Radio Science Instrument (RSI) PDS Data Review (Bistatic Observations) RORSI_4001_2014_238_V1.0

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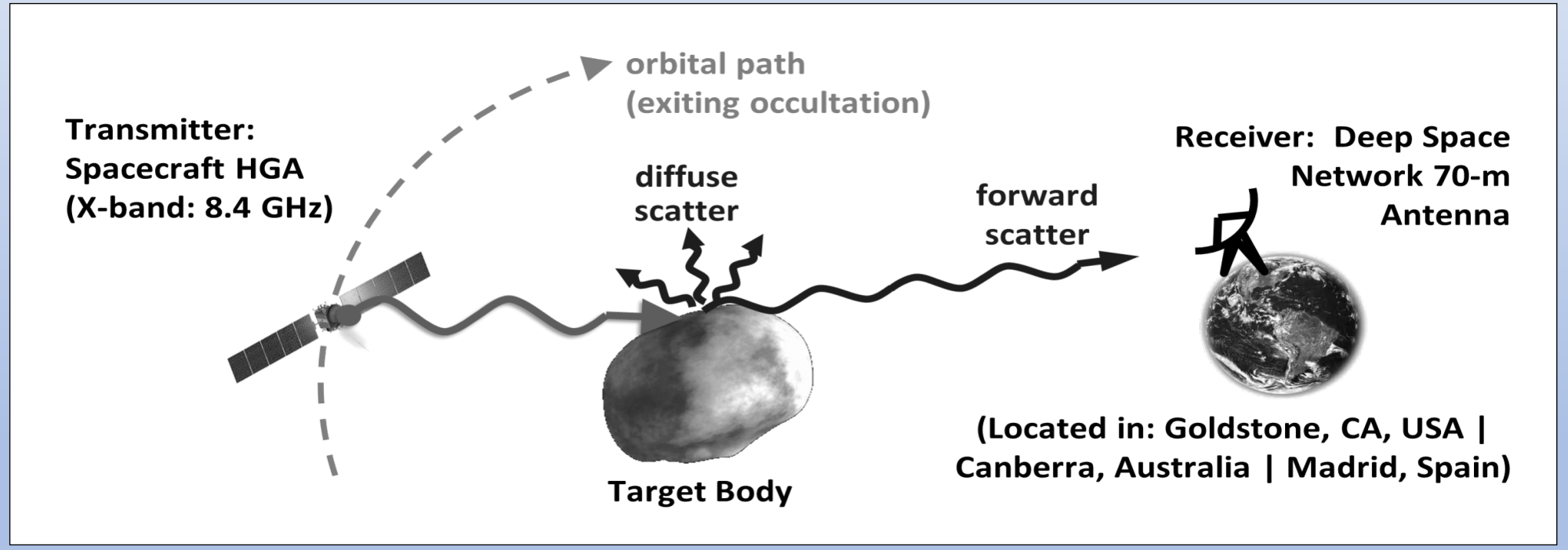
Rosetta-Orbiter RSI Prelanding 67P Bistatic Radar Measurement - 2014-10-10T21:57:00

