Imperial College London

MAG Data Release Report 2309

20 December 2023 (report covers data release for 1 September – 30 September 2023)

Report Version	1	L2 ground processing software version:	V2.26.1
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Data Summary

MAG was powered on for September. Burst Mode (BM) was available at 64 vectors/s for 24 hours per day.

A short period of 4 minutes has been quality flagged to level 2 on 13/09/2023 13:38. This is due to a solar array movement disturbing the thermal environment of the boom and affecting the sensor offsets. We have set the quality flag this to level 2 during this period as we are not confident that we have captured and corrected the impact on the offset. During perihelion the magnetic signature from our MAG heaters become more difficult to capture as the thermal environment of the boom changes. This is acute in periods where there is a smaller magnitude of magnetic field. This has occurred between 10/09/2023 15:00 - 11/09/2023 03:30 and this data has therefore been quality flagged to level 2. Please see the Residual MAG heater signal section below.

There were some small data gaps on the 6th and 3rd due to some downlink issues.

There was a large CME between 6th-7th with a magnitude of ~140nT.

The spacecraft started the month at 0.69AU on the 1st of September and at the end of the month it was at 0.34AU from the Sun.

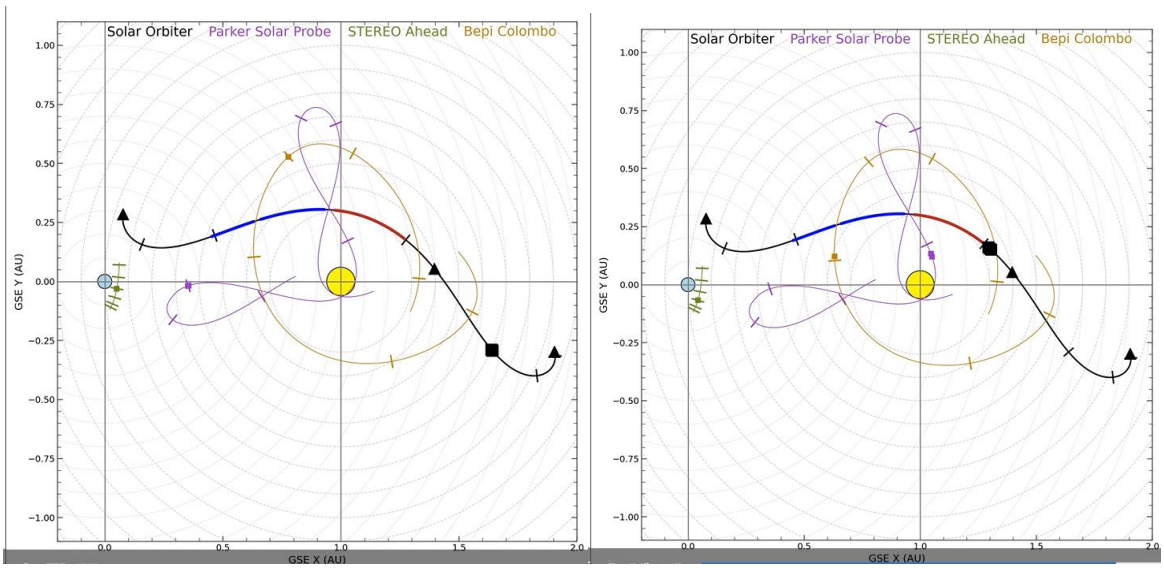
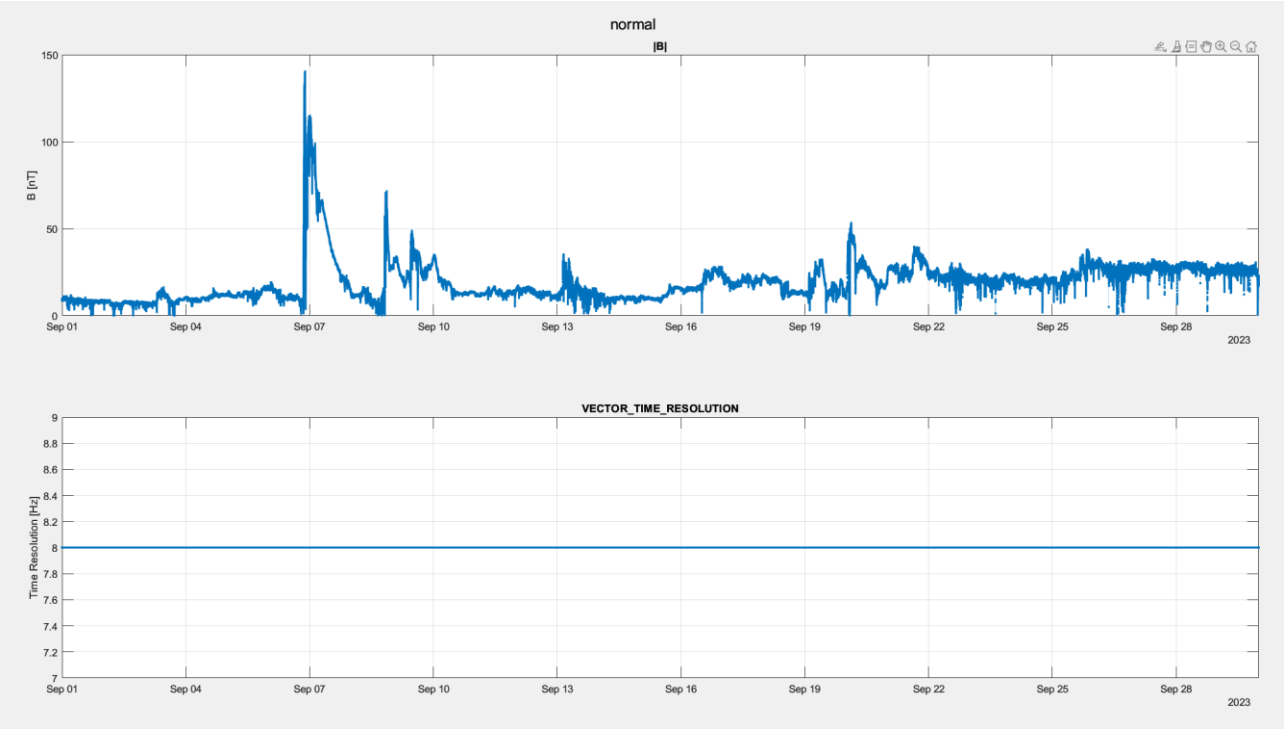
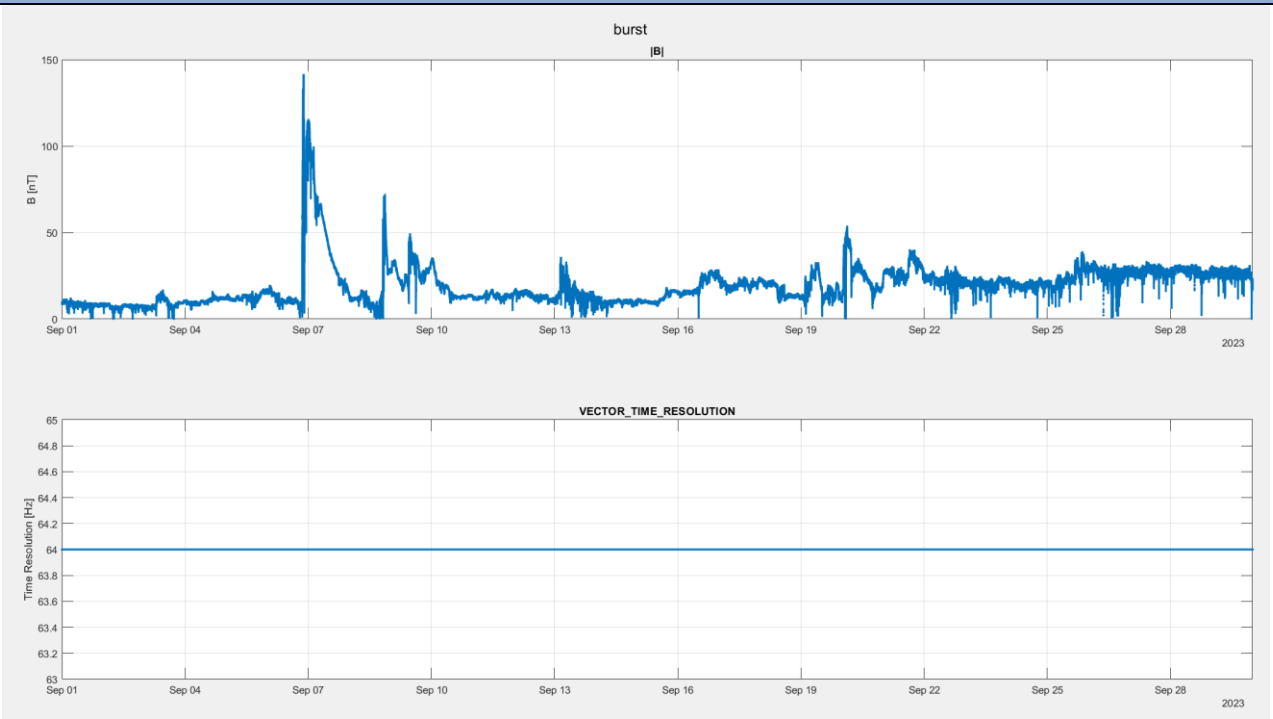


