GLAST-LAT International Collaboration Meeting

Roma, Sept. 15-18 2003

Overview of the Italian Activities

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INFN Pisa
Italian Project Manager

GLAST-Italia Collaboration

INFN contribution:

Sezioni INFN	F.T.E	Tot.
Bari	10.9	12
Perugia	7	8
Pisa	8.2	13
Roma2	4.4	8
Trieste	5.3	12
Padova	2.9	6
Totale	38.7	59

Observers and theorists:

35 astrophysicists belonging to various Institutions
(IAS, ASI, Arcetri, Brera, Bologna, Torino, and several Universities)

Technical collaboration with:

Dipartimento di Ingegneria Aerospaziale (Univ. Pisa)
Dipartimento di Ingegneria dei Materiali (Univ. Perugia)

ASI-INFN contribution to the LAT

"The funding of the Italian contributions to the LAT instrument project will be equally shared by INFN and ASI. The scientific and technical responsibility of the Italian effort in the construction of the LAT will be of INFN. .."

From DRAFT MoA SLAC-INFN-ASI

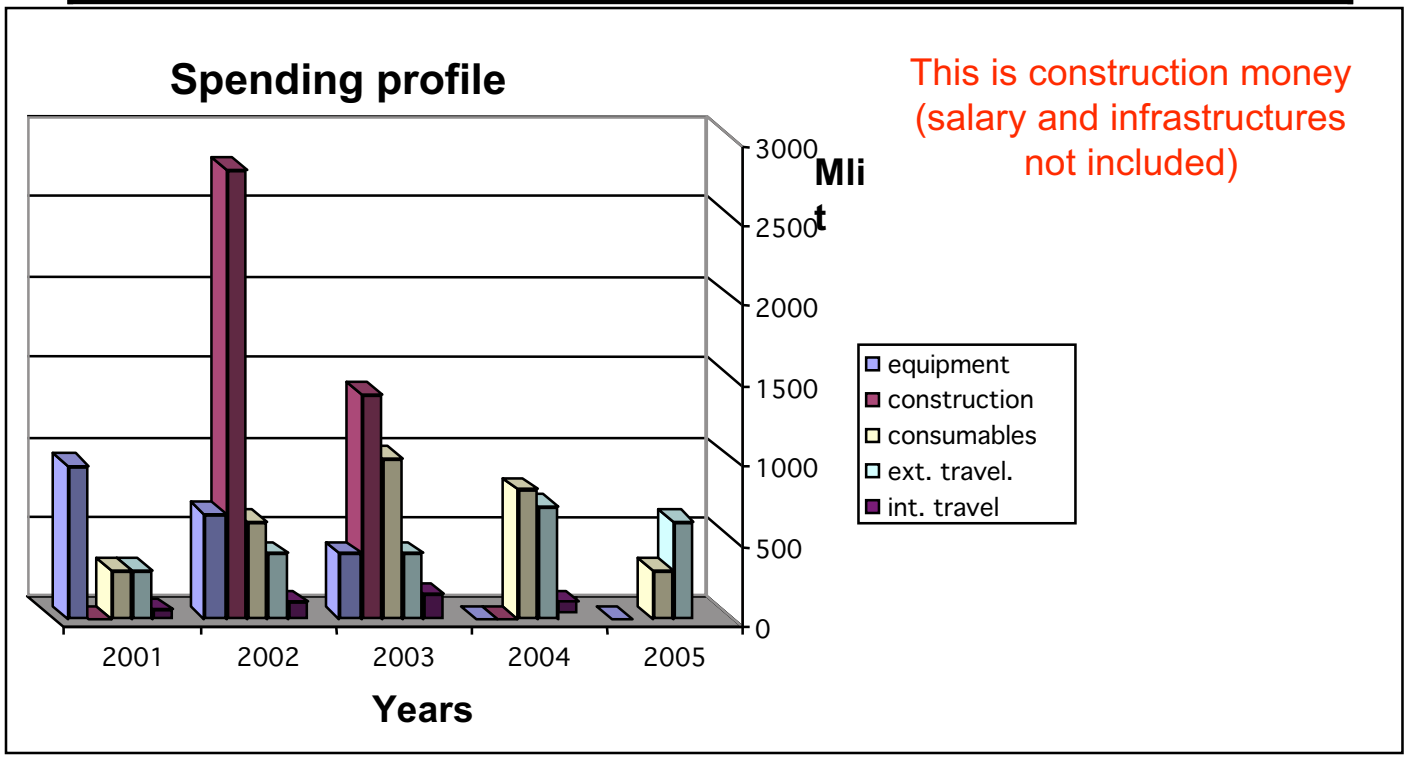
ASI has definitively approved GLAST and its financial budget for construction:

- 4.5 M€ for 2003
- 0.6 M€ for 2004

On going discussions between ASI and INFN to find the most effective way to spend this money.

INFN Financial budget (in Mliras)

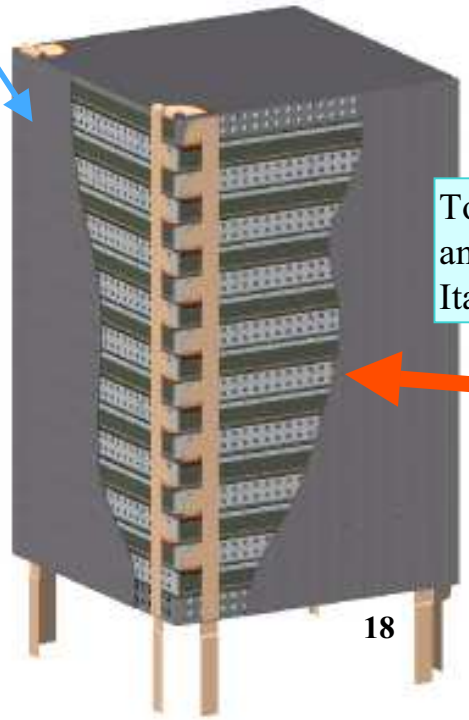
Years	Equipment	Construction	Consumables	Ext. travels	Int. travels	Tot.
2001	950	0	300	300	50	1600
2002	650	2800	600	400	100	4550
2003	400	1400	1000	400	150	3350
2004	0	0	800	700	100	1600
2005	0	0	300	600	0	900
	2000	4200	3000	2400	400	12000



This is construction money (salary and infrastructures not included)

TKR Flight-Tower Design & Assembly

Tower Structure (walls, fasteners)
Engineering: SLAC, Hytec
Procurement: SLAC. Italy

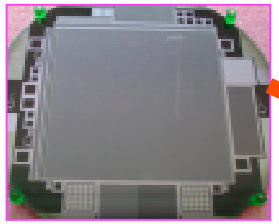


18

Cable Plant
UCSC

Tower Assembly
and Test
Italy (18)

SSD Procurement, Testing
Japan, Italy, SLAC

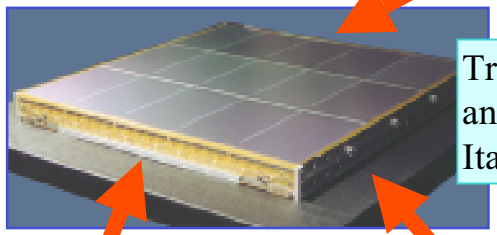


10,368

SSD Ladder
Assembly
Italy

2592

Tray Assembly
and Test
Italy



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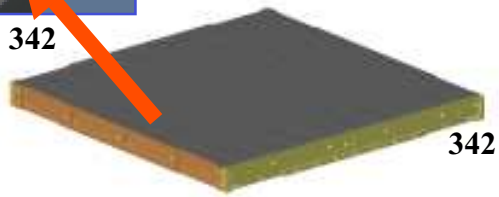

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Electronics Design,
Fabrication & Test
UCSC, SLAC

