

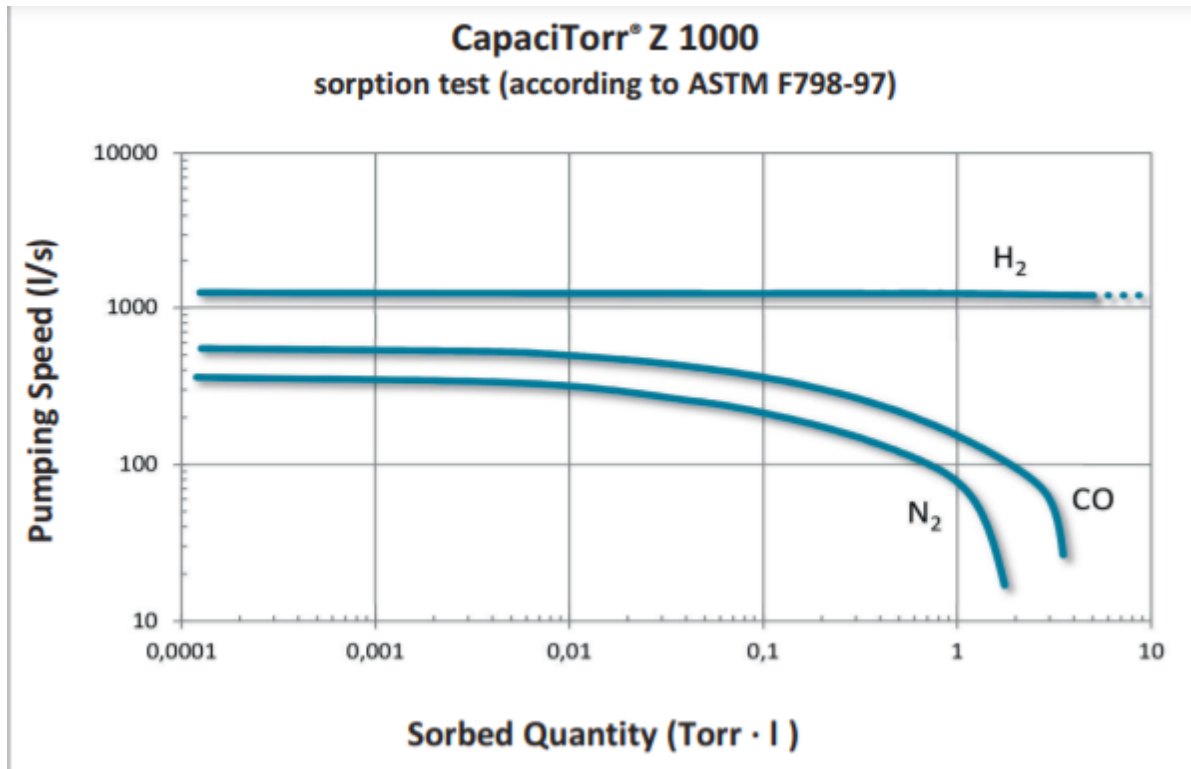
# CI Update

10/03/2022



UNIVERSITY OF  
LIVERPOOL

# NEG property



Typical Pump Characteristics		CapaciTorr Z 1000
Alloy Type		ZAO
Alloy Composition		Zr V Ti Al
Getter Mass (g)		280
Getter Surface (cm <sup>2</sup> )		1530
Activation Power (W)		190
Pumping Speed (l/s)	H <sub>2</sub>	1250
	H <sub>2</sub> O	900
	N <sub>2</sub>	360
	CO	550
Sorption Capacity (Torr·l)	H <sub>2</sub>	5600
	H <sub>2</sub> O	70
	N <sub>2</sub>	1.7
	CO	3.5

# Saturation Estimates

$$t_{saturation} = \frac{\text{Sorptions capacity}}{\text{Pumping speed} \times \Delta\text{Pressure}}$$

All data recorded here with a 5bar N2 Jet

$$\text{Where } \Delta\text{Pressure} = P_{\text{Jet on}} - P_{\text{Jet off}}$$

Sorption capacity  
= 2.26mbar L

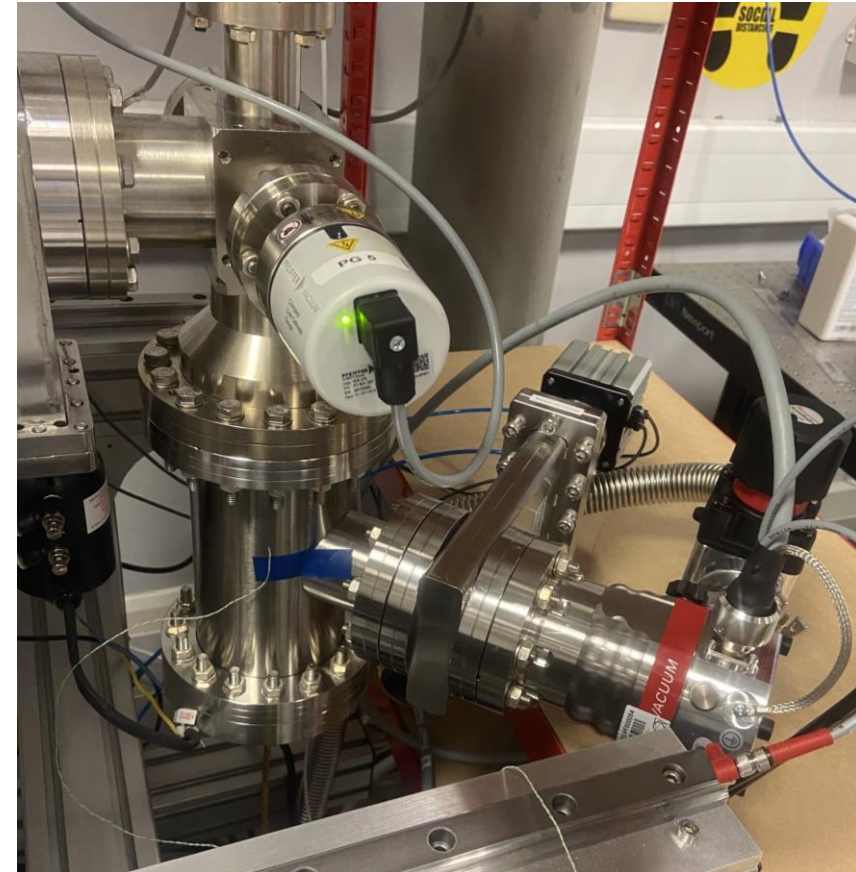
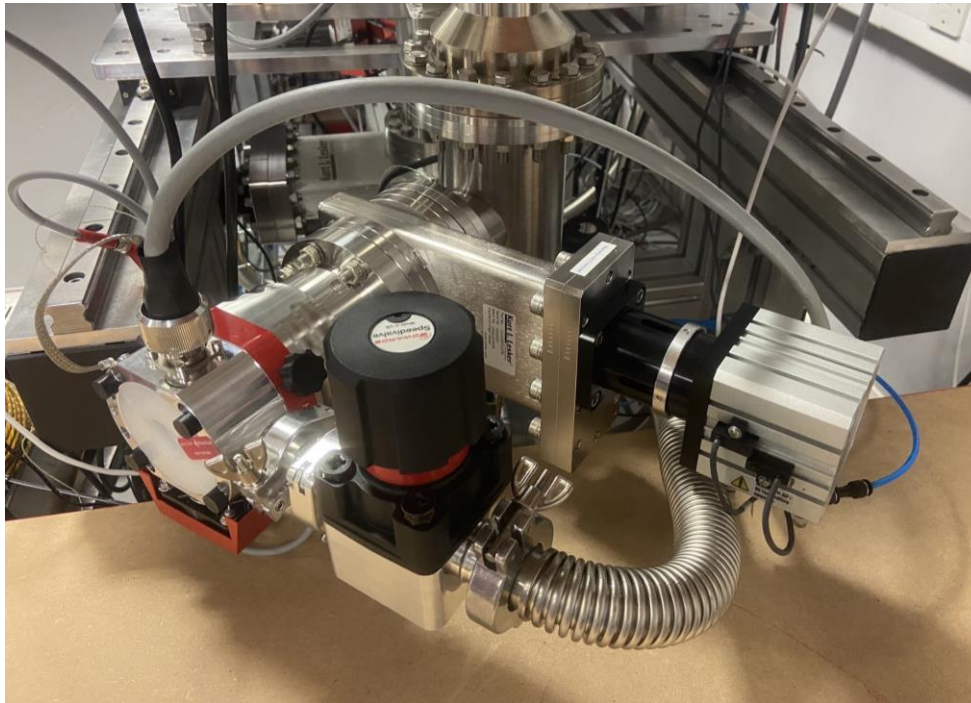
Pumping speed  
= 360 L/s

