ENERGETICS

MUR DM 118 - Design and multi-physics modeling of 20 T superconducting magnets for particle accelerators and for fusion machines

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] Politecnico di TORINO [P.iva/CF:00518460019]
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Context of the research activity	The PhD topic focus on the multi-physics modeling of 20 T superconducting magnets for particle accelerators and for fusion machines, that would help in the design of sound devices that would allow to increase the machine performance. The accelerators magnets will be targeted first, and the fallout on the fusion magnets will follow. Progetto finanziato nell'ambito del PNRR – DM 118/2023 - CUP E14D23001610006
Objectives	Next generation of superconducting magnets for particle accelerators and fusion applications will operate at a magnetic field of 20 T. At this field level, High Temperature Superconductors (HTS) are the only viable option, possibly combined with traditional Low Temperature Superconductors (LTS) like Nb3Sn and Nb-Ti in so-called hybrid configurations. The most promising HTS materials currently under consideration by both the accelerators and fusion magnet community are Bi2212 and REBCO. These superconductors are characterized by outstanding current-carrying capability at very high field, but are also prone to significant degradation when subjected to high strain. It is therefore extremely important to support the design and analysis of these magnets with modeling tools that can simulate simultaneously their mechanical, magnetic and thermal status during assembly, cool-down, powering and quenching. We propose here to develop multi-physics finite element codes aimed at modeling the thermo-magnetic-mechanical behavior of 20 T superconducting magnets designed to operate in future colliders and fusion reactors.
Skills and competencies	

competencies for the development of the activity	Know-how in superconductivity, nuclear engineering and numerical modelling.