

## INTRODUCTION

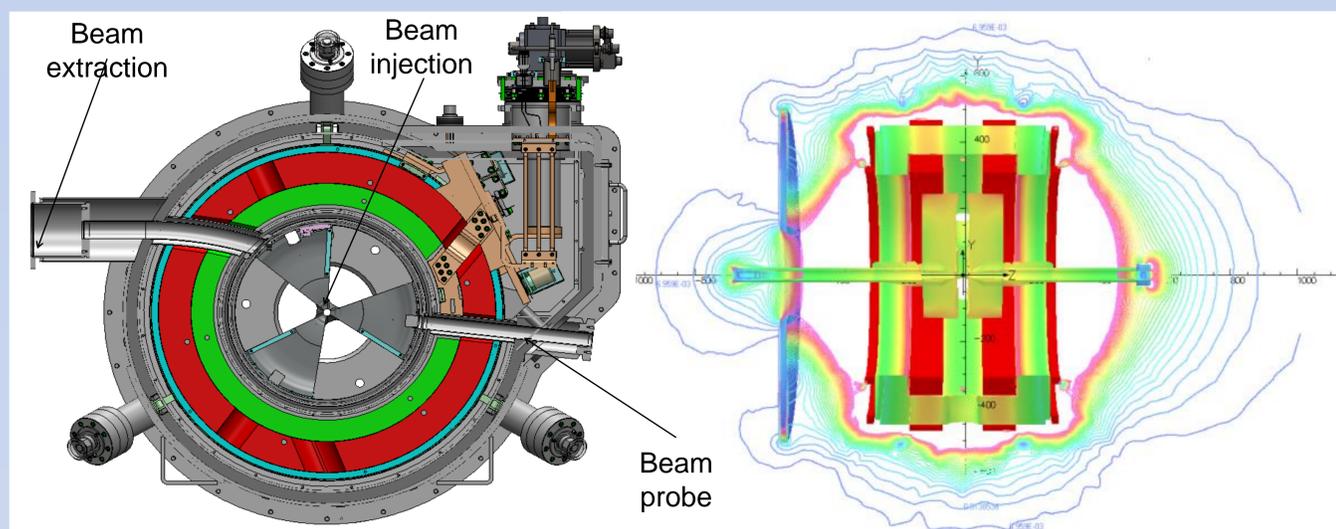
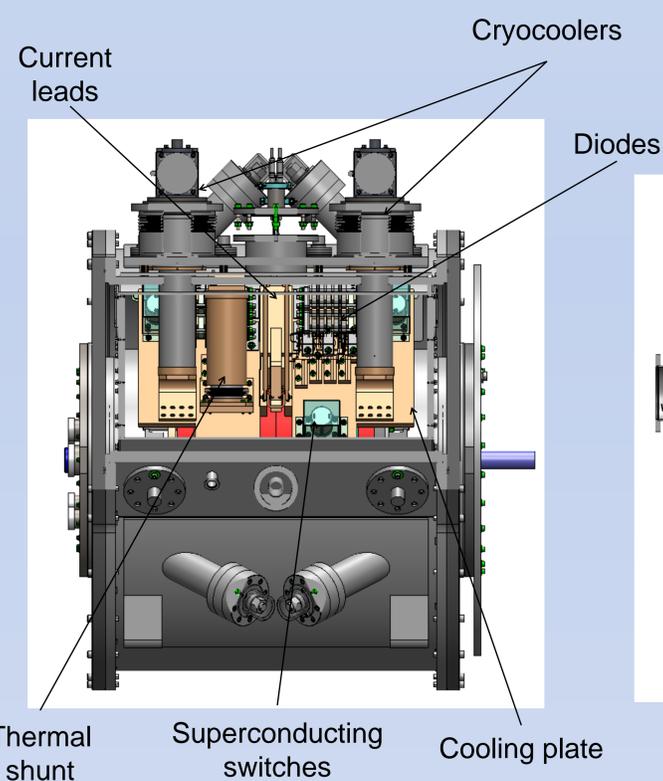
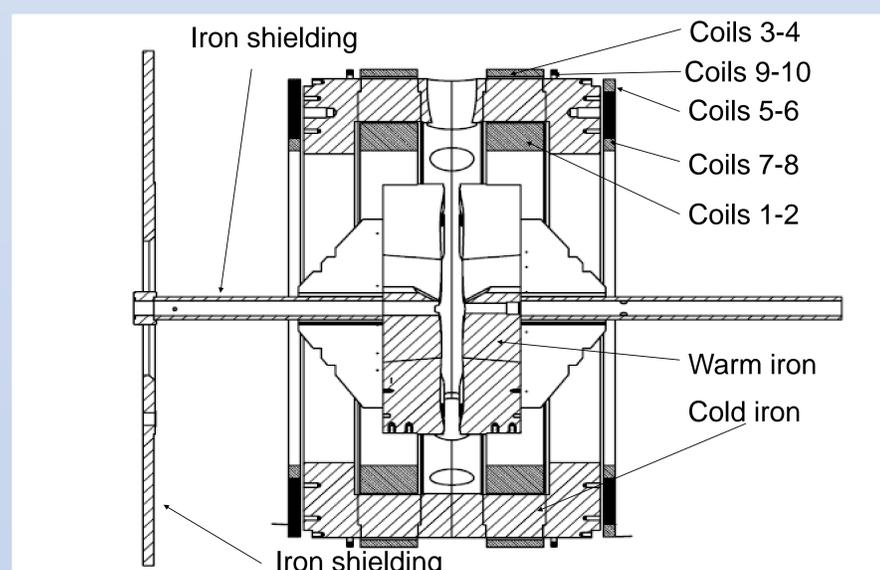
CEA labs (I2BM, IRFU, LETI, LIST) and two industrial companies PMB and SIGMAPHI are engaged in a large R&D project for developing an innovative compact fully automated system dedicated to radioisotope production. SIGMAPHI is developing in collaboration with CEA Irfu a helium free superconducting magnet for this project.

