PhD in "Fusion Science and Engineering"
Università di Padova - Napoli "Federico II"

Call for admission to the PhD courses 2020/21 (XXXVI cycle)

Research Topics reserved to employees of Consorzio RFX

PROJECT TITLE	Investigation of corrosion-erosion phenomena in primary cooling circuits of reactor components
CONTACT PERSON	Mauro Dalla Palma mauro.dallapalma@istp.cnr.it
SHORT DESCRIPTION	Corrosion-erosion phenomena occurring in actively cooled in-vessel components and primary heat transfer systems are problems to be monitored and controlled to improve experimental performance of nuclear fusion facilities and to support reliable operations in reactor perspective. In particular, demineralised water circulating in cooling channels of hit sink components reacts with inner channel surfaces made of copper alloys, aluminium, and stainless steel thus producing thinning of cooling channel walls and eventual plastic deformation under applied loads. Then, resistivity degradation of the demineralised water and failure at component cooling channels shall be analysed to plan maintenance and replacement operations to maintain maximum availability of the systems. Local and distributed corrosion-erosion phenomena can be investigated considering dissolved O_2 and CO_2, pH, flow velocity and turbulence, galvanic corrosion at dissimilar metal junctions, temperature, and water conductivity. Moreover, drying procedures required to avoid water spreading and contamination can enhance the corrosion phenomenon with trapped impurities in the system. Causes of water resistivity degradation and cooling channel corrosion-erosion will be investigated by the candidate in the components and plants of the ITER Neutral Beam Facility. Tests on wet specimens with demineralised water under controlled conditions can be performed using the Insulation and Cooling Experiment facility.

PROJECT TITLE	Integration of open source frameworks in industrial plant control systems for large experimental facilities
CONTACT PERSON	Gabriele Manduchi gabriele.manduchi@istp.cnr.it
SHORT DESCRIPTION	Industrial plant controls rely on well-established solutions ensuring high quality standards. A drawback of such systems is given by the slow adaptation of existing solutions to the rapid evolution of both Hardware and Software technologies. Moreover, the requirements of large experimental facilities are often more stringent than those of traditional industrial plants, requiring separate ad-hoc components for real-time control and large data management. The optimal balance between industrial systems and ad-hoc solutions targeted to domain specific requirements and often provided by open source systems developed by the specific research community is not yet well established. For example, in ITER a combined usage of industrial systems and open source frameworks is foreseen, but the actual level of integration is still debated. The target of the proposed research topic is to assess the optimal degree of integration, possibly introducing new software layers and components. The Control and Data Acquisition of RFXMod2 and NBTF may be used as case studies.