Measure of Radioactivity on Acrylic exposed to ^{222}Rn

Anna Gustavsson

IAESTE Placement Student
Queen's University
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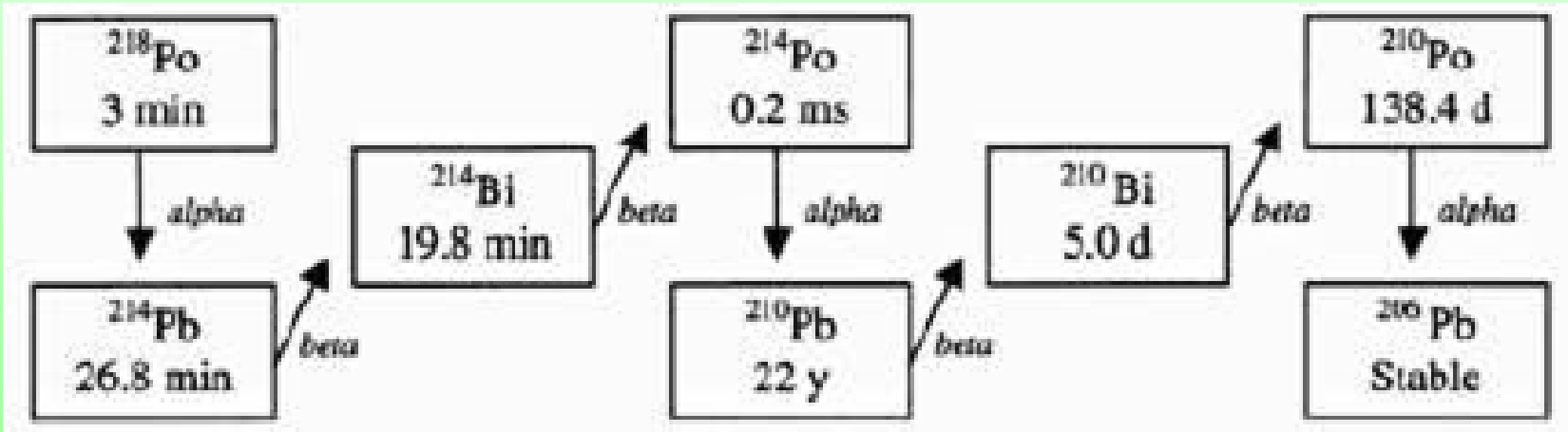
Background

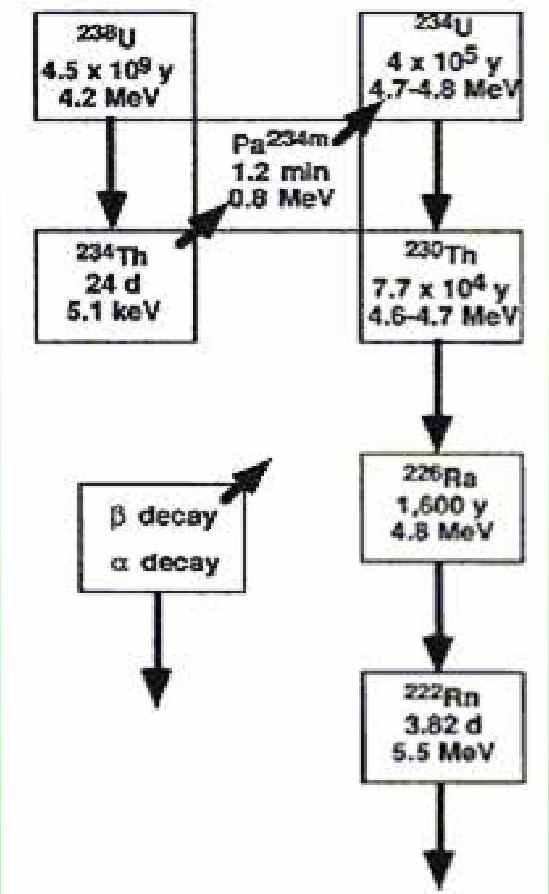
- Background in SNO detector
- Hypothesis: come from alpha decay of ^{210}Po
- Acrylic exposed to ^{222}Rn in the past
- ^{222}Rn $\rightarrow \alpha$-decay$\rightarrow$ ^{218}Po

