Solar Wind Around Pluto
SWAP

PRINCIPAL INVESTIGATOR
Dave McComas, SwRI

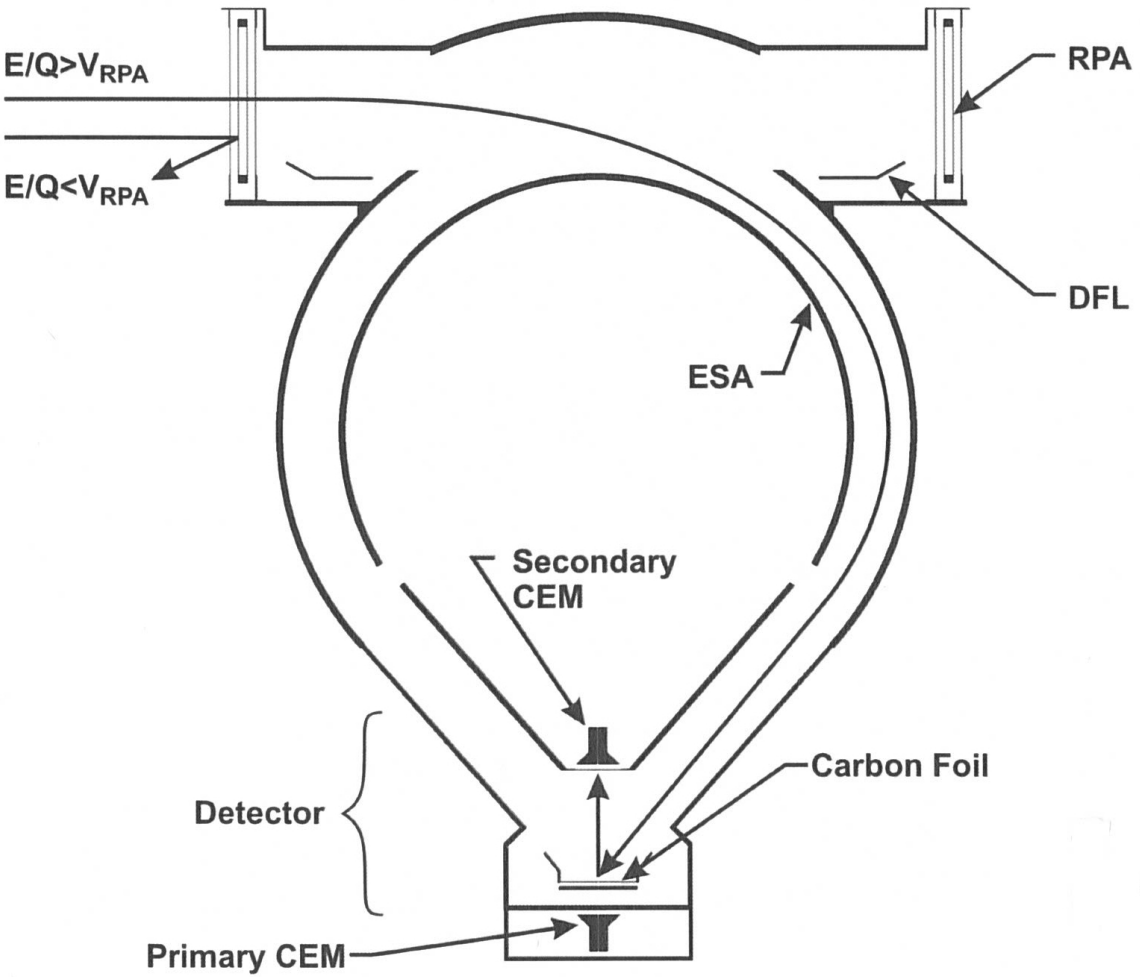
DESCRIPTION
Low Energy Plasma Instrument

ENERGY RANGE
30 eV - 7.7 keV

FIELD OF VIEW
270 deg x 10 deg
(deflection angles up to +15 deg)

ENERGY RESOLUTION
1 eV (< 2 keV); 9% (> 2 keV)

SPECIES
All Ions



New Horizons SWAP Data Sets

RAW -> nh-p-swap-2-pluto-v1.0

CALIBRATED -> nh-p-swap-3-pluto-v1.0

New Horizons SWAP Data Set Evaluation Tools

Staging and Evaluation -

Machine: Dell Precision T3400

Operating System: Fedora 18 linux

Data Processing -

Machine: Sun Ultra-350

Operating System: Sun Solaris OS 5.9

Minor Diagnostics -

Machine: IBM lenovo T60p ThinkPad

Operating System: Fedora 20 linux

Documentation Evaluation

Please add Note Somewhere in SWAP Data sets.

The PI of SWAP has moved and his address has not been updated within these documents. The new address for the SWAP PI is:

Dave McComas
Princeton University
PPPL
Peyton Hall
Princeton, NJ 08544

dmccomas@princeton.edu

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
aareadme.txt

Case Sensitivity – File names within double quotes (“...”) are shown in upper case characters, but are listed in the archive as lower case characters. This makes a difference to some machines. Should this be discussed here?

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
ref.cat - 1

The following slide was from the New Horizons review in 2014. At that time, these documents would not be released because of ITAR concerns by JPL. The SBN was going to look into this and there was some discussion about providing a non-ITAR sensitive reference to take the place of these references. There was also some discussion about demoting these references so that the could be released to the public. These references are again in the SWAP data reference list.

nh-j-swap-2-jupiter-v3.0/, nh-j-swap-3-jupiter-v3.0/, nh-x-swap-2-plutocruise-v2.0/, nh-x-swap-3-plutocruise-v2.0/ catalog/ref.cat - 2

- SwRI library unable to locate the following references:

```
OBJECT               = REFERENCE
  REFERENCE_KEY_ID   = "DSN810-5"
  REFERENCE_DESC     = "
Deep Space Network / Flight Project Interface Design Book, JPL-D-810-5, Jet
Propulsion Laboratory, Pasadena, CA 2003.
  "
END_OBJECT           = REFERENCE

OBJECT               = REFERENCE
  REFERENCE_KEY_ID   = "DSN821-104"
  REFERENCE_DESC     = "
Deep Space Mission Systems, Tracking and Navigation Service, Requirements and
Design, DSMS No. 821-104, Rev. B, JPL D-17235, Jet Propulsion Laboratory,
Pasadena, CA, 2003.
  "
END_OBJECT           = REFERENCE

OBJECT               = REFERENCE
  REFERENCE_KEY_ID   = "DSN821-110"
  REFERENCE_DESC     = "
Deep Space Mission Systems, Radio Science Service, Requirements and Design,
DSMS No. 821-110, Rev. A, JPL D-17241, Jet Propulsion Laboratory, Pasadena,
CA, 2001.
  "
END_OBJECT           = REFERENCE
```

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
ref.cat - 3

What is the status of these documents?
If they are still controlled documents, they do not belong in the SWAP reference list which is released to the public.

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
aareadme_bu.txt

Since this file is a duplicate of the aareadme.txt file in the home directory:

Case Sensitivity – File names within double quotes (“...”) are shown in upper case characters, but are listed in the archive as lower case characters. This makes a difference to some machines. Should this be discussed here?

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
soc_inst_icd.pdf - 1

In page 132 of the ICD, it refres to section 135 which does not exist:

column indicating if a background has been removed. The background is mentioned in section 135 and described in detail in the calibration document. Also in the TIME_LABEL_SPECT extension is a column

This is probably Section 14.5.10.

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
soc_inst_icd.pdf - 2

In page 133 of the ICD, it refers to section 13 which does not exist:

background has been removed. The background is described in mentioned in section 13 and described in detail in the calibration document.

