

# "Quench Detection in 9-Cell ILC Superconducting Cavities Using Second Sound in He-II"

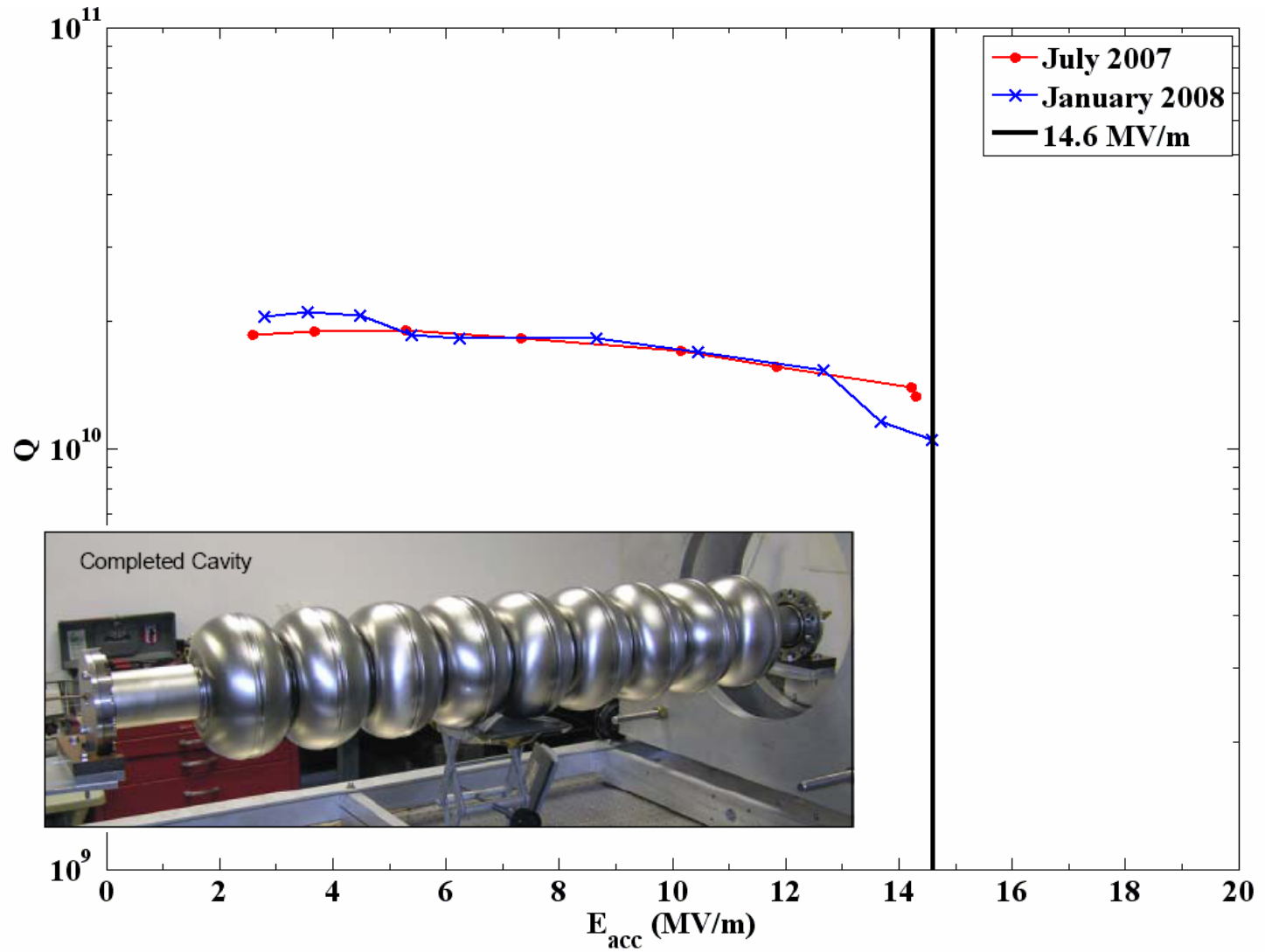
*Zach Conway, Don Hartill, Eric Smith  
and Hasan Padamsee*

