HELSINGIN YLIOPISTO
HELSINGFORS UNIVERSITET
UNIVERSITY OF HELSINKI
MATEMAATTIS-LUONNONTIETEELLINEN TIEDEKUNTA
MATEMATISK-NATURVETENSKAPLIGA FAKULTETEN
FACULTY OF SCIENCE

STUDY OF THE LOCAL BOW SHOCK ENVIRONMENT DURING MAGNETOSHEATH JET FORMATION: VLASIATOR RESULTS

Jonas Suni[1], Minna Palmroth[1,2], Markus Battarbee[1], Lucile Turc[1], Markku Alho[1], Giulia Cozzani[1], Maxime Dubart[1], Urs Ganse[1], Harriet George[3], Evgeny Gordeev[1], Maxime Grandin[1], Konstantinos Horaites[1], Konstantinos Papadakis[1], Yann Pfau-Kempf[1], Vertti Tarvus[1], Fasil Tesema[1], Ivan Zaitsev[1], Hongyang Zhou[1]

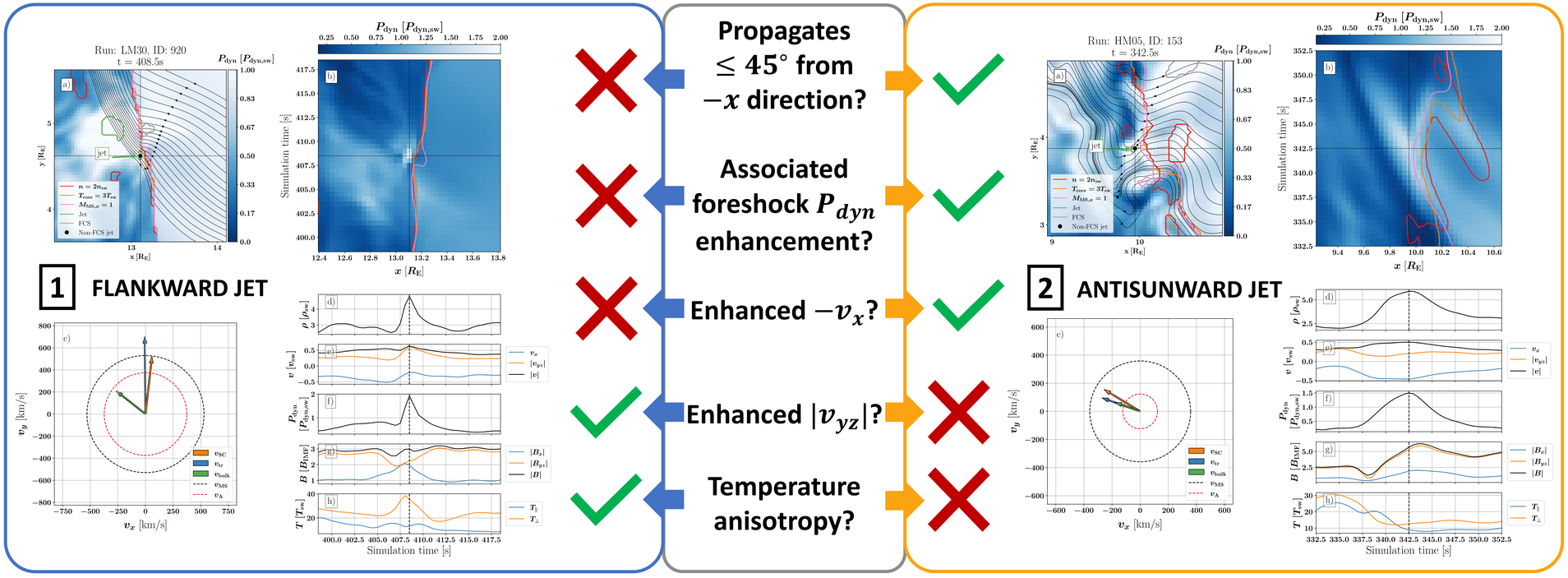
[1]University of Helsinki, Department of Physics, Helsingin yliopisto, Finland, [2]Finnish Meteorological Institute, Helsinki, Finland, [3]Laboratory for Atmospheric and Space Physics, University of Colorado Boulder, Colorado, USA.
Correspondence: jonas.suni@helsinki.fi See https://helsinki.fi/vlasiator for more information on Vlasiator and https://github.com/fmihpc/vlasiator for source codes.

INTRODUCTION

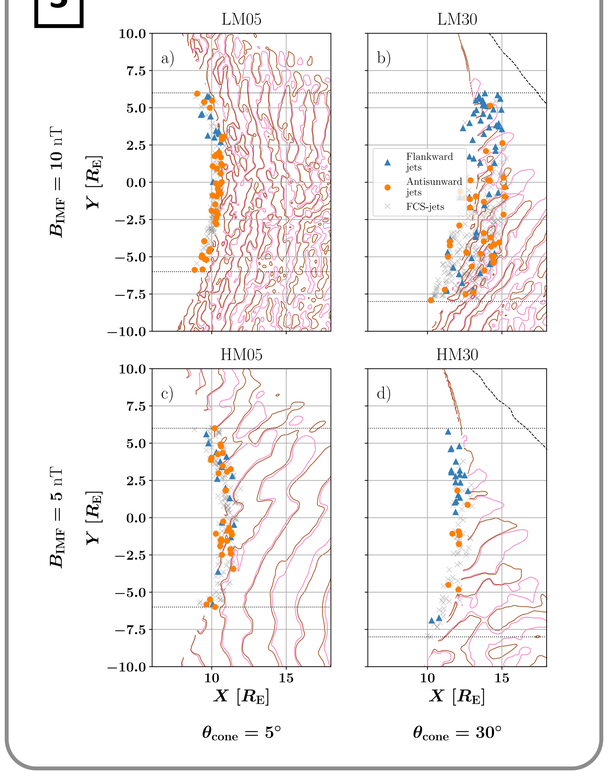
Magnetosheath jets are enhancements of dynamic pressure in the magnetosheath. In Suni et al. 2021 we investigated jets in 4 simulation runs of the global hybrid-Vlasov simulation Vlasiator (Palmroth et al. 2018), and found that 75% of jets that form at the bow shock are associated with structures of enhanced dynamic pressure and magnetic field in the foreshock, foreshock compressive structures (FCS). In this study, we continue that work by investigating the remaining jets that are not associated with FCS (non-FCS-jets). Our data set consists of a total 790 jets, of which 562 (71%) are associated with FCSs (FCS-jets), and 228 (29%) are non-FCS-jets. We analysed the non-FCS-jets through overview plots, virtual spacecraft (VSC) time-series, cut-through time-series, and multi-VSC timing analysis. We find that the 228 non-FCS-jets can be separated into classes based on propagation direction: 107 (47%) of the non-FCS-jets are “flankward jets” (Fig. 1), while 121 (53%) are “antisunward jets” (Fig. 2).

CONCLUSIONS

By conducting a statistical analysis of all flankward and antisunward jets as well as FCS-jets for comparison, we find that antisunward jets are very similar to FCS-jets and thus probably form the same way. Flankward jets, on the other hand, have very different properties. They appear to consist of quasi-perpendicular magnetosheath plasma, characterised by high temperature anisotropy. Fig. 3 shows that they form mainly at the ULF foreshock edge. We thus propose that flankward jets could form due to density enhancements that occur behind parts of the bow shock where oblique shock reformation by ULF waves locally changes the shock from quasi-parallel to quasi-perpendicular (Liu et al. 2021).



3 JET FORMATION LOCATIONS



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