

Preparation for Commissioning With Beam of "Advanced Demonstrator" Module With Heavy Ion Beam

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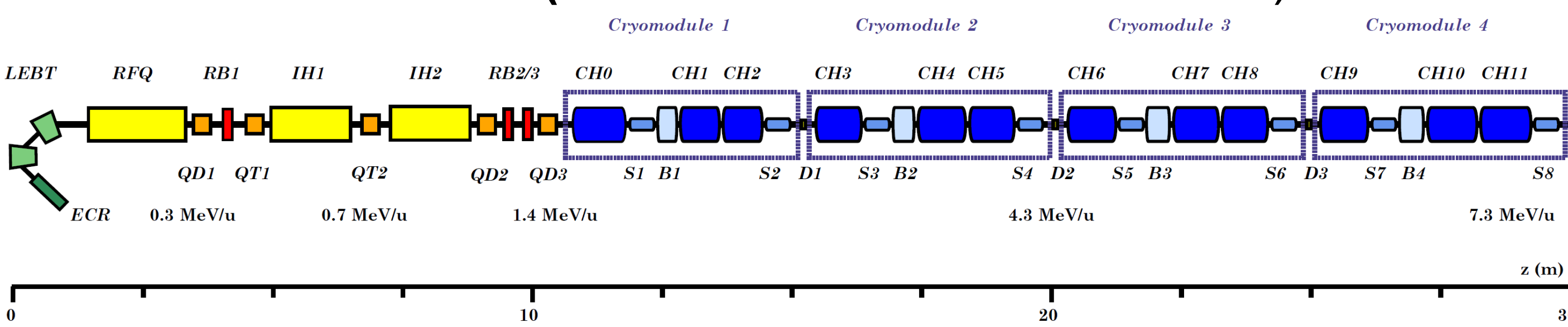
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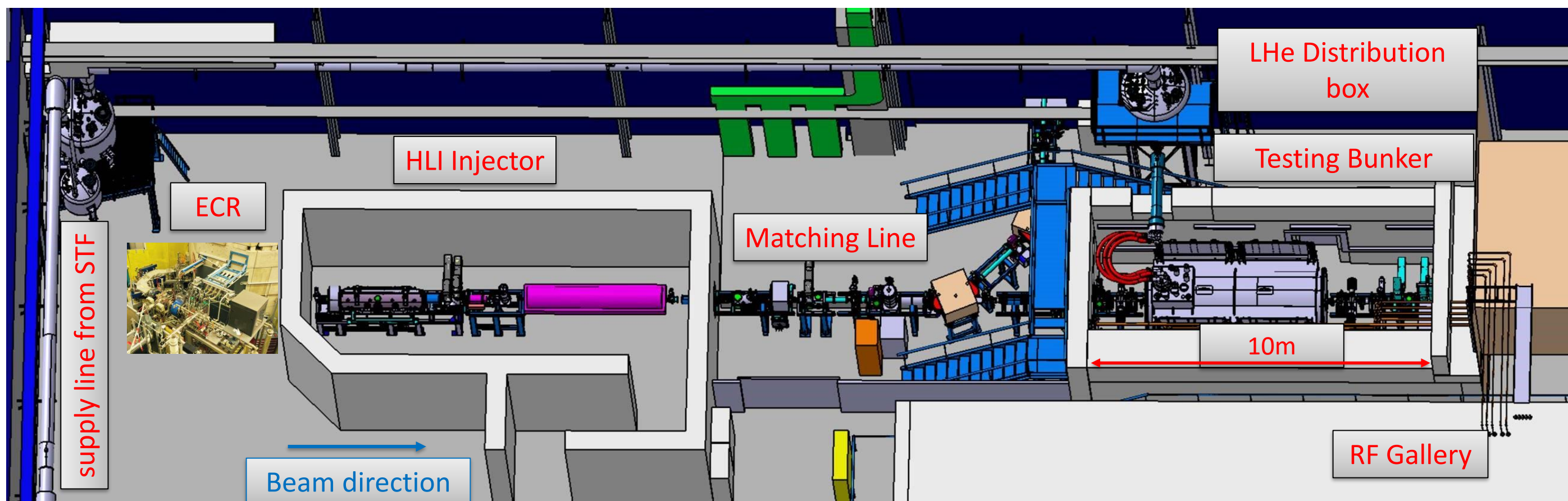
Abstract:

The integration of the accelerator components in to the cryogenic module prototype (Advanced Demonstrator) is a major milestone of the R&D for the superconducting heavy ion continuous wave linear accelerator HELIAC (HElmholtz Linear ACcelerator) at GSI. The HELIAC is joint project of Helmholtz Institute Mainz (HIM) and GSI developed in collaboration with IAP Goethe University Frankfurt. This module is equipped with three superconducting (sc) Cross bar H-mode (CH) acceleration cavities CH0-CH2 and a sc rebuncher cavity, as well as two sc solenoids. The commissioning of the cryogenic module with Argon beam at GSI is scheduled for August 2023. In preparation for the beam test activities, the beamline, which connects the High Charge State Injector (HLI) with the testing area, has been installed. The beamline comprises a pair of phase probes for Time Of Flight (TOF) measurement of the incoming beam energy, quadrupole lenses and a 4-gap RF-buncher cavity. The beam diagnostics bench behind the cryo module is equipped with phase probe pairs, a slit-grid device, a Bunch Shape Monitor (BSM Feshenko monitor) for measurements of the longitudinal beam profile. The bench allows complete 6d characterization of the ion beam.

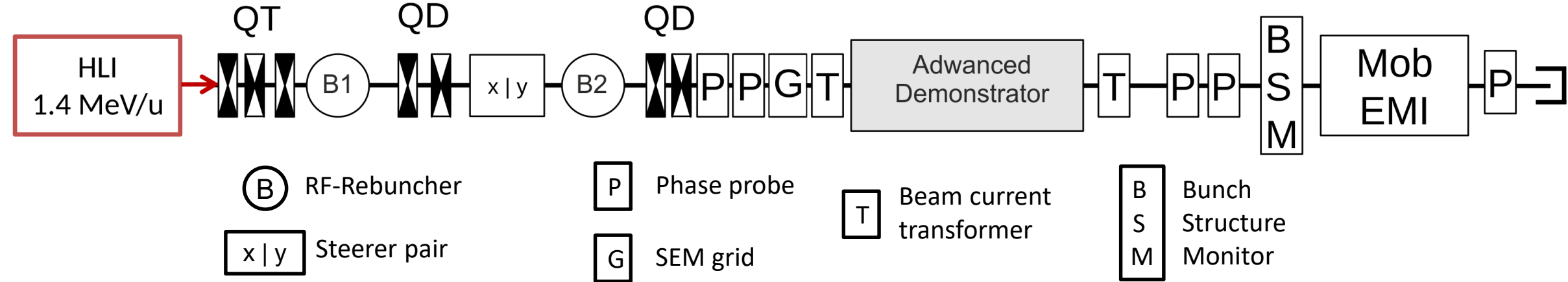
HELIAC (HElmholtz Linear ACcelerator)



