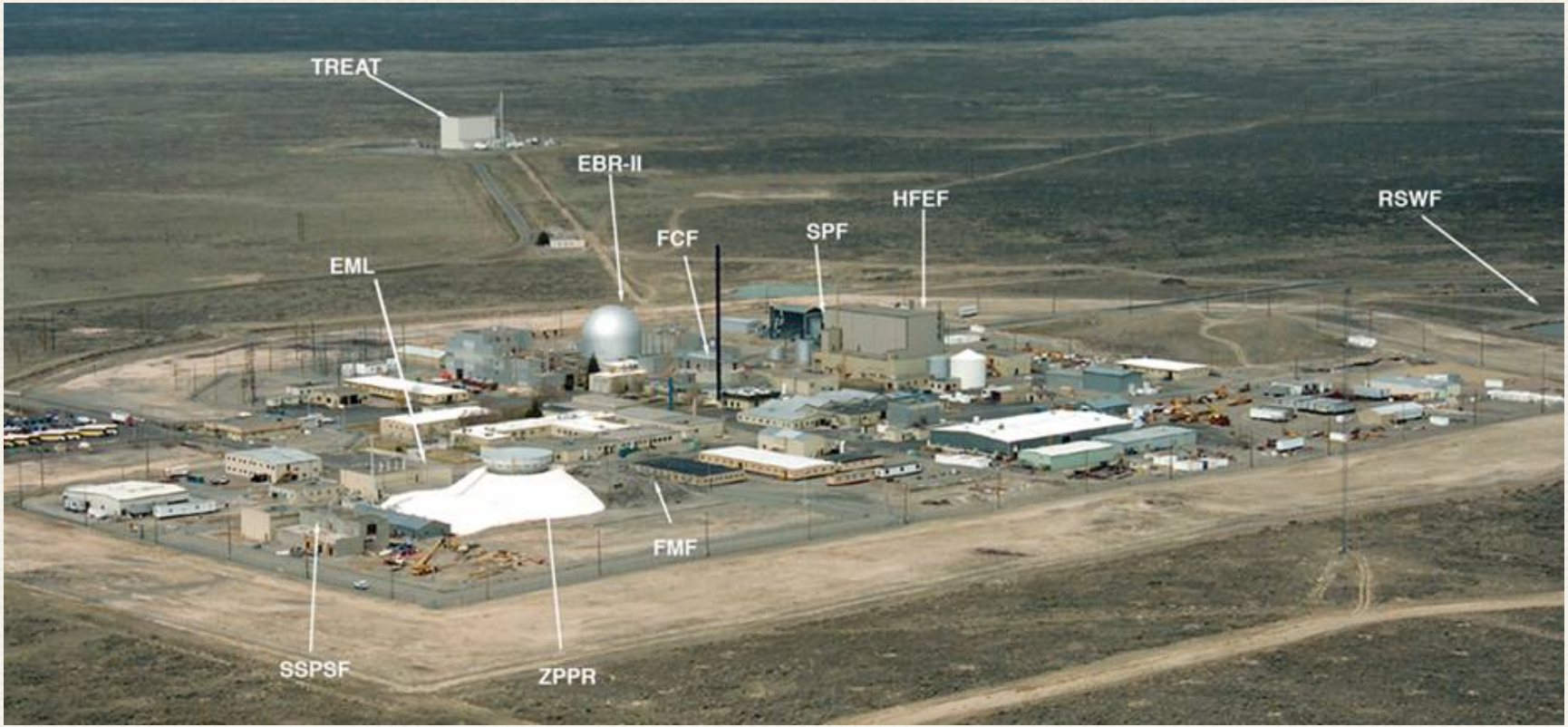
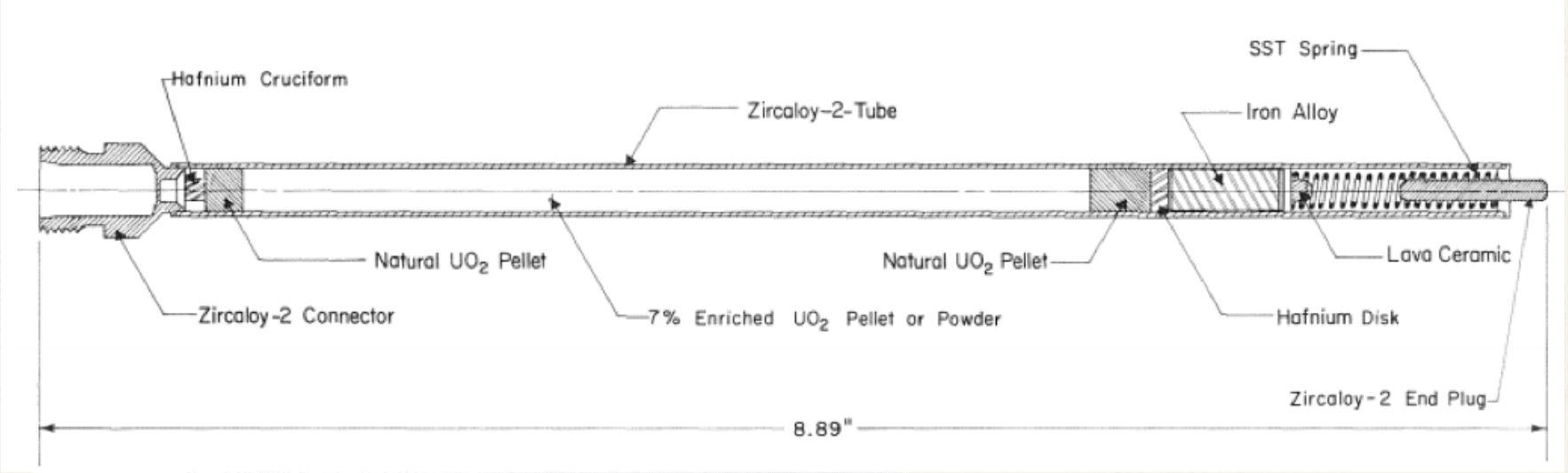
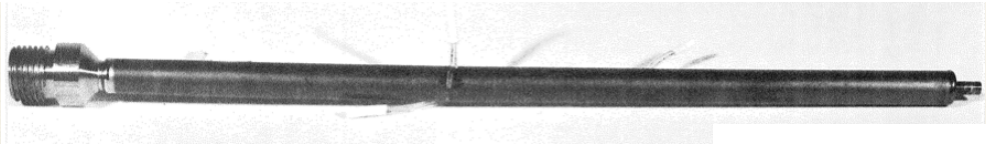
Fuel Rod Defect Detection

