Study of $\Delta^{++}(1232)$ Resonance at 7 TeV pp Collisions

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1-Analyzed Data Sets and Event Selection

DATA: LHC10c period, pass 2, pp@7TeV.

10 M events triggered events after physics selection.

Z-vertex of events: $|z|<10$cm

MC: LHC10d4 period, pp, Pythia6 Perugia-0, 0.5T, pp@7TeV, LHC10c anchor runs.

3.9 M triggered events after physics selection.

Z-vertex of events: $|z|<10$cm

- 2- Track Selection
- Eta Range(-0.9,0.9),
- Pt Range (0.2,10),
- ITS Refit,
- TPC Refit,
- Rejection of Kink Daughters,
- Minimum number of TPC Clusters (70),
- Max Chi2 Per Cluster TPC (4),
- At least one SPD point (+ anything else in ITS)-
- Pt Dependent DCA XY 7*(0.0026+0.0050/pt^1.01),
- DCA Z (0.5),

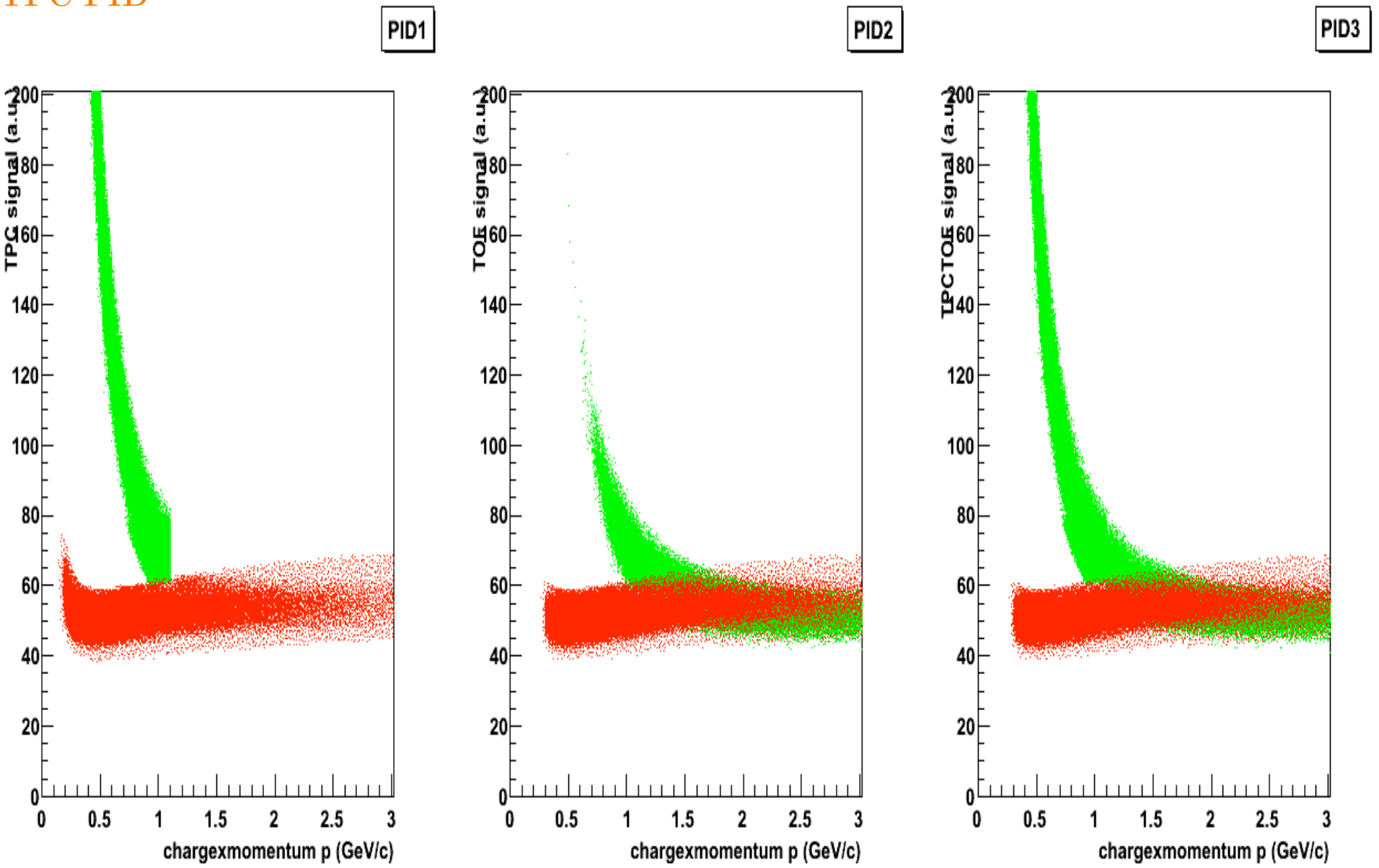
- 3- Signal Extraction
- $p_p > p\pi$ (See backup for the loosing ratio of Δ particles)
- $|y_\Delta| < 0.5$

- 4- PID
- i- TPC PID (PID1):
- σ_{TPC} =3.0
  - p cut for proton 1.1 GeV/c.
  - No cut for pion.

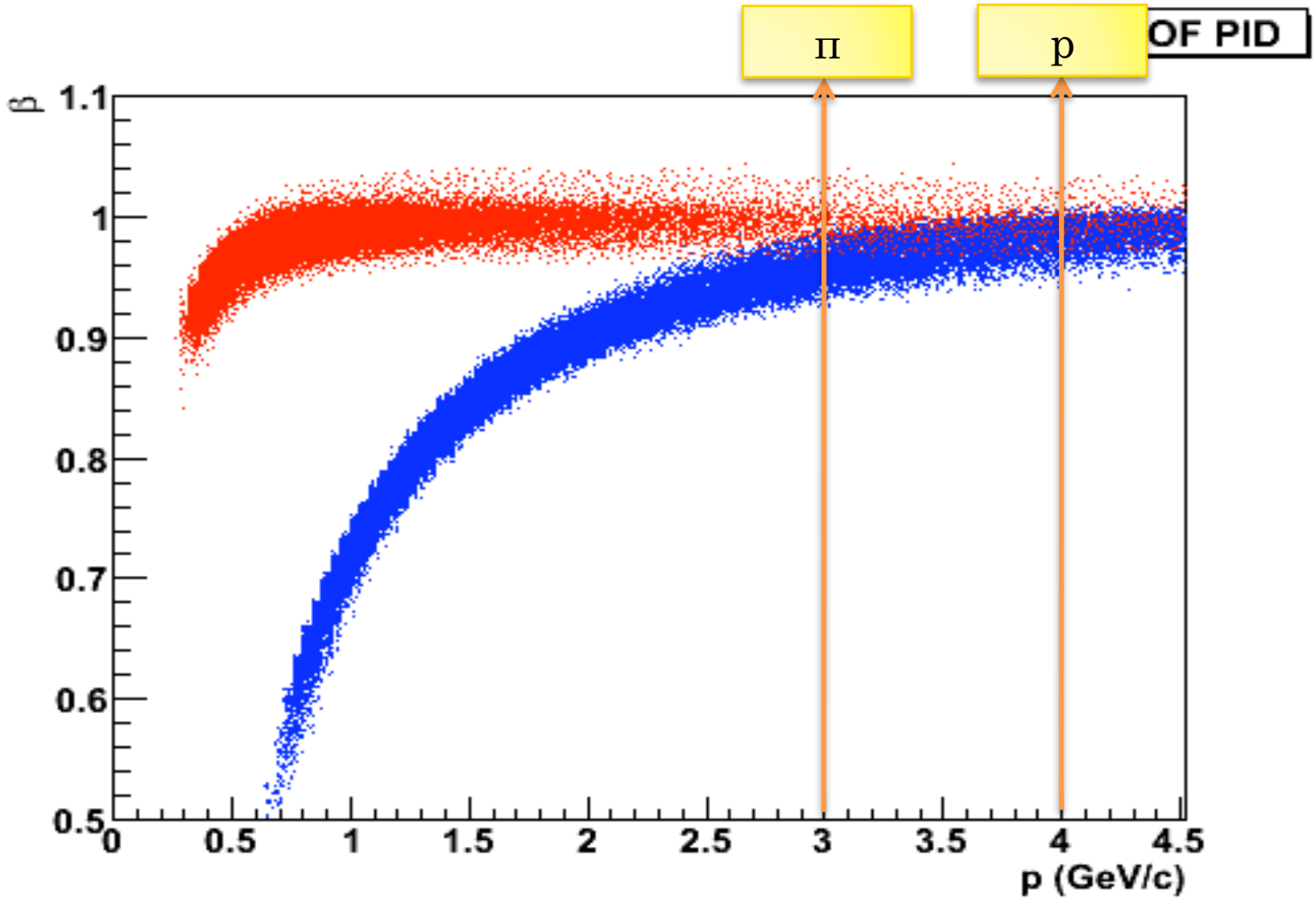
- ii- TPC+TOF PID (PID2):
- σ_{TPC} =3.0; σ_{TOF} =3.0
  - p cut for proton 4.0 GeV/c.
  - p cut for pion 3.0 GeV/c.

- iii- TPC+TOF PID (PID3):
- σ_{TPC} =3.0; σ_{TOF} =3.0
  - p_p<1.1GeV/c ➔ Only TPC PID.
  - 1.1GeV/c<p_p<4.0GeV/c ➔ TPC+TOF PID.
  - p_π < 3.0 GeV/c.

TPC PID


PID1
PID2
PID3
TPC signal (a.u.)
TOF signal (a.u.)
TPCTOF signal (a.u.)
chargexmomentum p (GeV/c)
chargexmomentum p (GeV/c)
chargexmomentum p (GeV/c)

TOF PID



Event Mixing Technique Used

1- Protons and pions taken from 10 different events.
2- Tracks taken from the events which has the maximum multiplicity difference is 20.
3- Tracks taken from the events which has the maximum vertex-z difference is 3 cm.
4- Protons and pions selected from the events which have same multiplicity and vertex bins.
5- Background normalized in 1.4<Mass<1.8 GeV/c^2 region where no signal expected.

