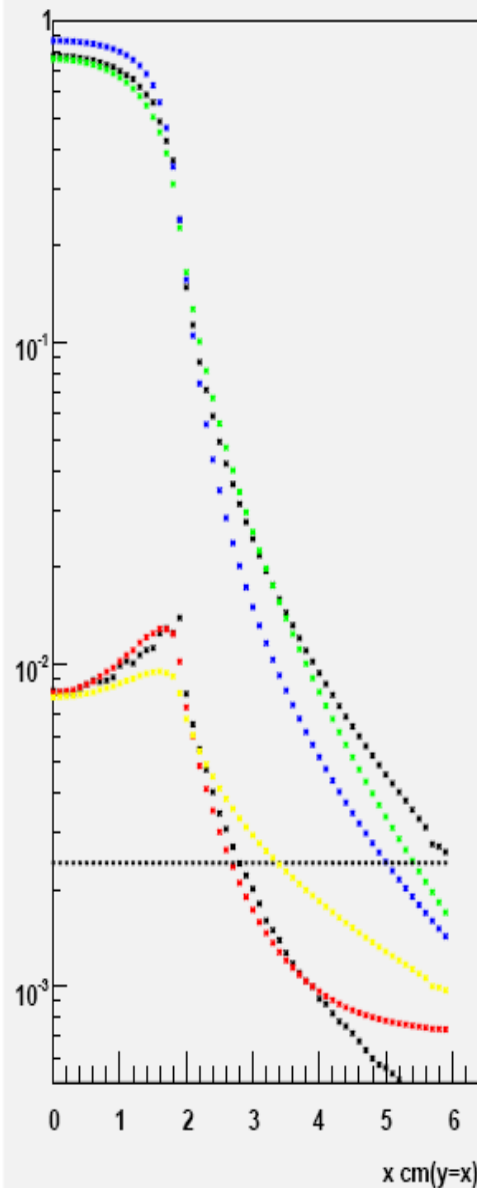
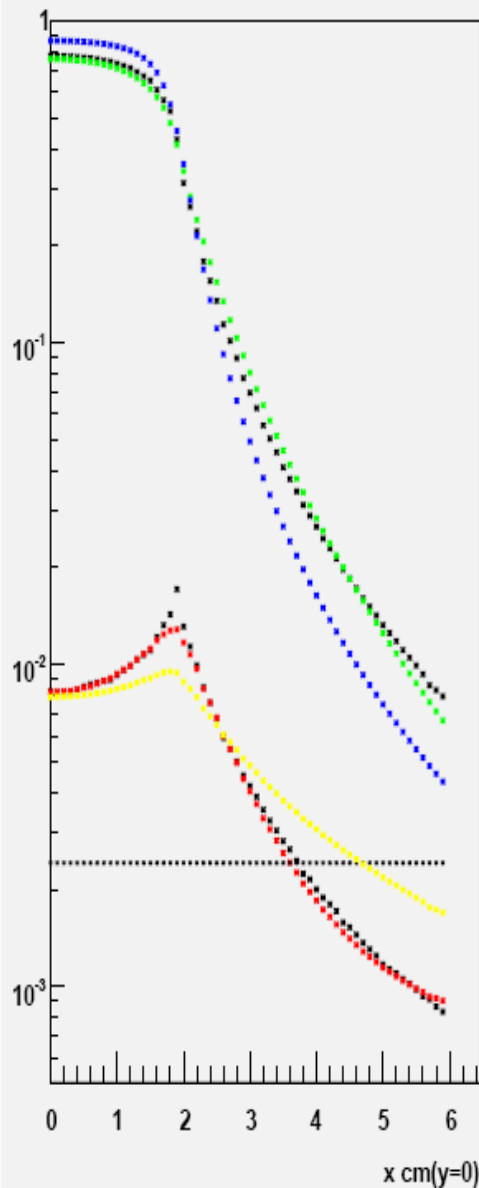


Shower Shape from FMS Real Data (Eta photons)

Energy=80.057396



Black upper: Shower shape from Geant4 analysis.

Green: default Shower Shape from reconstruction

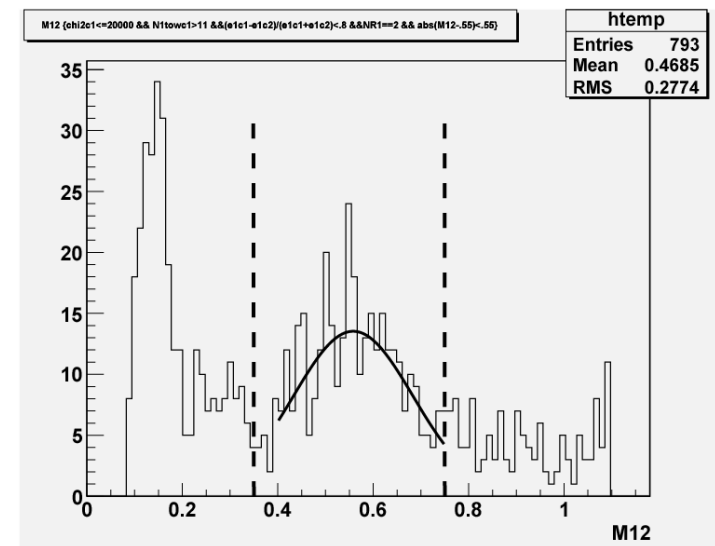
$a0[3]=\{.8,.3,-.1\};$

$b0[3]=\{.8,.2,7.6\};$

Blue Fit to FMS data (Eta photon)

