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Ion Source Development at IPP: on the Road Towards Achieving the ITER-NBI Targets and Preparing Concepts for DEMO

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ITER's neutral beam injection (NBI) systems are based on generation of negative hydrogen ions in a caesiated RF-driven ion source, their electrostatic acceleration and neutralisation in a hydrogen gas target. The large ion source (0.9 m×1.9 m) with 1280 apertures has to deliver 57 A D⁻ for 3600 s (286 A/m²) and 66 A H⁻ for 1000 s (329 A/m²). The RF ion source test facilities ELISE and BUG at IPP are aimed to demonstrate the ion source parameters, the homogeneity of the large beam (roughly 1 m×1 m) and its divergence. While the ITER parameters could be demonstrated in hydrogen, the achievement in deuterium for long pulses is still pending due to the large fraction of co-extracted electrons, their temporal dynamics and inhomogeneity in vertical direction, limiting the ion source performance. The contribution summarizes the achievements and challenges experienced in view of ITER and reports on the IPP contributions to an EU DEMO (DEMONstration reactor) based on a similar source concept.

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