Brief Update on A&M Work

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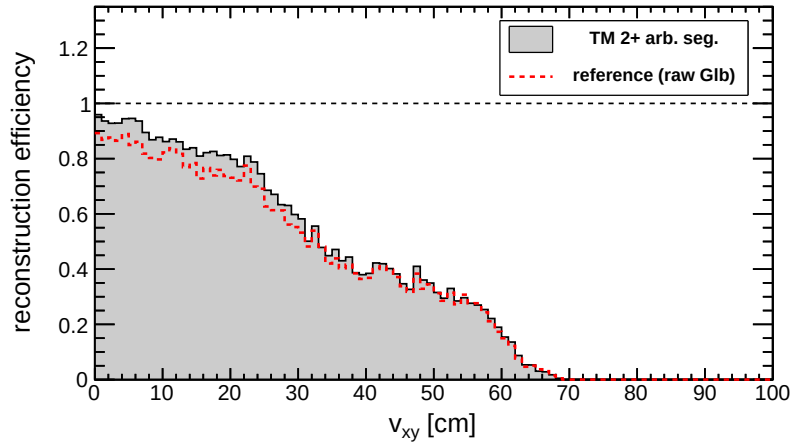
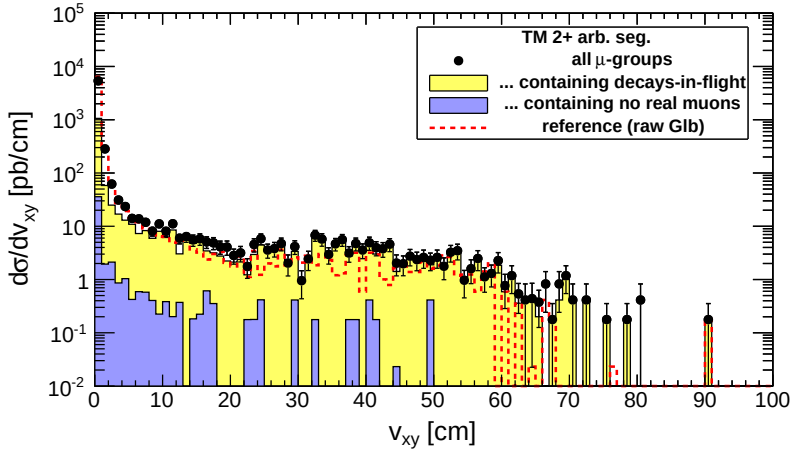
Since last time

