

Proposal for the Number of required SSD for GLAST

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This note is a proposal for the number of silicon detectors to be purchased by GLAST.

The following needs have to be covered:

- a) Prototyping
- b) 2 "Spare" towers, one of them used for qualification
- c) 16 towers of flight instrument
- d) Spares
- e) Wastage

There are 4 detectors ("sensors", "SSD") in a ladder, 4 ladders per tray face.

There are 32 detectors in a full tray (two faces).

There are 19 trays in a tower, two of them only populated half

There are 5 different tray types: top, bottom, normal, heavy, empty.

a) Prototyping:

The following prototypes need detectors:

- 1) 10 ladders for glue tests etc
- 2) > 1 regular tray prototype for shake tests
- 3) >1 superglast tray for shake tests
- 4) 3 trays for the Engineering Model

This amounts to about **200 detectors for prototyping.**

b) Spare Towers

The "spare" towers will be acceptance tested for flight. Even if the first "Qual" tower will not function after testing, the second one will be a spare, which can be swapped in during I&T as a full tower. If needed, one or both of the spare towers can be used as source of spare trays. This means we **would have at least 19 spare trays, about 6%, in one spare tower, or at most 38 spare trays, about 12%, in the two spare towers.**

c) Spare Trays

No repairs on the trays are envisioned beyond exchanging the TCM (readout electronics board) and minor single channel wire bonding. Thus no spare ladders or detectors are needed beyond wastage.

Spare trays are needed to swap out non-functional trays during tower assembly and I&T. They have to be fully acceptance tested. We have to assume that we need some spares beyond the trays in the spare towers, **at least 1 per type or about 5%**, which can be swapped in with a days notice. Table 1 shows a proposed number of spare trays. It first shows the number of trays in the 16 flight towers and the 2 spare towers, for each of the 5 types. It then shows the number of proposed spare trays, for each type, and the number of SSD required to populate these trays. **The total number of required SSD for 16 flight towers, 2 spare towers, and the spare trays is 10,816.**

Table 1 Number of Trays in Towers, Proposed Spare Trays & Spare SSD's

Tray Type	Flight Towers	Spare Towers	Spare Trays	Spare SSD's
Top	16	2	1	16
Bottom	16	2	1	16
Normal (3% Conv.)	16*11 = 176	22	8	256
Heavy (18% Conv.)	16*4 = 64	8	3	96
Empty (0% Conv.)	16*2 = 32	4	2	64
Total SSD	9216	1152		448 = 4.3%

d) Wastage

During assembly, a certain number of sensors are lost due to breakage, assembly mistakes etc. We will use the BTEM numbers to estimate the number of SSD lost during assembly (called here “wastage”). On the detector level, 9 SSD of 555 were lost. On the ladder level, 2 out of 130 were lost. (These numbers are based on the “official” detector data base and might differ slightly from the numbers in the NIM paper. They do not include screw-ups associated with ramp-up like gluing a ladder to a shelf or messing up the alignment completely). Thus the wastage is $1.6\% + 1.5\% = 3.1\%$. If on the other hand we count **all wastage in the BTEM** (including the obvious screw-ups easily avoided in a well planned assembly operation), **we arrive at 4.7%**, which we will adopt here in order to be conservative.

e) Total number of SSD needed

The total number of SSD needed is $(10,816+200)*(1+0.047) = 11,534$. In the first part of the pre-production run, we will get 35 detectors.

Thus the needed number after the first 35 SSD will be

11,500.

f) Spare Panels, TCMC

The proposal calls for the fabrication of 15 spare trays, divided among types as shown in Table 1.

Failure modes of the panels and TCMC have to be estimated to arrive at the panel and TCMC wastage number, and the number of panels and TCMC to be procured. The panel failures have to be detected before the ladder installation on the panels commences.

g) Spare Parts Inventory

The need for spares and the wastage number has to be watched carefully during the tray fabrication. The fairly long time of SSD procurement allows the number arrived above to be adjusted, if needed.