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TECHNICAL ARTICLE

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ASG SUPERCONDUCTORS
Corso F.M. Perrone 73R
Genova - Italy

www.asgsuperconductors.com

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## The Multi-Purpose Detector magnet for the NICA accelerator

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NICA (Nuclotron-based Ion Collider fAcility) is a new complex accelerator designed at the Joint Institute for Nuclear Research (Dubna, Russia) to study the properties of dense baryonic matter.

When the NICA will be ready, JINR scientists will be able to create in the Laboratory a special state of matter in which the Universe stayed shortly after the Big Bang – the Quark-Gluon Plasma (QGP).

NICA will provide variety of beam species ranged from protons and polarized deuterons to very massive gold ions. One interaction point at the NICA rings is the MPD detector for studying charged hadrons, electrons, and photons generated in heavy ion collisions at energies provided by the Collider.

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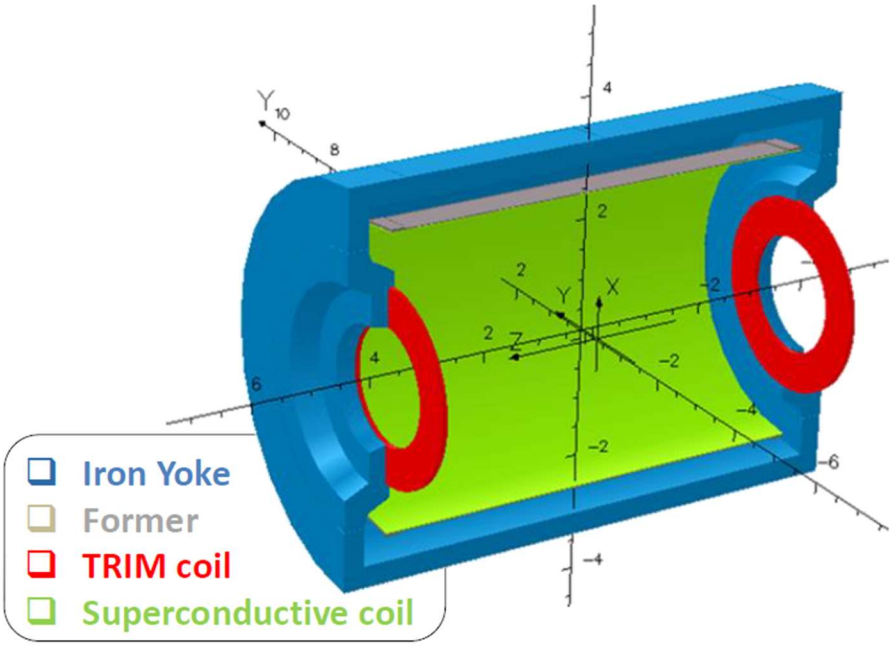
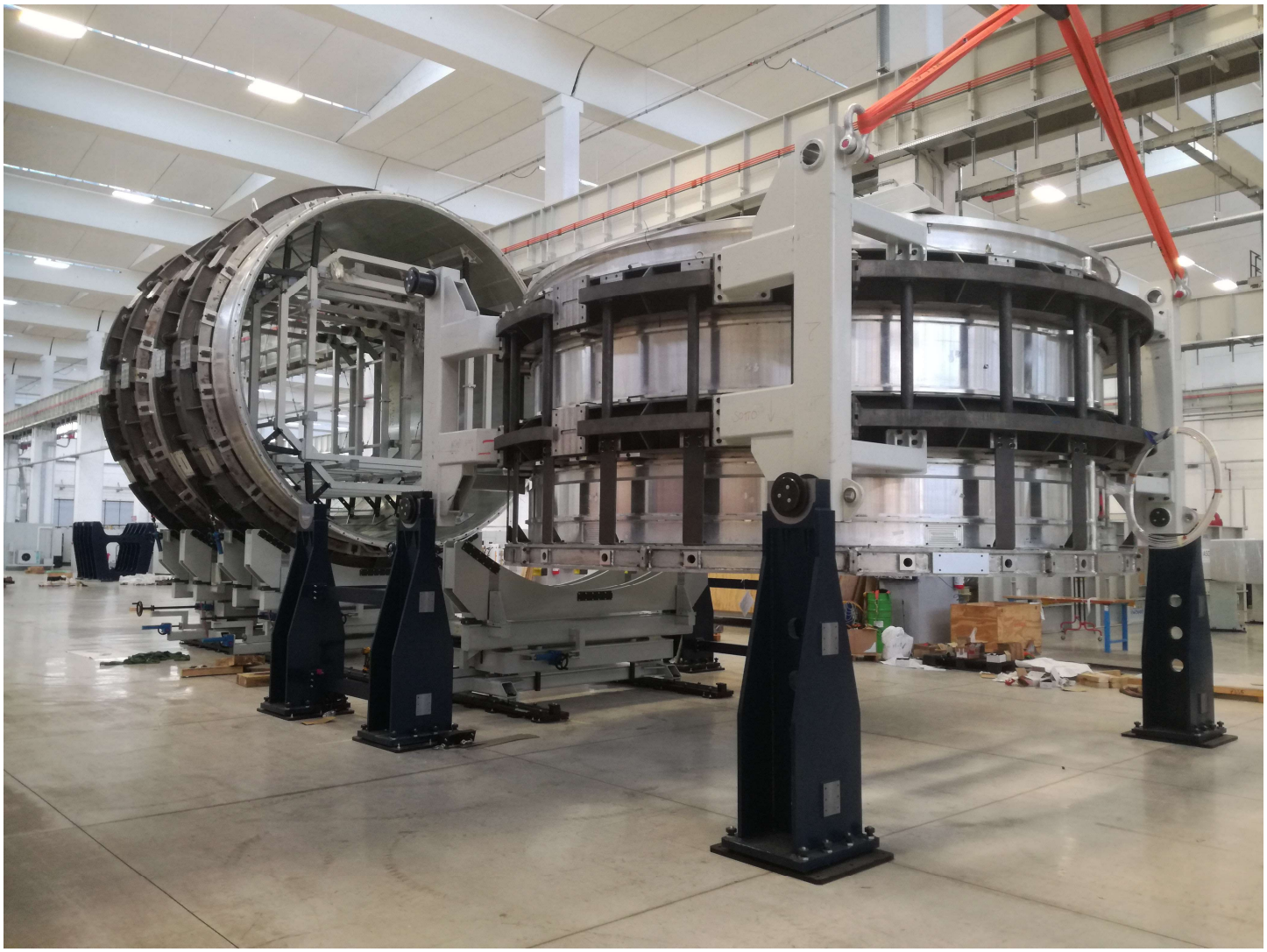