Skimmer	NEG Chamber	$\Delta P$	Saturation time
0.7x9mm	Interaction	9.45E-09	7.7 days
0.3x9mm	Interaction	3.50E-09	20.8 days
0.7x9mm	Dump	9.50E-08	18.4 hours
0.3x9mm	Dump	4.36E-08	40.0 hours

# NEG Explanation

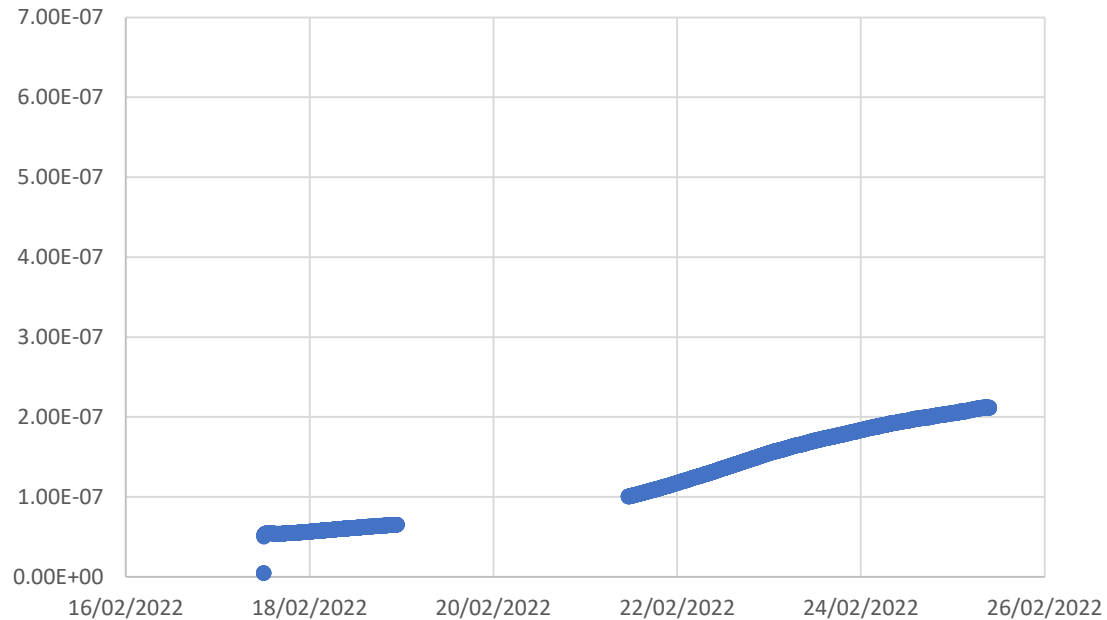
- Sorbed Quantity / mbar.L       $PV = nRT$        $PV = \text{mbar.L}$
- Pump lifetime is extended due to not always pumping at 360L/s especially at very low pressure, pumping speed is a function of sorbed quantity.
- Saturation defined as when entire NEG surface is covered and no longer pumps. We can define as when pressure is too high.

# Neg pump installed in the Dump Chamber



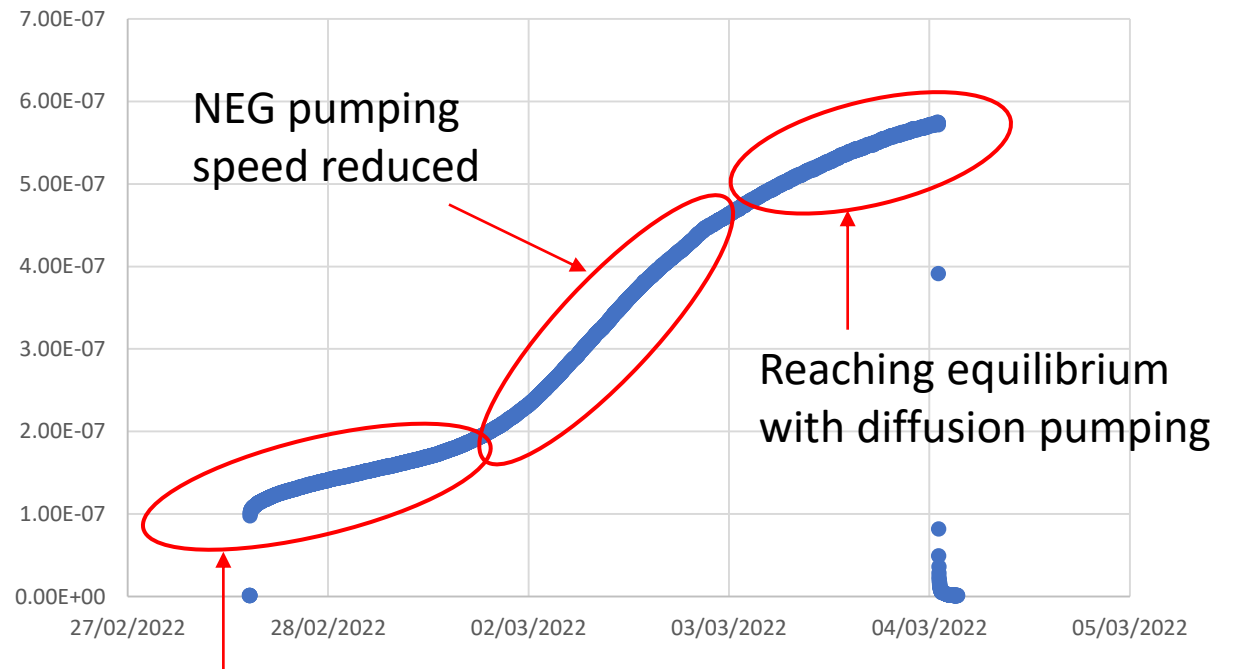
# Saturation Data (dump chamber)

