

# Topological changes associated with magnetic reconnection during Kelvin-Helmholtz instability at the Earth's Magnetopause

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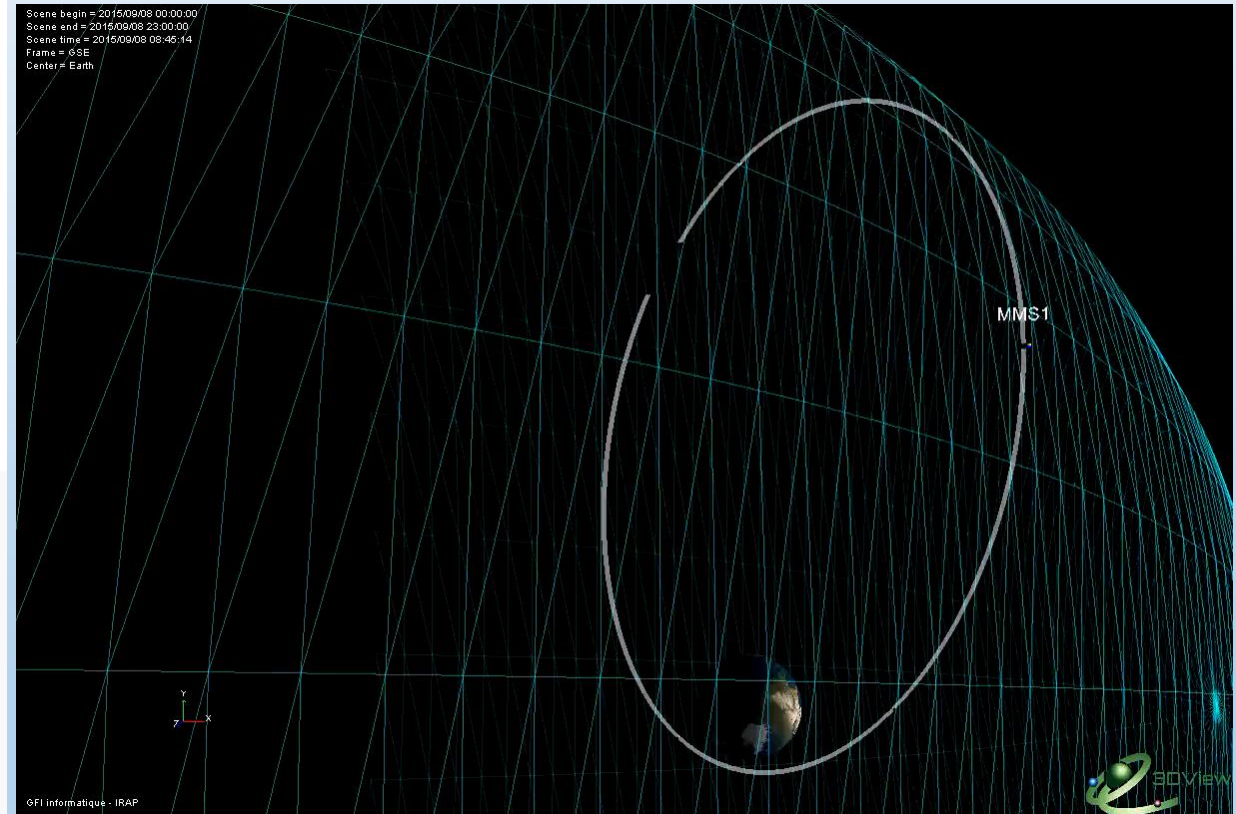
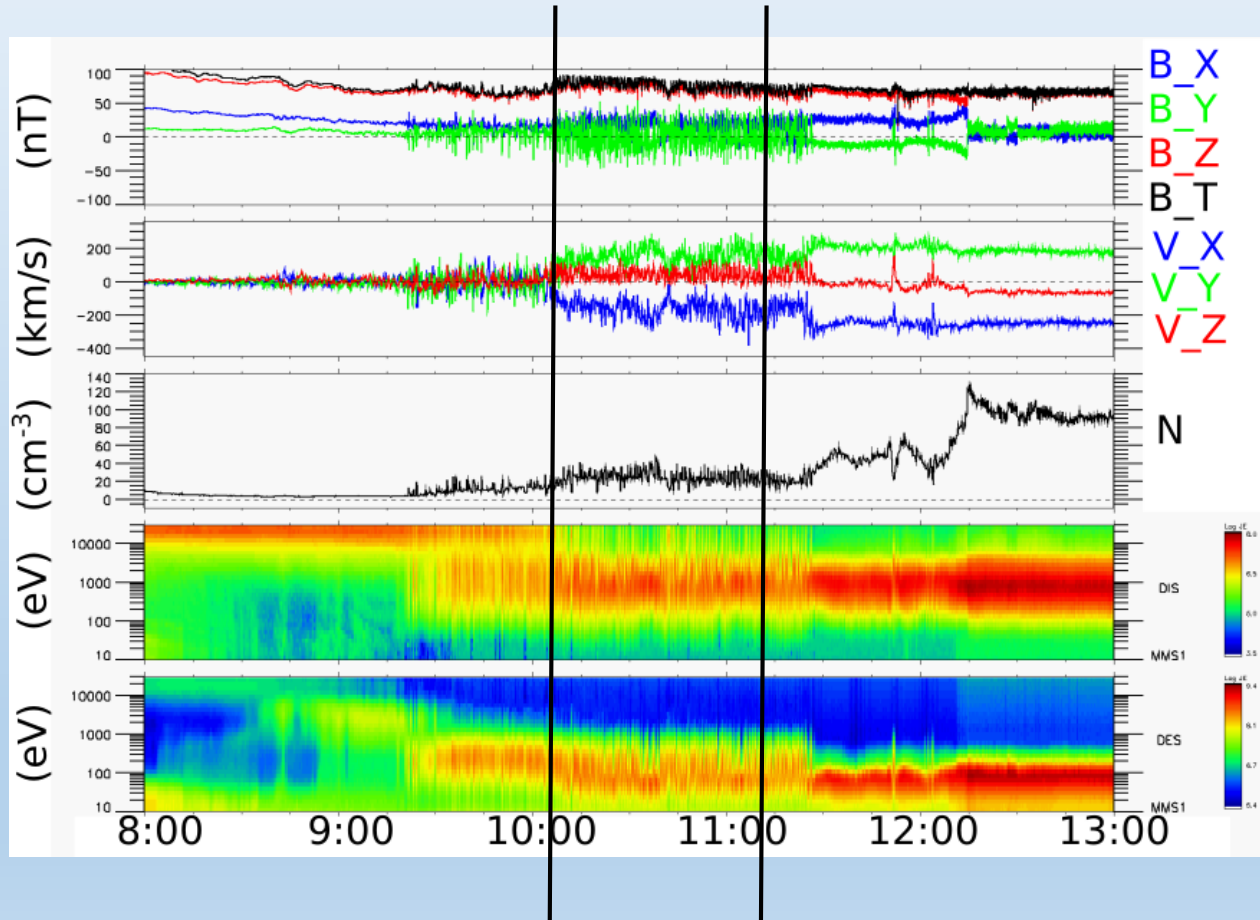
1. IRAP, UPS, Toulouse, France

2. LASP, University of Colorado, Boulder, Co

8 September 2015:

One hour of high resolution data from MMS 1, 2, 3, and 4, during a Kelvin-Helmholtz event

