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# Virtual Event

November 1 – 4, 2022

Virtual Event

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## New method of wafer test under temperature with high wattage dissipation

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Virtual ▪ November 1-4, 2022



## Content

- The challenge
- ProbeSense™ introduction
- Integrated power dissipation simulation
- New generation liquid chuck power dissipation data
- Future works: Concept of integrated power jig inside ProbeSense™



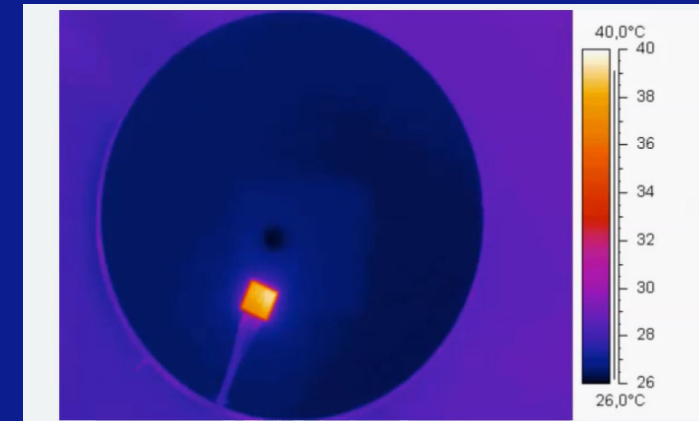
New method of wafer test under temperature with high wattage dissipation

2022

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## The Challenge

- High thermal load applied to wafer during probing
  - Thermal load is not applied uniformly to wafer
- Applications include
  - Photonics testing/Laser Burn-in Process (wafer level)
  - Memory chips/DRAM
  - CPU/GPU test
- Device characterization
  - Chuck system should be able to absorb high thermal load and maintain temperature
  - Multi-sensor monitoring to map chuck response to wafer
- Simulate behavior of DUT beforehand



## Simulating the thermal load

- Using a thermal jig with a temperature sensor to simulate thermal load
  - Benefit to test the chuck system before the wafer is tested
  - Better understanding of performance
- ERS presented a temperature calibration solution at SWTest San Diego:
  - “Automated calibration:  
Tackling the challenge of temperature accuracy and uniformity measurements in wafer probing”
- Adapting the ProbeSense™ for power measurements



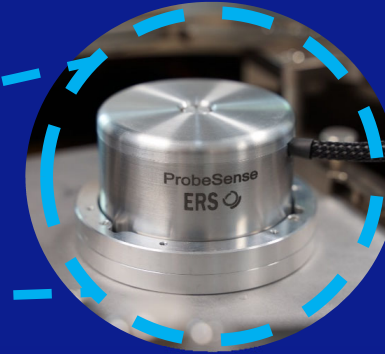
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## ProbeSense™ Set-up

PT100 Readout



Software tool on laptop



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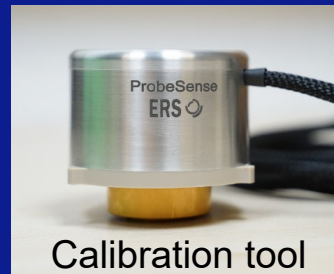
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## ProbeSense™ Introduction

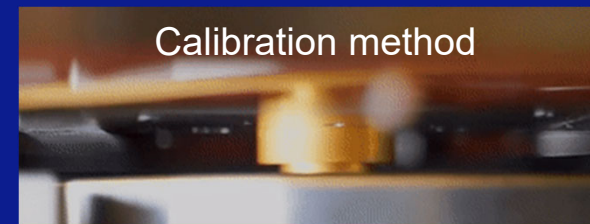
- ProbeSense™ is a chuck temperature calibration tool that addresses challenges of a traditional wafer-based calibration
  - Automation to reduce measurement uncertainty
  - Uses a single calibrated sensor
  - Increased temperature range (-65°C to +300°C)
  - Dynamic temperature uniformity measurement in wafer probing