Dump chamber pressure(mbar) 0.3x9mm



**0.3x9mm Skimmer, NEG at Dump**

Dump chamber pressure(mbar) 0.7x9mm

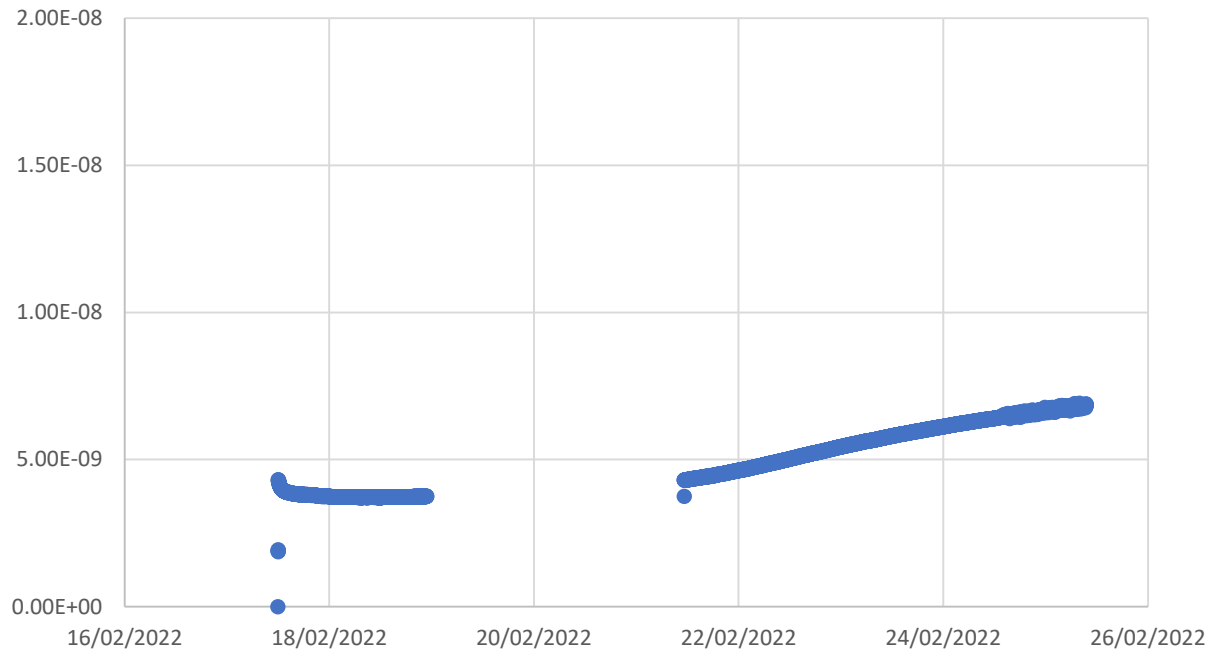


**NEG pumping at 360L/s**

**0.7x9mm Skimmer, NEG at Dump**

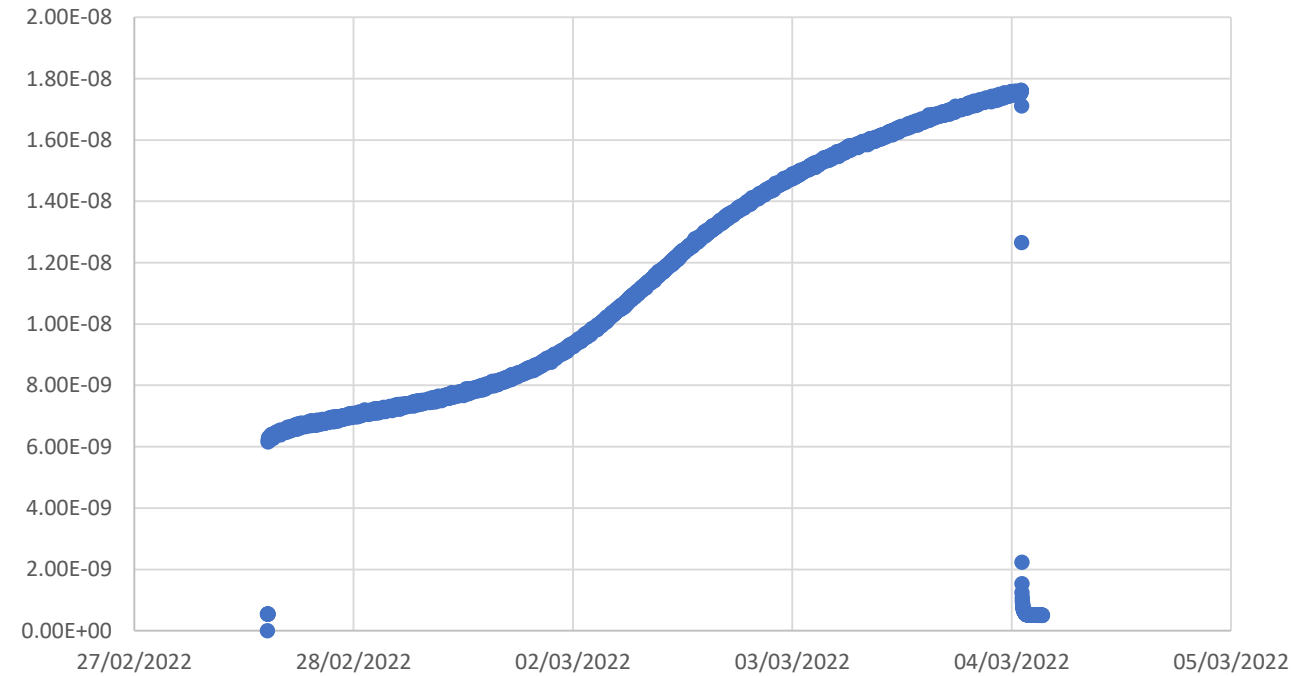
# Saturation Data (interaction chamber)

Interaction chamber pressure(mbar) 0.3x9mm



**0.3x9mm Skimmer, NEG at Dump**

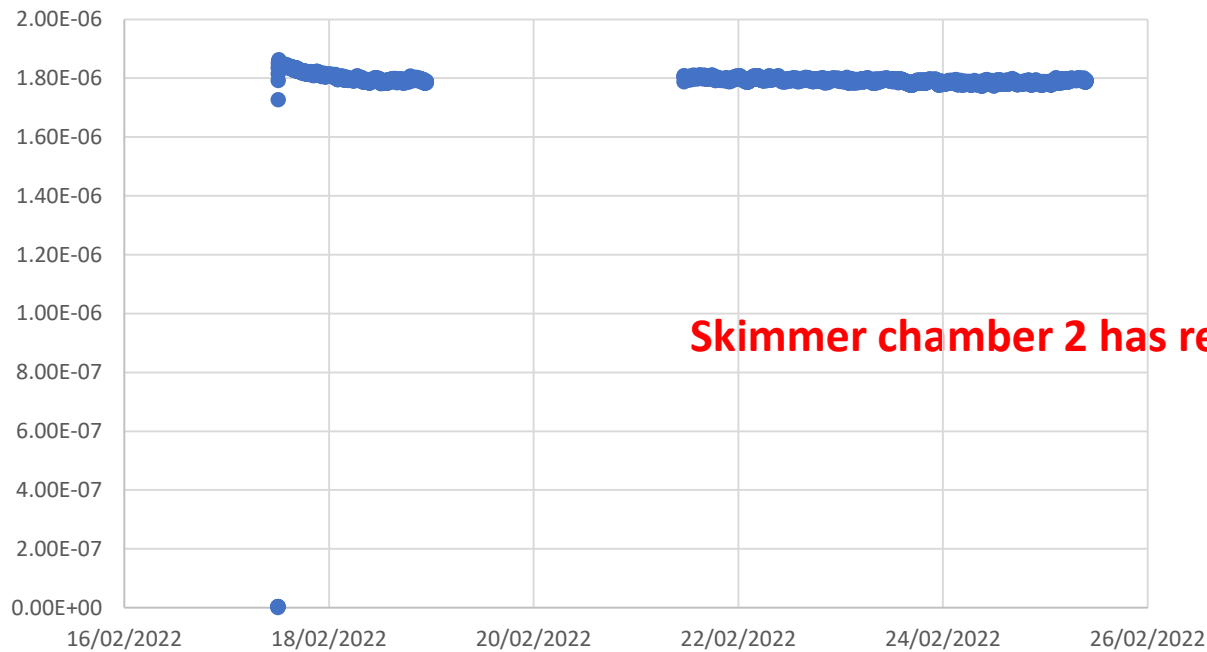
Interaction chamber pressure(mbar) 0.7x9mm



**0.7x9mm Skimmer, NEG at Dump**

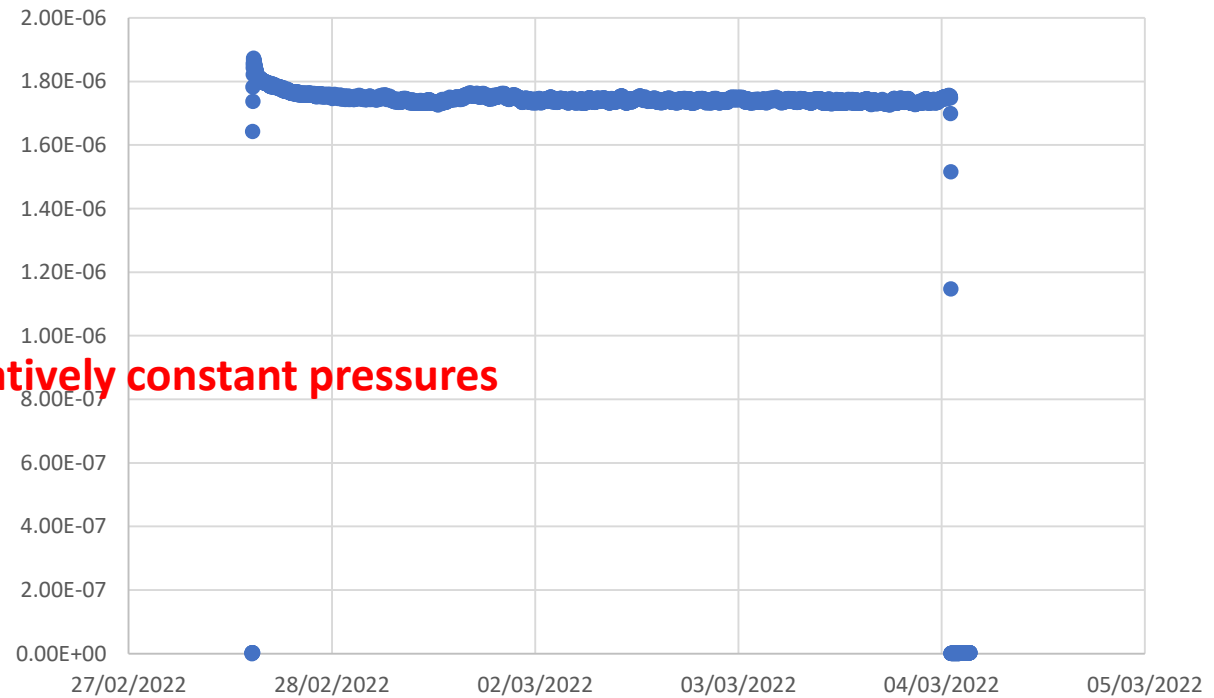
# Saturation Data (Skimmer 2 chambers)

