[HIN-14-009]
new MC Samples &
new Muon ID

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working meeting
18th September 2014

Monte Carlo status

- **Private production in EOS (~ 1M events each)**
  - Prompt J/psi :

    /store/caf/user/lamia/merged_PromptJpsi_PYTHIAboosted_1st_STARTHI53_V27_1Mevt.root

  - Prompt J/psi, reversely boosted :

    /store/caf/user/lamia/merged_PromptJpsi_PYTHIAboosted_2nd_STARTHI53_V27_1Mevt.root

  - Non-prompt J/psi :

    /store/caf/user/lamia/merged_B2Jpsi_PYTHIAboosted_1st_STARTHI53_V27_-v2_1Mevt.root

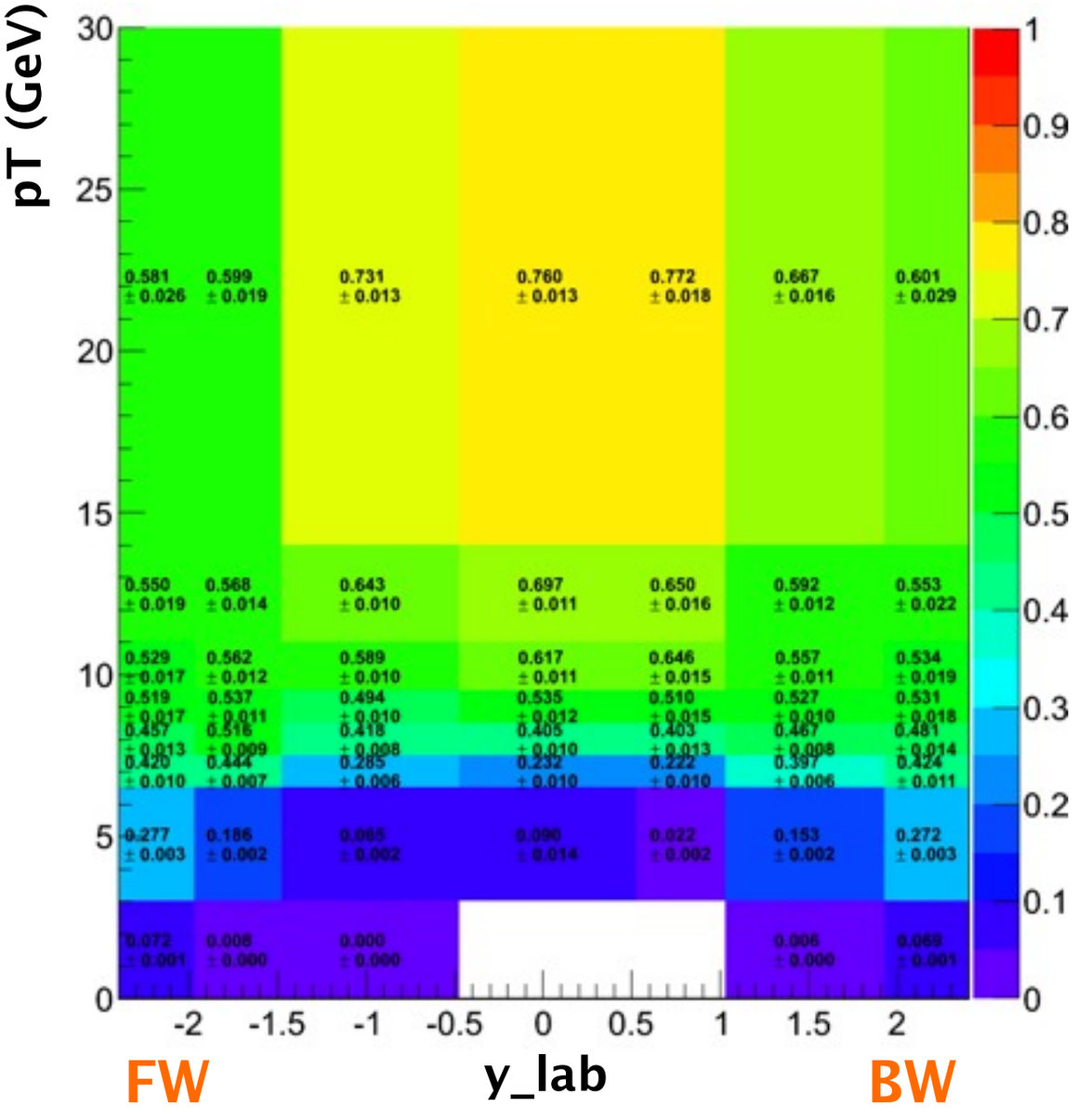
  - Non-prompt J/psi, reversely boosted:

    /store/caf/user/lamia/merged_B2Jpsi_PYTHIAboosted_2nd_STARTHI53_V27_1Mevt.root

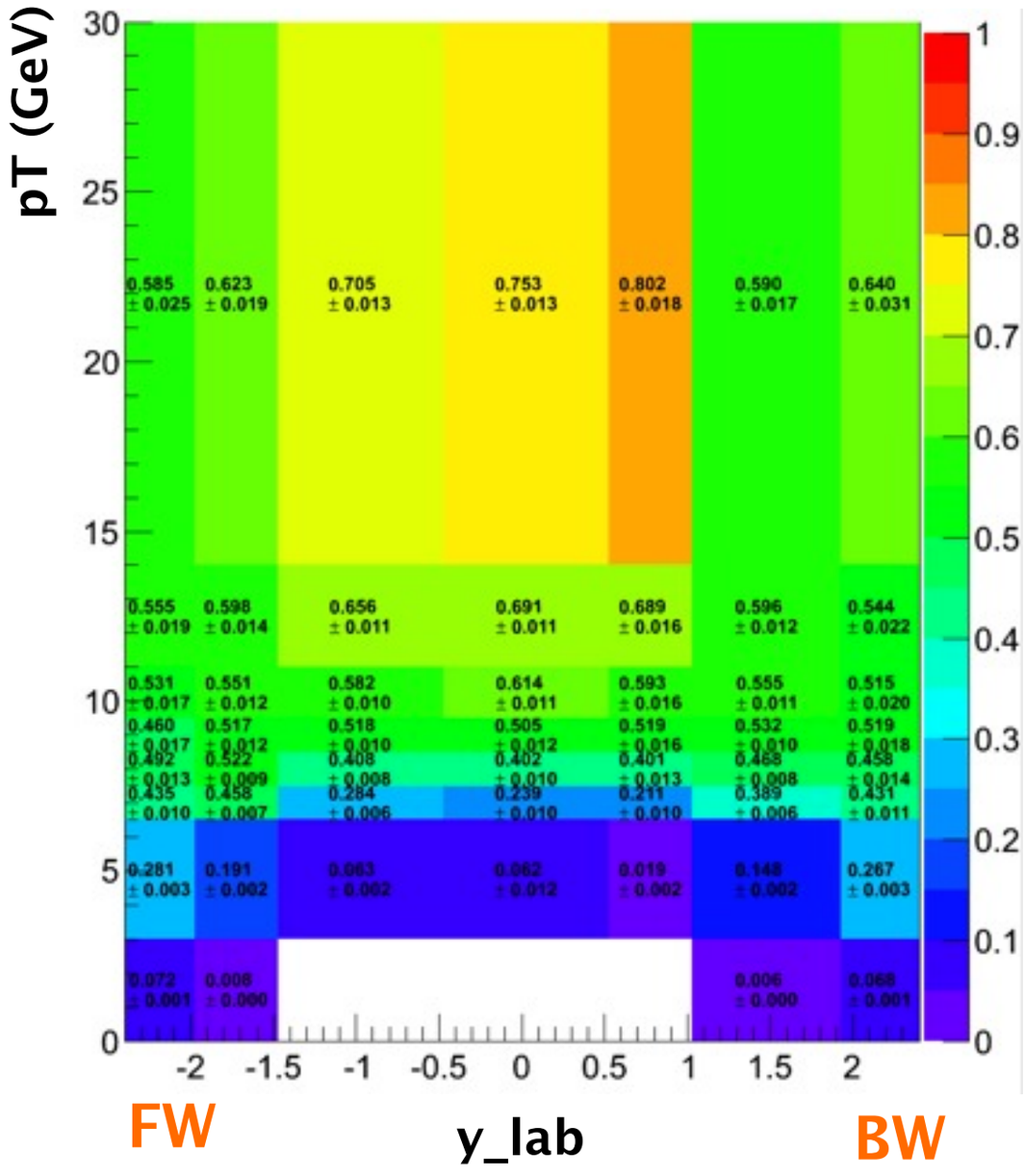
Efficiency value

- **e.g.) Prompt J/psi**

[boosted in 1st run direction]



[boosted in 2nd run direction]



- They agree within statistical uncertainties

soft muon ID

soft muon ID cut

[Old version]

- TMOneStationTight
- TrackerLayersWithMeasurement >5
- PixelLayersWithMeasurement >1
- $|d_z|$ < 30 cm , $|d_{xy}|$ < 3 cm
- track.normalizedChi2 < 1.8

[New version]

- TMOneStationTight
- TrackerLayersWithMeasurement >5
- PixelLayersWithMeasurement >0
- $|d_z|$ < 20 cm , $|d_{xy}|$ < 0.3 cm
- track high purity tag

More details

- muon selection wiki : https://twiki.cern.ch/twiki/bin/view/CMSPublic/SWGuideMuonId
- HiOniaAnalyzer with new muID : https://github.com/CmsHI/pPbJPsiAnalysis/blob/master/HiOniaAnalyzer.cc

New datasets in EOS

- 1st 7 run :

/store/caf/user/lamia/merged_pPbData_1st_ntuple_ReprocessedReco-v1_GR_P_V43F_pileupRej_muID_tot.root

- 1st run period (7 run excluded) :

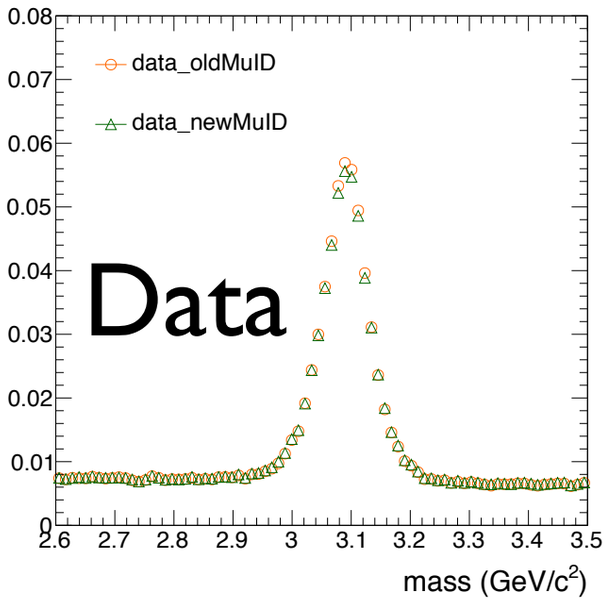
/store/caf/user/lamia/merged_pPbData_1st_ntuple_PromptReco-v1_GR_P_V43D_pileupRej_muID_tot.root

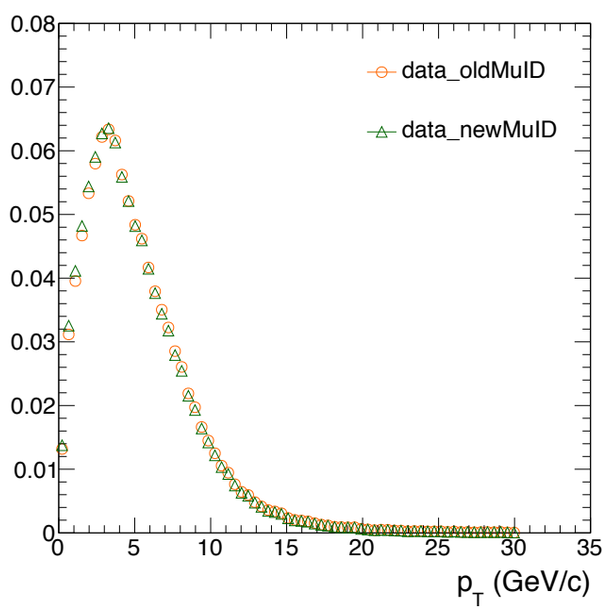
- 2nd run period :

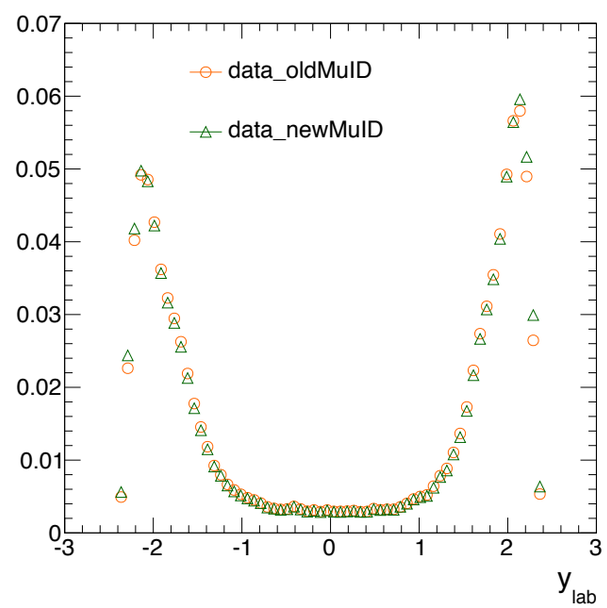
/store/caf/user/lamia/merged_pPbData_2nd_ntuple_PromptReco-v1_GR_P_V43D_pileupRej_muID_tot.root

