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Tray tolerance discussion

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Introduction

The tray assembly tolerance is discussed. A dimension of $368.5\text{mm}\pm 0.1\text{mm}$ is considered.

Drawings

LAT-DS-00148	LAT TRACKER MID TRAY ASSEMBLY
LAT-DS-00851	INTERFACE DEFINITION DRAWINGS
LAT-DS-00303-6	TOWER ASSEMBLY SIDE WALLS

Stay clear

From the DS-00851 a stay clear of 372mm is required for the lateral size of the tower.

EM results

The EM trays had a dimensional distribution of $368.55\text{mm}\pm 0.07\text{mm}$. (fig .1)
The EM tower, built with the first set of 1.4mm thick sidewalls with 2 missing YS90 tissue layers, had a final dimension of 371.3mm with a 0.1mm tolerance.

Flight tray tolerance

The tray dimensions indicated in LAT-DS-00148 are $368.5\text{mm}\pm 0.1\text{mm}$.
The sidewall thickness is indicated in LAT-DS-00303/6 to be $< 1.575\text{mm}$. The actual EM sidewalls fabricated by Plyform have a maximum thickness of 1.52mm.
Adding an extra 0.05mm Al layer, the sidewall max thickness becomes 1.625mm.
The sum of the worst case is
Tower size = $368.6 + 2 \times 1.625 = 371.85\text{mm}$
There is still a 0.15mm margin that has to take into account the tower tolerance and the tower alignment respect to the grid. This margin increases to 0.25mm if the extra Al internal layer of the sidewalls is not added or if the Al layers thickness is reduced to 0.025mm.

Thermal issues

Two consecutive trays could have a 0.2mm clearance. If we suppose that the thermal conduction occurs only through the 10 Ti M2.5 screws, the temperature drop for 0.35W is

$$\Delta T = W \cdot l / (K \cdot S) = 0.35W \cdot 2 \cdot 10^{-4}m / (22 \text{ Wm}^{-1}\text{K}^{-1} \cdot 4.9 \cdot 10^{-5}m^2) = 0.065^\circ\text{K}$$

There are no thermal conduction issues.

Conclusions

The tray dimensions indicated in LAT-DS-00148 (368.5mm±0.1mm) are recommended not to reject too many trays and to meet the schedule. The EM production well fit inside this requirement. The EM tower showed a construction tolerance = ±0.1mm. With 1.625mm sidewalls, the EM tower side dimension would be 371.75mm±0.1mm, reaching the tower stay clear of 371.85mm.

There is a clearance of 0.15mm to take into account for the tower to grid tolerance, which could be problematic: The actual experience showed a 0.1mm misalignment between the bottom tray and the grid simulator. This error scales by a factor 1.7 on top to the tower. These tolerances can be reached with a careful construction and could be our goals, but they leave us a very little clearance.

Our recommendation is to take into account the sidewall thickness increase due to the 2nd Al inner foil with the increase of the stay clear to 372.1mm.

Even preferable is the use of 0.025mm Al foils, well grounded together, with a mass reduction of 124g per tower, leaving the stay clear to 372mm.