$a1[3]=\{0.814, 0.882, -0.64\};$

$b1[3]=\{0.33, 0.318, 0.32\};$

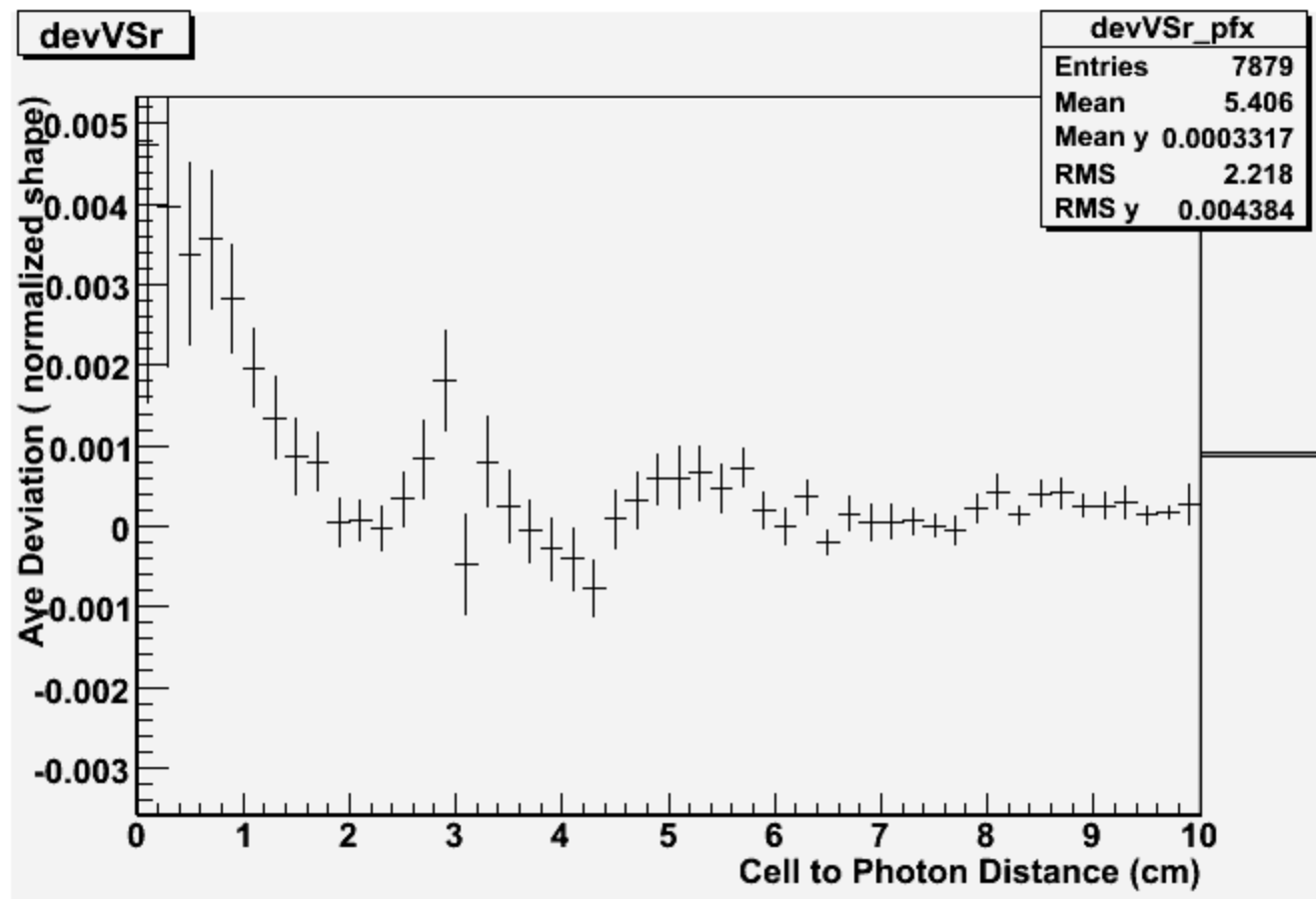


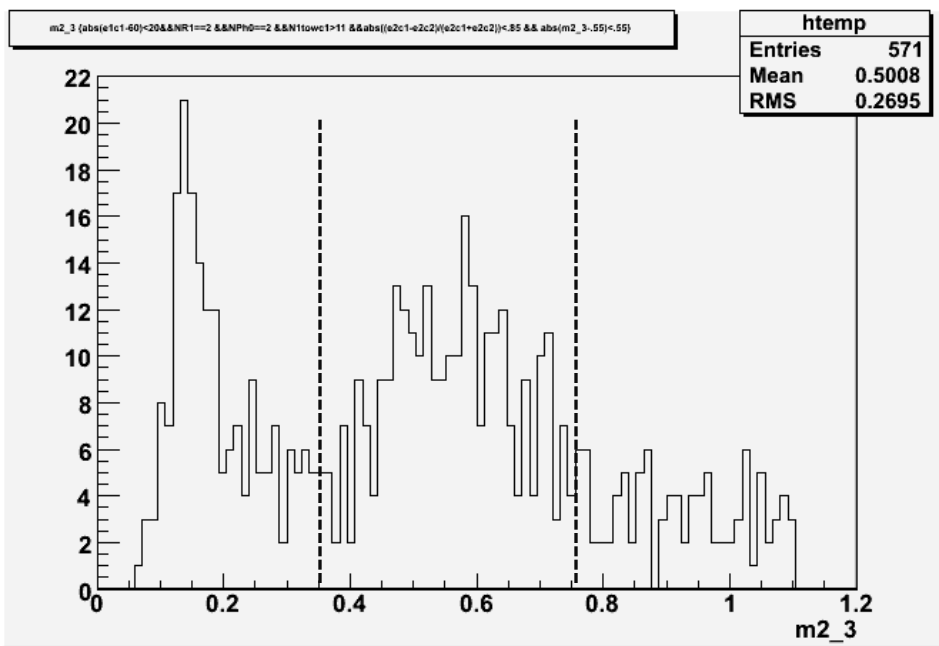
For “eta” single photon events, the average deviation as a function Of the distance between the cell and the photons is shown for

