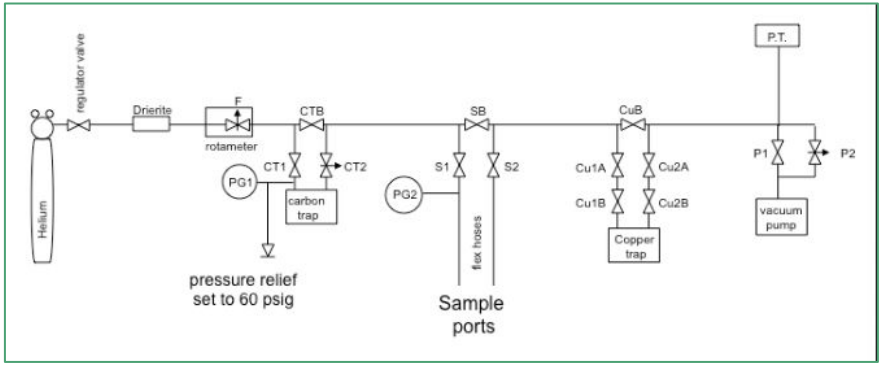
PSL Radon Emanation Update

Jonathan Nikoleyczik

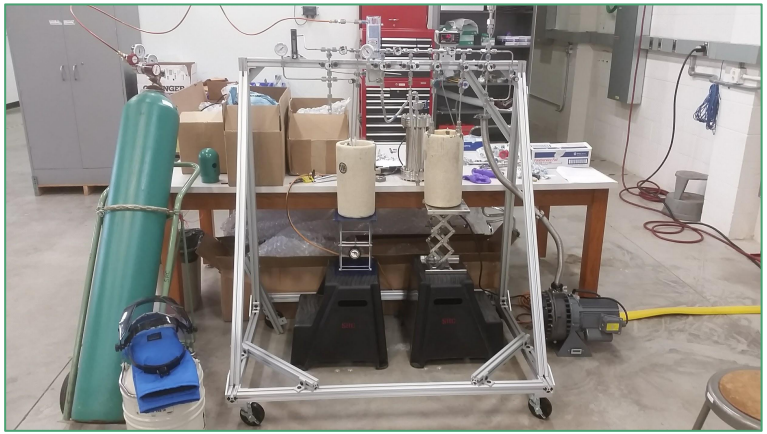
Radon Emanation Background

- 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)