

Development of Control Systems for the DC Electron Gun



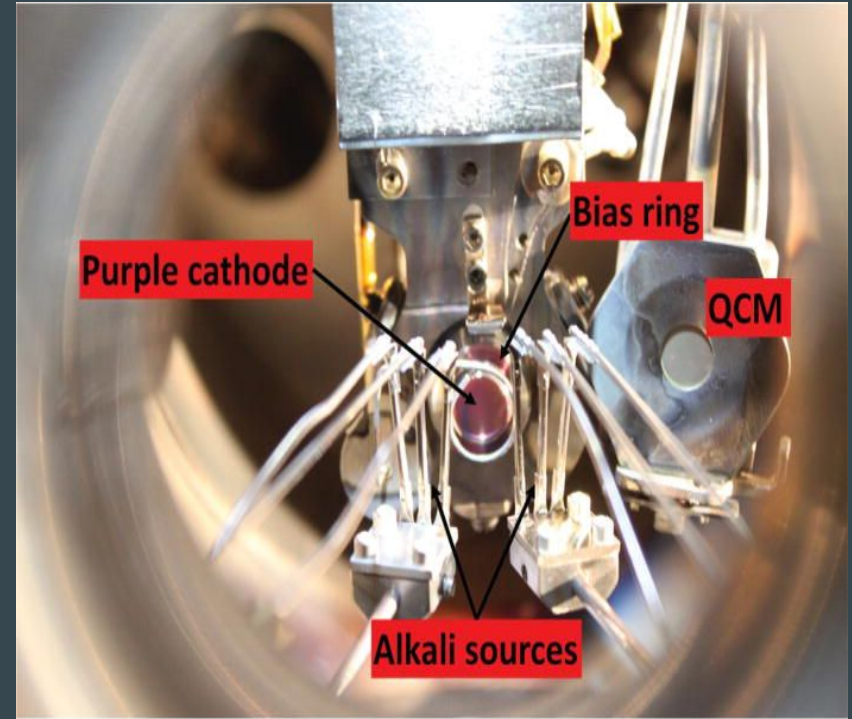
Arizona State University, Summer 2022
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Photocathodes Research

The goal is to demonstrate how novel photocathode materials can be used to produce brighter electron beams.

Novel photocathodes have not been tested in a high voltage accelerator.

200kV Cryocooled DC Electron gun to demonstrate use of these materials..





Liquid helium tank

1000
cryogun

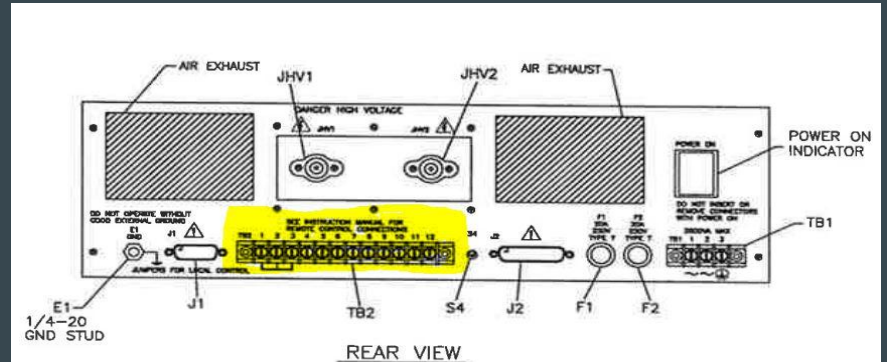
GeV
was
here

High
voltage
power
supply

High Voltage Power Supply

The Glassman HVPS :

- Cockcroft-Walton Multiplier Stack
- Maximum output voltage 250kV
- Reference voltage 10V
- Maximum output current: 8.0mA



High Voltage Conditioning

The process of **slowly increasing** the DC gun voltage to its maximum output voltage, often to a state of **breakdown** causing the DC gun to trip. Each attempt allows for an increase in voltage.

Breakdown is caused by field emissions.

High voltages to test special photocathode materials at high electric fields.