Fit Function

P-wave Breit Wigner x Phase Space Factor + Linear background

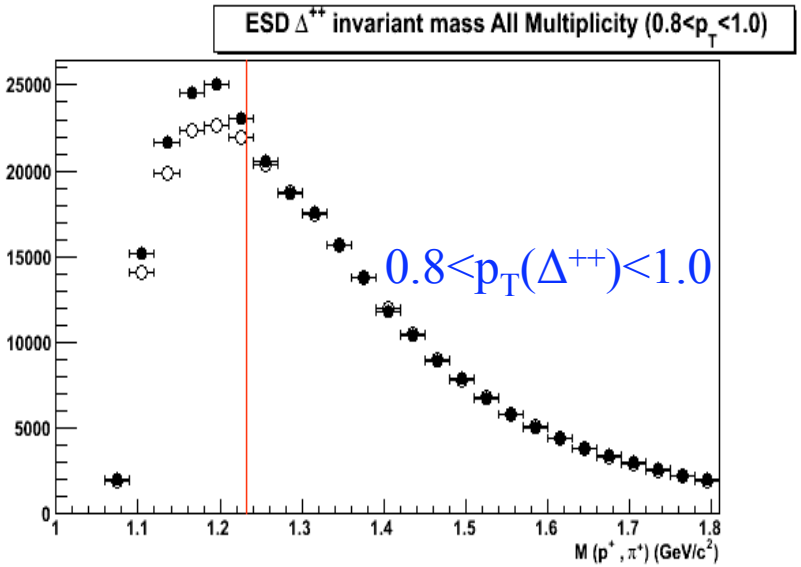
$$BW(M_{p\pi}) = \frac{Y M_{p\pi} M_{\Delta} \Gamma(M_{p\pi})}{(M_{p\pi}^2 - M_{\Delta}^2)^2 + M_{\Delta}^2 \Gamma(M_{p\pi})^2}$$

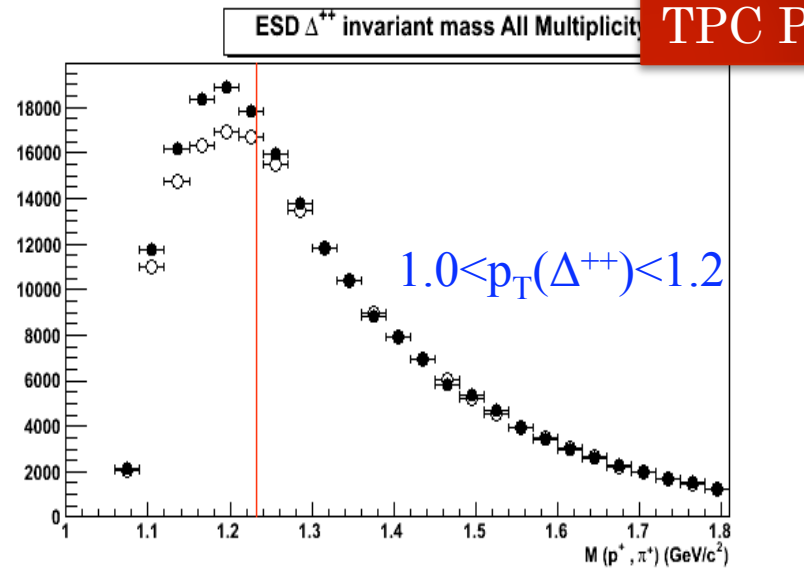
$$PSF(M_{p\pi}) = \frac{M_{p\pi}}{\sqrt{M_{p\pi}^2 + p_T^2}} exp\left(\frac{-\sqrt{M_{p\pi}^2 + p_T^2}}{T_{fo}}\right)$$

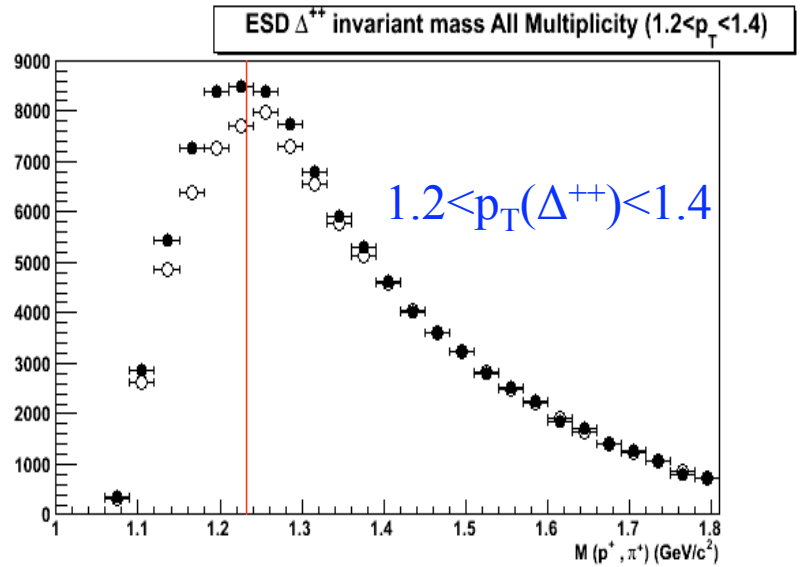
T_{fo}=160MeV
p_T = 0.8 GeV/c

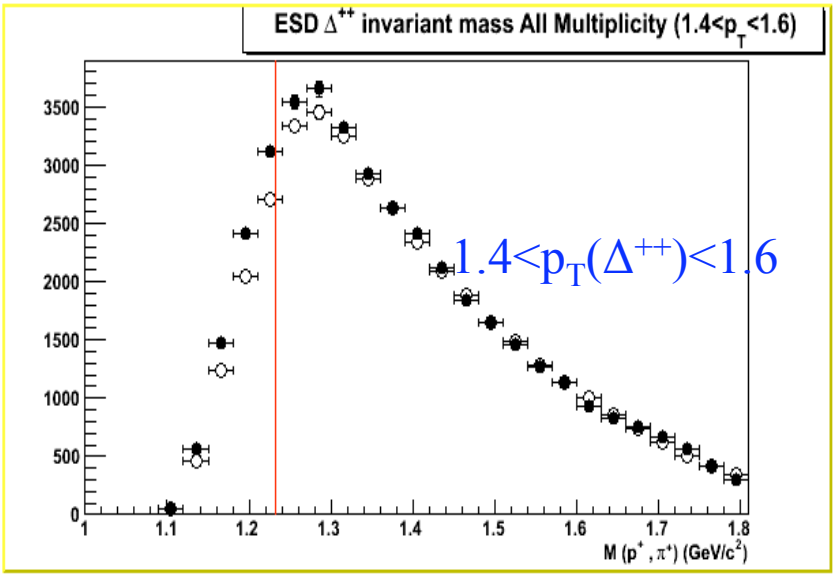
Δ^{++}-DATA Signal & Normalized Background

TPC PID





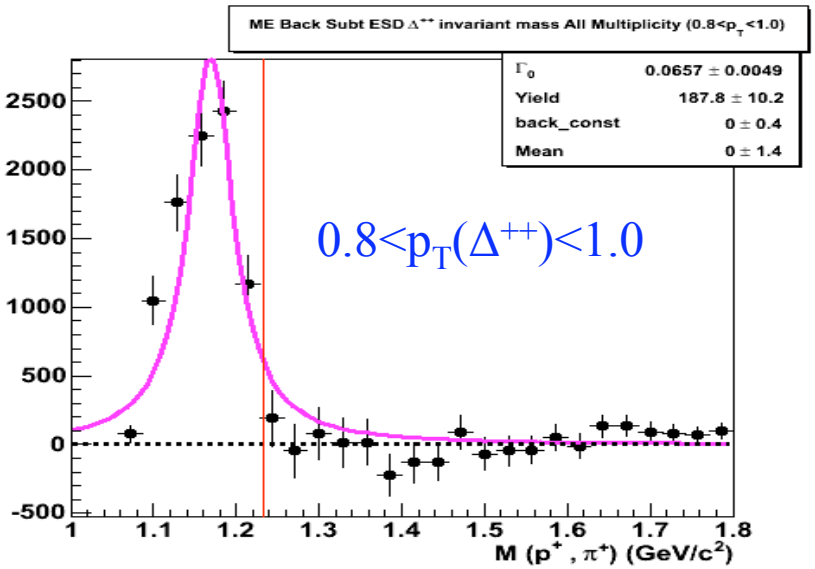


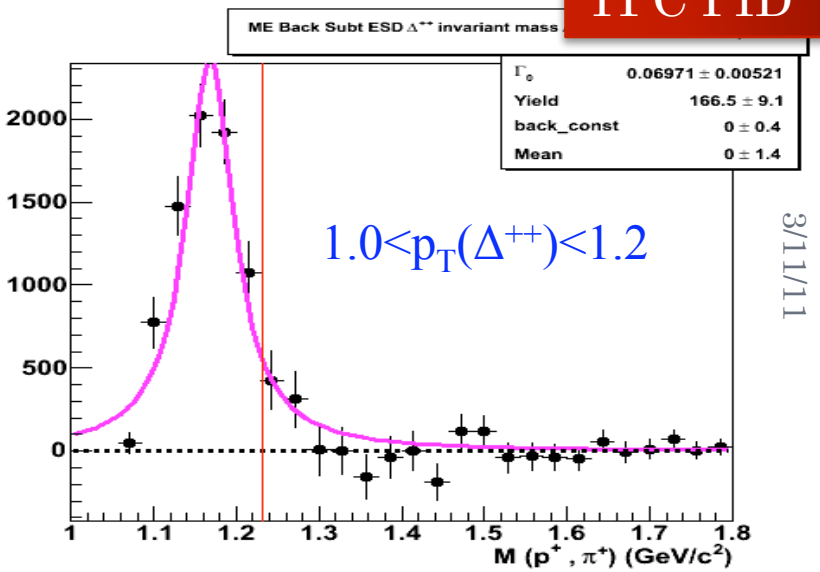


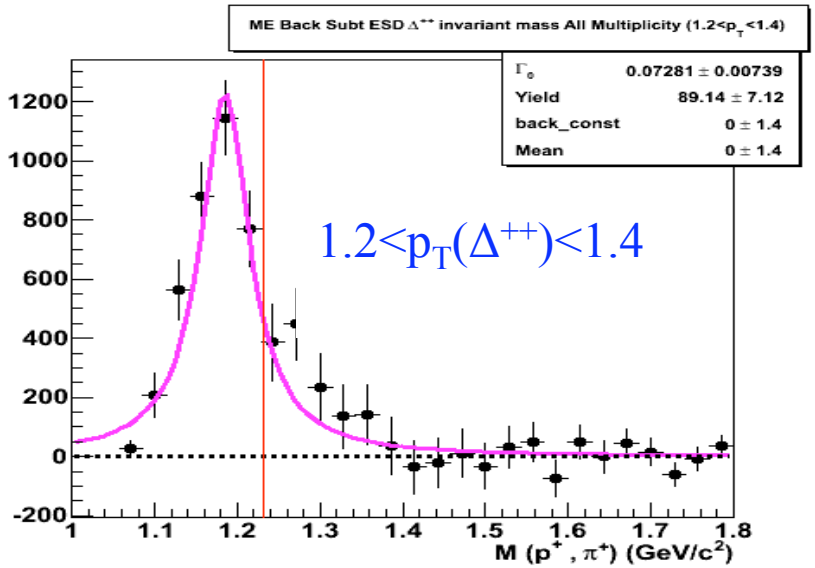
- Signal+ Background
  - Normalized Background

