RPW / SCM

The RPW/Search Coil Magnetometer onboard Solar Orbiter

Matthieu Kretzschmar
and the SCM team

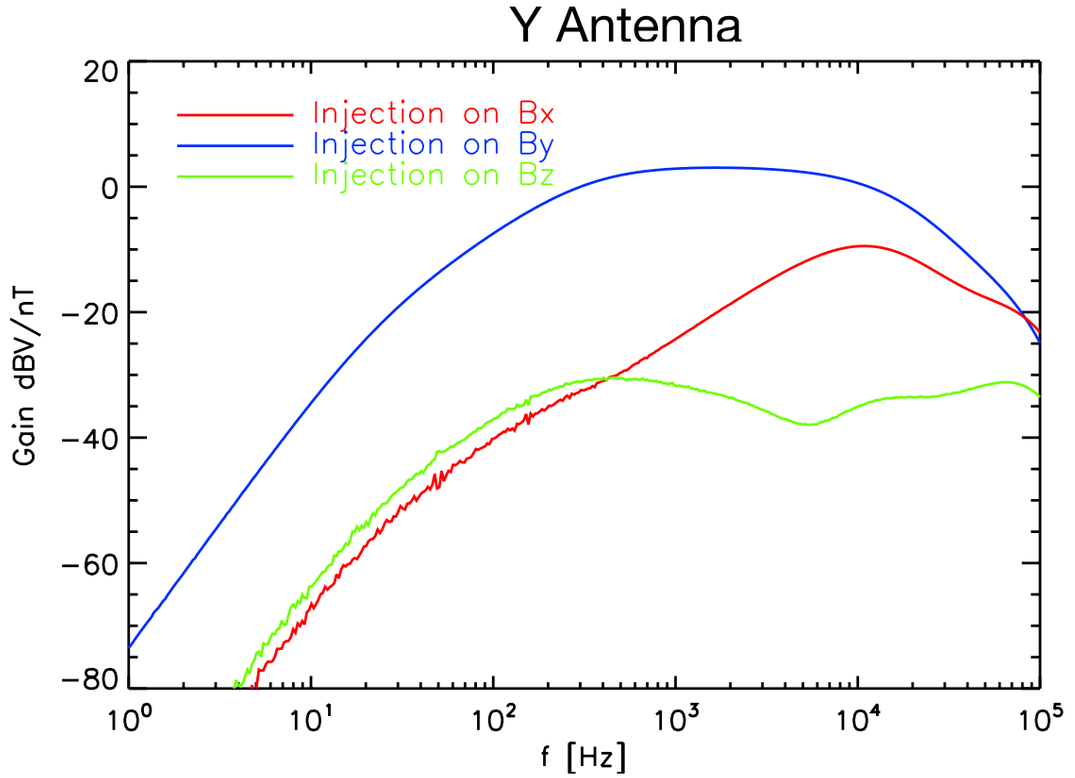
Overall status

- SCM working nicely
- software for magnetic waveform calibration ok (updated calibration). Quality flag to be implemented
- Several artefacts to correct or tags
- Team:
  - V. Krasnoselskih, G. Jannet, JY Brochot, T. Dudok de Wit, C. Froment, N. Colomban, one engineer being recruted

SCM Calibration

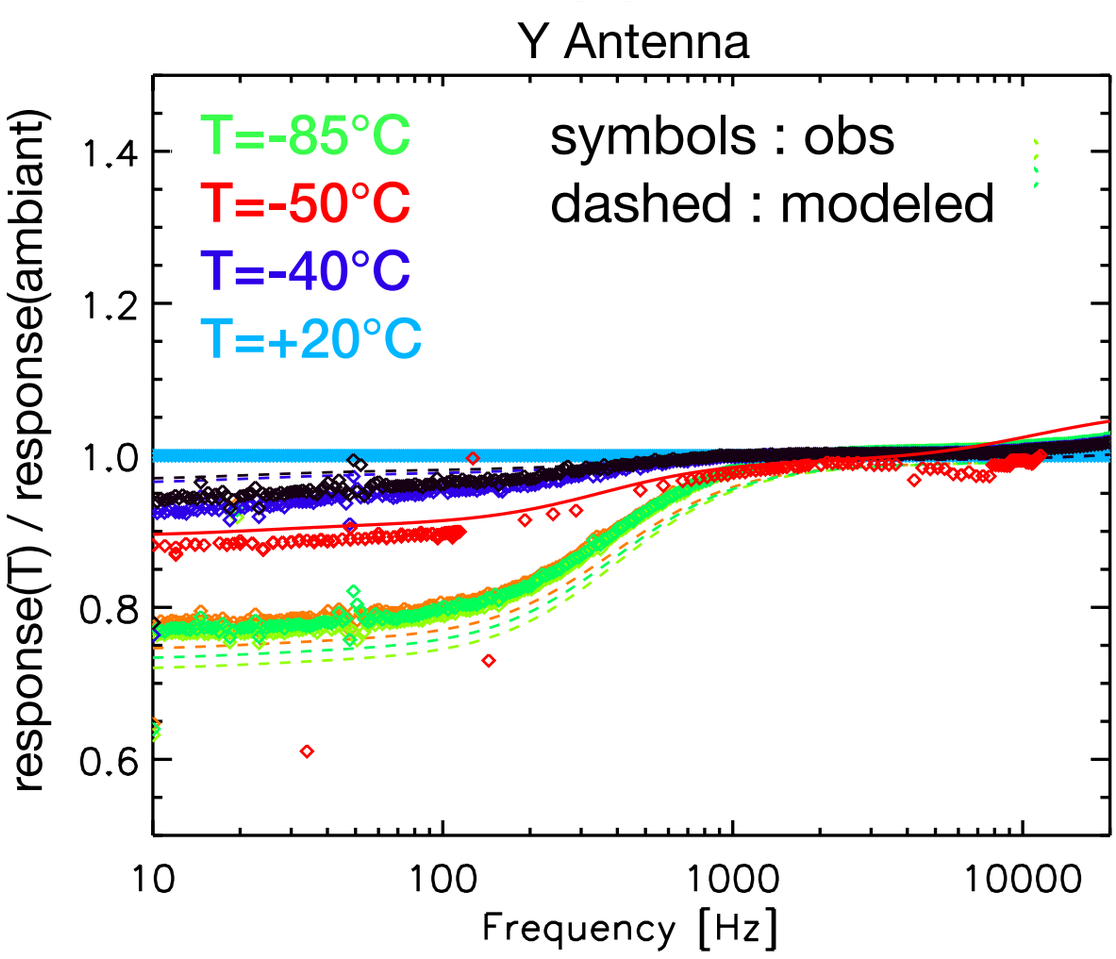
- Matricial calibration to deal with cross-talk between antennas

$$\begin{bmatrix} V_x \\ V_y \\ V_z \end{bmatrix} = \begin{bmatrix} R_{xx} & R_{xy} & R_{xz} \\ R_{yx} & R_{yy} & R_{yz} \\ R_{zx} & R_{zy} & R_{zz} \end{bmatrix} \begin{bmatrix} B_x \\ B_y \\ B_z \end{bmatrix}$$

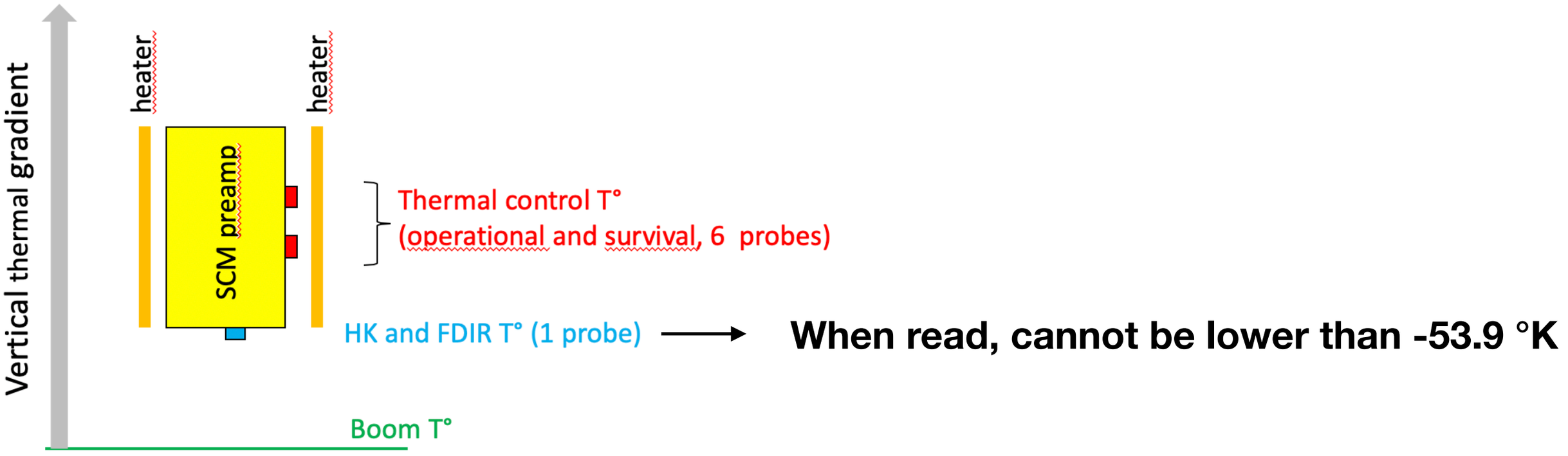


- Gain is temperature dependent.

