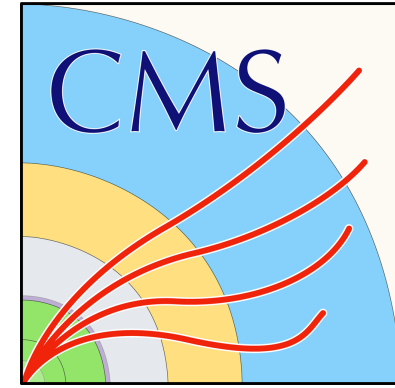




Search for New Heavy Resonances decaying into Muon pair

Minseok Oh

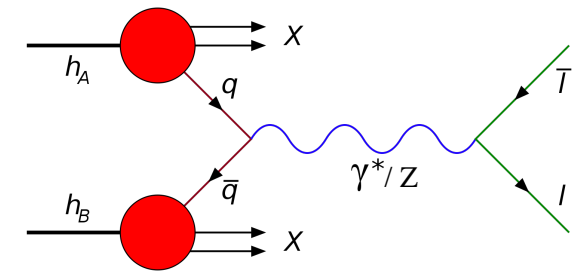
Seoul National University

BRL Workshop

2017. 6. 17.

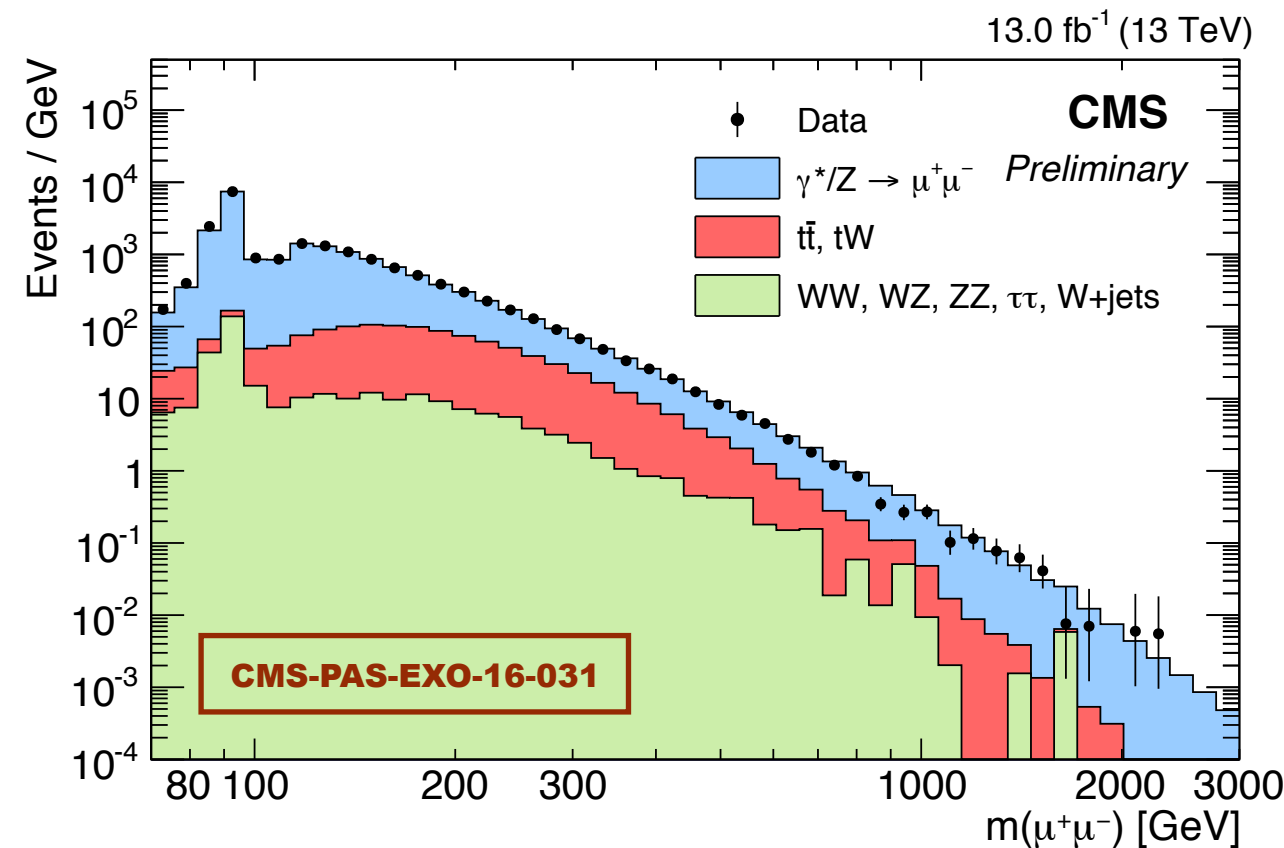
Introduction

- Many of new physics beyond standard model predict new massive neutral spin-1 particle called the **Z'**
- If such heavy bosons exist they would show up in the invariant mass spectrum as a narrow peak on top of the high mass tail that is dominated by the **Drell-Yan** process
- Latest public results : Early 2016 data collected by **CMS** corresponding to 13 /fb at 13 TeV
(CMS-PAS-EXO-16-031)



- Event selection**

- offline $p_T > 53$ GeV, $|\eta| < 2.4$