648

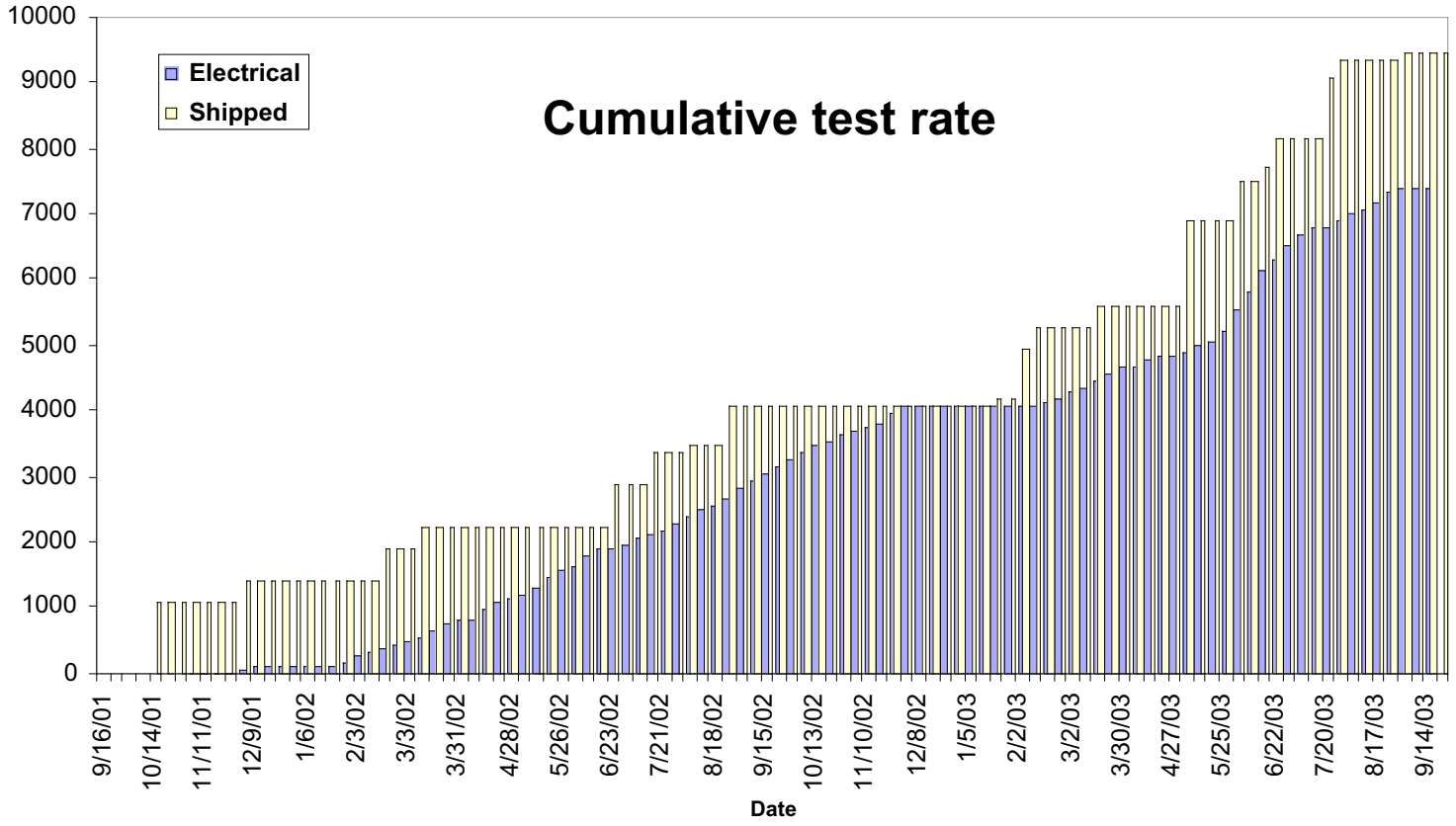
Composite Panel & Converters
Engineering:
SLAC, Hytec, and Italy
Procurement: Italy

On-going activities on hardware side

- Acceptance and tests of sensors
- Ladders production and tests
- Ladders assembly onto trays
- Tests of stacked trays with cosmics
- EM construction and tests

SSD Electrical Test Rate

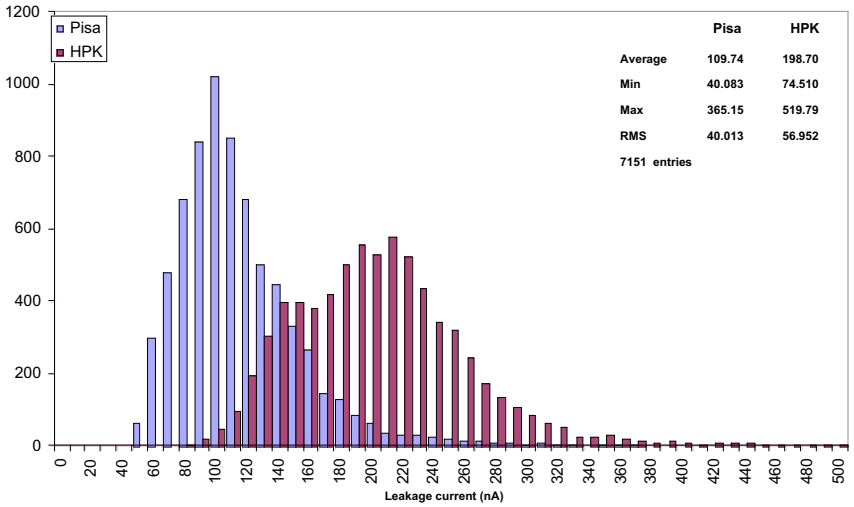
SSD in Italy	9452	enough for 16 towers
SSD tested	7373	
SSD to review	201	
SSD rejected	44	



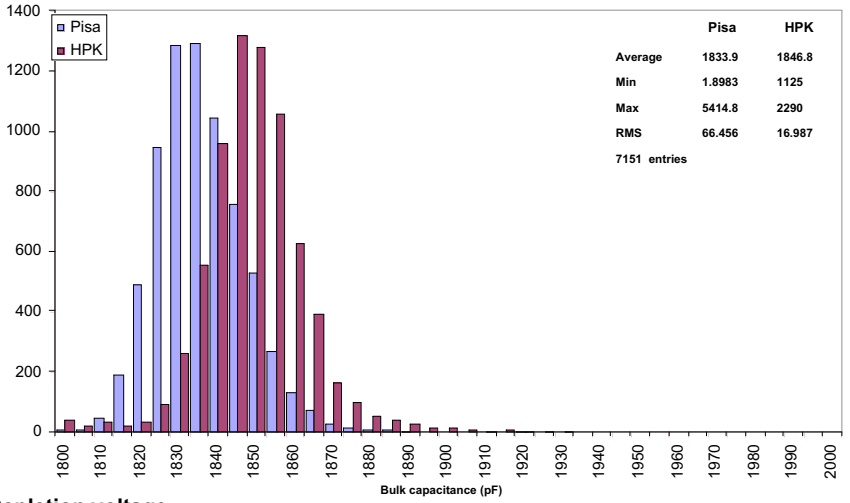
SSD Electrical Properties

Specification: leakage current <500 nA at 25□C and 150 V

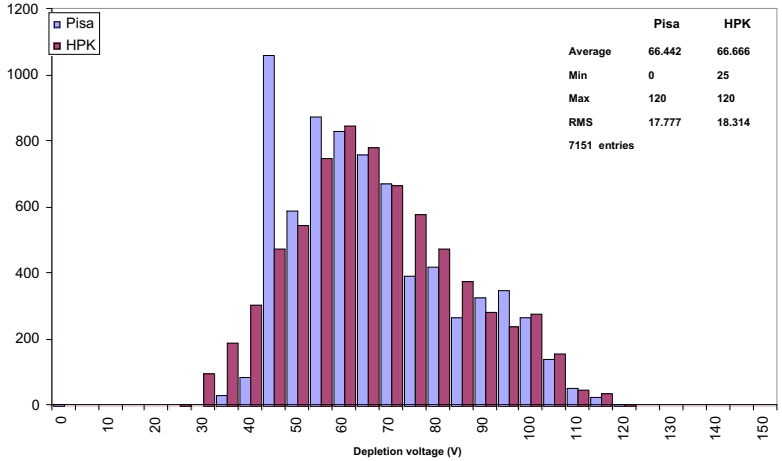
Leakage current at 150 V



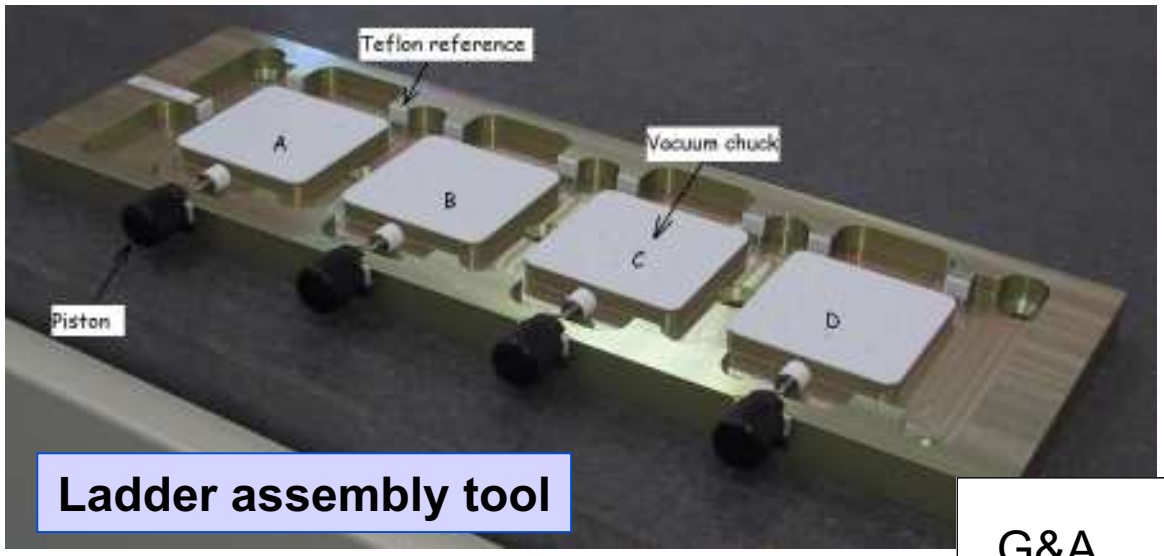
Bulk capacitance at 150 V



Depletion voltage



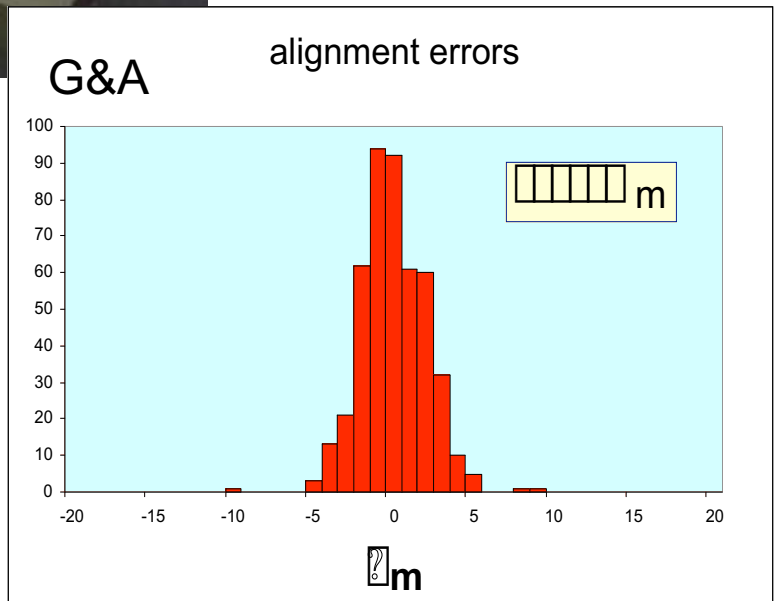
Ladders Production



Ladder assembly tool

50 ladders EM
470 flight ladders:
370 produced in G&A
100 produced in MIPOT

Manual fast AND precise method
24 ladder assembly tools used in parallel
Very good ladder alignment obtained

