Nußdorf tungsten plates CMM metrology

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6 new tungsten plates from Geselschaft für Wolfram Industrie mbH

- 3 plates from Nußdorf (purchased by ISS, used during TB'25)
  - N1
  - N2
  - N3
- 3 plates from Nußdorf (purchased TAU)
  - N4
  - N5
  - N6

Order/offer specification:

```
Sheet WP 99,95%
555 +- 0.2 x 100 +- 0.2 x 3.55(+0.0/-0.05) mm
Flatness 0,2 mm
Flatness 0,05 mm we can't offer

731,70 EUR Per 1 pcs
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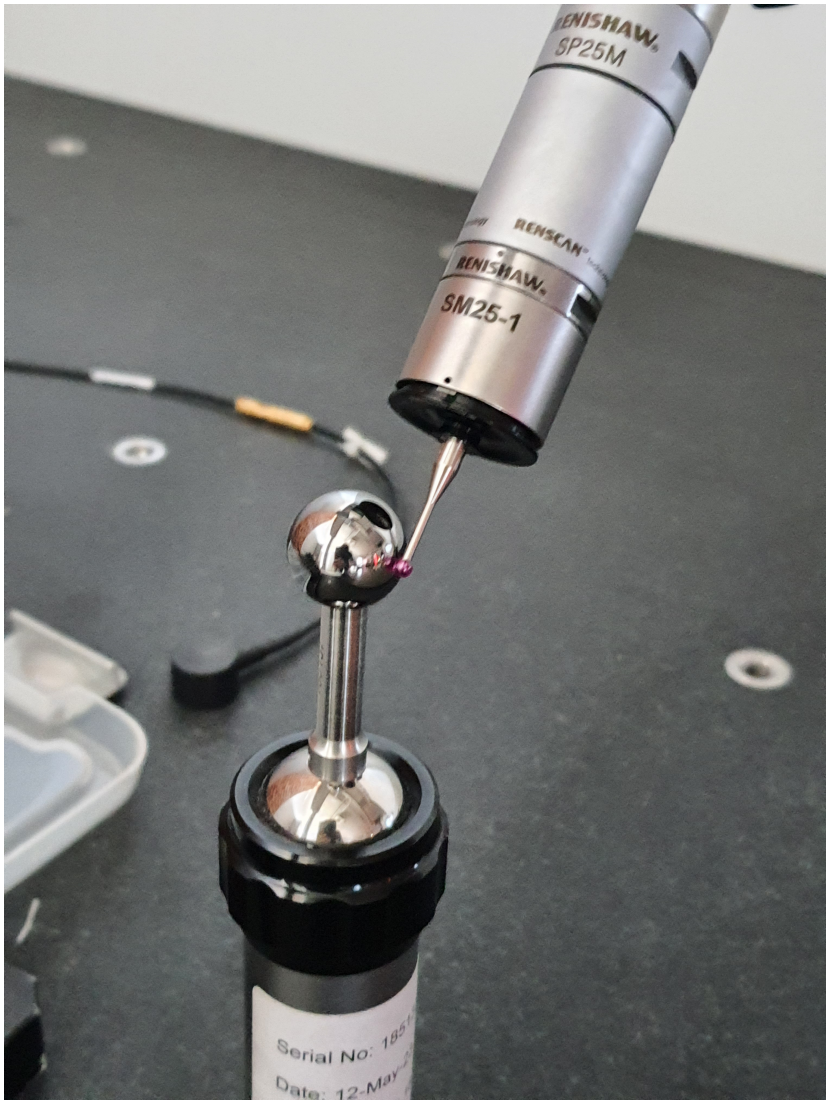
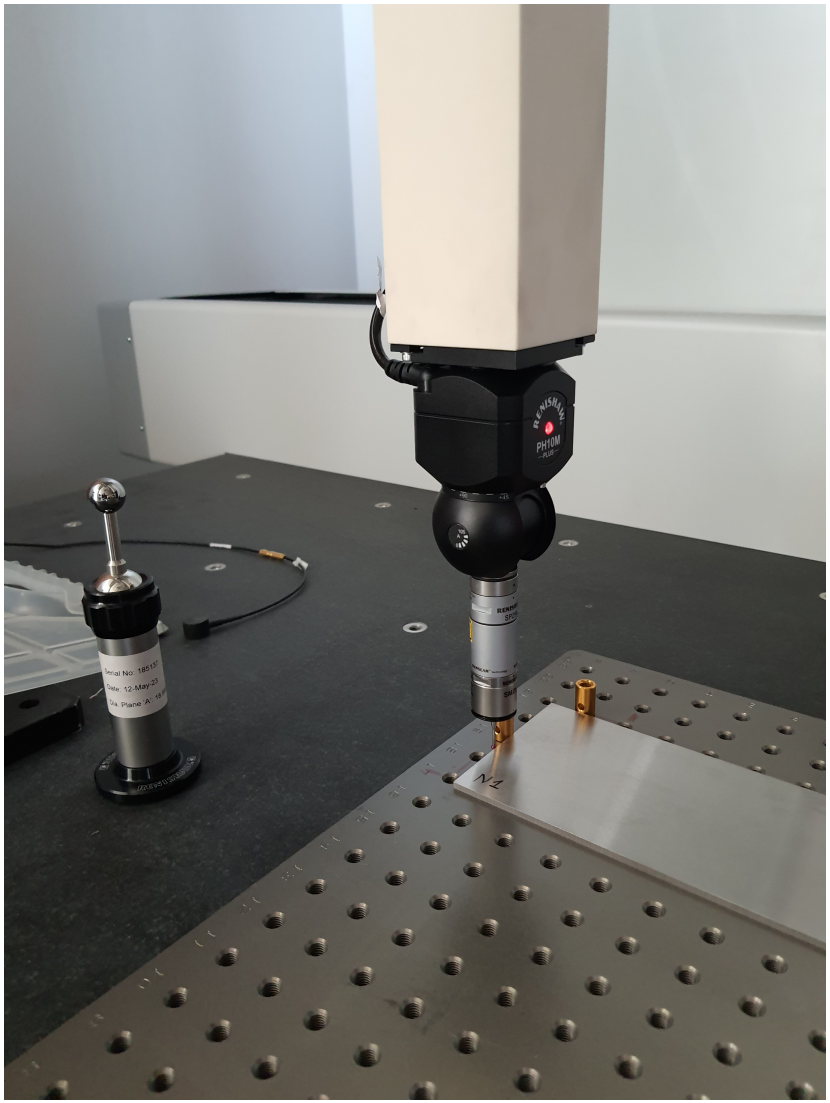
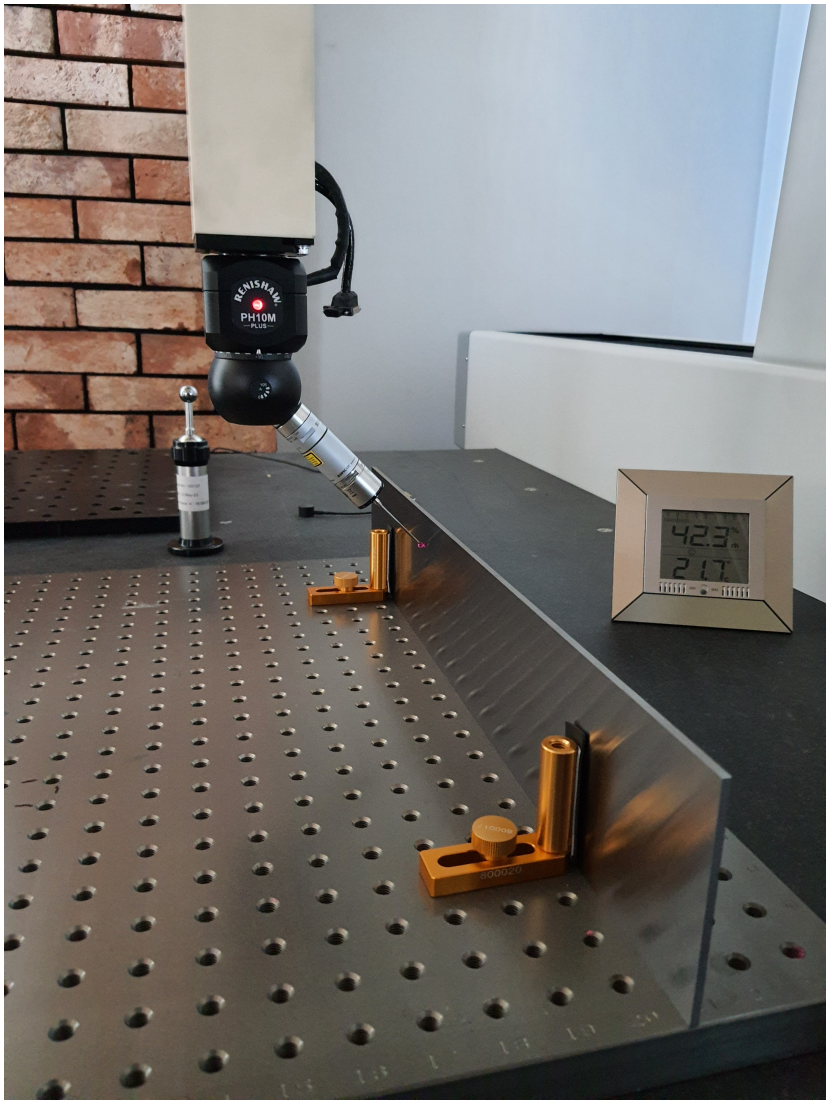
ALTERA CMM: table and calibration



- CMM self calibration wrt the reference sphere
- CMM XYZ precision $\sim 1 - 2\ \mu$m

CMM: tungsten montage





- XY dimensions in flat position
- Z dimensions in vertical configuration

CMM: grid

- $250 = 10 \times 25$ XY points on each side, starting 2.5mm from the edge
