

Interhemispheric Conjugacy of Multiple Auroral Arcs

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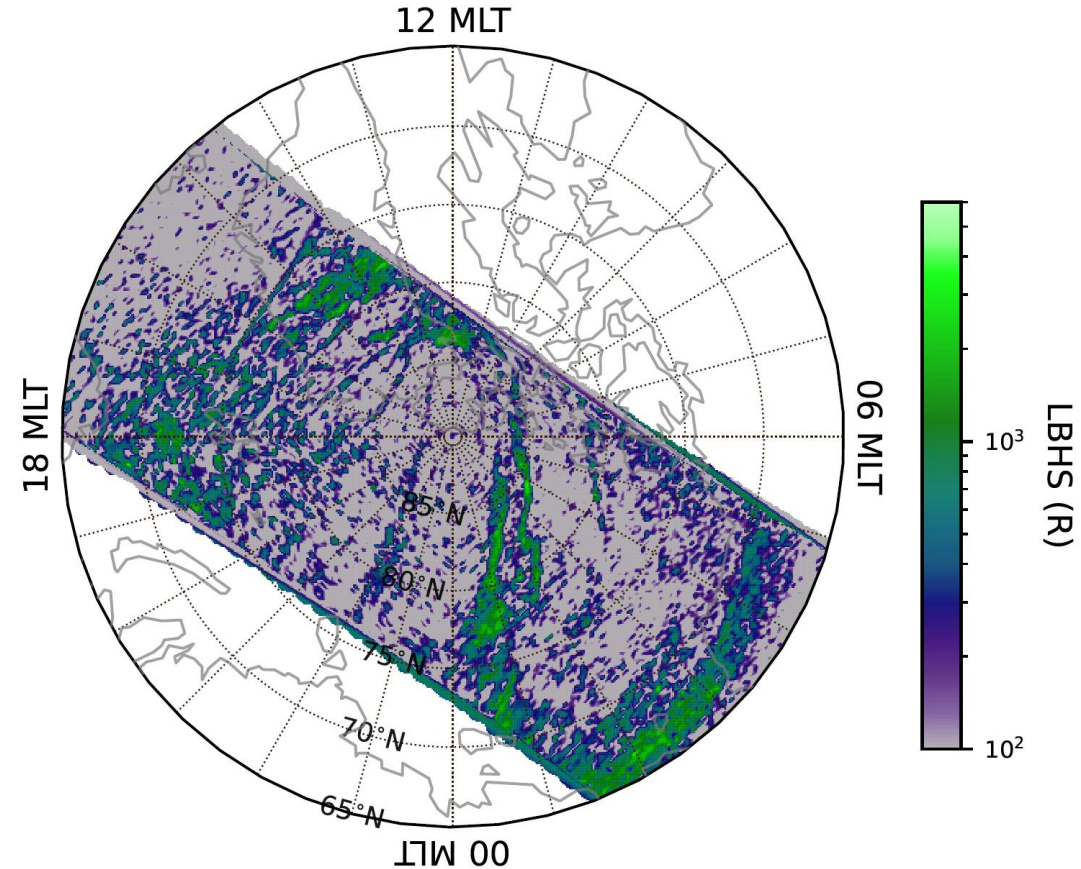
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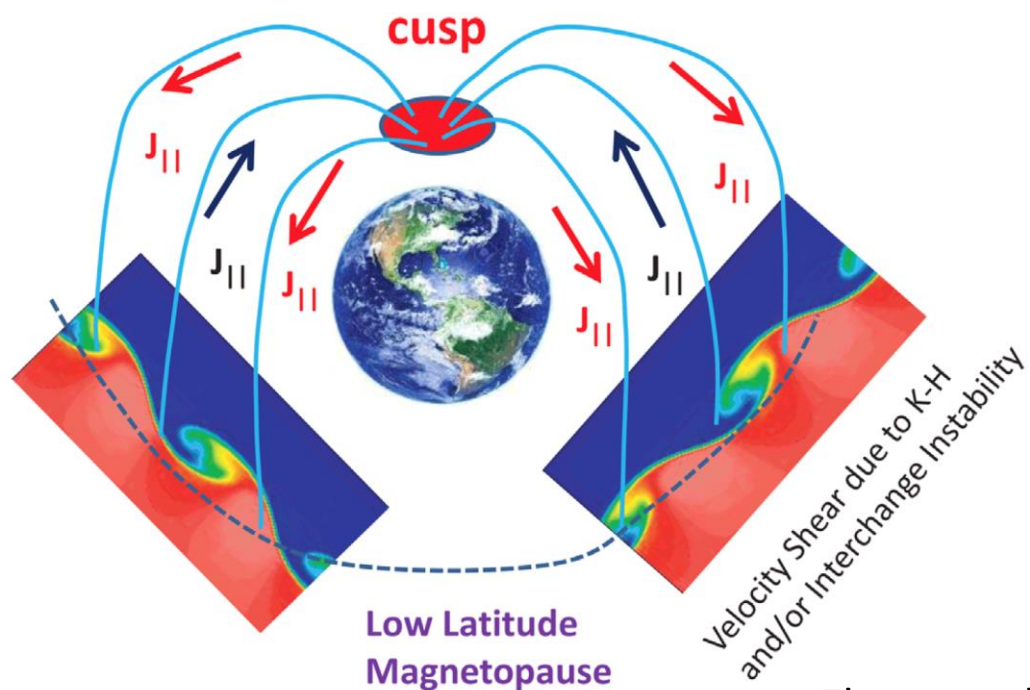
Transpolar Arc Data set