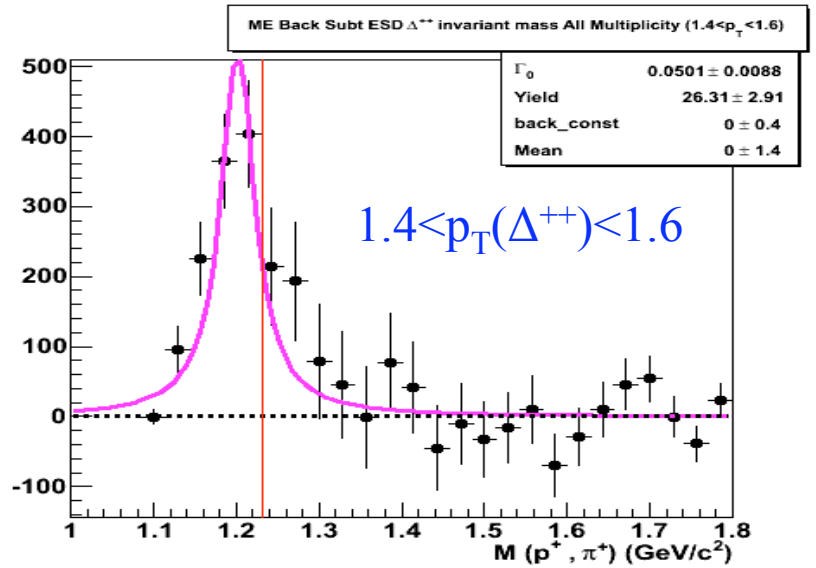
Δ^{++}-DATA Signal After Event Mixed Background Subtracted

TPC PID









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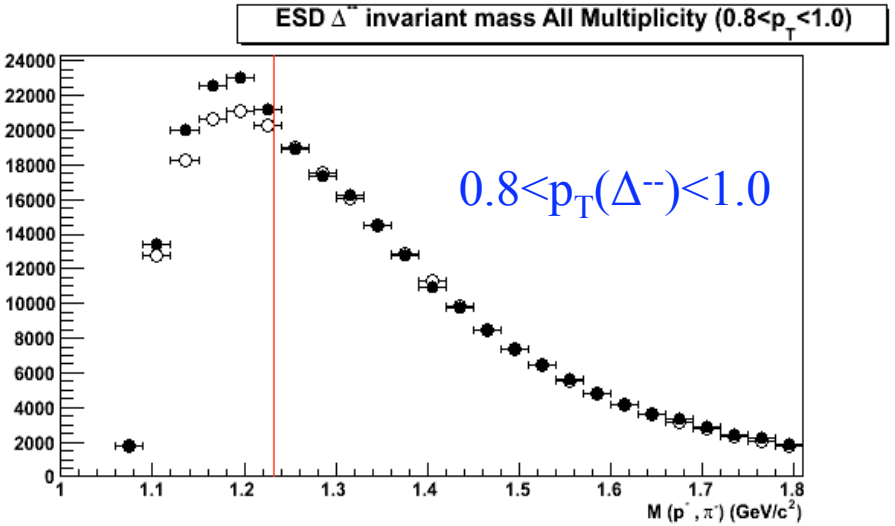
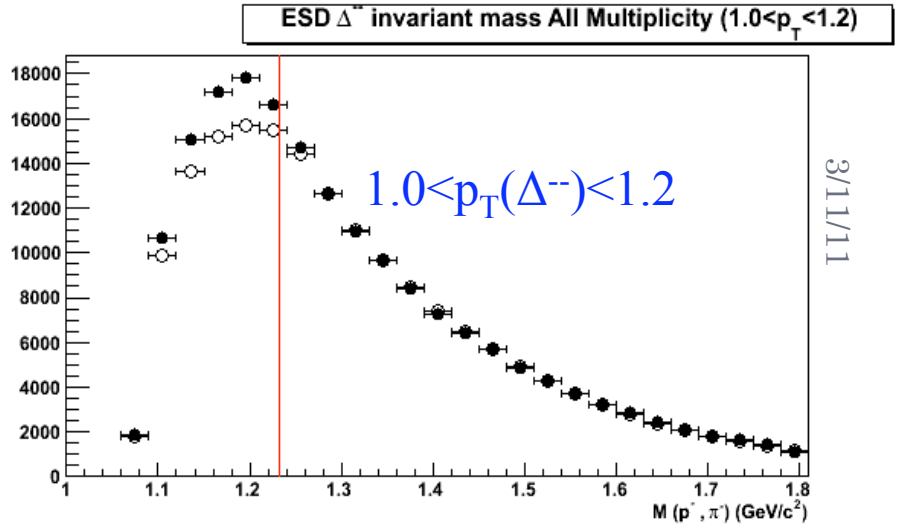
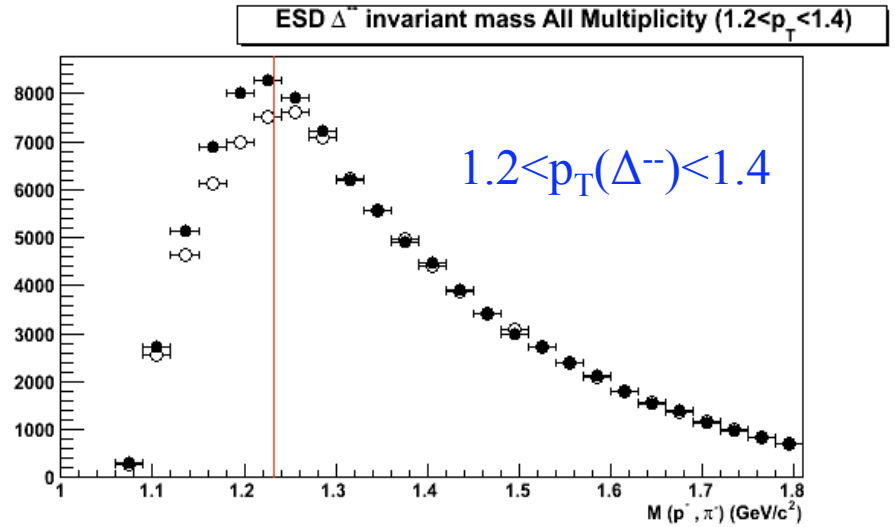
- $|y_{\Delta}|<0.5$

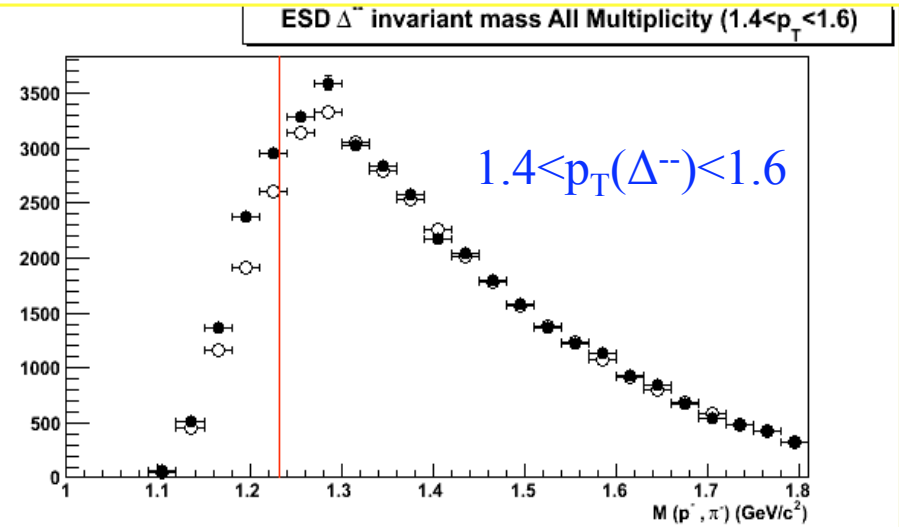
Δ^{--}-DATA Signal & Normalized Background

TPC PID









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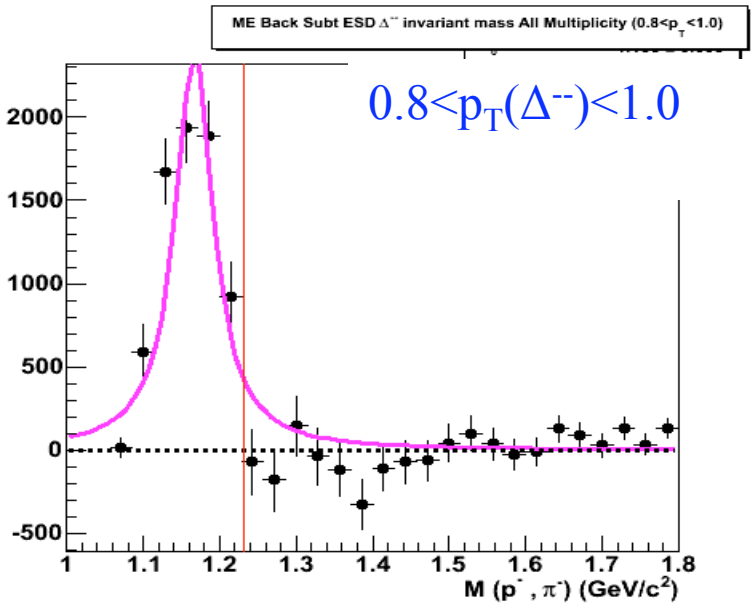
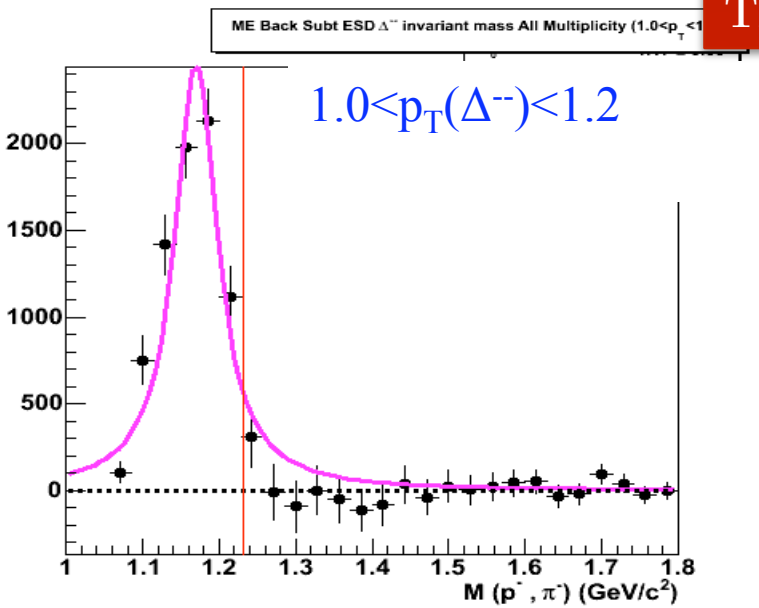
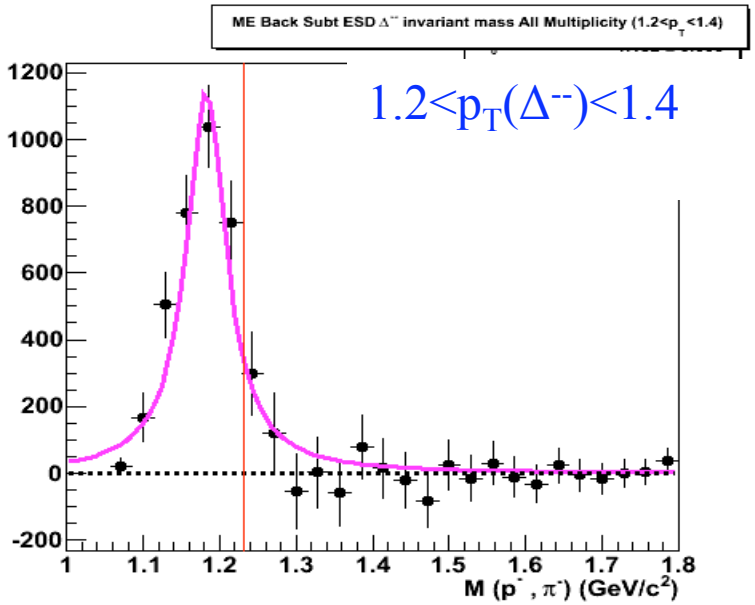
- Signal+ Background
  - Normalized Background