- In space, possibility to trace the frequency response



SCM Temperature

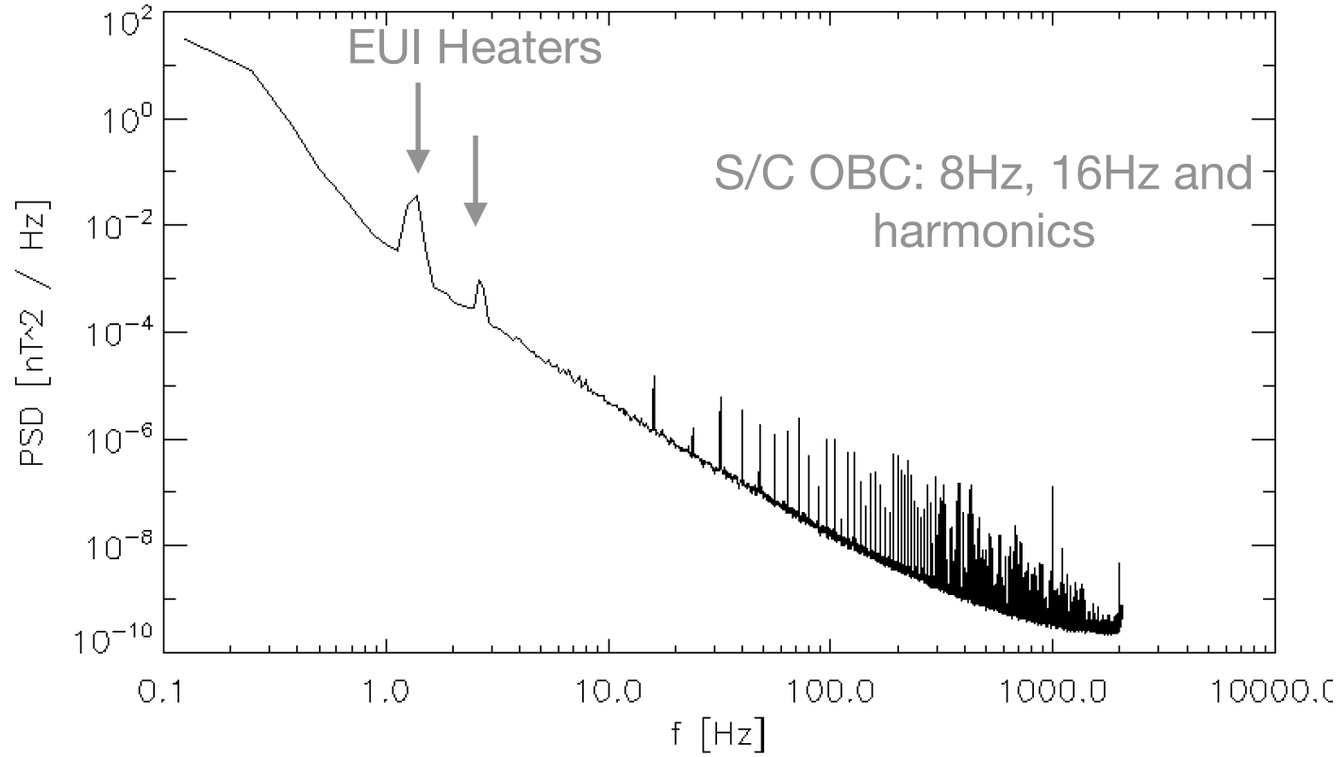


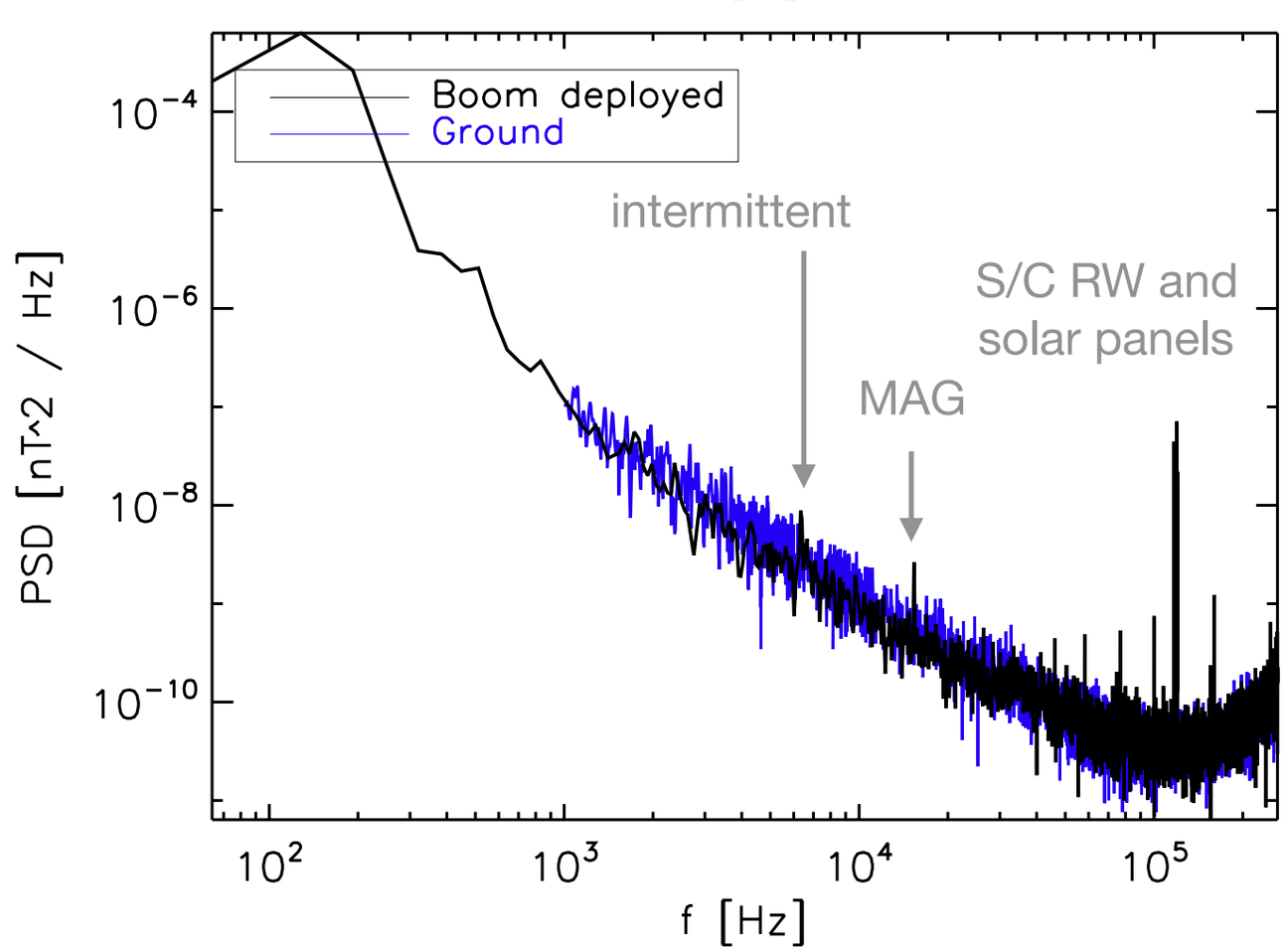
- Simulations reproduce very nicely the temperature observed during TVAC tests.
- In flight, I-boom temperature and SCM heater duty cycle are used to reproduce observed SCM heating power.

When boom temperature varies between -112° and -52°,
SCM antenna temperature goes from -52.4 ° to -47.5 °

Artefact signals

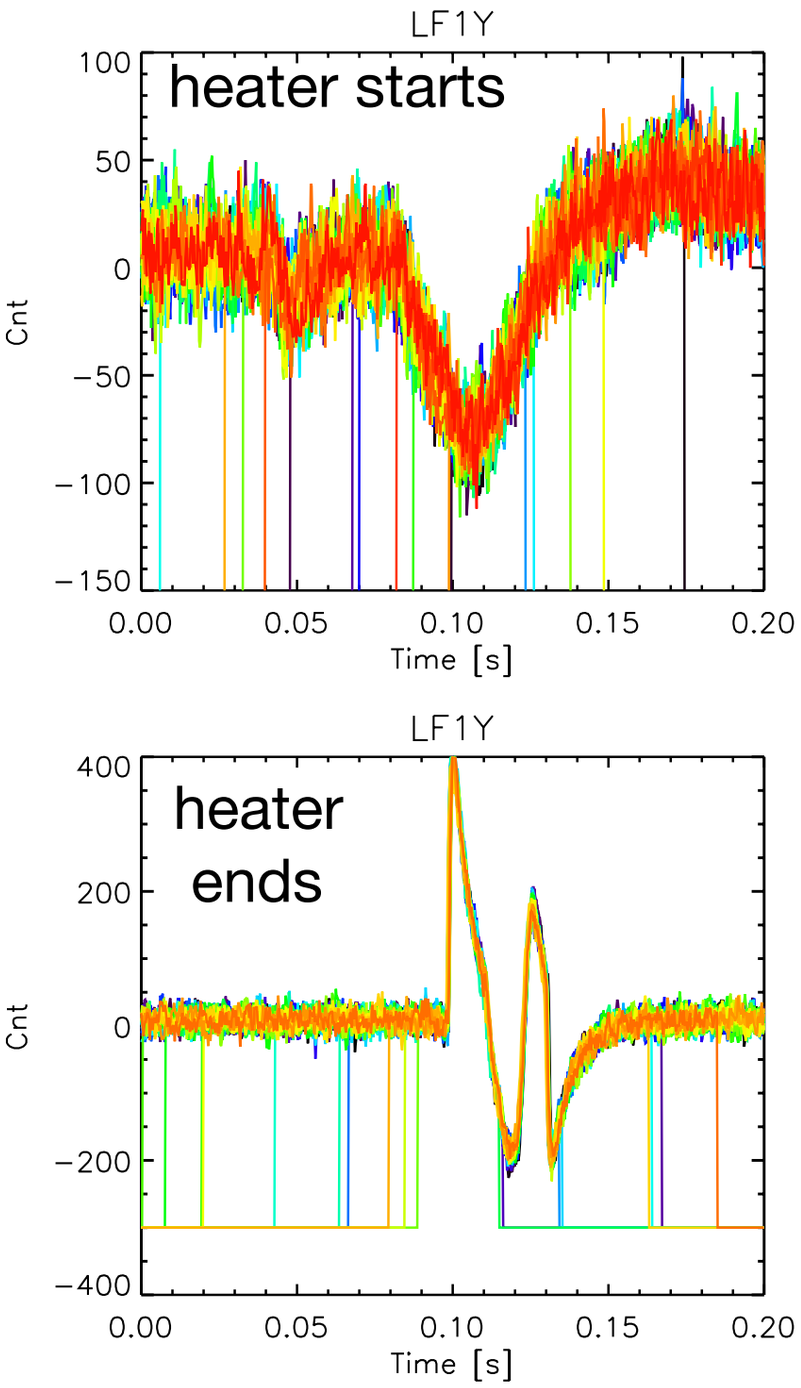
- EUI heaters **TBC** (1.33 & 2.66Hz)
- OBC (8Hz, 16Hz and harmonics)
- MAG driving frequency (15.36kHz and harmonics)
- RW DC converter for RW (80kHz)
- Solar Panel DC converter (120kHz)
- Others will come with EMC campaigns
- SCM heaters

