



SAAO Instrumentation Standard Operating Procedure

Title: Vacuum Pumping of Instruments

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Personnel authorized to perform procedure:

Date: 11 September 2020

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VERSION HISTORY

| Author | Version | Date | Change History |
|---------------|---------|--------------|----------------------|
| R Klein | 0.1 | 15 July 2019 | First Issue |
| P Swanevelder | 0.2 | 10 Sep 2020 | Added Sibonise |
| | 01 | 11 Sep 2020 | Add to config system |

ACRONYMS AND ABBREVIATIONS

| | |
|------|--|
| NRF | National Research Foundation |
| SAAO | South African Astronomical Observatory |
| SOP | Standard Operating Procedure |
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DEFINITIONS

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1. Purpose

The purpose of this document is to provide the procedure specific to the vacuum pumping of the STE3, STE4 and SpUpNIC instruments.

2. Constraints and Warnings

- These procedures should only be undertaken by trained personnel.
- The instruments must be put on the vacuum pump the day before the instrument change and must pump until just before instrument change the following day.
- If there is a power outage, the vacuum valve of the instrument must be closed and the pump must be started up again, as per the procedure below.

3. STE4 & STE3

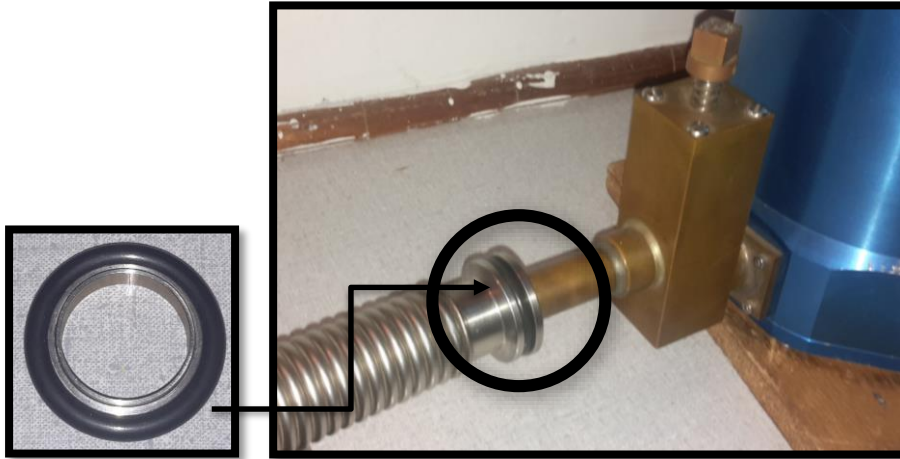


The following procedures must be performed when pumping down the STE4 and/or STE3 instrument.

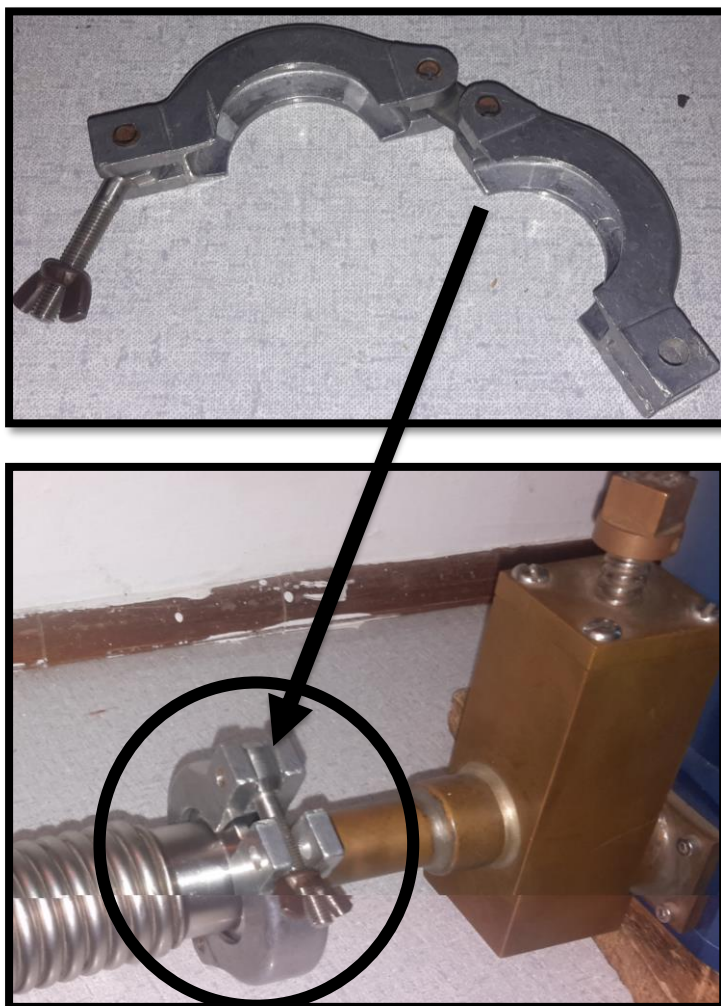
1. Remove the dust cap from the vacuum pipe as well as from the instrument.



