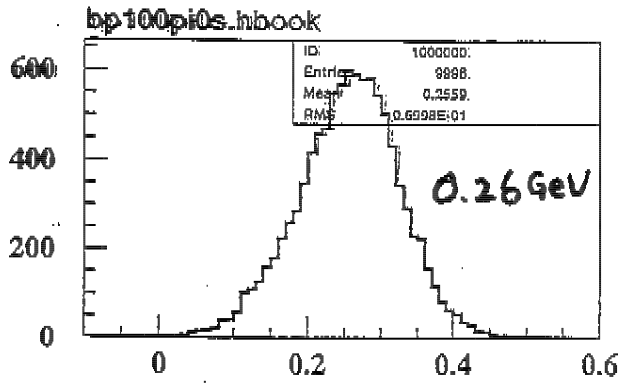


nhits

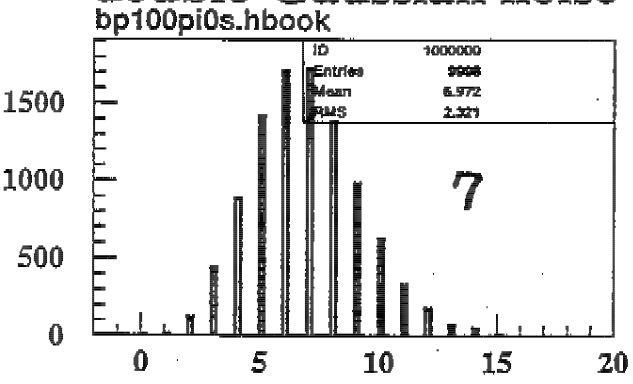
100 MeV pi0 w/BKG(0.8 MeV spars.)

