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Status of the Negative Ion Based Neutral Beam Injectors for ITER

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The R&D effort for the large surface area negative ion source for the neutral beam injectors of the International Tokamak Experimental Reactor (ITER) is well underway and results and achievements are reported in many contributions to this conference as well as the technical details of the multi aperture multi grid RF ions source chosen as the ITER ion source. This contribution highlights the status of the integration of the Heating Neutral Beam (HNB) and the Diagnostic Neutral Beam (DNB) systems into the ITER plant.

The current ITER baseline foresees 2 HNB's operating at 1 MeV 40 A D^0, each capable of delivering 16.5 MW of deuterium ions to the plasma, with a 3rd HNB injector foreseen as an upgrade option that would bring up the total neutral beam power to 50MW [1]. In addition a dedicated DNB will be injecting 100 keV 60 A of H^0 for charge exchange recombination spectroscopy (CXRS) [2]. Installation and maintenance logistics as well as the nuclear environment have strongly influenced the injector design. The beam line configurations have been optimised considering vacuum and gas feed requirements with special attention paid to the controlled transmission over long lengths (~22m) and through narrow ducts. The manufacturing technologies and the materials chosen have to be compatible with the ITER safety constraints.

The ITER operating scenarios will be briefly discussed and the required performance parameters emphasised, such as the HNB operation at 870keV H^0 hydrogen ions in the planned low current hydrogen phase which will allow commissioning of the auxiliary systems used on ITER.

References

[1] R. Hemsworth, et. al., Nuclear Fusion, 49 (2009) 045006
[2] A. Chakraborty., et. al., IEEE Transactions on Plasma Science, 38 (2010) 248