



The Radio and Plasma Waves (RPW) Instrument on Solar Orbiter : Capabilities, Performance and First results



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Š. Štverák and the RPW Team



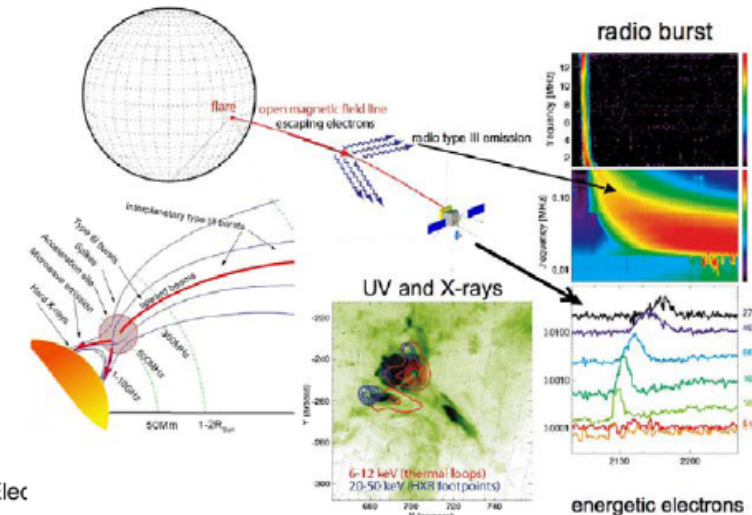
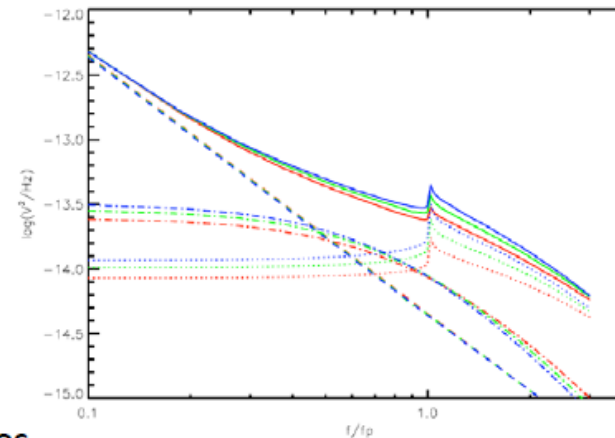
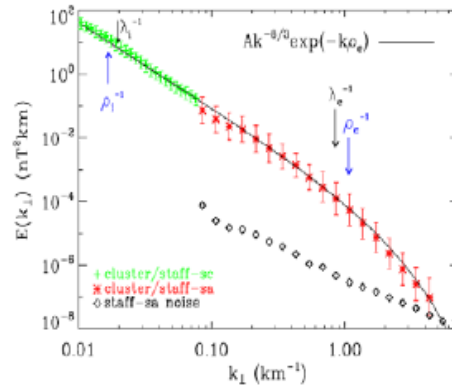
EGU 2020



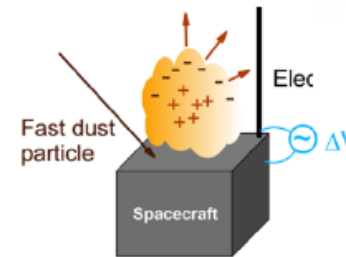
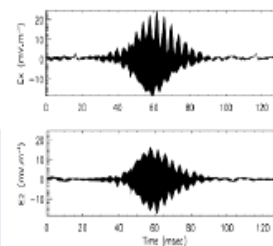
Laboratoire d'Études Spatiales et d'Instrumentation en Astrophysique



Measuring electric & magnetic fields from DC to 16 MHz



- Electric & Magnetic Turbulence up to the e- scales
- Plasma waves up to Fp (k-vector, polarisation)
- Shocks & discontinuities



- Quasi-Thermal Noise (Ne & Te) in dense & cold plasmas
- Electrostatic Langmuir waves
- Dusts

- Solar Radio emissions
- Interplanetary shocks (Type II)
- Strong Synergy with STIX, EUI, METIS, Solo HI

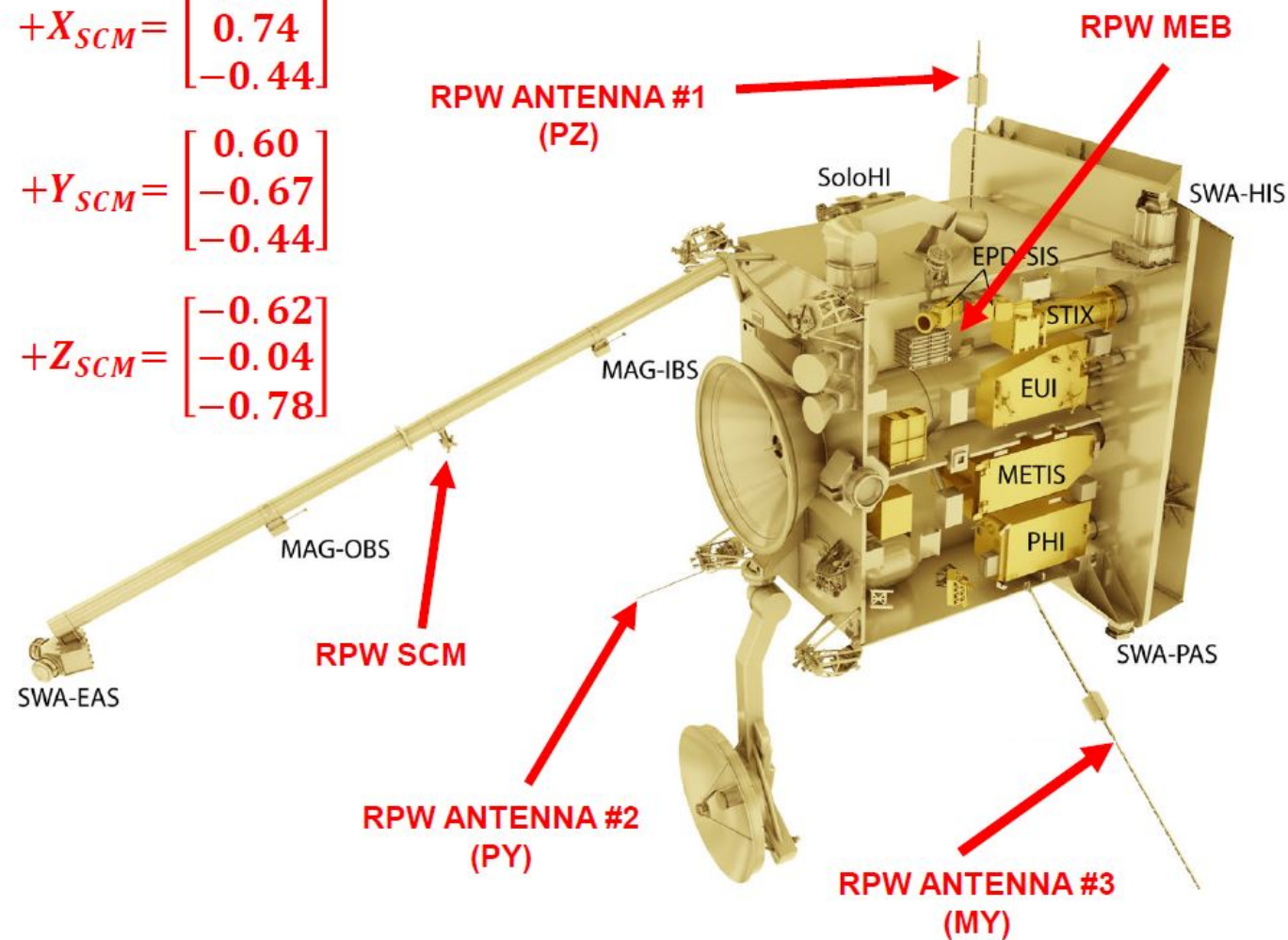
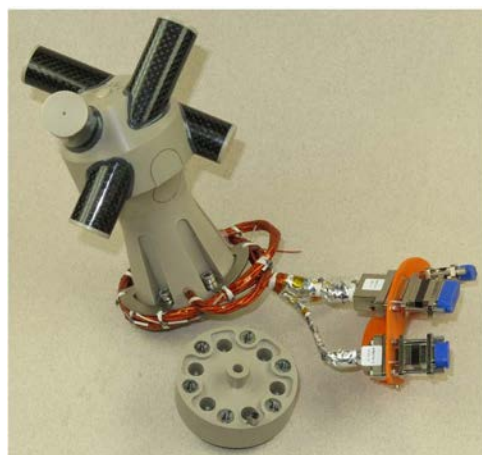
- Continuously operating (~5 kBps)
- On-Board shock & in-situ Type III detections (waveforms up to 3 kHz)
- Continuous 16 Hz Efield & S/C potential waveforms
- Burst modes (10 mins per day) with waveforms up to 1 kHz

