# Omega Production in 11.5 GeV AuAu Collision UpDate

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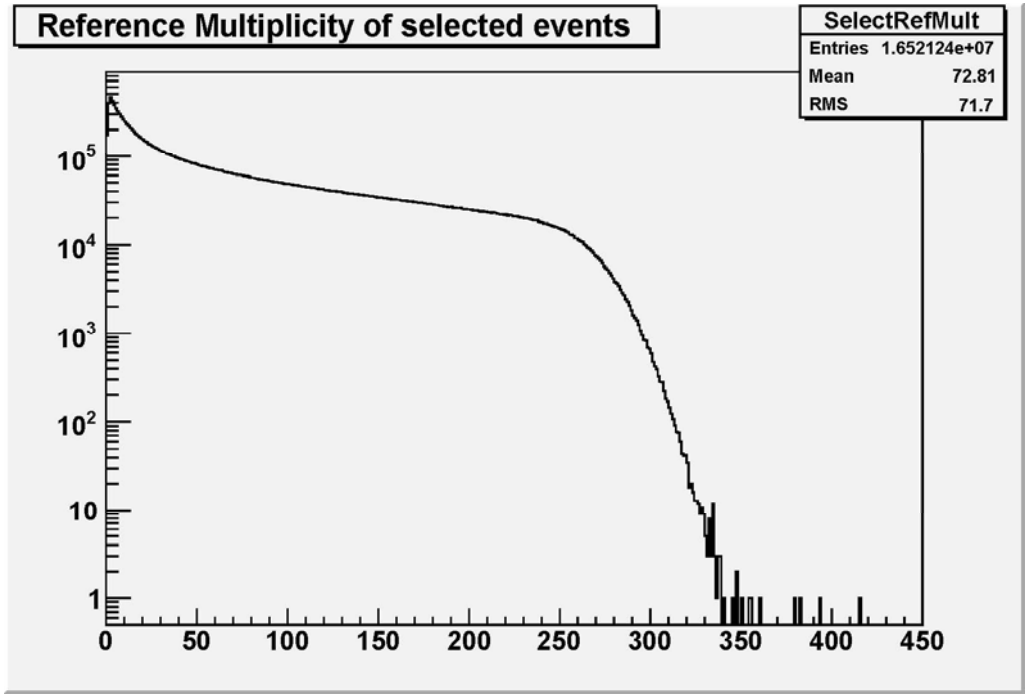
09/16/2010

# Data Set

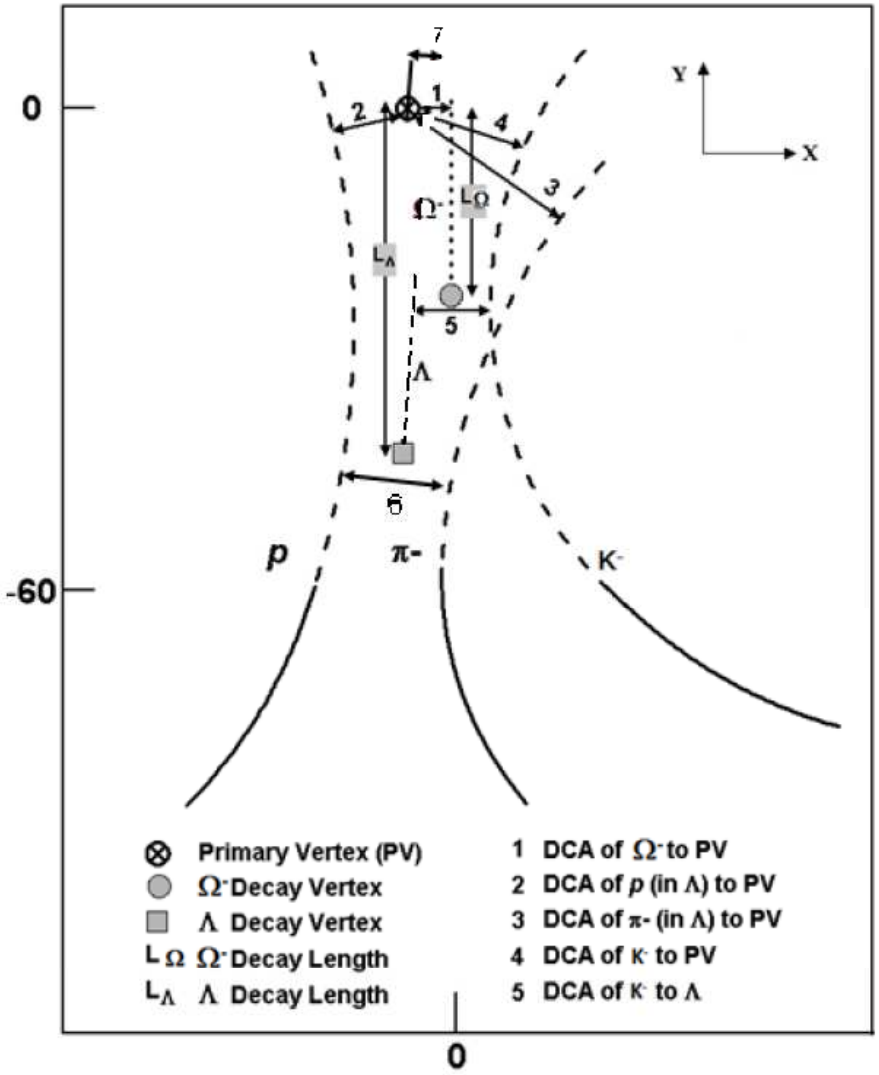
- AuAu 11.5GeV,  st_physics files
- Trigger ID: 310014
- Vertex_Z Cut: |Vz|<70cm,  sqrt(Vx^2+Vy^2)<2cm
- After Cut, we have 16.5 million data
- Centrality Definition  from Hiroshi Masui



# Track Selection:

- Nhits > 15
- $P_T$ >= 0.15 GeV/c
- |nSigma_dEdx| <= 4.0 (<= 3.0 for Proton)

# Geometrical Cuts on Ω




For Λ :

(2) Dca_Proton > 0.6cm

(3) Dca_Pion > 2.0cm

(6) Dca_Proton_to_Pion < 0.7cm

(7) Dca_ Λ > 0.4cm

($L_\Lambda$) DecayLength_Λ >5cm

For Ω :

