$W\gamma$, $Z\gamma$ - Background Studies

- QCD Background Sources
- Need estimate of fraction of jets that will fake a photon
- Run I measurement
- Method
  1. Jet Triggered Sample
  2. Exclude Trigger Jet
  3. investigate excluding 2nd aswell
  4. central jets only
  5. use cone 0.4 jets
  6. Question - Is a photon found within $\Delta R < 0.4$ of a jet?
- further investigations
  1. Chi-sq 5 cut
  2. photon Trigger bias
  3. Cone 7 study / comparison with run I
- results using predicted background measurement.

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What Background Sources ?

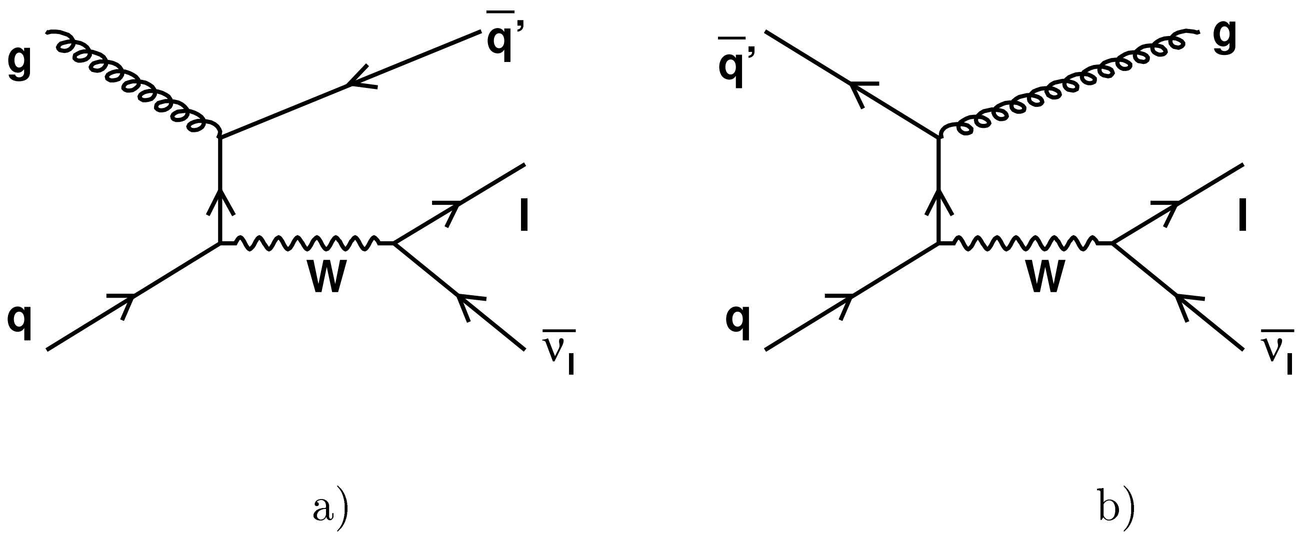


Figure 1: *Feynman Diagrams of QCD background events*

Photon Fakerate

Determine probability that a jet of E_T^{jet} fakes a photon with E_T^{γ}

1. Determine "raw" rate: $P_{raw}^{fake} = N_{\gamma}^{obs}/N_{jet}$
   contaminated by true photons ($N_{\gamma}^{obs} = N_{\gamma}^{true} + N_{\gamma}^{fake}$)
2. determine contamination: $N_{\gamma}^{true}/N_{\gamma}^{obs}$
3. subtract from raw rate $\Longrightarrow P_{true}^{fake}$
4. determine fragmentation function $E_T^{jet} \rightarrow E_T^{\gamma}$

Praw

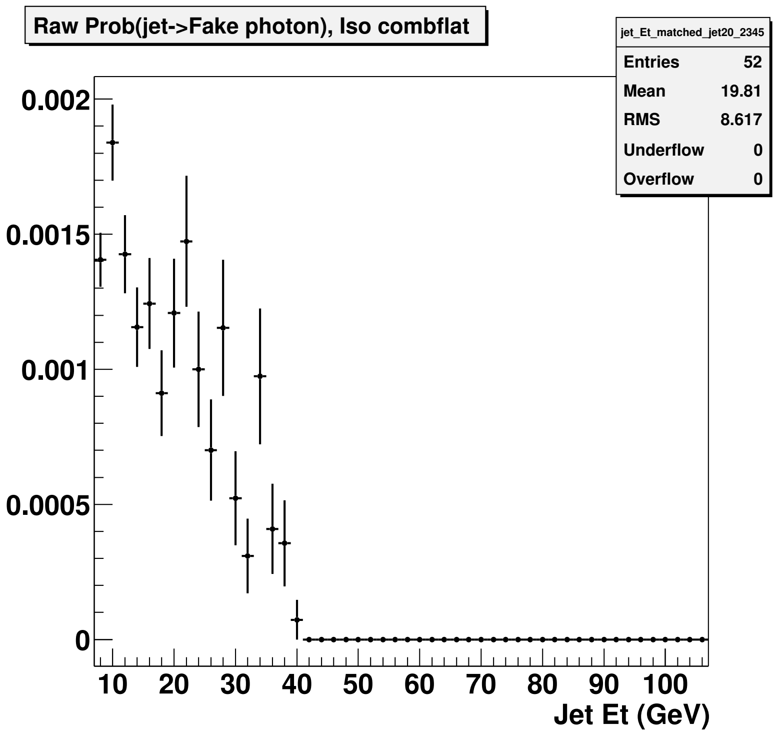
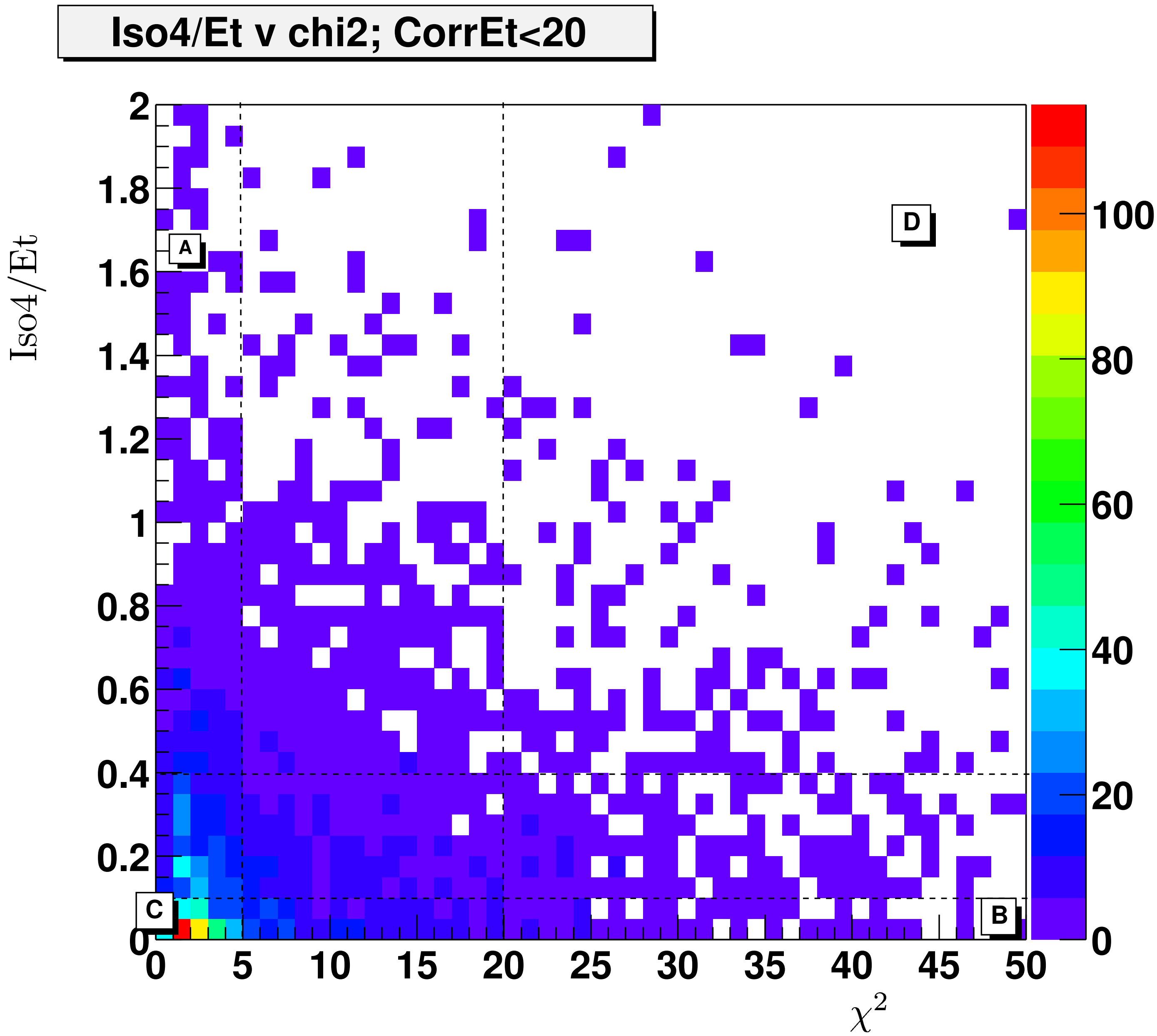