New physics: KH with the accuracy of MMS



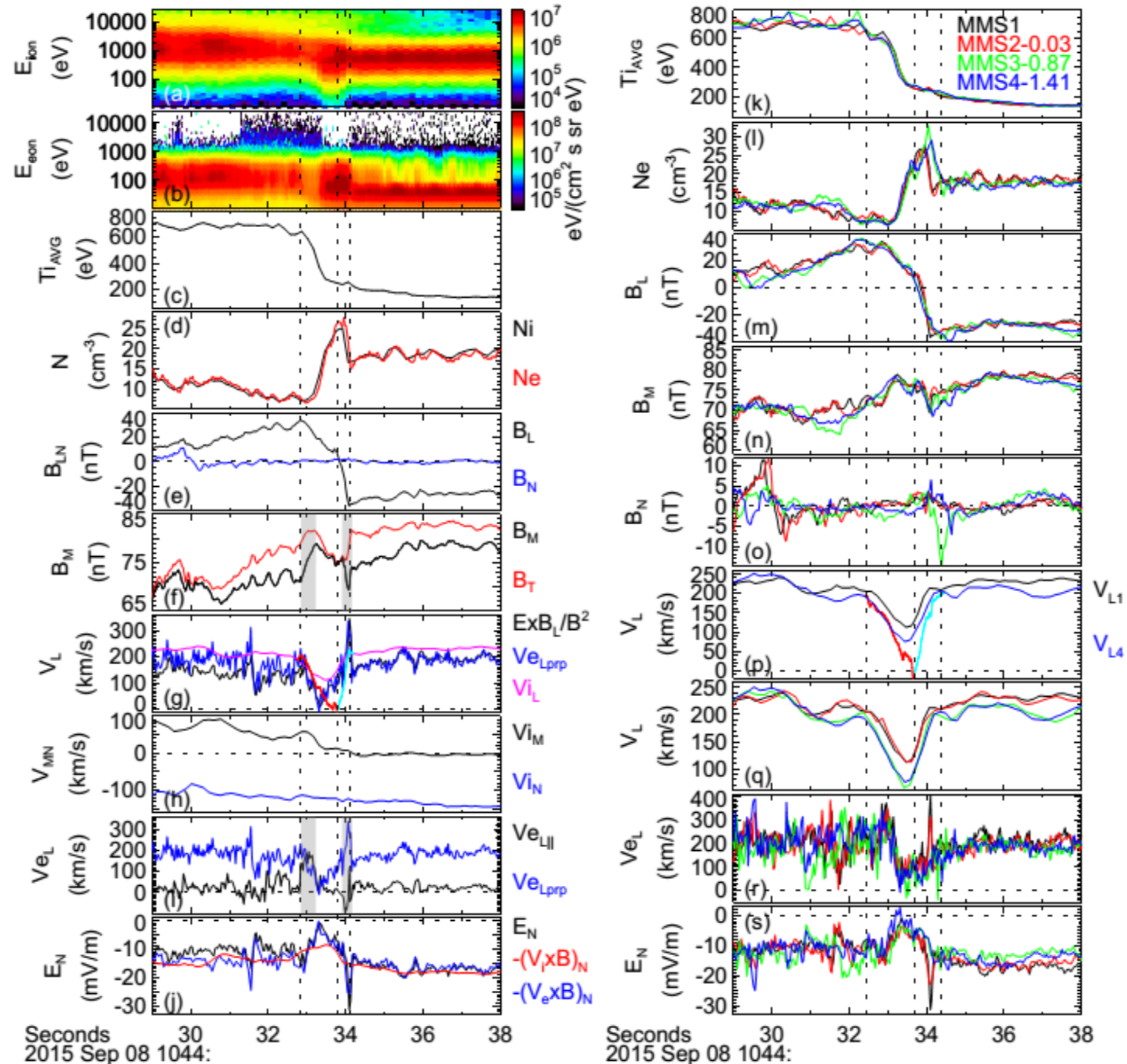
Orbits visualization: 3D view <http://3dview.cdpp.eu>



MMS direct evidence of reconnection by exhaust signature (Type I)

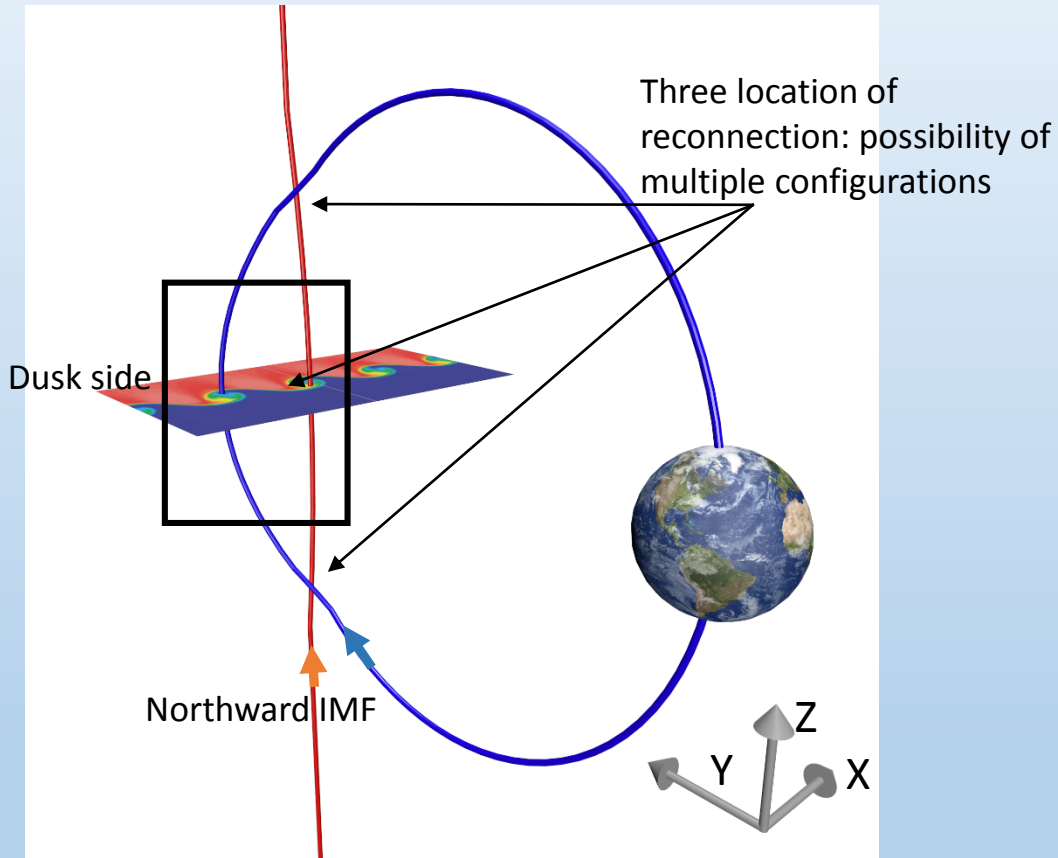
22 exhausts signature out of 42 current sheets

Eriksson et al., 2016

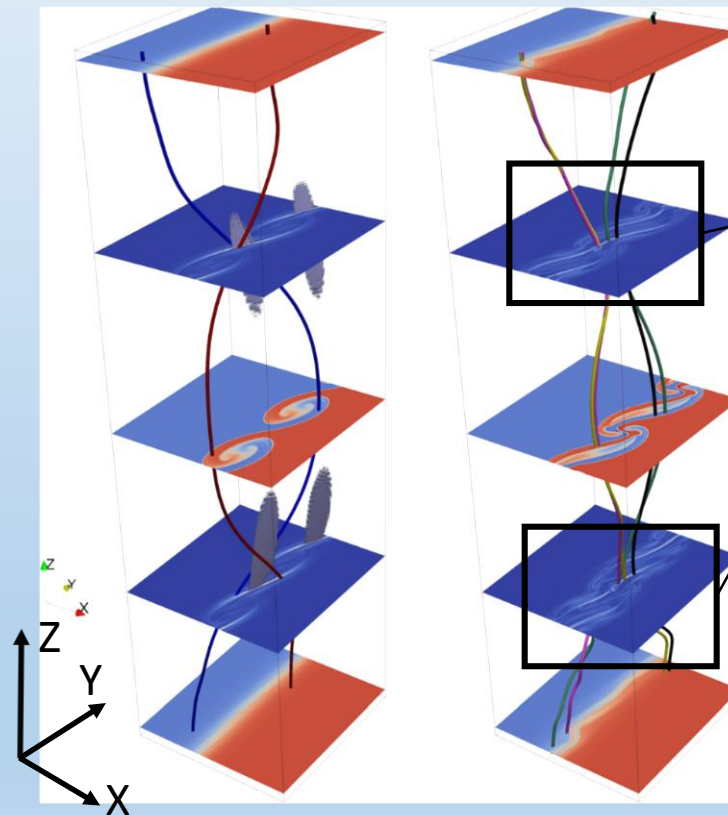


# Mid-latitude reconnection:

Tearing of field lines at the equatorial plane triggers reconnection at mid-latitude

