Los Alamos NATIONAL LABORATORY

# Vacuum Issues with Argon Gas in the LANSCE Accelerator

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The LANSCE accelerator experienced down times due to trips of ion pumps starting in 2017. It turned out to be due to argon gas.

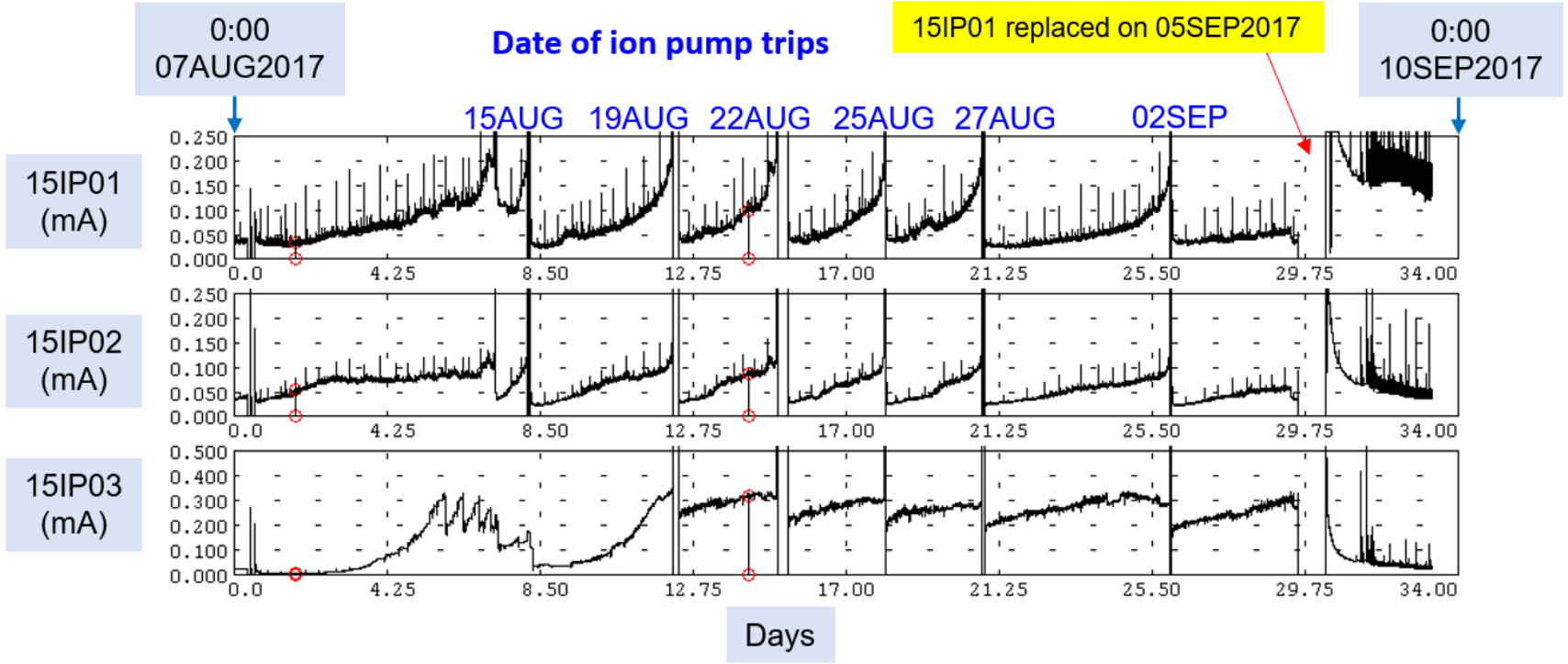



Figure: The currents of 3 ion pumps in module 15 from 07 August till the end of 09 September in 2017

# Facts

1. It started in 2017. To the best of our knowledge, this did not occur before in the history of the accelerator that started its operation in early 1970s.
2. It stopped after an ion pump 15IP01 was replaced on 10 September 2017, but it occurred again in 2018 starting on 14 May 2018 and there were 7 trips until 27 July 2018.
3. In 2019, it occurred again starting on 19 September 2019 and there were a total of 4 trips until 01 December 2019.
4. In 2019, with a residual gas analyzer (RGA) we monitored the gas to find out which gas is causing these trips and we found it was argon gas as shown on the next slide.

