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

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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 $E_M$. 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.