

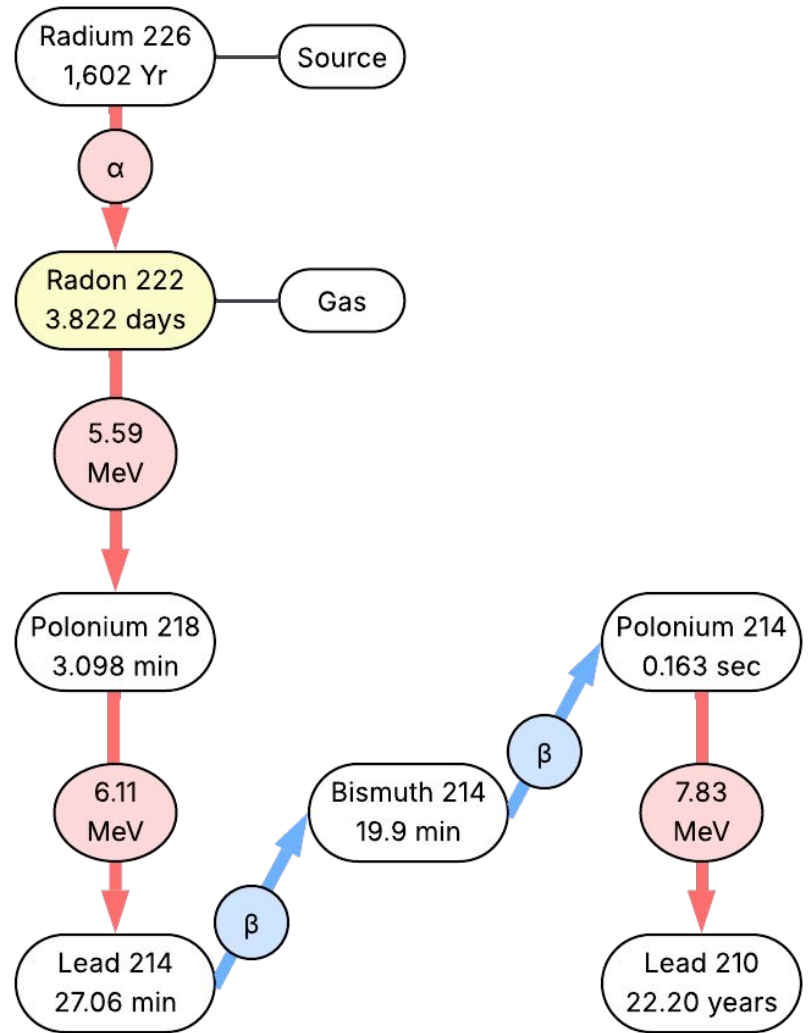
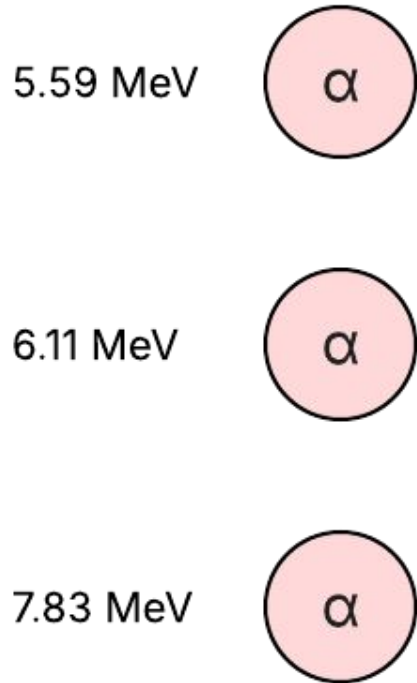
04/17/2026

# Alpha Decay in Spherical Proportional Counters

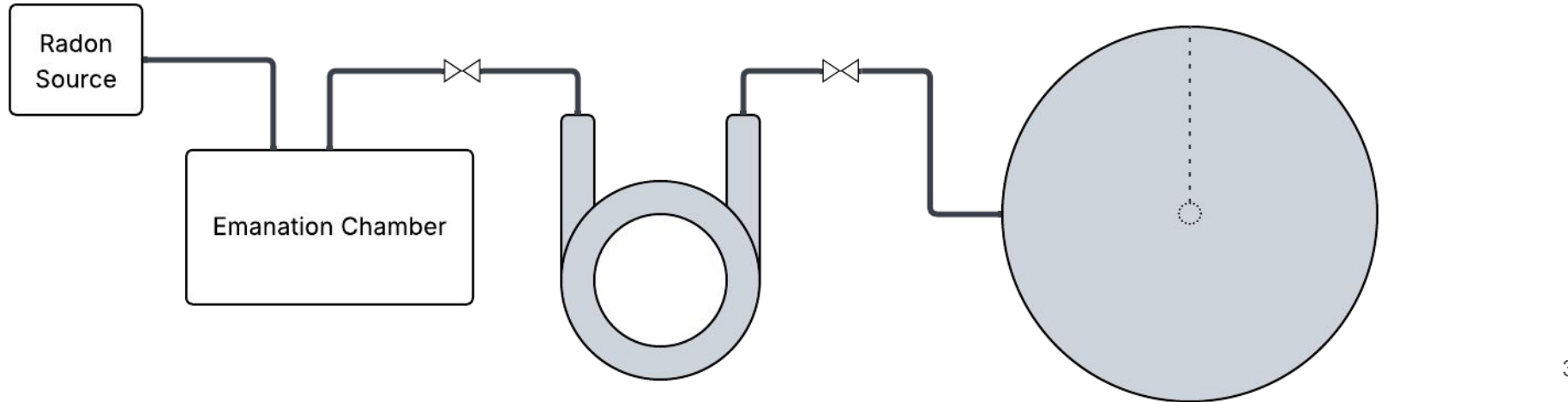
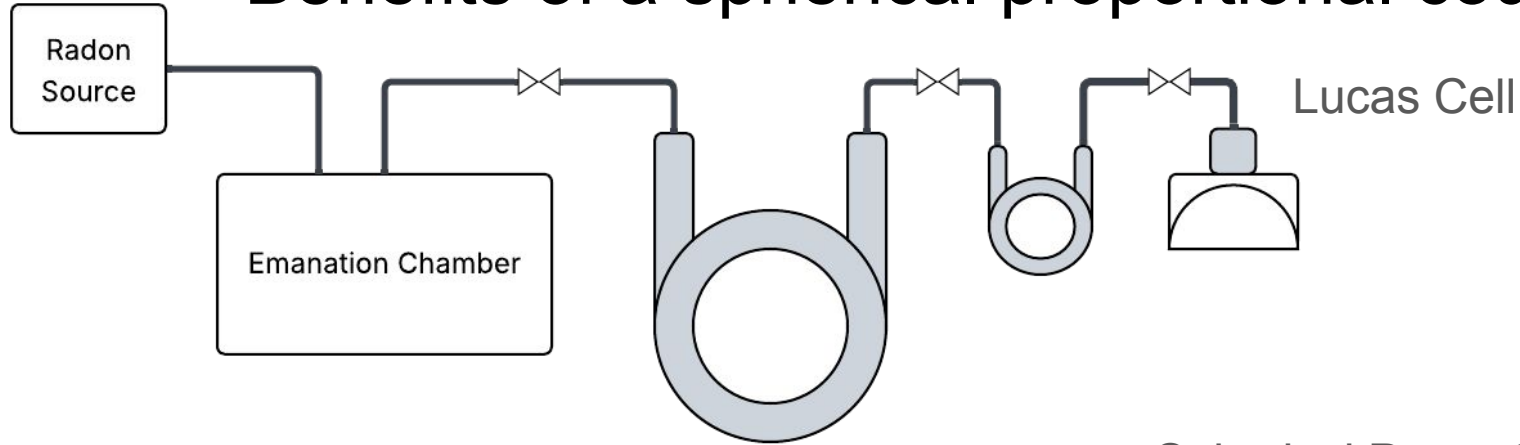
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Alyssa Sanden

