nDST QA for singlemuon analysis

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Santa Fe Workshop, Jun. 22th 2004

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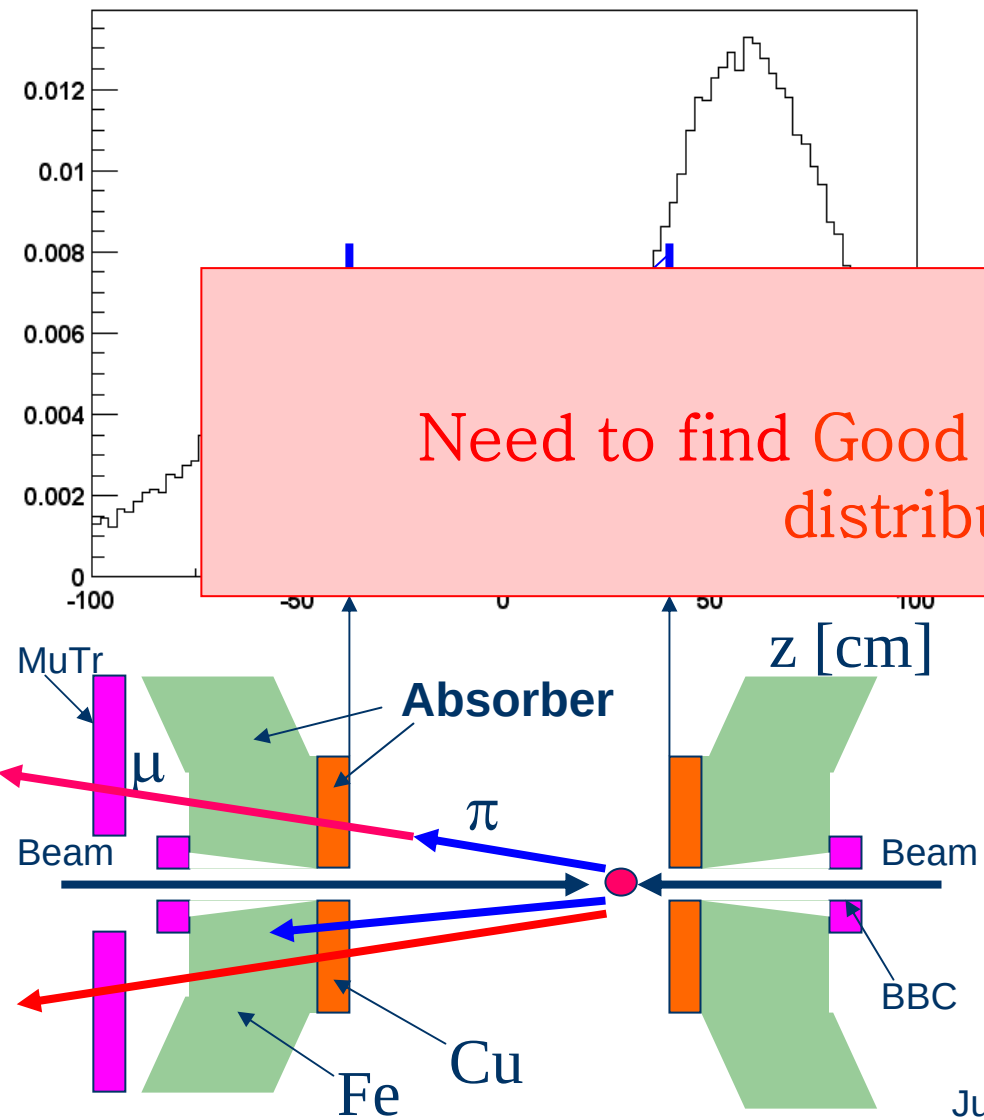
Z vertex Dependence

Normalized Muon Biased Z vertex

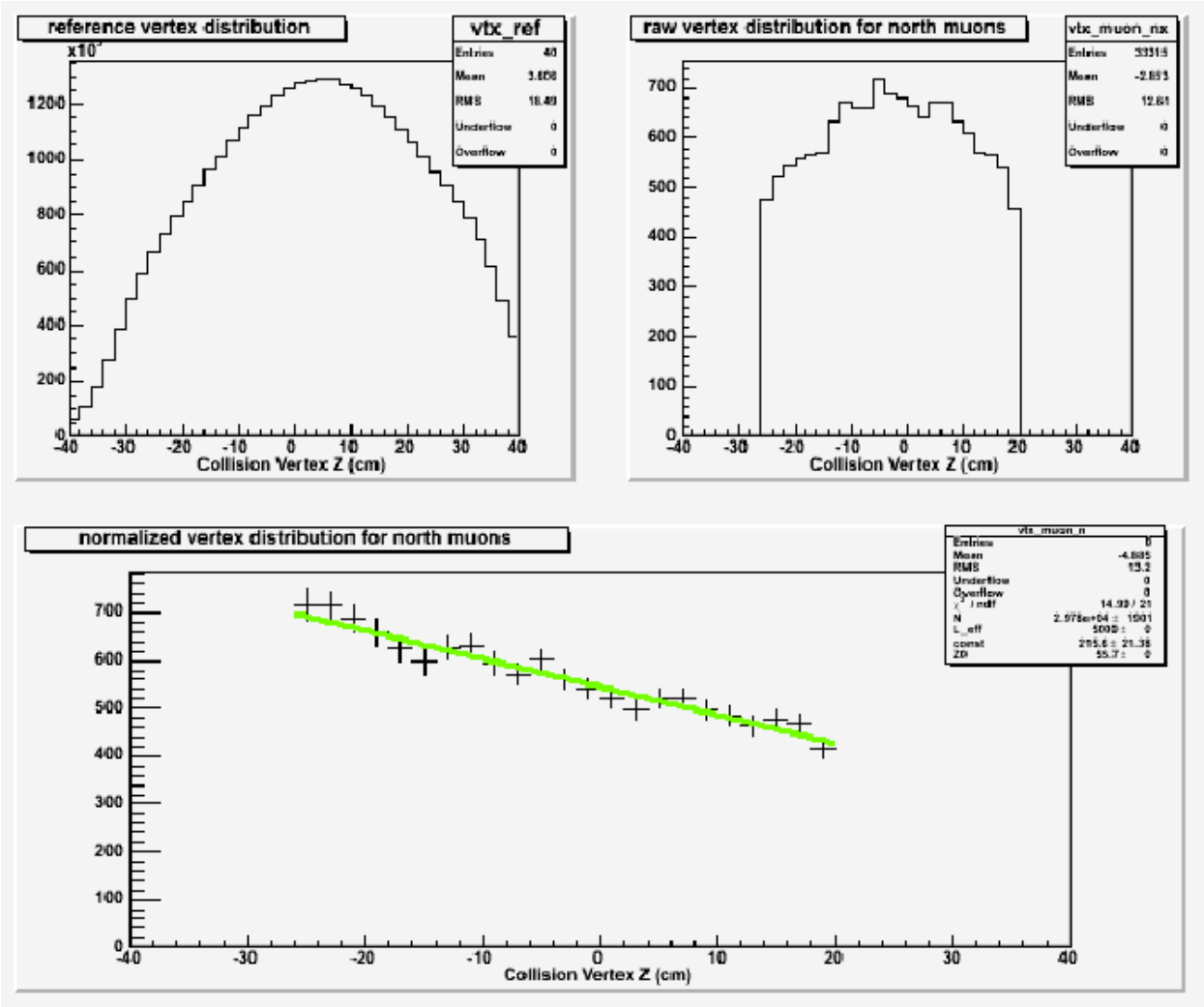


Need to find Good Reference Vertex distribution!!

- Filter out decay muon by Z-vertex analysis
- Muon yield increasing linearly
  - the
  - cay

  - pe
  - is because $c\tau\gamma$~100 [m].
- π/K decay μ dominates single muons.
- Prompt μ or punch through background has no vertex dependent.

