

# Glast Detector Alignment Tolerancing Considerations

Alec Webster, Gwelen Paliaga

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- Ladder Edge Straightness will be affected by the following items:
  1. Ladder Jig
    - 4 stages bored for dowel pins while assembled on rails
    - hard pins (vs. Teflon or soft pins)
    - no stage adjustment (y) perpendicular to long axis (x) of ladder
    - achieve 10 um straightness over 38 cm
    - other considerations?
  2. Detector Edges
    - must be burr free
    - sawn straight within 2 um
  3. CTE of alum. jig
    - alum CTE of 24 um/ degC m. , CTE of silicon negligible
    - temp. difference of less than 1 deg C over all stages, each stage is 10cm wide, worst case 2um thermal dimensional change
  4.  $10+2+2= 14\text{um}$ , worst case ladder straightness, presuming all assembly procedures done correctly
- Ladder Fiducial Alignment
  1. Detectors overall dimensions are quoted as +/- 20um
  2. Fiducials are centered within 10 um total
  3. Over length of ladder, referenced to jig, fiducials up to 30um out of alignment
- **Maximum fiducial alignment error in an assembled ladder is  $14+30= 44\text{um}$**
- IF, by a new specification, or by sorting, detector alignment edge to fiducial is held to +/- 5um, then all fiducials could be aligned to  $14\text{um} + 10\text{um} = 24\text{um}$
- Ladder to Tray Alignment: Mechanical Method
  1. Alignment jig to be manufactured so datum target bosses are parallel to ladder alignment bosses within 10 um
  2. Trays to be manufactured so datum targets are parallel to corner post holes within 20 um
  3. **Ladders can be aligned to tray pin holes within  $44\text{um}+10\text{um} + 20\text{um} = \underline{74\text{um}}$  with unsorted detectors**, or within  $24\text{um}+10\text{um} + 20\text{um} = 54\text{um}$  with sorted or new spec. detectors

## Discussion:

1. Total worst case mechanical alignment error of tray to ladder fiducials to is 74 um.
2. In our opinion this is the minimum allowable since we need to allow for other sources of error, such as: chicken feathers, operator variance, dust.
3. This analysis relies on highly toleranced parts which we think are achievable. Some issues are a full commitment to QC and the cost of these types of parts.