- DMSP SSUSI images used to identify TPAs during a six-week period around equinox
- 66 TPA events
- 19 of which are multiple arc events
- 10 multiple arcs are conjugate (NH+SH)
- 9 multiple arcs are non-conjugate (NH or SH)

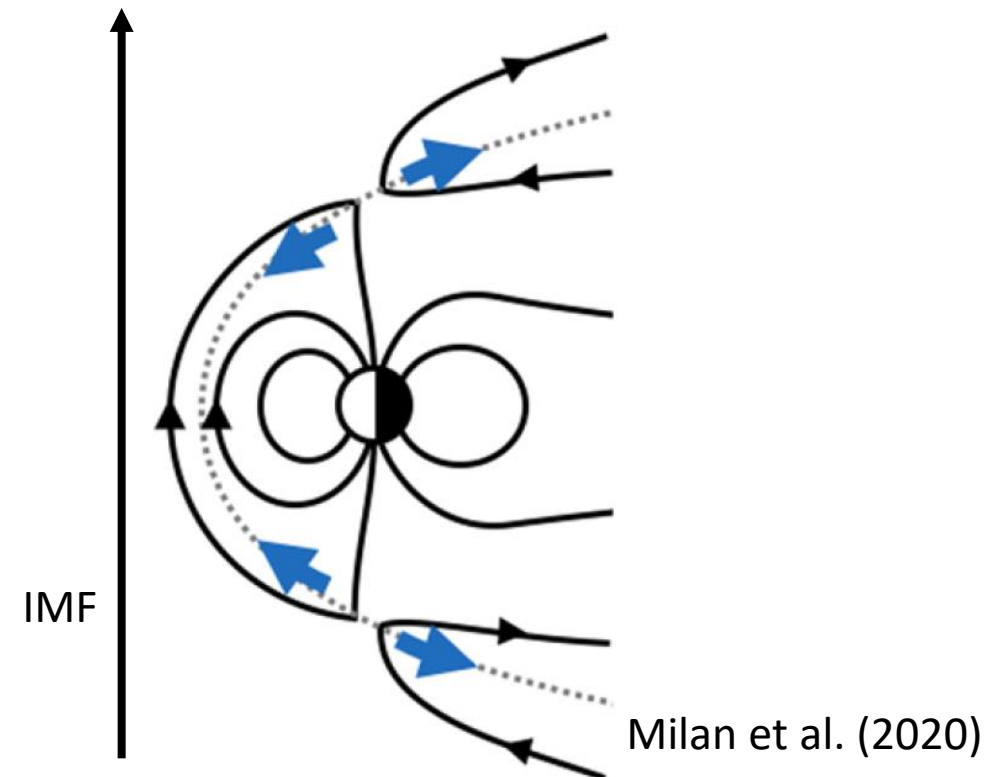


Possible Causes of Multiple Auroral Arcs

- Kelvin-Helmholtz instabilities
 - Requires high solar wind velocity and/or northward IMF
- Dual-lobe reconnection
 - Requires small IMF clock angle ($B_Y \approx 0$, $B_Z > 0$)



