

**Politecnico
di Bari**



RPC lab for CMS and ECOGAS

Outline:

- Lab involved in RPC for ECOGAS activities
- Dose study of the GIF++ and simulation of the dose in the bunker

Team:

1. **Iaselli Giuseppe (PO)**
2. **Pugliese Gabriella (PA)**
3. **Abbrescia Marcello (PA)**
4. **Ramos Dayron (Post-doc)**
5. **Lakshmaiah Umesh (Post-doc)**
6. **Ferrara Nicola (Ph.D. student)**

ECOGAS activities

- Involved in the CERN phase-down of fluorinated GHG emissions, the **CMS** within RPC **EcoGas@GIF++** collaboration have joined efforts to find a solution for the **environmentally friendly operation of RPCs** on view of the HL-LHC phase
- After a few months of aging campaign (charge integration: ~ 45 mC/cm²), **the performance of a prototype equipped with iRPC gaps has been verified** through beam test at GIF++
- The chamber has reported an **increased noise level after irradiation without** suffering **efficiency losses** even under higher gamma backgrounds
- Slightly higher WP were estimated after irradiation** for all the mixtures.
- Mean gamma cluster charge values** have been verified to be **40% higher when the chamber is operated with the ecological candidates** what might foresee the appearance of faster aging effects in case of their existence

	TFE (%)	HFO-1234ze (%)	CO ₂ (%)	iC ₄ H ₁₀ (%)	SF6 (%)	GWP
STD	95.2	-	-	4.5	0.3	1485
ECO2	-	35	60	4	1	476
ECO3	-	25	69	5	1	527
Density (g/l)	4.68	5.26	1.98	2.69	6.61	-
GWP	1430	7	1	3	22800	-

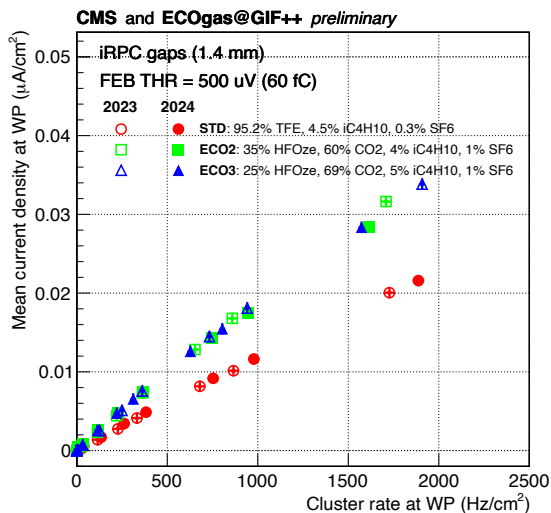
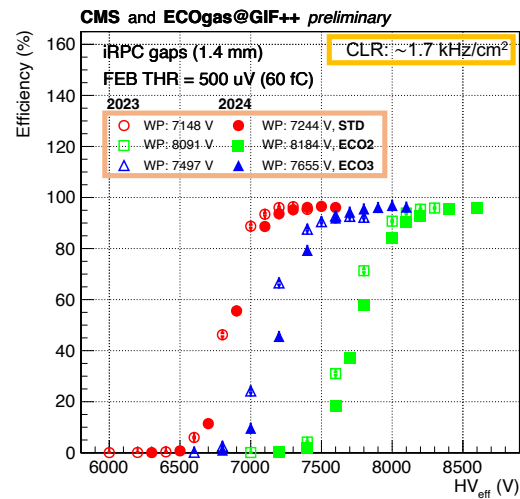
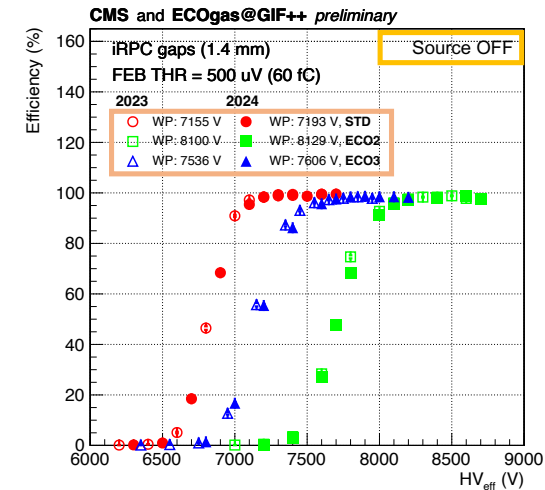
Team is involved in the R&D and aging studies of the new iRPC gaps with more eco-friendly mixtures!

