

Engineering at SLAC: Designing and Constructing Experimental Devices for SSRL

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Office of Science, Community College Internships (CCI) Program

This work was supported in part by the U.S. Department of Energy, Office of Science, Office of Workforce Development for Teachers and Scientists (WDTS) under the Community College Internships (CCI) program, under Contract No. DE-AC02-76SF00515.

Stanford Synchrotron Radiation Lightsource (SSRL)

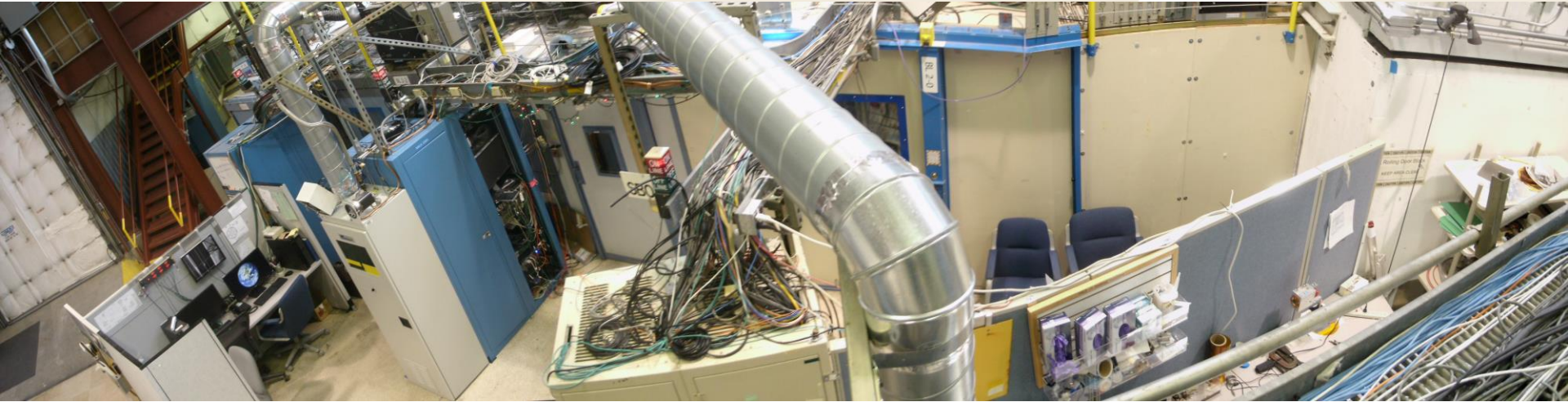


The Experimental Stations



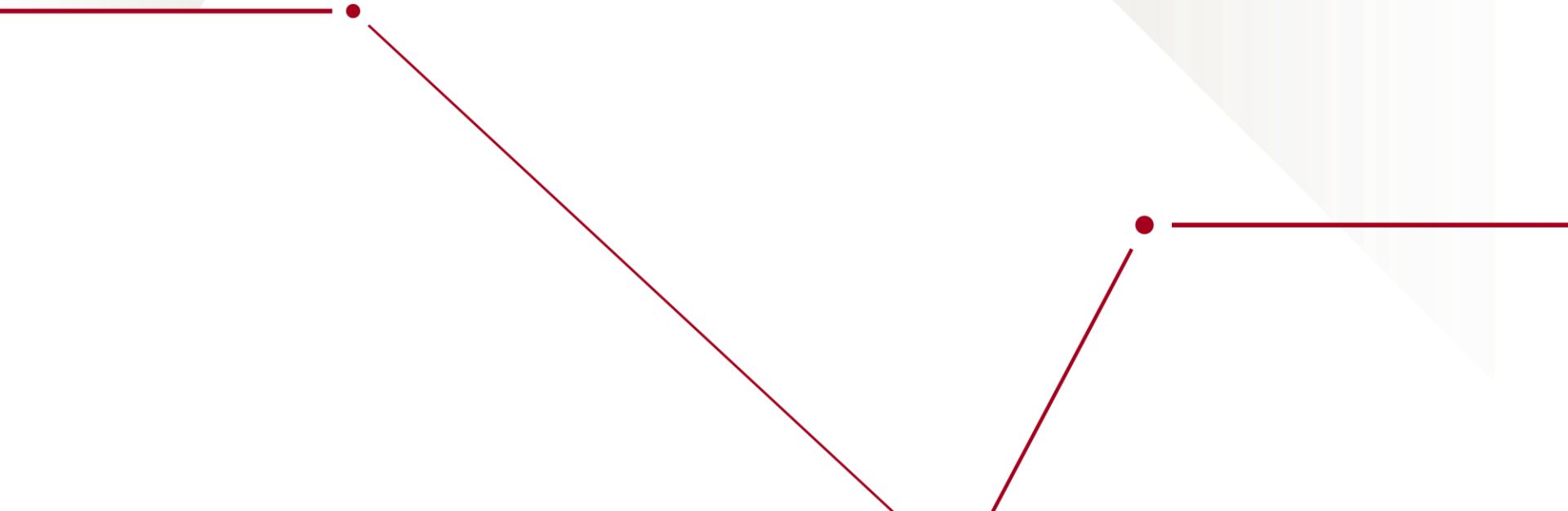
- 33 experimental stations
- Each has a lead-lined hutch within which the x-rays are emitted

The Experimental Stations



- Various experimental techniques are employed, including: spectroscopy, microscopy, crystallography, and diffraction, among others.
- Multiple fields: energy production, nanotechnology, and new materials
- New experiments; new challenges

