SWTW
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probing@hot temperature

a new thermal approach to probing accuracy

BOSCH
Invented for life

ERS
ERS elektronik GmbH

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Content

Introduction

- You cannot beat physics
- probing at high temperatures generates a very high amount of heat energy
- main problem is drift of X/Y/Z position
- Detailed explanation of these values and a model to explain these drifts are well known [Berger/Seitz, SWTW 2013]

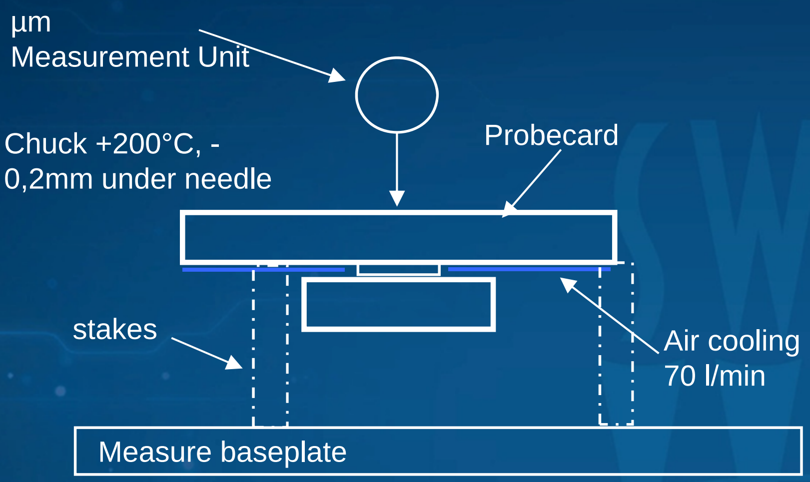
Present Solutions

Methode	Action	Advantage	Disadvantage
Optical realignment	correcting the drift	very accurate; no investment	time consuming; thermal disbalance while realignment; no control between realignments
Pre soaking	accelerates reaching a balanced situation	no investment	time consuming;
Pre-heating of probecard and / or headplate	accelerates reaching a balanced situation	faster than just soaking; not only probecard effected	time consuming; static, non local solution; cost of invest
mathematical prediction	Contol of position by temperature sensors an math. methodes	Local, no time loss	uncertainty remains (no controlling, no monitoring)

Present Solutions

Methode	Action	Advantage	Disadvantage
Passive shielding	prevents heat soaking for a certain time	few investment	Static, non local; retarding but not solving
Cooling of probe card	prevent heat soaking of probecard	Instant effect, no time lost; high invest	Static, non local
“thermal design” of probecard	Fit the design to high temperature use	Intrinsic solution, no other countermeasures	compromise to other PC features; expensive materials; high invest

