Summary of 2023 requests collected for GIF^{++}
(Alphabetic Order)

We have collected requests from 11 distinct groups for 18 individual setups.

1 ATLAS MPI (2 Setups)

Contact persons: O. Kortner
E. Voevodina

Motivation for the beam time request :
Test of new front-end electronics for ATLAS sMDT chambers.
Test of prototype ATLAS RPC chamber

Expected results from the beam time :
sMDT chamber performance improvements at very high background rates with the new front-end.
Performance of the prototypes. Test is part of the qualification of a new RPC manufacturer.

Beam request : 3 x 2 Weeks (May, July, October)

2 ATLAS NSW MM (2 Setups)

Contact persons: Ralf Hertenberger
Theodoros Alexopoulos
Valerio d'Amico

Description of the setup :
4 tracking detectors like in 2021
2 NSW MM modules (SM1 M40 and LM2 M40) as in 2021
same position in GIF^{++} as in 2021

Motivation for the beam time request :
test of the new VMM electronics with the Felix system
confirmation of non-observation of ageing effects using the Ar:CO2:isobutane mixture 93:5:2

Expected results from the beam time :
substantial improve of the VMM/Felix firmware
non-observation of ageing effects

Beam request : 1 x 2 weeks mid of 2023
1 x 2 weeks end of 2023,

3 ATLAS RPCs (3 Setups)

Contact persons: Giulio Aielli, Giorgia Proto
Alessandro Rocchi
Sinem Simsek

Description of the setup :

a) BIS7 mod zero trolley for long term ageing, 200x180x50. This will include a 50x50 chamber
for testing the standard atlas mixture added with CO2. Test running
b) BIL phase2 trolley for phase2 prototypes performance assessment. Start in February.
c) phase2 RPC production gas gap validation : 1 trolley 200x180x50. Will go in and out each Wednesday starting on March.

Expected results from the beam time :

Ageing assessment for 1mm gas gaps, using various gases; Compatibility of legacy 2 mm gas gaps with various eco gases; high rate performance assessment of phase 2 chambers; phase2 production gas gaps validation.

Beam request : 3 x 2 weeks in spring, summer autumn

4 CMS-CSC (3 Setup)

Contact persons: Kuznetsova Katerina
Perelygin Vicotr

Description of the setup :

ME1/1 and ME2/1 are two types of Cathode Strip Chambers of the CMS detector. ME1/1 type differs in geometry and construction materials from other CSCs of the CMS detector, while ME2/1 differs from other CSC types only by the size and its very forward location. Two full-scale production chambers installed in the downstream area of GIF^{++} are the subject of ongoing longevity studies with CSC gas mixtures containing reduced amount of CF4. ME1/1add will be installed in the upstream GIF^{++} region in second half of 2023 to study CSC performance with alternative gas mixtures containing potential CF4 substitutes.

Motivation:

The ongoing longevity studies aim to prove a possibility to reduce CF4 fraction in the CSC gas mixture by a factor of two. Irradiation of the CSCs with the optional gas mixture was started in the mid of 2022 and will be ongoing through the whole year 2023. Testbeam measurements are necessary for a direct monitoring of the chamber performance as a function of the charge accumulated during the irradiation. For the most efficient balance of the irradiation time and the performance measurements we prefer to have three TB slots in 2023, 2 weeks each, at the very beginning, mid and the end of the SPS operation.

Expected results:

During the testbeam measurements the spacial resolution of the irradiated CSCs are measured along with the relative gas gain and muon detection efficiency. The resolution and efficiency are measured for different background occupancies using various filters of the GIF^{++} source. The same set of the measurements are also considered for the ME1/1add chamber operating with various gas mixtures.

Beam request : 3 x 2 weeks

5 CMS-DT-MB2

Contact persons: Lisa Borgonovi

Description of the setup :

CMS-DT MB2 chamber installed upstream in the GIF bunker.

