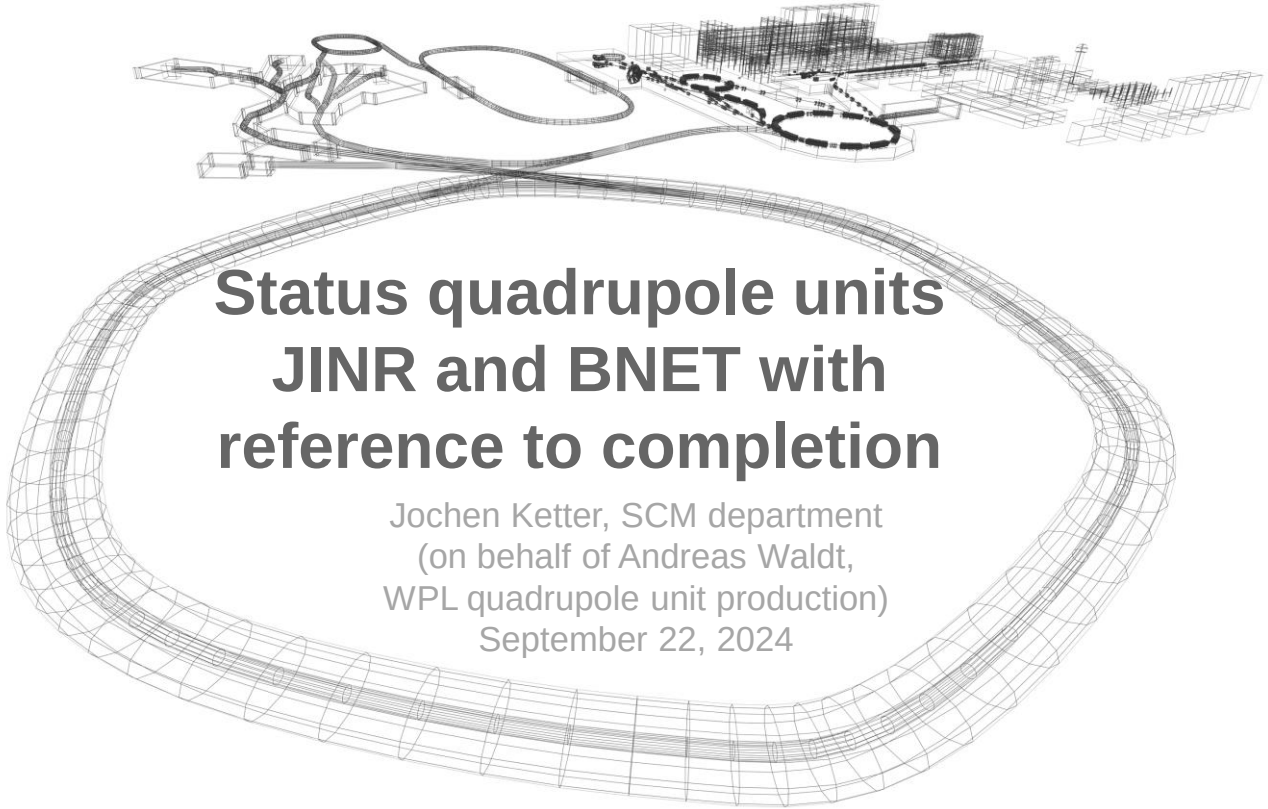


Status quadrupole units JINR and BNET with reference to completion

Jochen Ketter, SCM department
(on behalf of Andreas Waldt,
WPL quadrupole unit production)

September 22, 2024

Status in September 2024 (previous workshop)

JINR

- delivery of four units in May 2024
- delivery of four units upcoming in October 2024

BNET

- July 2024: FDR prototypes 1.6A, 2.8C
- procurement of tools
- quadrupole coils and busbars from left-over dipole cable
- waiting for delivery of corrector wire

Status in September 2025 (this workshop)

JINR

delivered four batches

- another 2 pairs of VQD, SF1B
  ⇒ delivery of QPUs for QDM 1.7B completed
- 11 out of 12 pairs of BQD, SF1H for QDM 1.6A

retested

- the first unit pair for QDM 2.5

BNET

- QPU prototype production completed
- FAT of all four units pending

- production of two multipole magnets (until February 2026)
- no FDR for multipoles

