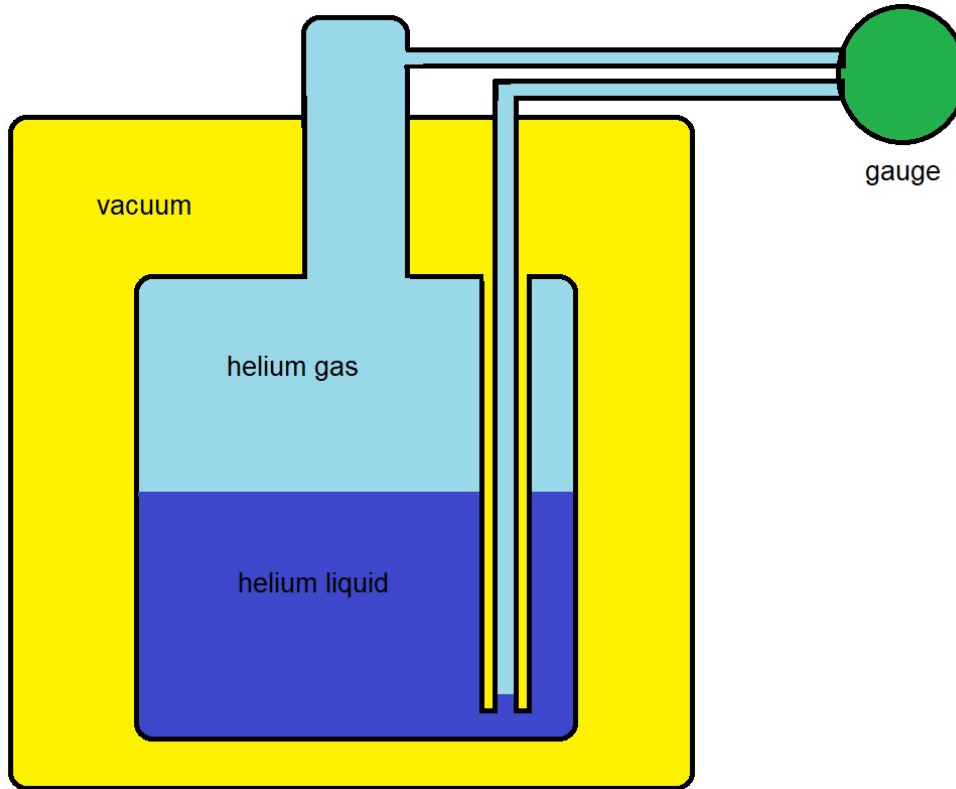


QT Dewar Cooldown Mode from Room Temperature

On 06 Mar 2023 we started the Liquefier A after cleaning up the Dewar A level sensors using the procedure (docdb). According to the procedure, the bottom tube did not vent gHe on 04 Mar 2023 when the cold head temperatures are slightly above 240 K. So, we had to wait until all the cold heads are above 272K.



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Since then (03/06/2023), Dewar A wasn't producing liquid until the 03/19/2023 afternoon. Below is the log of things that we did.

Around 11:26am on 03/12/2023

1. Set the "Mode End: Coldhead Temperature" to 3 K
[blocked URL](#)
2. Had to switch the LQ-A to the Manual mode for a minute and the switched back to Liquefy mode to enable the change made in the previous step.
3. See the cold-head temperatures since 03/06/2023.
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4. Flow change after making the change on Mode End: Coldhead Temperature" to 3 K.
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On 03/14/2023

LQ-A is still the same, LI501 shows 0.2 L. Adam suggested changing the outlet flow to 24 slm and I just changed it on the LQ-A Settings screen.
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The issue was that, the FCAI hasn't go up beyond ~8slm although FCAQ is set to 24slm. Then, on 03/14/2023 around 4:20pm CST, we closed the NV501A needle valve as Adam suggested, to improve the Liquefaction on LQ-A. It was between 1/4 and 1/2 a turn opened position before it was completely closed.

