PhD Programme	**FUSION SCIENCE AND ENGINEERING**
Curriculum *(if foreseen)*	
Type of scholarship	Ex DM 117/2023
Project title	The role of fusion in future energy carbon-free scenarios
Supervisor	Giuseppe Zollino
Supervisor Email	giuseppe.zollino@unipd.it
Project description	In the pathway towards EU economy decarbonization, nuclear technologies will cover a crucial role together with renewables and energy storage technologies. Nuclear power plants, thanks to their high capacity factor, can provide stable and continuous carbon-free electricity to cope with the increasing electrification of the energy sectors, enhancing security of electricity supply. Nuclear fusion offers the opportunity of generating electricity through inherently-safe fusion reactions and with limited low-activated material production; in particular no high level radioactive waste will be produced. The doctoral research is aimed at studying nuclear fusion as part of a future carbon-free energy system for the identification of benefits and hurdles of the technology deployment for a smooth integration with renewables. Energy scenarios will be developed and the studies will cover a variety of topics, ranging from economy, energy policy, climate policy, energy technologies development.
Mandatory traineeship	6
Company cofinancing	Eni SpA

PhD Programme	**FUSION SCIENCE AND ENGINEERING**
Curriculum ***(if foreseen)***	
Type of scholarship	Ex DM 117/2023
Project title	Development of Machine Learning methods to detect and solve failures in plasma diagnostics
Supervisor	Lidia Piron
Supervisor Email	lidia.piron@unipd.it
Project description	In the next years, the DTT device will contribute on identifying reliable and robust solutions for the power load and particle exhaust. To control the plasma dynamics and to monitor the plasma performance, DTT will be equipped with a wide range of diagnostics. To guarantee robust and reliable DTT operations, it is of paramount importance that the signals are reliable, especially the ones exploited for real-time machine protection. However, possible failure of signals can occur. To overcome this problem, a brand-new solution, which will be investigated in this PhD work, consists in the use of Machine Learning (ML). Once trained in a widespread operational database, ML methods will i) enable real-time health monitoring of the signals, with discrepancies between the learnt and actual responses highlighting an early indication of sensor failure and ii) will solve failure in diagnostics, supplementing missing data.
Mandatory traineeship	6
Company cofinancing	ENI SpA

PhD Programme	**FUSION SCIENCE AND ENGINEERING**
Curriculum *(if foreseen)*	
Type of scholarship	Ex DM 117/2023
Project title	Modelling and development of controllers for DTT
Supervisor	Lidia Piron
Supervisor Email	lidia.piron@unipd.it
Project description	In the next years, the DTT device will contribute on identifying reliable and robust solutions for the power load and particle exhaust in a reactor. To guarantee a successfully DTT operation, beside machine integrity, the plasma dynamic will be monitored in real-time by the plasma control system (PCS). The PCS will orchestrate the outputs from several diagnostics and will send actions to plasma actuators to tailor the plasma behavior and to regulate the proximity of the operation point to critical boundaries. Within this PhD project, the candidate will develop physics- and model-based Matlab Simulink controllers for DTT PCS.
Mandatory traineeship	6
Company cofinancing	DTT S.c. a r.l.

PhD Programme	**FUSION SCIENCE AND ENGINEERING**
Curriculum *(if foreseen)*	
Type of scholarship	Ex DM 117/2023
Project title	Analysis and development of a numerical code to simulate the behaviour of a high-frequency solid-state power amplifier for ICH systems
Supervisor	Paolo Bettini
Supervisor Email	paolo.bettini@unipd.it
Project description	Several controlled nuclear fusion experiments have been operated worldwide in the last decades, and a few (e.g., DTT and SPARC) are going to be built to support the first demonstration fusion reactors Both DTT and SPARC need a significant amount of additional heating that will be provided to a smaller or larger extent by an Ion Cyclotron Heating (ICH) system, able to inject electromagnetic waves into the plasma at the cyclotron frequency of the ion species. The aim of this PhD research is to develop a predictive model of high-power, solid-state RF amplifiers so as to simulate their behaviour in the real operational conditions as to Voltage Standing Wave Ratio (VSWR) and its rapid changes. The study resulting from this modeling would allow to fill the gap due to the missing direct experience of such systems on fusion plasmas, and could be used in the design of machines such as SPARC, ARC and DTT.
Mandatory traineeship	6
Company cofinancing	Eni SpA

PhD Programme	**FUSION SCIENCE AND ENGINEERING**
Curriculum *(if foreseen)*	
Type of scholarship	Ex DM 117/2023
Project title	Development of the injector for the DTT Neutral Beam Injection system
Supervisor	Paolo Bettini
Supervisor Email	paolo.bettini@unipd.it
Project description	The main purpose of the Divertor Tokamak Test facility (DTT) is to study solutions to mitigate the issue of power exhaust in reactor relevant conditions. In this context, the principal objective of DTT is to mitigate the risk of a difficult extrapolation to a fusion reactor of the conventional divertor based on detached conditions, which will be tested in ITER. The key feature is to equip the machine with a significant amount of auxiliary heating power to test innovative divertor concepts. The goal of this PhD work is to optimize the design of the main components of the beamline for DTT NBI and give support to the work team during the conceptual design and engineering design phases. The candidate will be trained on the usage of the necessary simulation codes by the design team and followed during the development of the design solutions.
Mandatory traineeship	6
Company cofinancing	DTT S.c. a r.l.