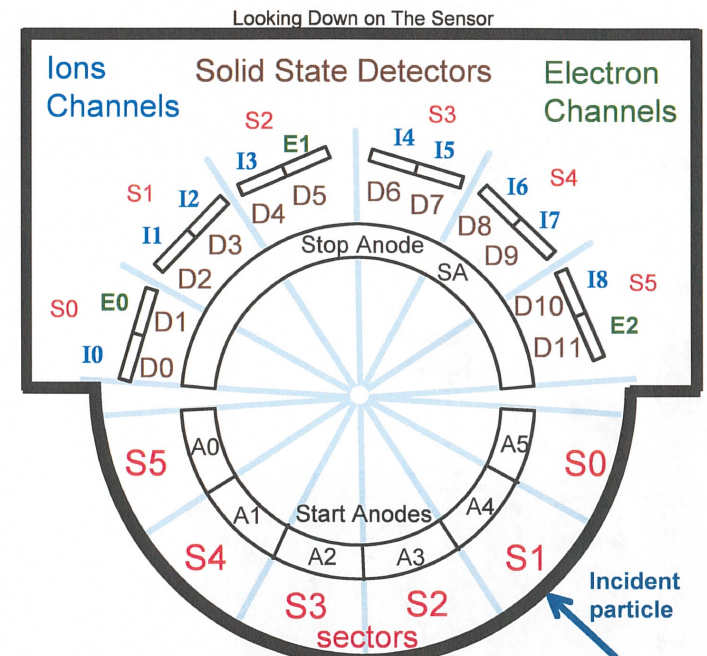
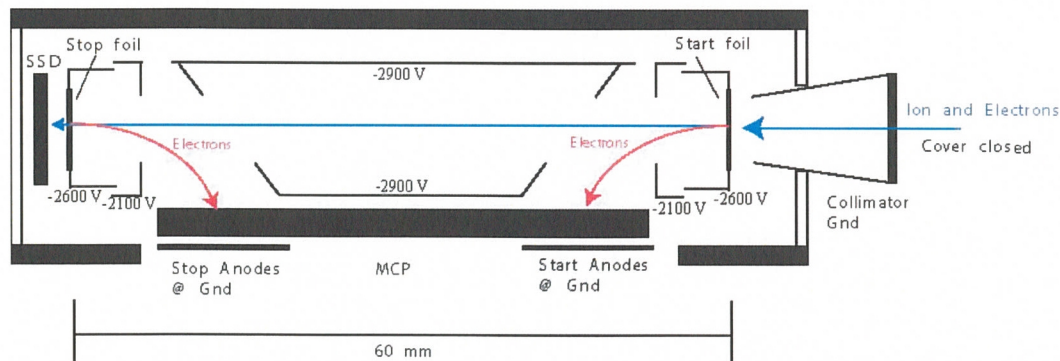


New Horizons Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI)

PRINCIPAL INVESTIGATOR: Ralph McNutt, APL
 DESCRIPTION: Medium Energy Particle Spectrometer
 ENERGY RANGE: 25-1000 keV (protons)
 60-1000 keV (atomic ions)
 25-500 keV (electrons)
 FIELD OF VIEW: 160 deg x 12 deg
 ANGULAR RESOLUTION: 25 deg x 12 deg
 ENERGY RESOLUTION: 0.25 keV
 SENSOR SIZE: 7.6 cm dia. x 2.5 cm thick
 POWER: 1.4 watt
 MASS: 1.5 kg



New Horizons PEPSSI Data Sets

RAW ->

nh-x-pepssi-2-plutocruise-v2.0

nh-p-pepssi-2-pluto-v2.0

CALIBRATED ->

nh-x-pepssi-3-plutocruise-v2.0

nh-p-pepssi-3-pluto-v2.0

New Horizons PEPSSI 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

All Data Sets in the Top Level Directory aareadme.txt

Left over commands from generic processing ->

```

/           Top level of volume
|
+-- AAREADME.TXT   The AAREADME file; a backup is in /DOCUMENT/
→ skel_DELETE_BETWEEN_IF_INSTRUMENT_IS_rex
|
+--/CALIB/        Top-level directory containing calibration files
|
| +-- CALINFO.TXT   Description of files in the CALIB directory
| +-- *.*          Calibration files
→ skel_DELETE_BETWEEN_IF_INSTRUMENT_IS_rex
|
|--/CATALOG/      Directory containing PDS catalog objects.
```