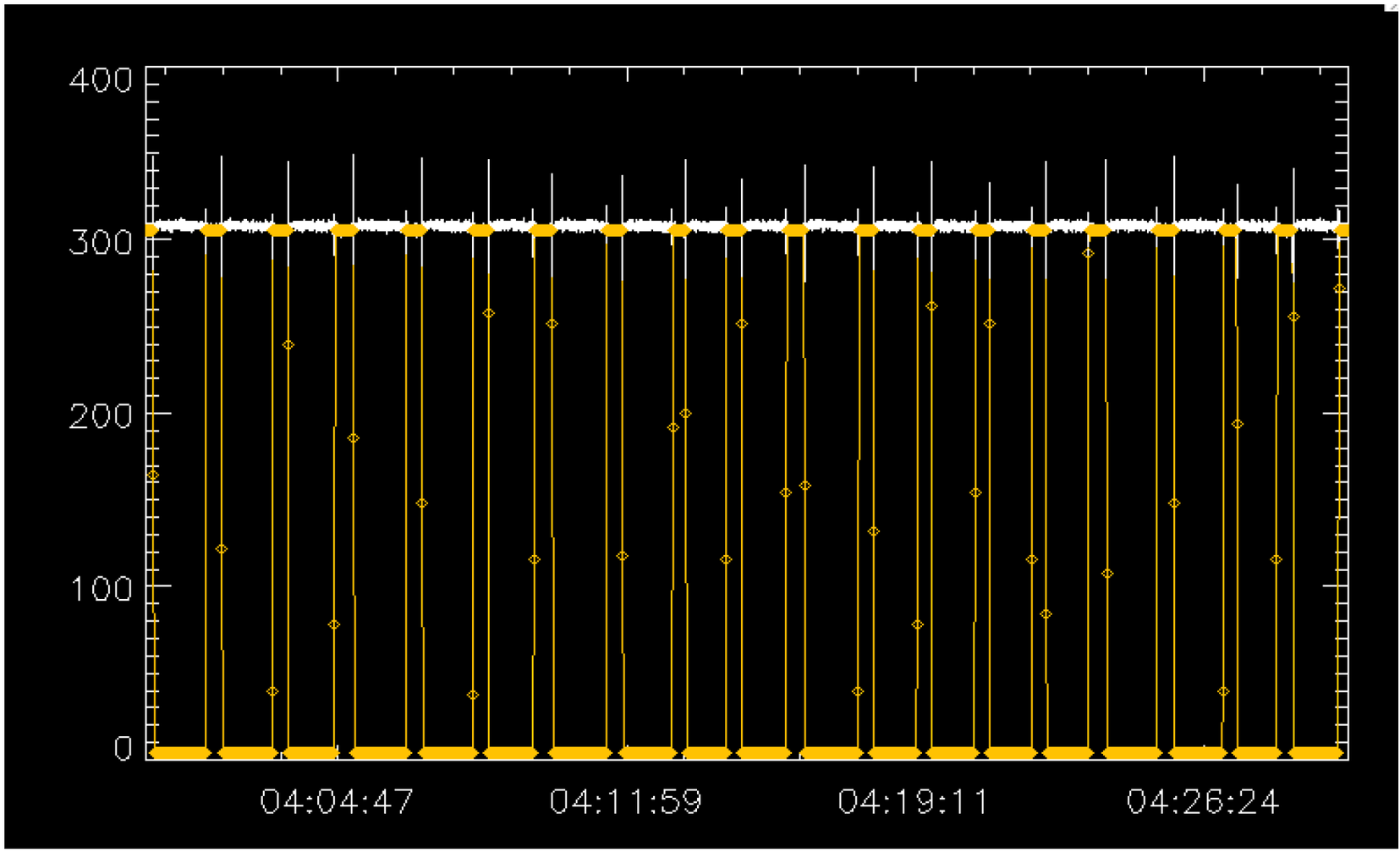




SCM heaters signature

L1 waveforms

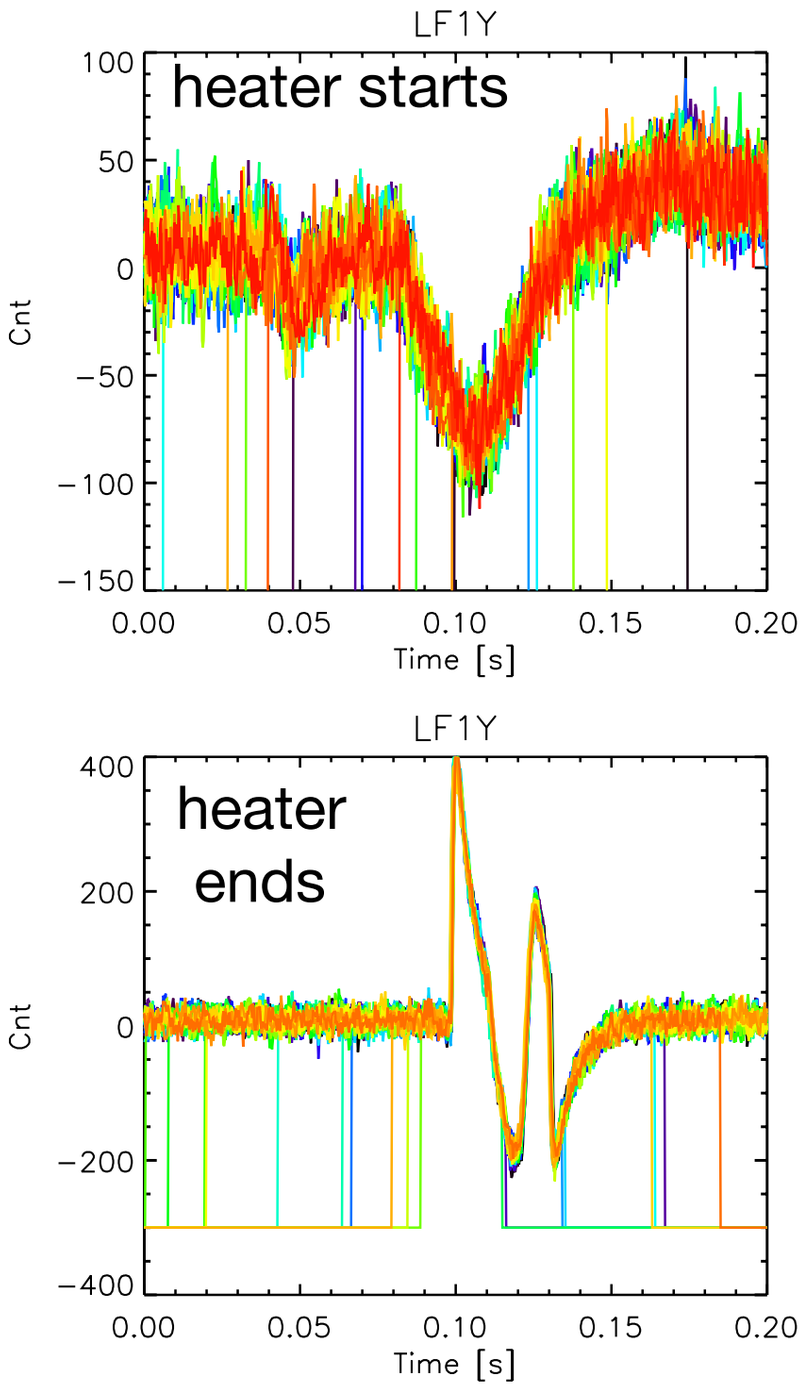




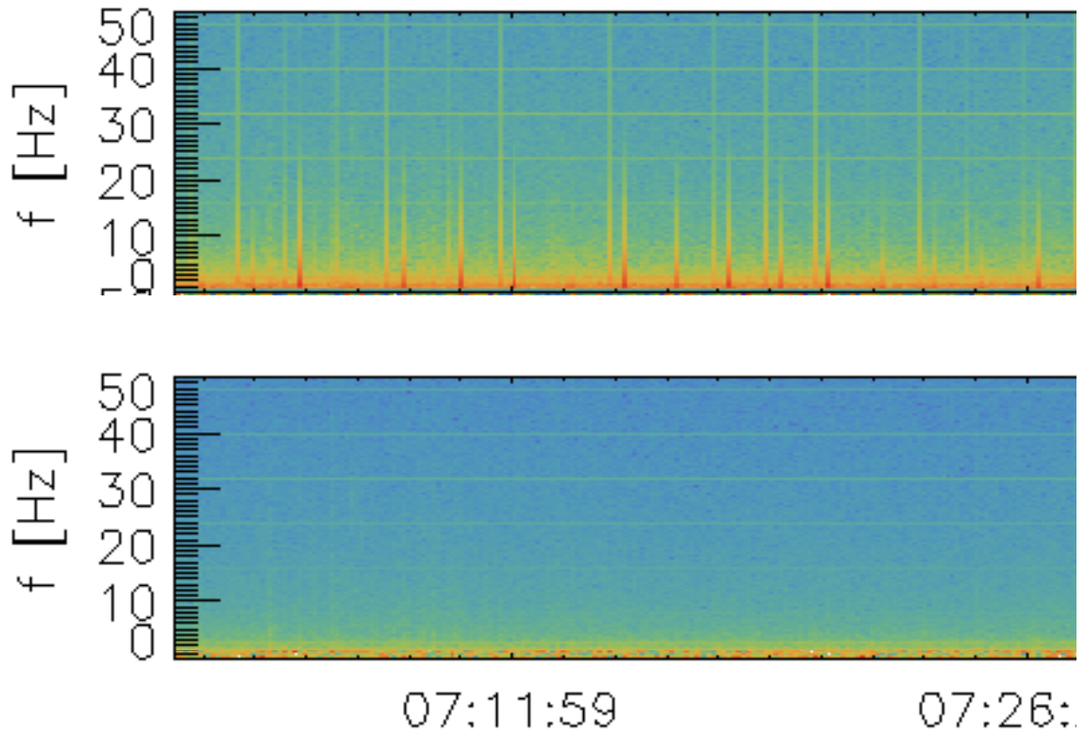
- affect less than 1% of the data
- affects all frequency
- might improve if SCM gets hotter
- some mitigation but not right now

