Quench and Trapped Flux Studies at Cornell

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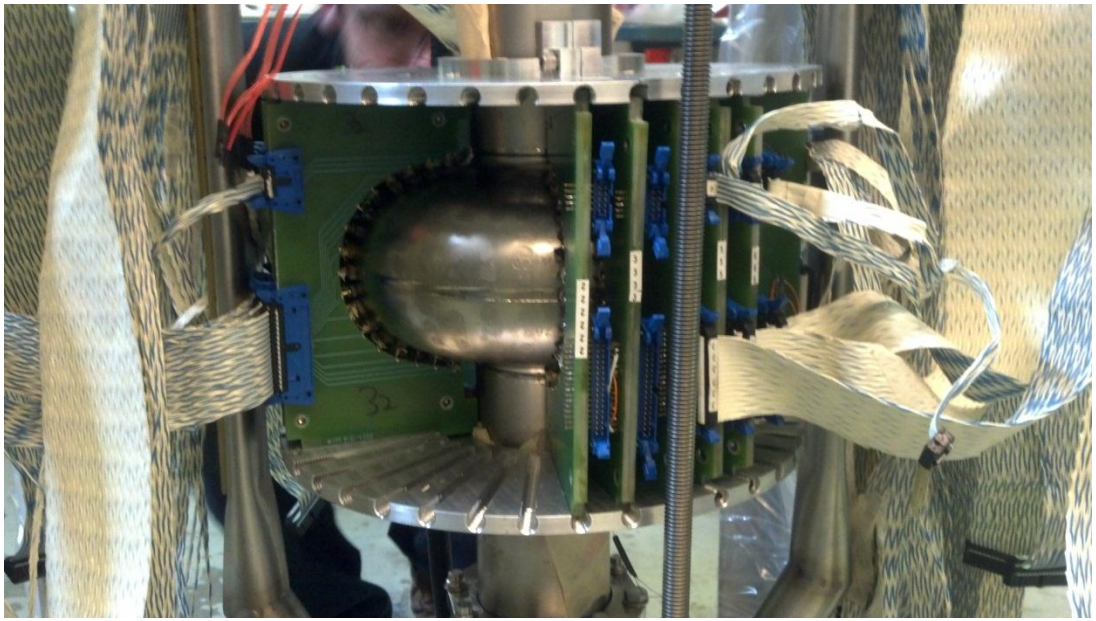
Outline

- Temperature Mapping System Hardware
- T-Maps Before Quench
- T-Maps After Quench
- Quench Detection with T-Map Hardware

