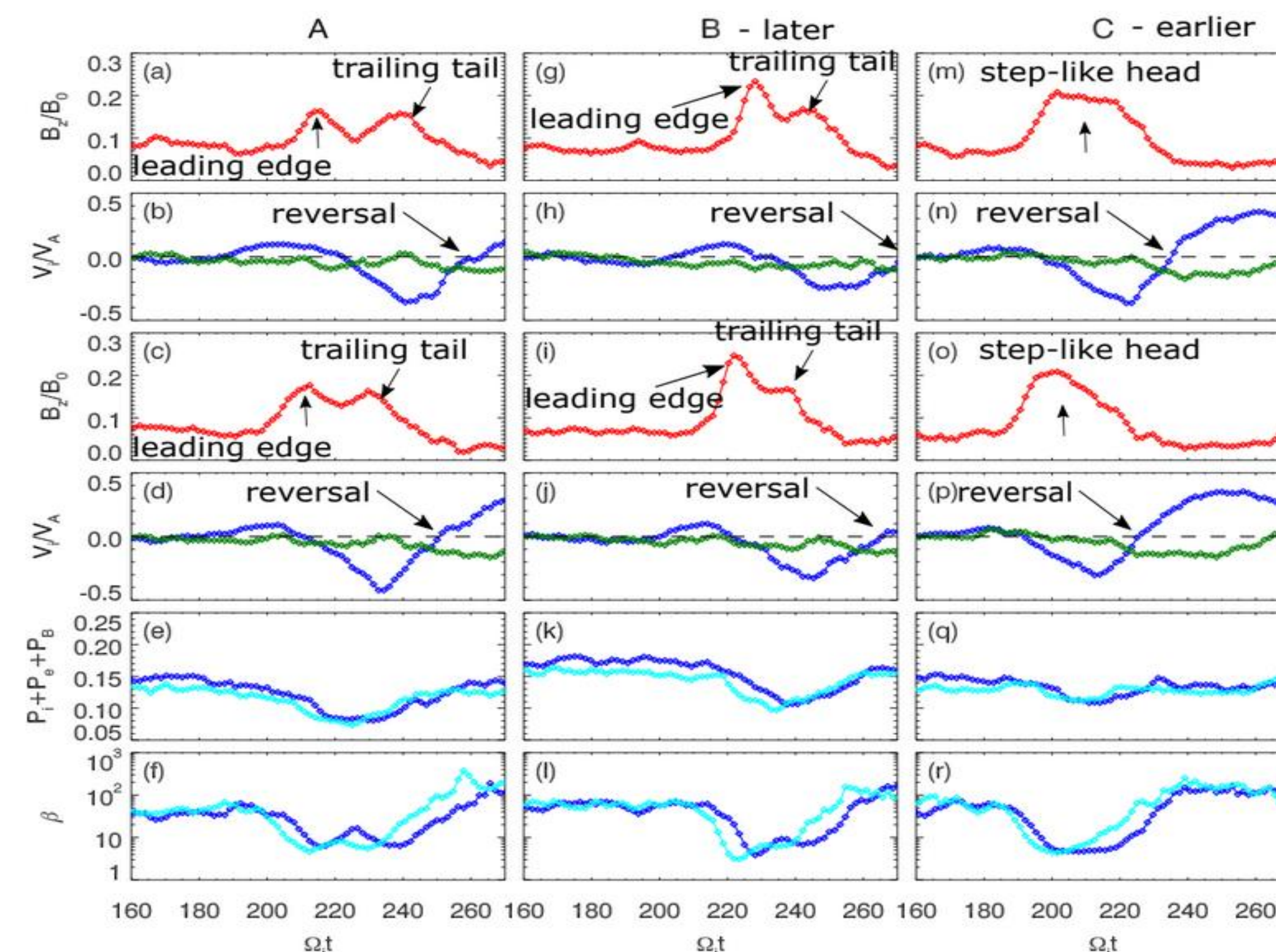


OBSERVATIONS OF MAGNETOTAIL INTERCHANGE HEADS'
SIGNATURES AT LATER STAGE OF DEVELOPMENTEvgeny V. Panov¹, San Lu², Philip L. Pritchett³¹Space Research Institute, Austrian Academy of Sciences, Graz, Austria, ²Department of Earth, Planetary, and Space Sciences, University of California, Los Angeles, CA, USA, ³Department of Physics and Astronomy, University of California, Los Angeles, CA, USA.