SCM heaters signature

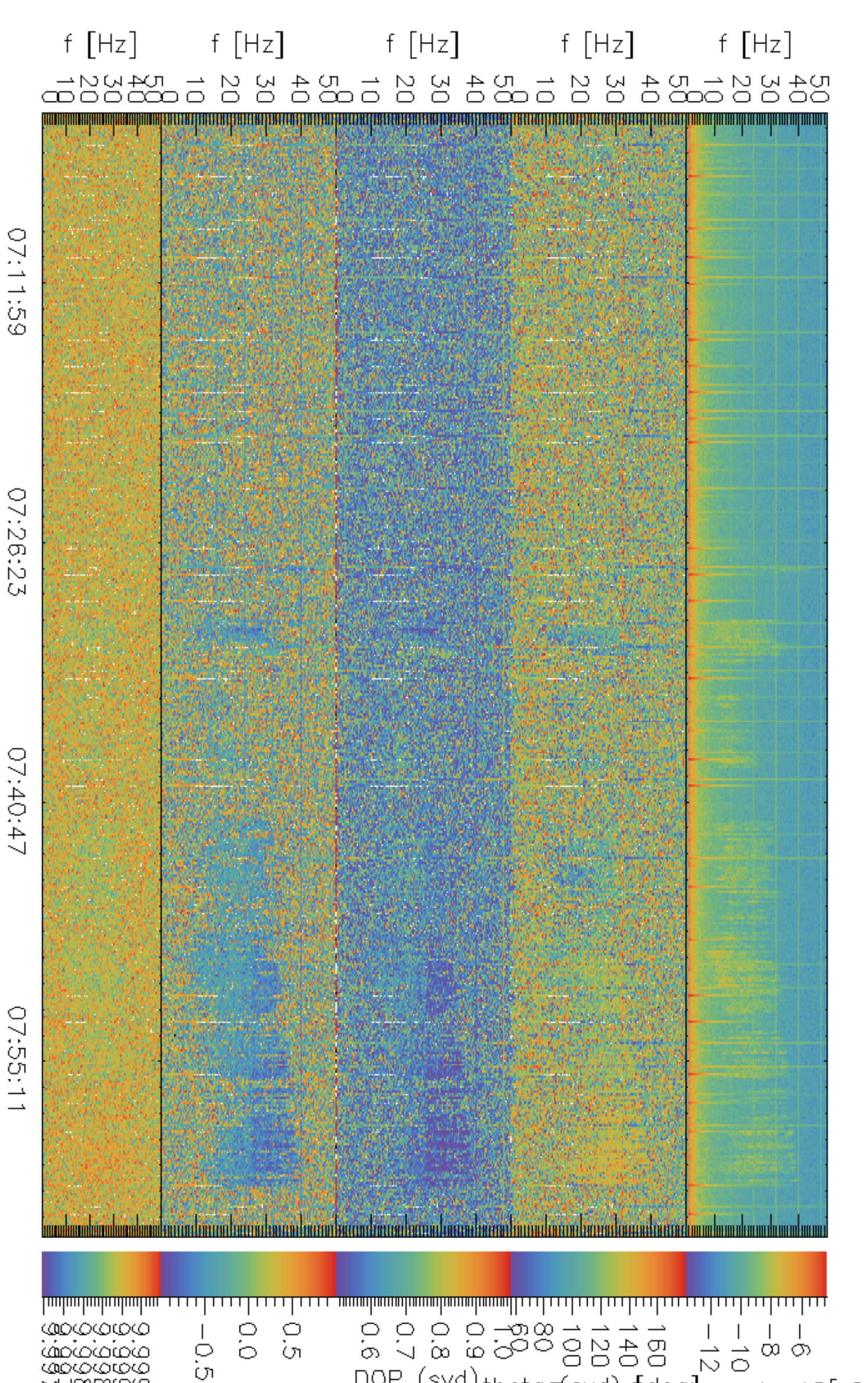
L1 waveforms

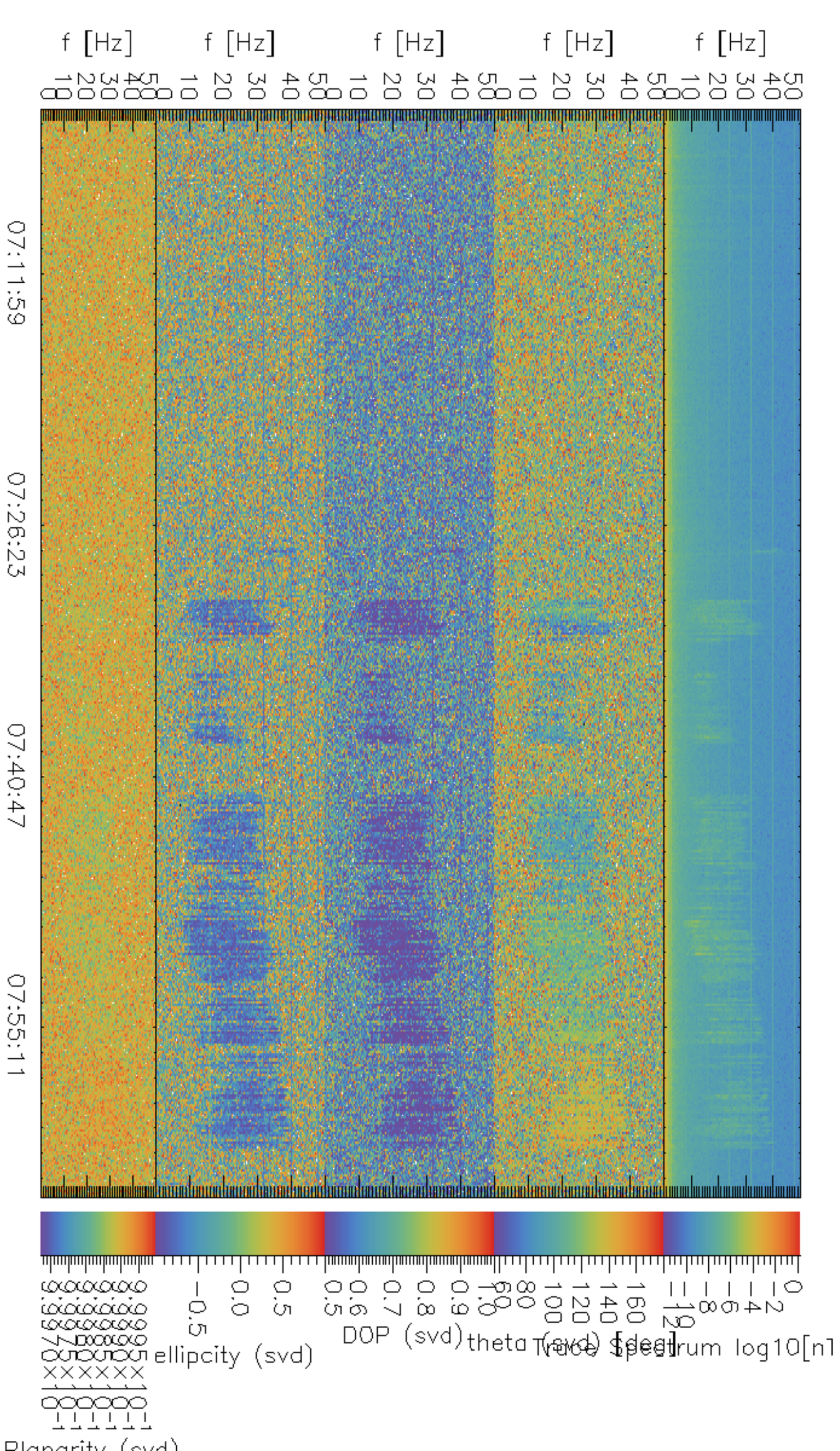


L2 waveforms, all frequency affected

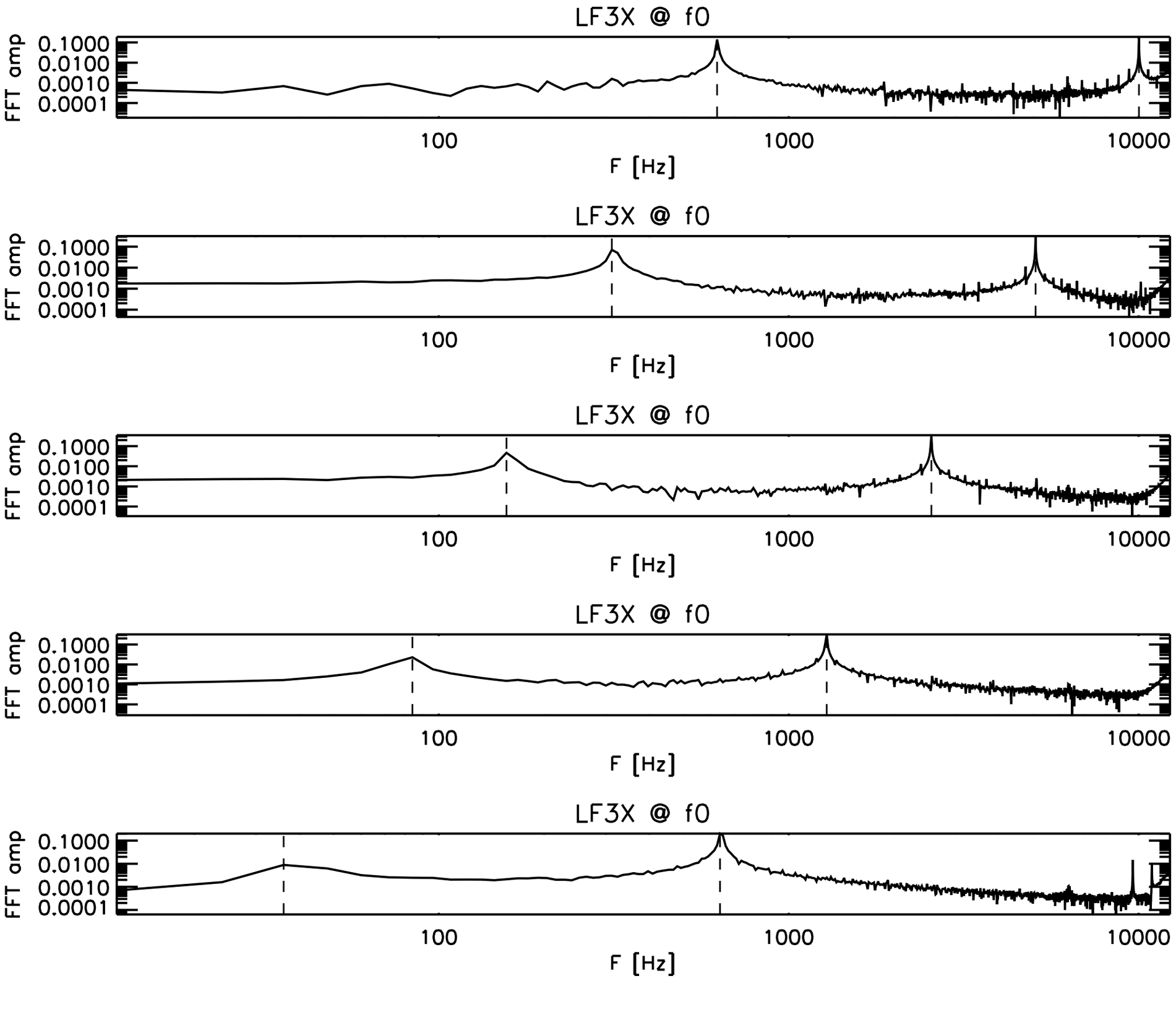


- affect less than 1% of the data
- affects all frequency
- might improve if SCM gets hotter
- some mitigation but not right now

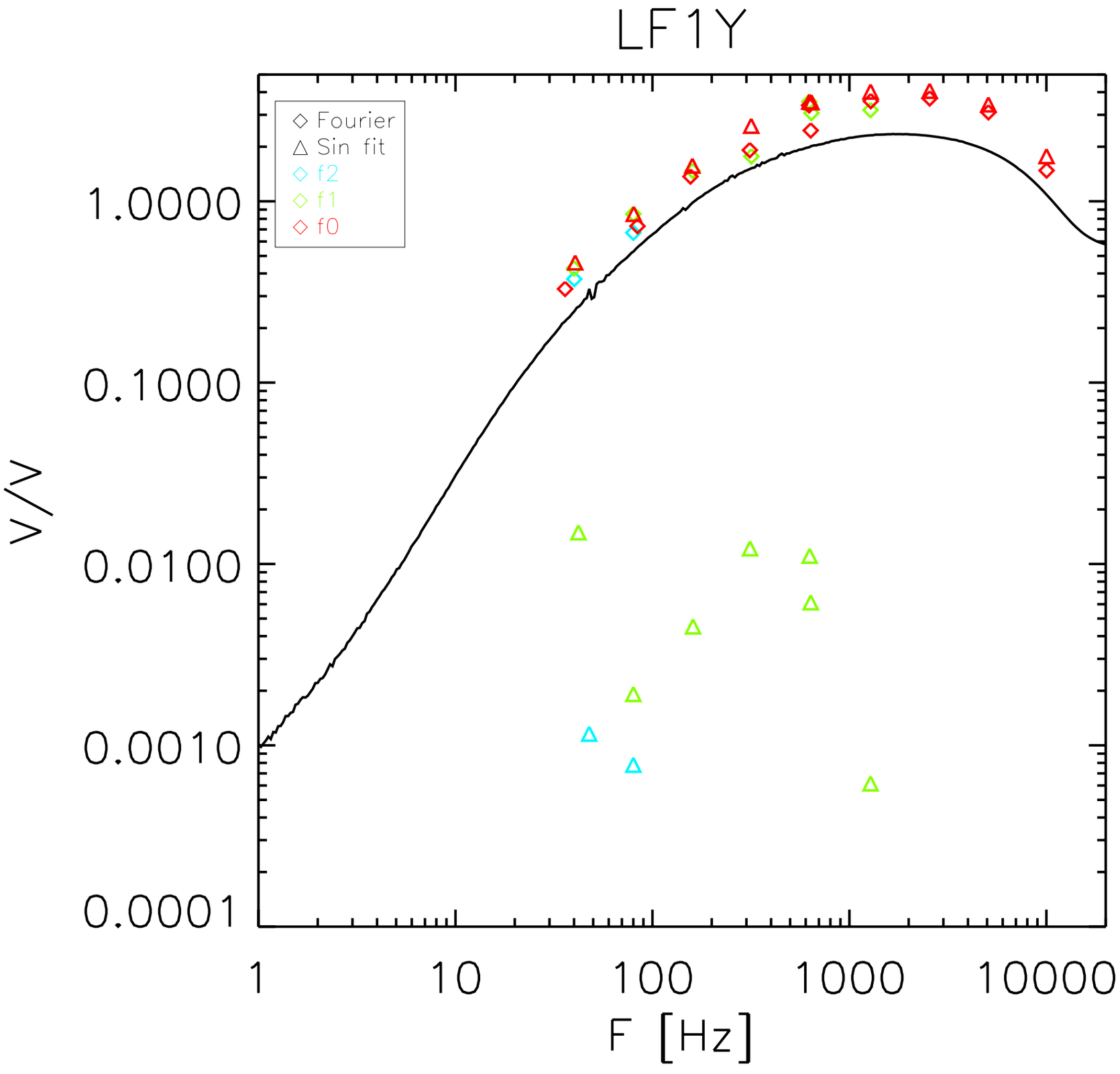

f [Hz]
f [Hz]
f [Hz]
f [Hz]
f [Hz]
07:11:59
07:26:23
07:40:47
07:55:11
Trace Spectrum log10[n]
theta (svd) [deg]
DOP (svd)
ellipcity (svd)
Planarity (svd)


f [Hz]
50 40 30 20 10 58 40 30 20 10 58 40 30 20 10 58 40 30 20 10 58 40 30 20 10
07:11:59
07:26:23
07:40:47
07:55:11
Trace Spectrum log10[nT²/Hz]
0 2 4 6 8 10 12
theta (svd) [deg]
160 140 120 100 80 60 40 20 0
DOP (svd)
1.0 0.9 0.8 0.7 0.6 0.5
ellipcity (svd)
0.5 0.0 −0.5
Planarity (svd)

