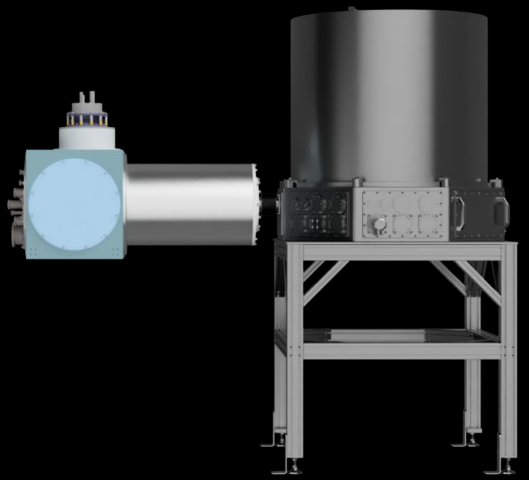
Design Documentation

DMRadio-50L Collaboration Meeting

October 7th, 2025

Aya Keller



AGENDA

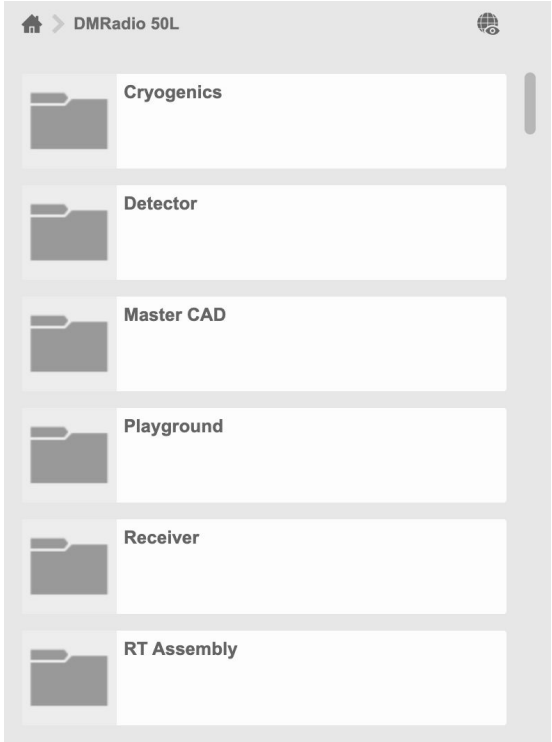
1 CAD

2 Assembly Procedures

3 Cooldown Logging

CAD

Shared Fusion 360 DMRadio-50L folder



CAD

List of CAD subassemblies on the confluence

DMRadio-50L → DMradio-50L CAD

Calendars Create ··· Search

Pages / DM Radio Home / DMRadio-50L Edit View inline comments Save for later Watching Share ···

DMRadio-50L CAD

Created by Simanovskaia, Maria, last updated on Jul 25, 2025 · 3 minute read

We store the DMRadio-50L CAD in the shared Fusion 360 folders. Here is the link to the shared DMRadio-50L folder:
https://mymit1306.autodesk360.com/g/projects/20210423406058081/data/dXJuOmFkc2sud2lwcHJvZDpmcy5mb2xkZXI6Y28uVGxRRTZPMi1TLUMxQUxTYjltZkdDdw

To gain access to this folder, the folder must be shared with your Fusion account. Please contact Maria at simanovskaia@stanford.edu with your name and email to be added.