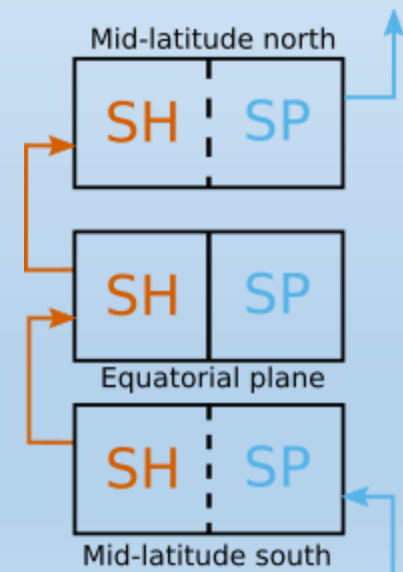


(Hand drawn)



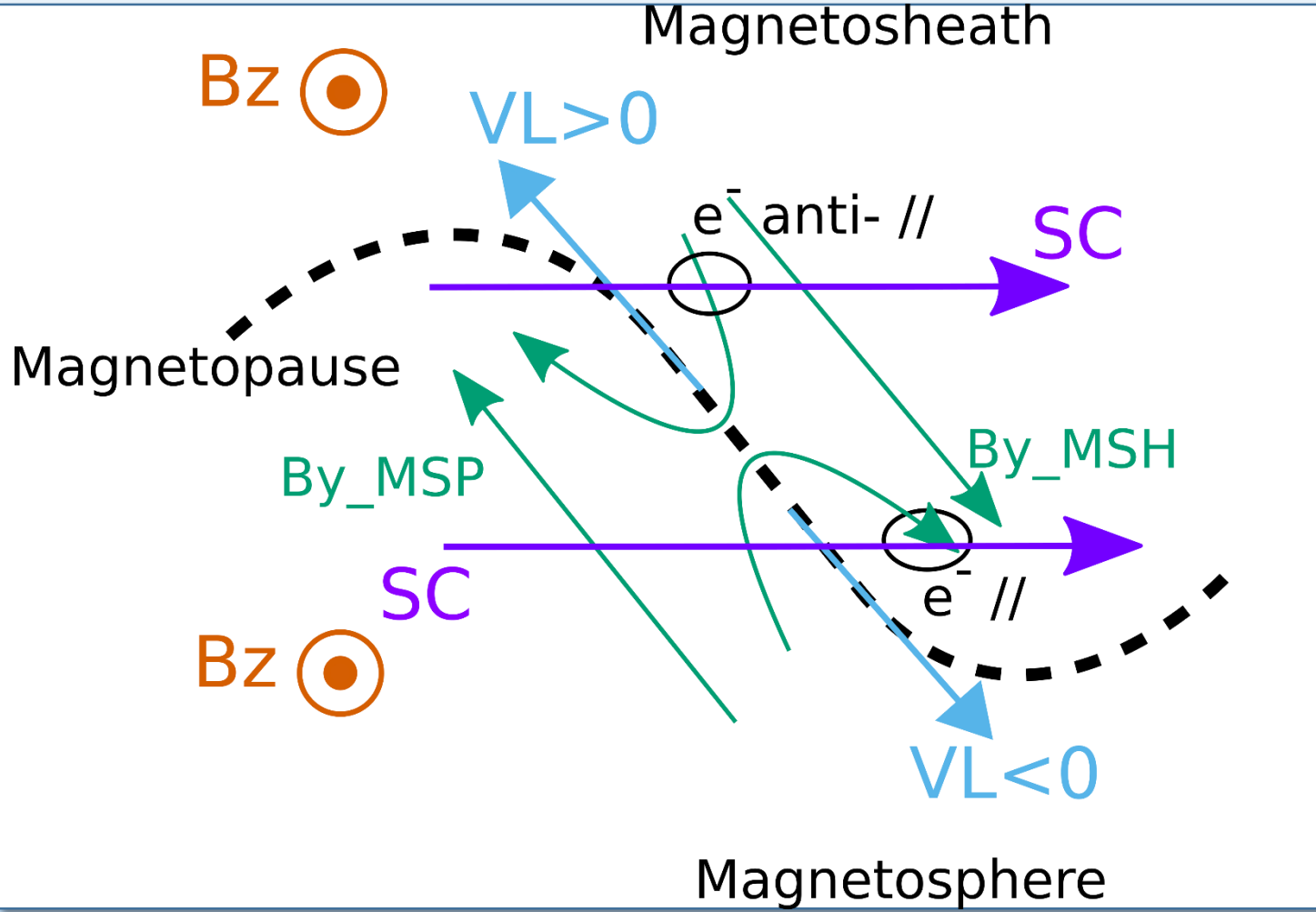
Simulation from Borgogno et al., 2015

South and North mid-latitude reconnection

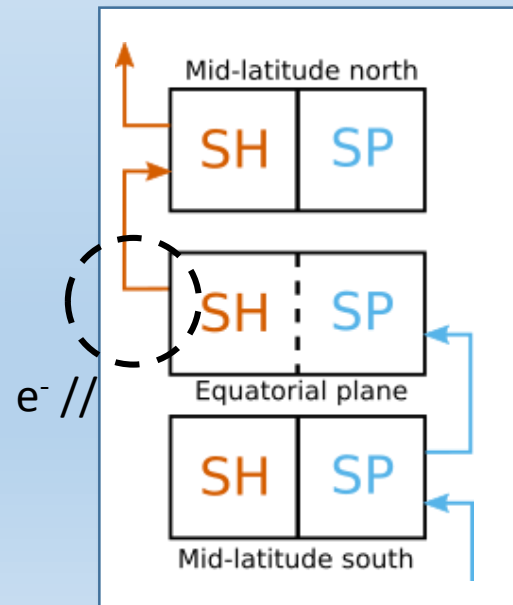
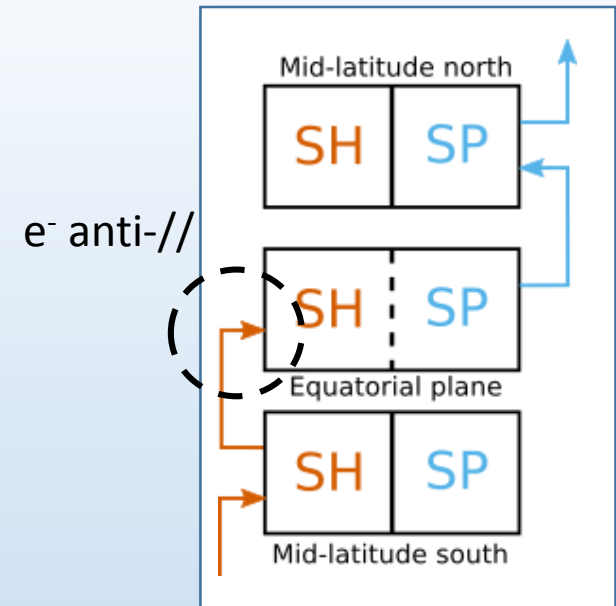