(4) Dca_Kaon > 1.0cm

(5) Dca_ Λ _to_Kaon < 0.7cm

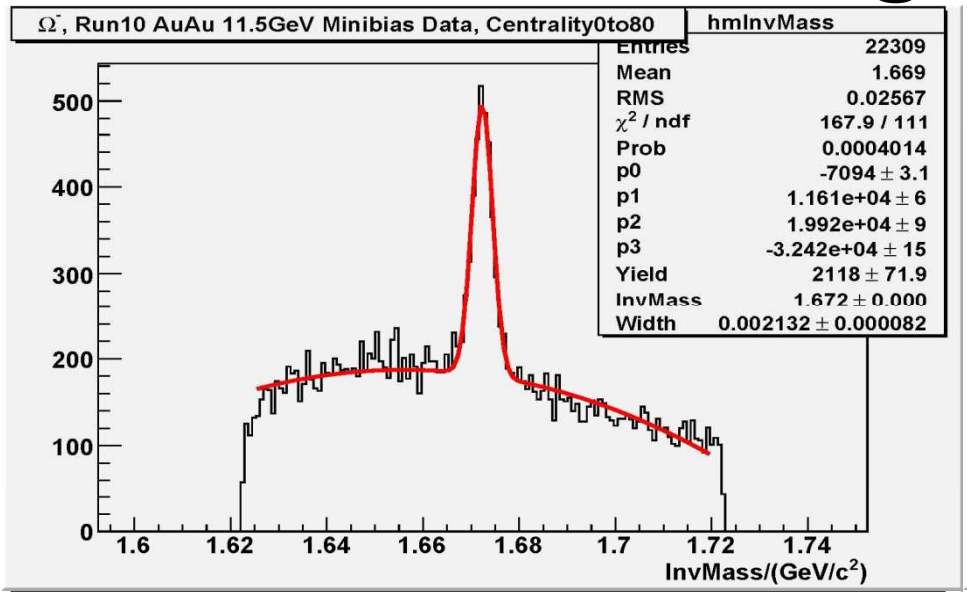
(1) Dca_ Ω < 0.4cm

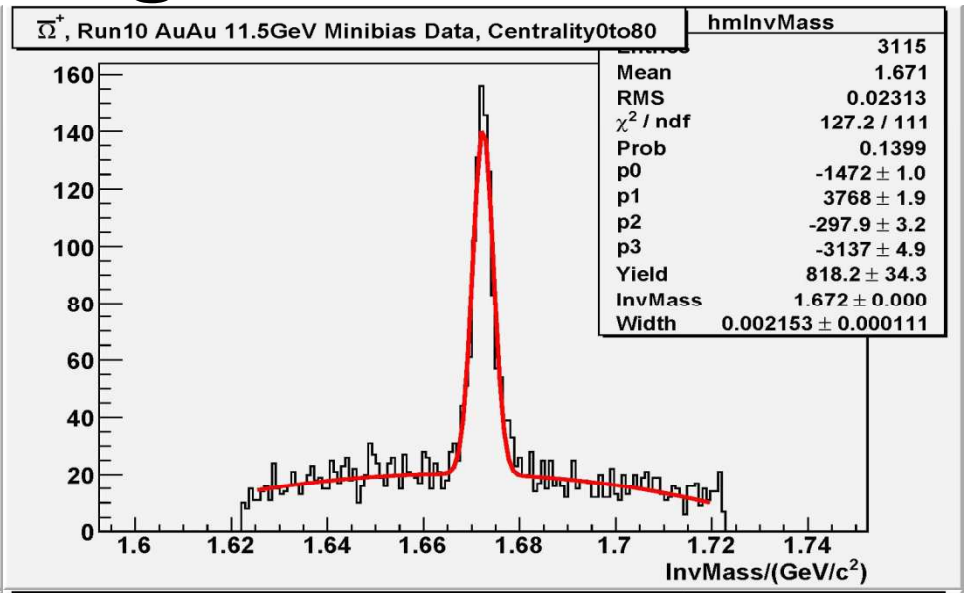
($L_\Omega$) DecayLength_Ω > 3cm

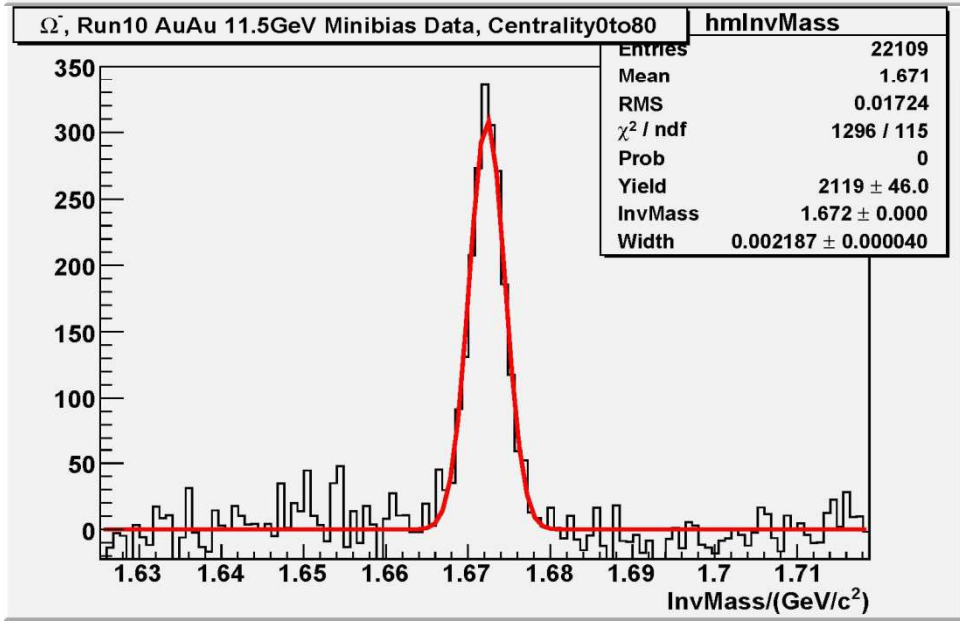
Besides, $L_\Lambda > L_\Omega$

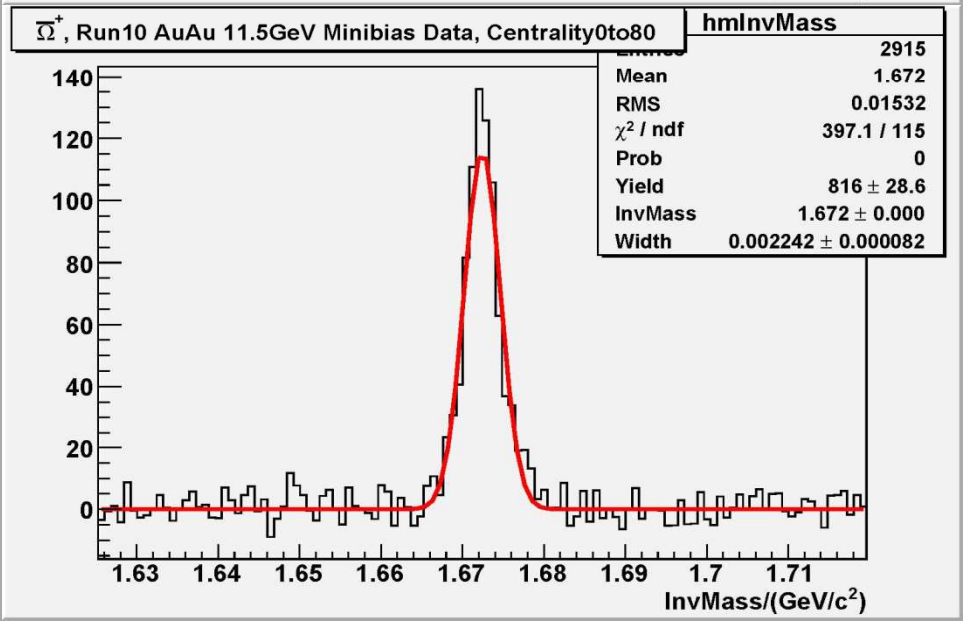
$$(\vec{r}_{V0} - \vec{r}_{Xi}) \cdot \vec{p}_{V0} > 0$$
$$(\vec{r}_{Xi} - \vec{r}_{PV}) \cdot \vec{p}_{Xi} > 0$$
$$(\vec{r}_{Xi} - \vec{r}_{PV}) \times \vec{p}_{Xi} / |\vec{r}_{Xi} - \vec{r}_{PV}| / |\vec{p}_{Xi}| > 0.15$$

