pPb & pp J/ψ TnP Status

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pPb vs. pp information

pPb

- CMSSW: CMSSW_5_3_20
- Data
  - DAS: /PAMuon/HIRun2013-PromptReco-v1/RECO
  - DAS: /PAMuon/HIRun2013-28Sep2013-v1/RECO
  - GT: GR_P_V43F:All
  - GT: GR_P_V43D:All
- MC
  - DAS: /JpsiWithFSR_tuneD67T_5TeV02/pAWinter13DR53X-pa_1st_run_STARTHI53_v27_ext1-v1/GEN-SIM-RECO
  - DAS: /JpsiWithFSR_tuneD67T_5TeV02/pAWinter13DR53X-pa_2nd_run_STARTHI53_v27_ext1-v1/GEN-SIM-RECO
  - GT: START53_V27:All

Trigger

DoubleMu: HLT_PAL1DoubleMuOpen_v*
Tag: HLT_PAMu3_v*

pp

- CMSSW: CMSSW_7_5_8_patch3
- Data
  - DAS: /SingleMuLowPt/Run2015E-PromptReco-v1/AOD
  - GT: 75X_dataRun2_Prompt_ppAt5TeV_v0
- MC
  - DAS: /JpsiMM_5p02TeV_TuneCUETP8M1/HINppWinter16DR-75X_mcRun2_asymptotic_ppAt5TeV_v3-v1/AODSIM
  - GT: 75X_mcRun2_asymtotic_ppAt5TeV_v3

Data
DoubleMu: HLT_HIL1DoubleMu0_v*
Tag: HLT_HIL2Mu3_NHitQ10_v*
MC
DoubleMu: HLT_HIL1DoubleMu0ForPPRef_v*
Tag: HLT_HIL2Mu3_NHitQ10ForPPRef_v*

Muon eta bins

$0<\|\eta\|<0.9$	$0.9<\|\eta\|<1.2$	$1.2<\|\eta\|<1.6$	$1.6<\|\eta\|<2.1$	$2.1<\|\eta\|<2.4$

Acceptance

$$|\eta|<1.2:\ p_T \geq 3.3$$

$$1.2 \leq |\eta| < 2.1:\ p_T \geq -\frac{1.0}{0.9}\times|\eta| + 1.2\times\frac{1.0}{0.9} + 2.6$$

