GEM TN-93-404

Muon Performance Meeting - SSCL

April 23, 1993

Abstract:

Agenda, attendees, and presentations of the Muon Performance Meeting held at the SSC Laboratory on April 23, 1993.

AGENDA - Muon Performance Meeting 4/23/93 9:00 to 5:00

Location: Room 125 at SSCL (GEM Meeting Room)

9am Taylor/McNeil -- Introductory remarks, schedule of PAC meeting

9:30-10:30 -- Y. Fisyak, Convener
What is in SIGEM, discussion of the structures,
frames, location of active area acceptance cracks -- Fisyak
Comparison with engineeri Marx, Wuest, Taylor
Plans for improvements -- Wuest, Taylor

10:30-12:30 -- M. Atiay, Convener
Trigger performance. dphi vs sagitta
method in the barrel/endcap -- Atiya, Marlow, Dingus
charge sharing and clustering in the trigger -- Balagura
Rosenson, Convener

1:30-3:30 -- L. Rosentson, Convener
Momentum resolution -- Rosenson, Sullivan
full Track reconstruction -- Wenaus, Dingus, Fisyak?
Energy loss correction -- Gavrilov, Zhu

3:30-5:00 -- discussion of the muon performance, plans for the
work between now and the PAC review. Input from the
Physics group -- All

4/23/93 Muon Performance Meeting

Name	E-mail
Frank Taylor	FET@MITLNS
Vladimir Glebov	GLEBOV@SSCVX1
Vladimir Gavrilov	GAVRILOV@SSCVX1
Vladislav Balagura	Balagura@SSCVX1
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Gena Mitselmakher	MITSELMAKHER@SSCVX1
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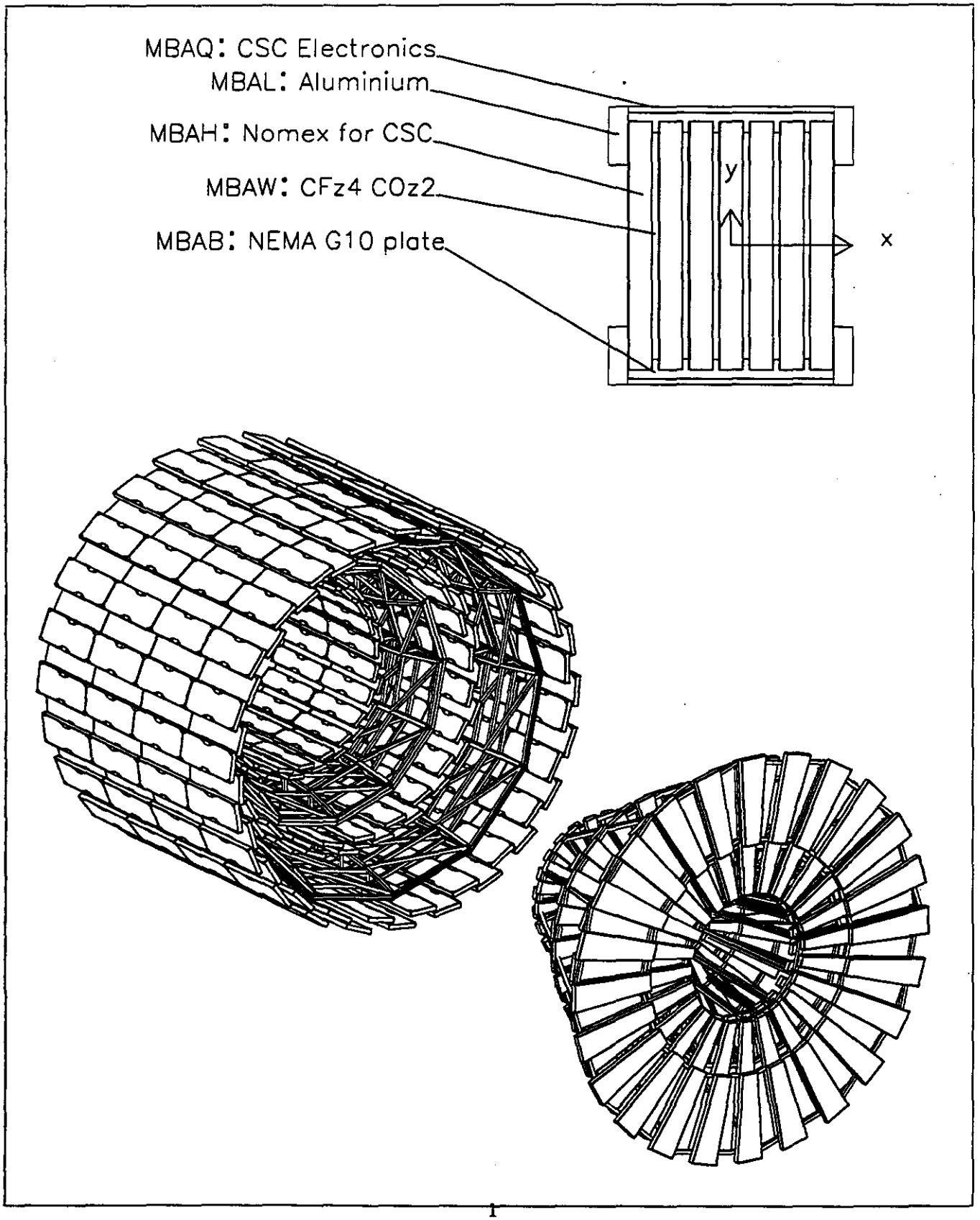
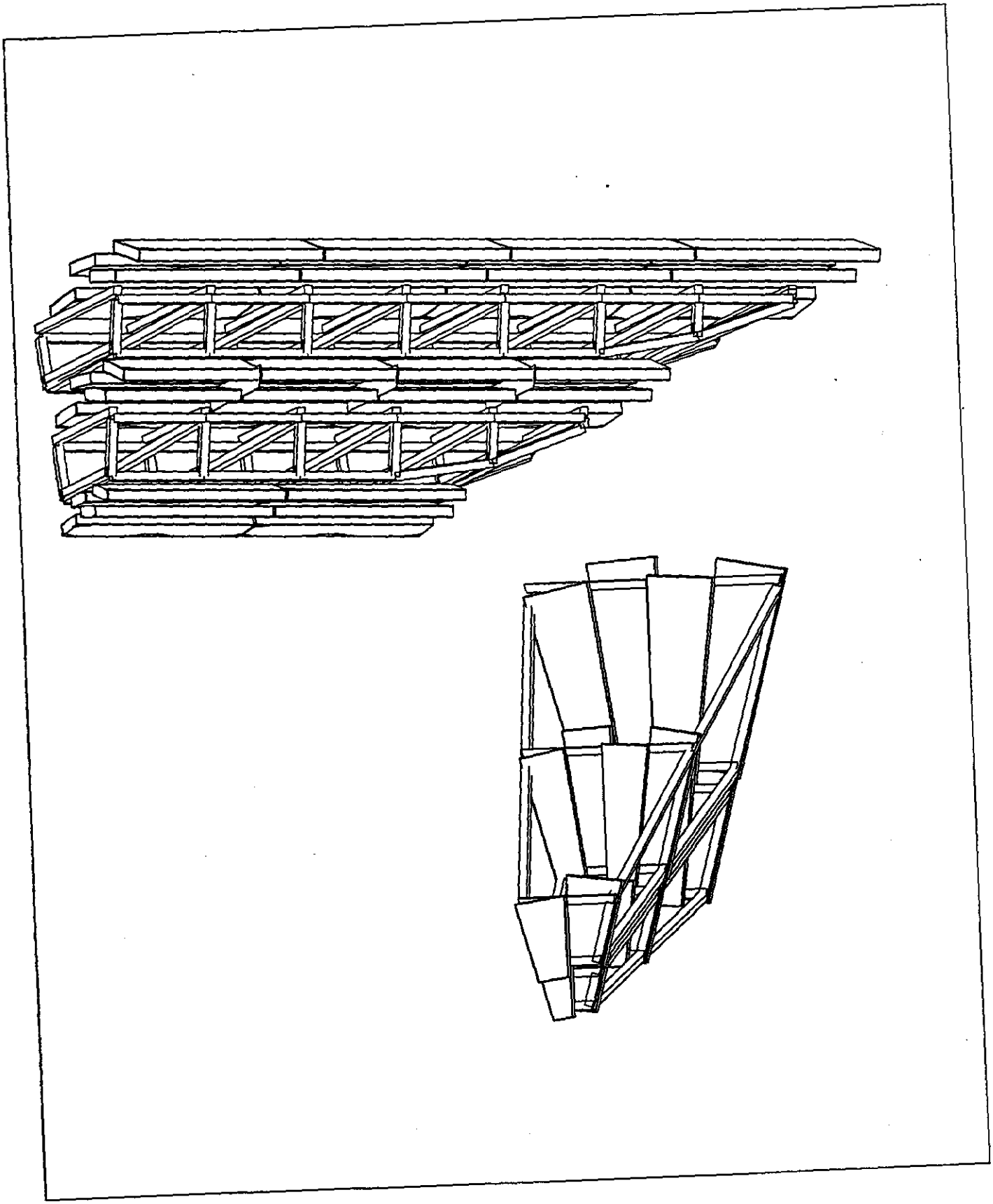
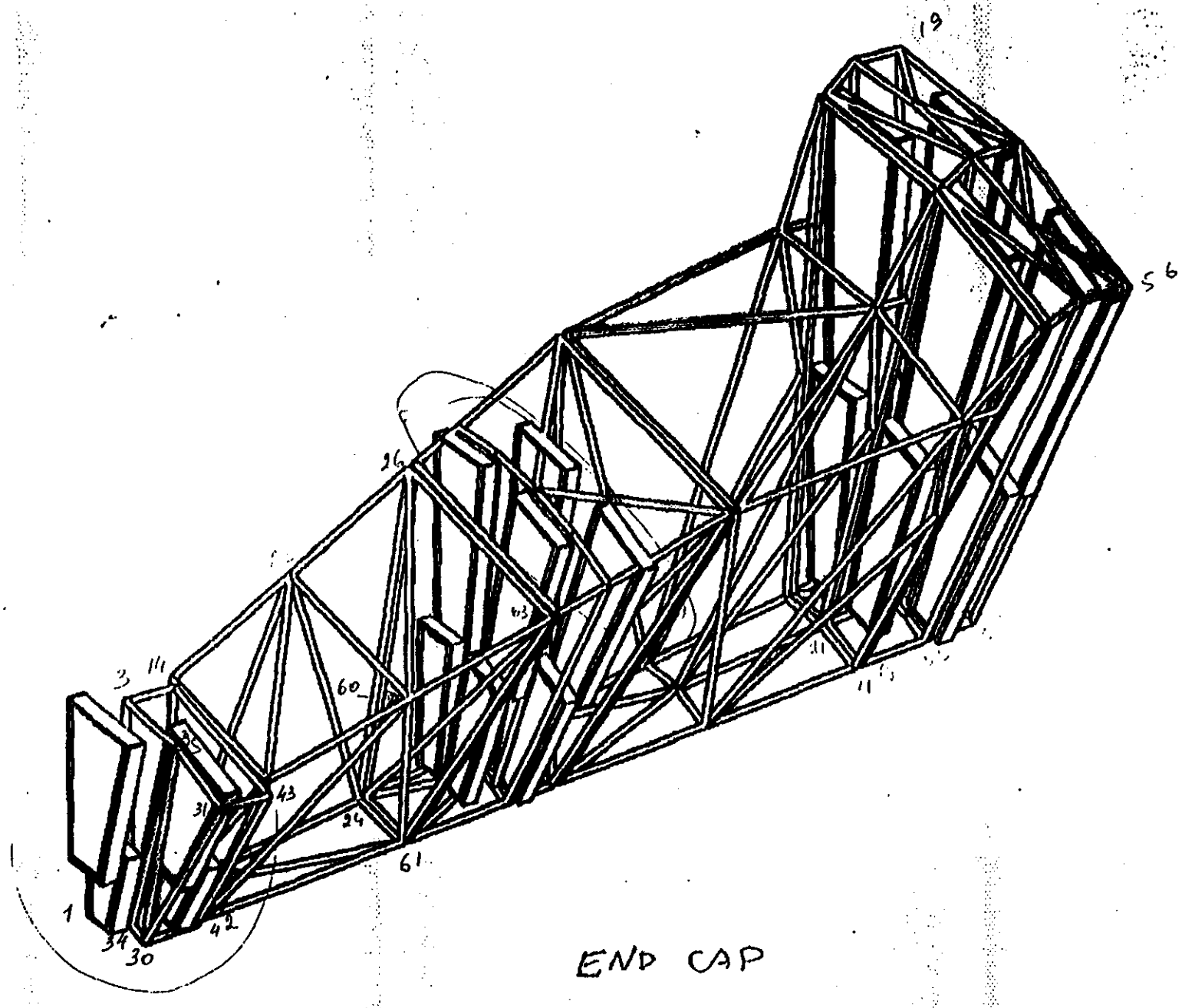
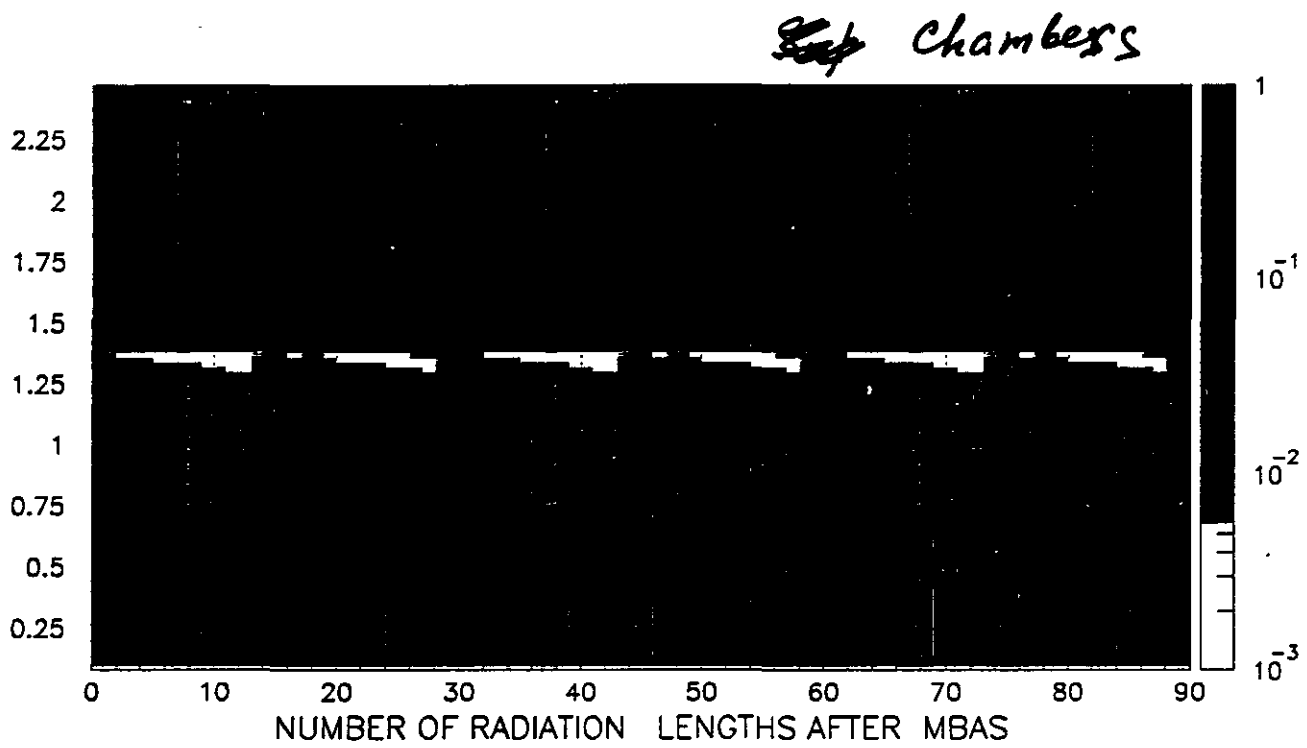
Yuri Fisyak	Fisyak@SSCVX1
Jim Sullivan	SULLIVAN@MITLNS
Mike Marx	Marx@sscvx1
LARRY ROSENSON	[illegible]
Peter Dingus	DINGUS@SSCVX1
Roger MCNEIL	PHMCNE@LSUVAX

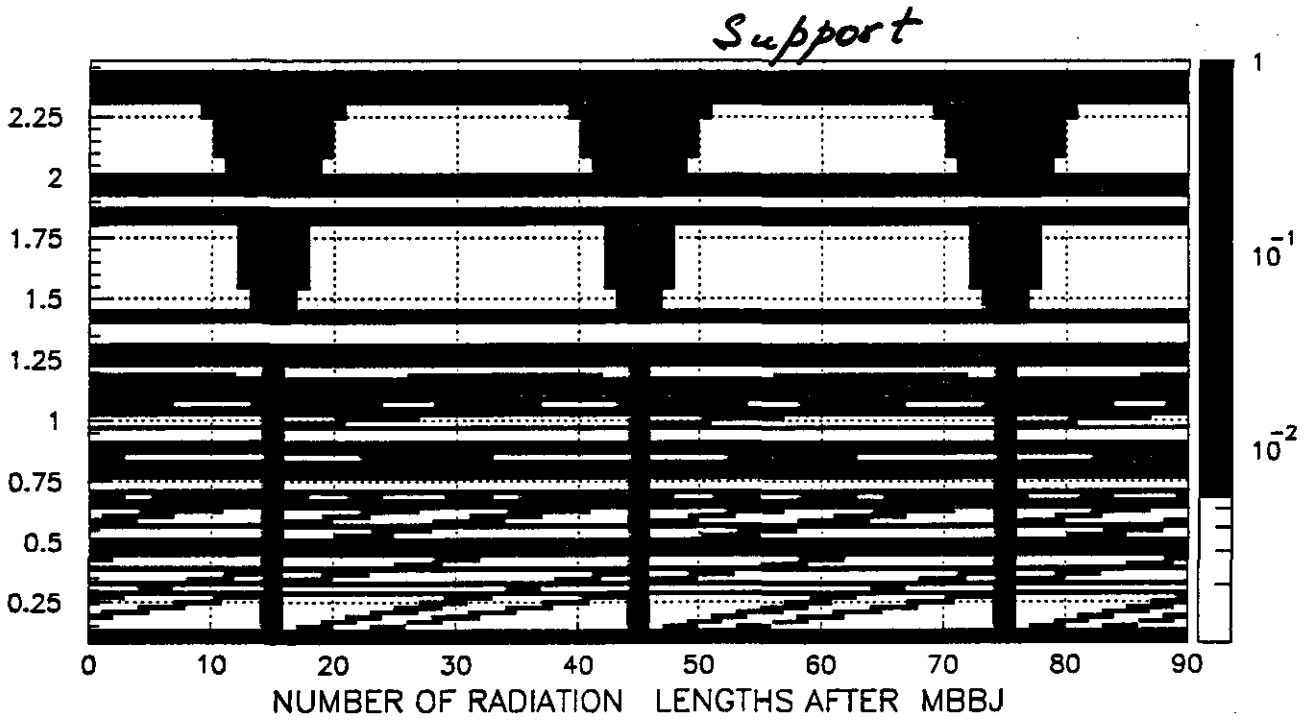

MBAQ: CSC Electronics
MBAL: Aluminium
MBAH: Nomex for CSC
MBAW: CFz4 COz2
MBAB: NEMA G10 plate
y
x

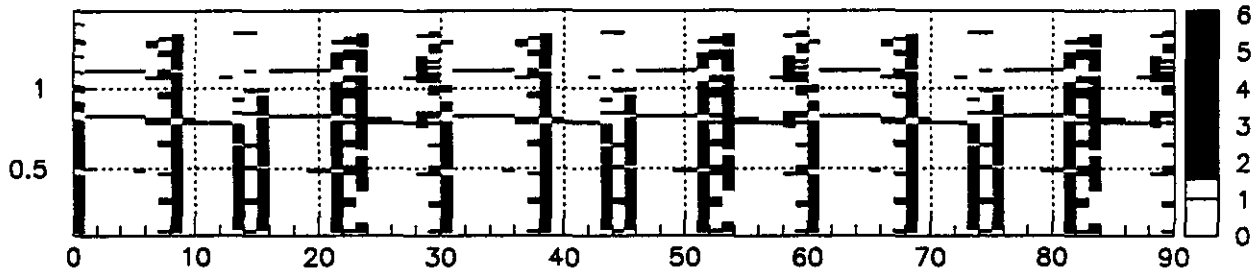




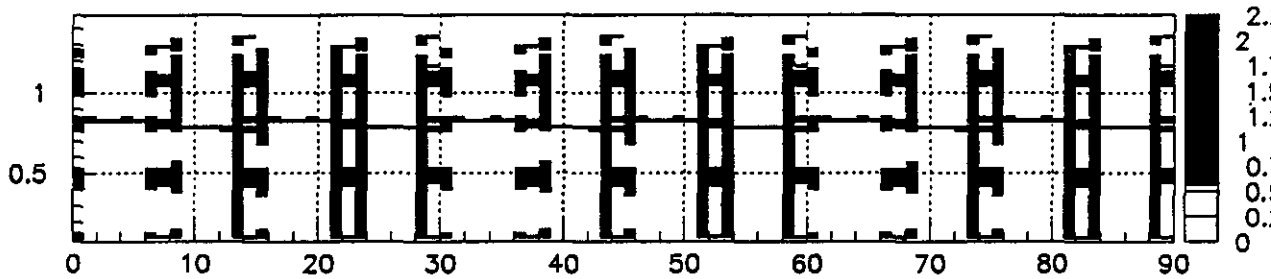
END CAP


Chambers
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
10
20
30
40
50
60
70
80
90
NUMBER OF RADIATION LENGTHS AFTER MBAS
1
10^{-1}
10^{-2}
10^{-3}

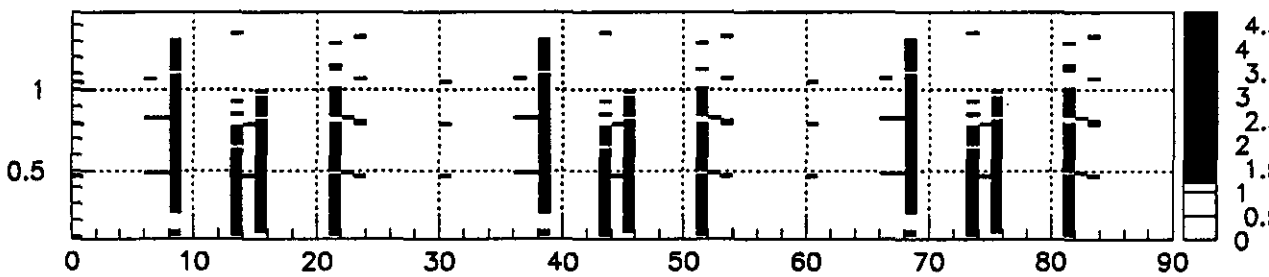

Support
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
10
20
30
40
50
60
70
80
90
NUMBER OF RADIATION LENGTHS AFTER MBBJ
1
10^{-1}
10^{-2}



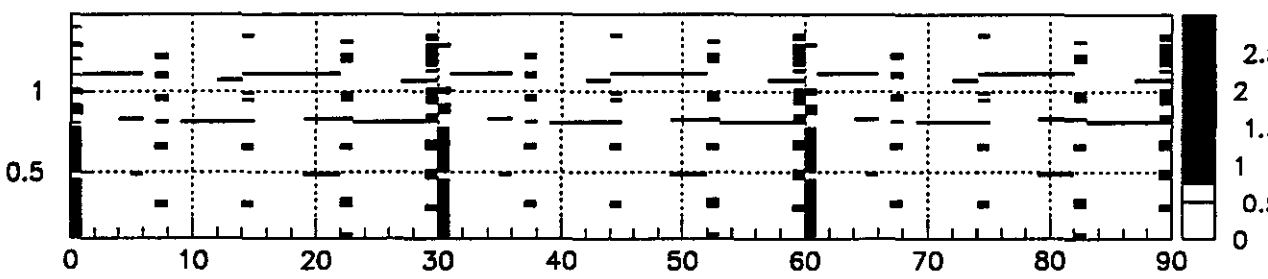
No. of radiation length after all chambers



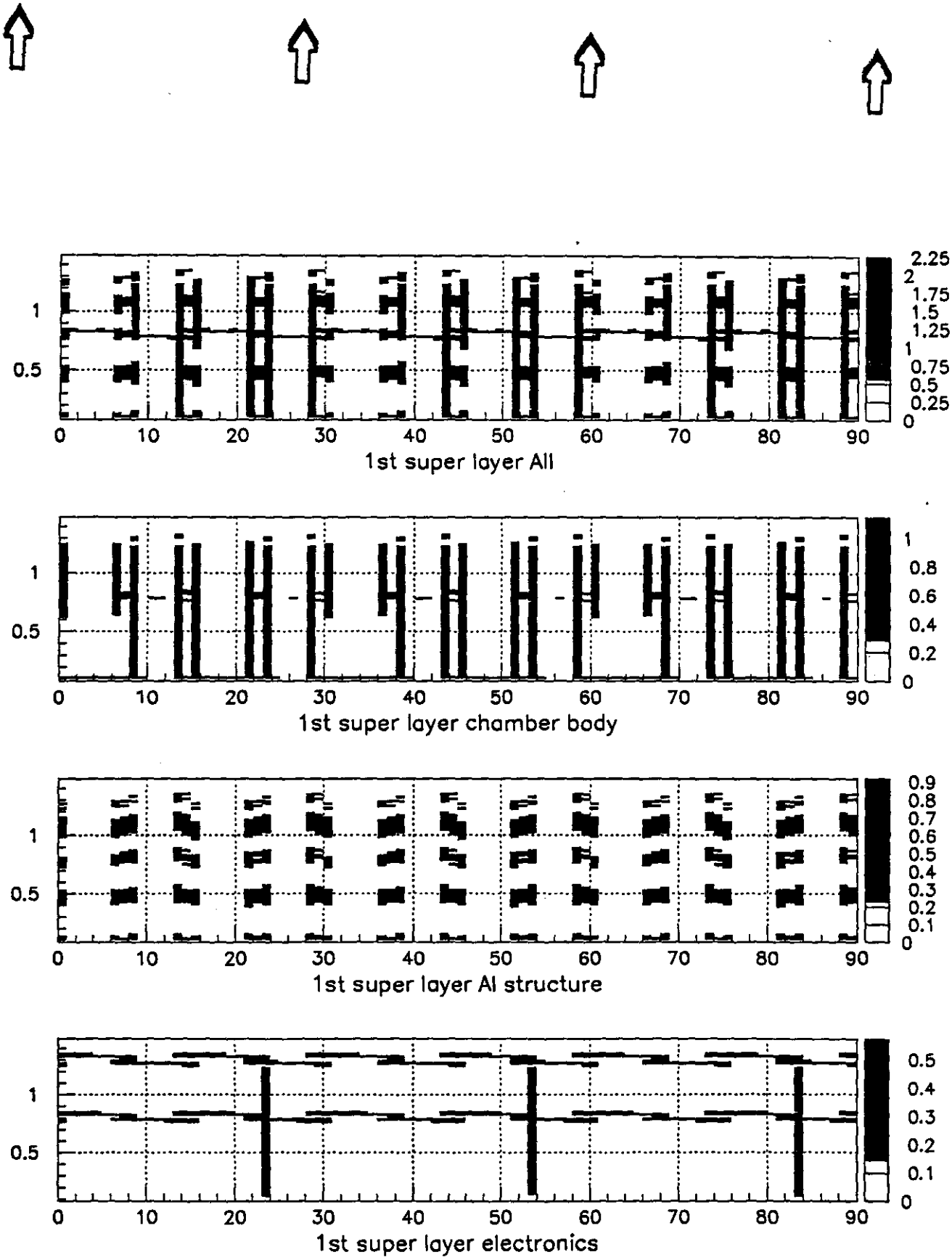
1st super layer All

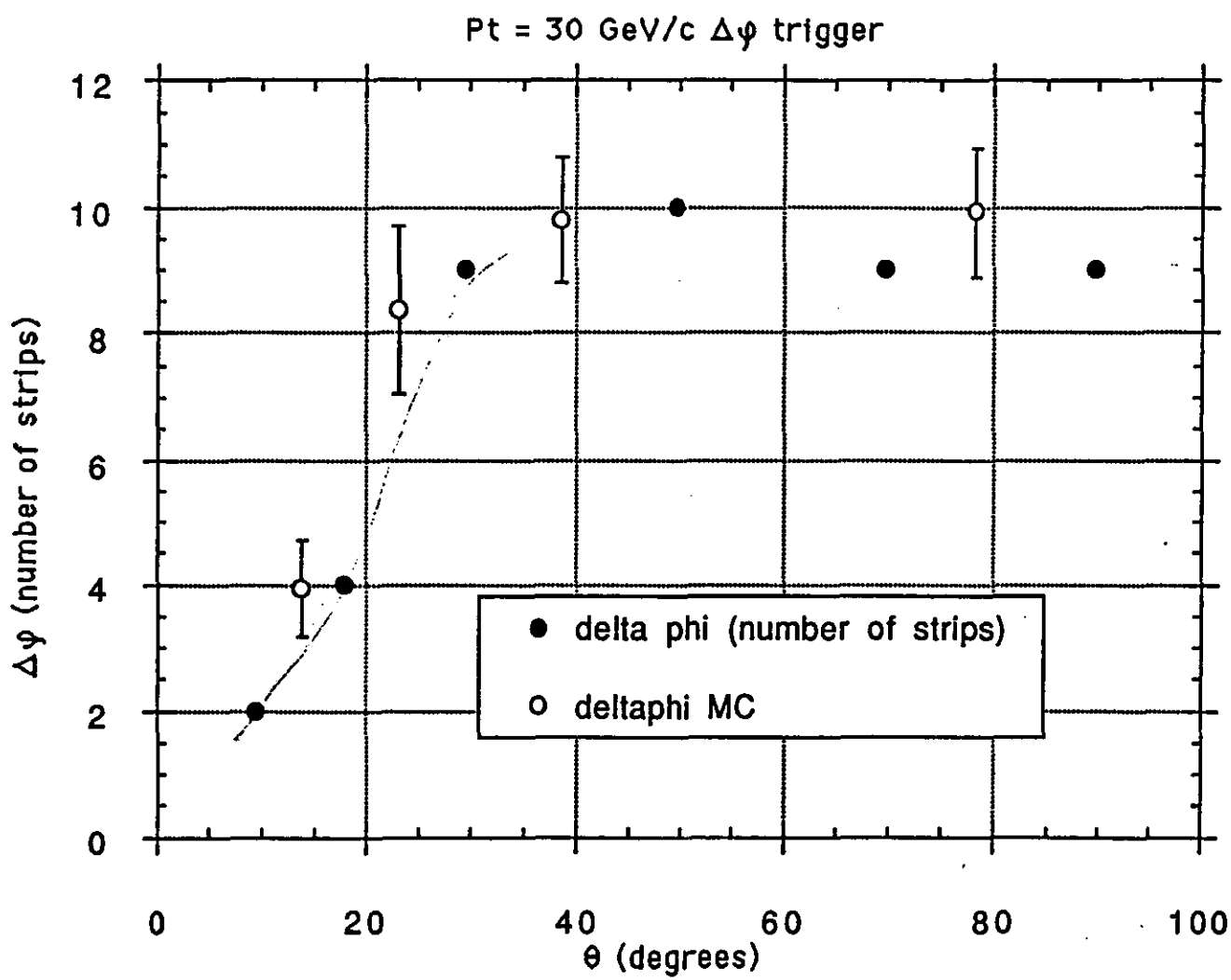


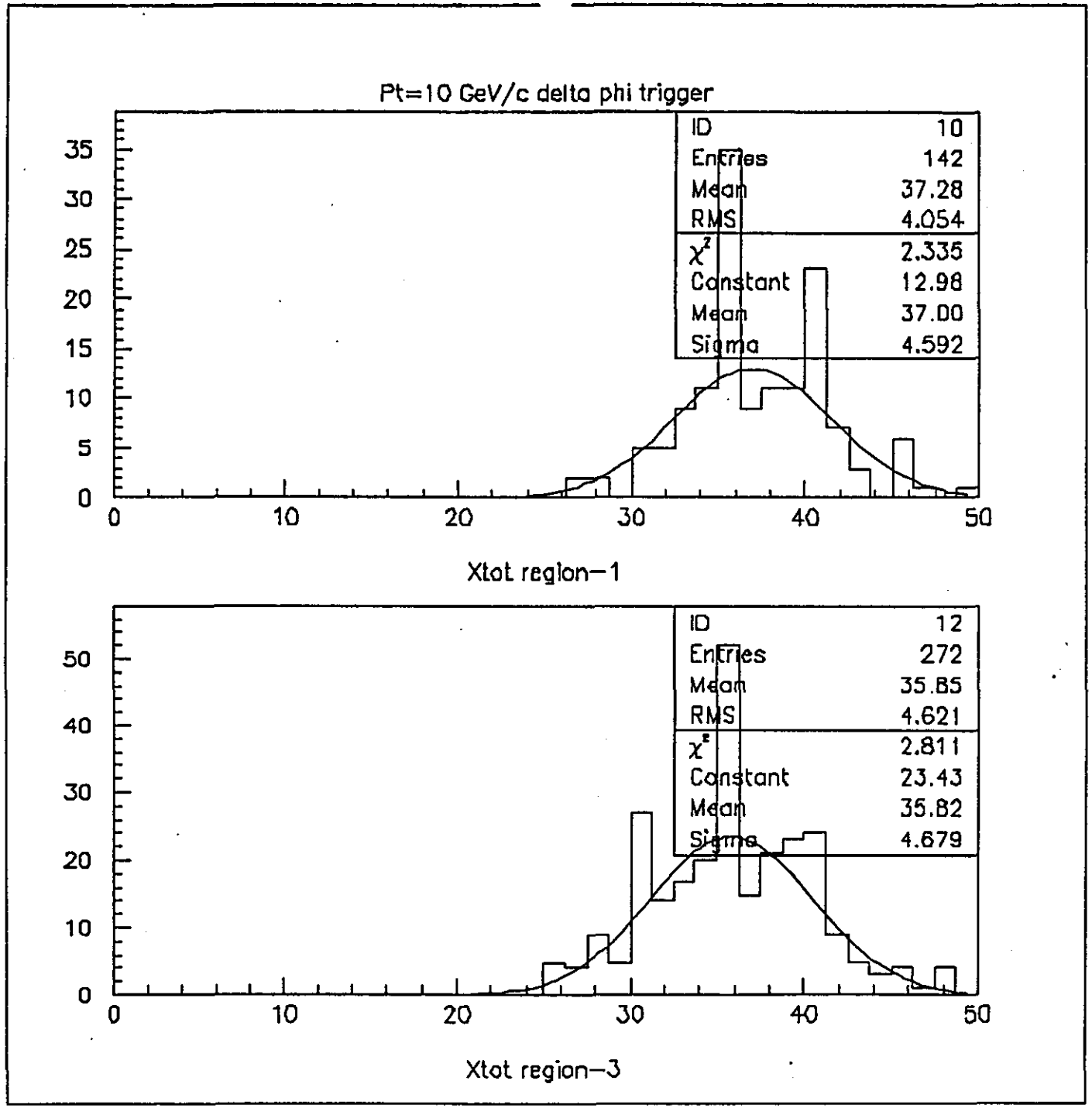
2nd super layer All

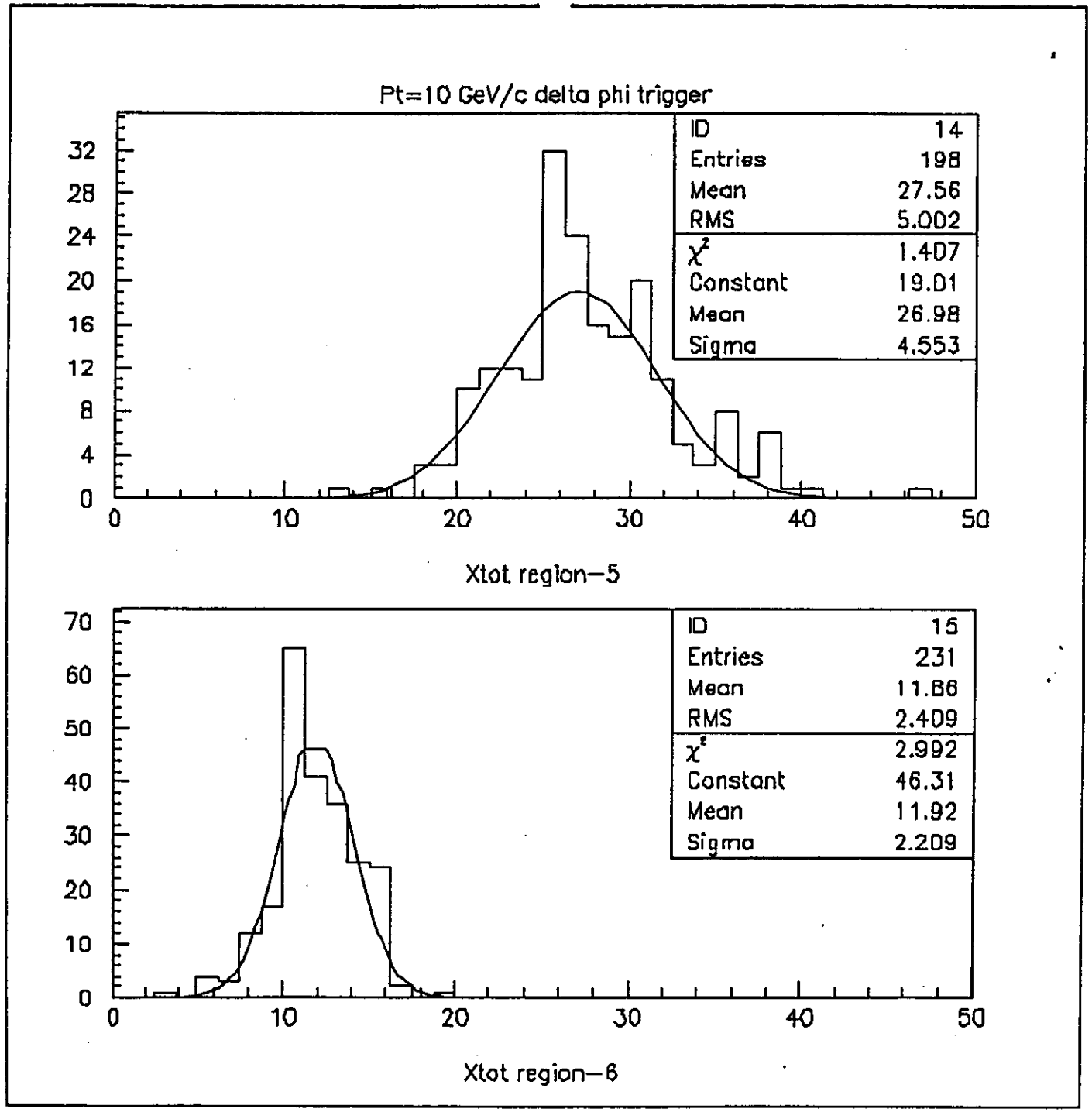


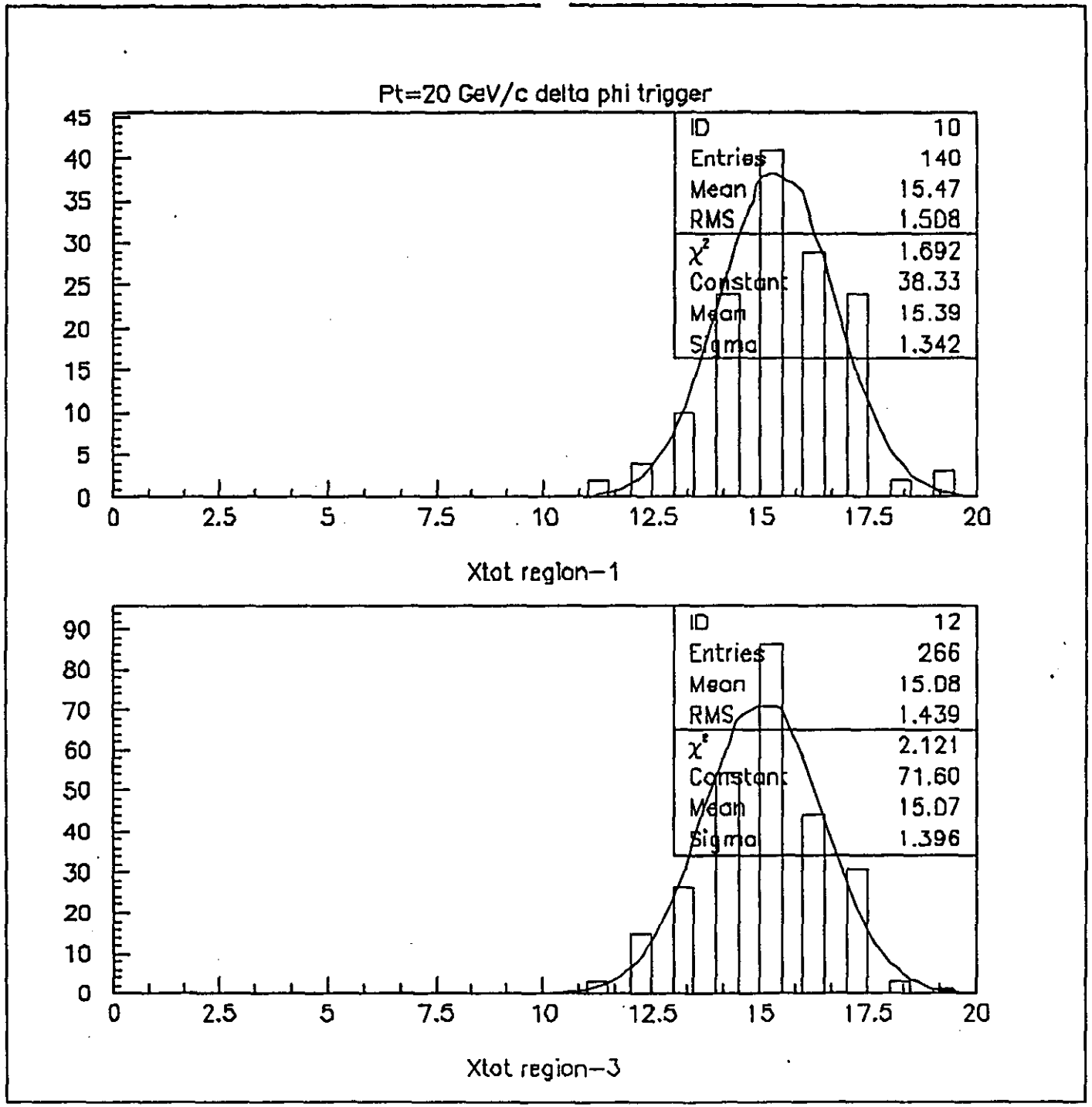
3rd super layer All

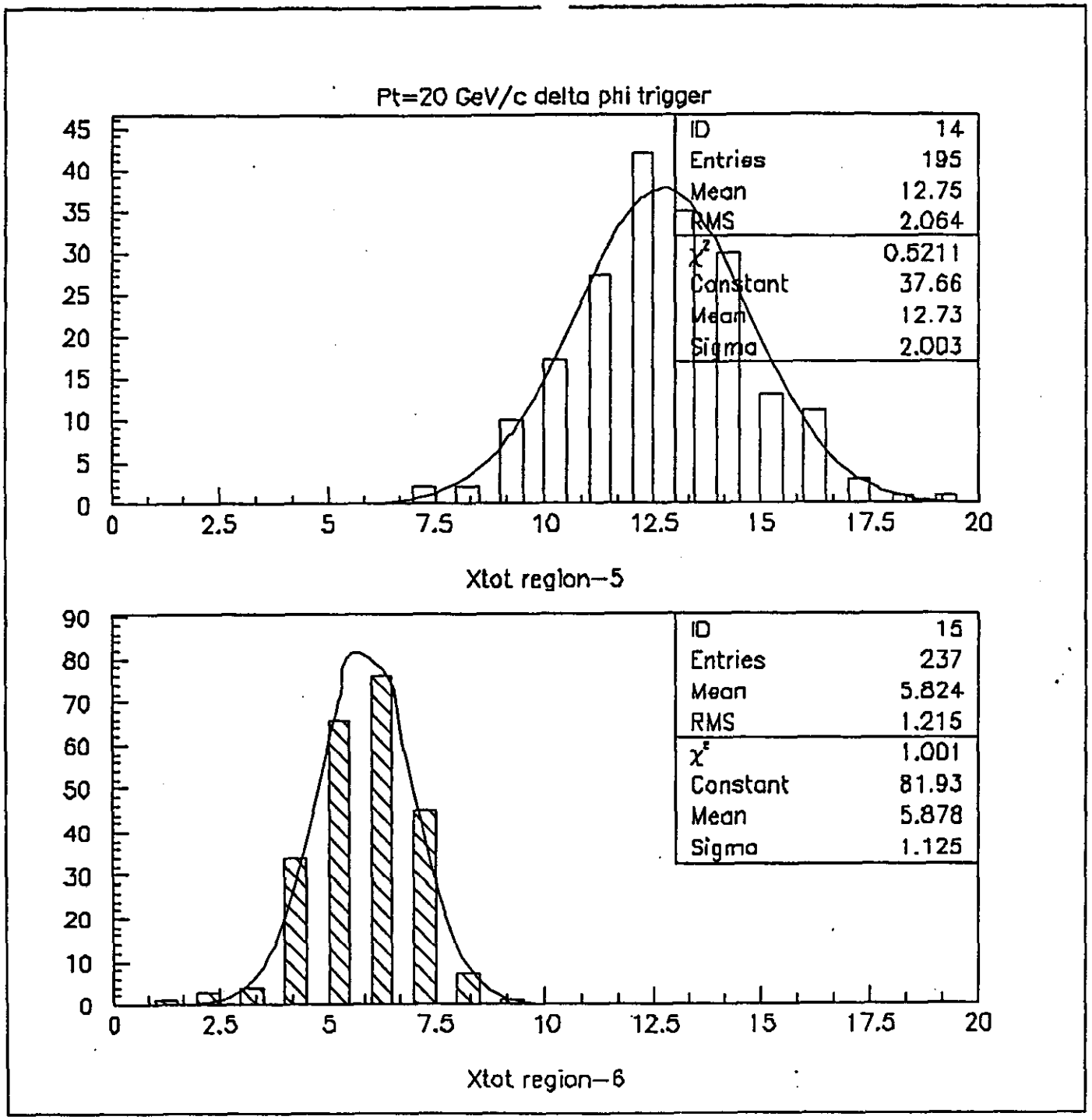

1st super layer All
1st super layer chamber body
1st super layer Al structure
1st super layer electronics

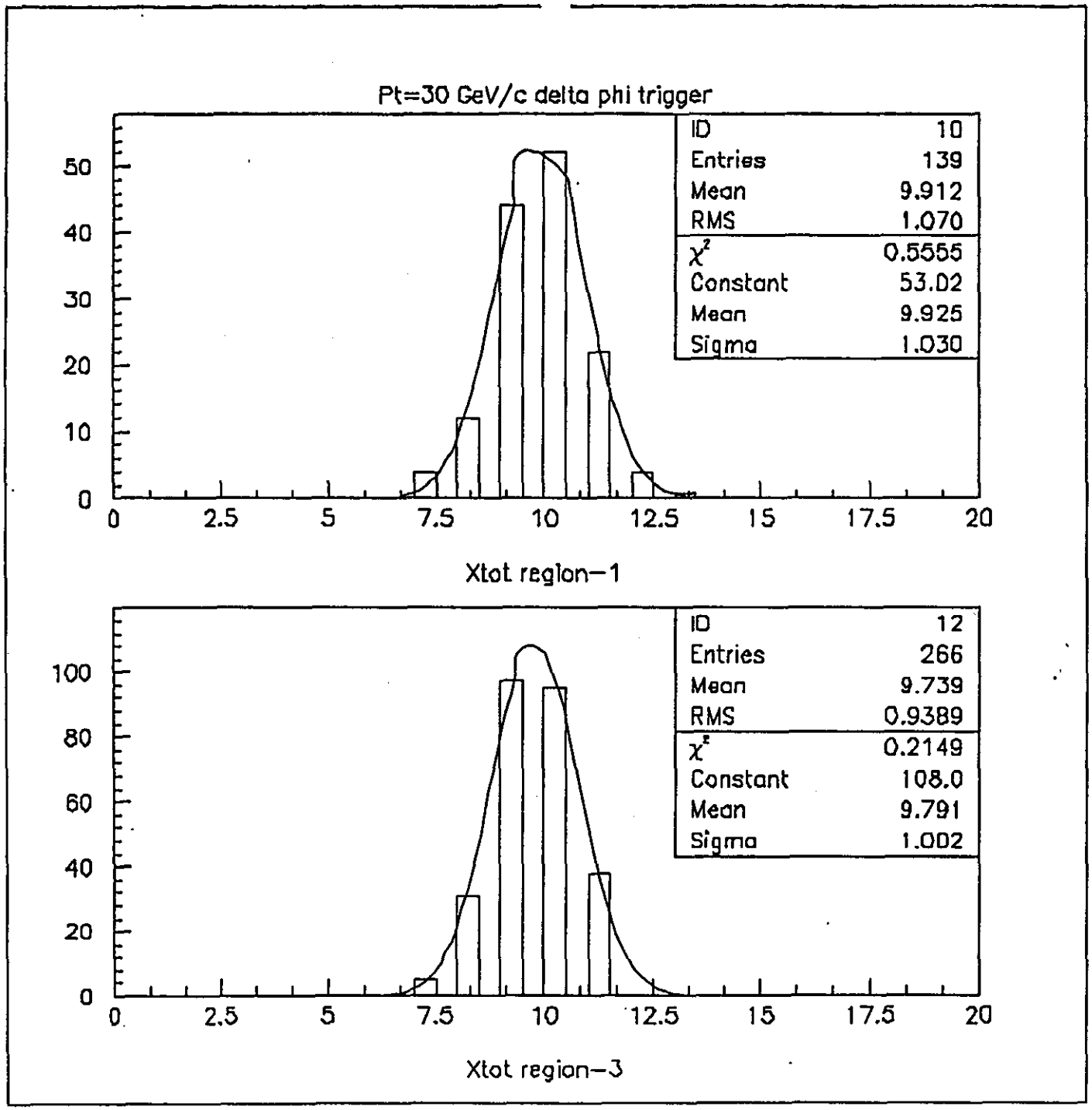

Pt = 30 GeV/c Δφ trigger
Δφ (number of strips)
θ (degrees)
0
2
4
6
8
10
12
0
20
40
60
80
100
delta phi (number of strips)
deltaphi MC