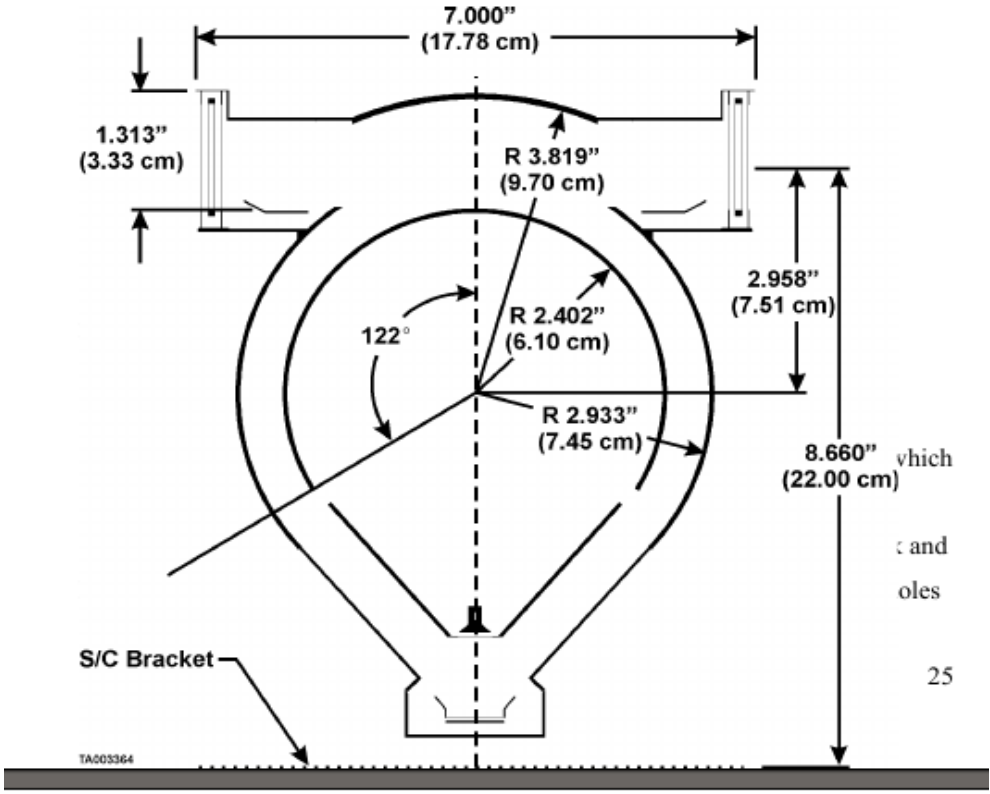
This is probably Section 14.5.10.

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf - 1

Some figures mask the underlying text. This occurred during creation of the pdf. Shown on the next set of slides are these figures:

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf
- 2

are restricted to the remaining 90°aligned with the – Y-axis. Figure 12 shows the key dimensions of the SWAP electro-optics.



vhich
and
oles

through nominal 0.394-mm-thick aluminum in a close-packed hexagonal configuration (Figure 13). From outermost to innermost, the outer diameters of

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf
- 3

electric field in the RPA region. The unobstructed Field of View (FOV) is 276° in the roll direction.

gy cutoff so that we
g it with a coarse
electrostatic "hill"
heir original energy
A grid.

ct particles from above the central plane of the instrument (from further out in the –Z axis of the spacecraft) into the ESA. The deflector is located just inboard of the RPA. The

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf
- 4

addition to these instrument subassemblies, we also discuss SWAP's structural and thermal design in the following sections.

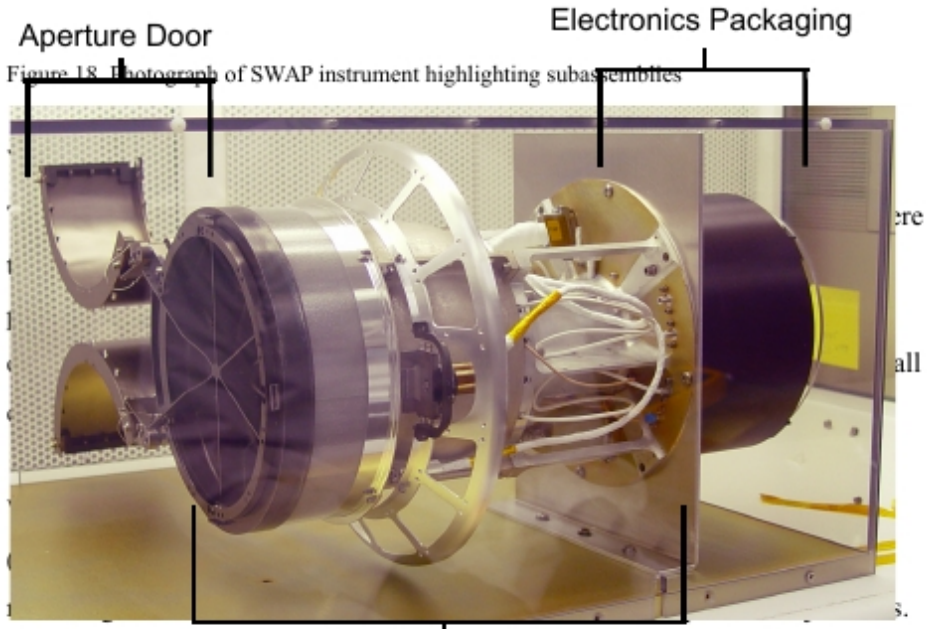


Figure 18. Photograph of SWAP instrument highlighting subassemblies

ere

all

s.

We accommodated this by [illegible] and Secondary CEM assemblies from a cantilevered support hidden in the 90° region where SWAP

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf
- 5

does not require particle viewing. The location of this cantilever matches up with the hinge assembly on the door.

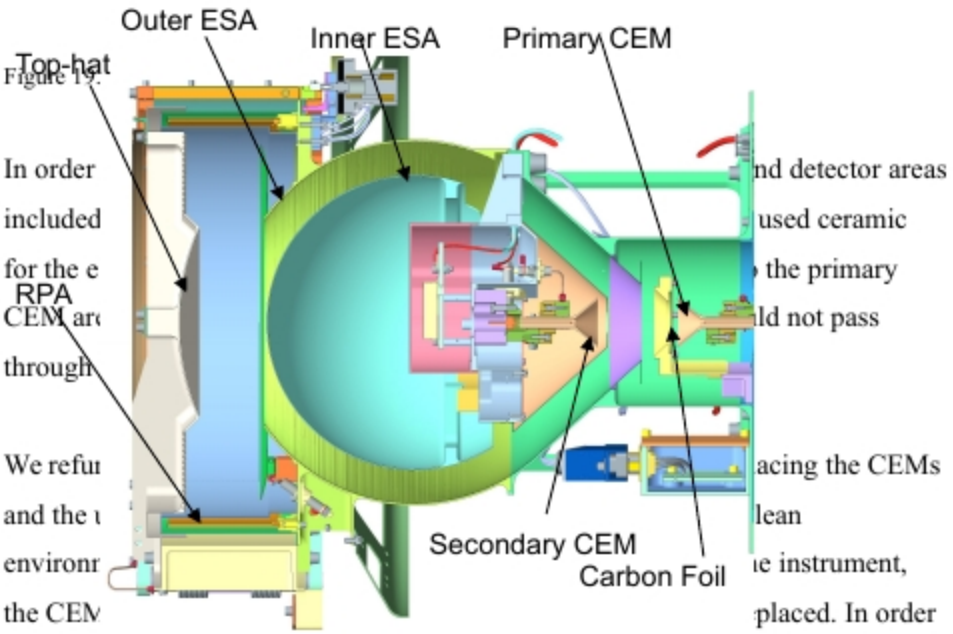


Figure 19:

In order nd detector areas included used ceramic for the e the primary CEM ar ld not pass through

We refu acing the CEMs and the lean environr e instrument, the CEM placed. In order to meet the alignment requirements for the electro-optics, we designed features that would control the concentricity and placement of the optics and detectors in relation to each other both before and after refurbishment.

