PROGRESS ON MANUFACTURING AND TESTING OF THE SC MAGNETS FOR THE NICA BOOSTER SYNCHROTRON

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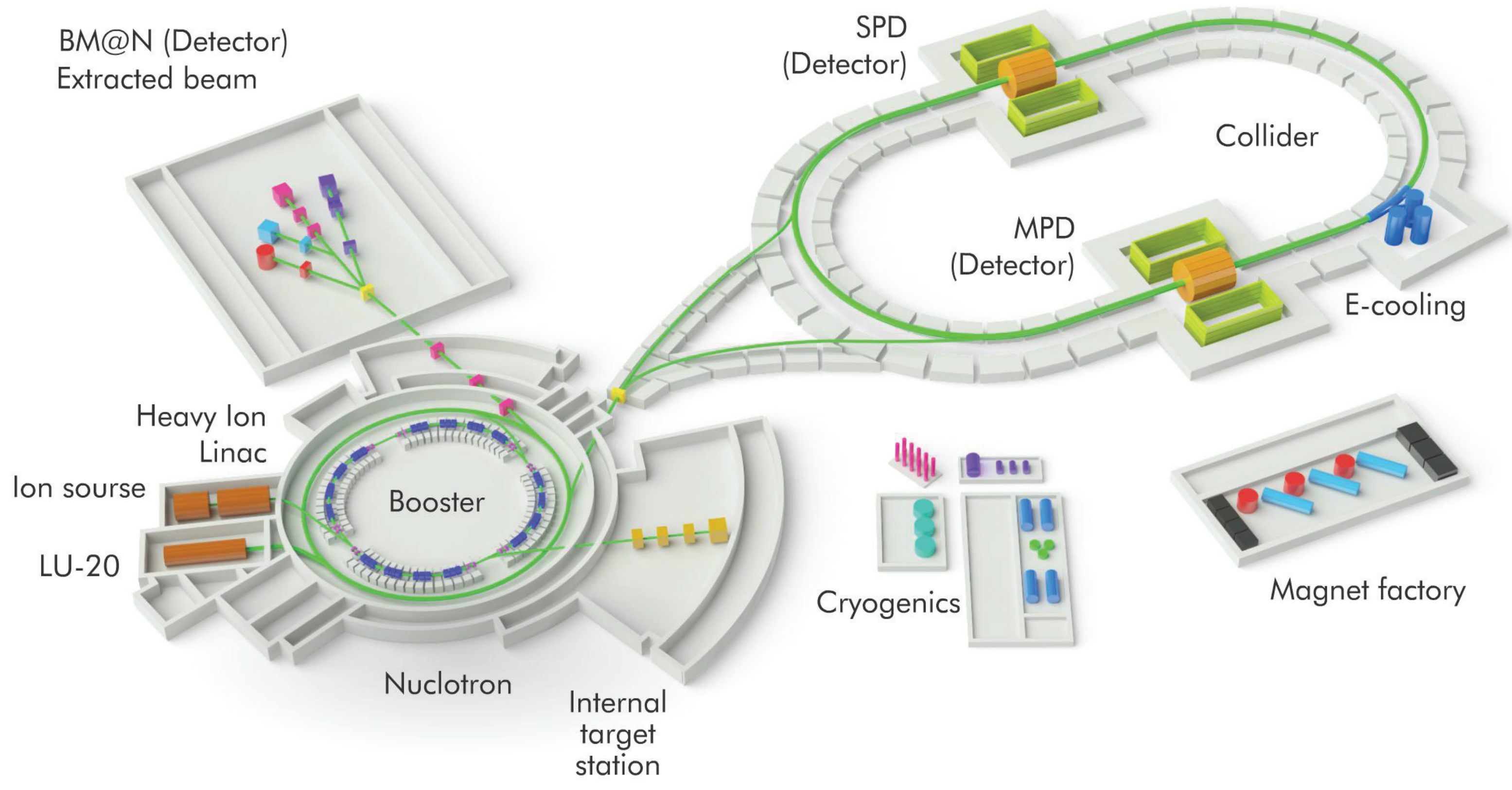
Outline