Project 1: Heated Sample Holder

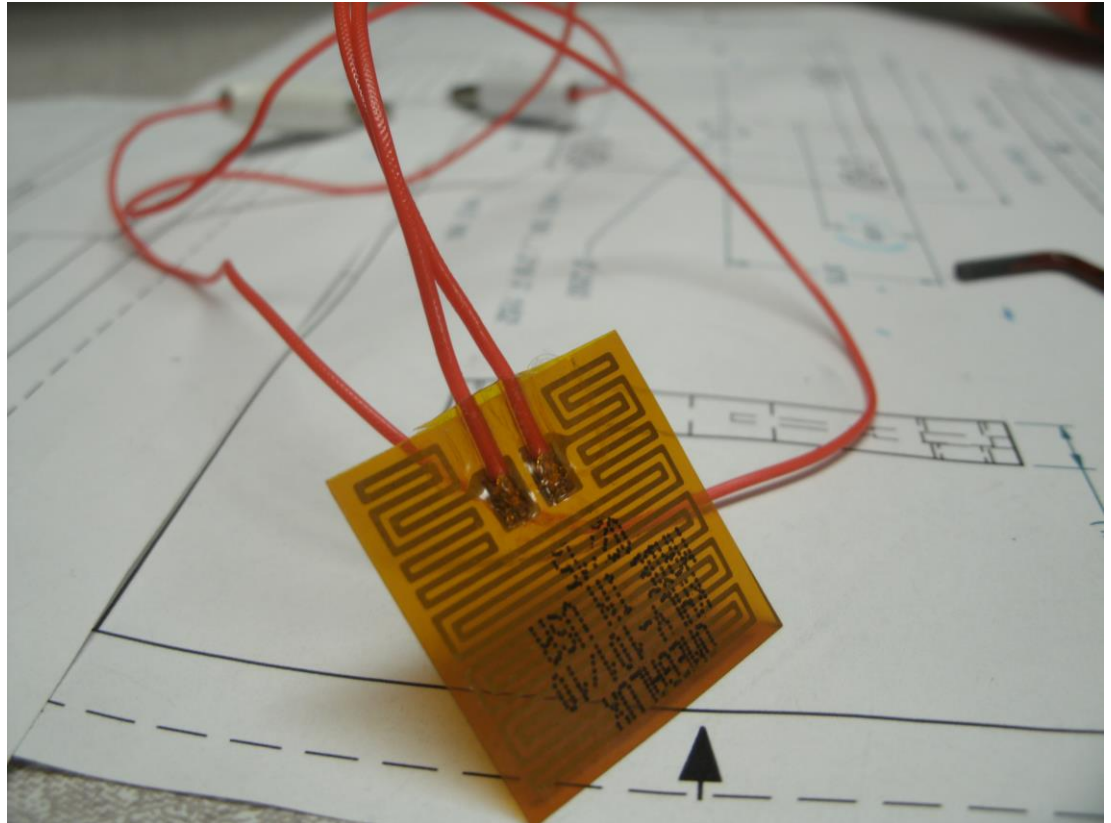


The Goal

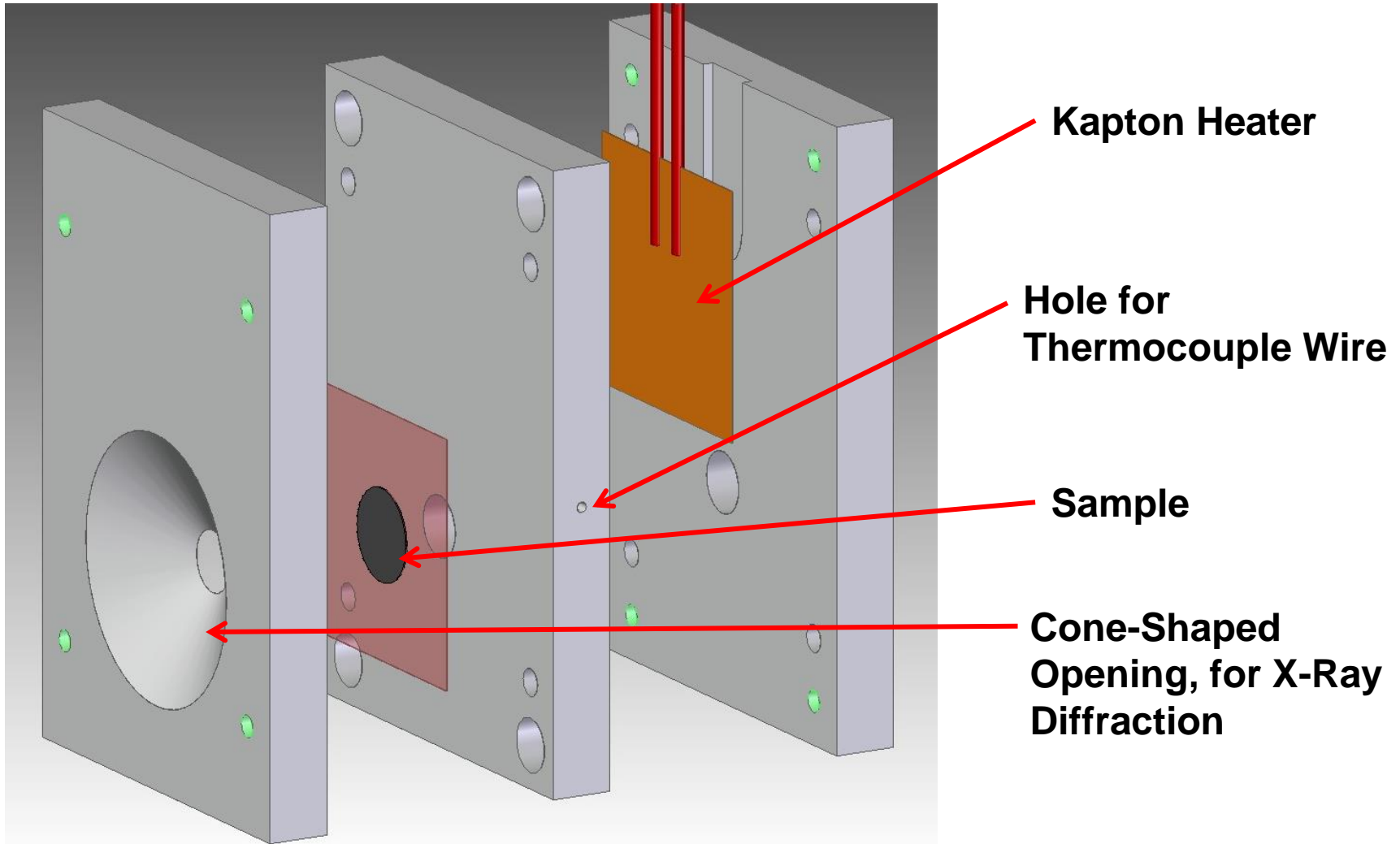
- A researcher from UC Santa Barbara wanted to heat a sample while observing its x-ray diffraction pattern.
- The sample holder needed to have the following features:
 - Holds the sample
 - Holds a thin heater
 - Holds a thermocouple wire
 - Distributes heat quickly and evenly
 - Has a wide opening
 - Relatively easy to assemble and use

The Materials

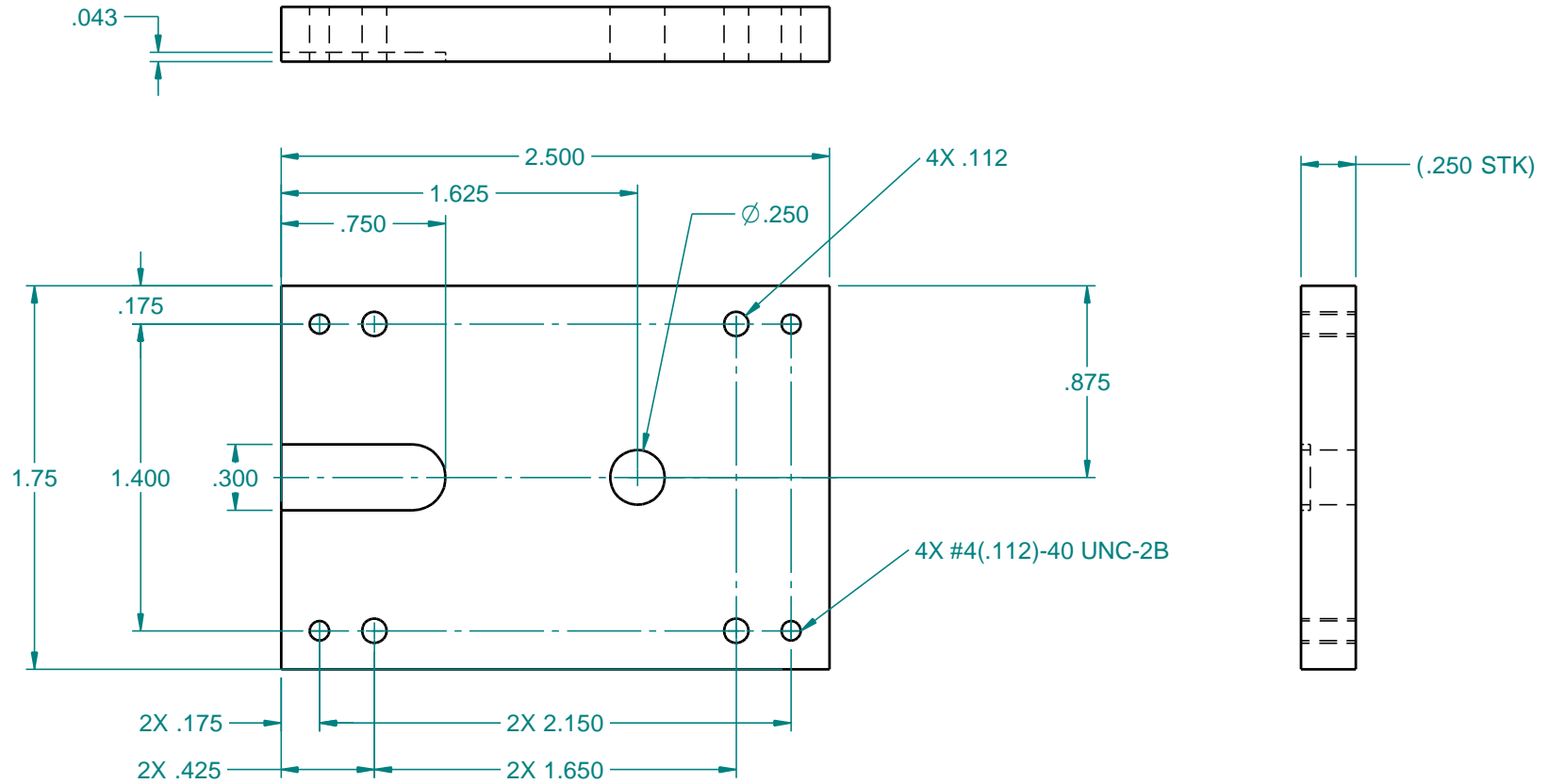
- Aluminum: cheap, easy to machine, high thermal conductivity
- Kapton tape:
 - -259°C to 260°C
(-452°F to 500°F)
- Kapton strip heater:
 - Up to 200°C (392°F)