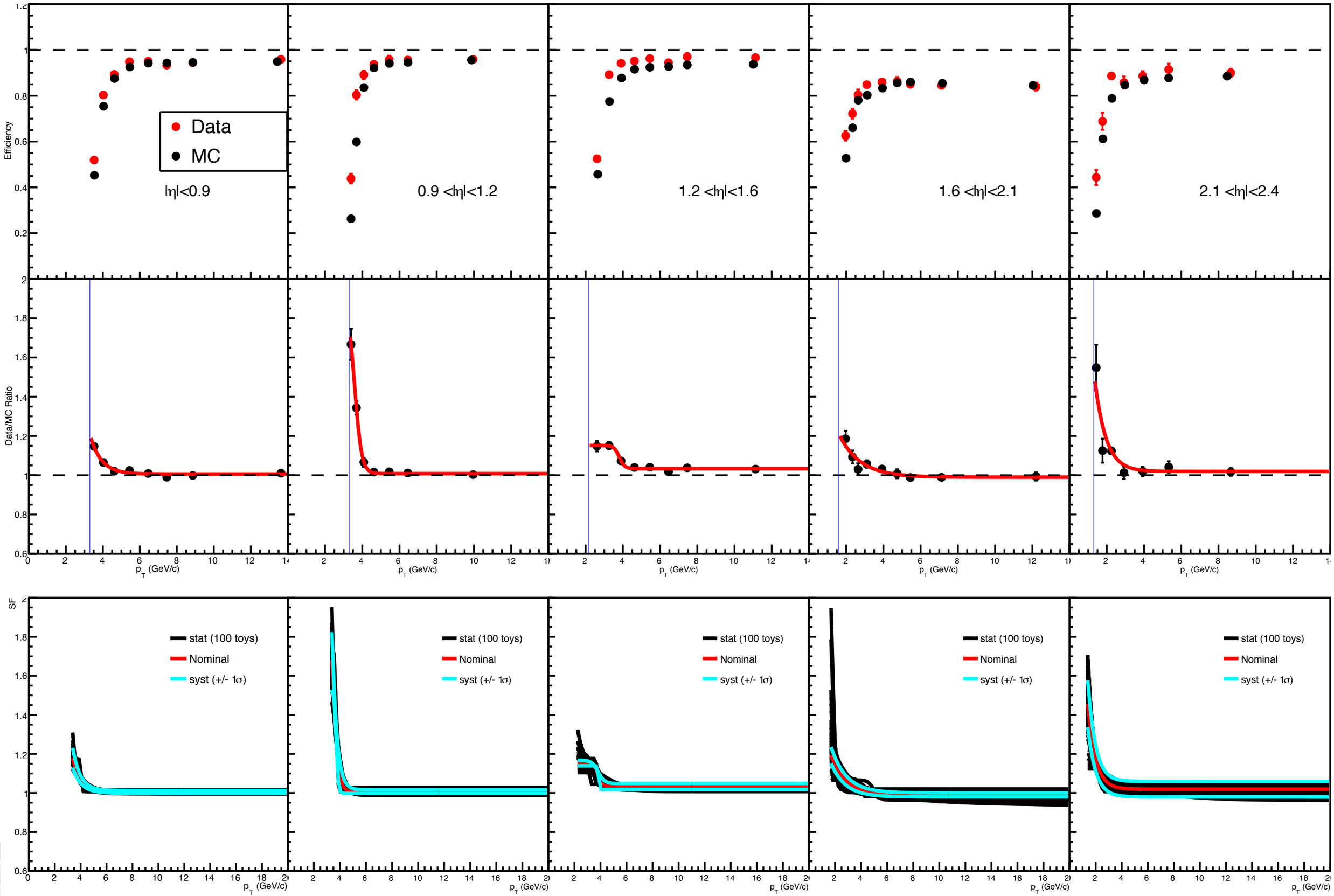
$$2.1 \leq |\eta| < 2.4:\ p_T \geq 1.3$$

