Continuously Monitoring the RPC Gas Mixture with a Gas Chromatograph

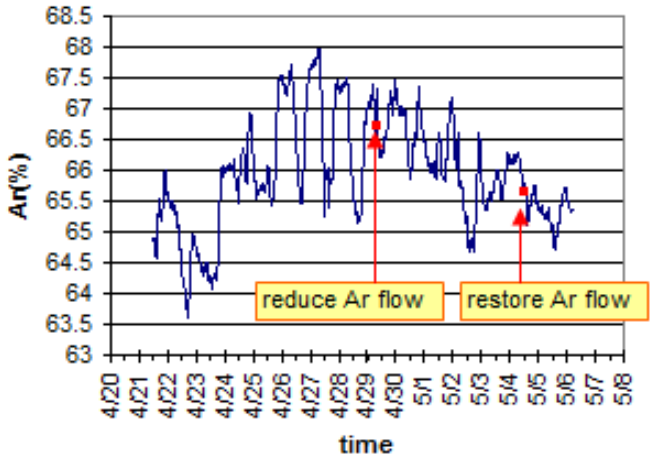
C. Lu

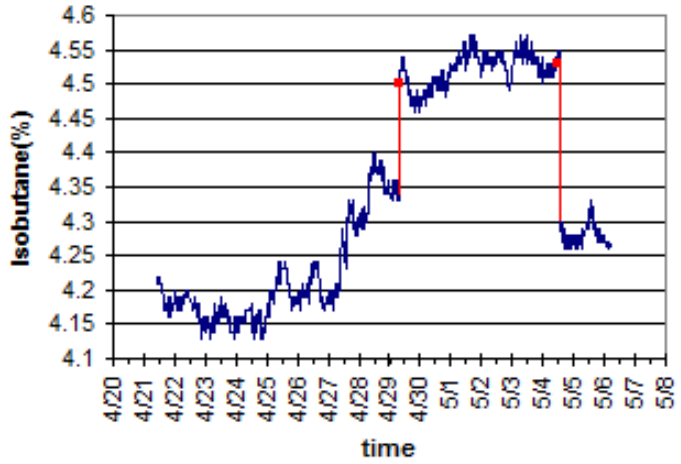
Princeton University

Operation of the Varian 3900GC GC in *sequence* mode

We created a *sequence*, which repeatedly executed a GC *method file* (program) and collect a gas chromatogram every 21 min. The gas mixing ratio (corrected for the sensititvies to the different gases) was directly written into a data base. We collected data continuously for more than 2 weeks.

Ar

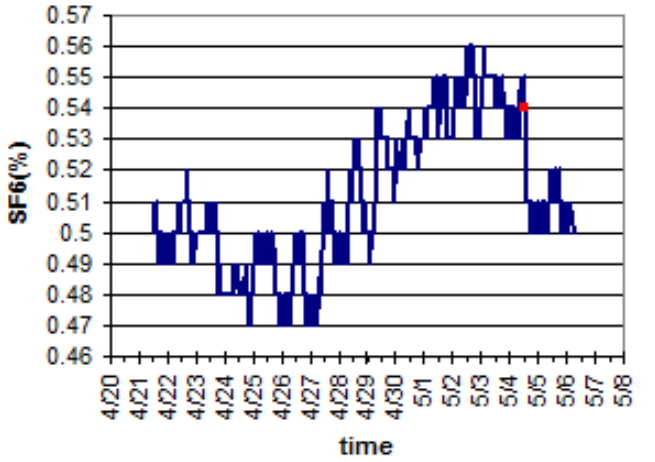


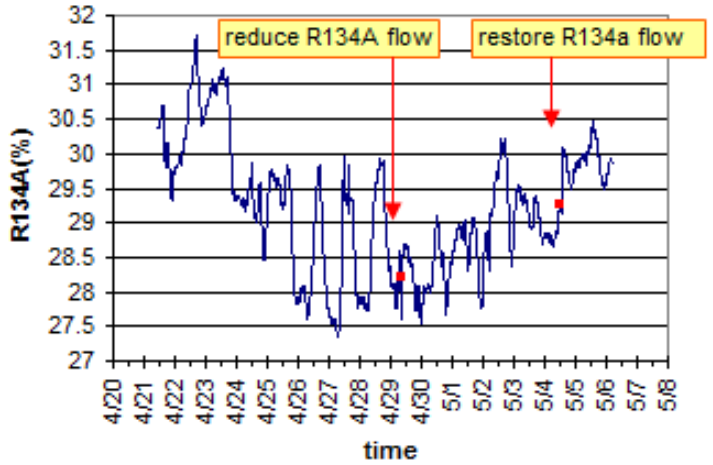


Isobutane

See the interpretation of the plot on next slide.

