HEARTS
Follow-up Session
2nd Annual Meeting
WP4

19 February 2025

https://indico.cern.ch/event/1500292/

Tim Wagner
GSI

Funded by the European Union

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Outline

- Tasks
- Deliverables and Milestones
- Status
- Plans for the future

Tasks

Task 4.1: Knowledge transfer between CERN and GSI *(CERN & GSI, M1 – M12)*

Task 4.2: Calibration of beam instrumentation for VHE ion beam extraction *(CERN, M1 – M24)*

Task 4.3: Beam delivery monitoring *(GSI, M12 – M36)*

Task 4.4: Target Station *(GSI, M12 – M36)*

Task 4.5: GCR/SPE simulator dosimetry *(GSI, M24 – M36)*

Task 4.6: Intercomparison between CERN and GSI *(CERN & GSI, M24 – M48)*

Deliverables due in Y2

Deliv. No.	Deliverable name	Due date	Status	Summary
D4.2	Calibrated CERN beam instrumentation documented and installed in the accelerator	31-12-2024	Achieved	Detailed description of the CERN beam instrumentation, their purpose and their method of use. Additionally, the calibration procedures for the different instruments are explained as well.

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

Milestones due in Y2

Milest. No.	Milestone name	Due date	Status	Summary
MS12	CERN beam instrumentation and dosimetry installed and running	31-12-2024	Achieved	

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

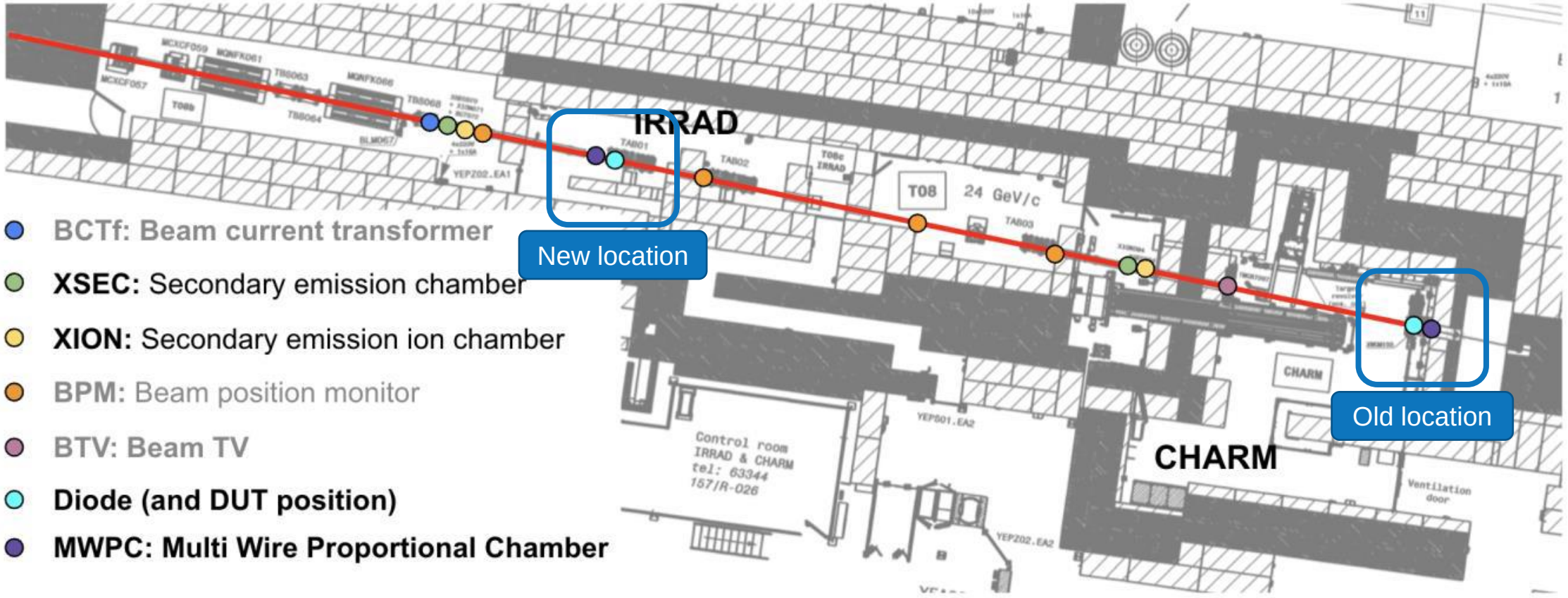
Upcoming Deliverables & Milestones

Deliv. No.	Deliverable name	Due date	Status
D4.3	Experimental measurements on GSI beam instrumentation and dosimetry	31-12-2025	Pending
D4.4	Documentation on the target station construction and use	31-12-2025	Pending
D4.5	Report on microdosimetry for GCR simulator calibration	31-12-2025	Pending
D4.6	Intercomparison between CERN and GSI instrumentation and standardisation	31-12-2026	Pending

