Solar Wind Turbulence Features for Parallel and Perpendicular Sampling Direction

Roberto Bruno[1], Raffaella D'Amicis[1], Rossana De Marco[1], Vamsee Krishna Jagarlamudi[1,2], Daniele Telloni[3], Denise Perrone[4], Silvia Perri[5], Francesco Valentini[5], Raffaele Marino[6], Francesco Califano[7], Luca Sorriso-Valvo[8], Marco Castronuovo[4], Mario Salatti[4], Leonardo Amoruso[9], Raffaele Ascolese[10], Vito Fortunato[9], Gennaro Mele[11], Christopher John Owen[12], Stefano A Livi[13], Philippe Louarn[14], Timothy Simon Horbury[15], Andrei Fedorov[14], Lorenzo Matteini[15], Jim M Raines[16] and Daniel Verscharen[12], (1)INAF-IAPS, Rome, Italy, (2)CNRS-LPC2E, Orléans, France, (3)INAF-OATO, Turin, Italy, (4)ASI, Rome, Italy, (5)University of Calabria, Rende (CS), Italy, (6)CNRS, ECL, Lyon, France, (7)University of Pisa, Pisa, Italy, (8)CNR-ISTP, Bari, Italy, (9)Planetek, Bari, Italy, (10)TSD, Pozzuoli, Italy, (11)Leonardo, Taranto, Italy, (12)UCL-MSSL, London, United Kingdom, (13)SwRI, San Antonio, TX, United States, (14)CNRS-IRAP, Toulouse, France, (15)Imperial College London, London, United Kingdom, (16)University of Michigan, Ann Arbor, MI, United States

