

Final Design of the Beam Source for the MITICA Injector

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The MITICA experiment (Megavolt ITER Injector & Concept Advancement) is the prototype and the test bed of the Heating and Current Drive Neutral Beam Injectors (HNB), which will be necessary for the full-performance exploitation of ITER. MITICA injector experiments shall demonstrate the reliable and accurate emission of a 17 MW beam of neutral particles of deuterium or hydrogen for duration up to 1 hour, fulfilling ITER specific requirements. MITICA test bed is in the final design phase and will be procured and installed in PRIMA facility (Padova Research on Injector Megavolt Accelerated) in Padova, Italy. The beam source is the key component of the system, as its goal is the generation of the 1 MeV accelerated beam of deuterium or hydrogen negative ions. The beam source is a complex system, having overall dimensions in the order of 4x4x3 m³ and a weight of around 20 tons.

A major effort has been put in place in the recent months for the design closure, in collaboration with ITER Organization, F4E and European and Japanese laboratories (IPP, CEA, JAEA), solving the remaining outstanding issues, namely the optimization of the thermo-mechanical behavior of the accelerator grid segments subjected to a substantial heat power deposition, the finalization of the mechanical structure of the accelerator coherently identifying a reliable assembly and alignment procedure, the completion of the design of all involved interfaces with surrounding components and maintenance tools, and the conclusion of last R&D campaign on large ceramic insulators.

Comprehensive analyses have also been carried out to finally verify the structural and electrostatic design of the overall structure with regard to normal operation, main fault conditions and seismic events.

This paper presents the highlights of the latest developments for the finalization of the MITICA beam source design, together with a description of the most recent analyses and R&D activities carried out in support of the design.

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