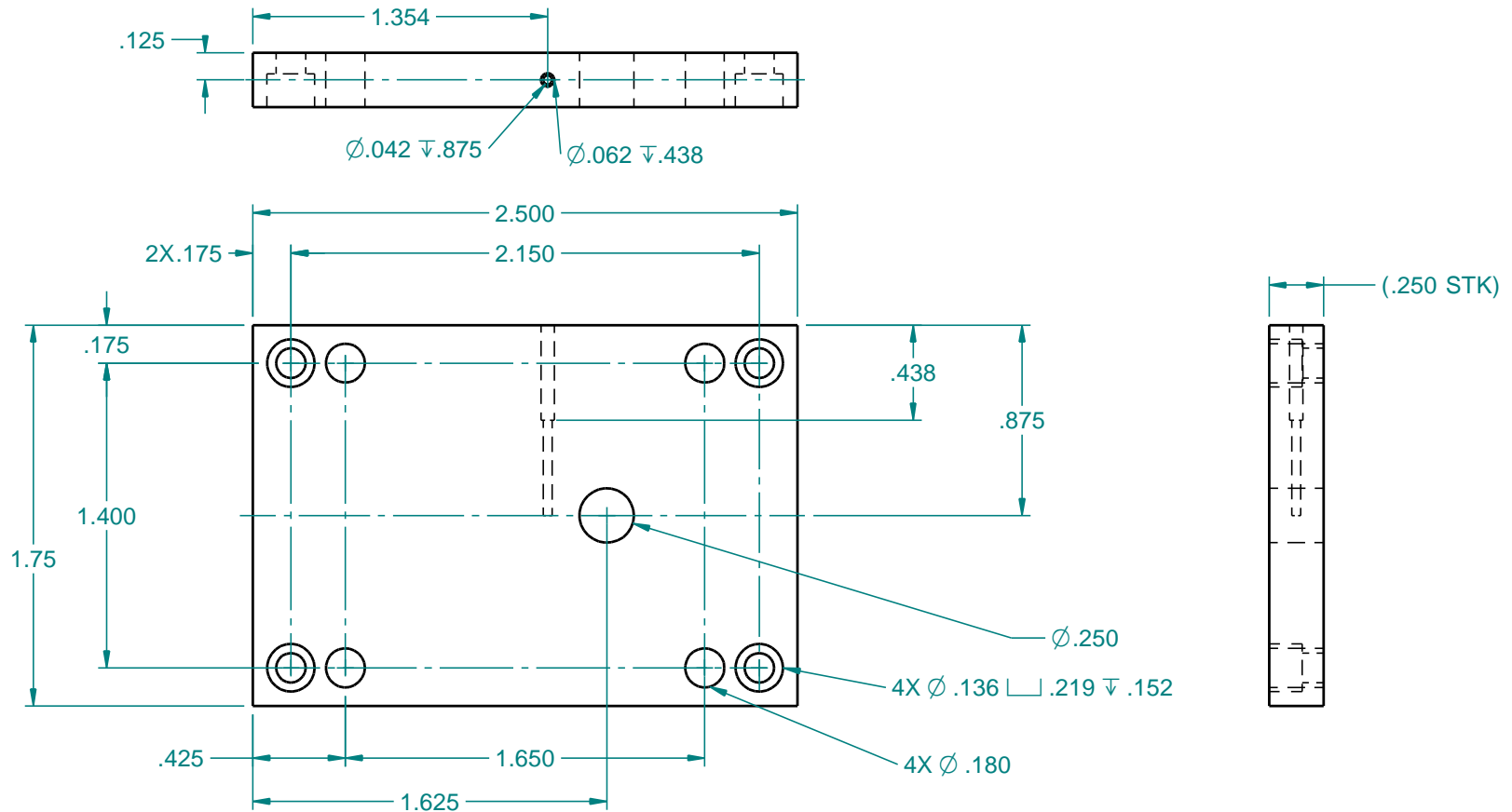
The SolidEdge Model



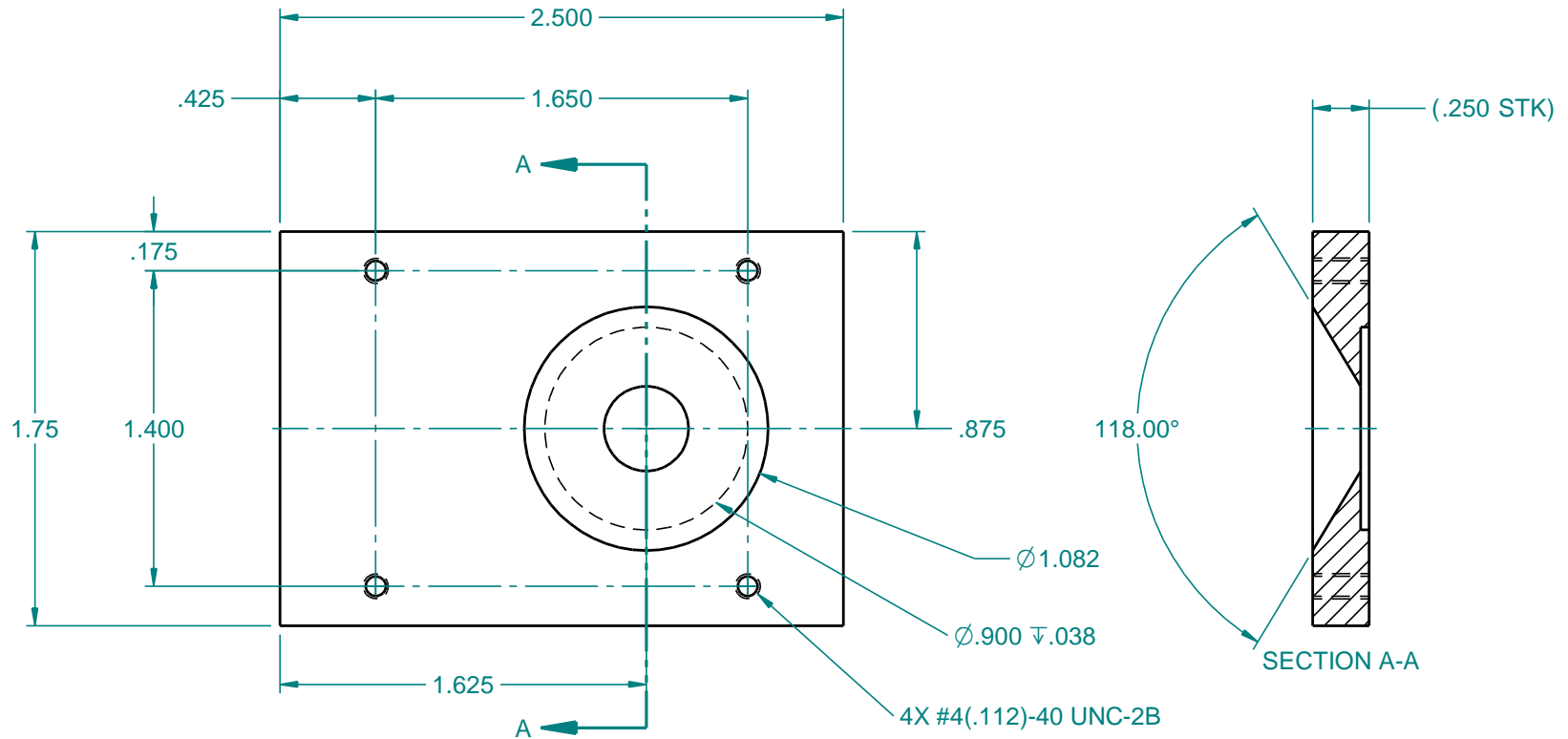
The Drafts



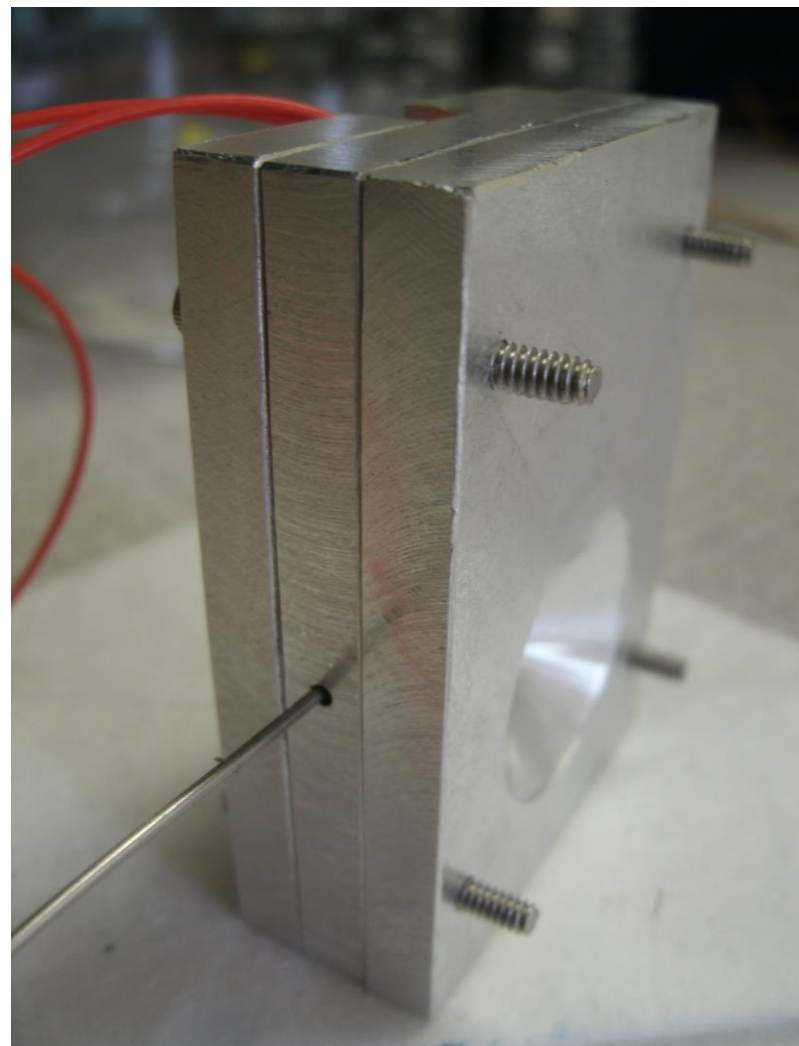
