

# CMS Analysis Status:

Inclusive  $b \rightarrow J/\psi X$ ,  $J/\psi \rightarrow \mu \mu$

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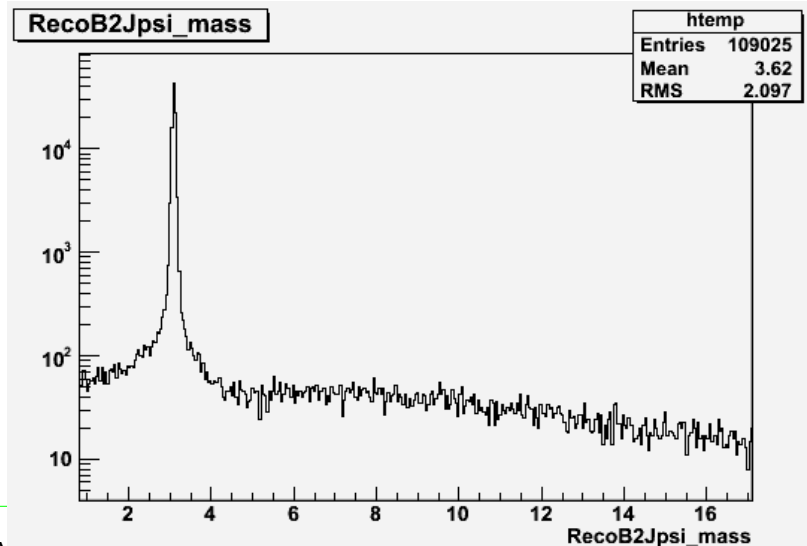
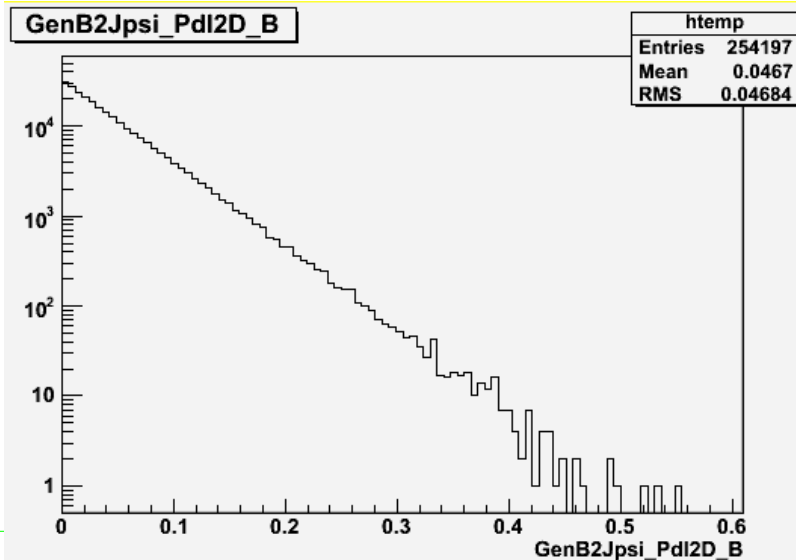
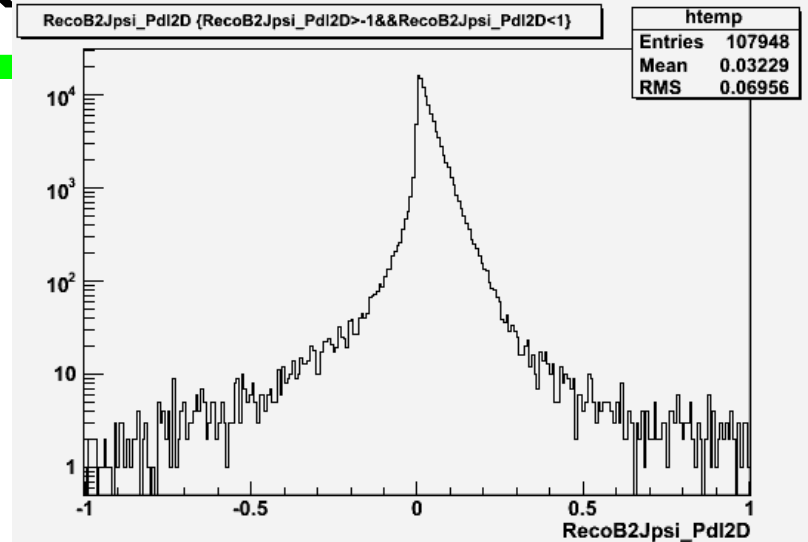
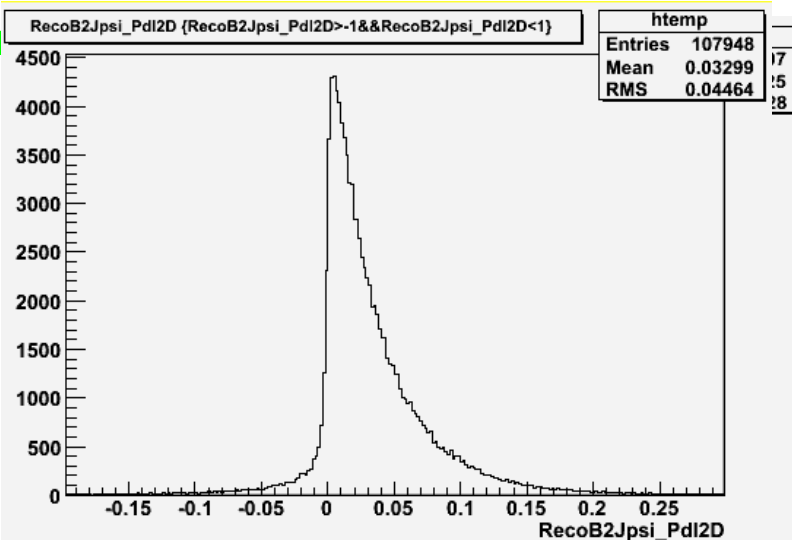
**May 15, 2009**