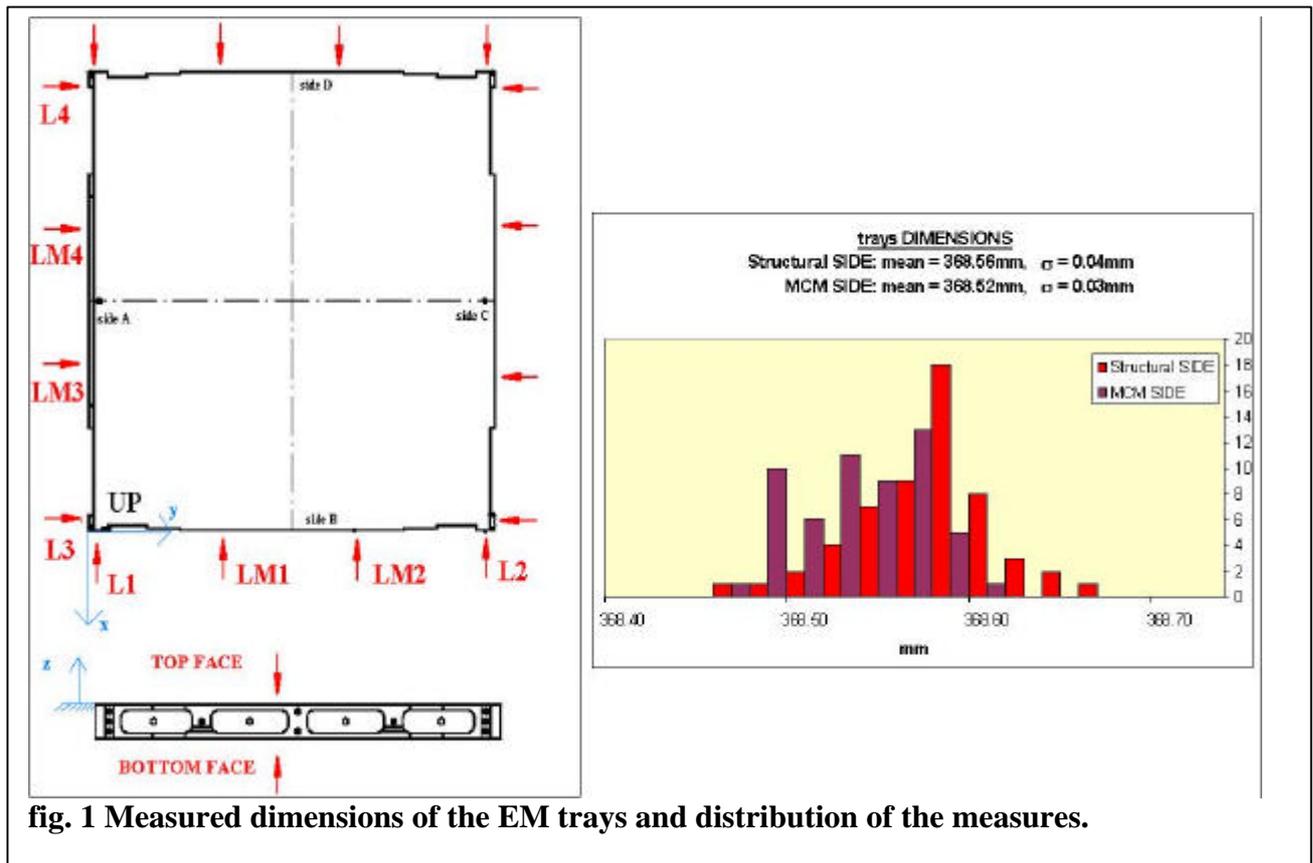


fig. 1 Measured dimensions of the EM trays and distribution of the measures.

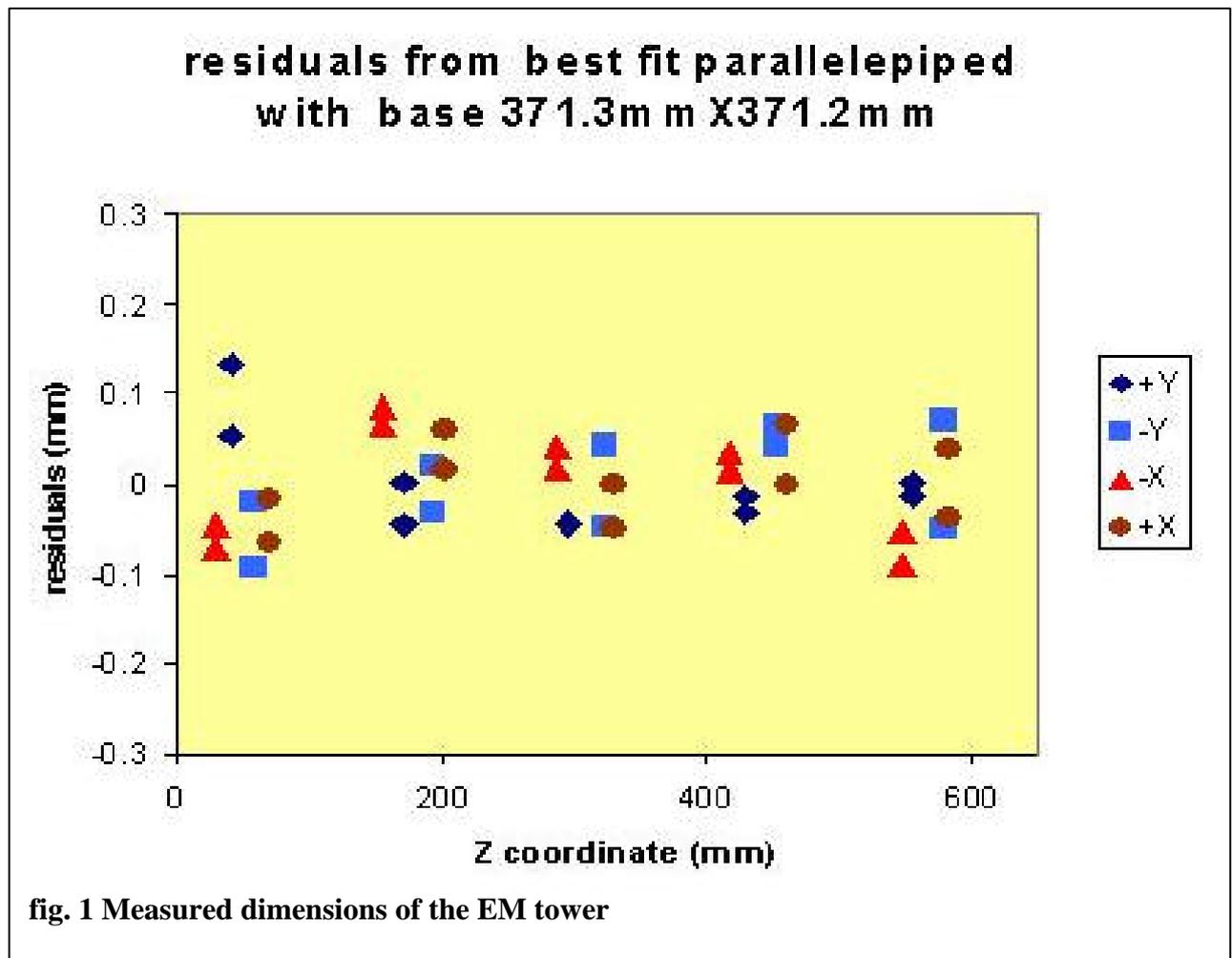


fig. 1 Measured dimensions of the EM tower