- no dead areas (narrow pillars)

Nußdorf plates: CMM mean dimensions XYZ

XYZ mean dimensions (mm)			
Plate	X	Y	Z
N1	555.1046	100.0891	3.5227
N2	554.9925	100.1020	3.5229
N3	555.1060	100.0924	3.5255
N4	555.1617	100.1675	3.5228
N5	555.1797	100.1441	3.5190
N6	555.1507	100.1670	3.5172
Mean	555.1159	100.1270	**3.5217**
Nominal	555.00±0.20	100.00±0.20	3.55 (+0.0/-0.05)

- NOTE: new specification of Z thickness
- XYZ: average (XY measured “flat on the table”)
- all dimensions within specification
- **thickness a bit below Xiamen and Beijing plates (next page) but within spec.**

Xiamen and Beijing plates : CMM mean dimensions XYZ

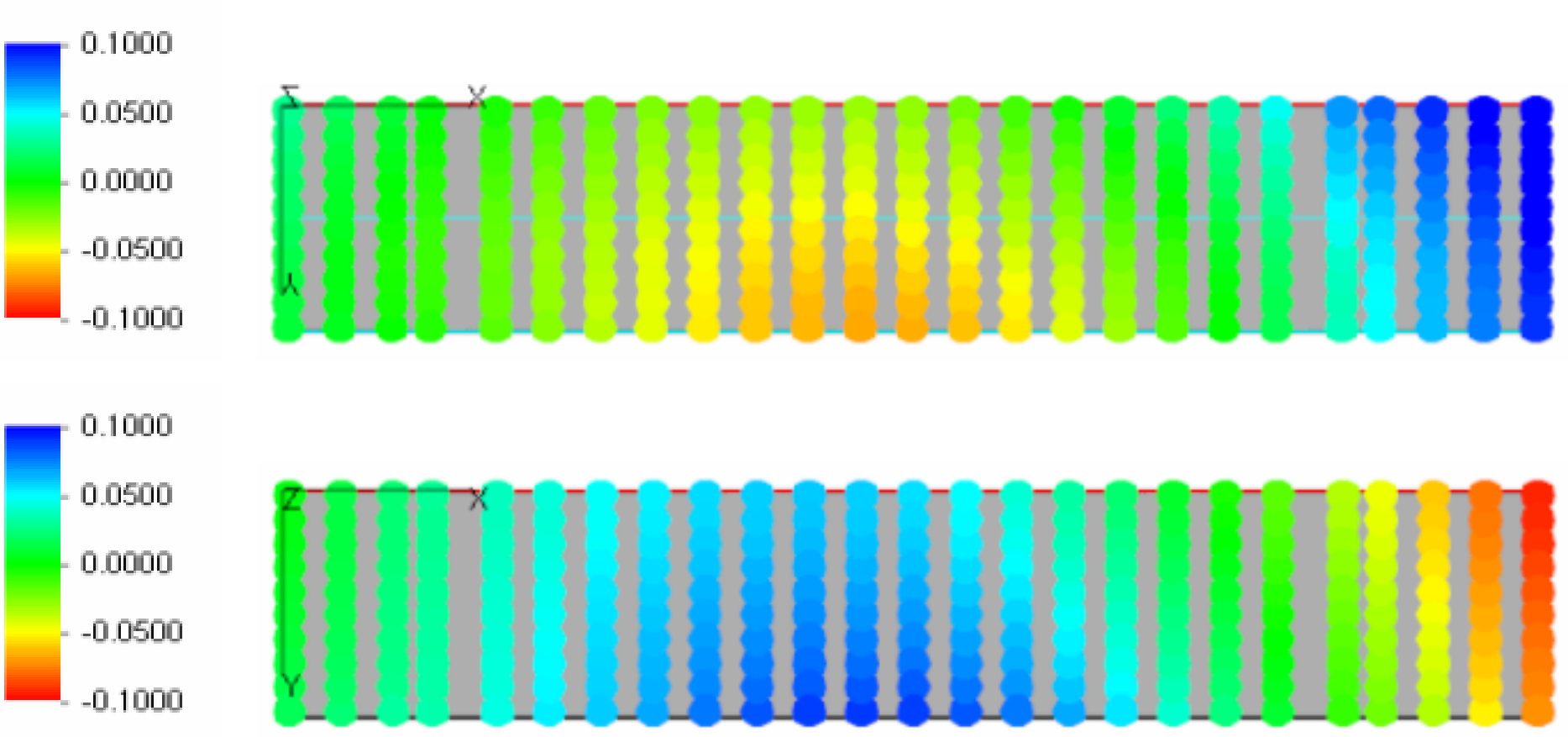
XYZ dimensions (mm)			
Plate	X	Y	Z
X1	555.1039	100.0907	3.5593
X2	555.1047	100.0864	3.5429
X3	555.1388	100.0964	3.5407
B1	555.0785	100.0640	3.5451
B2	555.0654	100.0458	3.5547
B3	555.0637	100.0366	3.5701
Nominal	555.00±0.20	100.00±0.20	3.50±0.05

- XYZ: average (XY measured “flat on the table”)