Expected results from the beam time :

We plan to continue taking data with our CMS-DT MB2 chamber in the current position of the setup upstream, irradiating at dose rates close to the expected ones for HL-LHC in CMS. Since we started a new irradiation campaign with increased gas flow, almost twice the one used during the 2021-2022 campaign, we would like to test the muon hit efficiency as a function of the dose rate and as a function of different HV conditions; this would be fundamental to compare the new results with the ones obtained in the previous test beams performed in 2021-2022. With the data we could be able to understand the impact of increased gas flow on the performance of the detector and possibly consider it as a mitigation strategy to reduce DT chambers ageing.

Beam request : 1 x 2 weeks (possible second slot if needed)

6 CMS GEM

Contact persons: D. Fiorina
A. Kumar

Description of the setup :

Small trolley about 60x60 cm footprint 2m high. 1x ME0 Module + 3x 100cm2 GEM detectors for tracking during the beam periods. The front-end readout electronics will be installed on the trolley. Back-end, NIM Crate, High Voltage mainframe and Low Voltage power system will be installed in the Racks zone. Overall, the need for rack space is about 35 Rack Units. Most of such space is already allocated since the beginning of 2022.

Motivation :

The ME0 GEM Chambers are expected to be operated with background particle fluxes ranging between 3 and 150 kHz/cm^2 on the chamber surface. Both the maximum background rate and the extensive range in particle rate set a new challenge for particle detector technologies. Voltage drops limit the rate capability of GEM detectors on the chamber electrodes due to avalanche-induced currents flowing through the resistive protection circuits (acting as discharge quenchers). The CMS GEM group proved, during 2022 tests at GIF^{++}, the possibility of restoring the amplification gain by adjusting the HV settings as a function of the amplification currents which flow on each electrode. However, in previous test beams at GIF^{++}, the CMS GEM group observed a muon efficiency loss that is not imputable to the effect of voltage drop but to the front-end electronics rate capability. New test beams are needed to test the new prototype and tune the ASIC parameters. GIF^{++} is the only place where a muon beam can be used along with the high-rate background.

Expected results from the beam time :

The group is working on a new detector prototype and optimising the AISC parameters to improve the rate capability. Two test beams at GIF^{++} will be needed to define and finalise the detector design and electronics. The CMS-GEM group expect to fully validate the ME0 detector design front-end with 2023 test beams at the GIF^{++} facility.

Beam request : 2 x 2

7 CMS-RPC (2 Setups)

Contact persons: Nikolaos ZAGANIDIS
Mehar Ali Shah

Description of the setup :

CMS-RPC-1
Consolidation studies of the present CMS-RPC System in GIF^{++}: A trolley hosting 4 RPC chambers identical to the ones installed in CMS has to be installed in the beam line in order to measure the performances of the detectors as their muon efficiency and cluster size after 1 Coulomb / cm^2 of accumulated charge during four years of irradiation in the GIF^{++} facility started in 2016. These measurements are essential to assess the present system for the HL-LHC. We want to continue our ongoing studies to reach the goal.

We would like to add 2 more chambers on the same setup (Trolley 01) to perform studies with source and beam with a new gas mixture with replacing 30% of Freon with CO2. This study will be crucial to evaluate the performance of this mixture which is cost effective and has less environmental impact.

Setups : CMS-RPC-3
QC of the new iRPC's for the CMS-Upgrade equipped with the new Front-end board and new BE electronics. Study the performance of the new uTCA based backend electronics with beam and high background conditions. Aging studies of the new iRPC detectors : Performance measurements with muon beam versus integrated charge.

Beam request : 4 x 2 weeks

8 EP-DT2

Contact persons: Gianluca Rigoletti
Beatrice Mandelli

Description of the setup :

The EPDT2 setup consists in a set of 3 single-gap Resistive Plate Chambers (RPCs) with a multi channel readout system made using a CAEN VME digitizer.

Motivation: The detectors are operated with a gas recirculation system with new environmentally friendly gas mixture. In general, RPCs are employed at ATLAS, CMS, ALICE experiments and are operated in avalanche mode thanks to the gas mixture composed of ~95% C2H2F4, ~4% iC4H10, ~1% SF6.