- Introduction, NICA complex
- Design of the magnets
- Status of magnets manufacturing
- Facility for SC magnet assembling and cryogenic tests
- Conclusion

NICA accelerator complex

- two injector chains
- new 600 MeV/u SC booster synchrotron
- upgraded SC synchrotron Nuclotron
- SC collider 503 m in circumference with luminosity up to $1 \cdot 10^{27}$ cm^{-2} s^{-1} for Au^{79+}
- two interaction points with MPD and SPD detectors



Design of the NICA booster magnets

The Nuclotron-type design based on a cold, window-frame iron yoke and a winding of the hollow superconductor was chosen for the NICA Booster.

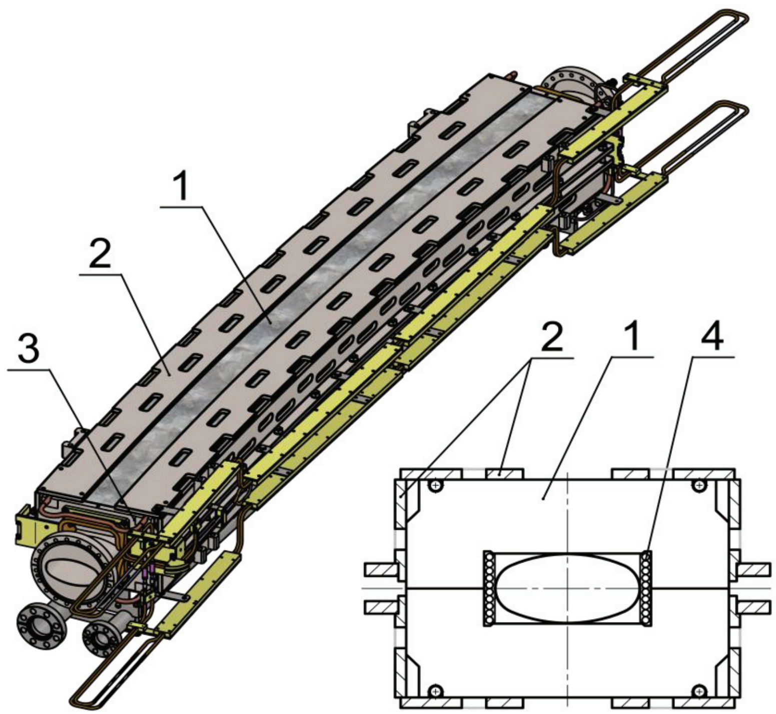


Figure 1: View of the dipole magnet. 1 – lamination, 2 - side plate, 3 - end plate, 4 – SC coil.