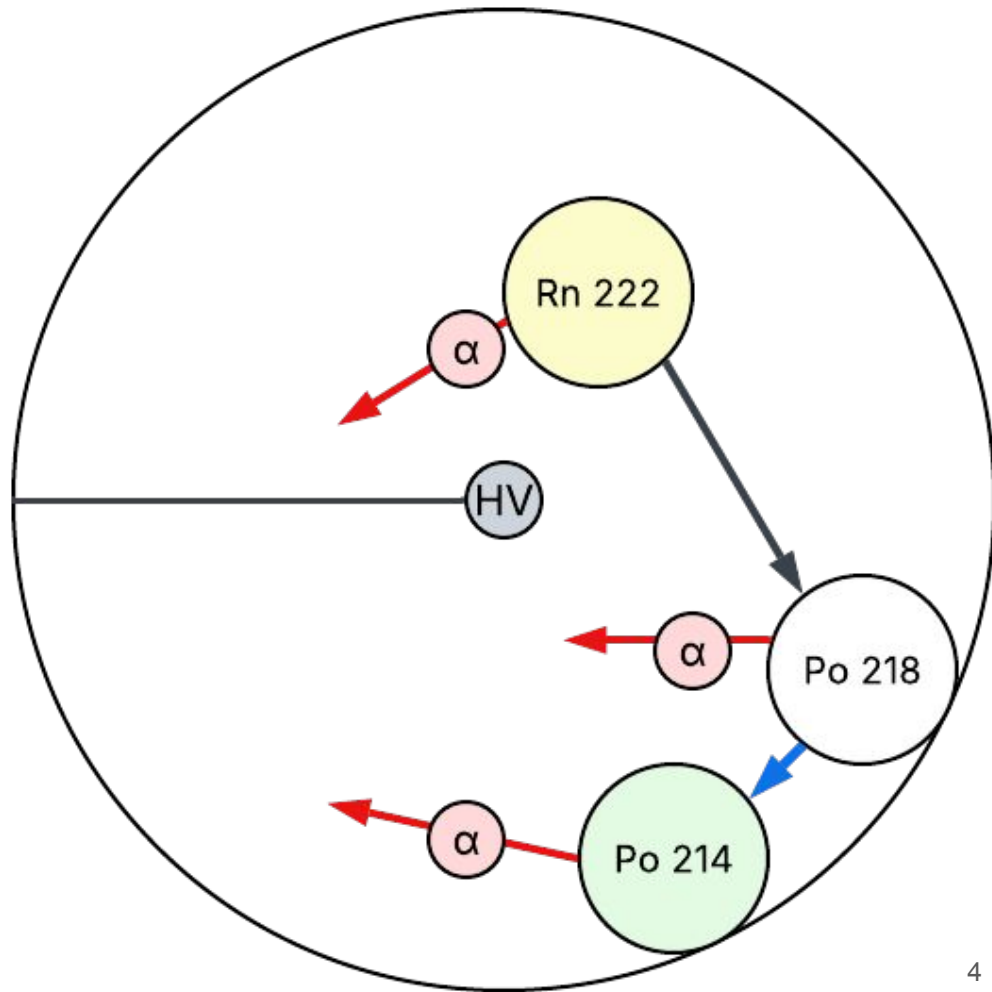
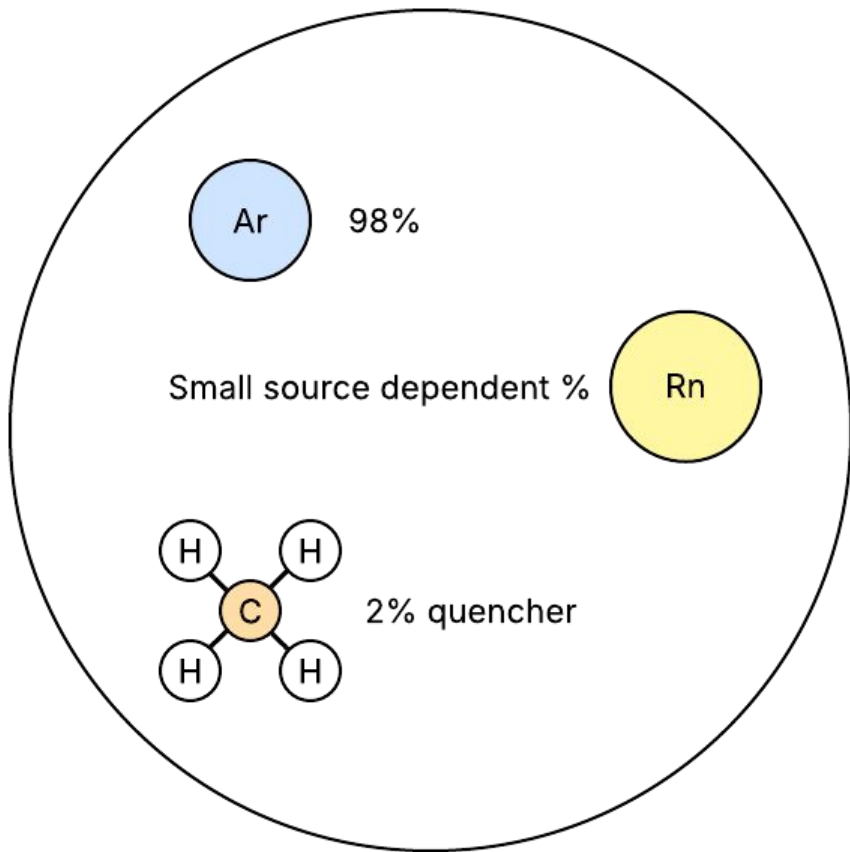
# The Radon Decay Chain



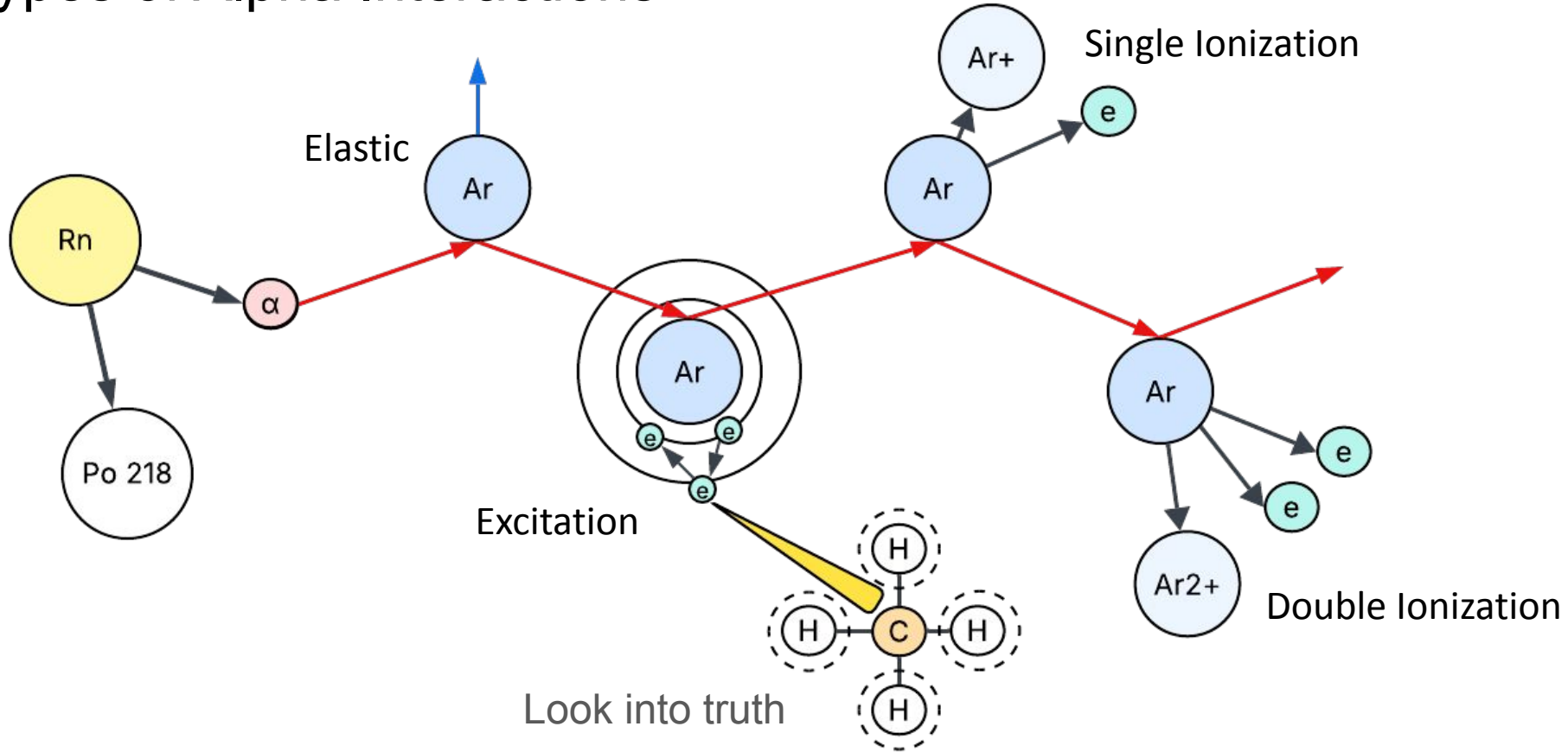
# Benefits of a spherical proportional counter