2. Ensure the O-ring is clean, and insert it between the vacuum pipe and the instrument.



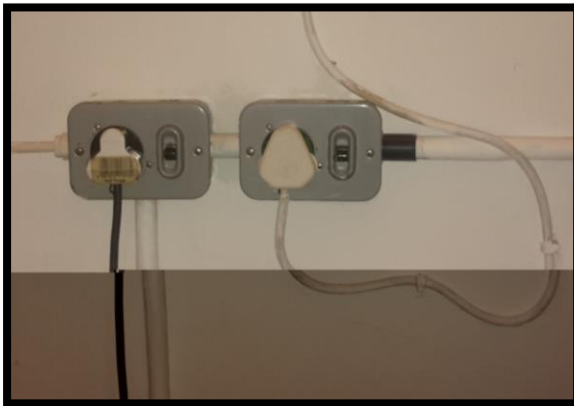
3. Lock the vacuum pipe to the instrument with the mechanical clamp.



4. Ensure all four brakes on the vacuum pump is locked before starting the pump.



Ensure the power on the wall socket to the vacuum pump is on.



5. Activate the vacuum pump by pressing the green (Number 1) button at the bottom of the pump. You will hear a click sound when pressing the button.

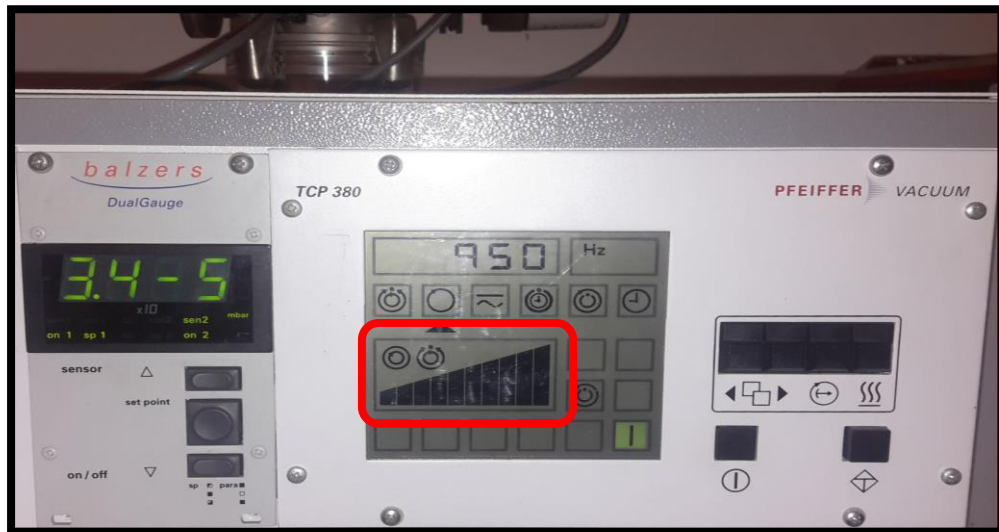


6. Start the vacuum pump by pressing the ON button as per the below image.



7. Let the pump run until all the blocks on the screen are full. You can also listen to the sound of the pump. The sound will increase as the

blocks on the screen fill up.



8. When the sound does not increase anymore, and runs equal or when the blocks are full, slowly open the vacuum valve on the instrument with the tap provided, turning it anti-clockwise until it is fully open.

