Status on J/Ψ Activities from Genova, Napoli and Roma

ATLAS Italia Meeting
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2/2/2010

Introduction

- Italian groups involved since Oct ’09:
  - Genova: T. Cornelissen, C. Gemme, L. Rossi
  - Napoli: M. Alviggi, G. Carlino, F. Conventi, M. Della Volpe, G. Iacobucci, E. Musto, A. Picazio, E. Rossi
  - Roma La Sapienza: G. Artoni, M. Biglietti, A. De Salvo, C. Dionisi, S. Giagu, V. Ippolito, F. Lo Sterzo, C. Luci, C. Maiani, M. Rescigno, L. Zanello
- Goals of this collaboration:
  - Detector and Trigger understanding and commissioning
  - Trigger and offline muon reconstruction efficiency studies
  - Physics measurements: e.g. both direct and b-produced J/Ψ cross-section, Branching Ratios, polarization measurement, ...
- J/Ψ Table of Actions (https://twiki.cern.ch/twiki/bin/view/AtlasProtected/JpsiWalkThrough) :
  - Trigger commissioning: LVL1 strategy, understanding of systematics, test of HLT algorithms, rate and efficiencies studies
  - Muons Reconstruction: studies on muons reconstructed at different levels, tag and probe method review
  - Backgrounds: studies on the backgrounds, in particular from decays in-flight and punch-through

Summary of Today's Talk

Review of the ongoing works..

- Common Tool Development for producing common ntuples
  - tool structure
  - tool contents
  - first validation of the ntuple produced
- Monte Carlo J/Ψ Analysis
- Studies on K/π rejection offline
- Validation and commissioning with '09 collision data
  - Preliminary results with reco muons
  - Preliminary results with LVL1 muon trigger

Common Tool Goal

- This tool is an Athena Algorithm, developed starting from the standard AnalysisSkeleton.cxx algorithm, that we will use to produce a common ntuple
- Each block of information (see next slide) is managed by an Athena AlgTool that is included in the Algorithm ➤ this way the common tool is modular
- When completed it will be possible to use it
  - to run over ESD, AOD, DnPD
  - to run over both real data and Monte Carlo
  - use the Grid
  - use ATLAS standard tools (good run list, luminosity block selection, ...)
  - use common tools like Bphys framework
- The validation of the ntuple produced with this new tool has already started: it has been tested on
  - J/Ψ Monte Carlo
  - Minimum Bias Monte Carlo
  - '09 collision data

mc08.108422.Pythia_directJpsimu2p5mu2p5.recon.ESD.e355_s462_s520_r809 ~30K events

mc09_2TeV.105001.pythia_minbias.recon.ESD.e499_s672_s673_d270_r1039 ~30K events

Common Ntuple Contents

- EventInfo: RunNumber, EventNumber, LumiBlock — On going
- Monte Carlo Truth: muons + parents information — Done
- Offline Reconstructed Muons — Done
  - from both Moore and MuonBoy algorithms
  - low p_T algorithms (MuGirl, MuTag)
- Offline Reconstructed ID Tracks — Done
- Trigger Information
  - Trigger Menus (from TrigDecisionTool) — On going
  - Muon trigger LVL1 information — Done
  - Muon HLT — Done
  - ID Tracks HLT — On going