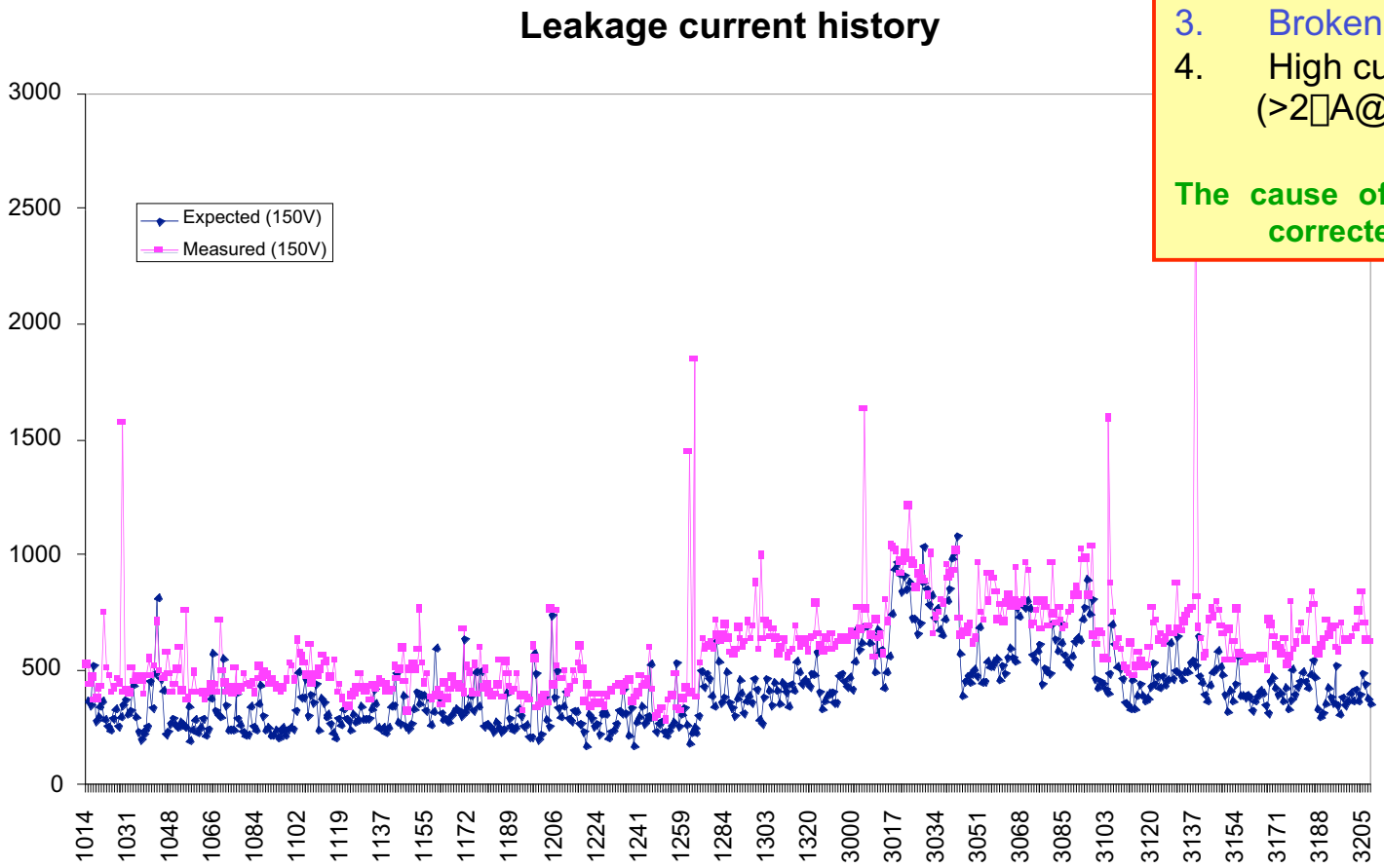


Ladders Electrical Tests

Electrical test results:

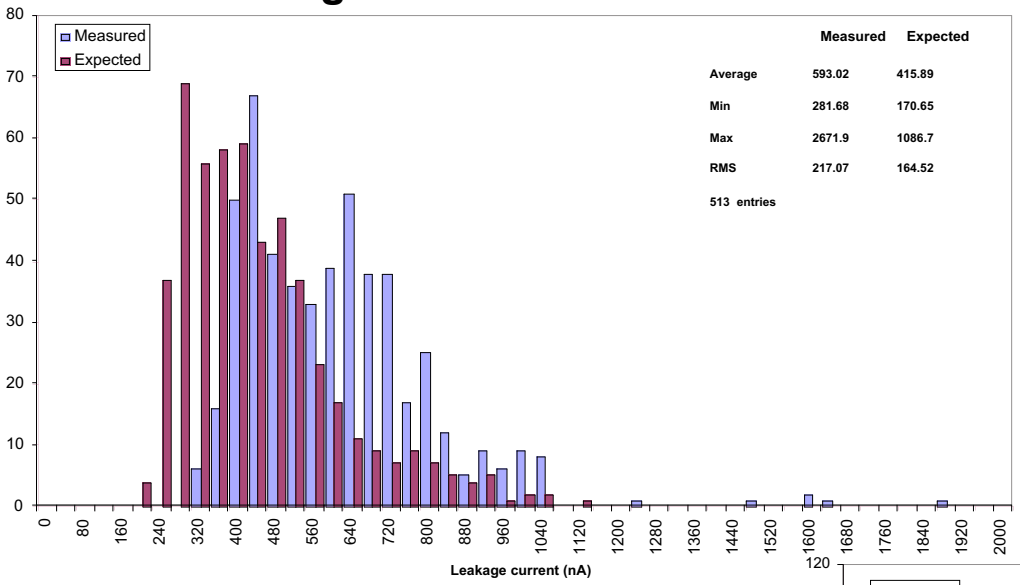
1.	Ladder tested	513
2.	Accepted	501(98%)
3.	Broken edge	6
4.	High current (>2□A@150V)	6

The cause of problem 3 has been corrected.

