

Tight Muon Reconstruction Efficiency (Slide 7 corrected)

Sept 30, 2019

Xiaoning Wang

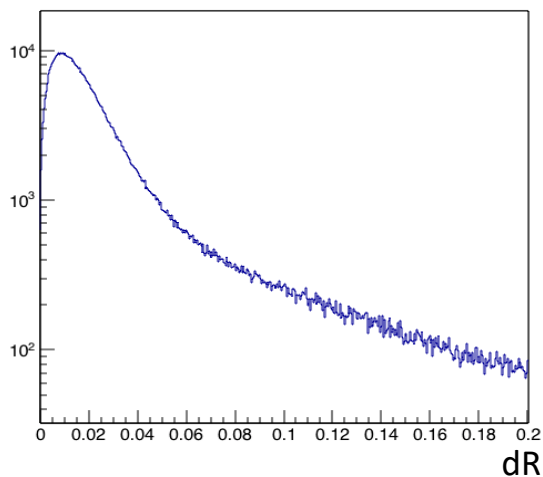
From Sept 25 EW/Onia Meeting

- Check the dR selection for ID efficiency calculation.
- Study the efficiency/scale factors' centrality dependence.

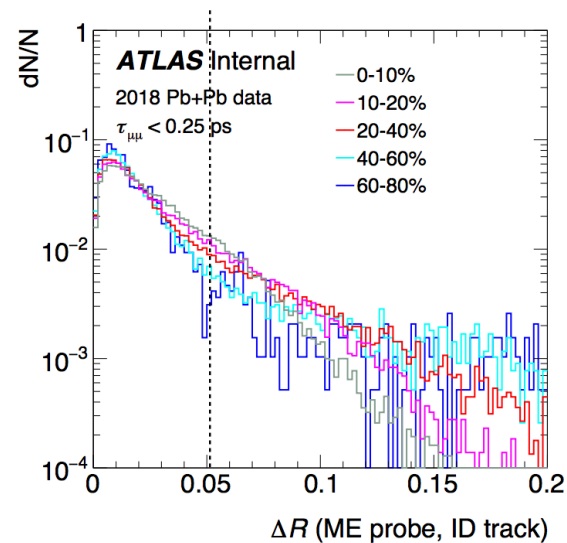
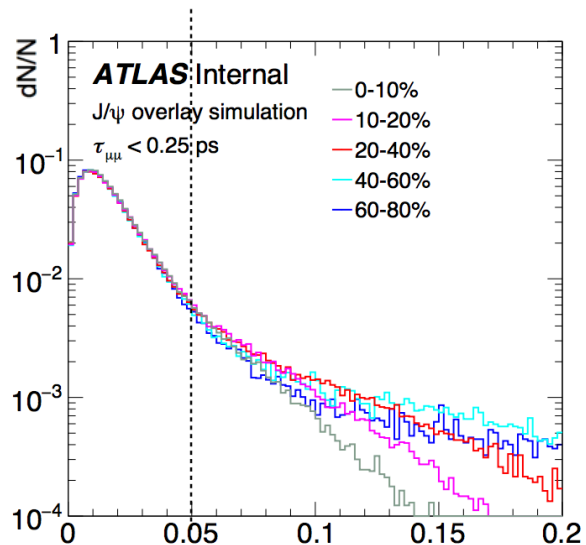
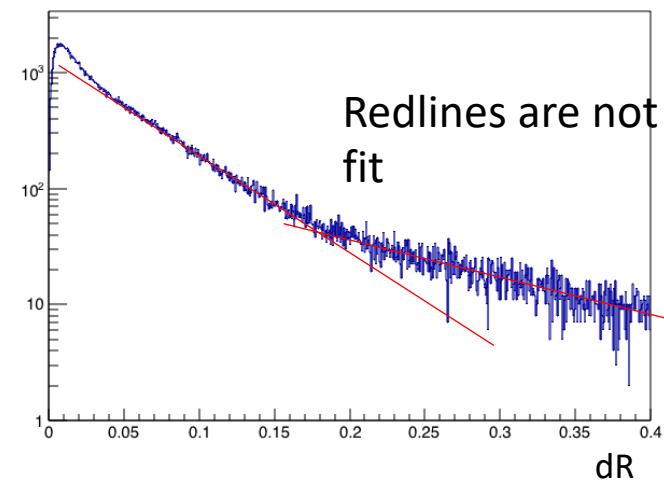
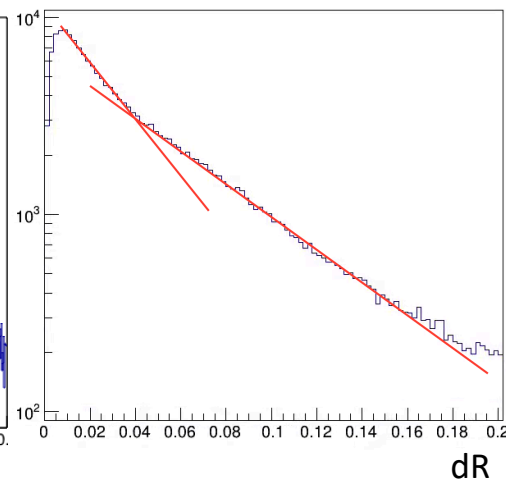
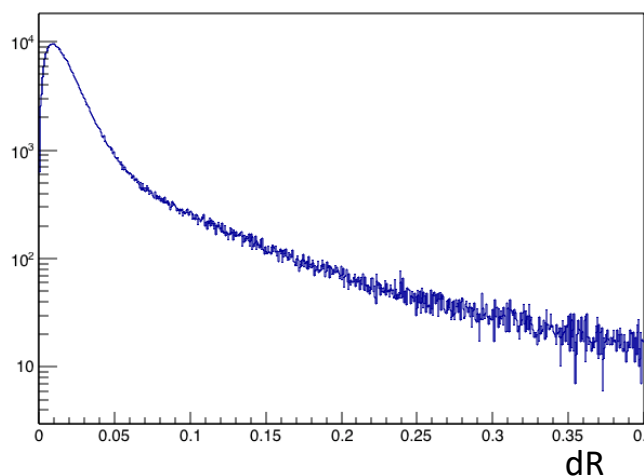
Progresses