SH039 - First Data from the Solar Orbiter Mission III

Monday, 14 December 2020

20:30 - 21:30

Virtual

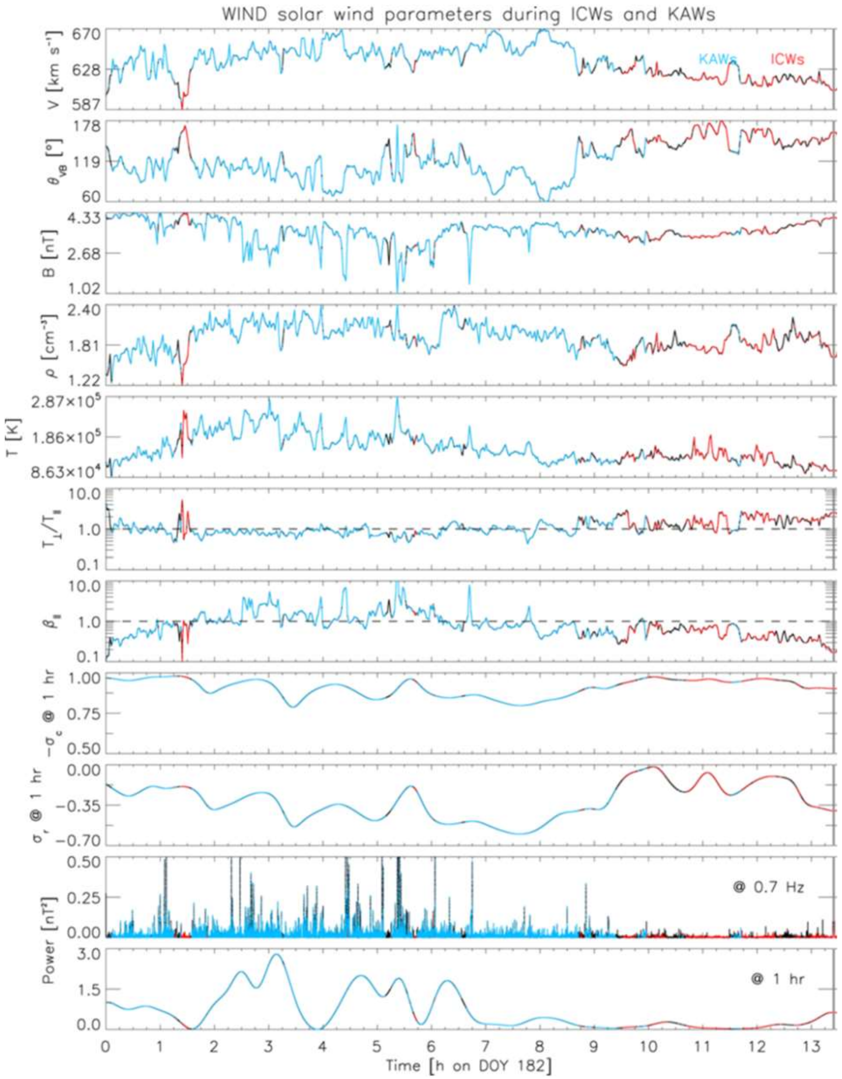
20:54

SH039-07

Solar Wind Turbulence Features for Parallel and Perpendicular Sampling Direction

Roberto Bruno

Virtual



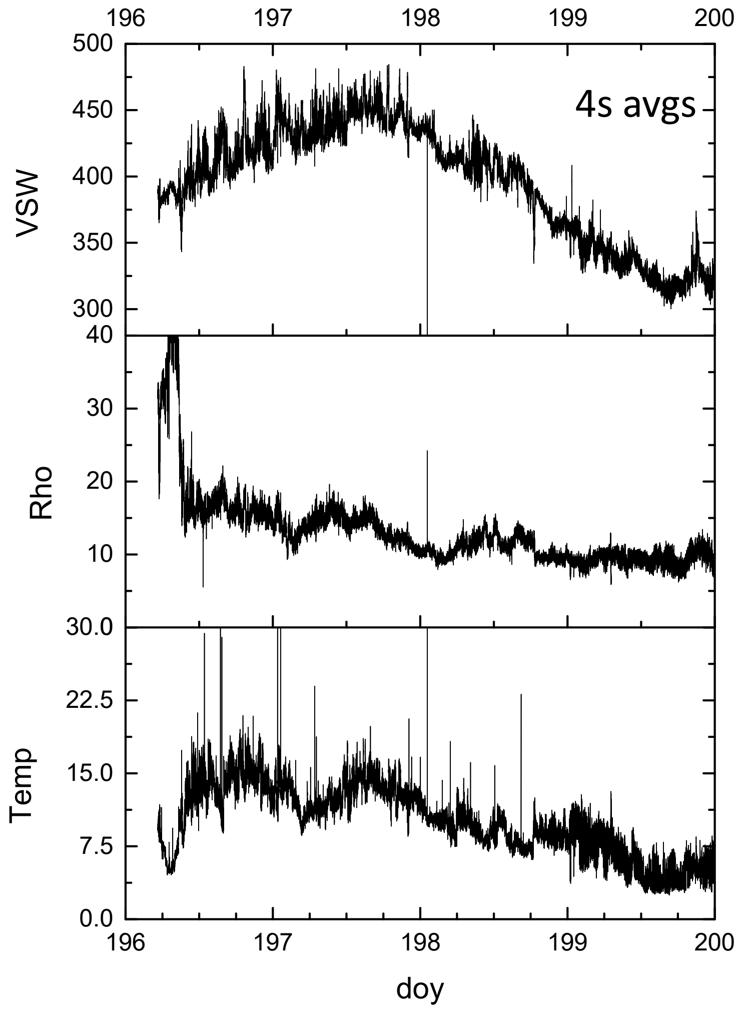
This work is a follow up of the paper

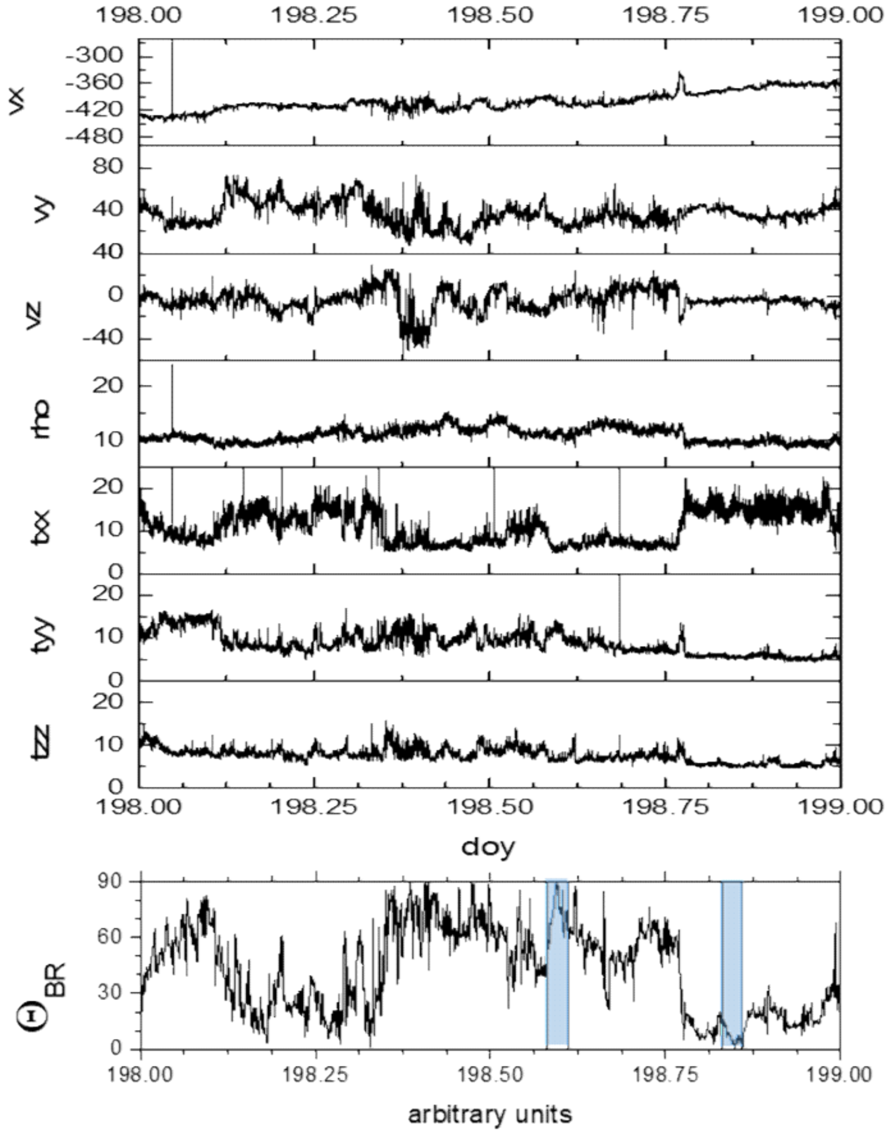
D. Telloni and R. Bruno, Linking fluid and kinetic scales in solar wind turbulence, MNRAS 463, L79–L83 (2016)