The MPD Magnet is a single solenoid more than 7 m long and with a diameter of about 5 m. The cable (custom designed on purpose) is manufactured by coextrusion of stabilizing high-purity aluminum and superconducting NbTi strand. The coil solenoid has an indirect cooling system that consists in a hydraulic LHe circuit welded directly on the coil former.

The NbTi cable has been insulated and wound from the inner side around three aluminum formers (modules), with vertical axis, by using special tools designed on purpose. Each module was impregnated with epoxy-resin into a special oven. The VPI process has been selected to get the best thermal, electrical and mechanical performances. The three modules were then tilted into horizontal axis and assembled together by using a dedicated fixture. The connections of the electric and L-He cryogenic circuits completed the assembly phase.



| MAIN DIMENSIONS | |
|---|---|
| SC Coil Ø: | 5.2 m |
| SC Coil lenght: | 7.6 m |
| SC Coil weight: | 15 Ton |
| Cryostat Ø: | 5.8 m |
| Cryostat lenght: | 8.1 m |
| TRIM coil Ø: | 3.2 m |
| TRIM coil depth: | 80 mm |
| Yoke + Coils weight: | ≈ 835Ton |

The most challenging issue of this job was to manage huge components and guarantee at the same time very tight tolerances after the assembly. These requirements were necessary to get the target field, a highly homogeneous magnetic field of 0.5 T in a cylindrical volume (2.4 m diameter, 3.4 m length). In addition, two resistive TRIM coils were manufactured to be installed at both ends of the solenoid to correct and trim the field.

Another challenge of this job has been to design and supply a complete keys-in-hand system, including the magnet itself with all the auxiliary systems as the power supplies, the pumping station, the cryogenic valves box and the Control System.

This last one integrates the information coming from all the systems in a user-friendly interface, to operate correctly the magnet, manages interlocks and retroactions, sets the parameters (i.e. SC cable ramp rate, temperature threshold, etc.) and switches the operating regimes, including emergencies.