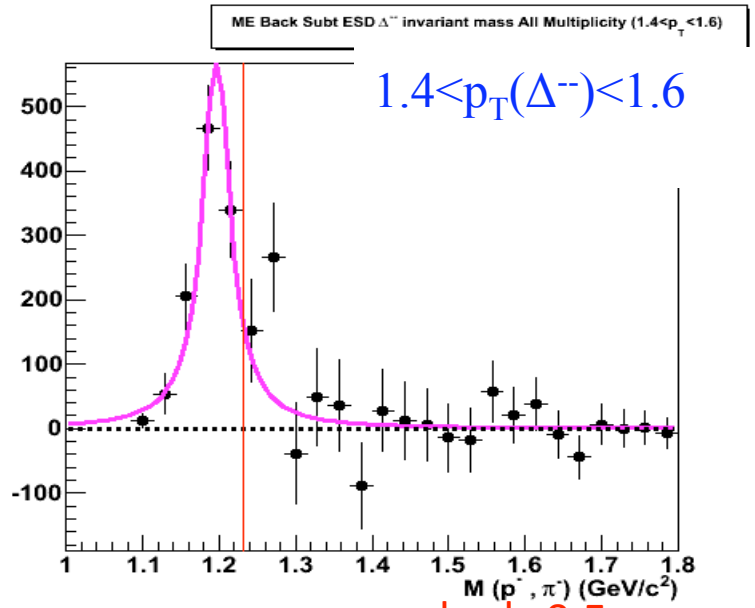
Δ^{--}-DATA Signal After Event Mixed Background Subtracted

TPC PID









- $|y_{\Delta}|<0.5$

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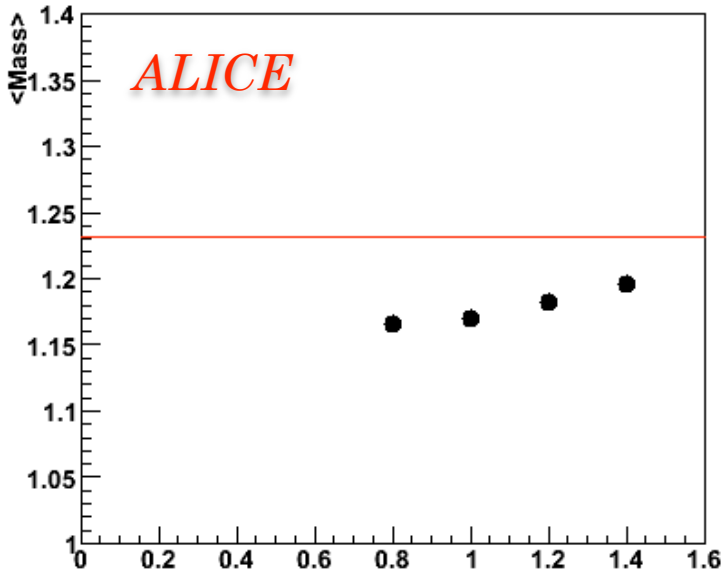
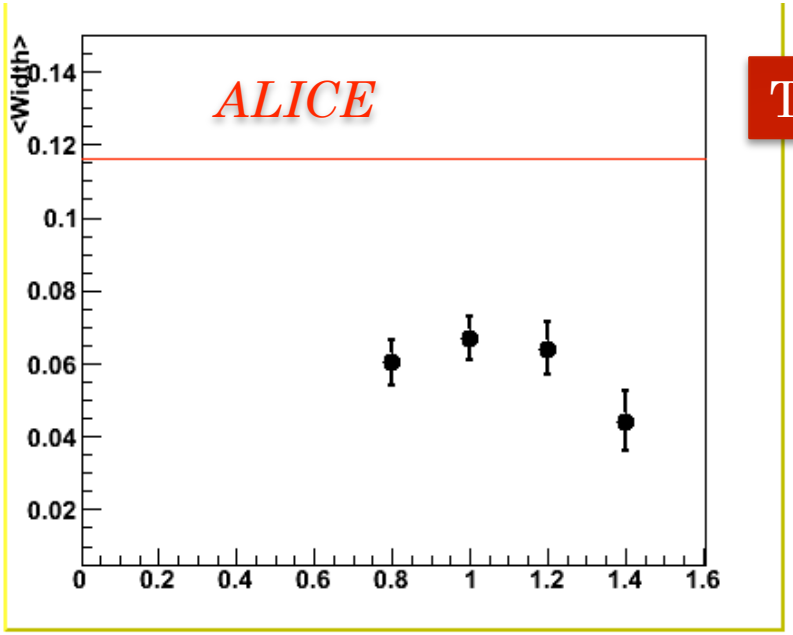
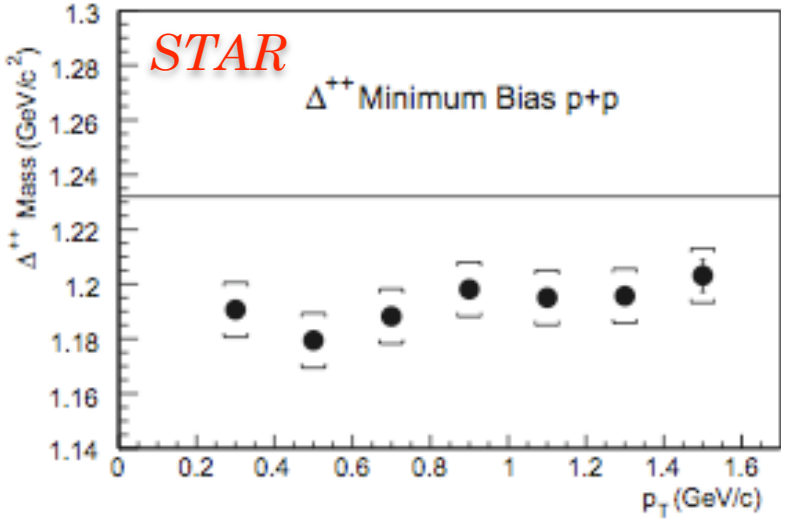
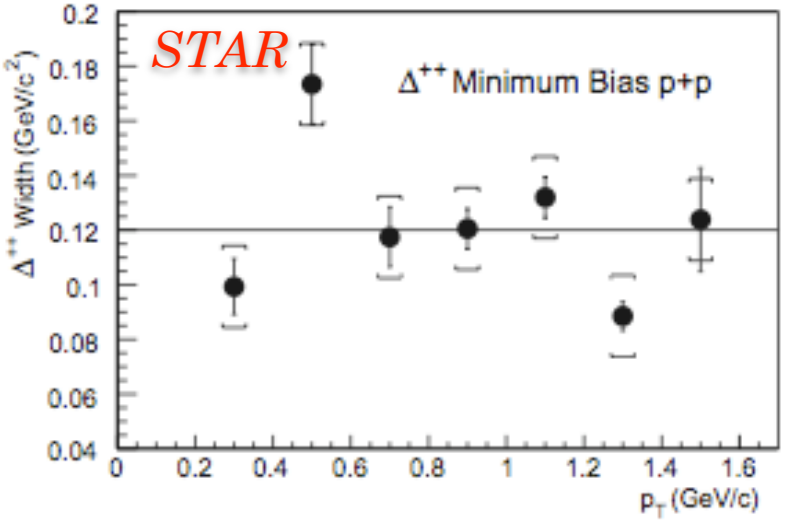
TPC PID

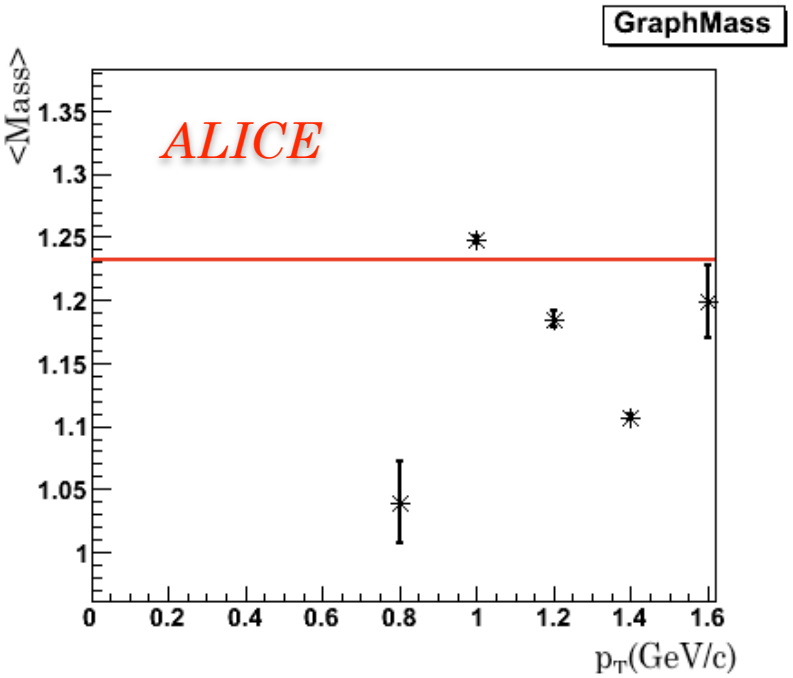

ALICE
<Mass>
1.4
1.35
1.3
1.25
1.2
1.15
1.1
1.05
1
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