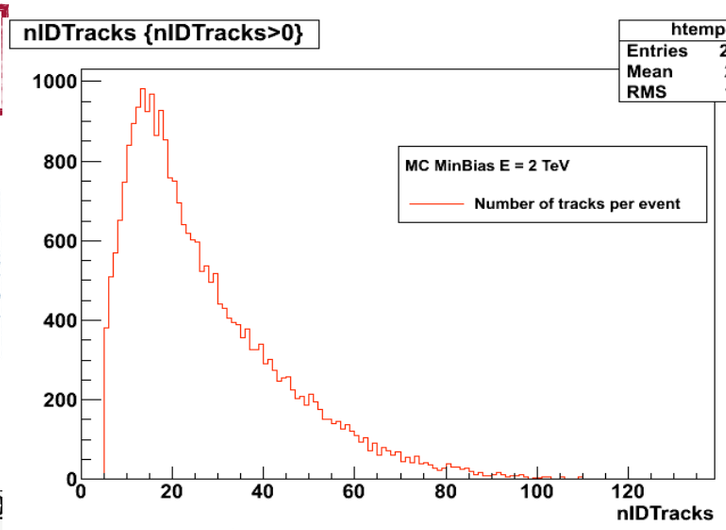
Common Tool

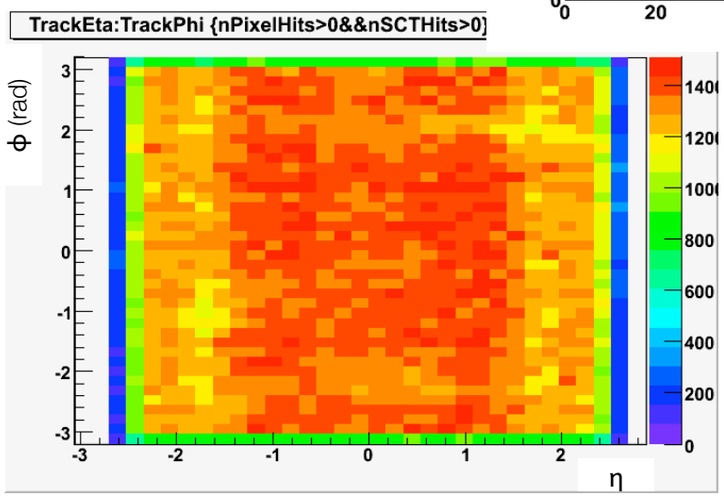
- Strategy
- Contents
- Validation

Common Ntuple Validation

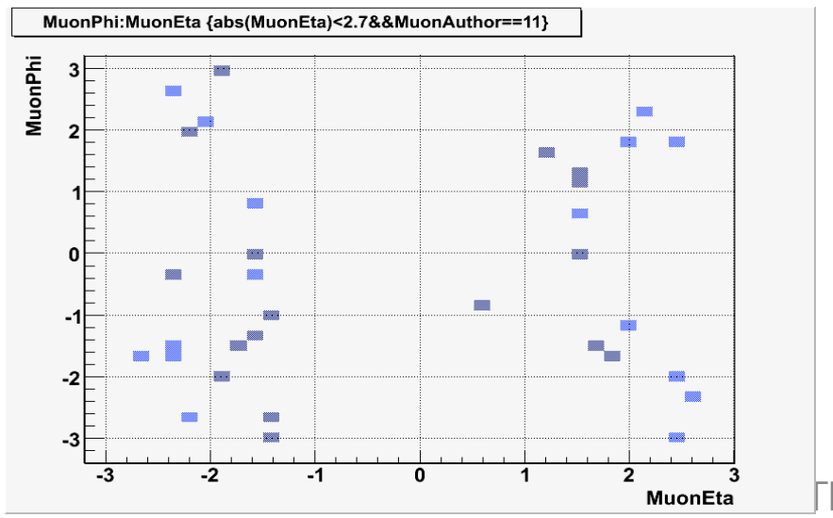
MinBias sample

number of ID Tracks



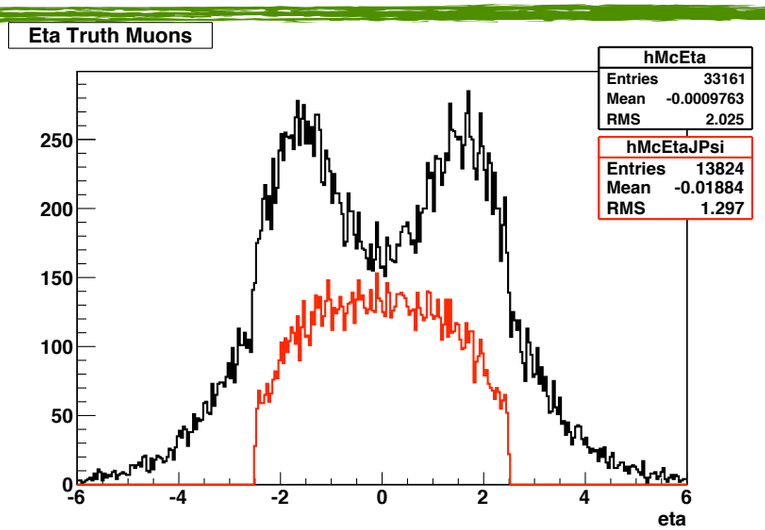


ID Track
ϕ vs η

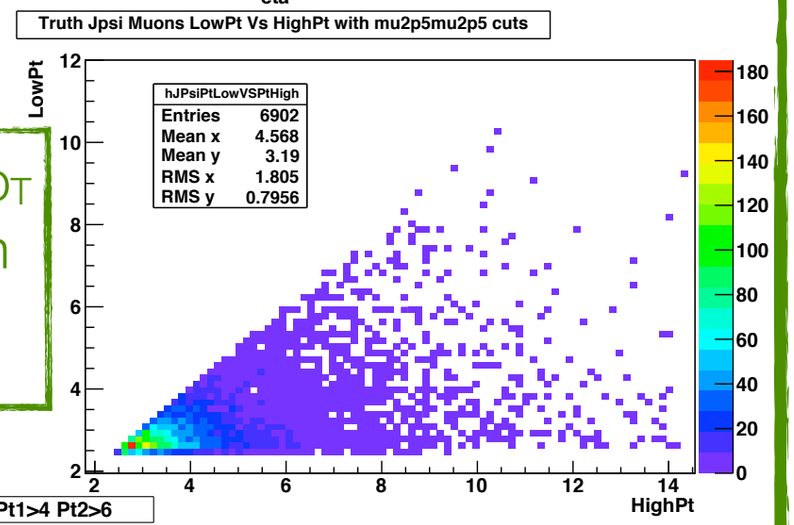


Muld reco muons
ϕ vs η

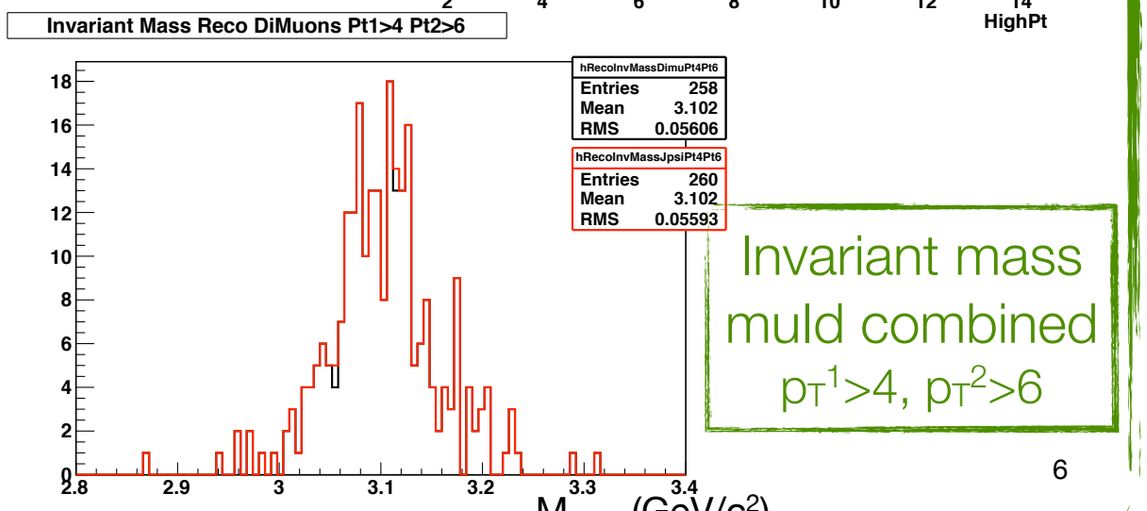
J/Ψ sample



η Distribution
On J/Ψ muons:
p_T^{μ}>2.5GeV/c
$|\eta^{\mu}|$<2.5



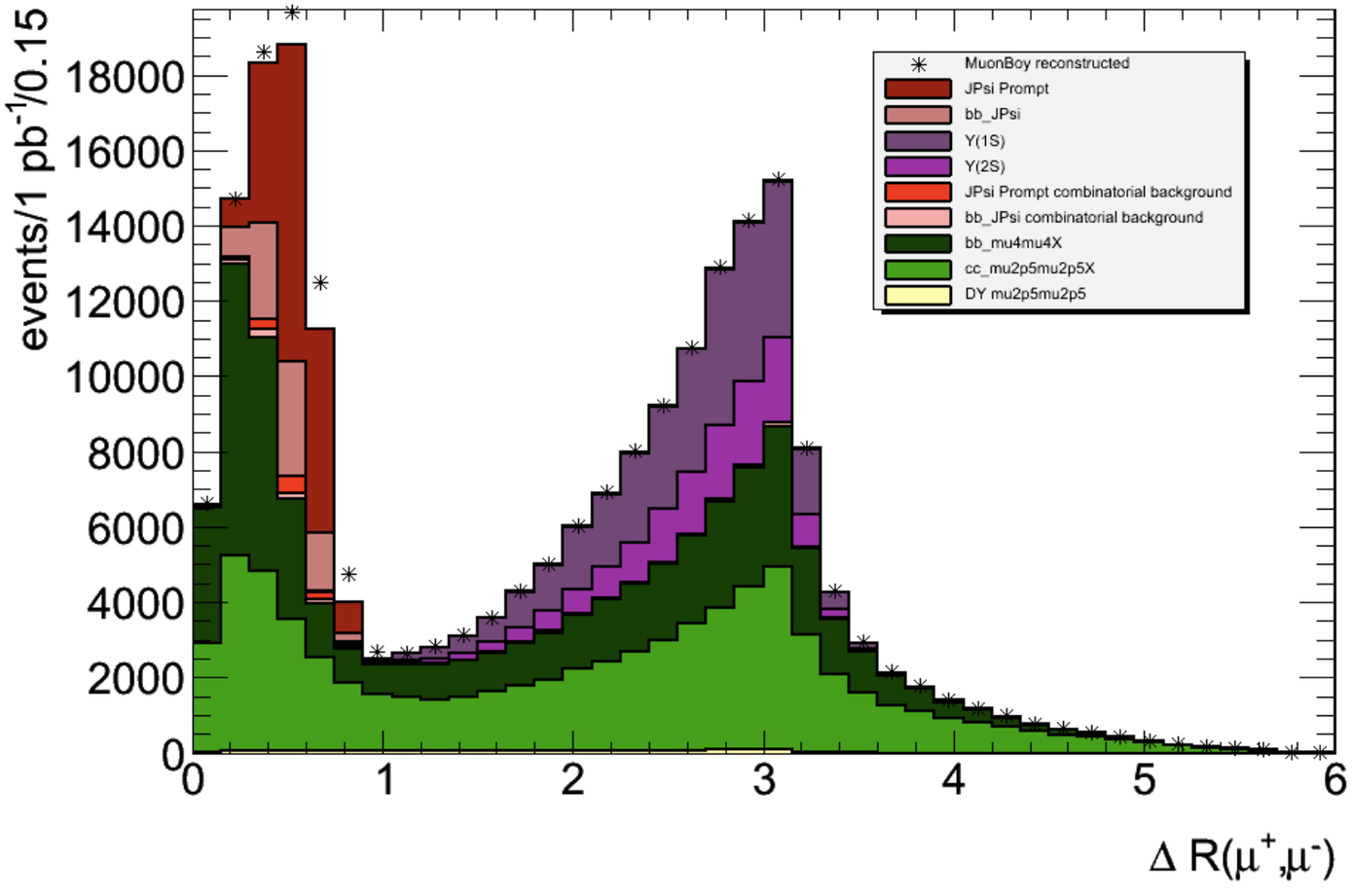
Low p_T vs High p_T truth distribution
p_T^{μ}>2.5GeV/c
$|\eta^{\mu}|$<2.5