Skimmer II chamber pressure(mbar) 0.3x9mm



**0.3x9mm Skimmer, NEG at Dump**

Skimmer II chamber pressure(mbar) 0.7x9mm



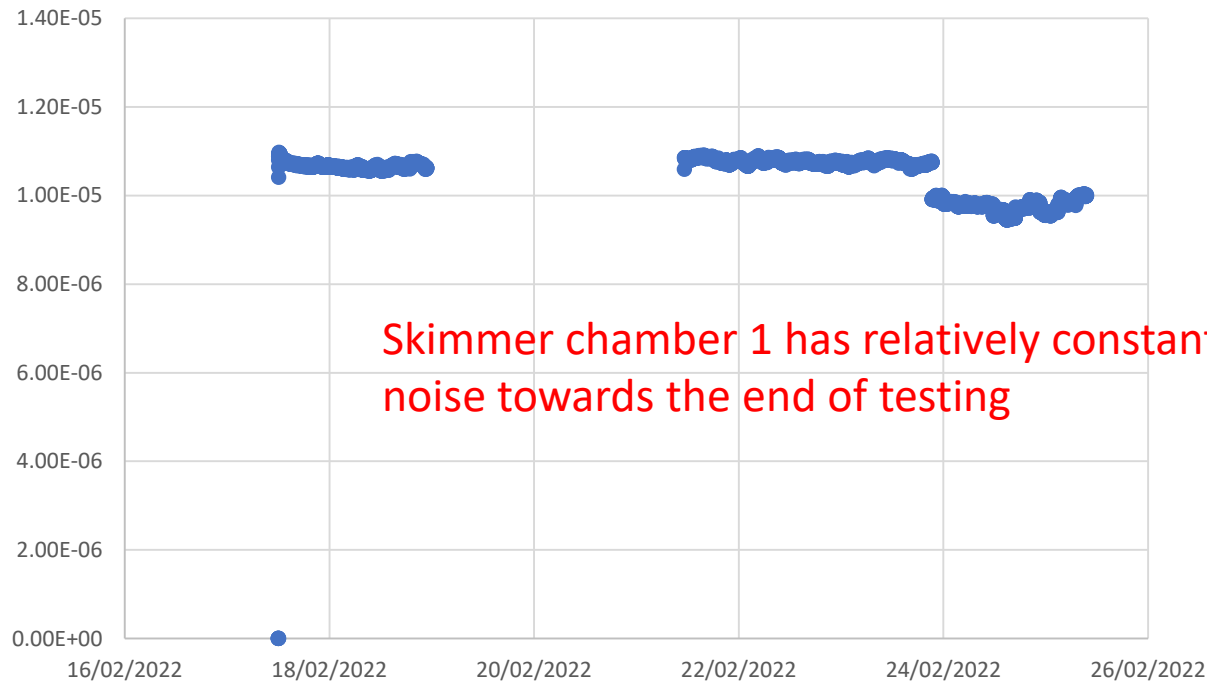
**0.7x9mm Skimmer, NEG at Dump**

Skimmer chamber 2 has relatively constant pressures



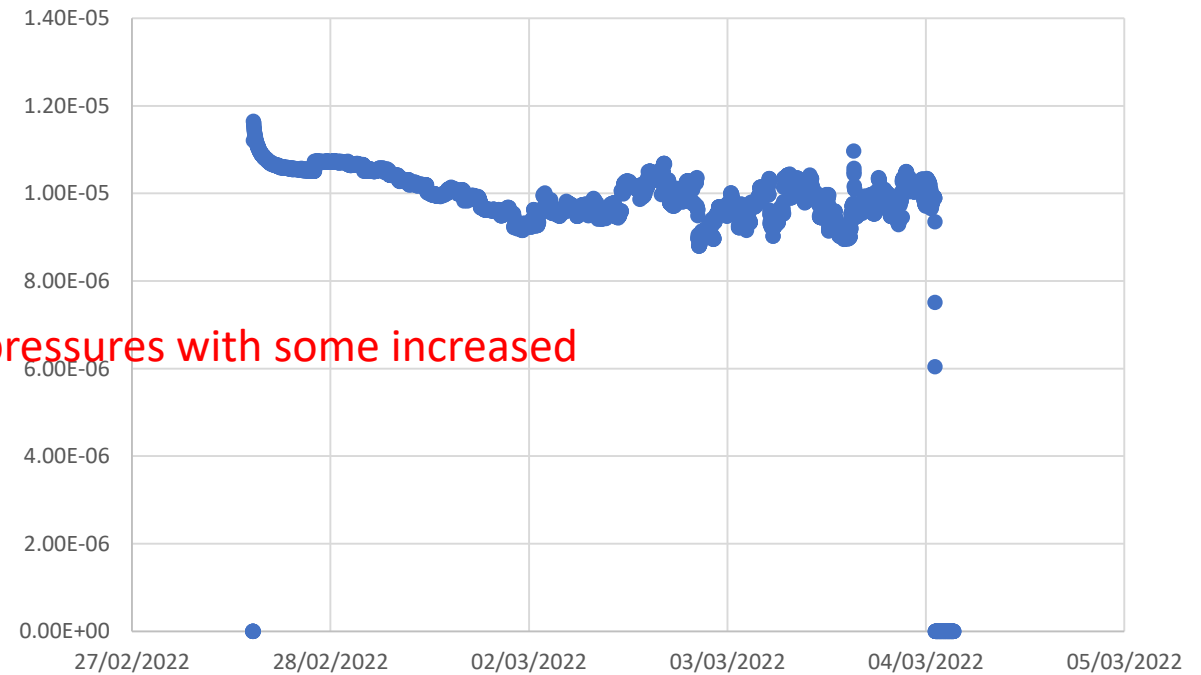
# Saturation Data (Skimmer 1 Chamber)

Skimmer I chamber pressure(mbar) 0.3x9mm



**0.3x9mm Skimmer, NEG at Dump**

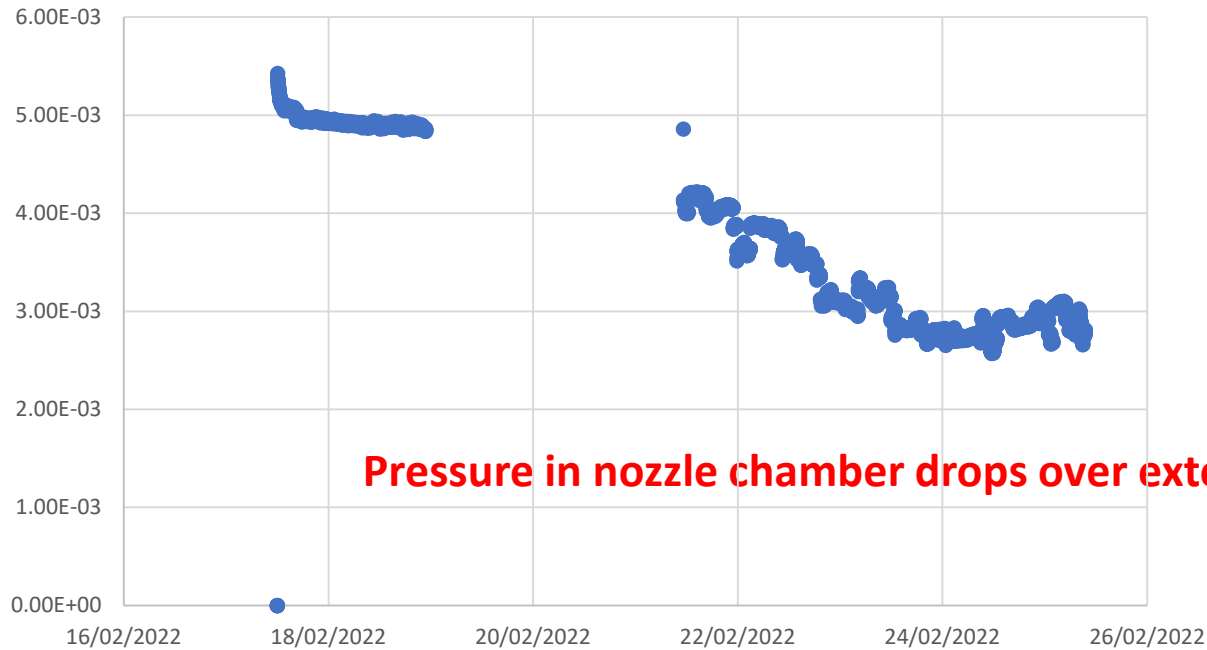
Skimmer I chamber pressure(mbar) 0.7x9mm