The Orbital Bistatic Radar Experiment

Basic Acquisition Geometry at 67P

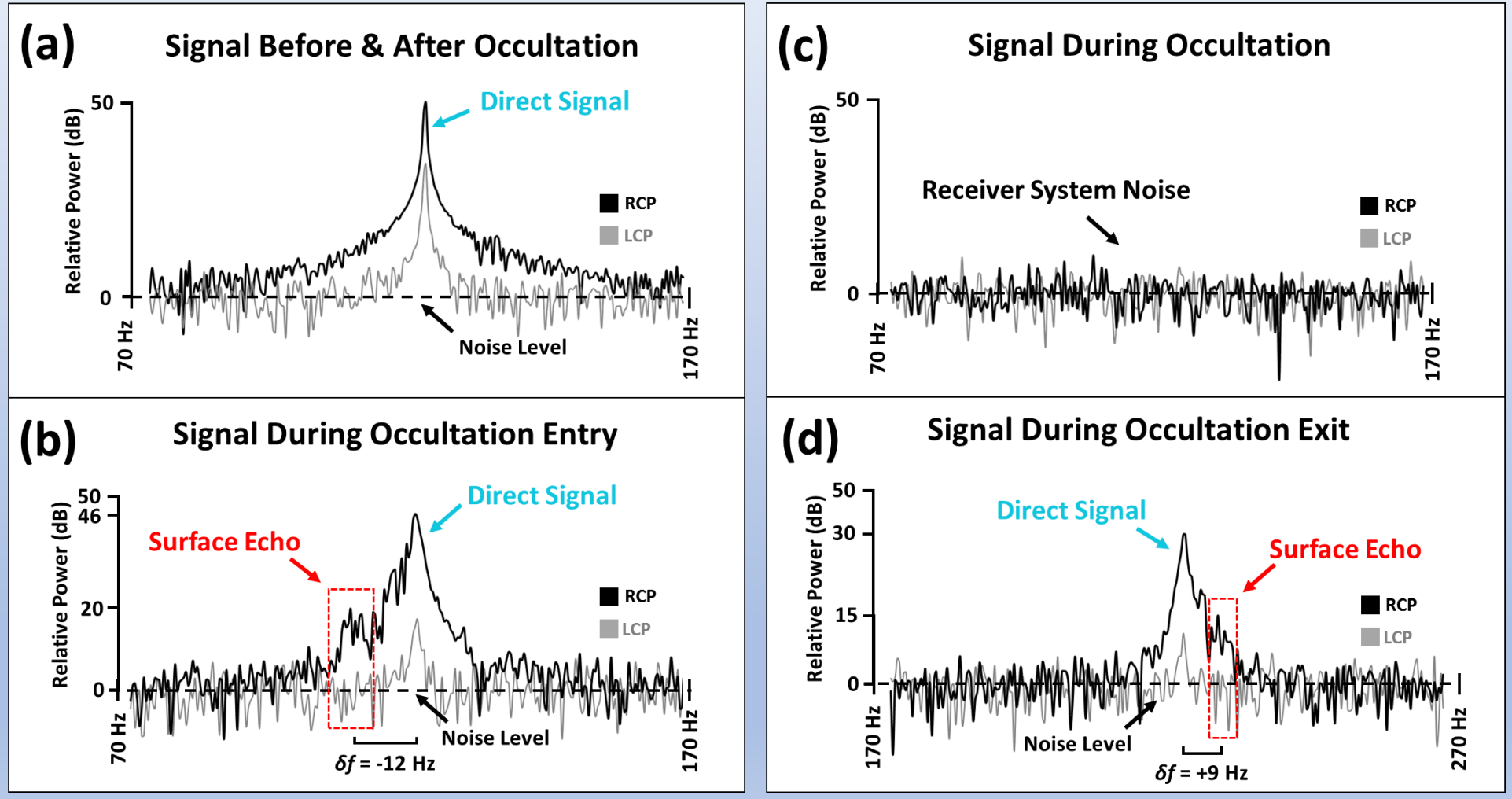
The RSI experiment use the spacecraft's radio carrier frequencies at *X*-band (8.4 GHz) and *S*-band (2.3 GHz) in order to measure slight changes of the orbit velocity via the classical Doppler effect induced by the gravity attraction of the comet nucleus.



The Rosetta spacecraft continuously transmits a right-hand circularly polarized (RCP) signal, while the DSN Goldstone 70-m antenna receives in both the right-hand (RCP) and left-hand (LCP) circular polarizations

(Palmer & Heggy, 2019)

RSI Surface Echo Detection at Vesta (example)



(Palmer, Heggy, Kofman, 2017, Nature Com)

aaReadme.txt

- The file header should refer to this data as “Bistatic Radar Observation”
- subdirectories for Level 1B and Level 2 data referred in the aareadme.txt that should be found within the DATA directory, but which are not there
- Suggest to add the start date and the end date of the acquisition in the file header: “Data from Experiments on 2014/238, RO PRELANDIN”
- “Data are organized in approximate chronological order, though receipt at Cologne was generally more important in determining placement than strict order of generation or applicability” this might make it difficult to analyze some observations that are timely tagged with other instruments. Suggestions to follow the strict acquisition order.
- The readme file should provide a minimal explanation of what is the physical quantities referred to by the “Data” to familiarize user with the products.
- Few typos mistake: “a appropriate” change to “an appropriate”

Data

- Data is readable, no problem
- Closed loop data is not yet in the level 1A ?
- Only DSN data is available (open loop), are there other data ?
- Data available is only in S band, Readme file suggest X & S bands

Browse

- There are only 3 plots in JPG browse products, the “browsinfot.txt “sate that there are 10 plots ?