Invariant mass muld combined
p_T^1>4, p_T^2>6

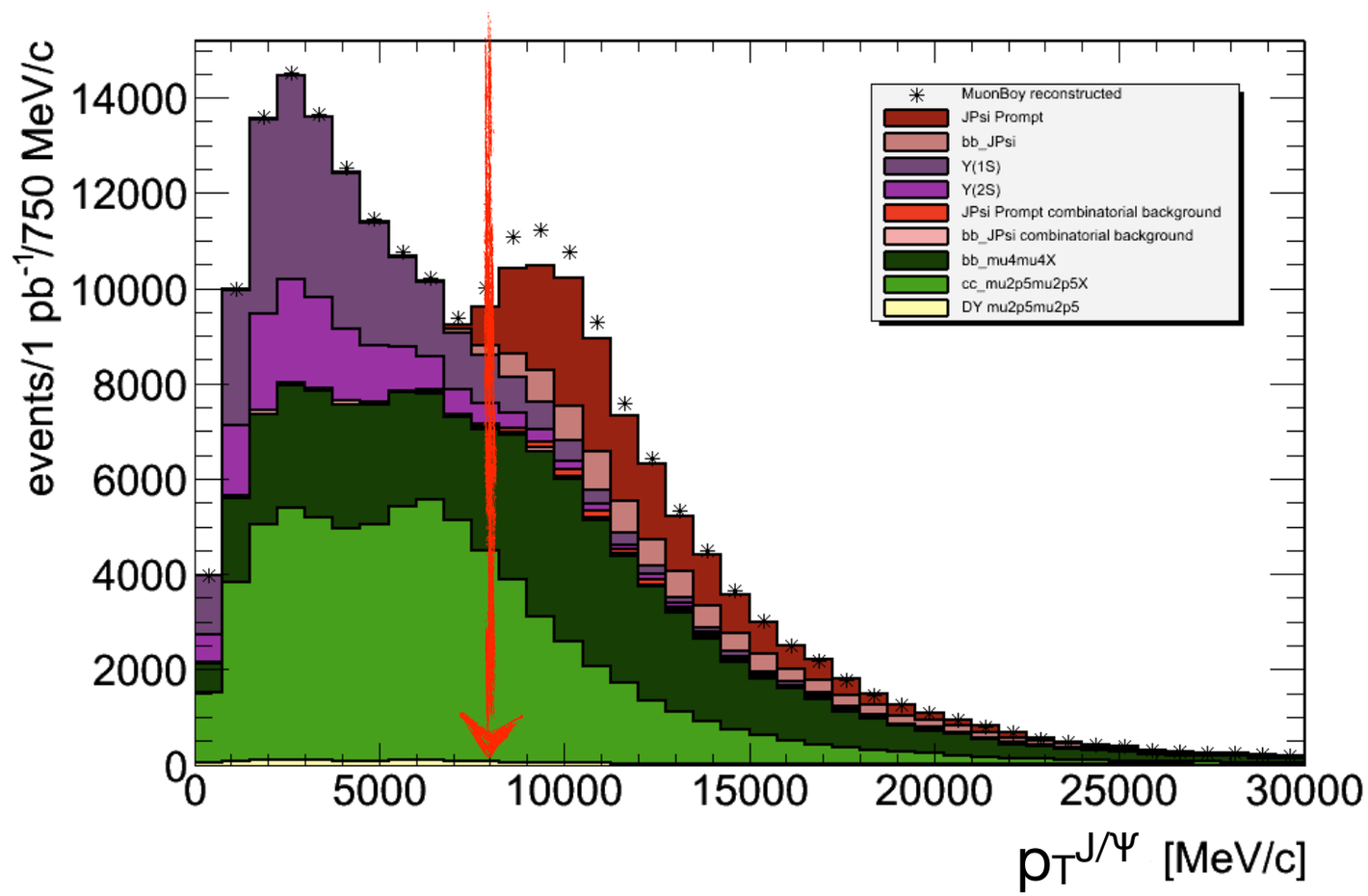
J/Ψ Analysis on Monte Carlo: Samples Used

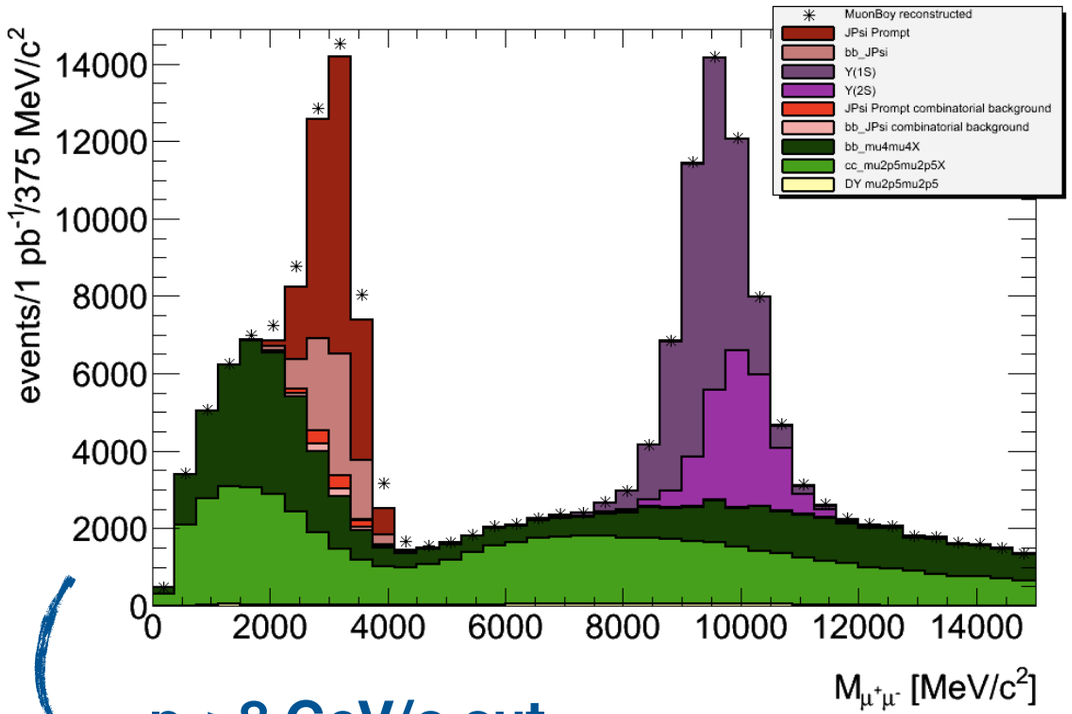
Dataset @ √s = 10 TeV	σ(nb)	$\mathcal{L}$(pb^{-1})
mc09_valid.108407.Pythia_directJpsimu4mu4.recon.ESD.e347_s585_s582_r812/	30	0.2
valid1.108411.PythiaB_bb_Jpsimu4mu4X.recon.ESD.e380_s593_r965/	13.5	0.72
mc09_valid.108401.PythiaB_bbmu4X.recon.ESD.e347_s585_s582_r812/		
mc08.108401.PythiaB_bbmu4X.merge.AOD.e347_s462_s520_r809_r838/	13170	0.01
mc08.108400.PythiaB_ccmu4X.merge.AOD.e347_s462_s520_r808_r838/	7900	0.01
mc08.108441.Pythia_DYLowBPhysM_mu2p5mu2p.merge.AOD.e388_s462_s520_r809_r838/	3	318.16
mc08.108423.Pythia_directUpsilonmu2p5mu2p5.recon.ESD.e355_s462_s520_r809/	90	0.23
mc08.108425.Pythia_Upsilon2S_mu2p5mu2p5.recon.ESD.e355_s462_s520_r809/	26	0.81