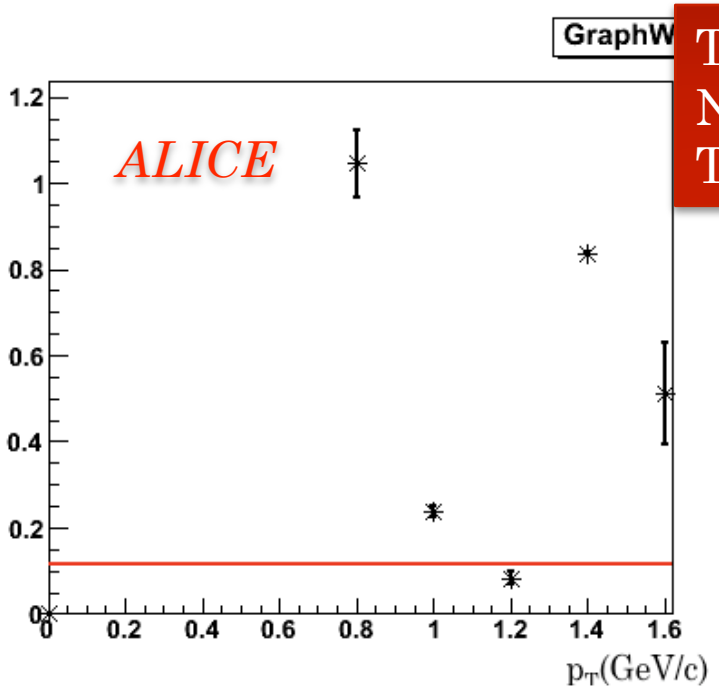

ALICE
<Width>
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6

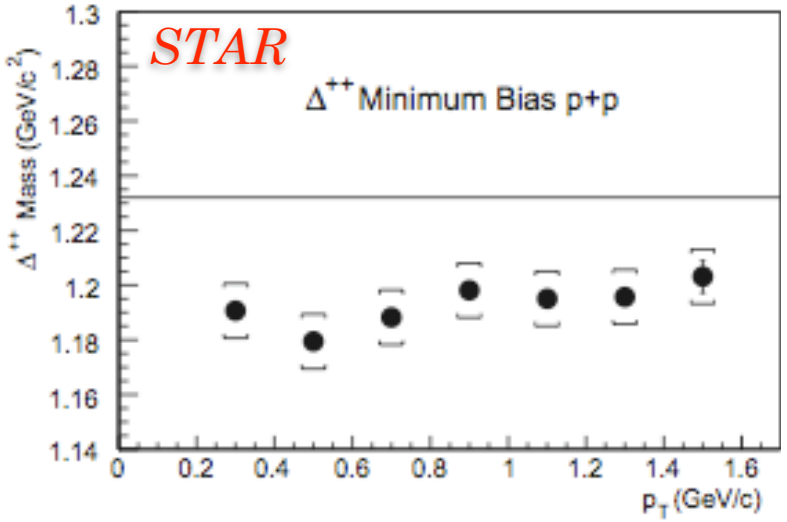

STAR
Δ++ Minimum Bias p+p
Δ++ Mass (GeV/c2)
1.3
1.28
1.26
1.24
1.22
1.2
1.18
1.16
1.14
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
pT (GeV/c)

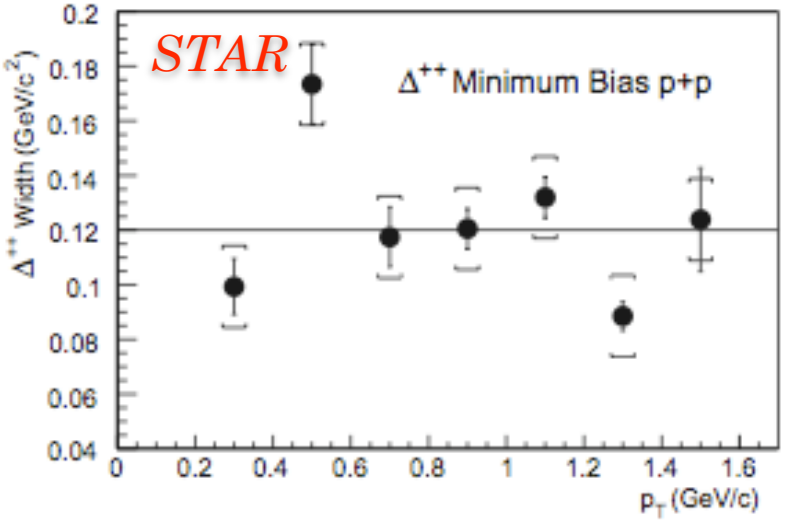

STAR
Δ++ Minimum Bias p+p
Δ++ Width (GeV/c2)
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
pT (GeV/c)

TPC+TOF PID
No p cut for TPC









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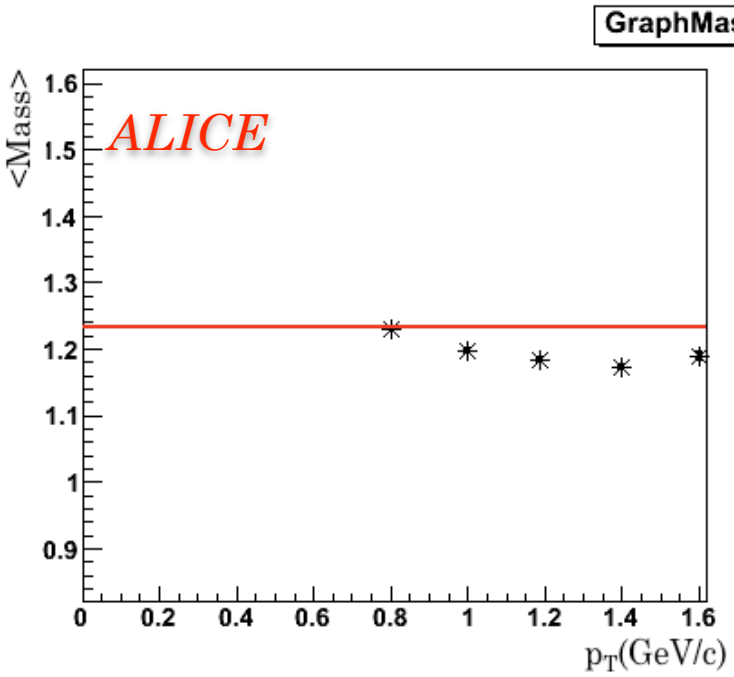
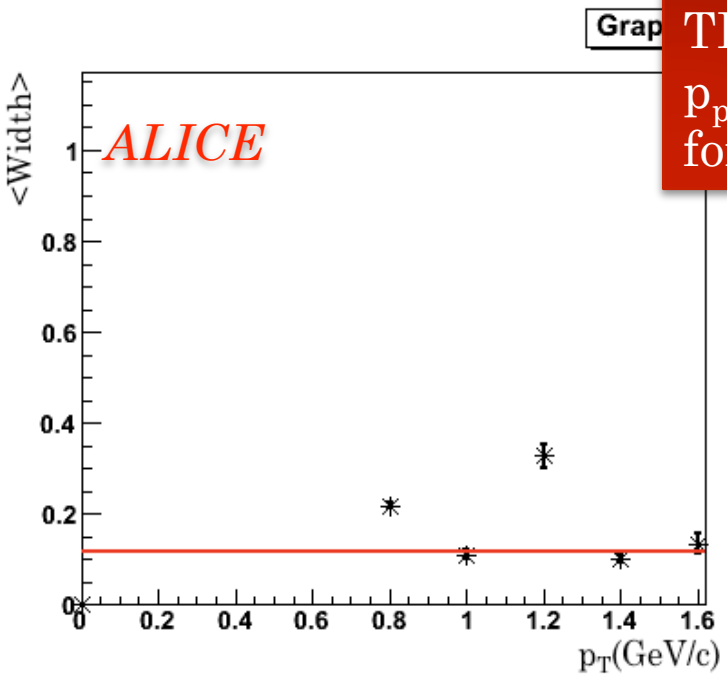
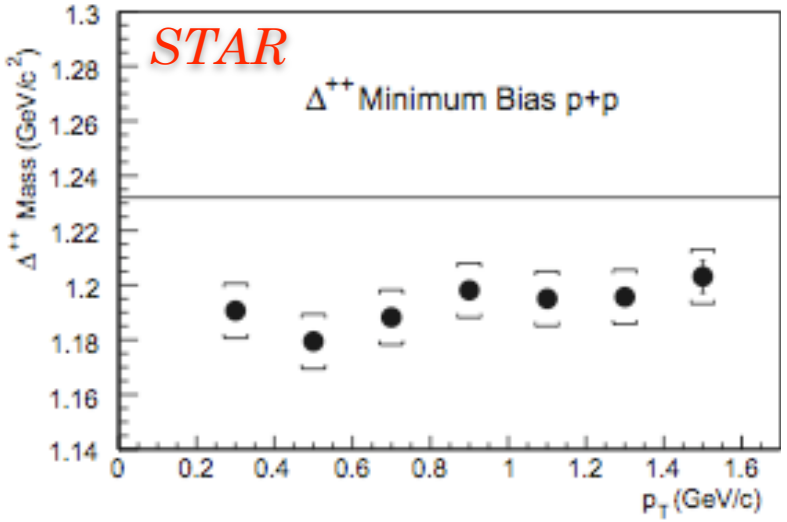
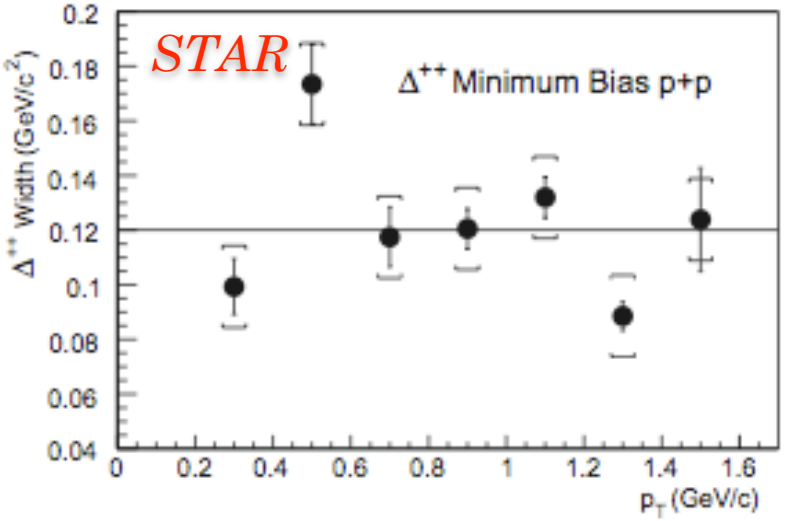
TPC+TOF PID
p_p<1.1 GeV/c
for TPC









