



Recent results from neutral beam source calibration by means of the novel Absolute Beam Monitor

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The IMAP mission by NASA is dedicated to extending the physical understanding of our heliosphere and its interaction with the interstellar medium by enhancing and refining the results obtained from IBEX. The neutral atom analysis instrument IMAP-Lo will observe and map fluxes of low-energy heliospheric neutral atoms (ENAs) and interstellar neutral (ISN) H, D, He, O and Ne with energies as low as 10 eV up to 1000 eV.

The instrument testing and calibration with a neutral atom beam is foreseen in the MEFISTO test facility for ion and neutral particle instruments at the University of Bern. MEFISTO is equipped with an electron-cyclotron resonance ion source that provides ion beams at a beam energy 3keV/q up to 100 keV/q. The beam fed into the test chamber is decelerated to 10 eV/q – 3 keV/q and effectively neutralized in a removable neutralization stage via surface reflection on a highly polished single crystal tungsten surface. The relative neutral beam intensity is permanently monitored via the neutralizing surface current. The neutralization process induces a considerable reduction of particle kinetic energy and conical widening of the neutral beam.

Thus, one key improvement for the calibration of a neutral atom instrument such as IMAP-Lo is to be able to measure the absolute neutral particle flux and beam energy into the instrument in the test chamber. To achieve this goal, the Absolute Beam Monitor (ABM) was developed recently.

The ABM is a dedicated laboratory device for absolute neutral particle flux measurements below 3 keV and coarse kinetic energy determination. Neutrals entering the ABM aperture strike a single crystal W conversion surface at grazing angle and are reflected into a channeltron to generate a stop pulse. The simultaneous monitoring of secondary electrons released at the W surface as start signal, the stop signal and the coincidence event rate allows inferring the rate of neutral atoms into the ABM aperture. The average neutral beam energy is obtained from the start-stop time-of-flight spectrum. The ABM is the first and so far the only device to measure the absolute neutral atoms flux in this low energy range below a few 100 eV. It serves as a primary standard for gauging the MEFISTO neutral beam source.

We report on recent calibration results of neutral H, He, O, Ne beams in the 10 eV – 1 keV energy range with the ABM in MEFISTO.