# Outline

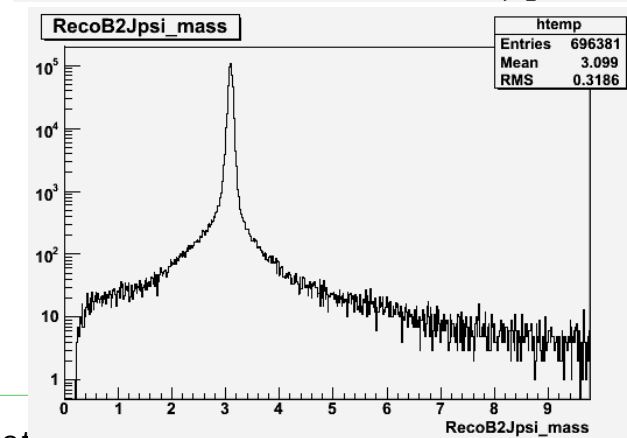
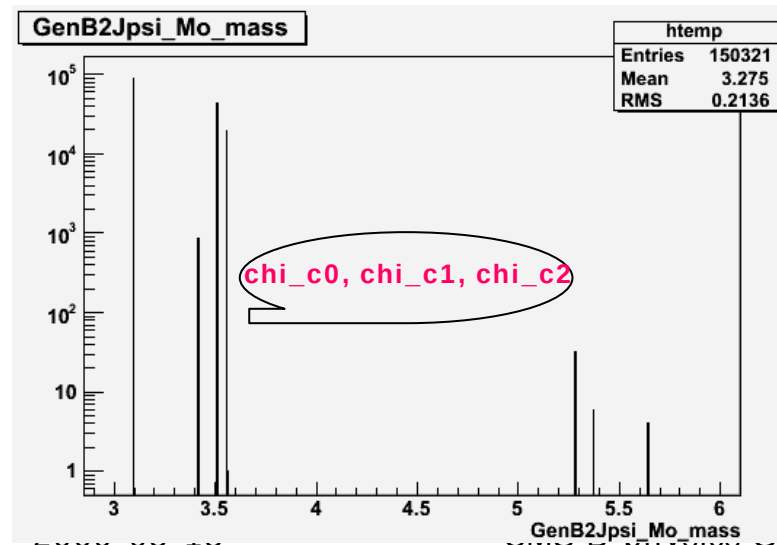
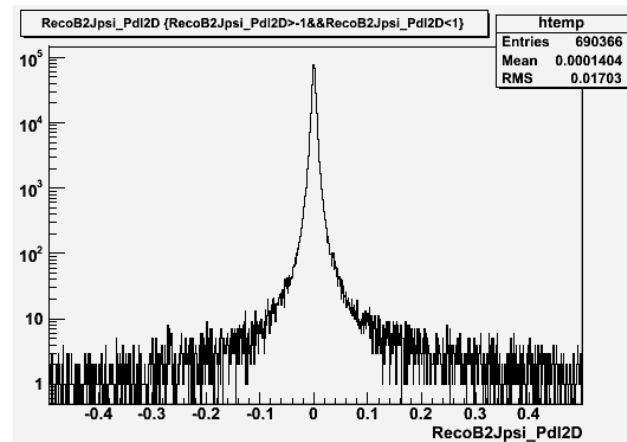
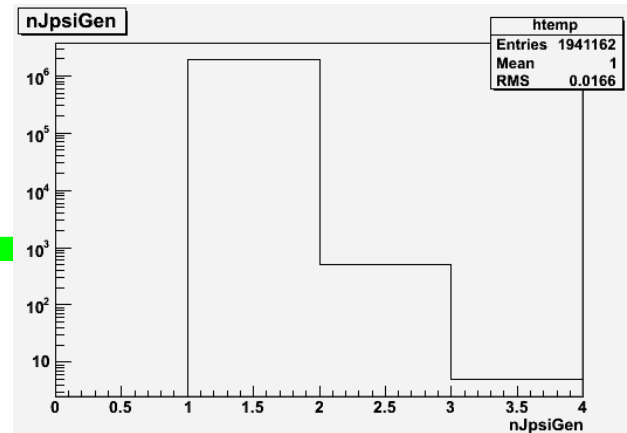
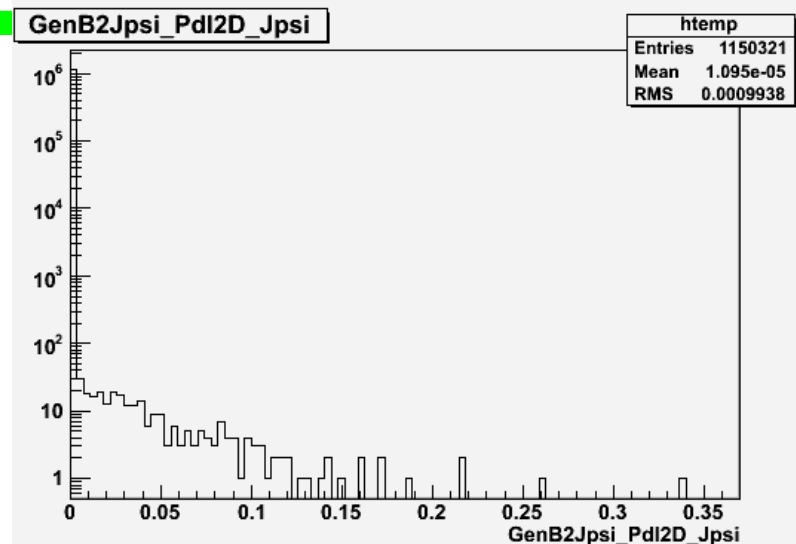
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- ☐ ppMuX bkg
- ☐ Pdl efficiency
- ☐ Fit data model
- ☐ Fit techniques
- ☐ Pdl resolution model
- ☐ Outlook

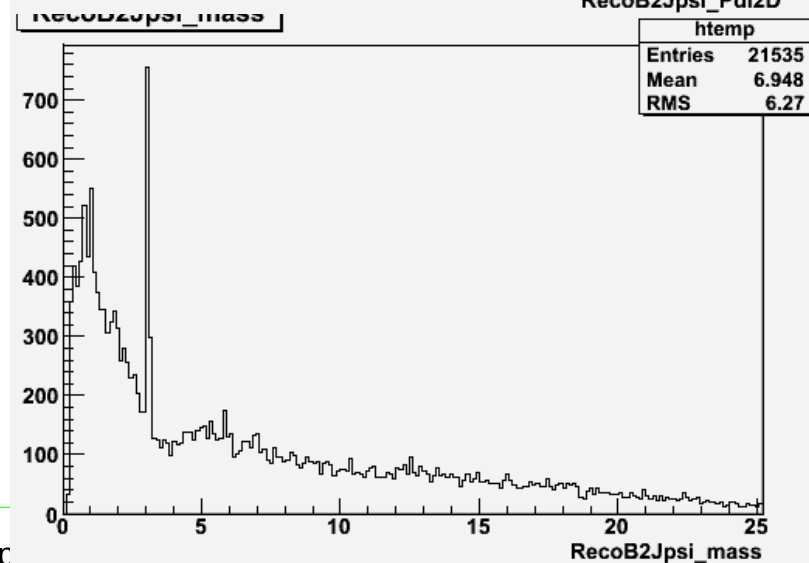
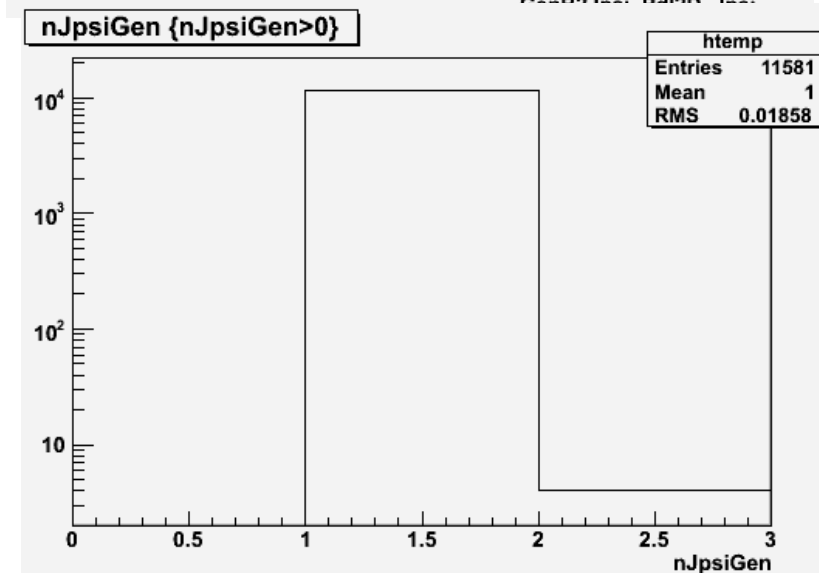
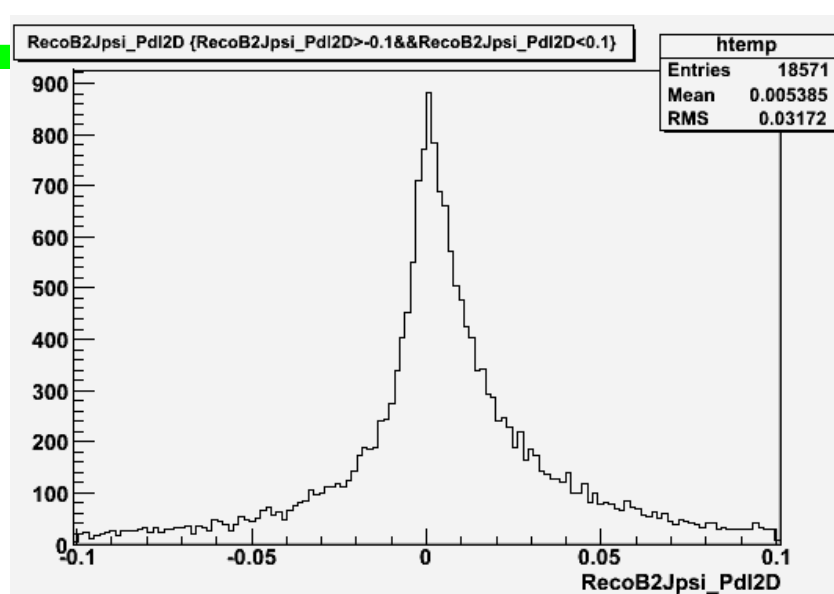
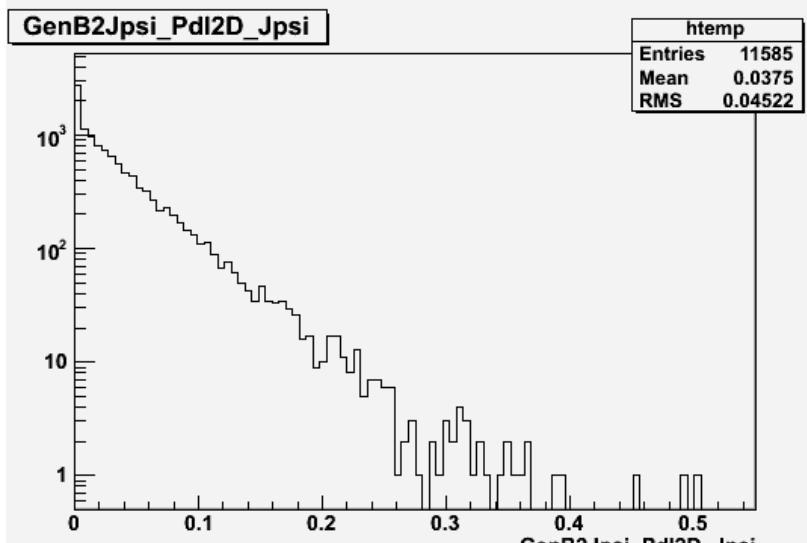
# Inclusive b: Gen & Reco