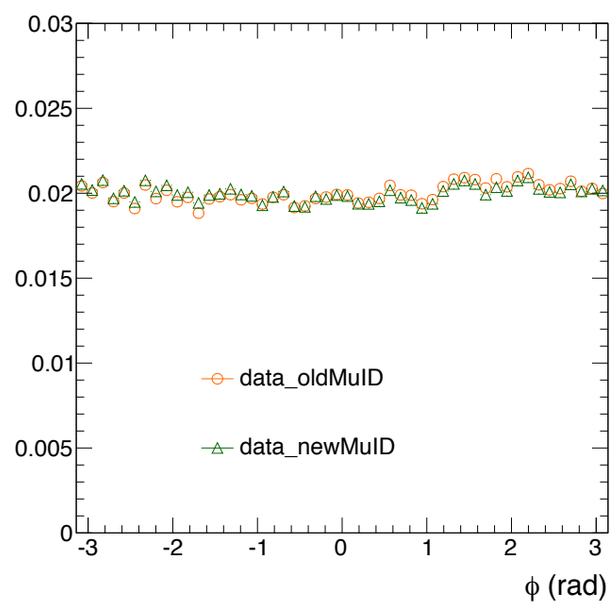
soft muon ID

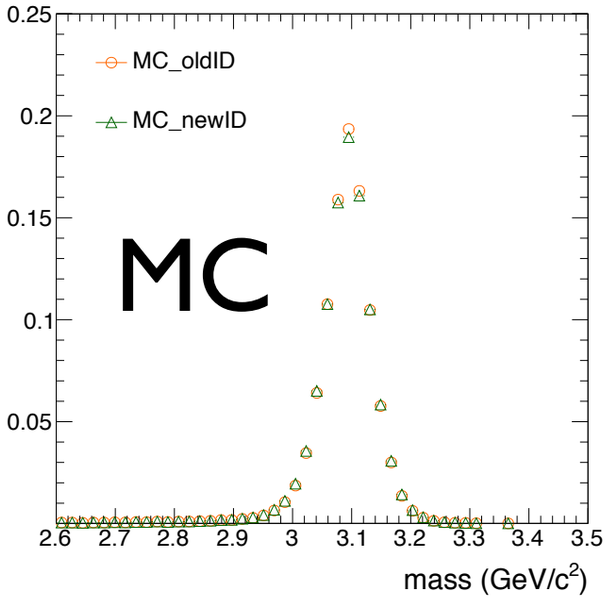
Dimuon variables

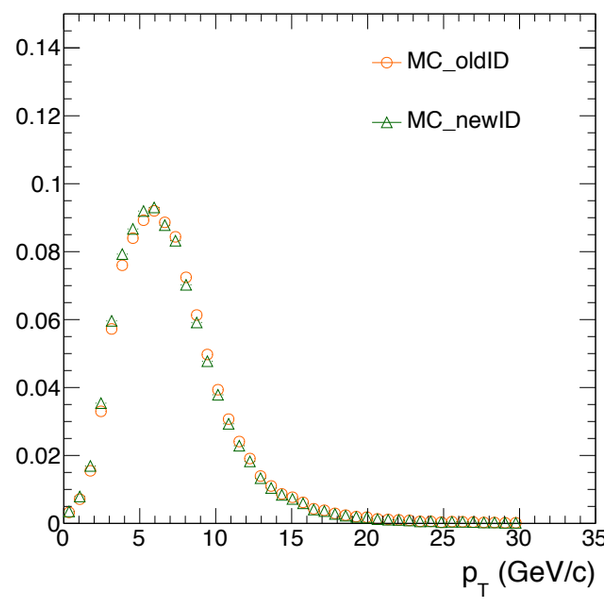


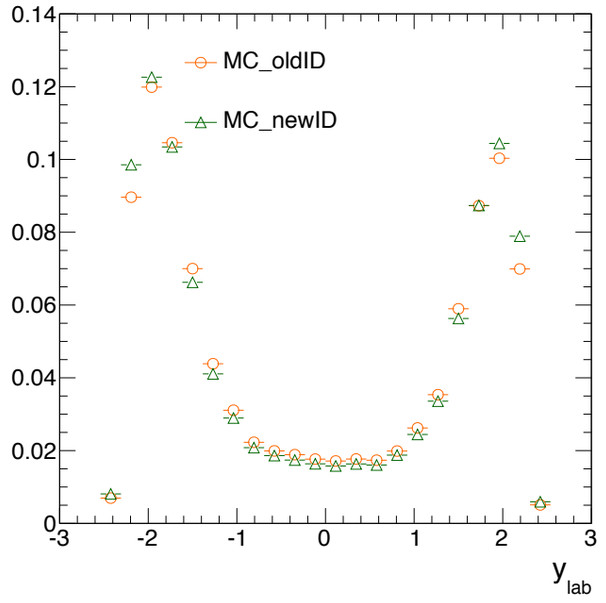


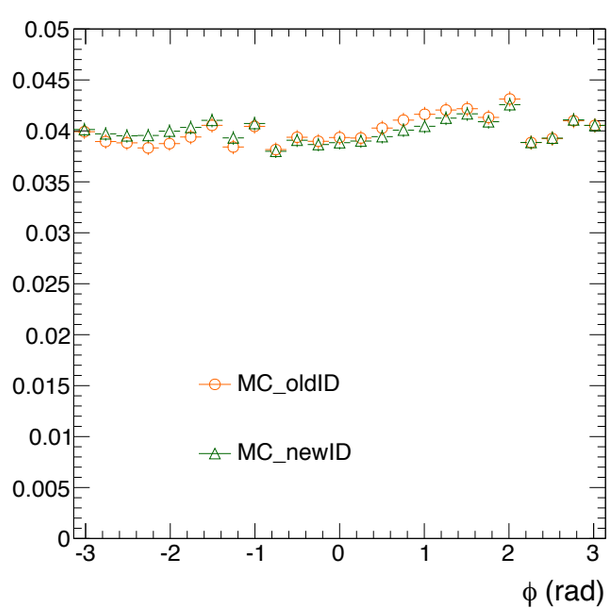








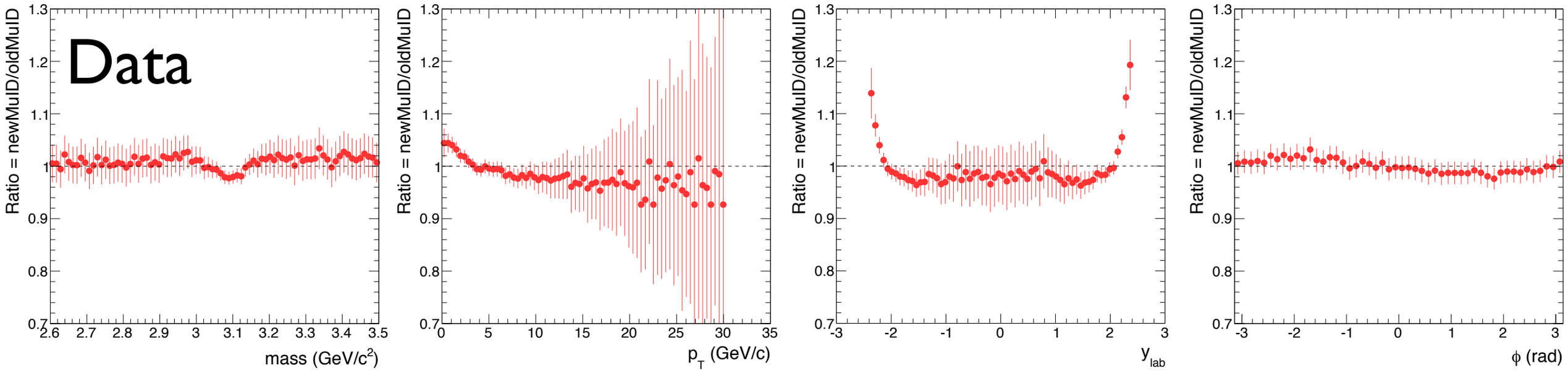


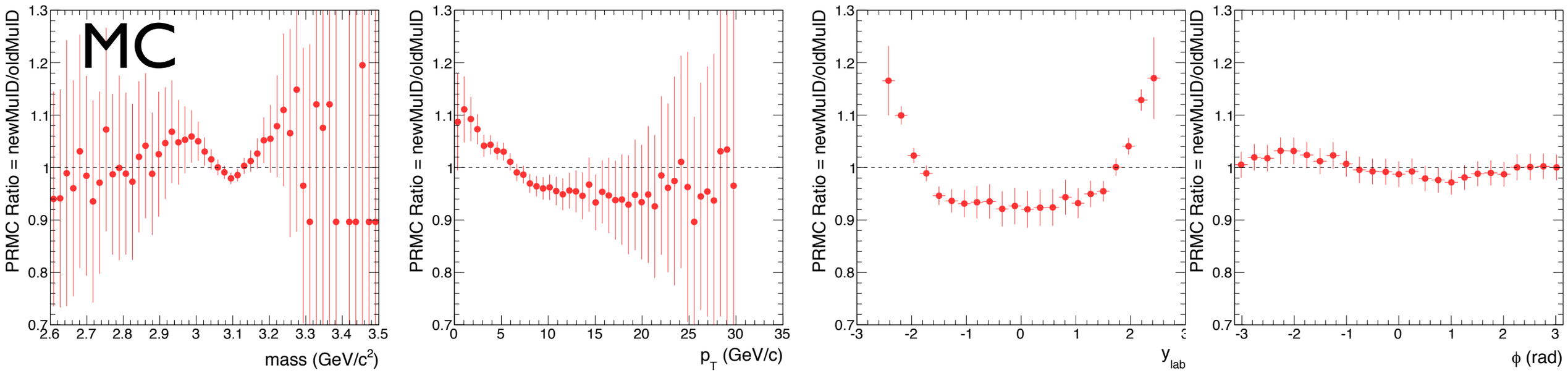


- Ratio of new ID / old ID -> Next slides

soft muon ID

- **Dimuon variables (new muID/ old MuID)**



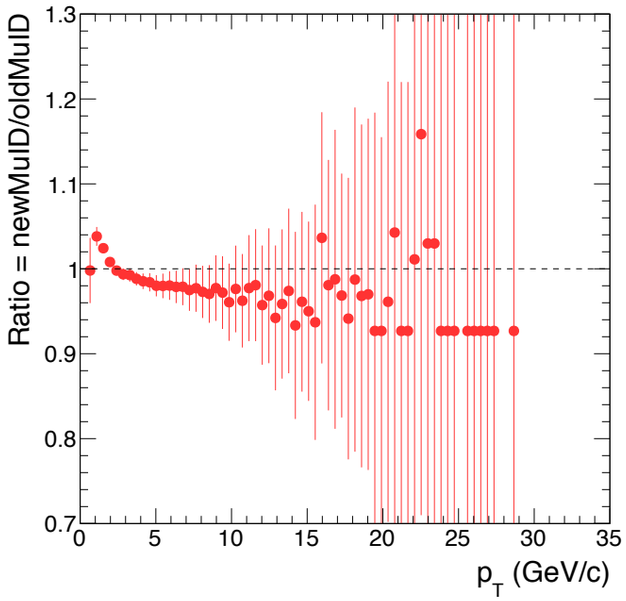


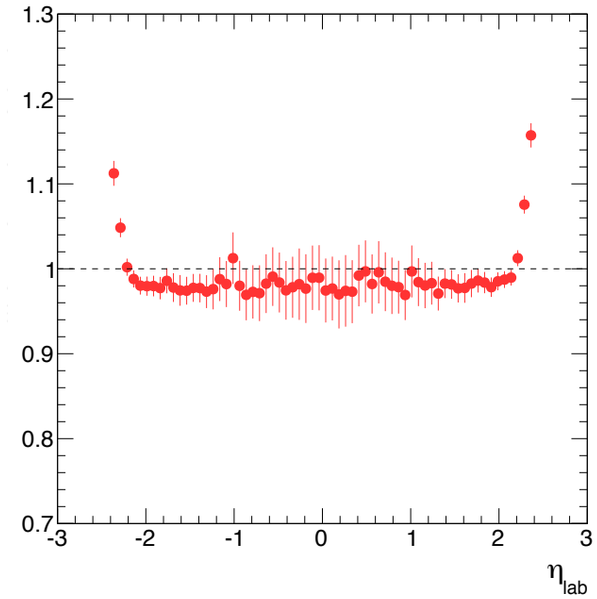
- Effect of new muID is similar for DATA and MC.
- maybe stronger for MC? but agree within uncertainties

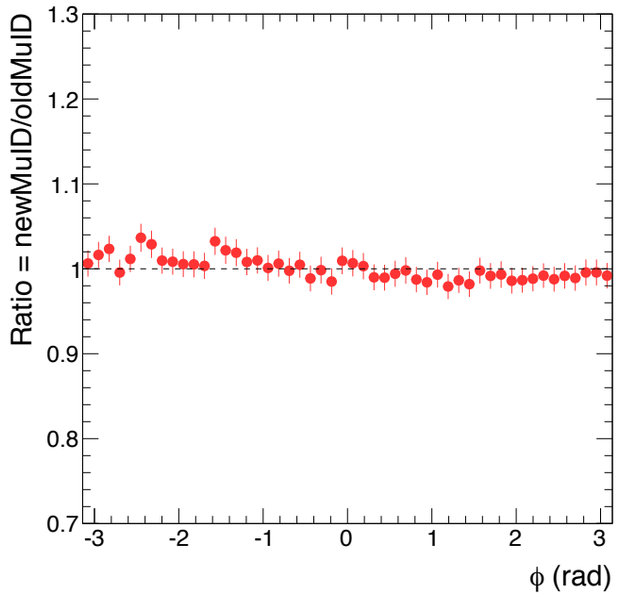
soft muon ID

- **Single muon variables (new muID/ old MuID)**

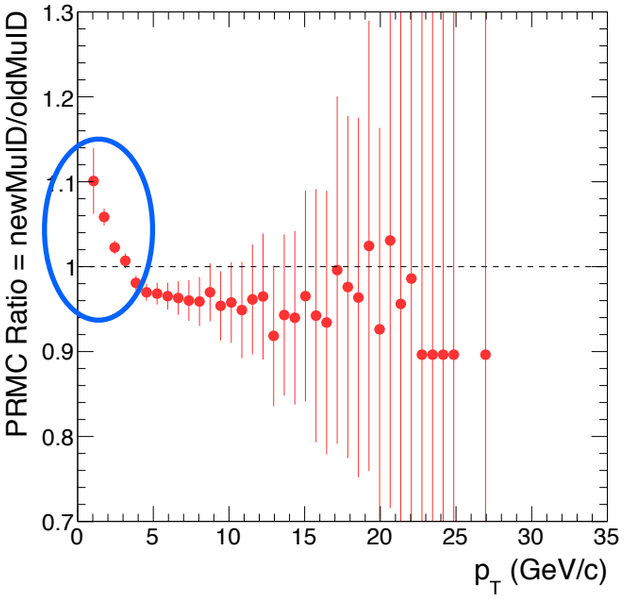
Data

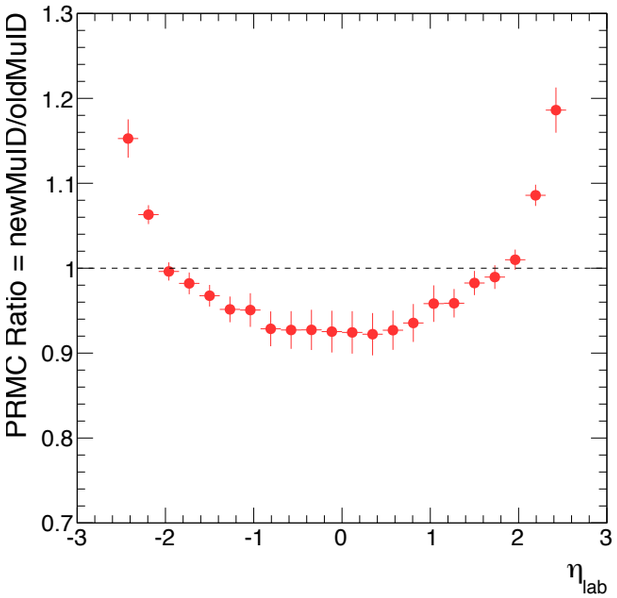


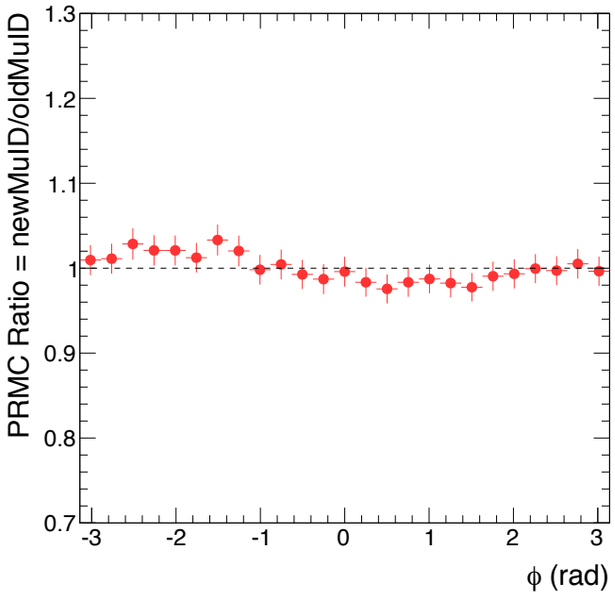




MC







- Effect of new muID is similar for DATA and MC.
- maybe stronger for MC? **-> lower pT region -> need to look at muID variable's distributions**