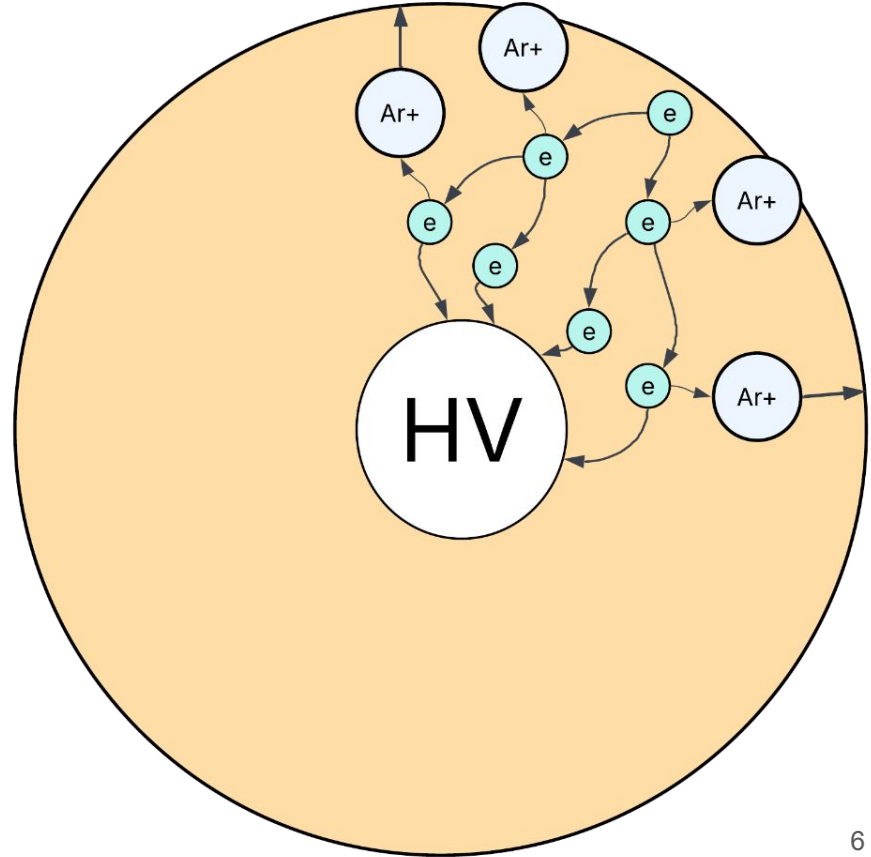
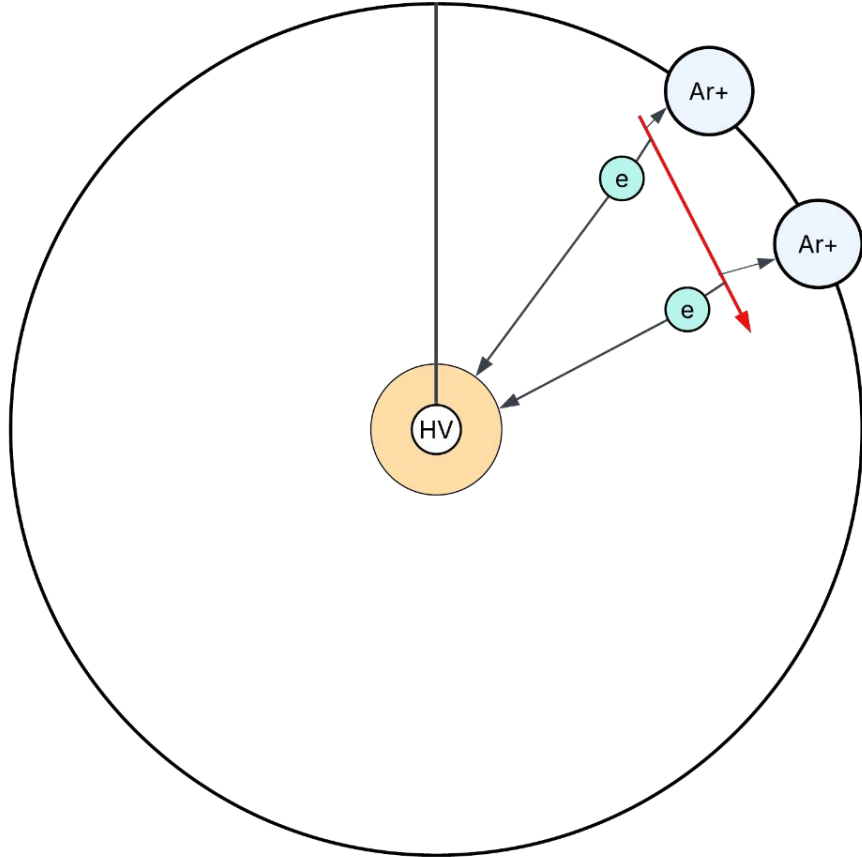
# Sphere Composition



