

R O S E T T A
FLIGHT REPORTS
of RPC-MAG

RO-IGEP-TR-0006

Issue: 7 Revision: 0

2019-02-07

Report of the
COMMISSIONING PART 1
Time period: March 17. - 19., 2004

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<h1 style="margin: 0;">ROSETTA</h1>	Document: RO-IGEP-TR-0006 Issue: 7 Revision: 0
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1 Summary

The first commissioning phase for RPC-MAG was executed in the time period March 17. – 19, 2004. All the performed steps were successful. MAG worked as expected. All modes were checked, both the OB and the IB sensor were checked as sensor. All voltages were stable and in the expected range. The sensor temperatures varied in a wide low range ($-100^{\circ}\text{C} - -85^{\circ}\text{C}$), because the sensors were obviously in the shadow. During the MAG boom deployment MAG was set to BURST mode. The boom rotation could be identified in the data. After the boom deployment the offset remained higher as expected. Most likely a source on the s/c (compensation magnet ?, Lander ?) is responsible for this behavior. It is obvious that the source of this high residual field is located the s/c, because there is no smooth transition in the magnetic field values during the last phase of the boom rotation. The changes in the magnetic field end abruptly and do not follow a smooth curve. Therefore, the influence of the s/c can be seen (especially with the IB sensor) even in the deployed boom position. A detailed investigation will be performed in the next weeks to create a model that can eliminate the disturbing residual field at the locations of the sensors.

In summary MAG is operating well and we are looking forward for the first scientific relevant measurements.

The next sections give a brief description of the executed activities and show the obtained data. Housekeeping data (Temperature of the OB & IB sensor, Filter Stages A & B, Filter configuration register, Reference voltage, negative and positive 5V supply voltage, and the coarse HK sampled magnetic field data of the OB sensor) are presented as well as magnetic field science data of the OB and IB sensor in the activated modes. Magnetic field data are plotted in instrument coordinates if not otherwise stated. They are calibrated according to the results of the ground calibration. Sensitivity, Misalignment, and Temperature effects are taken into account. The s/c residual field is not subtracted.

Amendment:

The results of the CVP2 and CVP3 campaigns in May and October revealed, that the ground calibration model for the temperature dependencies of the sensors has to be changed or better extended. As the ground calibration was only done in the range $-60^{\circ}\text{C} \dots +70^{\circ}\text{C}$ and the measured temperatures in space are going down to -120°C it is obvious that an extended model has to be applied. Such a model was created using the flight data from March until September 2004. A chapter with plots of the data, which are calibrated using the new model, is added at the end of this document.

The dynamic spectra show some clear lines which are varying with the time. A de-

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tailed investigation showed, that these lines have their origin in the reaction wheels of the ROSETTA S/C. As they are rotating with different speeds they generate different disturbance frequencies. The signatures of the reaction wheels are folded down in the measurement range of the magnetometers. A detailed investigation of this phenomenon is given in RO-IGEP-TR0012.

From time to time there are also horizontal lines in the dynamic spectrum to be seen. These lines represent constant frequencies and are caused by the LAP instrument. This behavior was investigated and proofed during the PC10 campaign in November 2010. See RO-IGEP-TR0030 for further details.

During the comet phase lots of data could be measured under a large variety of environmental conditions, leading to an enhanced sensor calibration model number 009. All calibrated data shown in this report have been reprocessed using that new model, to be consistent with all the other documentation and data.

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2 March 17, 2004:

2.1 Actions

MAG was switched on immediately after PIU. At the beginning of the RPC commissioning the MAG TM/TC check was carried out according to FCP_509 (start at 23:12). All commands passed smoothly and the instrument followed in the expected way. All modes were tested.

Time	Stage A, Stage B, Filter cfg	Stage 1, Stage 2, Stage3	Mode
22:57 – 23:16	1 2 0	1 2 0	SID2
– 23:18	4 3 0	4 3 0	SID5
– 23:20	2 0 0	2 0 0	SID4
– 23:22	3 0 0	3 0 0	SID6
– 23:25	0 0 0	0 0 0	SID3
– 23:27	1 2 0	1 2 0	SID2
– 24:00	4 3 1	4 3 3	SID1

IB and OB were switched to be primary sensors. The result can be seen in the following plots.