# Omega Signal

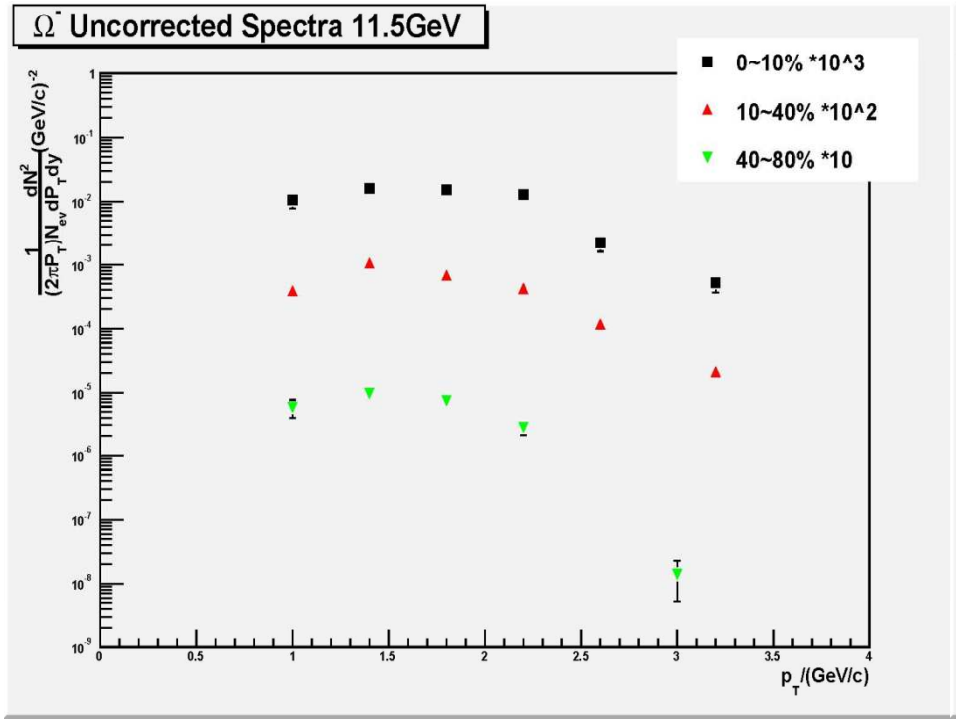


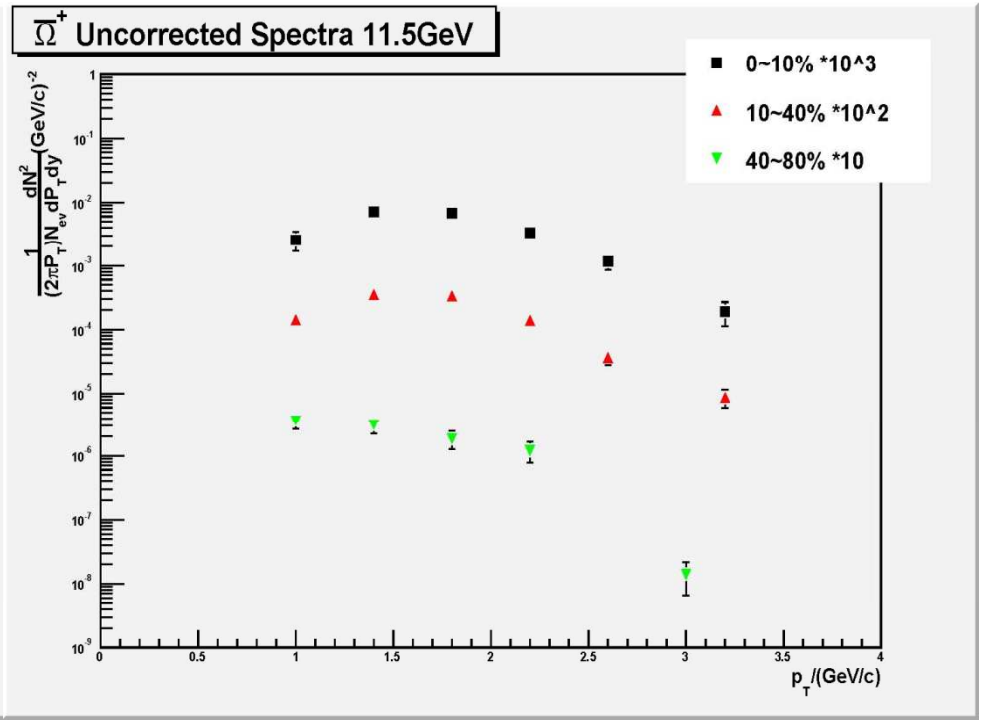



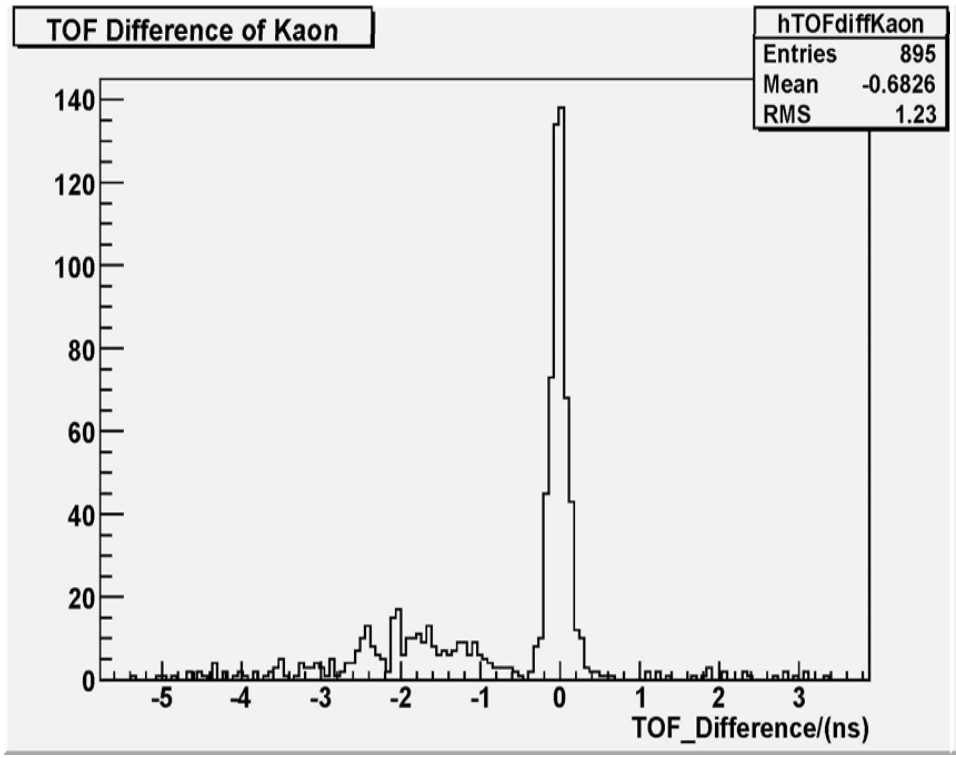
# Uncorrected Spectra

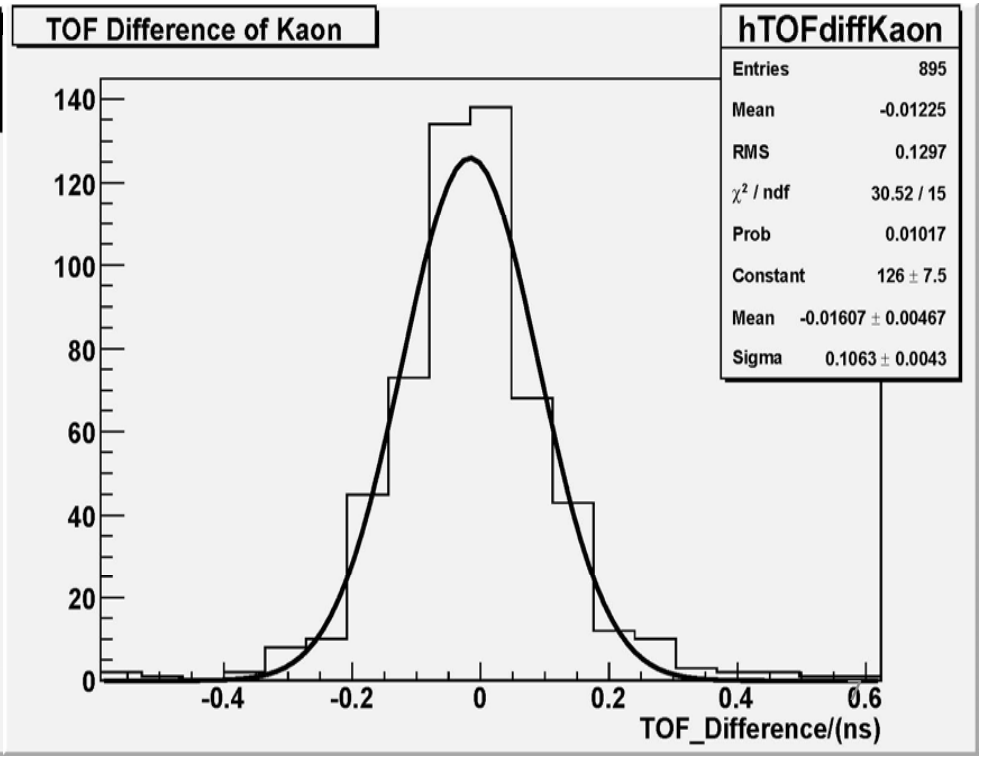


# TOF Cut on Kaon Track

- Theoretical Time of Flight = $\frac{\text{DecayLength}}{30 * \sqrt{1 + \frac{\text{Mass} * \text{Mass}}{\vec{P} \bullet \vec{P}}}}$
- Add the TOF_Kaon, TOF_Omega to be the TOF_theory
- TOF_difference = TOF_measured – TOF_theory

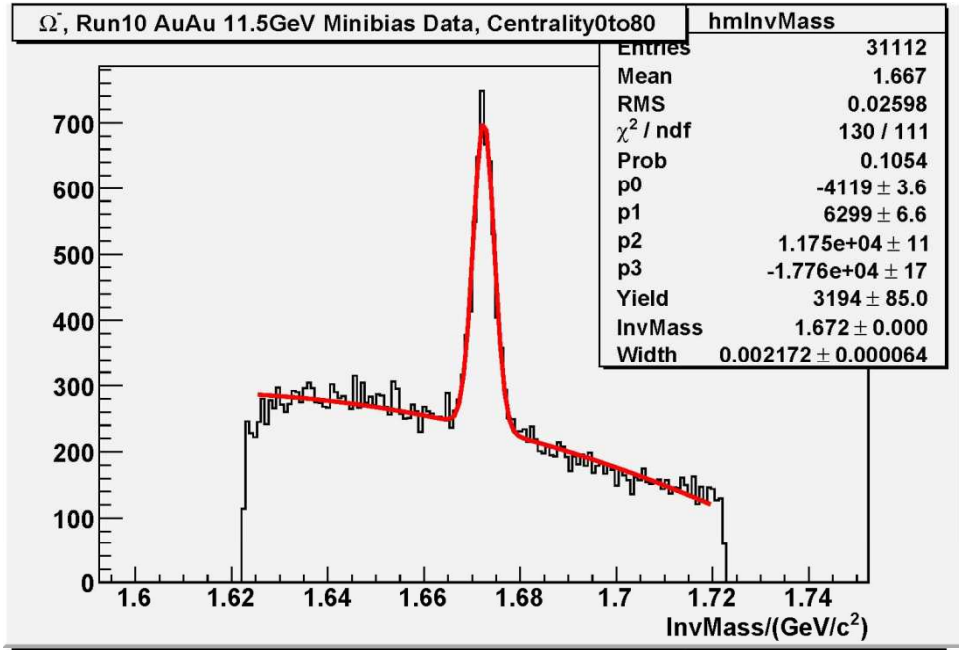


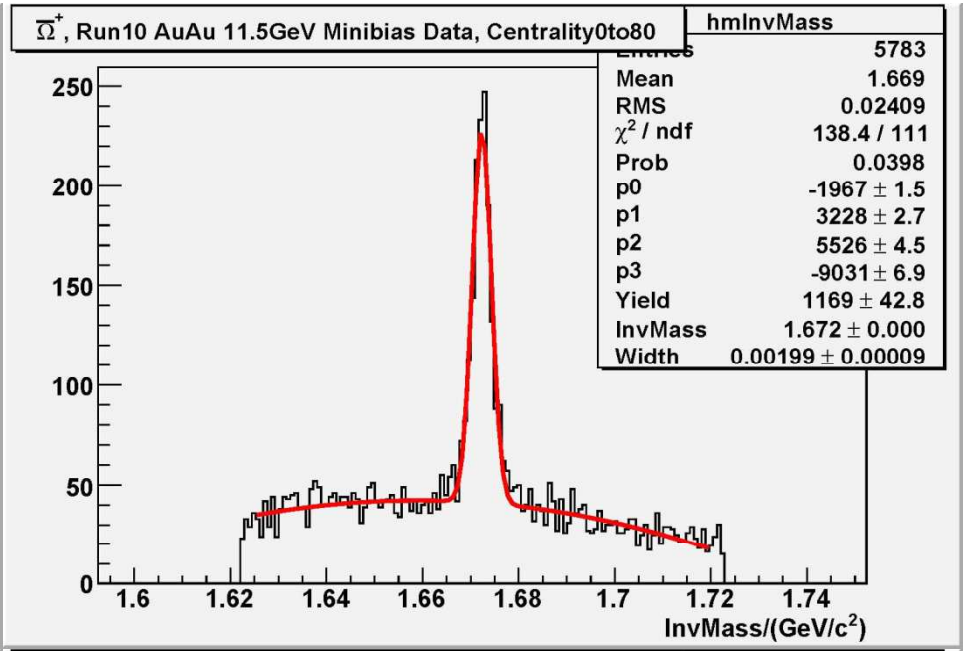



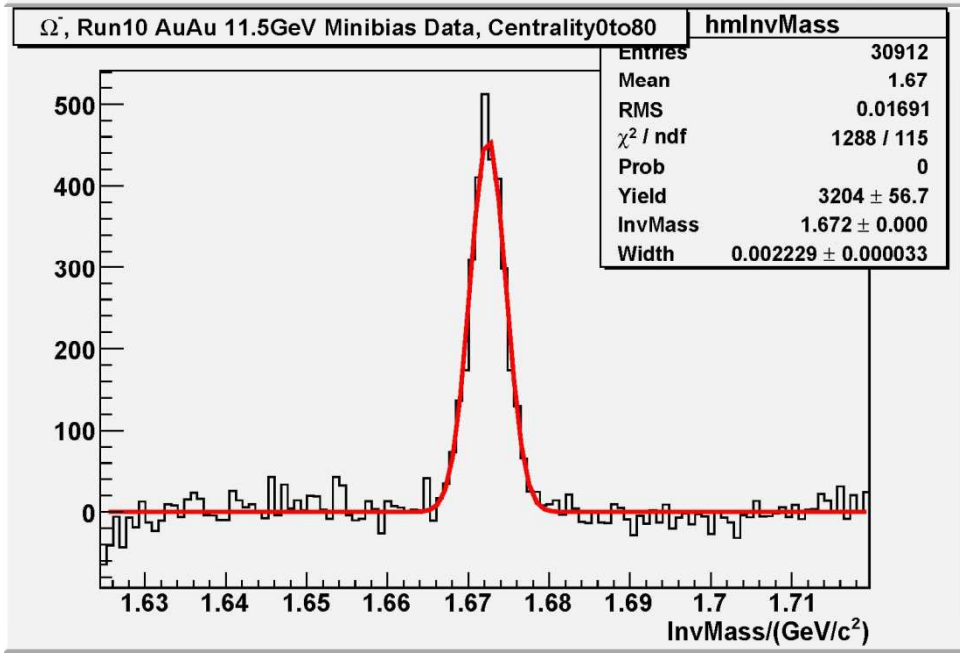
- Set |TOF_difference|<= 0.35 ns
  which is ~3 sigma of TOF resolution.
- Loose the geometrical cuts:

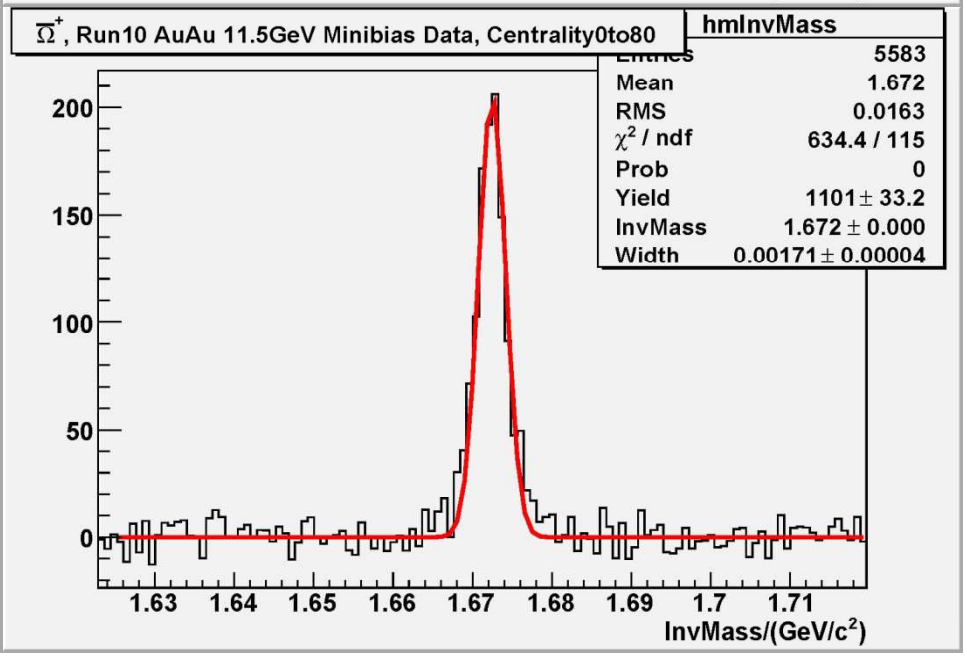
  Dca_Proton > 0.4cm
  Dca_Pion > 1.0cm
  Dca_Proton_to_Pion < 1.0cm
  Dca_ Λ > 0.3cm
  DecayLength_Λ >4cm
  Dca_Kaon > 1.0cm
  Dca_ Λ _to_Kaon < 1.0cm
  DecayLength_Ω > 2cm

- If a Kaon track has TOF match, then use TOF cut and the loose geometrical cuts; If doesn't have TOF match, then use strict geometrical cuts.




Ratio $\frac{\bar{\Omega}^+}{\Omega^-}$ = 0.37392, Error = 0.01911

# Omega Production in 7.7 GeV AuAu Collision

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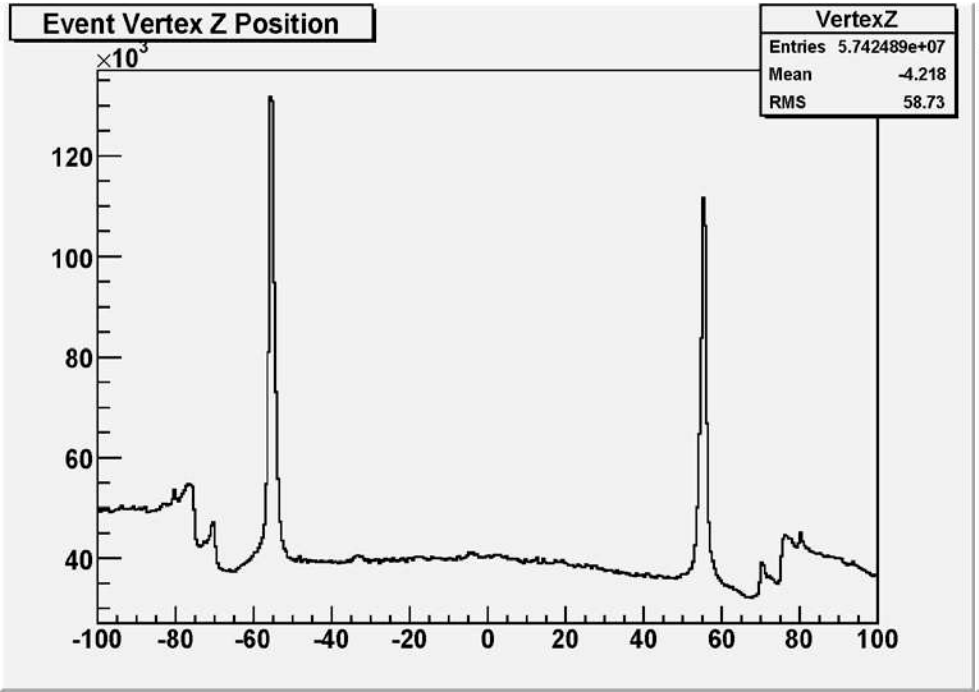
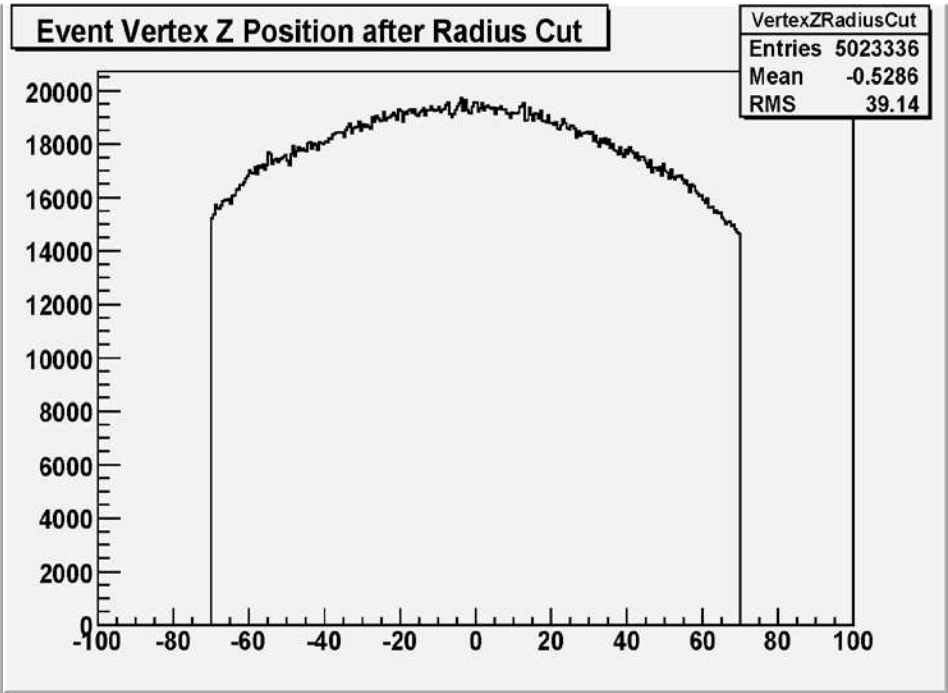
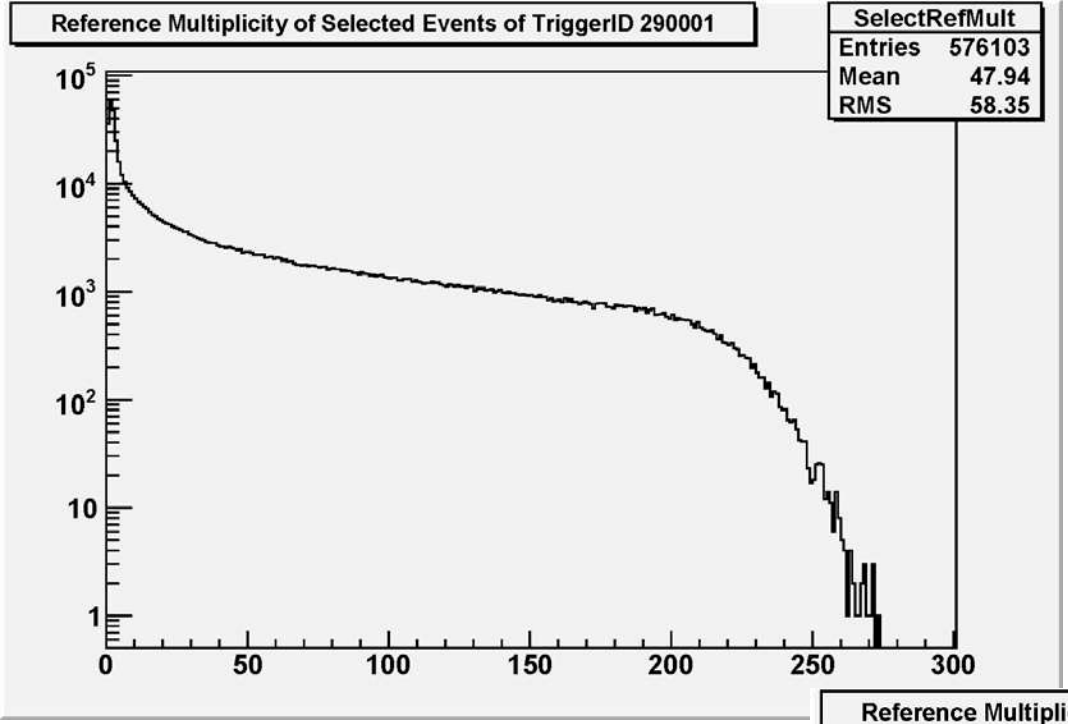
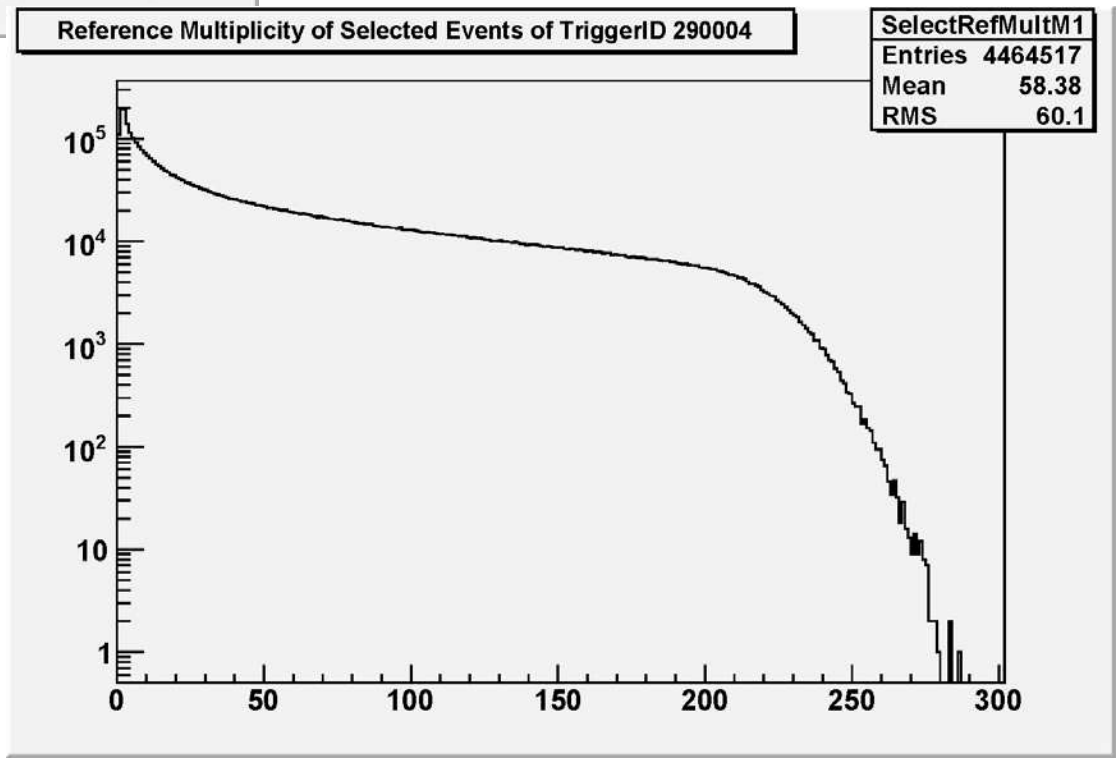
# Data Set