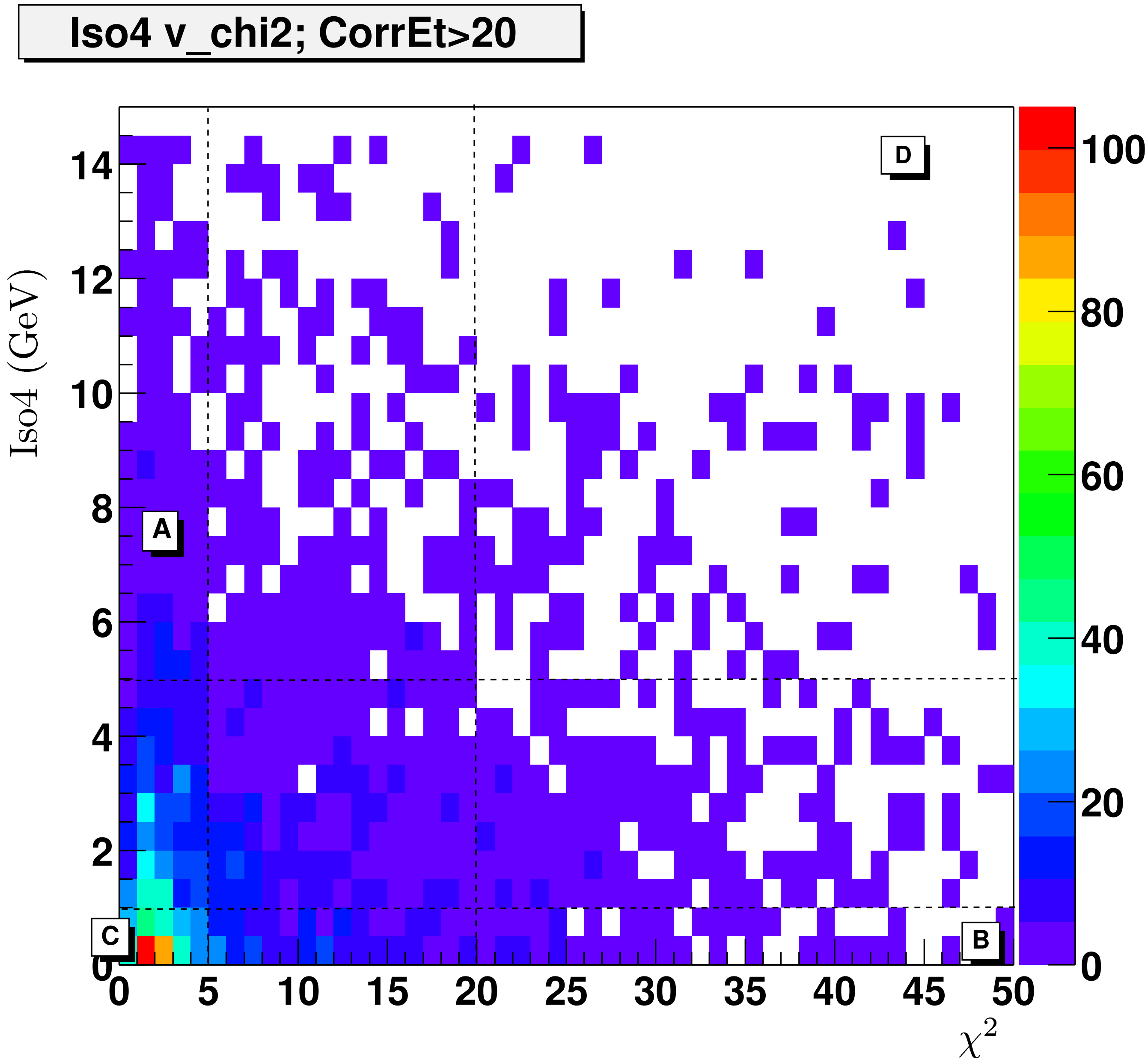
Figure 2: *The raw fake rate for a cut of IsoCombflat*

Question: What is the Contribution from Real photons?

Fqcd Regions



- $Fqcd = C_{pred}/C_{obs}$
- where $C_{pred} = \frac{A \times B}{D}$
- for $\chi^2 < x$ cut, regions A and C go from $0 < chi^2 < x$; $x = 5$ or 20.
- method breaks down for $E_T^\gamma > 40$; not even considered



	$7 < Et < 11$	$11 < Et < 20$	$20 < Et < 40$
IsoCombflat	1.00 ± 0.17	0.47 ± 0.11	0.087 ± 0.051