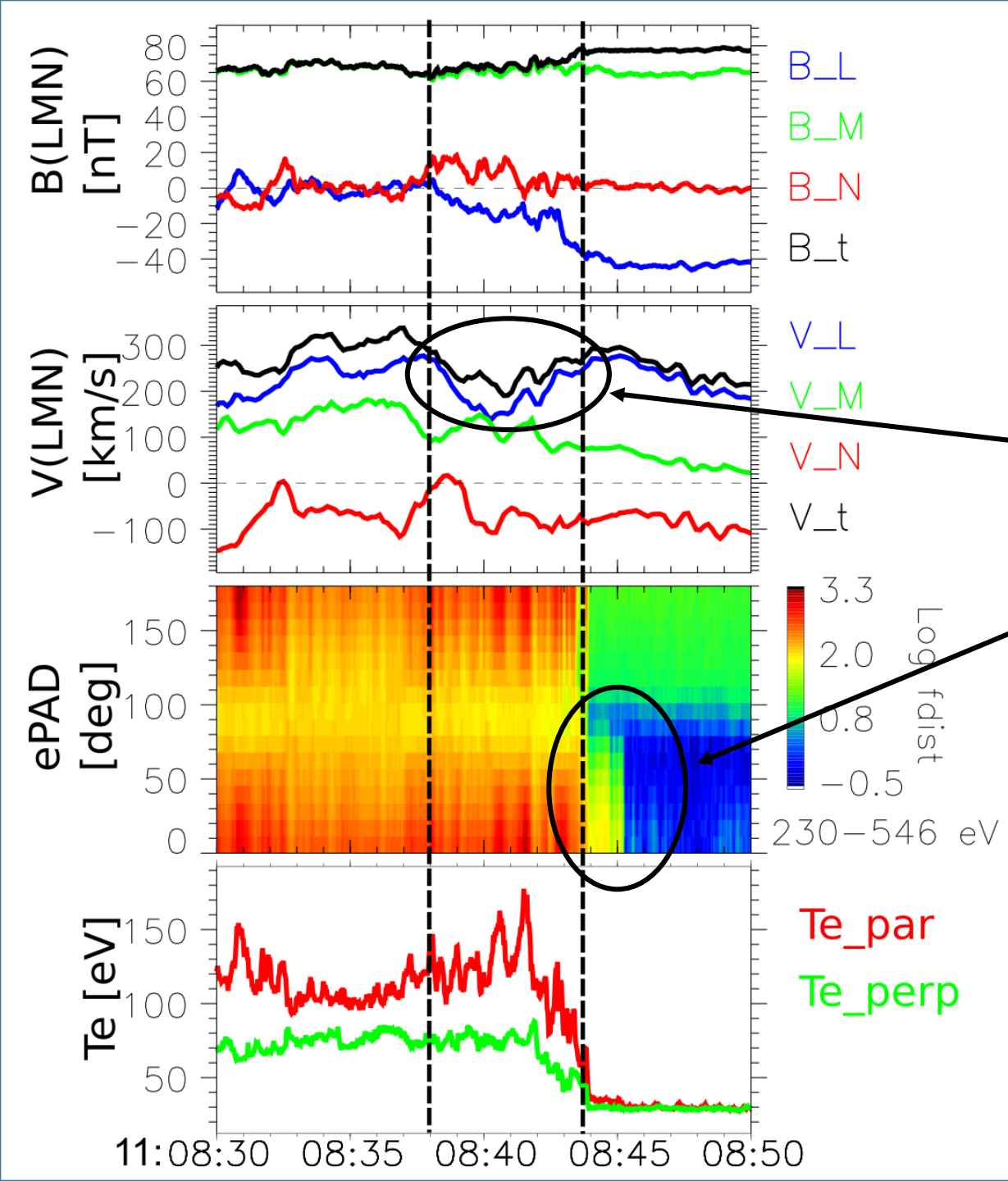
**B** Field line path

# Local KH Reconnection Geometry



Parallel or Anti-parallel electrons boundary layer measured depending on the relative position of the SC to the X-line

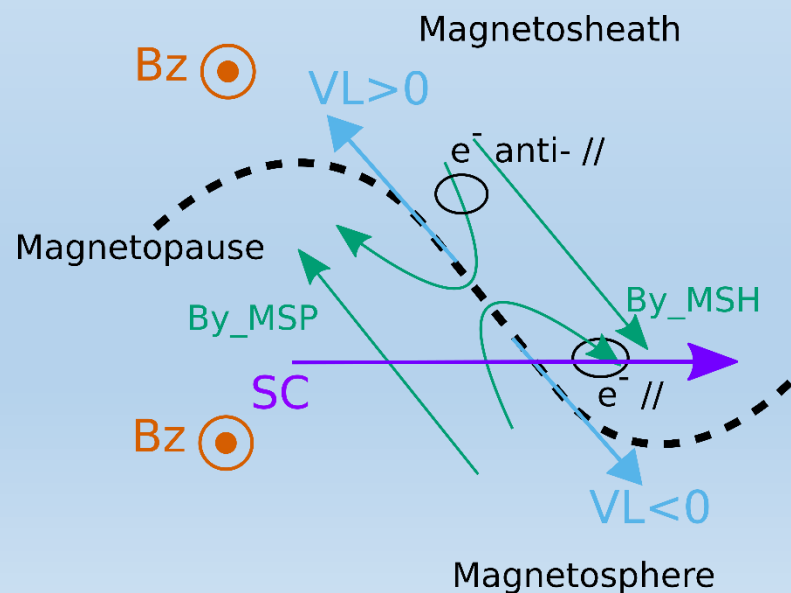
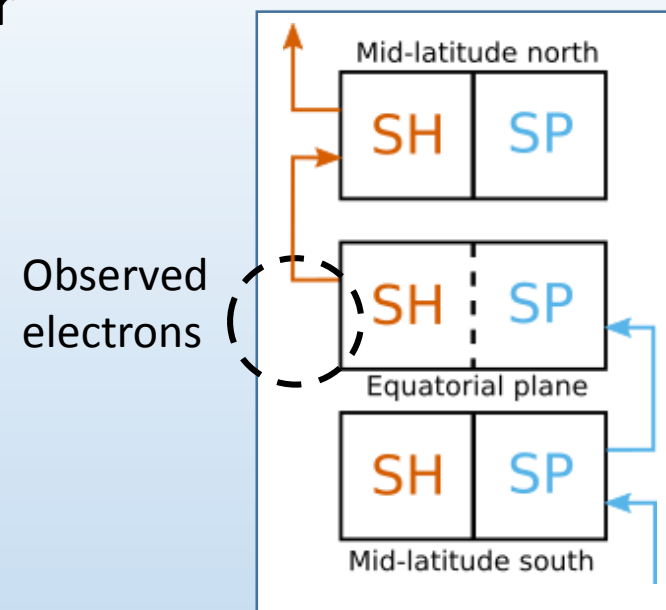


