Pre version

Inclusive $b \to J/\psi$ ($J/\psi \to \mu\ \mu$) X analysis VII

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Outline

- CSA07 Data Samples with SW_1_6_10
- HLT/RECO Eff.
- Tag&Probe
- Ongoing work

CMS CSA07 M.C. data samples 08'

b2J/psi

- /BtoJpsi/CMSSW_1_6_0-PreCSA07-HLT-A4/GEN-SIM-DIGI-RECO
  556324 events, 154 files, 18 block(s), 858.3GB
- /BtoJpsi/CMSSW_1_6_0-PreCSA07-A1/GEN-SIM-DIGI-RAW
  563463 events, 156 files, 16 block(s), 719.8GB

Incl b: 13.5 pb-1

- /BbartoJpsi/CMSSW_1_6_0-PreCSA07-HLT-A4/GEN-SIM-DIGI-RECO
  509527 events, 141 files, 16 block(s), 786.6GB
- /BbartoJpsi/CMSSW_1_6_0-PreCSA07-A1/GEN-SIM-DIGI-RAW
  520373 events, 144 files, 14 block(s), 665.0GB

CSA08 Incl b: 10 pb-1

p-J/psi

- /Charmonium_Pt_0_20/CMSSW_1_6_0-PreCSA07-HLT-A4/GEN-SIM-DIGI-RECO
  1021134 events, 160 files, 21 block(s), 1.0TB

3pb-1

- /Charmonium_Pt_0_20/CMSSW_1_6_0-PreCSA07-A1/GEN-SIM-DIGI-RAW
  1039884 events, 163 files, 19 block(s), 895.3GB
- /Charmonium_Pt_20_inf/CMSSW_1_6_0-PreCSA07-HLT-A4/GEN-SIM-DIGI-RECO
  1012650 events, 362 files, 37 block(s), 1.8TB

400pb-1

- /Charmonium_Pt_20_inf/CMSSW_1_6_0-PreCSA07-A1/GEN-SIM-DIGI-RAW
  1040964 events, 372 files, 32 block(s), 1.5TB

CSA08 p-J/Psi: ~10 pb-1

QCD

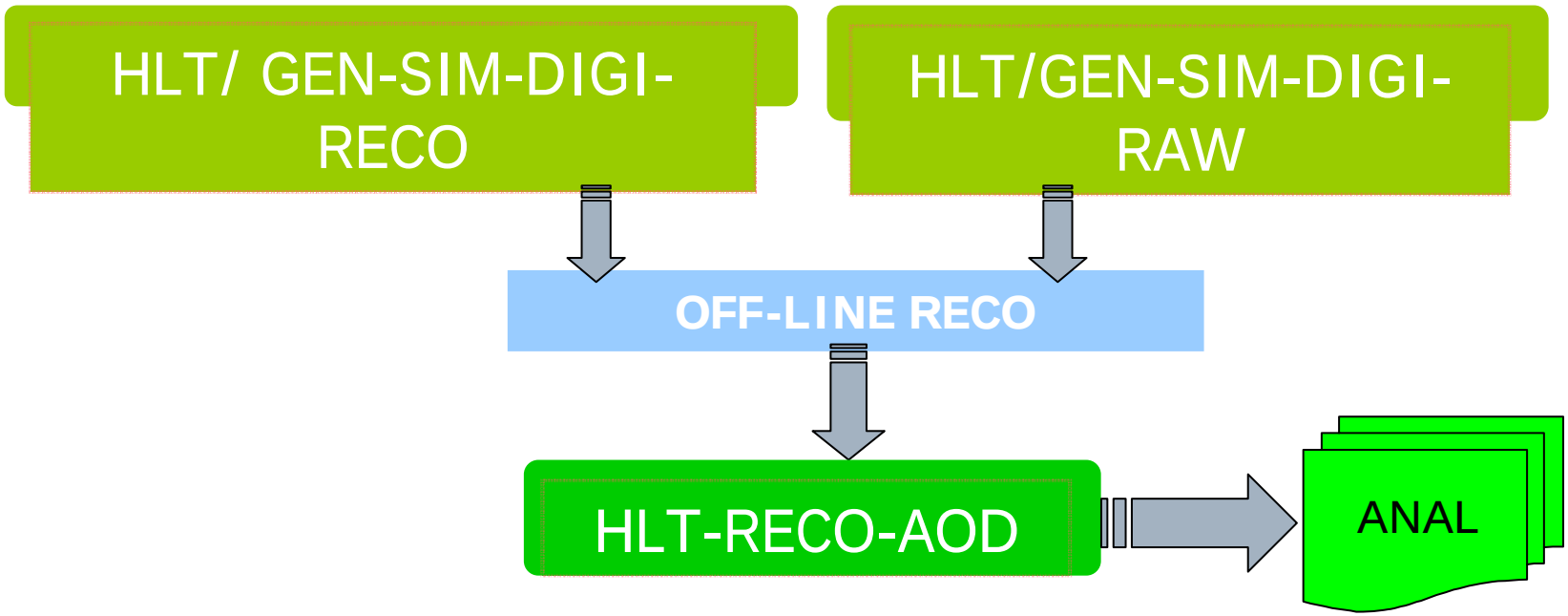
- /Muon_ppMuX/CMSSW_1_6_0-PreCSA07-HLT-B3/GEN-SIM-DIGI-RAW
  20697806 events, 5502 files, 29.3TB
- /Muon_ppMuX/CMSSW_1_6_0-PreCSA07-B2/GEN-SIM-DIGI-RAW
  21365589 events, 5679 files, 25.9TB

