Single Photon Tracking In the Scint/W Calorimeter

Jack Gill
University of Colorado

The goal

- Given a photonic cluster, reconstruct the track of the photon that produced it
- Calculate the distance of closest approach b/t the recon track and the origin of the photon

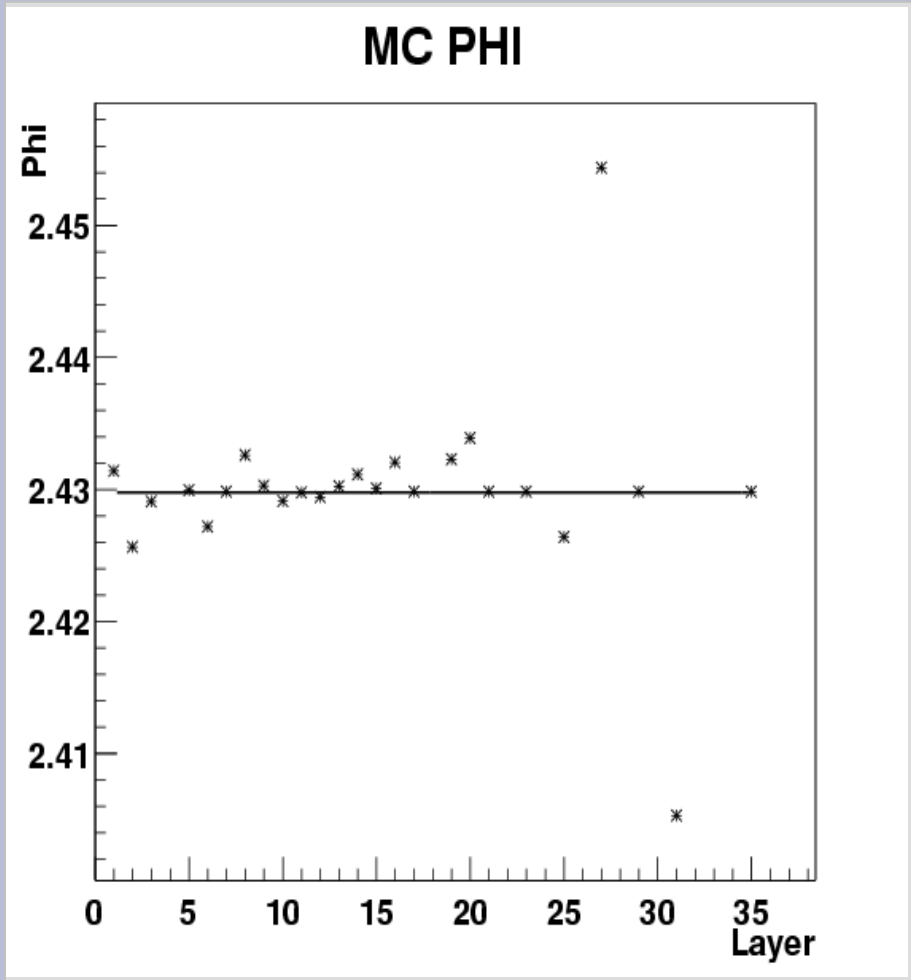
Motivation