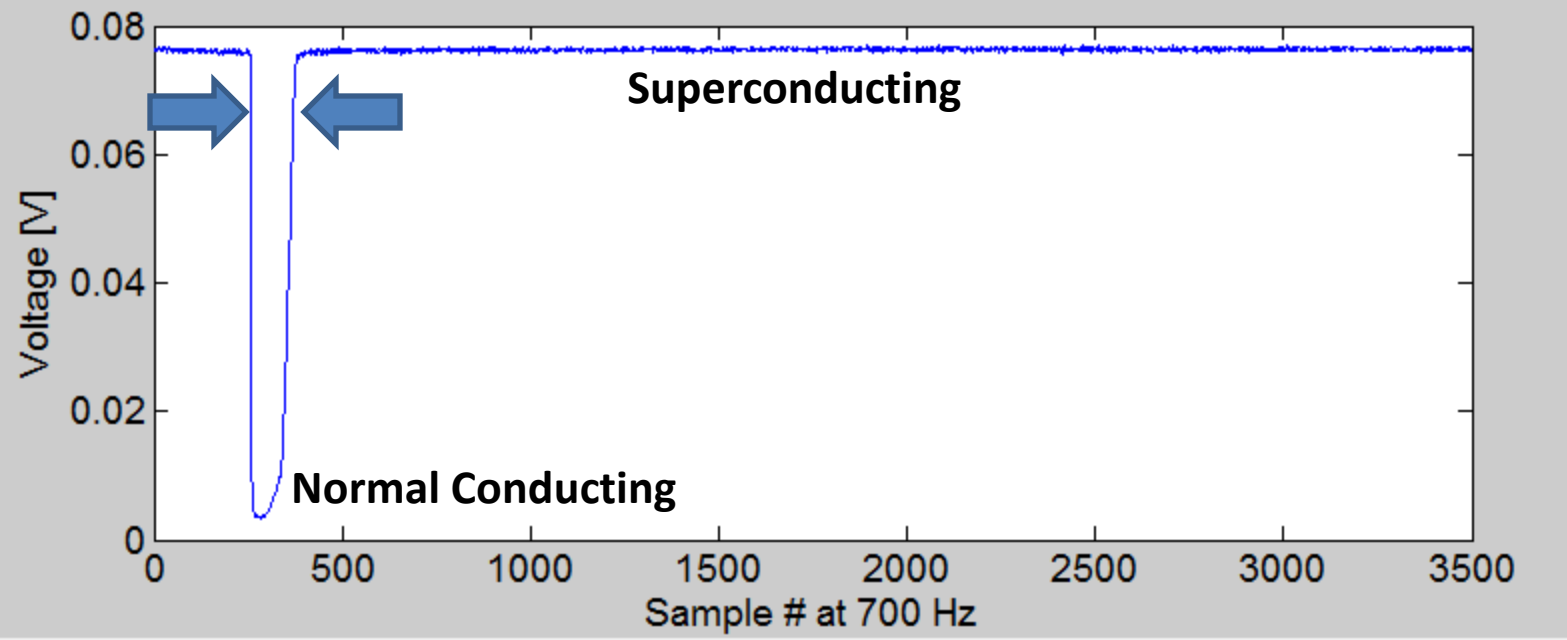
Temperature Mapping System

- A Temperature Mapping system was developed consisting of 646 resistors.
- This allows us to obtain a full temperature profile of the cavity during testing.



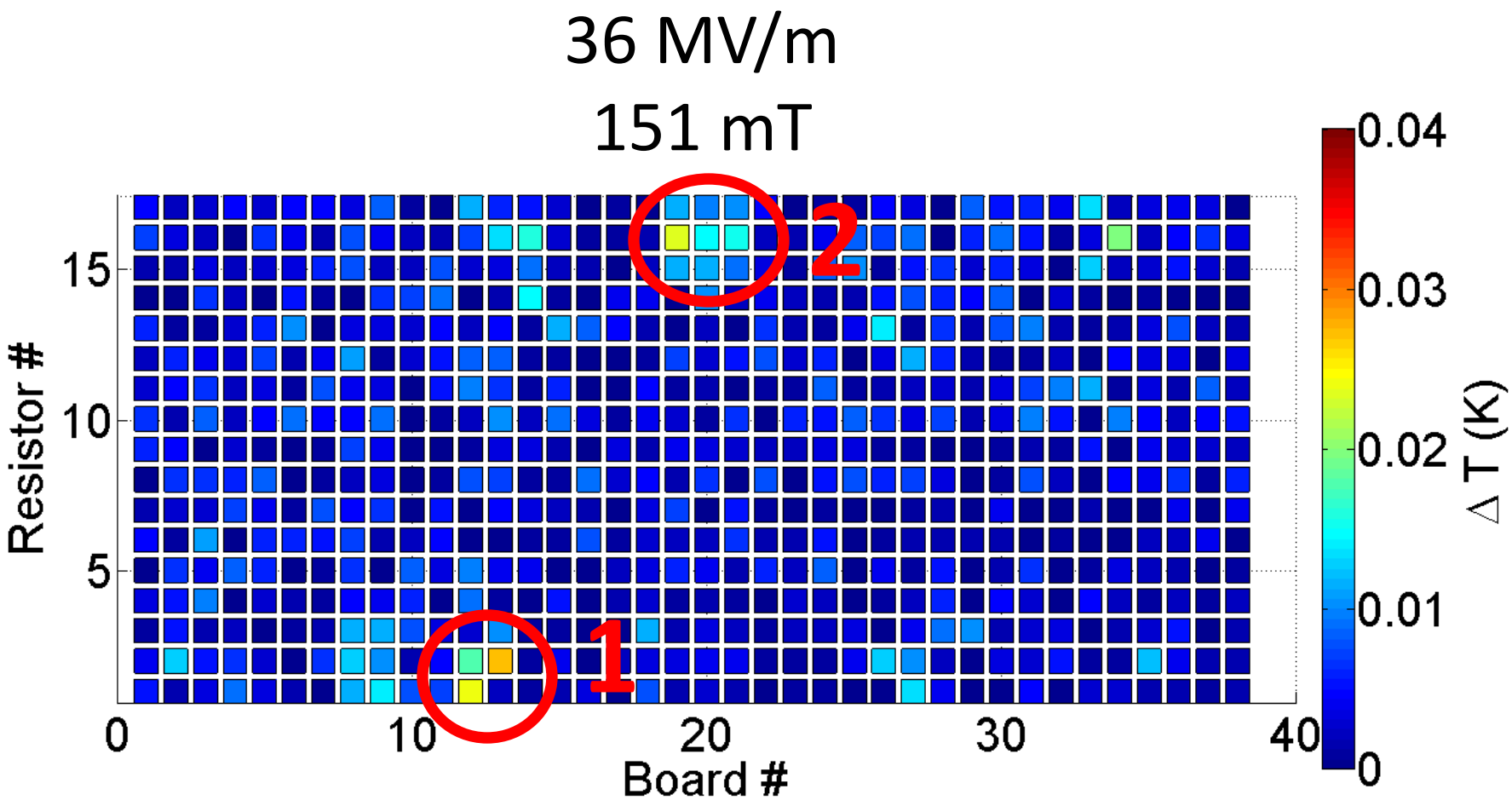
Temperature Mapping for Quench Detection

