Characteristics of Electron Velocity Distributions in Reconnection Inflow Regions

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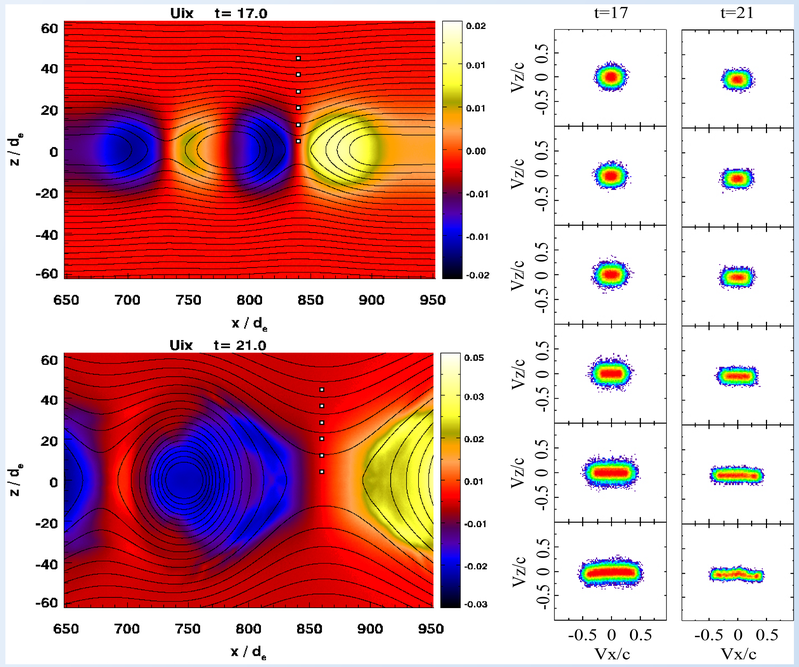
INTRODUCTION

- Space observations and PIC simulations have shown that electrons in the inflow region of reconnection exhibit a temperature anisotropy with $T_{e//}>T_{e\_|\_}$[2].
- The study was based on one single magnetotail reconnection event.
- Here we examine electrons in the inflow region for 30 magnetotail diffusion region crossings identified by Eastwood et al. [3] to further establish inflow electron characteristics.

PIC SIMULATION

- Inflow electron distributions are anisotropic with $T_{e//} > T_{e\perp}$
- $T_{e//} / T_{e\perp}$ between reversing Vix.
- $T_{e//} / T_{e\perp}$ increases with decreasing distance from the X-point
- The anisotropy started to develop near the time when reconnection rate peaks.
- $T_{e\perp}$ decreases with time while $T_{e//}$ is nearly constant

Spatial and temporal variations of inflow electron distributions

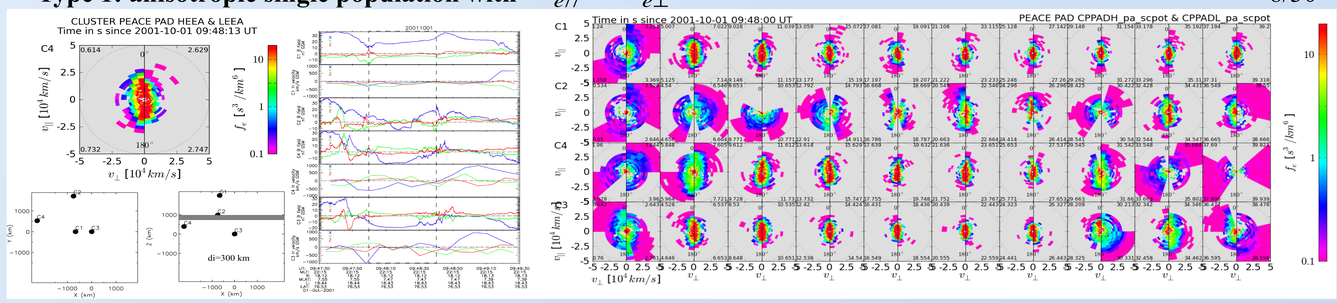


mi/me=400, Nb/N0=0.5, Tb/T0=0.333,
Ti / Te = 5 (Harris population), ωpe / Ωce = 2

