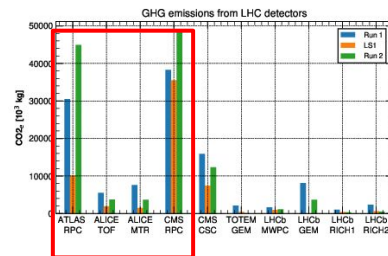


Studies on RPC detectors operated with environmentally friendly gas mixtures in LHC-like conditions

Resistive Plate Chambers detectors at LHC

- Used in ALICE, ATLAS, CMS gas systems
- Gas mixture: ~95 % R-134a (GWP 1430) and 0.3% SF₆ (GWP 22800)
- Responsible for 85% of GHG emissions, due to high GWP gas mixture and leaks at detector level

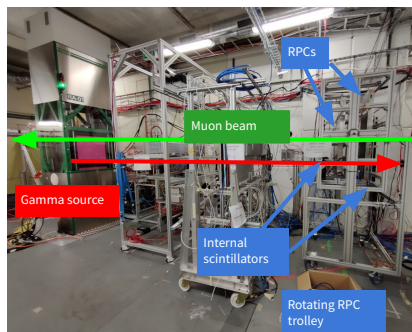


Goal:

Find a **low-GWP** gas mixture **suited** for **LHC-operation** that requires **no change** in the current RPC systems (i.e. no change in electronics, HV, gas systems, etc.)

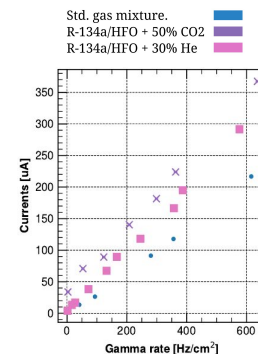
Experimental campaign

- HPL RPCs, 2 mm, single gap
- Laboratory setup: cosmics muons, low rates
- GIF++ setup: muon beam, gamma background, LHC-like conditions
- HV scans performed with different gas mixtures: characterization of efficiency, streamer probability, prompt charge, cluster size, time resolution



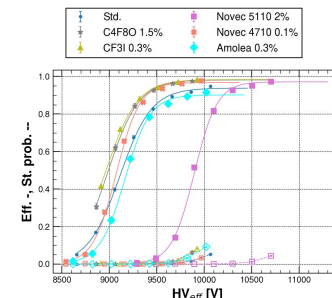
Alternatives to R-134a

- R-1234ze (HFO) main candidate
- Cannot replace 1:1 R-134a → too electronegative
- Addition of CO₂ or He necessary
- Some amount of R-134a kept to stabilize performances



Alternatives to SF6

- 5 alternatives tested
- Novec 4710 and Amolea 1224yd matching SF₆ performances
- Both gases requires more studies to understand their chemical stabilities under background radiation and electric field



Impurities studies

- Studies on F⁻ production from RPCs in LHC-like conditions
- Standard gas mixture and R-1234ze gas mixture characterized
- R-1234ze producing more F⁻ ions than R-134a