3.3.2 Aperture door design

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.pdf
- 6

that the door's torque margin was greater than 2.25. Testing demonstrated a torque margin of 3.10, and the door successfully opened in flight.

Figure 20. Do … it can spring open.

3.3.3 Ele…

Figure 21 s… f the SWAP instr… electronics … v different vi… RPA and E…

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
pdsdd_insert_newhorizons.txt

GOOD, but this file reads as through it was a left over file from creating the data files for delivery and not supposed to be included. Is is supposed to be here?

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/data_summary_plots
swap_pluto_datasumm.lbl

This file calls out that the data files in this directory are in upper case characters:

PNG_DOCUMENT =
{"SWAP_001DAY_201501132359.PNG",
"SWAP_001DAY_201501142359.PNG", ...

However, in the directory, the file names are listed in lower case characters as follows:

swap_001day_201501132359.png
swap_001day_201501142359.png

Is this important?

SWAP Summary Plots

Why are there plots with only frames included within the summary plots? Are they indications on no data or failure when generating the summary plot? I would recommend removing them either way.

nh-p-swap-2-pluto-v1.0
document/data_summary_plots
swap_001day_201507042359.png

New Horizons Solar Wind Around Pluto (SWAP) Data
07/04/2015 (185) 23:59:41 to 07/06/2015 (187) 00:00:01 UTC

HRS
DOY
MM/DD
AU

Software Version: ' 3.00000' Processed: 2016-02-12T18:58:52
Plot Created: Mon Mar 28 07:24:26 2016
Files: e/soc/data/pds-pluto/level2/swa/02 to e/soc/data/pds-pluto/level2/swa/02

Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

nh-p-swap-2-pluto-v1.0
document/data_summary_plots
swap_001day_201507052359.png

New Horizons Solar Wind Around Pluto (SWAP) Data
07/05/2015 (186) 23:59:41 to 07/07/2015 (188) 00:00:01 UTC

HRS
DOY
MM/DD
AU

Software Version: ' 3.00000' Processed: 2016-02-12T18:58:52
Plot Created: Mon Mar 28 07:24:48 2016
Files: e/soc/data/pds-pluto/level2/swa/02 to e/soc/data/pds-pluto/level2/swa/02

Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

nh-p-swap-3-pluto-v1.0
document/data_summary_plots
swap_001day_201507042359.png

New Horizons Solar Wind Around Pluto (SWAP) Data
07/04/2015 (185) 23:59:41 to 07/06/2015 (187) 00:00:01 UTC

HRS
DOY
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AU

Software Version: ' 3.00000' Processed: 2016-02-12T18:58:52
Plot Created: Mon Mar 28 07:24:26 2016
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Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

nh-p-swap-3-pluto-v1.0
document/data_summary_plots
swap_001day_201507052359.png

New Horizons Solar Wind Around Pluto (SWAP) Data
07/05/2015 (186) 23:59:41 to 07/07/2015 (188) 00:00:01 UTC

HRS
DOY
MM/DD
AU

Software Version: ' 3.00000' Processed: 2016-02-12T18:58:52
Plot Created: Mon Mar 28 07:24:48 2016
Files: e/soc/data/pds-pluto/level2/swa/02 to e/soc/data/pds-pluto/level2/swa/02

Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

nh-p-swap-2-pluto-v1.0 document/sampleswapplots/jupswap.lst

Why are the entries for the level 3 product under the level 2 sample plot?

jupswap.lst for Level 2:

nhjusw_3/data/20070225_003473/swa_0034732800_0x584_sci_1.fit

jupswap.lst for Level 3:

nhjusw_3/data/20070225_003473/swa_0034732800_0x584_sci_1.fit

Why is the jupswap.lst for entry for Level 2 not:

nhjusw_2/data/20070225_003473/swa_0034732800_0x584_eng_1.fit

nh-p-swap-2-pluto-v1.0 document/sampleswapplots/swapsgram.png

Why is the sample plot for level 3 SWAP data under the level 2 data product? Why is it not a level 2 SWAP data product example?

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/samples/swap_samples.lbl

This file calls out the data files in this directory are in upper case characters and this agrees with the text explanation later in this file, making a point that the files are in upper case. This file shows:

SAMPLE_ASCII_DOCUMENT =
{ "SWA_0283507232_586_E_00.ASC”,
"SWA_0283507232_586_E_01.ASC", ...

However, in the directory, the file names are listed in lower case characters as follows:

swa_0283507232_586_e_00.asc
swa_0283507232_586_e_01.asc

On some types of machines this does make a difference, like the SOC which uses the linux operating system. Is this a problem?

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/traj/traj_2006_2015_1d.lbl

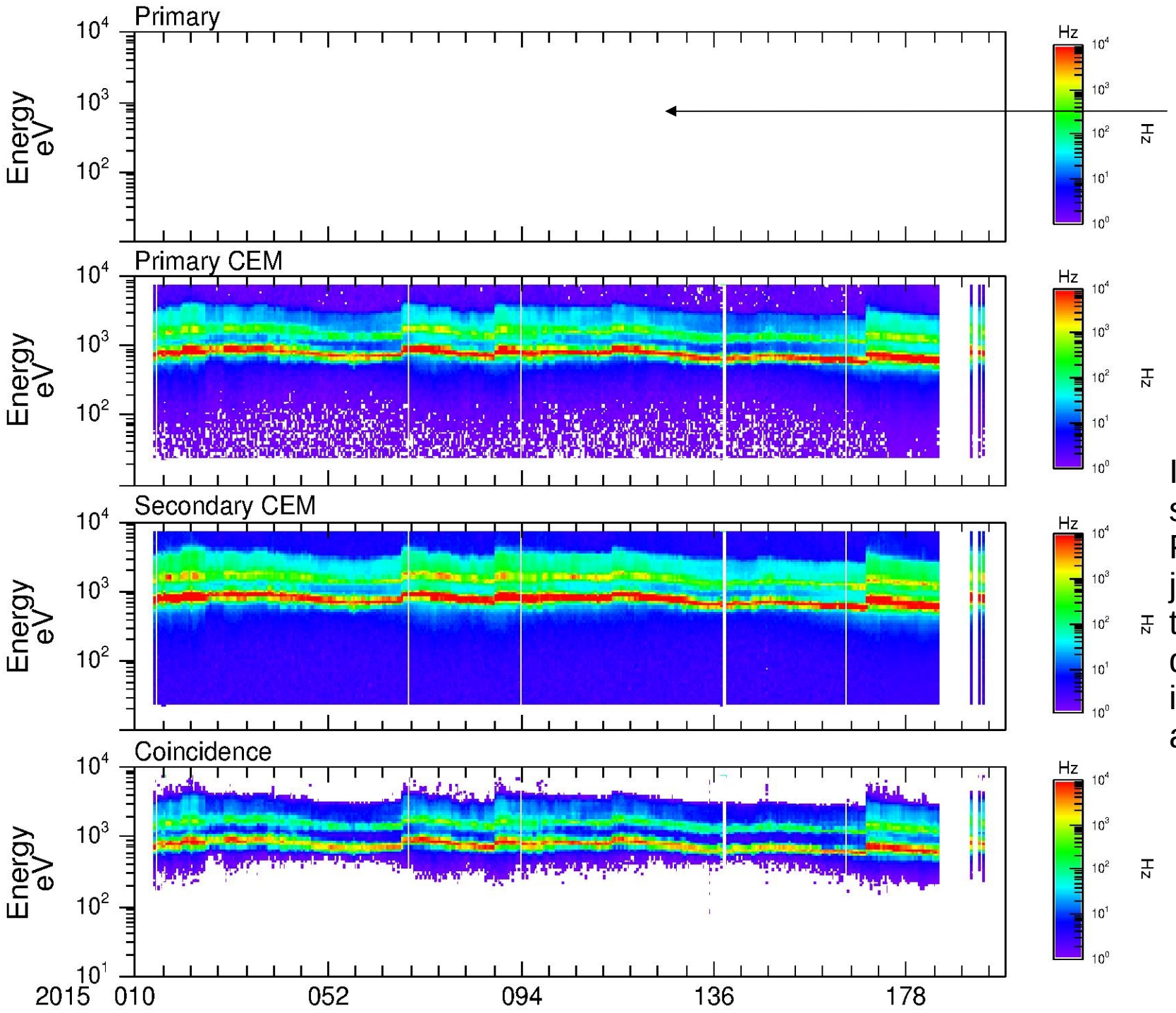
Table name is quoted in upper case but the file name is in lower case in the archive.

