The study on 7TeV

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MC and Data for 7TeV

-- looked at PAUs with -00-00-60 version

-- Data: Run# 152166, 152214, 152221, 152345, 152409, 152441, 152508, 152777, 152844, 152845, 152878, 152933,152994,153030,153134,153136,153159,153200

(Lumi=?)

-- For MC sample, I mixed JF17, J0 and J1 in order to increase the (fake) photons candidates.

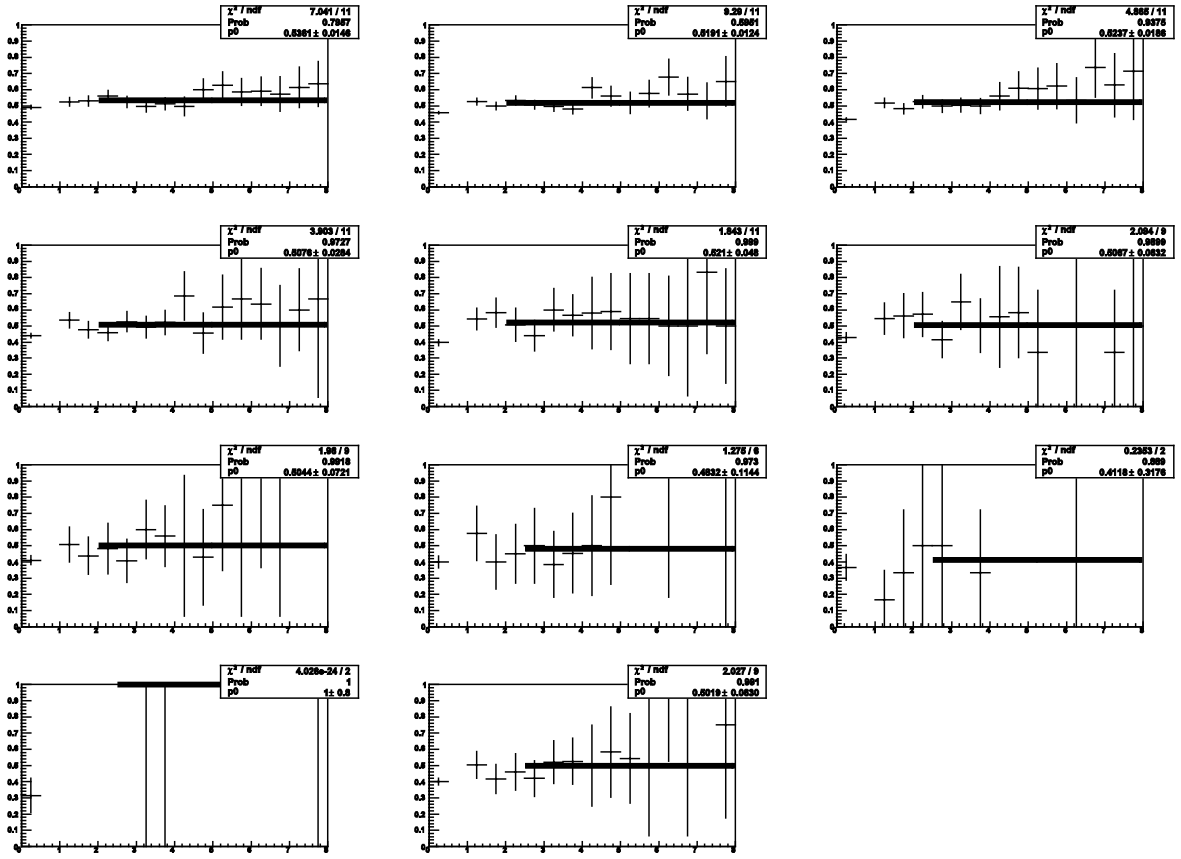
(So far, I do not care the normalization by luminosity weight)

Data for 7TeV

-- plots “Fraction v.s. track-isolation energy”
→Fb is calculated by samples with trk-iso > 2GeV.
(Note: the fitting results are not used as Fb.)