Blue Fit to FMS data (Eta photon)

$a1[3]=\{0.814, 0.882, -0.64\};$

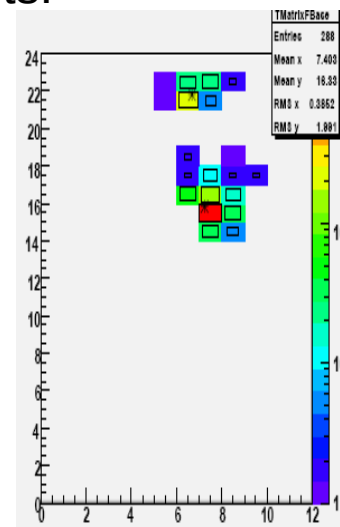
$b1[3]=\{0.33, 0.318, 0.32\};$



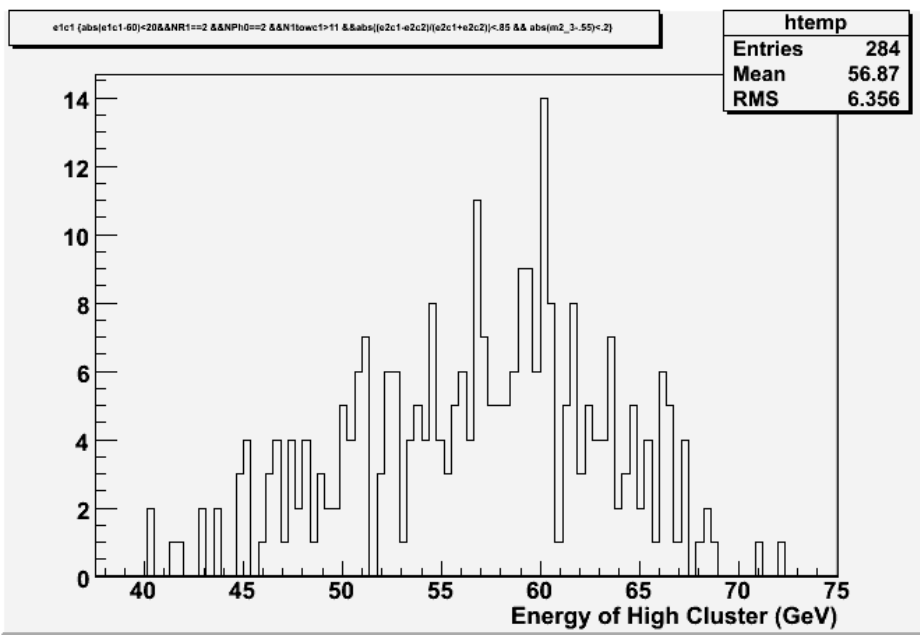


Data Set Definition Eta Single Photons (284 events)

- Two Cluster events.
- >11 Towers in high energy cluster
- $|Z| < 0.85$



- Eta mass cut as shown



I Have Made Two Special Versions of the 1 Cluster fitting Algorithm.

1. Forced reconstruction of Cluster into a single photon.
2. Forced reconstruction of Cluster into a pair of photons with mass = 0.135 GeV.

Each 1 cluster event is reconstructed with both models and the Chi2/DOF is determined from each algorithm.

For single photon fit

Number of DOF = number of towers-3

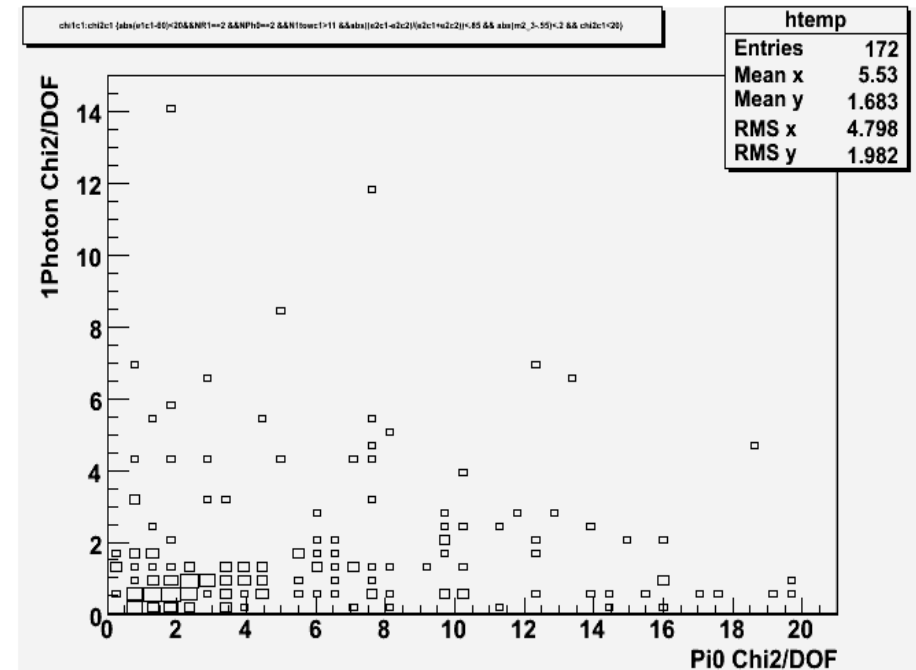
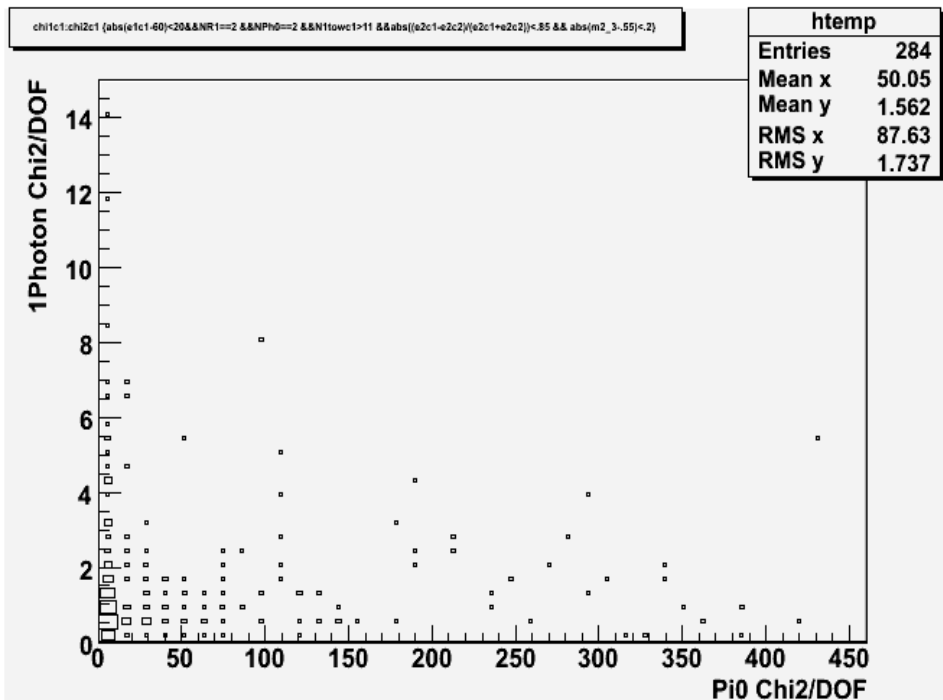
For two photon fit