WIND data:
plasma moments 92 sec
No VDF
mag field 11Hz

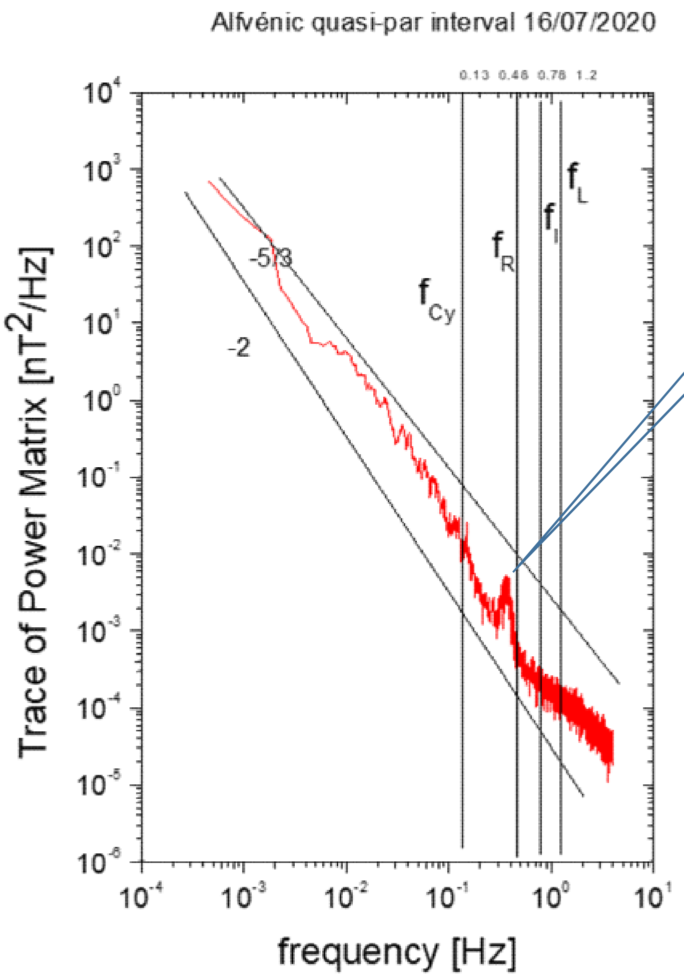
Figure 2. From top to bottom: wind speed, sampling angle, magnetic field strength, proton number density, total proton temperature, temperature anisotropy $T_\perp/T$, proton plasma β at the scale of 92 s, $-\sigma_c$ and σ_r at the scale of 1 h, power of the magnetic field strength fluctuations at 0.7Hz and at 1 h. KAWand ICW events are marked in blue and red colours, respectively.