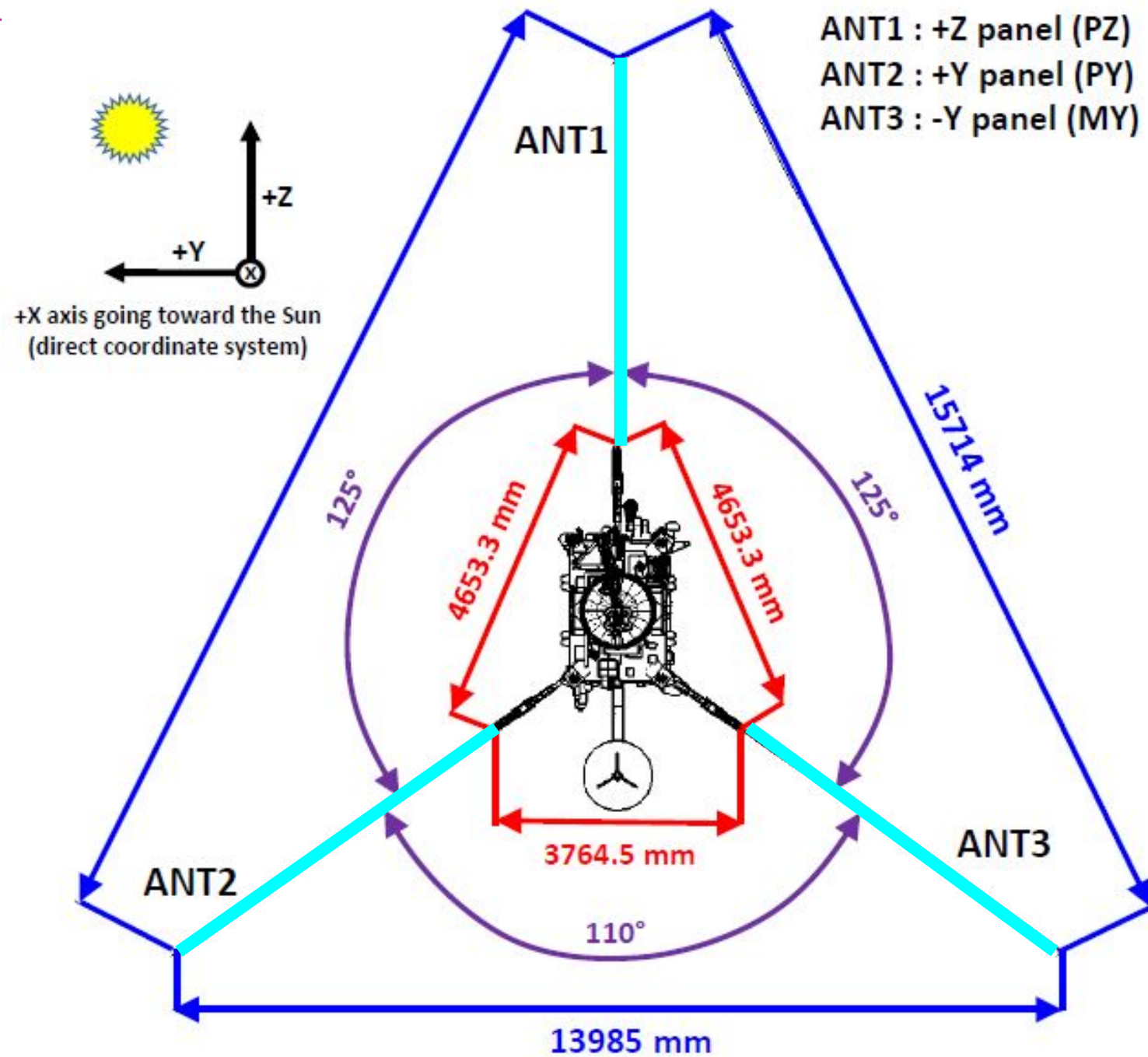


$$+X_{SCM} = \begin{bmatrix} 0.50 \\ 0.74 \\ -0.44 \end{bmatrix}$$

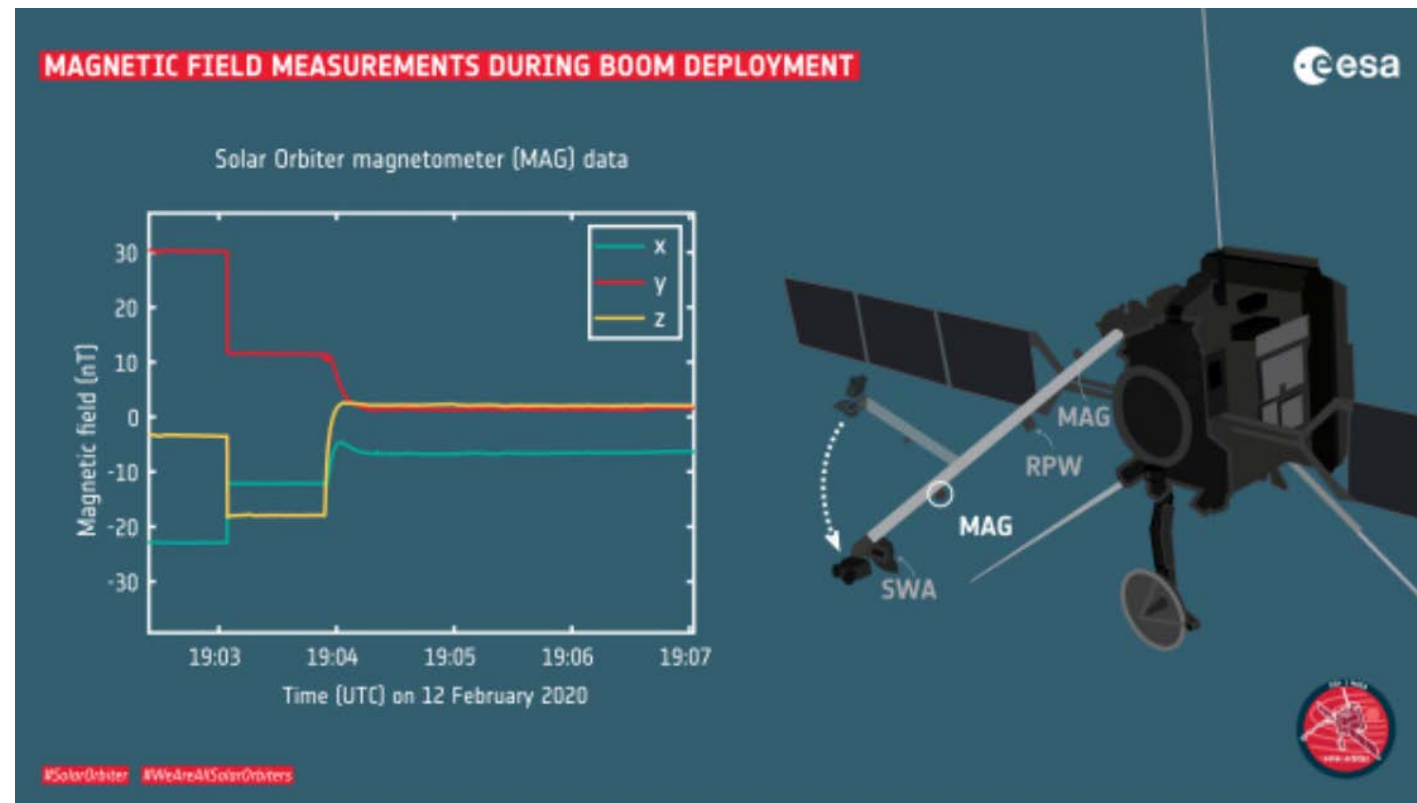
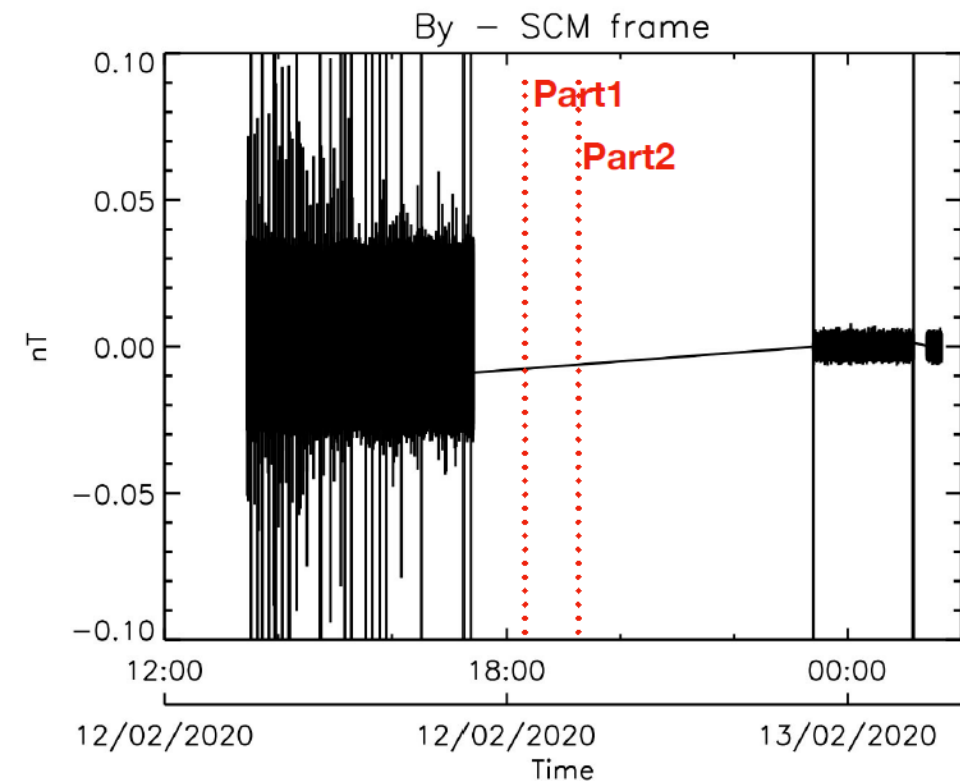
$$+Y_{SCM} = \begin{bmatrix} 0.60 \\ -0.67 \\ -0.44 \end{bmatrix}$$