JINR: FDRs and production order

QPUs for QDM 2.123, 2.13s (straight section)

- FDR in December 2024
- change of production order: straight-section units before QPU for QDM 2.9D and arc-end units (used to be last type)
- first delivery in April 2026

QPUs for QDMs 2.4(x), 1.E(i) (arc end modules)

- FDR due in February 2026
- delivery from June 2027 on

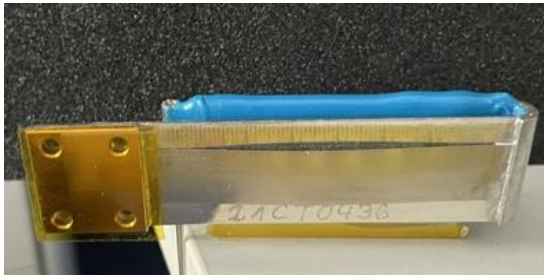
GSI/FAIR supplies

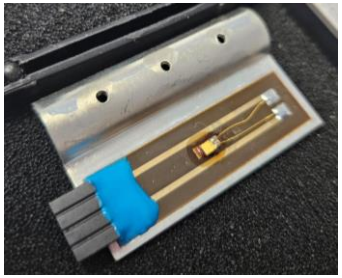
production (FAIR)

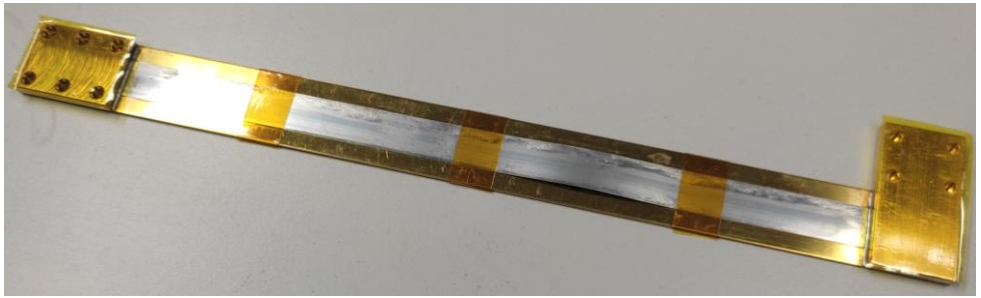
- cold terminals
- temperature sensors
- γ_t jump quadrupole
- corrector wire

testing (GSI)

