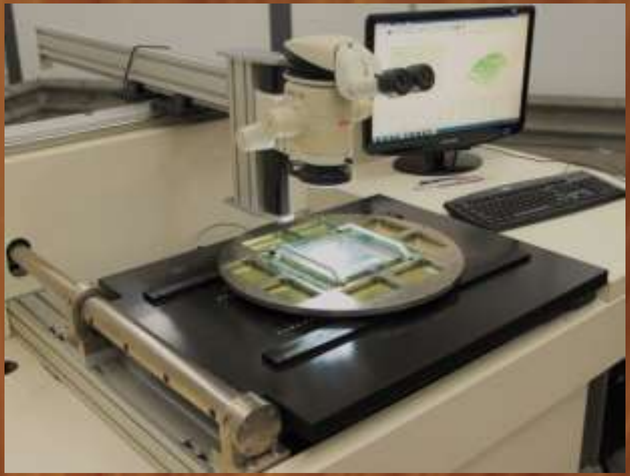
2024

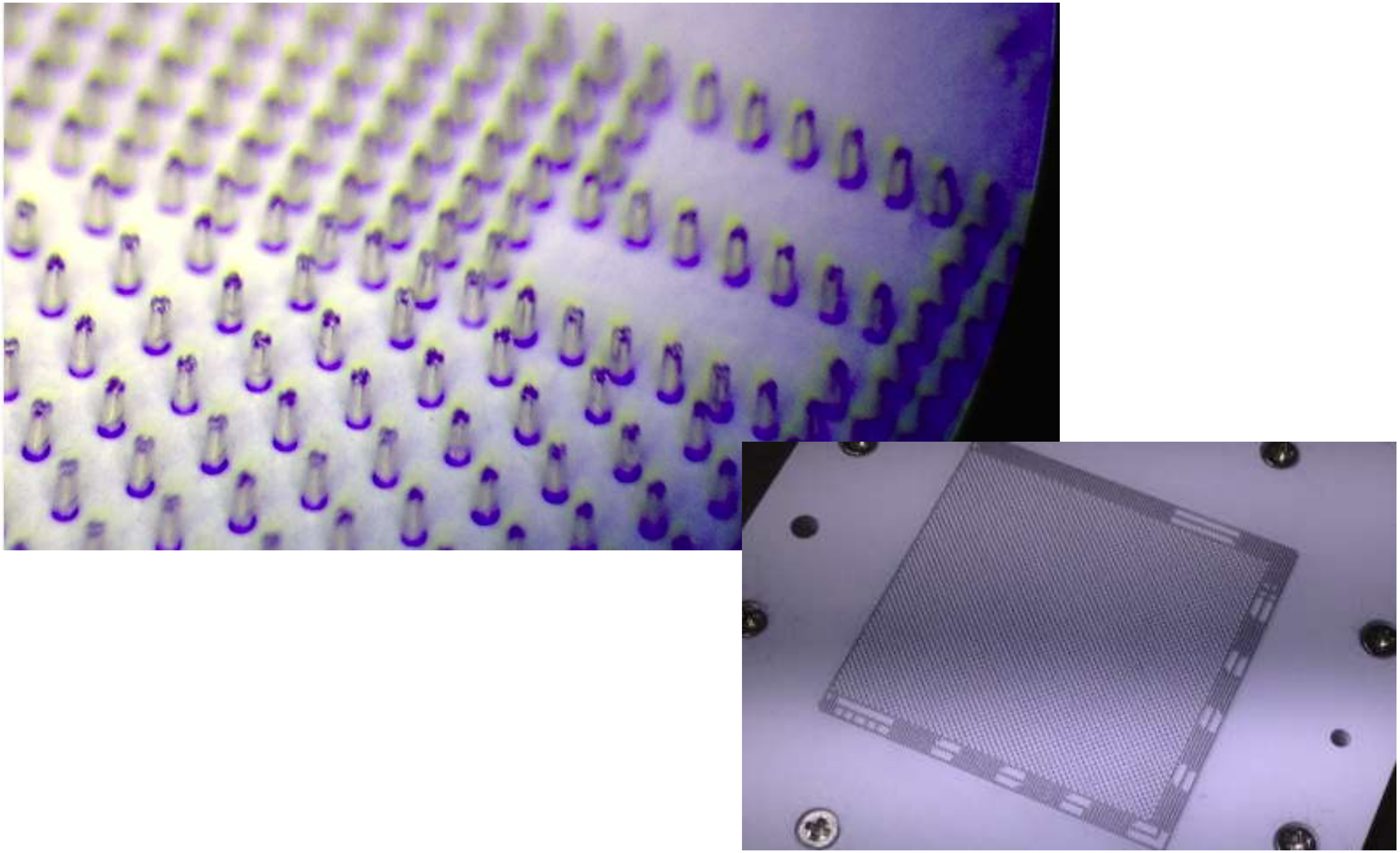


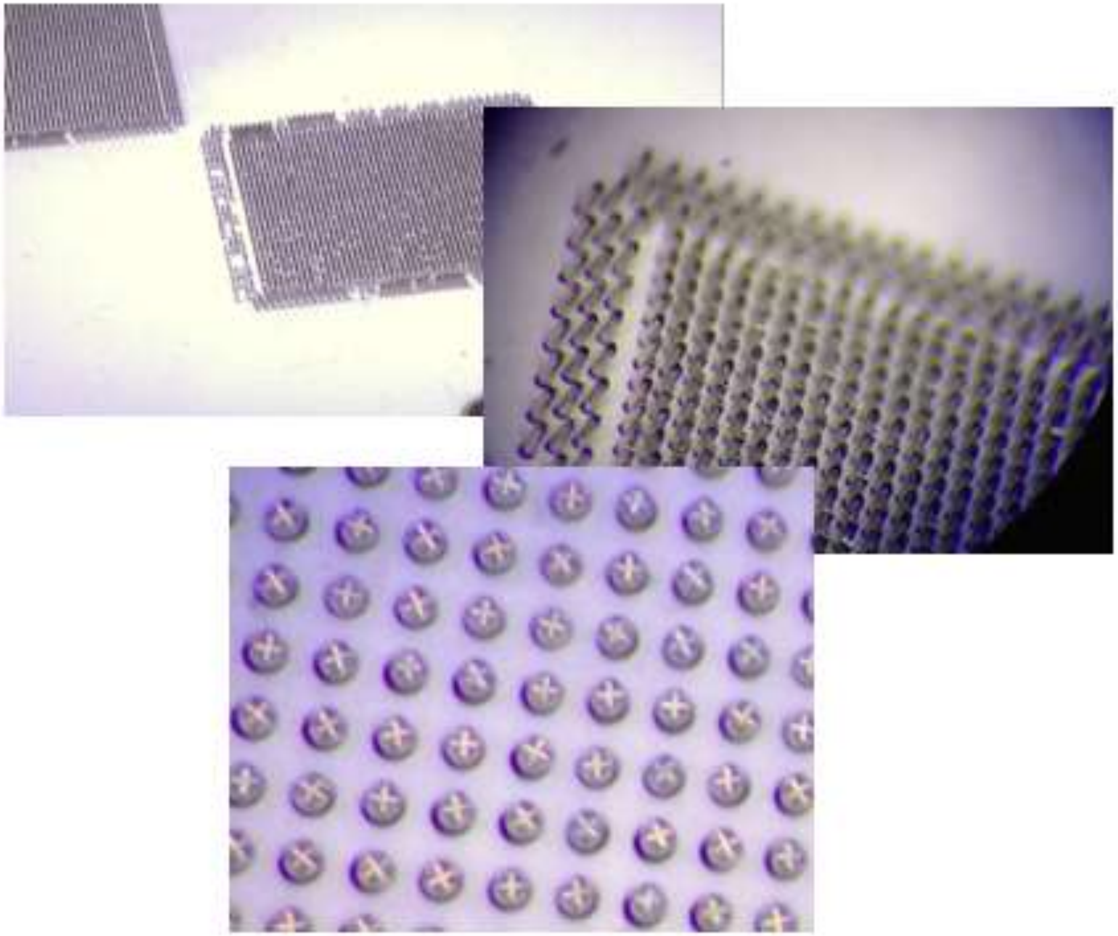
Contactless Inspection for Beam clearance and planarity inspection

