

Strategies for reducing the use of greenhouse gases from particle detectors operation at the CERN LHC experiments

Wednesday, 29 July 2020 16:00 (30 minutes)

A wide range of gas mixtures is used for the operation of different gaseous detectors at the CERN LHC experiments. Some gases, as C₂H₂F₄, CF₄, C₄F₁₀ and SF₆, are greenhouse gases (GHG) with high global warming potential and therefore subject to a phase down policy affecting the market with price increase and reduced availability.

The reduction of GHG emissions is an objective of paramount importance for CERN: four different strategies have been identified to achieve it.

The first strategy is based on the use of gas mixture recirculation systems. This solution is used in all plants supplying gaseous mixtures to the CERN LHC detector systems. The approach and the development of such technology made at CERN will be presented. Furthermore, to protect detectors against their intrinsic fragility, the development of additional modules is ongoing to achieve a pressure and flow stability which goes beyond original design.

The second research line is based on the development of systems for the recuperation of used gas mixtures followed by separation of the most critical GHGs for their re-use. Systems allowing the recuperation of different gases were developed in the past for several detectors: CMS CSC (CF₄), ATLAS TGC (nC₅H₁₂), LHCb RICH1 (C₄F₁₀) and LHCb RICH2 (CF₄). R&D studies are now on-going to improve the efficiency of the present systems and for the design of a C₂H₂F₄ recuperation plant. Indeed, C₂H₂F₄ represents the major contribution to GHG consumption at CERN. A first prototype was tested at the end of Run 2 on a LHC RPC system and further tests are nowadays on-going for the development of the final version for Run 3.

A third approach is making use of industrial available solutions for disposal of GHG when gases cannot be recuperated or re-used. However, these abatement systems solve only the GHG emission problem but not difficulties related to availability and price increase of these gases in the future.

Finally, the last research line is based on the long-term replacement of currently used gases for the operation of LHC detectors. The research of new eco-friendly gases is subject of many R&D programs by the particle research communities, in particular for the replacement of C₂H₂F₄. Few new gases have been tested but finding a suitable replacement for the RPC systems at the LHC experiments is particularly challenging.

The four strategies will be compared by considering investment required, potential return benefit and technological readiness.

Secondary track (number)

17

Primary authors: MANDELLI, Beatrice (CERN); GUIDA, Roberto (CERN); CORBETTA, Mara (Universite Claude Bernard Lyon I (FR)); RIGOLETTI, Gianluca (Universite Claude Bernard Lyon I (FR))

Presenter: GUIDA, Roberto (CERN)

Session Classification: Technology Applications, Industrial Opportunities and Sustainability

Track Classification: 17. Technology Applications, Industrial Opportunities and Sustainability