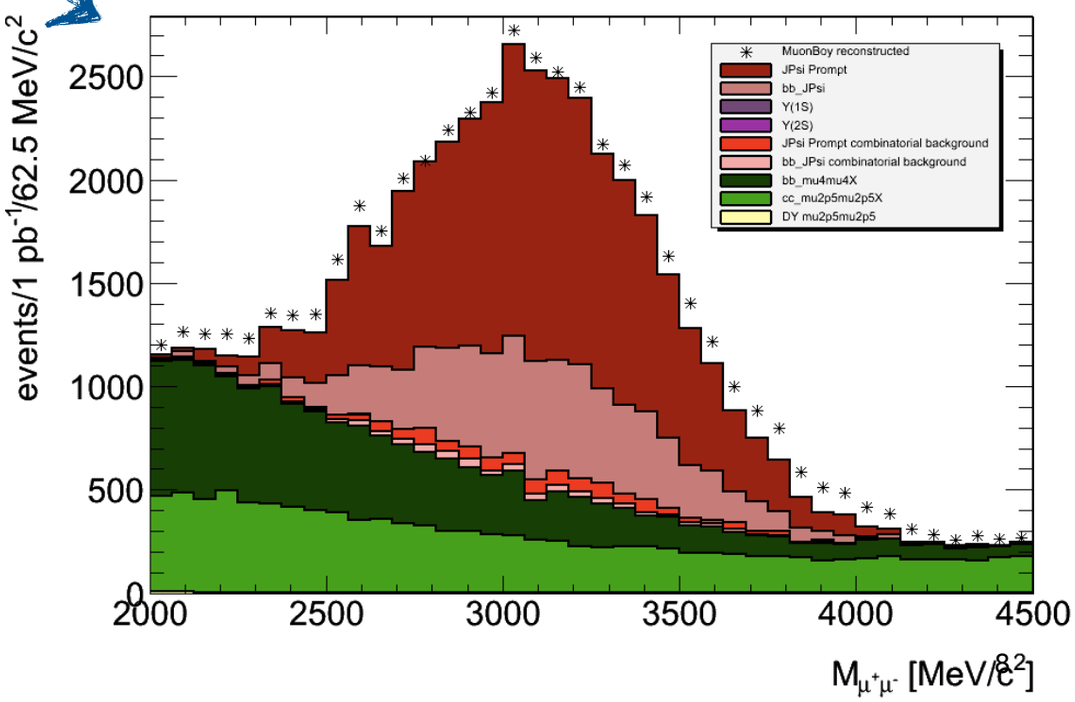
J/Ψ Analysis on Monte Carlo: Invariant Mass