*(15 min)*

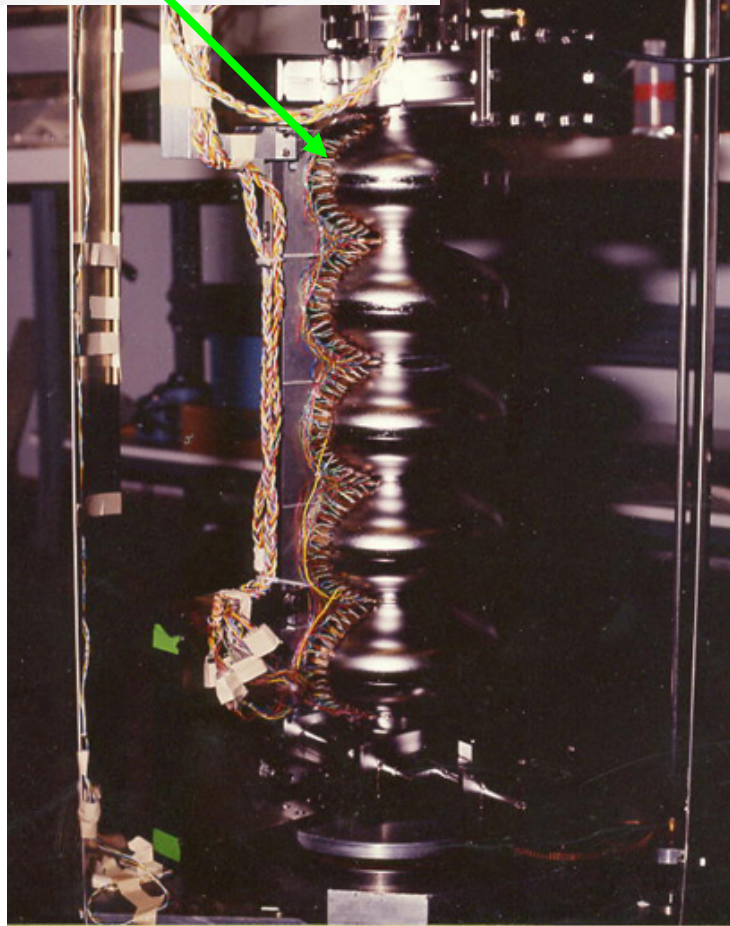
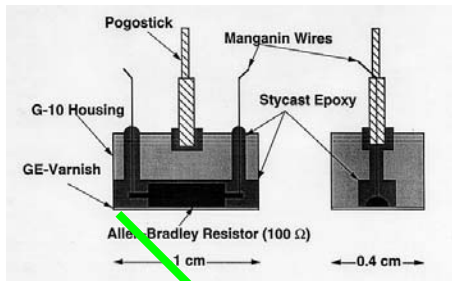
# What is 2<sup>nd</sup> Sound Quench Detection?

- 2<sup>nd</sup> Sound
  - Temperature wave propagation in superfluid helium due to large heat burst
- With well-known velocity, 20 m/sec at 1.8 K
- Use time delay to determine distance to quench spot
- Triangulate location of quench spot with information from 3 detectors
- Can be used to detect quench in several cells in one test by measuring pass-band modes

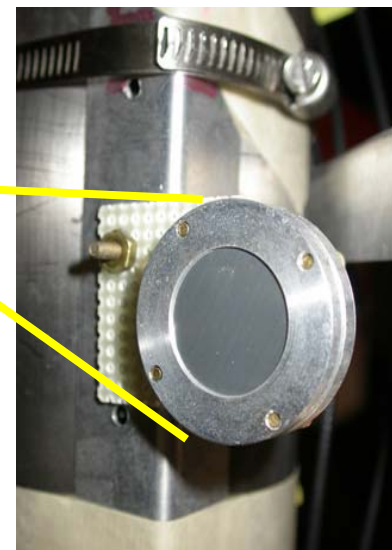
# 9-cell Re-entrant Cavity (AES)