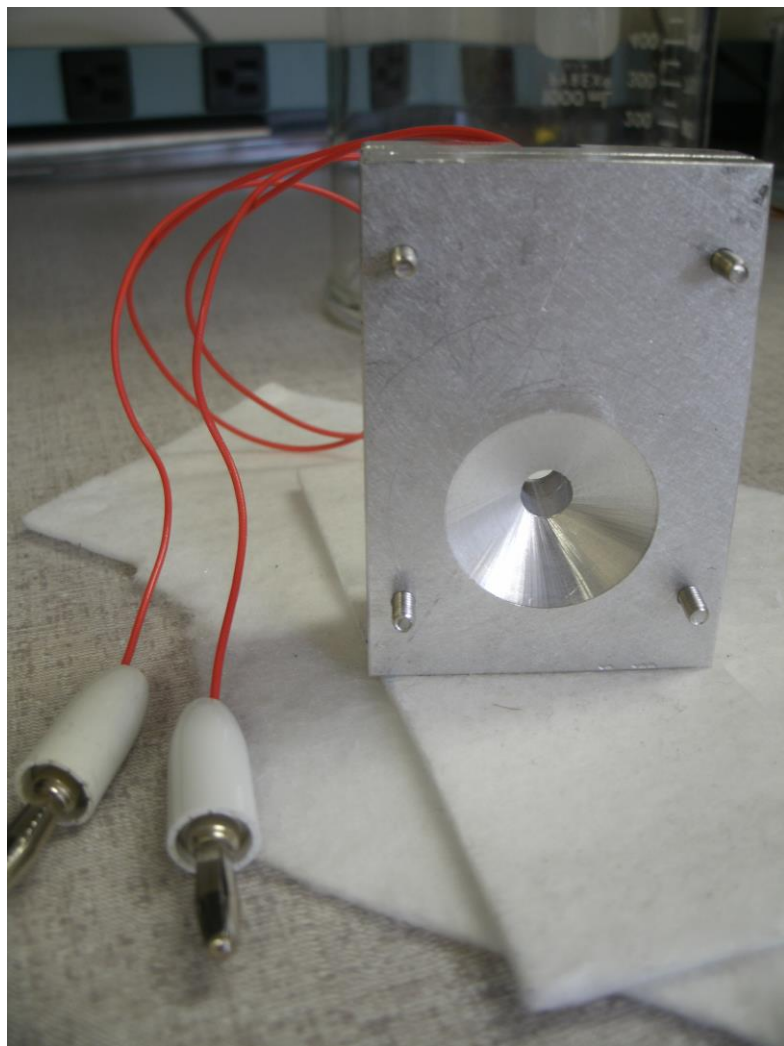
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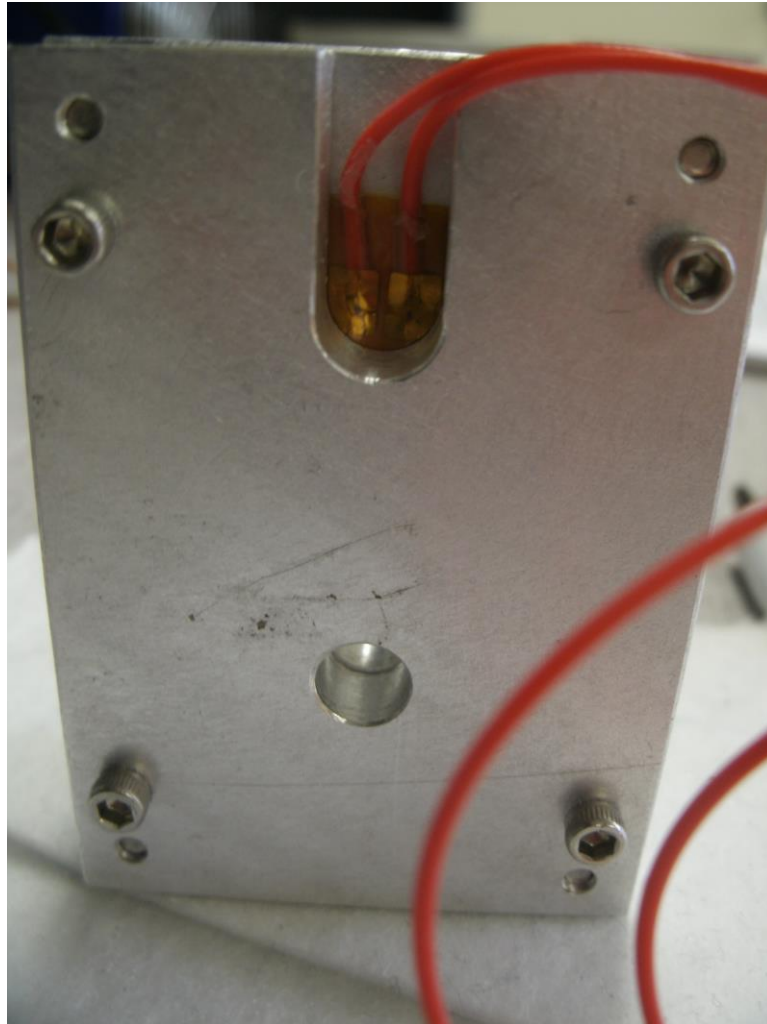