Onboard cal, quick look

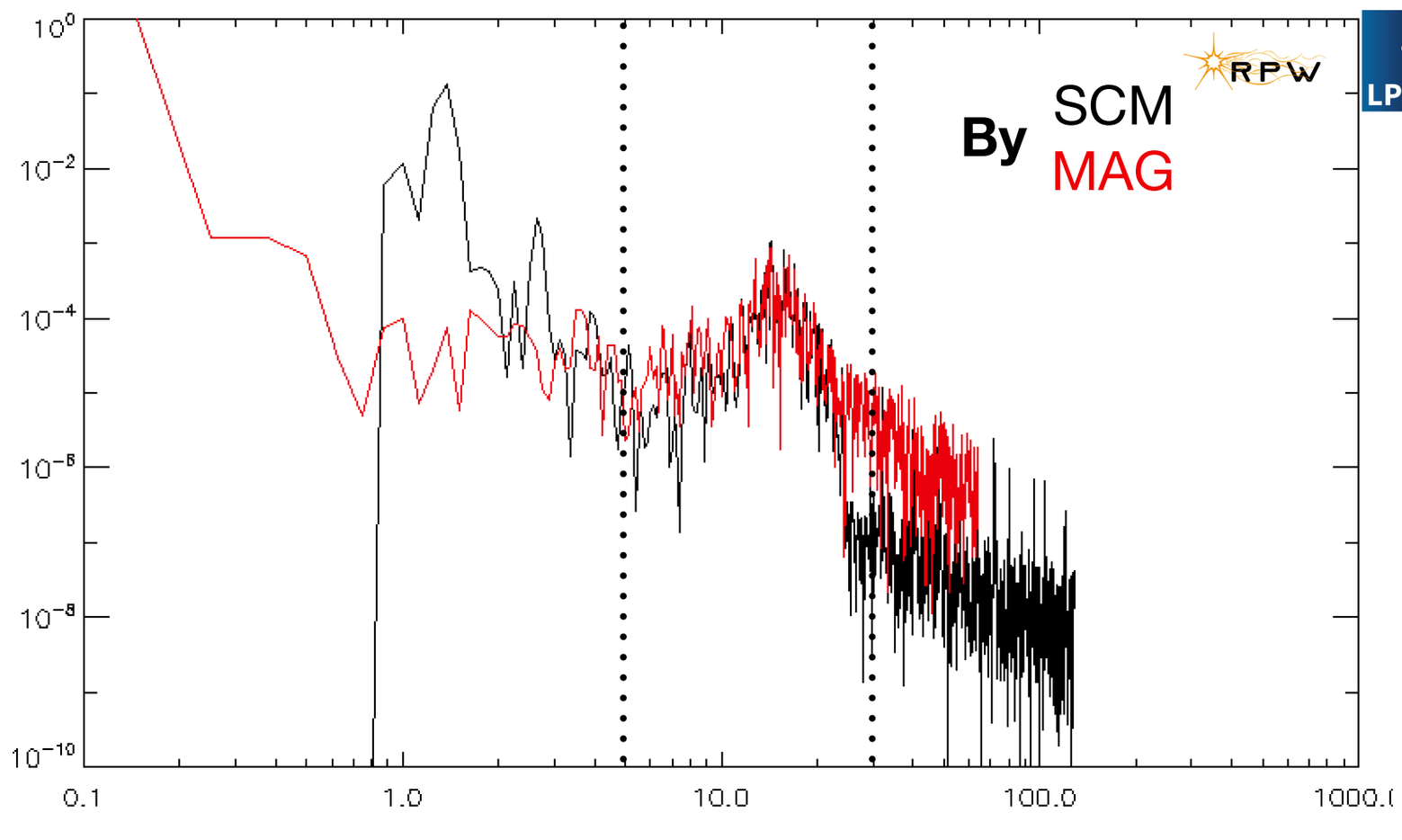


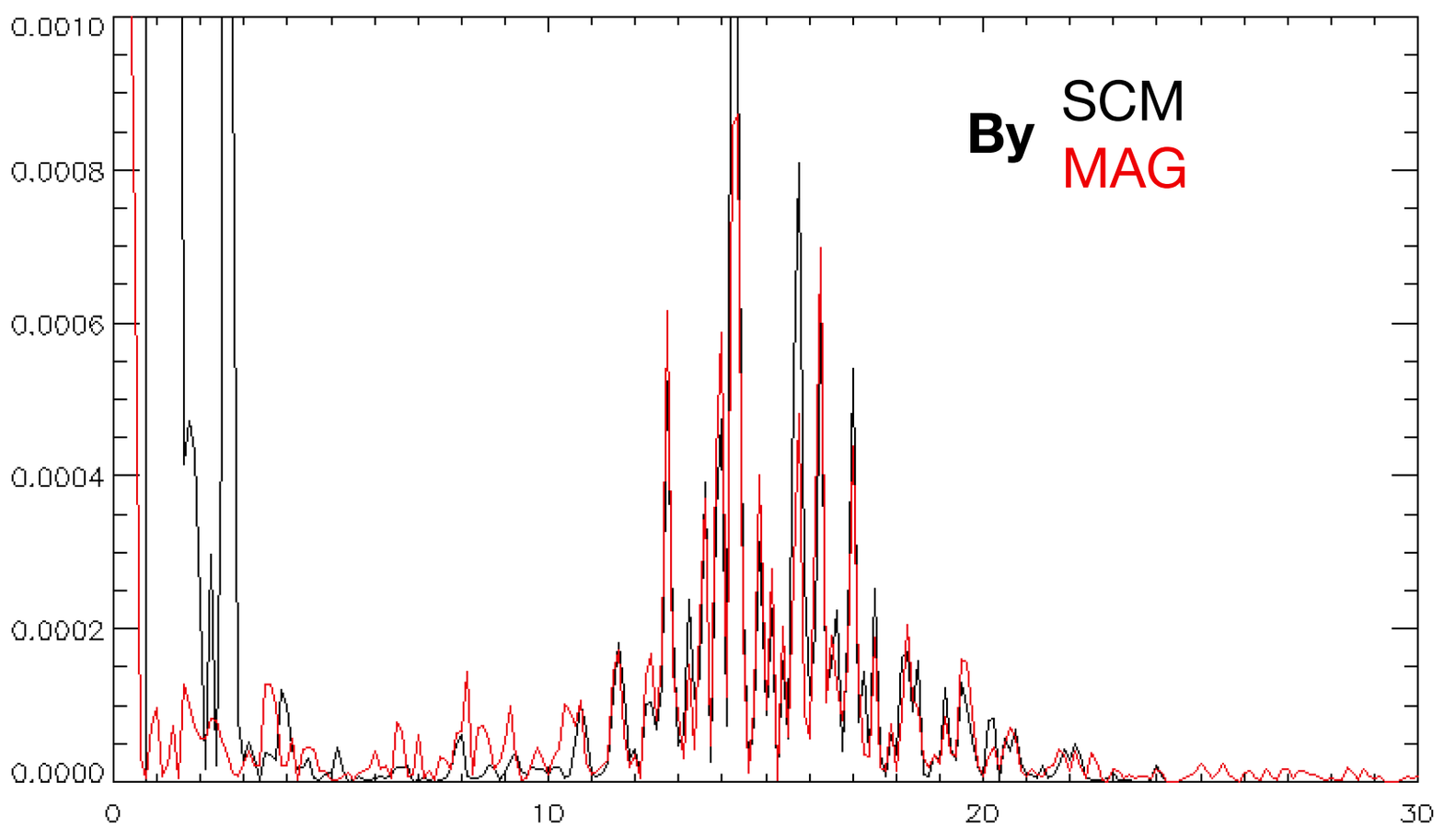
Onboard cal, quick look



SCM / MAG comparison

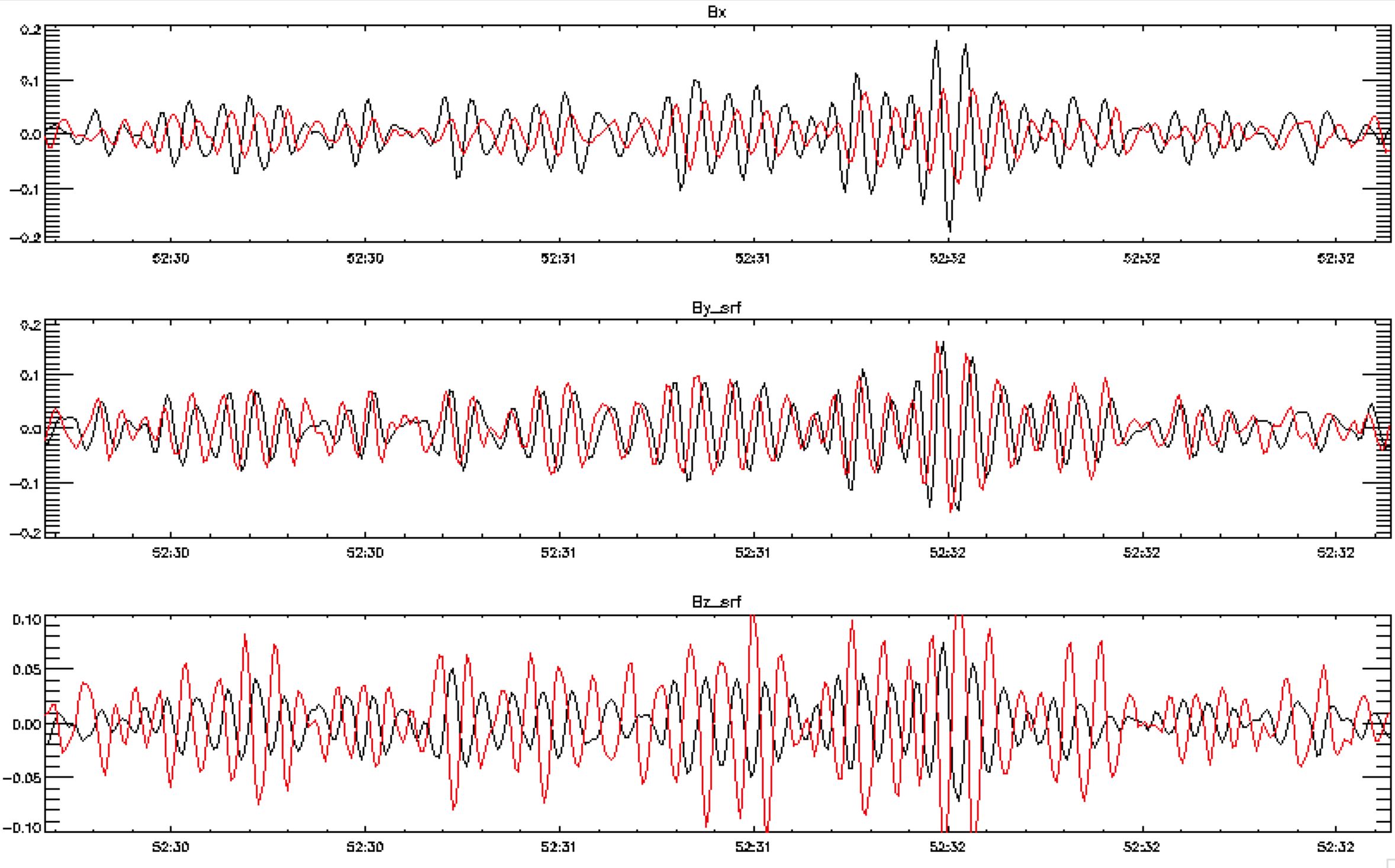
20200530 17:52





SCM_scmframe