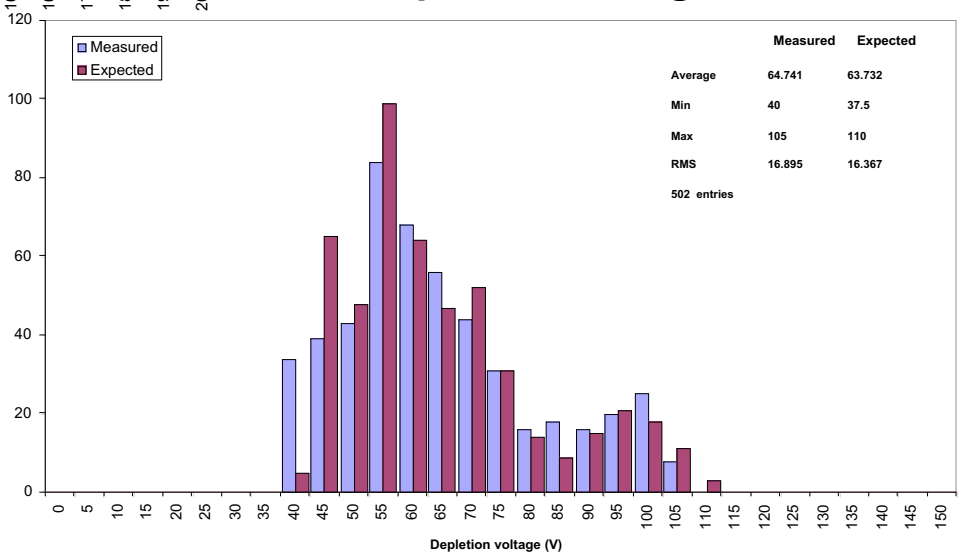


Ladders Electrical Tests

Leakage current at 150 V



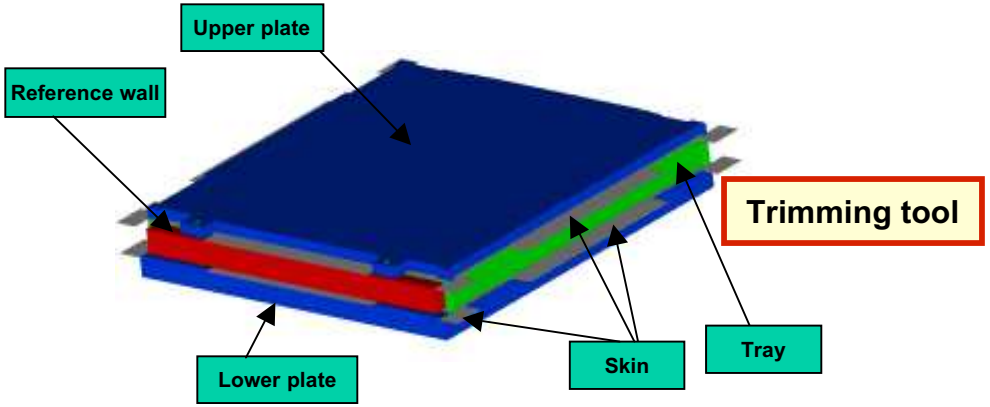
Depletion voltage



Tray assembly tools

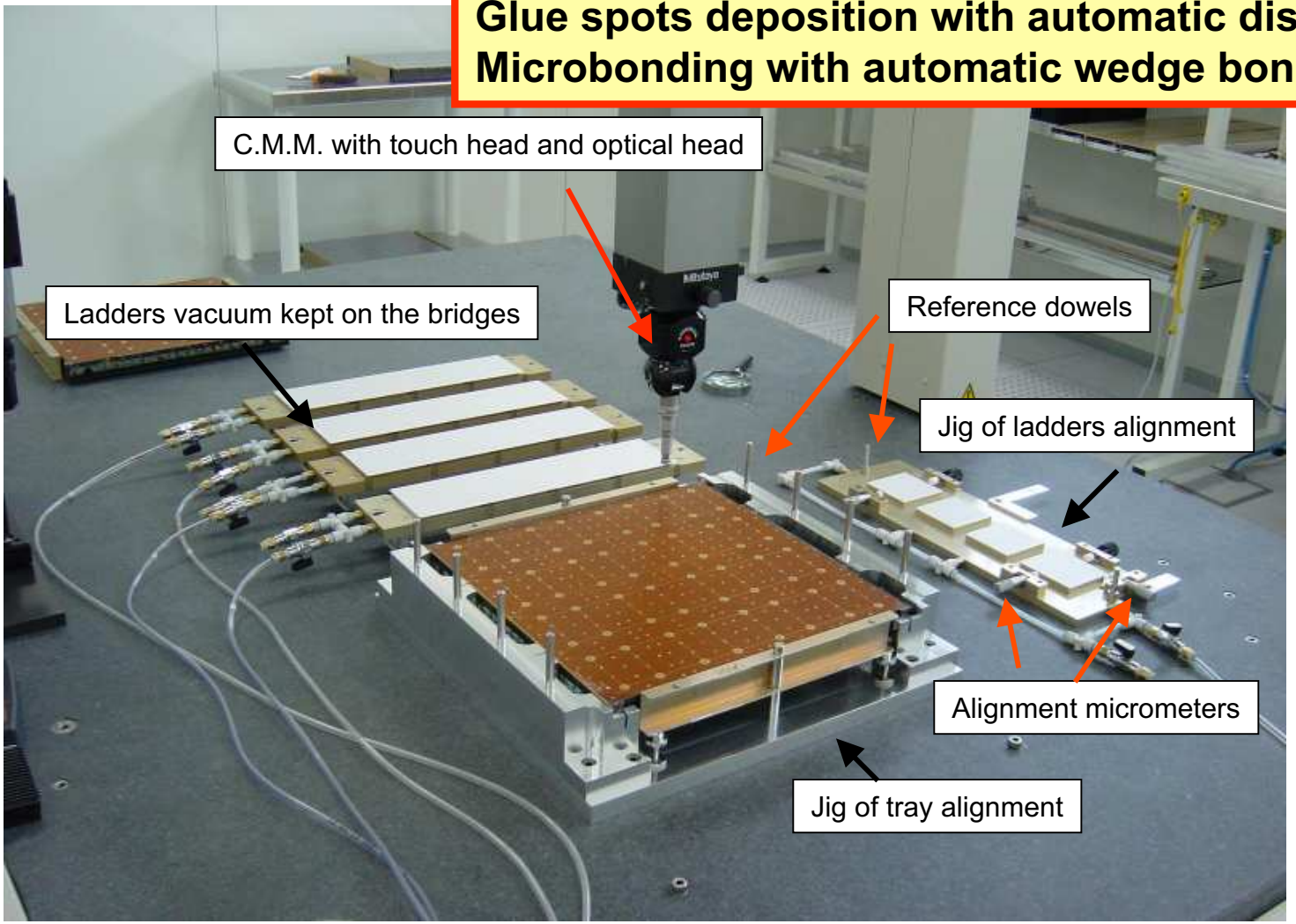
tool	In house	Under construction	total
assembly tool	3	4	7
Tungsten tool	2	1	3
Kapton tool	1	1	2
Trimming tool	1	0	1

Tray assembly rate capability: 3 trays/day

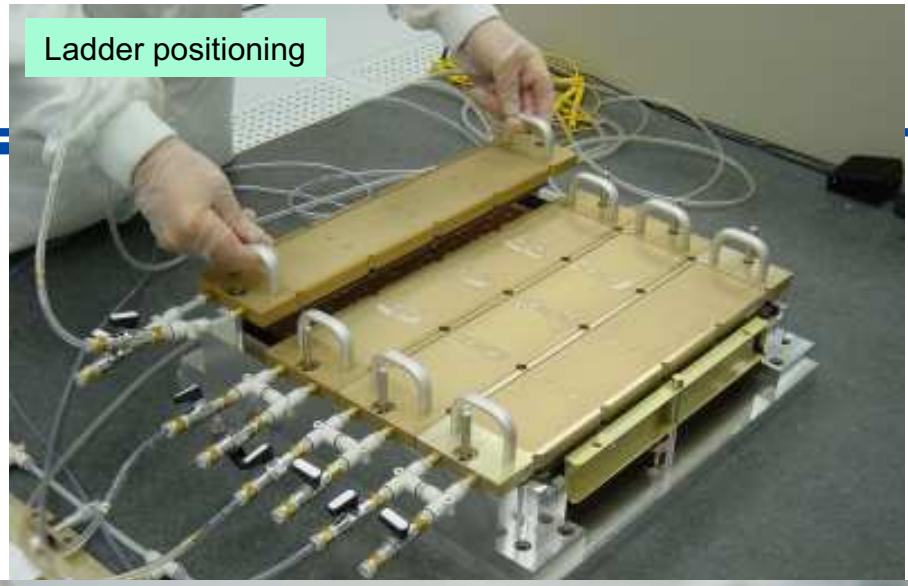


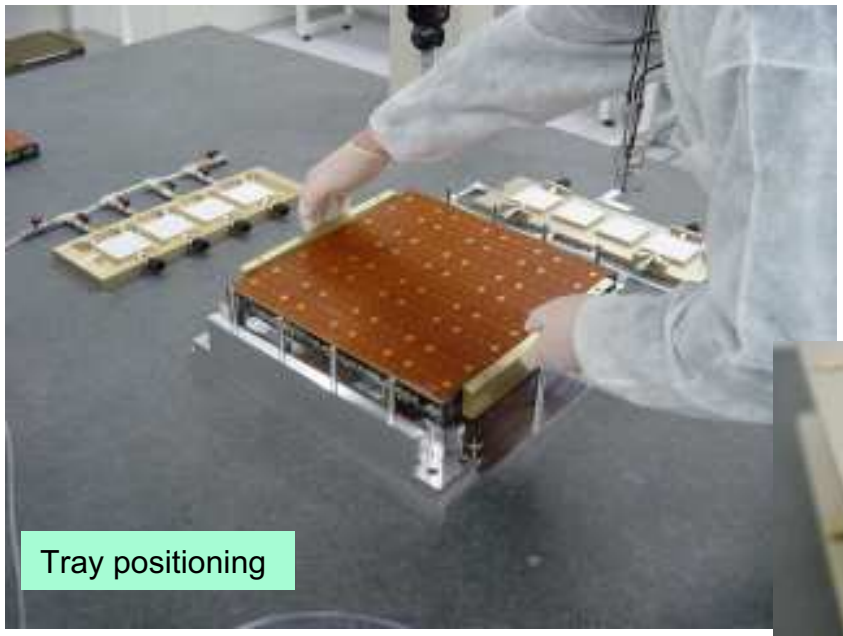
The tools

All the assembly operations under C.M.M.
Glue spots deposition with automatic dispenser
Microbonding with automatic wedge bonder