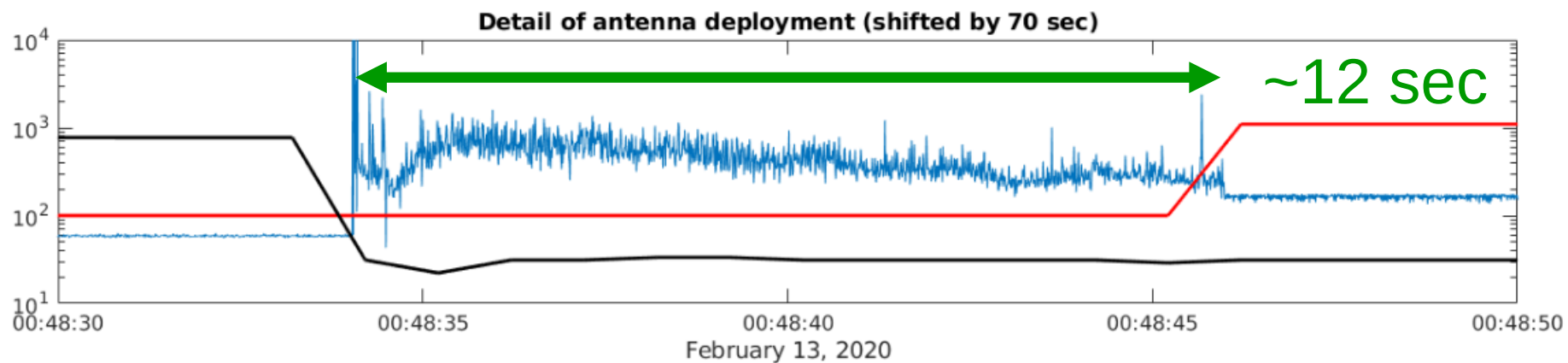
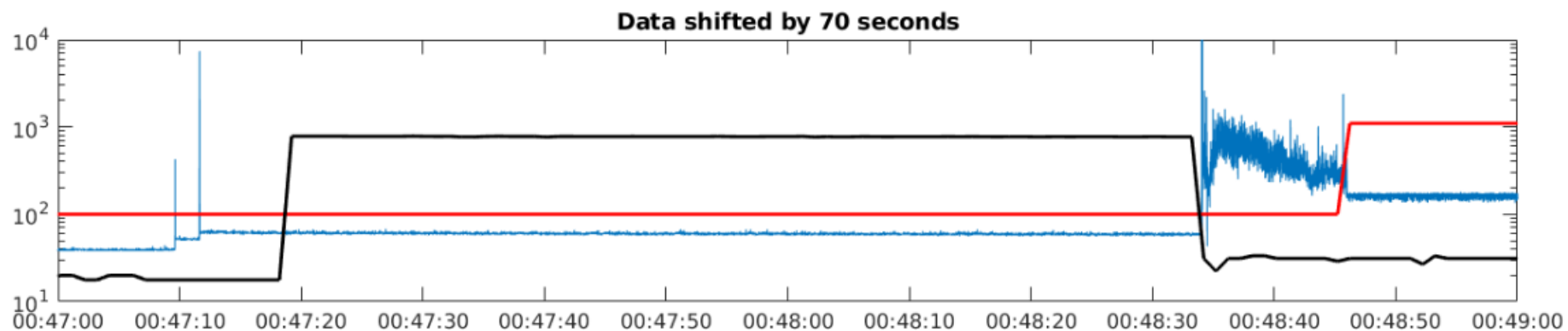
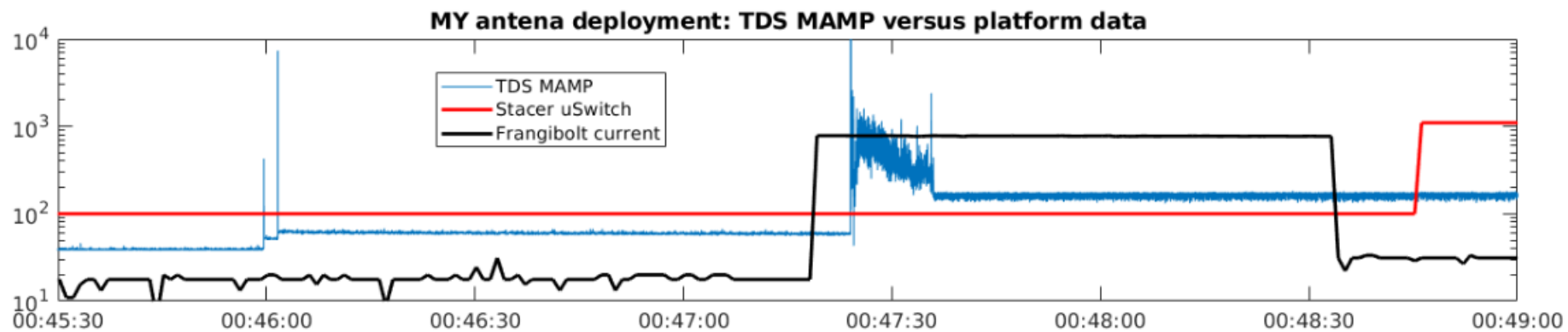
$$+Z_{SCM} = \begin{bmatrix} -0.62 \\ -0.04 \\ -0.78 \end{bmatrix}$$





