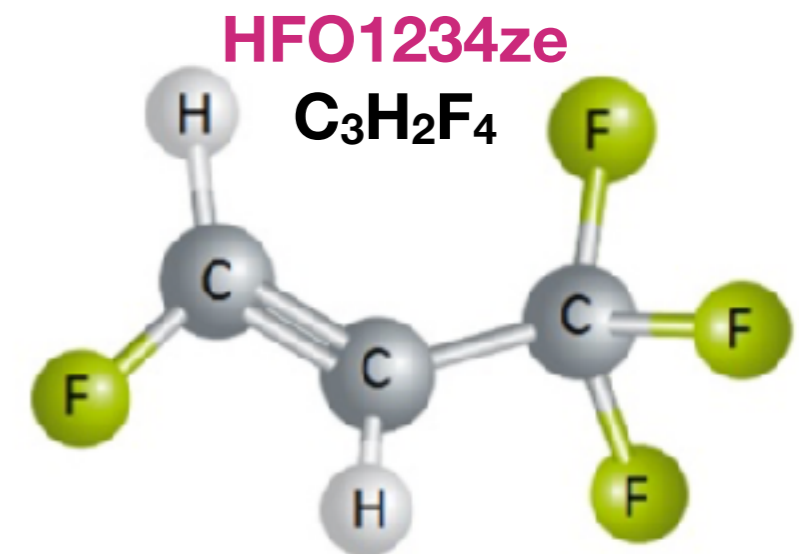


Ecological gas mixtures for RPCs

D. Piccolo for *RPC ECOGAS@GIF++ Collaboration*

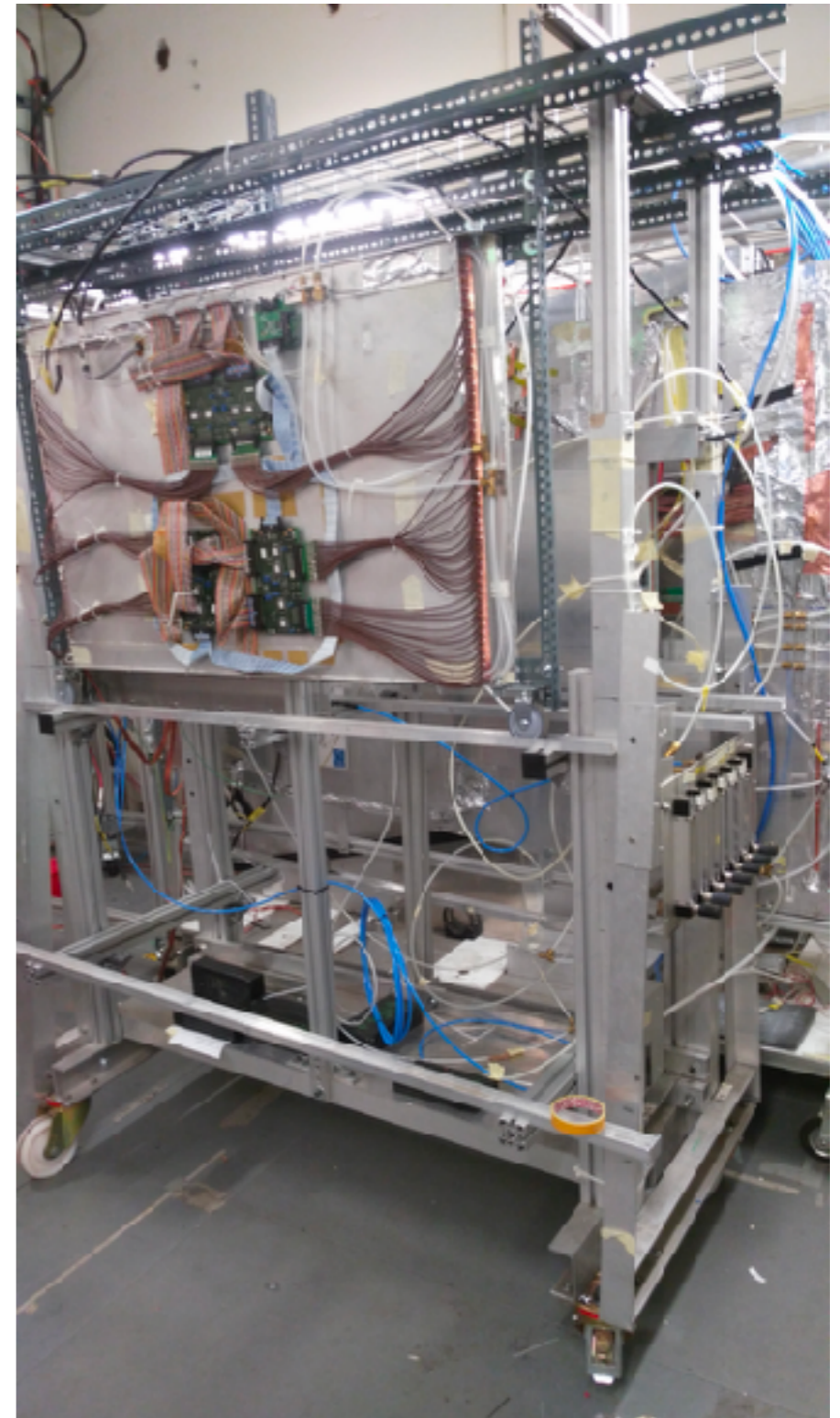
The eco gas issue

- The European Community has prohibited the production and use of gas mixtures with Global Warming Potential > 150 ($\text{GWP}(\text{CO}_2) = 1$)
- RPC gas mixture (for ATLAS-CMS and similar for ALICE)
 - **R134a – iCH₄ – SF₆ (95.2%–4.5%–0.3%)** with relative GWP: 1430 – 3.3 – 23600 has **Total GWP = 1433**
- A replacement for RPC gas mixture has been searched in laboratory since 2014 from different groups (LNF, ROMA2, Torino, CERN)
 - It should work for both already installed RPCs and future detectors
 - Several papers published with laboratory results
- **Possible Eco Gases identified:**
 - HFO1234ze, CF₃I, Novec
- **HFO1234ze** seems to be the most performing at moment
 - Nevertheless **no data are available regarding the long term behavior of this gas under irradiation**



The RPC ECOGAS@GIF++ Collaboration

- In 2019 a Collaboration between ATLAS, CMS, ALICE, EPDT and later on LHCb/Ship, has been formed.
- The goal is to test the performance of RPCs operated with ecological mixtures under irradiation at GIF++
- At moment we have several chambers of different size/gap thickness, coming from different experiments under test:
 - Current stability
 - HF contamination
- An upgrade of the system (new gas mixer, DAQ for efficiency measurement) is planned in the AidaInnova framework
 - WP 7: task 7.2.2

