

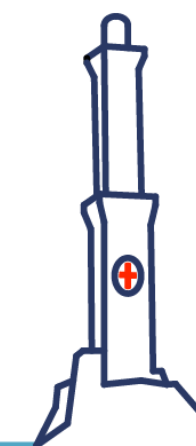
# Industrial capability: Italy

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Andrea Bersani  
on behalf of INFN Genova magnet group



**Sezione di Genova**  
Istituto Nazionale di Fisica Nucleare



# Introduction

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- ↪ Genova group designed, followed the construction and the acceptance tests of several magnets in the last decades
  - ↪ both detector and accelerator magnets
- ↪ INFN has a long expertise on magnets and accelerator, spread in different laboratories and divisions
  - ↪ in addition to Genova, Milano, Frascati, Legnaro, Napoli...
- ↪ Several of the largest magnets for HEP have been built in Italy

# Genova magnet group past activities

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- ↪ BaBar solenoid
  - ↪ project, industrial follow-up
- ↪ CMS solenoid
  - ↪ project, industrial follow-up, integration
- ↪ DiSCoRaP curved, fast ramping dipoles for accelerators
  - ↪ project, prototype construction, measurements
- ↪ QSAL double helical quadrupole
  - ↪ project, prototype construction, measurements
- ↪ SR2S space radiation superconducting shield
  - ↪ project in collaboration with ESA
- ↪ Cable measurements
  - ↪ critical current, joint resistance and magnetic susceptibility

# Genova magnet group present activities

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## ↪ Mu2e

- ↪ mainly characterisation of the cables for all the solenoids, support for the transfer solenoid project and industrial follow-up (production is ongoing)

## ↪ HiLumi-LHC MBRD

- ↪ project, industrial follow-up and tests (pre-production phase is starting)

## ↪ EuroCircol/FALCON-D Nb<sub>3</sub>Sn high field accelerator dipoles for FCC

- ↪ project, industrial follow-up (prototype phase is starting)

## ↪ BISCOTTO HTS canted solenoid dipole

- ↪ project, prototype construction (initial phase)



# Genova magnet group crew

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- ↪ 3 senior scientists

- ↪ Pasquale Fabbricatore

- ↪ Riccardo Musenich

- ↪ Stefania Farinon

- ↪ 2 scientists

- ↪ Andrea Bersani

- ↪ Barbara Caiffi (starting Oct. the 1st)

- ↪ 2 technicians

- ↪ 4 PhD students and research grants

# ASG Superconductors

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- ↪ ASG Superconductors is our main industrial partner
- ↪ Based in Genova, formerly part of Ansaldo (Ansaldo Superconduttori till 2001)
- ↪ Three units:
  - ↪ Magnets & systems unit
  - ↪ Columbus MgB2 wire unit
  - ↪ Paramed MRI unit
- ↪ Two plants
  - ↪ Genova: headquarters, Paramed, Columbus, small magnets
  - ↪ La Spezia: mainly large magnets
- ↪ More than 200 employees and collaborators