Instrument Boom deployment

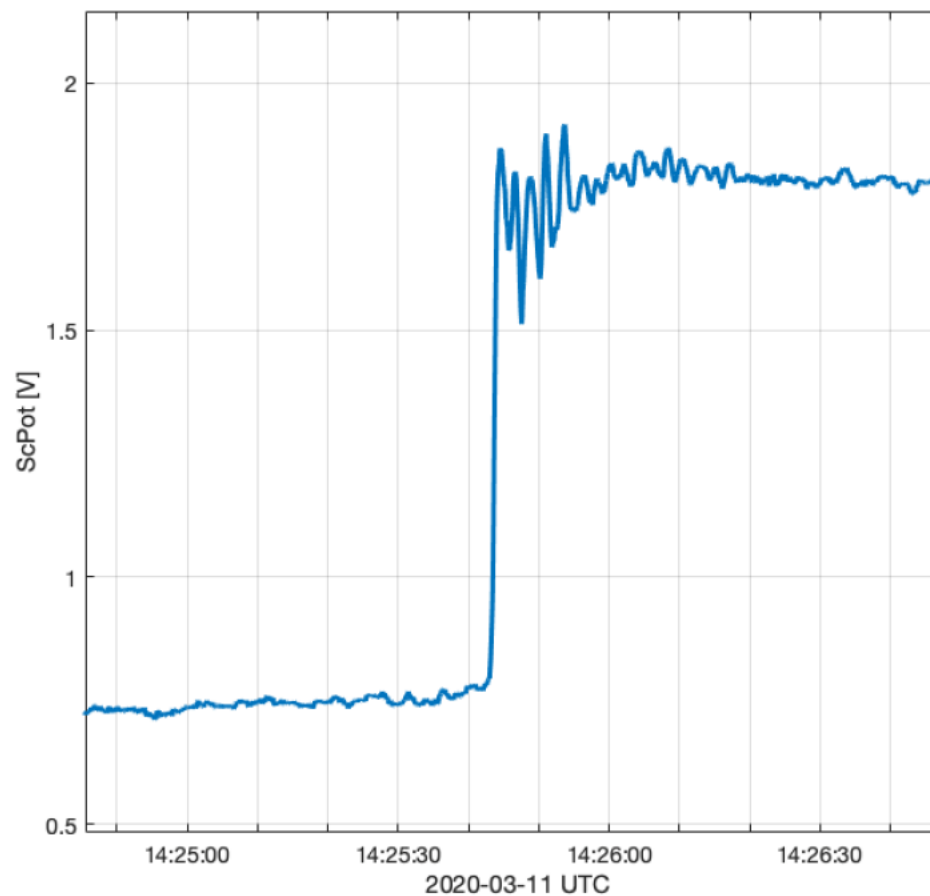






RPW-BIAS: IP shock

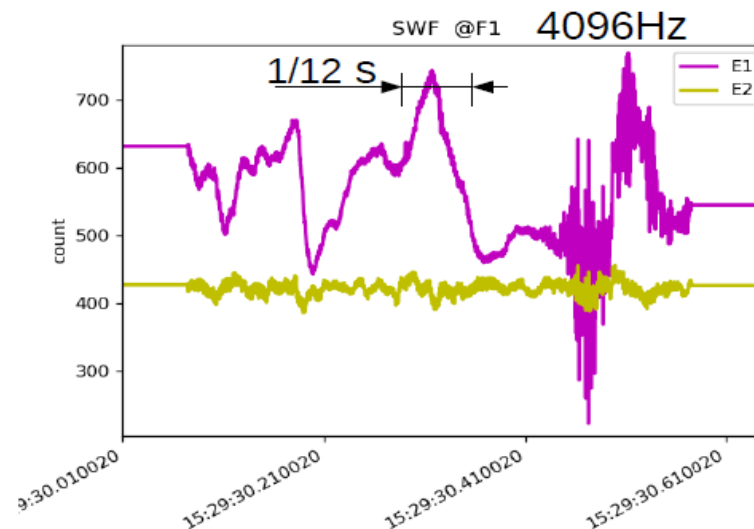
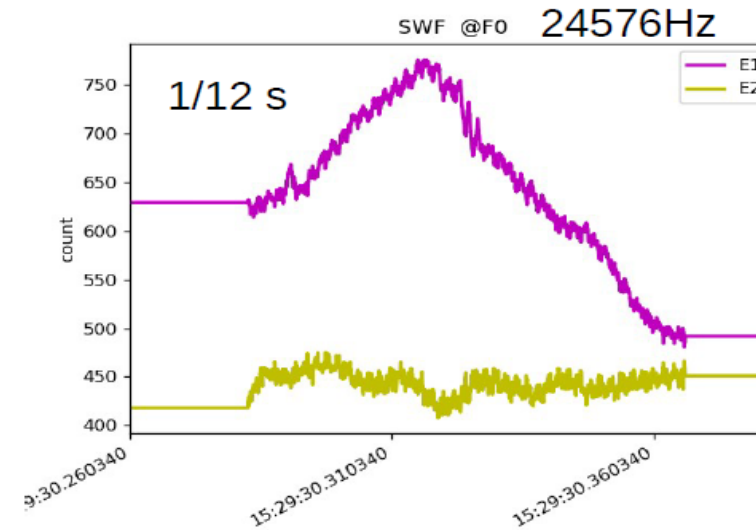
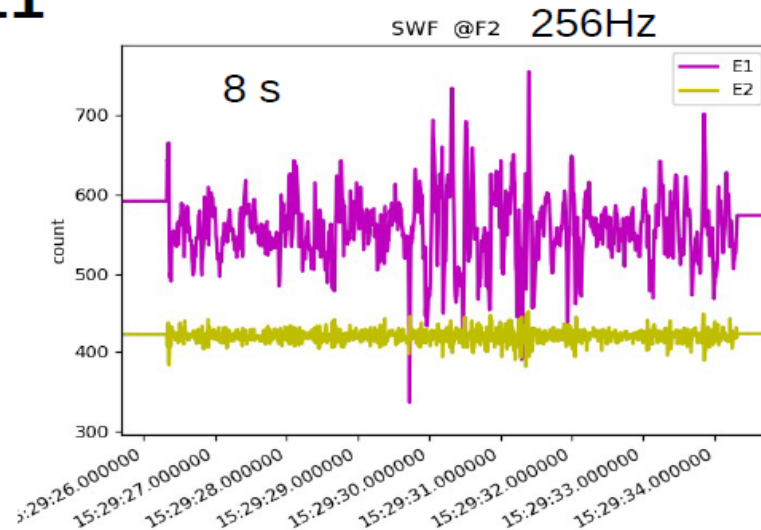
□ Probe-to-spacecraft potential – proxy for plasma density



Courtesy Y.
Khotyaintsev

LFR snapshots : Courtesy T. Chust

L1

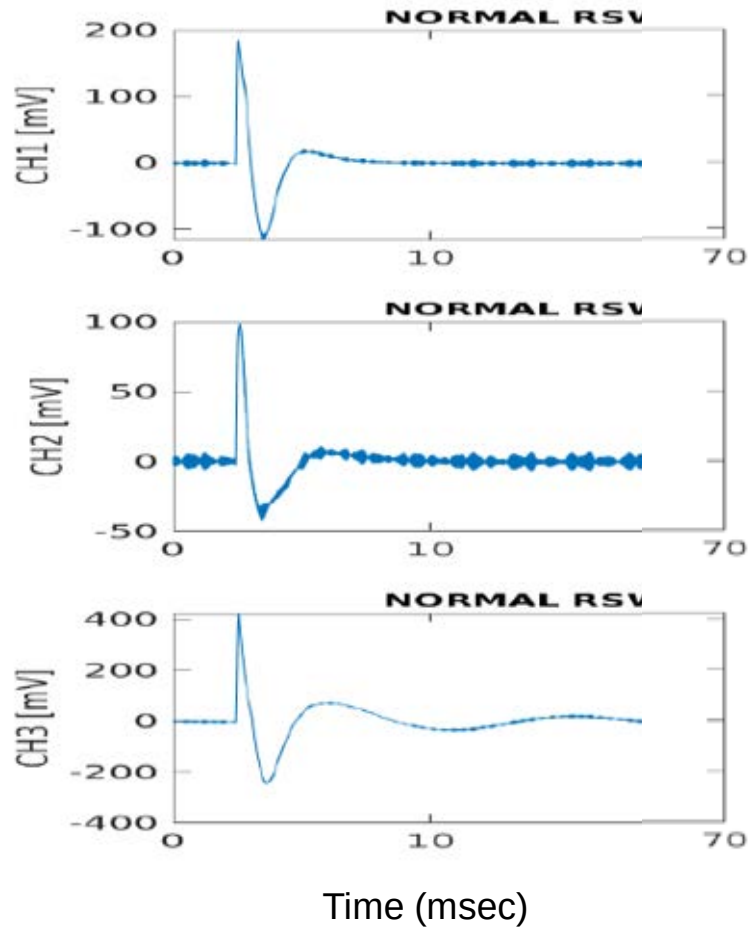


For all SWFs one has AC channels:

