Cosmic Ray Test Stand MC Study

Kurtis Nishimura

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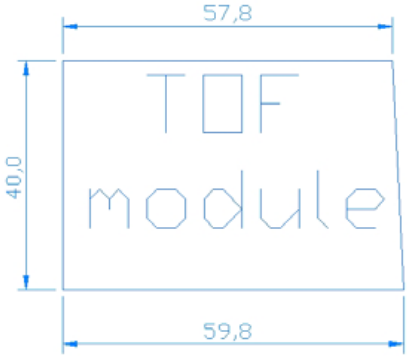
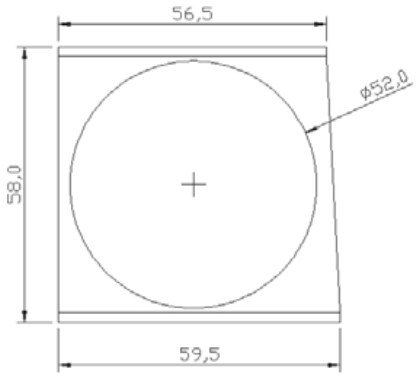
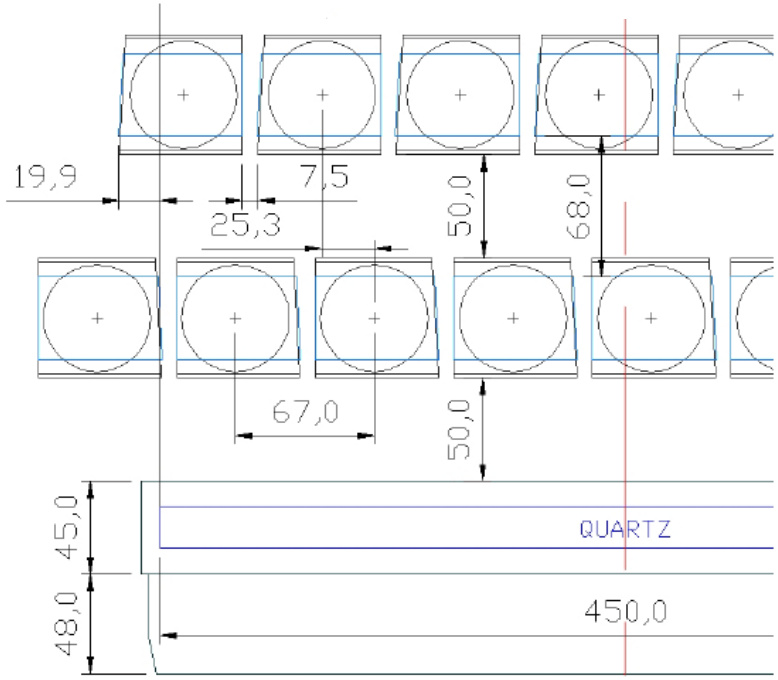
UH bPID Meeting

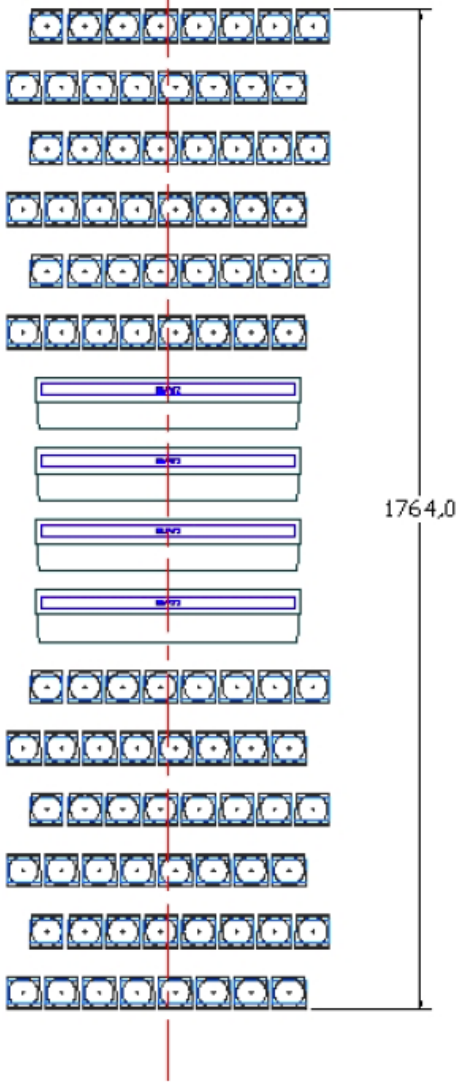
Geometry

- Starting point, (almost) Marc's drawings:



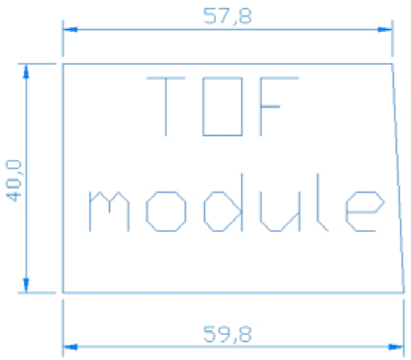


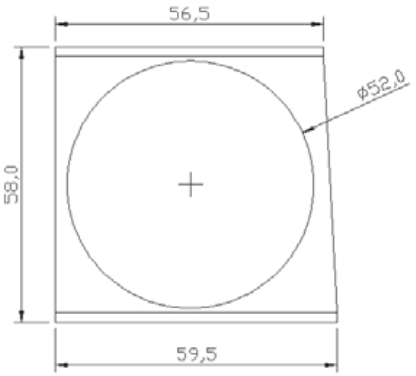




Geometry

- Starting point, (almost) Marc's drawings:

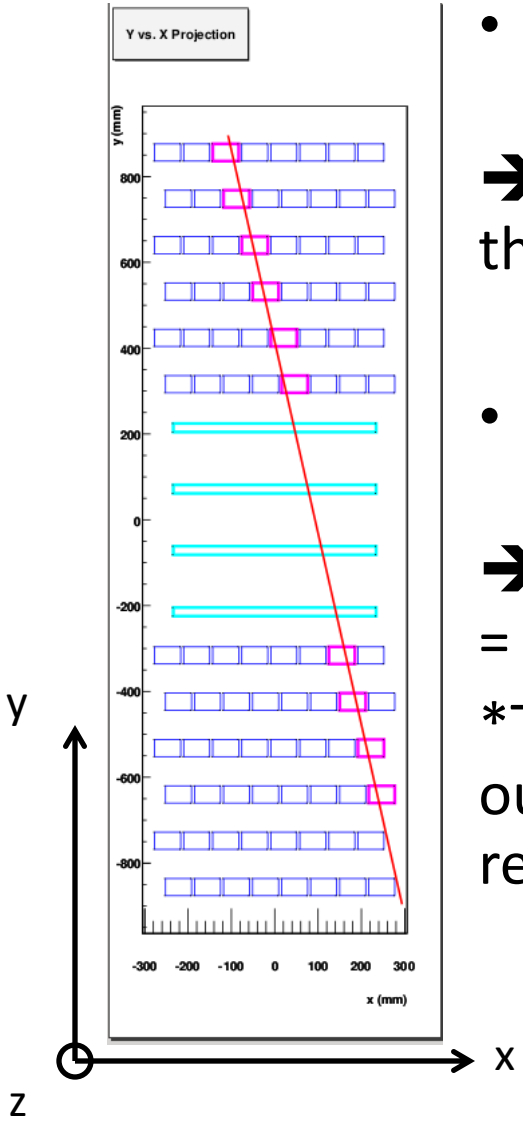




- Some slight changes:
  - Rectangular only
  - 60x40 mm^2
  - Only treating the scintillator, not including the PMT.

Conventions

- I've used the Belle / Belle II axis conventions:



- So mirror side of quartz bars is in the +z direction.

➔The projection to the left is looking from the front.