Comparison

- **e.g. Prompt J/psi, 1st run period, $1.5 < y_{CM} < 1.93$**

pT (GeV/c)
0--3
3-6.5
6.5-7.5
7.5-8.5
8.5-9.5
9.5-11
11-14
14-30

~~old muID wrong filter~~

Eff Pbp	err
0.076	0.001
0.267	0.002
0.376	0.007
0.394	0.009
0.454	0.012
0.452	0.013
0.48	0.014
0.465	0.018

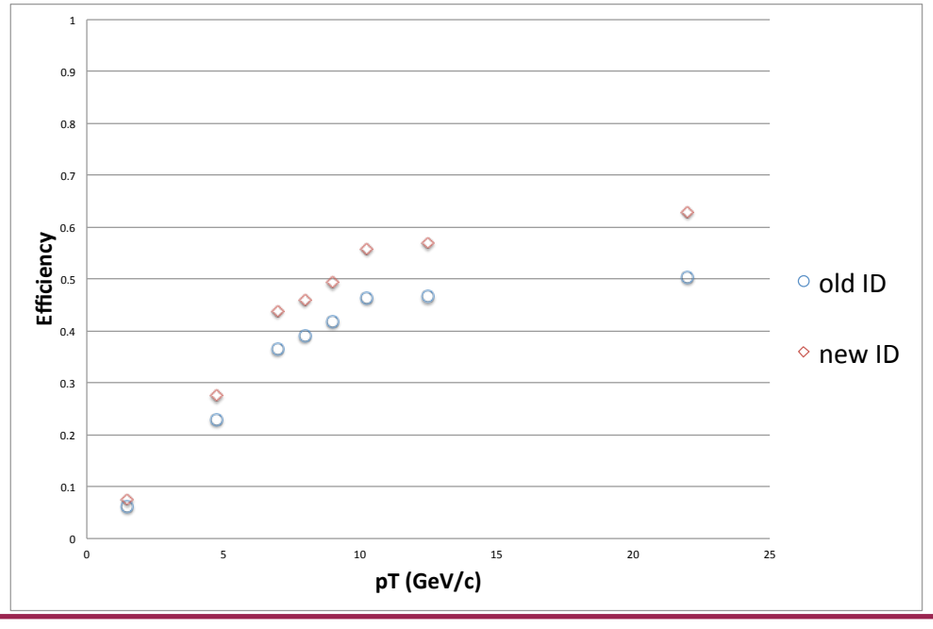
old muID correct filter

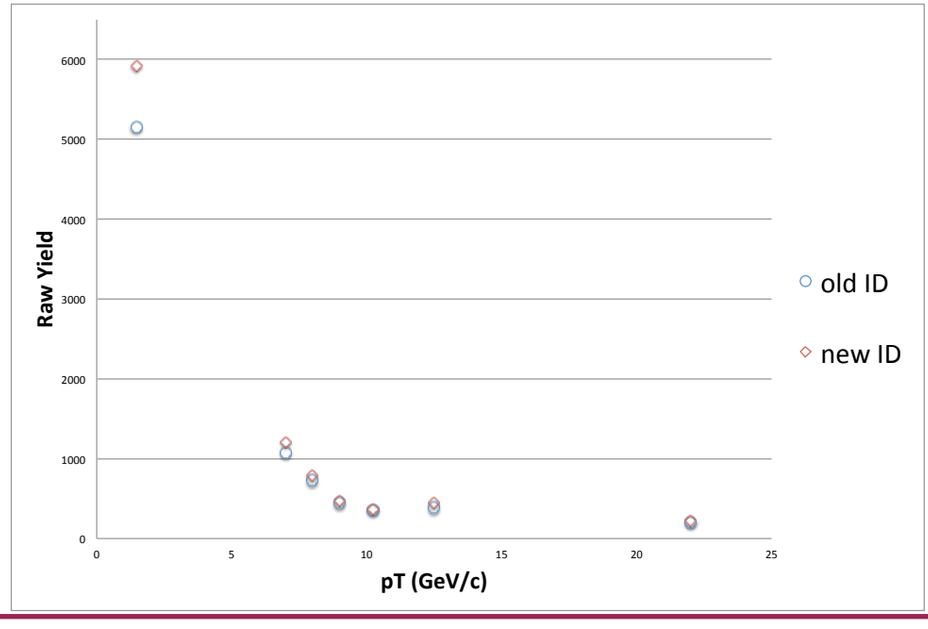
Eff Pbp	err	yield Pbp
0.061	0.001	5161.12
0.229	0.003	7261.88
0.365	0.01	1070.66
0.39	0.012	727.837
0.418	0.015	448.342
0.465	0.017	347.446
0.466	0.018	385.286
0.503	0.025	203.91

new muID correct filter

Eff Pbp	err	yield Pbp
0.075	0.001	5910.21
0.275	0.003	8103.91
0.438	0.01	1199.92
0.46	0.012	782.763
0.494	0.016	475.264
0.559	0.017	368.098
0.57	0.018	437.496
0.629	0.024	223.354

- Both yields and efficiency increased when new muID applied



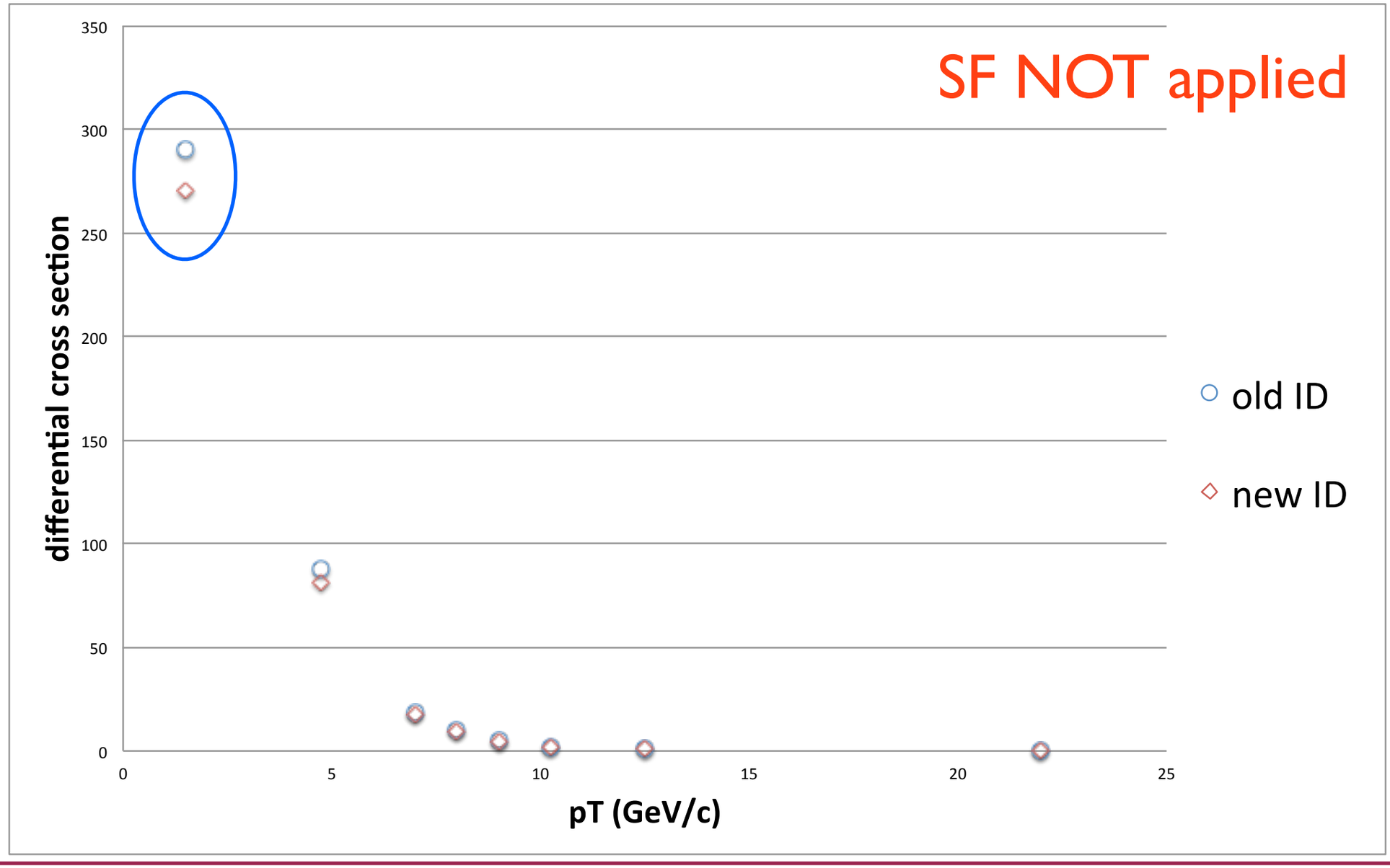


Quick check for results

Double differential cross section

$$\frac{d^2\sigma}{dp_T dy} = \frac{N_{fit}^{J/\psi} / (A \cdot \varepsilon)}{L_{int} \times B(J/\psi \to \mu^+\mu^-) \times \Delta p_T \Delta y}$$

- Quick check from the previous slide ($1.5 < y_{CM} < 1.93$)
- Cross-section values (corrected yield) becomes <u>smaller</u> with new muID applied
- Need to applied “scale factors” from TNP results



summary and plan

- **official MC request (Mihee & Songkyo)**
  - Mihee(MC contact) is working for validating cff files
  - Job will be submitted as soon as cff files are ready

- **MuID variables (Lamia)**
  - need to compare old and new muID cuts both with new MC samples
    (to exclude the effect of wrong mumuGenFilter)

- **TNP (Kisoo & Yongsun)**
  - Running with private prompt MC samples
    (Definition of probe for muID has been modified)

- **Update in muon POG meeting soon**

Back up

DAS link

- **Data RECO** (wiki : https://twiki.cern.ch/twiki/bin/viewauth/CMS/PA2013DatasetsAndAccess)
  - PromptReco

https://cmsweb.cern.ch/das/request?instance=prod%2Fglobal&view=list&limit=10&input=%2FPAMuon%2FHIRun2013-PromptReco-v1%2FRECO

  - ReprocessedReco : for the 1st 7 run, 210498-210658

https://cmsweb.cern.ch/das/request?instance=prod%2Fglobal&view=list&limit=10&input=%2FPAMuon%2FHIRun2013-28Sep2013-v1%2FRECO

- **private MC RECO**
  - Prompt J/psi :

https://cmsweb.cern.ch/das/request?view=list&limit=100&instance=prod%2Fphys03&input=dataset%3D%2FPromptJpsi_PYTHIAboosted_1st_GENSIM_STARTHI53_V27%2Fkyolee-PromptJpsi_PYTHIAboosted_1st_RECO_STARTHI53_V27-21b49fbef3a467e97fcda7a60a51a4ff%2FUSER

  - Prompt J/psi, reversely boosted :

https://cmsweb.cern.ch/das/request?view=list&limit=100&instance=prod%2Fphys03&input=%2FPromptJpsi_PYTHIAboosted_2nd_GENSIM_STARTHI53_V27%2Fkyolee-PromptJpsi_PYTHIAboosted_2nd_RECO_STARTHI53_V27-21b49fbef3a467e97fcda7a60a51a4ff%2FUSER

  - Non-prompt J/psi :

https://cmsweb.cern.ch/das/request?view=list&limit=10&instance=prod%2Fphys03&input=%2FB2Jpsi_PYTHIAboosted_1st_GENSIM_STARTHI53_V27%2Fkyolee-B2Jpsi_PYTHIAboosted_1st_RECO_STARTHI53_V27-21b49fbef3a467e97fcda7a60a51a4ff%2FUSER

  - Non-prompt J/psi, reversely boosted:

https://cmsweb.cern.ch/das/request?view=list&limit=10&instance=prod%2Fphys03&input=%2FB2Jpsi_PYTHIAboosted_2nd_GENSIM_STARTHI53_V27%2Fkyolee-B2Jpsi_PYTHIAboosted_2nd_RECO_STARTHI53_V27-21b49fbef3a467e97fcda7a60a51a4ff%2FUSER

Trees w/o muon ID cut

- **cf) Trees without muonID cut**
  - Prompt J/psi :

    /store/caf/user/lamia/merged_PromptJpsi_PYTHIAboosted_1st_STARTHI53_V27_noMuID_1Mevt.root
  - Non-prompt J/psi :

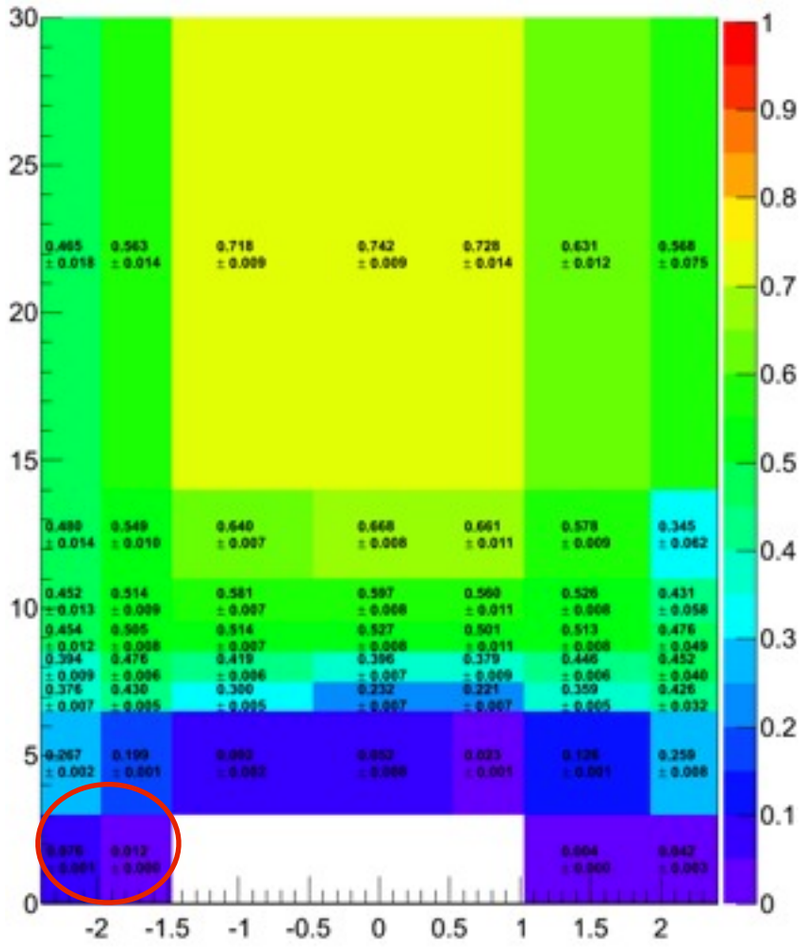
    /store/caf/user/lamia/merged_B2Jpsi_PYTHIAboosted_1st_STARTHI53_V27_noMuID_1Mevt.root
  - 1st run period (7 run excluded) :

