

ACD Recon Upgrade Sigma Distance and Tile Boundaries

Introduction

The POCA distance (in sigma) for tracks coming close to ACD tiles should give different distributions for tiles that are hit than for those that have no hit. Basically, this is saying that you expect tiles without hits to have track POCA that are more than 1 sigma from the tile active boundary. On the other hand hit tiles are expected to have POCA with negative sigma (distances inside the active tile). The cross-over from dominantly positive sigma POCAe to negative sigma should be a sharp feature which is present in the data and MC.

Monte Carlo

For a set of CrProtons generated from a modified HEAD1.1365 of GR, I grab the projected and propagated covariant distances of POCA from ACD tile elements. After selecting for well reconstructed tracks, I split POCA into two sets: those corresponding to hit tiles, and those corresponding to unhit tiles. I plot the distance (in covariant sigma) from the tile active element and the fraction of the total number of events at a given covariant distance which correspond to (un)hit tiles.

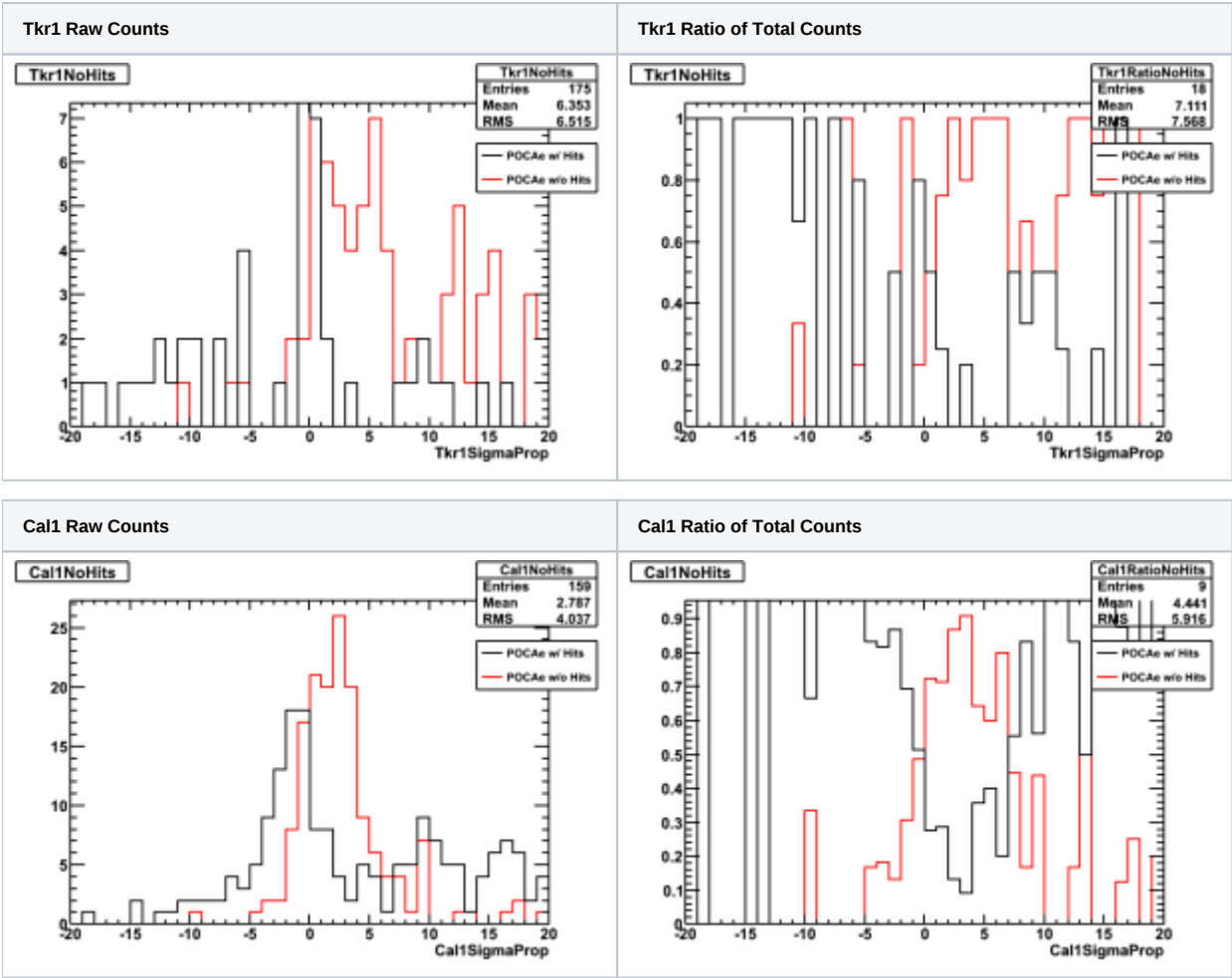
I examine the resulting distributions for POCA from both the first track and first cluster. For the first cluster, the covariance is being calculated simplistically (and incorrectly) as a constant error of 2 degrees on the cluster direction. Additionally, for the clusters we use the projected covariant error without any G4 propagation (since it doesn't really make much sense to compute the multiple scattering through the calorimeter).

