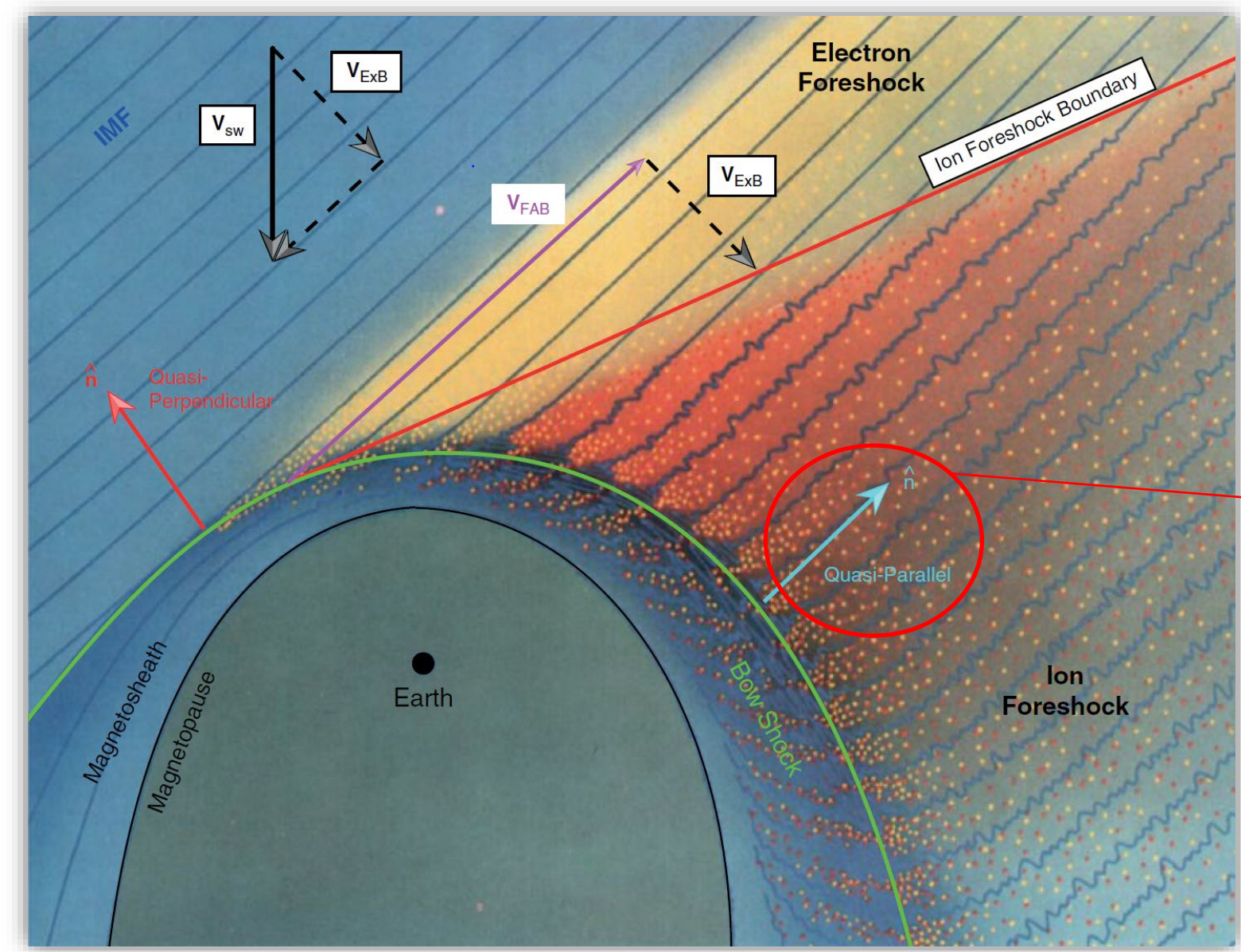