Reference Vertex Distribution – Run3 dAu

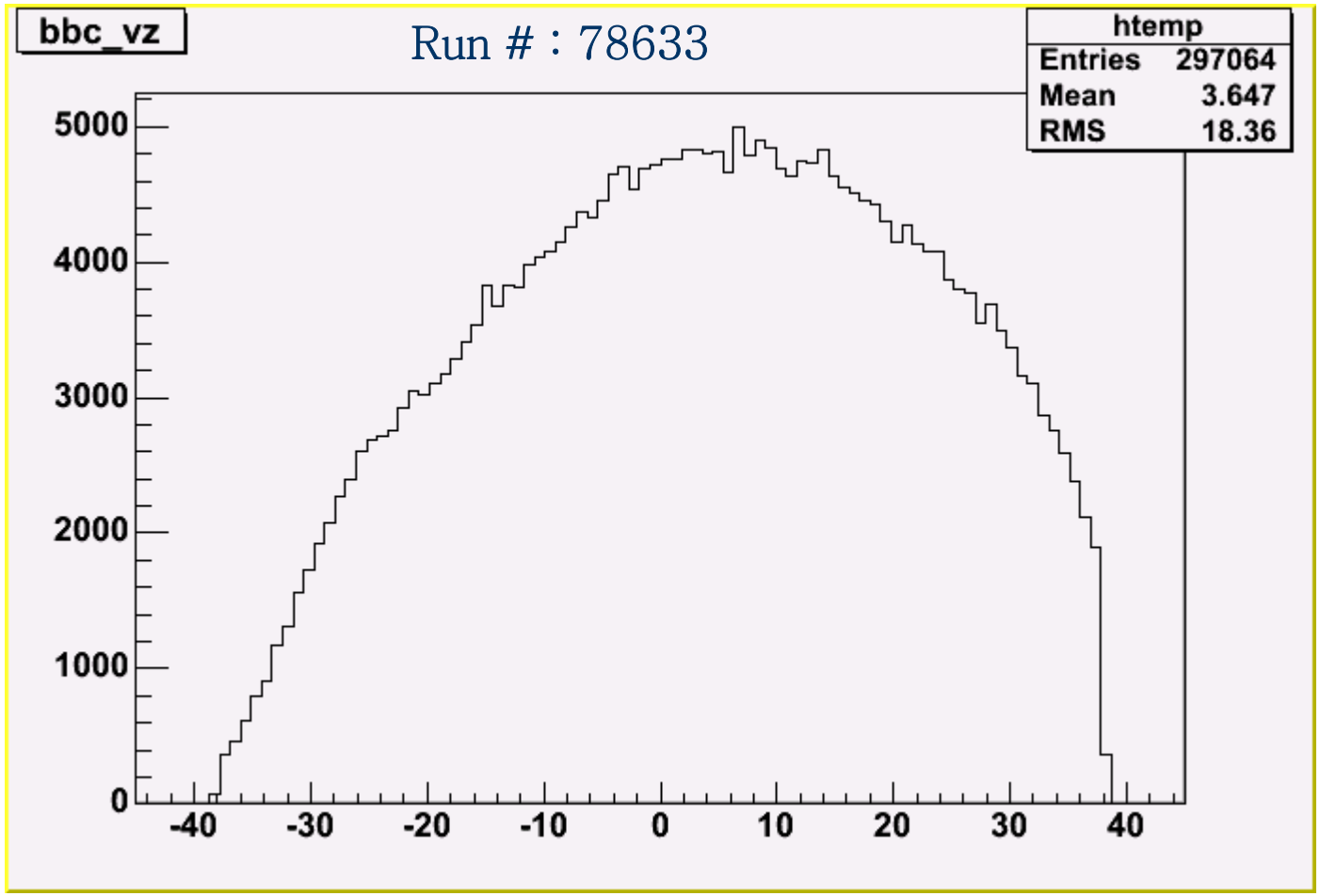


From Ming's analysis note

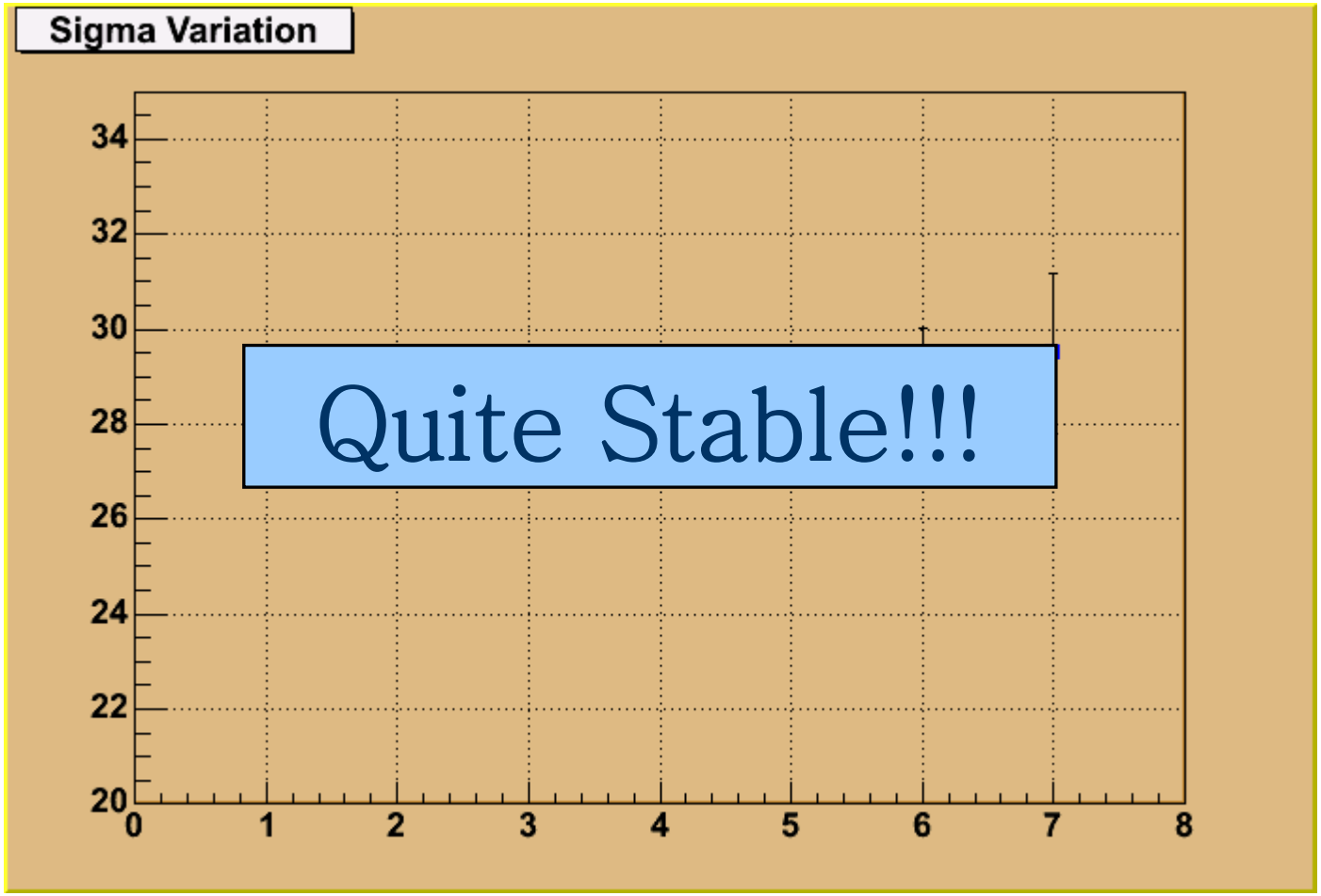
Vertex Distribution – Run3 dAu

1. Use pro.48 Minbias nDST
2. Total 504 runs
3. Merge all segments for each run
4. cut : abs(BBC_Z_vertex)<26
5. Fit with single gaussian function