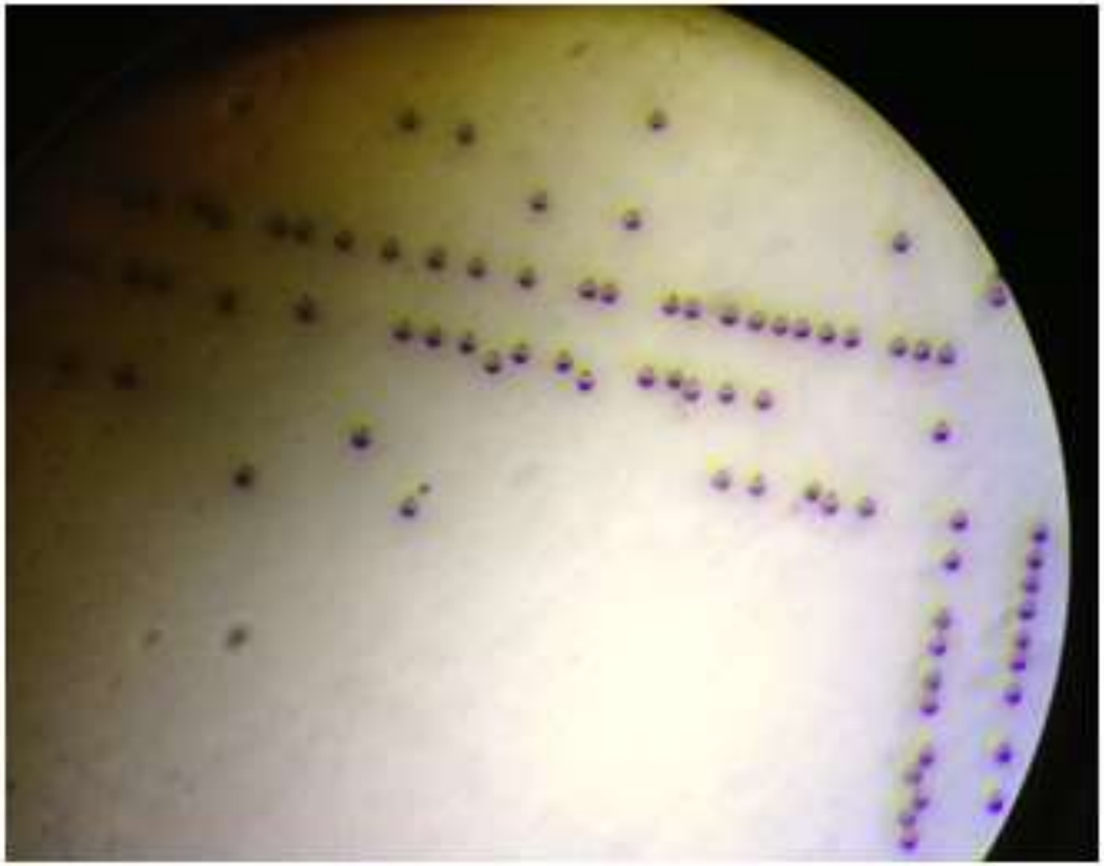
BE Precision Technology

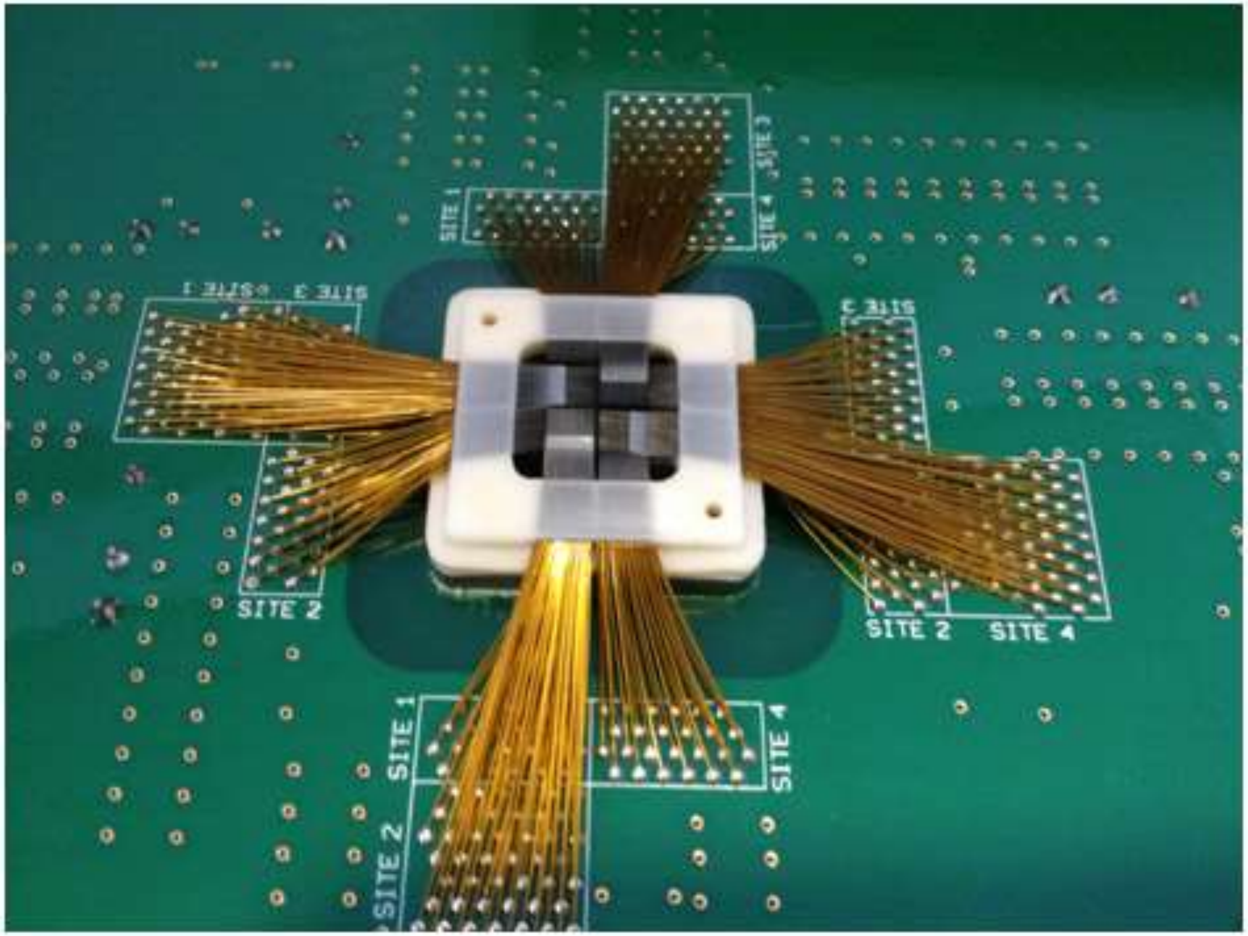
Samples we tested on the inspector