Idaho National Laboratory



SPERT Tests


Hafnium Cruciform
Zircaloy-2-Tube
SST Spring
Iron Alloy
Natural UO_2 Pellet
Natural UO_2 Pellet
Lava Ceramic
Zircaloy-2 Connector
7% Enriched UO_2 Pellet or Powder
Hafnium Disk
Zircaloy-2 End Plug
8.89"



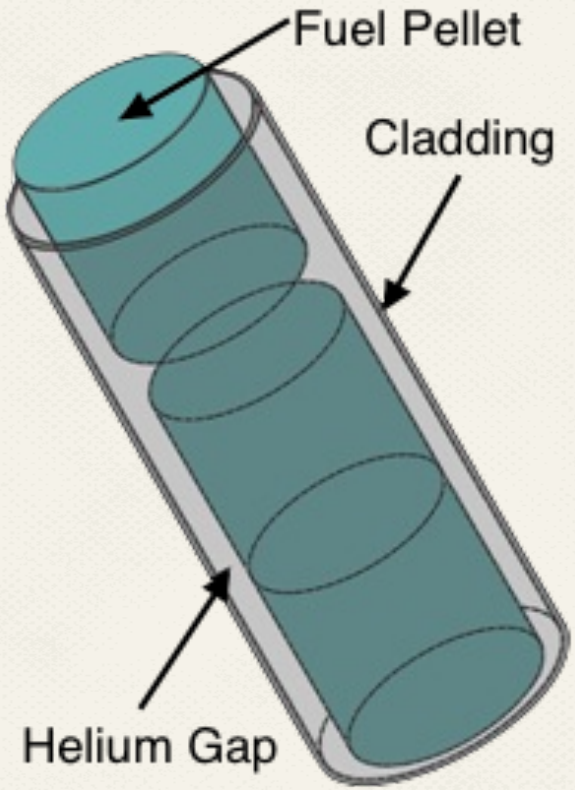
Project Definition

Deliver a test apparatus to be used for geometric and thermometric inspection of fuel rod test specimens. Rods will be analyzed both pre- and post-irradiation to measure ovality and to identify the location and geometry of cracks and end cap or weld faults.

