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P2.026 Advanced NBI beam characterisation capabilities at the recently improved test facility BATMAN Upgrade

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The test facility BATMAN was dedicated since its start in 1996 to the development of radio frequency driven negative hydrogen ion sources for ITER NBI with focus on formation and extraction of negative ions, technological developments and improved concepts. During 2017 the test facility has been upgraded in order to replace the former extraction system (which was derived from a positive ion accelerator from ASDEX Upgrade) with a new ITER-like extraction system comparable in size to an ITER beamlet group. In addition to the standard three grids extraction system a repeller electrode upstream of the grounded grid is installed which can be positively biased by 2 kV with respect to the grounded grid for reducing the amount of back-streaming positive ions and space charge blow up of the beam. For the magnetic filter field a current of up to 3 kA can be driven through the plasma grid, as well as permanent magnets embedded into a diagnostic flange or in an external magnet frame.
BATMAN Upgrade will focus now on the properties of a beam with an ITER relevant extraction system. One of the main diagnostics is beam emission spectroscopy with line of sight located at two positions from the grounded grid (26 cm and 130 cm) with spatial resolution in vertical direction. A newly developed tungsten wire calorimeter placed just 20 cm downstream of the grounded grid should provide quantitative measurements of individual beamlets, while the previous tungsten wire calorimeter at 2 m distance is still in use for qualitative beam profile diagnostic. Together with a beam dump calorimeter with a crosswise arrangement of thermocouples, beam divergence and uniformity can be studied. This is accompanied by modeling of the meniscus formation, the beam optics, and the beam transport up to the calorimeter with simulated BES diagnostics.

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