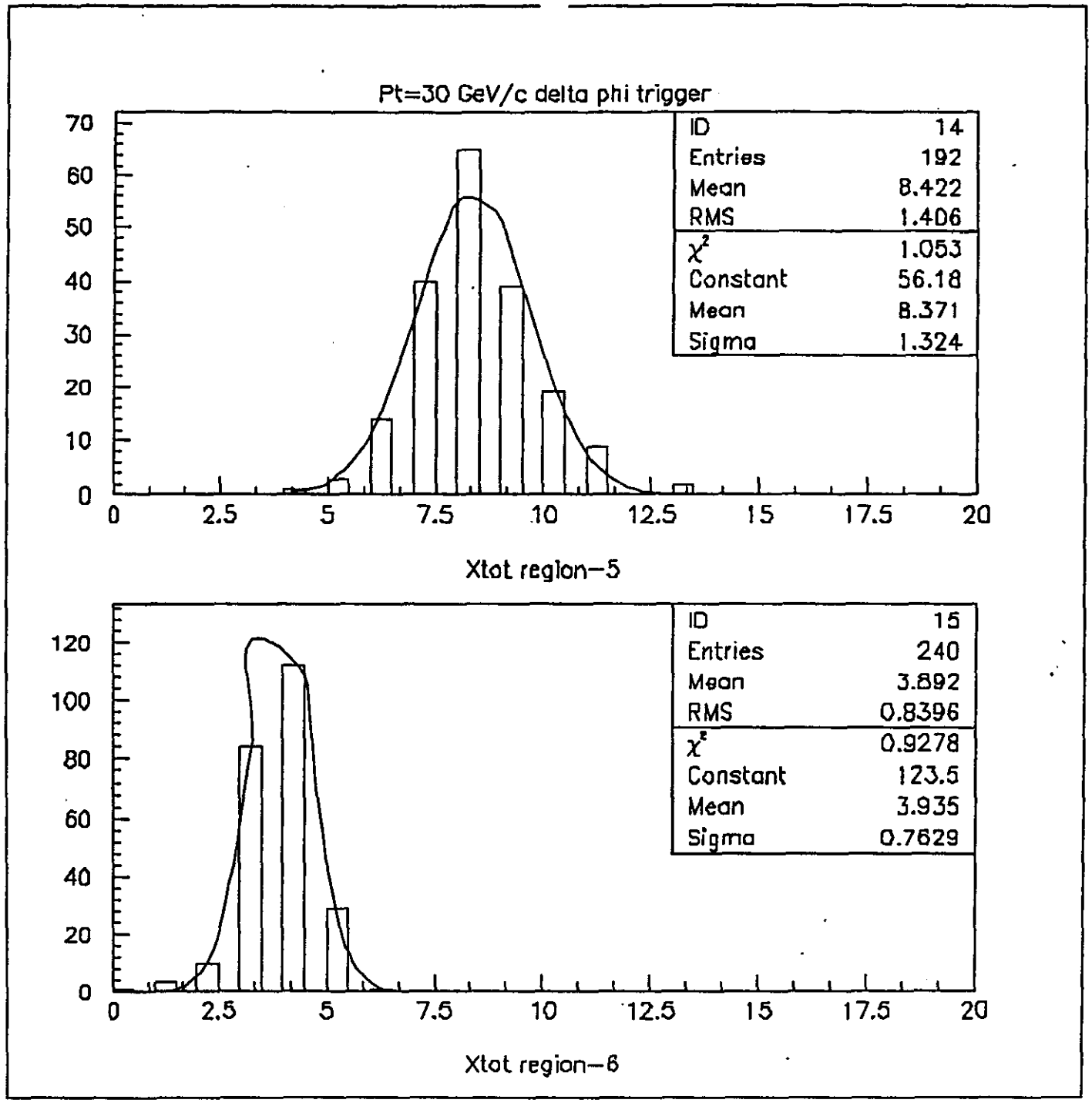

Pt=10 GeV/c delta phi trigger
ID 10
Entries 142
Mean 37.28
RMS 4.054
χ² 2.335
Constant 12.98
Mean 37.00
Sigma 4.592
Xtot region−1
ID 12
Entries 272
Mean 35.85
RMS 4.621
χ² 2.811
Constant 23.43
Mean 35.82
Sigma 4.679
Xtot region−3

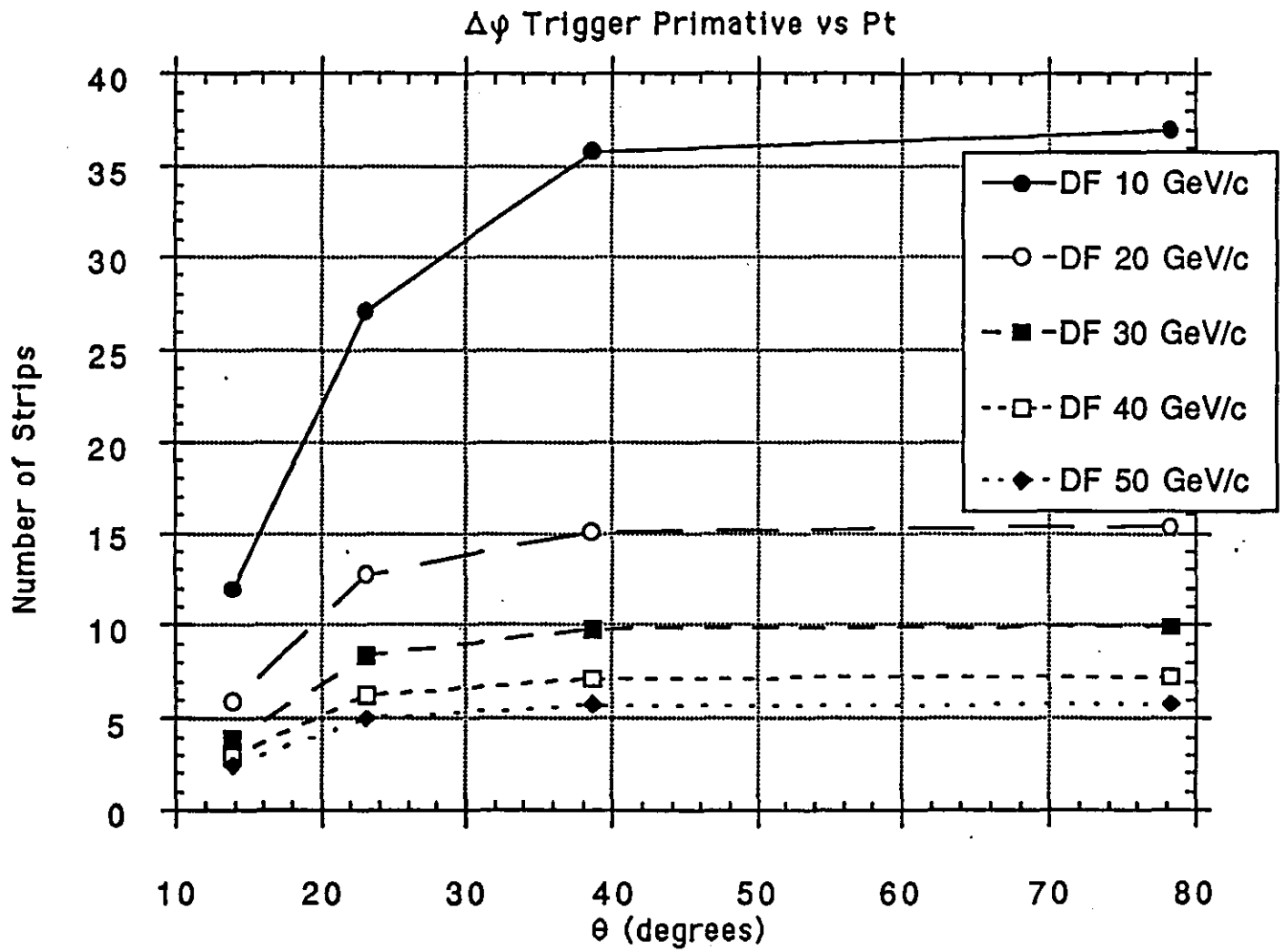

Pt=10 GeV/c delta phi trigger
ID 14
Entries 198
Mean 27.56
RMS 5.002
χ² 1.407
Constant 19.01
Mean 26.98
Sigma 4.553
Xtot region−5
ID 15
Entries 231
Mean 11.86
RMS 2.409
χ² 2.992
Constant 46.31
Mean 11.92
Sigma 2.209
Xtot region−6

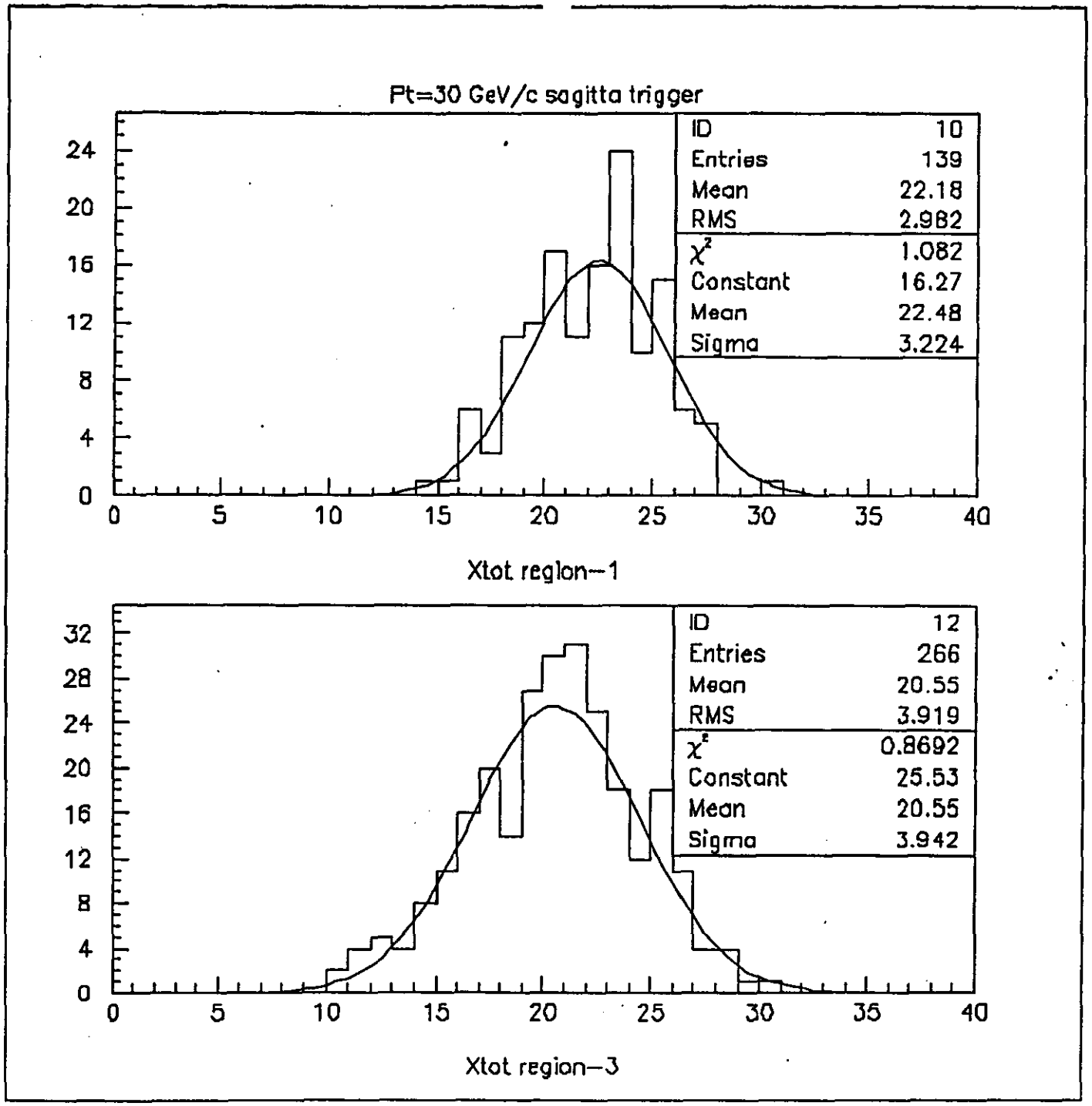

Pt=20 GeV/c delta phi trigger
ID 10
Entries 140
Mean 15.47
RMS 1.508
χ² 1.692
Constant 38.33
Mean 15.39
Sigma 1.342
Xtot region−1
ID 12
Entries 266
Mean 15.08
RMS 1.439
χ² 2.121
Constant 71.60
Mean 15.07
Sigma 1.396
Xtot region−3

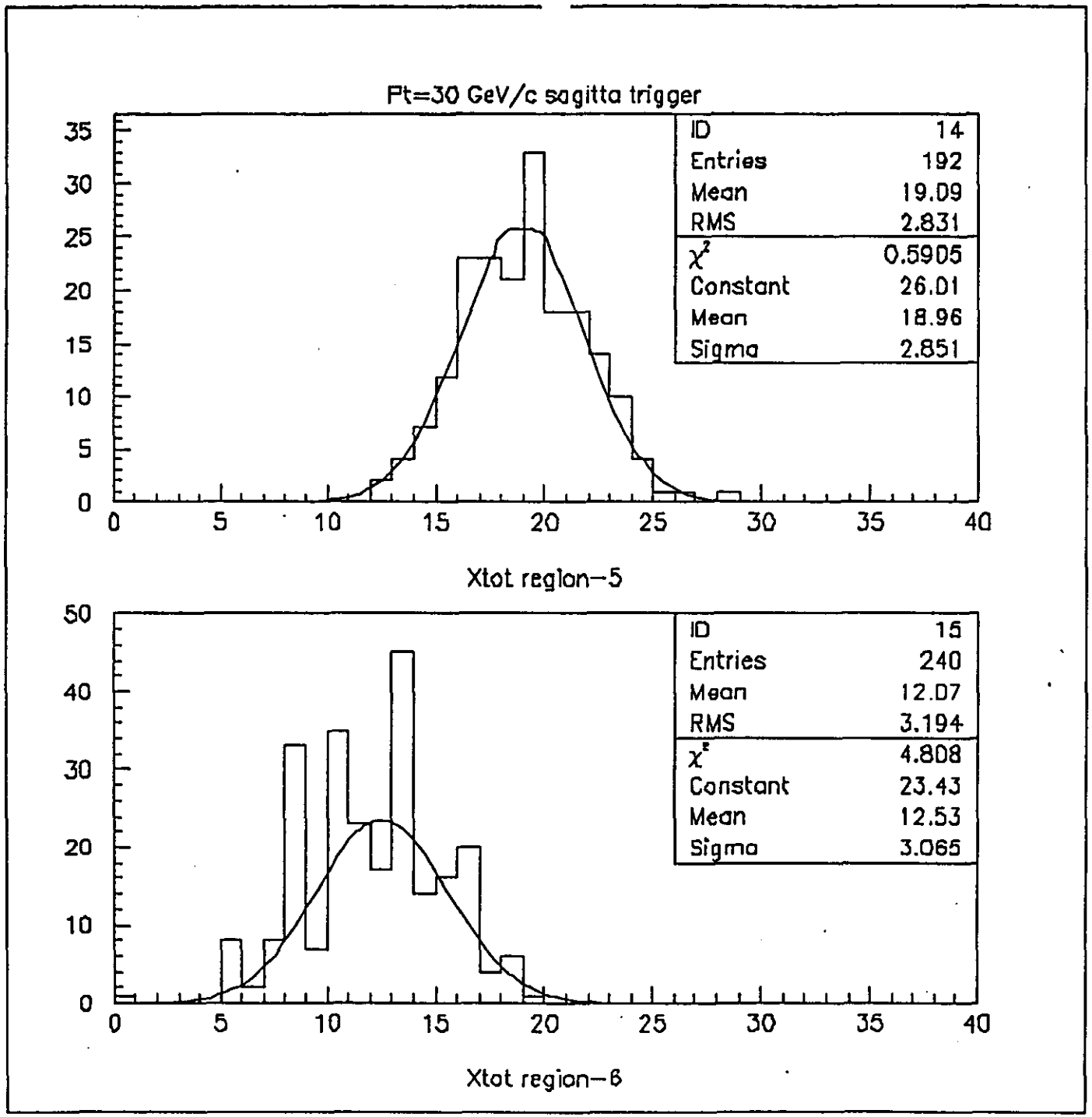

Pt=20 GeV/c delta phi trigger
ID 14
Entries 195
Mean 12.75
RMS 2.064
χ² 0.5211
Constant 37.66
Mean 12.73
Sigma 2.003
Xtot region−5
ID 15
Entries 237
Mean 5.824
RMS 1.215
χ² 1.001
Constant 81.93
Mean 5.878
Sigma 1.125
Xtot region−6

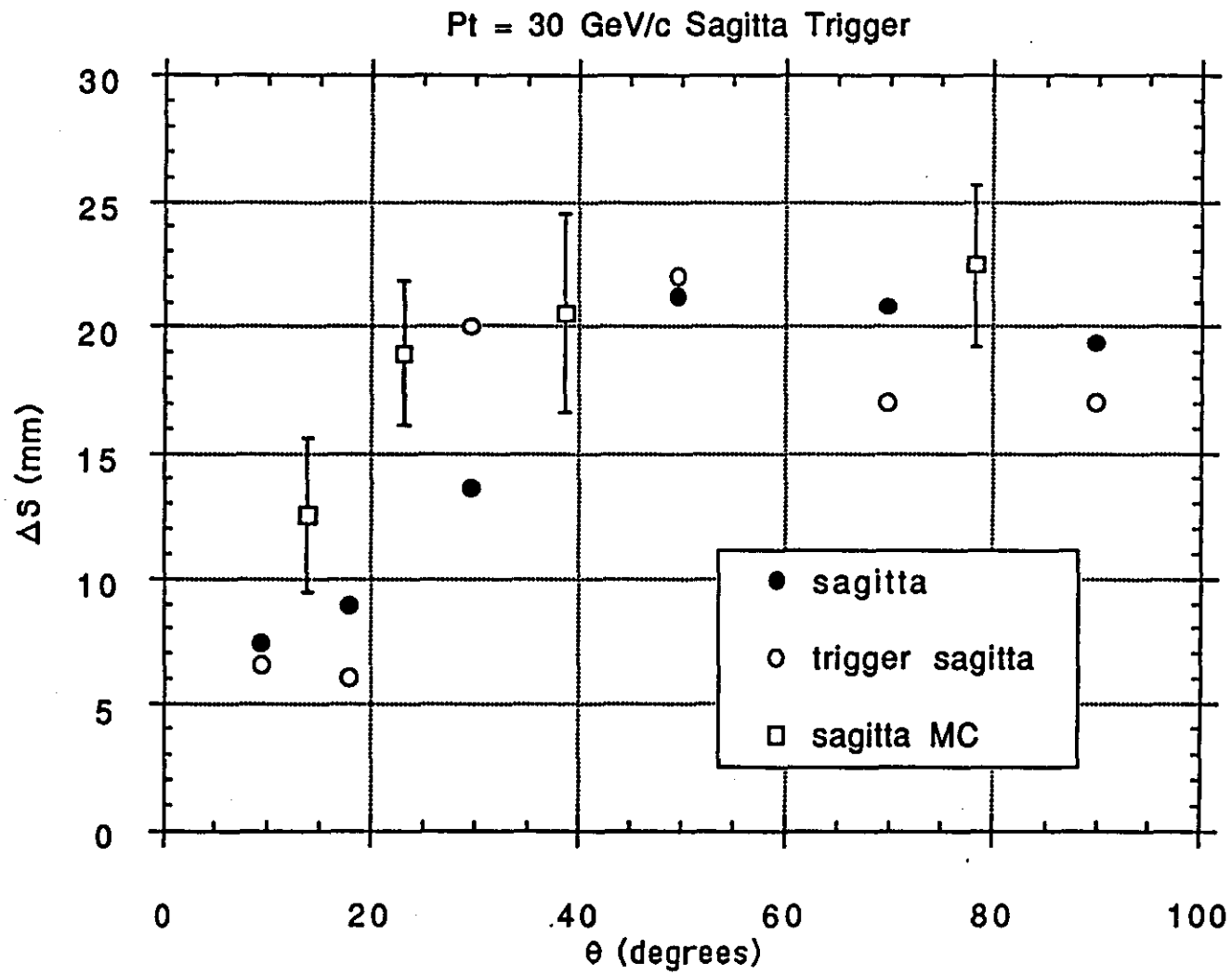

Pt=30 GeV/c delta phi trigger
ID 10
Entries 139
Mean 9.912
RMS 1.070
χ² 0.5555
Constant 53.02
Mean 9.925
Sigma 1.030
Xtot region−1
ID 12
Entries 266
Mean 9.739
RMS 0.9389
χ² 0.2149
Constant 108.0
Mean 9.791
Sigma 1.002
Xtot region−3

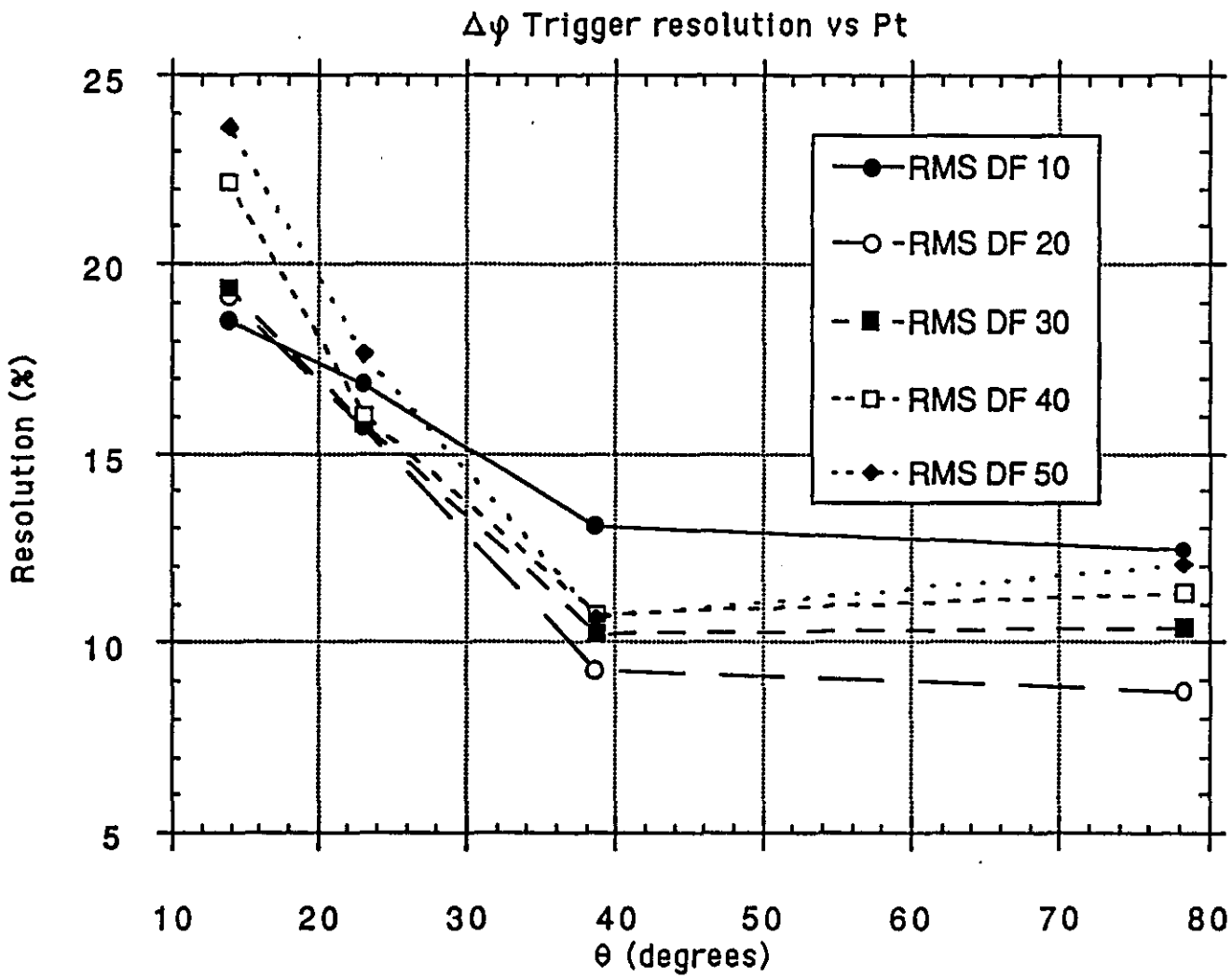

Pt=30 GeV/c delta phi trigger
ID 14
Entries 192
Mean 8.422
RMS 1.406
χ² 1.053
Constant 56.18
Mean 8.371
Sigma 1.324
Xtot region−5
ID 15
Entries 240
Mean 3.892
RMS 0.8396
χ² 0.9278
Constant 123.5
Mean 3.935
Sigma 0.7629
Xtot region−6

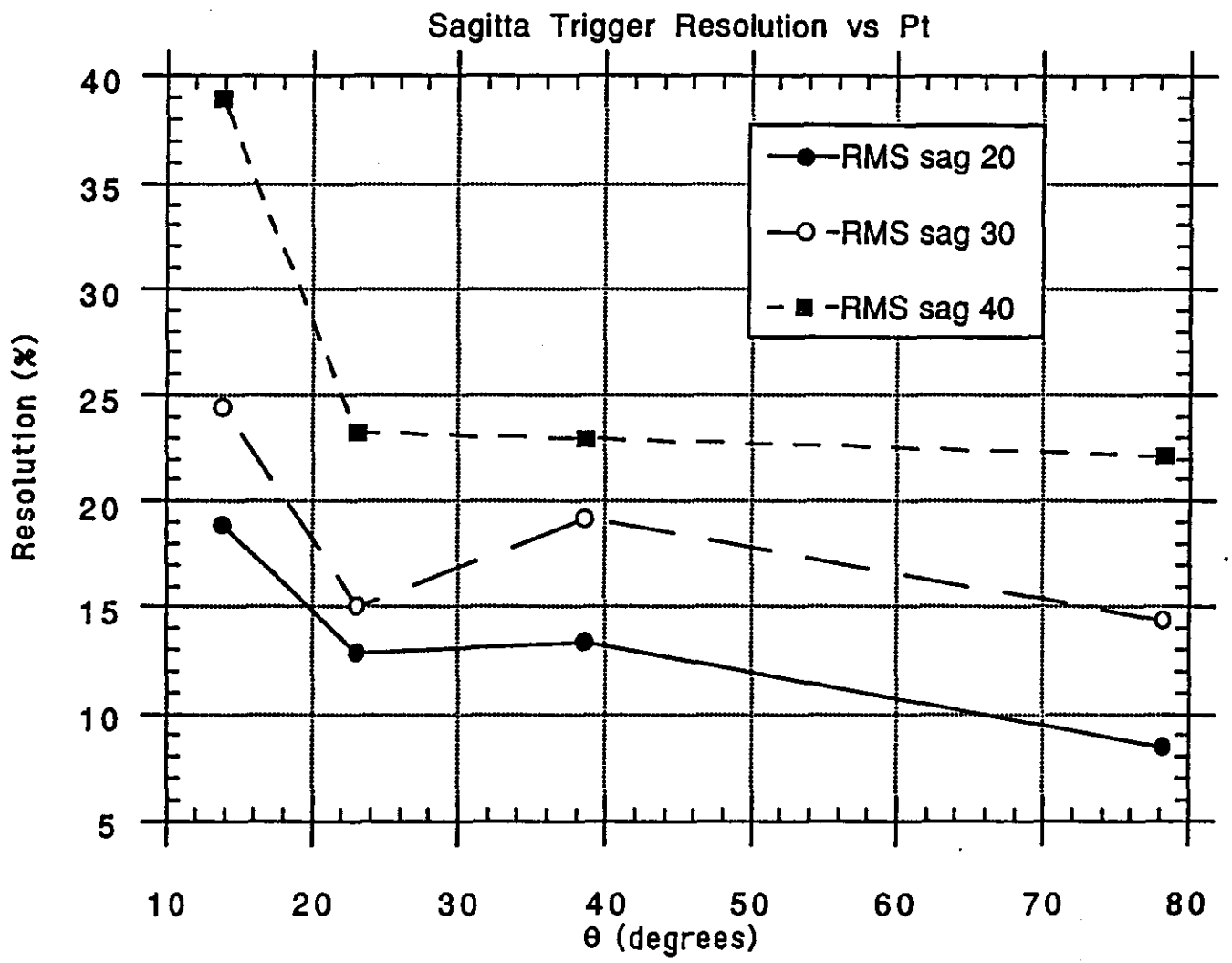

Δφ Trigger Primative vs Pt
Number of Strips
θ (degrees)
0
5
10
15
20
25
30
35
40
10
20
30
40
50
60
70
80
DF 10 GeV/c
DF 20 GeV/c
DF 30 GeV/c
DF 40 GeV/c
DF 50 GeV/c

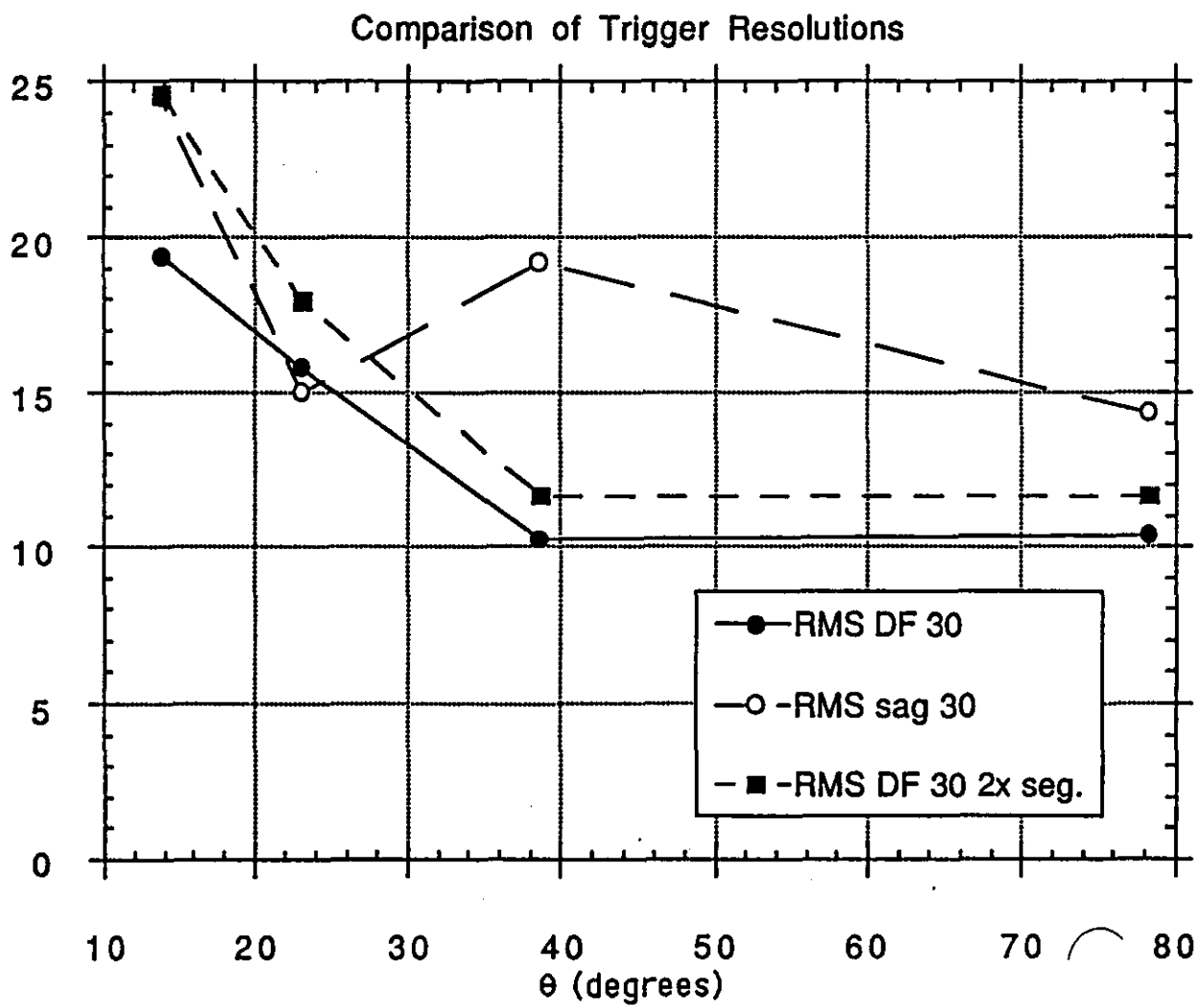

Pt=30 GeV/c sagitta trigger
ID 10
Entries 139
Mean 22.18
RMS 2.982
χ² 1.082
Constant 16.27
Mean 22.48
Sigma 3.224
Xtot region−1
ID 12
Entries 266
Mean 20.55
RMS 3.919
χ² 0.8692
Constant 25.53
Mean 20.55
Sigma 3.942
Xtot region−3

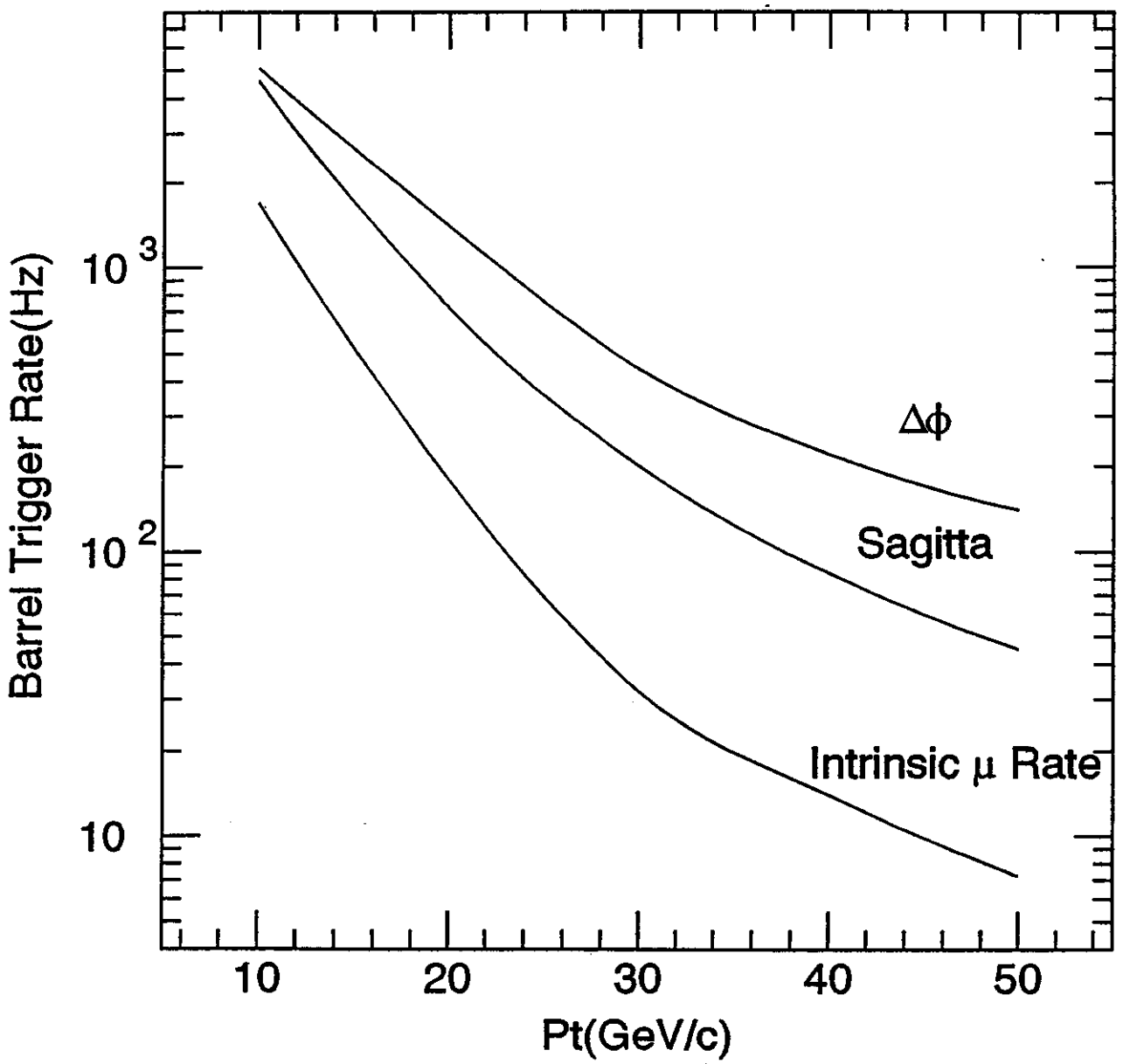

Pt=30 GeV/c sagitta trigger
ID 14
Entries 192
Mean 19.09
RMS 2.831
χ² 0.5905
Constant 26.01
Mean 18.96
Sigma 2.851
Xtot region−5
ID 15
Entries 240
Mean 12.07
RMS 3.194
χ² 4.808
Constant 23.43
Mean 12.53
Sigma 3.065
Xtot region−6

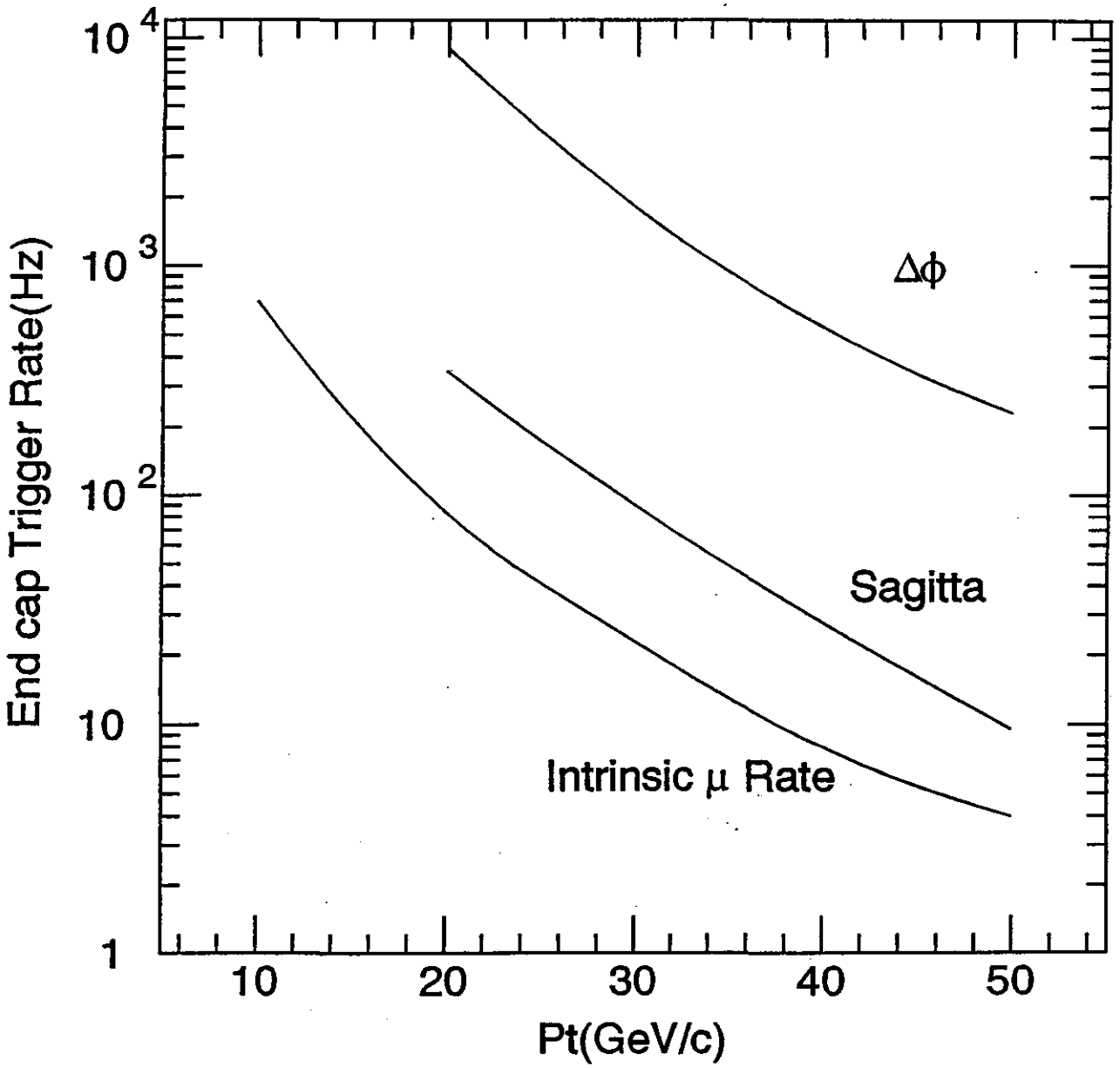

Pt = 30 GeV/c Sagitta Trigger
ΔS (mm)
θ (degrees)
0
5
10
15
20
25
30
0
20
40
60
80
100
sagitta
trigger sagitta
sagitta MC


Δφ Trigger resolution vs Pt
Resolution (%)
25
20
15
10
5
10
20
30
40
50
60
70
80
θ (degrees)
RMS DF 10
RMS DF 20
RMS DF 30
RMS DF 40
RMS DF 50

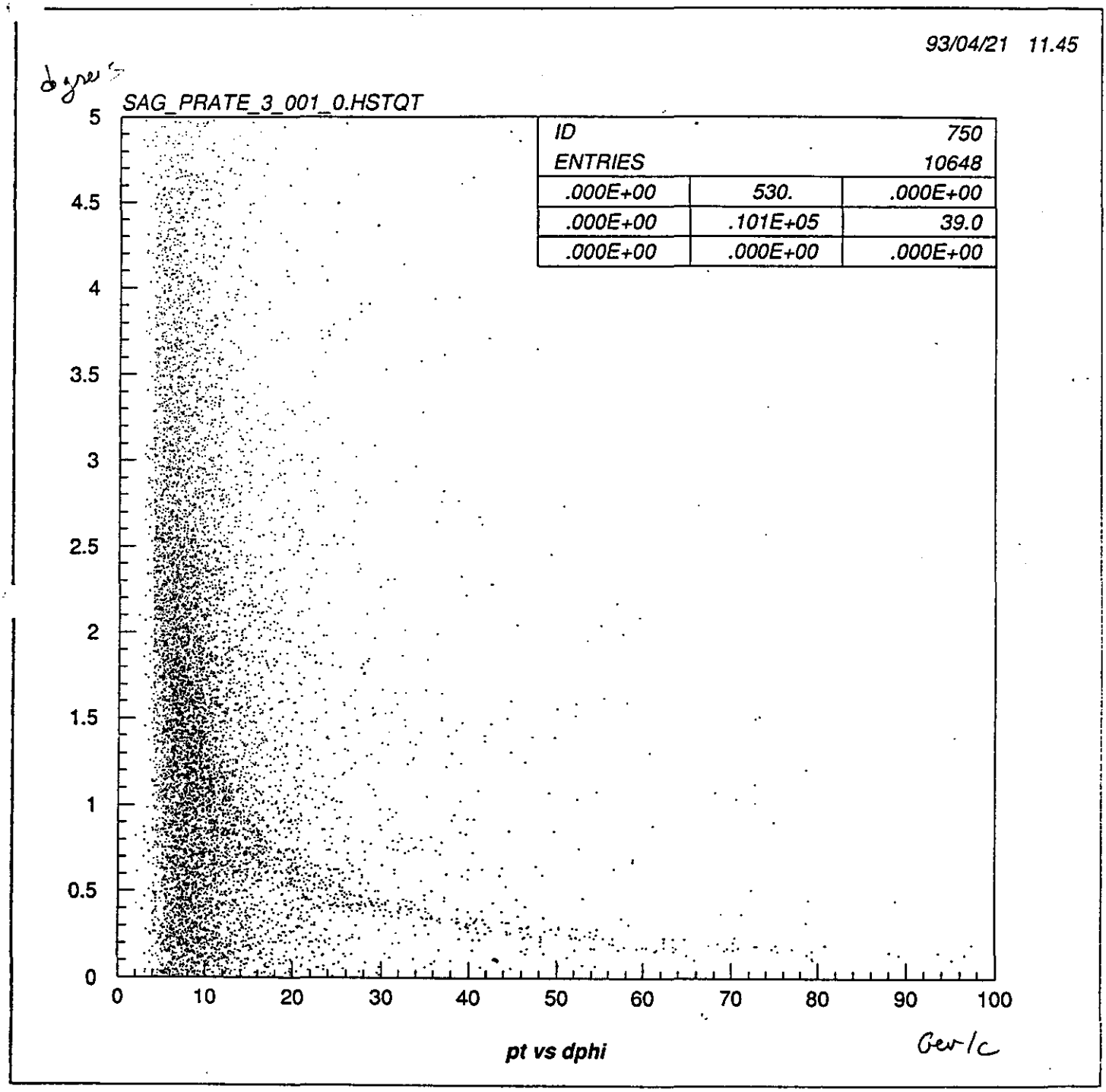

Sagitta Trigger Resolution vs Pt
Resolution (%)
40
35
30
25
20
15
10
5
10
20
30
40
50
60
70
80
θ (degrees)
RMS sag 20
RMS sag 30
RMS sag 40


Comparison of Trigger Resolutions
25
20
15
10
5
0
10
20
30
40
50
60
70
80
θ (degrees)
RMS DF 30
RMS sag 30
RMS DF 30 2x seg.