Assembly	Subassembly	Object	Owner / contact	Associated confluence page	File path to assembly	Alignment joint in master CAD
Master CAD (please do not edit!)			Aya Keller		*DMRadio 50L → Master CAD → Master assembly*	
Room temperature lifting and assembly structures		Cage (for lifting de-ceiver)	Alex Droster	DMRadio-50L de-ceiver lifting structure	*DMRadio 50 L → Detector → Cradle → Support → Design 2b → Design 2b Rod Design → Mod 4.0 → Lifting mechanism → assm mod 4.0*	
		Gliders	Nicholas Rapidis			
		RT stand / lifter	Aya Keller	DMRadio-50L room temperature test stand	*DMRadio 50L → Master CAD → RT stand → RT stand assembly*	
		Diode tower covering	Celeste Virador		*DMRadio 50L → RT Assembly → Diode_Tower_Covering v8*	
Cryogenics	Snoopy	Snoopy	BlueFors / Maria	DMRadio-50L Bluefors dilution refrigerator	*DMRadio 50L → Cryogenics → Snoopy dilution refrigerator → SO00747-system_asm*	Vacuum bellows attachment to Woodstock aligned.
	Woodstock	Woodstock	Four Nine Design / Maria	DMRadio-50L Woodstock (Four Nine Design cryostat)	*DMRadio 50L → Cryogenics → 4 K system (Four Nine Design CAD) → 387-FULL_G.STEP*	
	Cold Snout, testing	20 mK cold finger, 1 K cold finger, 4 K shield, 40 K shield, vacuum shell, etc	Aya Keller	DMRadio-50L Cold Snout	*DMRadio 50L → Cryogenics → Aya → Test assembly v7*	None, not used in master CAD.

CAD

List of CAD subassemblies on the confluence

DMRadio-50L → DMradio-50L CAD

Calendars Create ··· Search

Pages / DM Radio Home / DMRadio-50L Edit View inline comments Save for later Watching Share ···

DMRadio-50L CAD

Created by Simanovskaia, Maria, last updated on Jul 25, 2025 · 3 minute read

We store the DMRadio-50L CAD in the shared Fusion 360 folders. Here is the link to the shared DMRadio-50L folder:
https://mymit1306.autodesk360.com/g/projects/20210423406058081/data/dXJuOmFkc2sud2lwcHJvZDpmcy5mb2xkZXI6Y28uVGxRRTZPMi1TLUMxQUxTYjltZkdDdw

To gain access to this folder, the folder must be shared with your Fusion account. Please contact Maria at simanovskaia@stanford.edu with your name and email to be added.

Assembly	Subassembly	Object	Owner / contact	Associated confluence page	File path to assembly	Alignment joint in master CAD
Master CAD (please do not edit!)			Aya Keller		*DMRadio 50L → Master CAD → Master assembly*	
Room temperature lifting and assembly structures		Cage (for lifting de-ceiver)	Alex Droster	DMRadio-50L de-ceiver lifting structure	*DMRadio 50 L → Detector → Cradle → Support → Design 2b → Design 2b Rod Design → Mod 4.0 → Lifting mechanism → assm mod 4.0*	
		Gliders	Nicholas Rapidis			
		RT stand / lifter	Aya Keller	DMRadio-50L room temperature test stand	*DMRadio 50L → Master CAD → RT stand → RT stand assembly*	
		Diode tower covering	Celeste Virador		*DMRadio 50L → RT Assembly → Diode_Tower_Covering v8*	
Cryogenics	Snoopy	Snoopy	BlueFors / Maria	DMRadio-50L Bluefors dilution refrigerator	*DMRadio 50L → Cryogenics → Snoopy dilution refrigerator → SO00747-system_asm*	Vacuum bellows attachment to Woodstock aligned.
	Woodstock	Woodstock	Four Nine Design / Maria	DMRadio-50L Woodstock (Four Nine Design cryostat)	*DMRadio 50L → Cryogenics → 4 K system (Four Nine Design CAD) → 387-FULL_G.STEP*	
	Cold Snout, testing	20 mK cold finger, 1 K cold finger, 4 K shield, 40 K shield, vacuum shell, etc	Aya Keller	DMRadio-50L Cold Snout	*DMRadio 50L → Cryogenics → Aya → Test assembly v7*	None, not used in master CAD.

Please keep this updated!

CAD

Master CAD Rules

CAD

Master CAD Rules

CAD

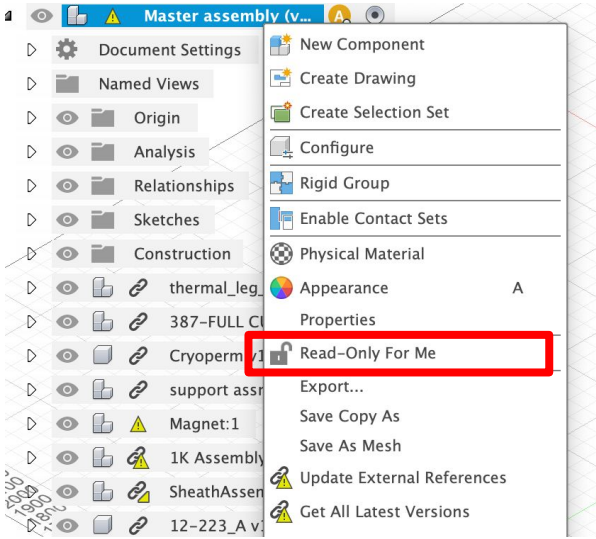
Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Only”

