Imperial College London

MAG Data Release Report 2006

30 September 2020 (report covers data release for 1 Jun - 30 June 2020)

Report Version	1.0	L2 software version:	1.3
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Data Summary

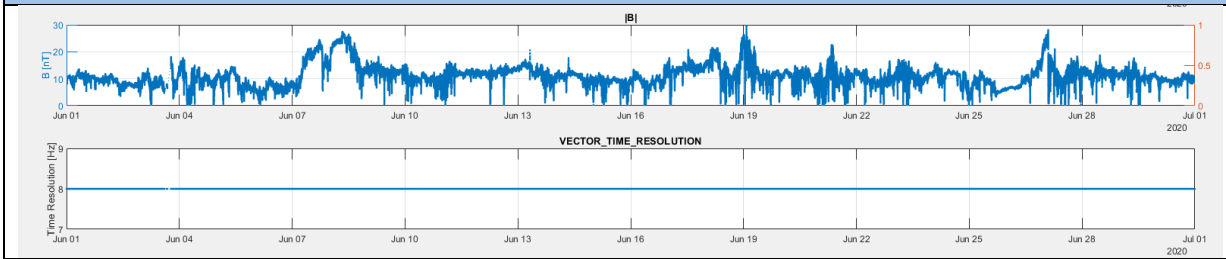
The operational philosophy of the MAG instrument was to be on throughout the period. 14 June 2020 saw the transition from the spacecraft commissioning phase (where a lot of spacecraft systems were being tested, and consequently there were more activities which can lead to magnetic interference) to cruise phase (where the spacecraft was in general executing fewer activities). The transition to cruise coincided with the first perihelion pass of 0.52AU on 15 June.

During the commissioning period, MAG was allocated sufficient telemetry to operate in burst mode at 128Hz for both the outboard and inboard sensors for the whole period. When transitioning into cruise phase, the MAG telemetry allocation was reduced: normal mode is continuous throughout, but burst mode is reduced to a number of hours per day.

The L2 MAG data products are based on the data collected by the outboard MAG sensor (OBS). Considerable effort has gone into cleaning the data of the major magnetic field signatures generated by the spacecraft, however the data is produced by a non-magnetically clean spacecraft so artificial artefacts will remain. Users are therefore encouraged to:

1. View the quality flag and bitmask in parallel to the data. Particularly take note when the quality flag has been dropped from Level 3, to Level 2 (survey quality).
2. If you see anything strange do contact the MAG team. We can ascertain a lot about the quality of the data by revisiting the inboard sensor (IBS) data for the period in question to judge if the spacecraft was generating a significant varying field at the time. Variations in the cleaned, calibrated IBS-OBS dataset is the baseline for the SCINTERFERENCE bit which indicates if there is a large signal present in the IBS-OBS time series, indicating a signal generated by the spacecraft, but our algorithms do not necessarily capture all events.

Normal Mode

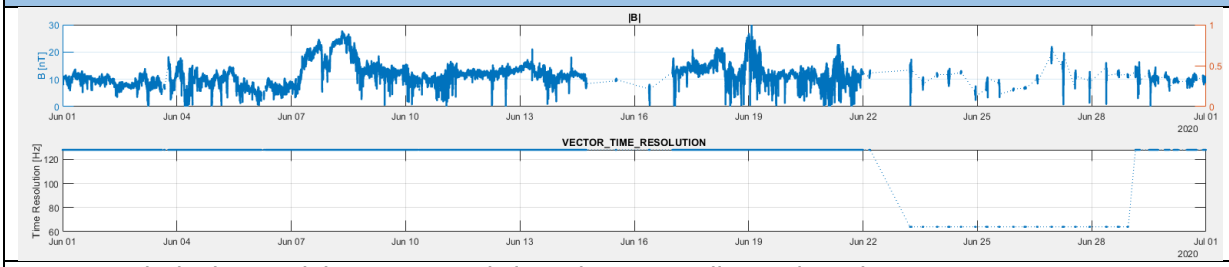


For whole month, MAG was on with 8Hz cadence normal mode data returned, for exception see below.

Operations	1 June	Commissioning phase
	14 June 17:55	Start of cruise phase
Operational Events of Note	31 May	Solar Array movement from 60 to 70 degree. This happened outside this period, but the effect was felt into the start of June. SA movements can have an impact of the spacecraft generated magnetic offset at the location of the OBS and IBS sensors. Current hypothesis is that this movement causes a significant thermal gradients, which generate thermoelectric currents and associated fields on the boom, which take some ~17 hours to stabilise. Data is flagged as quality level 2 until 13:30 on 1/6 as the sensor offsets are uncertain.

	2-3 June	EMC Interference campaign. During this time remote sensing instruments were operations for EMC monitoring. Not all operations are EMC quiet. Data is flagged as quality level 2 for this period.
	15 June:	Perihelion, 0.52AU
	17-21 June:	Remote Sensing Check out Window (RSCW). During this time all the remote sensing instruments were operational, and not all their operations are EMC quiet. Data is flagged as quality level 2 for this period.
	29 June:	Solar Array movement from 70 to 60 degree. As for the movement on 31/5, data is flagged as quality level 2 for SA movement and 17 hours post movement for offset stabilisation to occur.
Data Gaps	3 June ~14:30-18:30	MAG telemetry lost due to ground pass problem
	10 June ~07:30 – 08:30	Data gap due to MAG instrument reboot

Burst Mode



For Commissioning, and the RSCW early in cruise, MAG allocated continuous 128Hz BM coverage. For other times, coverage was not continuous and is a combination of 128Hz or 64 Hz cadence.

