Contribution ID: **56** Type: **Oral**

BATMAN Upgrade: general results from beam optics studies

Friday 7 October 2022 10:00 (30 minutes)

The BATMAN Upgrade (BUG) test facility at IPP is contributing to the development of RF-driven H^- sources towards the ITER neutral beam injection and beyond. BUG is equipped with an 1/8 size of the ITER NBI ion source and thus is highly flexible for setup changes or diagnostic access. The extraction and acceleration system consists of three grids (plasma grid PG, extraction grid EG and grounded grid GG, up to 45 kV total high voltage) with one beamlet group of 14x5 apertures. To cancel out the row-wise horizontal zig-zag deflection of the extracted beam caused by the alternating vertical polarity of the co-extracted electron suppression magnets installed in the EG, additional asymmetric deflection compensation magnets have been installed in the upper half of the EG.

One target of BUG are studies of whole beam and beamlet optics; for the latter, an individual beamlet is isolated in the upper half of the beamlet group. BUG is well equipped with beam diagnostics, among them is a CFC tile calorimeter, which is used to determine the divergence of the isolated, single beamlet and Beam Emission Spectroscopy, which is installed at a total of 16 lines of sight at two different axial positions. A robust compensation of the zig-zag compensation for the design parameters could be verified by these diagnostics. General results from beam optics investigations –in particular the dependence of the source filling pressure, the magnetic filter field and the influence of the PG bias –are summarized in this contribution and its impact on full-size sources for NBI is discussed.

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Session Classification: Oral session 11

Track Classification: 4. Beam formation and low energy transport