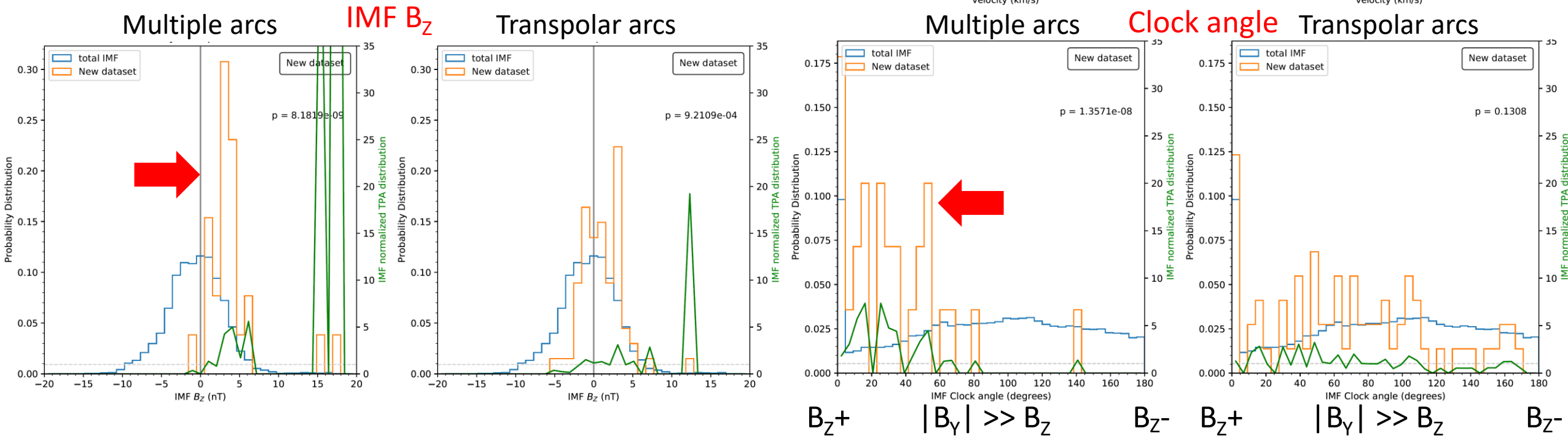
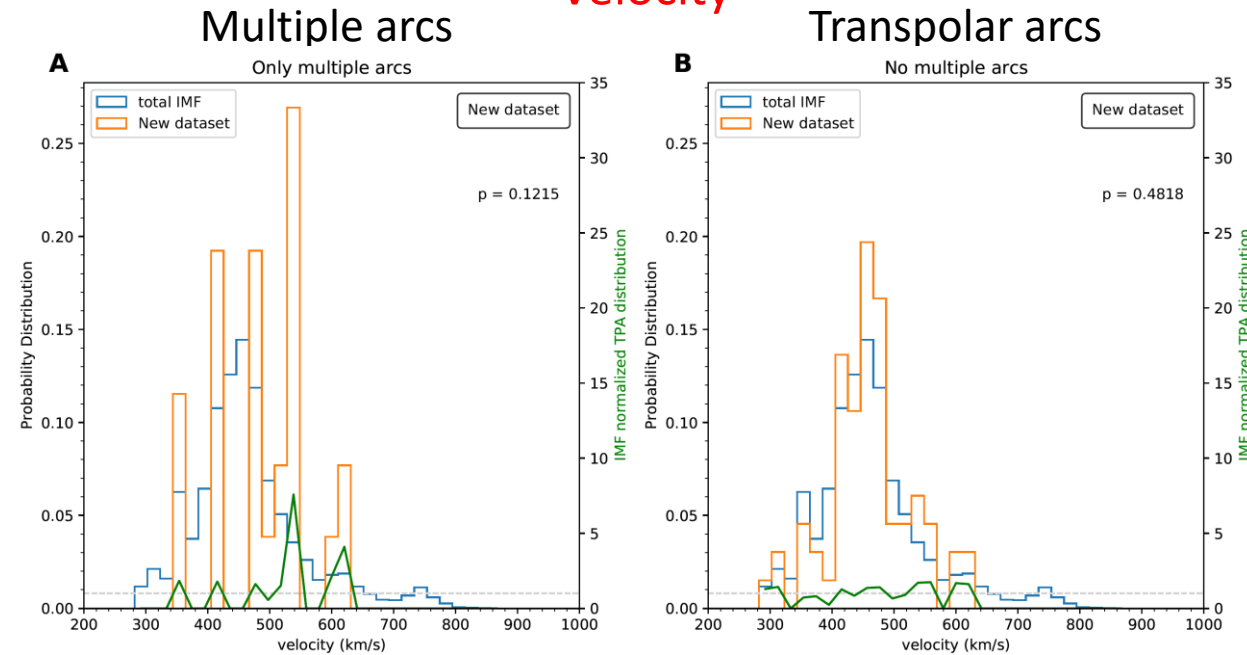
Zhang et al. (2016)