MAG_srf

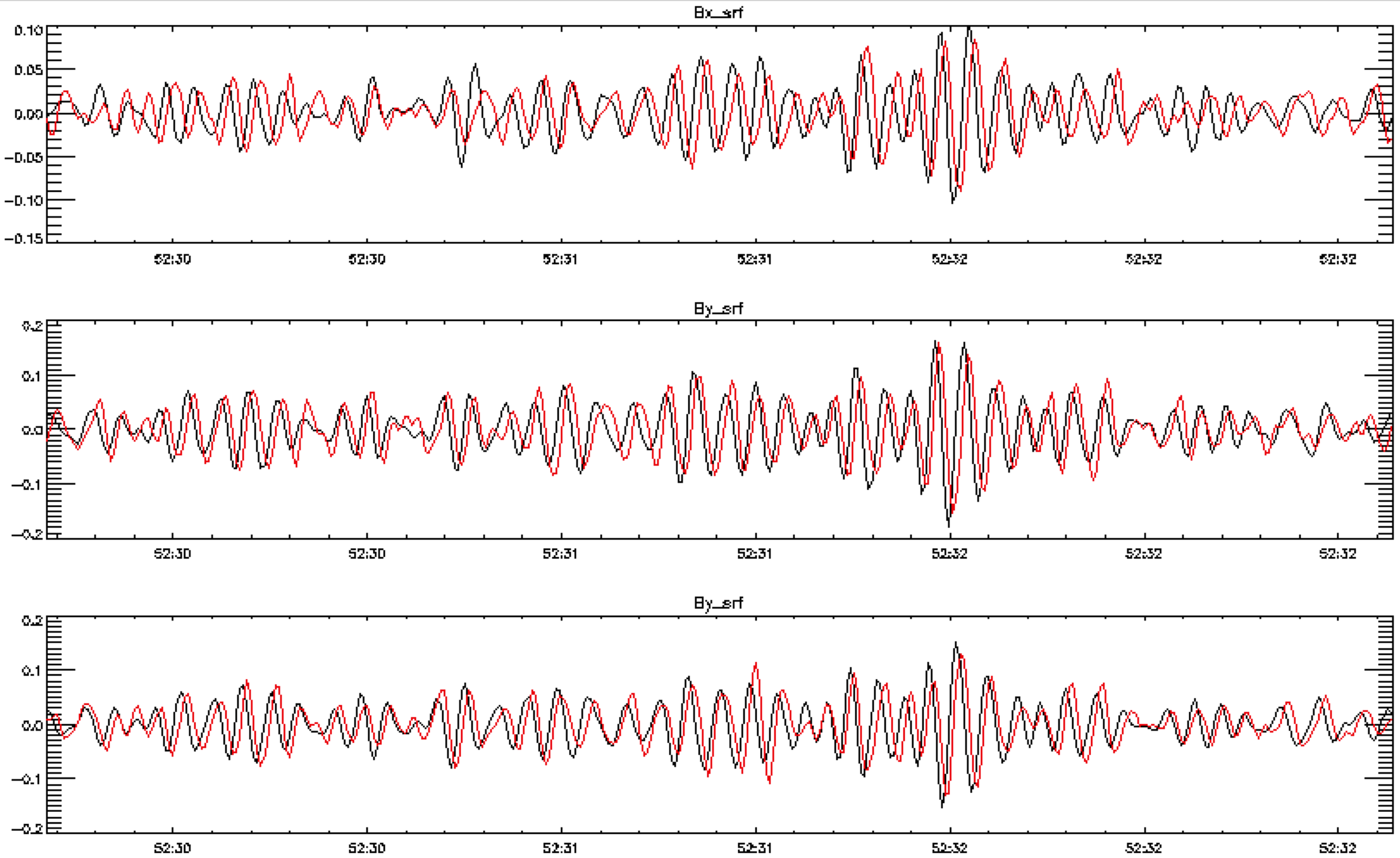
5-30 Hz



17h

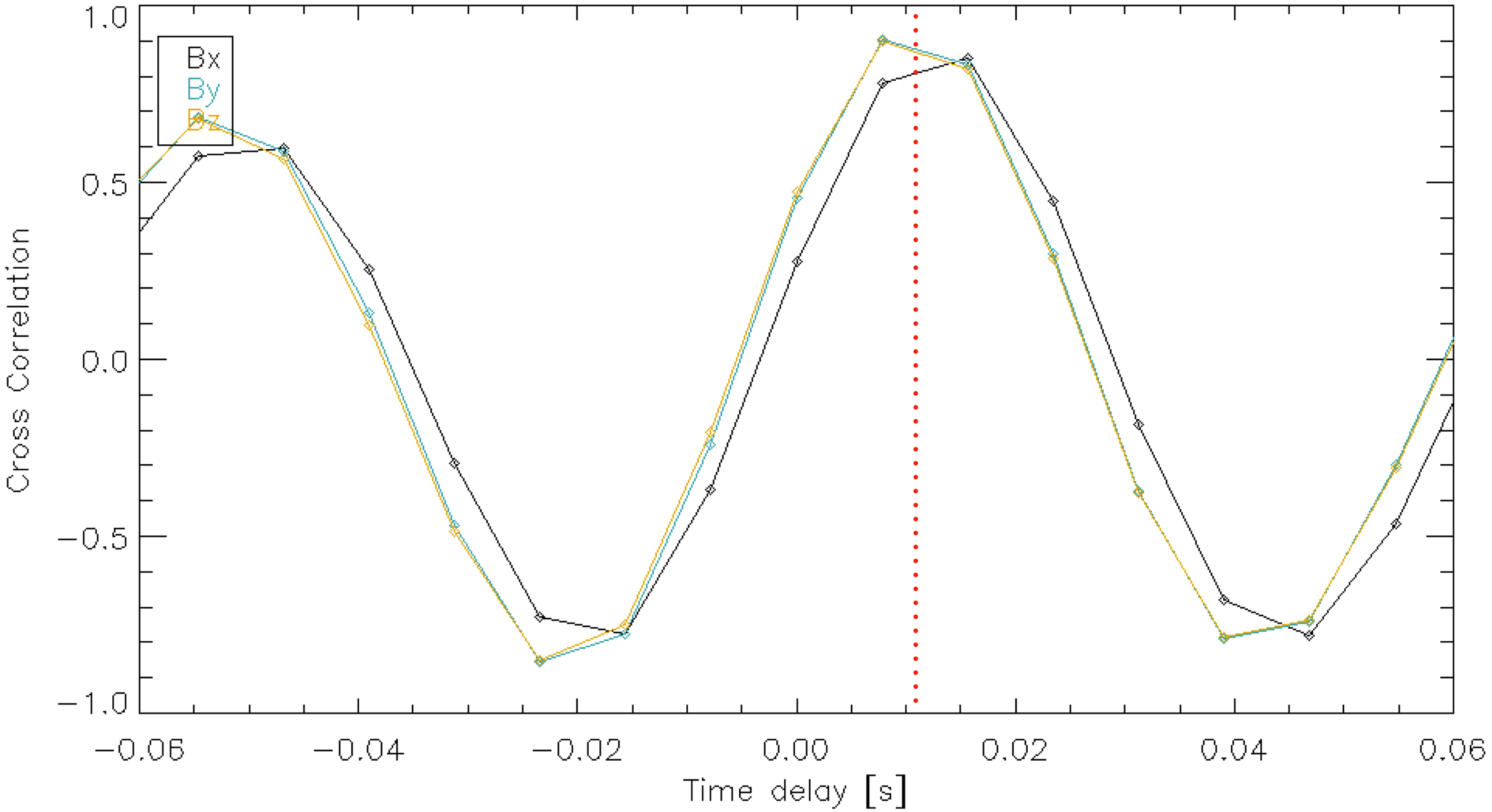
SCM_SRF
MAG_SRF

5-30 Hz



17h

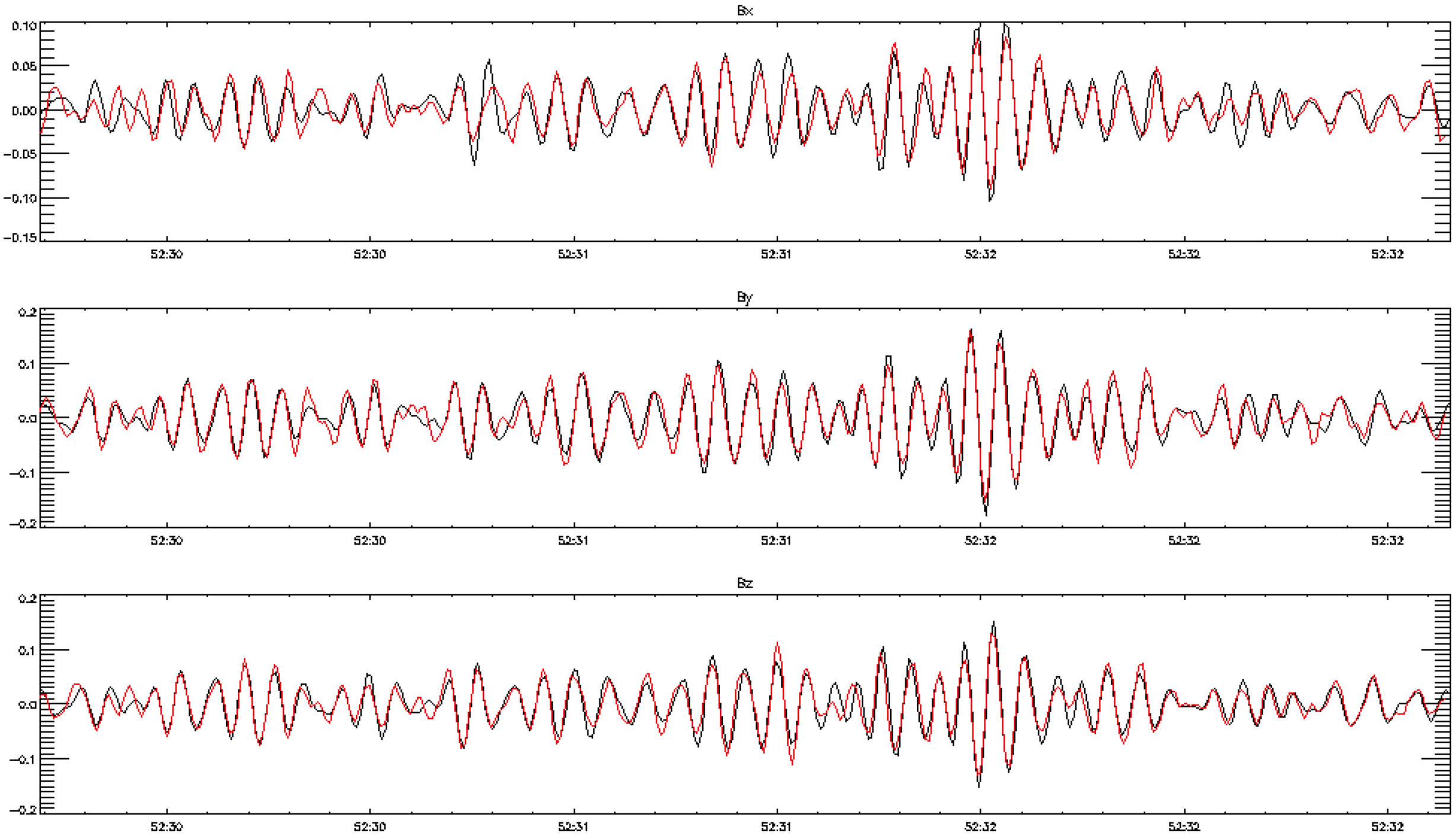
SCM Lag ~ 1.5/128 s = 11.71ms



SCM_SRF

