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How accurately can we determine the reconnection rate for the 2017-07-11 MMS magnetotail reconnection event?

Kevin Genestreti (1), Takuma Nakamura (1), Rumi Nakamura (1), Richard Denton (2), Wiliam Daughton (3), Roy Torbert (4), Robert Ergun (5), James Burch (6), Kyoung-Joo Hwang (6), Stephen Fuselier (6), Julia Stawarz (7), Jonathan Eastwood (7), Christopher Russell (8), Barbara Giles (9), Shan Wang (10), and James Webster (11)

(1) Austrian Academy of Sciences, Space Research Institute, Graz, Austria (kevin.genestreti@oeaw.ac.at), (2) Dartmouth College, Hanover, New Hampshire, USA, (3) Los Alamos National Laboratory, Los Alamos, New Mexico, USA, (4) University of New Hampshire, Durham, New Hampshire, USA, (5) University of Colorado Boulder, Boulder, Colorado, USA, (6) Southwest Research Institute, San Antonio, Texas, USA , (7) Blackett Laboratory, Imperial College London, London, UK, (8) University of California Los Angeles, Los Angeles, California, USA, (9) Goddard Space Flight Center, Greenbelt, Maryland, USA, (10) University of Maryland, College Park, Maryland, USA, (11) Rice University, Houston, Texas, USA

It is difficult to accurately determine the reconnection rate from in situ data. Since the reconnection rate is typically defined by the smallest component of a vector – e.g., the normal component of the magnetic field B_N, the normal component of the velocity V_N, and the tangential component of the electric field E_M – relatively small uncertainties in the LMN coordinate system of the reconnection site typically translate to large uncertainties in the reconnection rate. On 11 July 2017, NASA's Magnetospheric Multiscale (MMS) mission observed the central diffusion region of a magnetotail reconnection site. For this event, we apply a number of different techniques to the MMS data to determine LMN coordinate systems, within which we evaluate the reconnection rate EM. We apply these same techniques to virtual probe data from a 2-d fully kinetic particle-in-cell simulation of the 11 July event in order to determine (a) the uncertainties in the LMN coordinate axes determined by each of these techniques and (b) the accuracy of the reconnection rate E_M determined with each of these techniques.