8 GeV/c

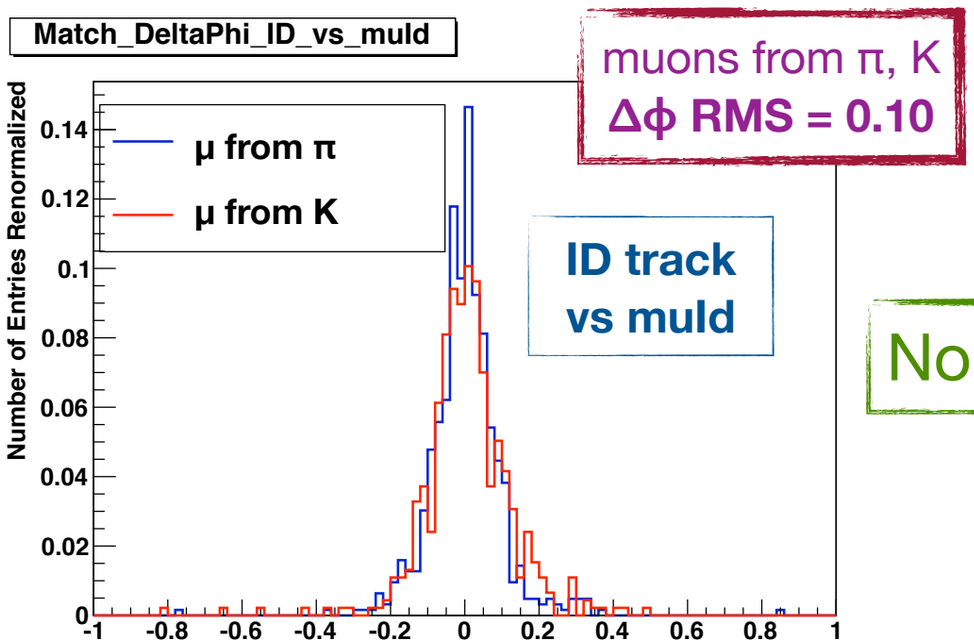




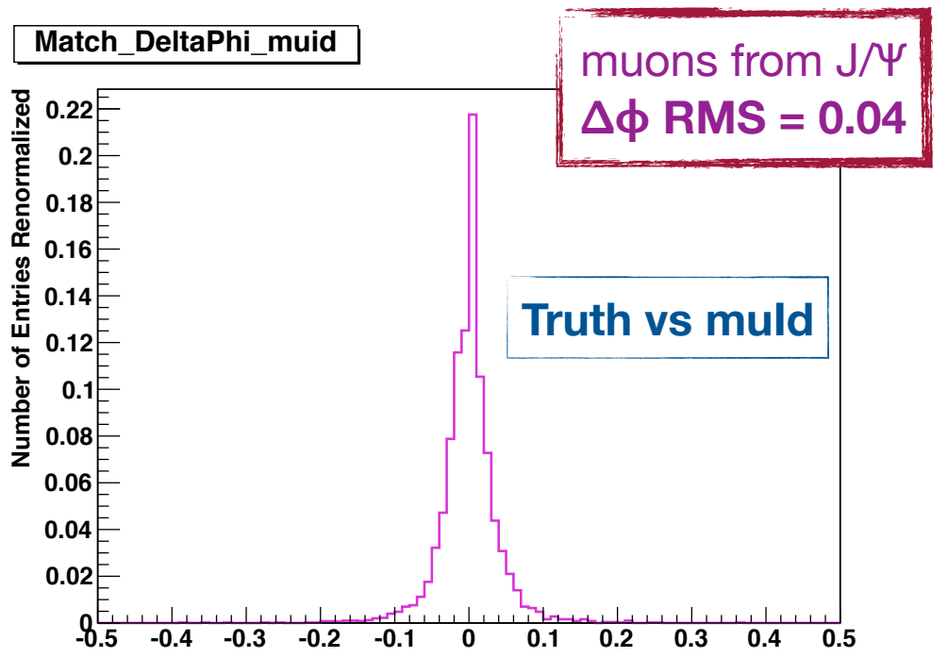
p_T>8 GeV/c cut

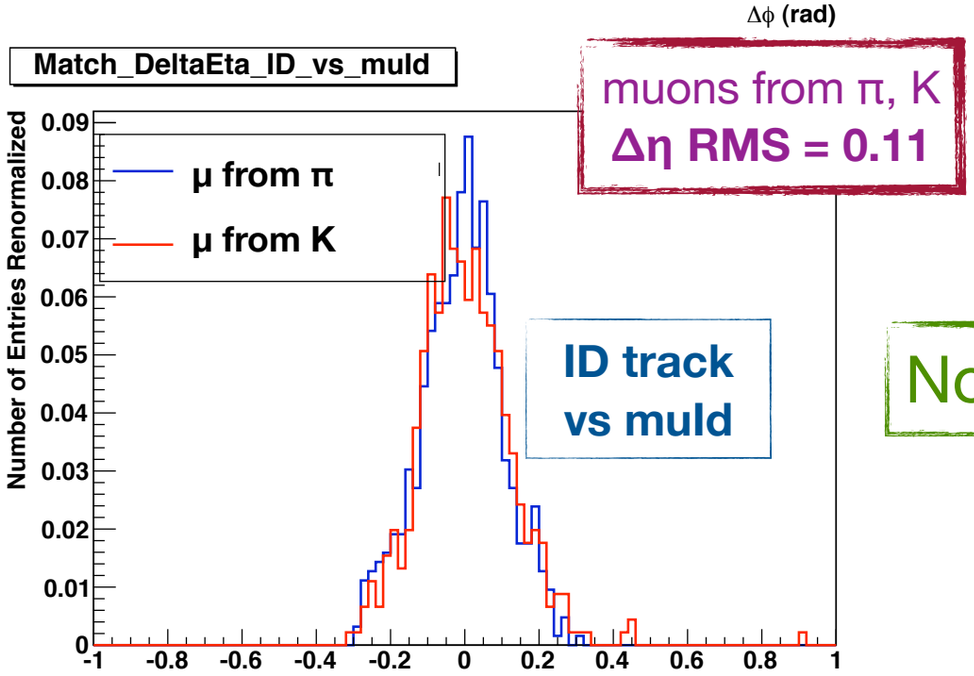


K/π Studies: Kink-Back Extrapolation

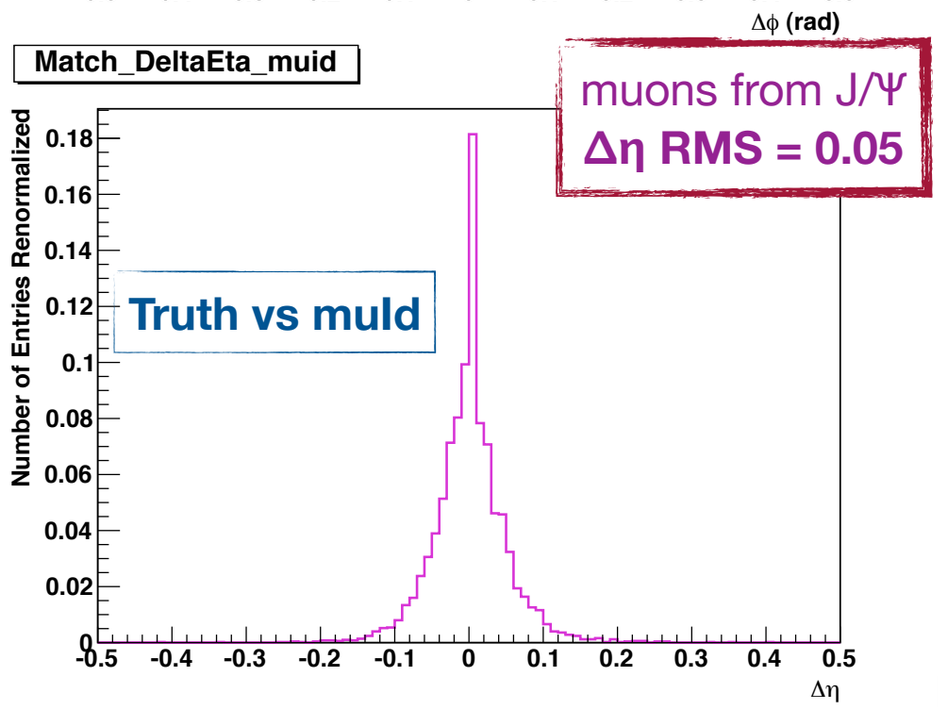


No p_T cut



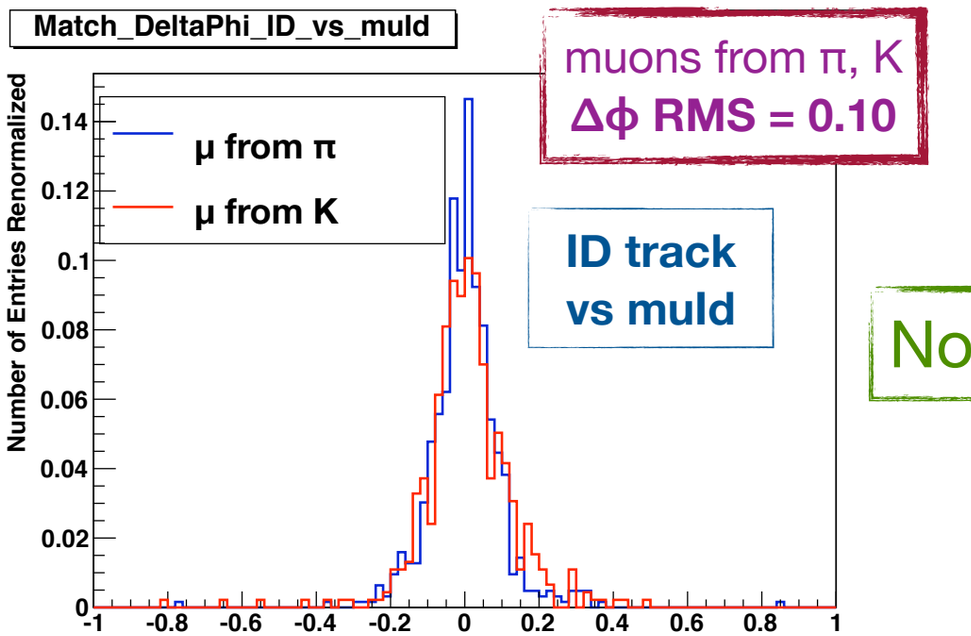