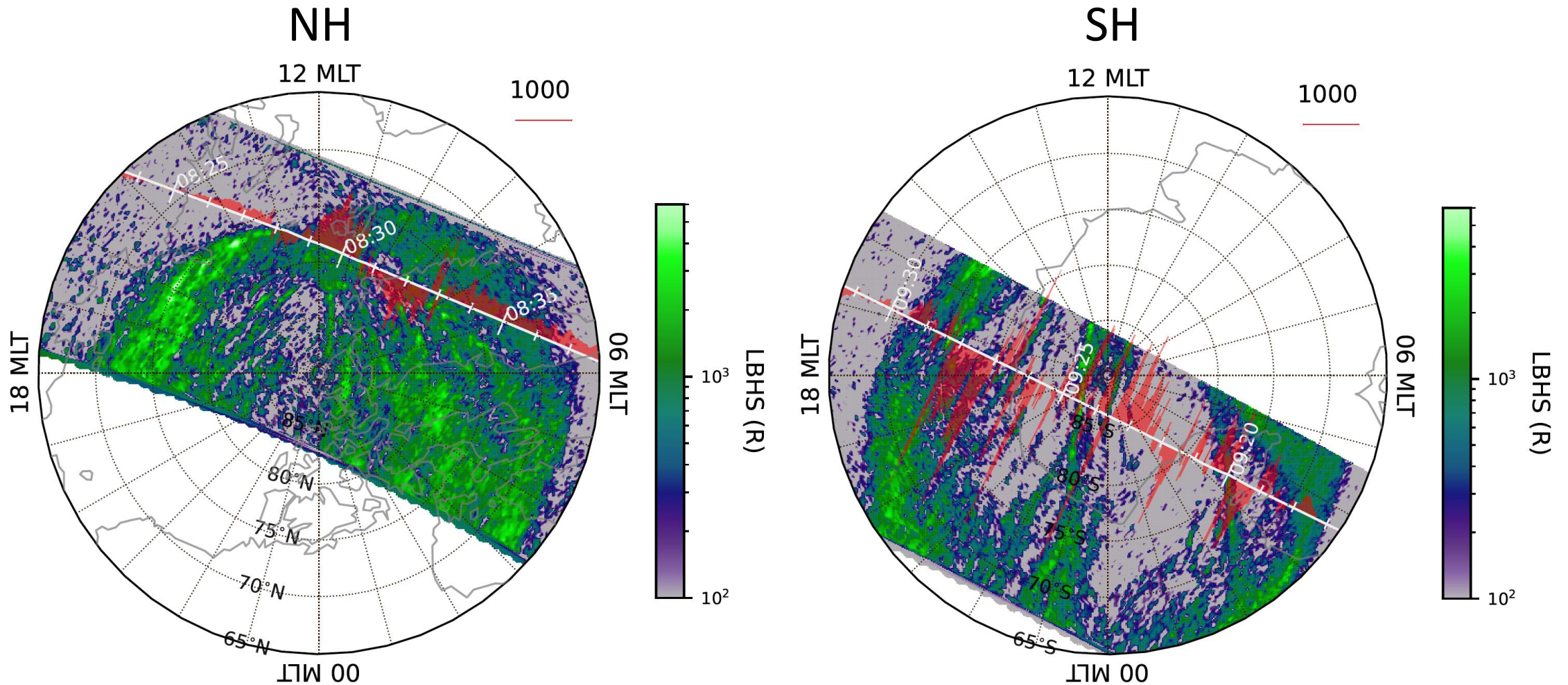
Multiple Arcs vs Transpolar Arcs

- No velocity dependence
- Larger IMF B_z and IMF clock angle dependence than regular TPAs