- HTS interceptions
- power converter for γ_t jump quadrupole







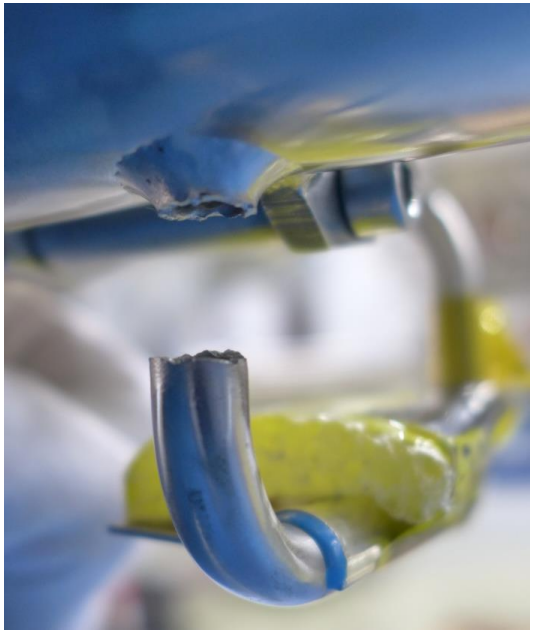
JINR: issues

no on-site support

- returning damaged parts
- shipping spare parts
- visit of service technician

⇒ extra load at GSI/FAIR

example: helium supply line broken off

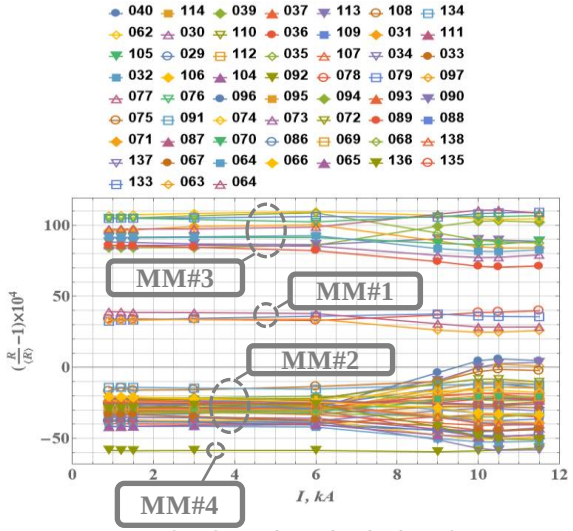


JINR: issues (beyond logistics)

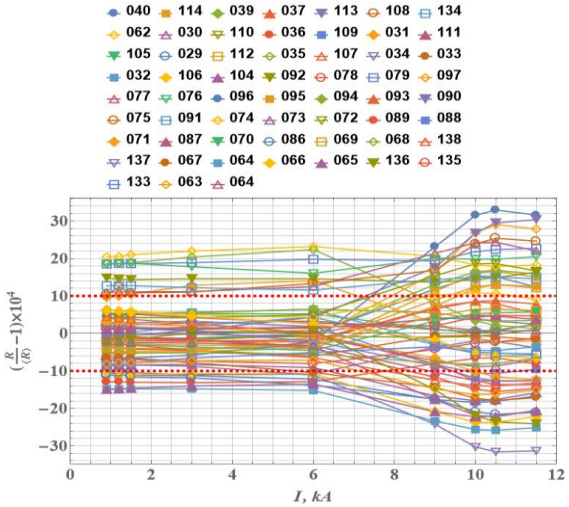
failing power converters

- service technicians and spare parts from Slovak company
- support by GSI/FAIR management via German authorities
- some technical investigations
- no full repair

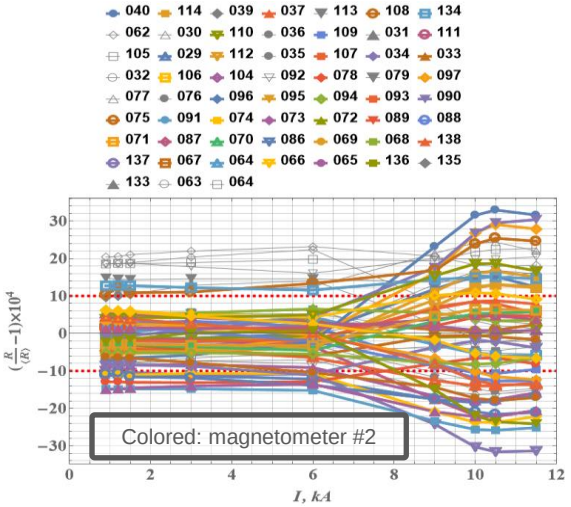
JINR: magnetic field



Transfer function deviation from mean, no cross-calibration factors applied.



Transfer function deviation from mean, JINR cross-calibration.

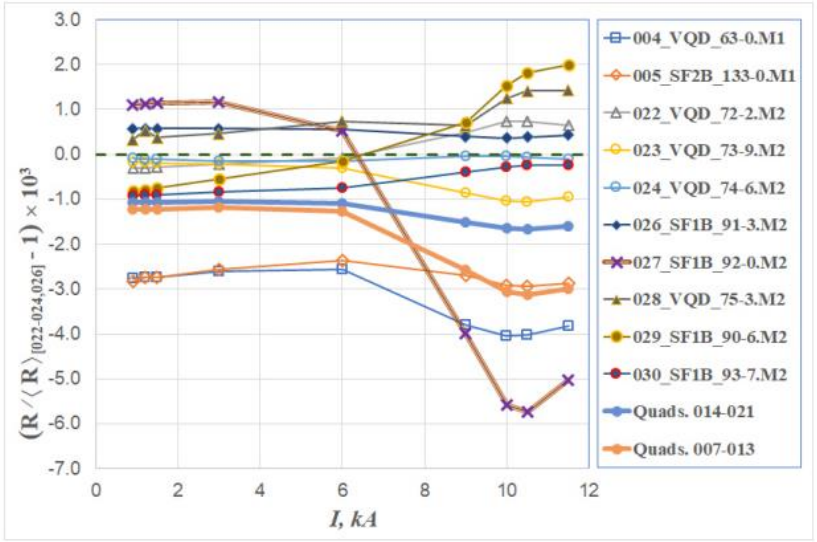


Transfer function deviation from mean, JINR cross-calibration, MM#2 highlighted.