- Looked into dR distribution, observed similar distribution with Qipeng's study.
 - Efficiency is lowered by ~5-7% (barrel: ~5%, endcap ~7%)
 - Looked into truth efficiency to use as a reference
 - Truth efficiencies are under 70% for both ψ & J/ψ . low efficiency region at $1.2 < |\eta| < 2$
 - No obvious dependence on charges/centrality.
 - Checked distribution of distances between a pair of tracks those are possibly from the same parent.
- Produced data distribution as a function of FCal, written codes for reweighting MC, yet to run since we're now unsure about our MC.

mindR in ID in Prompt J/psi MC

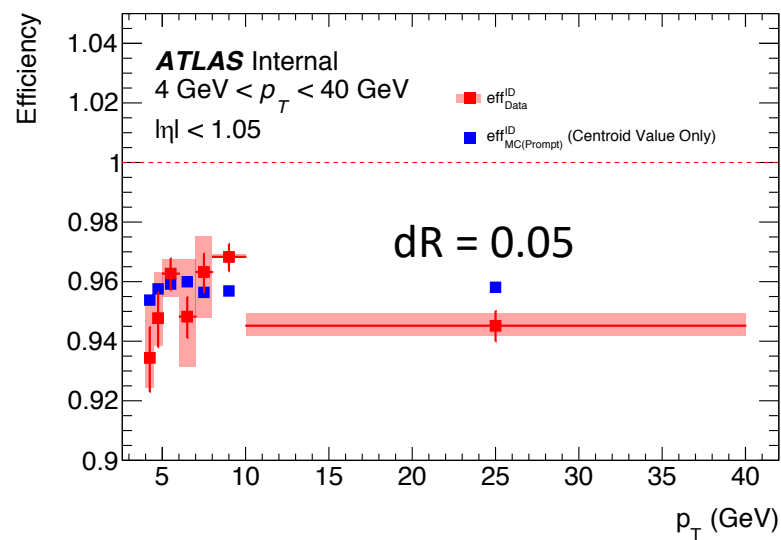
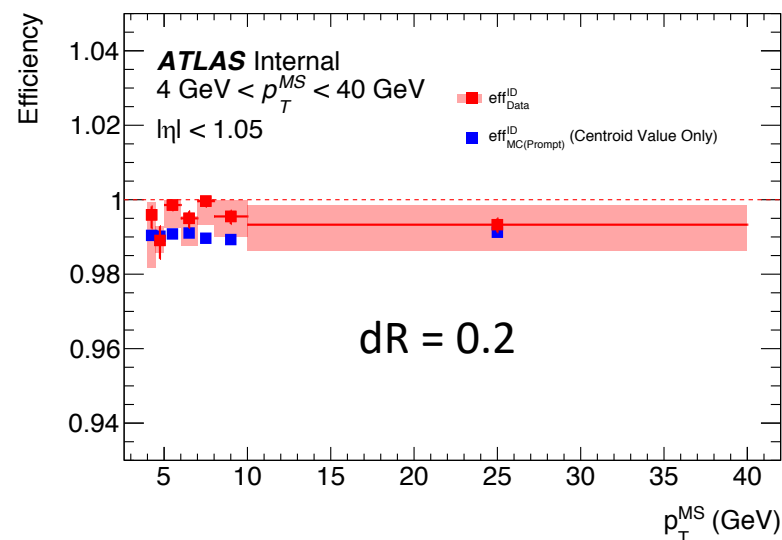