QCD: 0.45 pb-1

CSA08 QCD: 0.45 pb-1

- /Muon_ppMuX/CMSSW_1_6_7-CSA07-1197906039/GEN-SIM-DIGI-RAW
  5555458 events, 5487 files, 9.6TB

Data flow via SW_1_6_10



	avail/tot	jobs	Evts	pb-1
Inclusive b:	42(49)/56	~400k/520k	~10/13.5	
p-JPsi:	24(31)/40	~600k/1M	~1.8/3	
QCD ppmuX:	28(40)/208	~2.8M/20.8M	~0.06/0.45	

Objects & Para. : Muon and JPsi

- L1, L2, L2Update@vtx, L3
- Sta, StaUpdate@vtx, Tk, Glb,Muons
- L3JPsi, TkJPsi, GlbJPsi

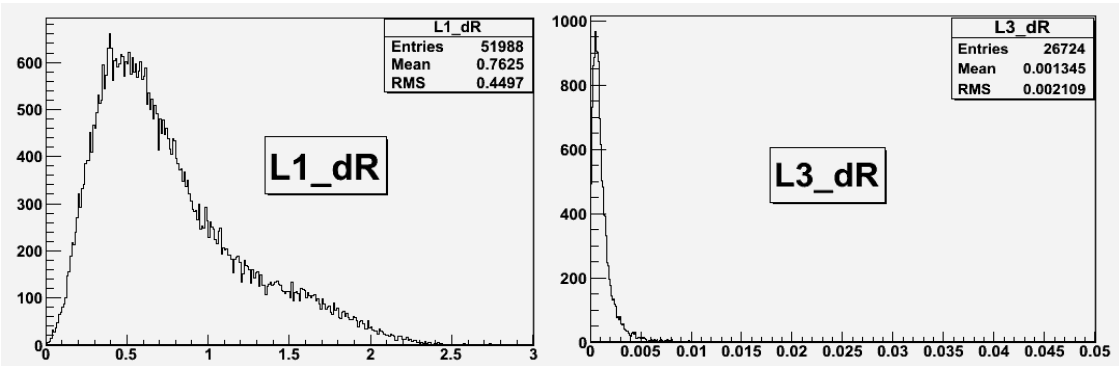
- GlbGlb, GlbSta, GlbTk-- for Tag&Probe

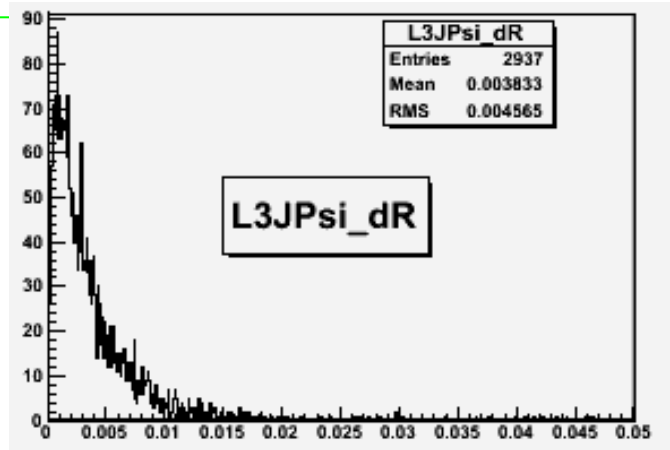
  efff: ~f(pT, η)

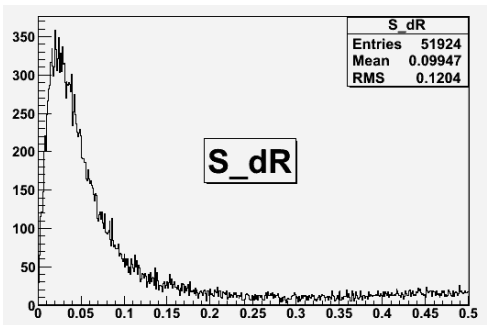
- pT, Eta, Phi; dpt,dpT/pT, dEta, dPhi; dR

from p-JPsi sample

dR distribution (trig,reco vs. gen)