# Types of Alpha Interactions

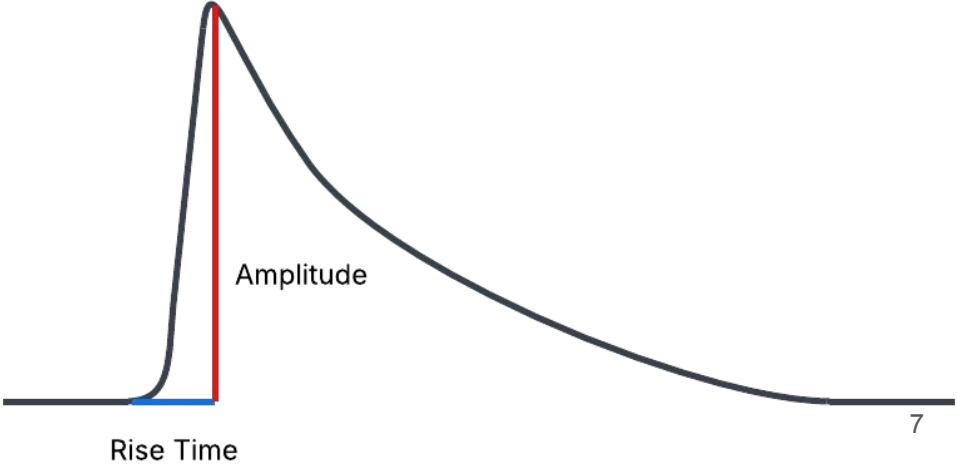
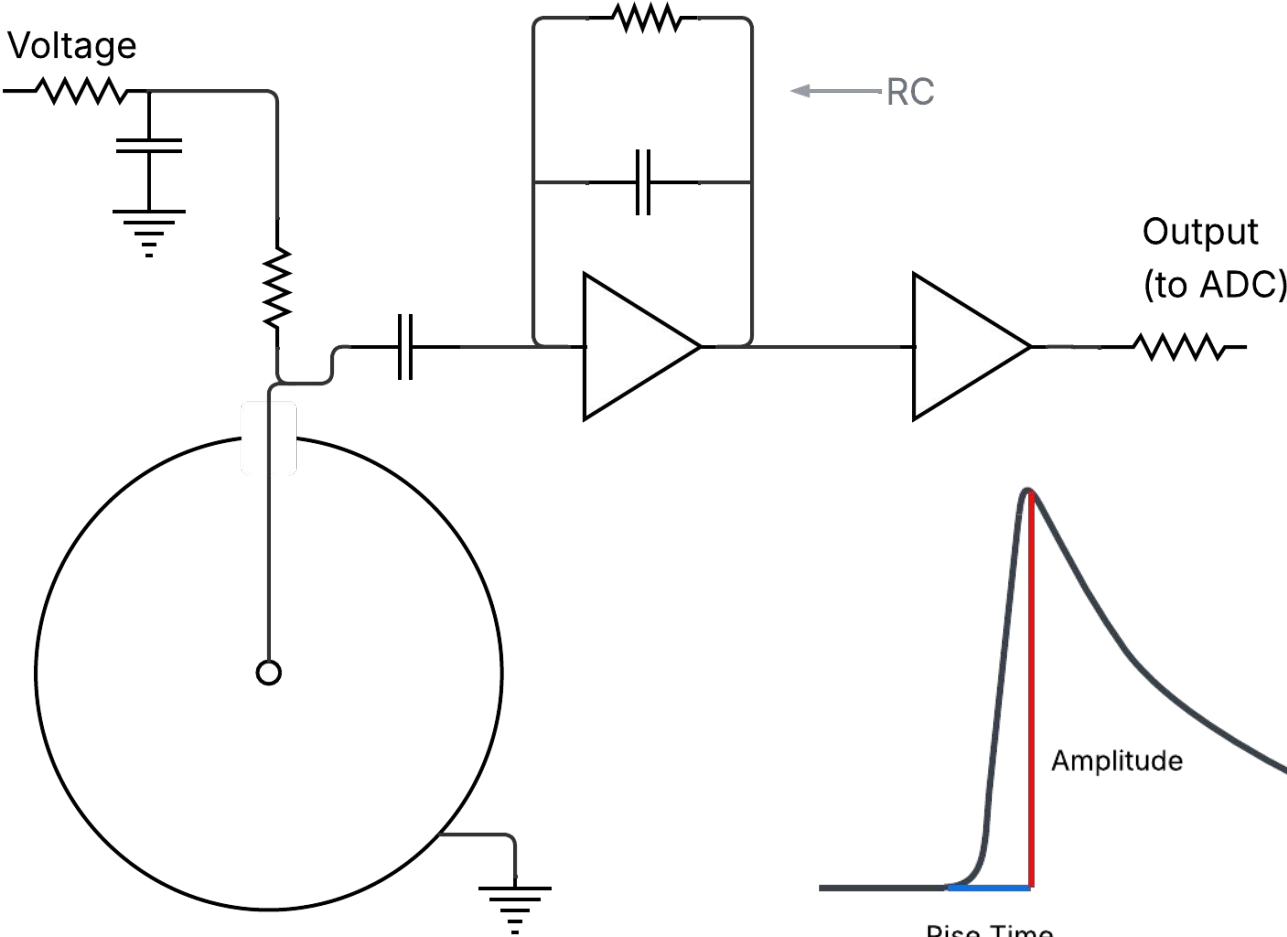


# High Voltage and Townsend Region



# Amplification

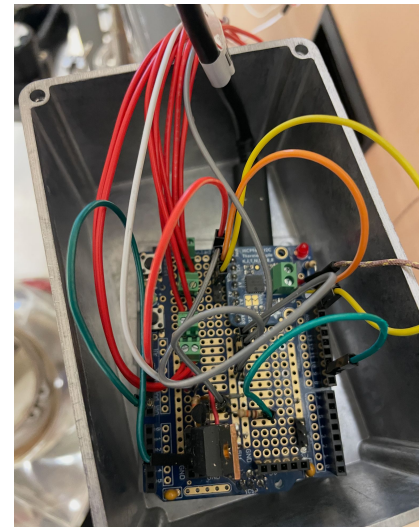
High Voltage



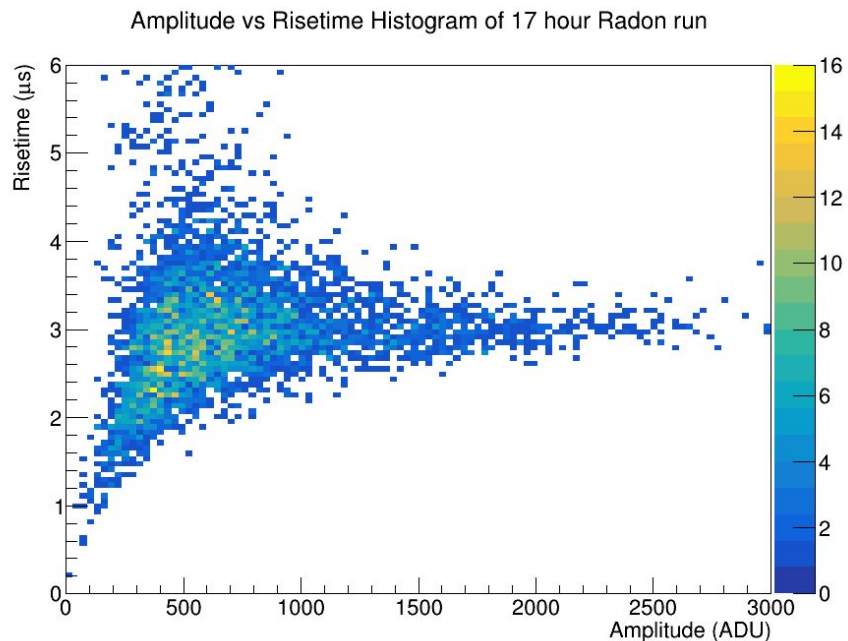
Can you use a spherical proportional detector to count the radon emitted from a source?

# Engineering Improvements

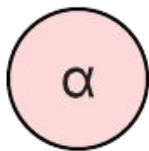
- Radon source
- Fixed computer with new hard drive
- Changed HV power supply
- New mount for amplifier
- Noise reduction methods
- Midas software for power supply control and monitoring
- Integration of computer and analog to digital converter
- Network setup for remote access
- Attached new spheres
- So much leak checking
- Heater circuit



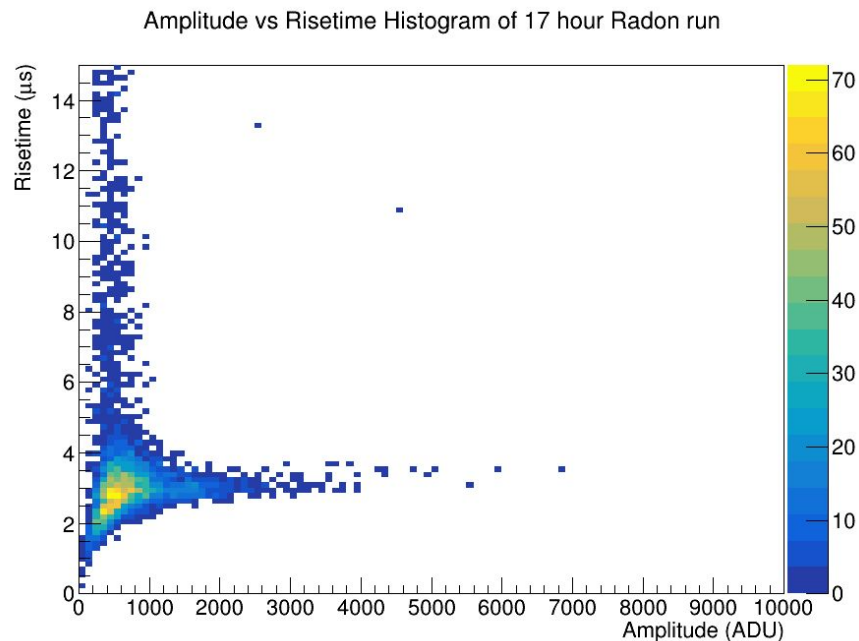
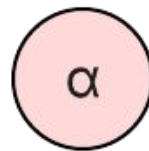
# First Data: No Radon?