mindR in ID in Data

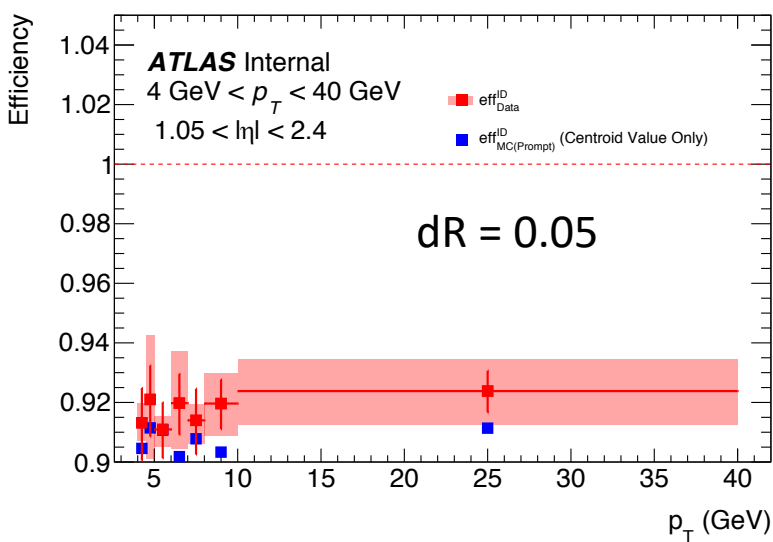
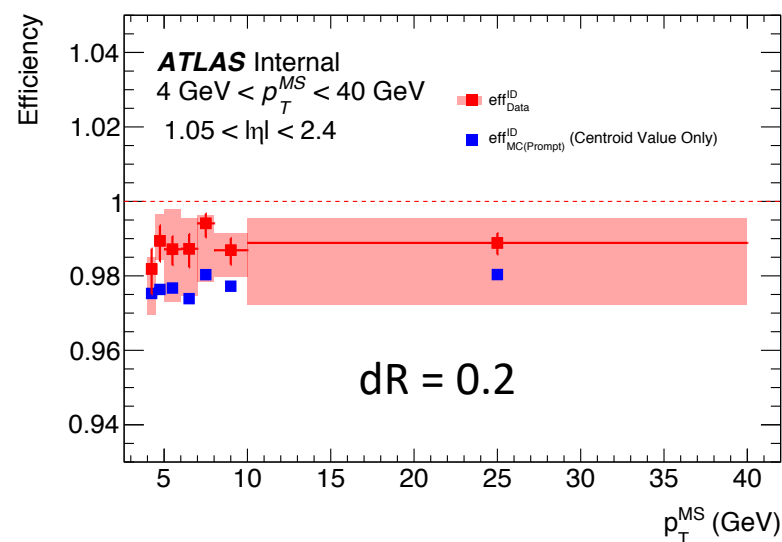


- Top 3 graphs, our data & MC using tight muons (integrated over centrality)
- Bottom 2 graphs, Qipeng's slides using medium muons
- Qualitatively similar.