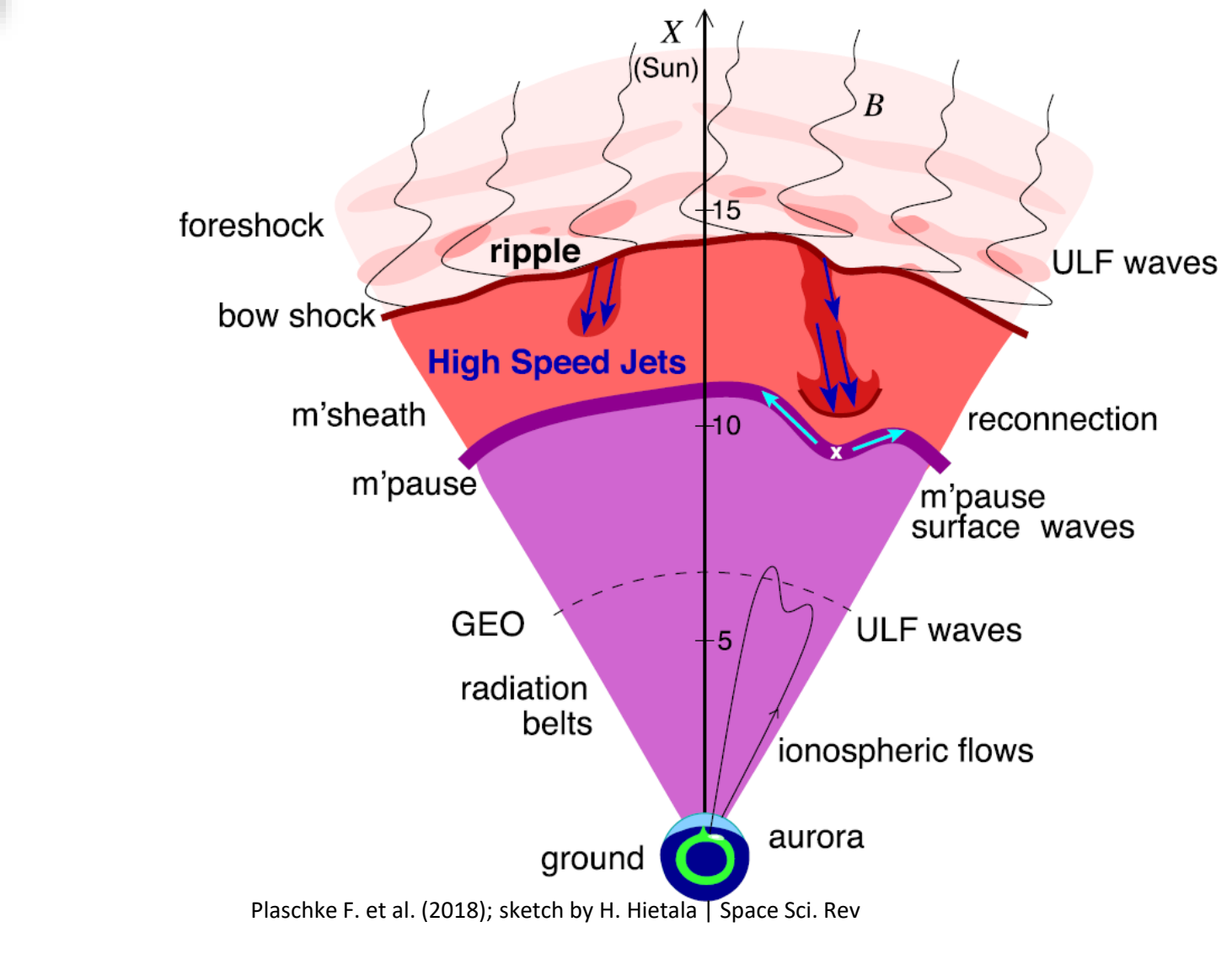