# Prompt J/Psi



# PPmuX



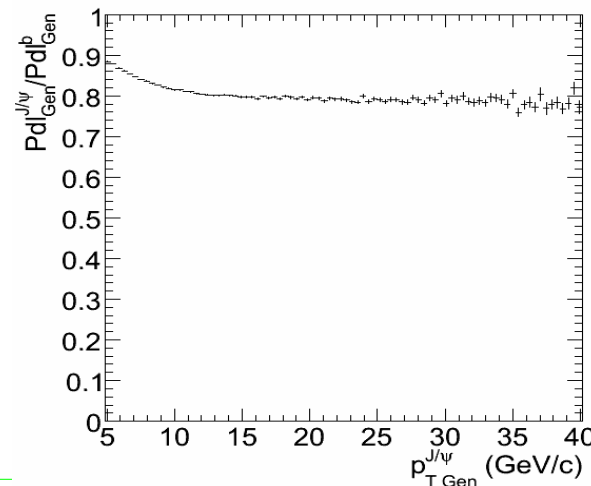
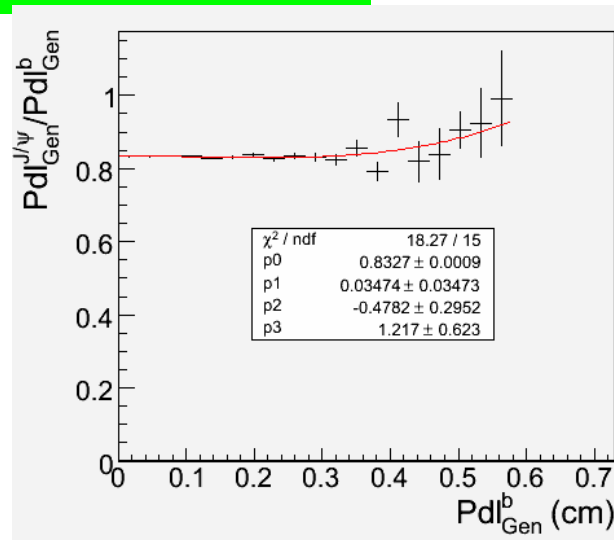
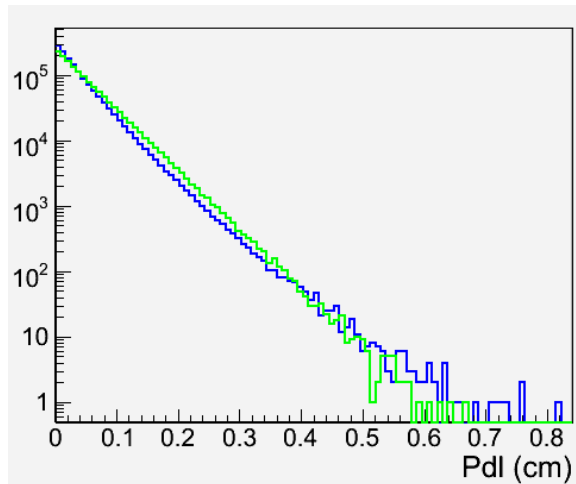
2009-05-15

CMS B-physics Group

# Fake candidates: cluster 91

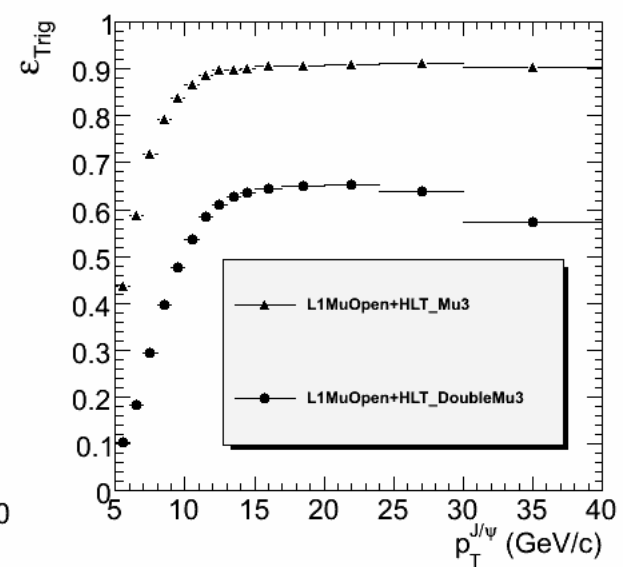
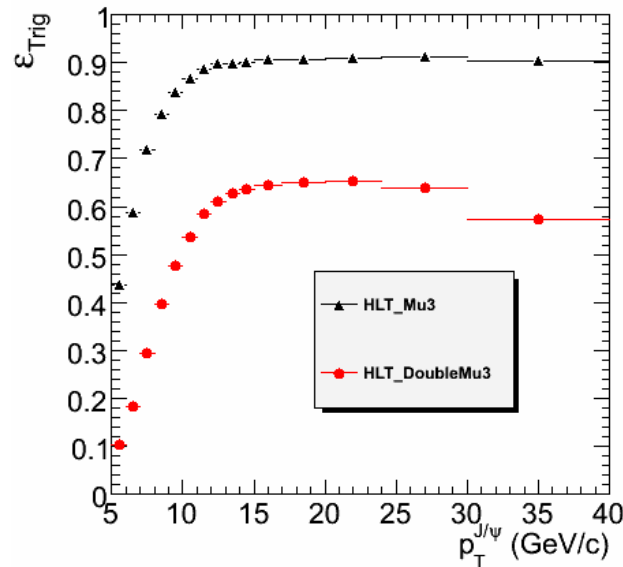
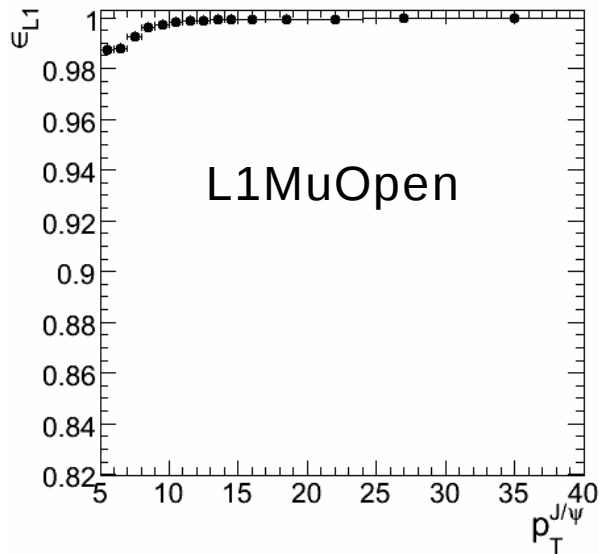


# Gen level pdl PDF correction: Jpsi's $\rightarrow$ b's



•Used for  $Pdl$ 's PDF for  $c\tau$  fitting (refer: p.19 )