Data Evaluation

Science Data Samples - 0x584

As a special note, the science data samples plots in the document/data_summary_plots were very helpful as the evaluator had issues with the FITS Viewer (FV).

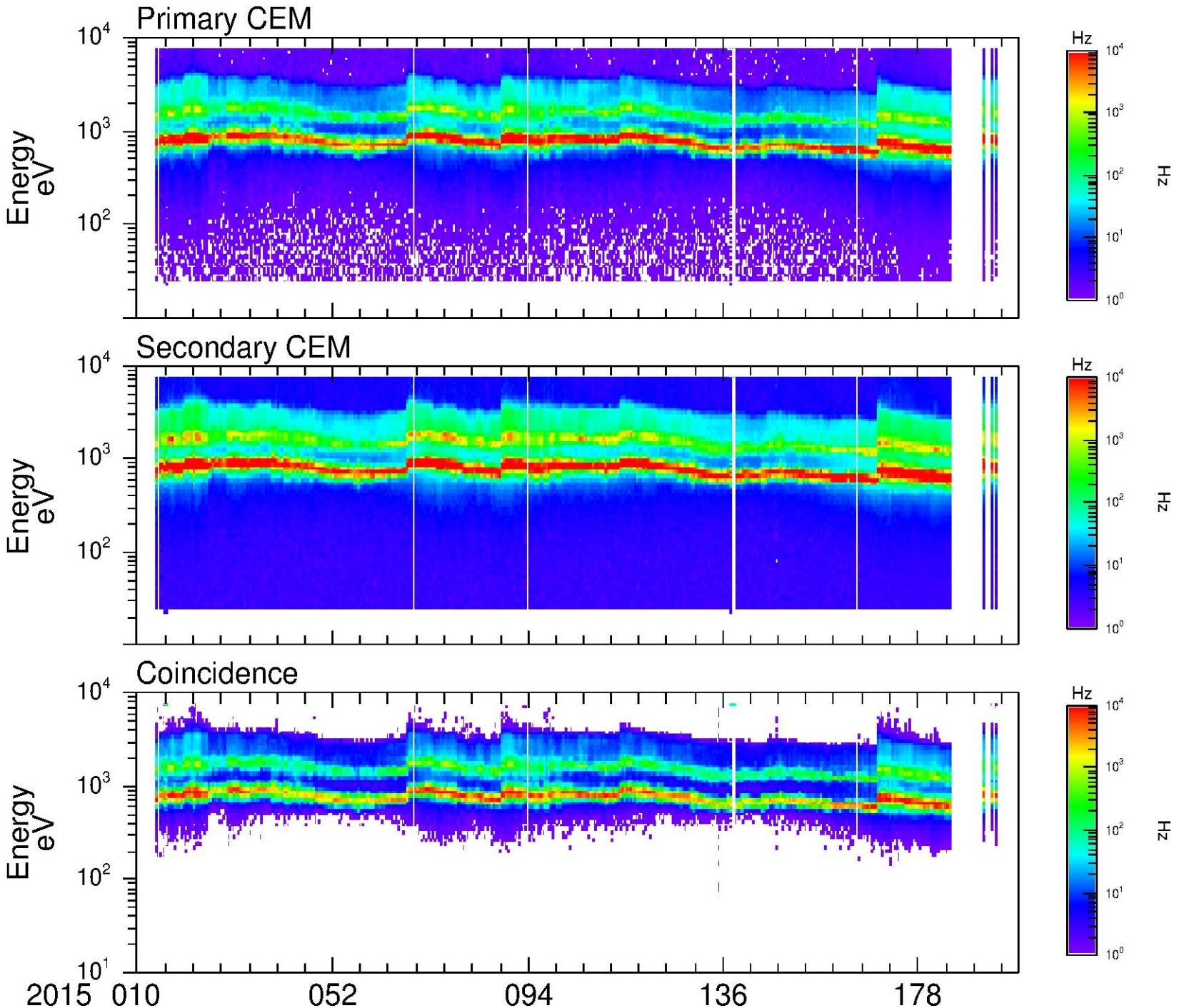
SWAP Science FIT Files



Primary HDU Empty – Change Not Documented

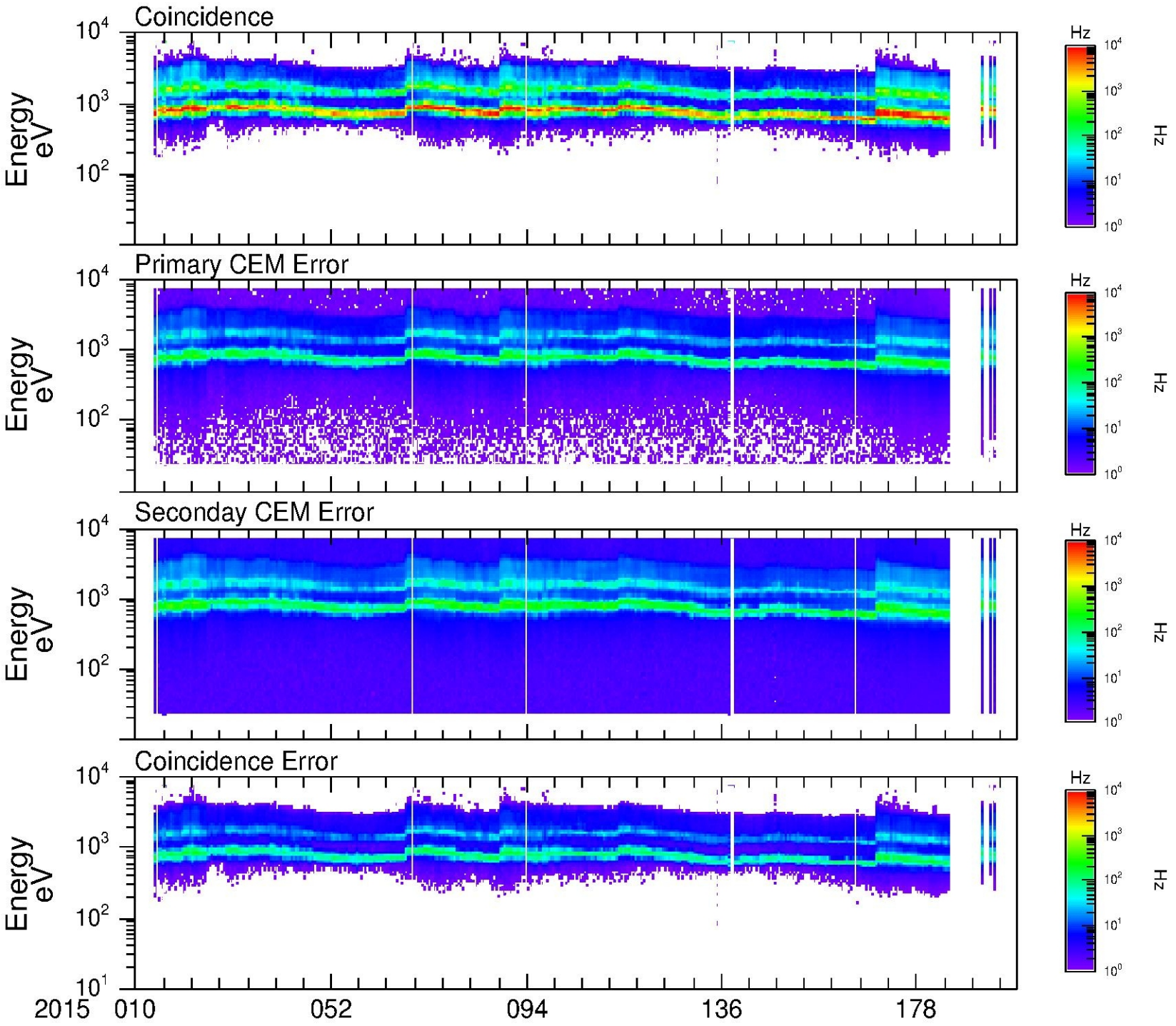
I think that it was said that the Primary data is just a copy of the Concidence data, so I removed it from further analysis.