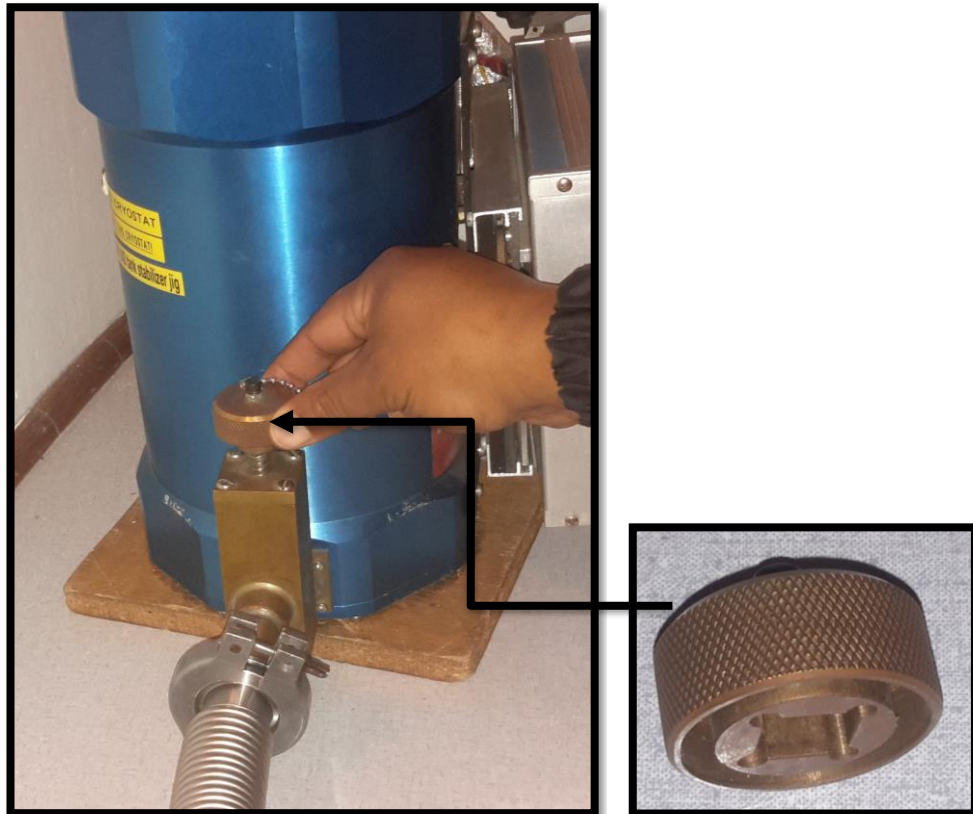
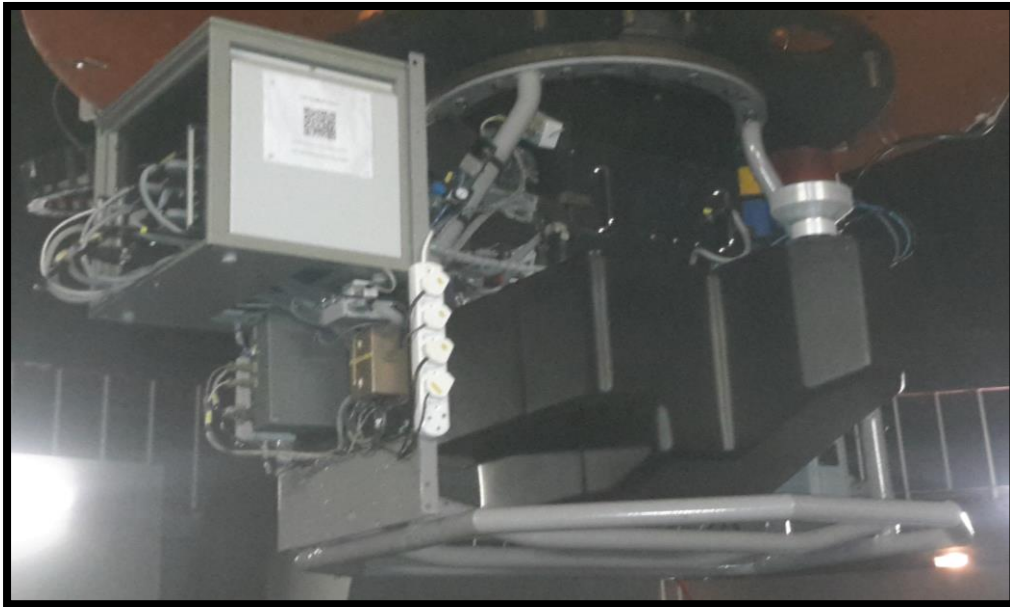