Mission Phase Definition

Mission phase abbreviations are defined in CATALOG/MISSION.CAT and DOCUMENT/ESA_DOC/RO_EST_TN_3372.PDF.

General description of radio science data

Closed-loop and Open-loop data:

There are in principle two different ways to record radio science data: Open-loop and closed-loop data.

The CLOSED-LOOP system used a phase-lock loop in the receiver to track the downlink signal, reporting both amplitude and frequency at rates typically of 1-10 times per second.

In the OPEN-LOOP system, the signal was simply converted to a baseband frequency range; the entire passband was sampled and recorded for later processing. Typical open-loop sampling rates for ROS were 2000 complex samples per second.

CLOSED-LOOP data are efficient for characterizing slowly changing signals; OPEN-LOOP data (because of their much higher volume) are usually used when the signal is very dynamic - such as during an occultation or bistatic radar measurement.

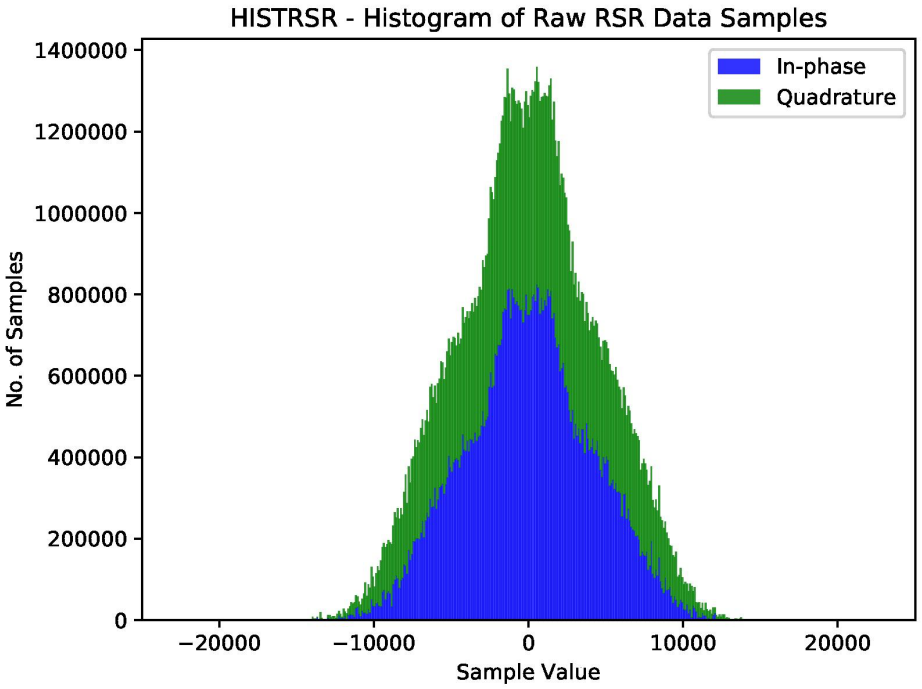
The data set includes four primary data types with respect to the two different ground station systems. These systems are on the one hand the ESA ground station in New Norcia, Australia (NNO) and the NASA Deep Space Network (DSN).

