Study of photon reverse method

Out line :

1. Photon Reverse Method Introduction
2. MC test
3. Ratio from QCD sample
4. Fitting and background estimation
5. Effect from FSR

Photon Reverse Method Introduction (1)

$$N_{\text{jet fake }\gamma} = f_{\text{jet fake }\gamma} \times N_{\text{jet}} \xrightarrow{\text{extrapolate}} N^{\text{Zjet}}_{\text{jet fake }\gamma} = \frac{N^{\text{QCD}}_{\text{jet fake }\gamma}}{N^{\text{QCD}}_{\text{BadEM}}} \times N^{\text{Z+jet}}_{\text{BadEM}} = R_{\text{jet fake }\gamma} \times N^{\text{Z+jet}}_{\text{BadEM}}$$

1. Get R from QCD sample ;

$$R^{\text{Raw}}_{\text{jet fake }\gamma} = \frac{N_{\text{GoodEM}}}{N_{\text{BadEM}}} = \frac{N^{\text{jet\_fake}}_{\text{GoodEM}} + N^{\text{real }\gamma}_{\text{GoodEM}}}{N_{\text{BadEM}}} = R_{\text{jet fake }\gamma} + R_{\text{real }\gamma}$$

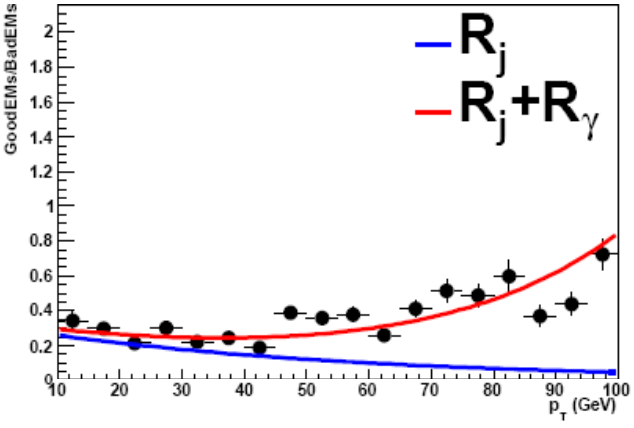
Good EM: *pass all gamma selection cuts*

Bad EM: reverse one of the gamma selection cut to get a bkgd dominant sample

$R_{jet}(pT) = e^{p_0 \cdot pT + p_1}$ is the ratio for the real jets

$R_{\gamma}(pT) = e^{p_2 \cdot pT + p_3}$ is the ratio for the real γ

Use iterative template fitting method to derive R_{jet}(pt)



2. Get $N_{(Z+BadEM)}$ from muon data stream ;

$$N^{Z+\text{jet}}_{\text{jet}\to\gamma} = R_{\text{jet}}(pt) \times N_{Z+\text{BadEM}}(pt)$$

Photon Reverse Method Introduction (2)

Samples

Jet trigger: →Get jet fake photon ratio

data11_7TeV.$RunNumber.physics_JetTauEtmiss.merge.NTUP_SMWZ.f361_m796_p605

μ trigger: →Get Z+BadEM Number

data11_7TeV.$RunNumber.physics_Muons.merge.NTUP_SMWZ.f387_m897_p605

MC: →Check the feasibility of the method

mc10_7TeV.105802.JF17_pythia_jet_filter.merge.NTUP_SMWZ.e577_s933_s946_r2302_r2300_p605

Event selection: in jet trigger sample

Z veto

Events with ≥ 2 good leptons candidates would be vetoed

(pt>20GeV,|eta|<2.5)