2.2 Plots of Ground Calibrated Data

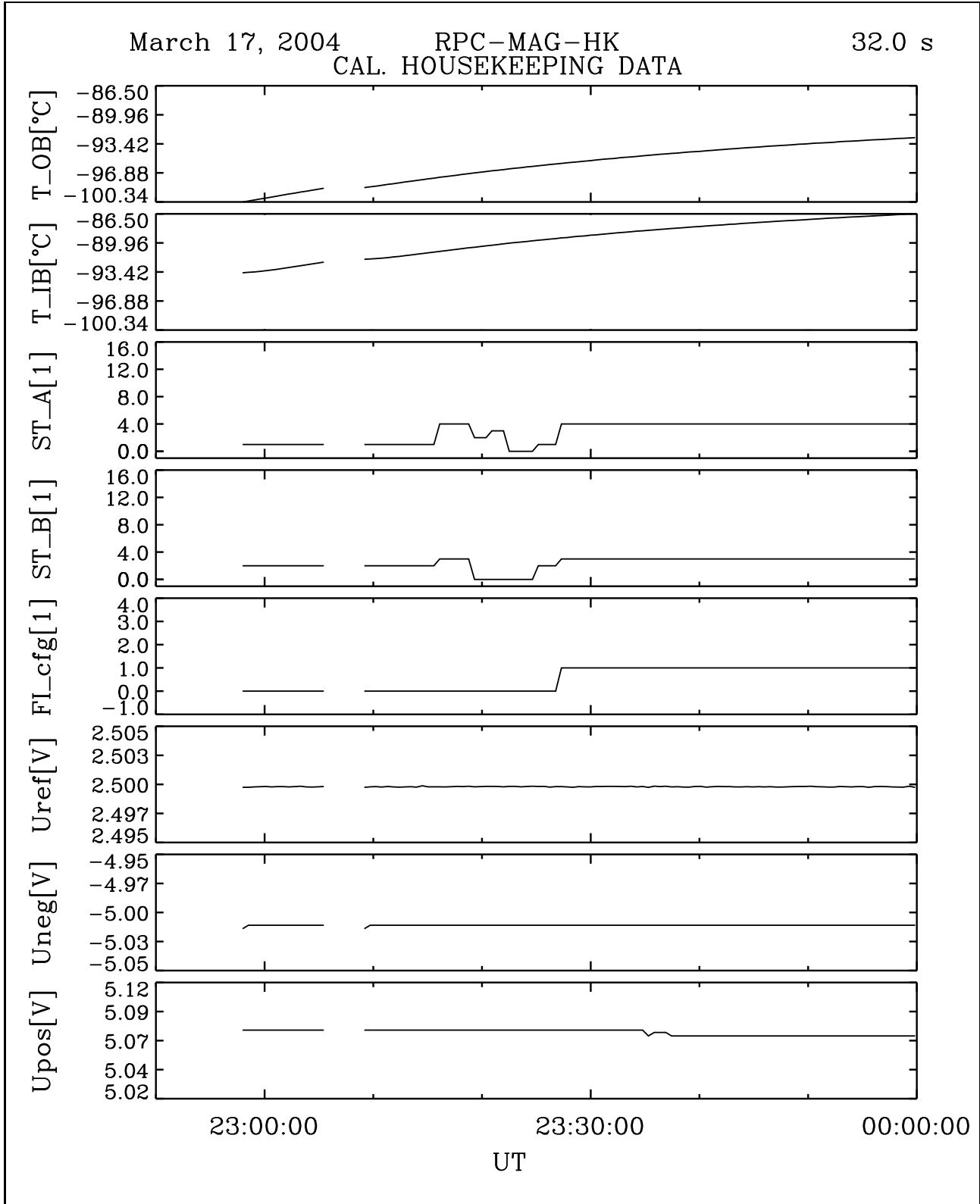


Figure 1: File: RPCMAG040317T2257_CLA_HK_P2250_2400

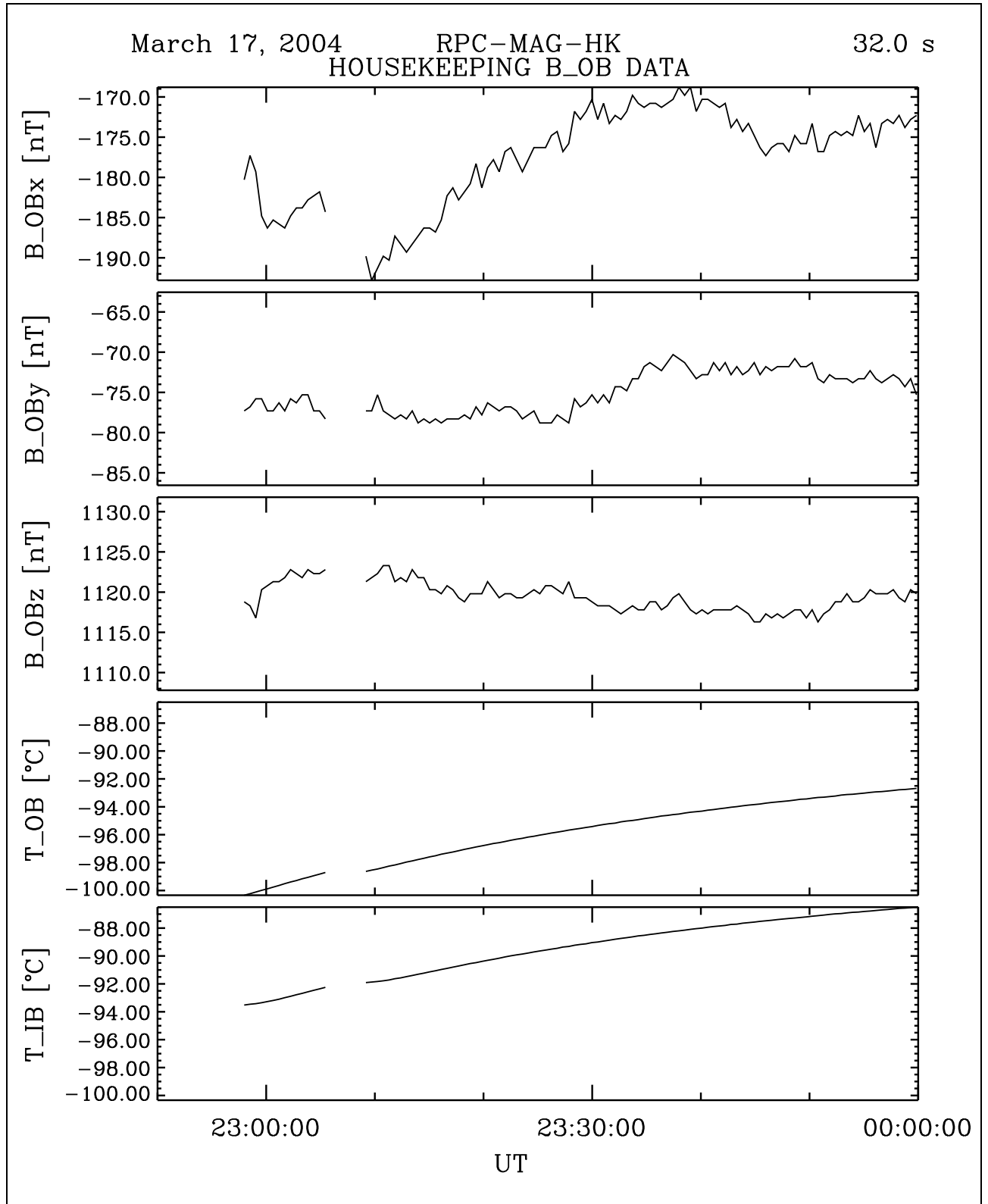


Figure 2: File: RPCMAG040317T2257_CLA_HK_B_P2250_2400

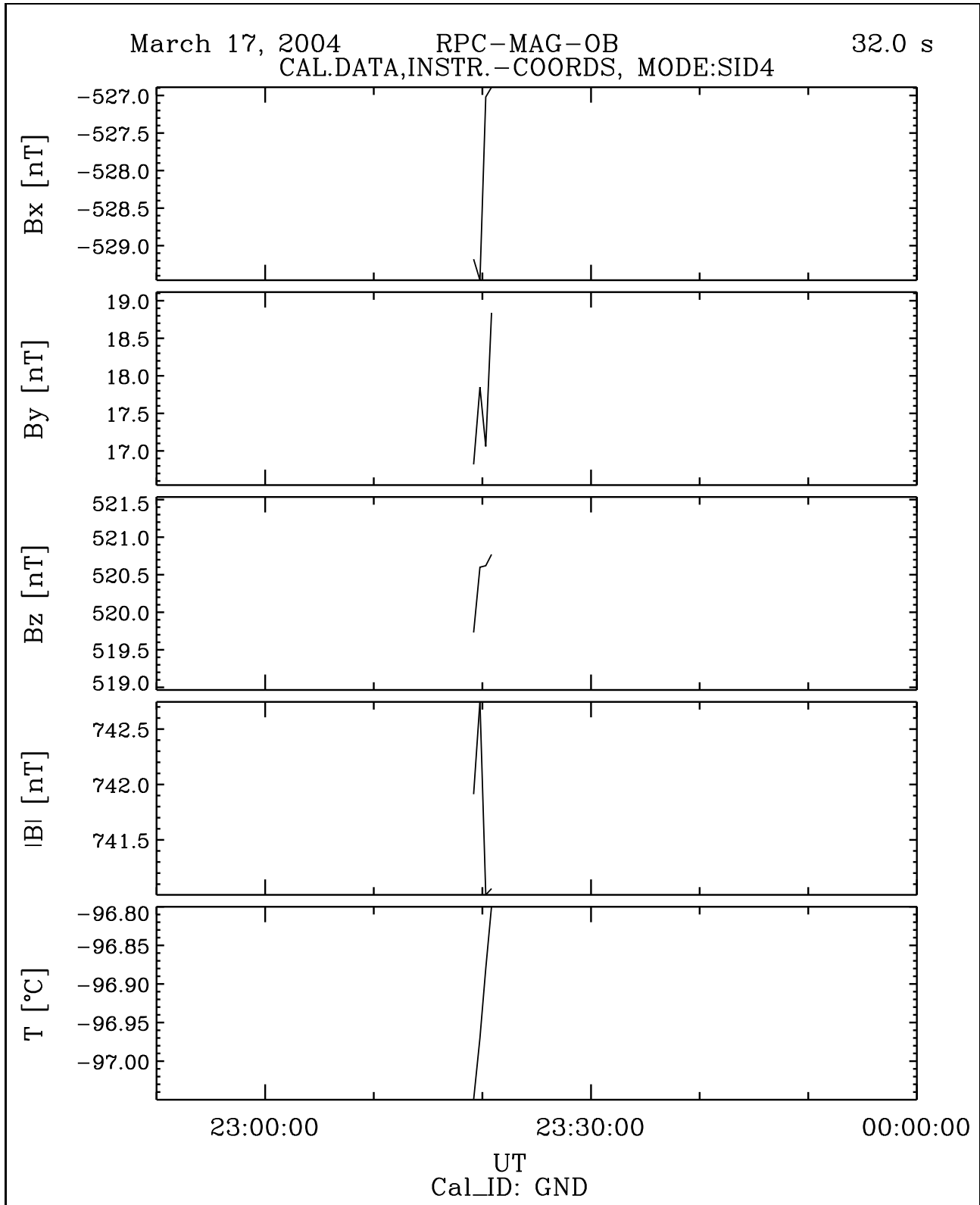


Figure 3: File: RPCMAG040317T2318_CLA_OB_M4_T2250_2400_GND

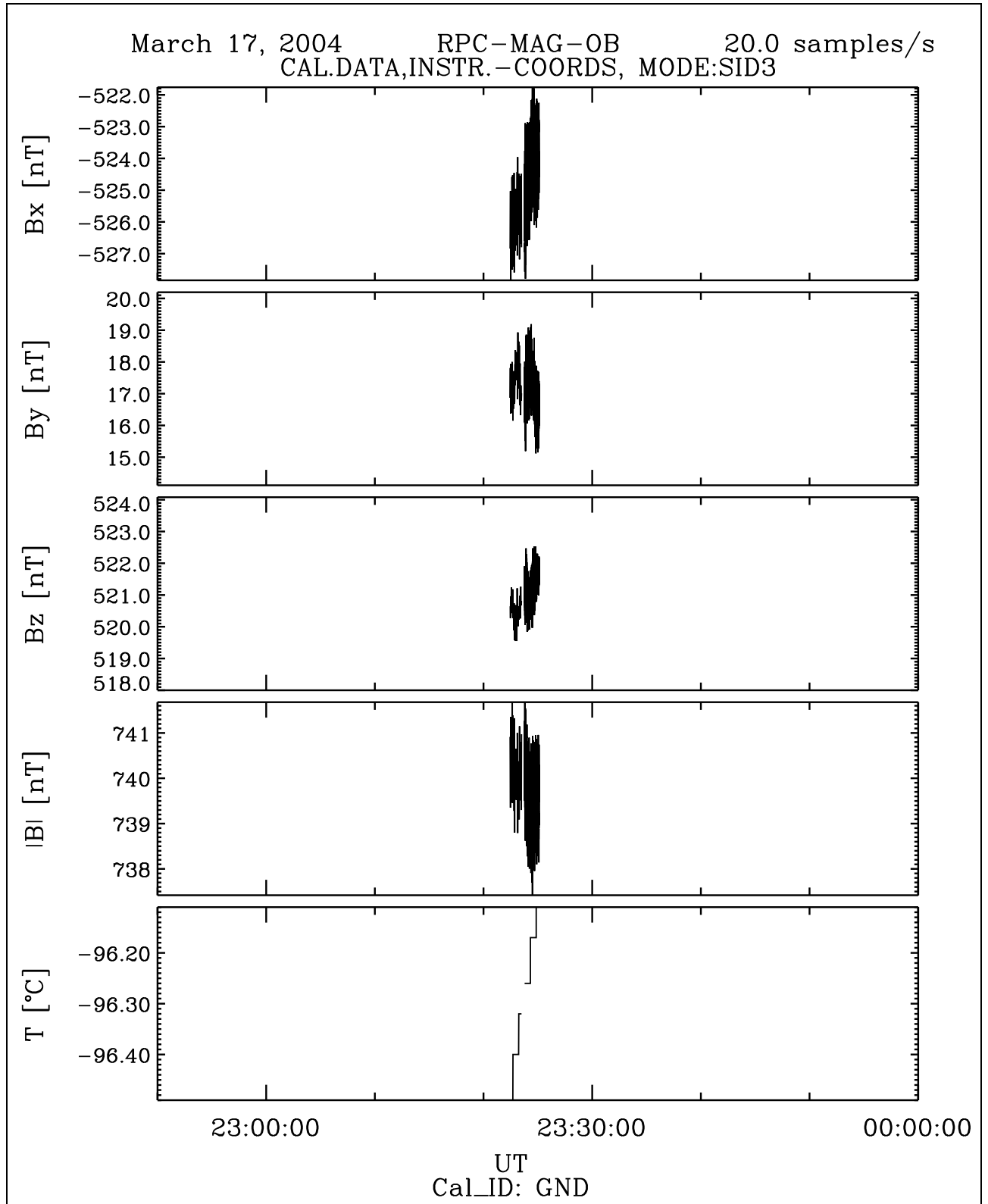


Figure 4: File: RPCMAG040317T2322-CLA_OB_M3-T2250-2400_GND

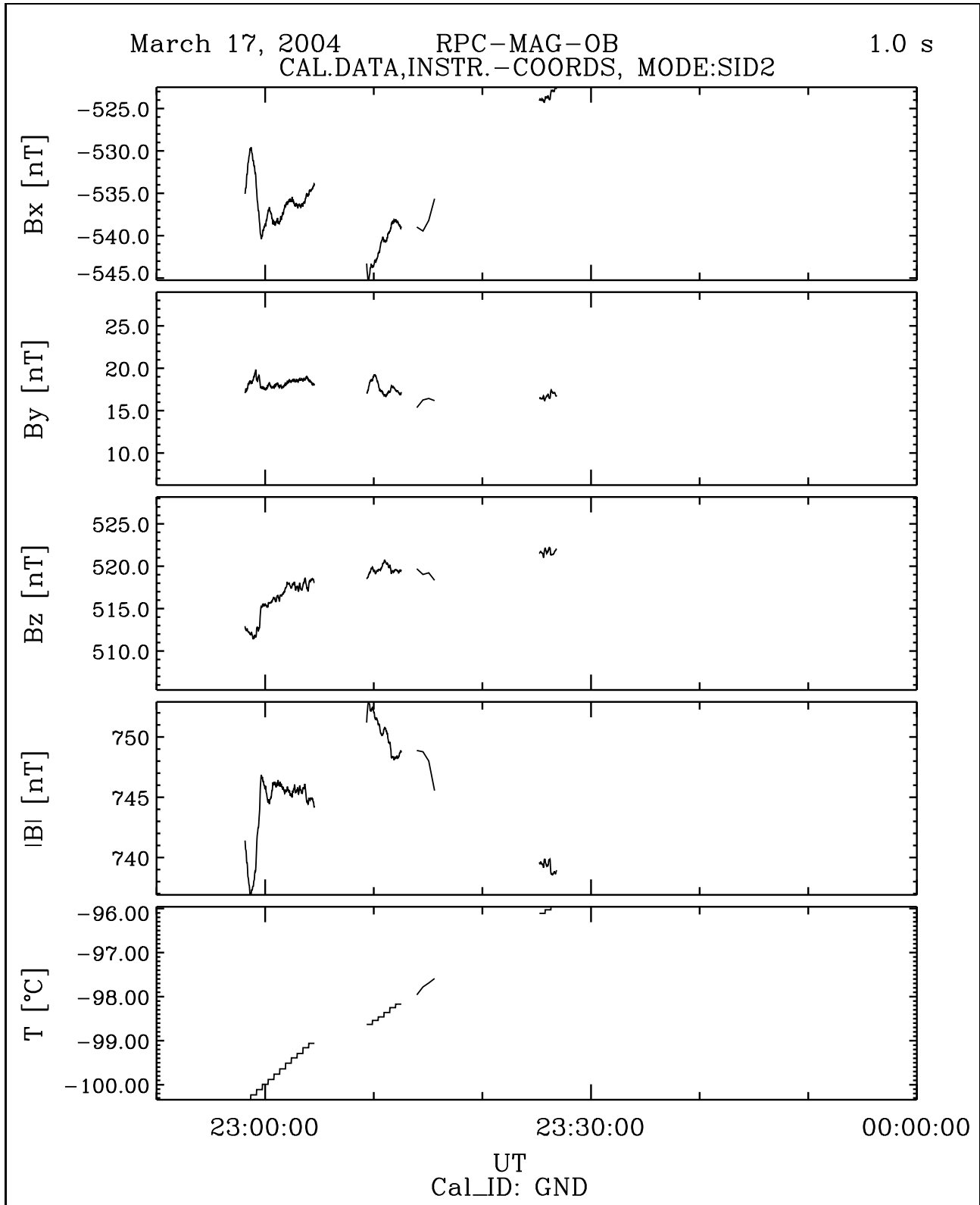


Figure 5: File: RPCMAG040317T2258_CLA_OB_M2_T2250_2400_GND

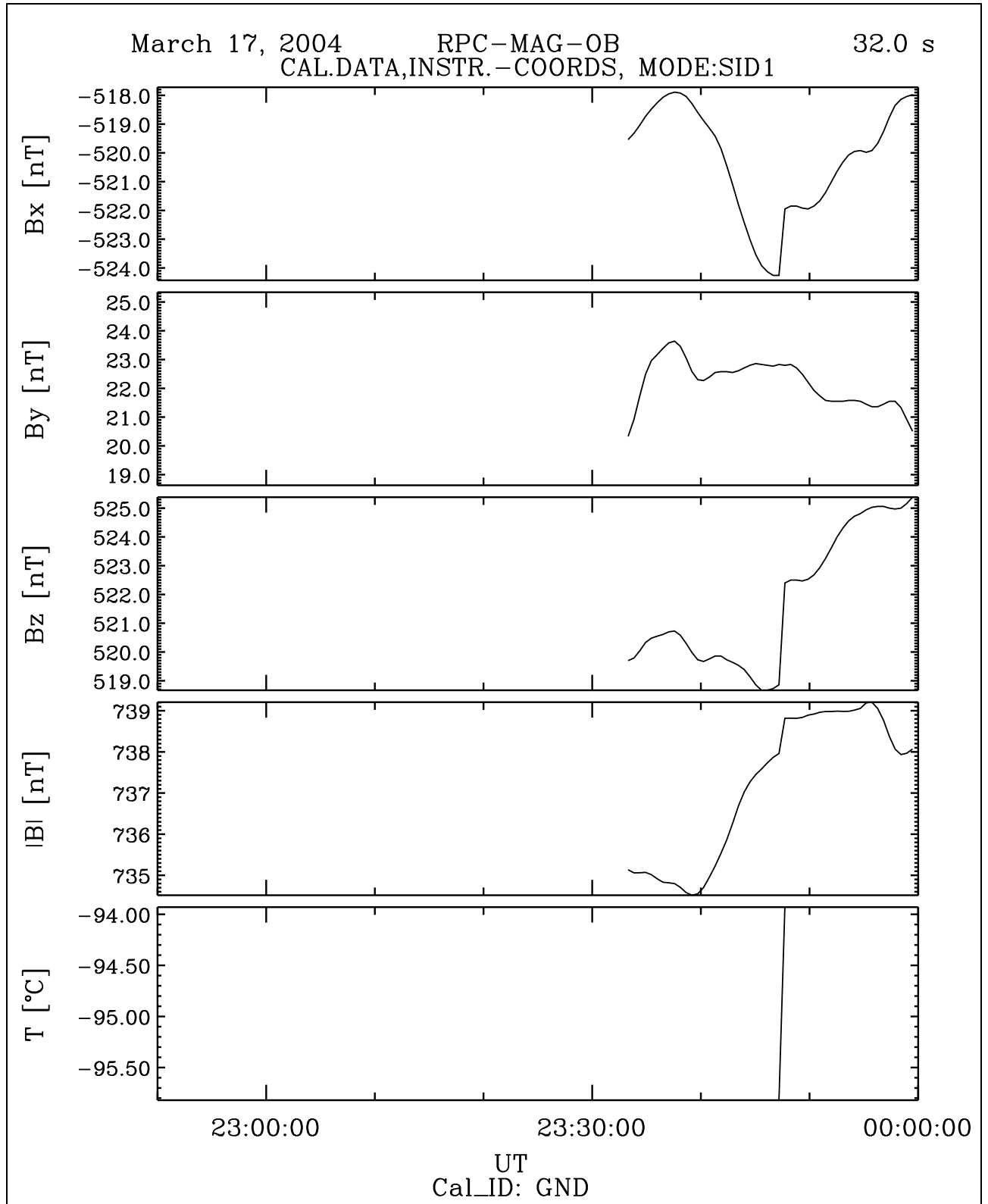


Figure 6: File: RPCMAG040317T2326_CLA_OB_M1_T2250_2400_GND

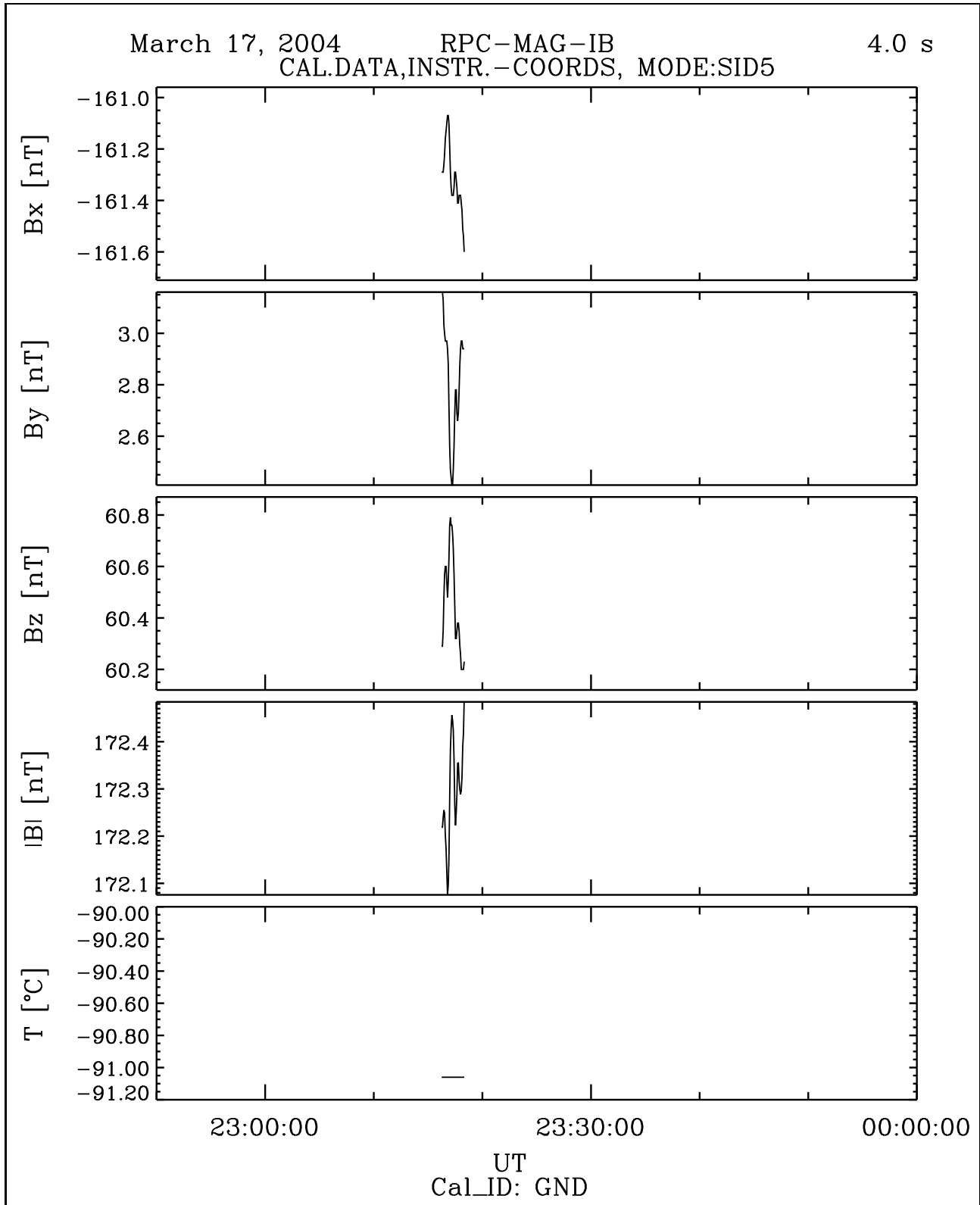


Figure 7: File: RPCMAG040317T2315_CLA_IB_M5_T2250_2400_GND

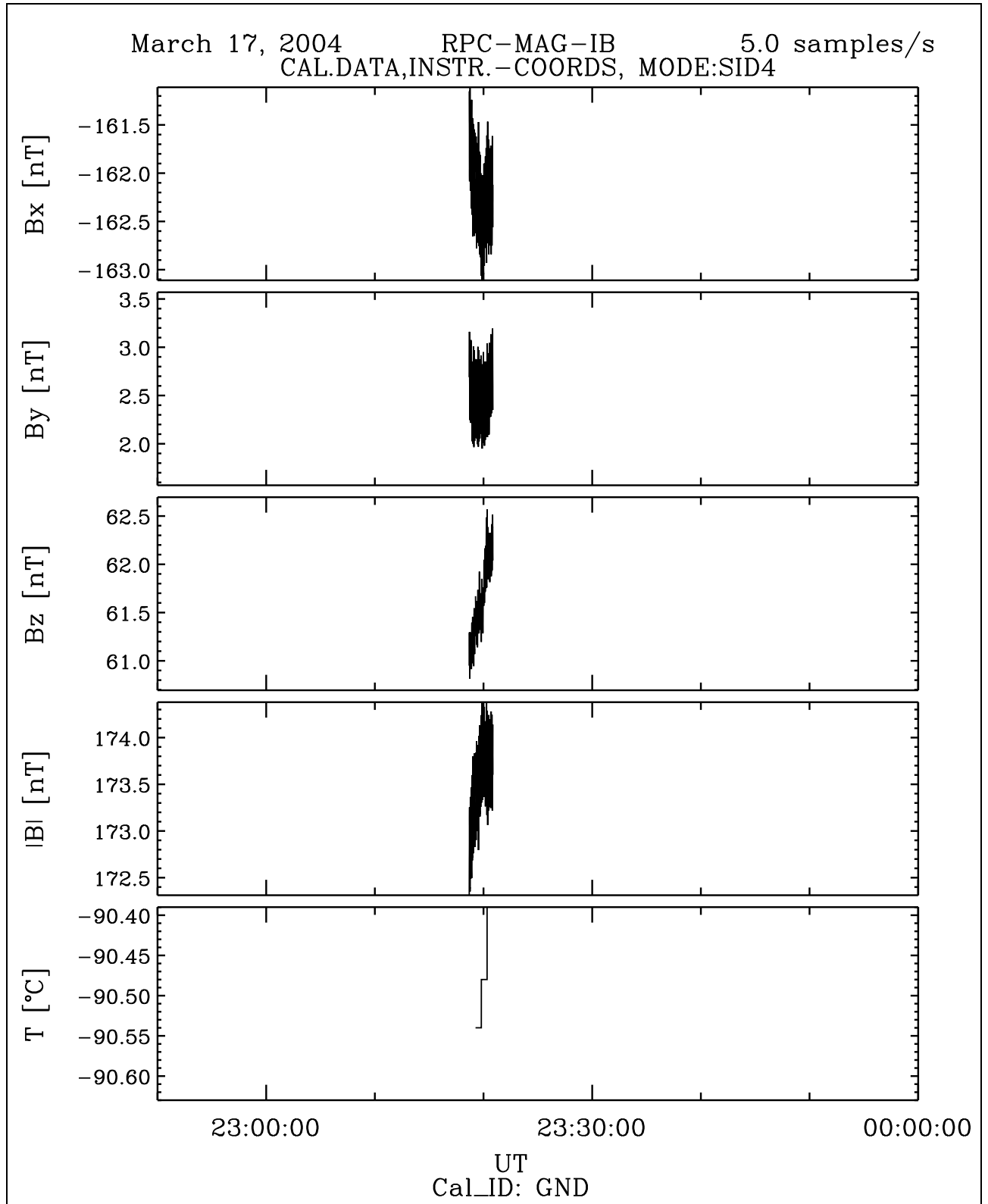


Figure 8: File: RPCMAG040317T2318_CLA_IB_M4_T2250_2400_GND

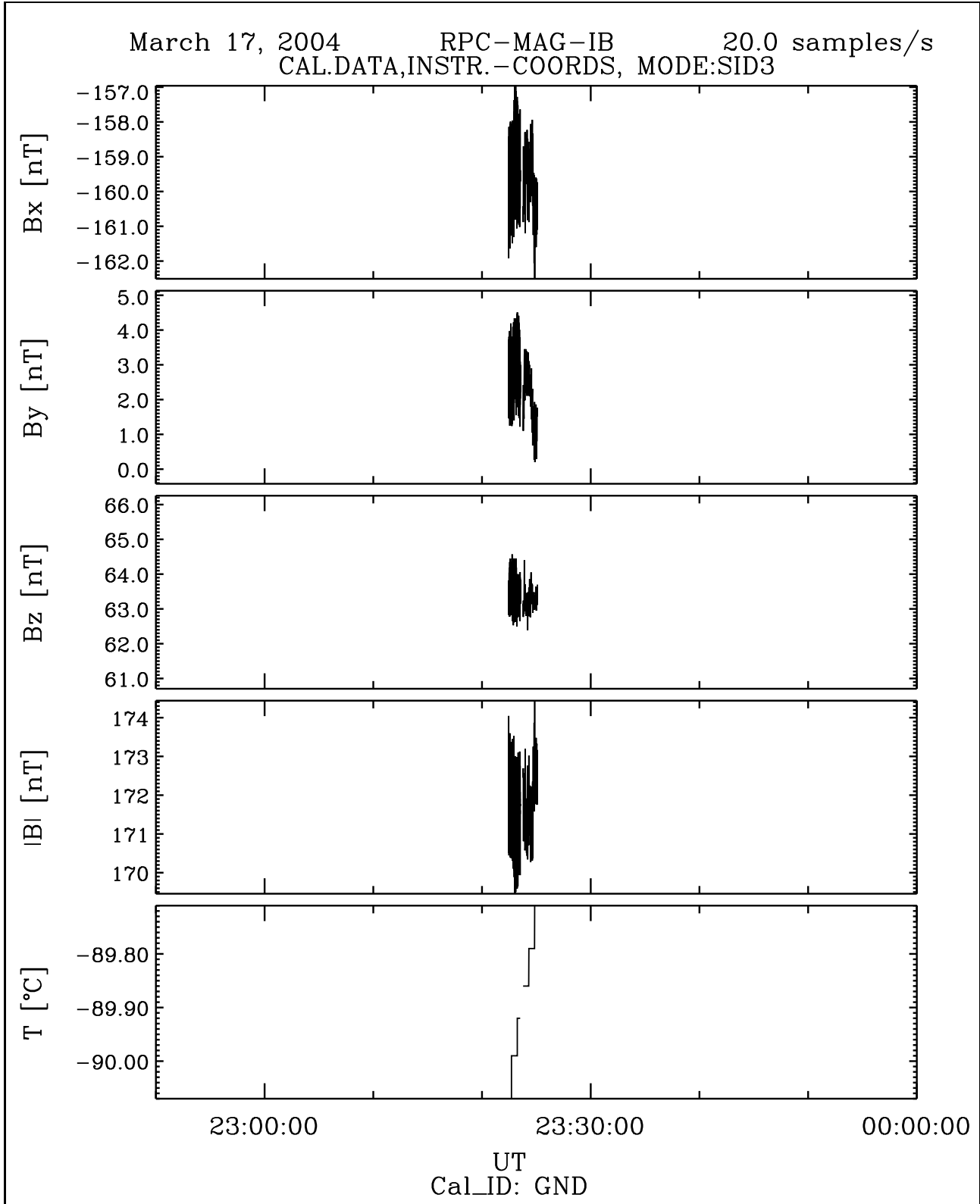


Figure 9: File: RPCMAG040317T2322_CLA_IB_M3_T2250_2400_GND

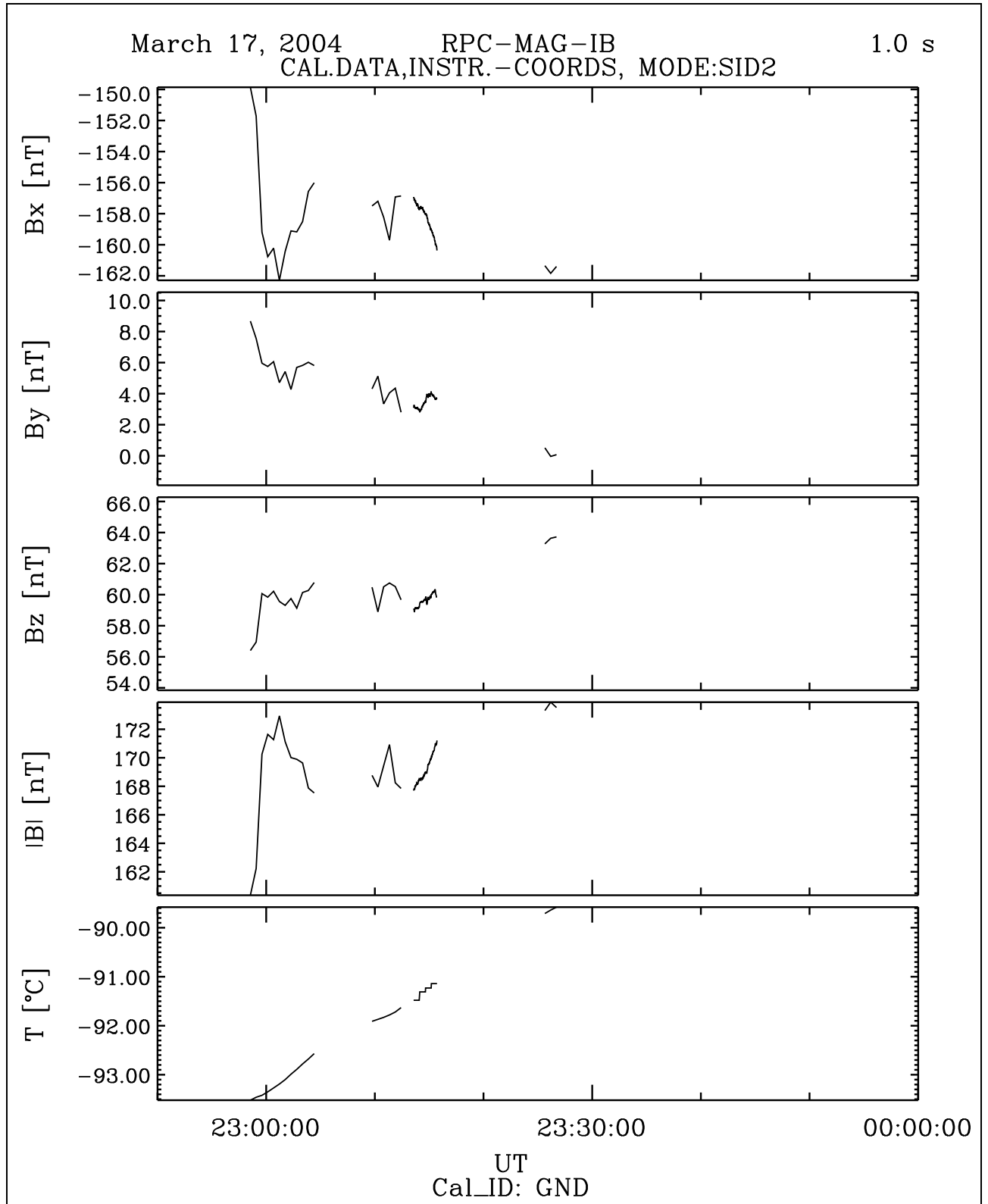


Figure 10: File: RPCMAG040317T2258_CLA_IB_M2_T2250_2400_GND

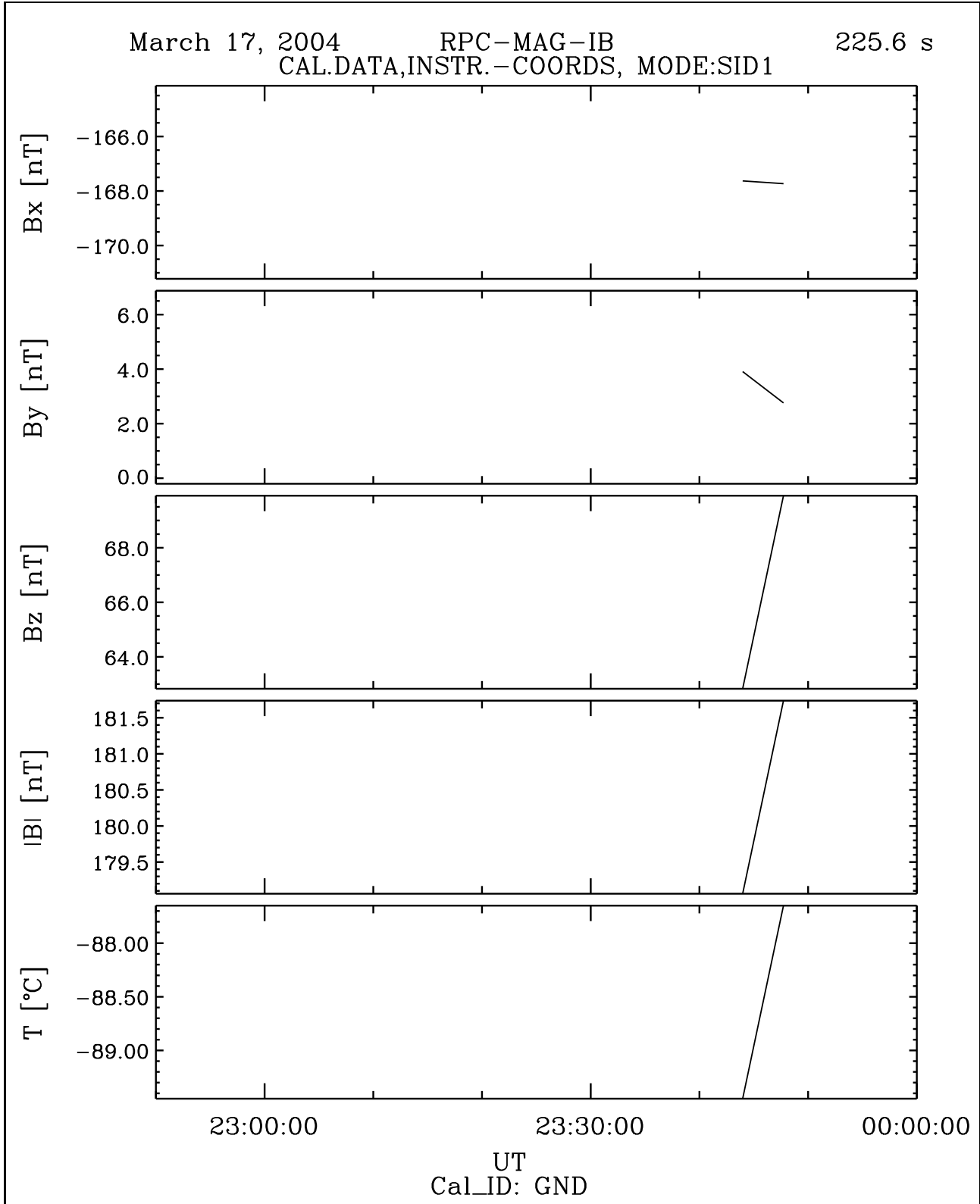


Figure 11: File: RPCMAG040317T2326_CLA_IB_M1_T2250_2400_GND

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2.3 Plots of ROSETTA's Reaction Wheels Speeds

The following plots show the time series of the revolutions of the 4 reaction wheels. Two kinds of data are shown:

- The original reaction wheel data as they are stored in the DDS.
- The theoretical response of the wheels impact seen by an instrument sampling with different frequencies. Here the response at 20 Hz and 1 Hz sampling frequency is plotted.

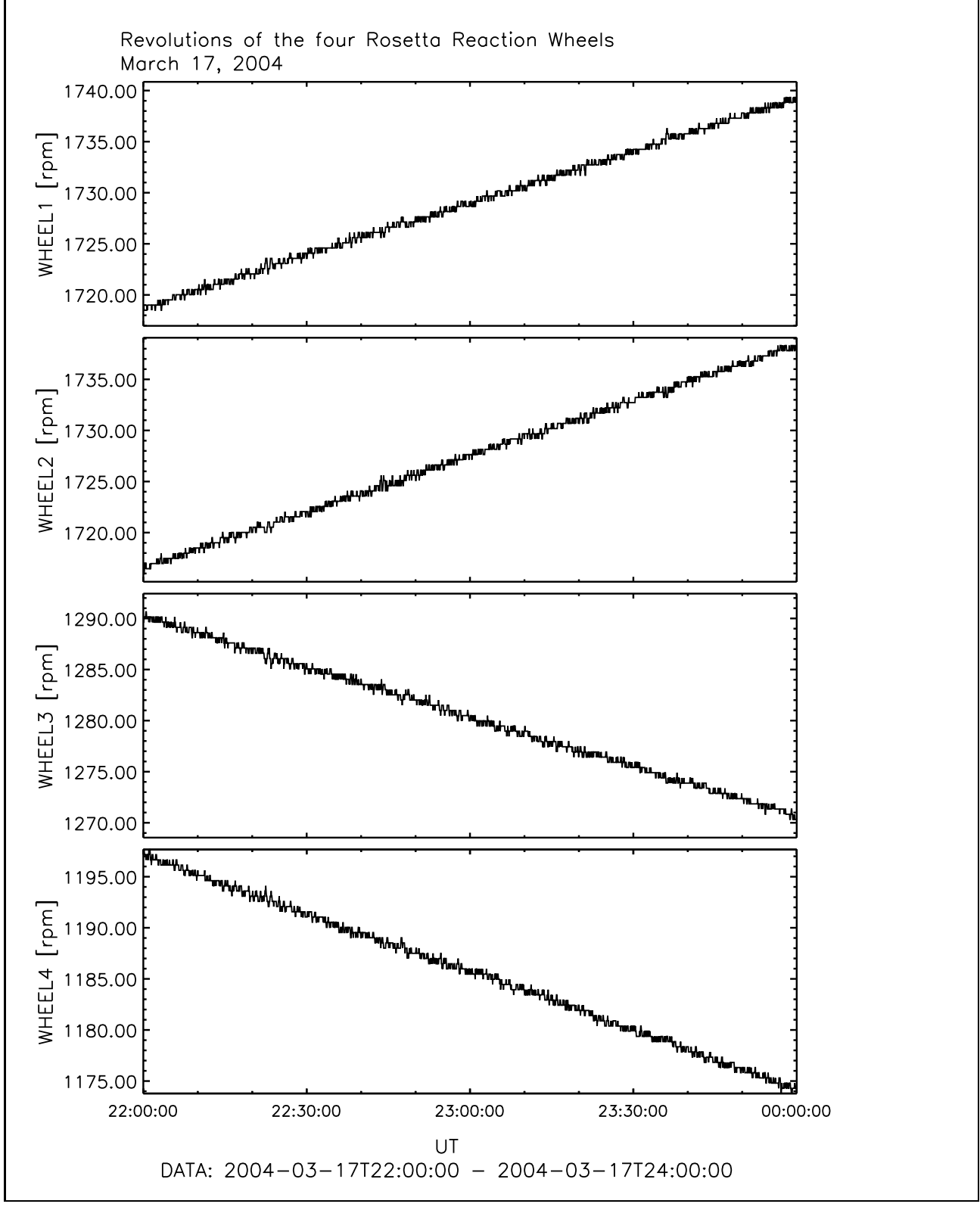


Figure 12: File: wheels_rpm2004-03-17T22-00

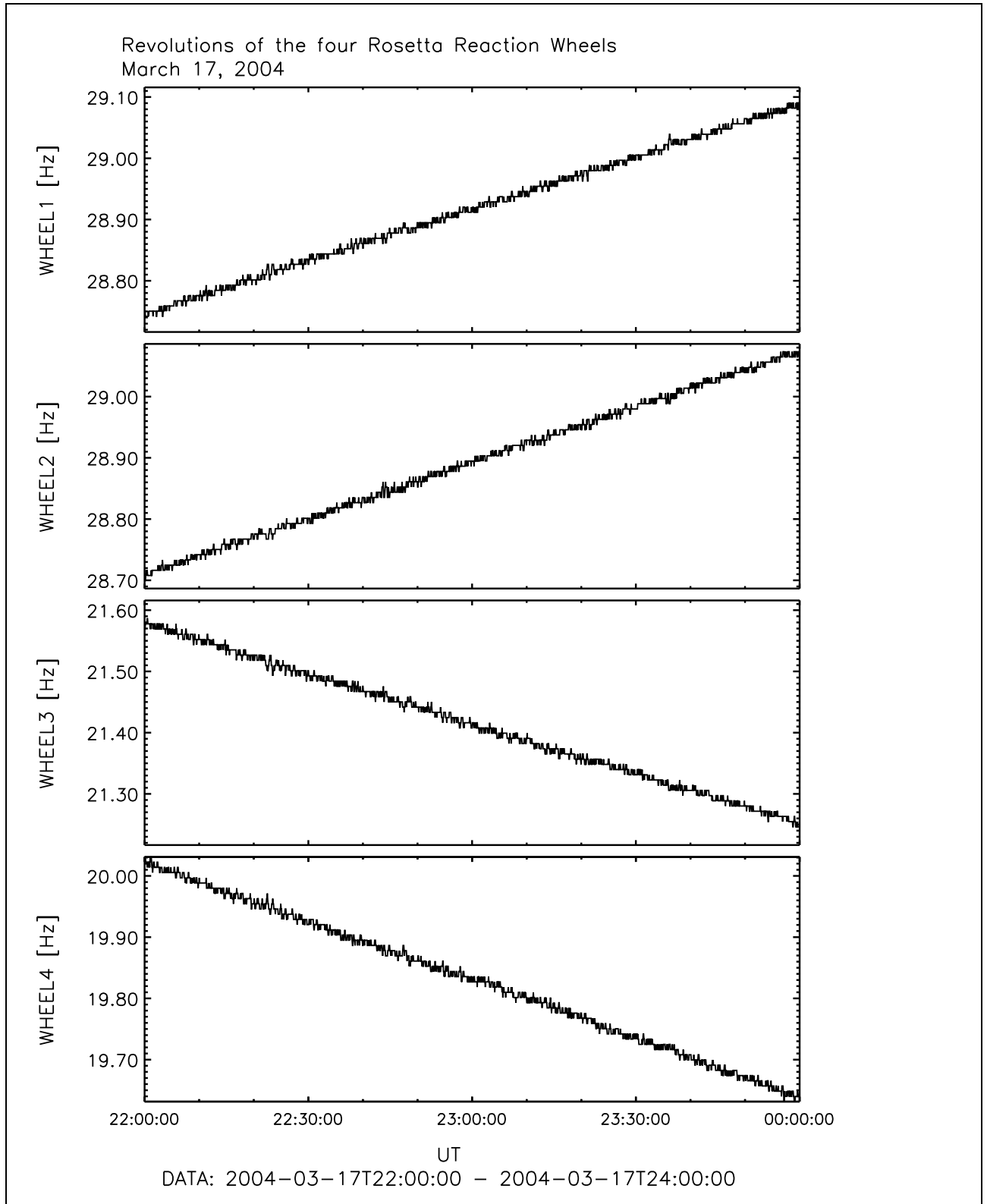


Figure 13: File: wheels_Hz2004-03-17T22-00

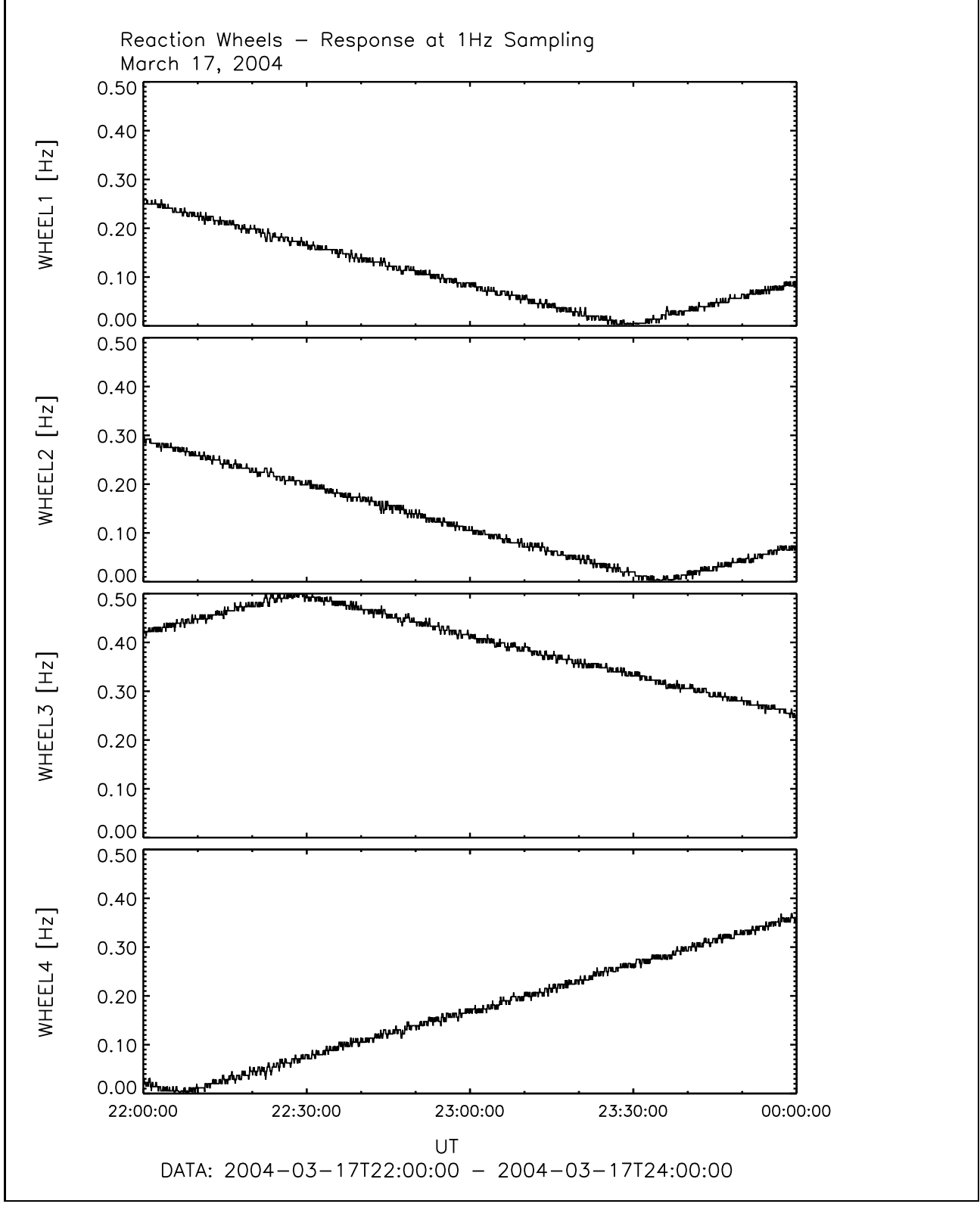


Figure 14: File: wheels_1Hz_Sampling2004-03-17T22-00

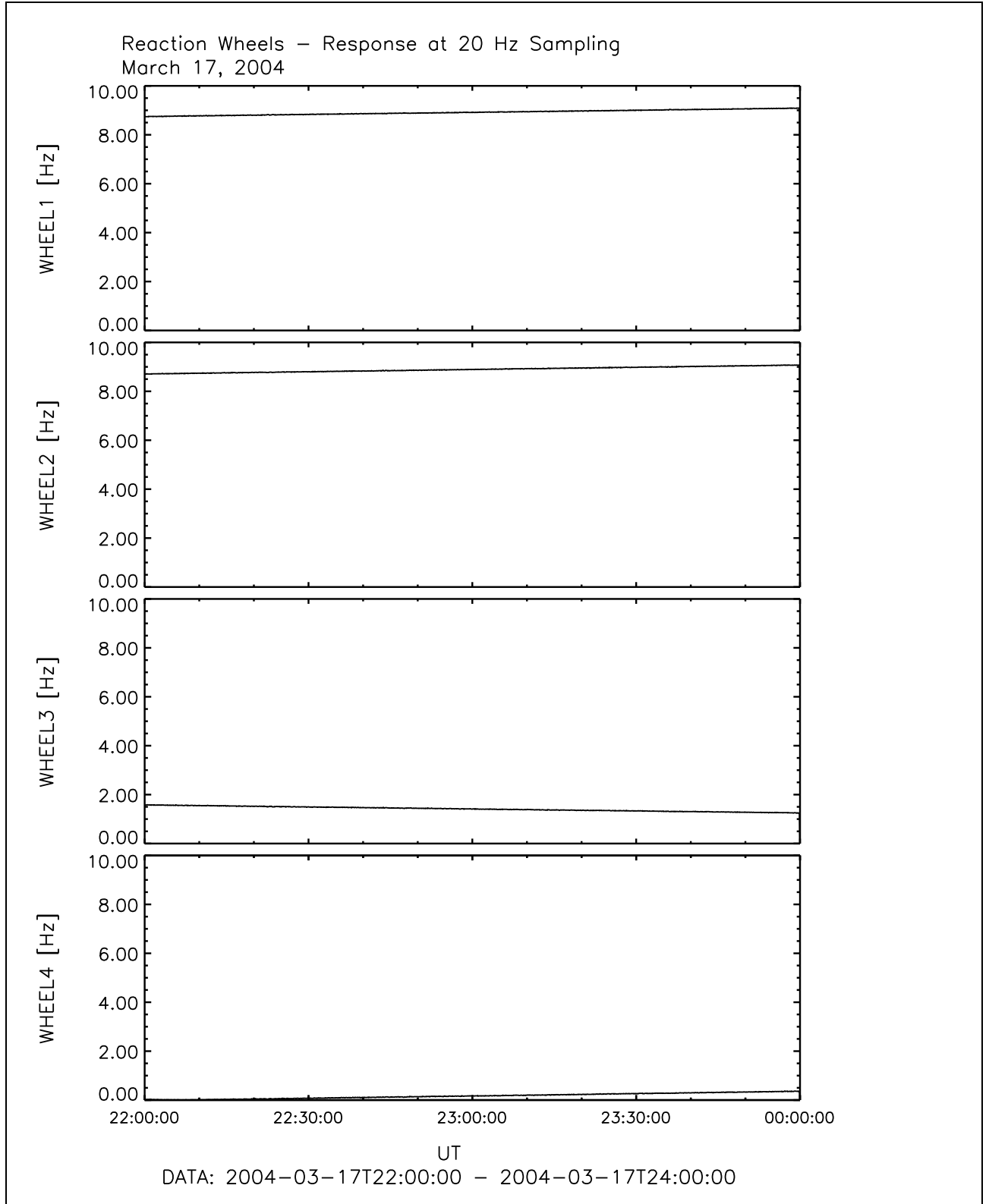


Figure 15: File: wheels_20Hz_Sampling2004-03-17T22-00

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3 March 18, 2004:

3.1 Actions

The tests carried on. MAG was set to BURST mode during the commissioning of the other RPC instruments. At 04:32 the redundant PIU was activated. MAG sent data until 04:42 when the PIU failure occurred. MAG worked properly all the time.

