Angular Dispersion with BT Gamma data

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Event classification

Score

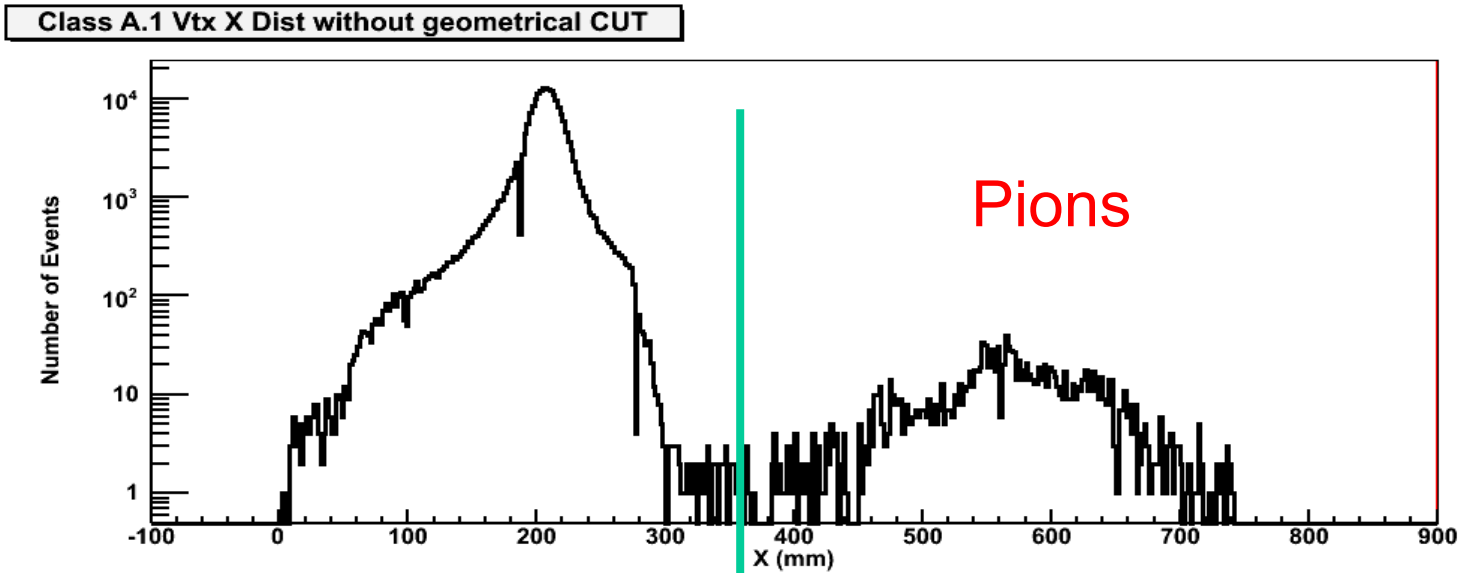
- Class A: events with 1 vertex
  - Class A.1: events with 2 tracks
  - Class A.2: events with 1 track
- Class B: events with 2 Vertices
- Class C: events with 3 o more Vertices

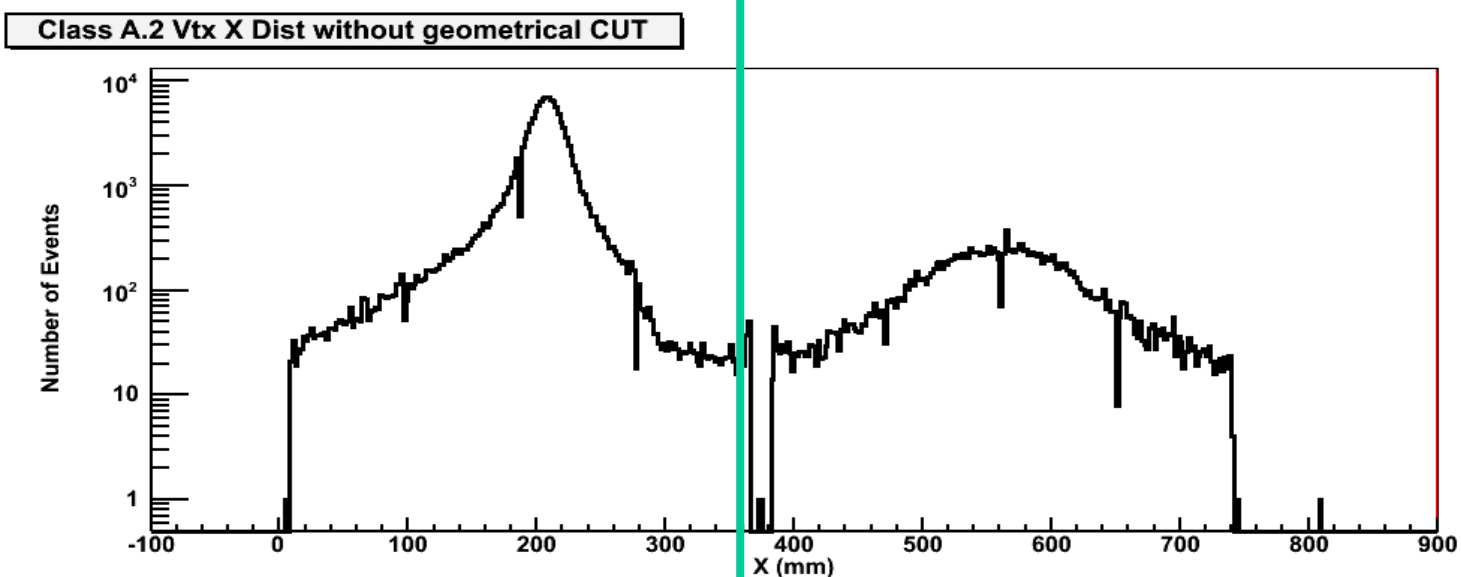
Input root files and cuts

- The Recon, Svac and Merit root files have been used (latest version available)
- The standard variables available in the root files have been used
- The CU has been used as standalone detector
  - Level 0 Cuts:
    - CalEnergyRaw > 0

