



# Magnetosheath jets using MMS: classification and generation mechanisms

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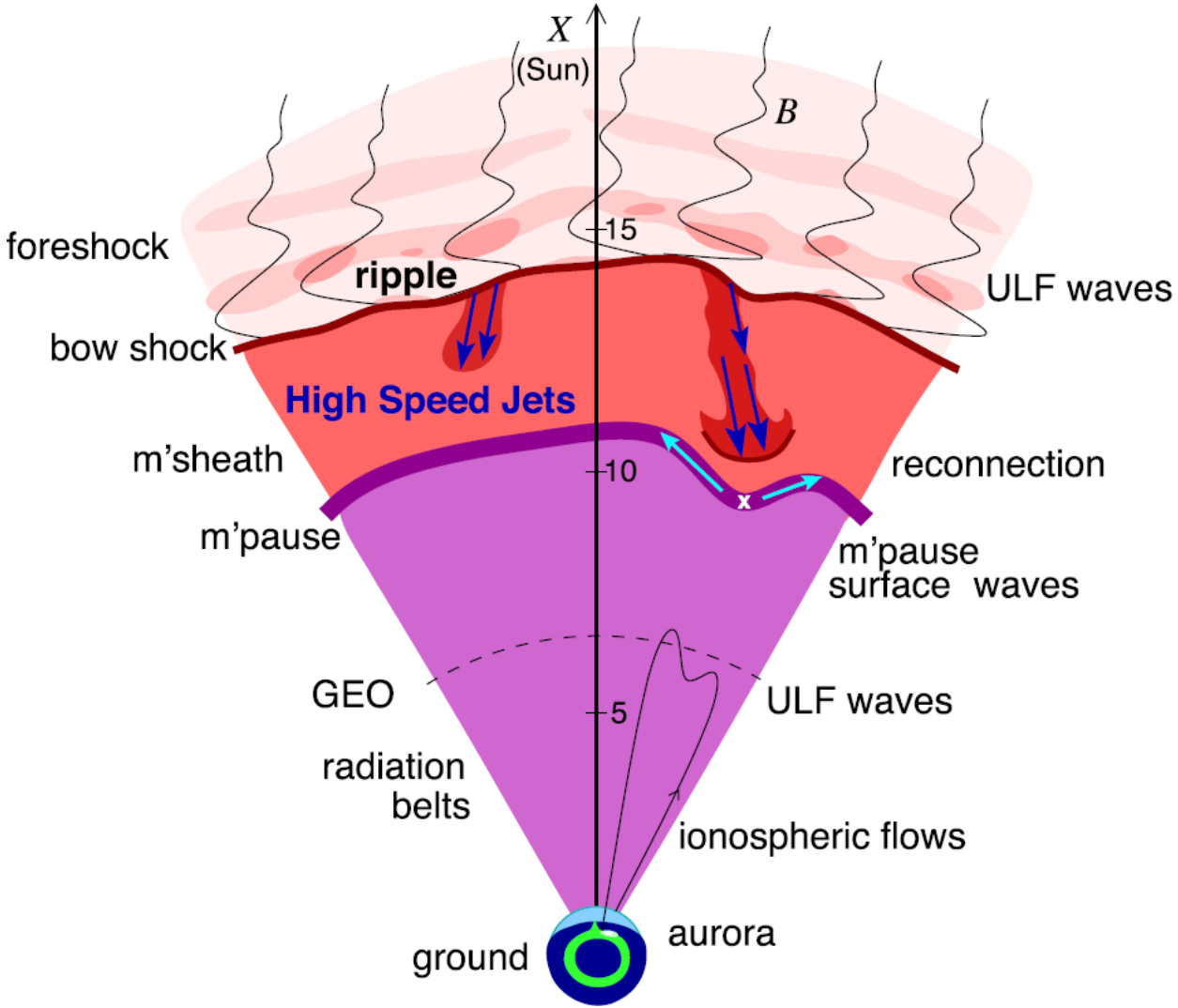
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Technology, Sweden