W veto

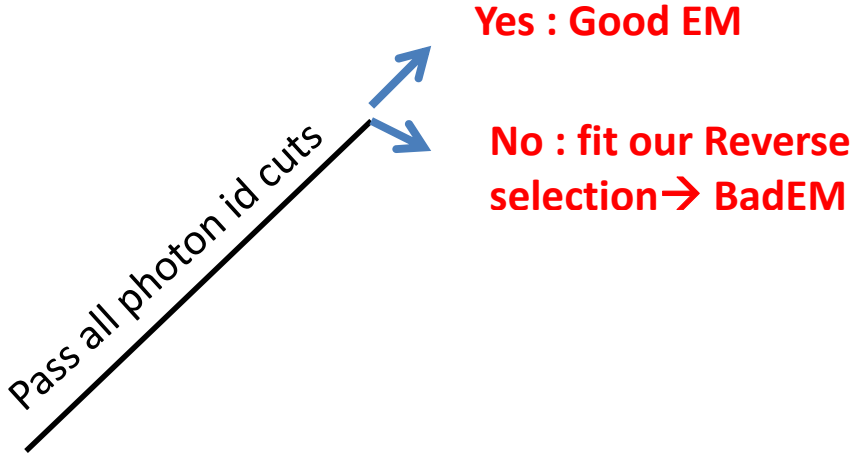
Events with missing Et > 10 GeV would be vetoed

Find a Jet

Pt>30GeV, |eta|<2.8, jet cleaning

Find a photon candidate back-to-back with jet

Dϕ(jet, photon)>2.5



Photon Reverse Method Introduction (3)

- **GoodEM selection: pass our photon selection cut**

Photon selection cuts:

- *pt >15GeV, |eta|<2.37, remove crack region;*
- *Calo Isolation cut: Etcone30<6GeV ;*
- *Tuned-Robust-Tight (tune6)*

- **BadEM selection**

Pass: (Etcone30<15GeV)

&& Pass: S2 ratio1, S2 ratio2

&& Fail: (any one of **tight4 cut**)

deltaE, ws3, fside, eratio

We choose these cuts, just to make the "Ratio" be more feasible for fitting

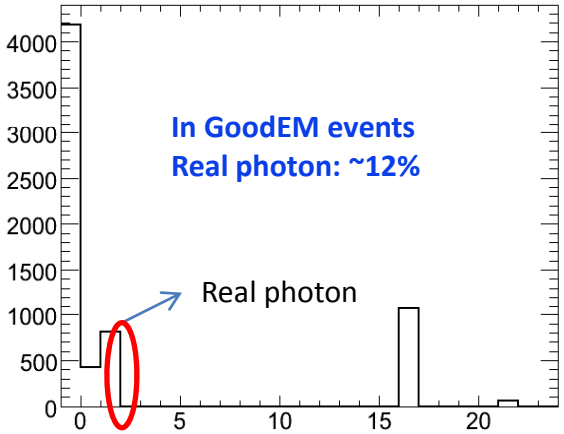
Attention:

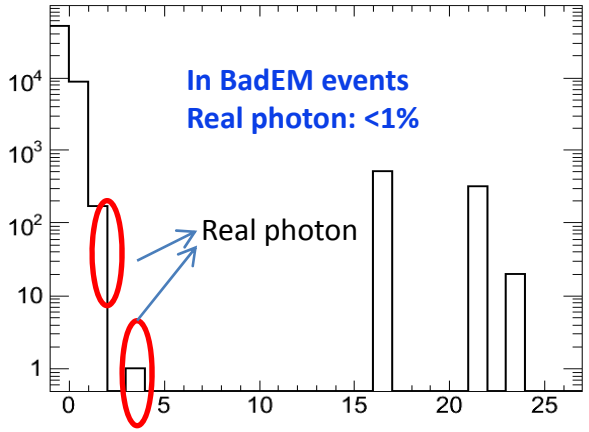
1. Make sure BadEM is bkgd dominant;
2. Make sure the ratio can be fitted by 2 exp() functions.