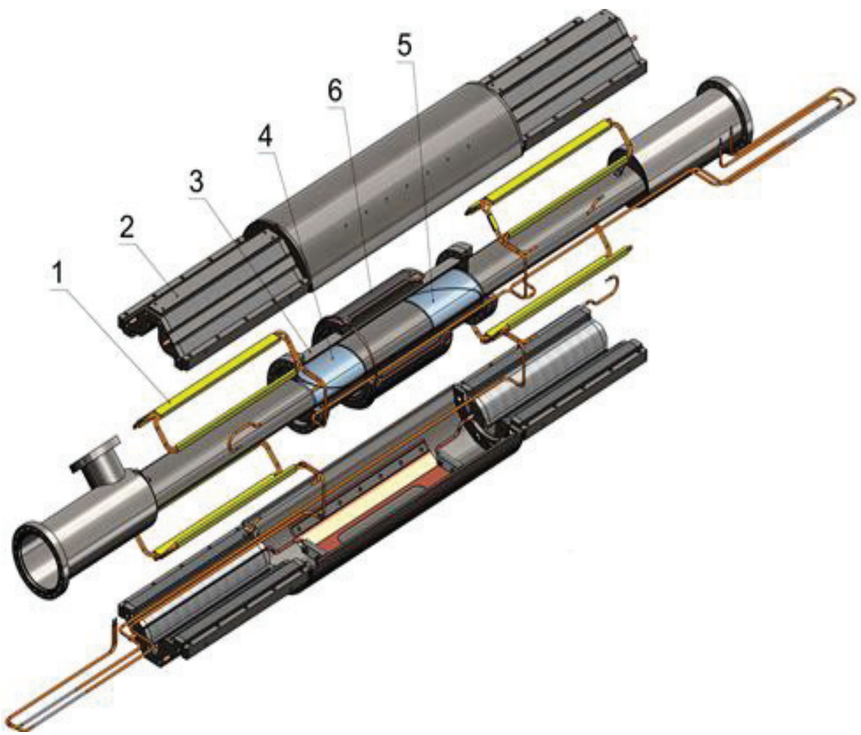
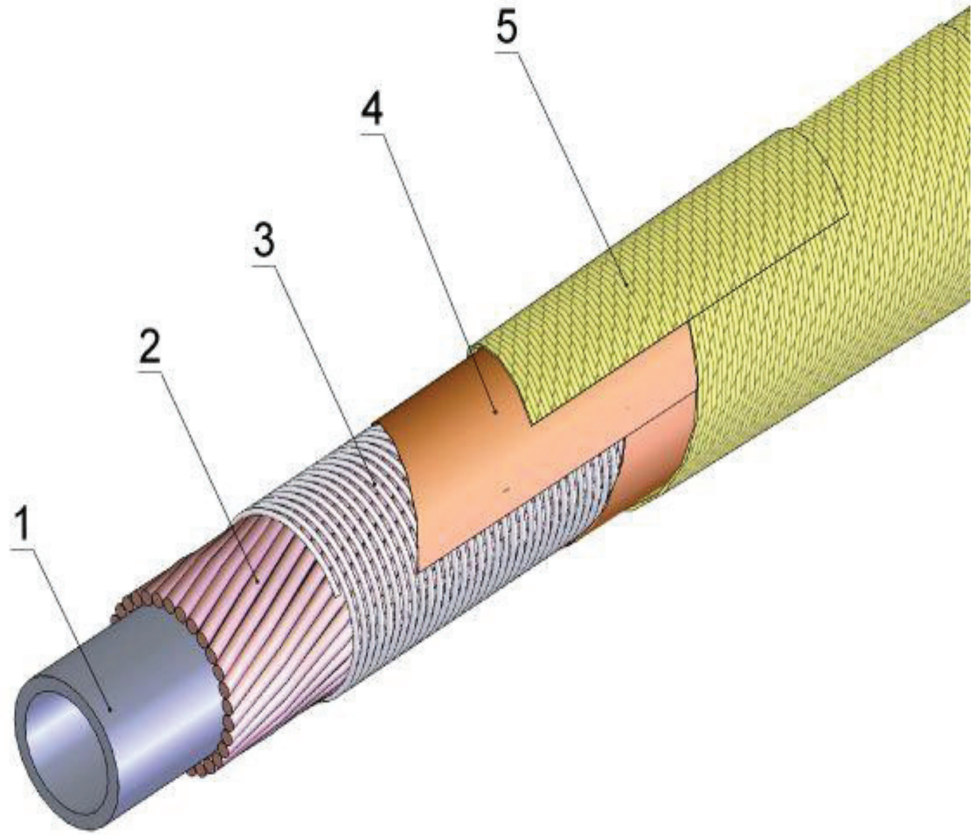


Figure 2: View of the doublet of the lenses. 1 – half-coil, 2 – half-yoke, 3 – beam pipe, 4, 5 – beam position monitors, corrector magnet

Nuclotron-type cable



View of the Nuclotron-type cable. 1 – cooling tube, 2 – SC wire, 3 – Ni-Cr wire, 4 and 5 - insulation