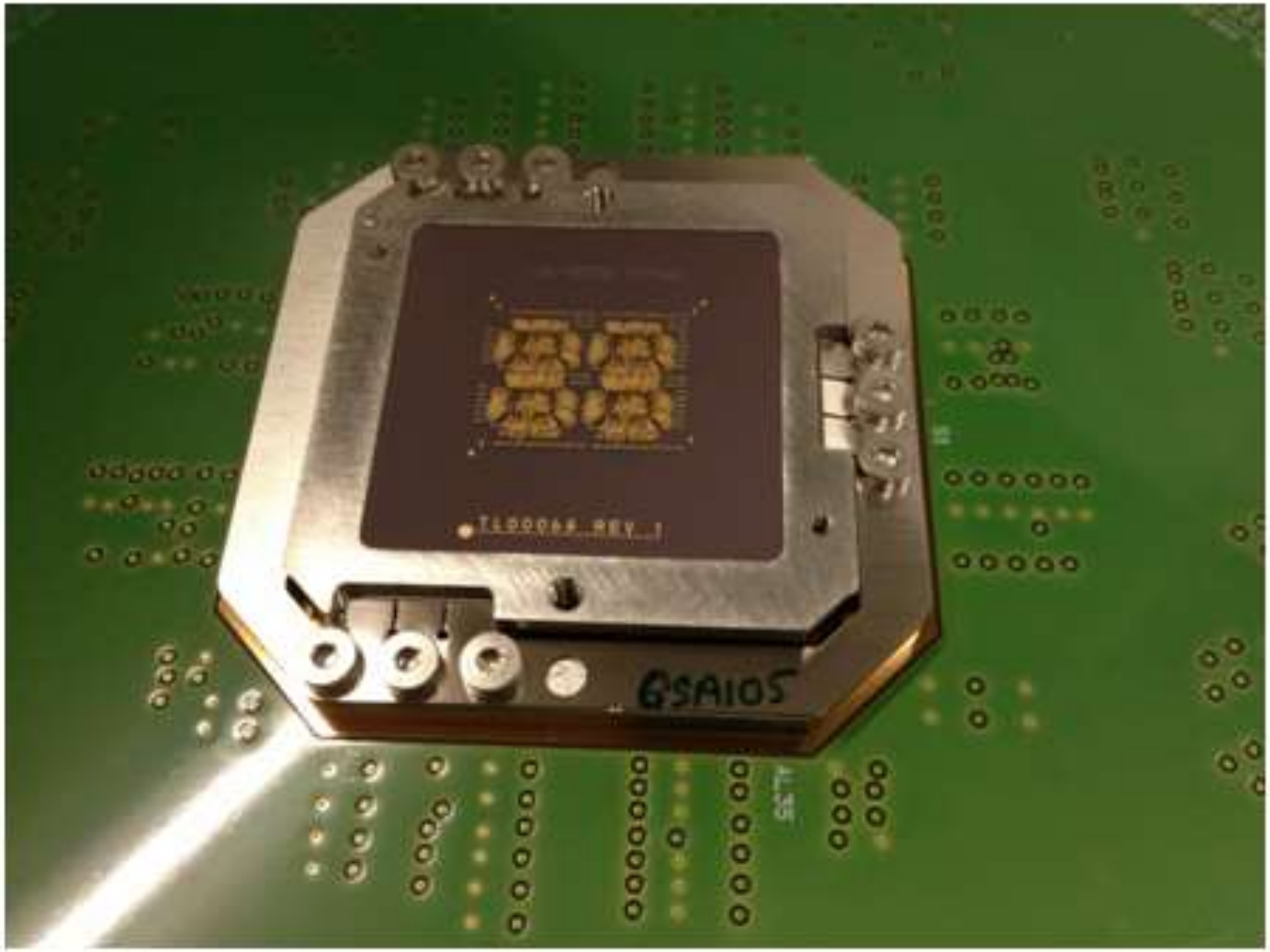
- 2 crown probes
- 1 mems
- 1 cantilever
- 1 vertical 6 micron pin