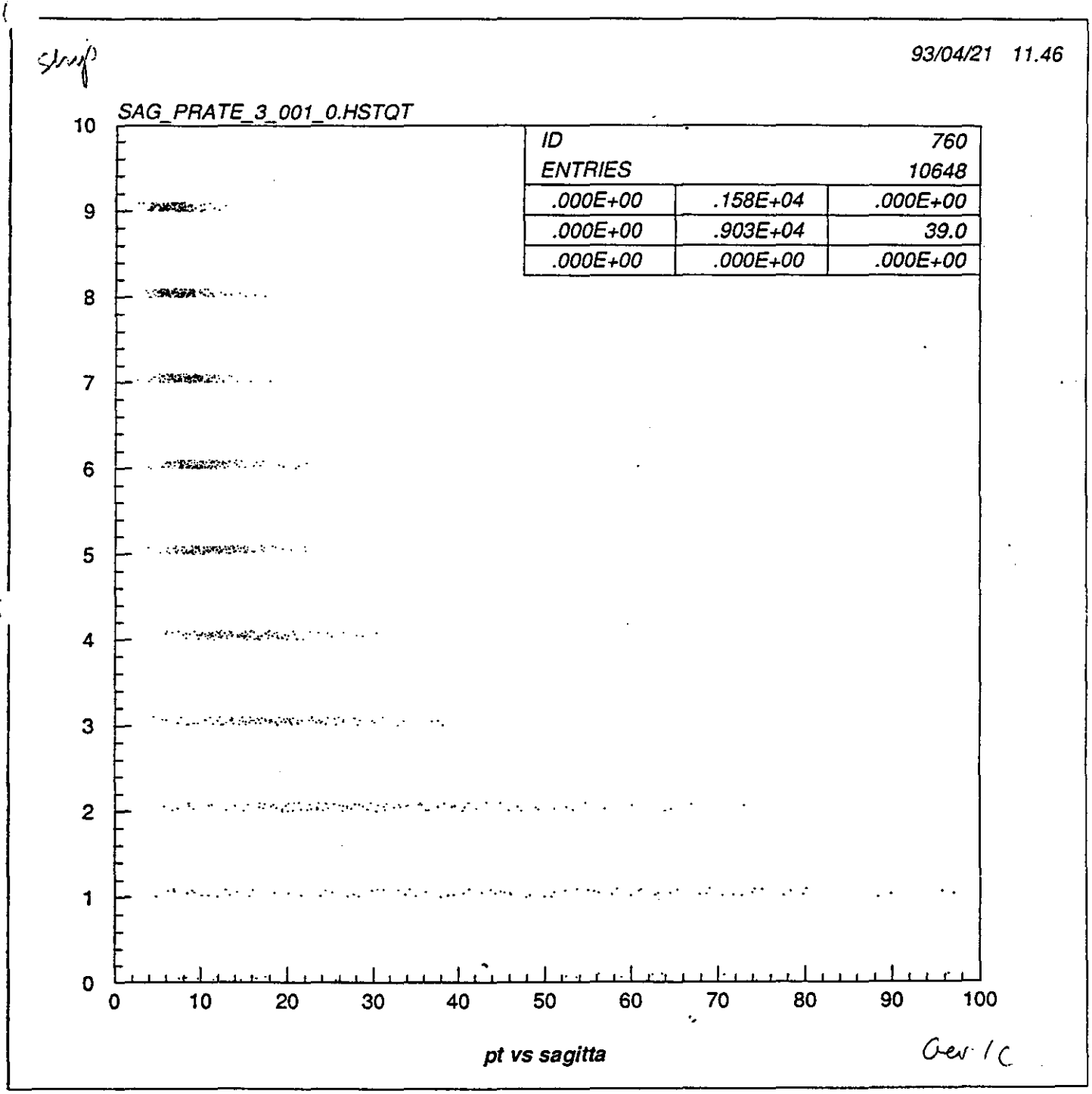

Barrel Trigger Rate(Hz)
10 3
10 2
10
10
20
30
40
50
Pt(GeV/c)
Δφ
Sagitta
Intrinsic μ Rate


End cap Trigger Rate(Hz)
10 4
10 3
10 2
10
1
10
20
30
40
50
Pt(GeV/c)
Δφ
Sagitta
Intrinsic μ Rate

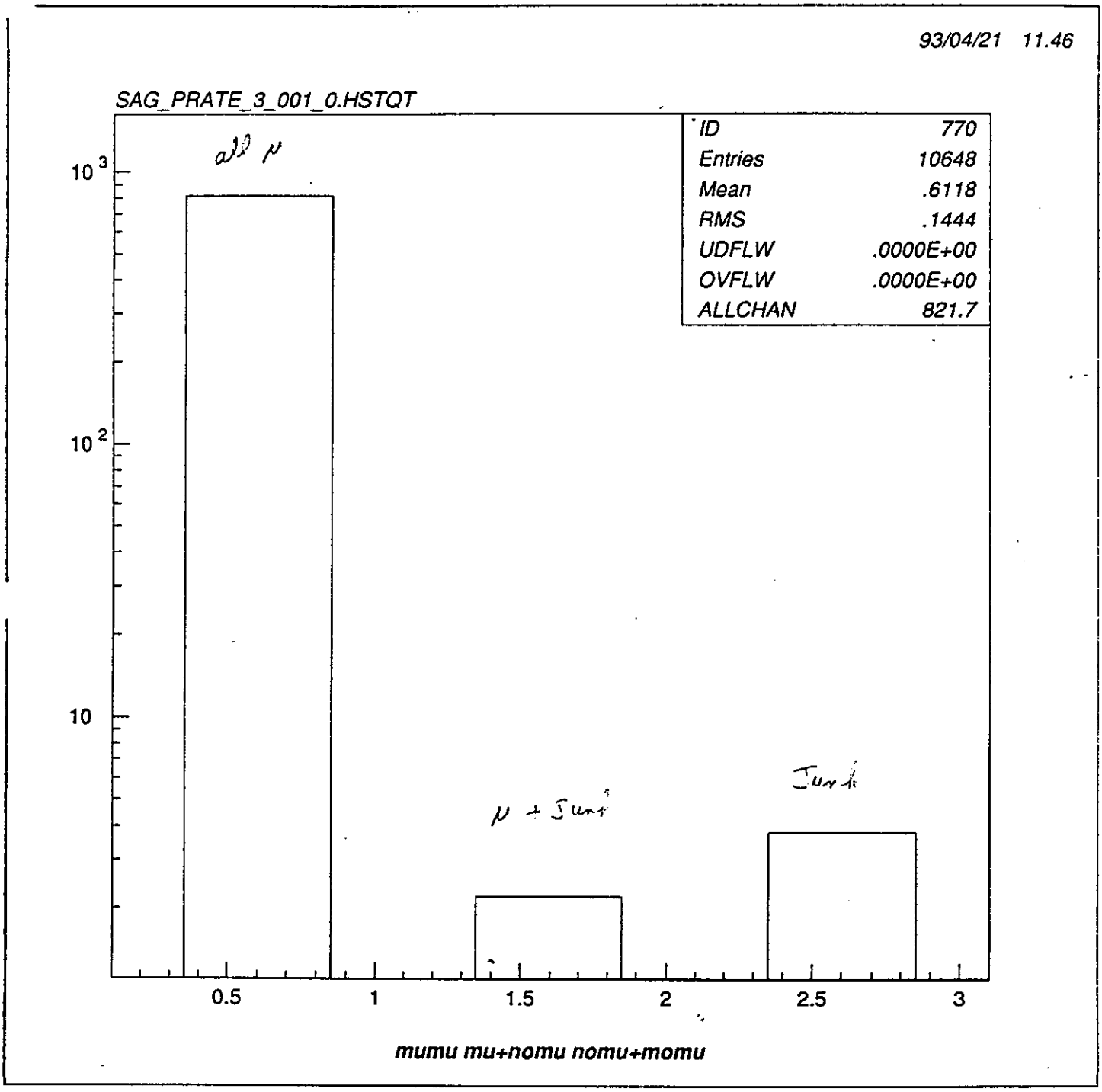
EC Dφ


93/04/21 11.45
degrees
SAG_PRATE_3_001_0.HSTQT
ID 750
ENTRIES 10648
.000E+00 530. .000E+00
.000E+00 .101E+05 39.0
.000E+00 .000E+00 .000E+00
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70 80 90 100
pt vs dphi
Gev/c

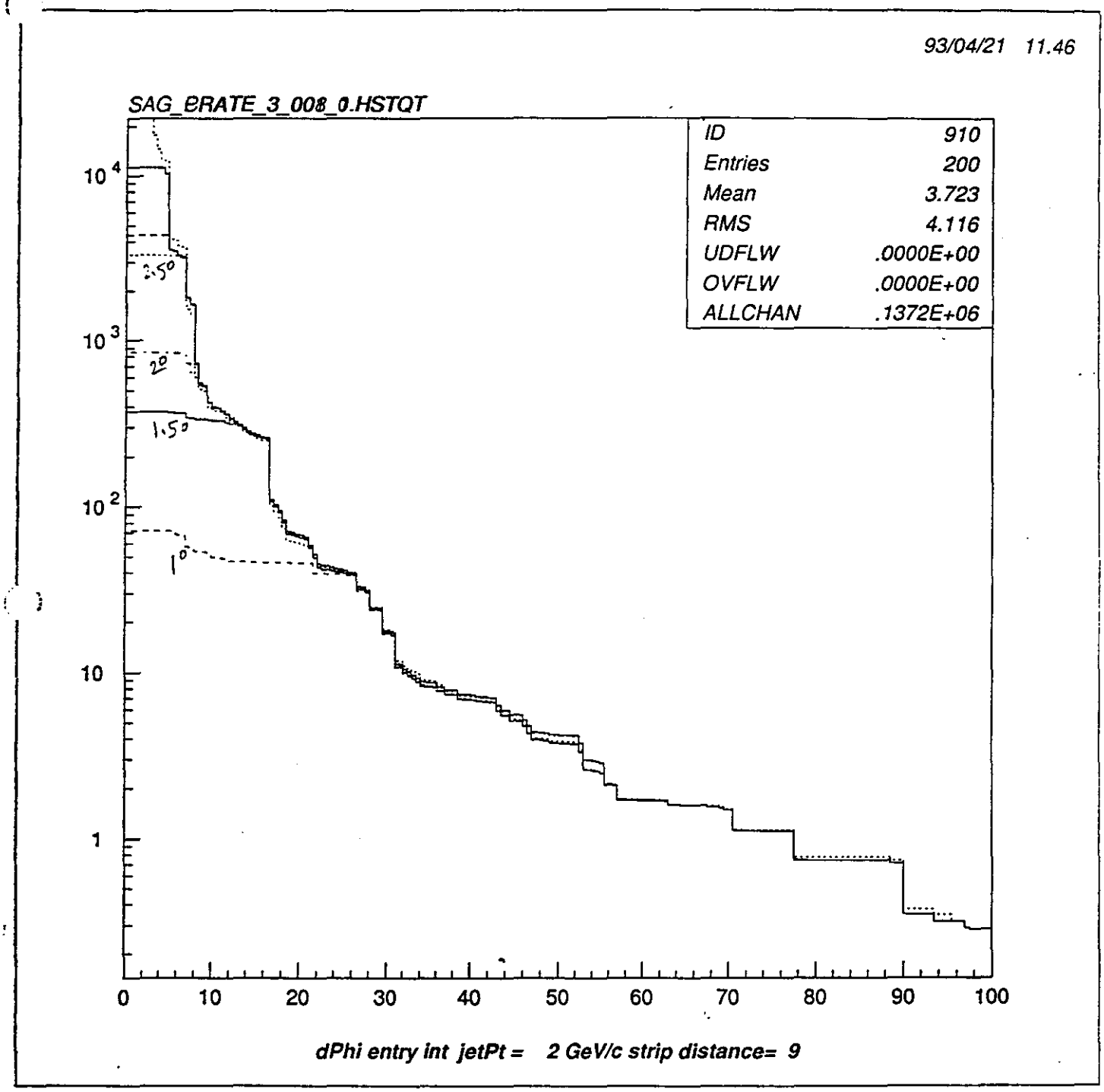
EC Sagitta


strip
93/04/21 11.46
SAG_PRATE_3_001_0.HSTQT
ID 760
ENTRIES 10648
.000E+00 .158E+04 .000E+00
.000E+00 .903E+04 39.0
.000E+00 .000E+00 .000E+00
0
1
2
3
4
5
6
7
8
9
10
0
10
20
30
40
50
60
70
80
90
100
pt vs sagitta
Over / C

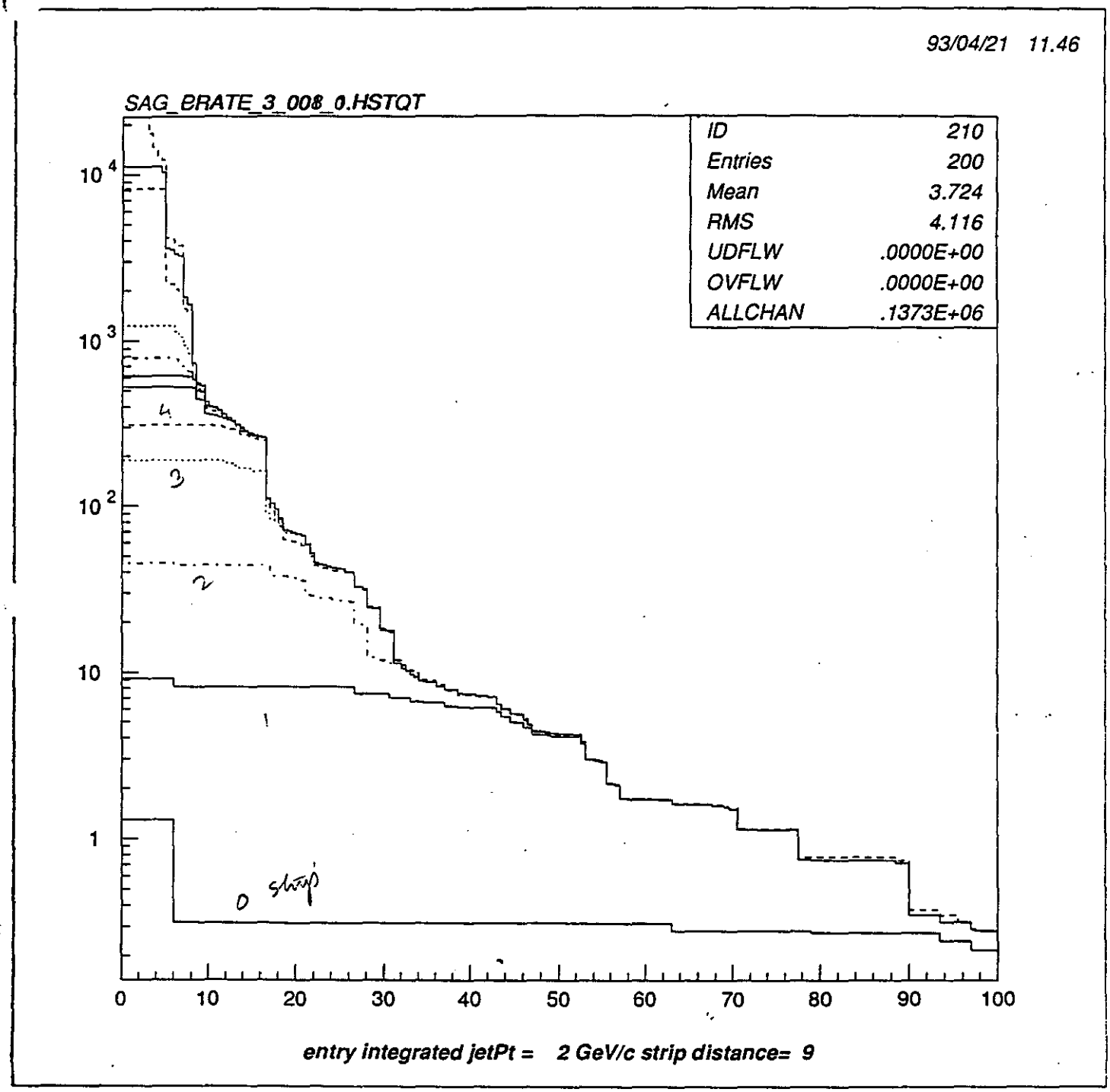
Ec Sagittar


93/04/21 11.46
SAG_PRATE_3_001_0.HSTQT
ID 770
Entries 10648
Mean .6118
RMS .1444
UDFLW .0000E+00
OVFLW .0000E+00
ALLCHAN 821.7
all μ
μ + Junk
Junk
10 3
10 2
10
0.5
1
1.5
2
2.5
3
mumu mu+nomu nomu+momu

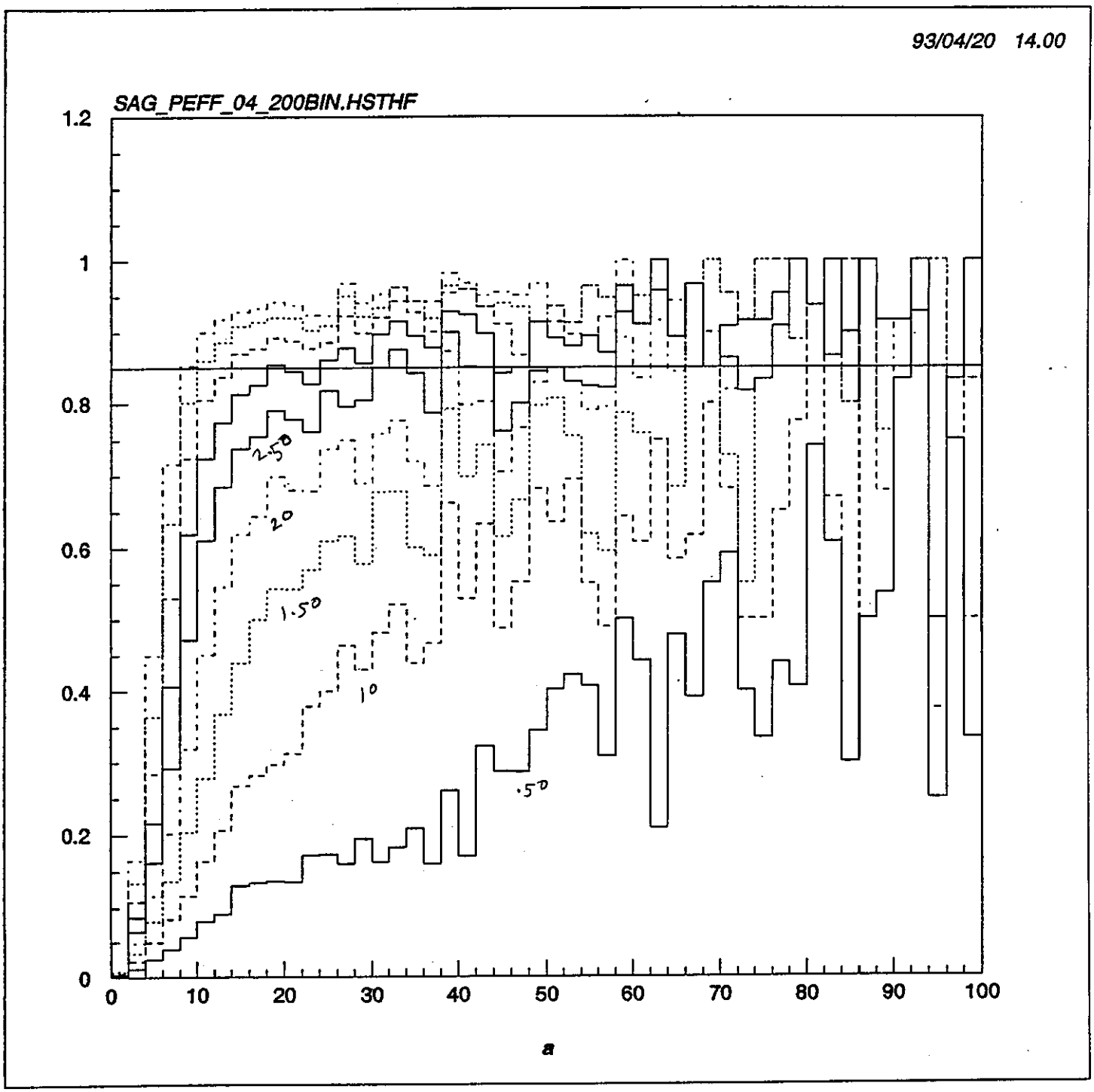
EC $\Delta\phi$


93/04/21 11.46
SAG_BRATE_3_008_0.HSTQT
ID 910
Entries 200
Mean 3.723
RMS 4.116
UDFLW .0000E+00
OVFLW .0000E+00
ALLCHAN .1372E+06
2.5°
2°
1.5°
1°
dPhi entry int jetPt = 2 GeV/c strip distance= 9

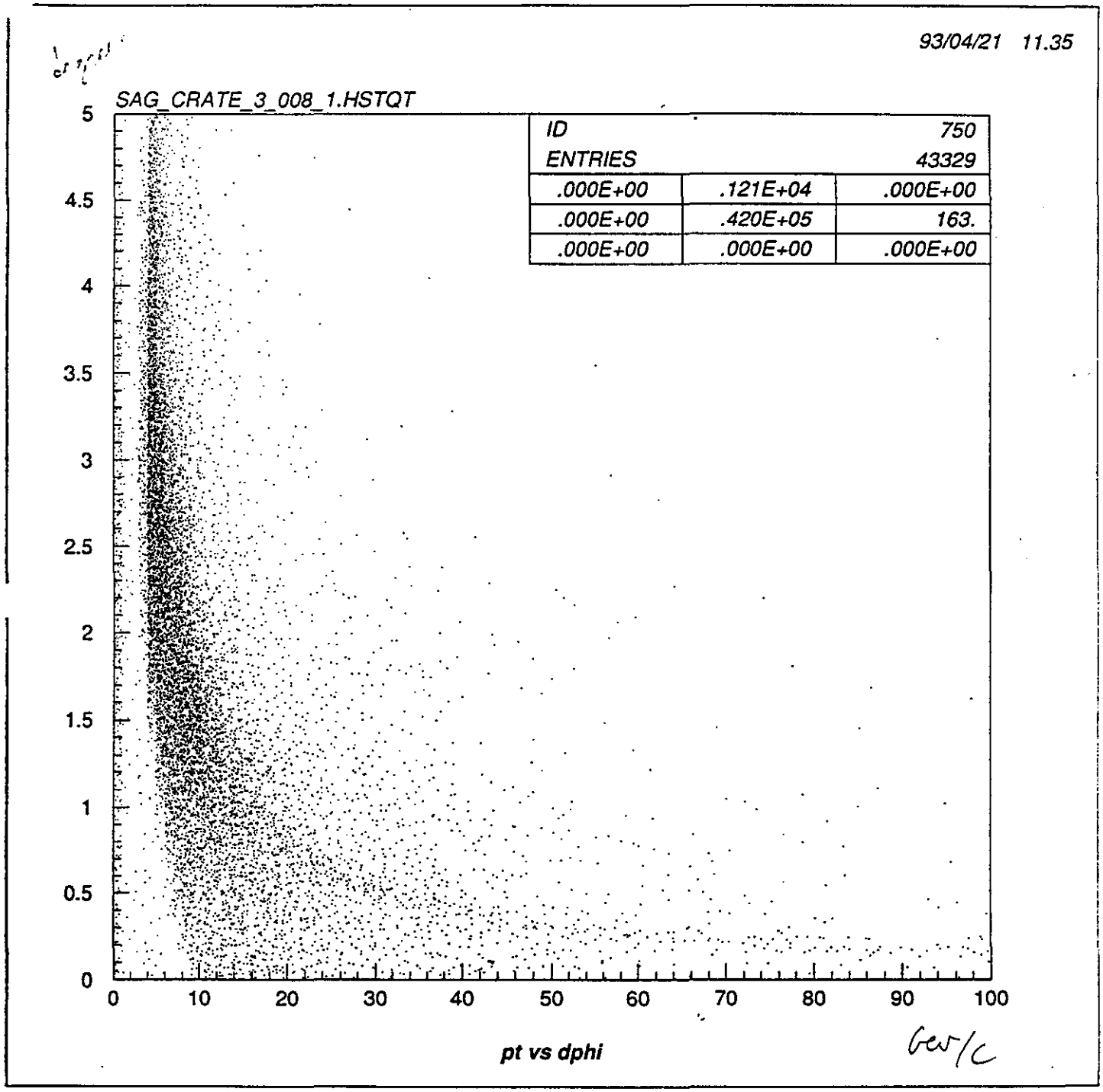
EC Sagitta


93/04/21 11.46
SAG_BRATE_3_008_0.HSTQT
ID 210
Entries 200
Mean 3.724
RMS 4.116
UDFLW .0000E+00
OVFLW .0000E+00
ALLCHAN .1373E+06
10 4
10 3
10 2
10
1
0 10 20 30 40 50 60 70 80 90 100
4
3
2
1
0 strip
entry integrated jetPt = 2 GeV/c strip distance= 9

EC 09


93/04/20 14.00
SAG_PEFF_04_200BIN.HSTHF
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
80
90
100
a
2.5°
2°
1.5°
1°
.5°

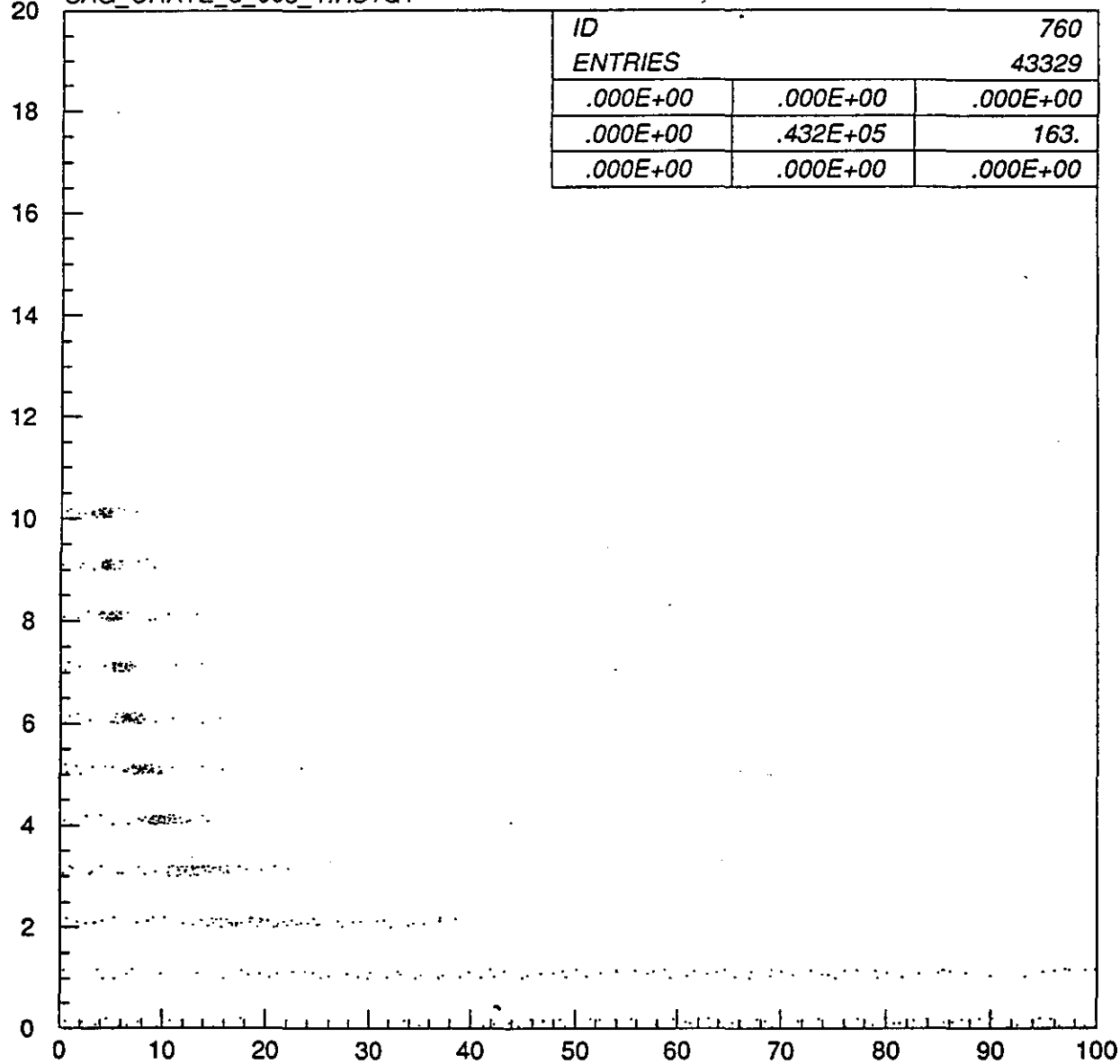
Barrel Δφ


93/04/21 11.35
SAG_CRATE_3_008_1.HSTQT
ID 750
ENTRIES 43329
.000E+00 .121E+04 .000E+00
.000E+00 .420E+05 163.
.000E+00 .000E+00 .000E+00
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0 10 20 30 40 50 60 70 80 90 100
pt vs dphi
GeV/c

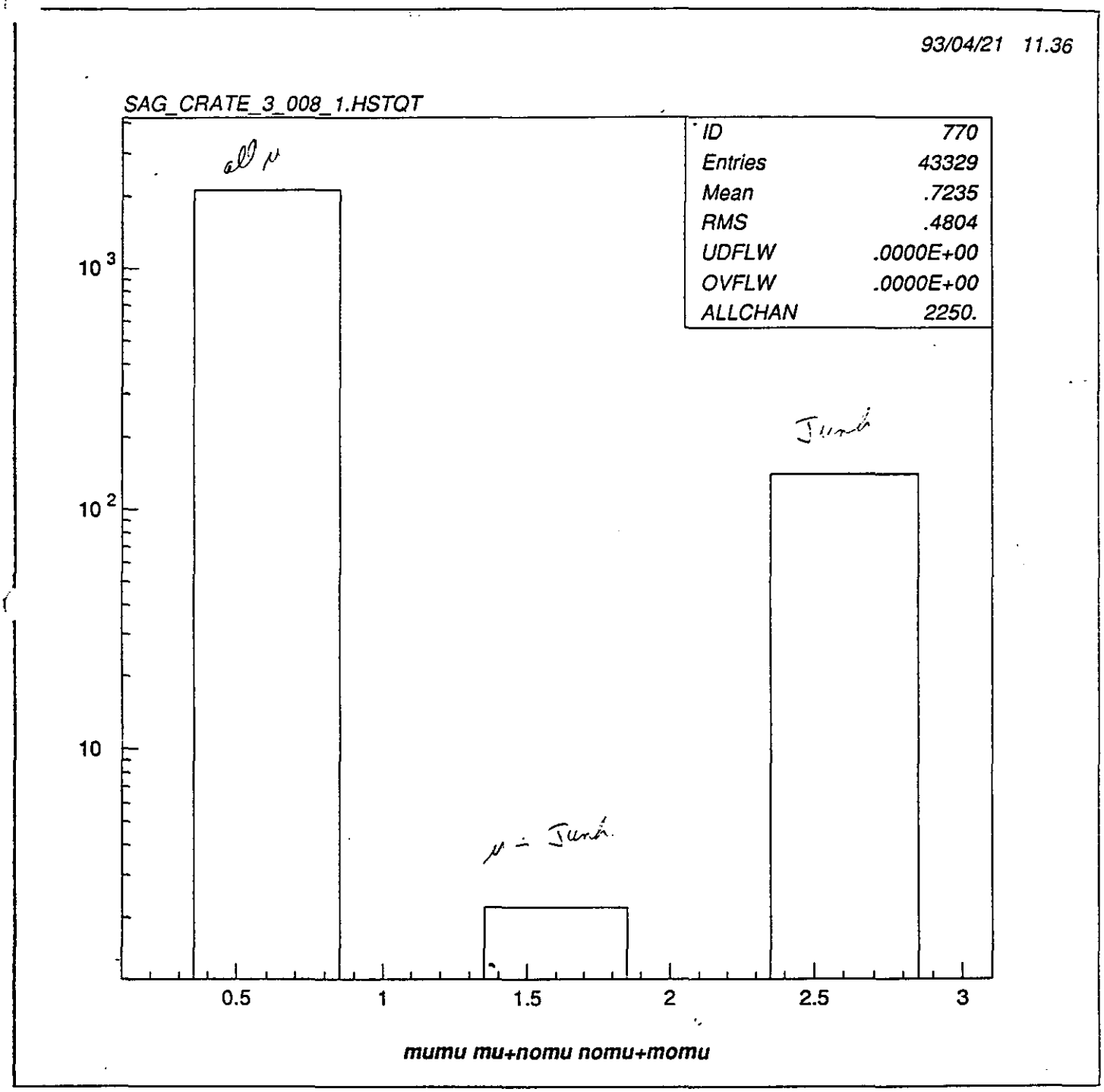
Barrel Sagitta

93/04/21 11.36

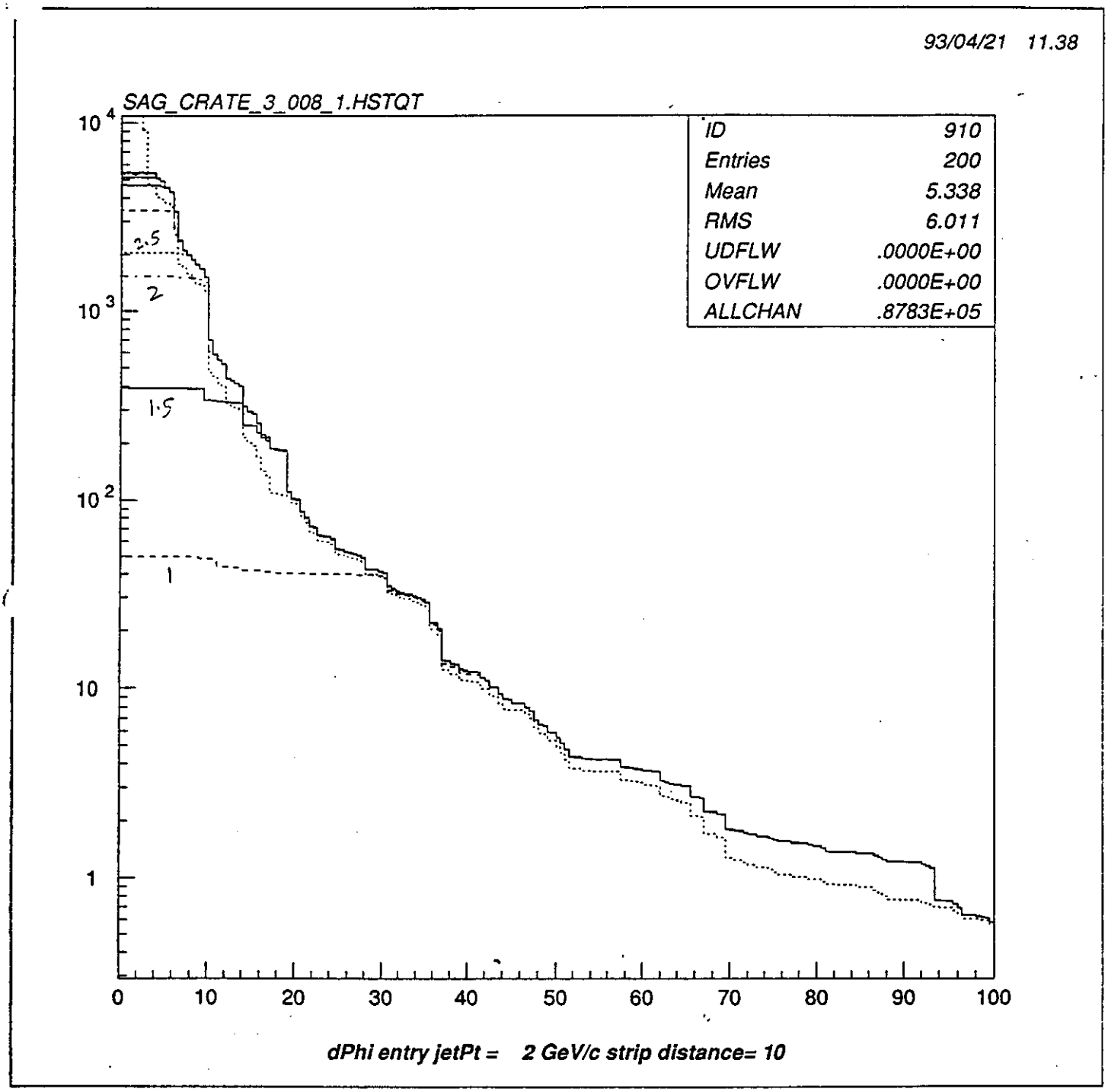
SAG_CRATE_3_008_1.HSTQT



pt vs sagitta

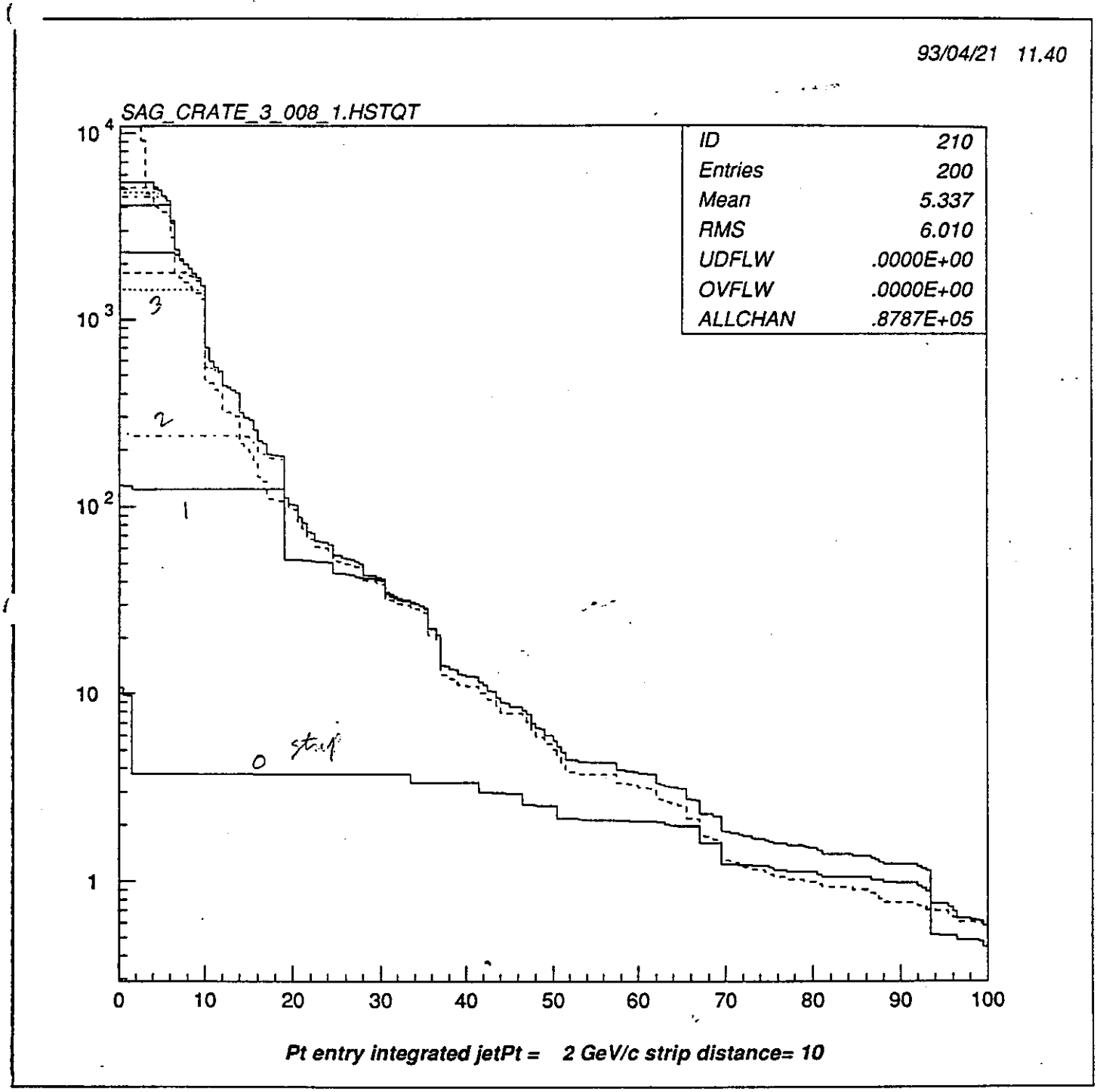

93/04/21 11.36
SAG_CRATE_3_008_1.HSTQT
ID 770
Entries 43329
Mean .7235
RMS .4804
UDFLW .0000E+00
OVFLW .0000E+00
ALLCHAN 2250.
all μ
μ - Junk
Junk
10 3
10 2
10
0.5
1
1.5
2
2.5
3
mumu mu+nomu nomu+momu

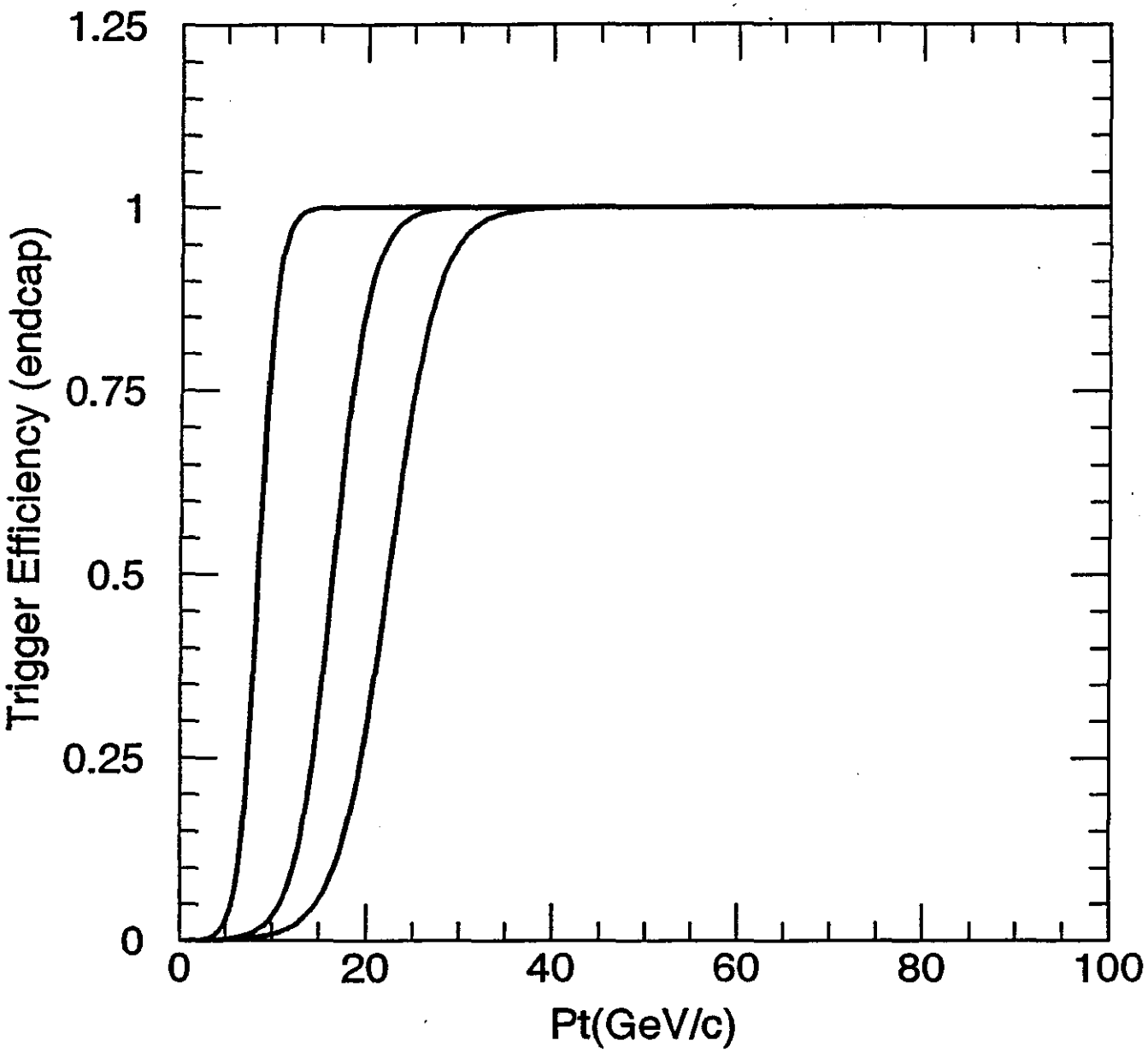
Barrel



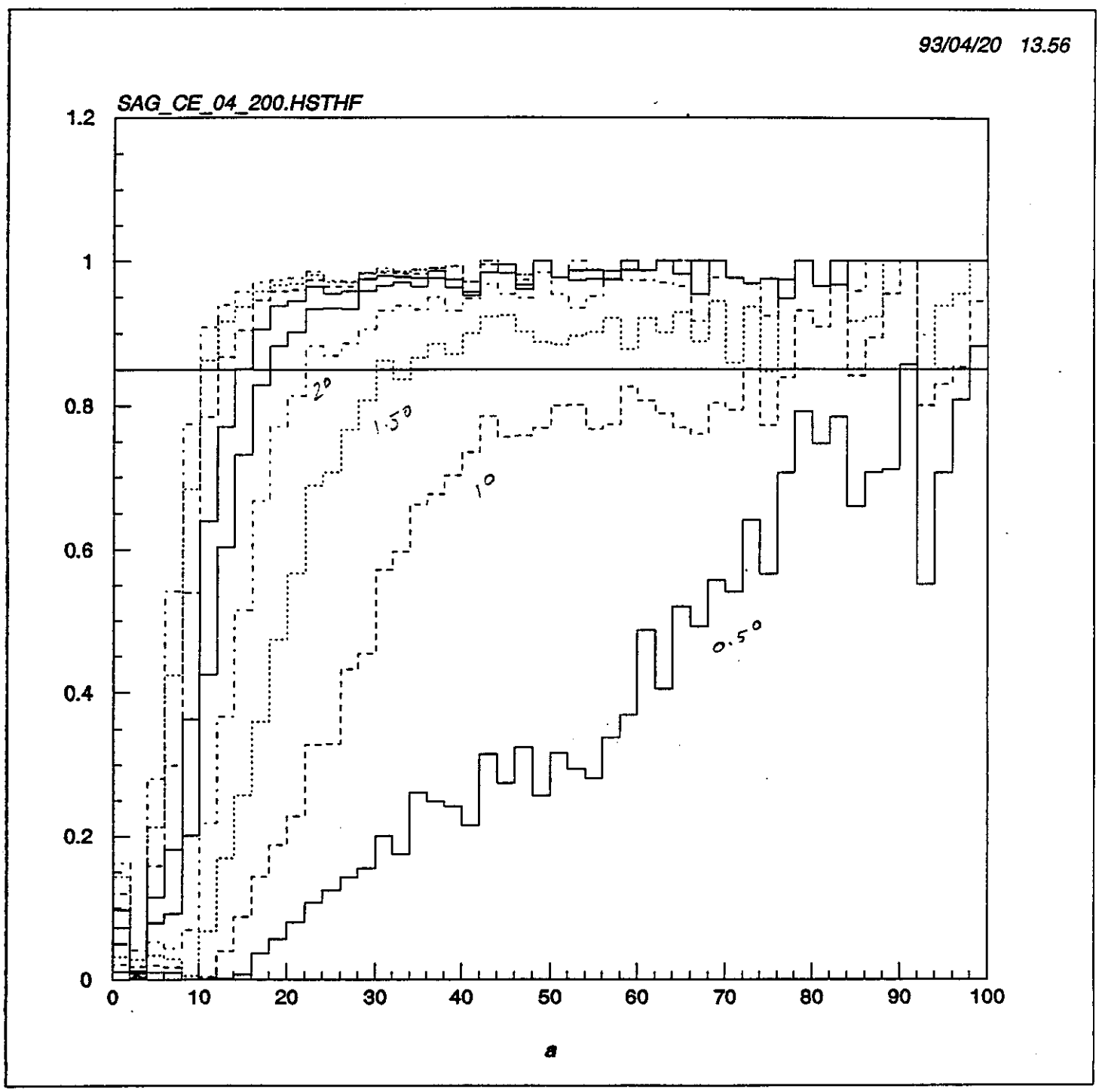
93/04/21 11.38
SAG_CRATE_3_008_1.HSTQT
ID 910
Entries 200
Mean 5.338
RMS 6.011
UDFLW .0000E+00
OVFLW .0000E+00
ALLCHAN .8783E+05
2.5
2
1.5
1
dPhi entry jetPt = 2 GeV/c strip distance= 10

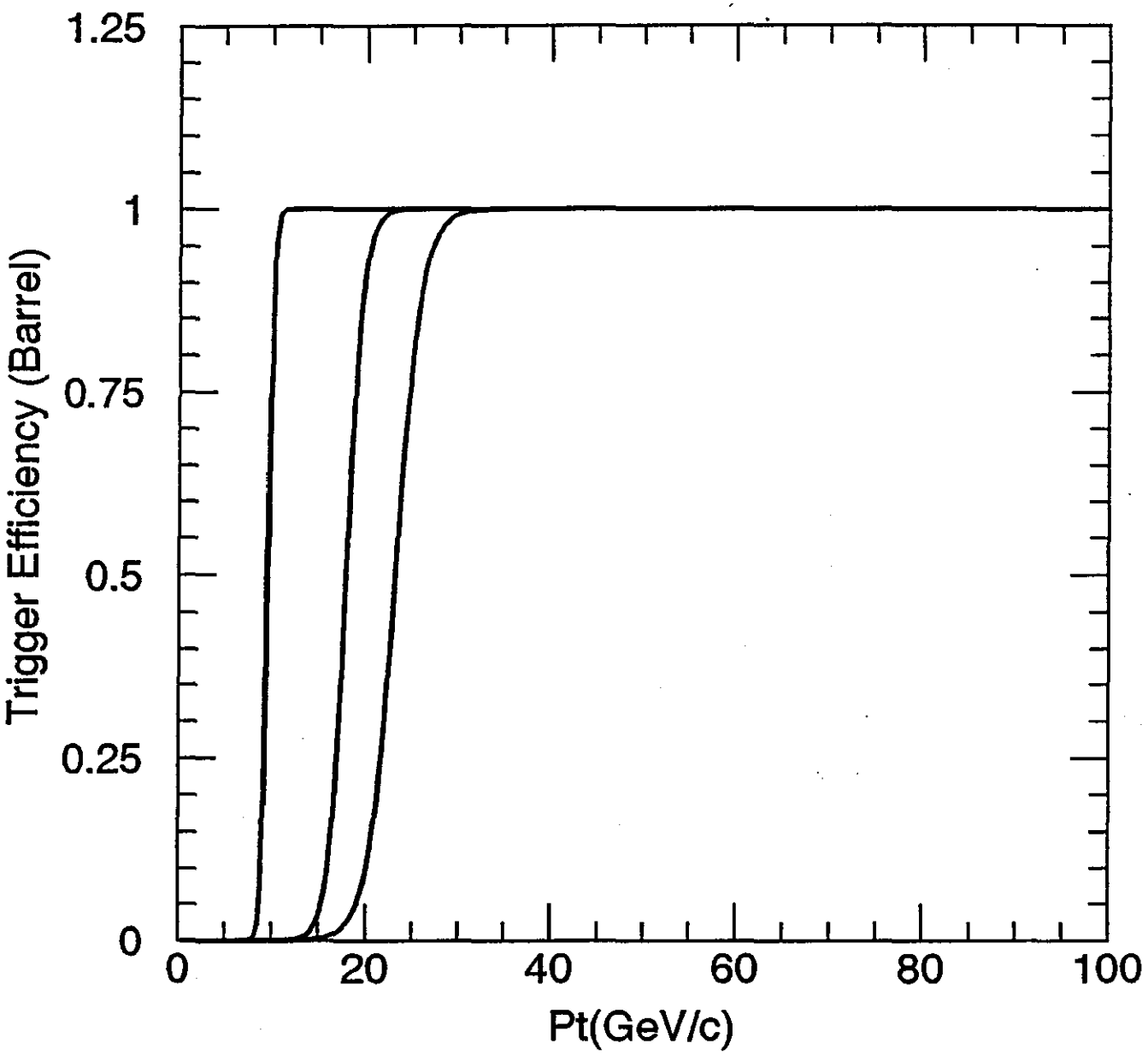
Barrel segll.