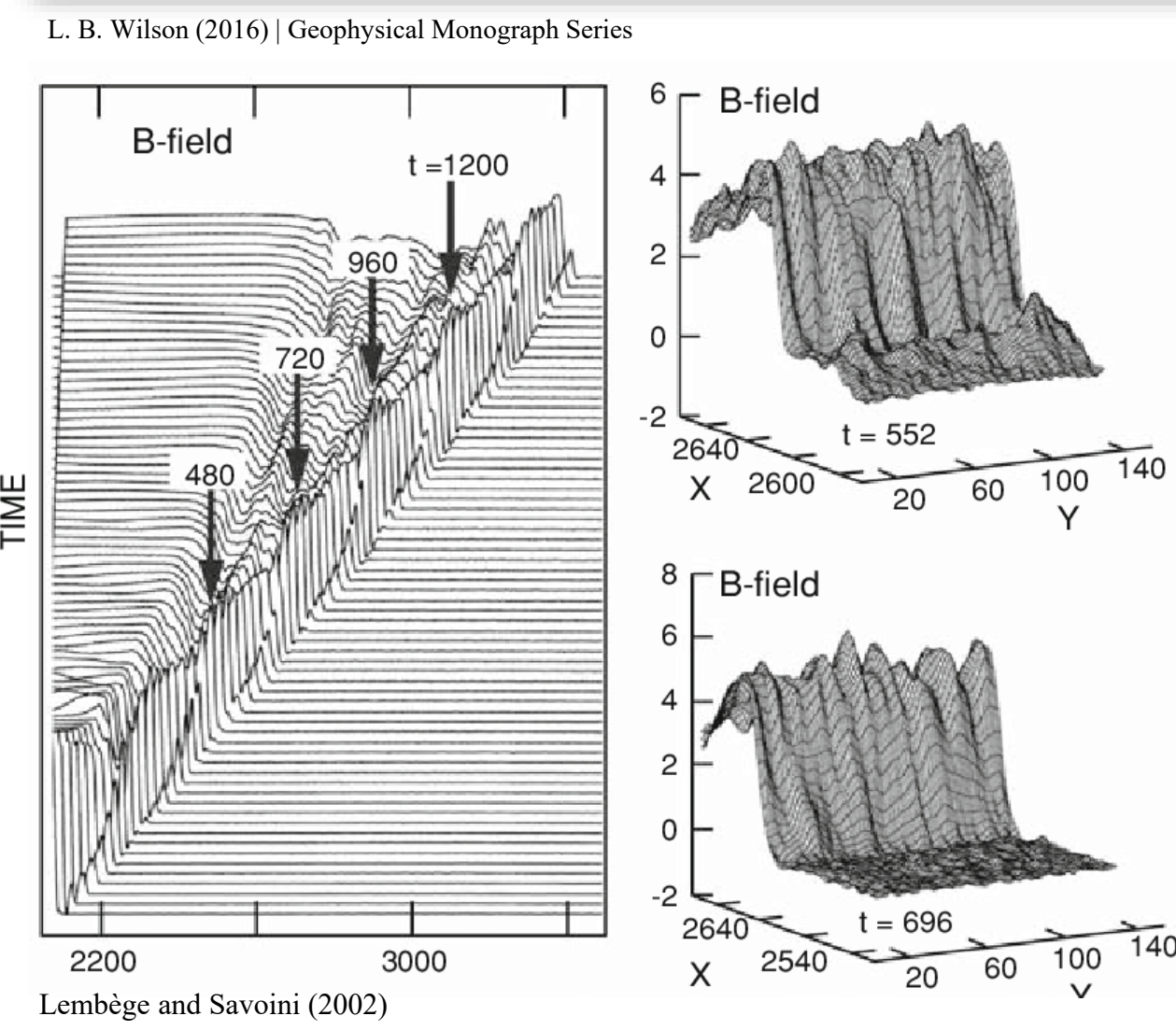