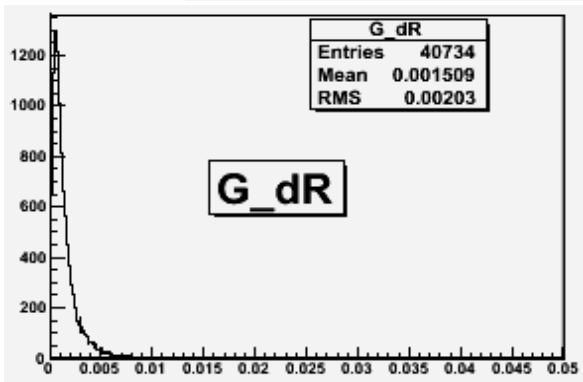


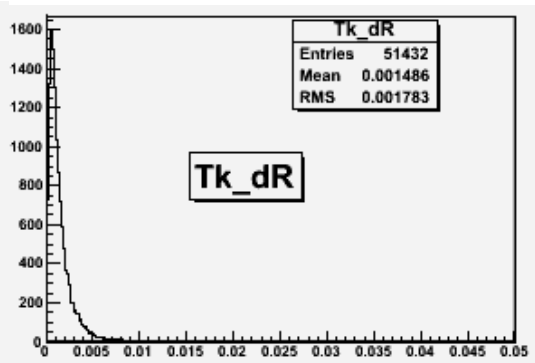


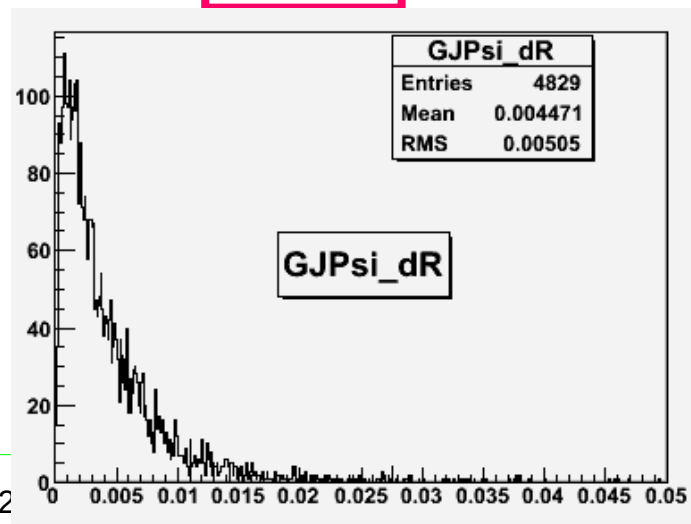


μ

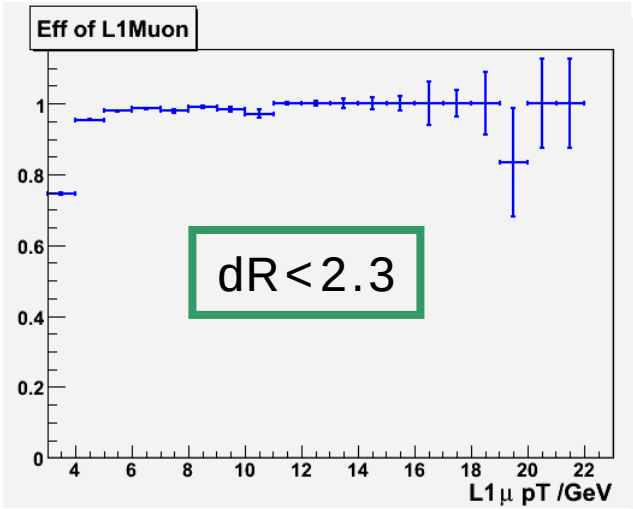
J/Ψ