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Austria

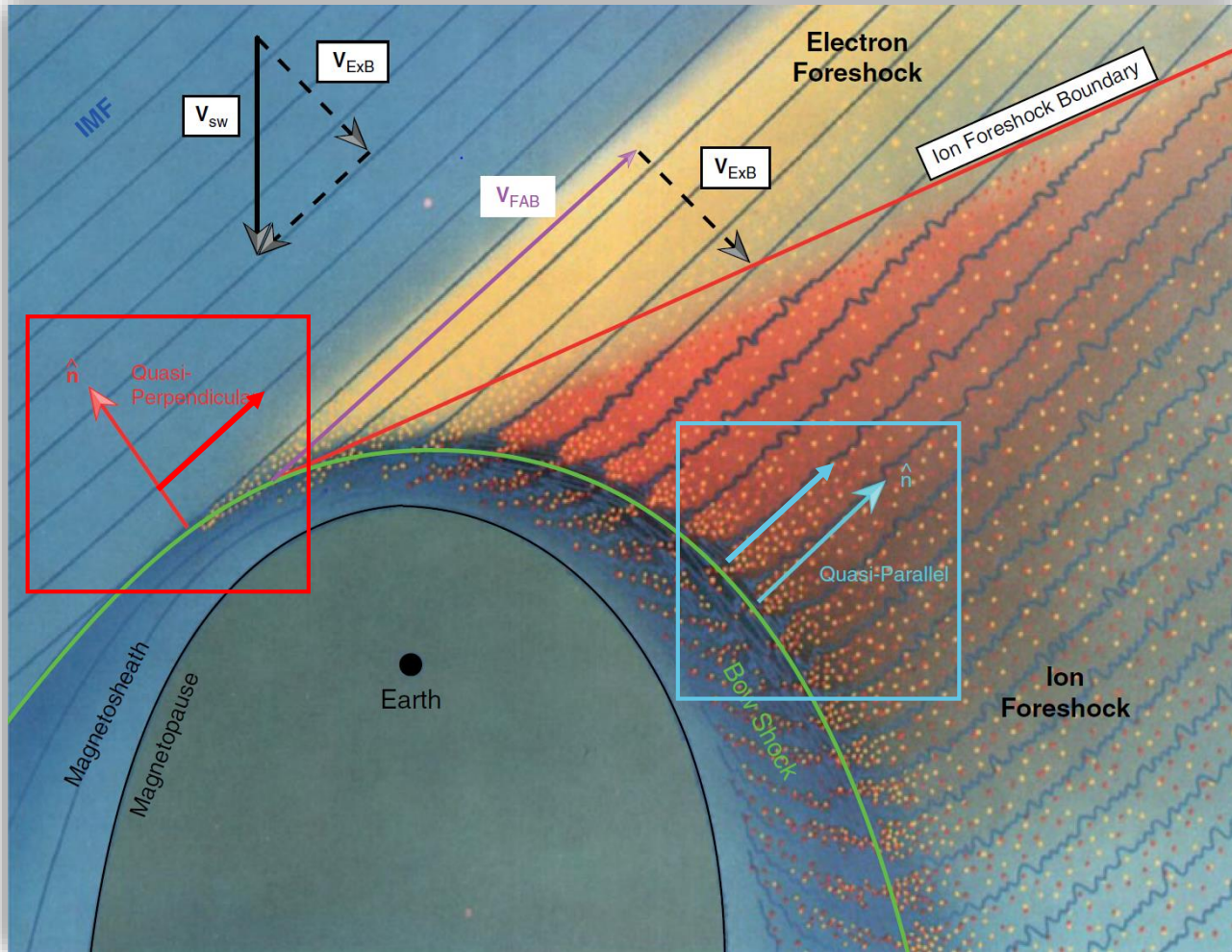
COSPAR 2021

31/01/2021

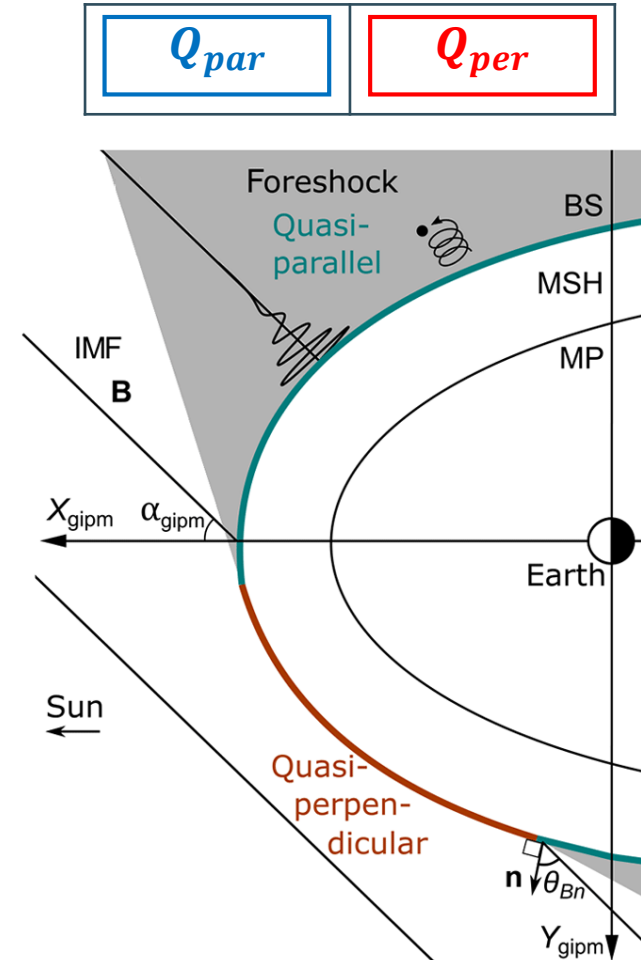
# Introduction – Magnetosheath Jets



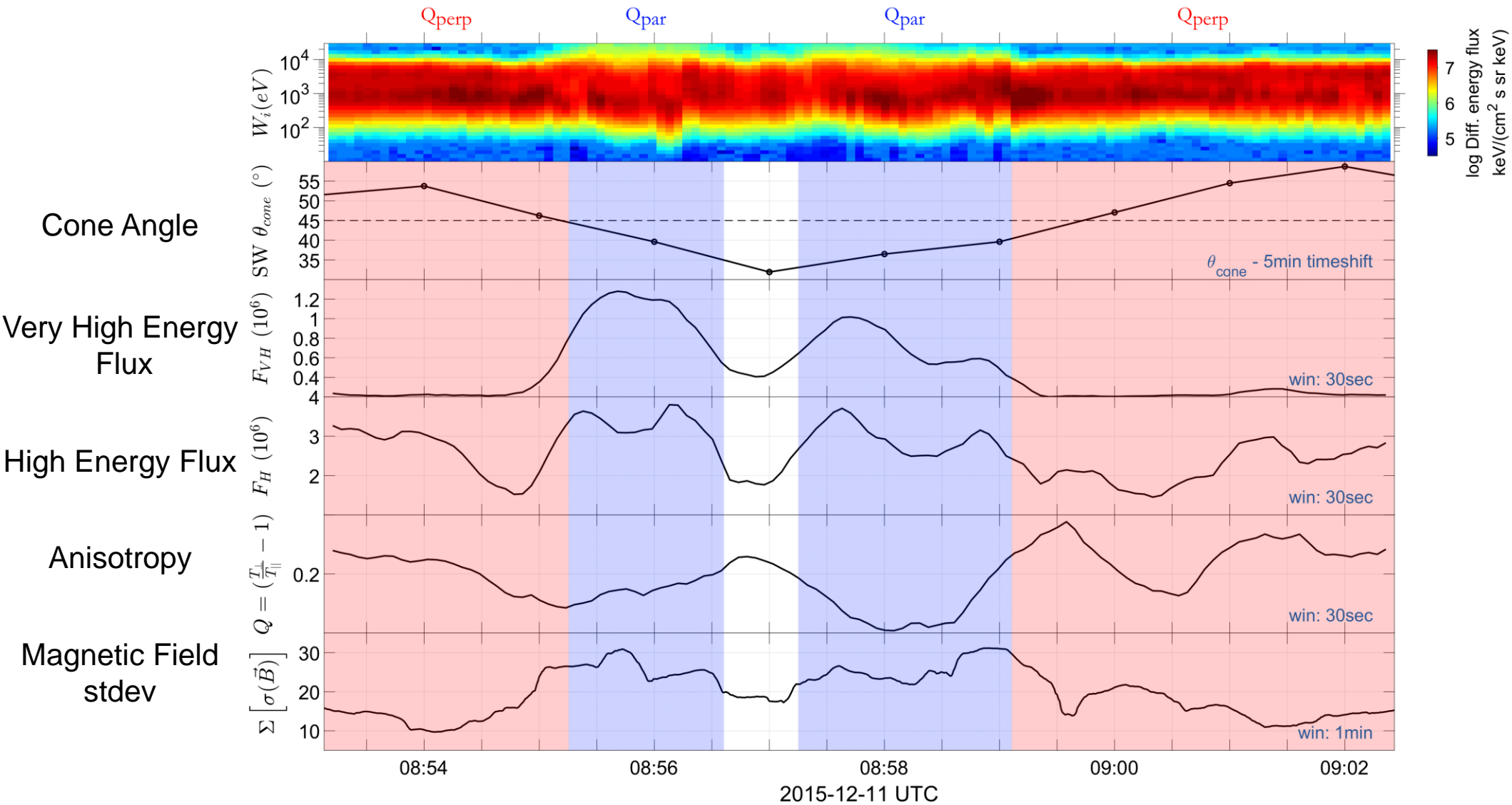
# Motivation – Main Subcategories



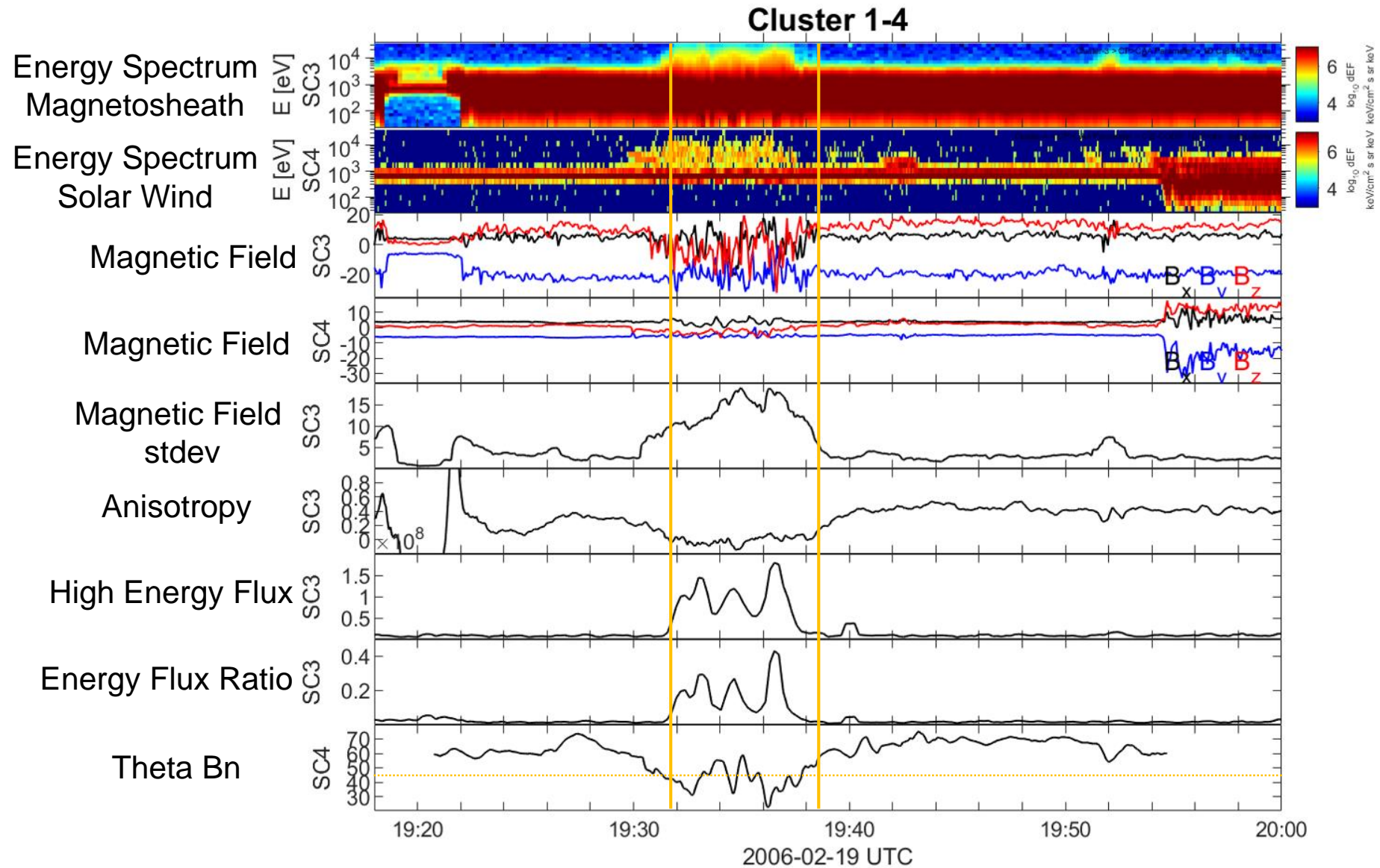
"Found ~9 times more often behind the Qpar bow shock"