Time	Stage A, Stage B, Filter cfg	Stage 1, Stage 2, Stage3	Mode
00:00 – 02:11	4 3 1	4 3 3	SID1
– 04:00	0 0 0	0 0 0	SID3
– 04:37	1 2 0	1 2 0	SID2
– 04:42	0 0 0	0 0 0	SID3

3.2 Plots of Ground Calibrated Data

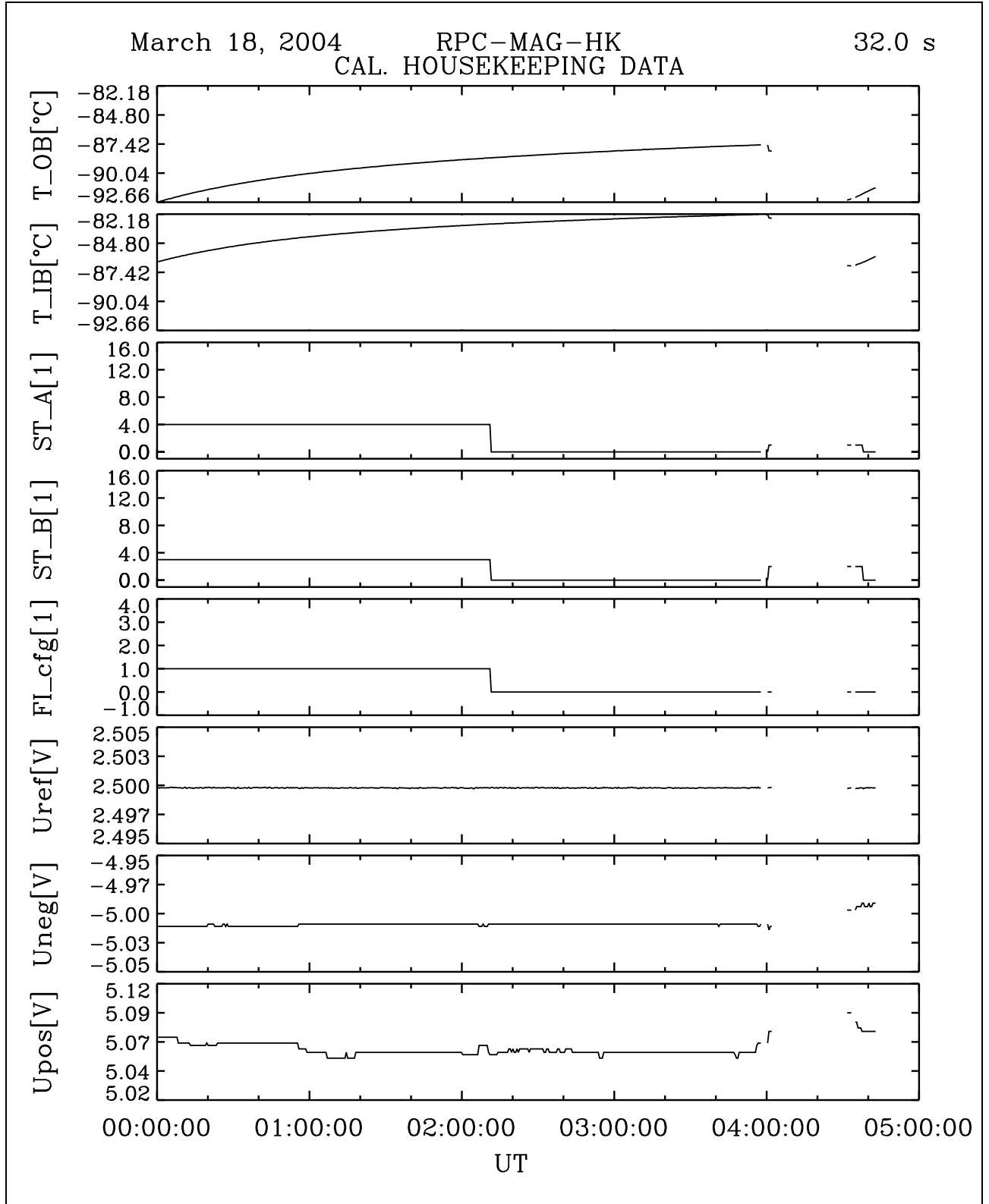


Figure 16: File: RPCMAG040318T0000_CLA_HK_P0000_0500

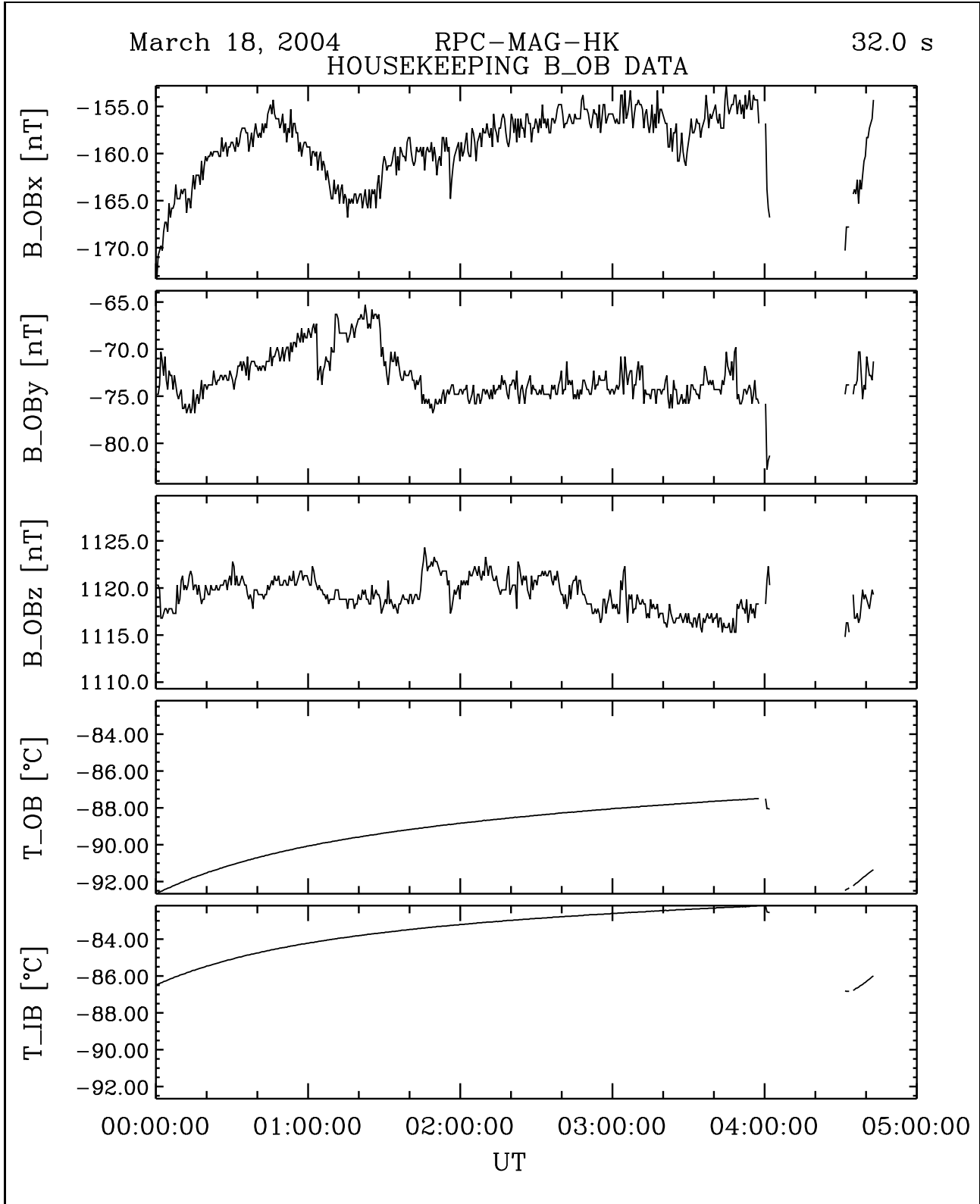


Figure 17: File: RPCMAG040318T0000_CLA_HK_B_P0000_0500

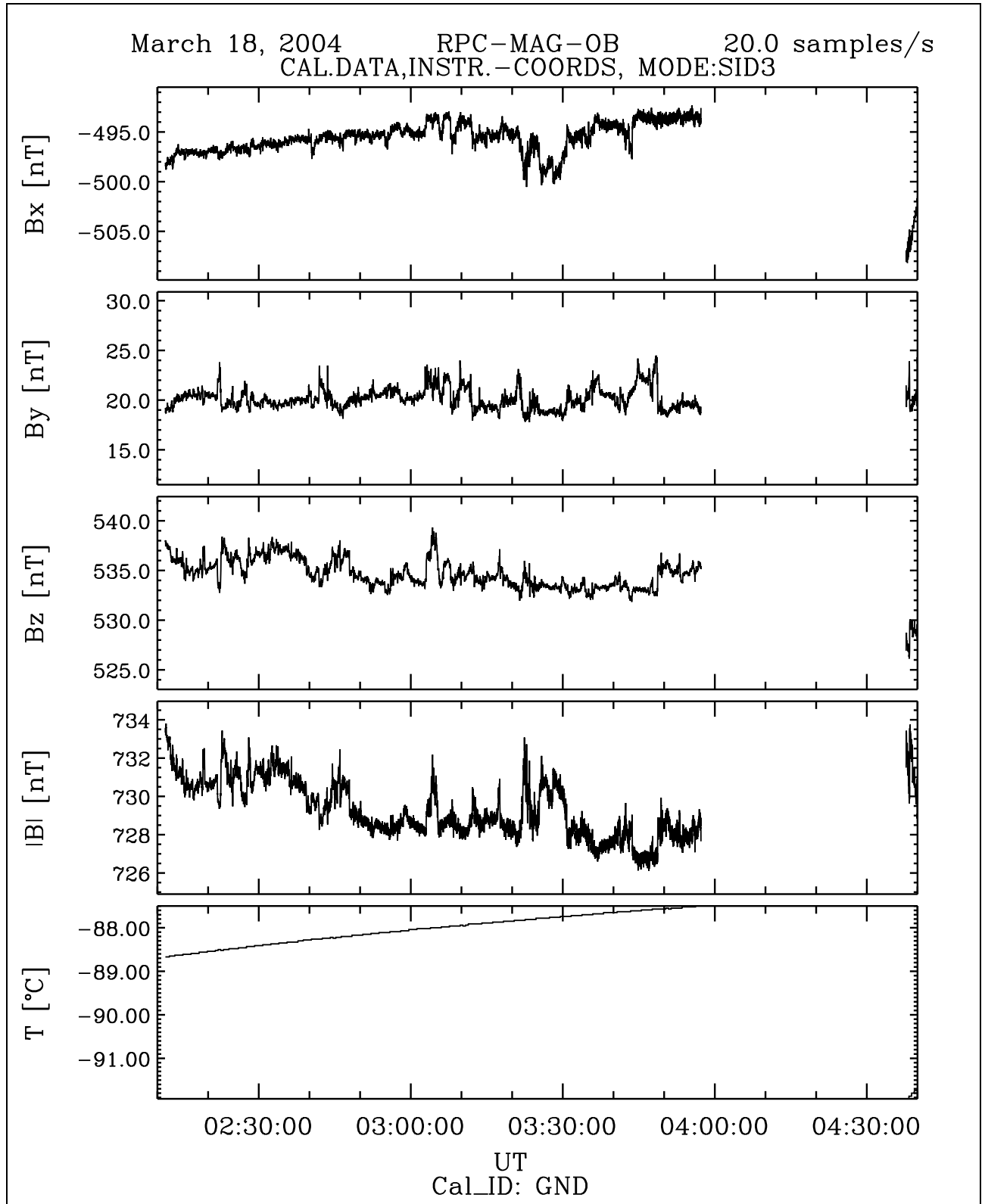


Figure 18: File: RPCMAG040318T0202_CLA_OB_M3_T0210_0440_GND

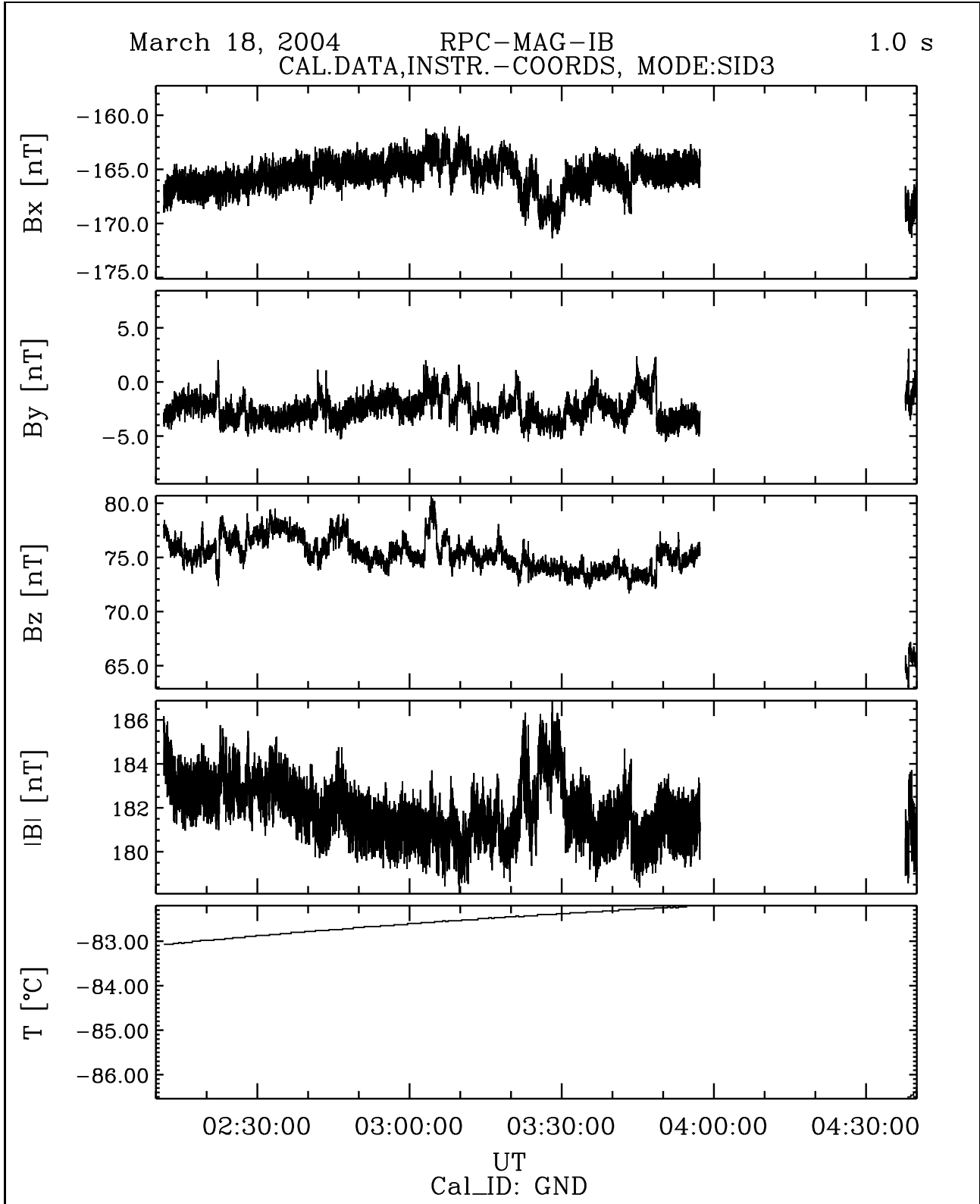


Figure 19: File: RPCMAG040318T0202_CLA_IB_M3_T0210_0440_GND

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3.3 Plots of ROSETTA's Reaction Wheels Speeds

The following plots show the time series of the revolutions of the 4 reaction wheels. Two kinds of data are shown:

- The original reaction wheel data as they are stored in the DDS.
- The theoretical response of the wheels impact seen by an instrument sampling with different frequencies. Here the response at 20 Hz and 1 Hz sampling frequency is plotted.

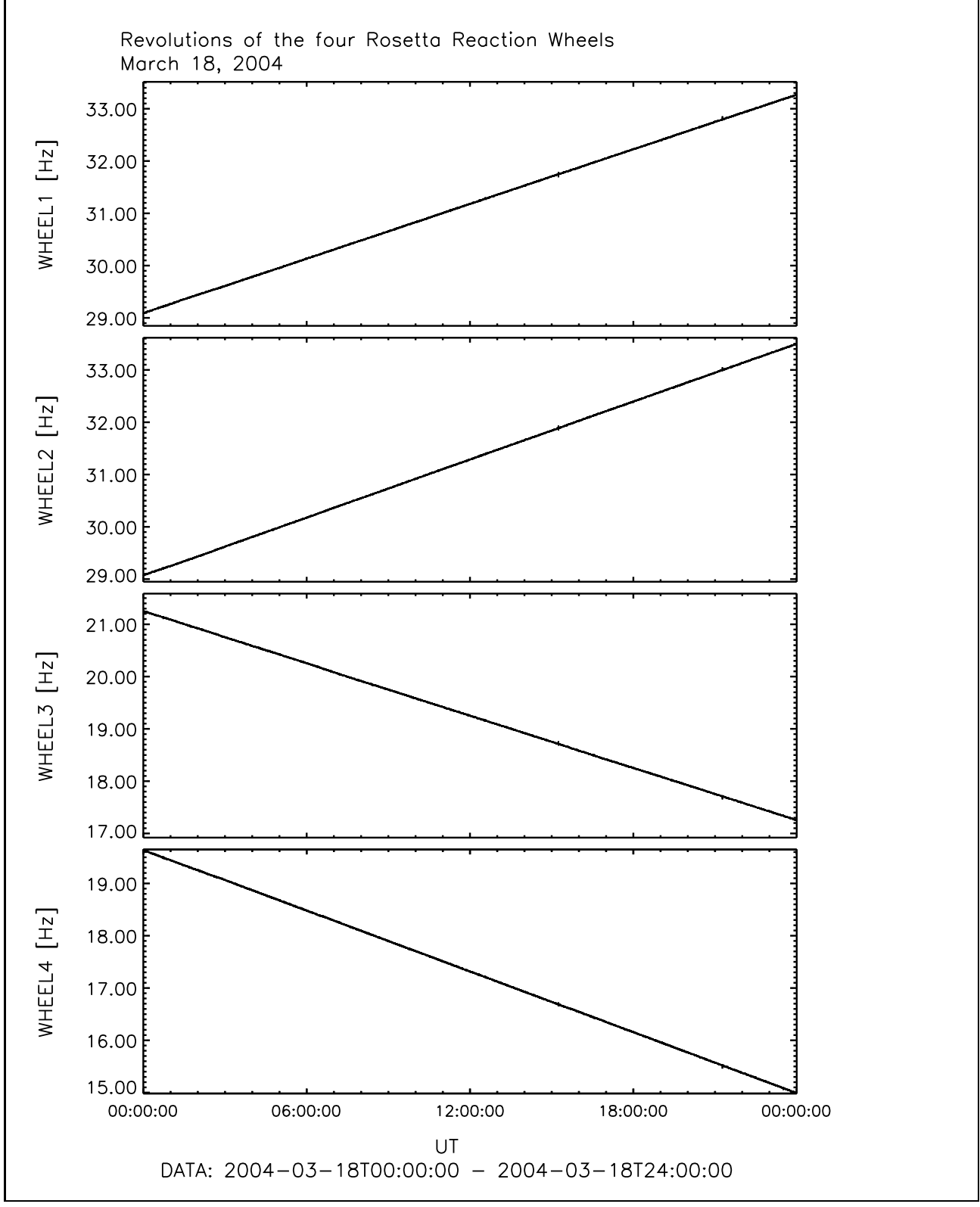


Figure 20: File: wheels_Hz2004-03-18T00-00

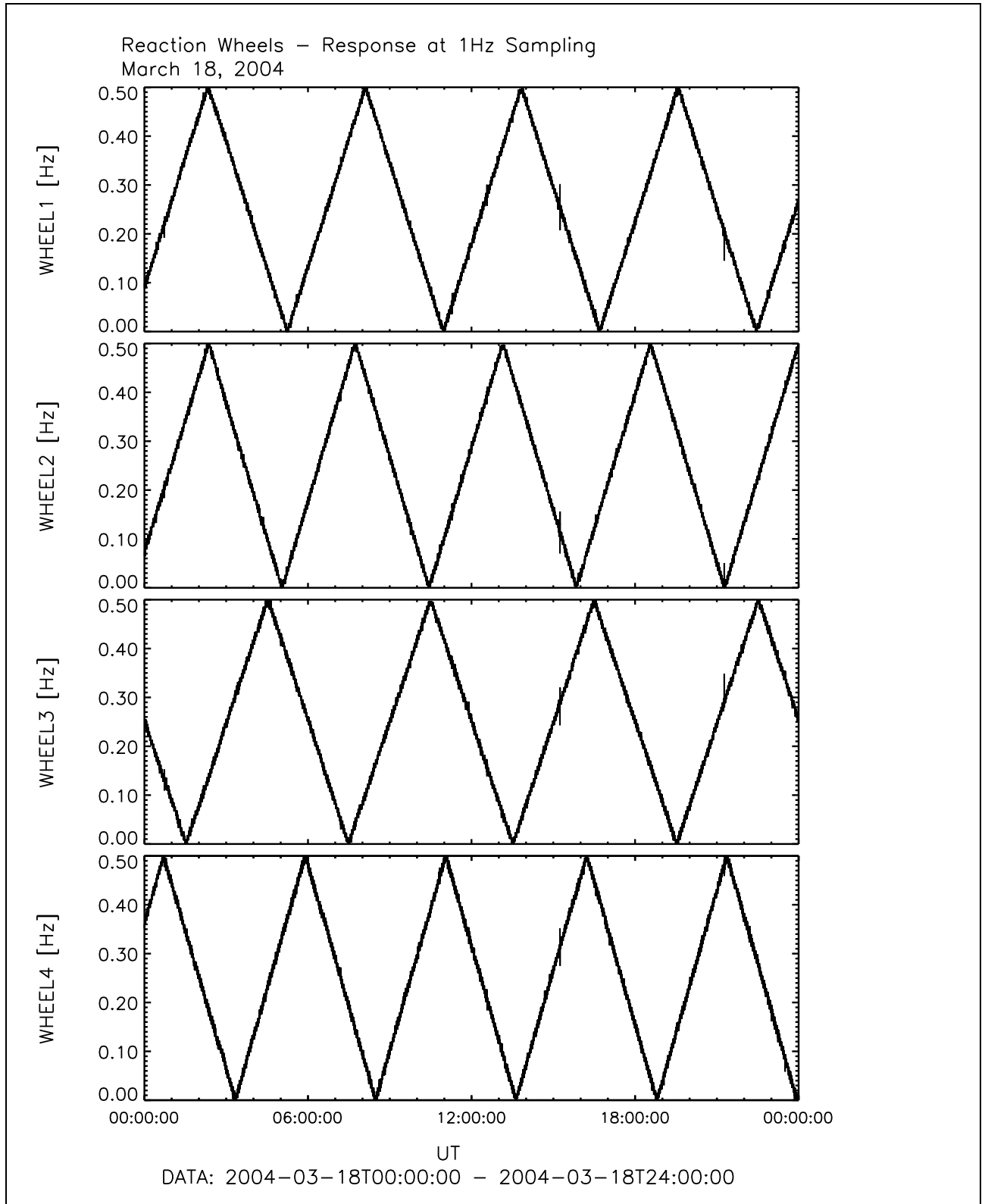


Figure 21: File: wheels_1Hz_Sampling2004-03-18T00-00

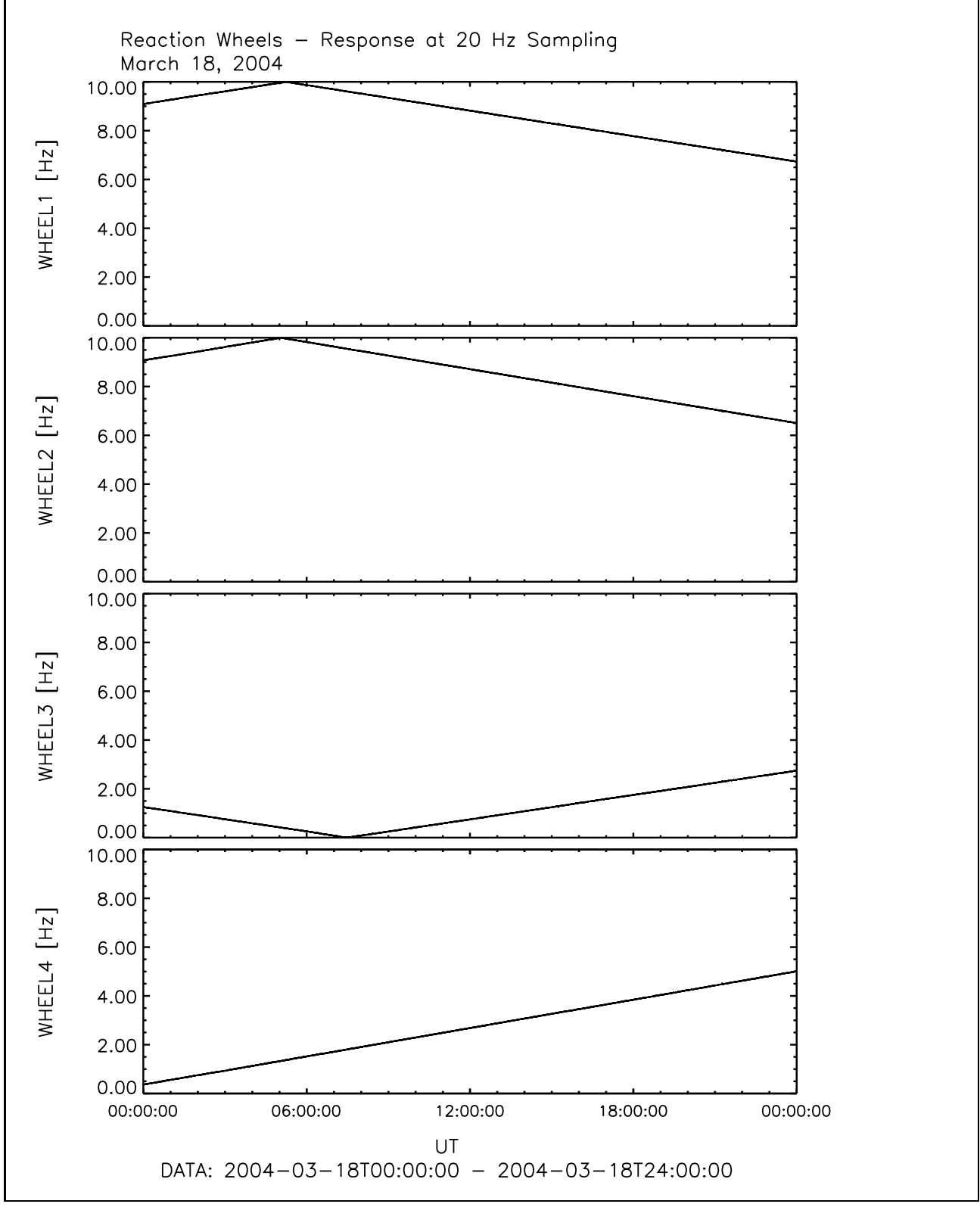


Figure 22: File: wheels_20Hz_Sampling2004-03-18T00-00

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4 March 19, 2004:

4.1 Actions

MAG was switched on immediately after PIU. MAG was set to BURST mode at 01:02.

Time	Stage A, Stage B, Filter cfg	Stage 1, Stage 2, Stage3	Mode
00:39 – 01:02	1 2 0	1 2 0	SID2
– 05:43	0 0 0	0 0 0	SID3

Today the booms were deployed. The deployment of the MAG boom can be seen in the magnetic field data. At about 03:08 the answer of the pyro firing can be seen as a spike in the magnetic field data. The real MAG boom deployment can be seen between 03:35 – 03:42. A detailed analysis of the MAG OB data (in s/c coordinates) shows:

Component	Level in STOWED position [nT]	Level in DEPLOYED position [nT]
B_x	518	-77
B_y	31	-13
B_z	-529	101
B	740	128

Component	Noise width in STOWED position [nT]	Noise width in DEPLOYED position [nT]
B_x	4	1.3
B_y	2	1.2
B_z	1.5	0.8

Results of the boom deployment:

- The measured residual field is, as expected, significantly lower in the deployed position. The field modulus decreases from 740 nT to 128 nT.
- The noise width decreases as well, as expected. The noise width is reduced by more than a factor of two in the deployed position.

As already mentioned in the summary, the field changes end abruptly and not smoothly at the end of the boom deployment. This is a clear indication for a remaining residual field caused by the s/c.

The deployment of the LAP boom can not be seen in the magnetic field data.

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Before the boom deployment we see significant peaks in the spectra of our data at the frequencies 1 Hz, 2.1 Hz, 3.1 Hz, 5.5 Hz . After the deployment only the peaks at about 3 Hz and 6 hz can be seen.

