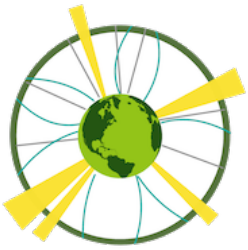

Contribution ID: **81** Type: **15 minute talk**

Recuperation plants for fluorinated gas at the CERN LHC Experiments

Thursday 15 May 2025 13:05 (15 minutes)

In the context of particle physics, different families of gaseous detectors are operated with fluorinated gases for different purposes at the Large Hadron Collider (LHC) at CERN. The main gases used in these detectors are tetrafluoromethane (CF4), tetrafluoroethane (C2H2F4), sulphur hexafluoride (SF6), perfluorobutane (C4F10). Given their high Global Warming Potential (GWP) and the increasingly stringent European regulations regarding the use and trade of these gases, different approaches have been adopted for reducing the GHG emissions. One of the strategies, currently operating at the LHC Experiments, is the use of gas recuperation systems. There are four operational recovery systems: two for the CF4, one for the R134a (C2H2F4), and one for the C4F10. These are industrial-scale systems, each of which relies on different principles of gas separation and purification. This is because, in most cases, fluorinated gases are used within gas mixtures where other components have lower Global Warming Potential (GWP).
The separation of fluorinated gases is carried out through membranes, absorbers, and distillation.
The recovery system efficiencies are approximately 70% for the CF4, 80% for the R134a, and 90% for the C4F10.
The goal is to reuse the purified gases within gas mixtures sent to detectors in variable fresh/recovered fractions, depending on the purity of the obtained gas (usually between 90% and 98%).
The various stages of the recovery processes are monitored through gas chromatographic analyses, GC/MS (Gas Chromatography/Mass Spectrometry), and infrared (IR) analyses.
The use of these recovery systems in recent years has led to significant savings both in economic and emissions terms. In 2023, 950 kg of recovered CF4 were utilized out of a total of 1400 kg, and 1200 kg of R134a were used out of a total of xxx kg. It's worth noting that the R134a system is still under test and it was operational only for some weeks starting from September 2023 onward.
The development and construction of two new recovery systems for SF6 and C4F10 are still ongoing, and they are expected to be operational by the end of 2024.

Authors: BOUZAIENE, Amin; MANDELLI, Beatrice (CERN); GALASSI, Damiano; RIGOLETTI, Gianluca (CERN); ARENA, Maria Cristina (Pavia University and INFN (IT)); GUIDA, Roberto (CERN)

Presenter: ARENA, Maria Cristina (Pavia University and INFN (IT))

Session Classification: Submitted Talks