Figure 1 - Orbit plot Sep 1 (left) and Sep 30 (right) where Solar Orbiter is represented by the black square.

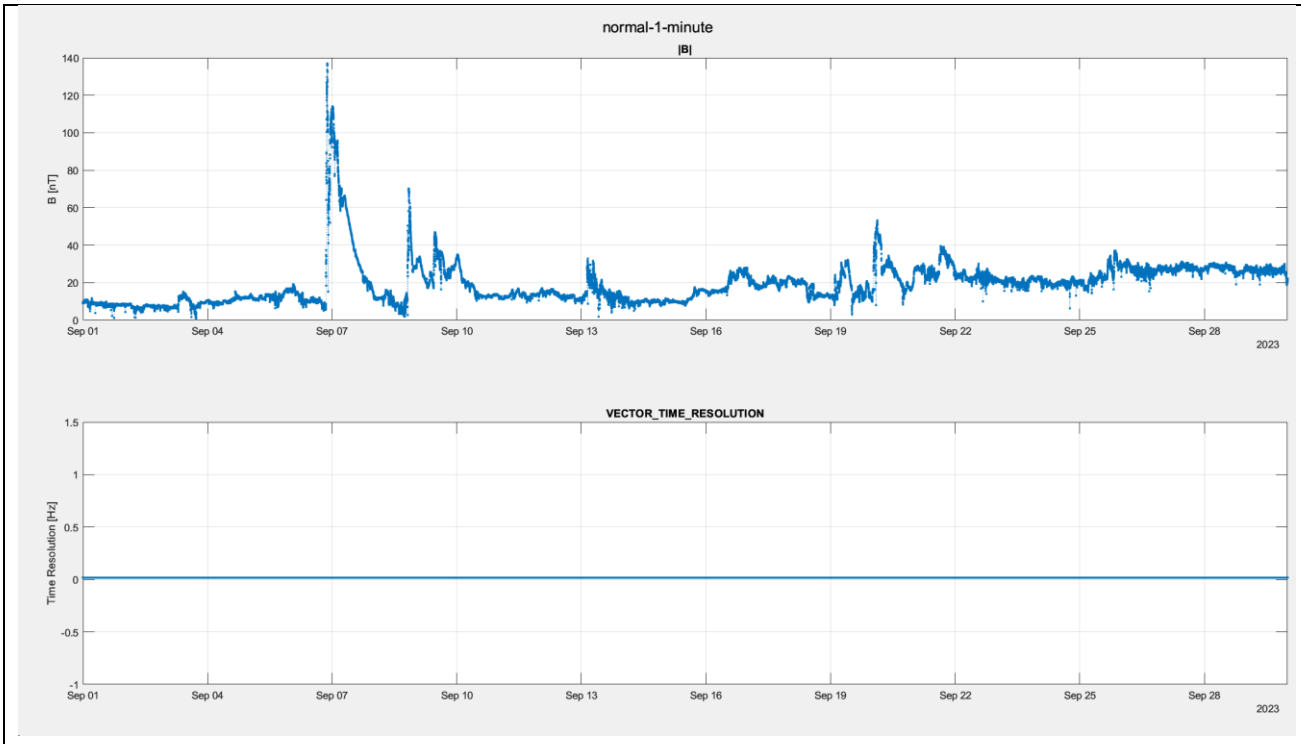
Normal Mode		
		
Operations	1 September – 30 September	Science phase throughout period, normal data produced.
Operational Events of Note		

