Solar Wind Around Pluto
SWAP

PRINCIPAL INVESTIGATOR
Dave McComas, Princeton University

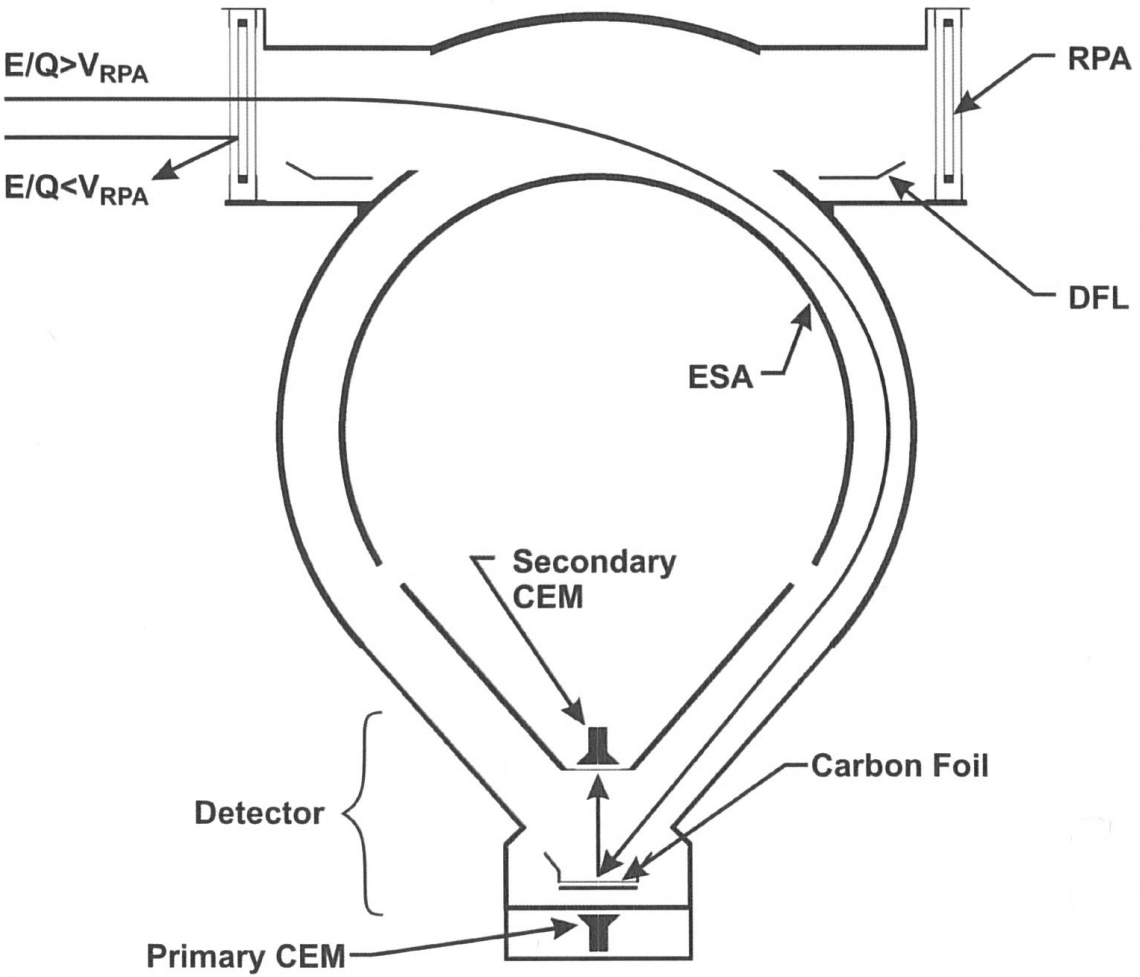
DESCRIPTION
Low Energy Plasma Instrument

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 Data Sets:
nh-x-swap-2-kemcruise1-v1.0

CALIBRATED Data Sets:
nh-x-swap-3-kemcruise1-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

Staging and Minor Diagnostics -

Machine: IBM lenovo T60p ThinkPad

Operating System: Fedora 25 linux

SWAP Documentation Evaluation

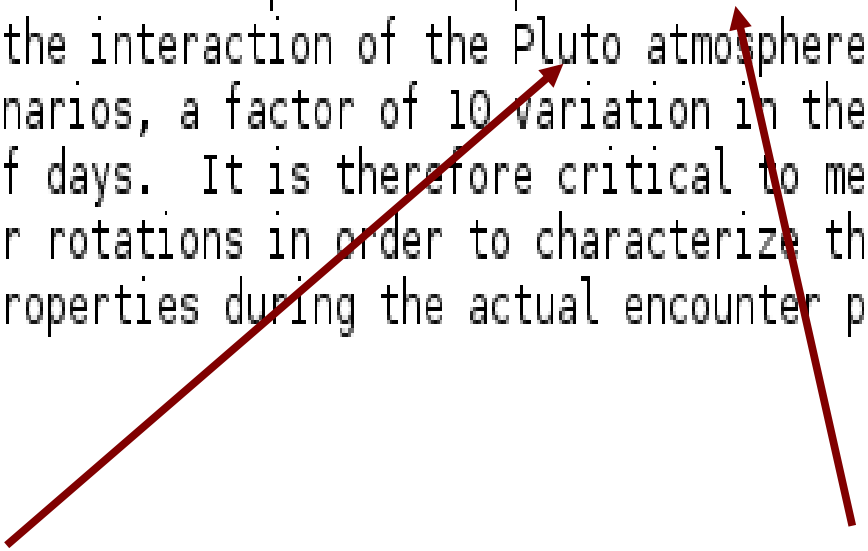
nh-x-swap-3-kemcruise1-v1.0/catalog
swap.cat 1 of 2

```
Calibration
========

See

   /DOCUMENT/SWAP/SWAP_CAL.*
```

The files SWAP_CAL.* are in the DOCUMENT directory directly, not in a separate SWAP subdirectory as shown.

nh-x-swap-3-kemcruise1-v1.0/catalog swap.cat 2 of 2

The SWAP experiment detects atmospheric escape from Pluto as a change in the solar wind caused by the interaction of the Pluto atmosphere with the solar wind. In certain scenarios, a factor of 10 variation in the solar wind may occur over a period of days. It is therefore critical to measure the solar wind for several solar rotations in order to characterize the most likely external solar wind properties during the actual encounter period.



Since this is the kem data set where the New Horizons spacecraft has already passed Pluto, should this text not be either updated to reflect the New object or removed from the Operational Considerations?

nh-x-swap-3-kemcruise1-v1.0/document swap_cal.pdf – 1 of 2

Formula for RPA Voltage as a function of Azimuth Angle

$$f = \cos^2(2\alpha), \qquad \alpha <= 4.0$$

$$f = \cos^2(3.5\alpha \mid 20) - 0.03, \qquad 4.0 < \alpha <= 10 \qquad (2)$$

$$f = \cos^2(5.5\alpha - 65) - 0.085, \qquad 10 < \alpha$$

This includes negative angles.

Unknown Math Symbol

I assume that this is an average value for f since it covers the same α range as the first two definitions.

I assume that $f = 0$ for $\alpha \geq 10°$ and $f = 0$ for $-10° \leq \alpha$

nh-x-swap-3-kemcruise1-v1.0/document
swap_cal.pdf – 2 of 2

Since you have to touch this file to fix the previous equation description, I would cite the instrument reference at the first instance. Say something like: the instrument paper is included in the document directory in the file swap_ssr.pdf.

nh-x-swap-3-kemcruise1-v1.0/document
nh_met2utc.lbl & nh_met2utc.pdf

These files need to be updated to include the current data. The last entry in the tab file is on January 2, 2016. Data should continue through the time covered by the data submitted in this archive.

nh-x-swap-3-kemcruise1-v1.0/document/traj
trajinfo.txt

This file needs to be updated to (1) extend the TRAJ_2006_2015_1D.TAB file to include the correct trajectory information and adjust the comments, and (2) remove the files and references to the TRAJ_PLUTO_FLYBY files.

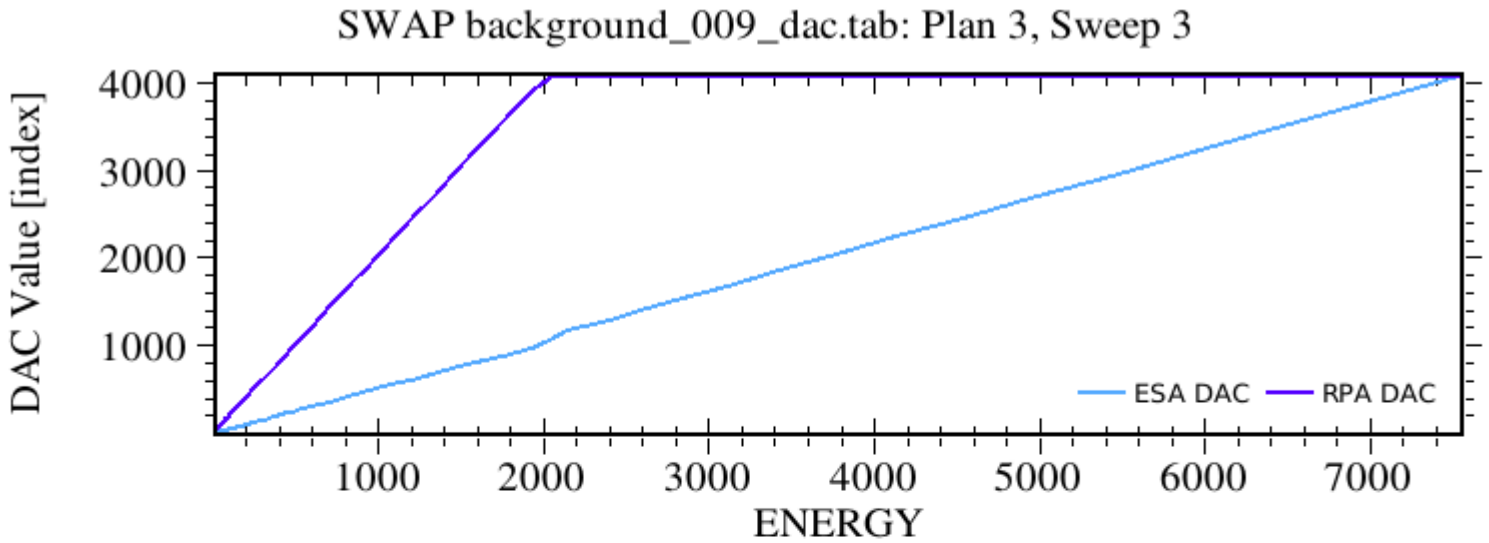
nh-x-swap-3-kemcruise1-v1.0/document/traj
traj_2006_2015_1d.lbl & traj_2006_2015_1d.tab