Number of DOF = number of towers - 6

For selected “Clean” 1 Photon Events (255 Eta Events- High Energy Photon)

Each 1 photon cluster is reconstructed with

1. a forced 1 photon fit
2. a forced pi0 fit 2 photon fit ($m=.135$ GeV).
3. fraction of events $\text{Chi}(1 \text{ photon}) < 2 = 223/284=80\%$
4. fraction of events $\text{Chi}(1 \text{ photon}) < 1 = 142/284=50\%$
5. fraction of events $\text{Chi}(\text{pi0}) < 2 = 51/284 = 18\%$
6. fraction of events $\text{Chi}(\text{pi0}) < 1 = 19/284 = 6\%$



Now consider the two photon signal from original reconstruction

The following has

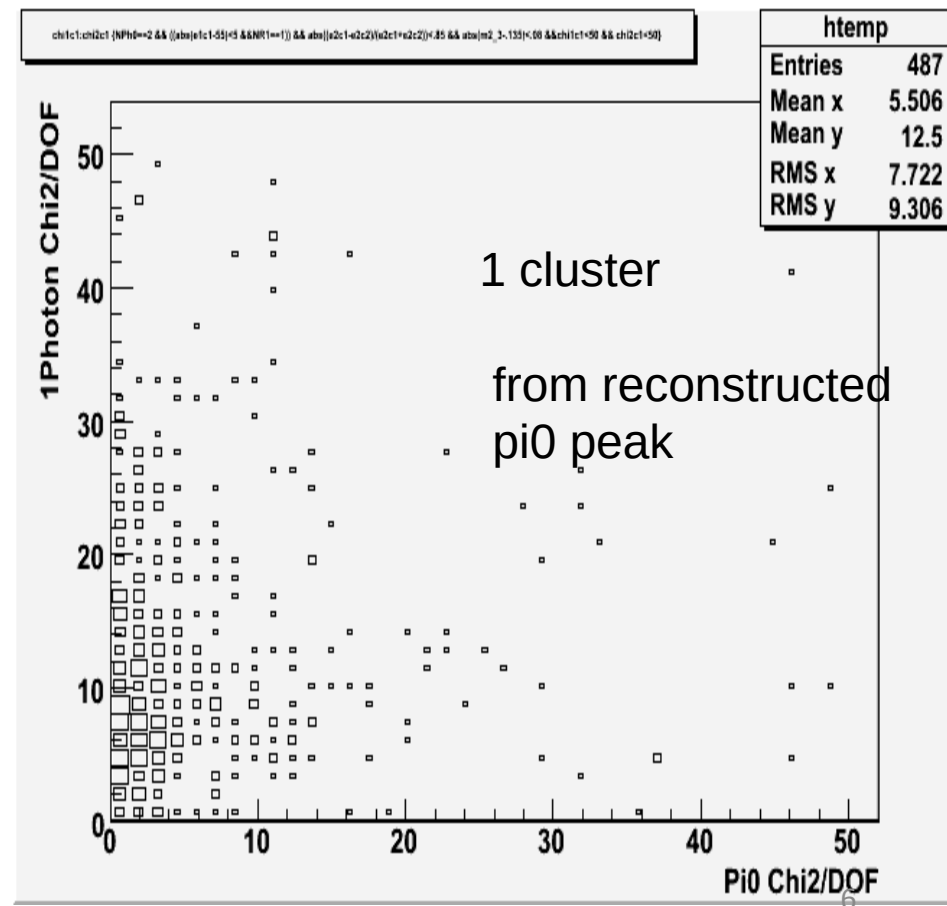
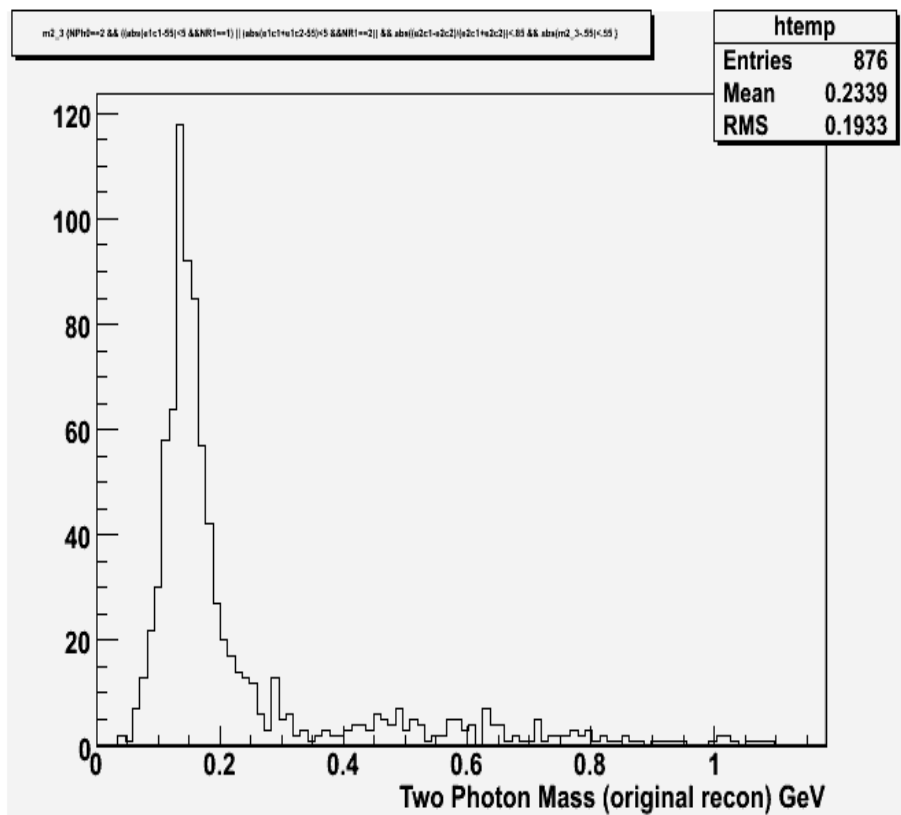
$50\text{GeV} < E < 60\text{GeV}$