TnP uncertainty method

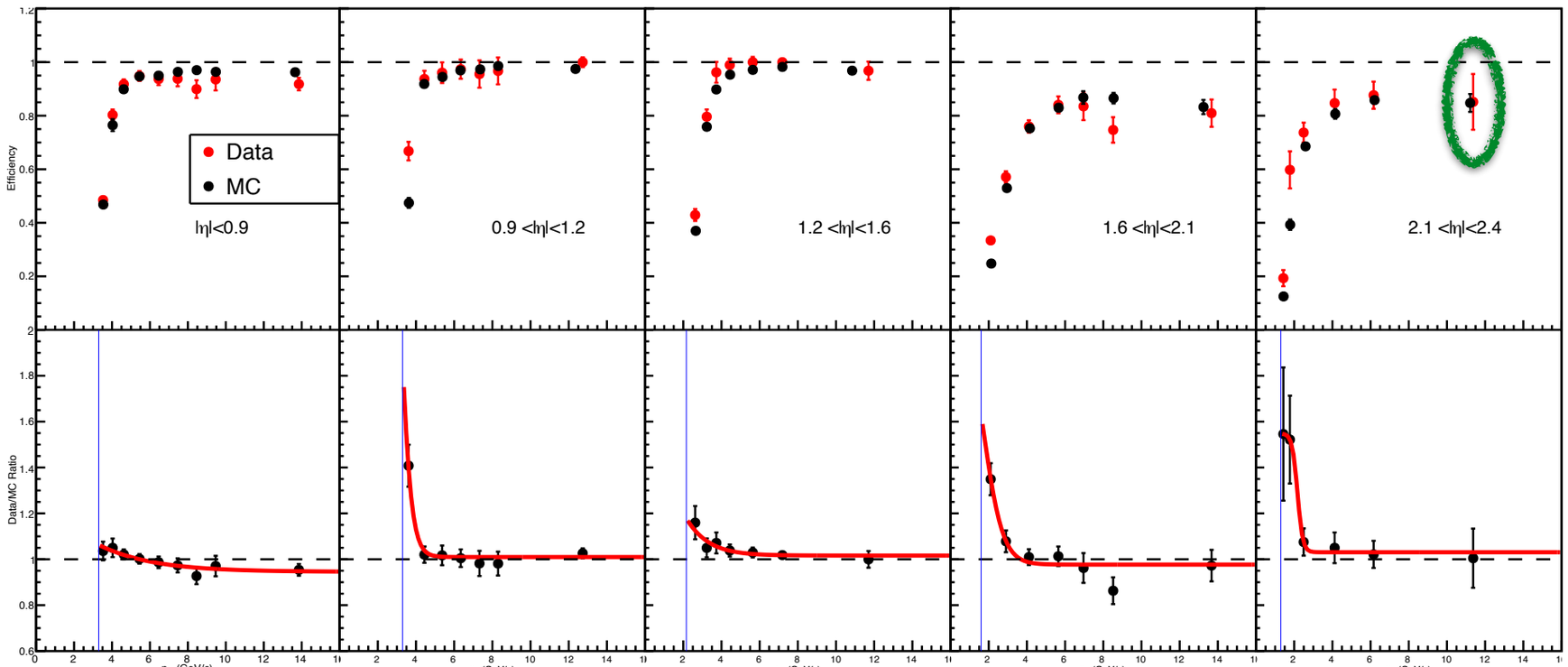
- Followed the same procedure in AN-15-028
- Variations
  - 1. Use two Gaussian instead of CrystalBall+Gaussian as signal function
  - 2. Use 1st order Chebyshev polynomial instead of exponential as background function
  - 3. Use Mu7 instead of Mu3 as single muon trigger
  - 4. Fit more tight mass region(2.9~3.3 GeV)
- Maximum data-to-MC ratio variation for each p_T bin quoted as systematic uncertainty on the scale factor
- 2 New scale factors are calculated by re-fitting the points shifted up and down by systematic uncertainty
- Maximum variation of di-muon efficiency is systematic part of TnP uncertainty(σ^{syst})
- 100 Toy MCs are generated by randomly moving SF points within 1 σ
- RMS of the di-muon efficiencies from Toy SF is statistic part of TnP uncertainty(σ^{stat})

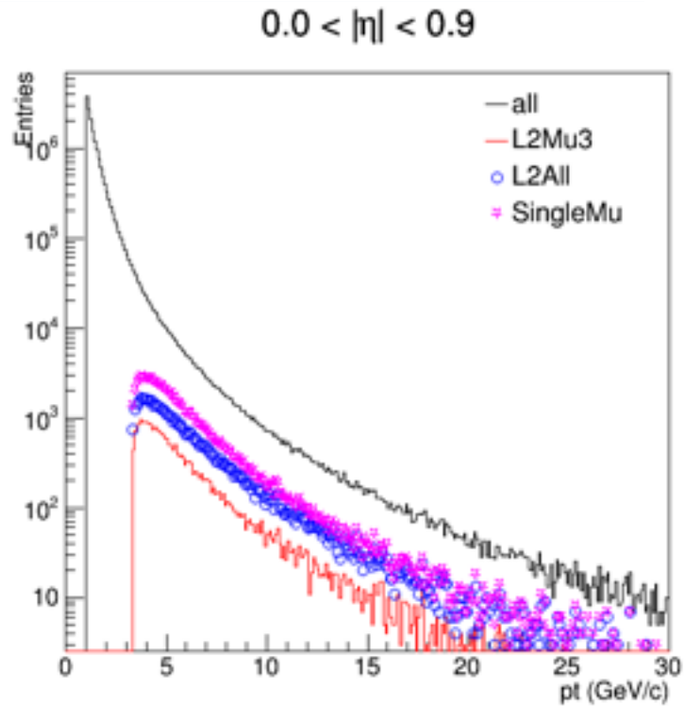
$$\sigma_{TnP} = \sqrt{(\sigma_{TnP}^{stat})^2 + (\sigma_{TnP}^{syst})^2}$$