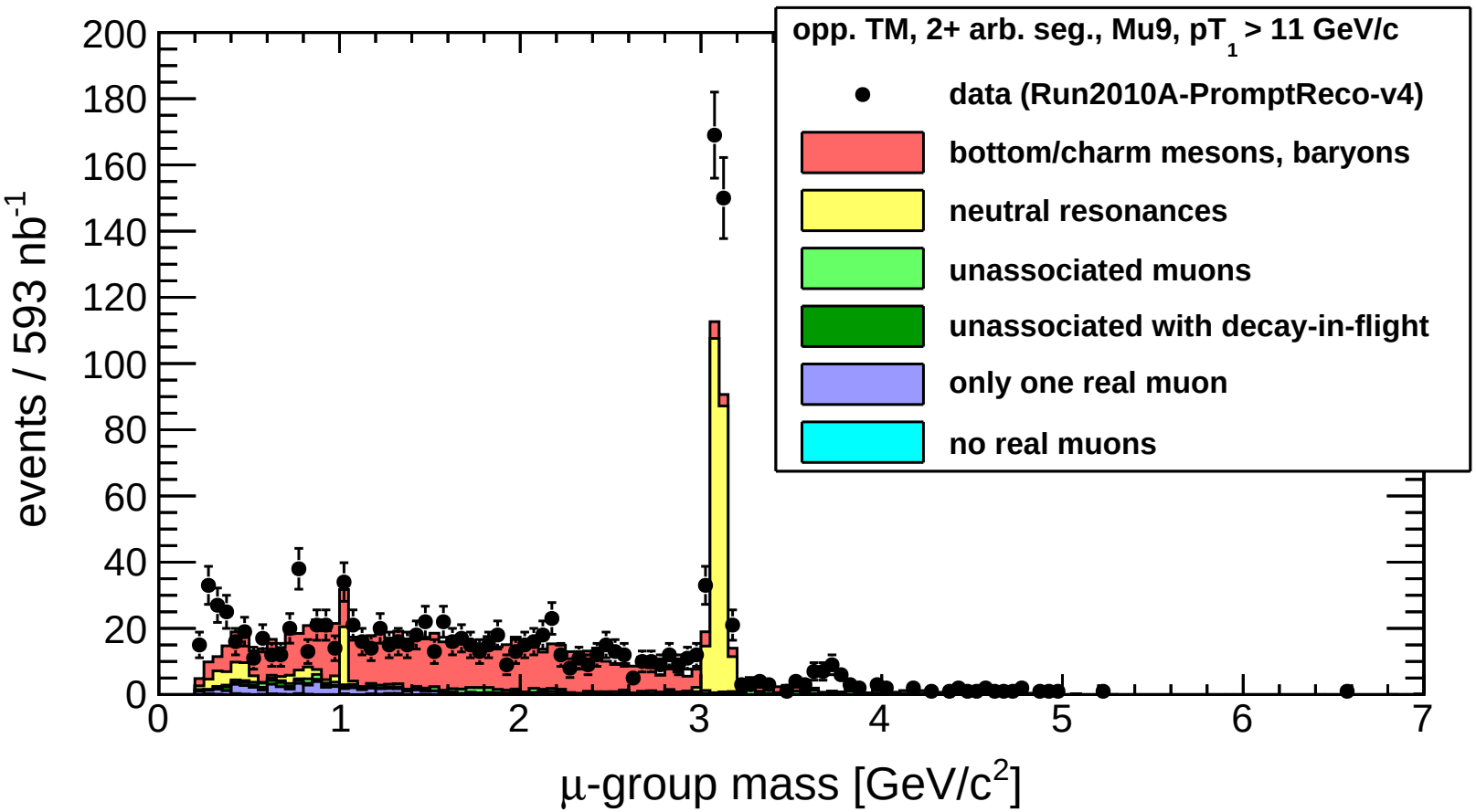
- Settled on a baseline set of cuts
  - TrackerMuons with $N_{\text{segments}} \geq 2$ yield the same purity as GlobalMuons
  - it is essential that the segments in the count are arbitrated
  - even with the cut, TrackerMuons have a higher and easier-to-understand reconstruction efficiency for prompt muons
  - new: by removing unnecessary additional cuts, TrackerMuons now have the same acceptance as GlobalMuons for highly displaced μ-groups (plot on the right)
- Starting to look at the new data



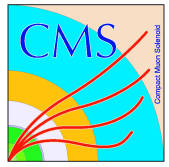


Single μ-group comparison

- Opposite-sign groups of TrackerMuons with $N_{\text{segments}} \geq 2$, HLT_Mu9, and $pT_1 > 11$ GeV/c compared to InclusiveMu5_Pt*
- Prompt J/ψ and $\psi(2S)$ are missing (understood)
- $\omega \to \mu\mu$ is not in the Monte Carlo? What about low-mass rise?



Next steps (conclusions slide)

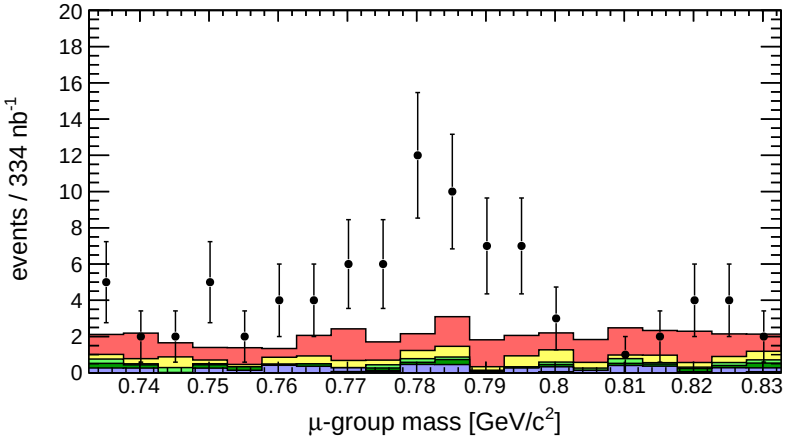


- Compare data and MC starting at the lowest levels of reconstruction (track-segment matching) and make sure everything is okay up to high level (kinematics)
  - for example, the low-mass rise needs to be understood, but if the discrepancy is due to something at a deeper level, the best way to find it is to methodically check everything from the bottom up
- Trigger efficiency studies
- Estimating backgrounds from data