Plots (GeV)
(1)10-15
(2)15-20
(3)20-25
(4)25-30
(5)30-35
(6)35-40
(7)40-50
(8)50-75
(9)75-100
(10)100-200
(11)for last 4 bins

Fraction v.s. track-isolation



Fs, Fb_true, Fb_mc and Fb_data

-- Fb_data and Fb_mc are input for the formula to measure the purity, and is basically estimated from the background sample by trackisolation.

-- Fb_true is estimated from non-photons (matched to the jet) in the background sample.

--Fs is estimated from true photons by requiring the standard cut with trackisolation. (caloisolation for the bottom plot)

(Note: the number of conversion is determined from the reconstruction, not from the truth.)

-- data: need more statistics.

-- MC :

1. good agreement between Fb_mc and Fb_true (Fb~ 0.55)
2. Fs ~ 0.35

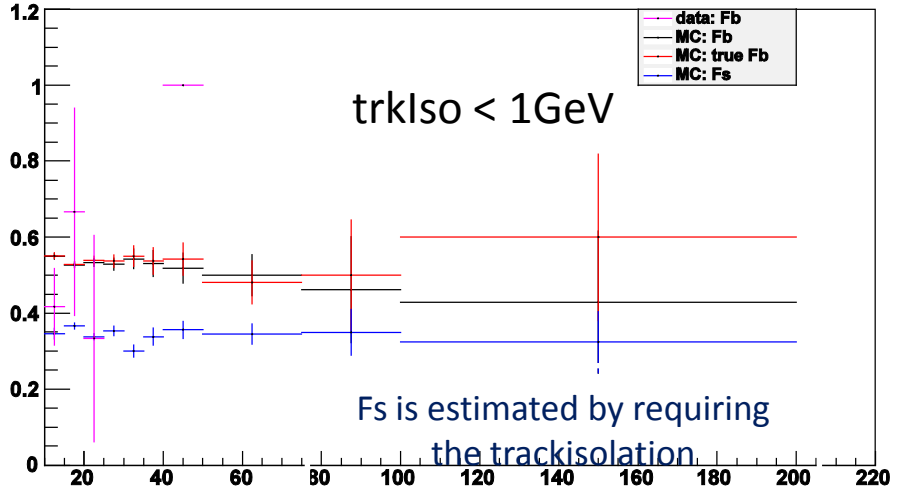
$$P = \frac{F_B - F_{obs}}{F_B - F_S}$$

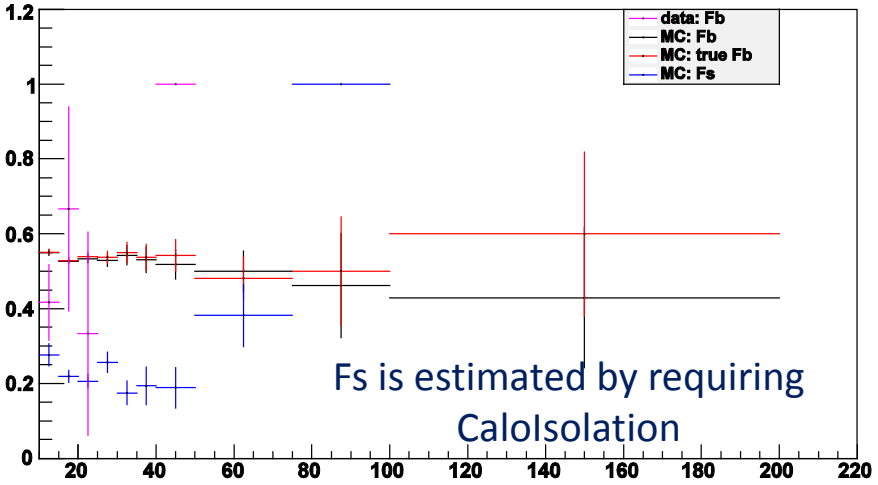
-- Fb_data : magenta

-- Fb_mc : black

-- Fb_true : red

-- Fs : blue





Fobs

-- Fobs_data : magenta
-- Fobs_mc : black
-- Fs : red

-- Fobs distributions

- -- Fobs_data : magenta
  (From real data by requiring the all photon selection)
- -- Fobs_mc : black
  (From MC by requiring the all photon selection)
- -- Fs : red