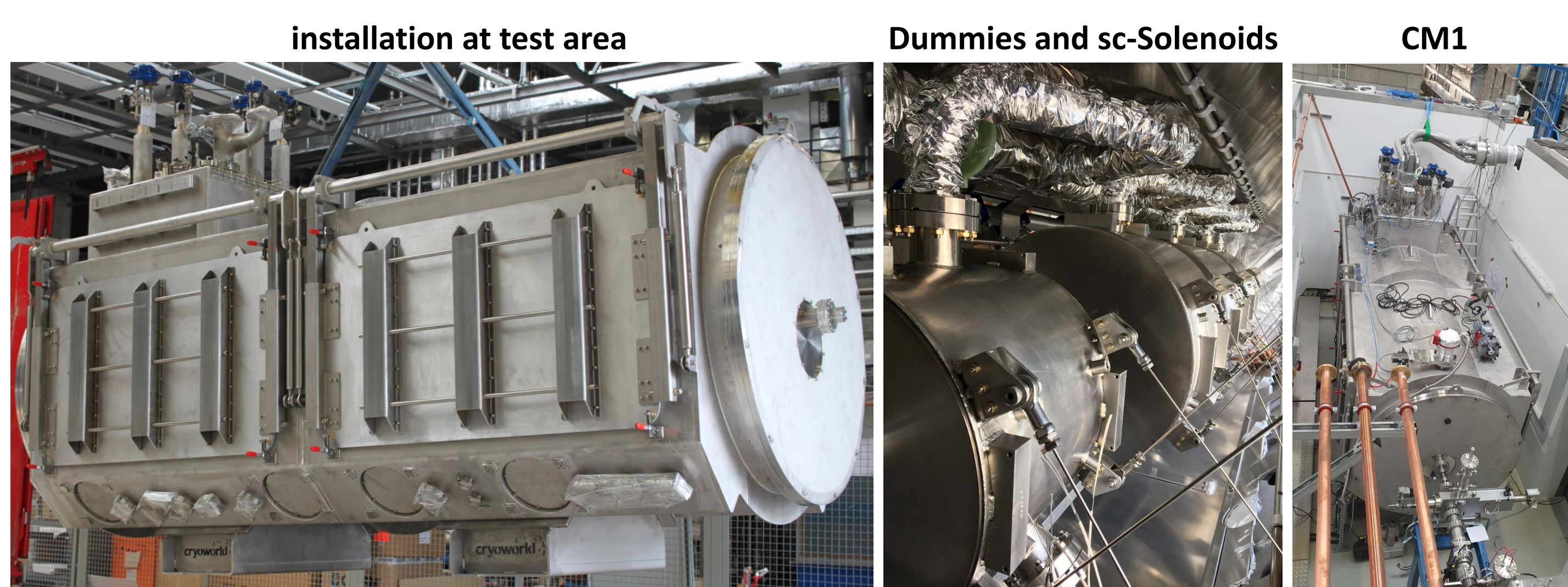
Cryogenic Module Testing Area @ GSI



