Detection features of the new bubble chamber (Preliminary).

N_2O + Cooled Hg bubble chamber irradiated with a PuC source at Argonne.

Fig. 1 shows the nucleation sites as produced by an image recognition code. The next two plots show projections on the x and y axes, respectively. (In real life, what I called here the x axis is the vertical direction, and the y axis is horizontal —sorry about this...)

Here are some of the features of our new bubble chamber:

1) In the y direction, the histogram shows a cosine distribution centered in the axis of the vessel. This is great as this is what one would expect from a zero (or at least very small) temperature gradient in the y direction.

2) In the x direction, the temperature gradient appears to have a more complex structure. First, the spherical cap of the vessel (x=150 and smaller) presents the highest count rate. No surprises here, but we just need to have in mind that most of our background events are going to show up in this region. However, the region between x=150 and x=300 appears to be sufficiently flat. This is where we can put the gamma ray beam without worrying too much about temperature gradients. In any case, the gradient can be modeled with this small count rate slope at the time of the data analysis.

Now, this new version of the device has what I believe to be a breakthrough in bubble chamber designs (kudos Brad):
If you look at the region x=390 and higher (the narrow neck of the glass vessel), the count rate drops sharply well below the value expected from geometric considerations only. This means that the temperature is substantially lower in this region of the vessel. The narrow neck insulates thermally the rest of the vessel from the cooling of the Hg. The original "submarine" design with a narrow neck will be an ideal cooled Hg bubble chamber for the next generation device.
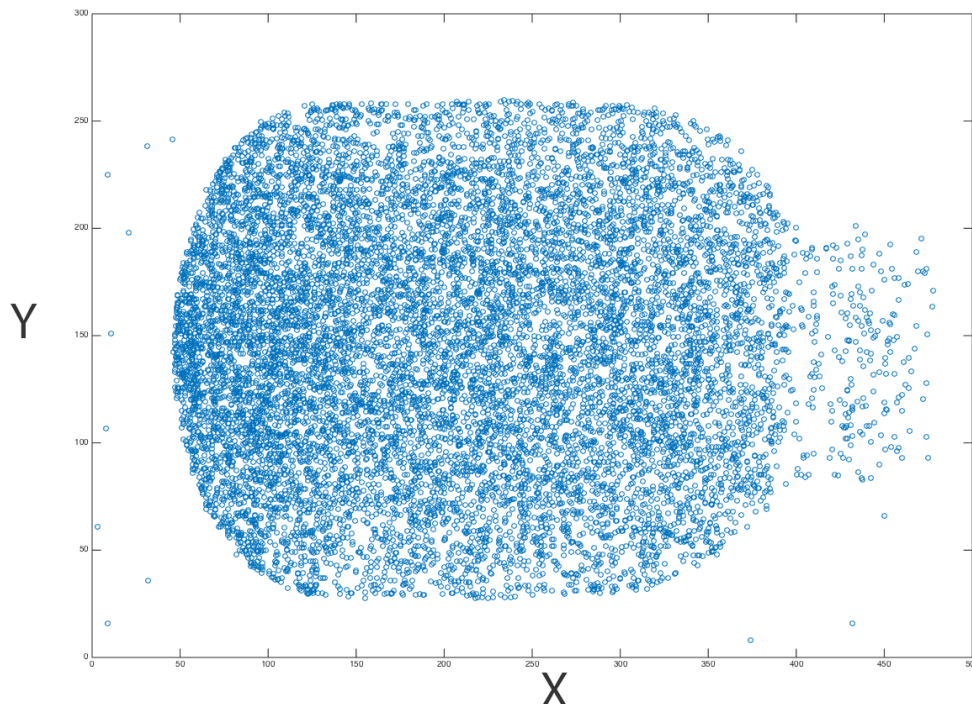

