

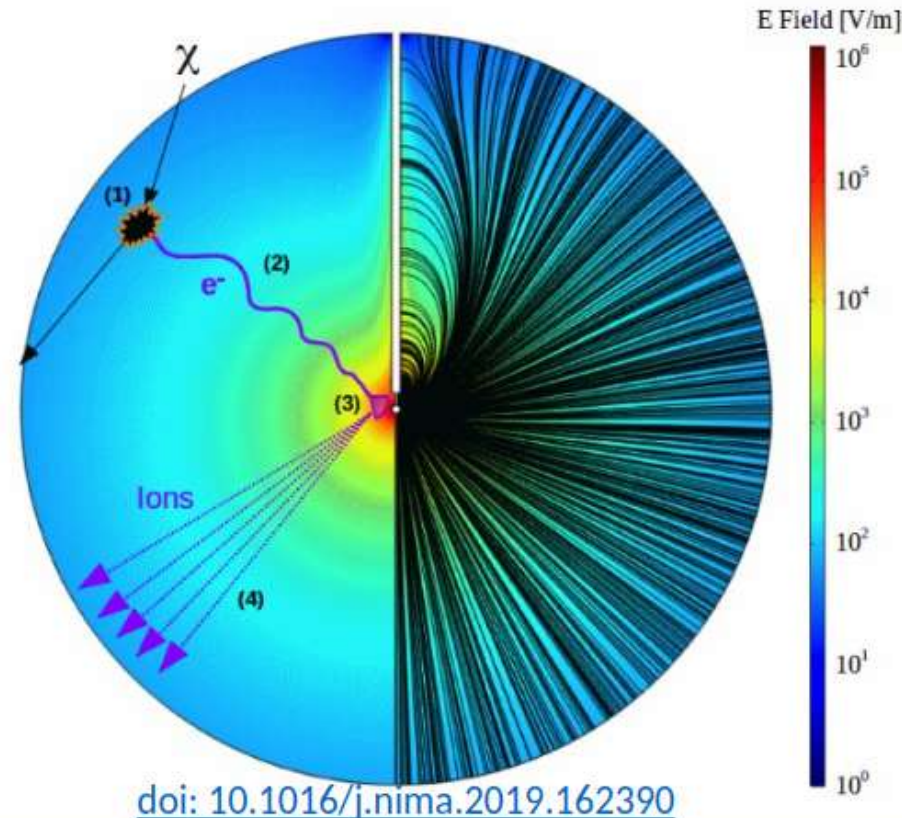


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# SPC lab

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1. Nuclear or electronic recoil causes ionization of the gas.
2. Primary electrons drift towards the central anode.
3. Townsend avalanche near the anode amplifies the signal.
4. Drifting secondary ions induce a current on the anode.





# Detector Kit



- Detector
    - Sphere
    - Rod assembly
    - Anode
  - Electronics
    - Preamplifier
    - HV power supply
    - Digitizer (Red Pitaya)
  - Gas
    - Gas cylinder (argon)
    - Flowmeter
    - Tubing
    - Bubbler
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# Choose configuration

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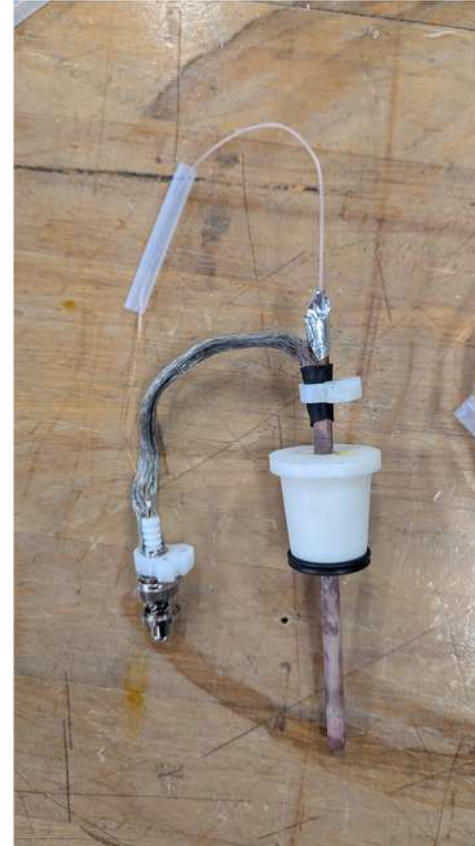
- Umbrella
    - Glass or Bakelite
  - Anode
    - 1mm or 0.4mm
  - Sphere
    - Flask or bottle
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# Rod assembly