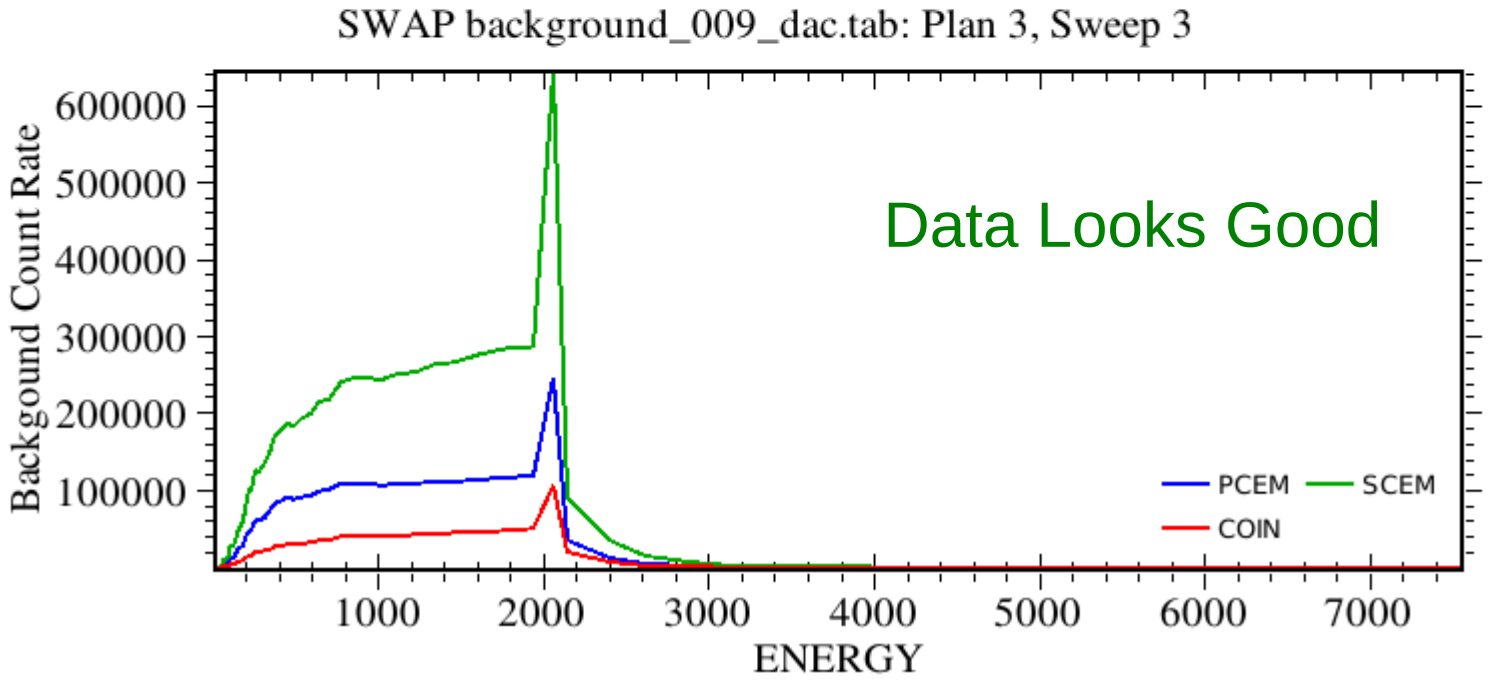
These files represent the trajectory of the New Horizons spacecraft and need to be updated to include the data for the time range of submission.

nh-x-swap-3-kemcruise1-v1.0/document/traj
traj_pluto_flyby.lbl & traj_pluto_flyby.tab

Remove these files from this archive. They are not relevant to the kem dataset.

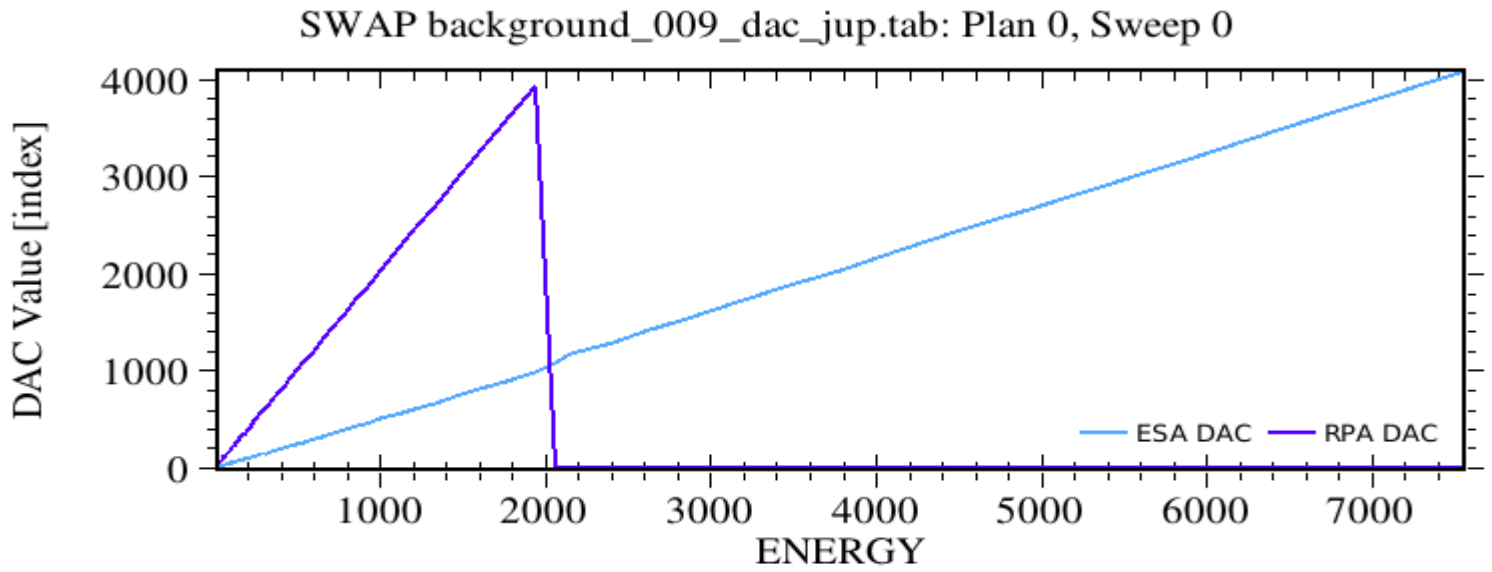
nh-x-swap-3-kemcruise1-v1.0/calib
background_009_dac.tab

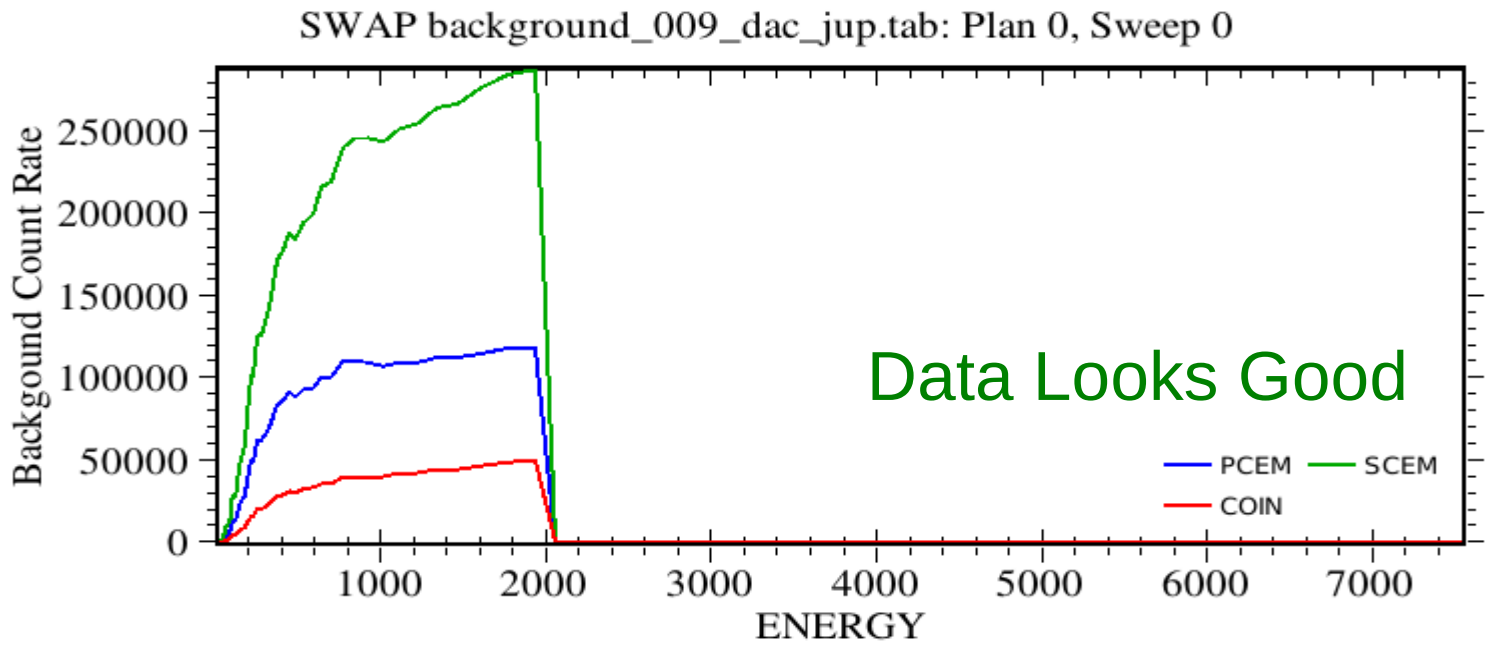




Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Sat Sep 29 20:28:35 2018.

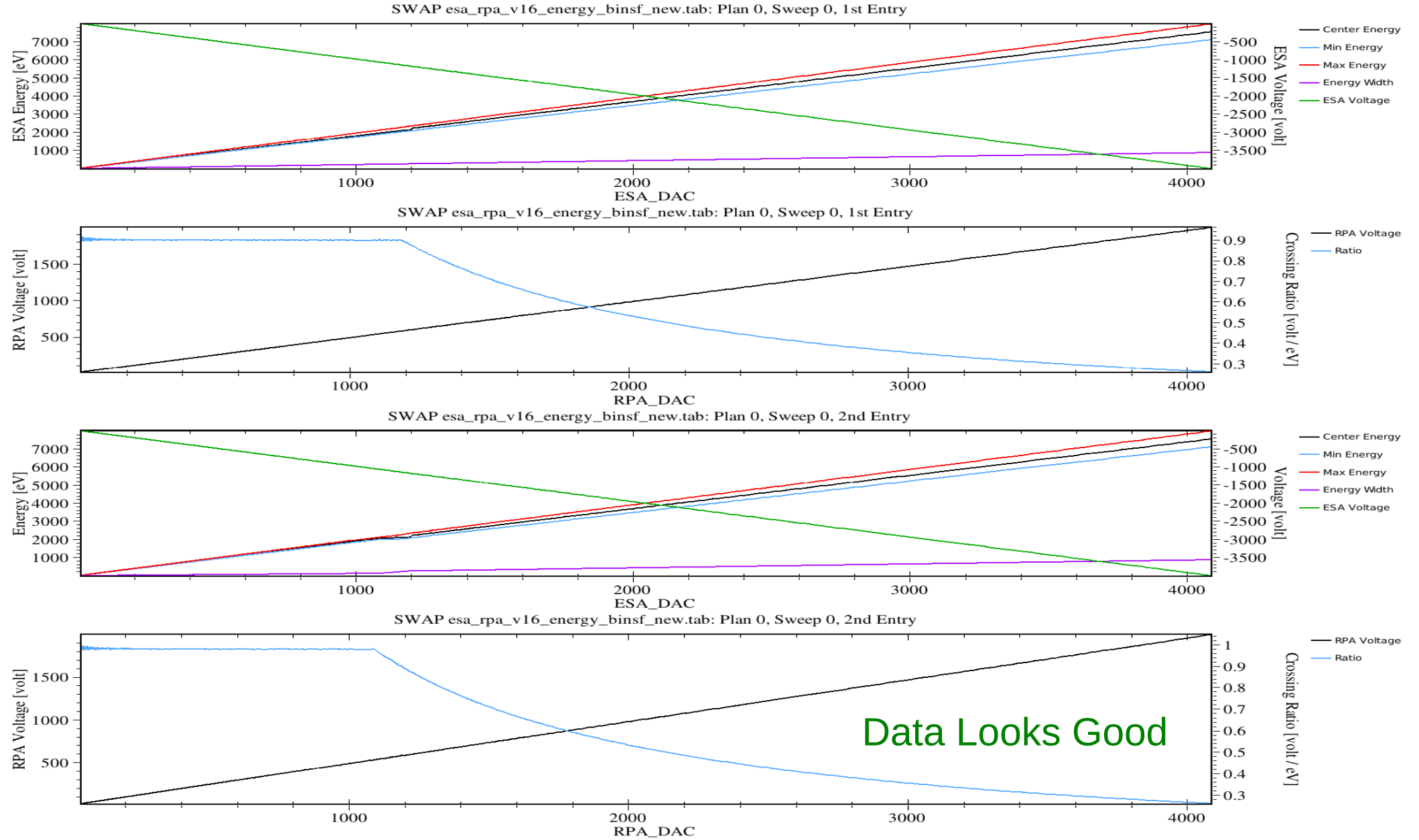
nh-x-swap-3-kemcruise1-v1.0/calib background_009_dac_jup.tab



