

PDS4 NEAR MAG Bundle Overview

(urn:nasa:pds:near.mag)

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1. Introduction

This bundle contains all primary instrument data (raw and calibrated) returned from the NEAR magnetic field experiment (MAG) and archived in the PDS, as well as higher level data derived from them. Documentation for the instrument, calibration, and data set is also included.

The NEAR mission operated in the years 1996-2001 with the goal of characterizing the S-type near-Earth asteroid 433 Eros to determine its composition and structure. On the way to Eros, NEAR also made a reconnaissance of the main belt asteroid 253 Mathilde. At the end of orbital operations, the NEAR spacecraft touched down on the surface of Eros, obtaining some surface observations.

The NEAR magnetometer was a fluxgate magnetometer using ring core sensors made of highly magnetically permeable material to detect and map the intrinsic magnetic fields of the asteroid 433 Eros. The primary scientific objectives were to establish the global characteristics and geometry of the magnetic field (internal, remnant, or surface) associated with Eros and any detectable interaction with the solar wind and interplanetary field. Secondary objectives included detection of the bow shock, boundary crossings, and magnetic signatures of surface features.

2. Archive Contents and History

The NEAR MAG instrument data were originally archived in PDS in the PDS3 archiving standard.

Table 1. PDS3 NEAR MAG data sets included in this bundle

Data Description	PDS3 Data Set ID	Date archived	PDS node
NEAR MAG Raw Cruise Phase 1	NEAR-A-MAG-2-EDR-CRUISE1-V1.0	2001-08-31	SBN
NEAR MAG Raw Cruise Phase 2	NEAR-A-MAG-2-EDR-CRUISE2-V1.0	2001-08-31	SBN
NEAR MAG Raw Cruise Phase 3	NEAR-A-MAG-2-EDR-CRUISE3-V1.0	2001-09-01	SBN
NEAR MAG Raw Cruise Phase 4	NEAR-A-MAG-2-EDR-CRUISE4-V1.0	2001-09-01	SBN
NEAR MAG Raw Earth	NEAR-A-MAG-2-EDR-EARTH-V1.0	2001-09-01	SBN
NEAR MAG Raw Eros Flyby	NEAR-A-MAG-2-EDR-EROS/FLY/BY-V1.0	2001-09-01	SBN

Data Description	PDS3 Data Set ID	Date archived	PDS node
NEAR MAG Raw Eros Orbit	NEAR-A-MAG-2-EDR-EROS/ORBIT-V1.0	2001-09-01	SBN
NEAR MAG Raw Eros Surface	NEAR-A-MAG-2-EDR-EROS/SURFACE-V1.0	2001-09-01	SBN
NEAR MAG Cal Cruise Phase 2	NEAR-A-MAG-2-EDR-CRUISE2-V1.0	2001-09-27	SBN
NEAR MAG Cal Cruise Phase 3	NEAR-A-MAG-2-EDR-CRUISE3-V1.0	2001-09-27	SBN
NEAR MAG Cal Cruise Phase 4	NEAR-A-MAG-2-EDR-CRUISE4-V1.0	2001-09-27	SBN
NEAR MAG Cal Earth	NEAR-A-MAG-2-EDR-EARTH-V1.0	2001-09-27	SBN
NEAR MAG Cal Eros Flyby	NEAR-A-MAG-2-EDR-EROS/FLY/BY-V1.0	2001-09-27	SBN
NEAR MAG Cal Eros Orbit	NEAR-A-MAG-2-EDR-EROS/ORBIT-V1.0	2001-09-27	SBN

During 2022-2024, the PDS3 NEAR MAG holdings were migrated to the PDS4 archiving standard by the Small Bodies Node, using the On-Line Archiving Facility (OLAF). The data files are unchanged. This bundle contains the NEAR MAG Raw and Calibrated Cruise, Earth, Eros Flyby, Eros Orbit, and Eros Surface data sets, which were in separate PDS3 data sets as shown in Table 1.

During the PDS3 to PDS4 migration, 108 files of the calibrated EBF and NSO data products were found to have an issue where one or more entries in the seconds field in the TIME column. This issue was due to an entry containing 60 in the seconds section. Comparison with entries before and after confirmed that changing the seconds field to zero and incrementing the minutes section was the correct solution. This solution has now been applied to the aforementioned files.

Another erratum in the PDS3 dataset that was corrected during the migration was the start and stop times in the calibrated labels. The solution to this was to use the raw data start and stop times for the calibrated label values.

Additionally, it should also be noted that the keyword "Data Quality Index (DQI)" was not able to be fully understood by the migration team based on the documentation that was previously archived. Although no changes were made to this keyword in the labels, and it was migrated into PDS4 normally, this was something the team felt should be noted to any future data users.