Slow but Alfvénic

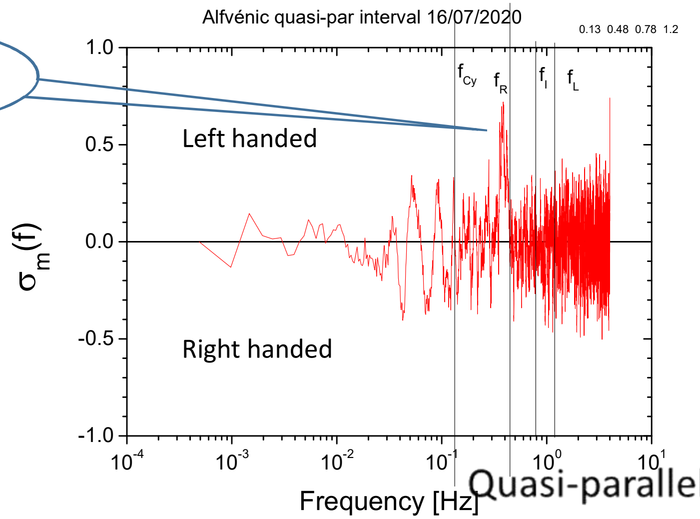




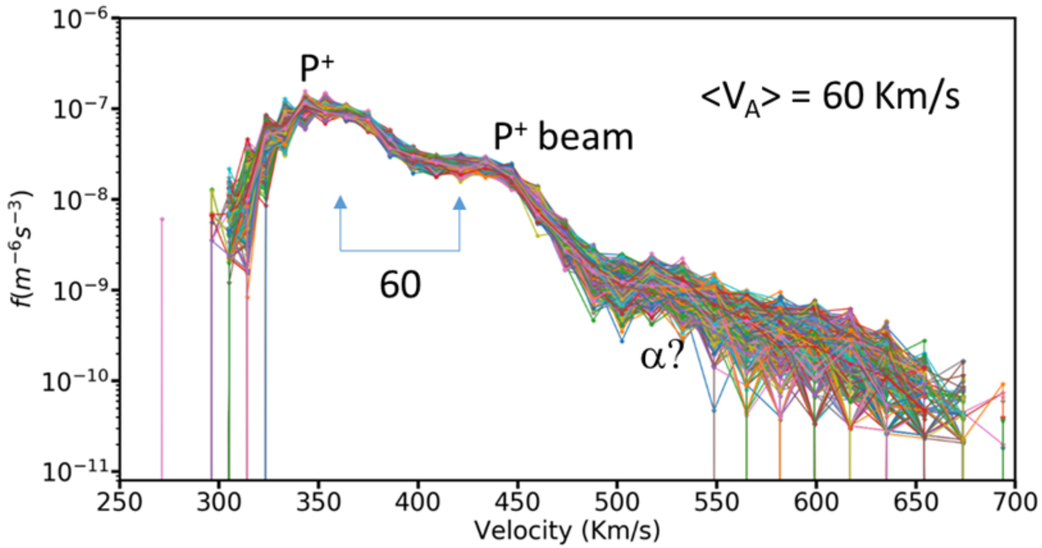
Alfvénic quasi-par interval



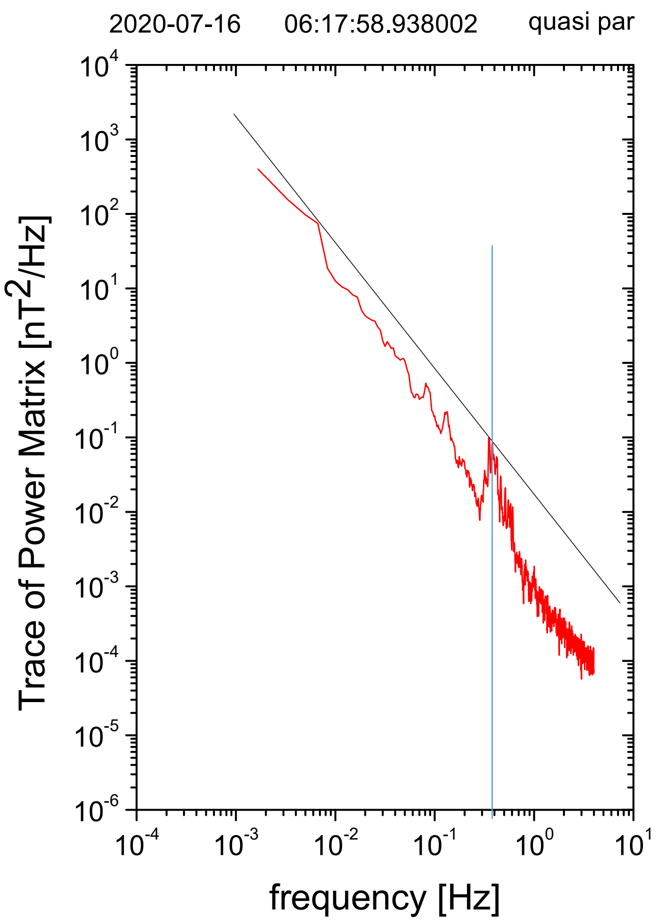
ICWs

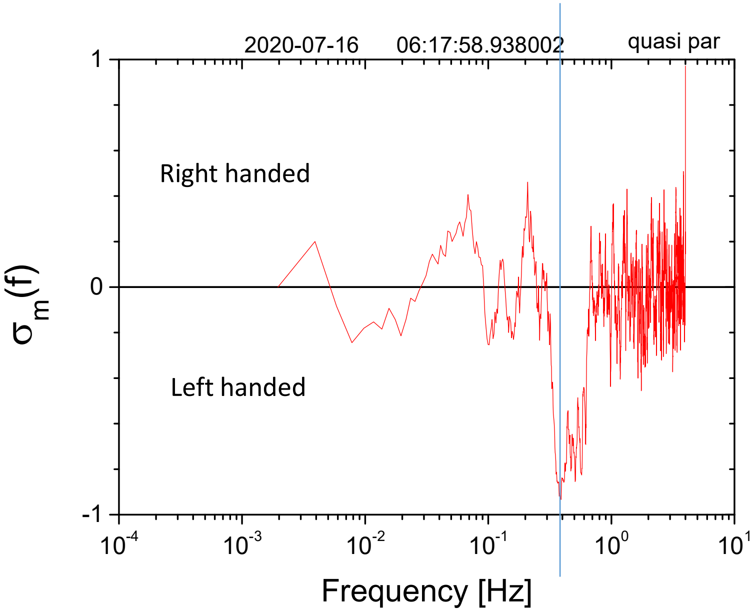


