SCENARIOS FOR GLAST SSD LADDER ASSEMBLY AND TRAY MOUNTING

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There has been some discussion about changing the technique for assembly of SSD ladders. Alternate techniques have some advantages such as easier electrical testing, safer handling, and reduced thermally induced stress. The proposed new procedures also have disadvantages and also don't have the prototyping and testing history of the BTEM (Beam Test Engineering Model) ladders. What follows is a discussion of the BTEM ladder technique and two alternatives.

1. BTEM TECHNIQUE

Detectors are aligned, using their diced edges, on a jig and edge glued together. After curing in an oven they are transferred to a "universal fixture" using a vacuum pickup tool. The detectors stay in the fixture for almost all the other procedures. The fixture is designed with a vacuum chuck, access for backside probing, a quick-change interface to other tooling, and a cover for transport. Procedures that are performed in this fixture are, in sequence: mechanical survey, IV curve, wire bonding, IV curve, Cap test. The detectors need to be placed in a new fixture for encapsulating the wire bonds which is done with the same vacuum pickup tool. Electrical testing is done by employing a backside-probing tool which has contacts that touch the back of each detector in the ladder through holes in the universal fixture. After encapsulant curing the ladders are put in long term storage. Ladders are aligned on trays in X and Y using their edges against an alignment jig and in Z by spacer tape on the tray surface.

Advantages:

- Well developed, tested, and proven technique. Out of 130 ladders produced, only 2 were rejected due to failures with unknown origin; 3 ladders were rejected and 2 were repaired for reasons that were avoidable.
- Detectors can be aligned very well with appropriate tooling.
- Easy to replace a detector even in a late stage of assembly (before potting).

Problems:

- Ladders are relatively fragile and need a universal fixture to avoid moving ladders independently.
- When the ladders are transferred there is potential to scratch the backplane.

2. EDGE GLUED LADDERS MOUNTED ON KAPTON STRIPS

This option would integrate the ladders onto the Kapton bias circuit prior to being mounted on the trays. The Kapton circuit would have a tail with electrical contacts to each detector bias for testing. Detector ladders would be edge glued in the same fashion

as the BTEM and then mounted on a Kapton bias circuit The ladder would either need to be aligned to the circuit in Z, or aligned to the tray somehow during tray assembly. Wire bonding, testing, and encapsulation would be done similarly to option 1. Mounting detectors on trays would be different since the gluing would now be between the Kapton and Lead vs. Detectors and Kapton.

Advantages:

- Electrical testing is simplified by removing the need for a backside probing tool.
- Ladders are more robust with the added stiffness of Kapton (this may be minimal).
- Reparability on tray? Arguably no different than option 1.
- Detector backplane is protected.

Problems:

- How to do Z alignment. Keeping planarity will be more difficult with floppy Kapton.
- Need to devise a way to have support under wire bonding pads
- Repairing ladders is harder. Removing single detectors isn't as easy as option 1.
- Complicates Kapton-lead or Kapton-facesheet bond. Put pressure on detectors?
- Kapton tails for testing need to be trimmed with detectors close by. Dangerous!

3. DETECTORS MOUNTED ON KAPTON- no edge glue

For this scenario there would need to be a stiffener supporting the Kapton such as a carbon sheet or rails. Detectors would be glued to the stiff bias circuit and aligned either mechanically or optically to fiducials on the Kapton. The major advantage of this option is the "possibility" of removing thermal mismatch induced stress in the detector edge bonds. Also the ladder should be stiff enough to be transferred from jig to jig without special pick up tools. All other procedures would be similar to option 2.

Advantages:

- Mediate thermal mismatch induced stress in detector edge glue.
- Detector backplane is protected.

Problems:

- Needs rigid support. This changes the ladder-tray interface.
- Alignment is based on dimensional stability of Kapton and stiffener.
- Maintaining detector planarity is even harder than options 1 or 2.
- Encapsulation is problematic since it probably would introduce the same thermally induced strains, even with compliant adhesive.
- Single detector replacement on a ladder is harder than option 1.
- Trimming Kapton tail is dangerous.

Discussion: If we move towards integrating Kapton to the ladders early on, ladder production may be simplified due to a cost savings on tooling, i.e. a less complicated universal fixture. If option 3 could be designed to truly eliminate stress between

detectors then it should be considered. Maybe there are other options for design of the facesheet-lead assembly that would reduce the strain in the ladders?