Milest. No.	Milestone name	Due date	Status
M13	GSI beam instrumentation and dosimetry installed and running	31-12-2025	Pending

Status Task 4.2: Calibration of beam instrumentation for VHE ion beam extraction (CERN) [1/4]

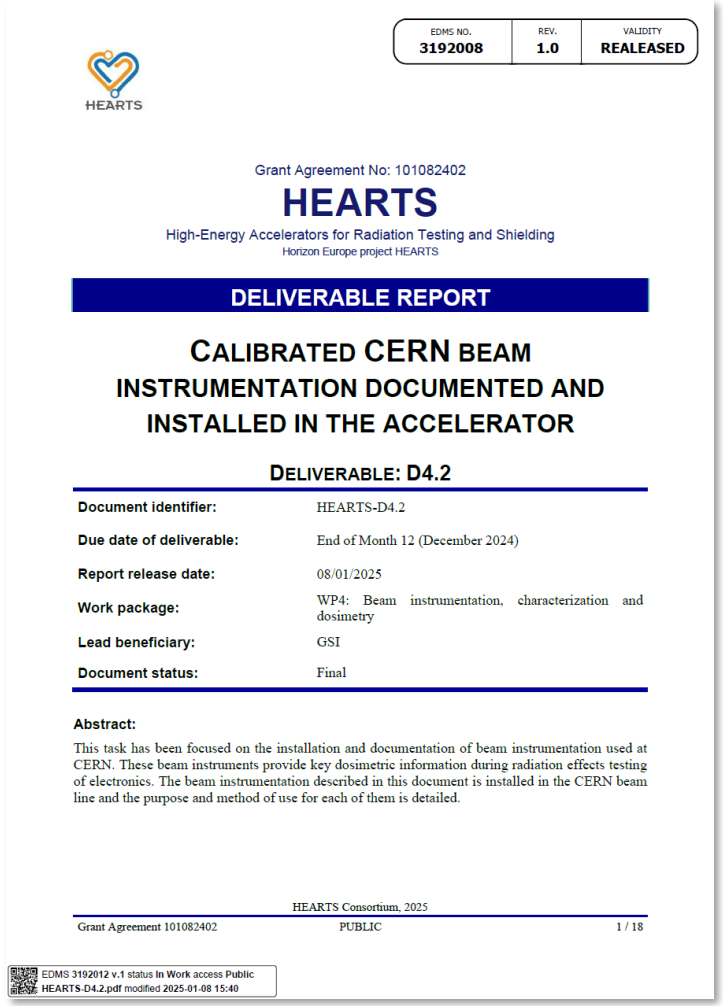
- Moved irradiation location from CHARM to IRRAD



Picture by CERN

Status Task 4.2: Calibration of beam instrumentation for VHE ion beam extraction (CERN) [4/4]

- Deliverable D4.2: „Calibrated CERN beam instrumentation documented and installed in the accelerator“
- Reporting on the CERN beam instrumentation
  - Instruments: Scintillator, MWPC, SECs, Diode
  - Beam manipulators: Beam masks & Degraders
  - Energy calibration
  - Flux calibration



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HEARTS

Grant Agreement No: 101082402

HEARTS

High-Energy Accelerators for Radiation Testing and Shielding

Horizon Europe project HEARTS

DELIVERABLE REPORT

CALIBRATED CERN BEAM INSTRUMENTATION DOCUMENTED AND INSTALLED IN THE ACCELERATOR

DELIVERABLE: D4.2

Document identifier:	HEARTS-D4.2
Due date of deliverable:	End of Month 12 (December 2024)
Report release date:	08/01/2025
Work package:	WP4: Beam instrumentation, characterization and dosimetry
Lead beneficiary:	GSI
Document status:	Final

Abstract:

This task has been focused on the installation and documentation of beam instrumentation used at CERN. These beam instruments provide key dosimetric information during radiation effects testing of electronics. The beam instrumentation described in this document is installed in the CERN beam line and the purpose and method of use for each of them is detailed.