We found in 2019 that it was argon gas (mass 40 amu) that was causing the ion pump trips.

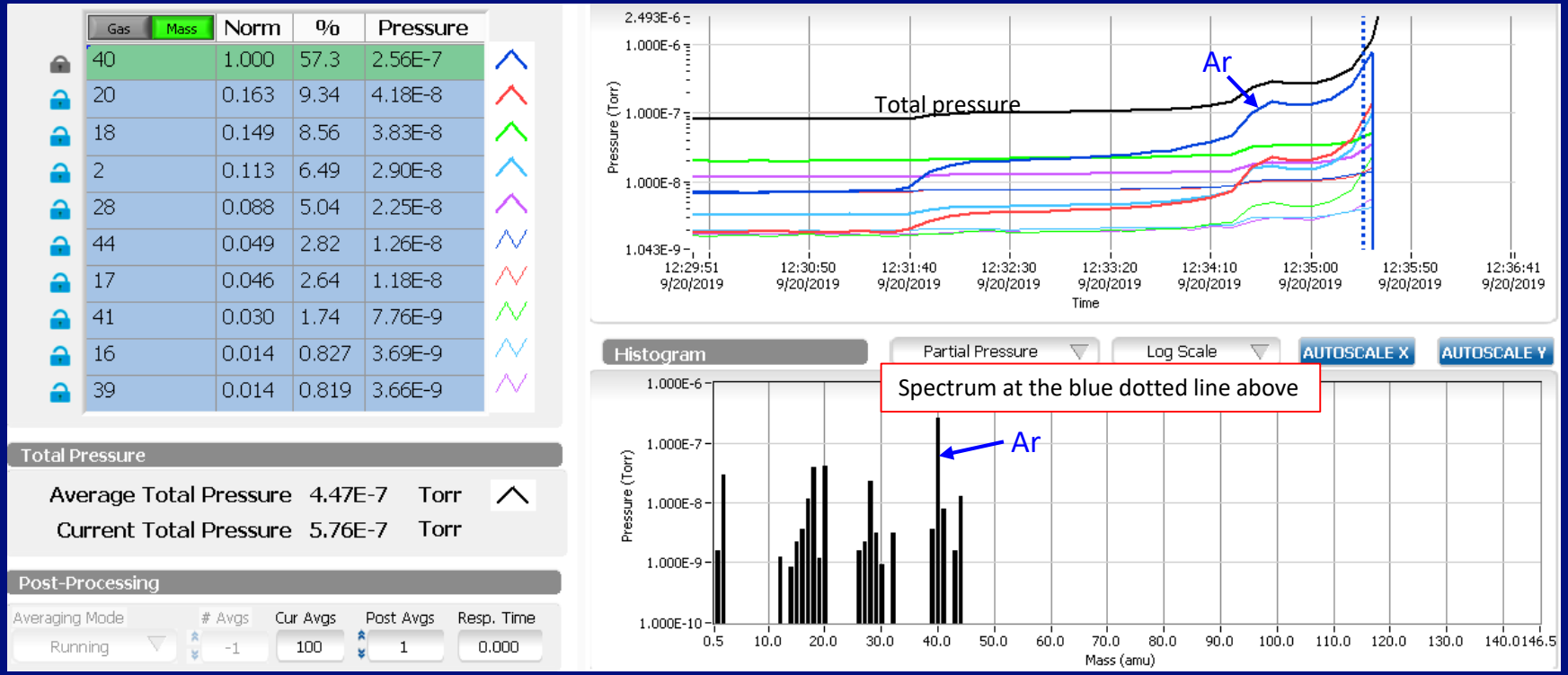
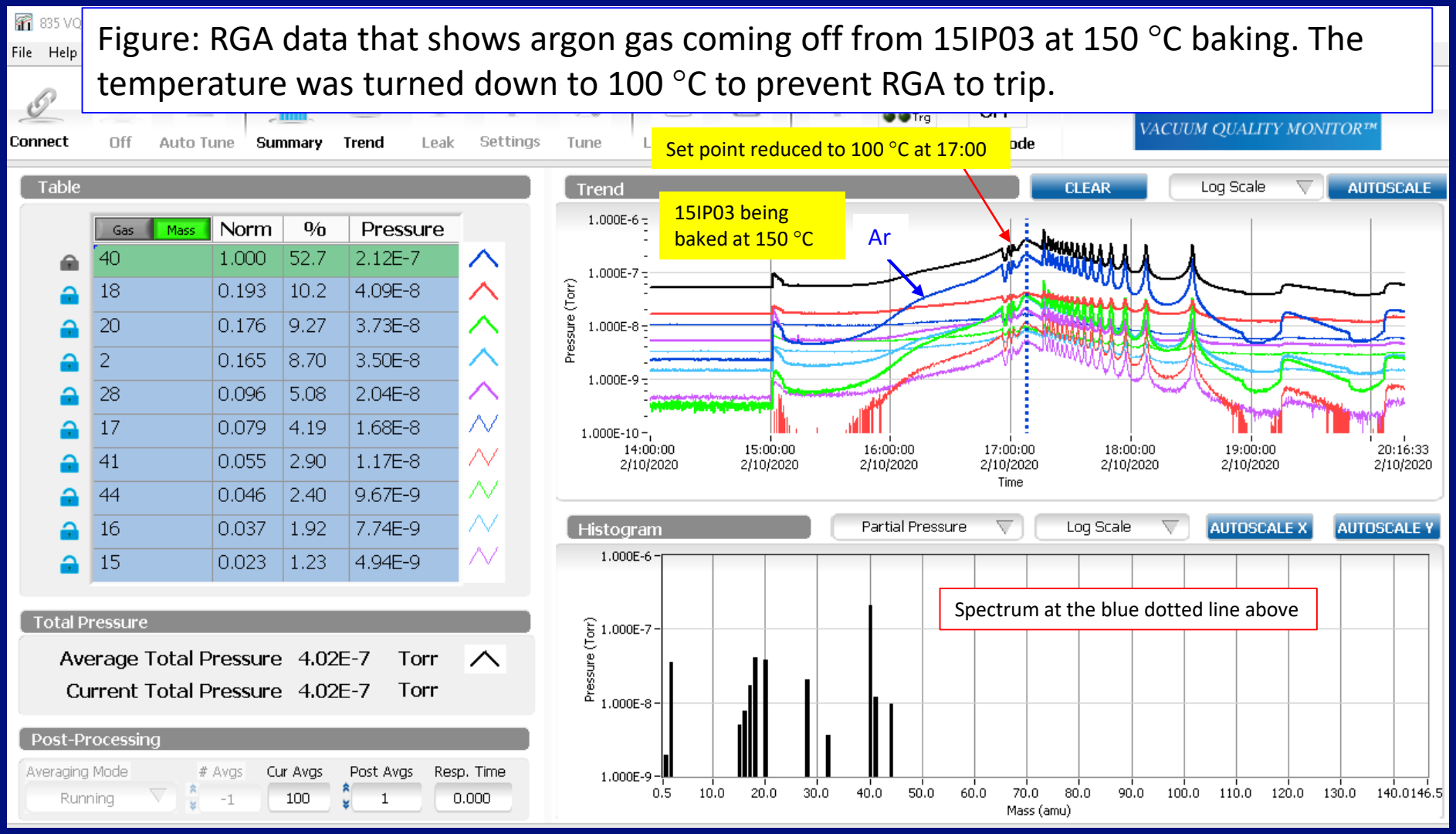