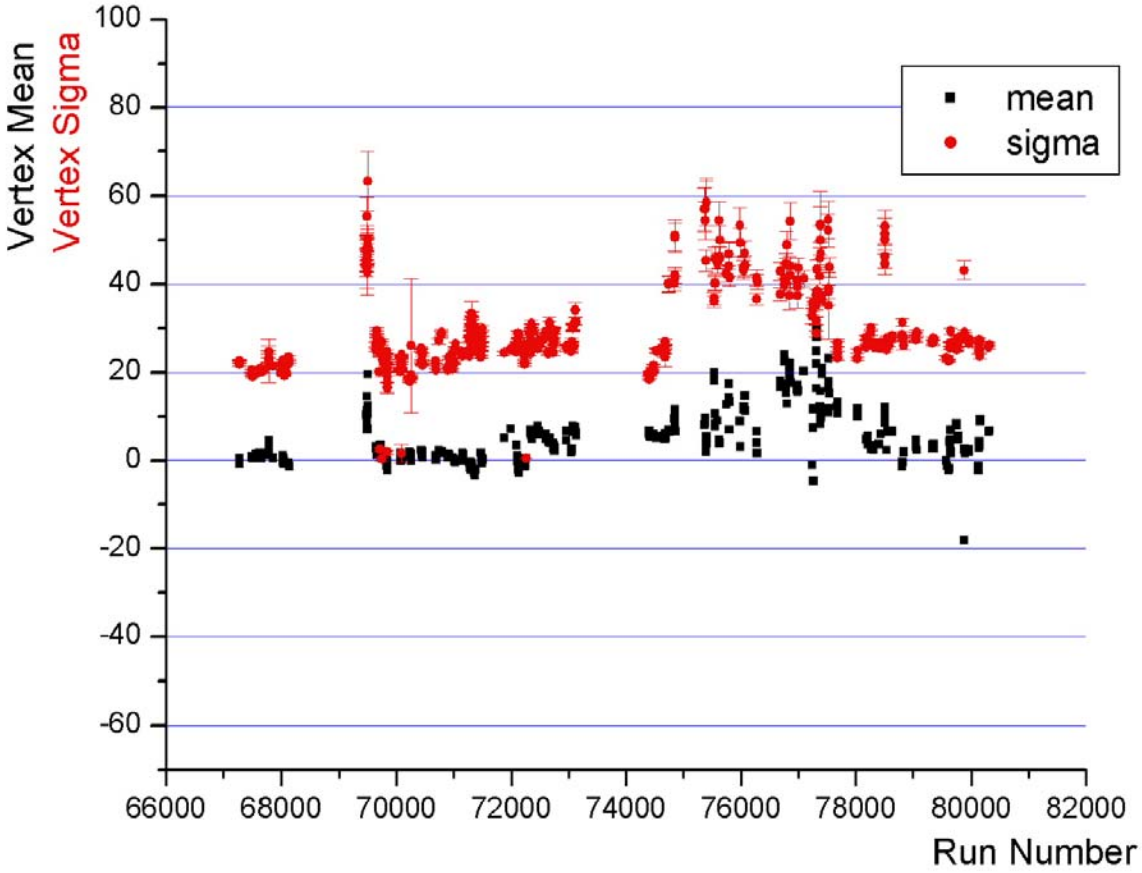
Example Plot – Run3 dAu



Variation within a run – Run3 dAu



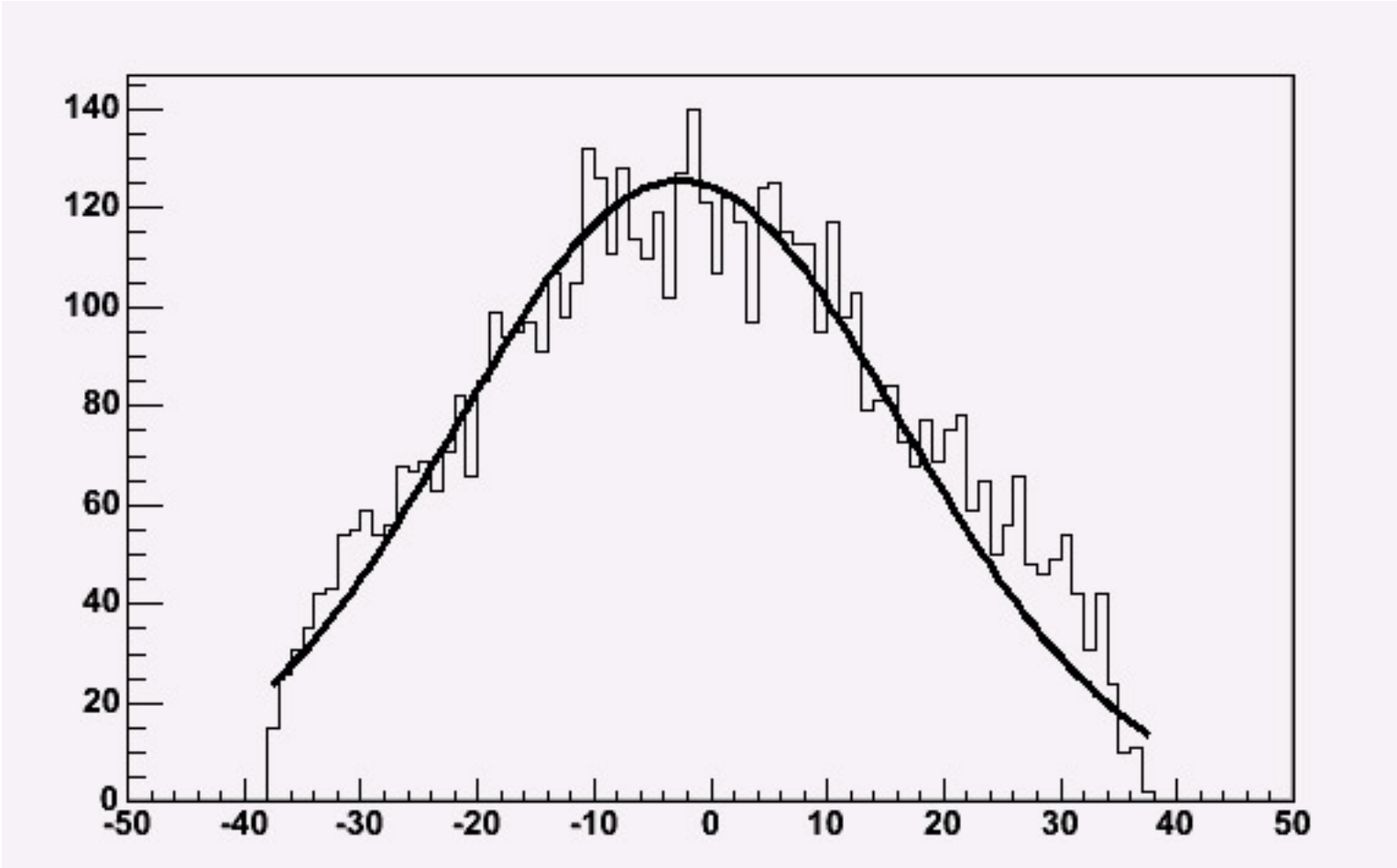
Variation over all runs – Run3 dAu



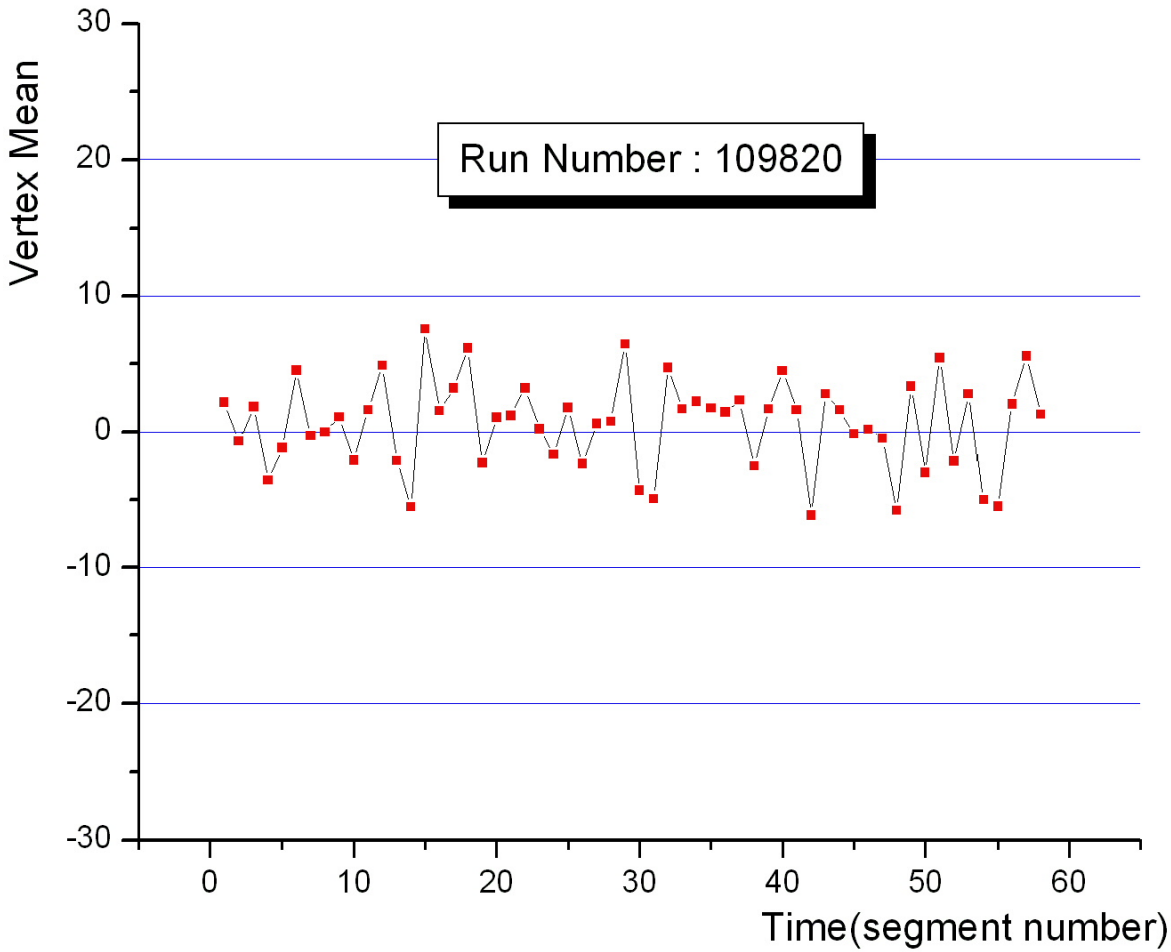
Vertex Distribution – Run4 AuAu

1. Use private repass Minimum Bias nDST samples
2. Total 162 runs
3. Use first segment for each run
4. The number of events per run is 7000
5. Fit with single gaussian function