HEARTS Consortium, 2025

Grant Agreement 101082402 PUBLIC 1 / 18

EDMS 3192012 v.1 status In Work access Public
HEARTS-D4.2.pdf modified 2025-01-08 15:40

Status Task 4.3: Beam delivery monitoring (GSI)

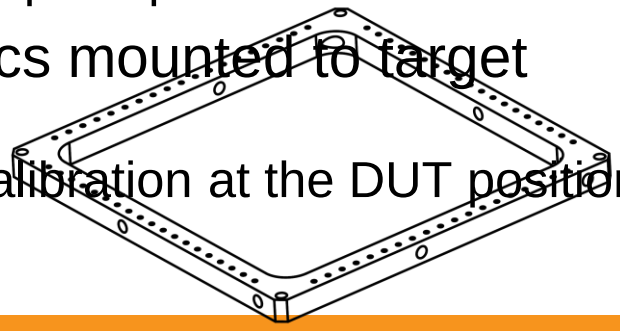
- Standard GSI beam monitoring detectors:
  - Parallel Plate Ionization Chambers (Used for medium to high intensities)
  - Scintillators (Used for low intensities, as single particles are counted)
- Calibration detectors:
  - Farmer Chamber
  - Octavius detector array
  - Various other absolute dosimetry detectors, e.g., Pinpoint, Markus Chamber, etc.

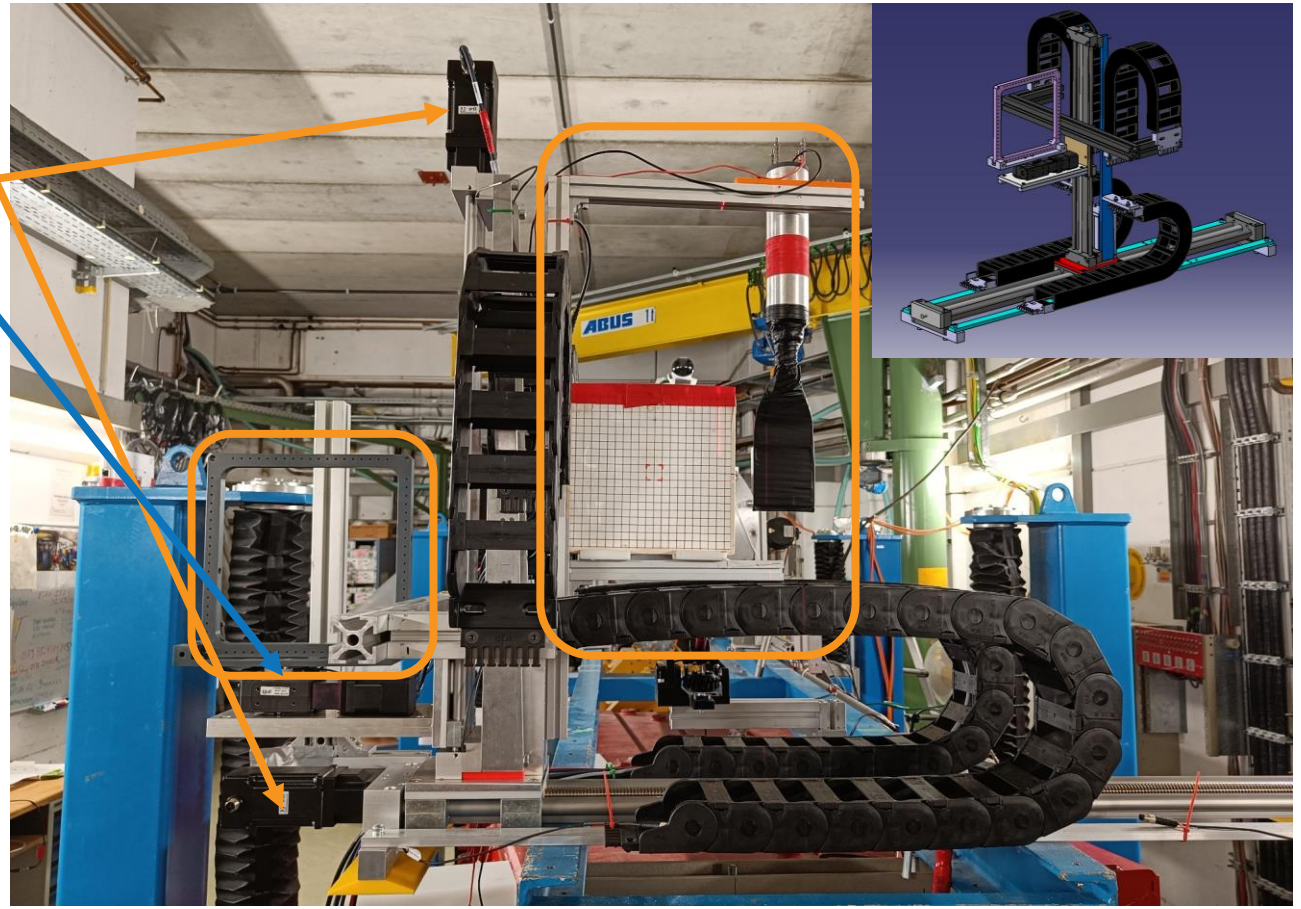
→ All of the above detectors are described in D4.1 in detail

