THE NEUTRAL BEAM TEST FACILITY IN PADOVA: THE NECESSARY STEP TO DEVELOP THE NEUTRAL BEAM INJECTORS FOR ITER

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The neutral beam injectors are an essential ingredient of the mix of heating system to guarantee the ITER goal that is the experimental demonstration of the sustainability of the fusion reactions with a Q factor ranging from 5 to 10 in a stationary condition.
The main requirements of the Neutral beam injector is the capability to deliver to the plasma a total power of 33 MW up to one hour in a stationary condition through the presence of two injectors positioned in two adjacent equatorial ports of the vacuum vessel. This level of power is delivered through a beam accelerated at 1 MV. Each injector is required to accelerate at 1 MV a beam of negative deuterons of 40 A at the exit of the last accelerating grid.
These requirements have never been experimentally assessed and therefore a strong experimental demonstration to optimize the crucial components and systems has been endorsed by ITER. A test facility is presently in the starting phase of construction and procurement. It will be hosted in Italy in the CNR research area of Padova where is operating the Consorzio RFX. The facility requires the construction of new buildings covering a surface of 2 hectares and the adaptation of the existing 400 KV power substation. To the facility site and the overall activities on the experimental devices installed in it has been assigned the name of PRIMA (Padova Research on ITER Megavolt Accelerator).
The first experimental device hosted into the facility is a full size negative ion source aiming to demonstrate the capability to create and extract a current based on negative Deuteron/Hydrogen ions up to approximately 50/60 A on a wide surface (more than 1 m^2) with an uniformity within the 10 %. To this device has been assigned the name of SPIDER (Source for the Production of Ions of Deuterium Extracted from Rf plasma). All the experimental plants and components of SPIDER are ready for the procurement phase. To the construction of this device it is involved also the Indian Domestic Agency in charge of the procurement of the diagnostic beam injector (DNB) for ITER. The diagnostic beam injector shares some requirements and components with SPIDER and therefore this last will be also a prototype for some components and technologies to be applied in the DNB.
The second experimental device is the prototype of the ITER injector aiming to develop all the knowledge and the technologies to guarantee the successful operation of the two injectors to be installed in ITER. To this device has been assigned the name of MITICA (Megavolt ITer Injector and Concept Advancement). To the construction of MITICA there will be the contribution of the Japan Domestic Agency in charge for the procurement of the 1 MV power supplies, the 1 MV transmission line and the 1 MV bushing between the transmission line and the injector vacuum vessel. Many MITICA plants and components are well developed and close to be ready for the procurement.
To the success of this enterprise are cooperating also some European laboratories: KIT-Karlsruhe, IPP-Garching, CCFE- Culham and other European research institutions.
In the paper the main requirements will be discussed as well as the design of the main components and systems will be described. Finally the planning of the overall facility will be presented.