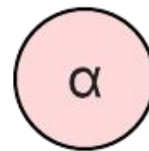
5.59 MeV



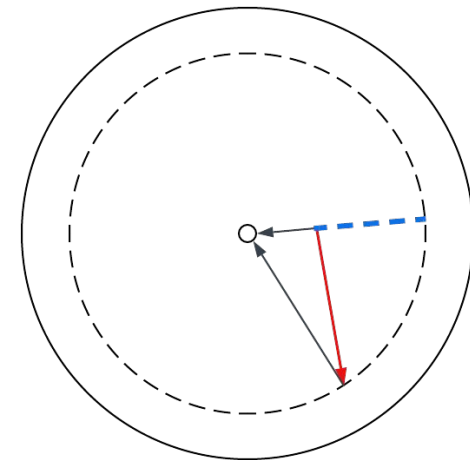
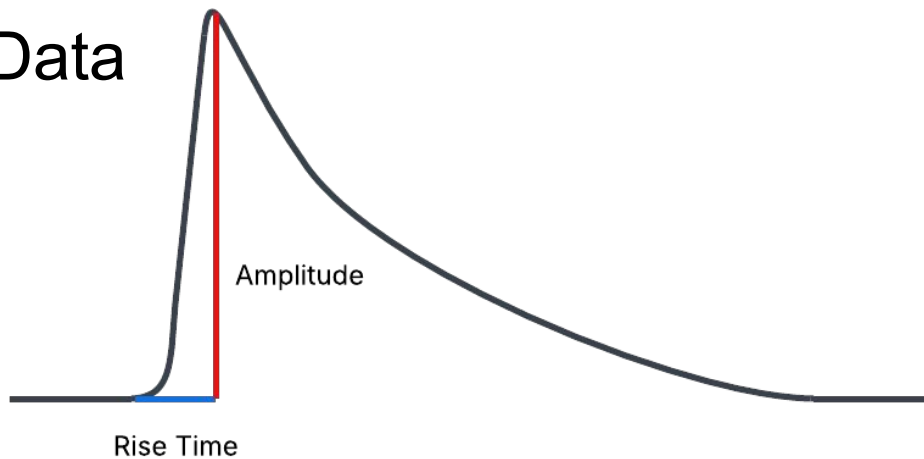
6.11 MeV



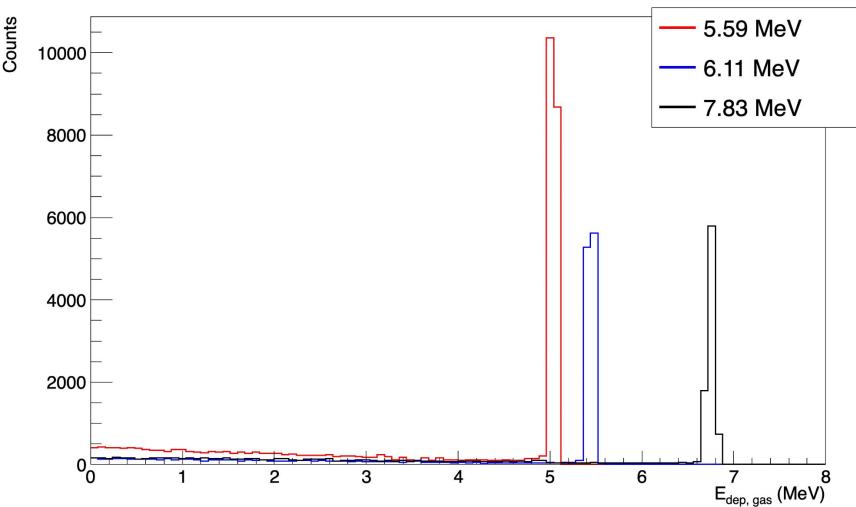
7.83 MeV



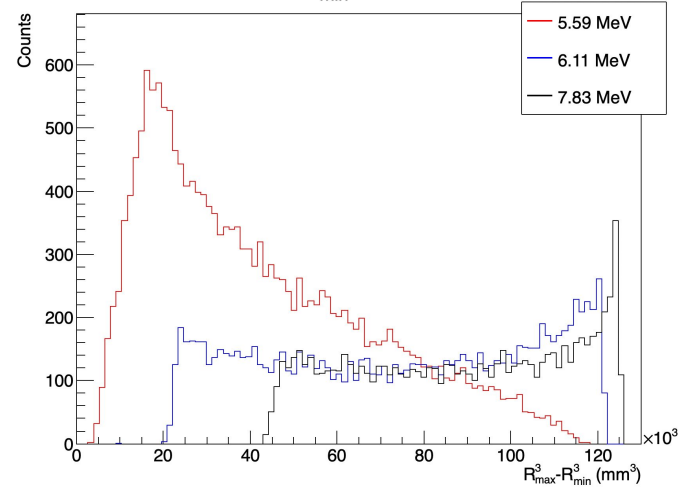
# Simulation Data



Energy Deposited in Gas by Particle



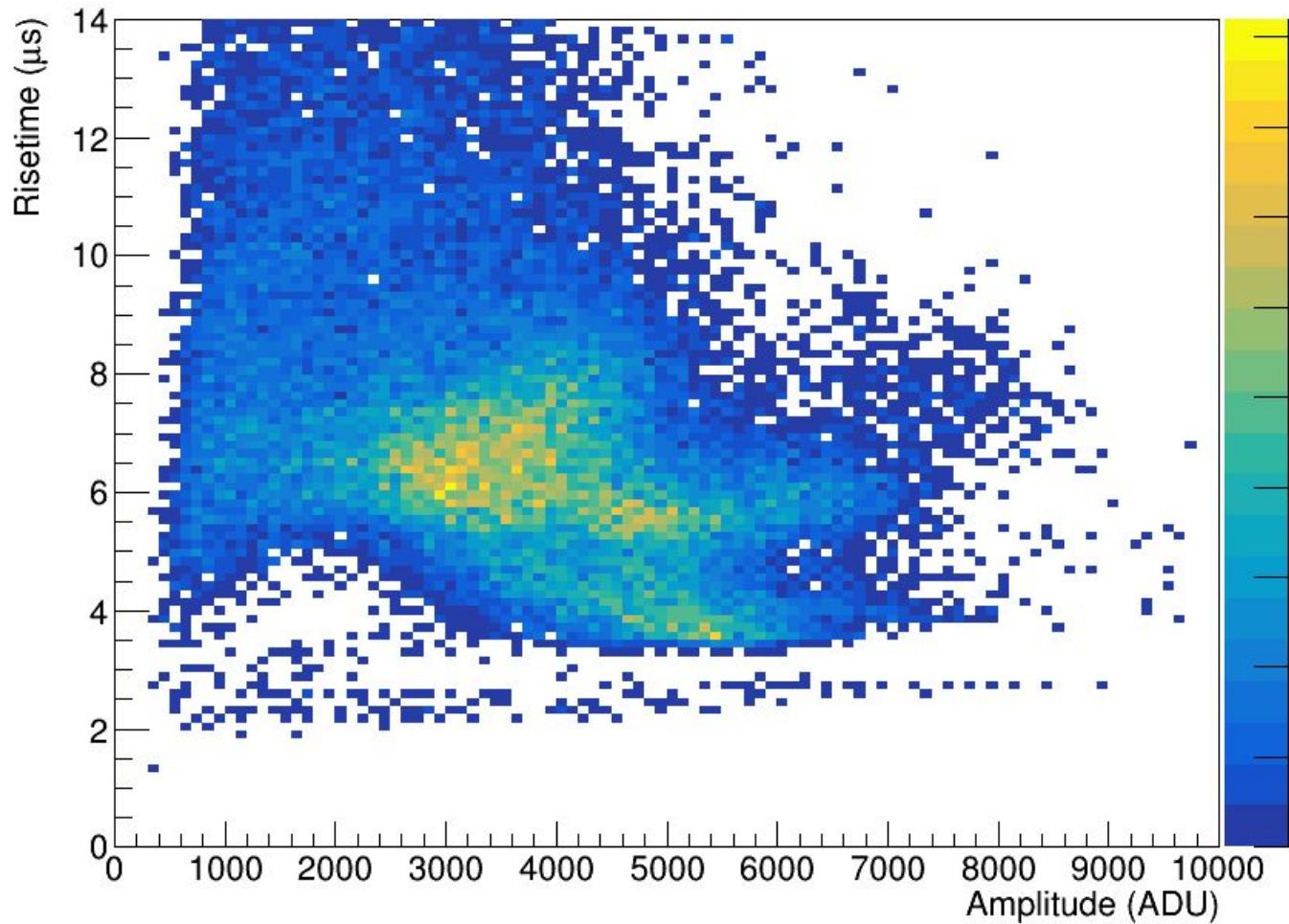
$R_{\text{max}}^3 - R_{\text{min}}^3$  by Energy