Table 1: Fqcd values used for central result

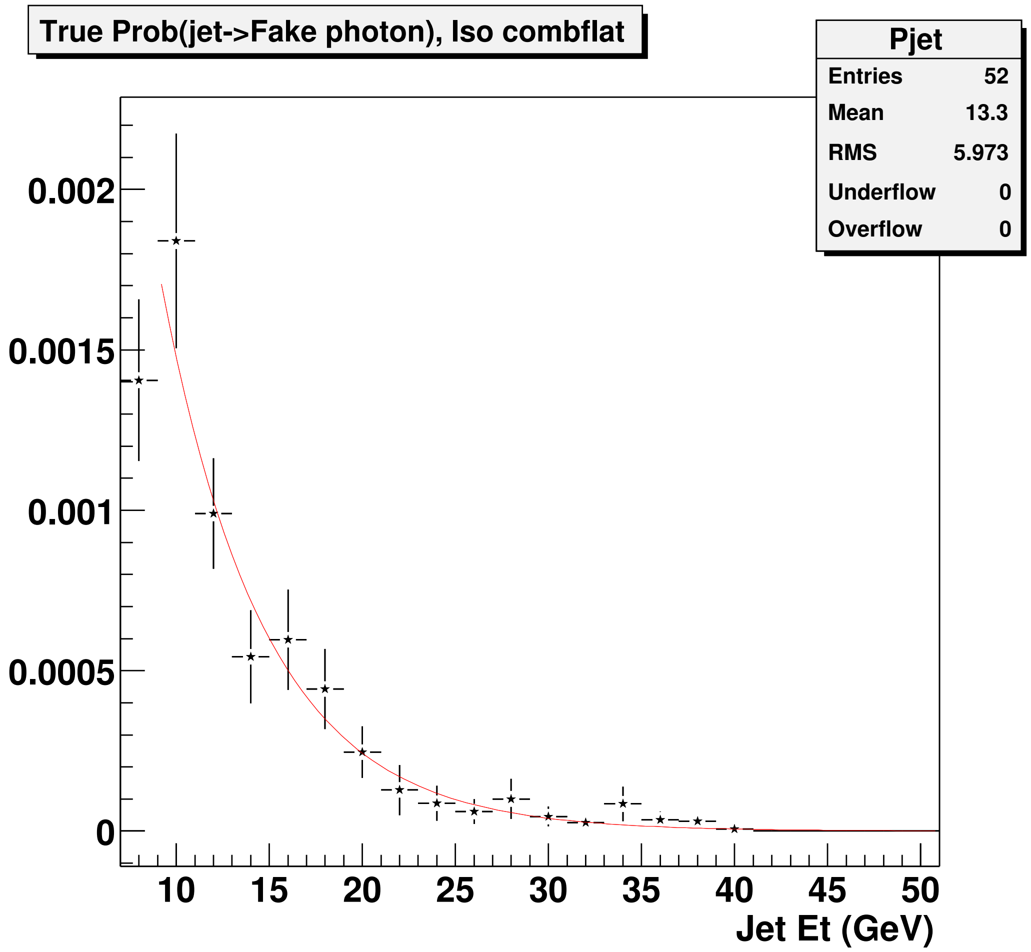
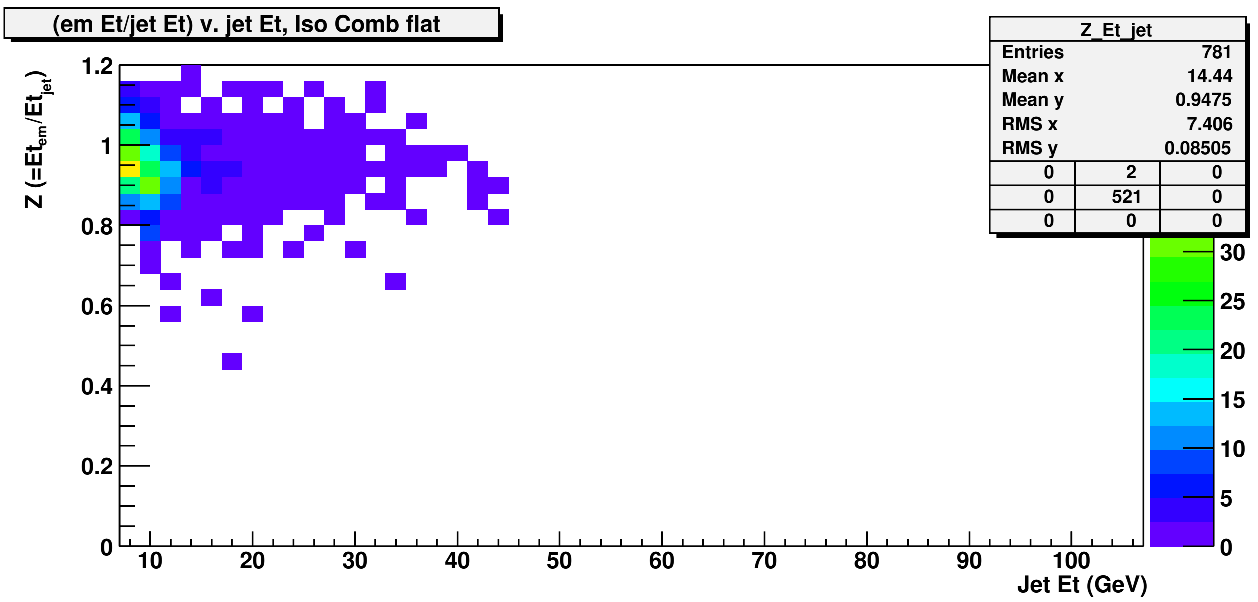


Figure 3: *The Central Result for Ptrue, for IsoCombflat*

The fit of the above plots is An exponential of the form: e^{-ax+b} where $a = -4.71 \pm 0.28, -0.180 \pm 0.017$

Q. What Et_t^{γ} do these jets correspond to?

Fragmentation



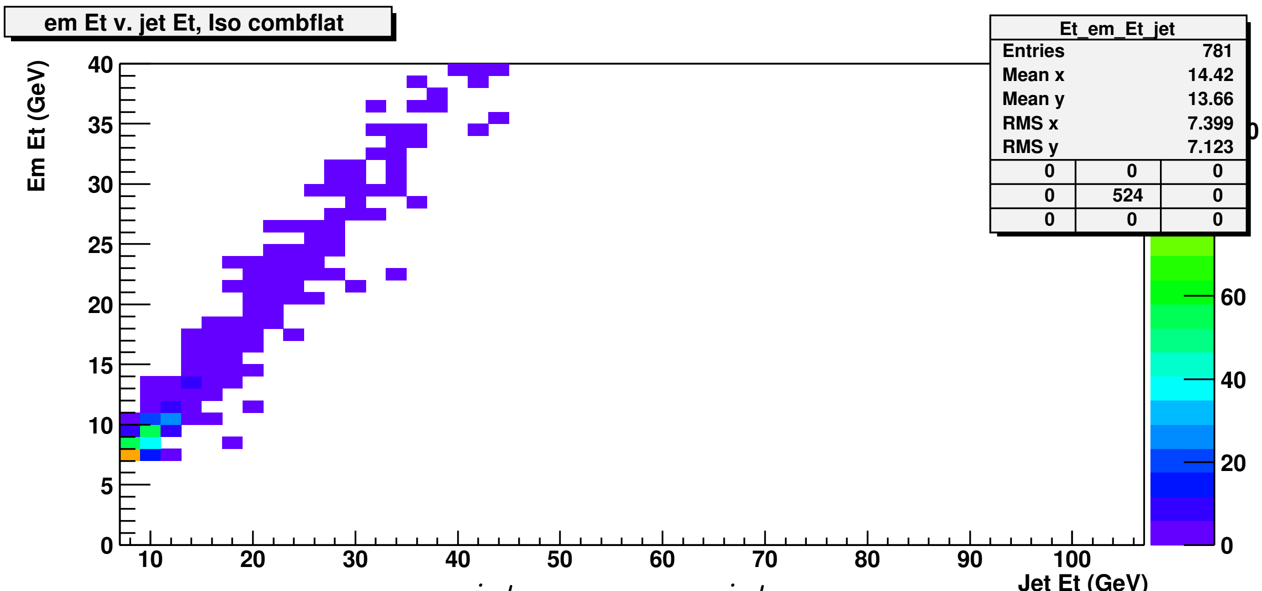


Figure 4: $Z = E_t^{\gamma}/E_t^{jet}$ versus E_t^{jet} (upper) and E_t^{γ} versus E_t^{jet} for jets which fulfill the photon cuts.

$$Z = \frac{Et^{jet}}{Et^{\gamma}}$$

a)

