Summary of the photon purity measurement with 10TeV MC

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Method

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

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

-- Fb : estimated from data (selected by requiring the track-isolation greater than 2GeV)
--Fs : estimated from pure photons from simulation.
(selected by requiring the track-isolation less than 1 GeV)
-- Fobs : fraction after requiring all standard photon selection.

Note: In the standard photon selection "calo-isolation" is used instead of "track-isolation“, But calo-isolation gives the bias for conversion fraction in the method.

Systematics

- Accuracy of the measurement of the ID material: systematic uncertainty is estimated by changing the amount of material by 2.5% in Fs.

  (2.5% is expected accuracy.)

- Conversion reconstruction efficiency: changing by 6% in Fs.

- Purity of the background enriched sample: use the true FB in simulation instead of the estimated FB.

- Selection of background enriched sample: use Reta to produce the background enriched sample instead of the track-isolation.

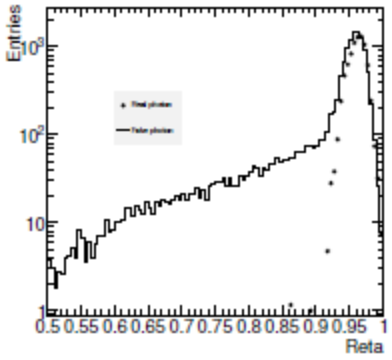
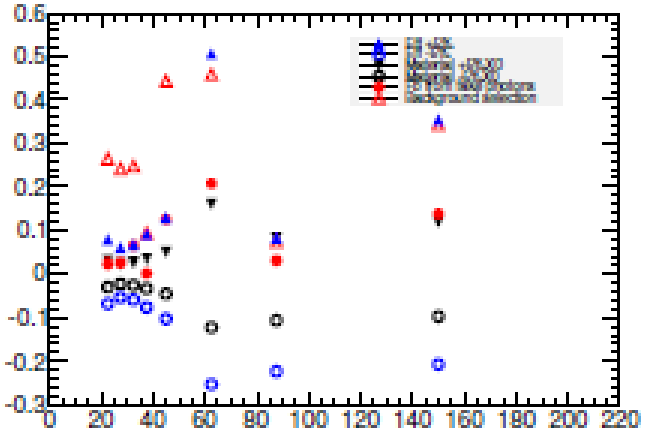
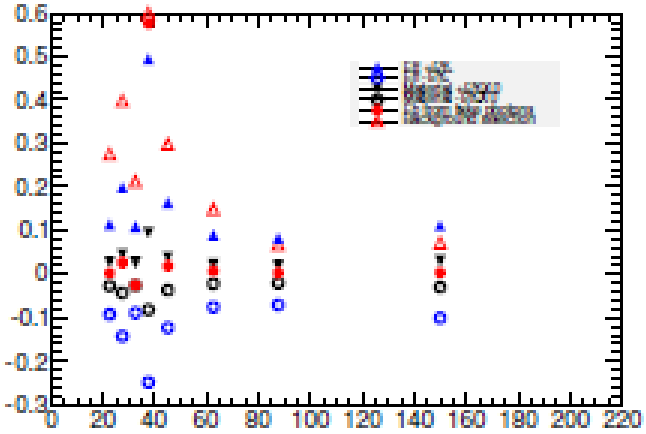


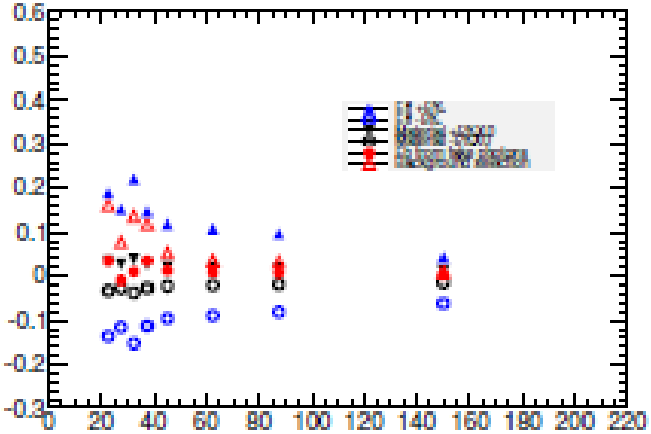
Figure 13: the distribution of the ratio of the energies in 3×7 cells over 7×7 cells in the second layer of the liquid Argon calorimeter (R_η)