- Isolation
- Opposite charge
- 3D angle $< \pi - 0.02$ to reject cosmic muons



Strategy and Results

- **Eta categories**

- BB : Both muon in the Barrel region ($|\eta| < 1.2$)
- BE + EE : At least one muon in the endcap ($1.2 < |\eta| < 2.4$)

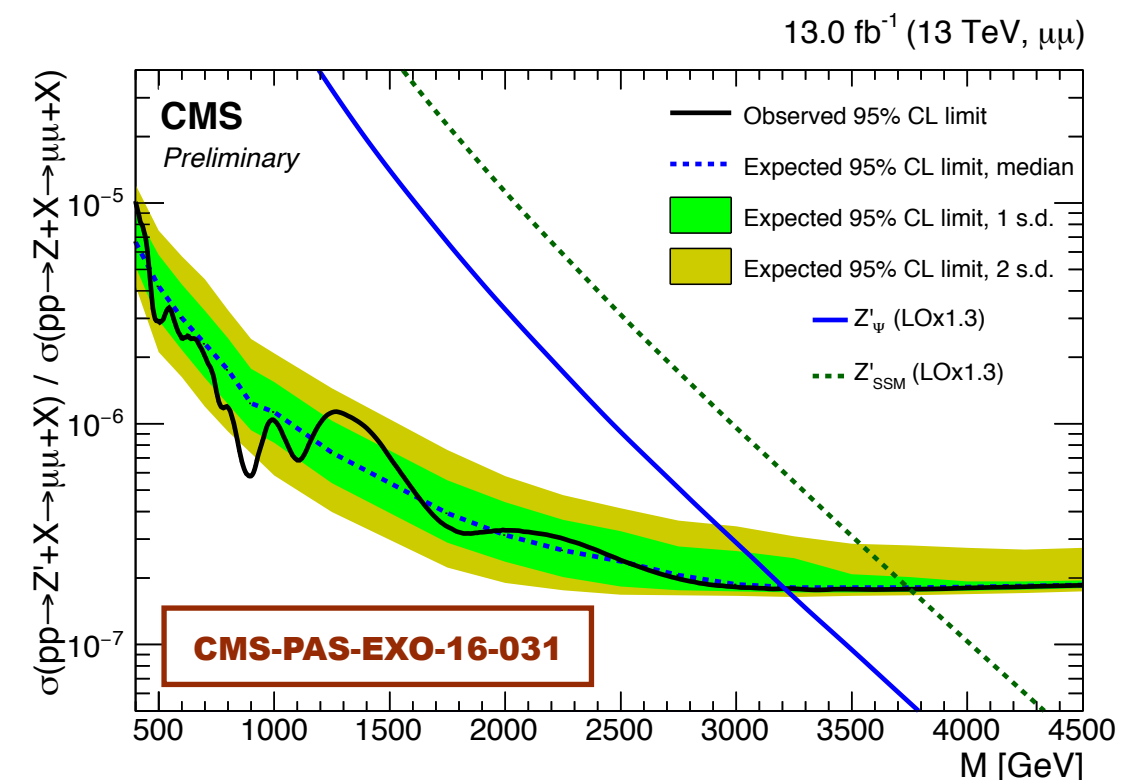
- **Normalize to the Z resonance**

- Cancel out luminosity uncertainty and pT dependent effects

$$R_\sigma = \frac{\sigma(pp \rightarrow Z' + X \rightarrow \mu^+ \mu^- + X)}{\sigma(pp \rightarrow Z + X \rightarrow \mu^+ \mu^- + X)}$$

- **No significant deviations from Standard Model**

- Sequential Standard model : $M(Z'_{SSM}) > 3.75$ TeV
- Superstring inspired model : $M(Z'_\psi) > 3.25$ TeV