$Z < .85$

~640 events in π^0 peak.

~550 1 cluster 1 events

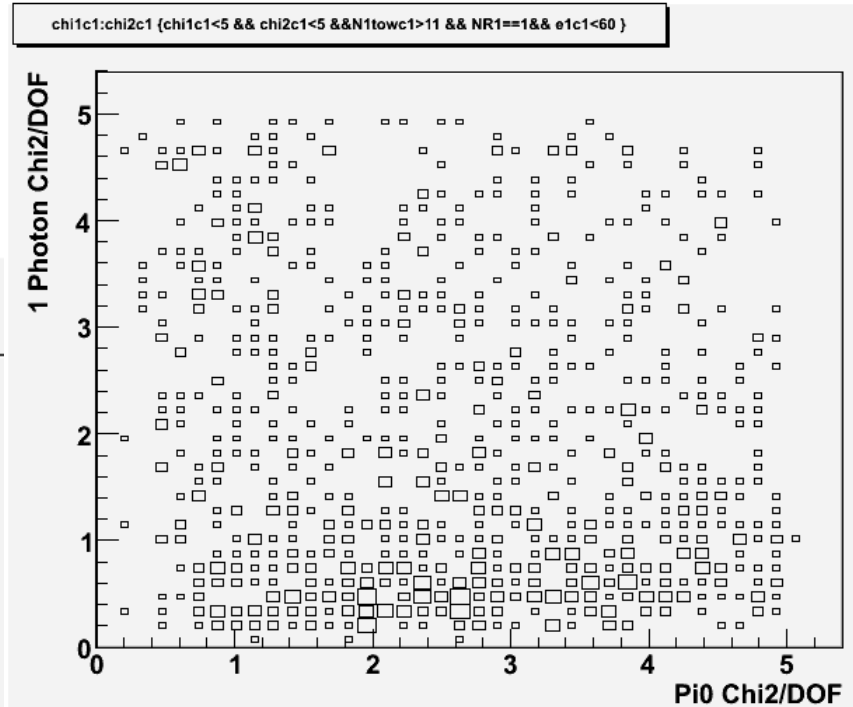
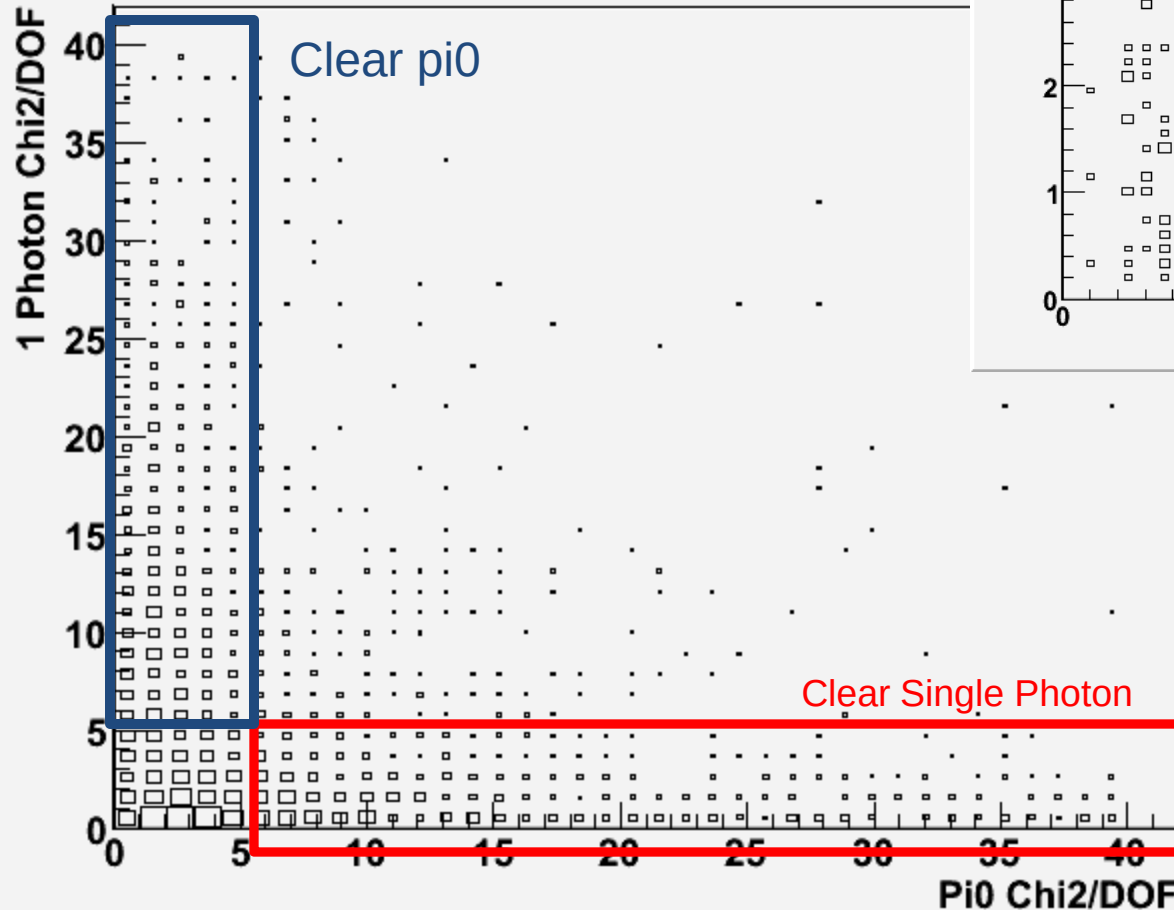
~90 2 cluster events.