- AuAu 7.7GeV,  st_physics files
- Trigger ID: 290001, 290004
- Vertex_Z Cut: |Vz|<70cm,  sqrt(Vx^2+Vy^2)<2cm
- After Cut, we have about 5 million data
- Centrality Definition  from Hiroshi Masui



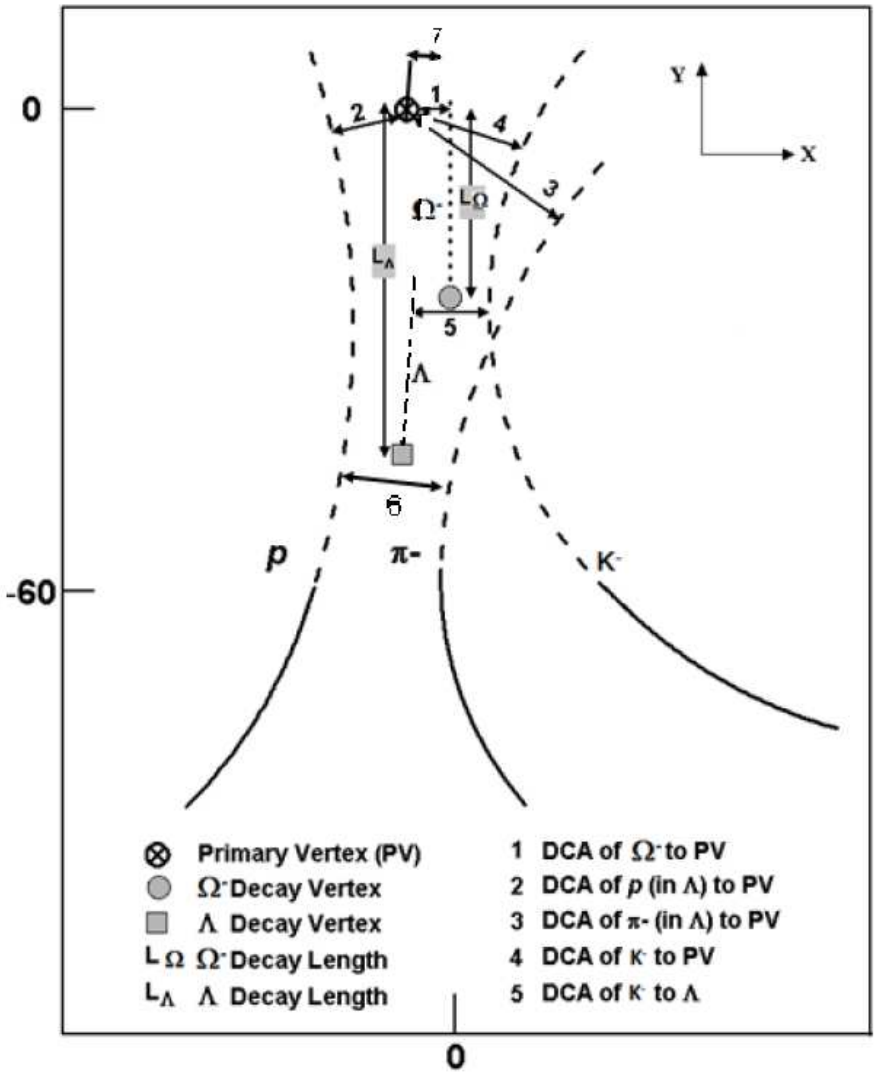

Reference Multiplicity of Selected Events of TriggerID 290001
SelectRefMult
Entries 576103
Mean 47.94
RMS 58.35
10^5
10^4
10^3
10^2
10
1
0
50
100
150
200
250
300


Reference Multiplicity of Selected Events of TriggerID 290004
SelectRefMultM1
Entries 4464517
Mean 58.38
RMS 60.1
10^5
10^4
10^3
10^2
10
1
0
50
100
150
200
250
300

# Track Selection:

- Nhits > 15
- $P_T$ >= 0.15 GeV/c
- |nSigma_dEdx| <= 4.0 (<= 3.0 for Proton)

# Geometrical Cuts on Ω




For Λ :

(2) Dca_Proton > 0.6cm

(3) Dca_Pion > 2.0cm

(6) Dca_Proton_to_Pion < 0.7cm

(7) Dca_ Λ > 0.4cm

($L_\Lambda$) DecayLength_Λ >4cm

For Ω :