- The system can also be used to find the quench location.
- The length of time that each resistor is warm is measured.



T-Maps Before Quench

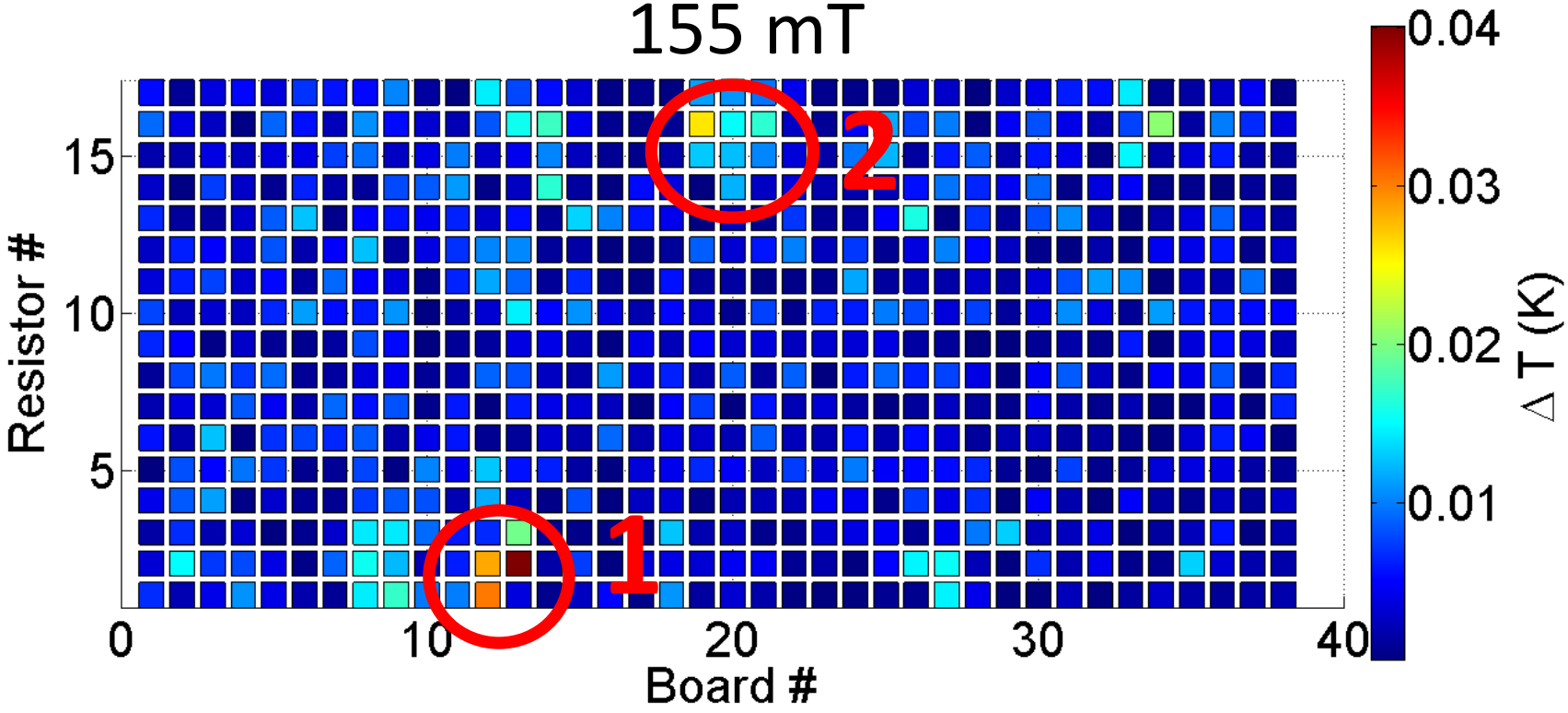
- Prior to quench, the cavity is dominated by heating at two hotspots.