50-60 GeV Single Cluster Events.

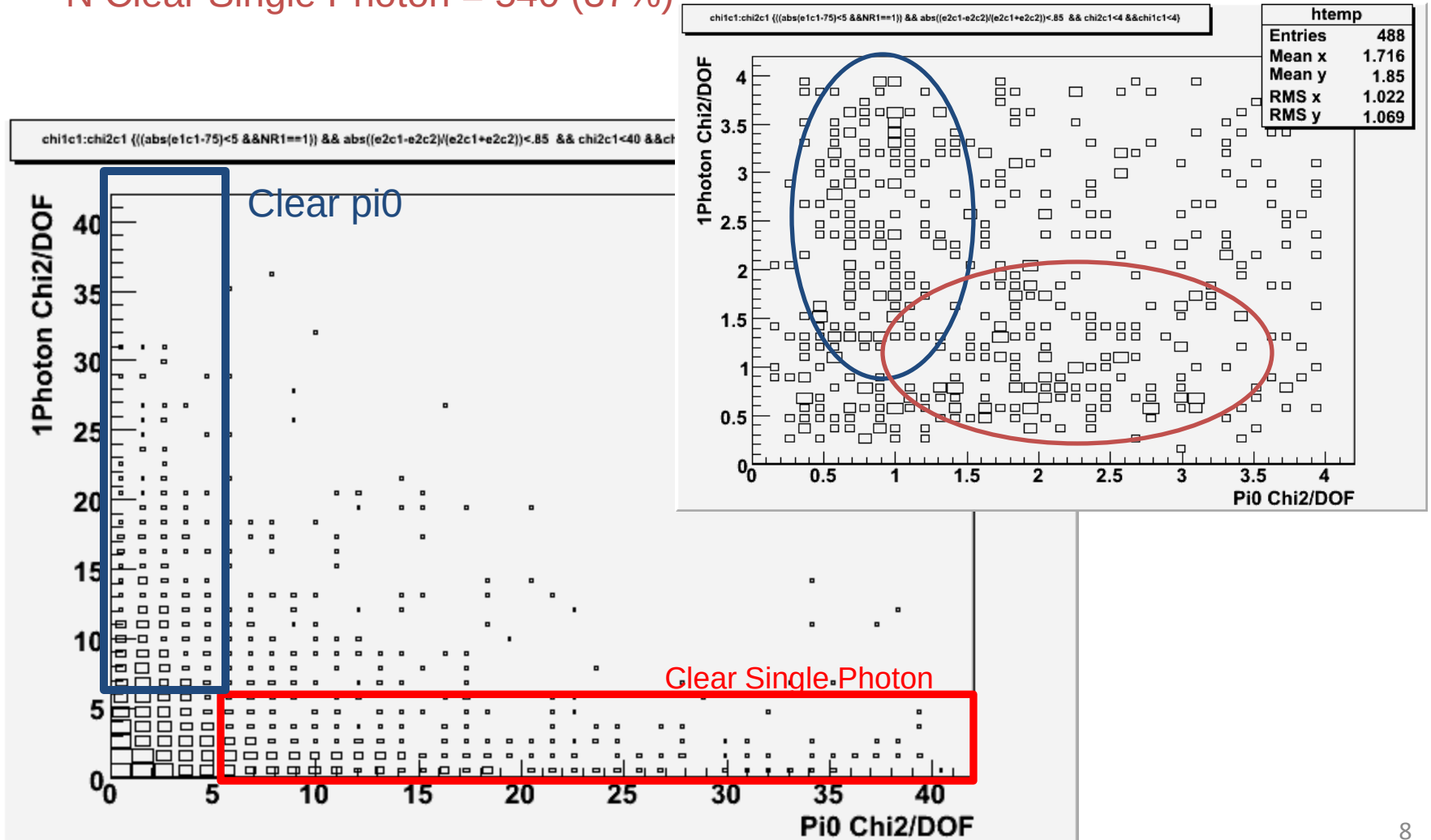
- $N = 3000$
- $N \text{ chi2}(\text{photon}) < 5 \ \&\& \ \text{chi2}(\text{pi0}) < 5 = 30\%$
- $N \text{ Clear pi0} = 30\%$
- $N \text{ Clear Single Photon} = 40\%$

`chi1c1:chi2c1 {chi1c1<40 && chi2c1<40 && N1towc1>11 && NR1==1&& e1c1<60 }`



70-80 GeV Single Cluster Events.