**0.7x9mm Skimmer, NEG at Dump**

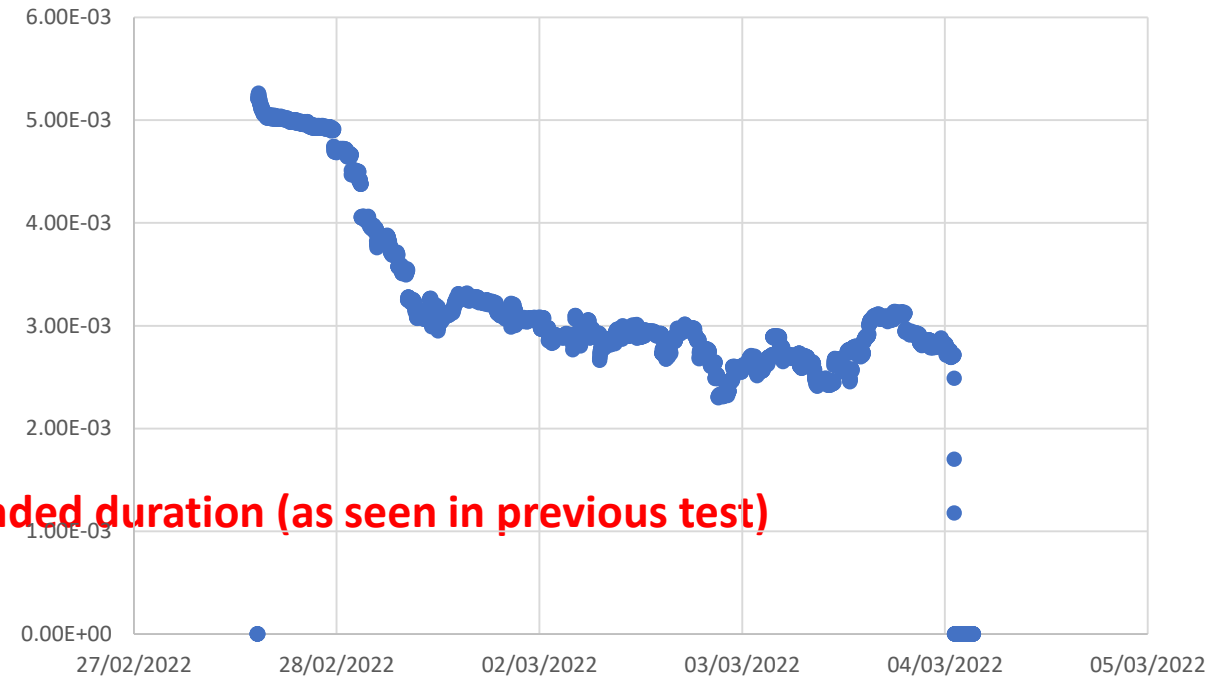
# Saturation Data (Nozzle chamber)

Nozzle chamber pressure(mbar) 0.3x9mm



**0.3x9mm Skimmer, NEG at Dump**

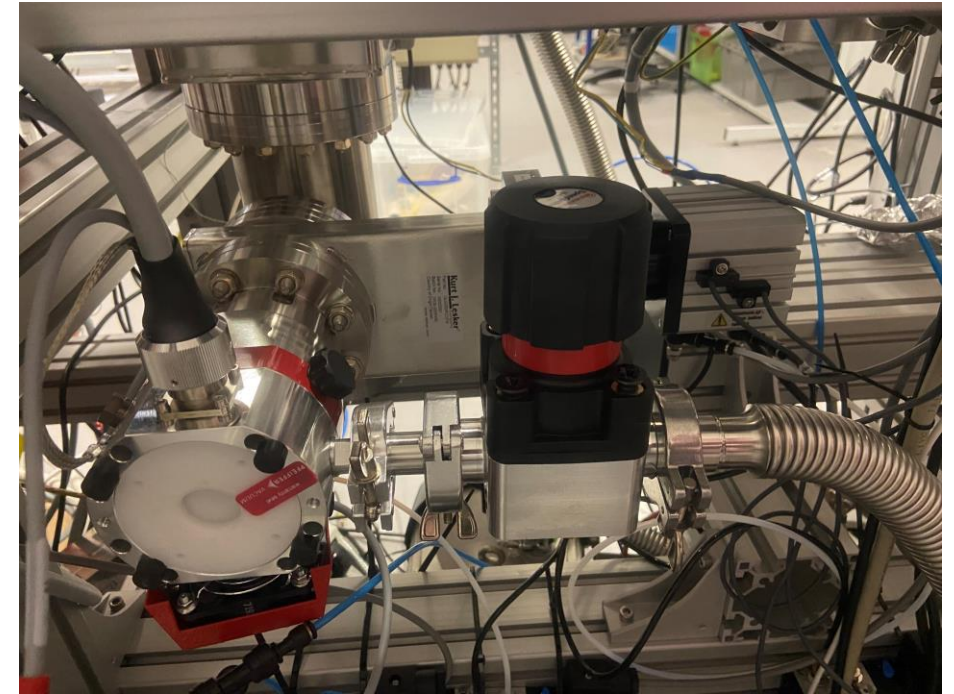
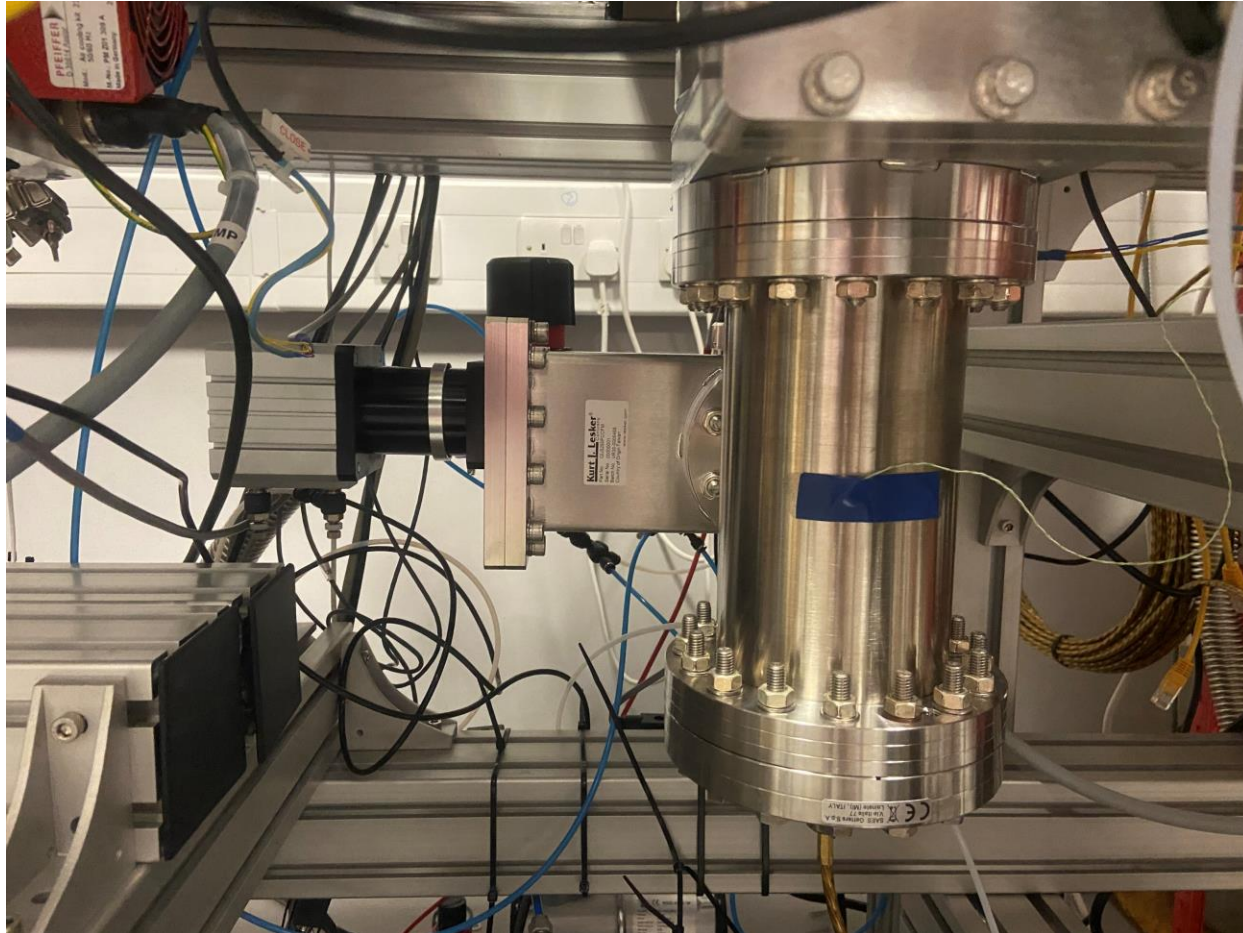
Nozzle chamber pressure(mbar) 0.7x9mm