Fig 1. The nucleation sites as produced by a Matlab image recognition code.
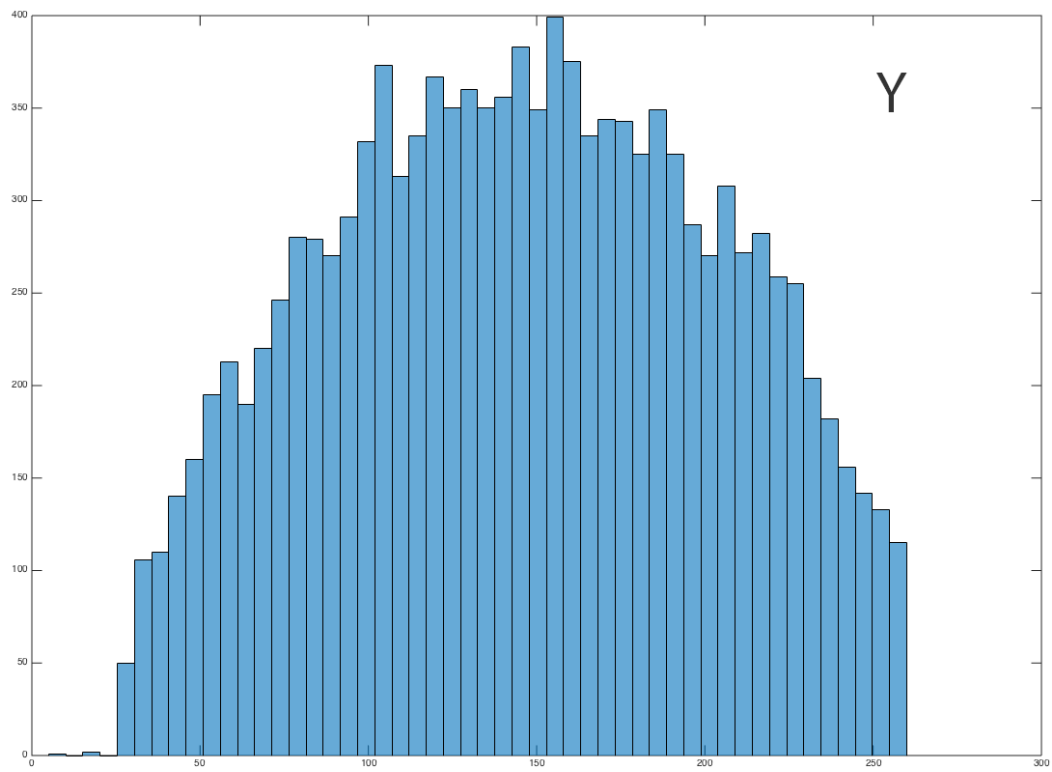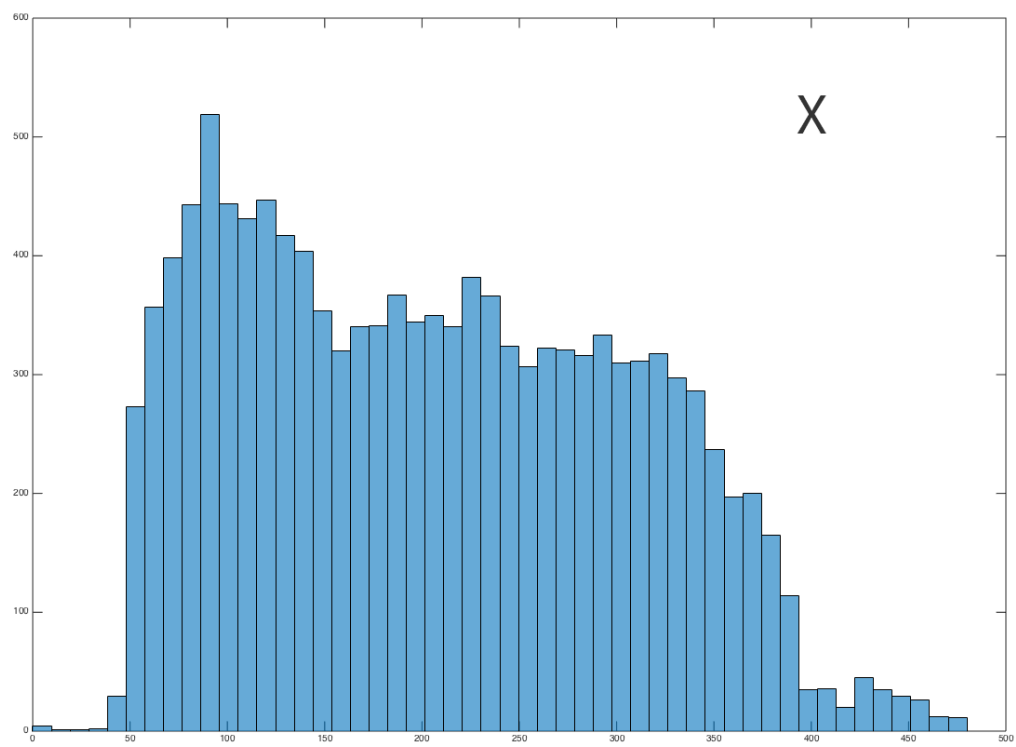
Fig. 2 Histogram of projection of events on the y axis

Fig. 3 Histogram of projection of events on the x axis