Bow shock & Magnetosheath Jets



Bow Shock
Solar wind is braked, thermalized and compressed, forming the magnetosheath, downstream of the shock

Quasi-par shock
 $\theta_{BN} \approx 45$ (angle between IMF & shock normal) \rightarrow reflected ions \rightarrow wave and particle interaction
 \rightarrow turbulent foreshock & magnetosheath



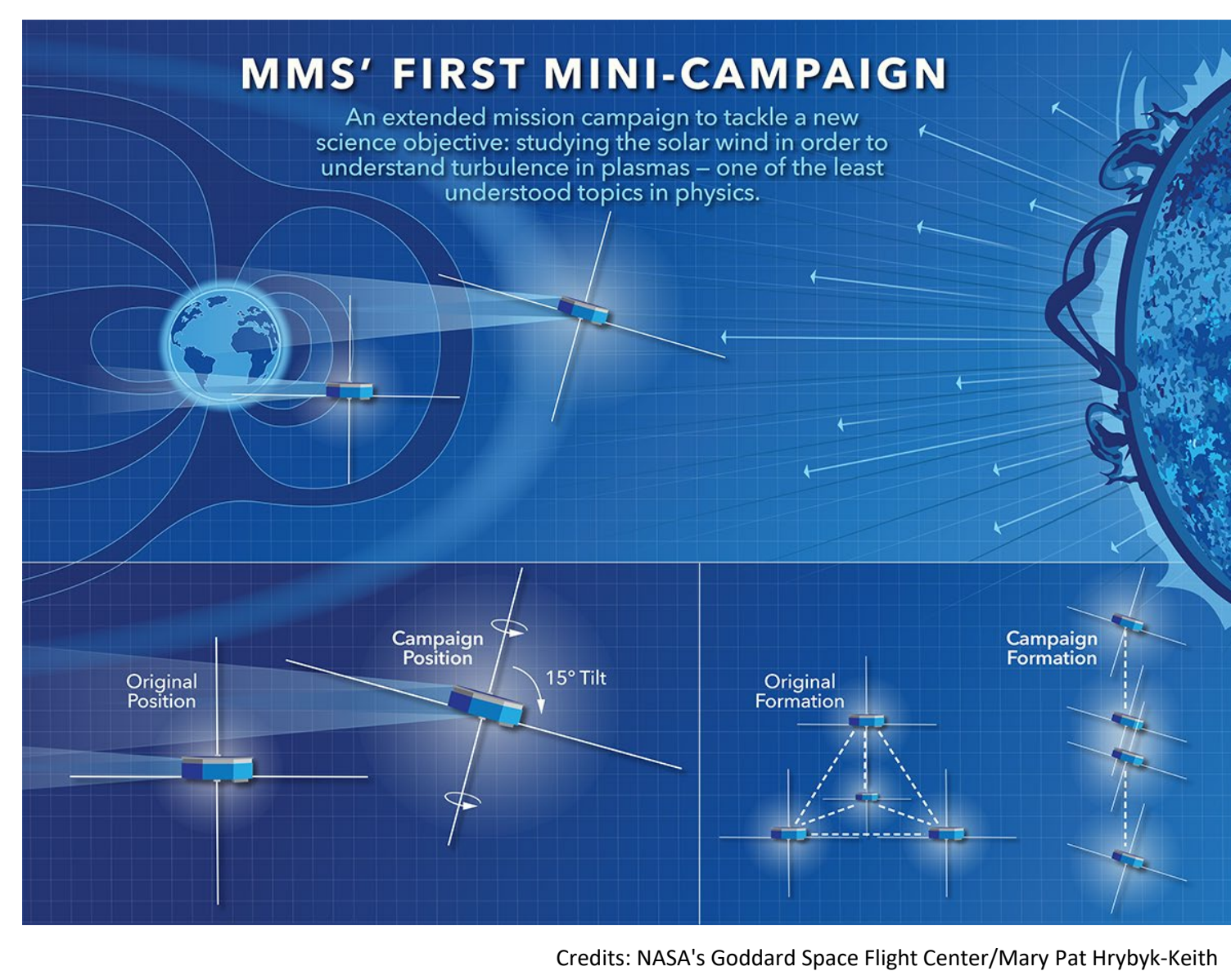
Shock Reformation
Shock is constantly *reforming*, due to the evolution of foreshock compressive structures (e.g. SLAMS/shocklets) that effectively form the shock front locally

Magnetosheath jets are dynamic pressure enhancements relative to the background magnetosheath.
 $P_{dyn} \geq 2 \langle P_{dyn} \rangle_{MHS}$

