GIF^{++} Facility News

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http://gif-irrad.web.cern.ch/

8th Annual User Meeting

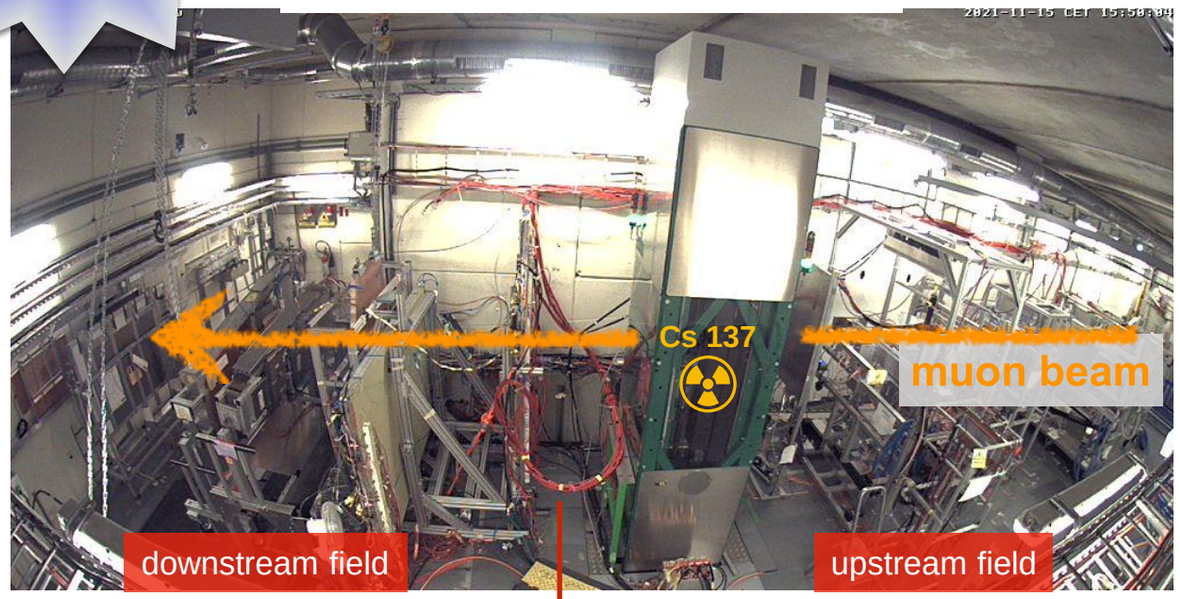
03.12.2024

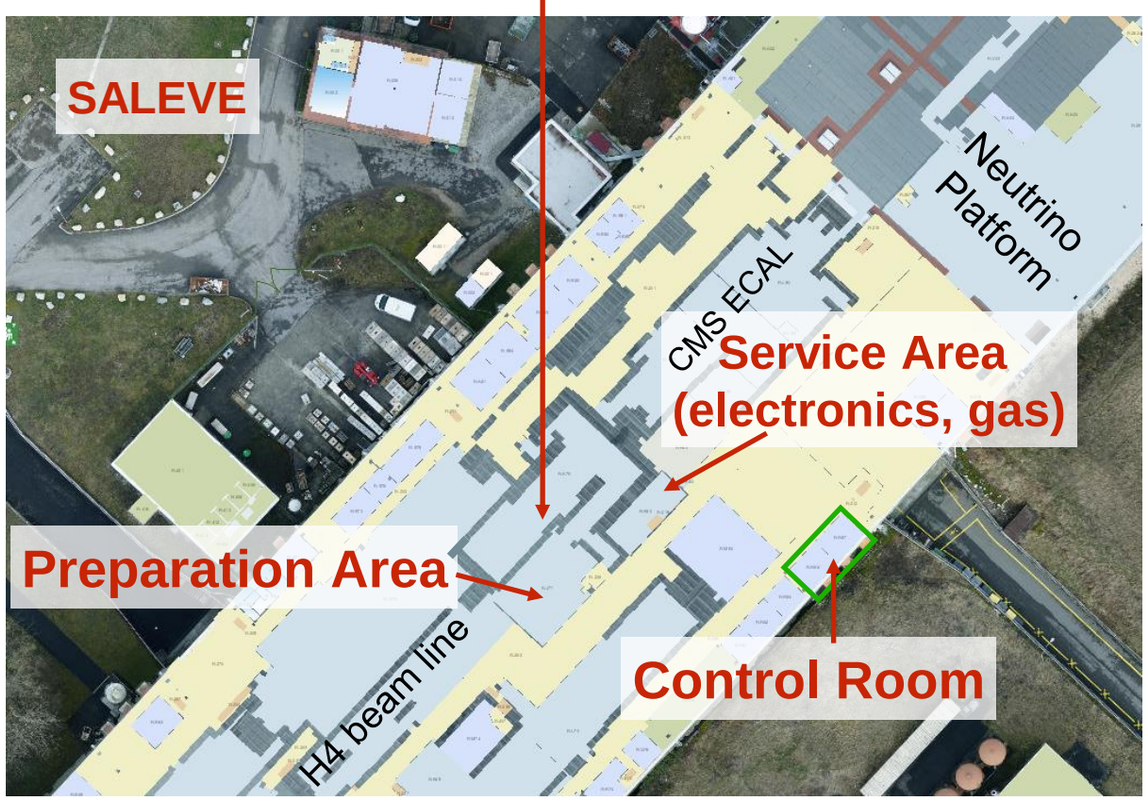
CERN
EP-DT
Detector Technologies

GIF++ @ EHN1

Irradiator operation throughout the whole year

Irradiation Bunker





Introduction :

- Unique place, combining a high energy muon beam with a 12 TBq* ^{137}Cs gamma source
- Joint EP & BE facility, operated by EP-DT
- Designed for testing real size detectors
- ≈100 m^2 irradiation fields, 2 irradiation zones with independent attenuation systems
- Central Control System, wide range of available gases (+ custom gases), common DCS…

*) 14TBq as of 2014

Current R&D Program :

- Detector validation tests under realistic conditions: high radiation background & muon beam
- Ageing studies under HL-LHC radiation conditions
- Search for eco-friendly gas mixtures
- Mass-production test of muon chambers
- Radiation tests of electronics and optical components