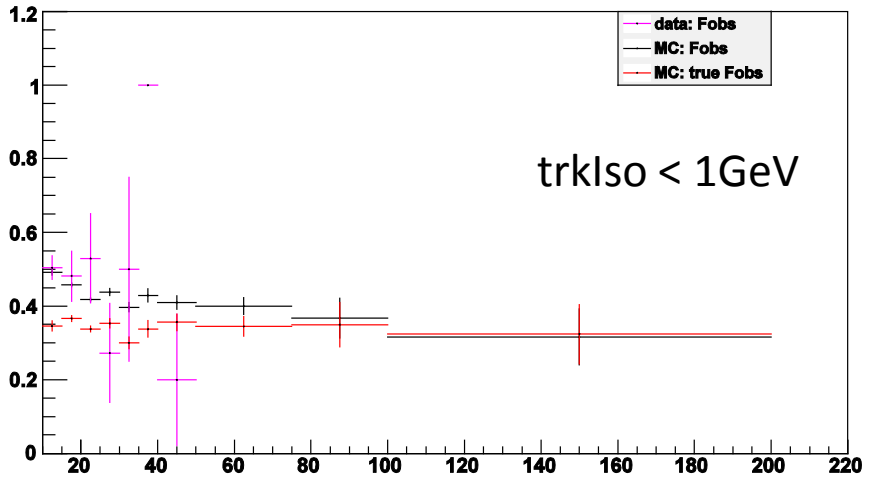
1. Calo-Isolation cut is tighter than trak-isolation.

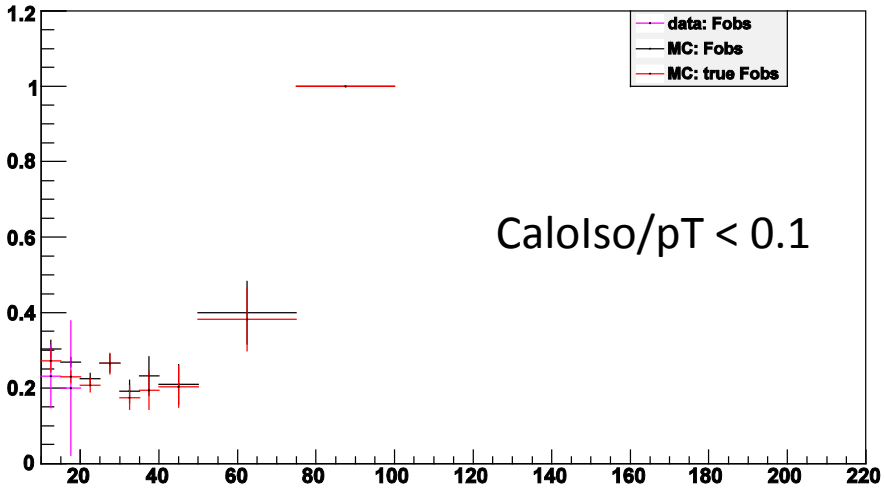
   Trackisolation: Fobs ~0.35

   Caloisolation: Fobs ~ 0.25 - 0.30

   Note: CaloIsolation: Fobs < Fs (from track-isolation). It is not possible to estimate purity of photons selected caloisolation using Fs and Fb by trackisolation.

2. The estimated Fobs_data(_mc) become large in the low pT region.





Purity

$$F_{obs} = \frac{N_{conv}}{N} = \frac{F_S.N_S + F_B.N_B}{N_S + N_B} = F_S * P + F_B * (1 - P)$$