T-Maps Before Quench

37 MV/m

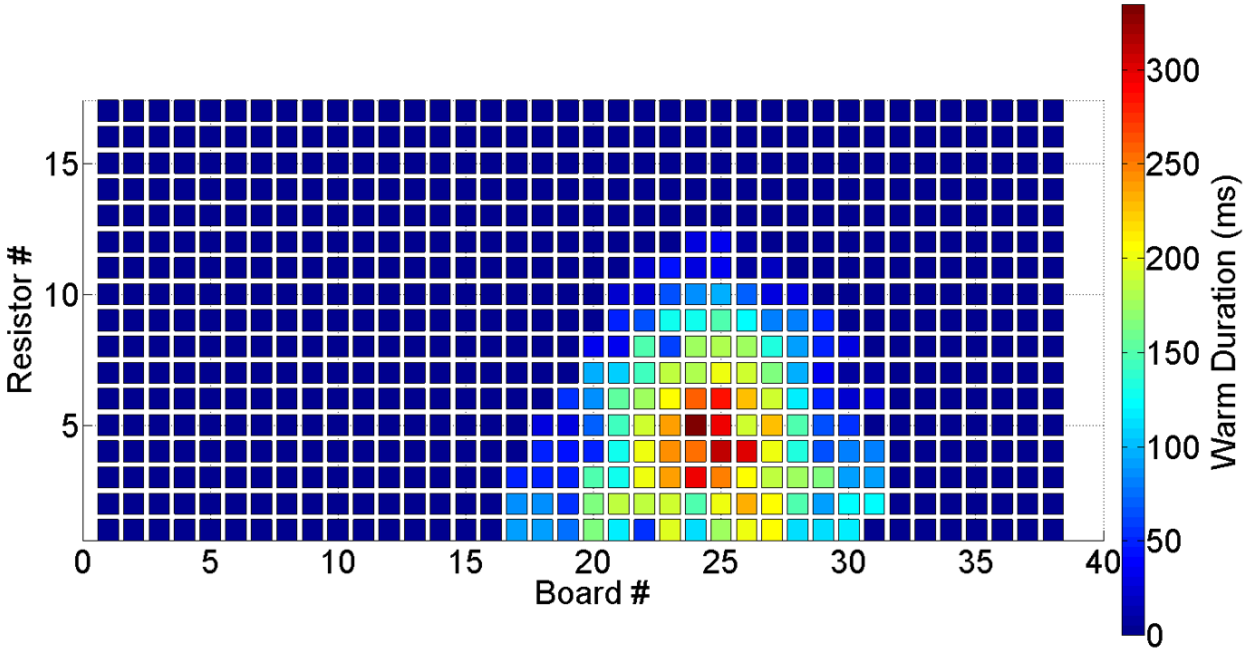
155 mT

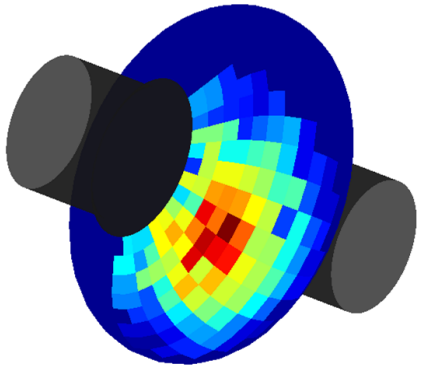


- The quench occurs at 37.1 MV/m.
- The magnetic field in these regions is 86% of the peak value and the electric field is 60% of the peak.