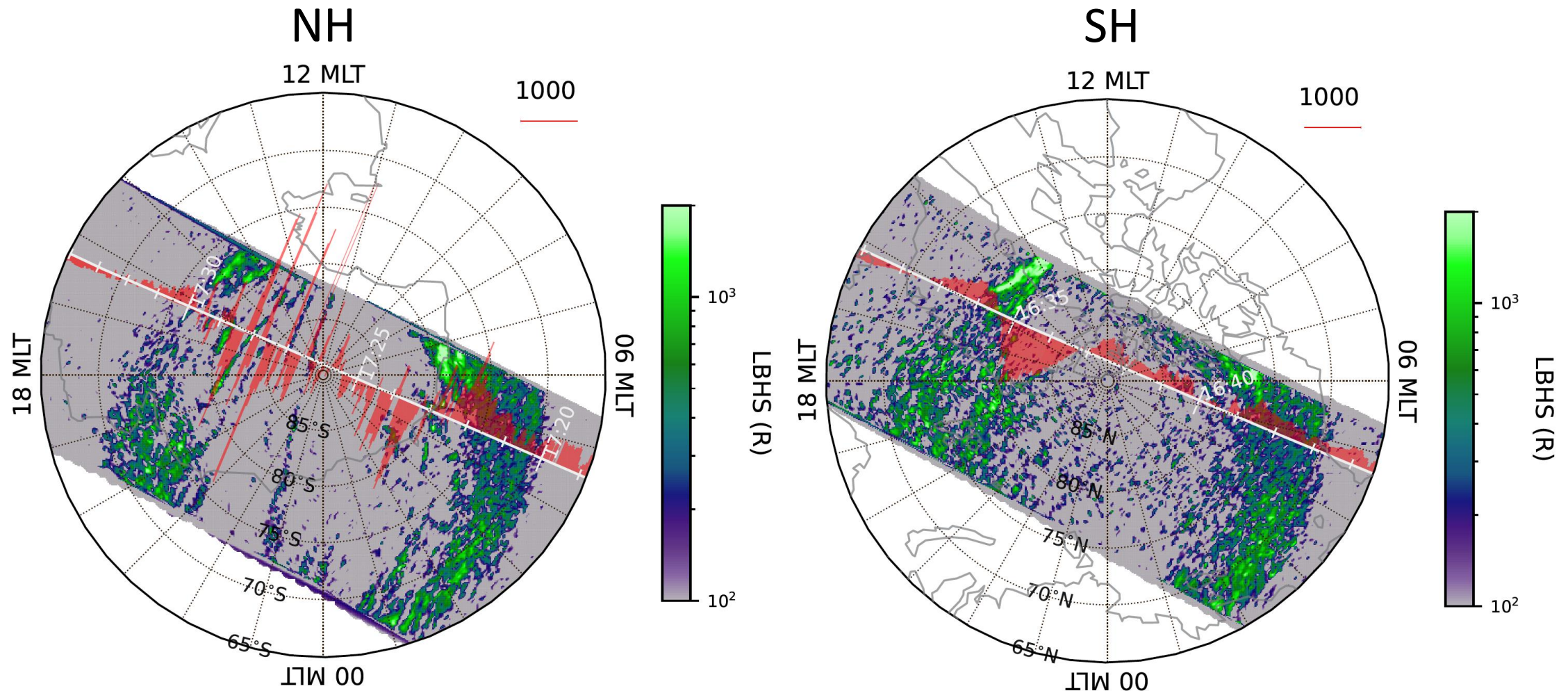
Velocity



Conjugate Multiple Arc Event



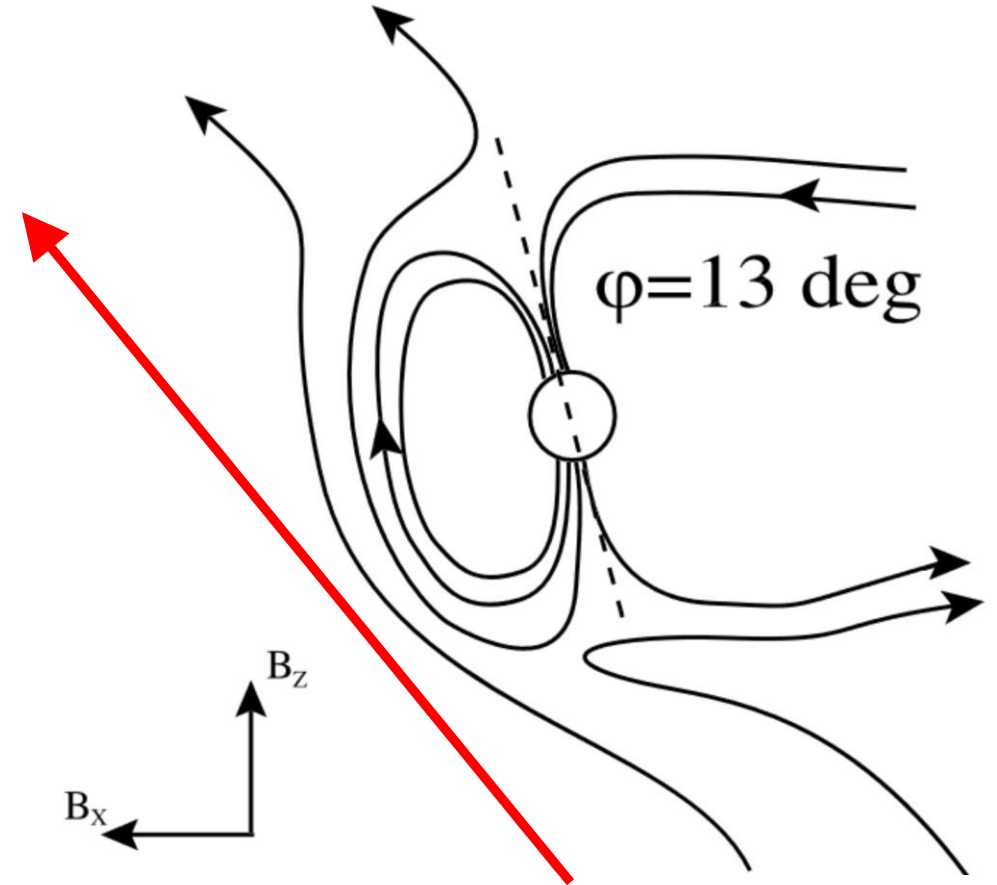
Non-Conjugate Multiple Arc Event



IMF B_x and Dipole Tilt Dependence

Conjugate vs Non-conjugate Multiple Arcs