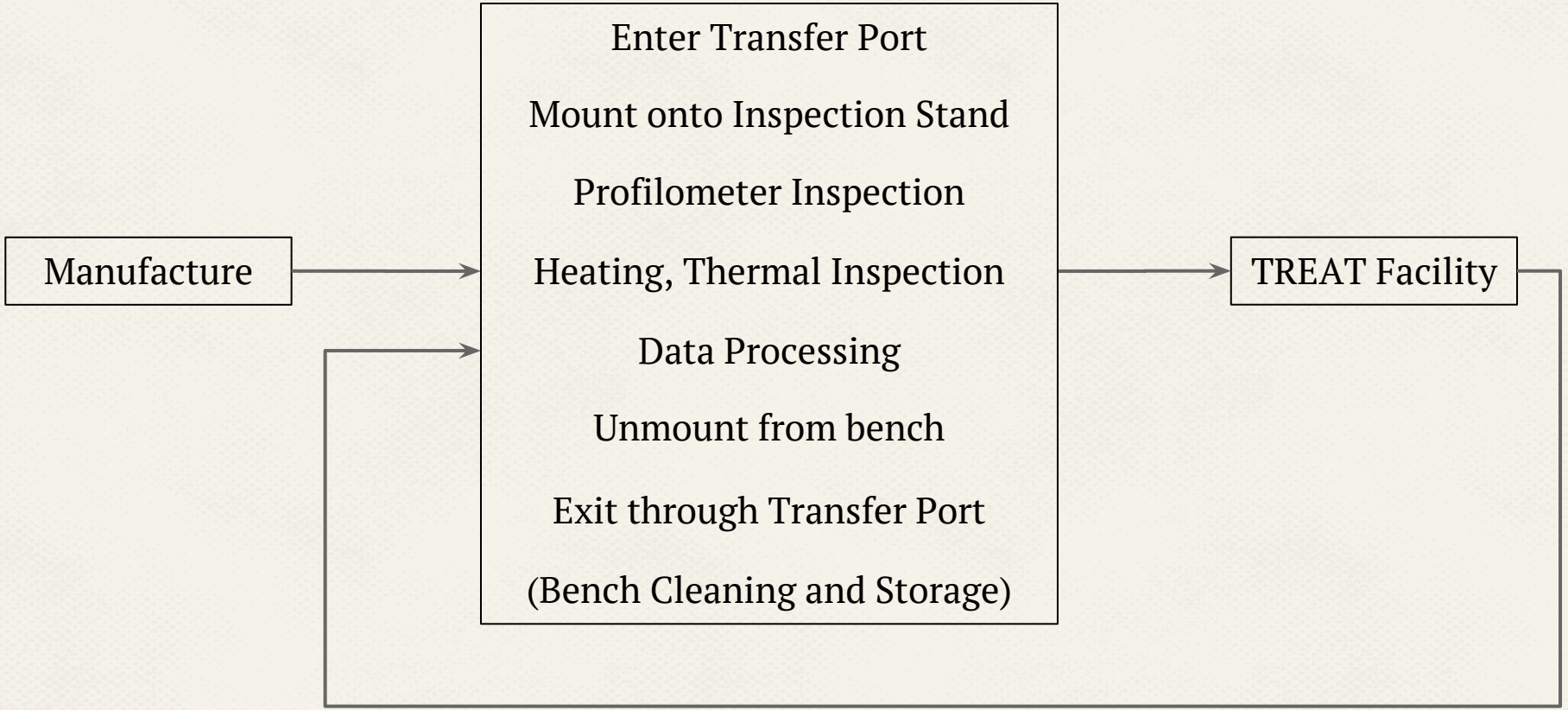
Test Rodlets

Lessons Learned

- Materials
- Rod geometry
- Post-testing condition
- Types of failure



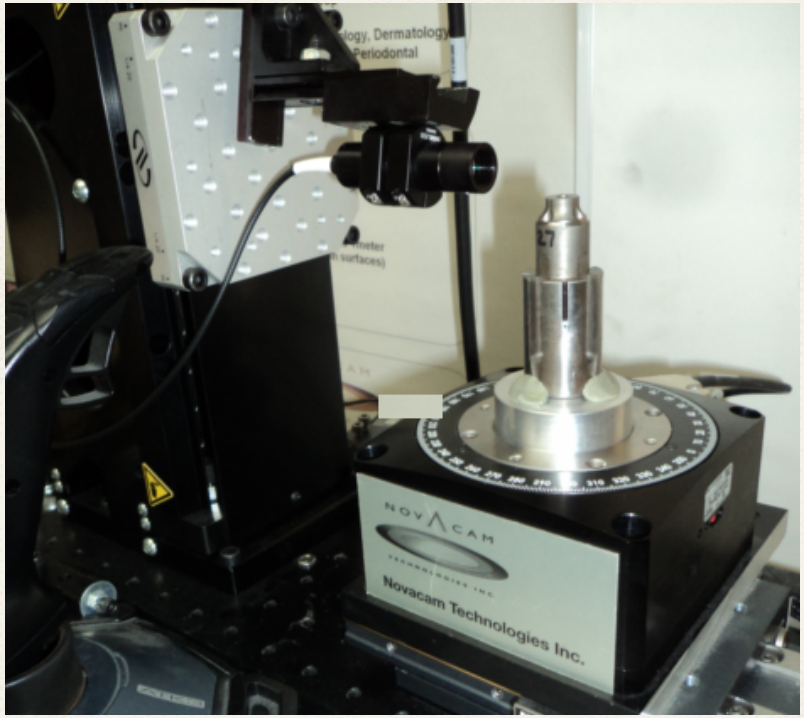
Test Specimen Life Cycle

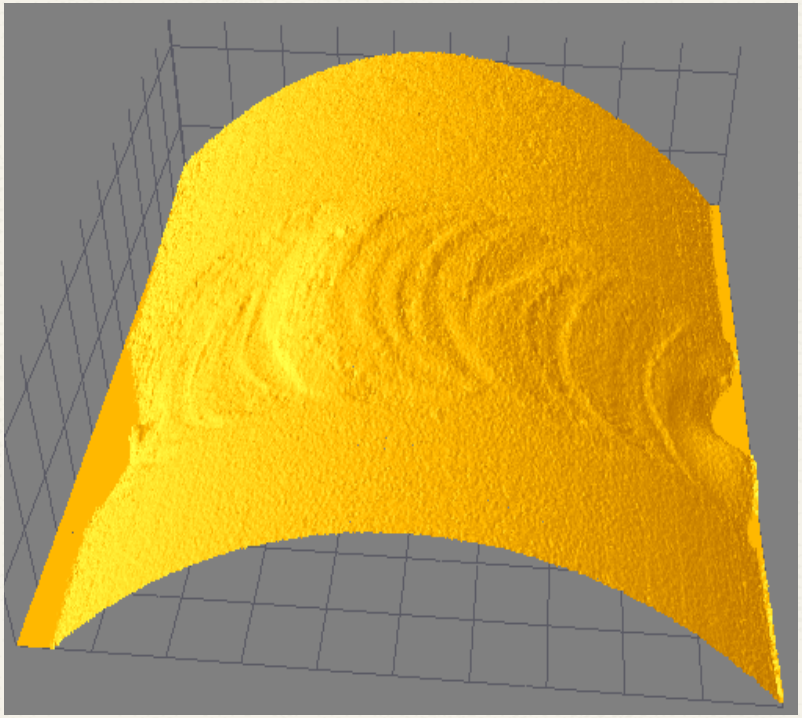


Profilometer Selection

Model	Advantages	Disadvantages
Novacam	• Small form factor • Radiation tolerant • Fast scanning time	• 1 µm finest resolution • Less flexible export
Nanovea	• 0.9 µm XY- & 1 nm Z-resolution	• Higher cost • Significantly larger form factor