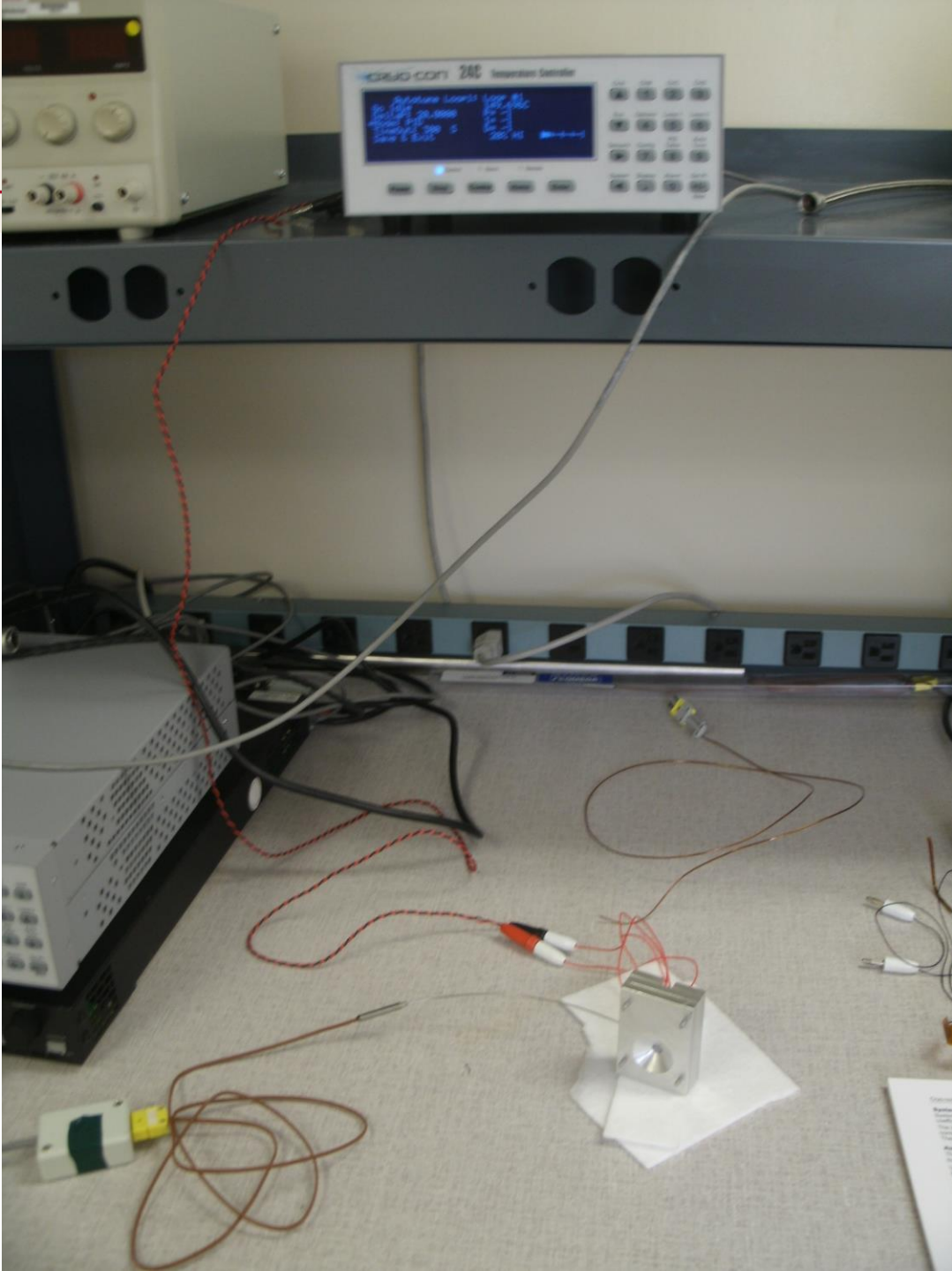
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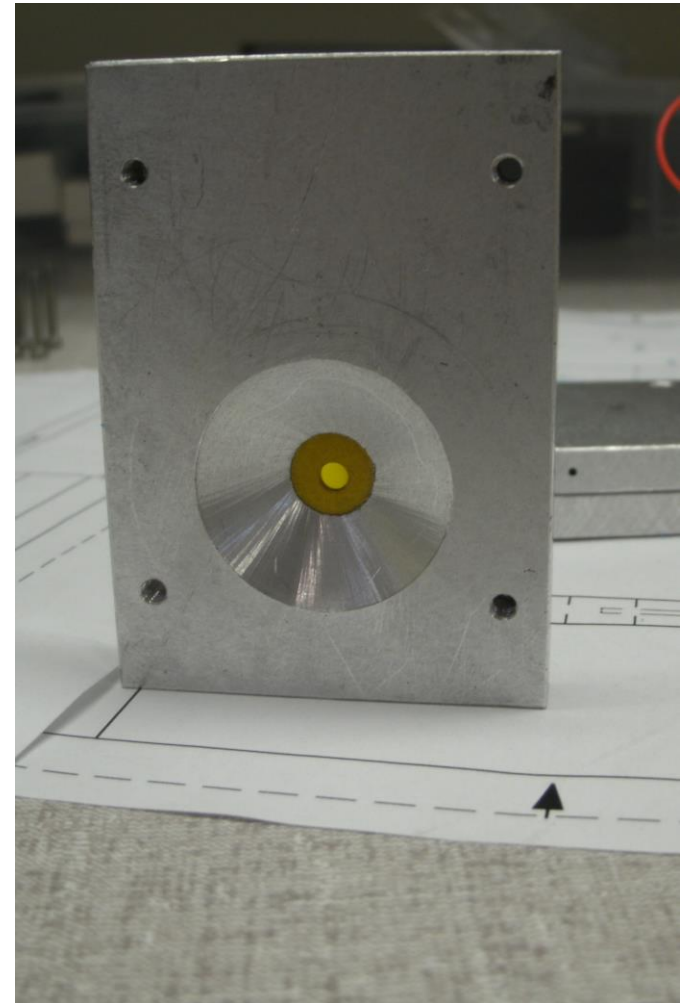
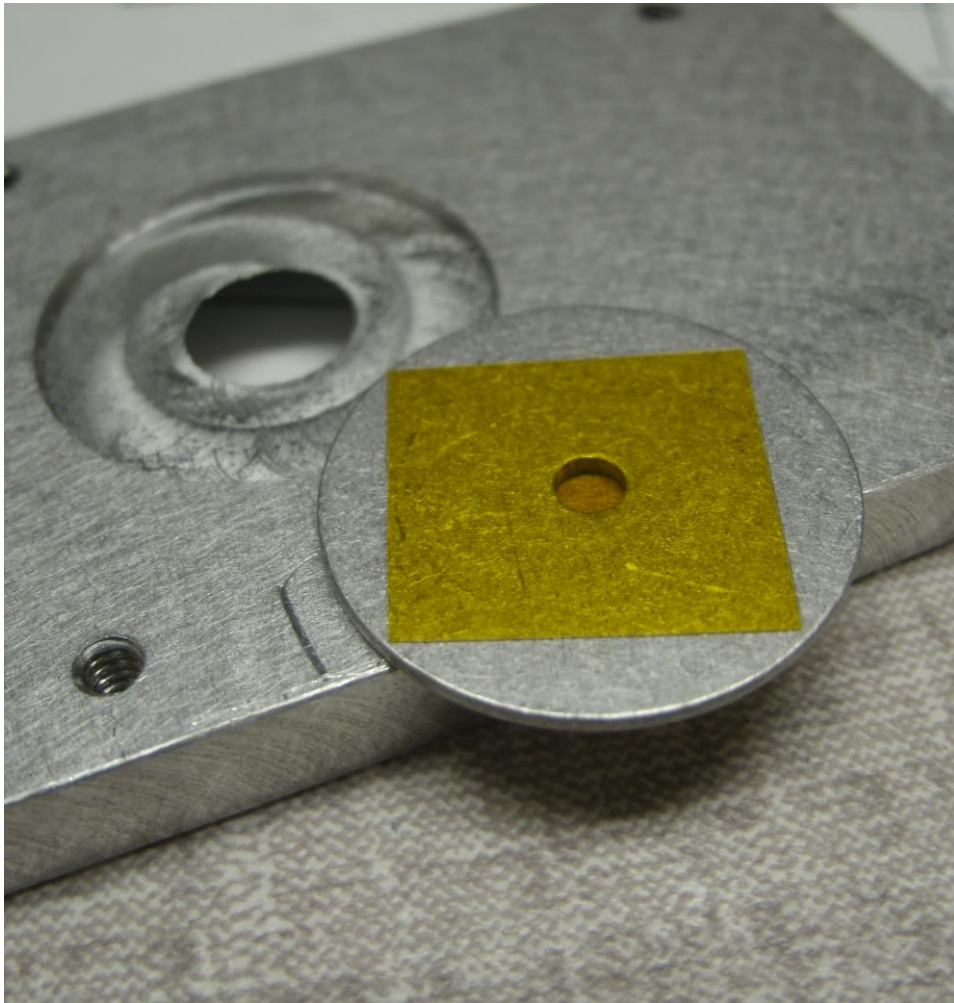
Assembled Plates