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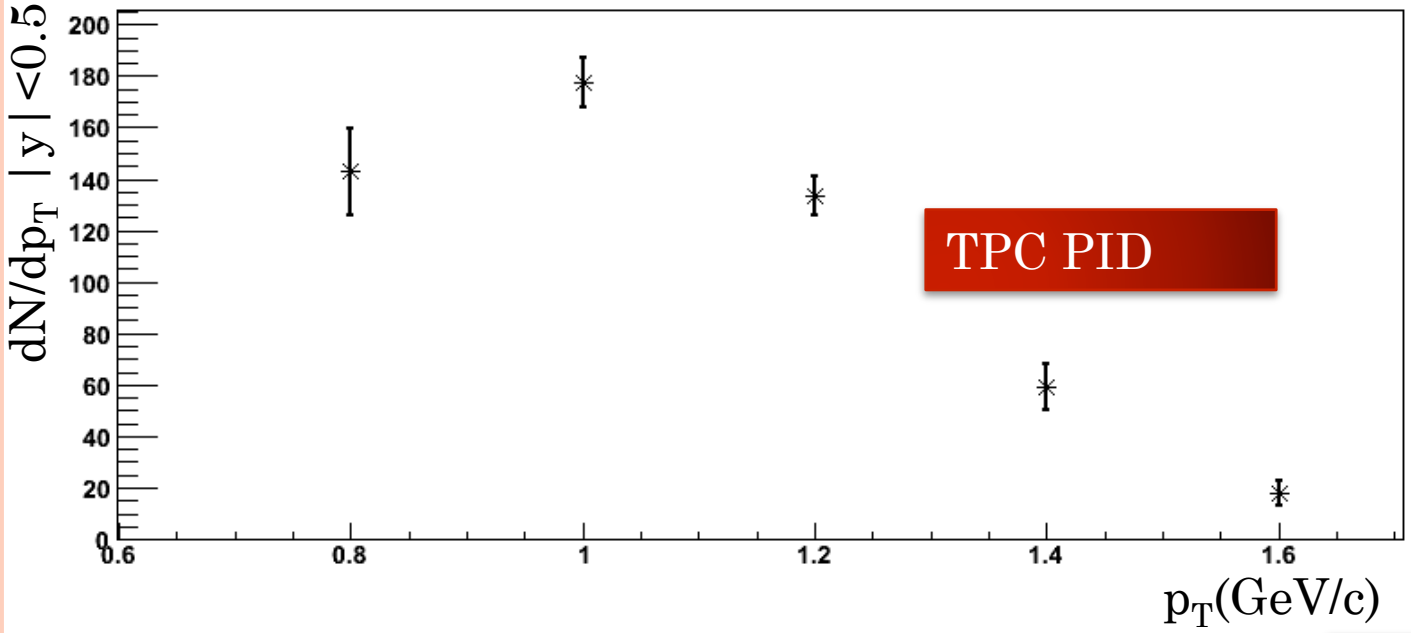
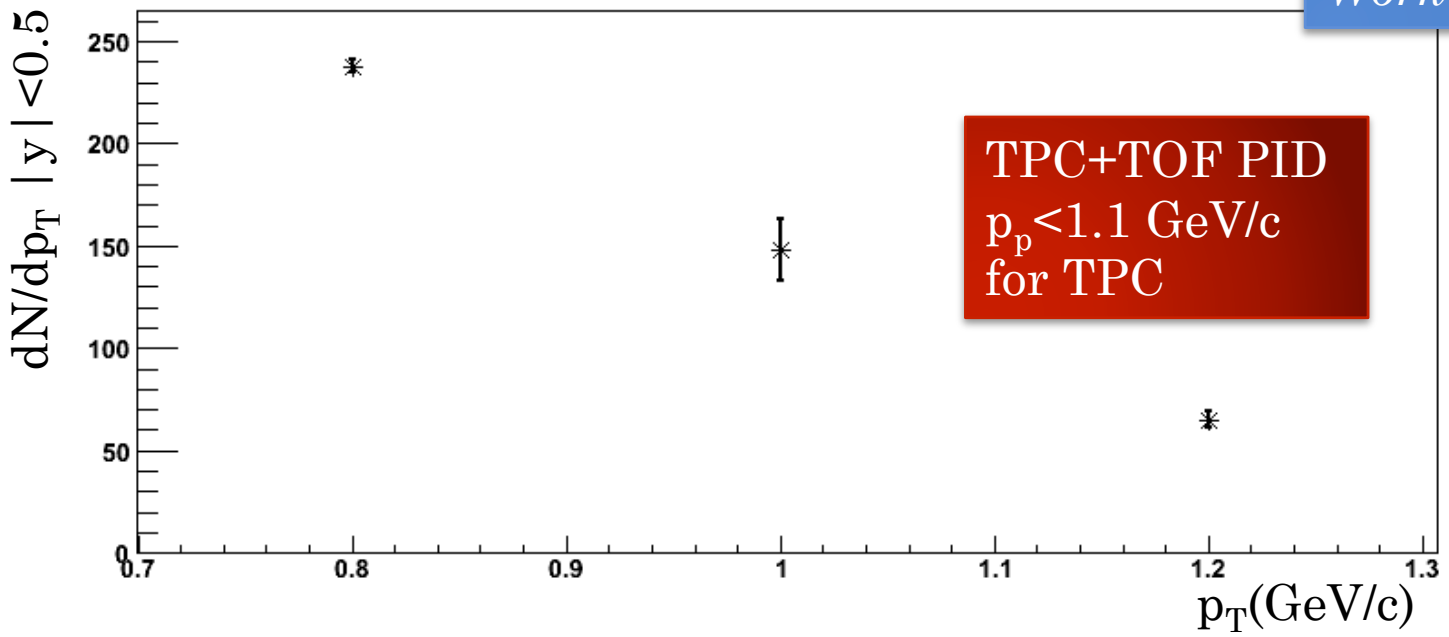


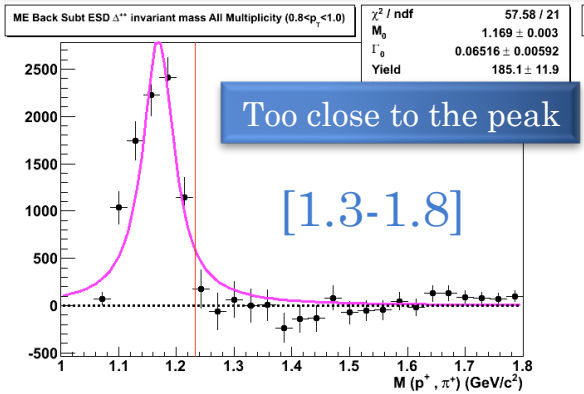
TPC PID

No correction applied
Statistical errors only
Work in progress



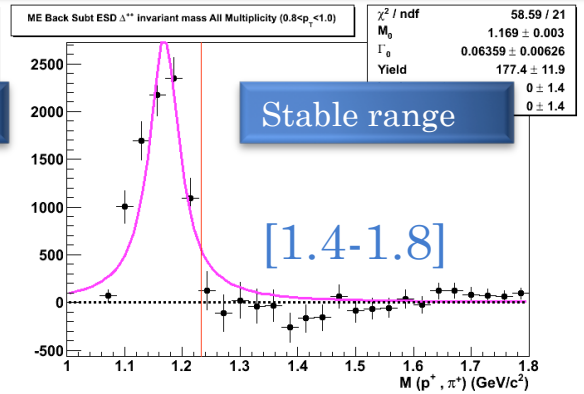
TPC+TOF PID
p_p<1.1 GeV/c
for TPC

Background Normalization Range



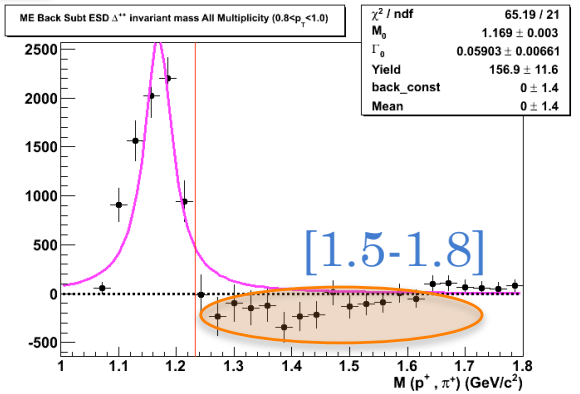
Too close to the peak

[1.3-1.8]

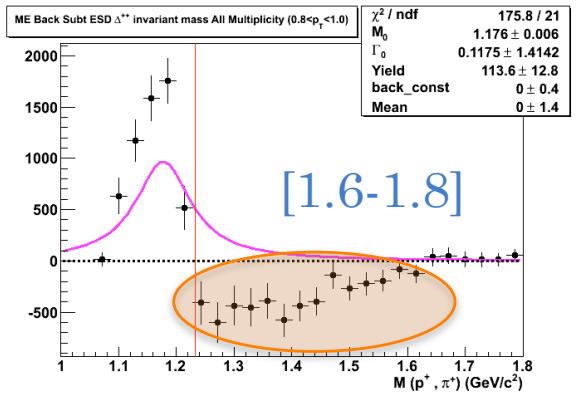


Stable range

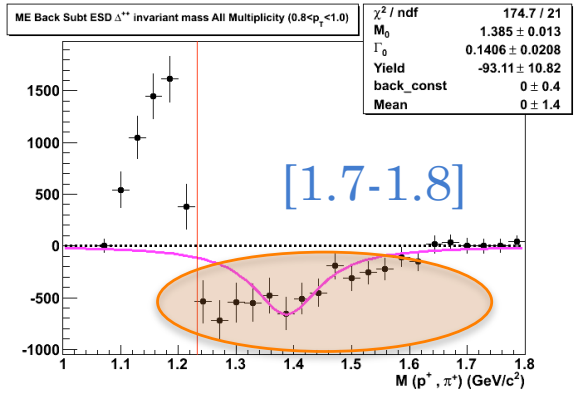
[1.4-1.8]



[1.5-1.8]



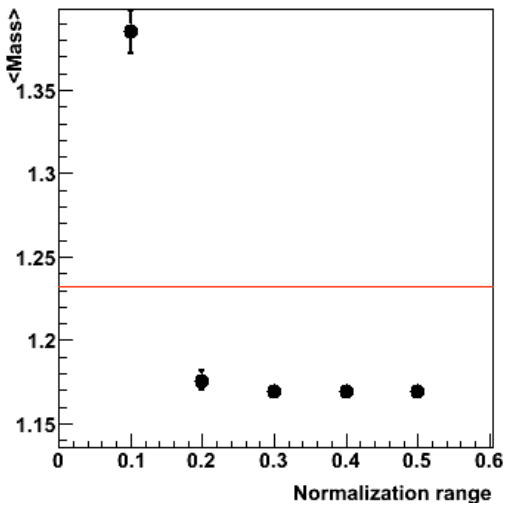
[1.6-1.8]