Expected results:

The goal of EPDT2 is to study the performance of RPC detectors operated with new environmentally friendly gas mixture in the presence of LHC-like background radiation.

Beam request : 3 x 2 weeks

9 PROToV/ATLAS

Contact persons: Alessandro Rocchi
Barbara Liberti

Description of the setup :

Small Trolley 70 cm x 70 cm x 180 cm (WxLxH) with small prototypes of RPC detectors. Close to the irradiator in the Upstream side. Three gas lines:

- Atlas/CMS Standard Mixture wet: 95% R134A, 4,7% iC4H10, 0,3% SF6
- Atlas/CMS Standard Mixture dry: 95% R134A, 4,7% iC4H10, 0,3% SF6
- CO_2

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Motivation: Test of innovative RPC detectors for very high-rate environments.
Characterization of new muon detectors in high gamma background.

Expected results:

Measurement of rate capability, efficiency and time resolution of GaAs RPCs and Resistive Cylindrical Chambers. Study of the performance of RCCs with CO_2.

Beam request : 3 x 2 weeks

10 RE21/ CBM MUCH

Contact persons: Zubayer Ahammed

Description of the setup :

We will test one RPC detector and 2 GEM Detectors nearest to the source. The setup will occupy about 60 cm in the Z-axis of the source

Motivation for the beam time request :

GEM and Bakelite based Resistive Plate Chamber (RPC) will be used at CBM Muon Chamber (MUCH), at FAIR Germany. The expected maximum particle rate at these stations is very high**.** For this purpose, low resistivity bakelite RPCs are being developed. We plan to test one such RPC module and two GEM modules to test the rate capability and efficiency using muon beam in presence of high intensity gamma flux at GIF^{++} facility at CERN SPS.

Expected results from the beam time :

We will measure muon detection efficiency of the detector using two finger scintillators as a measure of detector performance with muon only and in presence of photon flux. We expect that our detector design parameters will be valid under extreme photon intensity.

Beam request : 1 x 2 Weeks

 # 11 RPC Ecogas

Contact persons: Barbara Liberti
Gianluca Rigoletti

Description of the setup & Motivation :

The ECOGAS collaboration setup consists of a set of Resistive Plate Chambers (RPCs) detectors employed in ALICE, ATLAS, CMS, SHiP experiments. The detectors are produced by different manufacturers and include RPCs of different shape, sizes and gap thickness. RPCs at LHC are operated in avalanche mode using a high Global Warming Potential gas mixture composed of ∼95% C2H2F4, ∼4% iC4H10, ∼1% SF6. The goal of the ECOGAS collaboration is to study the performance of eco-friendly gas mixture in the presence of background radiation. The detectors in the setup are operated in open mode with HFO-based, eco-friendly gas mixtures. The system is governed by an online DCS tool, which is used both to control the CAEN power supply and also the TDCs used for the data acquisiton. An online monitoring tool is also used to store all the relevant detector and ambient parameters during the data taking.

Expected results from the beam time :

The motivation for the use of beam time is to test the performance of the detectors operated with these new gas mixtures. Furthermore, we are also carrying out an extensive aging campaign and, for this reason, will also use the beam time to carry out a comparison of all the key parameters of detector operation (efficiency, cluster

size etc) with the ones obtained in 2022 beam periods, before the start of the irradition.

Beam request : 3 x 2

Summary of requests :

ATL – MPI :	3 x 2 Weeks
ATL - NSW MM :	2 x 2 Weeks
ATL - RPC :	3 x 2 Weeks
CMS – CSC :	3 x 2 Weeks
CMS - DT :	1 x 2 Weeks
CMS – GEM :	2 x 2 Weeks
CMS – RPC :	4 x 2 Weeks
EP-DT2 :	3 x 2 Weeks
ProToV/ATLAS :	3 x 2 Weeks
RE21/CBM MUCH :	1 x 2 Weeks
RPC Ecogas :	3 x 2 Weeks