SF6





R134A

Interpretation of the results

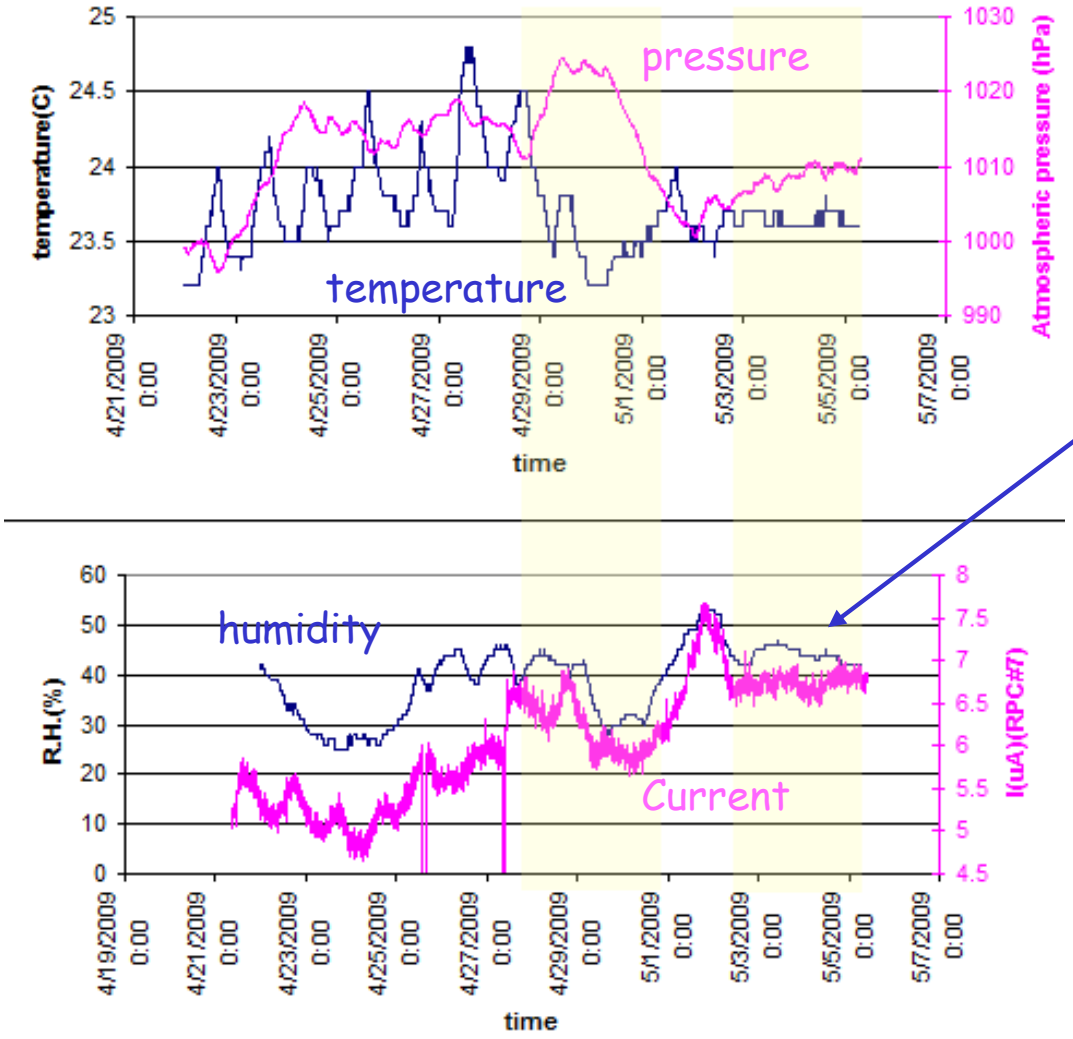
The relative mixing ratio measured by the GC for each gas component varied by 5-10% over several days. Was this due to gas mixing panel or GC?

Most likely it was due to the gas mixing panel. The repeatability of the MKS flow controllers is 0.2% of full range. The full range for the mixing panel we are using was chosen for use in the Daya Bay Near Hall RPC system. The Ar full range is ~2800 sccm, thus the precision would be 2800*0.2% = 5.6 sccm. Now we only used 65 sccm of Ar, so we should expect fluctuations at the level of 5.6/65 = 8.6%. The other three controllers are also operated at the low end of their range, and so can be expected to show fluctuations of a few per cent.

To confirm that the GC can distinguish a small increase of the Isobutane percentage, we altered the gas mixing ratio at two times. At the first time (4/24) we decreased the flow rate for Ar and R134A, at the second time (5/4) we changed the flow rates back to their original values. The small percentage increase of Isobutane can be clearly identified. This gives us confidence that the GC will be able to carry out the task as a safety device as well.

Dark current and ambient parameters

We recorded an RPC chamber's current with a Co-60 source: HV = 7600V, Daya Bay gas mixture. We also recorded the ambient parameters.



It appears that the ambient parameter which is most sensitive to the RPC current is relative humidity. We can see that the current follows R.H. nicely.

Conclusions

- The Varian 3900GC system is a reliable, high-quality tool to monitor Daya Bay RPC gas system, including the concentration of isobutane.
- A 0.5% absolute change of the Isobutane mixing ratio can be reliably detected by the GC.
- The RPC operating current is sensitive to the ambient parameters, particularly the relative humidity.