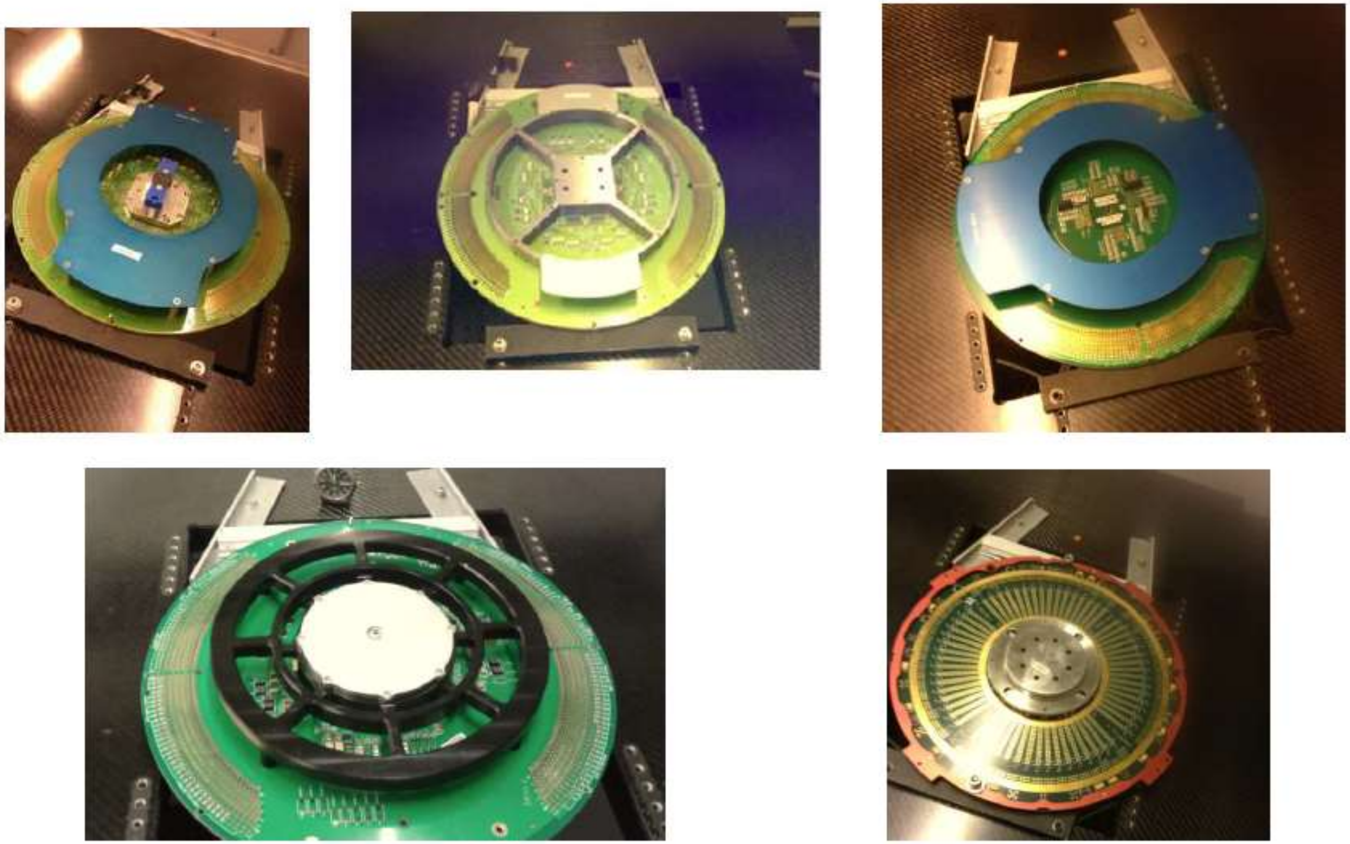




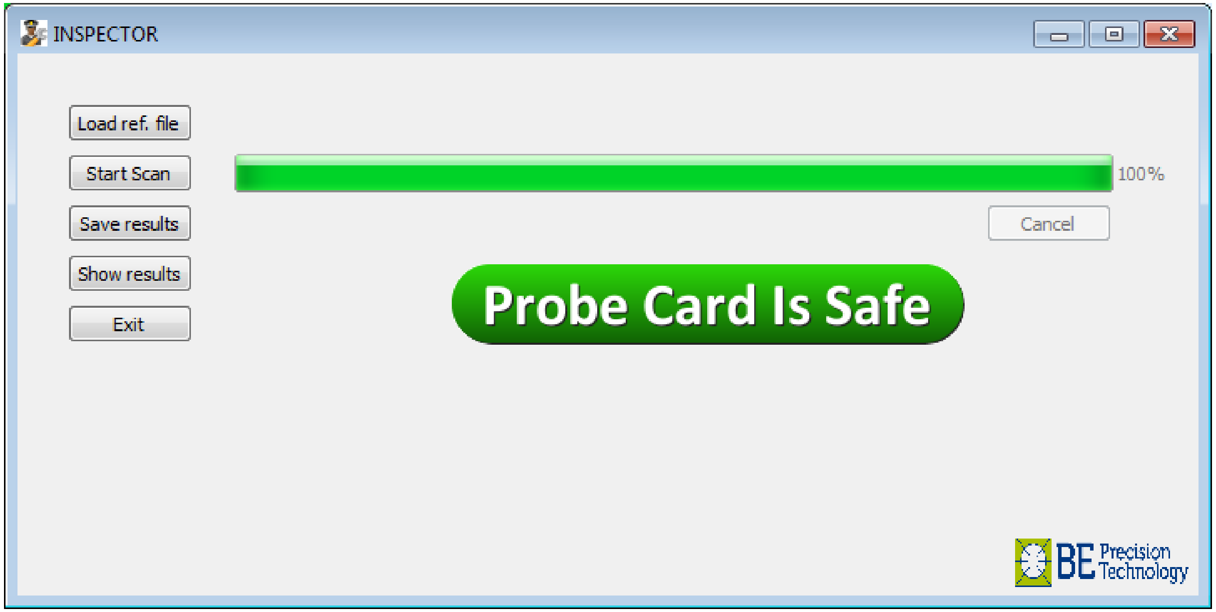

SITE 1
SITE 3
SITE 4
SITE 1
SITE 3
SITE 2
SITE 3
SITE 2
SITE 4
SITE 1
SITE 4
SITE 2


TL00068 REV 1
GSA105

6. Card setup in system



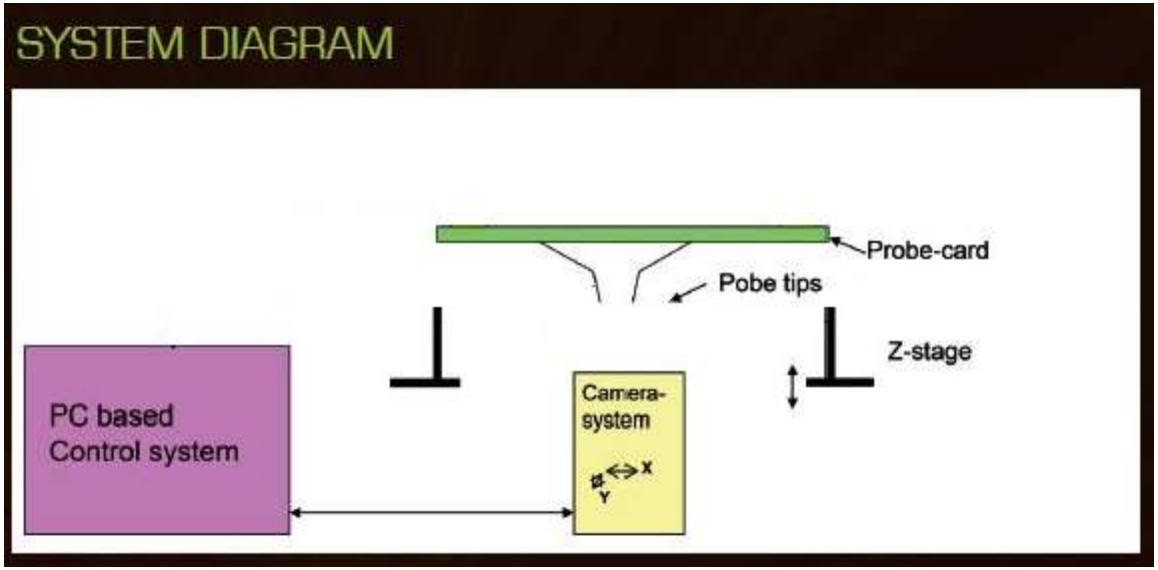
7. Software settings



- Color information for the operator
- Warning for *parts sticking out* over the amount of probes on the card
- Data storing for reference
- Conclusion measurement: this probe card is safe / not safe
- Leveling probe card
- Other data from probe card possible on request