- $N = 1870$
- $N \text{ chi2}(\text{photon}) < 5 \ \&\& \ \text{chi2}(\text{pi0}) < 5 = 488 \ (33\%)$
- $N \text{ Clear pi0} = 460 \ (30\%)$
- $N \text{ Clear Single Photon} = 540 \ (37\%)$



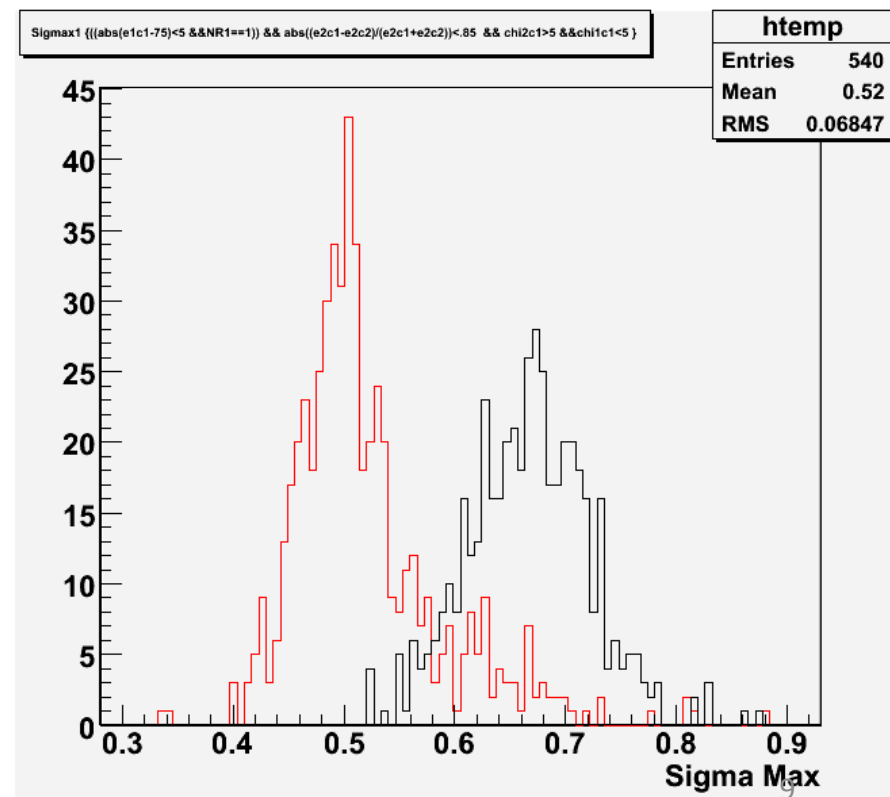
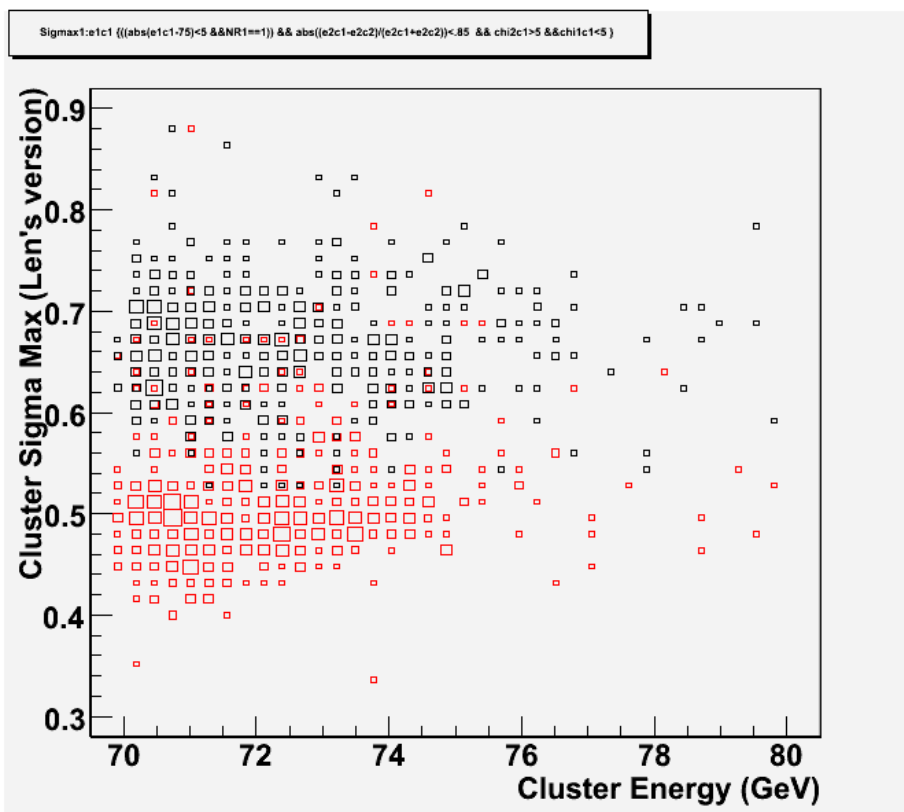
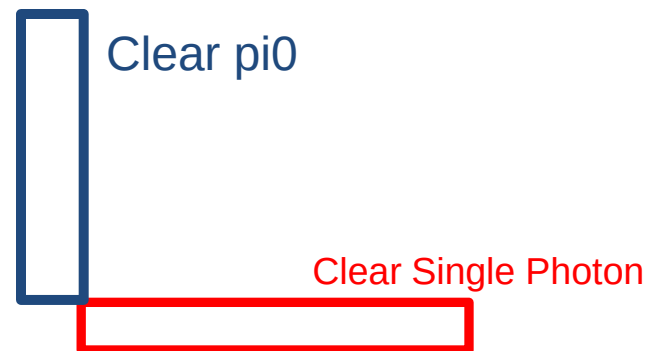
Sigma Max for the 67% of events that have well separated pi0 and single photon.