# Trig. Efficiency vs. pT : JPsi's

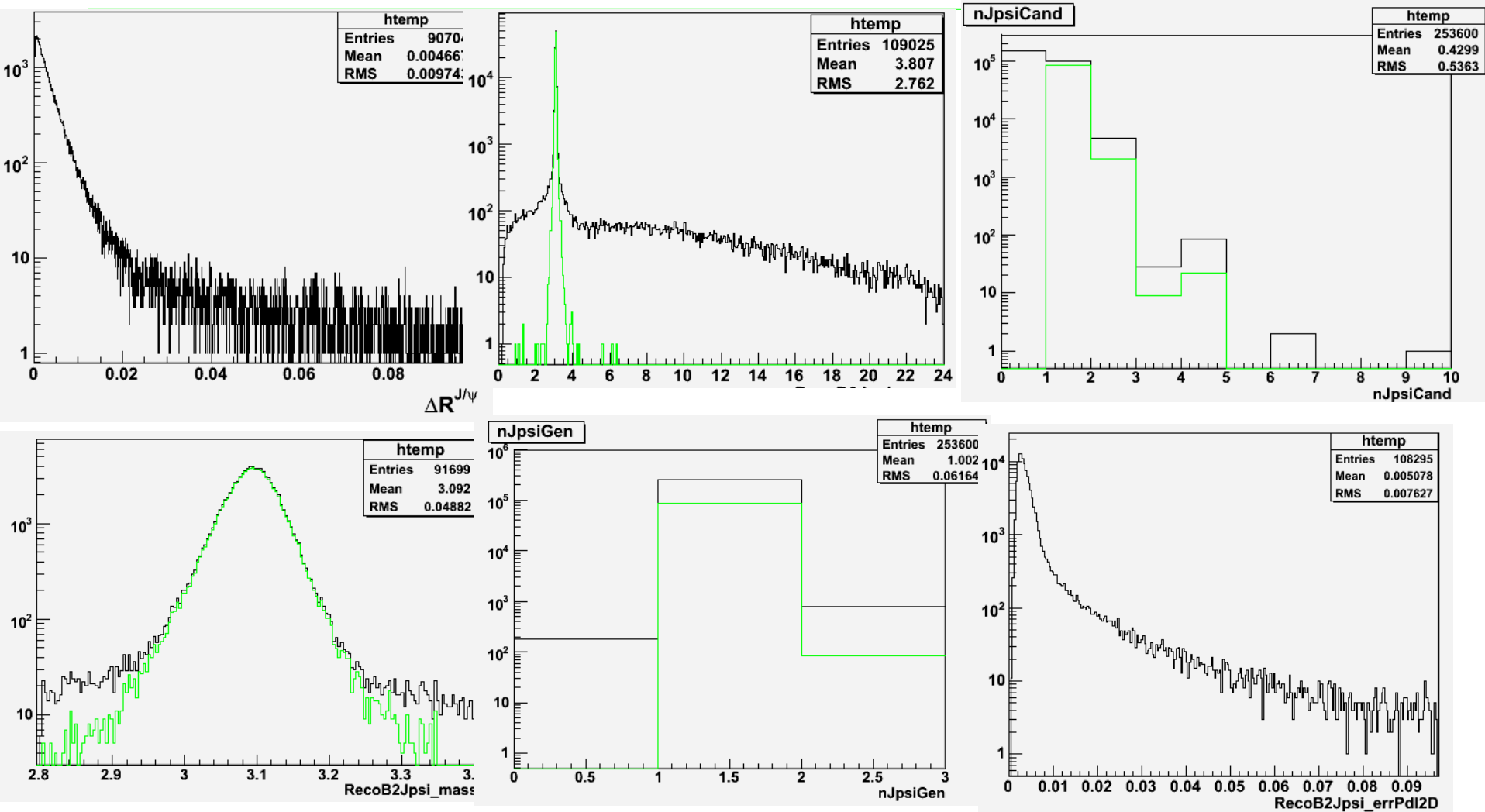


loose L1 mu trigger selection

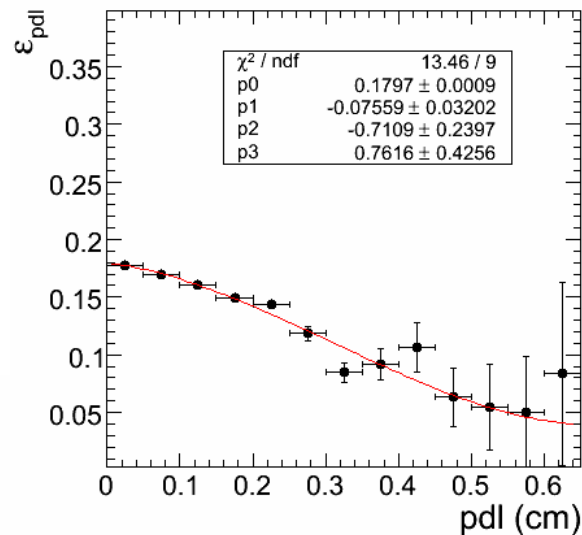
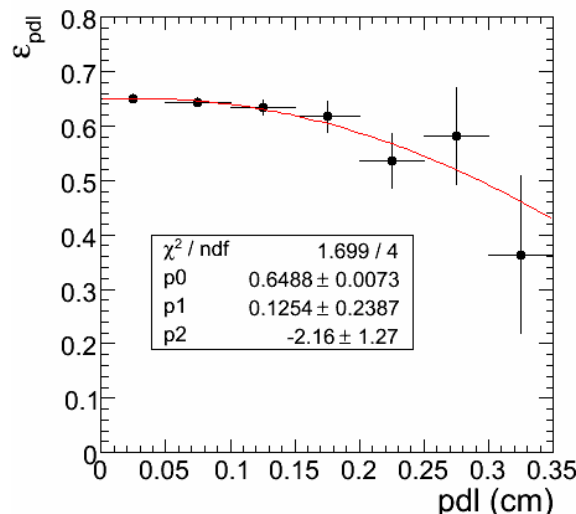
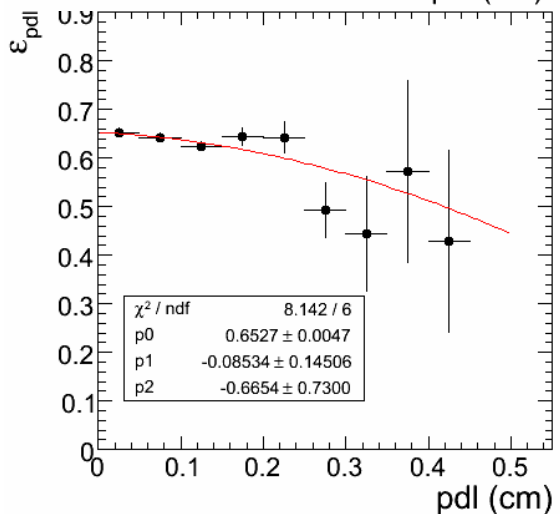
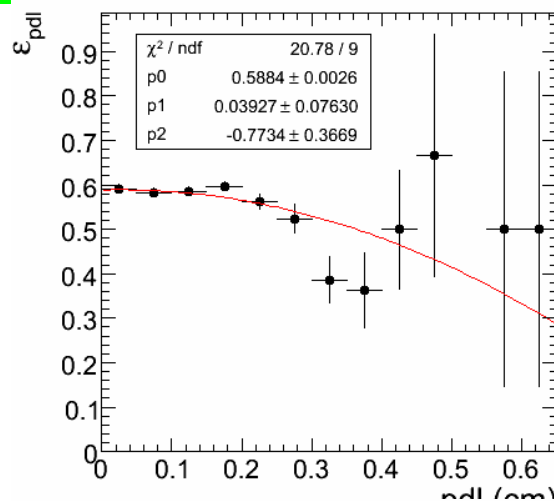
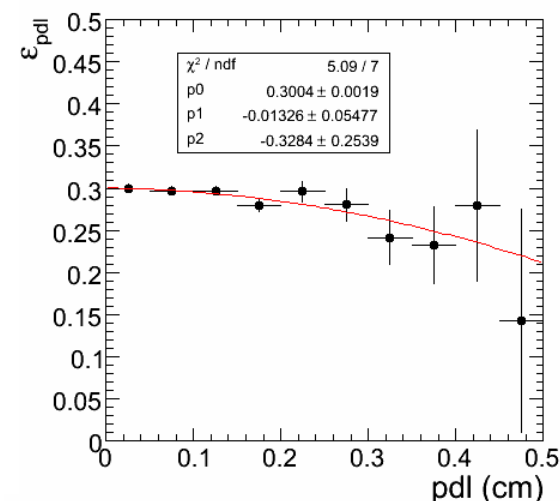
$$\mathcal{E}_{L1,L1+HLT}^{w.r.t.Offline} = \frac{N_{L1,L1+HLT}^{Offline+Glb}(p_T^{J/\psi}, |\eta^{J/\psi}| < 2.4)}{N^{Offline+Glb}(p_T^{J/\psi}, |\eta^{J/\psi}| < 2.4)}$$