MC test

Test 1

JF17 MC



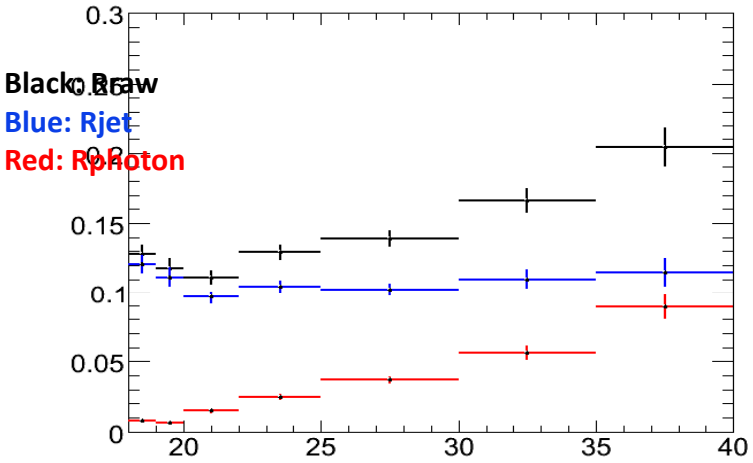


Document value

badEM is bkgd dominant

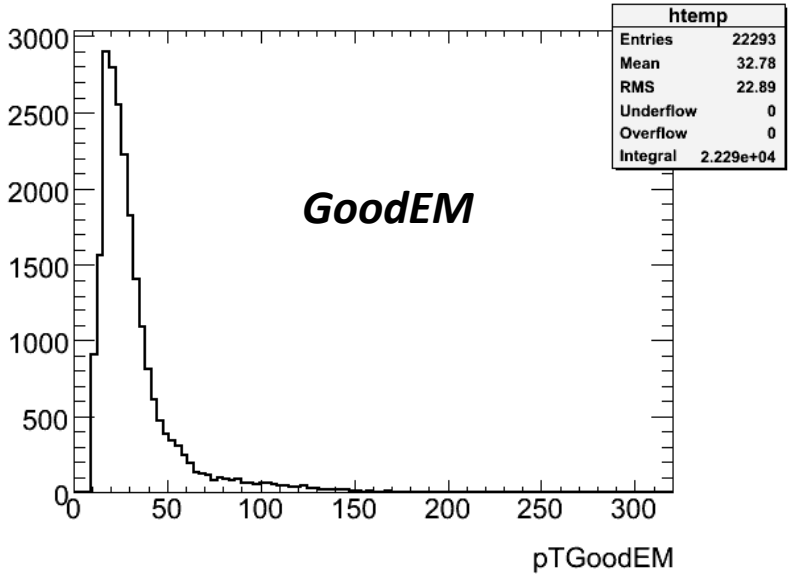
Test 2
(closure test)