Measurement of Temperature and Displacement



µm
Measurement Unit

Chuck +200°C, -
0,2mm under needle

Probecard

stakes

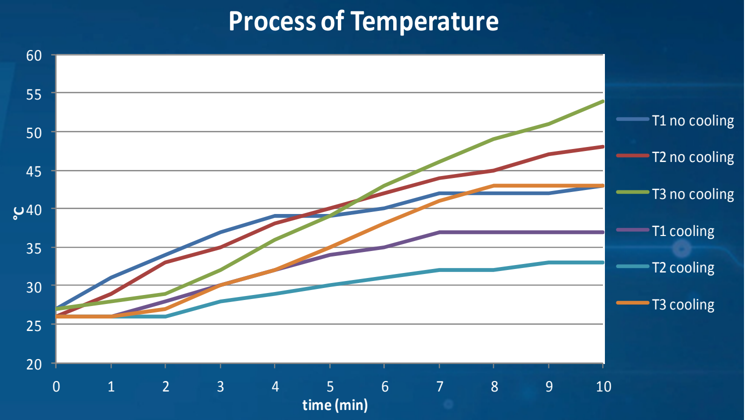
Air cooling
70 l/min

Measure baseplate

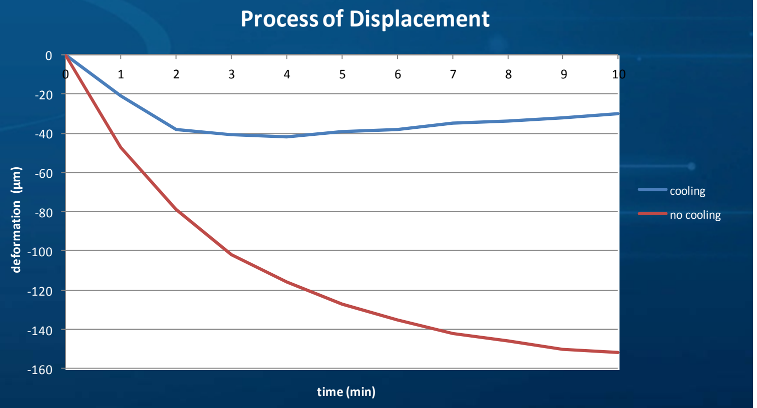
T
1

T
3

T
2

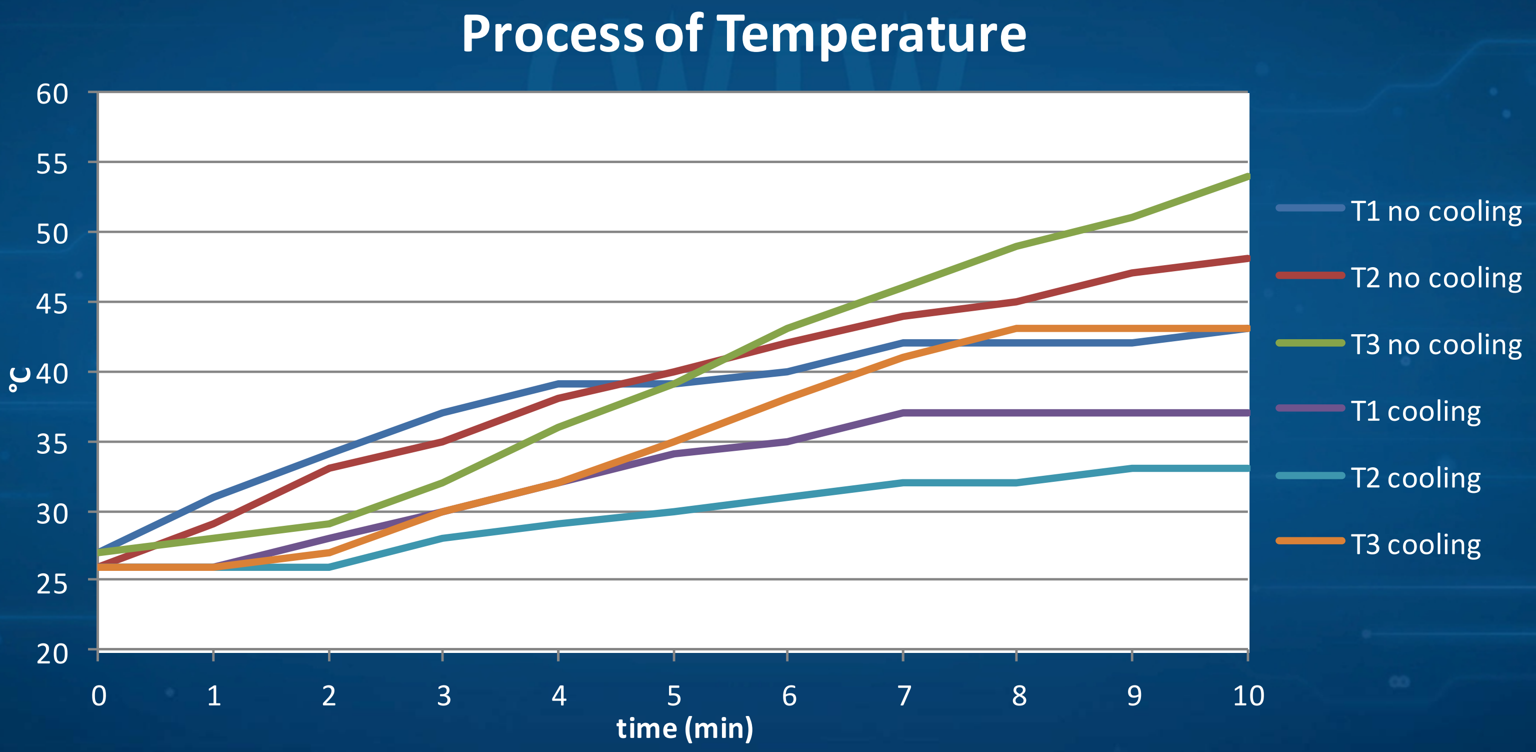


