

**Parker Solar Probe observations of solar wind energetic proton beams produced by
magnetic reconnection in the near-Sun heliospheric current sheet**

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Current Sheet Coordinate System

The data in this paper is displayed in the RTN coordinate system for simplicity, because it is extremely close to the current sheet coordinate system. Here we provide details of the determination of the current sheet XYZ coordinate system for Encounters 07 and 08.

The current sheet normal points along \mathbf{Z} , \mathbf{X} along the anti-parallel magnetic field direction and $\mathbf{Y} = \mathbf{Z} \times \mathbf{X}$ in the out-of-plane ('X-line') direction. The XYZ coordinates for E08 were determined using the minimum variance analysis of the magnetic field (Sonnerup and Cahill, 1967) on the interval 2021-04-29/08:13:32 - 2021-04-29/08:28:56 UT, obtaining $\mathbf{X} = (0.991, 0.041, 0.127)_{\text{RTN}}$, $\mathbf{Y} = (-0.043, 0.999, -0.013)_{\text{RTN}}$ and $\mathbf{Z} = (-0.126, -0.019, 0.992)_{\text{RTN}}$.

For E07, a hybrid method (Gosling and Phan, 2013) was used on the interval 2021-01-17/13:10 - 2021-01-17/13:36 to obtain $\mathbf{X} = (0.989, -0.079, 0.099)_{\text{RTN}}$, $\mathbf{Y} = (0.081, 0.994, -0.023)_{\text{RTN}}$ and $\mathbf{Z} = (-0.097, 0.031, 0.995)_{\text{RTN}}$.