All Data Sets in the Top Level Directory
voldesc.cat

GOOD

All Data Sets in the catalog Directory
catinfo.txt

GOOD

All Data Sets in the catalog Directory dataset.cat – 1 of 2

```
=====
PEPSSI          PEP                                0X691 - 0X698 *
=====
```


```
* Not all values in this range are in this data set
** ApIDs are case insensitive
```

```
There are other ApIDs that contain housekeeping values and
other values. See SOC Instrument ICD (/DOCUMENT/SOC_INST_ICD.*)
for more details.
```


```
Here is a summary of the types of files generated by each ApID
(N.B. ApIDs are case-insensitive) along with the instrument
designator that go with each ApID:
```

ApIDs	Data product description/Prefix(es)
0x691	PEPSSI High Priority Science/PEP
0x692	PEPSSI Medium Priority Science/PEP
0x693	PEPSSI Low Priority Science (Up to 500 PHA events)/PEP
0x694	PEPSSI Low Priority Science (Up to add'l 500 PHA events)/PEP
0x695	PEPSSI High Priority Science/PEP
0x696	PEPSSI Medium Priority Science/PEP
0x697	PEPSSI Low Priority Science (Up to 500 PHA events)/PEP
0x698	PEPSSI Low Priority Science (Up to add'l 500 PHA events)/PEP

PEPSSI ApIDs
not discussed
in ICD.



What is the
Difference
Between these
two sets of
ApIDs? There
seems to be a
missing word
in the description.



All Data Sets in the catalog Directory dataset.cat – 1 of 2

The PHA event data are 'raw' values and some subset of them are noise or other instrumental artifacts, so PHA events with parameters outside the stated instrument sensitivity limits (see SPECIFICATION above) should be ignored, or, at the very least, used with extreme caution.

There is no SPECIFICATION listed in this document. Unable to locate text which discusses why a PHA event could be outside an instrument limit.

For PEPSSI, the electron count rates have not changed as expected with distance from the sun. The team is aware of this and is reviewing the data.

Note that this is of concern. If the electron count rates are found to be caused by some instrumental artifact and not representative of the heliospheric environment, then they should be removed as a science data product from this data set and a note added to the data set documentation to explain the findings. We do not want someone to pick up these electron measurements if they do not represent electrons in the heliosphere

All Data Sets in the catalog Directory nh.cat

GOOD, some minor issues reported to PDS

All Data Sets in the catalog Directory ref.cat

The fact that possible ITAR controlled documents are referenced is of concern and this file should be reviewed by the State Department before public release because a review of this file by SwRI finds that some of the listed references violate ITAR.

Reported by the SwRI Library: The references are marked as possibly being under ITAR control are indeed under ITAR control.

Reported by SwRI Legal Department: Revealing the existence of an ITAR controlled document is itself a violation of ITAR.

All Data Sets in the catalog Directory nhsc.cat

circuits is grouped functionally by pairs (to minimize the number of switches required), so that a total of 16 switches control the heater elements, allowing great flexibility to operate the spacecraft safely while drawing the minimum required power. Operational requirements for catalyst bed heater



Missing Text

The pulse duration and total on-time of each thruster are commanded very precisely, providing accurate control of the total impulse generated during a maneuver. The 0.8N thrusters can be turned on for periods as short as 5 ms. The initial propellant load was allocated

All Data Sets in the catalog Directory

pepssi.cat – 1 of 4

The calibration parameters are ideally be determined through a combination of all of the following: ground measurements; analysis of the in-flight calibration alpha-particle source; modeling; intercalibration with known measurements. Currently only the final method has been employed, which has the obvious drawback of not providing an independent determination of the absolute flux. Therefore the fluxes provided in CODMAC Level 3 data should not be used as is to conduct science that is relying on absolute fluxes for scientific interpretation unless the user determines the fluxes independently.