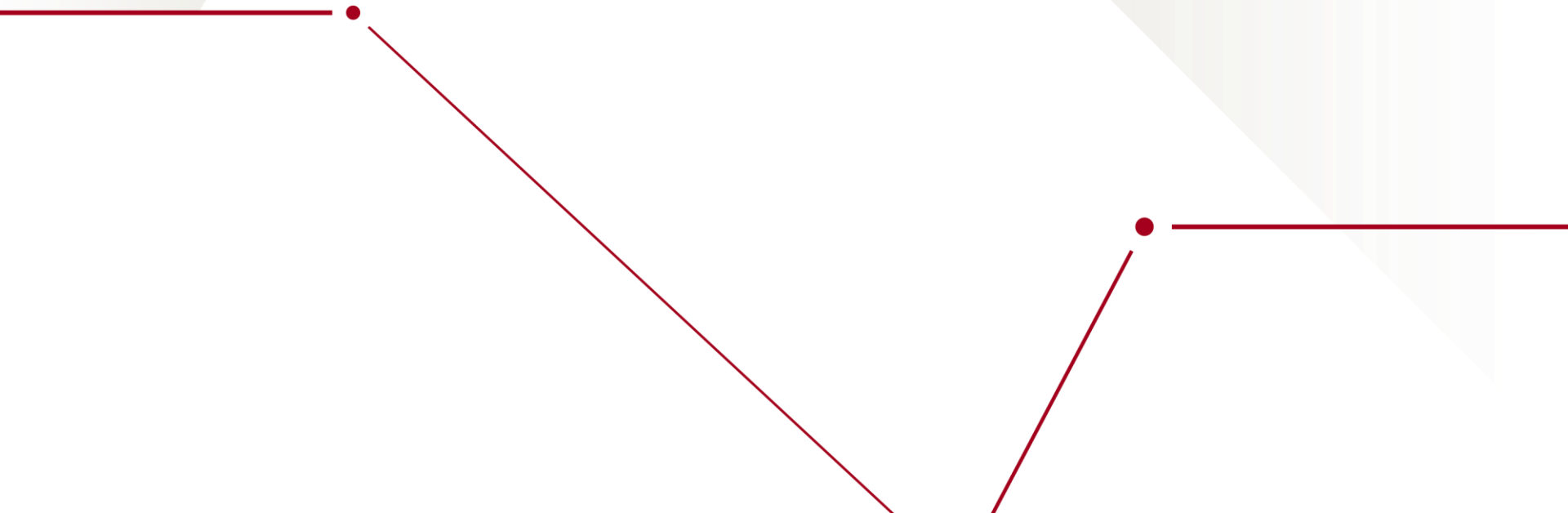




A Slight Modification



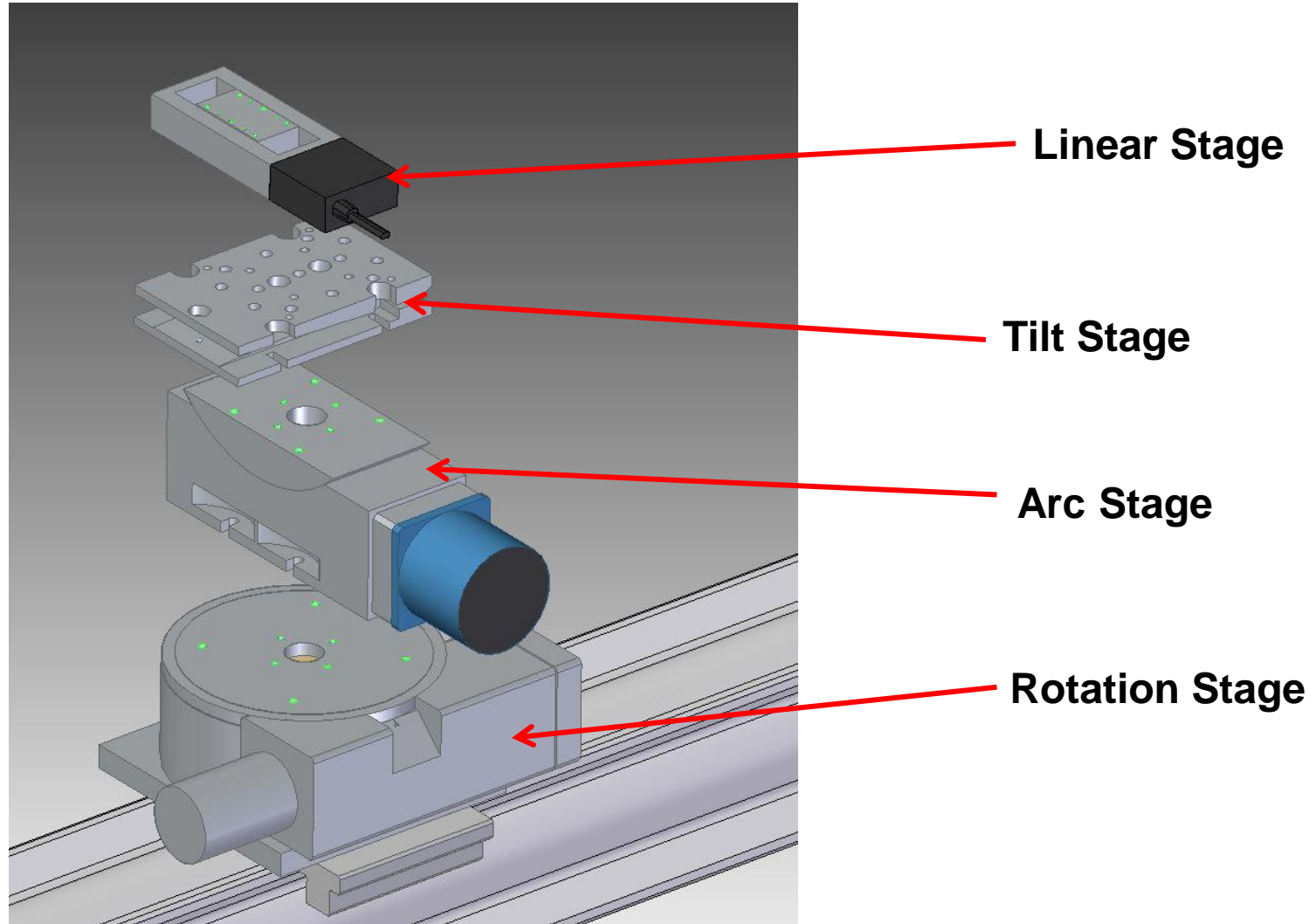
Project 2: Imaging Test Setup



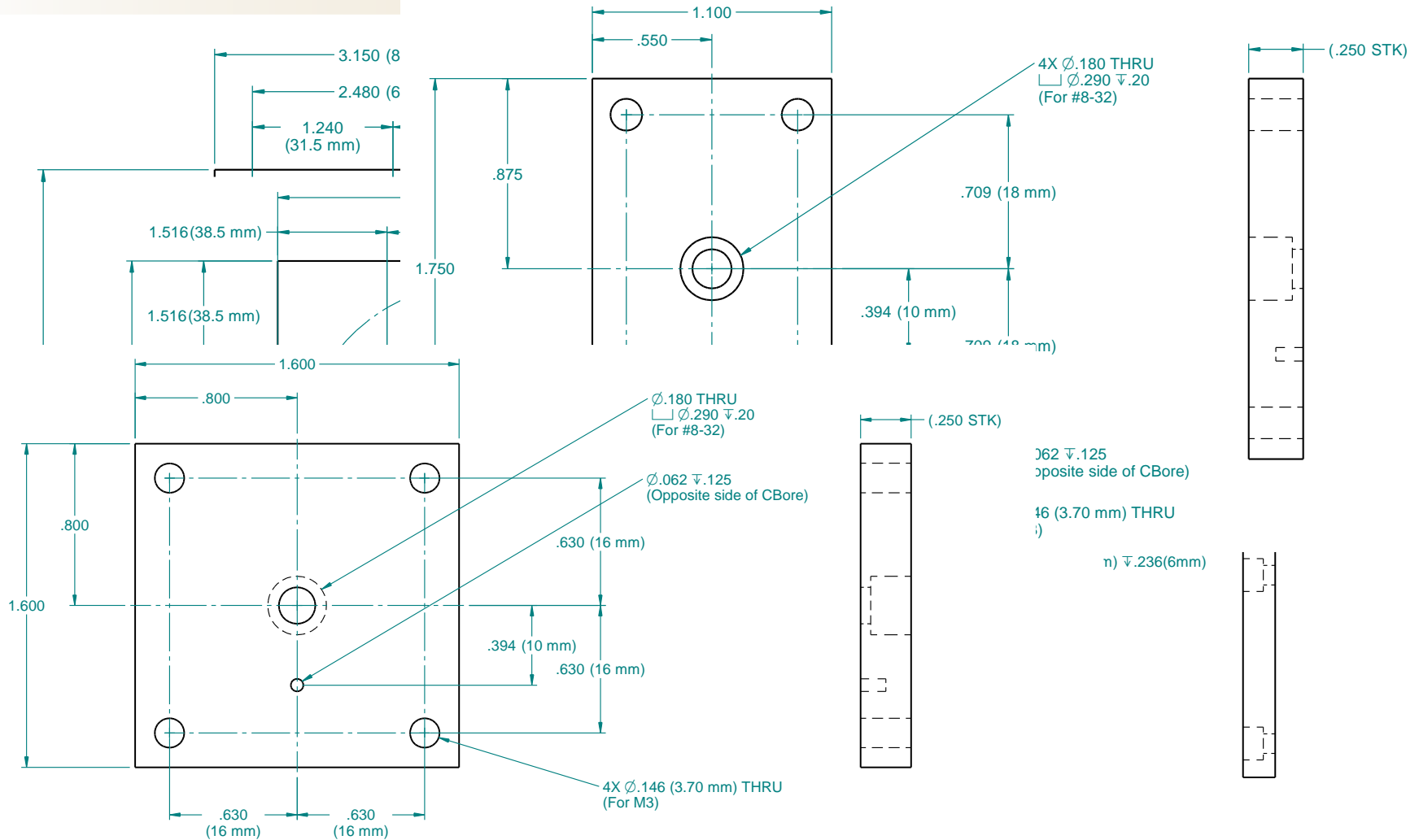
The Goal

- A researcher from Stanford wanted to shine x-rays through a series of three diffraction gratings
- Investigate a method of x-ray imaging called phase-contrast imaging (PCI) that offers improved soft-tissue contrast.
- The positioning of the gratings had to be **extremely precise**.

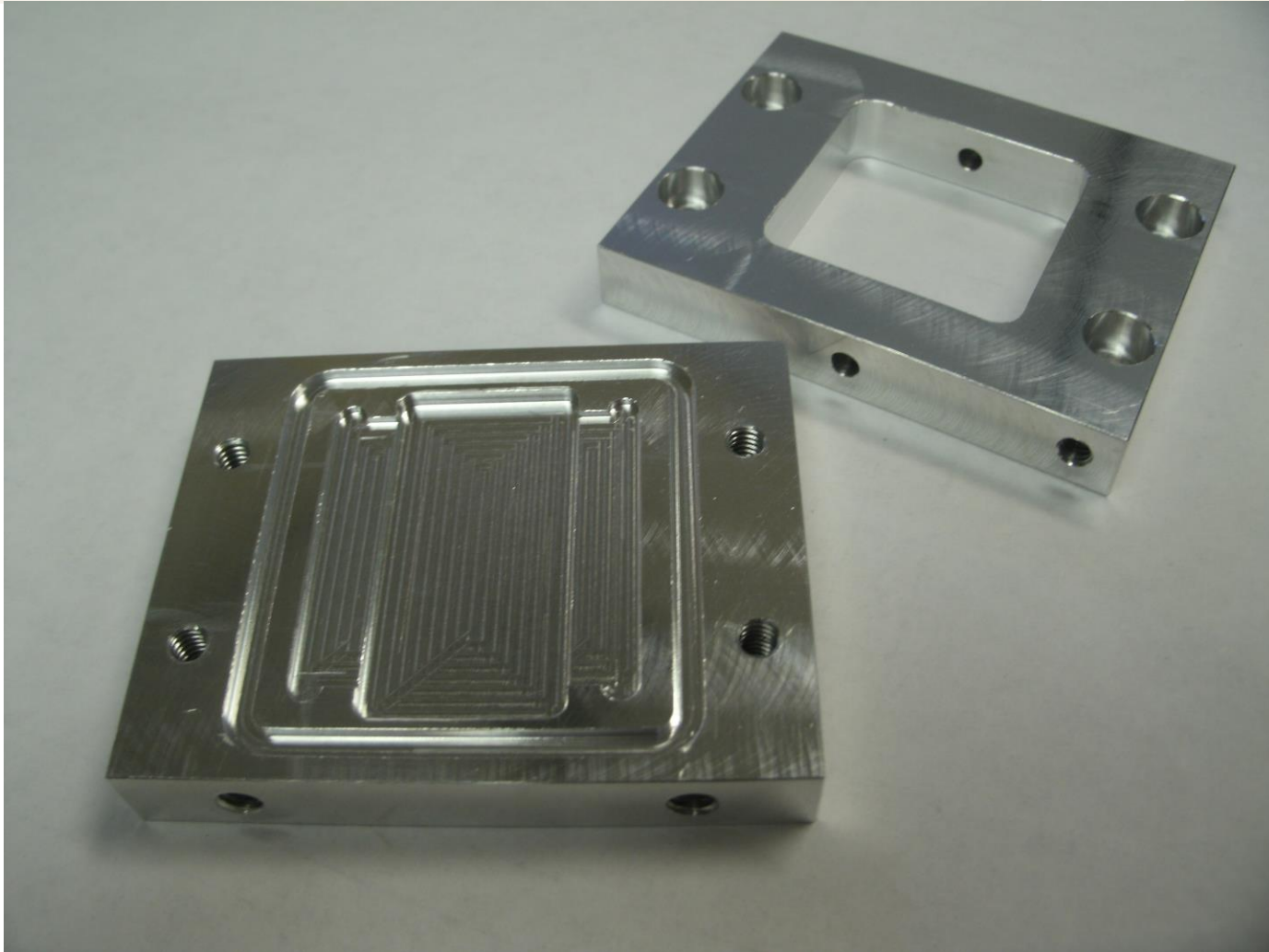
The Positioning Stages



The Plates...



Grating Holder





This block shows the leftmost motorized stage. It consists of a silver metal base with a blue motor mounted on top. A vertical probe is attached to the motor's shaft. The motor has a label with technical specifications. A black cable is connected to the motor's control system. The stage is mounted on a white aluminum rail.