For the bottle

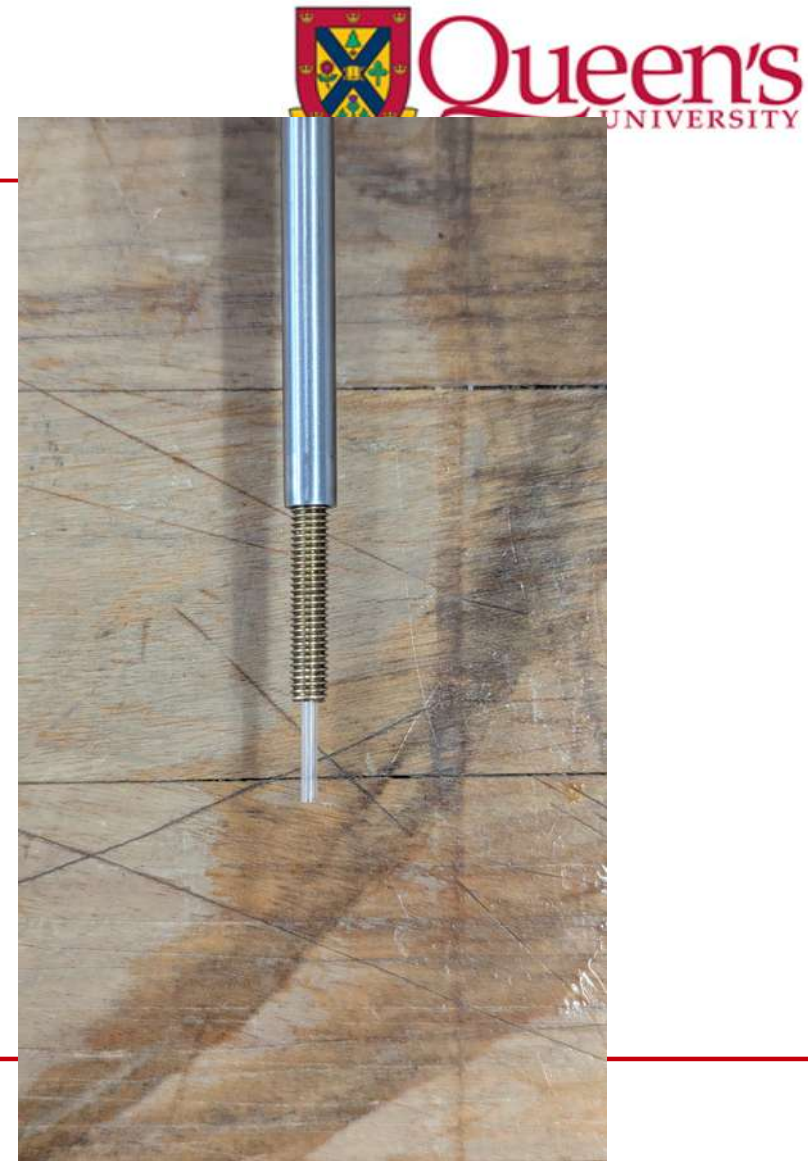


For the flask



# Attach umbrella

- Screw the umbrella into the rod
- Secure with metal tape if necessary (if loose)
- The umbrella is a resistive electrode to correct the electric field and allow uniform amplification
- Resistive enough to quench discharges, conductive enough not to charge up