Process of Temperature

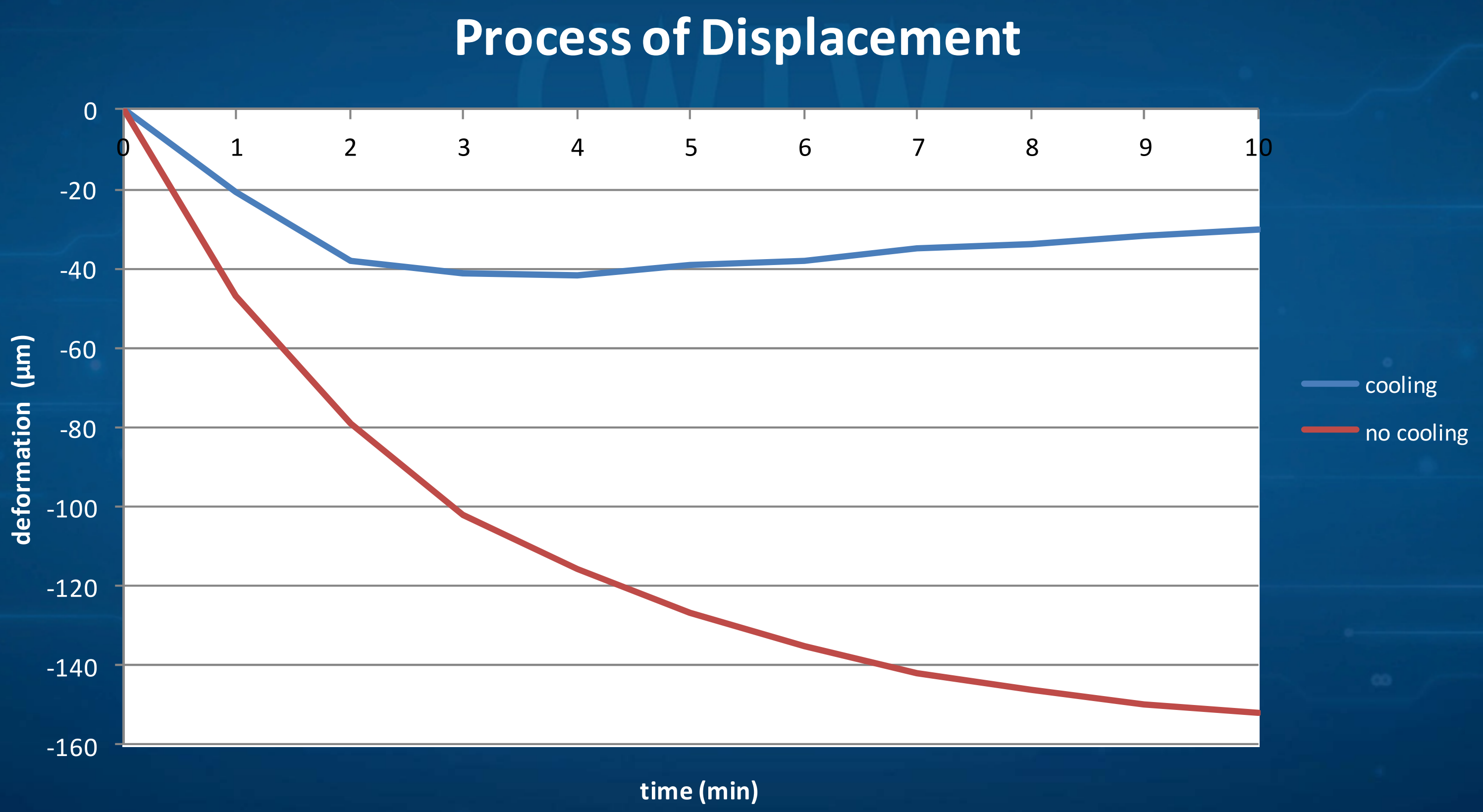


Process of Displacement

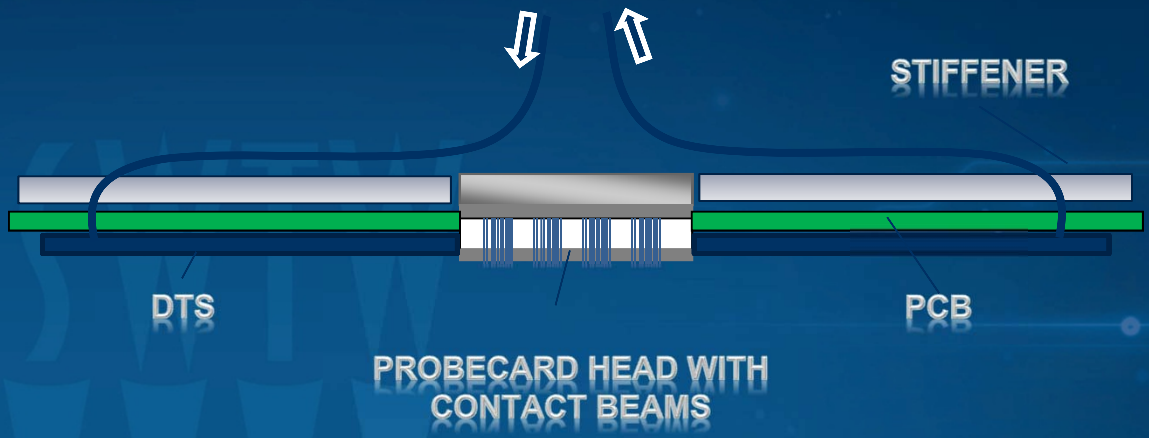
Measurement of Temperature and Displacement

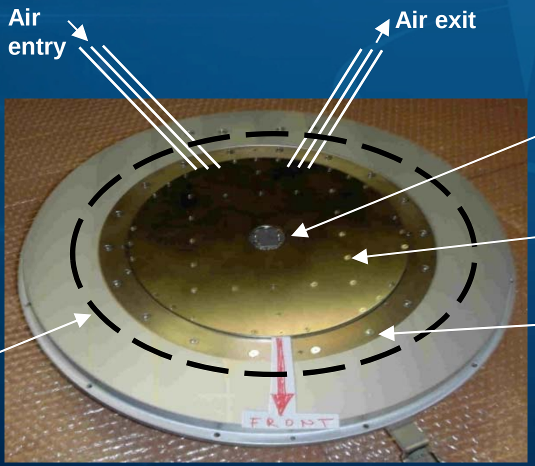


Measurement of Temperature and Displacement



Concept of dynamic thermal shielding (DTS)