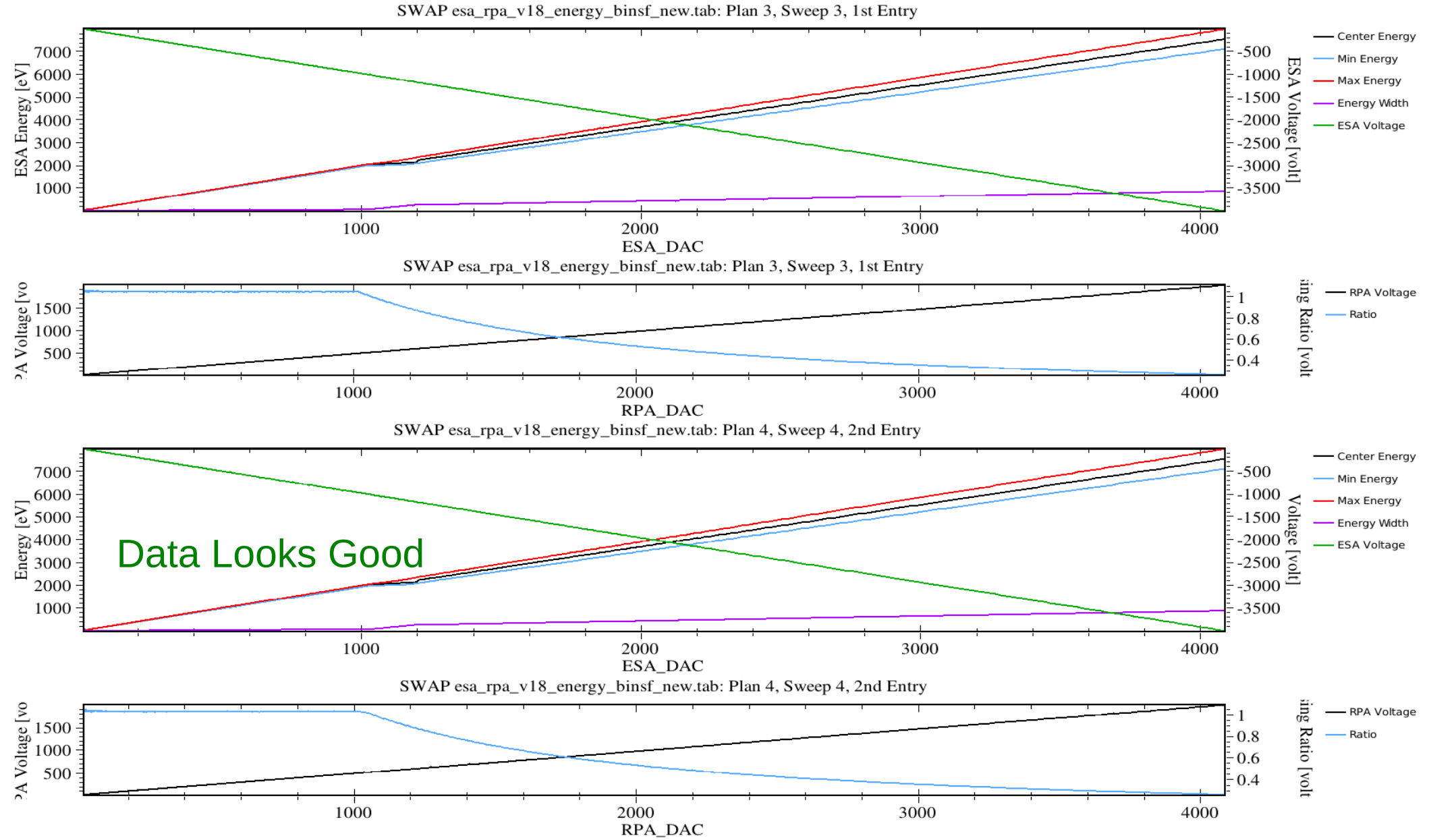


Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Sat Sep 29 20:36:07 2018.

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v16_energy_binsf_new.tab

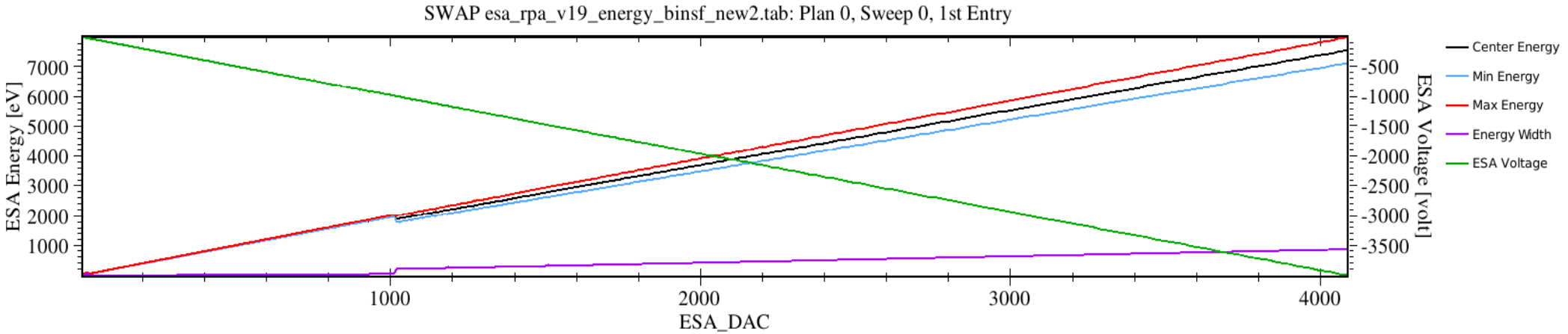


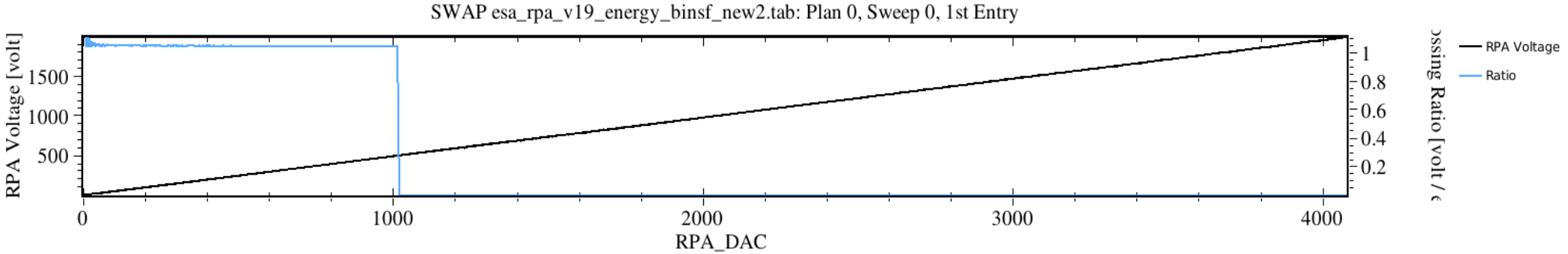
nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v18_energy_binsf_new.tab

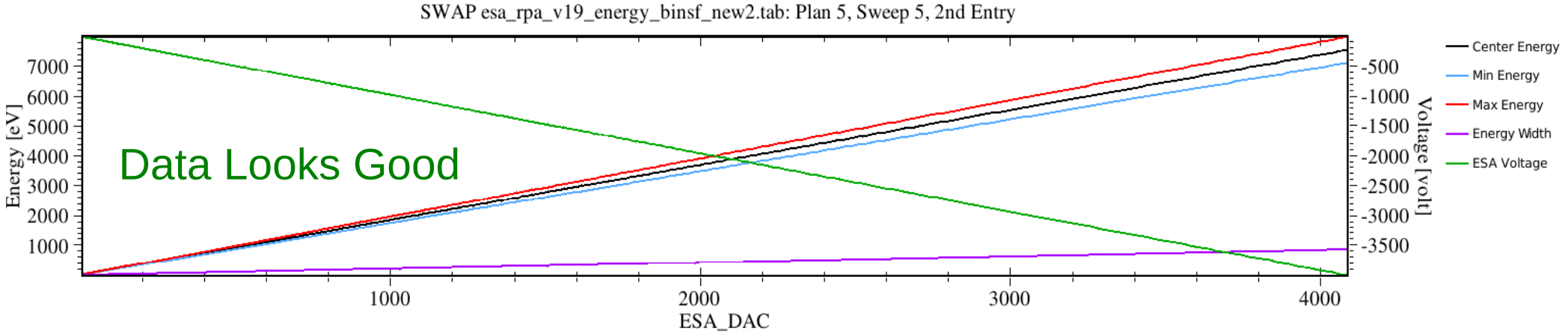


Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Sat Sep 29 21:04:03 2018.

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v19_energy_binsf_new2.tab – 1 of 2