(4) Dca_Kaon > 1.0cm

(5) Dca_ Λ _to_Kaon < 0.7cm

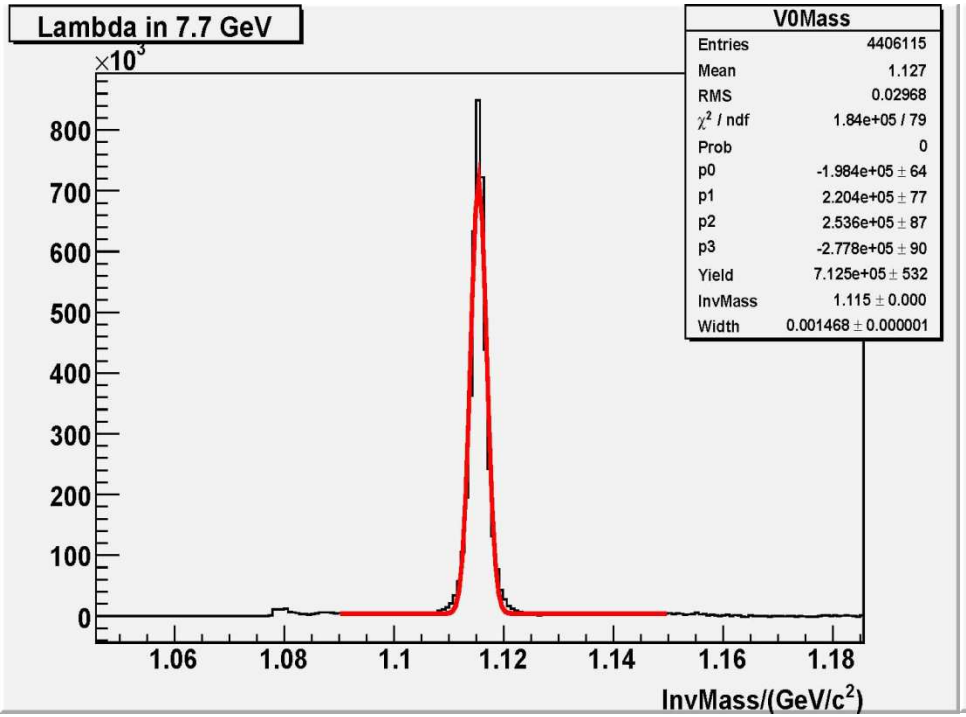
(1) Dca_ Ω < 0.4cm

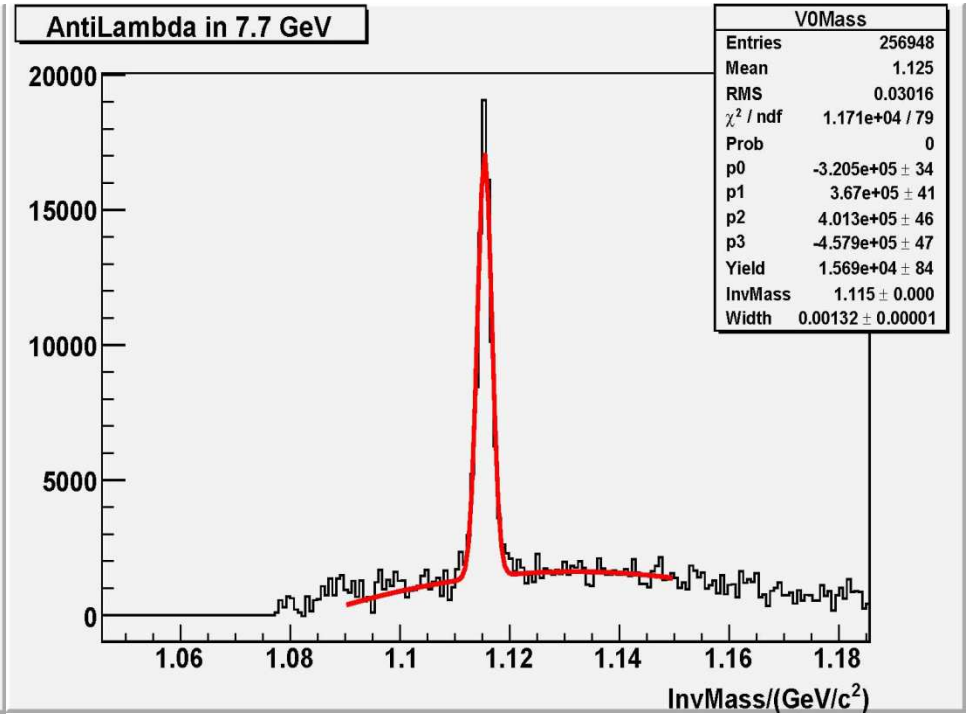
($L_\Omega$) DecayLength_Ω > 2cm

Besides, $L_\Lambda > L_\Omega$

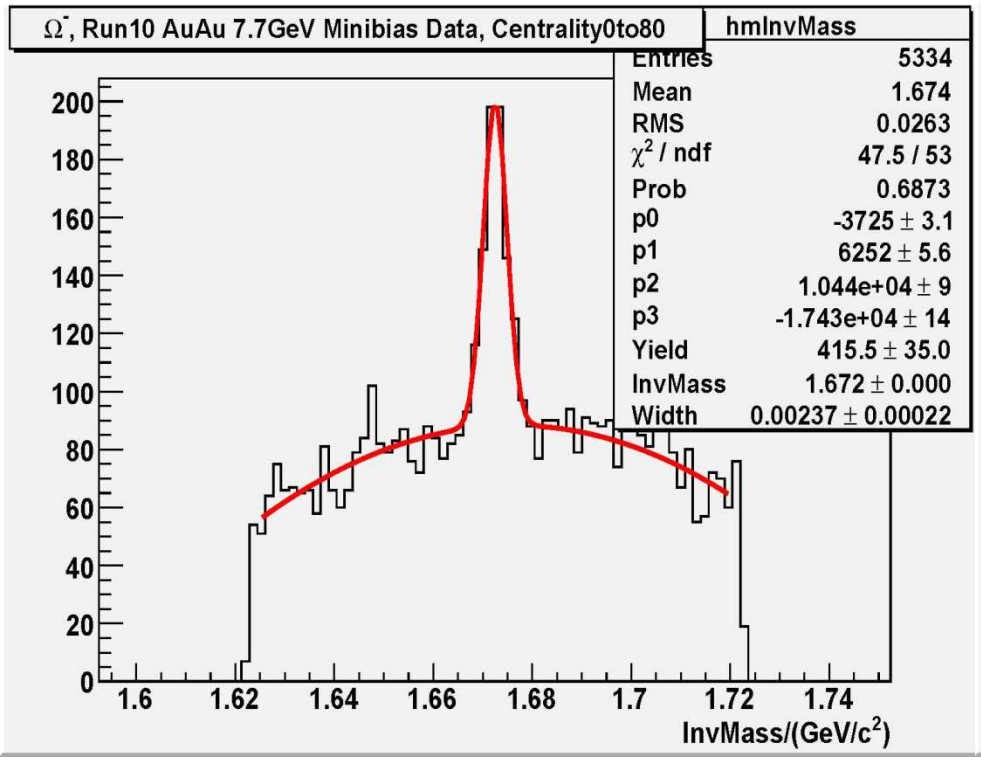
$$(\vec{r}_{V0} - \vec{r}_{Xi}) \cdot \vec{p}_{V0} > 0$$
$$(\vec{r}_{Xi} - \vec{r}_{PV}) \cdot \vec{p}_{Xi} > 0$$
$$(\vec{r}_{Xi} - \vec{r}_{PV}) \times \vec{p}_{Xi} / |\vec{r}_{Xi} - \vec{r}_{PV}| / |\vec{p}_{Xi}| > 0.15$$

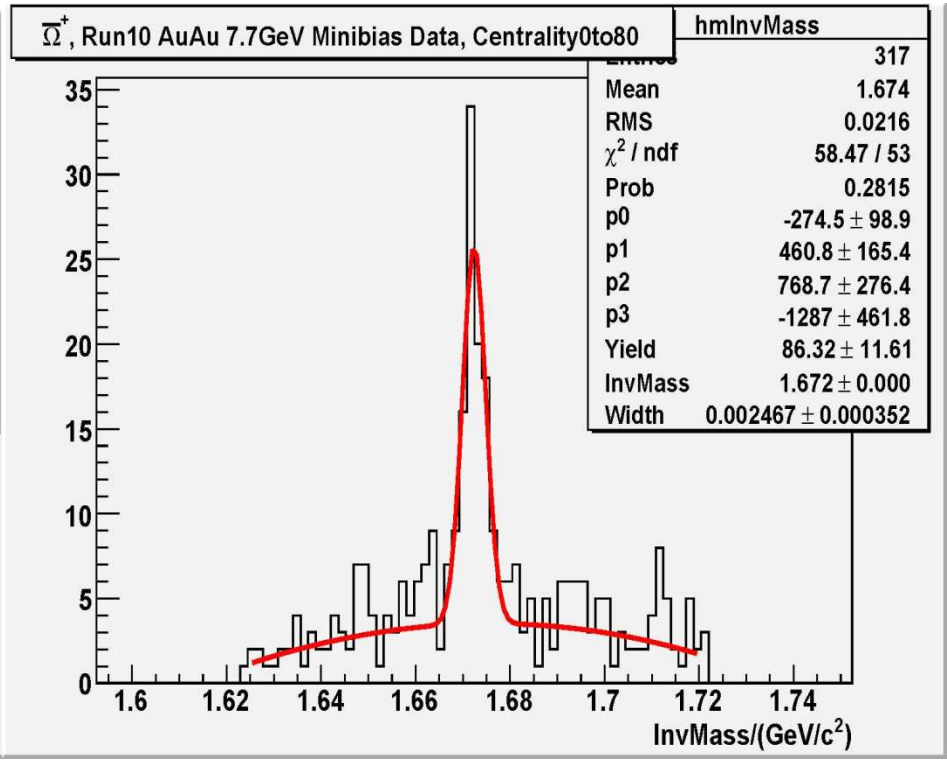
# Λ Signal


Lambda in 7.7 GeV
×10³
800
700
600
500
400
300
200
100
0
1.06
1.08
1.1
1.12
1.14
1.16
1.18
InvMass/(GeV/c²)
V0Mass
Entries 4406115
Mean 1.127
RMS 0.02968
χ² / ndf 1.84e+05 / 79
Prob 0
p0 -1.984e+05 ± 64
p1 2.204e+05 ± 77
p2 2.536e+05 ± 87
p3 -2.778e+05 ± 90
Yield 7.125e+05 ± 532
InvMass 1.115 ± 0.000
Width 0.001468 ± 0.000001

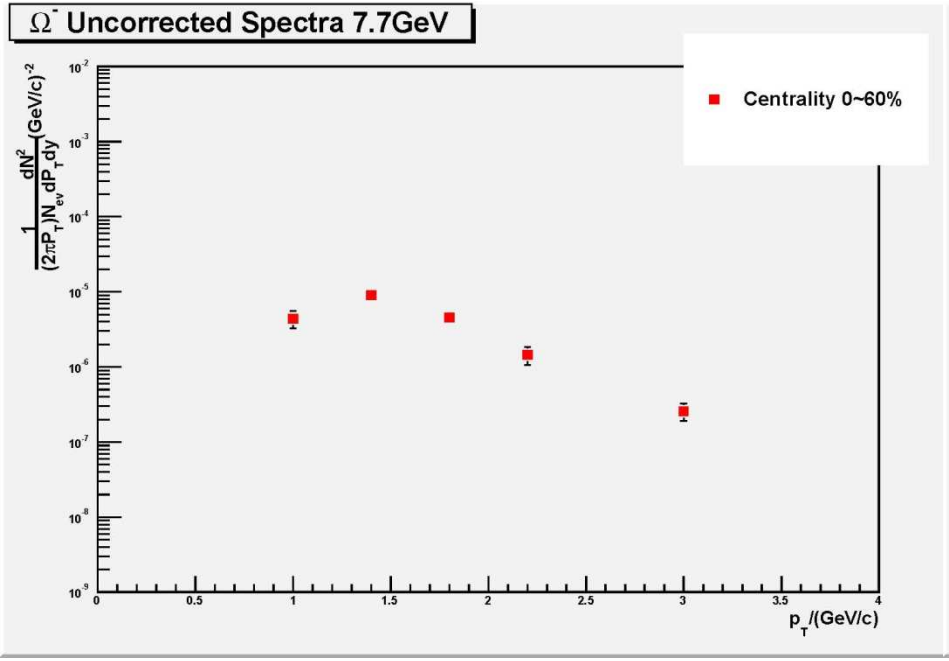

AntiLambda in 7.7 GeV
20000
15000
10000
5000
0
1.06
1.08
1.1
1.12
1.14
1.16
1.18
InvMass/(GeV/c²)
V0Mass
Entries 256948
Mean 1.125
RMS 0.03016
χ² / ndf 1.171e+04 / 79
Prob 0
p0 -3.205e+05 ± 34
p1 3.67e+05 ± 41
p2 4.013e+05 ± 46
p3 -4.579e+05 ± 47
Yield 1.569e+04 ± 84
InvMass 1.115 ± 0.000
Width 0.00132 ± 0.00001