Main characteristics of the magnets

Characteristic	Dipole	Lens
Number of magnets	40	48
Max. magnetic field (gradient)	1.8 T	21.5 T/m
Effective magnetic length	2.2 m	0.47 m
Beam pipe aperture (h/v)	128 mm/ 65 mm	
Radius of curvature	14.09 m	-
Overall weight	1030 kg	110 kg

Status of Manufacturing the Magnets

- Yoke of the Dipole Magnets – 27 or 68%
  Coil of the Dipole Magnets - 16 or 40%
- Yoke of the Quadrupole Magnets – 48 or 100%
  Coil of the Quadrupole Magnets - 38 or 79%
- Yoke of the Corrector Magnets – 8 or 25%
  Coil of the Corrector Magnets - 2 or 6%
- Cryostat for magnets – 71 or 100%%

Facility for SC Magnets Assembling and Cryogenic Tests

Commissioning of test facility in full configuration is scheduled for 28 November 2016.

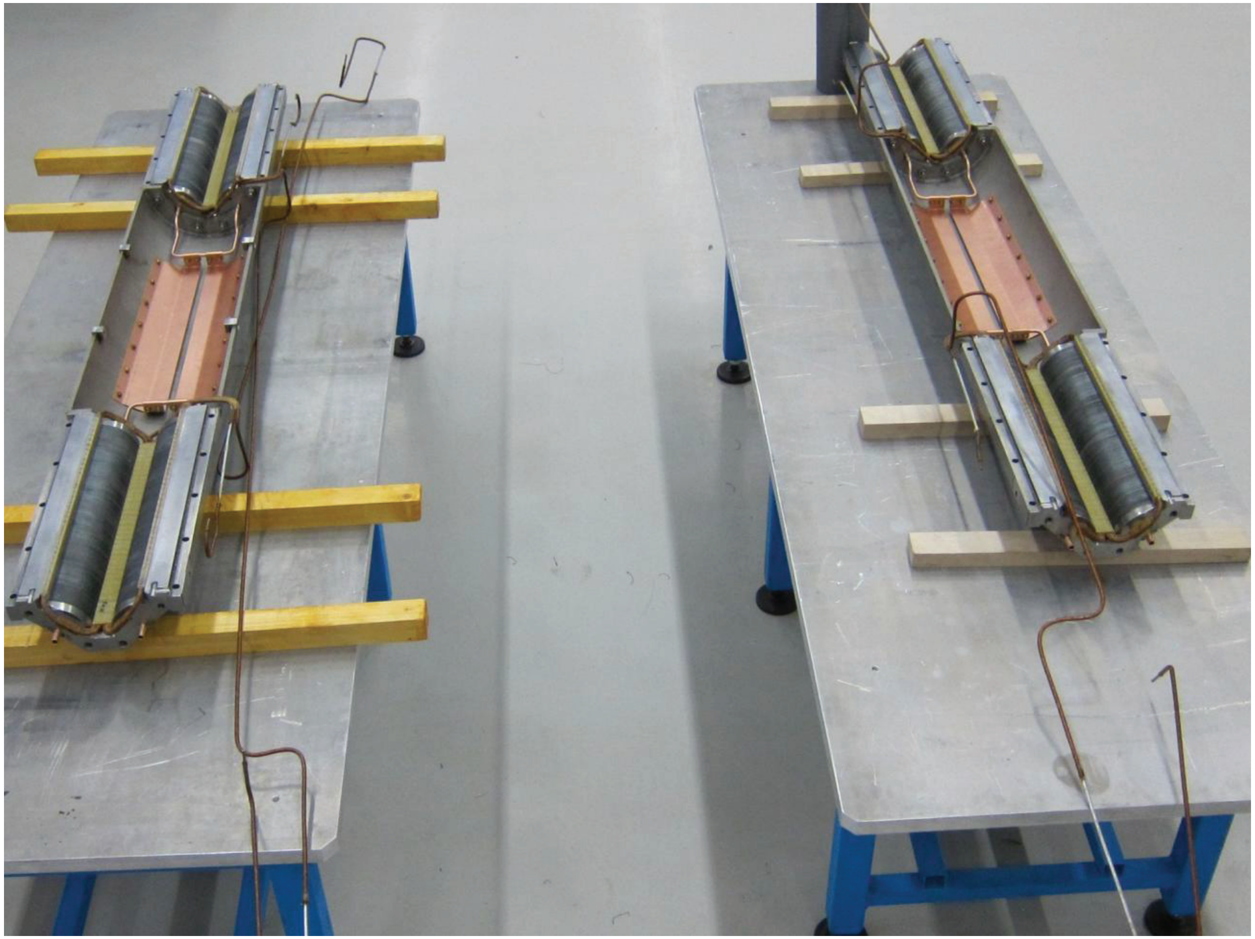
SC Cable Production

Machine for production Nuclotron-type superconducting cable.