Full 2016 Dataset Analysis



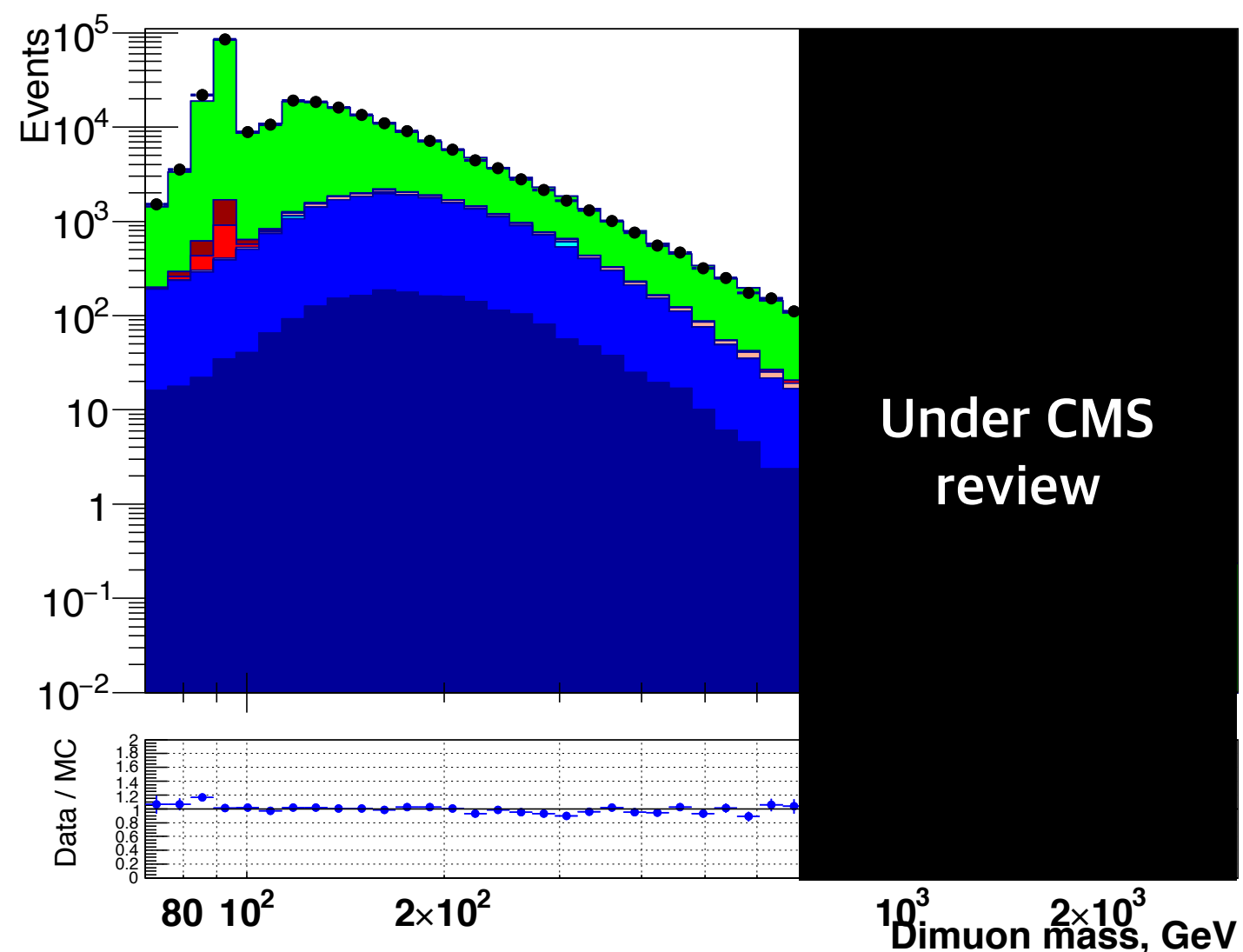
4

◎ Current status

- Full 2016 data collected by **CMS** corresponding to 37 /fb at 13 TeV
- Same analysis strategy as previous results
- Under review in CMS

◎ What I'm Doing

- Acceptance X Efficiency measurement
- High pT muon reconstruction study
- Level 2 trigger study