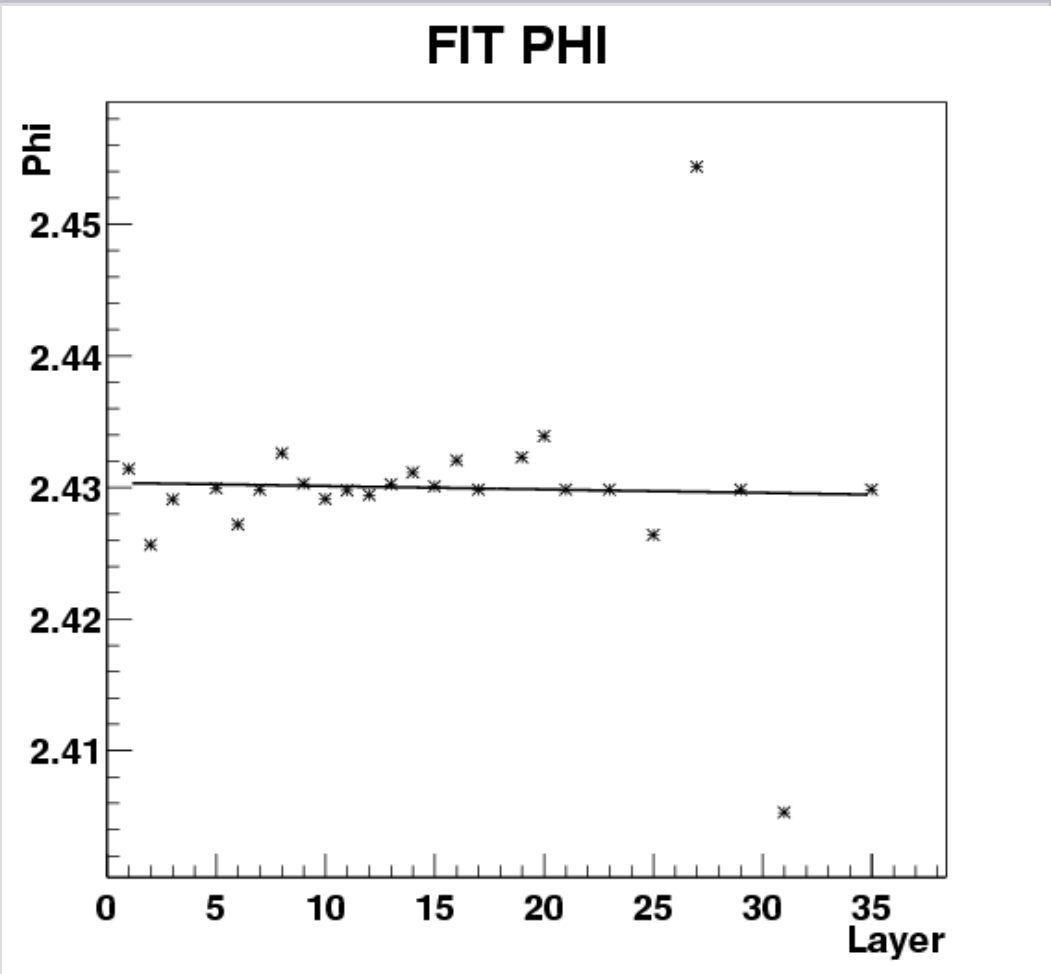
- Better FastMC photon spatial resolution -> better W and Z mass peaks
- Reconstructing the point of origin of a $\pi 0$
- Ks -> $\pi 0$ $\pi 0$ (31.05%), $c\tau = 2.68$ cm
- Λ -> n $\pi 0$ (35.8%), $c\tau = 7.89$ cm
- Source: 2004 PDG Particle Physics Booklet

Previous Methodology (FastMC)