Joined Facility BE/EP

Unchanged

Beams Department

EP-DT Detector Technologies

- **EHN1 infrastructure**
- **Beam line H4**
- **General GIF++ infrastructure**
  - **Electricity, cooling & ventilation, gas primary system…**
- **Access system (contact to)**
- **General safety EHN1 (incl. GIF++)**

- **^{137}Cs Irradiator**
- **Local gas distribution**
- **User operation**
  - **Irradiation requests, beam request, space management**
  - **User installations**
  - **User contact**
- **Safety (setups & users)**

GIF++ Facility Layout

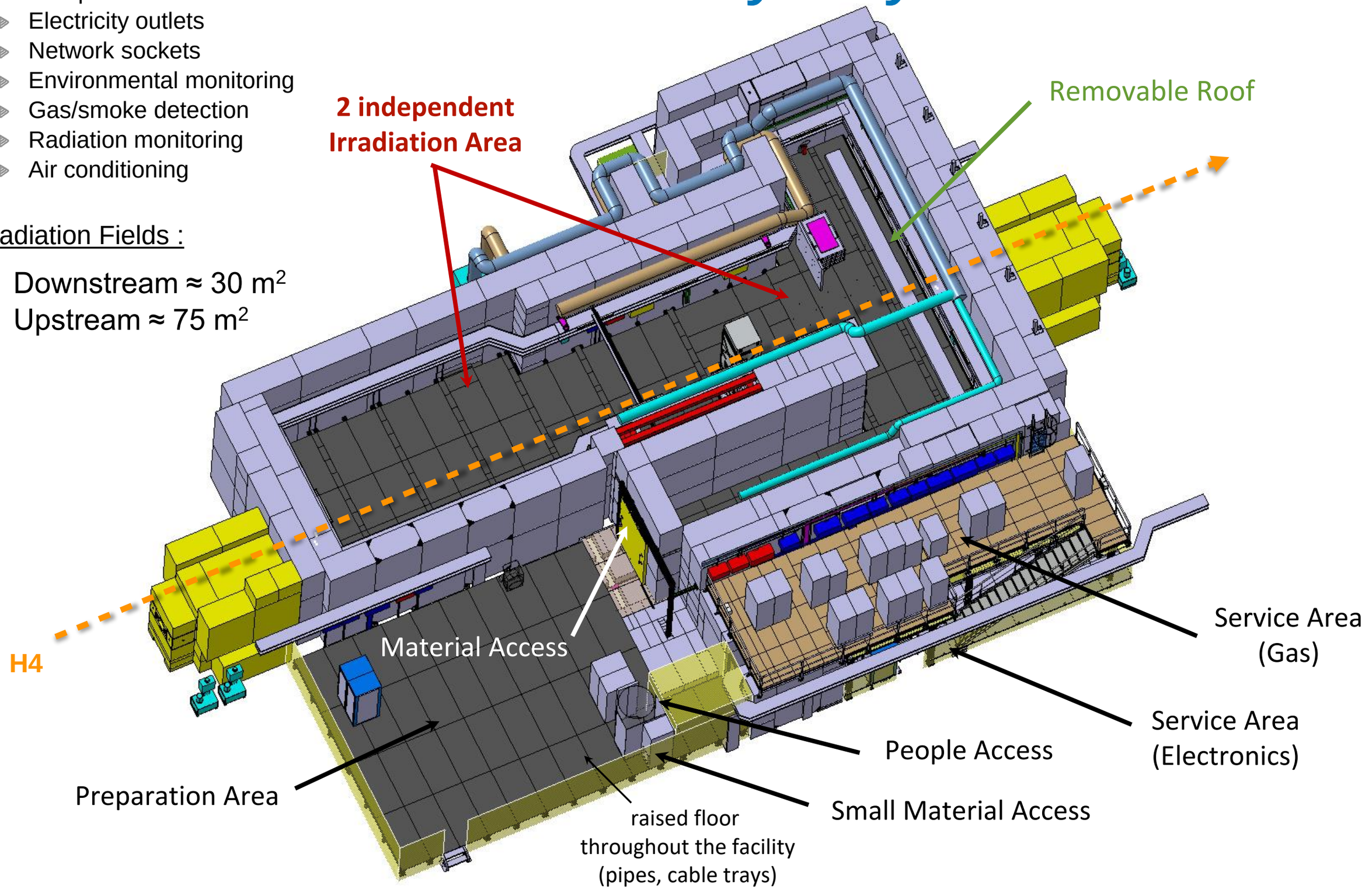
Unchanged

Bunker area contains :

- Gas panels
- Electricity outlets
- Network sockets
- Environmental monitoring
- Gas/smoke detection
- Radiation monitoring
- Air conditioning

Irradiation Fields :

- Downstream ≈ 30 m^2
- Upstream ≈ 75 m^2

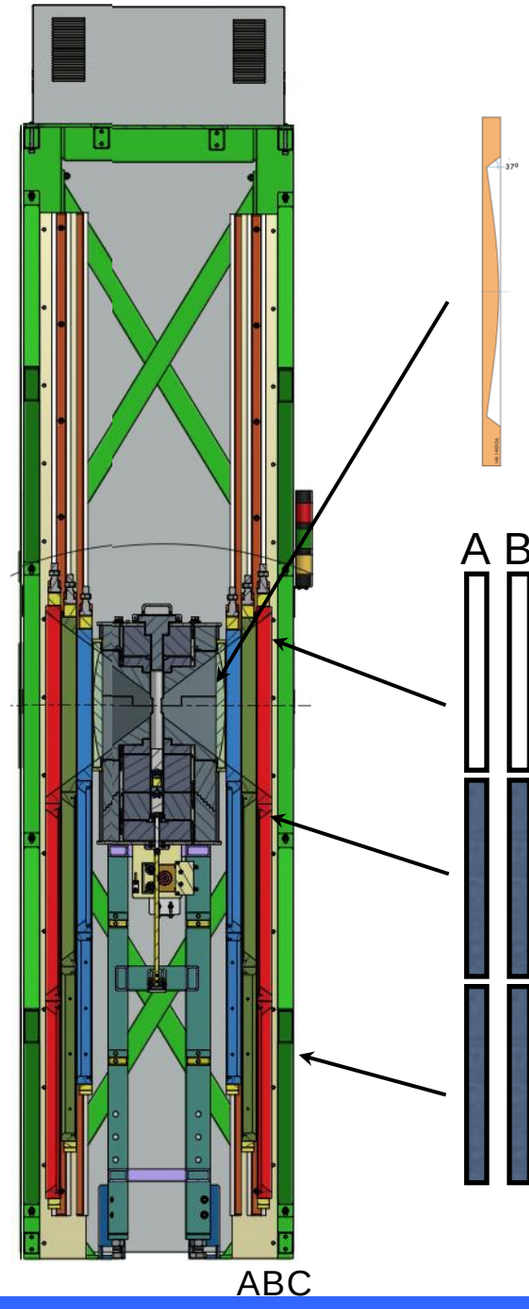


Unchanged

GIF++ Irradiator & Attenuation Filters

One ^{137}Cs source, two identical attenuation systems, each consisting of one angular correction filter (Fe) and 6 absorption filters - a total of 14 custom shaped filters

