Search for excited muons in four muons final state

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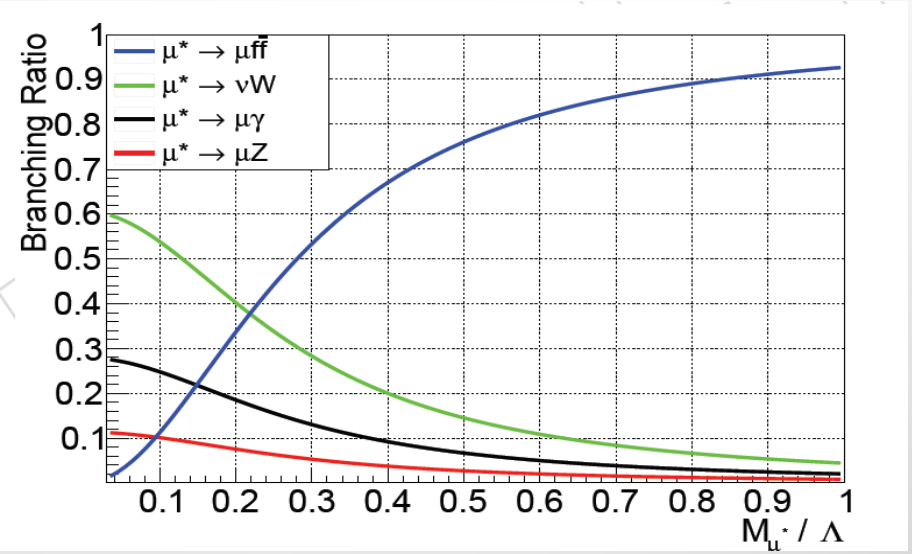
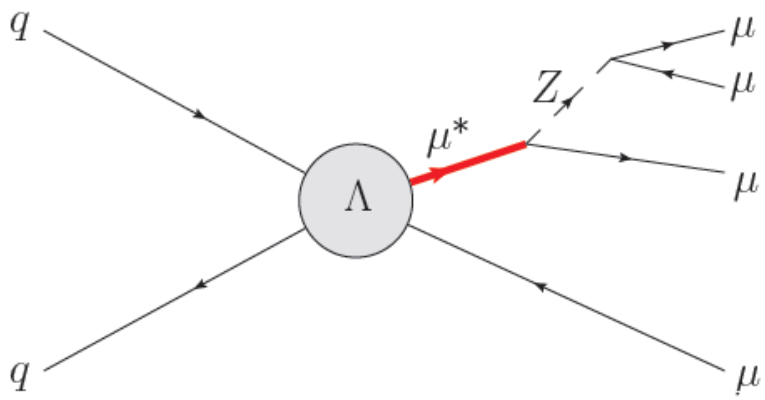
- **Fermion compositeness models** aim at reducing the number of fundamental matter constituents by describing SM fermions as bound states of more-elementary particles.
- Search of excited lepton in 4-muons final state is done by using pp collision data collected in **2012**. The integrated luminosity is $19.fb^{-1}$, with center of mss energy 8 TeV.
- 4-muons final state gives out less background.