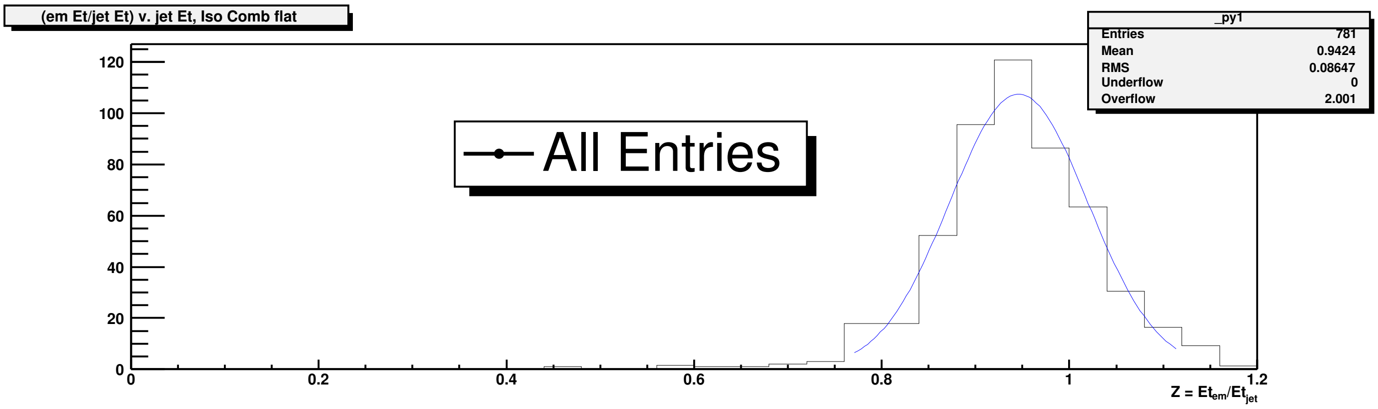


Figure 5: The distribution of $Z = E_t^{\gamma}/E_t^{jet}$ for all jets faking a photon.

$\bar{Z} = 0.946$ $\sigma Z = 0.0736$

a)

b)