SWAP Science



GOOD

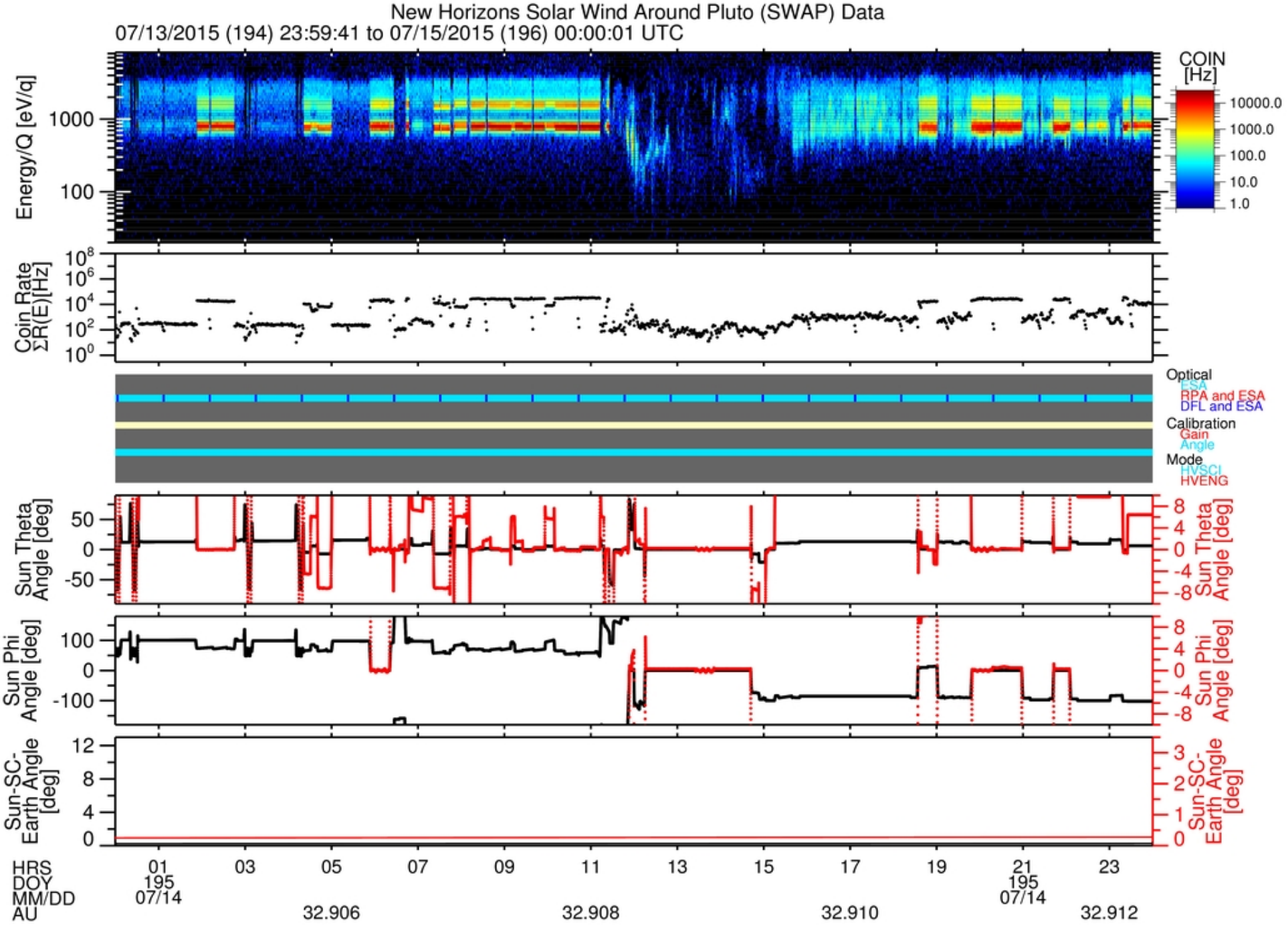
SWAP Science Errors



GOOD

SWAP Science
Check at the Pluto Encounter Day

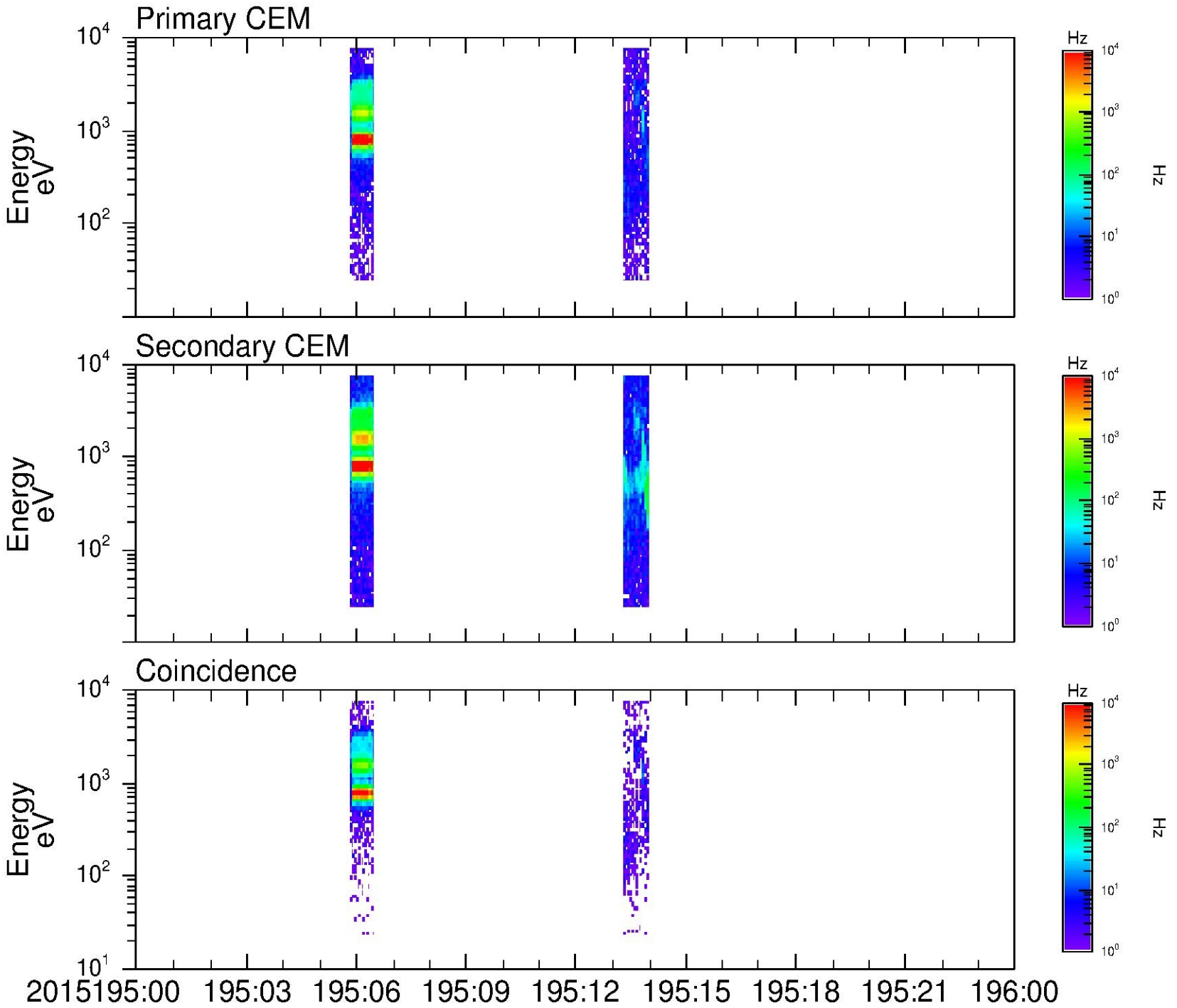
Test of science to see if it appears as the summary plots. Let's look at the Pluto encounter day to see if we reproduce the summary plot?