Comparison of Using different dR selection

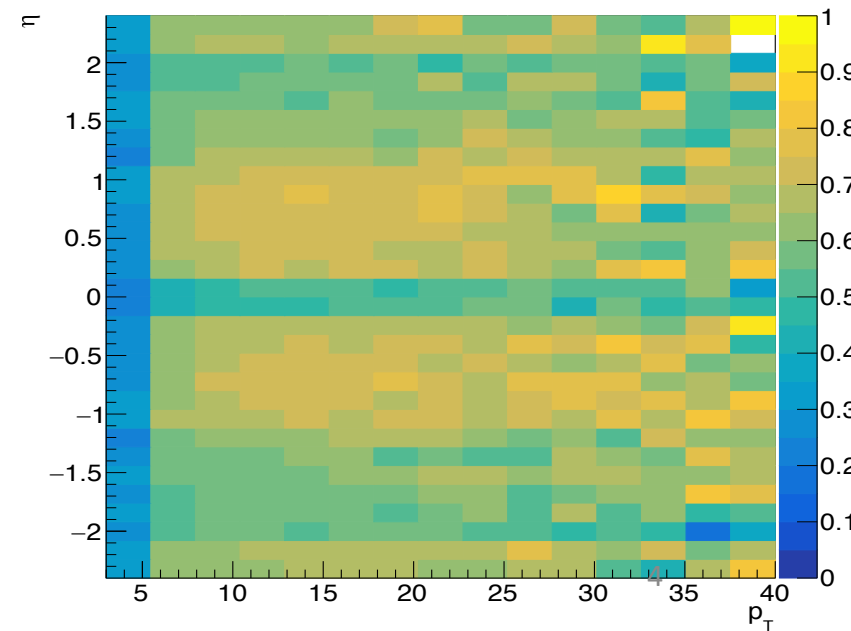
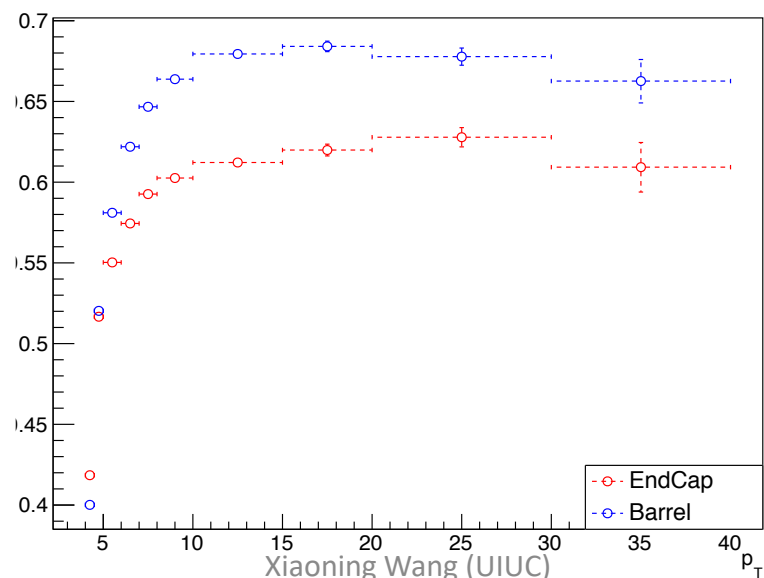