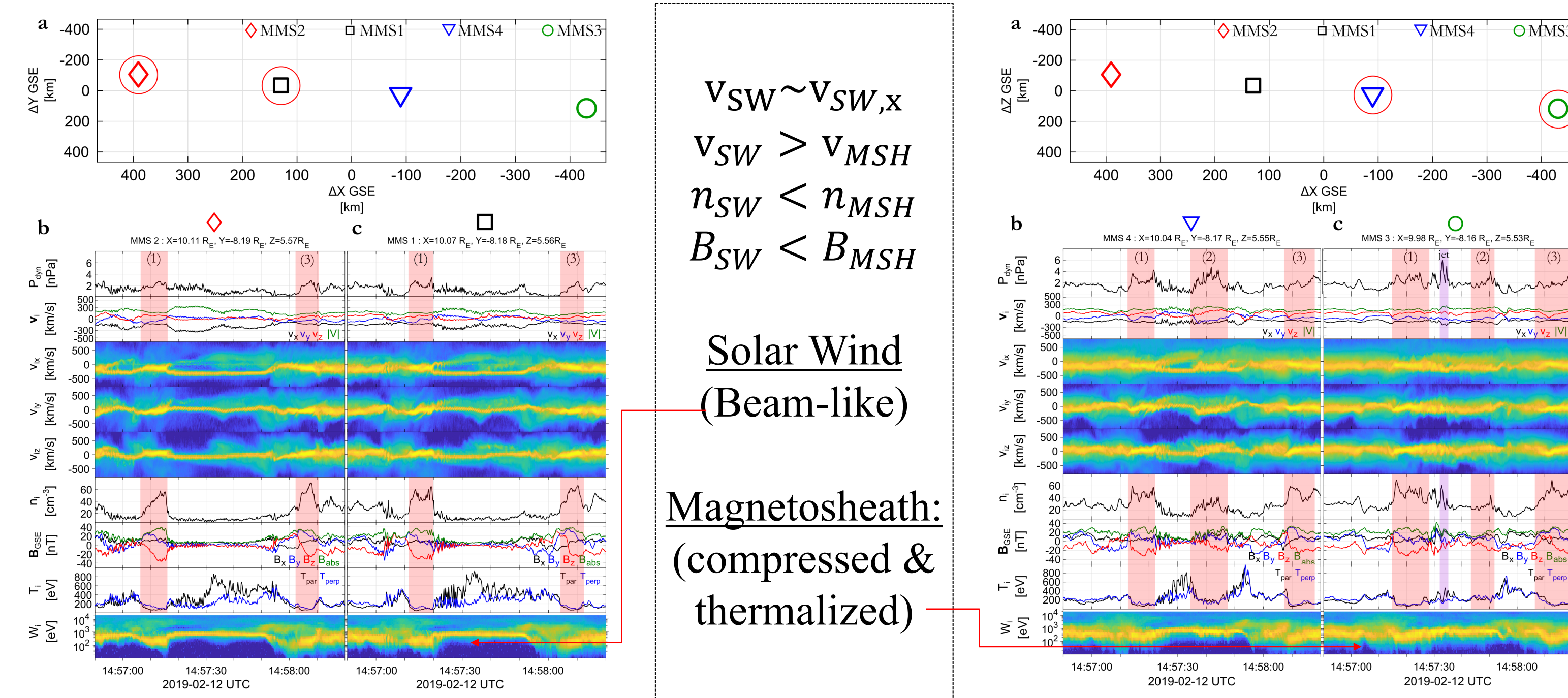
MMS mission

Unique opportunity for shock research for the Magnetosphere Multiscale (MMS) Mission

- Turbulence campaign (large separation)
- Spacecraft aligned in the x direction (GSE)
- Burst data (high resolution) available