Profilometer Selection





Novacam

Early Thermal Testing

Results

- Saturation issues

  Need shielding from heat source

- New methods of heating required

  More transient control

- Reflectivity issues

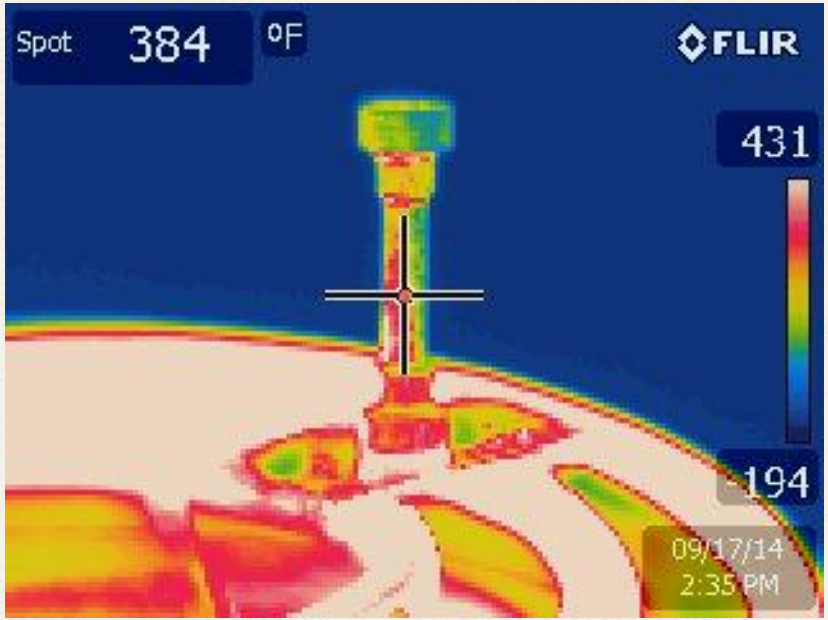
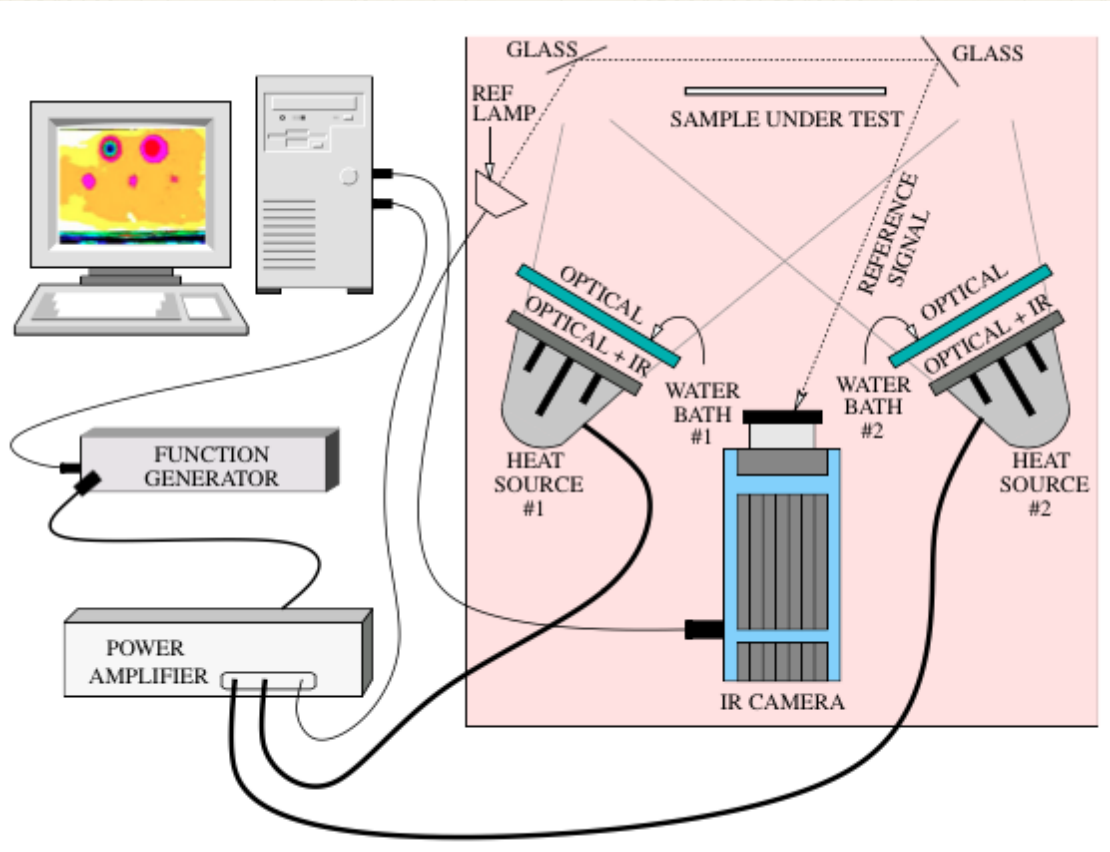