Assembly phases

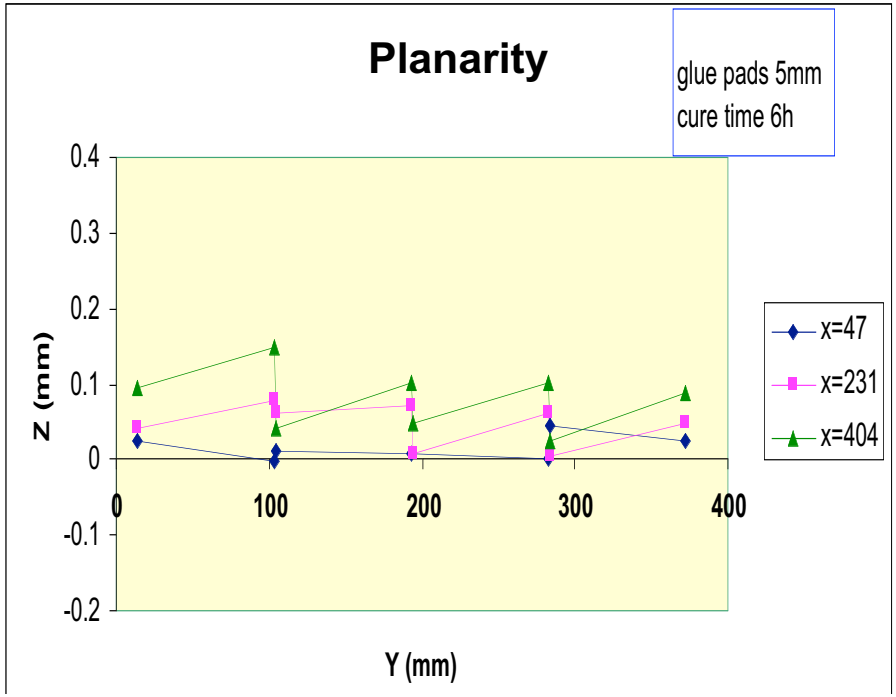


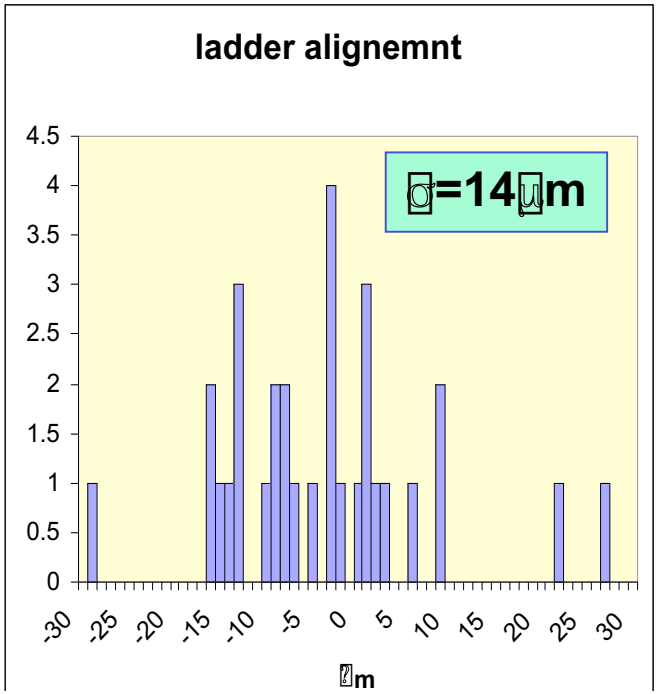


1 assembly chain ready
5 assembly chains in construction
Max assembly rate : 15 trays/week
Foreseen assembly rate: 10 trays/week

Tray assembly results

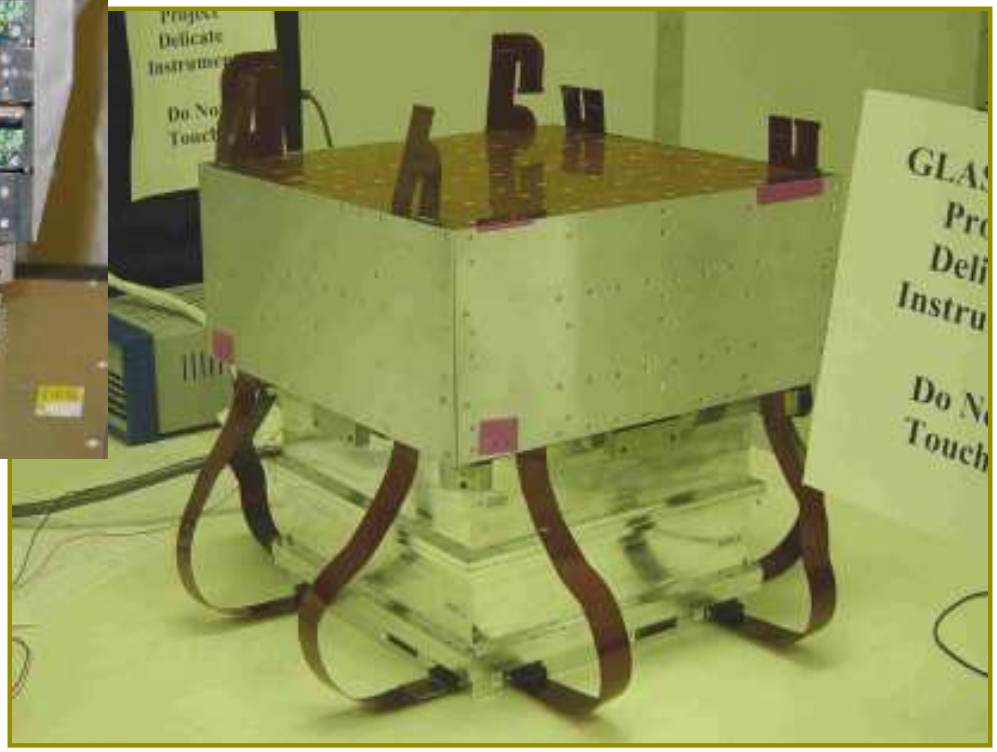
Requirements: Alignment error < 50μm
Planarity 100μm





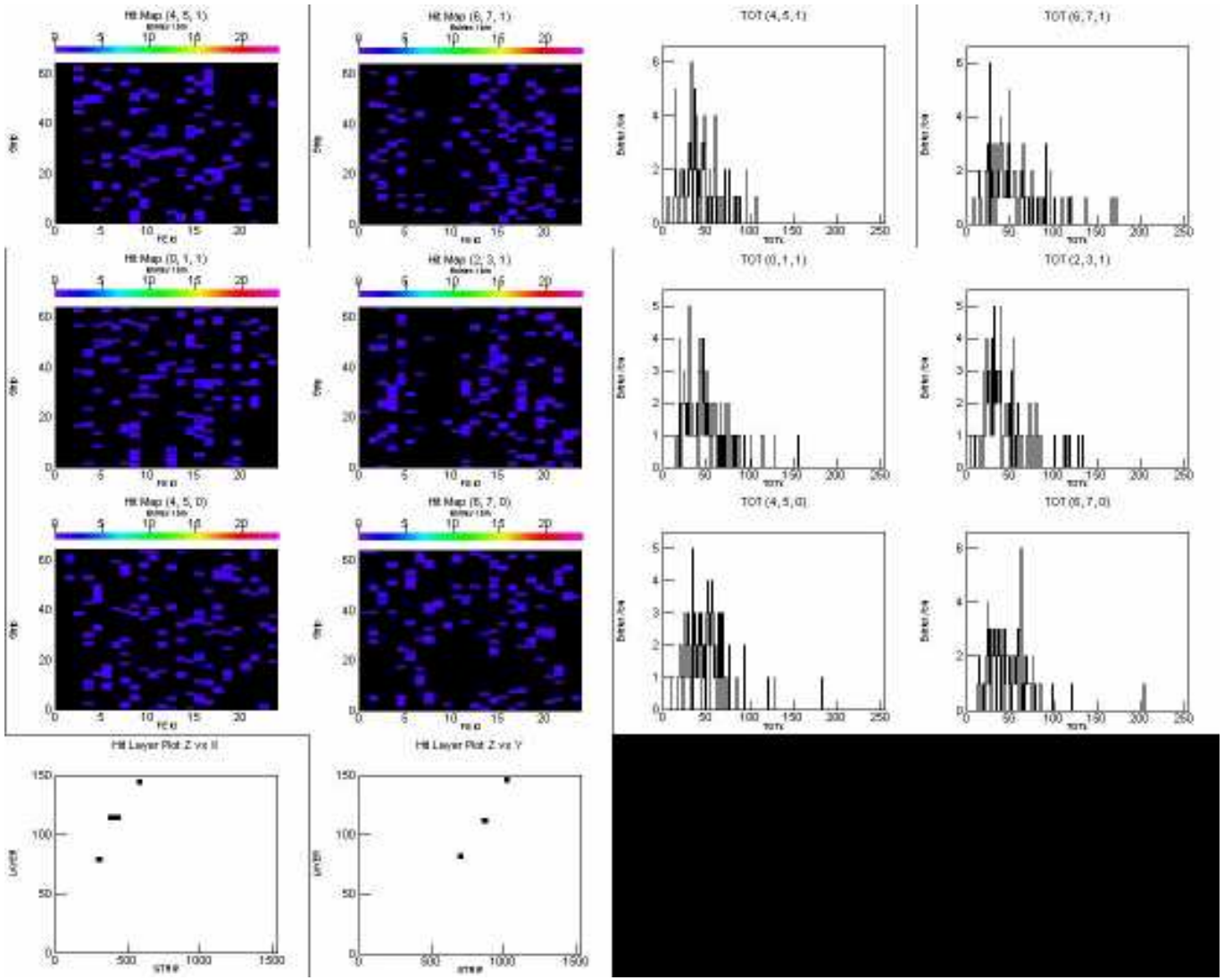
- The tray assembly has been successfully tested: the alignment and planarity of the ladders are in specification with possible improvements.
- The number of tools in production will allow an assembly rate of 40 trays/month (2 towers/month) that well matches with the test rate of the trays and towers.