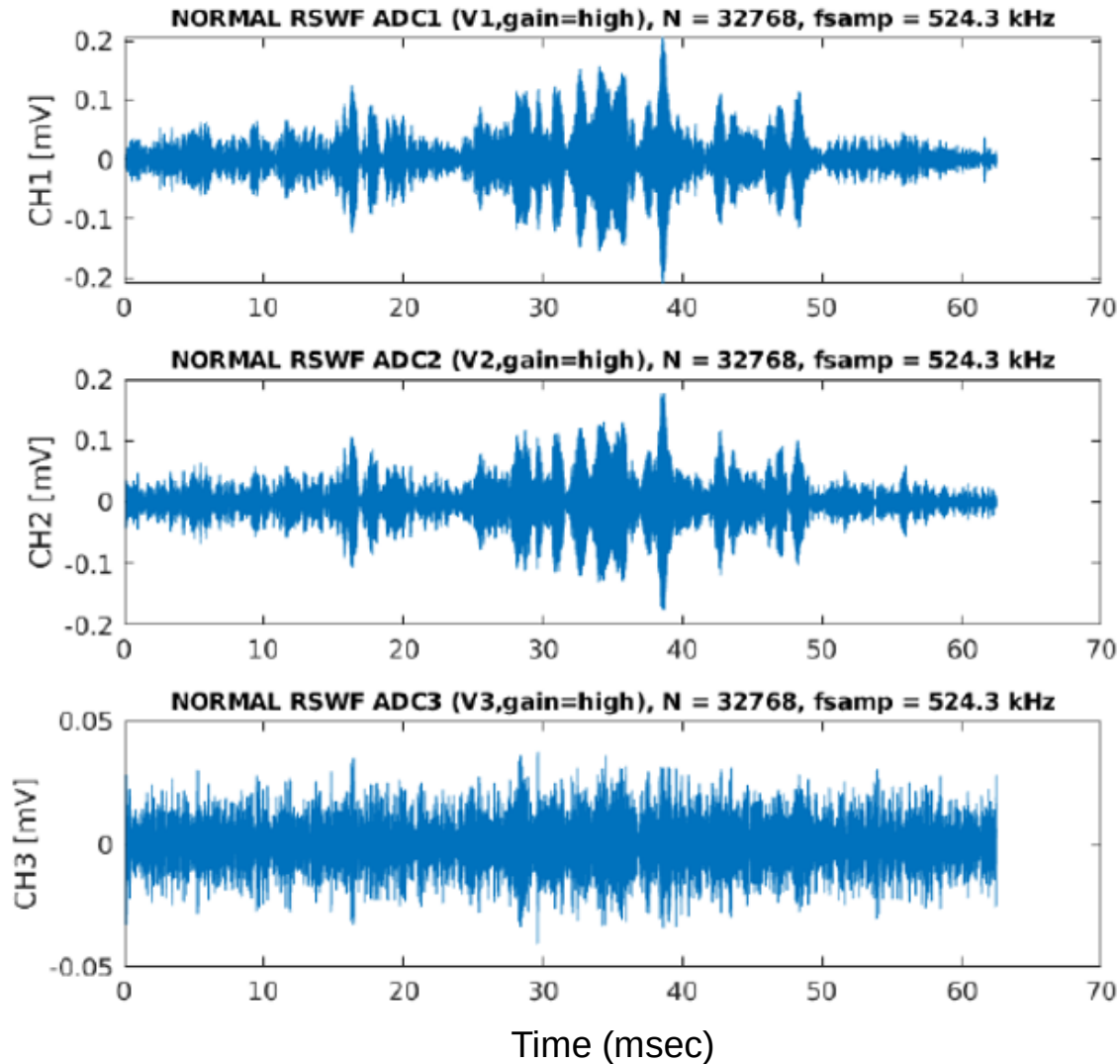
E1 = V12_AC
E2 = V23_AC

0.5 s

Interplanetary Dust



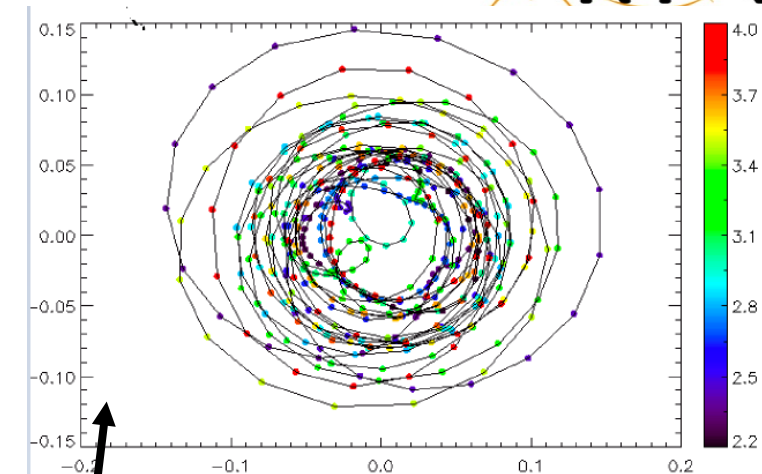
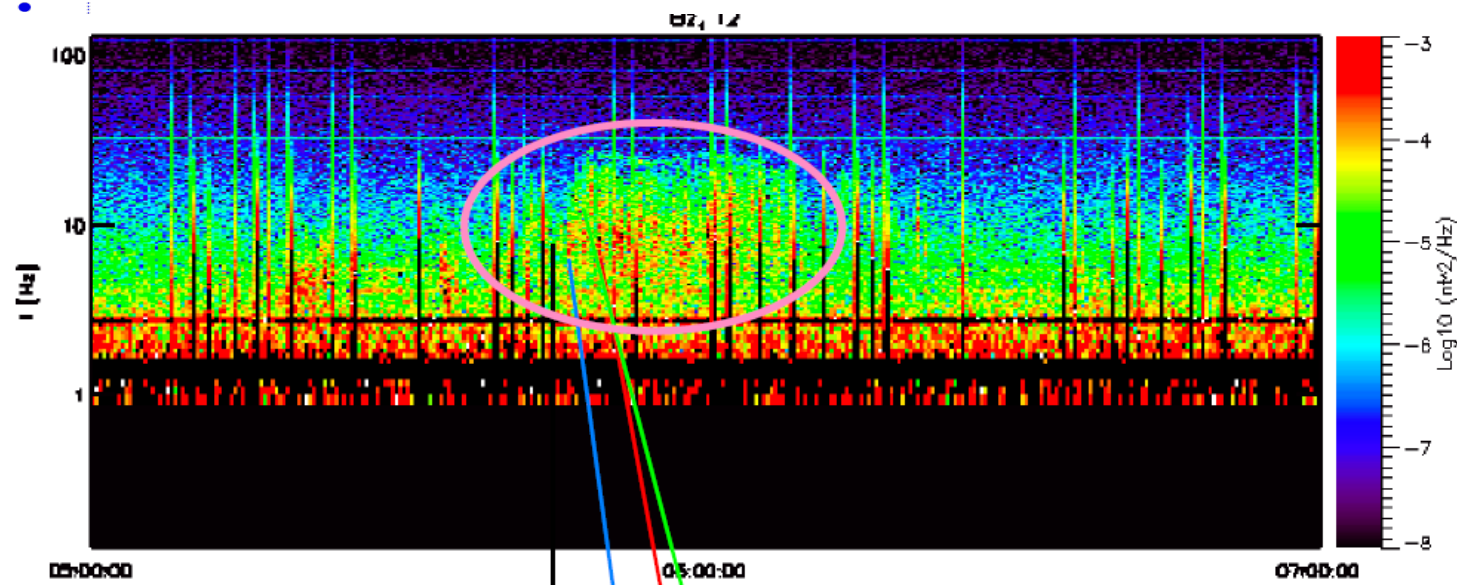
Langmuir Waves



