

GLAST-LAT International Collaboration Meeting
Roma, Sept. 15-18 2003

ACCADEMIA NAZIONALE DEI LINCEI
Palazzo Corsini - Via della Lungara, 10 - Roma

Sponsored by:

NASA
INFN
AGOS

Poster by:
S. Djavanmard, A.A. Moradifard

The poster features a central image of a spiral galaxy with a greenish tint, set against a dark background. Below the galaxy is a photograph of the Palazzo Corsini in Rome, showing its classical architecture and a central fountain. To the left of the main image is a vertical strip containing the GLAST-LAT logo, a satellite illustration, and the flags of France, Germany, Italy, Japan, Sweden, and the United States. At the bottom, there are logos for NASA, INFN, and AGOS, along with the text 'Sponsored by:'. The bottom left corner credits the poster to S. Djavanmard and A.A. Moradifard.

GLAST-LAT International Collaboration Meeting

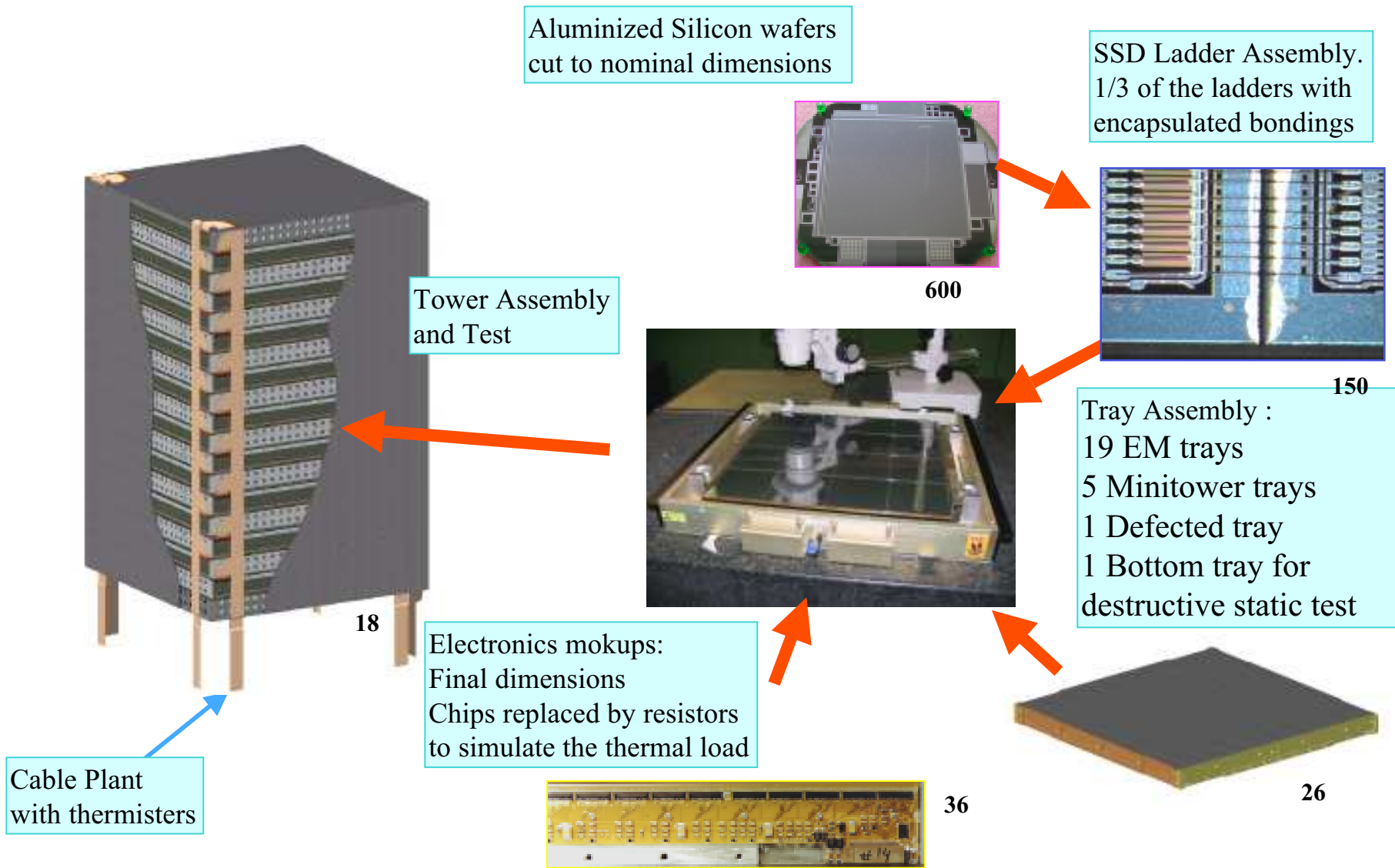
Roma, Sept. 15-18 2003

EM tower construction and test

Alessandro Brez
INFN Pisa