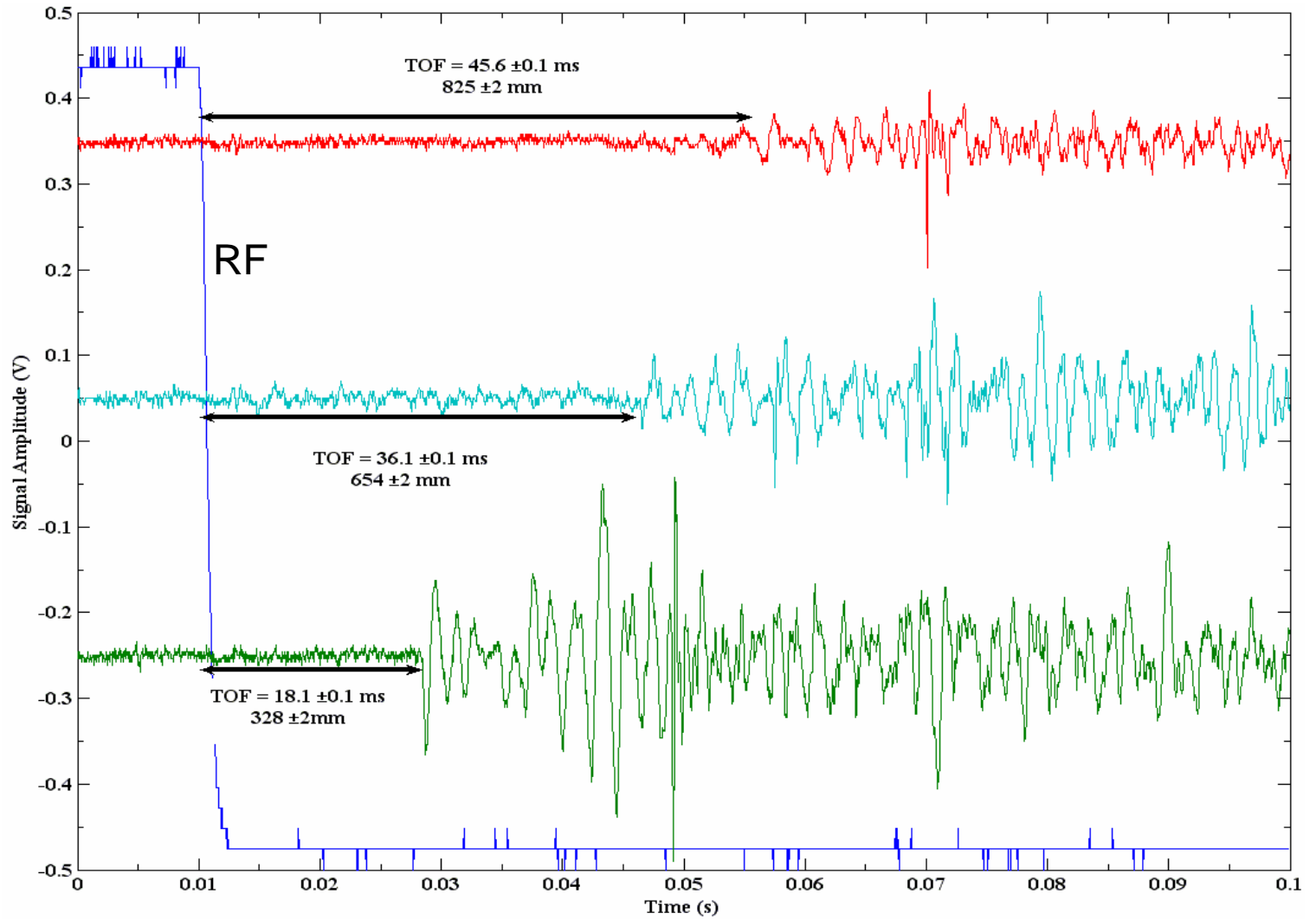
- 100 rotating thermometers



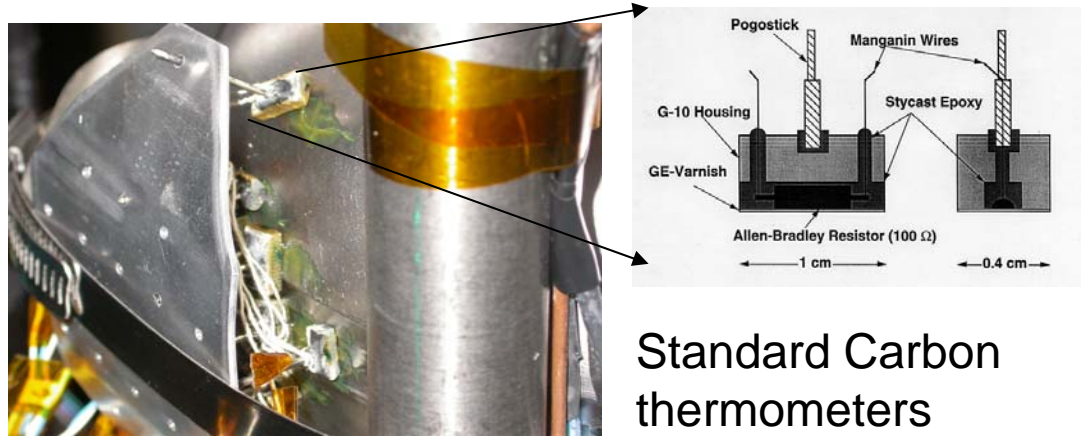
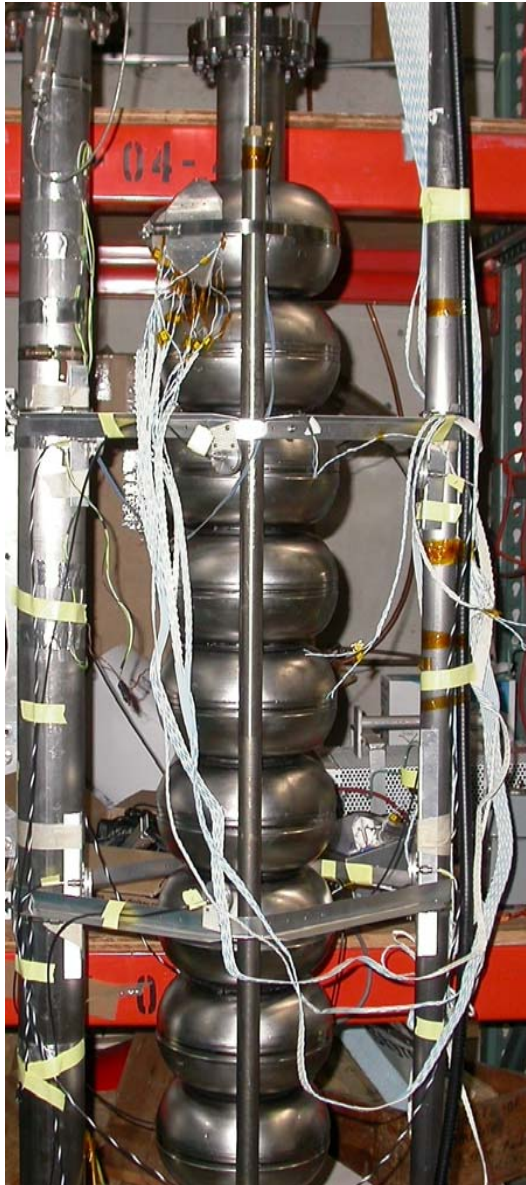
- 8 Superfluid 2<sup>nd</sup> Sound Detectors