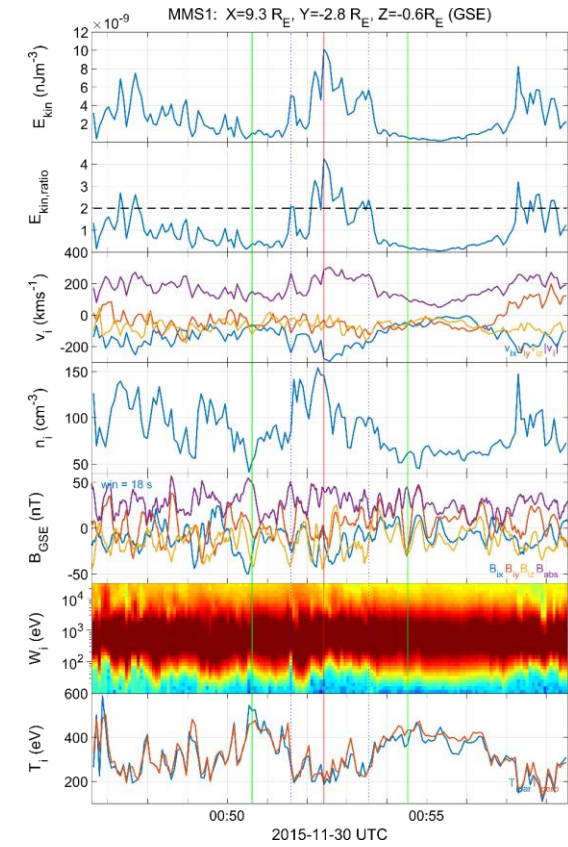
# Classification Procedure in progress



# Multispacecraft Classification using Cluster

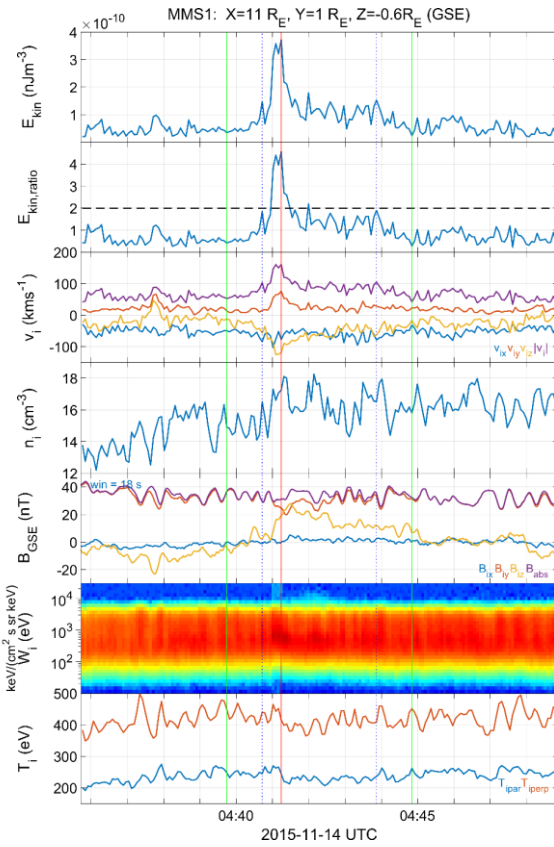


# Main Categories of Jets



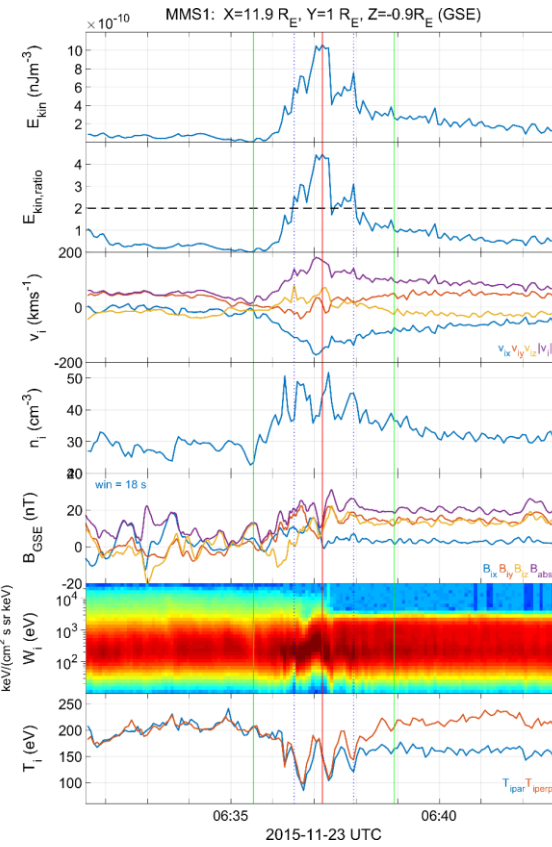
Qpar Jet

Jets found in  $Q_{||}$  MSH



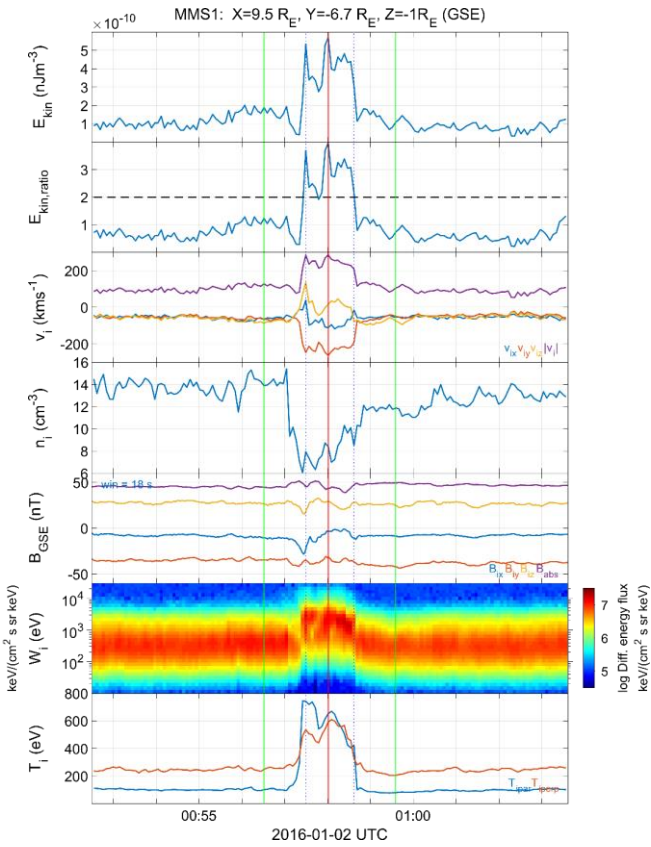
Qperp Jet

Jets found in  $Q_{||}$  MSH



Boundary Jet

Jets found in the boundary between  $Q_{||}$  and  $Q_{\perp}$  MSH

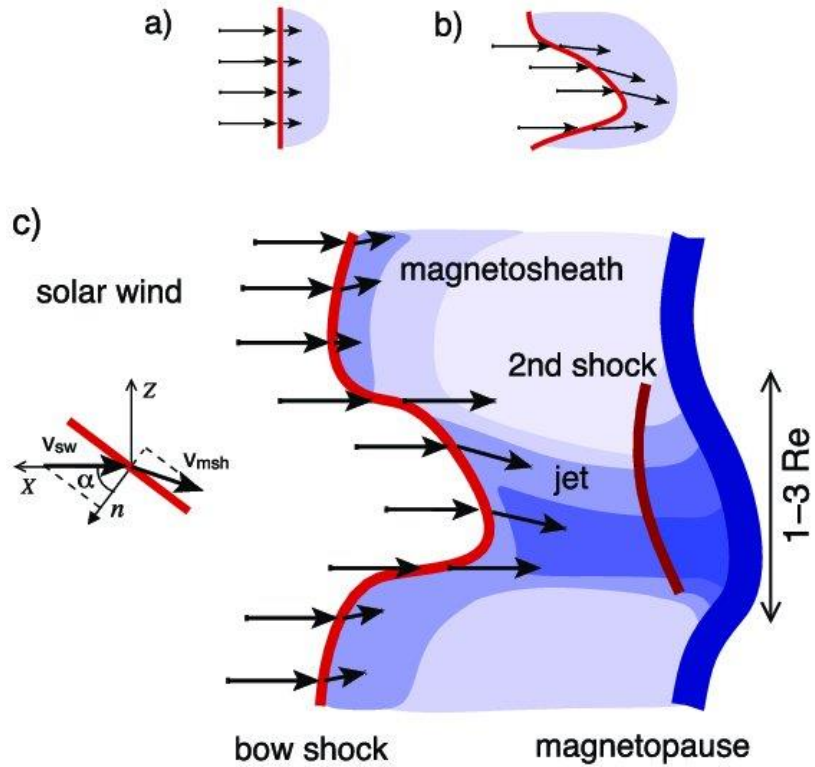