# ASG non-INFN present activities



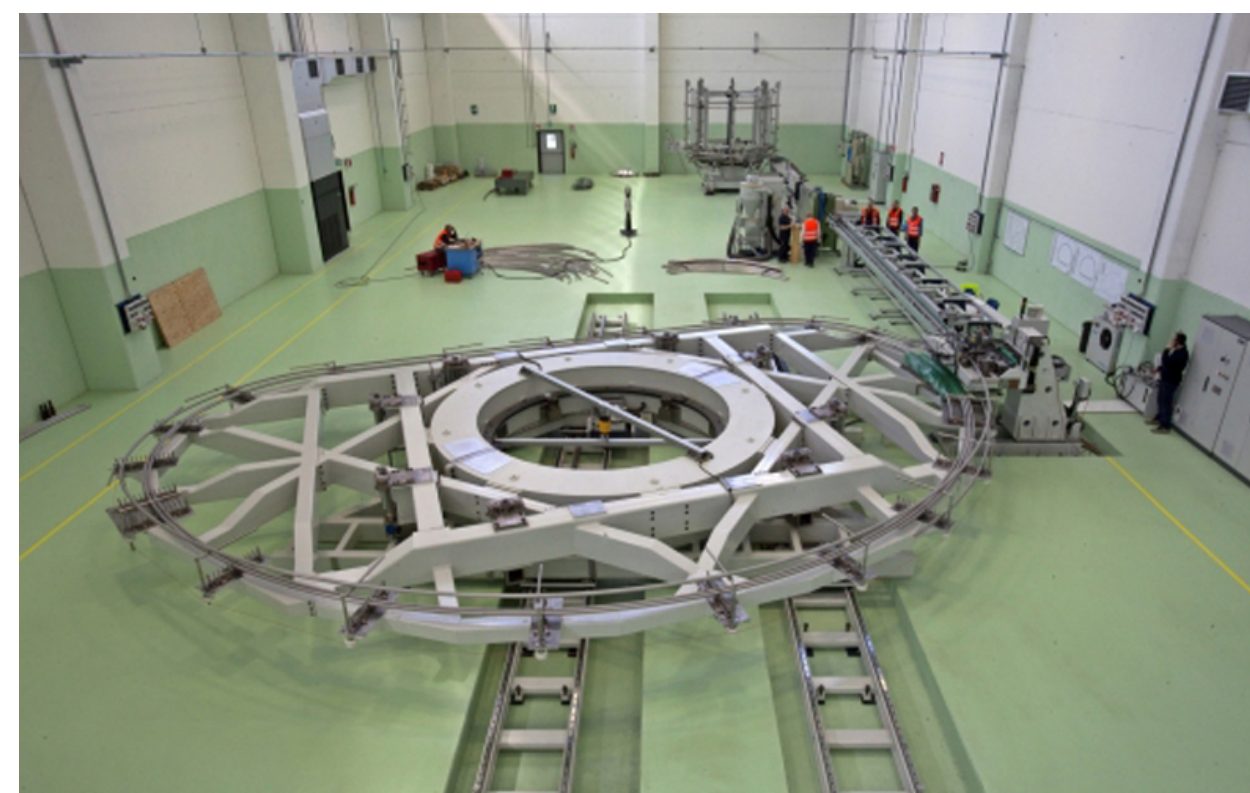
↪ 11.7 T MRI magnet



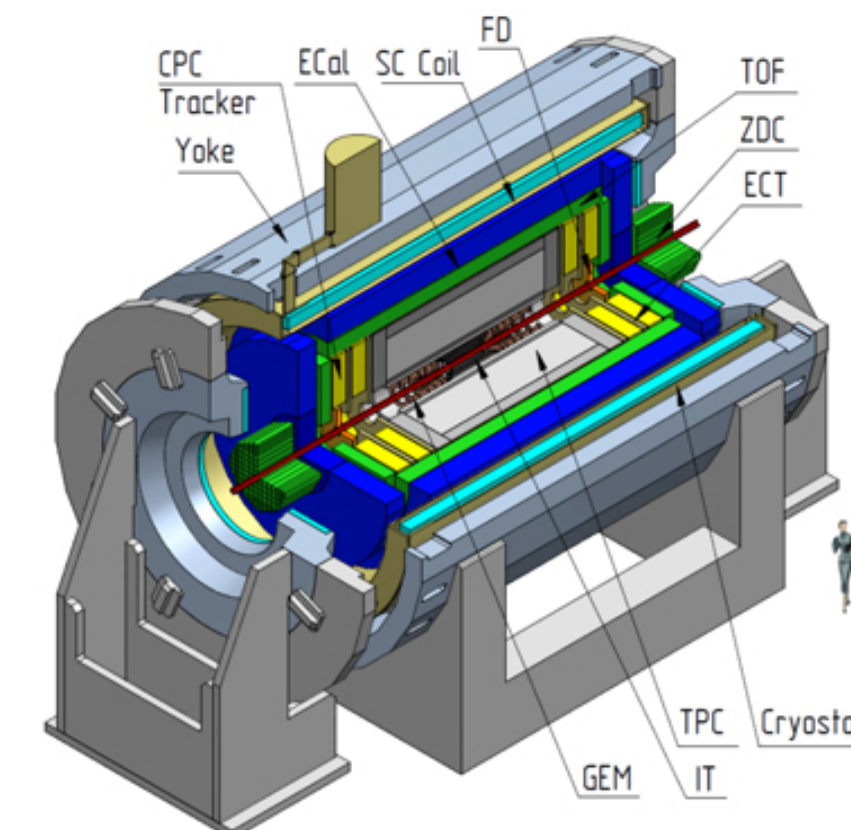
↪ "Open" MgB<sub>2</sub> MRI