(a) $0 < |\eta| < 0.6$



(b) $0.6 < |\eta| < 1.37$



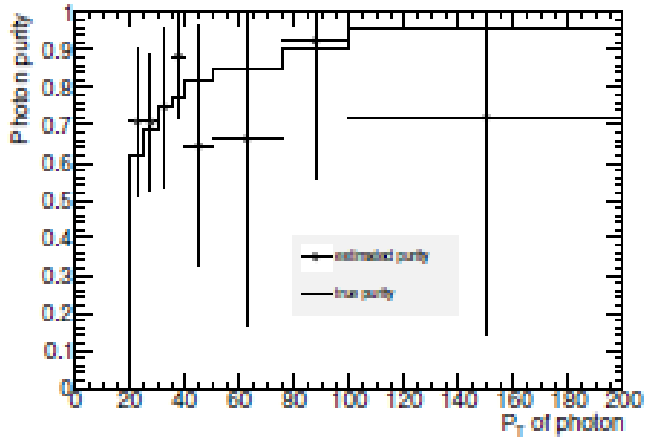
(c) $1.52 < |\eta| < 2.47$

-- Main uncertainties

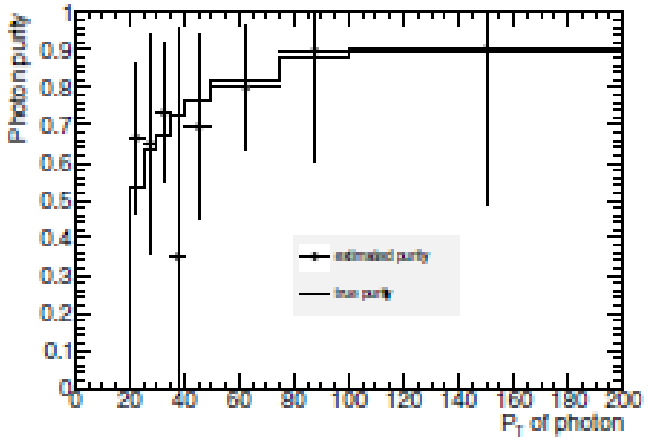
1. Selection of the background sample : Reta can lead the bias. Even in eta direction, cluster from the converted photon becomes a wider than that from the un-converted photon.
   → because of the different between electron and photon, and of the difference of momentum between tracks in a conversion.
2. Conversion reconstruction : in the large eta region

Single pi0 with 40GeV	1 conversion	2 conversions
Reconstruction efficiency(%)	83.3 ± 0.56	63.0 ± 1.1

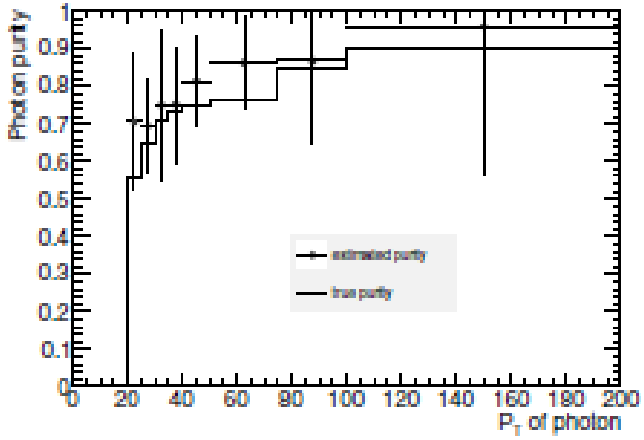
Fraction	1 conversion	2 converions
1) True photon conversion	67%	37%
2) Fake conversion	16%	13%
3) Wrong track conversion	17%	50%



(a) $0 < |\eta| < 0.6$



(b) $0.6 < |\eta| < 1.37$



(c) $1.52 < |\eta| < 2.47$

Comments for future

- Need to study the correlation “Calo-isolation v.s. conversion“, if we want to use the conversion method as a purity measurement.

- If we can produce the signal sample from data, we can reduce the systematics from the reconstruction efficiency and the accuracy of the ID material because of the cancelation.

- Strategy ?