Tower 2 Full Brems at 0°
2.5 GeV/c Beam Electron

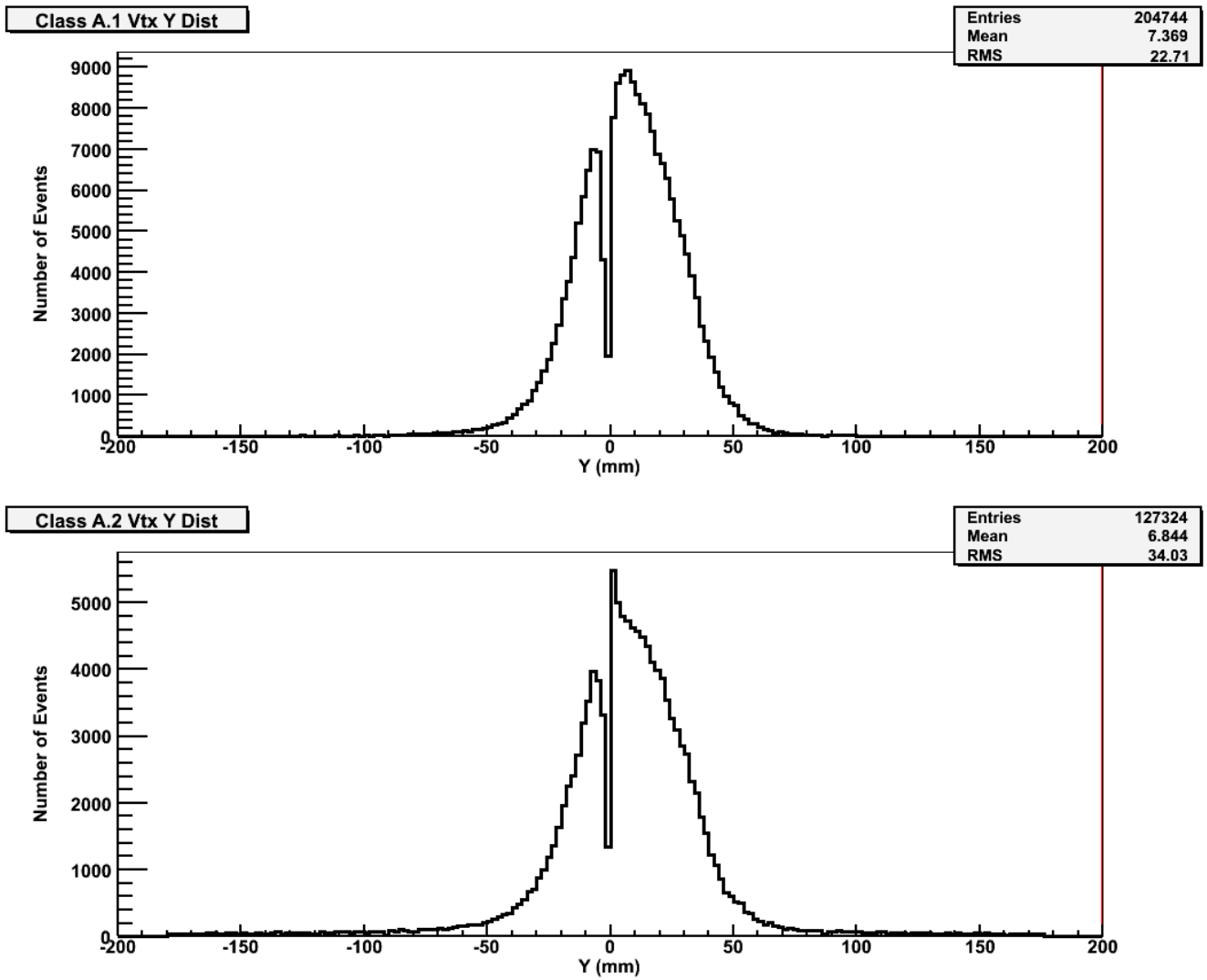
X Vertex position



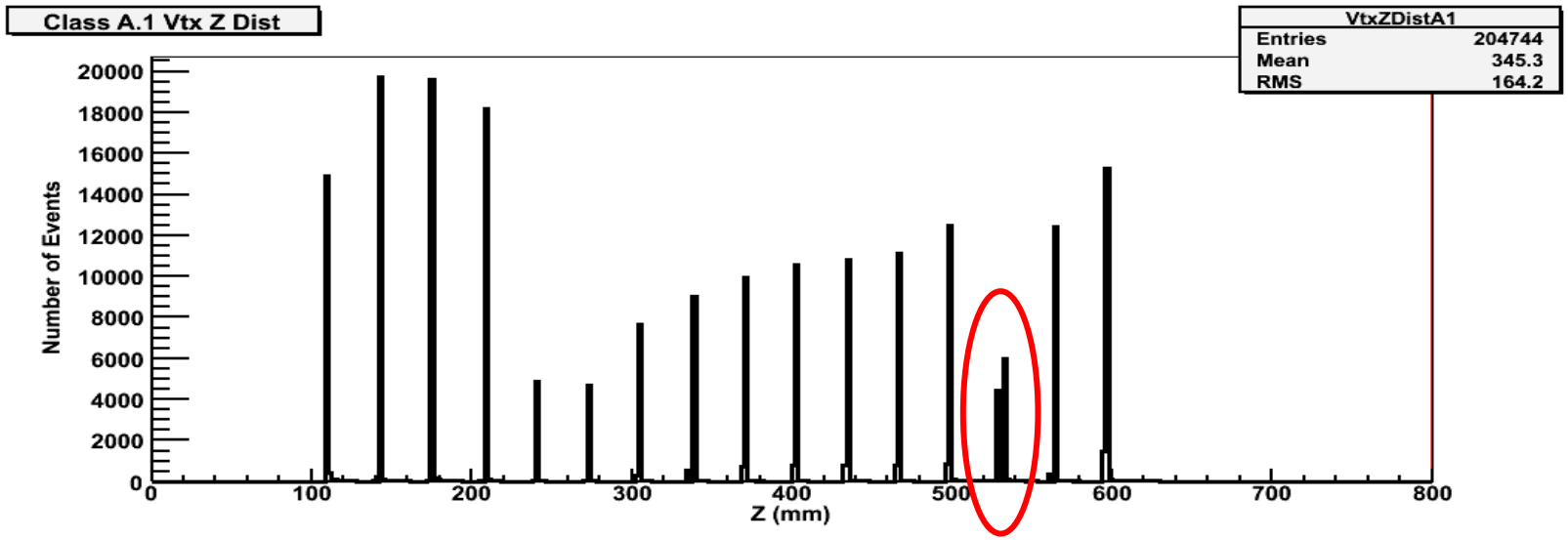


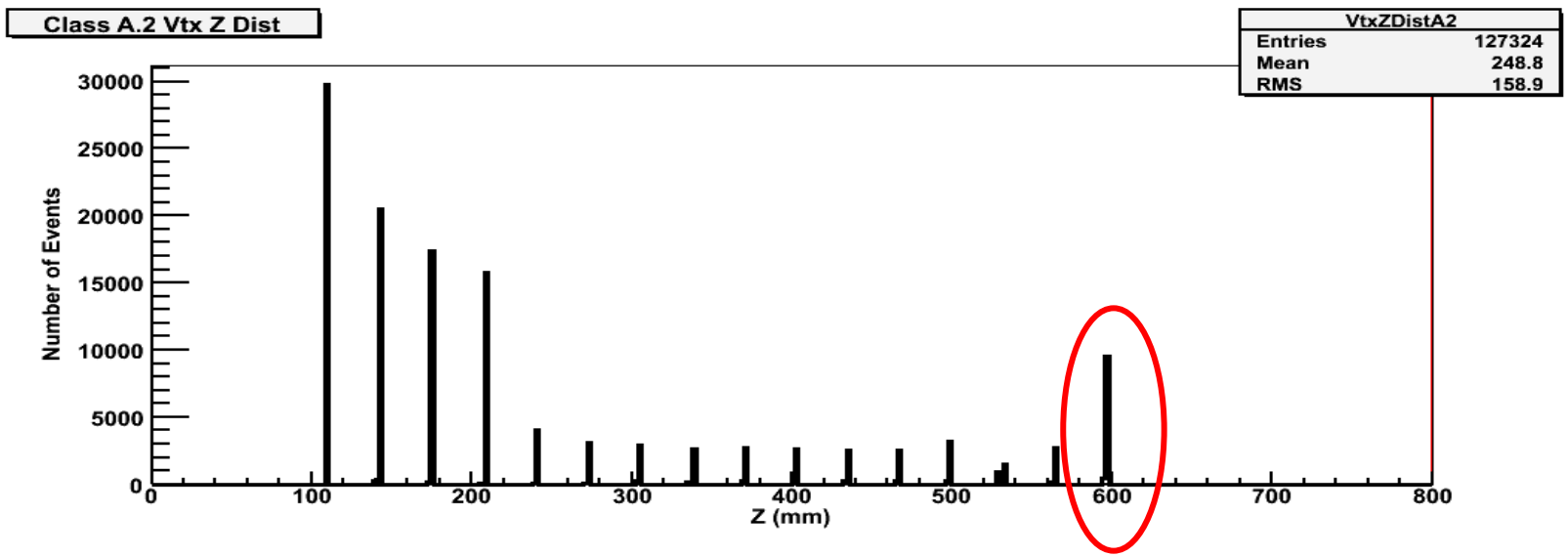
Geom Cut X<350.

Y and Z Vertex position with geometrical cut in X axis



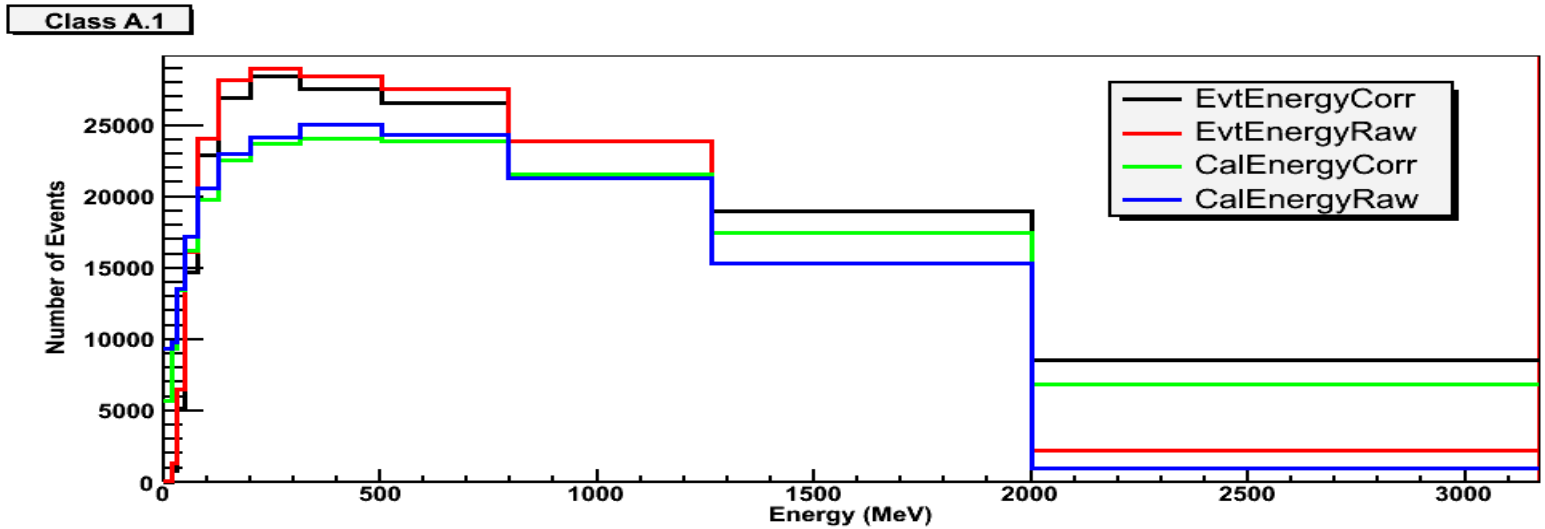
Z Vertex position with geometrical cut in the X axis