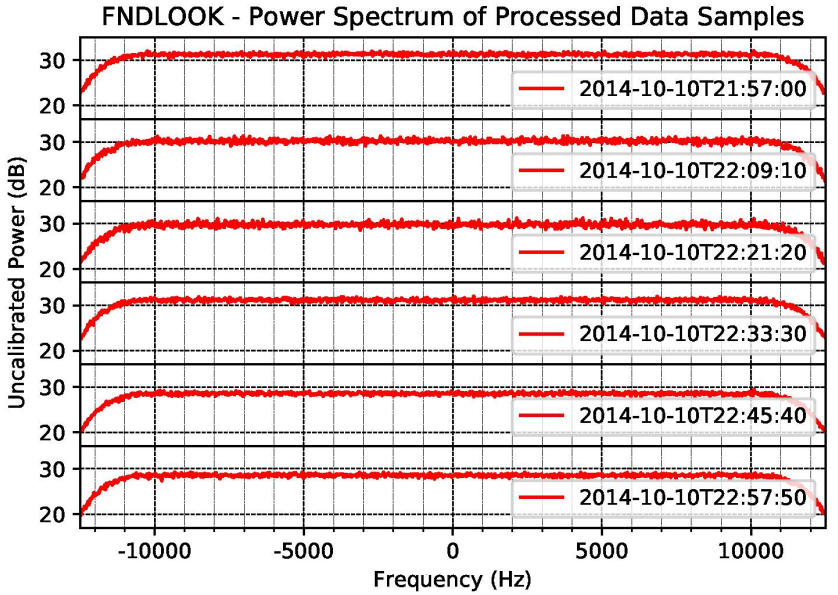
ERRATA.TXT

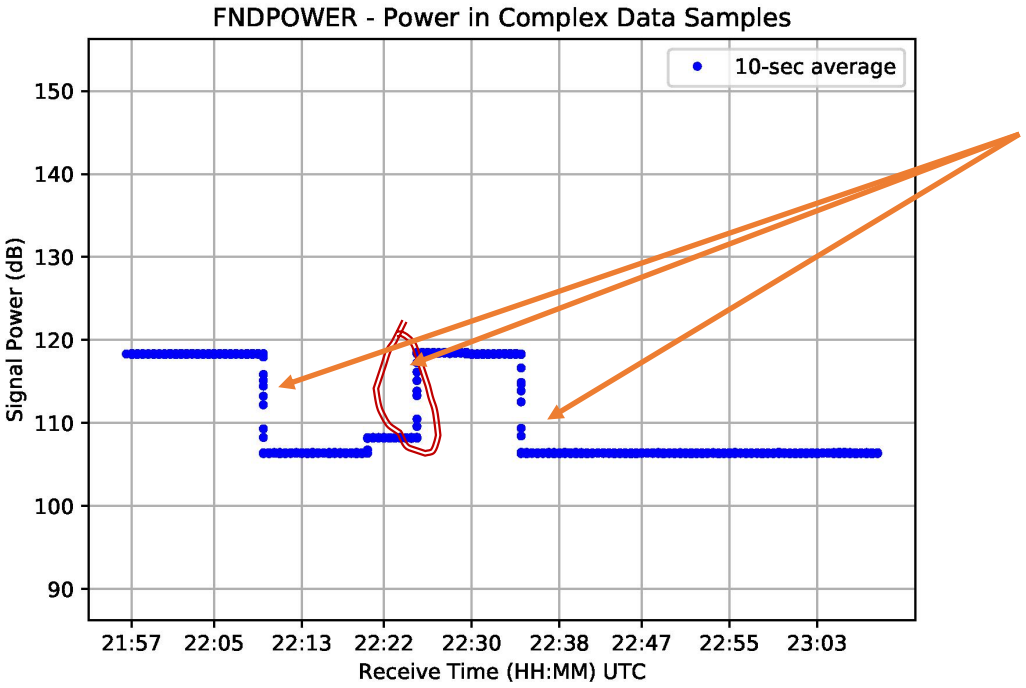
- Considering that this is the first of kind RSI measurement in a microgravity environment, It would be useful to put an assessment of the error / accuracy in the Doppler measurement for this data set.

Documents

- The BSR experiments is well described even though the user will benefit from showing examples of how data products are derived.