# Time of flight of 2<sup>nd</sup> Sound for 3 detectors

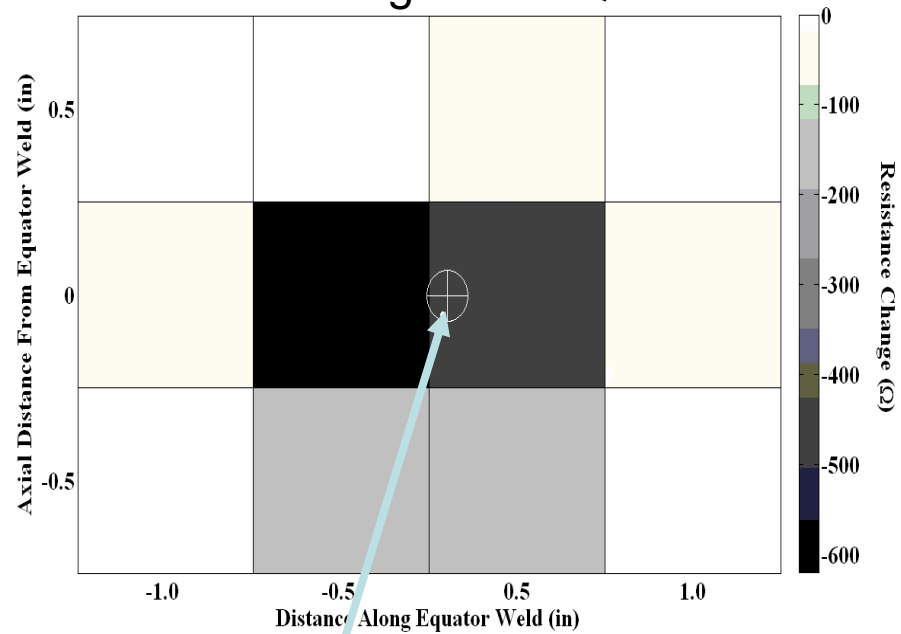


# Comparison Between 2<sup>nd</sup> Sound Location and Standard Thermometry Location



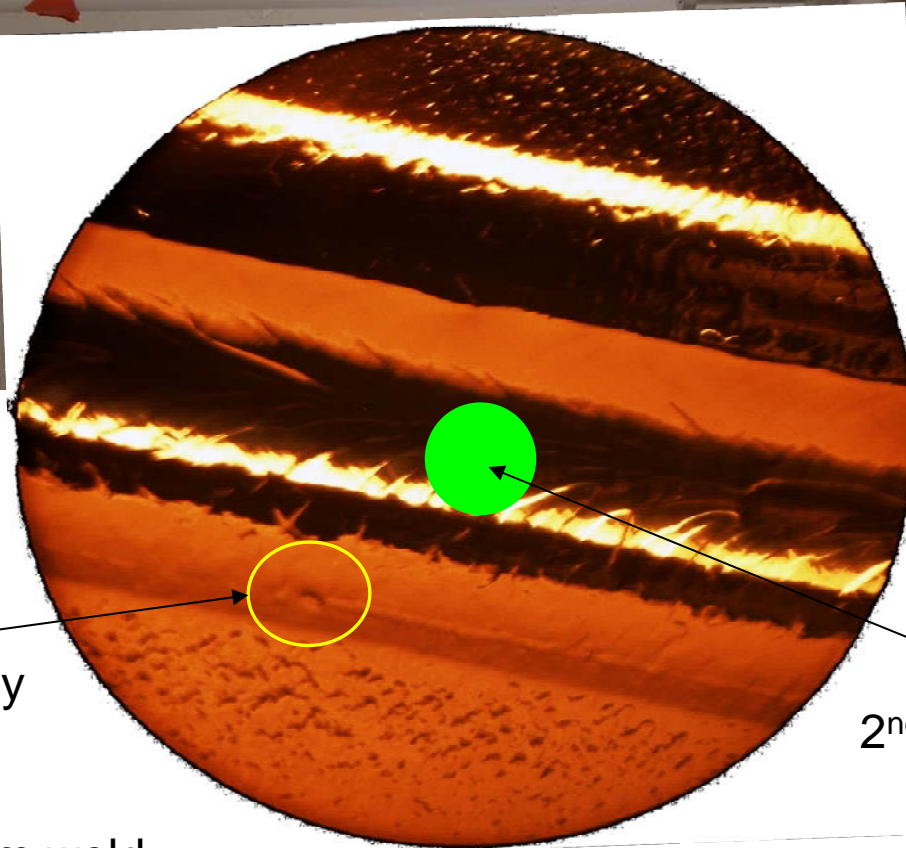
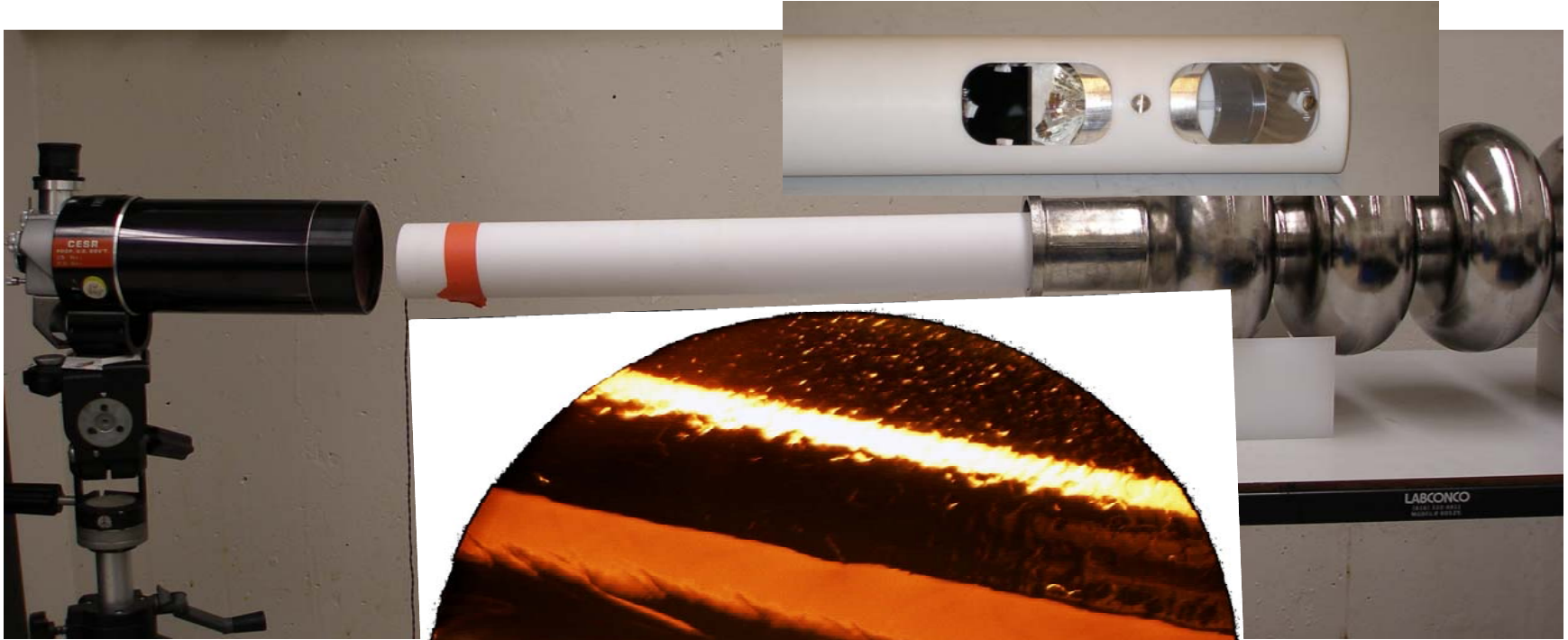
Standard Carbon thermometers