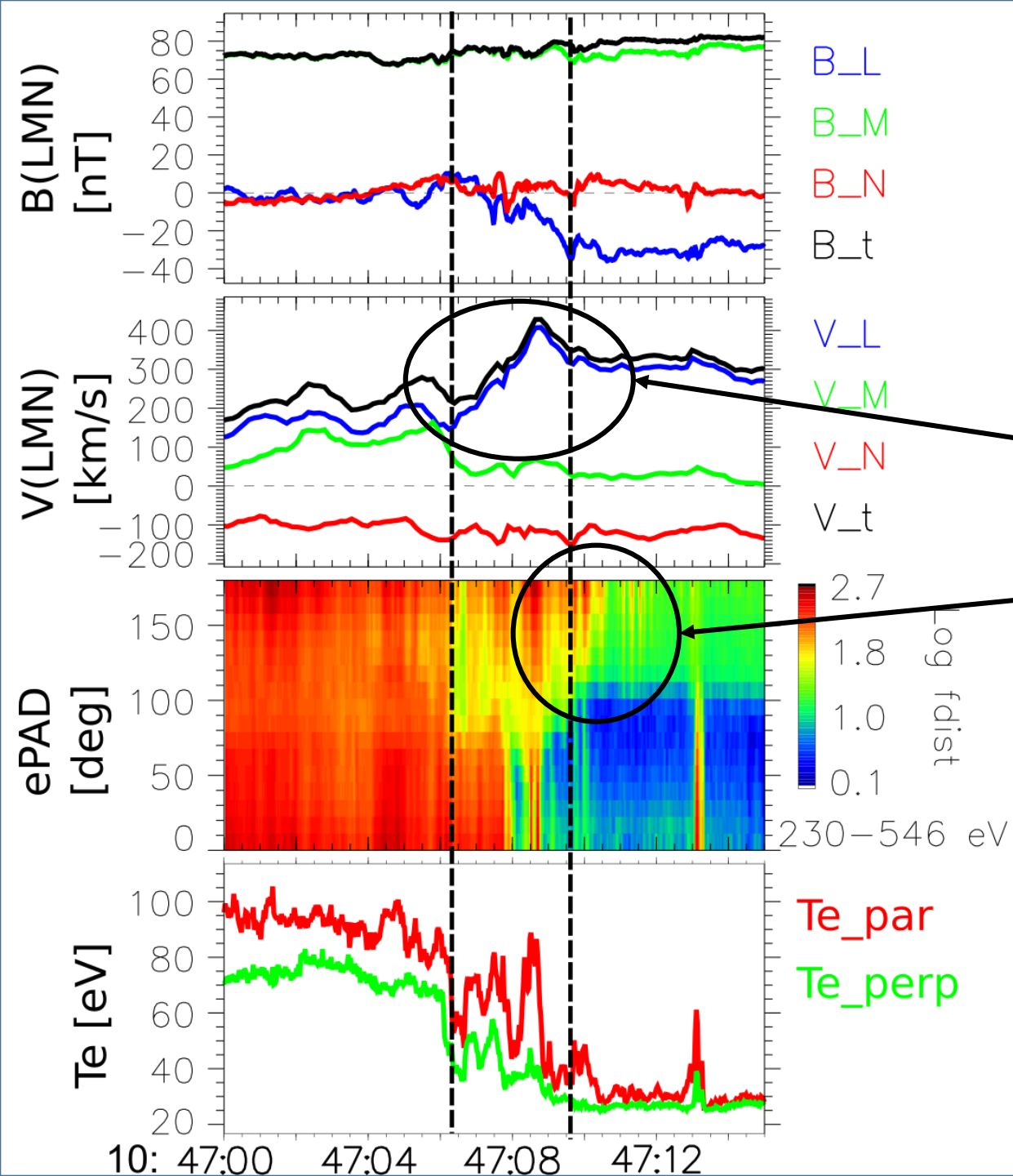


Example 1/4 : Exhaust with  $V_L < 0$  and parallel electron boundary layer

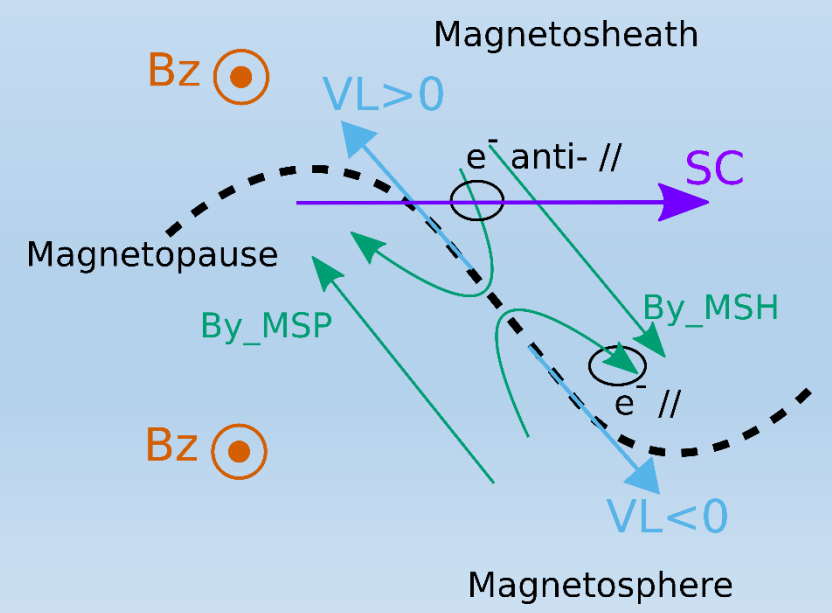
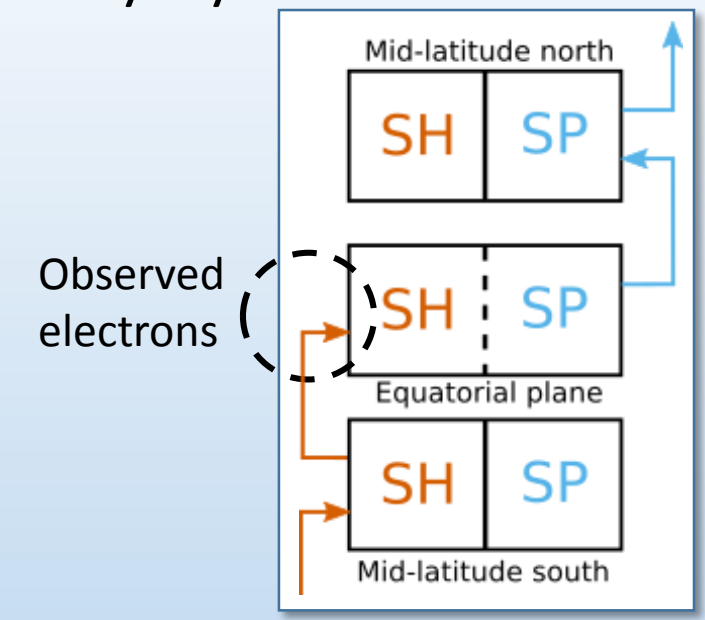
$V_L < 0$