Mini-Tower Assembly & Test



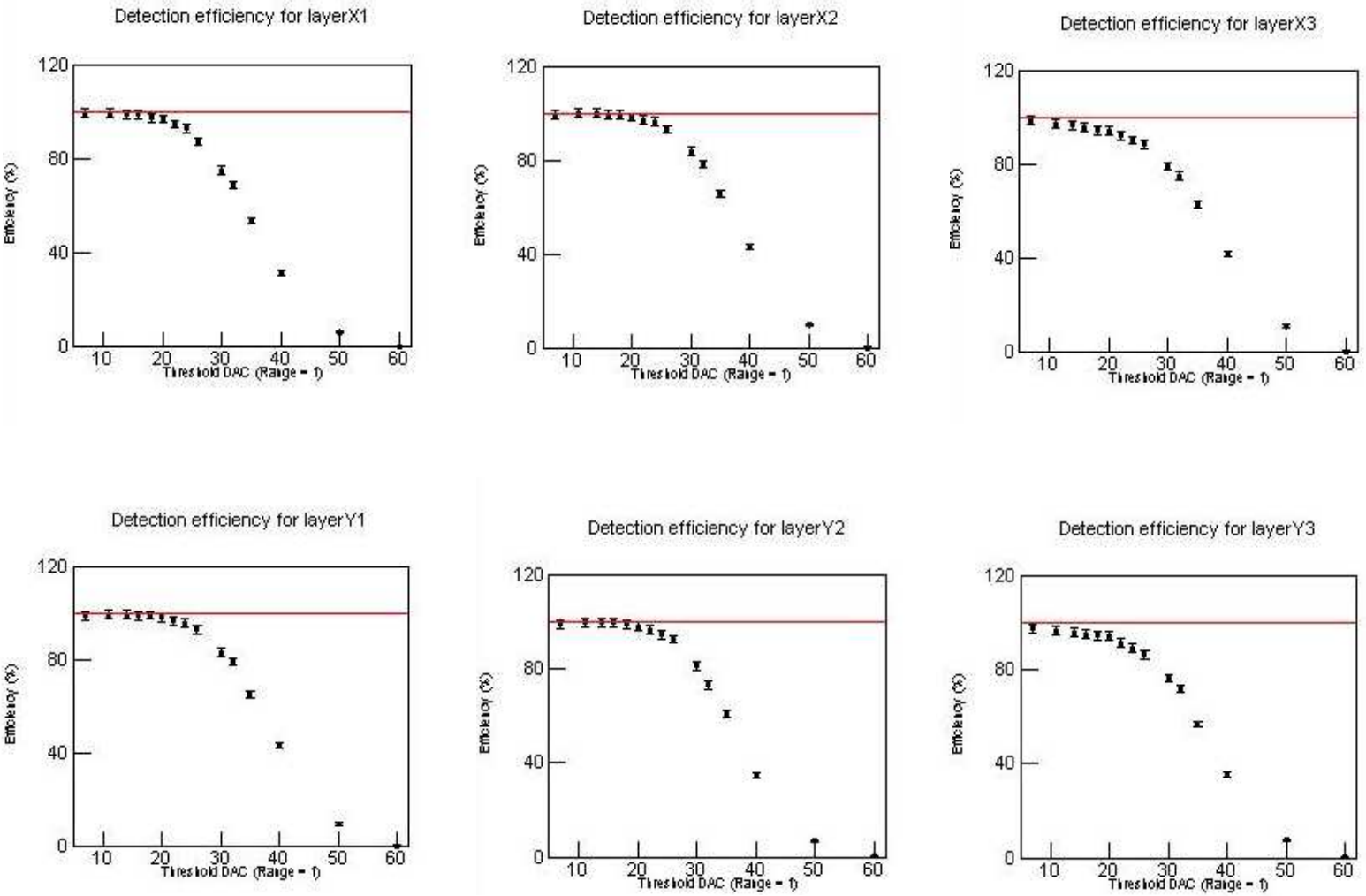
(Aluminum grid fixture is removed)

Cosmic Rays _ Online DATA

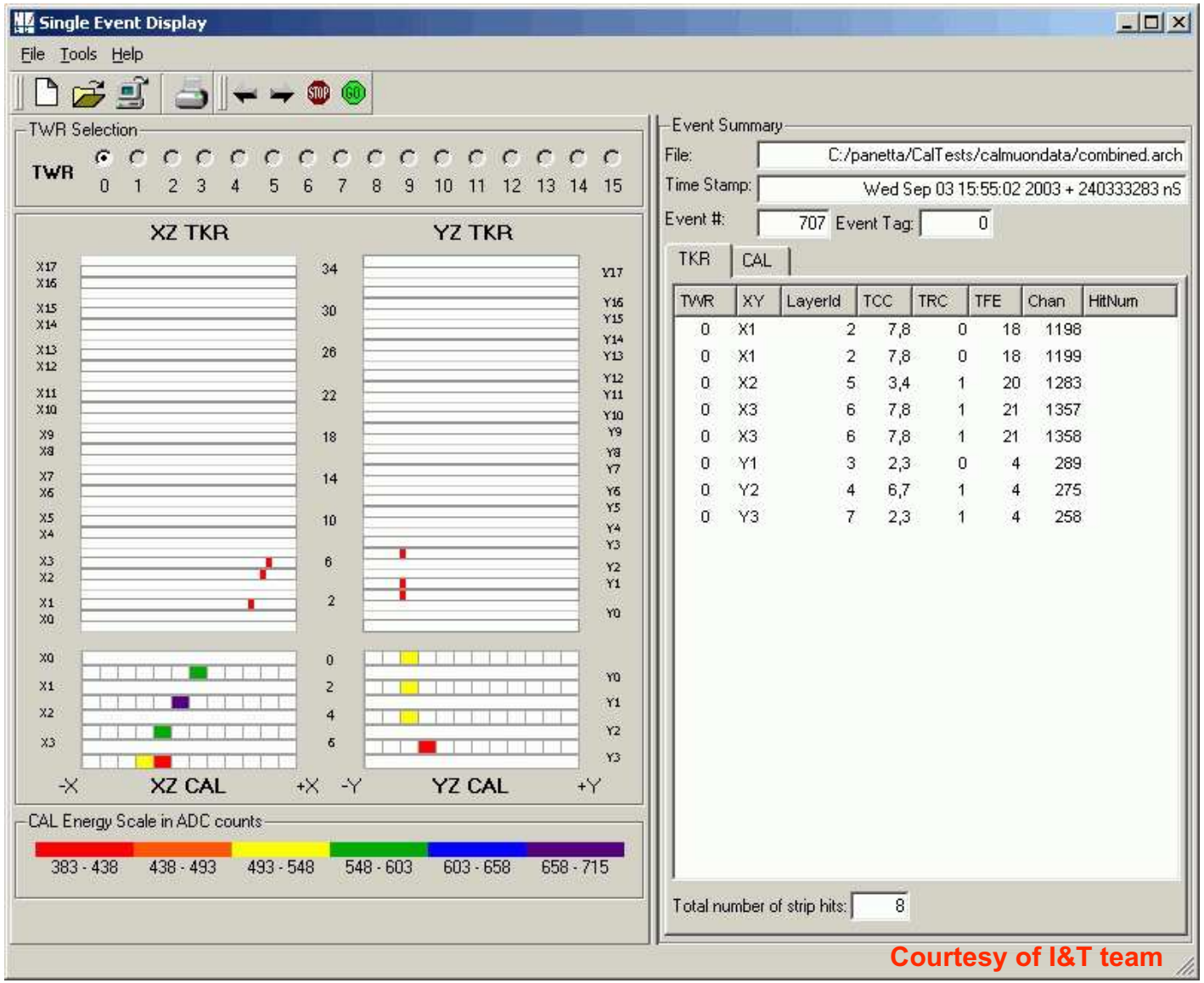


The trigger occurs when particles traverse the 6 consecutive layers of the MiniTower.

Detection Efficiency

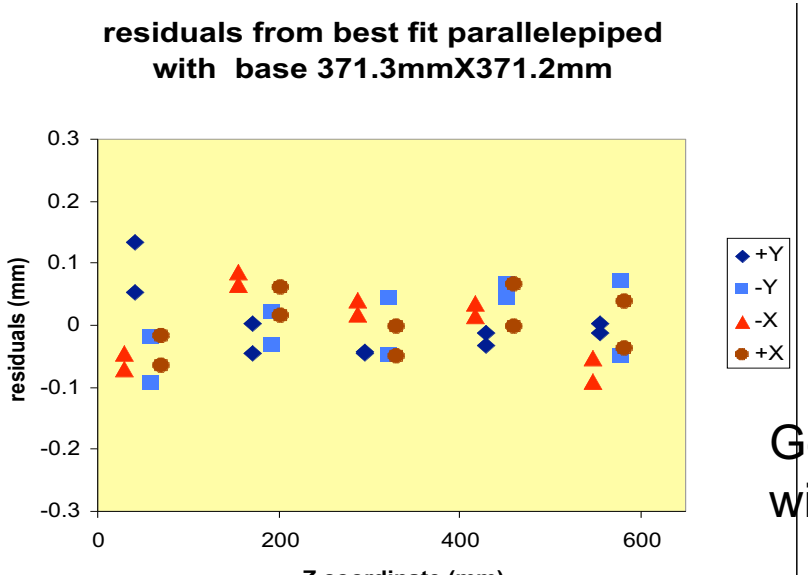


Integration of MiniTKR and CAL at SLAC



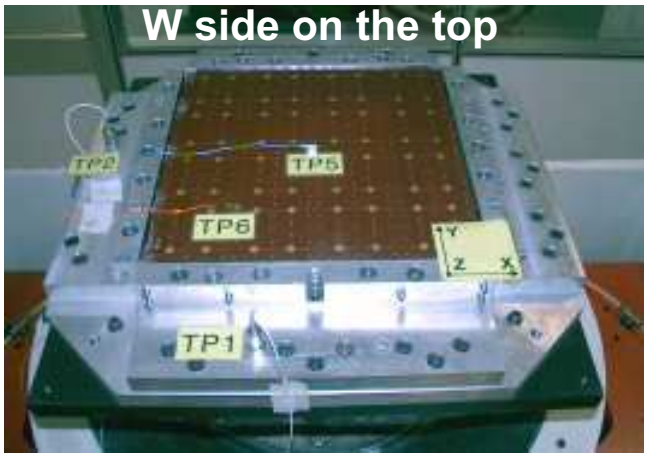
Courtesy of I&T team

Assembly of EM Tower in G&A

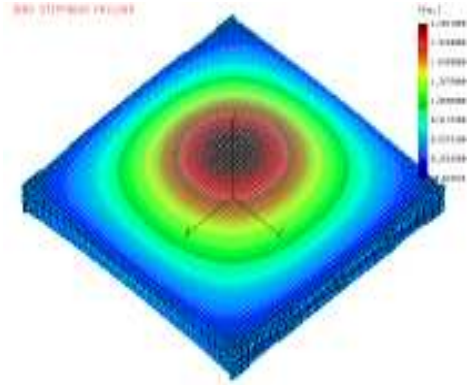


Geometrical tolerances well within limits (0.3 mm).