    /store/caf/user/lamia/merged_pPbData_1st_ntuple_PromptReco-v1_GR_P_V43D_pileupRej_noMuID_tot.root

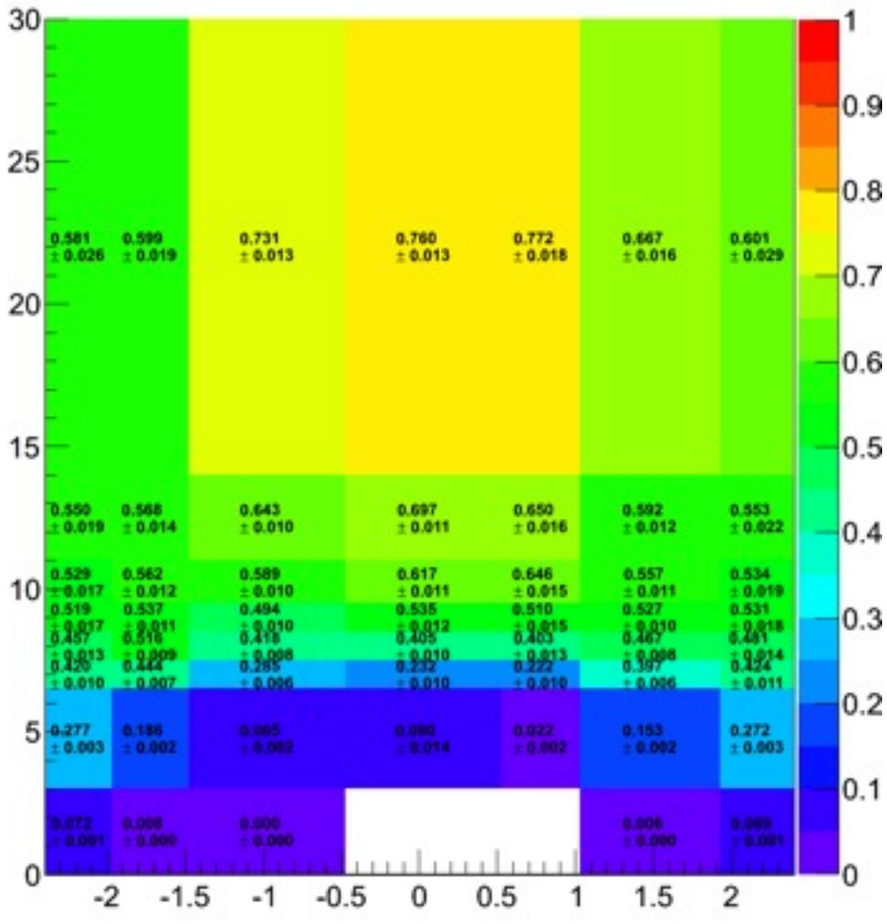
Efficiency value

- **Prompt J/psi**

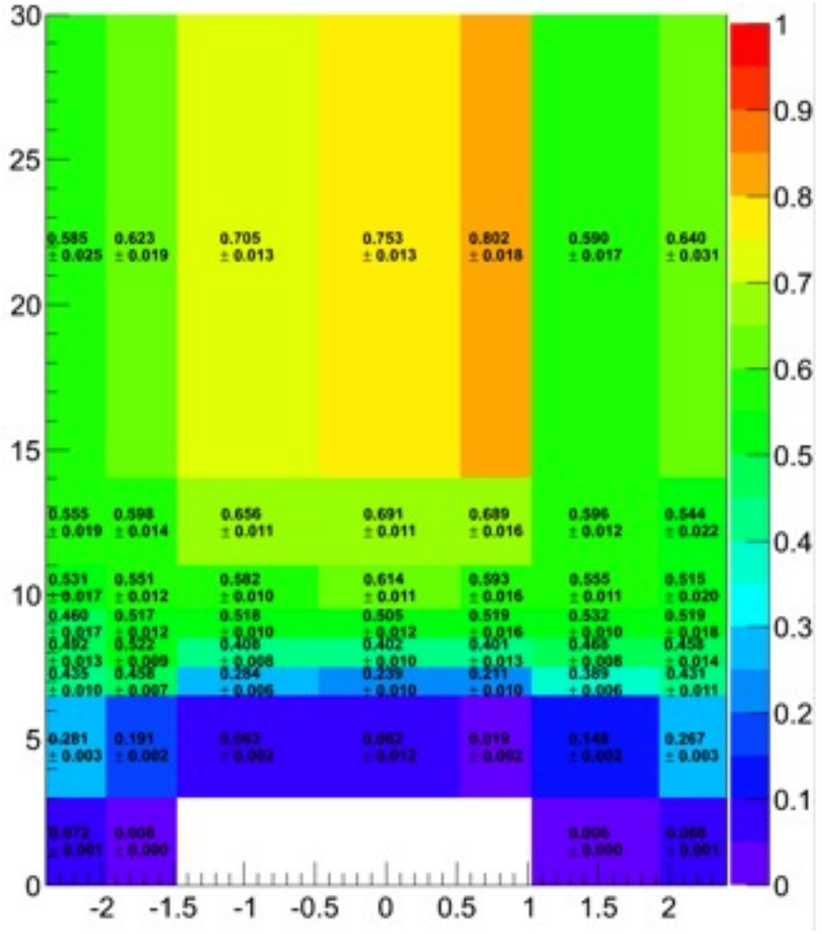
- **Old result**



- **New – 1st boost**



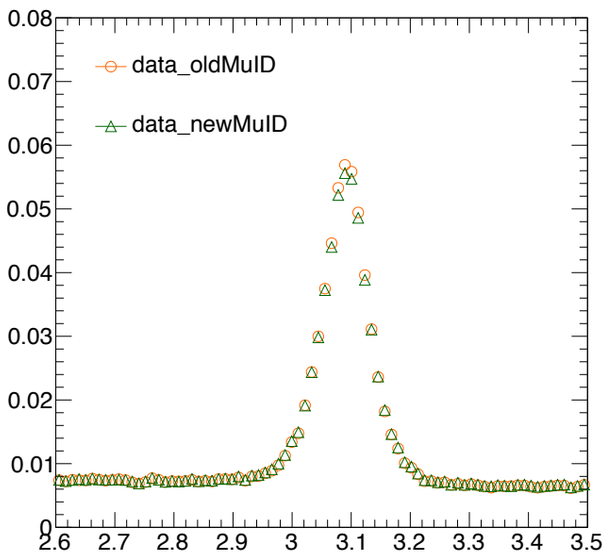
- **New – 2nd boost**

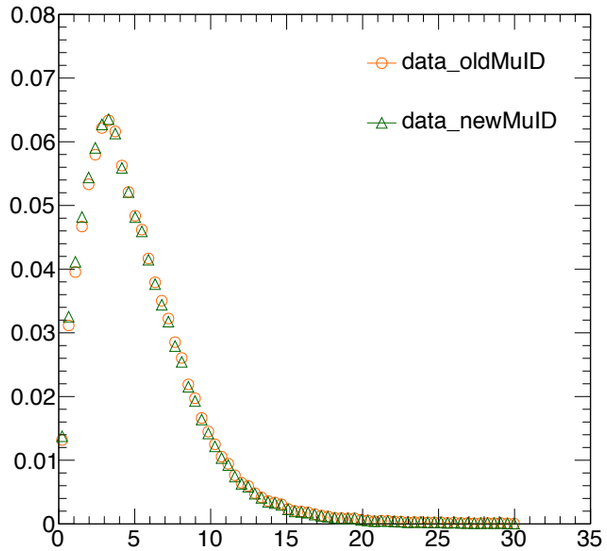


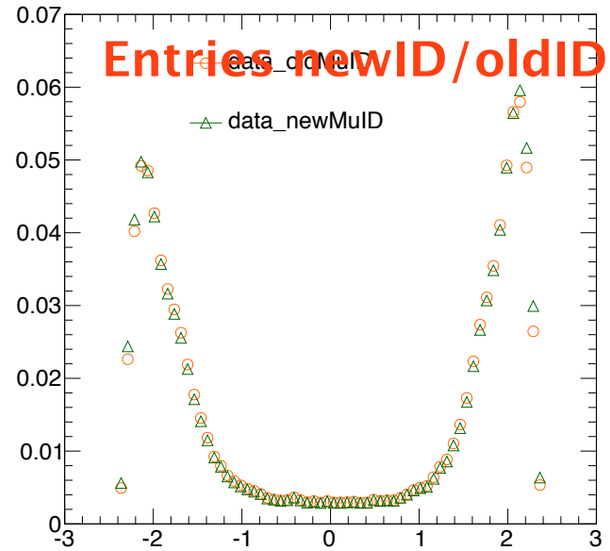
soft muon ID

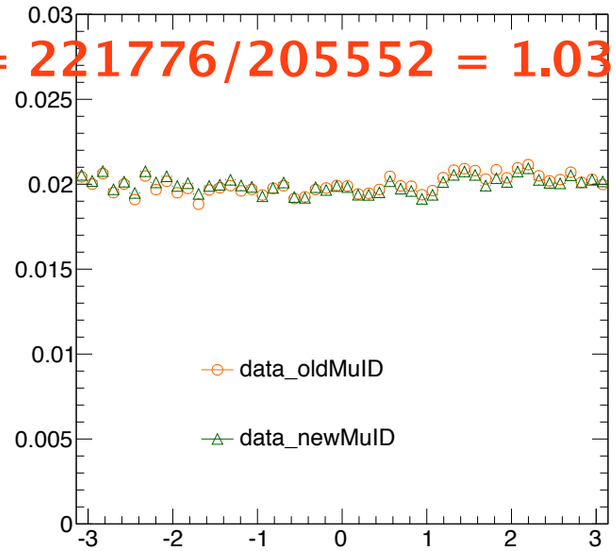
- **Dimuon variables (old muID vs new muID)**

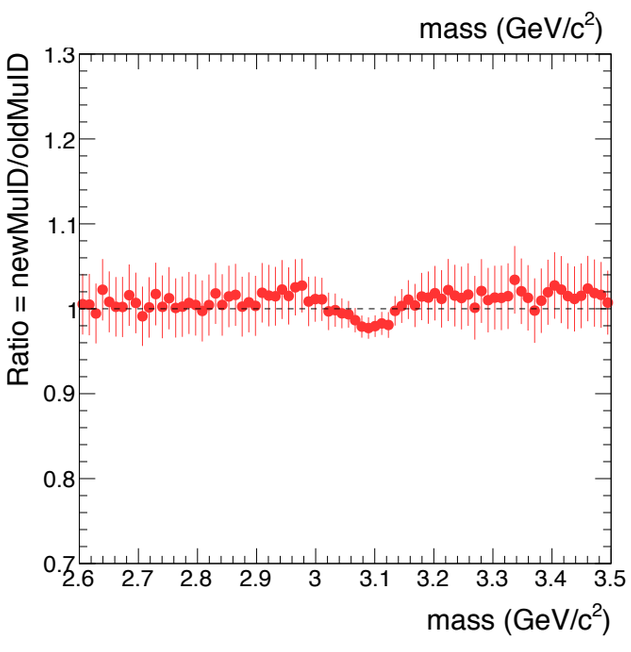
Data

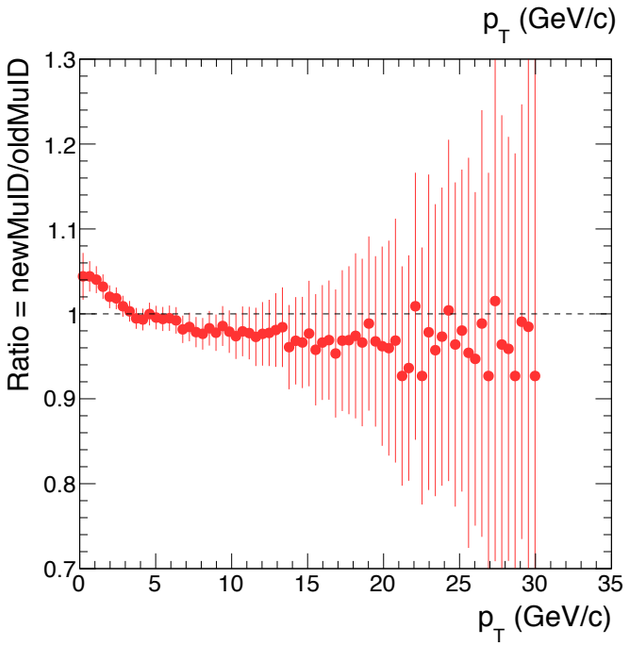


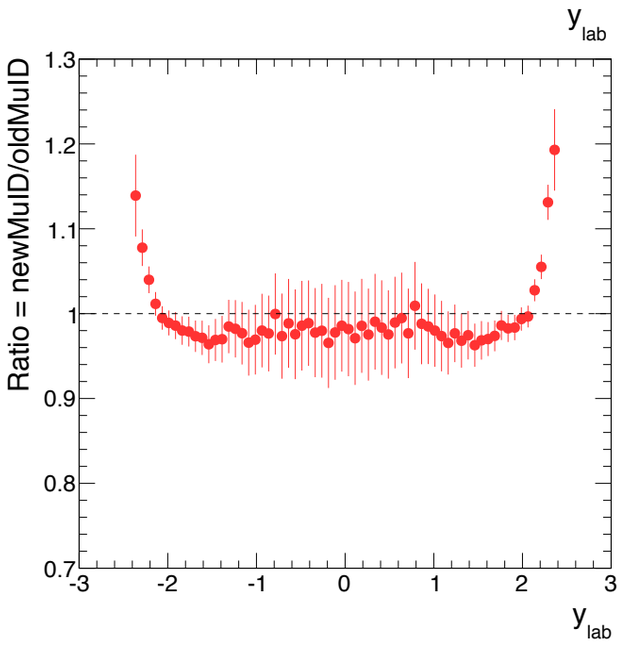


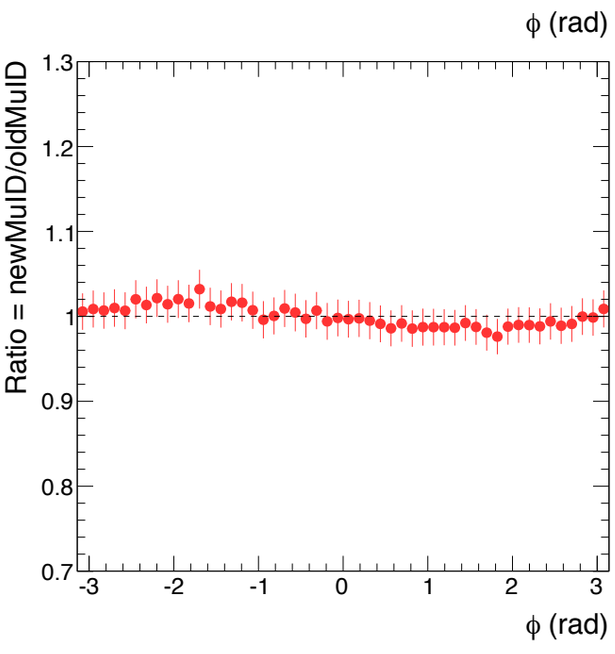












[New muID]