Quasi-parallel



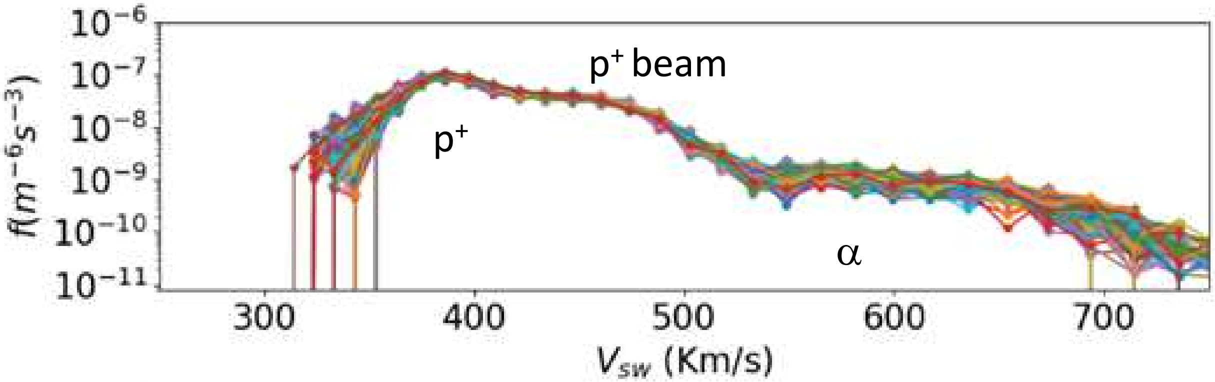
Alfvénic quasi-par interval





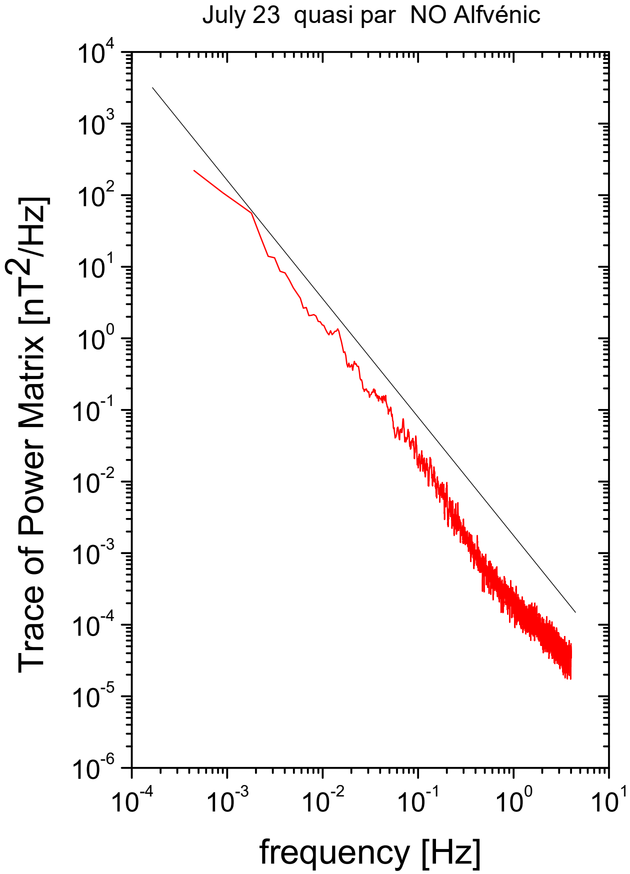
First 10 min of the time series built by Vamsee for quasi-par intervals

