

LCLS II Cryomodule Testing at Fermilab

RuthAnn Gregory, Michigan State University, MI, USA

Introduction

LCLS-II is a 2nd generation x-ray free electron laser being constructed at SLAC National Accelerator Laboratory. Fermilab's contributions to LCLS-II include designing, assembling, and testing seventeen 1.3 GHz cryomodules consisting of eight nine-cell superconducting cavities.

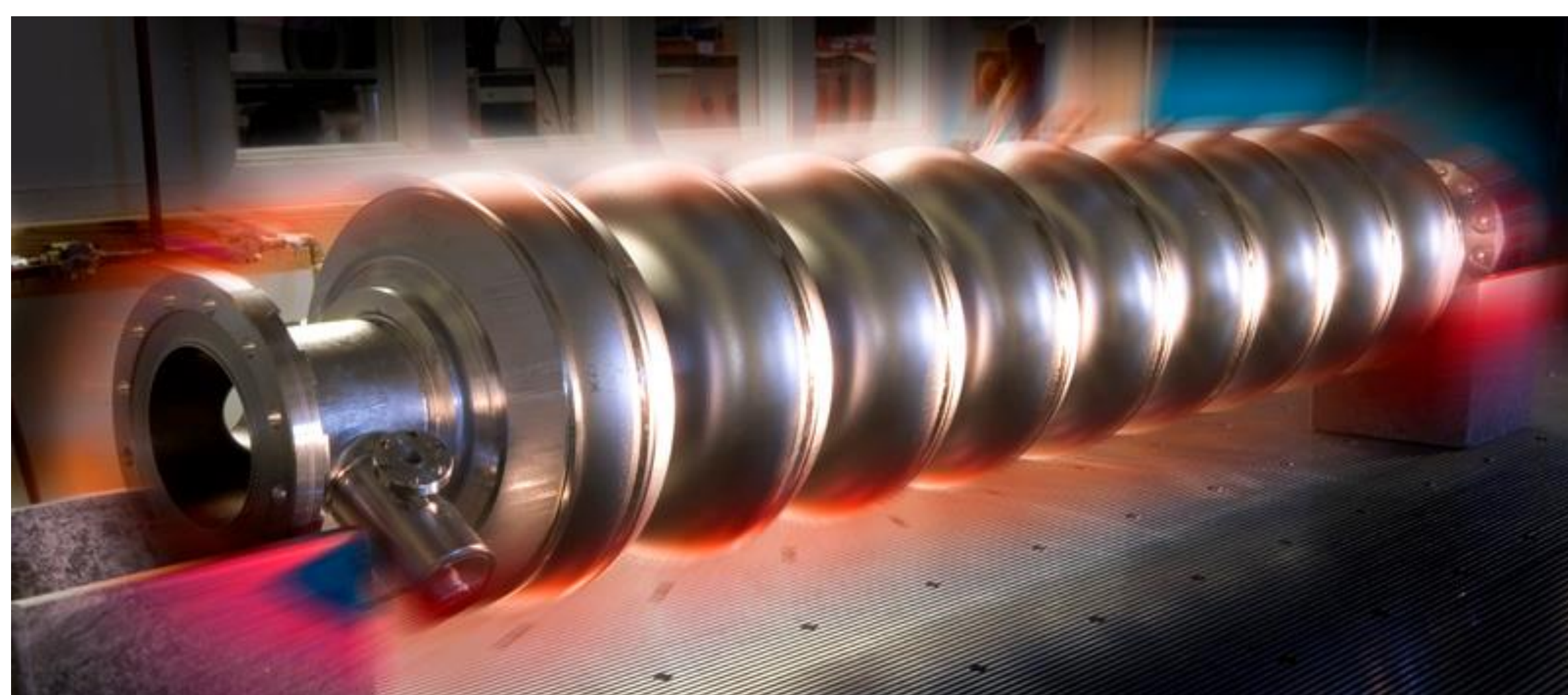


Figure 1. 1.3 GHz Superconducting Radio Frequency (SRF) cavity



Figure 2. An SRF cavity at Fermilab's cryomodule test stand

Motivation for Cryomodule Testing

The cryomodule tests aim to characterize the performance of the cryomodules and their cavities. These tests include:

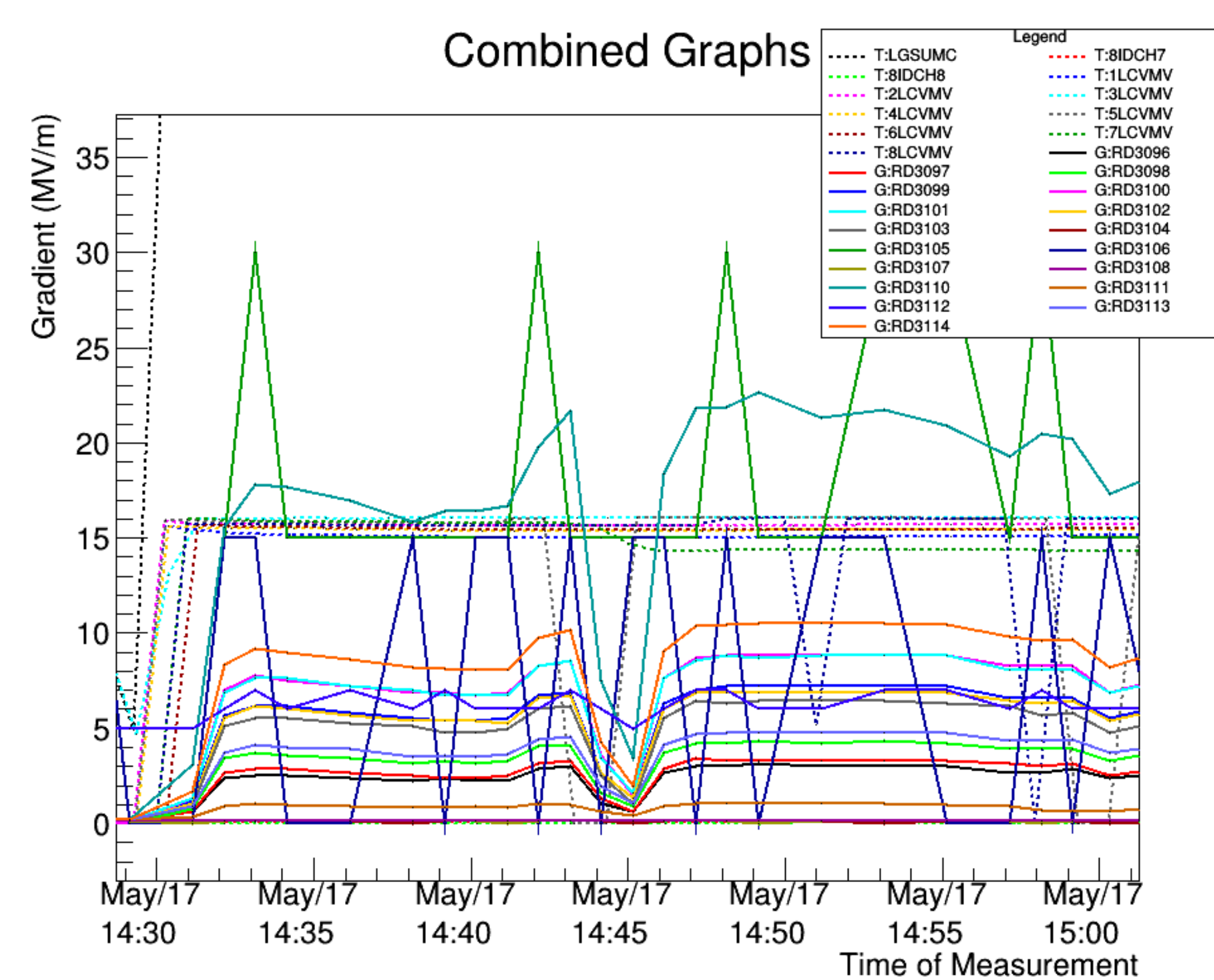
- Assessing which cavities produce dark current.
- Determining which cavity(ies) produce the most radiation and dark current.
- Finding the peak radiation for each cavity.
- Determining the dark current response as a function of cavity gradient.