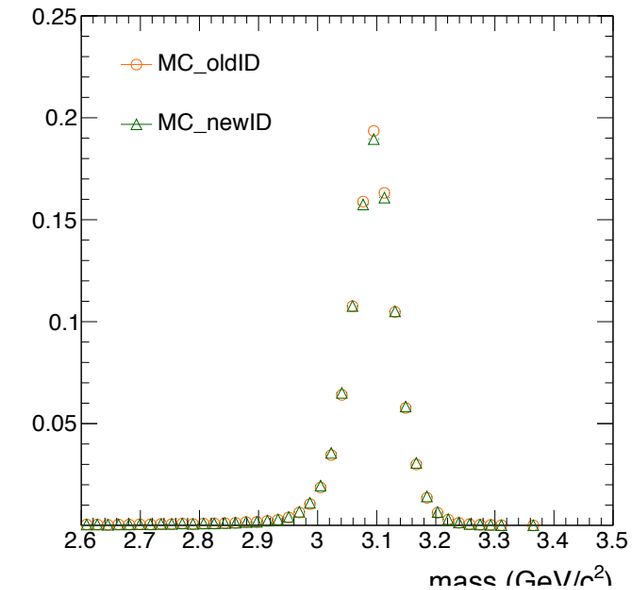
- slightly less dimuons in signal region? (2.95-3.25 GeV/c)
- More dimuons in lower p_T region (which affect rapidity distributions also)

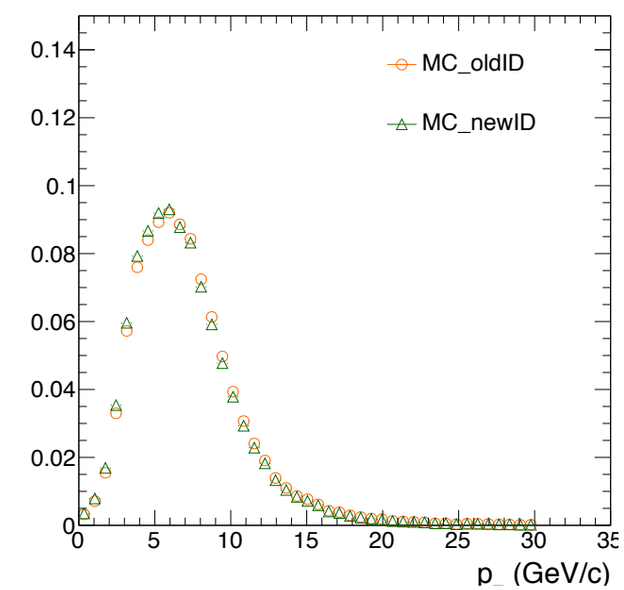
soft muon ID

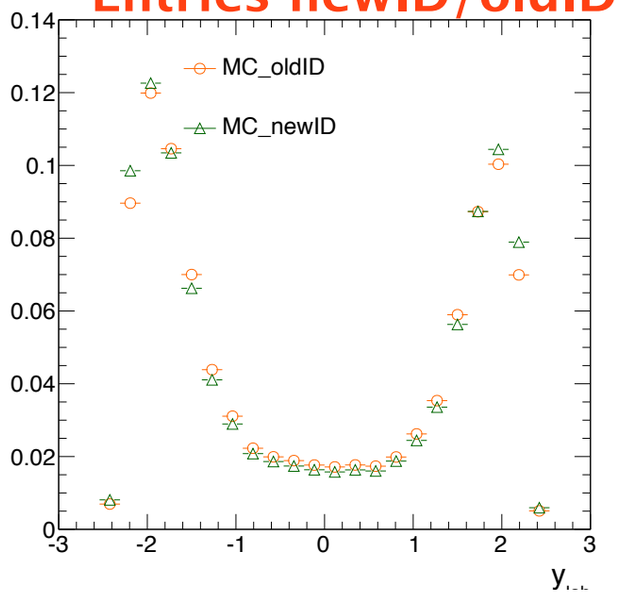
- **Dimuon variables (old muID vs new muID)**

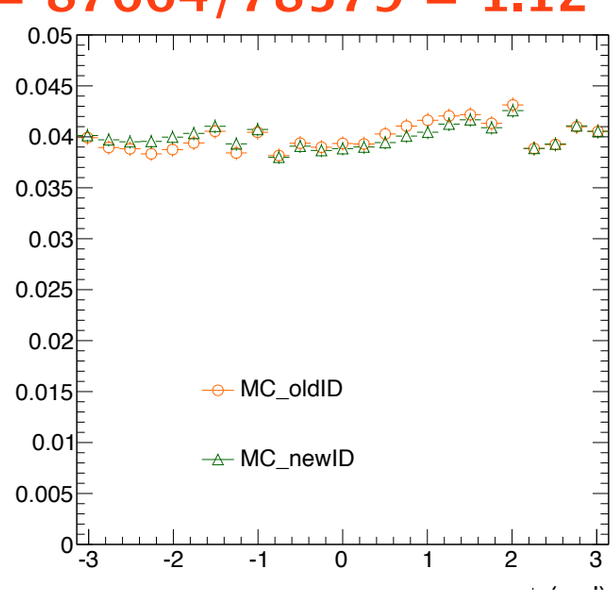
MC

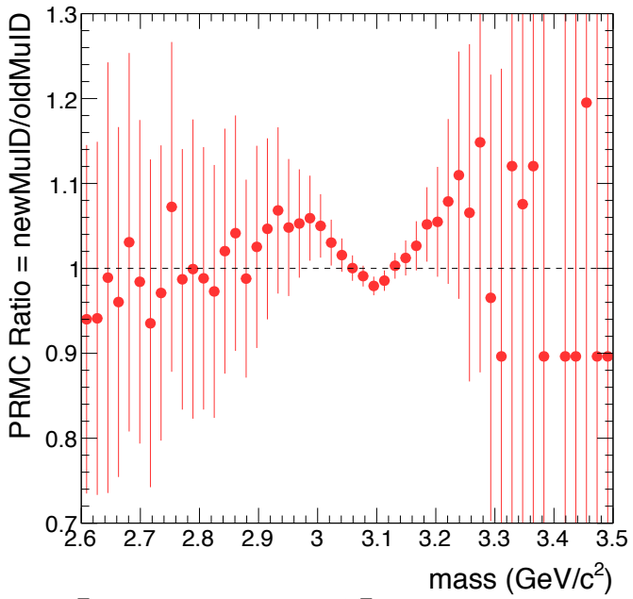
Entries newID/oldID = 87664/78579 = 1.12

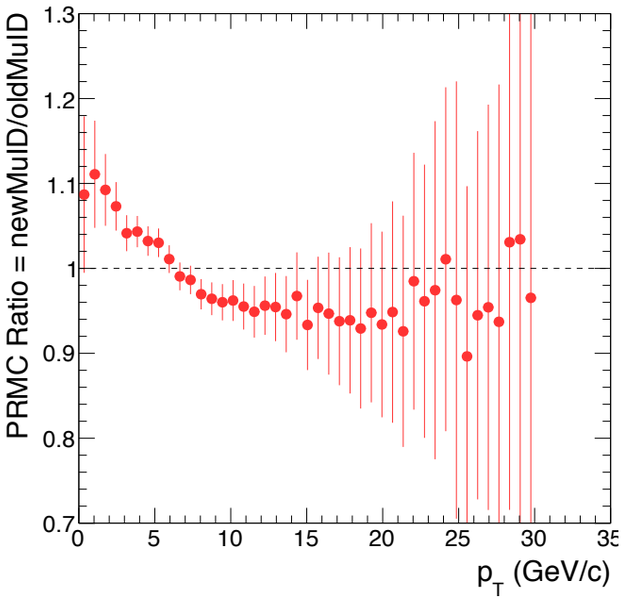


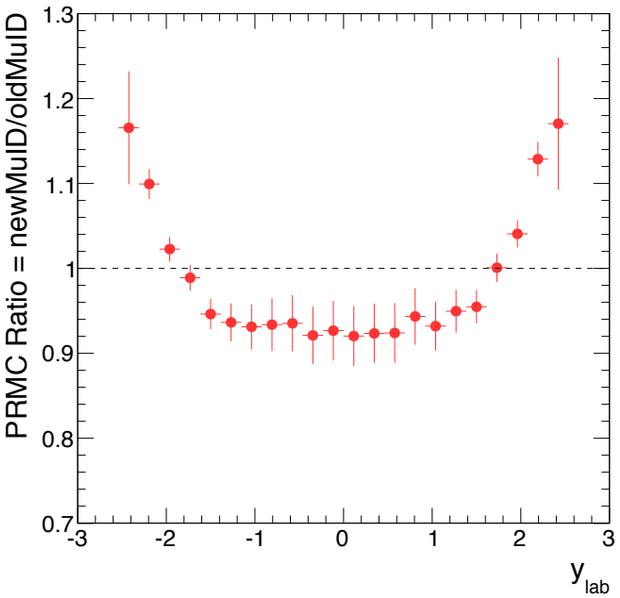


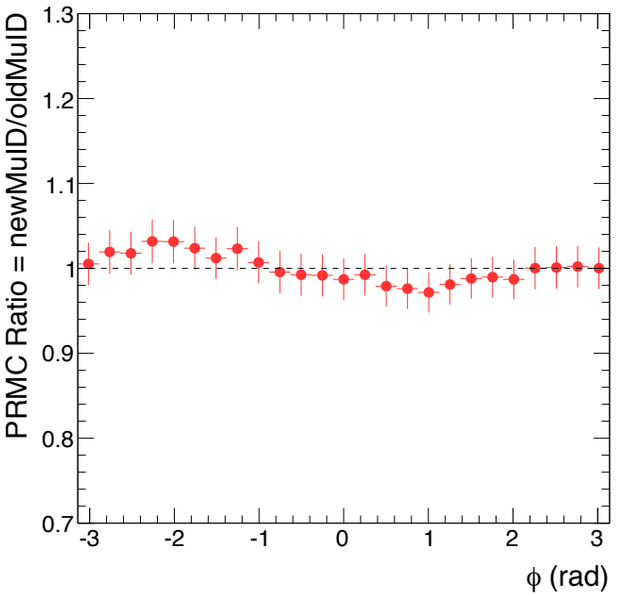












[New muID]

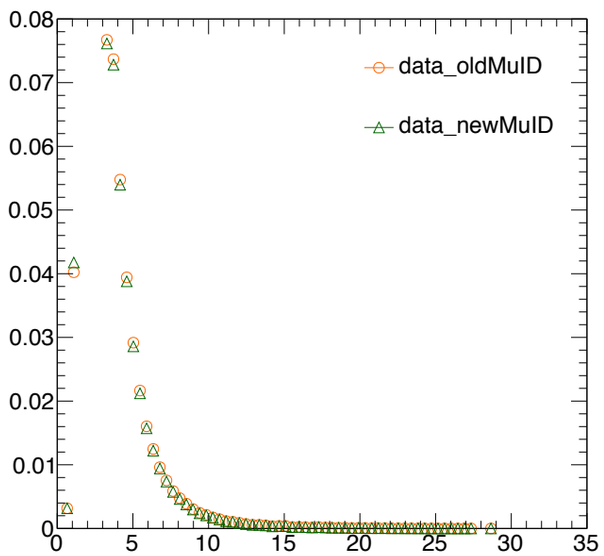
- slightly less dimuons in signal region? (2.95-3.25 GeV/c)
- More dimuons in lower p_T region (which affect rapidity distributions also)

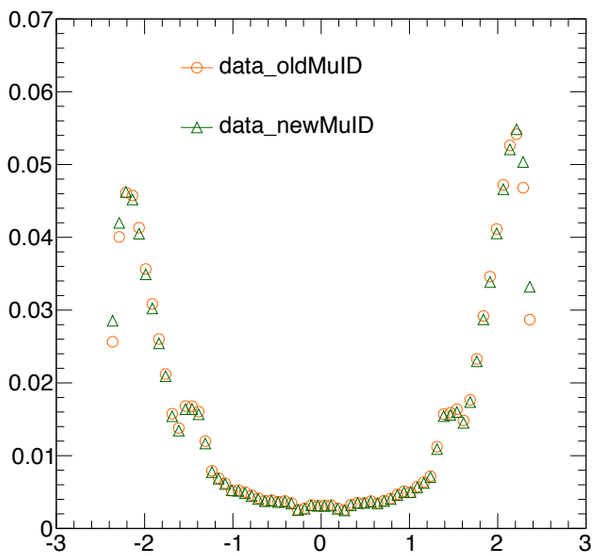
soft muon ID

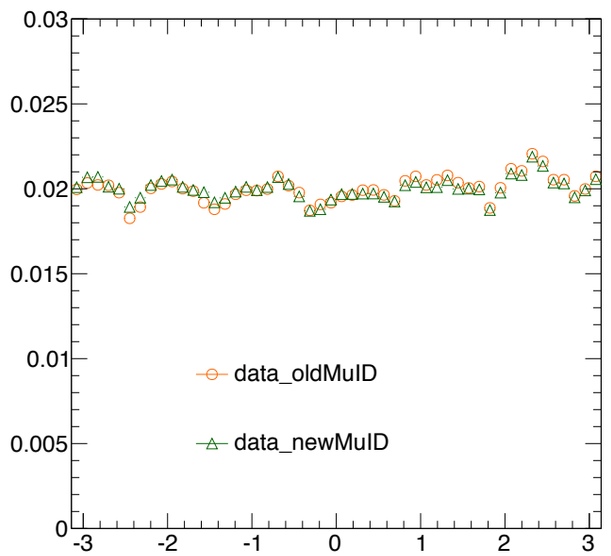
- **single muon variables (old muID vs new muID)**

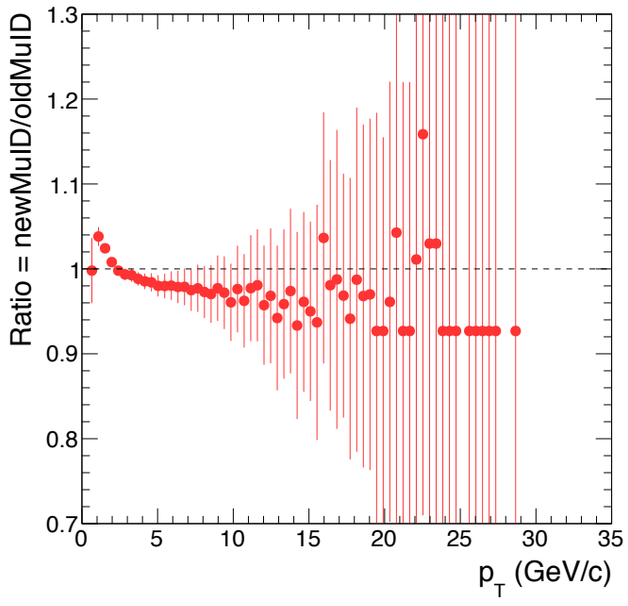
Data

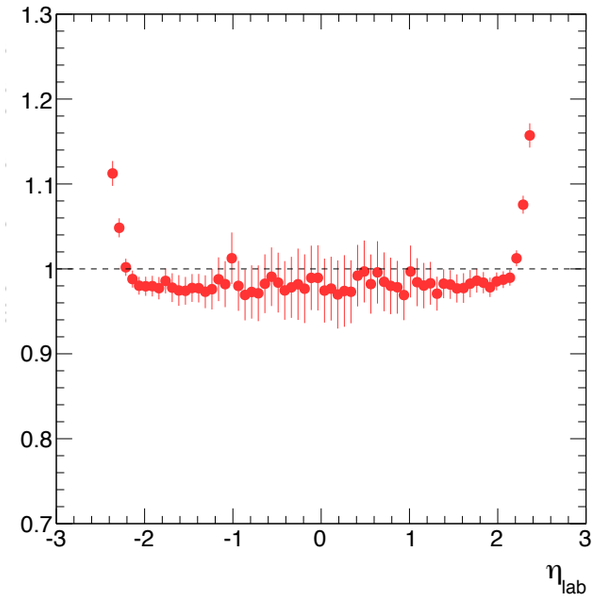
Entries newID/oldID = 443452/411104 = 1.08