Software Version: ' 3.00000' Processed: 2016-02-12T19:21:27
Plot Created: Mon Mar 28 11:26:55 2016
Files: e/soc/data/pds-pluto/level2/swa/02 to e/soc/data/pds-pluto/level2/swa/02

Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

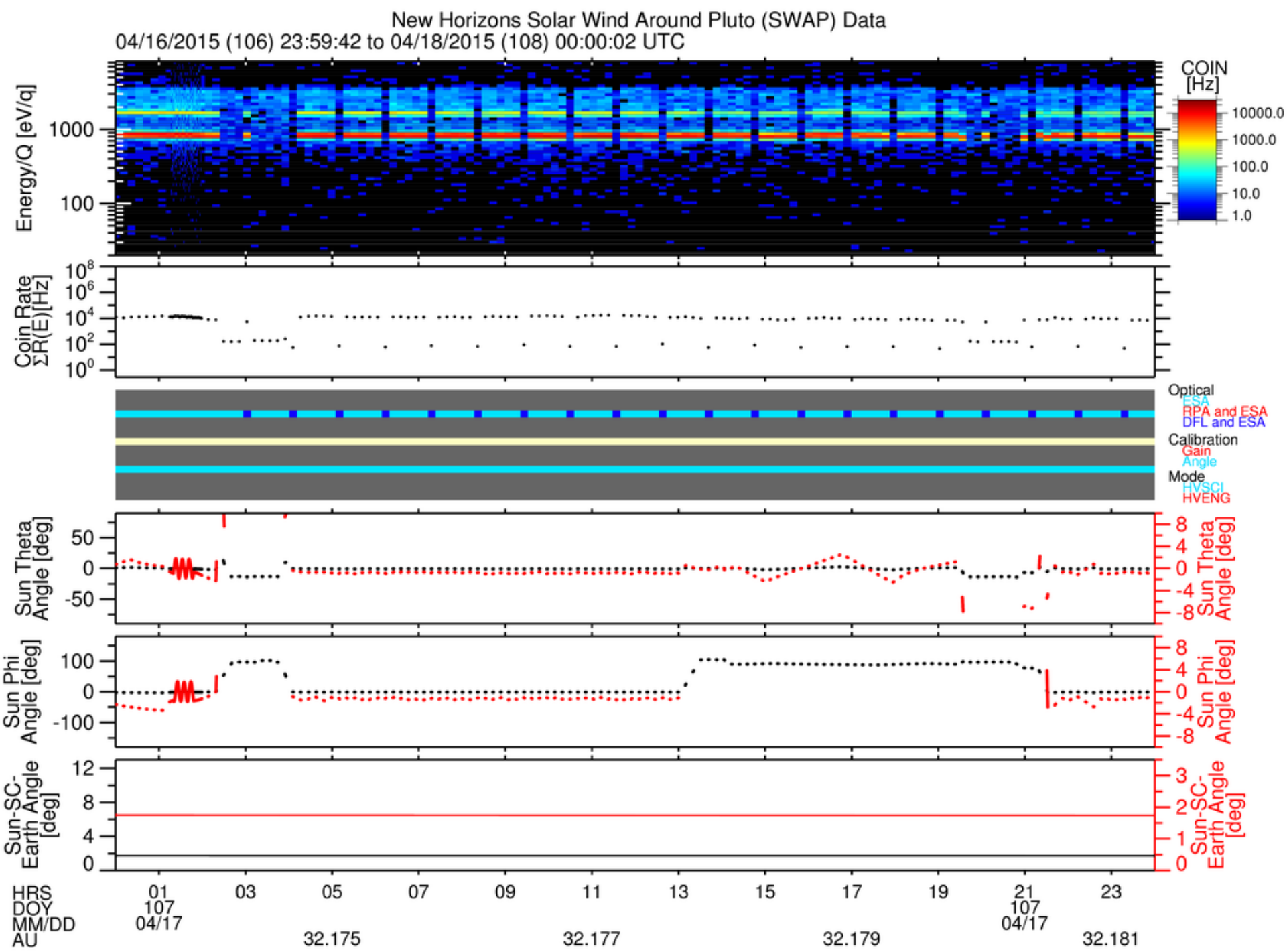
SWAP Data From Pluto Encounter



SWAP data is currently limited during Pluto encounter due to telemetry download schedule. A subsequent data delivery is to contain this data.