$e //$

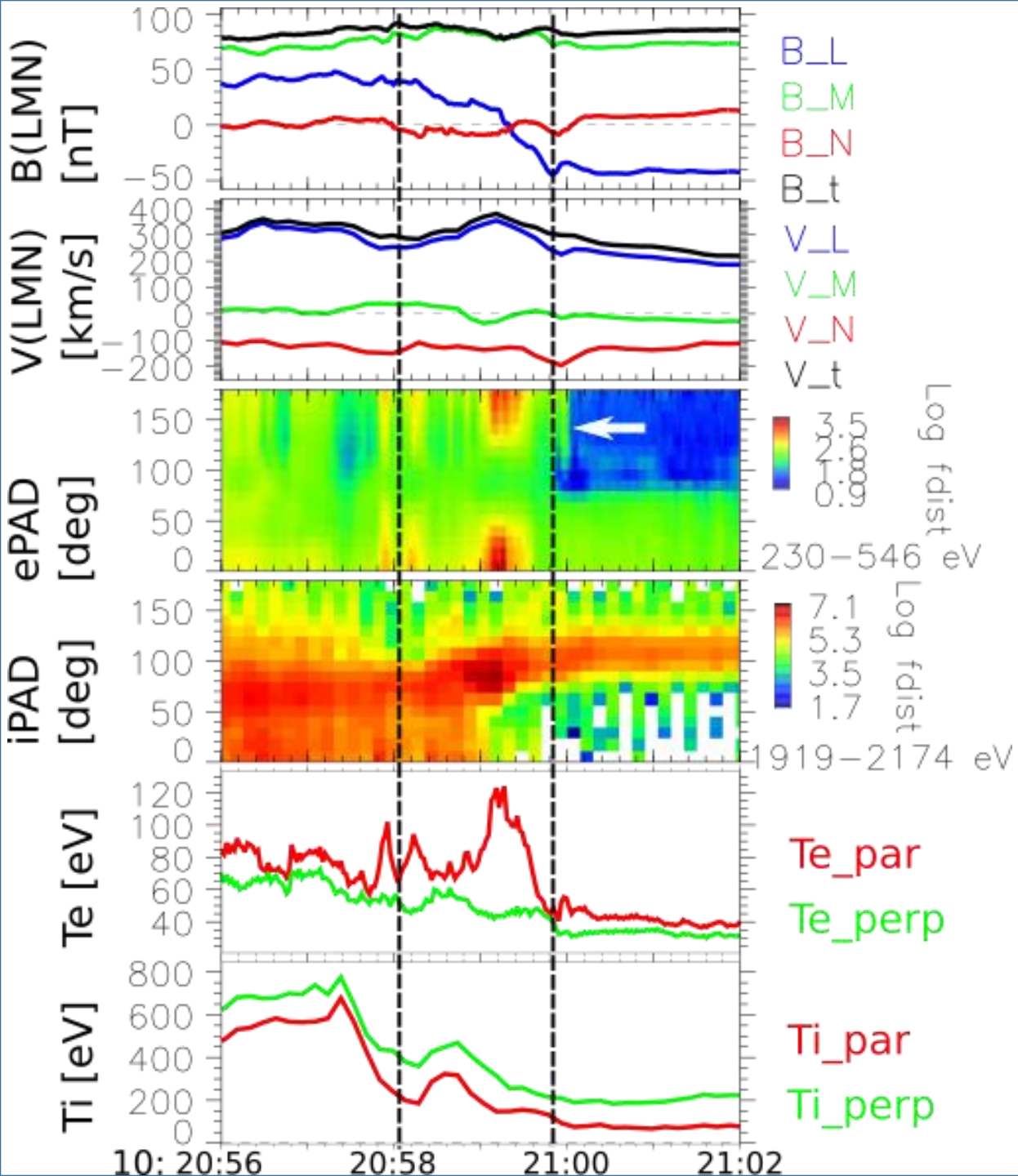




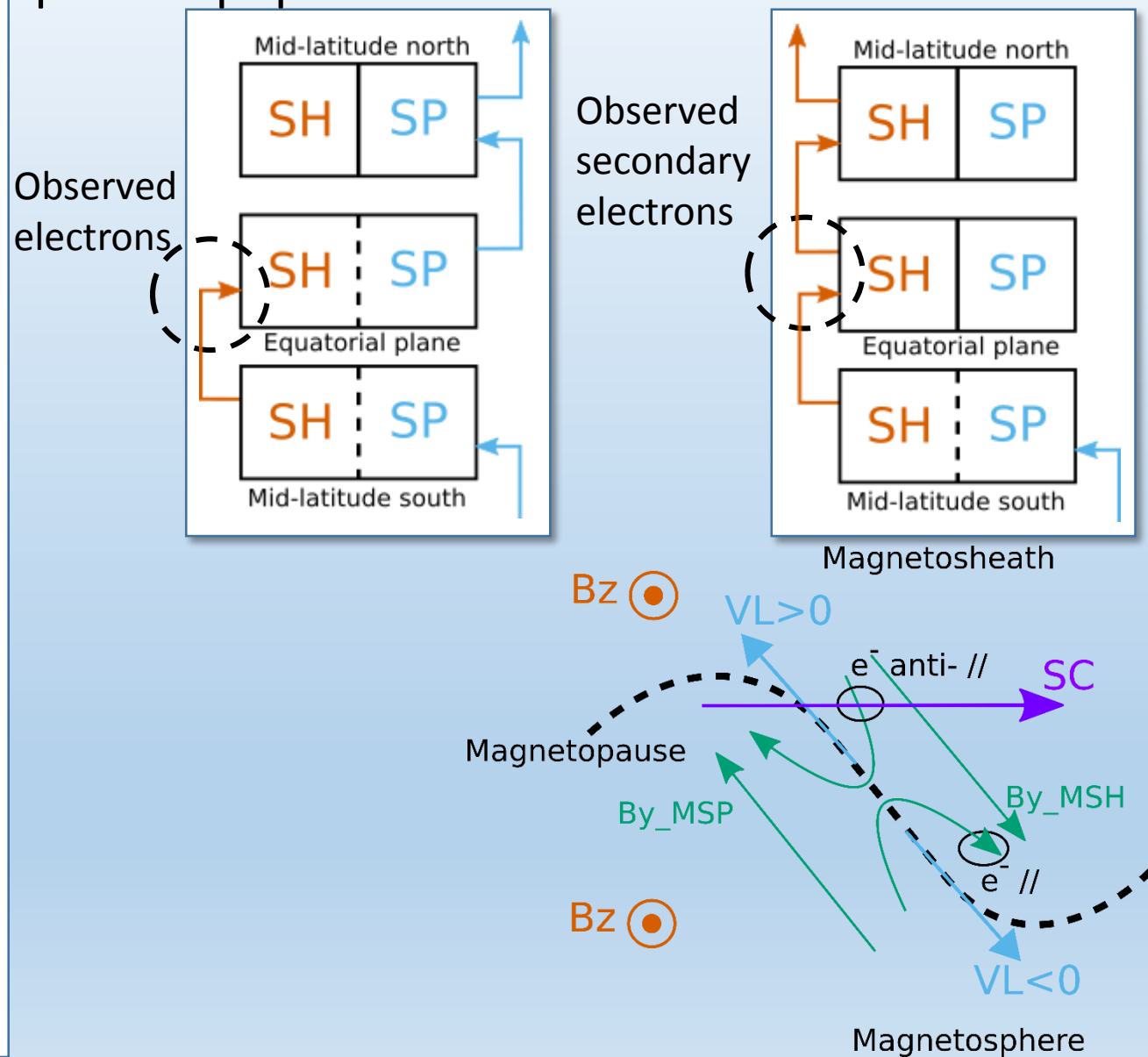
Example 2/4 : Exhaust with  $V_L < 0$  and anti-parallel electron boundary layer