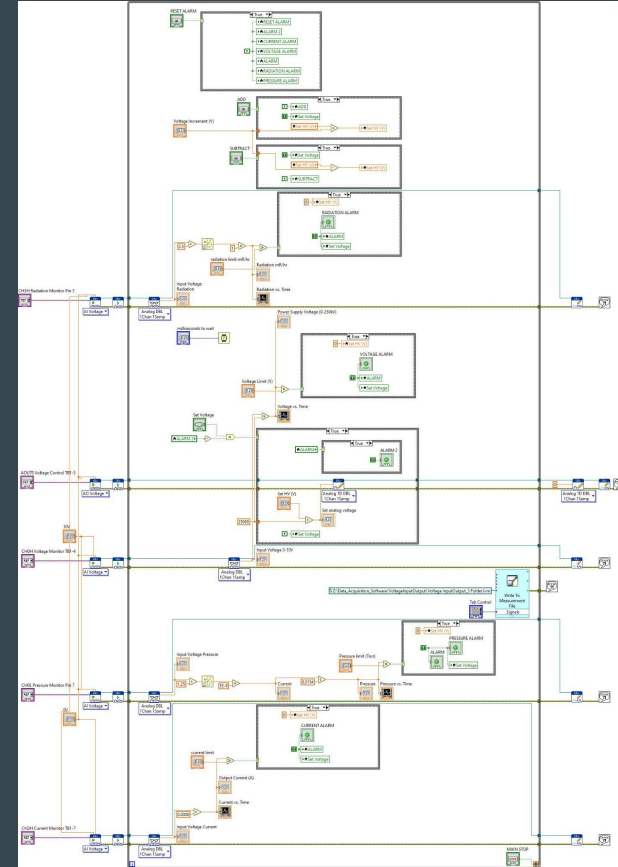
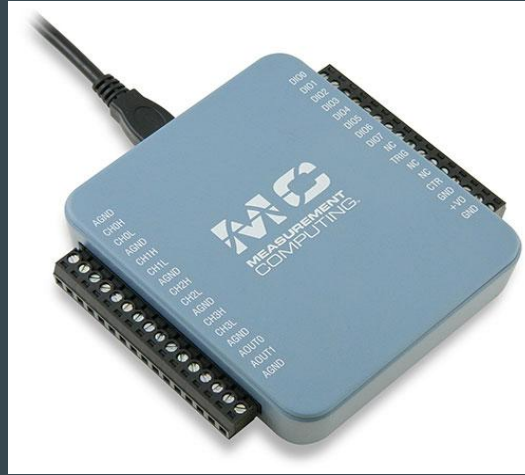
Ion Pumps and Area Monitor

Along with monitoring the HVPS voltage, it is also useful to have a measure of current, pressure, and radiation. The power supply for the ion pumps provides a current which can then be converted into a local pressure by using a conversion rate of 200A/Torr.

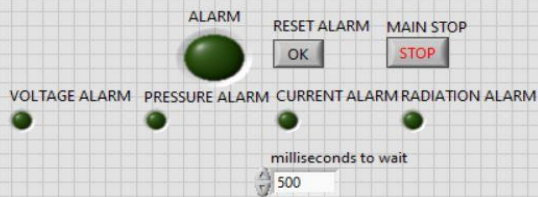
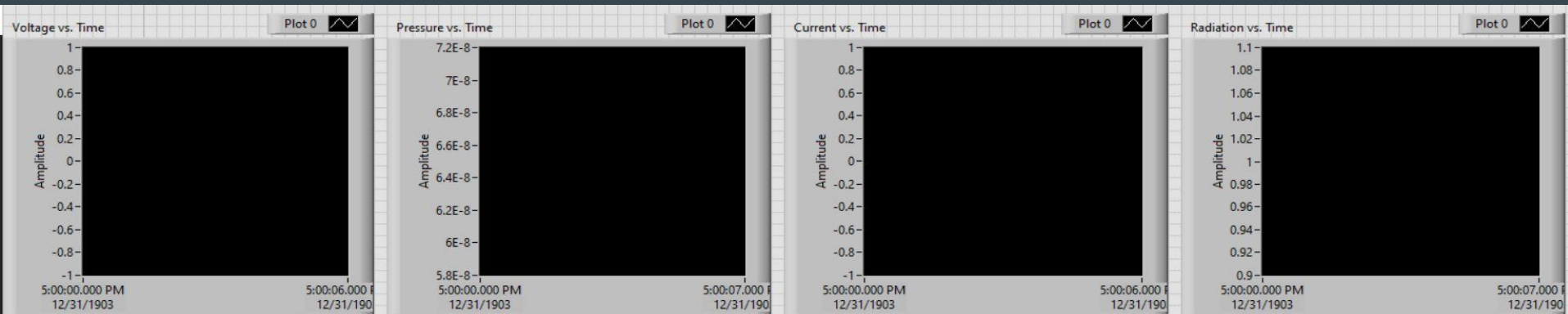
The area monitor, which monitors radiation, gives a five-decade logarithmic voltage output that then can be converted to radiation.