Analysis Methods

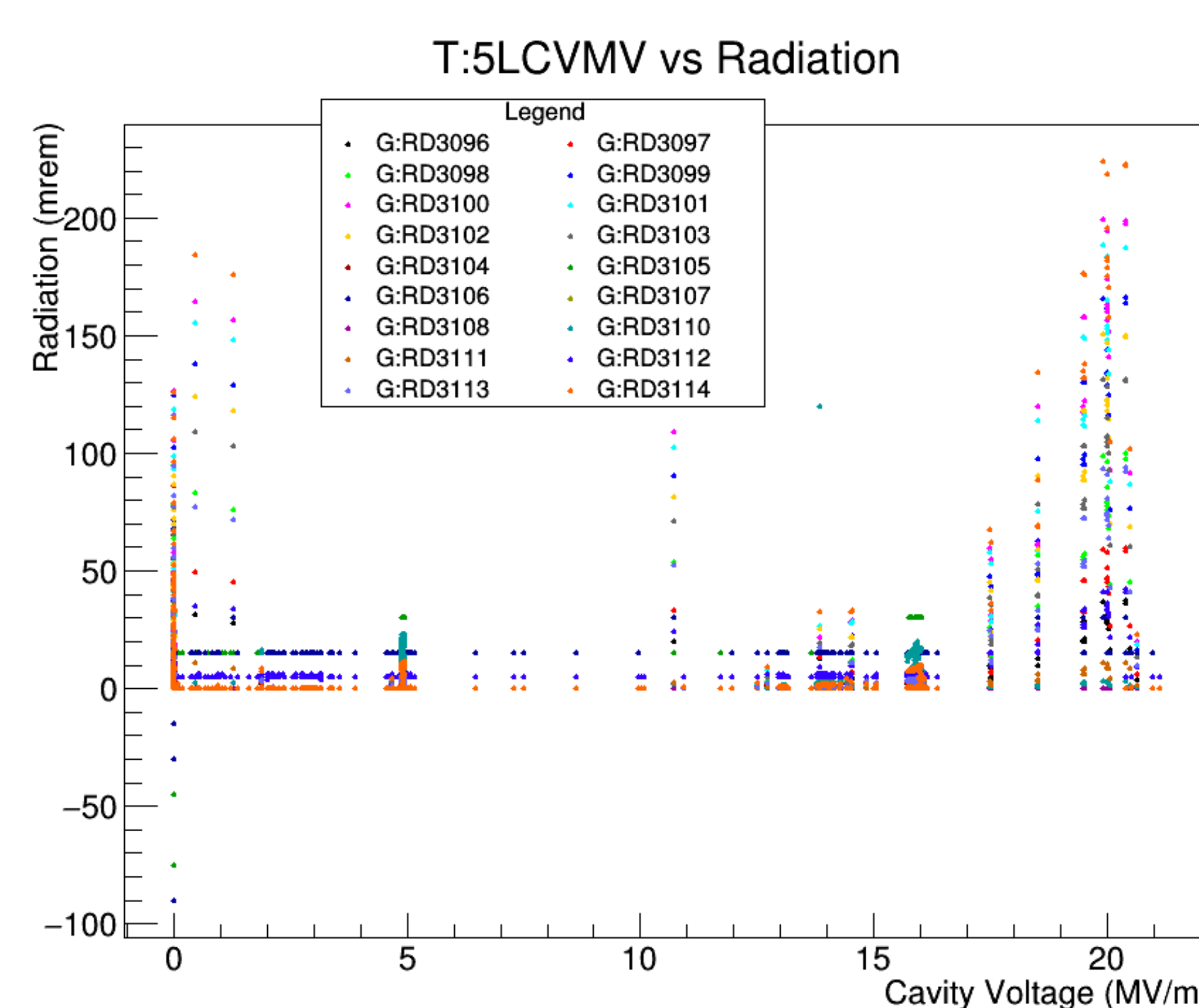
Cryomodule data is gathered and processed using an ACL script and a Root/C++ program which generates:

- Plots of the data from each cavity and radiation detector over time.
- Plots of cavity voltage vs radiation
- Plots of dark current vs cavity voltage
- Peak values for each cavity and radiation detector

