

CMS GEM aging study at GIF++

Jeremie Merlin

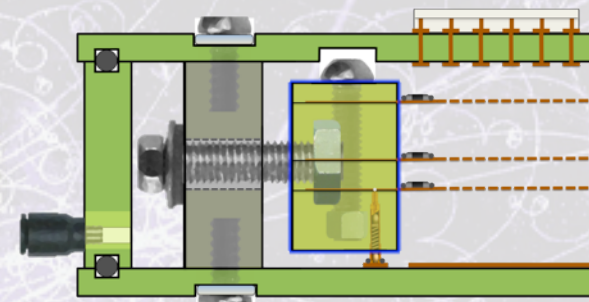
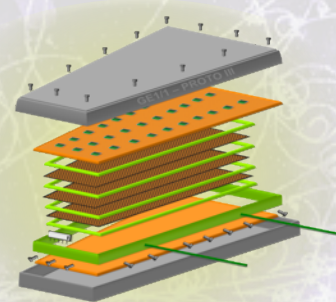
12/01/2015

On behalf of the CMS GEM collaboration

Project and Goals

Long term study of CMS GEM GE1/1 detectors :

- Large triple-GEM detectors ($100 \times 50 \text{ cm}^2$)
- Ar/CO₂/CF₄:45/15/40
- 3 mm conversion gap



→ Classical aging test :

- Reproduce* 20 years of real operation in CMS endcaps ($1.55 < |\eta| < 2.18$)
- @ gas gain $2 \cdot 10^4$ --- Total accumulated charge = **100 mC/cm²** (average rate : $5 \cdot 10^3 \text{ Hz/cm}^2$)

* Requirement : test in realistic conditions == acceleration factor < 100x real operation