14 TBq
^{137}Cs
(as of 2014)
≈ 12 TBq now



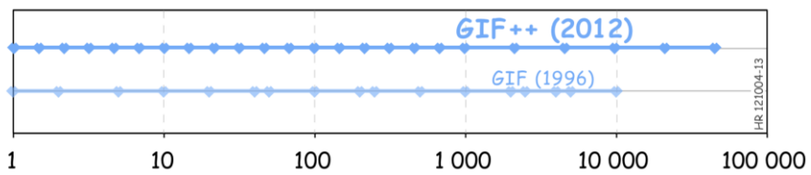
Angular correction filter provides uniform photon distribution for large area detectors

Filter System :

Absorption factor		
0	0	0
10	1.47	2.15
100	100	4.64

24 possible attenuation factors :

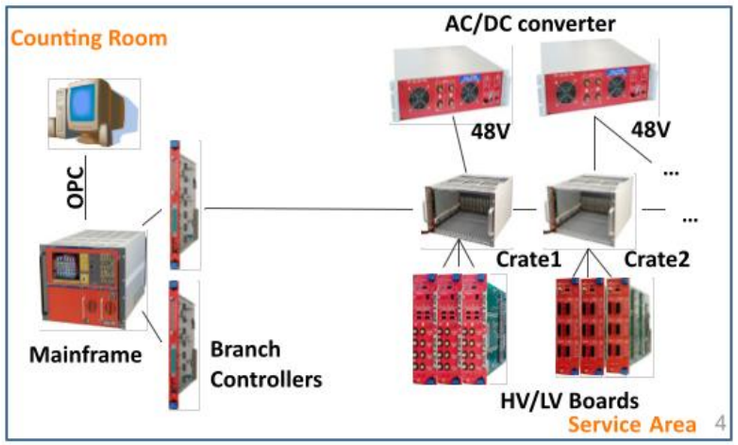
1	21.54	464.2
1.47	31.62	681.3
2.15	46.42	1000
3.16	68.12	2154
4.64	100	4642
6.81	146.8	10000
10	215.4	21544
14.68	316.2	46415



(calculated values for un-scattered gammas)

Unchanged

GIF++ Infrastructure & Safety



Mixture distribution

Monitoring of pressure, O2/H2O, temperature, atmospheric pressure

Additional software controlled pressure regulation for very low flow regimes

Gas mixing unit

Access / Safety / Procedures

GIF ++

Go back to main frame

Access Requirements for GIF Areas :

Zone	Access Rights & PPE	
EHN1	• CERN Card • Personal Dosimeter • Personal Protection Equipment	
GIF Control Room	• CERN Card • Personal Dosimeter + "Control Room HNA-487 (0887-1-R87)"	
GIF Service and Preperation Areas	• CERN Card • Personal Dosimeter • Personal Protection Equipment	
GIF Irradiation Bunker	• CERN Card • Personal Dosimeter • Personal Protection Equipment • Activated (!) Operational Dosimeter + ADMAS rights : "GIF++ Zone Turnstile (EHN1-GIF)" + Training Rank : "10800 : CERN - Beam Facilities" +Training Rank : "10350 Radiation Protection - Supervised Area" + Valid IMPACT request	

The dosimeter service (building 55) will hand out personal- and operational dosimeters to you.

GIF++ Important Dates

- **Christmas Closure** :
  - Irradiator stop on MONDAY morning 18.12.2024 at latest
  - Please position all set-ups in “source maintenance position” by 18.12 evening
  - gas supply stopped ~ 3h NOW, neutral gases restart this afternoon
  - Access will still be possible until Friday mid-day 20.12.2024
  - **STRICTLY NO ACCESS** during 21.12.2024 – 06.01.2025
    The IDS (Intrusion Detection System) will be active - see next slides

- **Annual & exceptional Irradiator maintenance :**
  - First two weeks of new year: 06-17.01.2025
    No access, priority given to VF (if you really need access contact us)
  - DSO Source Test on Thursday 16.01.2025 afternoon.

- **Restart of facility**
  - We expect access possible from Monday 20.01 onwards
  - Getting back into normal position of setups
  - Restart of gas supply: 03.02.2025
  - Restart of irradiator: 03.02.2025 at latest

GIF++ Important Dates

- **2025 Muon beam request call already submitted :**
  - Requests (3 x 2 weeks) for the GIF++ have to be submitted via GIF++ Physics Coordinator
  - Request to run (with some restrictions) during LS3 was also submitted
- **IMPACTs 2025** :
  - As every year, we will CLOSE all active IMPACTs with the end of the operation year.
  - Please renew (clone) your IMPACT declaration
  - Review the description, modus operandi and the participant list (!)
  - With the start of the new year we will sign the IMPACT activities
  - The new IMPACT number needs to be displayed on each setup hosted in the bunker or preparation area
  - Start now !
- **SAFETEY Clearance :**
  - We have agreed to renew the safety clearance at least once a year.
  - Following the restart of the facility in February, we will organize a renewal of the safety clearance for all setups affected
  - See Federico’s talk for details

GIF++ Important Information

- **Intrusion Detection System** :
  - Active during the Christmas Shutdown (will be communicated when turned on)
  - STRICTLY no access when the IDS light is **YELLOW** (Green = Off, Red = Alarm)
  - Works like any burglar alarm. When you open the first door, you will trigger the alarm and CERN security is informed.
  - Depending on their assessment (cameras), the French police will be involved

If you really need access during the CERN closure, contact Martin, Federico or Giuseppe