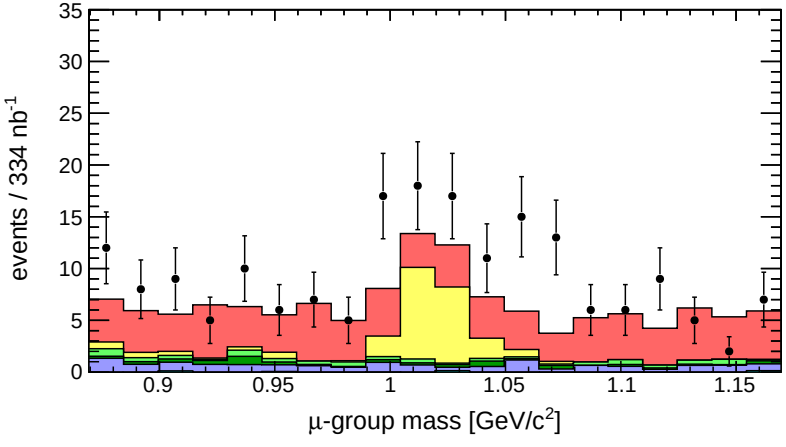
Backup 1: close-ups of mass

Note: these two are from HLT_Mu5 with $pT_1 > 7$ GeV/c

$\omega \to \mu\mu$ is in real data, but not MC

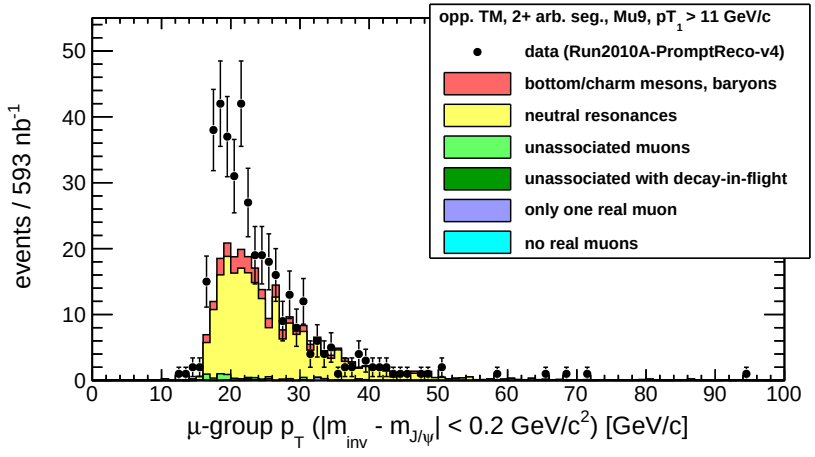


$\phi \to \mu\mu$ is in MC, but perhaps too few



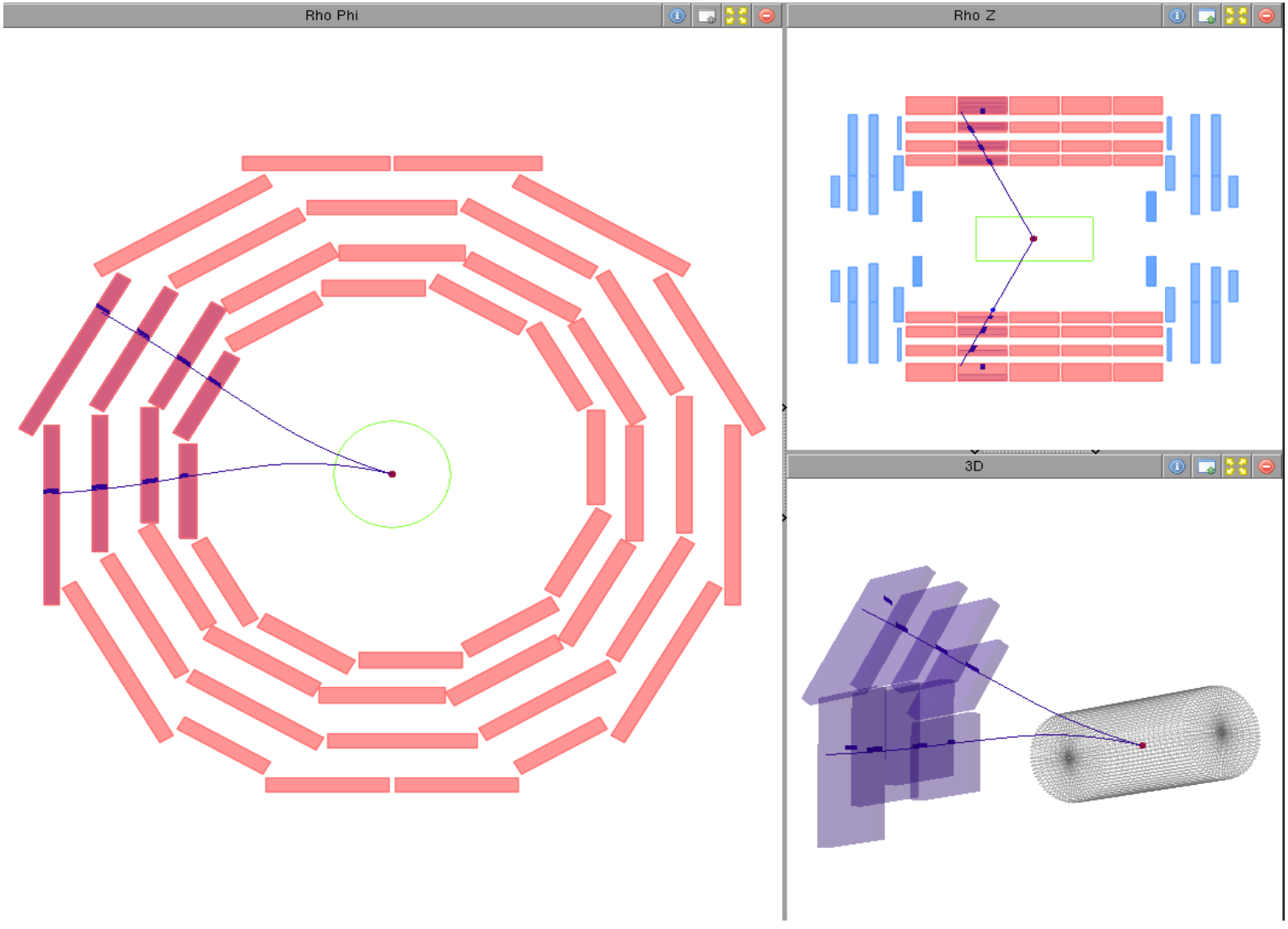
This is a p_T distribution of μ-groups in a mass window around the J/ψ

It's the low-momentum part that's missing, and I know that prompt J/ψ are not included in the InclusiveMu5_Pt*

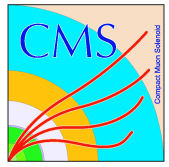


Backup 2: low-mass event

The $\mathcal{O}(100)$ $m_{\text{inv}} < 0.4$ GeV/c^2 events in data but not MC are good-looking di-muons (this one has $m_{\text{inv}} < 0.25$ GeV/c^2)