Acceptance X Efficiency

- Simulated with Drell-Yan events from 50 to 6000 GeV

- Acceptance**

$$\frac{\text{\# of events within kinematic cuts}}{\text{Total \# of events}}$$

- Efficiency**

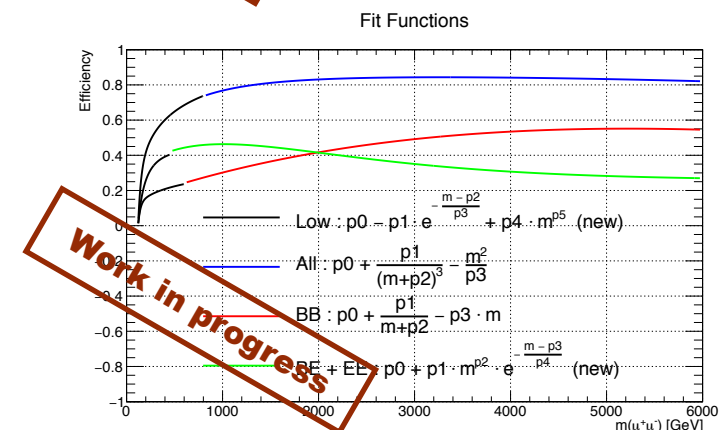
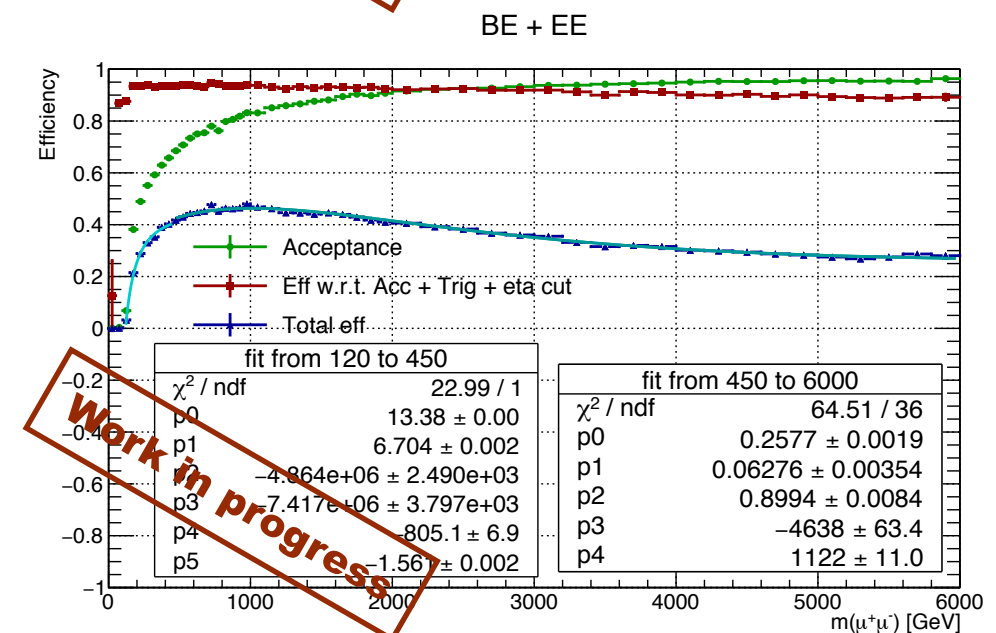
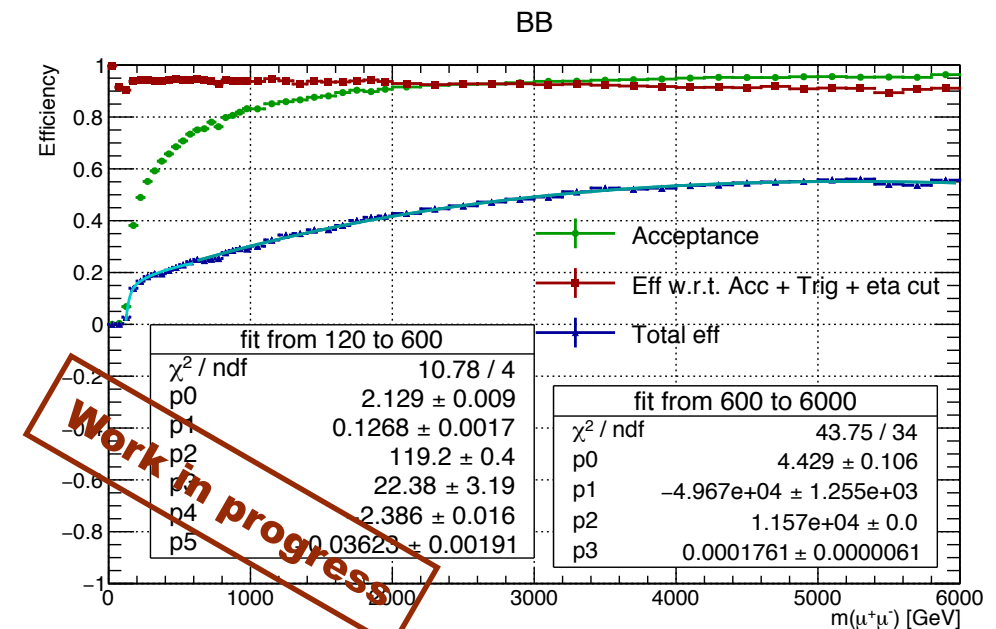
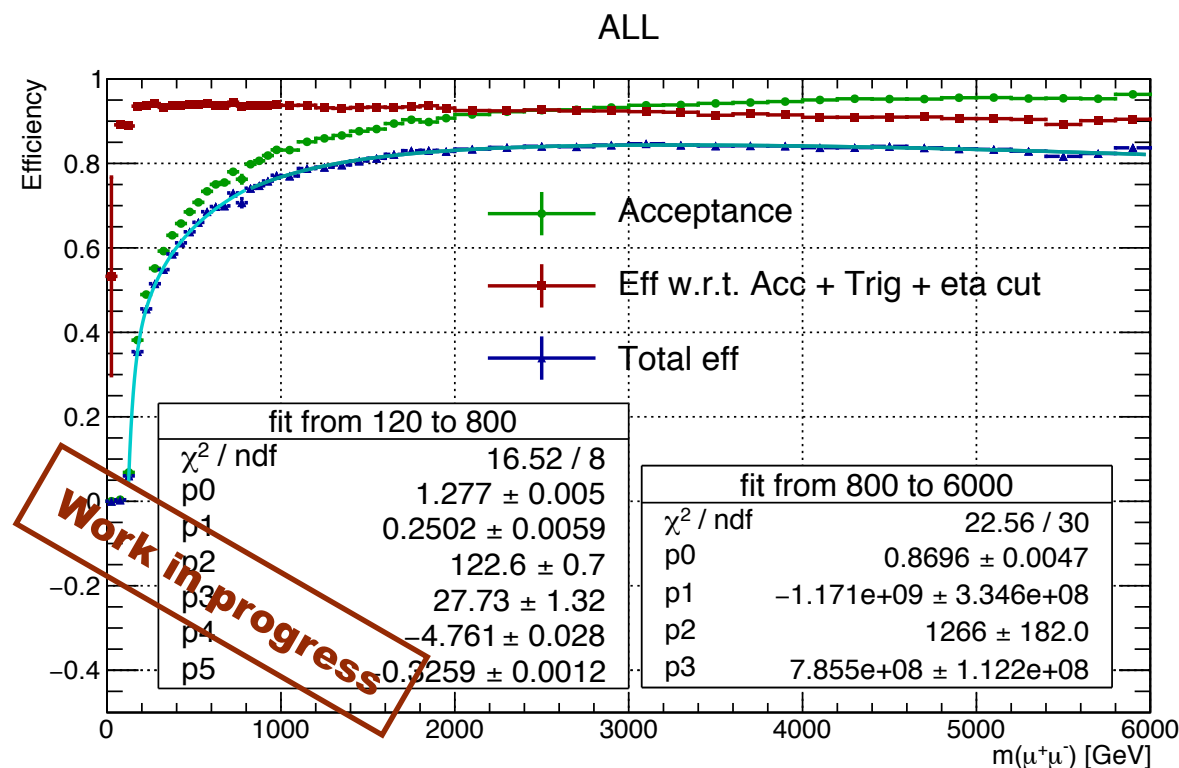
$$\frac{\text{\# of reconstructed events}}{\text{\# of events within acc.} \times \text{trigger fired} \times \text{eta cat. cut}}$$