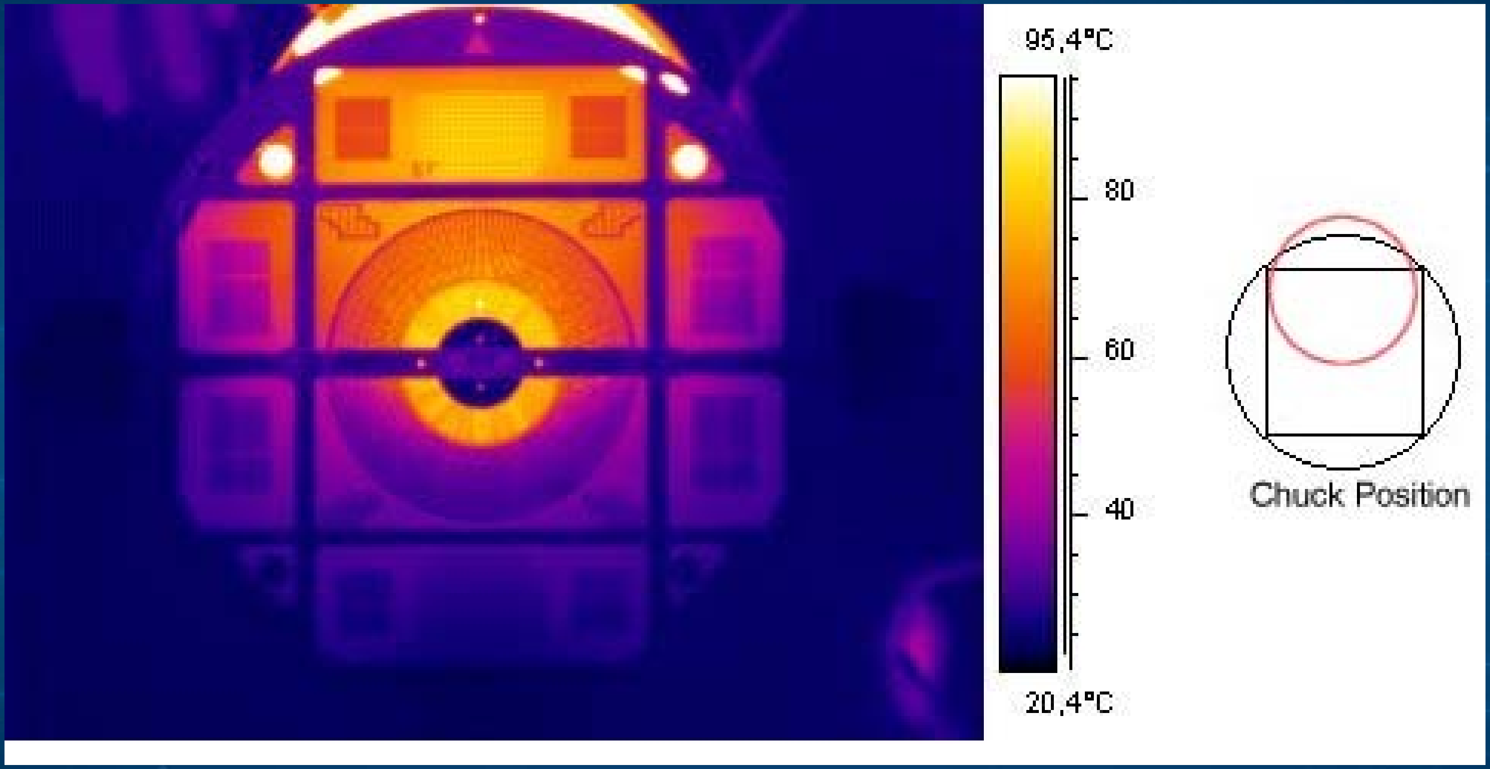


Probecard Center
TBD

Fixture of DTS

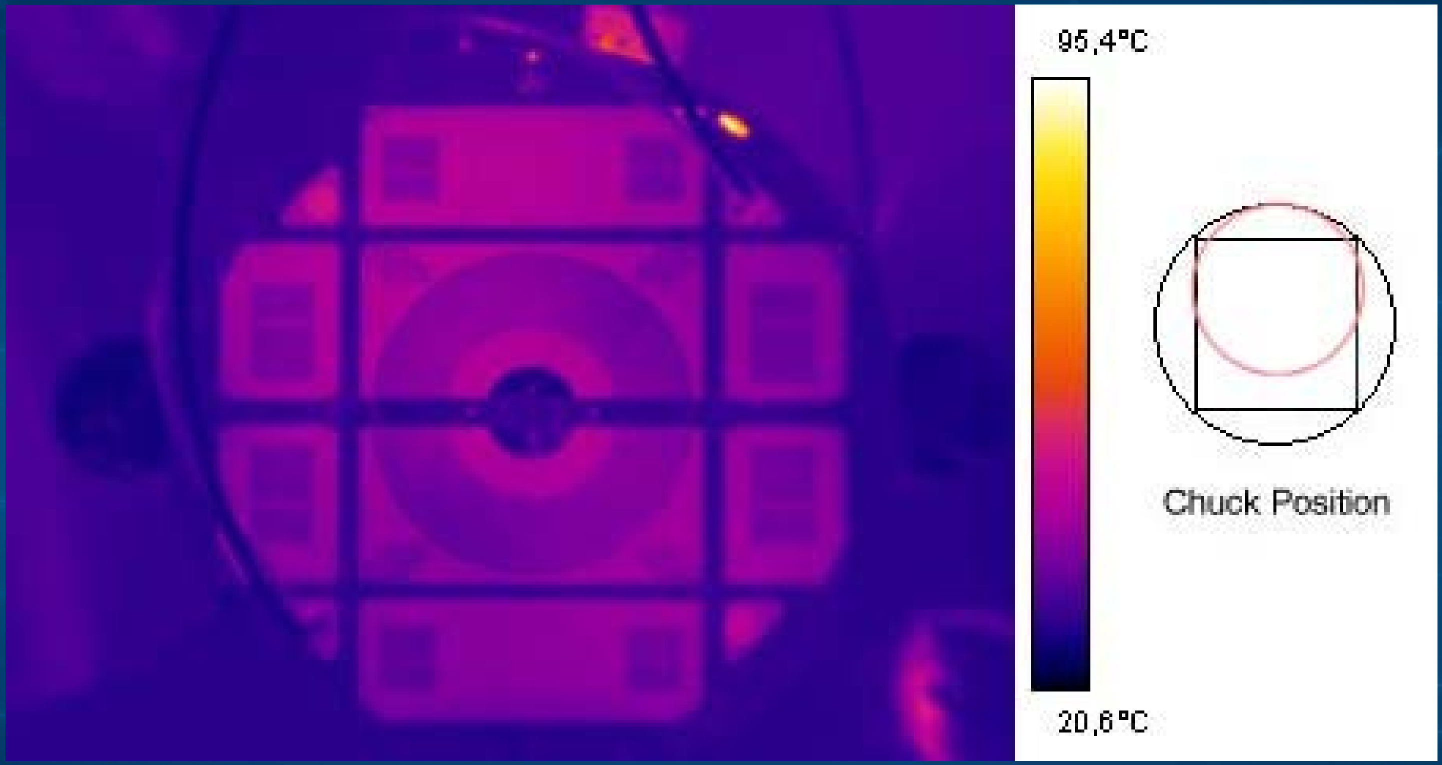
Enlargement of
cooler