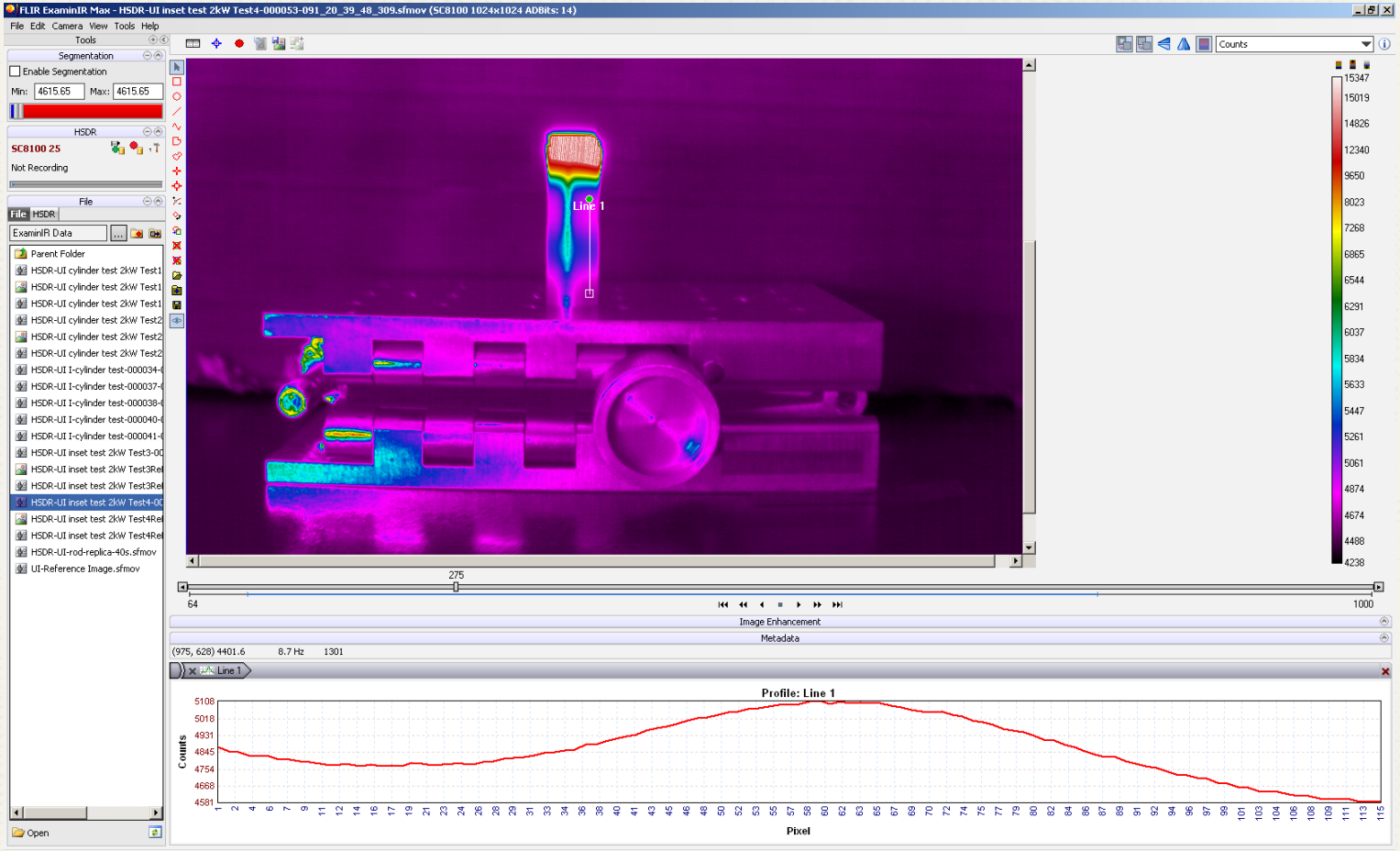
Figure 1. Heating of a tensile specimen

Frequency Modulated Thermal Wave Imaging

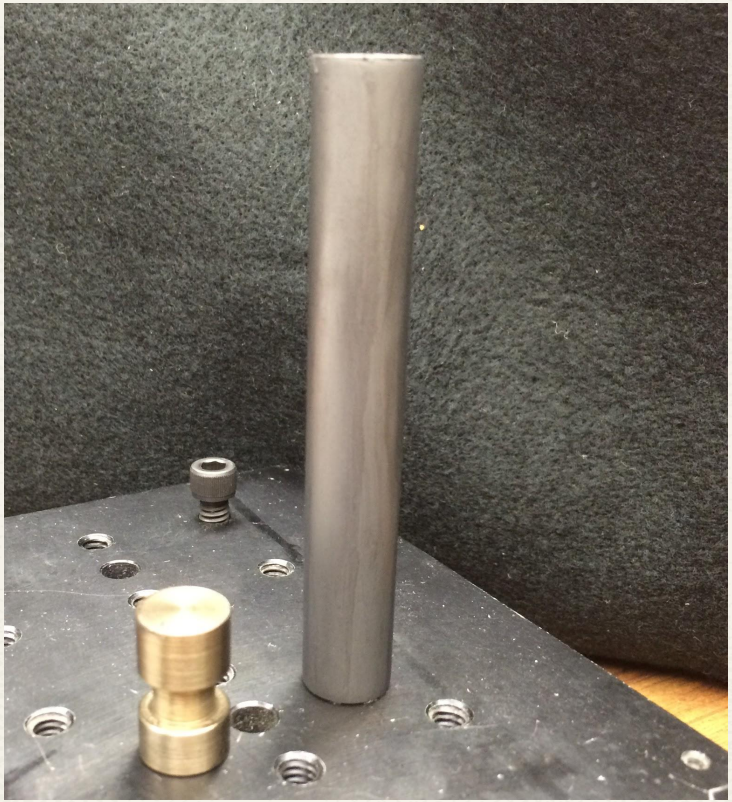