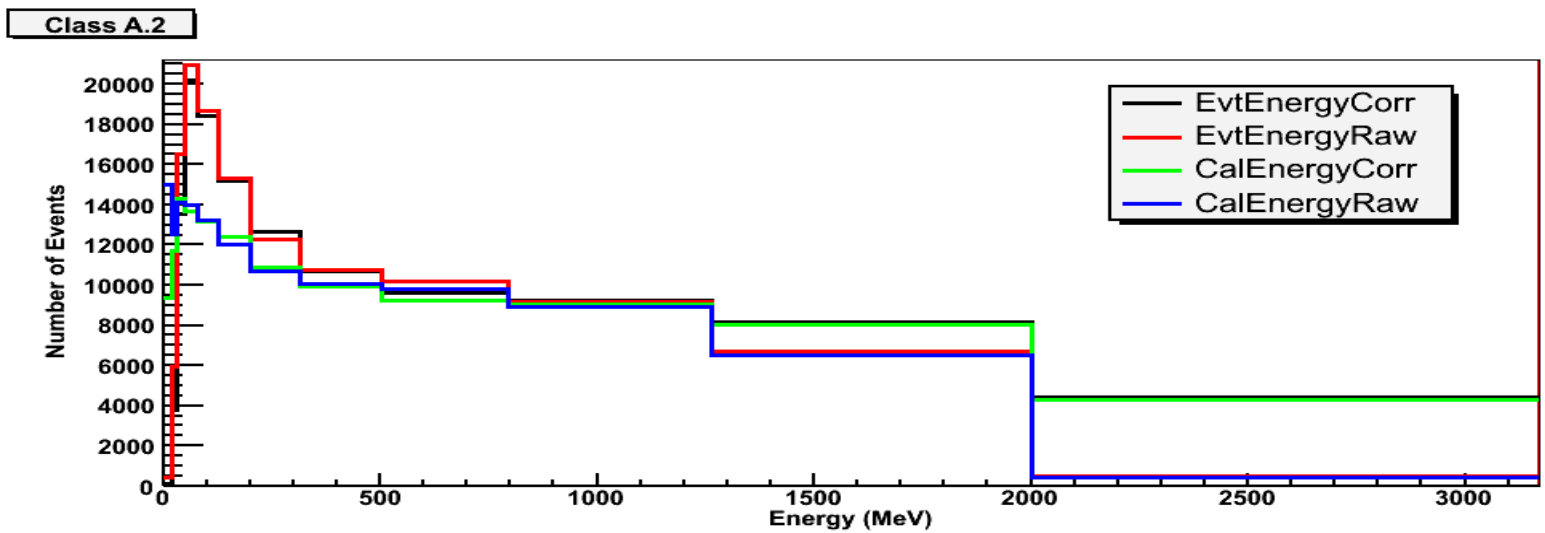




Energy distribution

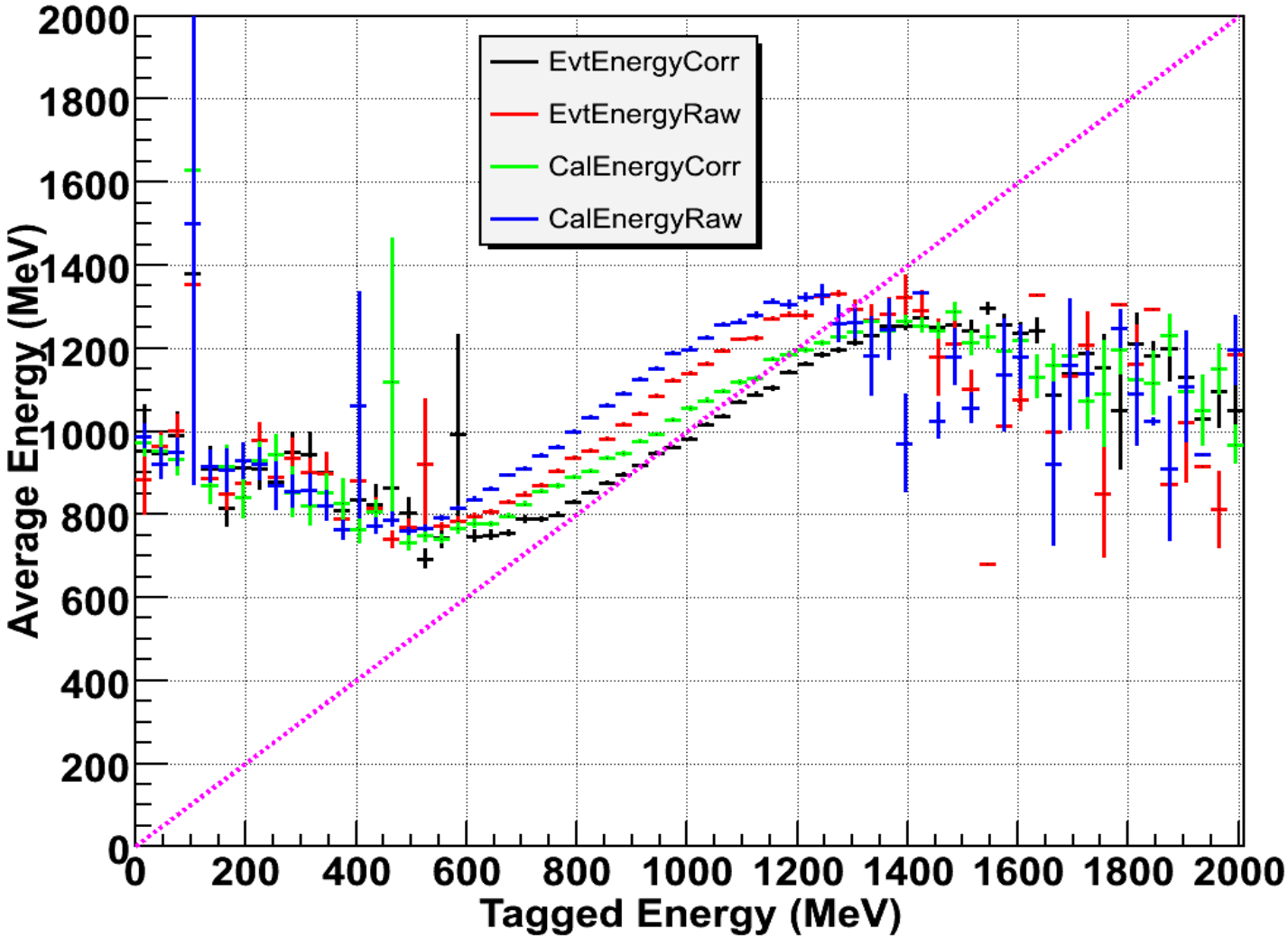
5 bins per decade starting from 20 MeV have been defined