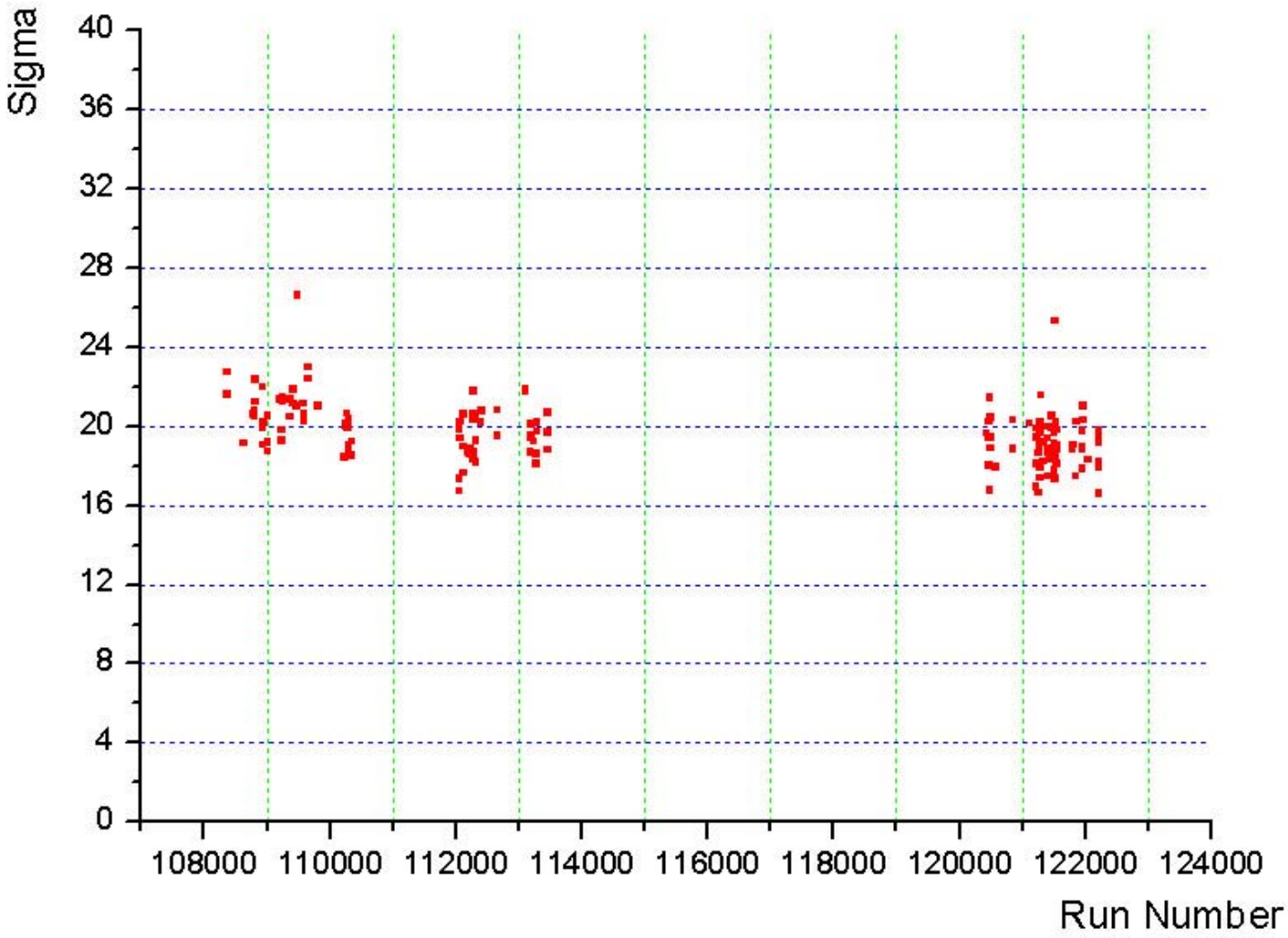
Example Plot – Run4 AuAu



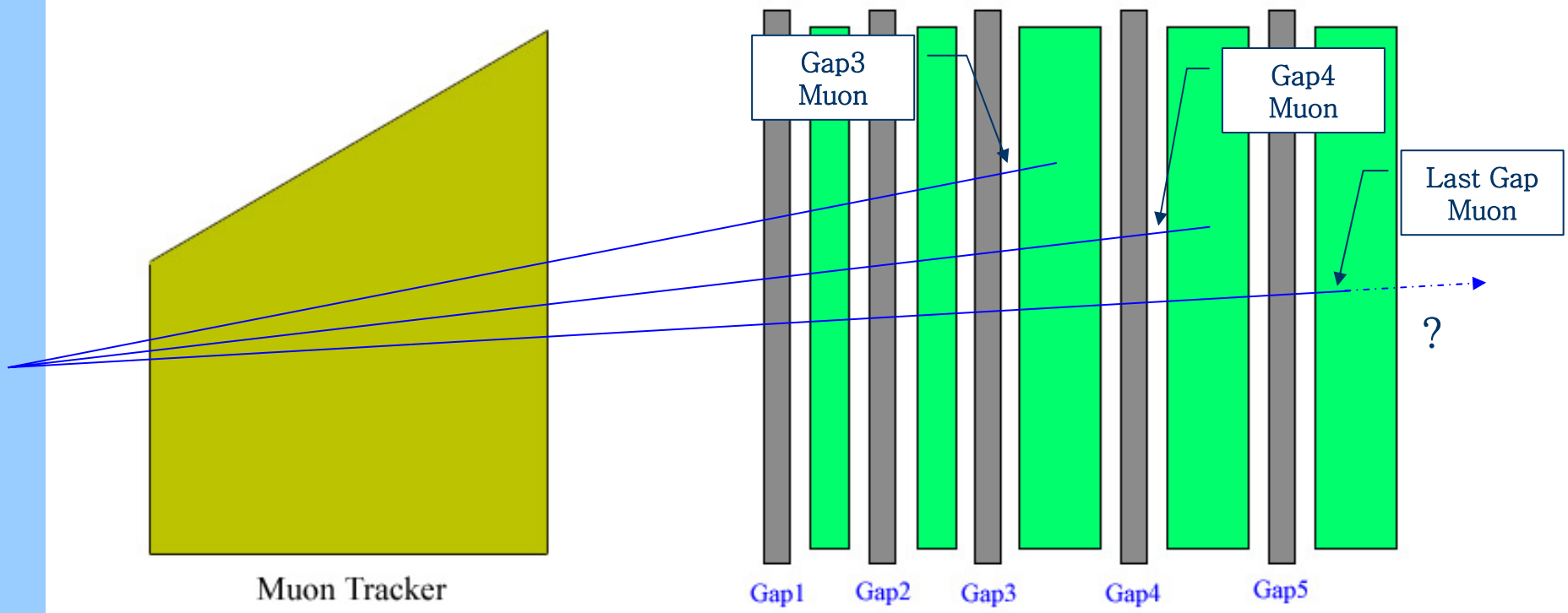
Variation within a run – Run4 AuAu



Run by Run Variation – Run4 AuAu

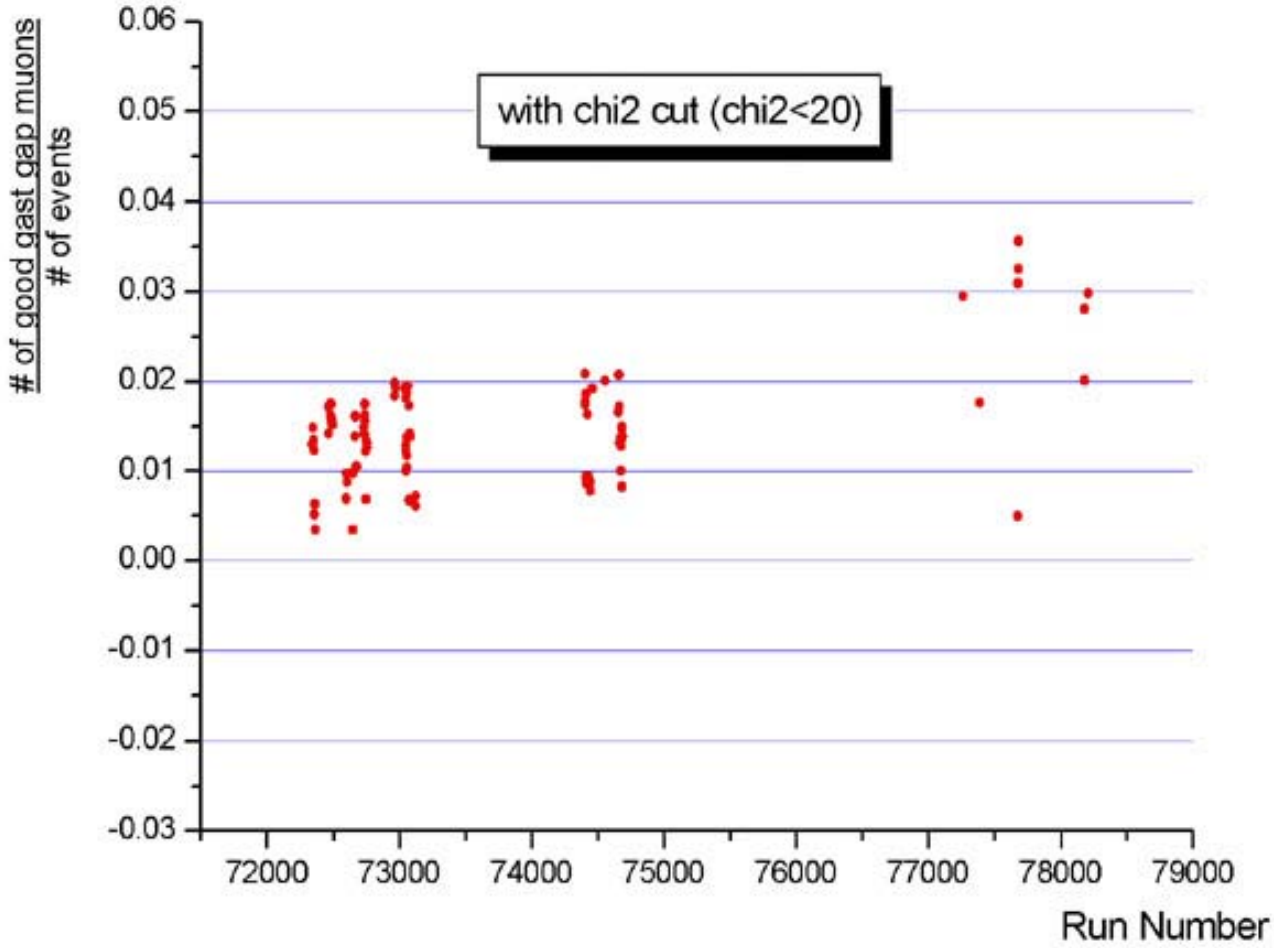


Last Gap Muon for Open Charm