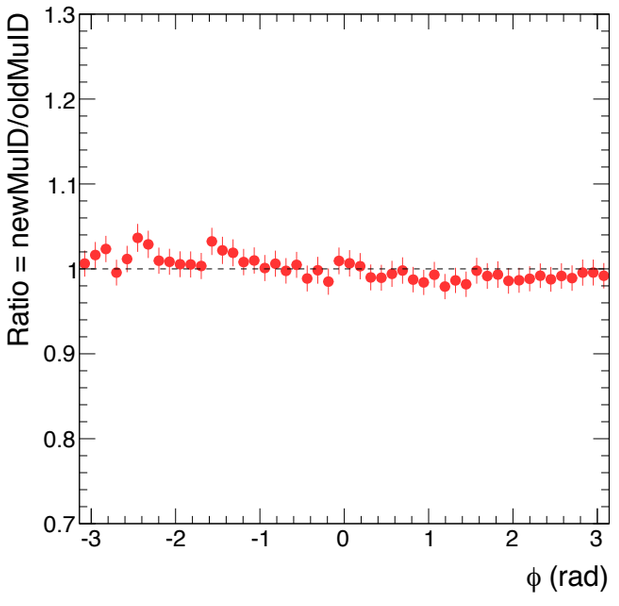












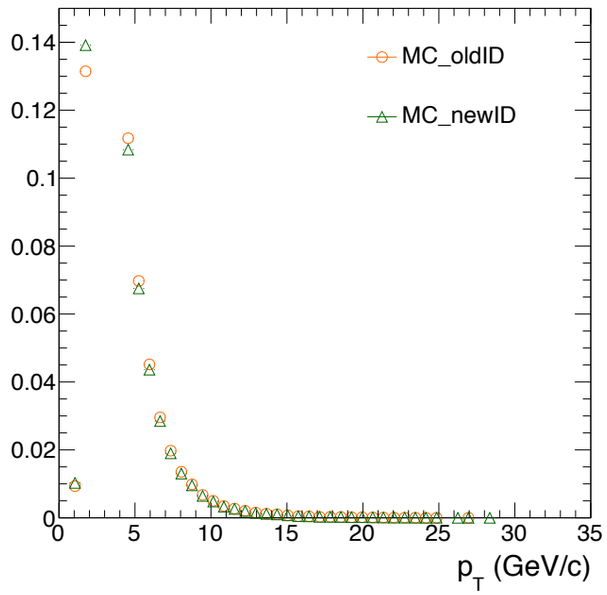
[New muID]

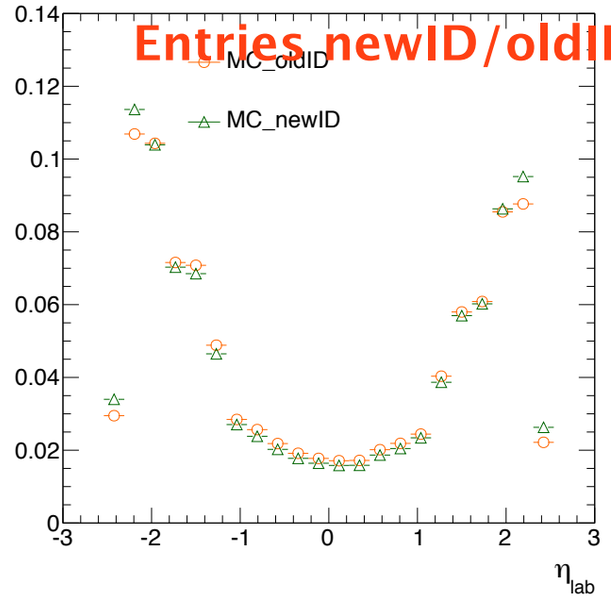
- slightly less dimuons in signal region? (2.95-3.25 GeV/c)
- More dimuons in lower p_T region (which affect rapidity distributions also)

soft muon ID

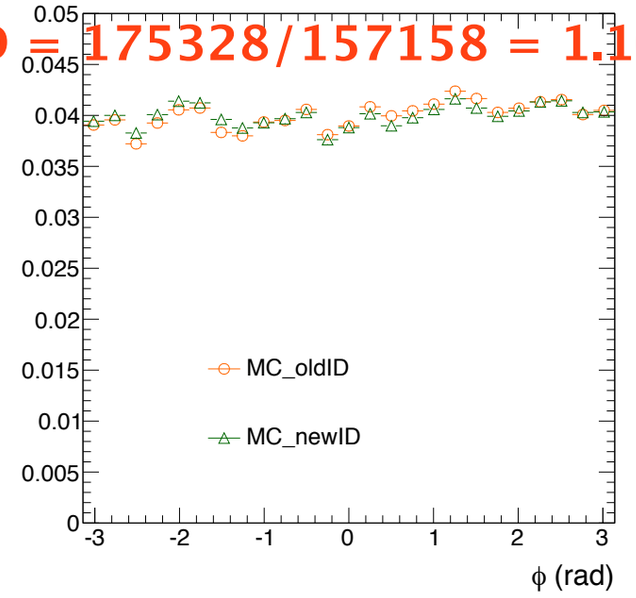
- **single muon variables (old muID vs new muID)**

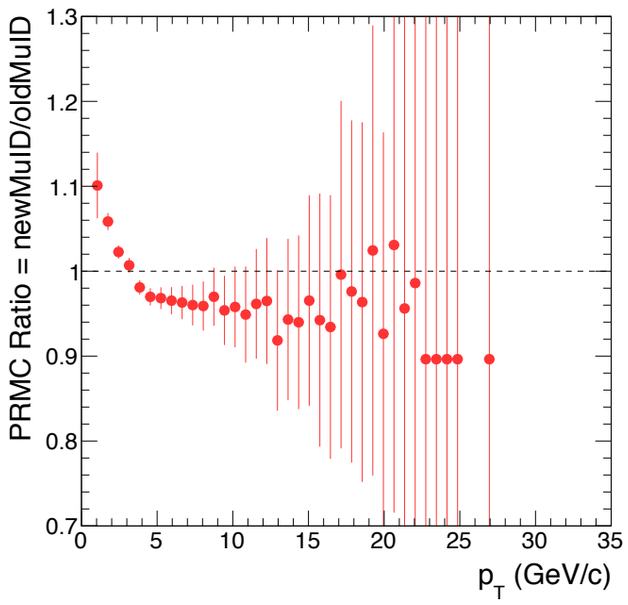
MC

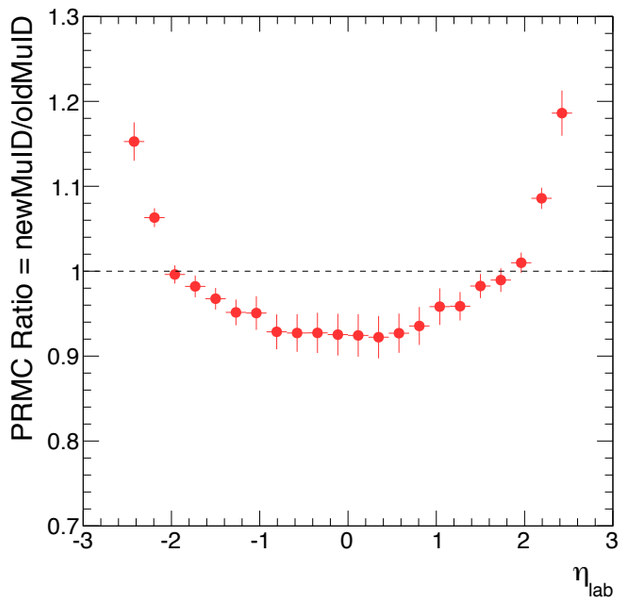


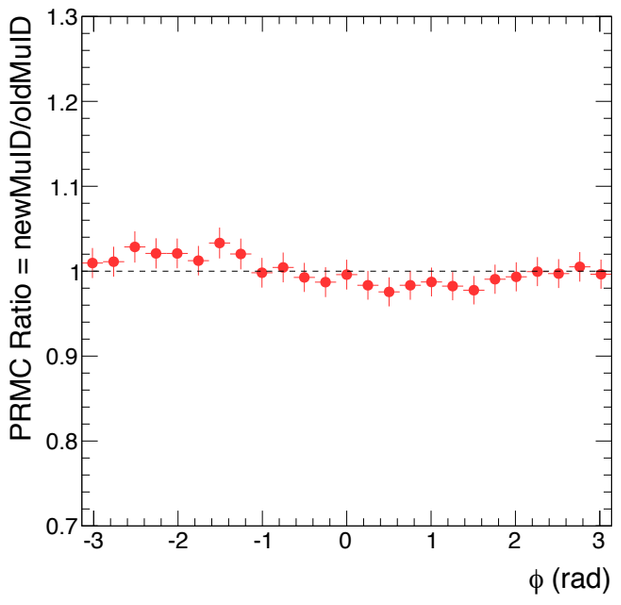


Entries newID/oldID = 175328/157158 = 1.16









[New muID]

- slightly less dimuons in signal region? (2.95-3.25 GeV/c)
- More dimuons in lower p_T region (which affect rapidity distributions also)

Comparison

- **Prompt J/psi**

most forward 1.5 < y_{CM} < 1.93

[Old results]

pT (GeV/c)	Eff Pbp	yield Pbp
0--3	0.103	5161.12
3-6.5	0.31	7261.88
6.5-7.5	0.408	1070.66
7.5-8.5	0.423	727.837
8.5-9.5	0.482	448.342
9.5-11	0.475	347.446
11-14	0.499	385.286
14-30	0.469	203.91

old muID
wrong filter

[New results]

pT (GeV/c)	Eff Pbp	yield Pbp
0--3	0.098	5910.21
3-6.5	0.322	8103.91
6.5-7.5	0.456	1199.92
7.5-8.5	0.489	782.763
8.5-9.5	0.55	475.264
9.5-11	0.557	368.098
11-14	0.57	437.496
14-30	0.585	223.354

new muID
correct filter

SF applied,
but old and wrong
TNP results

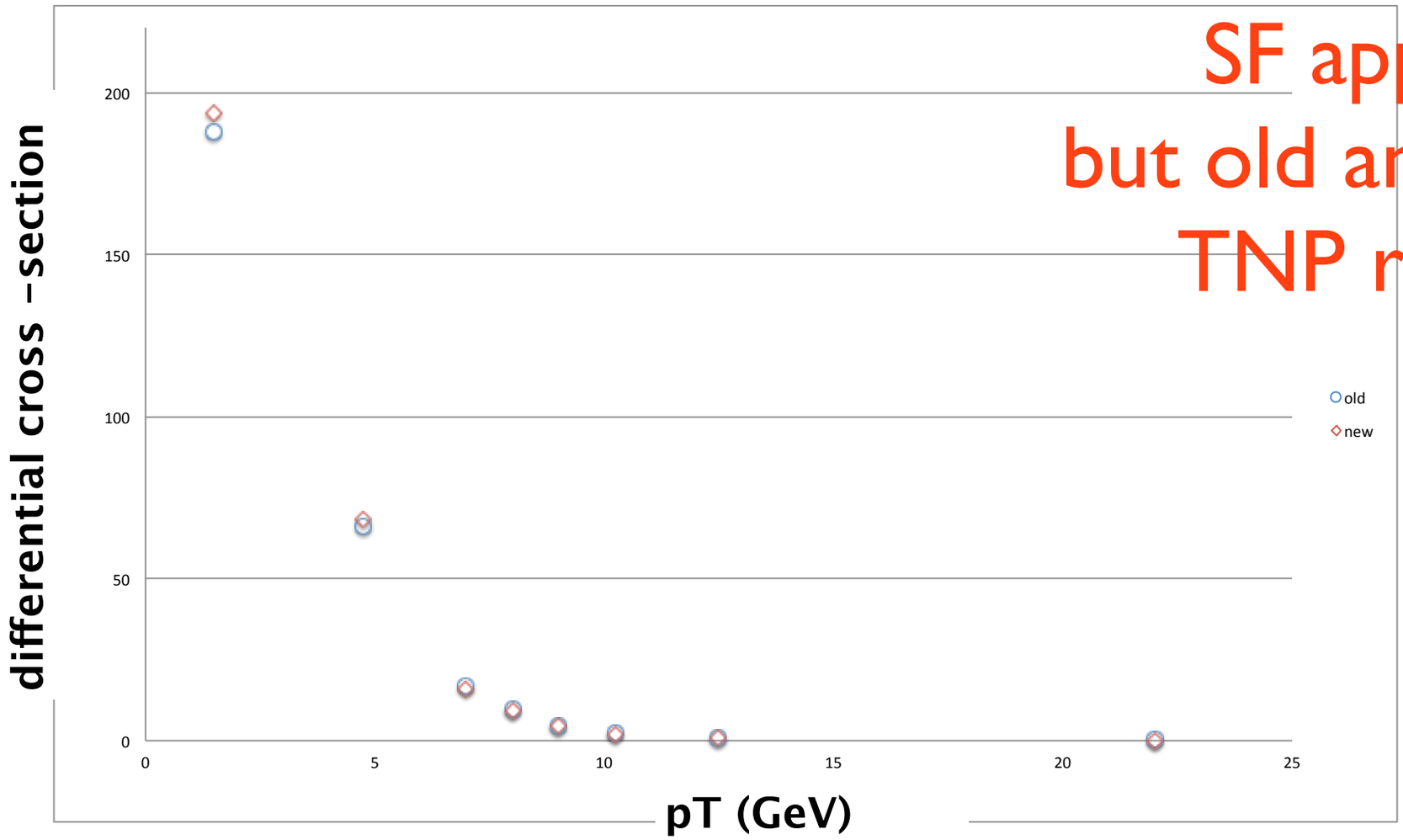
- Both yields and efficiency values increased
- **For pT 0-3 GeV, efficiency values decreased while yields increased.**

Quick check for results

Double differential cross section

$$\frac{d^2\sigma}{dp_T dy} = \frac{N_{fit}^{J/\psi} / (A \cdot \varepsilon)}{L_{int} \times B(J/\psi \to \mu^+\mu^-) \times \Delta p_T \Delta y}$$

- Quick check for the most forward region : $1.5 < y_{CM} < 1.93$
- Cross-section values become slightly smaller for pT > 6.5 GeV/c
- values become larger for pT < 6.5 GeV/c ?