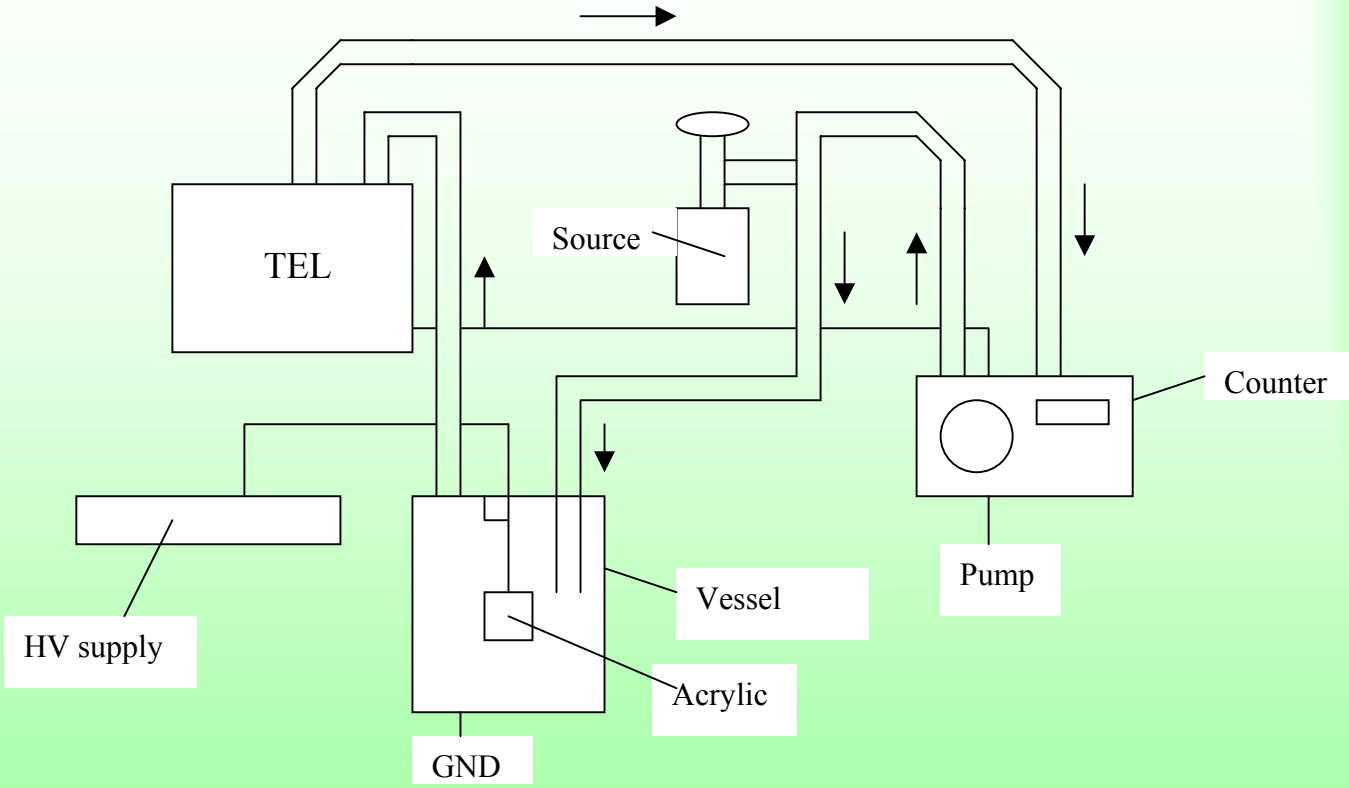


Experiment

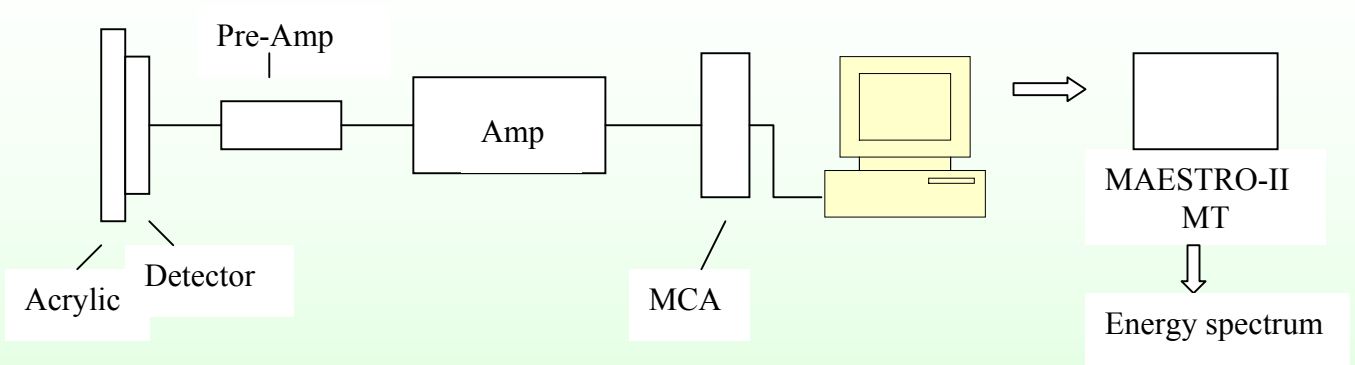
- Put acrylic in a ^{222}Rn enriched environment
- Apply electric charge to acrylic to attract ^{218}Po (positively charged)