Figure: RGA data taken on module 15 on 20 September 2019.

# What we have done to mitigate this problem

1. After we found that argon gas bursts were causing these trips definitively, we decided to bake out the oldest pump 15IP03 that was installed in March 1996. (FYI, 15IP02 was installed in August 2006.)
2. We baked the pump in February 2020.
3. When the temperature was raised from 135 °C to 150 °C, a large amount of argon gas was released from the pump as shown on the RGA data on the next slide.
4. We baked it at 150 °C for ~6 days while pumping the module with a turbo molecular pump.
5. We have not had any trips since 15IP03 was baked out in February 2020.
6. However, we are not 100 % sure if we have entirely eliminated the problem yet and we don’t know why this particular module or section caused this problem.

Figure: RGA data that shows argon gas coming off from 15IP03 at 150 °C baking. The temperature was turned down to 100 °C to prevent RGA to trip.



# Figure: RGA data shows argon gas is being pumped down with a turbo pump effectively.

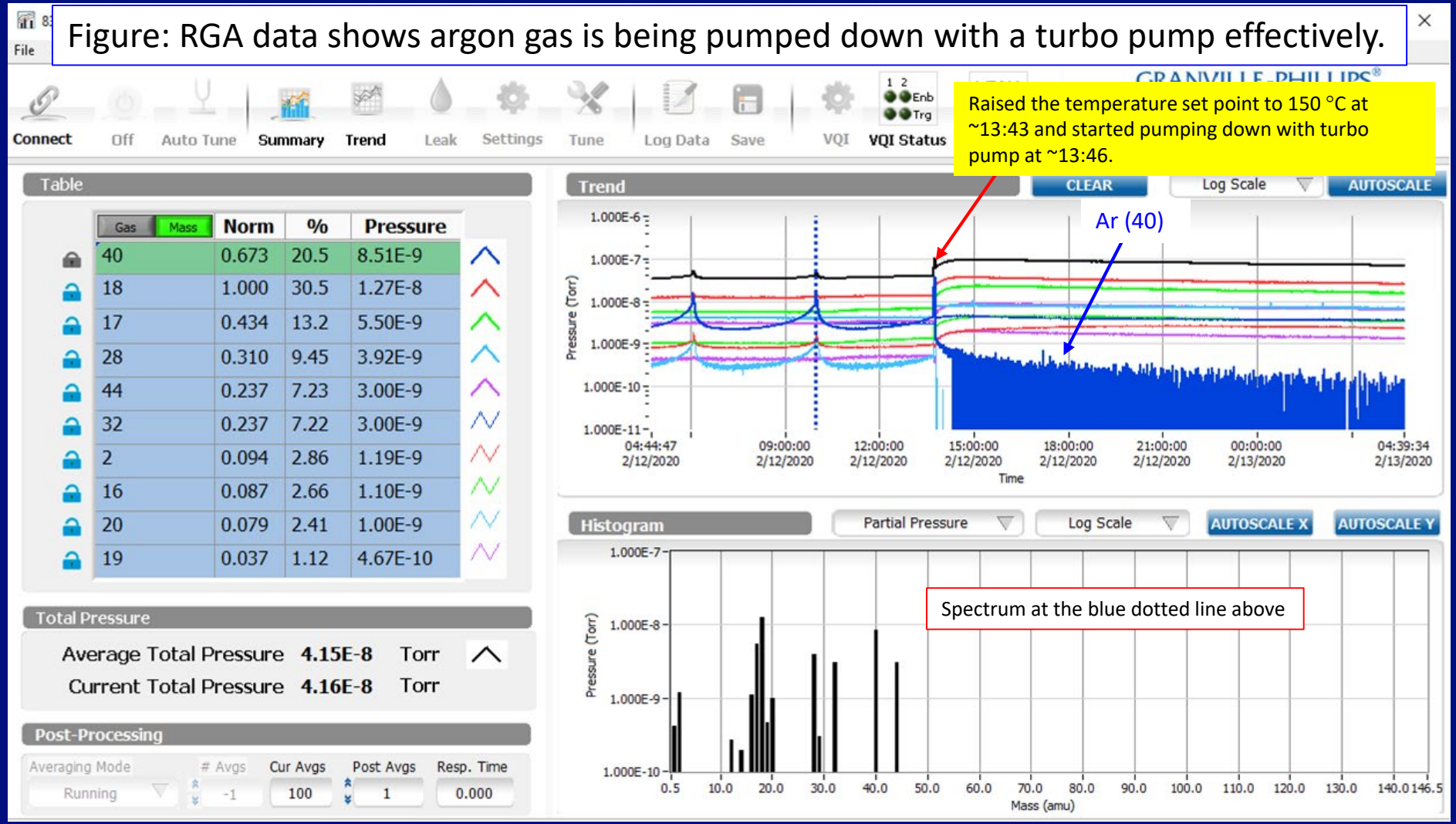
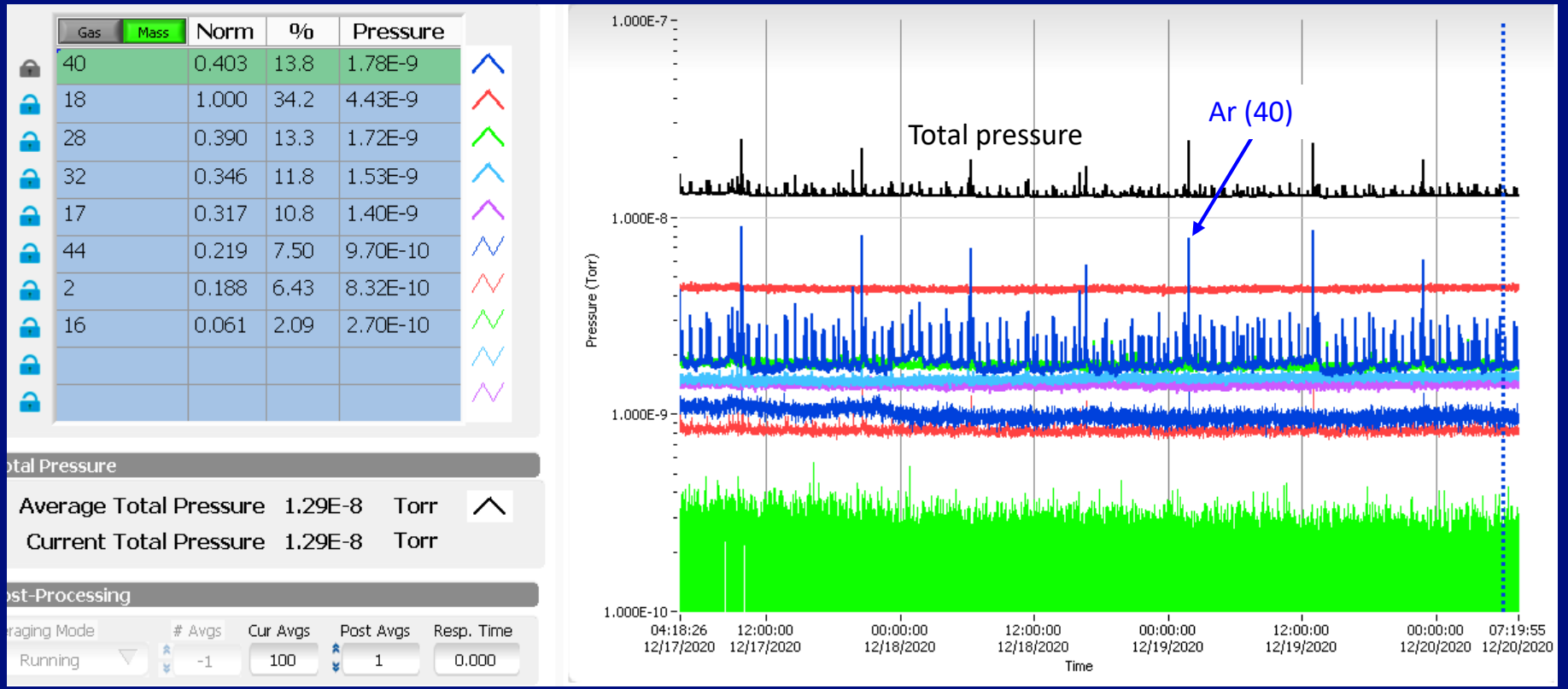


Figure: RGA data still shows small argon pulses in December 2020, but they have not led to a large burst of argon gas and resulting trips of ion pumps.



# Conclusion

- The issue with argon gas bursts that caused accelerator down times due to trips of ion pumps in the LANSCE LINAC module 15 in 2017, 2018 and 2019 may have been solved by baking the oldest ion pump on this module since no ion pump trips have occurred since the baking in February 2020.
- We don’t know if this problem could occur at other sections in the accelerator, but we plan to carefully monitor ion pumps currents and bake out the ion pumps that show spikes that might cause this problem in the future as a preventive maintenance.