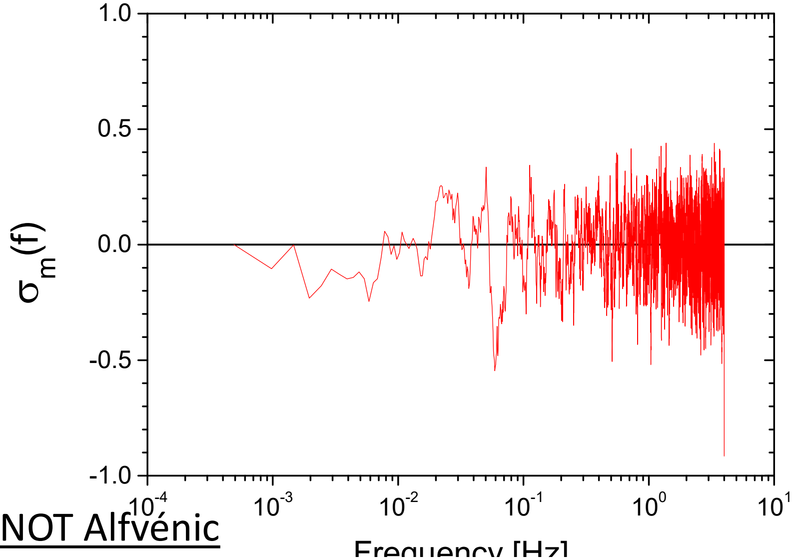
Clear evidence for ICWs and proton beam



NOT Alfvénic quasi-par interval

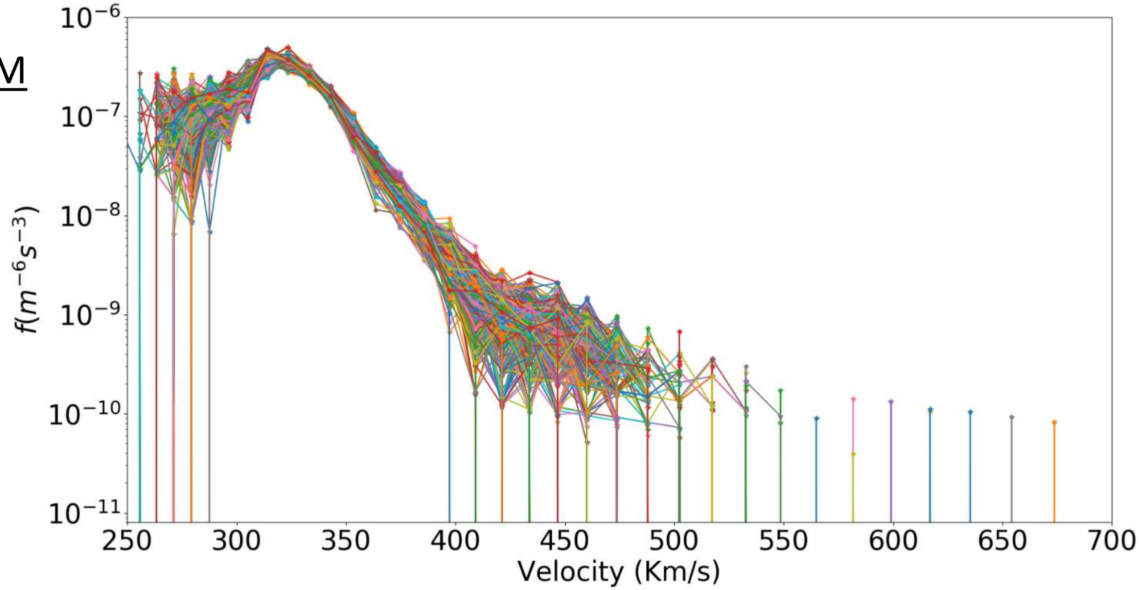
July 23 quasi-par





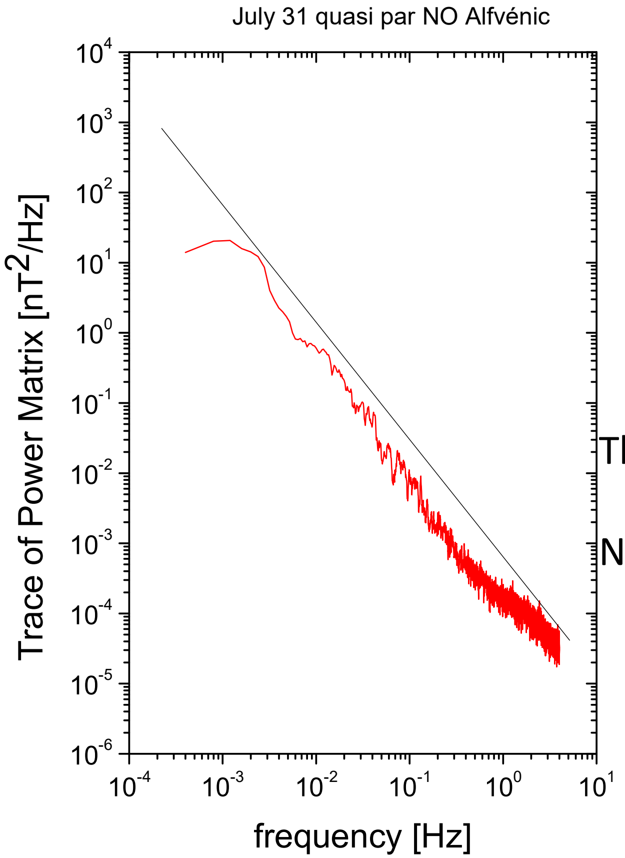
<u>This interval is quasi-par but NOT Alfvénic</u>