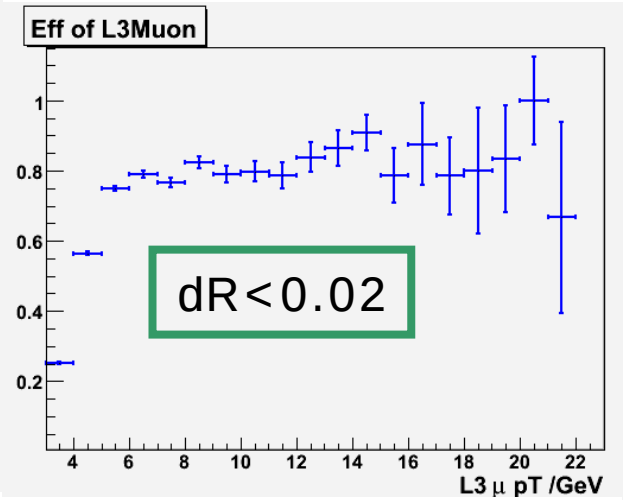


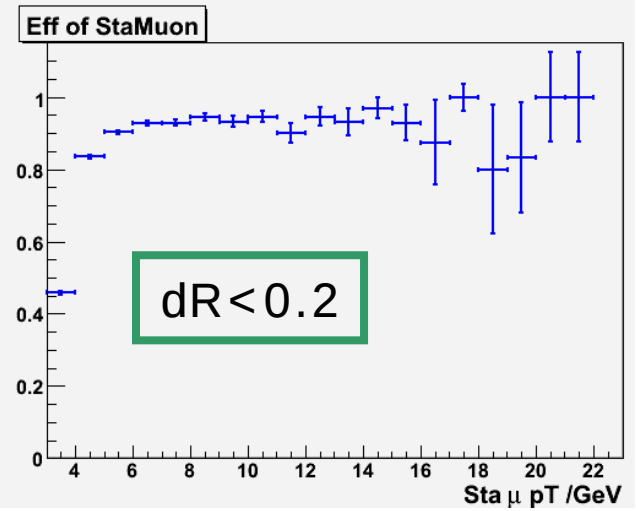


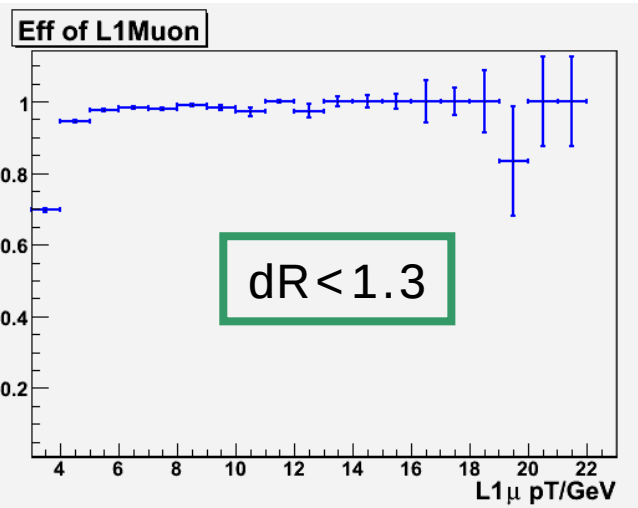


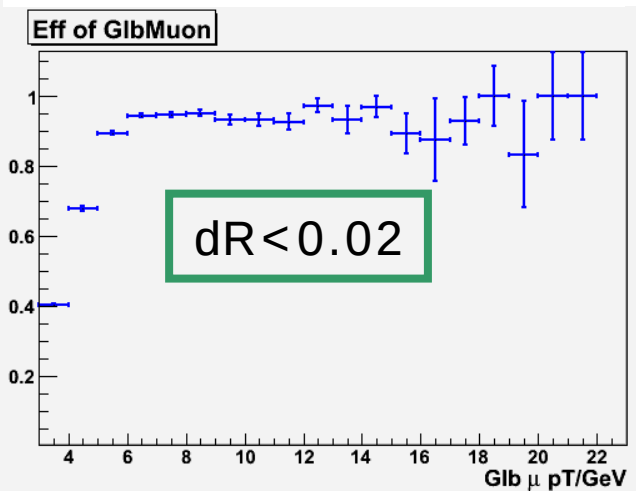
L1 , L1*L3, Sta,Glb & Tk: muon Eff. vs. pT