Temperature Measurement w/o DTS



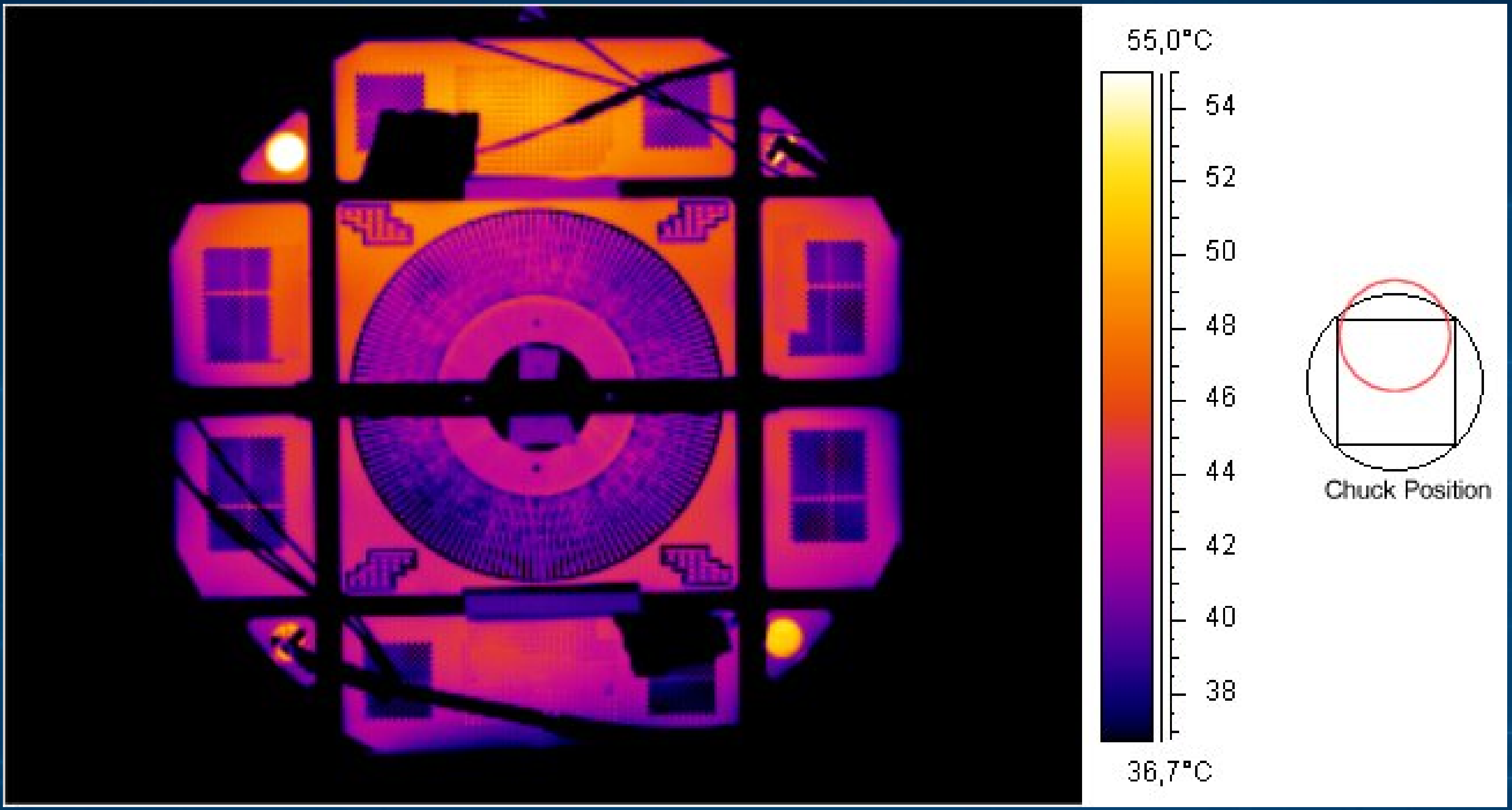
Temperature distribution on Probecard with +165°C Chuck at rear position