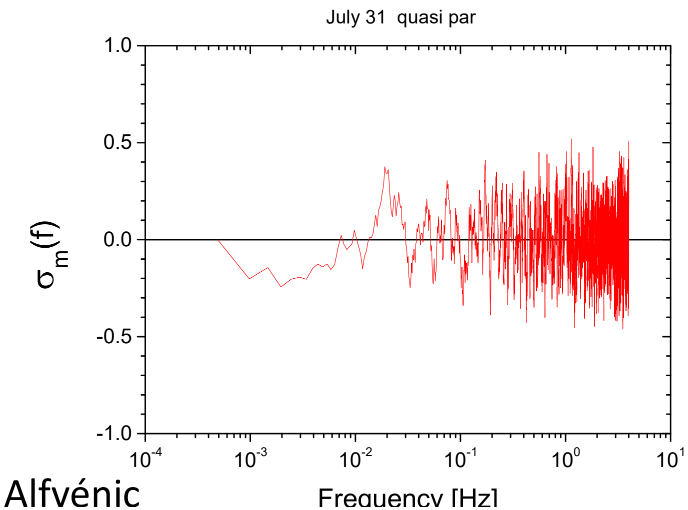
<u>NO ICWs, NO BEAM</u>



NOT Alfvénic quasi-par interval

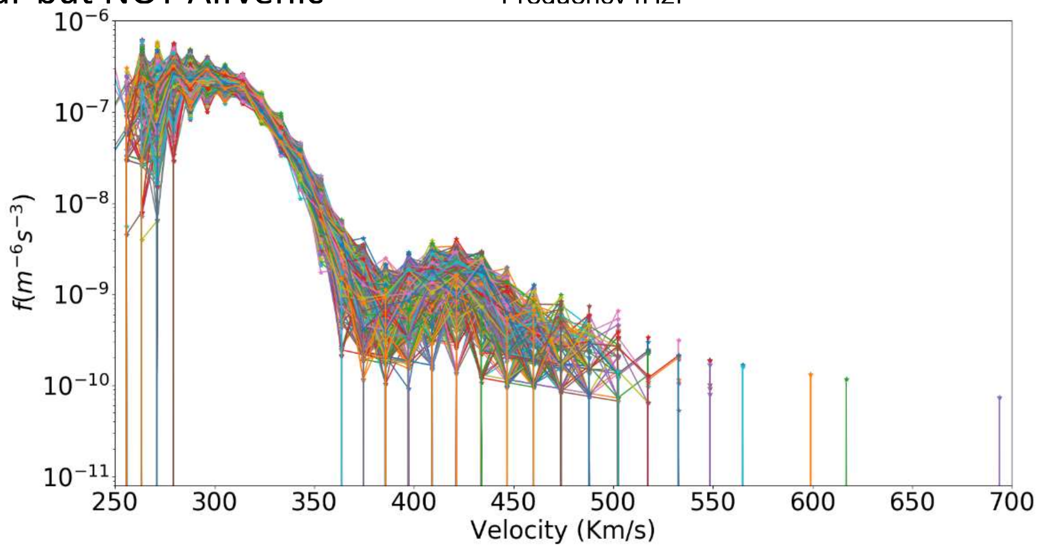
July 31 quasi-par



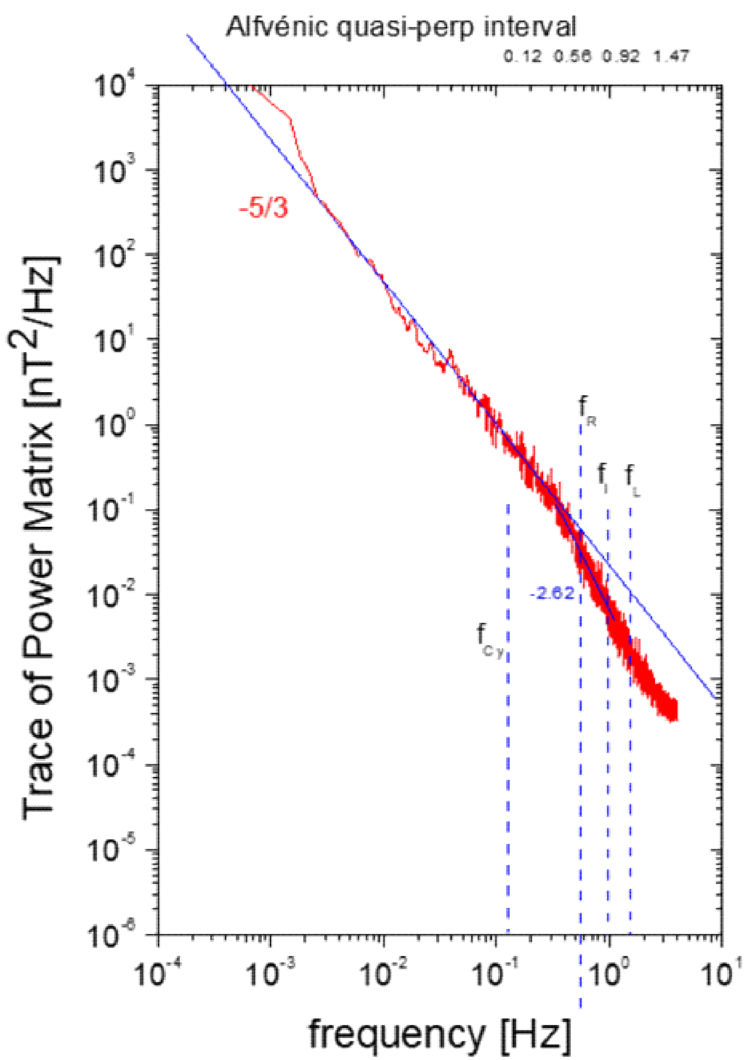


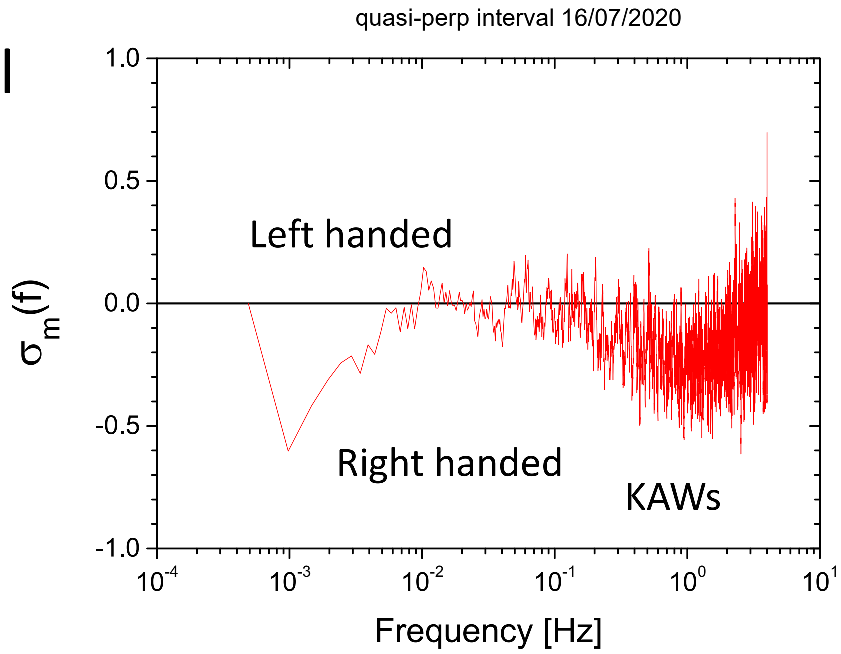
This interval is quasi-par but NOT Alfvénic