↪ JT60 toroidal magnet



↪ ITER toroidal magnet



↪ JINR MPD solenoid

- ↪ IBA S2C2 solenoids
- ↪ MgB<sub>2</sub> current limiters
- ↪ ITER poloidal magnet at Cadarache
- ↪ ...



# ASG – INFN Genova present activities

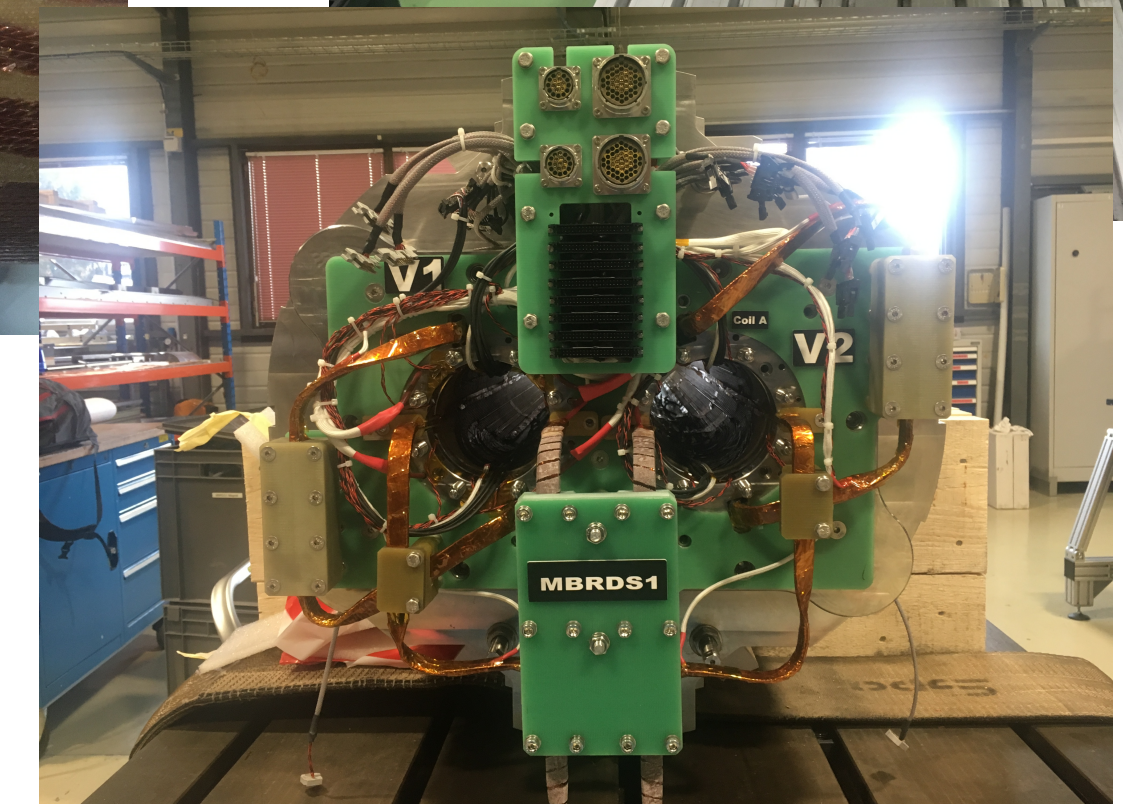
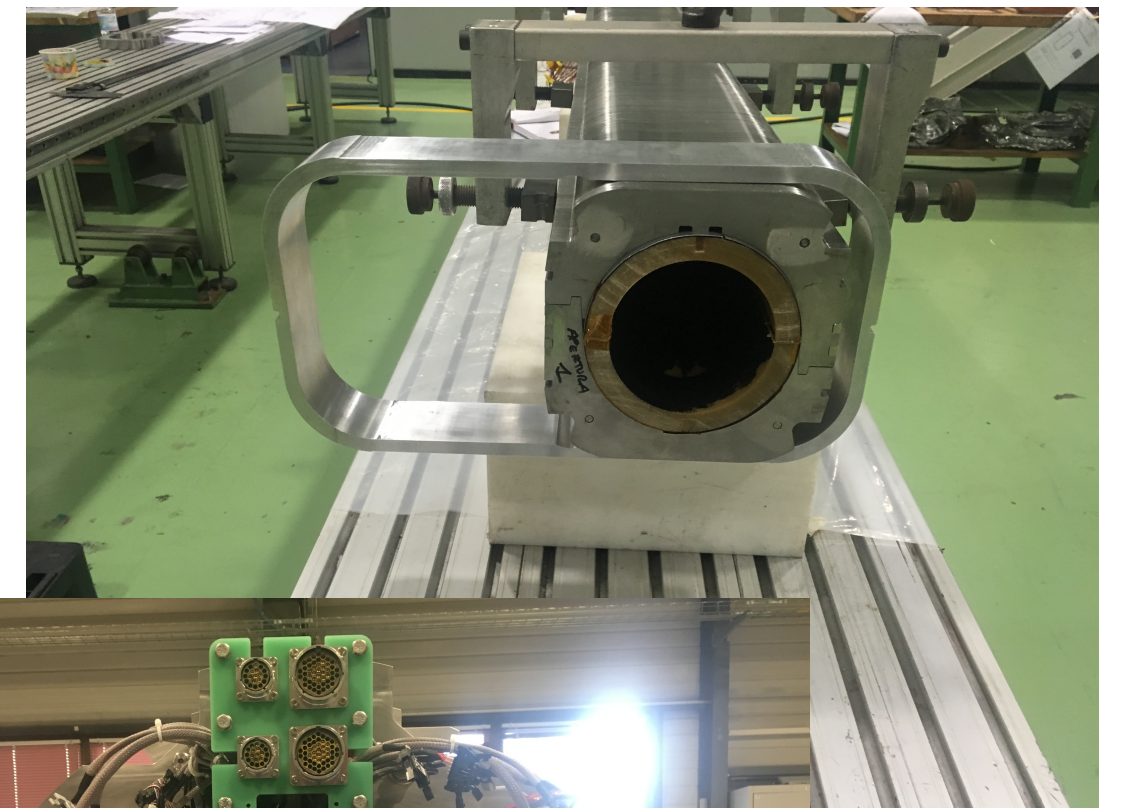
## ↪ Mu2e transfer solenoid