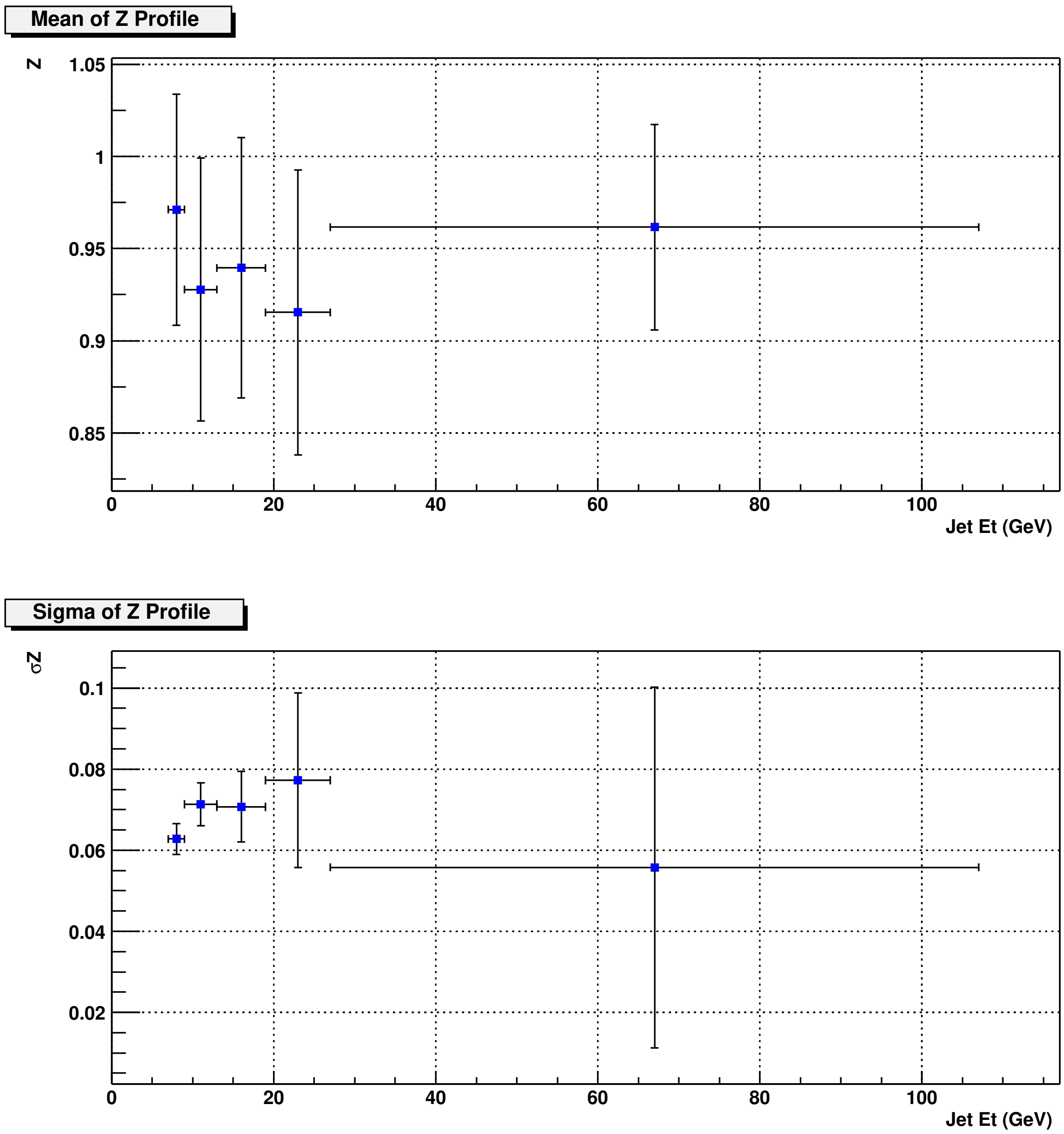


Figure 6: *Dependence of the Mean and Sigma of Z distribution on Jet Et.*

χ^2 cut

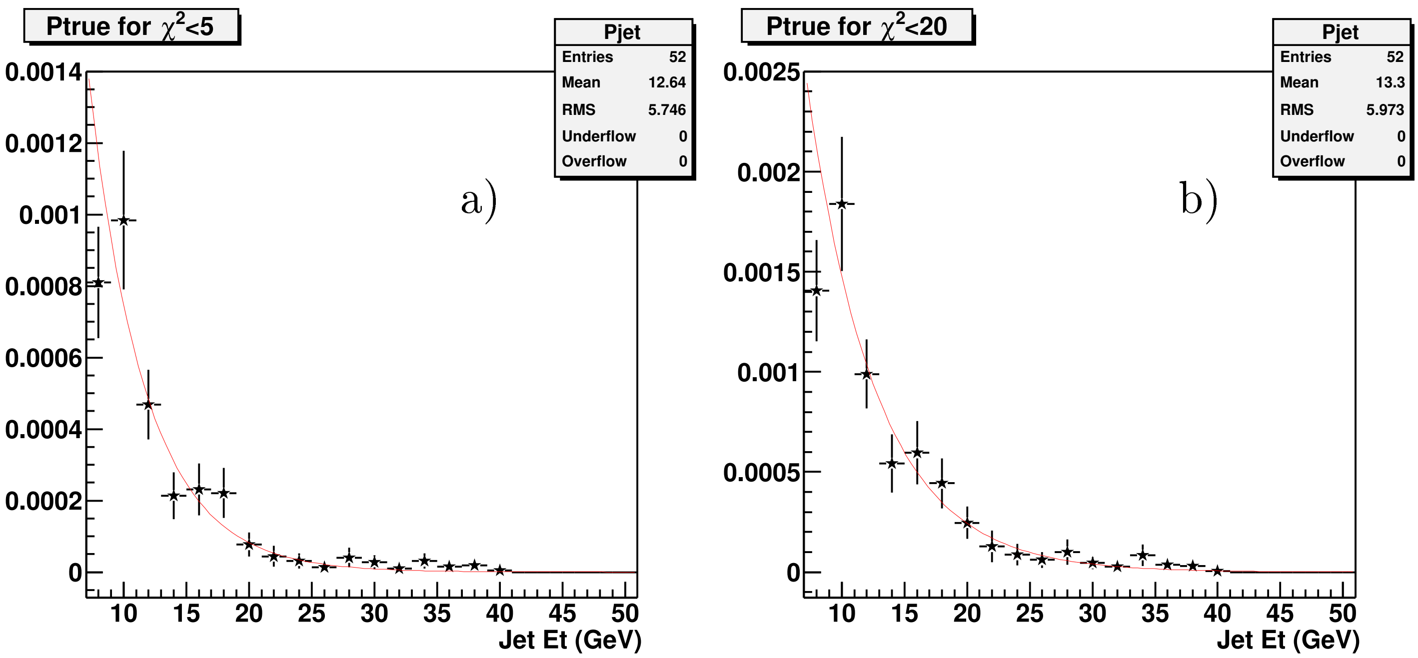


Figure 7: *Ptrue for a χ^2 <5 (left) and χ^2 <20 (right)*

E_T^γ Threshold check

Q. Is there any bias selecting photons with $E_T^\gamma > 7$ matched to jets with $E_T^{jet} > 7$?