# Insert PTFE sleeve

- Use PTFE sleeve long enough to go through the rod
- Protects the wire from sharp edges



# Attach umbrella

- Screw the umbrella into the rod
- Secure with metal tape if necessary (if loose)



# Adjust anode

- PTFE sleeve fully inside the umbrella
- Anode ball at a distance of about 1.5x its diameter





# Solder the wire to the SHV connector



- Melt and remove the insulating enamel at the end of the wire using a soldering iron
- Solder the wire into the solder cup of the SHV connector
- Include a PTFE sleeve to cover the exposed part of the wire (HV safety)
- Heat shrink can be used to secure the pieces in position





# Connect the grounding



- Connect the grounding braid to the ground of the SHV connector
  - Insert the rod assembly in the sphere
  - Put a copper mesh around the sphere (Faraday cage)
  - Connect the grounds together (alligator clips)
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# Connect the gas

- Connect the gas tube into the cap
- Seal as much as you can
- Connect the input to the regulator on the gas cylinder
  - Include a way to insert the thorite source
- Connect the output to a bubbler
- Flow gas at  $\sim 1\text{L}/\text{min}$





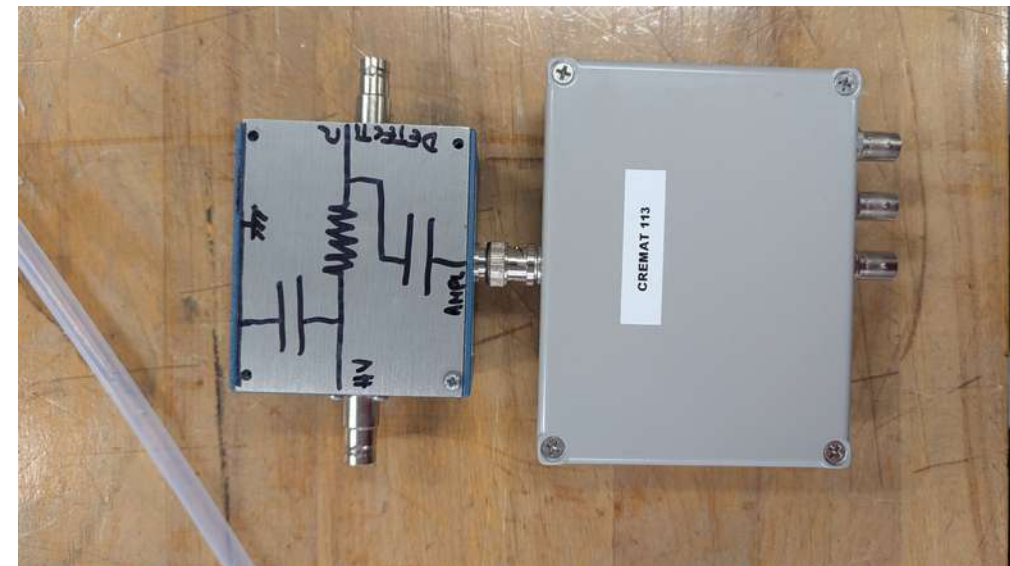
# Connect the HV



- Connect the HV decoupling box to the detector and the HV power supply
  - Increase voltage until you see a spark, or reach 2500V
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# Connect the DAQ

- Ramp down HV to 0V
- Connect the preamp to the HV decoupling box
- Connect the Preamp to the digitizer (Red Pitaya)





# Ramp up HV

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- Open the oscilloscope app on the RP
  - Put the thorite source in the gas system
  - Ramp up HV, staying safely below the highest voltage reached in the previous step
    - Stop when you see pulses
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The detector is working





# Have fun



- Check that the rate changes when you put/remove the source
  - Measure a spectrum from the source using the MCA
  - Measure the effect of changing the voltage
  - Measure the effect of changing the distance from the umbrella to the anode
  - Or any interesting thing you want to try
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