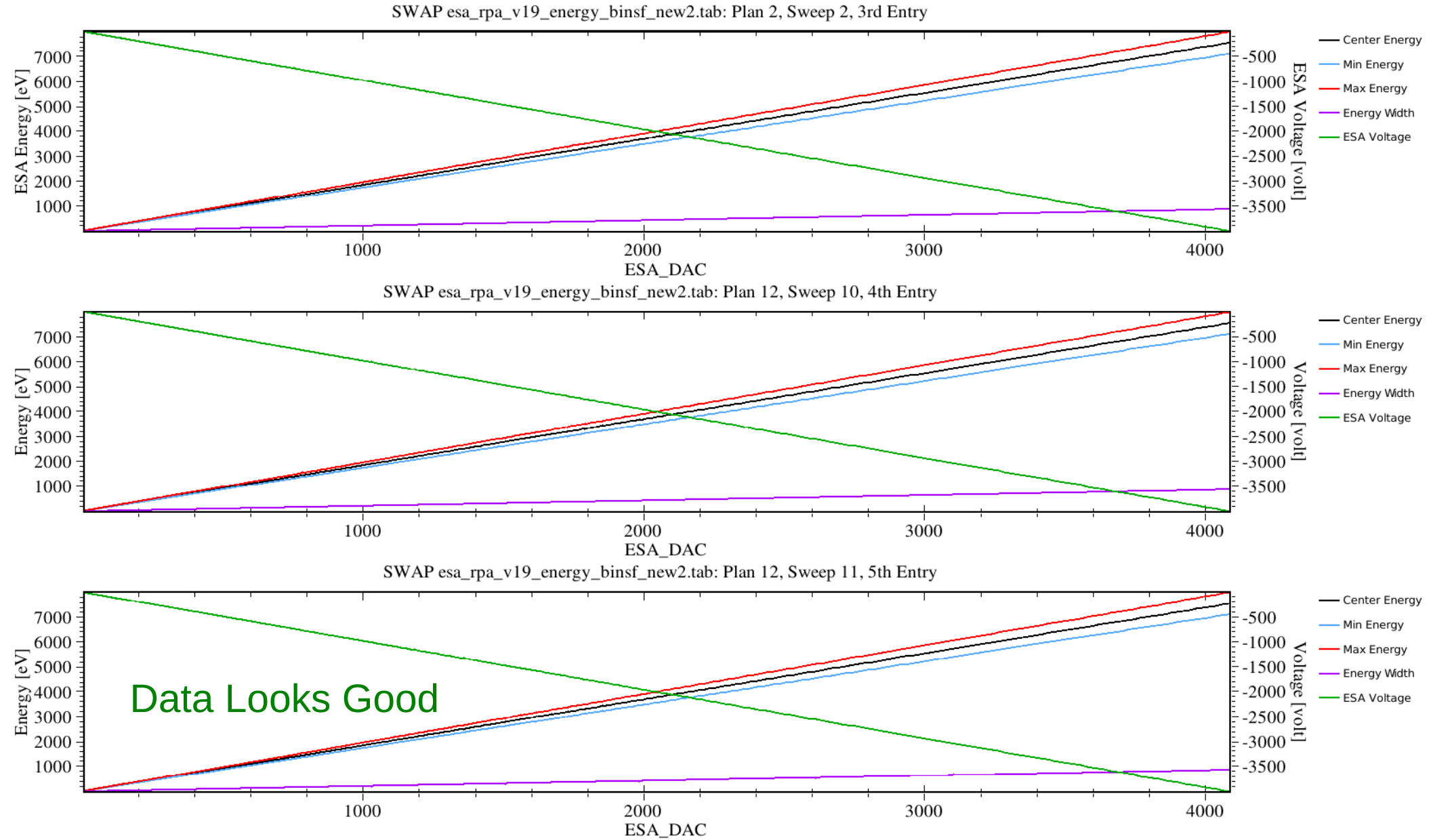




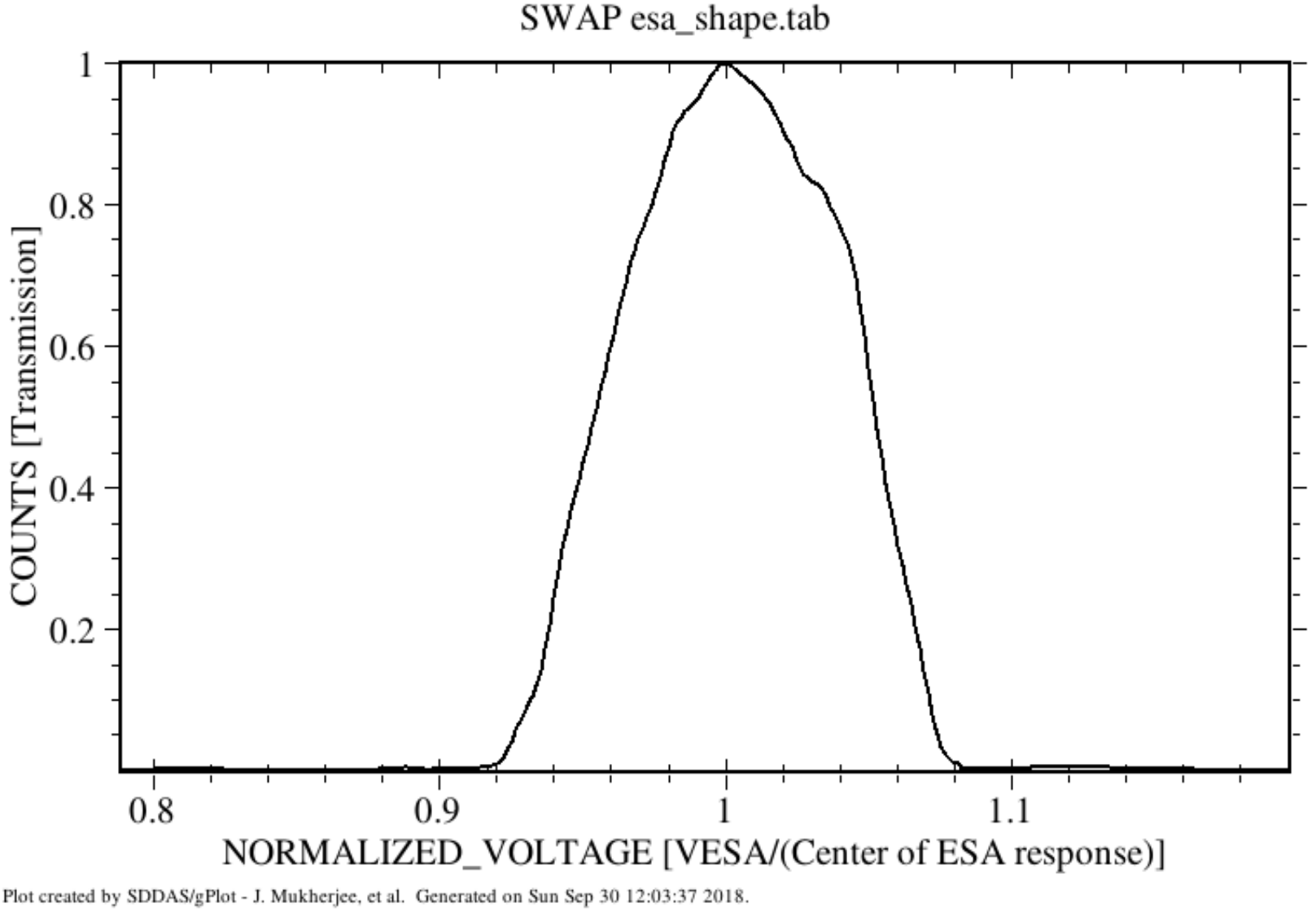


Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Sun Sep 30 12:02:51 2018.

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v19_energy_binsf_new2.tab – 2 of 2

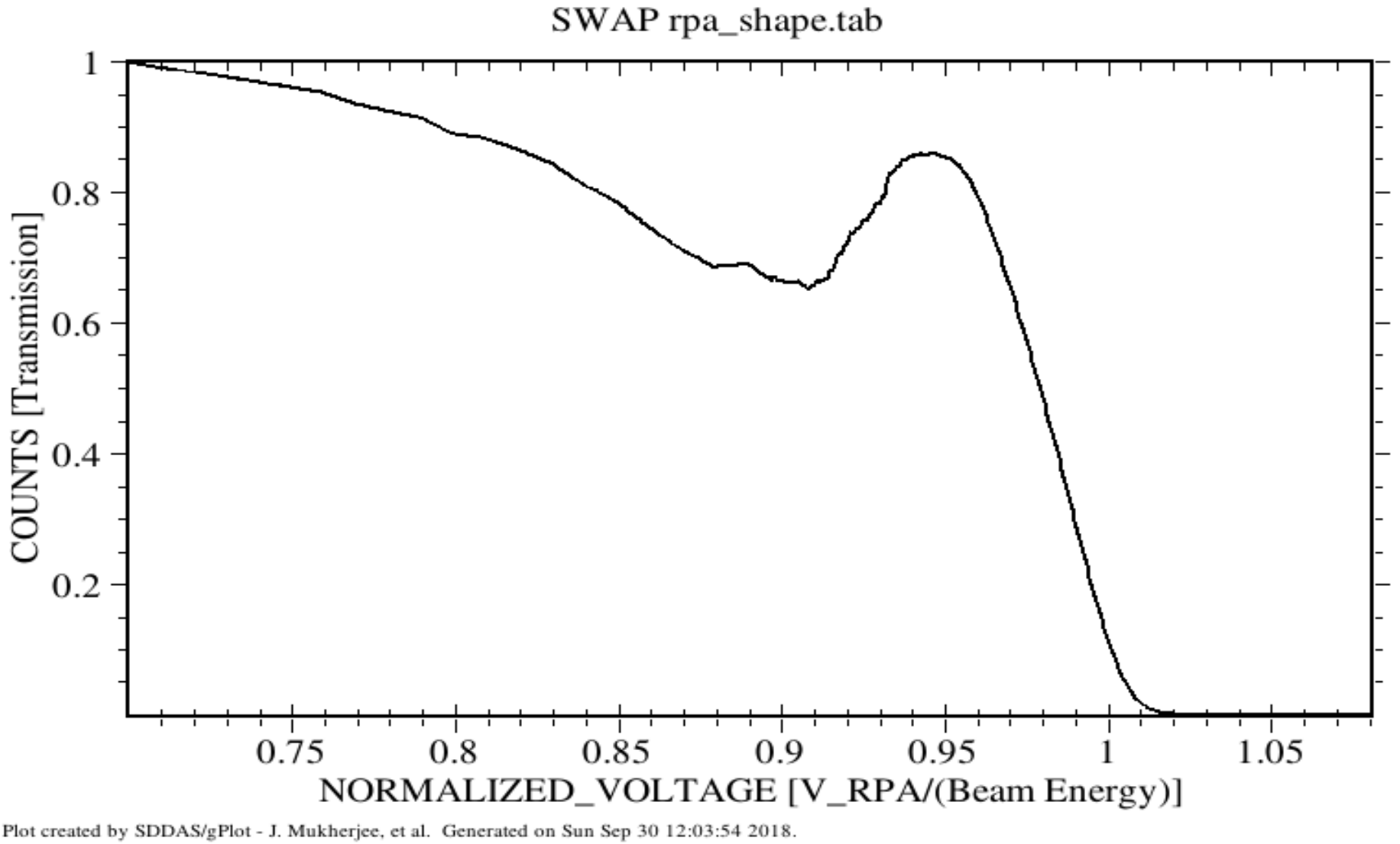


nh-x-swap-3-kemcruise1-v1.0/calib
esa_shape.lbl & esa_shape.tab



Data Looks Good

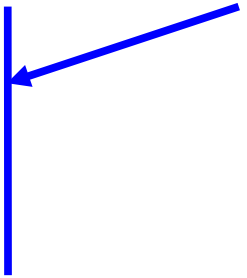
nh-x-swap-3-kemcruise1-v1.0/calib
rpa_shape.lbl



Data Looks Good

nh-x-swap-3-kemcruise1-v1.0/index
index.lbl & index.tab

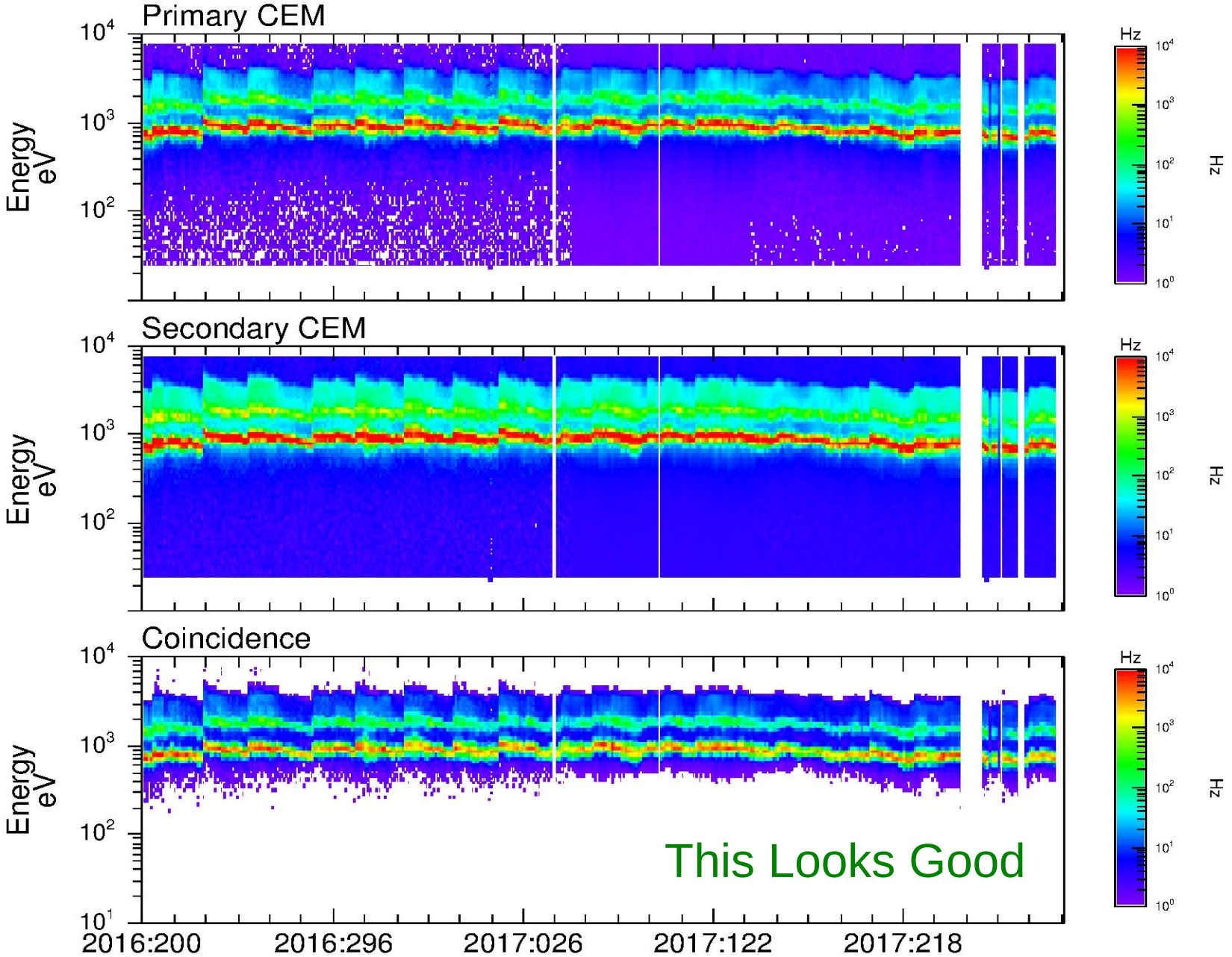
```
OBJECT     = COLUMN
  COLUMN_NUMBER = 7
  NAME = REDUCTION_LEVEL
  START_BYTE = 172
  BYTES = 10
  DATA_TYPE = CHARACTER
  FORMAT = "A10"
  DESCRIPTION = "This parameter provides the level of data
    reduction:

      LEVEL1  = Uncleaned data in units of DN

      LEVEL2  = Reduced data in engineering units
                appropriate for the instrument.
    "
END_OBJECT = COLUMN
```



