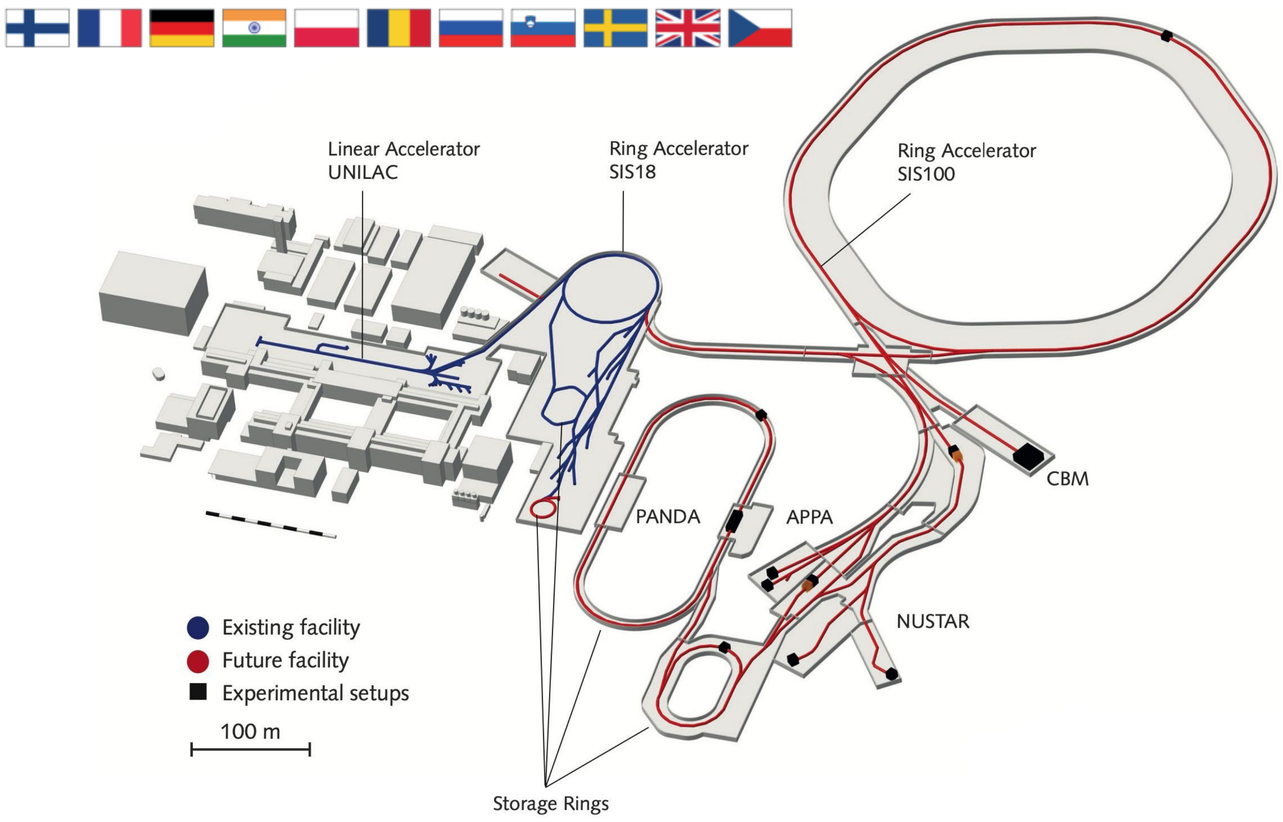
Status of the FAIR Control System and Controls Upgrade Activities at GSI

R. Bär, F. Ameil, D. Beck, C. Betz, M. Dziewiecki, J. Fitzek, K. Höppner, S. Jülicher, V. Rapp, R. Vincelli
GSI Helmholtz Centre for Heavy Ion Research, Darmstadt, Germany

Abstract

The FAIR accelerator complex (Facility for Antiproton and Ion research) is presently under construction at the GSI Helmholtz Centre in Darmstadt. FAIR will extend the present GSI accelerator chain, then being used as injector, and provide antiproton, ion, and rare isotope beams with unprecedented intensity and quality for a variety of research programs. After many years of machine development and civil construction works, the installation and commissioning of FAIR is now imminent. This paper reports about the progress of the FAIR facility in general, the general technical overview and the present status of the new FAIR control system, covering development, deployment, and operational experience at the existing GSI synchrotrons and storage rings. Although not feature-complete for FAIR yet, we will reflect on the experience of already 4 operational beam-times with the new control system. The paper will briefly address other challenges like our parallel activities to retrofit the legacy and obsolete linac control system by deploying the new control system stack at the UNILAC in the next years.

The FAIR Project @GSI



What is FAIR?