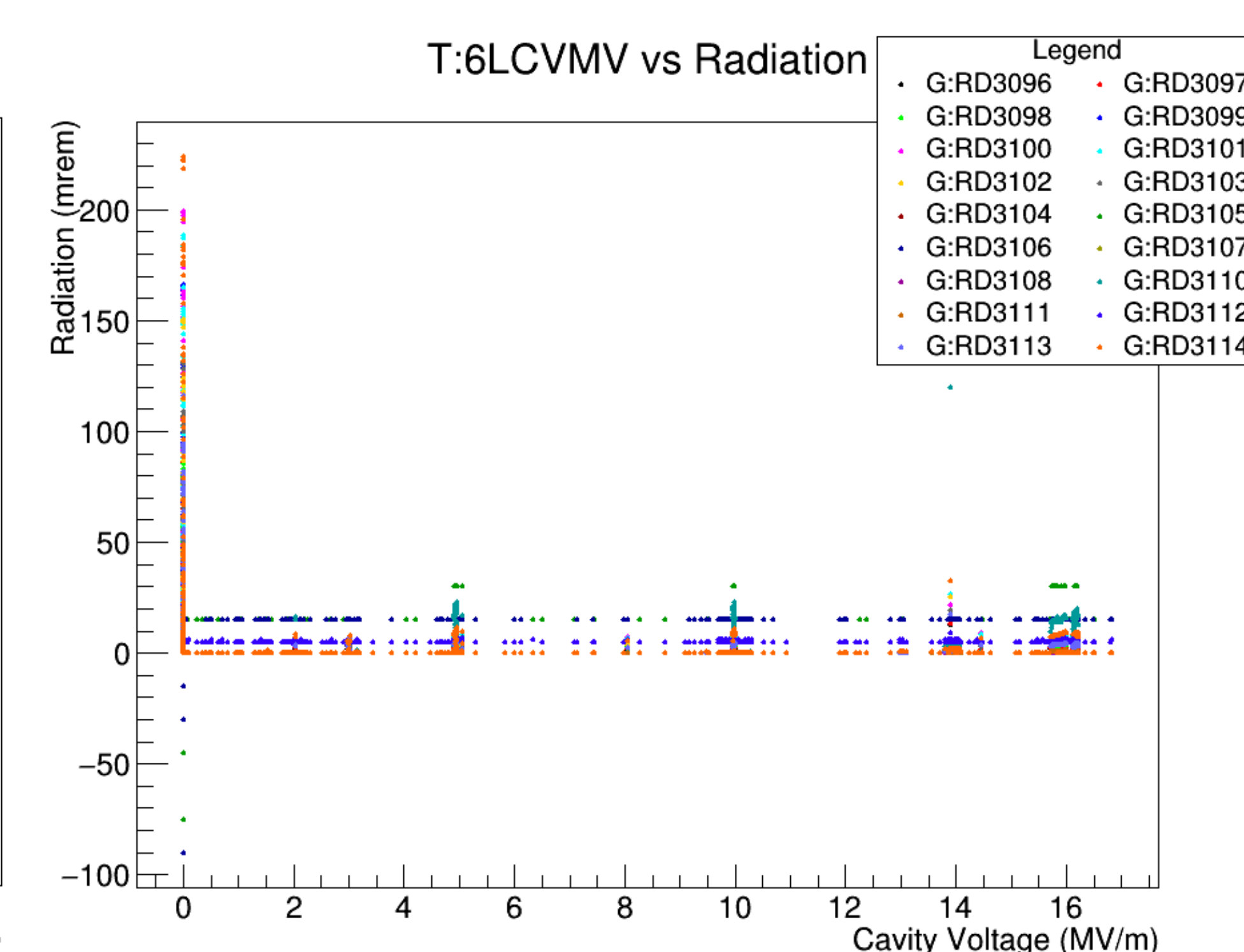
Results



Plot 1. Data from each cavity and radiation detector plotted over time.



Plot 2. Cavity 5 voltage vs radiation levels. This cavity has spikes in radiation levels around 20 MV/m.



Plot 3. Cavity 6 voltage vs radiation levels. This cavity has relatively small radiation levels around 20 MV/m.

Conclusion & Outlook

- Cryomodule data for the travelers can now be obtained relatively easily with the ACL script and Root/C++ program.
- The next step in the analysis will be to determine the gradient (MV/m), for each cavity, where detectable radiation starts to appear.

Acknowledgements

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