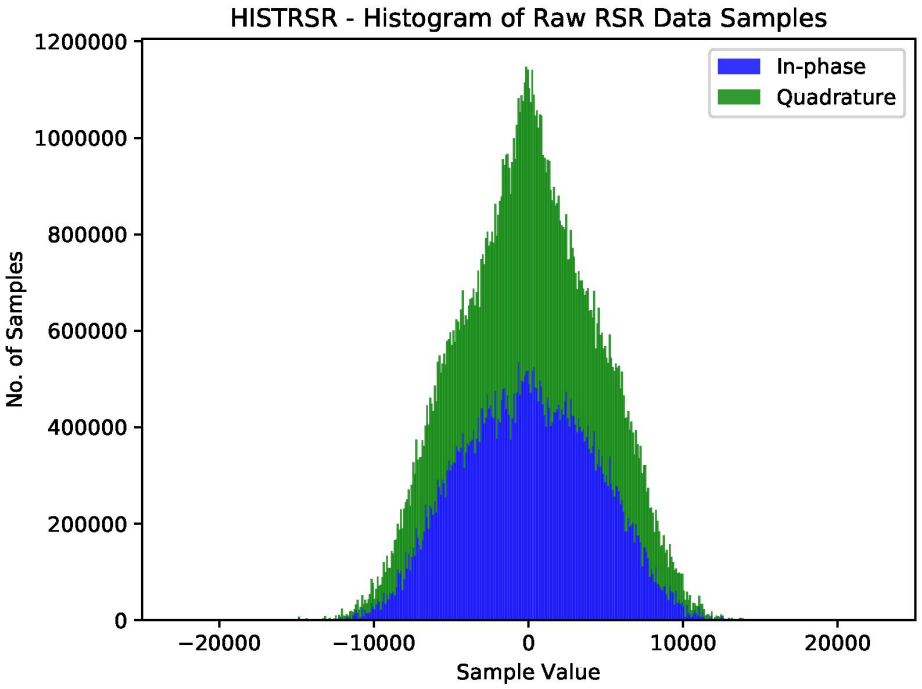


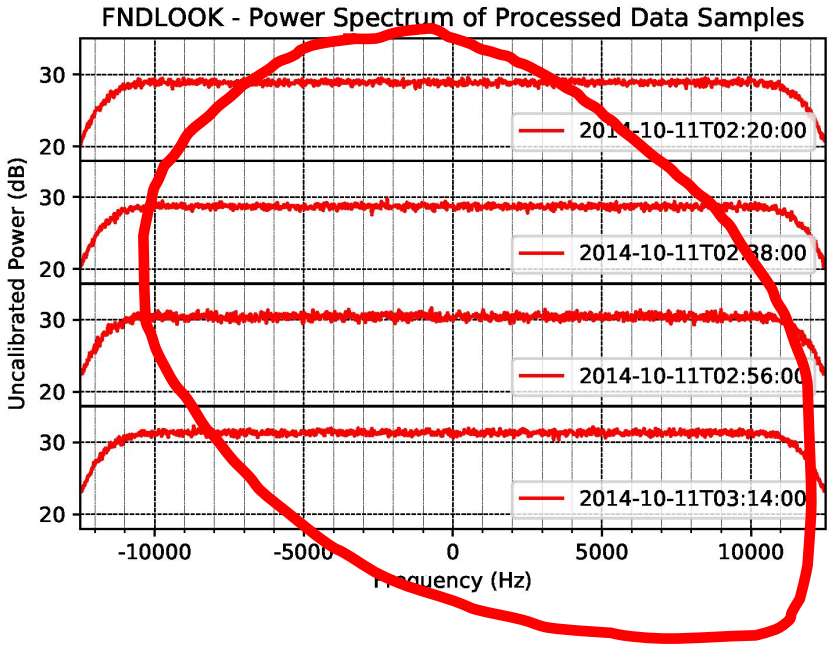


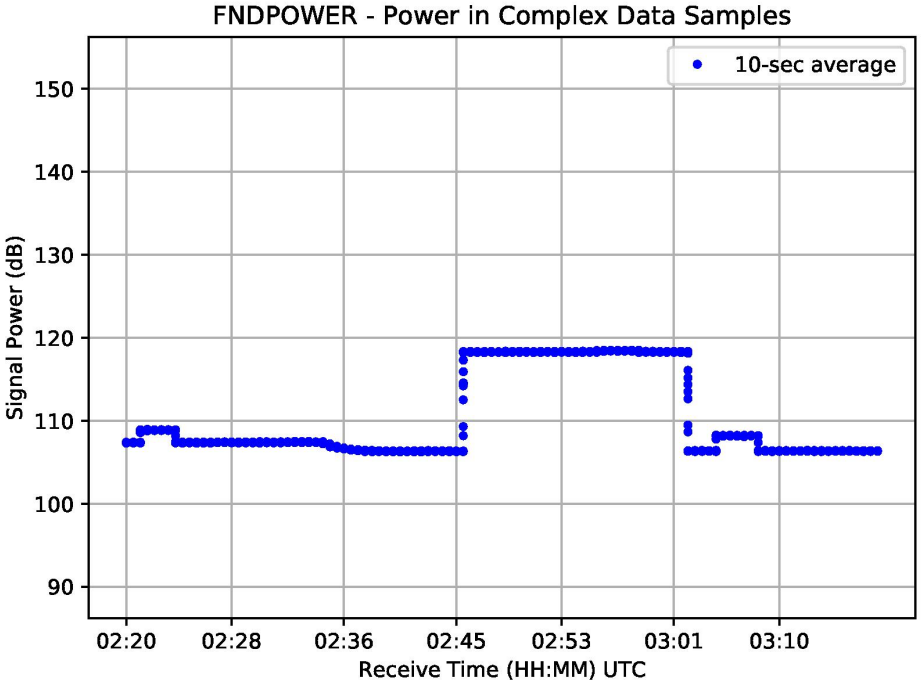