# Find Radon?

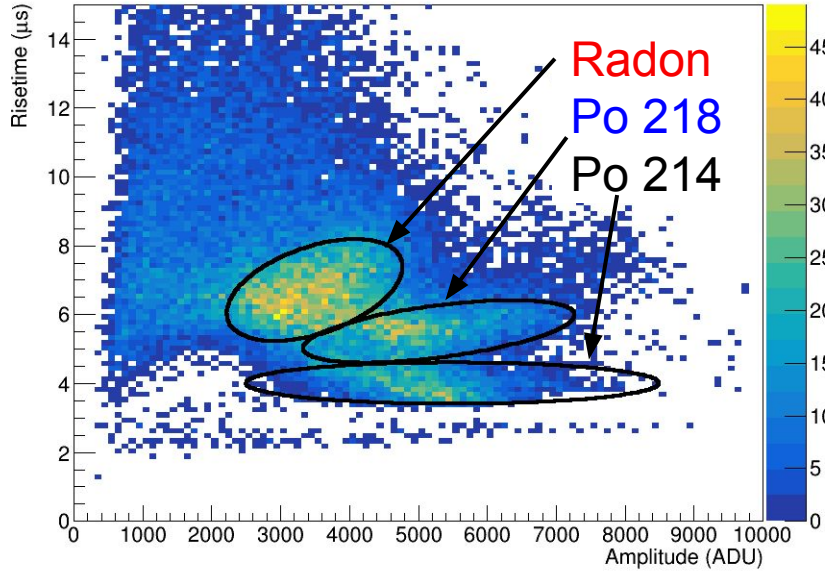


Amplitude vs Risetime Histogram of 17 hour Radon run



# Radon Event Identification

Amplitude vs Risetime Histogram of 17 hour Radon run



Event counts inside each ellipse:

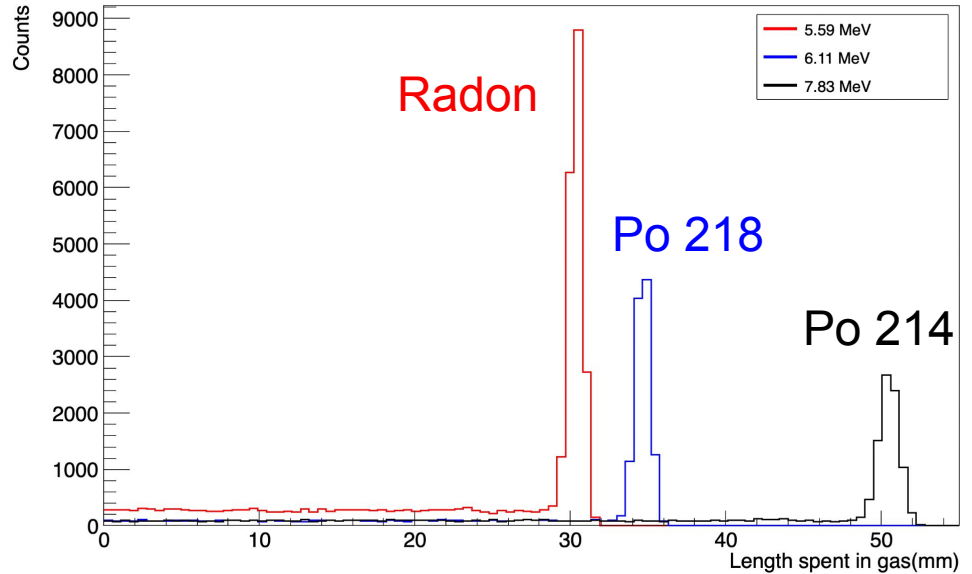
ellipse1: 8804

ellipse2: 5036

ellipse3: 3480

**1** : **0.57** : **0.40**

Distance of Alpha Particle Track in Gaseous Volume



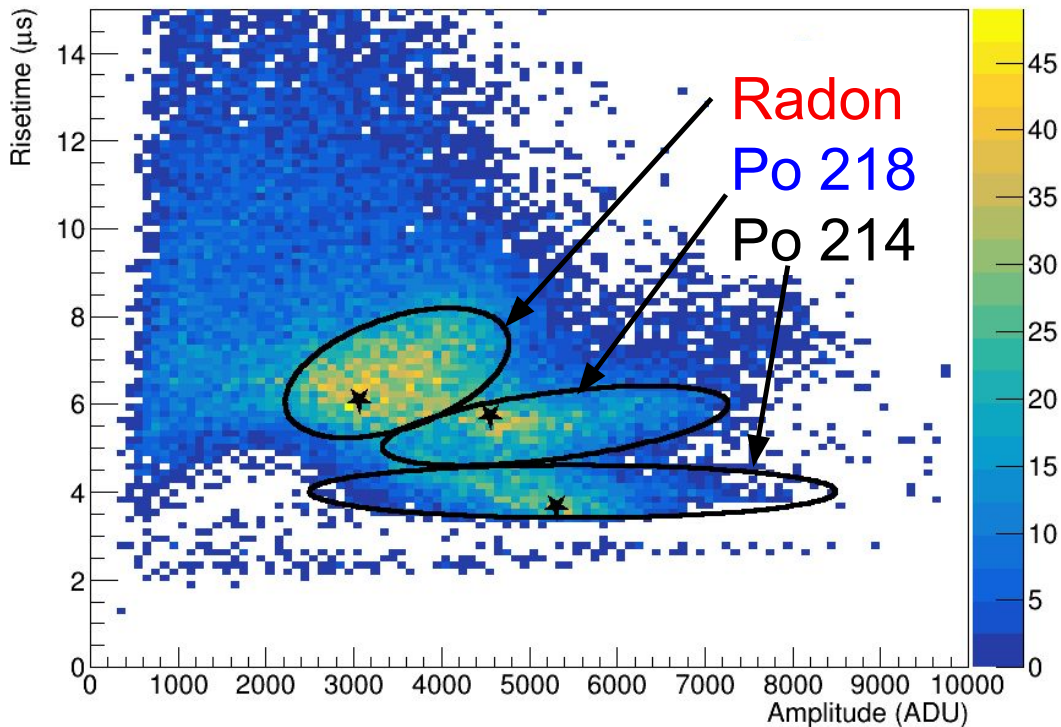
Area under curve

- 5.59 MeV → ~ 10580
- 6.11 MeV → ~6061
- 7.83 MeV → ~4661

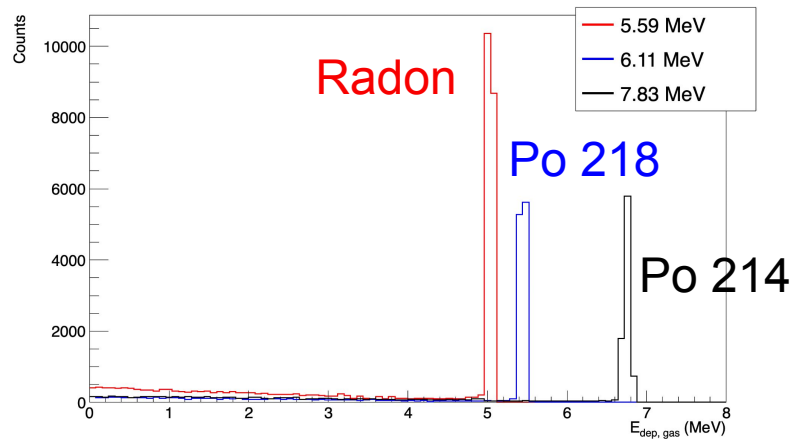
**1** : **0.57** : **0.44**

# Further Confirmation

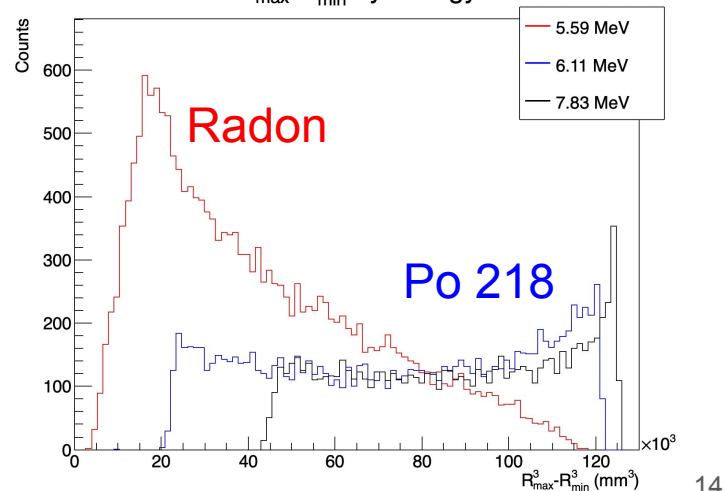
Amplitude vs Risetime Histogram of 17 hour Radon run