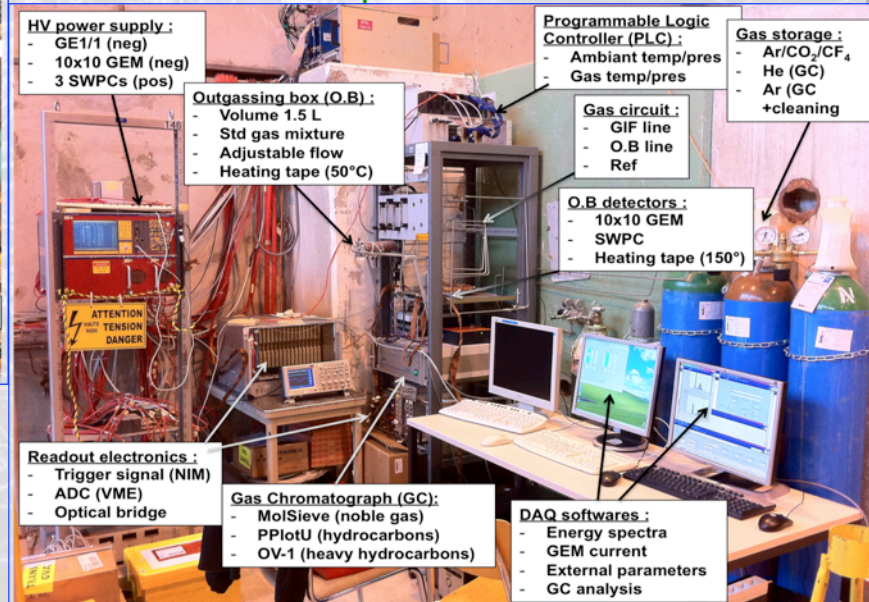
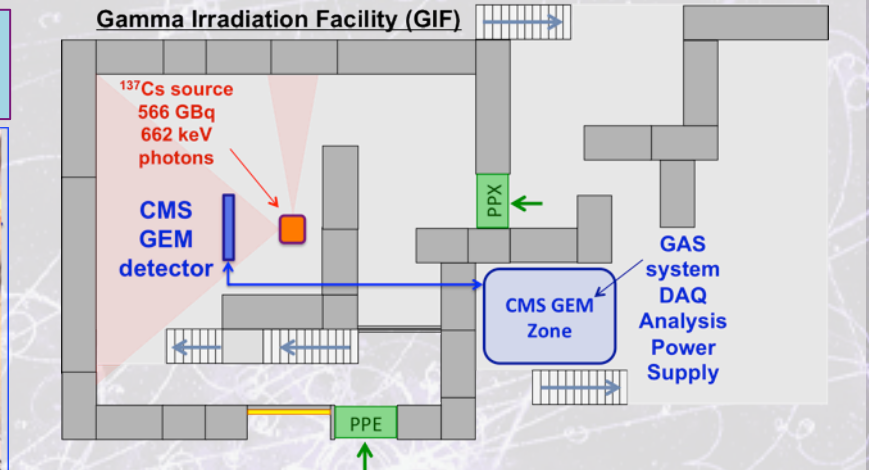
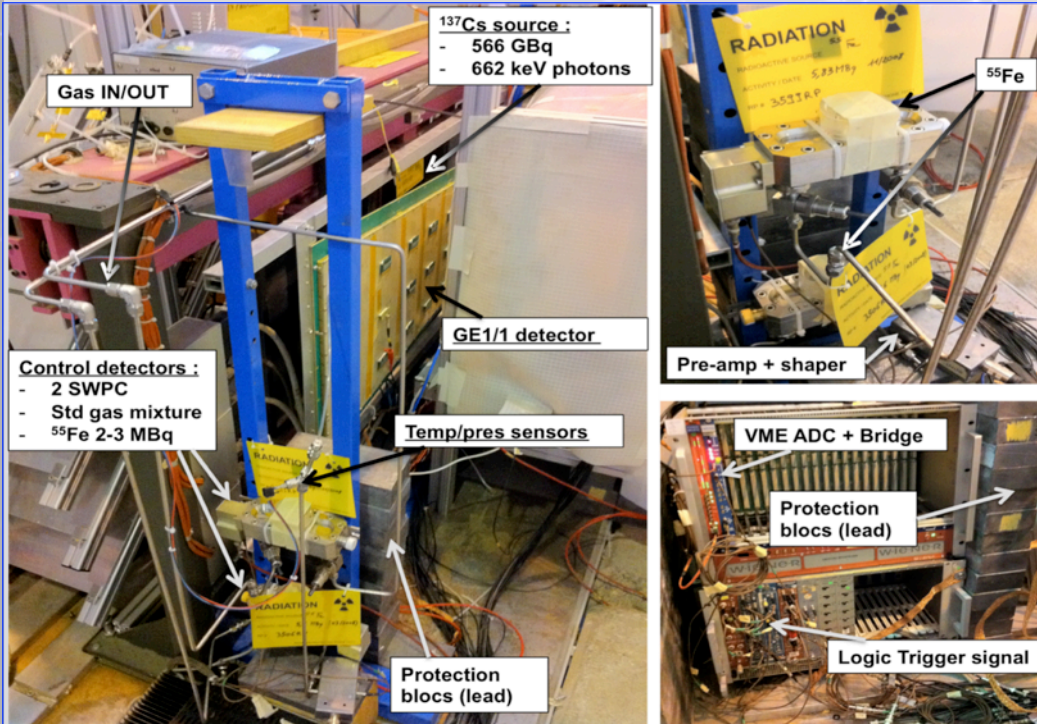
→ Possibility to extend the test for the **ME0 project** (order of C/cm²)

→ Outgassing study :

- Remove all possible source of pollution from detectors to avoid self contamination

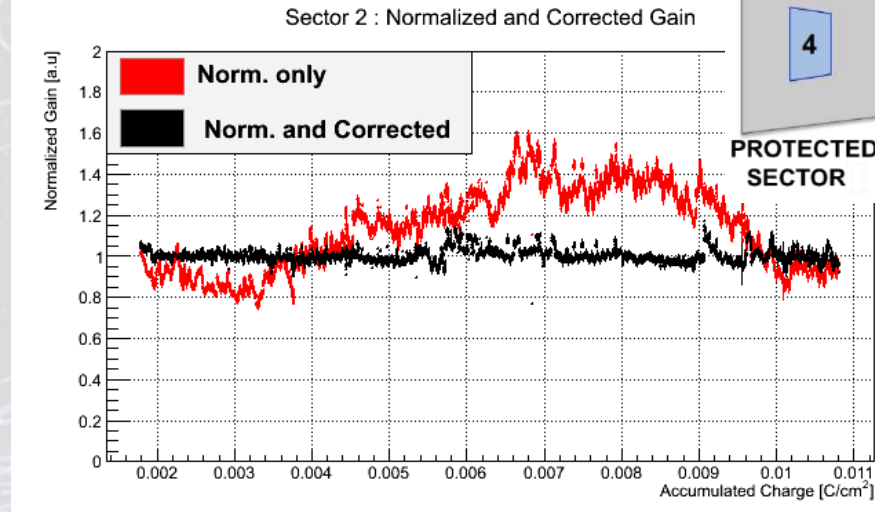
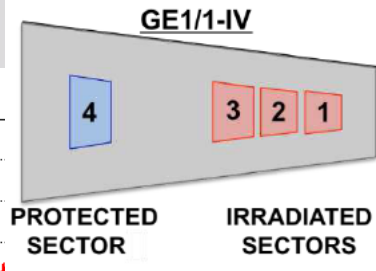
→ Ensure good operation of detectors with longest lifetime for final installation in 2018