Occultations ?

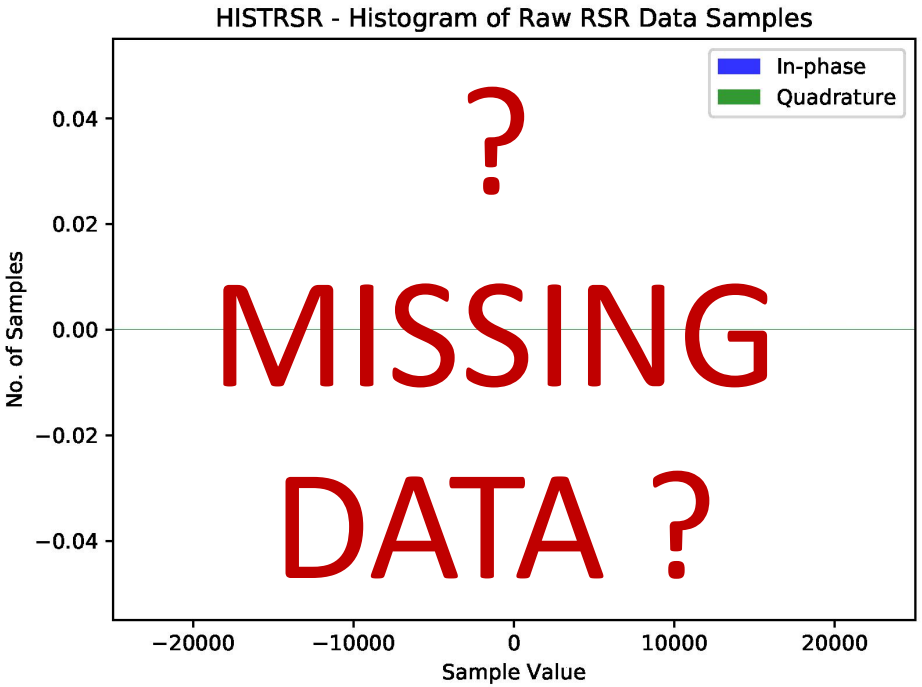
Can’t see the carrier frequency in the power spectrum !

