

Timing technique for determining the crossing parameters of a 2D, non-planar magnetopause

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For a multi-point mission like Cluster, the differences in position and time when each satellite detects a discontinuity like the magnetopause (MP) can be used to infer its orientation, thickness and velocity. This so-called timing technique, which assumes a planar MP, proves reliable and offers an independent check for various single-spacecraft techniques like minimum variance analysis of the magnetic field (MVAB), minimum Faraday residue (MFR) and deHoffmann-Teller (HT) analysis.

We extended the timing method in order to accommodate situations when the MP behaves like a two-dimensional, non-planar discontinuity. This is the case, for example, when the MVAB method provides different individual MP normals, all of them contained approximately in the same plane. Such a configuration can be produced by a local bulge/indentation in the MP or by a large amplitude traveling wave on this surface. We illustrate our technique with a test case and compare the results with those provided by the single-spacecraft techniques of MVAB, MFR and HT analysis.