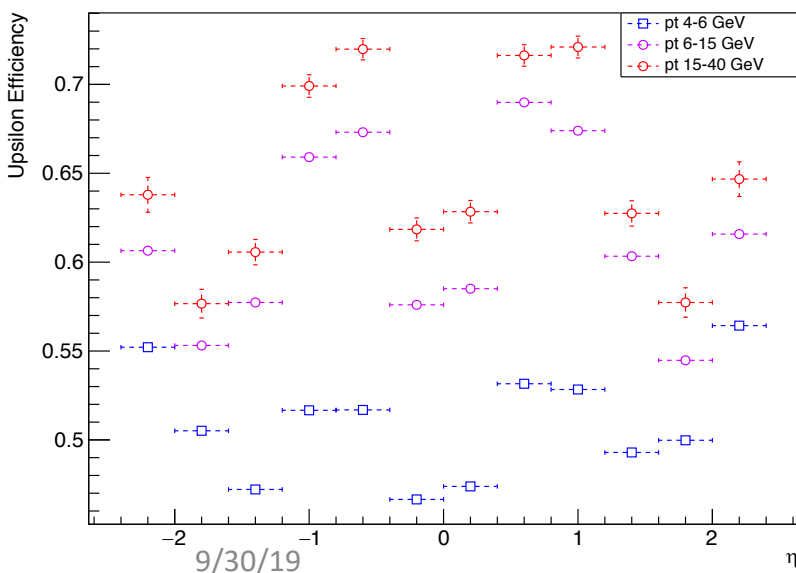
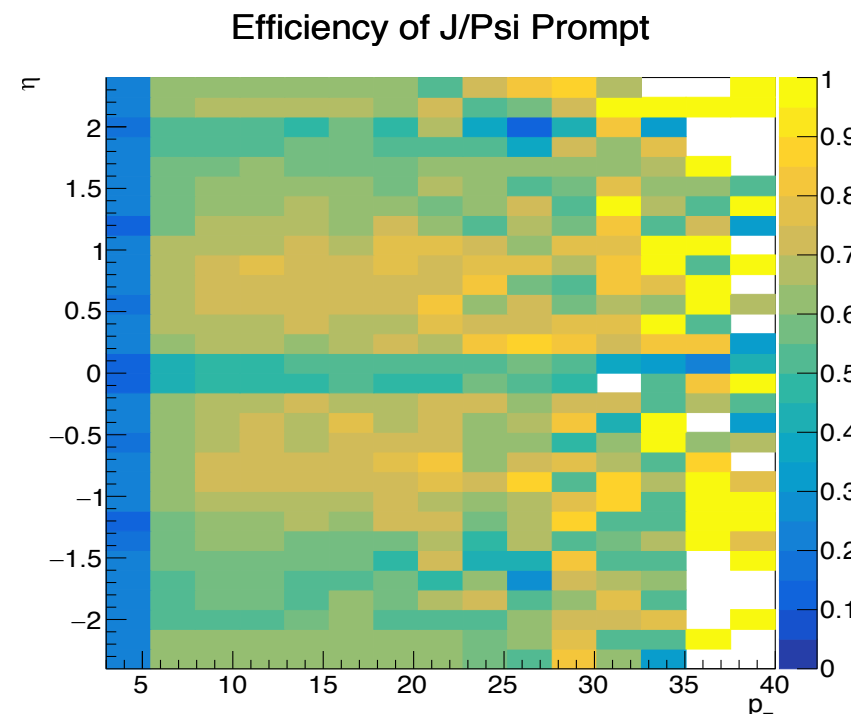
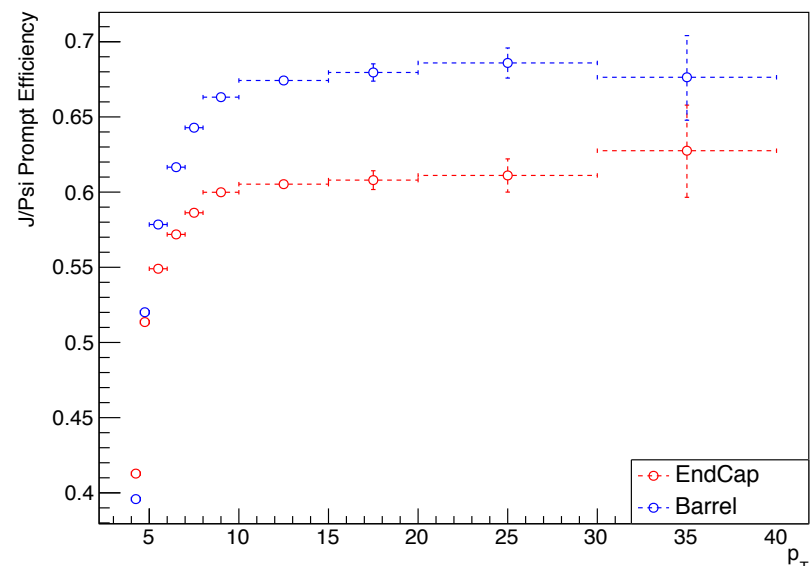
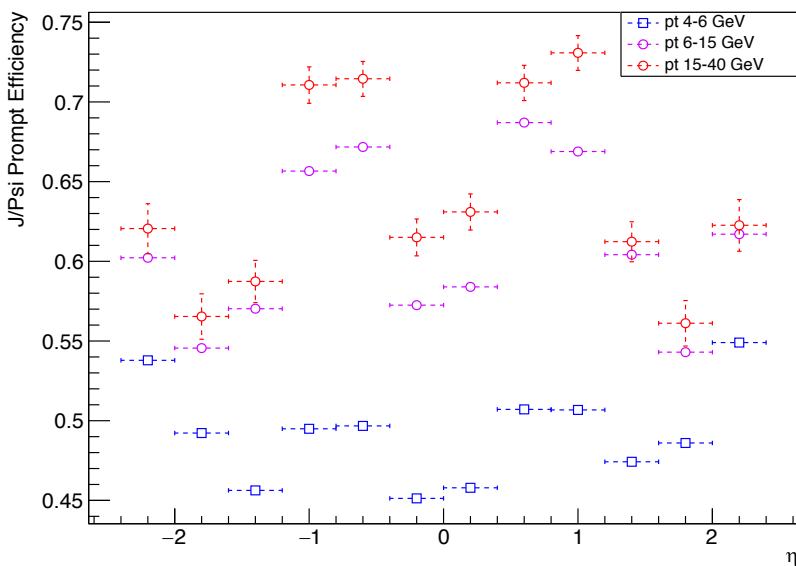