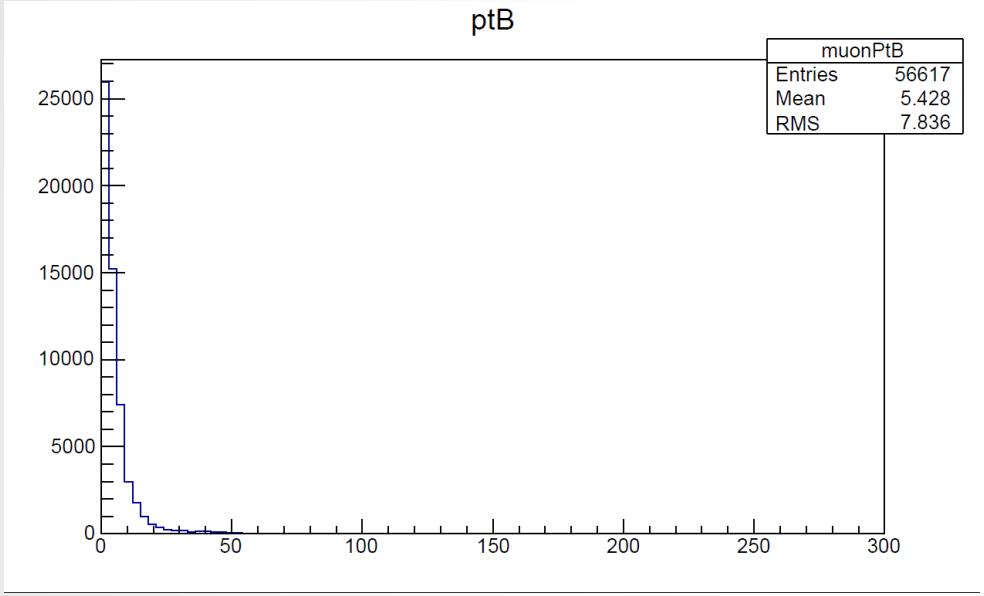


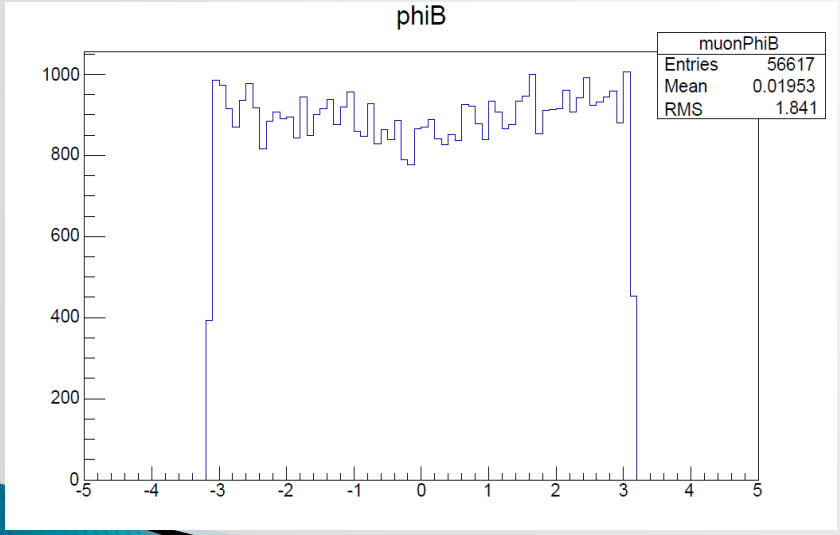
• The concerned production of excited lepton always accompany with a SM lepton of same flavor and opposite-sign pp->μμ* then decays by emitting a Z boson μ*->μμZ, resulting 4-muons final state.

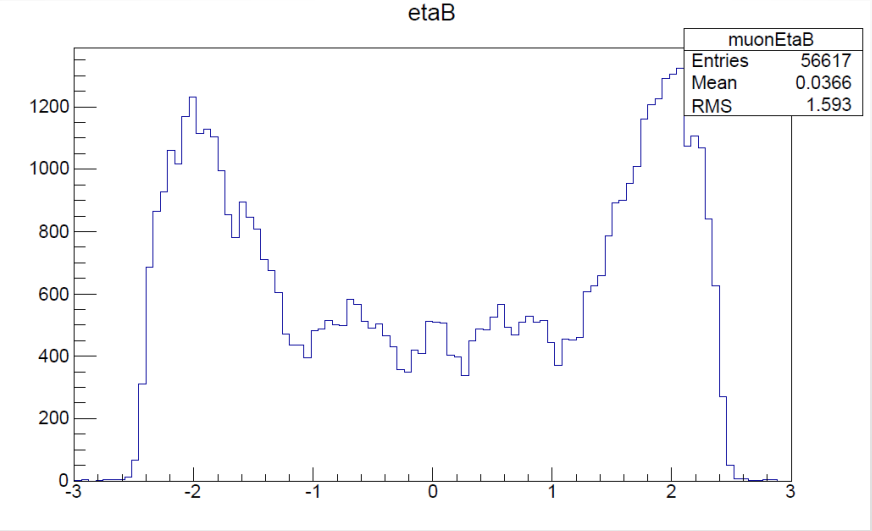


•The data was analyzed using the **CMS** release **CMSSW5314**, and double muon trigger.