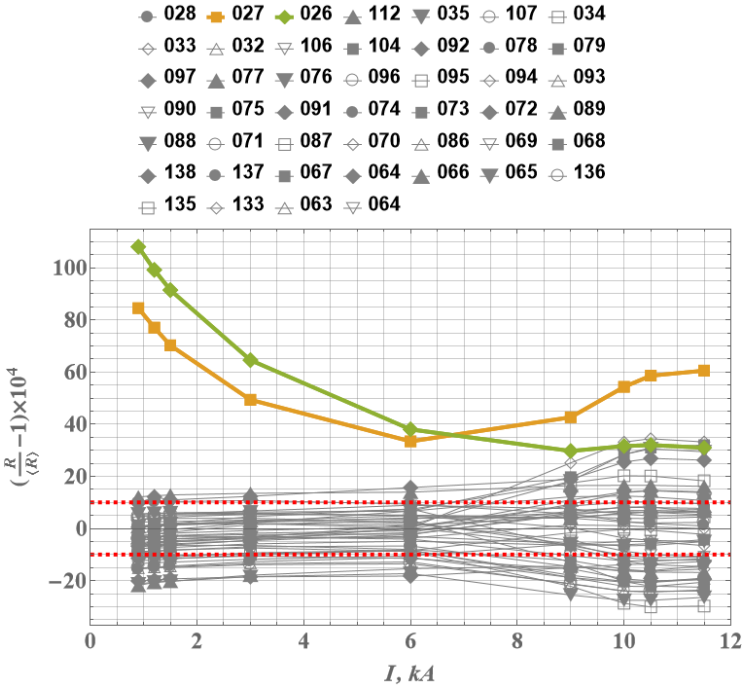
JINR cross-calibration: magnetometers #1, #3 and #4 are scaled to #2 with a common factor for all magnetometer segments.

JINR: outliers

092-0 (end of 2021)



026-5, 027-2 (still in discussion)