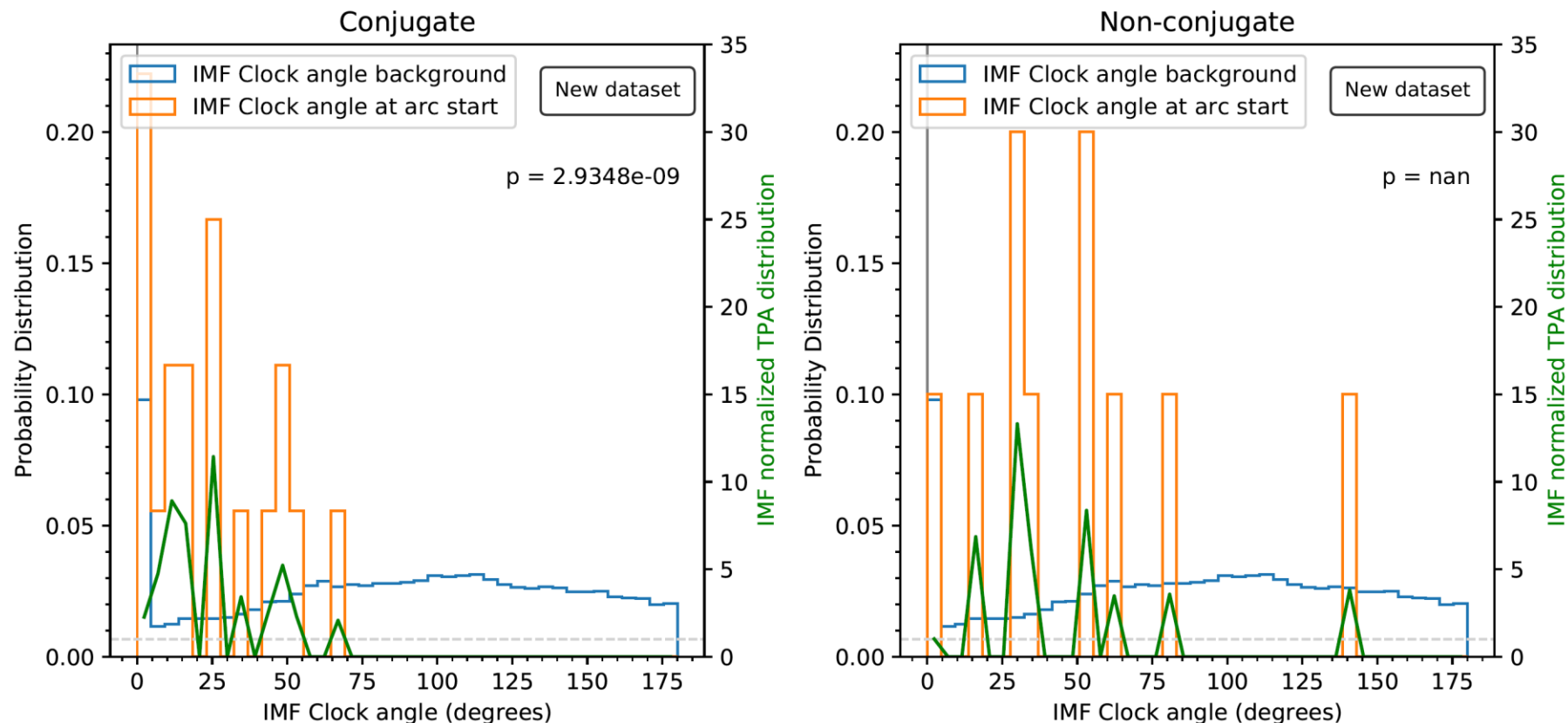
- No clear IMF B_x dependence
- No difference between conjugate and non-conjugate events
- Dipole tilt dependence unclear due to orbit bias



IMF Clock Angle Dependence

Conjugate vs Non-conjugate Multiple Arcs

- Nearly all conjugate multiple arcs occur during small clock angles ($= \text{Northward } B_z \gg |B_y|$)
- **Dual-lobe reconnection could cause conjugacy of multiple arcs**