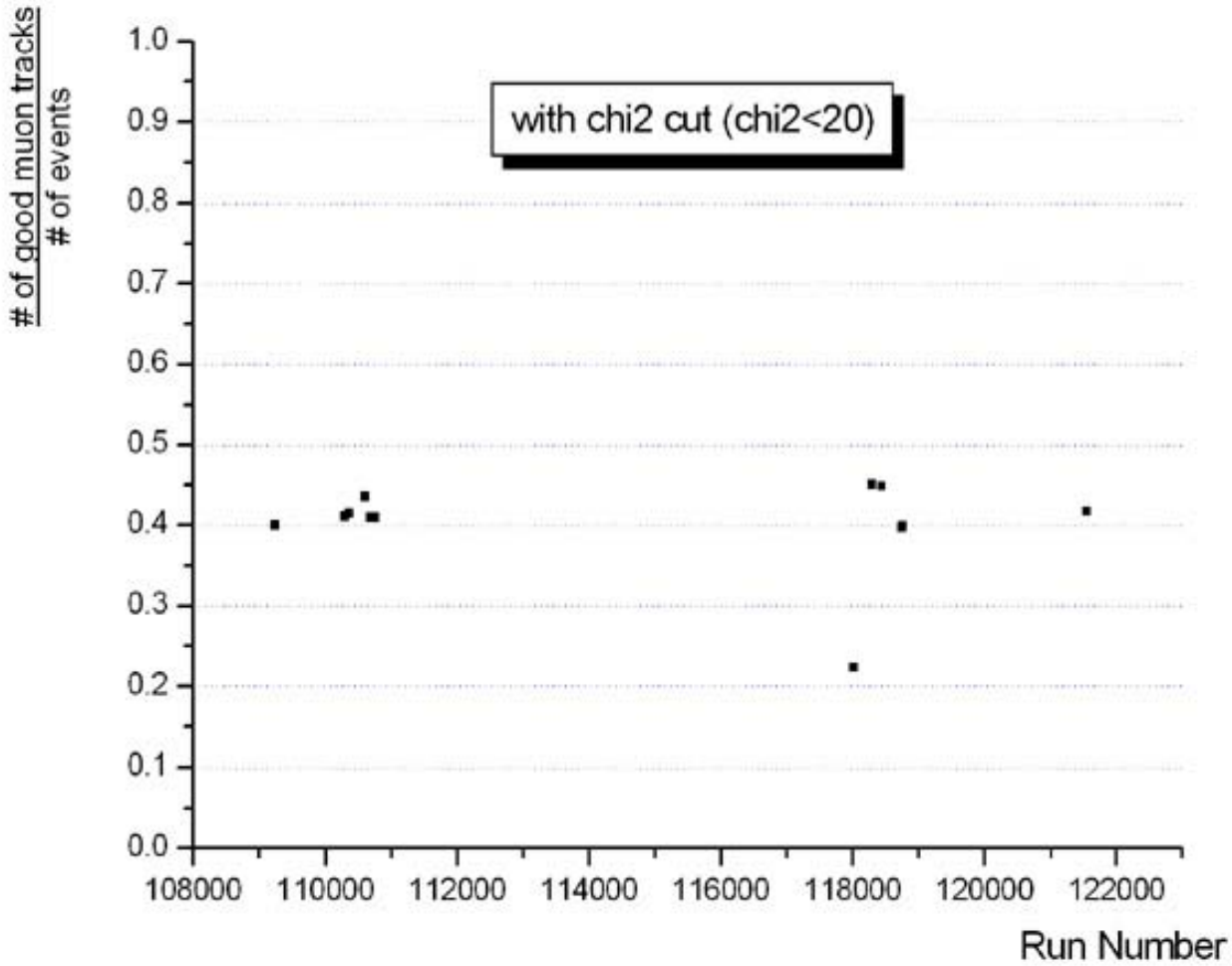


- Muon from the open charm has large momentum as compared with other muons
- There is every probability that it can be reached to the MuID last gap
- But we cannot measure the number of last gap muons directly