Figure 1: Tap knob for opening/closing vacuum valve

9. Let the instrument pump down until the next day, just before the instrument change. STE4 & STE3 vacuum after pump-down should be $\sim 10^{-7}$ mbar range.
10. Before switching off the vacuum pump, first close the vacuum valve of the instrument, by turning it clockwise until it is completely closed.
11. Ensure to attach the dust caps which was removed in 'Step1' to the instrument and the vacuum pipe again, once the pump is disconnected from the instrument and store all vacuum components in the vacuum room.

4. SpUpNIC

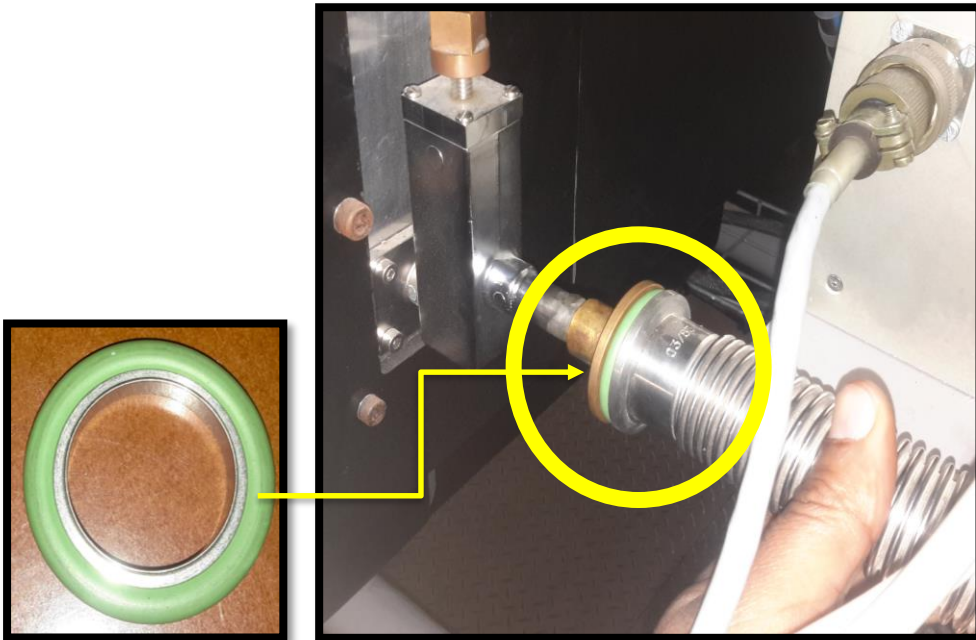


The following procedures must be performed for pumping down SpUpNIC.

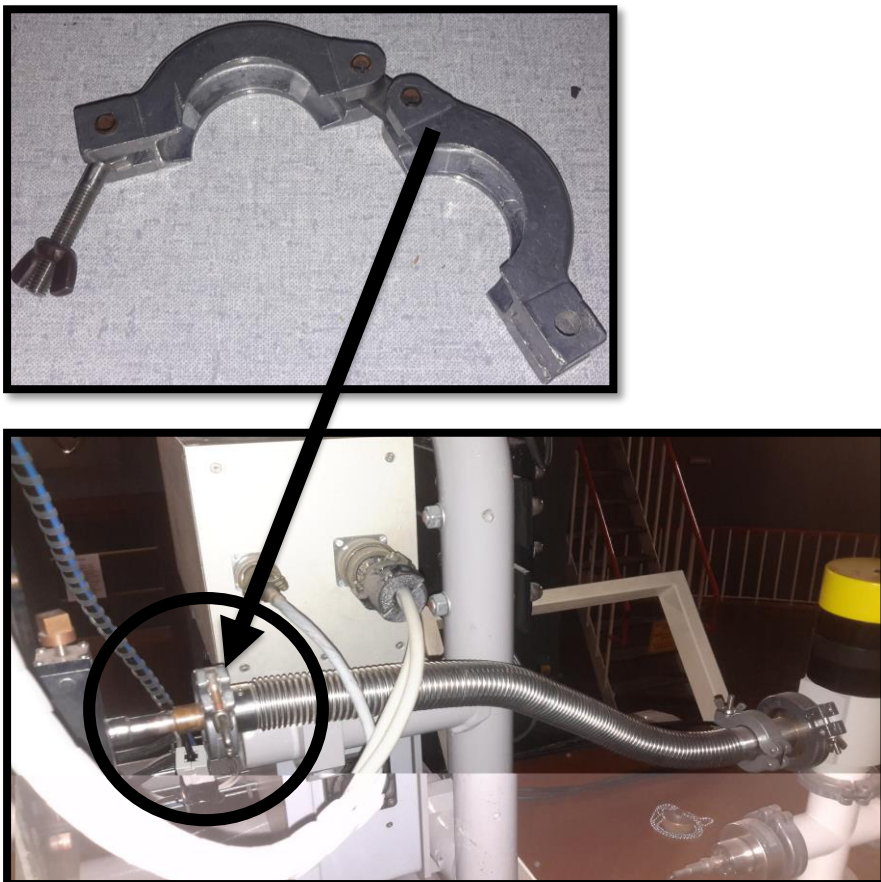
1. Remove the dust cap from the vacuum pipe as well as from the instrument.