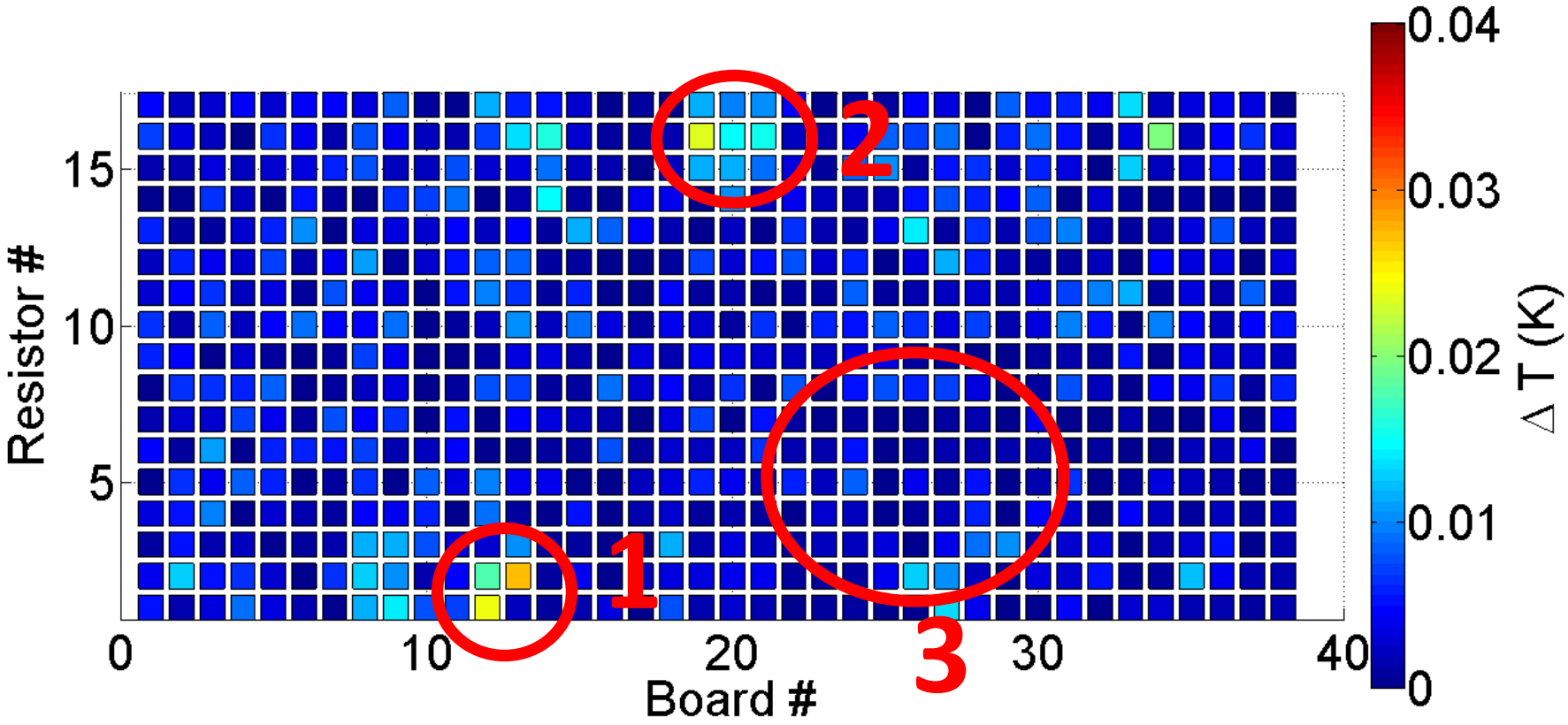
Quench Detection

- The quench location was also found using the T-Map system.





