

LUCY Radio Science Investigation and Telecom Subsystem Data Review

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Planetary Plasma Interactions Node

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LUCY RSS Datasets

Data:

collectionID:

data_cruise1_rss

data_cruise1_tracking

productID:

lucy_2022_274_2022_305_ion (ion_dopr)

lucy_2022_285_104518_2022_285_165503_53 (trk234)

Data: Time Coordinates ION (CSP File)

```
<Time_Coordinates>  
  <start_date_time>2022-10-01T08:00:00Z</start_date_time>  
  <stop_date_time>2022-11-01T11:05:00Z</stop_date_time>  
</Time_Coordinates>
```

lucy_2022_274_2022_305_ion.xml	lucy_2022_274_2022_305_ion.csp
<start_date_time>2022-10-01T08:00:00Z</start_date_time>	22/10/01,08:00:00
	22/10/01,15:23:00
	:
	:
	:
	22/10/31,22:17
<stop_date_time>2022-11-01T11:05:00Z</stop_date_time>	22/11/01,11:05

Data: Observing System ION (CSP File)

```
<Observing_System>
  <Observing_System_Component>
    <name>Global Positioning System</name>
    <type>Instrument</type>
    <description>
      Path delays from multi-frequency observations of GPS satellites
      are used to model path delays along the DSN-to-spacecraft
      radio link resulting from passage through Earth's troposphere
      as a function of time.
    </description>
    <Internal_Reference>
      <lid_reference>urn:nasa:pds:context:instrument:dsn.media</lid_reference>
      <reference_type>is_instrument</reference_type>
    </Internal_Reference>
  </Observing_System_Component>
</Observing_System>
```

See page 18 & 19 of DSN TRK-2-23

Data: DSN TRK-2-23 (CSP file)

```
# FITSIG= .0254331
ADJUST(DOPRNG)BY NRMPow( 1.3963, -1.2750, 1.7128, -1.3736, 3.3967,
 3.8142, -8.1935, -4.0516, 3.9466, 2.1107) MODEL(CHPART)
FROM(06/05/01,03:01:00.001)TO(06/05/01,13:00)DSN(C40)SCID(82). #S01 ADJ 060504 15:31
```

Figure 3-1: Example Ionosphere Calibration

```
ADJUST(ALL)BY TRIG(31557600., 0.0870, -0.0360, -0.0336, 0.0002,
0.0200, 0.0008, -0.0021, -0.0036, -0.0002) MODEL
(WET NUPART)FROM(72/01/01,00:00)TO(48/01/01,00:00)DSN(C10). #ADJ 920121 02:23
ADJUST(ALL)BY TRIG(31557600., 2.0521, 0.0082, -0.0005, -0.0004,
0.0033, -0.0015, 0.0005, -0.0011, 0.0036) MODEL
(DRY NUPART)FROM(72/01/01,00:00)TO(48/01/01,00:00)DSN(C10). #ADJ 920121 02:23
...
ADJUST(ALL)BY CONST( 0.0094947) MODEL(DRY NUPART)
FROM(72/01/01,00:00) TO(48/01/01,00:00) DSN(012). #ADJ
...
```

Figure 3-2: Seasonal Troposphere Models for DSCC 10

```
# FITSIG= 0.0056 FLG=03
ADJUST(DOPRNG)BY NRMPow(4.6317, .4552, -.3223, -.7704, 1.4063, .8841, -2.0122,
-.7738, .8838, .3307)MODEL(CHPART)
FROM(22/10/08,10:47:00.001)TO(22/10/08,14:02)DSN(C60)SCID(49). #S01 ADJ 2022/10/10,15:35:26
# FITSIG= 0.0056 FLG=03
ADJUST(DOPRNG)BY NRMPow(5.9741, 1.8265, .4775, -1.6441, -.8456, 3.4482, .8575,
-2.8988, -.1941, .8245)MODEL(CHPART)
FROM(22/10/08,14:02:00.001)TO(22/10/08,17:09)DSN(C60)SCID(49). #S01 ADJ 2022/10/10,15:35:26
```