JINR: outliers and spares

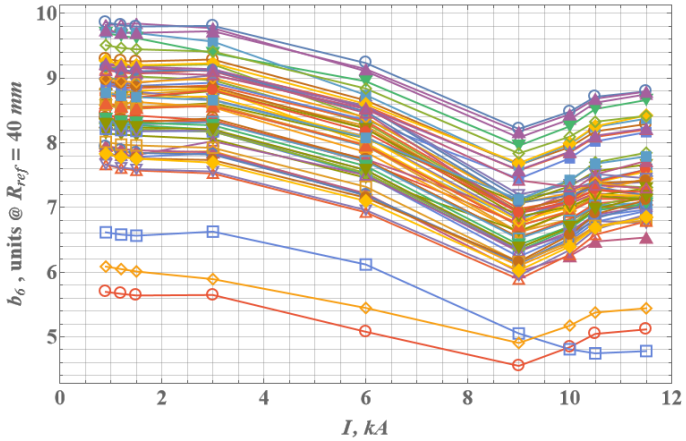
028-9

- geometrical deviations
- magnetic axis

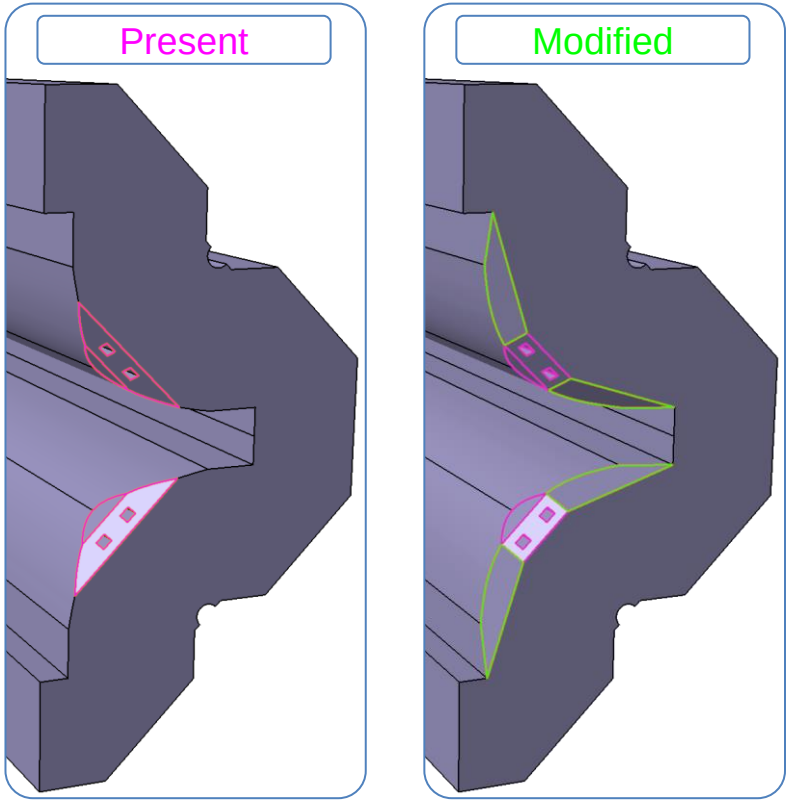
ongoing production

- four quadrupole yokes presented and not released for delivery
- no spare quadrupole yoke

b_6 component in main quadrupole



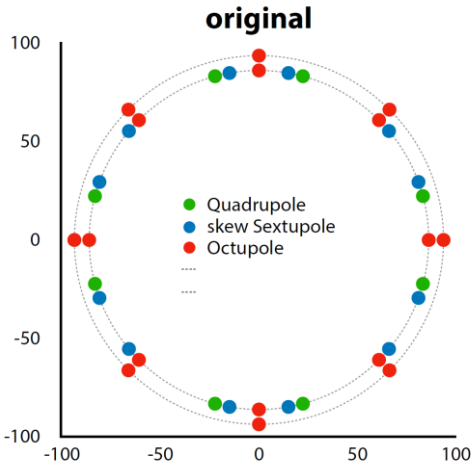
- no modification of yokes at JINR
  - all yokes produced
- BNET prototypes
  - one pair with present profile
  - one pair with modified profile

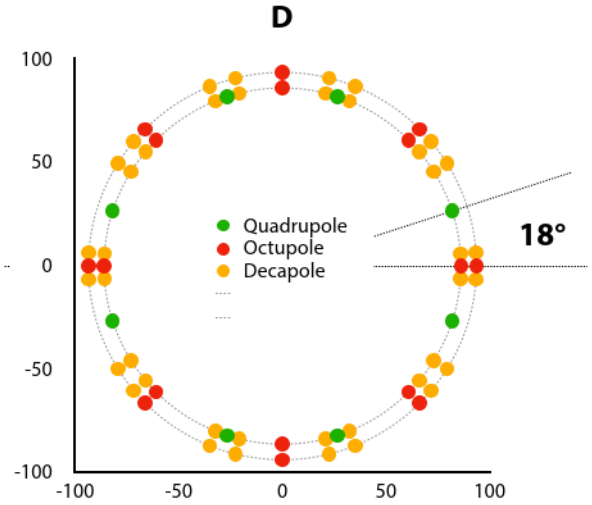


Multipole corrector

Decisions *(on options)*

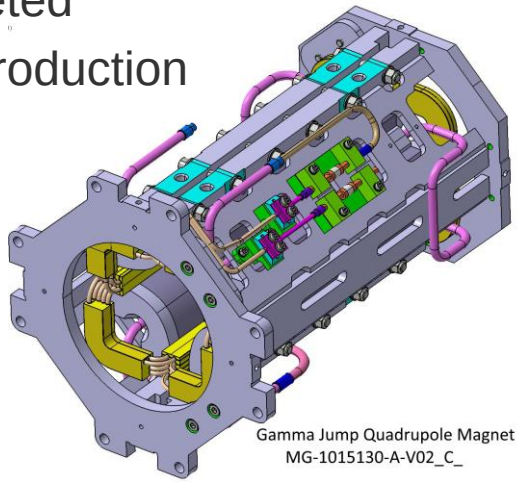
- b_6 or b_5
- required strength:
  - single layer or two layers
- three or four nested coils
- 6 or 12:
  - 1.E(i): $b_2+a_3+b_4$
  - 2.4(x): $b_2+b_5+b_4$