Initial position

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Completely closed position

On 03/15/2023 around 2:20 pm

We opened the NV501A needle valve by two full turns from the current setting(fully closed position) as Joey (QT) recommended.

On 03/16/2023

- 1. In addition to the 2 turns (open) on 03/15/2023, NV501A was opened with one more full turn.
- 2. We adjusted the PRV501A, in order to obtain a smooth inlet flow.

(Initial
Position)
al Position)

(Fin

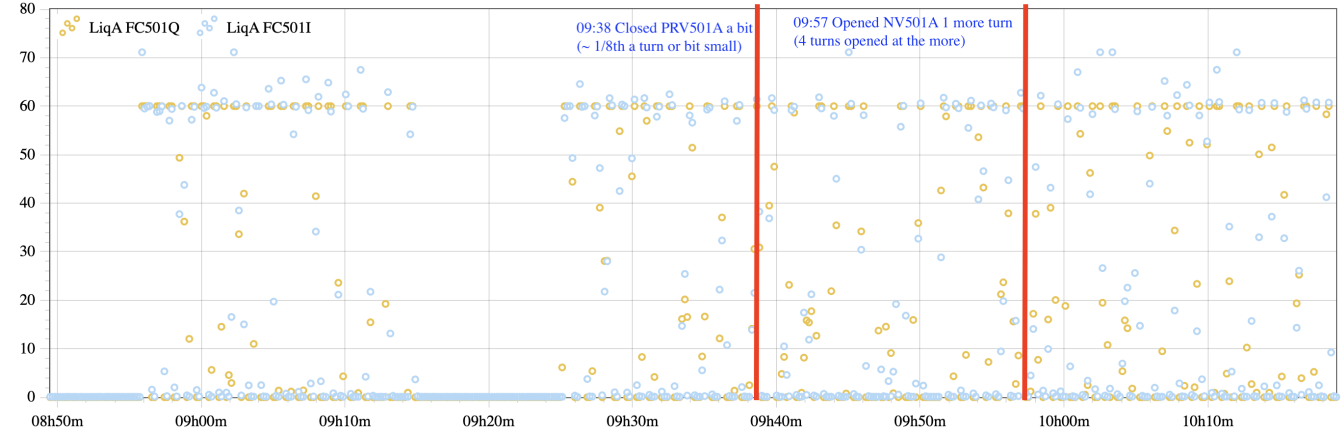
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* We noticed that it takes about ~10min response time after changing PRV501A.

On 03/18/2023

In addition to the 3 turns (open) since 03/16/2023, NV501A was opened with one more full turn.
PRV501A was opened slightly a bit (~1/8th of a turn).