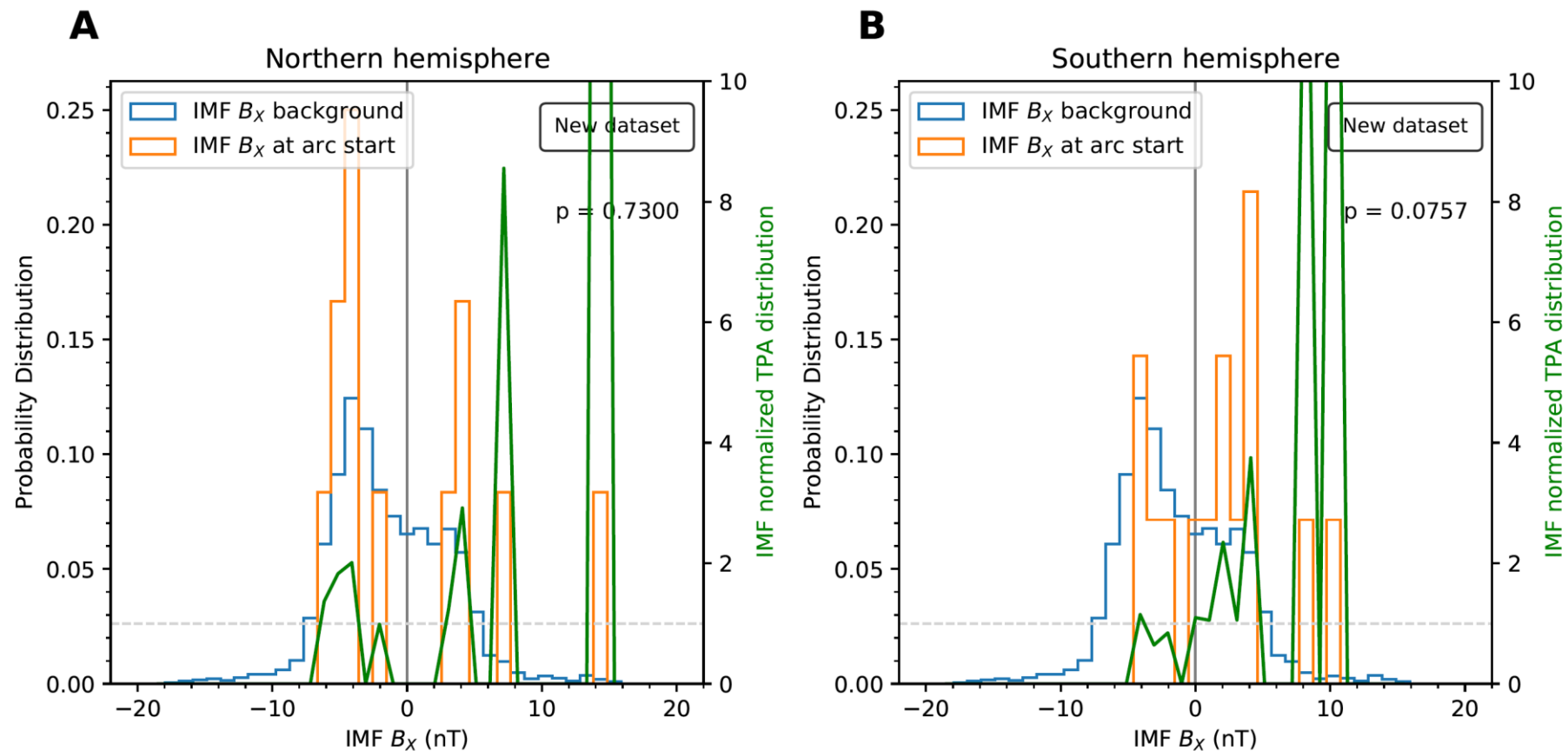
Summary

- **Multiple arcs vs isolated** transpolar arcs
 - Smaller IMF clock angle for multiple arcs (strongly northward IMF)
 - Multiple arcs similar to horse-collar aurora
- **Conjugate vs non-conjugate** multiple arcs
 - Non-conjugacy appears independent of IMF B_x
 - Smaller IMF clock angle for conjugate multiple arcs (~pure northward IMF)
 - Both dual-lobe reconnection (Milan et al., 2020) and KH instability (Zhang et al., 2016) could explain conjugacy of multiple arcs

Thank you!

Appendix: IMF B_x Distribution for Multiple Arcs

- B_x : no statistically significant deviation from background



Appendix: vB^2 for Multiple Arcs vs Transpolar Arcs

- vB^2 : no statistically significant difference