**0.7x9mm Skimmer, NEG at Dump**

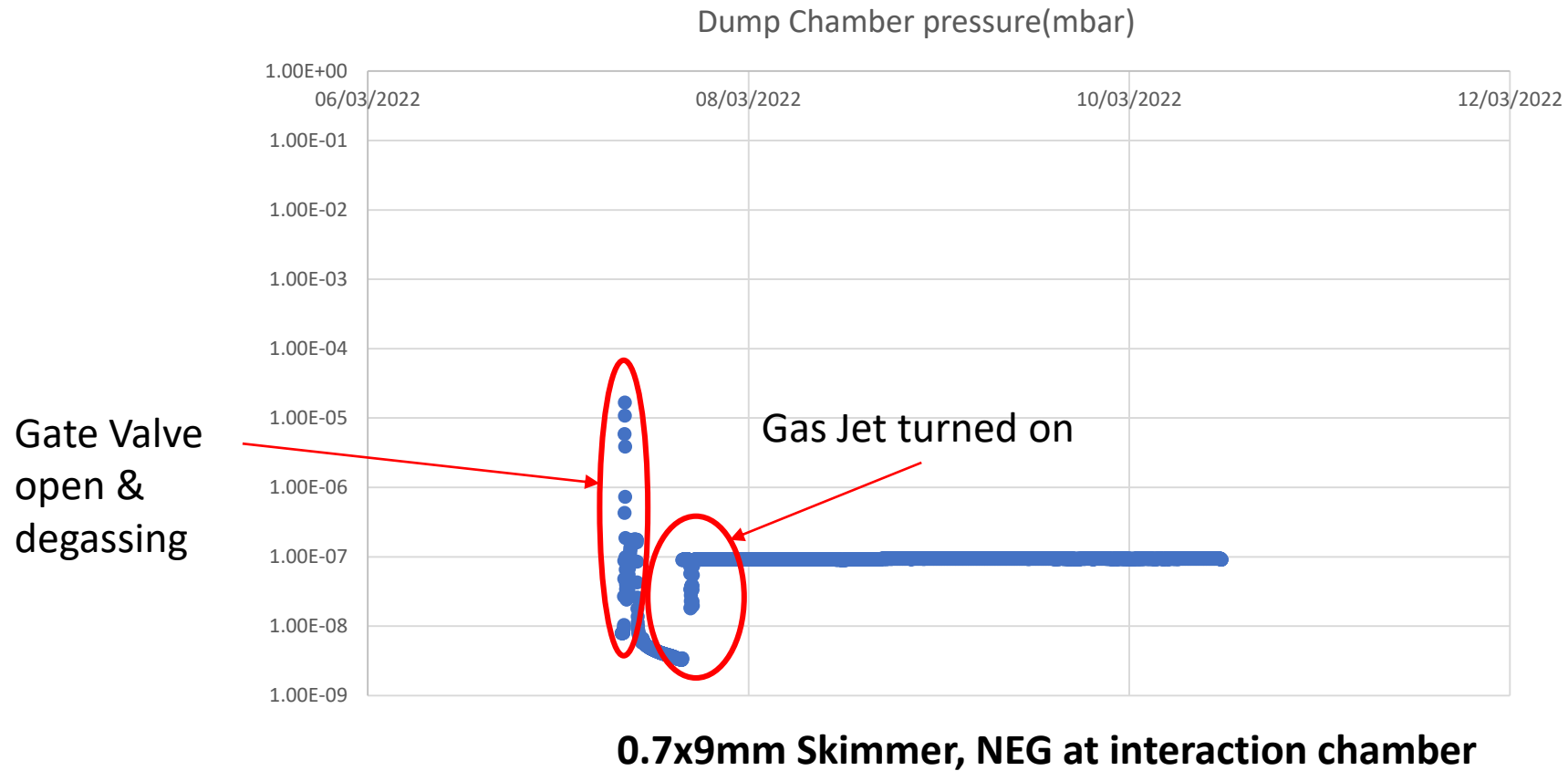
Pressure in nozzle chamber drops over extended duration (as seen in previous test)

