Herschel – SPIRE

Instructions for SMEC Bench geometry control Tool

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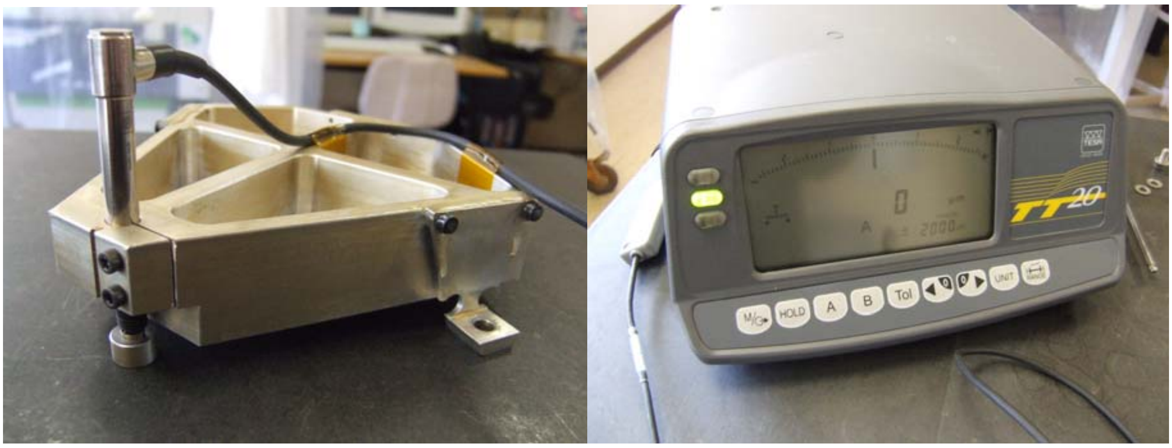
Contents

1 Object of the document

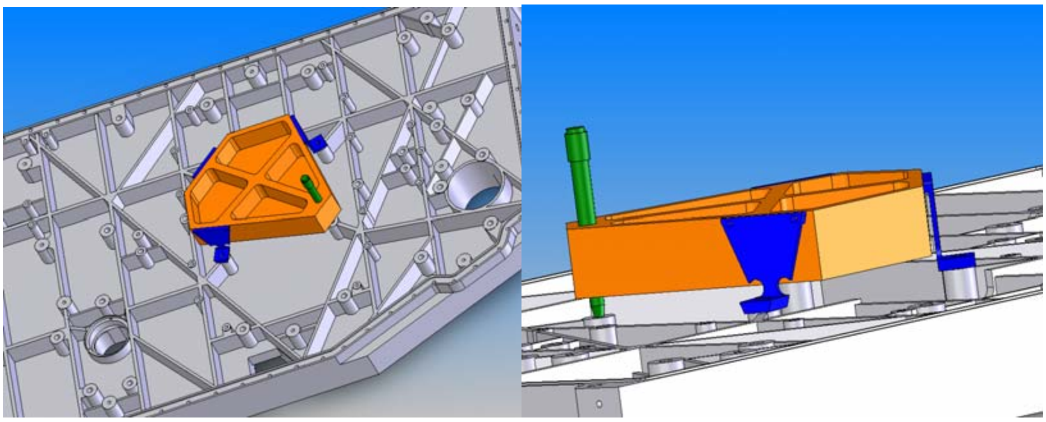
This document gives the instructions for the use of a specific tool dedicated to SMECm Bench geometry control.
This tool controls the flatness of 4 supporting zones analysis.
Flatness variations can be recorded when bench is stressed during various operations.

2 Tool description

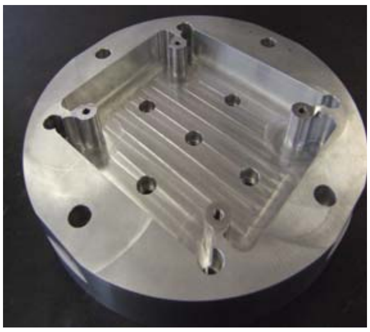
The tool is composed of a thick frame, three flexible feet and a high accuracy LVDT calibrated probe (cylindrical key) with its associated monitor.
The probe is a “TESA GT22” precalibrated LVDT. Its range is +/- 2000 µm, with 0,1 µm of accuracy.
The monitor is a “Tesatronic TT20”
A calibration plate is used to verify the calibration of the tool.



Measuring tool on marble

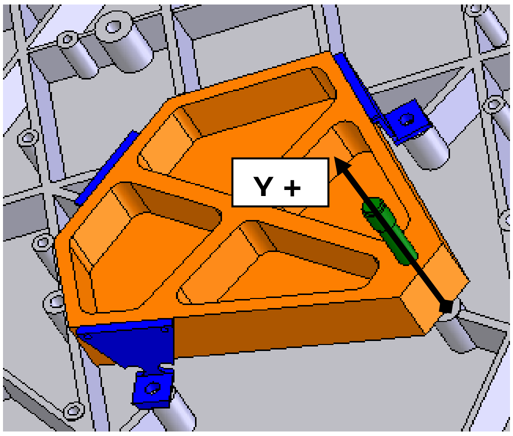


Measuring tool mounted on Spire Optical Bench



Calibration plate

3 Axis of measurement



The tool measures along the Y axis.
This axis is perpendicular in the plan of interface and directed to the top when the plan is horizontal (SMECm being posed above, head in top).
It is the SPIRE and SMECm Y axis.