8. System

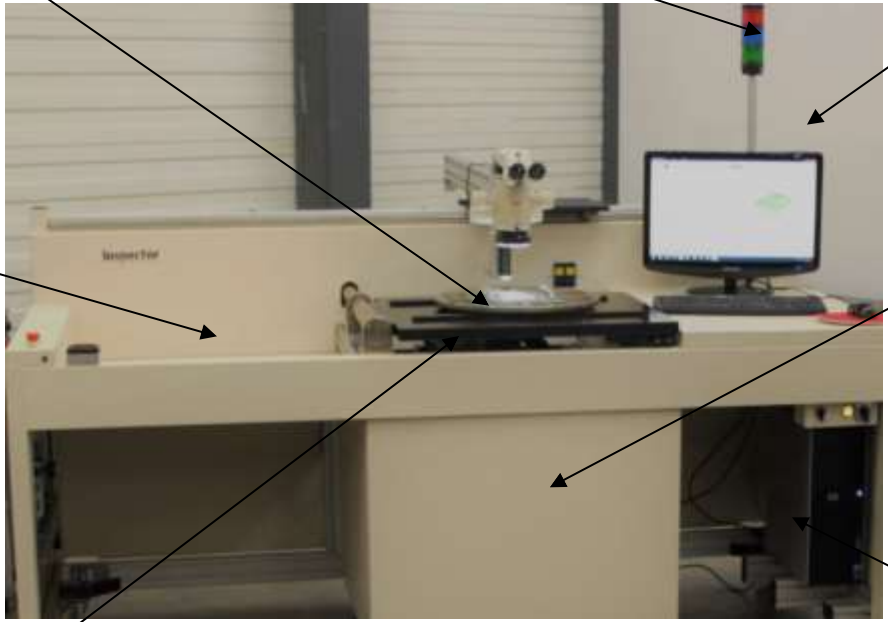
- System operates explained as below



8. System

- System overview

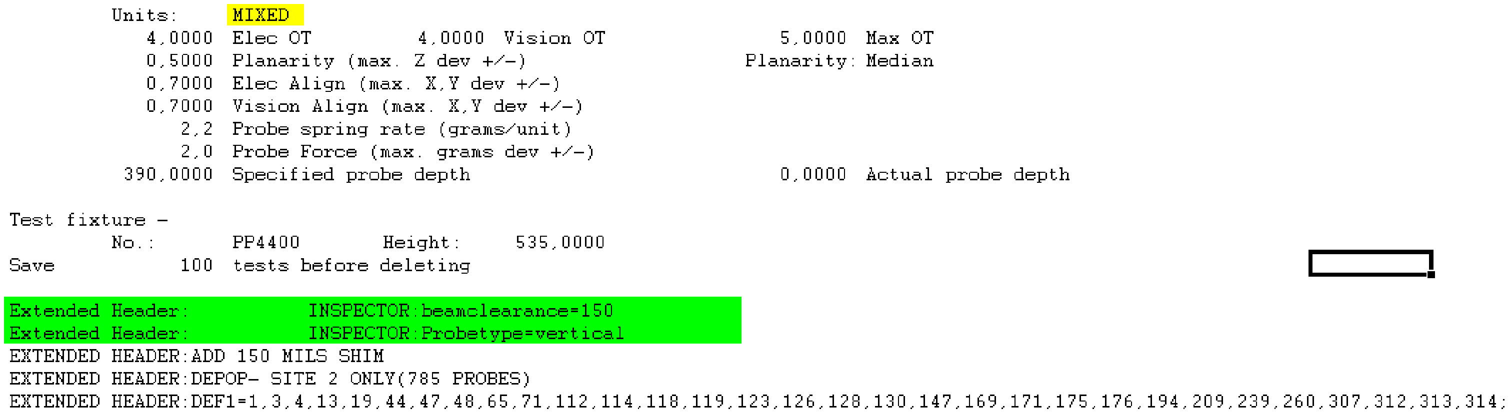
8. System overview



- Scanning area
- System status
- Operator workspace
- Rework table
- Control desk
- Large platform holding probe cards 23 inch and larger
- PC win10 with remote diagnostics

9. Ref file

- Test file is compatible with VX3/4 or M3/5
- System uses this data for analyses
- Add features to the STD ref file
- Few settings; only 1 time setup for each *family* type



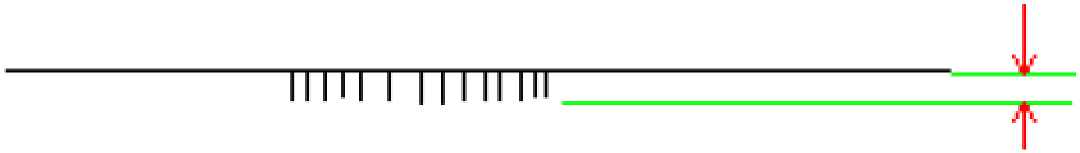
```
          Units:     MIXED
             4,0000  Elec OT          4,0000  Vision OT              5,0000  Max OT
             0,5000  Planarity (max. Z dev +/-)                   Planarity: Median
             0,7000  Elec Align (max. X,Y dev +/-)
             0,7000  Vision Align (max. X,Y dev +/-)
                2,2  Probe spring rate (grams/unit)
                2,0  Probe Force (max. grams dev +/-)
           390,0000  Specified probe depth                           0,0000  Actual probe depth

Test fixture -
         No.:        PP4400        Height:     535,0000
Save           100   tests before deleting

Extended Header:           INSPECTOR:beamclearance=150
Extended Header:           INSPECTOR:Probetype=vertical
EXTENDED HEADER:ADD 150 MILS SHIM
EXTENDED HEADER:DEPOP- SITE 2 ONLY(785 PROBES)
EXTENDED HEADER:DEF1=1,3,4,13,19,44,47,48,65,71,112,114,118,119,123,126,128,130,147,169,171,175,176,194,209,239,260,307,312,313,314;
```

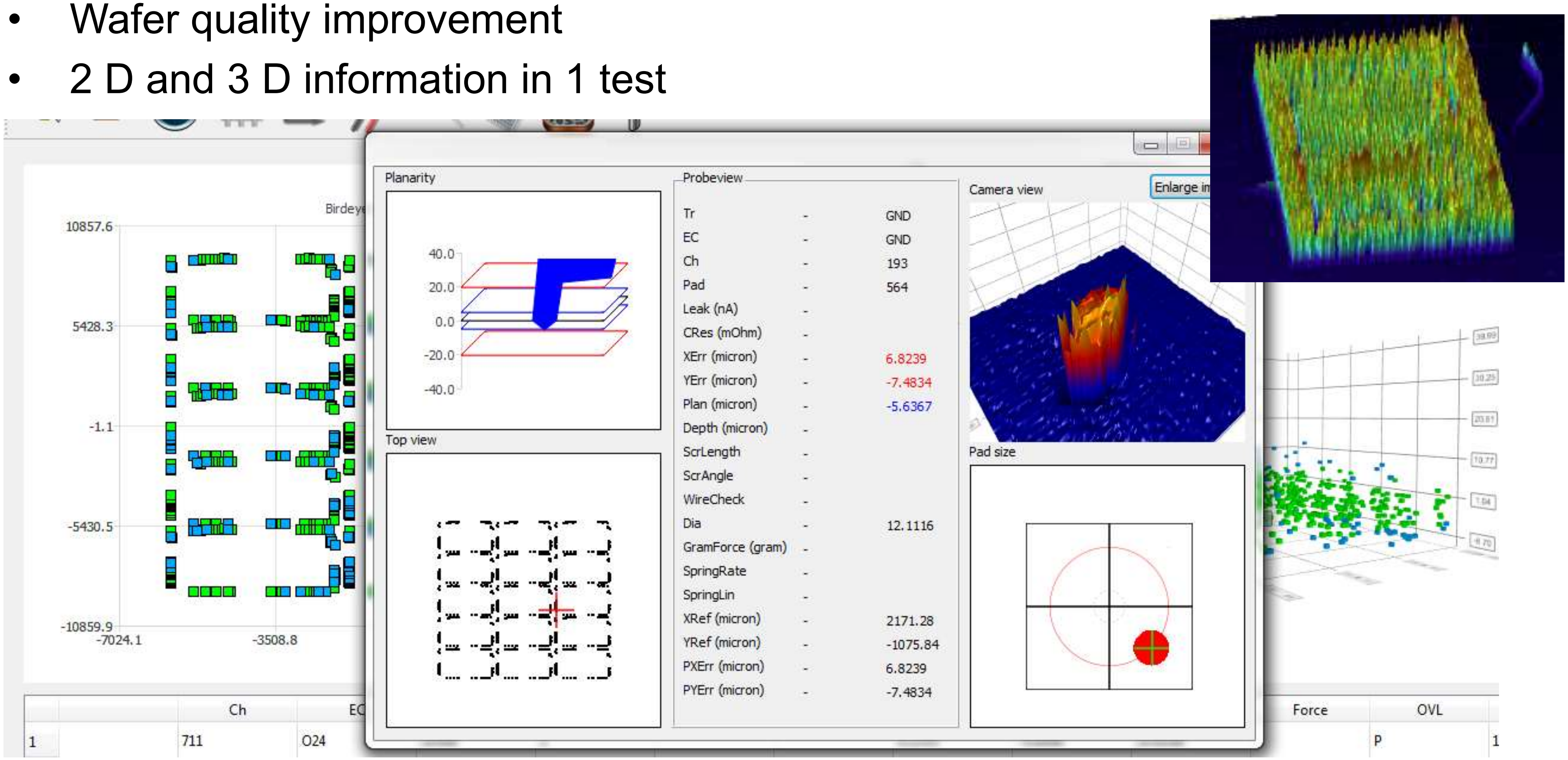
9. Pass / Failure analyses

- System warning for sticking out parts over probes on the card.
- Software shows *free zone* level from lowest tip to higher fixture up to 200 / 400 Micron.
- Software shows result *free zone* to operator.
- Safety level is programmed in ref file.