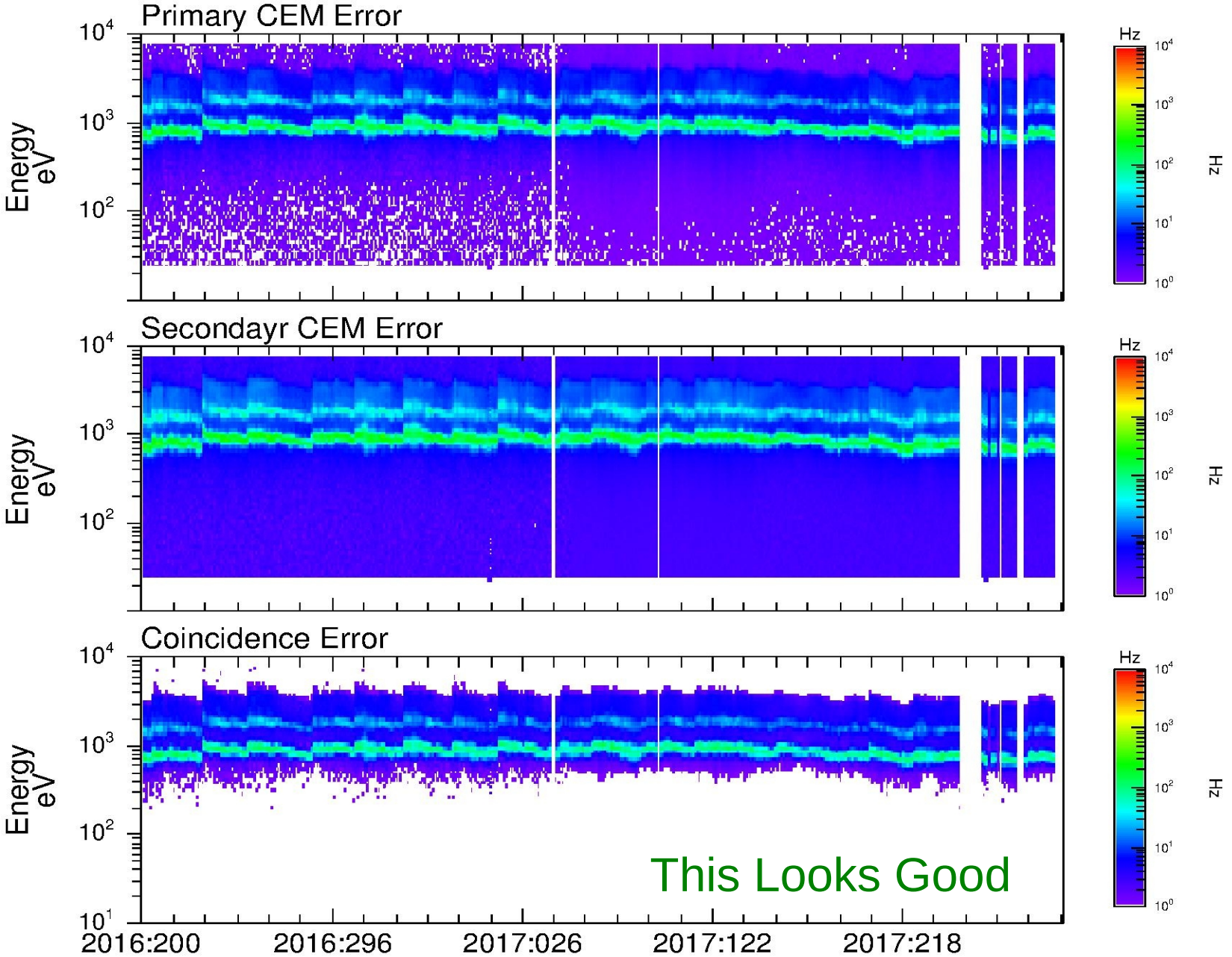
This Level 3 index file looks odd to me. In the label description only describes the option for “Level 1” or “Level 2”, despite this being a Level 3 archive. In the table files are listed the “Level 2”; however, the names of the data files described in the table are the Level 3 file names.
I checked the Level 2 archive. The Level 2 table shows “Level 1” in the field and Level 2 file names are shown.

SWAP Data Evaluation

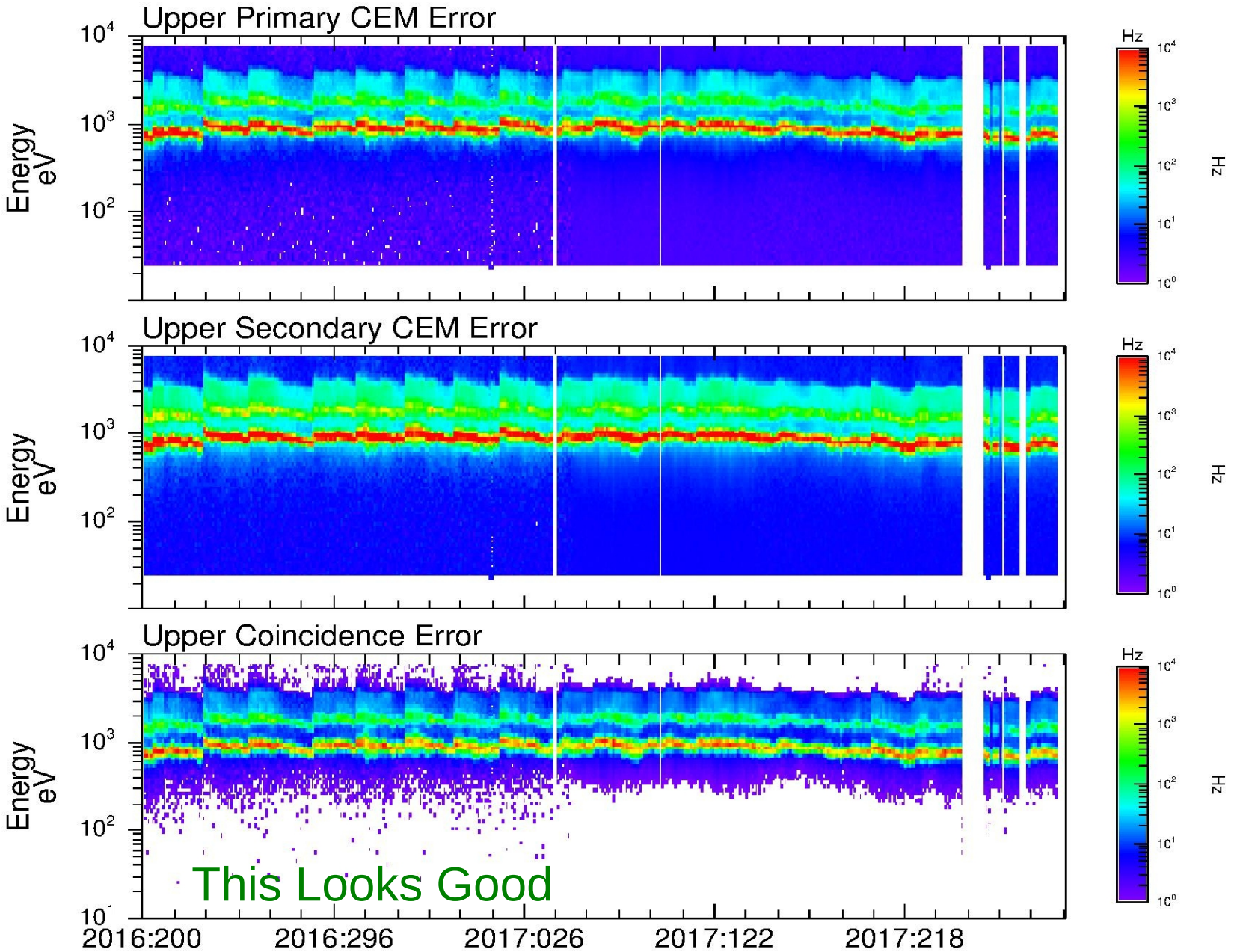
nh-p-swap-3-pluto-v3.0/data
Science Data (0x584)



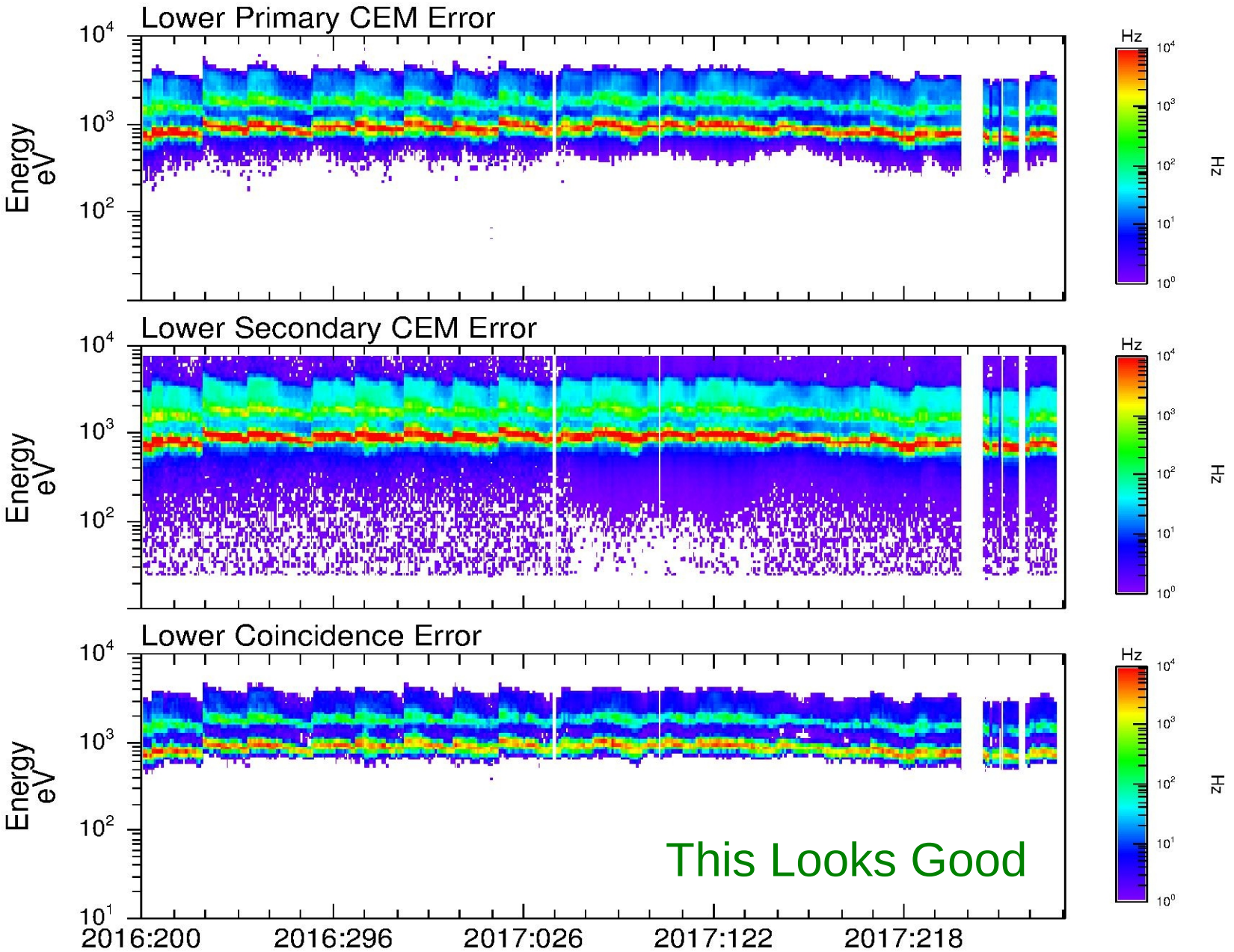
nh-p-swap-3-pluto-v3.0/data
Relative Uncertainty