4.2 Plots of Ground Calibrated Data

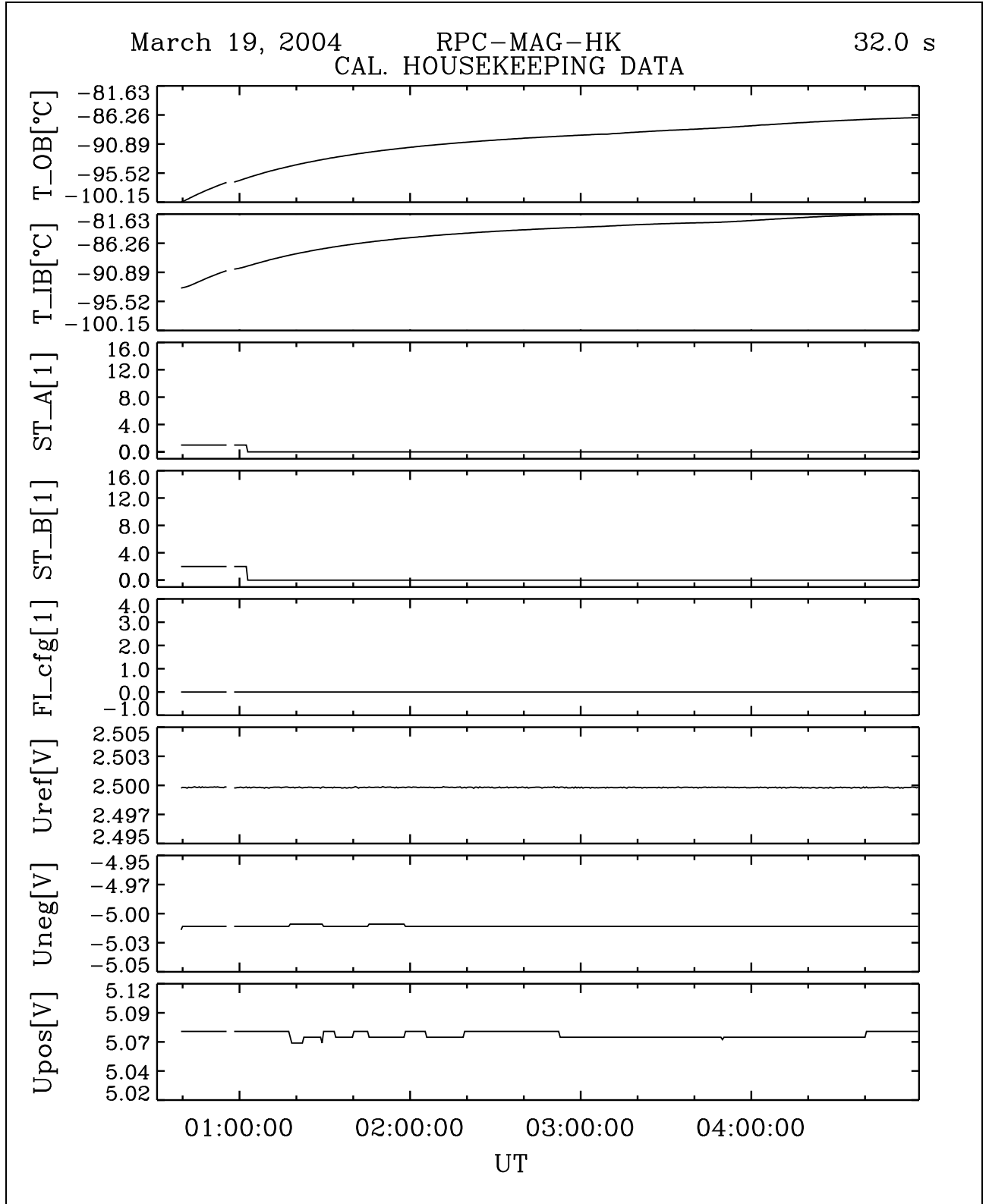


Figure 23: File: RPCMAG040319T0038_CLA_HK_P0031_0459

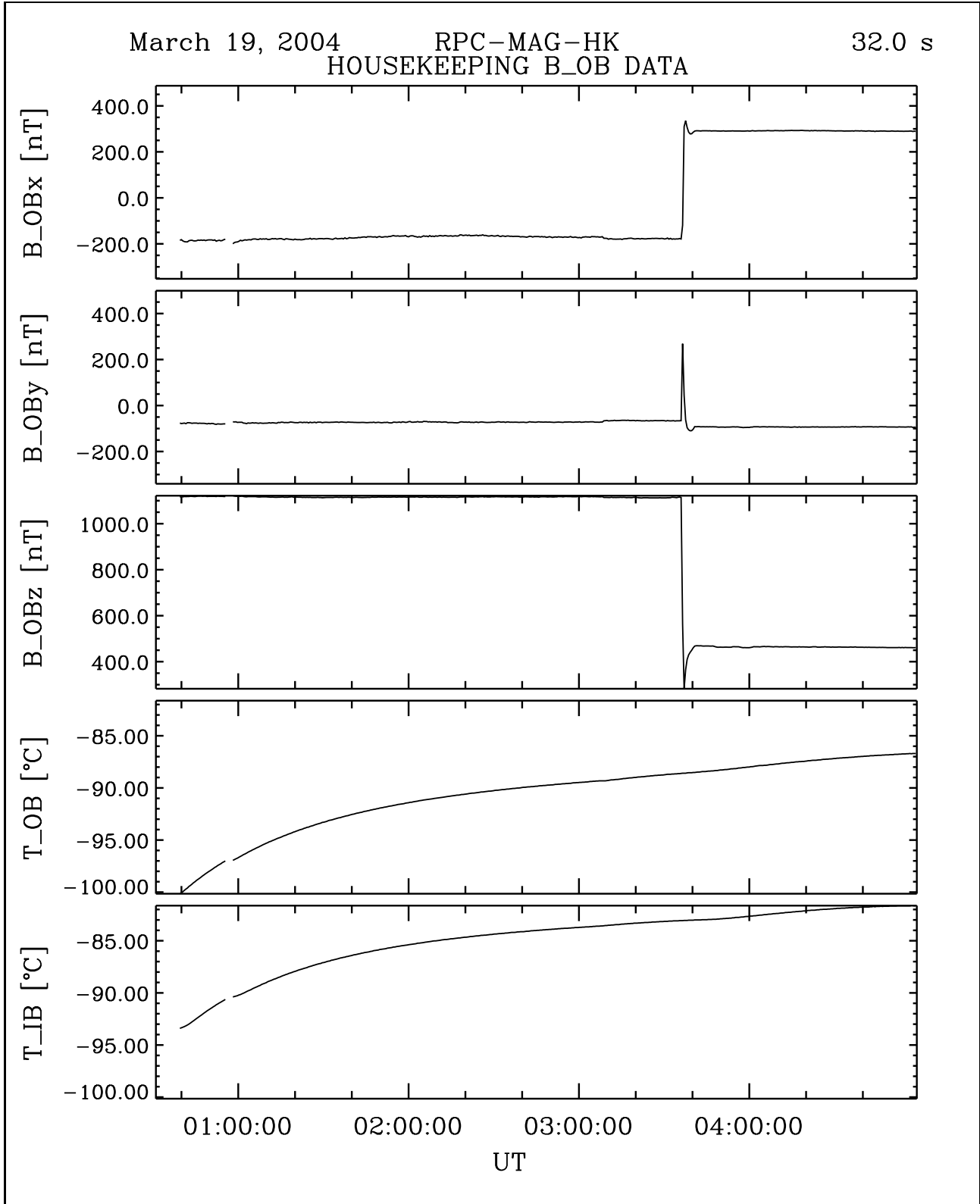


Figure 24: File: RPCMAG040319T0038_CLA_HK_B_P0031_0459

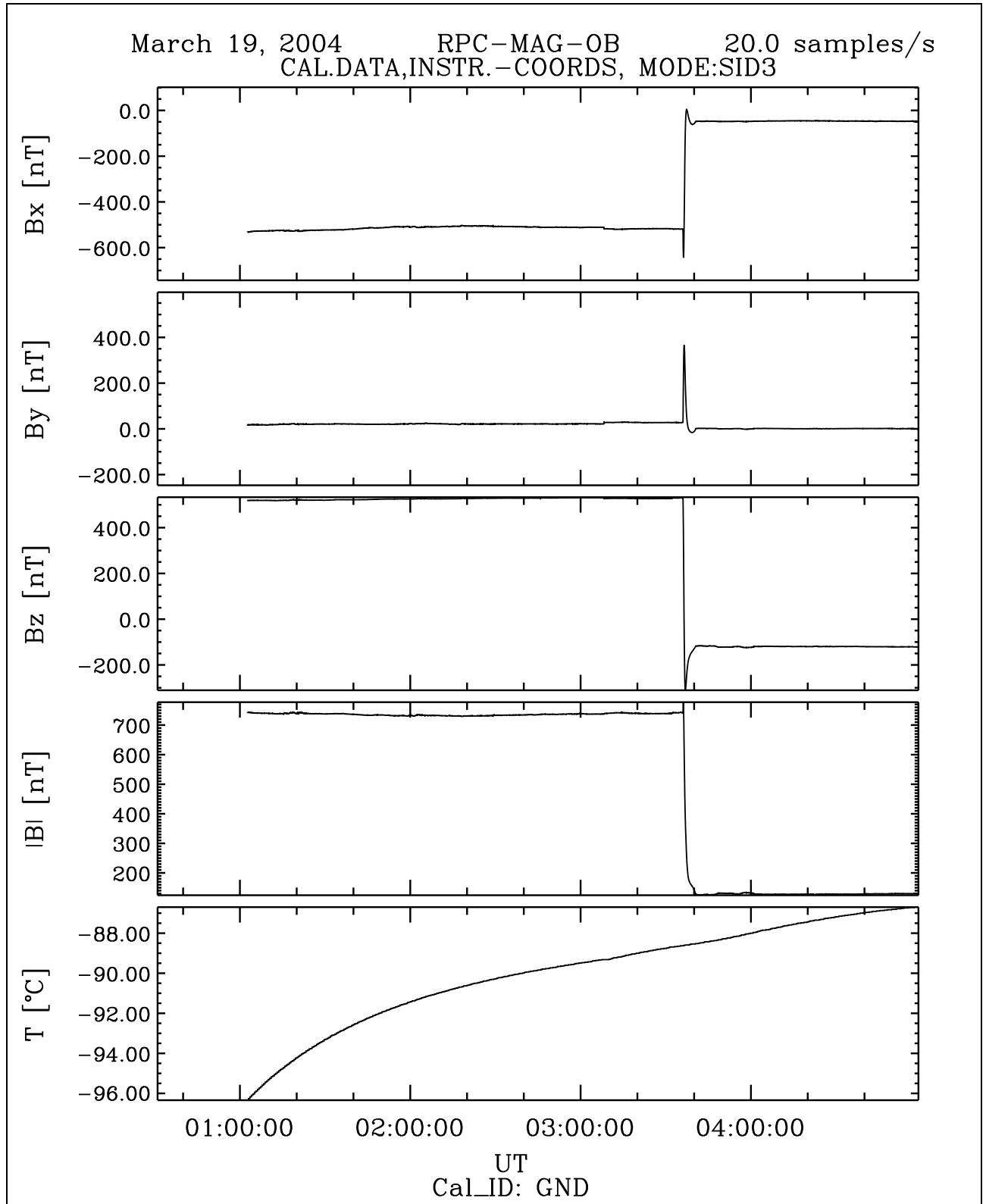


Figure 25: File: RPCMAG040319T0102_CLA_OB_M3_T0031_0459_GND

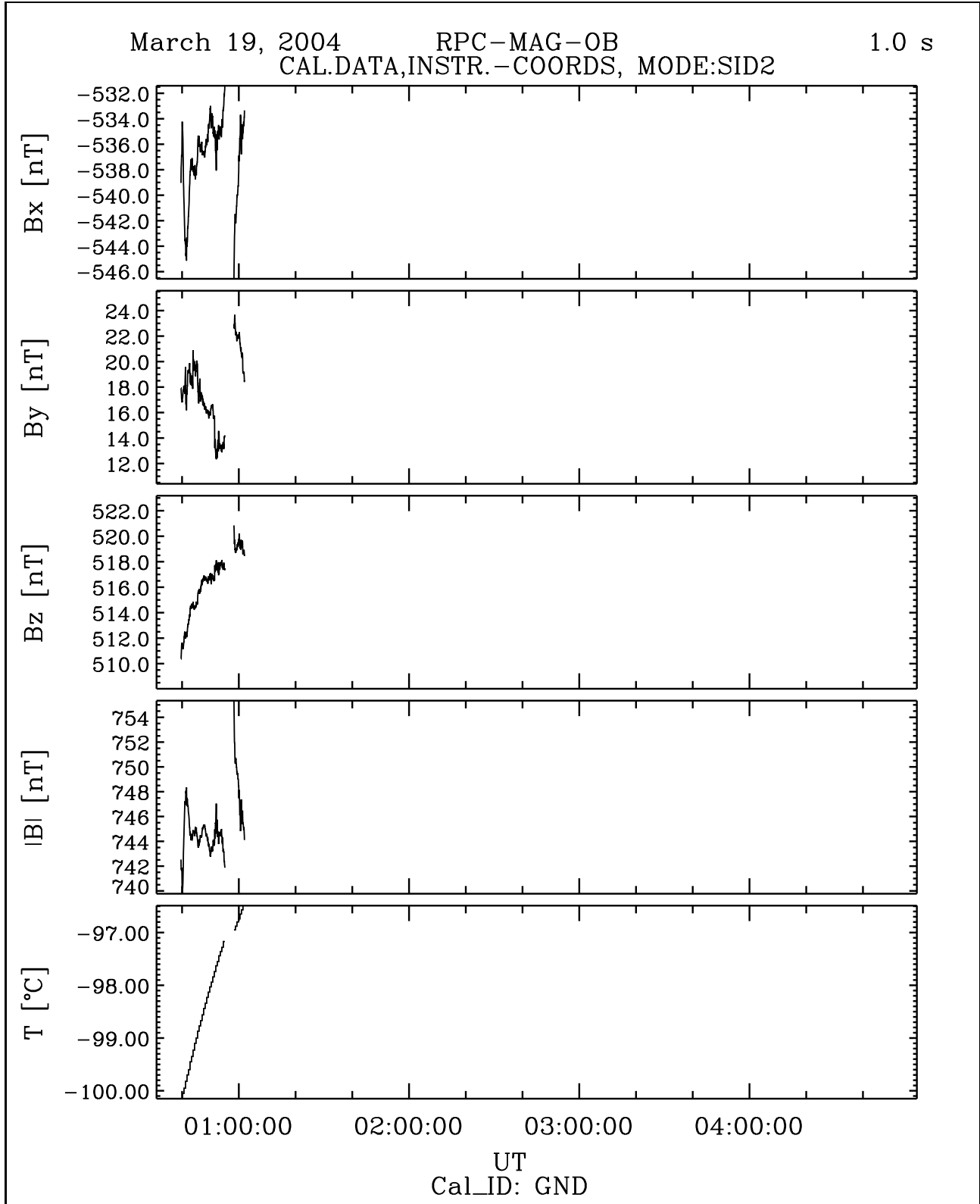


Figure 26: File: RPCMAG040319T0039_CLA_OB_M2_T0031_0459_GND

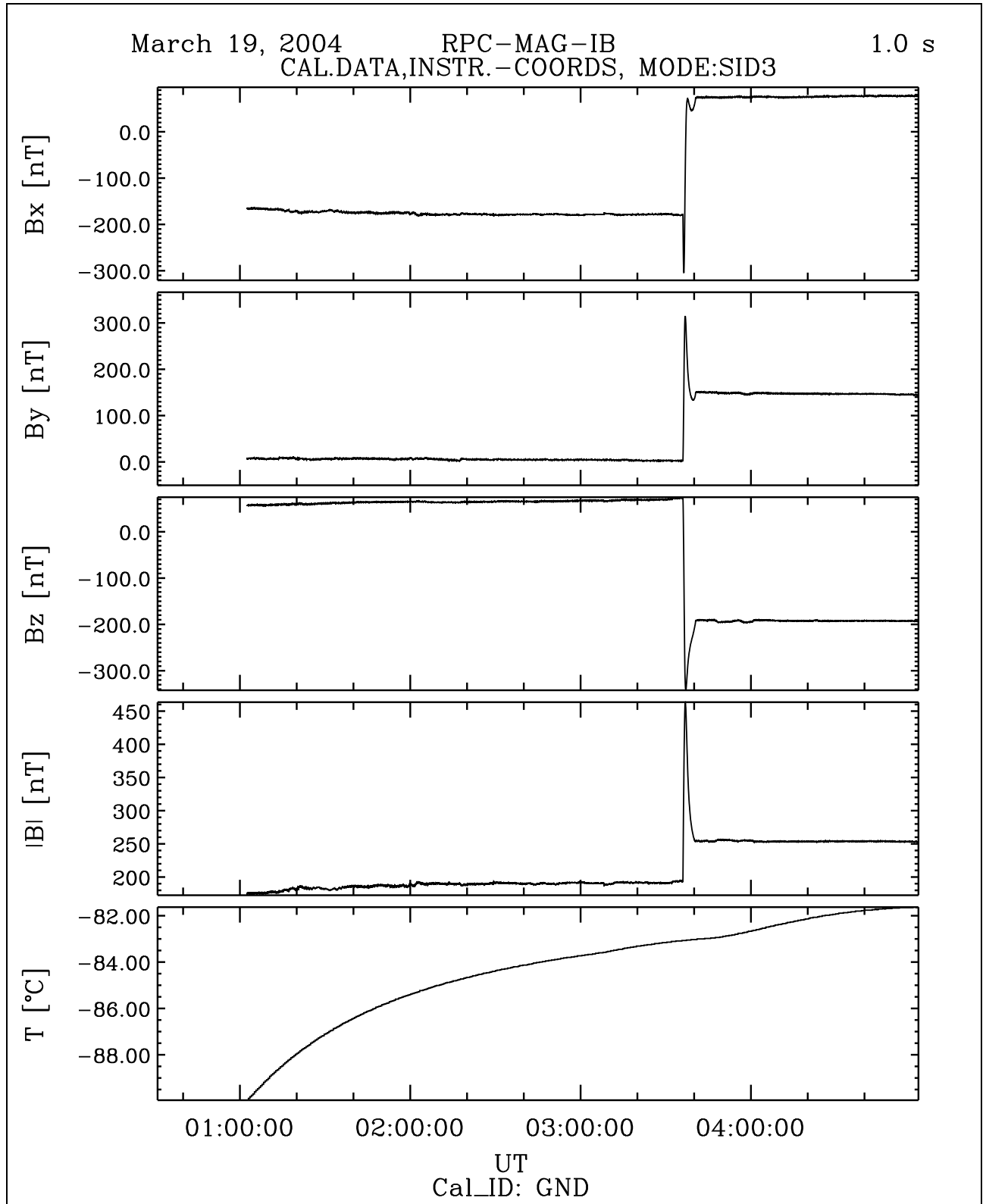


Figure 27: File: RPCMAG040319T0102_CLA_IB_M3_T0031_0459_GND

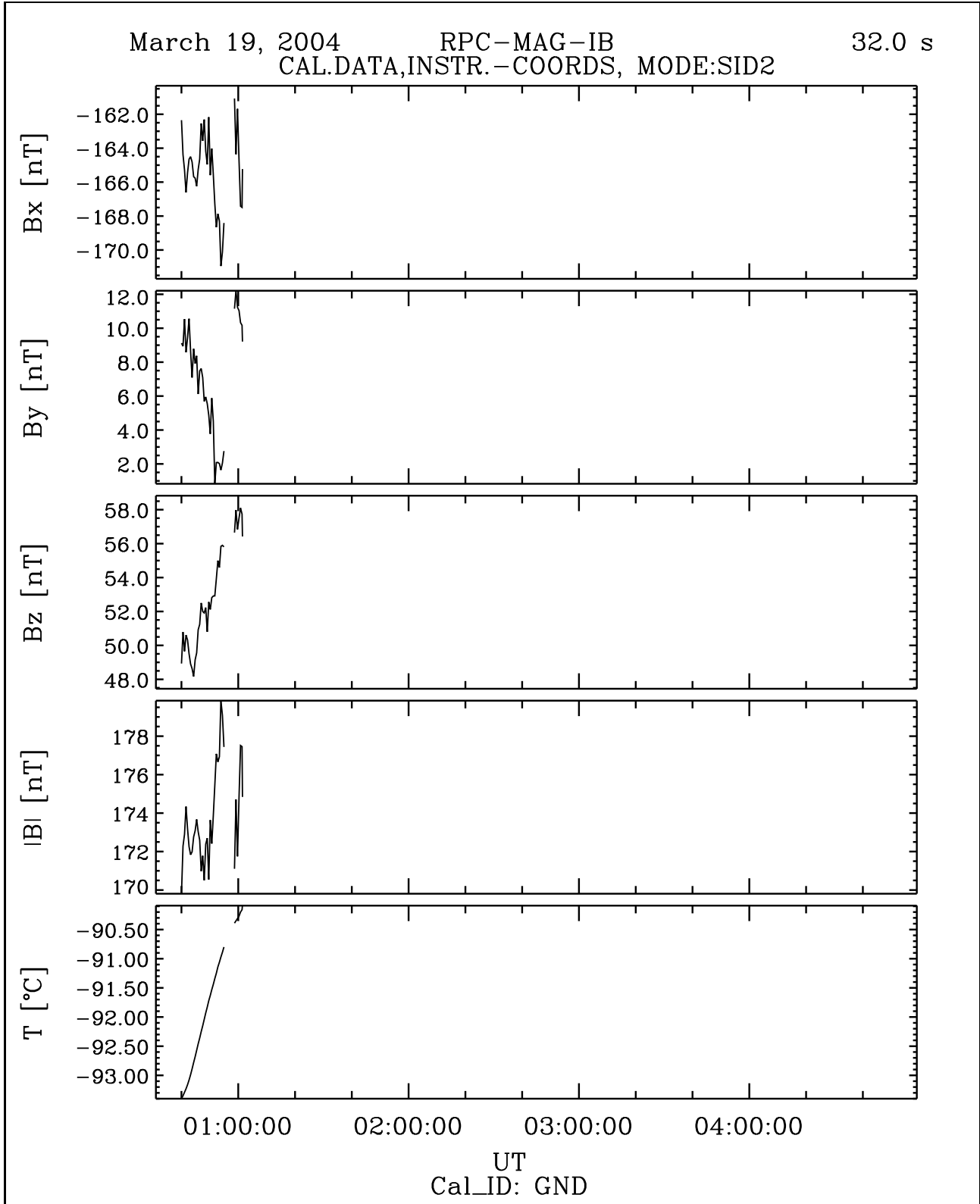


Figure 28: File: RPCMAG040319T0039_CLA_IB_M2-T0031_0459_GND

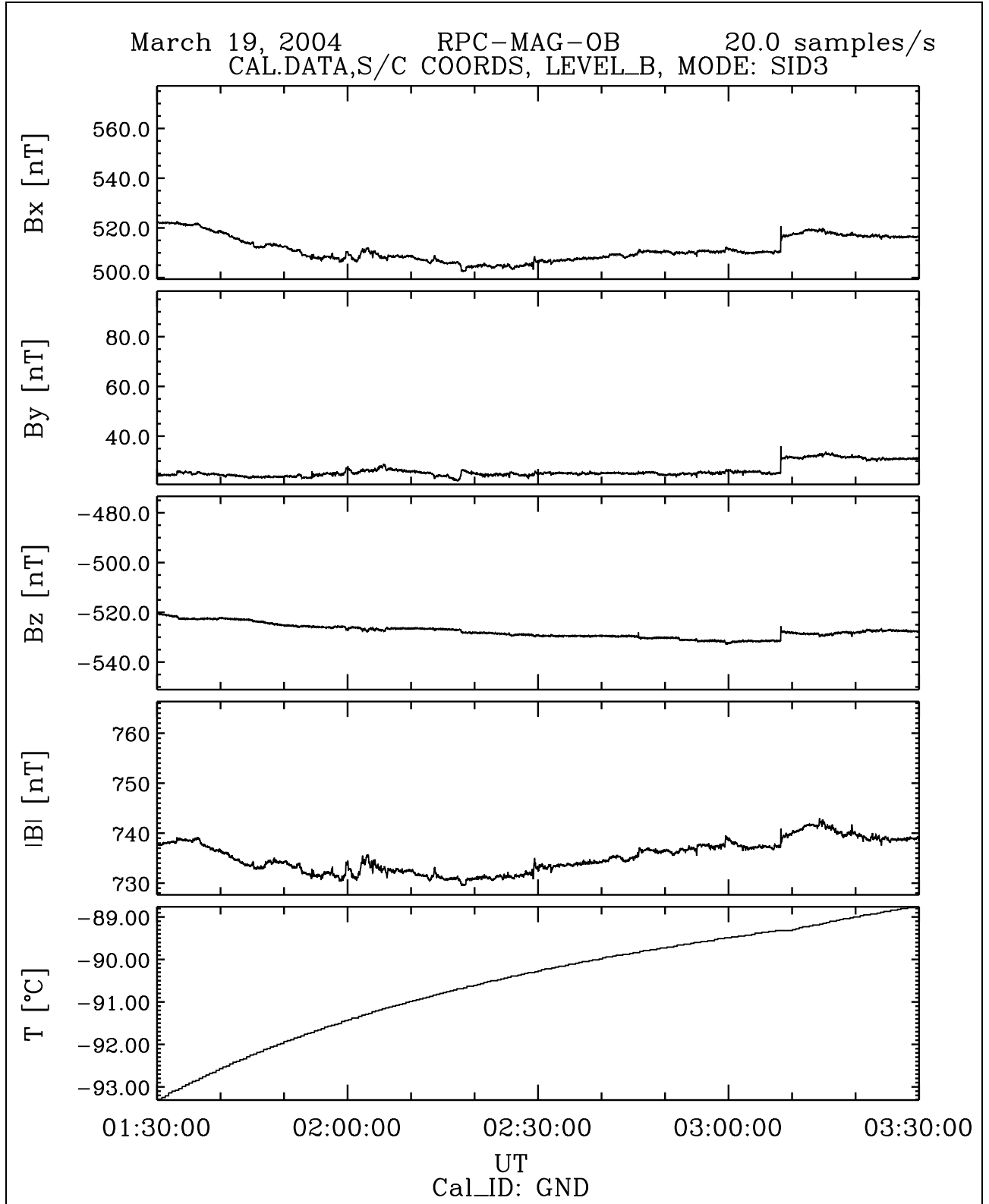


Figure 29: File: RPCMAG040319T0105_CLB_OB_M3_T0130_0330_GND

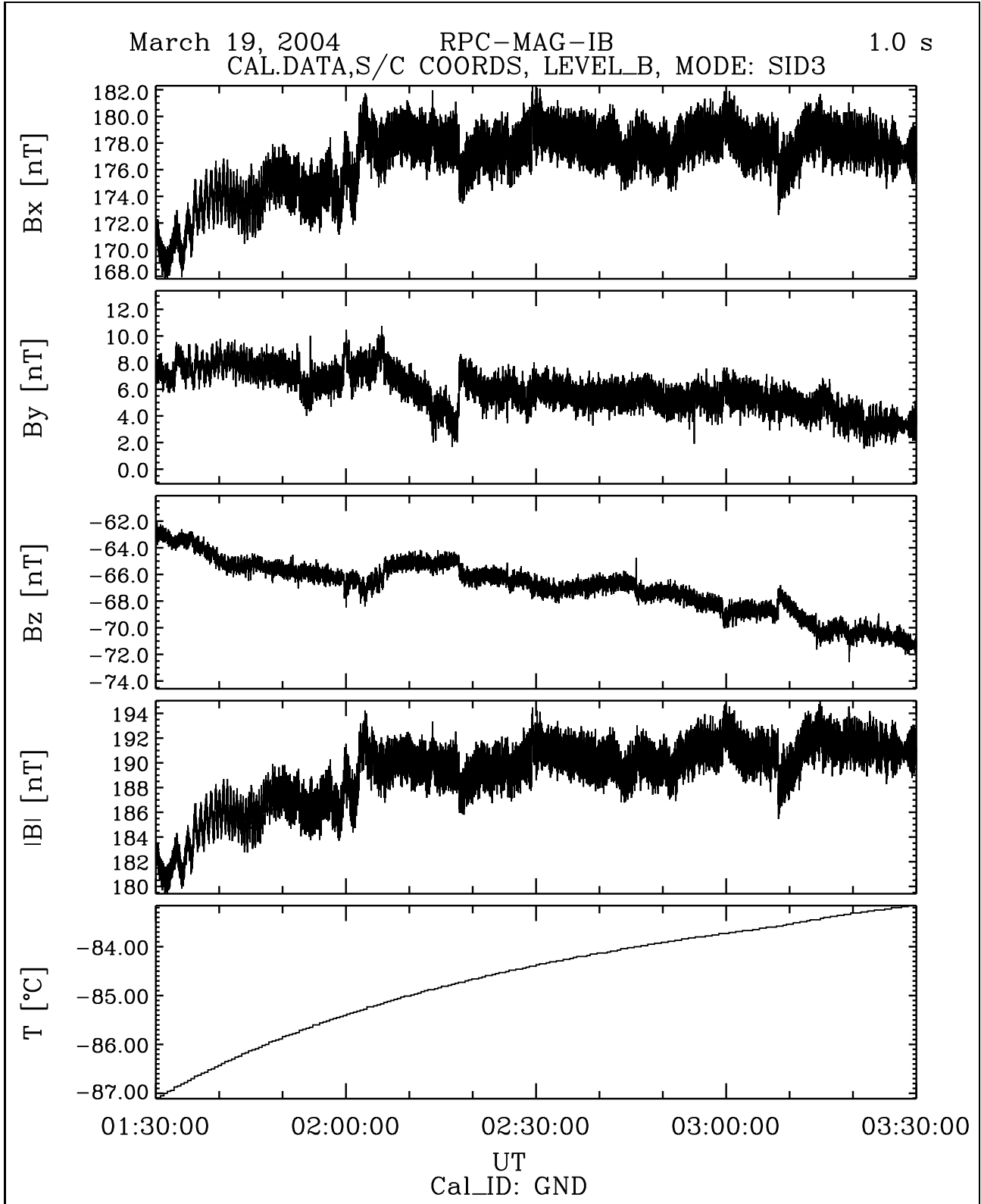


Figure 30: File: RPCMAG040319T0105_CLB_IB_M3_T0130_0330_GND