But do you really, really need access ? 🙂

Upgrade to Gas Exhaust System

EP-DT-FS
R.Guida et al

The gas system infrastructure is a key element of the successful R&D programs performed at the GIF++

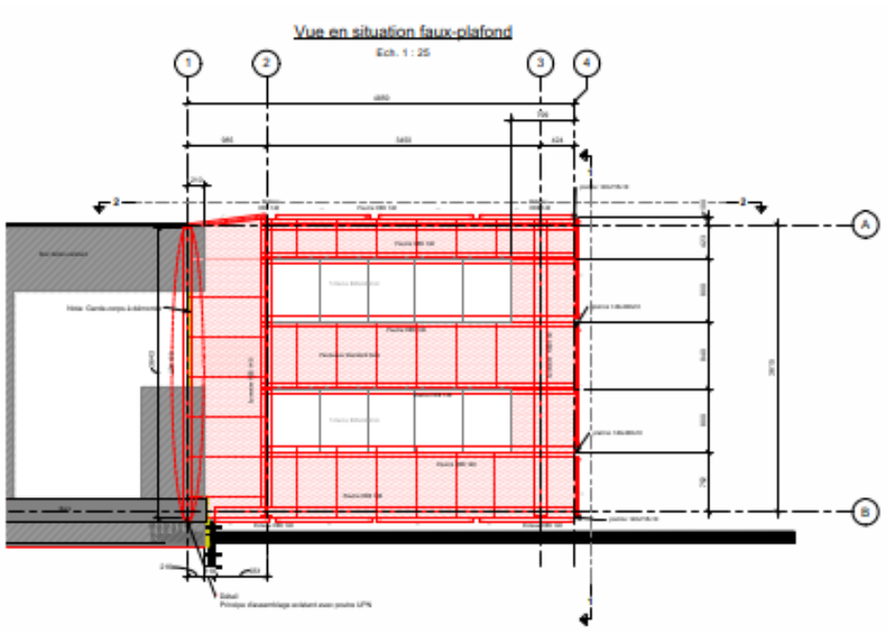
Gas recirculation module

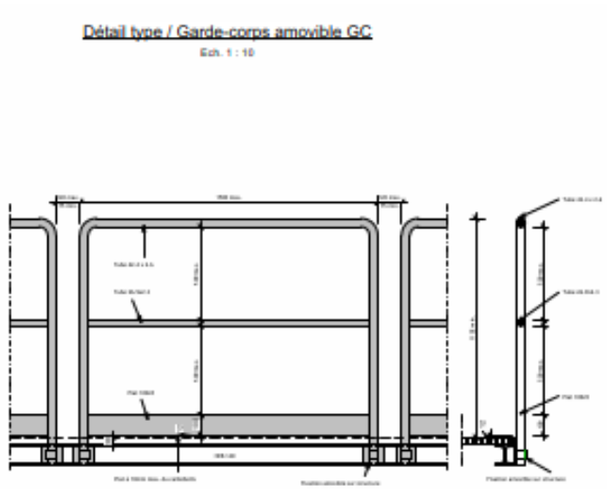
- **2023 showed a significant increase in RPC chambers tested** at GIF++
  - Increase in the overall gas consumption, especially in the RPC mixture
  - **Gas consumption / extraction no longer negligible**
- We currently have one simple exhaust line to the outside, gas consumption contributes to the **CERN environmental footprint**

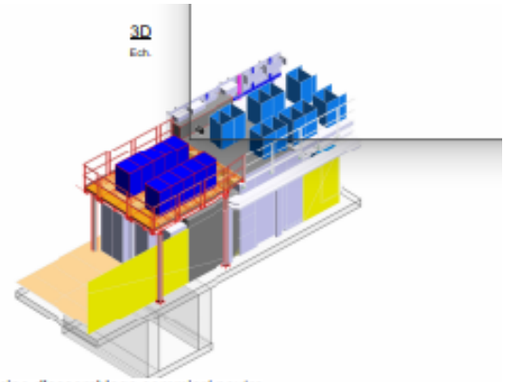
ECO-Gas

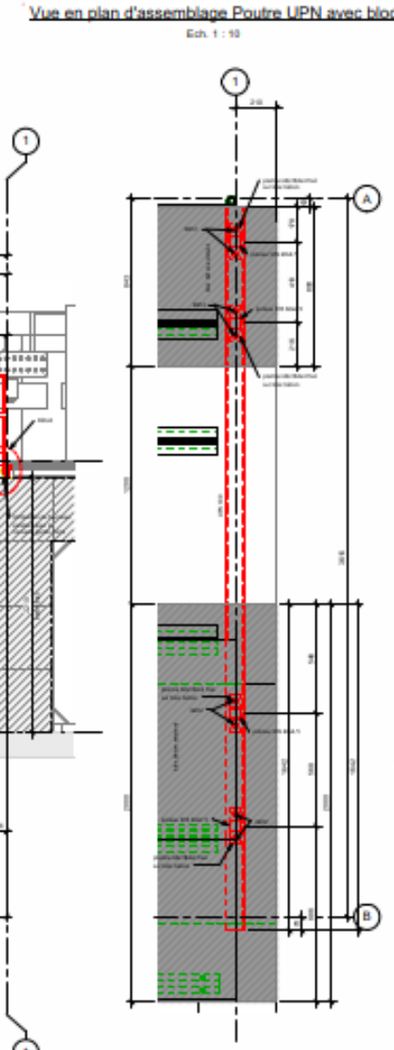
- **Proposal to install an RPC gas-recuperation system at GIF++**
  - Planning in 2024 with installation in 2025/26
- **Discussion on optional recirculation system**.
  - Only feasible for long term stable setups
  - Not suitable for systems where chambers get often swapped

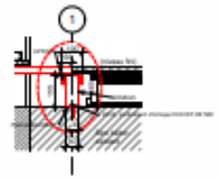
Extension of the gas balcony progressing

