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Project: Vanadium Superconducting Heat Switch

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Sponsor: NASA



# Background

- Application: Continuous Adiabatic Demagnetization Refrigerator (CADR)
  - ADR – stores entropy in magnetic moments of paramagnetic substances
  - Continuous ADR (CADR) – multistage ADR. Passes heat through each stage
- One critical component – superconducting heat switch
  - Superconducting metal – very low thermal conductivity at low temperatures. When magnetic field is applied, allows heat to transfer through as normal.
  - Currently made of lead due to availability
  - **High purity vanadium foils** to have **17 times greater** on/off switching ratio than lead
    - Switching ratio: How effective the heat switch acts as a thermal conductor when open vs when closed.
- Increasing switching ratio of heat switch will allow for increased thermodynamic performance of CADR.

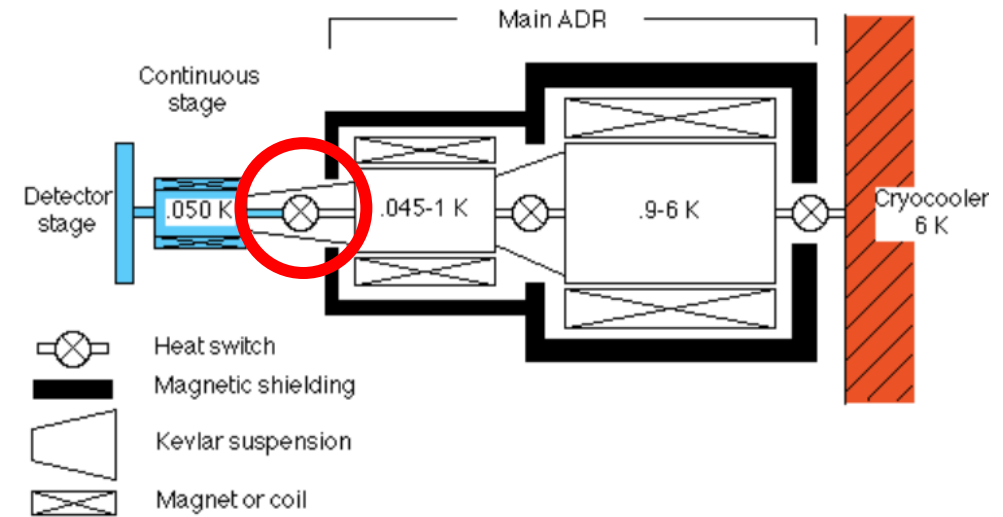


Figure 1: Schematic of CADR highlighting the superconducting heat switch



# Project Goals

- Develop method for purifying vanadium foils
- Use the method to develop test samples
- Measure the thermal conductivity of test samples in on and off states
- Use results to make preliminary designs for heat switch