No p_T cut

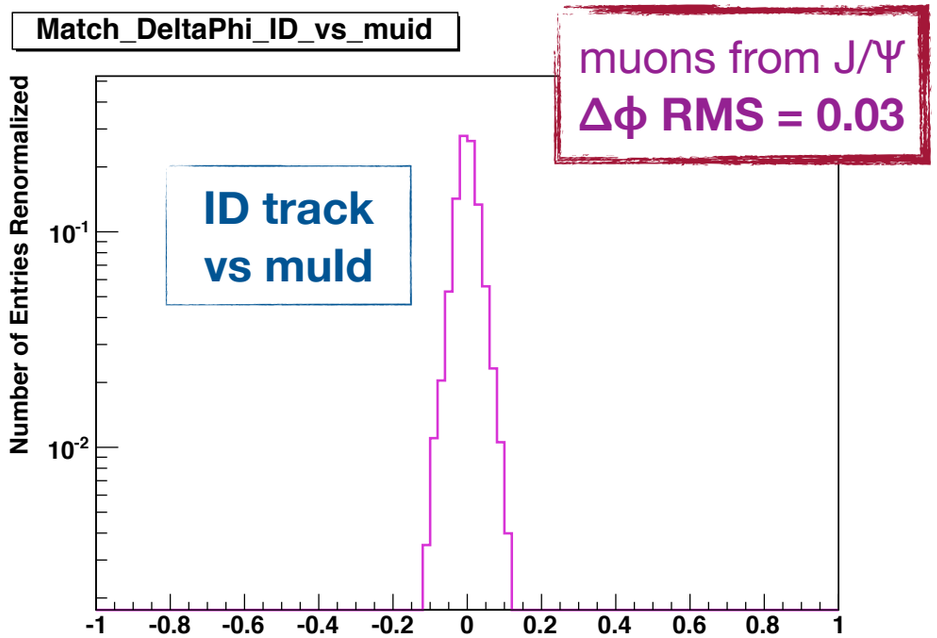


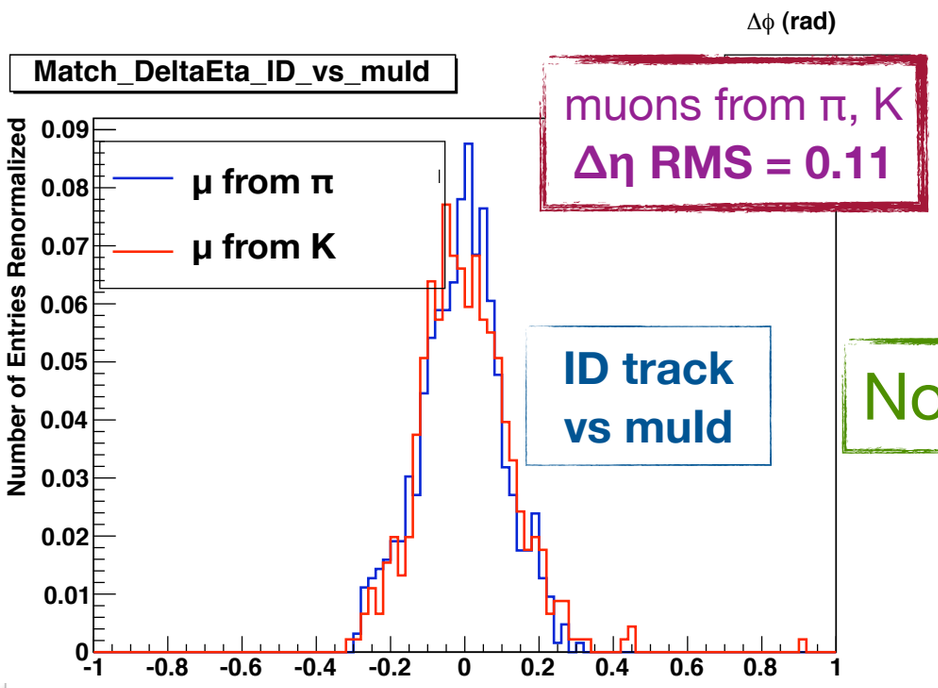
mc09_900GeV.108310.pythia_minbias_DW.recon.ESD.e504_s655_s657_r1007 ~9Mev @900GeV
valid1.108407.Pythia_directJpsimu4mu4.recon.ESD.e380_s680_r1046_tid105787_00

