

# Cryogenic Testing of Heaters and Thermal Cut-off Switches for the GIRMOS detector



<sup>1</sup>Brian Muhwezi-Banyweine, <sup>1</sup>Vladimir Reshetov, <sup>2</sup>Ivan Wevers, <sup>2</sup>Jeffrey Crane, <sup>2</sup>Jenny Atwood, <sup>3</sup>Luc Simard  
<sup>1</sup>NRC-Herzberg



## GIRMOS Overview

- GIRMOS (Gemini Infrared Multi-Object Spectrograph) is intended to be applied to the Gemini North telescope to generate high-resolution, highly-sensitive infrared images of the sky.
- Wide range of science topics from globular clusters, IMBH, transients, star formation, nearby galaxies and distant galaxy evolution [1]

## Objective

- The GIRMOS IMGR Detector requires cryogenic temperatures to minimize background IR
- The heaters and thermal cut-offs switches need to be tested to ensure they function under cryogenic conditions (Table 1)

Conditions	Value
Temperature	70 K [-203.15°C, -333.67°F]
Pressure	4x10 <sup>-5</sup> mBar [3x10 <sup>-5</sup> Torr]
Cut-off Temperature	313.15K [40°C, 104°F]

Table 1: Cryogenic specifications

## Experiment Background

- The heaters allow for the precise control of the temperature of the detector
- The thermal cut-off switches are used as a safety factor to prevent heaters from overheating the detector
- The components will undergo several cycles in the cryostat (Fig 2) to validate their function

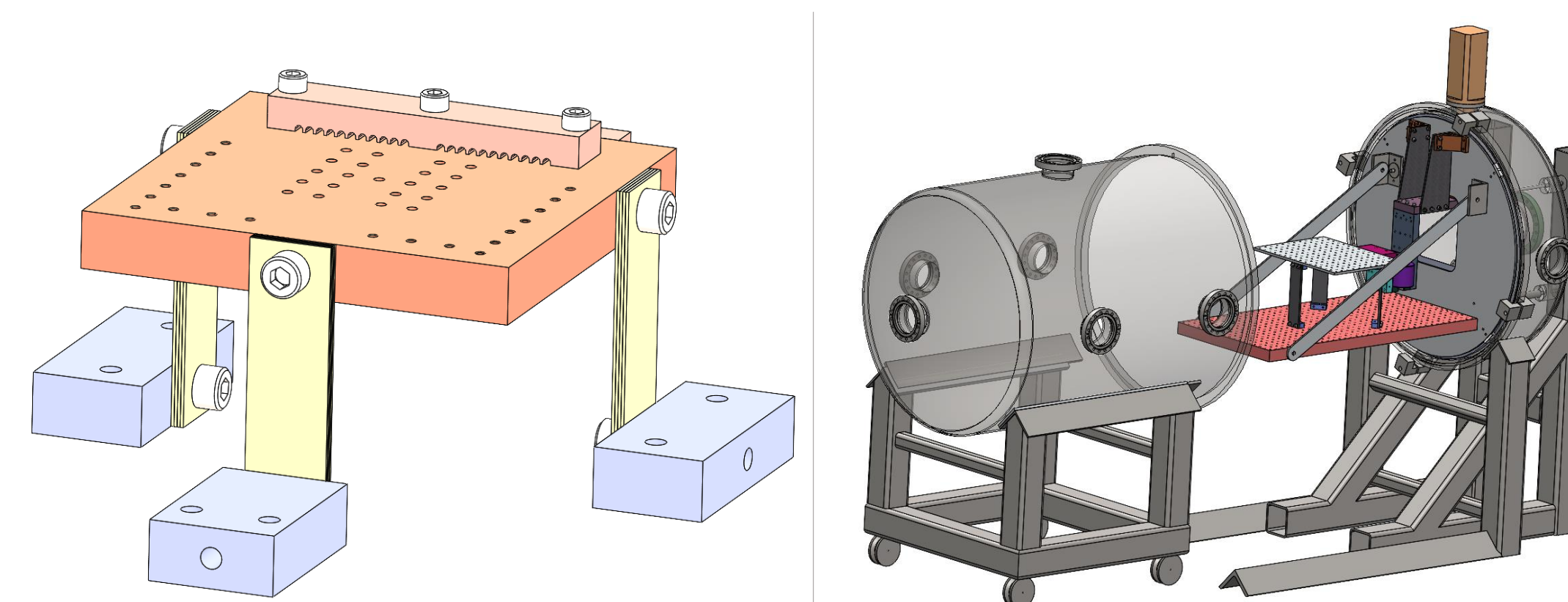


Figure 1: Experiment apparatus assembly Figure 2: Test Cryostat (NRC-Herzberg)