Last Record	LiqA FC501Q	LiqA FC501I
2023/03/18 10:18:56	26	0
	0	0.08246528

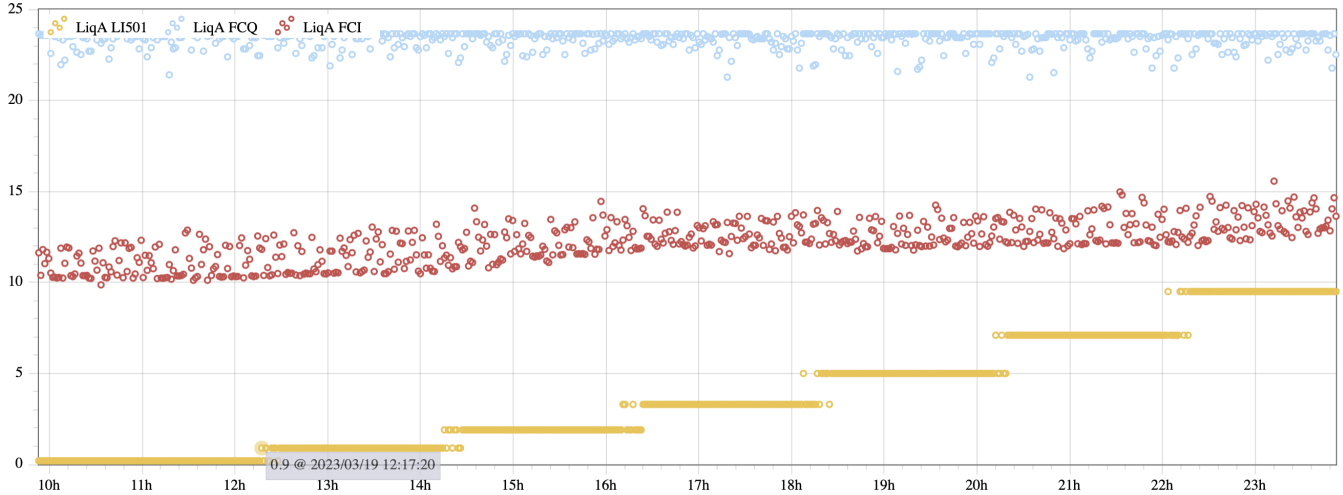


On 03/19/2023

After 13 days of starting the Cooldown of the Liquefier A, today the level sensor indicated that the Dewar A has started accumulating liquid. Notice that the outlet flow actual value is around ~13slm although FCAQ is still set to 24slm.

For 14 h 0 m 0 s | ☒ Auto-Update in 6 / 30 sec | Manual-Update | Chart Option »
Last updated @ 2023/03/19 23:52:40

Last Record	LiqA LI501	LiqA FCQ	LiqA FCI
2023/03/19 23:52:10	30	9.5	22.51792
			13.63498



On 03/20/2023

In the morning we noticed that the Liquefier A switched to the "Liquefy" mode automatically because the condition "Mode end: Dewar level" 5% was met.