LABVIEW and USB-231

LABVIEW was the data acquisition software used to develop the control systems for the high voltage power supply, ion pumps, and area monitor.



LABVIEW and USB-231



The control panel is titled 'Voltage' and contains the following settings:

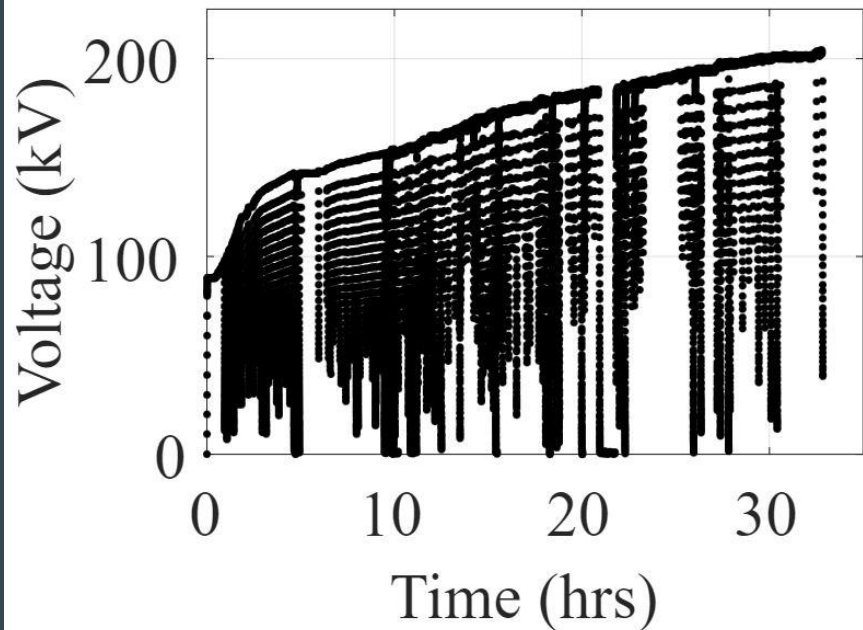
- CH0H Voltage Monitor TB1-4:** Includes a dropdown menu for 'Dev0/Ai0', a '10V' label, and a numeric input field set to '10'.
- Set Voltage:** A green indicator light.
- Set HV (V):** A numeric input field set to '0'.
- AOUT0 Voltage Control TB1-5:** Includes a dropdown menu for 'Dev0/Ao0', a '0V' label, and a numeric input field set to '0'.
- Voltage Increment (V):** A numeric input field set to '0'.
- Input Voltage 0-10V:** A numeric input field set to '0.00000'.
- Power Supply Voltage (0-250kV):** A numeric input field set to '0'.
- ADD (+) SUBTRACT (-):** Two buttons for voltage adjustment.
- Voltage Limit (V):** A numeric input field set to '250000'.
- Set analog voltage:** A numeric input field set to '0'.

Controls

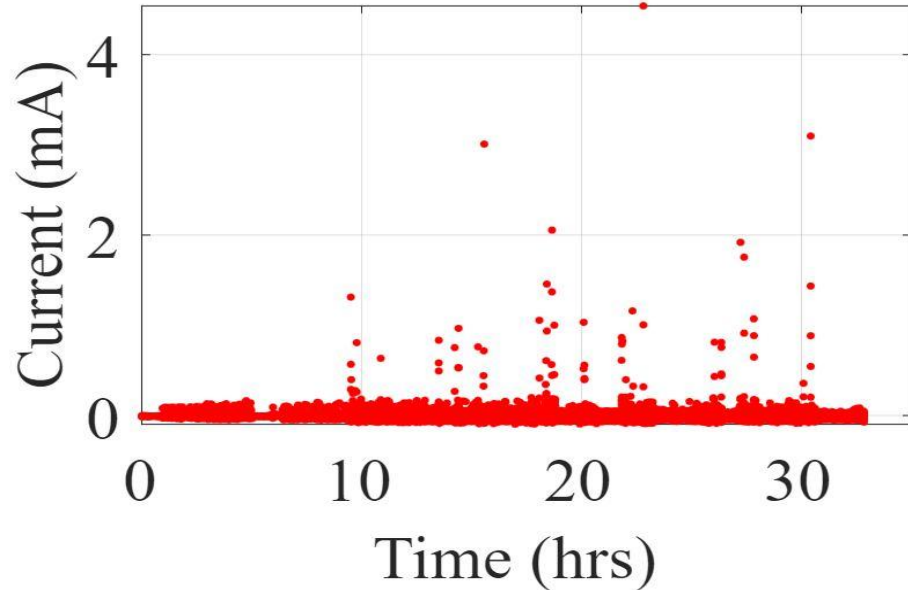
- It is possible to manually set the increments used to increase the voltage.
- The limits for voltage, current, pressure, and radiation can be manually set.
- If above limit, all values are forced back down to zero.