Temperature Measurement w/o DTS



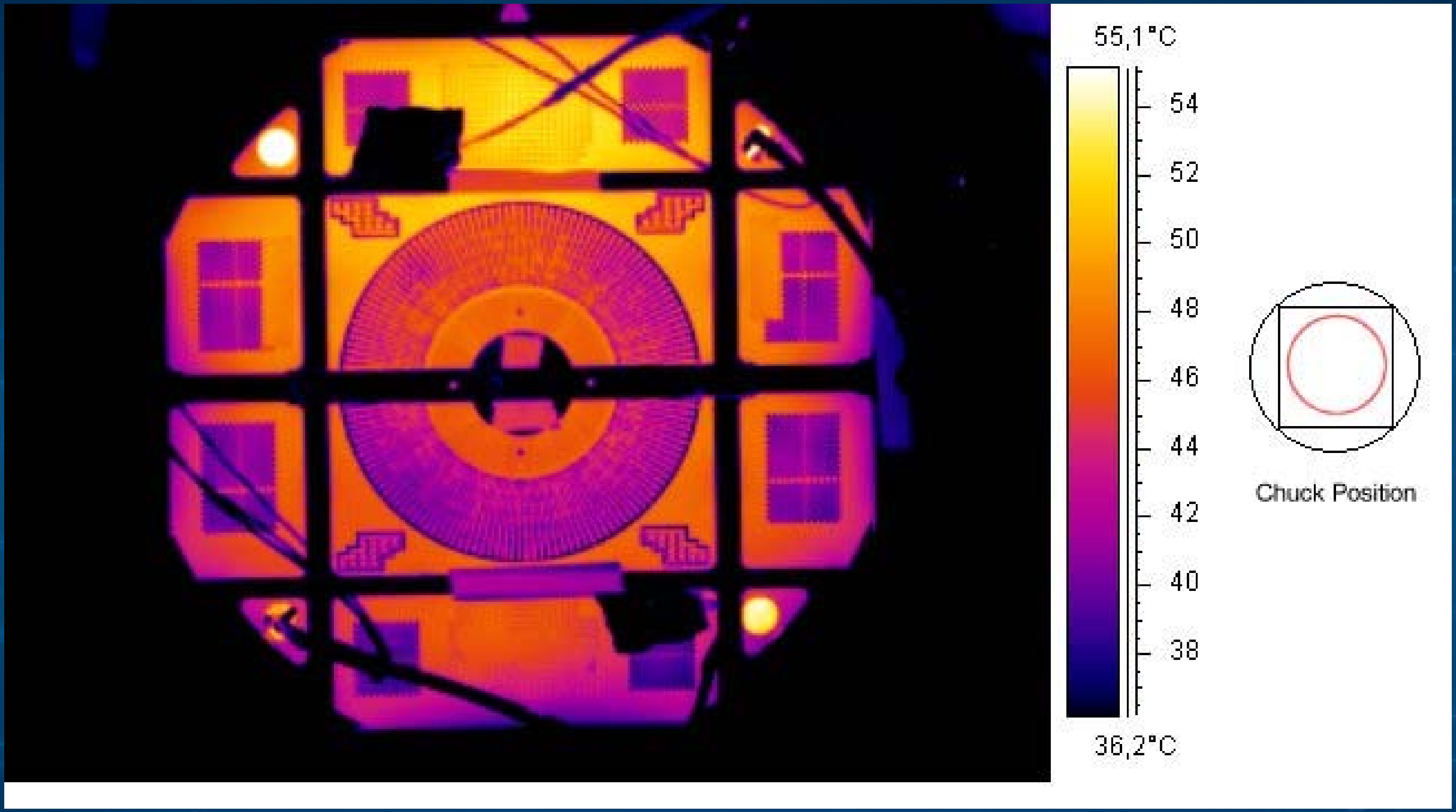
Temperature distribution on Probecard with +165°C Chuck at rear position