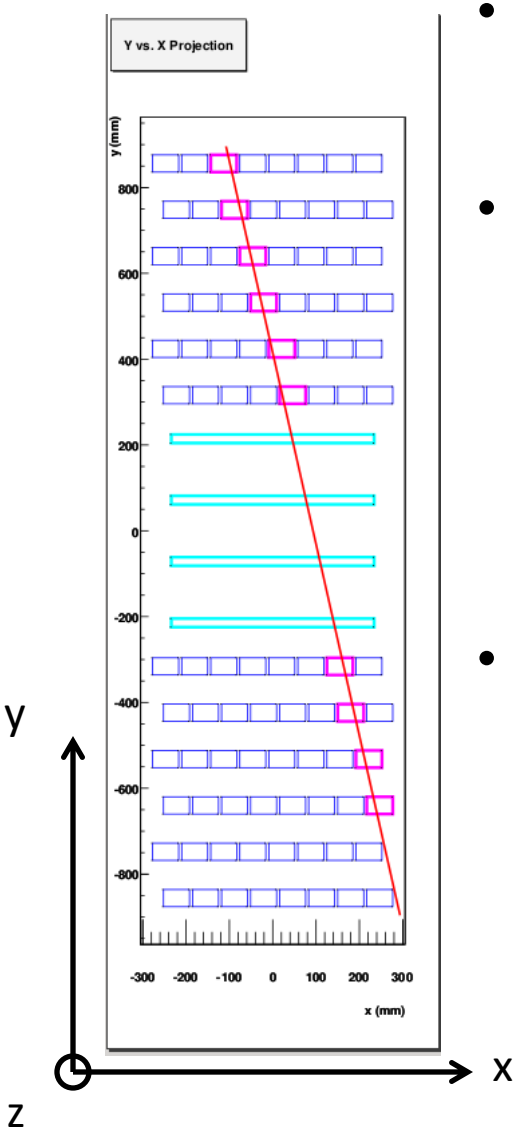
- Polar and azimuthal angles are defined as in Belle.

➔Cosmic rays will be primarily near $\theta = 90^\circ$, $\phi = 90^\circ$.

*This can be changed, but if we use these axes our resolutions on θ and ϕ are more easily relatable to those expected in Belle II.

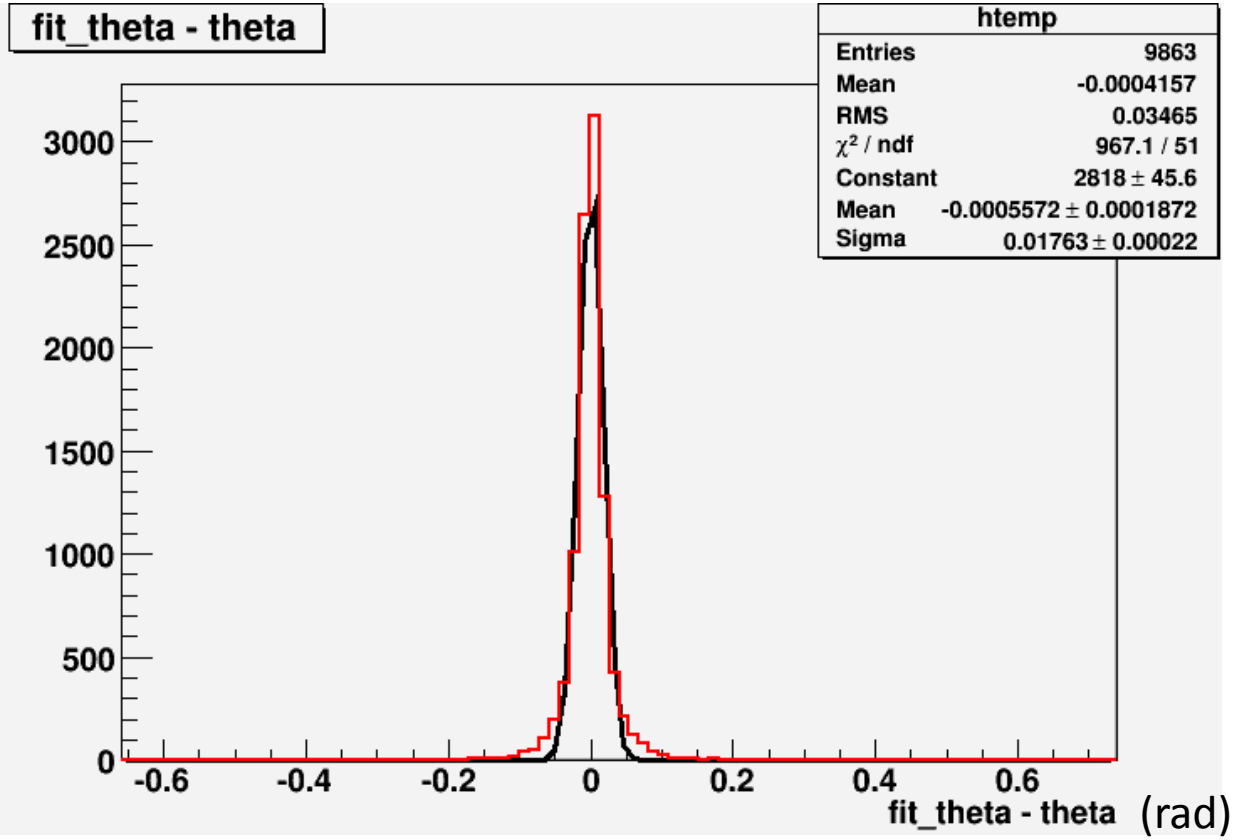
Simulation & Reconstruction

- Simple simulation and reconstruction:

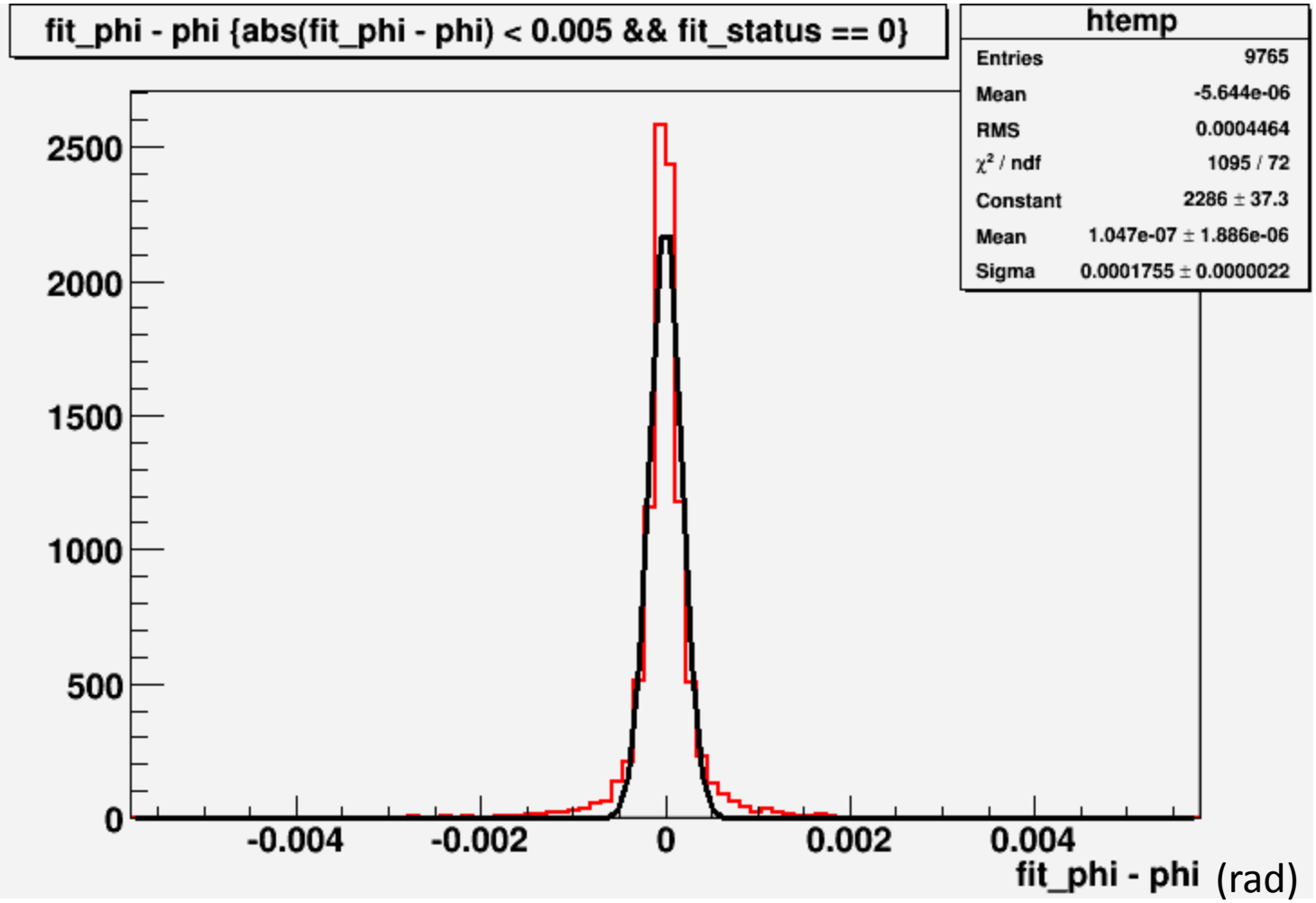


  - All tracks are infinite momentum (straight lines).
    - Uniform distribution in θ, ϕ (70° – 110°); x_0, z_0 (from one bar edge to the other)
  - A point is assigned to each bar that is hit with the following parameters:
    - x_{hit} = x center of bar
    - y_{hit} = y center of bar
    - z_{hit} = z position of track when y_{track} is equal to y center of bar, with a Gaussian smearing of 20 mm.
  - Reconstruction:
    - Require at least 1 hit in top TOF layers and 1 hit in the bottom TOF layers.
    - Fit a line to the points.
    - *Initial guesses are based on the input value… should eventually be based on hits themselves.

