HEARTS P1 Review Meeting: WP8

25 September 2024

https://indico.cern.ch/event/1411185/

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GSI

Funded by the European Union

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Outline

- Reminder about WP8 Tasks
- Status of WP8 Tasks
- WP8 Deliverables and Milestones
- Plans for the future
- Conclusion

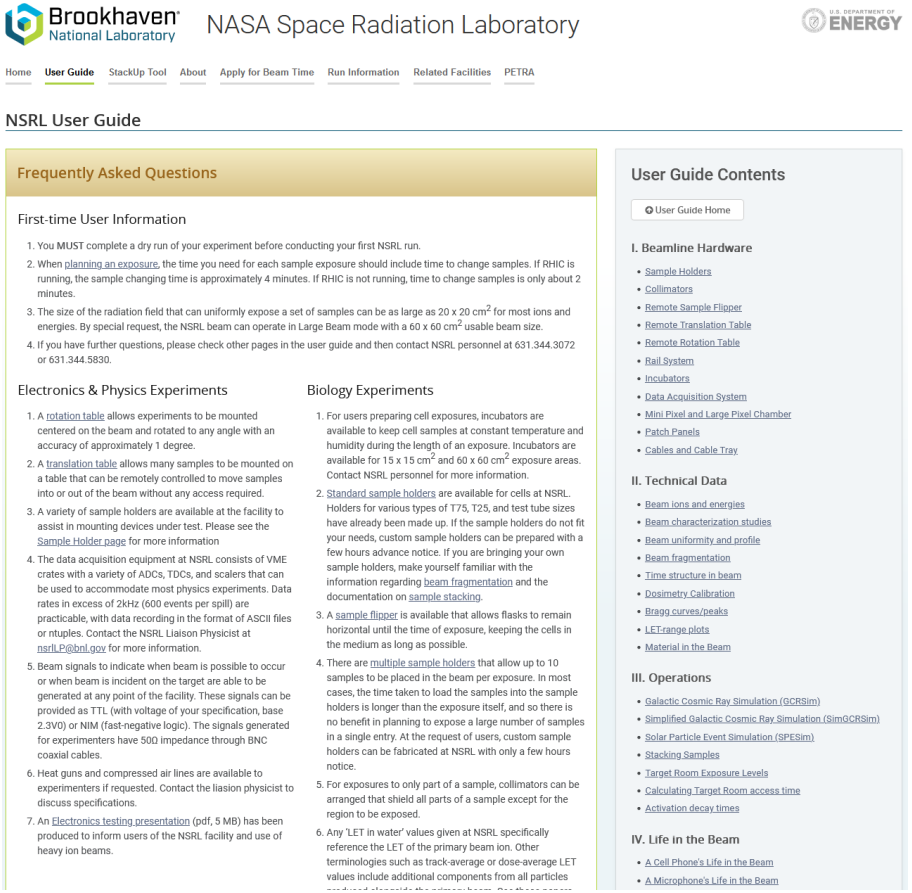
Tasks & Objectives

- **Task 8.1:** Framework for user access *(GSI, M1 – M48)*
  - Development of the framework and procedure to make the facility available to external users for VHE irradiation testing
  - The framework will be developed through the experience of accommodating external users for testing at GSI/SIS18 and Cave A
- **Task 8.2:** GCR simulator installation in APPA cave or CBM vault *(GSI, M36 – M48)*
  - Installing the GCR simulator in the CBM vault
  - Transferring the dosimetry system from Cave A and making it adequate for shielding, radiobiology and microelectronics testing
  - Will start already before the opening of the SIS100, so that the GCR/SPE simulator will be ready on FAIR-day-1
- **Task 8.3:** Test of the GCR simulator *(GSI, M47 – M48)*
  - On FAIR-day-1, one of the first experiments will be the testing of the GCR simulator using Fe-ions at 10 GeV/n in the CBM vault
  - Extend to a higher cutoff, around 3 GeV/n in a first test, before reaching the final goal of 10 GeV/n
  - Focus on dosimetry and on a first biological measurement to be compared to the result in Task 6.4

Status Task 8.1: Framework for user access (GSI) [1/3]

User experience

- Started the process to make accessing and understanding the facility easier for users
- User Guide webpage
  - Inspired by the NSRL User Guide
  - Idea: Make an easy to understand guide for the users, both for GSI and CERN
    - Highlight similarities and differences between the facilities
  - Draft available, shared with the CERN team