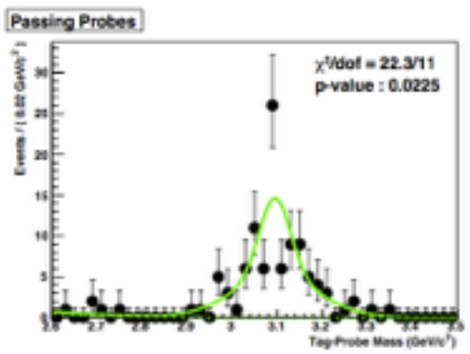
pPb scale factors

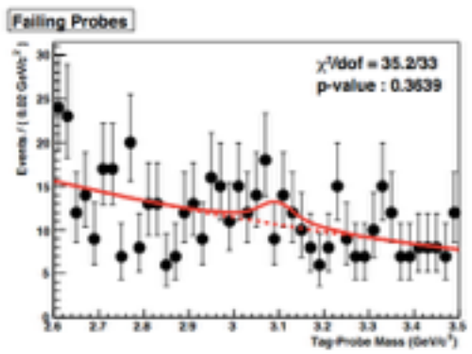


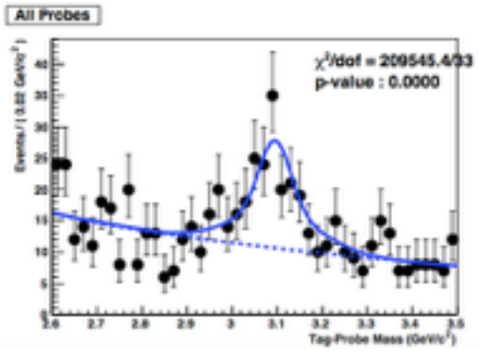
Issue 1. reduced pp statistics

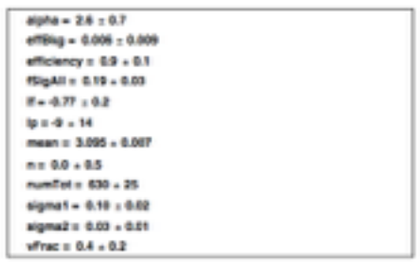








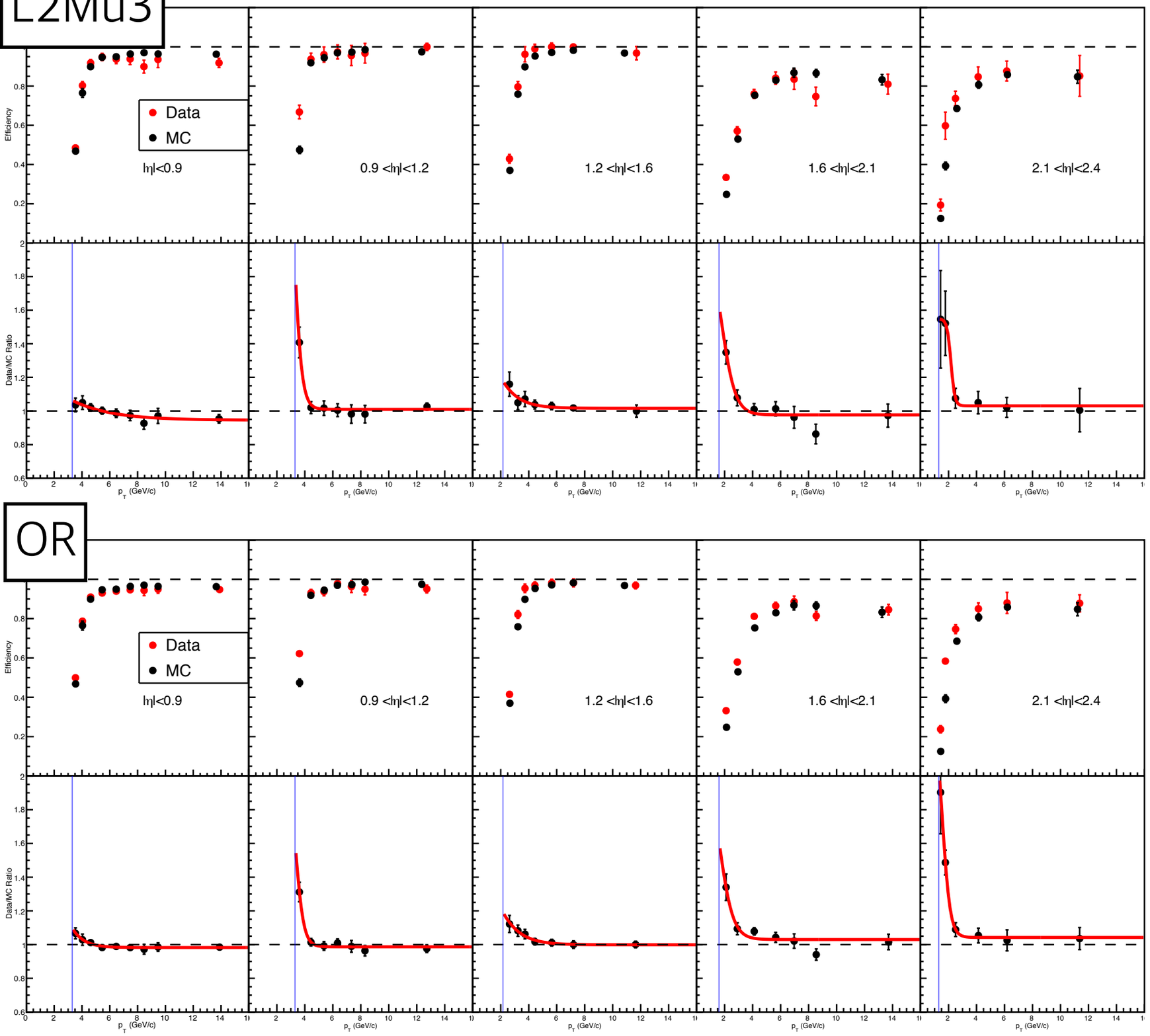


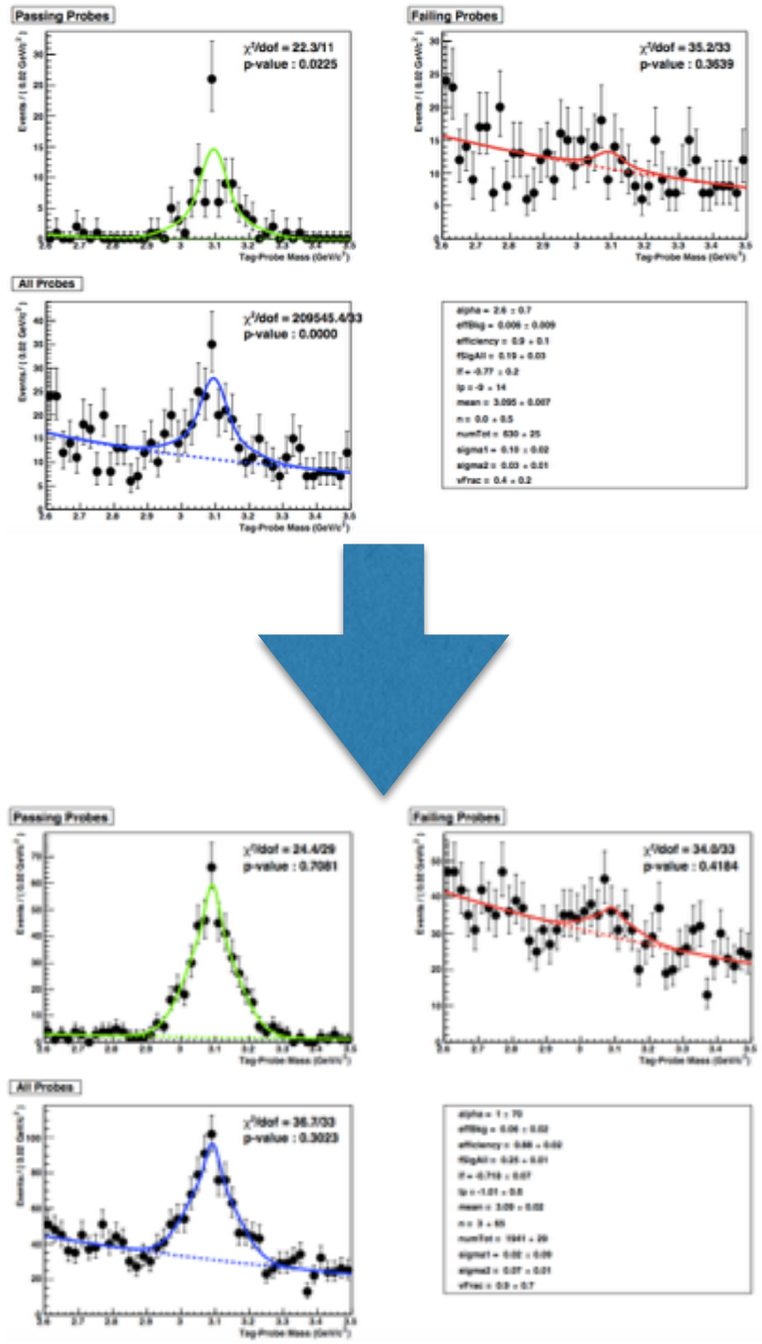


- For the pp data, mu3 triggered events are reduced due to pre-scale
- To keep those events ‘OR’ triggers are tried
- ‘OR’ trigger: L2Mu3 or L2Mu5 or L2Mu7

Improved fitting with ‘OR’ trigger