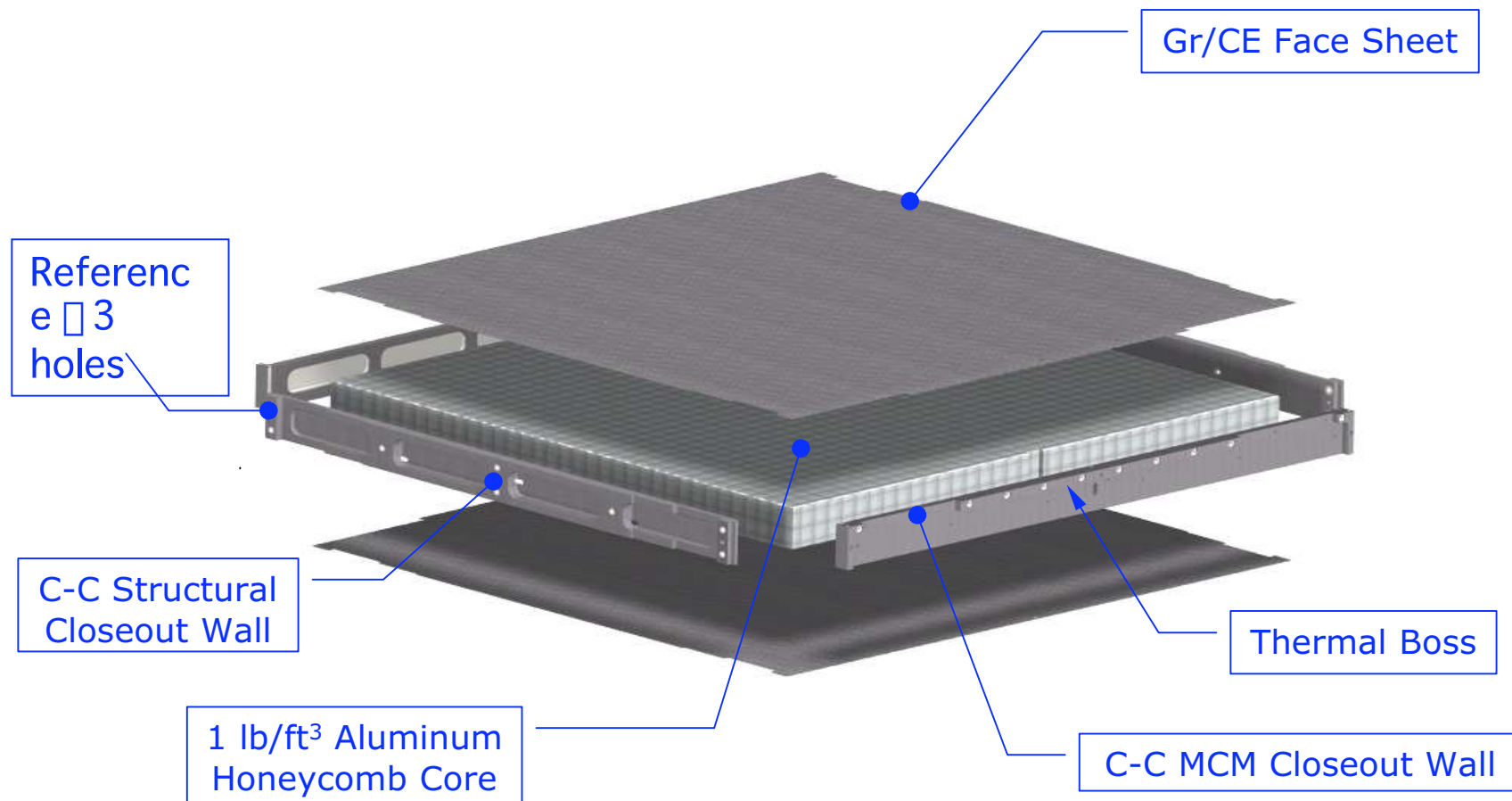
TKR Engineering Model-Tower





Tray Sandwich Structure

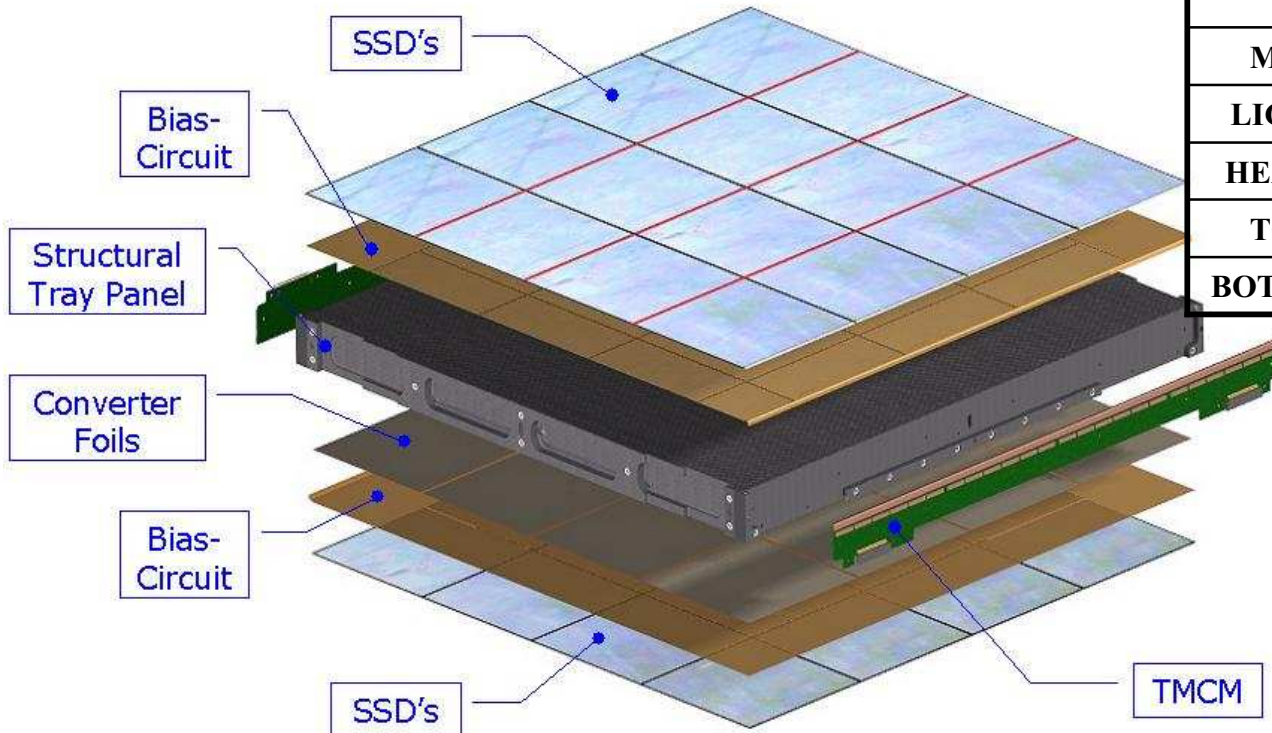
- Lightweight 4 pieces machined closeout frame, bonded to face sheets and core to form a sandwich structure





Tracker Tray with Payload

- The tray "payload" is bonded to the sandwich structure using epoxy, with the exception of the SSD bonding, which is done with silicone.
 - Silicone decouples the thermal/mechanical effects from the tray



Tray Type	Honeycomb Core	Face sheet Plies	W Converter
MID	1 lb/ft ³	4	3% Xo
LIGHT	1 lb/ft ³	4	NO
HEAVY	3 lb/ft ³	6	18% Xo
TOP	1 lb/ft ³	4	3% Xo
BOTTOM	3 lb/ft ³	6	NO



Tray assembly tools



Tray assembly tool

tool	EM series	Production series	total
assembly tool	3	4	7
Tungsten tool	2	1	3
Kapton tool	1	1	2
Trimming tool	1	0	1

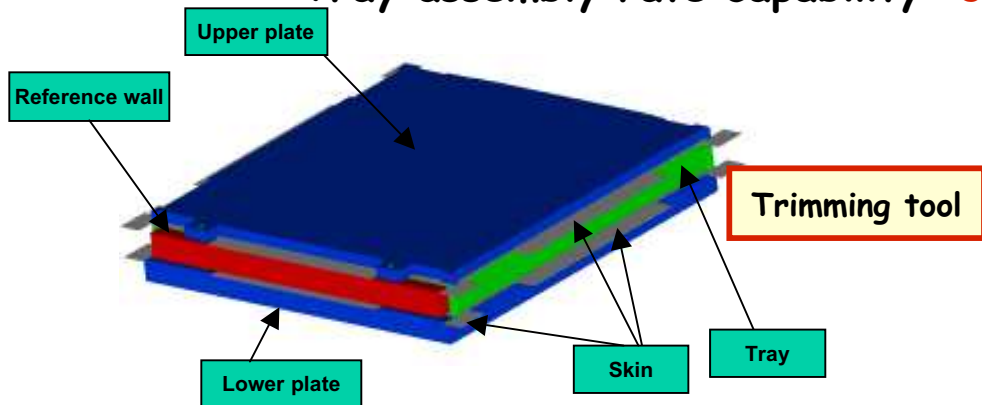


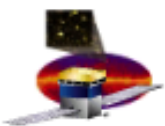
Tungsten assembly tool



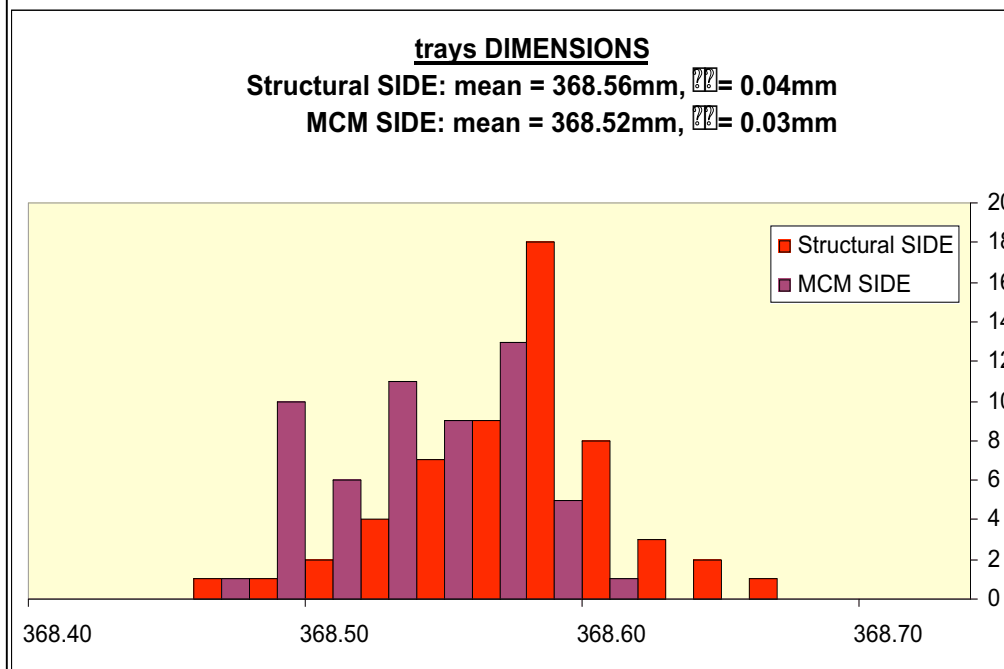
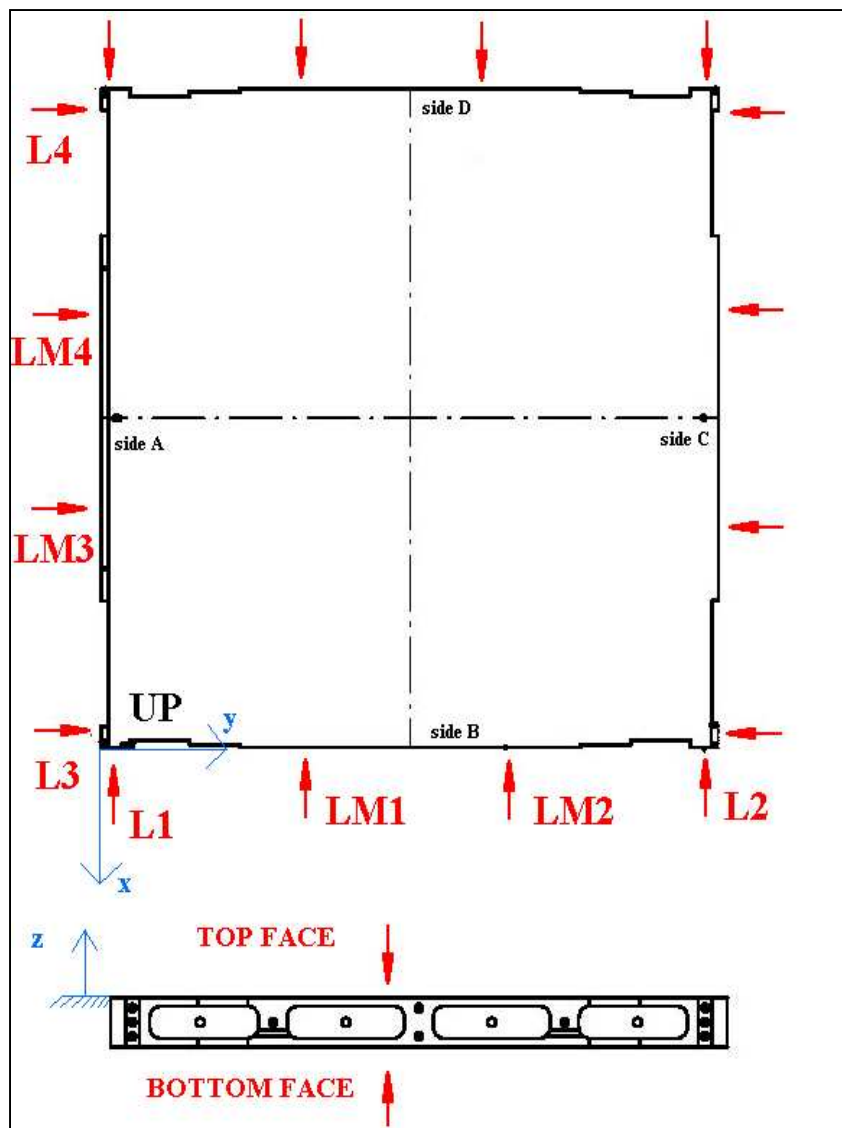
Kapton assembly tool