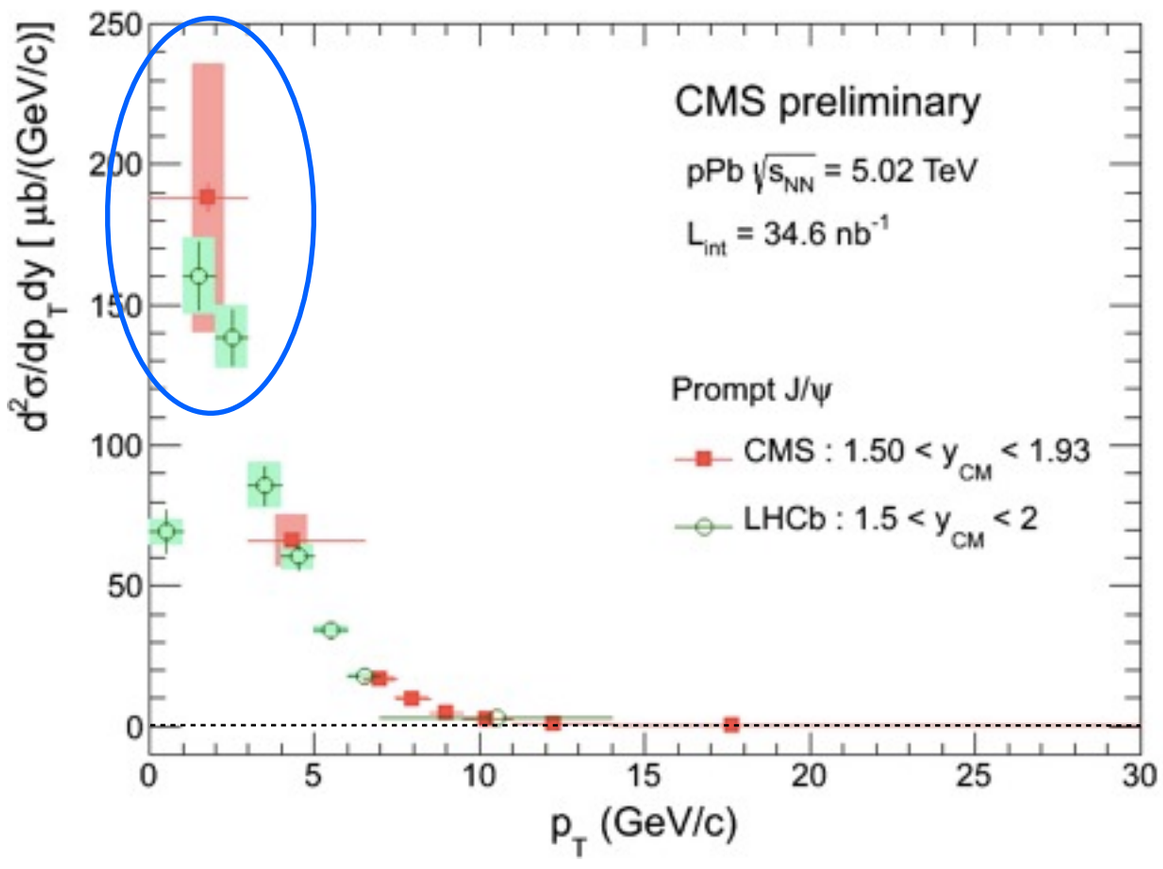
SF applied,
but old and wrong
TNP results

New sample

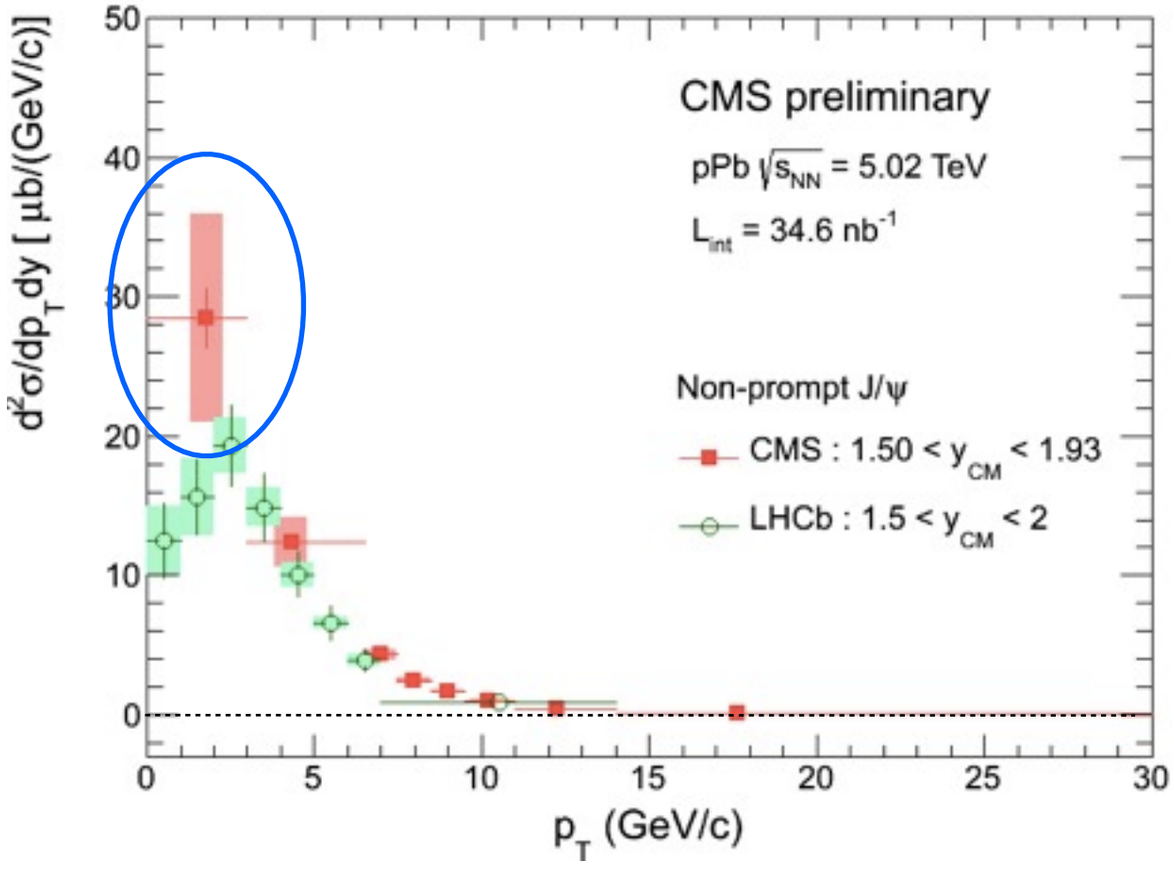
- **Double differential cross section**
  - LHCb points plotted at the center of the bin
  - Our points plotted at < p_T >

$$\frac{d^2\sigma}{dp_T dy} = \frac{N_{fit}^{J/\psi} / (A \cdot \varepsilon)}{L_{int} \times B(J/\psi \to \mu^+\mu^-) \times \Delta p_T \Delta y}$$

[Prompt]



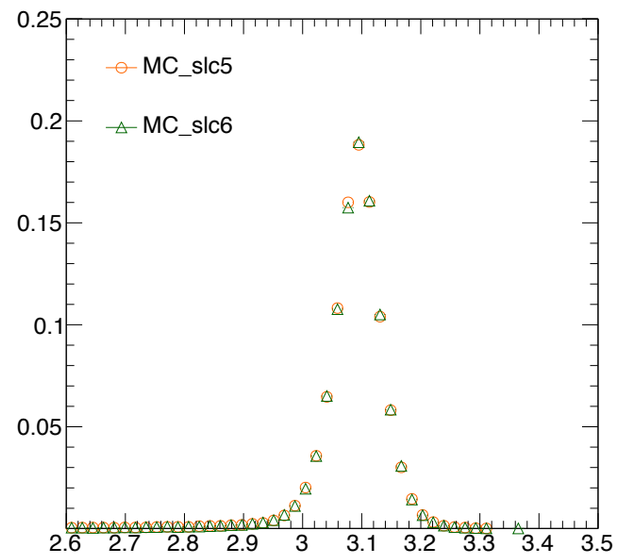
[Non-prompt]

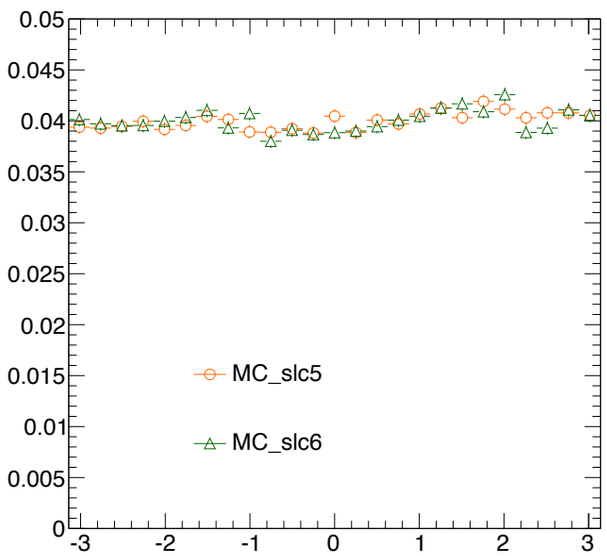


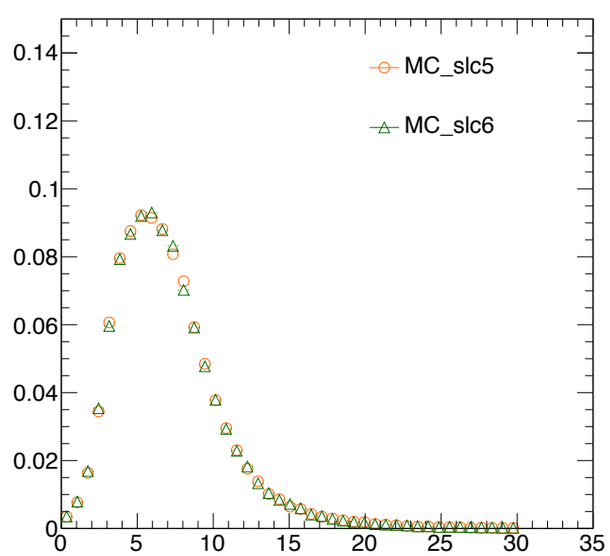
- **Large discrepancies at lower p_T < 3 GeV/c**
  - **acceptance or efficiency underestimated?**

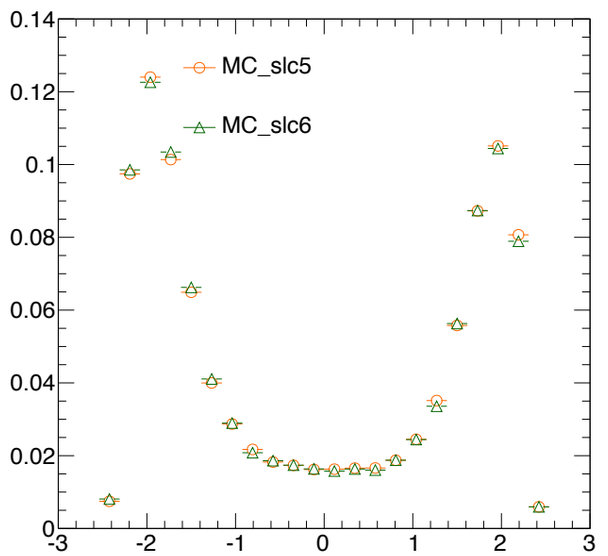
MC 5_3_8_HI vs 5_3_19

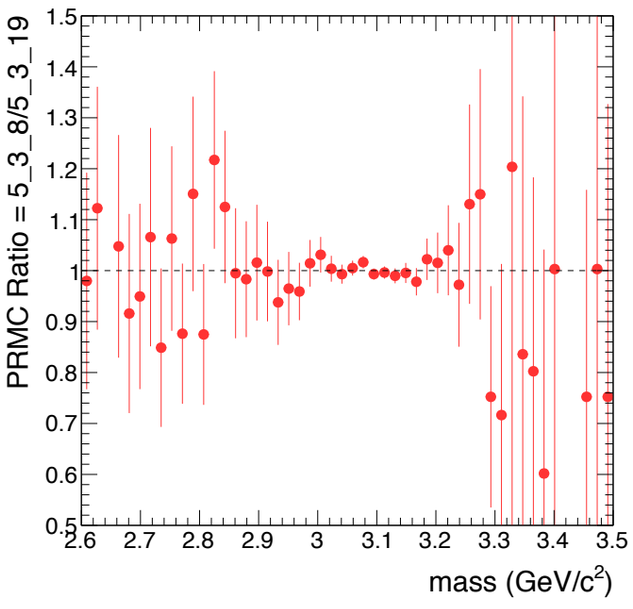
- **cf) Whole process (GEN-RECO) in different machine**