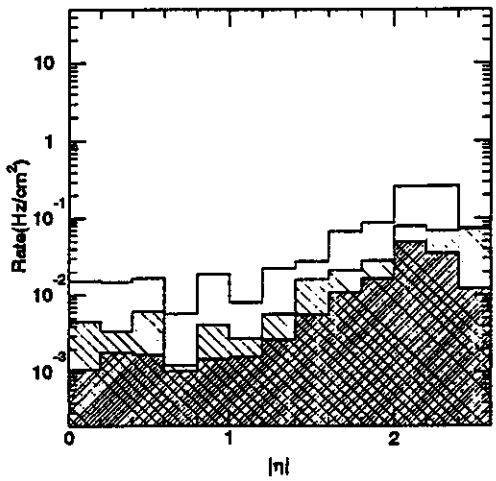

1.25
1
0.75
0.5
0.25
0
Trigger Efficiency (endcap)
0
20
40
60
80
100
Pt(GeV/c)

Barrel $\Delta\phi$

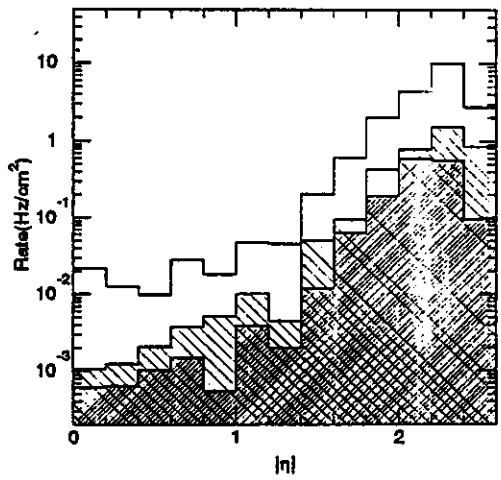



1.25
1
0.75
0.5
0.25
0
Trigger Efficiency (Barrel)
0
20
40
60
80
100
Pt(GeV/c)

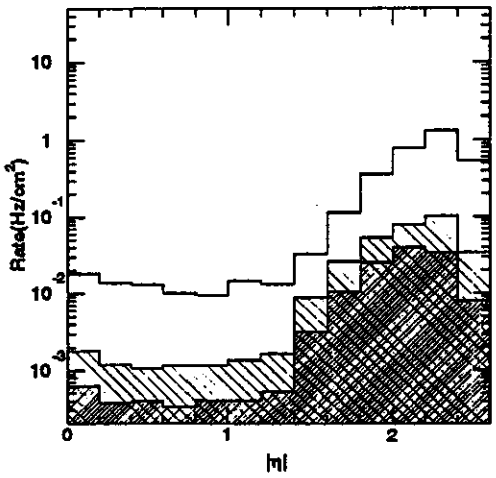
Direct particls Rate



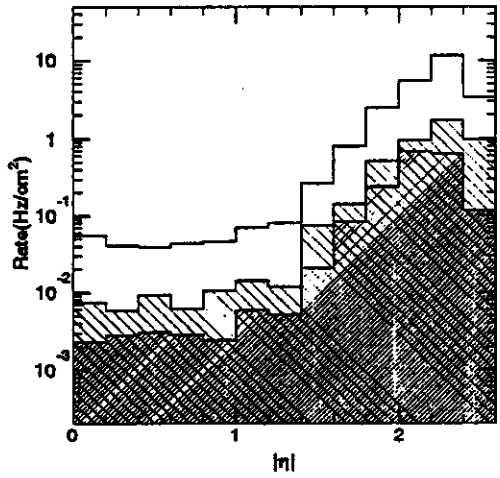
Decayed particle rate

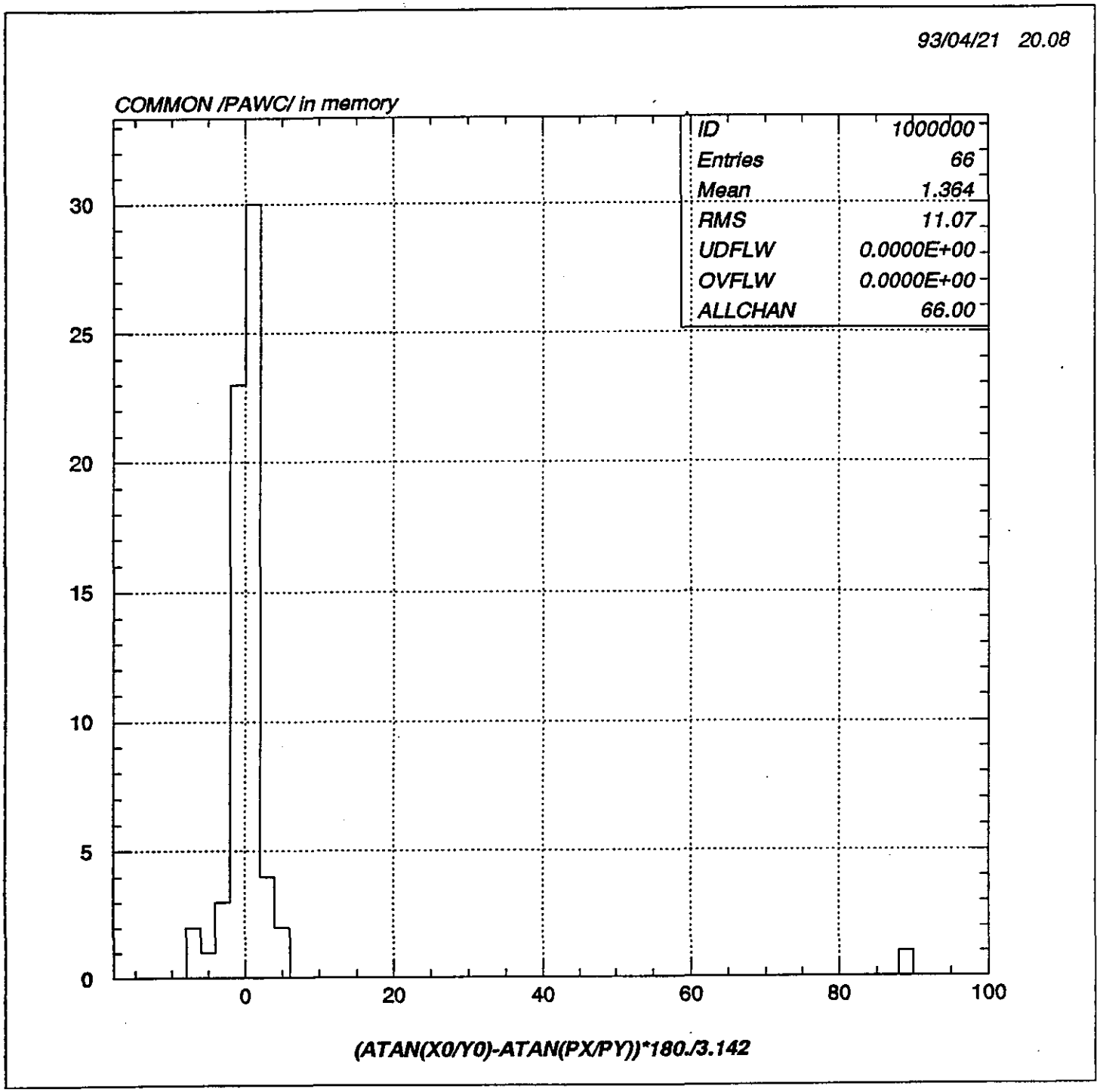


Punchthrough particle rate



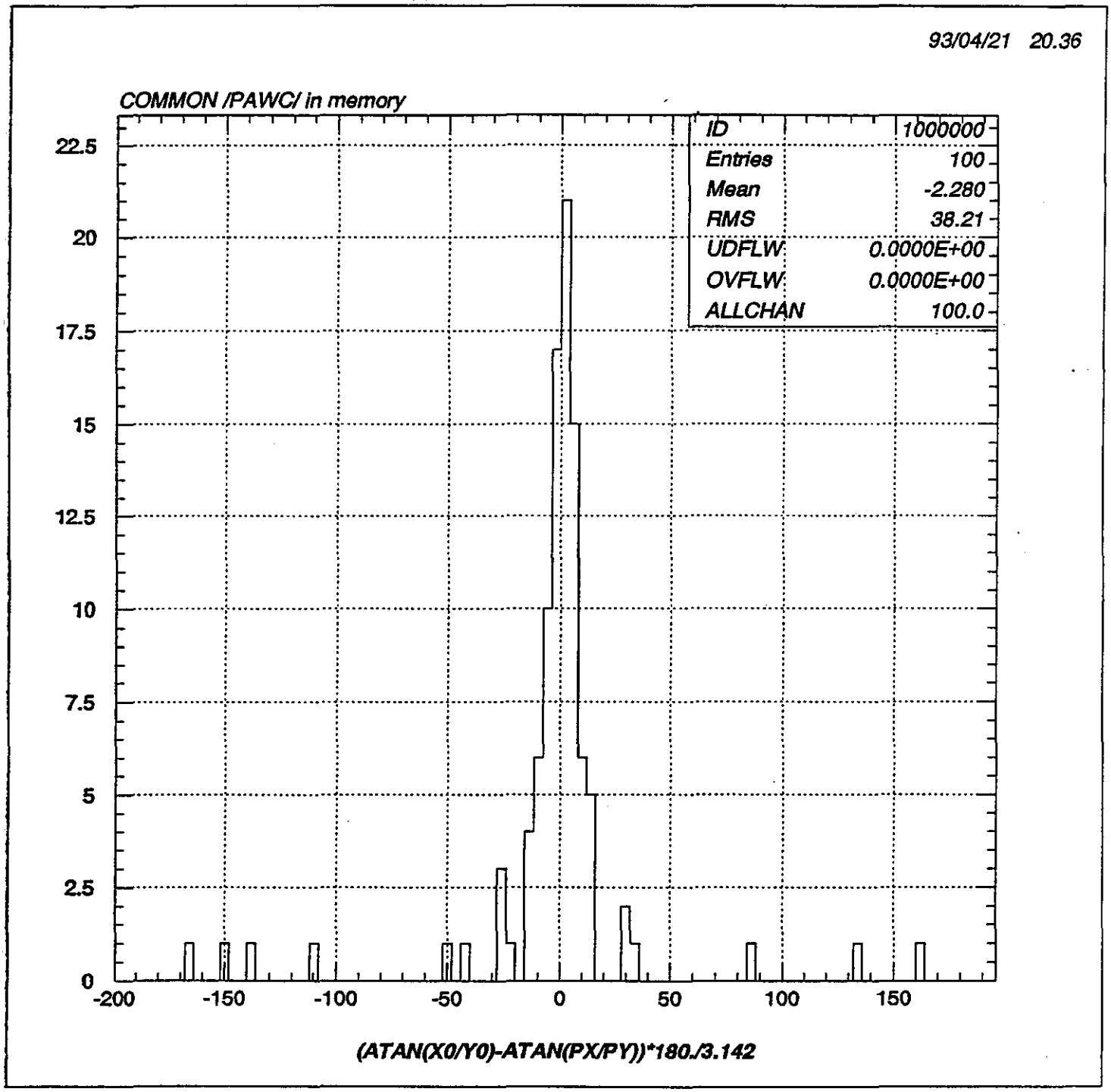
Total rate





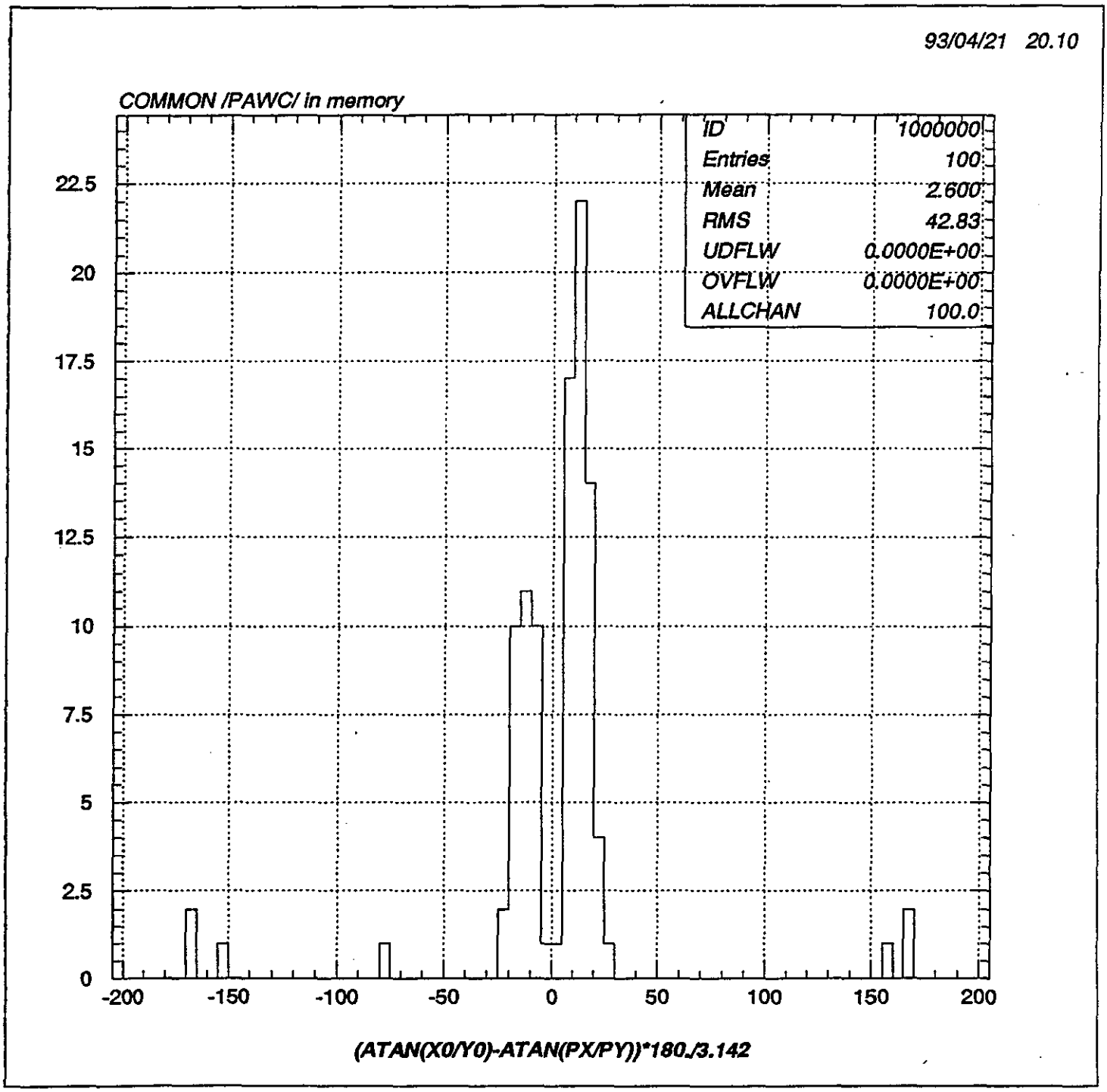
$P_t > 20$

$\Delta\varphi < 0.5$



$p_t < 10$

$\Delta\varphi > 0.5$



$P_e < 10$

$\Delta\varphi < 0.5$

P Dingus 4/29/93

THIS VARIABLE DOES NOT INCLUDE FLUCTUATIONS FROM CALO SINCE P_T^{MC} IS TAKEN FROM GEANT AFTER THE CALO.

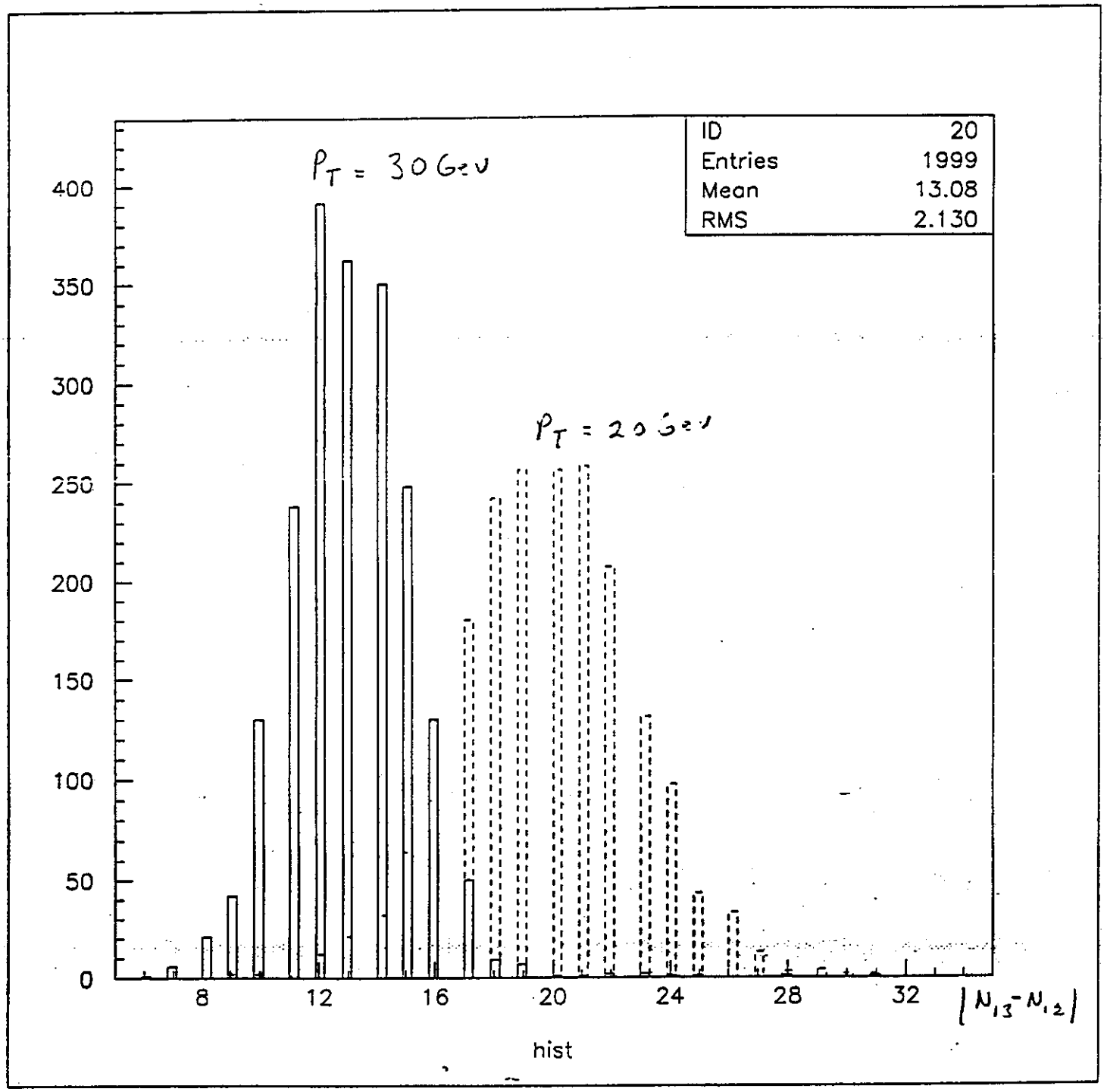
For $$\frac{\Delta P}{P} \equiv \left(\frac{\sum \left(\frac{P_T^{FIT} - P_T^{MC}}{P_T^{MC}} \right)^2}{N} \right)^{1/2}$$ AVERAGED over η Bin

P_T	$0<\eta<.5$	$.5<\eta<1$	$1<\eta<1.7$	$1.7<\eta<2.5$
100GeV	.02278	.0322	.04398	.08378
500GeV	.062	.062	.07697	.11755
100GeV	.1209	.1178	.1856	.2333

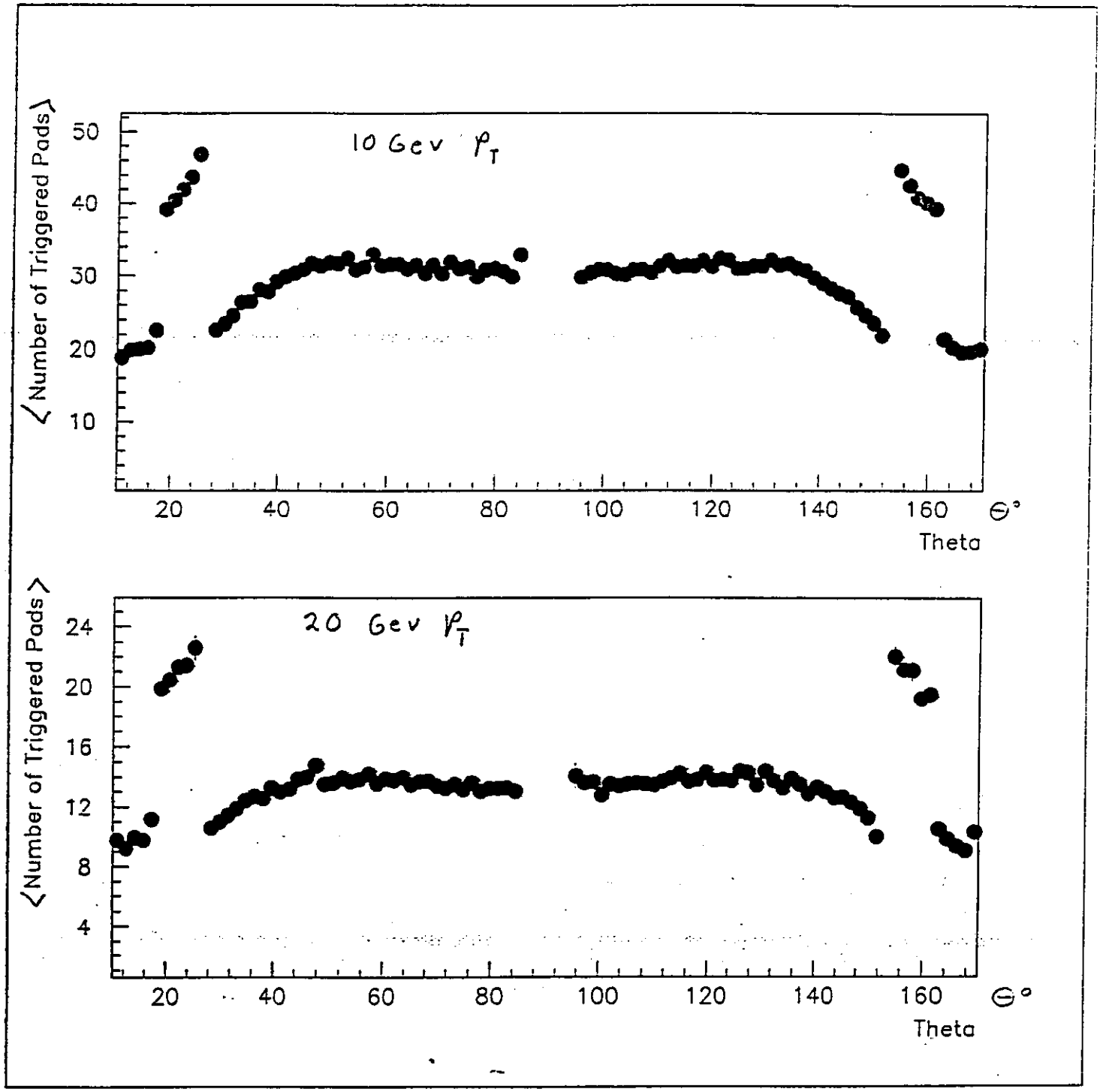
EACH SAMPLE HAD 1500 EVENTS 1st 2 η Bins AND 1000 EVENTS IN THE ENDCAP FOR 100 GeV P_T, 2000 FOR 500 GeV AND 1 TeV IN THE ENDCAP.

$$Q \simeq (10 \times 20\ Hz/cm^2)(1.78)(0.5)(3)(300 \times 10^{-9})$$

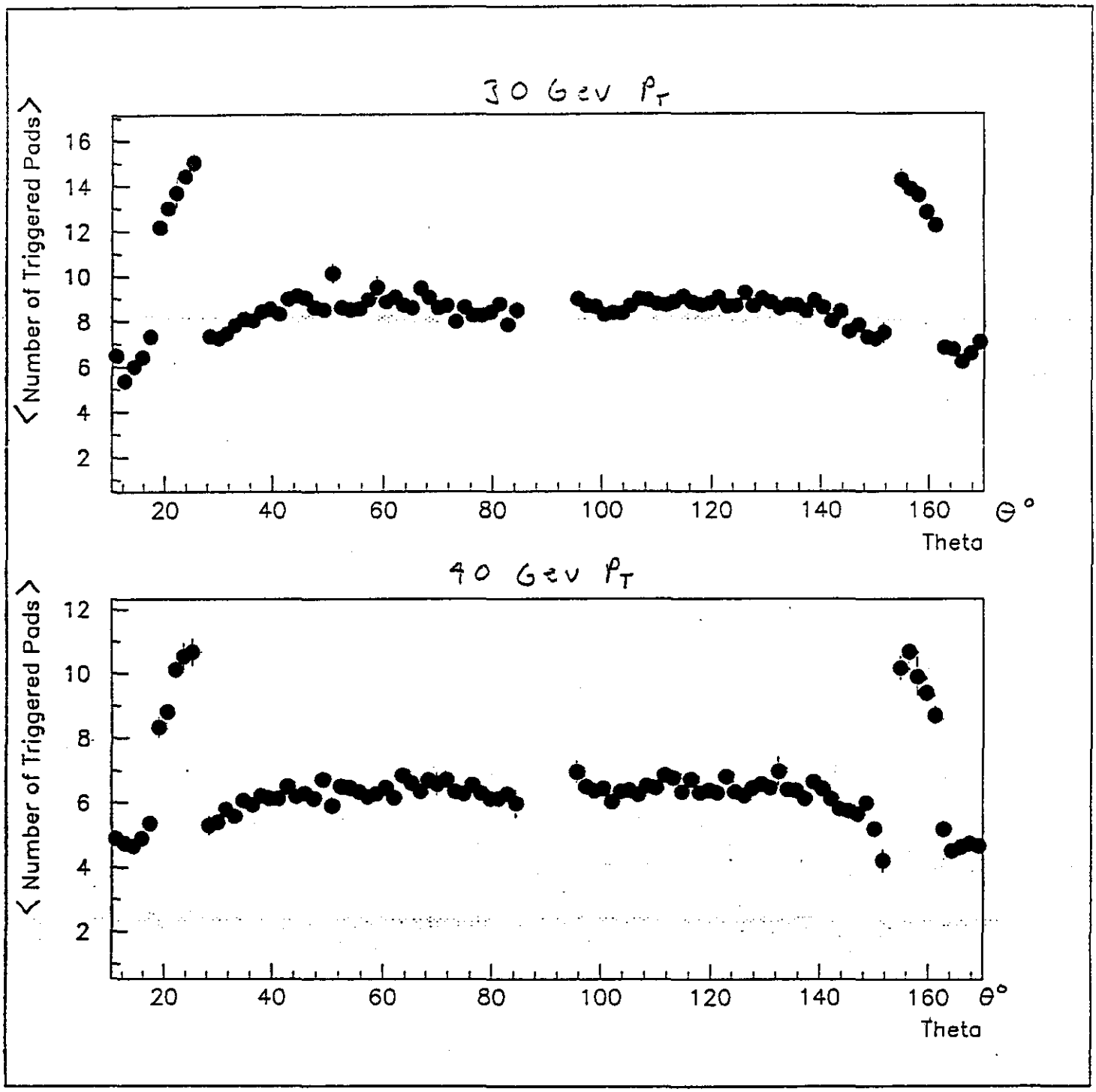
$$= 1.69 \times 10^{-4}$$


ID 20
Entries 1999
Mean 13.08
RMS 2.130
P_T = 30 GeV
P_T = 20 GeV
400
350
300
250
200
150
100
50
0
8
12
16
20
24
28
32
$|N_{13} - N_{12}|$
hist

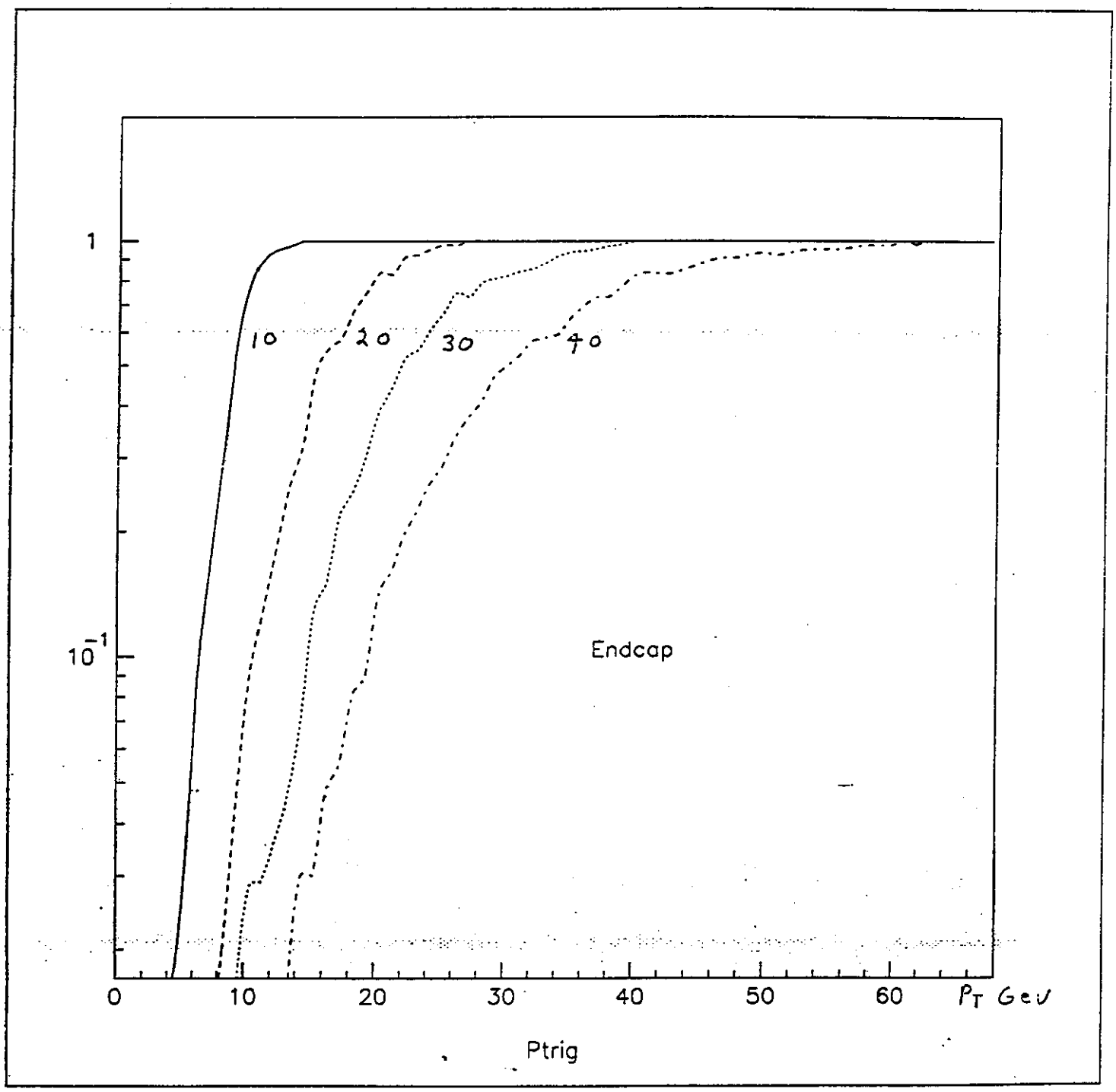
$\theta = 20°$

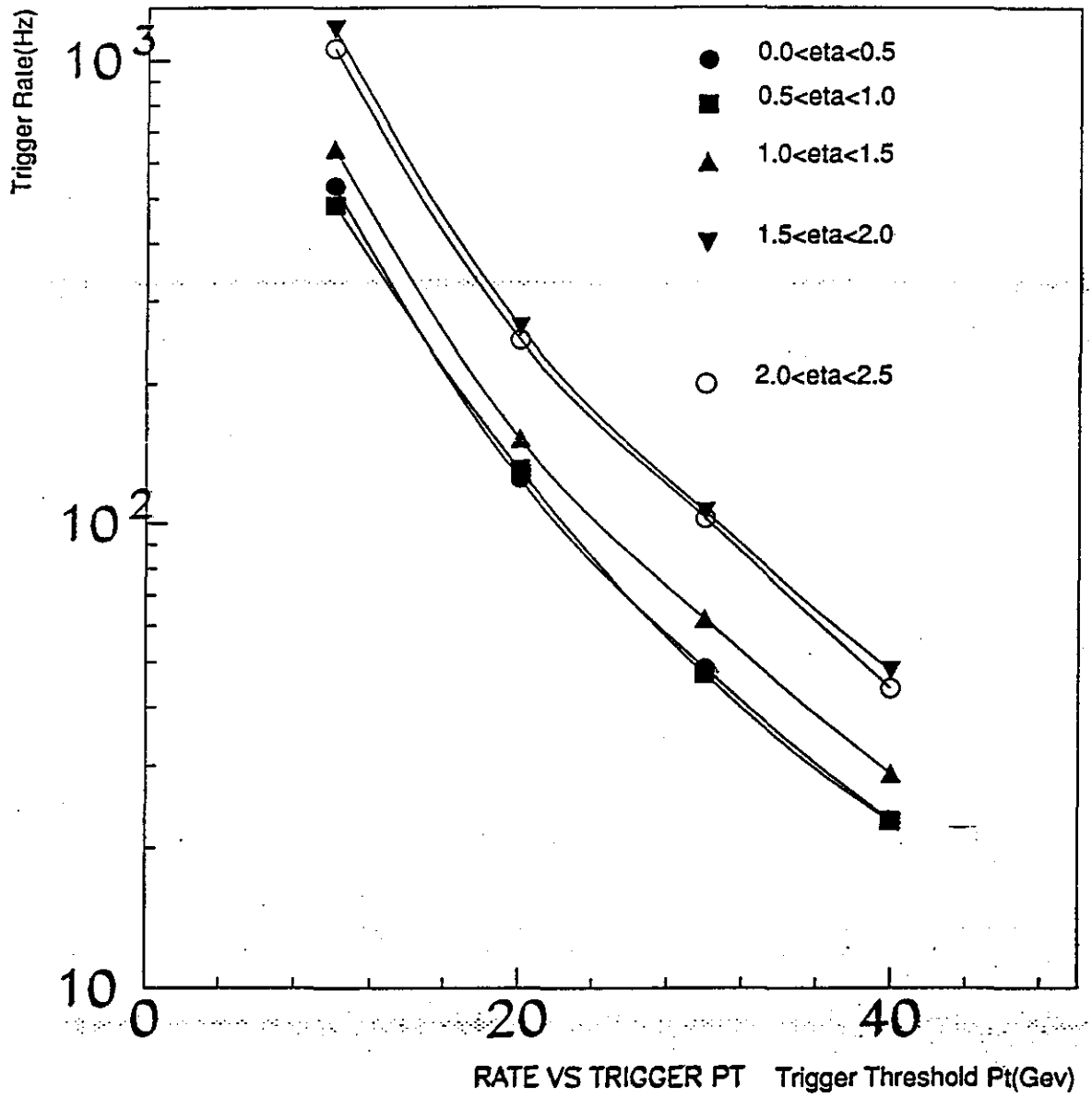


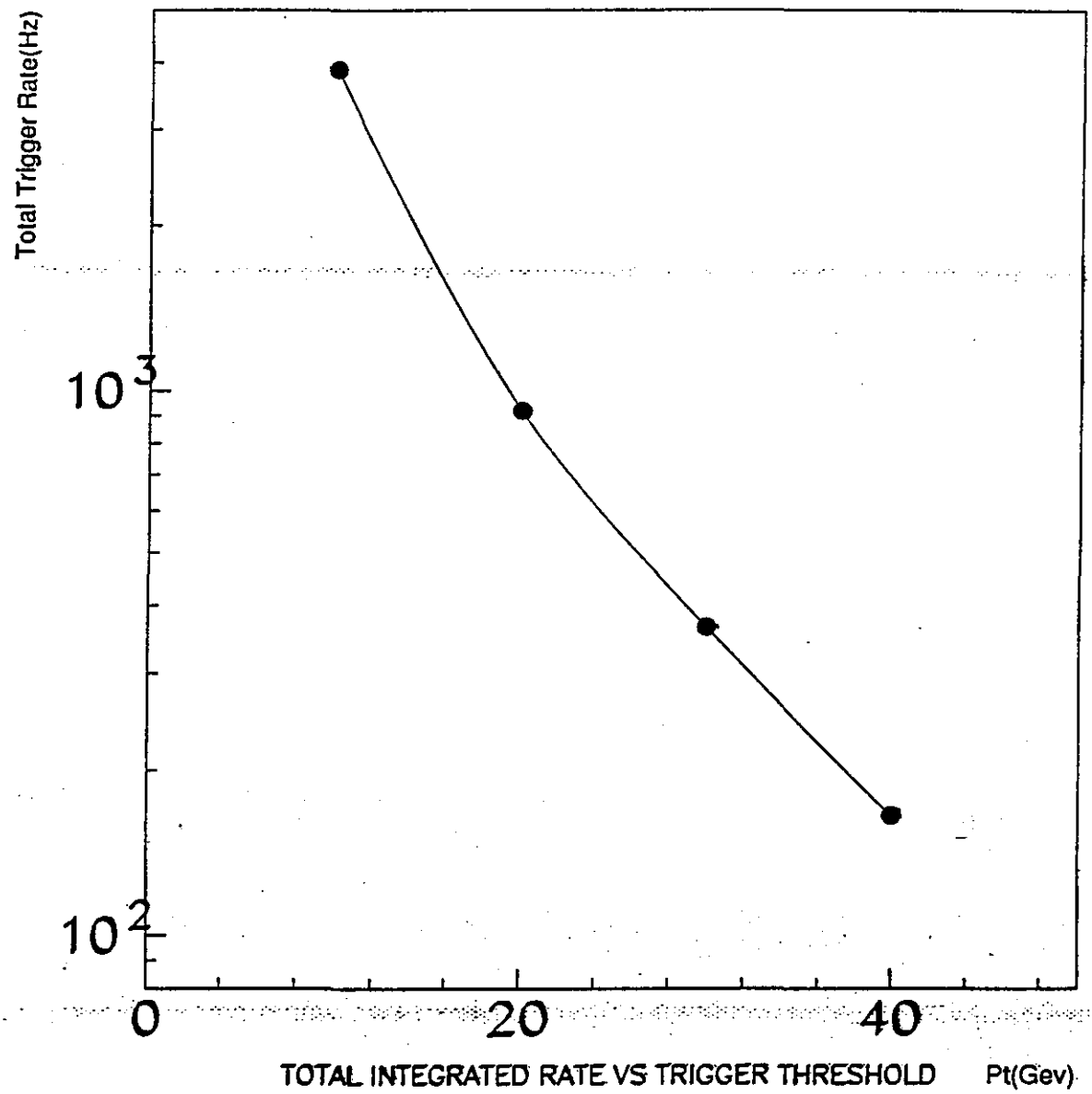
$\langle$ NUMBER OF TRIGGERED PADS $\rangle \equiv \langle |N_{13} - N_{12}| \rangle$



$$\langle \text{NUMBER TRIGGERED PADS} \rangle = \langle | N_{13} - N_{12} | \rangle$$


1
10^{-1}
10
20
30
40
Endcap
0
10
20
30
40
50
60
P_T GeV
Ptrig


Trigger Rate(Hz)
10^3
10^2
10
0
20
40
0.0<eta<0.5
0.5<eta<1.0
1.0<eta<1.5
1.5<eta<2.0
2.0<eta<2.5
RATE VS TRIGGER PT
Trigger Threshold Pt(Gev)


Total Trigger Rate(Hz)
10^3
10^2
0
20
40
TOTAL INTEGRATED RATE VS TRIGGER THRESHOLD
Pt(Gev)

μ TRACK FINDING + FITTING

TRACK FITTING AND FINDING WAS IMPLIMENTED USING SIGEM AND THE LJ KALMAN FILTER BASED ON THE GEANE PACKAGE.

TWO DIFFERENT RUNS WERE MADE. BOTH INCLUDE:

1) ALL BACKGROUNDS; J RAY, γ CONV, DEBRIS FROM CALO CORRELATED WITH μ. TWO TRACK RESOLUTION OF J. THOMAS WAS USED WITH ENERGY WEIGHTED CENTRIC OF μ, Bg WHEN DIST BETWEEN μ, Bg => .02cm < $\Delta D_{\mu,Bg}$ < 2 PADS.

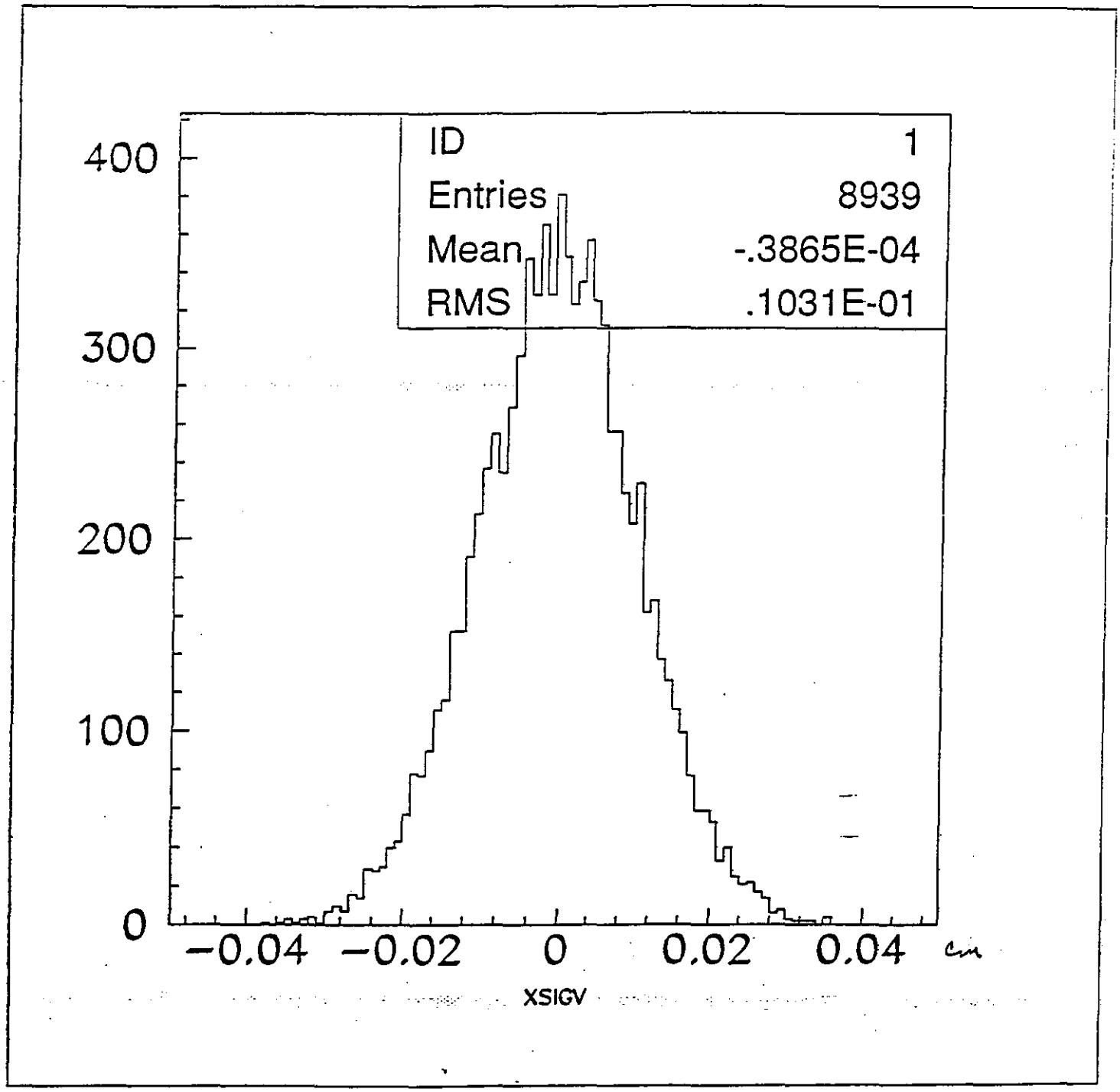
2) DETERIORATION OF RESOLUTION (POSITION) AS A FUNCTION OF ϕ_{TW} AS PER TDR WAS USED.

3) ± 5 cm IN DIRECTION OF WIRES WAS IMPOSED

RUN 1 => FIT TUNED TO FIND 95% OF TRACKS

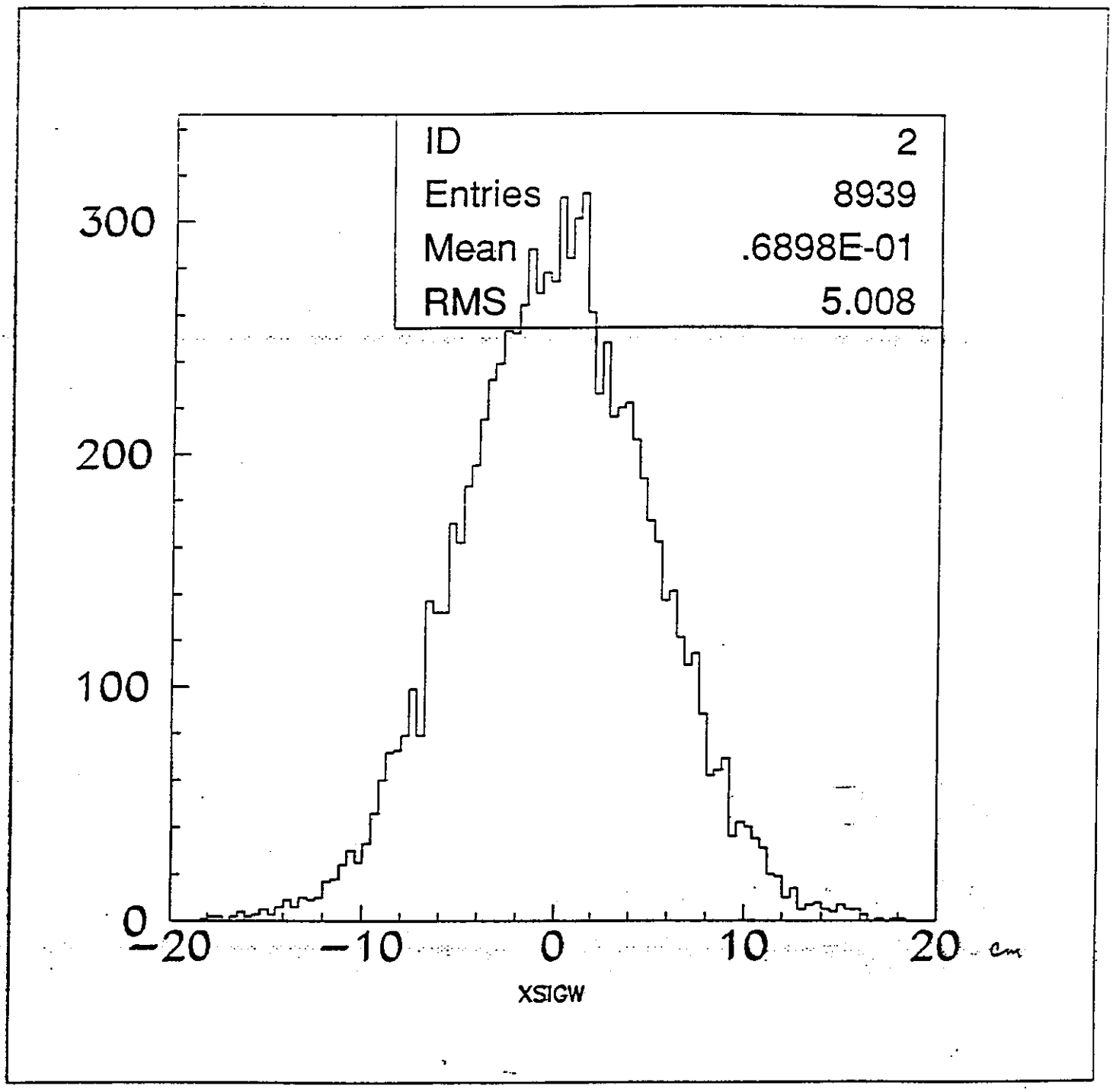
RUN 2 => FIT TUNED SO AS TO GIVE SMALL χ^2, FLAT $P(\chi^2)$, FOUND 75% OF TRACKS.