Brookhaven National Laboratory — NASA Space Radiation Laboratory

Home | User Guide | StackUp Tool | About | Apply for Beam Time | Run Information | Related Facilities | PETRA

NSRL User Guide

Frequently Asked Questions

First-time User Information

1. You MUST complete a dry run of your experiment before conducting your first NSRL run.
2. When planning an exposure, the time you need for each sample exposure should include time to change samples. If RHIC is running, the sample changing time is approximately 4 minutes. If RHIC is not running, time to change samples is only about 2 minutes.
3. The size of the radiation field that can uniformly expose a set of samples can be as large as 20 x 20 cm^2 for most ions and energies. By special request, the NSRL beam can operate in Large Beam mode with a 60 x 60 cm^2 usable beam size.
4. If you have further questions, please check other pages in the user guide and then contact NSRL personnel at 631.344.3072 or 631.344.5830.

Electronics & Physics Experiments

1. A rotation table allows experiments to be mounted centered on the beam and rotated to any angle with an accuracy of approximately 1 degree.
2. A translation table allows many samples to be mounted on a table that can be remotely controlled to move samples into or out of the beam without any access required.
3. A variety of sample holders are available at the facility to assist in mounting devices under test. Please see the Sample Holder page for more information
4. The data acquisition equipment at NSRL consists of VME crates with a variety of ADCs, TDCs, and scalers that can be used to accommodate most physics experiments. Data rates in excess of 2kHz (600 events per spill) are practicable, with data recording in the format of ASCII files or ntuples. Contact the NSRL Liaison Physicist at nsrlLP@bnl.gov for more information.
5. Beam signals to indicate when beam is possible to occur or when beam is incident on the target are able to be generated at any point of the facility. These signals can be provided as TTL (with voltage of your specification, base 2.3V0) or NIM (fast-negative logic). The signals generated for experimenters have 50Ω impedance through BNC coaxial cables.
6. Heat guns and compressed air lines are available to experimenters if requested. Contact the liasion physicist to discuss specifications.
7. An Electronics testing presentation (pdf, 5 MB) has been produced to inform users of the NSRL facility and use of heavy ion beams.

Biology Experiments

1. For users preparing cell exposures, incubators are available to keep cell samples at constant temperature and humidity during the length of an exposure. Incubators are available for 15 x 15 cm^2 and 60 x 60 cm^2 exposure areas. Contact NSRL personnel for more information.
2. Standard sample holders are available for cells at NSRL. Holders for various types of T75, T25, and test tube sizes have already been made up. If the sample holders do not fit your needs, custom sample holders can be prepared with a few hours advance notice. If you are bringing your own sample holders, make yourself familiar with the information regarding beam fragmentation and the documentation on sample stacking.
3. A sample flipper is available that allows flasks to remain horizontal until the time of exposure, keeping the cells in the medium as long as possible.
4. There are multiple sample holders that allow up to 10 samples to be placed in the beam per exposure. In most cases, the time taken to load the samples into the sample holders is longer than the exposure itself, and so there is no benefit in planning to expose a large number of samples in a single entry. At the request of users, custom sample holders can be fabricated at NSRL with only a few hours notice.
5. For exposures to only part of a sample, collimators can be arranged that shield all parts of a sample except for the region to be exposed.
6. Any 'LET in water' values given at NSRL specifically reference the LET of the primary beam ion. Other terminologies such as track-average or dose-average LET values include additional components from all particles

User Guide Contents

User Guide Home

I. Beamline Hardware
- Sample Holders
- Collimators
- Remote Sample Flipper
- Remote Translation Table
- Remote Rotation Table
- Rail System
- Incubators
- Data Acquisition System
- Mini Pixel and Large Pixel Chamber
- Patch Panels
- Cables and Cable Tray

II. Technical Data
- Beam ions and energies
- Beam characterization studies
- Beam uniformity and profile
- Beam fragmentation
- Time structure in beam
- Dosimetry Calibration
- Bragg curves/peaks
- LET-range plots
- Material in the Beam

III. Operations
- Galactic Cosmic Ray Simulation (GCRSim)
- Simplified Galactic Cosmic Ray Simulation (SimGCRSim)
- Solar Particle Event Simulation (SPESim)
- Stacking Samples
- Target Room Exposure Levels
- Calculating Target Room access time
- Activation decay times

IV. Life in the Beam
- A Cell Phone's Life in the Beam
- A Microphone's Life in the Beam

https://www.bnl.gov/nsrl/userguide/

Status Task 8.1: Framework for user access (GSI) [2/3]