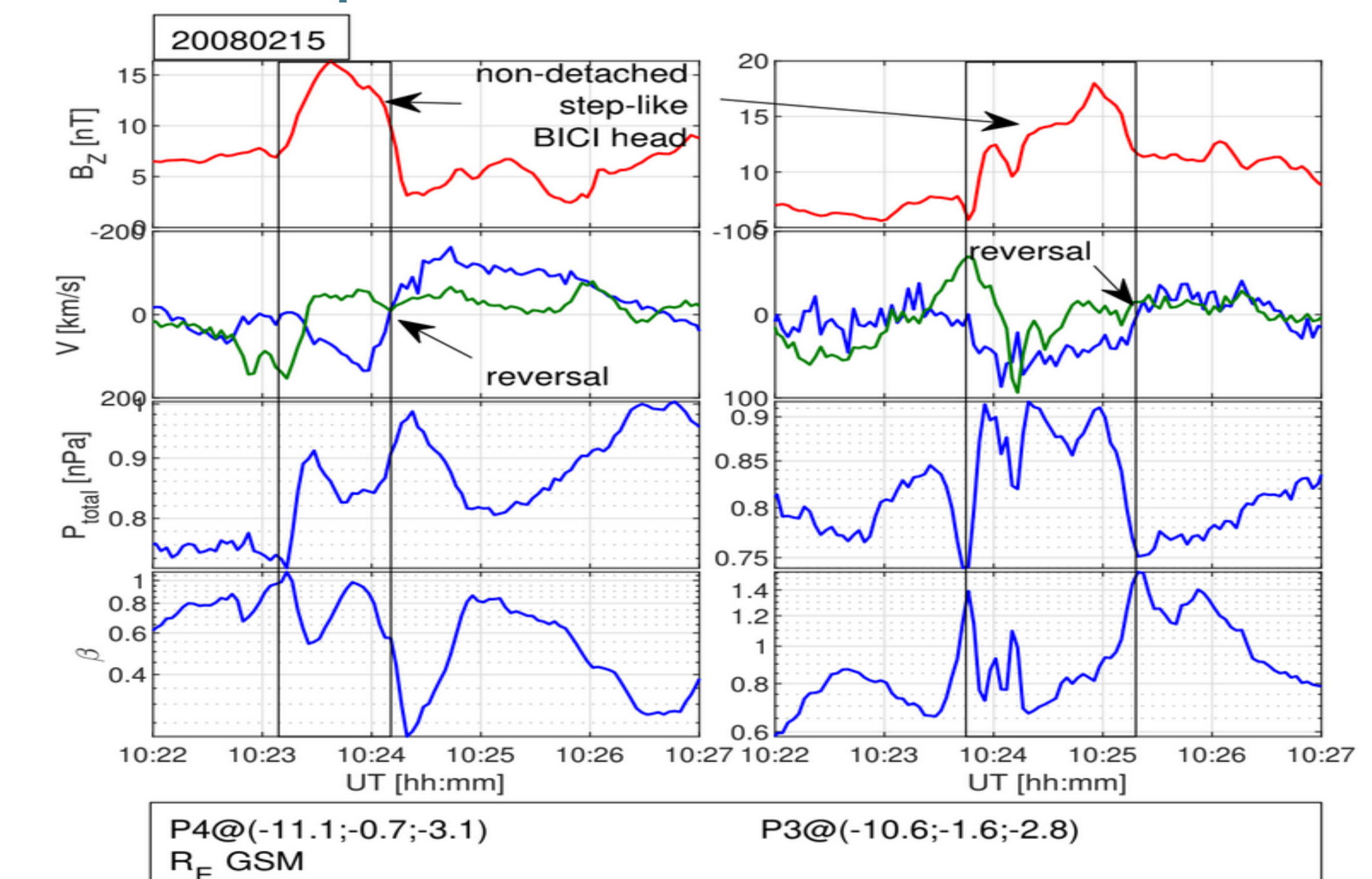
The kinetic ballooning/interchange instability (BICI) was recently found to produce azimuthally narrow interchange heads extending from the near-Earth magnetotail into the dipole region. In their nonlinear evolution individual heads were predicted to grow into transient earthward moving northward magnetic field intensifications (dipolarization fronts; DFs). The distinguished signatures of such fronts would be their oblique propagation and cross-tail localization due to the finite k_y structure of the BICI modes. We compare DFs that were observed by two THEMIS probes at 11 Earth's radii (R_E) downtail amidst previously identified interchange heads with a simulated interchange head during later-stage BICI development. The comparison shows that the DFs propagated downward at about 45° to the earthward direction. The leading edges and trailing tails of the DFs were structured similarly to those of the simulated interchange head. The analysis evidences that BICI indeed releases obliquely propagating azimuthally localized dipolarization fronts in the Earth's magnetotail. [Panov, E.V., S. Lu, P.L. Pritchett, Understanding Spacecraft Trajectories through Detached Magnetotail Interchange Heads, JGR, 2020]