ERS chuck system



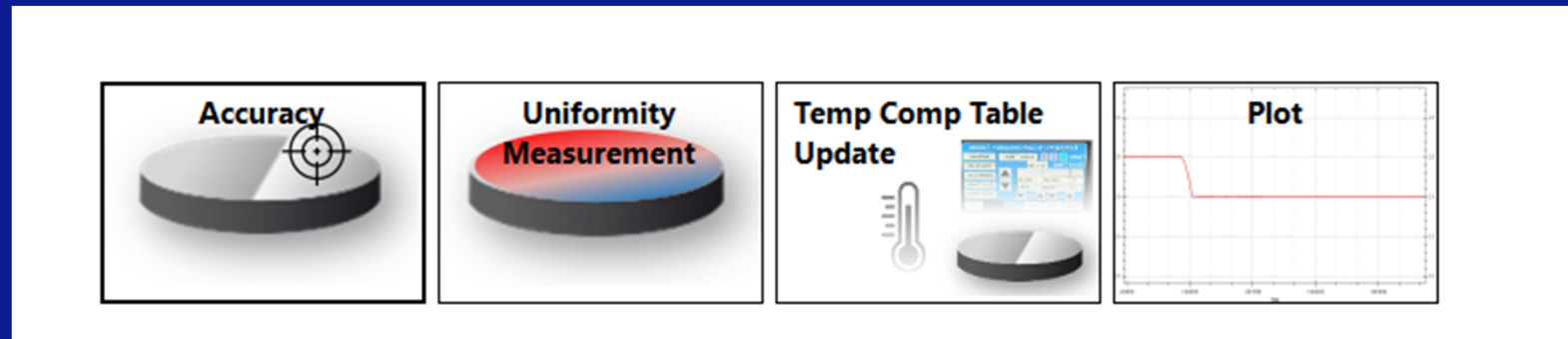
Calibration tool





## ProbeSense™ Automation

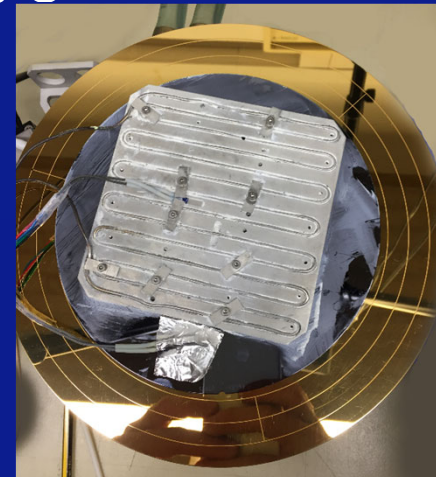
- No special operator skill required
- Automated software
- Measurement points can be defined
- Compatible with different prober types and chuck systems





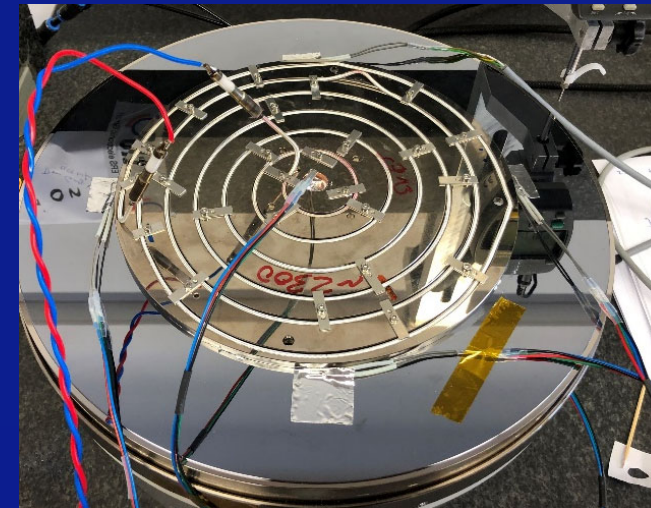
## Power Measurements

- Using a power jig to simulate the behavior of the chuck under different loads
  - Simulates the performance of the chuck under high thermal load
- Small power jig vs. large power jig