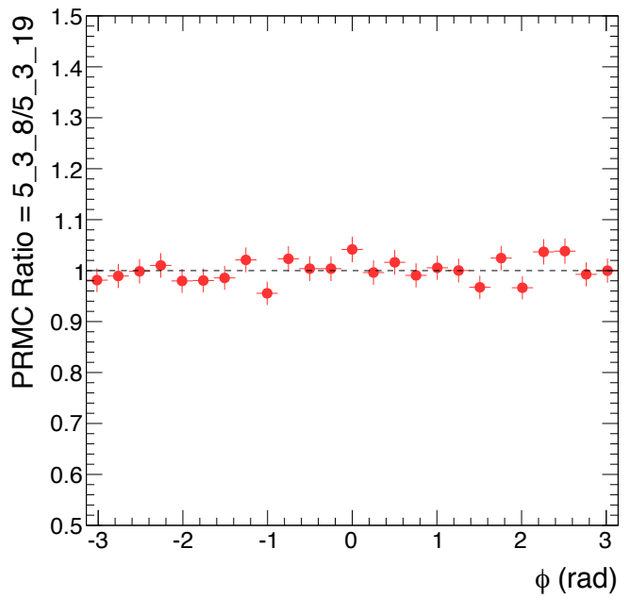


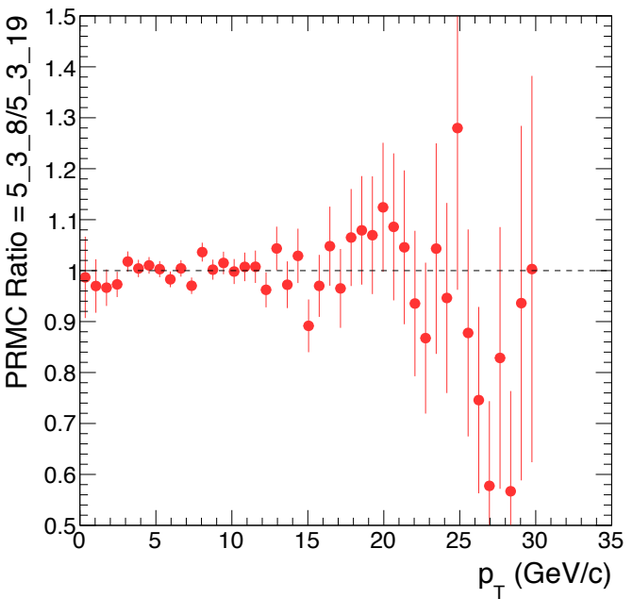


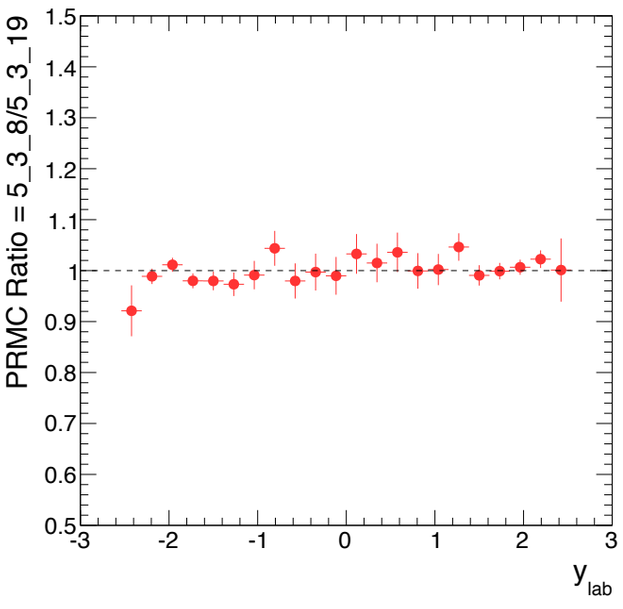








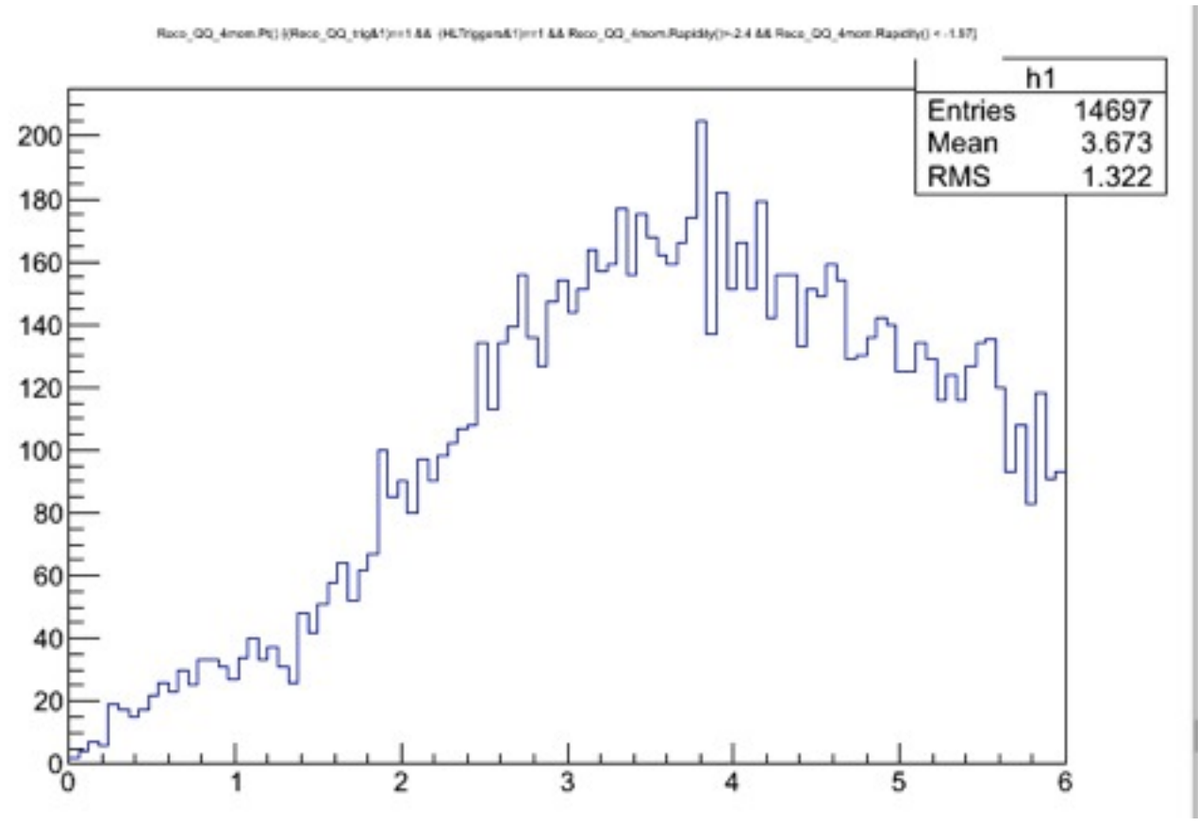




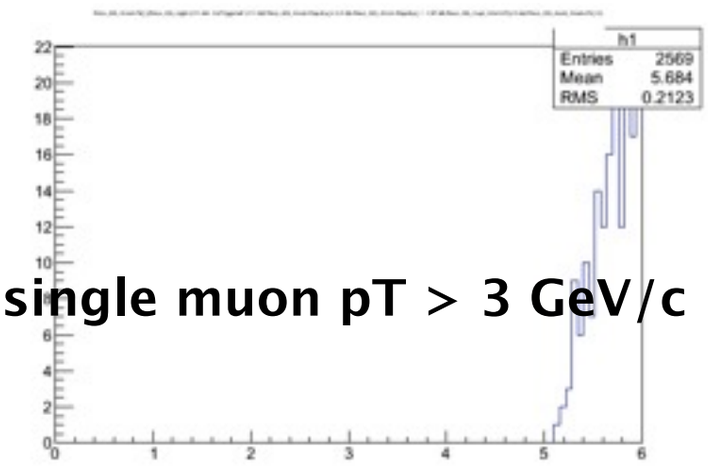
New sample

- yCM 1.5~1.93 (y_lab -1.4~-1.97)
- **trigger selected**

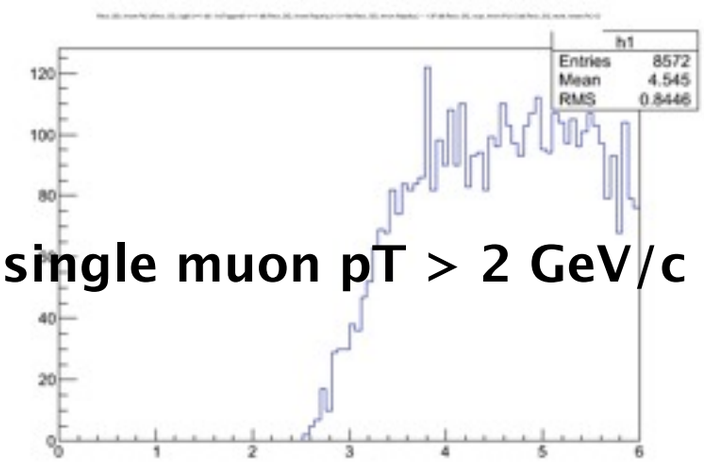
common acceptance cut



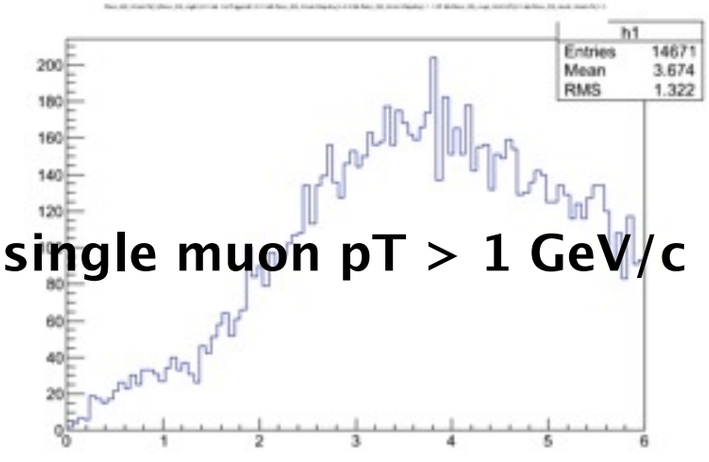
dimuon pT



single muon pT > 3 GeV/c



single muon pT > 2 GeV/c



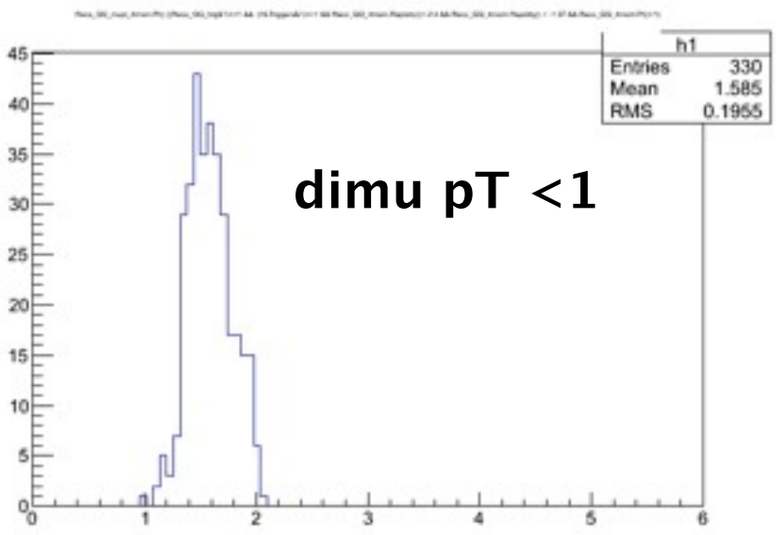
single muon pT > 1 GeV/c

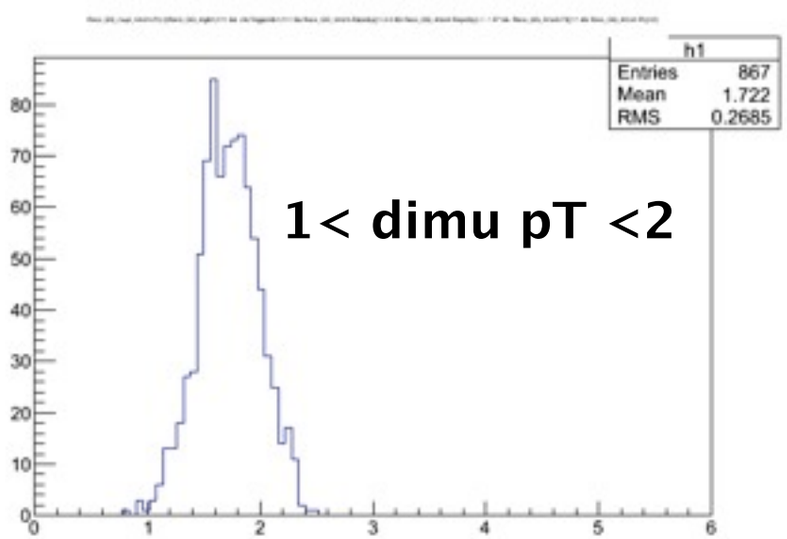
dimuon pT

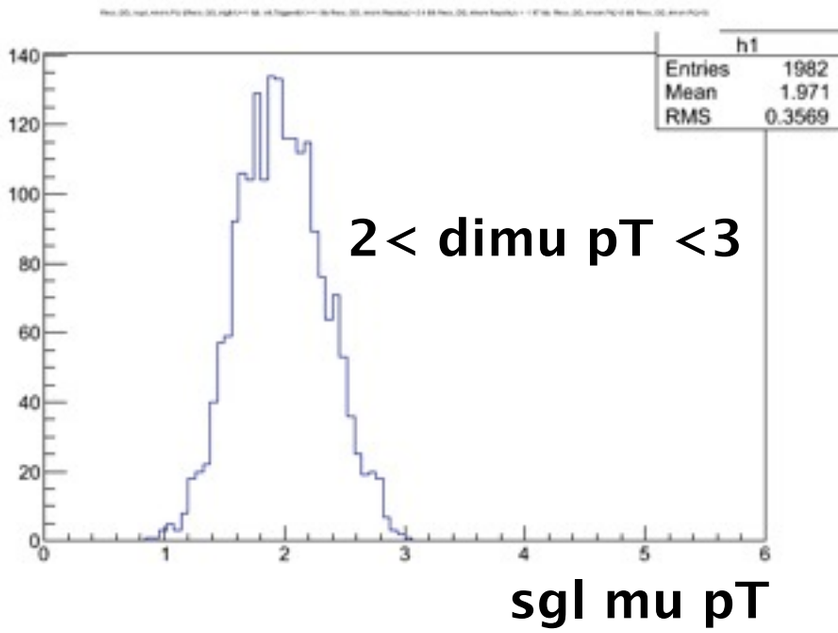
New sample

- yCM 1.5-1.93 (y_lab -1.4--1.97)
- **trigger selected**

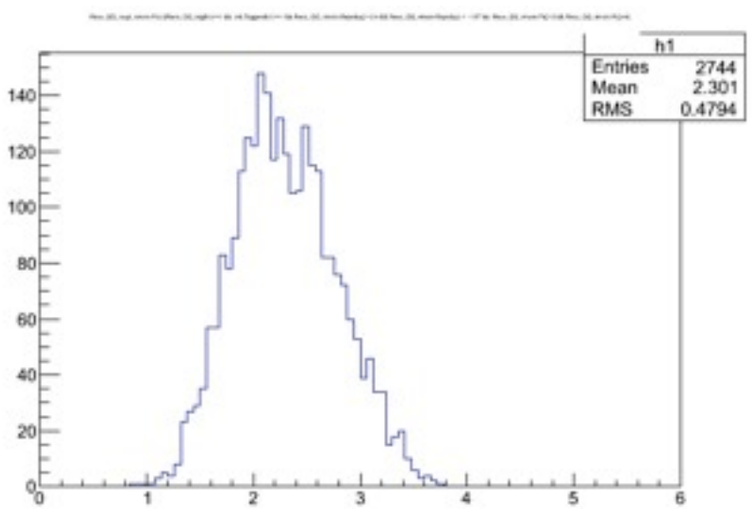
mupl



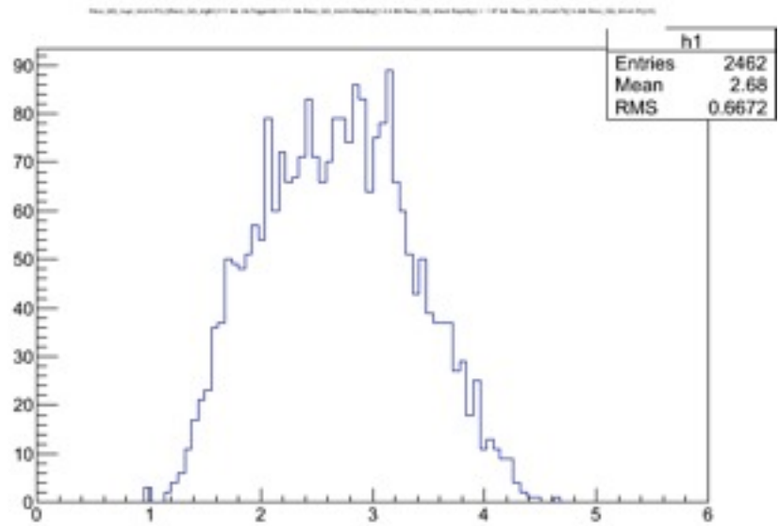




3< dimu pT <4



4< dimu pT <5



5< dimu pT <6