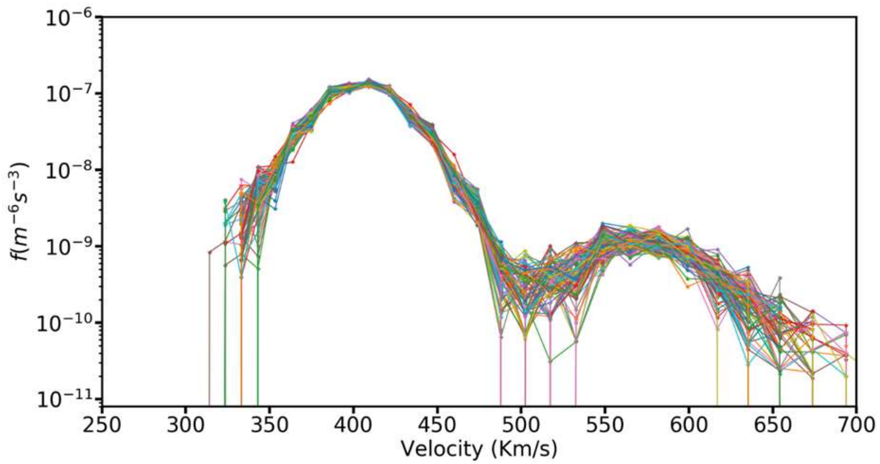
NO ICWs, NO BEAM



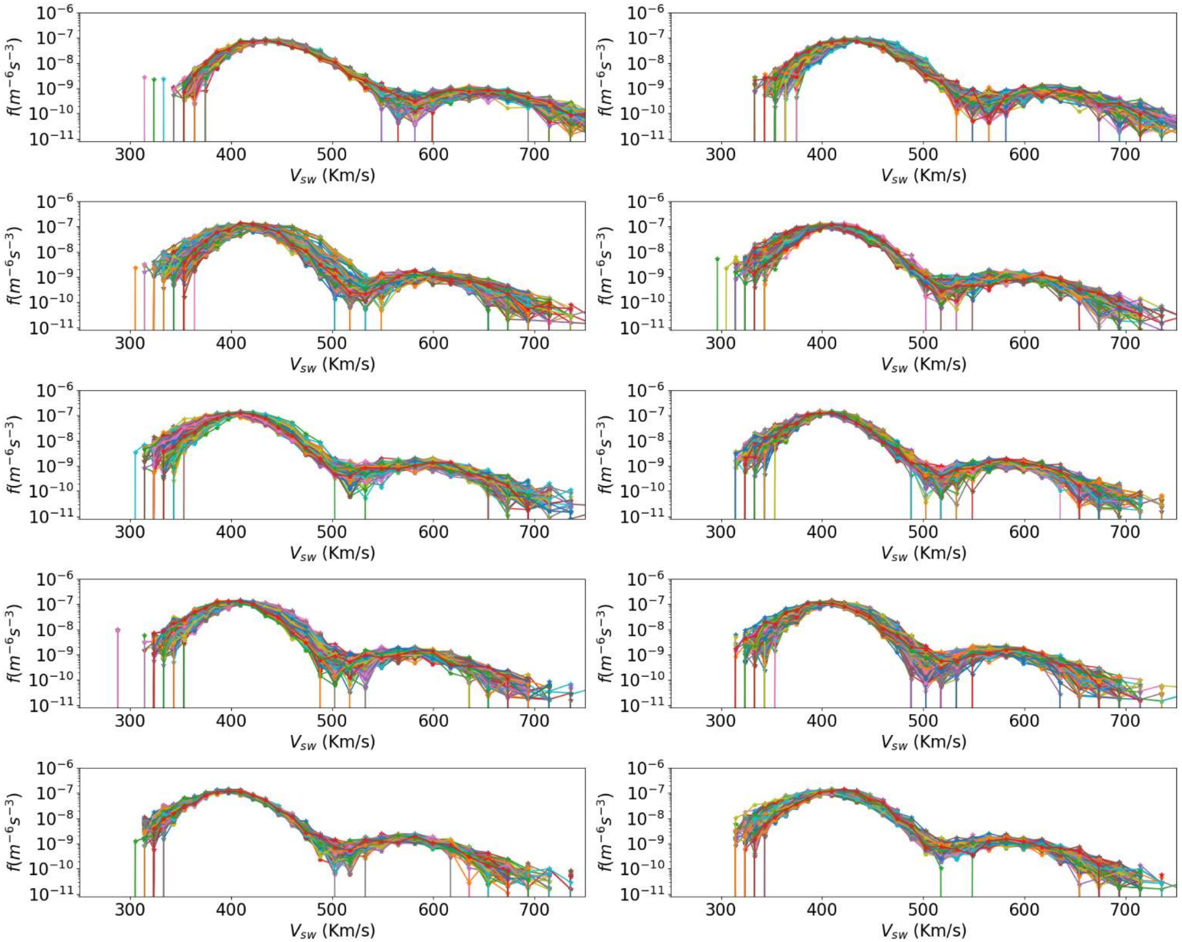
Alfvénic quasi-perp interval



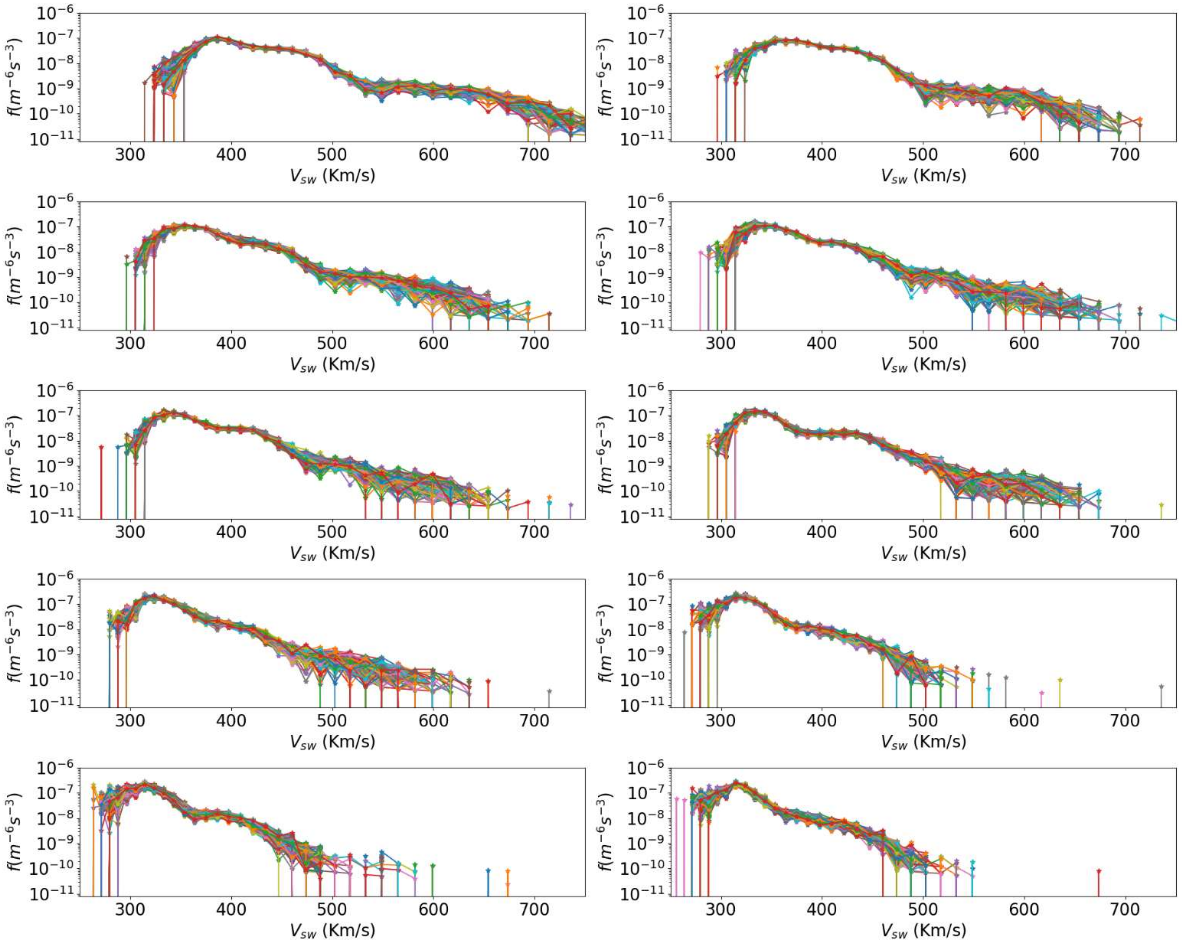




Alfvénic quasi perpendicular intervals: $50° < \Theta_{BR} < 90°$



Alfvénic quasi-parallel intervals: $0° < \Theta_{BR} < 20°$



summary

Based on what we have seen so far, if there are not ICWs (within quasi-par intervals) there is no beam.
This does not necessarily mean that the ICWs produce the beam.
ICWs and beam might be two different effects of the interaction of Alfvén waves with protons at the frequency break.

Probably we observe distinct beams only when we sample in the quasi-par direction because beams lie on that direction. (sampling direction effect??)

Next step: using 2D cuts in the VDF, we will look for beams also within quasi-perp intervals