PhD in Energetics

Research Title: Sfide tecnologiche per il reattore a fusione termonucleare ARC/SPARC

(The design of Affordable Robust Compact (ARC/SPARC) reactor)

Funded by	ENI

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Context of the research activity	A new keystone for fusion energy has been achieved, namely high temperature superconductors (HTS), now available on industrial scale, are able to tear down one of the most concerning issues of this research field, it is possible indeed to shrink the size of a tokamak without undermine its power, this would lead to way cheaper reactors and thus electricity, someday. The design of Affordable Robust Compact (ARC) reactor, a Tokamak concept proposed by MIT (Massachusetts Institute of Technology) and PSFC (Plasma Science and Fusion Center) scientists, relies on these premises [1]. [1] B.N., Sorbom, et al. ARC: A compact, high-field, fusion nuclear-science facility and demonstration power plant with demountable magnets. Fusion Engineering and Design 100 (2015) 378-405.

Objectives	Many studies are being carried out and planned at POLITO, either onsite and in collaboration with MIT-PSFC, such as neutronics, neutron-induced radioactivity, estimate of tritium inventory, tritium transport, accidental analysis, release scenarios, estimate of doses to population and workers, thermomechanical analyses, design and optimization of components (vessel, blanket, magnets), transport phenomena for liquid metals and molten salt in magnetic fields [2,3]. This research activity, in particular, will be focused on thermomechanical analyses, design and optimization of components (such as divertor, vessel, blanket, magnets), main load identification. thermal requirements and neutronic interaction with materials. Also modeling and experimental activity on transport phenomena for

	liquid metals and molten salt in magnetic fields, by means of specific tools such as MATLAB and COMSOL The research activity will be carried out in part at POLITO and in part at MIT/PSFC. [2] S. Segantin, D. Whyte, M. Zucchetti, Fusion Energy and the ARC Project, International Journal of Ecosystems and Ecology Science (IJEES), 7,4 (2017) 839-848. [3] S. Segantin, R. Testoni, M. Zucchetti, The lifetime determination of ARC reactor as a load-following plant in the energy framework, Energy Policy 126 (2019) 66-75.

Skills and competencies for the development of the activity	Specific knowledge and skills in the field of nuclear engineering, radiation protection, engineering of high-field tokamaks. At least three/six months of computational/experimental activity in a university/research centre in this specific field