•The L1T/HLT efficiency is calculated based on the numbers of an offline reconstructed J/psi passes or not corresponding triggers

# M.C. Truth Matching $\Delta R$

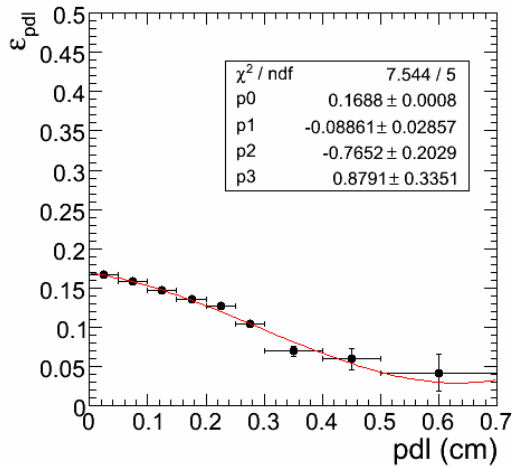


# pT bins: 5-10, 10-15, 15-20 & 20-30 GeV/c



Correction shape nearly uniform for Pdl's PDF for the cttau fitting

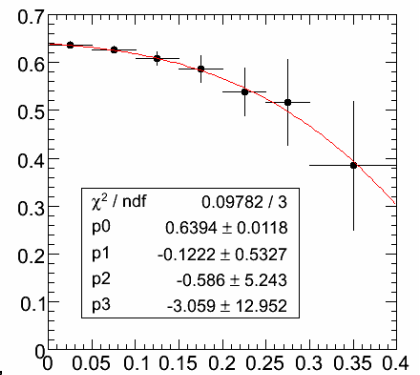
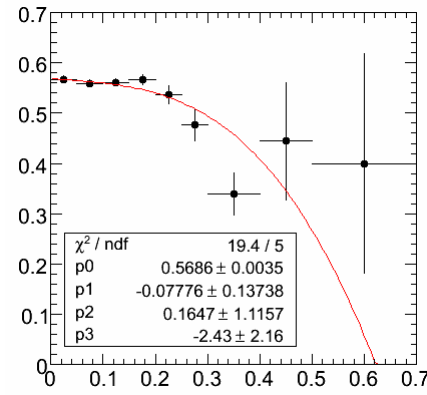
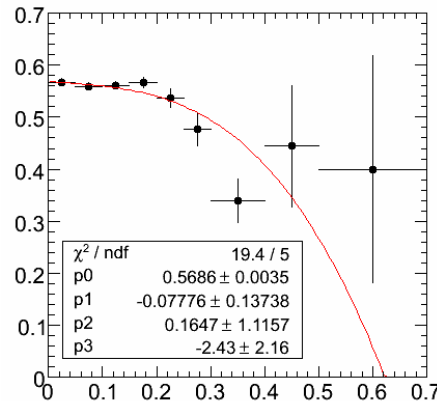
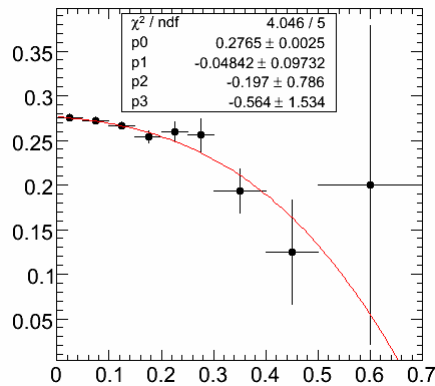
•Used for Pdl's PDF for cttau fitting (refer: p.19 )



Fitting results:

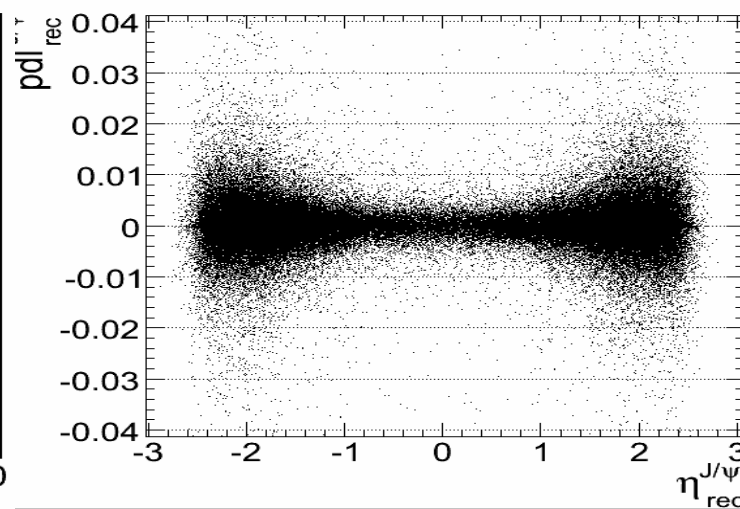
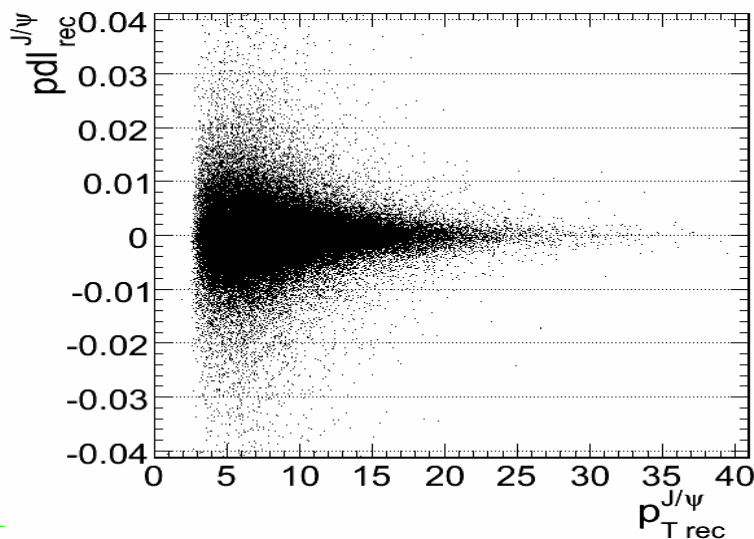
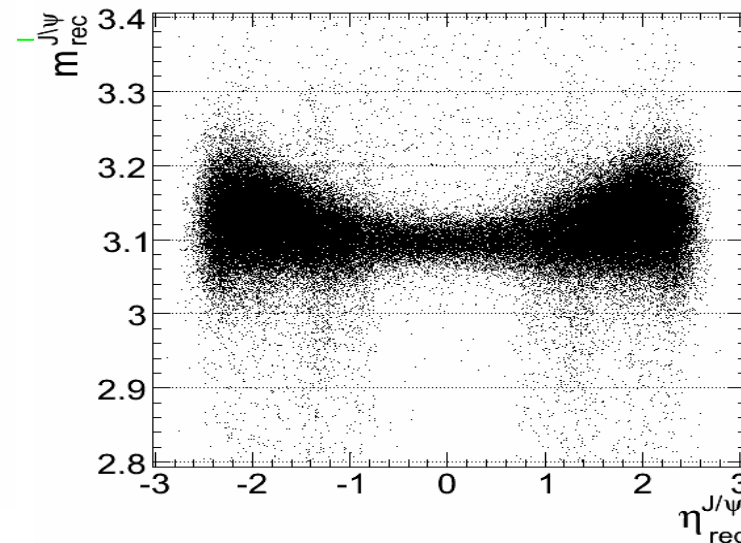
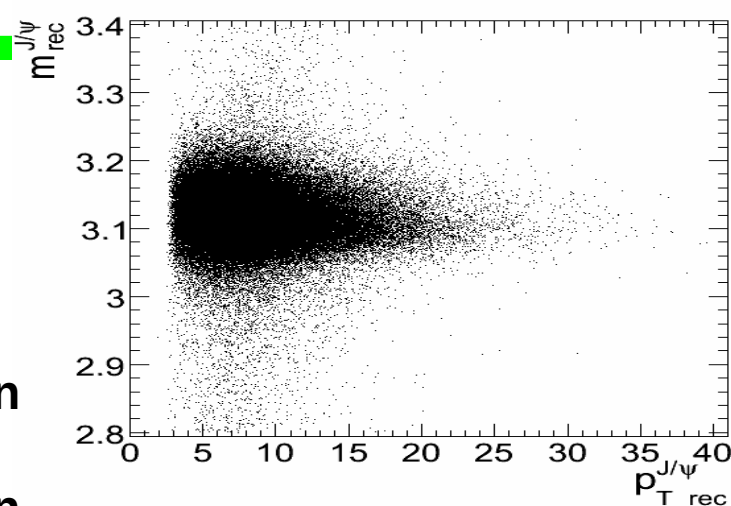
Parameters:

| NO. | VALUE         | ERROR        |
|-----|---------------|--------------|
| 0   | 1.688481e-01  | 8.149378e-04 |
| 1   | -8.861205e-02 | 2.857298e-02 |
| 2   | -7.652492e-01 | 2.029058e-01 |
| 3   | 8.791283e-01  | 3.351234e-01 |

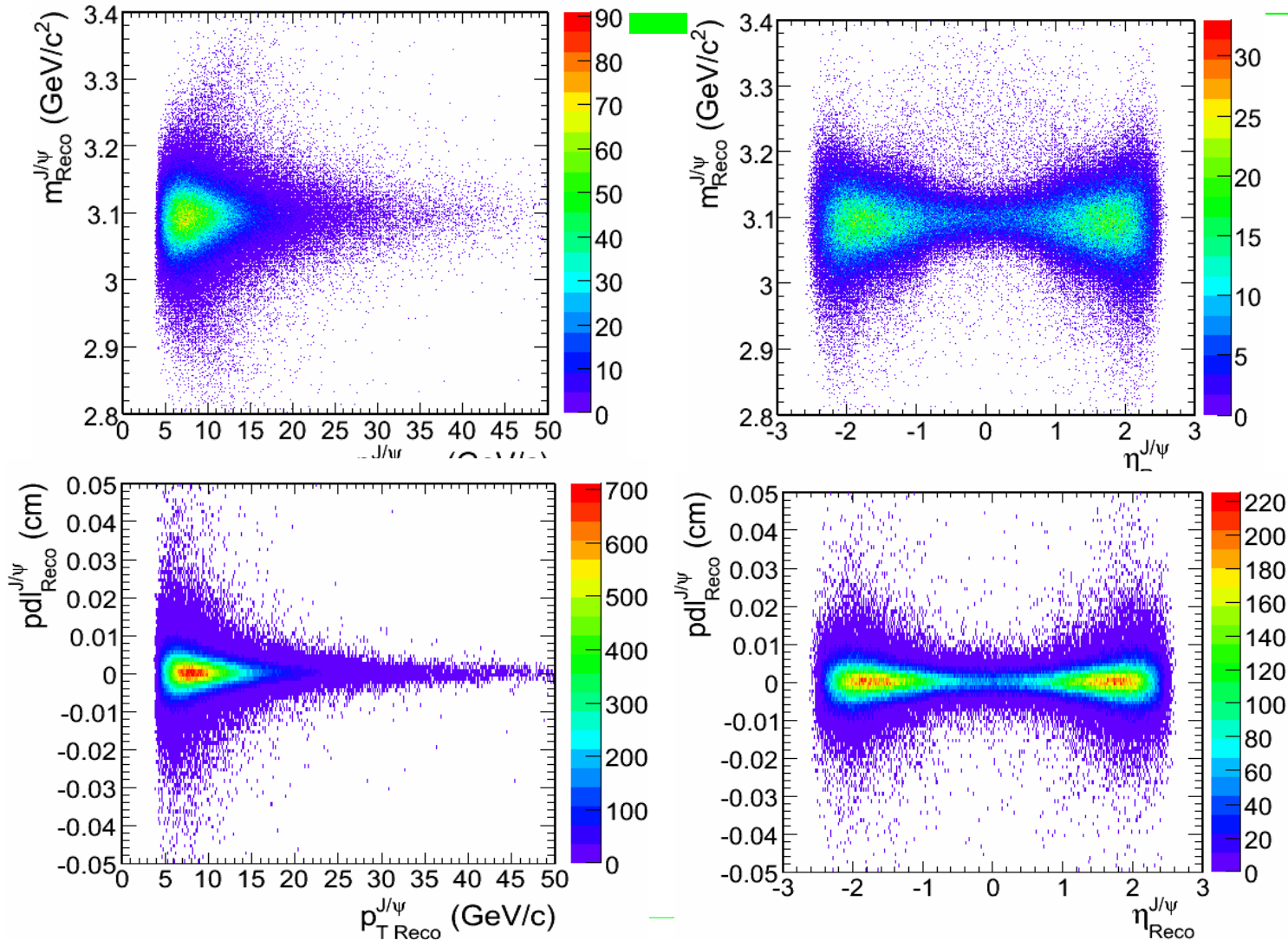


# Mass & pT fitting: resol. Model CSA07

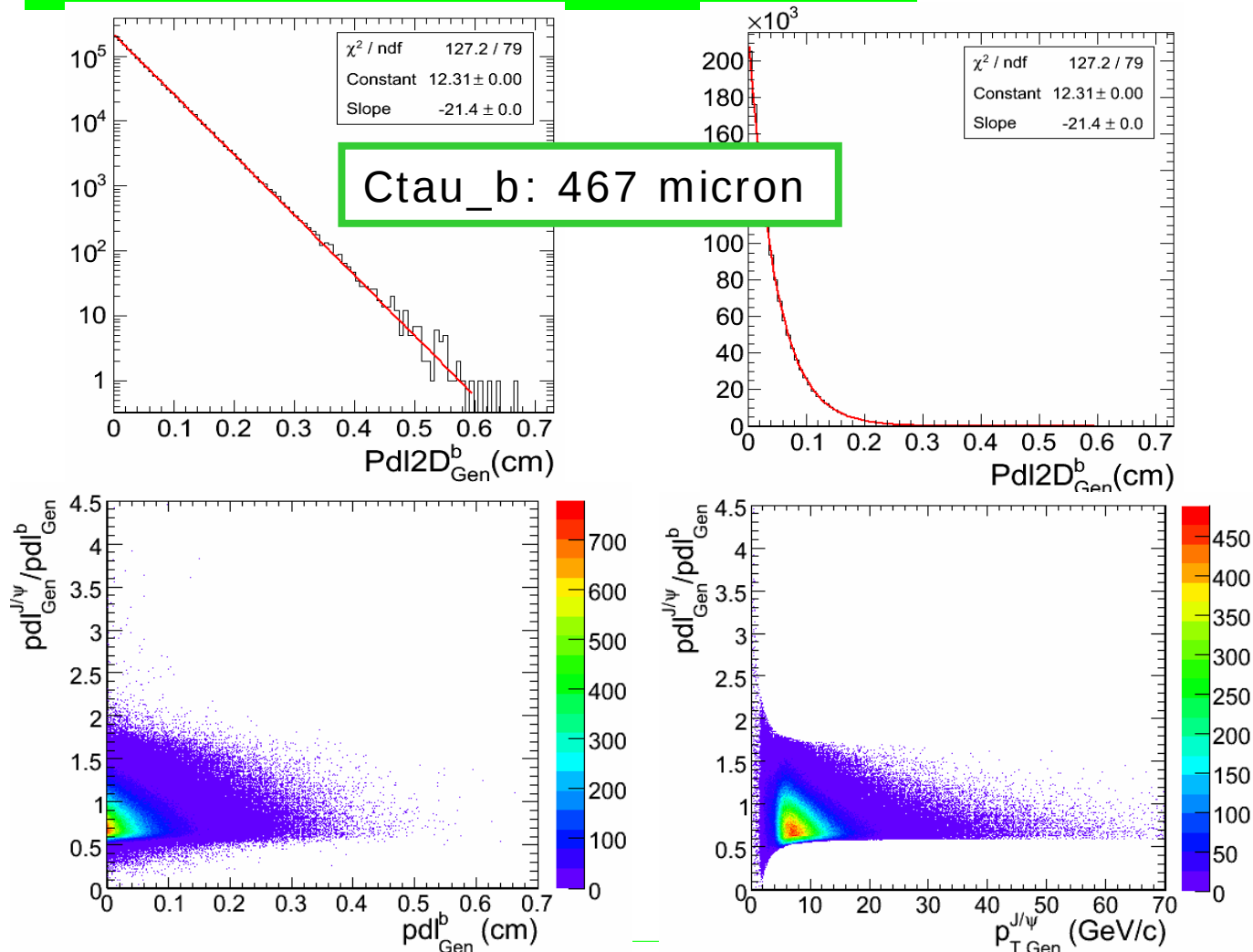
Mass:  
3Gaussian  
Pdl:  
2Gaussian



# Mass & pdl fitting: resol. Model Sum08



# b ctau at Gen: pdl's PDF correction



# pT: 9-10GeV

Offline p-jpsi: 11545

b: 4288

a finite experimental resolution  
on each measurement

$$F_I(t) = \exp(-t/\tau)$$

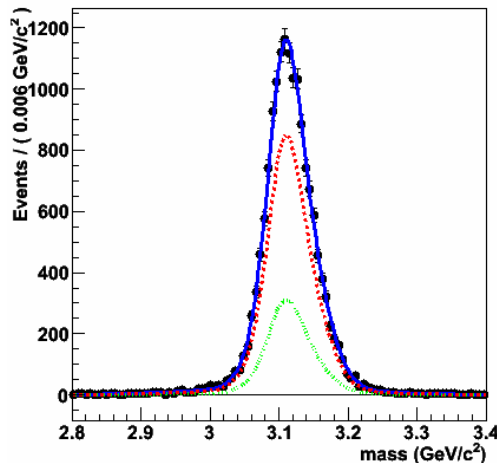
$$F_R(t) = \exp(-t/\tau) \otimes G(t, \mu, \sigma) \\ \equiv \int dt' \exp(-t'/\tau) G(t-t', \mu, \sigma)$$