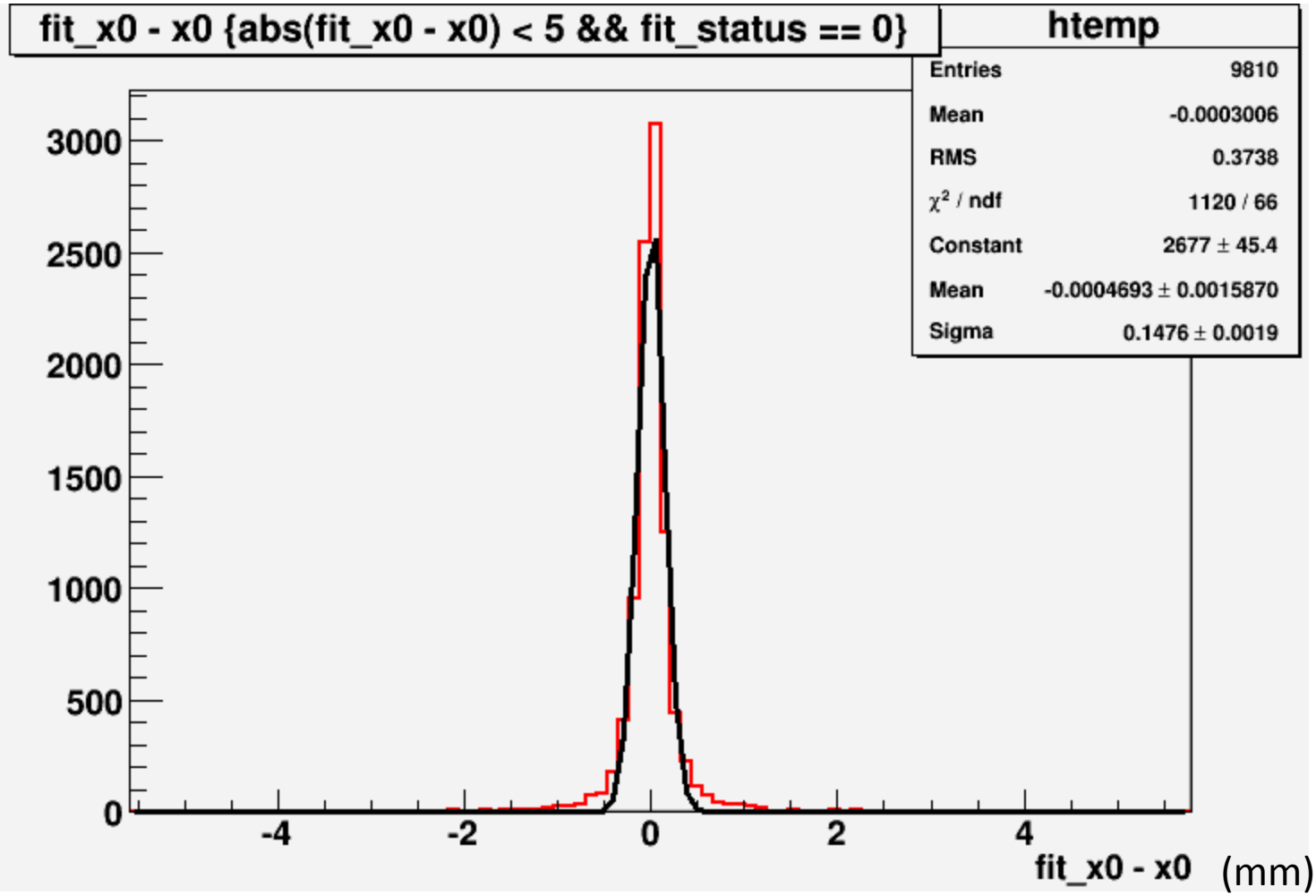
θ resolution



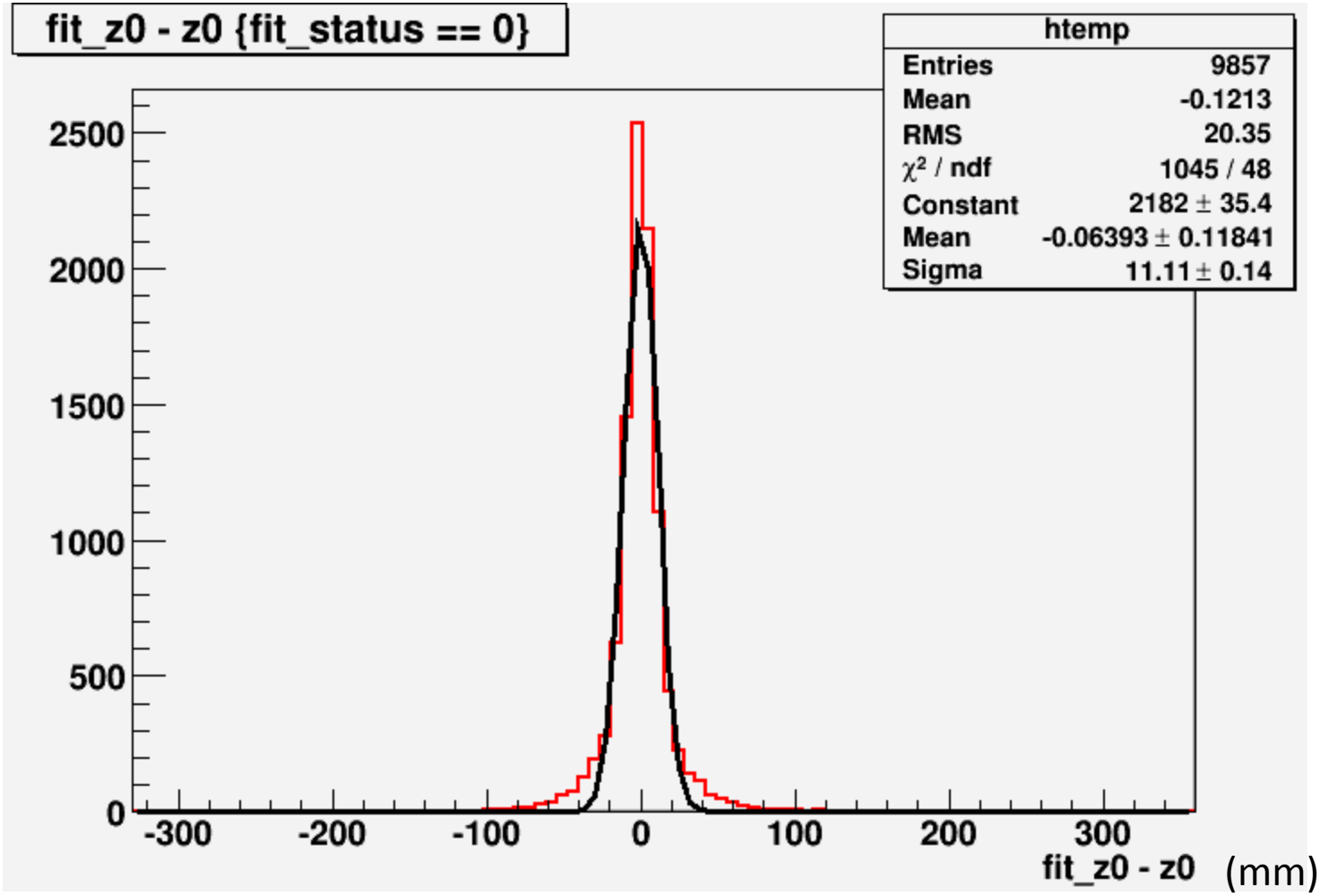
ϕ resolution



x_0 resolution



z_0 resolution



Next…

- Resolution on ϕ and x_0 seem too good?
  - Bug check.
  - Implement more realistic first guess procedure.
- Easy to run more geometries…
  - 10k events run in a couple minutes.
  - Optimize for best resolutions & acceptance.