User experience

- Short introduction to LISE++ for simple calculations
- Development of Geant4-based template simulation
  - Quick calculation of more complicated scenarios without requiring full knowledge and experience in Monte Carlo (MC) codes
- Development of standardized user manuals and face-to-face user interaction
  - Facilitate campus access
  - Clarify general and radiation safety related topics

→ Developments partially in use since beginning of 2024 and being refined based on user feedback

Status Task 8.1: Framework for user access (GSI) [3/3]

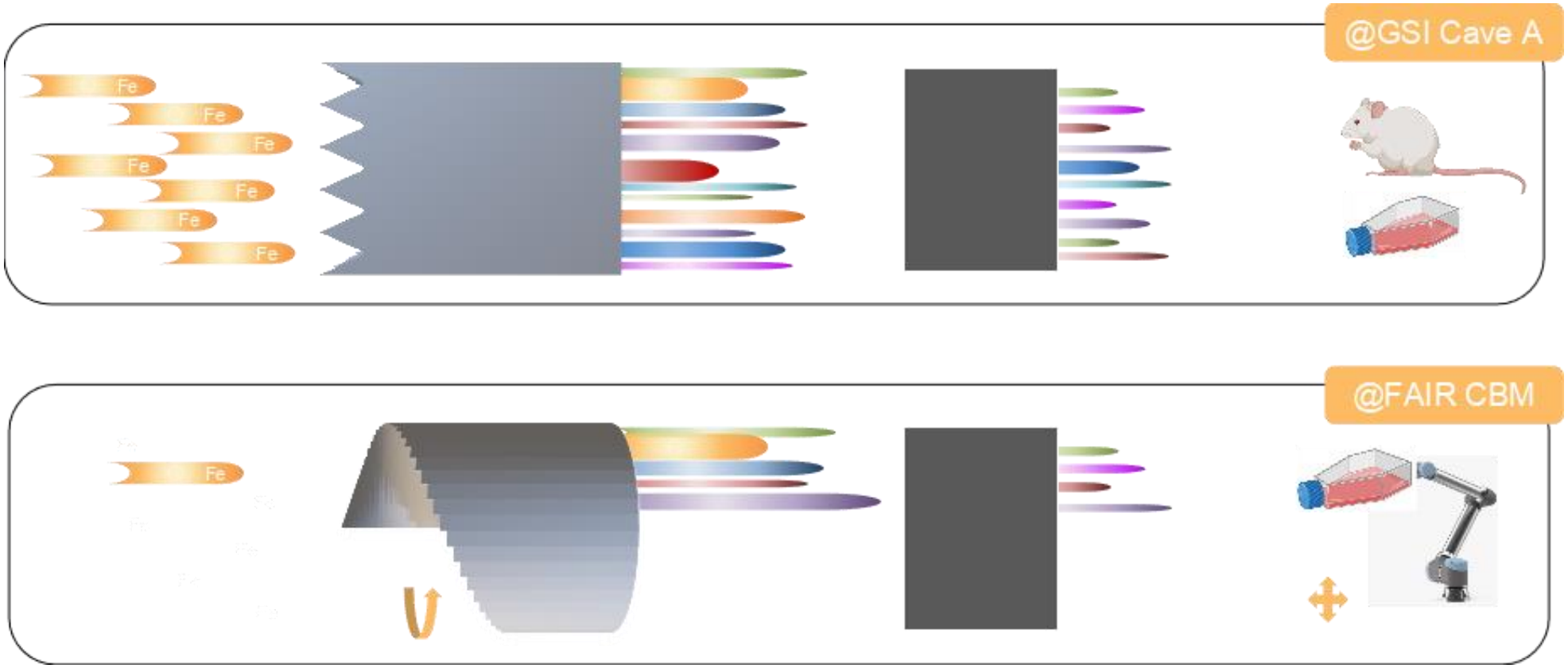
Access to beams

- Started development of a potential business model via the “GSI/FAIR Innovationsfond”
- Major discussion points:
  - Determination of long-term cost of running GSI/FAIR including overhead and how to fund it
  - Handling of short-term scheduling of multiple exposure opportunities per year within the long-term beamtime scheduling of GSI/FAIR

Status Task 8.2: GCR simulator installation in the CBM vault (GSI) [1/4]