Example Data point from:
lucy_2022_274_2022_305_ion.csp

```
# FITSIG= .0008888
ADJUST(ALL)BY NRMPow( 0.0197, -0.0150, -0.0212, 0.0786, 0.0789,
-0.1863, -0.0938, 0.1683, 0.0342, -0.0518) MODEL
(WET NUPART)FROM(06/05/01,03:00:00.001)TO(06/05/01,09:00)DSN(C10). # 060502 15:40
# FITSIG= .0001873
ADJUST(ALL)BY NRMPow( 0.0020, 0.0027, 0.0039, -0.0014, -0.0025) MODEL
(DRY NUPART)FROM(06/05/01,03:00:00.001)TO(06/05/01,09:00)DSN(C10). # 060502 15:40
```

Figure 3-3: Example Troposphere Calibrations

Data: Target ID Reference ION (CSP File)

```
<Target_Identification>
  <name>Earth</name>
  <type>Planet</type>
  <description>
    Dual-frequency GPS radio signals penetrate Earth's ionosphere,
    providing information on path delay that can be used to
    calibrate radio tracking data.
  </description>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:context:target:planet.earth</lid_reference>
    <reference_type>data_to_target</reference_type>
  </Internal_Reference>
</Target_Identification>
```

Data: Internal Reference ION (CSP File)

```
<Reference_List>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:radiosci.documentation:dsn.trk-2-23</lid_reference>
    <reference_type>data_to_document</reference_type>
  </Internal_Reference>
</Reference_List>
```

```
<Reference_List>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:radiosci.documentation:dsn.trk-2-23:2000-05-31</lid_reference>
    <reference_type>data_to_document</reference_type>
  </Internal_Reference>
</Reference_List>
```

Data: Validation Report ION (CSP File)

- This data is pending the creation of the context product:
urn:nasa:pds:context:investigation:mission.lucy

Data: Logical Identifier (TNF File)

- Delivered in the data collection ID:
data_cruise1_rss
- However, the logical identifier listed includes:
data_cruise1_tracking

Data: Descriptions (TNF File)

- Very Minor:
 - The  may cause compiling issues?
 - More unique titles?

```
<title>$opt.spacecraft Radio Science Tracking and Navigation File (TNF)
      From: START_TIMEZ to STOP_TIMEZ
      DSN: DSSUSED
</title>
```

Data: Investigation Area (TNF File)

- Pulled in OSIRIS-REx Mission instead of LUCY?

```
<Investigation_Area>
  <name>OSIRIS-REx</name>
  <type>Mission</type>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:context:investigation:mission.orex</lid_reference>
    <reference_type>data_to_investigation</reference_type>
  </Internal_Reference>
</Investigation_Area>
```

Data: Observation System (TNF File)

- Include Antenna's used?

For example:

```
<Observing_System_Component>
  <name>DSN Antenna DSS 55</name>
  <type>Telescope</type>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:context:telescope:madrid.dss55_34m</lid_reference>
    <reference_type>is_telescope</reference_type>
  </Internal_Reference>
</Observing_System_Component>
<Observing_System_Component>
  <name>DSN Antenna DSS 63</name>
  <type>Telescope</type>
  <Internal_Reference>
    <lid_reference>urn:nasa:pds:context:telescope:madrid.dss63_70m</lid_reference>
    <reference_type>is_telescope</reference_type>
  </Internal_Reference>
</Observing_System_Component>
```

Data: Validation Report (TNF File)

- This data is pending the creation of the context product:
urn:nasa:pds:context:investigation:mission.lucy
- Using pds4_viewer only SFDU_00 compiles the fields to correctly form a table.
- error.table.field_value_data_type_mismatch
 - Value does not match its data type 'ASCII_String'

Checklist

ion_dopr (CSP file)

- mission.lucy investigation context product
- troposphere -> ionosphere in the Global Positioning System
- Include 2005-05-31 in Internal_Reference LIDVID

trk234 (TNF file)

- More Specific Titles
 - CRLF in description
- Modify Investigation_Area
 - mission.lucy investigation context product
 - Include DSN Telescopes in Observing_System_Component