SWAP Science
Check at a Solar Wind Day

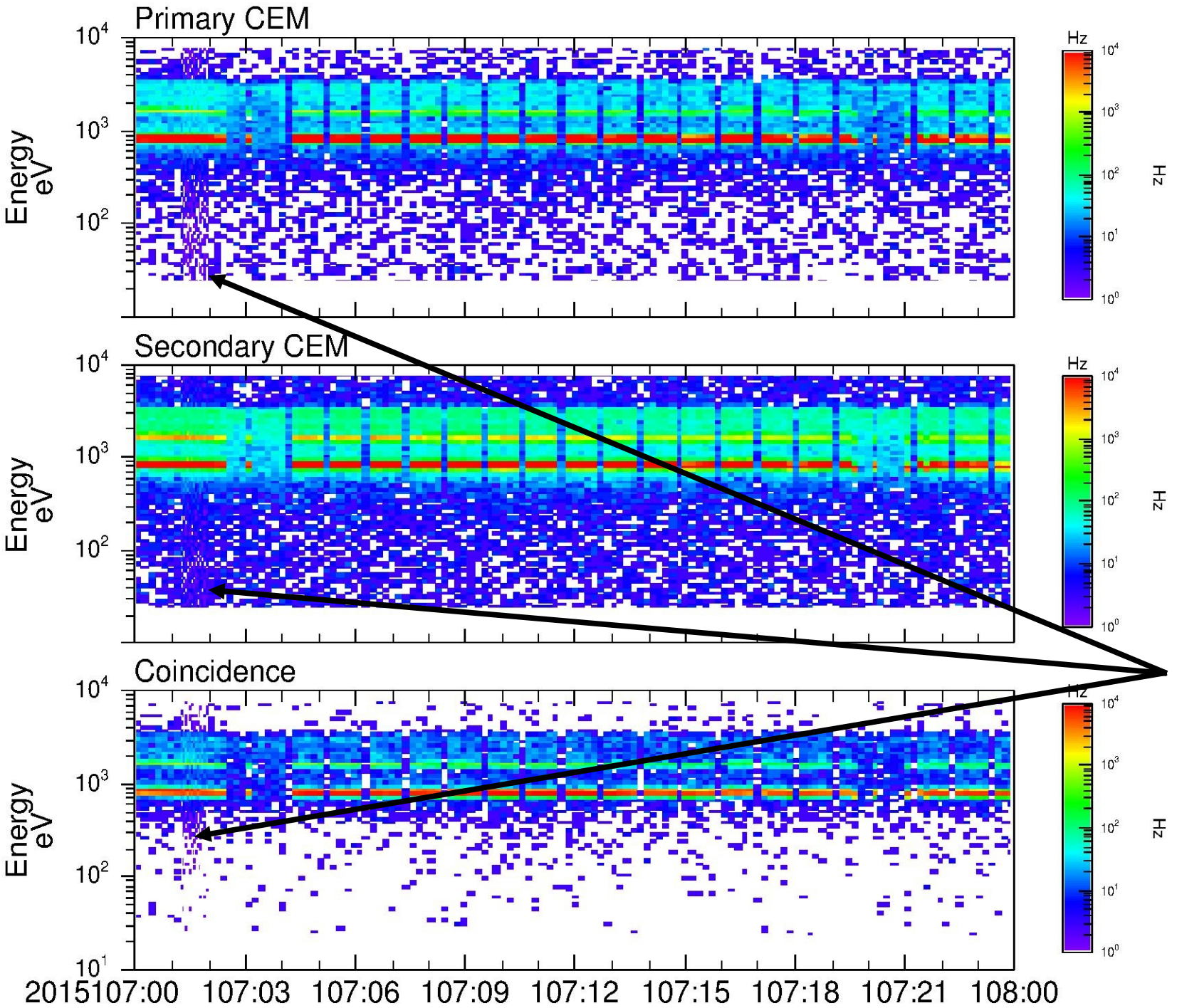
It turns out that the Pluto encounter day is not a very good time period to check because this is a partial data delivery which only included a limited amount of Pluto science data. This data includes data from the approach to Pluto. On the next slide we have chosen data from a solar wind time period.



Software Version: ' 3.00000' Processed: 2016-02-12T17:53:08
Plot Created: Mon Mar 28 01:44:18 2016
Files: e/soc/data/pds-pluto/level2/swa/02 to e/soc/data/pds-pluto/level2/swa/02

Spectrogram Timing Accurate to Within: 20.00 [sec]
Plot Width:: 0.754545 [norm]
Plot Width: 8.3000 [in]

Solar Wind Day



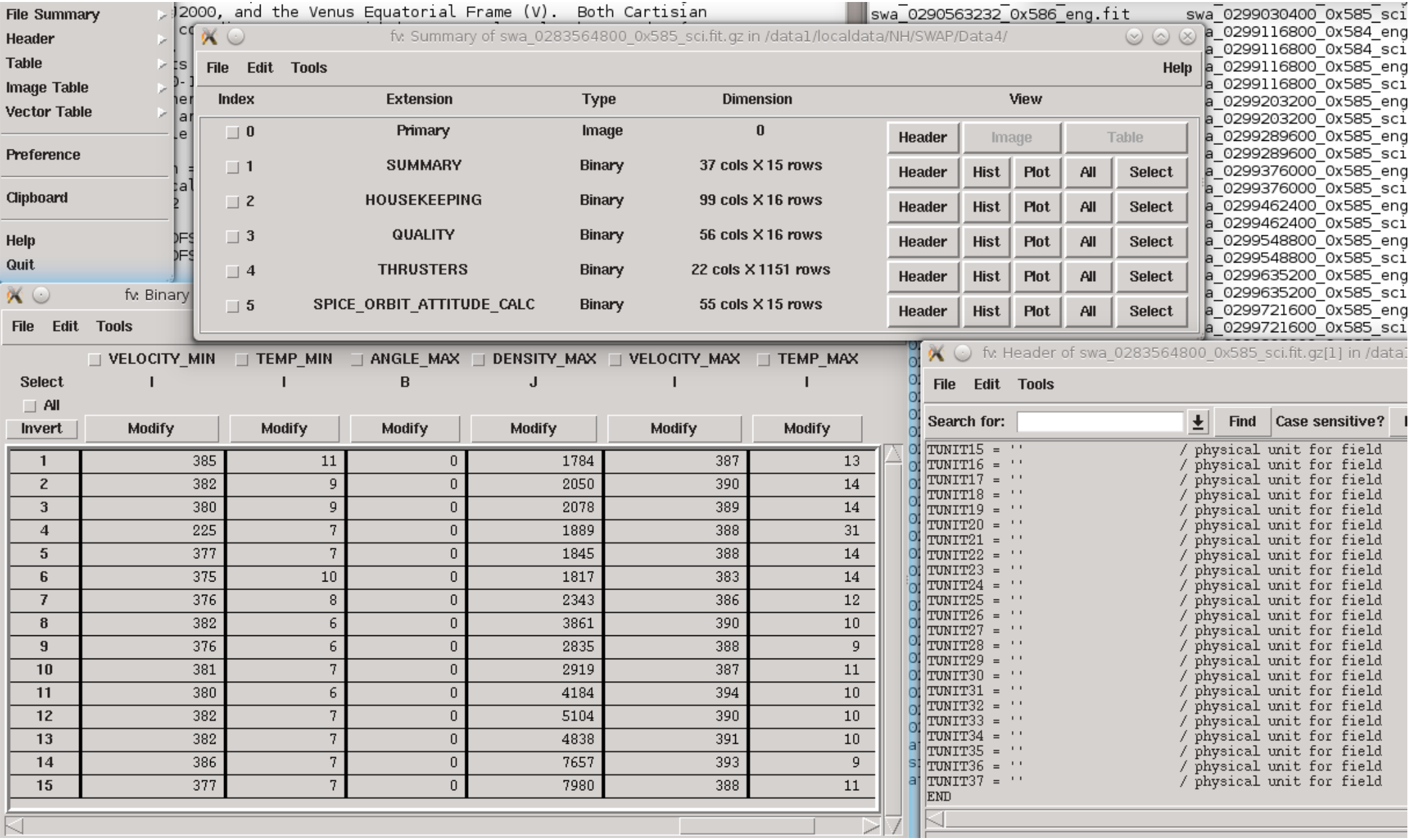
See the same deviations at Regular intervals and changes in intensity

Increased time resolution, hard to see if it is there on the summary plot.

Summary Data 0x585

Tried to interpret solar wind density, temperature, and velocity from the Summary Data. Found no information on the parameter units. The next page shows a fits viewer screen shot from the file swa_0283564800_0x585_sci.fit. It shows that there is data for the Summary parameters of solar wind density, temperature, and velocity. The header shows that these have units of “physical unit for field”. The label file has “N/A” for the unit. The ICD does not show the units for these parameters. What are they?

Example Entry from swa_0283564800_0x585_sci.fit



Example Entry from swa_0283564800_0x585_sci.lbl

OBJECT = COLUMN
NAME = "DENSITY_MAX"
BYTES = 4
COLUMN_NUMBER = 33
DATA_TYPE = "MSB_INTEGER”
START_BYTE = 231
DESCRIPTION = “
Full Mnemonic:
SWAP_SM.DENSITY_MAX
General Description:
Maximum Density
Subsystem: SWAP
Packet ApID: 0X585
Byte Offset within ApID packet: 79
Bit Offset within Byte of ApID packet: 0
Bit Length within ApID packet: 24
Type of value: UNSIGNED
Units: N/A
"
OFFSET = 2147483648.00
SCALING_FACTOR= 1.00000000000
UNIT = "N/A"
END_OBJECT = COLUMN

Missing Definition of Mission Sub Phases

The dataset.cat file calls out sub-phases of the Pluto encounter:

During the Pluto 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 first SWAP delivery for

However, I can not find any information about sub-phases for the Pluto encounter, their duration and definition.