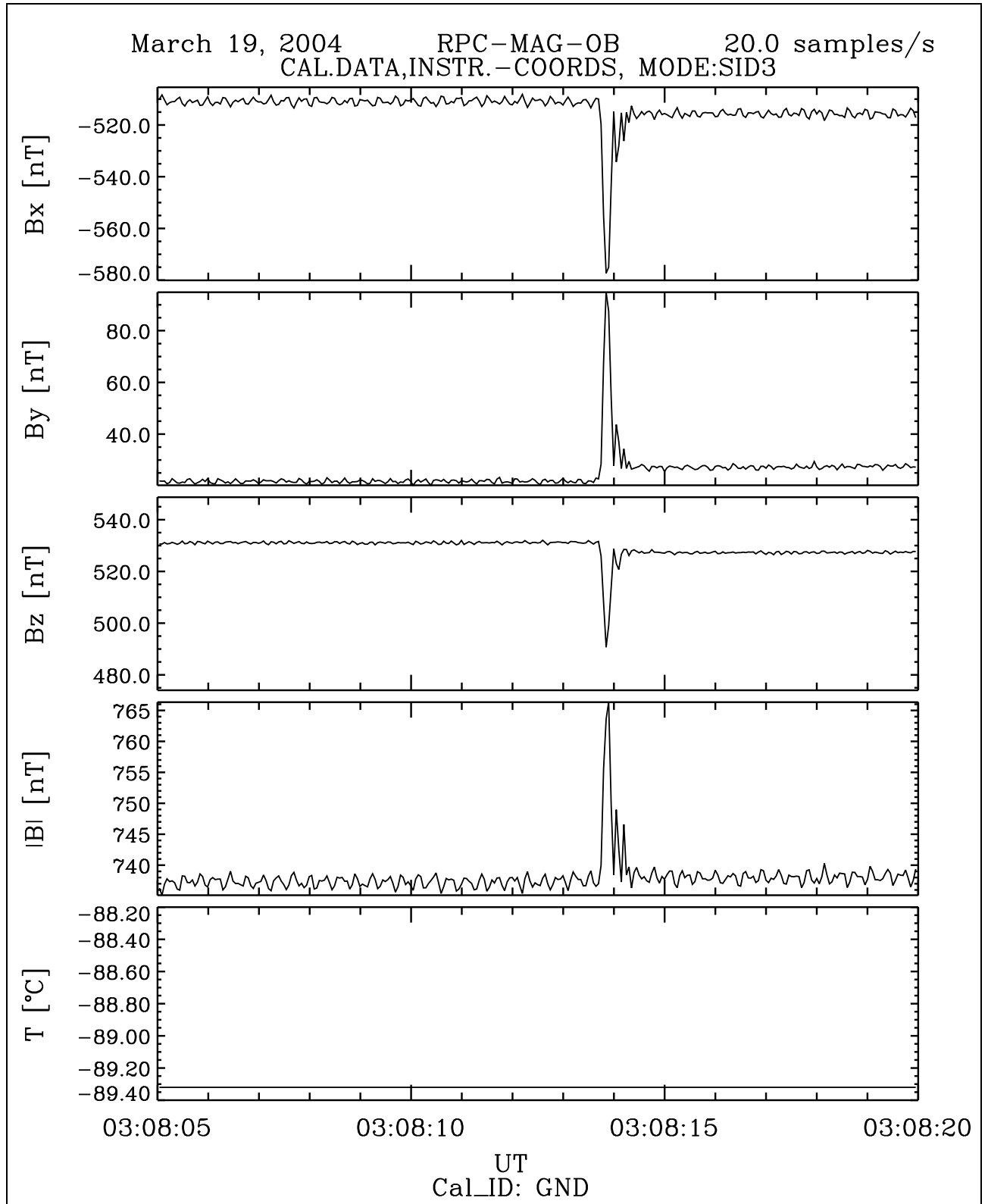


Figure 31: File: RPCMAG040319T0102_CLA_OB_M3_T0308_0308_GND

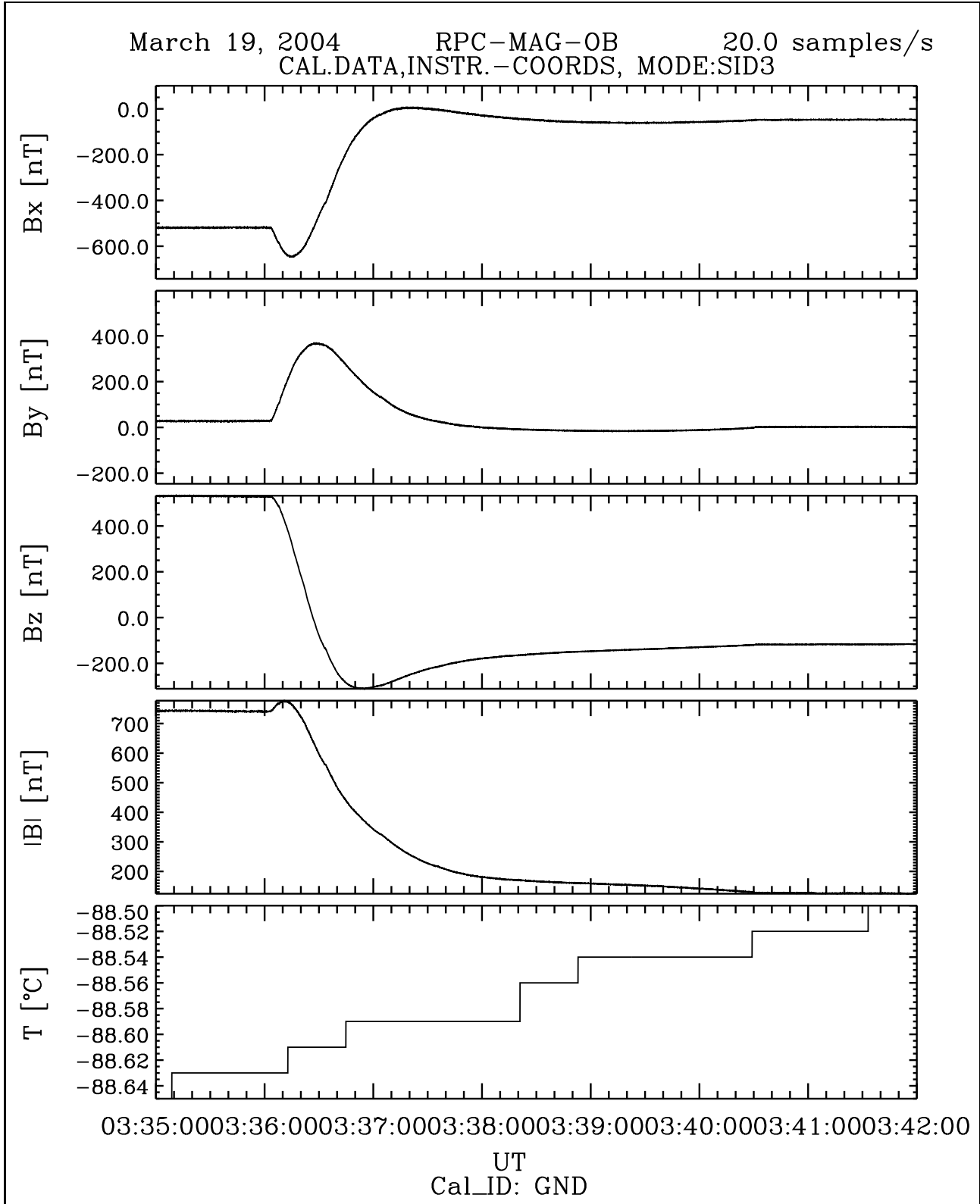


Figure 32: File: RPCMAG040319T0102_CLA_OB_M3_T0335_0342_GND

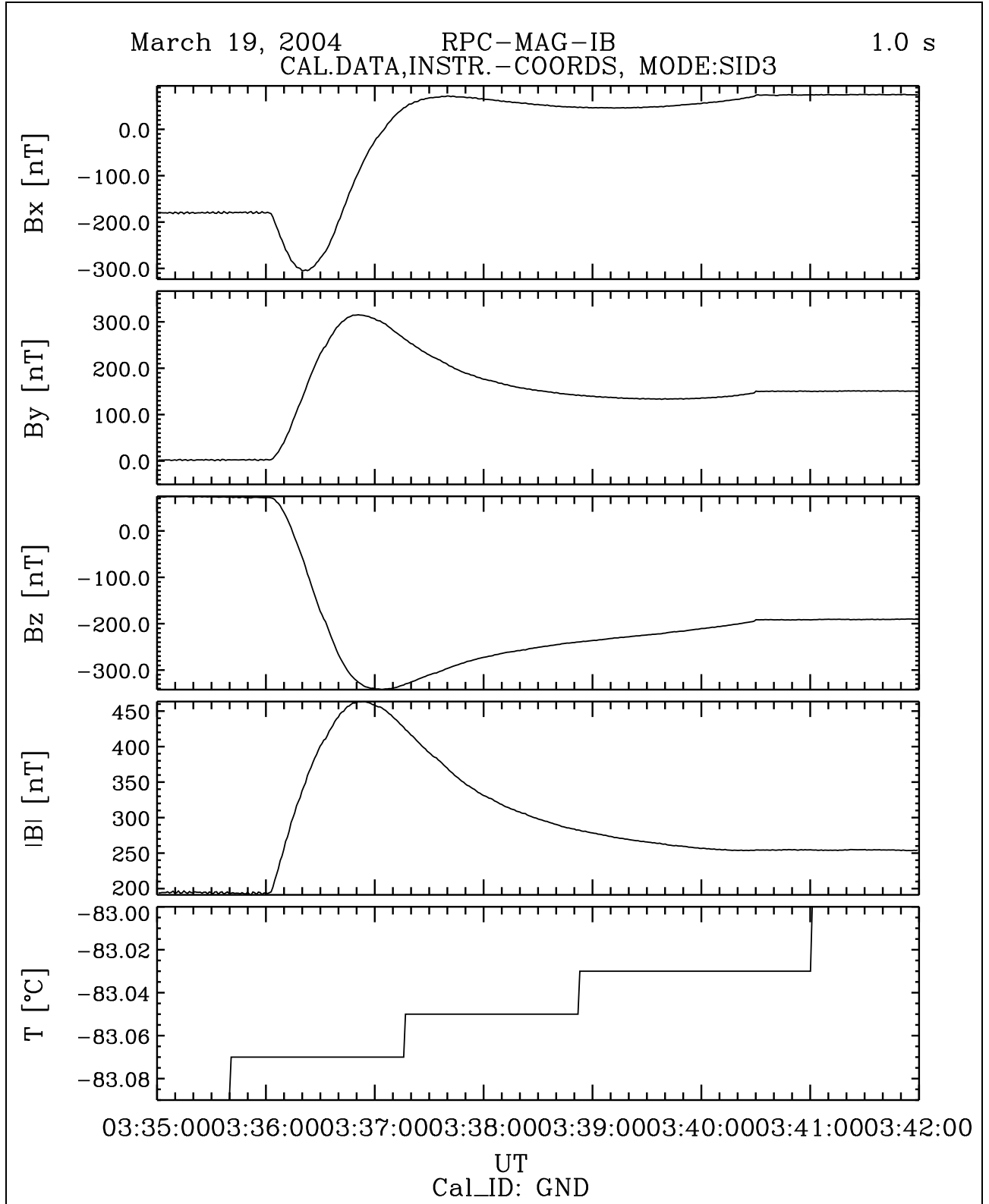


Figure 33: File: RPCMAG040319T0102_CLA_IB_M3_T0335_0342_GND

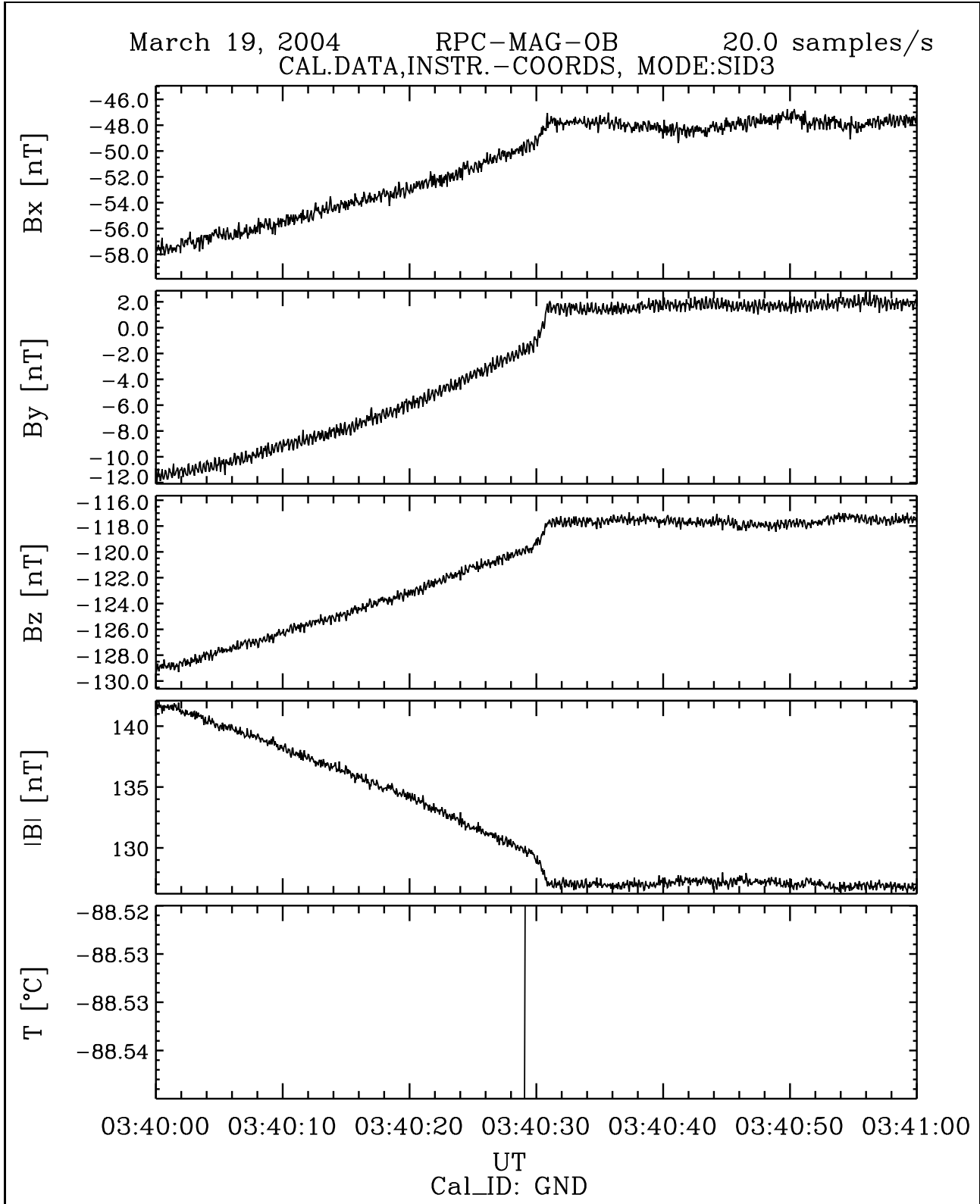


Figure 34: File: RPCMAG040319T0102_CLA_OB_M3_T0340_0341_GND

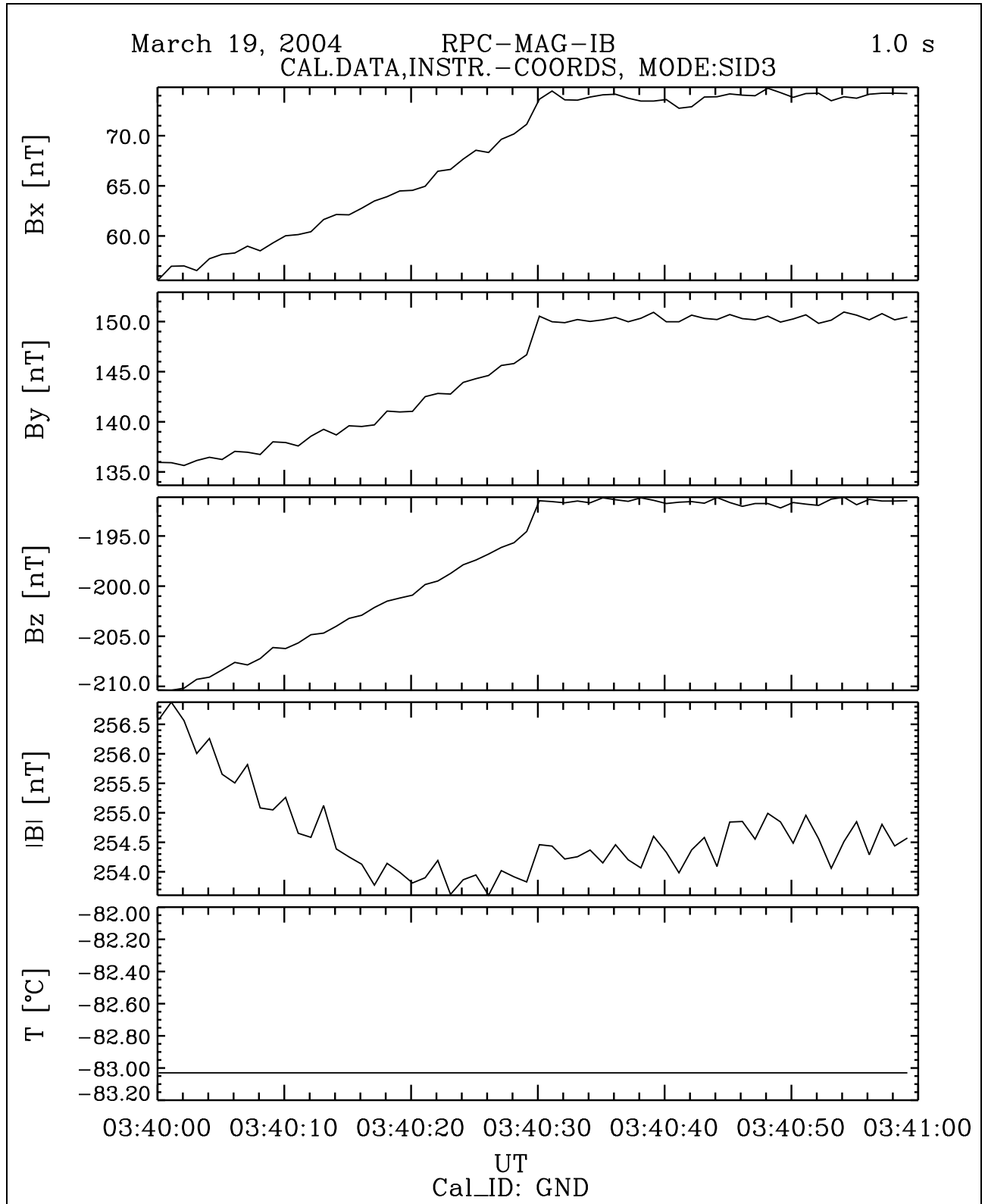


Figure 35: File: RPCMAG040319T0102_CLA_IB_M3_T0340_0341_GND

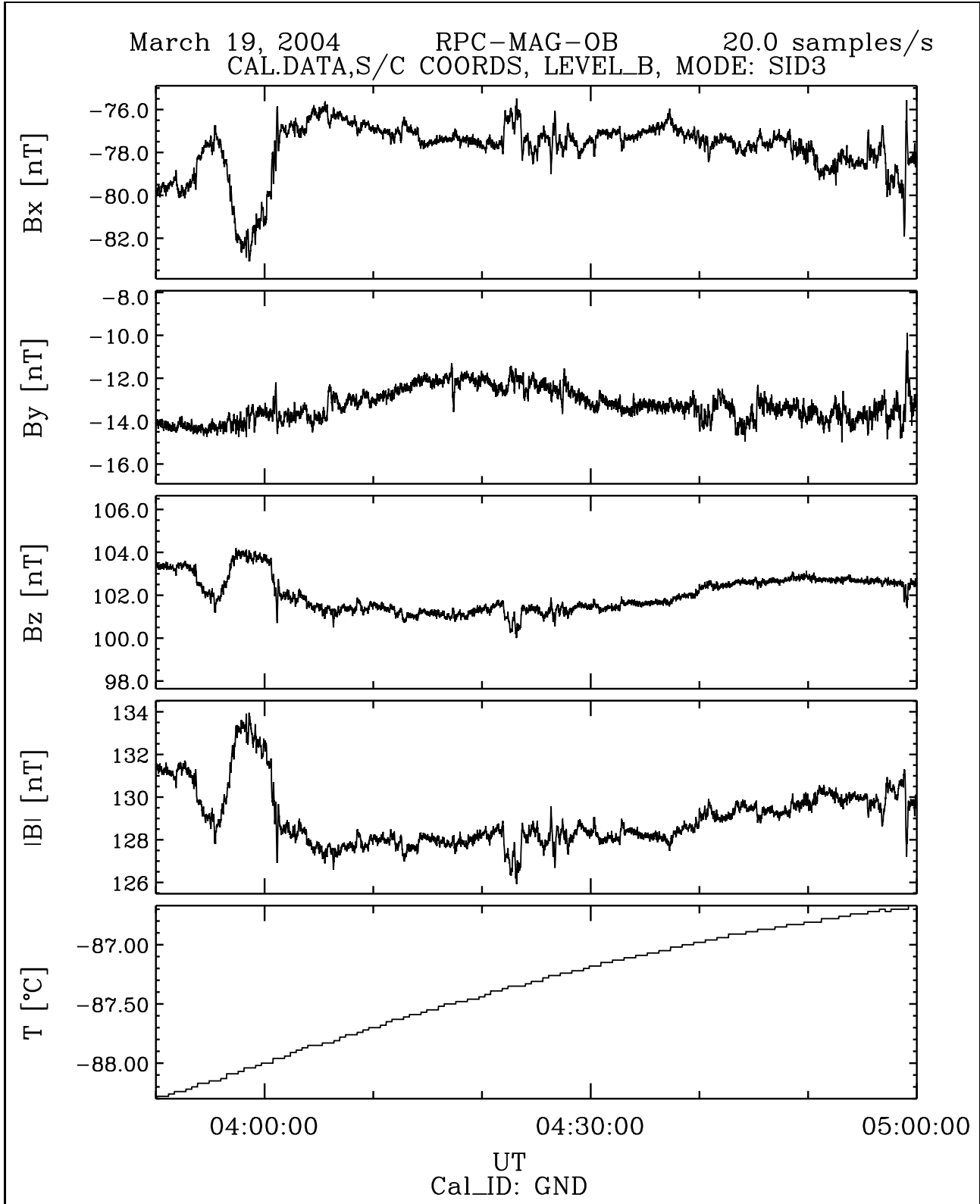


Figure 36: File: RPCMAG040319T0350_CLB_OB_M3_T0350_0500_GND

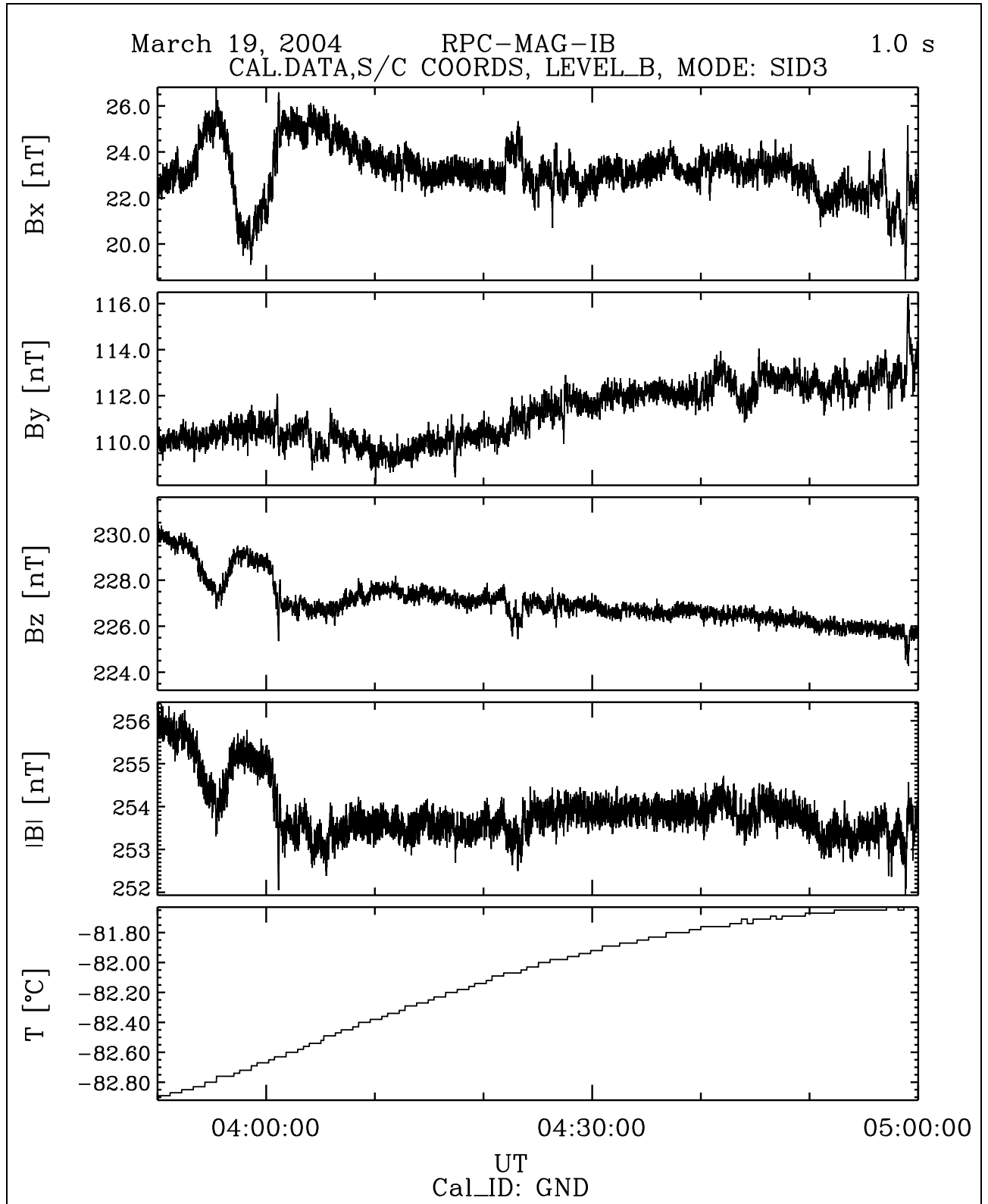


Figure 37: File: RPCMAG040319T0350_CLB_IB_M3_T0350_0500_GND

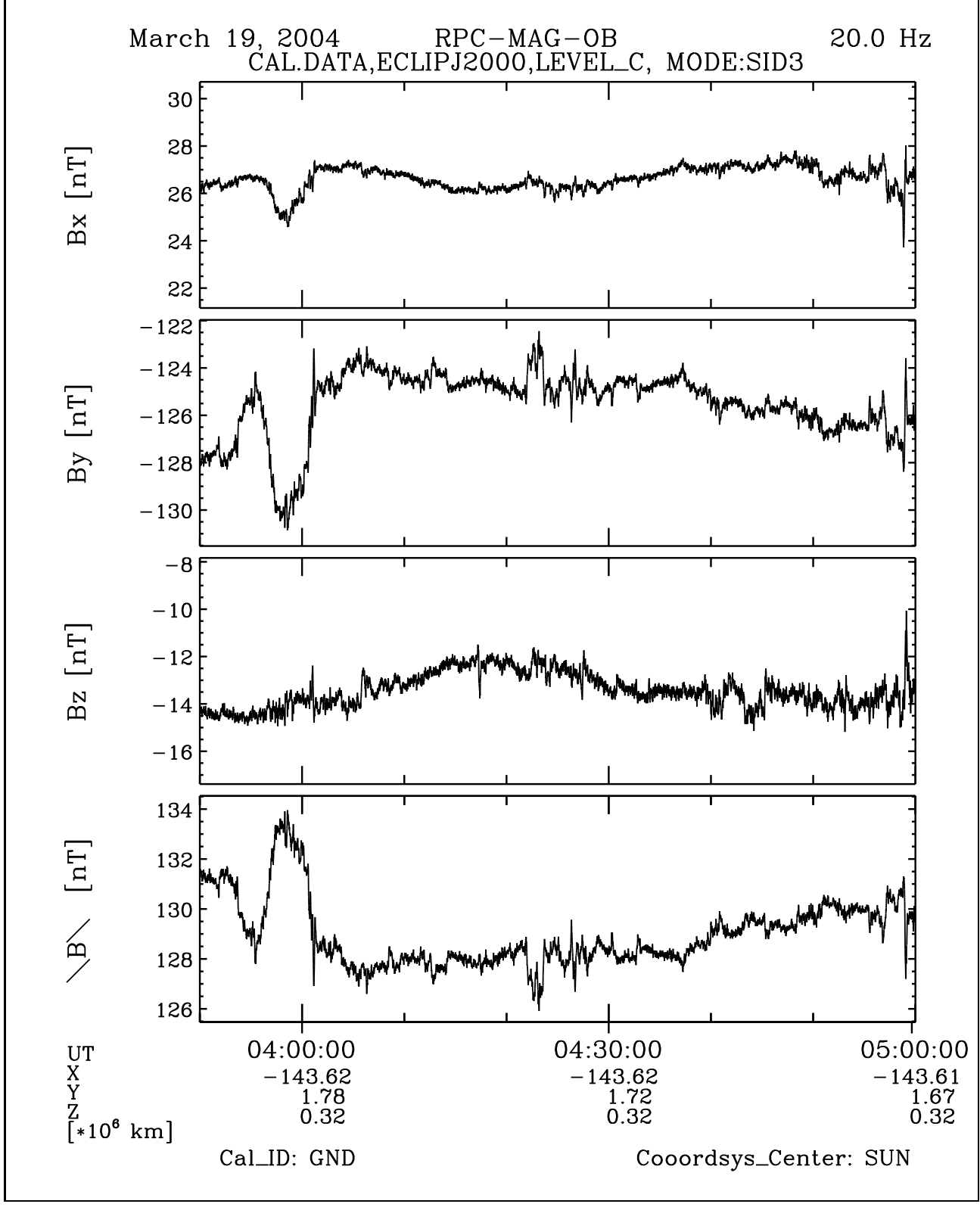


Figure 38: File: RPCMAG040319T0350_CLC_OB_M3_T0350_0500_GND

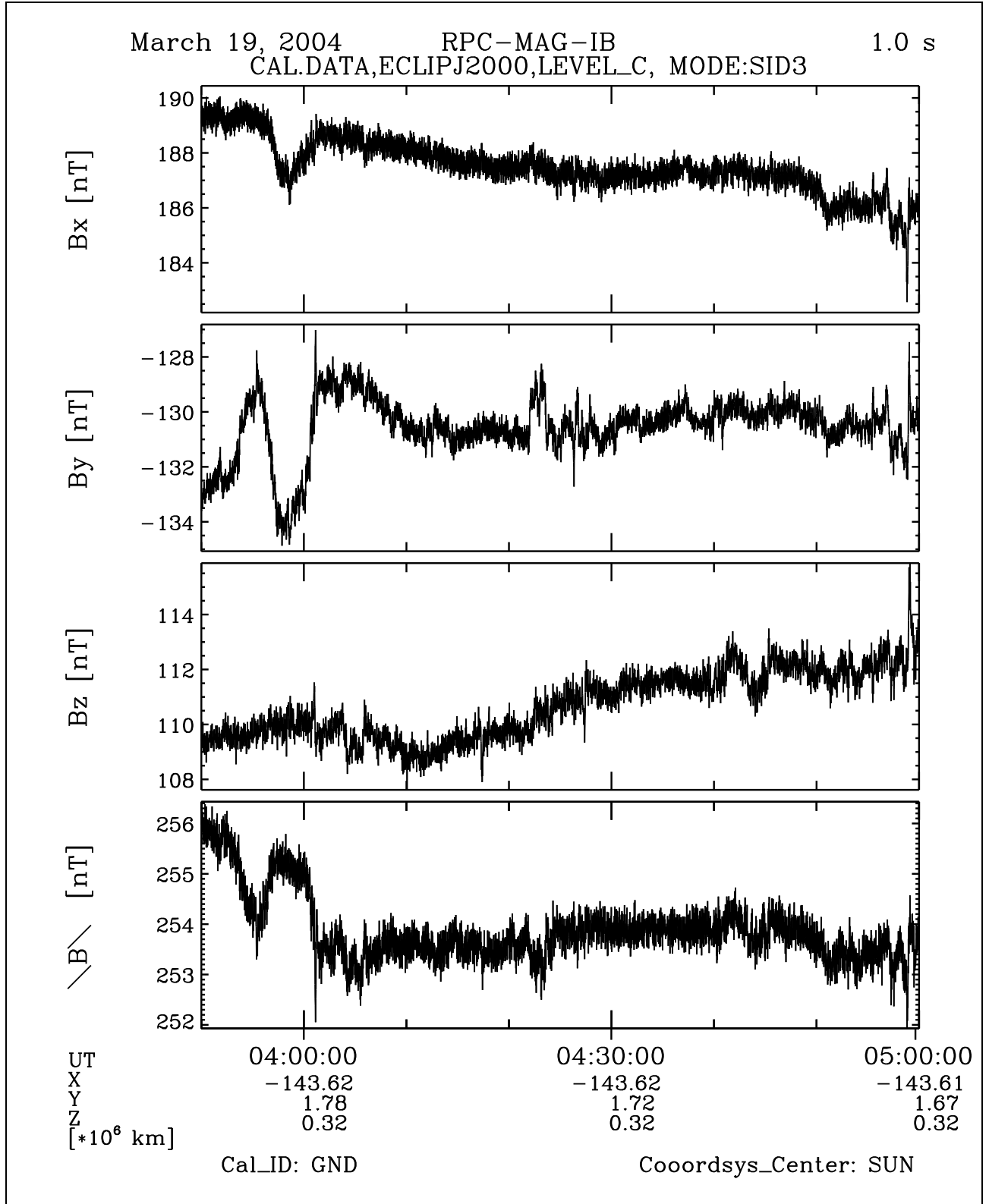