SC ProductionCoil

Coil manufacturing for the NICA booster quadrupole magnet

Coil with Yoke Assembling

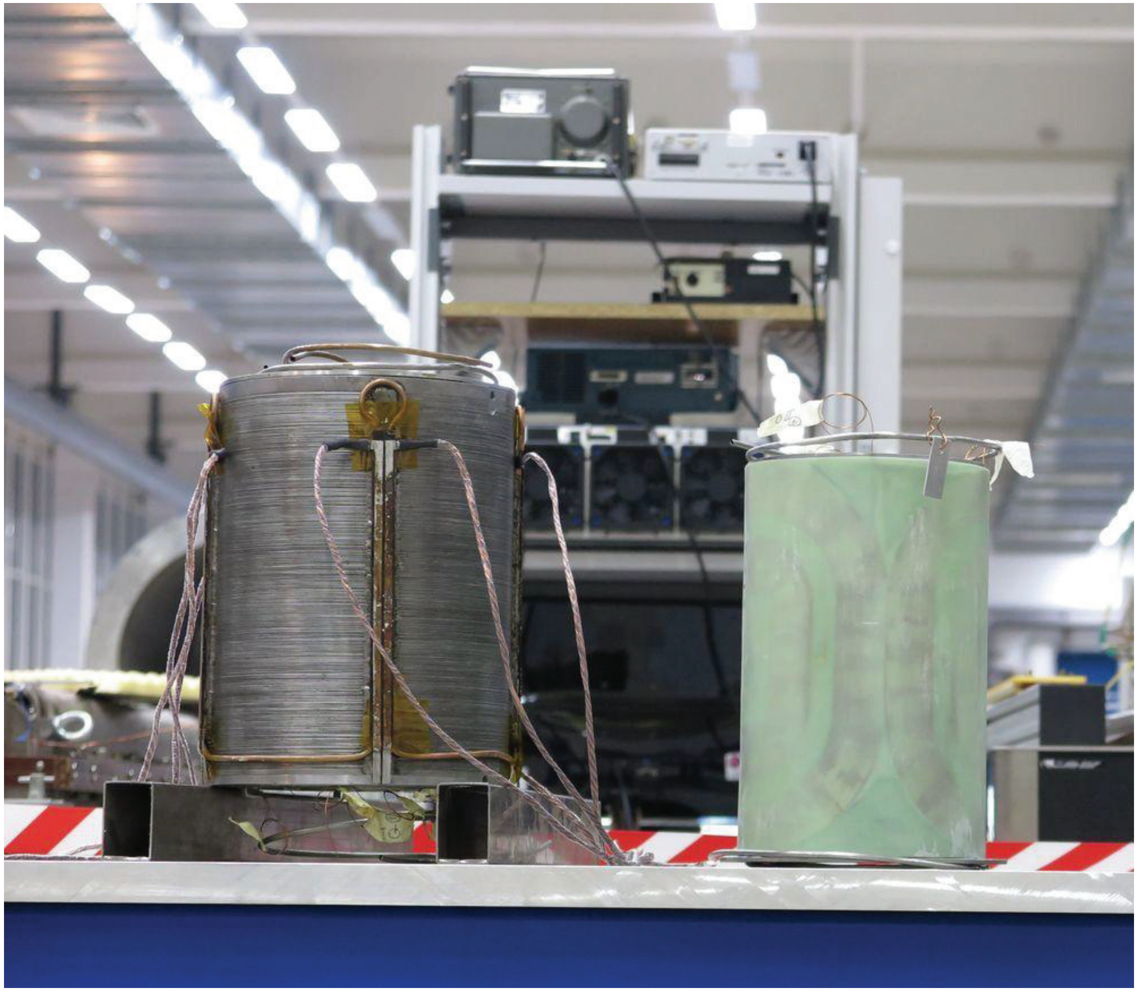