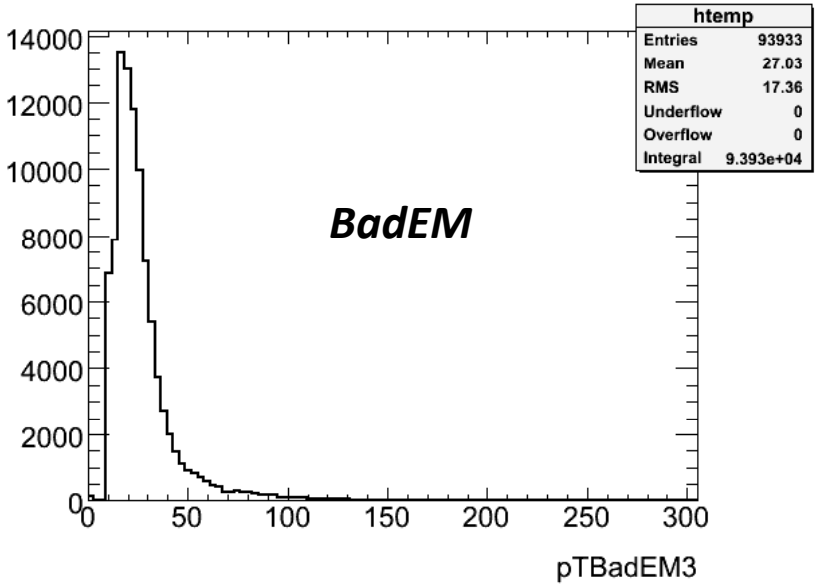
JF17 MC

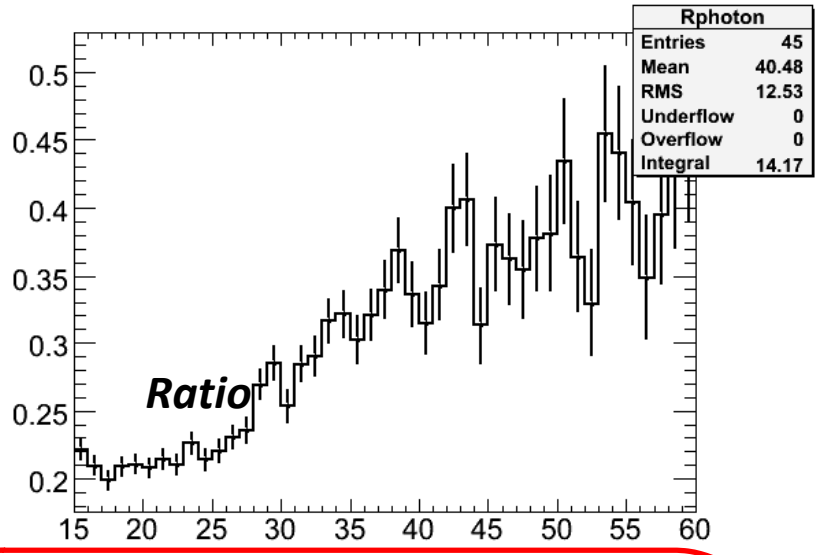


R_{jet}&R_{γ} in JF17 MC

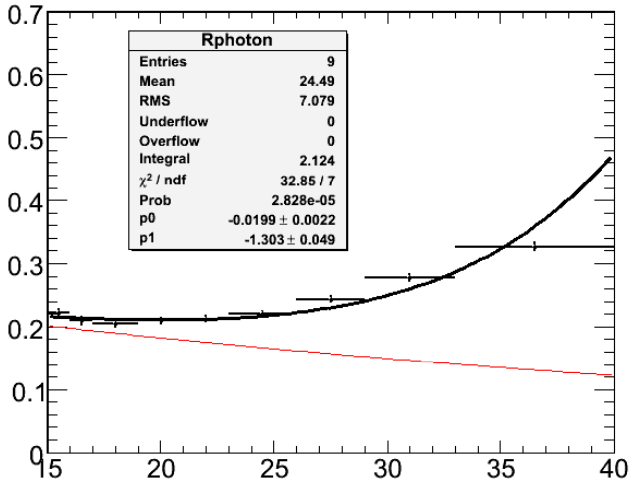
Ratio from QCD sample





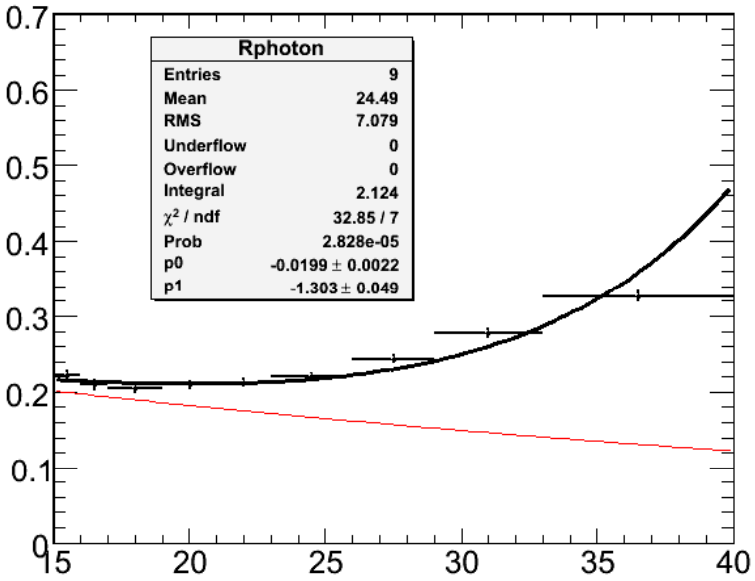


Jet fake rate: exp(-0.0199* pT – 1.303)