Barrel



End Cap

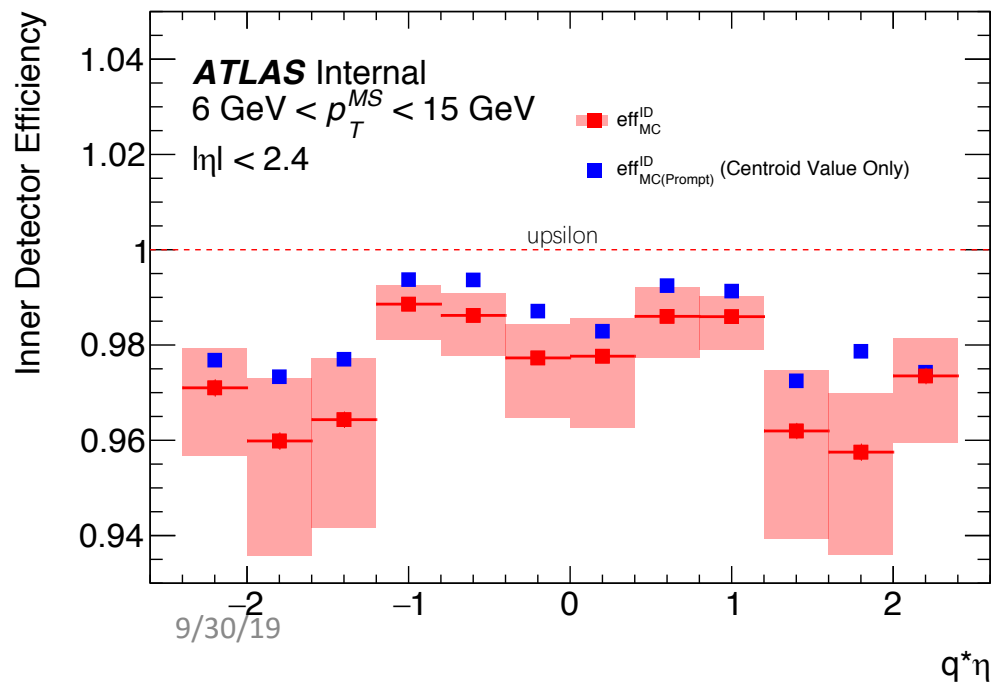
Use Truth Efficiency as a reference?



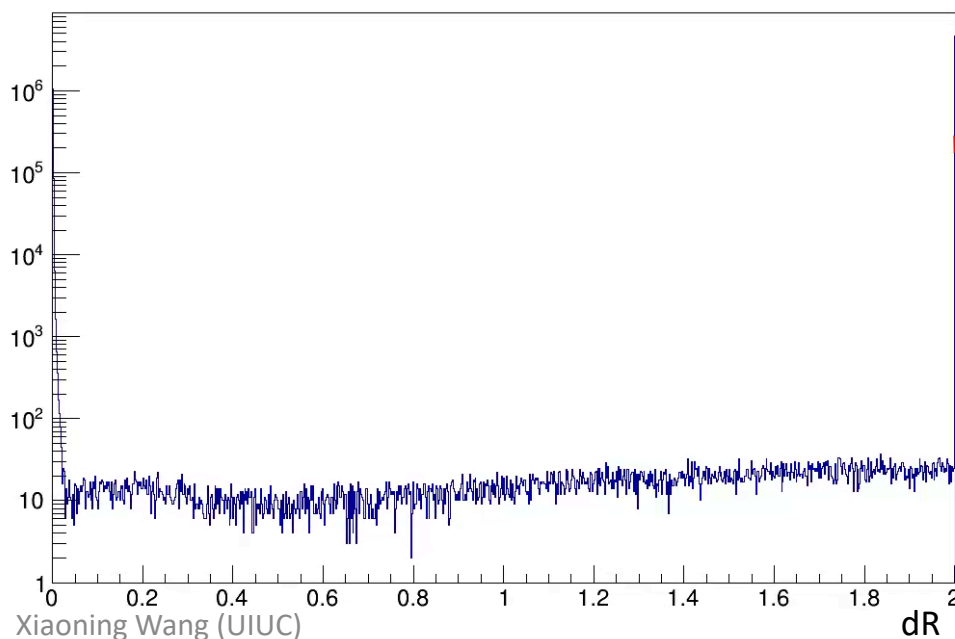
9/30/19

Xiaoning Wang (UIUC)

- Truth efficiency follows a reasonable trend as a function of p_T .
- Have low efficiency regions around $1.2 < |\eta| < 2$, this is also seen in T&P method.
- Separating charges & different centrality does not show obvious differences. (see backup slides)
- Major sources of inefficiency come from truth muons with no reco muons closer than $dR=2$, so the selection of matching dR threshold is not the reason for overall low efficiency. (see below)