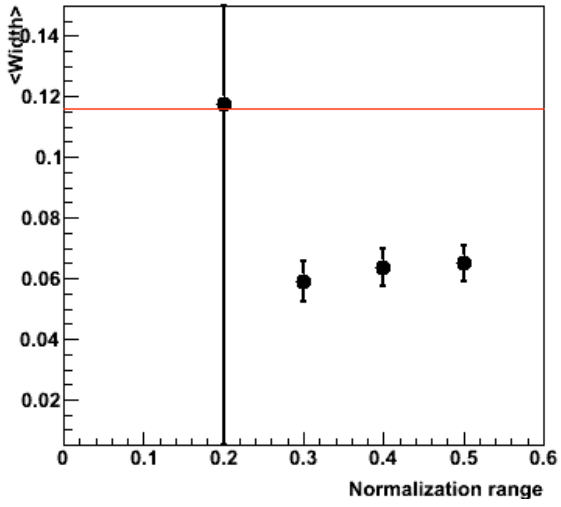


[1.7-1.8]

$0.8<p_T(\Delta^{++})<1.0$

TPC PID





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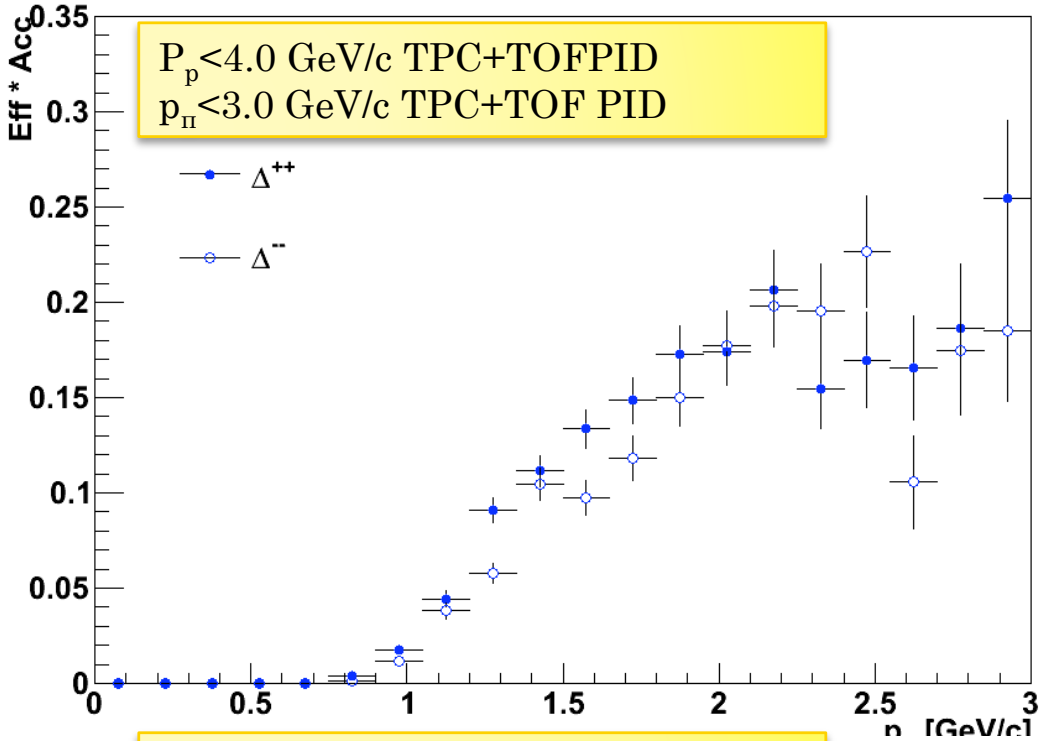
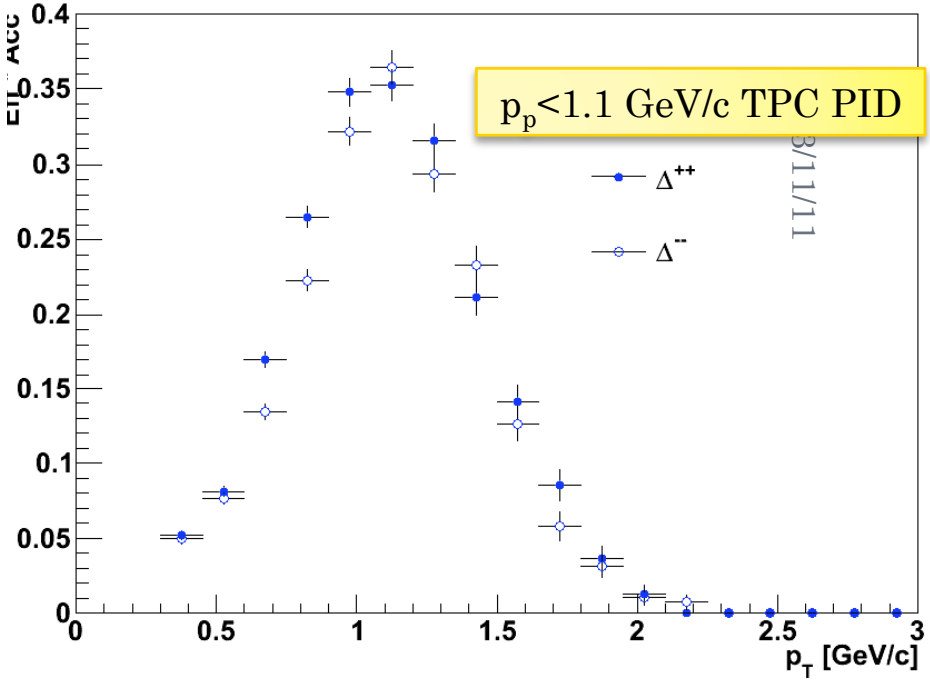
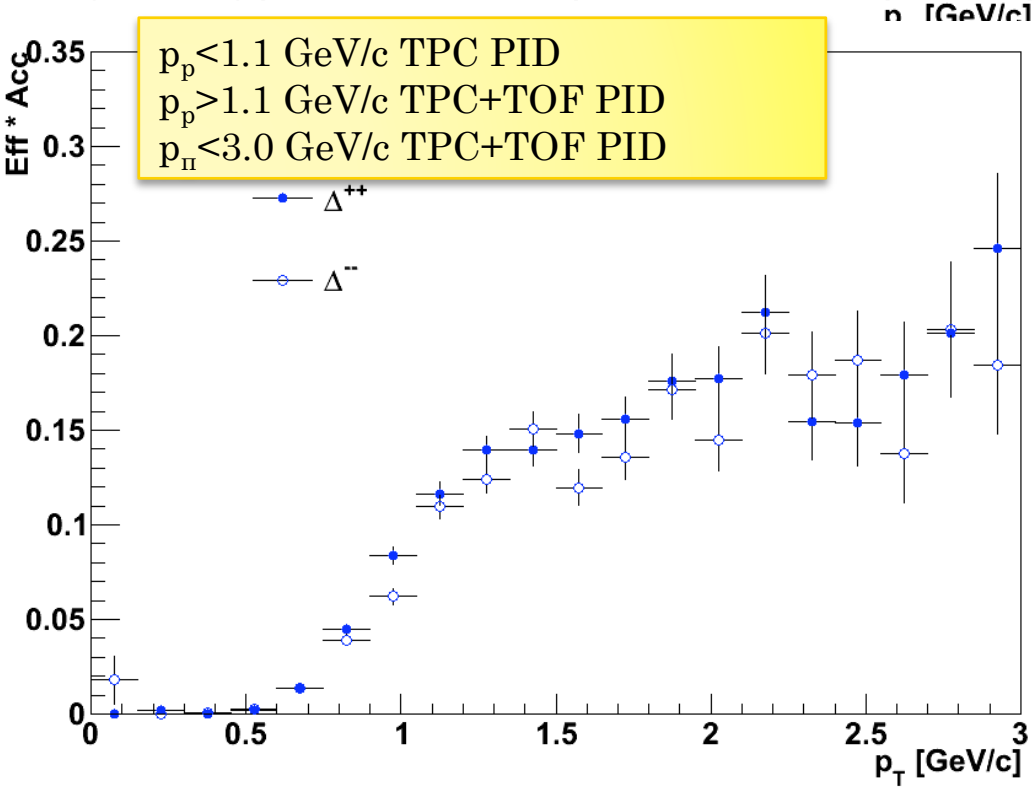






$$\varepsilon * Acc = \frac{Number\ of\ rec.\ \Delta\ in\ |Y| < 0.5}{Number\ of\ gen.\ \Delta\ in\ |Y| < 0.5}$$

THERMUS MODEL

•Thermus is a ROOT package of statistical-thermal model analyses for particle production in relativistic collisions.

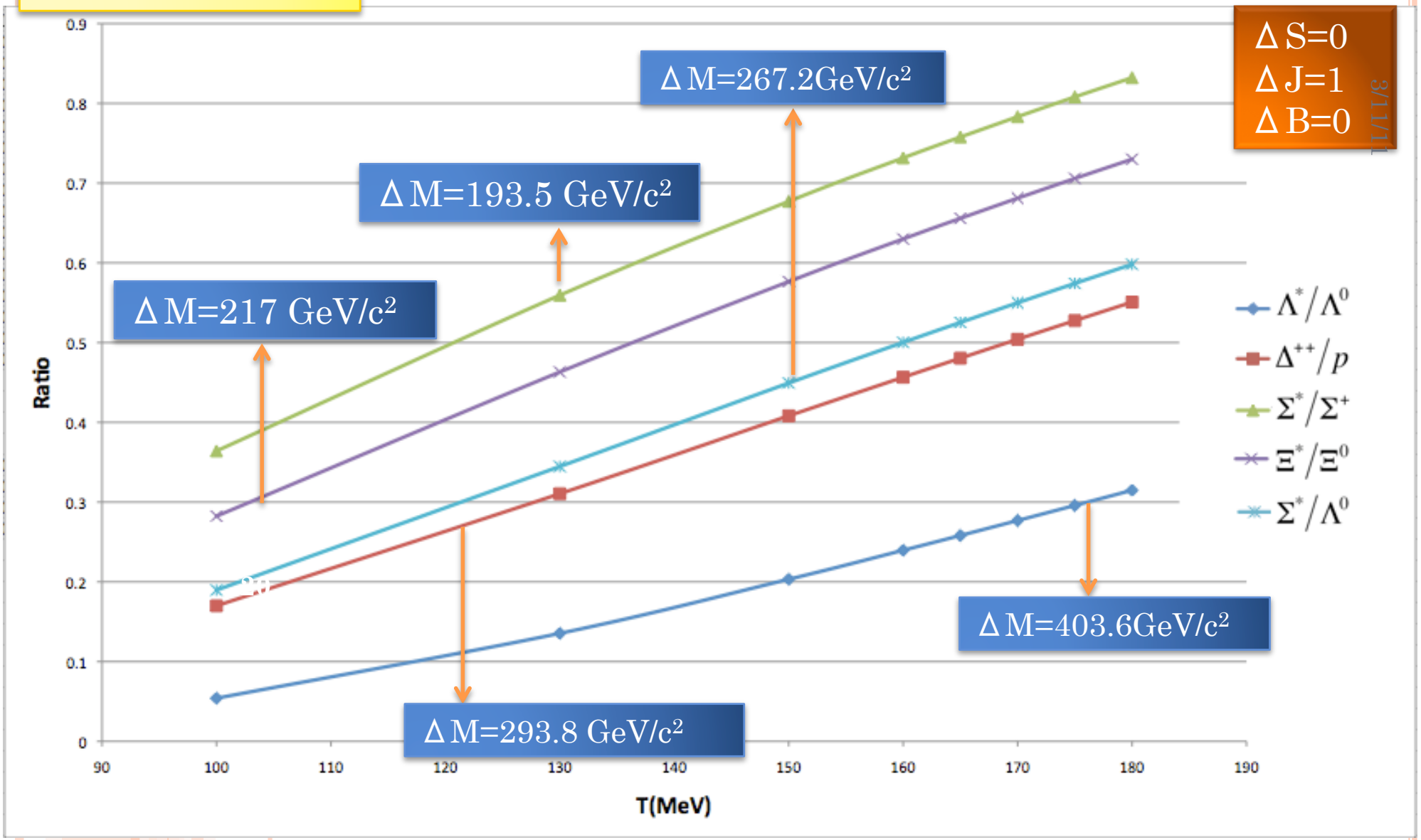
•Calculations are possible within three statistical ensemble,