Data, document, and metadata changes made during the migration of the data sets include:

- 108 calibrated data files were changed to reflect the correct values in the TIME column.
- Metadata in the PDS3 labels were migrated to PDS4 labels.
- The raw data start and stop times were applied to the calibrated data labels in order to display the correct values.
- A new NEAR mission dictionary was created to support previous PDS3 keywords

- All previous PDS3 bundles were combined to create one NEAR MAG bundle
- Definitions documents were corrected to reflect the label contents correctly
- All documentation was moved to a new document collection
- A new bundle overview document (the one you are currently reading) was created
- Previous data documentation was restructured to create a more human readable format

3. NEAR MAG Bundle Contents

The NEAR MAG bundle contains two data collections, a browse collection, and a document collection:

The `data_raw` collection contains the magnetometer (MAG) data observations made during the NEAR mission. The data are separated into subdirectories based upon mission phase, `cruise1`, `cruise2`, `cruise3`, `cruise4`, `earth`, `eros flyby`, `eros orbit`, and `eros surface`. The data are presented as FITS binary tables with detached PDS labels. (See section 4)

The `data_calibrated` collection contains subdirectories organized by mission phase, and are then organized in subdirectories by date. The calibrated data collection contains vector magnetic field data acquired by the MAG instrument during the NEAR mission. The data are presented as tabulated files with detached PDS labels. (See section 5)

The browse collection contains the NEAR MAG series of JPG files that provide a simple method for browsing through the NEAR MAG archive. (See section 6)

The document collection contains one main directory and three subdirectories. The main directory contains all documents about the whole bundle. The `data_info` subdirectory contains all the documentation needed to understand the NEAR MAG data products. The calibration subdirectory contains all the information regarding the NEAR MAG data products calibration. The instrument subdirectory contains all of the documentation describing the NEAR MAG instrument. (See section 7)

4. The `data_raw` Collection

The `data_raw` collection contains magnetometer (MAG) observations which are separated into eight sub-directories, each subdirectory contains data from one mission phase (**`cruise1`, `cruise2`, `cruise3`, `cruies4`, `earth`, `eros_flyby`, `eros_orbit`, `eros_surface`**). The data contained in these subdirectories are the raw telemetry data from the Magnetometer instrument. All data in this collection is in FITS binary table format. (For more information see the *`data_raw_collection_description.txt`* document in the *`document/data_info`* subdirectory).

5. The `data_calibrated` Collection

The `data_calibrated` collection contains the higher level MAG data products which are separated into six subdirectories by mission phase (**`cruise2`, `cruise3`, `cruies4`, `earth`, `eros_flyby`, `eros_orbit`**).

This data set contains vector magnetic field data acquired by the fluxgate magnetometer (MAG) on the NEAR spacecraft during the NEAR mission. The data are processed science data provided in physical units (nT) in two coordinate systems Near Sun Orbital (NSO) and Eros

Body Fixed(EBF). Instrumental and spacecraft effects have been removed from the data during processing. The data are provided in ASCII tables labeled *ebfyyddd.tab* and *nsoyyddd.tab* (yyddd indicates year and day of year). (For more information see the *data_calibrated_collection_description.txt* document in the *document/data_info* subdirectory).

6. The Browse Collection

The **browse** collection contains a series of JPG files that provide a simple method for browsing through the NEAR MAG archive.

The browse images are organized into directories by mission phase (**cruise2, cruise3, cruies4, eros_flyby, eros_orbit**), and then organized into subdirectories by date.

The **browse_info.txt** document describes the browse collection.

7. The Document Collection

The document collection contains one main directory and three subdirectories.

Main Directory

The **near_mag_bundle_overview.pdf** which is the document you are reading now.

The **reference.txt** document contains the references in the NEAR MAG bundle.

The **errata.txt** document describes the problems found in the MAG bundle during migration.

The data_info Documents

The **data_raw_collection_description.txt** describes the raw data products in the *data_raw* collection.

The **data_calibrated_collection_description.txt** describes the calibrated data products in the *data_calibrated* collection.

The **mag_raw_column_definitions.txt** document contains the column definitions of the raw data products.

The **fits_format_description.txt** document contains the Mar. 29, 1999 NOST 100-2.0 version of the FITS standard documentation. This version of FITS was used for the NEAR Magnetometer FITS data.

The calibration Documents

The **mag_calibration.pdf** document describes the near magnetometer calibration.

The **software** subdirectory contains four documents. *sci_proc_description.txt* describes the sci_proc Processing Code for NEAR Magnetometer. *sci_proc.txt* provides the codes for the

production of the science data files for the NEAR Magnetometer experiment.
sdc_proc_description.txt describes the *sdc_proc* Processing Code for NEAR Magnetometer.
sdc_proc.txt provides the codes for the production of the science data files for the NEAR Magnetometer experiment produced by the NEAR Science Data Center (SDC).

The instrument documents

The ***near_mag_instrument_description.txt*** contains an overview description of the NEAR Magnetometer taken verbatim from the PDS3 instrument catalog file archived with the data in 2002.

The ***near_mag_instrument_paper.txt*** is the primary published instrument paper on the NEAR Magnetometer