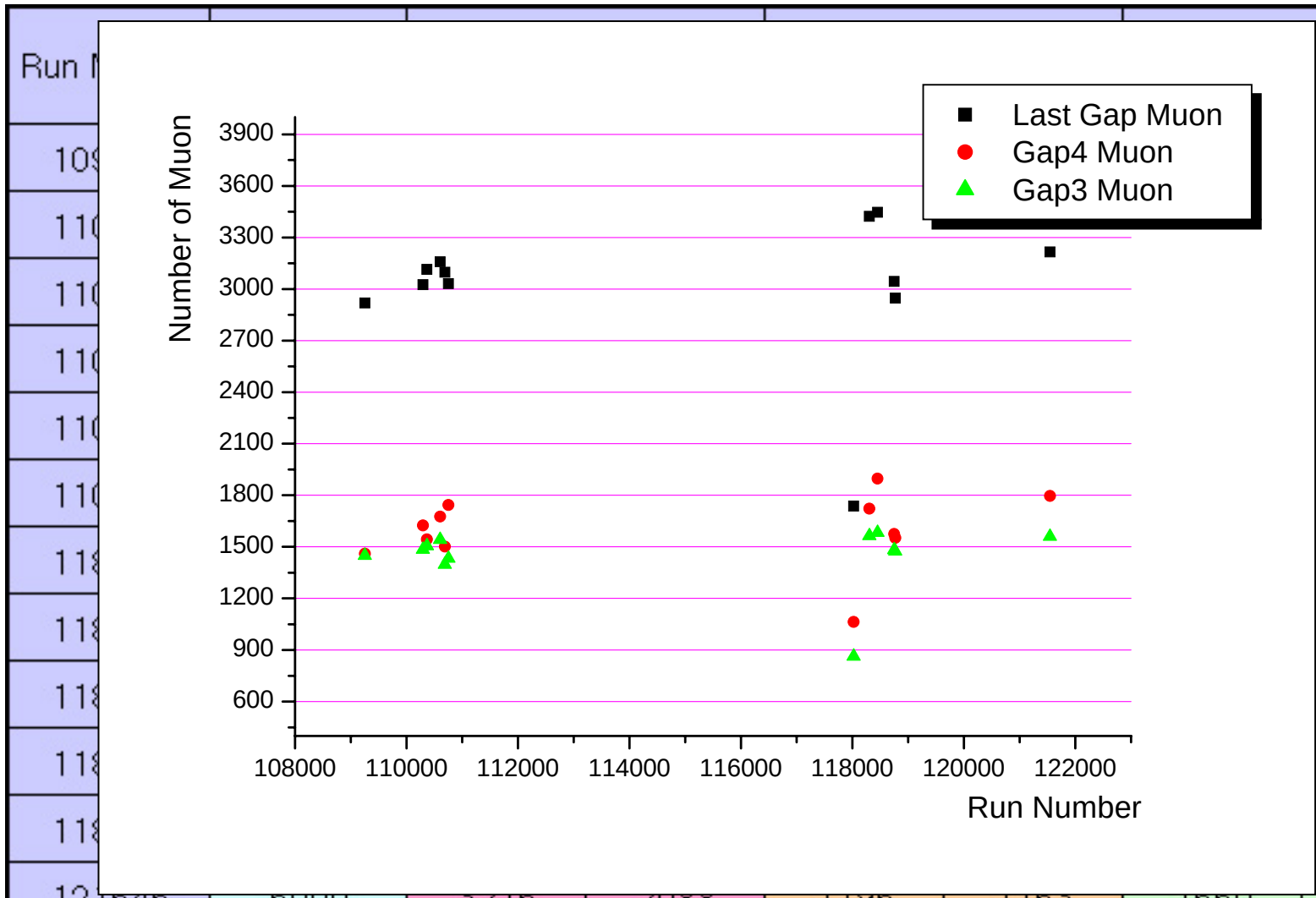
Last Gap Muon for Run3 dAu



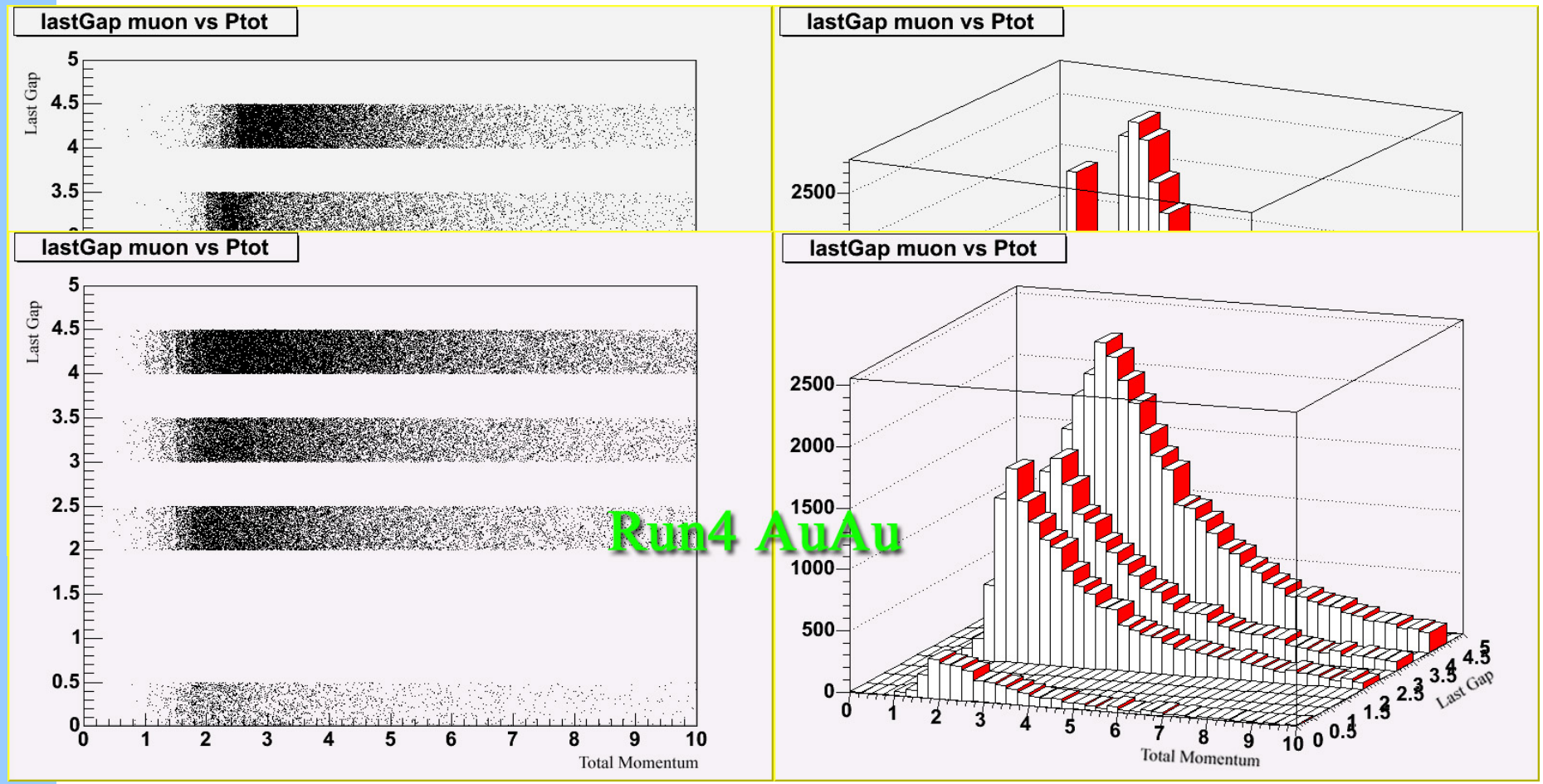
Last Gap Muon for Run4 AuAu

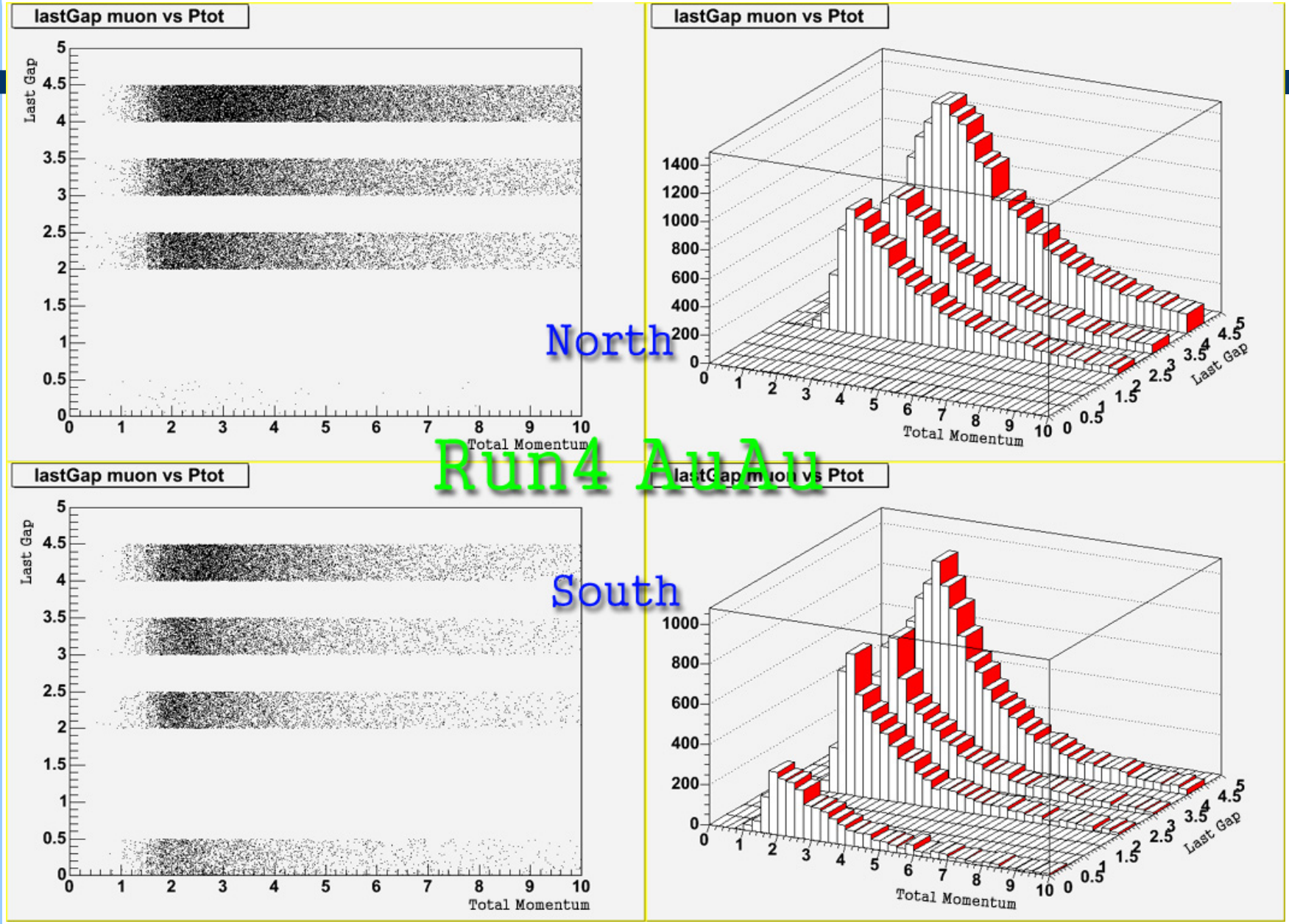


Number of Gap3, Gap4 and Last Gap Muon – Run4 AuAu



Last Gap Muon vs Total Momentum




lastGap muon vs Ptot
Last Gap
Total Momentum
lastGap muon vs Ptot
Last Gap
Total Momentum
North
Run4 AuAu
lastGap muon vs Ptot
Last Gap
Total Momentum
South
Total Momentum
Last Gap