Cut Definitions

CalTrackAngle < 0.1; //Well Reconstructed Tracks
mipsPmtA() < 0.001 && mipsPmtB() < 0.001; //Hit Tile Definition

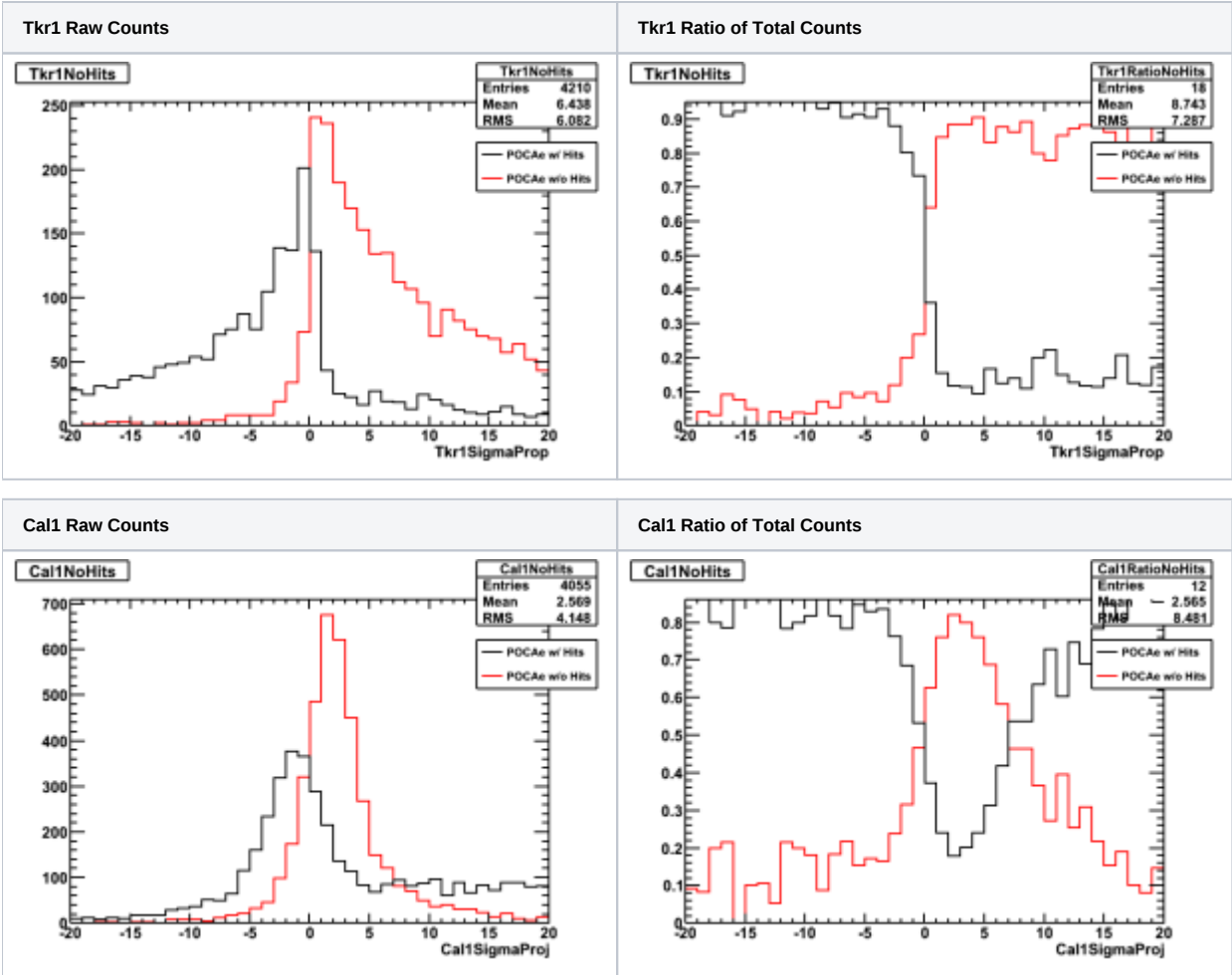
Tile 22

Looking at an individual tile in the center of the ACD, the statistics are too limited to draw any real conclusions. However, these plots hint hit tiles tend to have POCA with negative covariant distances while the unhit POCA tend to have positive covariant distances (as expected).

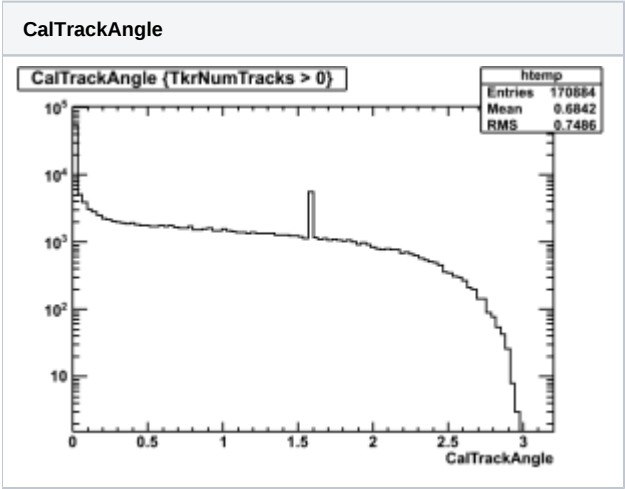


Top Tiles

Taking all the top ACD tiles substantially increases the statistics. It is now clear that there is a sharp shift from hit to unhit tiles at a covariant distance of 0.



An interesting feature in the CalTrackAngle suggests that some non-negligible number of events have their cluster direction mis-aligned with the tracker track by 90 degrees. This comes from the fact that when a single crystal is hit in the calorimeter, the CAL axis is set to (0,0,0). When dotted into the TKR direction and taking the arccosine, you are left with 1.57...



Data