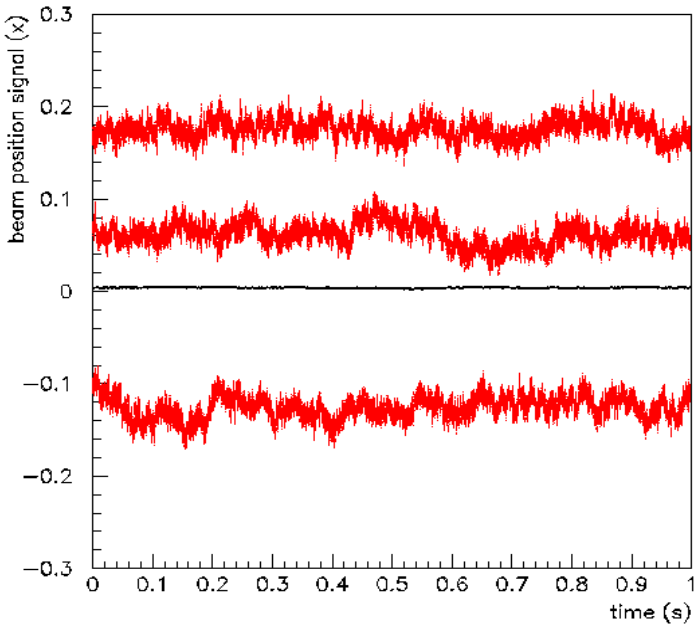
Tuesday 3/29

Richard Jones, Mar. 29 06:00
I set up jobs to copy the data files from the hard drive on gummo back to the cluster. My intention is to collect all of the trace files that go with a run summary file (runN) into a tarball and store them as runN_trc.tgz in the same directory. These can then be archived on dcache.

Analysis of Active Collimator Data

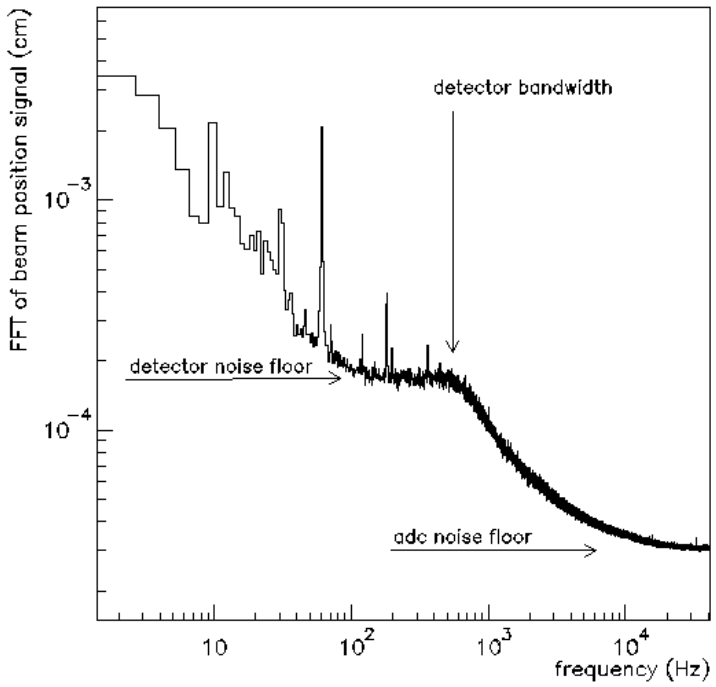
As an initial look at the frequency response of the active collimator, I look at 1-second traces on the inner two wedges that were captured when the beam was within a few mm of the center of the hole. The following traces came from 3.28.2011-run1.



Photon beam centroid x position signals (red) formed from difference/sum of the two inner wedges, converted to cm. The traces were taken at different offsets of the beam from alignment on the central axis of the collimator. The reference trace (black) formed from measurements taken without beam present indicates the level of detector and electronics noise

The above measurements were taken at 15 nA electron beam current, with a radiator of 10^{-4} radiation lengths thickness. The black trace was taken without beam present represents the intrinsic noise of the detector and electronics. It was formed by taking the difference between left and right wedges when the detector was mounted next to the photon beam dump in Hall B, without any beam in the hall, and dividing the difference by the average current sum observed on these two wedges under the conditions of 15 nA electron beam with the photon beam close to centered on the collimator. The total current in the active collimator is roughly constant as long as the photon beam is within 5 mm of centered on the collimator axis.

The data were collected using an ADC sampling at a rate of 82.5 kHz. This high sampling rate allows a detailed frequency analysis to be carried out on the signals. The following plot shows the FFT of the signal traces shown above. It has been averaged over 100 one-second traces, during which time the active collimator was scanned across the center of the photon beam in steps of 50 microns. The total range of the scan was from -2.5 mm to +2.5 mm in x. The detector was stationary during the sampling period, so only the zero-frequency component of the FFT is affected by the shifts in x. That bin has been suppressed in the plot below.



FFT coefficients (magnitude) of the x beam position signal taken while the photon beam is within 2.5 mm of the center of the collimator axis. Prominent peaks are seen in the spectrum at 30, 60, 120, 180, 198, and 360 Hz, corresponding to different modes of beam motion. The edge near to 600 Hz shows the bandwidth of the preamplifier at the gain setting used in this measurement.