CAD

Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Only”



CAD

Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Only”
- Final subassemblies should be centered on the magnet’s center of mass but should not include the magnet itself (or any additional components already present in the master CAD)

CAD

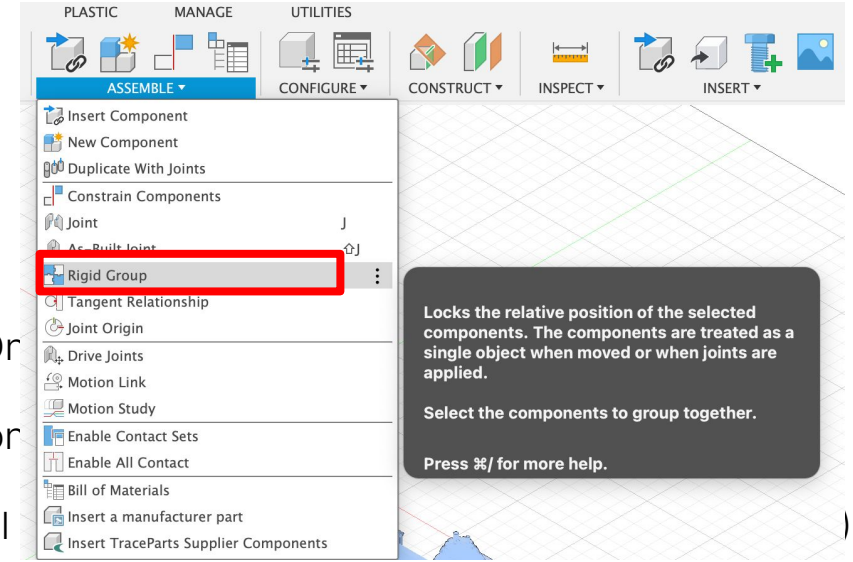
Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Only”
- Final subassemblies should be centered on the magnet’s center of mass but should not include the magnet itself (or any additional components already present in the master CAD)
- Final subassemblies should be made into rigid groups

CAD

Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Or
- Final subassemblies should be centered or
  include the magnet itself (or any additional
- Final subassemblies should be made into rigid groups



CAD

Master CAD Rules

- Do not edit the master CAD
    - If looking at it, please select “Read Only”
- Final subassemblies should be centered on the magnet’s center of mass but should not include the magnet itself (or any additional components already present in the master CAD)
- Final subassemblies should be made into rigid groups
- With any questions or concerns about the master CAD or to request a subassembly to be added, please contact Aya!

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

- List of components (excluding fasteners)

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

- List of components (excluding fasteners)
    - For each component: name, function, material, weight, and photo (or CAD image)

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

- List of components (excluding fasteners)
    - For each component: name, function, material, weight, and photo (or CAD image)
- List of fasteners

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

- List of components (excluding fasteners)
    - For each component: name, function, material, weight, and photo (or CAD image)
- List of fasteners
    - Each line: interface, number of fasteners, material, size (thread, diameter, length), washers, nuts, and torque

Assembly Procedures

Subassemblies should have an assembly procedure written ~ 1 week before planned assembly!

Required components of an assembly procedure:

- List of components (excluding fasteners)
    - For each component: name, function, material, weight, and photo (or CAD image)
- List of fasteners
    - Each line: interface, number of fasteners, material, size (thread, diameter, length), washers, nuts, and torque
- Detailed assembly steps with before and after photos for each step!