Tray vib set up

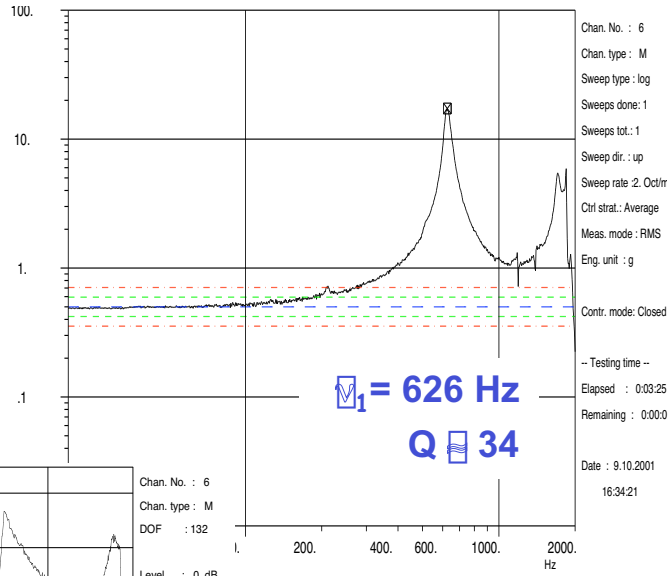


Centrotecnica set up:
- **1 LDS V864LT shake table**
- **2 fixtures**
- **9 read out channels**
- **4 trays/day test rate capability**



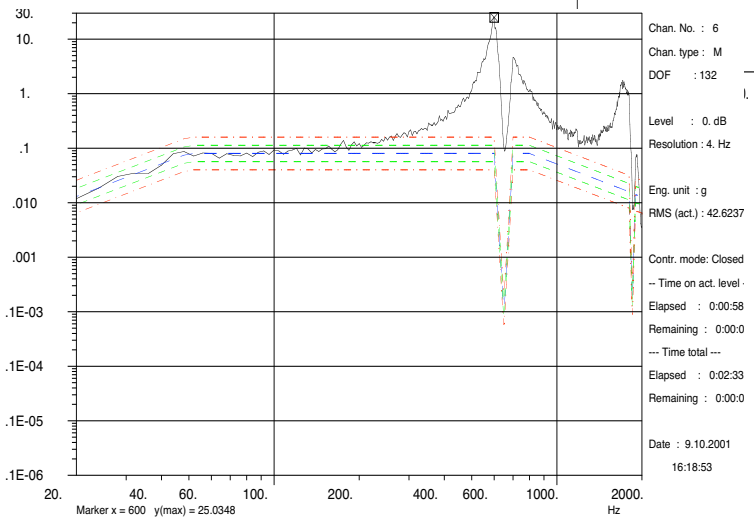
FEM prediction=610Hz

Normal modes search results



ν_1 = 626 Hz

Q ≅ 34



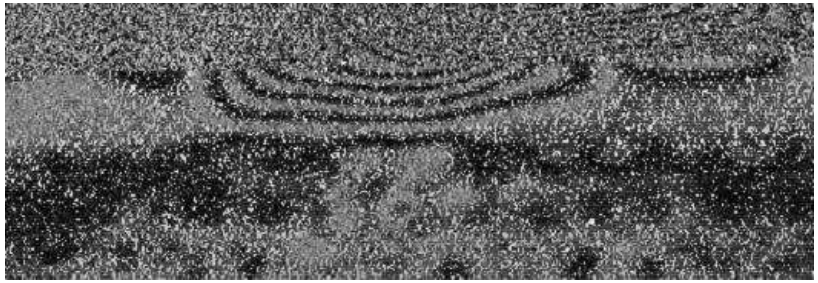
Random vibration spectrum response (acceptance level)

Bare Panel: N.D.I. Test

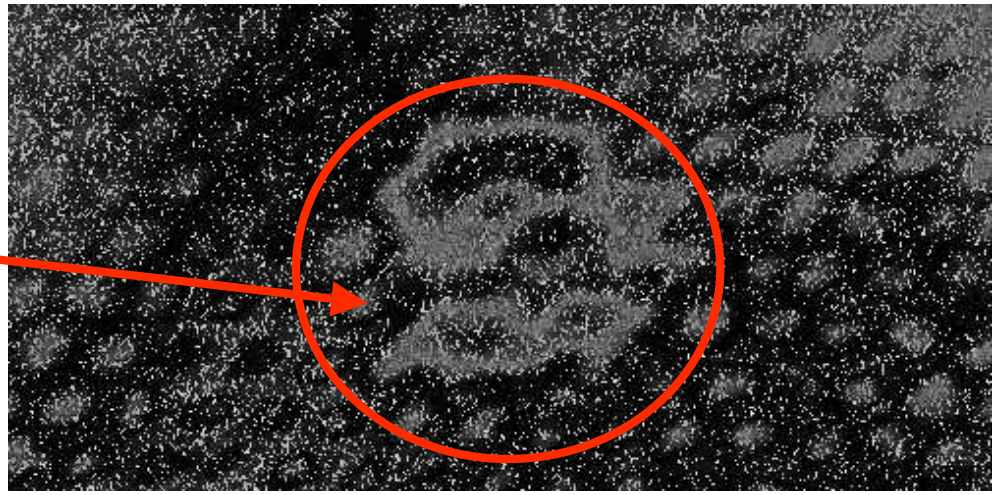
ESPI: Thermal Loads very effective to detect bare panel defects