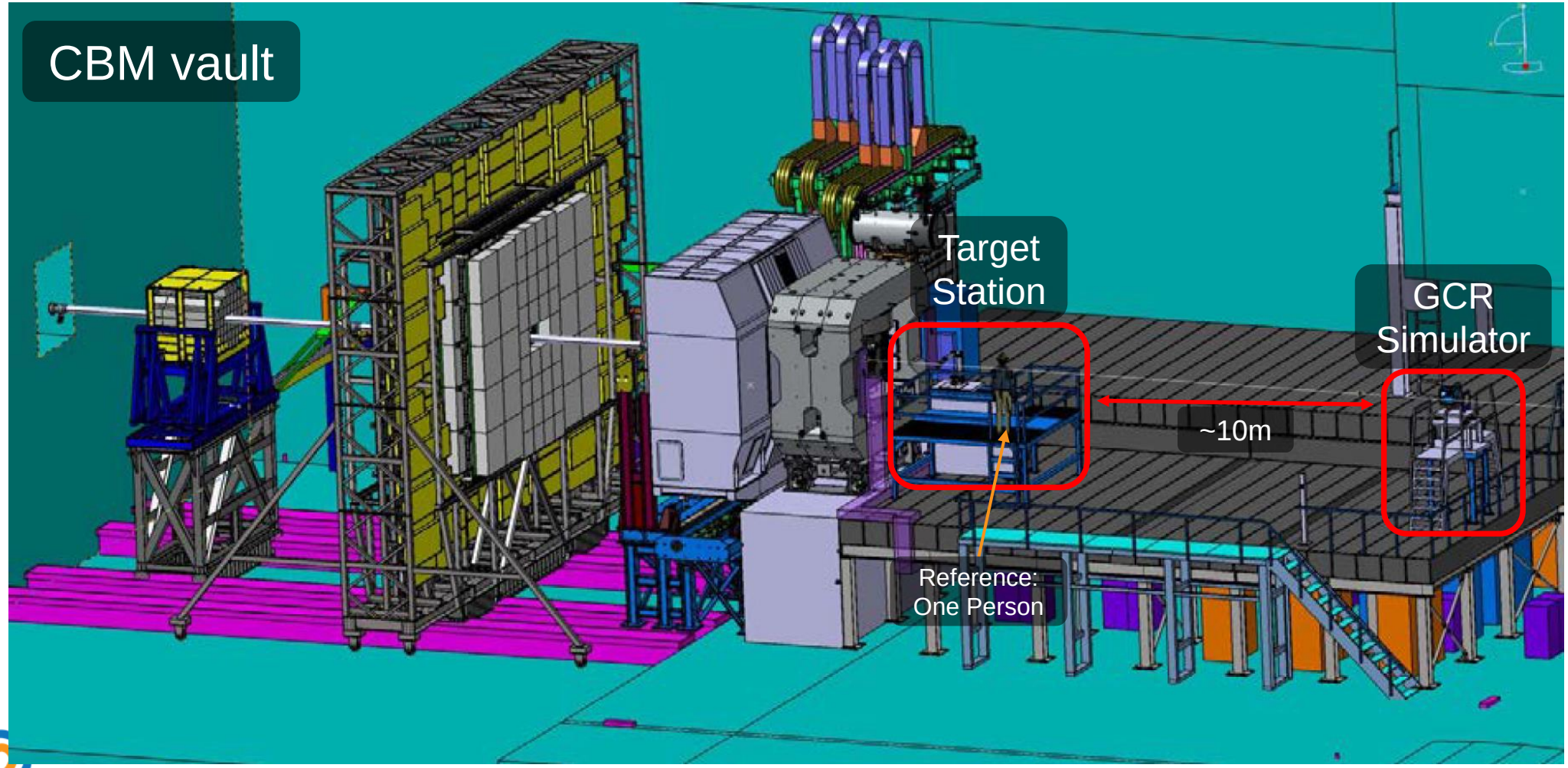
- PhD student (Luca Lunati) working on the design of the high energy GCR simulator
- Still a hybrid design for CBM, but differs from Cave A (or APPA) design
  - No beam scanning available in the CBM vault
  - Complex, rotating modulator
  - Scanning with the target, e.g. with a robotic arm
  - Has to be compatible with other equipment by other experiments in the CBM vault → Many design constraints
- Plans and designs made how to integrate GCR Experiments into the CBM vault
- Memorandum of Understanding signed with the CBM collaboration for the installation of the GCR simulator

Status Task 8.2:
GCR simulator installation in the CBM vault (GSI) [2/4]