A measure of +10µm means that the plane measured by the LVDT is at Y=+10µm altitude compared to the plan defined by the 3 feet of the tool.

4 Calibration

The calibration is done once at L.A.M. on a metrology marble, at 19°C +/- 1°C.
The tool is deposited on the marble, and the probe clamp is released.

The probe vertical position is adjusted so that the LVDT absolute measurement is near Zero. This guarantees that the gauge head works in a range near to its zero position (the most accurate range).
The cylindrical key is indexed towards the left (seen from top) (4µm Delta of difference of the right to left)
The nominal measure for "a perfectly flat plane" is ***0 µm*** (+/-0.5µm: flatness default of the marble)

The clamp is delicately tightened at torque: 0.6Nm
Then, the monitor is switched on, and a control of calibration is made.

The measure of the calibration plate gives -1µm of default (feet free and/or feet tight)

Measuring tool on the calibration plate, feet free

5 Gravity effect

The calibration is done horizontally on the marble, so that gravity is perpendicular to the frame plane, and towards the interface.
With the feet tightened on the calibration plate, the measure gives +1µm.
A test of variation of gravity direction shows that:

- When gravity is reversed, the proper weight of probe (not of frame) makes measurement increase by -2.5 µm. (the measure gives -1.5µm)
- When gravity is parallel to frame plane, the measurement increases by -1µm (the measure gives 0µm)

6 Temperature effect

The temperature of the room should be at 19°C +/- 1°C.
A big Delta of T° implies a stabilisation of the calibration plate and of the measuring instrument.

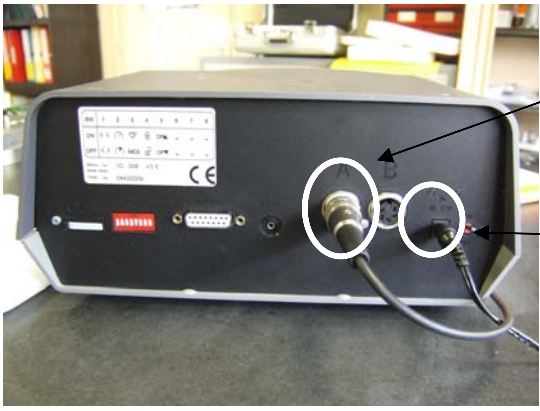
Time (mn)	Temperature (°C)	Dilation (µm)
0	(Tool + calibration plate T°) 19	-0.9
20	22.3	-1.35
40	22.8	-1.5
60	23.4	-1.8
80	(ambient temperature)23.7	-1.9
Disassembling/Reassembly		-1.6
0	(Tool + calibration plate T°) 23.5	-1.5
120	(ambient temperature)19	-0.2

One hour minimum is necessary to homogenise the temperatures of the various parts and to reach the steady state conditions for the electronic components, before beginning the measurements.
Zero will then be made according to the calibration plate.

7 Implementation

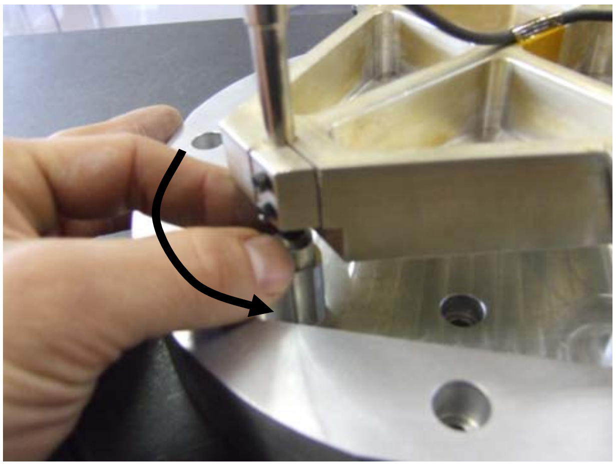
The measuring tool can be used for any bench dedicated to SMECm (all with 120x100 mm2 footing):

- Machining bench
- Mounting bench
- Transport bench
- Ground tests bench (vibration and thermal)
- Spire Optical Bench



Starting

Before any measurement, it can be useful to check the calibration on the calibration plate.
Before the assembly of the instrument on the bench, clean the plans of interfaces (optical fabric and Iso alcohol)
The three feet must be tightened to the bench with adequate screws and adequate torque. Be careful not to force the feet when tightening.



The cylindrical key is indexed towards the left (for top)(towards the cross)

There are two possible positions.

- For static measurement (flatness analysis), both positions should be tested, although they should show the same results (except for local defects). The calibration value should be subtracted to the monitor result to get the absolute flatness defect (it should be checked that no offset has been adjusted to the monitor).
- For dynamic measurements, during caps mounting operations for example, it is easier to adjust an offset to monitor 0 µm at beginning of the test. One can read the relative variations of flatness with no calculation, and should just take gravity effect into account.