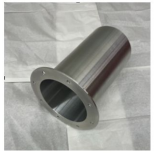
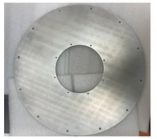
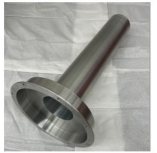
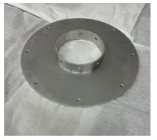
Example Assembly Procedure

Example Assembly Procedure

List of components

1 Cold Snout

1.1 Components

Component	Material	Description	Photo
T-bar	Al 6061	Acts as the mechanical support for the 1 K cold finger from the still plate. Attached to the still plate.	
Hinge rest	Al 6061	Acts as a rest for the cold finger during assembly. Attached to the MXC plate.	
4 K test shield[1]	Al 6063	Attaches to the 4 K flange and closes off the 4 K space for the Snoopy configuration.	
40 K can bottom	Al 6063	Replaces Snoopy's 40 K can bottom	
Shim	Al 6061	Inserts between the 40 K can bottom and the 40 K shield to correct for the concentricity problem.	
40 K shield	Al 6063	Attaches to the 40 K can bottom and shields the 4 K space.	
40 K test flange[1]	Al 6063	Attaches to the 40 K shield for the Snooppy configuration to mate to the 40 K test shield.	

Example Assembly Procedure

List of fasteners

1.2 Fasteners

Interface	#	Screw	Washers	Nuts	Torque [in-lbs]
T-bar - still plate	4	Al6061 #3 TR, 5cm	No	2 x SS #3	NA
T-bar - still plate	1	Al6061 #10 TR, 7.5cm	No	2 x SS #10	NA
Still plate - 1K braid	8	Al7075 M3, 2cm	2 x brass M3	Al6061 M3	5
1K braid clamp	8	Al7075 (black) M3, 3cm	2 x brass M3	Al6061 M3	NA
T-bar - 1K CF	1	Al7075 M4, 2cm	No	SS M4	NA
1K CF rod - tube	4	Al7075 M4, 2cm	No	No	16
Hinge rest - MXC plate	3	Al7075 M3, 2cm	No	Al6061 M3	5
MXC plate - 20mK braid	8	Al7075 M3, 2cm	2 x brass M3	Al6061 M3	5
20mK braid - 20mK CF	1	Al7075 M6, 2cm	brass M6	No	25
Puck - 4K can bottom	12	Al7075 M4, 8mm	No	No	5
4K can bottom - 4K shield	8	Al7075 M4, 8mm	No	No	5
4K shield - 4K test flange	8	Al7075 M4, 8mm	6 x brass M4	No	5
4K test flange - 4K test shield	8	Al7075 M4, 8mm	No	No	5
40K can bottom - shim - 40K shield	8	Al7075 M4, 8mm	No	No	5
40K shield - 40K test flange	8	Al7075 M4, 8mm	6 x brass M4	No	5
40K test flange - 40K test shield	8	Al7075 M4, 8mm	No	No	5
Snoopy vacuum can - nipple	12	1-sided clamps	No	No	NA
Nipple - nipple flange	12	2-sided clamps	No	No	NA

Example Assembly Procedure

Assembly steps

1.3 Pre-Assembly Checklist

☐ All small parts and fasteners sonicated with soap, acetone, and IPA.

☐ All large parts cleaned with acetone and IPA (using clean wipes).

☐ Clean gloves and tools prepared for use at all times except for outer RT components.

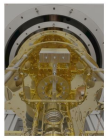
☐ O-rings cleaned with IPA and re-greased.

☐ Continuity checks passed on all wiring.

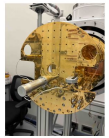
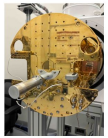
1.4 Assembly Procedure

- *At any time when the cold finger assembly is supported by the still plate, a step-ladder with a pillow of Kimwipes can be used to support the other end. While the hinge rest is usually appropriate to use for this, the braids may experience some force if they are attached to the cold fingers too far away from the plates.*

1. Attach T-bar to still plate.
   - Make sure to lift the T-bar so that it's not resting on the threads before tightening.