Successful first step at GIF



- 7 months of preliminary operation with GE1/1 generation 3 → demonstrate the reliability of the setup
- 12 months of accelerated aging with generation 4 (acceleration factor x3) → accumulated 10mC/cm²

Successful first step at GIF



Classical aging test :

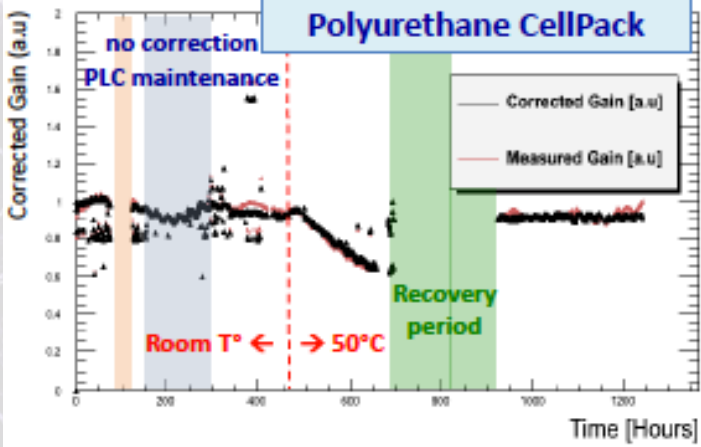
- current measured 1/5min
- T°,P,H% 1/min
- 2 M data points
- Half of the chamber irradiated
- No aging effect was observed
- Dose equivalent to 3 years of real operation

Outgassing test :

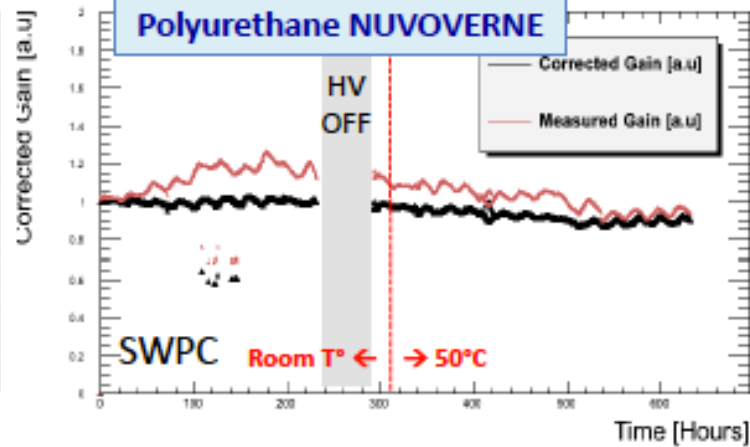
- 3 materials tested
- 1 rejected and replaced

Will not move to GIF++

Exemple of rejected material



Exemple of accepted material



Plans for GIF++

- Continue the irradiation up to 100 mC/cm^2
- Add min 1 detector to the setup with different gas mixture (Ar/CO₂)
- Complete the DAQ system by systematically pulse-height spectra from GE1/1s

Requirements

Irradiation :

- 12 months with constant (maximum) gamma rate – no attenuators
- no access require during test (if no problems)
- continue irradiation for ME0 project (2 years)

Gas system :

- based on pre-mixed gas bottles + pressure reducer + safety valve + flow-meter
- need min 3 supply/return lines from gas zone to bunker (stainless steel)

Requirements

In the bunker :

- 70x50 cm² Aluminum support with detectors
- 50x50 cm² for NIM+VME crates and pico-ammeter
- + need lead wall for shielding ? (1x1 m)

Position : ideal case

- need $5 \cdot 10^4$ Hz/cm² in the detector

→ Sensitivity to photons = 10^{-4}

→ Need $5 \cdot 10^8$ Hz/cm² in front of the detector

In the control room :

- 2 desktop computers with eth. Switch
- 1 PLC station for environment monitoring

From bunker to control room :

- optical link (50 m) x2
- USB link (16 m)
- HV cables x3

→ Need 2-3 days installation + debugging (now ready to start)



Thank you

Status report from GIF

