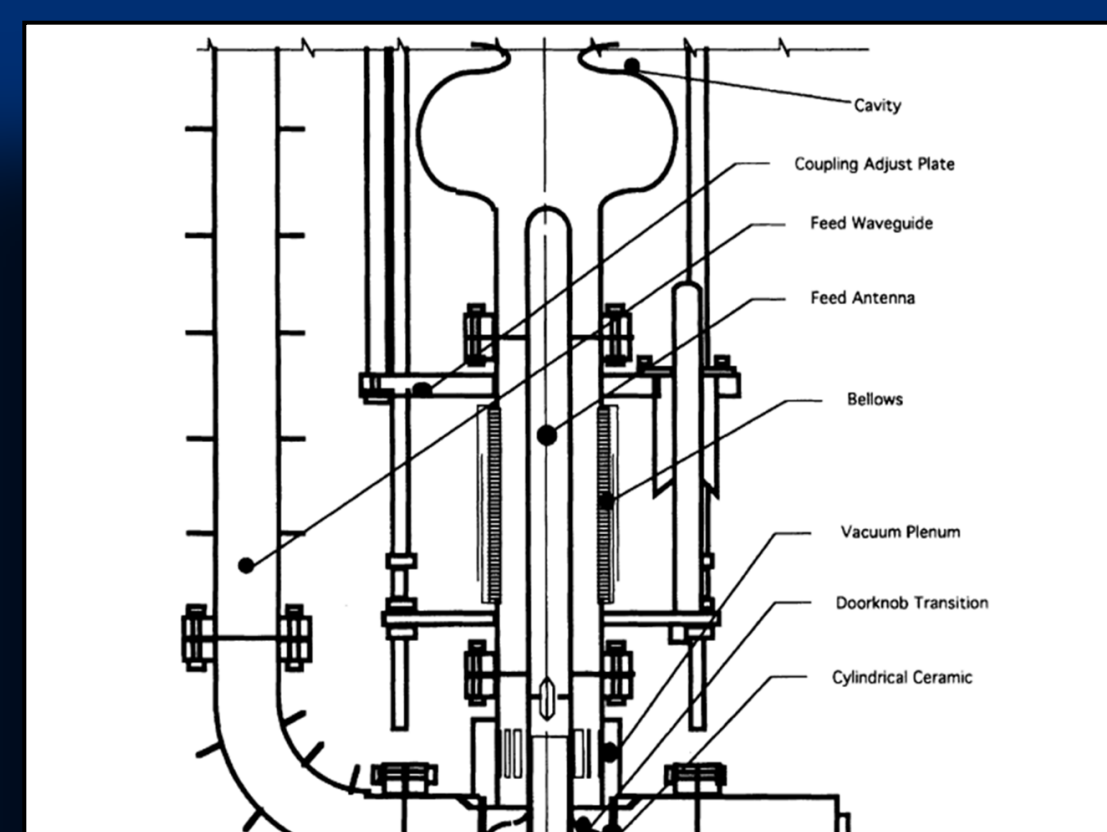


Summer Research for Community College Students – 2011

Development of RF Cavity Testing Software

Importance of Optimizing Cavity Testing Software: During the testing of an RF cavity different field strengths are excited within the cavity. This is done by connecting the cavity to a RF power source. The power is carried to the input coupler via a coaxial cable. The strength of the field is adjusted by adjusting power being driven to the cavity. The testing of a RF cavity requires avid attention be paid to power levels being driven to and from the cavity, as well as various RF equipment and electronics. By integrating important measurements into a single program we eliminate the inconveniences involved in routinely checking different instruments and devices. This in turn allows us to focus on the actual testing of the cavity instead of the maintenance of it.



Intent: To develop a program able to continuously display liquid Helium levels, Radiation levels, as well as cavity temperatures. To efficiently and conveniently localize the processes involved within a cavity test into a single program. To create a Graphical User Interface able to provide regular plots of Q vs. E measurements.

Graphical User Interface (GUI)

The GUI was created using Matlab's GUI editor (guide). The interface consists of three small graphs as well as one larger graph. It contains a User Control Panel that allows the user to take various measurements.

An image created by "Gary Tonge (Urantia Foundation)" was edited using Adobe Photoshop to create a background for the interface.

The finished Graphic User Interface is capable of plotting measurements of Quality versus E.field. It also continuously updates and displays liquid Helium levels, Radiation levels, and Cavity temperatures.