$$F_E(t, dt) \\ = \exp(-t/\tau) \otimes G(t, \mu, dt)$$

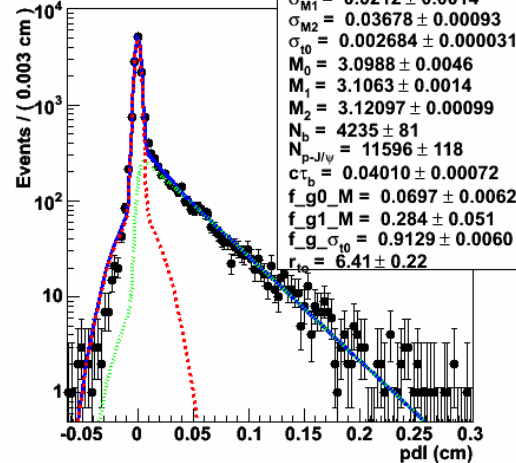
$$F_E(t, dt) \\ = \varepsilon(t) \cdot \exp(-t/\tau) \otimes G(t, \mu, s \cdot dt)$$

(t, dt) fitting with new  
version RooFit package  
in Root 5.22

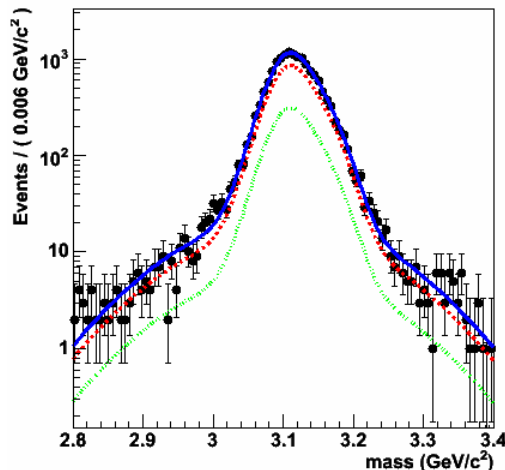
A RooPlot of "mass"



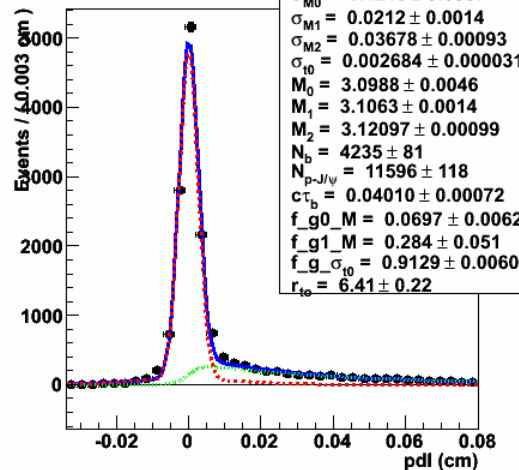
A RooPlot of "proper time"



A RooPlot of "mass"



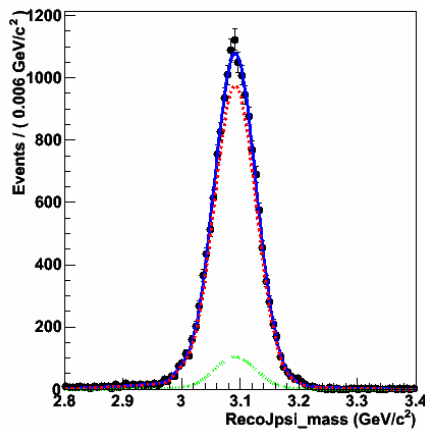
A RooPlot of "proper time"



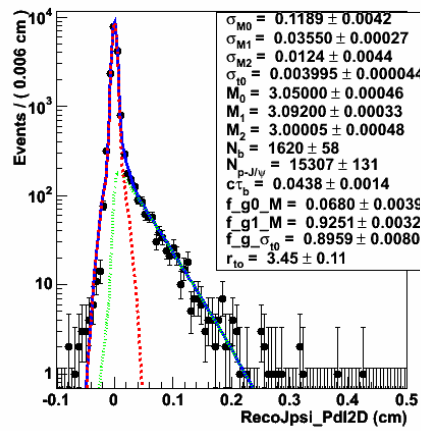
# Jpsi Pt bins: 5-6, 30-40 GeV/c

p-jpsi: 15126  
b: 1801

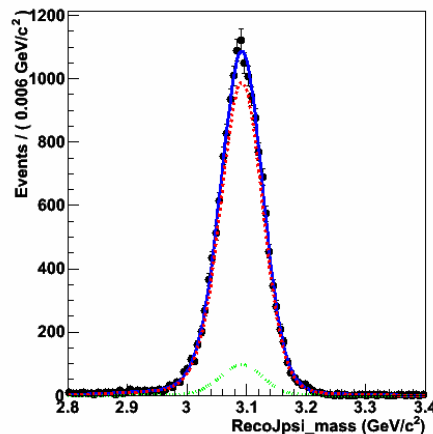
A RooPlot of "RecoJpsi\_mass"



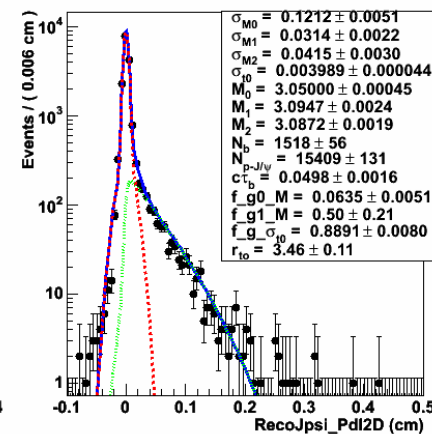
A RooPlot of "RecoJpsi\_Pdl2D"



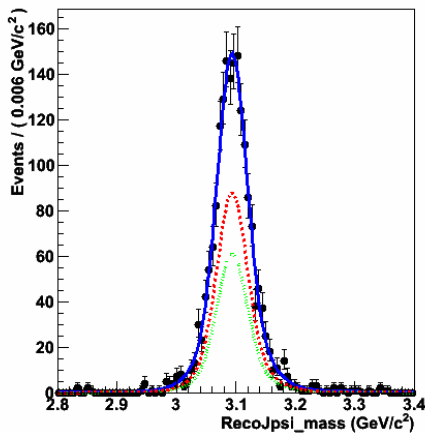
A RooPlot of "RecoJpsi\_mass"



