Contribution ID: **82** Contribution code: **THP03** Type: **Poster Presentation**

Design choices for the Cryogenic Current Comparator for FAIR

Thursday, 12 September 2024 16:00 (1h 30m)

The Cryogenic Current Comparator (CCC) is a superconducting SQUID-based device, which measures extremely low electrical currents via their azimuthal magnetic field. Triggered by the need for nA current measurement of slow extracted beams and weak beams of exotic ions in the storage rings at FAIR and CERN, the idea of the CCC as a diagnostics instrument has been revitalized during the last ten years. The work of a collaboration of institutes specialized on the various subtopics resulted in a large variety of CCC types with respect to field-pickup, magnetic shielding, SQUID types and SQUID coupling. Many of them have been tested under laboratory and under beamline conditions, which formed a detailed picture of the application possibilities for CCCs in accelerators.
In parallel to CCC detector development the cryogenic support system has steadily been optimized, to fulfil the requirement of a standalone liquid helium cryostat, which is nonmagnetic, fit for UHV application, vibration damped, compact and accessible for maintenance and repair.
We present the major development steps of the CCC for FAIR. The latest beamtime results are shown as well as recent tests with the cryogenic system. The most promising CCC type for FAIR is the so called Dual-Core CCC (DCCC), which runs two pickups in parallel with independent electronics for noise reduction. The magnetic shielding has an axial meander geometry, which provides superior attenuation of external magnetic noise.

Footnotes

Funding Agency

Supported by BMBF (German Ministry of Research) under contracts 05P18RDRB1 and 05P18SJRB1

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Session Classification: THP: Thursday Poster Session

Track Classification: MC1: Beam Charge and Current Monitors