

## USE OF PDS4 IN AN OPERATIONAL ARCHIVE – EXPERIENCE FROM BepiColombo.

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**Introduction:** Most ESA planetary missions have delivered data to the archive in the classical way – by instrument teams providing large deliveries every few months. The downside to such an approach is that issues can only be caught, and detailed validation only performed, on delivery and can require significant re-processing before acceptance in the archive.

The ESA Planetary Science Archive (PSA) [1] has adopted a different approach with current missions using the NASA PDS4 format. In this operational archiving approach, products are delivered on a frequent (often daily) basis, and delivery starts early in the mission - even before products are “feature-complete”. In this way the archive products can be used immediately for both science and engineering.

**Technical implementation:** The design of a PDS4 archive typically assumes the more traditional delivery style in which data providers periodically deliver complete bundles. With the operational approach, batches of individual products are delivered to the archive, which then produces or updates the corresponding bundle and collection inventories. Some small changes to the products are also necessary to accommodate this philosophy, mostly in the use of version numbers; versioning of collection inventories is less useful due to their continual increments, and individual products may undergo many versions before the product is finalised. In general version numbers less than unity are used within the PSA for operational data releases. In addition, true deletion of products from the archive is allowed to avoid polluting the end archive with older and less complete copies of products. Finally, this approach results in data being ingested into the archive long before it becomes public, and hence data access rights must be respected.

**Experience from BepiColombo:** The ESA/JAXA BepiColombo mission to Mercury was successfully launched in October 2018. The data handling approach within the Science Ground Segment (SGS) for the BepiColombo mission has differed from previous planetary missions, and follows a style more often used in astronomy. As such the first level data processing is performed by SGS, which runs the instrument pipelines producing raw level archive data from telemetry and sending them to the PSA on a daily basis. This has also enabled the development of a Quick-Look Analysis (QLA) system which uses these PDS4 products for visualisation of housekeeping and science data and provides rapid feedback on the quality of the

archive data products whilst enabling rapid feedback for science and operations. Using this approach, science data from several instruments were available in the archive, and visible in the QLA, within the first week of the mission (Figure 1).

This paper discusses the experience gained within the BepiColombo SGS using this approach, including the benefits and challenges. Amongst the benefits are:

- early review and testing of archival formats,
- higher likelihood of instrument teams developing a single pipeline and format for science analysis and archiving,
- restricted access to science data in a centralised repository from day one, and
- enabling of near-real-time functionality such as the QLA.

Postcard	Product Identifier	Observation Start Time
N/A	mag_raw_sc_ib_4_urf_00000_20181024	2018-10-24 15:21:16.790
N/A	mag_raw_sc_ob_4_urf_00000_20181024	2018-10-24 15:21:16.790
N/A	mag_par_sc_ob_4_urf_00000_20181024	2018-10-24 15:21:16.790
N/A	mag_par_sc_ib_4_urf_00000_20181024	2018-10-24 15:21:16.790
N/A	mag_raw_hk_ib_temperature_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_hk_ib_sensor_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_sc_ob_s4_urf_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_hk_ob_sensor_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_sc_ib_s4_urf_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_hk_ob_temperature_00000_20181024	2018-10-24 15:21:16.791
N/A	mag_raw_sc_ob_2_urf_00000_20181024	2018-10-24 15:43:16.711

Figure 1: BepiColombo products in the PSA

### References:

- [1] Besse, S. et al. (2018) *Planet. Space Sci.* 150, 131–140 .