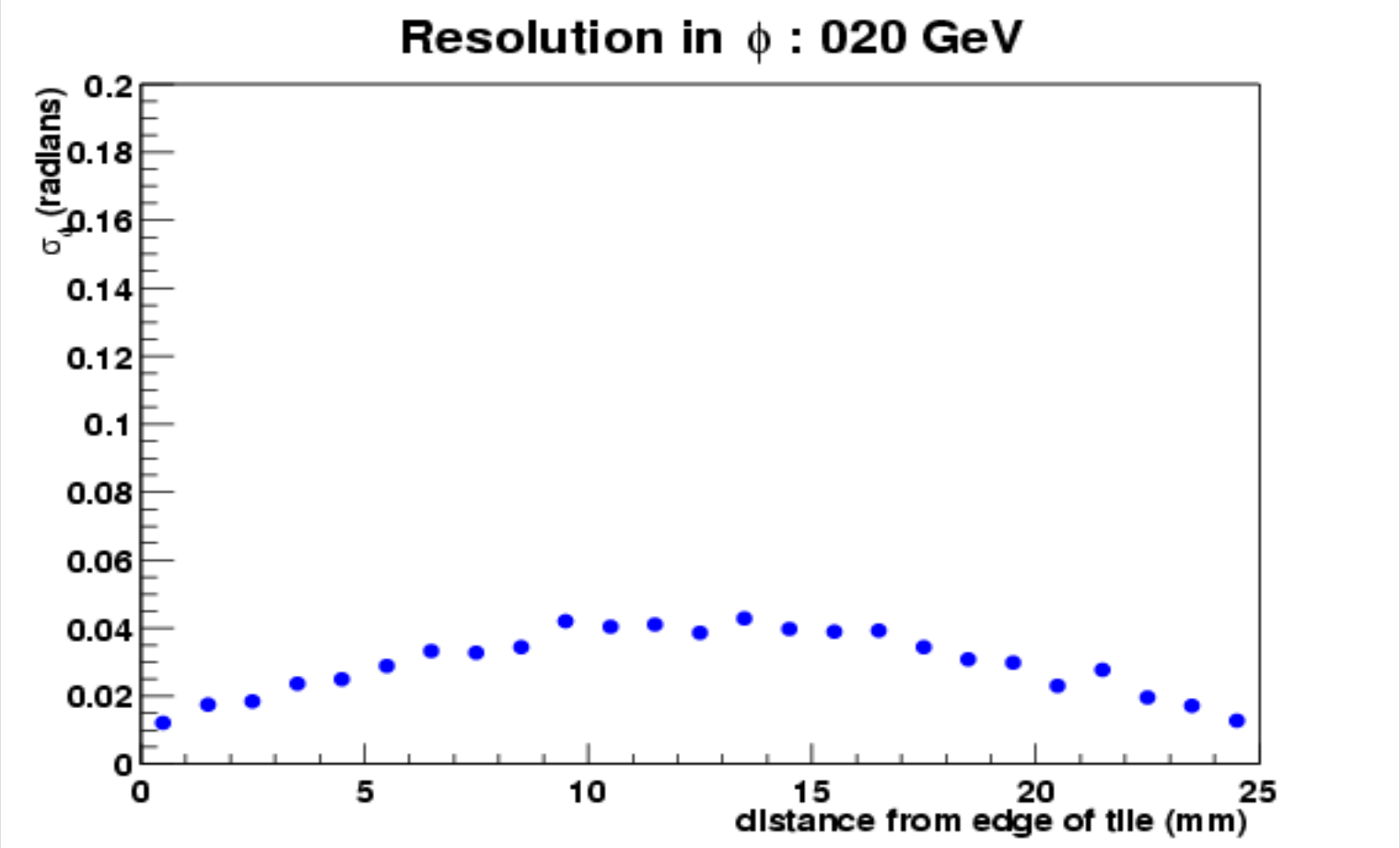
- Calculate the energy centroid per layer
- Fit in theta and phi to the energy centroids, correcting for a bias towards the center of the tile
- Fits are very sensitive to outliers