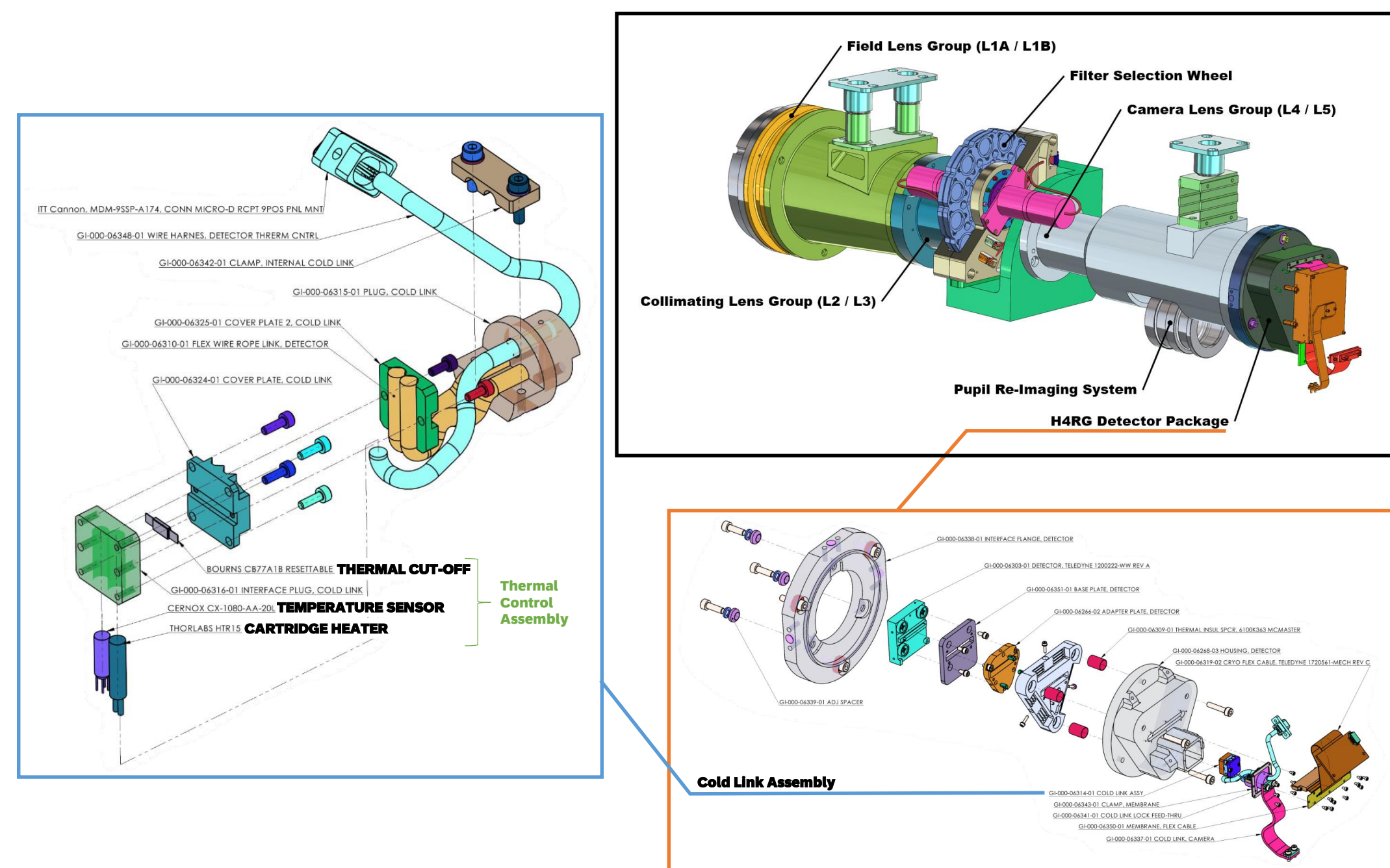


Figure 3: GIRMOS IMGR (Black), Detector Package (Orange) and Thermal Control Assembly (Blue) [2][3]

## Design Points

- To cool the apparatus quickly enough to have an ideal cycling time, several cold links are required to be attached to the copper block (Approx 55 thermal paths ≈ 23 cold links)
- Placement of components on block to allow for easy wiring