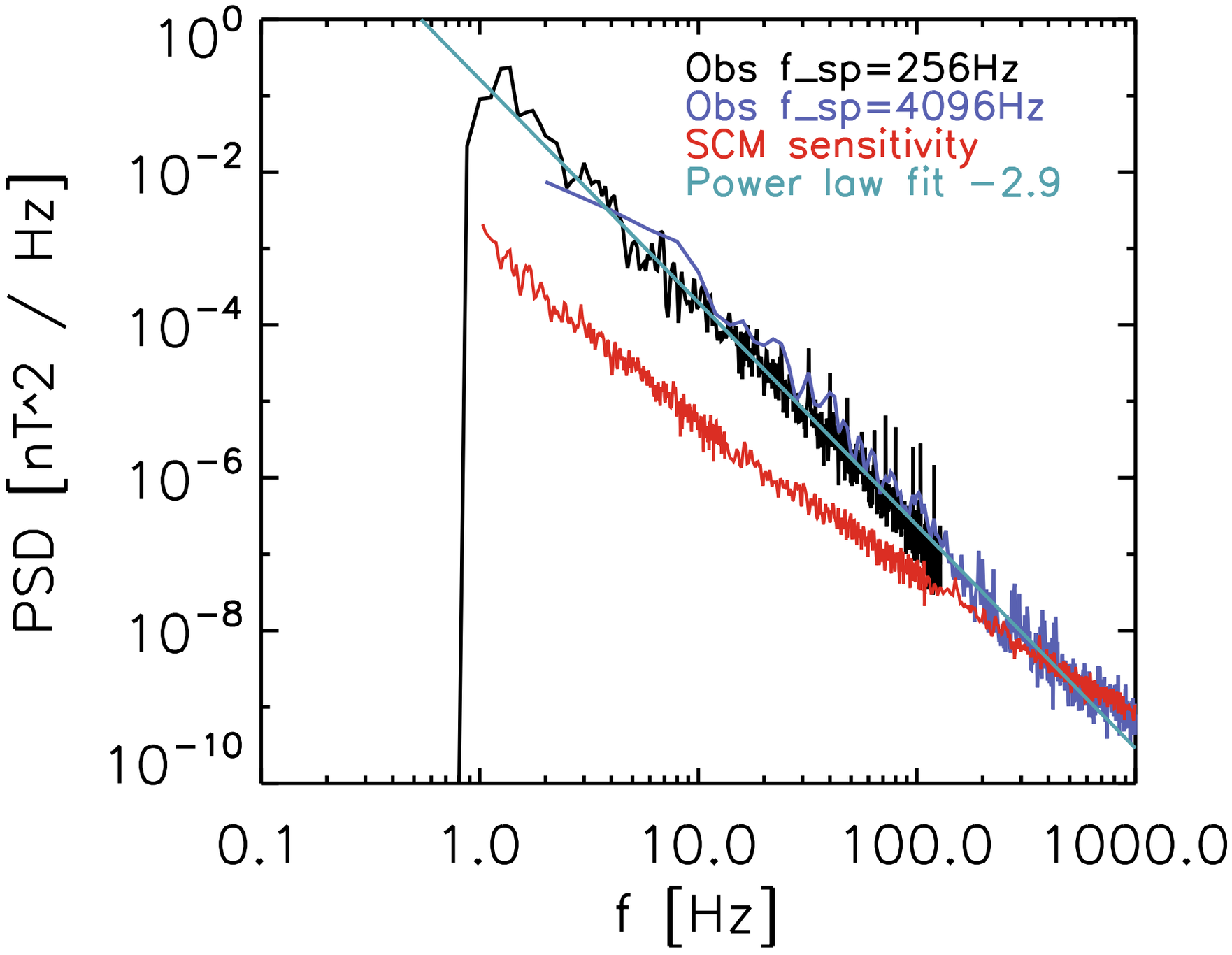
MAG_SRF (delay 1.5/128 s = 11.71ms)

5-30 Hz



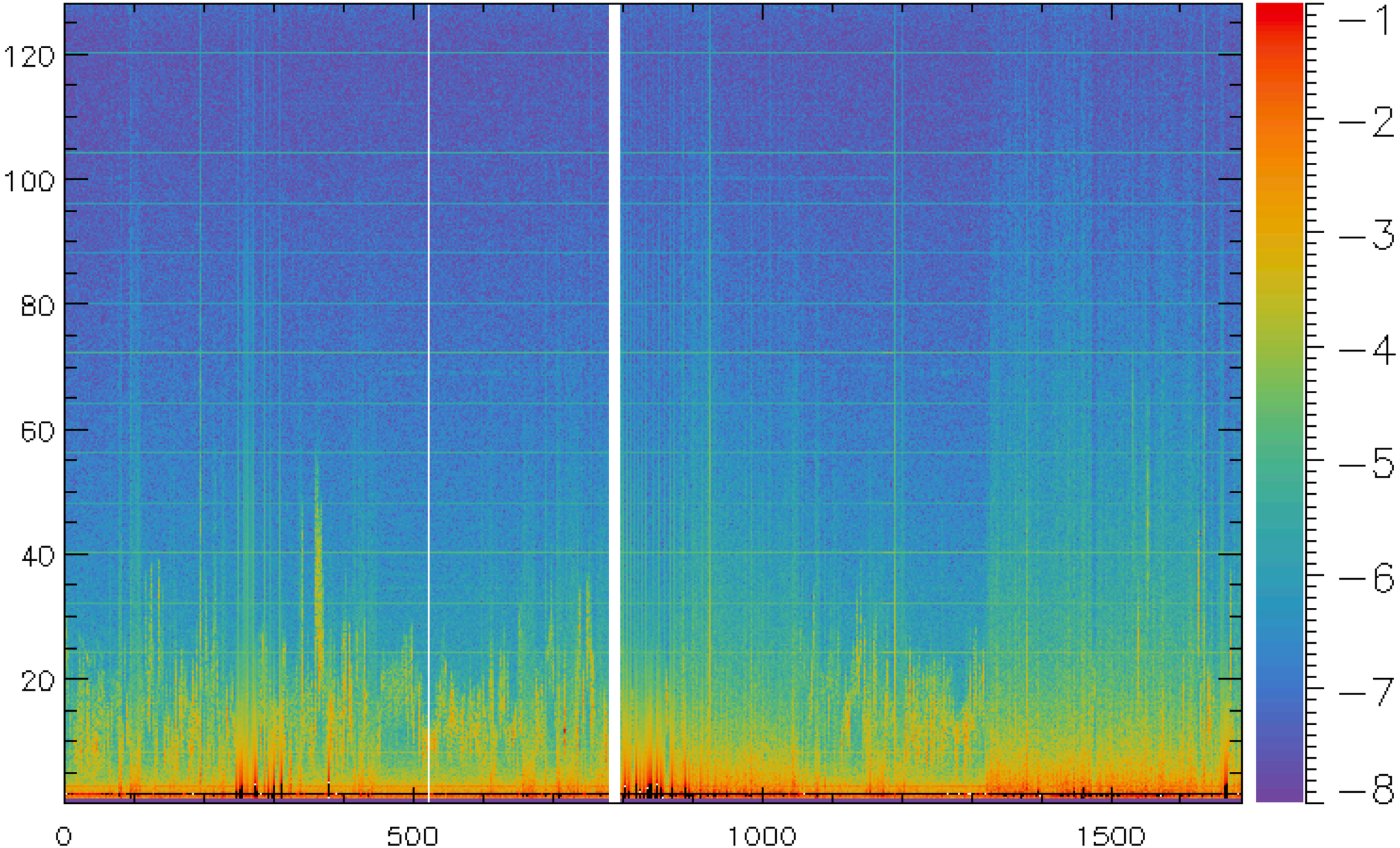
Excellent agreement, meaning some confidence on absolute physical value and orientation of calibrated data