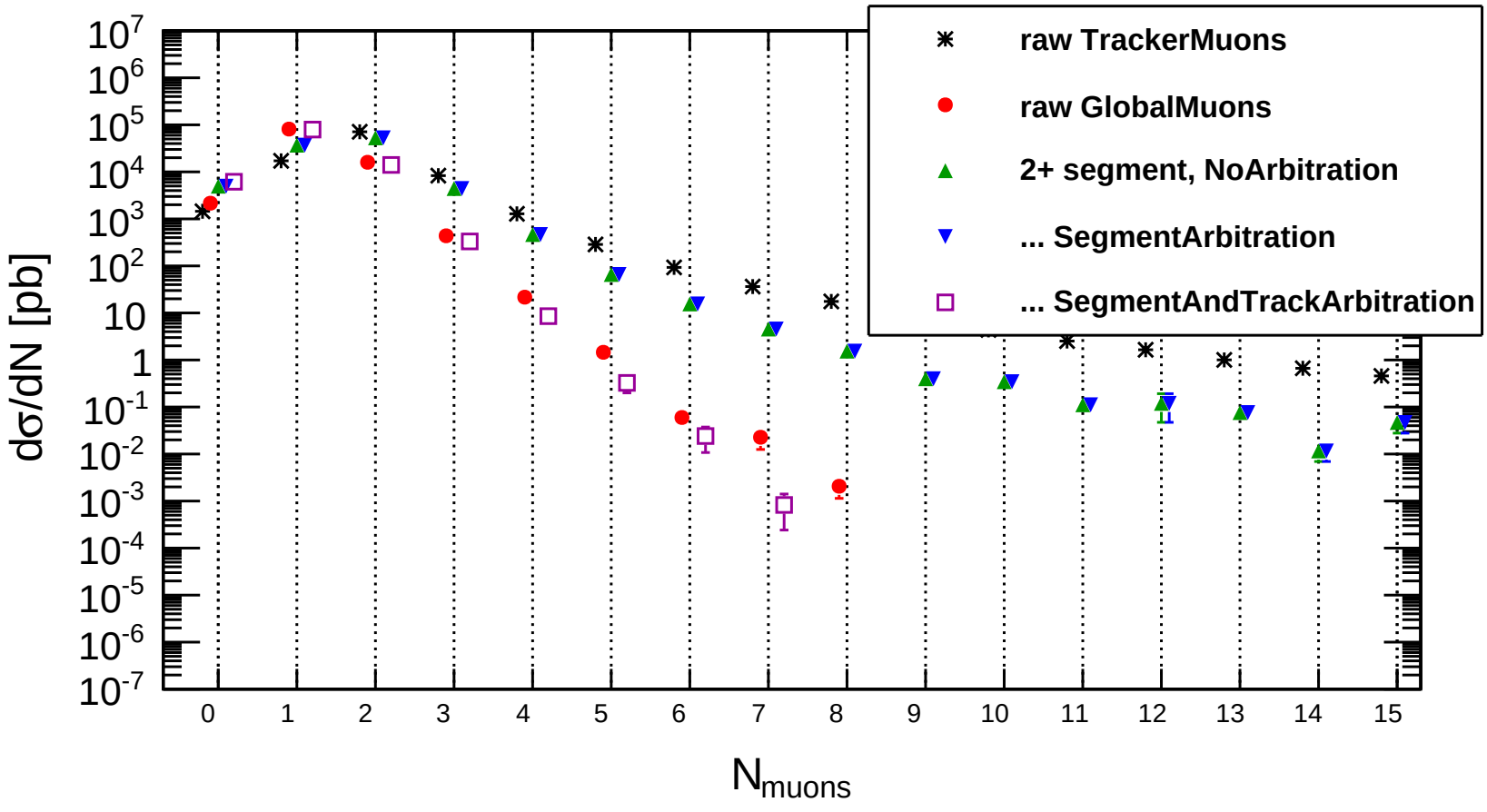
Backup 3: cuts



- Run/LS selection: good tracking, muons, and trigger, selected by runregparse.py and luminosity calculated by lumiCalc.py
- Event-level:
  - HLT_Mu9 (or HLT_Mu5, correcting for prescale)
  - leading track $p_T > 11$ GeV/c (or 7) and $|\eta| < 2.1$
  - at least one primary vertex with $|z| < 24$ cm (hn-cms-PO7TeV)
  - filter out scraping (Collisions2010Recipes)
- Muon tracks:
  - $p_T > 5$ GeV/c, $|\eta| < 2.4$
  - TrackerMuons with $N_{\text{segments}} \geq 2$ (arbitrated)
  - all default cuts inherited
- Muon-group "closeness" definition:
  - ($m_{\text{pair}} < 5$ GeV/c^2 **and** $P_{\text{vertex}} > 1\%$) **or** $\Delta R < 0.1$
  - pairs must be oppositely charged