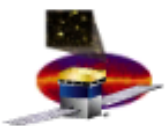
Tray assembly rate capability: 3 trays/day





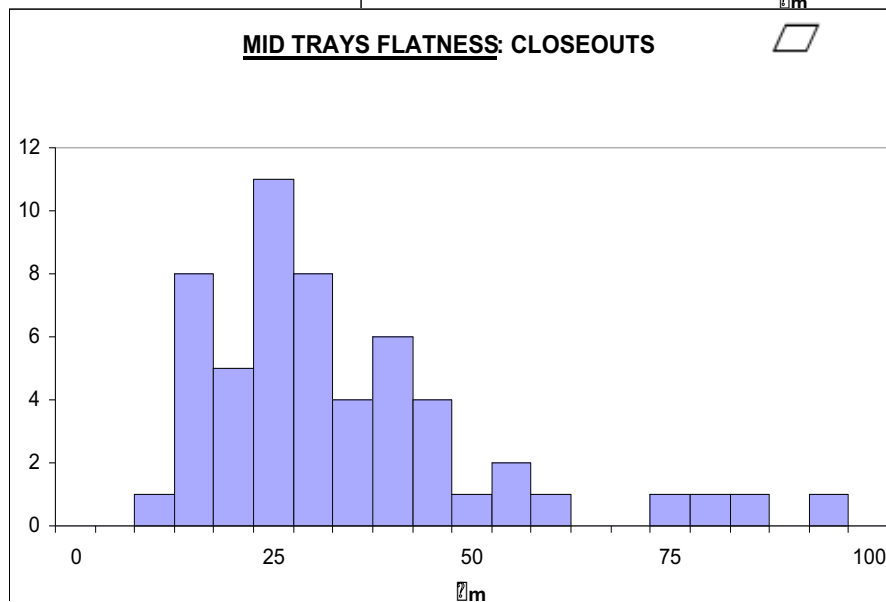
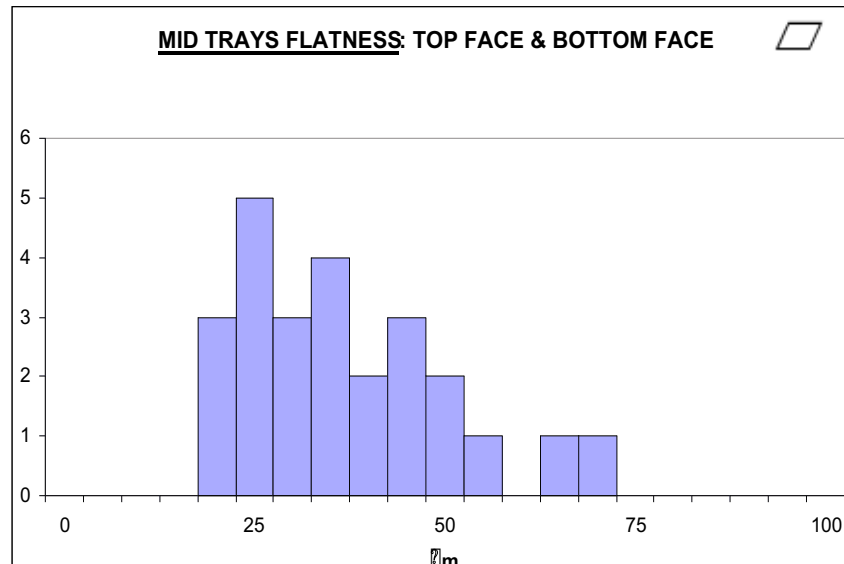
E.M. Results: DIMENSIONS

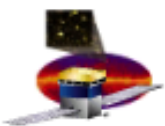




E.M. Results: FLATNESS

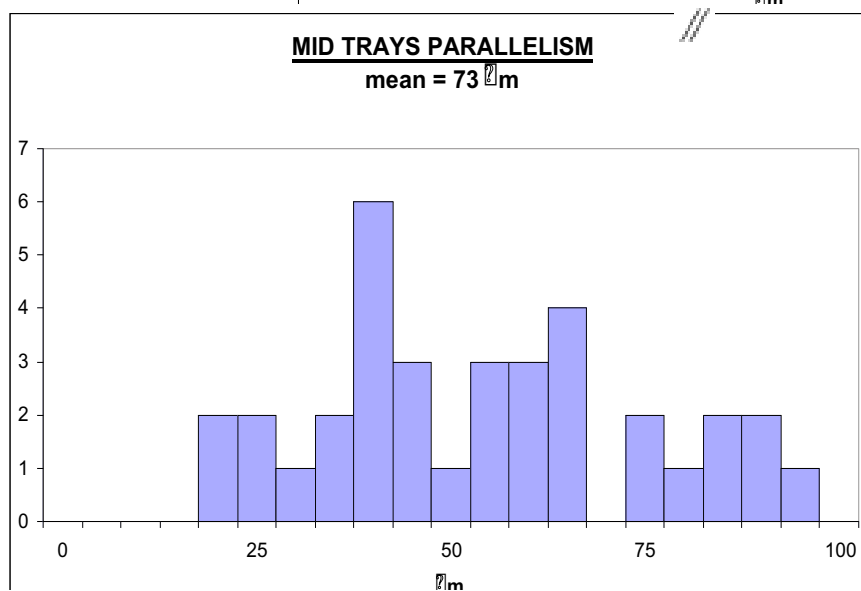
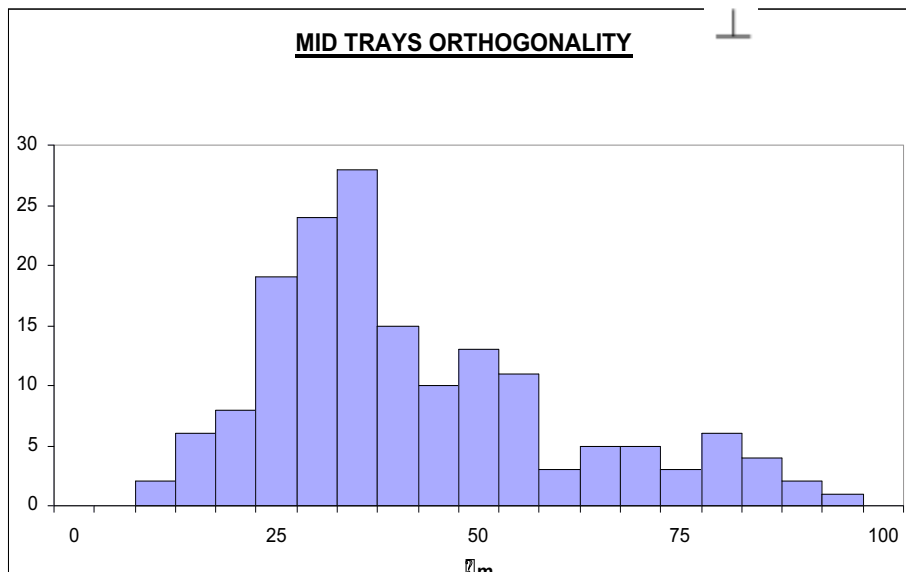
Measured Surface		Geometrical Tolerances
TOP FACE		
BOTTOM FACE		
SIDE A		
SIDE B		
SIDE C		
SIDE D		
TOP FACE	SIDE A	
TOP FACE	SIDE B	
TOP FACE	SIDE C	
TOP FACE	SIDE D	
BOTTOM FACE	SIDE A	
BOTTOM FACE	SIDE B	
BOTTOM FACE	SIDE C	
BOTTOM FACE	SIDE D	
SIDE B	SIDE A	
SIDE B	SIDE C	
SIDE D	SIDE A	
SIDE D	SIDE C	
SIDE B	SIDE D	
SIDE A	SIDE C	