## Defect Heating Below Quench



2<sup>nd</sup> Sound Defect Location

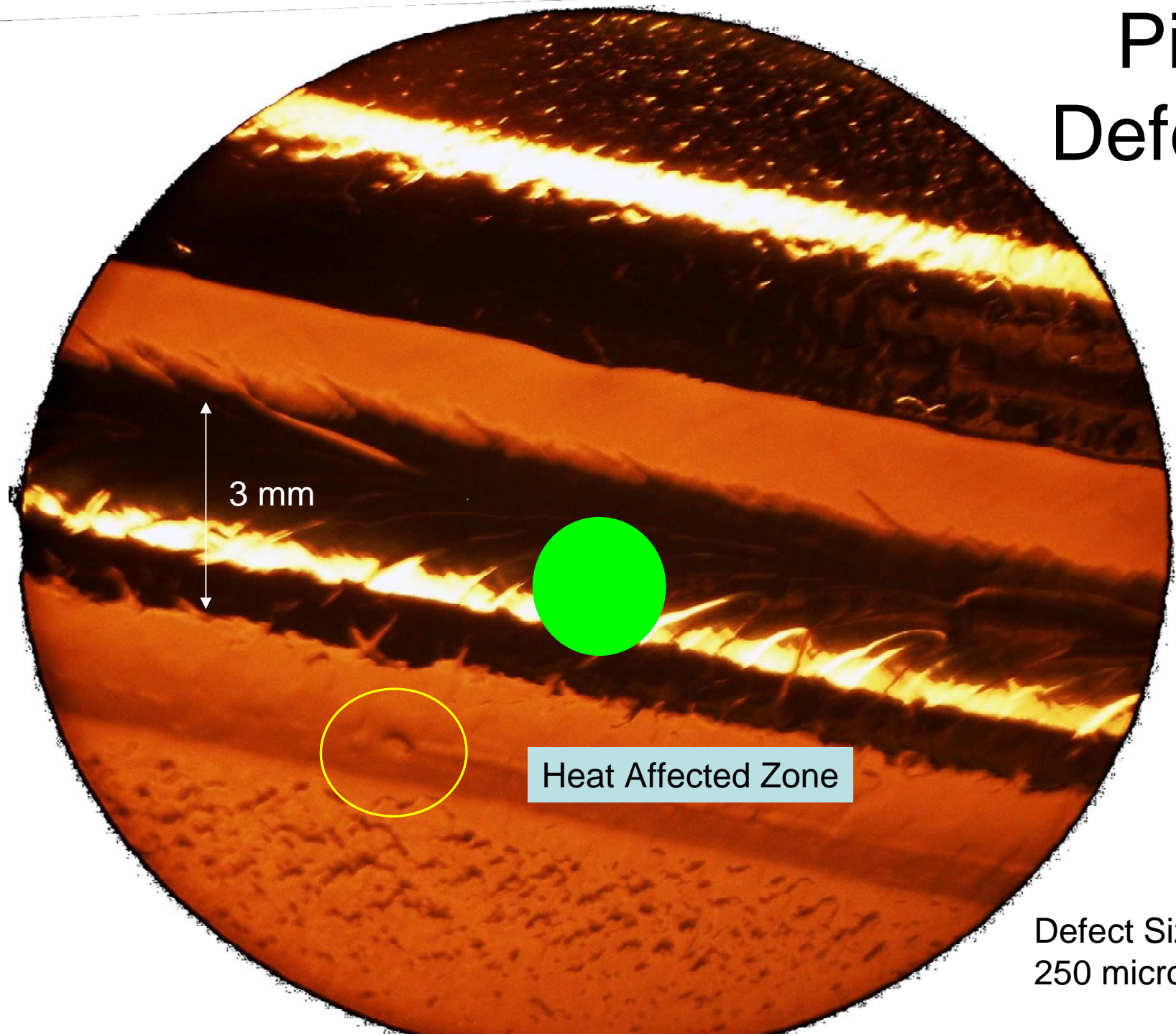
# Questar Observation



Weld Defect located by  
questar  
100 micron Pit in heat  
affected zone of ebeam weld