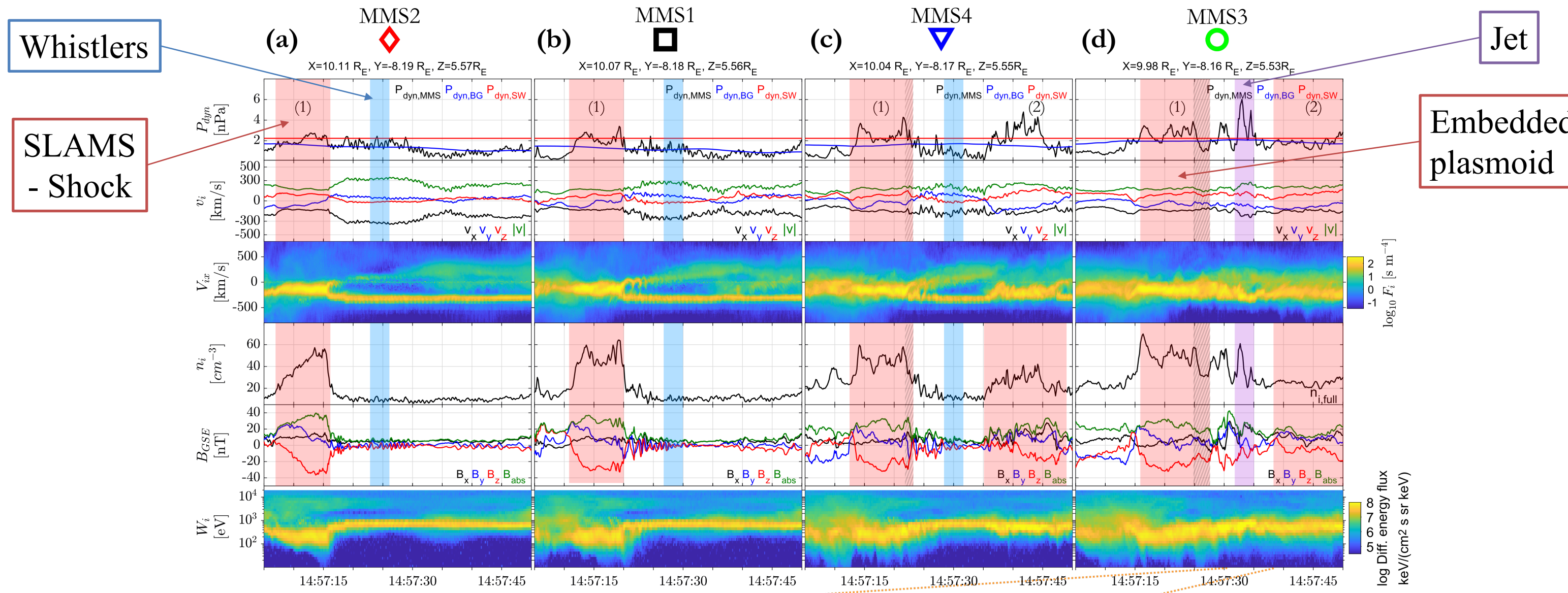
Results | in-situ observations



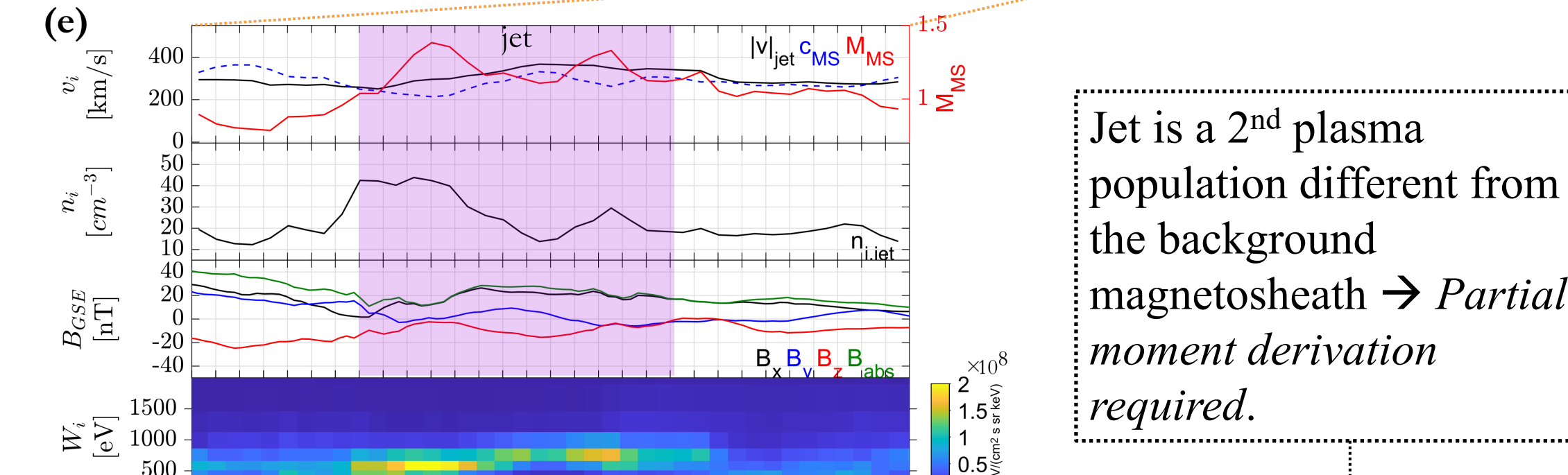
$v_{SW} \sim v_{SW,x}$
 $v_{SW} > v_{MSH}$
 $n_{SW} < n_{MSH}$
 $B_{SW} < B_{MSH}$