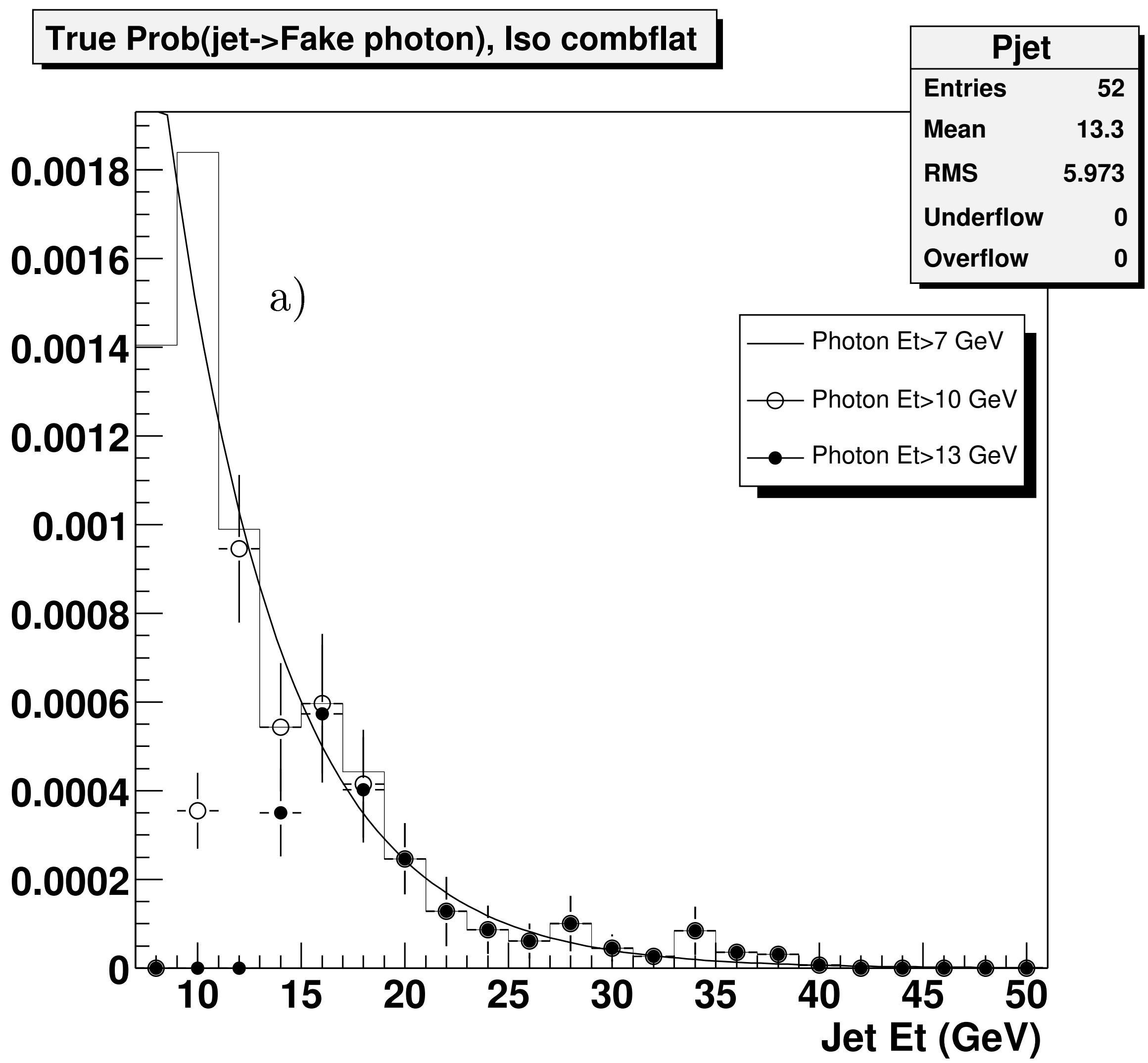


Figure 8: *Ptrue for different photon Thresholds*

Jet Cone 7 studies

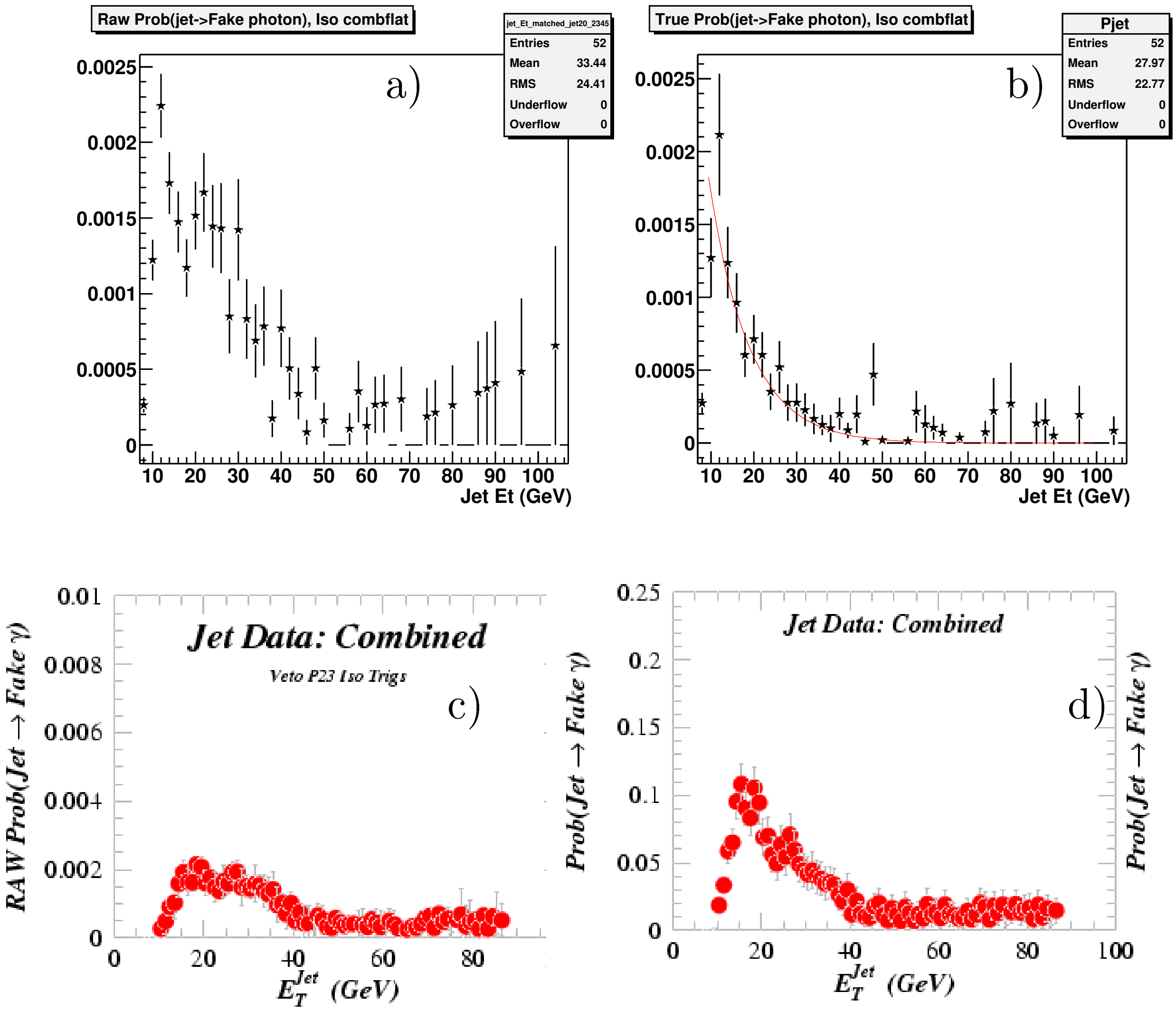


Figure 9: *Praw (left) and Ptrue (right) plots for run II(top) and run I(bottom) data and selection cuts.*