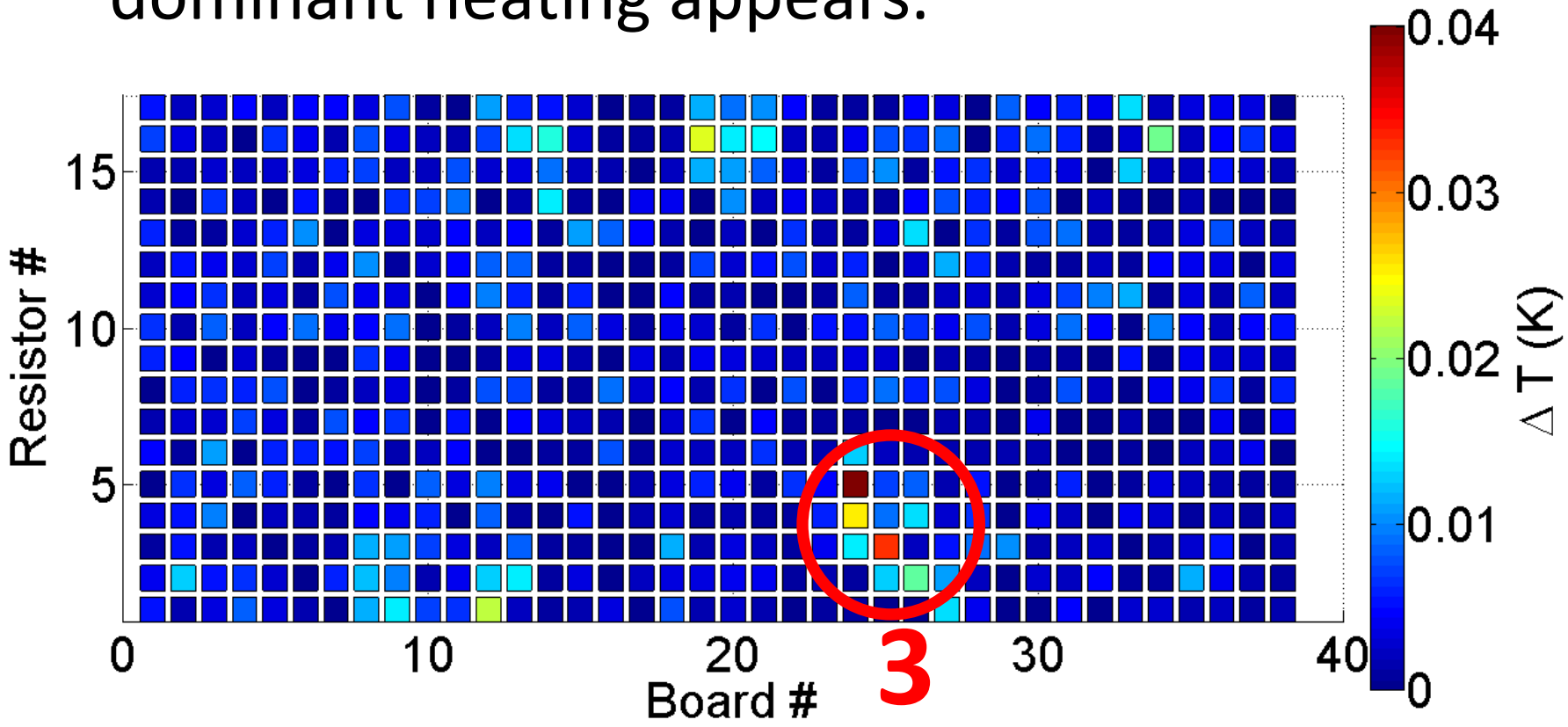
Quench Detection



- Prior to quench, no heating appears at the quench location.

T-Maps After Quench

- Immediately after quench the previous hot spots remain, but a new one, with more dominant heating appears.



Interpretation of Post Quench Heating

- After a quench, new heating appears in region “3”, where previously no significant heating was found.
- This hot spot remains for all subsequent T-Maps until a thermal cycle is performed.
- This new heating may be the manifestation of trapped magnetic flux in the region.

Pre-Quench Heating and Quench Location

- Prior to quench, no significant heating appears at the quench location.
- This implies that the quench is not caused by heating on the surface.
- The quench was caused by the sudden transition of region “3” to the normal conducting state.

Possible Causes of Quench

The sudden transition from the superconducting state to normal conducting state may be caused by:

- Region “3” being a region of suppressed superconductivity.
- Magnetic field enhancement caused by surface topology.

Conclusions

- Prior to quenching, heating is confined to two hot spots.
- After quench, a new, dominant hot spot appears. This spot is also the center of the quench location.
- This suggests that magnetic flux is being trapped in region “3” and showing up as heating in subsequent t-maps.
- In the future, the quench location will be inspected to determine the cause of the quench.