P. D[illegible] 4/[illegible]

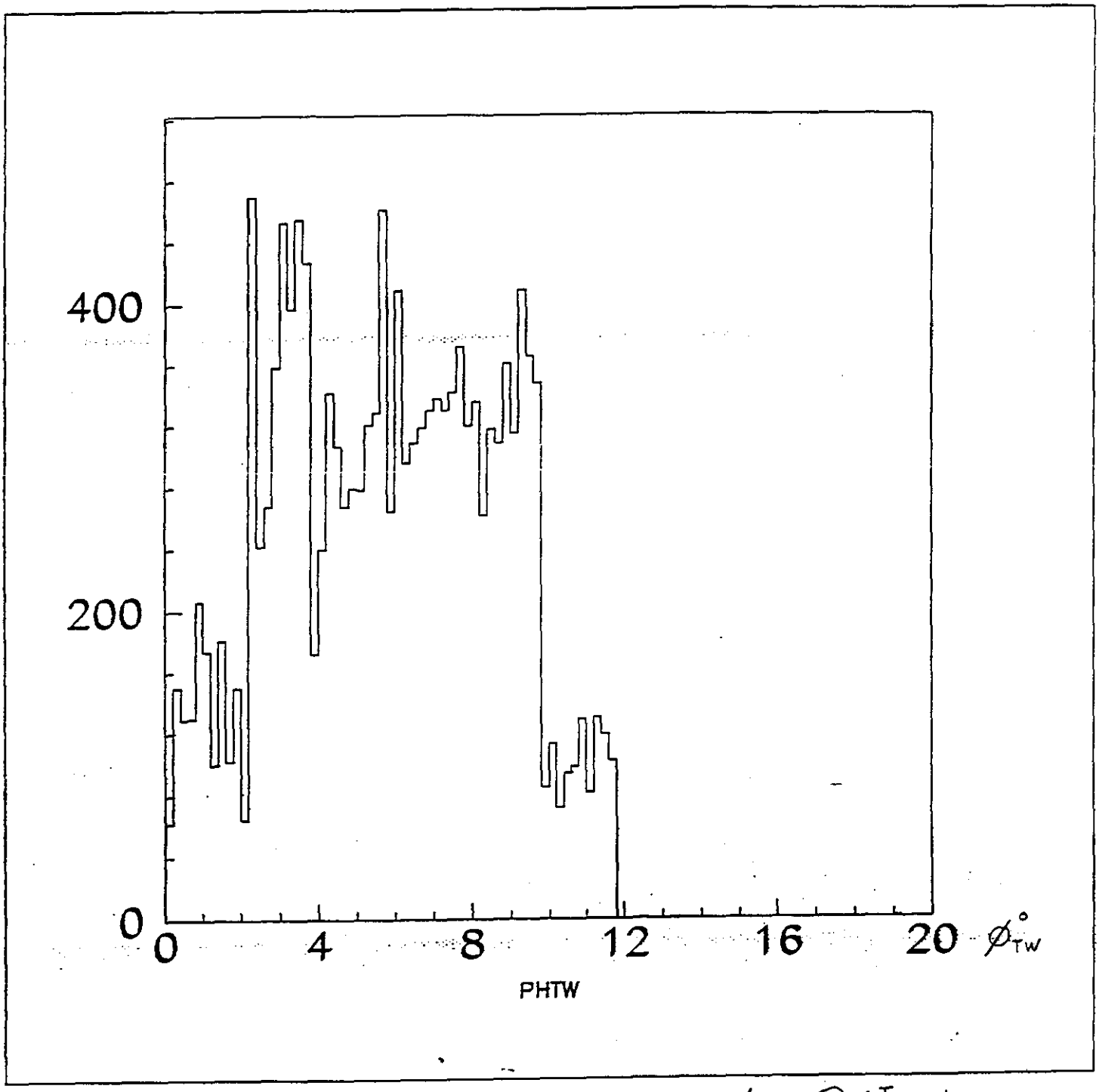


POSITION RESOLUTION
ALONG PADS

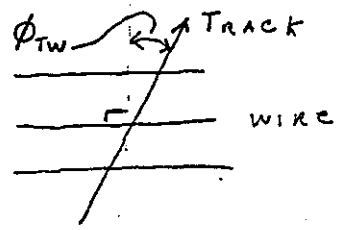
BACKGROUNDS (δ, CONVER'S) INCLUDED
=> ENERGY WEIGHTED CENTROID
FOR .02 < |ΔDIST| < 2 PADS + TWO
TRACK RESOL OF J. THOMAS



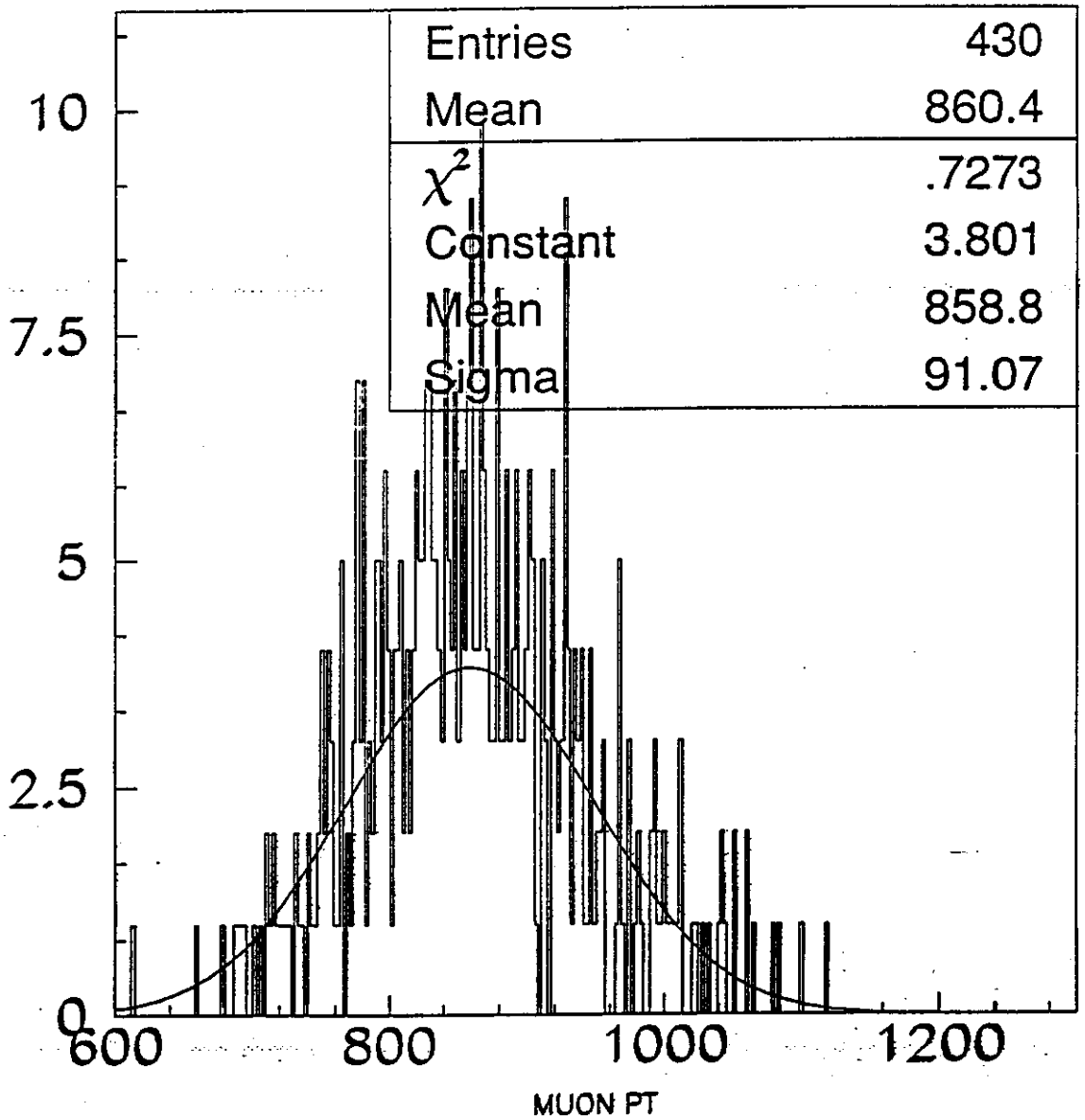
POSITION RESOLUTION
ALONG WIRES



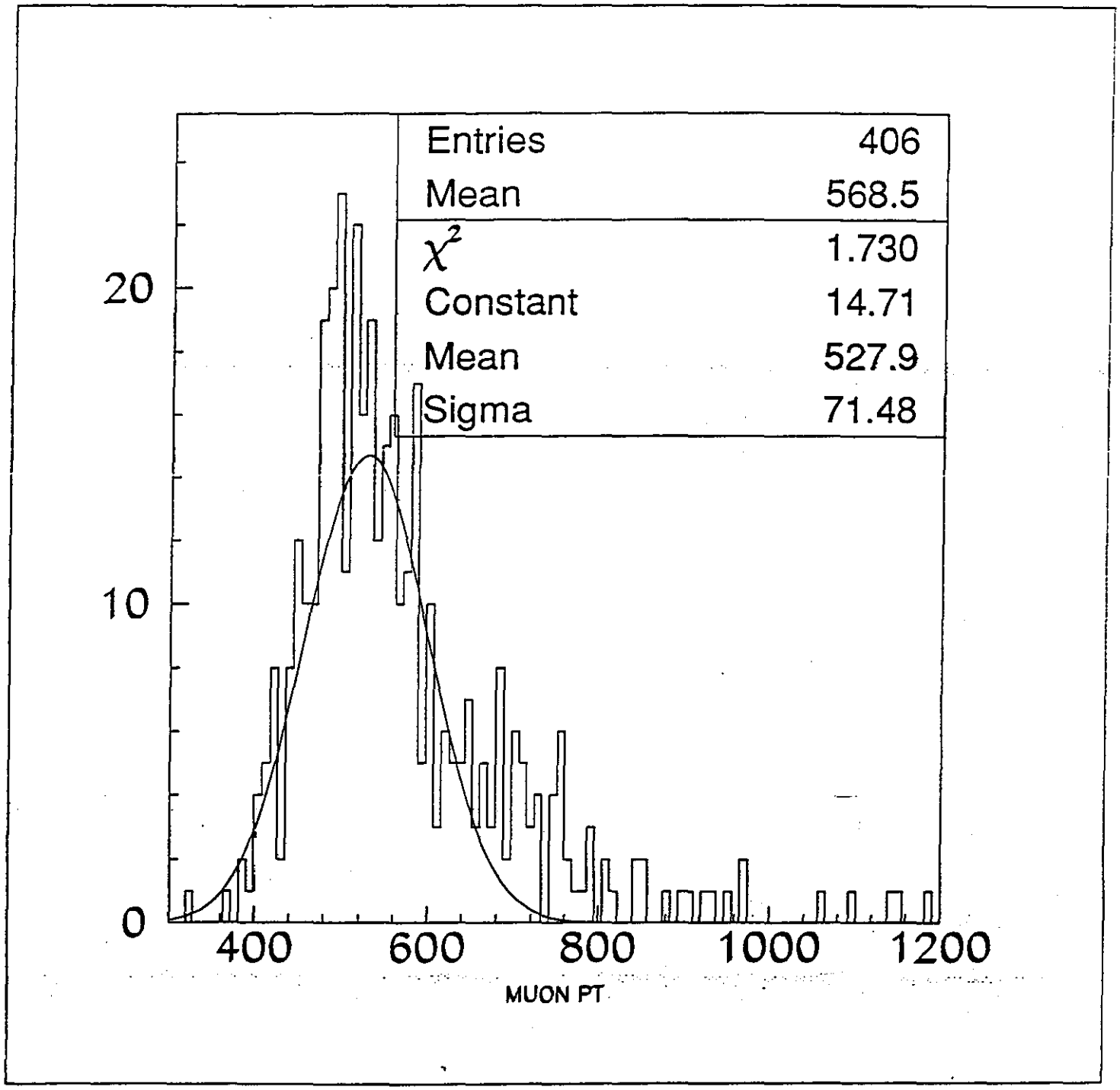
ϕ_{TW} FOR 2000 EVENTS
OVER ENTIRE μ SYSTEM
1 TeV P_T



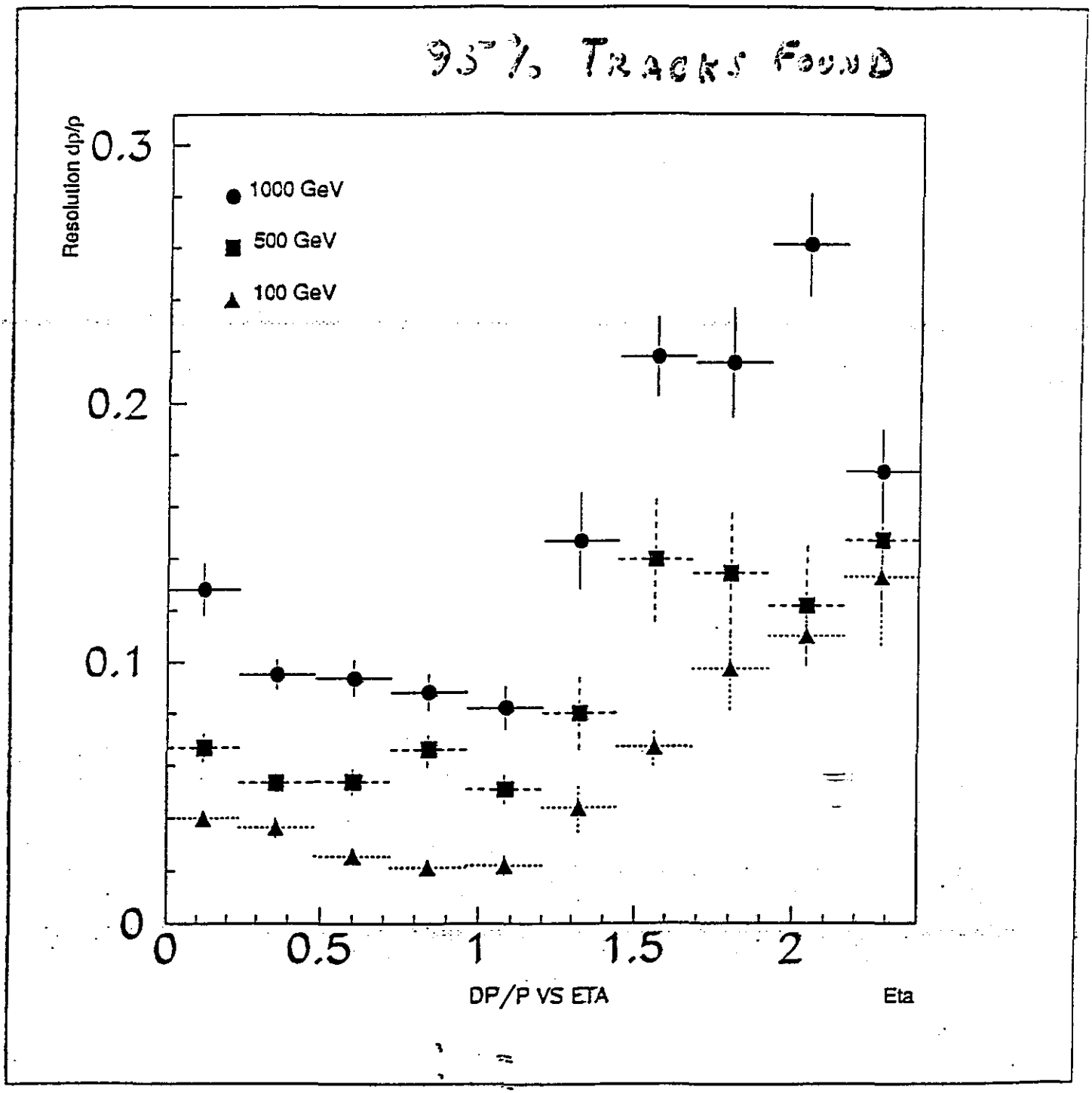
CORRECTION IN RESOLUTION (CHAM)
MADE AS FUNCTION of ϕ_{TW}



Barrel $\theta = 60°$
1 Tev MAG
$P_T = 1000 \sin 60$
$= 866$ GeV

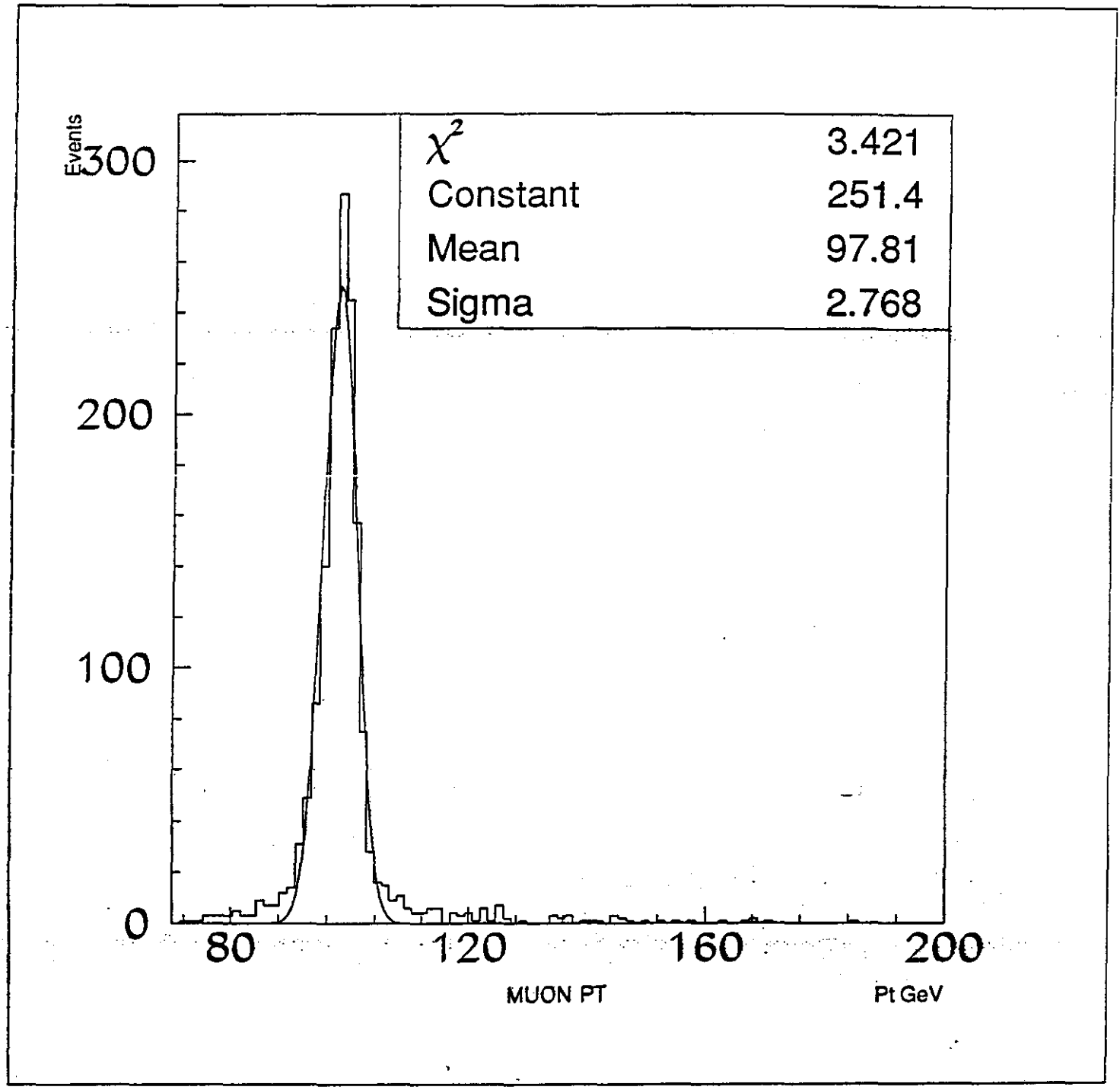


ENDCAP, $\theta = 20°$
500 GeV P_T



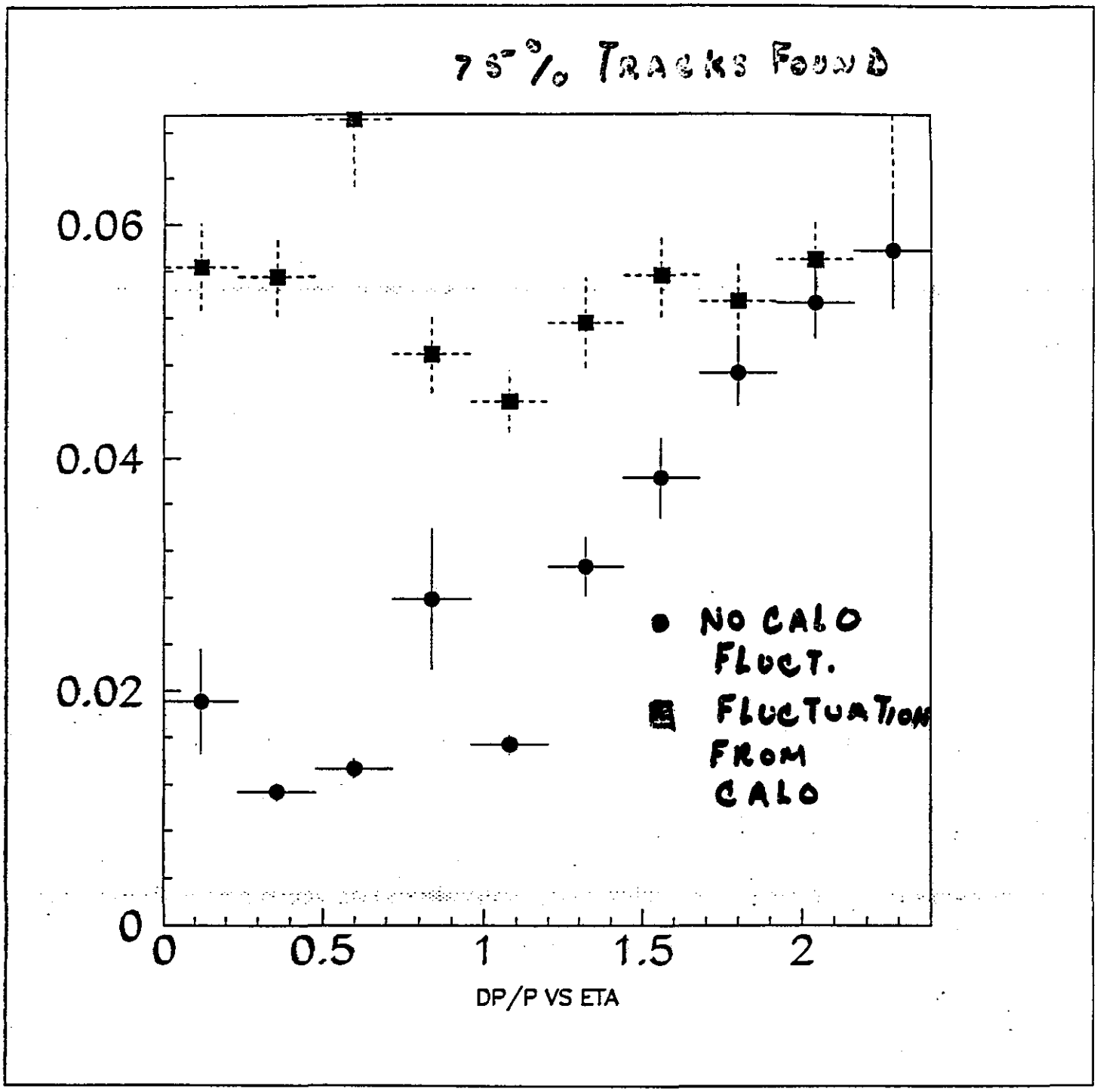
$$\text{Res} = \frac{|p_T^{FIT} - p_T^{MC}|}{p_T^{FIT}} = \Delta p/p$$

$$= \sqrt{\frac{2}{\pi}}\,\sigma \quad \text{(L. ROSENSON)}$$



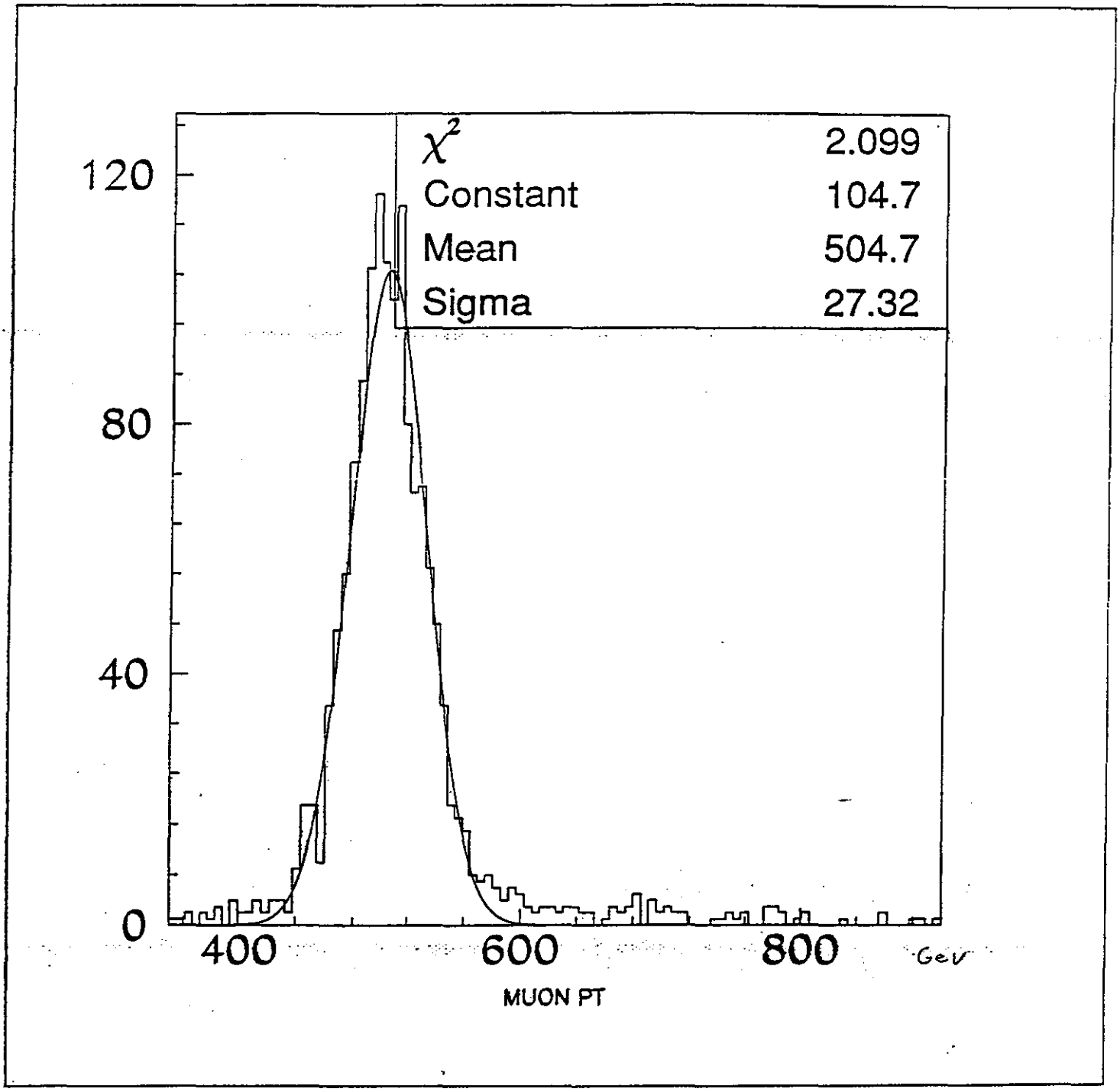
100 GeV P_T μ's over
ENTIRE GEM μ SYSTEM

100 GeV P_T

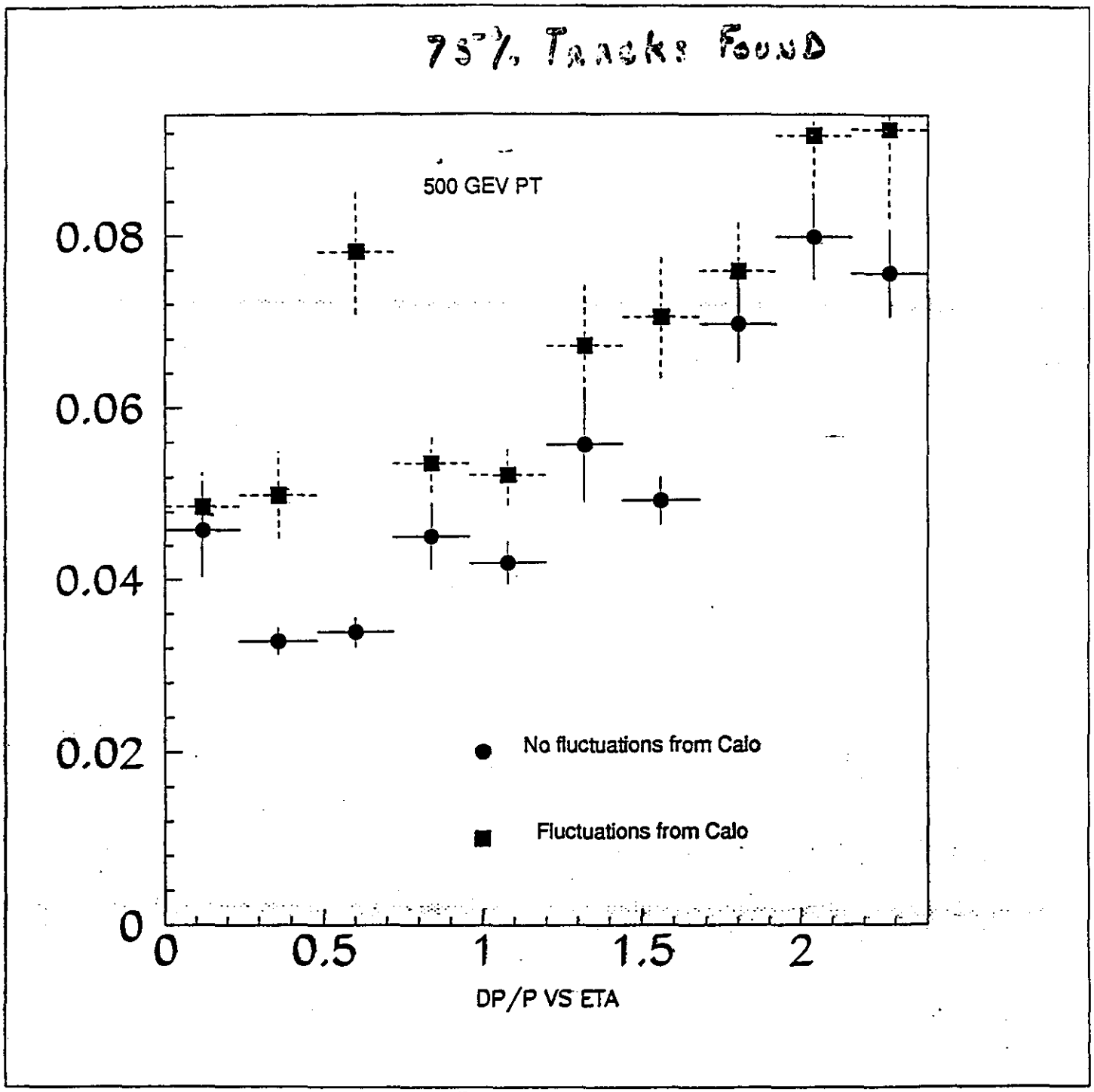


$$Res \equiv \frac{|P_T^{FIT} - P_T^{MC}|}{P_T^{MC}} \Rightarrow \bullet$$

$$\equiv \frac{|P_T^{FIT} - P_T^{GEN}|}{P_T^{GEN}} \Rightarrow \blacksquare$$

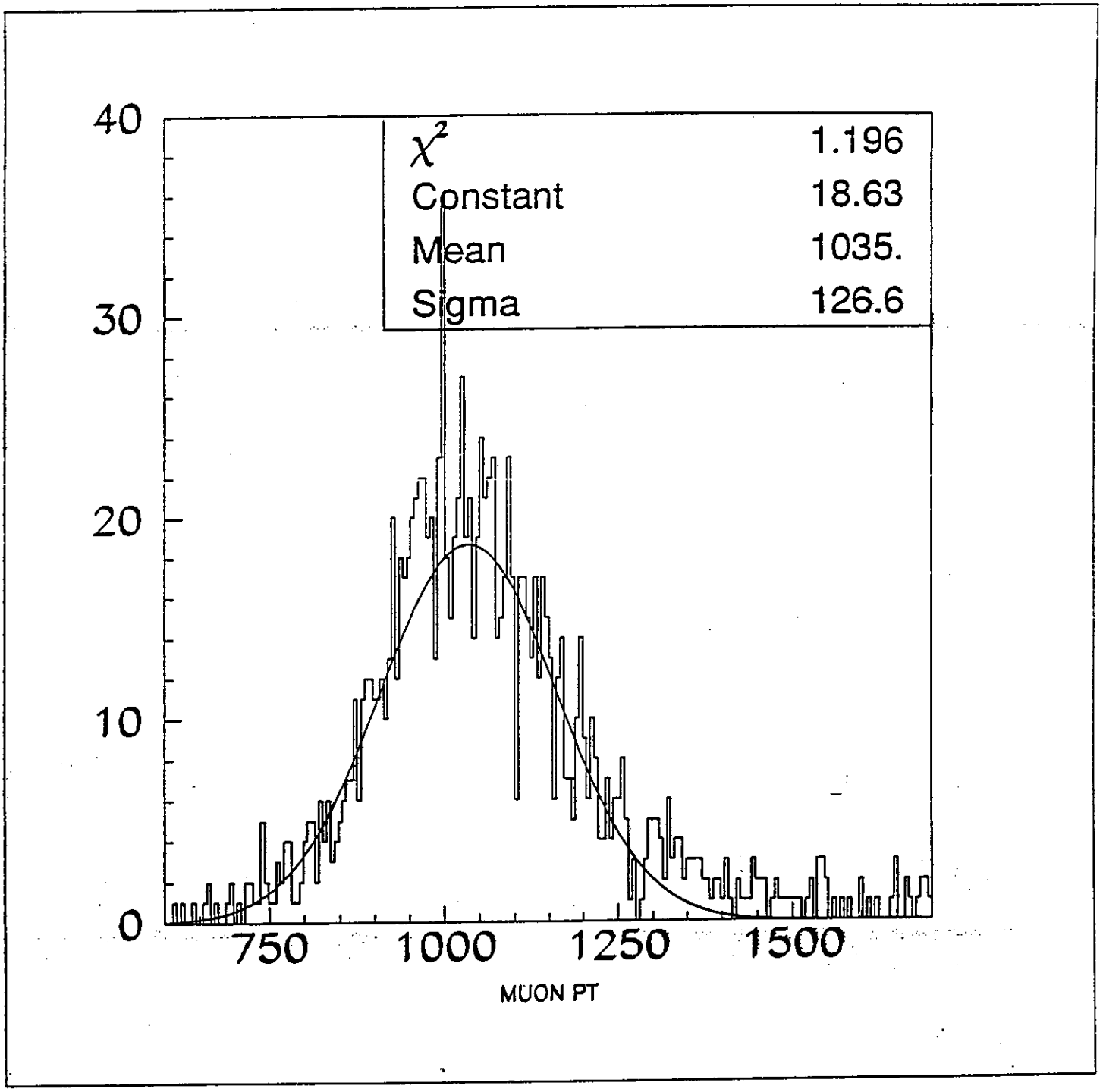


500 GeV P_T μ's
over ENTIRE μ System



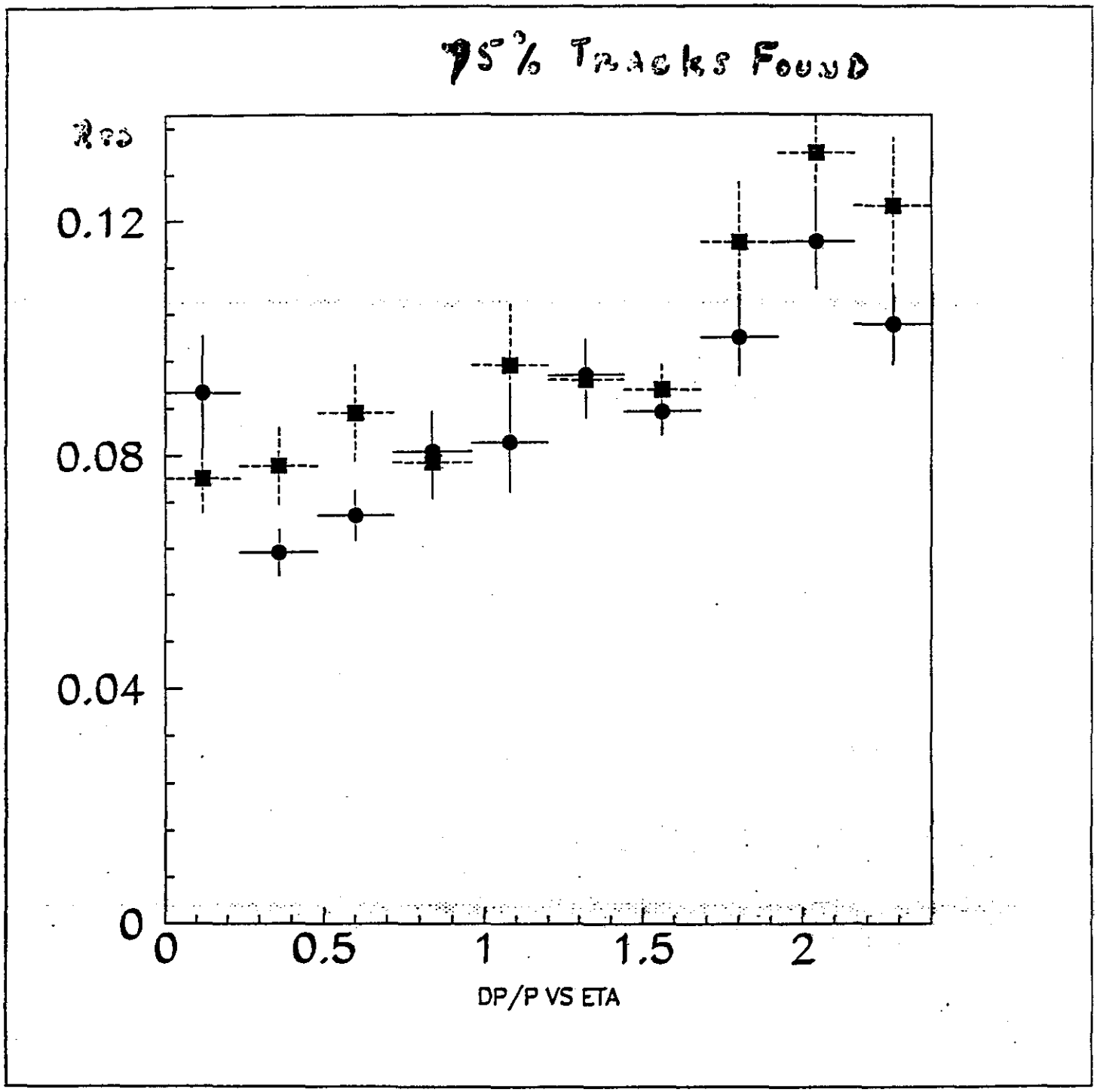
$$Res \equiv \frac{|p_T^{FIT} - p_T^{MC}|}{p_T^{MC}} \Rightarrow \bullet$$

$$\equiv \frac{|p_T^{F} - p_T^{GEN}|}{p_T^{GEN}} \Rightarrow \blacksquare$$



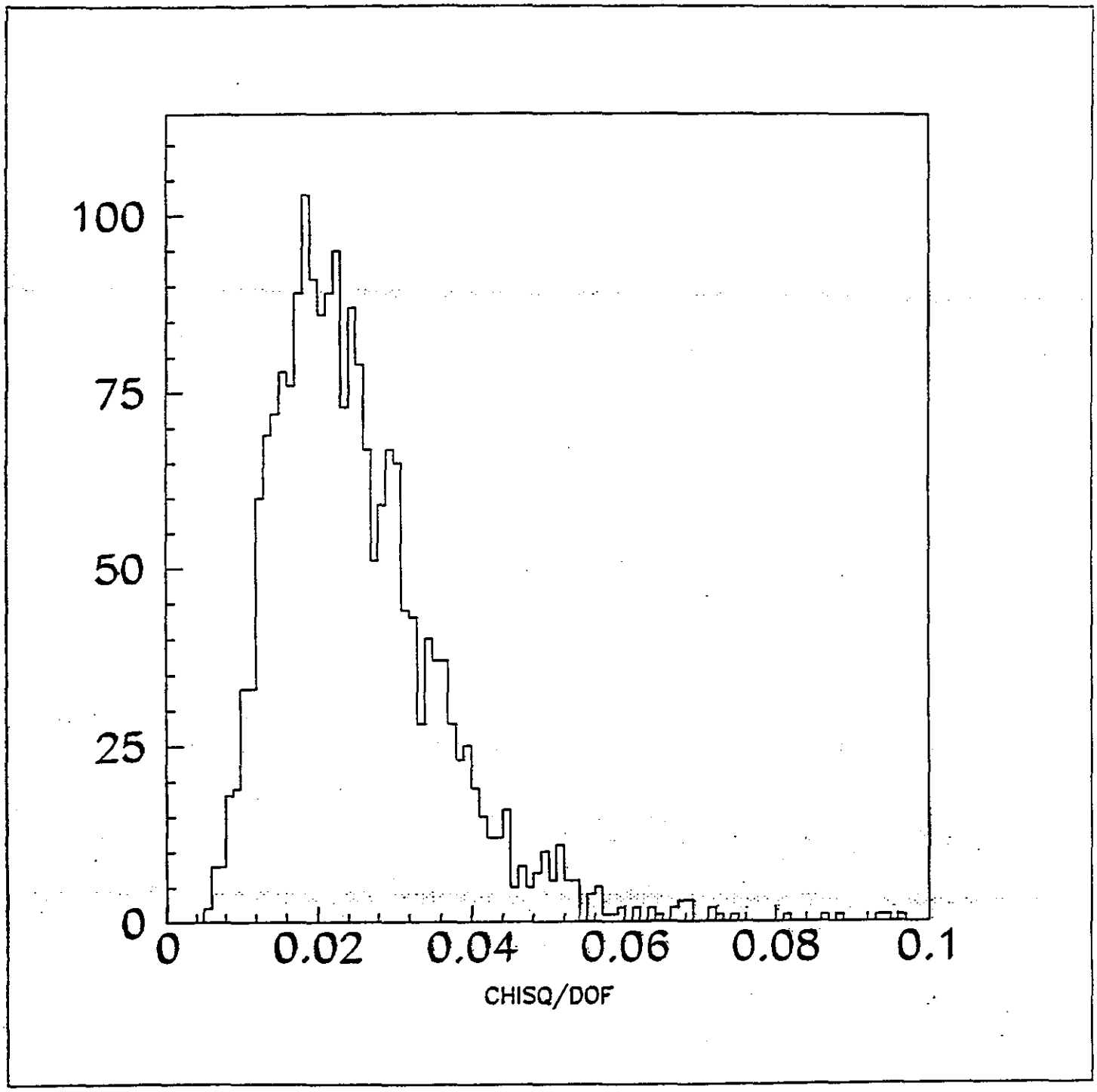
1 Tev P_T μ's over entire μ system

1 TeV P_T



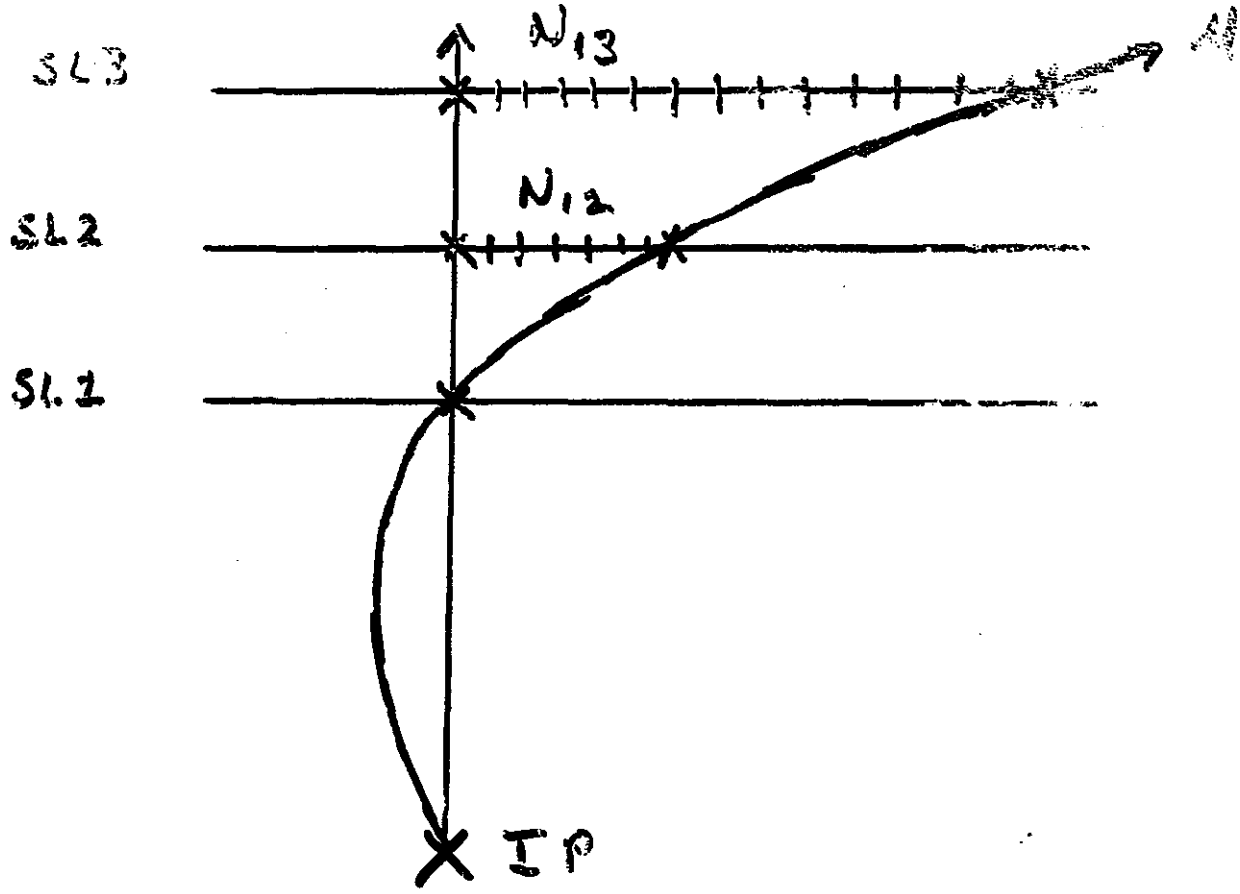
$$\text{Res} \equiv \frac{|P_T^{FIT} - P_T^{MC}|}{P_T^{MC}} \Rightarrow \bullet$$

$$\equiv \frac{|P_T^{FIT} - P_T^{GEN}|}{P_T^{GEN}} \Rightarrow \blacksquare$$



OVER ESTIMATED ERRORS IN REJECTING BAD EVENTS (ONLY ACCEPT 75% OF TRACKS)

WE BASED A MUON TRIGGER ALGORITHM ON A SAGITTA-LIKE VARIABLE;



$$S\phi = |N_{13} - N_{12}|$$

A BASELINE II hit-level MONTE CARLO WAS USED, WITH THE MAGNETIC FIELD MAP 'GOO' SUPPLIED BY J. S.

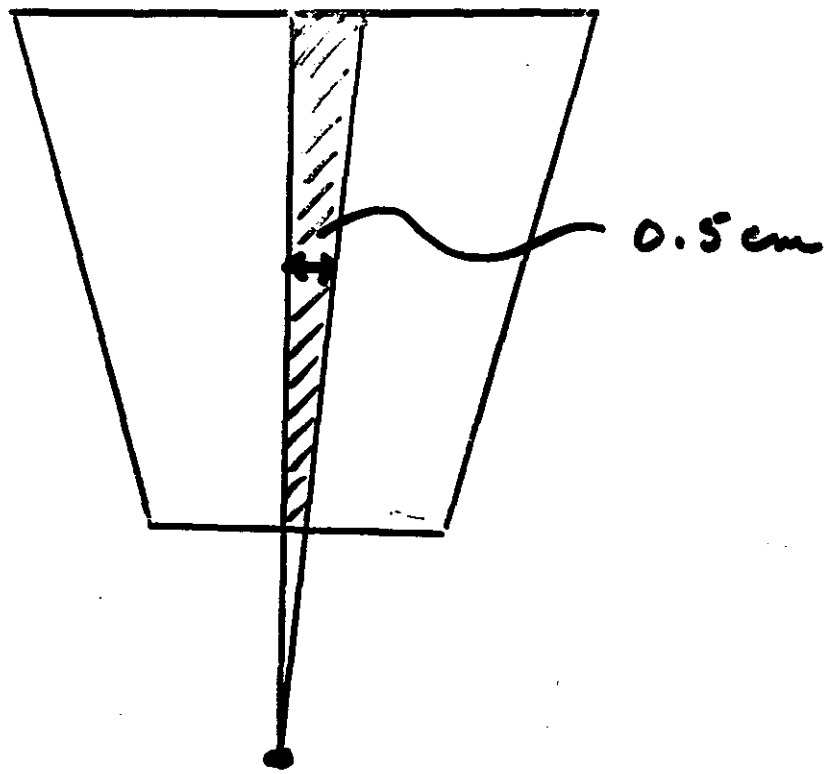
THE PLANE CONFIGURATION 6-6-6 WAS USED IN THE BARREL WITH PAD SIZES;

SL1 → 0.5 cm

SL2 → 0.8 cm

SL3 → 1.0 cm

THE END-CAP HAD 8-6-6 CONFIGURATION WITH PIE-SHAPED RADIAL PADS SUCH THAT AT THE RADIAL CENTER

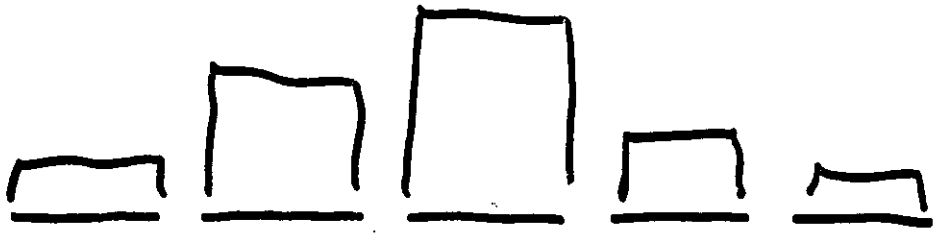


OF A STRIP. THE PAD SIZE WAS 0.5 CM.

THE HITS SEEN ON EACH OF THE SUPERLAYERS (THE "AVERAGE" PAD NUMBER) WERE DETERMINED BY ONLY THE 1ST AND LAST PLANE OF THAT SUPERLAYER.

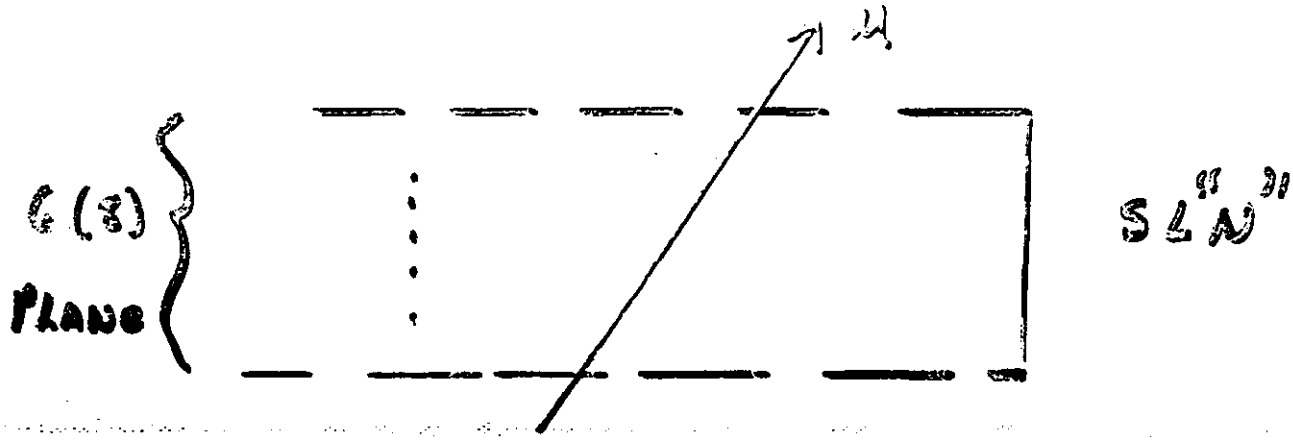
1) THE TRIGGER CAN BE GANGED

2) THE SIGNAL APPEARING ON DIFFERENT PADS CAN BE DISCRIMINATED:



AND ONE OF SEVERAL PADS TAKEN.

3) SOME % OF THE TIME ~10% THE RESOLUTION OF THE HIT IS SPOILED BY BACKGROUND.