2<sup>nd</sup> Sound location

# Pit Defect



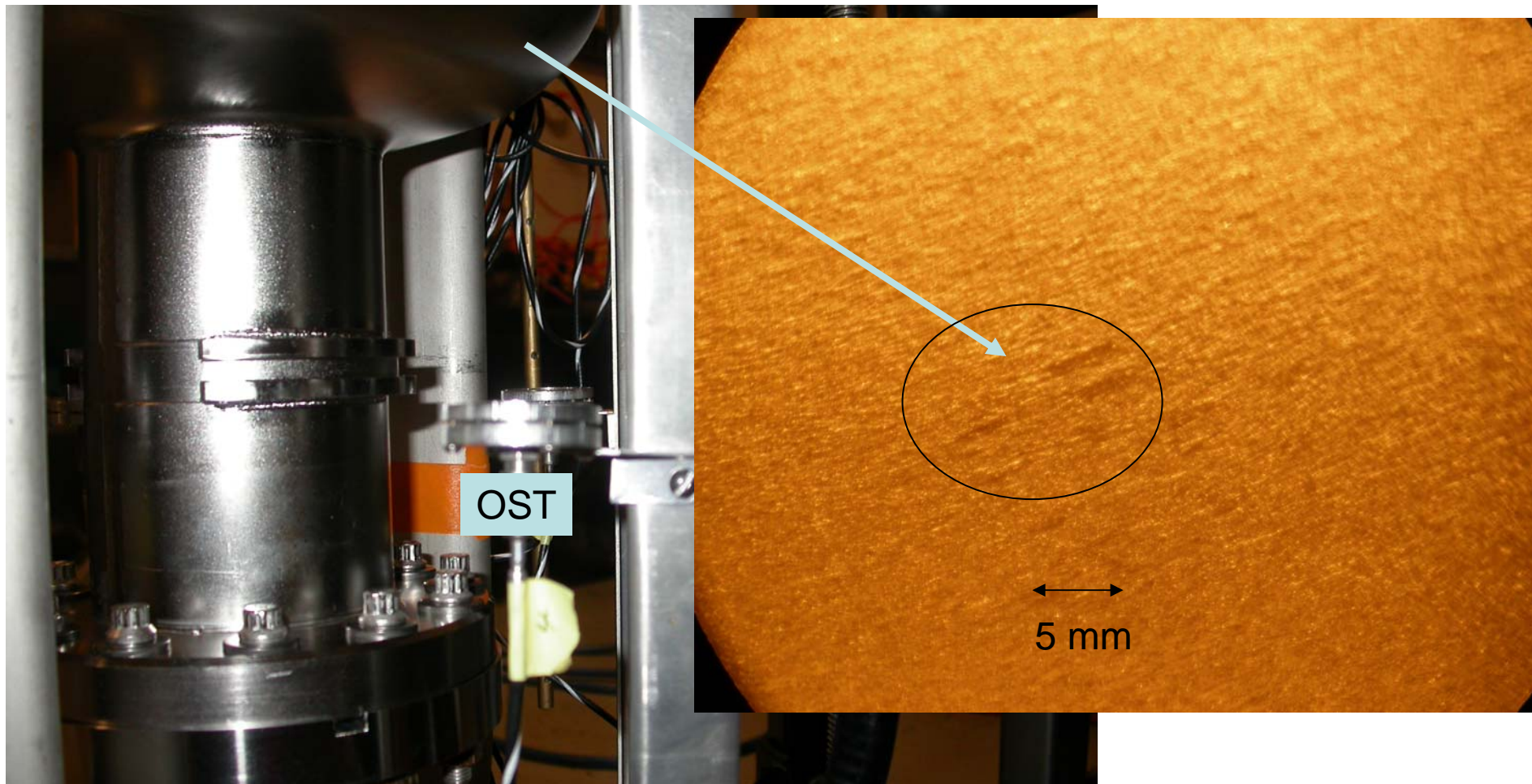
3 mm

Heat Affected Zone

Defect Size  