Quantum technology

P504 UVA Liquefier System

System Status
On

Operator

Time 8:40:33 AM

QLHe100A Liquefy

PurifierA Manual

HR3 On

Date 3/20/2023

QLHe100B Liquefy

PurifierB Disabled

Liquefier Pressure Settings

Dewar Pressure Setpoint 6.0 PSI

Increase Vent Flow Pressure Increase 1.0 PSI

Enable Heater Pressure Drop 1.0 PSI

Cooldown Mode Settings

Outlet Flow Setpoint @300K 24.0SLPM

Mode End: Dewar Level 5.0%

Mode End: Coldhead Temperature 3.0K

Liquefier Operational Settings

Outlet Flow Setpoint 2.0SLPM

Pre-transfer Cooldown Mode Settings

Enable SVV Quick Vent OFF

Mode End: Dewar Pressure 6.0 PSI

Mode End: Timeout 60 Min

Mode End: Timeout Vent Enable OFF

Transfer Line Cool and Transfer Settings

Recovery Inlet Target Pressure 0.3 PSI

Dewar Pressure Adjustment 0.1 PSI

Dewar Pressure Adjustment Interval 30.0s

Dewar Max Pressure 5.0 PSI

Dewar Min Pressure 2.0 PSI

Alarm Settings

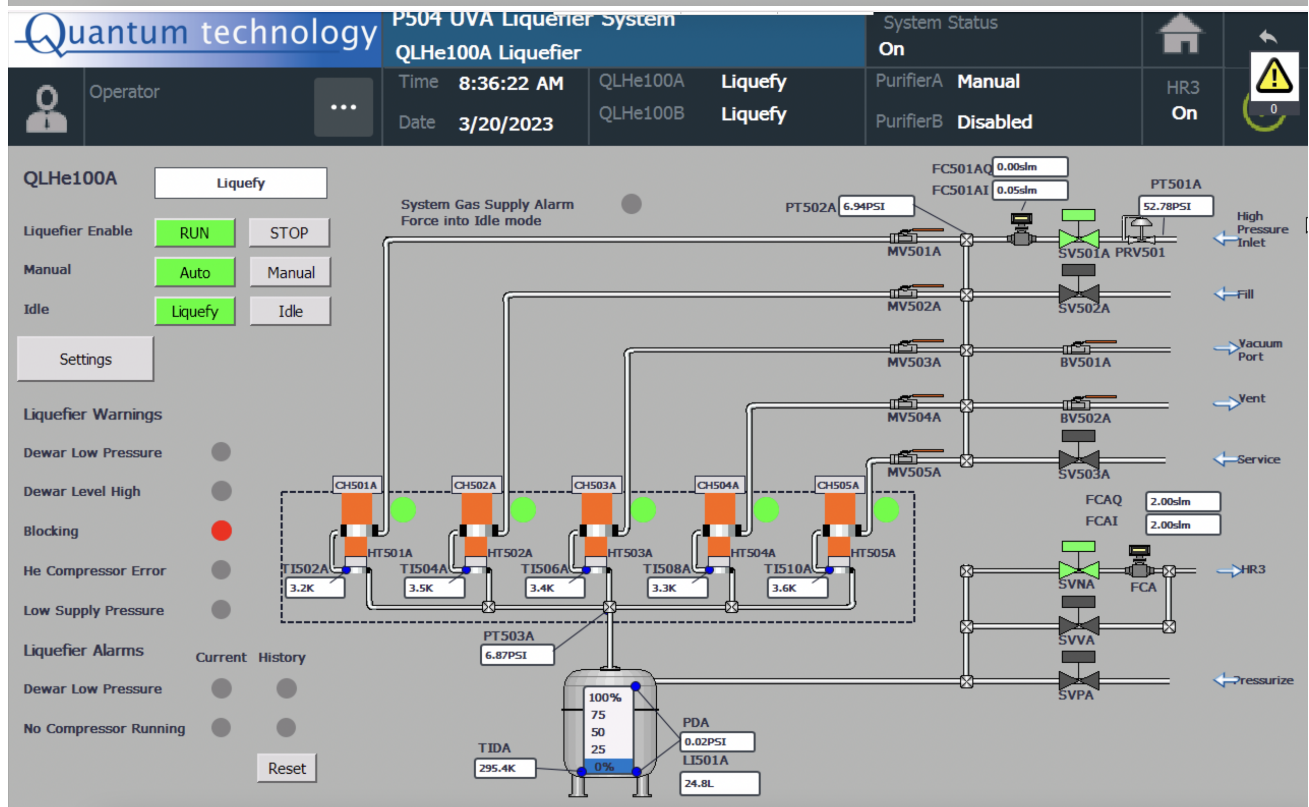
Low Pressure PT503< 1.00 PSI

Warning Settings

Dewar Level High 90.00%

Coldhead Temperature Low 4.0K

Low Storage Supply Pressure 10.0 PSI



QLHe100A

Liquefy

Liquefier Enable RUN STOP

Manual Auto Manual

Idle Liquefy Idle

Settings

Liquefier Warnings

Dewar Low Pressure

Dewar Level High

Blocking

He Compressor Error

Low Supply Pressure

Liquefier Alarms

Dewar Low Pressure

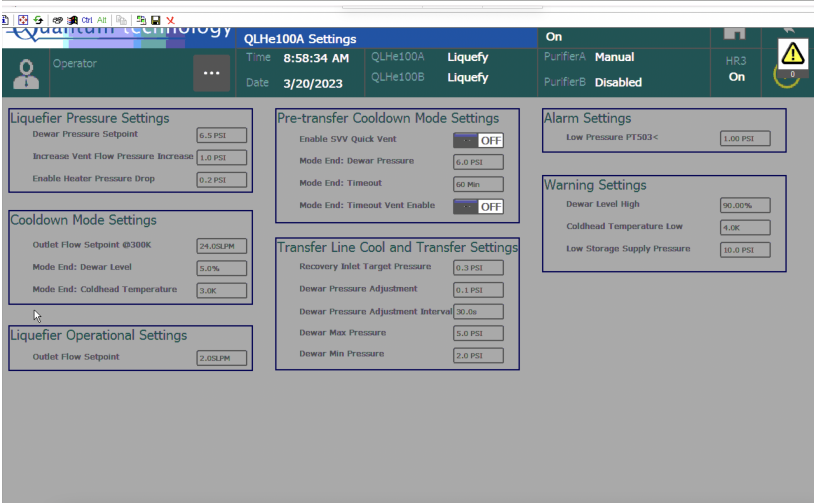
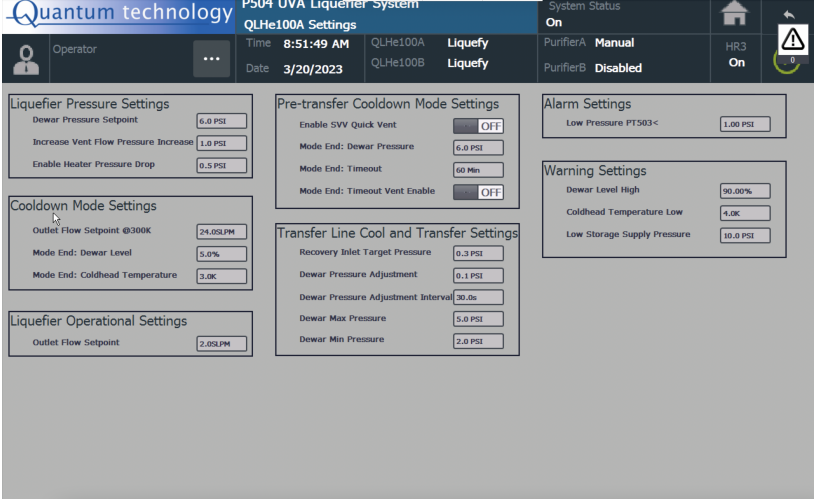
No Compressor Running

Reset

System Gas Supply Alarm
Force into Idle mode

FC501AQ 0.00slm
FC501AI 0.05slm
PT502A 6.94PSI
PT501A 52.78PSI
MV501A
MV502A
MV503A
MV504A
MV505A
SV501A PRV501
SV502A
BV501A
BV502A
SV503A
FCAQ 2.00slm
FCAI 2.00slm
SVNA
SVVA
SVPA
HR3
Pressurize
TIDA 295.4K
PDA 0.02PSI
LI501A 24.8L
TI502A 3.2K
HT501A
TI504A 3.5K
HT502A
TI506A 3.4K
HT503A
TI508A 3.3K
HT504A
TI510A 3.6K
HT505A
PT503A 6.87PSI

The liquid level is ~24L and artificial blockage appeared. So, the Dewar pressure and heater were adjusted to get rid of the blockage.



A screen video of Liquefier A