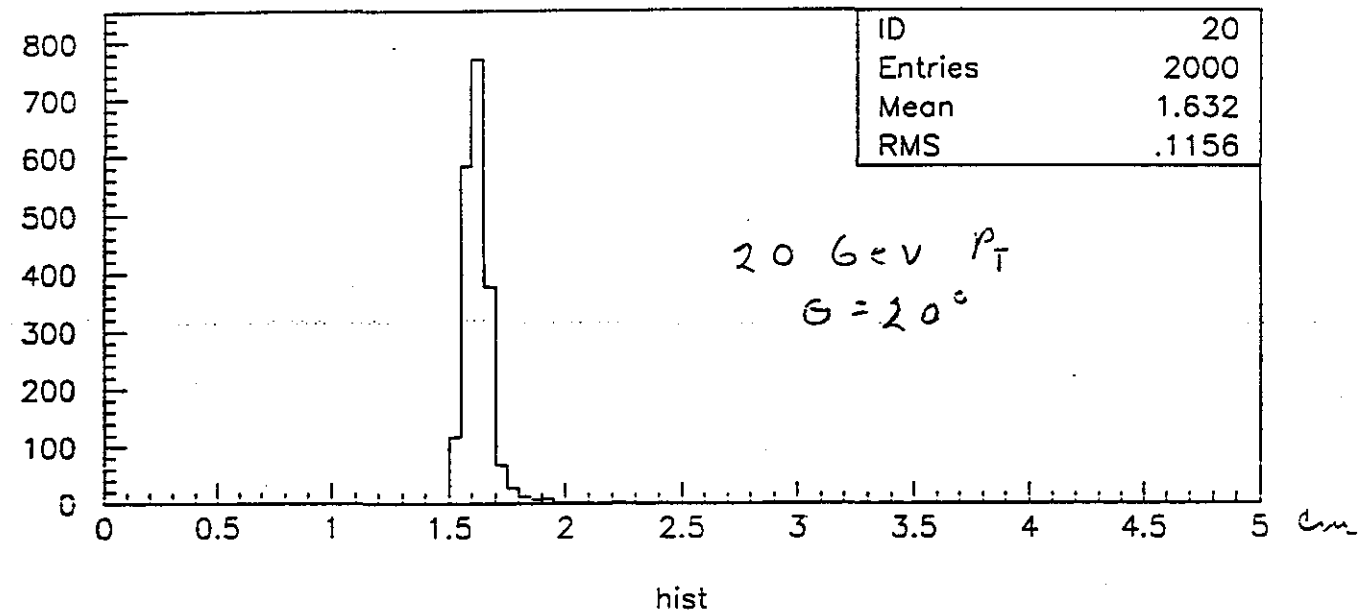


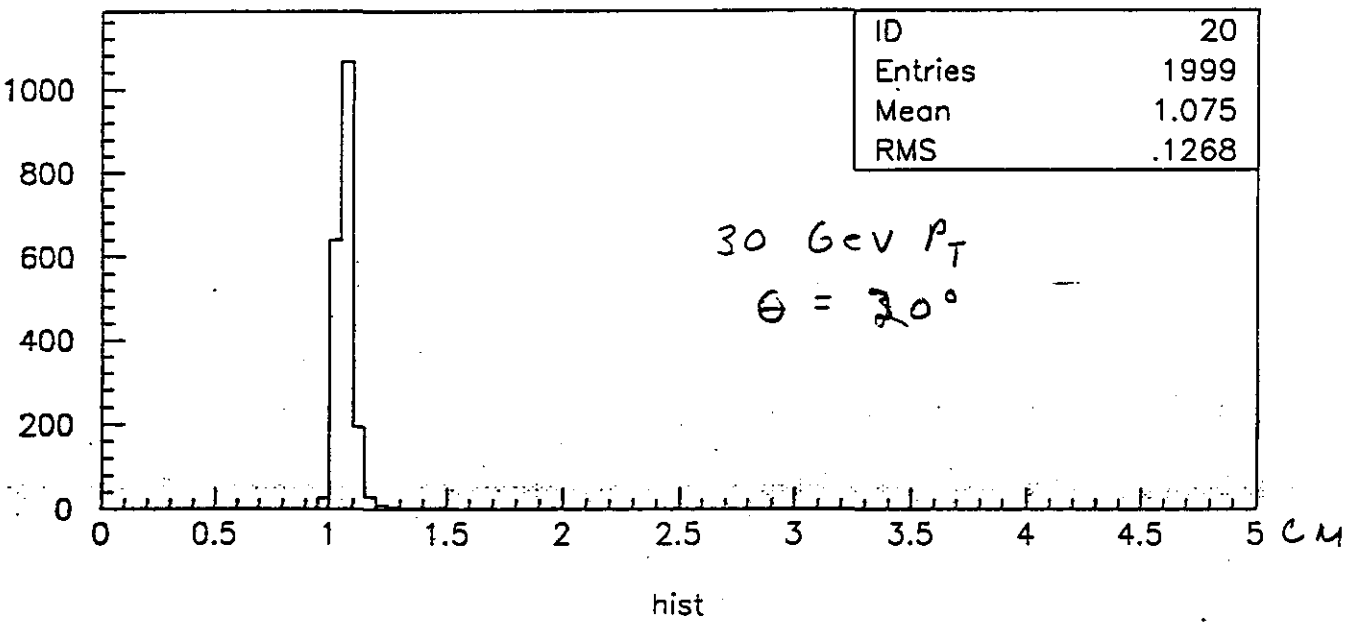
THIS HAD THE EFFECT OF MAKING SØ A "MORE" GAUSSIAN VARIABLE EVEN AFTER AVERAGING. TO INHANCE THIS THE PADS IN SUBSEQUENT PLANES WERE OFFSET BY 1/2 A PAD.

IN ORDER TO BE AS CONSERVATIVE AS POSSIBLE A LARGE UNCERTAINTY WAS ASSUMED IN THE DIGITIZATION.

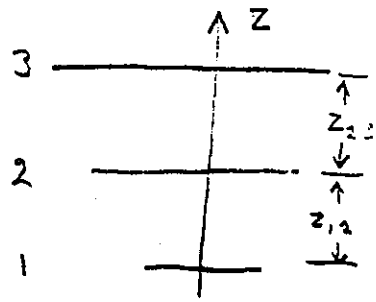
OWING TO THESE EFFECTS THE PLANE SPACE-POINT WAS "UNIFORMLY" RANDOMIZED BY $\pm\frac{1}{2}$ PAD.

SAGITTA



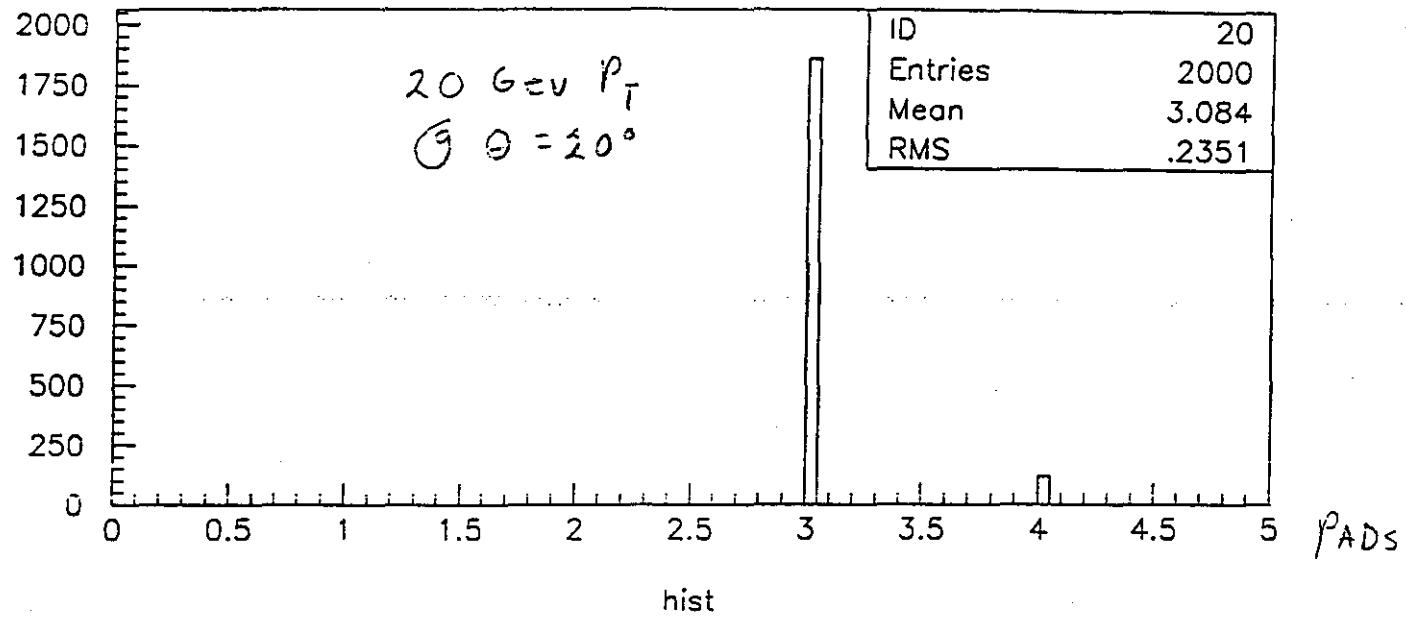


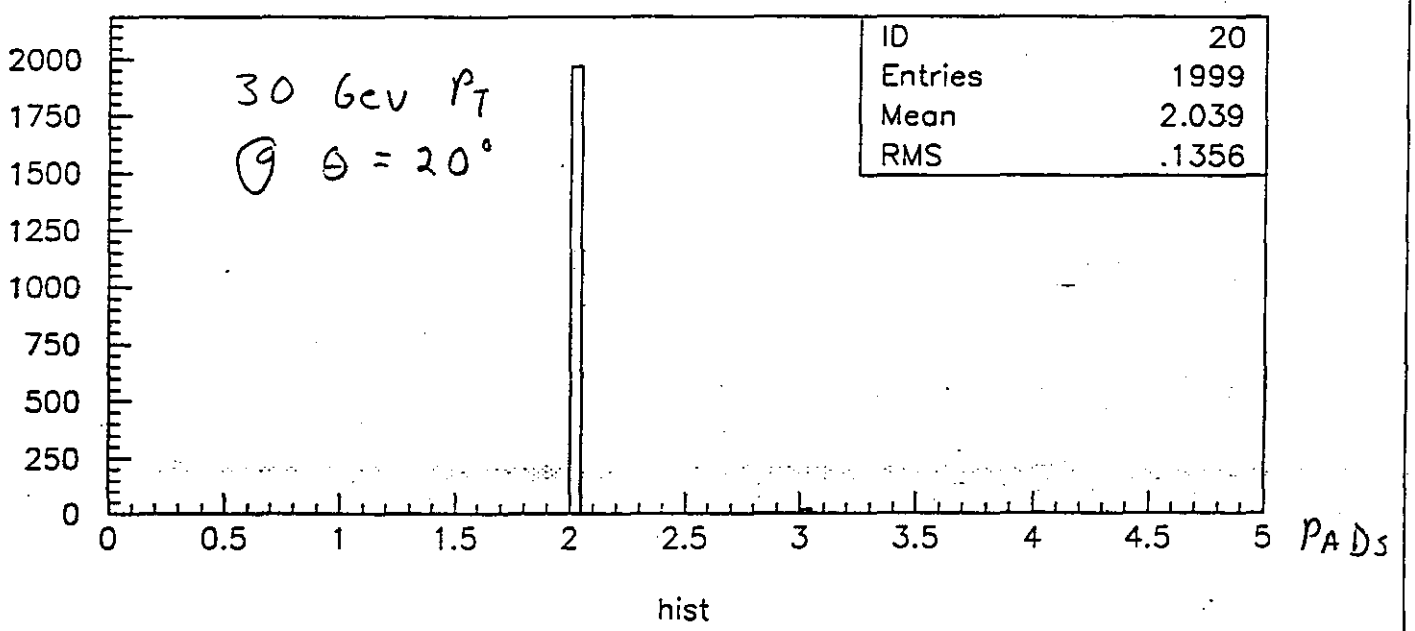
$$J \equiv \left[(\vec{x}_3 + \vec{x}_2) * \frac{Z_{12}}{Z_{12} + Z_{23}} - \vec{x}_1 \right]$$



STICK MAN

NO DIGITIZATION



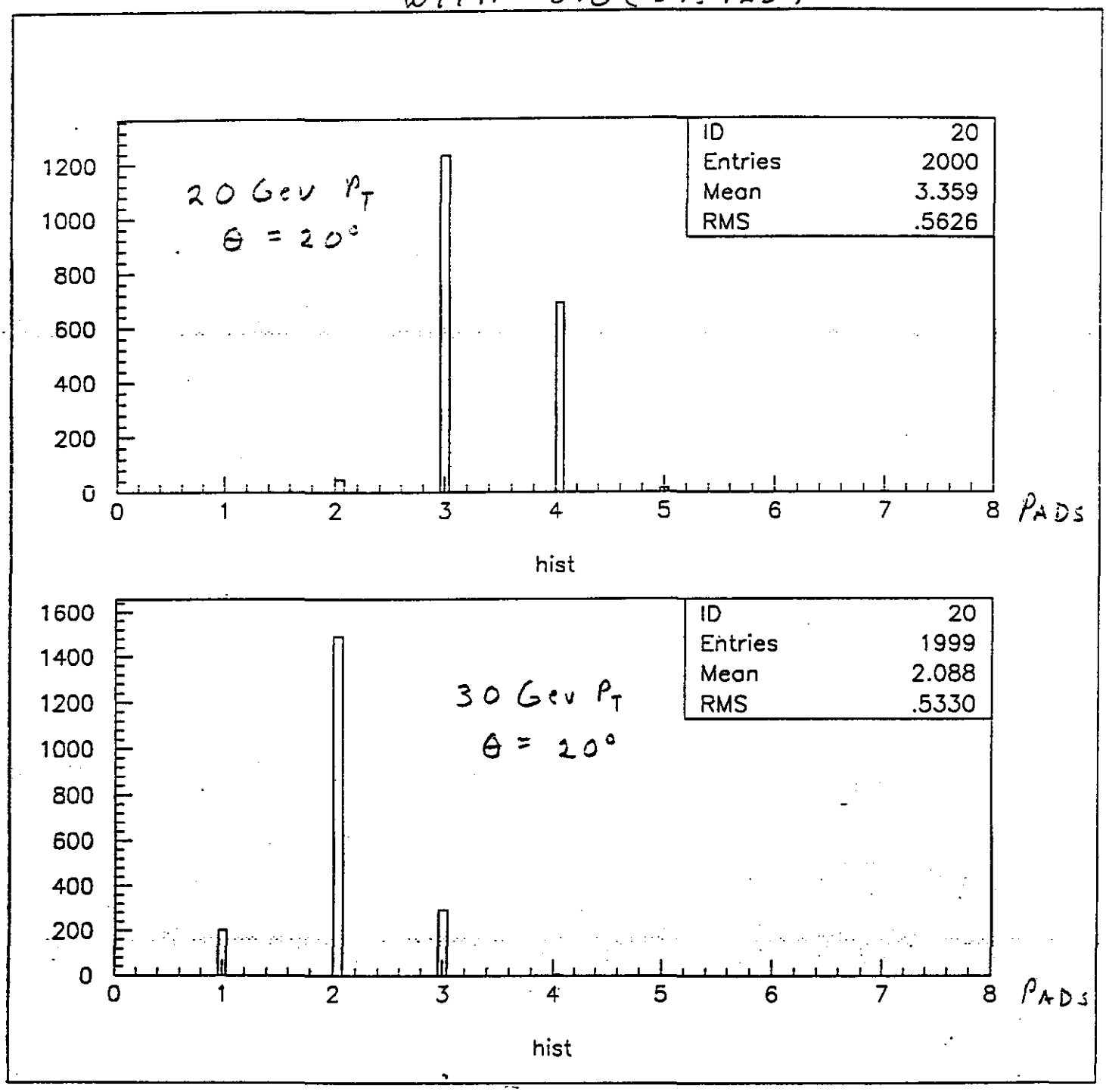


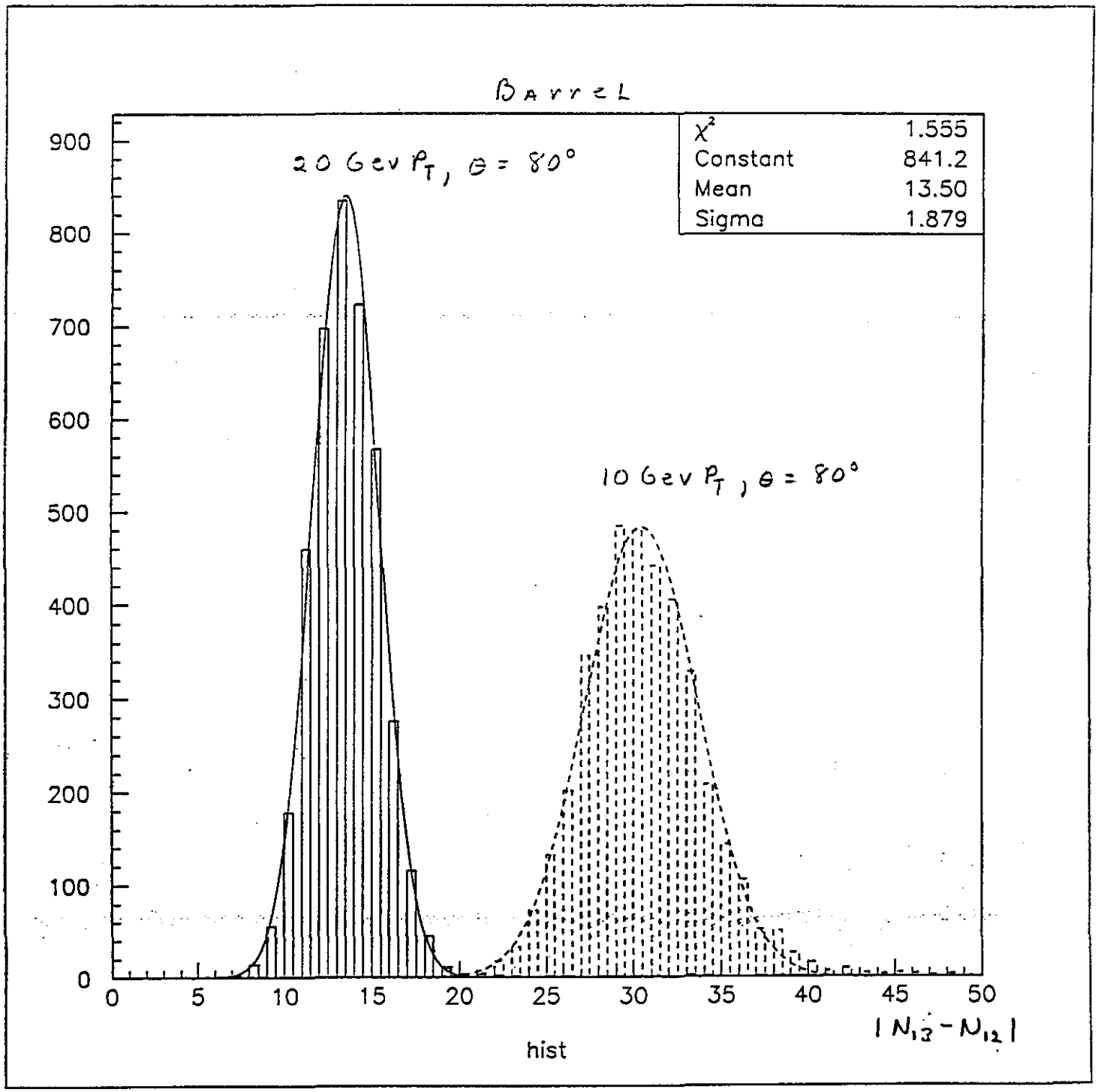
$$\delta_{mm} = \frac{.3(.8)(9.4)^2}{8\, P_T(\text{GeV}) \times 10^{-3}} = \frac{500}{P_{T_{GeV}}} = \frac{500}{20} = 2.5\text{ cm}$$

$$= \frac{594}{30} = \qquad \frac{500}{30} = 1.66\text{ cm}$$

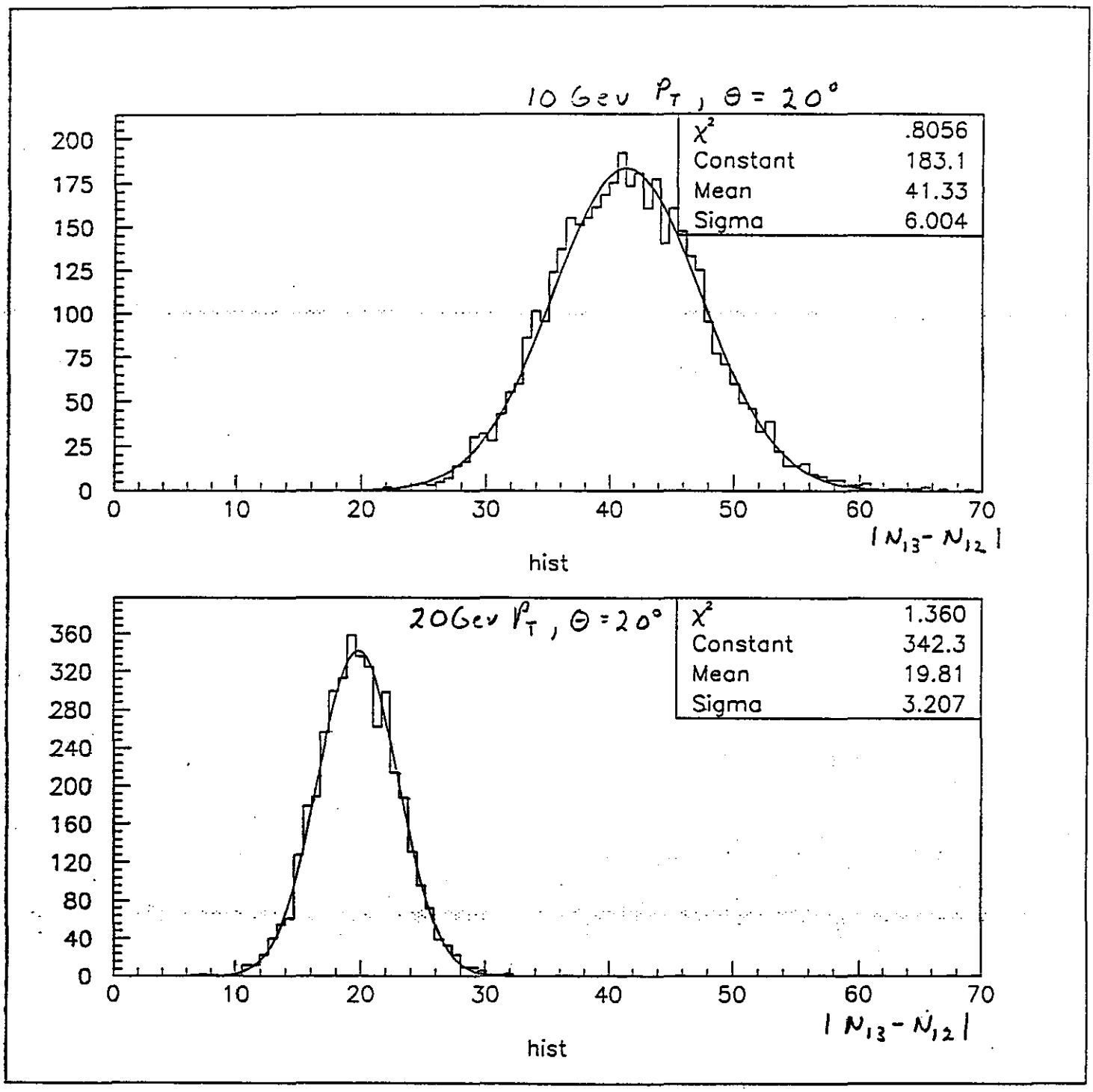
SAGITTA SIGMA

WITH DIG (±.5 PAD)




Barrel
20 Gev P_T, $\theta = 80°$
10 Gev P_T, $\theta = 80°$
χ^2 1.555
Constant 841.2
Mean 13.50
Sigma 1.879
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
50
$|N_{13} - N_{12}|$
hist

END CAP


10 GeV P_T, $\theta = 20°$
χ^2 .8056
Constant 183.1
Mean 41.33
Sigma 6.004
$|N_{13} - N_{12}|$
hist
20 GeV P_T, $\theta = 20°$
χ^2 1.360
Constant 342.3
Mean 19.81
Sigma 3.207
$|N_{13} - N_{12}|$
hist

V. Balagura,
April 23, 1993

Charge sharing and clustering in the trigger

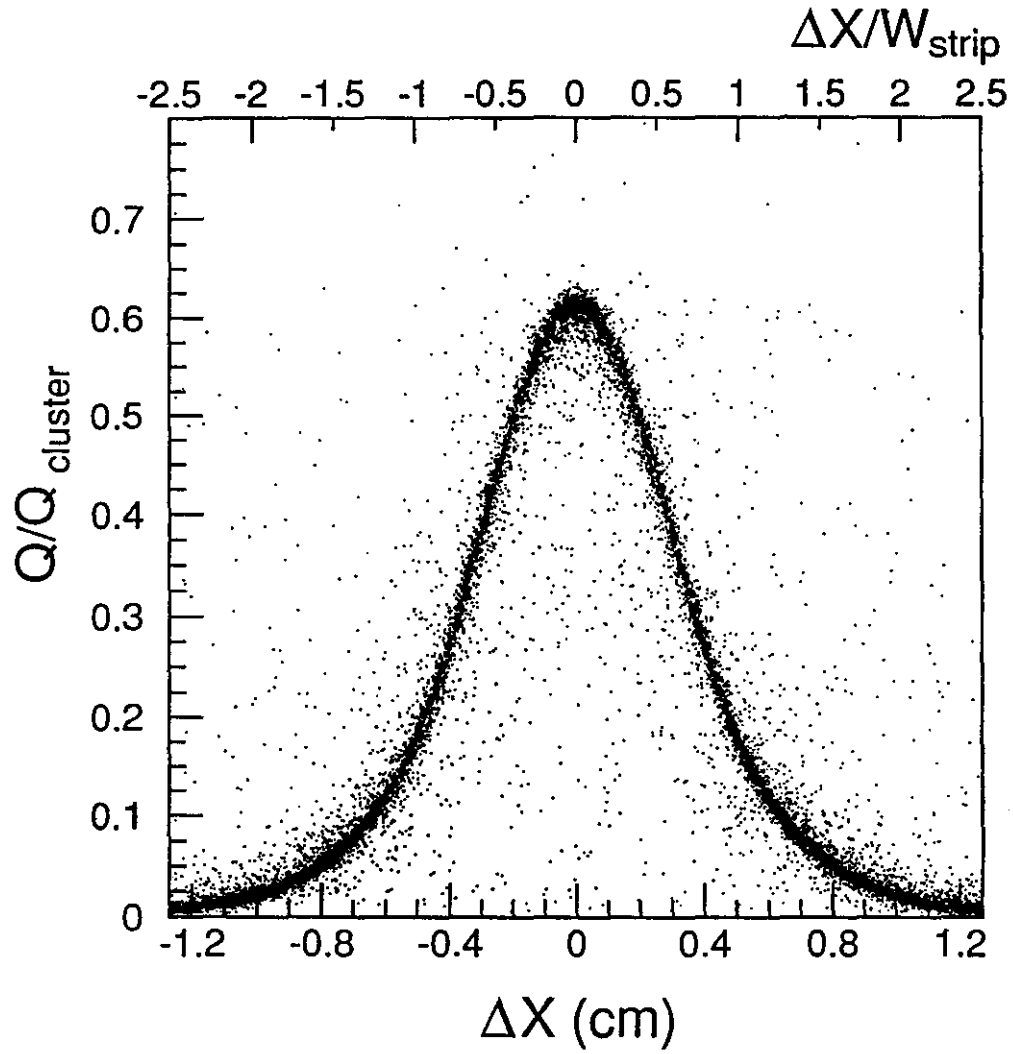
- SIGEM (Yu. Fisyak)

Geometry — multiple scattering — μ energy loss

Electromagnetic backgrounds
(low cuts on e, γ momenta $- 10 \frac{\text{KeV}}{c}$)

- Discretness due to strips
- Distribution of charge induced on strips
- Clustering

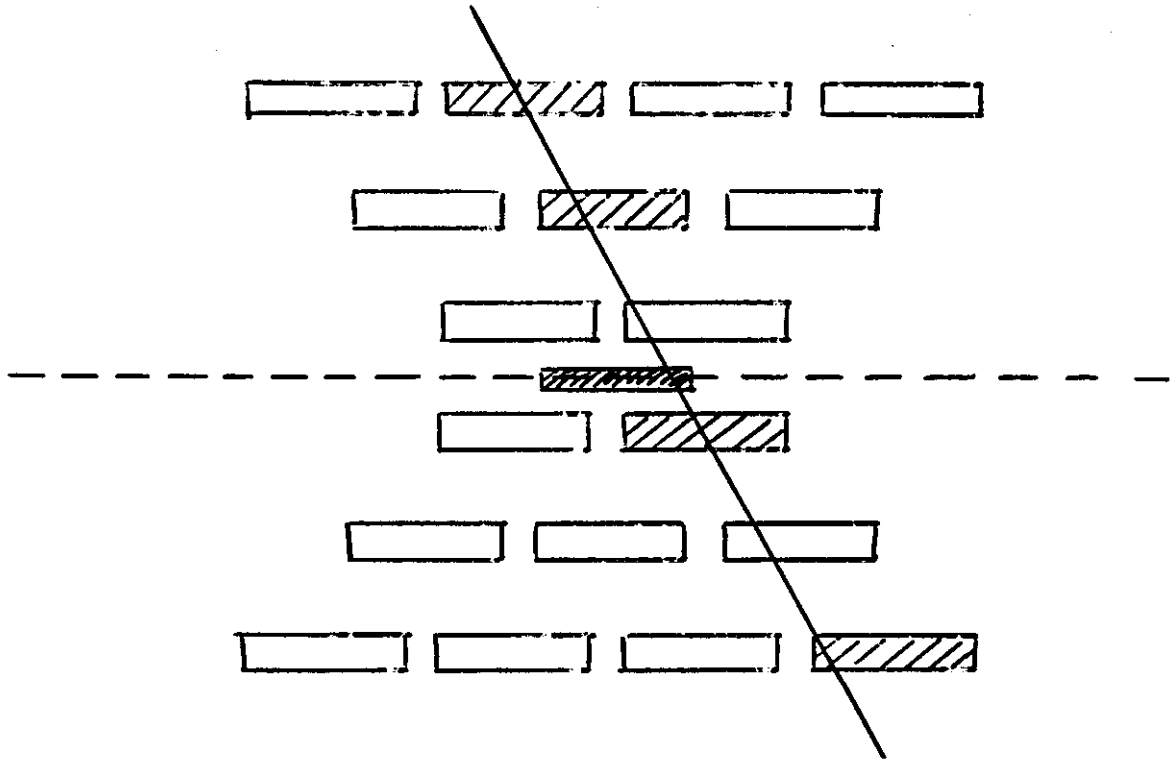
TTR test of CSC



Distribution of charge induced on strips

$$Q_{threshold} = 0.5 \cdot Q_{threshold}^{(dE/dx)}$$

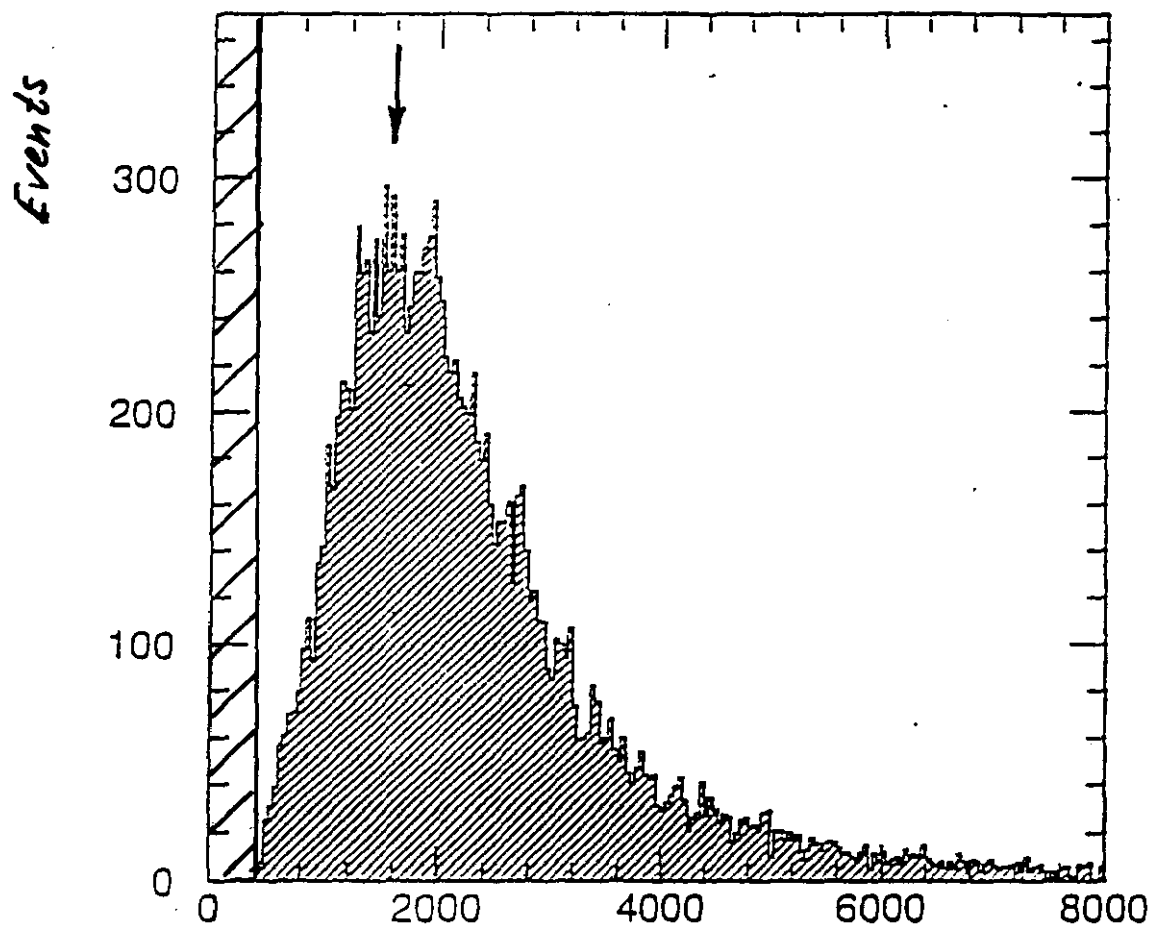
Definition of the tower



virtual strip ≡ tower

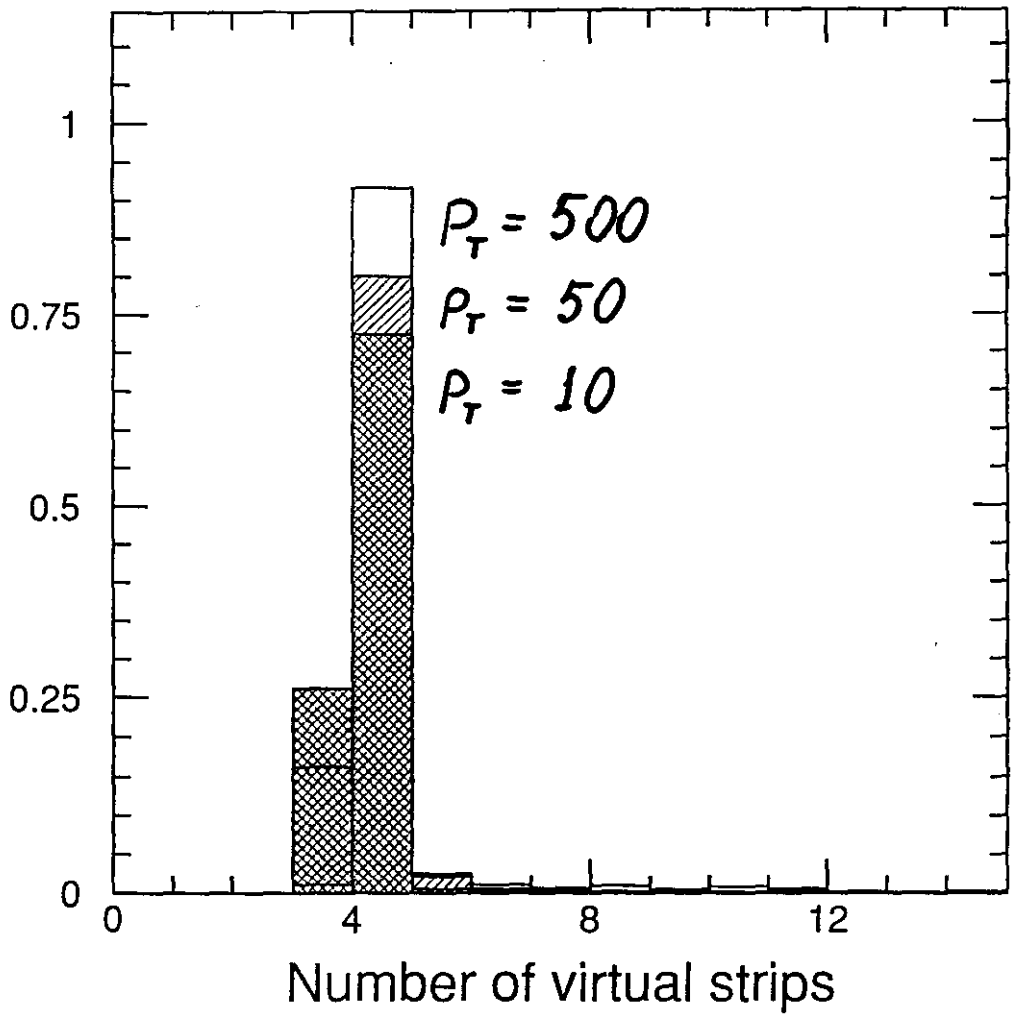
with at least 4 strips

with $Q > Q_{threshold}$



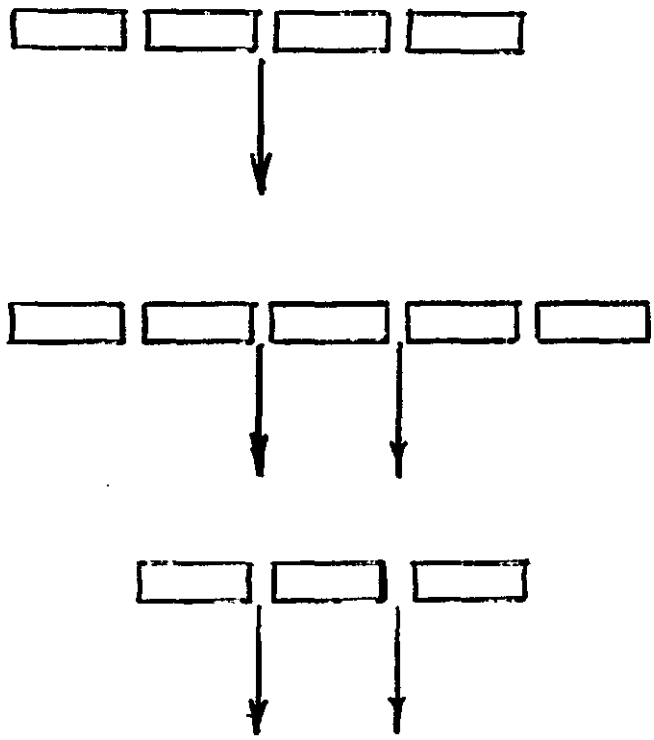
dE/dX curve

$$Q^{(dE/dx)}_{threshold} = \frac{1}{4}(\text{The most probable } Q)$$

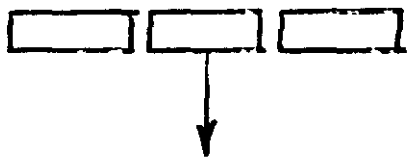

1
0.75
0.5
0.25
0
0
4
8
12
$P_T = 500$
$P_T = 50$
$P_T = 10$
Number of virtual strips

Definition of the cluster

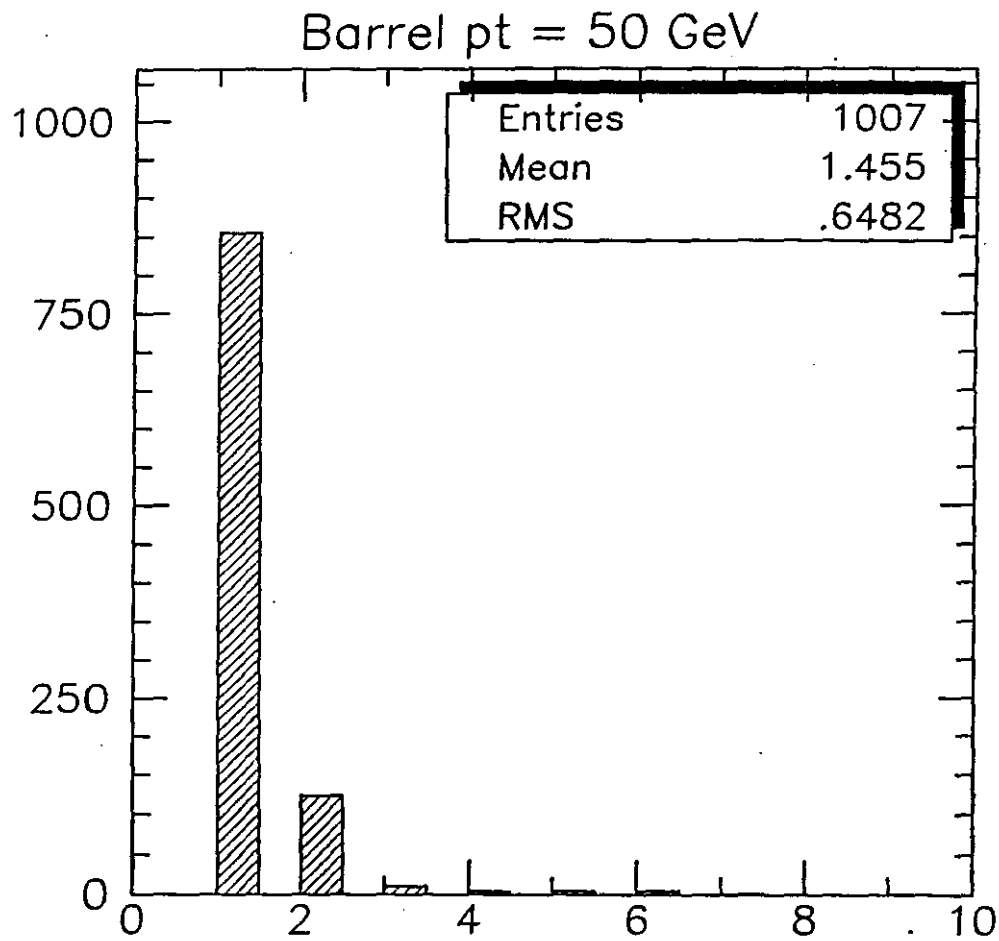
1)



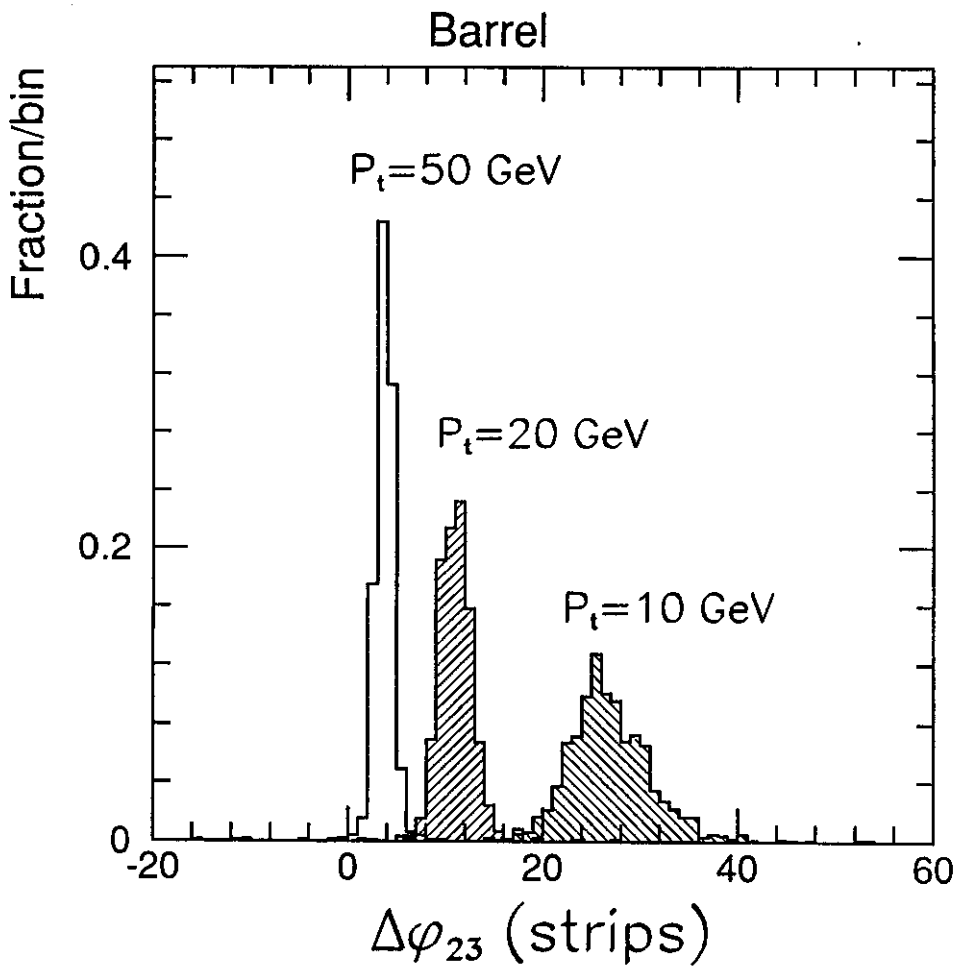
2)