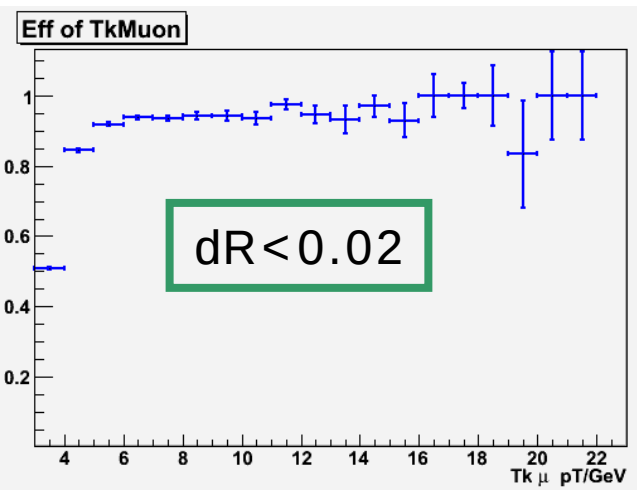




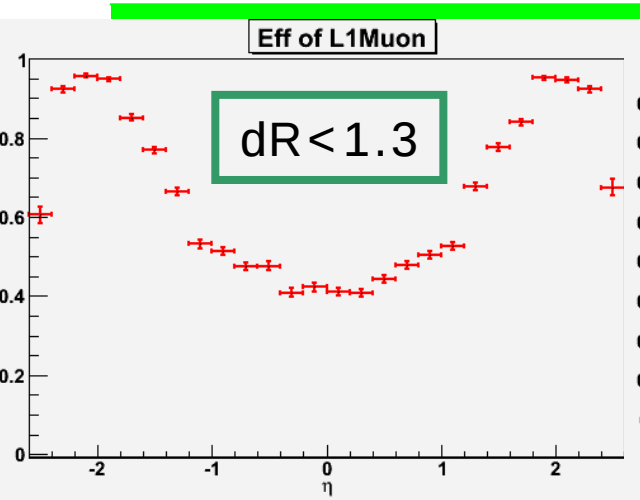


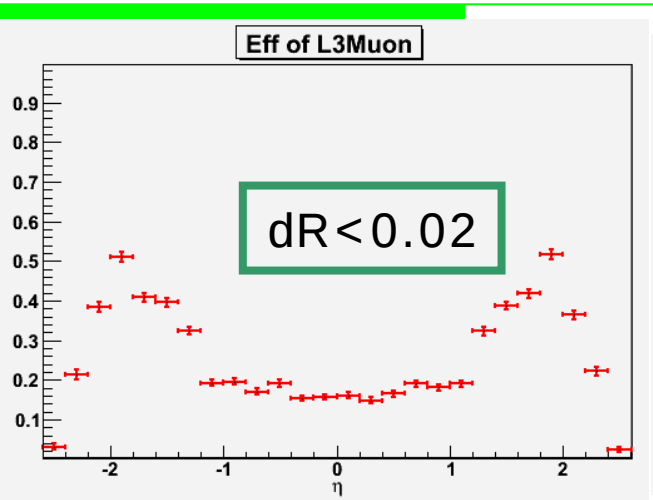