- ↪ 52 NbTi, Al-stabilised solenoids
- ↪ ~ 1 m diameter, different sections
- ↪ shrink fitted
- ↪ assembly in a complex structure



## ↪ MBRDS

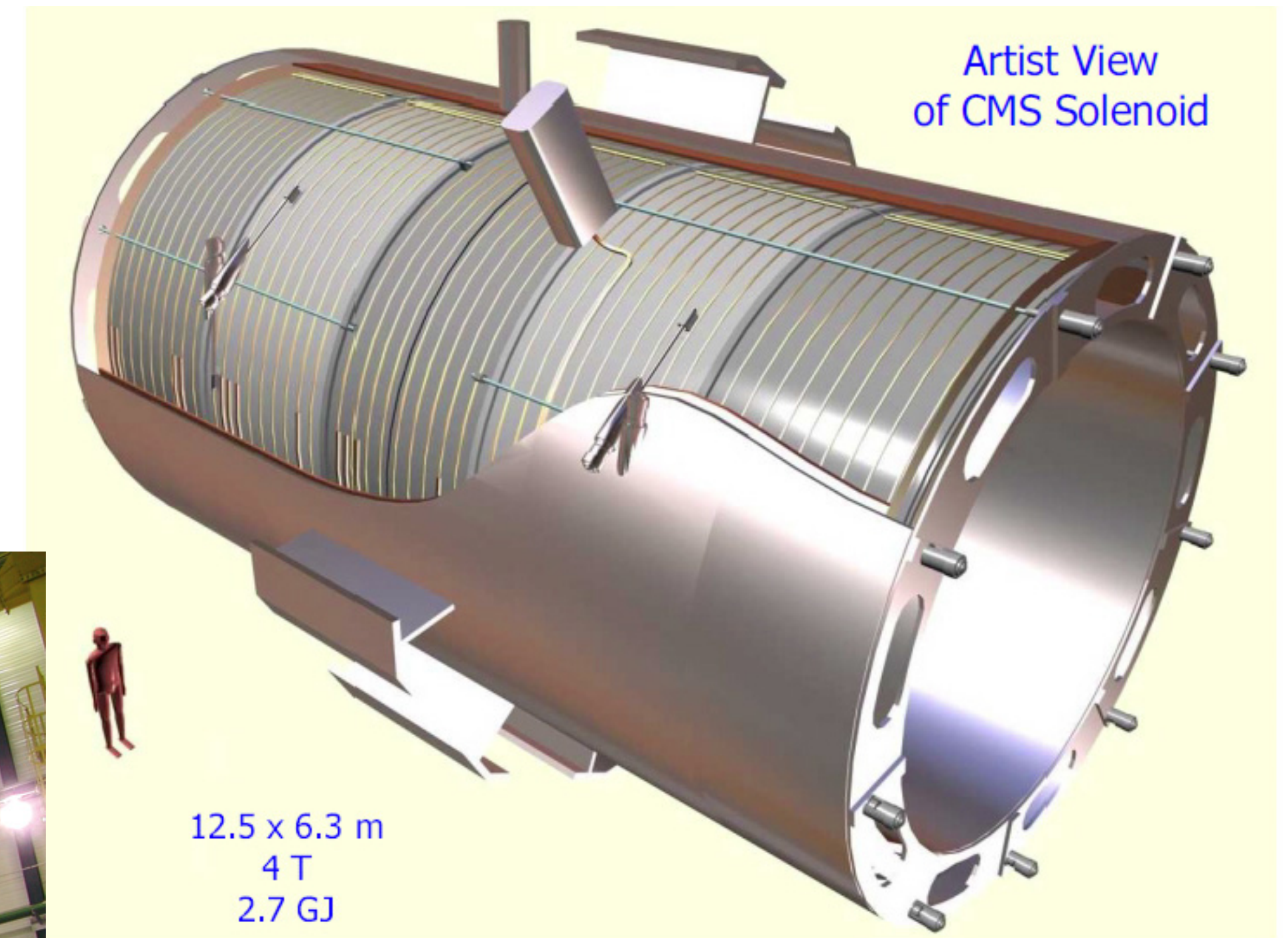
- ↪ two apertures recombination dipole
- ↪ 4.5 T, 8 m long, NbTi
- ↪ 1 model, 1 prototype, 6 magnets
- ↪ quite novel design





# Past joint activities: CMS

- ↪ Largest HEP solenoid in the world
- ↪ pure aluminium stabilised NbTi
- ↪ cable reinforced with aluminium alloy
- ↪ central field: 4 T
- ↪ 12.3 m long, 6.8 m diameter
- ↪ built in segments