- Beijing a bit better in XY precision, both within spec.
- **in Z both similar ($\sim$ 3.55 mm), oversized by $\sim$ 50 μm, out of spec.**

CMM: flatness

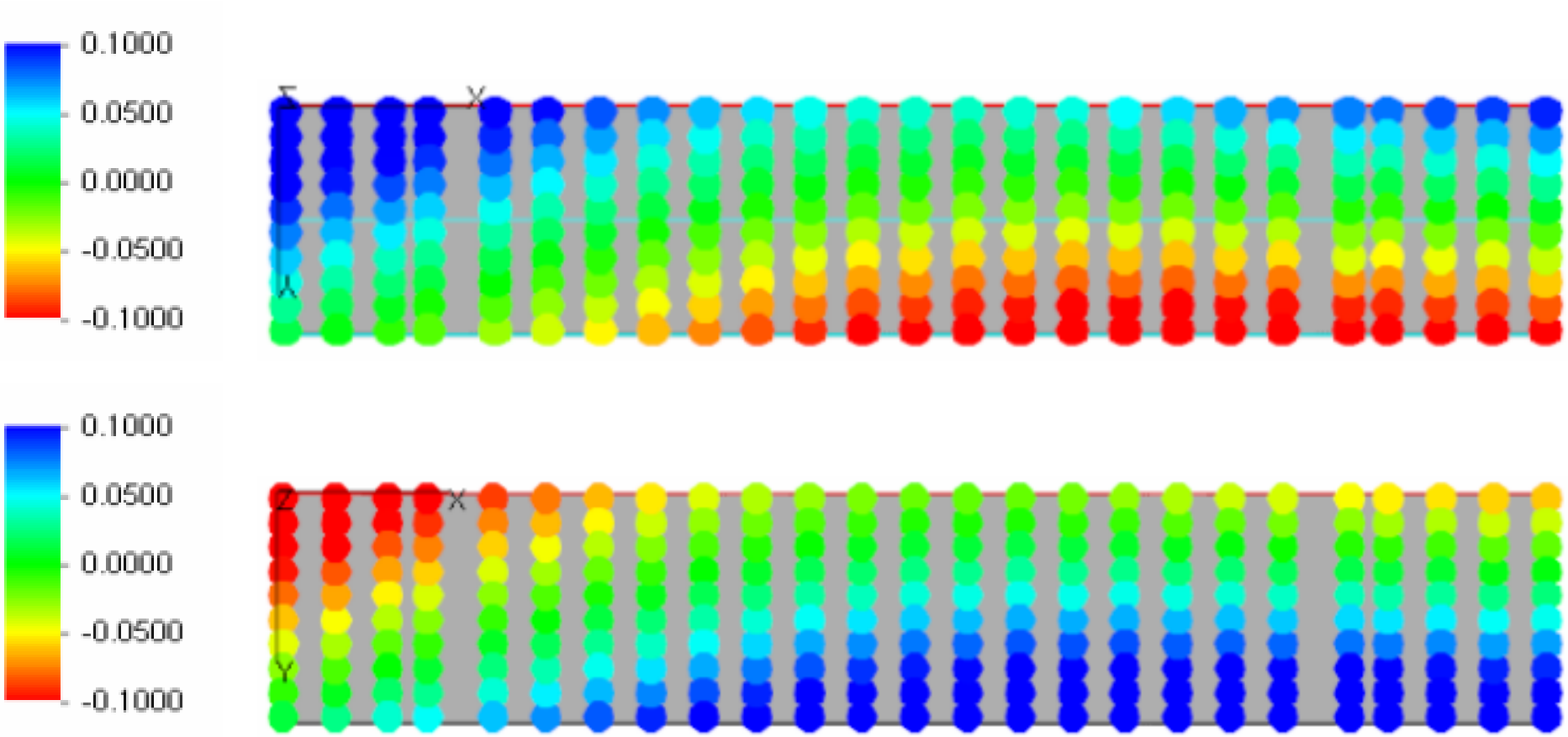
- on next pages plotted are deviations (residua) in local Z-direction from the nominal/ideal $555 \times 100 \times 3.5$ mm^3 shape fitted as a rigid body (rotation and translation only) to the set of 3D CMM measurements points (“cloud of points”)
- the (0,0,0) point is in upper left corner on plane 1