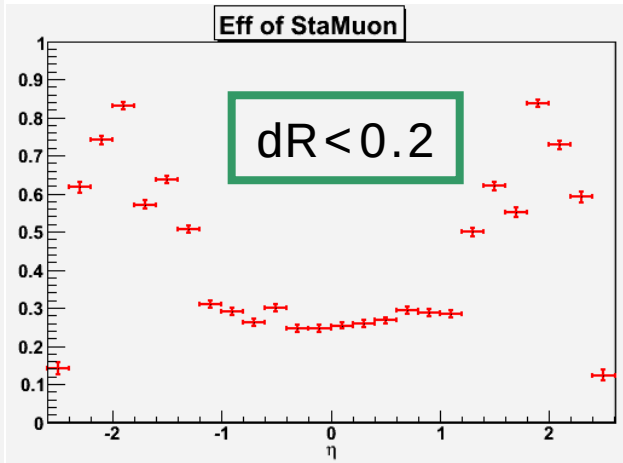


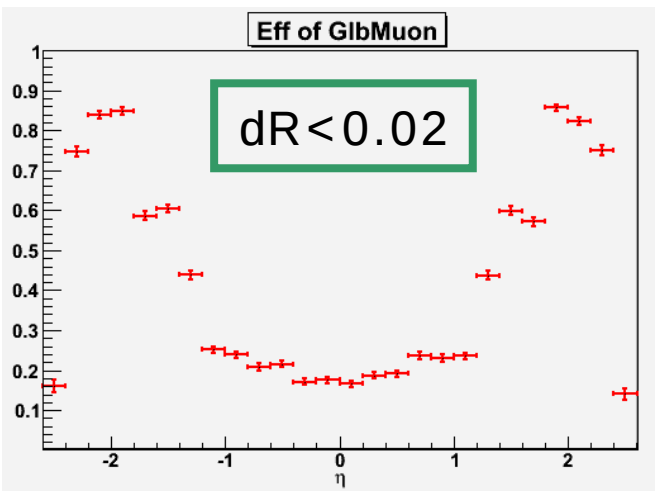


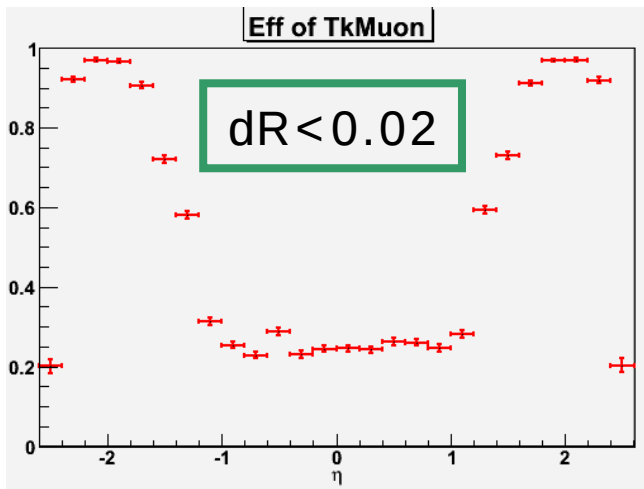
L1 , L1*L3, Sta,Glb & Tk: muon Eff. vs. η



