Continuously Monitoring the RPC Gas Mixture with a Gas Chromatograph

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Run GC in sequence mode

We created a sequence, which repeatedly execute a GC method file (program) and collect a gas chromatogram every 21'. The corrected gas mixing ratio is directly wrote into a data base. We have collected data continuously for more than 2 weeks.



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Interpretation of the results

The GC tested mixing ratio for each gas component is not so stable. Is this due to gas mixing panel or GC?

Most likely it is due to the gas mixing panel. The repeatability of the MKS flow controller is 0.2% of full range. The full range for the mixing panel we are using is for the Daya Bay near hall RPC, Ar full range is ~2800 sccm, thus the precision would be 2800*0.2% = 5.6 sccm. Now we only use 65 sccm for Ar controller, so we should expect the fluctuation at the level of 5.6/65 = 8.6%. The other three controllers are having similar limitation.

To confirm if GC can distinguish small increase of Isobutane percentage, we adjusted the gas mixing ratio at two points. At the first point we decreased the flow rate for Ar and R134A, at the second point we change their flow rates back to original. The small percentage increase of Isobutane can be clearly identified. It gives us a 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.





Conclusion

- The Varian 3900GC system is a reliable, high-quality tool to check Daya Bay RPC gas system, including the concentration of isobutane.
- 0.5% of Isobutane mixing ratio change can be reliably detected by GC.
- Ambient parameters are sensitive to RPC operating current. Since the humidity can change wildly, its effect on the dark current is very important.





5