https://myuva-my.sharepoint.com/:v:/r/personal/dmk9m_virginia_edu/Documents/Attachments/DewarCooldown.mp4?csf=1&web=1&e=863qws



Liquefier_A.mov

Dewar Cooldown Mode:

Historically we have had more trouble with cooling Dewar A down than Dewar B. Dewar A has taken more than 3 days in the past and this most recent time (March '23) its taken about two weeks.

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This is likely just because the settings were not optimized for cooling and we had better pay more attention to the system setting for switching between production and cooling modes. If the pressure in the dewar is greater than that on the cold heads the dewar will never cool and the system enters a perpetual state where the cold heads are cold but the dewar is warm.

It seems that the green-handled regulator on the QT manifold should not be open too much. This will make the MFC letting in the helium to the cold heads fluctuated a lot which is not optimal for cooling. During cooldown mode you want a large flow running in and out of the dewar with the goal of around 60 slm going in and 24 slm going out. In order for this to work the pressure in the cold heads much stay slightly above the dewar pressure so flow continuously runs to the dewar to cool things down. The black-handled needle valve should be open a lot (maybe all the way) to keep the flow through this area as high as possible. This will lead to lots of frost and ice build up on the dewar neck. This should not be a problem but should be checked and defrosted regularly. When everything is set appropriately the accumulation of liquid should happen in about 24 hours.

Cooldown Mode Settings

1. Open the NV501 (A/B) as much as it doesn't affect producing a lot of ice on the Dewar neck. This will allow a higher flow circulation between the Dewar and coldheads.
2. In the "Cooldown Mode Settings": Set the outlet flow to 24slm and End mode cold head temperature to 3K
3. Reduce PRV501 (A/B) (green-hand valve) to barely provide the flow that FC501(A/B) flow controller asking for.