- Total reconstruction efficiency (Acc x Eff)**

$$\frac{\text{\# of reconstructed events}}{\text{Total \# of events}}$$

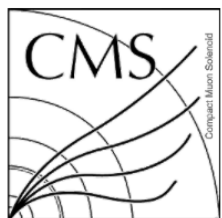
- Parametrization**

- Acceptance X efficiency is parametrized with different fit functions

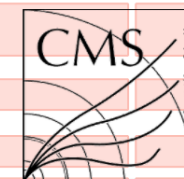
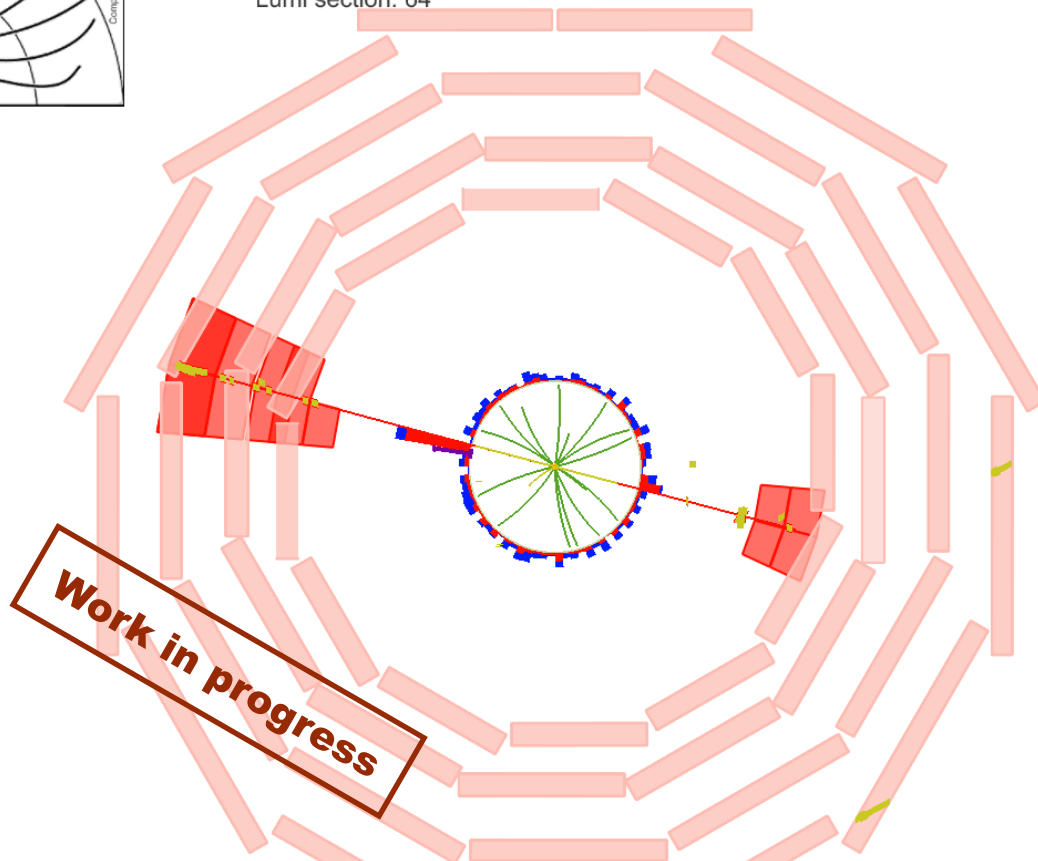