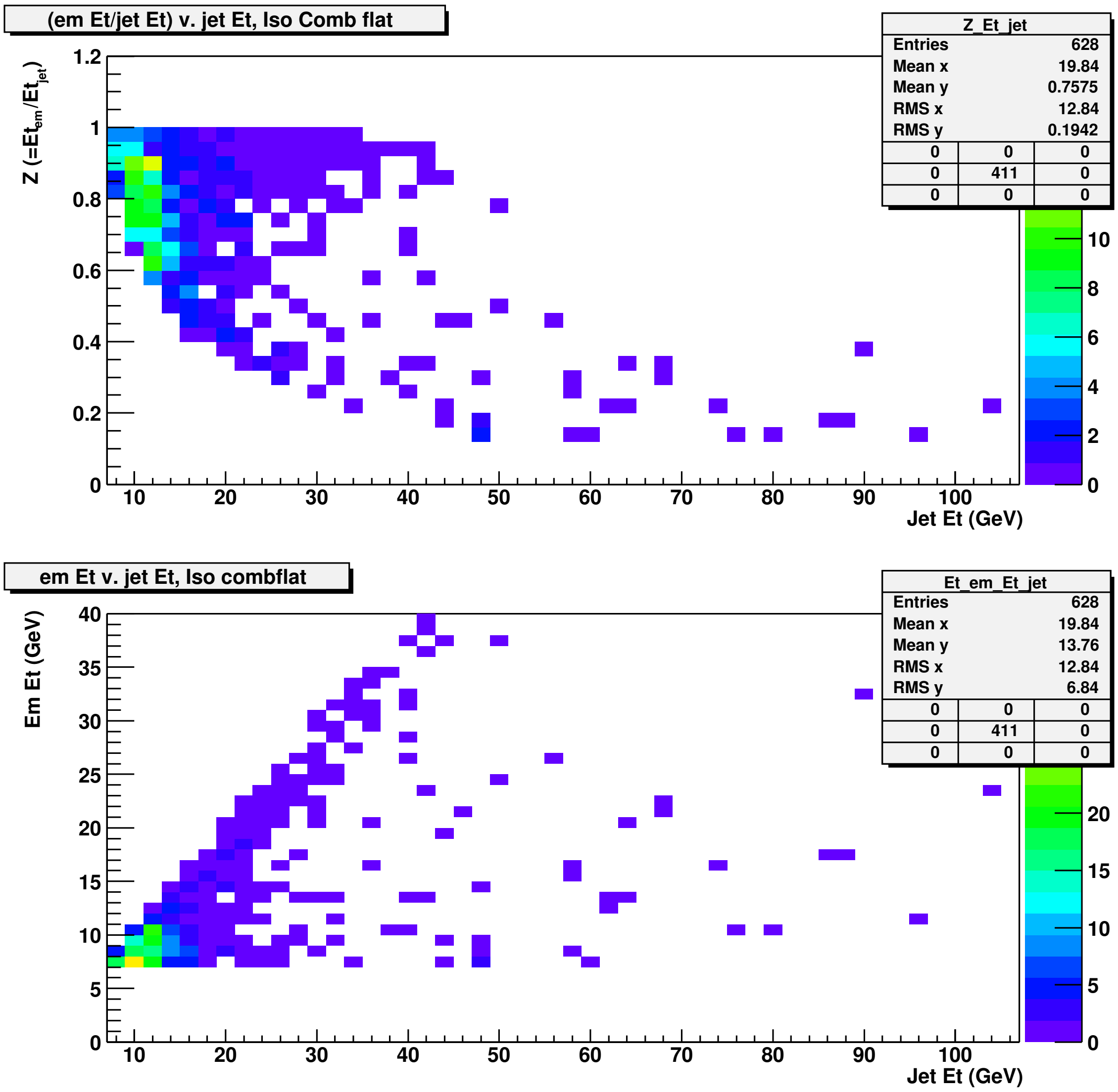


Figure 10: *Fragmentation plots for Cone 7 jets*

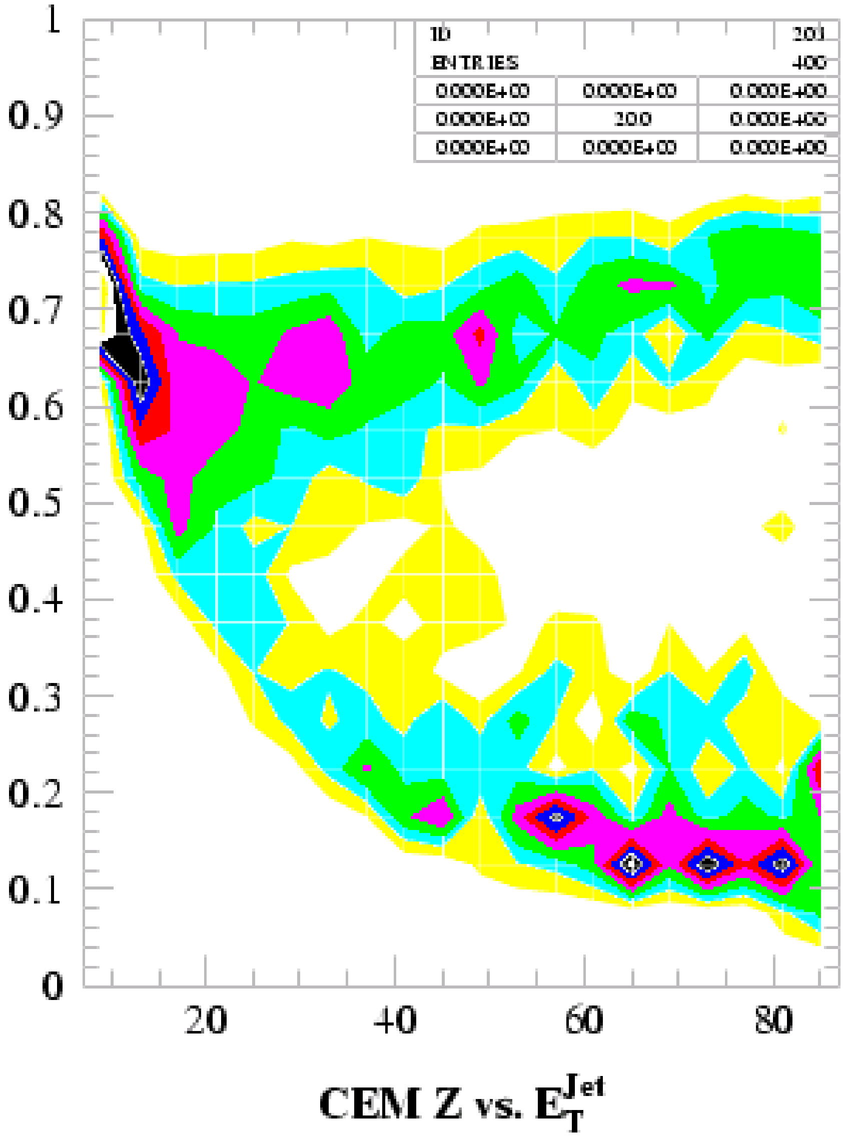


Figure 11: *Fragmentation plots for Cone 7 jets, Run I results*

Results

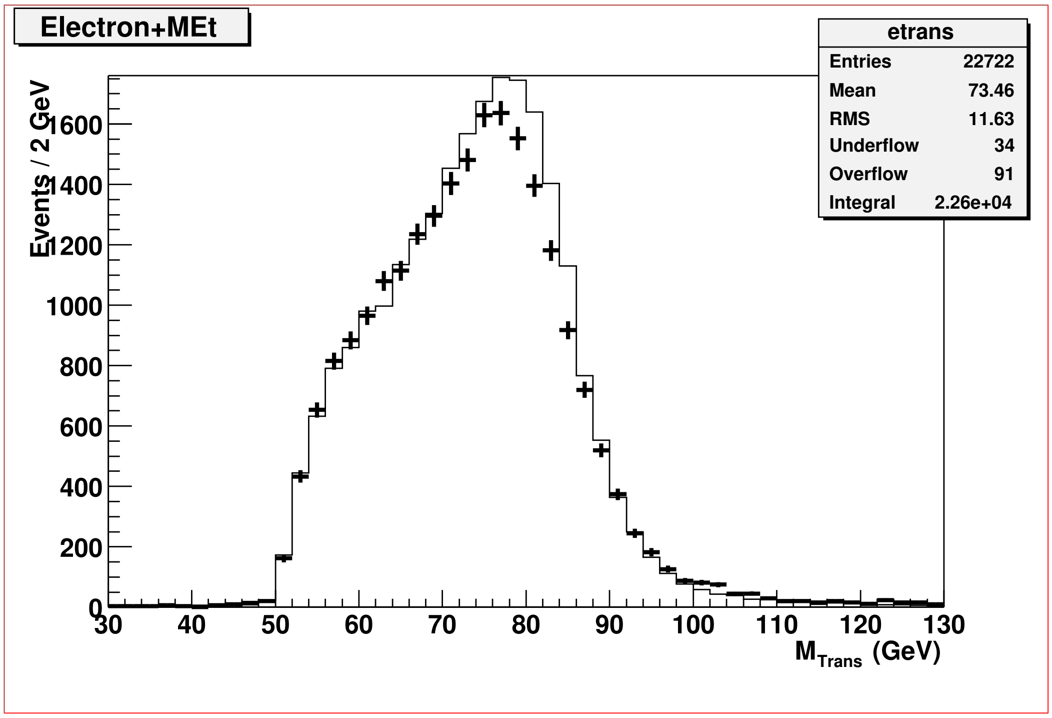


Figure 12: M_T *plot for inclusive* $W \to e\nu$ *sample*

Conclusions and Further Studies

- Have a complete measurement for the central region for jet triggered 20, 50, 70 and 100 data samples.
- produced a function that other people can use to predict QCD background to any photon event.
- further validation:
    1. MC studies
    2. Photon Triggered data sample
- further studies:
    1. plug result
    2. more specific measurement for $l\not{E}_t\gamma$ events