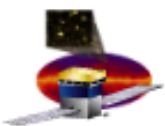




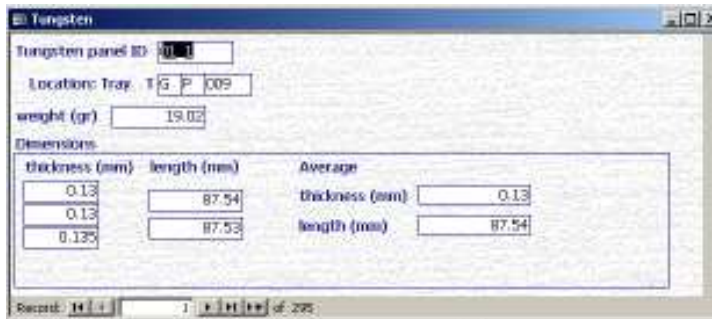
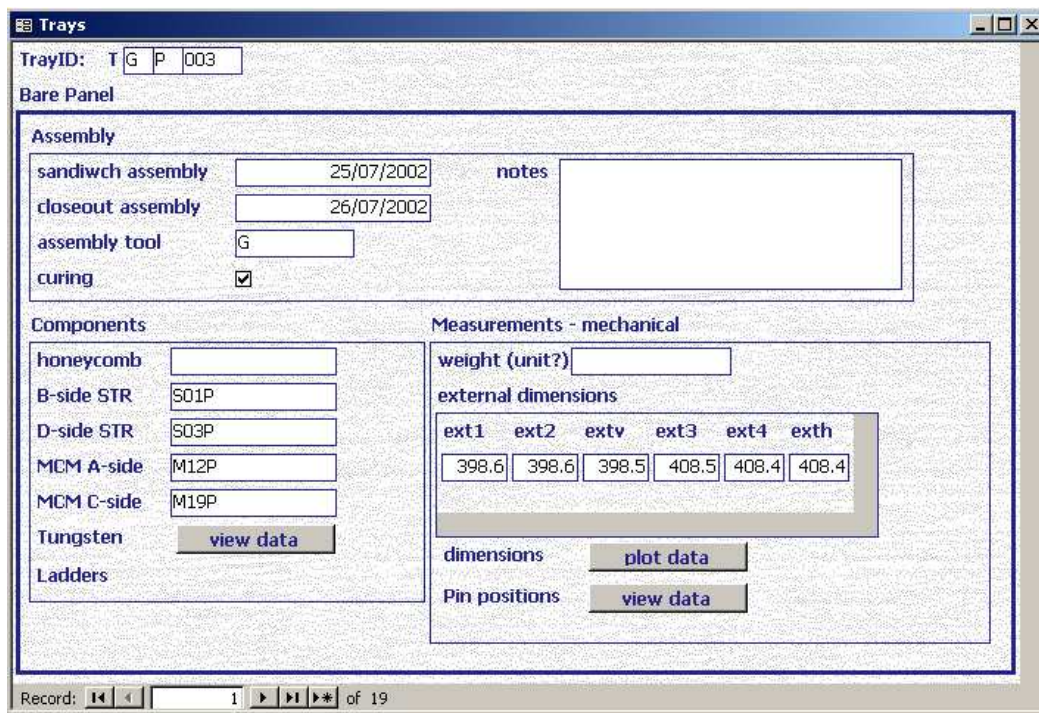
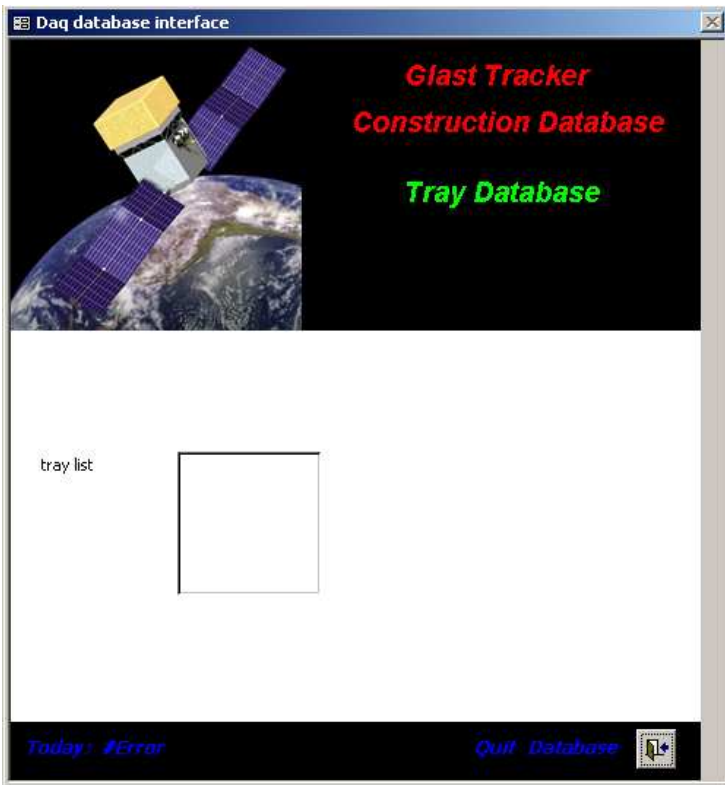
E.M. Results: ORTHOGONALITY & PARALLELISM

Measured Surface		Geometrical Tolerances
TOP FACE		
BOTTOM FACE		
SIDE A		
SIDE B		
SIDE C		
SIDE D		
TOP FACE	SIDE A	
TOP FACE	SIDE B	
TOP FACE	SIDE C	
TOP FACE	SIDE D	
BOTTOM FACE	SIDE A	
BOTTOM FACE	SIDE B	
BOTTOM FACE	SIDE C	
BOTTOM FACE	SIDE D	
SIDE B	SIDE A	
SIDE B	SIDE C	
SIDE D	SIDE A	
SIDE D	SIDE C	
SIDE B	SIDE D	
SIDE A	SIDE C	



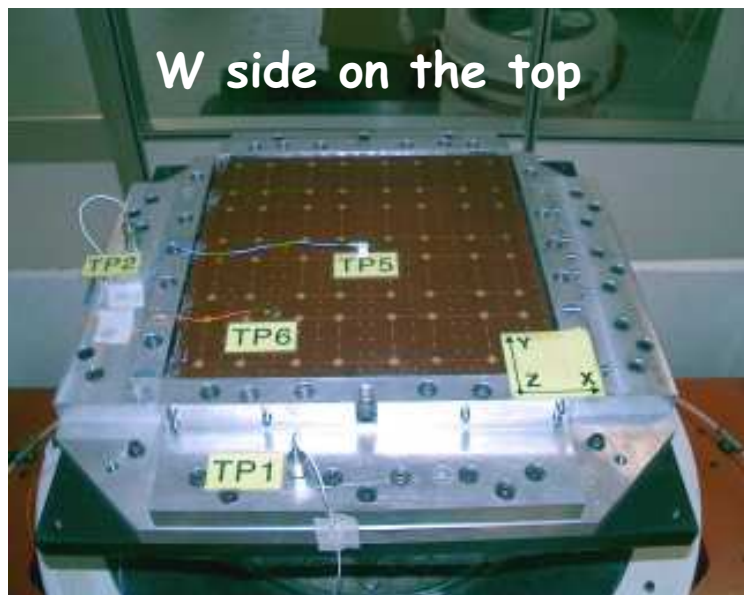


E.M. Results: Plyform TRAY DATABASE





Tray vib set up



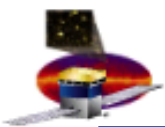
Accelerometers position:

- Control: two mono-axial accelerometers positioned on two of the four L-shaped block TP1&TP2
- Fixture: three mono axial accelerometers placed on a corner on one of the four L-shaped block TP6
- Tray: one three-axial accelerometer in the middle TP5

Sine sweep

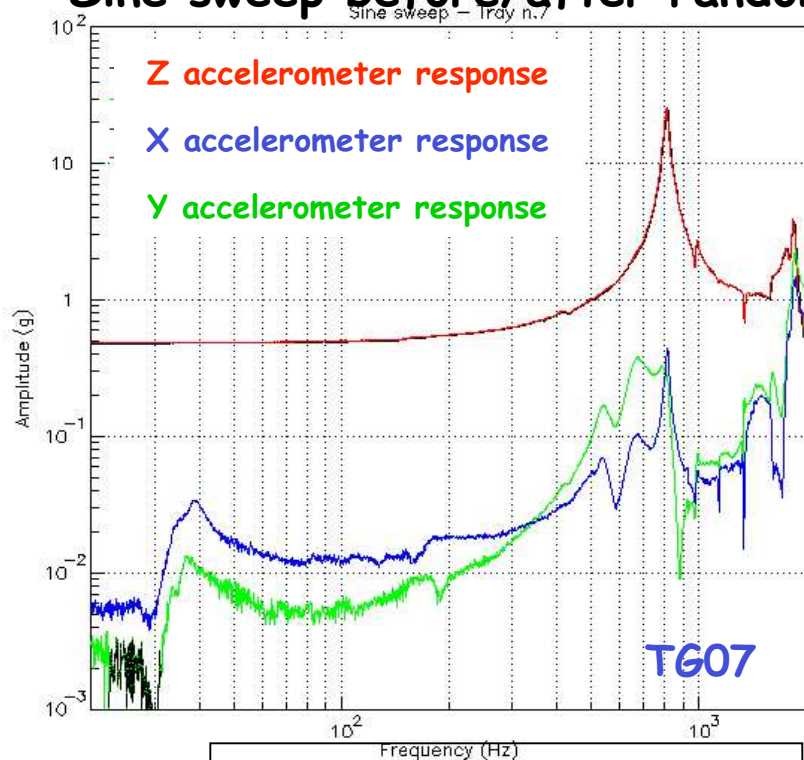
Frequency range	20 \square 2000 Hz
Sweep rate	2 oct/min
Target Amplitude	0.5 g_{0-pk}

Frequency (Hz)	ASD Qual Level (g^2/Hz)	ASD Accept Level (g^2/Hz)	ASD Launch Level(g^2/Hz)
20	0.026	0.013	0.0065
20-50	+6 dB/oct	+6 dB/oct	+6 dB/oct
50-800	0.16	0.08	0.04
800-2000	-6 dB/oct	-6 dB/oct	-6 dB/oct
2000	0.026	0.013	0.0065
Overall	14.0 g_{rms}	10.0 g_{rms}	7 g_{rms}
Duration	2 min	1 min	1 min



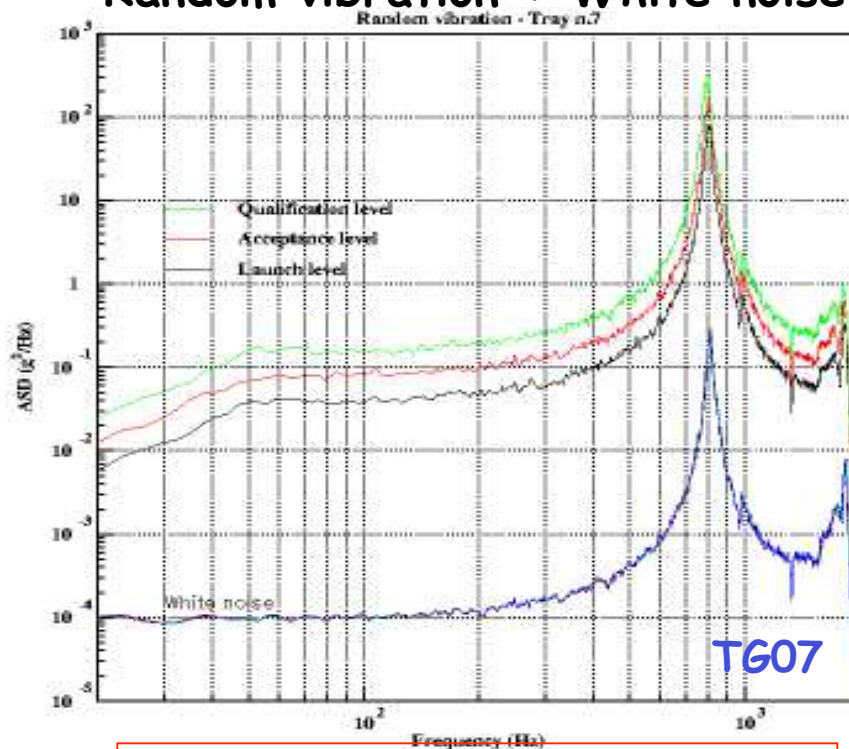
Vibrational test

Sine sweep before/after random



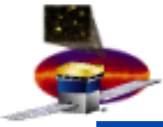
Resonance search:
 $\omega_0 = 815 \text{ Hz}, Q = 51$

Random vibration + White noise



Resonance check:
 $\omega_0 = 809 \text{ Hz}, Q = 49$

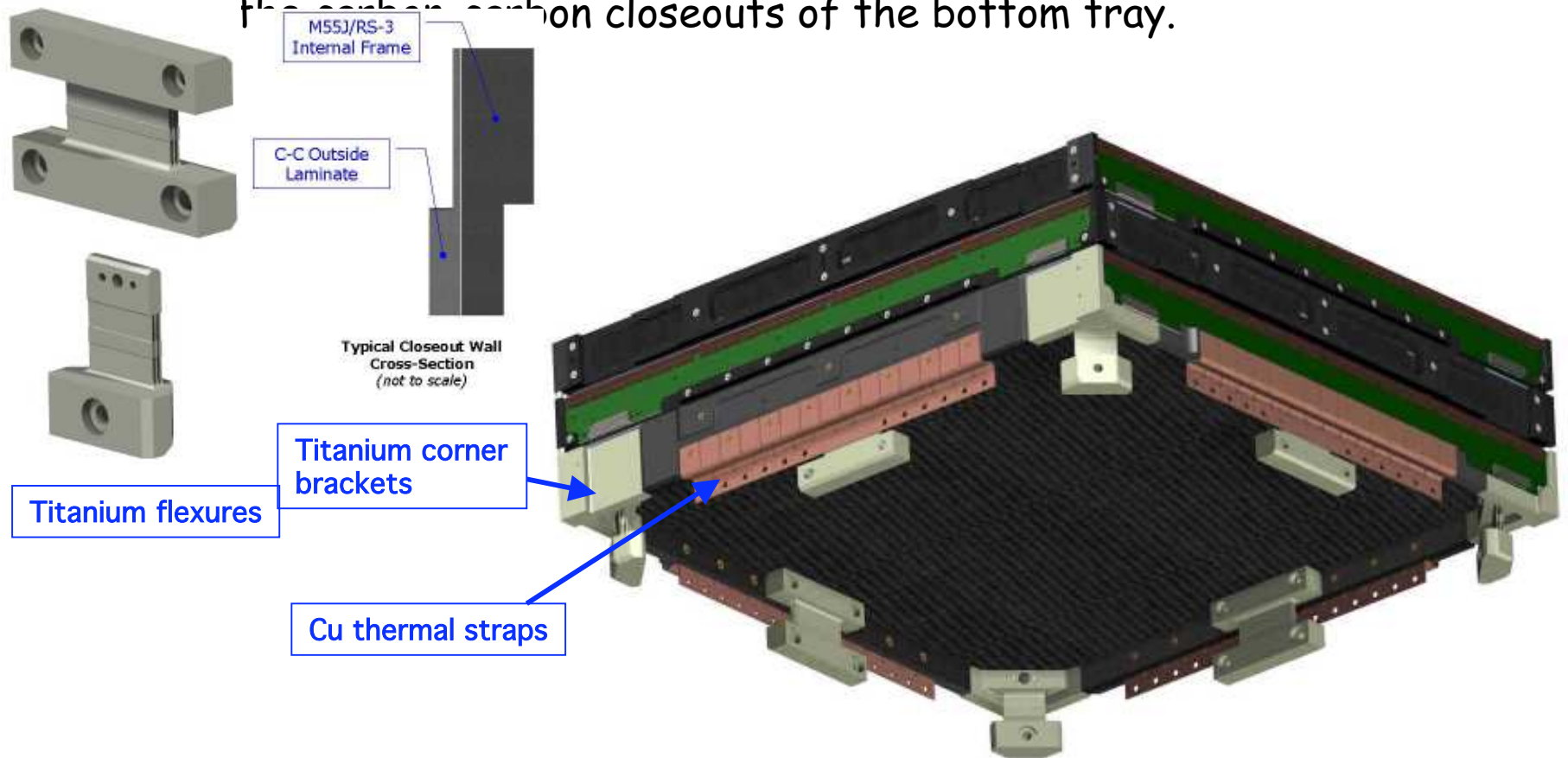
All the EM trays have been successfully tested at qualification level.
No damages or relevant frequency shifts have been observed



Bottom tray redesign

Close-up view of the interfaces on the bottom of a Tracker module.