To Do List from now on

- Vertex Analysis
  - Need more study on Run4 AuAu data
  - Reference vtx distribution : run by run? seg by seg?
  - Make reference vtx distribution after production
  - Goodrun list based on vertex analysis

- Last Gap Muon Analysis
  - Need to find good quality cut
  - Need to understand the correlation between gap3, gap4, and last gap muon

Summary

- Vertex Analysis
  - We can separate decay muon and prompt muon by vertex analysis
  - Run 3 { small variation within a run / large variation over the run } ⇒ run by run reference
  - Run 4 { large variation within a run / small variation over the run } ⇒ need more study!!

- Last Gap Muon Analysis
  - We can separate open charm decay muons and hadron decay muons by last gap muon analysis
  - Need more study on Run4 data

BACKUP SLIDES

Estimation of the Number of Last Gap Muon

$$N^{\pi}(i) = N_0 \cdot e^{-\frac{\Delta L_i}{\lambda}}$$

Where,

- $N^{\pi}(i)$ *is the number of gap i pion*
- N_0 *is the number of pion at vertex*
- ΔL_i *is the total thicknesses of the absorber*
- λ *is the slope*

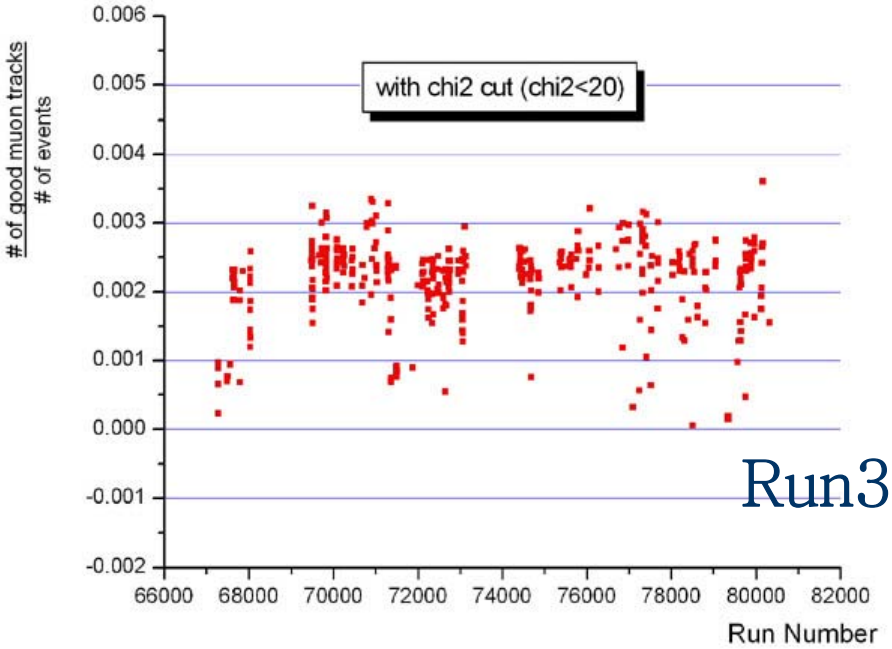
Estimation of the Number of Last Gap Muon

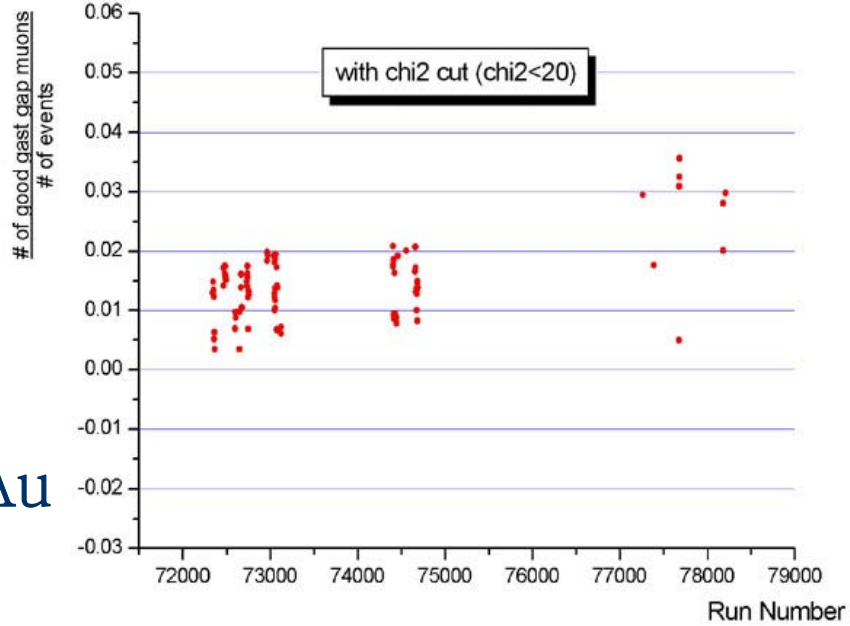
$$N^{\pi}(3) = N_0 \cdot e^{-\frac{\Delta L_3}{\lambda}}$$

$$N^{\pi}(4) = N_0 \cdot e^{-\frac{\Delta L_4}{\lambda}}$$

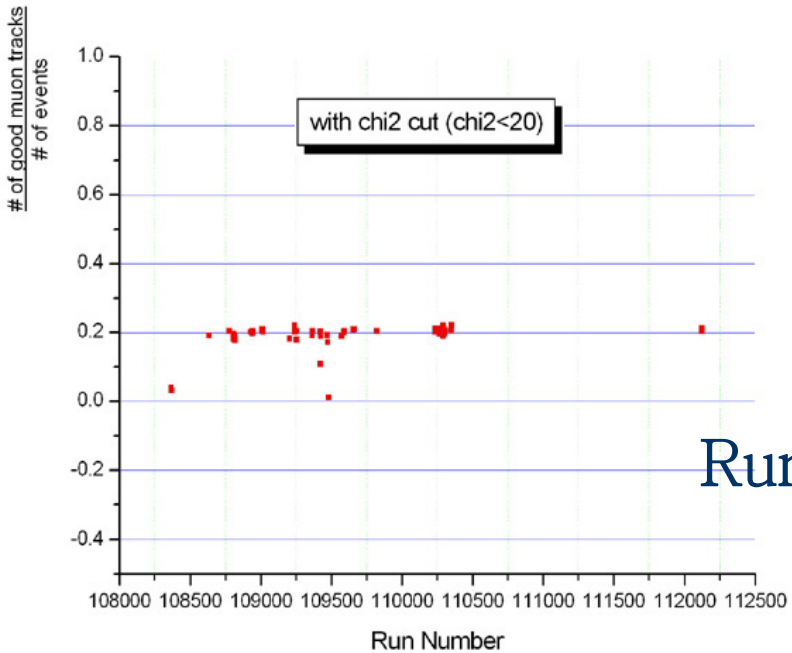
We can get N_0 and λ

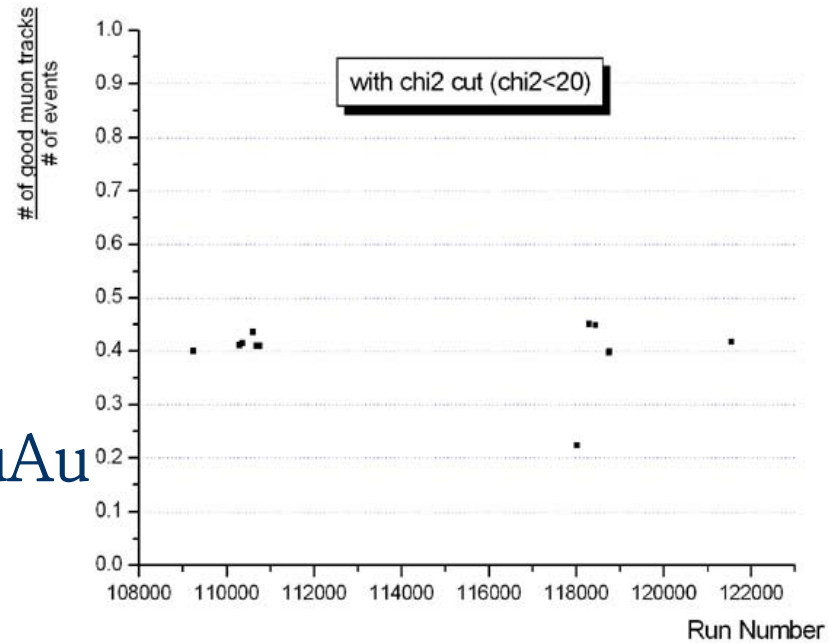
$$N^{\pi}(5) = N_0 \cdot e^{-\frac{\Delta L_5}{\lambda}}$$