- Calculate what fraction of ^{218}Po stick by
  - Calculate how many ^{218}Po there are in vessel that could stick by
  - Observe number of ^{218}Po and ^{214}Po that decay

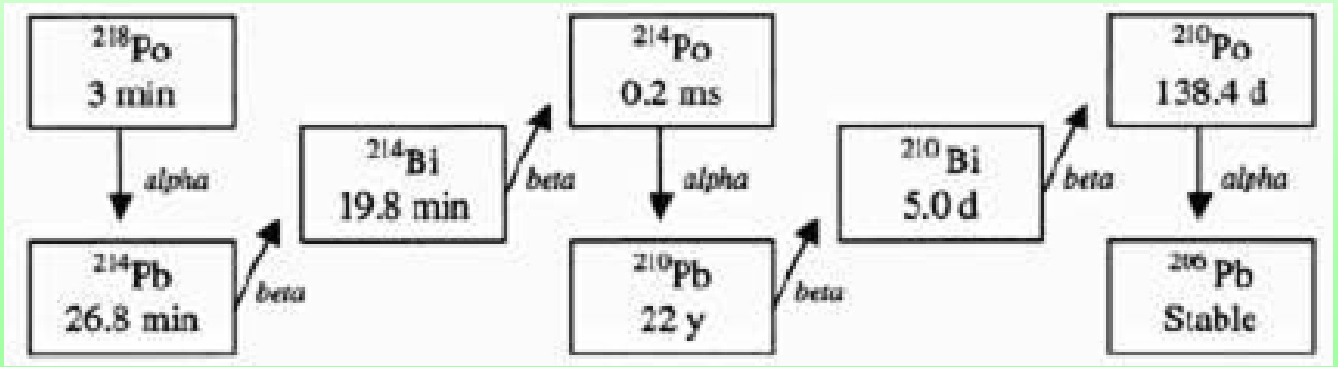
Experimental Setup – Radon “bath”