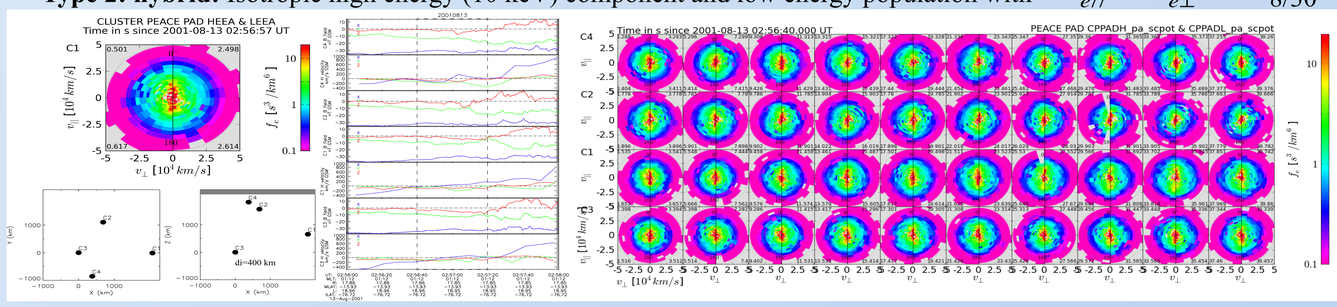
INFLOW ELECTRON DISTRIBUTIONS IN MAGNETOTAIL RECONNECTION

- 4 distinct types of inflow electron distributions are found
- Inflow regions must exist between the reversing ion flows
- Event data base: 30 magnetotail diffusion region crossings identified by Eastwood et al. [2010] based on correlated inflow and Bz reversal

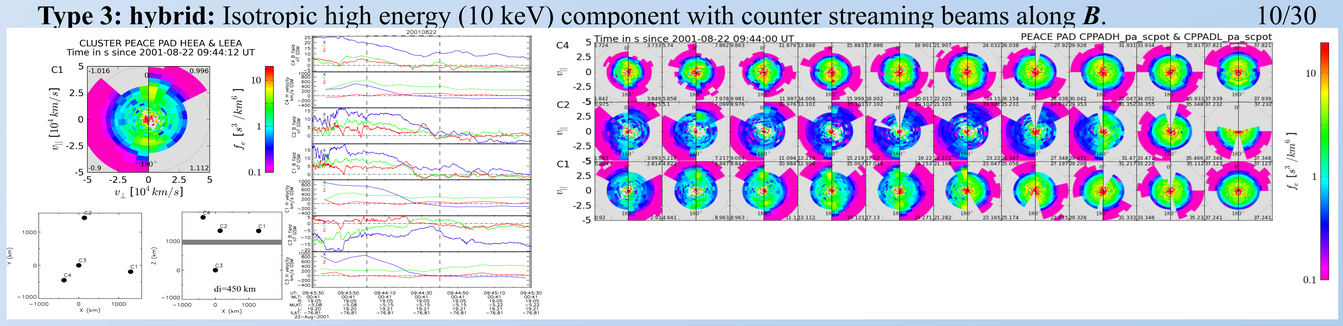
Type 1: anisotropic single population with $T_{e//} > T_{e\perp}$ 8/30



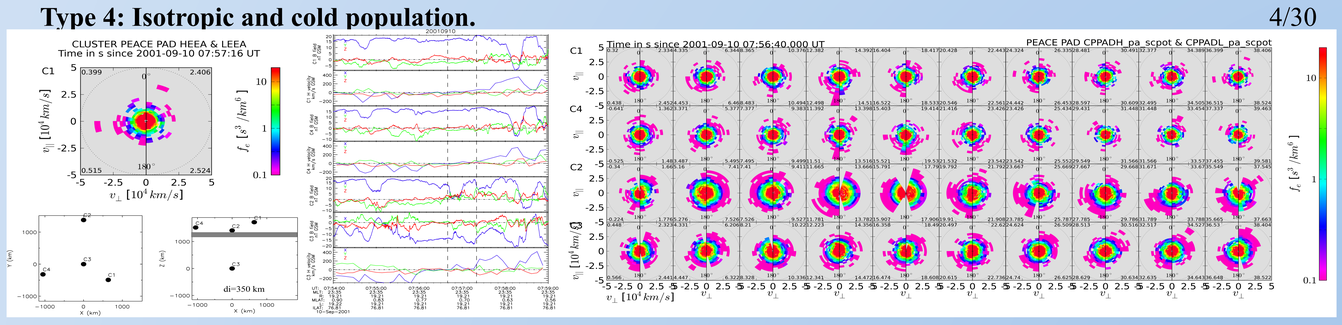
Type 2: hybrid: Isotropic high energy (10 keV) component and low energy population with $T_{e//} > T_{e\perp}$ 8/30



Type 3: hybrid: Isotropic high energy (10 keV) component with counter streaming beams along ***B***. 10/30



Type 4: Isotropic and cold population. 4/30



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REFERENCE

[1] Chen et al., J. Geophys. Res., 2008, doi: 10.1029/2008JA013385
[2] Eastwood, et al., J. Geophys., Res., 2007, doi:10.1029/2006JA012158
[3] Eastwood, et al, J. Geophys. Res., 2010, doi: 10.1029/2009JA014962