Energy Deposited in Gas by Particle



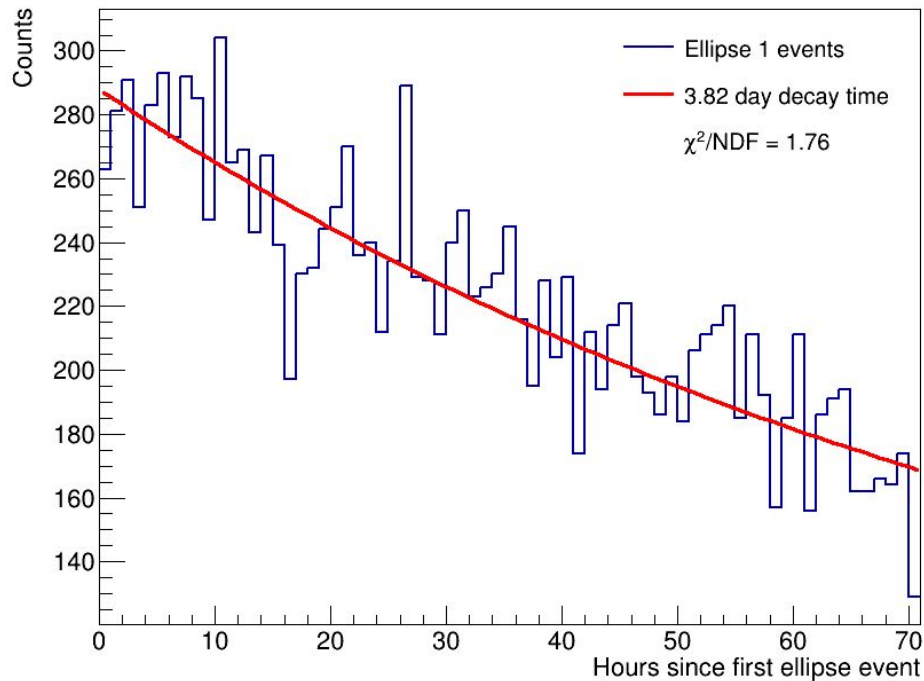
$R_{\max}^3 - R_{\min}^3$  by Energy



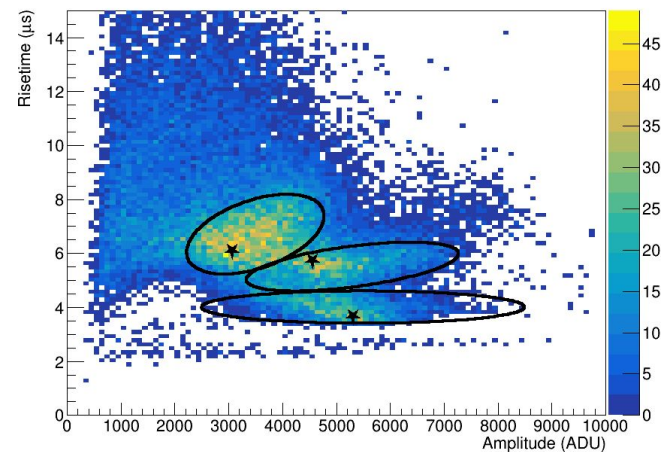
Po 214

# So how much radon is there?

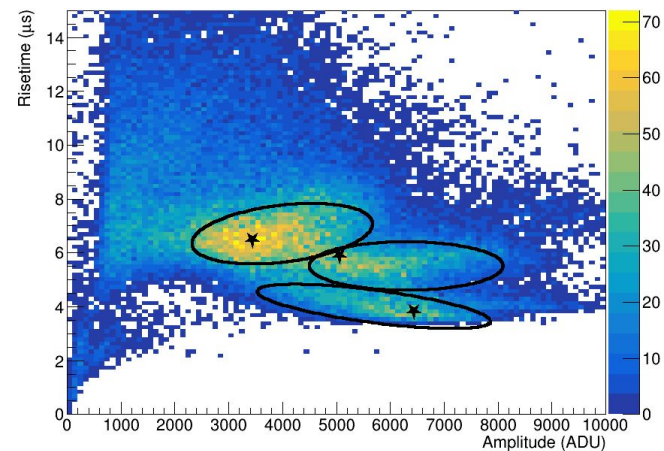
Ellipse 1: Events per hour with 3.82 Day Decay Fit



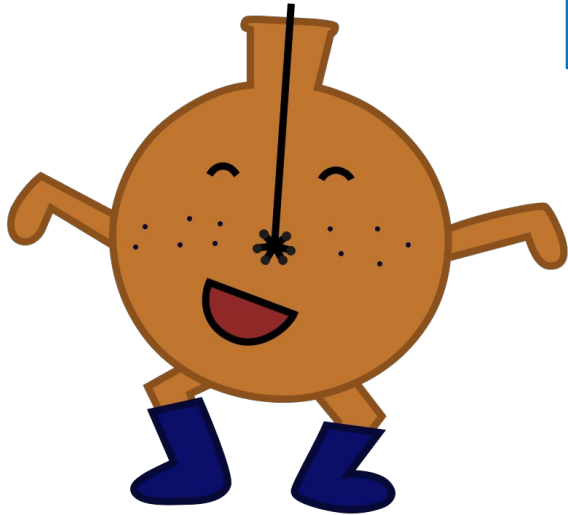
Amplitude vs Risetime Histogram of 17 hour Radon run



Amplitude vs Risetime Histogram of 79 hour Radon run



# Final Remarks

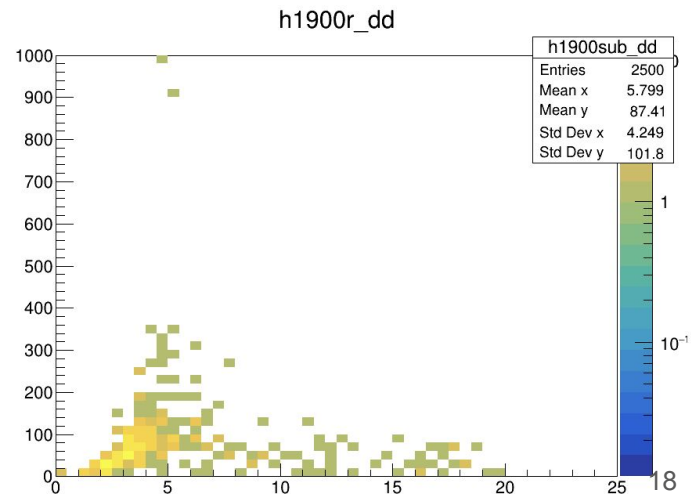
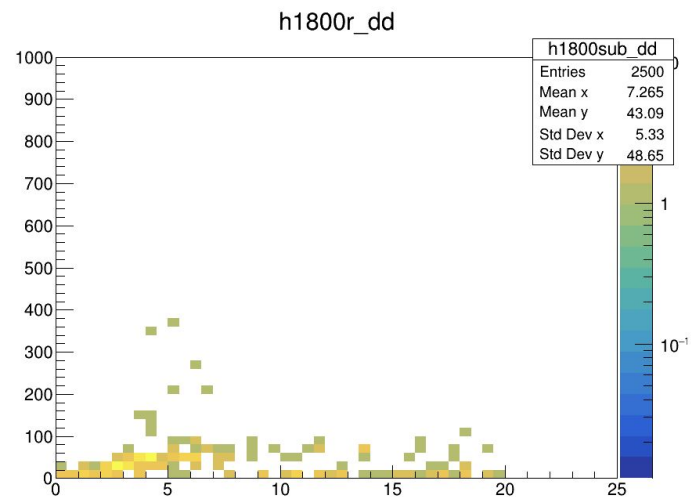
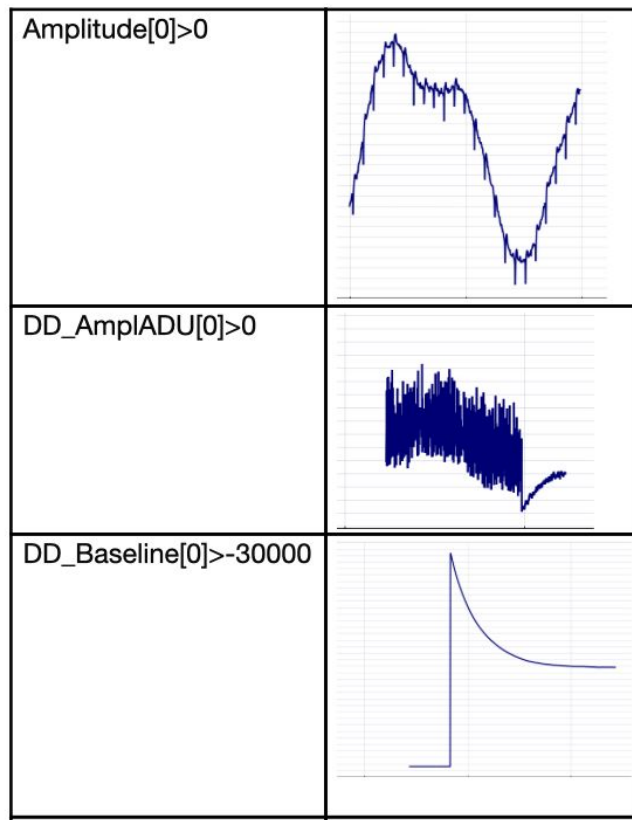
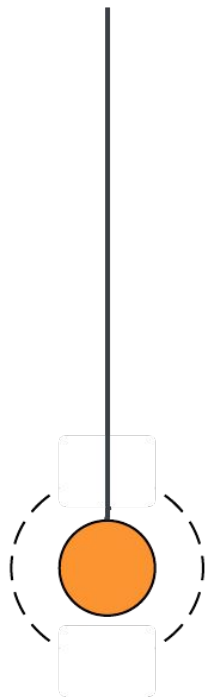