Results

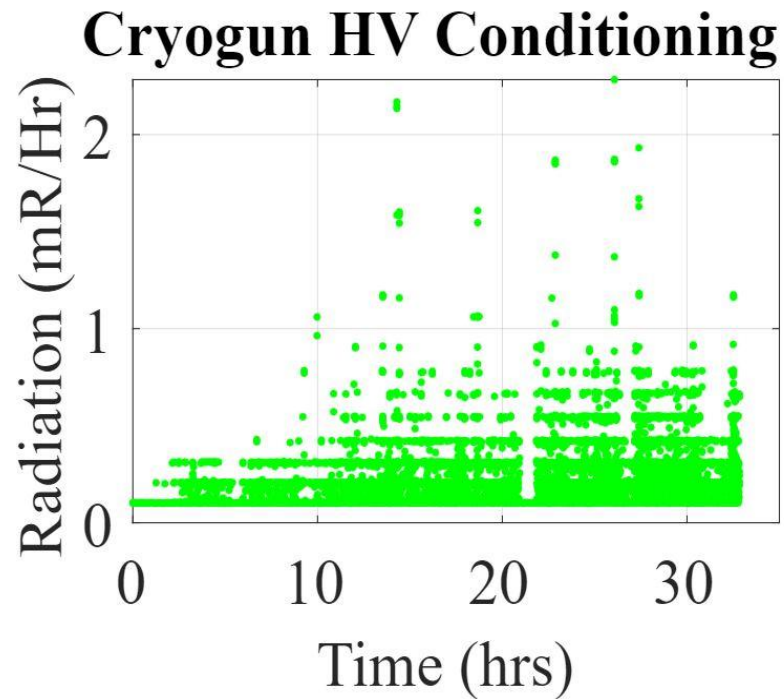
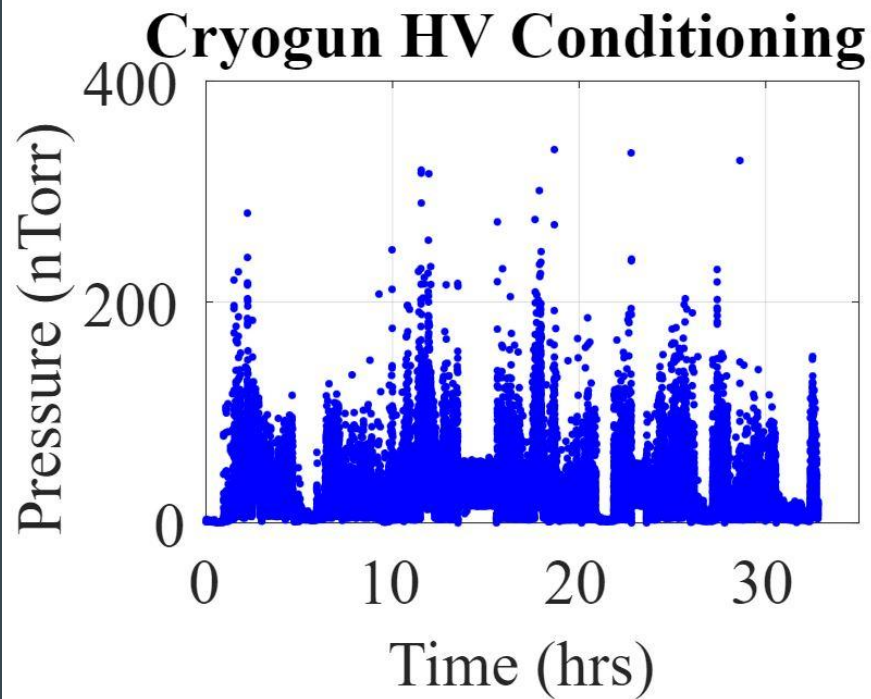
Cryogun HV Conditioning



Cryogun HV Conditioning



Results



Results

Successful in getting to our goal voltage of 200kV