•The three fundamental kinematic variables was plotted before the selection of muons:


ptB
muonPtB
Entries 56617
Mean 5.428
RMS 7.836
25000
20000
15000
10000
5000
0
0
50
100
150
200
250
300

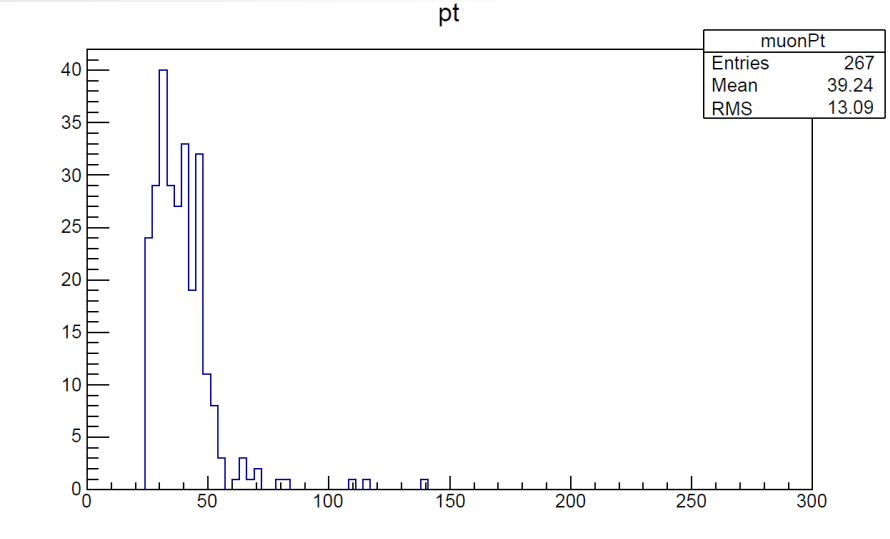

phiB
muonPhiB
Entries 56617
Mean 0.01953
RMS 1.841
1000
800
600
400
200
0
-5
-4
-3
-2
-1
0
1
2
3
4
5

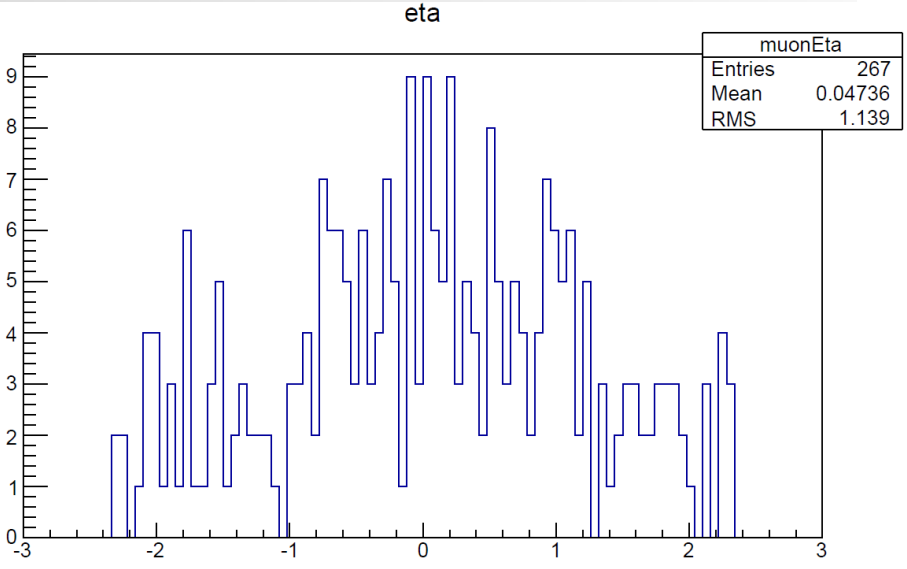

etaB
muonEtaB
Entries 56617
Mean 0.0366
RMS 1.593
1200
1000
800
600
400
200
0
-3
-2
-1
0
1
2
3