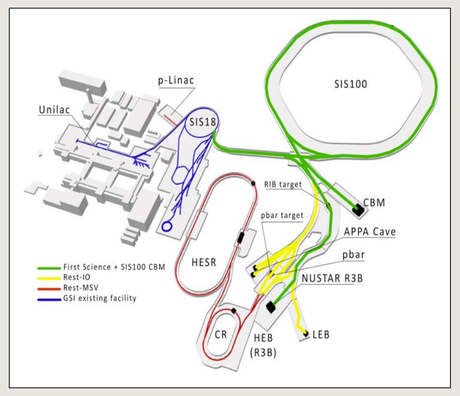
- New international accelerator **F**acility for **A**ntiprotons and heavy **I**on **R**esearch
- build at GSI in Darmstadt, extending the present GSI acceleraor chain
- Construction with international shareholders (financed and in-kind contribution)
- Political and economical situation challenging (RUS re-procurements, energy, inflation…)

Status

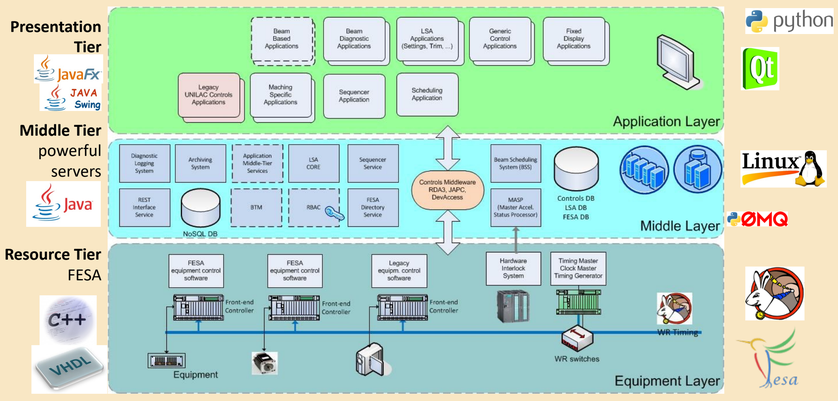
- Civil construction works advanced according to schedule
- Accelerator installation works start 01/2024
- New intermediate scope and time schedule (staged approach)
- “Early Science” in 2027 → HEBT, Super-FRS
- “First Science” in 2028 → SIS100 operation, CBM

Control System

- Control system provided by GSI as host-lab
- with in-kind contributions from Slovenia (Cosylab), Poland (S2Innovation)
- Implemented at GSI injector chain first



Control System Stack



Control system stack: standard model with 3 layers
OO distributed system, modular design with well defined interfaces

- Equipment layer (C++)
- Middle/business layer (C++/Java)
- Application layer (Java/Web)
- Industrial Controls (UNICOS SCADA system)

Application Layer

- JavaFX based applications
- Prototype of WebAssembly for beam based apps/feedback

Middle Tier

- Common middleware with adapters for different object frameworks
- LSA setting management system
- Beam scheduling system
- RBAC, Interlock processor, Archiving, Logging, Sequencer…

Resource tier

- White Rabbit based high/precision synchr. & timing system
- FESA framework
- modular local equipment controllers (SCU)

FAIR Control Centre

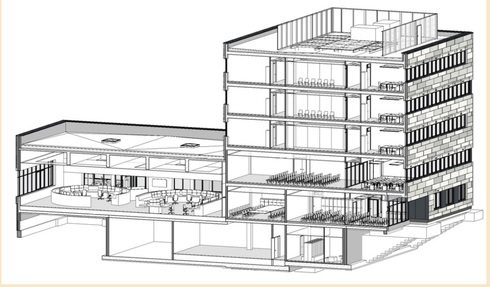
New FAIR Control Centre (FCC)
under civil construction

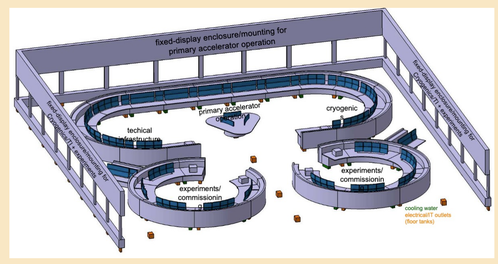
- sufficient room (640 m²) for operation of GSI & FAIR acc. Complex
- includes control/monitoring of technical infrastructure, cryogenics and SR experiments

- fully digital control room
- Digitisation of analog signals (project)

Outlook

- Building completion in 10/2025 for installation of Consoles & displays
- Operation of GSI facility from 2026+
- Hardware & beam commissioning FAIR from 2026+





Upgrade and Modernisation Projects

New FAIR control system successfully implemented for present GSI accelerator chain
→ SIS18 synchrotron, ESR & CRYRING storage rings, HEBT transfer lines

Beam Times after Controls Replacement
2016 – First Tests at CRYRING (early adopter machine)
2018 – First Operation at SIS18, ESR, HEBT
2019 – Storage Ring Mode implemented at ESR
2020 – UNCOS vacuum control system at UNILAC
2021 – cross-system performance upgrade
2022 – SIS18 booster mode (1.3 Hz operation) and B2B transfer

Injector Controls Replacement Project →Poster P. Gerhard (this conference)
→ Linac (ion sources, UNILAC) ongoing
Completion until 2026 to move to FCC control room