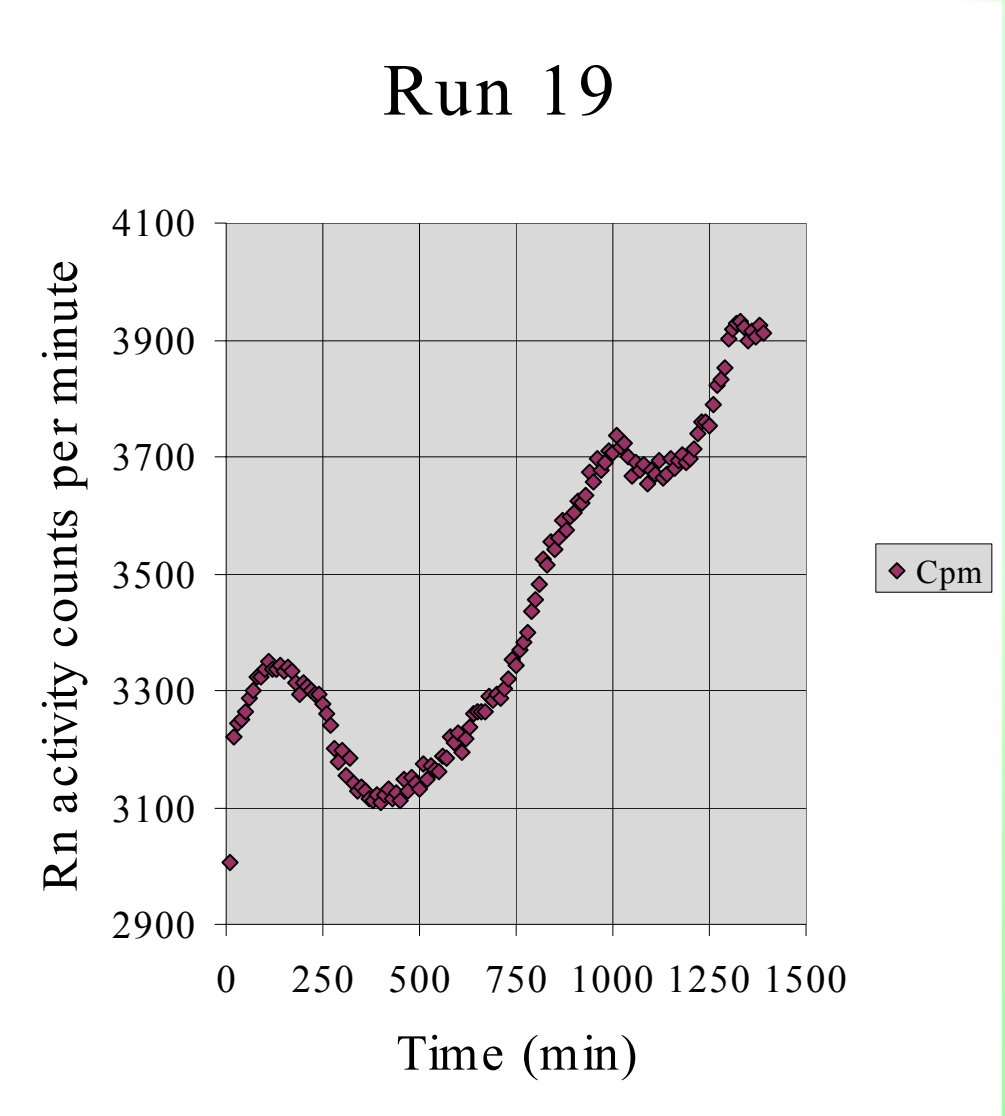
Monitoring the decay





Problems

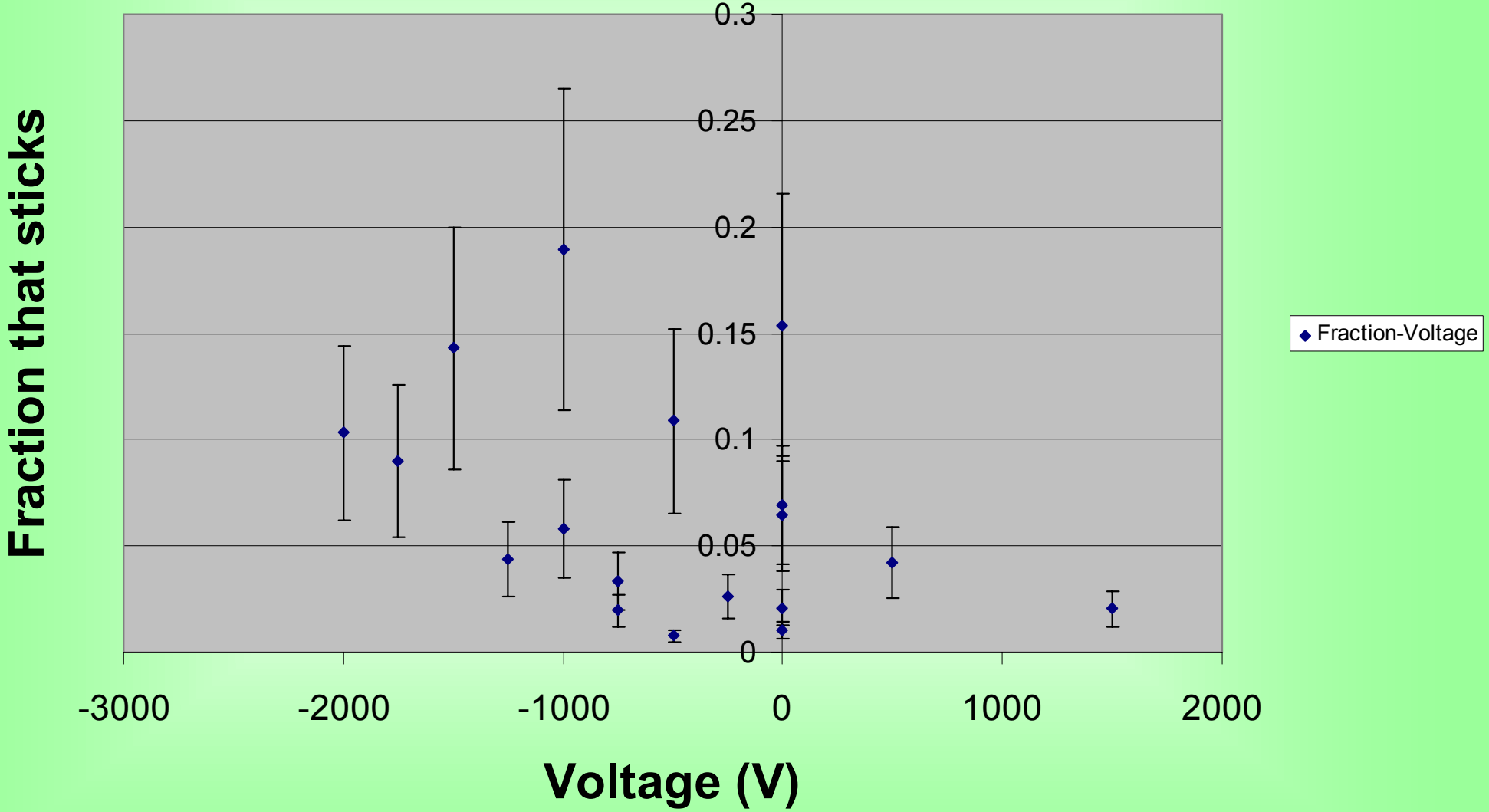
- Calculating the concentration of ^{222}Rn in vessel holding acrylic
- Concentration measured by Pylon TEL detector
  - Observes the total number of α-decays
  - Large volume
  - Unidentified behavior



Rough Estimate

- Assumptions
  - Constant concentration of ^{222}Rn throughout "bath"
    - Used average concentration
  - ^{218}Po sticks evenly across surface of acrylic
    - Ignoring edge effects
  - α-detector 100% efficient

Fraction that sticks vs Voltage



Play with numbers

- SNO detector
  - Volume $\approx 905 m^3$
  - Inside surface area $\approx 452 m^2$
  - ^{222}Rn concentration in air $\approx$ 3pCi/l
  - Exposure time: 2 years
- $\approx$ 5% sticks

  $\Rightarrow$ Activity of ^{210}Po after 4 years: 0.3 Bq/m^3

Future plans

- Understand TEL's behavior
  - Improve accuracy of concentration in vessel used for calculation
- Possibility of replacing TEL with α-counter investigated
- Analyse spectra wrt time
  - Read out spectra at intervals by running procedure file in MT on top of MAESTRO-II
- Set up two counters to measure spectra of both pieces of acrylic in "bath"
  - Position dependent
- What effect does rinsing the acrylic after exposure have