L2Mu3





OR

Issue 2. Background function

- Current nominal background is exponential function
- 2nd order Chebyshev polynomial was suggested to nominal background function
- Fit probability is compared to find proper background function
- Fit probabilty: probability that an observed chi2 exceeds the value chi2 by chance, even for a correct model

pt range		expo pass	expo fail	expo all		pol pass	pol fail	pol all
etabin1								
3.3 < pt < 3.8		0.0021	0.0565	0.1749		0.0484	0.1704	0.1351
3.8 < pt < 4.3		0.4397	0.4069	0.4915		0.0013	0.3109	0.3813
4.3 < pt < 5.0		0	0.0764	0.1391		0.1073	0.1127	0.0866
5.0 < pt < 6.0		0.3275	0.0197	0.0744		0	0.0383	0.0283
6.0 < pt < 7.0		0	0.6049	0.483		0	0.4029	0.3460
7.0 < pt < 8.0		0	0.574	0.2194		0.0008	0.3838	0.1978
8.0 < pt < 9.0		0	0.0744	0.0491		0	0.0357	0.0417
9.0 < pt < 10.0		0	0.2538	0.4771		0	0.1472	0.0794
10.0 < pt < 30.0		0	0.4795	0.3938		0.0352	0.3218	0.3656

Summary

- ‘OR’ L2 trigger used to keep events(fitting quality is improved)