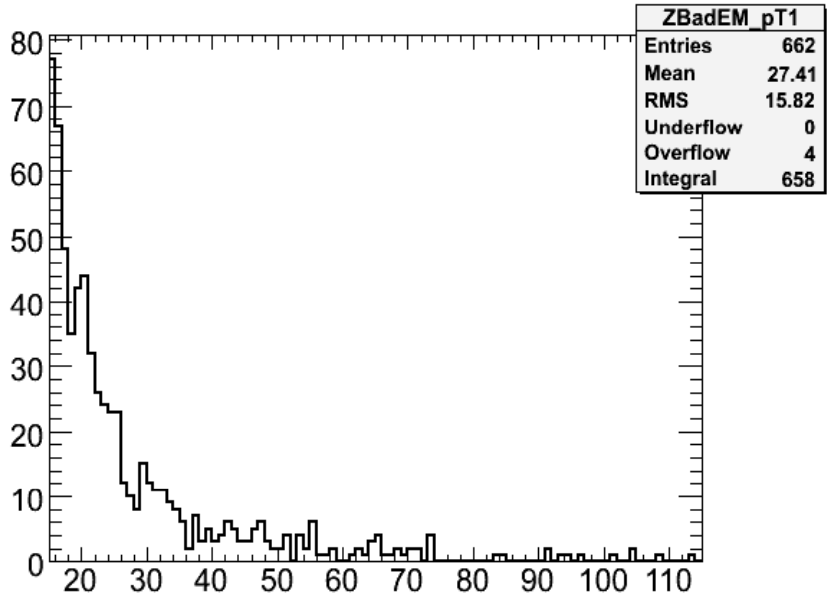


Background estimation

Ratio from QCD sample



BadEM number from muon stream sample

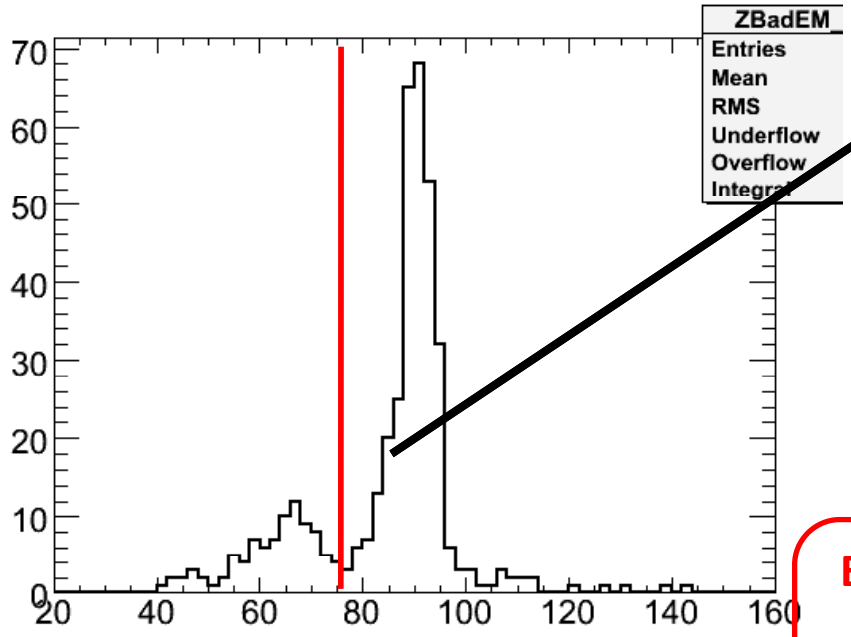


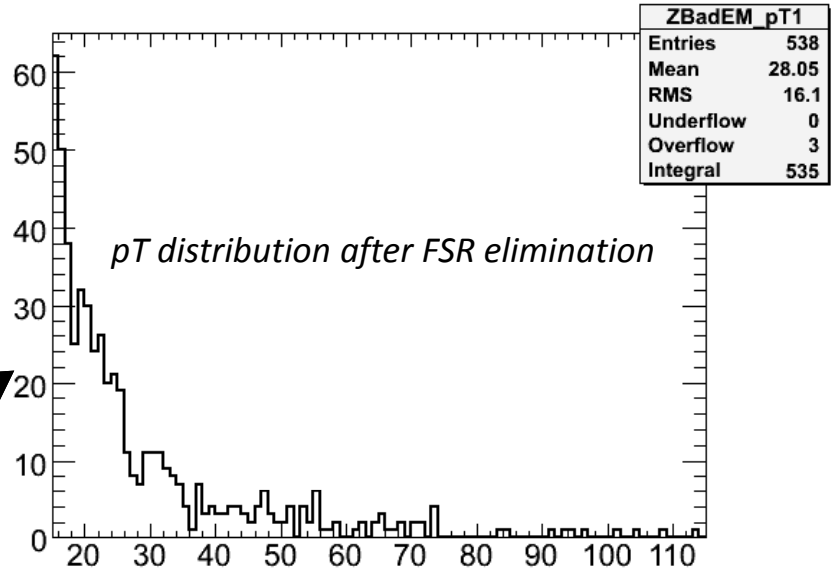
Background:

$$N_{jet->\gamma} = \sum ratio_i * BadEM_i = 108.84$$