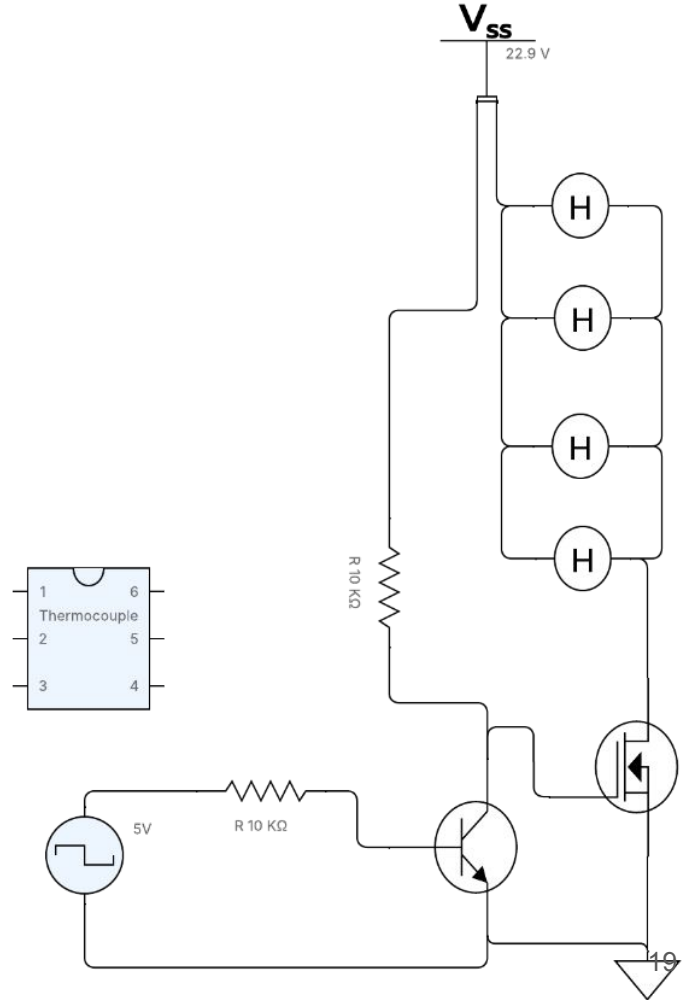
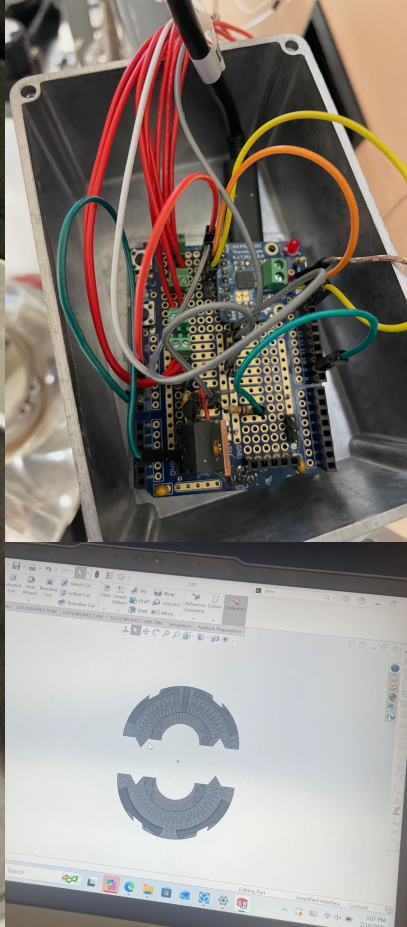
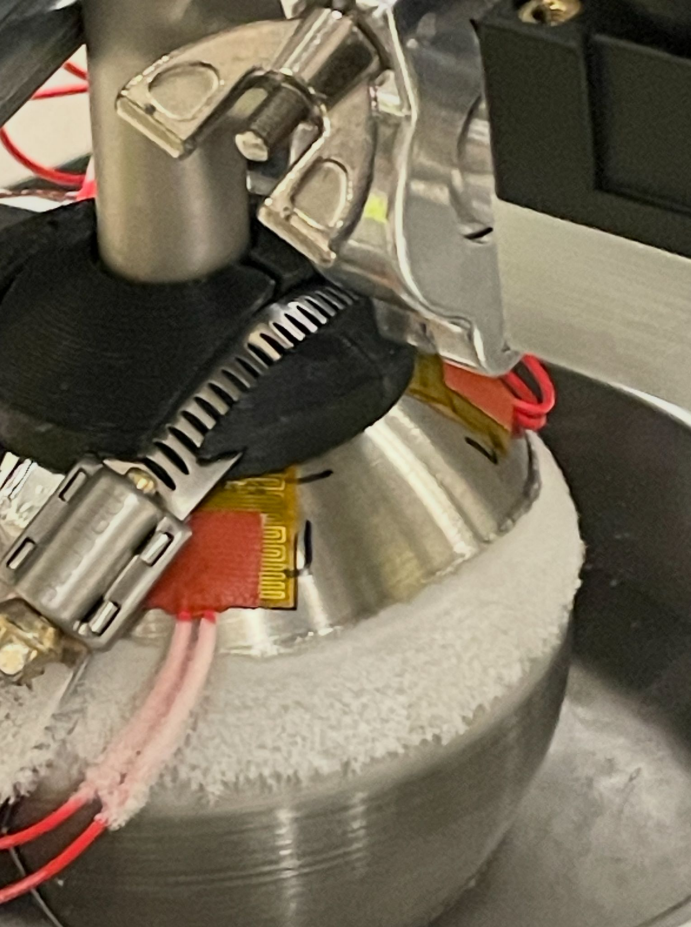
Thanks!  
Questions?

(Image credits: Alyssa Sanden, NEWS-G for mascots)

# Attempting to get Better Data



# Heater Development



# Why its better than lucas cells / purpose of detecting radon

(better from connor later on)

(Full radon board description)

(number slides)

(Does software or amplifier flip it)

Ions moving away changes voltages

Check % on cylinder (maybe 98, 2)

Fix dates

Flip direction of amplifier plot

Ignore T1 entirely

Take off step

Pick new colors, arrows on 17

Units on everything

Using geant4 for simulation