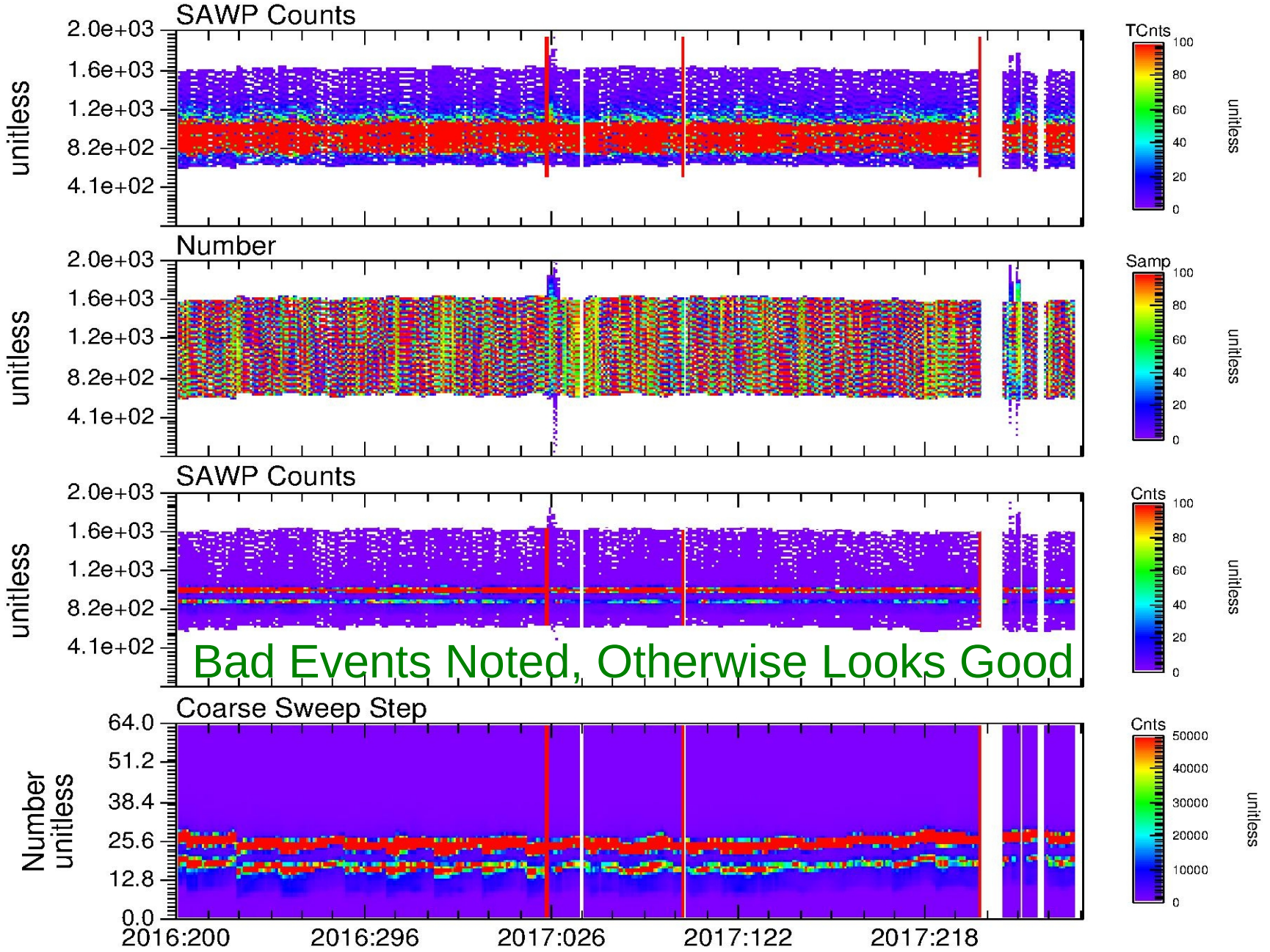
nh-p-swap-3-pluto-v3.0/data
Absolute Maximum Uncertainty



nh-p-swap-3-pluto-v3.0/data
Absolute Minimum Uncertainty



nh-p-swap-3-pluto-v3.0/data
Histogram Data (0x586)

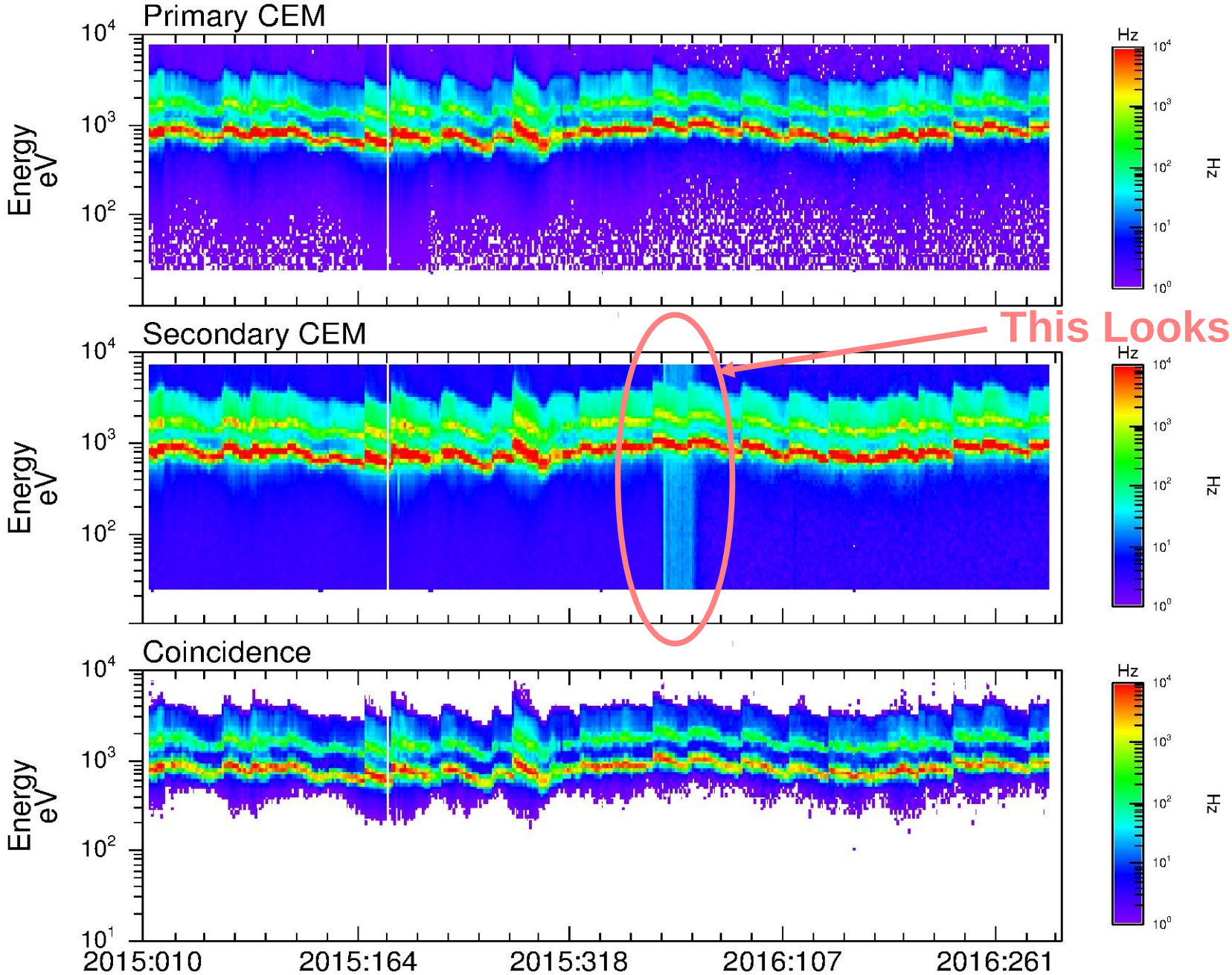


Certification

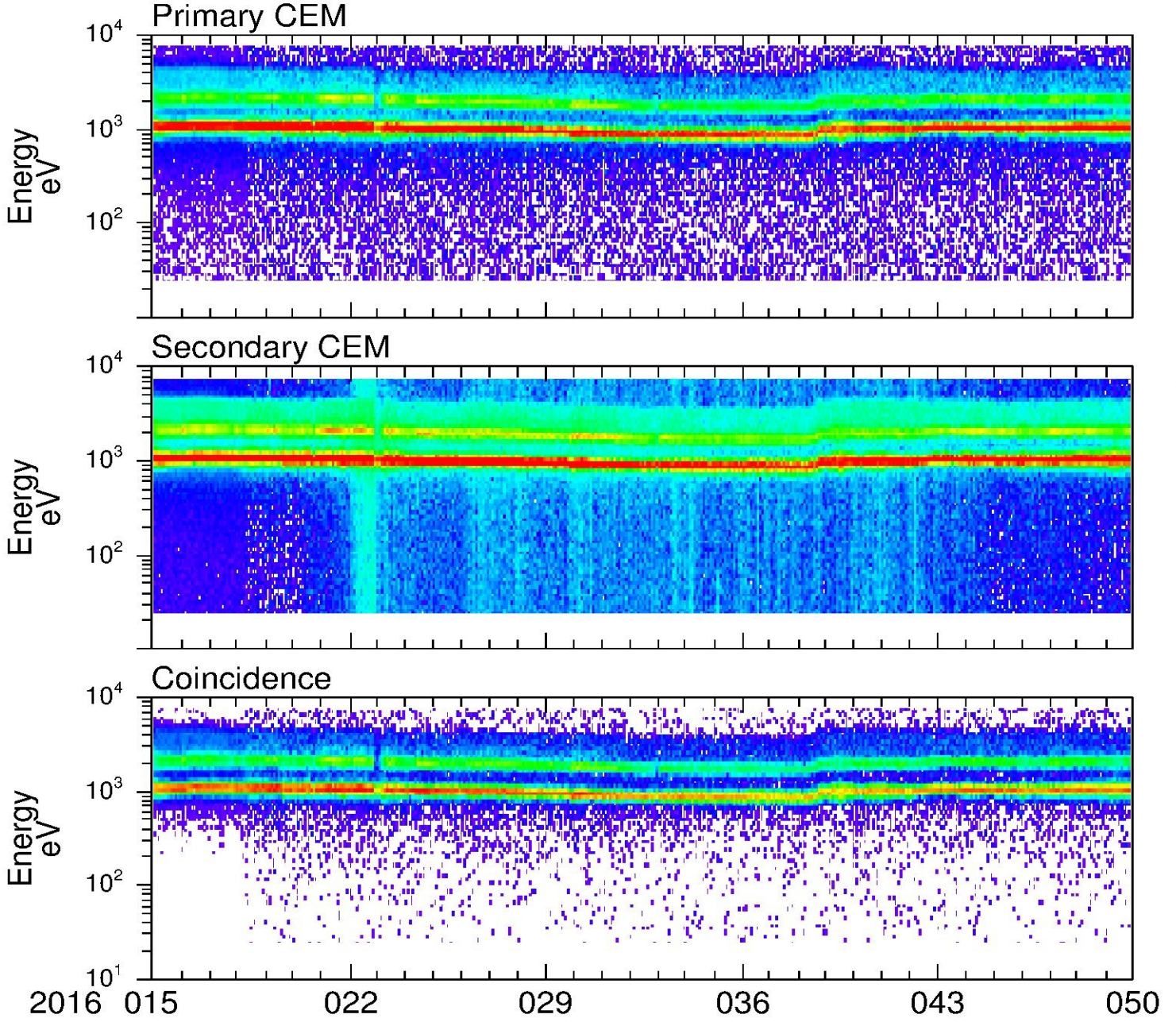
These data are certifiable once the minor documentation errors are corrected.