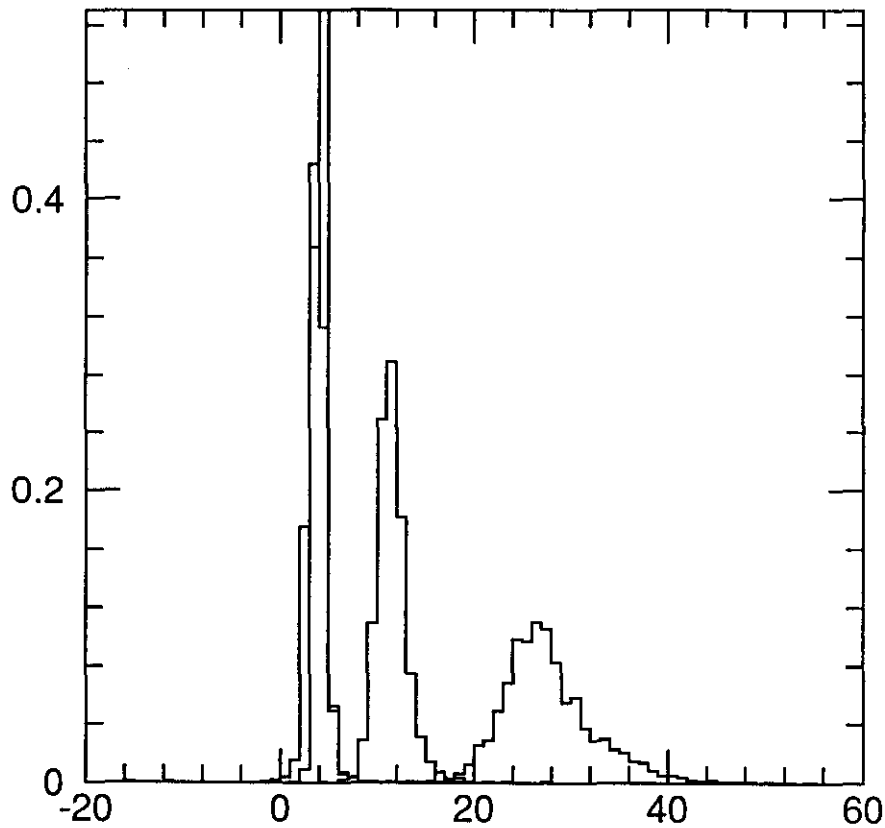


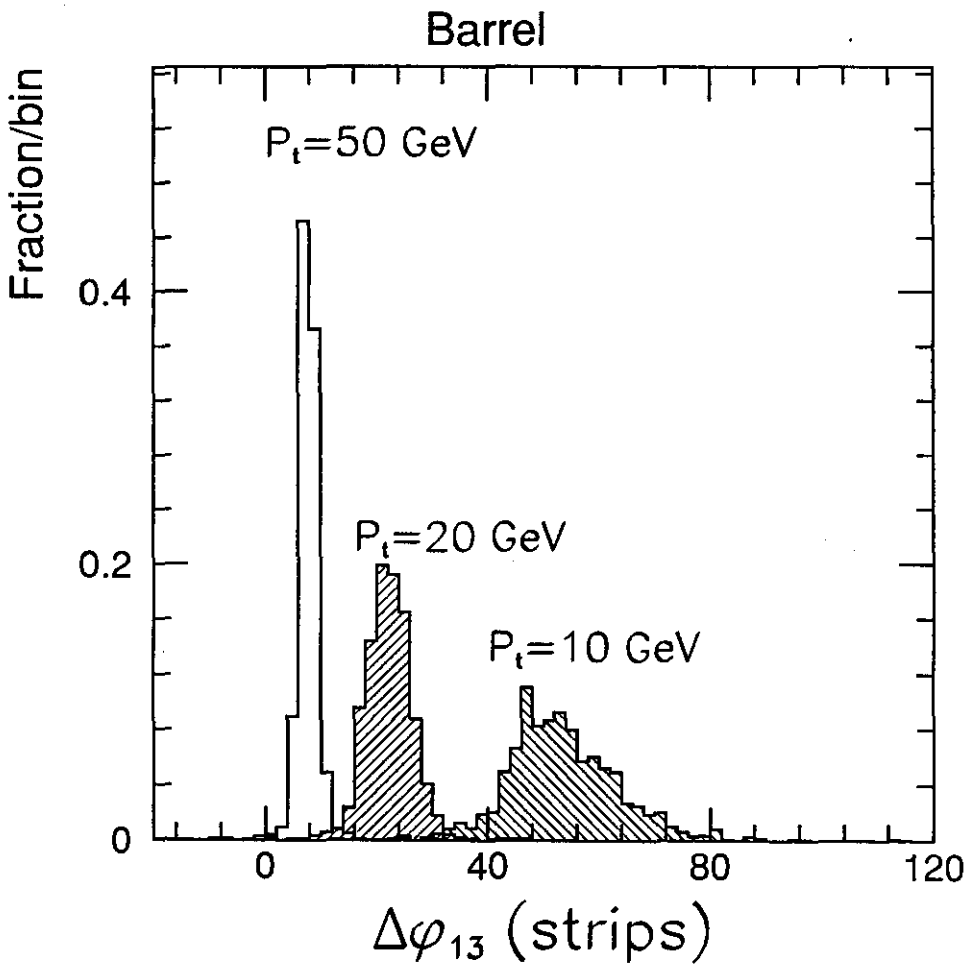
Too many clusters

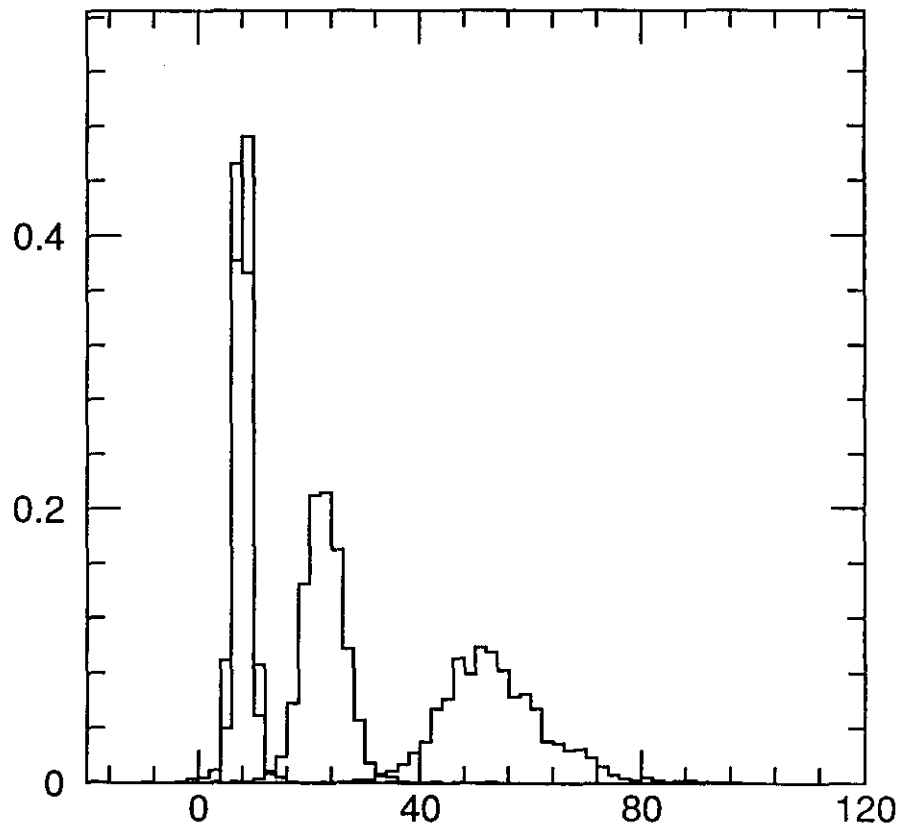


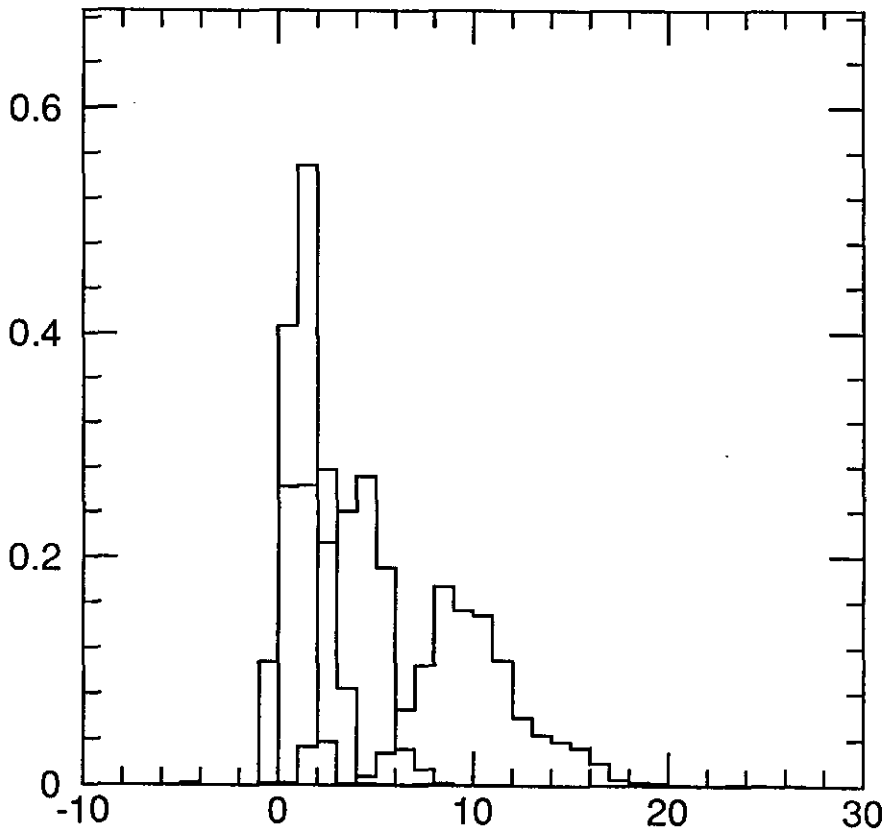
Number of clusters

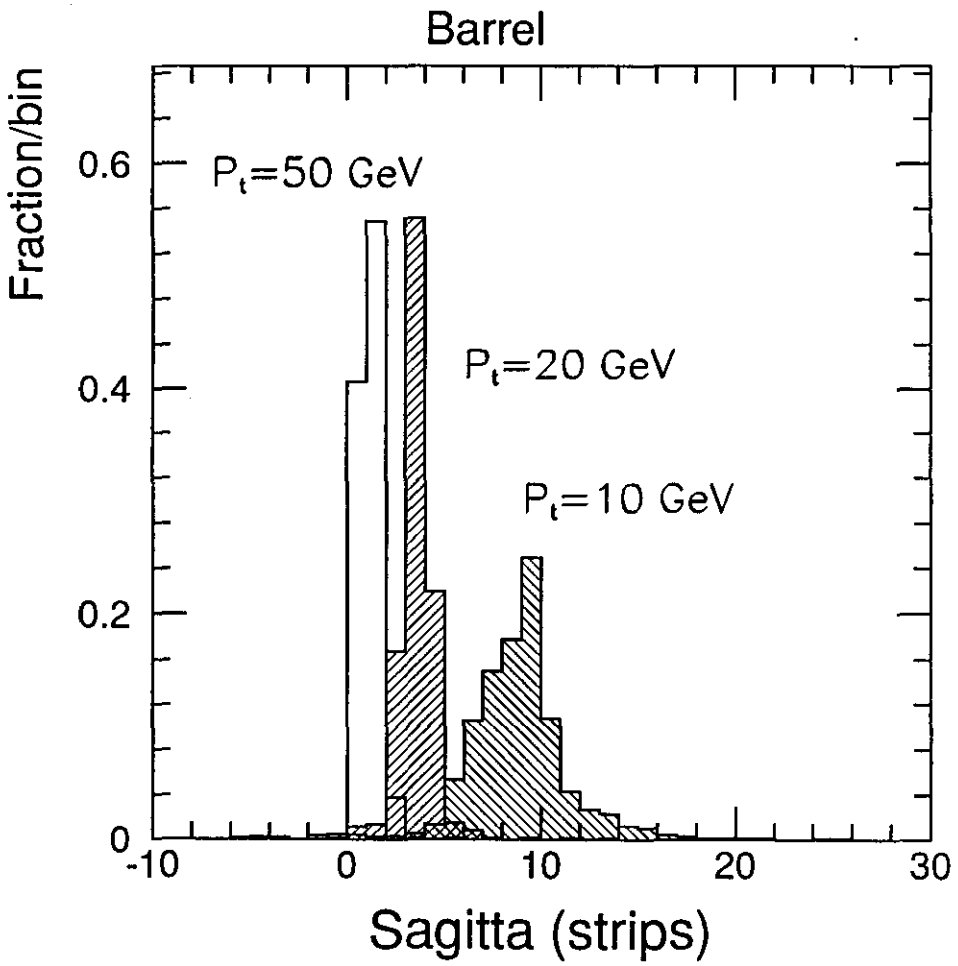

Barrel
Fraction/bin
0.4
0.2
0
-20
0
20
40
60
P_t=50 GeV
P_t=20 GeV
P_t=10 GeV
$\Delta\varphi_{23}$ (strips)

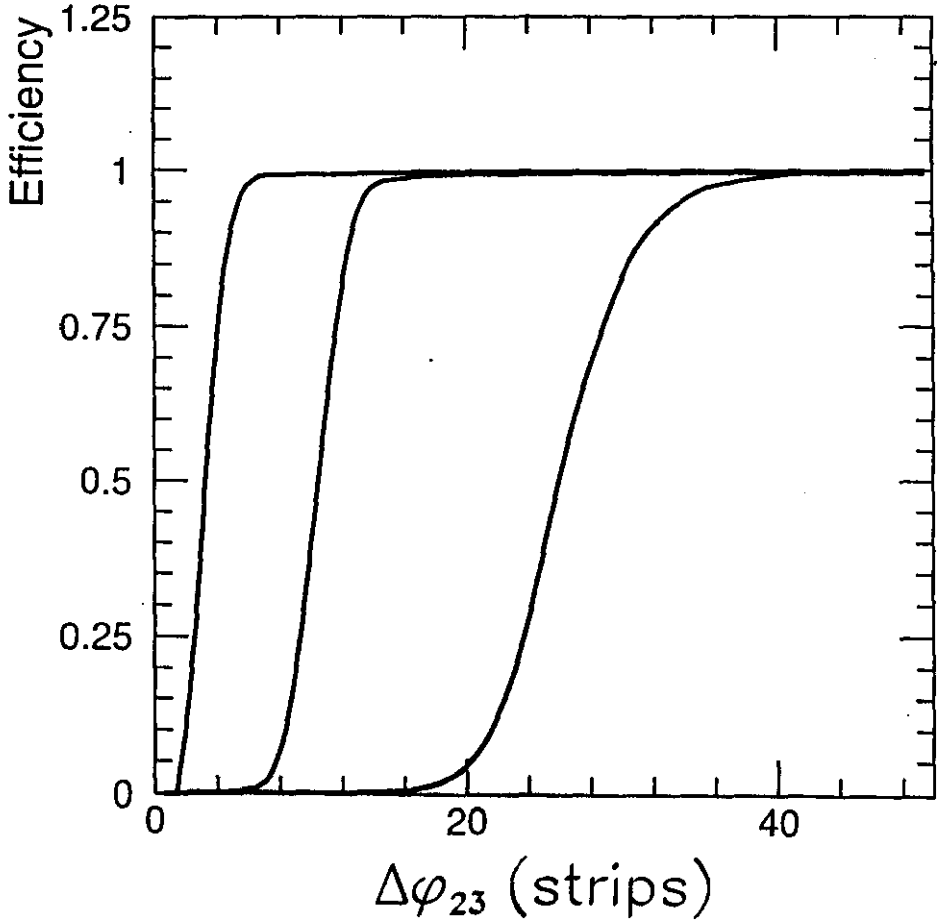

0.4
0.2
0
-20
0
20
40
60


Barrel
Fraction/bin
0.4
0.2
0
P_t=50 GeV
P_t=20 GeV
P_t=10 GeV
0
40
80
120
$\Delta\varphi_{13}$ (strips)

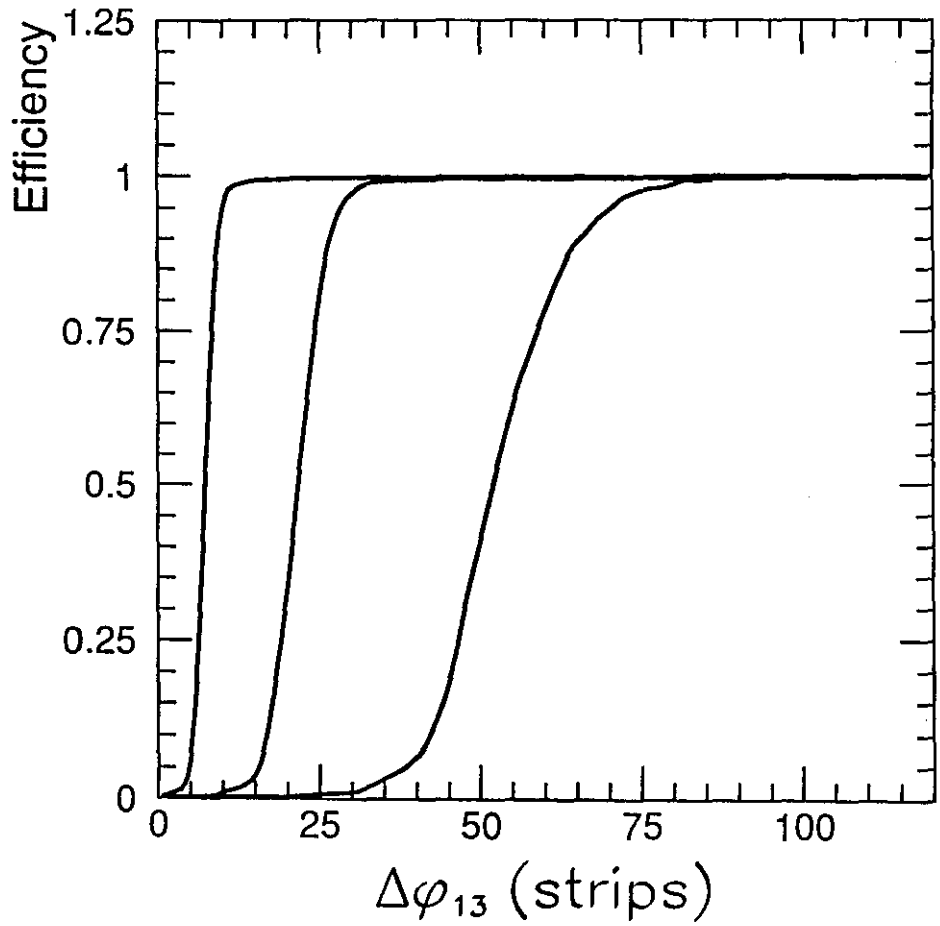

0.4
0.2
0
0
40
80
120


0.6
0.4
0.2
0
-10
0
10
20
30

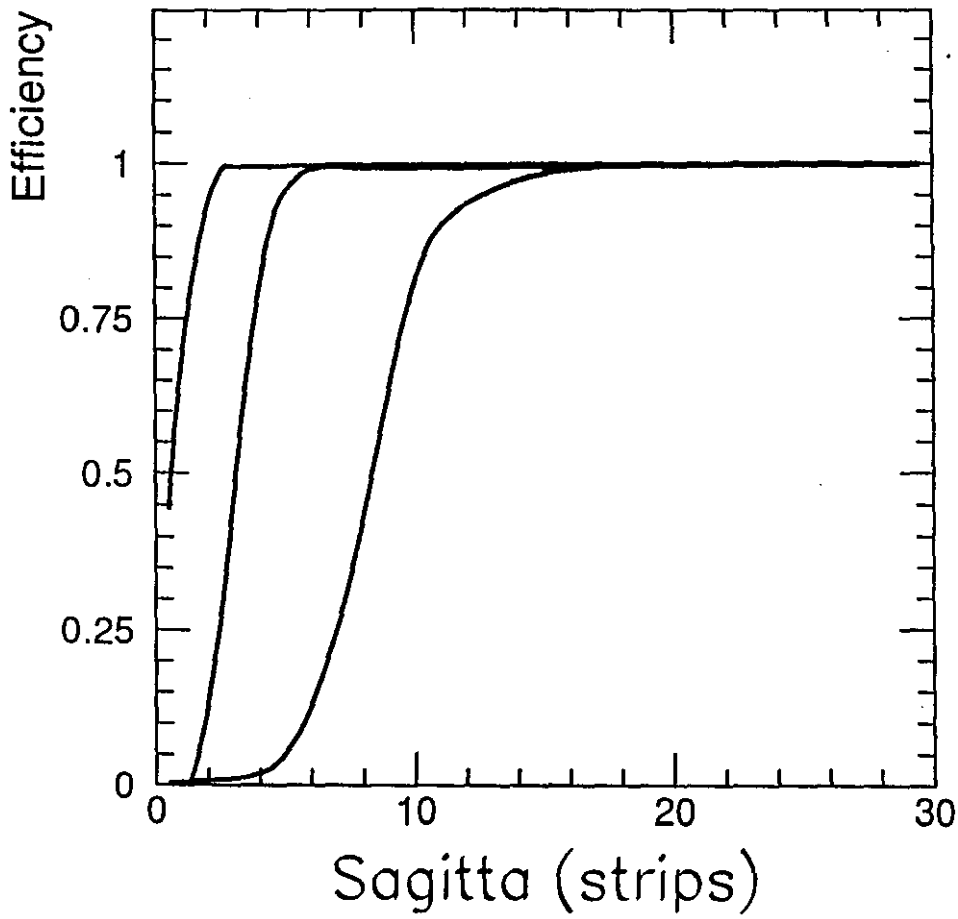

Barrel
Fraction/bin
0.6
0.4
0.2
0
-10
0
10
20
30
Sagitta (strips)
P_t=50 GeV
P_t=20 GeV
P_t=10 GeV



$P_t^M = 50, 20, 10 \ \frac{GeV}{c}$



$P_t^{\mu} = 50, 20, 10 \quad \frac{GeV}{c}$



$P_t^{\mu} = 50, 20, 10 \quad \frac{GeV}{c}$

What else?

- Endcap

(towers smaller, sagitta smaller, strip width depends on radius, background larger)

- Time

(how the induced charge develops and how it is processed by electronics.
What will be the electronic output for different shapes of induced charge pulses?)

- Logics for trigger

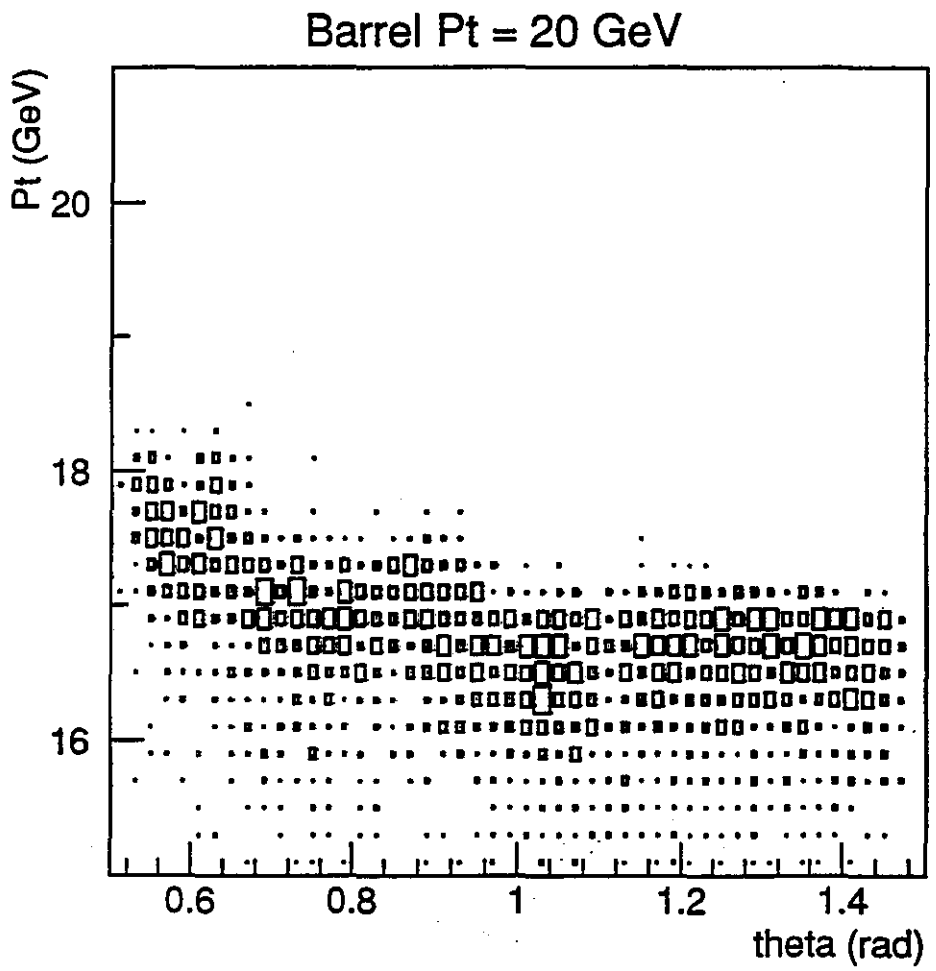
(Definitions of virtual strips, clusters)

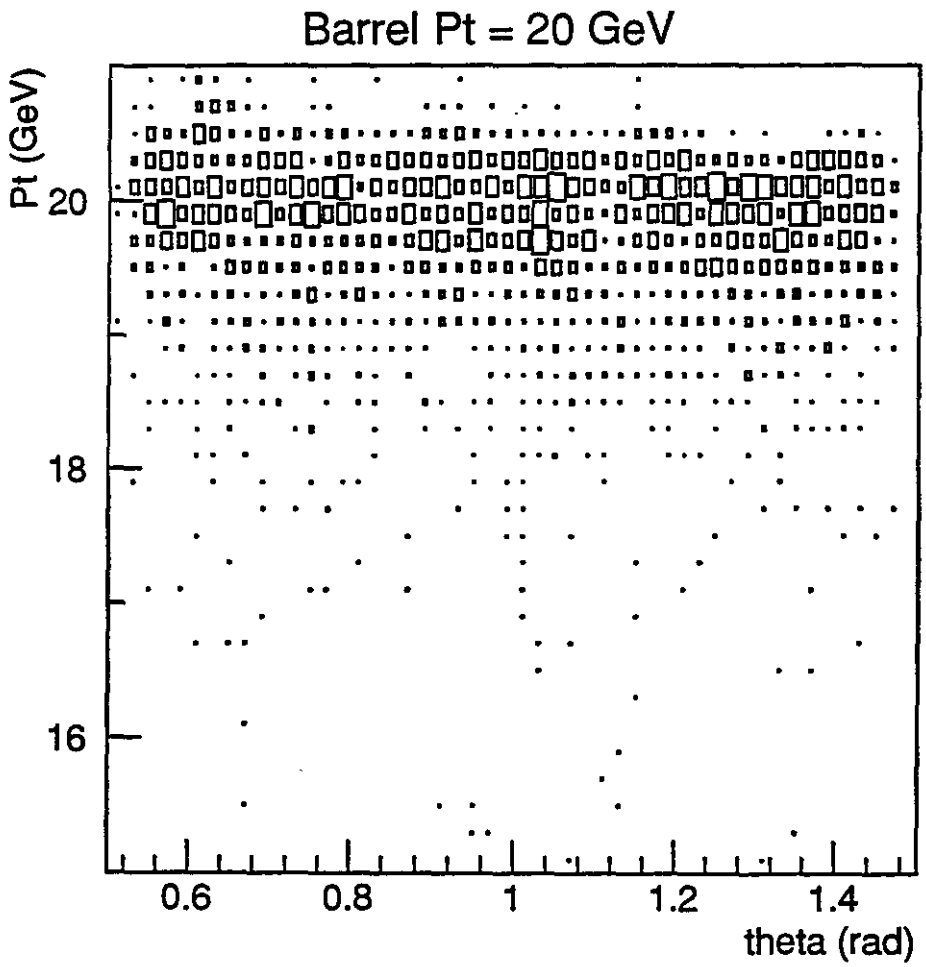
- Punchthrough
(especially for endcap)

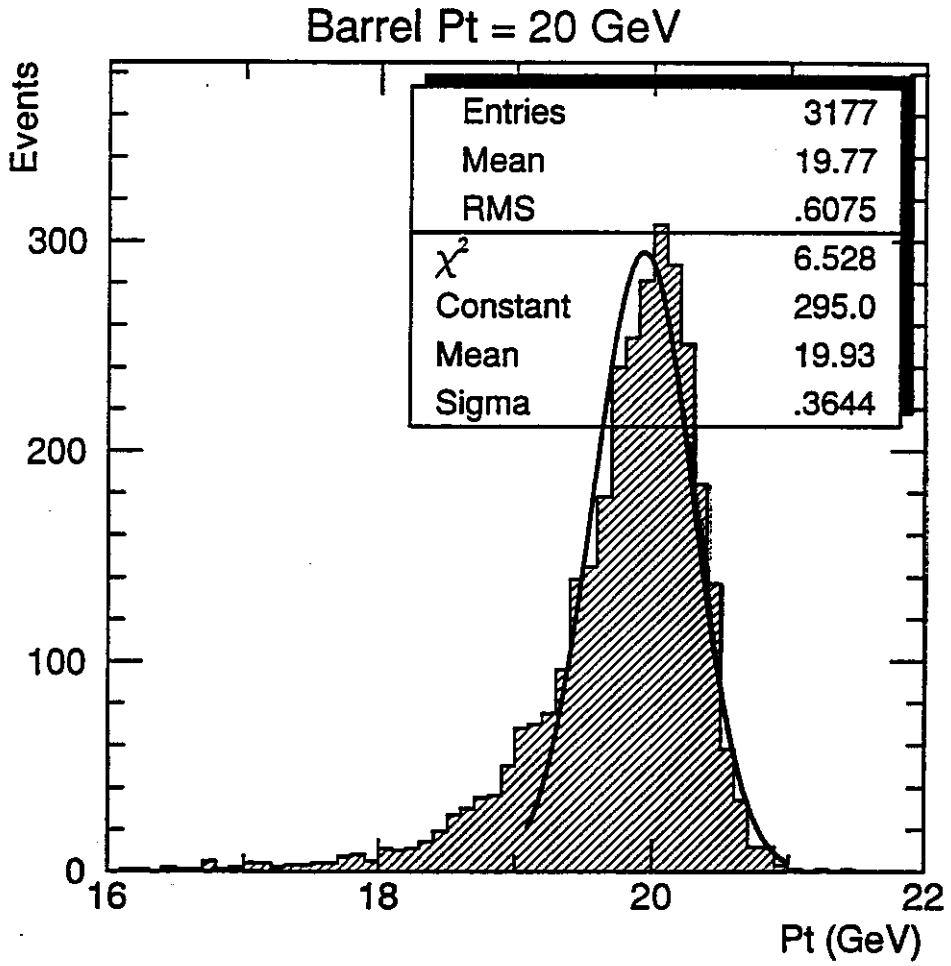
- Reliability

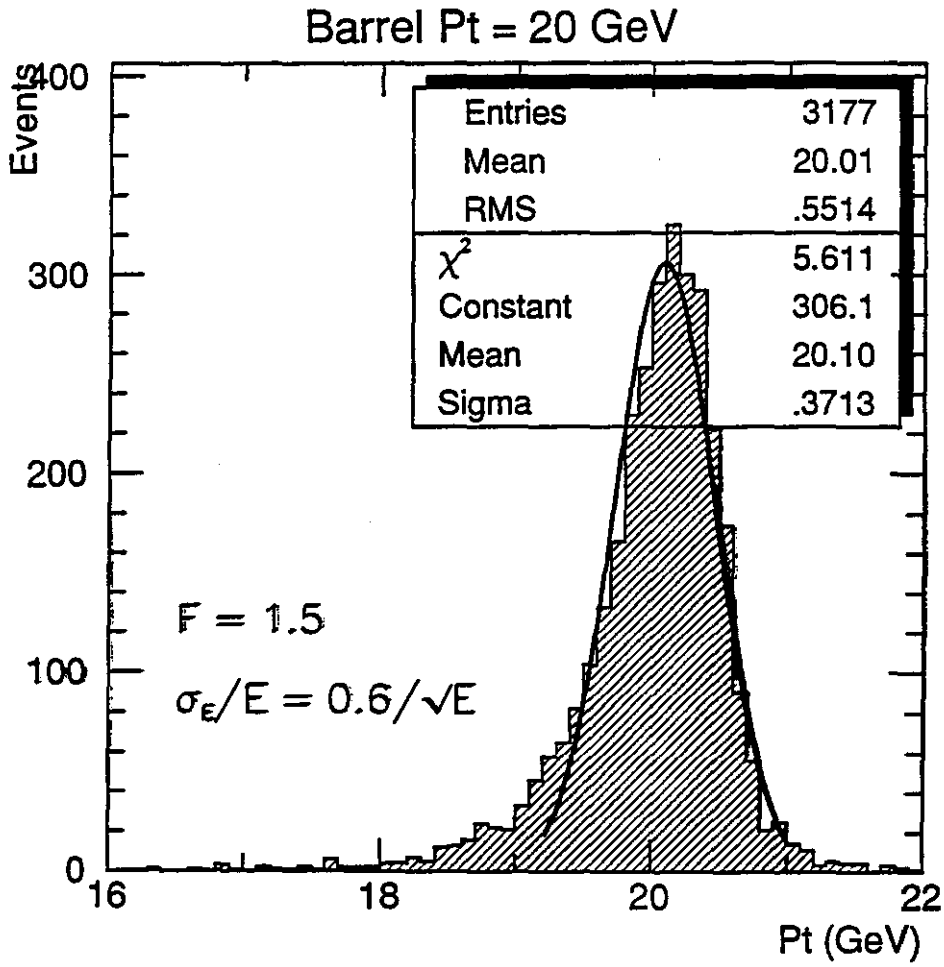
(Will the trigger work with one bad layer?)

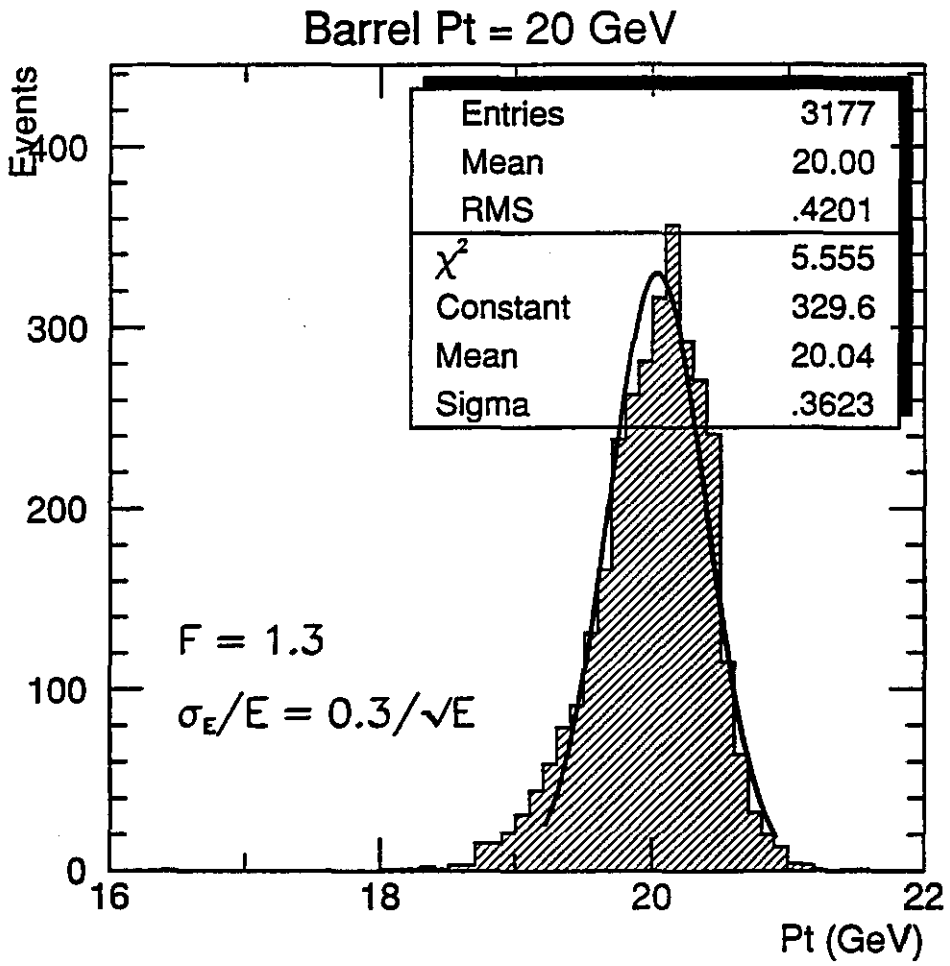
- Using sagitta and delta phi methods together.

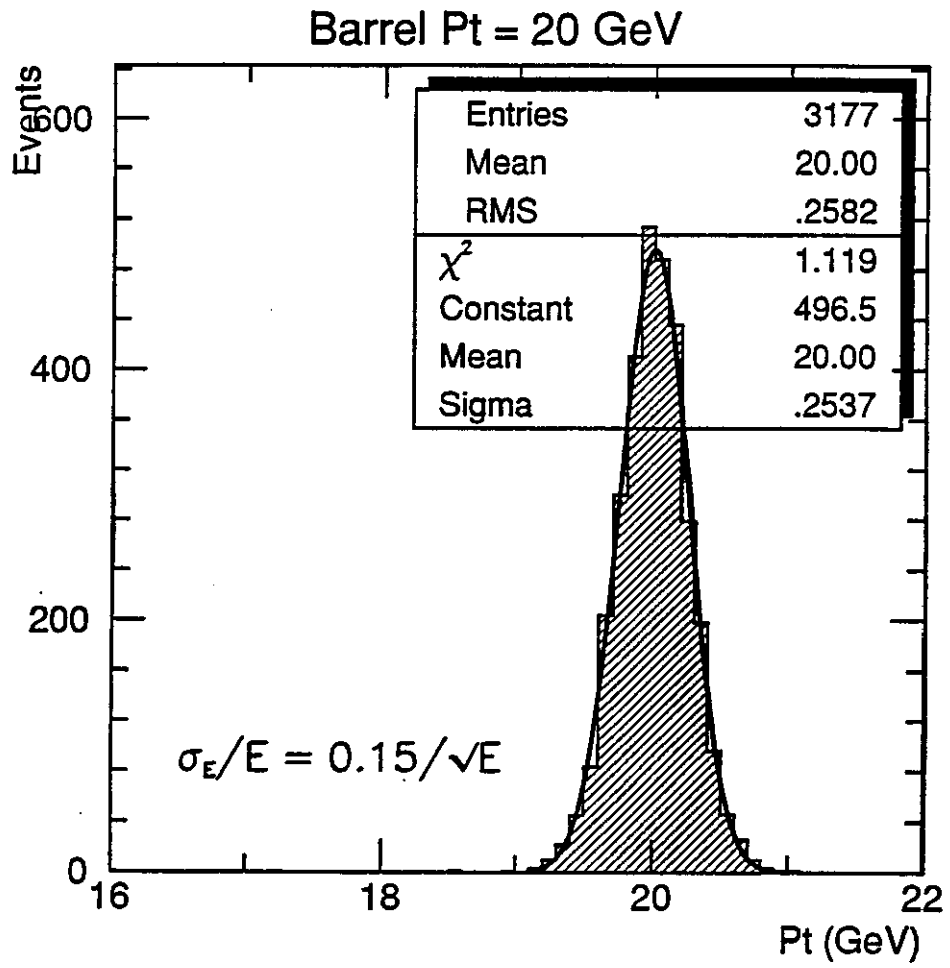

Barrel Pt = 20 GeV
Pt (GeV)
20
18
16
0.6
0.8
1
1.2
1.4
theta (rad)


Barrel Pt = 20 GeV
Pt (GeV)
20
18
16
0.6
0.8
1
1.2
1.4
theta (rad)


Barrel Pt = 20 GeV
Events
Entries 3177
Mean 19.77
RMS .6075
χ^2 6.528
Constant 295.0
Mean 19.93
Sigma .3644
300
200
100
0
16
18
20
22
Pt (GeV)


Barrel Pt = 20 GeV
Events
400
300
200
100
0
16
18
20
22
Pt (GeV)
Entries 3177
Mean 20.01
RMS .5514
χ^2 5.611
Constant 306.1
Mean 20.10
Sigma .3713
F = 1.5
$\sigma_E/E = 0.6/\sqrt{E}$

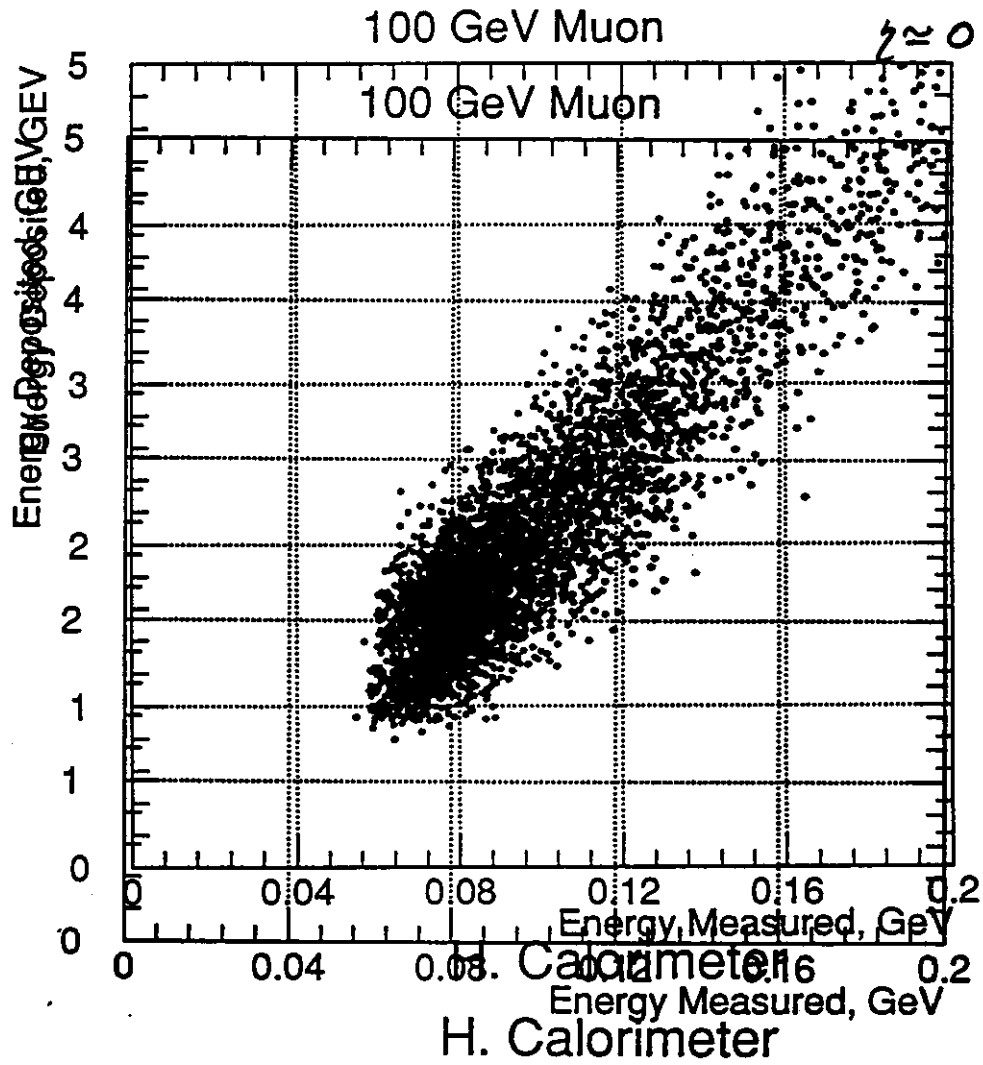

Barrel Pt = 20 GeV
Events
Entries 3177
Mean 20.00
RMS .4201
χ² 5.555
Constant 329.6
Mean 20.04
Sigma .3623
F = 1.3
σE/E = 0.3/√E
0
100
200
300
400
16
18
20
22
Pt (GeV)


Barrel Pt = 20 GeV
Events
600
400
200
0
16
18
20
22
Pt (GeV)
Entries 3177
Mean 20.00
RMS .2582
χ^2 1.119
Constant 496.5
Mean 20.00
Sigma .2537
$\sigma_E/E = 0.15/\sqrt{E}$

4/21/93

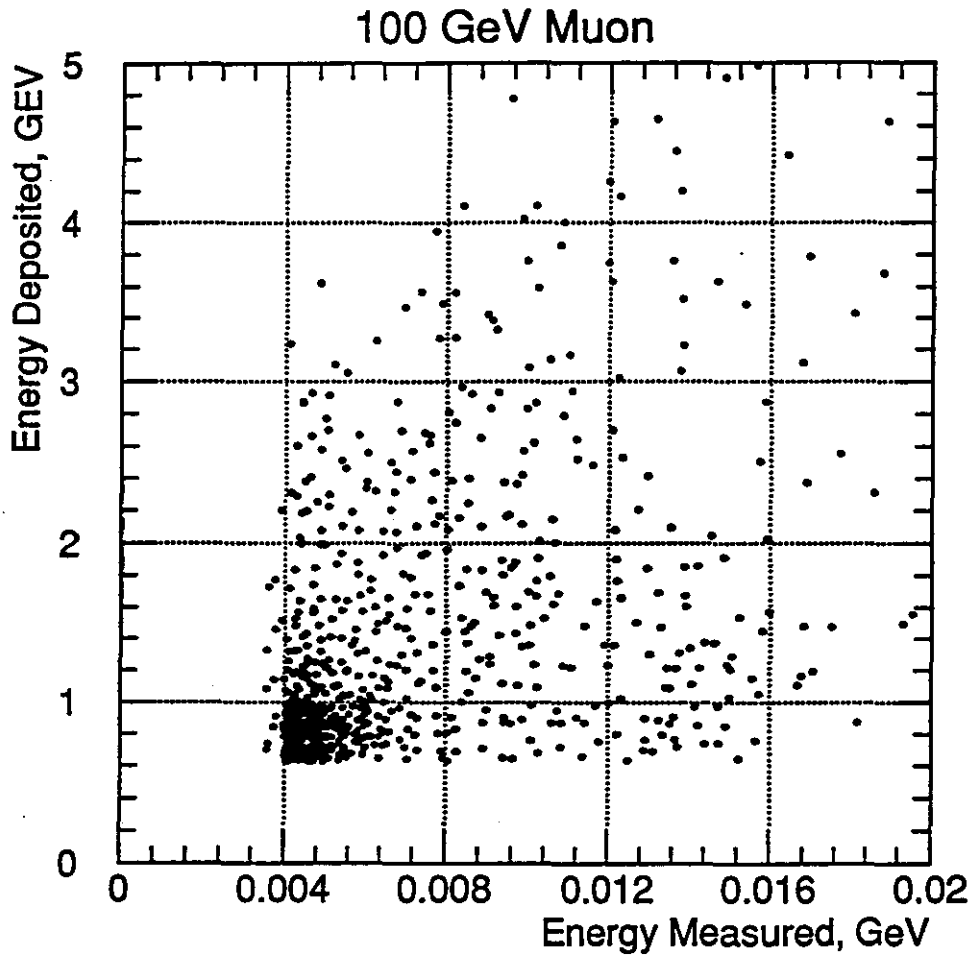
4/21/93

Yu. Efremenko



Yu. Efremenko
4/20/93

$\zeta \simeq 0$



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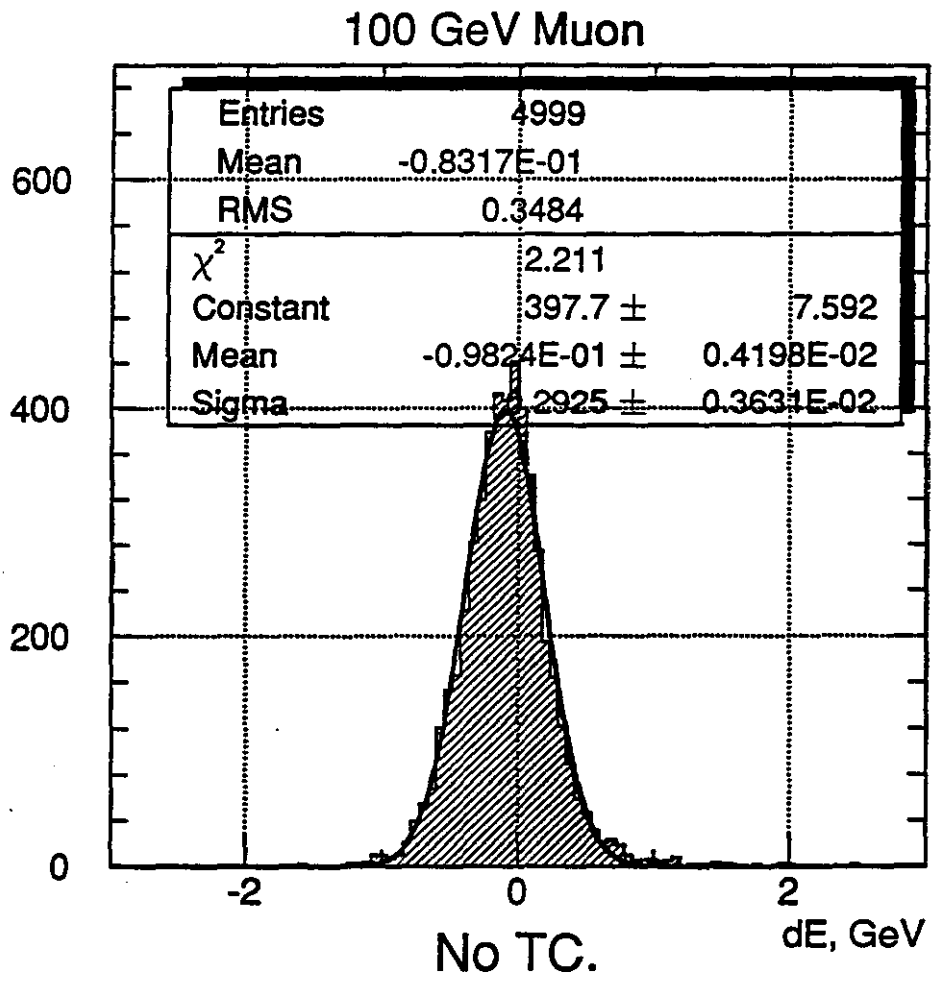
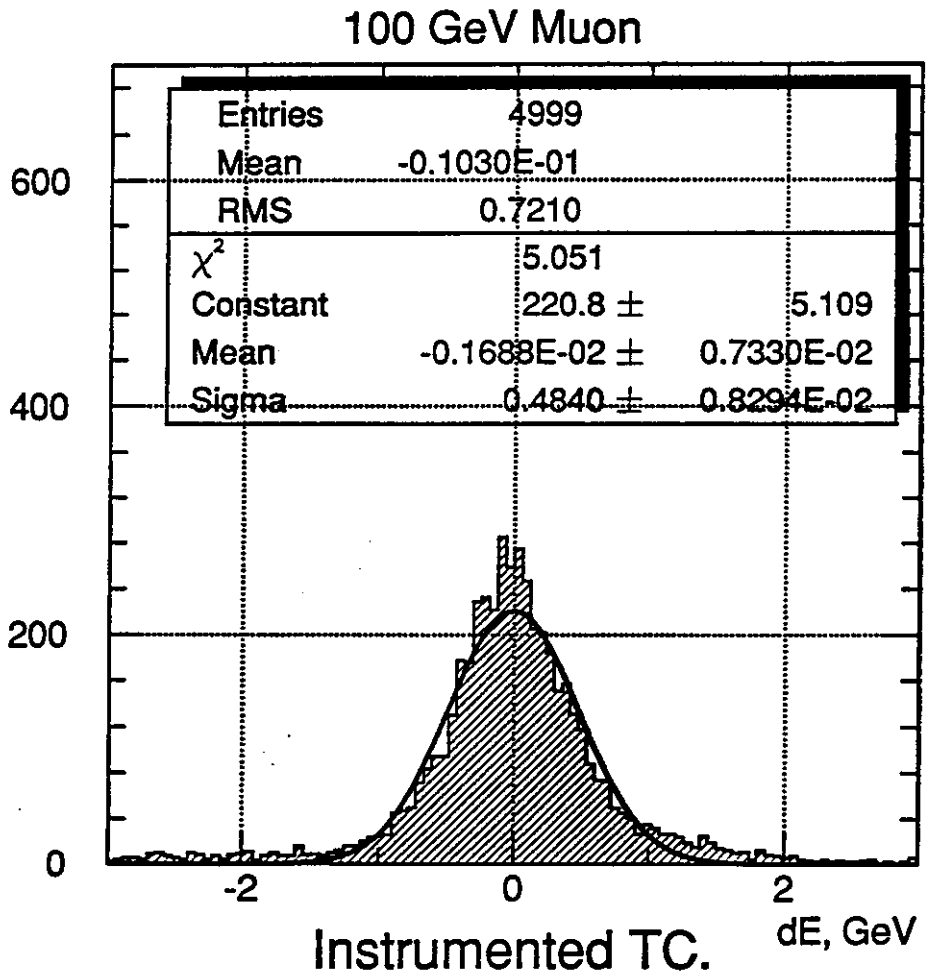
Yu. Efremenko