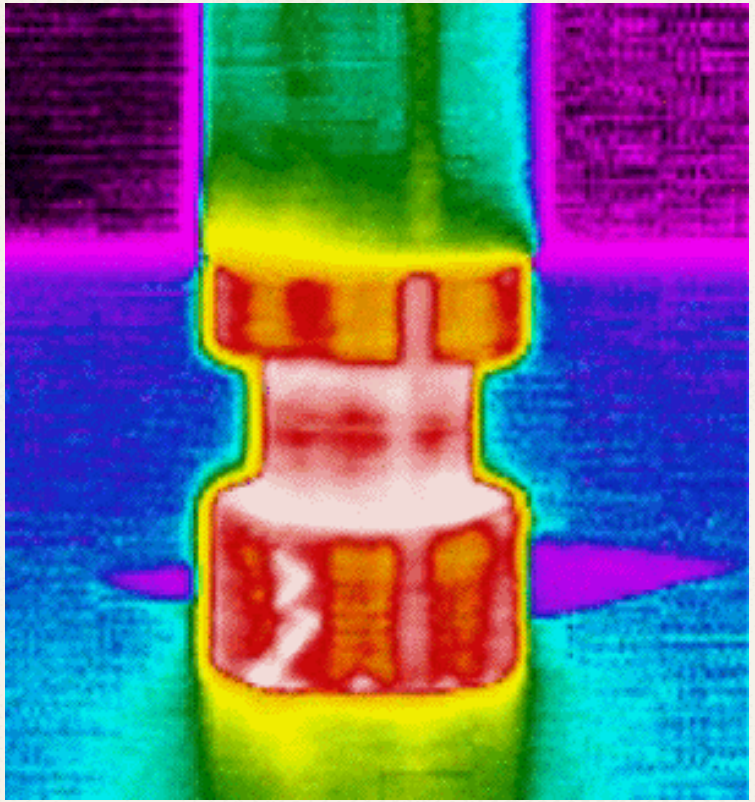
Current Testing Setup

FLIR Software



Heated Insert Test





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