- first points on the circumference are 2.5 mm from the edge (to ensure thickness measurement within the comb/rib area)

CMM: N1 plate: plane 1, 2



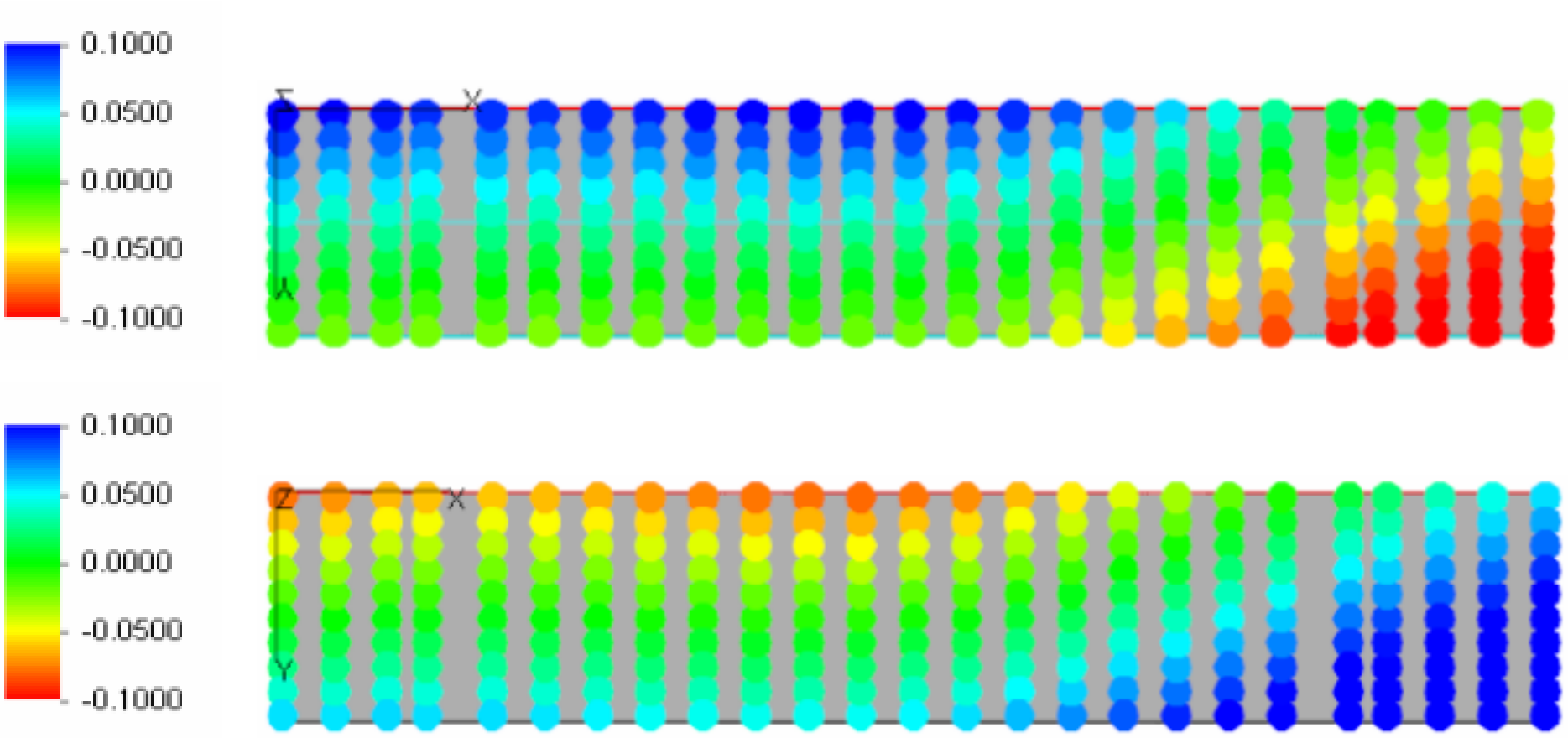
- bending for large X values, $\sim$ 100 μm, plane 1,2 correlated
- little “wave” visible in the middle, hills and valleys correlated, $\sim$ 75 μm depth

CMM: N2 plate: plane 1, 2



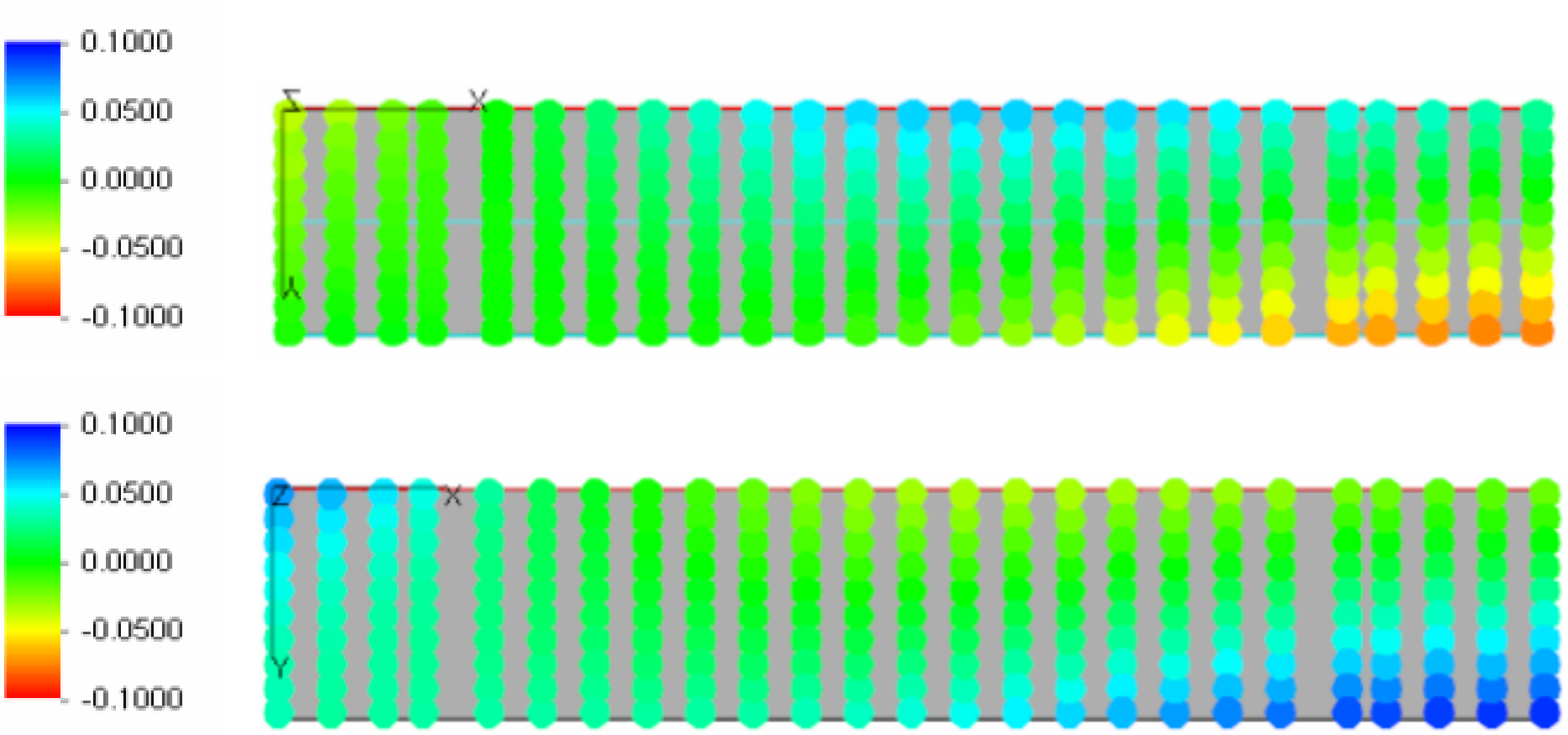
- horizontal strips structure visible ± 100 μm
- bending like propeller (?)