Burst Mode

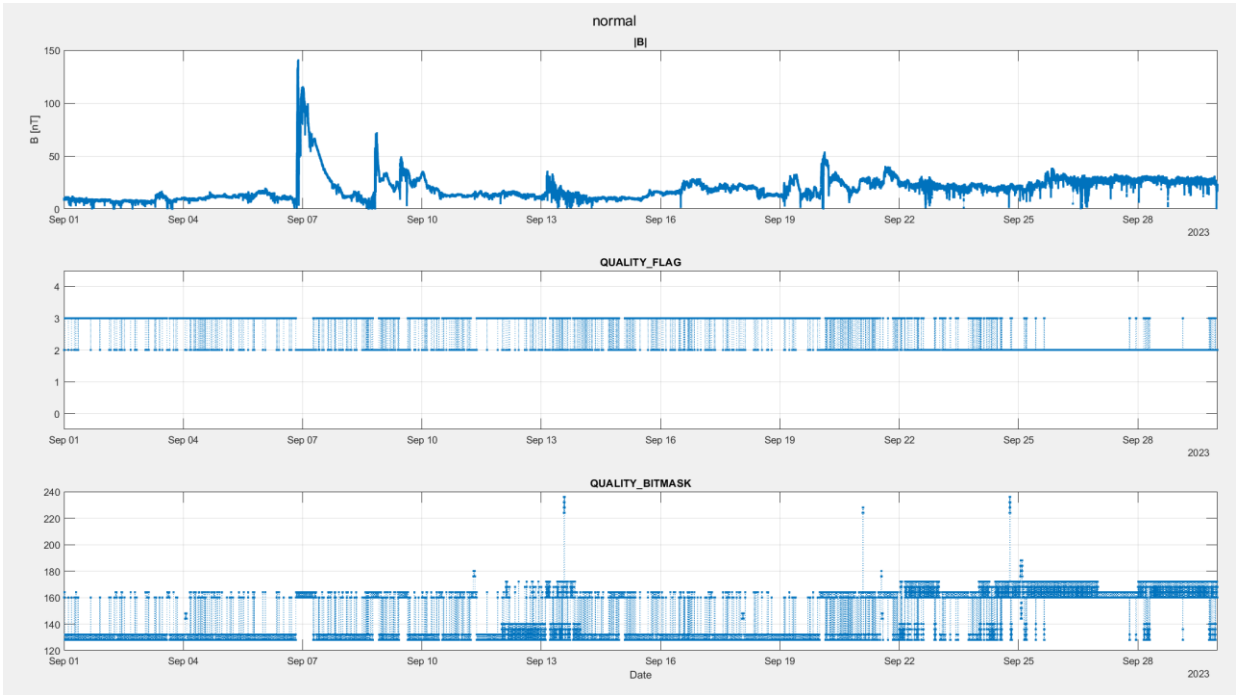


Coverage	From	To	Coverage
	01/09	30/09	24h per day of 64 vectors/s

Normal – 1min



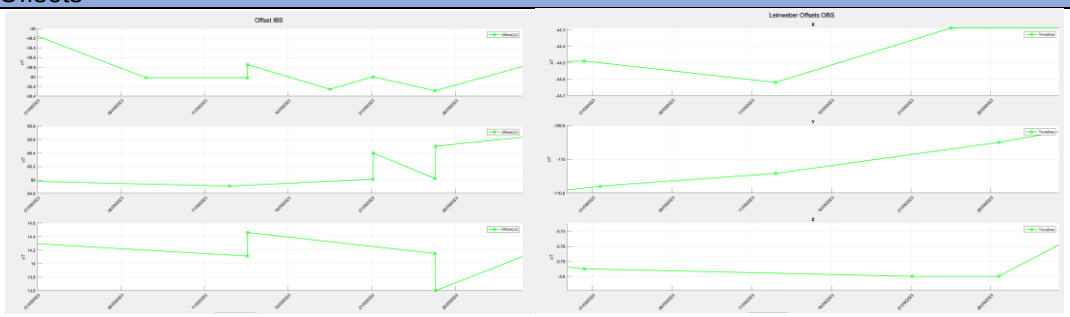
Quality bitmask



Quality bit mask events

SC events which disturb the field	1. Solar array movements (solar array angle is changed, and then remains at new angle due to sun-SC distance thermal constraints) 2. High gain antenna movements 3. Battery Top Up
SC related issues	13/09/2023 13:38 - 13:42 : SA event affecting the thermal environment of the boom, especially in IBS. 11/09/2023 06:00 - 09:00 : Battery top up event interference affecting IBS 10/09/2023 15:00 - 11/09/2023 03:30 : Heater profile signature visible