- •Grand-canonical treatment of the conserved charges B,S and Q,➔HI collisions
- •Fully canonical treatment of the conserved charges
- •Strangeness-canonical ensemble, combining a canonical treatment of strangeness with a grand canonical treatment of baryon number and and electric charge.➔pp and HI collisions

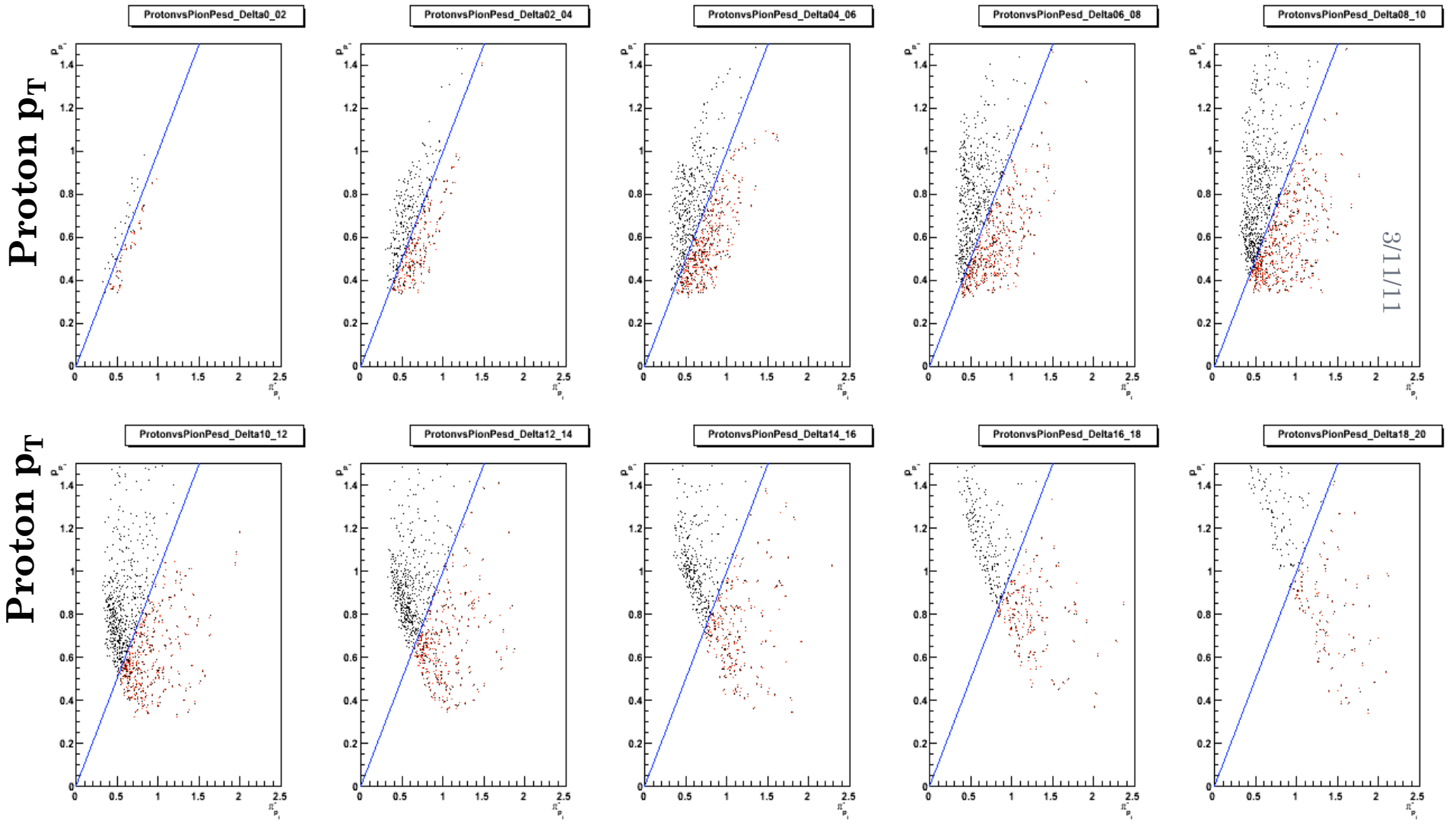
More Details: http://arxiv.org/abs/hep-ph/0407174v2

μ_B= 0.000092,
μ_q= 0.0,
γ_s=1,
R_c= 1.5 fm,
R= 4.0 fm

✓Ratio proportional with the T
✓Ratio inversely proportional with the mass difference



BACKUP


ProtonvsPionPesd_Delta0_02
ProtonvsPionPesd_Delta02_04
ProtonvsPionPesd_Delta04_06
ProtonvsPionPesd_Delta06_08
ProtonvsPionPesd_Delta08_10
ProtonvsPionPesd_Delta10_12
ProtonvsPionPesd_Delta12_14
ProtonvsPionPesd_Delta14_16
ProtonvsPionPesd_Delta16_18
ProtonvsPionPesd_Delta18_20
Proton p_T
Proton p_T
Pion p_T
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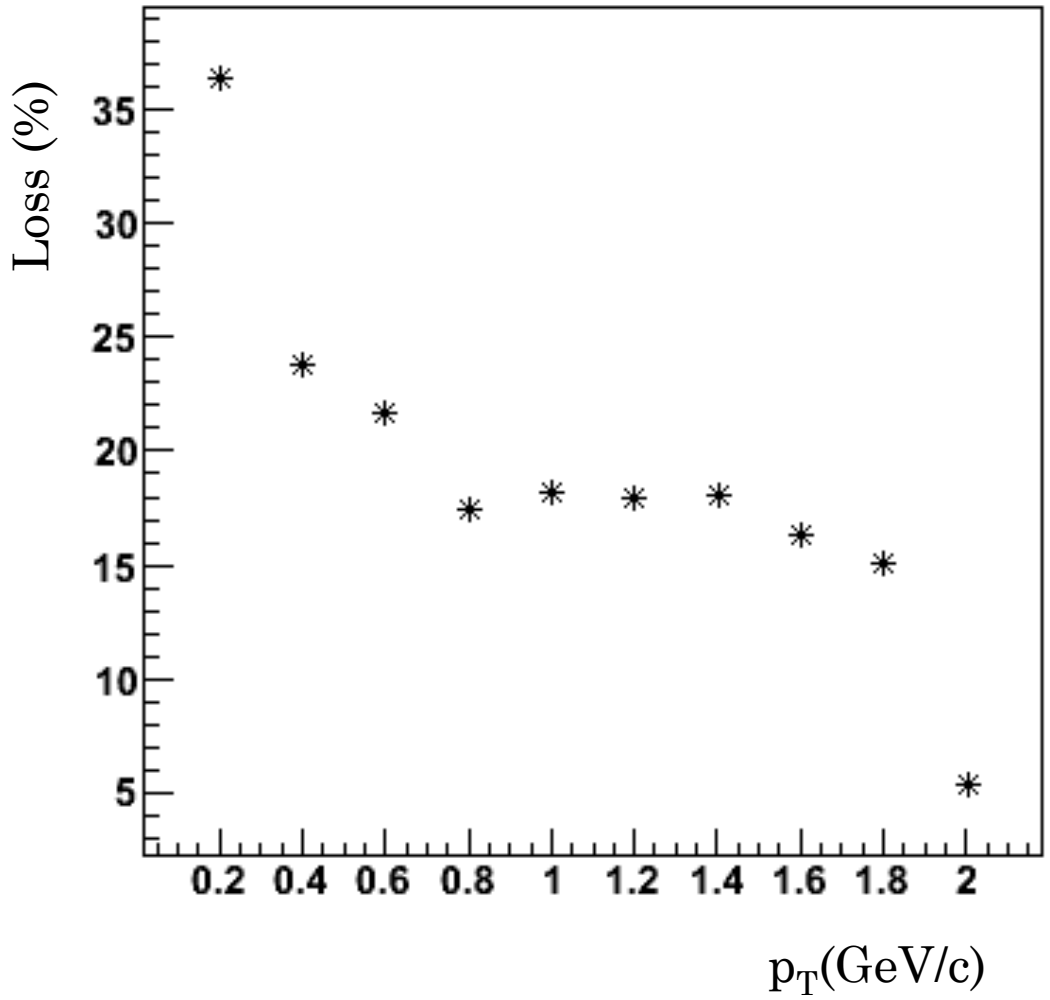

Loss Ratio of Δ particles when $p_p > p_\pi$ momentum cut applied

	Δ^{++}	p	Λ^0	Λ^*	Σ^+	Σ^{*+}	Ξ^0	Ξ^*	K^*	K^0_s
Mass	1232	938.2	1115.6	1519.5	1189.3	1382.8	1314.8	1531.8	891.66	497.61
Width (MeV/c)	116	-	24.9	15.6	81.9	35.8	22.6	9.1	48.7	73.5
$c\tau$ (fm/c)	1.7	-	7.89	13	2.404	5.51	8.71	21.6	4.05	2.68
J	3/2	1/2	1/2	3/2	1/2	3/2	1/2	3/2	1	0
Isospin	3/2	1/2	0	0	1	1	1/2	1/2	1/2	1/2
Parity	+	+	+	-	+	+	+	+	-	-
Strangeness	0	0	-1	-1	-1	-1	2	2	1	1
Baryon number	1	1	1	1	1	1	1	1	0	0