$\eta \simeq 0$



4/20/93
Z=0

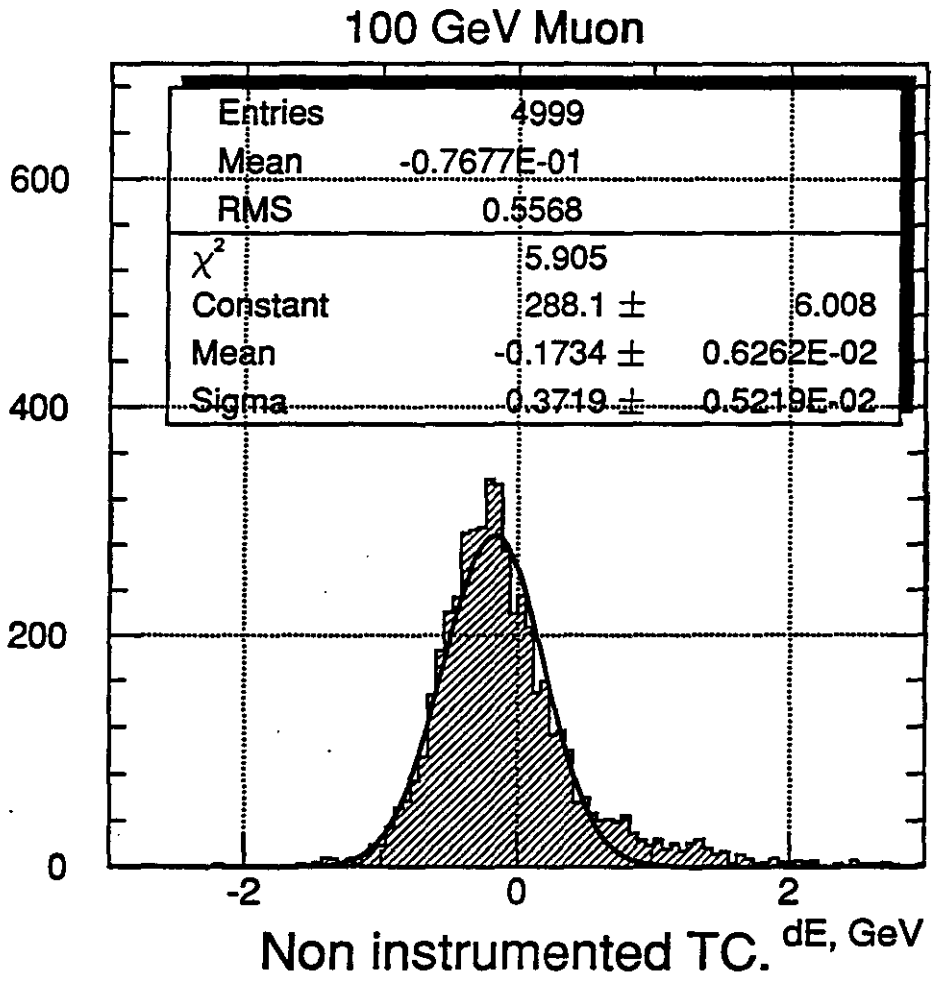
Yu. Efremenko



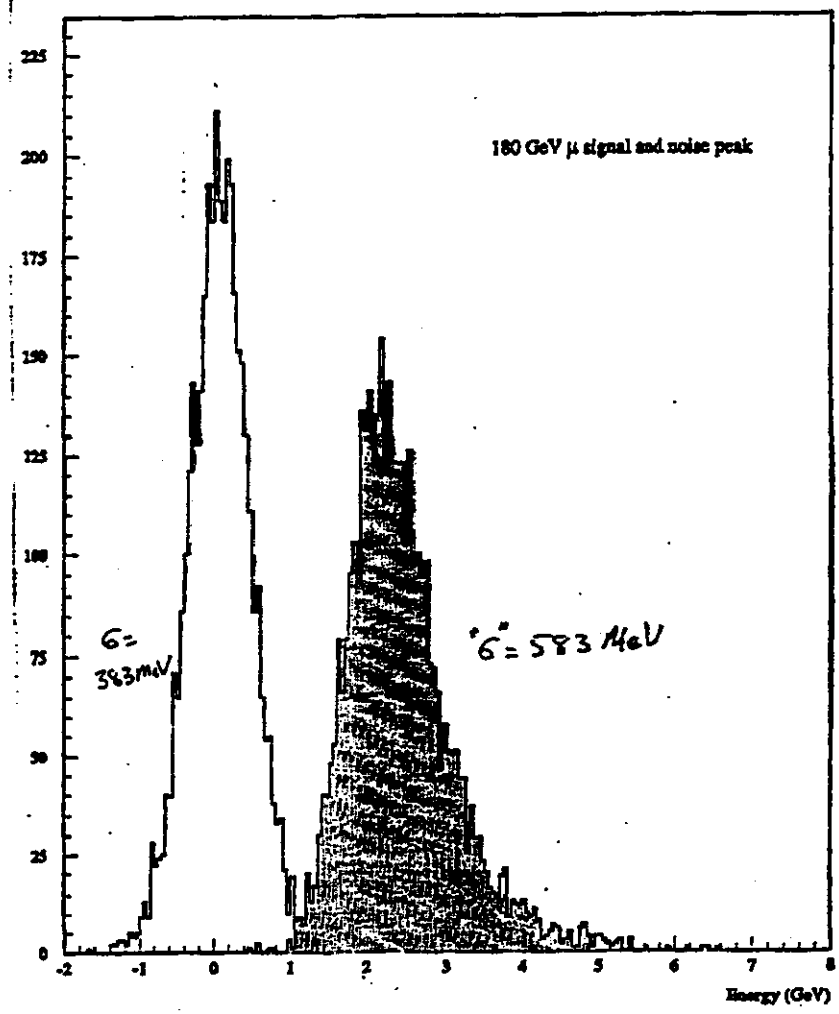
4/20/93

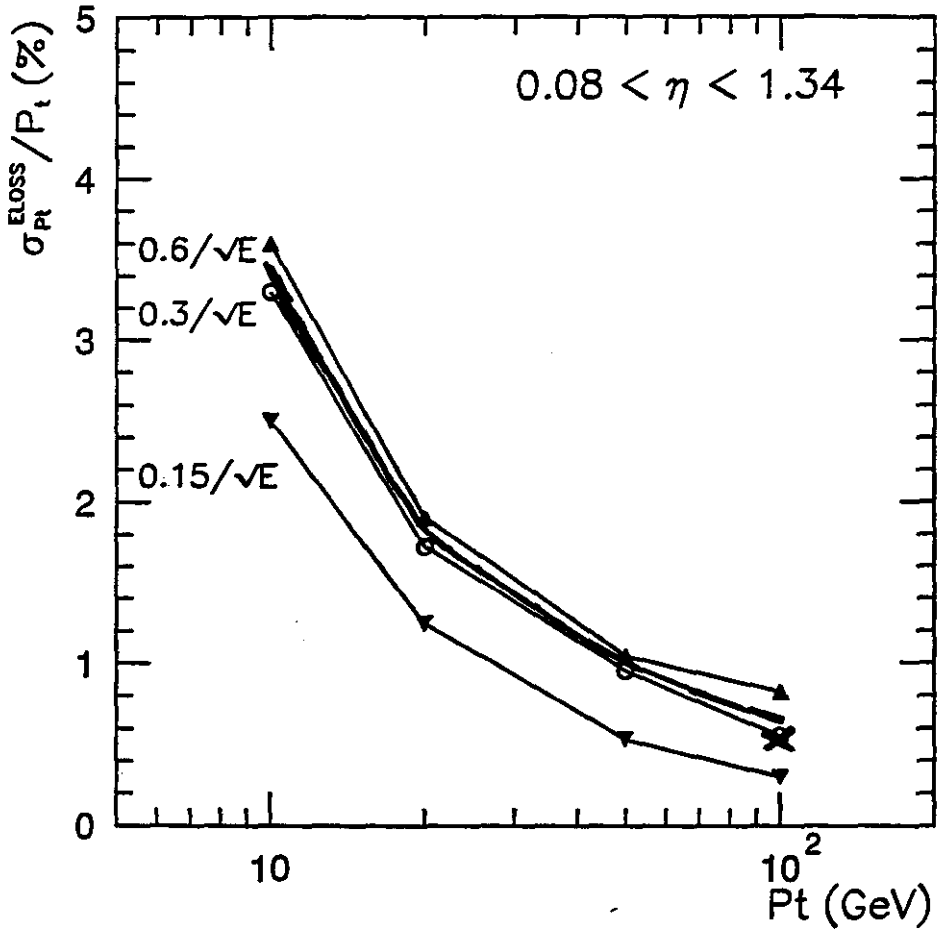
Yu. Efremenko

$z \simeq 0$

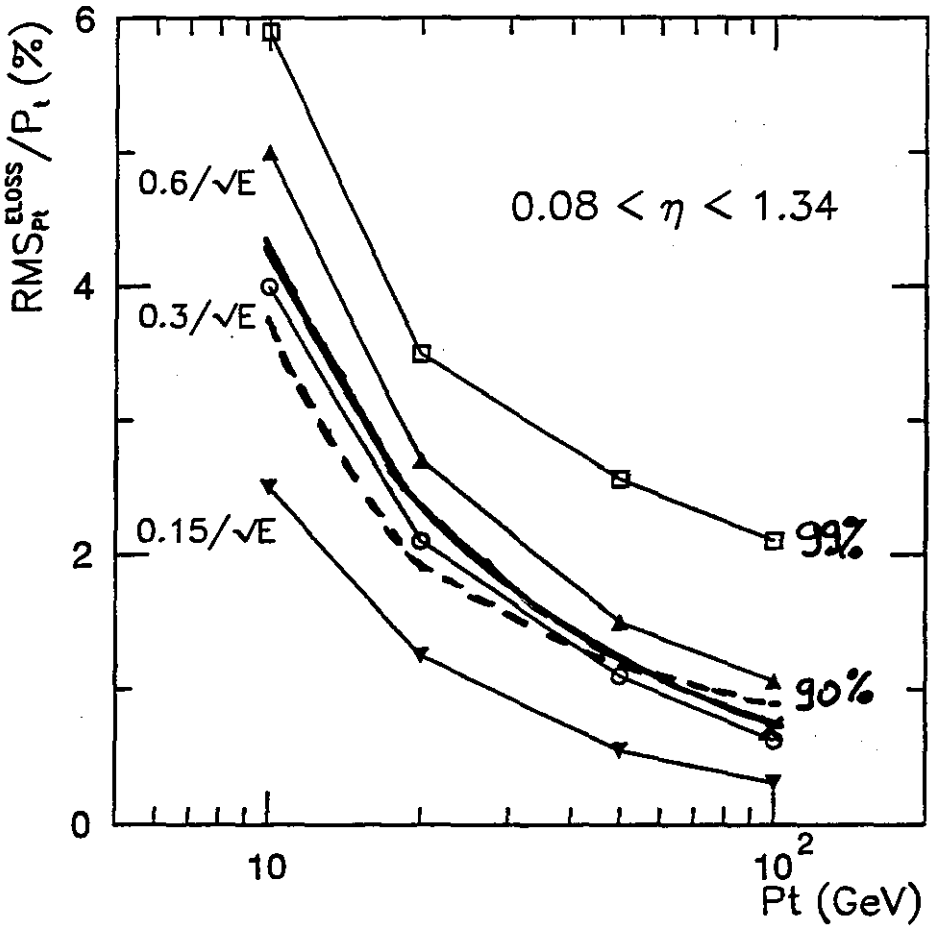


RD3 1992 Beam Test ~6λ





xEfremenko
4/20/93



x Efremenko
4/20/93

L3
PL B271 (1991) 453

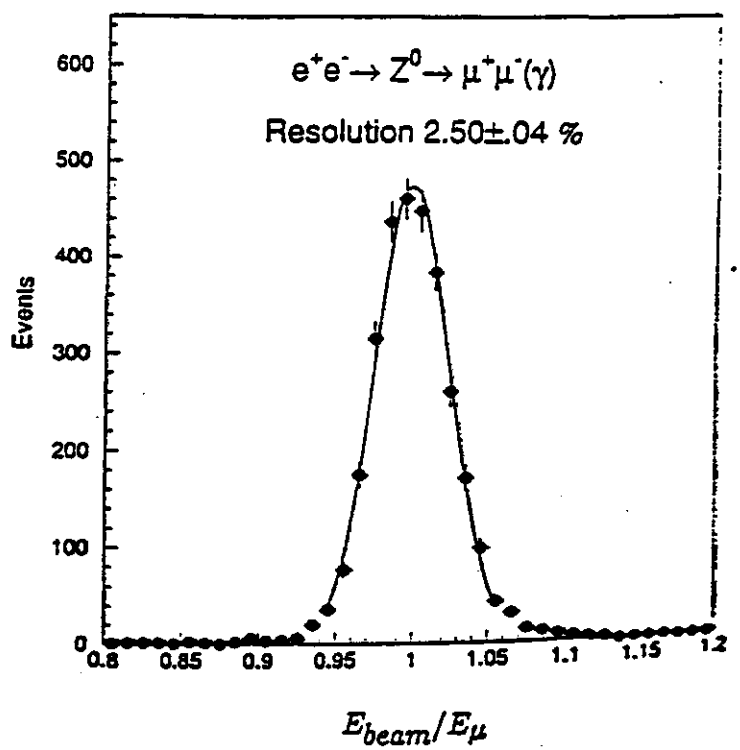


Fig. 1. Muon energy (E_μ) resolution from $Z^0 \rightarrow \mu\mu(\gamma)$ events.

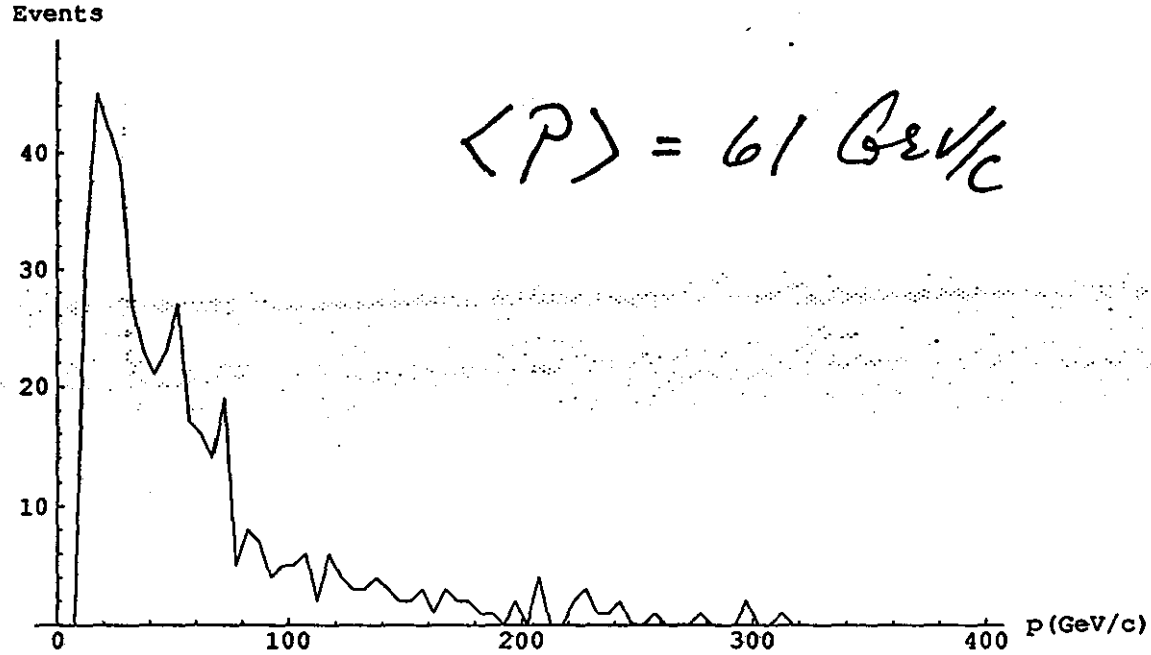
L. ROSSON
4/23/93

MUON MOMENTUM RESOLUTION + RECONSTRUCTION

1. ENERGY FLUCTUATIONS IN THE CALORIMETER
   - Y. GAVRILOV
2. PARAMETRIC RESOLUTION STUDIES -
   - L. ROSSON
3. FULL RECONSTRUCTION STUDIES
   - T. WENUS
   - Y. FISYAK
   - P. DINGUS

$M_{HIGGS} = 130$ GeV

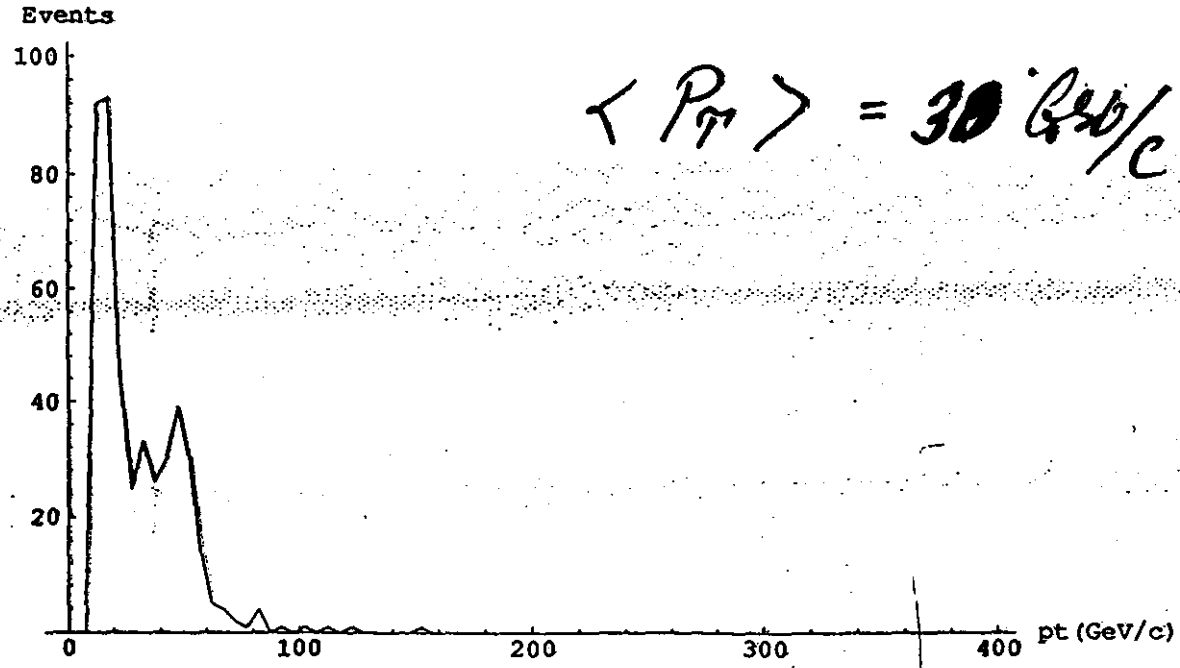
Var: p1
Crit: True
Events = 447
Mean = 60.592 - 2.5564
Sigma = 54.0484 - 1.80765



$\langle P \rangle = 61$ GeV/c

1a

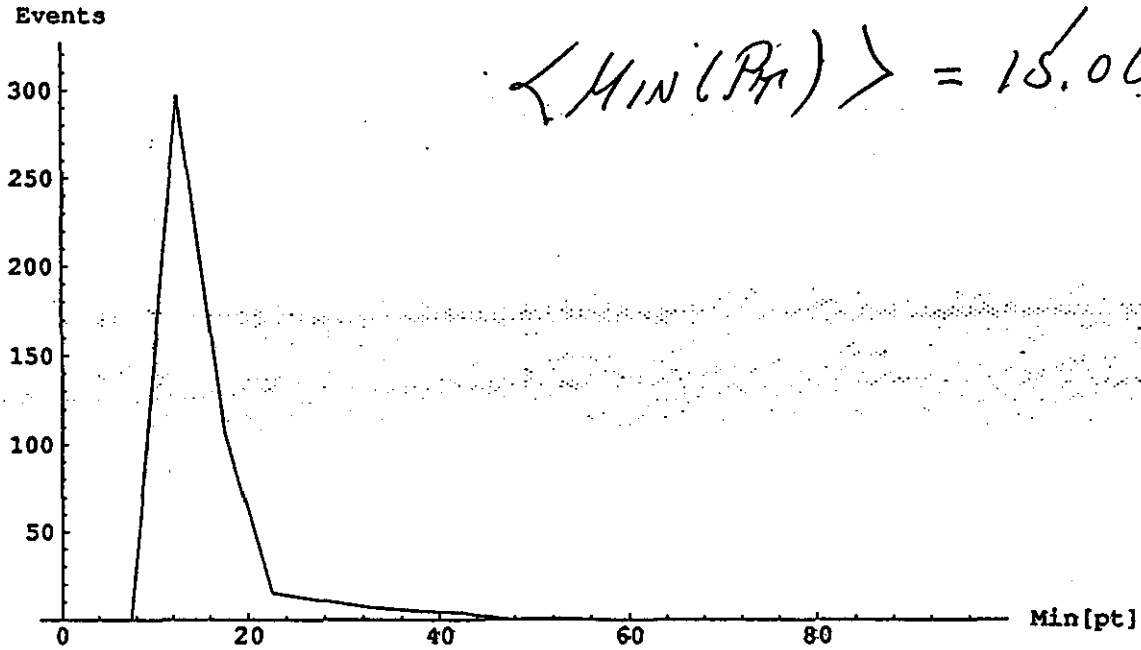
Var: Norm[Cross[P1, {0, 0, 1}]]
Crit: True
Events = 447
Mean = 30.6518 - 0.893854
Sigma = 18.8982 - 0.63205



$\langle P_T \rangle = 30$ GeV/c

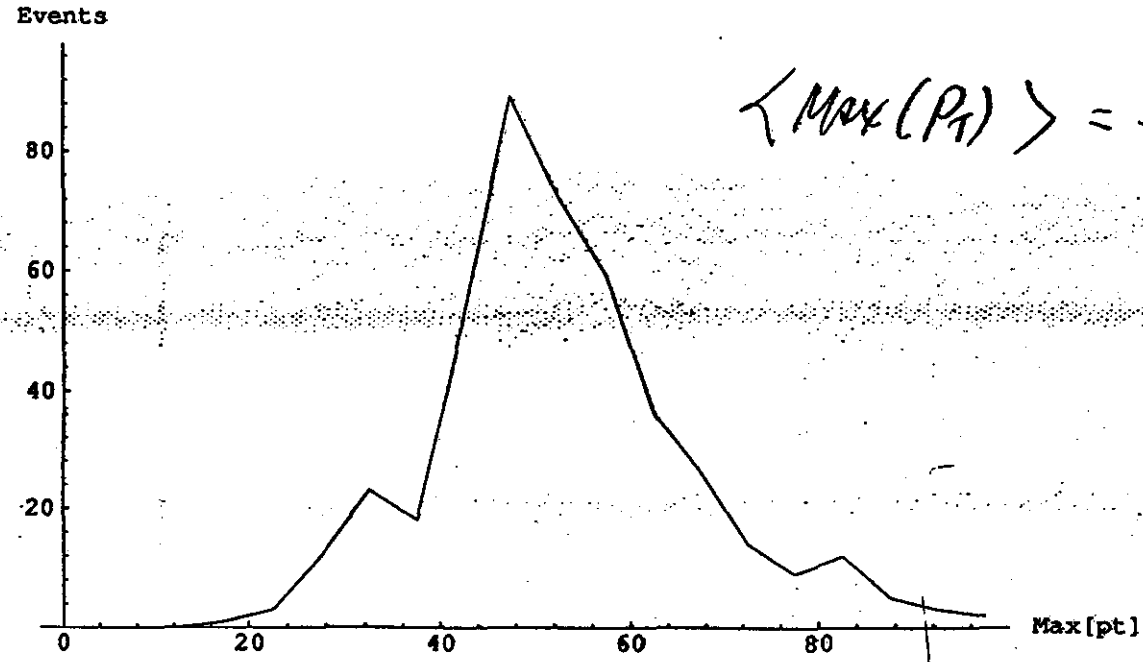
1b

Var: Min[{ptPerp[P1], ptPerp[P2], ptPerp[P3], ptPerp[P4]}]
Crit: True
Events = 447
Mean = 15.0111 - 0.270454
Sigma = 5.71803 - 0.19124



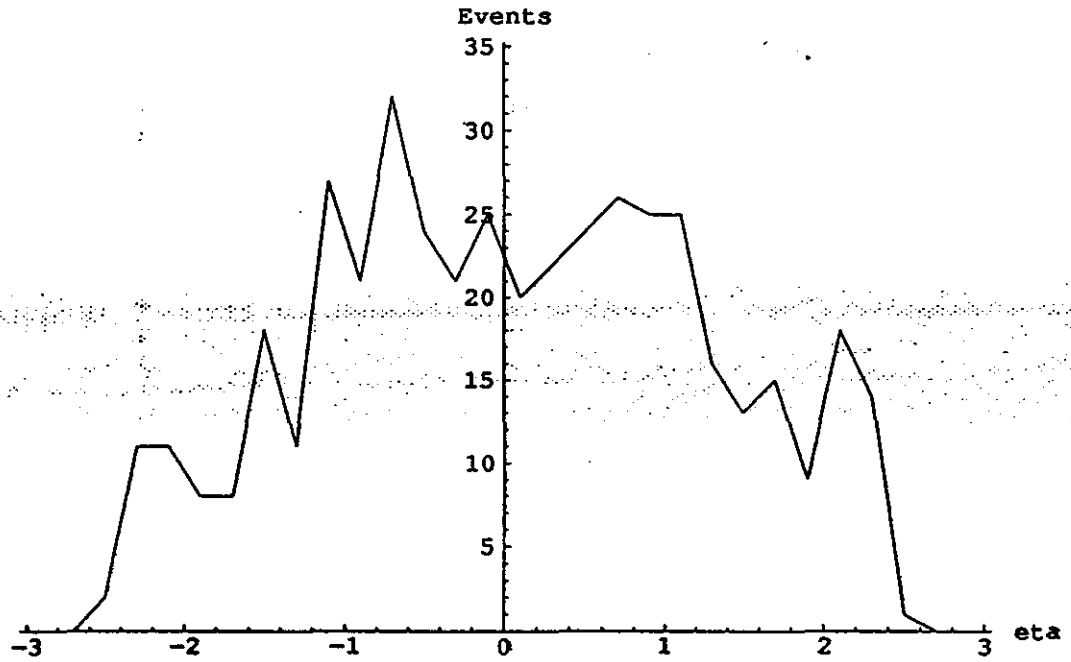
$\langle Min(P_T) \rangle = 15.0 \, GeV/c$

Var: Max[{ptPerp[P1], ptPerp[P2], ptPerp[P3], ptPerp[P4]}]
Crit: True
Events = 436
Mean = 52.9546 - 0.647943
Sigma = 13.5294 - 0.458165



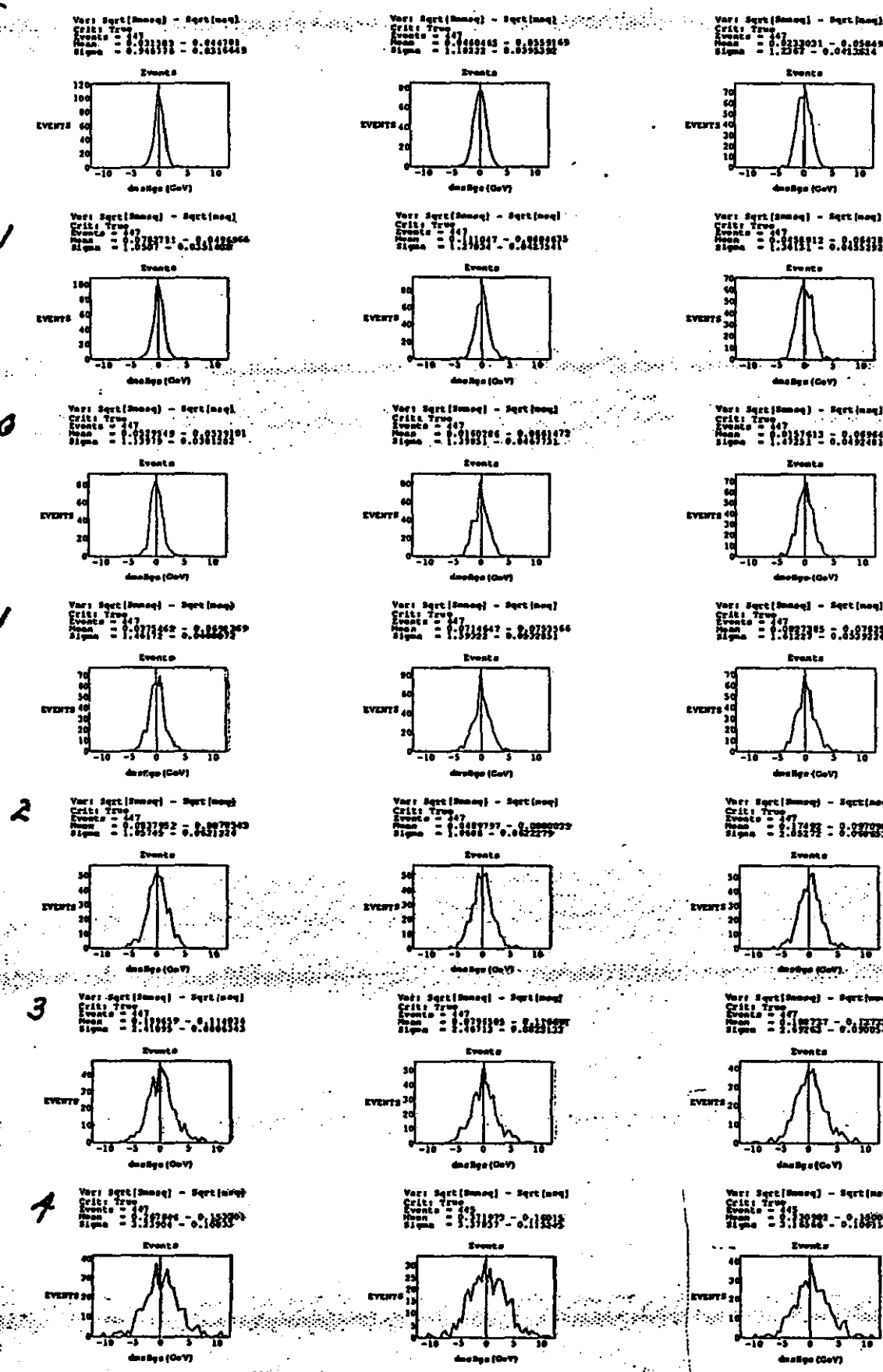
$\langle Max(P_T) \rangle = 53 \, GeV/c$

Var: eta[P1]
Crit: True
Events = 447
Mean = 0.0652978 - 0.0577065
Sigma = 1.22005 - 0.0408046

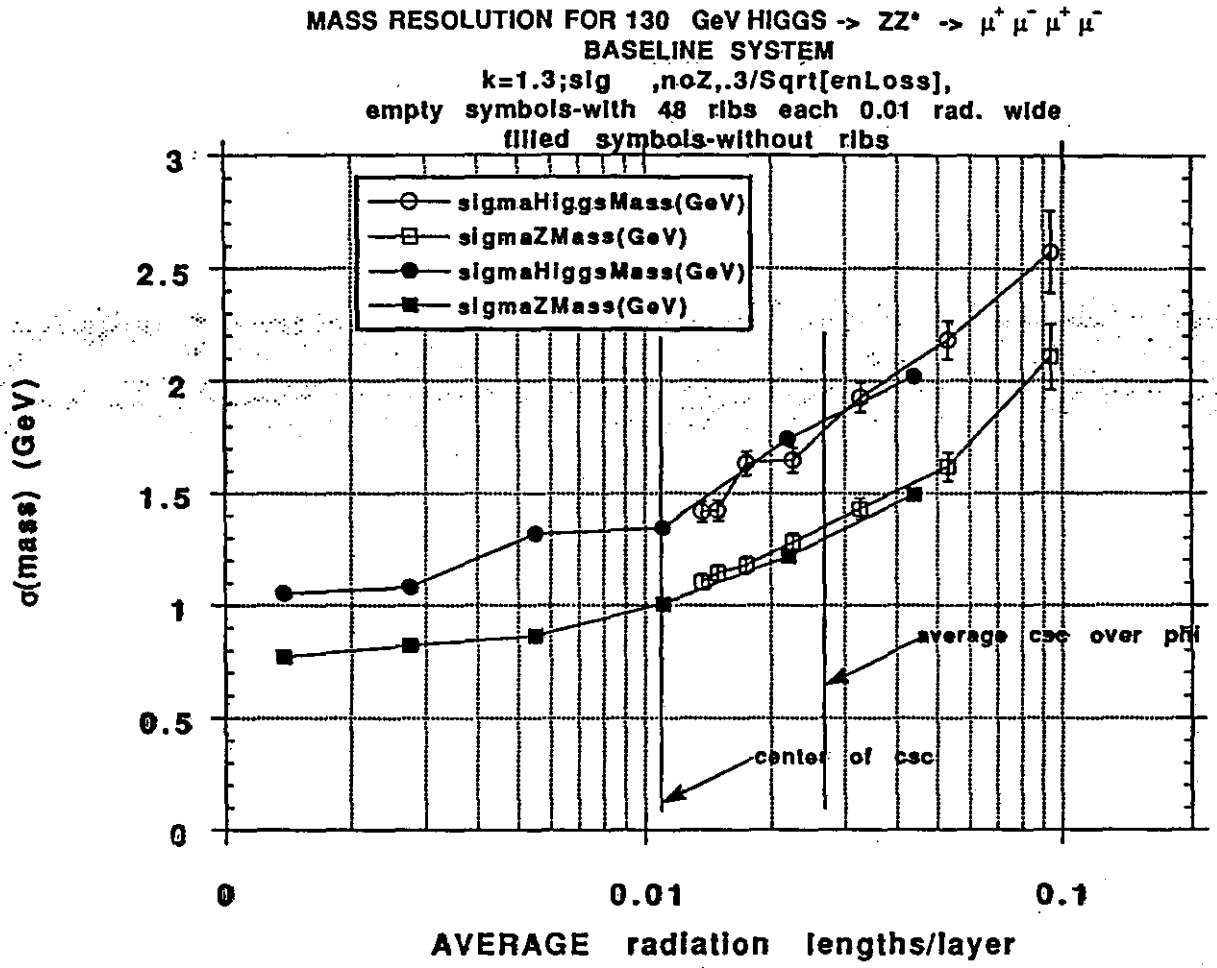


PSEUDORAPIDITY

$\frac{cr/=.011 \times 2^n}{n}$ | $.15/\sqrt{\Delta E}$ | $.30/\sqrt{\Delta E}$; $k=1.3$ | $.6/\sqrt{\Delta E}$; $k=1.5$

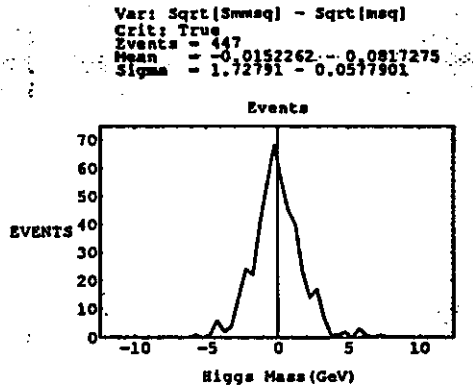


445 EVENTS - M_{HIGGS} = 130 GeV


MASS RESOLUTION FOR 130 GeV HIGGS -> ZZ* -> μ+ μ- μ+ μ-
BASELINE SYSTEM
k=1.3;sig ,noZ,.3/Sqrt[enLoss],
empty symbols-with 48 ribs each 0.01 rad. wide
filled symbols-without ribs
sigmaHiggsMass(GeV)
sigmaZMass(GeV)
sigmaHiggsMass(GeV)
sigmaZMass(GeV)
average csc over phi
center of csc
σ(mass) (GeV)
3
2.5
2
1.5
1
0.5
0
0
0.01
0.1
AVERAGE radiation lengths/layer

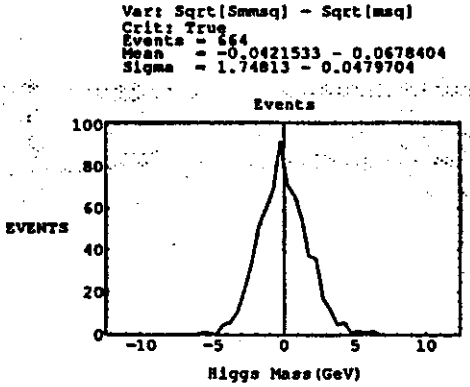
$0.6/\sqrt{\Delta E}$; $R = 1.5$

$M_H = 130$ GeV



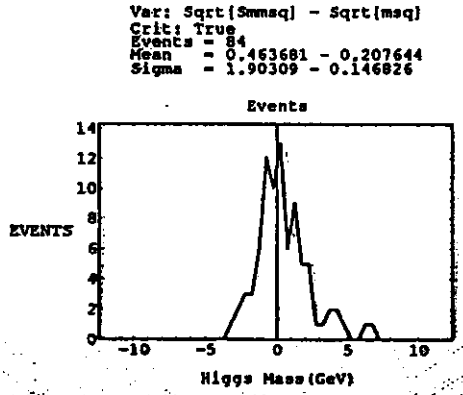
$\sigma(\text{MASS}) = 1.73 \pm 0.05$ GeV

$M_H = 150$ GeV



$\sigma(\text{MASS}) = 1.74 \pm 0.05$ GeV

$M_H = 170$ GeV

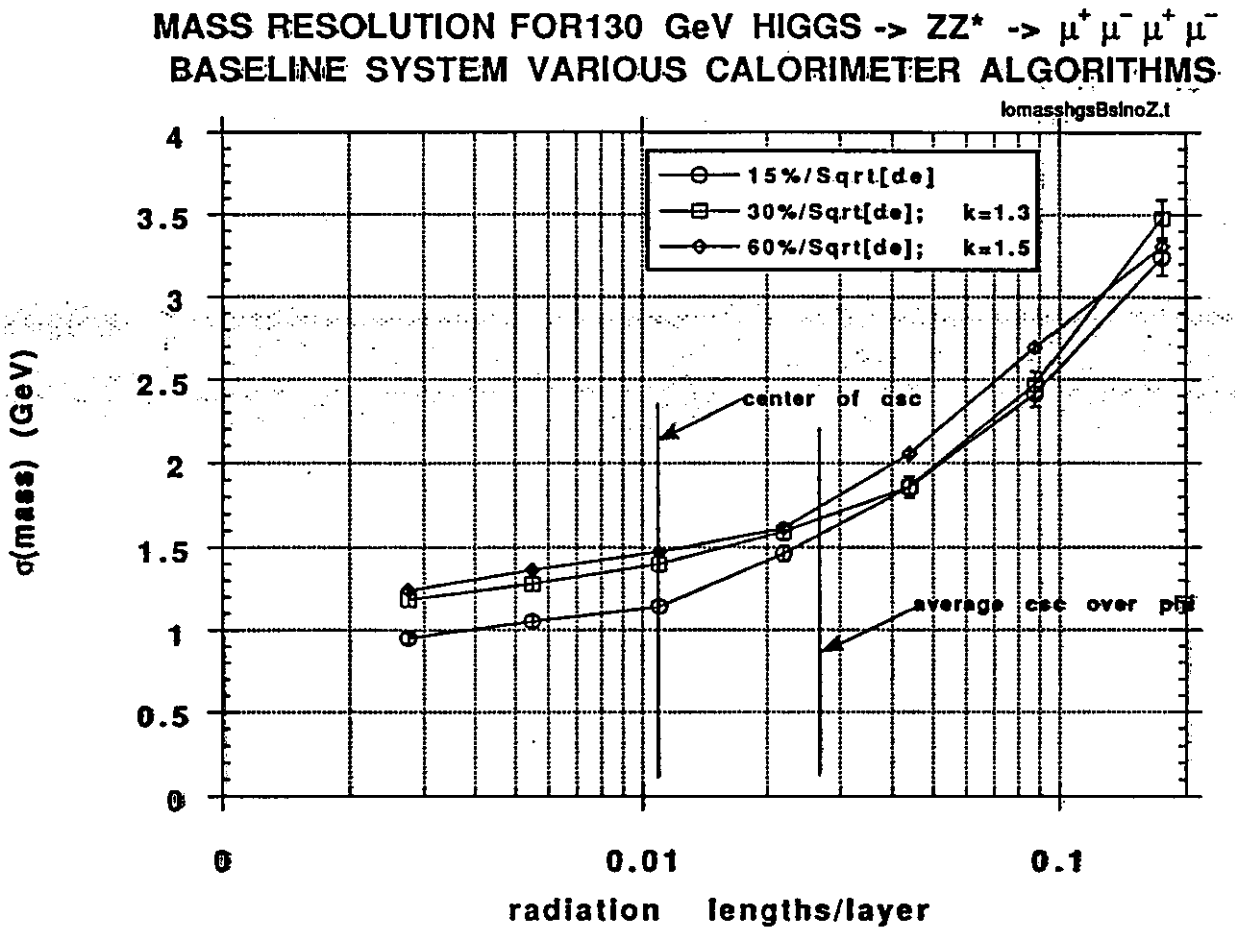


$\sigma(\text{MASS}) = 1.90 \pm .15$ GeV

Cal $\rightarrow \dfrac{.6}{\sqrt{\Delta E}}$; $k = 1.5$

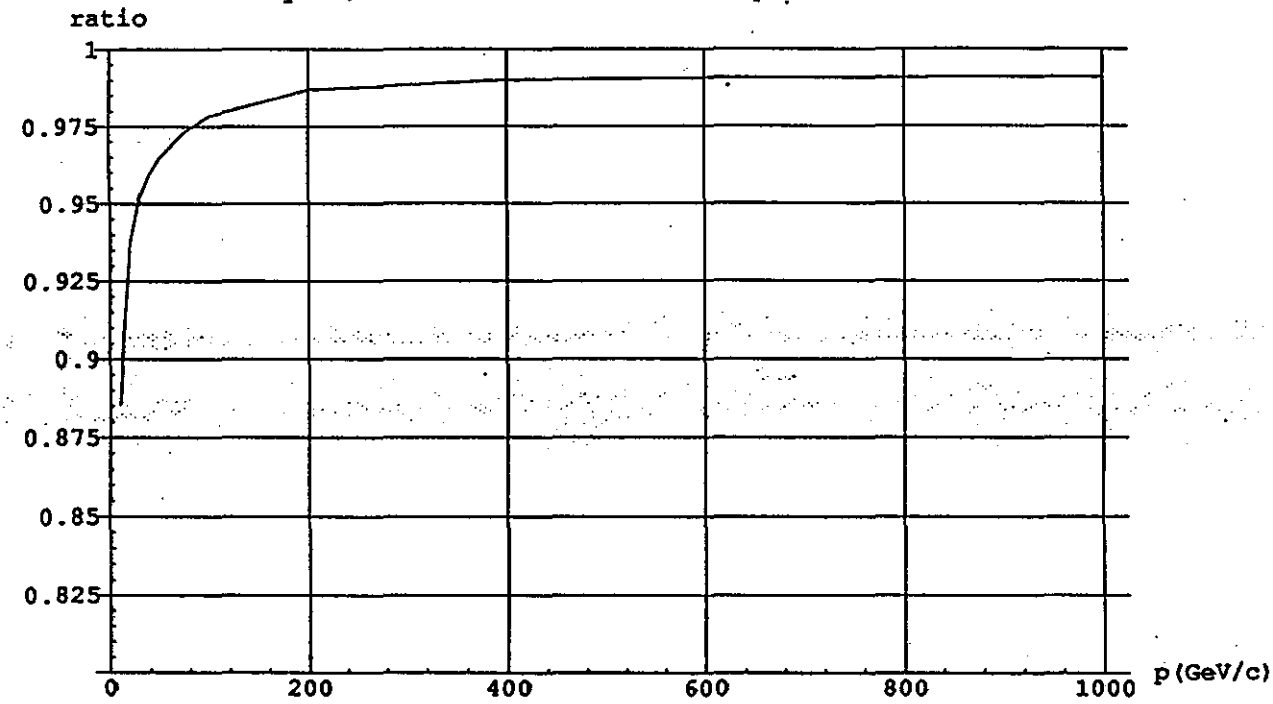
1 RADIATION LENGTH CHAMBER FRAMES COVERING ~ 0.07 OF AREA.

UNIFORM CHAMBER MATERIAL



6.9/1E

Ratio of post calorimeter p resolutions @ eta=0.0:
(extended superlayer)/(compact superlayer)
s0=75 microns, sint=50 microns, sext=25 microns
6 layers;extended case:t=4 cm; compact case:t=0 cm.



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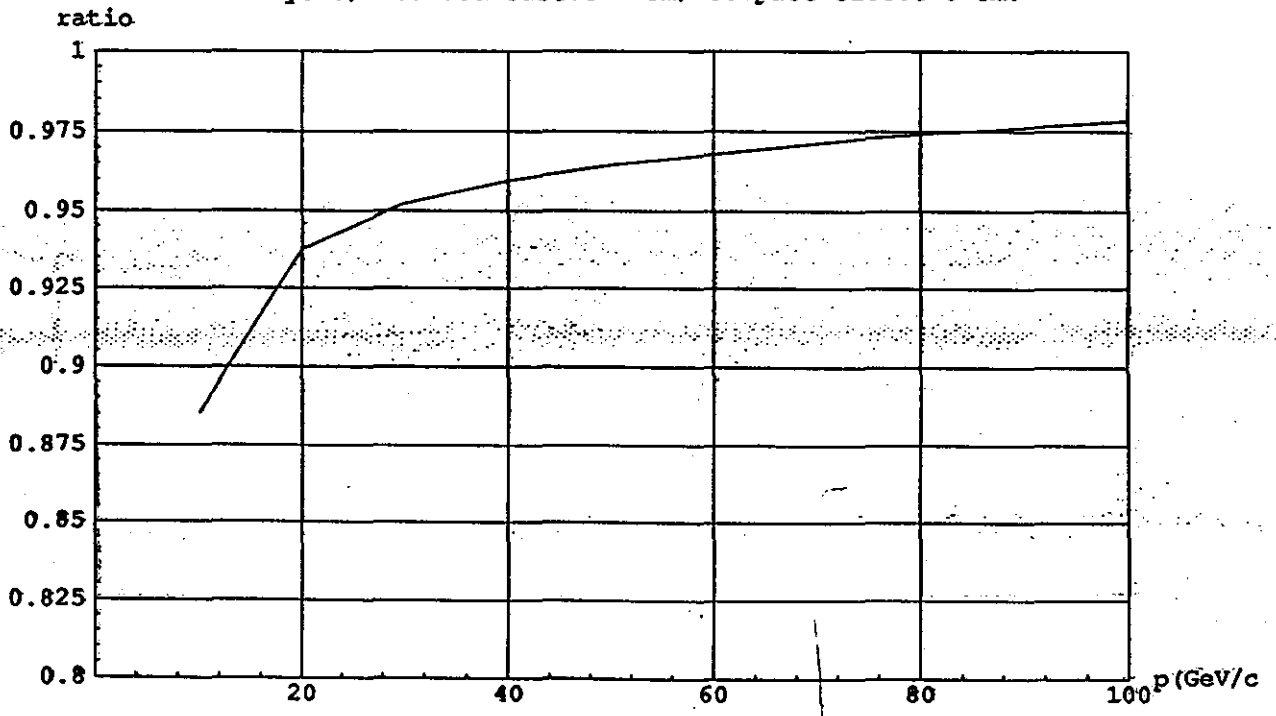

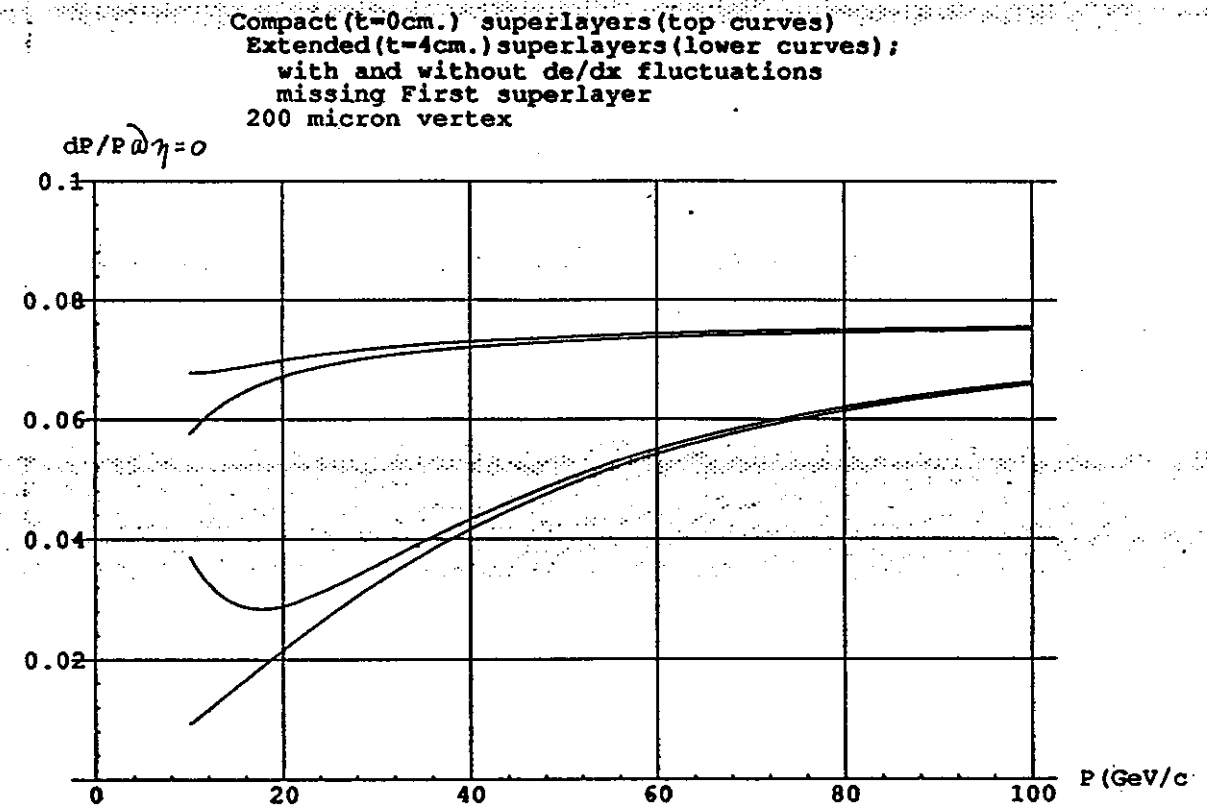
Compact(t=0cm.) superlayers(top curves)
Extended(t=4cm.)superlayers(lower curves);
with and without de/dx fluctuations
missing First superlayer
200 micron vertex
dP/P @ η=0
0.1
0.08
0.06
0.04
0.02
0
20
40
60
80
100
P(GeV/c