Virtual spacecraft observations of the head



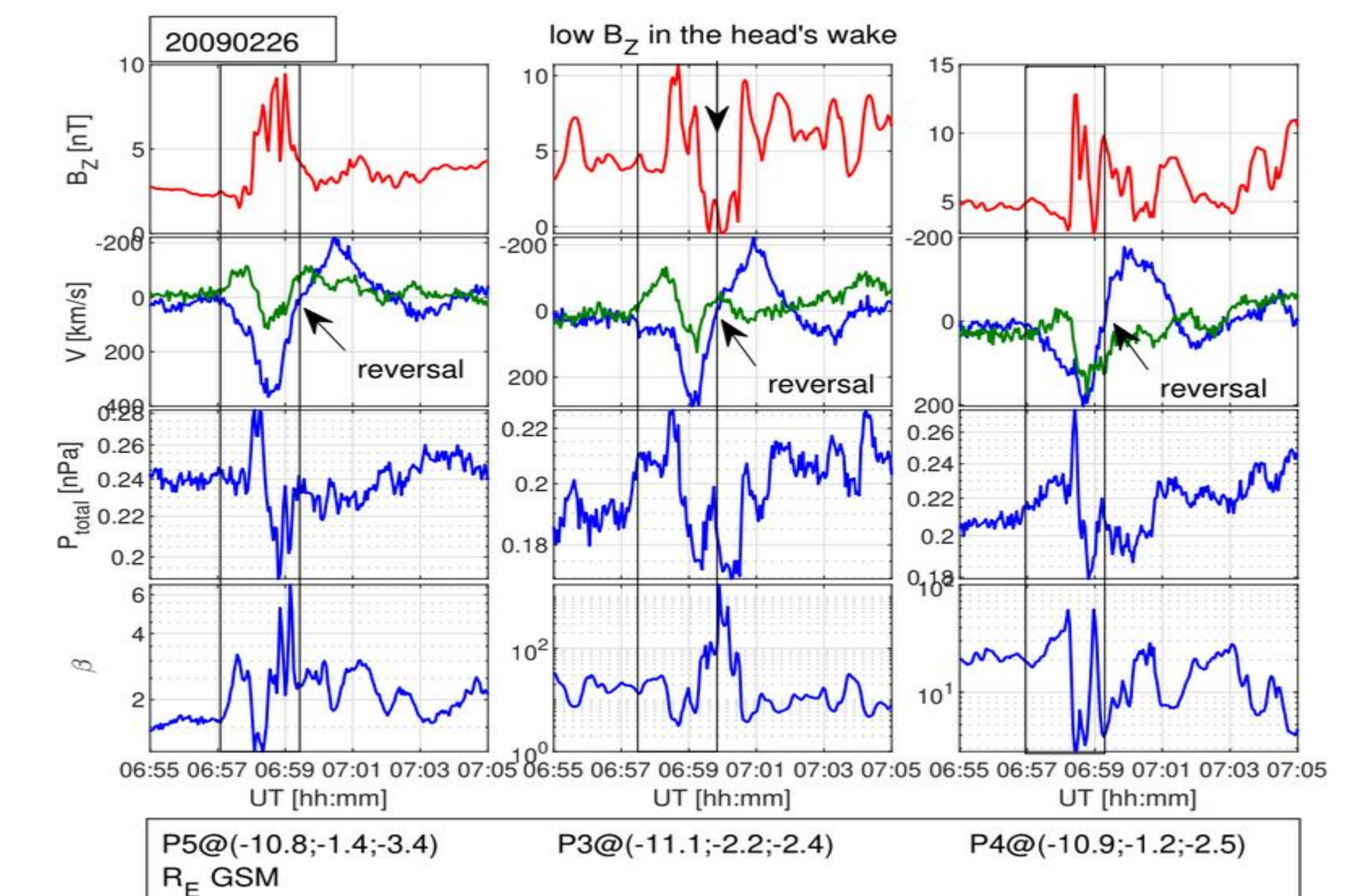
- ✓ Leading edge and trailing tail are seen as similar-size B_z maxima
- ✓ The leading edge B_z grew larger at later time (B)
- ✓ Step-like head before detachment (C)