- Exploration of addition of a position sensitive detector to the beamline instrumentation of Cave A
  - Possibility to always monitor the beam position during the irradiation
  - Possible options: multi-wire proportional chamber (MWPC) or silicon strip detector
- Exploration of the addition of microdosimetric spectra as part of the standard dosimetry for Cave A

Status Task 4.4: Target station (GSI) Electronics Target Station

- Movement in 2 dimensions + 1d rotation possible
  - 2d movement for the positioning of the sample
  - 1d rotation for irradiation with grazing angles, if desired by the user
- Compatible with the “ESA standard frame” (according to the recommendation of D5.1)
  - “ESA standard frame” allows users familiar with other electronics irradiation facilities to mount their samples quicker and easier
- Beam diagnostics mounted to target station
  - Allows beam calibration at the DUT position

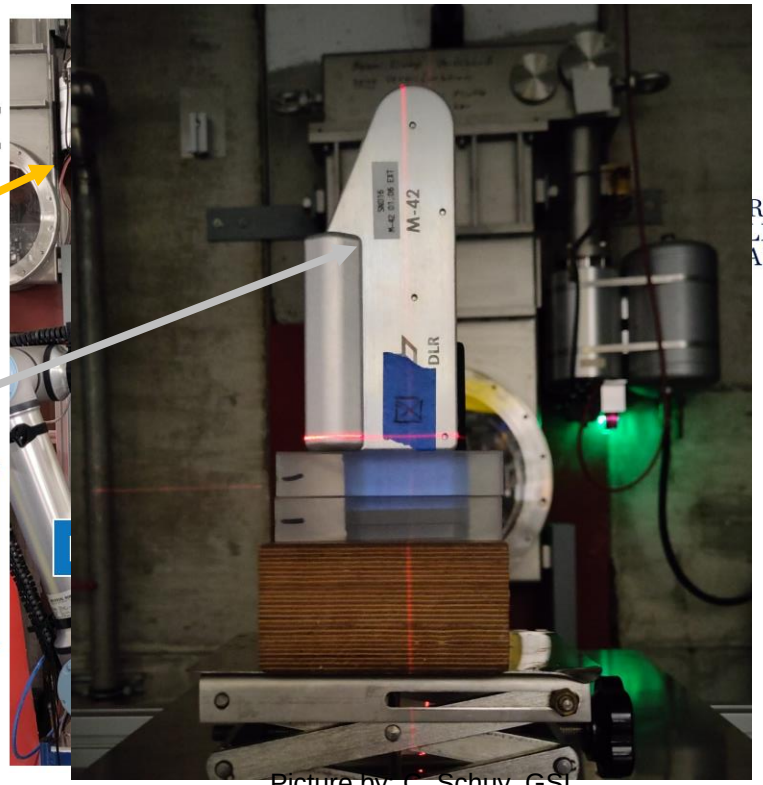




Picture by: A. Gera & T. Wagner, GSI

Status Task 4.5: GCR simulator dosimetry (GSI)

- Detailed characterization of the GCR Simulator for Cave A done in April 2024
- Used various different detectors:
  - Standard dosimetry detectors
  - Microdosimetry detectors
    - Tissue Equivalent Proportional Counter (TPEC)
    - Silicon microdosimeter (courtesy of University of Wollongong)
  - Dosimeters by DLR, which have been to space already
  - etc.