Solar Wind
(Beam-like)

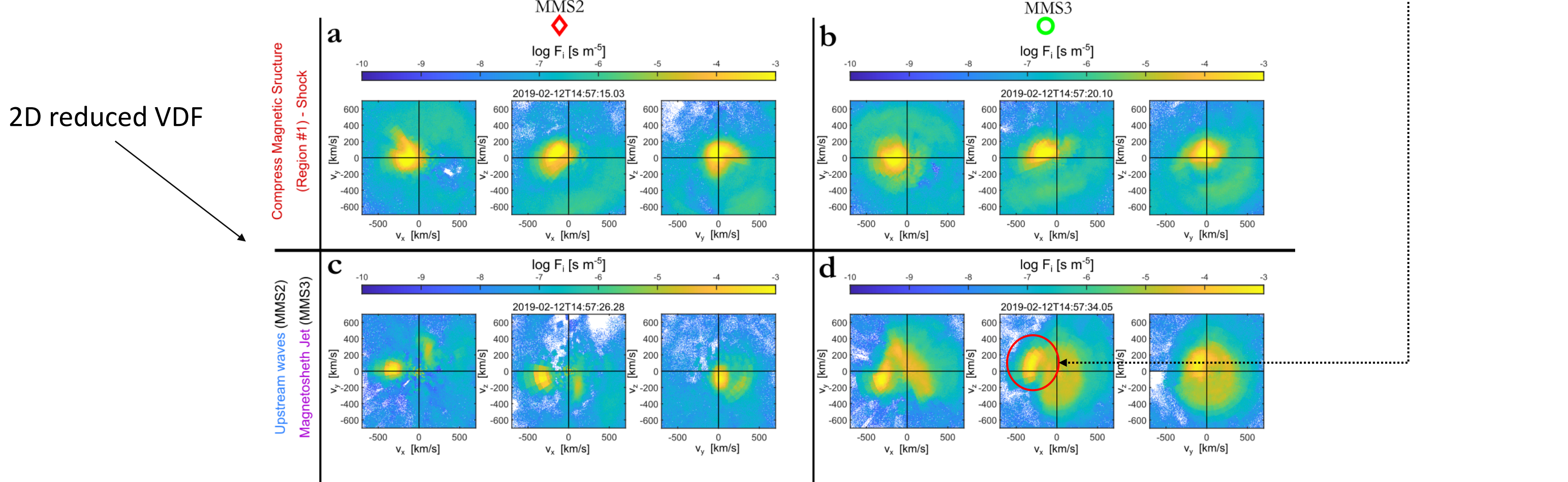
Magnetosheath:
(compressed & thermalized)



- Supermagnetosonic: $M_{MS} \approx 1.2 - 1.4$
- Anti-sunward: $V_x \approx 350$ km/s
- $\frac{P_{dyn,jet}}{P_{dyn,MSH}} \approx \frac{P_{dyn,jet}}{P_{dyn,SW}} \approx 3$

