

## HiLumi LHC



MAGNETS  
FOR FUSION



MAGNETS FOR HIGH  
ENERGY PHYSICS



MAGNETS FOR  
MEDICAL  
APPLICATIONS



SYSTEMS  
FOR ENERGY



SERVICES & REPAIRS



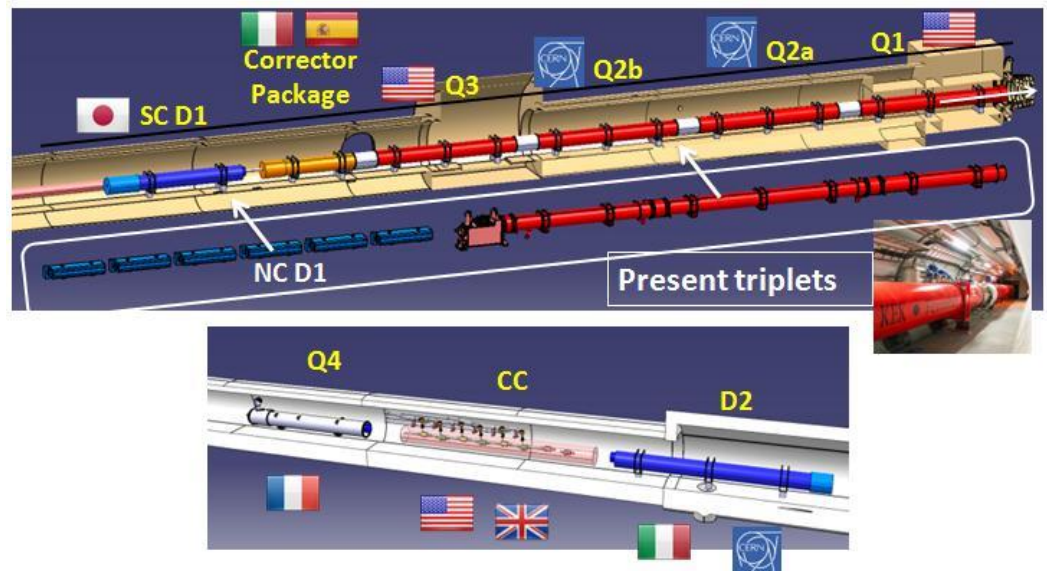
ASG Superconductors was involved in the research program for the Hi-Lumi LHC since September 2014 until October 2017.

An engineer and two technicians were permanently relocated at CERN's premises for this purpose, working in close collaboration with the CERN team.

In particular, the job was focused on the two main projects for the upgrade of the LHC:

- The MQXF quadrupoles, that will replace the existing ones in the interaction region of the collider;
- The 11T dipoles, which will replace selected existing dipoles in the dispersion suppressor regions of the machine, to create space for additional collimators.

ASG has collaborated with CERN for the development of the prototypes for these magnets, starting from short models of reduced length with respect to the final one, to switch then to real scale magnets.



**Magnets in the framework of HiLumi-LHC (courtesy of CERN)**



MAGNETS FOR FUSION



MAGNETS FOR HIGH ENERGY PHYSICS



MAGNETS FOR MEDICAL APPLICATIONS

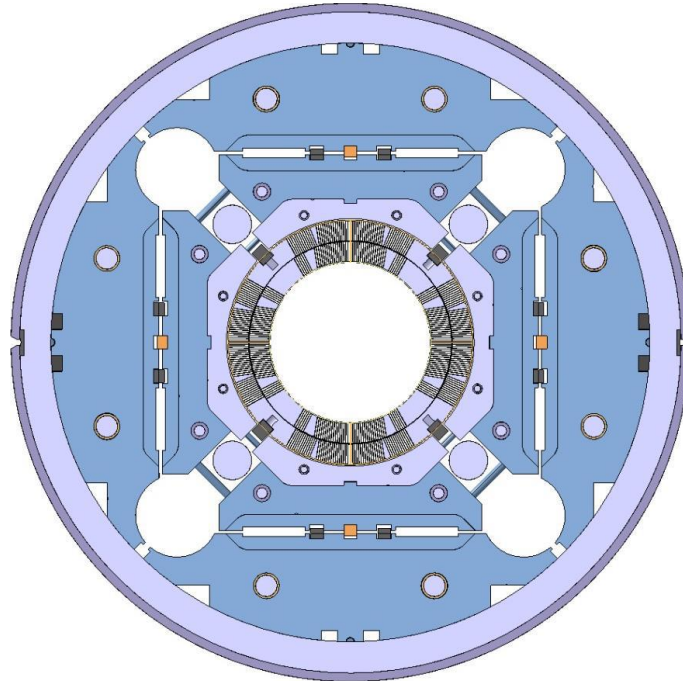


SYSTEMS FOR ENERGY



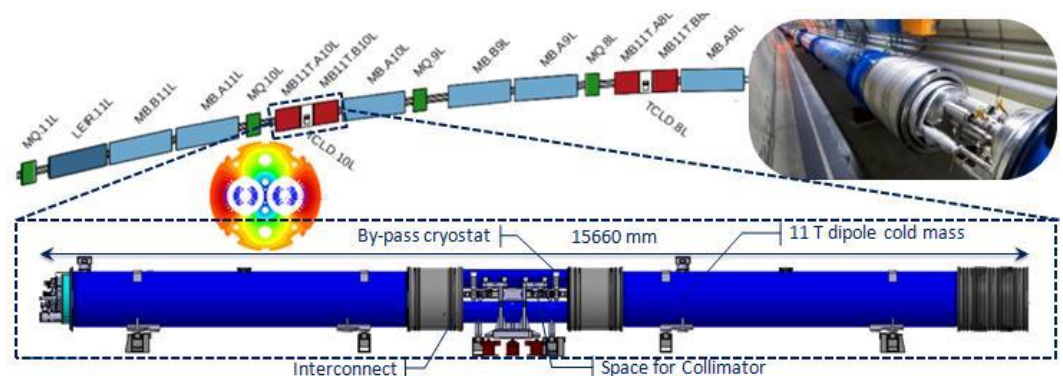
SERVICES & REPAIRS

As to the quadrupoles, ASG has collaborated to the short models of the cold mass, in particular to the manufacturing of several short coils, in order to set up the production process and to test these coils in short models of the cold mass.



*cross section of the MQXF quadrupole (courtesy of CERN)*

As to the 11T dipoles, ASG was first in charge of the design of the tools for the assembly and collaring of the long coils, and then of the real assembly operations. A total of three apertures have been assembled and collared, one with low performance coils, and two with full performance coils, which have then been installed in the full-scale prototype of the 11T magnet.



*The 11T dipoles (courtesy of CERN)*



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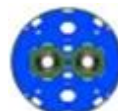
SERVICES & REPAIRS



**MQXF**

Type	Single aperture
Aperture	150 mm
Gradient	132.6 T/m
Peak field	11.4 T
Current	17.45 kA
Cable Material	Nb <sub>3</sub> Sn
Temp margin	4.5 K
Length	2x7.2 m

To be installed in 2023-'24



**11T**

Type	Two-in-one aperture
Aperture	60 mm
Field	11 T
Current	11.85 kA
Cable material	Nb <sub>3</sub> Sn
Length	2x5.5 m

To be installed during different shutdowns