2. Attach hinge rest to MXC plate.

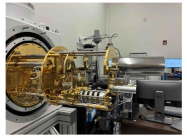
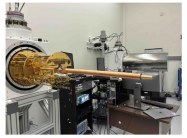



3. Complete the cold finger assembly if not already assembled via the following steps:
   - Make sure any wiring is connectorized and taped down to the 20 mK cold finger.
   - Scotch-brite both sides of the interface between the 1 K cold finger tube and 1 K cold finger rod to remove any oxidation.
   - Scotch-brite both sides of the interface between the 1 K braid and the 1 K cold finger rod.
   - Gently insert the 20 mK cold finger into the 1 K cold finger tube vertically, lowering the 20 mK cold finger into the tube without scraping the walls. Lay it flat and insert the 3D printed alignment piece on the end of the 1 K cold finger tube which doesn't interface to the 1 K cold finger rod.

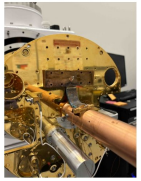
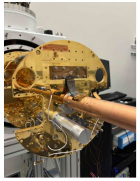

   - Attach the 20 mK braid to the cold finger with the appropriate torque while firmly gripping the other side of the 20 mK cold finger to prevent rotation.


   - Attach the 1 K cold finger rod to the 1 K cold finger tube.


4. Insert cold finger assembly into the DR and attach to the T-bar. Rest the cold finger assembly on the hinge rest.

5. Attach the 20 mK braid to the MXC plate, lifting it up to make sure it's not resting on the threads before tightening with the appropriate torque.

6. Clamp the 1 K cold finger braid onto the 1 K cold finger rod with the reinforcement plate on top, and

Assembly Procedures Location

Assembly Procedures / SOPs Location

Confluence: DMRadio-50L → DMRadio-50L Cryogenic Operations

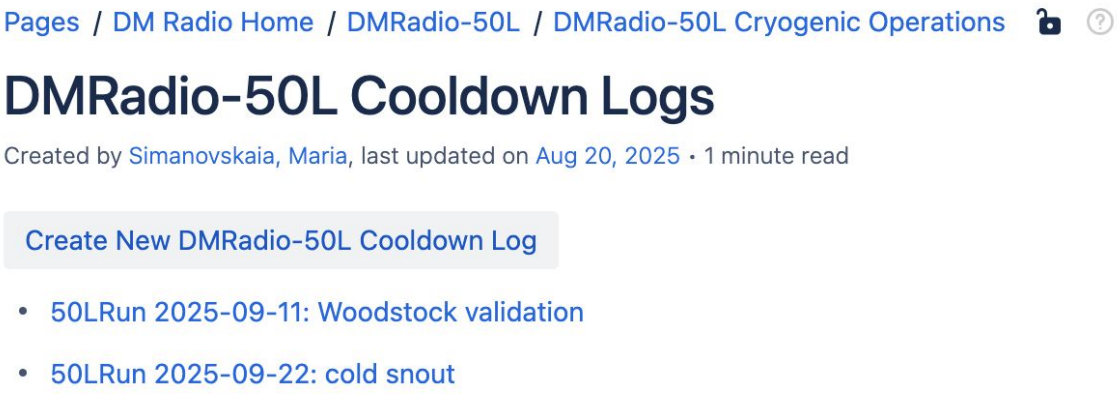
Standard Operating Procedures (SOPs)

Procedures	Document or link
Setting up database logging for a cooldown	Temperature & Pressure Monitoring for 50L
Woodstock: opening up shields, closing up shields, installing rail, removing rail	Woodstock_SOP.pdf
Cold snout: full assembly	Cold_snout_assembly_procedure.pdf
1 K space: full assembly	
20 mK space: full assembly	

Cooldown Logging

Cooldown Logging

Everything done during a cooldown (including while cold) should be recorded in the log!