Picture by: C. Schuy, GSI

Aimed lower than the marked (sensitive) area on the DLR detector on purpose, as the GCR field is large and the top part of the detector should be spared (electronics).

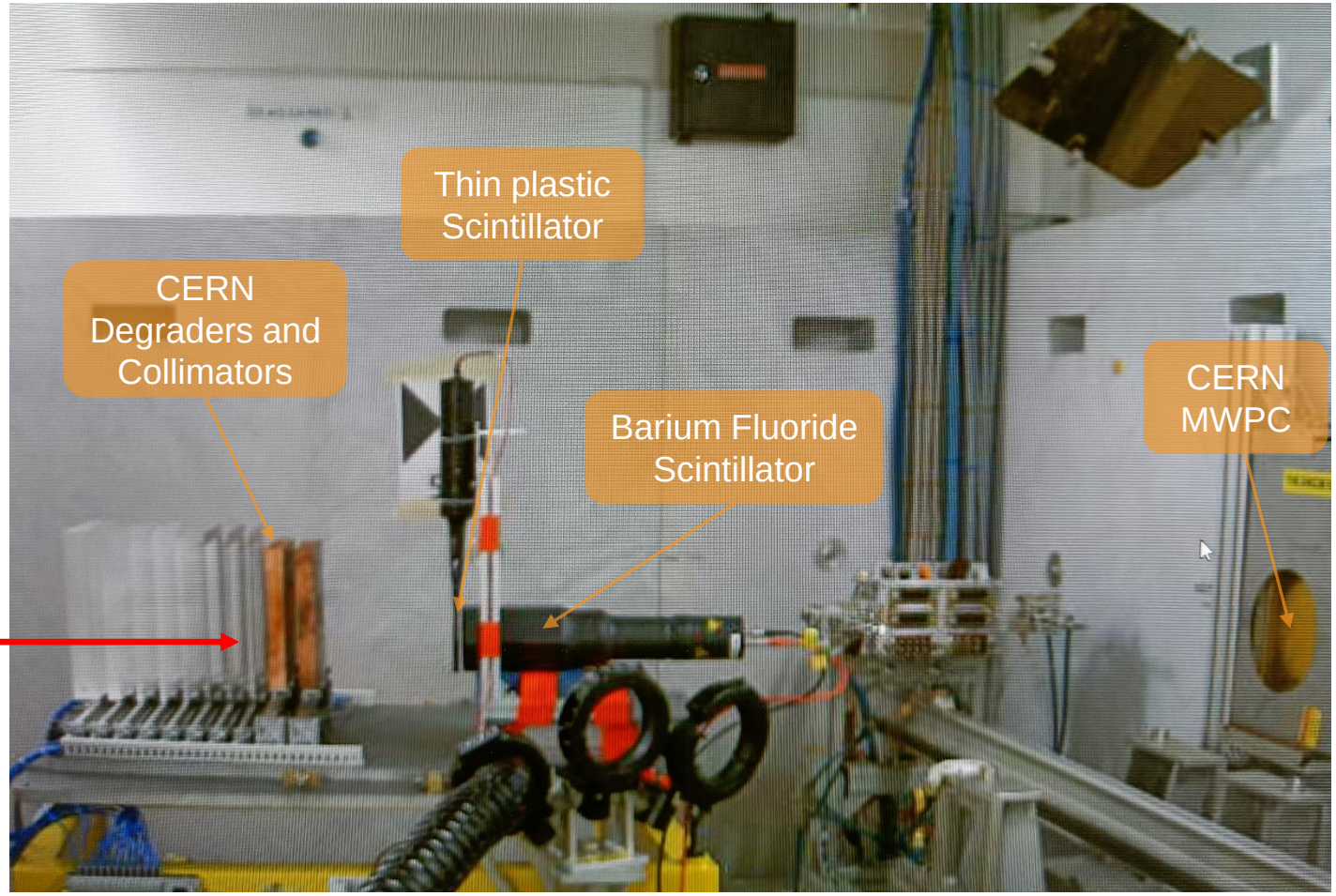
Status Task 4.6: Intercomparison between CERN and GSI (CERN & GSI)