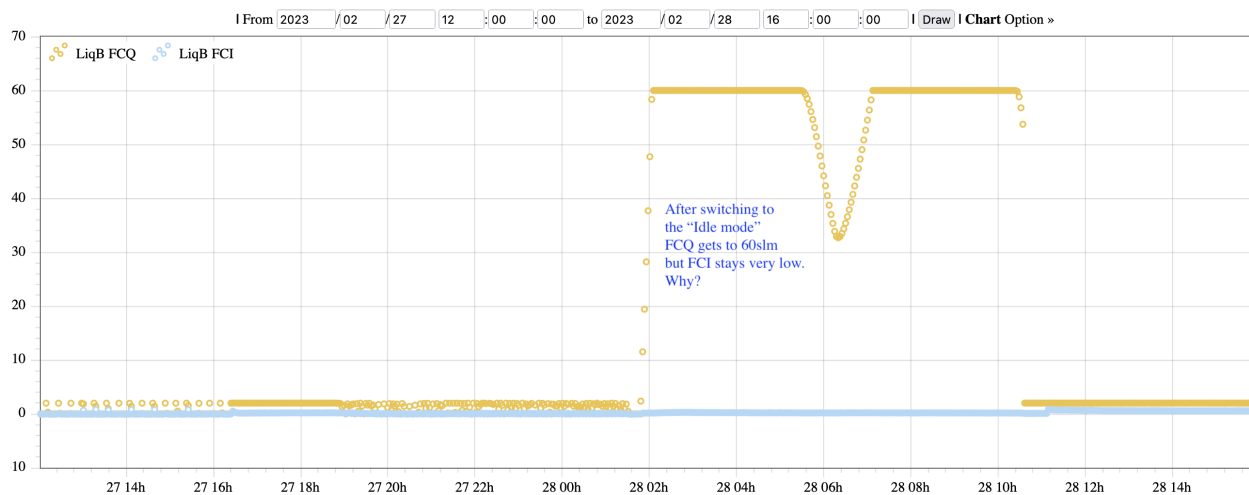
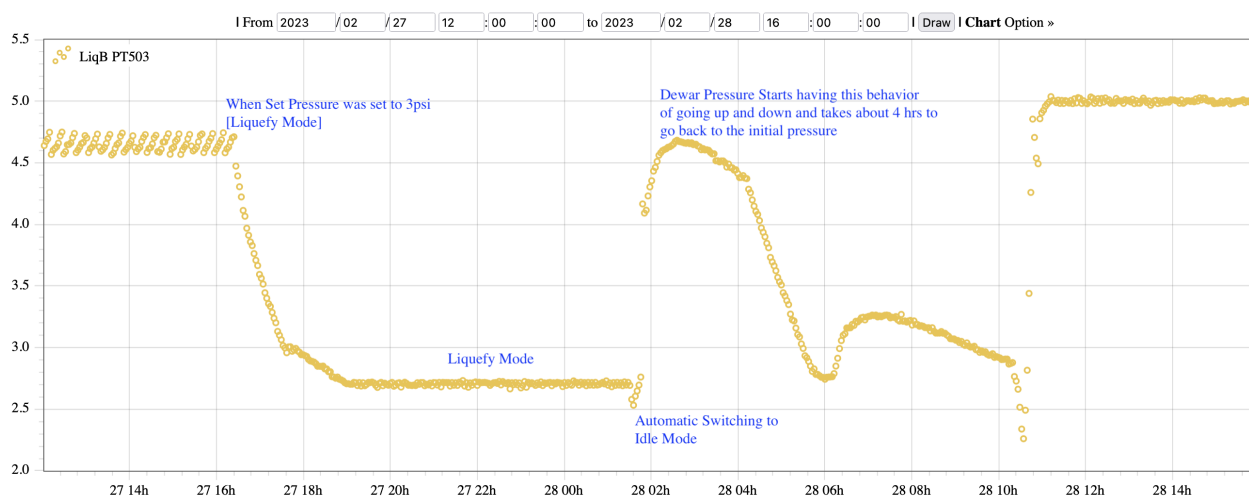
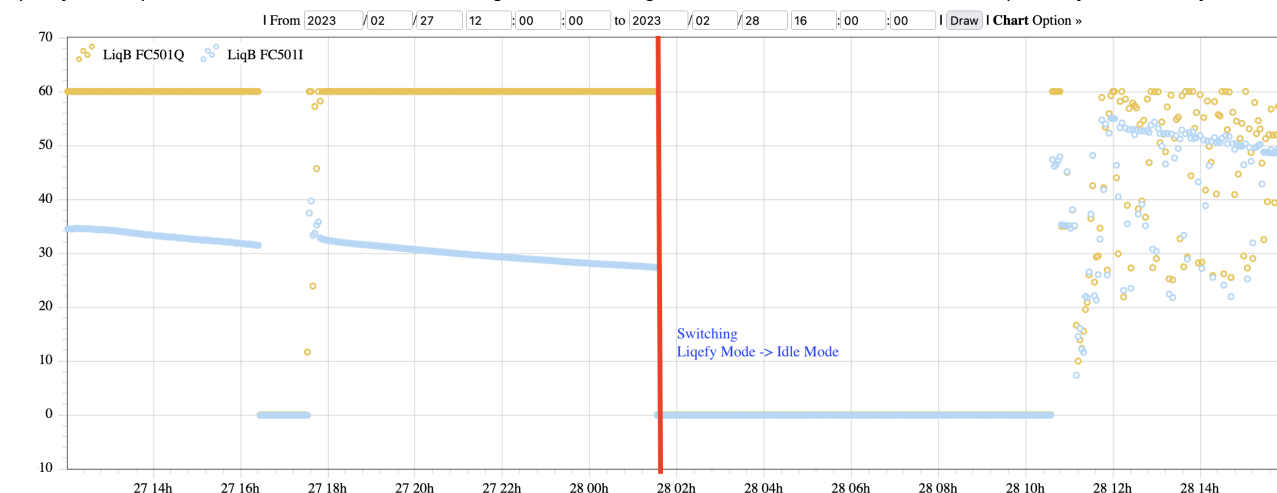
Liquefy Mode Settings