2. Ensure the O-ring is clean, and insert it between the vacuum pipe and the instrument.



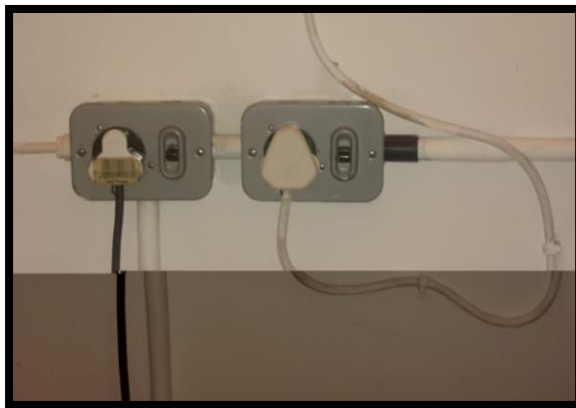
3. Lock the vacuum pipe to the instrument with the mechanical clamp.



4. Ensure all four brakes on the vacuum pump are locked before starting the pump.



5. Ensure the power on the wall socket to the vacuum pump is on.



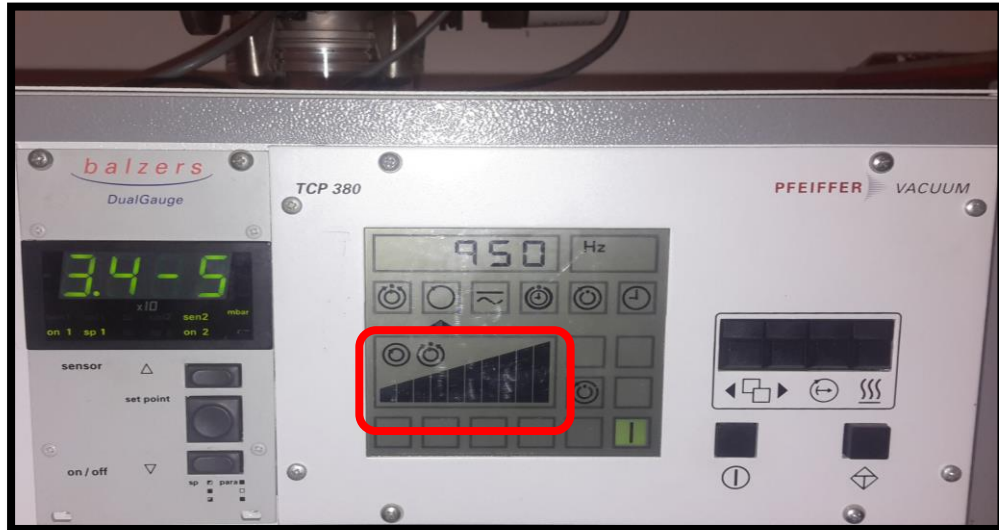
6. Activate the vacuum pump by pressing the green (Number 1) button at the top-left corner of the pump. You will hear a click sound when pressing the button.