- Cross comparison of GSI and CERN detectors during a beamtime in October 2023 @ CERN
- Analysis of data still ongoing Will be reported on in D4.6
  - Some spill fluctuations (possible energy shift?) complicate the analysis of the data

Detector 1	Detector 2	Reason
Parallel Plate Ionization Chamber (GSI)	Farmer Chamber (GSI)	Calibration of IC with an absolute detector and Cross-check of RF-gain intensity adjustments
Parallel Plate Ionization Chamber (GSI)	Silicon Diode (CERN)	Comparison between standard GSI and CERN detectors
Thin plastic Scintillator (GSI)	Silicon Diode (CERN)	Comparison between standard GSI and CERN detectors (for lower intensities)
Thin plastic Scintillator (GSI)	Barium Fluoride Scintillator (GSI)	Measurement of beam spectra and Characterization of the fragments

The CERN emission chambers (XSEC and XION) were always placed in the beam.

Status Task 4.6: Intercomparison between CERN and GSI (CERN & GSI)



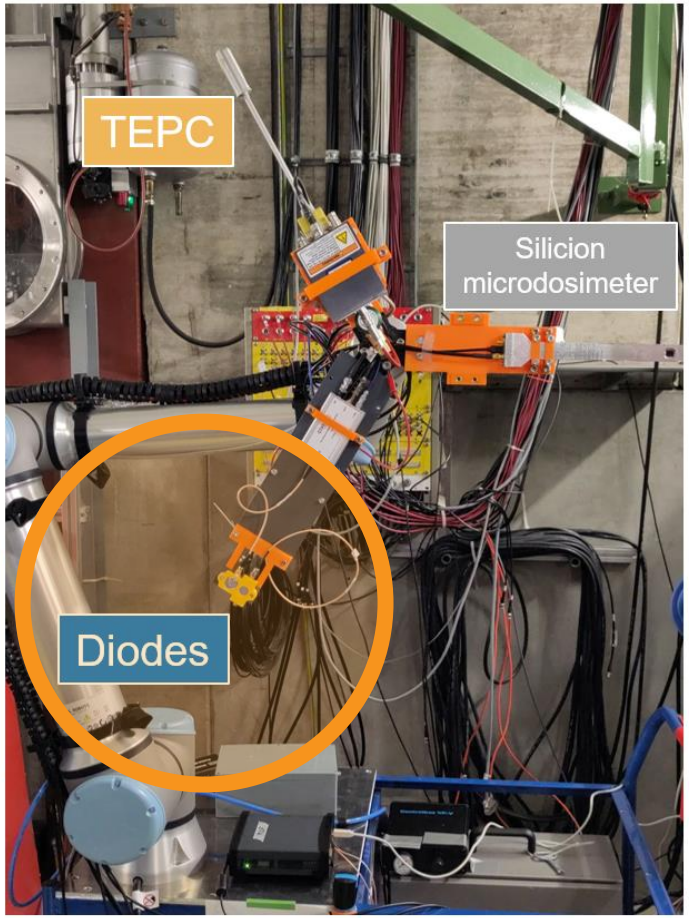
Experimental setup for the measurement of the thin plastic scintillator vs the Barium Fluoride scintillator in October 2023 at CERN.

Picture by:
T. Wagner, GSI

Status Task 4.6: Intercomparison between CERN and GSI (CERN & GSI)

- Measurements with CERN‘s Silicon Diodes
  - Pure Iron beam at different energies
  - Some of the GCR irradiation conditions
- “Automatic” comparison with GSI’s Parallel Plate Ionization Chamber

 Will be reported on in D4.6



Picture by: C. Schuy, GSI

Outlook 2025 and beyond

- **Task 4.3:** Beam delivery monitoring
  - Explore addition of microdosimetric spectra as part of the standard dosimetry of Cave A
- **Task 4.4:** Target Station
  - Improve laser alignment of the Target Station
  - Detailed report on the GSI Target Station with Deliverable D4.4
- **Task 4.5:** GCR simulator dosimetry
  - Analysis of collected data and comparison of the results from the different detectors
- **Task 4.6:** Intercomparison between CERN and GSI
  - Analysis of the measured data so far
  - Detailed report about the comparison measurements in Deliverable D4.6

Thank you for your attention. Questions?

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