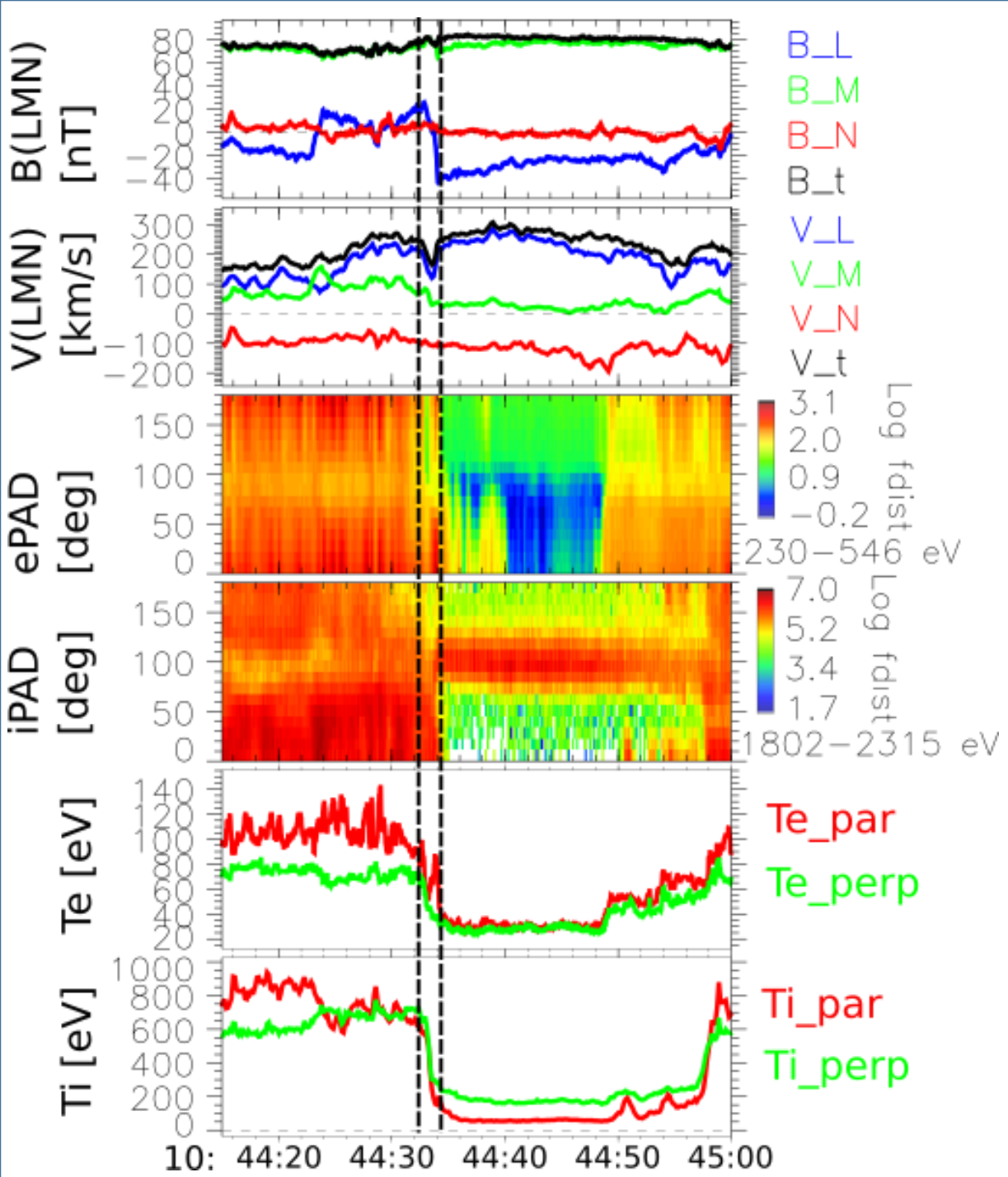




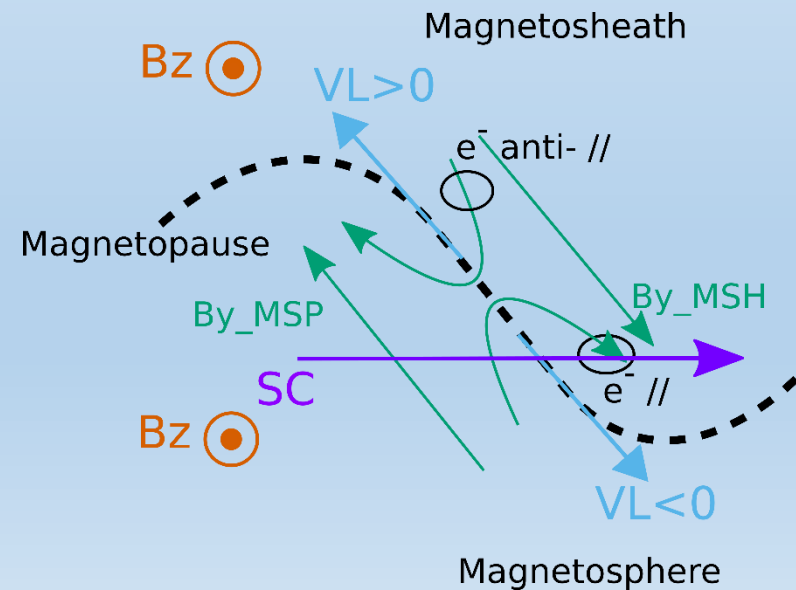
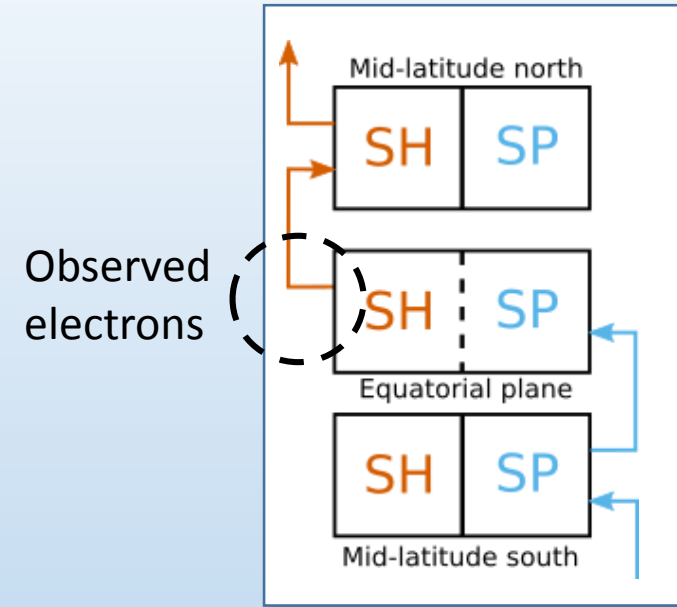


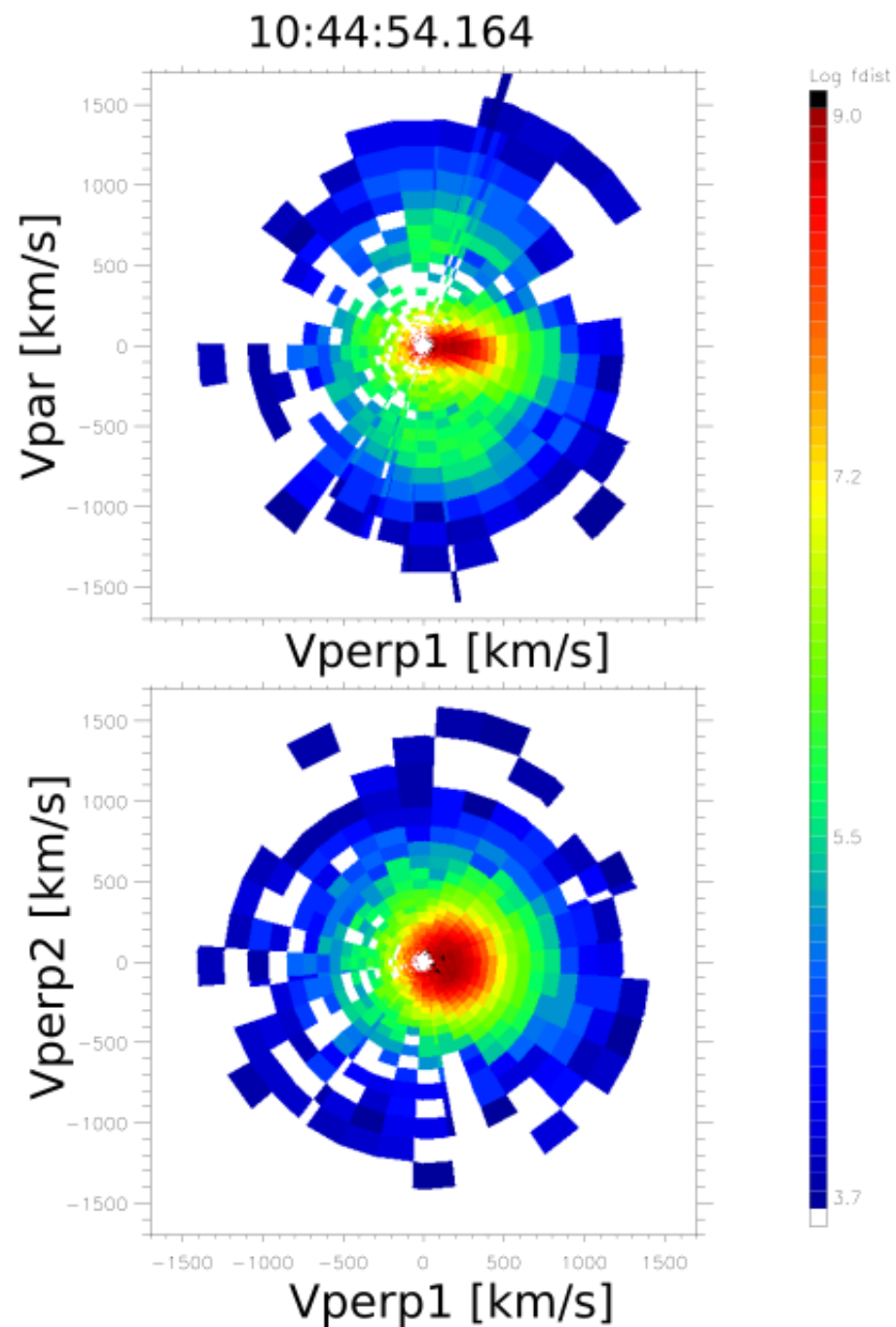
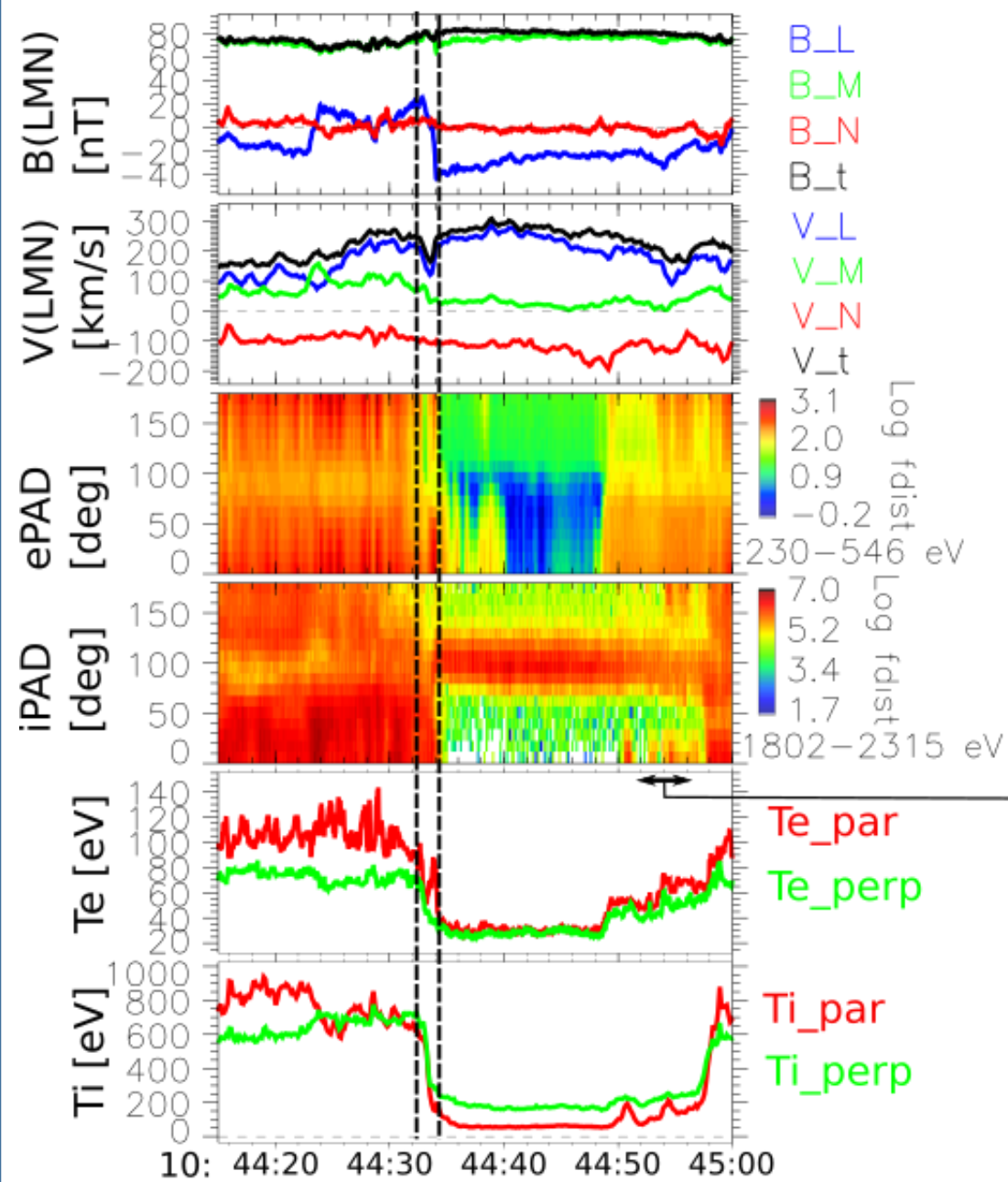
Example 3/4 : Exhaust with  $V_L > 0$ , anti-parallel electron boundary layer and simultaneous parallel population