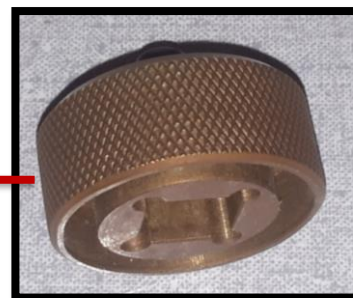
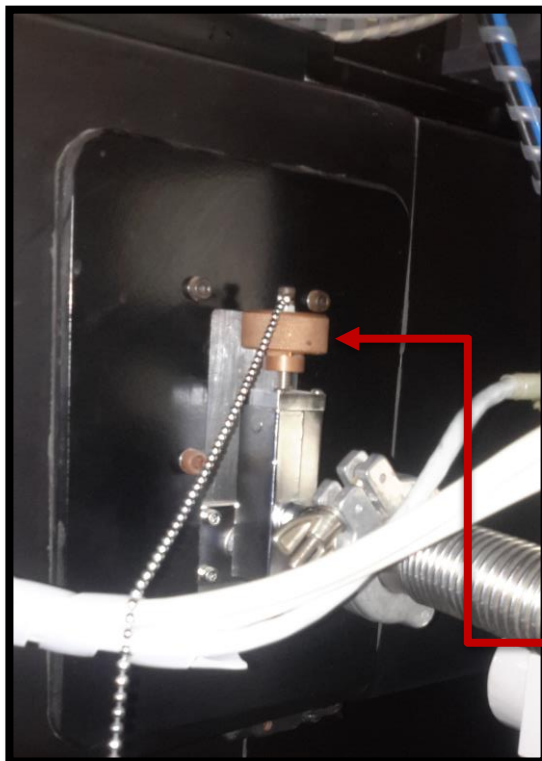
7. Start the vacuum pump by pressing the ON button as per the below image.



8. Let the pump run until all the blocks on the screen are full. You can also listen to the sound of the pump. The sound will increase as the blocks on the screen fill up.



9. When the sound does not increase anymore, and runs equal or when the blocks are full, slowly open the vacuum valve on the instrument with the tap provided, turning it anti-clockwise until it is fully open.



10. Let the instrument pump down until the next day, just before the instrument change. SpUpNIC vacuum after pump-down should be $\sim 10^{-6}$ mbar range.
11. Before switching off the vacuum pump, first close the vacuum valve of the instrument, by turning it clockwise until it is completely closed.
12. Ensure to attach the dust caps which was removed in 'Step1' to the instrument and the vacuum pipe again, once the pump is disconnected from the instrument and store all vacuum components in the vacuum room.

5. Sibonise

Note that the IRSF Portable Vacuum Pump is a 110V unit – it requires a 220:110Vac kVA transformer!