N.Ferrara, D. Ramos and U. Lakshmaiah joined Test beam activity at GIF++.

Activities in BARI:

- RPC prototype building
- HV and LV test

ECOGAS performance verification



- **Lower current values** monitored operating the prototype with **STD mixture**
- **Similar values and slope** using **eco-friendly candidates**
- **Stable chamber:** current values in agreement after irradiation according the cluster rates measured

- Efficiency measured up to the higher background conditions achievable at GIF++ shows **no drops** after irradiation
- **Slightly shift** of WP to higher values have been observed

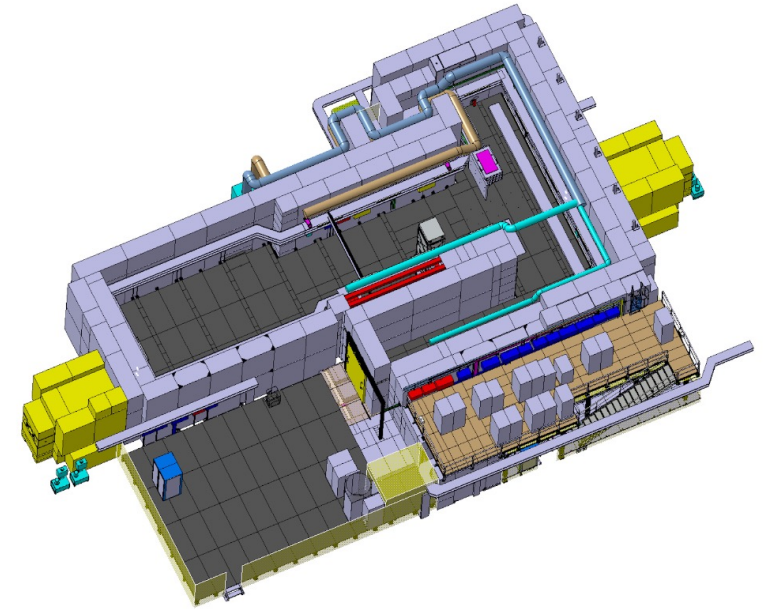
Muon cluster size and gamma cluster charge

Negligible differences values reported after irradiation without large differences between mixtures and similar slopes.

Mean charge values reported $\sim 40\%$ higher cluster charge when the chamber is operated with ecological candidates. No changes after irradiation

Dose study at GIF++

- Since 2014 the Gamma Irradiation Facility at CERN is extensively used for: Eco-gas, longevity and R&D detector studies involving several Detector technology: DT, MDT ,CSC ,RPC, iRPC, GEM...
- One simulation study is available (without detectors) done on by Pfeiffer Dorothea. She developed simulation Software in GEANT4-10.0 to simulate GIF++ radiation background: **“The radiation field in the Gamma Irradiation Facility GIF++ at CERN”** [1]
- New bunker geometry was implemented in 2018 → new simulation work is needed → **shared interest activity** with other experiment as ALICE, ATLAS, ...



[1] <http://dx.doi.org/10.1016/j.nima.2017.05.045>

DOSE CAMPAIGN ON NOVEMBER 2024

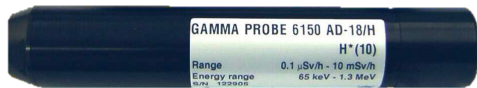
- Source of ^{137}Cs of 662 keV photons at 11.5 TBq (January 2024)
- Gamma Probes 6150AD-15 was used
- ABS (effective attenuation) used: 1, 2.2, 3.3, 4.6, 6.9, 10, 22, 33, 46, 69 and 100
- Conducted measurements at the distance (m) from the source indicated below with full clearance (no RPC trolleys)
- At 3m and 6m, ABS 1, 2.2 and 3.3 measurements were carried out with RPC trolleys in between the source and probe.

Team: N.Ferrara, D. Ramos and U. Lakshmaiah joined dose campaign test at GIF++ and performed the upgraded simulation!