This interface has been substantially redesigned since the May '02 random vibration tests of the prototype tower module, during which structural failures of the carbon-carbon closeouts of the bottom tray.





Bottom tray static tests

The static test will be performed on each bottom tray.

The test load on all the axes is equivalent to **3 σ Static Equivalent Random Vibration Loads in tension.**

2 trays have been produced.

The first have been successfully tested.

The **Vertical test setup** tray is going to be tested

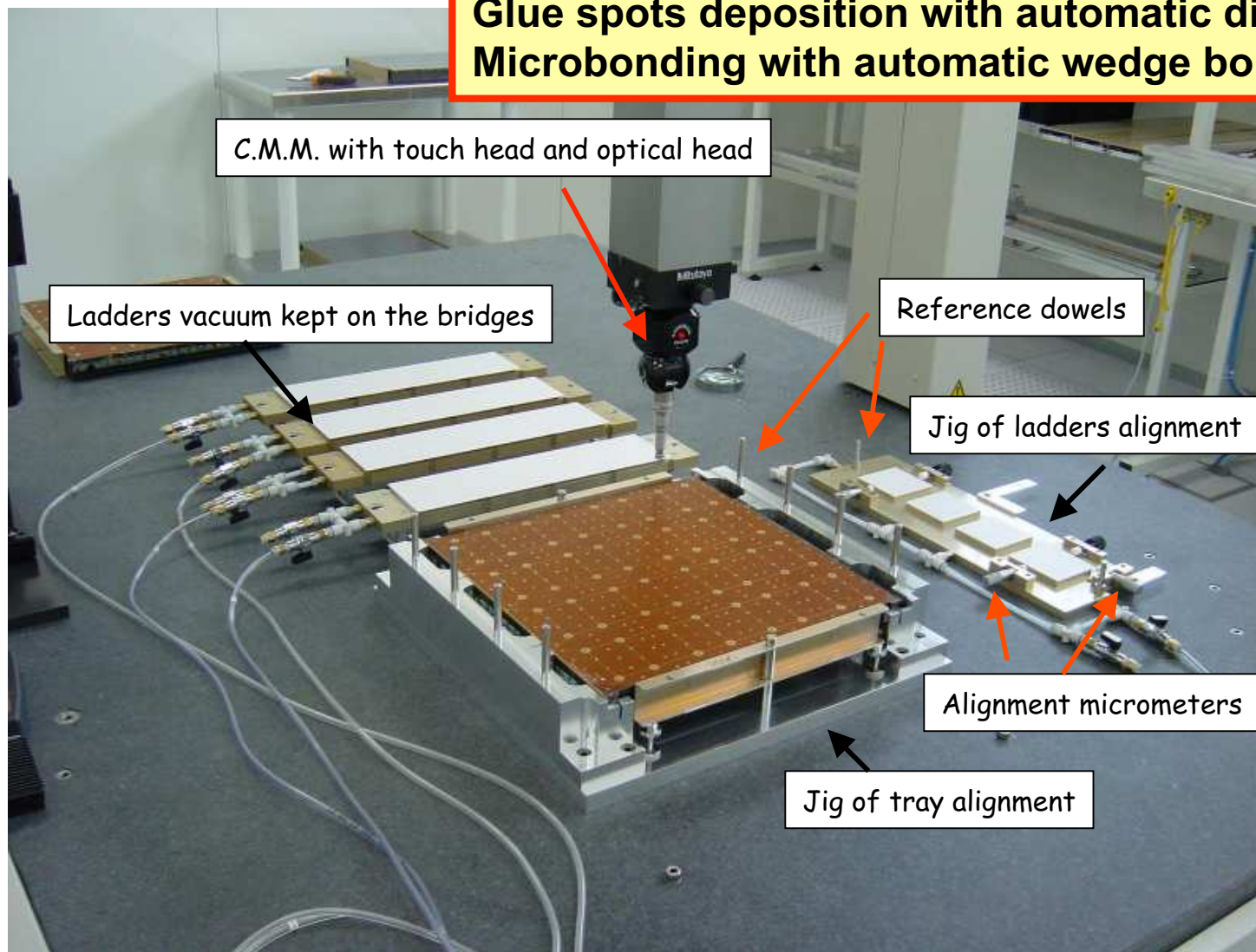
Horizontal test setup, 45 $^\circ$ configuration

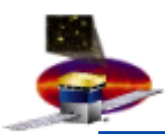




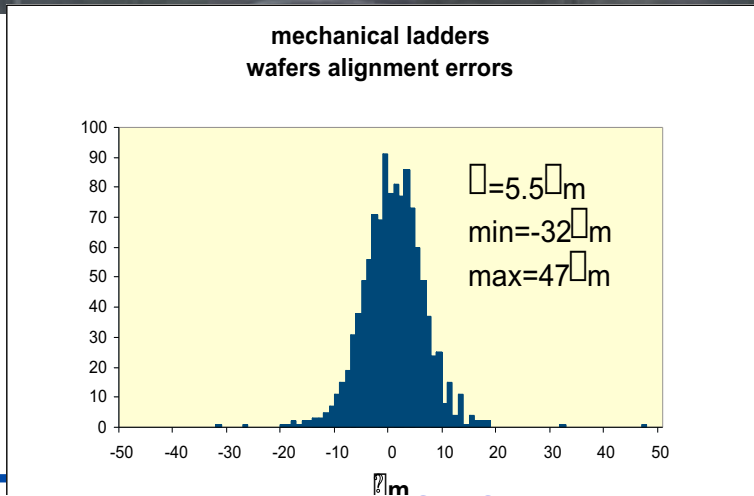
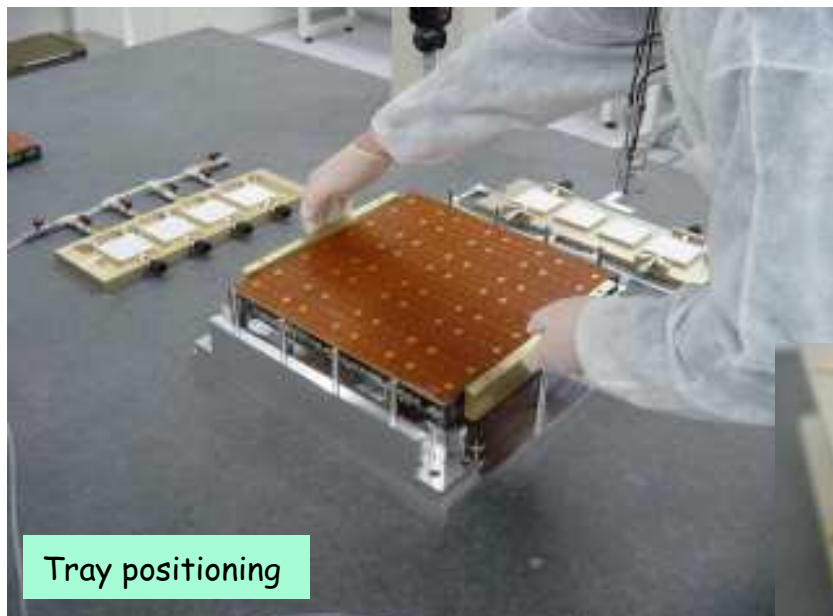
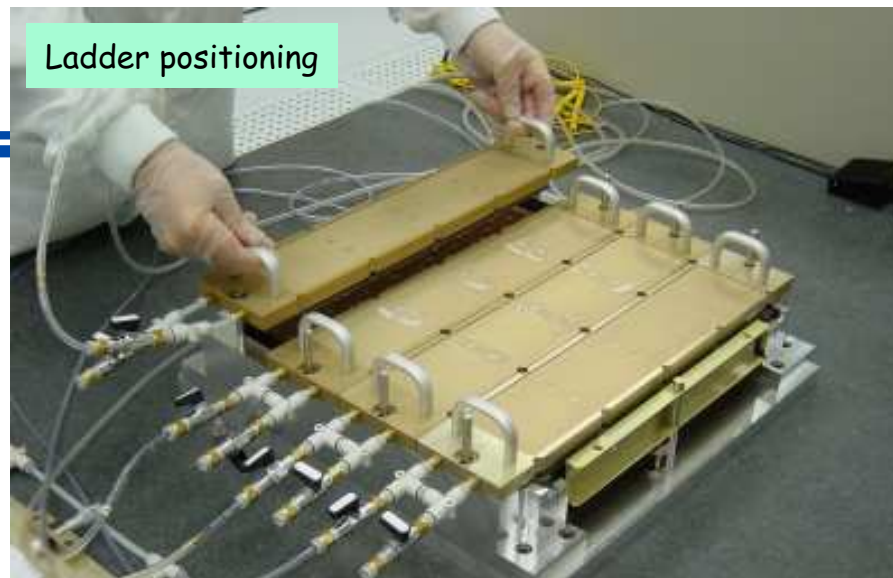
Assembly of the ladders on the trays