BACK-UP SLIDES

nh-p-swap-3-pluto-v3.0/data
Science Data (0x584)



nh-p-swap-3-pluto-v3.0/data
Blow-up of Odd Secondary CEM



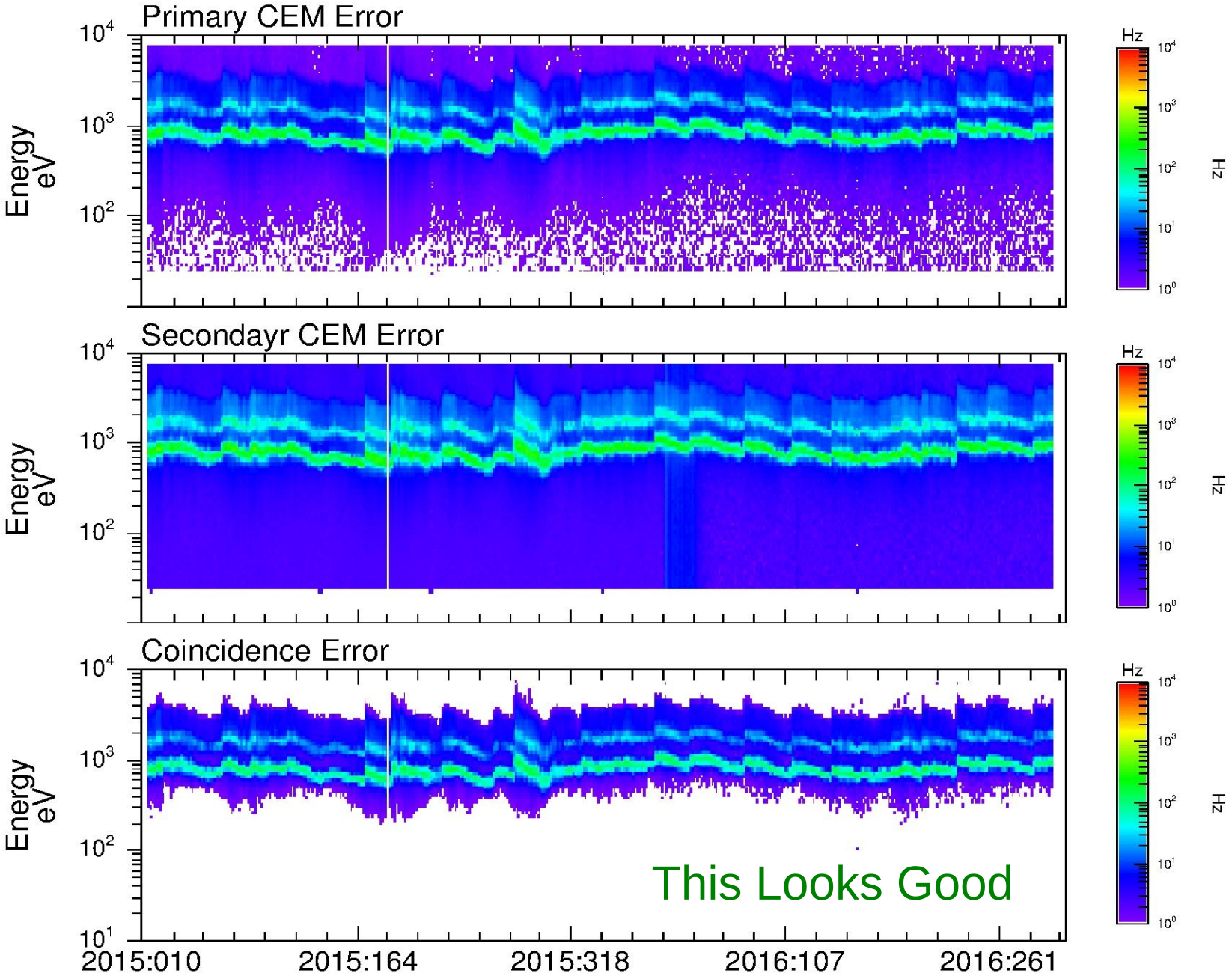
Primary CEM
Not Efffected

Primary CEM
Measures Ions
Transmitted
Through Foil,
Secondary CEM
Measures
Electrons
Backscattered
From Foil

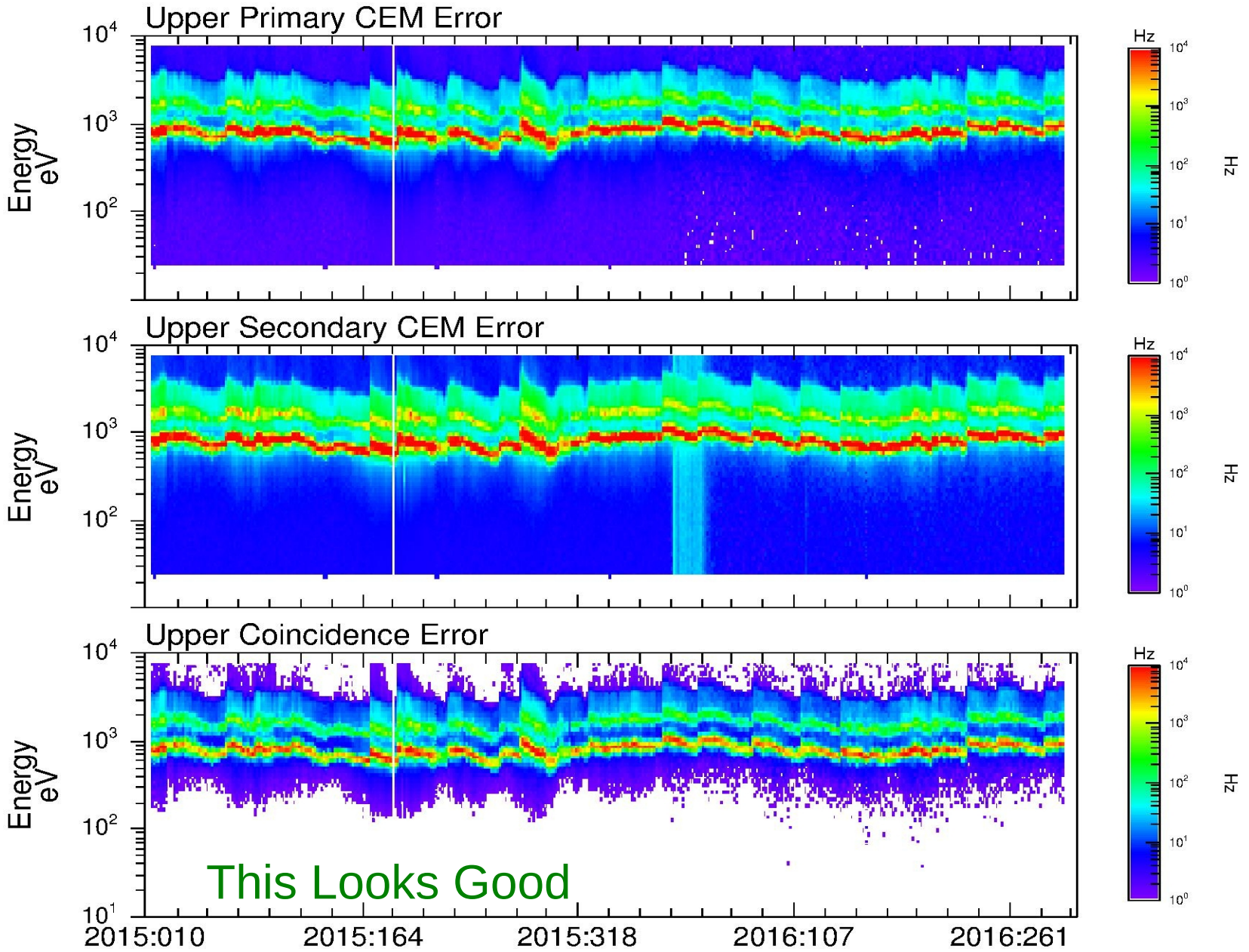
Foil and CEM Bias
Could be Enough
to Cause Difference

Possibly Caused
by Dust Grain

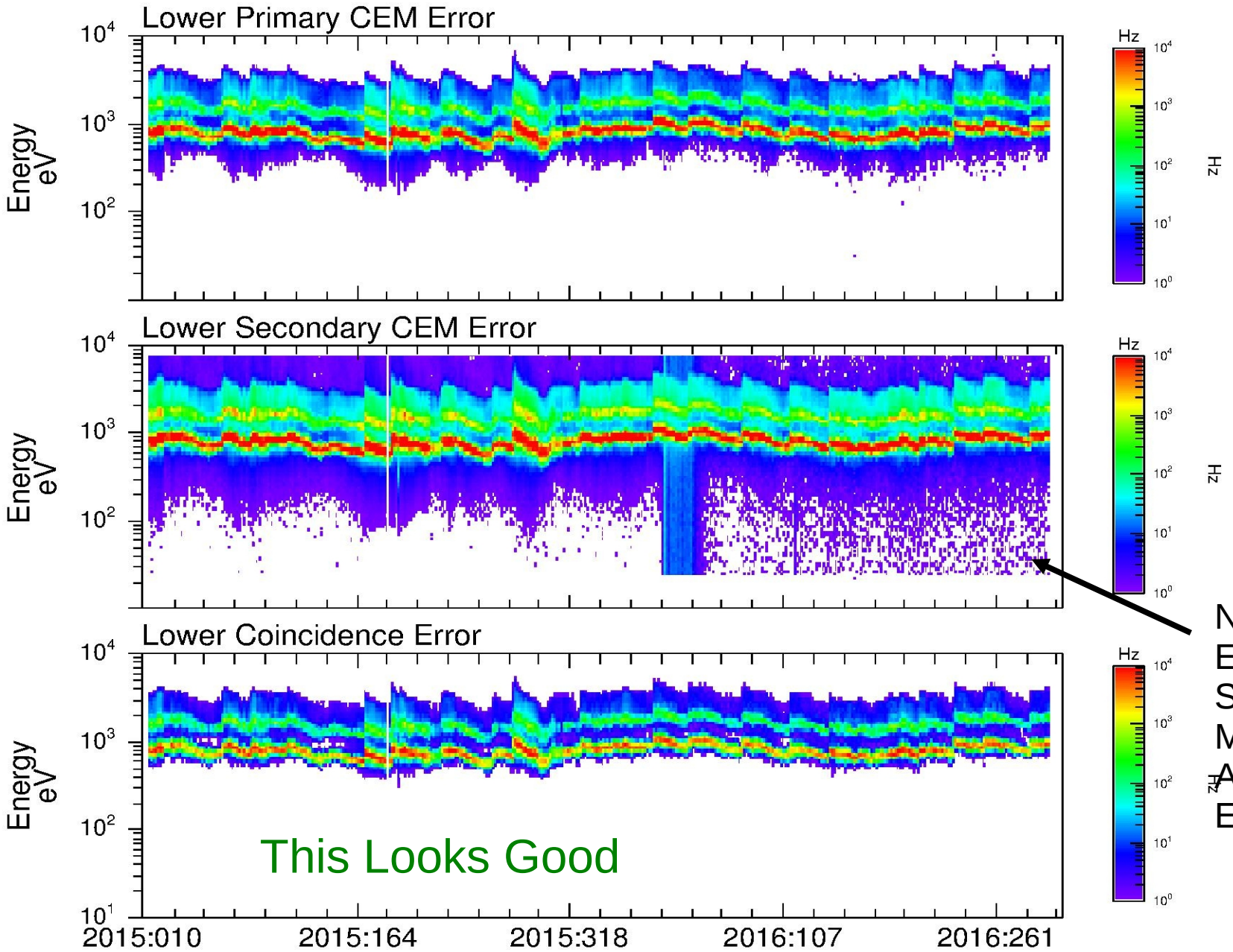
nh-p-swap-3-pluto-v3.0/data
Relative Uncertainty