Encapsulated Jet

Jets corresponding to  $Q_{||}$ -like MSH plasma enclosed in  $Q_{\perp}$  MSH

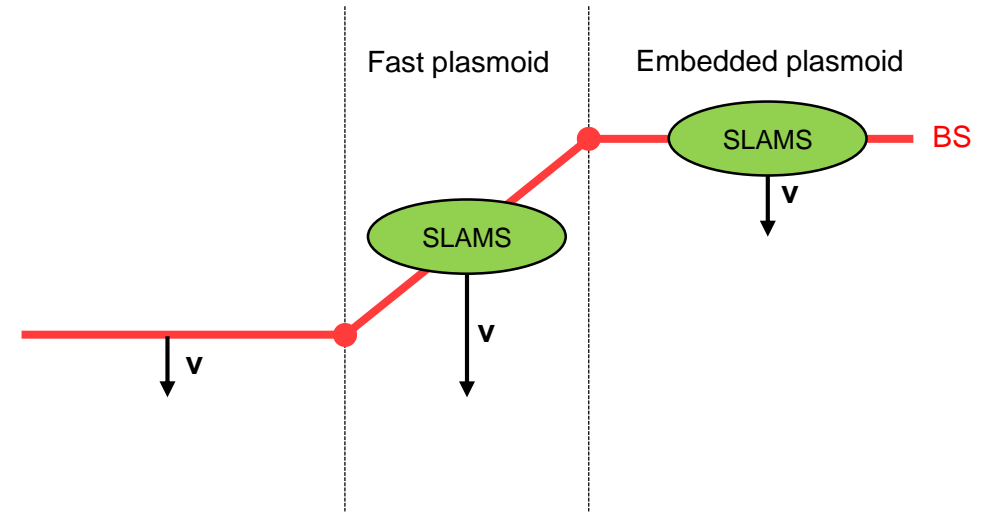
# Connecting to existent mechanisms

## Bow shock ripples



Faster flow ( $\Delta V$ )  $\rightarrow$  Less heated ( $\Delta T$ )

## SLAMS penetration



Steepened wave ( $\Delta B$ )  $\rightarrow$  Density enhancement ( $\Delta n$ )

# Recent Results

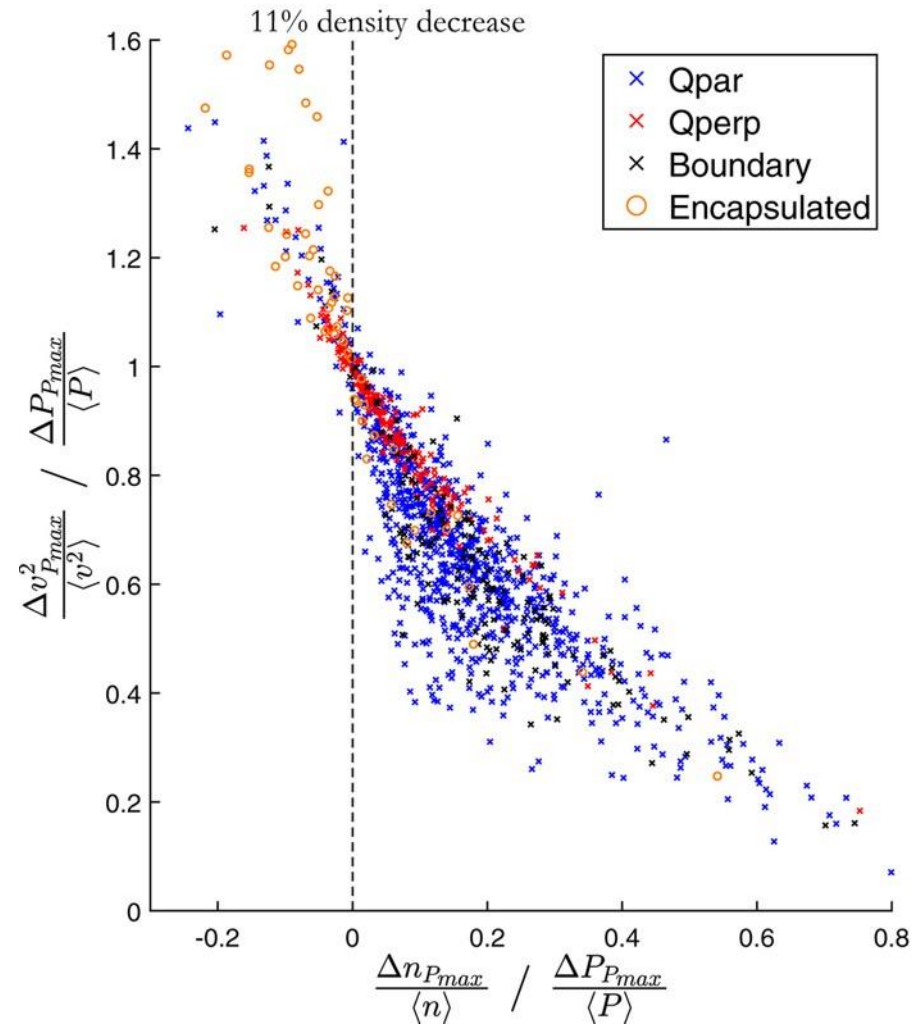
**Raptis S.**, Karlsson T., et al. (2020) | JGR