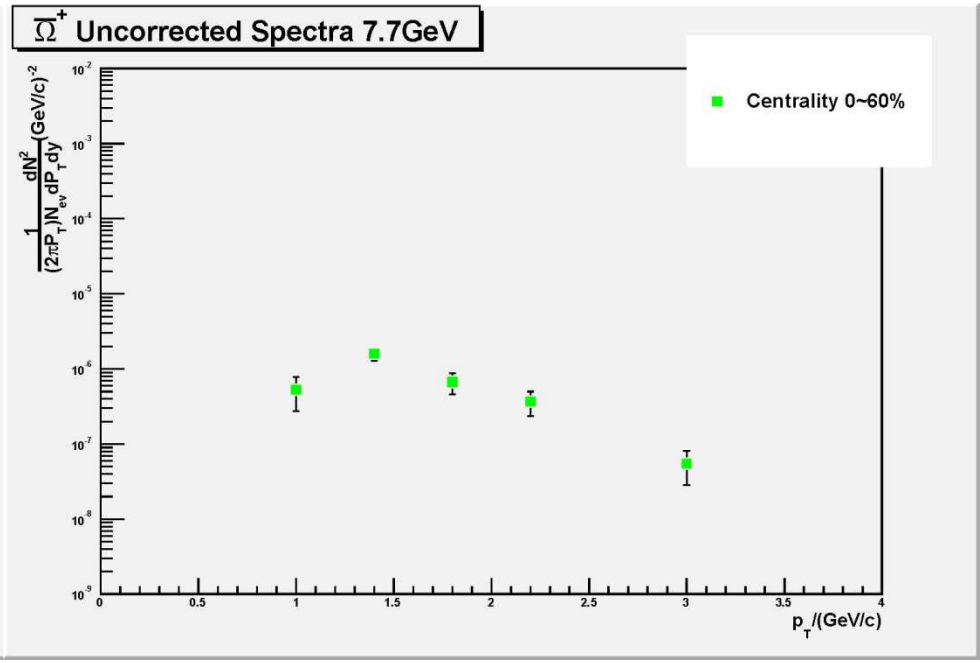
# Omega Signal



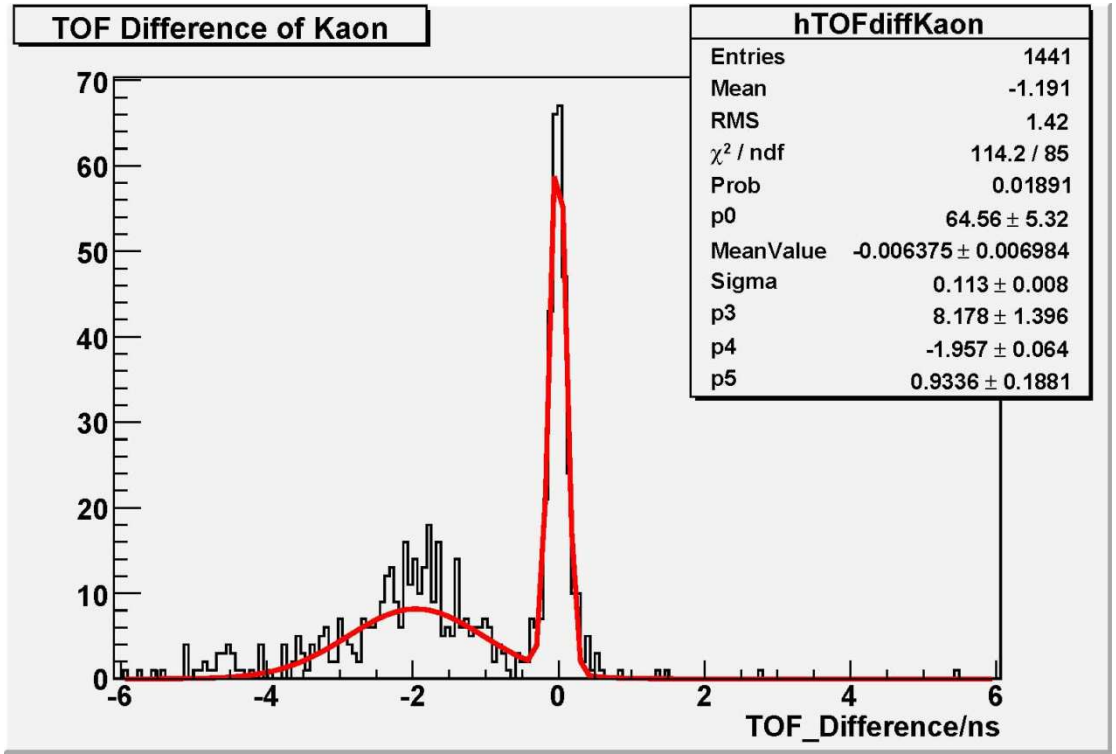
# Uncorrected Spectra



# TOF Cut on Kaon Track

- Theoretical Time of Flight = $\frac{\text{DecayLength}}{30 * \sqrt{1 + \frac{\text{Mass} * \text{Mass}}{\vec{P} \bullet \vec{P}}}}$
- Add the TOF_Kaon, TOF_Omega to be the TOF_theory
- TOF_difference = TOF_measured – TOF_theory



- Set |TOF_difference|<= 0.35 ns

  which is ~3 sigma of TOF resolution.
- Loose the geometrical cuts:

  Dca_Proton > 0.4cm

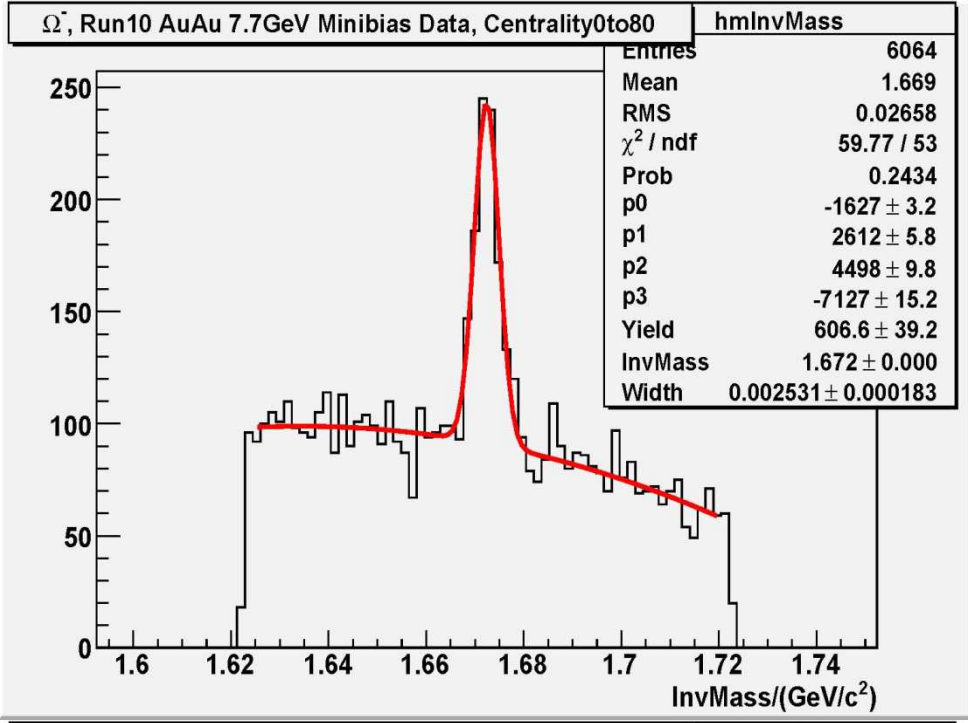
  Dca_Pion > 1.0cm

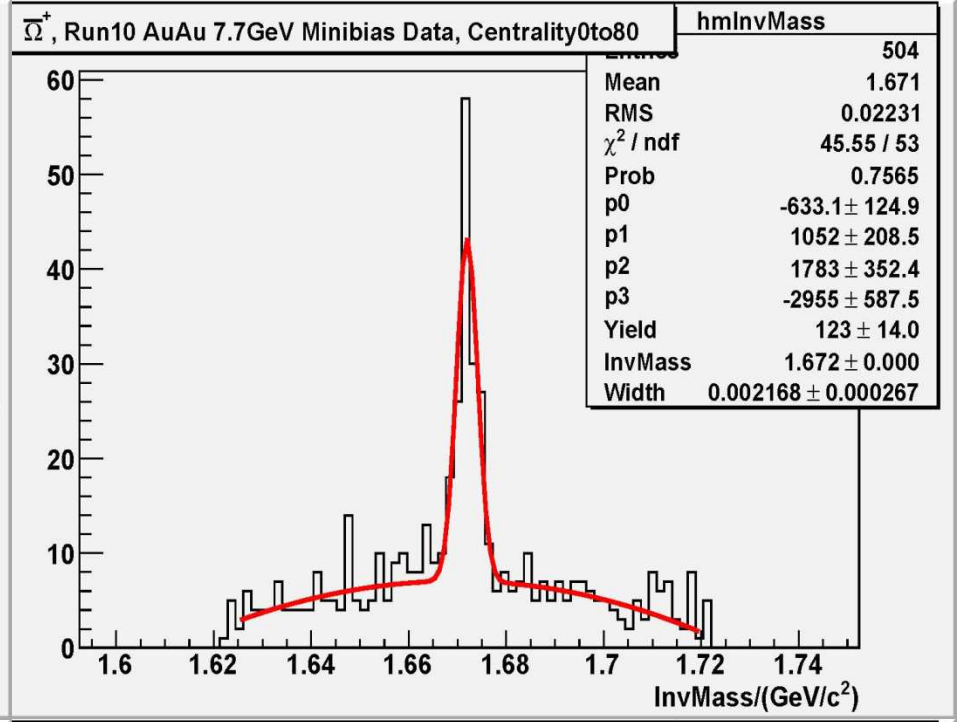
  Dca_Proton_to_Pion < 1.0cm

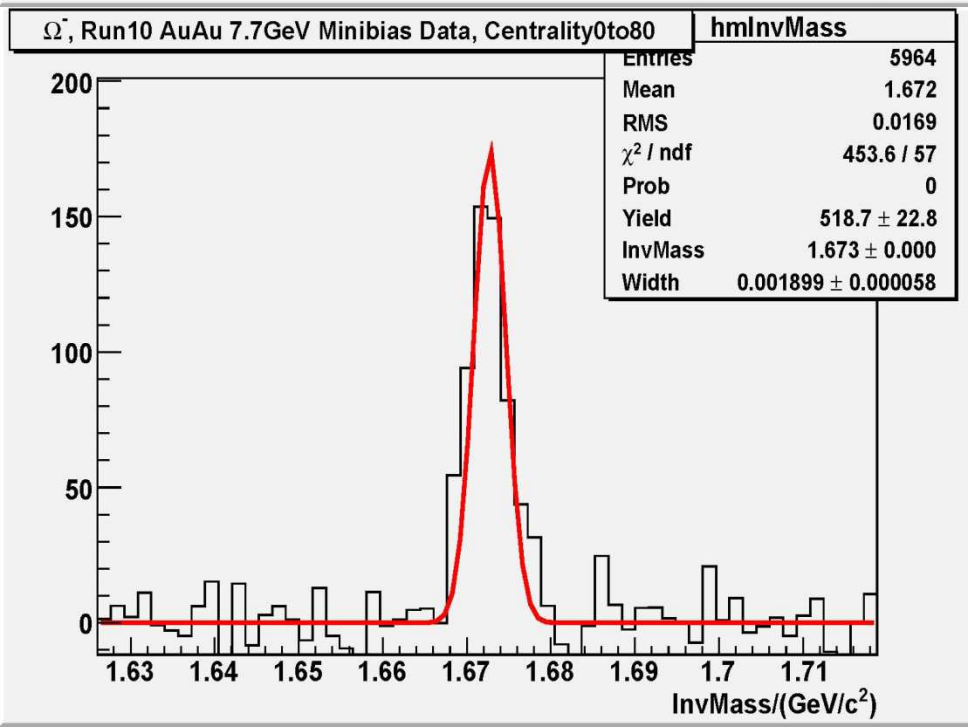
  Dca_ Λ > 0.3cm

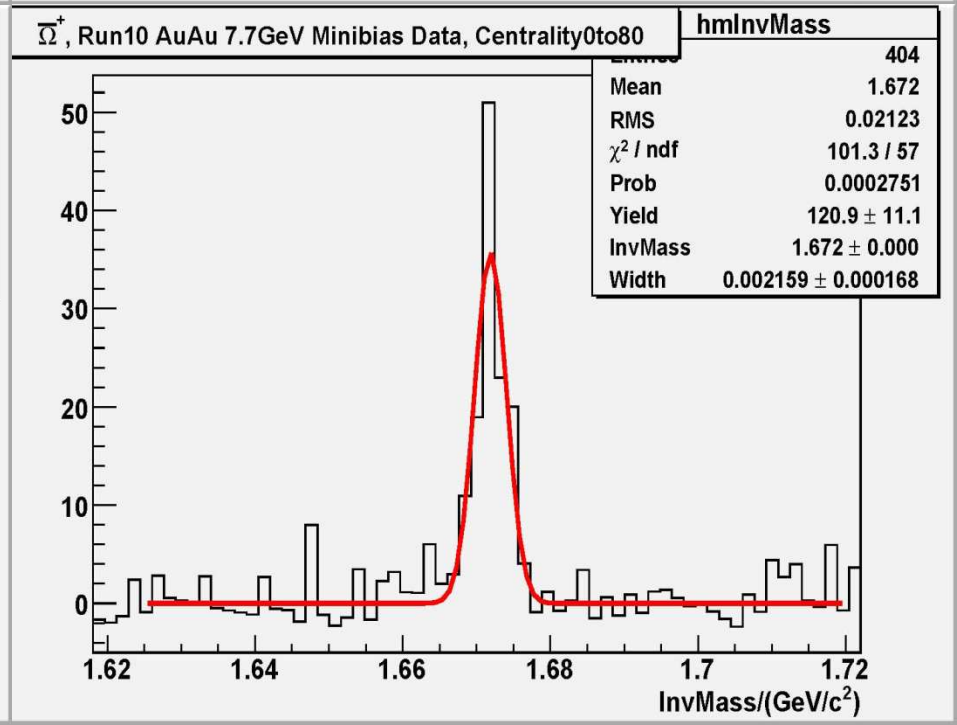
  Dca_Kaon > 1.0cm

  Dca_ Λ _to_Kaon < 1.0cm
- If a Kaon track has TOF match, then use TOF cut and the loose geometrical cuts; If doesn't have TOF match, then use strict geometrical cuts.

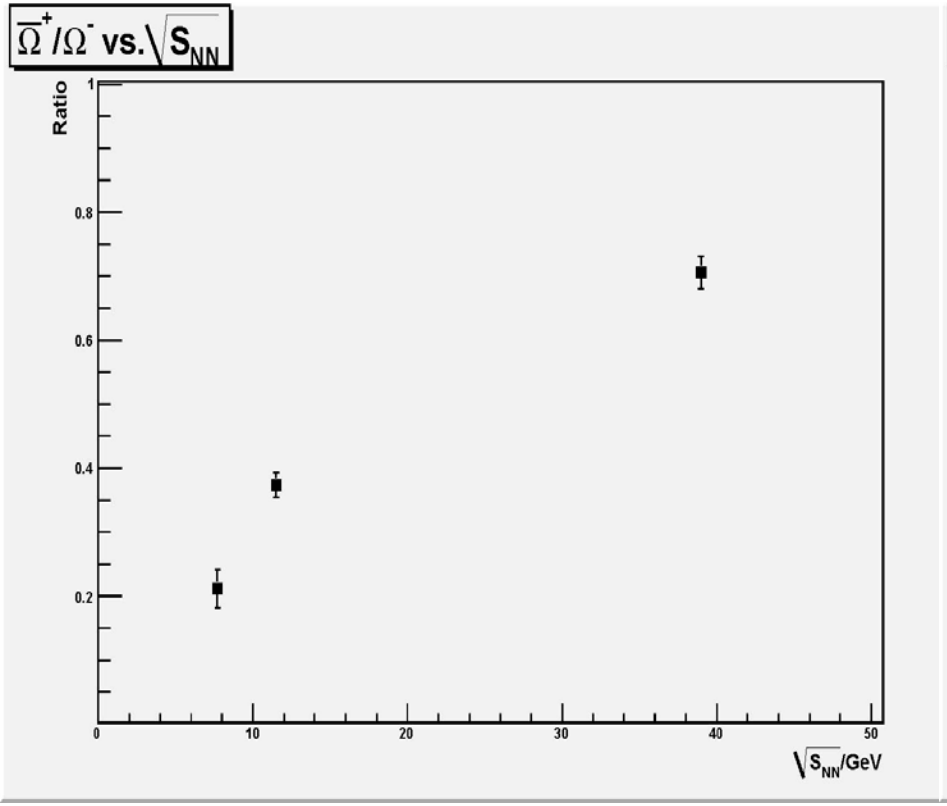

Ω⁻, Run10 AuAu 7.7GeV Minibias Data, Centrality0to80
hmInvMass
Entries 6064
Mean 1.669
RMS 0.02658
χ² / ndf 59.77 / 53
Prob 0.2434
p0 -1627 ± 3.2
p1 2612 ± 5.8
p2 4498 ± 9.8
p3 -7127 ± 15.2
Yield 606.6 ± 39.2
InvMass 1.672 ± 0.000
Width 0.002531 ± 0.000183
InvMass/(GeV/c²)

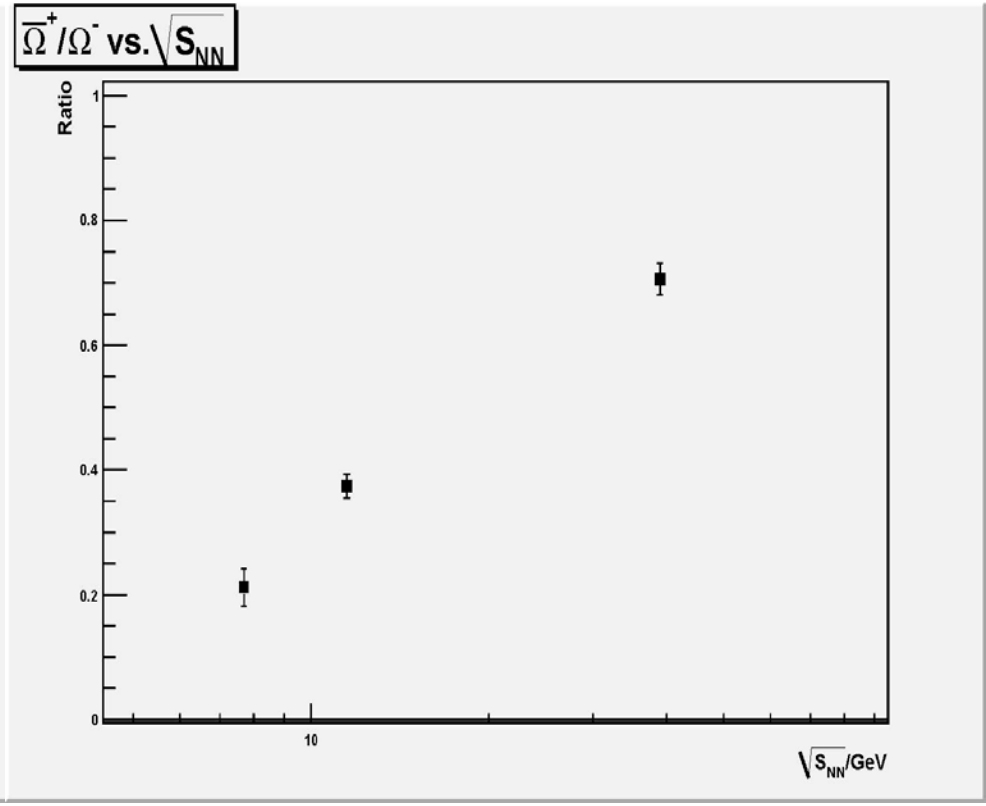

Ω̄⁺, Run10 AuAu 7.7GeV Minibias Data, Centrality0to80
hmInvMass
504
Mean 1.671
RMS 0.02231
χ² / ndf 45.55 / 53
Prob 0.7565
p0 -633.1 ± 124.9
p1 1052 ± 208.5
p2 1783 ± 352.4
p3 -2955 ± 587.5
Yield 123 ± 14.0
InvMass 1.672 ± 0.000
Width 0.002168 ± 0.000267
InvMass/(GeV/c²)


Ω⁻, Run10 AuAu 7.7GeV Minibias Data, Centrality0to80
hmInvMass
Entries 5964
Mean 1.672
RMS 0.0169
χ² / ndf 453.6 / 57
Prob 0
Yield 518.7 ± 22.8
InvMass 1.673 ± 0.000
Width 0.001899 ± 0.000058
InvMass/(GeV/c²)


Ω̄⁺, Run10 AuAu 7.7GeV Minibias Data, Centrality0to80
hmInvMass
404
Mean 1.672
RMS 0.02123
χ² / ndf 101.3 / 57
Prob 0.0002751
Yield 120.9 ± 11.1
InvMass 1.672 ± 0.000
Width 0.002159 ± 0.000168
InvMass/(GeV/c²)

# Ratio $\frac{\bar{\Omega}^+}{\Omega^-}$ = 0.21344, Error = 0.03012



# To Do List:

- Refine the cuts.
- Analyze the Omega & Xi ;

  Omega & Lambda;

  Omega & Kaon Correlation.
- Request the Embedding.