PSL Radon Emanation Update

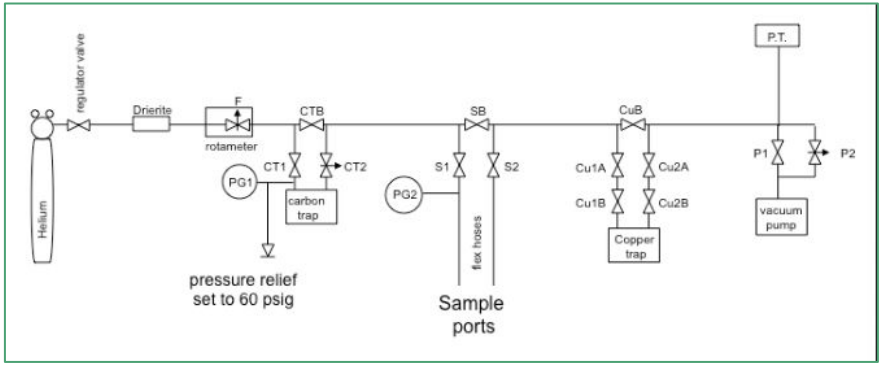
Jonathan Nikoleyczik

Today's update is on slide 7

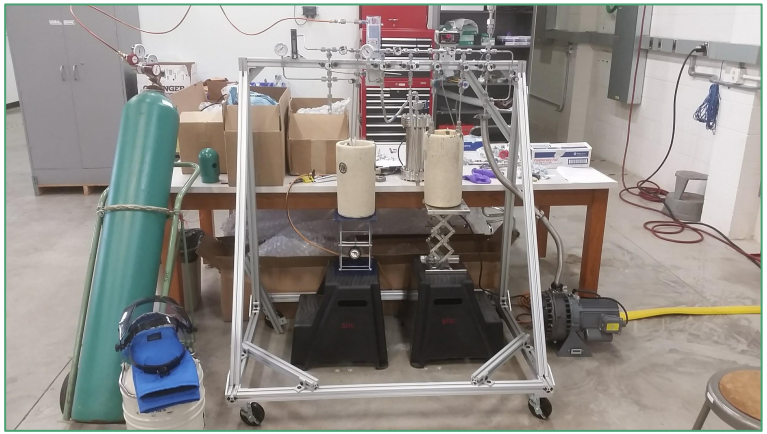
Radon Emanation Background

- Radon Emanation is the process of removing all the existing radon from a sample and letting new radon be produced
- Radon has a half-life of 3.8 days
- Once the sample has been refilled with radon intrinsic to the sample it is harvested

P&ID of the portable radon panel



Portable radon panel



Emanation Process

- Helium is used as a carrier gas since it is unaffected by all of the following steps
- Our bottle of helium might have some trace amount of radon in it so we need to clean it first
- Cleaning of helium is done with Carbon at LN2 temperature (77 K). Any radon “sticks” to the carbon and the helium moves on
- After the panel is clean and we have a supply of clean helium the gas inside the sample volume can be replaced with helium
- The radon is collected in a copper trap which is also “sticky” to radon at LN2 temperature
- The copper trap is shipped to UMD for counting

Recent results of Radon Emanation

Rubber Sample:

- EXO-200: 4.9 mBq
- Summer 2016:
  - MD1: 5.2 ± .4 mBq
  - MD2: 5.9 ± .4 mBq
- Spring 2018:
  - PSL2UMD1: 12.1 +1.5/-1.4 mBq
  - PSL2UMD2: 8.5 ± .4 mBq
  - PSL2UMD3: 8.3 ± .7 mBq
- Summer 2018:
  - MD3: 7.8 ± .8 mBq

Why such a big change? Current best guess: the rubber was cleaned with alcohol and this changed it's radon emanation rate

Consistent results between my measurement at PSL and more accurate results at UMD

LUX Bellows

- LUX cable conduit (bellows) prior to etching (summer 2017) = 1.33 ± 0.19 mBq
- After citric etch, first measurement (June 2018) = 0.14 ± 0.07 mBq
- We see a significant reduction in radon emanation after citric etching that is why we will repeat this process on many components soon

Upcoming Emanation Schedule

- Compressor maintenance panel started emanation Thursday 6/21
- Will likely harvest early next week (we want about a week of emanation time and can’t harvest on a Thursday or Friday)
- Once compressor arrives need to do a Rad 7 measurement for Thorium
    - Do we have the one from UW available?
    - Haven’t heard back about the one from UMD
- Then need to modify the compressor to do the emanation (will likely need to make up some VCR adapters and tubing to connect inlet and outlets of compressor heads)

Thoron measurement

- Using a RAD7 to make measurements of radon and thoron
- Have 2 units from UMD and UW
- Both will need to be calibrated getting a rock source to do the calibration
- Thoron half life is ~1 min and flow through of plumbing is slow. Need to calculate how much of each weld we can “see”