99/05/20 17.05

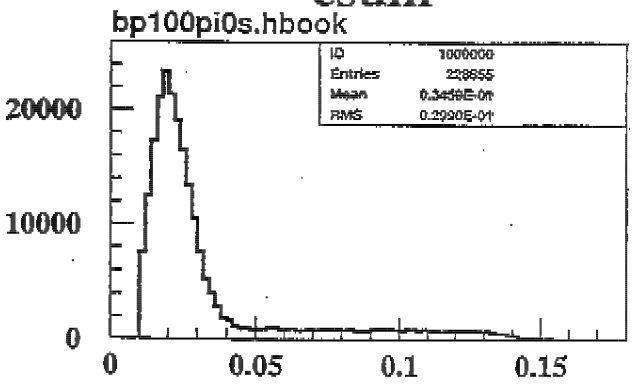




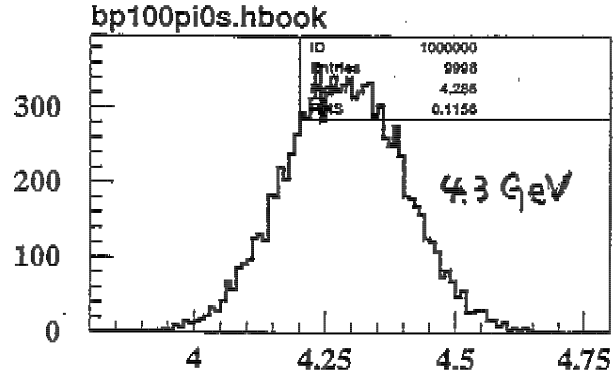
double-Gaussian noise



csum

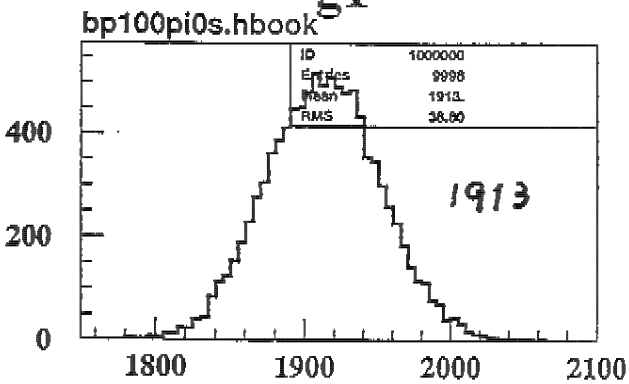


ncl

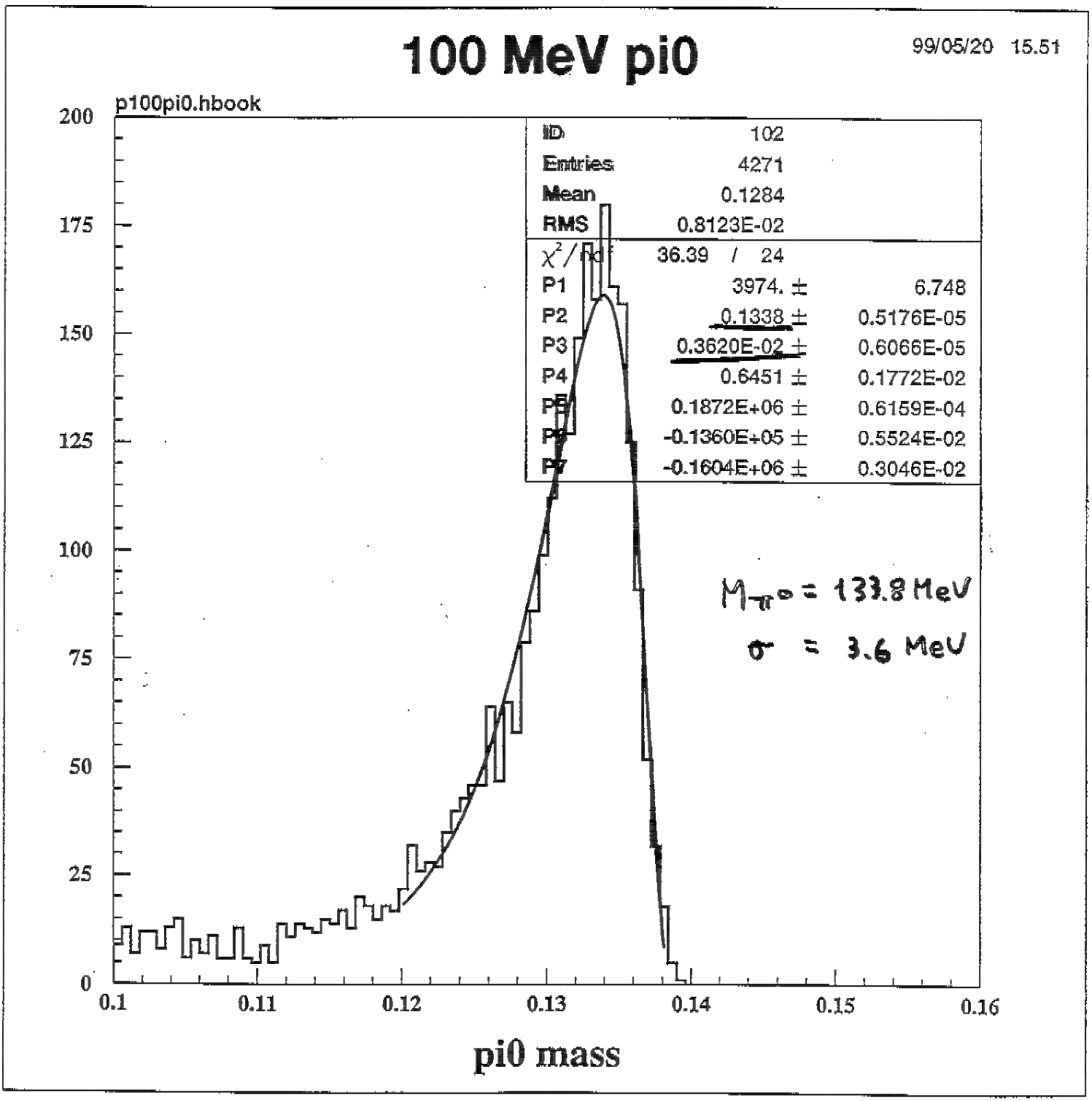


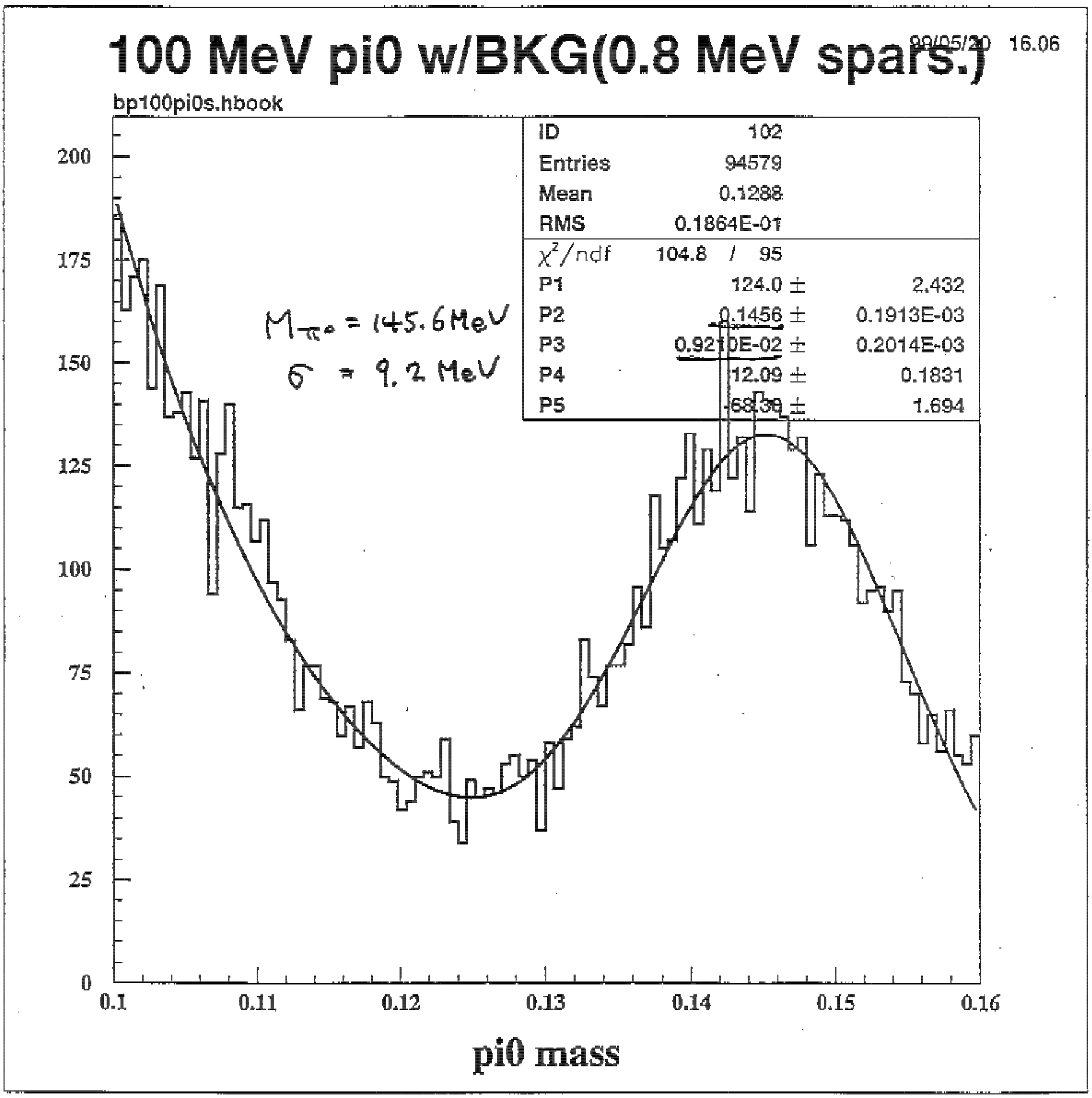
dsum

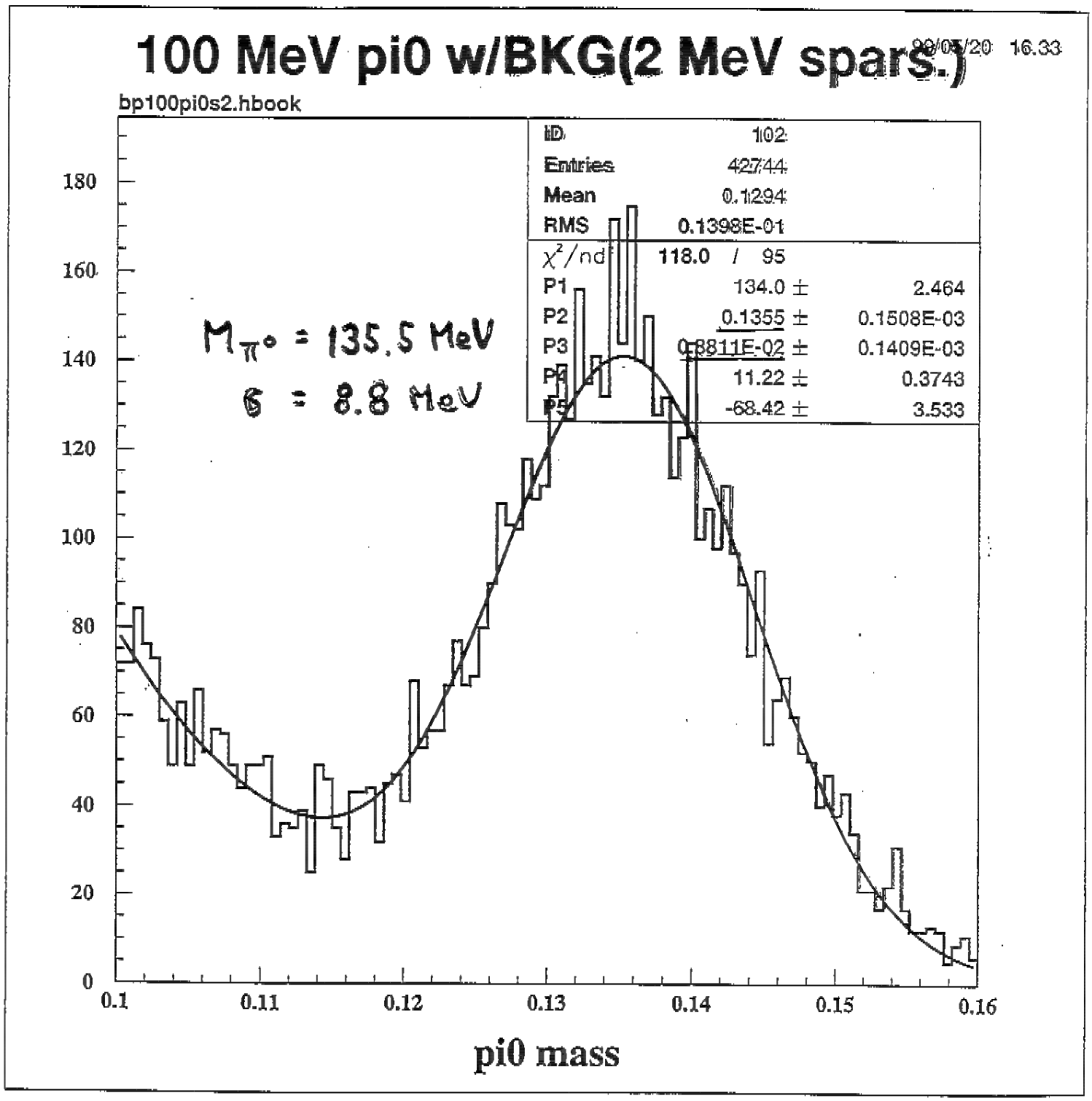
g1



nhits

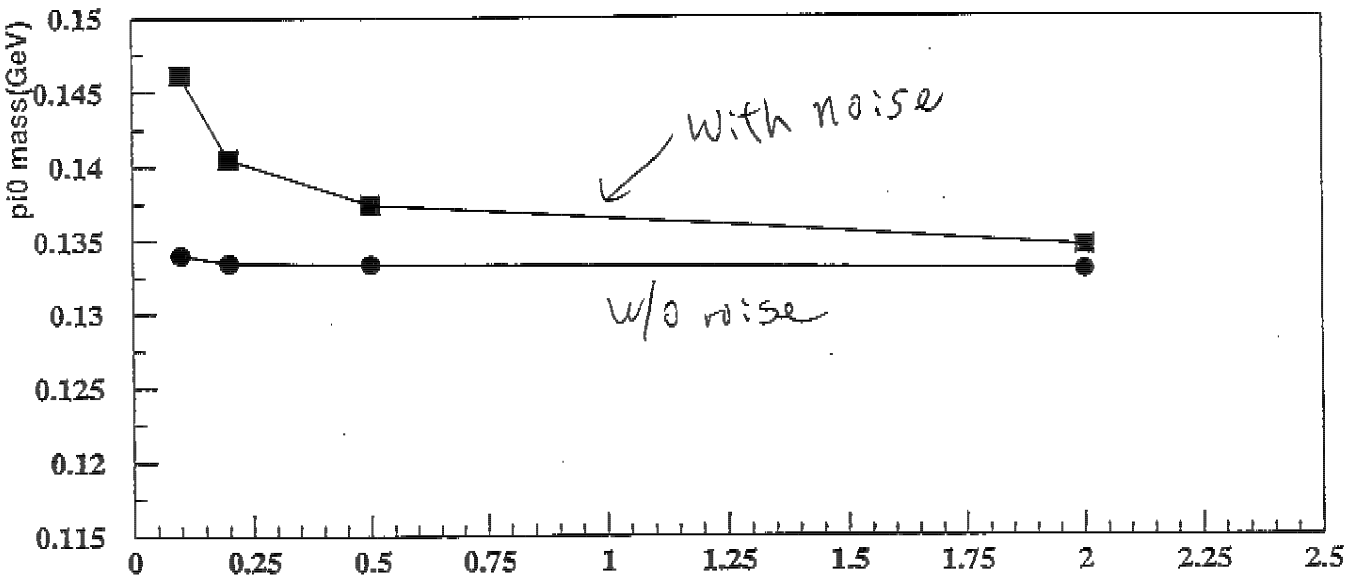

100 MeV pi0
99/05/20 15.51
p100pi0.hbook
ID 102
Entries 4271
Mean 0.1284
RMS 0.8123E-02
χ²/ndf 36.39 / 24
P1 3974. ± 6.748
