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Gas recirculation systems for RPC detectors: from LHC experiments to laboratory set-ups

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The Resistive Plate Chamber (RPC) detectors are extensively used worldwide and at CERN LHC experiments thanks to their excellent time resolution and low cost. RPCs are often operated with a humidified gas mixture made of $C_2H_2F_4$, SF_6 and iC_4H_{10} . Unfortunately, $C_2H_2F_4$ and SF_6 are greenhouse gases (GHGs) with a global warming potential (GWP) of 1430 and 22800 respectively and they are subject to a phase-down policy in Europe (EU F-gas regulation). It is therefore foreseeable that F-gases availability would be uncertain for the future and their price could raise possibly making gas detectors operation very costly.

The reduction of GHG emissions is an objective of paramount importance for CERN and four different strategies have been identified to achieve it. One of these strategies is based on the use of gas recirculation systems. This solution is already implemented in all gas systems supplying gaseous mixtures to the CERN LHC detectors. These recirculation systems are complex and sophisticated apparatus for big detector volumes (tens to hundreds m^3) that extend from surface to underground cavern and they are controlled through an industrial Programmable Logic Controller (PLC). Their cost is considerable and therefore they are used for large detector apparatus.

In order to cope with the increase of small experiments and detector facilities, the CERN gas team has developed two new portable gas recirculation systems at affordable cost. The first gas recirculation unit can be used for several detectors connected in series or parallel flushed with hundreds of liters per hour. It is controlled through a small PLC and it can regulate detector pressure at the level of the mbar. Some of these gas recirculation systems are already in use since several years at CERN GIF++ facility for CSC, GEM and RPC detectors.

A second gas recirculation unit has been developed for laboratory purpose where one or two detectors are flushed with few liters per hour. In this case, the unit has to be very cheap and user-friendly in order to allow an easy operation from the final user. A first prototype has been designed, assembled and tested on a RPC chamber of the EEE experiment.

Both portable gas recirculation systems can be easily adapted for the different types of detector systems and set-ups thanks to their low price, flexibility and user-friendly operation. An overview of the LHC, medium and small gas recirculation systems will be given in this contribution.

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