# NEG Re-installed in Interaction Chamber

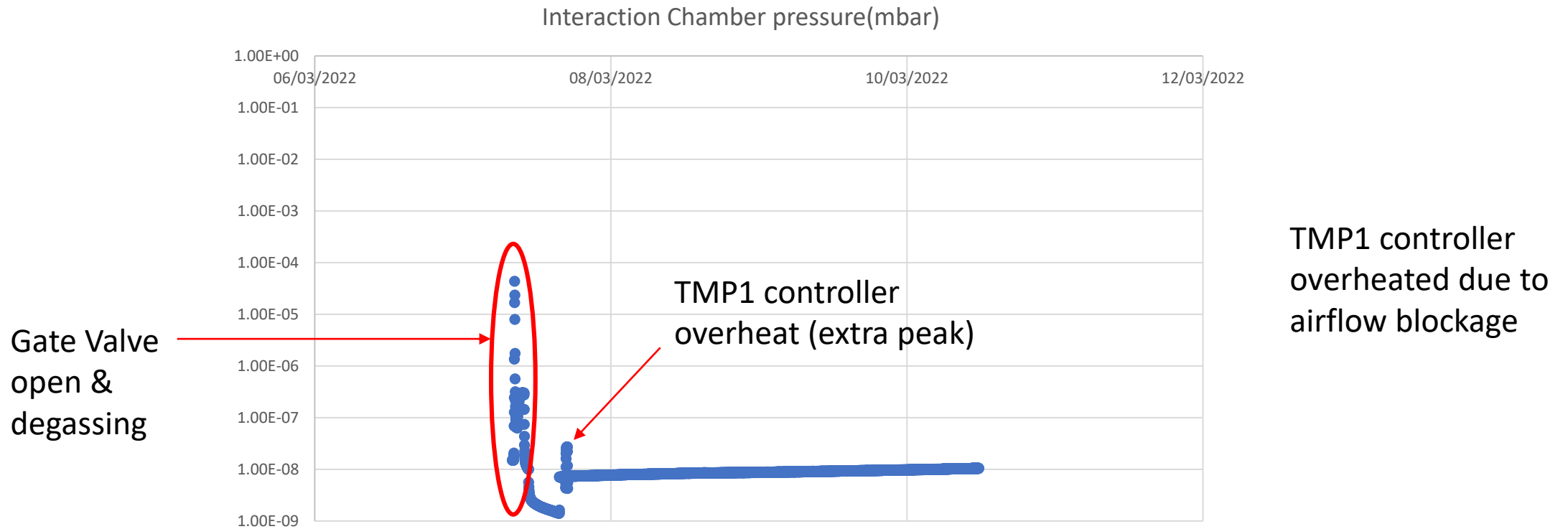


Next results with 0.7x9mm skimmer

# Saturation Data (Dump Chamber)

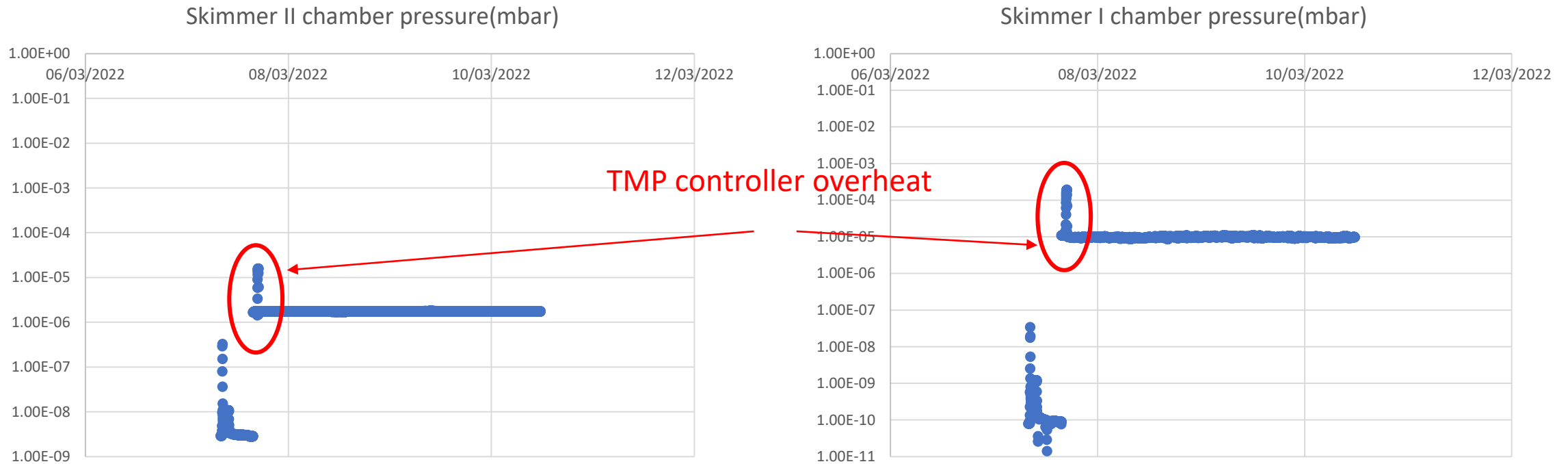


# Saturation Data (Interaction Chamber)



**0.7x9mm Skimmer, NEG at interaction chamber**

# Saturation Data (Skimmer 1&2 Chamber)

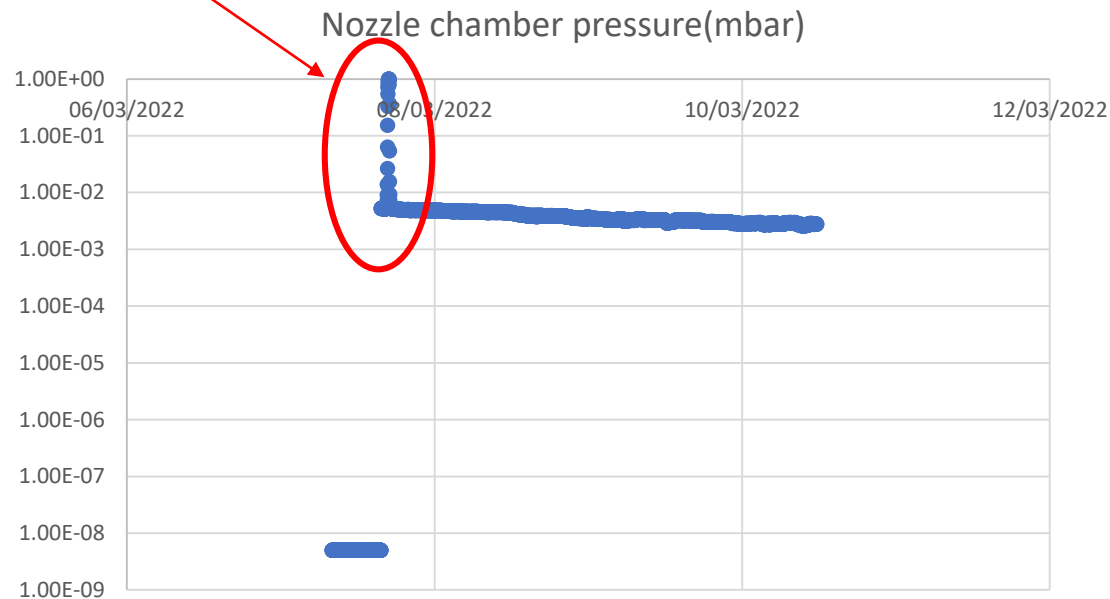


**0.7x9mm Skimmer, NEG at interaction chamber**

\*Note: the overheat is due to the controller is covered with the lab book not the pump itself.

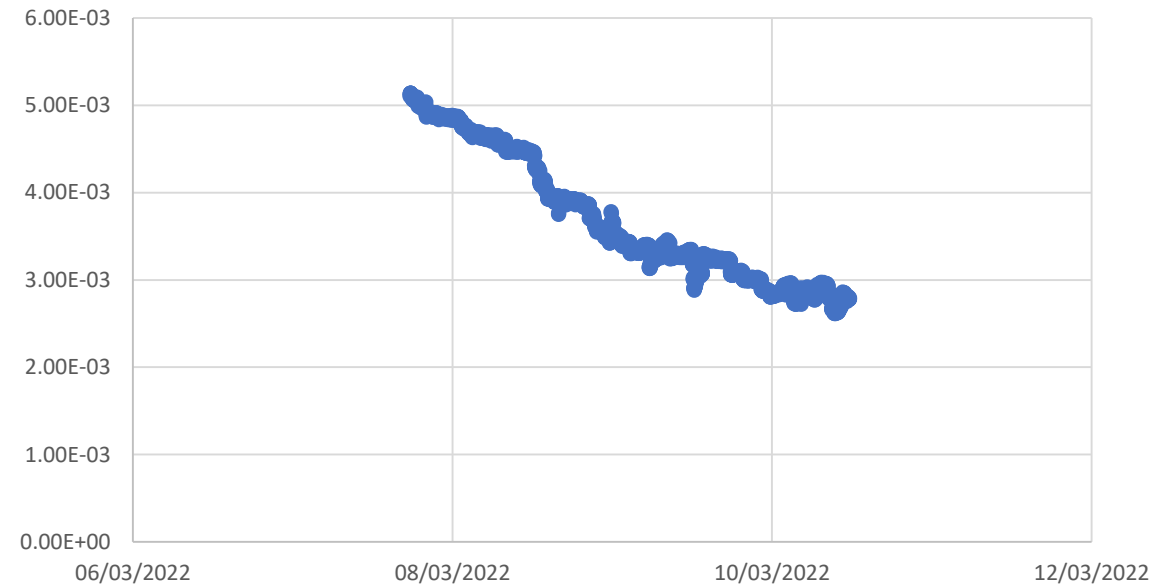
# Saturation Data (Nozzle Chamber)

TMP1 controller  
overheat



0.7x9mm Skimmer, NEG at interaction chamber

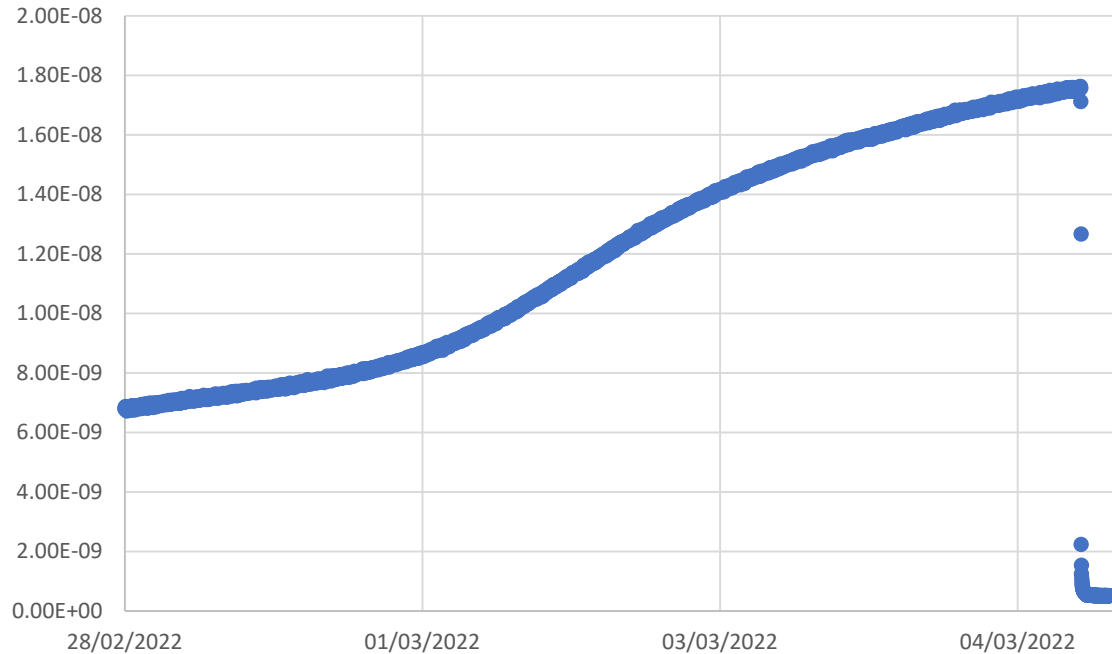
Nozzle chamber pressure(mbar)