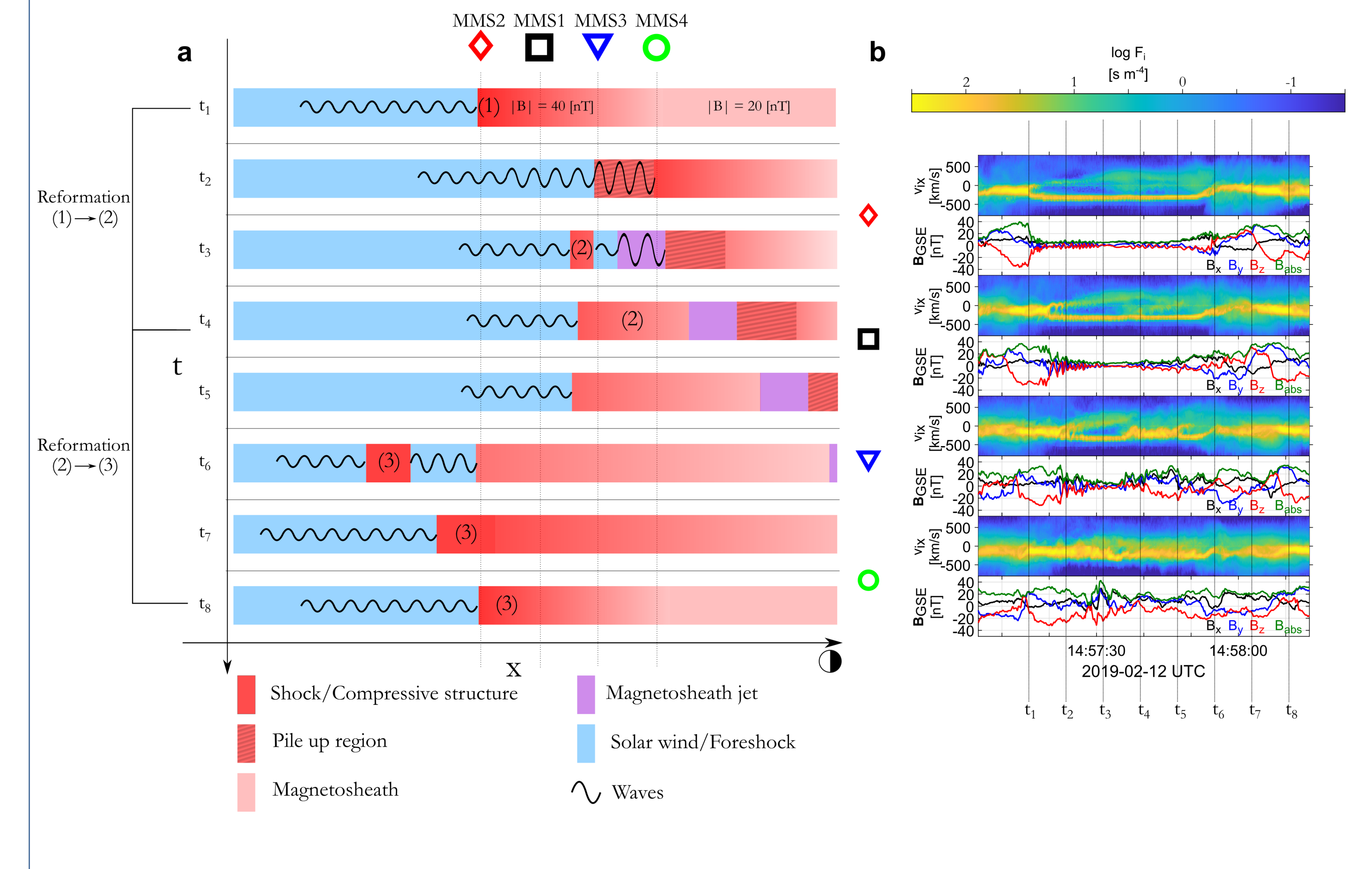


Jet is a 2nd plasma population different from the background magnetosheath \rightarrow Partial moment derivation required.



Results | Model

Model of the shock evolution, reformation and the generation of a magnetosheath jet.



Summary & Conclusion

- **Super-magnetosonic downstream jets are generated directly from the bow shock evolution.** Density enhancement is associated to upstream foreshock waves while velocity is connected to solar wind having a weak interaction with the reforming shock.
- **Embedded plasmoids** (downstream density enhancements) appear to be shock remnants originating from the same shock reformation process.
- We show a **generation mechanism that does not require specific geometry or external effect.** Jets are generated from a fundamental collisionless shock process.
- Results may be relevant to other shock environments & acceleration mechanisms (cosmic rays, astrophysical shocks, planetary shocks, etc.).