Effect of FSR

There is **FSR contamination** in BadEM from muon trigger sample. We can eliminate the effect **by InvM(μμ)>80GeV**





Background estimation without FSR effect

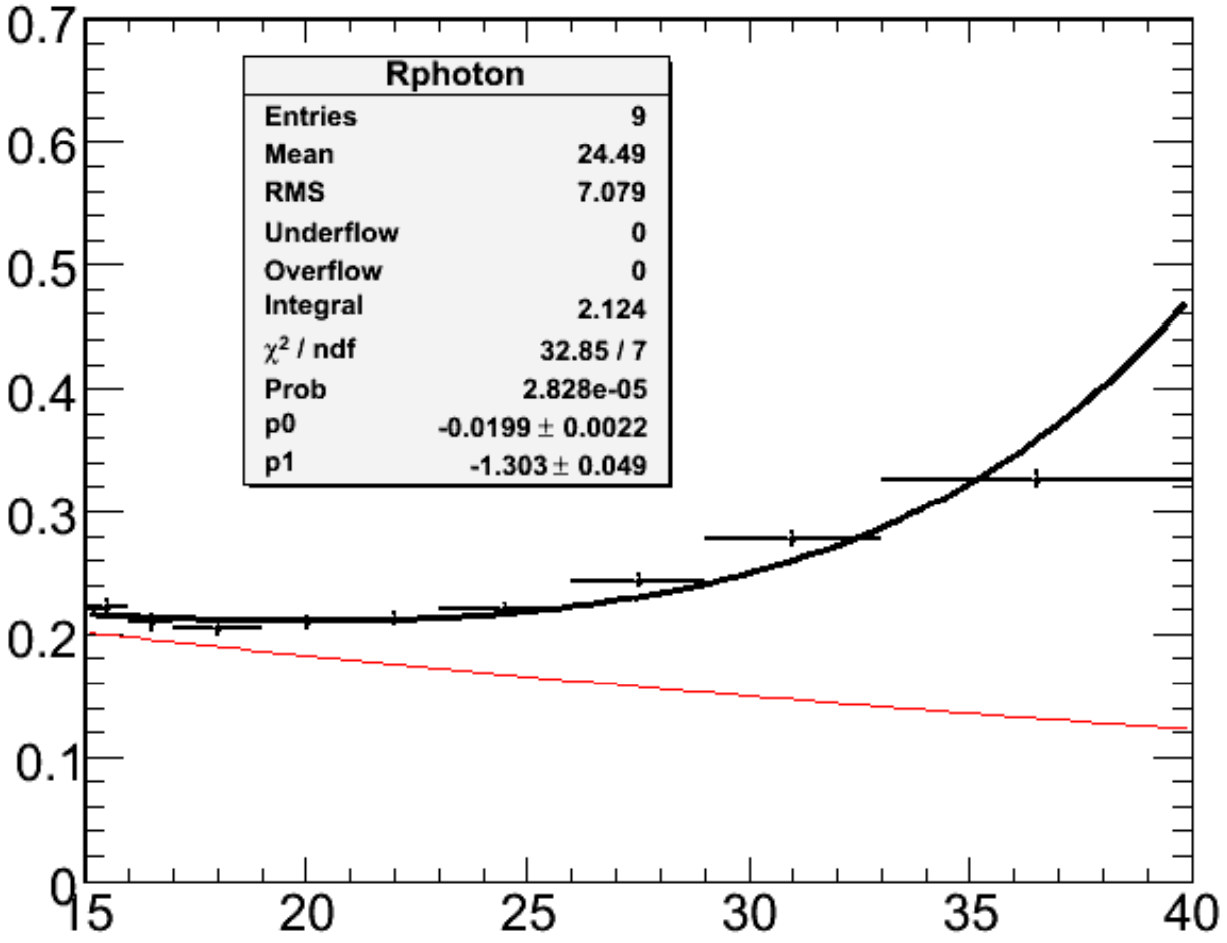
$$N_{jet->\gamma} = \sum ratio_i * BadEM_i^{noFSR} = 87.52$$