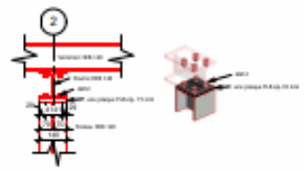


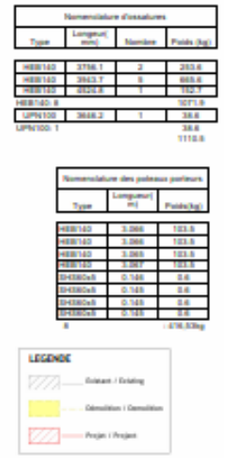


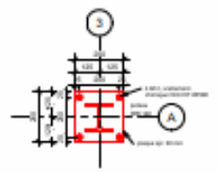


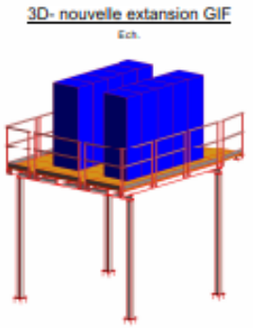


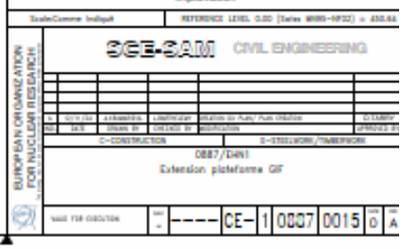


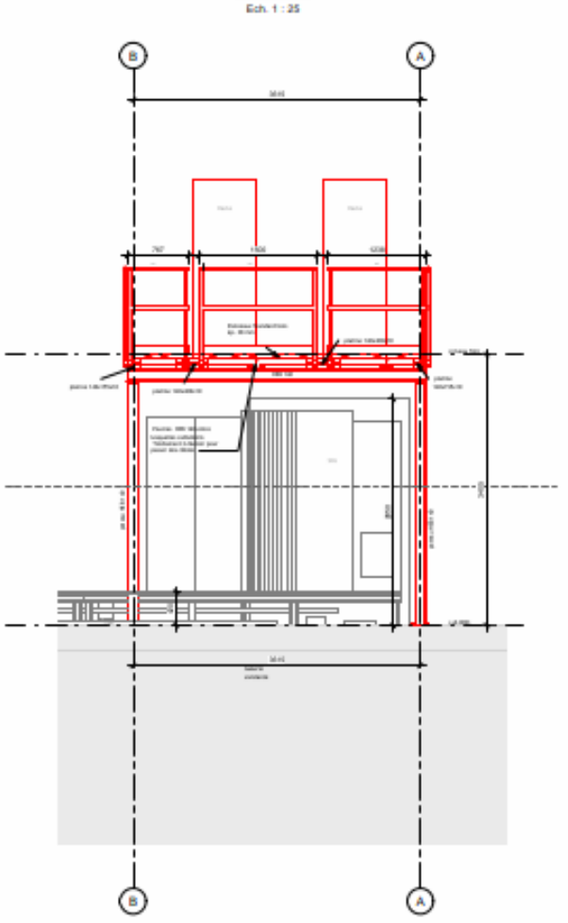


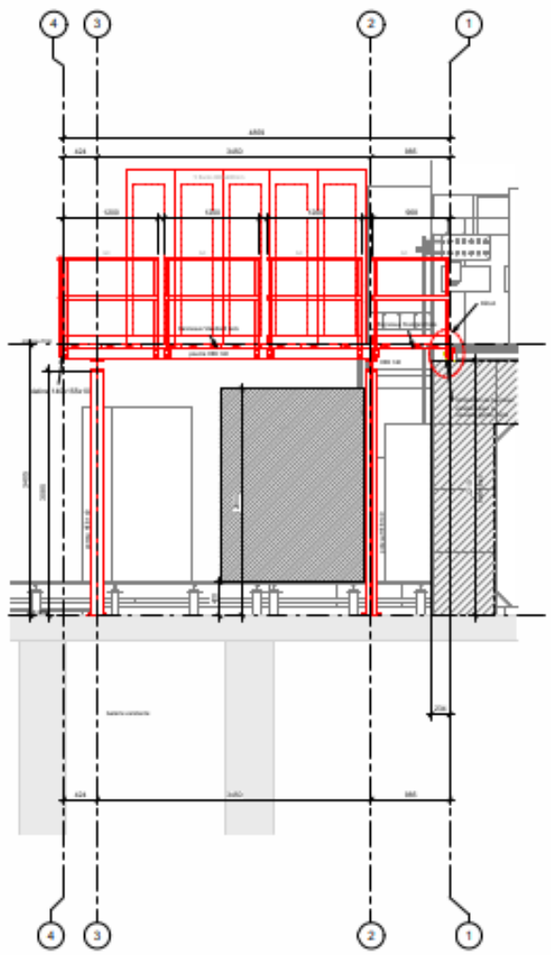


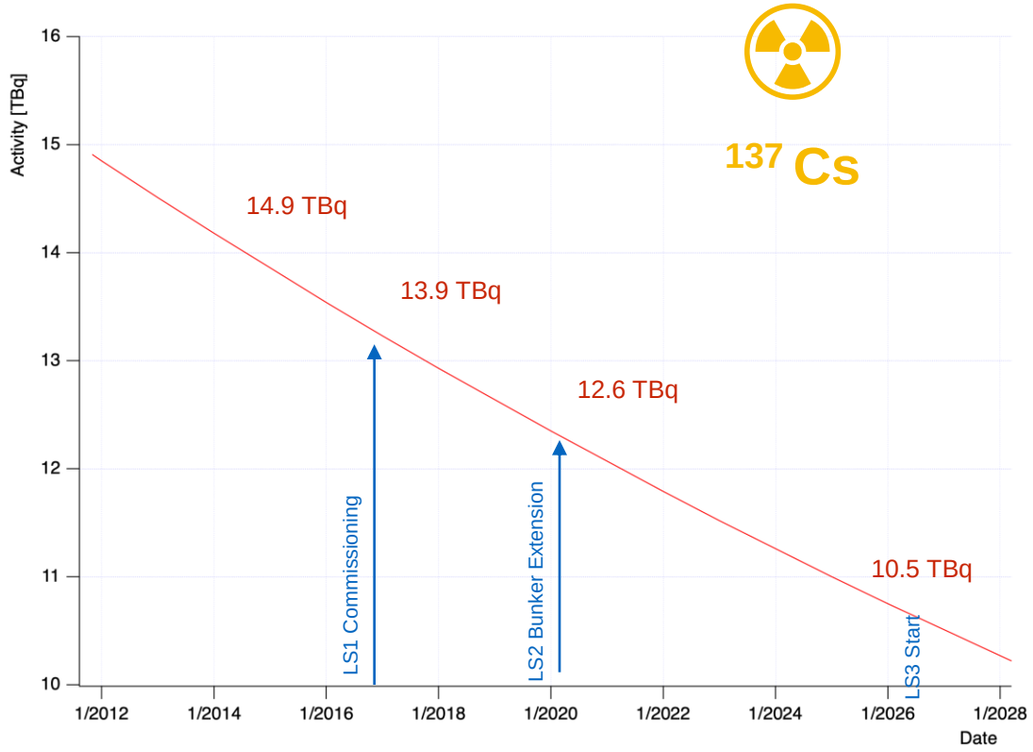












Extension of life time beyond 2025

From original 14 TBq (2014), we will be < 11 TBq by LS3

To ensure & improve the efficient operation of the facility beyond LS3, we started to look for a new source !