P2 0.1338 ± 0.5176E-05
P3 0.3620E-02 ± 0.6066E-05
P4 0.6451 ± 0.1772E-02
P5 0.1872E+06 ± 0.6159E-04
P6 -0.1360E+05 ± 0.5524E-02
P7 -0.1604E+06 ± 0.3046E-02
M_π0 = 133.8 MeV
σ = 3.6 MeV
200
175
150
125
100
75
50
25
0
0.1
0.11
0.12
0.13
0.14
0.15
0.16
pi0 mass

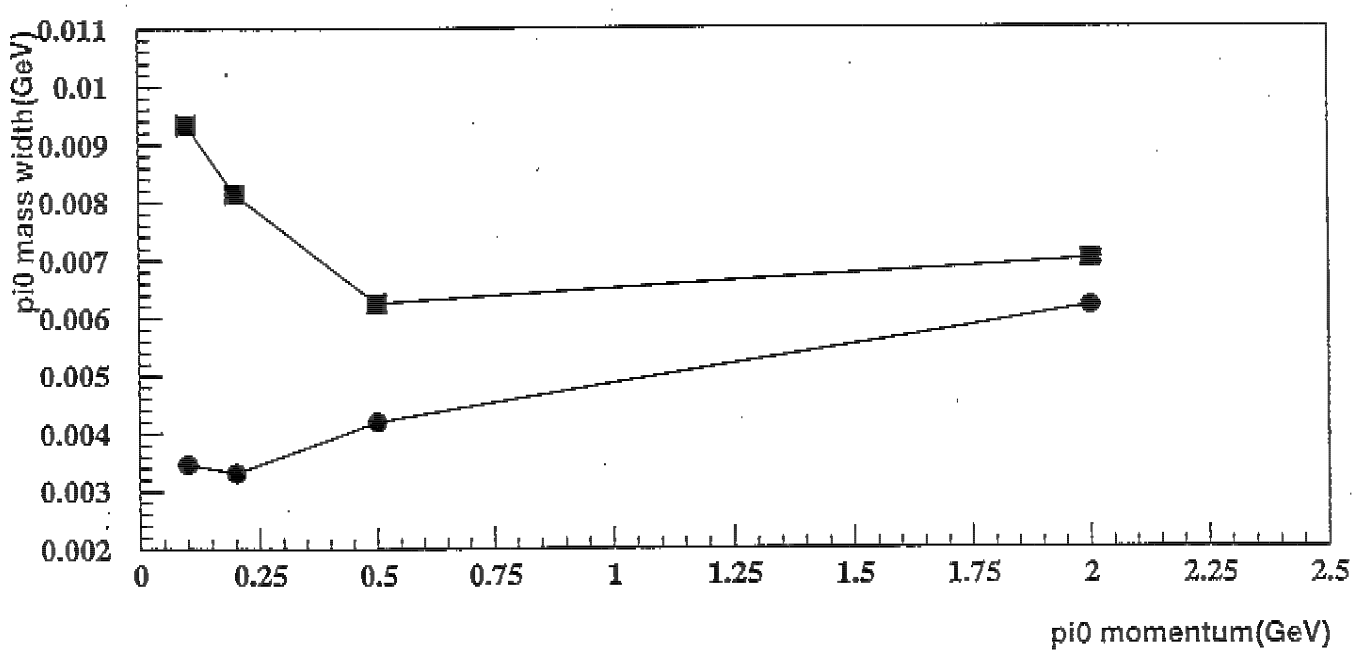

100 MeV pi0 w/BKG(0.8 MeV spars.)
99/05/20 16.06
bp100pi0s.hbook
ID 102
Entries 94579
Mean 0.1288
RMS 0.1864E-01
χ²/ndf 104.8 / 95
P1 124.0 ± 2.432
P2 0.1456 ± 0.1913E-03
P3 0.9210E-02 ± 0.2014E-03
P4 12.09 ± 0.1831
P5 -68.36 ± 1.694
M_π0 = 145.6MeV
σ = 9.2 MeV
200
175
150
125
100
75
50
25
0
0.1
0.11
0.12
0.13
0.14
0.15
0.16
pi0 mass


100 MeV pi0 w/BKG(2 MeV spars.)
99/05/20 16.33
bp100pi0s2.hbook
ID 102
Entries 42744
Mean 0.1294
RMS 0.1398E-01
χ²/nd 118.0 / 95
P1 134.0 ± 2.464
P2 0.1355 ± 0.1508E-03
P3 0.8811E-02 ± 0.1409E-03
P4 11.22 ± 0.3743
P5 -68.42 ± 3.533
Mπ0 = 135.5 MeV
σ = 8.8 MeV
0
20
40
60
80
100
120
140
160
180
0.1
0.11
0.12
0.13
0.14
0.15
0.16
pi0 mass

pi0 with BKG(0.8 MeV spar.)