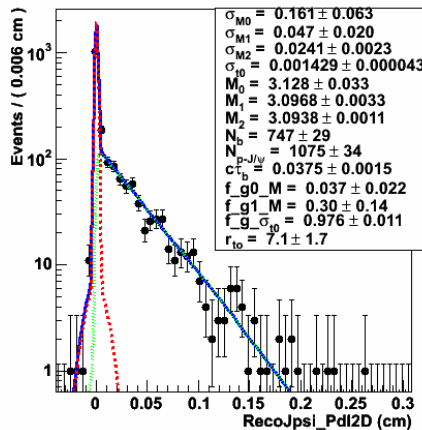
A RooPlot of "RecoJpsi\_Pdl2D"



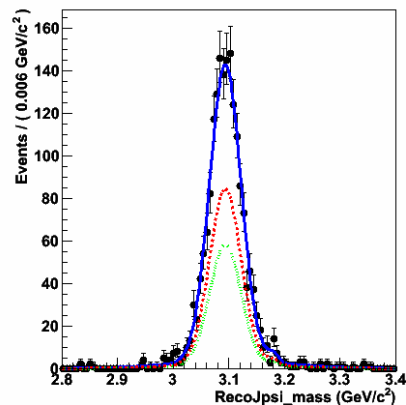
A RooPlot of "RecoJpsi\_mass"



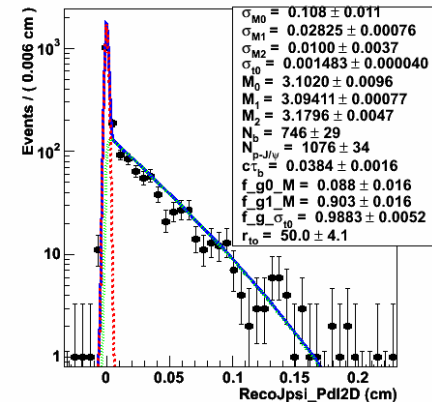
A RooPlot of "RecoJpsi\_Pdl2D"



A RooPlot of "RecoJpsi\_mass"



A RooPlot of "RecoJpsi\_Pdl2D"



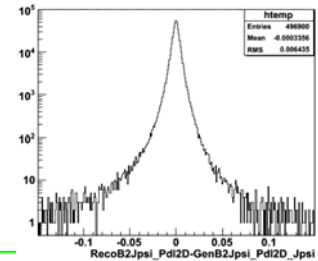
p-jpsi: 1060  
b: 762

# Pdl fitting Techniques

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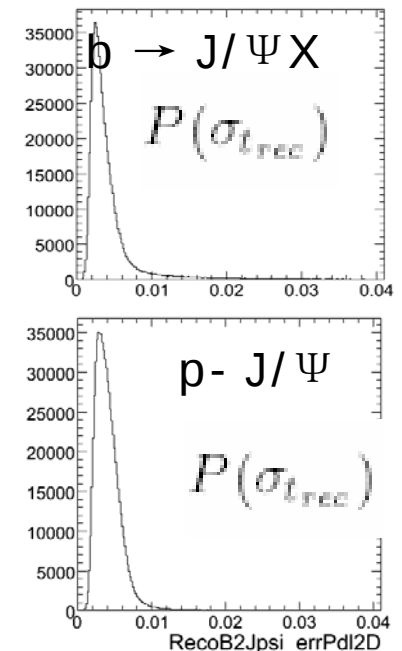
- Pdl and with gaussian model on its resolution
- $(Pdl \mid pdl\_error)$
- $(pdl, pdl\_error)$   
=  $(Pdl \mid pdl\_error)(pdl\_error)$

# Proper time resolution model



$$\mathcal{R}(t_{rec} - t_{true}, \sigma_{t_{rec}}) = R(t_{rec} - t_{true} | \sigma_{t_{rec}}) \times P(\sigma_{t_{rec}})$$

$$R(x) = \frac{N}{\sqrt{2\pi}} \left[ (1 - f_1(\sigma_{t_{rec}}) - f_2(\sigma_{t_{rec}})) e^{-\frac{1}{2} \left( \frac{x - M(\sigma_{t_{rec}})}{S(\sigma_{t_{rec}})} \right)^2} + f_2(\sigma_{t_{rec}}) e^{-\frac{1}{2} \left( \frac{x}{S_{fixed}} \right)^2} + f_1(\sigma_{t_{rec}}) \left( e^{-\frac{1}{2} \left( \frac{x}{S(\sigma_{t_{rec}})} \right)^2} \otimes e^{-\left( \frac{x}{\tau(\sigma_{t_{rec}})} \right)} \right) \right]$$



Now,  $R(x)$  consists of three terms with different fractions defined by the fraction parameters:  $f_1$  and  $f_2$ . The first term is a Gaussian of mean  $M$  and width  $S$ . The second term is a Gaussian of mean zero and width  $S_{fixed}$ , where  $S_{fixed}$  is not a free parameter but a fixed number, set to 10 ps, to describe the wide tails of the distribution. The third term is a Gaussian with mean 0 and sigma  $S$  convolved with an exponent with index  $-\tau^{-1}$ .

# New data samples: from zongchang



## Onia $\rightarrow \mu^+ \mu^-$ samples



| sample                  | N <sub>evt</sub> | $\sigma_{\text{total}}$<br>(mb) | Filter<br>efficiency | Pre-selection                                          | Int. lumi.<br>(pb <sup>-1</sup> ) |
|-------------------------|------------------|---------------------------------|----------------------|--------------------------------------------------------|-----------------------------------|
| Prompt J/ $\psi$        | 10 M             | 2.615E-1                        | 0.074                | at least one muon<br>$p_T > 2.5$ GeV/c, $ \eta  < 2.5$ | 8.7                               |
| Non-prompt<br>J/ $\psi$ | 10 M             | 5.156E+1                        | 0.00308              | the same                                               | 18                                |
| Psi(2S)                 | 500 K            | 6.301E-1                        | 0.34                 | the same                                               | 32                                |
| Upsilon(1S)             | 1 M              | 5.703E-3                        | 0.13                 | the same                                               | 54                                |
| Upsilon(2S)             | 300 K            | 5.516E-3                        | 0.074                | the same                                               | 38                                |
| Upsilon(3S)             | 200 K            | 1.929E-4                        | 0.54                 | the same                                               | 88                                |
| total                   | 22 M             |                                 |                      |                                                        |                                   |

- The filter efficiency is the selection efficiency of the config file: N(passed)/N(total).
- Prompt J/ $\psi$  includes the feeddown from  $\chi_c$ , and so does Upsilon(1S).
- With such pre-selection, we are able to study the low pT J/ $\psi$  by using global+calo Muons and single muon trigger.
- Tested in CMSSW\_3\_1\_0\_pre4

# New data samples: from zongchang



## Inclusive $\mu$ samples (background)



| sample     | $N_{\text{evt}}$ | $\sigma_{\text{total}}$ (mb) | Filter efficiency | Pre-selection                                                                                                                                     | Int. lumi. (pb <sup>-1</sup> ) |
|------------|------------------|------------------------------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| ppMuX      | 10 M             | 5.156E+1                     | 0.074             | at least one muon<br>$p_T > 2.5$ GeV/c, $ \eta  < 2.5$                                                                                            | 0.075                          |
| ppMuMuX    | 10 M             | 5.156E+1                     | 0.00308           | at least two muons $p_T > 2.5$ GeV/c, $ \eta  < 2.5$                                                                                              | 5.0                            |
| ppMuXLoose | 10 M             | 5.156E+1                     | 0.34              | at least one muon:<br>$p_T > 0.6$ GeV/c, $1.7 <  \eta  < 2.5$ ;<br>$p_T > 1.0$ GeV/c, $1.2 <  \eta  < 1.7$ ;<br>$p_T > 1.5$ GeV/c, $ \eta  < 1.2$ | 0.004                          |
| total      | 30 M             |                              |                   |                                                                                                                                                   | 5.1                            |

- All the inclusive  $m$  samples include the muons in-flight.
- The ppMuXLoose sample is for HLT\_DoubleMu0 trigger study and has been tested in CMSSW\_3\_1\_0\_pre4.



# backups