Figure 39: File: RPCMAG040319T0350_CLC_IB_M3_T0350_0500_GND

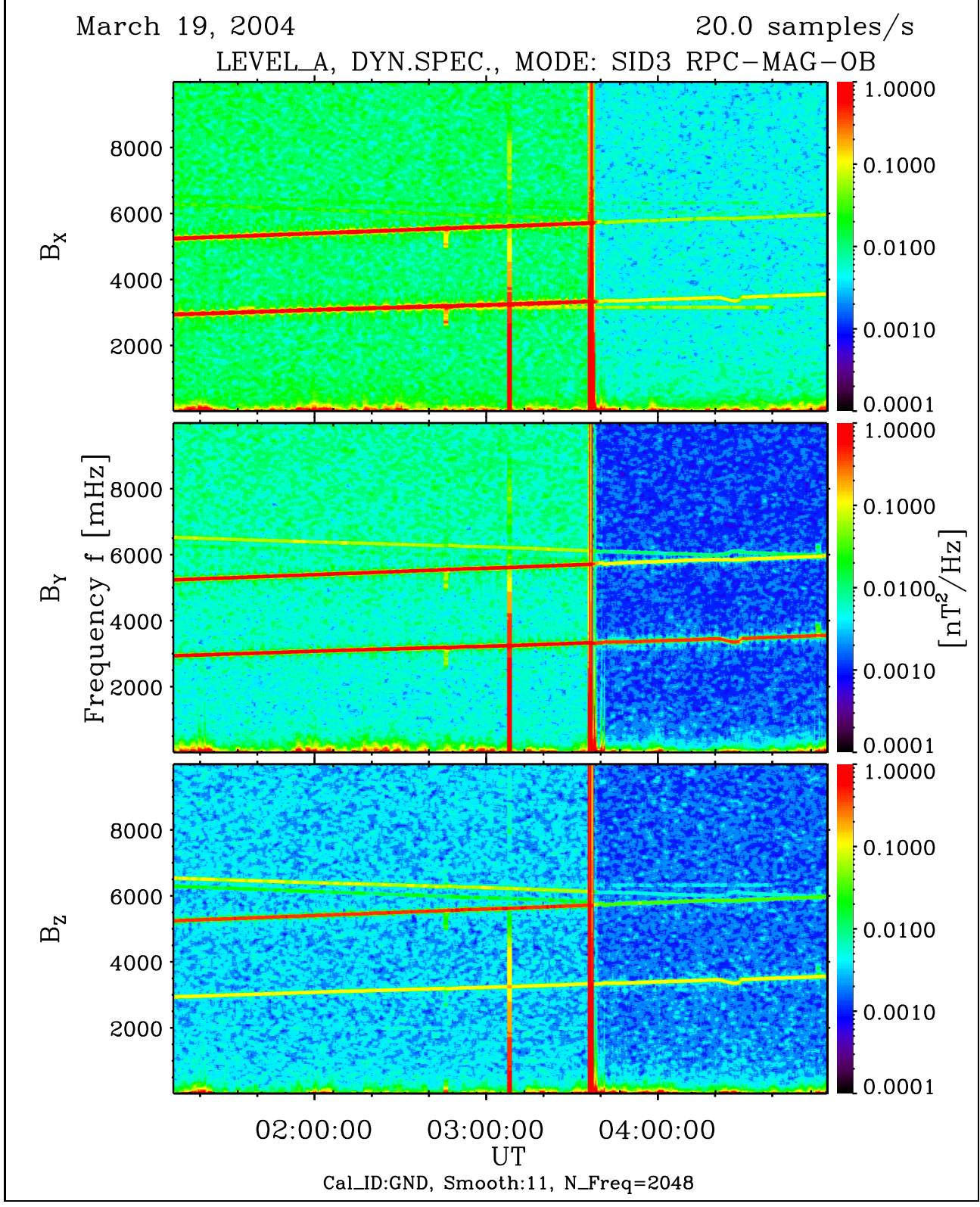


Figure 40: File: RPCMAG040319T0102_CLA_OB_M3_DS1_10000_GND

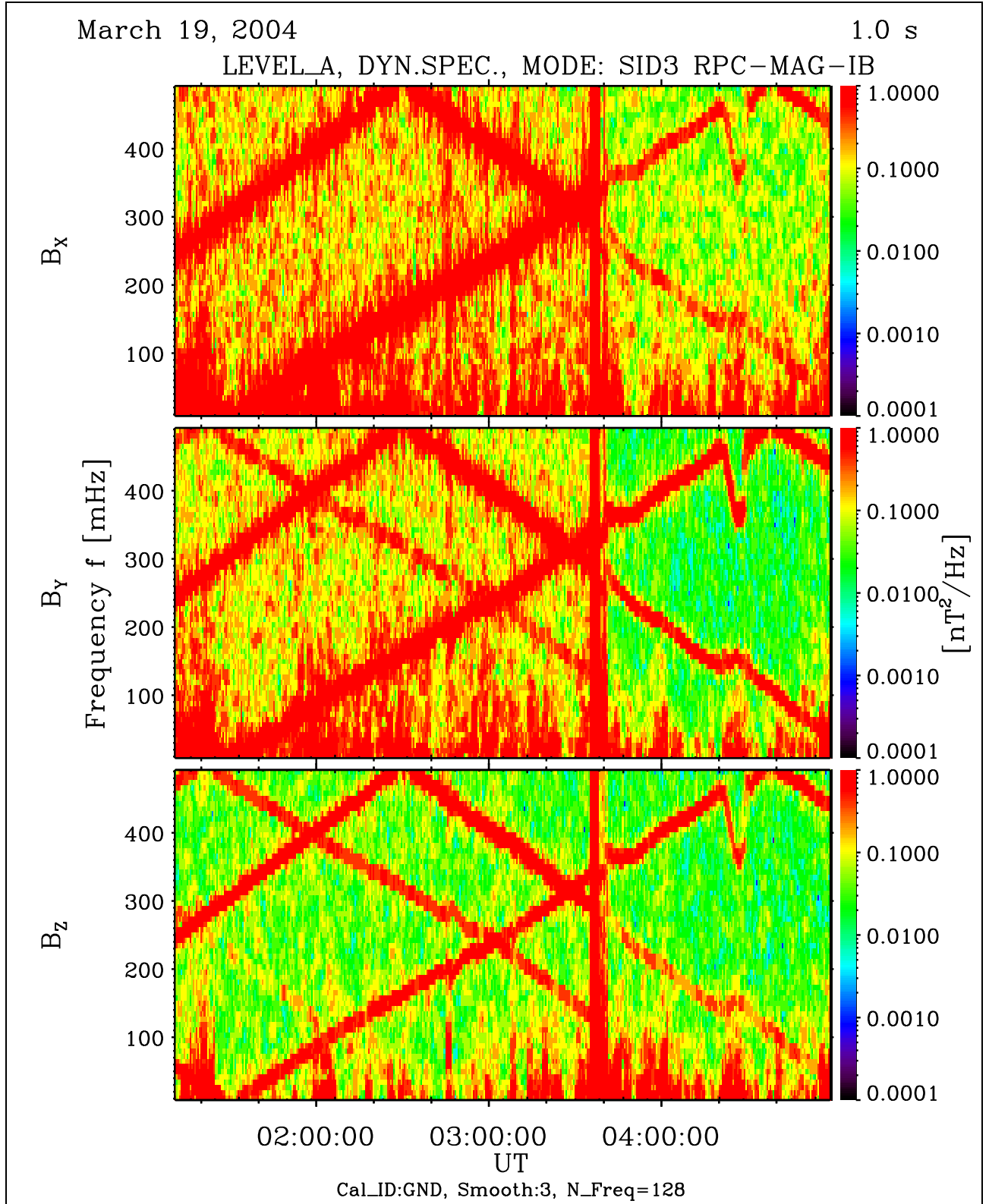


Figure 41: File: RPCMAG040319T0102_CLA_IB_M3_DS1_500_GND

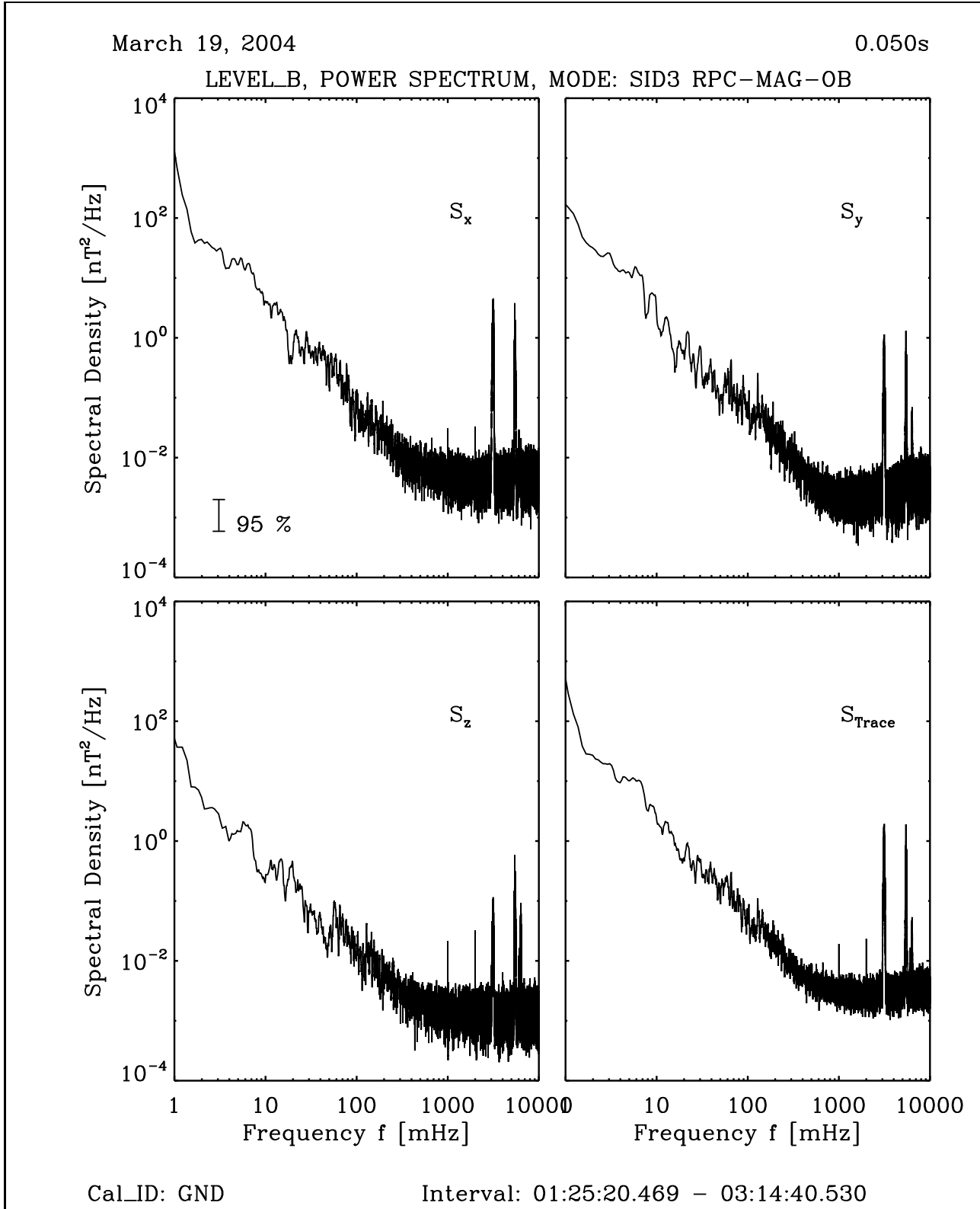


Figure 42: File: RPCMAG040319T0105_CLB_OB_M3_PS1_10000_GND

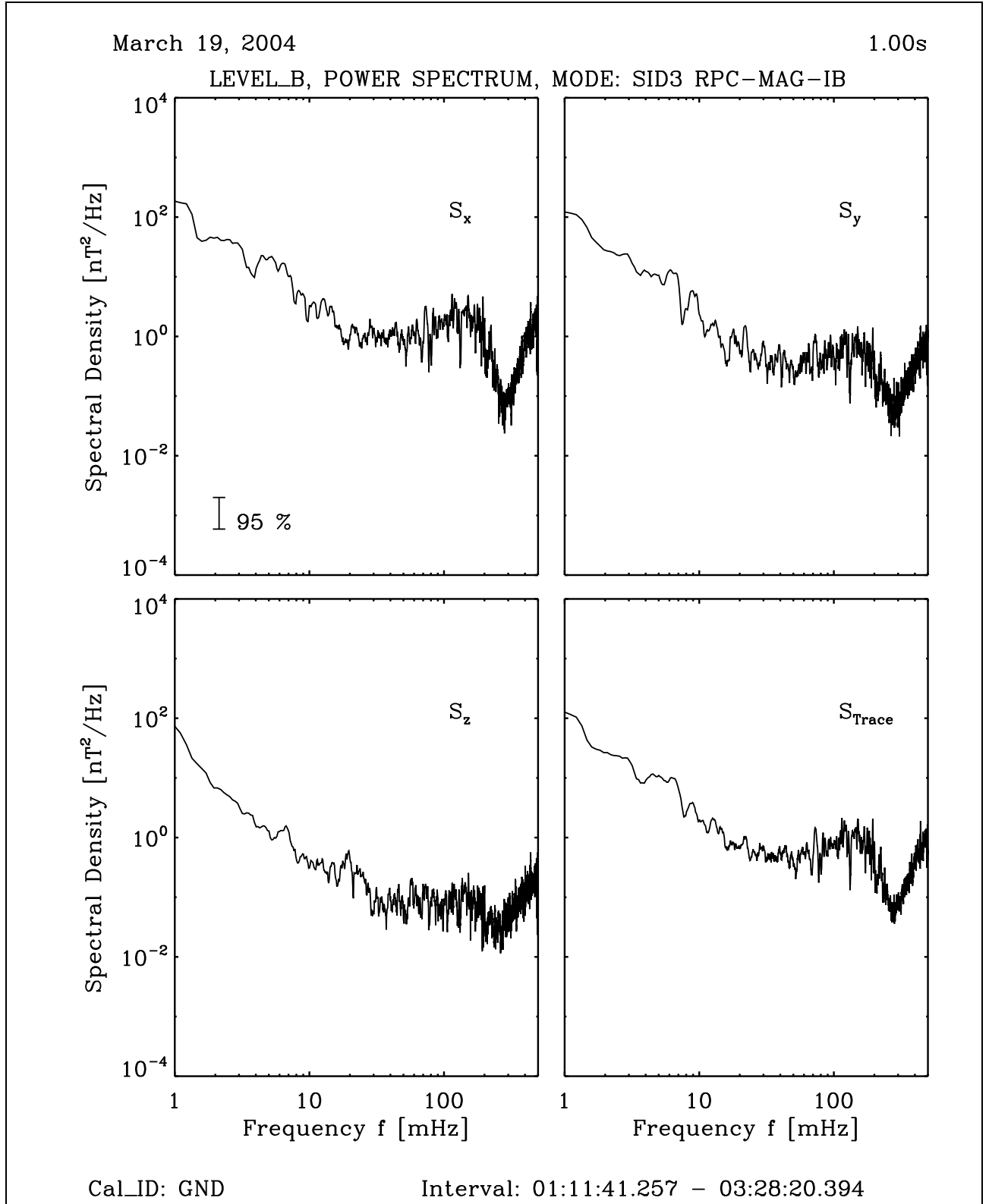


Figure 43: File: RPCMAG040319T0105_CLB_IB_M3_PS1_10000_GND

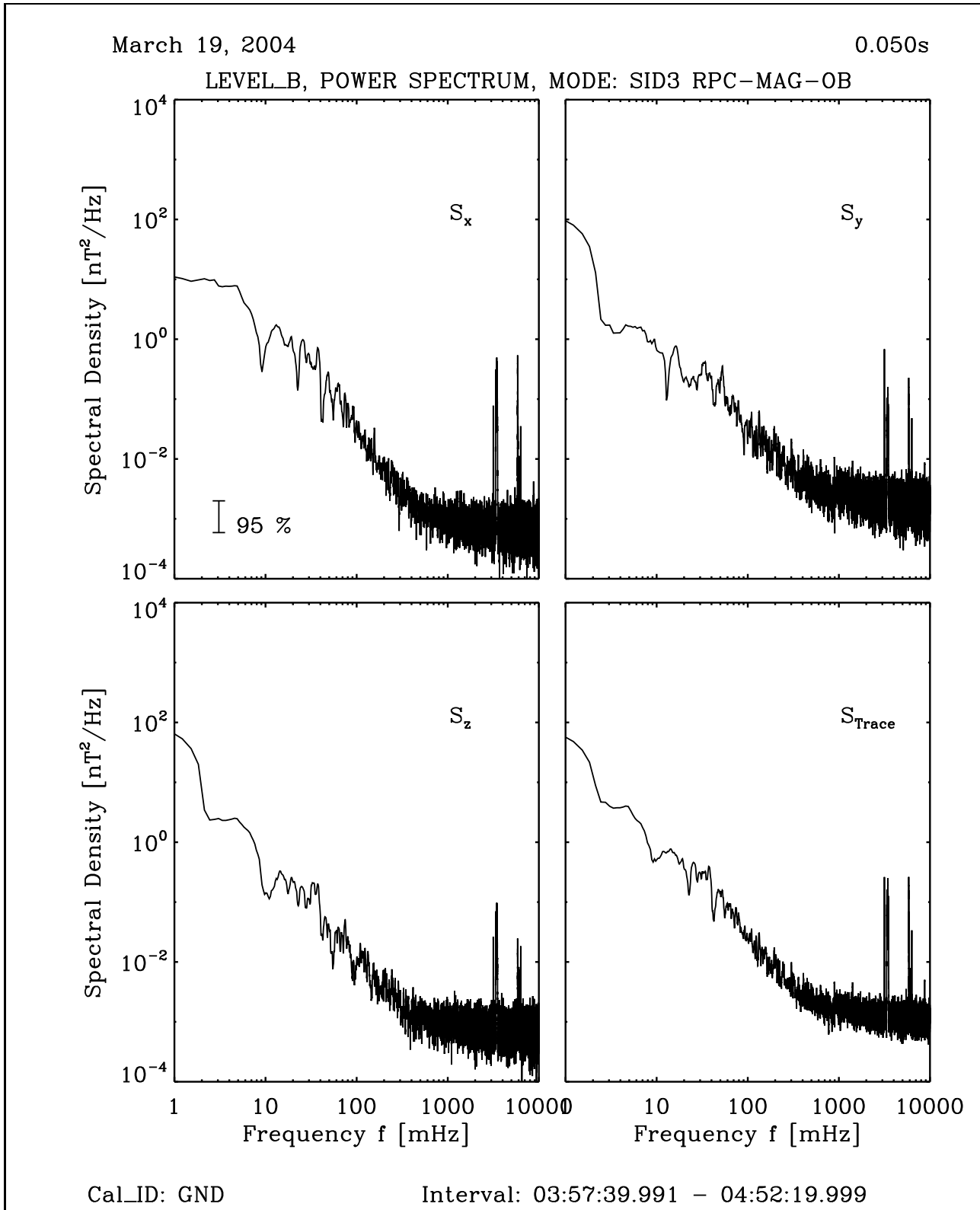


Figure 44: File: RPCMAG040319T0350_CLB_OB_M3_PS1_10000_GND

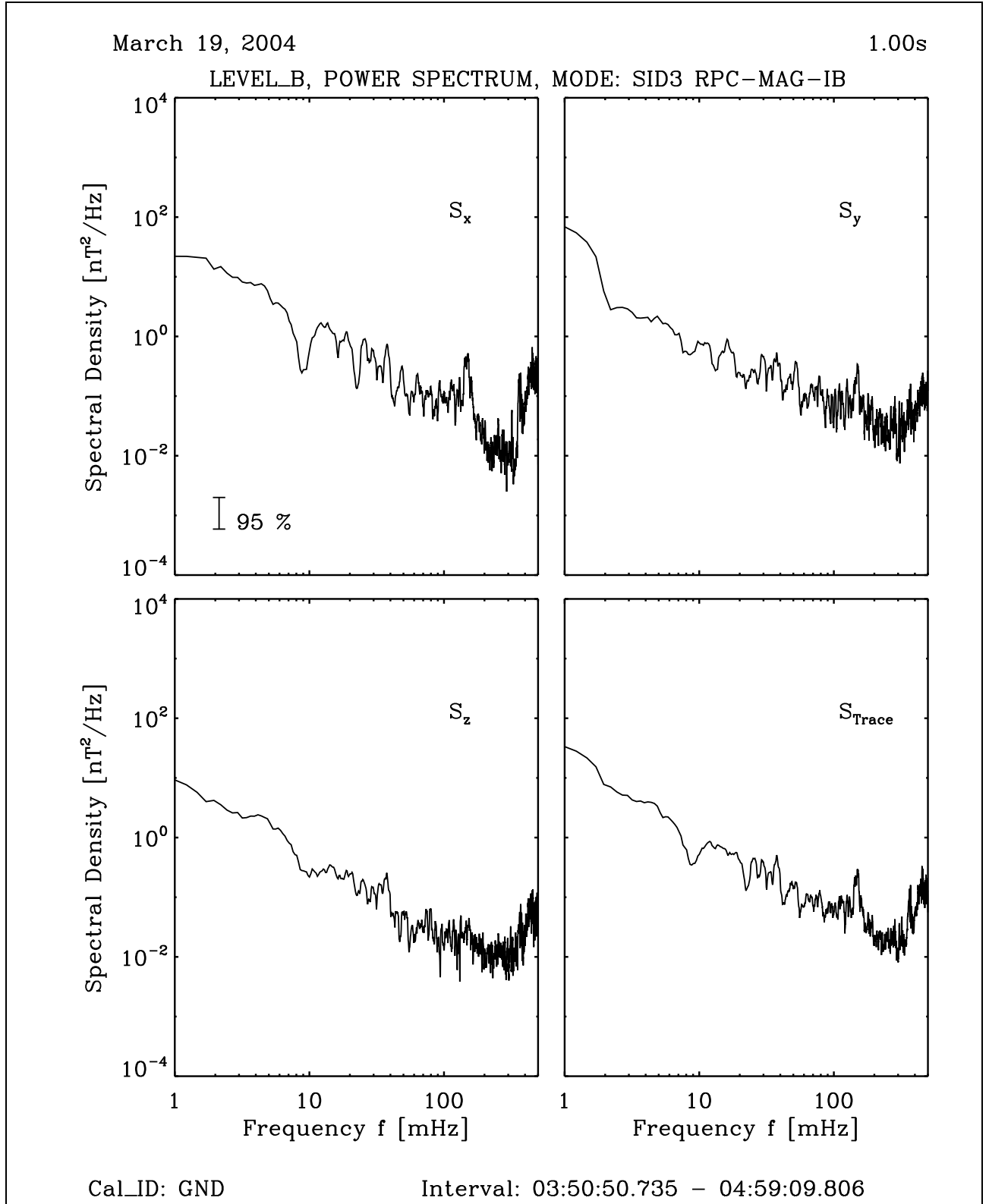


Figure 45: File: RPCMAG040319T0350_CLB_IB_M3_PS1_10000_GND

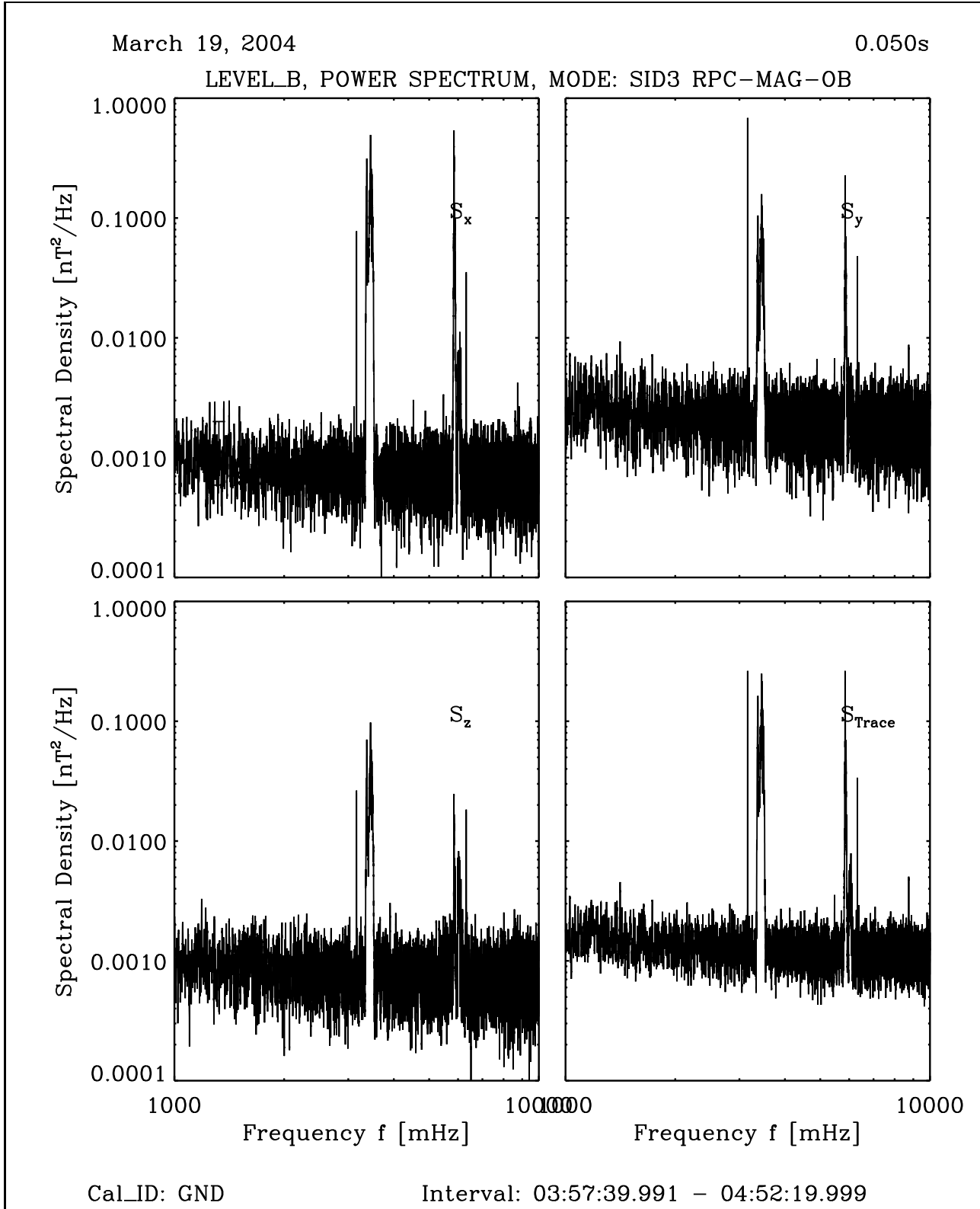


Figure 46: File: RPCMAG040319T0350_CLB_OB_M3_PS1000_10000_GND

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4.3 Plots of Calibrated Data using the new Temperature Model