1. Close the NV501 (A/B) until there is no ice accumulation on Dewar neck

Questions

- a.) Is there a downside to having the needle valve open too much during the dewar cooldown?
- b.) Are the seals at the top of the neck something we should try to keep warm or will this run into contamination issues?
- c.) Do we understand why the overfilling (just up to 220L) leads to this contamination issue? Can this be fixed with different tubing?
With past experiences, the level sensor's large fluctuations happened if the Dewar was kept full (> 210 L) for more than two or three days.
- d.) How to adjust the outlet flow while in the Liquefy mode? (without going to the manual mode)
Especially, when we want to bring down the Dewar pressure for a fill (like from 5psi to 3psi), it usually takes about 5 hrs. How can we improve that?
By experience, we noticed in the past, if we use higher flow using the bypass SVVA/B, those solenoid valves got stuck-open, and we will have to avoid that situation too.

e.) Why Dewar pressure, inlet/outlet flows start behaving like the following when it was switched to the Idle mode (either by automatically or manually)?



e.) Purifier is still in Manual mode since the beginning, any plans to enable the "auto" mode?

We noticed that once the Liquefiers are accidentally go to "Stop" mode, the v9 and v21 solenoid valves get closed.

f.) Calibrations of

- (i) FMR : This was done by Sam by applying a conversion equation with the characteristic parameters for gHe.
- (ii) Dewar Level sensors: We can adjust this by comparing with the manual gauges

g.) PT8:

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It seems that this pressure sensor is accurate at high pressure but has about ~15psi off when it's below 50 psi.

Sam recommended this product (the same one): https://www.automationdirect.com/adc/shopping/catalog/process_control_-_measurement/pressure_sensors/pressure_transmitters/sptd25-20-0300h