10. Advantages

- See beam clearance at ones, broken head etc
- Maximize the life time of the probecard, no worrie on beam length.
- Detect particals on probecard thats can damage wafer
- Wafer quality improvement
- 2 D and 3 D information in 1 test



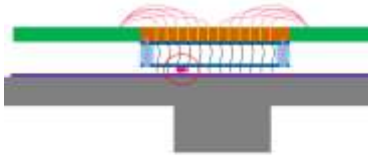
Probeview

```
Tr                  -    GND
EC                  -    GND
Ch                  -    193
Pad                 -    564
Leak (nA)           -
CRes (mOhm)         -
XErr (micron)       -    6.8239
YErr (micron)       -    -7.4834
Plan (micron)       -    -5.6367
Depth (micron)      -
ScrLength           -
ScrAngle            -
WireCheck           -
Dia                 -    12.1116
GramForce (gram)    -
SpringRate          -
SpringLin           -
XRef (micron)       -    2171.28
YRef (micron)       -    -1075.84
PXErr (micron)      -    6.8239
PYErr (micron)      -    -7.4834
```

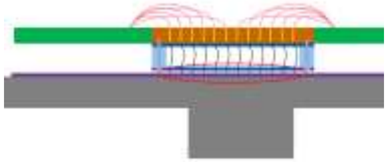
```
1      711      O24      ...      P      1
```

10. Advantages

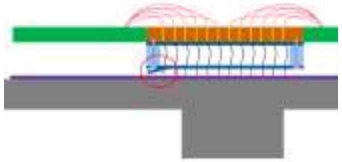
Imprint Risk #1: Particle



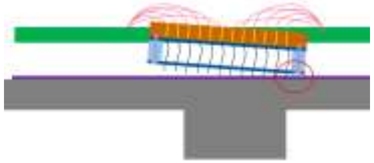
Imprint Risk #2: Short Needles



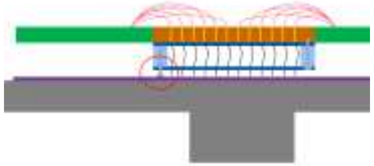
Imprint Risk #3: Broken Ceramic



Imprint Risk #4: Tilted Probe Head

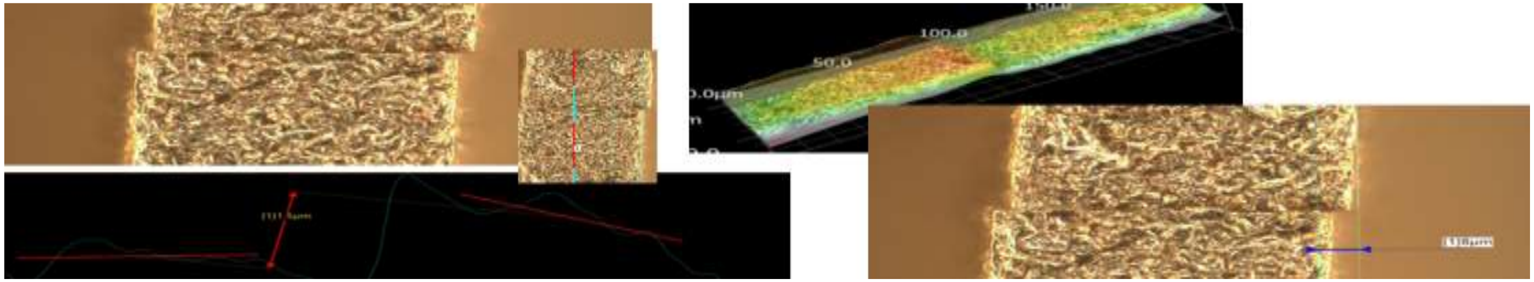


Imprint Risk #5: Loosened Screws



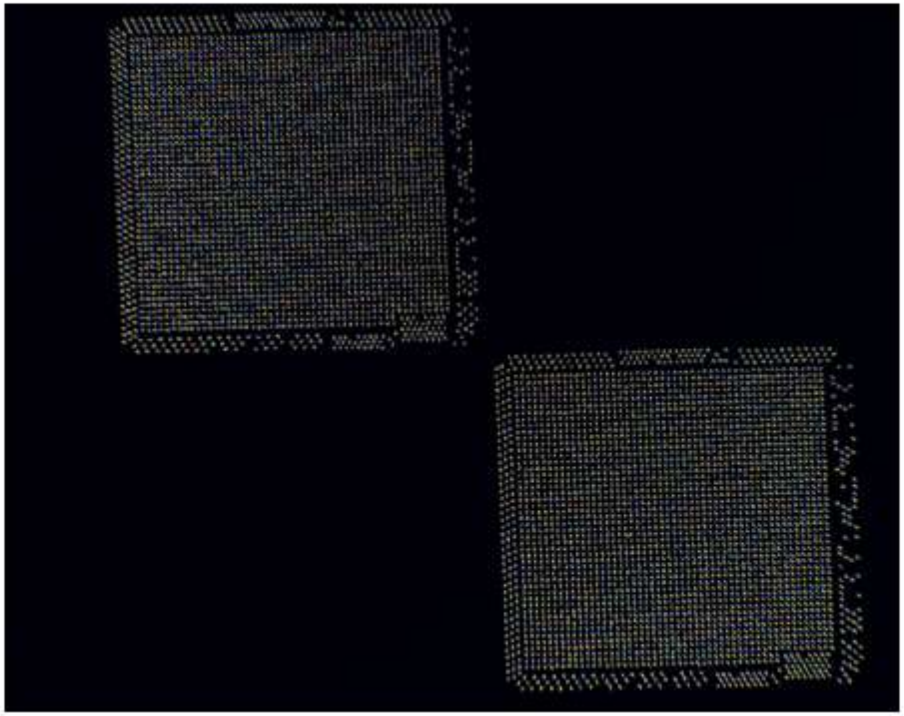
Potential Risks causing Wafer Imprints

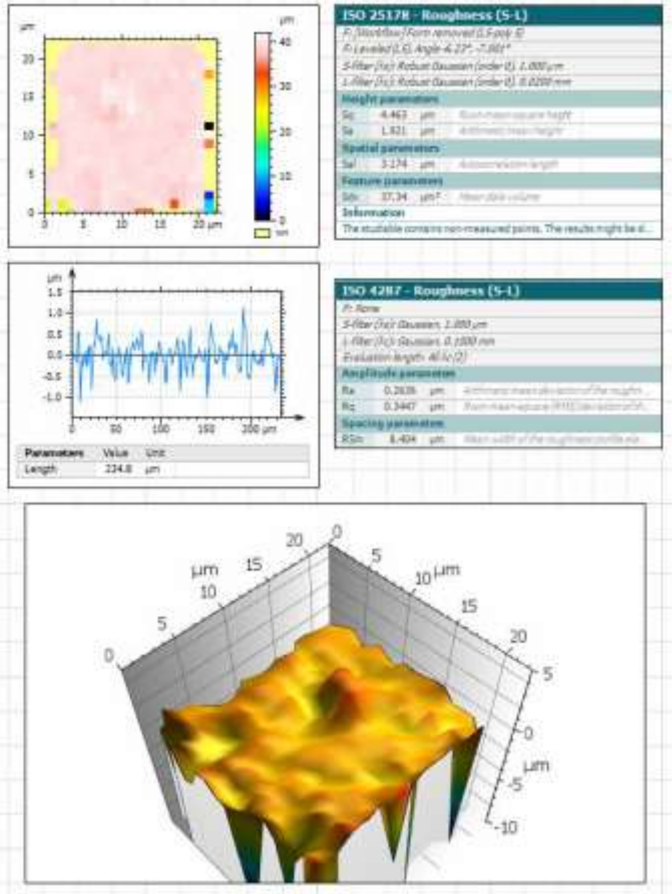
- Loose particle on probe head or wafer
- Tip wear out
- Broken ceramic / epoxy-ring
- Tilted probe head
- Tilted prober head plate
- Loosened screws
- High overdrive
- Wafer bow
- ..