**Raptis S.**, Aminalragia-Giamini S., et al. (2020) | Frontiers

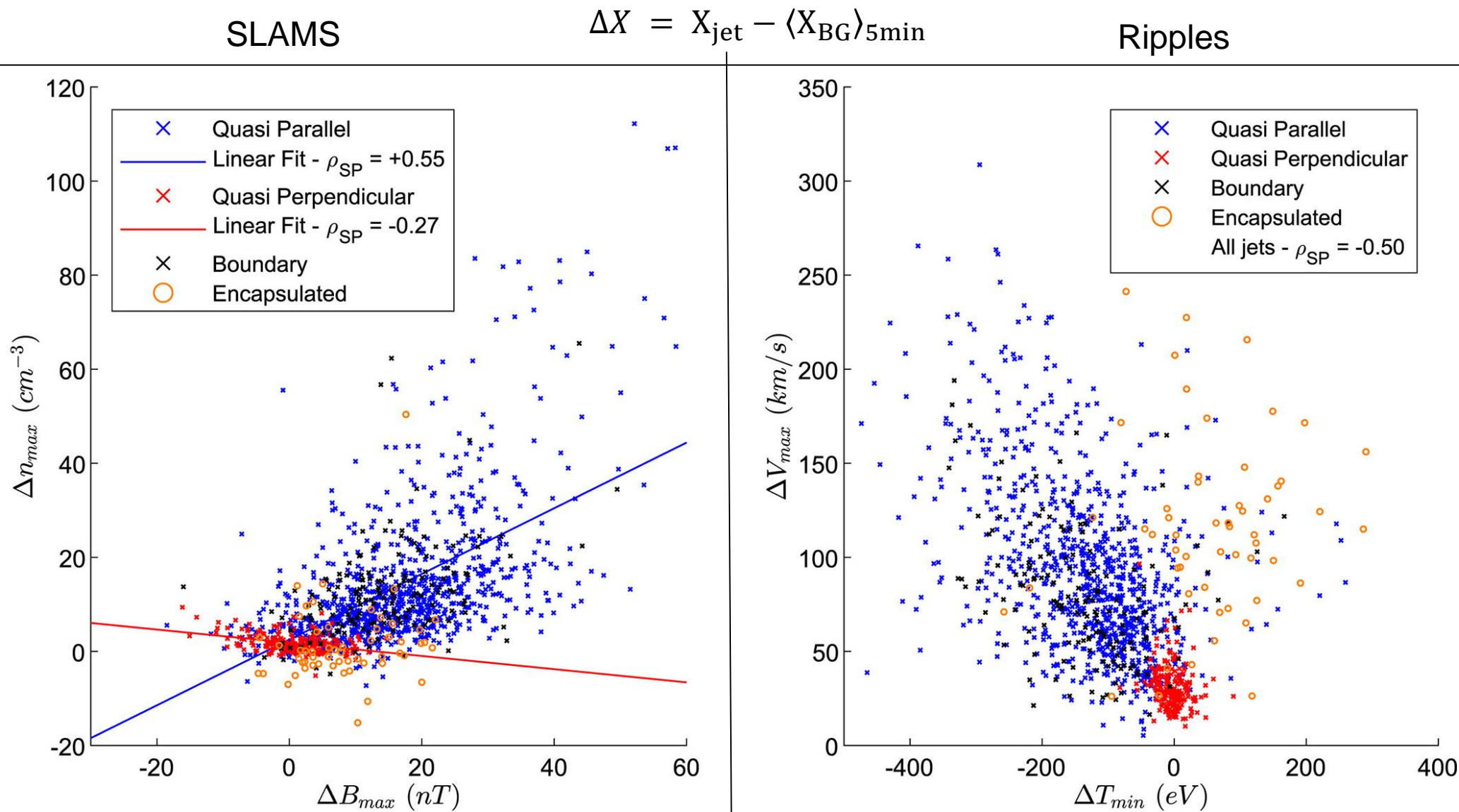
Palmroth M., **Raptis S.**, et al. (2020) | Annales (under review)



