Hi Jay,

The FMS/FPD code has used a shower shape made up of three terms

$$F[x,y] = f_{a_1,b_1}[x,y] + f_{a_2,b_2}[x,y] + f_{a_3,b_2}[x,y]$$

where

$$f_{a,b}[x,y] = \frac{a}{2\pi b^2\left(1+\frac{x^2}{b^2}+\frac{y^2}{b^2}\right)^{3/2}}$$

Thus the shape is defined by a set of 6 numbers $\{a_1, a_2, a_3, b_1, b_2, b_3\}$.

For a normalized distribution

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} F[x,y]dx\,dy = 1$$

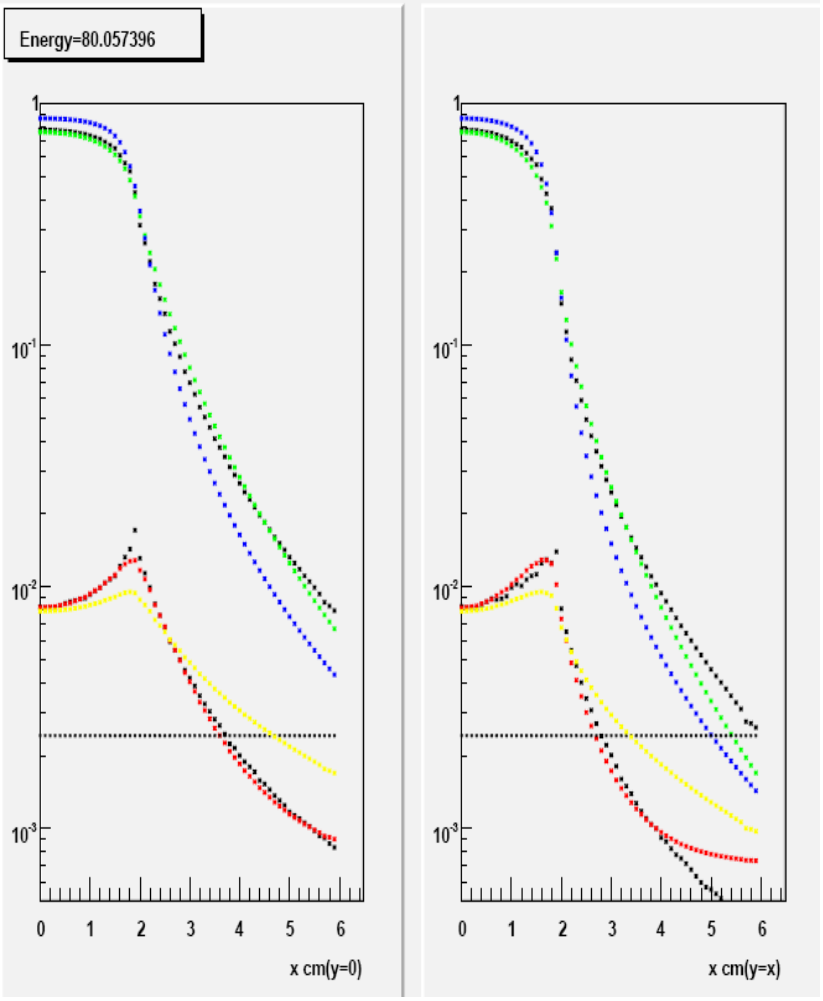
it is required that the weighting factors $a_1 + a_2 + a_3 = 1$, while b_i sets the width of the "I" term.

For square FPD/FMS cells, the definite integral over a square has a simple analytic form but this is not so simple for circles.

The single photon fitting for FPD/FMS is based on a Minuit fit where the input is the set of energies in a cluster of towers. The 3 parameters for a single photon fit are photon position (x,y) and photon energy (E). Parameters are varied to minimize the chi-square of the cell energy observed vs. that predicted by the shower shape.

What follows is a Geant 4 analysis (black) compared to two parameterizations of the shower shape, one from the original Russion code (green) and another based on analysis of Eta events from Run9 (blue). The x axis is in cm and the square cell width is 3.8 cm.

Shower Shape from FMS Real Data (Eta photons)



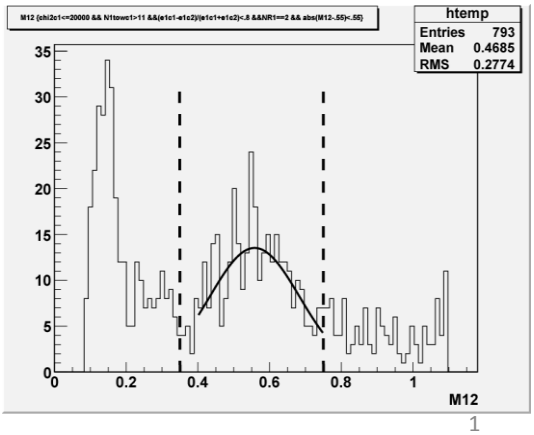
Black upper: Shower shape from Geant4 analysis.

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 Run 11 data, we have been using the following parameterization for the shape,

float a1[3]={1.070804, 0.167773, -0.238578}; //top frac 85

float b1[3]={0.535845, 0.850233, 2.382637};

We now have a very large Eta sample from Run 11 that we will use to really nail down this shape as we also improve calibration.

As an example, below is a two photon event that is very likely an Eta from Run 11 of energy about 90 GeV. The energies per cell are printed in GeV. Fitted photon positions are shown as stars.