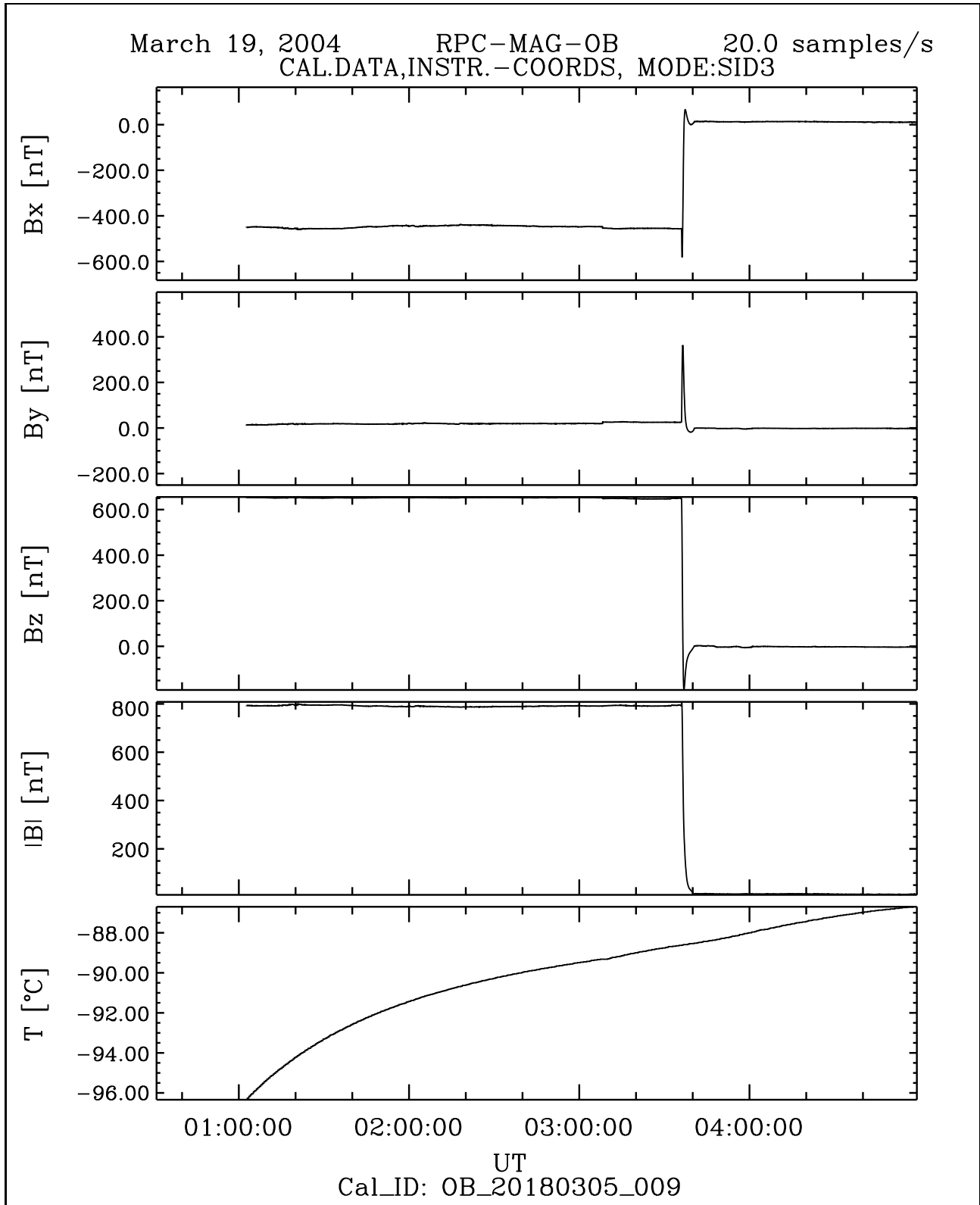


Figure 47: File: RPCMAG040319T0102-CLA_OB_M3-T0031_0459_009

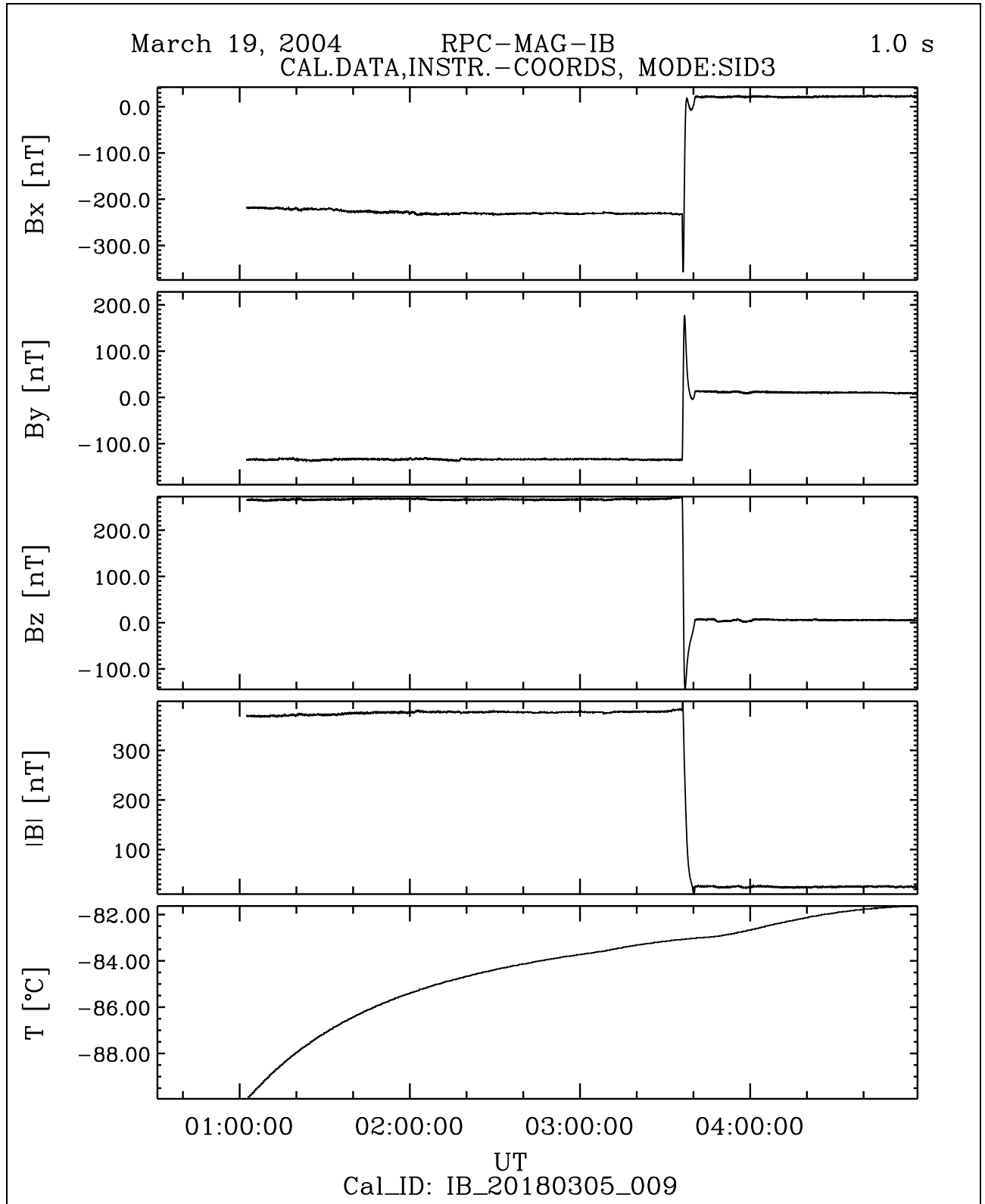


Figure 48: File: RPCMAG040319T0102_CLA_IB_M3_T0031_0459_009

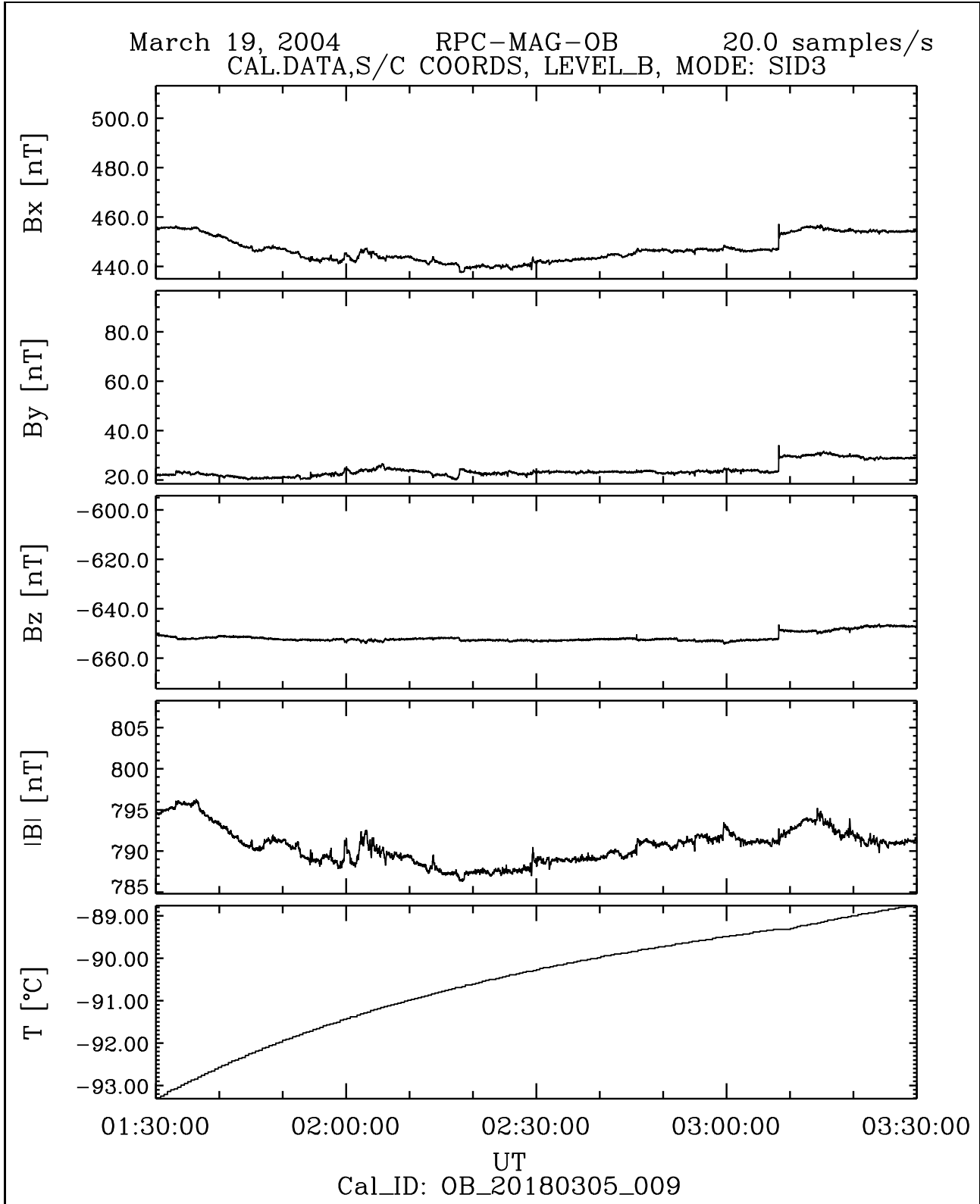


Figure 49: File: RPCMAG040319T0105_CLB_OB_M3_T0130_0330_009

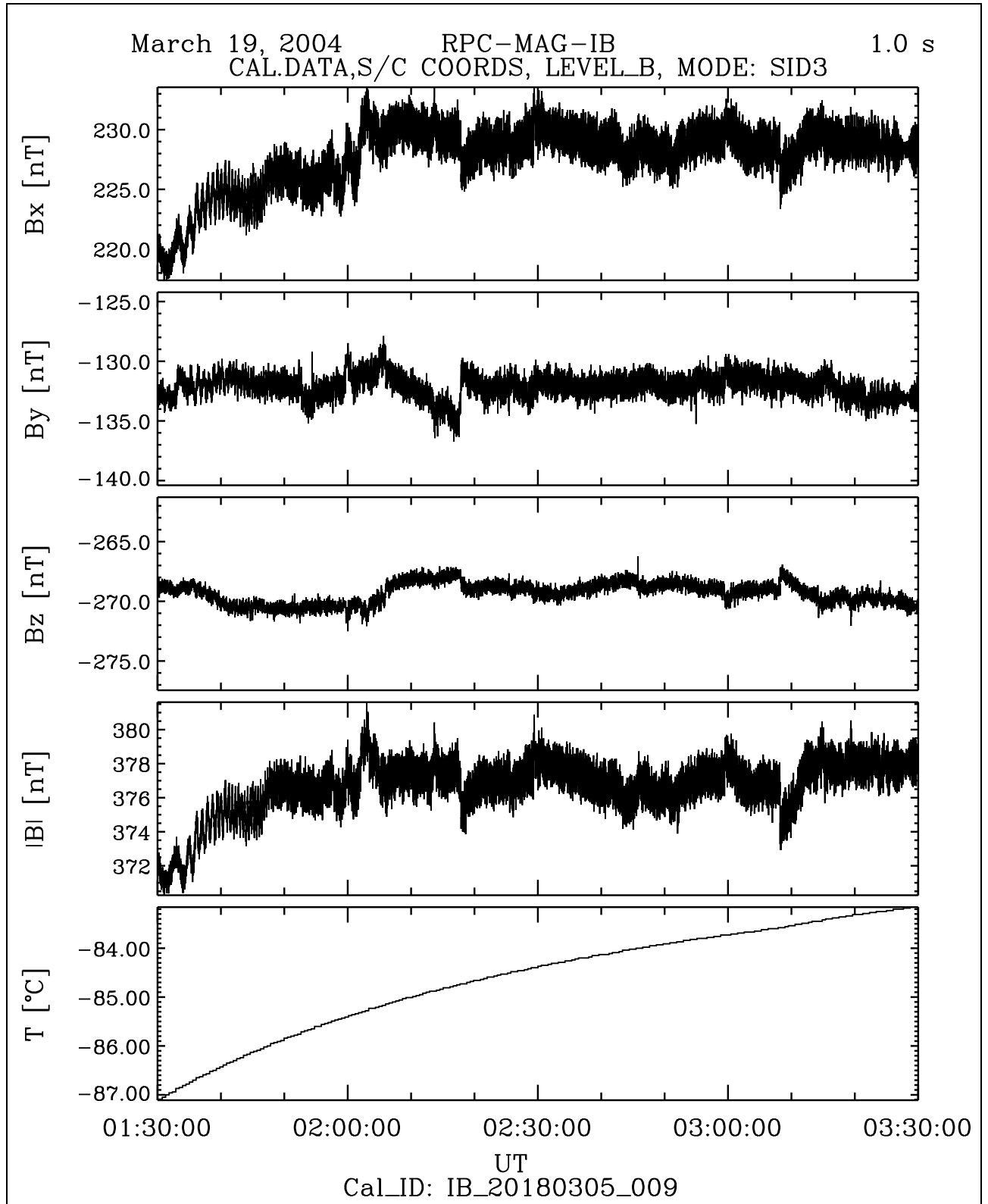


Figure 50: File: RPCMAG040319T0105_CLB_IB_M3_T0130_0330_009

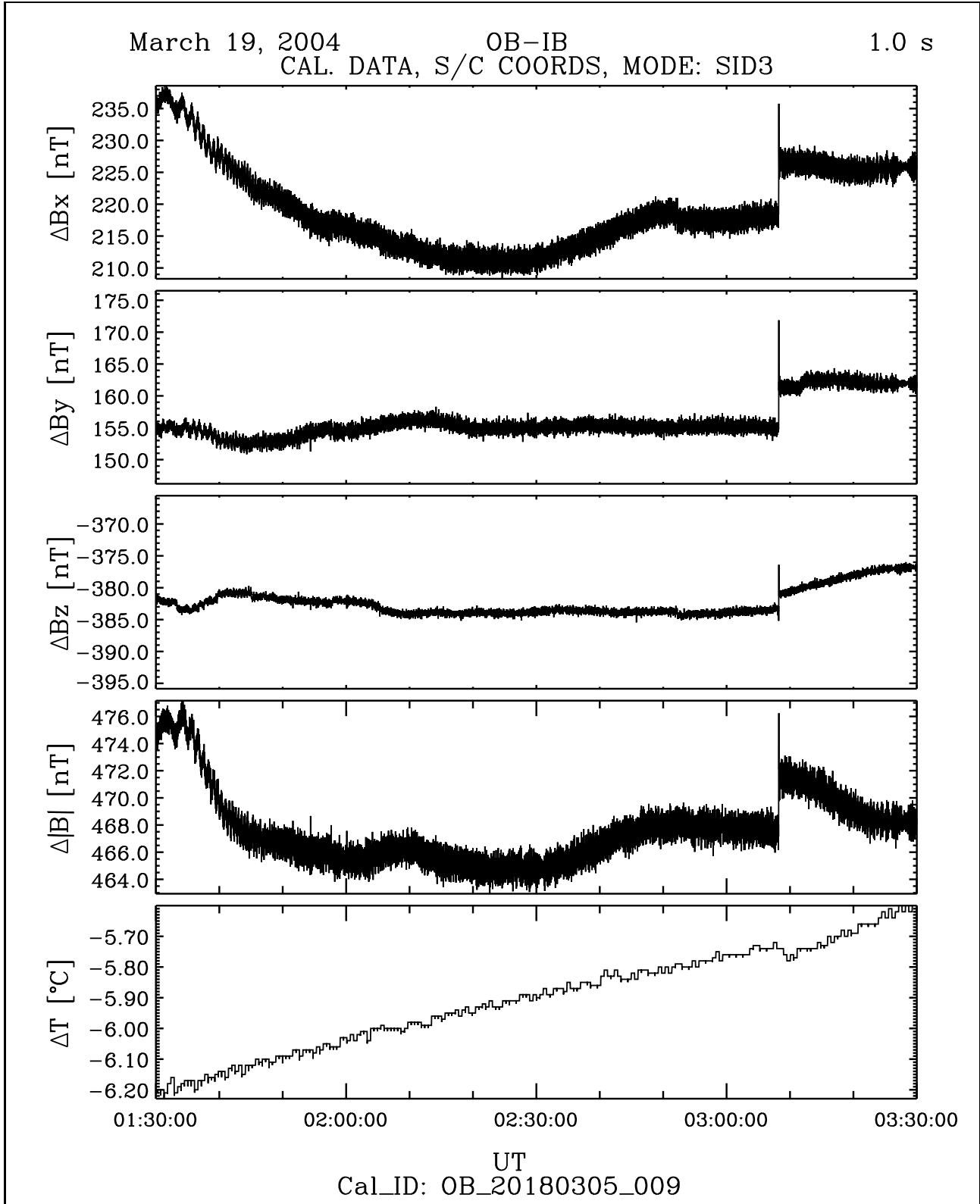


Figure 51: File: RPCMAG040319T0105_CLB_M3_DIF_P0130_0330_009

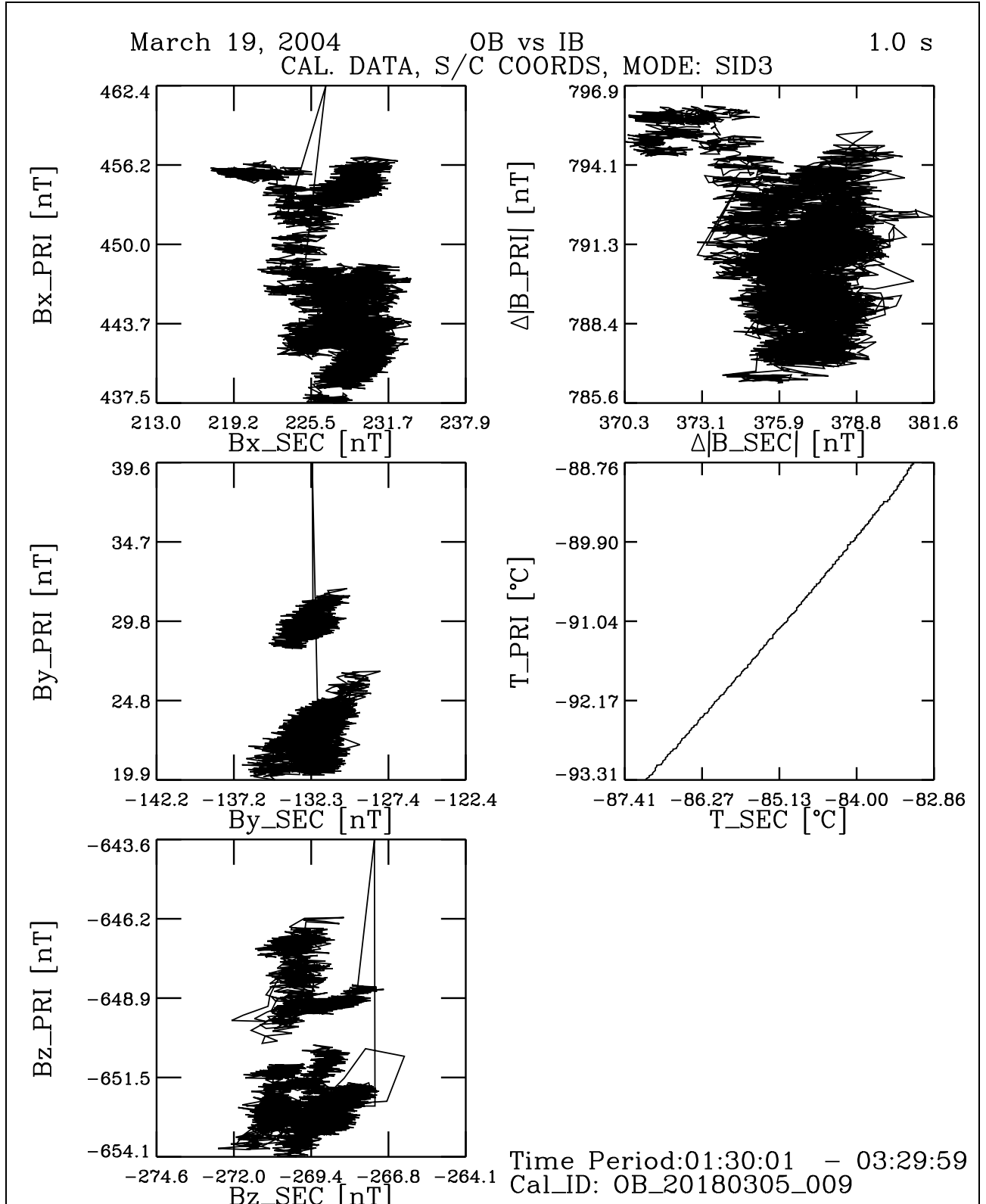


Figure 52: File: RPCMAG040319T0105_CLB_M3_XXYYZZ_P0130_0330_009

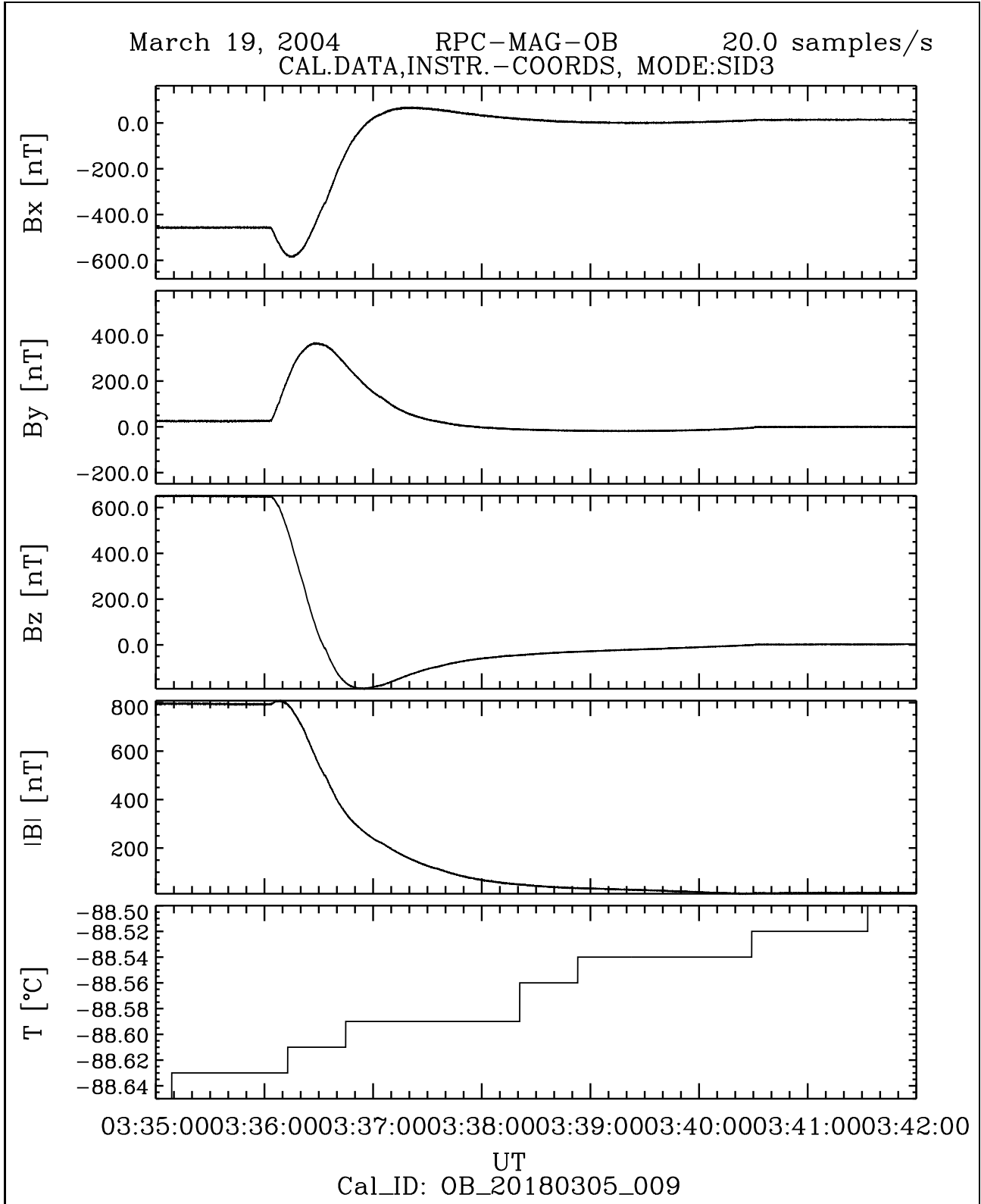


Figure 53: File: RPCMAG040319T0102_CLA_OB_M3_T0335_0342_009

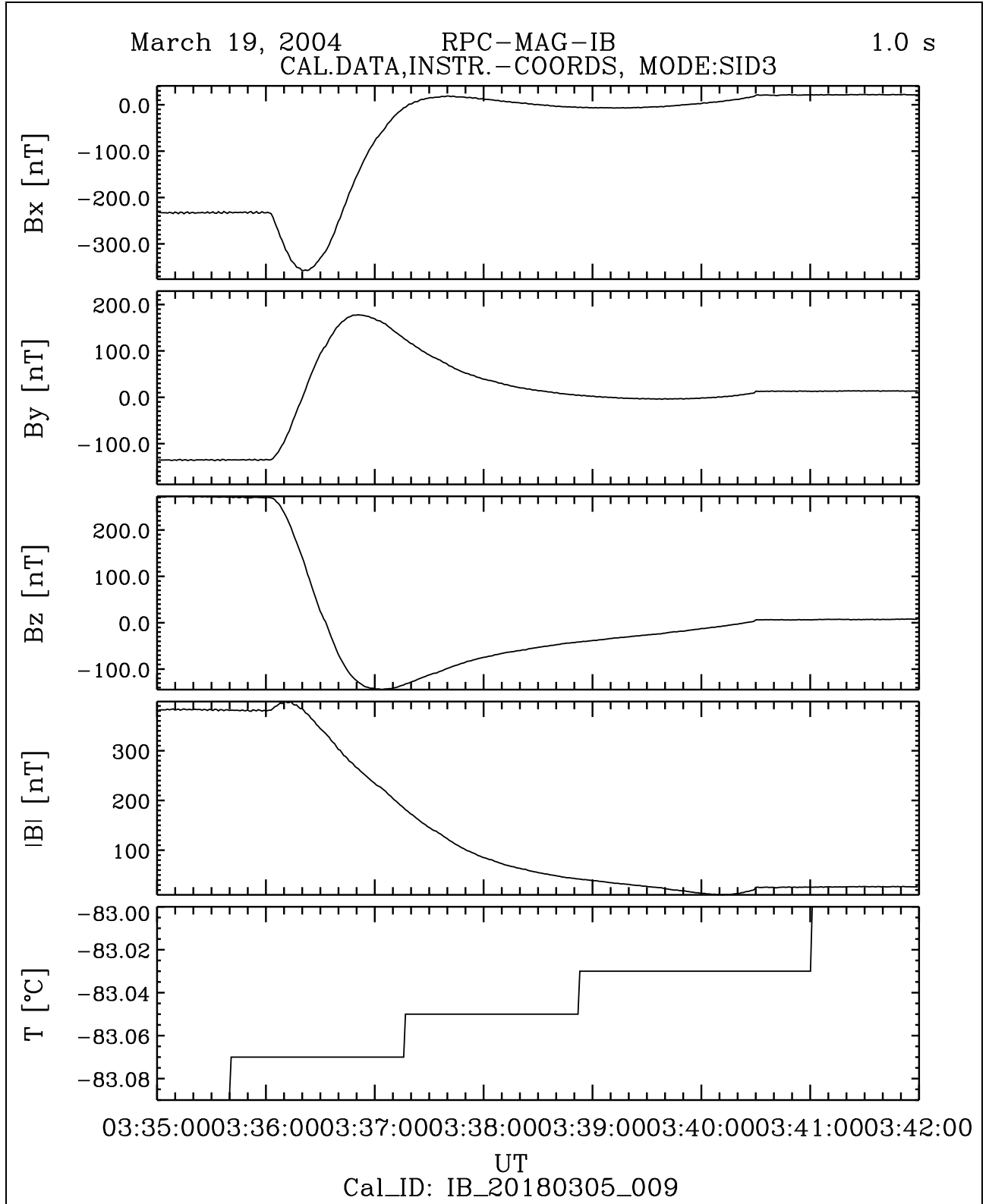


Figure 54: File: RPCMAG040319T0102_CLA_IB_M3_T0335_0342_009

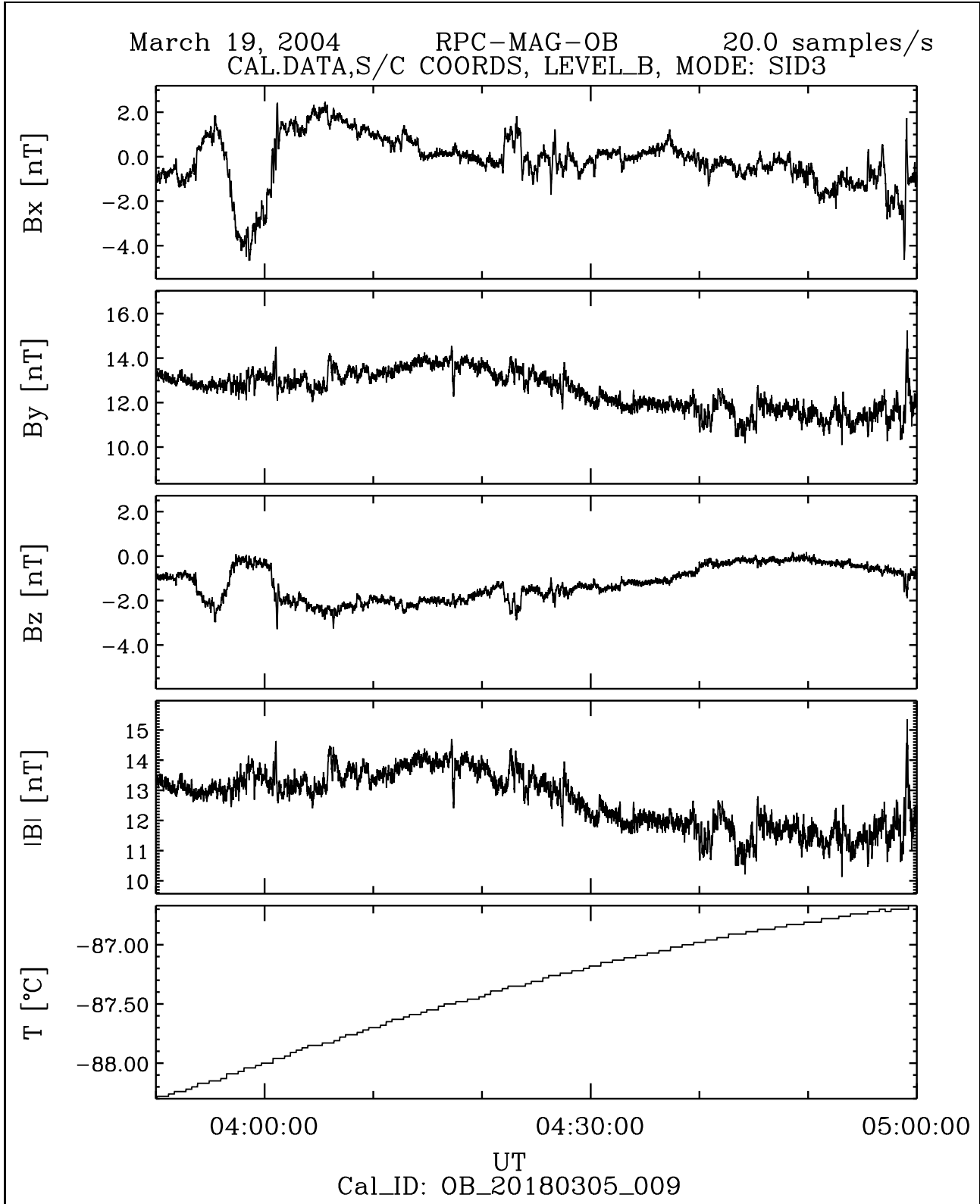


Figure 55: File: RPCMAG040319T0350_CLB_OB_M3_T0350_0500_009

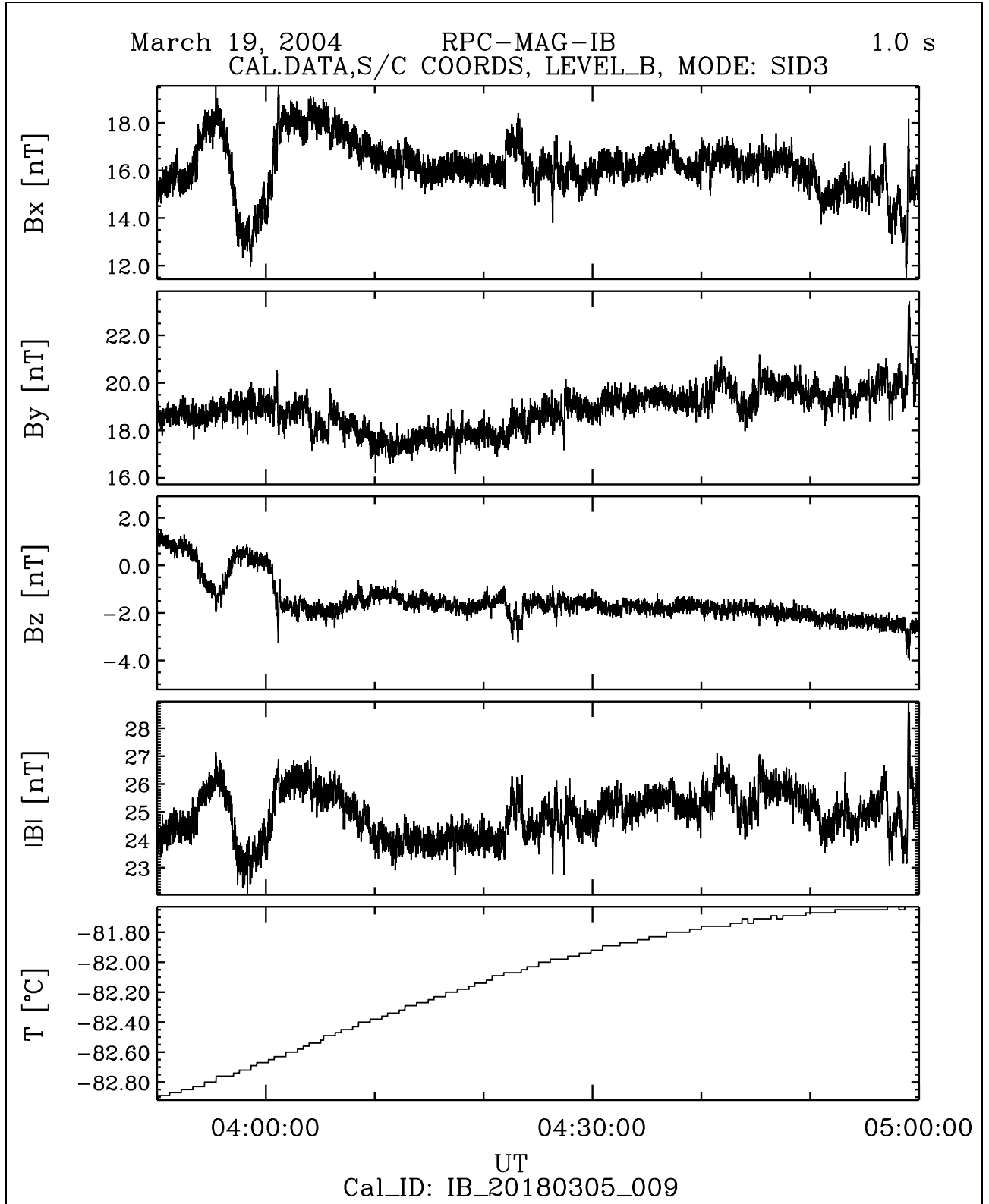


Figure 56: File: RPCMAG040319T0350_CLB_IB_M3_T0350_0500_009

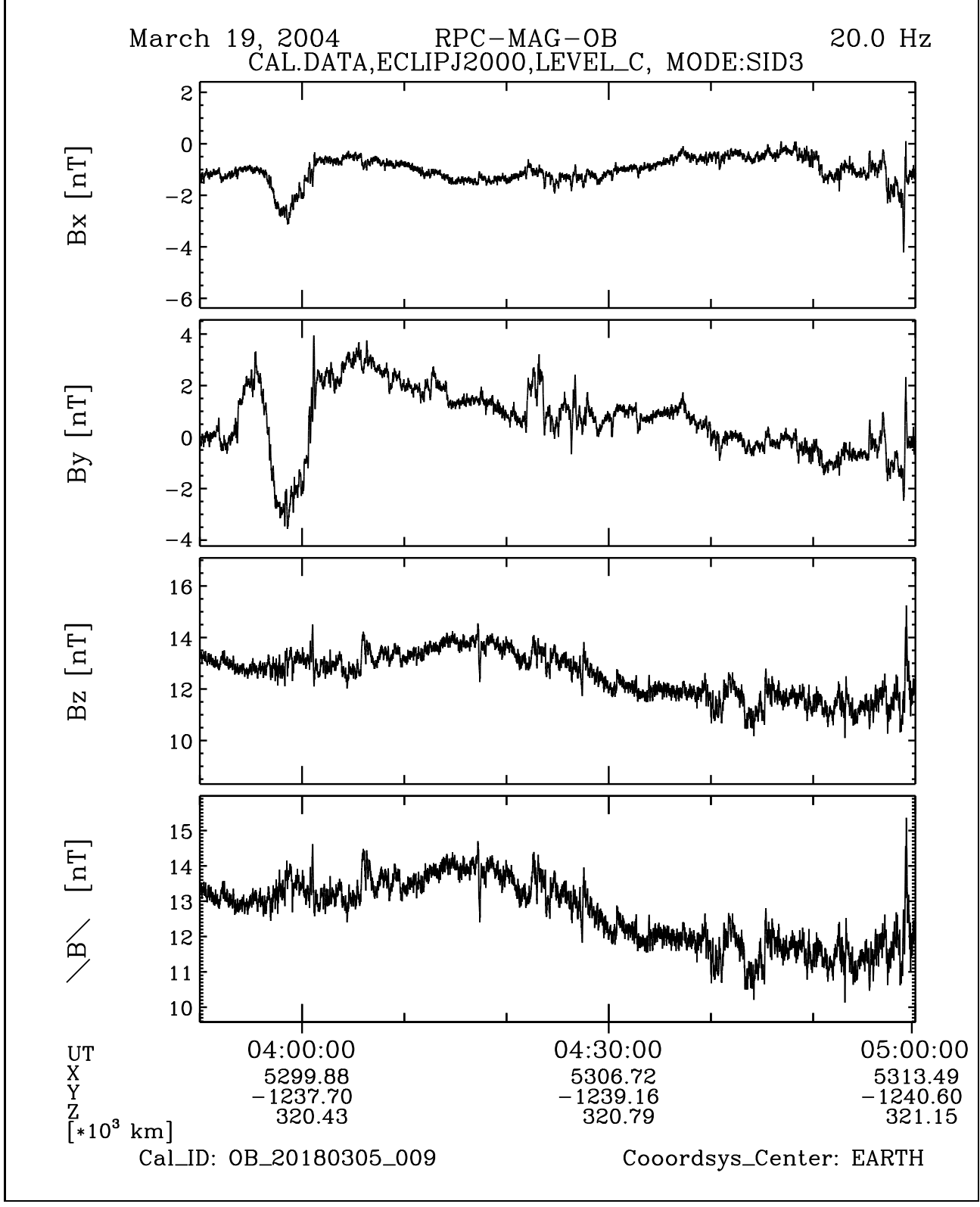


Figure 57: File: RPCMAG040319T0350_CLC_OB_M3_T0350_0500_009

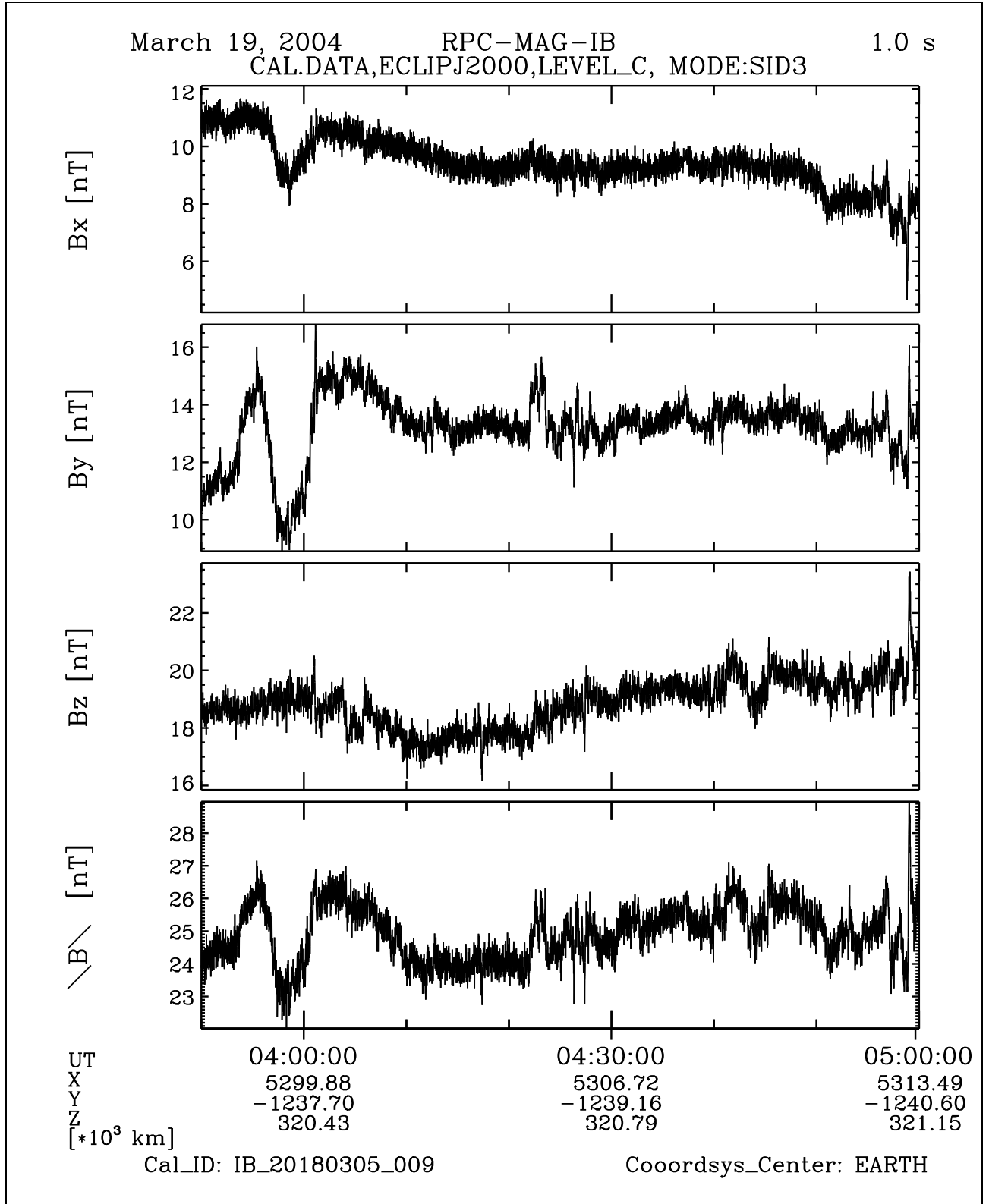