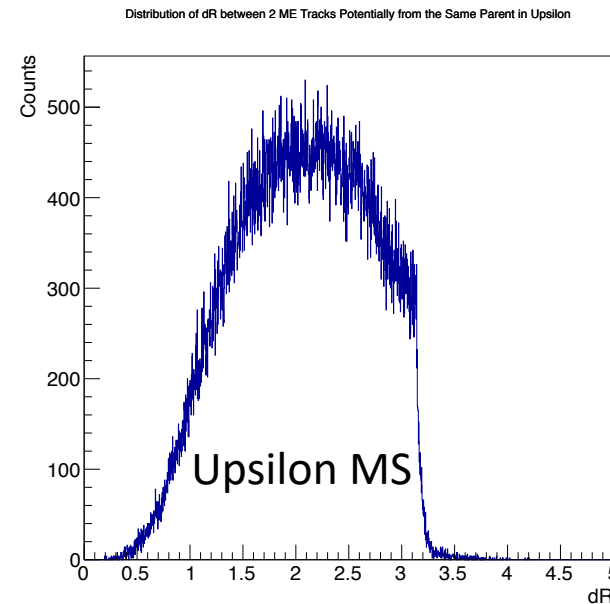
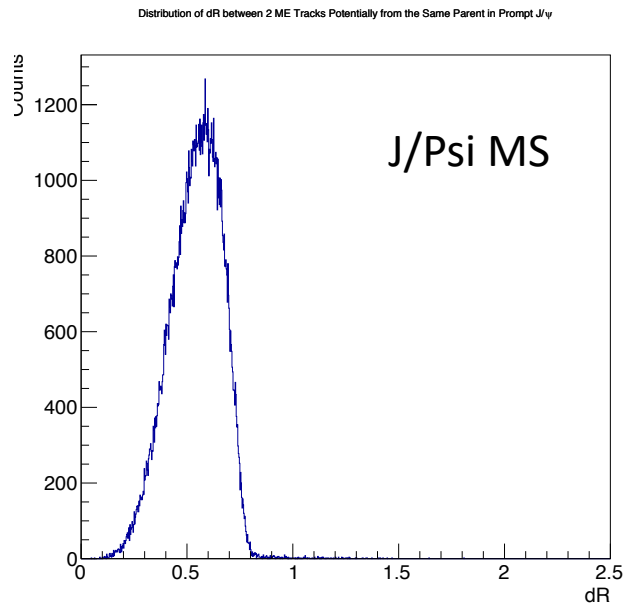
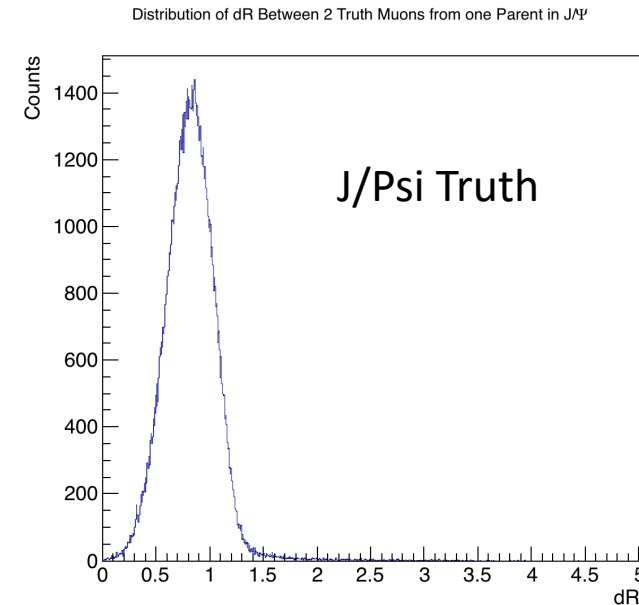
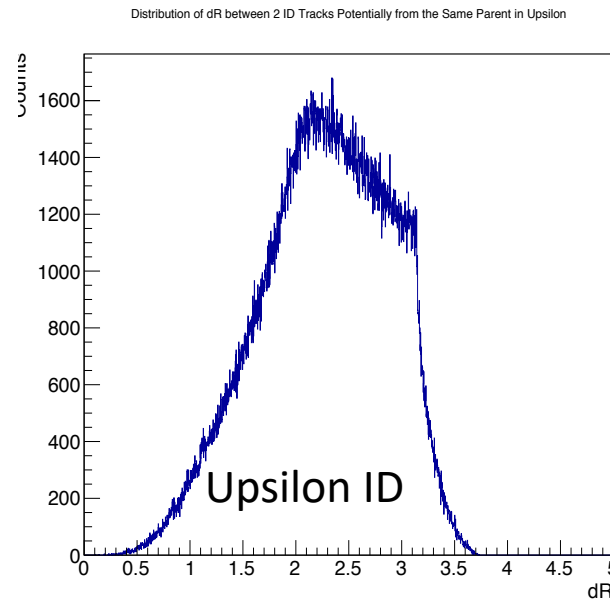
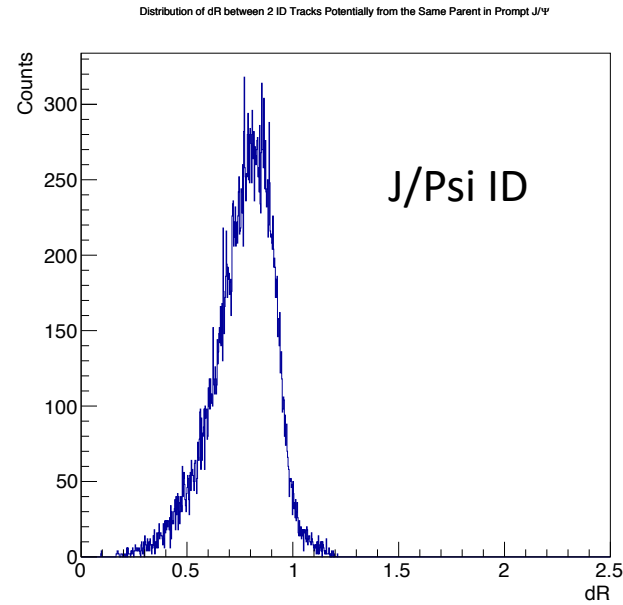