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



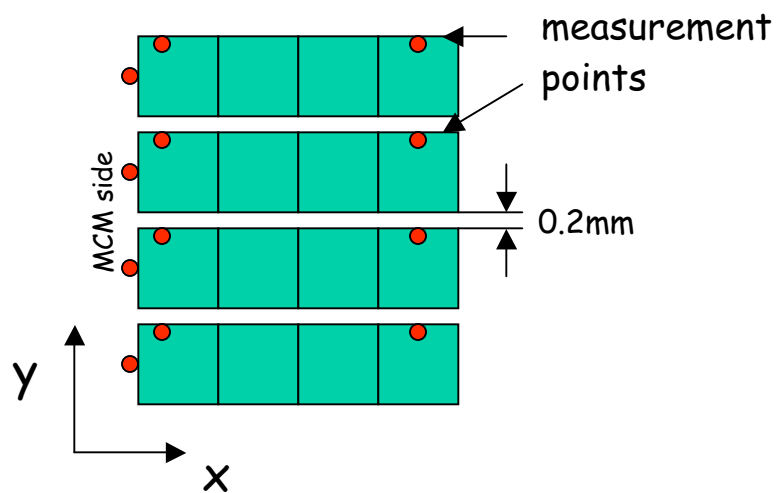


GLAST LAT Project Assembly phases

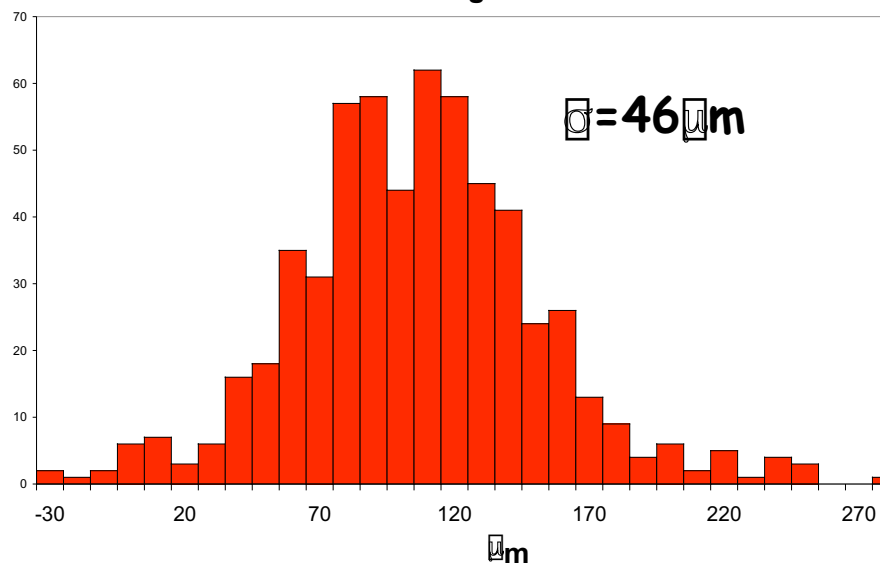




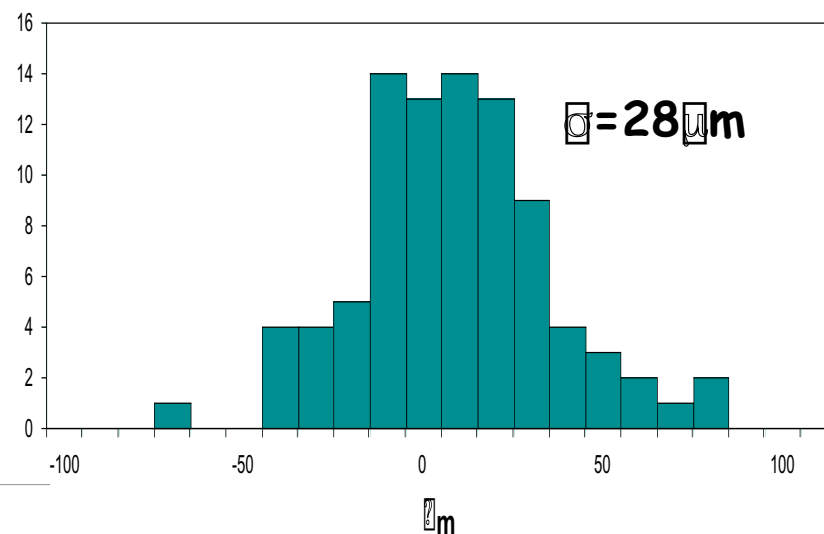
Ladder alignment results



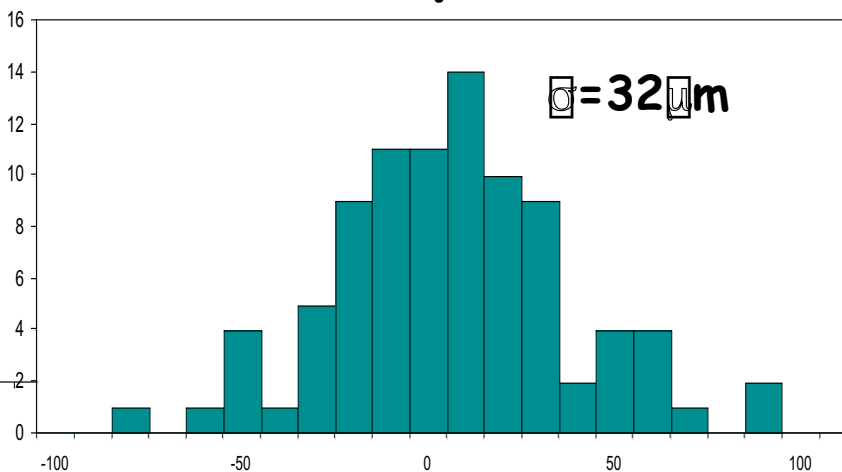
Z alignment



Y alignment



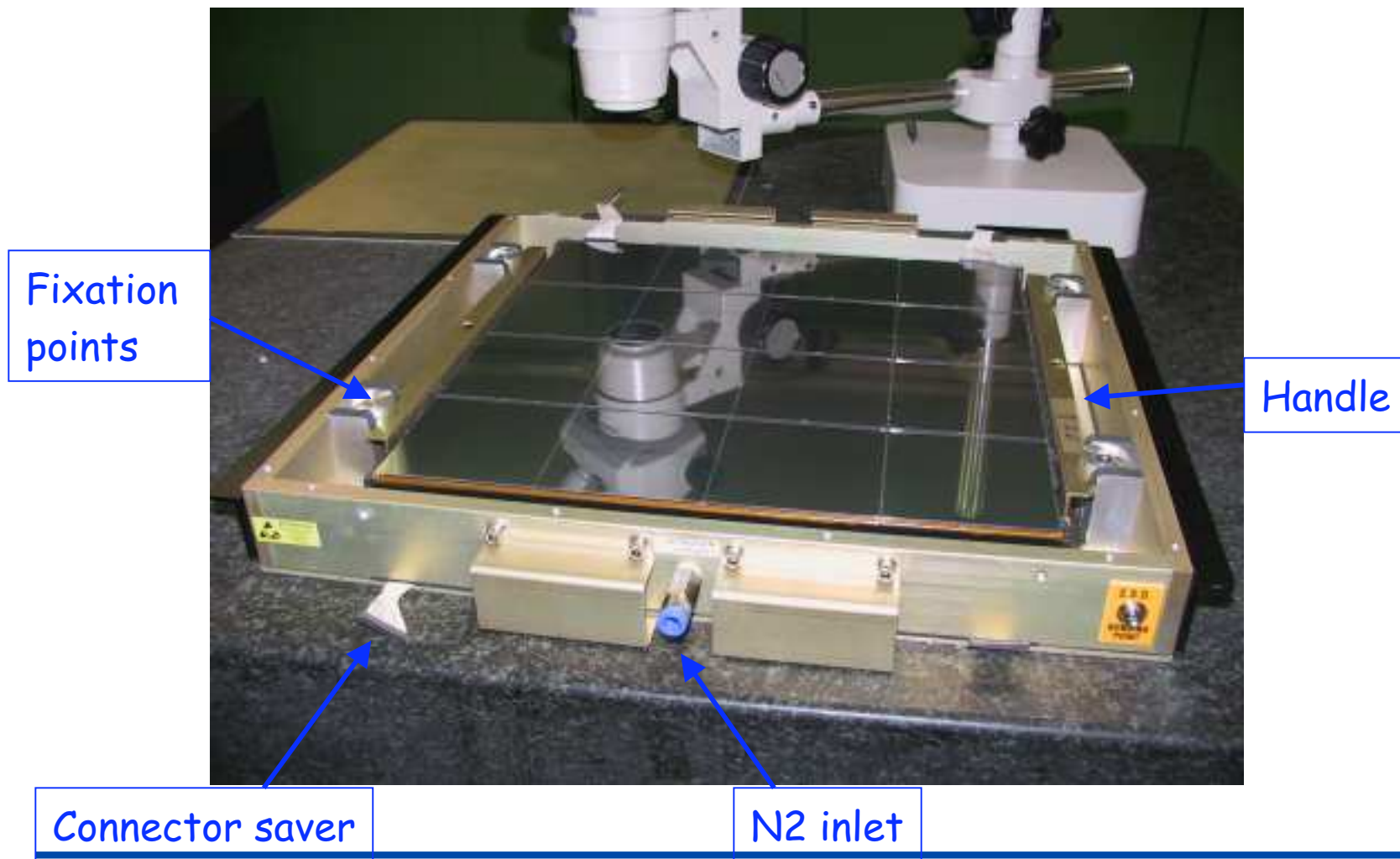
X alignment





Tray box

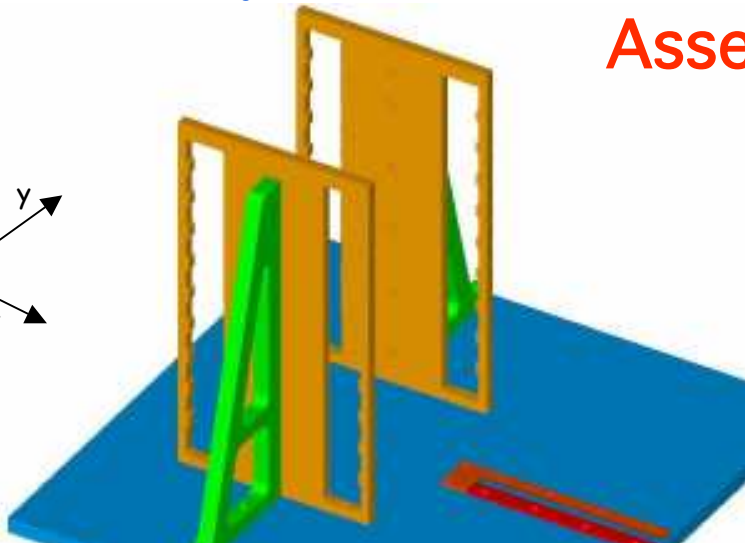
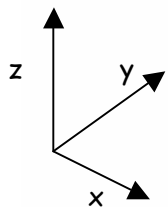
The tray box allows safe shipping and storage.
Through the connector savers the tray can be fully tested in the closed box.





GLAST LAT Project

Assembly of EM Tower in G&A



Trays alignment on assembly jig

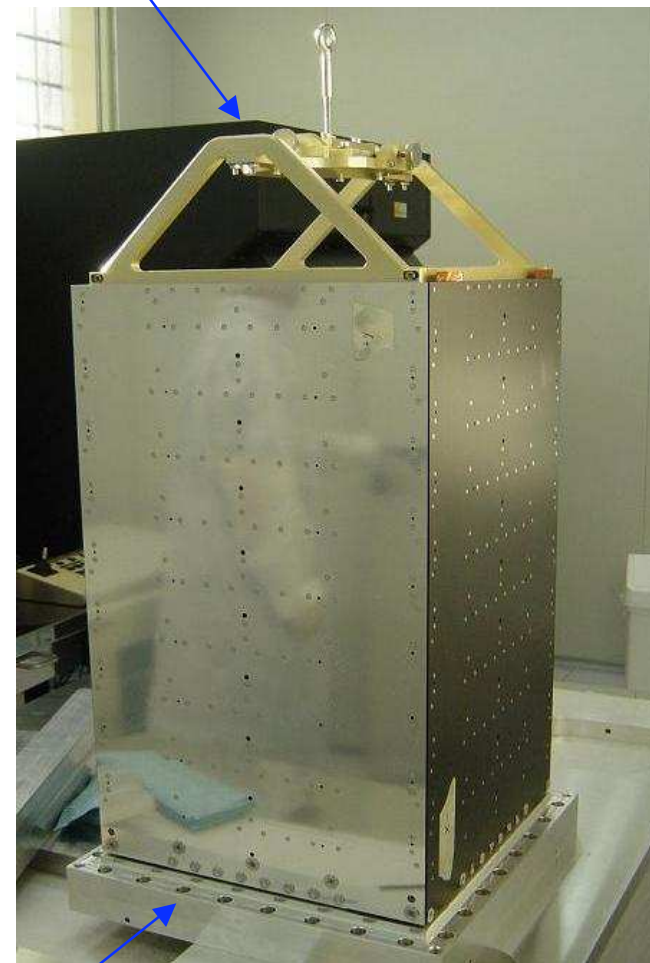


Cabling





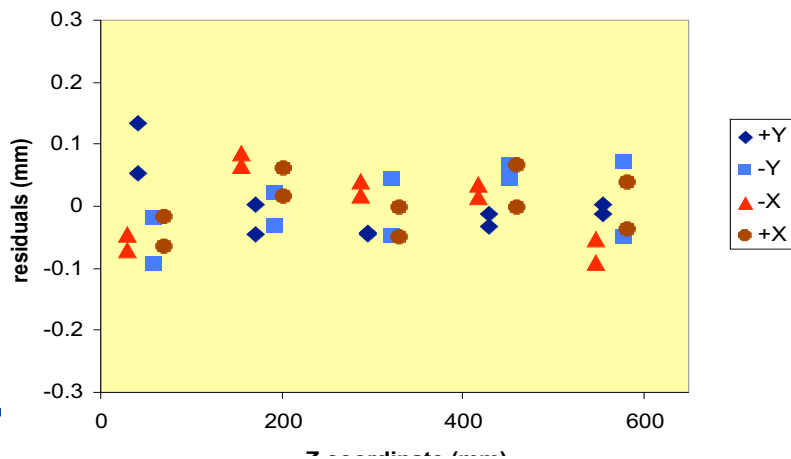
Lifting tool



Fixture

residuals from best fit parallelepiped with base 371.3mmX371.2mm

Geometrical tolerances well within limits (0.3 mm).





EM tower assembly problems

The July assembly could not end with the tower shake test because of several problems:

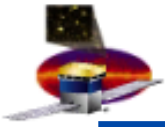
- Due to a wrong indication in the drawings, the sidewalls were not at specs (2 missing YS90 tissue layers).
- The fixture and the cable holder, 2 interface frames between the shaker and the tower, had constructive problems that could not be worked out. The fixture and the cable holder are now in SLAC for reworking

Other minor problems found during the assembly:

Few screws did not enter to the end ⇒ **cleaning of the thread holes**

The connectors of the cactus cable were difficult to connect and quite fragile ⇒ **new connectors and special tools will be used in flight cables**

The thermisters of 2 cables were removed because mounted in the wrong place ⇒ **these 2 cables will be replaced before the thermal test**



EM test program

- Completion of the EM tower (new sidewalls, reworked shaker interfaces)
- 3 axes tower **vibrational** test
- Tower disassembly for damages check
- Single tray **thermal** tests
- Reassembly of the EM tower
- EM tower **thermo-vacuum** test