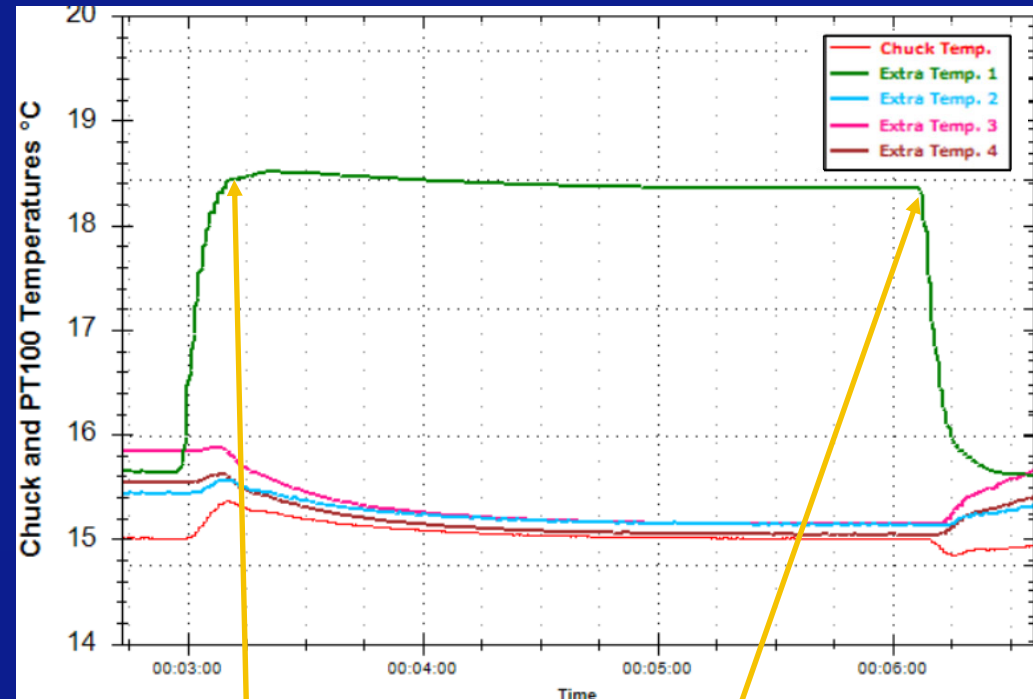


## New Generation Liquid Chucks

- Power measurements were done on ERS liquid chucks
- ERS liquid chucks are optimized for better heat dissipation
- Equipped with multiple sensors for zonal monitoring
- 2500 W at -40°C dissipation capability