Half-coils assembling with half-yokes for doublet of the lenses

Beam Pipe Installation

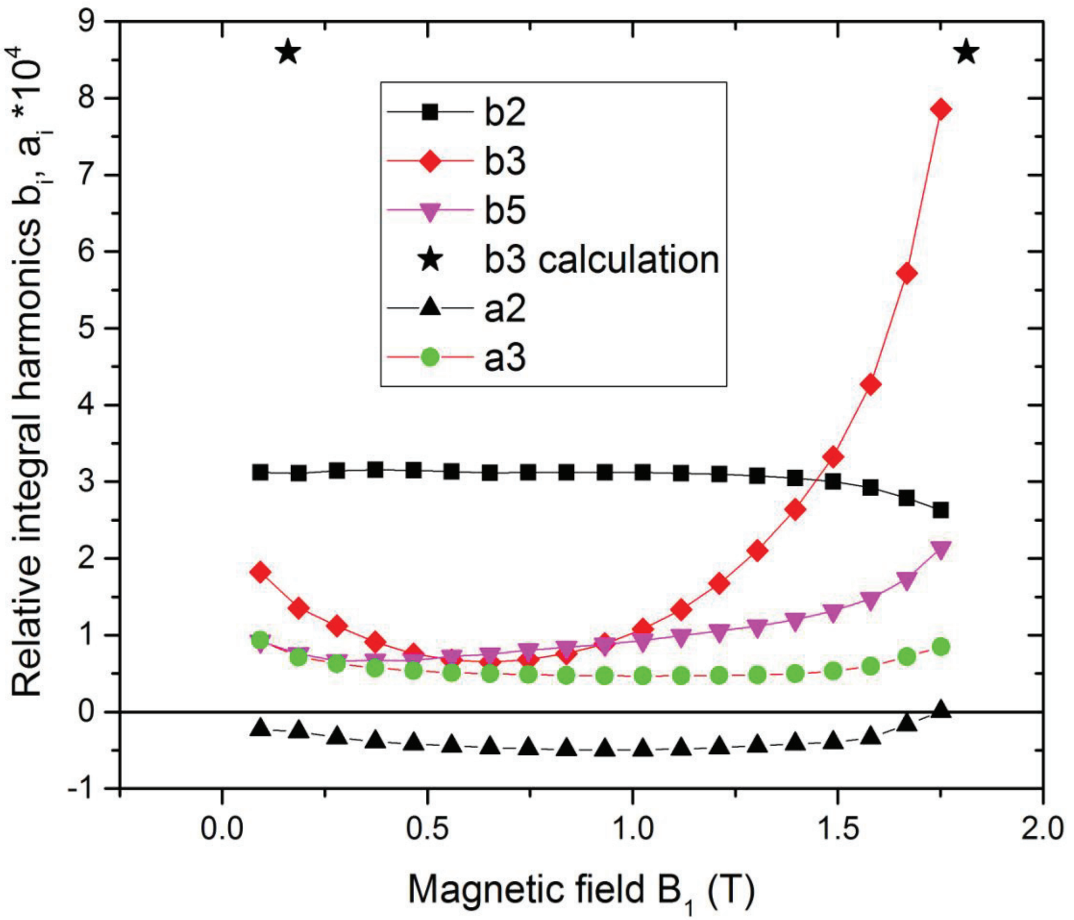
The beam pipe installation in the dipole magnet