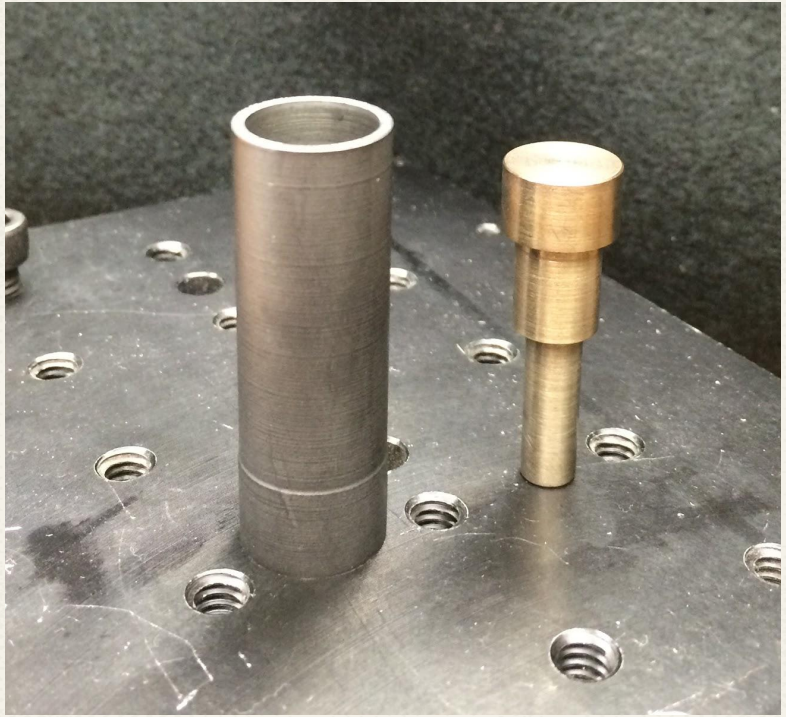
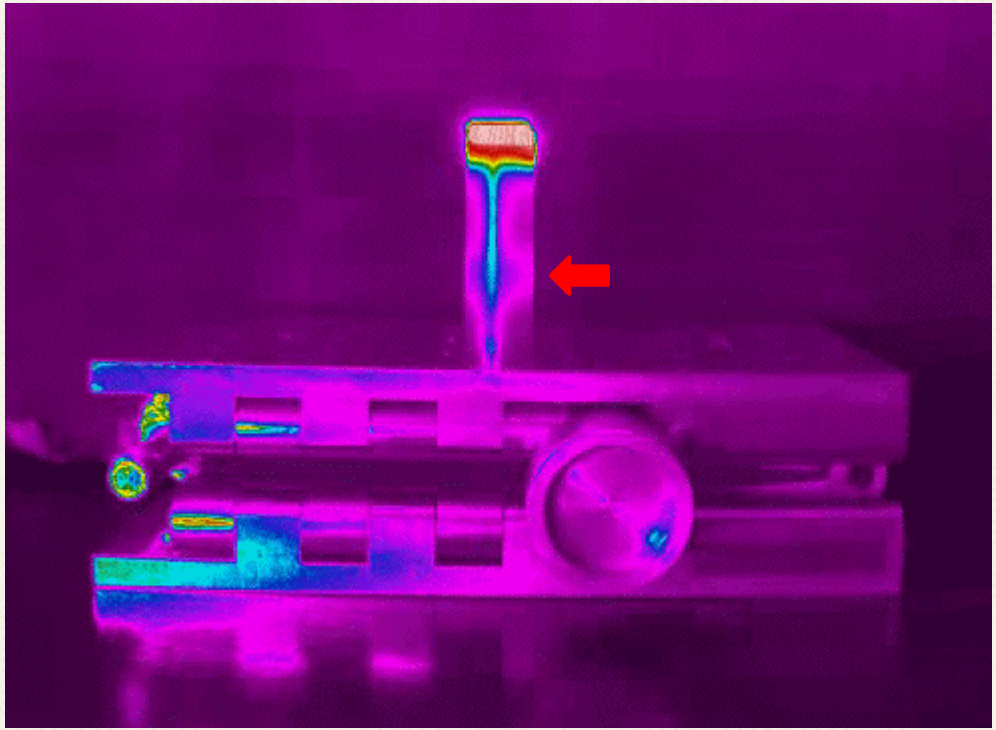
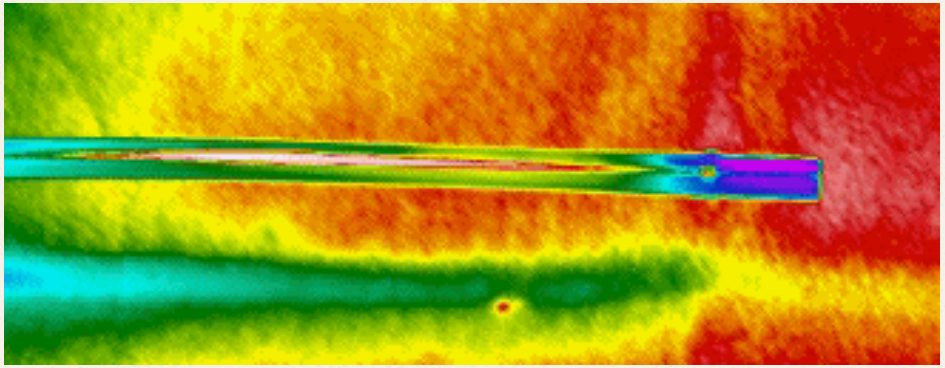




Halogen Lamp Test



Questions