## Small Jig: Position 1 at 15°C

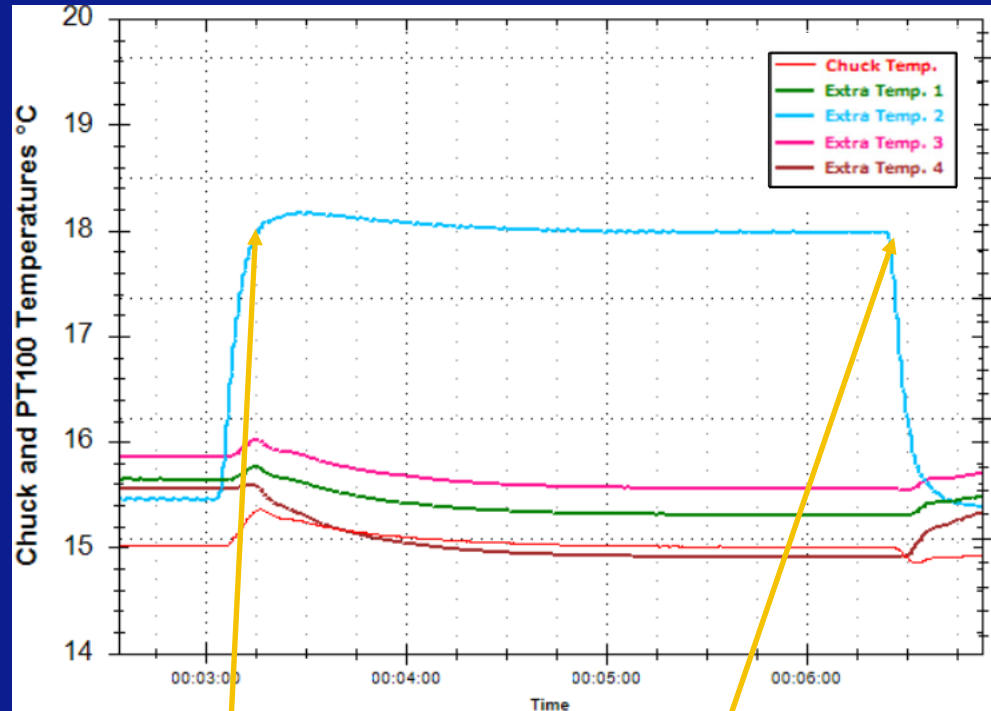


Load applied

Load removed

Load Power: 120W

## Small Jig: Position 2 at 15°C

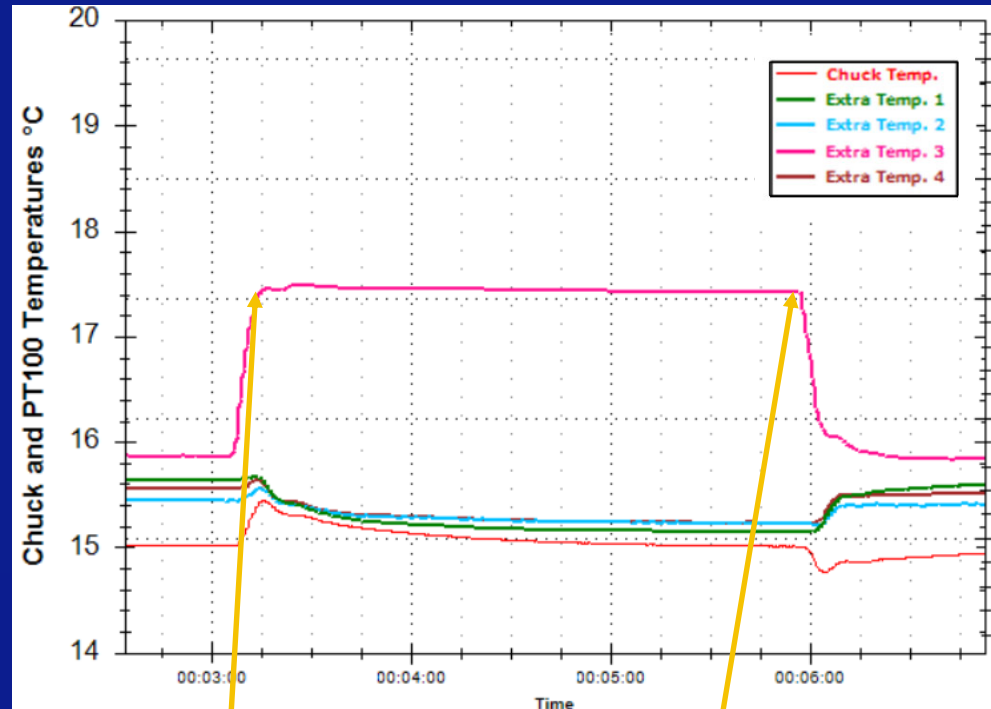


Load applied

Load removed

Load Power: 120W

## Small Jig: Position 3 at 15°C

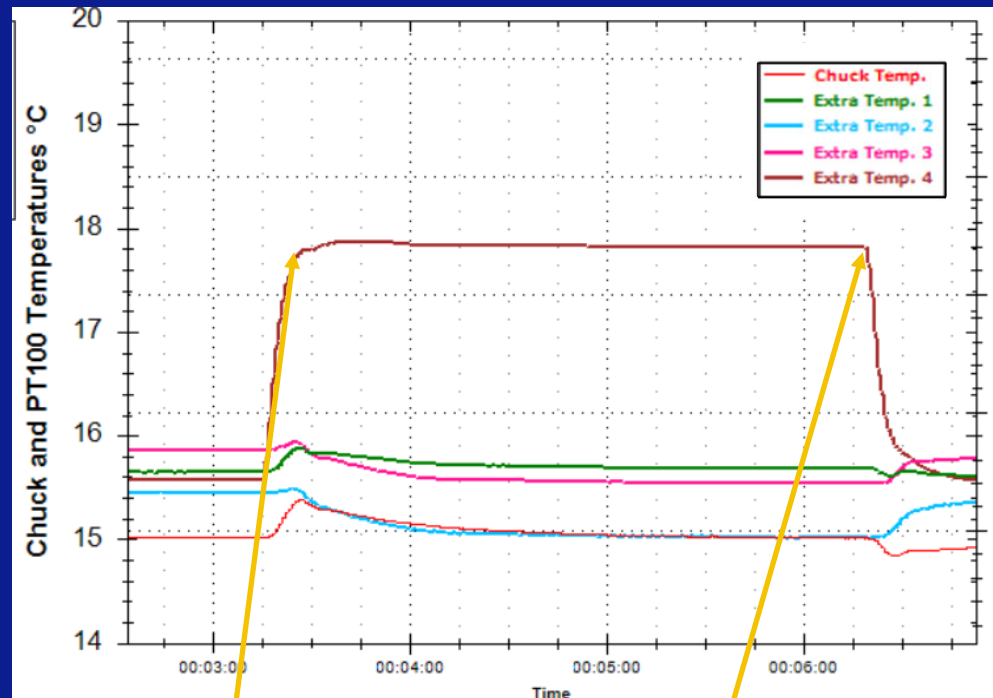


Load applied

Load removed

Load Power: 120W

## Small Jig: Position 4 at 15°C

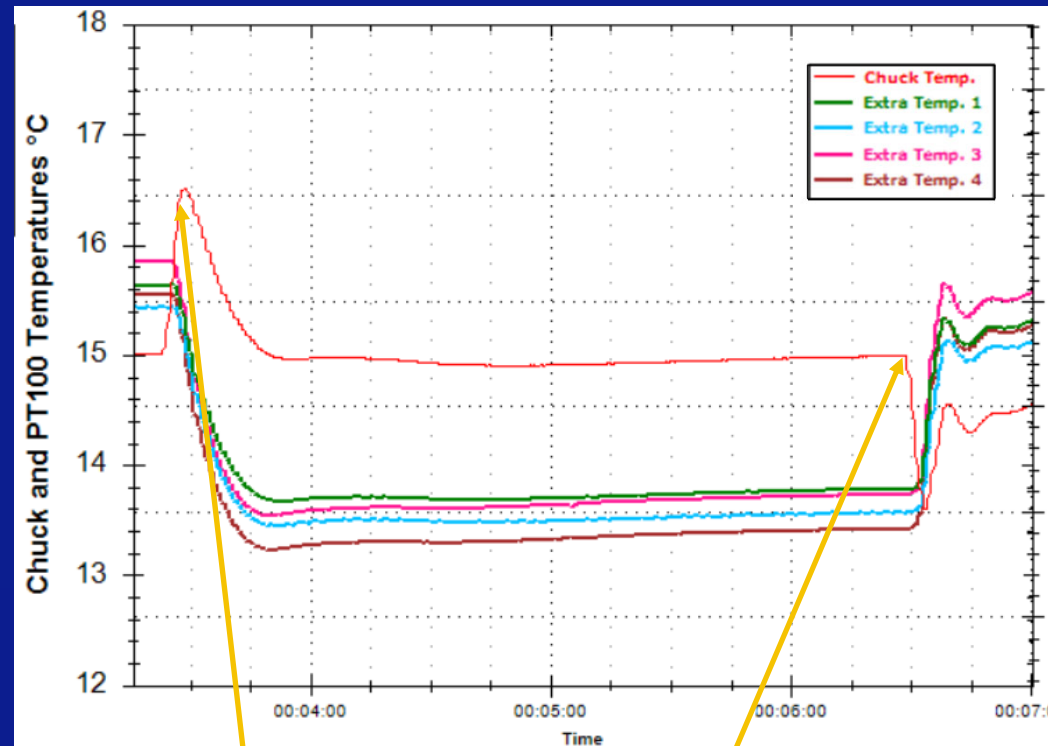


Load applied

Load removed