Corrector Magnet



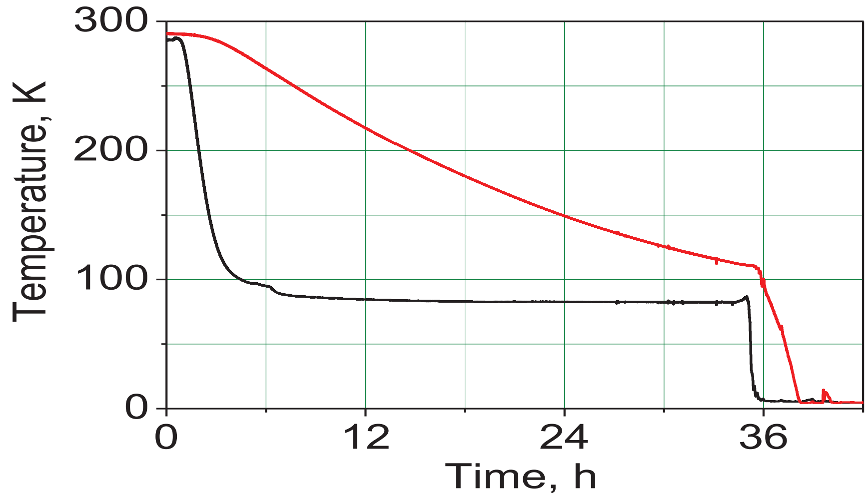
The iron yoke (left) and the coil (right) for corrector magnet

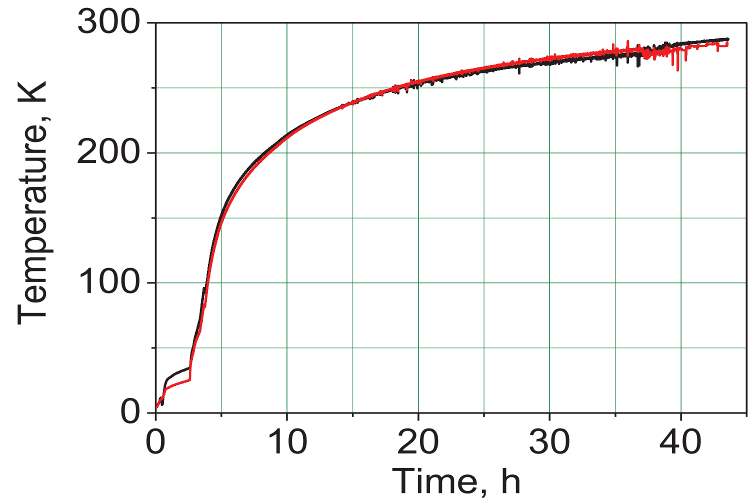
Series Test of the magnets



Relative integral harmonics of the magnetic field in the aperture of the NICA booster magnet at the radius of 30 mm as a function of the magnetic field in the magnet center.

Series Test of the magnets





Cooling-down (left) and warm-up (right) of the dipole magnet for the NICA booster. Black line is inlet and red line – outlet of the magnet.

Series Test of the magnets

Series dipole magnet (left) and doublet (center) for NICA booster, and pre series dipole magnet for NICA collider (right).

Conclusion

- Serial production of the magnets for the NICA booster at the LHEP of JINR has passed the halfway.
- Completion of manufacturing the magnets for the NICA booster synchrotron is planned for the middle of 2017.
- Facility for assembling and cryogenic tests of the SC magnets for the NICA and FAIR projects is prepared for commissioning in full configuration at Dubna in next week.
- Serial cryogenic tests of the magnets successfully started at new test facility.
- Completing the cold tests of the magnets is scheduled for the end of 2017.


Thank you for your attention