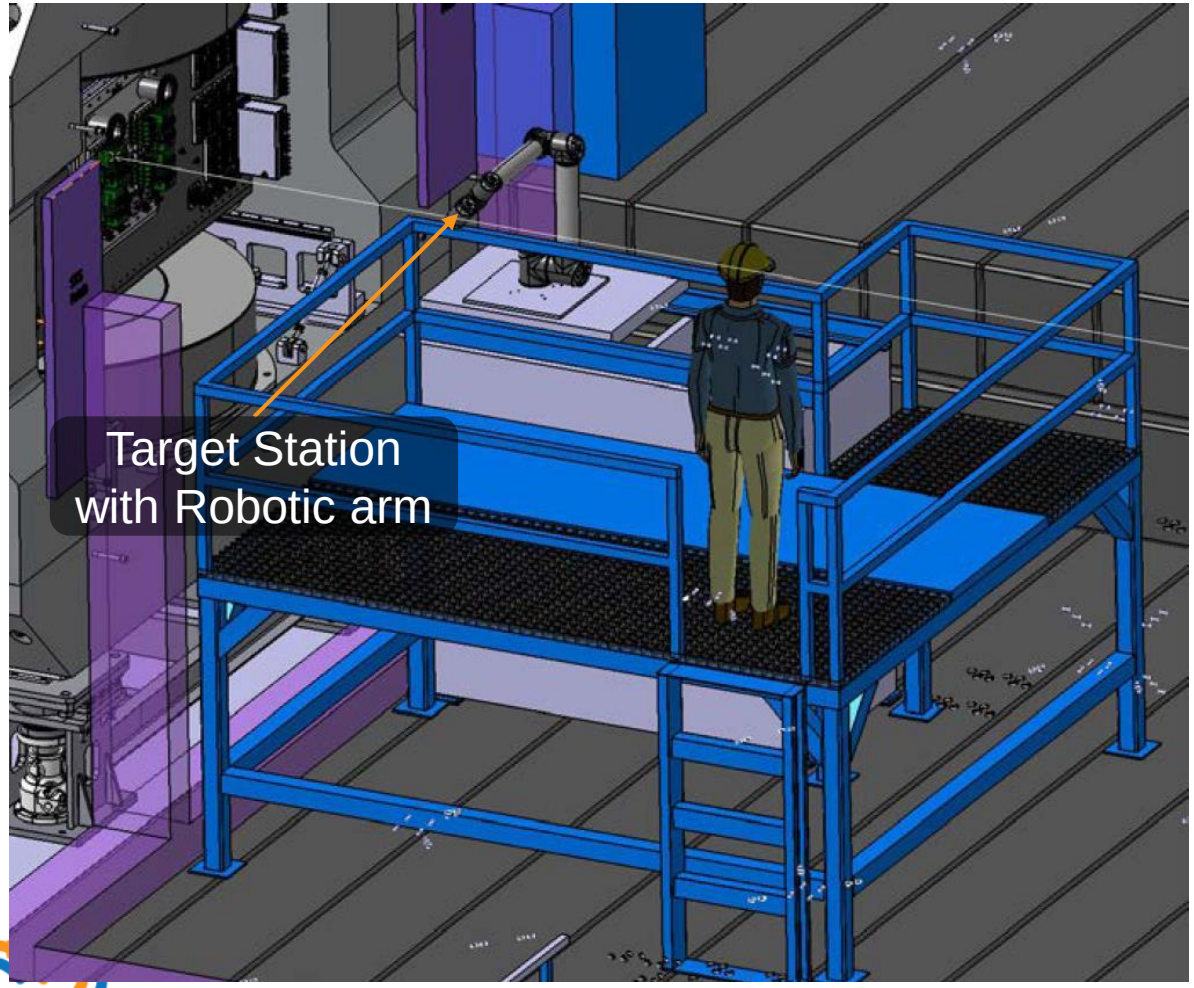
Visualization of the main differences between the GSI Cave A and future FAIR GCR simulator concept.