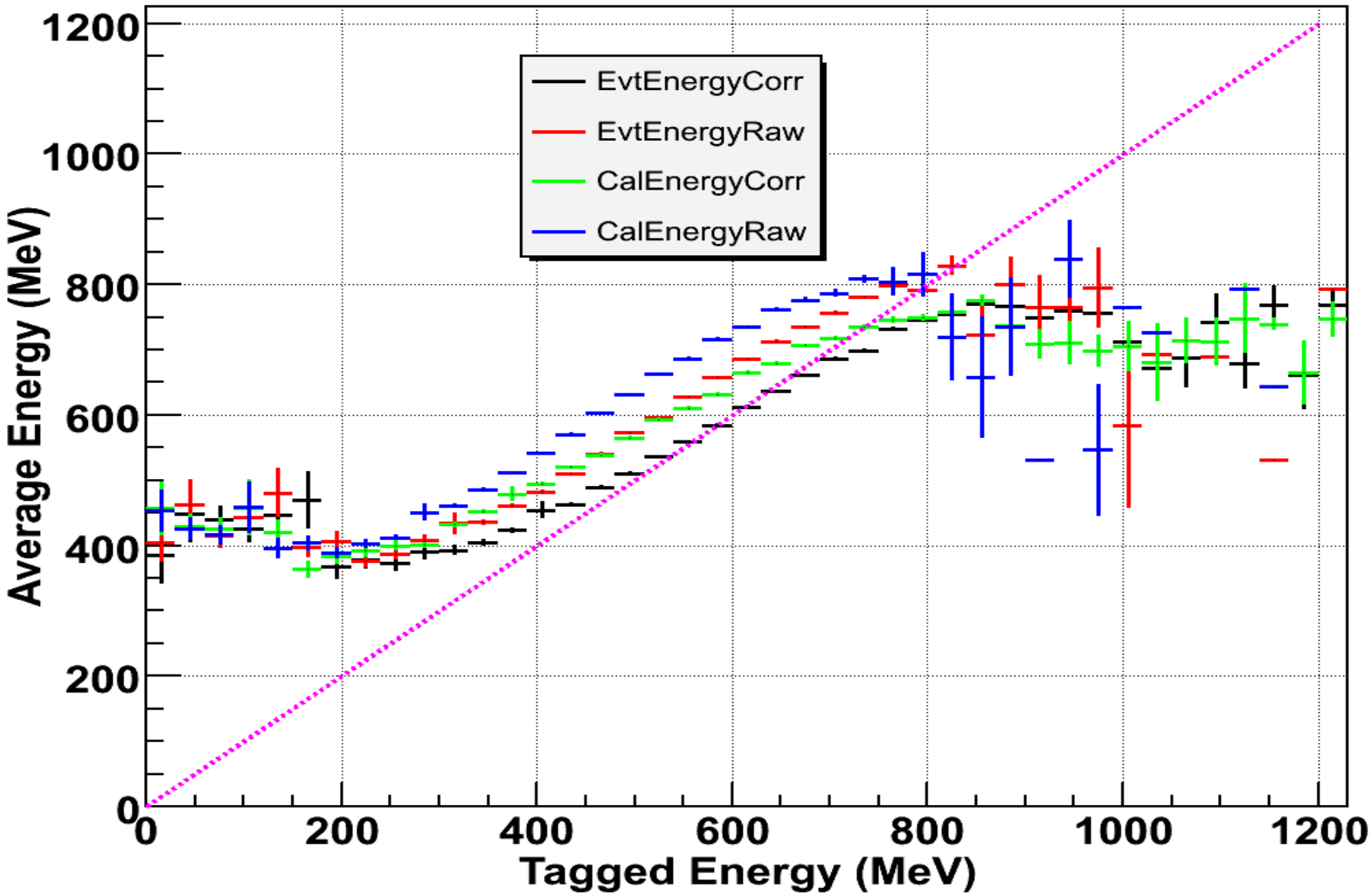


About the energy: Comparison with the tagged energy in the Tagged runs

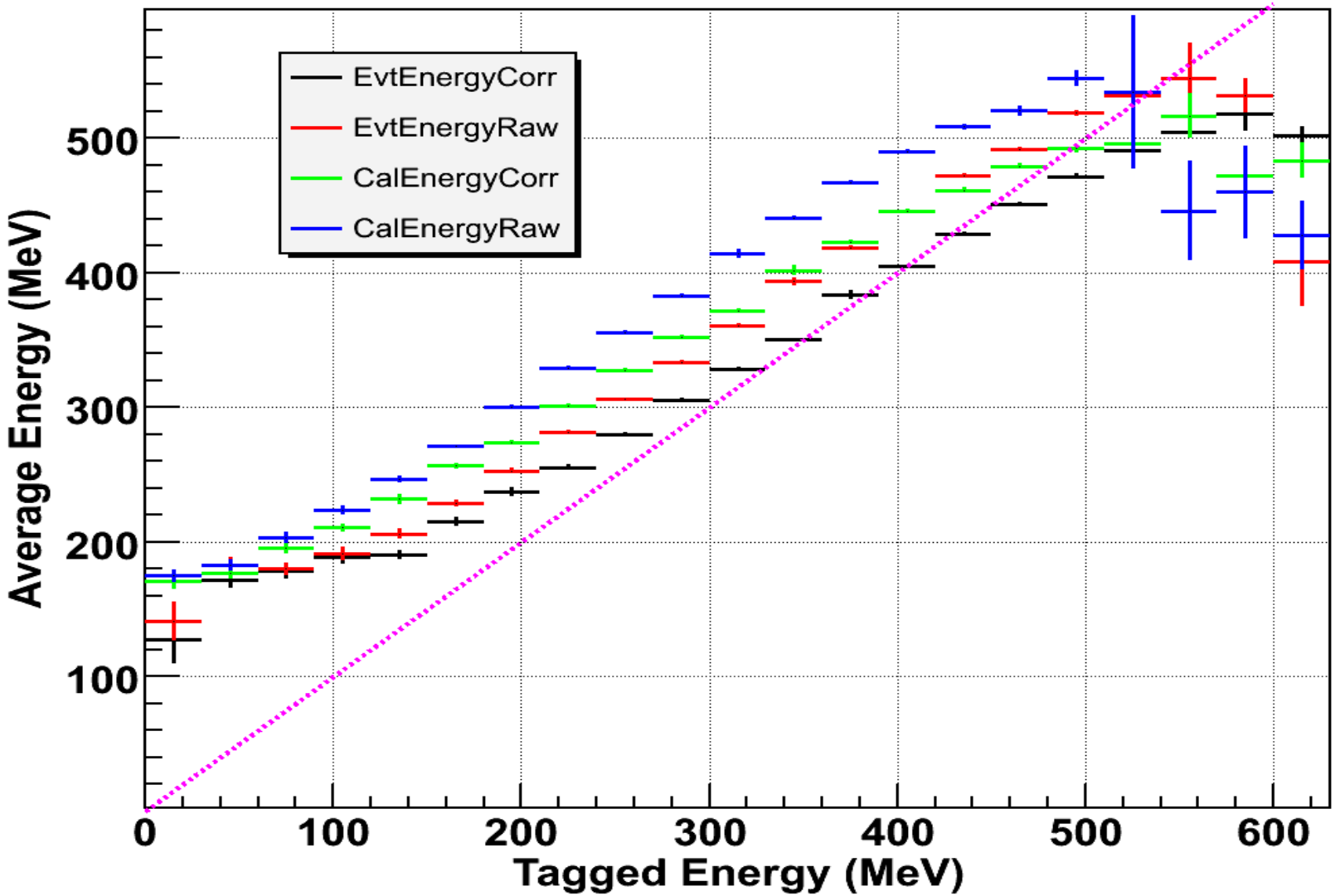
Class A Events: 2.5 GeV/C beam



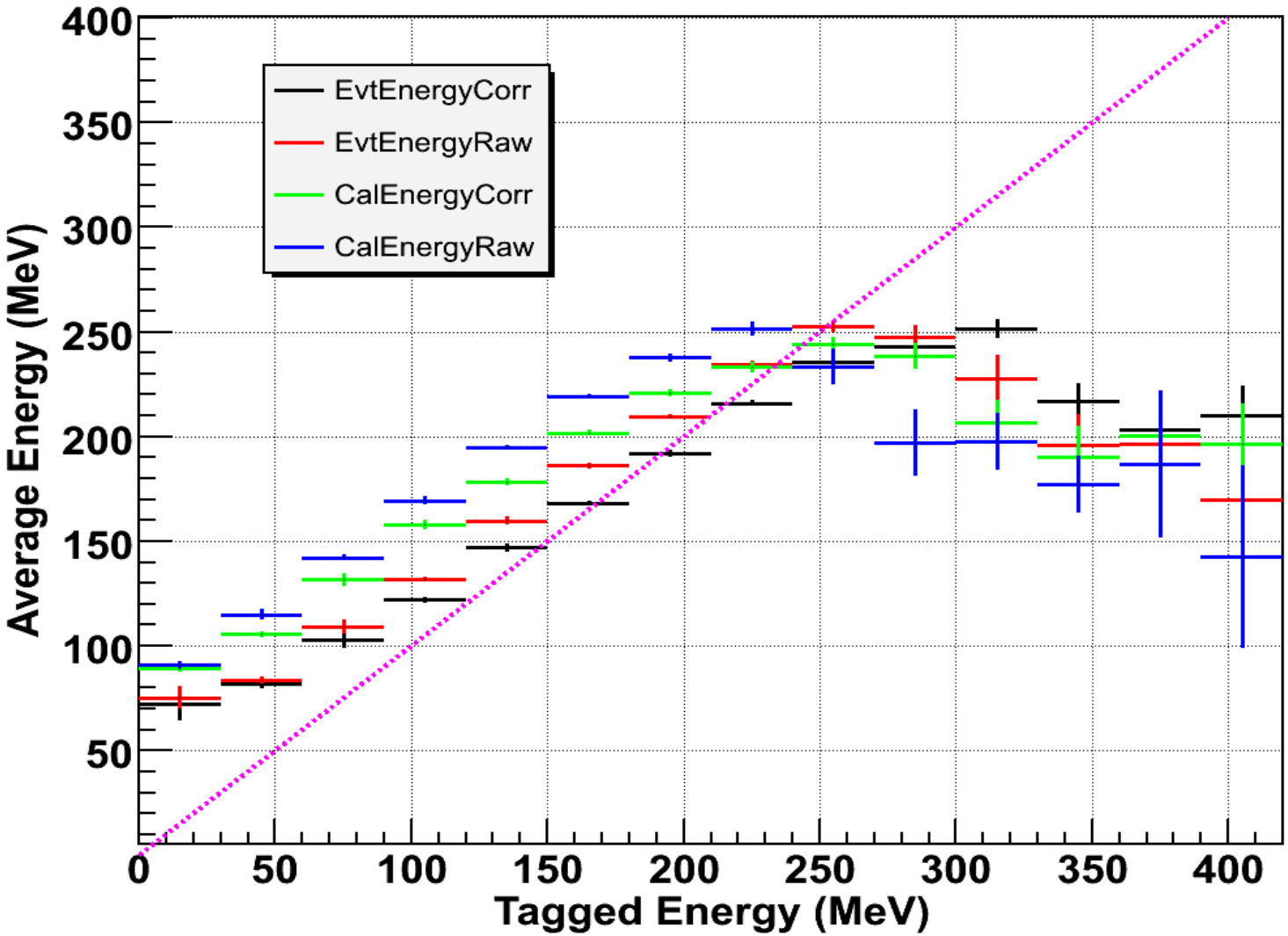