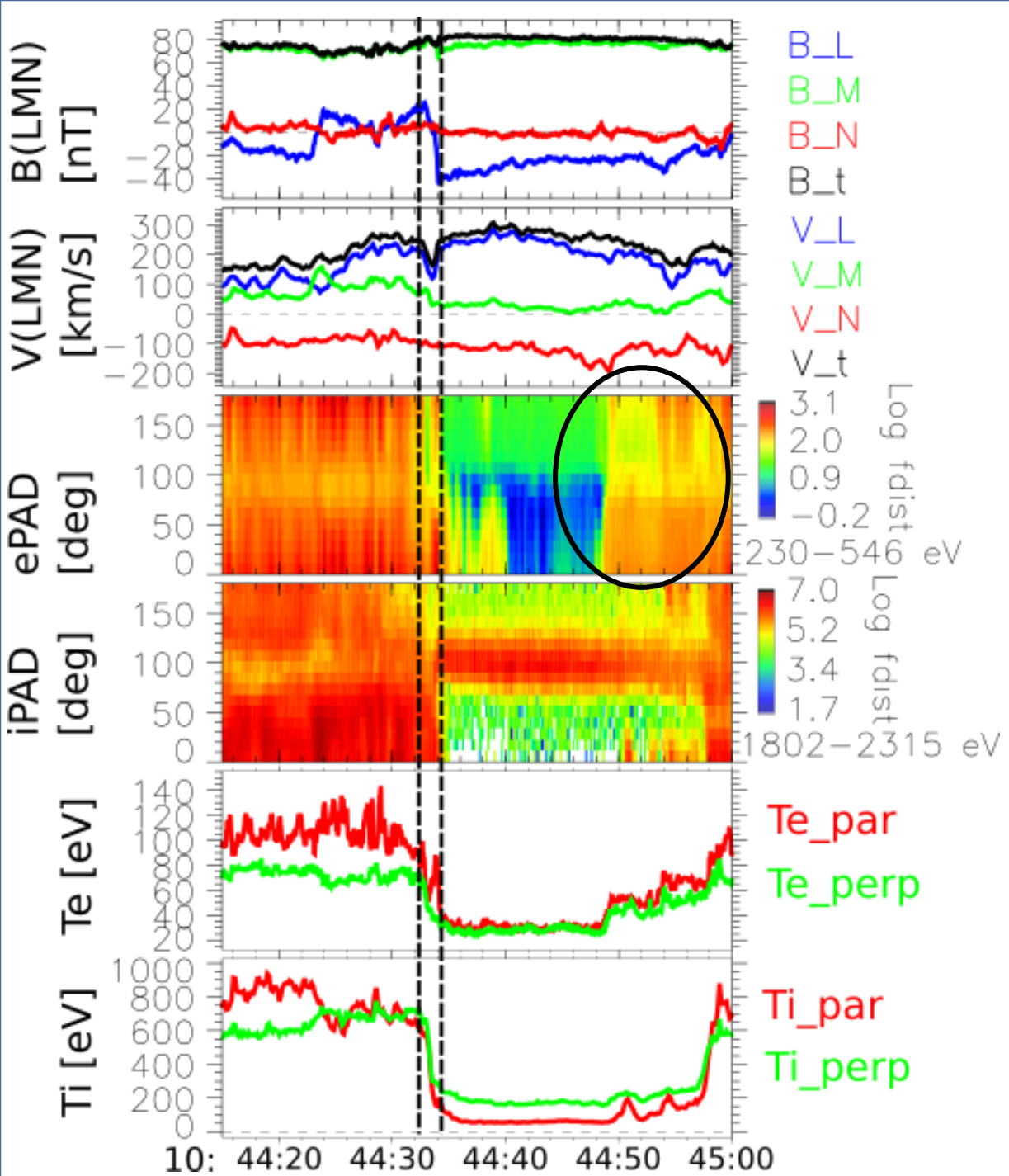




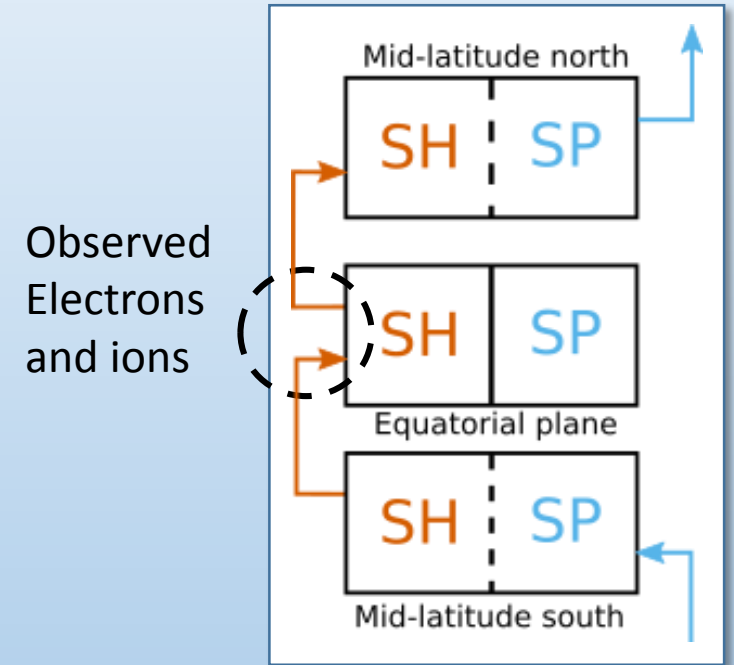
Example 4/4 : Exhaust with  $V_L < 0$  , parallel electron boundary layer and later bidirectional populations







Example 4/4 : Exhaust with  $V_L < 0$  , parallel electron boundary layer and later bidirectional populations



# Statistical results

- 86% of ion exhaust observed by Eriksson et al. (29 over 42), 2016 confirmed with leaking out electrons (25 over 29)
- 87% (34 over 39 magnetosheath crossings) presented secondary electron boundary layer in the magnetosheath
- 59% (20 over 34) presented secondary ion boundary layers

# Conclusion

- Confirmation of observed exhaust with the electron boundary layer
- Confirmation of reconnection at mid-latitude with ions and electron signatures
- Multiple field line topologies around the KHI, including mixing of multiple population due to reconnection