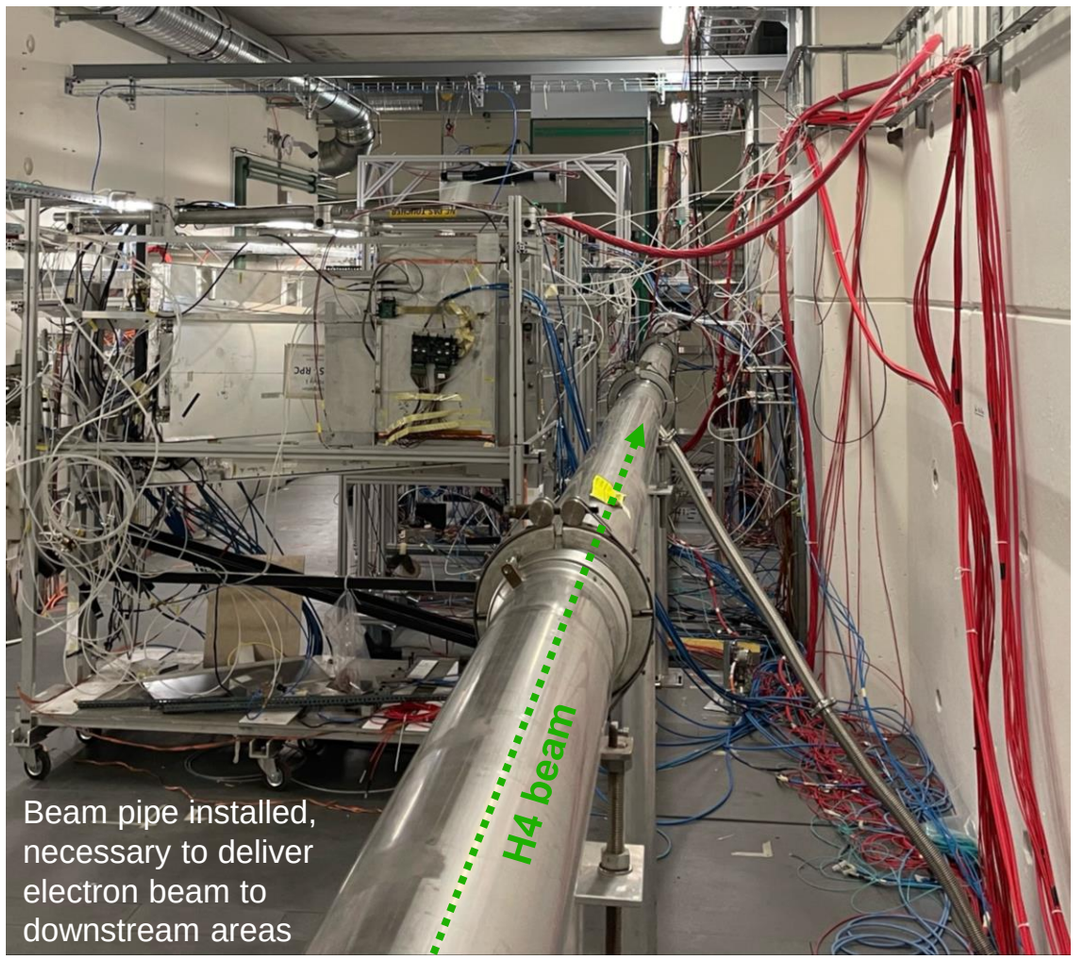
- Extension of Irradiator maintenance contract ✓ (*)
- Market survey for new source. Currently challenging. ✗

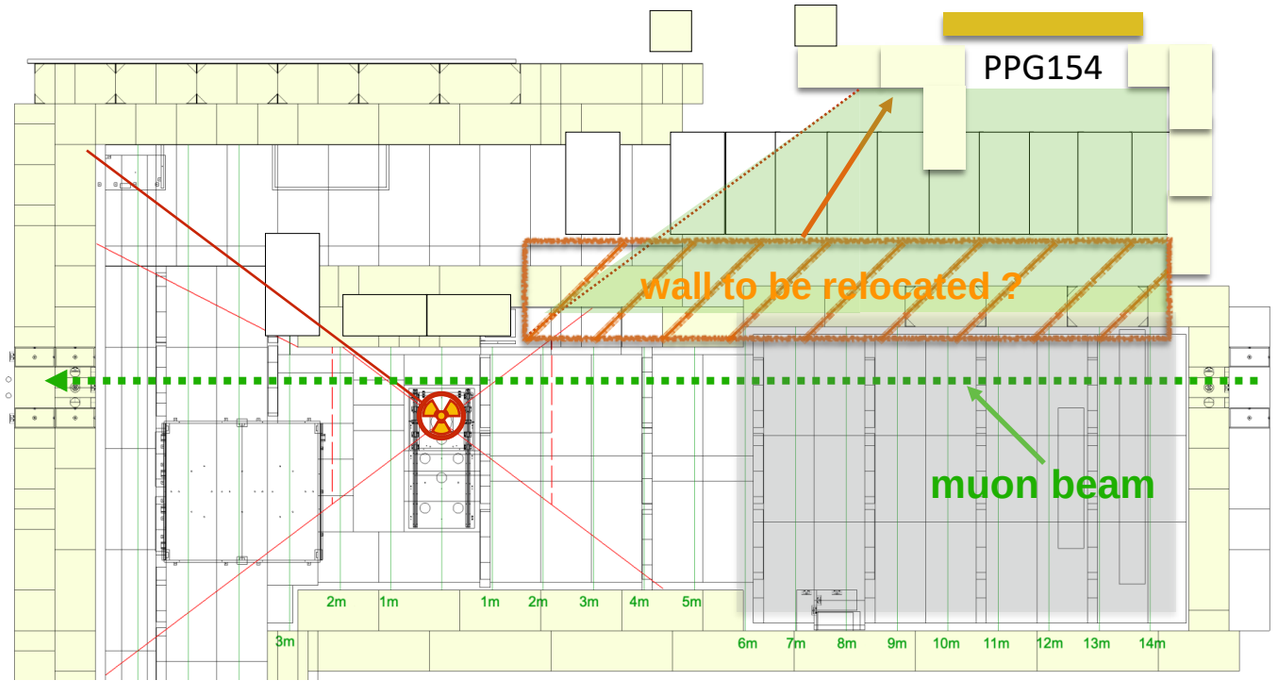
- Difficult to plan the replacement of the current Cs source
  - Very few producer of high intensity sources, with biggest manufacturer currently not available
  - Prices of available (existing) sources are extremely high
- Current dimensions of Irradiator capsule can limit the reachable activity
  - Housing and bunker designed for ≤ 100 TB, but capsule dimensions will limit us to ≈ 20 TBq
  - On site loading of new source appears to be technical possible
  - A new Irradiator with increased dimension could be envisaged.
    Opens the possibility to add multiple sources in one Irradiator via loading carousel
  - Significant higher costs. Might need a redesign of the attenuator system.
  - Very challenging in current financial situation
  - Activity was measured in November (Nicola Ferrara), new map soon available