Fits


MC PHI
Phi
2.45
2.44
2.43
2.42
2.41
0
5
10
15
20
25
30
35
Layer


FIT PHI
Phi
2.45
2.44
2.43
2.42
2.41
0
5
10
15
20
25
30
35
Layer

Resolution

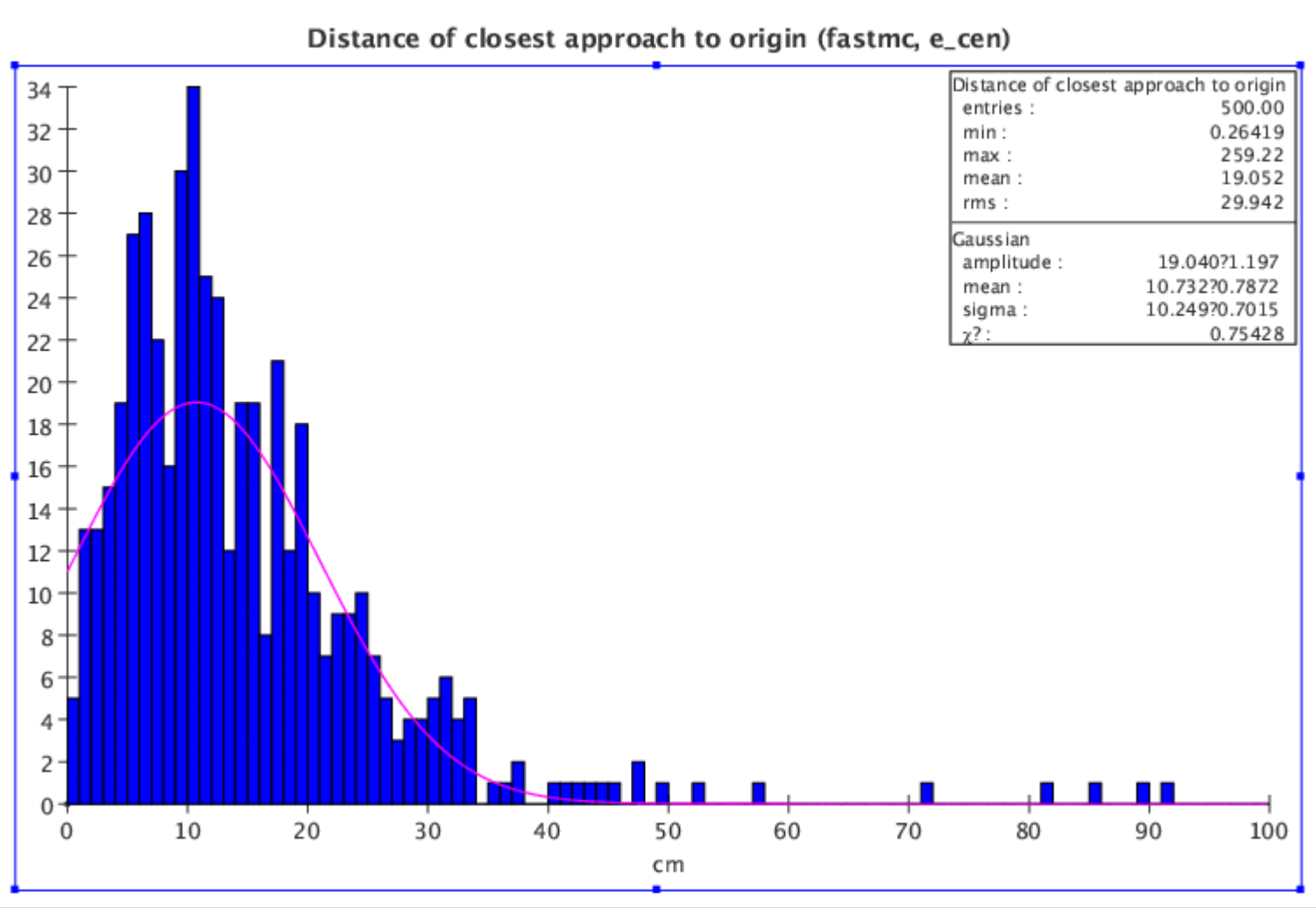


Attribution:

Joseph Poulx

σ ~= .04 rads ~= 8 cm

Results of Old Methodology

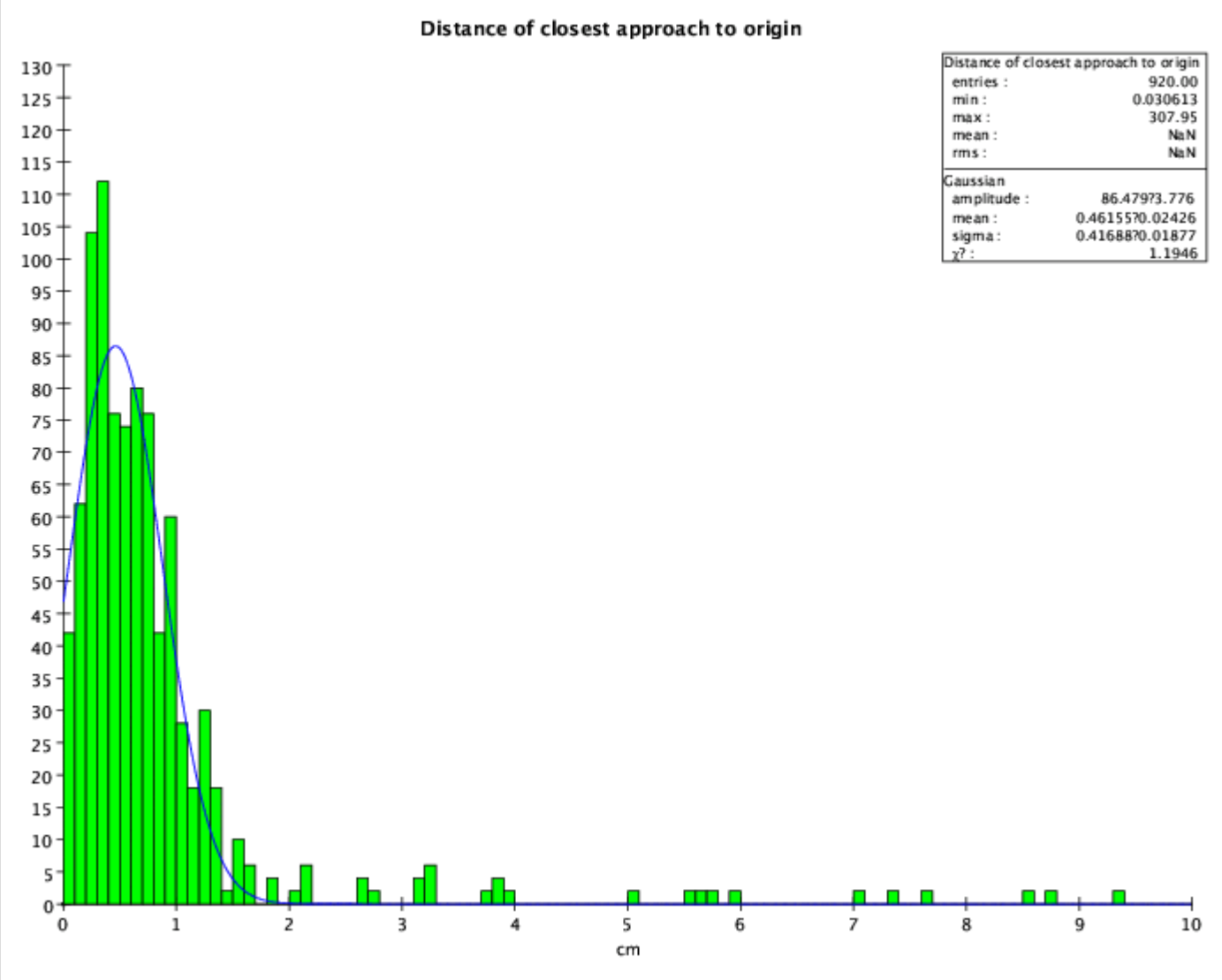


$\sigma \sim= 10$ cm

New Methodology

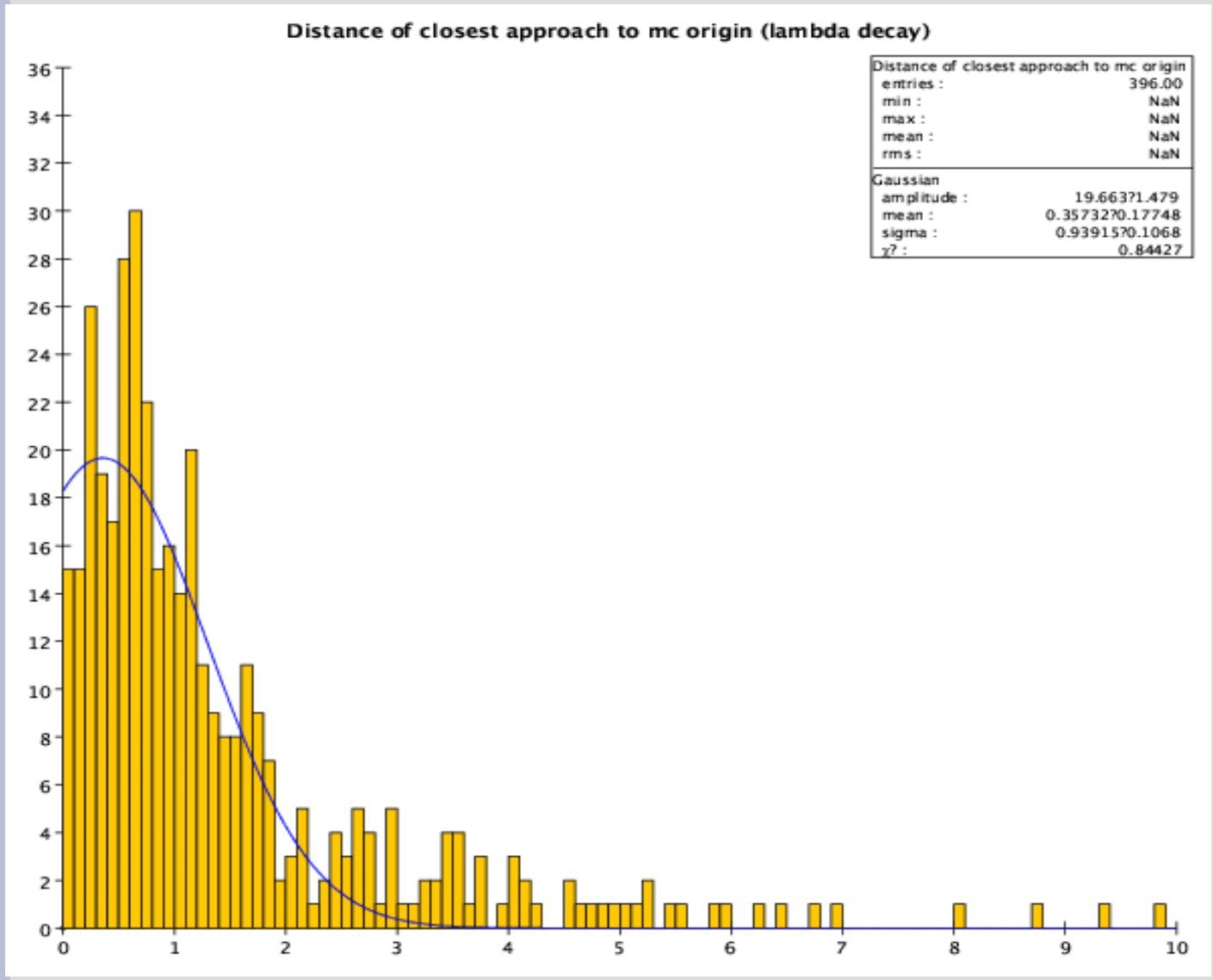
- Use perfect clustering algorithm (modified ClusterCheater)
- Find the most energetic hit in each layer
- Plot the theta and phi values of each hit as a function of layer, and do a least squares fit. Do this for the even and odd layers separately, and average the result

Tentative Results of New Methodology



$\sigma = .04$ cm

New Methodology Applied to Lambda Decays



σ ~= 0.93 cm

~= .004 rads

Future Work

- Bias towards origin? Non-projective geometry?
- Pion, Λ reconstruction
- Re-run FastMC with improved resolution assumptions, improve W and Z mass resolution