

New Horizons REX Data Set Review – Level 2

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Executive Summary

The Level 2 (“raw”) data with DATA_SET_ID `nh-p-rex-2-pluto-v1.0` was reviewed a second time based upon the lien resolution from the first review held in May 2016 and addition of new data downlinked during the P2 phase. Like before, REX instrument data from the New Horizon’s Pluto encounter are well documented and referenced. Minor improvements to clarify exactly which data are contained within this dataset in the `dataset.cat` are recommended for ease of use. Utilizing python examples provided in the documentation and code already utilized for other radio science analyses, the reviewer was able to extract frequency estimates from the data stored in the FITS-packed data files. All the reviewer’s comments from the previous review in May 2016 have been addressed.

Changes from Previous Version

Reviewer noted the following changes while examining the archive

- 8827 new *.fit files in DATA (out of 17267)
 - Examined several of the new files near Pluto occultation (see next section), which were as expected
- 3 new *.tnf files in DATA, 6 new associated *.tab files
 - Two tests of *.tab files match the associated binary data in the *.tnf (see next section)
- Various updates to labels
 - Labels describe data appropriately
- Updates to catalog files
 - All of this reviewer’s previous comments were corrected/addressed
- New document files/Updates to documentation files
 - All of this reviewer’s previous comments were corrected/addressed

Data

The raw Pluto encounter data are stored in FIT files in the DATA directory. These data contain sampled IQ values. Starting with a software sample in the DOCUMENT directory, it was easy to extract the IQ values and utilize a spectral fast Fourier transform technique to estimate frequency. The frequency values are as expected with a brief glance. The Bistatic scattering experiment is seen in the left of Figures 1 and 2, and the Pluto occultation to the right. Both the 0x7b1 and 0x7b3 data exhibit similar frequency values, which is expected. The uplink Doppler compensation (“ramps”) are visible when zoomed in, which is one method to determine these data contain real frequency values received by the Deep Space Network.

Much of the baseline data (before/after occultation) was not present in the original data; the addition of these extra data is beneficial and allows for a longer baseline to establish frequency drifts and signal levels prior to the occultation.

I have verified that the DATA/TNF/pcooc_ulfile_dss43.tab and pr1_ulfile_dss43_rexa.tab files match the content that is stored in the DATA/TNF/nhpc_rex_2015195_pco.tnf and nhpc_rex_2015194_pr1.tnf files, respectively, as a test to ensure the *.tab files match the *.tnf files (for correct uplink frequency).

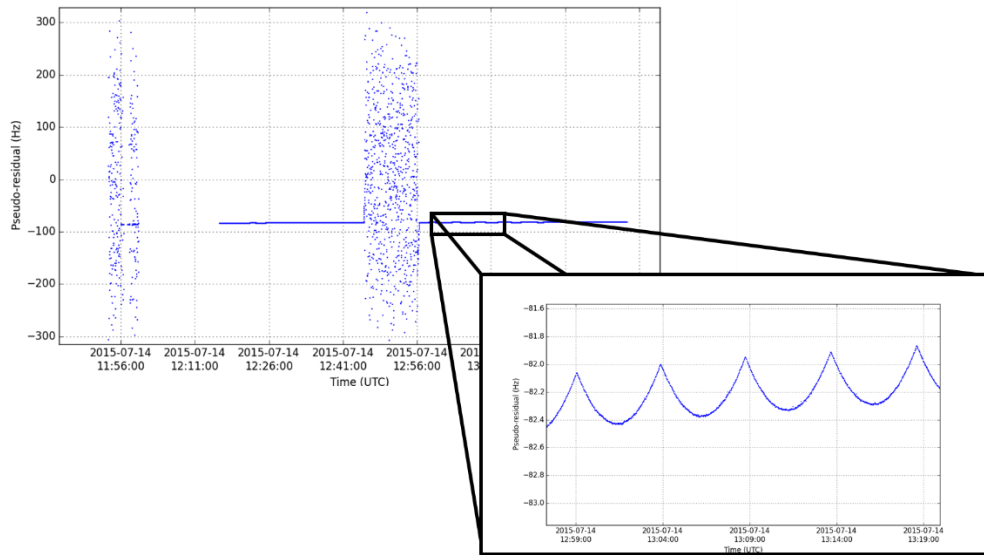


Figure 1. Extracted frequency residuals from the REX 0x7b1 raw data at the Pluto encounter. The uplink frequency ramps are clearly noted in the frequency, an indication that the data is well structured and contains the expected data.