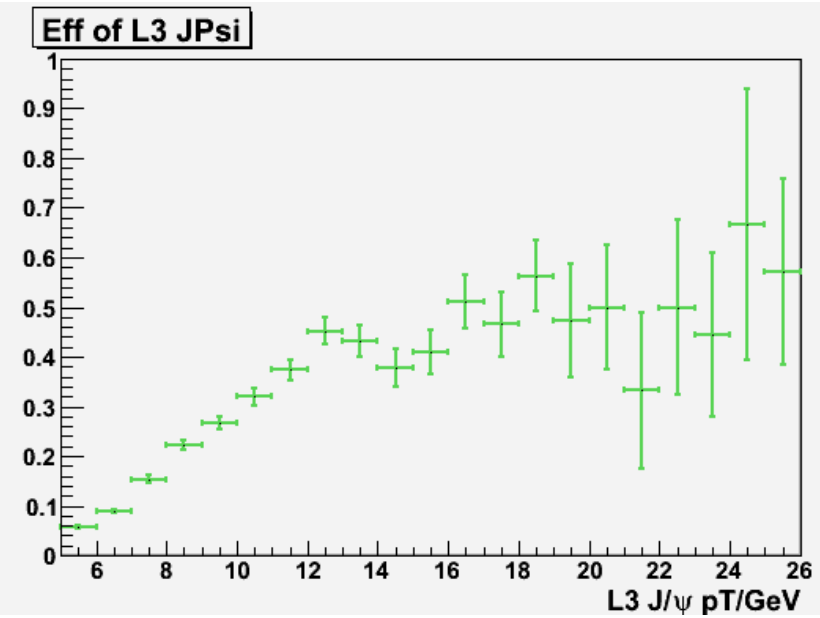


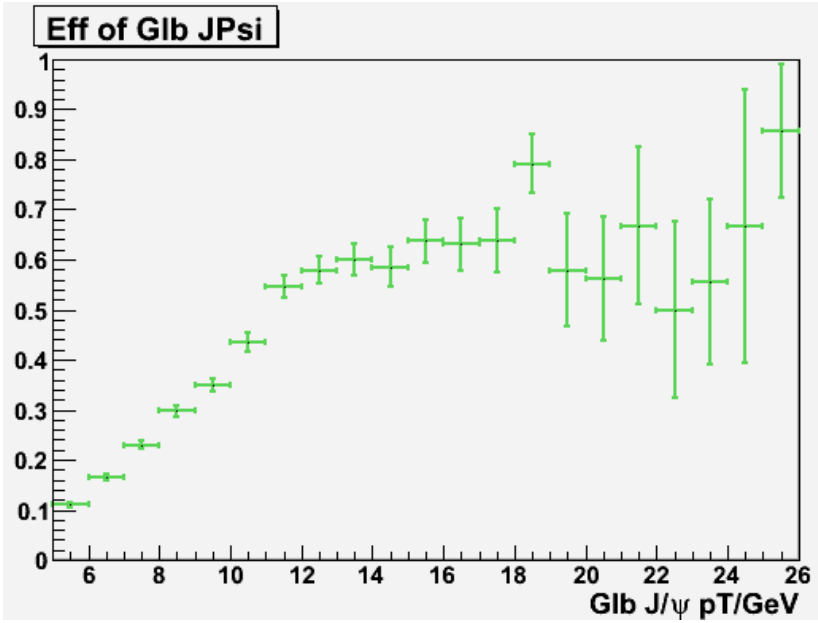






L3 & Glb JPsi Eff. vs. pT





dR<0.02

Efficiencies from data: Tag-And-Probe

- Tag-and-Probe
  - Successfully used in experiments: CDF and D∅
- Current availability of code
  - Egamma: EgammaAnalysis/EgammaEfficiencyAlgos
  - Muon: MuonAnalysis/TagAndProbe

code in dev.: MuonTagProbeAnalyzer/

Efficiency Measurements

- **The overall dimuon efficiencies of the measurement are assumed to be the product of several parts**

$$\varepsilon = \varepsilon_{\text{acceptance}} \times \varepsilon_{\text{trigger}} \times \varepsilon^{2}_{\text{offline}}$$

$$\varepsilon_{\text{trigger}} = \varepsilon_{\text{L1}} \times \varepsilon_{\text{HLT}}$$

$$\varepsilon_{\text{offline}} = \varepsilon_{\text{global}} \times \varepsilon_{\text{isolation}} \times \varepsilon_{\text{id}}$$

$$\varepsilon_{\text{global}} = \varepsilon_{\text{standalone}} \times \varepsilon_{\text{tracker}} \times \varepsilon_{\text{matching}}$$