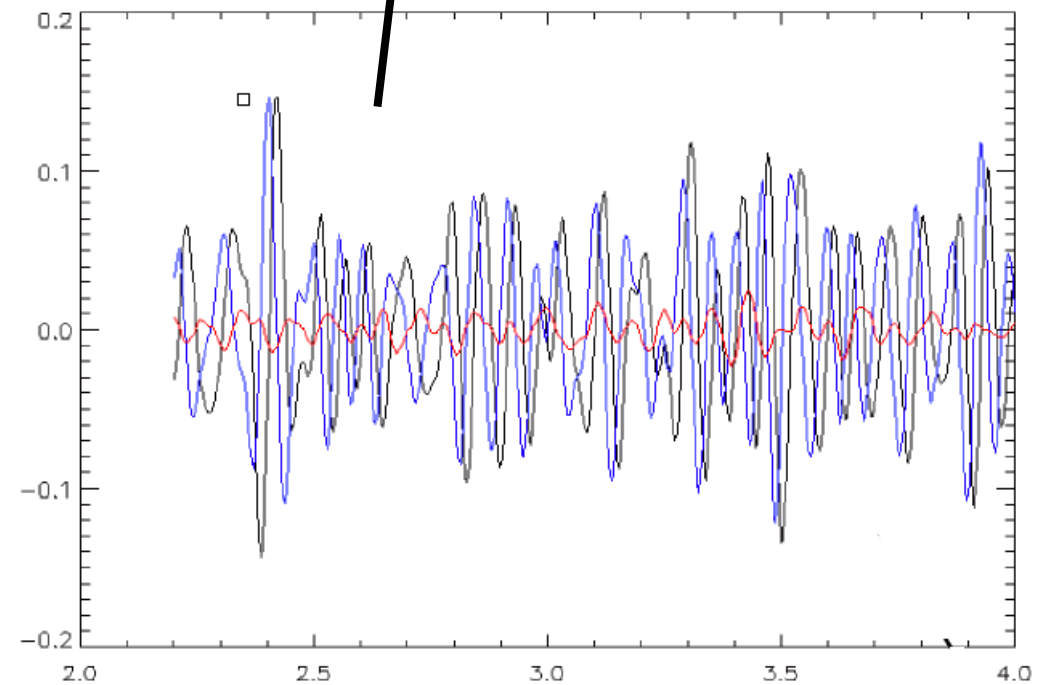
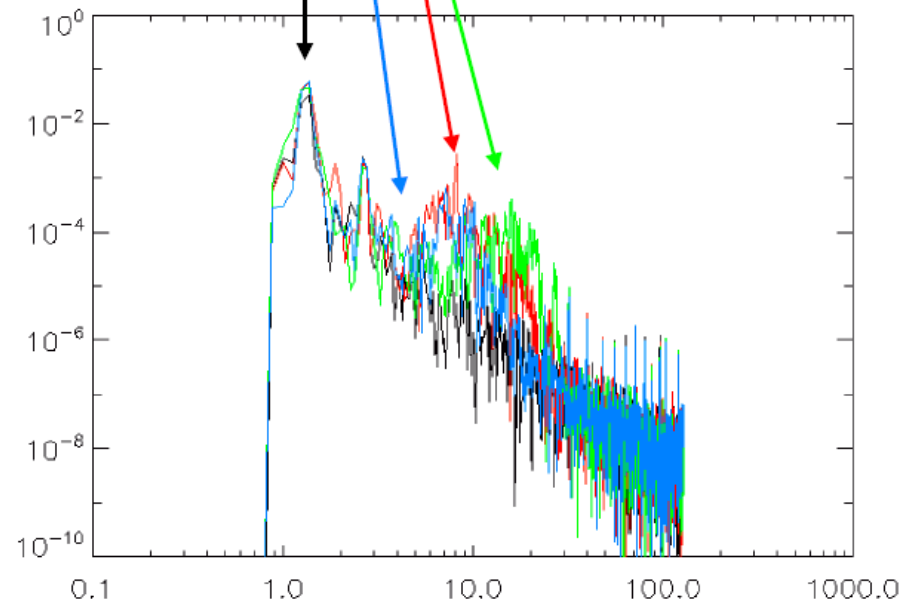
Ant 1

Ant 2

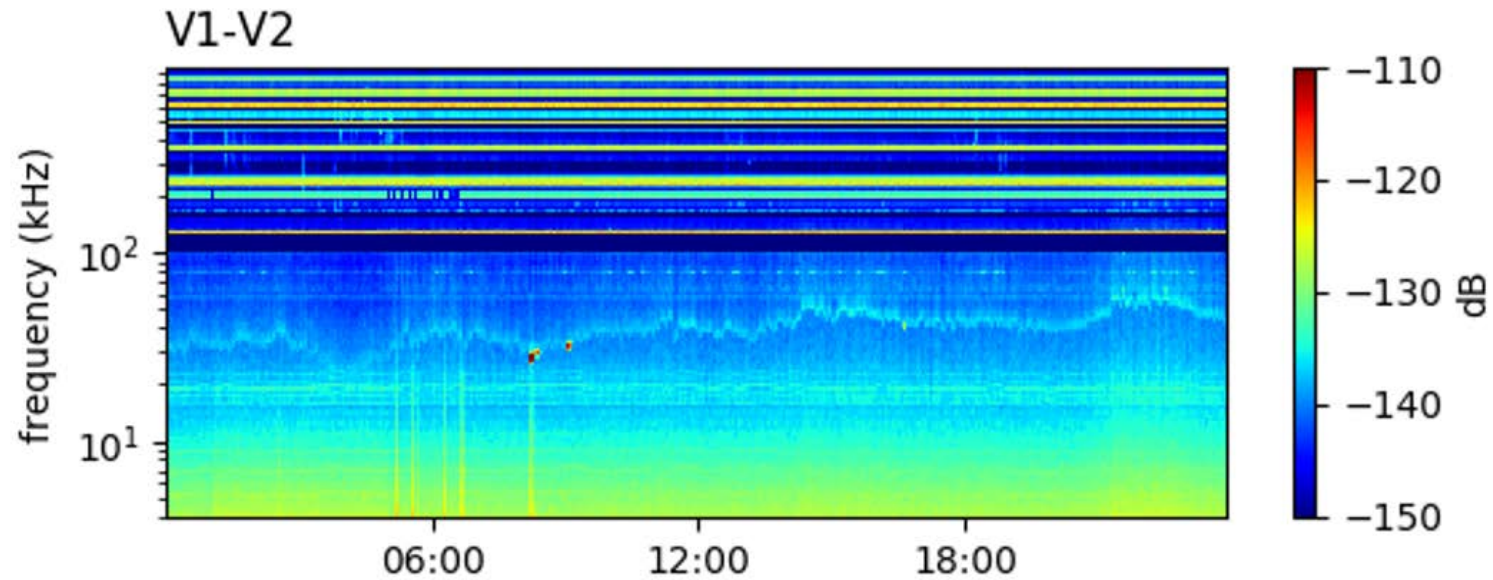
Ant 3



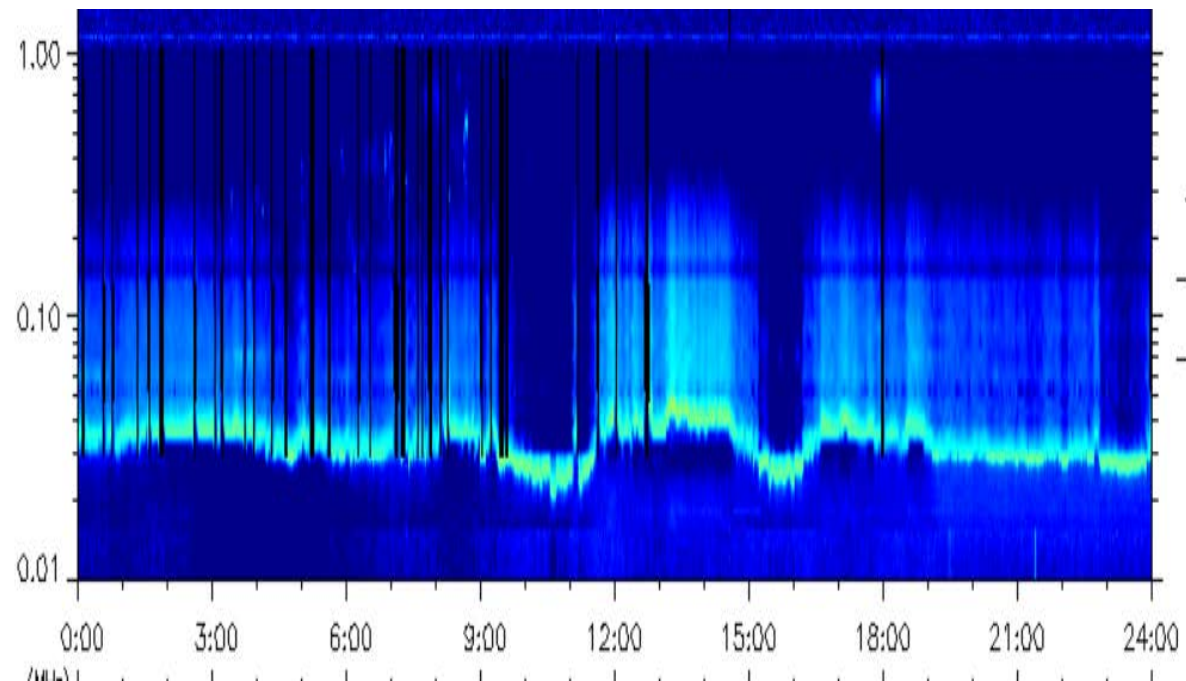
Possibly first
whistlers
observations
Courtesy M.
Kretzschmar