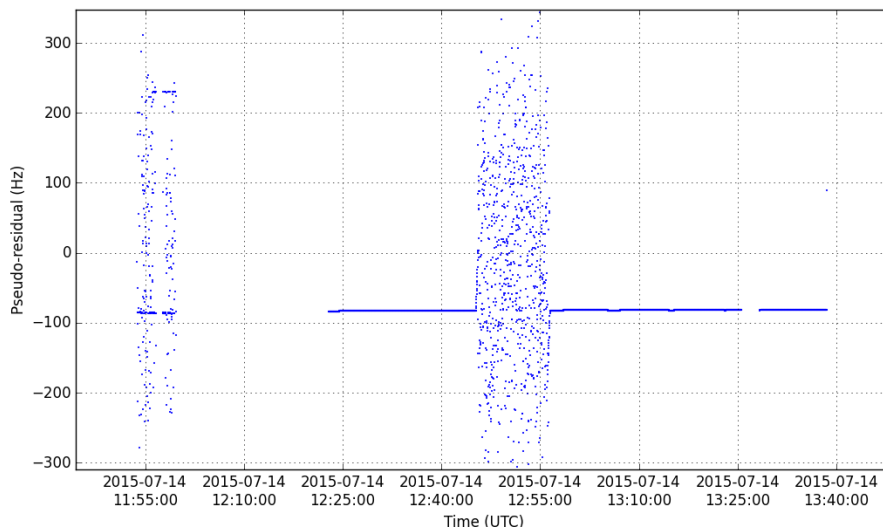


Figure 2. Extracted frequency residuals from the REX 0x7b3 raw data, which is nearly identical to the 0x7b1 data, as expected due to simultaneous uplinks in RCP and LCP

File Comments

catalog/rex.cat, section “REX Use of the DSN” has a table with exceptions to the Side A/Side B RCP/LCP reception, but has TBDs. If there were no exceptions, it should explicitly say so

The only exceptions to this were as follows:

Date	REX Sides in operation	Uplink Polarity
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TBD	TBD	TBD

catalog/dataset.cat, first section:

During the Pluto Charon Encounter mission phase starting in January, 2015, there were several sub-phases: three Approach sub-phases, (AP1, AP2 and AP3); a CORE sequence for the Pluto flyby on 14.July, 2015 (Day Of Year 195), sometimes also referred to as NEP (Near-Encounter Phase); three Departure sub-phases (DP1, DP2, DP3). **For this second REX delivery for the Pluto mission phase, this data set includes only the Approach data plus a subset of the CORE and departure sequences data that was downlinked through the end of January, 2016.** The rest of the Pluto data will be delivered in future versions of this data set according to the schedule worked out by the Project and NASA.

[...approach summary...]

From the day of encounter, **this data set includes data from two CORE observations: (1) the bi-static radar THERMSCAN data, which measured DSN uplink signal reflected off of Pluto during the flyby; (2) the Pluto occultation data for both ingress and egress.**

There is also a backup USO Stability characterization observation taken in November, 2015, to replace a attempt in the weeks after encounter that failed du to a DSN misconfiguration.

It would be beneficial to state exactly which observations are expected in future datasets in the same section. The first paragraph also mentions “departure sequences” that are included in the data set. Are these departure sequences the “backup USO Stability” test? Clarifying this section will help understand the sequence. An additional paragraph on what is *not* included and yet to come in future iterations would also be useful.