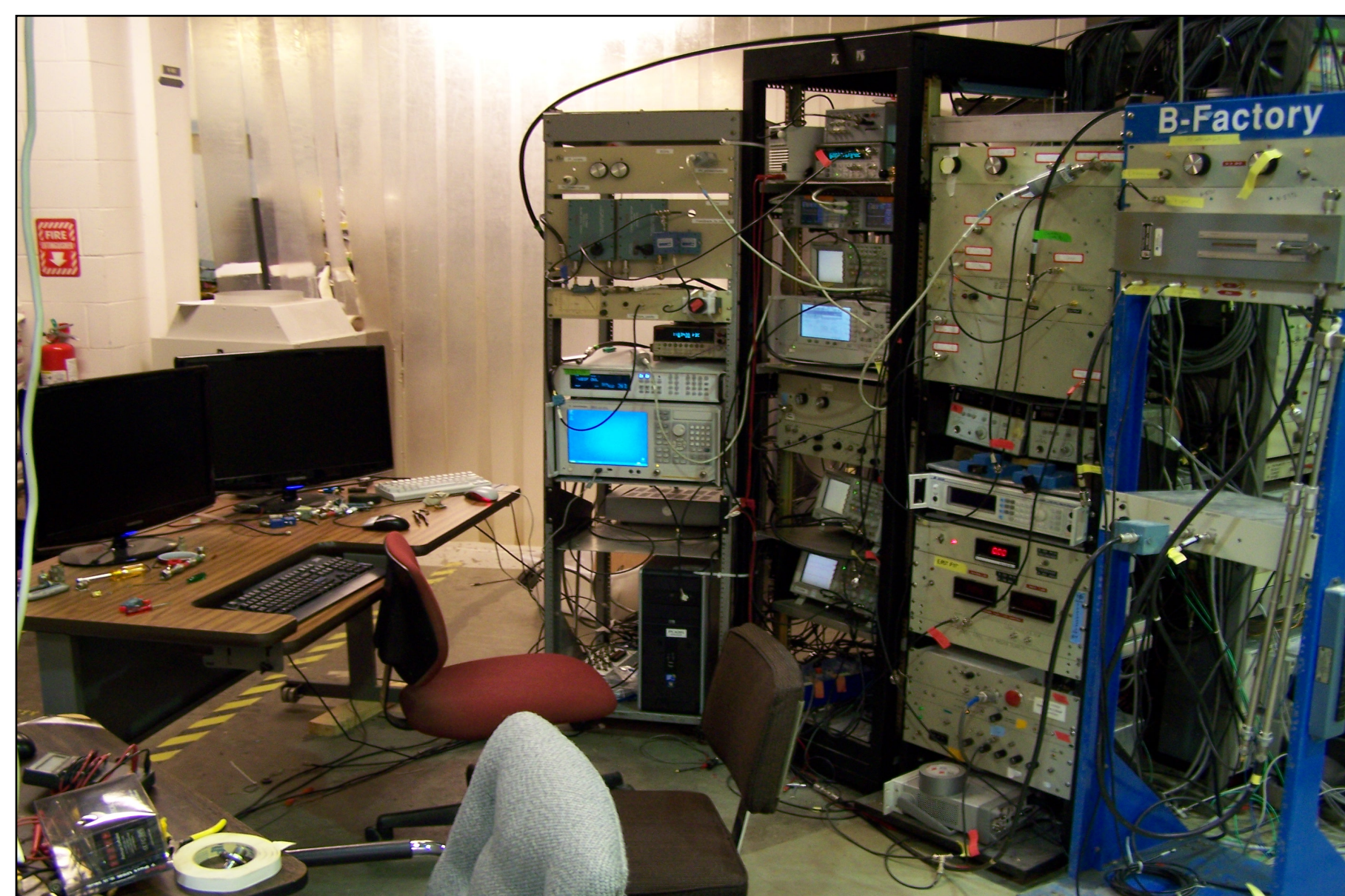
Connecting the Helium level monitor to the data acquisition card (daq card)

Monitoring Temperature:
Niobium cavities remain in a superconducting state only below the critical temperature of 9K. If the cavity temperature is increased beyond this critical temperature the cavity will "quench" and transition to a state of normal conductivity. Also the surface resistance of the cavity is strongly dependent on the temperature and therefore makes the temperature important in evaluating a cavity's performance

Monitoring Liquid Helium:
During a RF cavity test the RF cavity sits within a Dewar and is surrounded by liquid Helium. Liquid Helium has a boiling point roughly equal to 4K however it has a Lambda point of around 2K. (The Lambda point is the point at which liquid Helium transitions to superfluid Helium). The heat conducted throughout the Dewar as well as the heat created from the fields within the cavity causes the liquid Helium to boil off.

Monitoring Radiation:
 μm size defects within the cavity emit electrons in high E-fields. These electrons are then accelerated by the fields within the cavity and collide with the cavity wall. These collision cause more electron emissions and potential X-rays.

Measuring Q versus E:
When we are testing RF cavities we are testing their performance under varying field strengths. Therefore to evaluate a cavity's performance, we measure the Quality factor of the cavity as a function of the cavity's field level.



Cavity Testing Control Area