Solar Orbiter

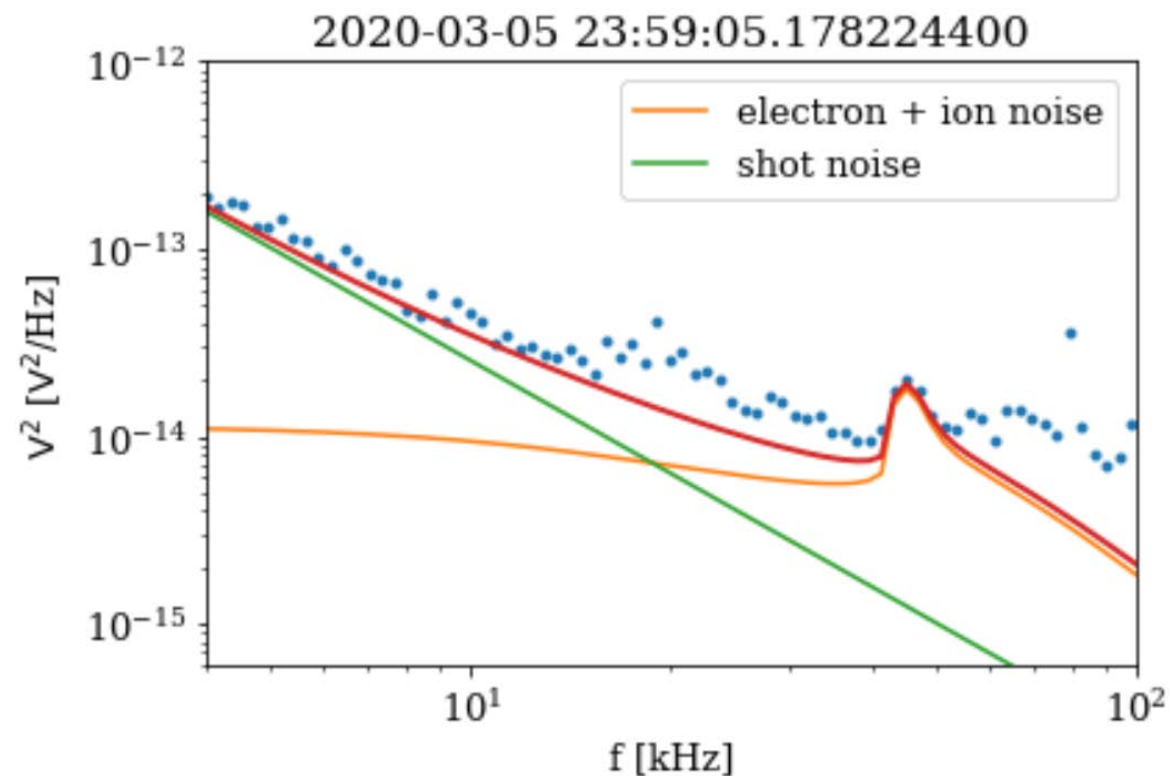
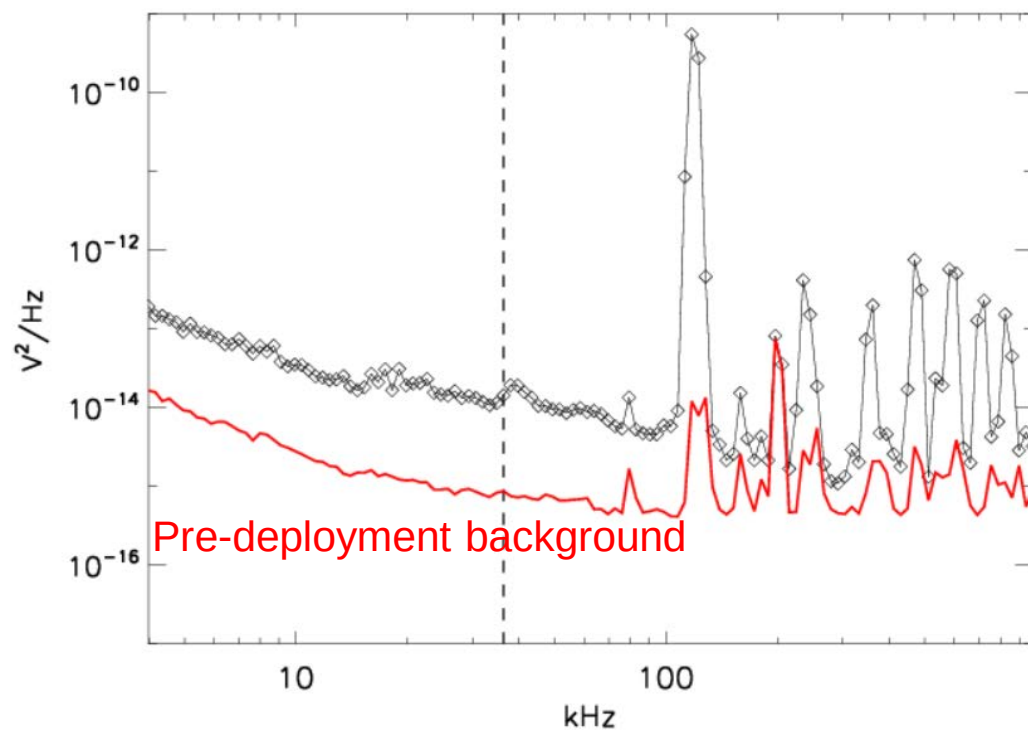