K/π Studies: MS-ID Match

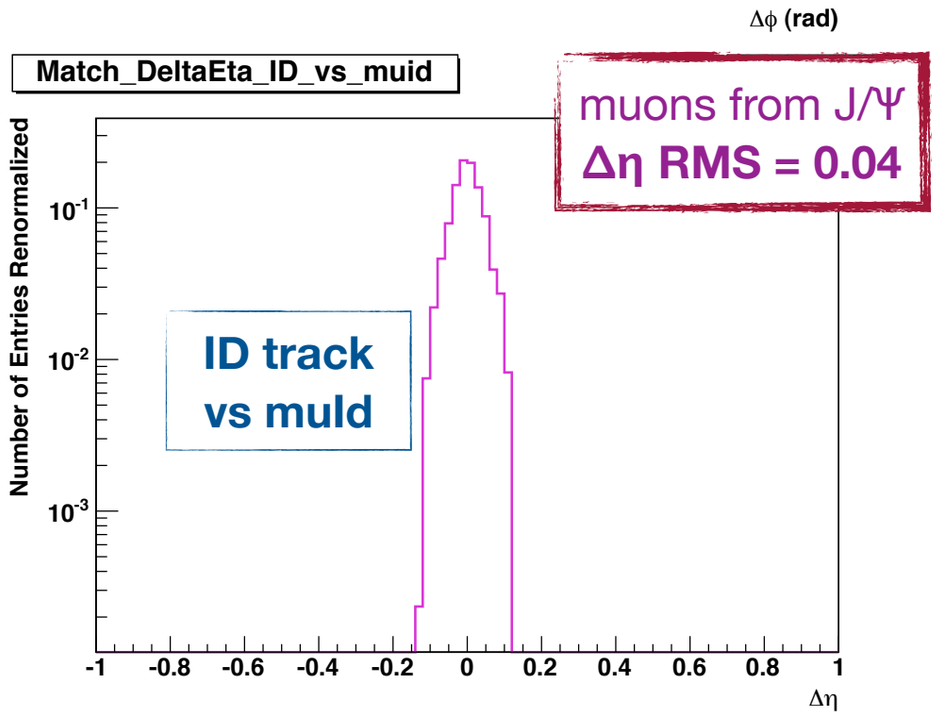


No p_T cut



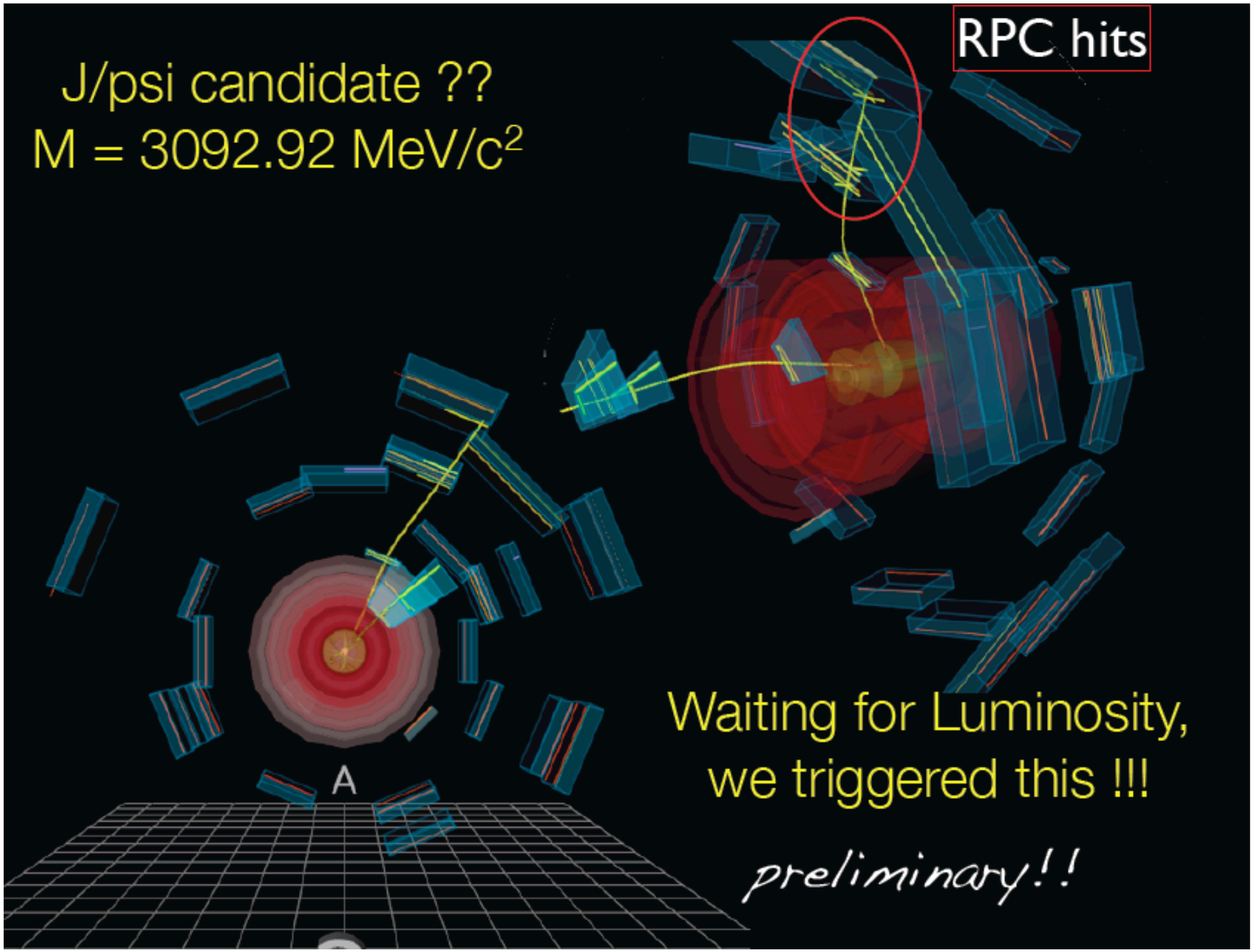


No p_T cut



mc09_900GeV.108310.pythia_minbias_DW.recon.ESD.e504_s655_s657_r1007 ~9Mev @900GeV
valid1.108407.Pythia_directJpsimu4mu4.recon.ESD.e380_s680_r1046_tid105787_00

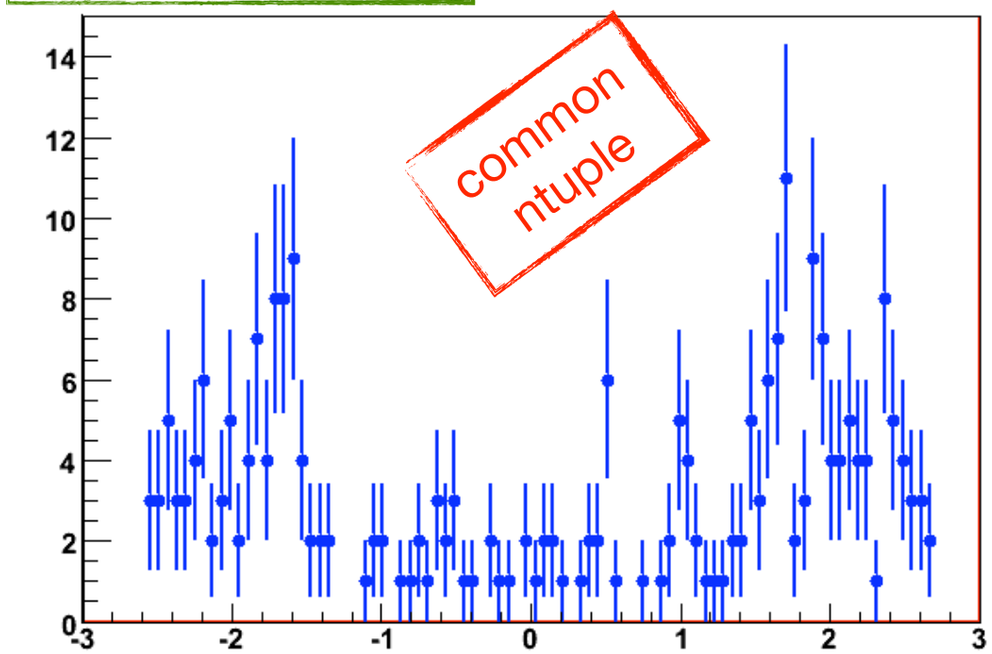
J/Ψ Candidate Event



- Muon in the barrel reconstructed with both Moore and Muld, p_T~4GeV/c
- Muon in the endcaps reconstructed with muTag, p_T~2.5GeV/c
- $\Delta R^{\mu+\mu-}$~1
- Event triggered by RPCs MU6

Selected Muons From ’09 Collision Data

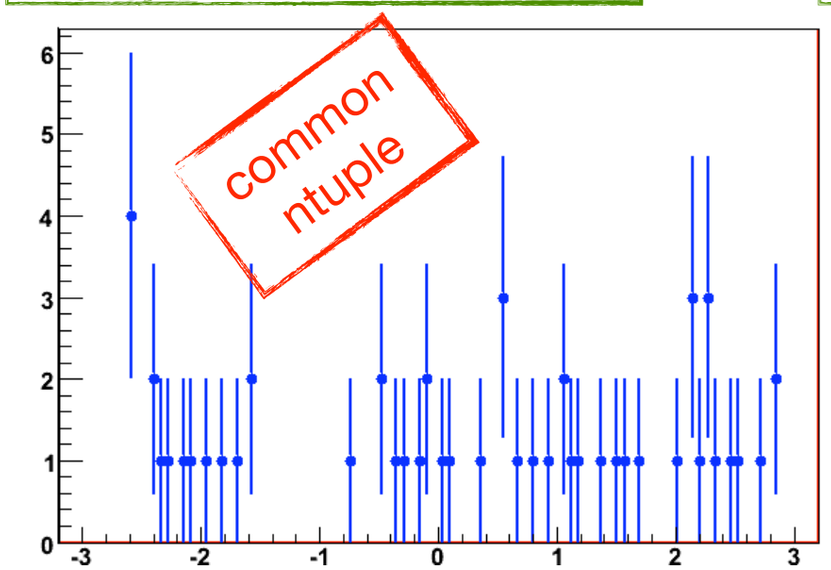
η distribution



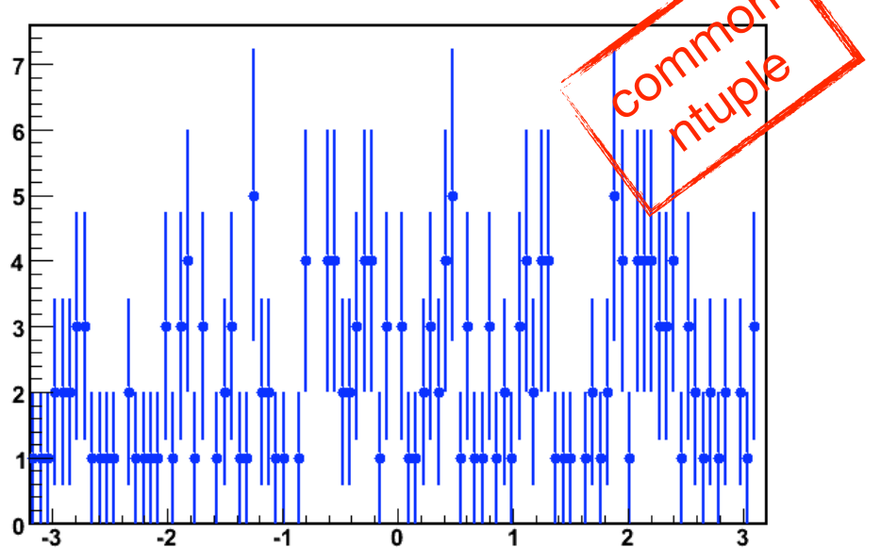
Selection:

- Ran over all collision runs with muon candidates
- Trigger MBTS: coincidence in both scintillator stations
- Number of ID tracks ≥ 10
- At least 1 combined track or at least 1 match with $\Delta R < 0.3$
- Cosmic veto: reject two top-bottom muons

ϕ barrel distribution

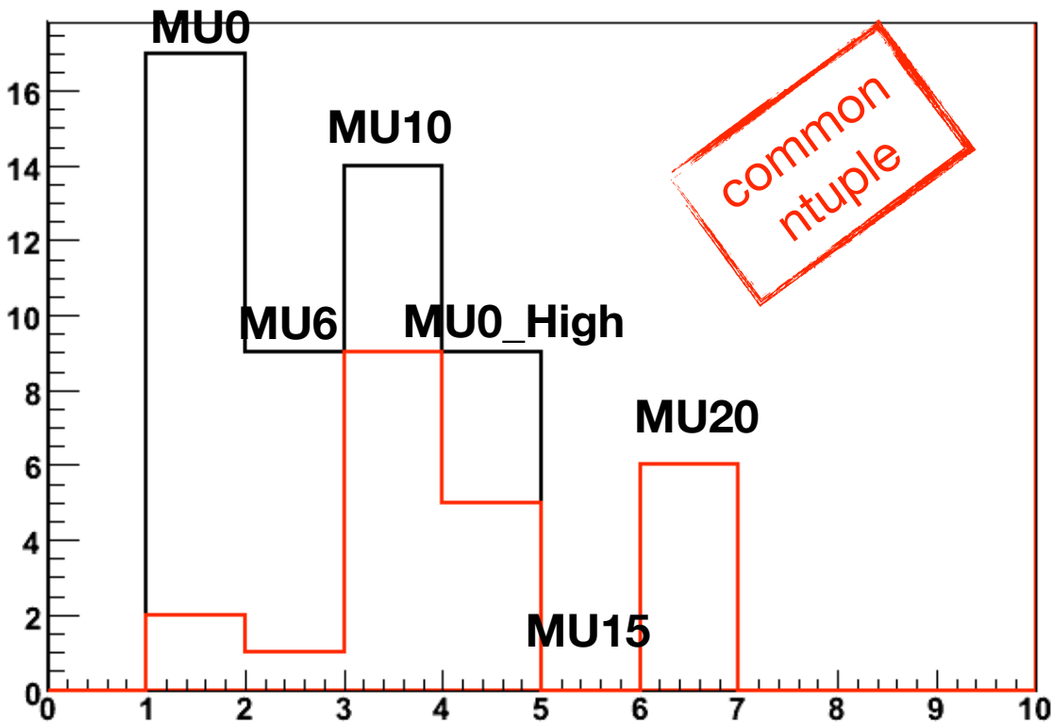


ϕ endcaps distribution



255 muons selected
51 in the barrel, with Moore/MuId

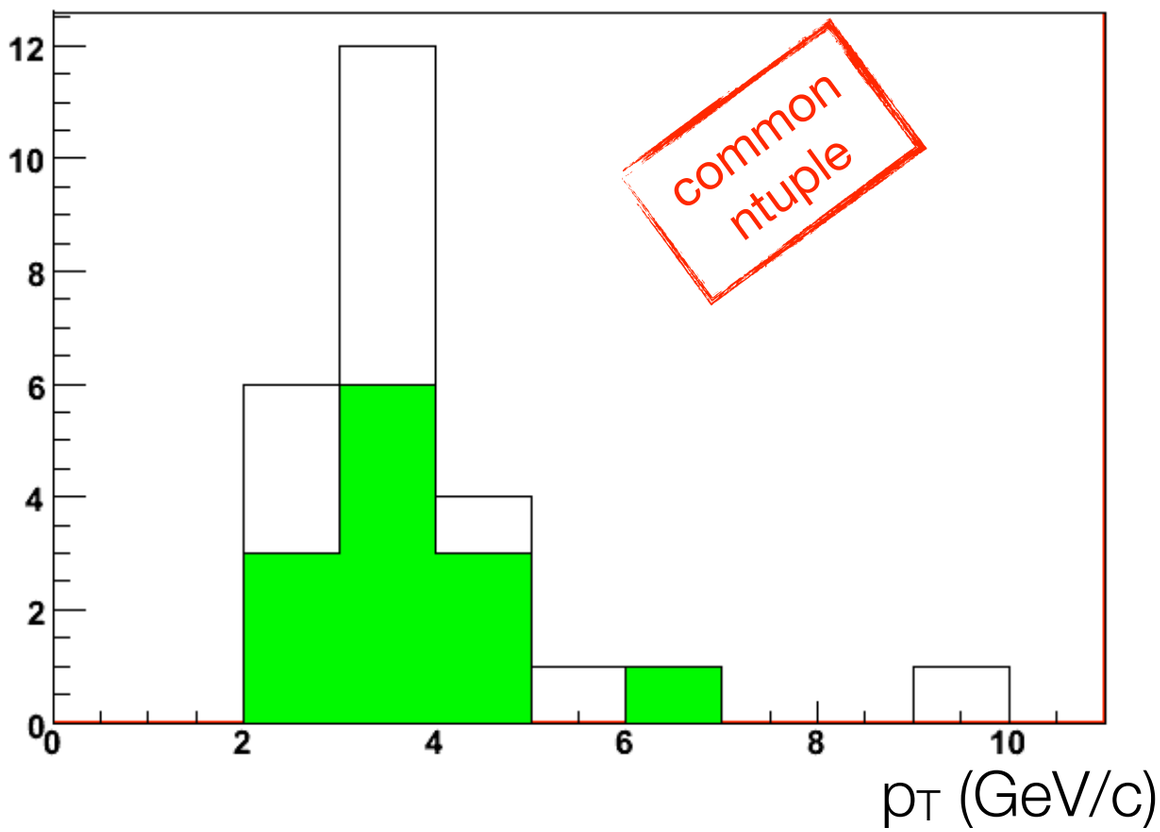
RPC Studies with ’09 Collision Data



toroid OFF + toroid ON
toroid OFF

p_T thr

Reco Muons
Match with MuCTPI



p_T (GeV/c)

Toroid	Efficiency
ON	62%
OFF	89%

➤ Too few muons to trust the efficiency estimate

Conclusions and Plans

- Many different activities at different levels started since the forming of the group
  - technical organization (common ntuple)
  - MC signal and backgrounds studies
  - validation of muon reconstruction and trigger with very first collision data
- Interested people are obviously welcome