This block shows the middle motorized stage. It is similar in design to the others, with a silver metal base and a blue motor. A vertical probe is also present. The motor has a label with technical specifications. A black cable is connected to the motor's control system. The stage is mounted on a white aluminum rail.

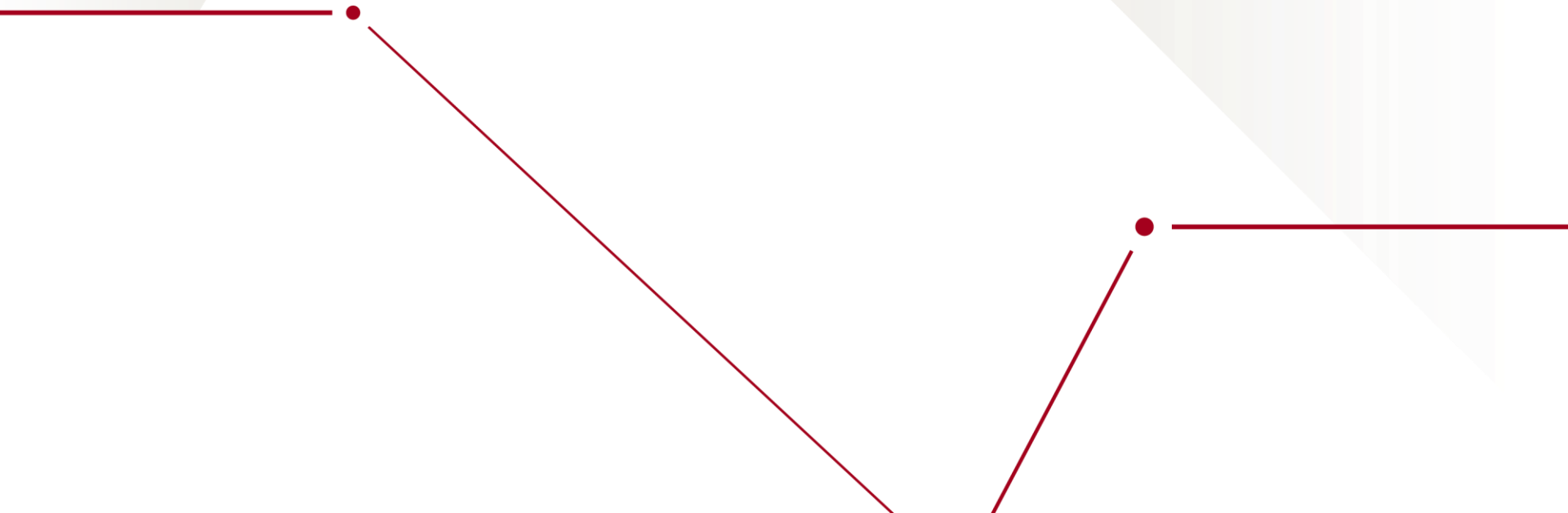
This block shows the rightmost motorized stage. It is similar in design to the others, with a silver metal base and a blue motor. A vertical probe is also present. The motor has a label with technical specifications. A black cable is connected to the motor's control system. The stage is mounted on a white aluminum rail.