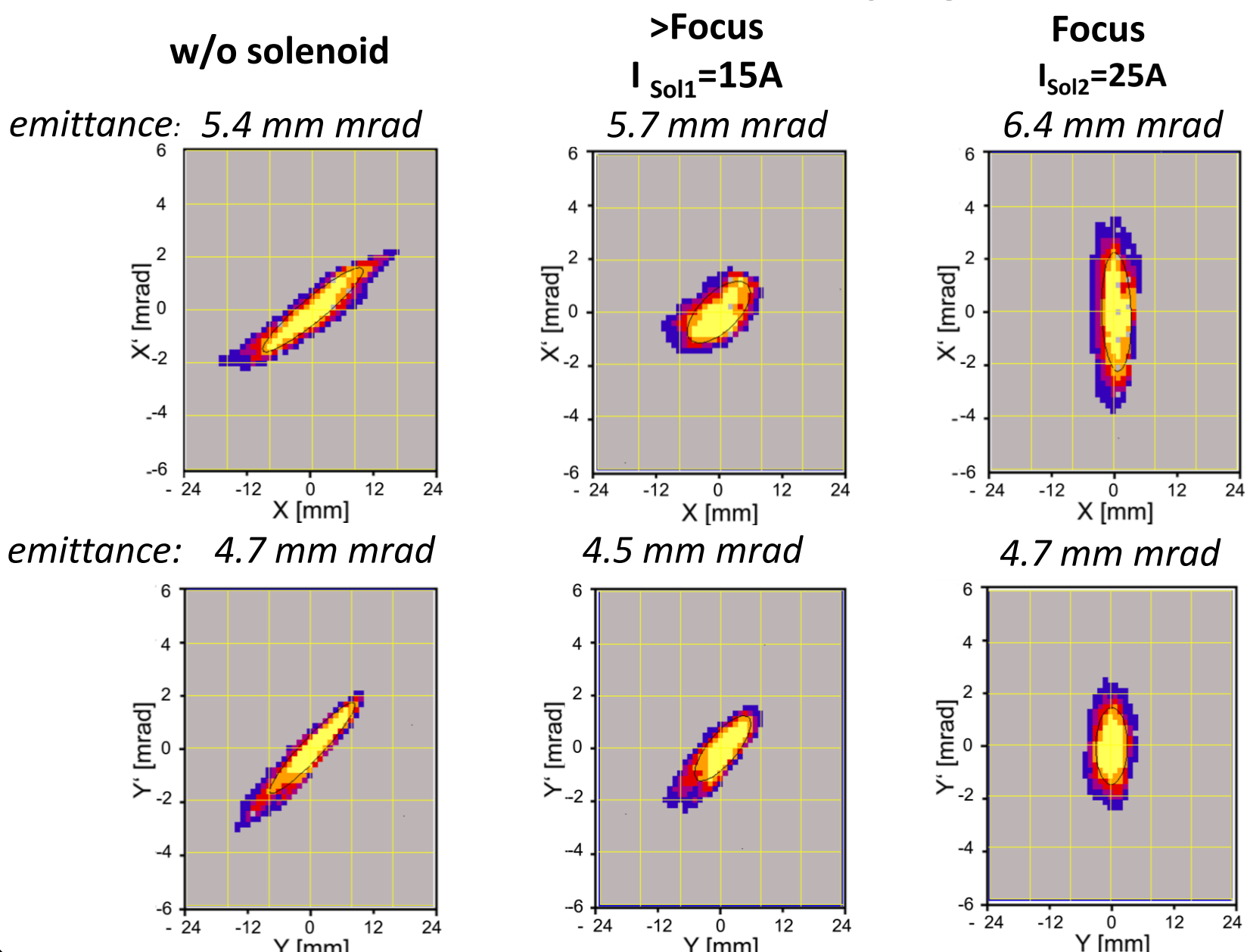
Detailed schematic layout of matching line and test bench