Class A Events: 1.5 GeV/C beam



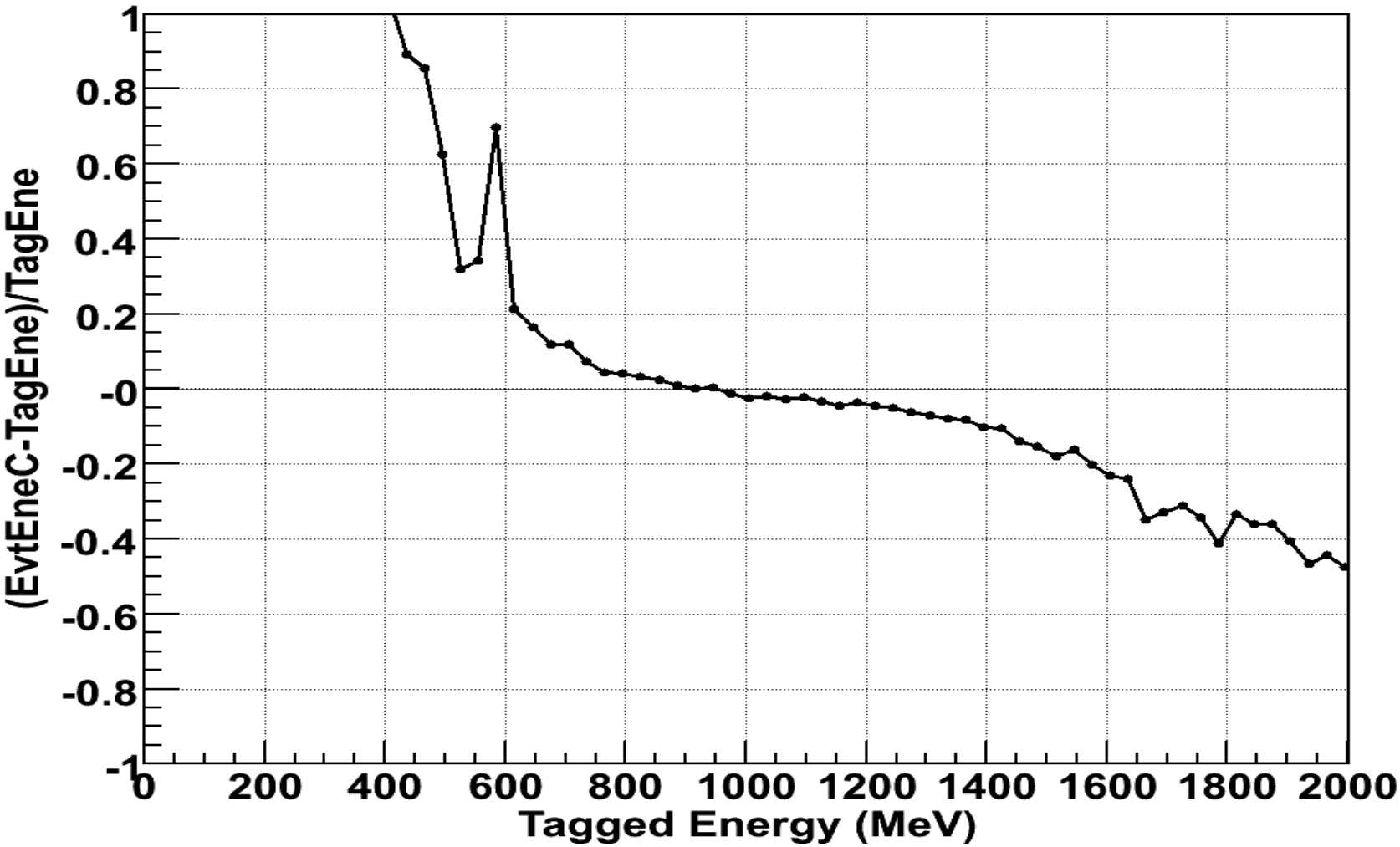
Class A Events: 1.0 GeV/C beam



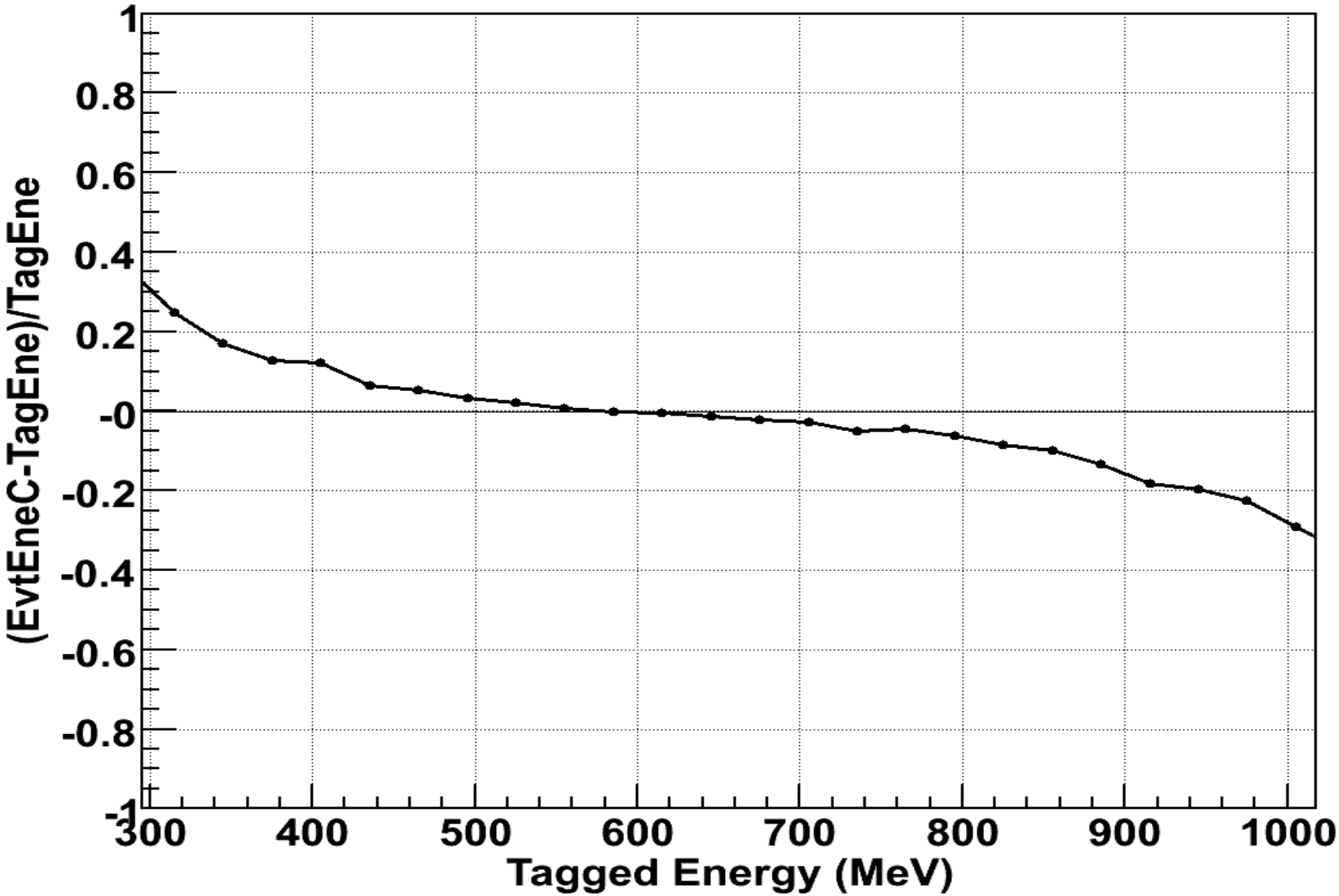
Class A Events: 0.5 GeV/C beam



Comparison (2.5 GeV/c Beam)



Comparison (1.5 GeV/c Beam)