SPEC Computer Control



Project 3: 3D-Printed Pencil Holder



MakerBot Replicator Z18



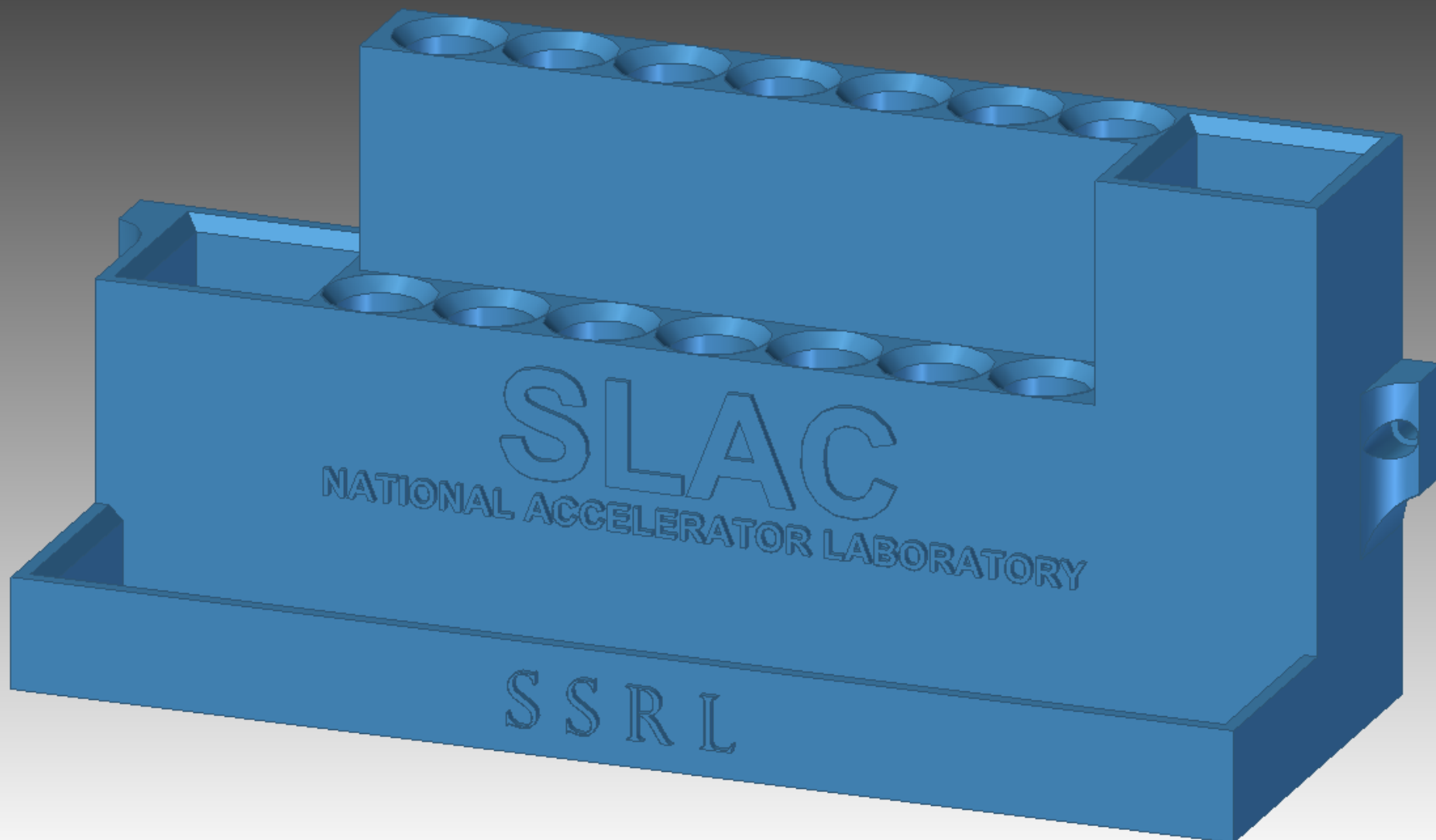
The Problem



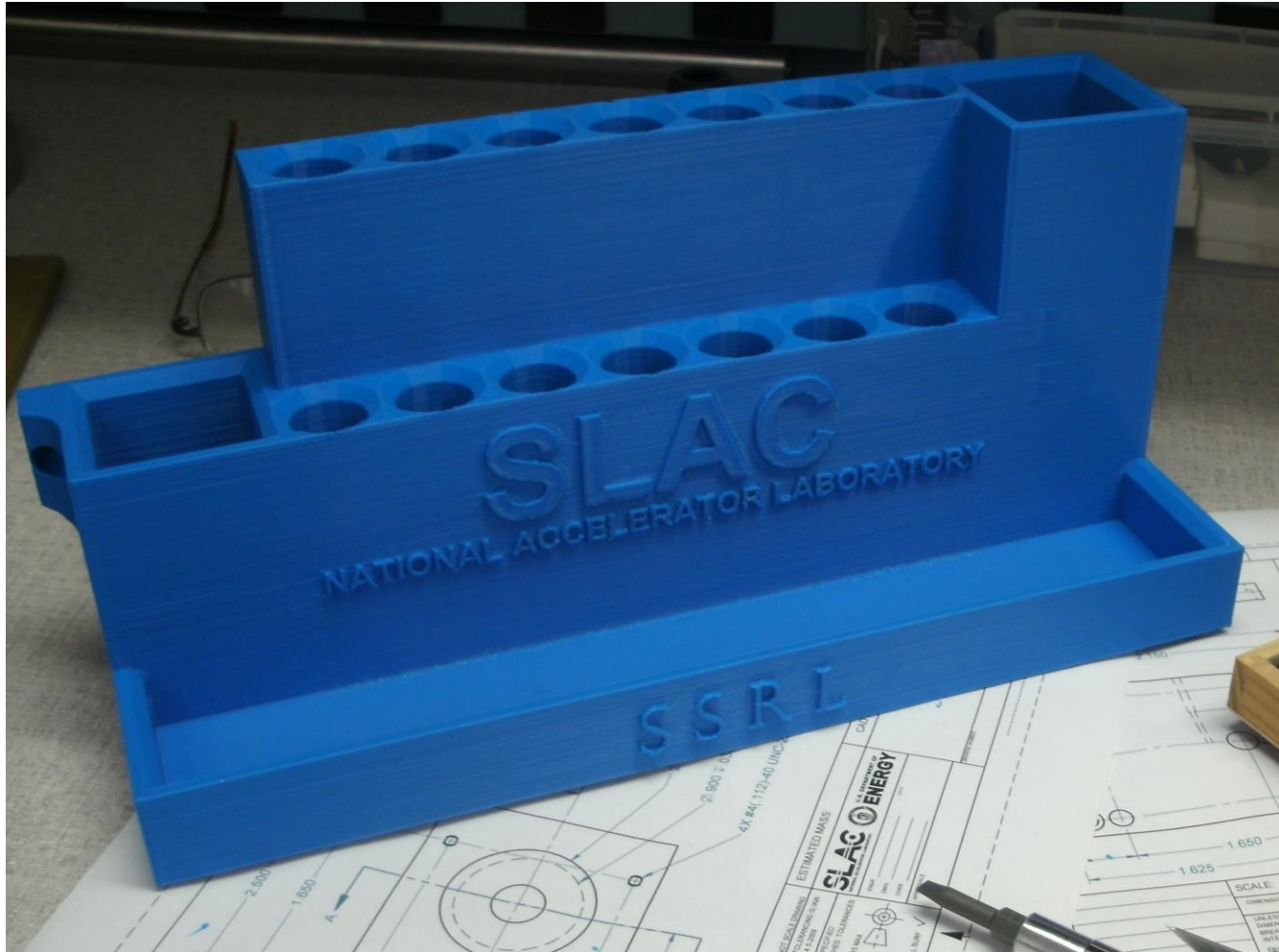
The Previous Solution



The Design



The Result



Acknowledgments

- Doug Van Campen
- Enrique Cuellar
- Samuil Belopolskiy, Valery Borzenets, Dave Day, Tim Dunn, Chunlei Li



Questions?