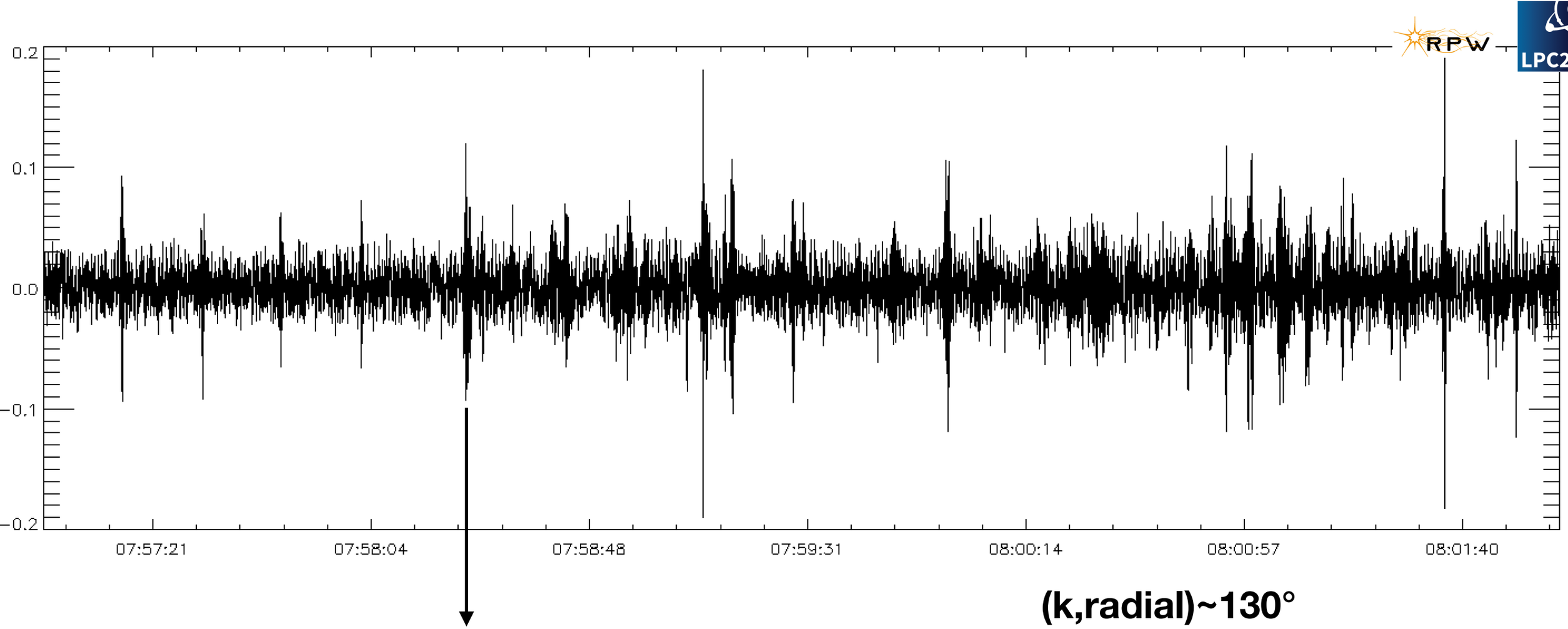
turbulence in the kinetic range

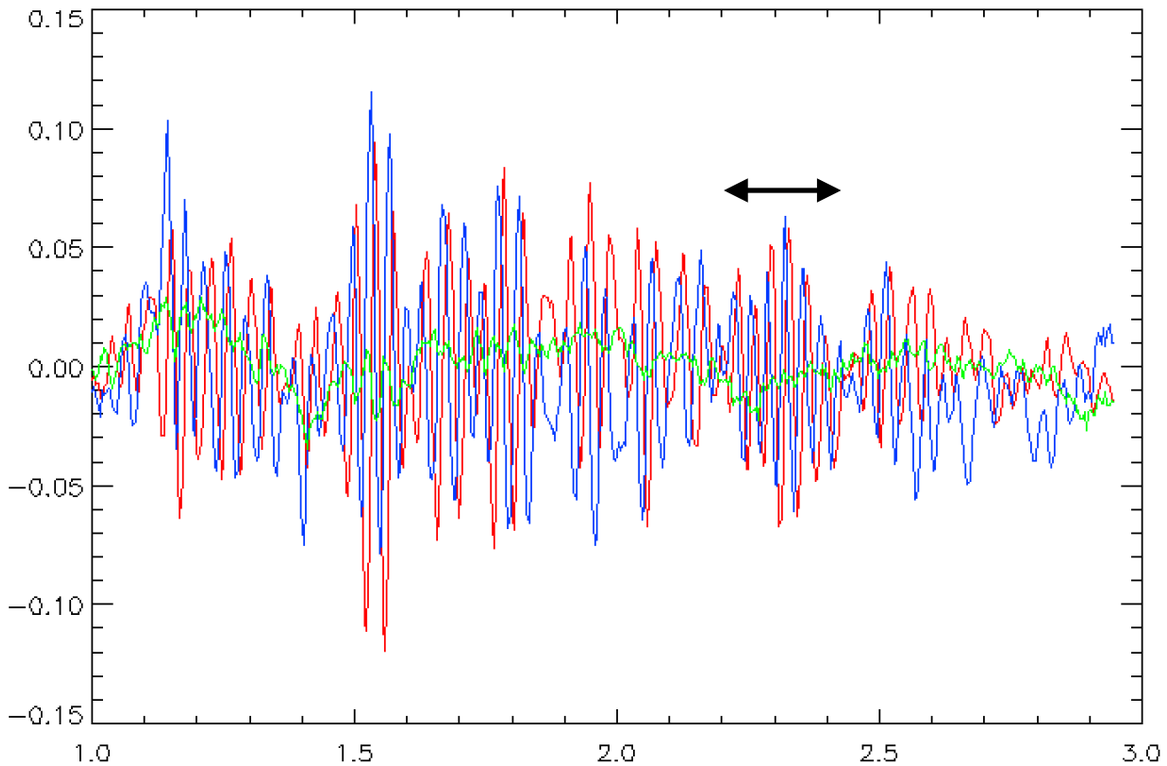


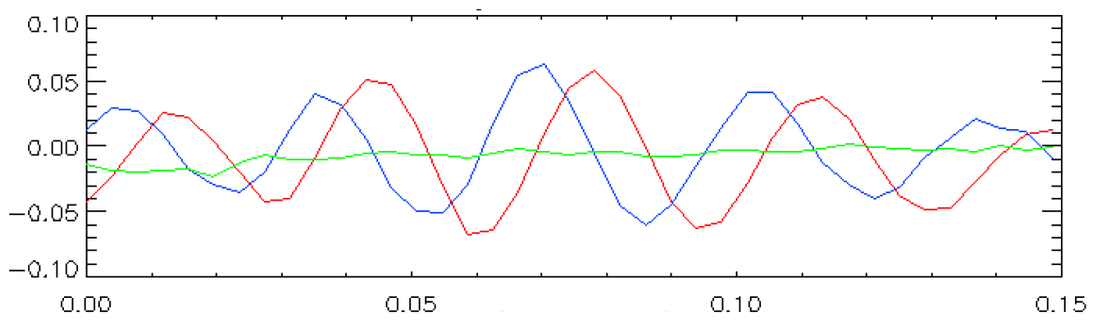
Waves

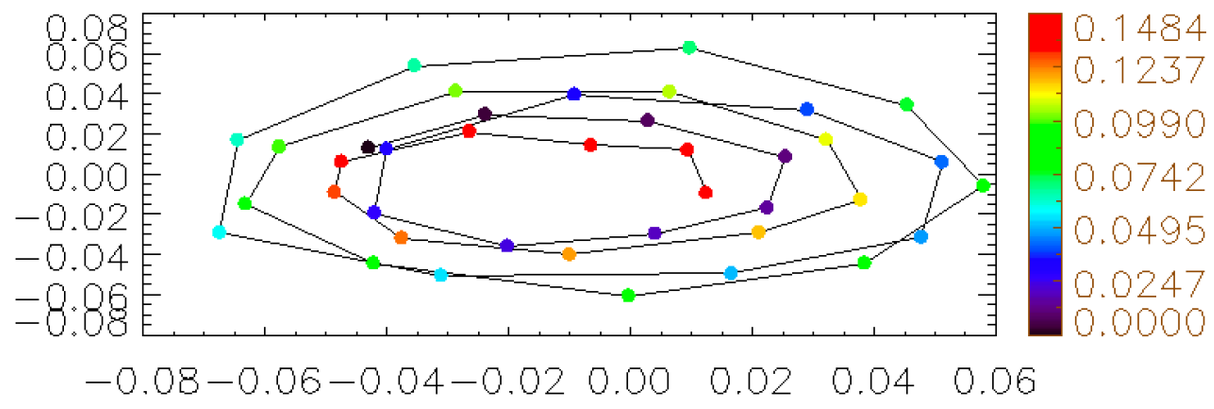
Feb27 May 1 June 1

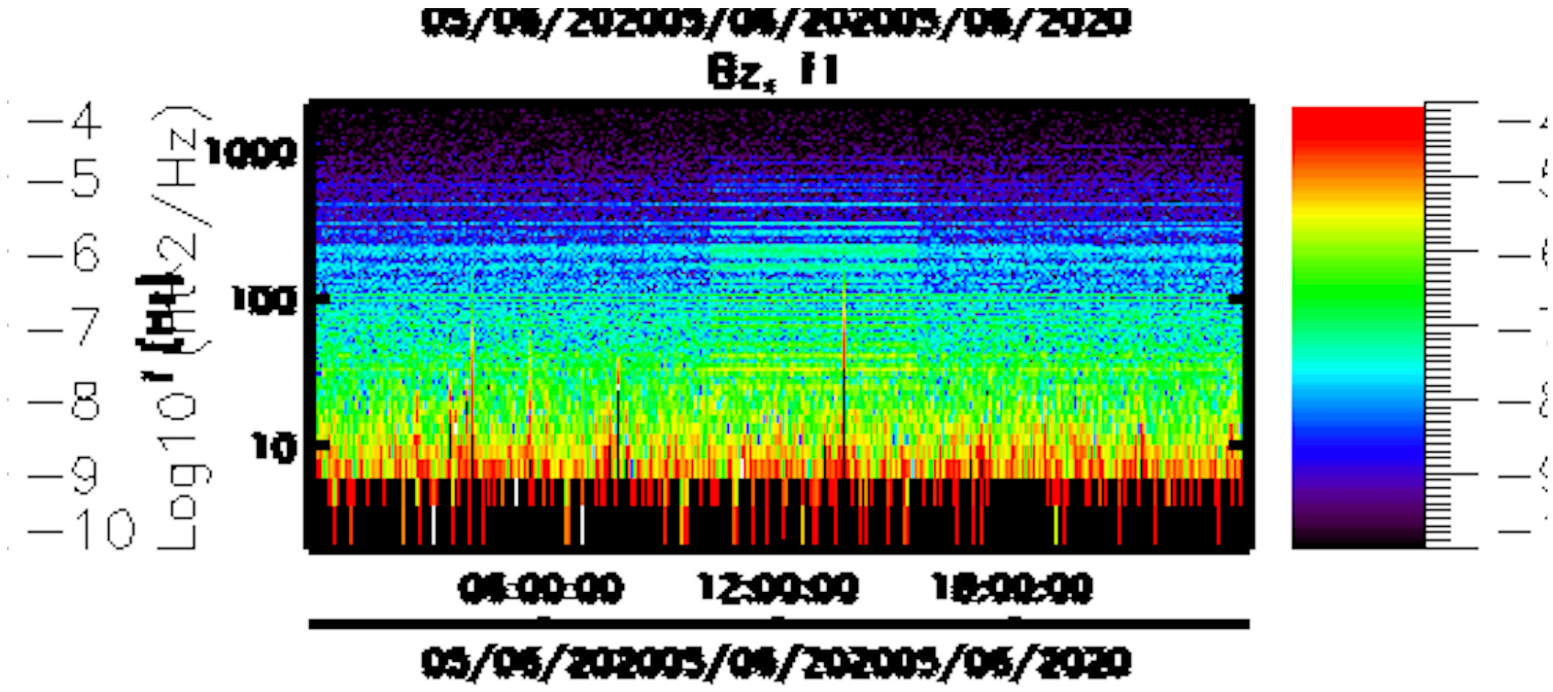
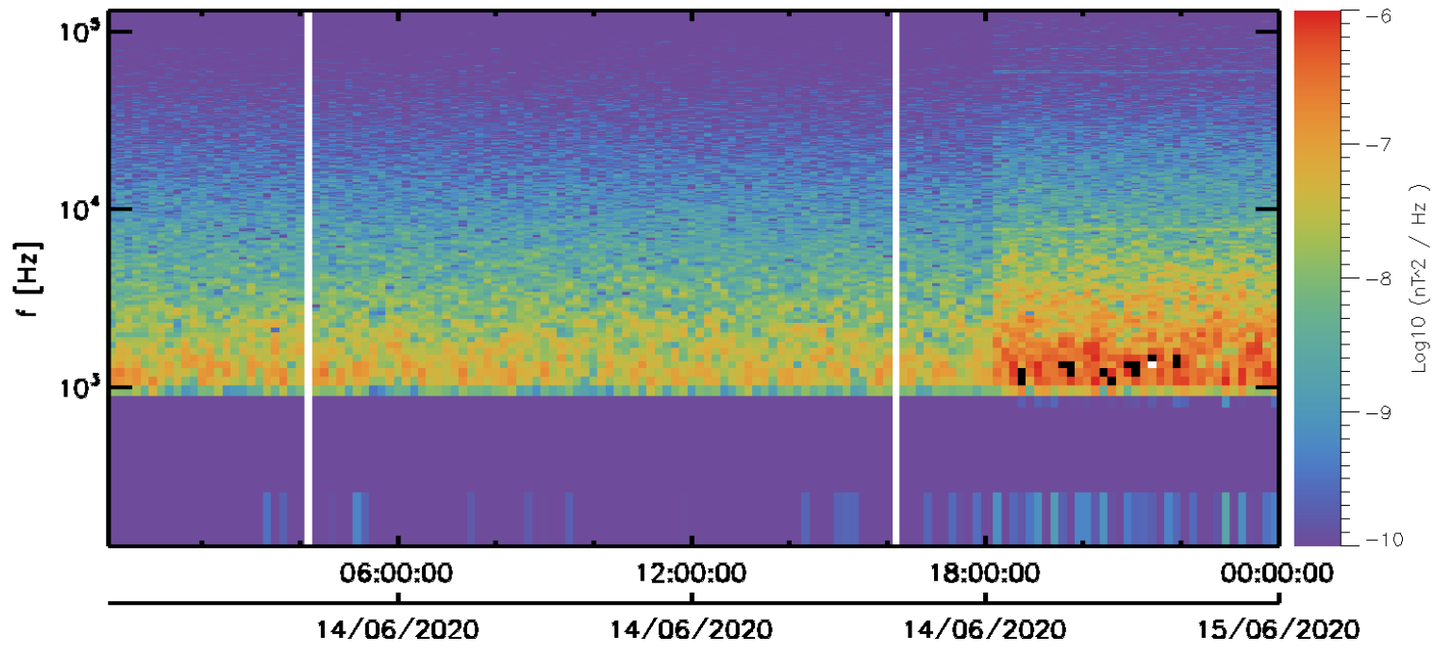



RPW
LPC2E
0.2
0.1
0.0
−0.1
−0.2
07:57:21
07:58:04
07:58:48
07:59:31
08:00:14
08:00:57
08:01:40
(k,radial)~130°


0.15
0.10
0.05
0.00
−0.05
−0.10
−0.15
1.0
1.5
2.0
2.5
3.0


0.10
0.05
0.00
−0.05
−0.10
0.00
0.05
0.10
0.15


0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
−0.08
−0.08 −0.06 −0.04 −0.02 0.00 0.02 0.04 0.06
0.1484
0.1237
0.0990
0.0742
0.0495
0.0247
0.0000

To be done

- SCM / MAG timing
- SCM onboard cal
- EMC:
  - Clean 8Hz and co
  - SCM heater signature
  - new stuff:
- TDS/LFM