Temperature Measurement w DTS



Temperature distribution on Probecard with +165°C Chuck at rear position

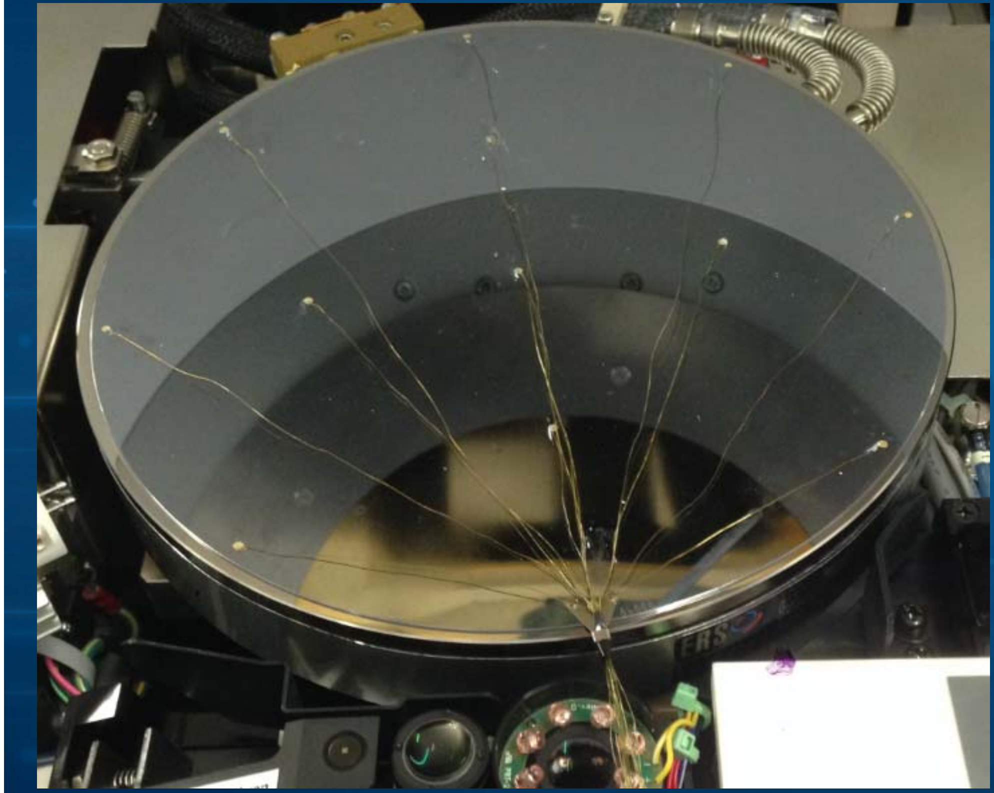
Temperature Measurement w DTS



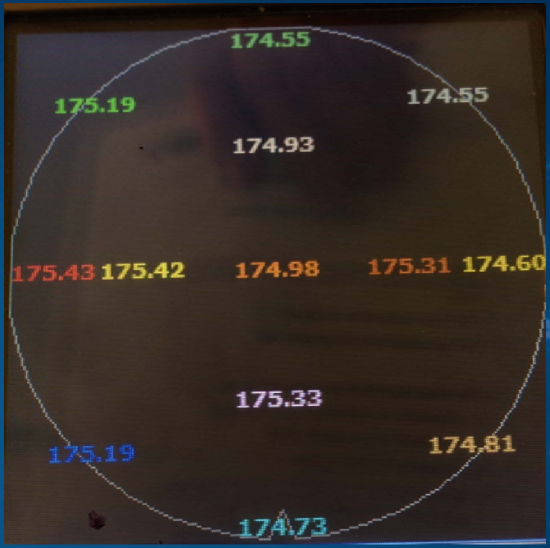
Temperature distribution on Probecard with +165°C Chuck center position (no delay)