Commissioning of Cryostat with sc-Solenoids

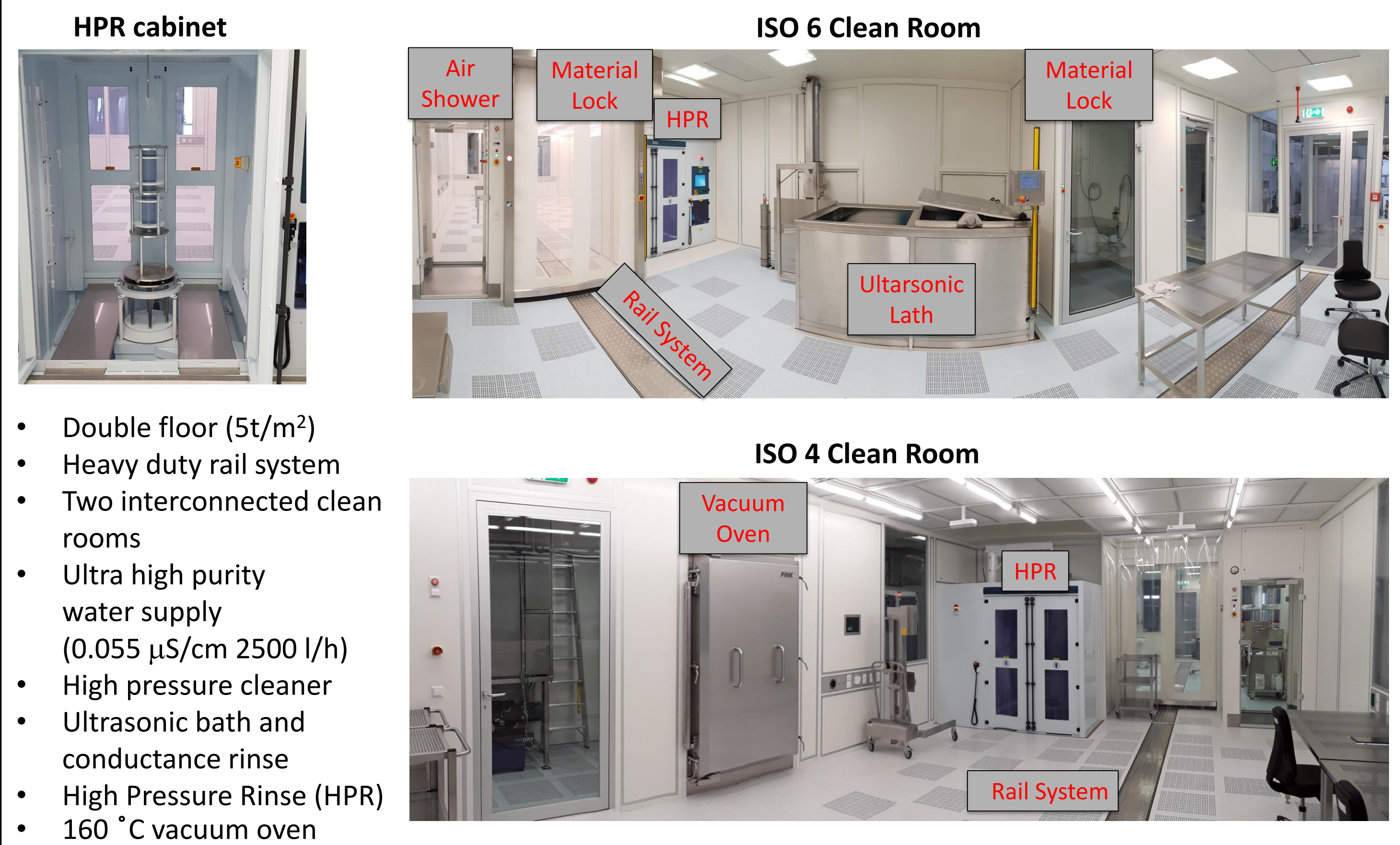


Beam emittance measurements applying sc solenoids



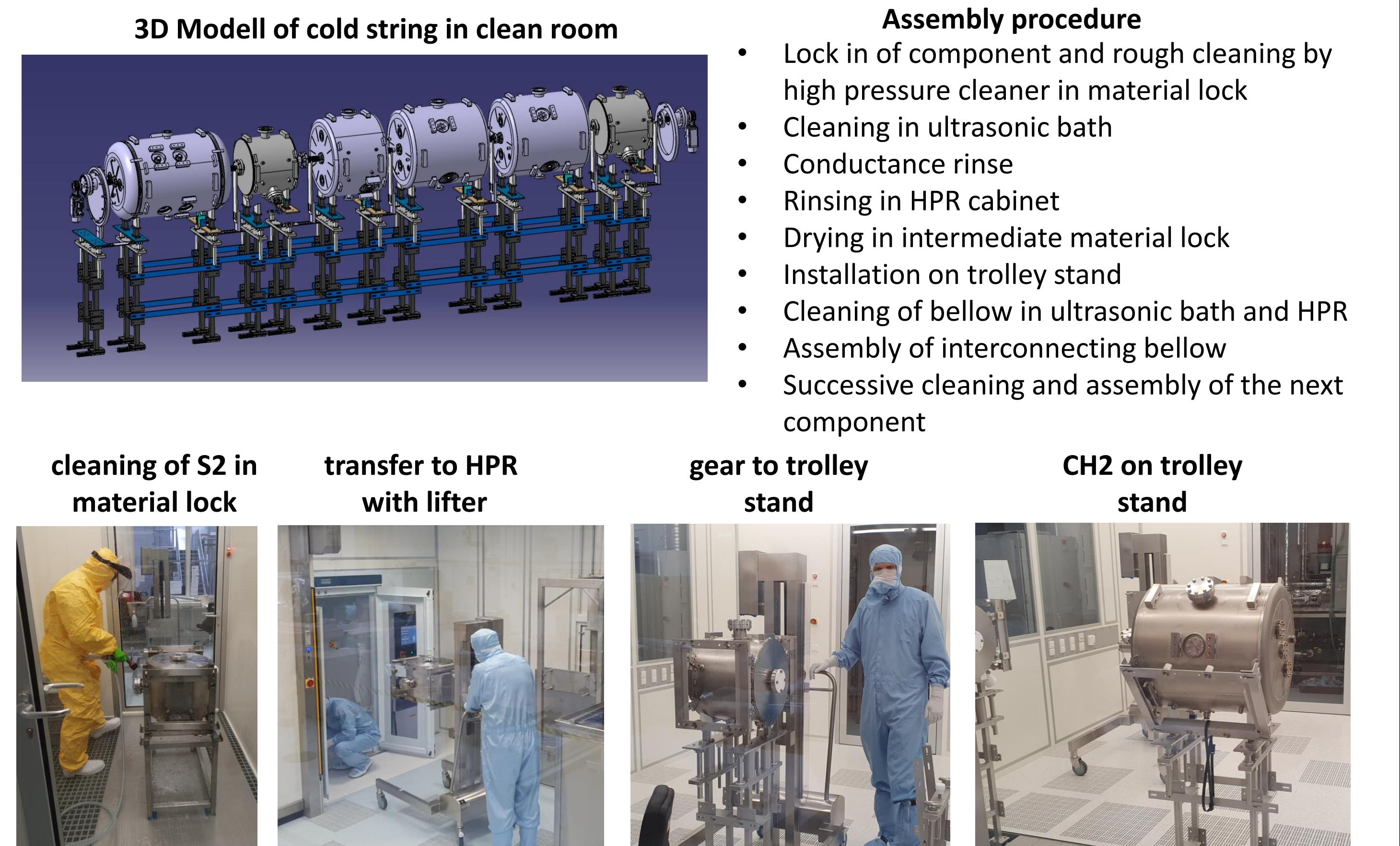
- ✓ Commissioning of cryogenic infrastructure
- ✓ Cryostat loaded with dummies of cavities and sc-solenoids
- ✓ sc-Solenoids are commissioned with beam
- ✓ Minimal steering observed
- ✓ Minimal emittance growth
- ✓ Transversal emittance measurements
- ✓ Bunch profile measurements
- ✓ Tomographic reconstruction procedure of longitudinal phase space
- ✓ Matching line and beam diagnostics successfully commissioned with beam

Clean Room Infrastructure @ HIM



- Double floor (5t/m²)
- Heavy duty rail system
- Two interconnected clean rooms
- Ultra high purity water supply (0.055 μS/cm 2500 l/h)
- High pressure cleaner
- Ultrasonic bath and conductance rinse
- High Pressure Rinse (HPR)
- 160 °C vacuum oven

Assembly of Cold String in Clean Room @ HIM



Time Schedule

- 10/2022 Assembly of the cold string
- 11/2022 Integration into cryostat
- 12/2022 Integration into beamline @ GSI
- 02/2023 Cryo commissioning
- 03/2023 RF conditioning and commissioning of LLRF
- 08/2023 Commissioning with beam

Outlook

- R&D on 18GHz ECR source
- Prototyping on cw RFQ
- Manufacturing of APF cw IH-DTL
- Specification of injector RF-amplifiers
- Purchasing of sc-cavities for CM2&3
- Manufacturing of cryostat for CM2
- Preparation of LINAC tunnel
- Final layout of beam transfer line to experimental area
- Beam line magnets & power supplies