High pT muon Reconstruction

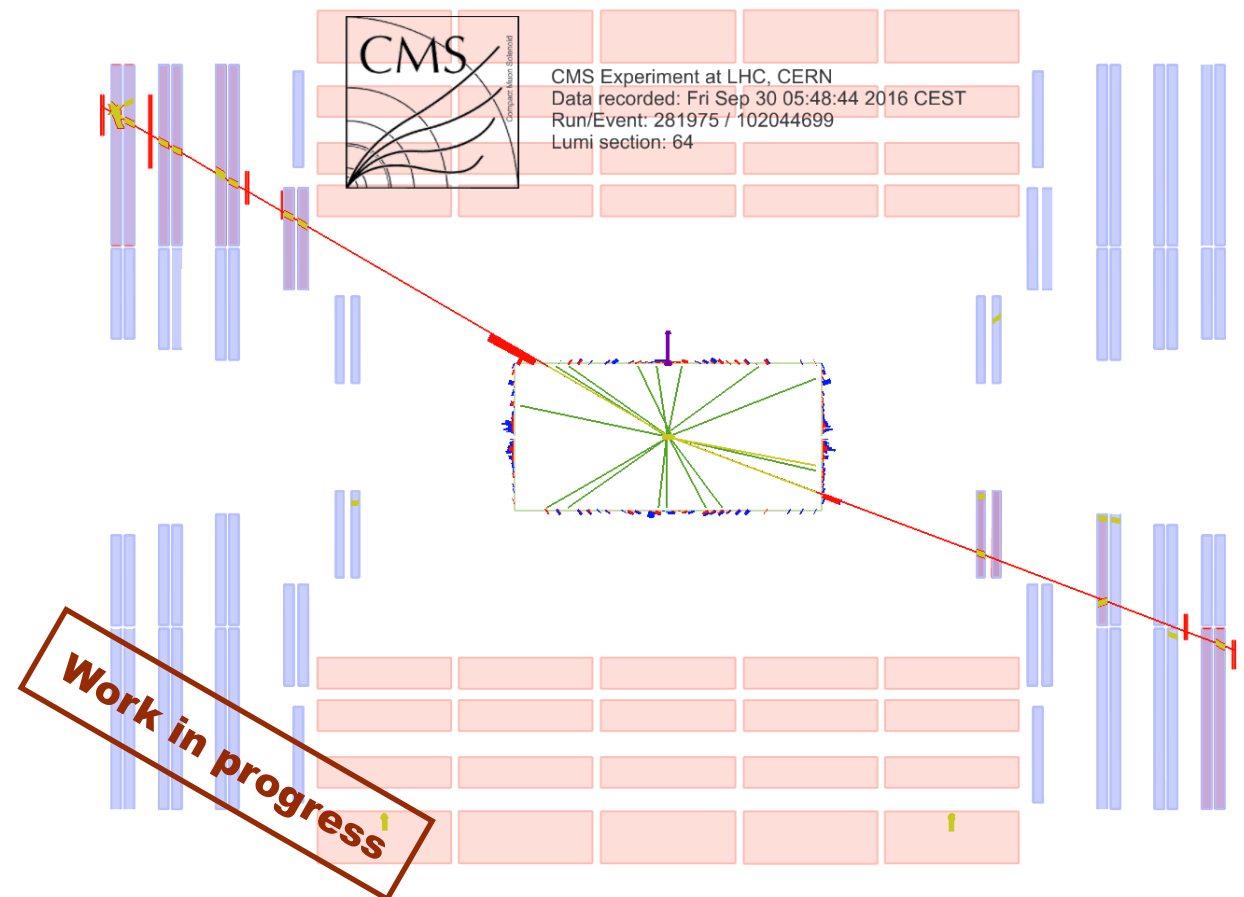
- High pT muon reconstruction is **VERY IMPORTANT** for heavy resonance search
- Studying with **MuonPOG**
 - Characteristics of high pT **tracks** and **muons**
 - Possible failure in high pT muon reconstruction



CMS Experiment at LHC, CERN
Data recorded: Fri Sep 30 05:48:44 2016 CEST
Run/Event: 281975 / 102044699
Lumi section: 64