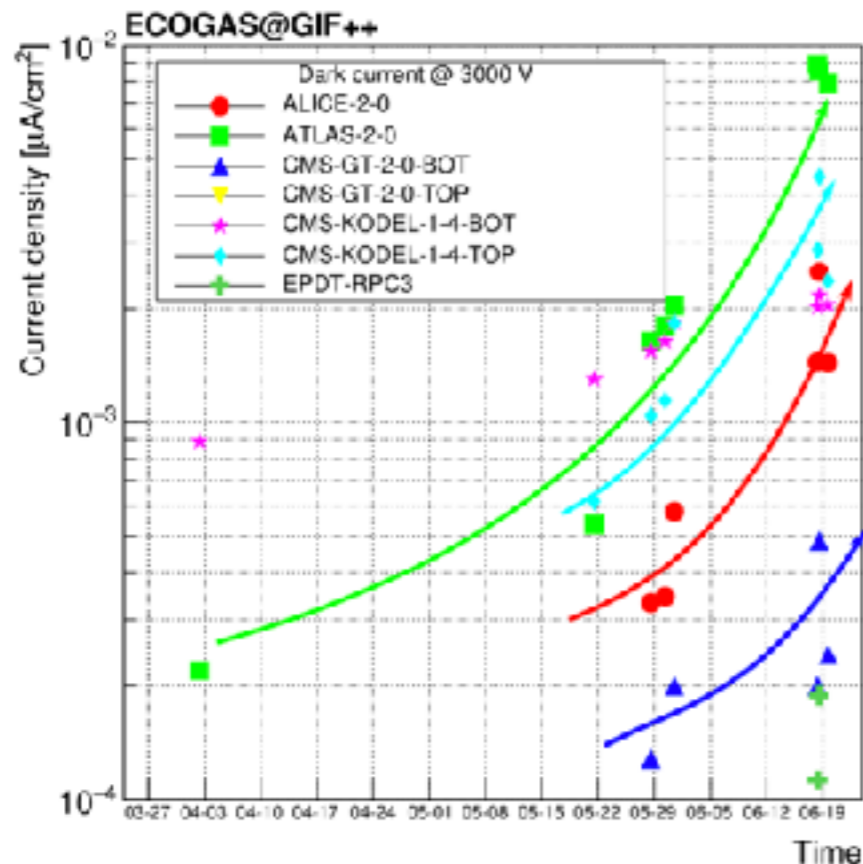


Results with first EcoMixture tried

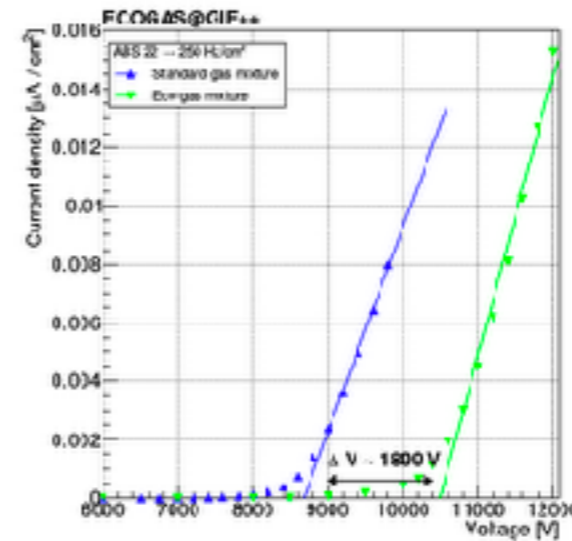
Studies of RPC detector operation with eco-friendly gas mixtures under irradiation at the CERN Gamma Irradiation Facility

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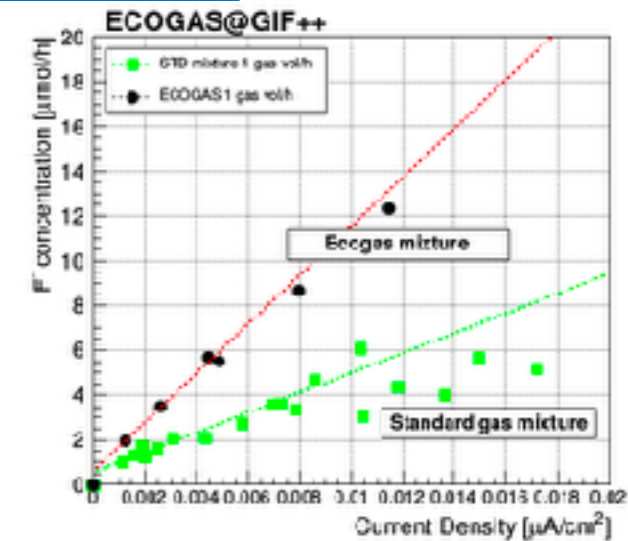
Gianluca Rigoletti^{xxxx}, G. Alelli^b, G. Alberghi^c, L. Benussi^d, A. Bianchi^k, S. Bianco^d, D. Boscherini^c, A. Bruni^c, P. Camarri^b, R. Cardarelli^c, M. Corbetta^{xxxx}, S. Delsanto^k, A. Di Ciaccio^b, L. Di Stante^b, P. Dupieux^f, J. Eysermans^j, A. Ferretti^k, M. Ferrini^c, M. Gagliardi^k, A. Gelmi^c, R. Guida^c, B. Joly^f, B. Liberti^c, B. Mandelli^g, S.P. Manen^f, L. Micheletti^k, L. Passamonti^d, E. Pastori^a, D. Piccolo^d, D. Pierluigi^d, A. Polini^c, G. Pugliese^e, L. Quaglia^k, A. Russo^f, P. Salvini^b, R. Santonico^b, G. Saviano^c, L. Terlizzi^k, M. Tytgatⁱ, E. Vercellin^k, N. Zaganidisⁱ



**HFO-CO₂-iCH₄-SF₆.
(50%-45%-4%-1%)**



(a) Current scan for the EP-DT chamber with same irradiation conditions and different gas mixtures. The difference in the knee is 1.8kV



(b) Rate of F^- production for the CMS-GT chamber with the same flow per volume and different gas mixtures. The accumulation of ions linearly depends on the current of the detector and the ECOGAS mixture has a higher rate of production with the respect to the Standard Gas Mixture

Since 2020 new mixture is under study but due to covid just now we are starting in a more systematic way
**HFO-CO₂-iCH₄-SF₆.
(35%-60%-4%-1%)**