Offsets

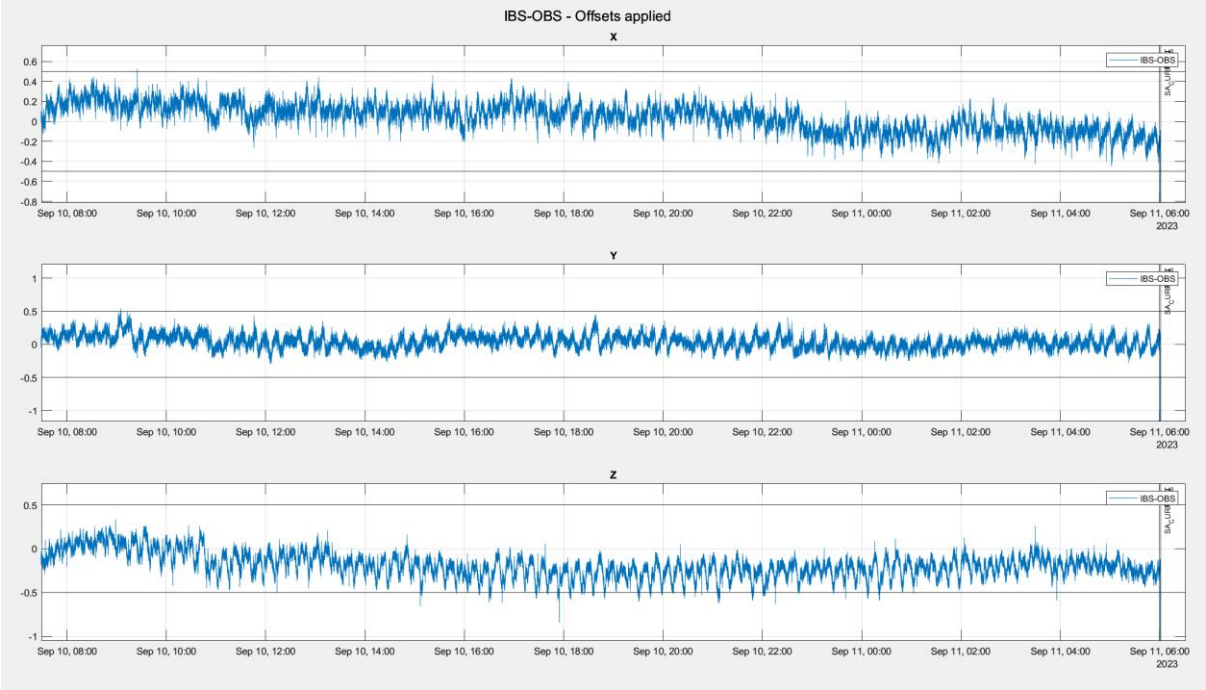


1 Sep – 30 Sep:
The OBS Z offsets were very stable throughout September, changing by less than 1nT. OBS Y shows the recovery in the offset since the last MAG OFF event in May. The OBS X offset changed in the middle of the month, recovering closer to perihelion at the beginning of October, most likely due to the change in thermal environment. The IBS offsets were disturbed by several SA events, especially on the 13th , 21st and the 24th.

OffsetNumber	Date	OBSX	OBSY	OBSZ	IBSX	IBSY	IBSZ	Comment
220989	29/08/2023 12:00		-110.48		-49.09			OBS Y,IBS X trend
220990	31/08/2023 12:00	-44.49		-5.79	-49.09	84.98	14.3	
220991	01/09/2023 12:00		-110.4					OBS Y trend
220993	07/09/2023 12:00				-50.02			IBS X trend
220995	12/09/2023 12:00	-44.62	-110.21			84.91		OBS X,Y trend IBS Y trend
220996	13/09/2023 13:38				-50.02		14.11	SA movement affecting IBS
220997	13/09/2023 13:42				-49.75		14.46	IBS X,Z trend
221000	18/09/2023 12:00				-50.26			IBS X trend
221002	21/09/2023 01:38				-50	85.01		SA movement affecting IBS
221003	21/09/2023 01:55			-5.8		85.4		OBS Z and IBS Y trend
221004	23/09/2023 12:00	-44.29						OBS X trend
221005	24/09/2023 18:23				-50.29	85.02	14.15	SA movement affecting IBS
221006	24/09/2023 19:33					85.5	13.6	IBS Y,Z trend
221007	26/09/2023 12:00		-109.75	-5.8				OBS Y,Z trend
221008	30/09/2023 12:00	-44.29			-49.74		14.15	OBS X, IBS X,Z trend