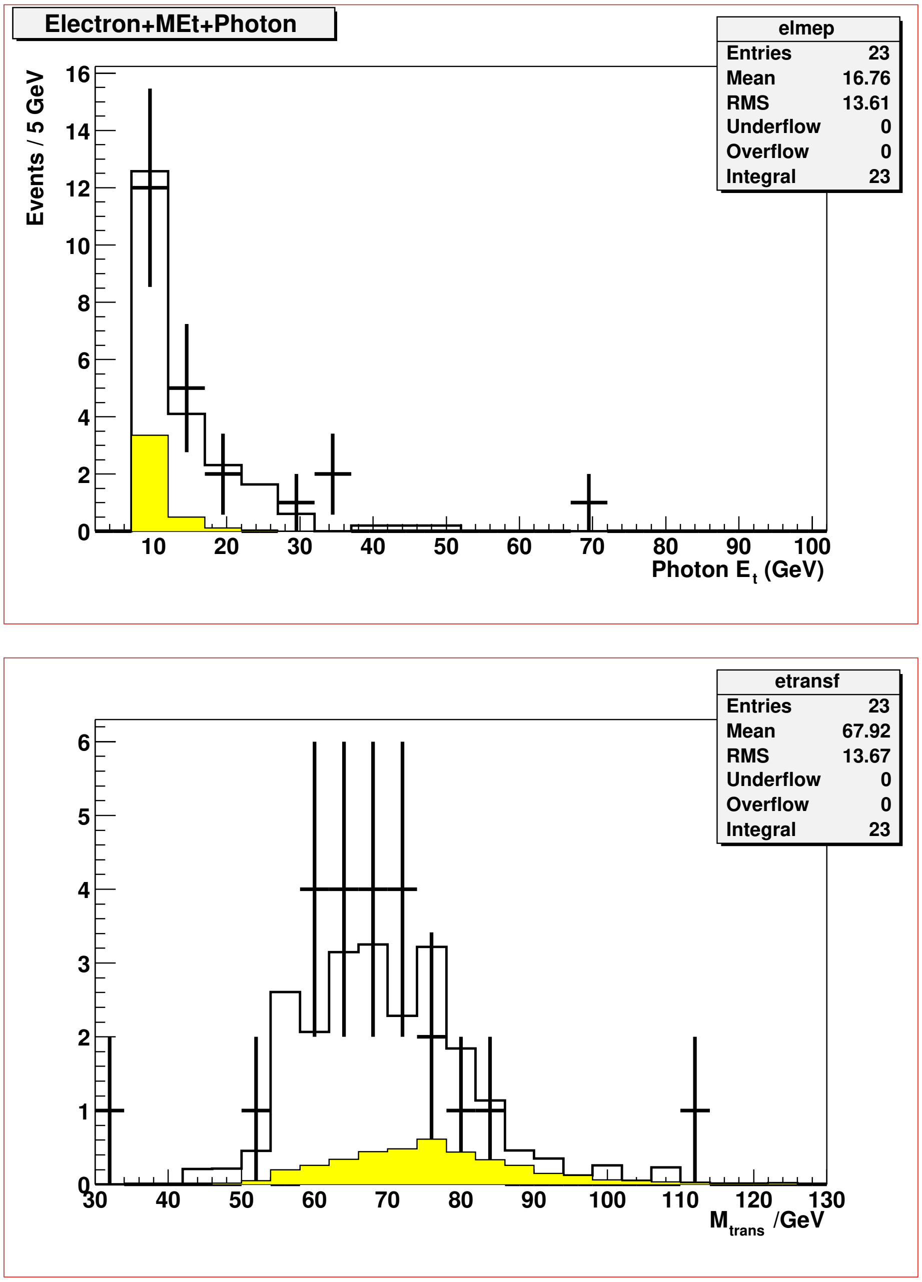


Figure 13: E_T^γ (top)and reconstructed WM_T (bottom) for $e\not{E}_t\gamma$ events with signal and QCD background MC predictions

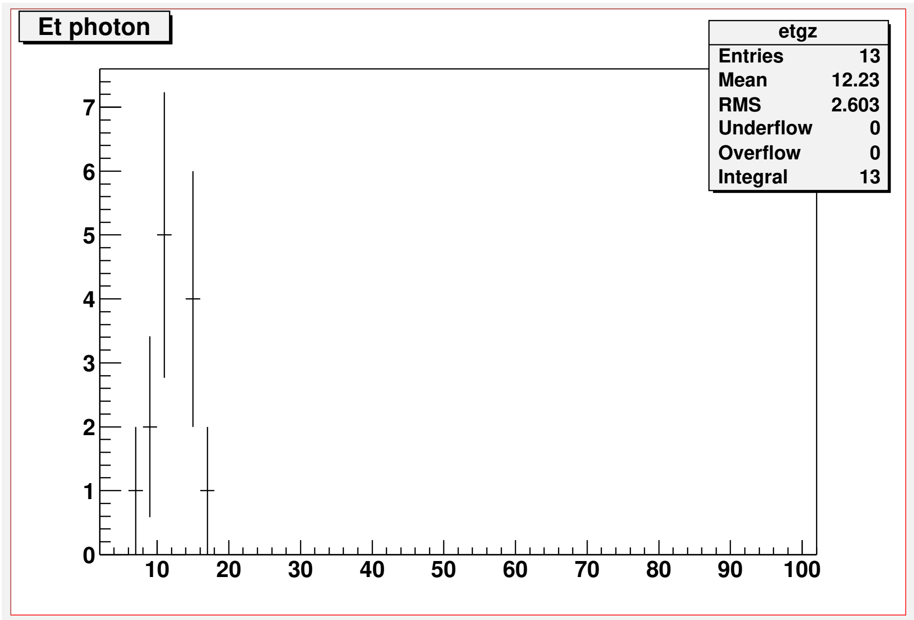


Figure 14: *E_T^γ distribution for selected $Z\gamma$ events*

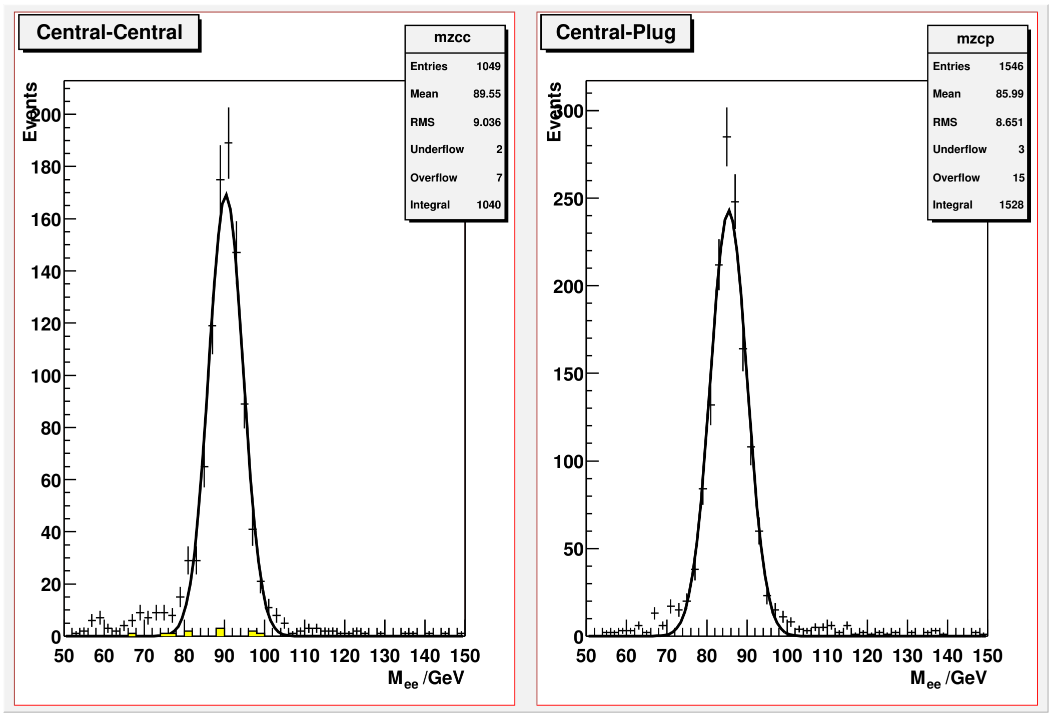


Figure 15: *Reconstructed M_{ee} for inclusive $Z \rightarrow ee$ sample*

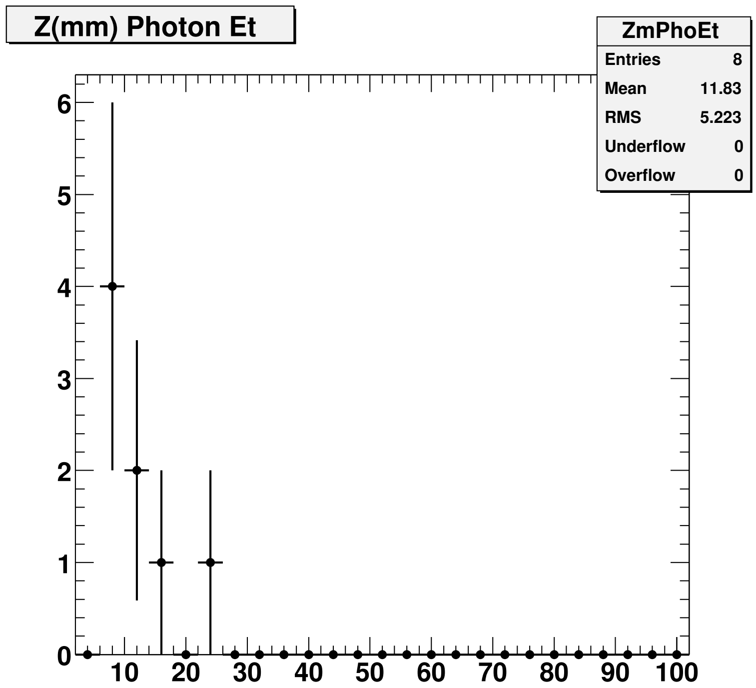


Figure 16: E_T^{γ} (top)and reconstructed WM_T (bottom) for $e\not{E}_t\gamma$ events with signal and QCD background MC predictions