250 microns

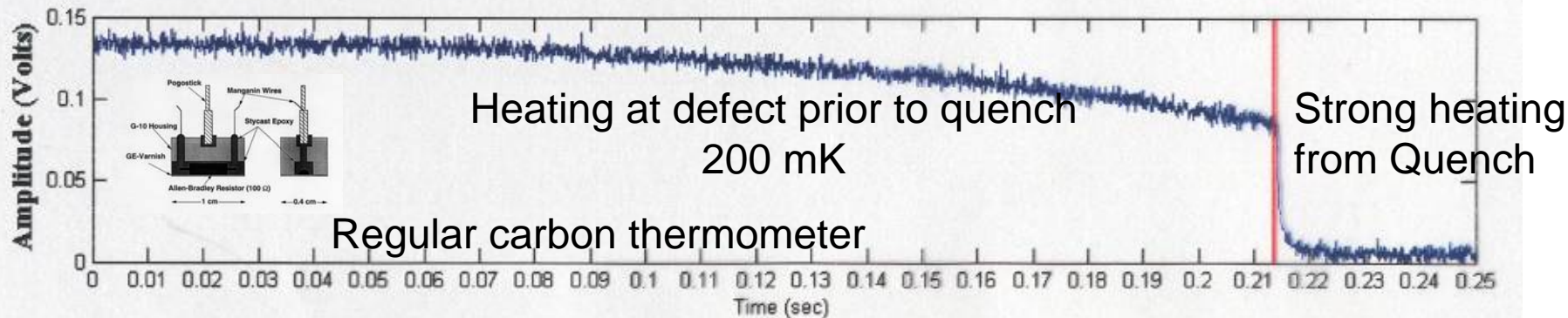
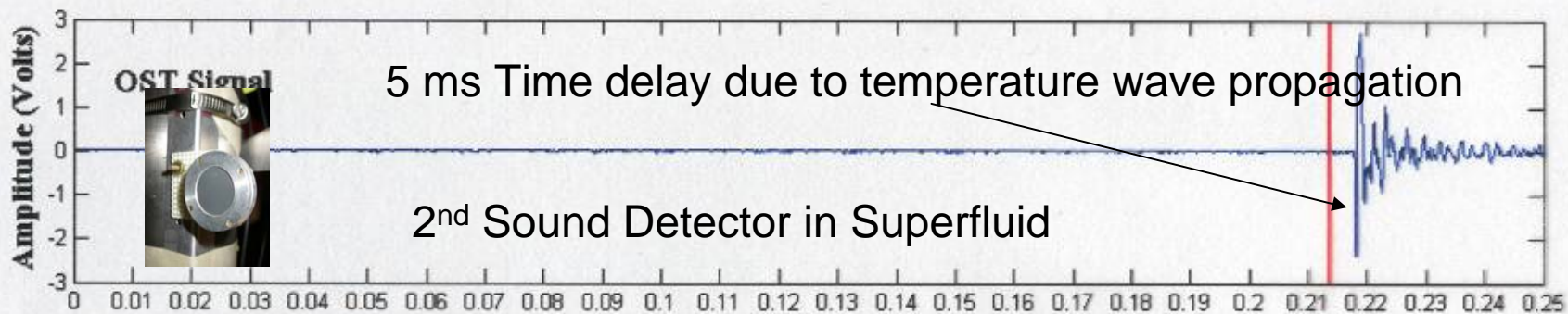
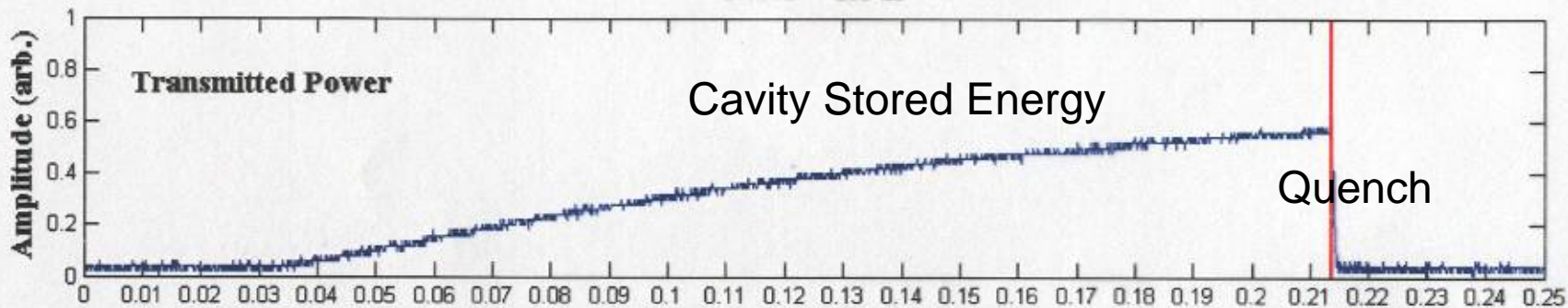


