

Renewing Motor Box Seals

Ryan Bayes

February 22, 2024

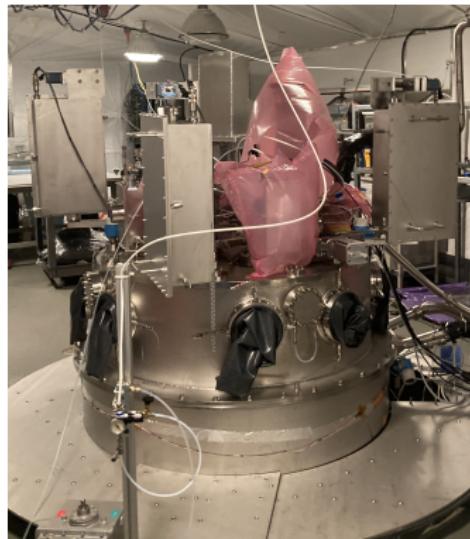
Motivation

- ▶ Know that the UI radon seal is not great
- ▶ Leak rate is significantly reduced through the used of nitrogen bags
 - ▶ Isolation bag around full UI has produced low radon monitor rates (before pump)
 - ▶ Isolation bags around problematic features reduced rate relative to none
- ▶ Main sources are;
 - ▶ North siderope motor box
 - ▶ East rope extension box
- ▶ Both require o-ring require o-ring replacement
 - ▶ Reduce nitrogen use by the experiment
 - ▶ Restore functionality of North Motor box (bag cuts off access)



Motivation

- ▶ Know that the UI radon seal is not great
- ▶ Leak rate is significantly reduced through the used of nitrogen bags
 - ▶ Isolation bag around full UI has produced low radon monitor rates (before pump)
 - ▶ **Isolation bags around problematic features reduced rate relative to none**
- ▶ Main sources are;
 - ▶ North siderope motor box
 - ▶ East rope extension box
- ▶ Both require o-ring require o-ring replacement
 - ▶ Reduce nitrogen use by the experiment
 - ▶ Restore functionality of North Motor box (bag cuts off access)



Summary of Prior Leak Checking Campaigns

Feature	Status	Leak (mbar L/s)	Date
East and west motor box	good	$< 2 \times 10^{-8}$	June 2023
West extension box seal	good	$< 10^{-10}$	June 2023
South motor box outer seal	pass	5×10^{-7}	June 2023
South motor box inner seal	fail	1.4×10^{-5}	July 2023
South exten. box outer seal	fail	$< 10^{-5}$	June 2023
South exten. box inner seal	pass	2×10^{-9}	July 2023
North motor box	fail	$> 10^{-4}$	Oct 2019
North exten. box	pass	$< 10^{-9}$	June 2023
East extension box seal	fail	$> 10^{-4}$	Oct 2019

- ▶ CF flanges checked with helium/Argon sniffer
 - ▶ Neck tube base flanges (Leaks observed and corrected)
 - ▶ Level sensor flanges (no leaks observed)
 - ▶ CF flanges on motor box (motor, electrical feedthroughs; no leaks)
- ▶ Gloves tested by pumping and purging with N₂
 - ▶ East gloves shown to leak, South and West gloves good.

Proposed Intervention

- ▶ Detector at low voltage
- ▶ Connect N₂ source to UI to "flush" UI
- ▶ Remove bag from North Motor Box/East Extension Box
- ▶ Remove cover from box
- ▶ Examine/replace O-rings
- ▶ Replace box cover

Radon mitigation



- ▶ Keep the UI at positive pressure by adding nitrogen to UI (monitor through DeltaV)
- ▶ Purge air from box after sealing by pulling air from motor box using auxiliary port
 - ▶ Motor box is 35 L
- ▶ Restrict air flow path size to less than the 1/2" port available

Additional Steps

Inner o-ring on South Motor Box

- ▶ TEV o-ring bad; Viton o-ring "good" but emanates radon
- ▶ Replacing TEV o-ring could remove radon source

Outer o-ring on South Extension Box

- ▶ TEV o-ring good; Viton bad
- ▶ Unknown if this is damage or displacement
- ▶ TEV o-ring seal requires more torque; can relax with time
- ▶ Opening the box to inspect/replace Viton o-ring will improve stability

Neck Tube Radon Mitigation

- ▶ HV feedthroughs are "known" to be radon permiable
 - ▶ Attempted isolation test but inconclusive
 - ▶ Two isolation bags clearly hold pressure
 - ▶ Two others are not so obvious (but that may be a flow problem)
- ▶ Seal cannot be improved without completely changing the connection plate
- ▶ May need another attempt at isolation bags
- ▶ Increased pressure could improve isolation measure (get that by removing the large bags)
- ▶ Could improve the material; use aluminized mylar



Summary

- ▶ UI is known to leak radon
 - ▶ 10^{-4} suppression relative to air from UI gas assays
 - ▶ Radon monitor assays give a (much) higher number
- ▶ Current solution is not sufficient
 - ▶ Push to complete calibration program makes full UI bag problematic
 - ▶ Current isolation bags interfere with side rope motor box operation
 - ▶ Current bags are not as good as full bag (something is missing)
 - ▶ N₂ use is restrictive; unclear if we can add further bags and maintain function
- ▶ Propose to replace radon seals on selected motor box
 - ▶ North Motor box and East Extension boxes need both o-ring sets replaced
 - ▶ South motor box needs inner o-ring replaced
 - ▶ South extension box needs outer o-ring replaced
- ▶ Isolation bags on neck tubes should be more efficient without side rope isolation bags
 - ▶ Some improvements could be considered there