## Activities

- Researching components to determine possible means of testing
- Experimental design to validate components function as intended
- CAD of parts necessary to place components in the cryostat for testing (Fig 1)
- FEA Modelling for transient thermal analysis to determine the feasibility of desired cooling time

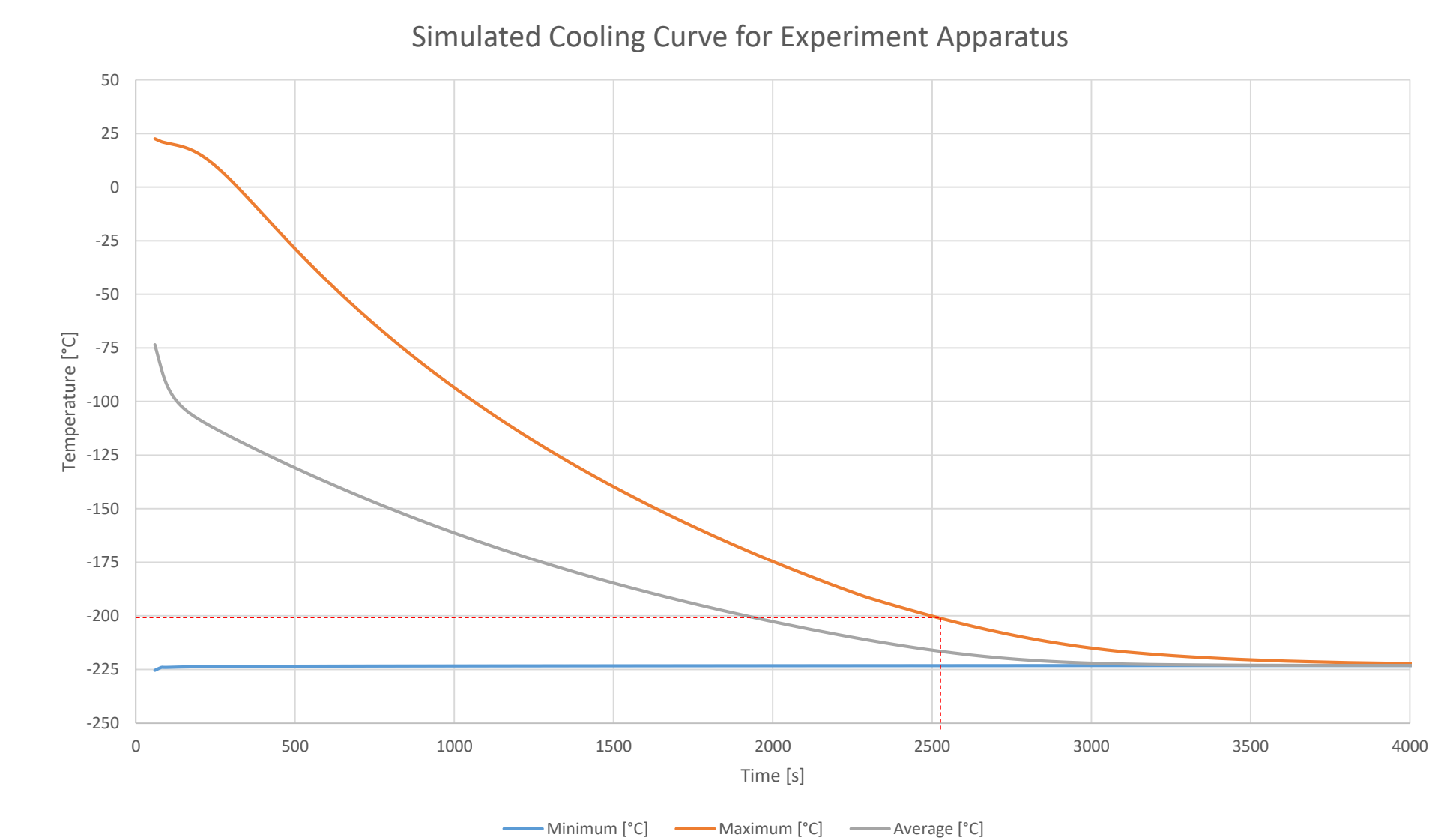


Figure 4: Results of FEA of designed experimental apparatus cooling from ambient temperature

## Areas of Concern

- Should heaters and thermal cut-off switches function as intended, they can be applied in the detector
- If components fail during the experiment, another source will need to be determined or, for the heaters, a different kind (non-cartridge) will need to be considered