CMM: N3 plate: plane 1, 2



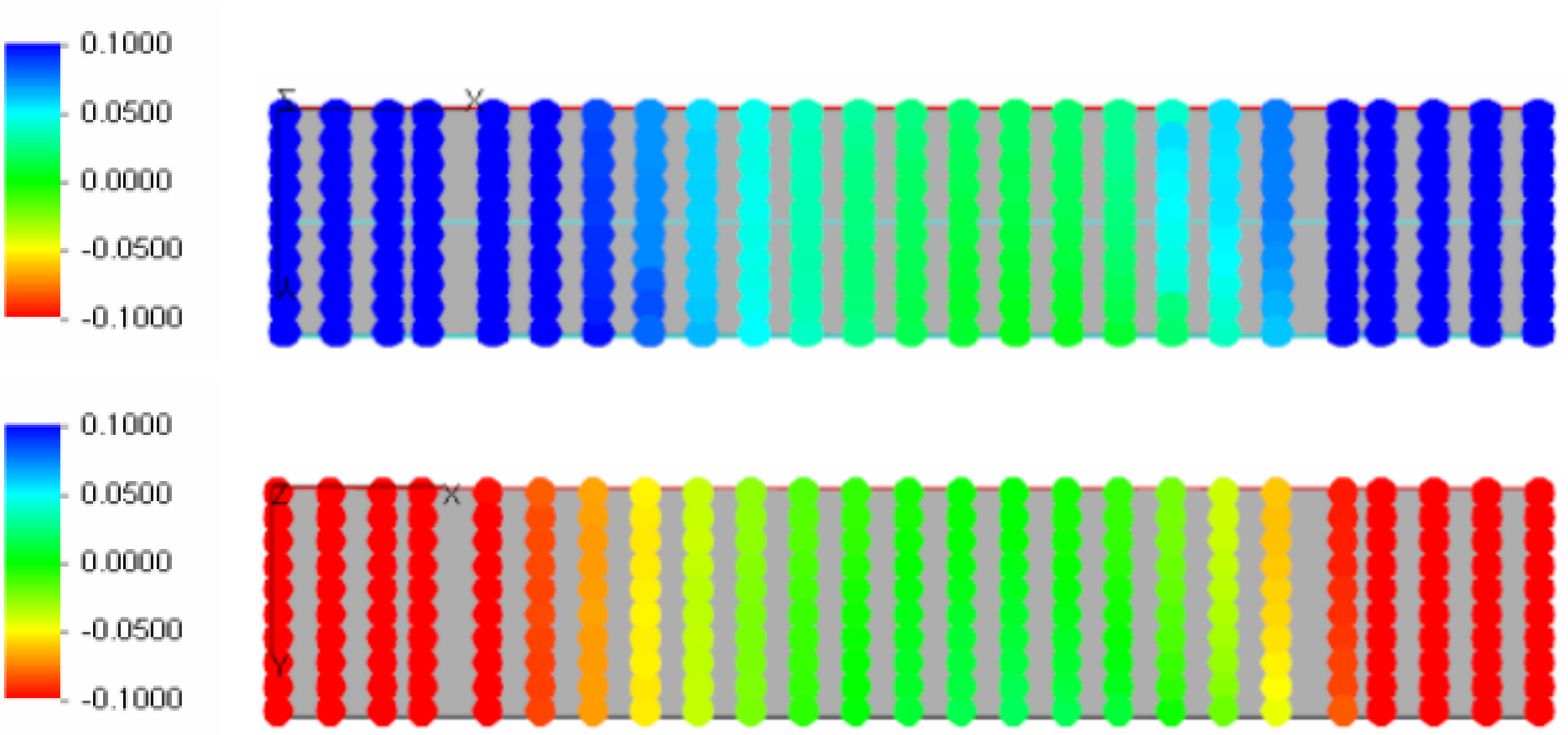
- horizontal strips structure visible ± 100 μm
- bending like propeller (?)