Example of a Non-Detached Head



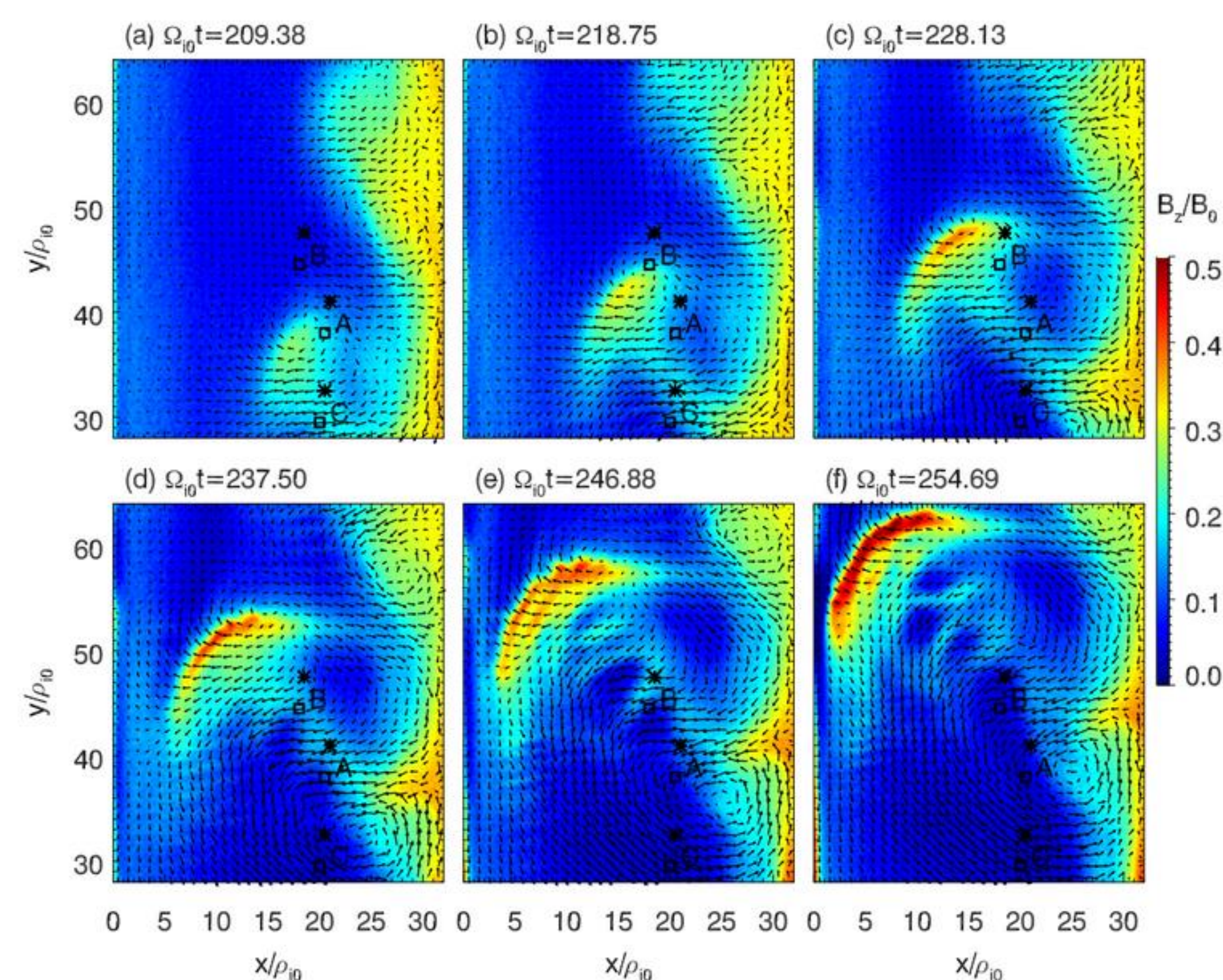
- ✓ Non-detached step-like head that propagated downward