- Inspector cares for all these issues and controles the Yield of the probecard
- Even haircracks in probes are now measured and warned to the operator

10. Advantages





ISO 25178 - Roughness (S-L)

Height parameters			
Sq	4.463	µm	[illegible]
Sa	1.321	µm	[illegible]
Spatial parameters			
Sal	3.174	µm	[illegible]
Feature parameters			
Sdv	37.34	µm³	[illegible]
Information			
The studiable contains non-measured points. The results might be d...			

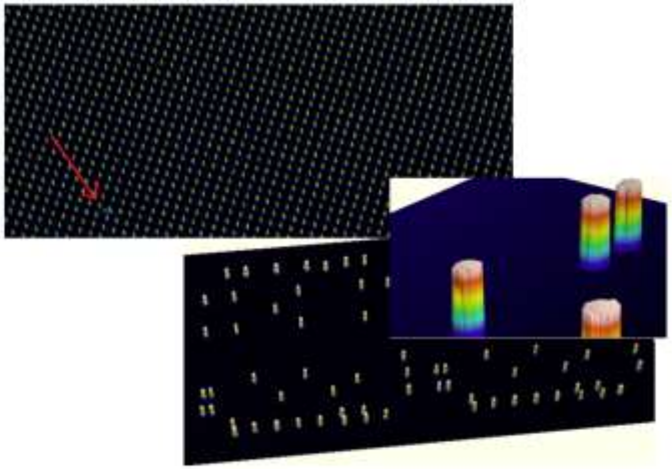
ISO 4287 - Roughness (S-L)

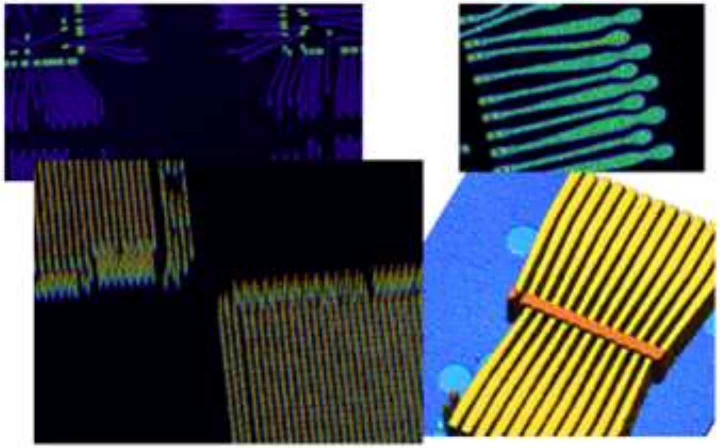
Amplitude parameters			
Ra	0.2828	µm	[illegible]
Rq	0.3447	µm	[illegible]
Spacing parameters			
RSm	8.404	µm	[illegible]

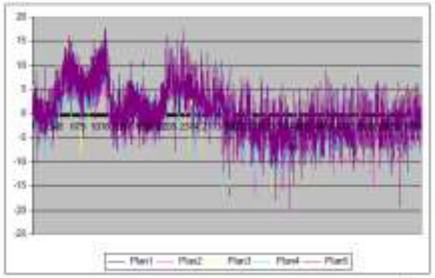
Parameters	Value	Unit
Length	224.8	µm

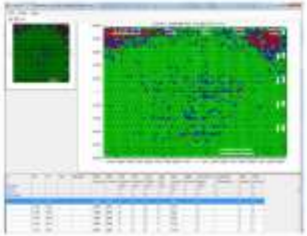
- Maximum details not just XYZ but full head inspection
- Maximize the life time of the probecard, dust parts poluting the wafer
- Detect particals on probecard thats can damage wafer
- Probe tip roughness measurement, is the probe sliding over the pad or collecting materials?

10. Advantages

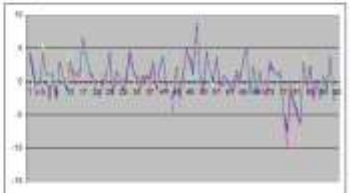


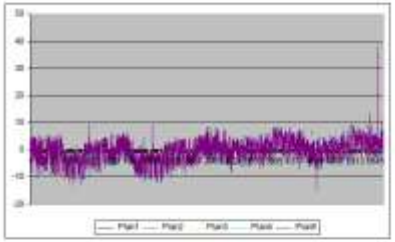


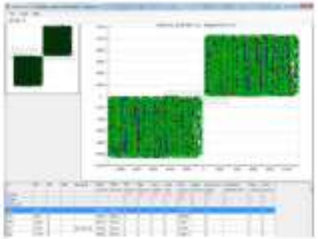




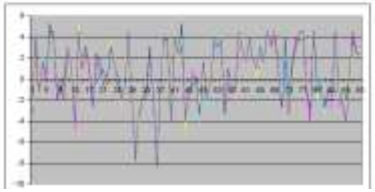
- The cards where measured 5 times to see the repeatability of the system
- Bottom pictures is the zoomout out of the first 100 pins





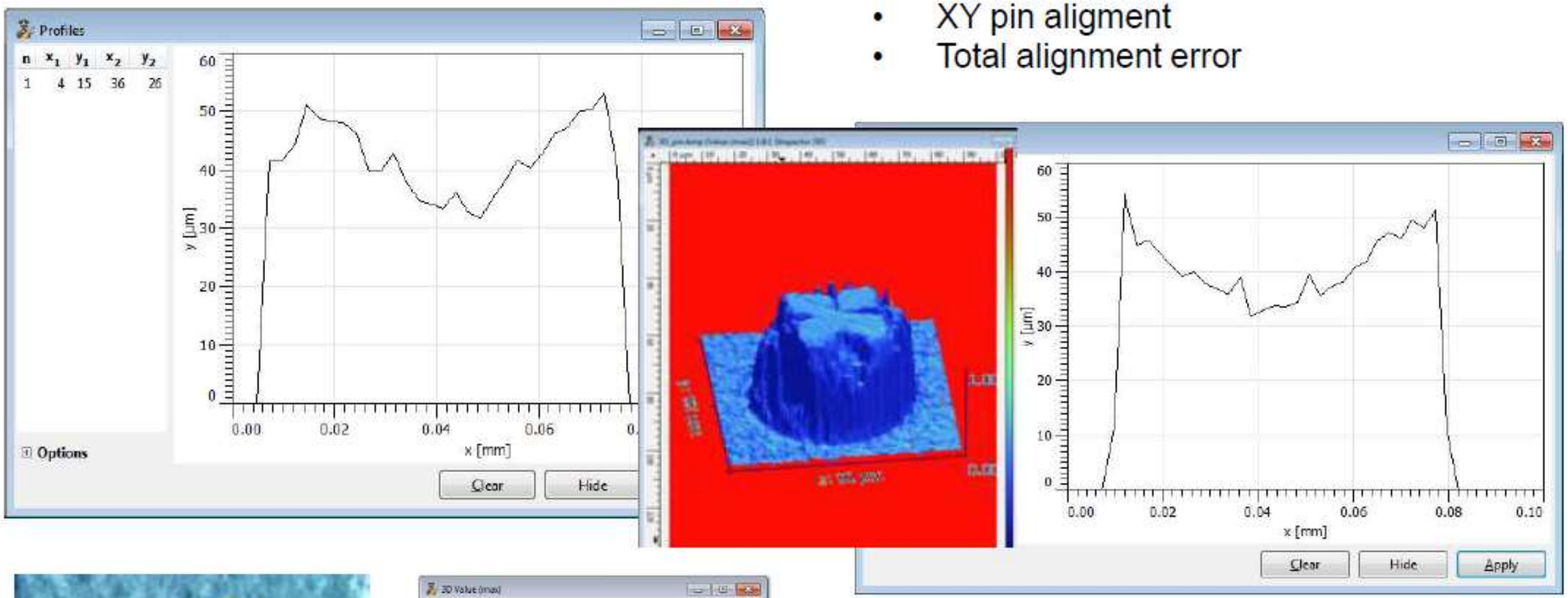


- The cards where measured 5 times to see the repeatability of the system
- Side picture is the zoomed out data of the first 100 probes

