Preliminary Results from the Dimensional Testing of GLAST-97 Detectors (Hamamatsu)

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56 detectors were delivered to UCSC and their dimensions were measured.
This is a preliminary analysis to allow assessment of different assembly methods.
A few measurements were not valid, but will be repeated and included in the final analysis.

A complete set of measurements on the 4 corners of the detectors were made with a manual probe station (Dennis is working on automating this procedure). Here we show only the distances between the left detector edge (resistor on top), which had been visually checked for straightness to within a few microns, and

a) the left side of the close bias ring Xa
b) the left side of the far bias ring Xb
c) the far edge of the detector Xc,

each on the Top and the Bot of the detector.
We report only on the measurements in the x-direction, normal to the strip direction, to find out how well a simple alignment of the detectors with a gig will work. The totality of the measurements are indicated in Fig. 1. Our working assumption is that the active area of the detector is well maintained between detectors due to the accuracy of the masks, but that the active area can be displaced and rotated relative to the detector due to the dicing process.

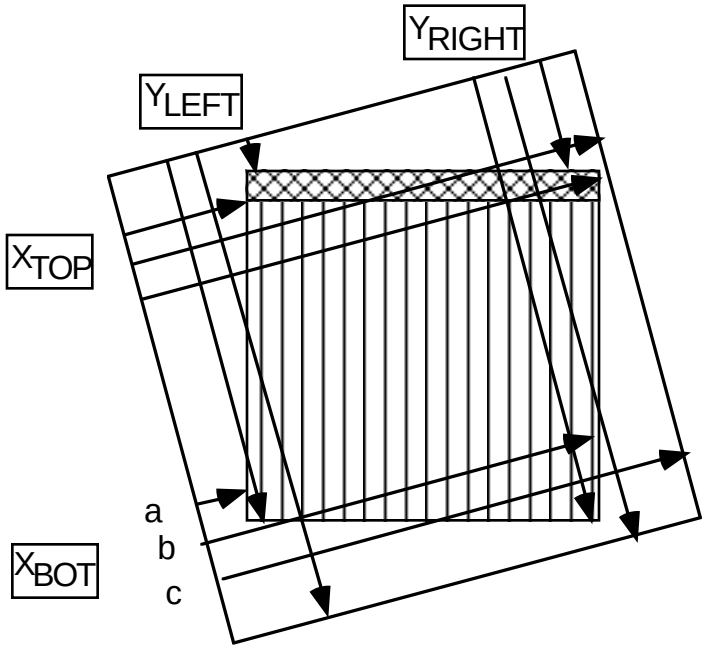

Fig. 1 Definition of distance measurements taken on the detector

We are interested in several distances across the detector, which were extracted from the measured distances and will be discussed below in turn:

Detector width W_D = Xc

The detector width indicates the quality of the dicing operation. The specs ask for 64.000+-0.050mm. The result (Fig. 2) is that the detectors are on the average 13microns oversized, well within the specification. The undersized straggler (detector 47) will be remeasured to assure that is not due to a mis-measurement. There are a few measurements missing for detectors with ID# in the 50's which have to be remeasured (see below).

