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ITR/P1-03: Status of the Negative Ion Based Diagnostic Neutral Beam for ITER

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In ITER a dedicated 100keV Diagnostic Neutral Beam (DNB) based on negative ion technology will be injecting 18-20A of hydrogen to provide helium ash measurements via Charge Exchange Recombination Spectroscopy (CXRS). The CXRS diagnostics will also provide measurements of ion temperatures and other essential plasma parameters and the DNB will also be used for Beam Emission Measurements (BES). Recently on-axis Motional Stark Effect (MSE) has been proposed as an additional complementary diagnostics. Reliable DNB performance predictions are essential input parameters for the design of the diagnostic systems which will pass the conceptual design stage this year. They also assure the correct characterization of all ITER interfaces to allow safe operation of the ITER plant. The expected performance parameters of the system will be critically re-assessed taking into account the recently increased neutral edge density predictions in the plasma chamber. The DNB duty cycle will be discussed in detail, indicating all operational limitations identified in the design phase.
An overview of the current status of the DNB system and the interface constraints will be given. The consolidated design, including the recently updated magnetic field reduction system, will be presented and the most challenging design features highlighted. While the performance of the RF ion source –identical to the one used in the Heating Neutral Beams but operated at much more challenging current densities - will be demonstrated in the dedicated Ion Source Test Bed SPIDER in Padua, the full DNB Beamline will be demonstrated in the Indian Test Facility (INTF). The INTF will specifically allow far-field measurements to confirm the beam divergence and allow reliable predictions of the DNB power delivered to the plasma. This parameter is essential for obtaining dependable signal to noise estimates for the design of the diagnostic systems.
Procurement of the DNB Beamsource, part of the DNB power supplies and the proto-type DNB beamline components will start in 2012, while the INTF building premises are already available. The availability of the DNB as a diagnostic tool in the hydrogen/helium phase will be discussed shortly looking both at the shine through limitations and the commissioning planning to identify the earliest date the DNB will be available for CXRS measurements.

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