Using the “one cluster” events (70 to 80 GeV) from the previous page:
We now look at “Len’s Sigma Max” variable that is used to categorize Clusters.

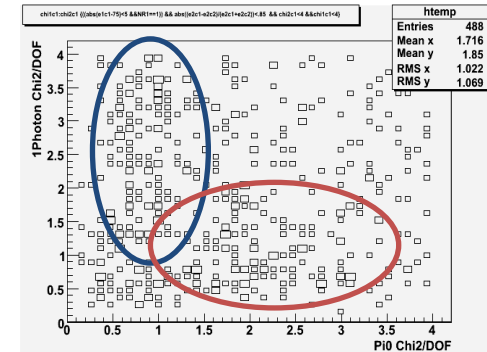
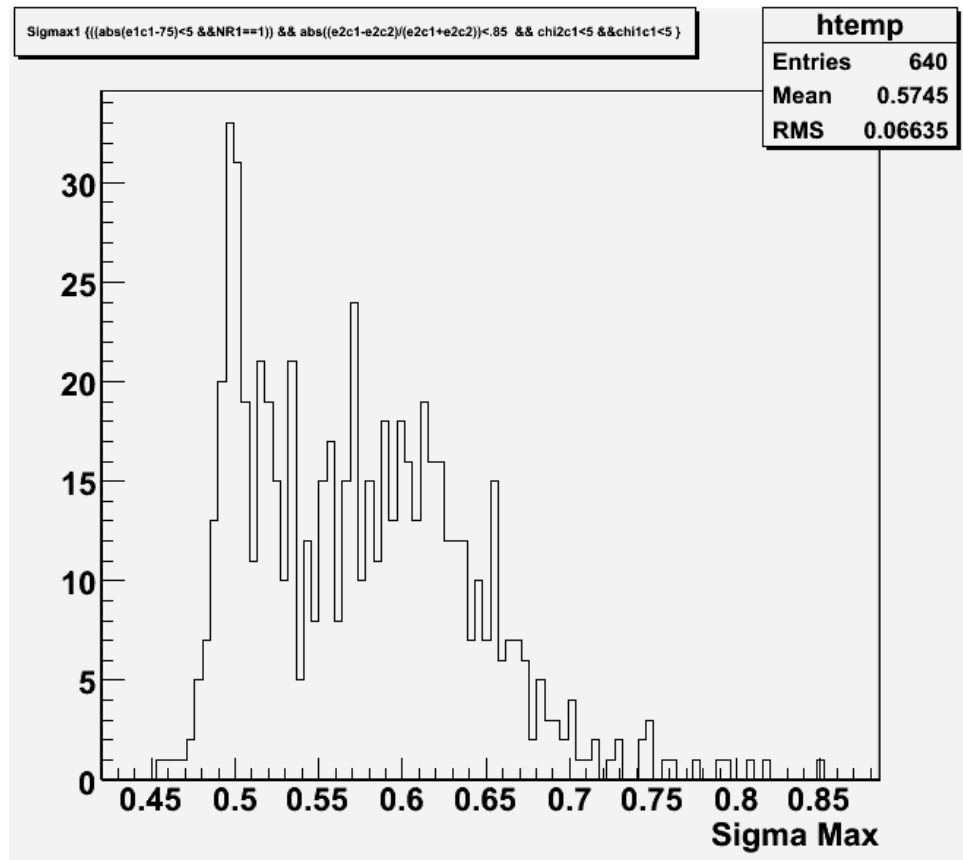
In the figures below, the “Sigma Max” distributions are shown.

The red represents events with $\chi^2(\pi) > 5$ && $\chi^2(\gamma) < 5$.

The black represents events with $\chi^2(\pi) < 5$ && $\chi^2(\gamma) > 5$.



Sigma Max for the 33% of events that good chi2 for both pi0 and single photon.



Conclusion from Data Analysis:

For the South FMS Run 9 Data

Eta's are identified with single photon energy 45-65 GeV

For these tagged isolated single photon events

1. The shower shape is narrower than that of MC (slide 1-slide 2)
2. 80% of single photons have $\chi^2(\text{single photon}) < 2$ ($\sim 100\% < 5$)
3. 80% of single photons have $\chi^2(\pi^0) > 2$ (slide 4-5)

Single cluster π^0 's are identified in energy range 50-60 GeV

1. Most of the π^0 's have $\chi^2(\pi^0) < 5$ and $\chi^2(\text{gamma}) > 5$ (slide 6)

For all single cluster events in energy range (50-60) GeV

1. Similar numbers of single photons and π^0 clusters.
2. For 70% of the cluster topologies, the separation between single photon and π^0 is very clear. (slide 7)

For all single cluster events in energy range (70-80) GeV

1. Similar numbers of single photons and π^0 clusters.
2. For 67% of clusters topologies, the separation between single photon and π^0 is very clear. (slide 8)
3. For well separated 67% of clusters, Len's log weighted Sigma Max variable is will separated also. (slide 9)
4. For remaining 33% of clusters, significant separation still appears in sigma max or χ^2 plots. (slide 8 and 10).