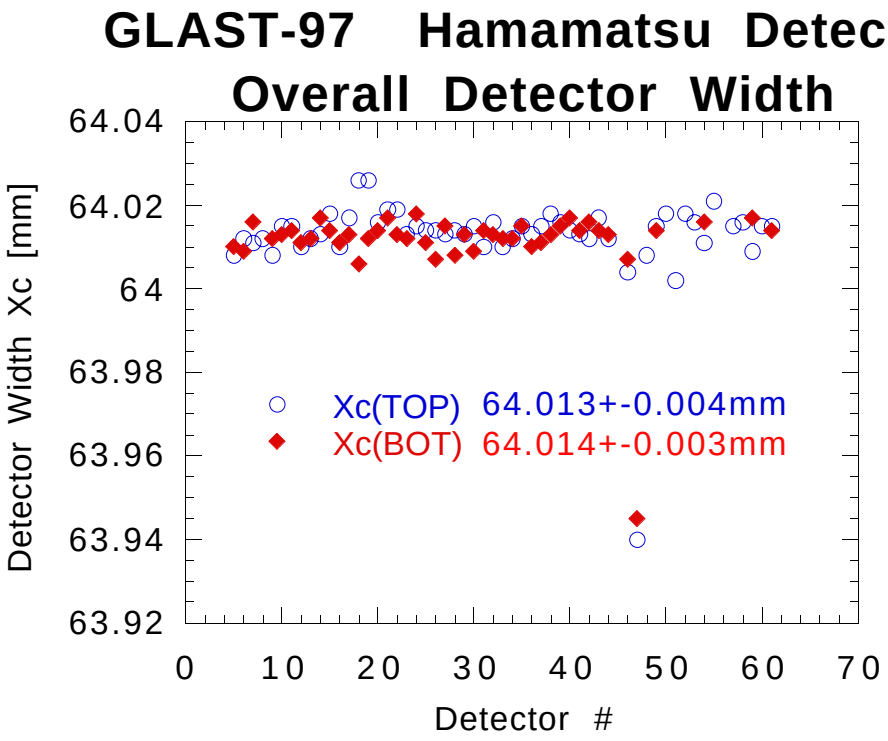

Fig. 2 Overall detector width Xc as a function of detector ID

Width of active area $W_A = Xb - Xa$

This should be a tightly controlled dimension because it is based on the lithography process. As indicated in Fig. 3, this is correct and the central values are 62.331mm for both TOP and BOT measurements. The specified dimension is 62.324mm. There a few notable exception of this: detector #47 (see above!), #21, and a few in the 50's ID range. Those have to be remeasured and the smart money is on them being mis-measurements (most likely confusions what is being measured).

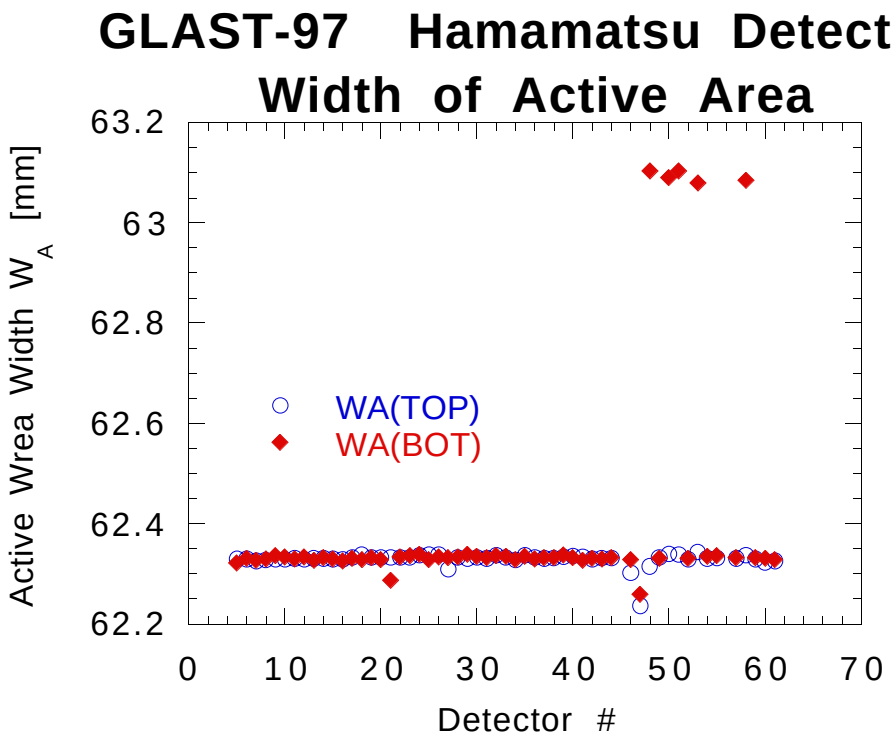

Fig. 3 Width WA of the active area as a function of detector ID. The detectors outside the narrow band are predicted to be mis-measurements.

Distance of active area from edge Xa

This dimension is a the important one for mechanical assembly with a jig. The measured means (Fig. 4) are in good agreement with the specified distance of 0.838mm. A systematic off set between the bottom and top measurement is seen, indicating a rotation of the active area in the detector.