# Current main results (1)

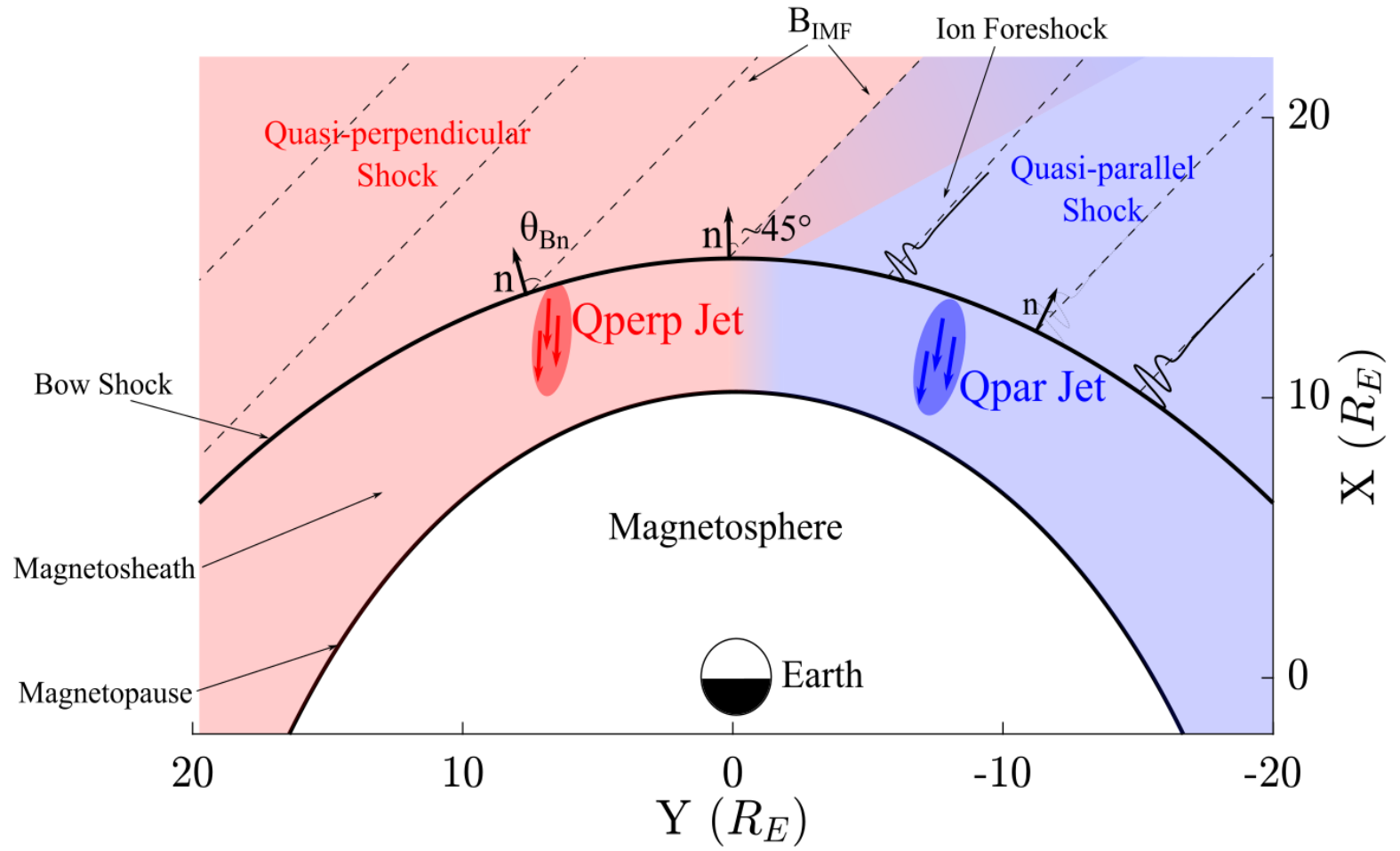
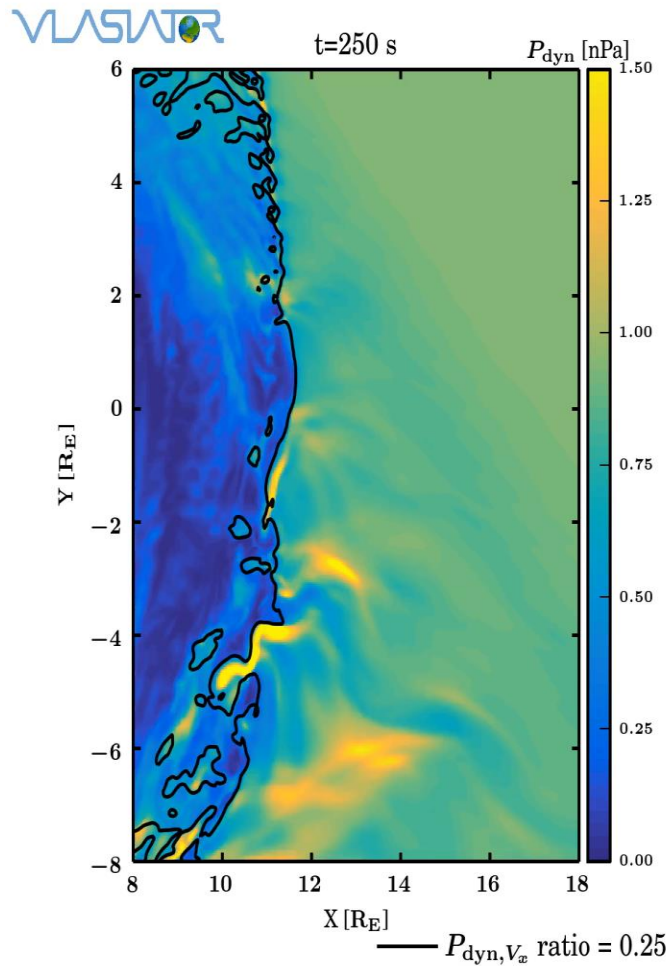


# Current main results (2)



# Ongoing Work

# Ongoing work – Approaching the shock



# Updated database of jets

Initial: N = 8499

Subset	Number	Percentage (%)
Quasi-parallel	2284	26.9
Final cases	<b>860</b>	10.1
Quasi-perpendicular	504	5.9
Final cases	<b>211</b>	2.5
Boundary	744	8.8
Final cases	<b>154</b>	1.8
Encapsulated	77	0.9
Final cases	<b>57</b>	0.7
Other	4890	57.5
Unclassified/Uncertain	3499	41.2
Border	1346	15.8
Data Gap	45	0.5