*) Contract signed.

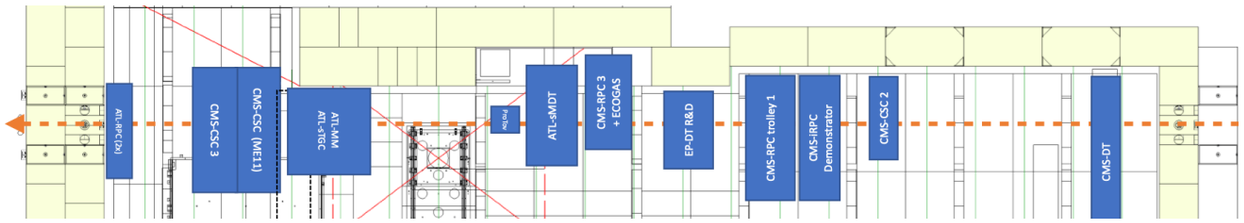
MAIN UPGRADE

- **Proposal : Bunker extension to increase space on the Saleve side of the beam line to allow better distributions of detectors, while significantly limiting the shadowing effect on detectors further away from the source**
  - Possibility to place the full width of a detector inside the muon beam
  - No extra floor space in EHN1 needed. Dedicated preparation area converted into irradiation area.
  - Will need dedicated funding





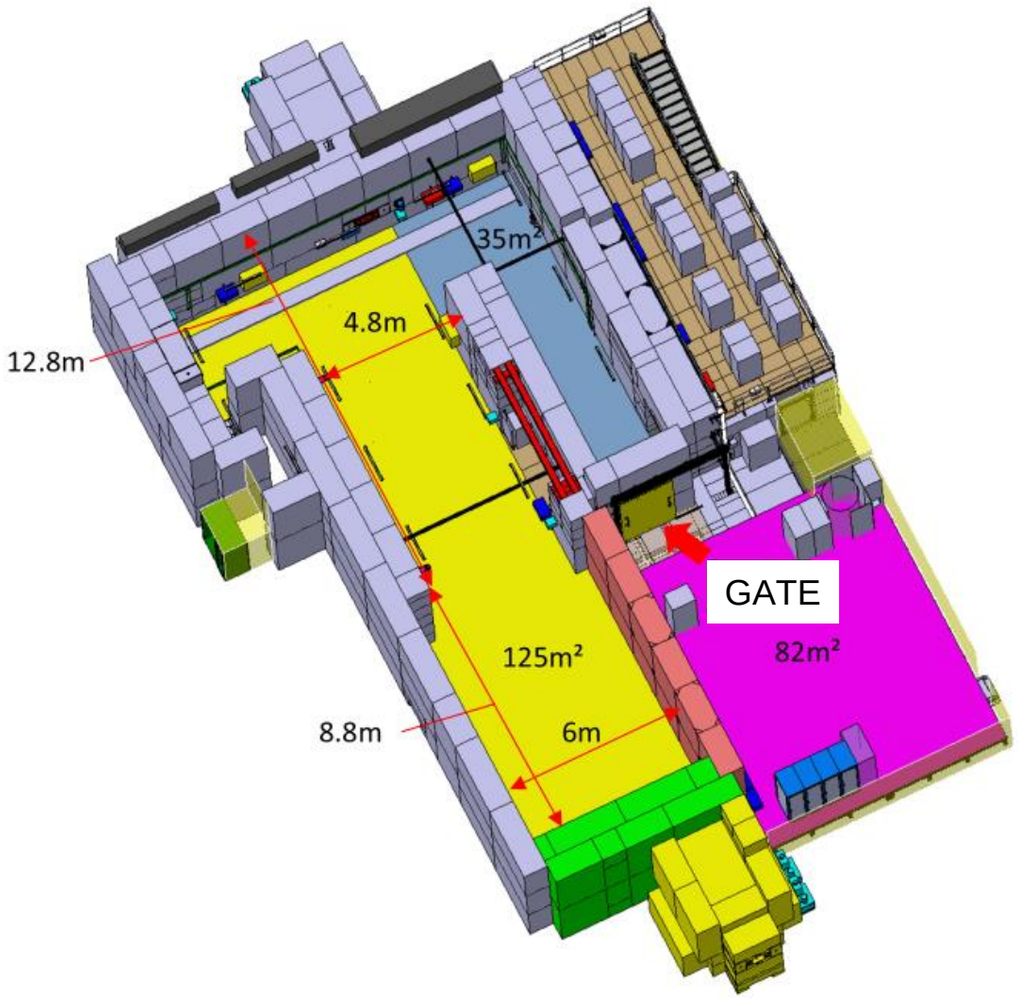
Uneven shadowing for setups :