Honeycomb crash

Skin-closeout debonding

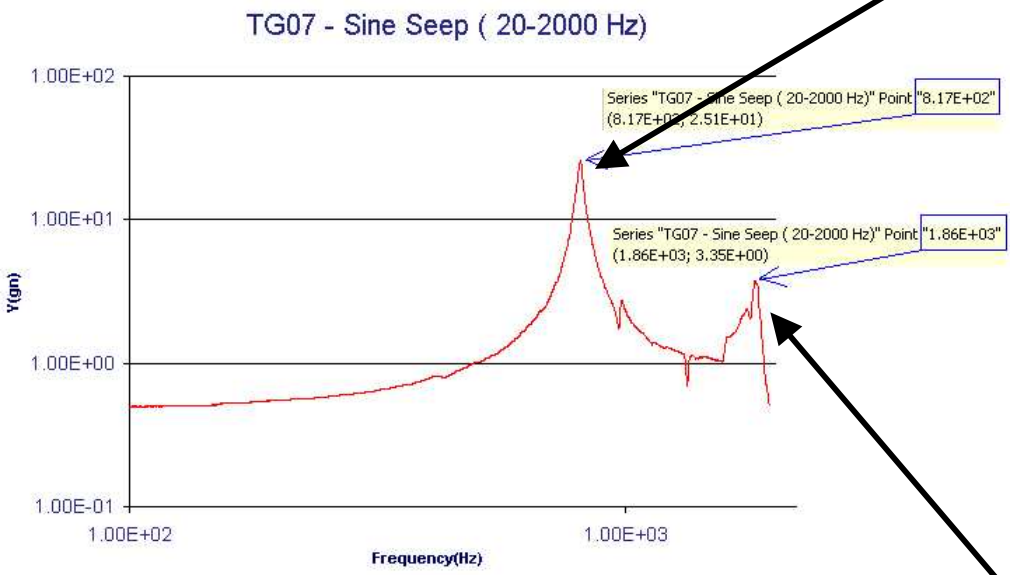


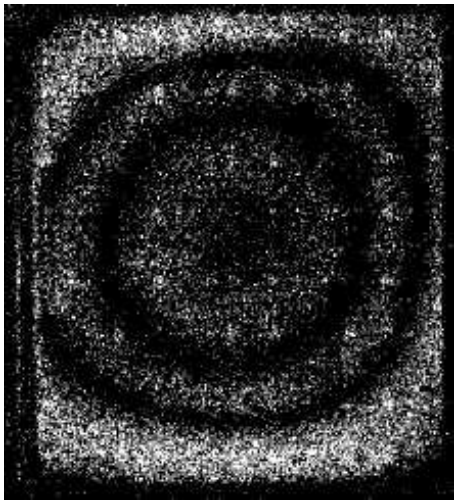
Honeycomb – Skin debonding



ESPI: Vibration TEST

TG07: Bare Panel + W + Bias Plane





817Hz first resonance mode

1860Hz second resonance mode

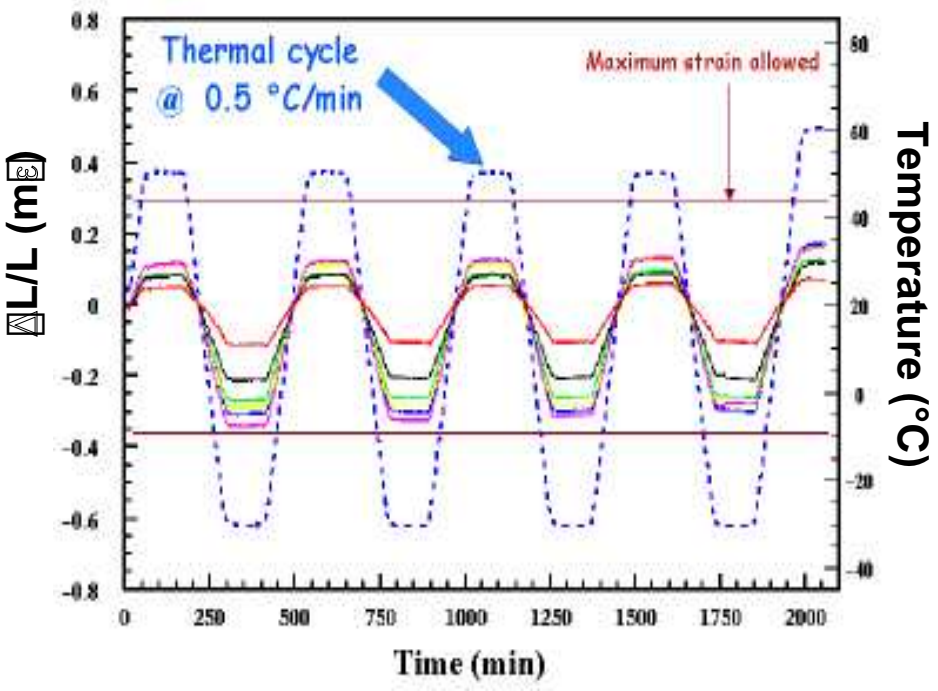
Trays Thermal qualification cycles

Qualification-like test:

- temperature range: -30°C □ +50°C
- T_0= 24°C
- number of cycles: 4
- 2 hr @ -30 °C, +50 °C
- (dT/dt) = 0.5 °C/min

□T=25 °C: □L/L □ 100 □□

□T=-55 °C: □L/L □ - 350 □□

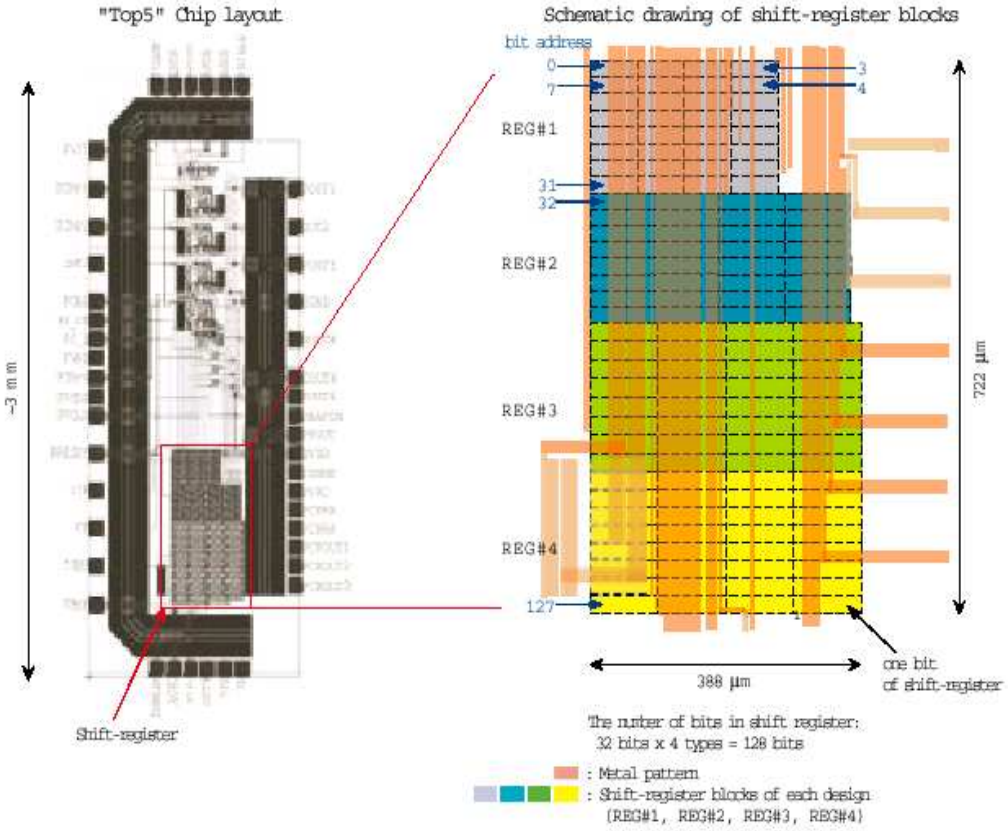


Thermal test lot ≥ 4 trays/cycle in 4 climatic chambers
(2 ready by Pg in Terni, 1 foreseen in Pi, 1 foreseen in Ba)

Test rate/climatic chamber _ 1 tower/month

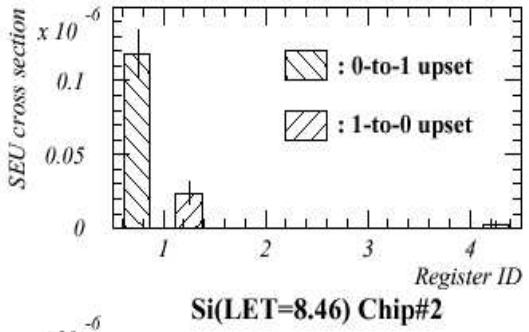
SEE test at Legnaro Ion beam

Irradiation facility set-up

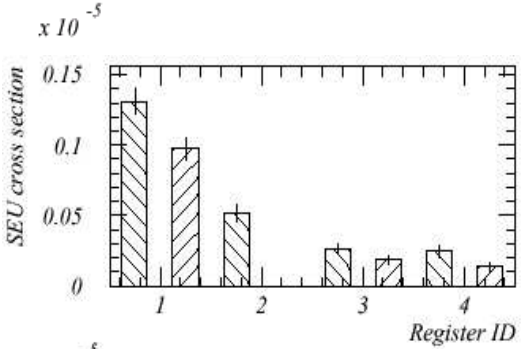


Chip lay-out

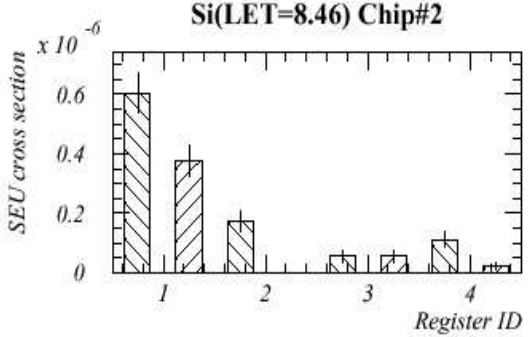
SEE test results



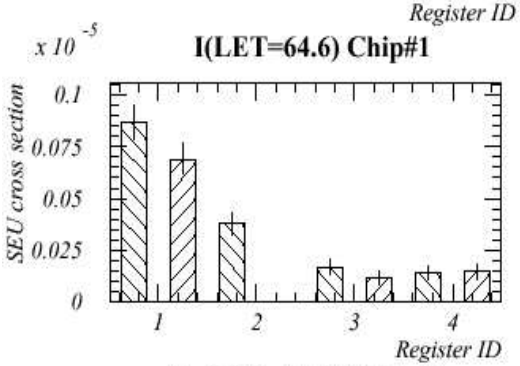
Si(LET=8.46) Chip#2



I(LET=64.6) Chip#1



Ni(LET=27.4) Chip#2



Au(LET=78.17) Chip#1

Table 3: Estimated SEU rate on the whole GLAST ASICs

Register type	SEU rate (#SEUs bit^{-1} day^{-1})		In the whole GLAST (#SEUs (1,893,888 bit)$^{-1}$ (10yr)$^{-1}$)	
	Galactic CR @Solar minimum	Solar event @worst day	Galactic CR @Solar minimum	Solar event @worst day
REG#1	2.05×10^{-8}	1.01×10^{-9}	142	6.96
REG#2	6.25×10^{-10}	1.30×10^{-10}	4.32	0.896
REG#3	1.35×10^{-10}	8.32×10^{-10}	0.93	0.575
REG#4	2.02×10^{-10}	9.13×10^{-10}	1.40	0.631

Software activity of the Italian Collaboration

Detector software - main areas of collaborations:

- I – Tracking (reconstruction and vertexing)
- II - Detector description
- III - Event display and graphics
- IV - GLAST simulation
- V - Construction and test software
- VI – Science analysis

Conclusions

The GLAST italian Collaboration is actively preparing itself to start construction of flight units and to exploit the GLAST science.

- ✓ 82% of SSDs already procured (Italy+SLAC+Japan)
- ✓ 64% of SSDs already tested and accepted
- ✓ 500 flight ladders already produced, tested and accepted
- ✓ 1350 flight ladders in production (2/3 total)
- ✓ 200 flight trays in production (50% of total)
- ✓ 21 EM trays already produced, mechanically and vib tested
- ✓ 5 *live* trays produced and electrically tested
- ✓ EM *live* tracker MiniTower assembled and tested
- ✓ EM *mechanical* tracker Tower assembled and ready to be tested
- ✓ Large software and science preparation effort on going
  (see A. DeAngelis presentation)

this presentation at http://glastserver.pi.infn.it/glast (conference reports & talks)