Load Power: 120W

## Small Jig: Any position at 15°C



Load applied

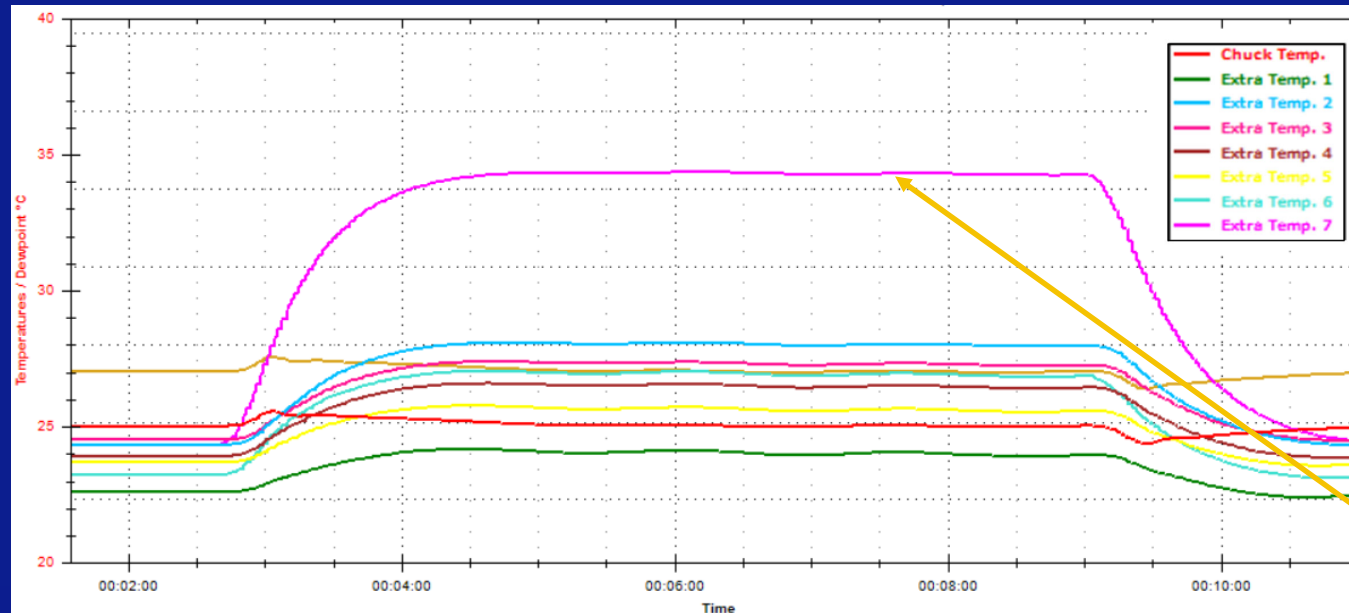
Load removed

Solution: Software detecting of power input location

Load Power: 120W



## 25°C, 1000W Big Jig (200mm)



Max: +36,5°C

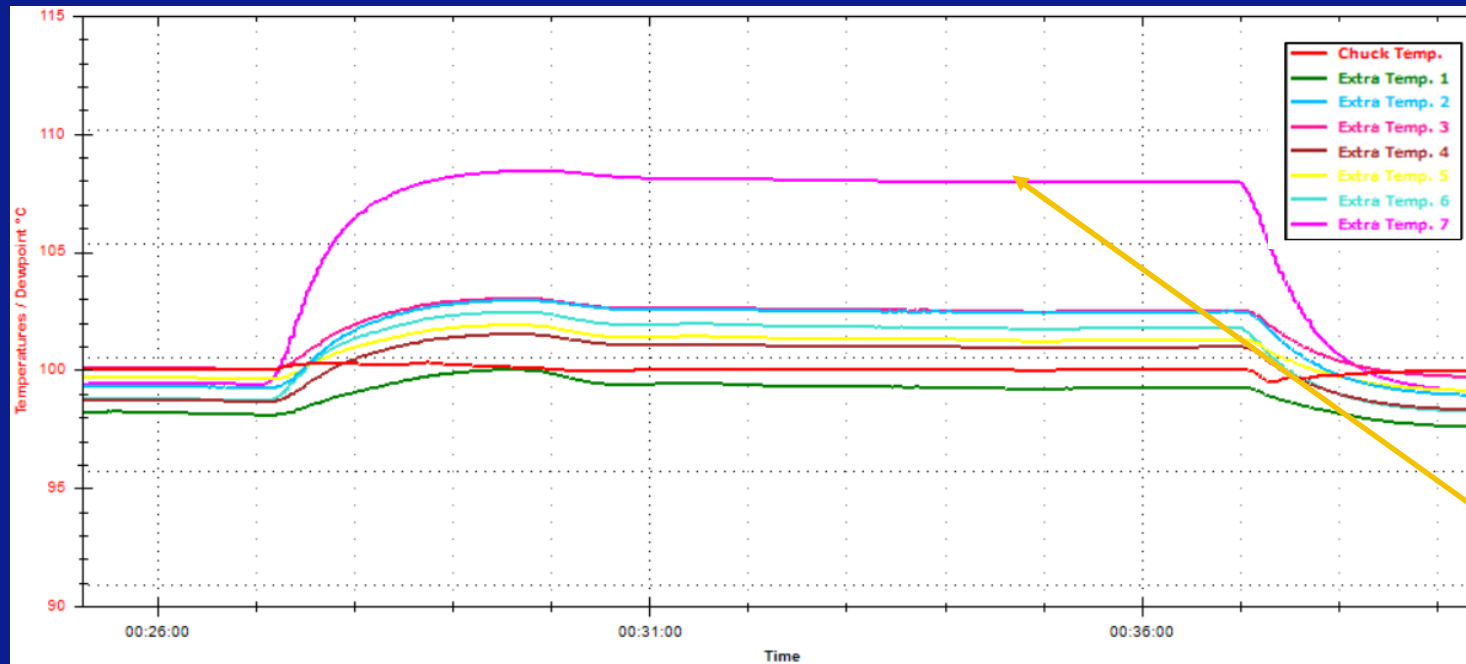
Min: +33,0°C

Delta under  
Load = 3,5°C

Center position

Improvement: heat dissipation in center position

## 100°C, 1000W Big Jig (200mm)



Max: +109,5°C

Min: +106,2°C

Delta under  
Load = 3,3°C