Cooldown Logging

Detailed descriptions of the setup

Cooldown Logging

Detailed descriptions of the setup

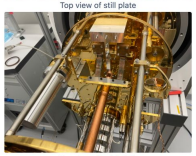
50LRun 2025-09-22: cold snout

Created by Simanovskaia, Maria, last updated by Aya Keller about 3 hours ago • 10 minute read

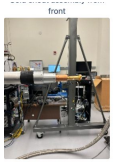
Cryostats included in cooldown	Snoopy and Woodstock
Config id for database logging	15
Start date	28 Sep 2025
Users	MS, AK, TA, PS
Short description	Cold snout with vacuum bellows, 40 K flexible connection (fingerstrips on Bock blacked cylinder), 4 K flexible connection (Al strips with Al tape on the back), small 4 K shim. Bock blacked sheets on 4 K plate, Bock blacked complete 4 K plate cover, removed 4 K ring, taped some light leak gaps on the 4 K panel as good as possible and one 40 K panel, brass screws in all holes of 4 K plate. Attocube and SQUID in Snoopy.
Initial base temperature	Date base temperature was achieved: • Woodstock 1st stage PT: • Woodstock 2nd stage PT: • Woodstock 40 K plate: • Woodstock 4 K plate: • Woodstock 4 K ring: • Snoopy 40 K plate: • Snoopy 4 K plate: • Snoopy still plate: • Snoopy MXC plate:
End date	

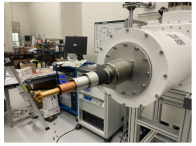

Top view of still plate

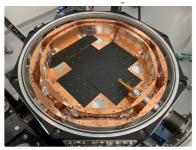
Smaller 4 K shim installed.


Top view of cold plate

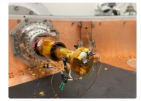

Smallest clearance between 4 K and 1 K


front
Cold snout assembly from side


Cold snout assembly ready to mate to Woodstock


Final cooldown configuration


Final cooldown configuration

Thermometer	Location	Description	Readout	RT value	Photo
U10858 (with white shrink wrap)	gold-plated copper shmount at end of 20 mK cold finger	20 inch*oz with M3 Al7075 screw and Al7075 nut, brass washer	CH8 on LS372AC	1.008 kohm	
RO600-5870 (Scientific Instruments)	copper shmount near the end of the 1 K cold finger	20 inch*oz with M3 Al7075 screw into copper threads on shmount	CH7 on LS372AC	1.0007 kohm	
X229480 (usually 4 K ring thermometer)	4 K plate near Woodstock PT	20 inch*oz with M3 screw, a flat washer, and a lock washer	CH3 on LS336A	294 K	

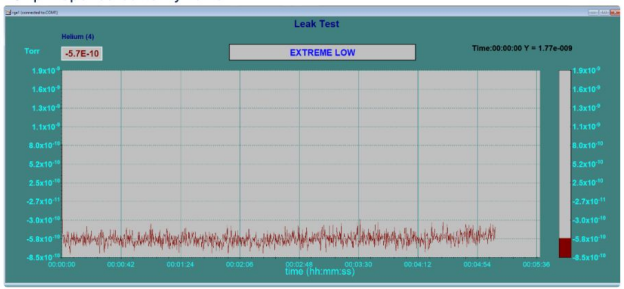
Cooldown Logging

Each log entry should contain date, initials, and detailed notes

Date: 29 Sep 2025

Initials: MS, AK, TA

Log Entry:

- 1:31 pm: P6 is 6.43e-3 mbar = 4.82 torr, blue lesker 3.4 mTorr, agilent 4.0 mTorr.
- 2:50 pm: P6 is 6.00d-3 mbar, blue lesker 3.0 mTorr, agilent 3.4 mTorr. Starting to leak check.
  - 2:51 pm opened butterfly valve
  - 

- 3:18 pm: going to pump out Snoopy's cold trap and DU
  - system pressures: open and closed keg valve, P5 = 759 mbar
  - system pressures: P2 = 9.15 mbar, P3 = 3.75 mbar.
  - 3:21 pm open V2 → P2 = 7.84 mbar, P3 = 3.75 mbar
  - 3:24 pm close V16 and V14, turn on P1 = 3.6e-3 mbar
  - 3:29 pm open V17, P6 went from 7.4e-3 to 3.22, going to pump this out
  - 3:31 pm on scroll2, wait 10 seconds, open V21. After a few seconds, close V21 and see P6 not change much.
  - 3:32 pm open V7, P6 went up to 11 mbar, open V21. After a few seconds, close V21 and see P6 increase again. Leaving for ~10 mins pumping with scroll2 on the cold trap.
- 4:37 pm installed linear driver on Woodstock compressor