Prompt J/Psi minimum dR of Reco Muons from Truth Muons histogram



This is the peak for truth muons with no reco muons closer than $dR = 2$. This peak doesn't go away with increasing p_T .

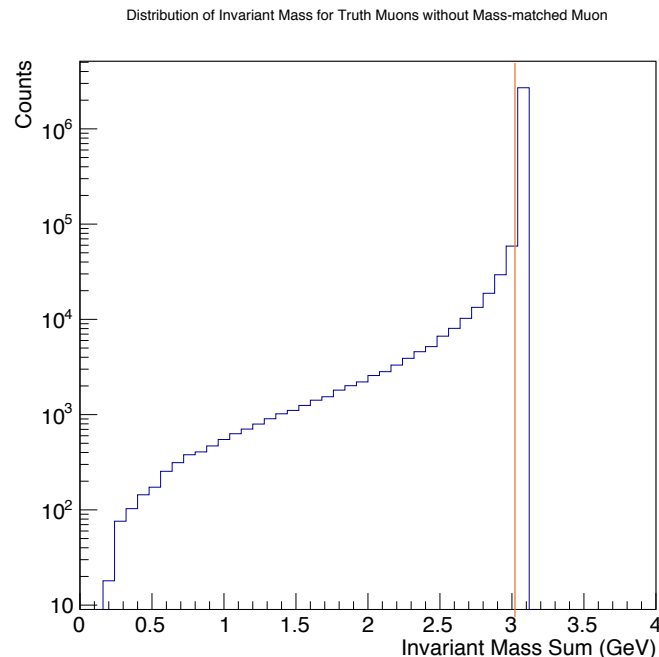
Distribution of distances between a pair of tracks those are possibly from the same parent



- Looped over tracks (ID or MS or Truth muons) in each event, and for J/Psi, plotted the dR between all pairs with an invariant mass in the range of 3.3-3.5 GeV (peak of mass histogram at around 3.4 GeV), or 9.25-9.55 GeV for Upsilon (peak of mass histogram at around 9.4 GeV).

What have been checked

- Distribution of p_T , η , FCal for Truth muons without a dR-matched Reco Muon in J/Psi (see Slide 4)
- In J/Psi data, 99.54% of events have 1 pair of truth muons, others have 2 or 3 pairs. Looking only at the 1 pair events:
 - About 5% of truth muons pairs do not have correct invariant mass, and the pairs with “wrong” invariant mass all have smaller mass.



- In the p_T and η range we're interested in, 46.6% truth muons do not have reco muons closer than $dR = 2$.
- Of the 46.6%, ~~83%~~ are lost in pairs, other pairs lost only one muons.

56.1% Previously I only limited p_T and η on either of the tracks with $dR > 2$, thus overcounting the numerator.
- If the missing reconstructed muons are uncorrelated, given 46.6% lost rate on each muon, would expected 46.6% \times 46.6% muons to be lost in pair, which is 21.7% of total number of truth muons, and 46.6% of lost muons.
- In MC-prompt JPsi we saw 26.1% of total muons lost in pair, which is 56.1% of lost muons.

Efficiency versus FCal in Data (ID: dR = 0.2, MS: dR = 0.01)