Feedback of dynamic thermal shielding (DTS) to wafer

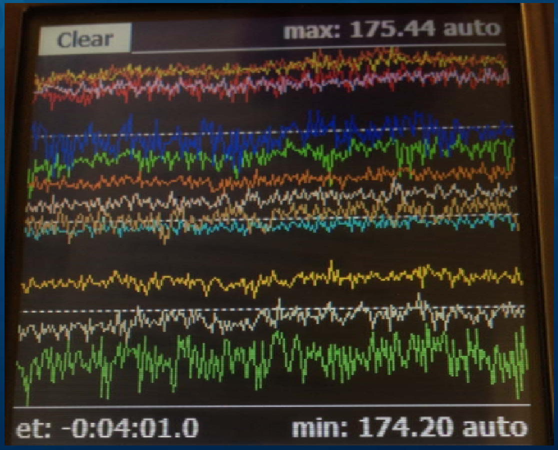
T(chuck) = 175°C

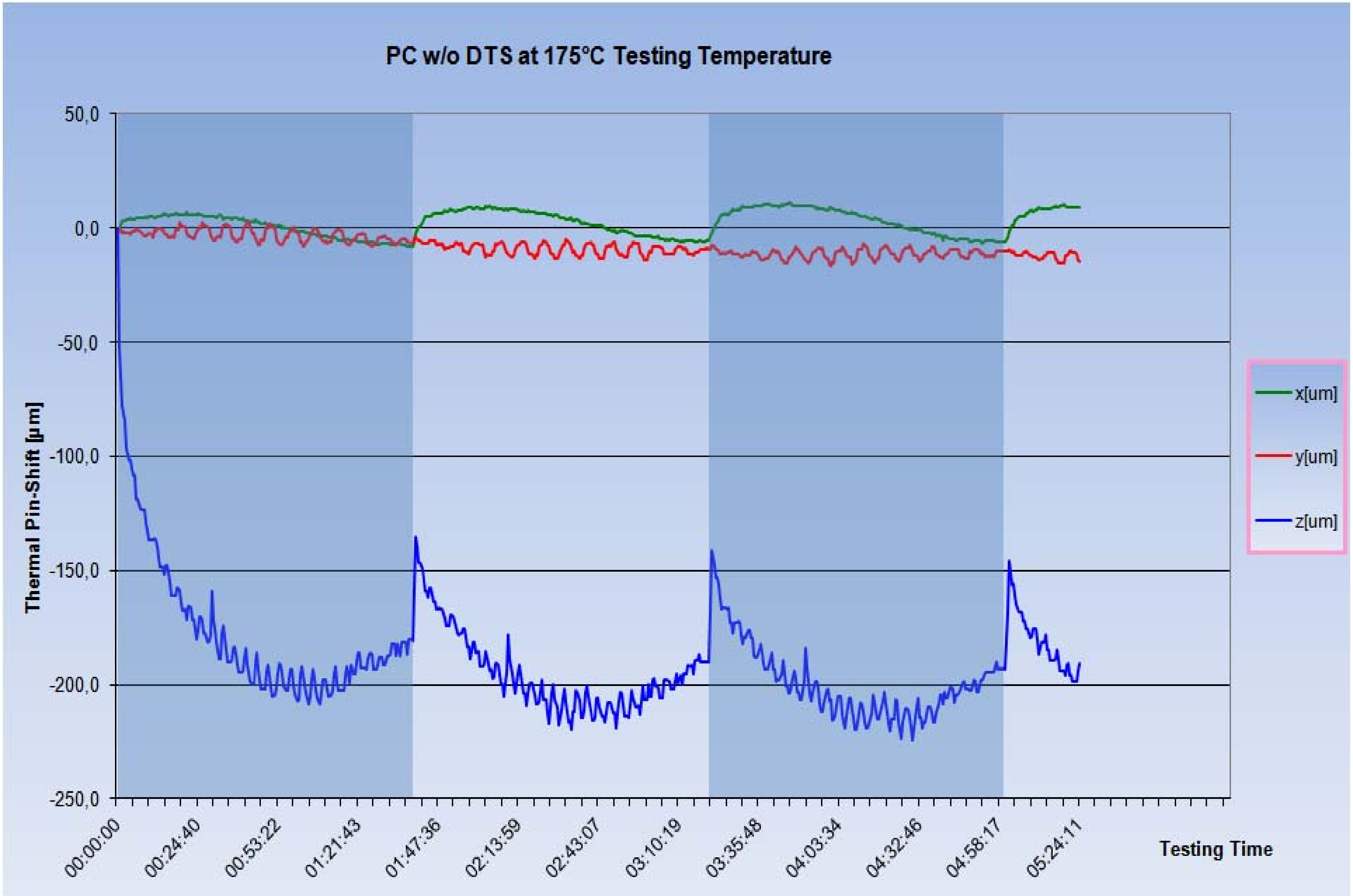


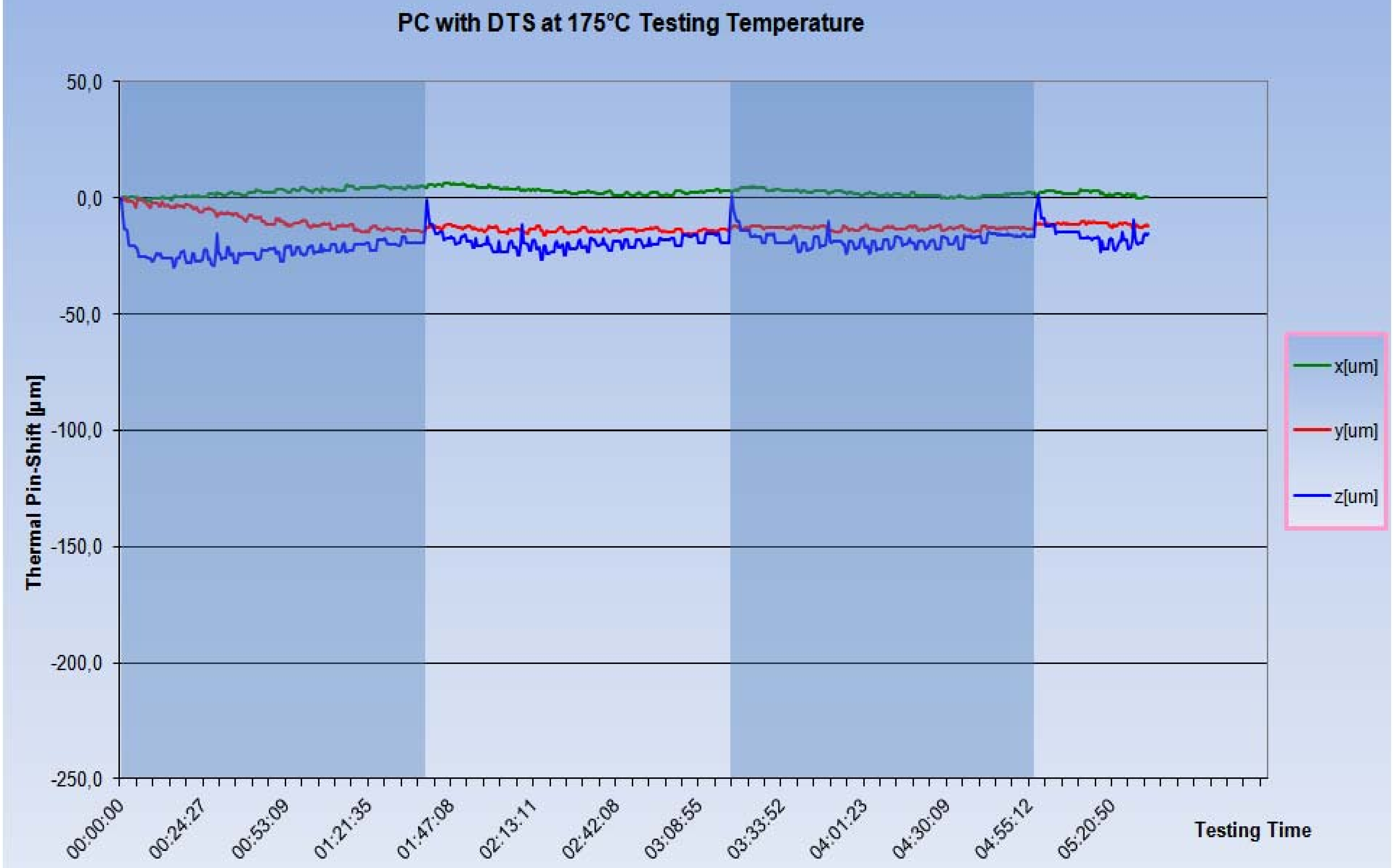
static



dynamic




PC w/o DTS at 175°C Testing Temperature
Thermal Pin-Shift [µm]
50,0
0,0
-50,0
-100,0
-150,0
-200,0
-250,0
00:00:00
00:24:40
00:53:22
01:21:43
01:47:36
02:13:59
02:43:07
03:10:19
03:35:48
04:03:34
04:32:46
04:58:17
05:24:11
Testing Time
x[um]
y[um]
z[um]


PC with DTS at 175°C Testing Temperature
Thermal Pin-Shift [µm]
50,0
0,0
-50,0
-100,0
-150,0
-200,0
-250,0
00:00:00
00:24:27
00:53:09
01:21:35
01:47:08
02:13:11
02:42:08
03:08:55
03:33:52
04:01:23
04:30:09
04:55:12
05:20:50
Testing Time
x[um]
y[um]
z[um]

Number of realignments necessary:

Dimension	Probecard w/o cool shield	Probecard w cool shield
X	23	3
Y	14	6
Z	34	4
sum	71	13

Outlook:

- Thermal stabilizing of ceramic head will result in further improvement
- Docking of probecard has to be simplified for production

Summary:

- Stable thermal equilibrium reached by cool shield
- Accuracy improved by factors
- Especially fast changes of heat source can be completely compensated
- Effort for realignment can be reduced dramatically