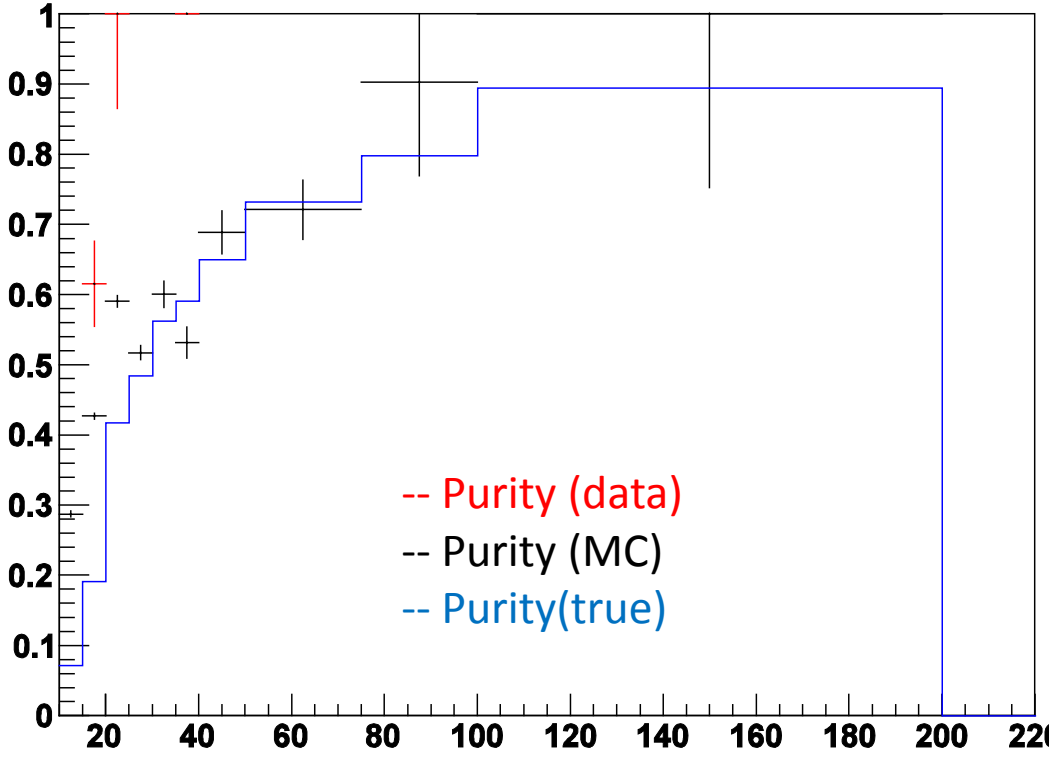
$$P = \frac{F_B - F_{obs}}{F_B - F_S}$$

-- The low pT region is horrible..

Possible check to do

1. True Purity for the1st bin (10GeV-15GeV) is reasonable ? Too low ? A bug? ?

2. Is the number of converted photons correct in the reconstruction level? (Unconverted photon in truth may become converted photon, or opposite case)



Photon purity measurement by CDF

- Two paper

  (1)Prompt photon cross section measurement in pp-bar collision at sqrt(s)= 1.8TeV

  (2)Comparison of the isolated direct photon cross section in pp-bar collision at sqrt(s)= 1.8TeV and sqrt(s)= 0.63TeV

- CaloIsolation (R<0.4)was used as photon selection.

- Idea : basically same as our conversion method to measure the purity.

  -- conversion is defined by energy of the pre-radiator (sampler).

  -- What is the differences ? → Both of Fs and Fb are estimated by MC.

  (1) 1st paper

  1. Fs is estimated from real photons in MC
  2. Fb= 1-(1-Fs)**2 = 2Fs-Fs**2

  (2) 2nd paper

  1. Fs = 1- exp(-7/9*M) , M : amount of material in front of the pre-radiator (sampler).
  2. Fb= 1-exp(-7/9*M*N_gam(Pt))

  (Note: number of photons in the background is different from the species of mother particle (pi0, eta and Ks))

Backup

Fraction of conversion v.s. Calo-Isolation

--Background enriched sample was created by the Reta variable (Reta < 0.9)

--Plots of correlation b.w. fraction of conversion and Etcone40/pt(photon) with fake photons among the BG enriched sample.
(separately for each pT region
20-25, 25-30, 30-35,35-40, 40-50, 50-70, 70-100. 100-200 GeV)

--There is the clear correlation in the plots.

→ In the small calo-isolation, number of conversions is small because the converted photons's calo-Isolatation becomes larger than unconverted photon's as we can predict.
(Originally, fake photon is "real" photon from pi0)

Fake photons