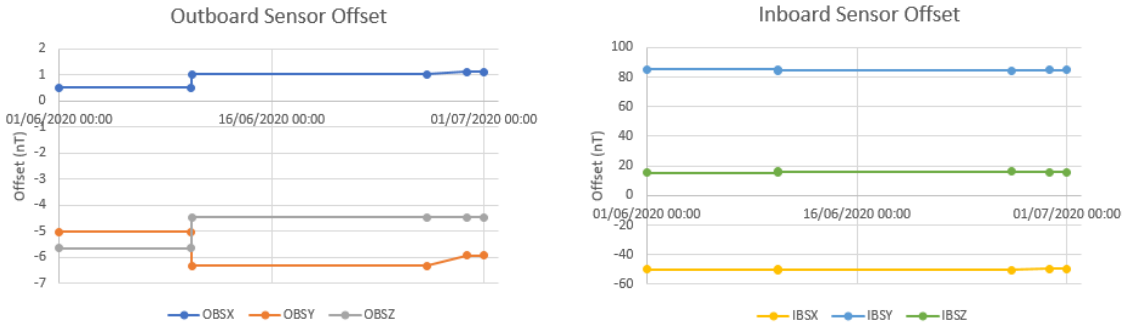
	From	To	
Coverage	1/6	14/6 17:55	24 hours per day 128Hz • Gap 3/6 and 10/6 as for normal mode • Gap @21:47 on 2/6 (lasting 24 mins) for EMC interference campaign – MAG set to Normal mode only. • Gap 5-8am (except for 10 mins ~645) due to IIC testing campaign
	15/6	16/6	0.5 hours per day 128Hz
	17/6	21/6	24 hours per day 128Hz
	22/6	22/6	0.5 hours per day 128Hz
	23/6	28/6	2 hours per day 64Hz
	29/6	30/6	12 hours per day 128Hz

Quality Flag

Quality Flag	Flags in use for this period

	Level 3 – good for publication, subject to PI approval Level 2 – survey data, possibly not publication quality		
Causes of flag drop from 3 to 2			
1. SC events which disturb the field	• Thruster firings • Solar array lubrications (solar array is moved 15 degrees, then returned to original position) • Solar array movements (solar array angle is changed, and then remains at new angle due to sun-SC distance thermal constraints)		
2. SC related issues	From	To	Comment
	31/05/2020 20:30	01/06/2020 13:30	17 hours after SA movement (60 to 70 degrees) for impact on offsets to reduce
	02/06/2020 06:30	03/06/2020 14:40	EMC interference campaign, instrument operations
	10/06/2020 08:35	10/06/2020 09:00	MAG reboot, thermal settling
	14/06/2020 22:07	15/06/2020 07:00	Start of cruise
	17/06/2020 00:00	21/06/2020 23:59	Remote Sensing Checkout Window (RSCW), instrument operations
	22/06/2020 17:45	22/06/2020 22:00	Daily Periodic signal 1 of 5, we see a step change in OBS-IBS for this time. The step is repeated for the following 4 days.
	23/06/2020 17:00	23/06/2020 22:00	Daily Periodic signal 2 of 5
	24/06/2020 18:00	24/06/2020 22:00	Daily Periodic signal 3 of 5
	25/06/2020 18:00	25/06/2020 22:00	Daily Periodic signal 4 of 5
	26/06/2020 16:45	26/06/2020 22:00	Daily Periodic signal 5 of 5
	28/06/2020 04:40	30/06/2020 12:00	SC signals generated head of SA movement, plus 17 hours after SA movement (70 to 60 degrees) for impact on offsets to reduce
	Throughout for smaller time periods.		Large signal detected in IBS-OBS

Offset



The instrument reboot on 10 June and SA movement on 29 June had an impact on the offsets. This has been quantified and removed from the L2 data.

Offset	Date	Comment
	01/06/2020 00:00	Valid from start of June until 7:43 10 June (reboot)
	10/06/2020 08:00	Power down ahead of reboot to get out of high power mode
	10/06/2020 08:30	Constant until 27 June
	27/06/2020 00:00	Linear transition to SA movement on 29 June for OBS but not IBS
	29/06/2020 18:55	Transition after SA movement
	29/06/2020 18:56	Constant OBS and IBS until end June

Known bugs/features

The follow are known bugs or features of this data release.

Issue#	Period affected	Comment
1	10 June	Range change (bug) – you see erroneous data when the OBS range changes from 2 to 3 following the reboot.
2	3 June	Gap related bad data points in 1-minute data (bug). Around the gaps associated with the EMC interference campaign, the 1-minute data is
3	Throughout	8Hz tone from spacecraft (feature). A sharp digital tone can be seen periodically in the burst mode data. It is generated by the spacecraft.
4	Throughout	Inconsistencies between SC interference flags in BM and NM. The times listed in the SC related issues above, the SCINTERFERENCE flag is raised in both BM and NM. However, the algorithm that picks out smaller time scale discrepancies between IBS and OBS which indicate SC generated signals is run independently on the normal and burst streams – so although in general they are raised at similar times, there are some point where the NM flag is raised, but the BM is not and vice versa.