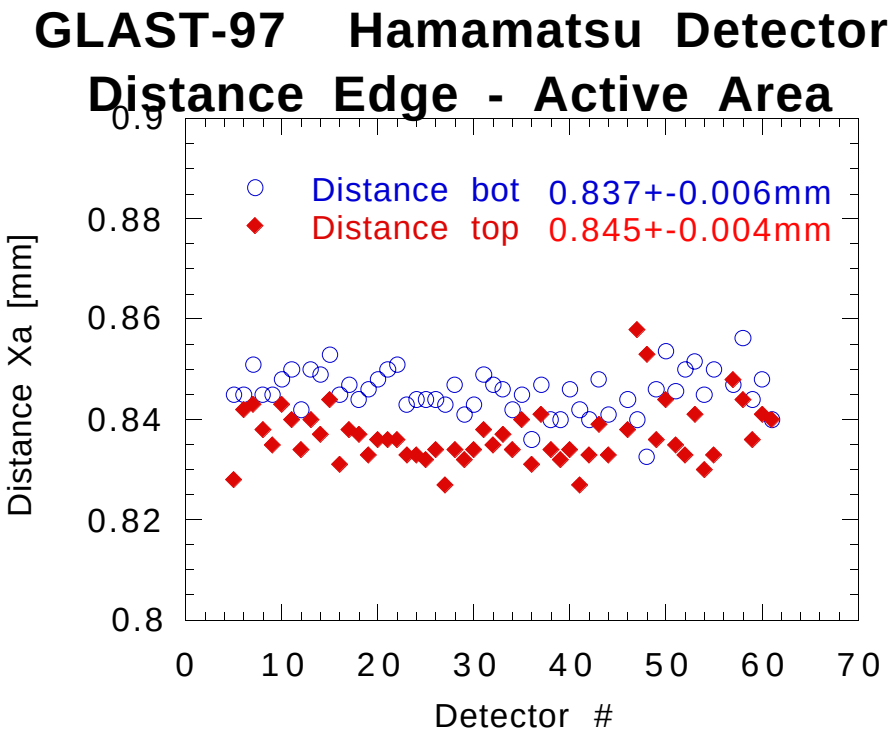

Fig. 4 Distance between edge and the active region Xa.

Average Distance of active area from edge Av = (Xa(TOP) + Xa(BOT))/2

The distance of the active region can be parametrized as an average distance and a rotation. The average distance is specified as 0.838mm. Good agreement is found (Fig. 5).

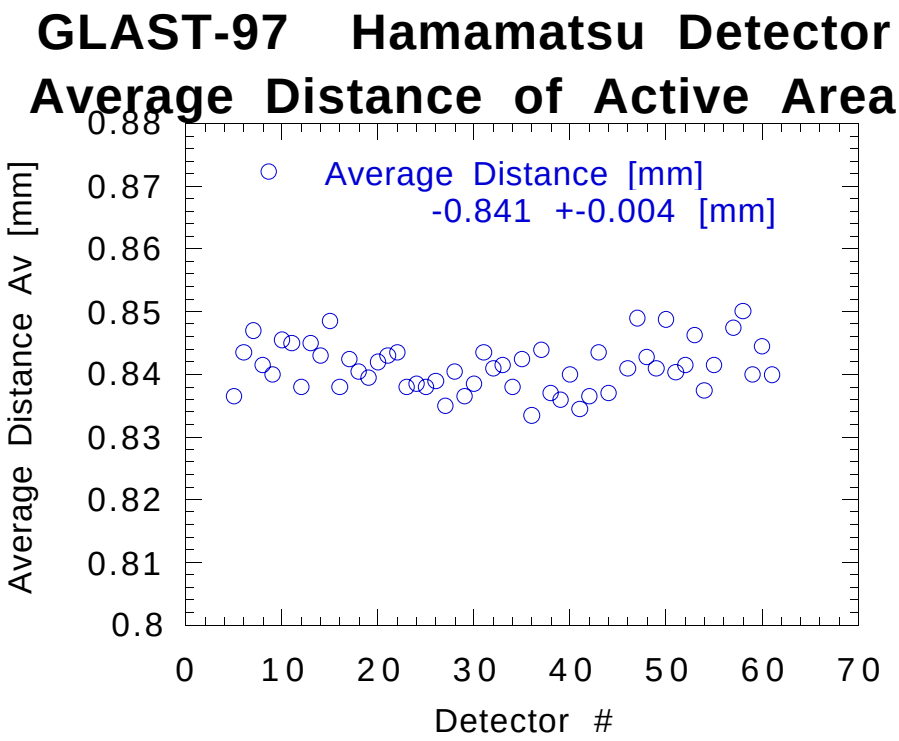

Fig. 5 Average distance Av between edge and the active region Xa.

Rotation of active area rel. to detector Rot = (Xa(TOP) - Xa(BOT))/2

Already seen in Fig. 4, there is a net rotation between the active area and the detector edges (Fig. 6). Without the detector#47, which should be remeasured, this rotation amounts to 0.005mm.