γ_t jump quadrupole

- produced by Partzsch
- prototype built
- FDR to be completed
- ready for series production



Gamma Jump Quadrupole Magnet
MG-1015130-A-V02_C_

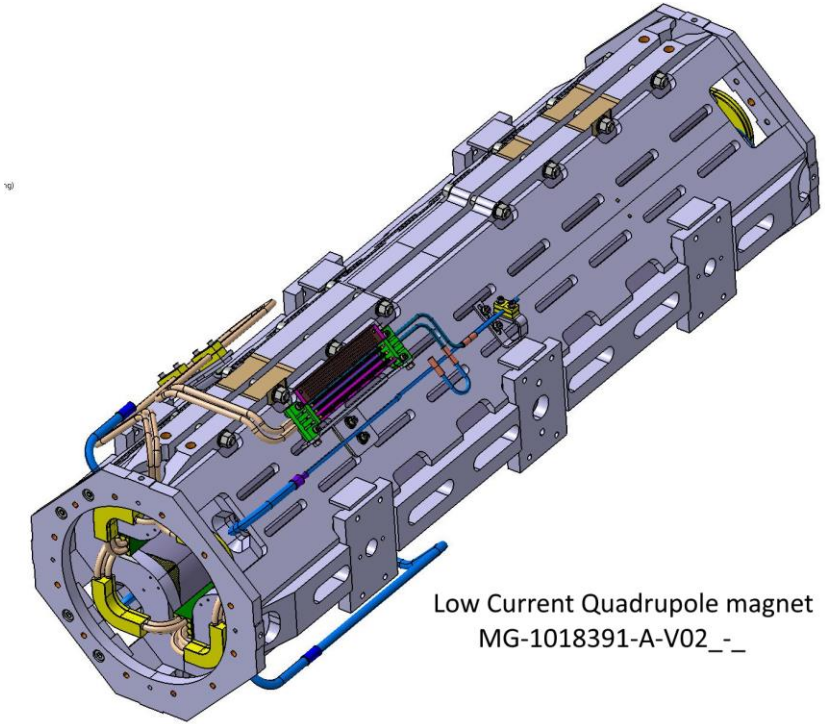
questions for testing

- interaction of main quadrupole with another quadrupole
  - magnetic field
  - quenches?
- magnetometer
  - arcing at full ramp rate?