CMS Experiment at LHC, CERN
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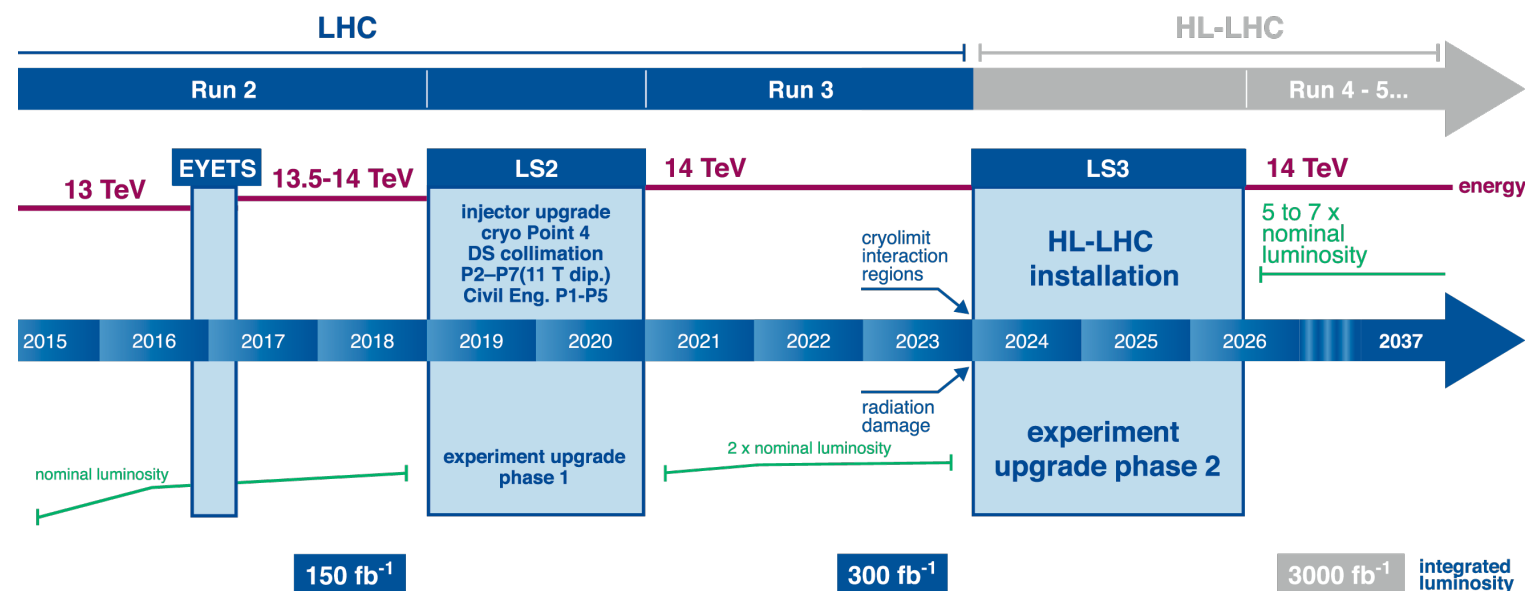
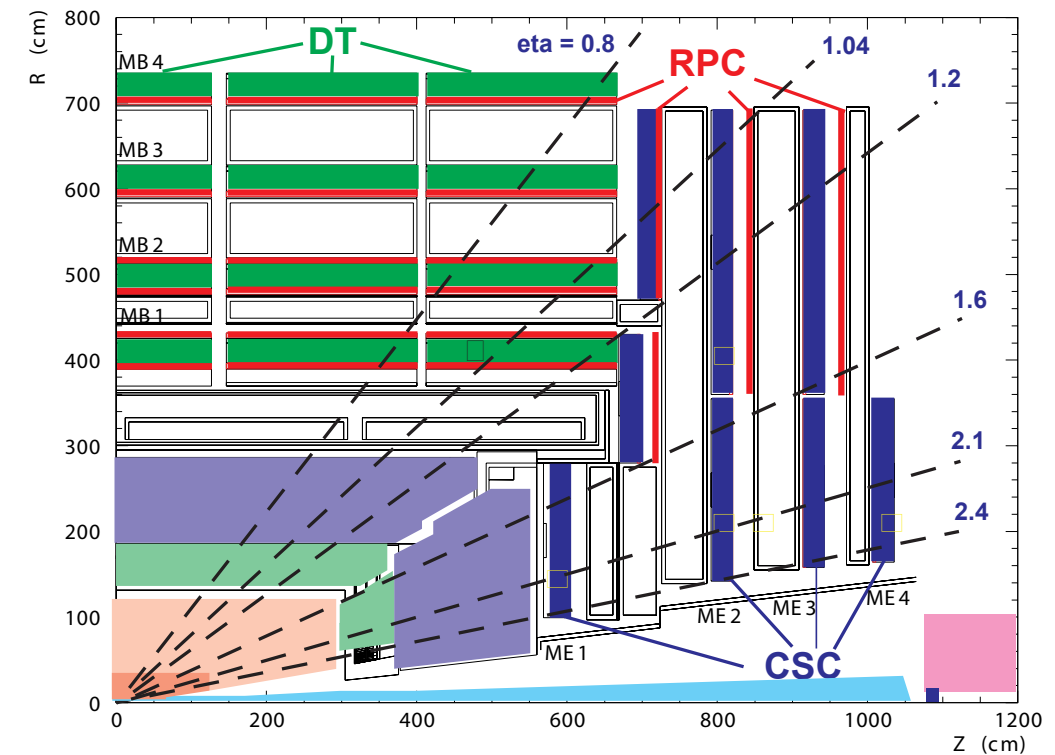
* $M_{\mu^-\mu^+} = 2191 \pm 97$, $pT_{\mu^-} = 521 \pm 36$, $pT_{\mu^+} = 413 \pm 23$

Level 2 Trigger Study

- In the overlap region ($0.9 < |\eta| < 1.2$), muon passes both **DT** and **CSC**

Trigger Efficiency in overlap region is relatively low because trigger is using information from two different detectors

- Need to be prepared for luminosity increase of LHC to maintain good trigger performance
- ➔ Study on L2 trigger seeding step to be more robust to ghost muons and duplicates



Summary and Plans

● Summary

- Acceptance X Efficiency measurement for Z' dimuon analysis has been done
- Study on high p_T muon reconstruction is on going
- Study on Level 2 trigger system is on going

● Plans

- Finalize Z' dimuon analysis for full 2016 data
- Continue with new 2017 data
- Participate more tasks in Z' team to improve the analysis

Backup