Conclusion

- Need to tune our fitting to make result more reasonable (slide 6)
- Need to exclude EW events(ttbar, Ztautau) when we select Z+badEM

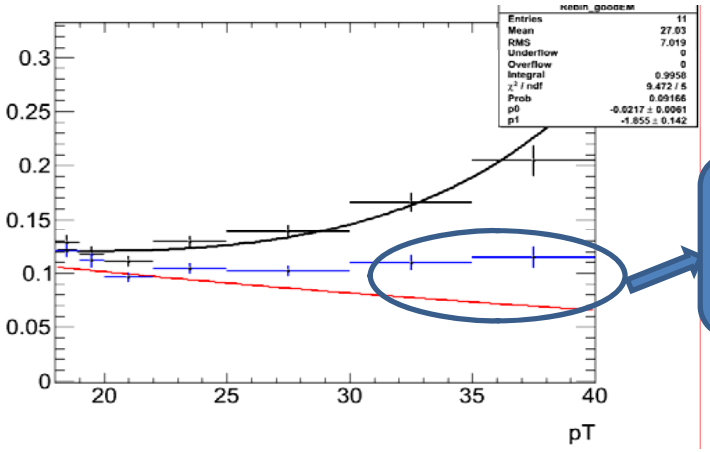
Back up

Fitting result



Jet fake rate: exp(-0.0199* pT – 1.303)

Fitting method with MC result

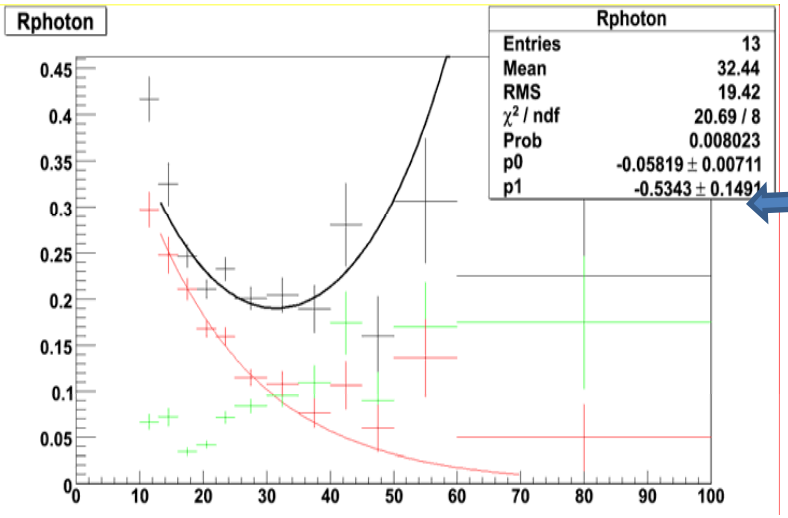


Problem ?
Need to tune our fitting

Red: Rjet from our fitting method
Blue: real Rjet from truth match

This is a backup of slide 6

Our fitting method seems work in 2010 study(MC)



Black(with error): R from JF17
Red(with error): R_jet from JF17
Green(with error): R_photon from JF17
Red line: our fitted R_jet

Our fitting can describe the real R_jet