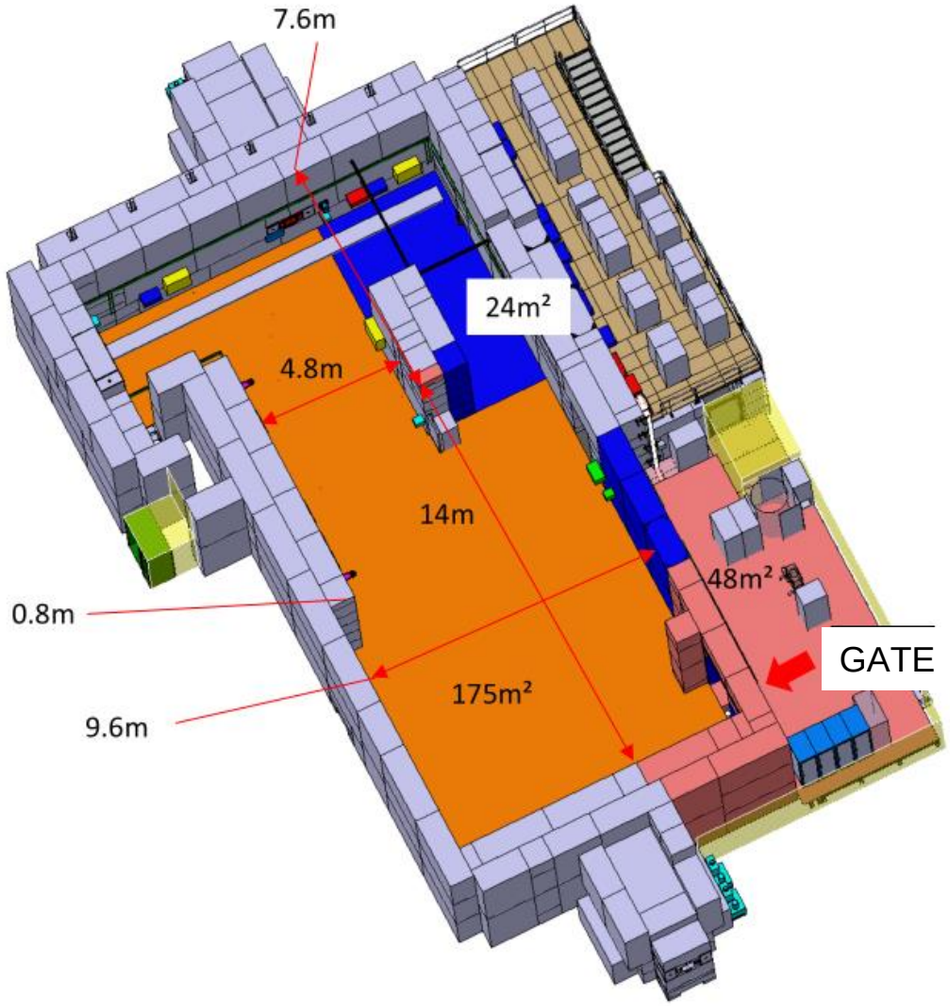
Mainly from support frames, shielding blocks, etc…

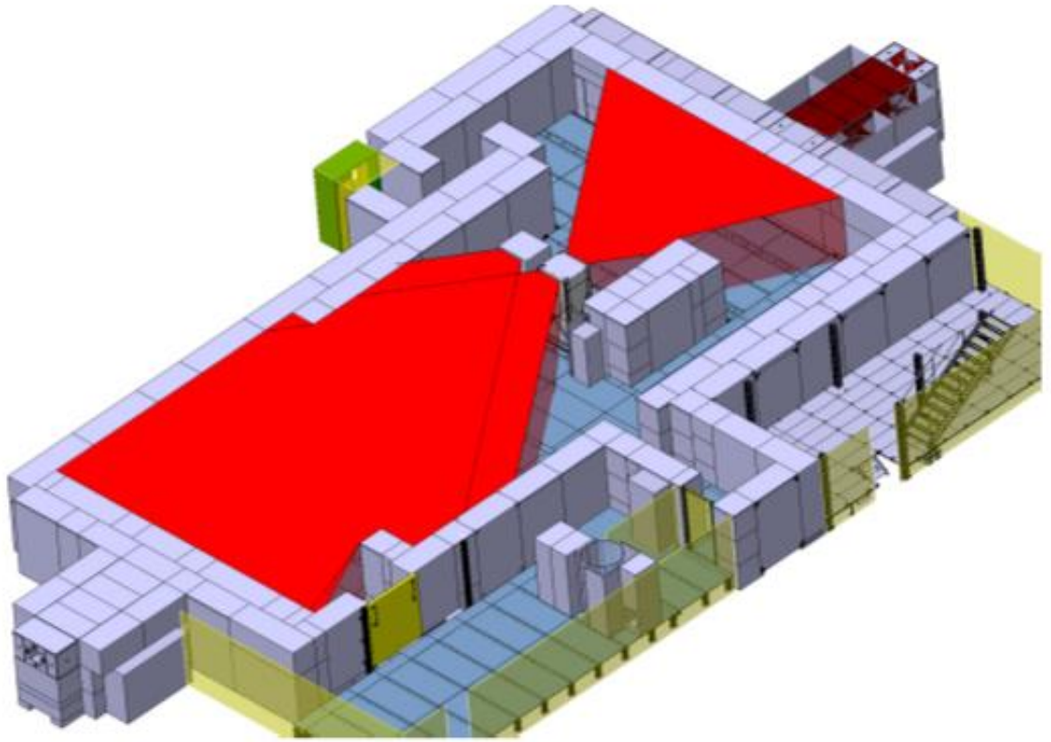
COMPARISON GIF++ PHASE 1 / GIF++ PHASE 2

NOW



PROPOSAL





- ECR (technical details) ~ ready, including cost
- pending approval by CERN management
- Your support is important, please discuss with your TC

Highlights & Conclusions

GIF^{++} is a unique facility purpose-built for testing detectors in realistic environment with LHC experiments readout systems & gas mixers

No existing alternatives worldwide

Thank you very much for your collaboration all along the year !

Expected increase in users coming from DRD1 collaboration

Proposal to operate the GIF^{++} beyond Run 2 (and after LS3) has clear support from EP and the LHC experiments

To provide the necessary service for the foreseeable future, we need to consolidate the facility

Merry Xmas
and Happy New Year !