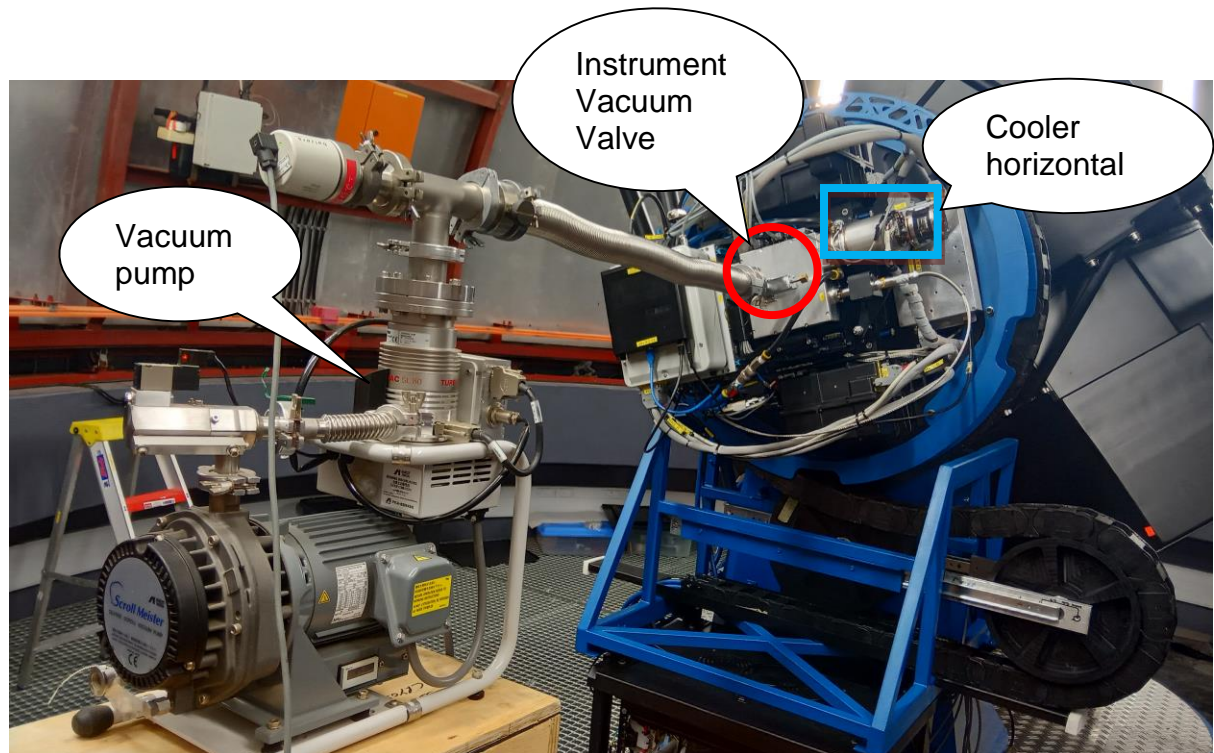


Figure 2: Vacuum pumping Sibonise

5.1. Required components

1. Lake Shore Temperature Controller
2. Cryotel-AVC and MOXA-RS232-to-Ethernet Converter
3. Coolant pump and Coolant circulating through Cryotel-AVC collar at ~ 10 (TBC) cm^3/min
4. Ion Pump and – Controller
5. Host pc – ccd@10.2.4.147
6. Lesedi TCS
7. Portable vacuum pump, vacuum gauge, vacuum hoses, and fittings.
8. Vacuum valve knob (available in 1.0m and 1.9m domes – see Figure 1 on Page 10)
9. 220:110Vac (1kVA?) isolation transformer in case of IRSF pump.
10. Platform to secure vacuum pump in line with instrument.

5.2. Preparation of instrument and vacuum pump

1. Rotate Left Fork until Cooler is horizontal (Figure 2)
2. **LOCKOUT:**
 - a. Ensure all SiTech software is closed (7 GUIs). Contact Hannah Worters (hannah@sao.ac.za) for queries.
 - b. Disable the telescope by unplugging the SiTech Icron device mounted underneath the north pier.
 - c. (Optional) Lockout the dome by switching dome lockout switch ON at north end of observing floor.
3. Remove Sibonise instrument rack door – in case access is required to components in rack.
4. Provide safe platform for equipment (TBD)
5. Mount and secure IRSF 110V Vacuum Pump (portable) on platform
6. Connect 110V Vacuum Pump via 220:110V isolation transformer to 220Vac UPS power.

5.3. Pumping – Cryostat already evacuated

Note this procedure can be performed with the cryostat at ambient (warm) or operating (cold) temperature.

1. Move the pump close to the instrument
2. Connect the pump and vacuum gauge mains cables (AC100V)
3. Connect the hose to the instrument
4. Open the valve on the pump using the valve knob (see Figure 3).
5. Switch Button A ON to start the scroll pump (see Figure 4)
6. Wait until the pressure in the hose reaches ~5 torr or better. This should take no longer than 5 minutes.
7. Switch Button B ON to start the turbo molecular pump (see Figure 4)
8. Wait until the vacuum level in the hose reaches a similar or lower pressure than in the instrument. (TBD ~Ion Pump available)
9. Open the valve on the instrument (See Figure 2), using the valve knob (see Figure 1), or by hand.
10. Pump down the cryostat for a minimum of 6 hours, ensuring the vacuum reaches 10^{-6} mbar or better.

Monitoring vacuum:

The cryotel collar temperature and power can be monitored on the Sibonise dashboard to confirm vacuum is improving. Both should decrease with improving vacuum.

prometheus.cape.sao.ac.za:3000/d/kYxhpd4Gk/sibonise

5.4. Pumping – Cryostat at atmospheric pressure

1. Move the pump close to the instrument
2. Connect the pump and vacuum gauge mains cables (AC110V)
3. Connect the hose to the instrument and ensure the pump valve is open (see Figure 3).
4. Open the valve on the instrument (see Figure 2).
5. Switch Button A ON to start the scroll pump (see Figure 4)
6. Wait until the pressure reaches ~5 torr or better.
7. Switch Button B ON to start the turbo molecular pump (see Figure 4)
8. Pump overnight, ensuring the vacuum reaches 10^{-6} mbar or better.