nh-p-swap-3-pluto-v3.0/data
Absolute Maximum Uncertainty

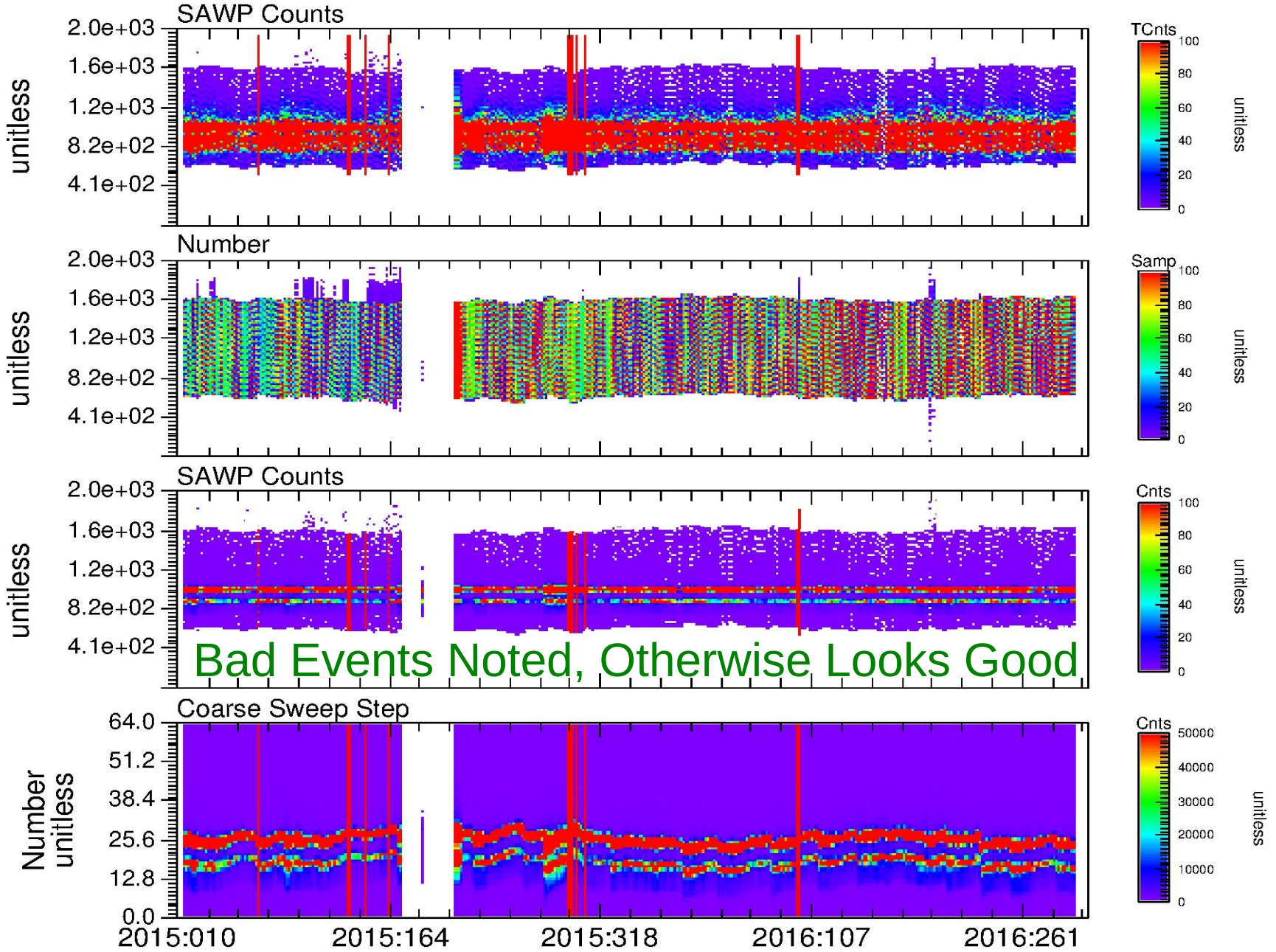


nh-p-swap-3-pluto-v3.0/data
Absolute Minimum Uncertainty

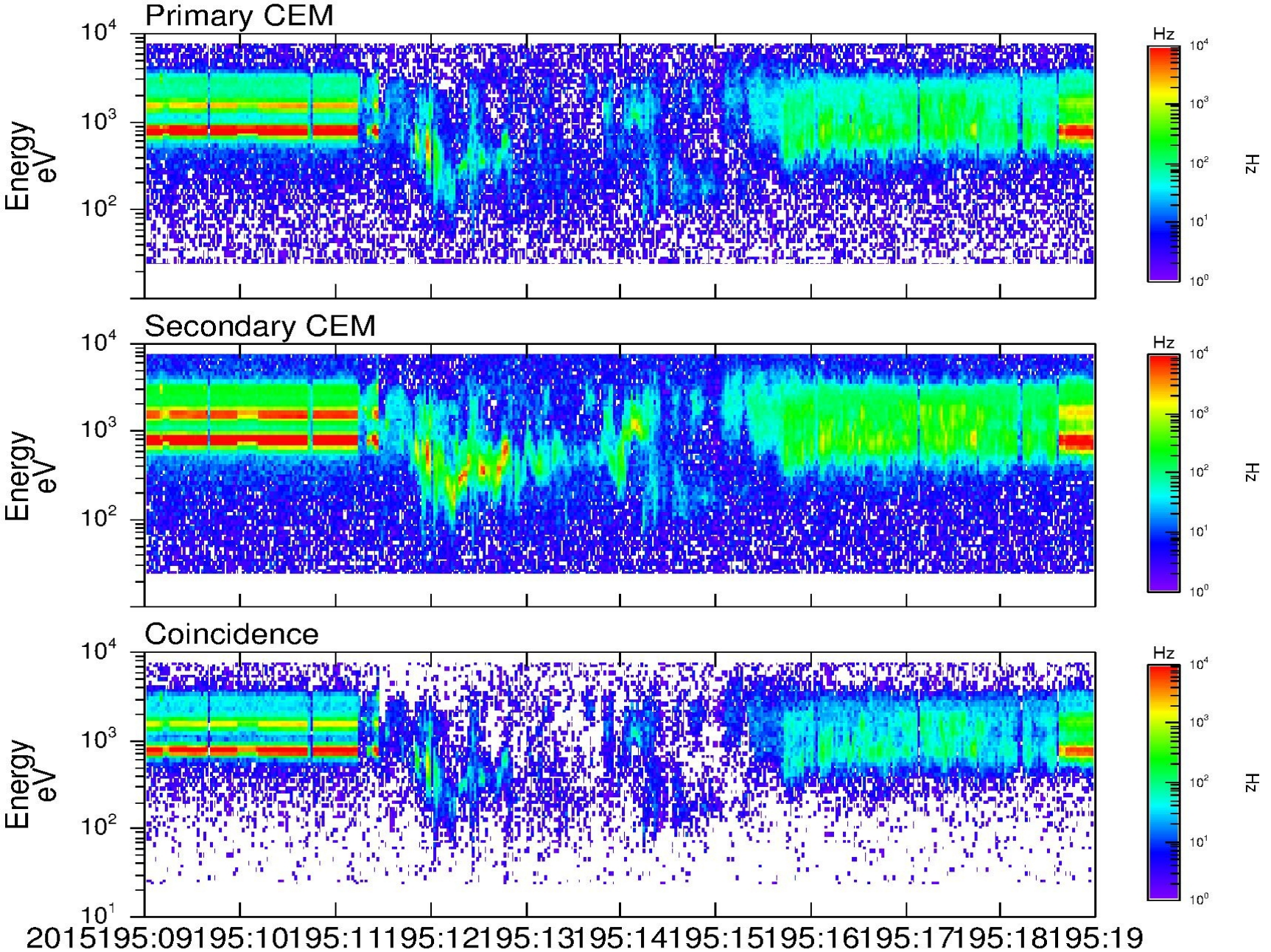


Note: More Lower Energy Noise in Secondary CEM Measurement After High Noise Event

nh-p-swap-3-pluto-v3.0/data
Histogram Data (0x586)



nh-p-swap-3-pluto-v3.0/data
Pluto Encounter



nh-x-swap-2-kemcruise1-v1.0
aareadme.txt

GOOD

nh-x-swap-2-kemcruise1-v1.0
voldesc.cat

GOOD

nh-x-swap-3-kemcruise1-v1.0/catalog
catinfo.txt

GOOD

nh-x-swap-3-kemcruise1-v1.0/catalog
dataset.cat

GOOD

nh-x-swap-3-kemcruise1-v1.0/catalog
nh_kem.cat

GOOD

nh-x-swap-3-kemcruise1-v1.0/catalog
ref.cat

GOOD

nh-x-swap-3-kemcruise1-v1.0/document docinfo.txt

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
codmac_level_definitions.lbl
codmac_level_definitions.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
nh_fov.lbl & nh_fov.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
lunineetal1995.lbl & lunineetal1995.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
payload_ssr.lbl & payload_ssr.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
swap_ssr.lbl & swap_ssr.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
swap_cal.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
soc_inst_icd.lbl & soc_inst_icd.pdf

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
nh_mission_trajectory.lbl
nh_mission_trajectory.tab

GOOD

nh-x-swap-3-kemcruise1-v1.0/document
quat_axyz_instr_to_j2k.lbl
quat_axyz_instr_to_j2k.asc

GOOD

nh-x-swap-3-kemcruise1-v1.0/document/traj
traj.fmt

GOOD

nh-x-swap-3-kemcruise1-v1.0/document/data_summary_plots/data_summary.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
calinfo.txt

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
background_009_dac.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
background_009_dac_jup.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v16_energy_binsf_new.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v18_energy_binsf_new.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
esa_rpa_v19_energy_binsf_new2.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
fov_mask_2d.lbl & fov_mask_2d.tab

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
list_energy_files.lbl & list_energy_files.tab

GOOD

nh-x-swap-3-kemcruise1-v1.0/calib
rpa_shape.lbl

GOOD

nh-x-swap-3-kemcruise1-v1.0/index
indxinfo.txt

GOOD

nh-x-swap-3-kemcruise1-v1.0/index
checksum.lbl & checksum.tab

GOOD

nh-x-swap-3-kemcruise1-v1.0/index
slimindx.lbl & slimindx.tab

GOOD