  → Use ‘OR’ trigger as nominal

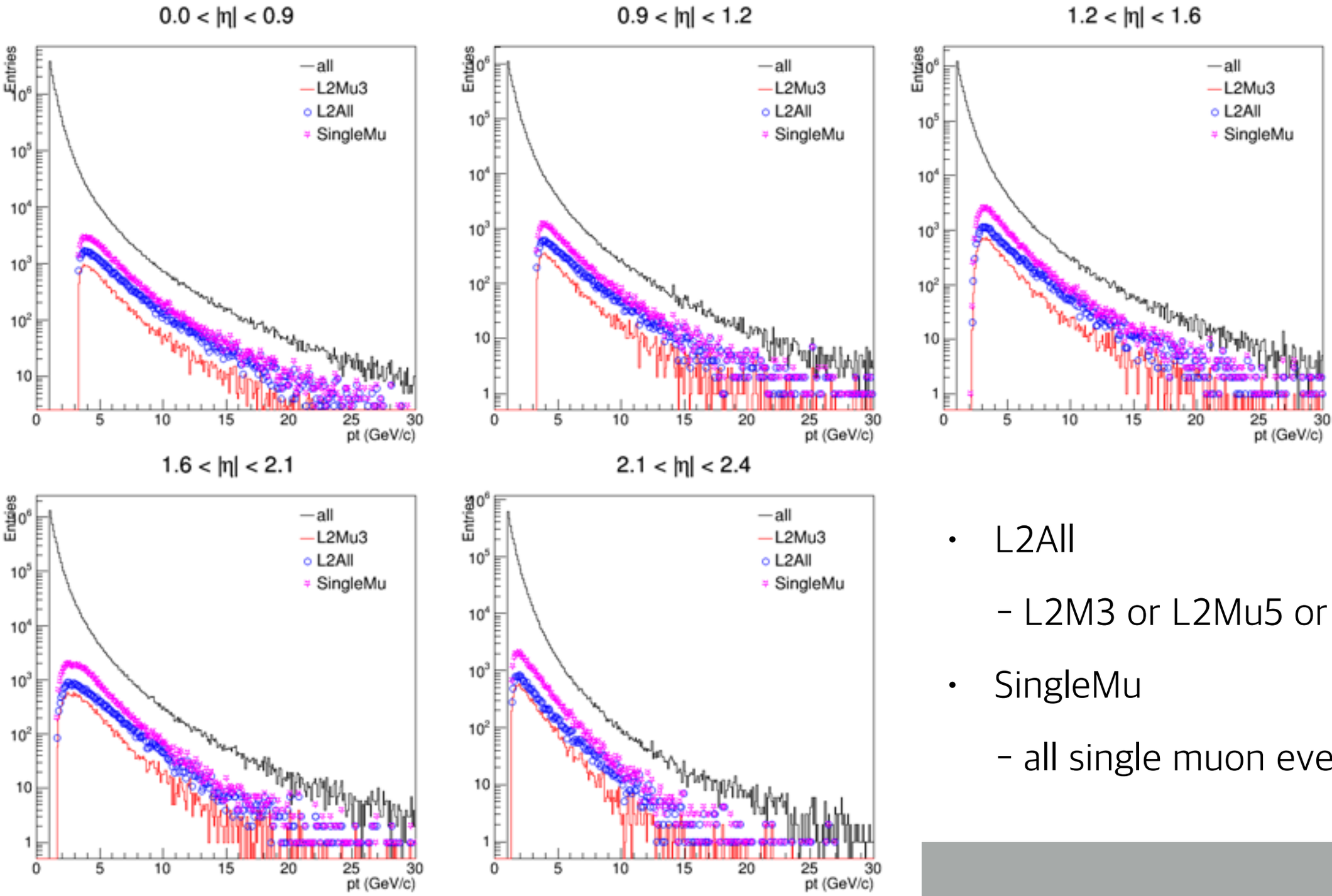
- 2nd order Chebyshev polynomial background is suggested
- Exponential background have larger fitting probability

  → Keep using exponential background as nominal
- New ToyMC needed
- New variation with ‘OR’ trigger is ongoing

back up

‘OR’ trigger

- For the pp data, mu3 triggered events are reduced due to pre-scale
- To keep those events ‘OR’ triggers are tried



- L2All
  - L2M3 or L2Mu5 or L2Mu7
- SingleMu
  - all single muon even high p_T