Non-log scale to show pressure reducing after TMP controller cooled down

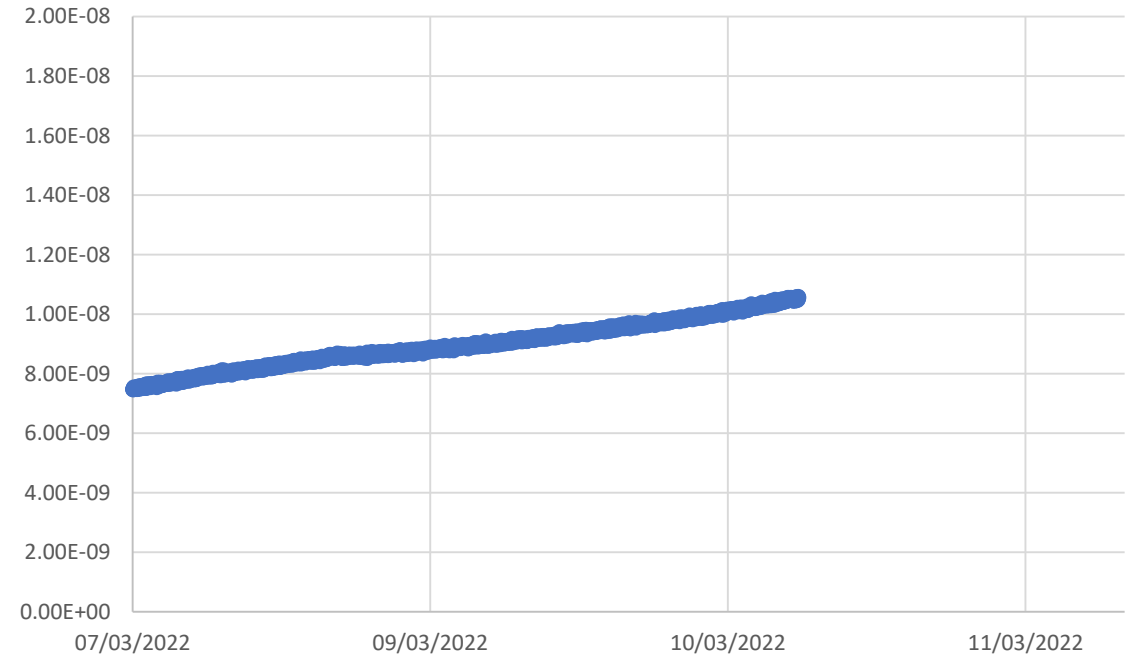
# 0.7\*9 mm skimmer comparison (interaction chamber)

Interaction chamber pressure(mbar) 0.7x9mm



NEG at Dump

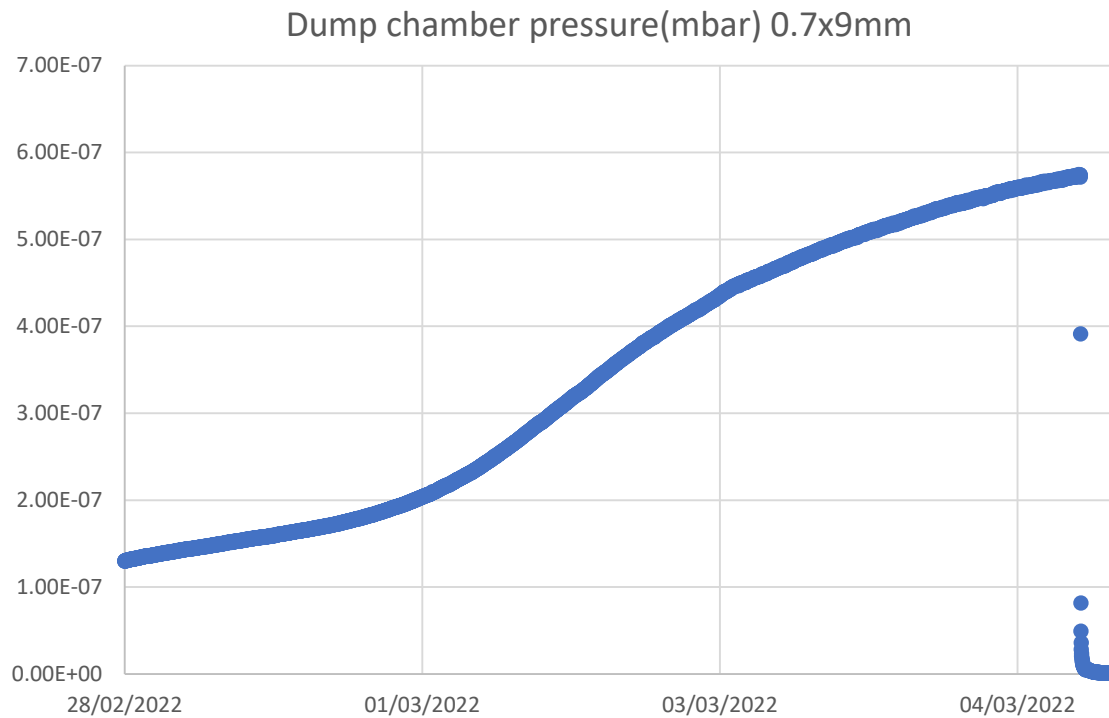
Interaction Chamber pressure(mbar)



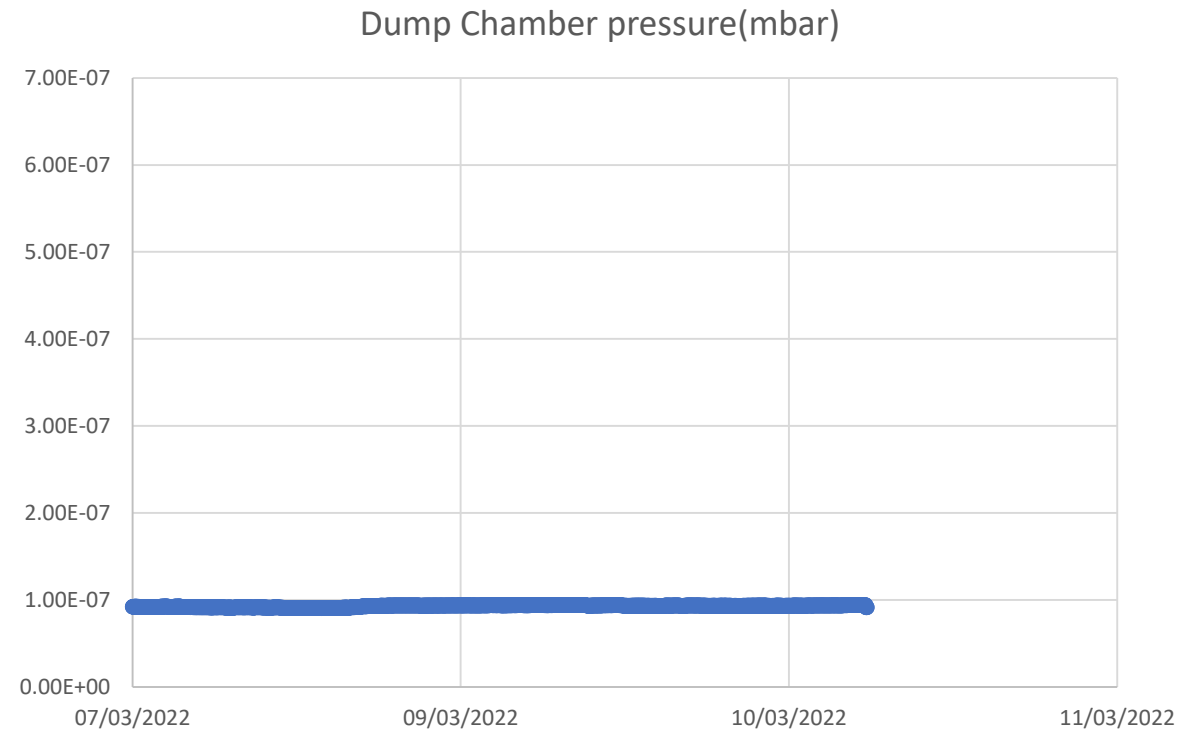
NEG at Interaction chamber



# 0.7\*9 mm skimmer comparison (dump chamber)



**NEG at Dump**



**NEG at Interaction chamber**

# Shipping

We will pack on Tuesday (March 15<sup>th</sup>), ship on March 16<sup>th</sup>, Hopefully it will arrive at Friday (March 18<sup>th</sup>).

# Summary

- Week long data shows the NEG is not saturated for 0.3\*9 mm 3<sup>rd</sup> skimmer (5bar inlet pressure).
- Future work:
  - Preparation for shipping.