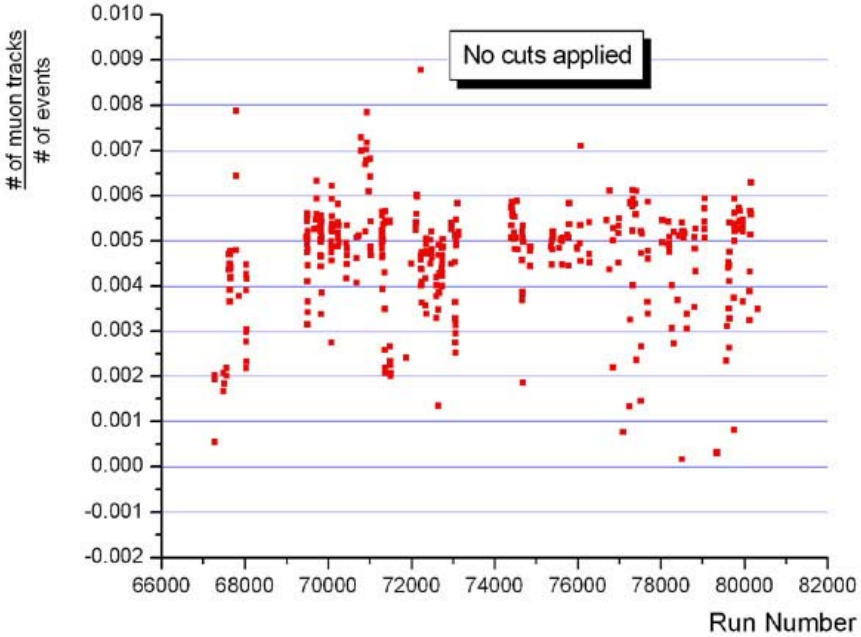


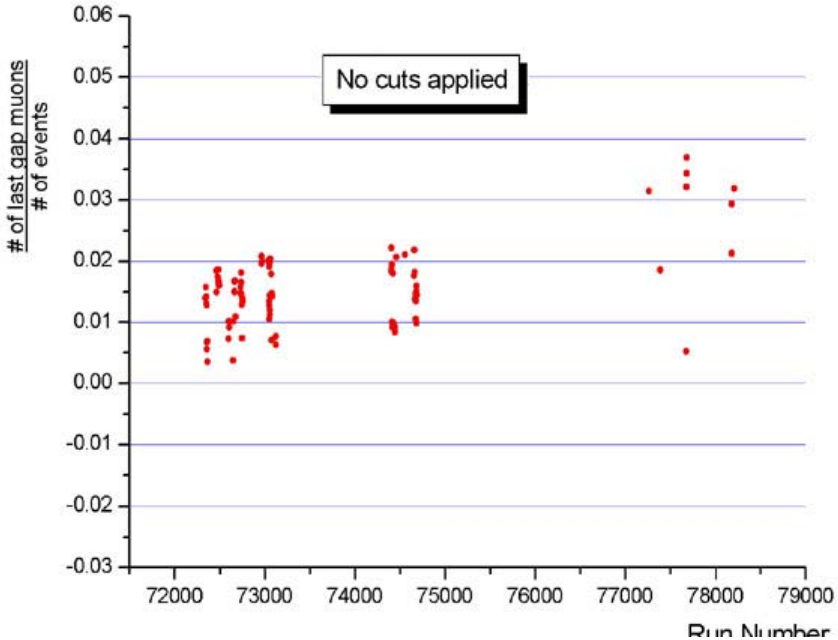
Run3 dAu

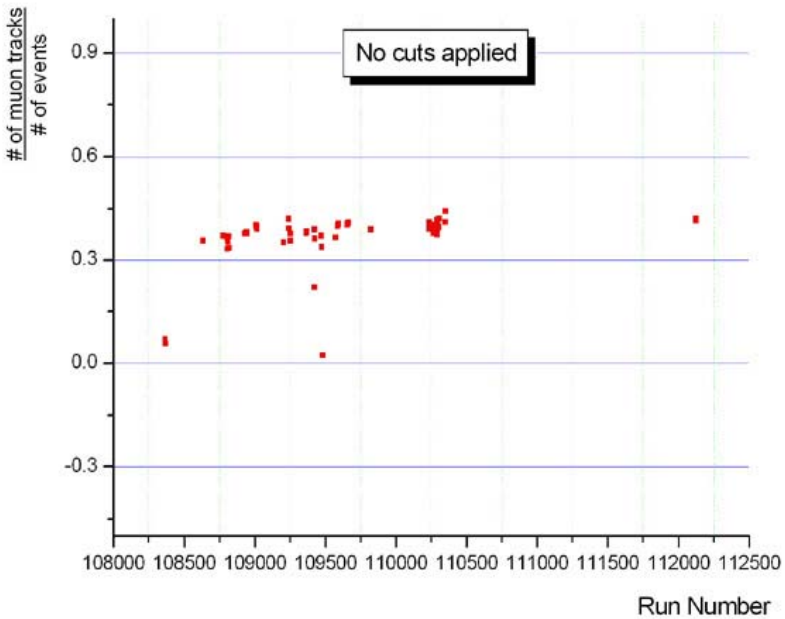


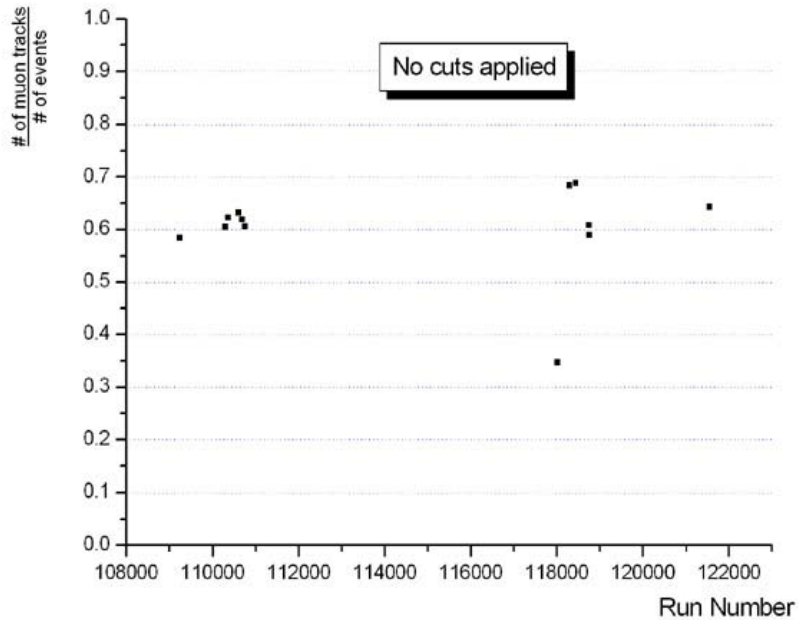


Run4 AuAu


No cuts applied
# of muon tracks
# of events
0.010
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0.000
-0.001
-0.002
66000
68000
70000
72000
74000
76000
78000
80000
82000
Run Number


No cuts applied
# of last gap muons
# of events
0.06
0.05
0.04
0.03
0.02
0.01
0.00
-0.01
-0.02
-0.03
72000
73000
74000
75000
76000
77000
78000
79000


No cuts applied
# of muon tracks
# of events
0.9
0.6
0.3
0.0
-0.3
108000
108500
109000
109500
110000
110500
111000
111500
112000
112500
Run Number


No cuts applied
# of muon tracks
# of events
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
108000
110000
112000
114000
116000
118000
120000
122000
Run Number

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