# Defect Found in 1-Cell Niowave Cavity #1 with 2<sup>nd</sup> Sound Detection and Questar Inspection



### Thermometer 22 Event

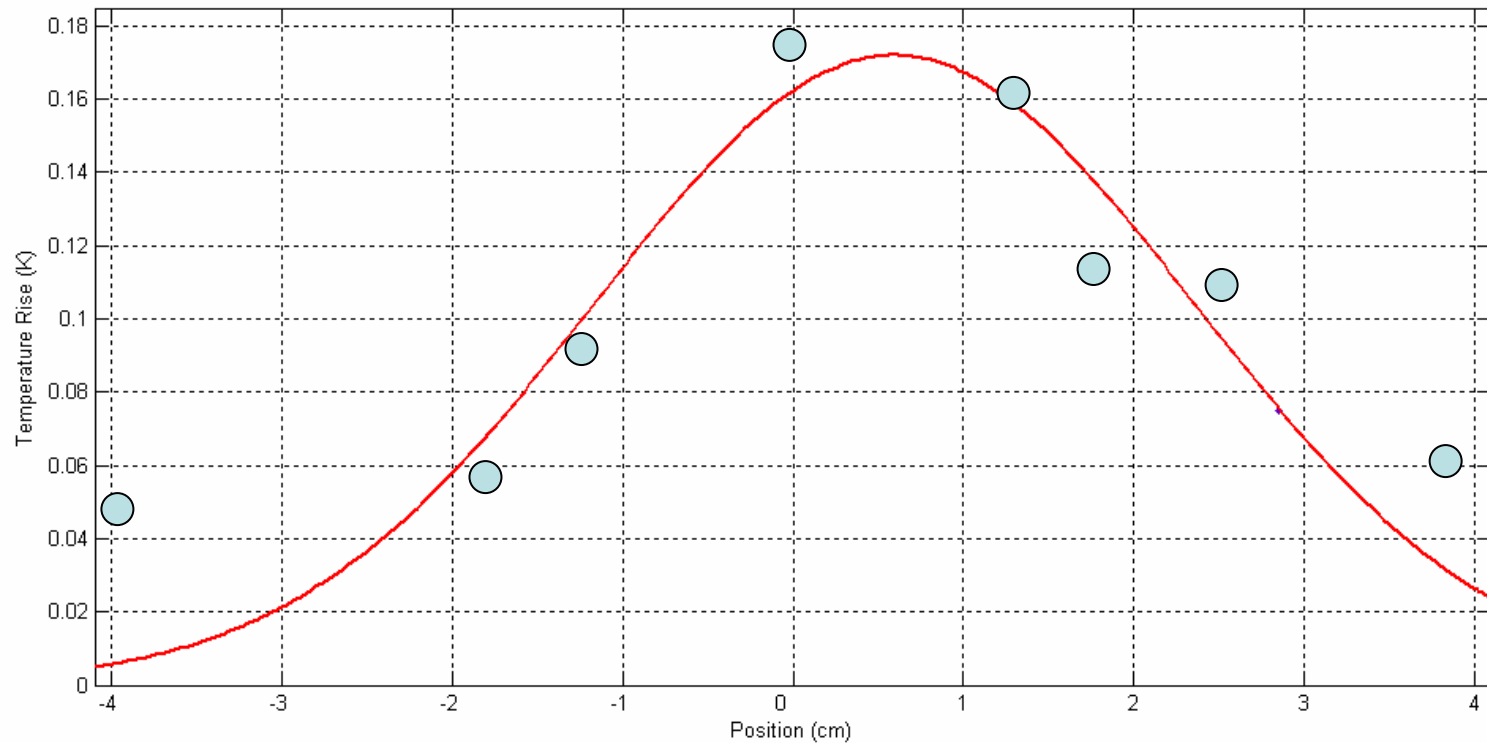
6 torr 1.6 K



# Several Standard Thermometers Placed Near 2<sup>nd</sup> Sound Quench Location

## Temperature Rise vs. Position

Compared to Prediction for Defect Heating Spread on He side



End