Figure 58: File: RPCMAG040319T0350_CLC_IB_M3_T0350_0500_009

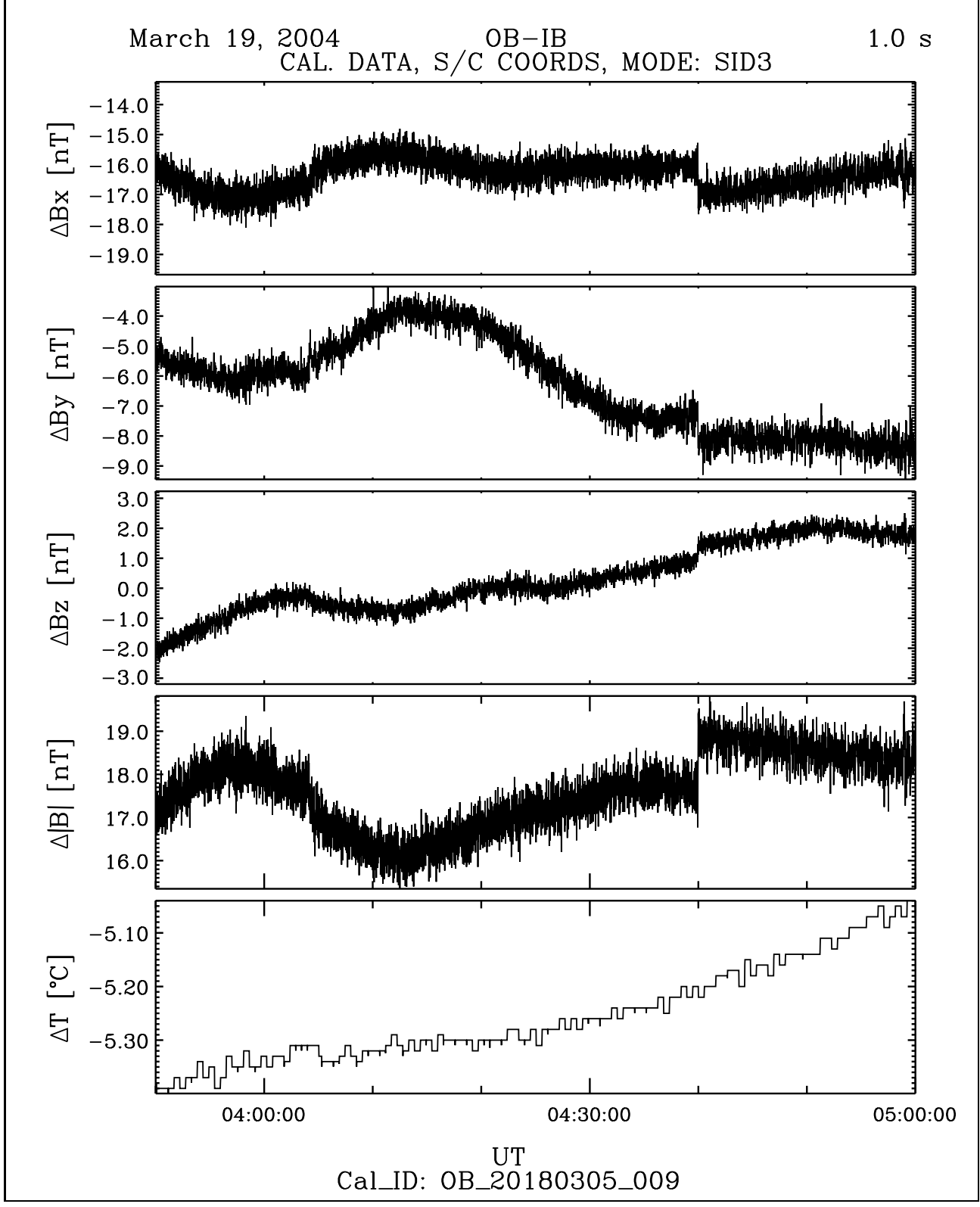


Figure 59: File: RPCMAG040319T0350_CLB_M3_DIF_P0350_0500_009

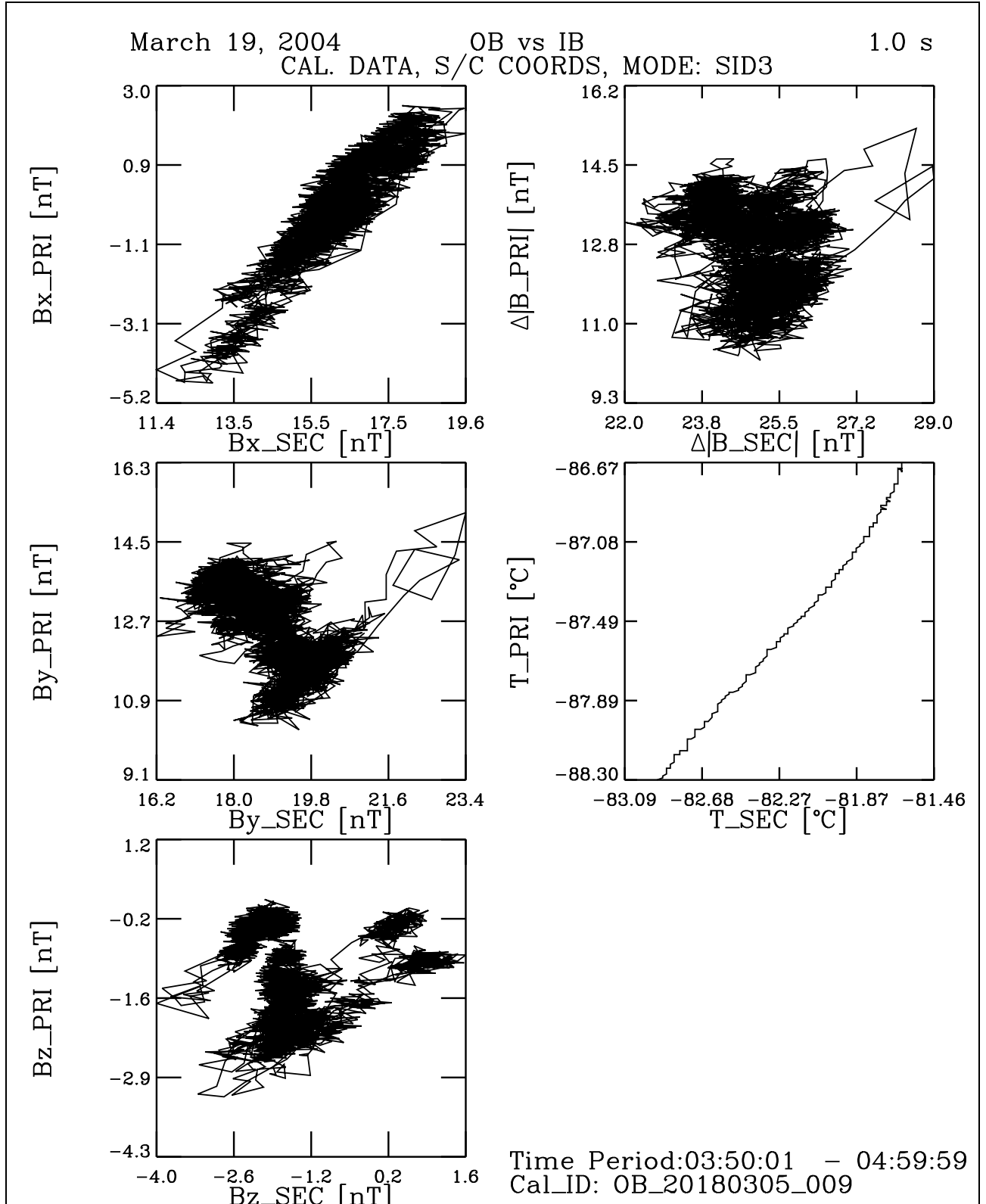


Figure 60: File: RPCMAG040319T0350_CLB_M3_XXYYZZ_P0350_0500_009

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4.4 Plots of ROSETTA's Reaction Wheels Speeds

The following plots show the time series of the revolutions of the 4 reaction wheels. Two kinds of data are shown:

- The original reaction wheel data as they are stored in the DDS.
- The theoretical response of the wheels impact seen by an instrument sampling with different frequencies. Here the response at 20 Hz and 1 Hz sampling frequency is plotted.

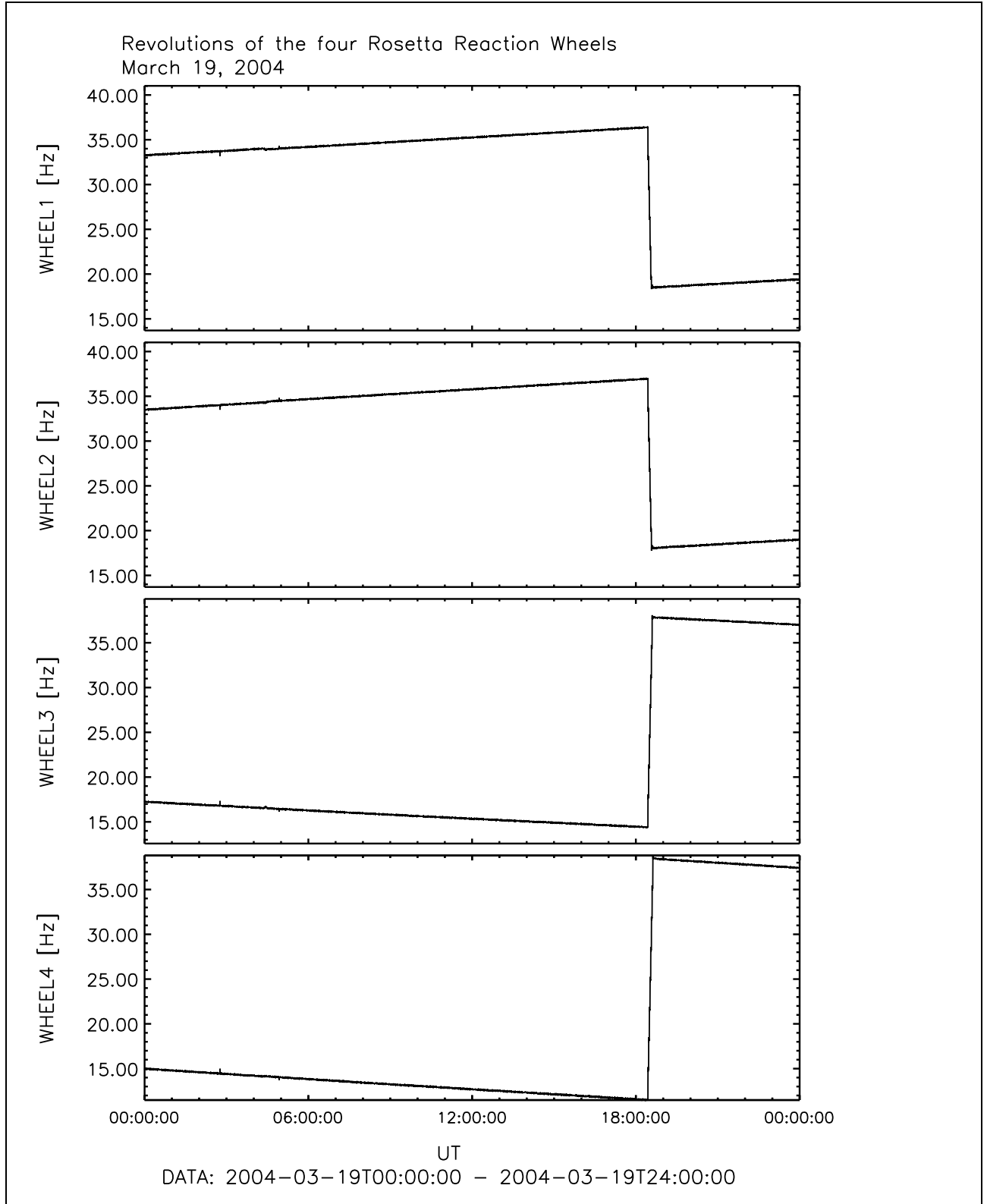


Figure 61: File: wheels_Hz2004-03-19T00-00

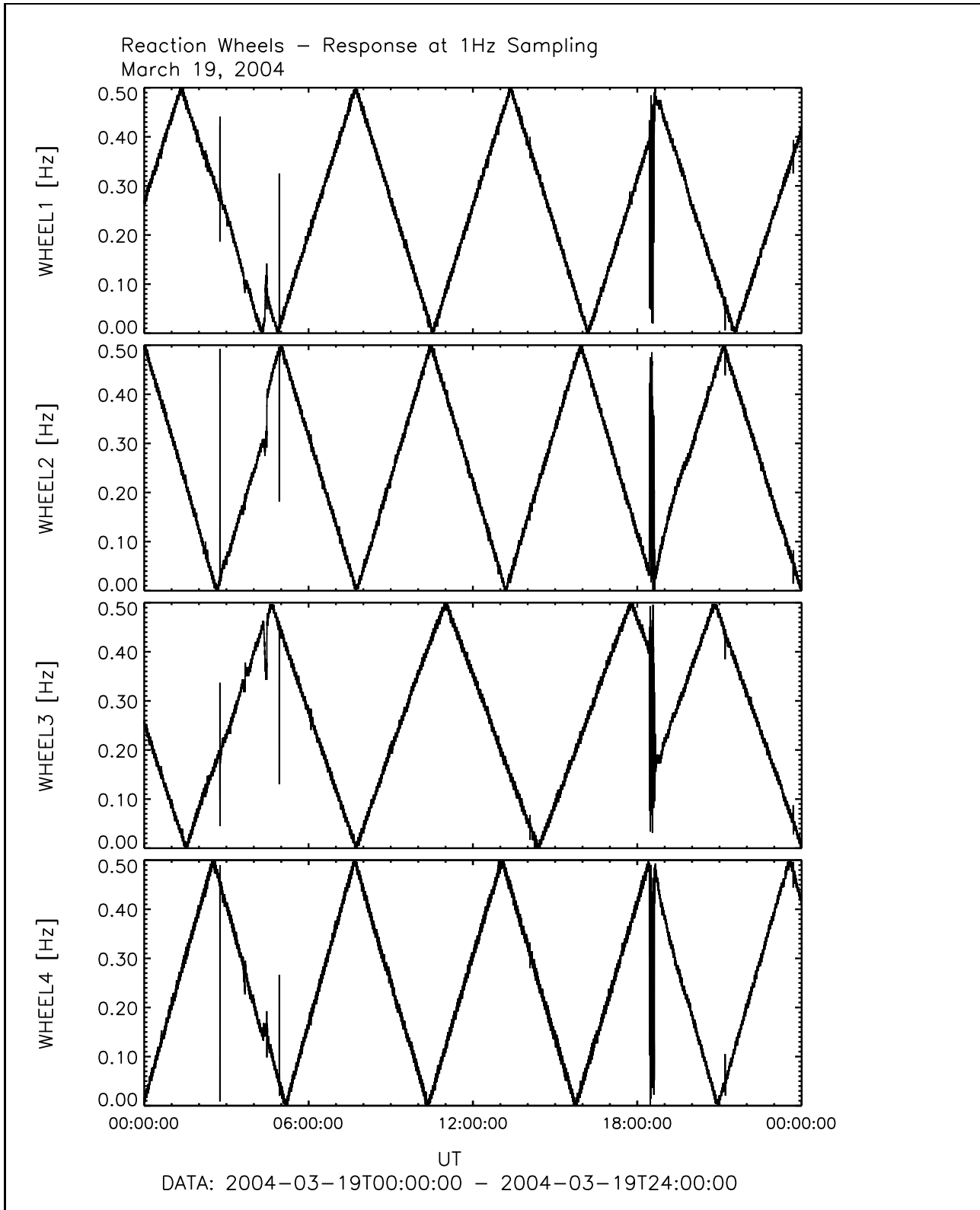


Figure 62: File: wheels_1Hz_Sampling2004-03-19T00-00

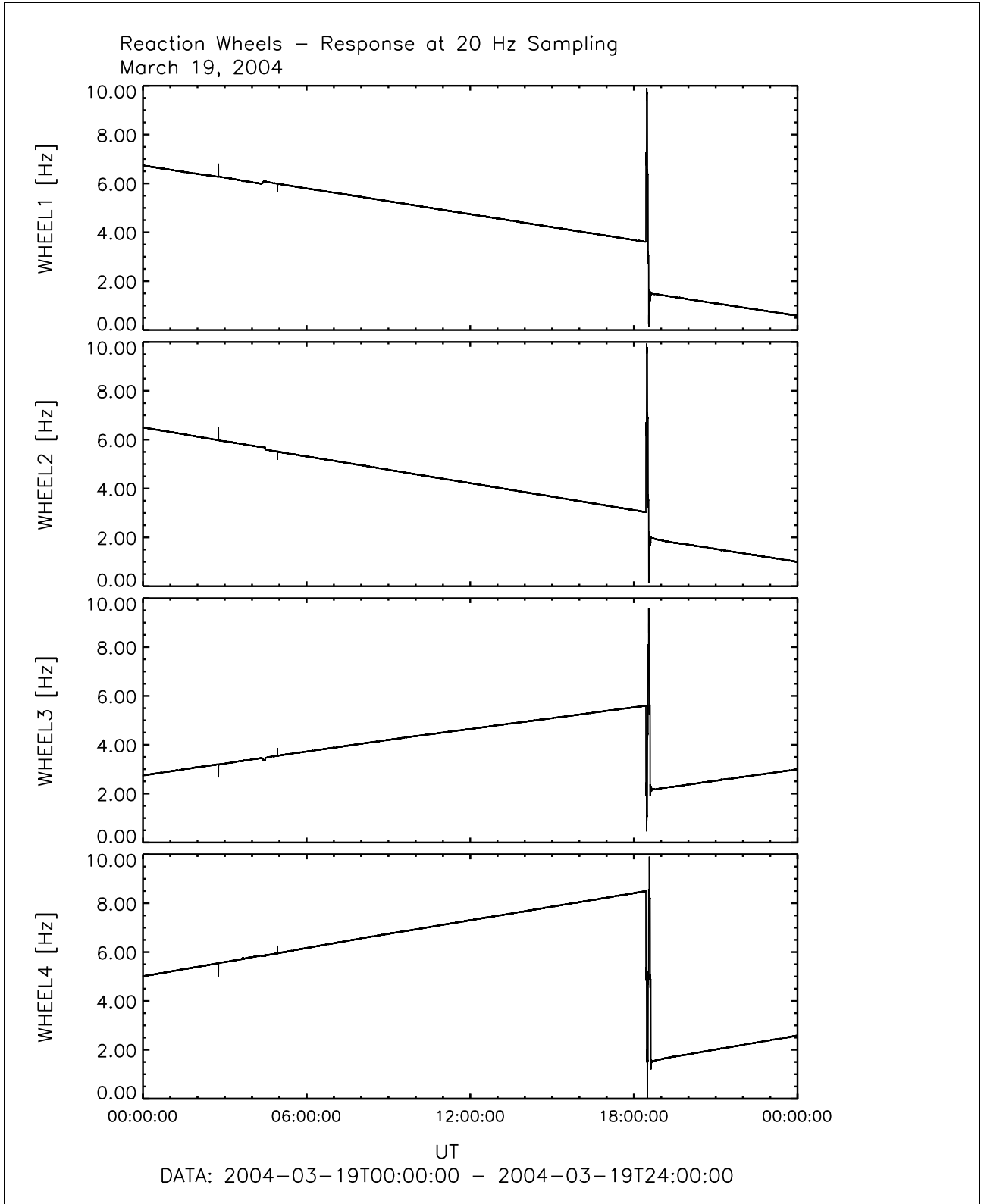


Figure 63: File: wheels_20Hz_Sampling2004-03-19T00-00

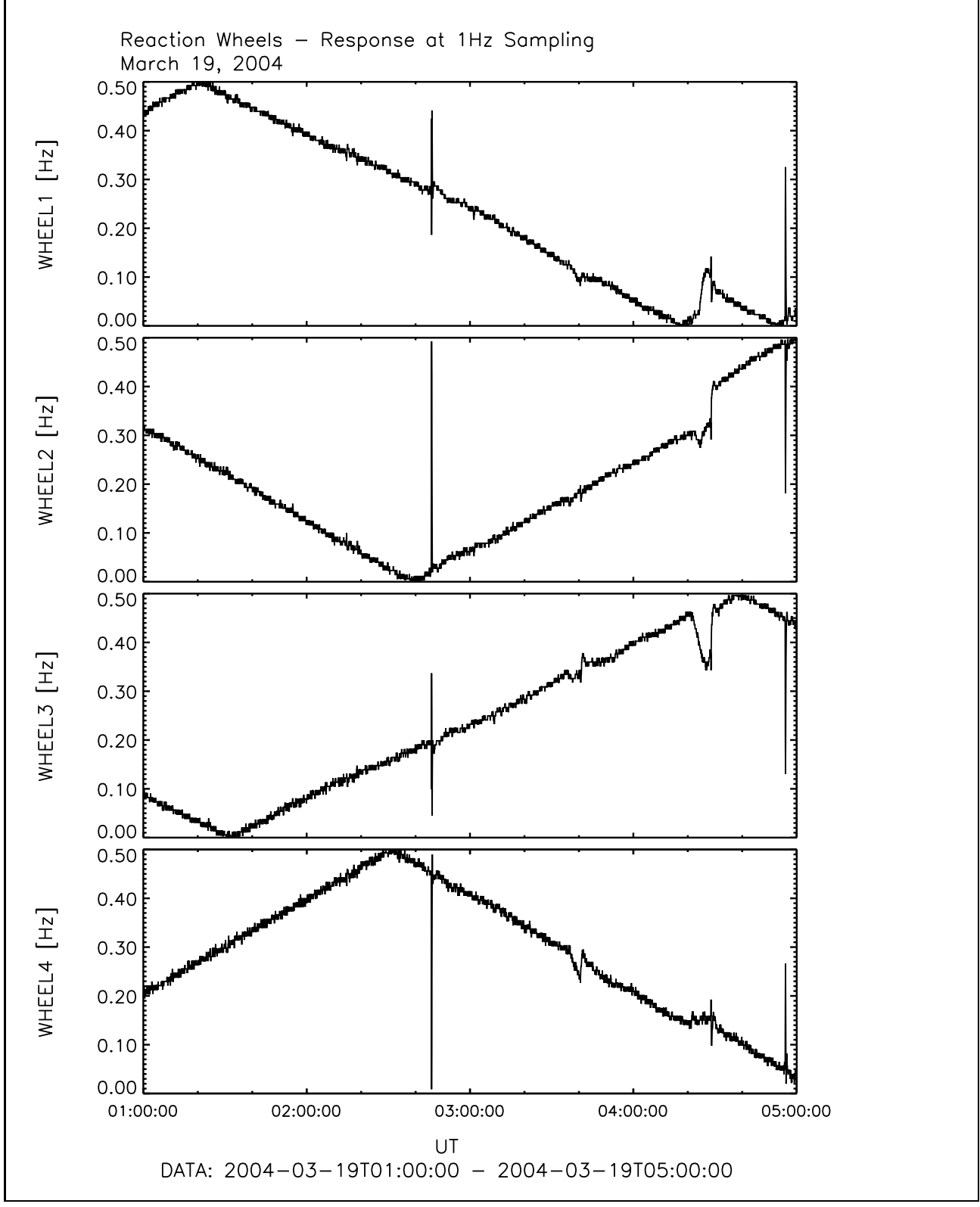


Figure 64: File: wheels_1Hz_Sampling2004-03-19T01-00

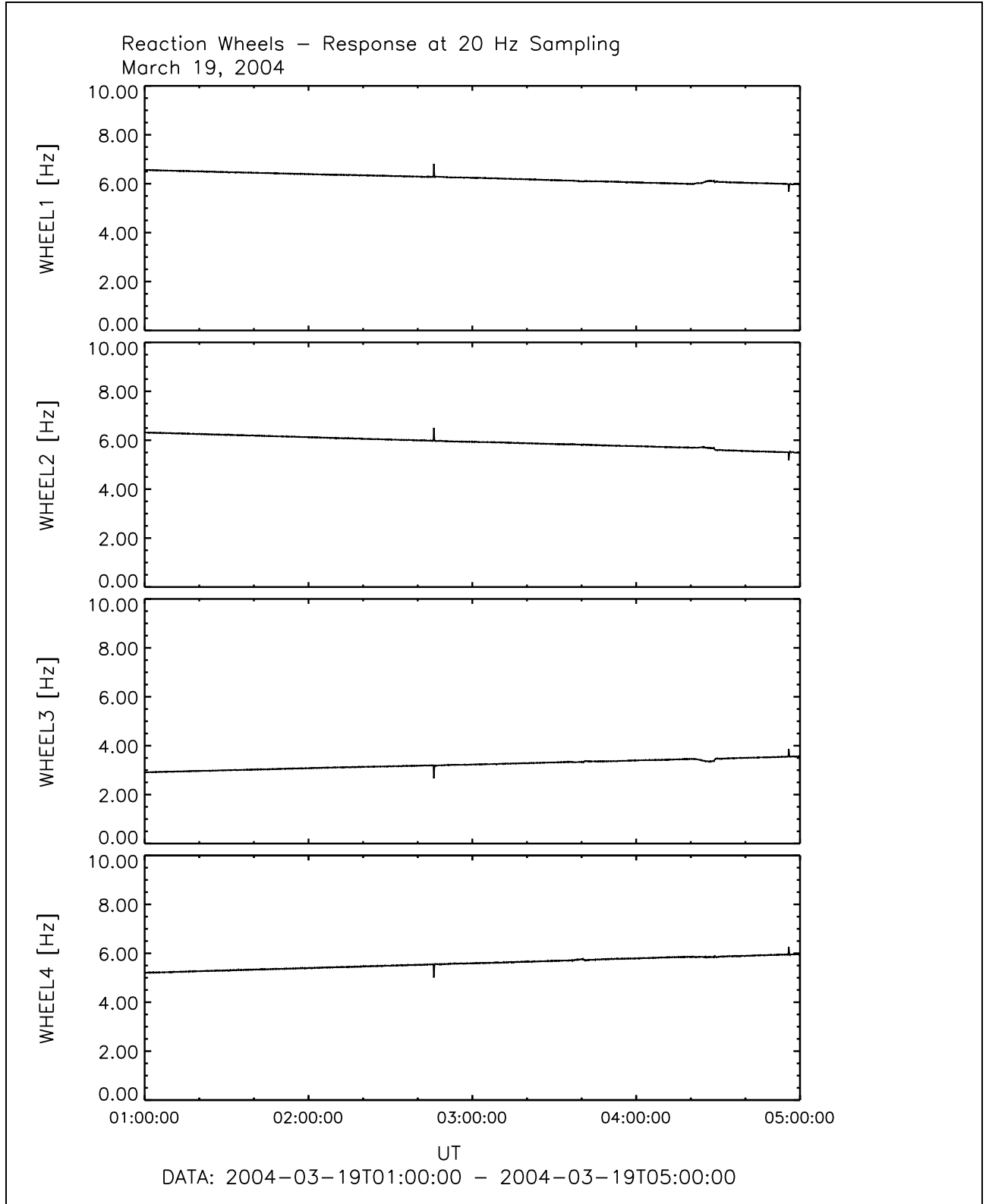


Figure 65: File: wheels_20Hz_Sampling2004-03-19T01-00