Determination of Flux-Gate Magnetometer Spin Axis Offsets with the Electron Drift Instrument

Ferdinand Plaschke (1), Rumi Nakamura (1), Lukas Giner (2), Robert Teubenbacher (3), Mark Chutter (4), Hannes K. Leinweber (5), and Werner Magnes (1)

(1) Space Research Institute, Austrian Academy of Sciences, Graz, Austria (ferdinand.plaschke@oeaw.ac.at), (2) Graz University of Technology, Graz, Austria, (3) Materials Center Leoben Forschung GmbH, Leoben, Austria, (4) University of New Hampshire, Durham, NH, USA, (5) IGPP/ESS, University of California Los Angeles, CA, USA

Spin-stabilization of spacecraft enormously supports the in-flight calibration of onboard flux-gate magnetometers (FGMs): eight out of twelve calibration parameters can be determined by minimization of spin tone and harmonics in the calibrated magnetic field measurements. From the remaining four parameters, the spin axis offset is usually obtained by analyzing observations of Alfvénic fluctuations in the solar wind. If solar wind measurements are unavailable, other methods for spin axis offset determination need to be used.

We present two alternative methods that are based on the comparison of FGM and electron drift instrument (EDI) data: (1) EDI measures the gyration periods of instrument-emitted electrons in the ambient magnetic field. They are inversely proportional to the magnetic field strength. Differences between FGM and EDI measured field strengths can be attributed to inaccuracies in spin axis offset, if the other calibration parameters are accurately known. (2) For EDI electrons to return to the spacecraft, they have to be sent out in perpendicular direction to the ambient magnetic field. Minimization of the variance of electron beam directions with respect to the FGM-determined magnetic field direction also yields an estimate of the spin axis offset.

Prior to spin axis offset determination, systematic inaccuracies in EDI gyration period measurements and in the transformation of EDI beam directions into the FGM spin-aligned reference coordinate system have to be corrected. We show how this can be done by FGM/EDI data comparison, as well.