Center position

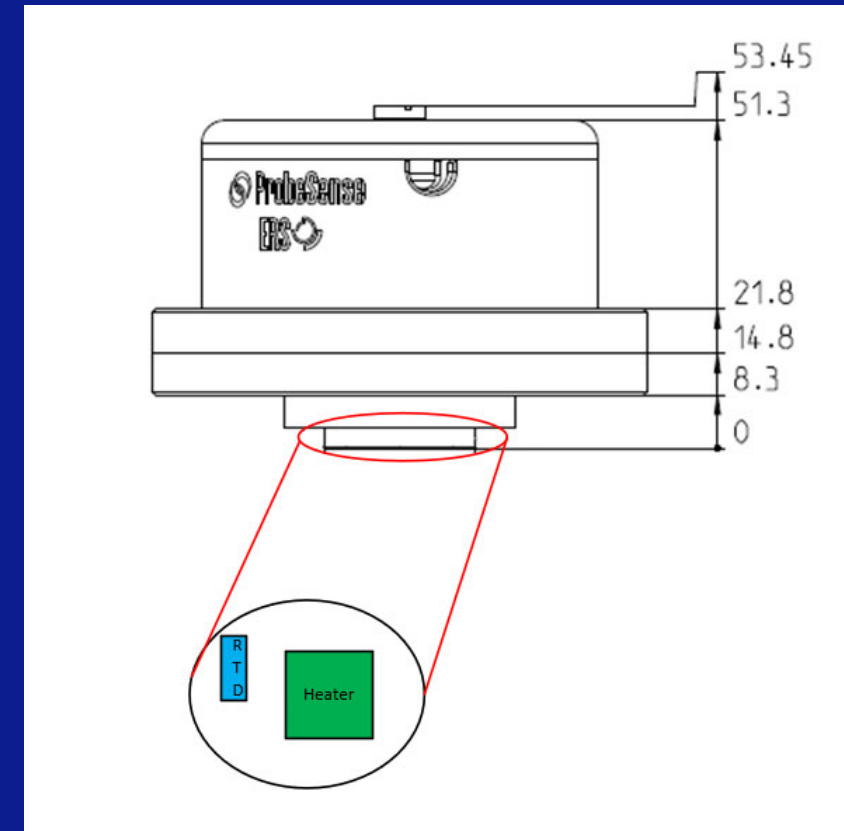
Improvement: heat dissipation in center position

## Results

- Large thermal load is applied over a small area
  - The controlling sensor doesn't always observe a temperature change
  - The extra monitoring sensors give a better indication of the area under test
  - Small area can be compensated with a special software
- Large thermal load is applied over a larger area
  - Creates a uniform temperature change on the chuck surface
  - Chuck needs to be capable of removing the power at given temperature
  - Large area needs suitable hardware to compensate the load

## Future works: Power Jig in ProbeSense™

- Integration of power Jig within a ProbeSense™
- RTD to measure the surface temperature response to thermal load
- Dynamic measurement capabilities
- Integrated within probing environment
- Automation adjusted to control the power jig



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