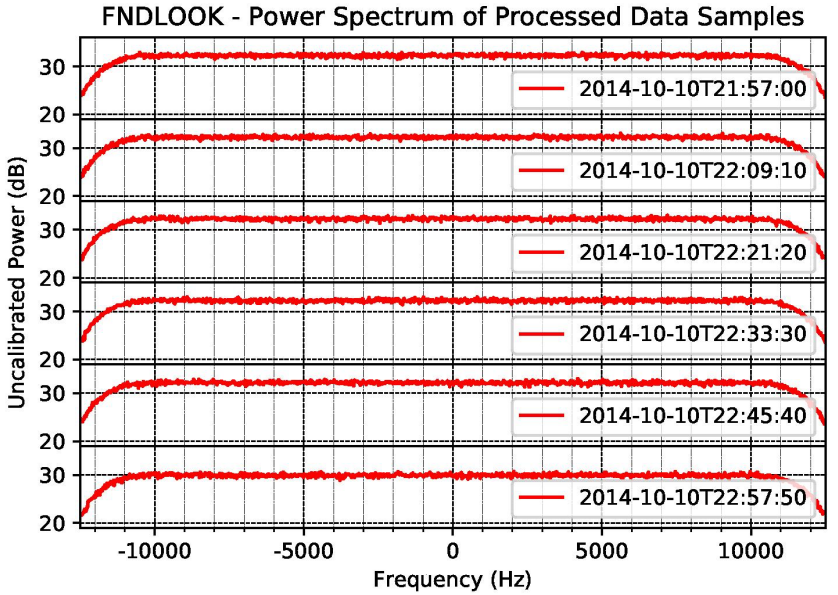


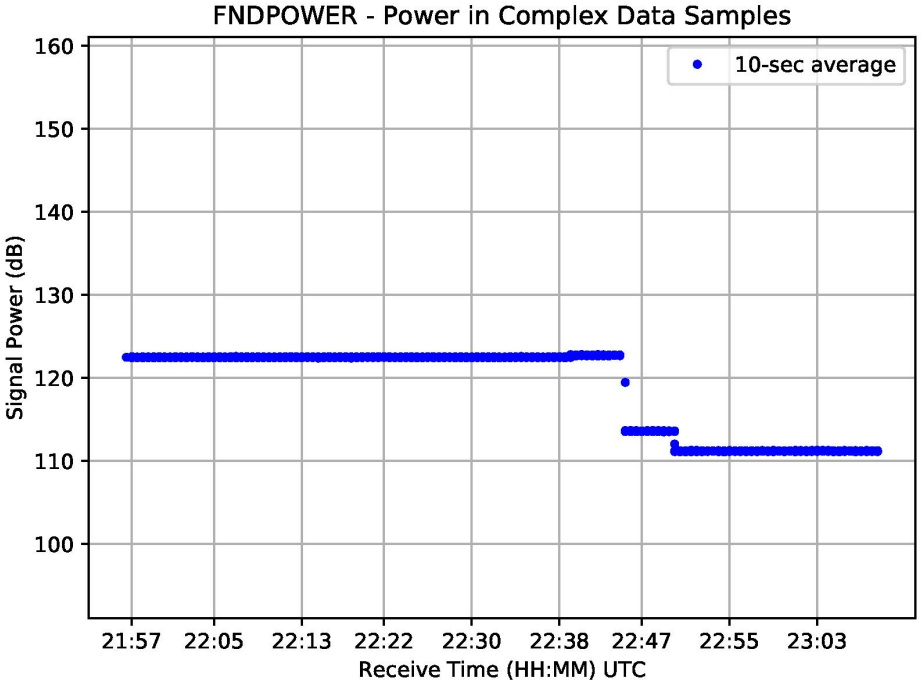




IT IS NOT CLEAR HOW PLOTS PREVIEWS CHANGE IN NUMBERS


HISTRSR - Histogram of Raw RSR Data Samples
In-phase
Quadrature
?
MISSING
DATA ?
No. of Samples
0.04
0.02
0.00
−0.02
−0.04
−20000
−10000
0
10000
20000
Sample Value


FNDLOOK - Power Spectrum of Processed Data Samples
Uncalibrated Power (dB)
2014-10-10T21:57:00
2014-10-10T22:09:10
2014-10-10T22:21:20
2014-10-10T22:33:30
2014-10-10T22:45:40
2014-10-10T22:57:50
-10000
-5000
0
5000
10000
Frequency (Hz)


FNDPOWER - Power in Complex Data Samples
10-sec average
Signal Power (dB)
160
150
140
130
120
110
100
21:57
22:05
22:13
22:22
22:30
22:38
22:47
22:55
23:03
Receive Time (HH:MM) UTC