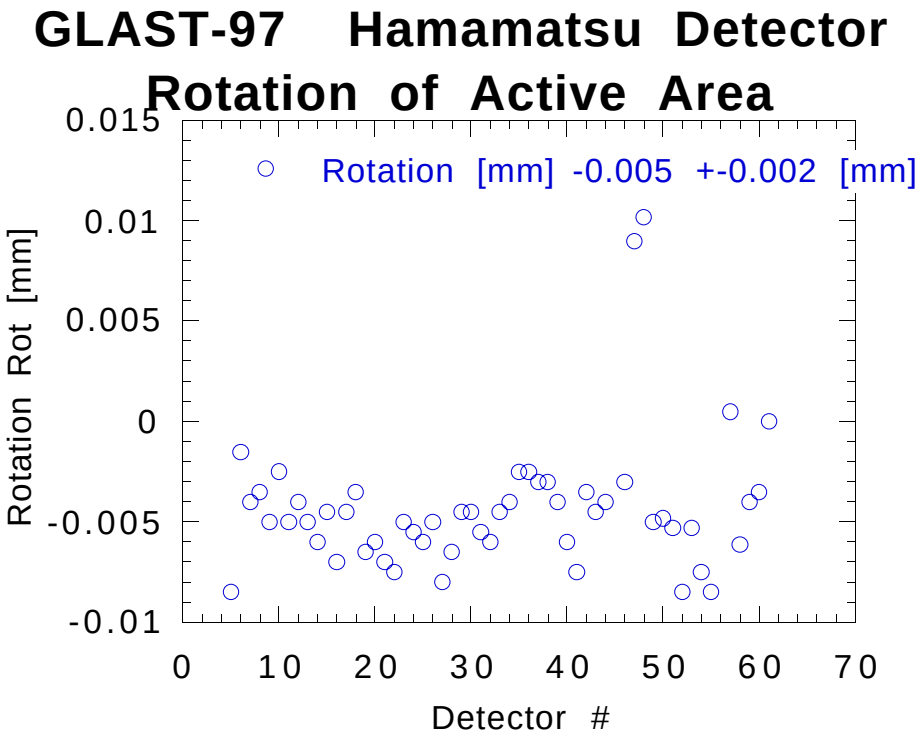

Fig. 6 Rotation between the detector edge and the active region.

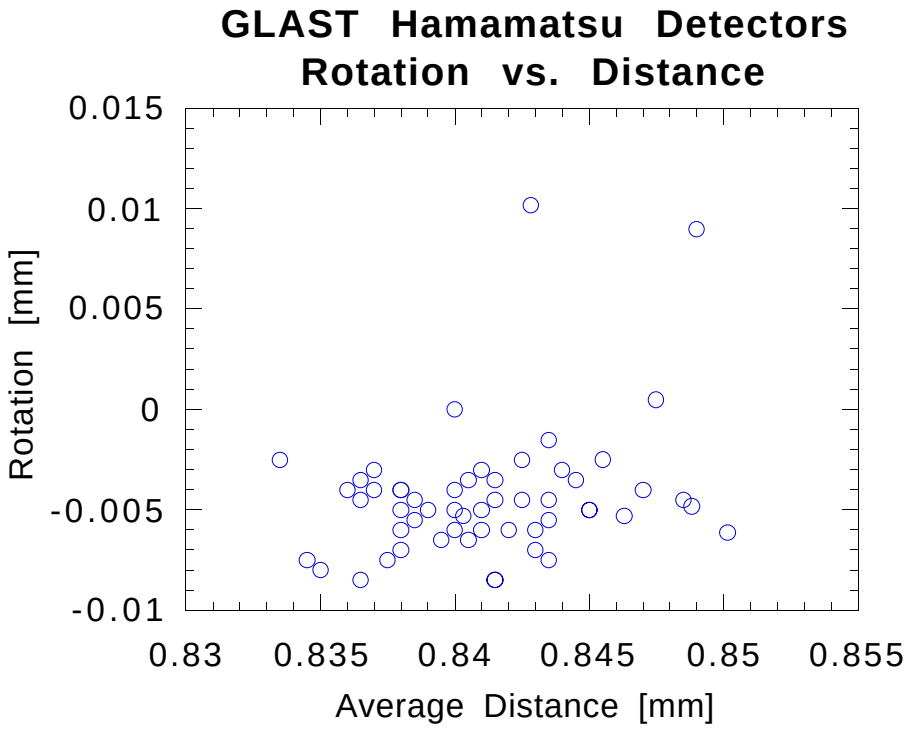

Fig. 7 Rotation between the detector edge and the active region vs. the average distance between the detector edge and the active region..

Conclusions

The mechanical dimensions of first 50 GLAST-97 detectors from Hamamatsu have been measured. The measured distances are within specification, subject to remeasuring a few stragglers. The dicing of the detectors seems to be well in hand with a typical sigma of 10micron, corresponding to an engineering tolerance of 25micron, a factor two better than specified. This bodes well for a simple assembly methods using jigs as the main tool and microscopes only as control.