

# The Development of an Apparatus to Test the Performance of Superconducting Tapes in a Cryocooled Environment

## Project Goals:

- Obtain an operational cryocooler
- Test its capabilities
- Design a sample holding unit
- Use the device to test the stability and propagation of normal zones of YBCO samples in a cryocooled environment

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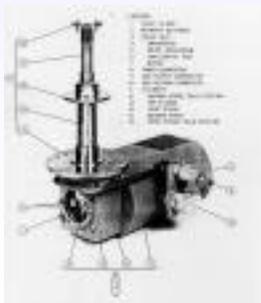
## Major Tasks:

- Test all the cryocoolers we had for operation
- Characterize the cooler's cooling ability
- Design a sample holding unit that transmits heat to the cold head well, while minimizing heat load from external sources
- Perform YBCO testing

## The Cryocooler-

### Testing the coolers:

- 4 Cryocoolers had been obtained by the staff at the site, each in varying degrees of functionality
- Each was decontaminated and recharged
- Each was then run to determine if it operated correctly
- Problems with each cooler were analyzed, and a working cooler was assembled from the remaining parts



### Characterizing the cooling power:

- After the internals of the sample holder had been worked out, the system was assembled
- The system was cooled to 15K, then the heater element was used to bring the system up to higher temperatures
- The power the cooler could absorb was recorded at each temperature

### What now?

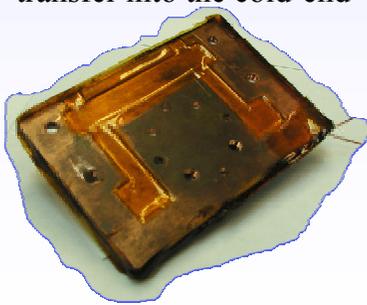
- The cooler will be used for future studies where quick cool-down and ease of use are important
- The cooler will then be shipped to Florida where it will be used by NASA labs as part of a DOE-NASA partnership

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## The Sample Holder/Testing Unit-

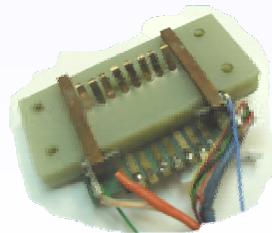
### Requirements for the holder:

- It must hold the sample in such a way that contraction of components won't cause loss of contact with the leads
- It must protect the sample from accidental damage
- It must minimize heat transfer into the system
- It must maximize heat transfer into the cold-end



### How we accomplished this:

- Spring clips were used for voltage contacts
- The voltage assembly covers the sample during testing and storage
- Lead sizes were optimized for the current load through them and the length they had to run using the  $I^2L/A$  parameter
- The sample is mounted to a copper plate covered in non electrically conductive yet high thermally conductive tape, which is then mounted with to the cold-end with indium foil as a heat-transfer medium



### Final Words:

- Testing results were unable to be obtained due to time constraints
- Initial tests show the cryocooler to be very effective at low temperatures, making it ideal for a number of applications