Dose measure and simulation study

Dosimeter

gamma probe 6150AD-15(H)

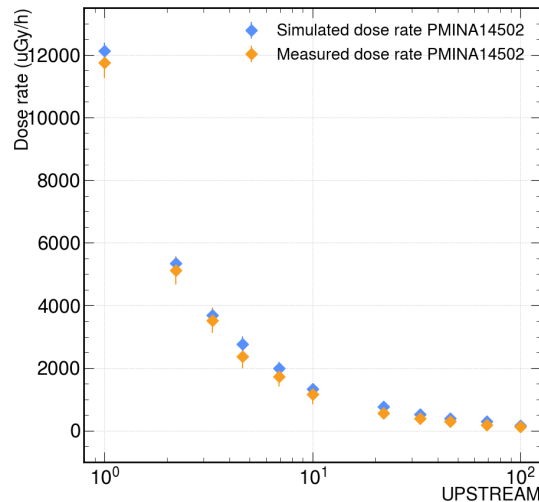


Detector repose: $H^*(10) \rightarrow$ Ambient
Equivalent Dose Rate (Sv/h)

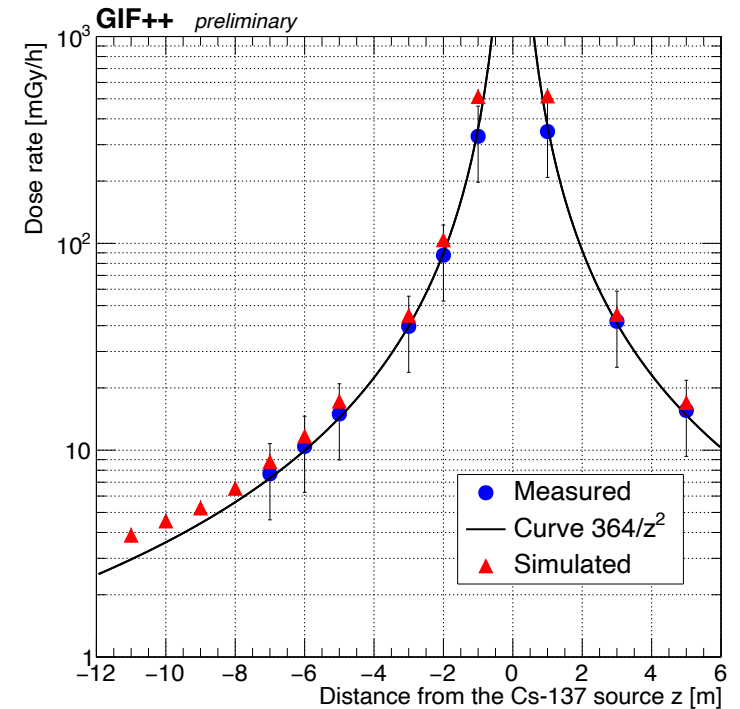
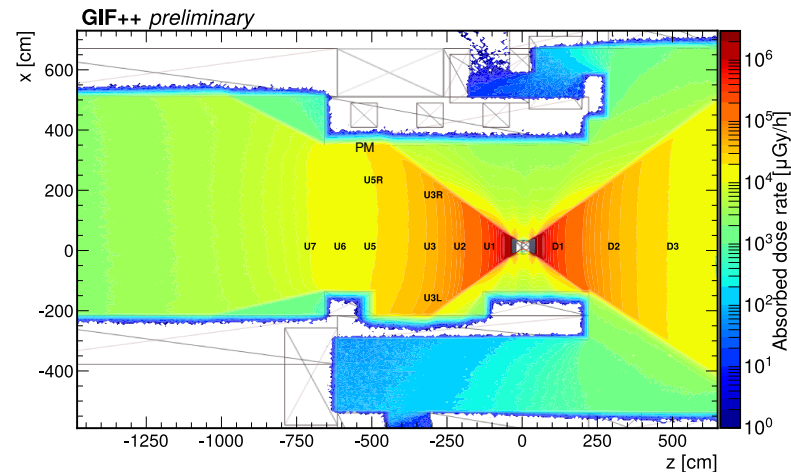


Dosimeter PMINA14502

- Ionizing dosimeter for radiation protection inside bunker
- Position in **Upstream** with full clearance, while in **Downstream** shadowed by RPC.
- Positioned at $z=1,4$ meter from the source (below **PM** label)



ABS 1 set in both irradiation filters (US/DS)



ABS	1.0	2.2	3.3	4.6	6.9	10	22	33	46	69	100
b	364	164	128	81	62	42	21	16	10	8	5

All experimental data fitted to:
 $D(\text{mGy/h}) = b/z^2$, where **D** is Absorbed Dose rate, **z** is the distance from the source in beam axis at $x=0$ and **b** free parameter.