MMS observations of reconnection separatrix region in the magnetotail at different distances from the active neutral X-line

Victor Sergeev¹, Sergey Apatenkov¹, Rumi Nakamura², Simon Wellenzohn², Ferdinand Plaschke², Wolfgang Baumjohann², Yuri Khotyaintsev³, Jim Burch⁴, Roy Torbert⁵, Christopher Russell⁶, and Barbara Giles⁷

¹St. Petersburg State University, Physics Faculty, Earth's Physics Dept., St. Petersburg, Russian Federation (victor@geo.phys.spbu.ru)
²Space Research Institute of Austr.Acad.Sci., Graz, Austria
³Swedish Institute of Space Physics, Uppsala, Sweden
⁴Southwest Research Institute, San Antonio, TX, USA
⁵Space Science Center, University of New Hampshire, Durham, NH, USA
⁶IGPP/EPSS, University of California, Los Angeles, CA, USA
⁷NASA Goddard Space Flight Center, Greenbelt, MD, USA

The region surrounding the reconnection separatrix consists of the multitude of particle and wave transient features (electron, cold and hot ion beams, Hall E&B fields, kinetic Alfven and LH waves, holes etc) whose pattern and intensities may vary depending on the stage of reconnection process as well as on the distance from the active neutral line (XNL), whose characterization from observations is not a trivial task. We explore quick MMS entries into the plasma sheet boundary layer from the lobe in 2017 and 2018 tail seasons which potentially could be the crossings of the active separatrix as suggested by energy dispersed beams and polar rain gap features. By combining the observations of beam dispersion with the measured plasma convection and PSBL motion (obtained using the timing method) we attempt to separate temporal and spatial (velocity filter) contributions to the observed beam energy dispersion and evaluate the MMS distance from the XNL. In this report we discuss similarities and differences of separatrix manifestations observed far from the XNL (at distances exceeding several tens Re) and those found close to it (where the outermost electron beam directed toward the XNL is seen). One of surprizes was that we were often able to identify the intense Hall-like E&B field structures at very large distances from the XNL.