# Past joint activities: BaBar

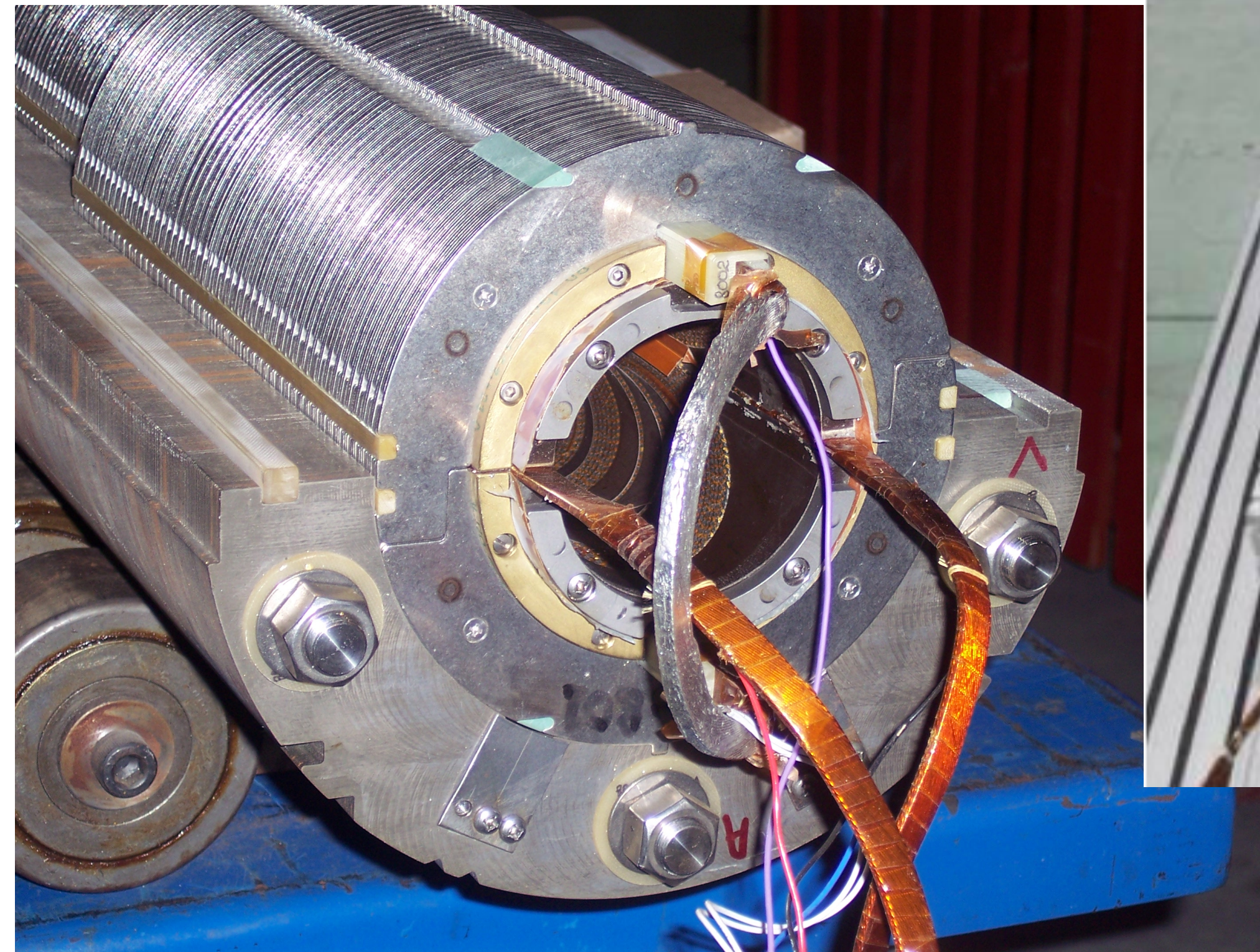
- Thin solenoid, aluminium stabilised NbTi
- central field: 1.5 T
- uniformity on the tracker:  $\pm 2\%$
- cryostat inner radius: 2.8 m
- winding length:  $\sim 4$  m
- graded conductor





# Past joint activities: DiSCoRaP

- ↪ Curved fast ramp dipole for SIS300 at FAIR
- ↪ nominal field: 4.5 T
- ↪ ramp rate: 1 T/s
- ↪ coil aperture: 100 mm
- ↪ length: ~ 4 m
- ↪ curvature angle:  $3.3^\circ$





# Final considerations

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- ↪ In our opinion, ASG has demonstrated the capability to build DUNE ND magnet
- ↪ Other companies in Europe have probably this capability
  - ↪ namely, Bilfinger Noell in Germany, less suitably Tesla or Oxford Instrument in the UK
- ↪ As far as we know, no company in Europe can provide the cable
- ↪ INFN Genova magnet group expresses great interest in this activity