CMM: N4 plate: plane 1, 2



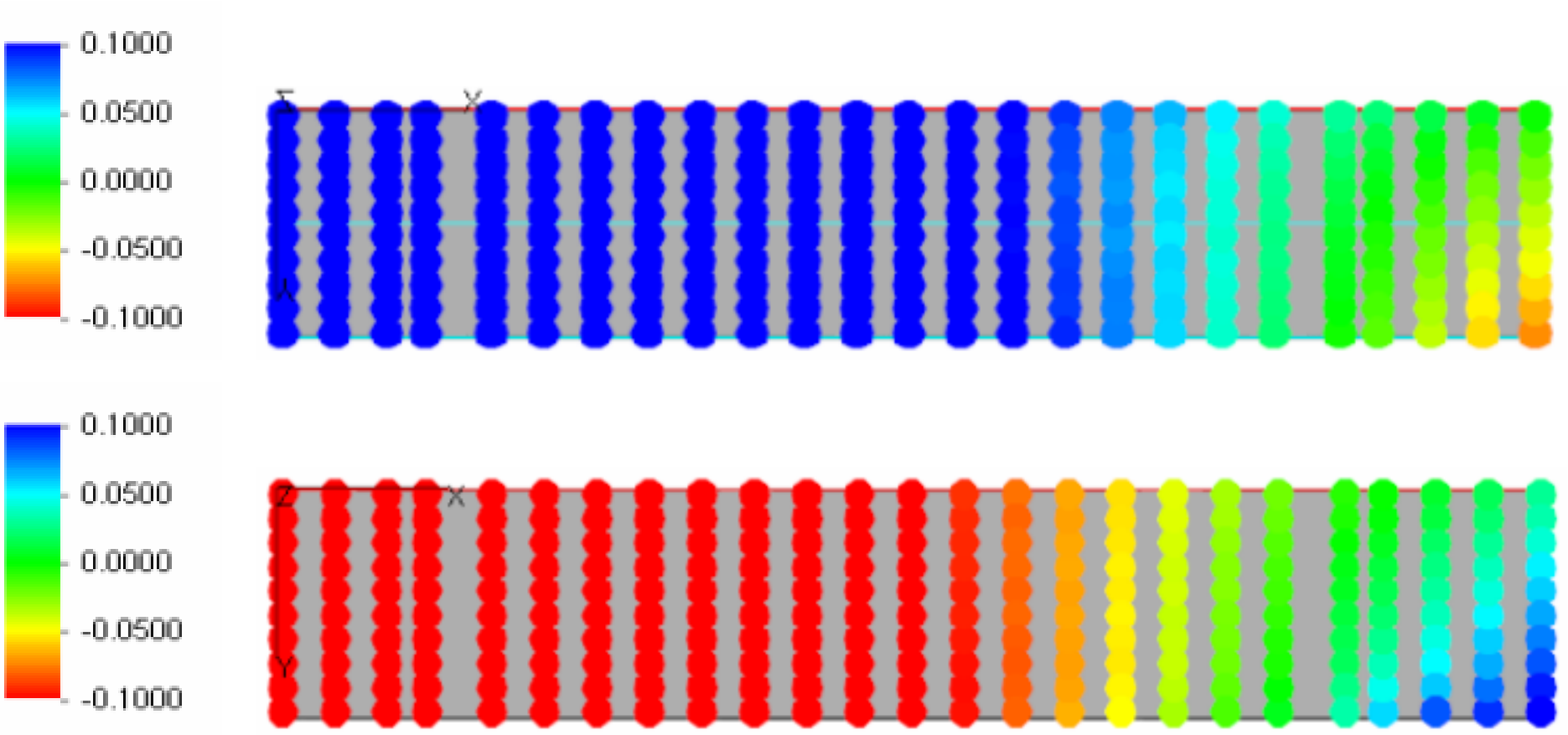
- best plate, small flatness deviations less then ± 50 μm

CMM: N5 plate: plane 1, 2



- very “undulating” plate, wavy structure, more then ± 100 μm
- but this kind of deformation should be corrected in tight combs

CMM: N6 plate: plane 1, 2



- bended like “angle bracket” more then ± 100 μm
- again: this kind of deformation should be corrected in tight combs

Summary : plates from Nußdorf Wolfram Industry

- **XY dimensions OK**
- **Z (thickness) OK**, within our new spec (a bit below 3.55 mm) (good for Si sensors insertion)
- flatness/planarity: $\sim \pm 100$ μm for majority of plates
- usually it is due to the some bending (good news but: $\rightarrow$ **wait for thickness profiles**)
- *tungsten tension (rigidity) is not very big we can compensate the bending in the combs*

- **density measurements coming soon**