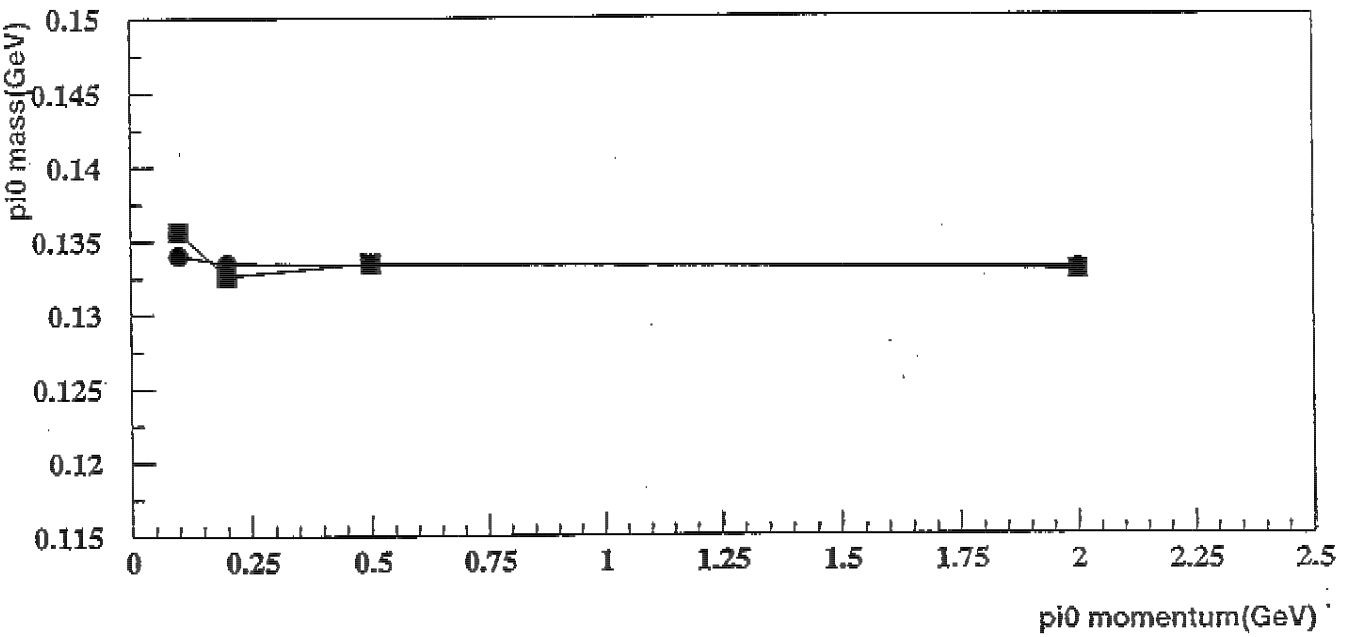
99/05/20 02.30

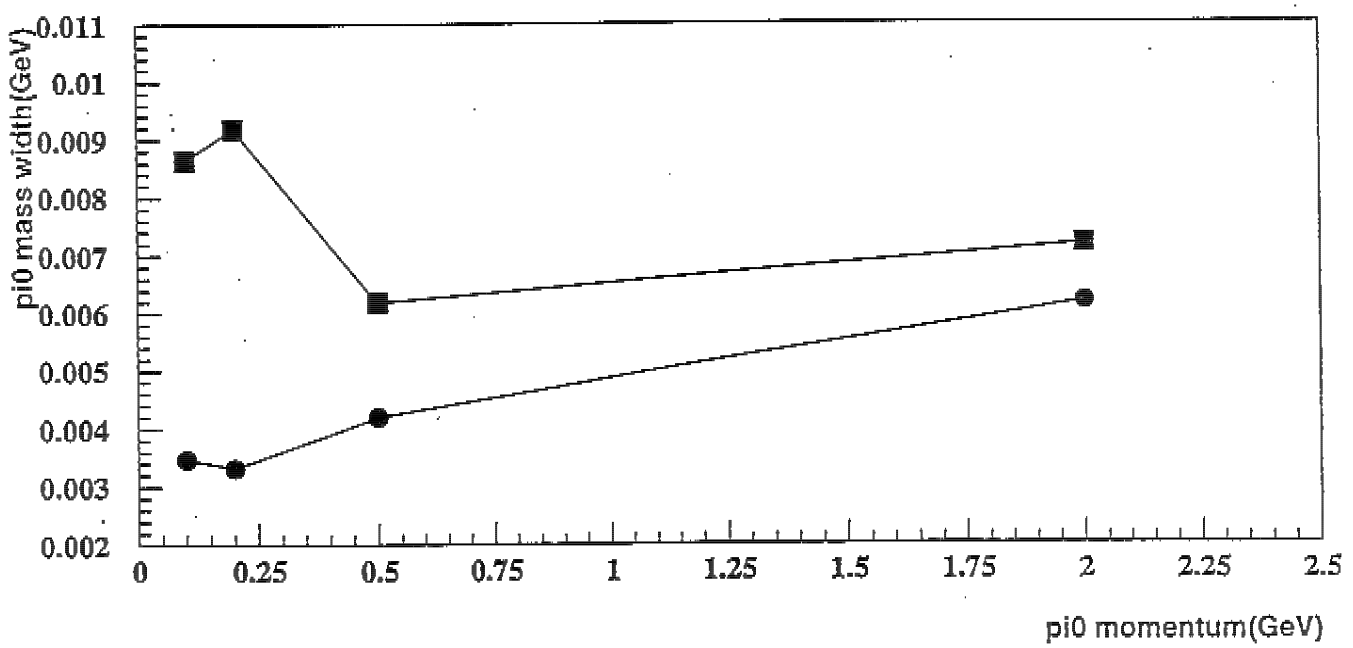




pi0 with BKG(2 MeV spar.)