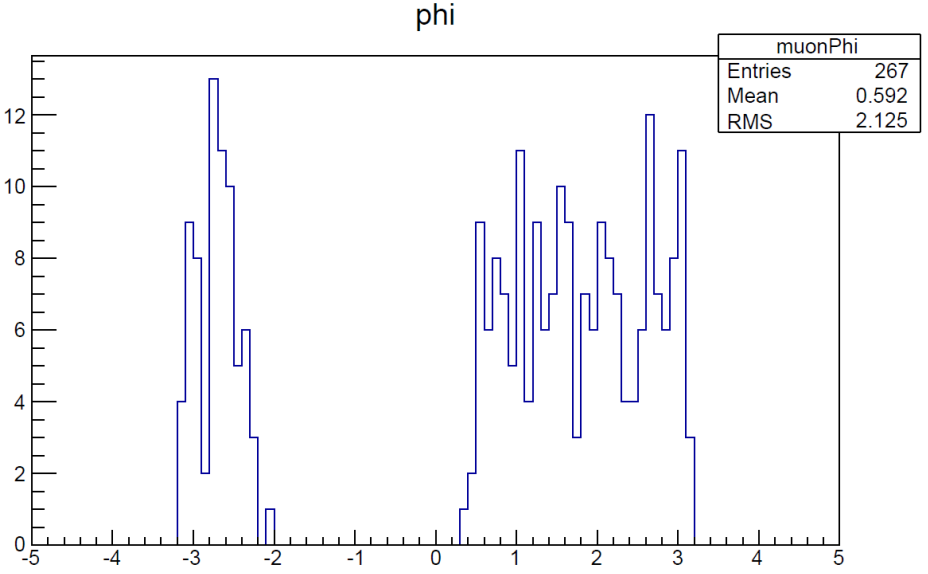
To select the muon, we use a slightly modified "**High p_T ID**" of the **muon POG**:

1. Acceptance: All four muons should have a pT > 25 GeV and |eta| < 2.4.
2. Longitudinal distance with respect to primary vertex dz < 0.5 cm.
3. Transverse impact parameter with respect to the primary vertex d_{xy}<0.02.
4. Particle Flow based relative isolation in a cone of size delta(R) = 0.4 < 0.12
5. Muon is a global muon.
6. Number of muon hits in the global track > 0.
7. At least two muon stations with segments.

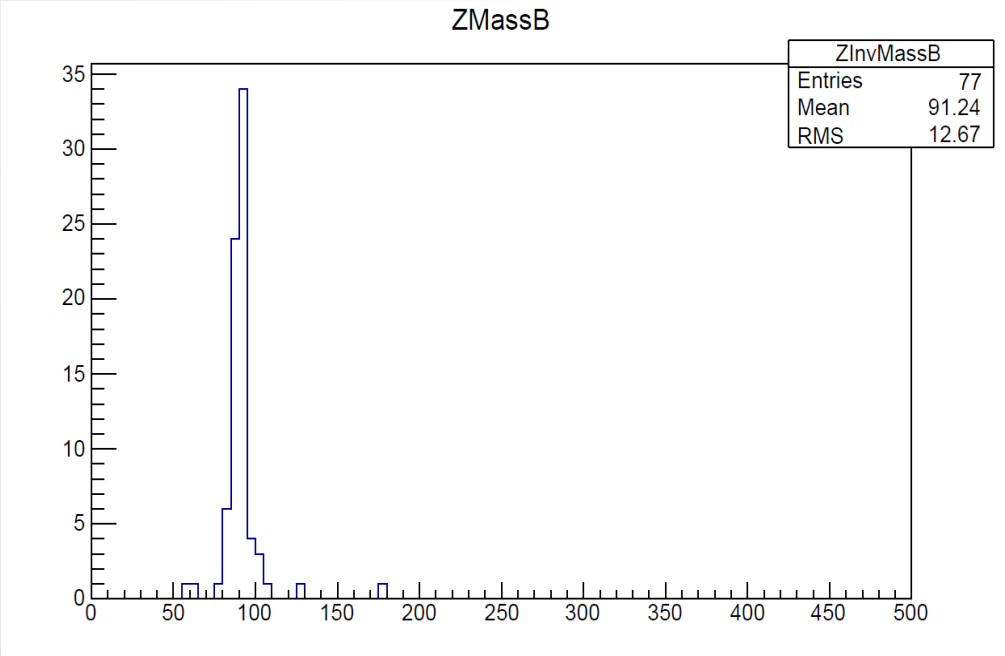
The three fundamental kinematical quantities after the selection of muon are:



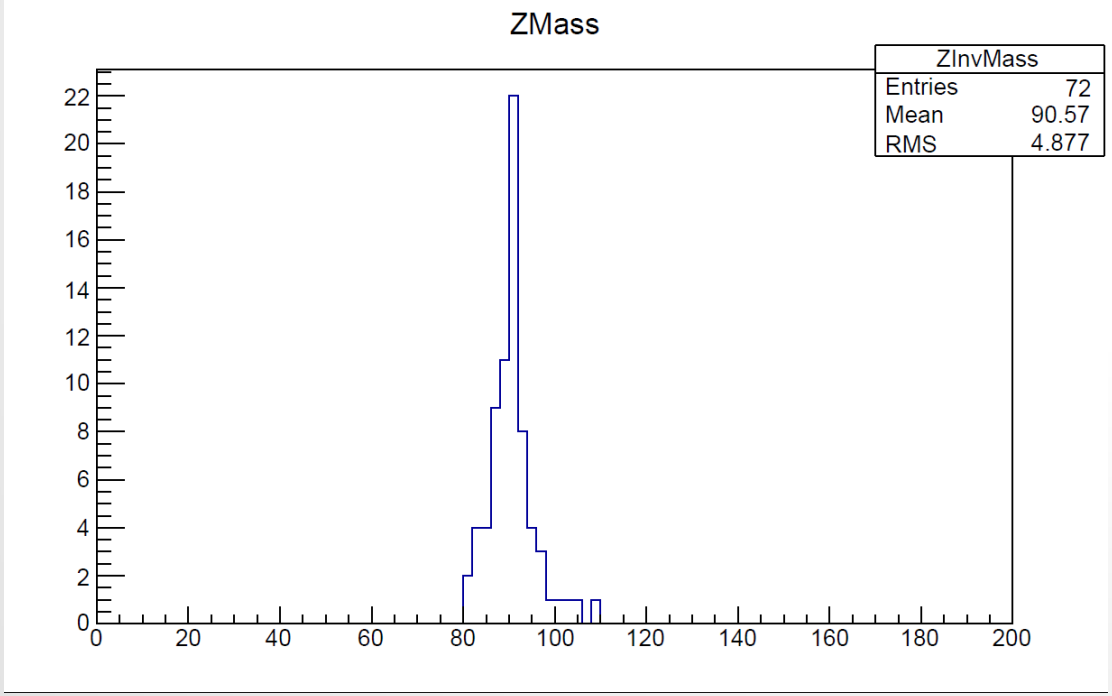




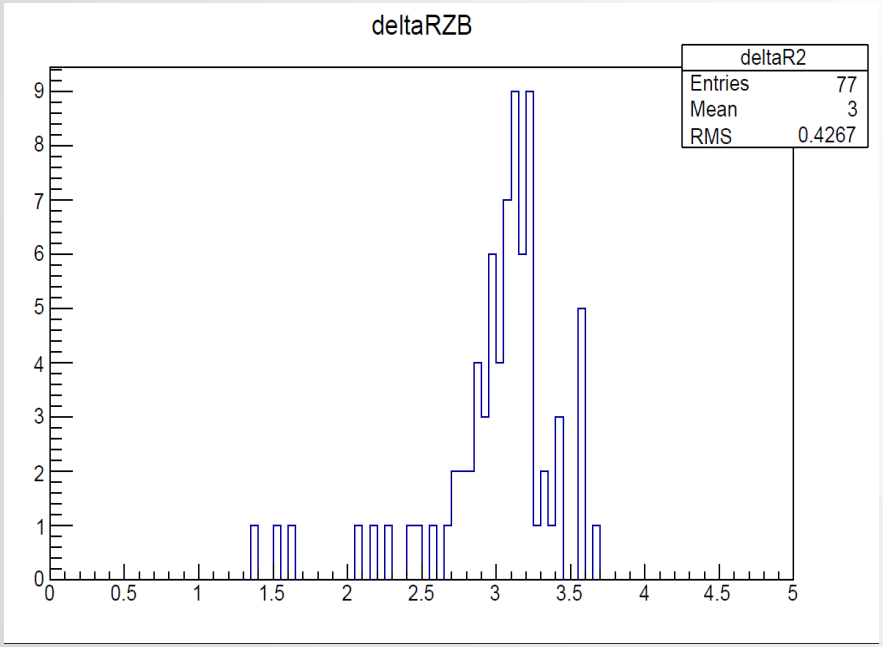
- The Z peak of the signal before invariant mass cut:

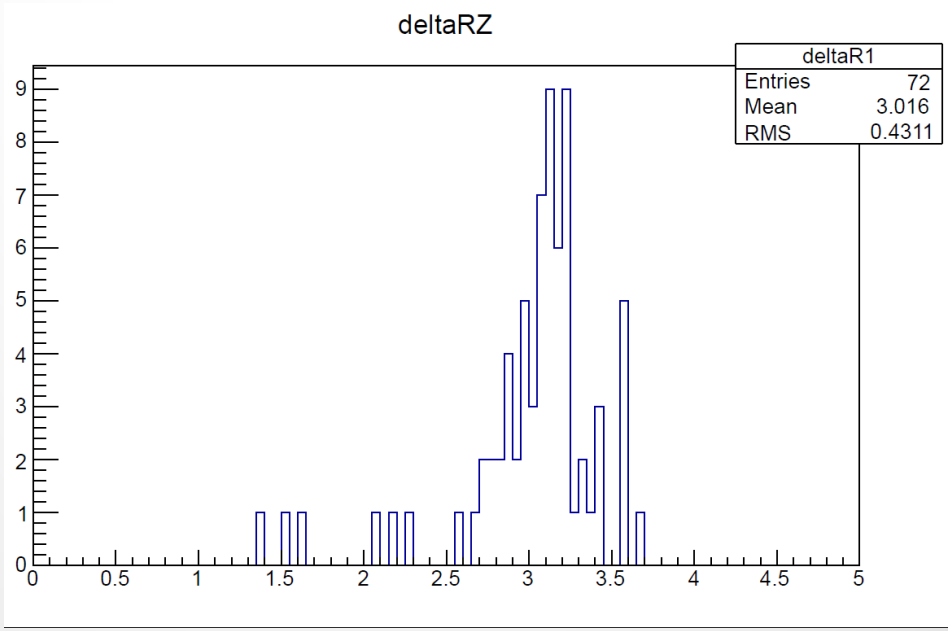


- The invariant mass cut of Z is a mass window 80-120 GeV, the Z peak after invariant mass cut:



- delta(R) of the two muons from the Z decay **before** (left), and **after** (right) invariant mass cuts:





Current work status:

1) Phenomology of the contact interactions, and the compositeness model using the **LanHEP** package , and **CalcHEP**.

2) Run the code on the background process that give rise to 4 muon final state, and calculating the pileup MC weighting, and efficiency.

3) Optimize the code to run on the full dataset of 2012 (double muon trigger).