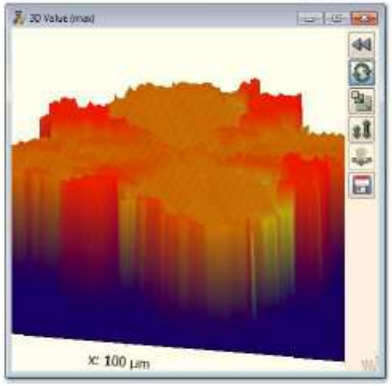


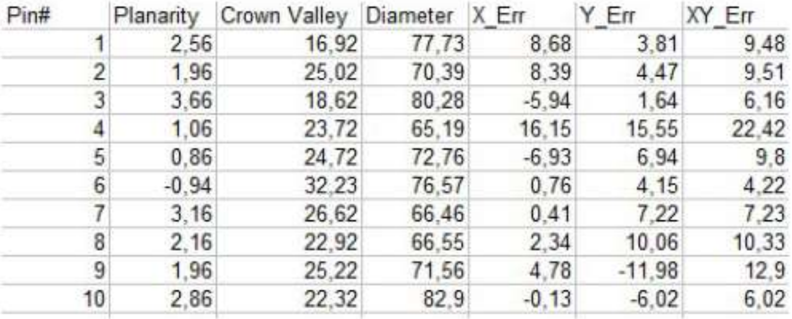
10. Advantages

- The valley depth
- XY pin aligment
- Total alignment error



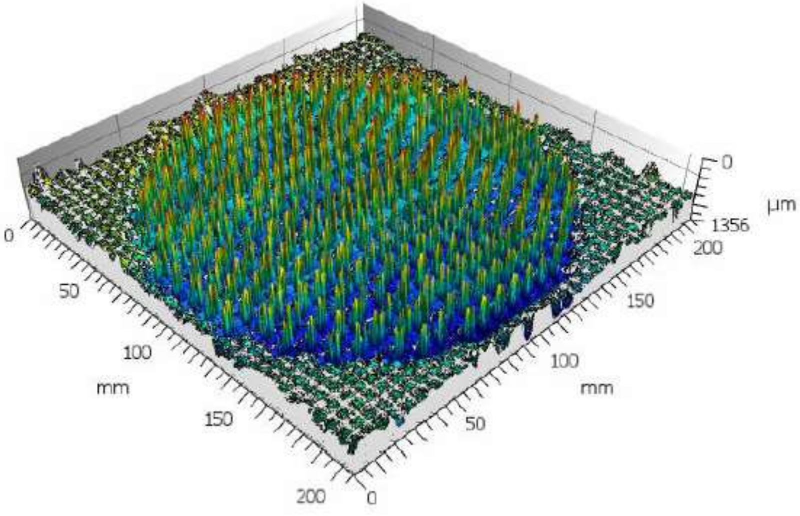
n	x_1	y_1	x_2	y_2
1	4	15	36	26

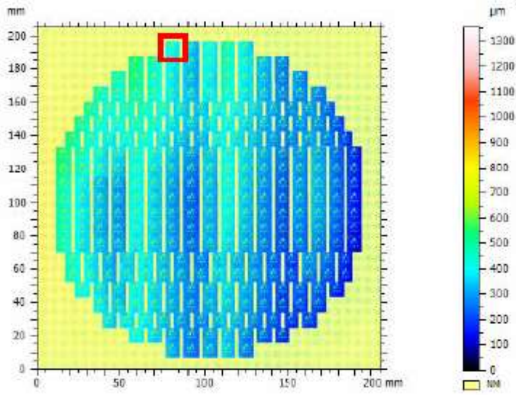


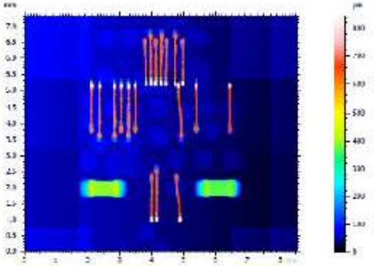


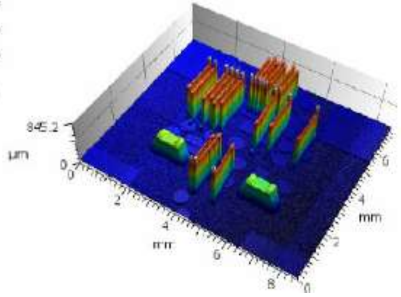
Pin#	Planarity	Crown Valley	Diameter	X_Err	Y_Err	XY_Err
1	2,56	16,92	77,73	8,68	3,81	9,48
2	1,96	25,02	70,39	8,39	4,47	9,51
3	3,66	18,62	80,28	-5,94	1,64	6,16
4	1,06	23,72	65,19	16,15	15,55	22,42
5	0,86	24,72	72,76	-6,93	6,94	9,8
6	-0,94	32,23	76,57	0,76	4,15	4,22
7	3,16	26,62	66,46	0,41	7,22	7,23
8	2,16	22,92	66,55	2,34	10,06	10,33
9	1,96	25,22	71,56	4,78	-11,98	12,9
10	2,86	22,32	82,9	-0,13	-6,02	6,02

11. Fast scan full probecardAdvantages





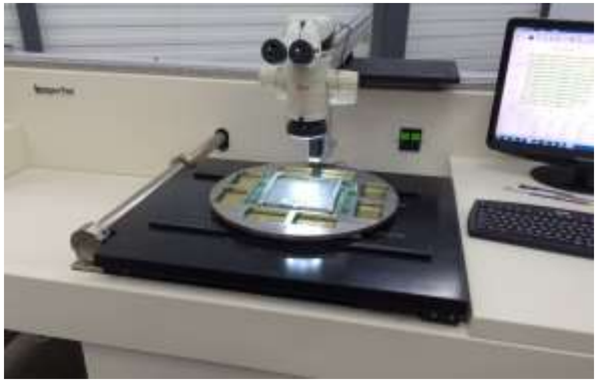




- Full probecard can be scanned with 1mm deep searching area for full protrusion, XY alignment, planarity and many others parts/ issues.

- Depending of size of the Die / tiles from 5 minutes to 1 hour maximum 300 mm

12 Specifications



- Scanning area 200 mm till 480 mm
- XY resolution from 0.5 to 5 micron
- Z resolution 0.1 micron
- High speed in 5 micron mode
- 80 mm area less then 6 minutes (resolution 5 micron)
- 200 mm probecard 10 minutes full test
- 300 mm probecard 30 minutes full test
- Vertical card sample was scanned in 65 seconds
- Contactless measurement, no investement in expensive fixtures
- Scanning height 400 micron in 1 step, more steps give large depth
- Total Z stage travel 25 mm
- Large probecard can be mounted with large various platforms
- Fully automated process after setup
- Win 11 operating system
- Re-test in higher resolution for detailed diagnostics
- Other features to be discussed, like roughness measurement on tip

Contactless Inspection

BE Precision Technology

info@probecardtester.com www.probecardtester.com