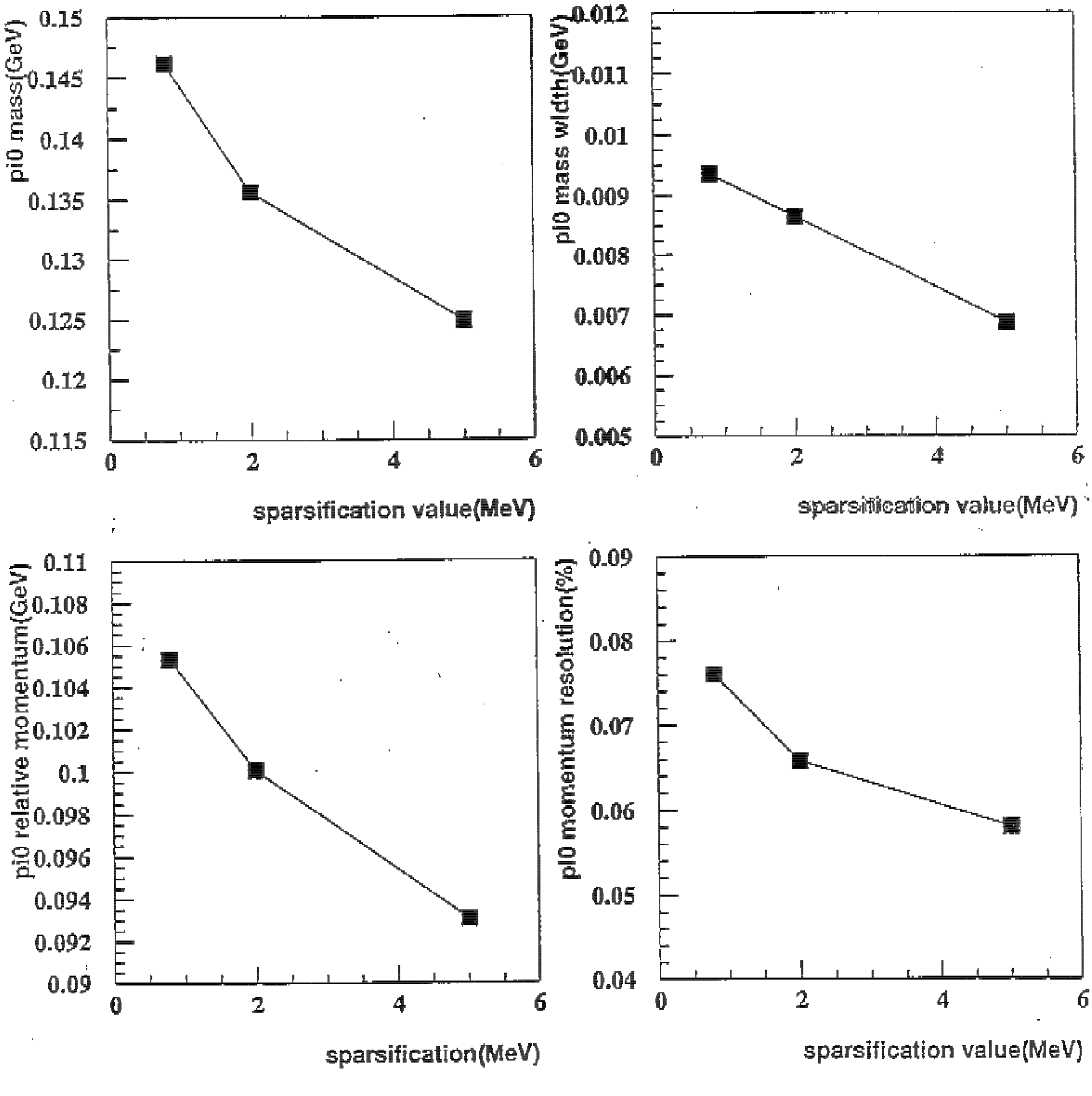
99/05/20 02.30

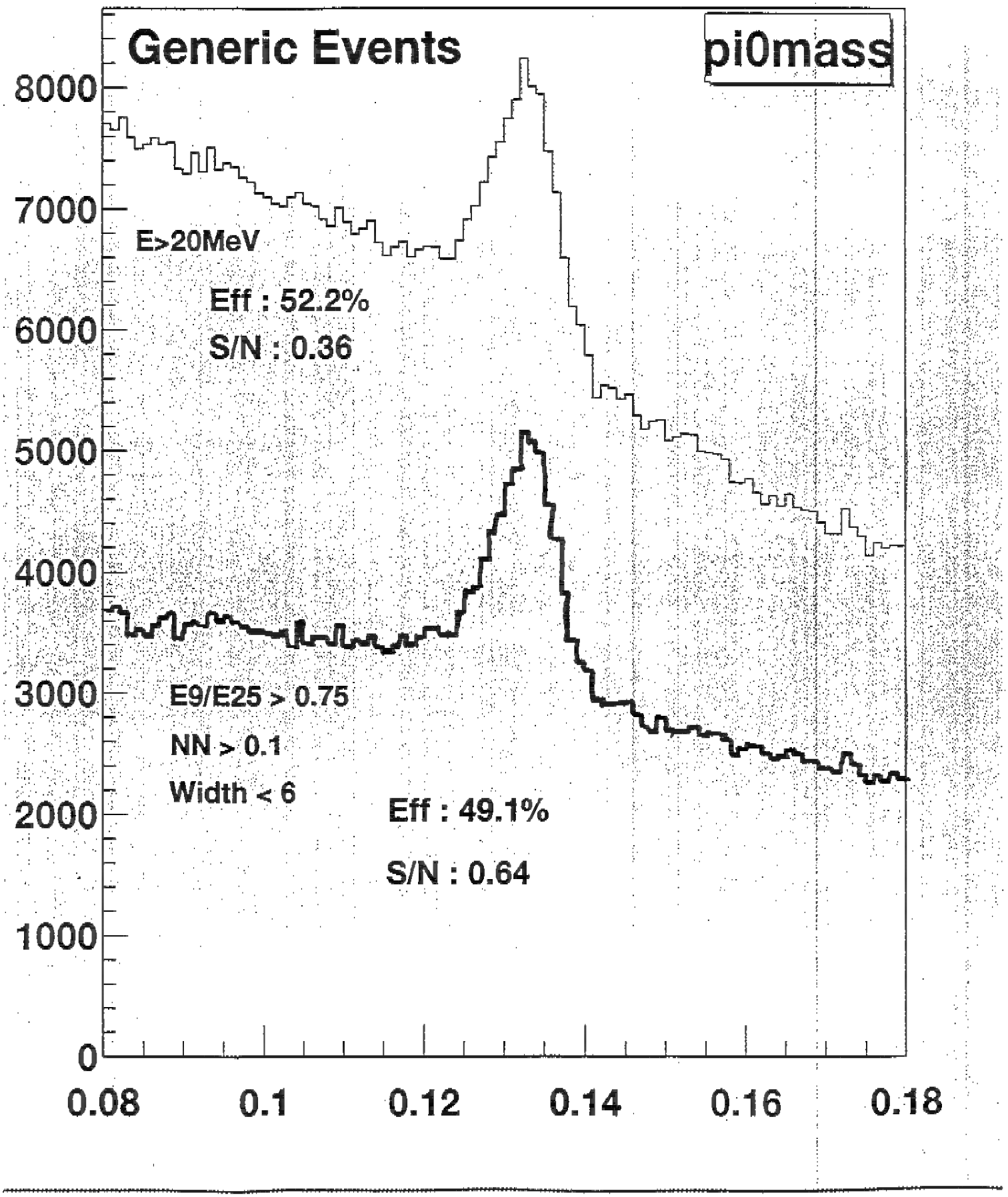


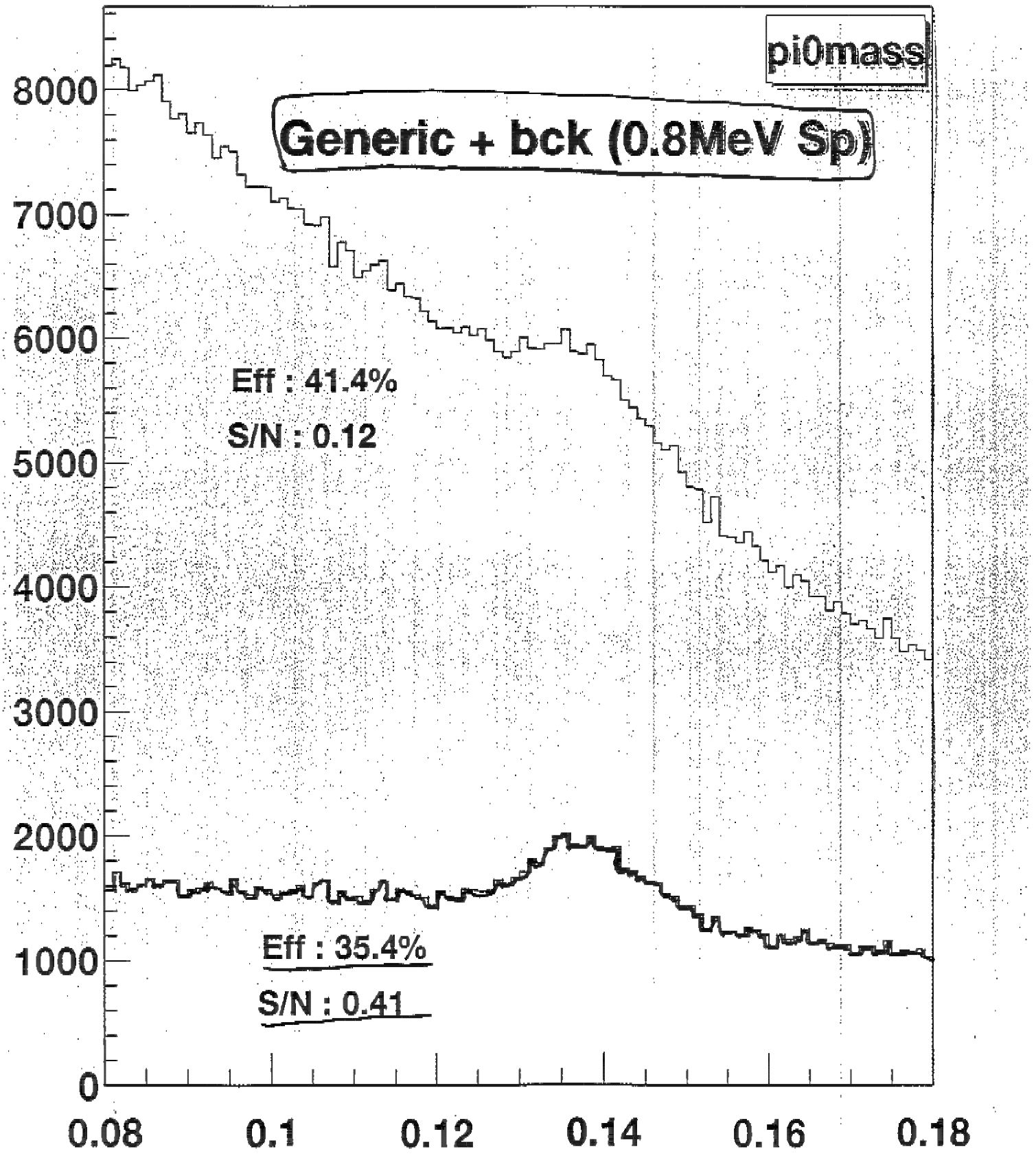


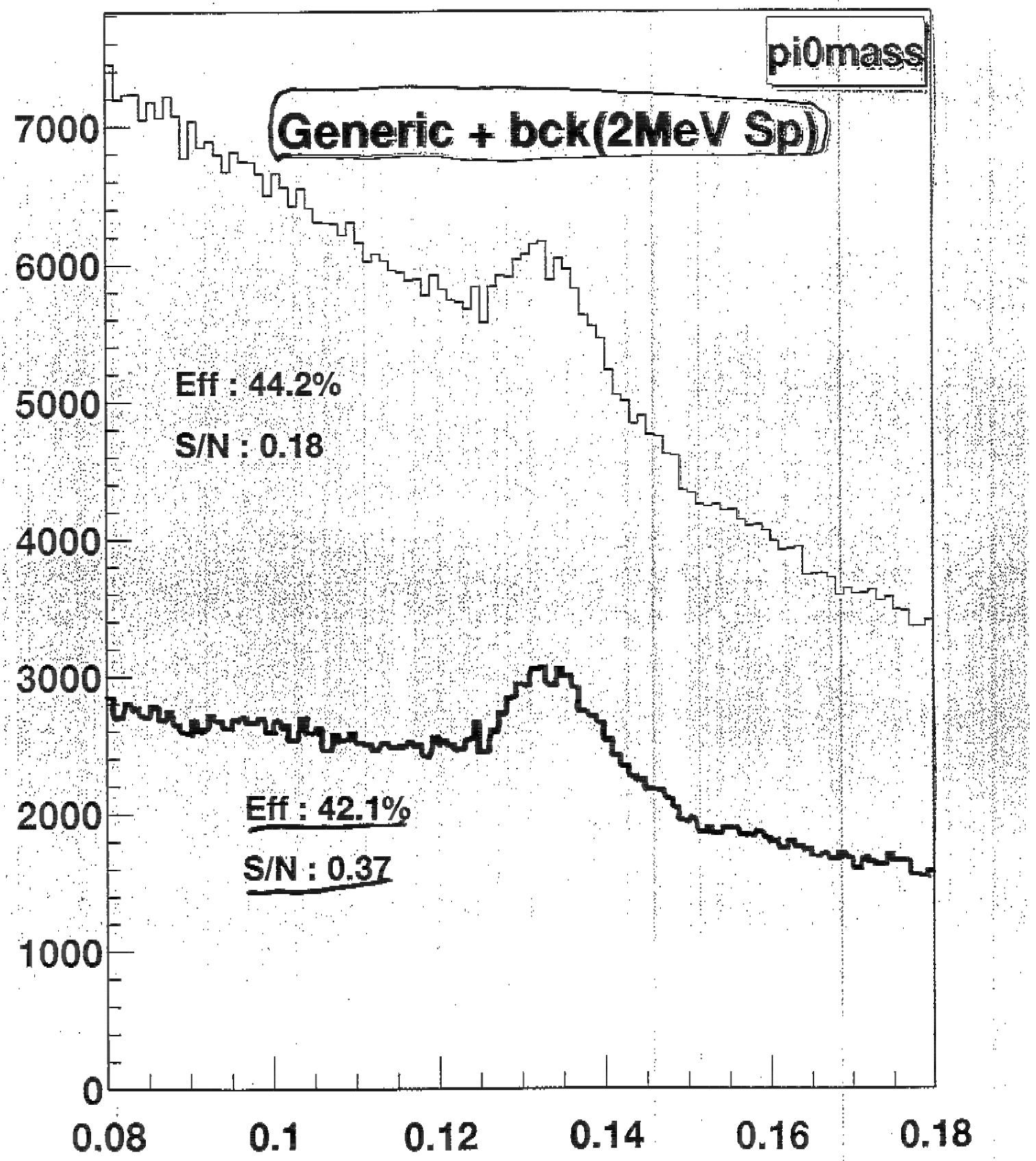
100 MeV pi0 with BKG

99/05/20 02.30




Generic Events
pi0mass
E>20MeV
Eff : 52.2%
S/N : 0.36
E9/E25 > 0.75
NN > 0.1
Width < 6
Eff : 49.1%
S/N : 0.64
8000
7000
6000
5000
4000
3000
2000
1000
0
0.08
0.1
0.12
0.14
0.16
0.18


pi0mass
Generic + bck (0.8MeV Sp)
Eff : 41.4%
S/N : 0.12
Eff : 35.4%
S/N : 0.41
8000
7000
6000
5000
4000
3000
2000
1000
0
0.08
0.1
0.12
0.14
0.16
0.18


pi0mass
Generic + bck(2MeV Sp)
Eff : 44.2%
S/N : 0.18
Eff : 42.1%
S/N : 0.37
7000
6000
5000
4000
3000
2000
1000
0
0.08
0.1
0.12
0.14
0.16
0.18

Summary and Plan

- Optimal γ cut values for π° to have the best S/N and efficiency are studied with the generic events. To be implemented in the next library.
- Beam background effect are studied with single π° and generic events. Tuning of sparsificatoin value helps to improve ϵ and S/N in generic events and for mass peak value in single π°.
- Ready for the real physics data.