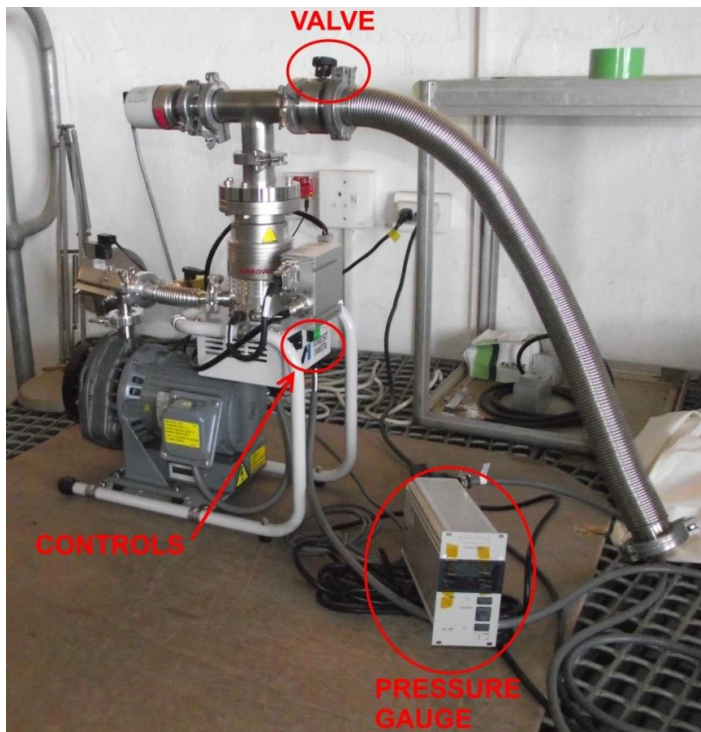


Figure 3: IRSF 110V Portable vacuum pump

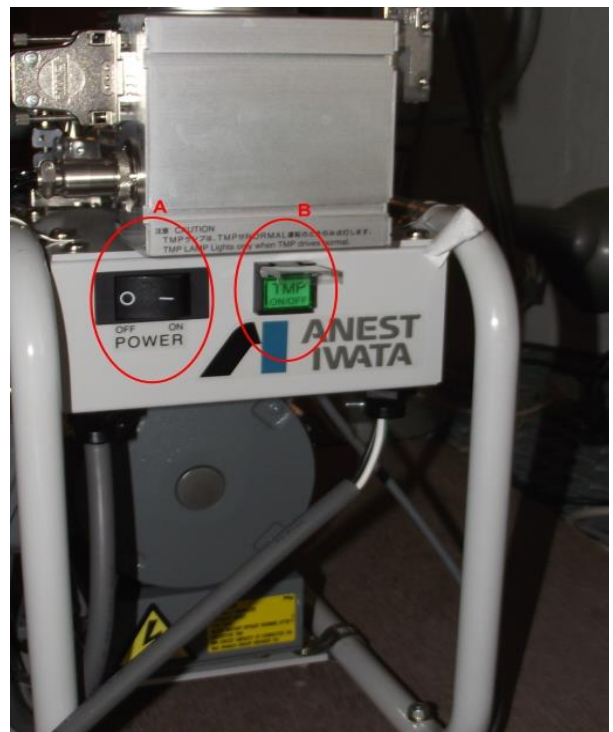


Figure 4: Vacuum pump control panel

5.5. Removing vacuum pump

1. Close instrument vacuum valve (Figure 2), as well as the pump valve (Figure 3), if applicable.
2. Switch off Turbo Pump (B) and Roughing Pump (A) (Figure 4)
3. Let the pump run down. Avoid moving the pump while it is still operating or running down.
4. Remove hoses and close with end caps
5. Replace Instrument end cap
6. Pack away vacuum pump and isolation transformer

5.6. Returning Telescope to Operations

1. Ensure dome lockout switch is set to OFF.
2. Reconnect the SiTech Icron device plug underneath the north pier.
3. Notify Hannah Worters (hannah@saao.ac.za) for restart and testing of the SciTech software. Stand by during restart for any power cycling needed.