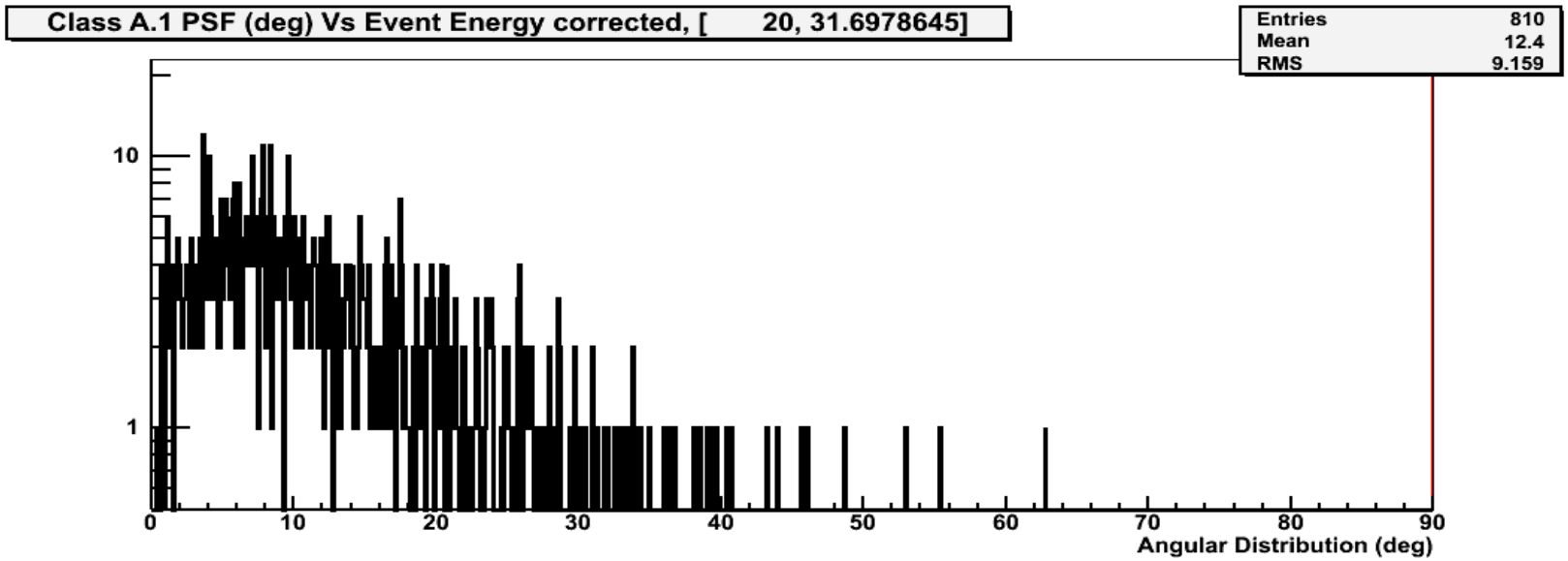


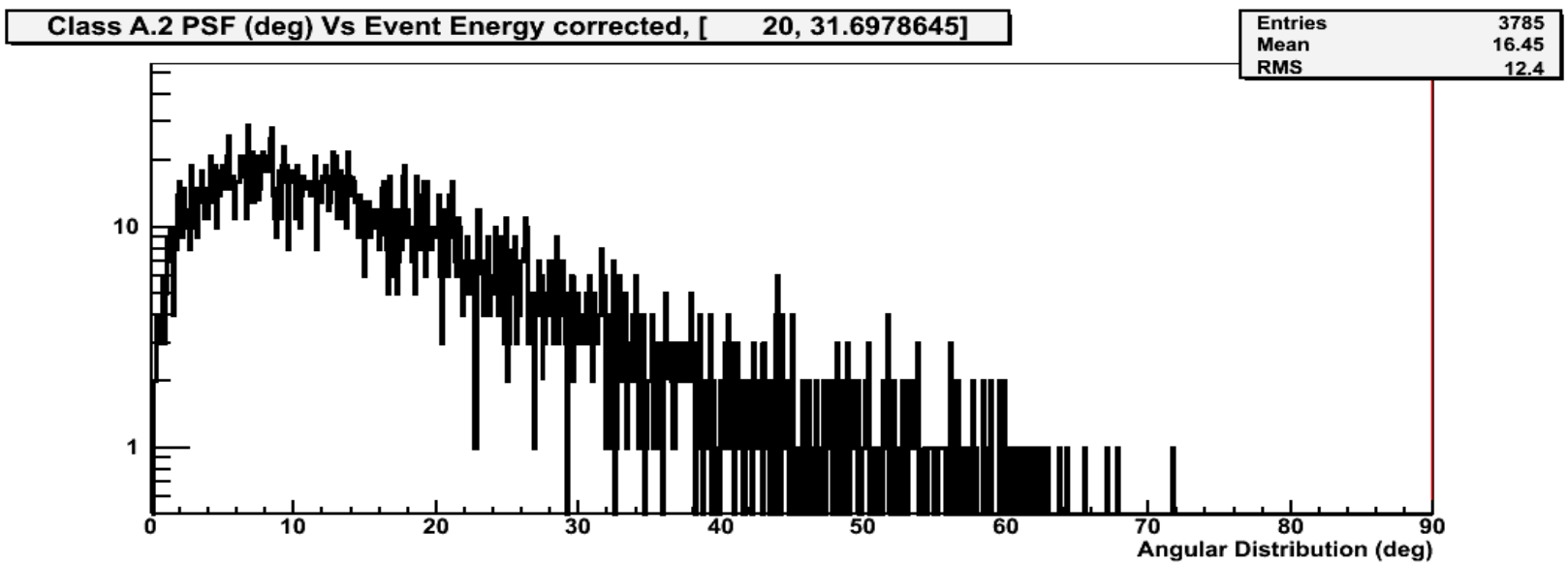
So, we select the EvtEneCorr to describe the angular dispersion as function of the gamma energy.

Angular dispersion evaluation

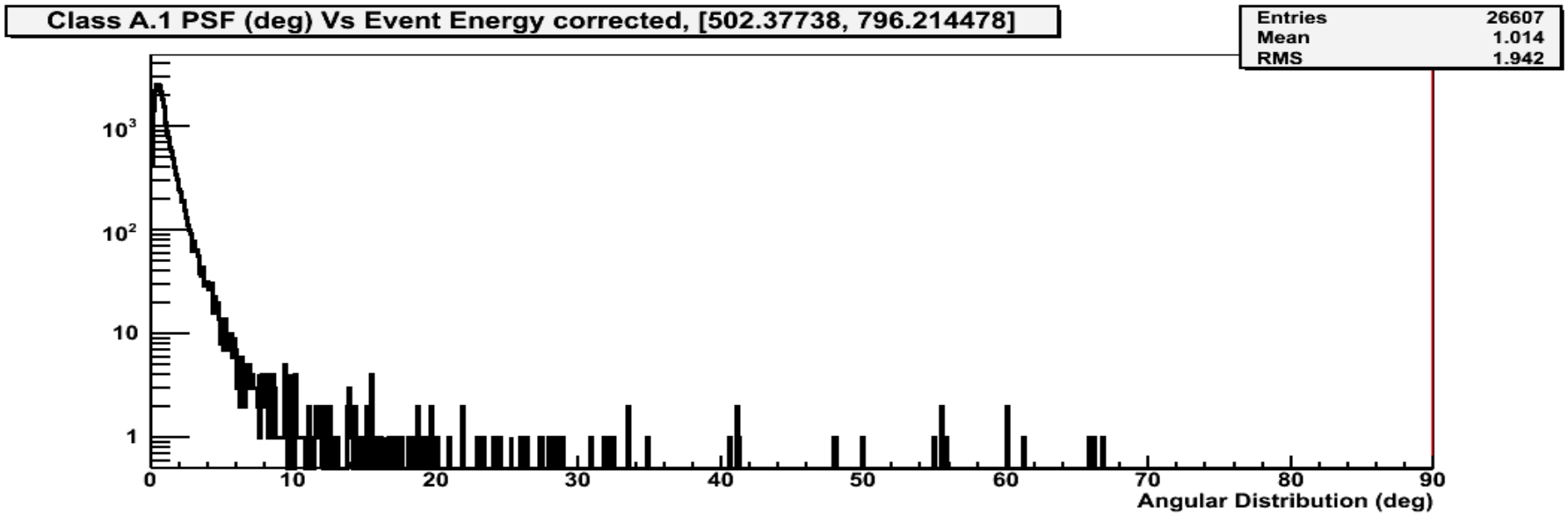
- The gamma angle has been calculated with the respect the nominal beam direction
  - Beam direction: (-Sin(theta), 0, -Cos(theta)) where theta is the tilted angle of the CU
  - Measured direction: Vertex direction in the root files
- For each bin energy, the angular dispersion distribution is filled in a histogram with 0.01° bin width