Back-Up Slides

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
voldesc.cat

GOOD

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
nhsc.cat

GOOD

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
catinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
nh.cat

GOOD

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
swap.cat

GOOD

nh-p-swap-2-pluto-v1.0/catalog
nh-p-swap-3-pluto-v1.0/catalog
dataset.cat

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
docinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
codmac_level_definitions.lbl
codmac_level_definitions.pdf

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
soc_inst_icd.lbl

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
nh_fov.lbl and nh_fov.png

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
lunineetal1995.lbl and lunineetal1995.pdf

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
nh_met2utc.lbl and nh_met2utc.tab

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
nh_mission_trajectory.lbl
nh_mission_trajectory.tab

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
nh_trajectory.lbl and nh_trajectory.tab

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
payload_ssr.lbl and payload_ssr.pdf

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/swap_ssr.lbl

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
nh_swap_v200_ti.txt

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
quat_axyz_instr_to_j2k.lbl
quat_axyz_instr_to_j2k.asc

GOOD

nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
seq_swap_pluto.lbl and seq_swap_pluto.tab

GOOD

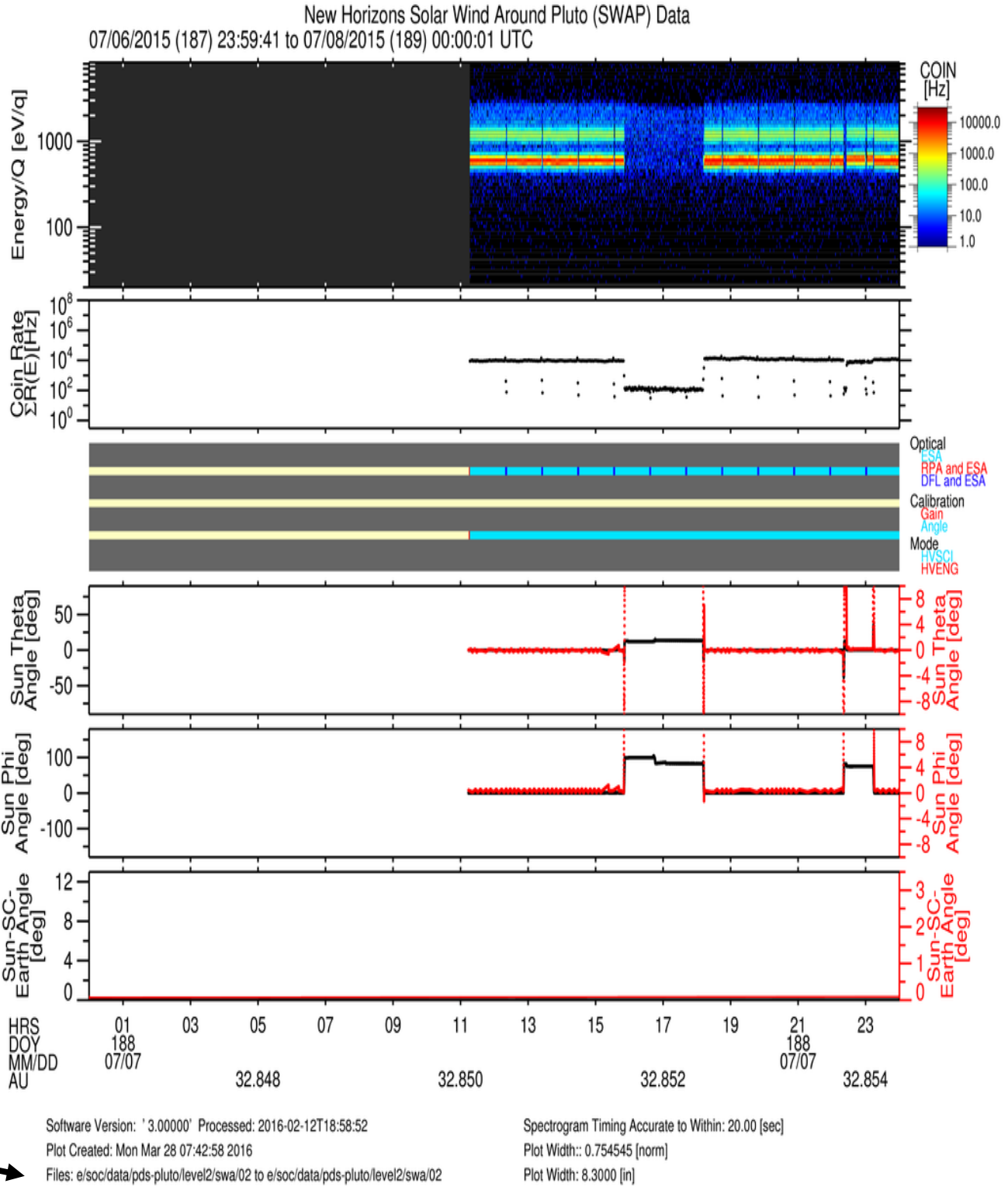
nh-p-swap-2-pluto-v1.0/document
nh-p-swap-3-pluto-v1.0/document
swap_cal.lbl and swap_cal.pdf

GOOD

nh-p-swap-3-pluto-v1.0 document data_summary_plots swap_001day_20150706 2359.png

Answer – These are generated In the SOC where the data File used to generate these Plots are called level 2 data. These are not PDS levels.

Why do these plots say the File is Level 2? It can not be this plot file since it is a Level 3 file and has a different Name.



nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/sampleswapplots/00readme.asc

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/sampleswapplots/swapplots.lbl

GOOD

nh-p-swap-3-pluto-v1.0
document/sampleswapplots/jupswap.lst

GOOD

nh-p-swap-3-pluto-v1.0
document/sampleswapplots/swapsgram.png

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/sampleswapplots
getswapplotdata.pro, swapplots.pro,
tvimage.pro

Unable to evaluate, did not try out this code.

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/samples/sampinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/samples Data Files

A few files were spot checked and I could not determine there were any issues.

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/traj/trajinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/traj/traj.fmt

GOOD

nh-p-swap-2-pluto-v1.0
nh-p-swap-3-pluto-v1.0
document/traj/traj_2006_2015_1d.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
calinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
background_009_dac_jup.lbl
background_009_dac_jup.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
background_009_dac.lbl
background_009_dac.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
esa_rpa_v16_energy_binsf_new.lbl
esa_rpa_v16_energy_binsf_new.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
esa_rpa_v18_energy_binsf_new.lbl
esa_rpa_v18_energy_binsf_new.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
esa_rpa_v19_energy_binsf_new2.lbl
esa_rpa_v19_energy_binsf_new2.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
esa_shape.lbl and esa_shape.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
fov_mask_2d.lbl and fov_mask_2d.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
list_energy_files.lbl and list_energy_files.tab

GOOD

nh-p-swap-2-pluto-v1.0/calib
nh-p-swap-3-pluto-v1.0/calib
rpa_shape.lbl and rpa_shape.tab

GOOD

nh-p-swap-2-pluto-v1.0/index
nh-p-swap-3-pluto-v1.0/index
indxinfo.txt

GOOD

nh-p-swap-2-pluto-v1.0/index
nh-p-swap-3-pluto-v1.0/index
checksum.lbl and checksum.tab

GOOD

nh-p-swap-2-pluto-v1.0/index
nh-p-swap-3-pluto-v1.0/index
index.lbl and index.tab

GOOD

nh-p-swap-2-pluto-v1.0/index
nh-p-swap-3-pluto-v1.0/index
slimindx.lbl and slimindx.tab

GOOD