- Choose a *tag* muon
  - A “high quality” reconstructed muon
- Choose a *probe* track
  - A probable muon in tracker or muon system
- Requiring $M_{\mu\mu}$ consistent with $M_{J/\Psi}$ yileds a high-purity and almost unbiased sample of *probe* muons

Description of TAG and PROBE

TAG	**Global muon with p_T > 5GeV** **Associated to a L3 muon**

Probe Type	Description
Golden	Global muon that is also a TAG
Matched	Global muon that is not a TAG
Unmatched	Tracker track AND Standalone muon found, but they are not associated with a Global Muon
Tracker Only	Only a tracker track
Stand Alone Muon	Only a standalone muon

With the five types of probes, we get five combinations of tag-and-probe: GG, GM, GU, GS, GT

Tracking and Matching Efficiencies

- Standalone, Tracking, and Matching efficiencies calculated with simple event counting

$$\varepsilon_{\text{standalone}} = \frac{2N_{GG} + N_{GM} + N_{GU}}{2N_{GG} + N_{GM} + N_{GU} + N_{GT}}$$

$$\varepsilon_{\text{tracker}} = \frac{2N_{GG} + N_{GM} + N_{GU}}{2N_{GG} + N_{GM} + N_{GU} + N_{GS}}$$

$$\varepsilon_{\text{matching}} = \frac{2N_{GG} + N_{GM}}{2N_{GG} + N_{GM} + N_{GU}}$$

Single Muon Trigger Efficiency

- Study the single muon trigger efficiency using the dimuon sample selected
- Ask for a muon in the event passing the HLT no-isolated single muon trigger threshold (pt>3 GeV/c, $|\eta| < 2.4$) and count how often also a second muon fulfills the same HLT no-isolated single muon trigger criteria

Prescaled triggers are dedicated ones to provide essential data samples for

-**Physics: data from PS triggers are used to measure trigger efficiencies, selection efficiencies and backgrounds, extend cross-section measurements to low pT.. and are essential for several B (and other low-pT) physics items…**

-**Calibration: data samples of known mass particles Z, W,Y,J/Ψ, collected with dedicated PS triggers, are used for detector calibration and reconstruction studies**

-Monitoring: dedicated PS triggers select data to control basic quantities in the experiment such as, eg, the vertex position or the luminosity.

Trigger Efficiency

- a muon is *tag* if pt > 5GeV/c, | η | < 2.4, is isolated and it is selected by the Level-1 and HLT trigger criteria (that is, passing Level-1, Level-2 and Level-3 requirements).
- The efficiency is the fraction of events in which the second muon (*probe*) meets each of the trigger requirements (Level-1, Level-2 and Level-3 trigger criteria) over the total number of *probe* muons. If both muons satisfy the criteria of the *tag* and *probe* muons, the event is used twice in the efficiency calculation.
- The equation to determine the trigger efficiency is then

$$\varepsilon_{\text{trigger}} = \frac{2N_{LL}}{2N_{LL} + N_{LN} + N_{NL}}$$

where “L” denotes a muon satisfying the trigger criteria at a given level

Done & to do list

- Unbinned combined MLH fit & analysis method
- Unfolding method (test cnt.)

To use CSA07 data

still limited statistics for this pT-bin-based analysis!!!

- Acceptance and efficiency

1. Geometric & kinematic Acceptance: A(pT, η)
2. Trig. Efficiency: L1 moun, L3 dimuon, etc.
3. Reco. Efficiency: local reco., matching & selection cuts, Glb muon,etc.

Tag & Probe

- Systematic uncertainties: sources & estimation

with CMSSW_1_6_10