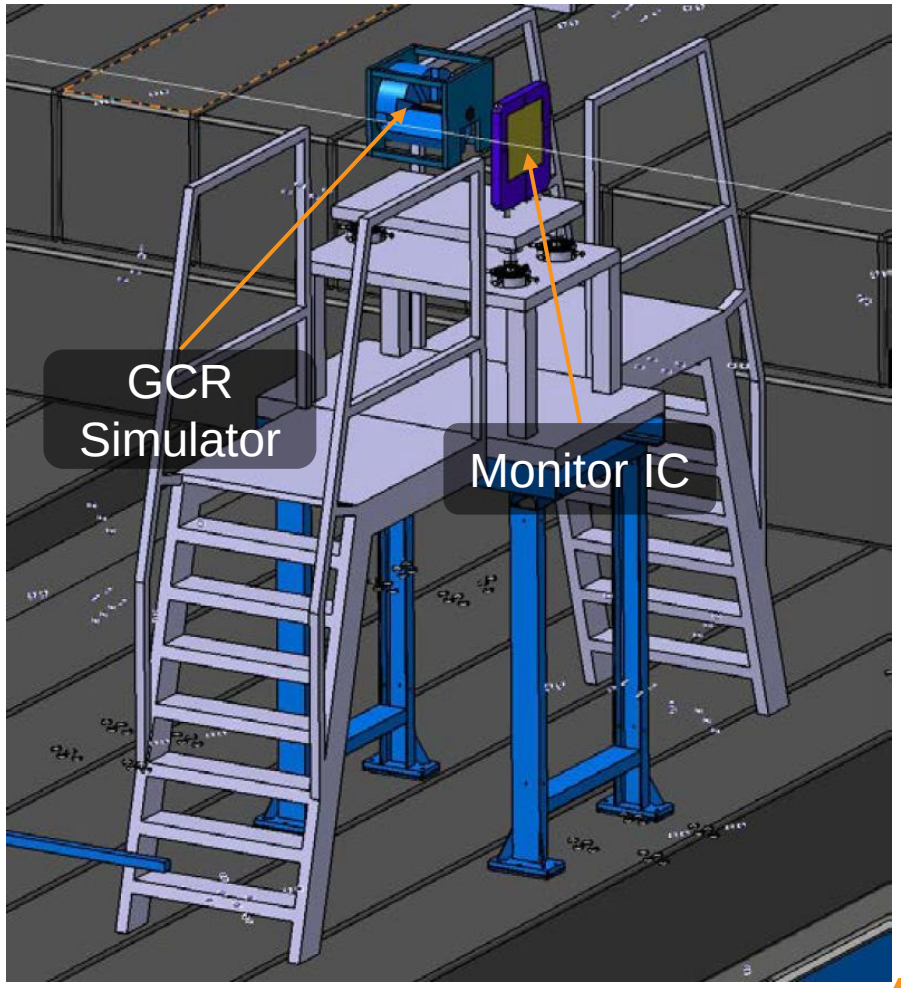
Status Task 8.2:
GCR simulator installation in the CBM vault (GSI) [3/4]



Technical Design Report: BIOMAT in CBM

Status Task 8.2:
GCR simulator installation in the CBM vault (GSI) [4/4]





Technical Design Report: BIOMAT in CBM

Status Task 8.3: Test of the GCR simulator (GSI)

- No progress yet, as FAIR is still under construction and Task 8.2 is a requirement for this Task

Deliverables and Milestones in P1

Deliv. No.	Deliverable name	Due date	Status	Summary
-	-	-	-	-

Milest. No.	Milestone name	Due date	Status	Summary
-	-	-	-	-

- No deliverables or milestones were due in P1 for WP8

The achieved deliverables and milestones are available on the HEARTS website: https://hearts-project.eu/project/deliverables/ and https://hearts-project.eu/project/milestones/

Upcoming Deliverables & Milestones

Deliv. No.	Deliverable name	Due date	Status
D8.1	Established framework for user access to the GCR simulator	2026-12-31	Pending
D8.2	Installation of the GCR simulator in APPA cave or CBM vault	2026-12-31	Pending
D8.3	First measurements with GCR simulator with and without shielding in APPA Cave or CBM vault at 10 GeV/n cutoff	2026-12-31	Pending

Milest. No.	Milestone name	Due date	Status
M22	Routine access for external users at FAIR GCR simulator	2026-12-31	Pending
M23	First test at FAIR GCR simulator	2026-12-31	Pending

Plans for the (near) future

- **Task 8.1:** Framework for user access *(GSI, M1 – M48)*
  - Continue writing the User Guide including any new instrumentation developed during the HEARTS project (e.g. Task 4.4 Target Station)
- **Task 8.2:** GCR simulator installation in the CBM vault *(GSI, M36 – M48)*
  - Continue development of the new GCR Simulator design for the CBM vault
  - Perform simulations verifying new designs
- **Task 8.3:** Test of the GCR simulator *(GSI, M47 – M48)*
  - Wait for completion of Task 8.2

Conclusion

- Work Package progressing as planned

Thank you for your attention. Questions?

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