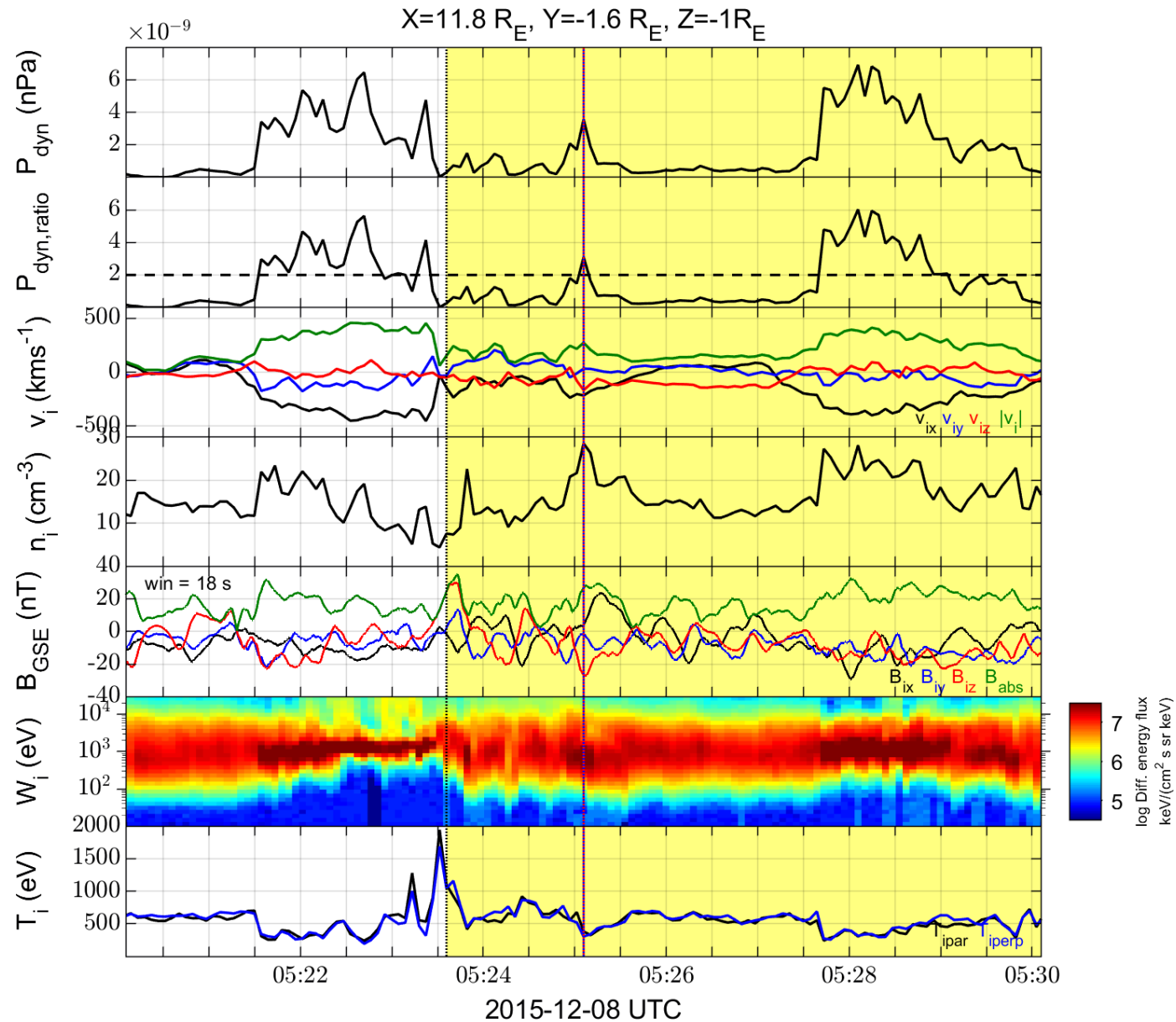
09/2015 - 04/2019

Updated: N = 9196

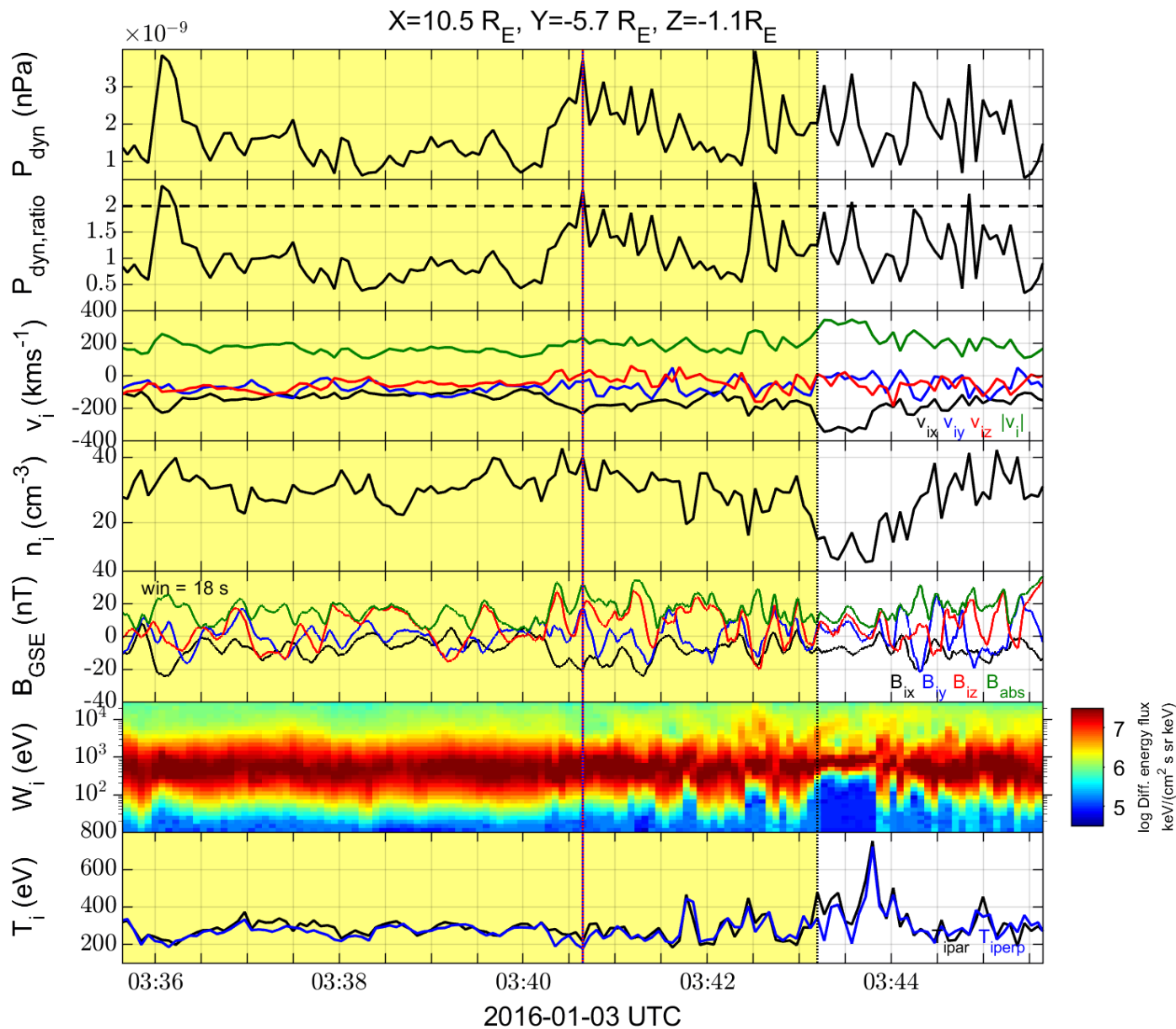
Subset	Number	Percentage (%)
Quasi-parallel	2458	26.7
Final cases	<b>901</b>	10.1
Quasi-perpendicular	542	5.9
Final cases	<b>214</b>	2.3
Boundary	781	8.5
Final cases	<b>191</b>	2.1
Encapsulated	80	0.9
Final cases	<b>60</b>	0.7
Other	5335	58.0
Unclassified/Uncertain	3789	41.2
Border	1500	16.3
Data Gap	46	0.5