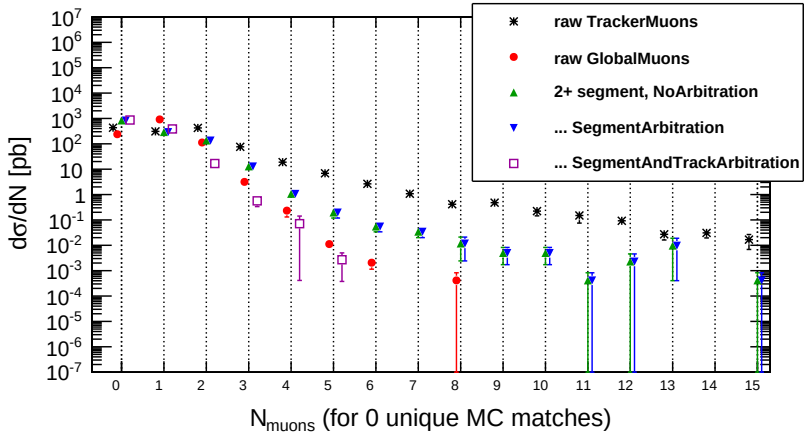
From last time: N_{segments} cut

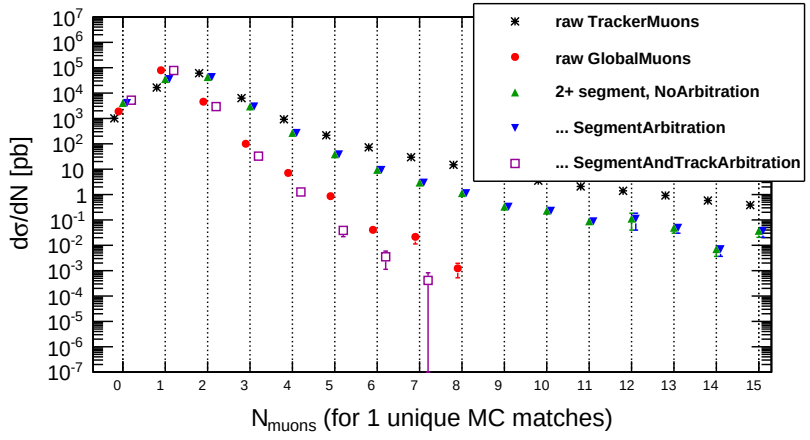
- Requiring at least 2 *fully arbitrated* segments in TrackerMuons recovers purity of GlobalMuons

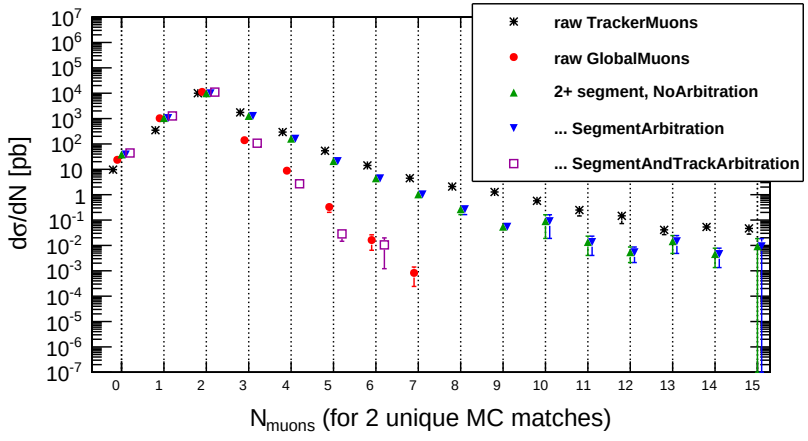


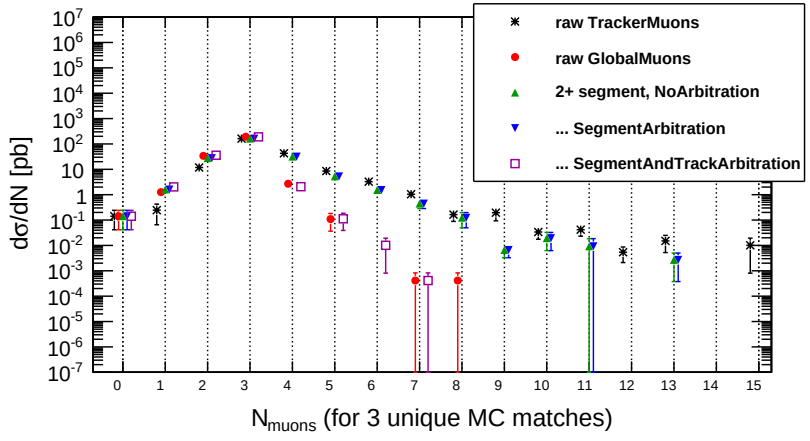
From last time: N_{segments} cut

- We see that we usually get the *right* number of muons
- GlobalMuons and TrackerMuons + cut have the same backgrounds









From last time: efficiency of cut

- Efficiency versus $\Delta\phi = \phi_{\mu^+} - \phi_{\mu^-}$ in barrel (left) and endcap (right)
- Top: GlobalMuons (barrel dependency not fully understood)
- Bottom: TrackerMuons with arbitrated $N_{\text{segments}} \geq 2$