2.4x, 1.Ei

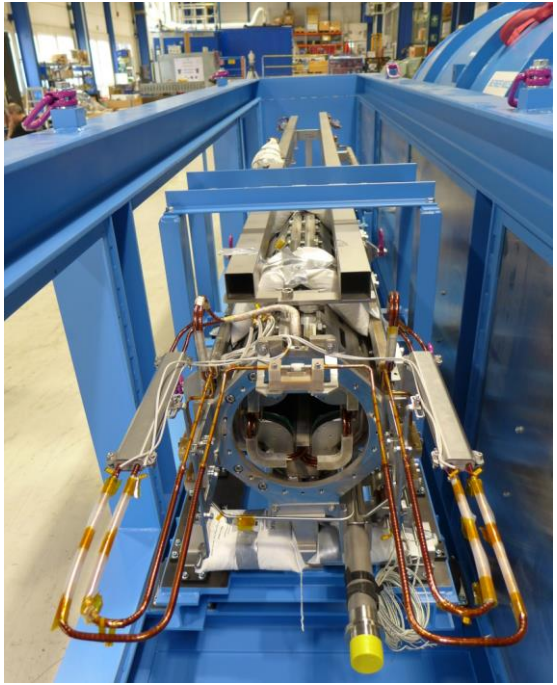
Low-current quadrupole

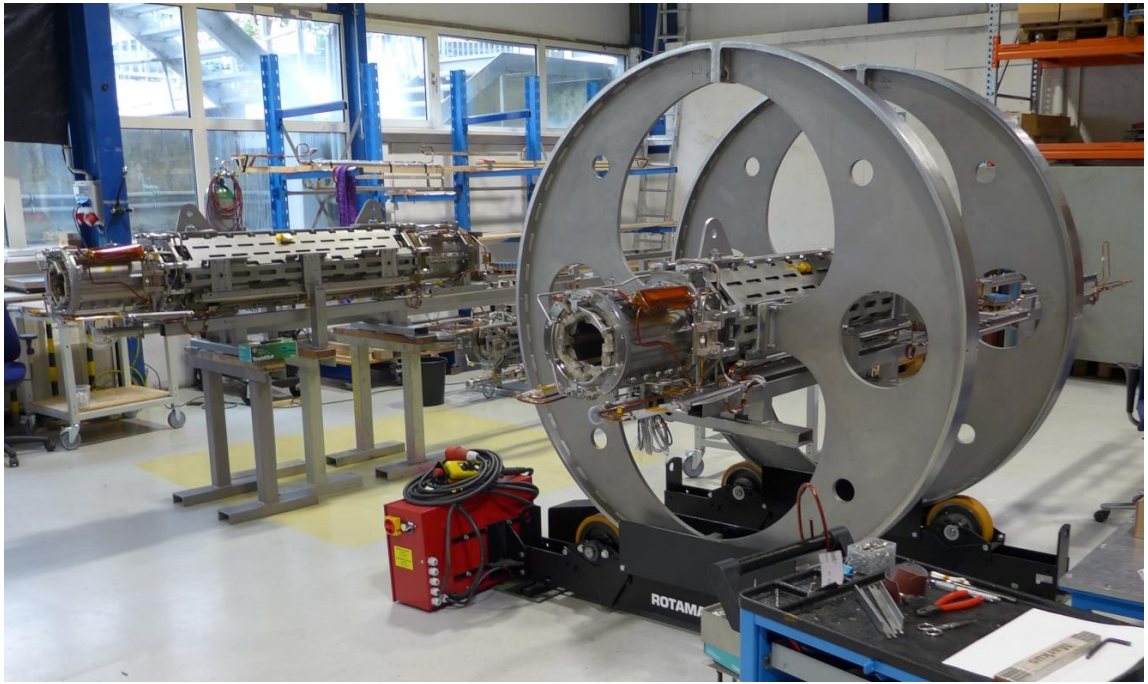
- one pair for injection and extraction branch each
- insulated quadrupole wire
  - BNET: some adjustments
- no prototype, no FoS
- not contracted
  - no FDR
- concept for cold terminals to be revised:
  - two standard cold terminals in parallel for 500 A
  - extraction quad may require 2 kV test voltage



Low Current Quadrupole magnet
MG-1018391-A-V02_-_

BNET: FAT inspection on 23 July 2025





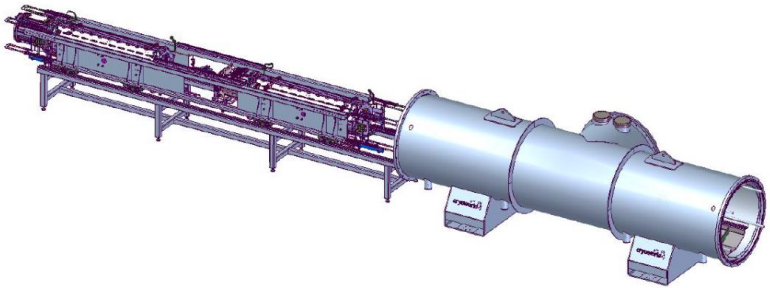
Testing BNET prototypes

in QDM vacuum vessel

- BQD#2 + SF1H
- available in October 2025
- test scope at STF
  - powering
    - dry quadrupole cable
    - dry corrector cable
  - no magnetic field

with GSI test cryostat

- BQD#1 + SF2H
- adaption to multipole magnets?



Final slide

- Stop scrolling
- End of presentation.
- No back-up slides

- Thank you for your attention.
- Questions?