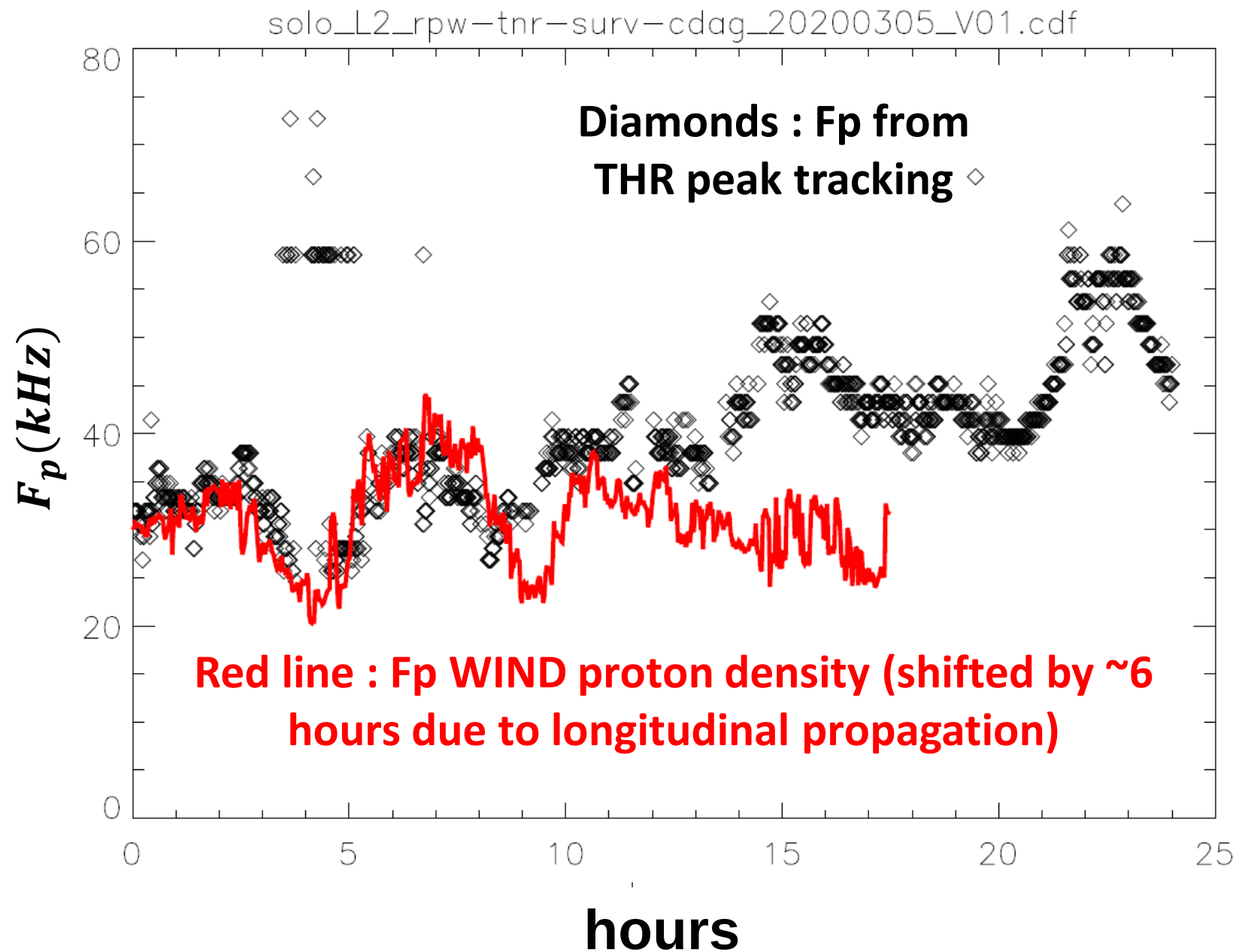
WIND @ L1



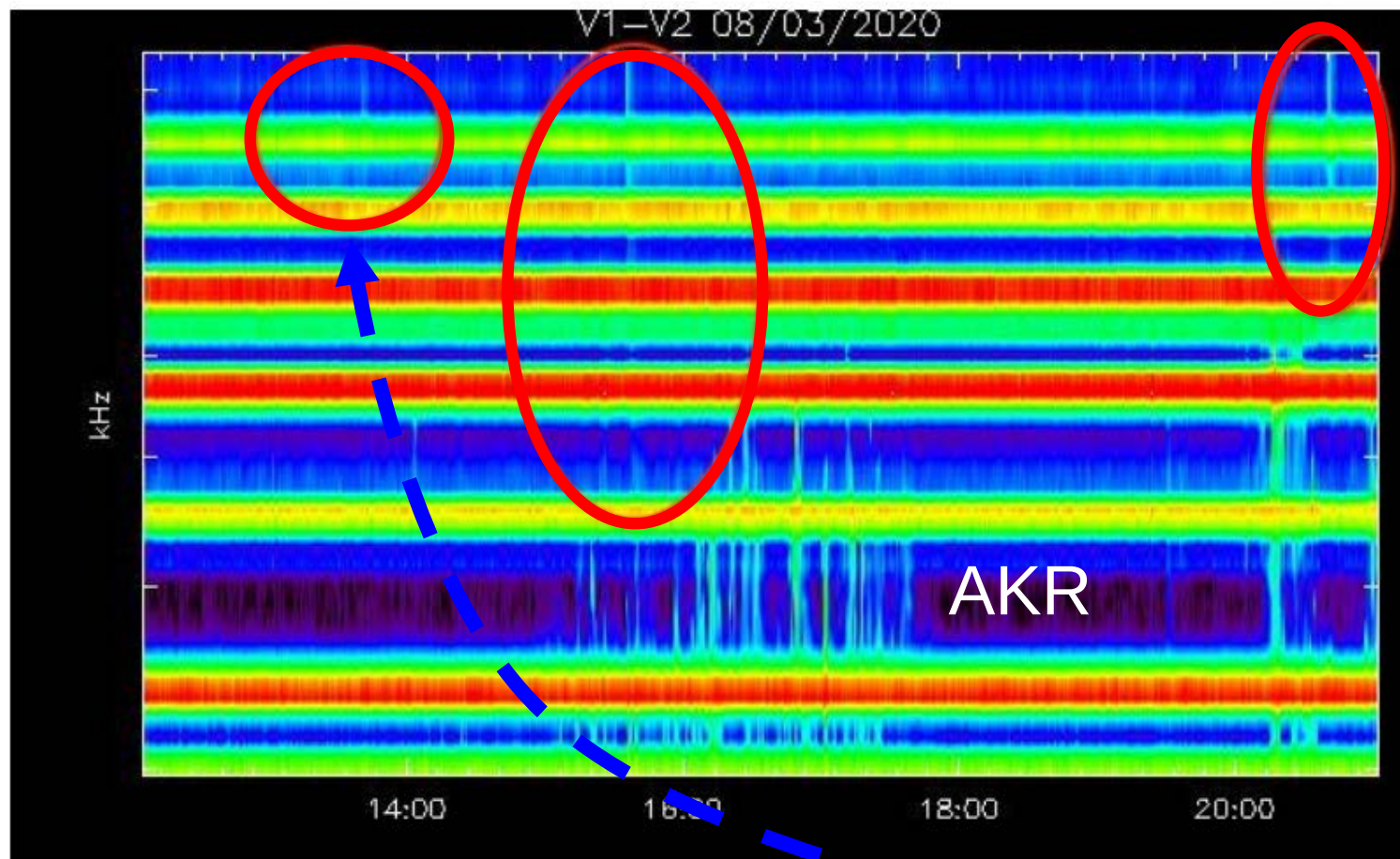
Very first QTN fit attempt (M. Martinović, K. Issautier)

- $T_e = 10^5 K$
- Two Maxwellians populations (core and halo)
- possibly effect of the « hole » between the monopoles)



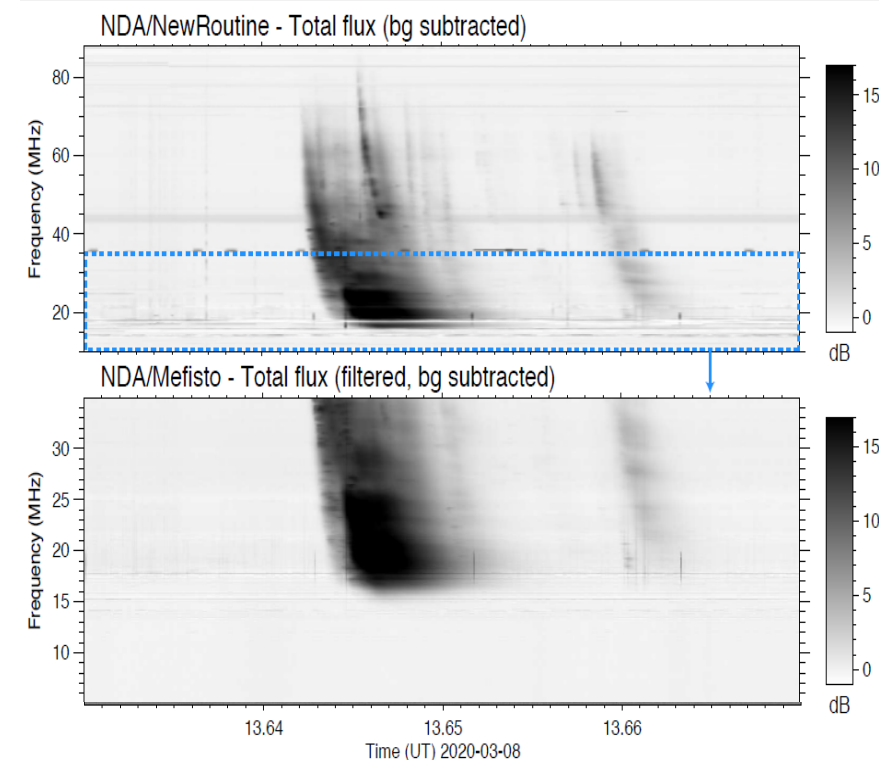


We still see weak Type IIIs « in between spurious lines »



Courtesy
A. Vecchio

NDA, courtesy L. Lamy



Conclusions

- The RPW instrument is operating extremely well ... but sitting on a very noisy spacecraft
- Many S/C (and possibly instrument) EMC perturbations, especially for the radio receiver
- First Langmuir waves and dust measurements
- Probably first shock & whistlers waves
- The THR can still see Quasi-Thermal Noise from time to time and Type IIIs for very few frequencies not completely corrupted. Cleaning of data is necessary
- Data available for the Cols for the time being
- Hope to be ready for the first public delivery of cruise phase data