This magnet features a 514 mm warm bore and 2.35 T field. The total weight is 3 tons and the magnet is operated in persistent mode with two cryocoolers.

This project has started in October 2012 and the magnet design is now completed. The prototype manufacturing have started in September 2015 and will be completed in 2016.

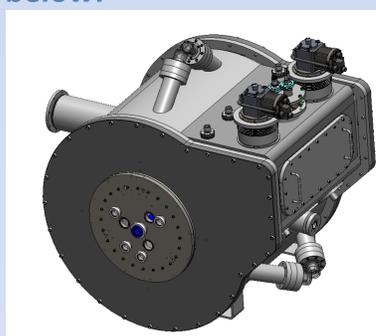
Main technical objectives are the following:

- Solenoid axial field: 1.777 T
- Warm bore: 514 mm
- Central field with cyclotron warm iron: 2.35 T
- Persistent operating mode: current decay  $\leq 10^{-4}$  per year
- Cryogen free
- Cool down time  $\leq 14$  days
- Compact dimensions
- Mechanical interfaces with the cyclotron: RF cavity, Beam injection, Beam probe, Beam extraction
- Radiation resistant up to 1 Mrad



A full set of Finite Analysis Element was performed to check the magnet design. Main parameters are listed below:

- Field at magnet centre: 2.35 T
- Coil peak field: 4.6 T
- Stored energy: 421 kJ
- Operating current: 90.6 A
- Shimming current: +/- 10 A
- Quench peak voltage: 2kV
- Quench peak temperature: 105K
- Heat load: 26.6 W @ 55K and 1.3 W @ 5K
- NbTi conductor weight: 256 kg (1.08 x 0.68 mm<sup>2</sup>) and 2.6 Kg (0.36mm)
- System total weight: 3 tons
- Cool down time: 10 days



## CONCLUSION

The design meets the expected performances. A magnet prototype is under construction at Sigmaphi for final validation. A specific winding line and testing cryostat was built for this purpose. First prototype coil manufacturing has started and the full prototype assembly and testing is expected in 2016.