9/2015 - 9/2020

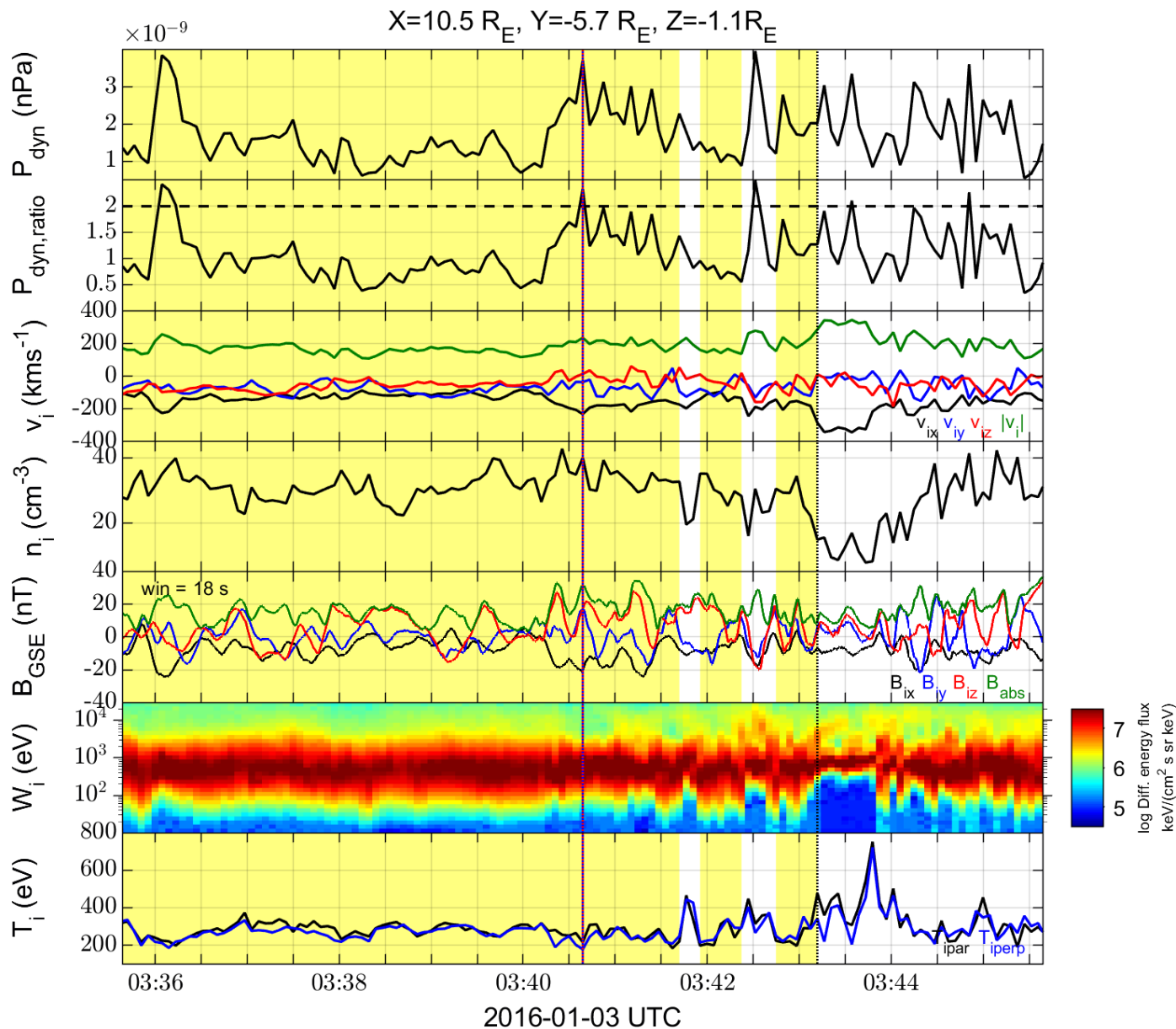
# Close to the bow shock jet



# Background – Fully automated



# Background – Manual Addition



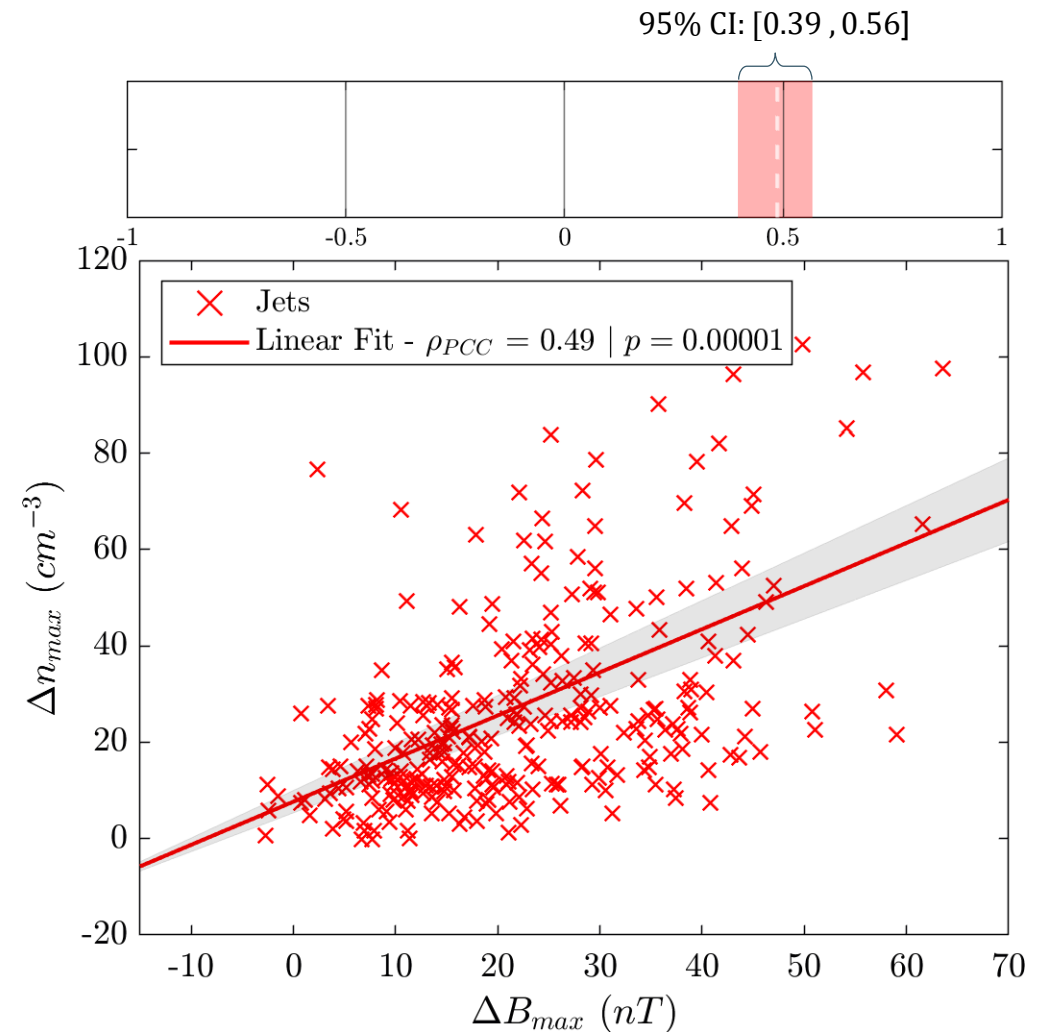
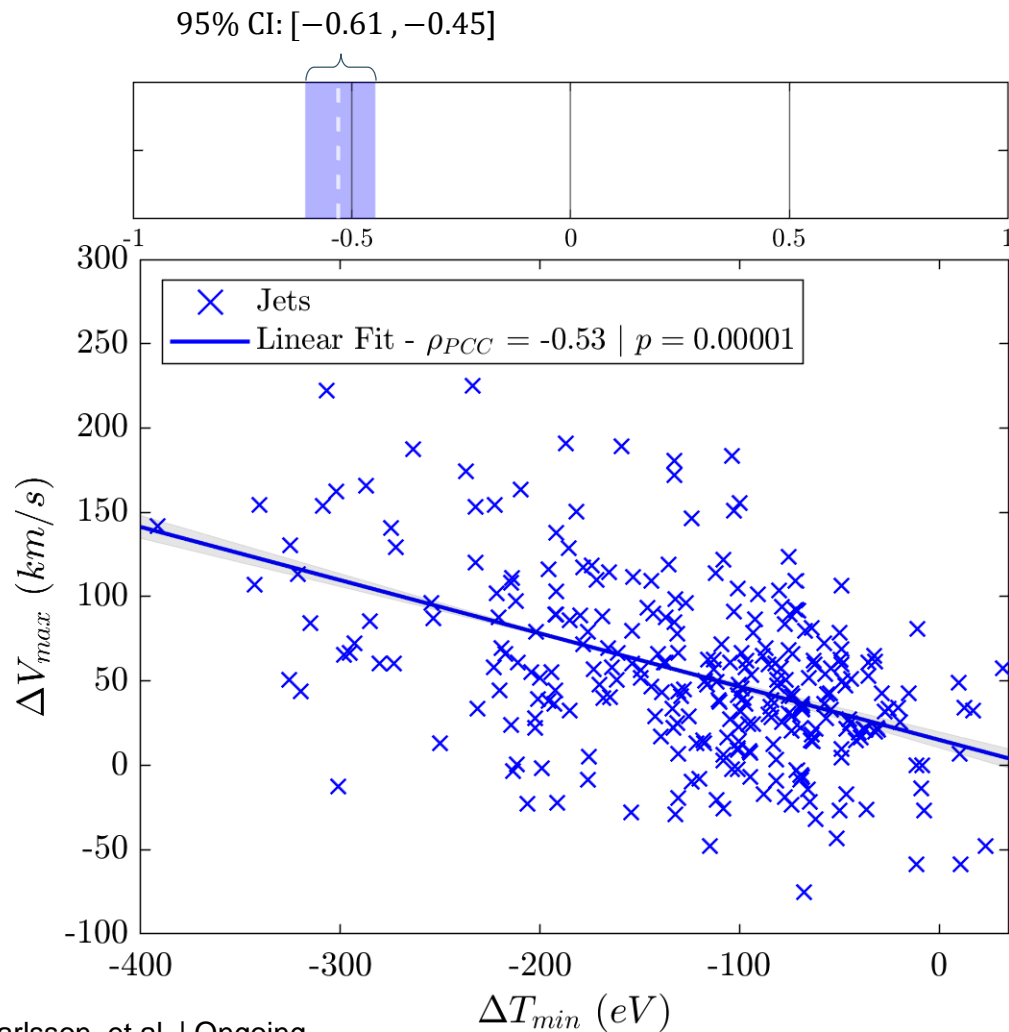


# Ongoing Results

Ripples

$n = 310$

SLAMS



# Summary & Conclusion

Good indication that **existent mechanism are at least partially responsible** for what we see.

Quite a few things to be done:

- See **class specific correlations** close to the bow shock.
- Check **other tools** of connecting mechanisms (time series analysis, mutual information (MI), prediction power scores (PPS), machine learning (ML) etc.)
- Search for **other generation mechanisms** (e.g. reconnection plasmoids Preisser et. al. 2020 | ApJL).
- Inspect for **statistical artifacts** (e.g. partial shock crossings, foreshock, other irregularities etc.)