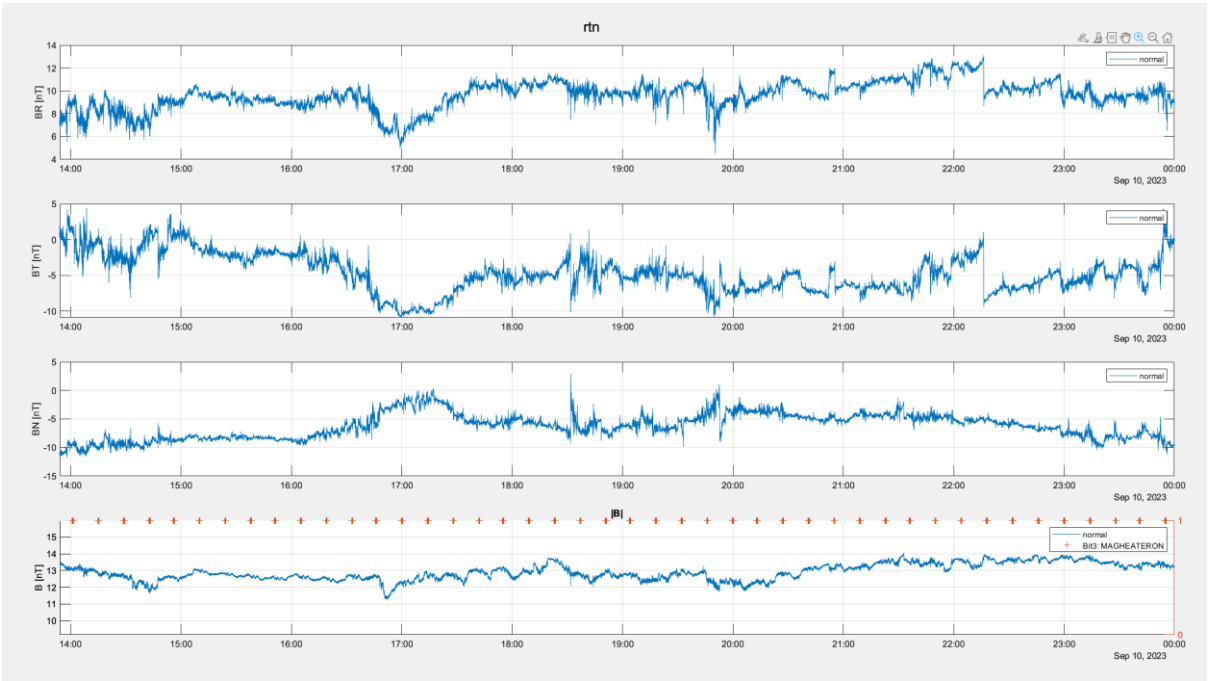
Residual MAG heater signal

Interference from the MAG heater is routinely characterised and removed from the data. This removal is not perfect, and there is evidence in the MAGIBS-MAGOBS data (shown below) that some residual level of signal is still present in the archive data on 10/09. The magnitude of this error in the released archive data will be less than the error presented below in IBS-OBS. The heater cycle is ~15 minutes, and heater on/off status is reported in the quality bitmask.



Example of heater generated interference as seen in the MAGIBS-MAGOBS time series for September 10 2023. Y axis is in nT.

Analysis was undertaken to look at the magnitude of the natural signal against the heater interference signature, and typically the natural signal is much higher than the error profile from the heater.
At very quiet times (particularly on 10/09) there is some evidence of the heater operation in the field magnitude:



When looking at the components, the heater signal is much less than the natural magnetic field.

Therefore, the data has been released with a quality flag.

Appendix

Appendix A: Files within this release

Filename
solo_L2_mag-rtn-burst_20230901_V01.cdf
solo_L2_mag-rtn-burst_20230902_V01.cdf
solo_L2_mag-rtn-burst_20230903_V01.cdf
solo_L2_mag-rtn-burst_20230904_V01.cdf
solo_L2_mag-rtn-burst_20230905_V01.cdf
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