Head Observed late after Detachment



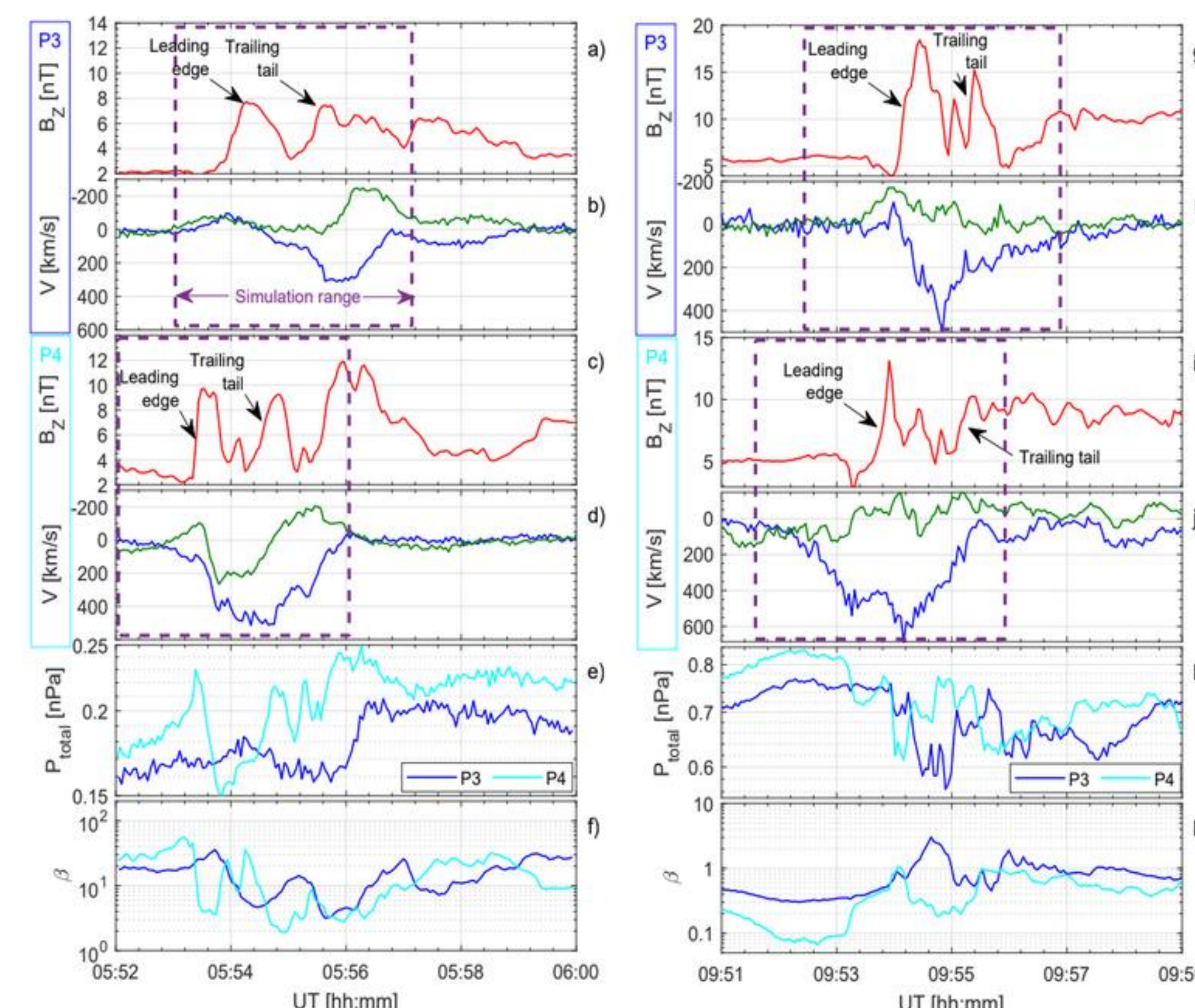
- ✓ Later development after detachment

Development of detaching BICI head in PIC



- ✓ The head drifted earthward and downward.
- ✓ The leading edge grew in size and strength.
- ✓ The trailing tail followed the leading edge and eroded

THEMIS Examples of Detached Heads



- ✓ Dipolarization fronts amidst non-detached BICI heads exhibit signatures that are similar to those predicted in the simulations

Summary

- THEMIS crossings of detached magnetotail interchange heads are compared with PIC-simulated later-stage BICI development.
- Similar signatures of the head's leading edges and trailing tails are identified in both in situ and simulated data.
- The signatures appeared to be the result of oblique (earthward/dawnward) propagation of the detached heads.