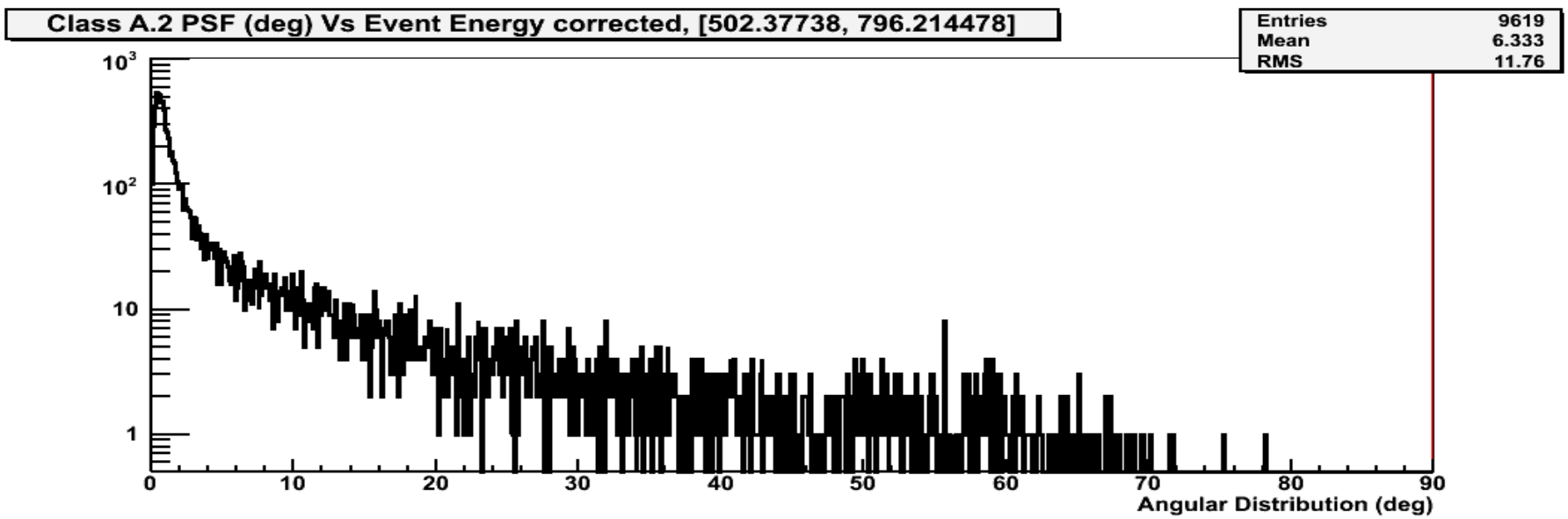
Angular distributions



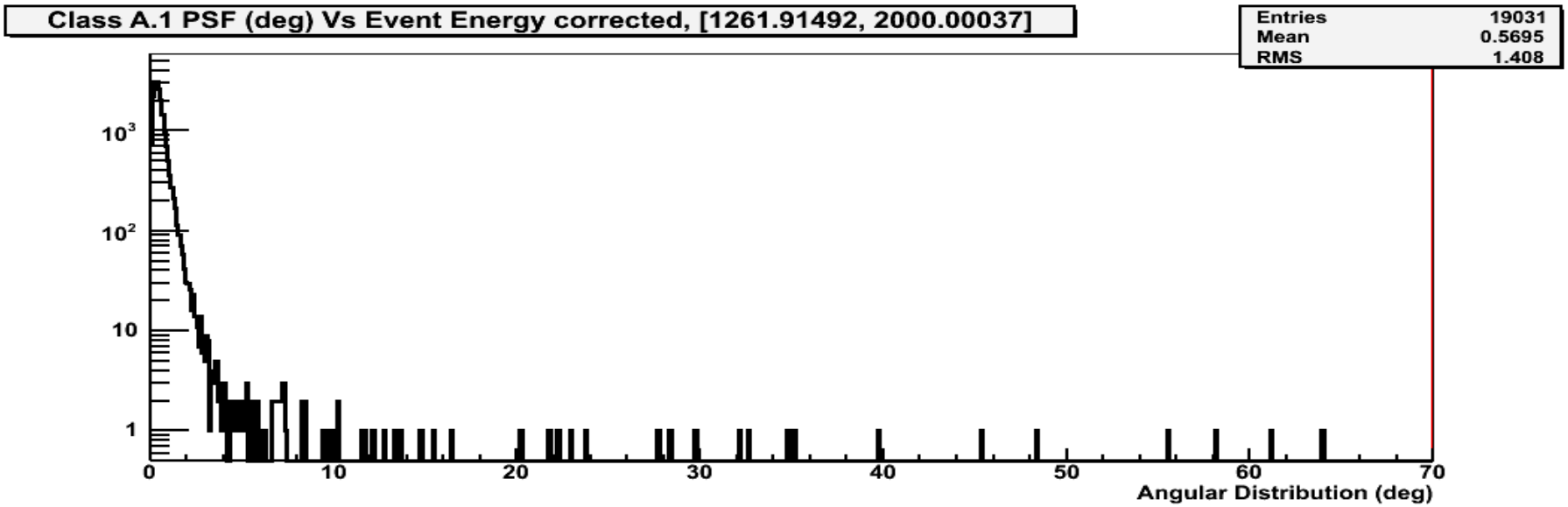


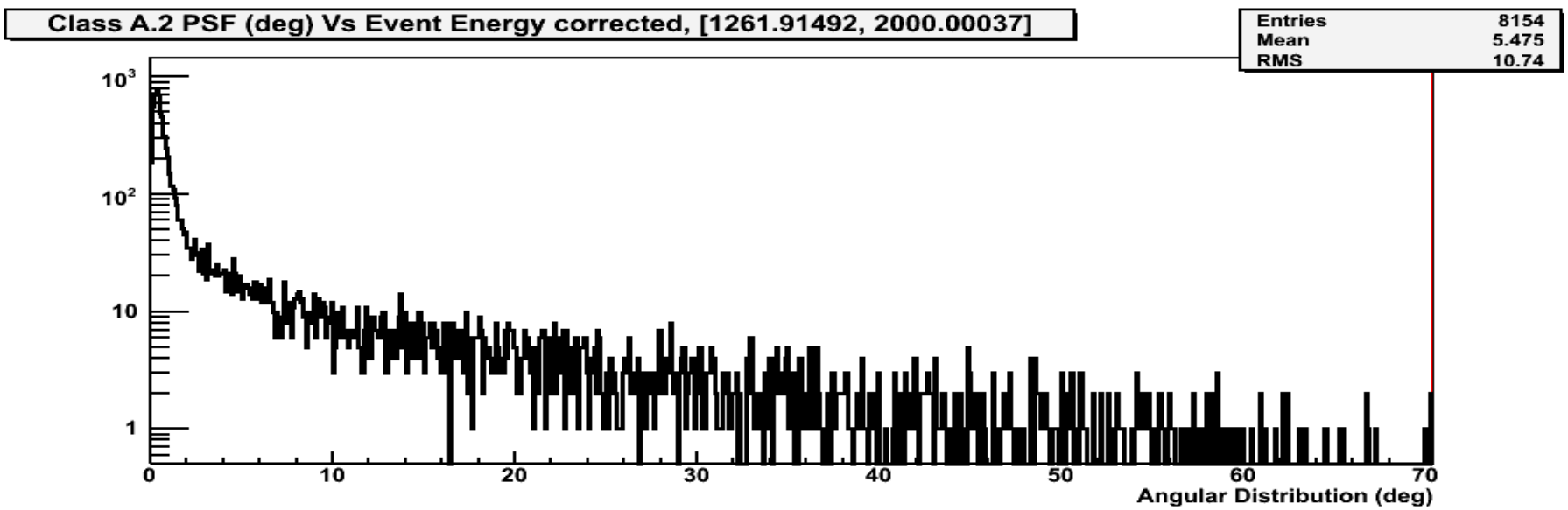
Angular distributions





Angular distributions

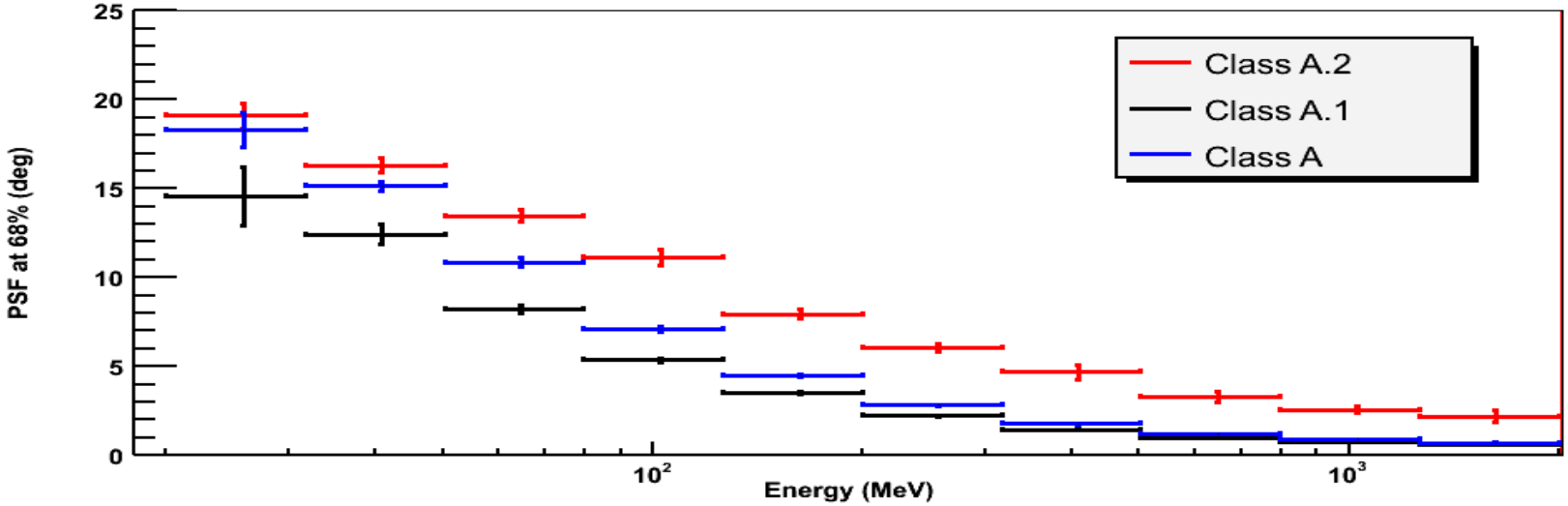


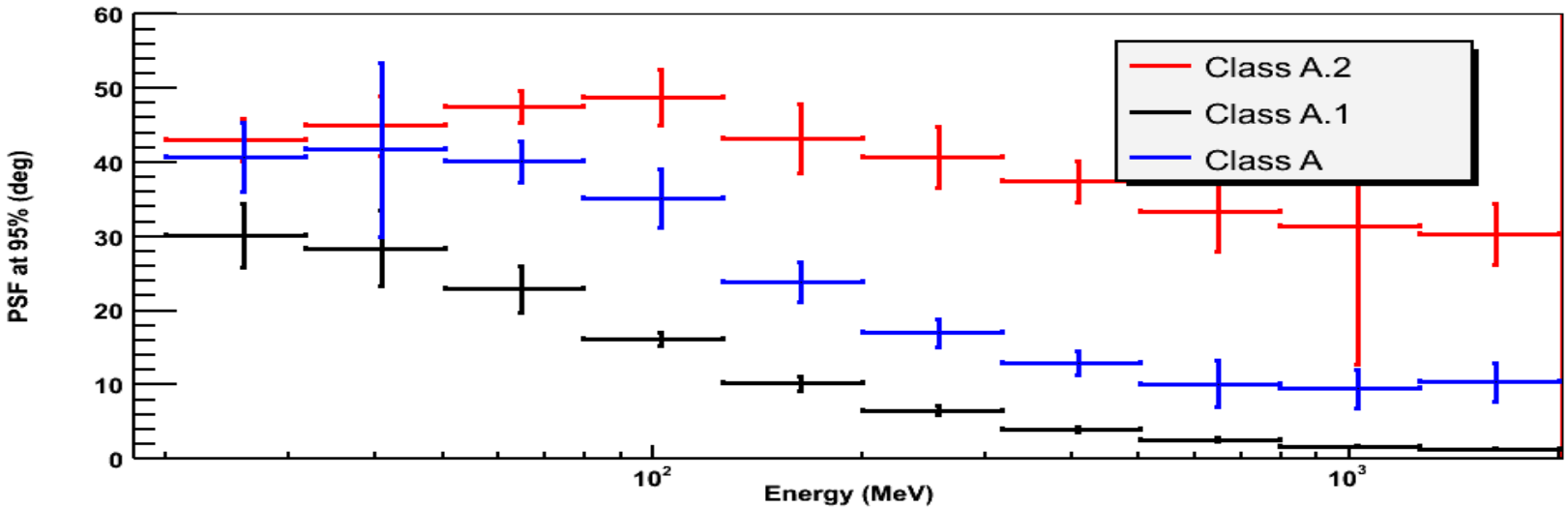


PSF evaluation

- At given fraction, f, (e.g. 68% or 95%), the angular bin number i is found such that the integral of events, P_i, is $P_i < f\,N < P_{i+1}$, where N is the total number of entries.
- The angle, θ_f, at the fraction f is evaluated as $\theta_f = \theta_i + h\,(f\,N - P_i)/(P_{i+1} - P_i)$, where h is the angular bin step (0.01°)
- The statistical error $\delta\theta_f$ has been evaluated by taking only the error (Poisson) for the number counts N, P_i *and* P_{i+1}, i.e. $\delta\theta_i = 0$ *and* $\delta h = 0$

PSF at 68% and at 95% (only statistic error)

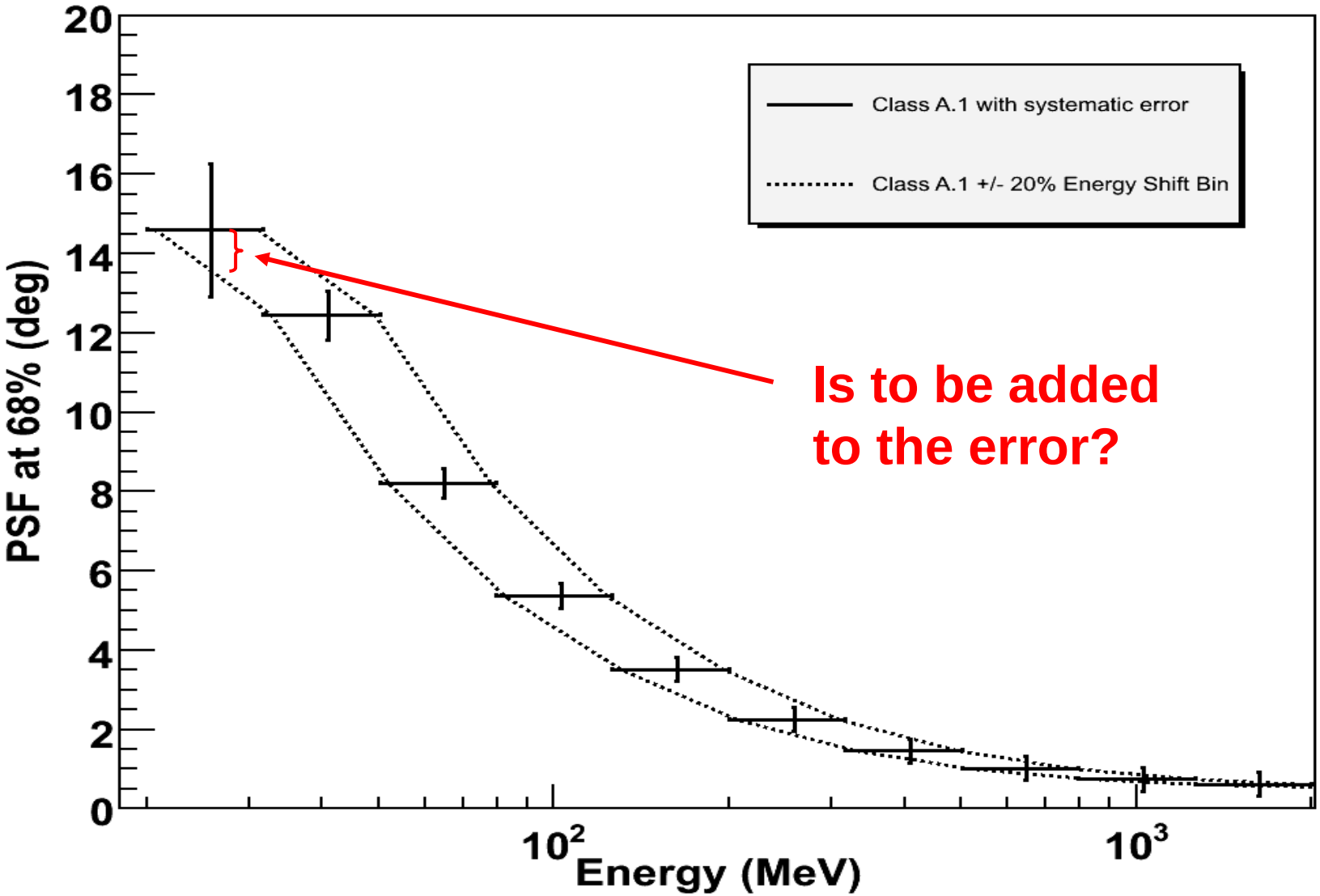




Systematic errors

- Beam divergence: few mrad, $\delta\theta_f \sim 0.1°$
- CU position with respect to the beam: $\delta\theta_f \sim 0.1°$
- Gamma production angle by bremsstrahlung with respect to the electron: few mrad, $\delta\theta_f \sim 0.1°$
- Gamma Energy evaluation: the effect is to shift to the left/right the PSF

Class A.1 PSF at 68% and at 95% (statistic + systematic errors)



Conclusion

- The angular dispersion has been evaluated in the full brems data in tower 2, at 0° and 2.5 GeV electron beam energy
- An events classification has been introduced
  - Class A is well understood
  - Class B needs to be investigated. We think that in these events there are a pion pollution, so many of Class B events will fall in the Class A
- The analysis need to be reviewed with further cut, e.g. a minimal track length should be requested in the CAL
- An attempt to evaluate the systematic error is discussed
- The angular dispersion is being to evaluated at 30° and 50°