Although accurate and it should be in this text, it seems odd that such statement needs to be included at this stage of the mission. Is there a good reason why the PEPSSI instrument was not and has not been absolutely calibrated at this late stage in the mission?

All Data Sets in the catalog Directory

pepssi.cat – 2 of 4

In this initial delivery of the PEPSSI data from the Launch and Jupiter phases of the New Horizons mission these values are supplied to convert the instrument specific data (e.g., count rates) into physical instrument-independent units (e.g., differential intensity), as well as computing the physical quantities themselves. It must be stressed that these are preliminary values that should not be used without significant effort from the user to understand their limitations (see the SOC Instrument ICD, provided with this archive, and McNutt et al. (2008) [MCNUTTETAL2008A] for a description of the method used to calculate differential intensity, also called flux).

This text would seem to indicate that there have been no adjustments made to the PEPSSI calibration parameters in a while. Shouldn't the experimenters pay more attention to these "preliminary" values so that they can be finalized? This statement and the previous statements raise the question of whether the PEPSSI data is of high enough quality to be useful for future scientific investigations.

All Data Sets in the catalog Directory

pepssi.cat – 3 of 4

The Rate_Normalized_Weight quantities have had Priority Group artifacts removed from the PHA data by the procedure described in the SOC Instrument ICD. This column is usually used in making histograms of the High Energy Ion PHA data.

It is not clear to which column is being referred. Since this information is expected in the data files, both the science and engineering data packets were examined. No column holding the rate weights was found. The ICD is not clear whether or not any data other than that in the Primary HDU is rate corrected.

All Data Sets in the catalog Directory

pepssi.cat – 4 of 4

Events with the multi-hit (cross talk) flag set have been excluded. Quantities of limited usefulness (such as Heavy Ion Discriminator triggers) have been excluded. Because of the difficulty of removing priority scheme biases from non-N2 PHA data, only N2 (APID == 0x692) PHA data is present in the calibrated PHA data.

Only ApID = 0x691 is found in the calibrated data sets. The ICD agrees with this file and calls out ApID = 0x692 as the L3 data product.

nh-x-pepssi-2-plutocruise-v2.0
nh-p-pepssi-2-pluto-v2.0
calib/calinfo.txt

- | - [calpars] Directry containing calibration parameters
- | - calpinfo.txt Description of [calpars] directory contents
- | - *.* Calibration parameters files

Directory does not exist. It only exists in the L3 structure.

All Data Sets in the calib Directory

hk_stat_input_20041016.tbl

hk_stat_input_20041016.tab

GOOD

All Data Sets in the calib Directory
rateboxdefinitionplanes.fit

GOOD

All Data Sets in the calib Directory rateboxdefinitionplanes.lbl

The octal dump was examined. As far as I could tell, the main sections agreed with the byte description in the lbl file. There was no description of what was in the header portion of the fit file, but an octal dump showed that it was ASCII characters, and thus, could be read. Some other minor issues reported to PDS

All Data Sets in the calib Directory

hk_n1_input_20050228.tbl

hk_n1_input_20050228.tab

GOOD

nh-p-pepssi-3-pluto-v2.0
nh-x-pepssi-3-plutocruise-v2.0
calib/calpars/calpinfo.txt

Shouldn't the file `calpar_columns.fmt` be
listed?

nh-p-pepssi-3-pluto-v2.0
nh-x-pepssi-3-plutocruise-v2.0
calib/calpars/calpar_columns.fmt

GOOD

nh-p-pepssi-3-pluto-v2.0/calib/calpars
pep_0294990715_0x691_calpar.tab

GOOD

All Data Sets in the index Directory
indxinfo.txt

GOOD

All Data Sets in the index Directory
index.tbl

GOOD

All Data Sets in the index Directory
checksum.tbl & checksum.tab

GOOD

All Data Sets in the index Directory slimindx.tbl

GOOD

All Data Sets in the document Directory
soc_inst_icd.tbl

GOOD

All Data Sets in the document Directory soc_inst_icd.tbl – 1 of 2

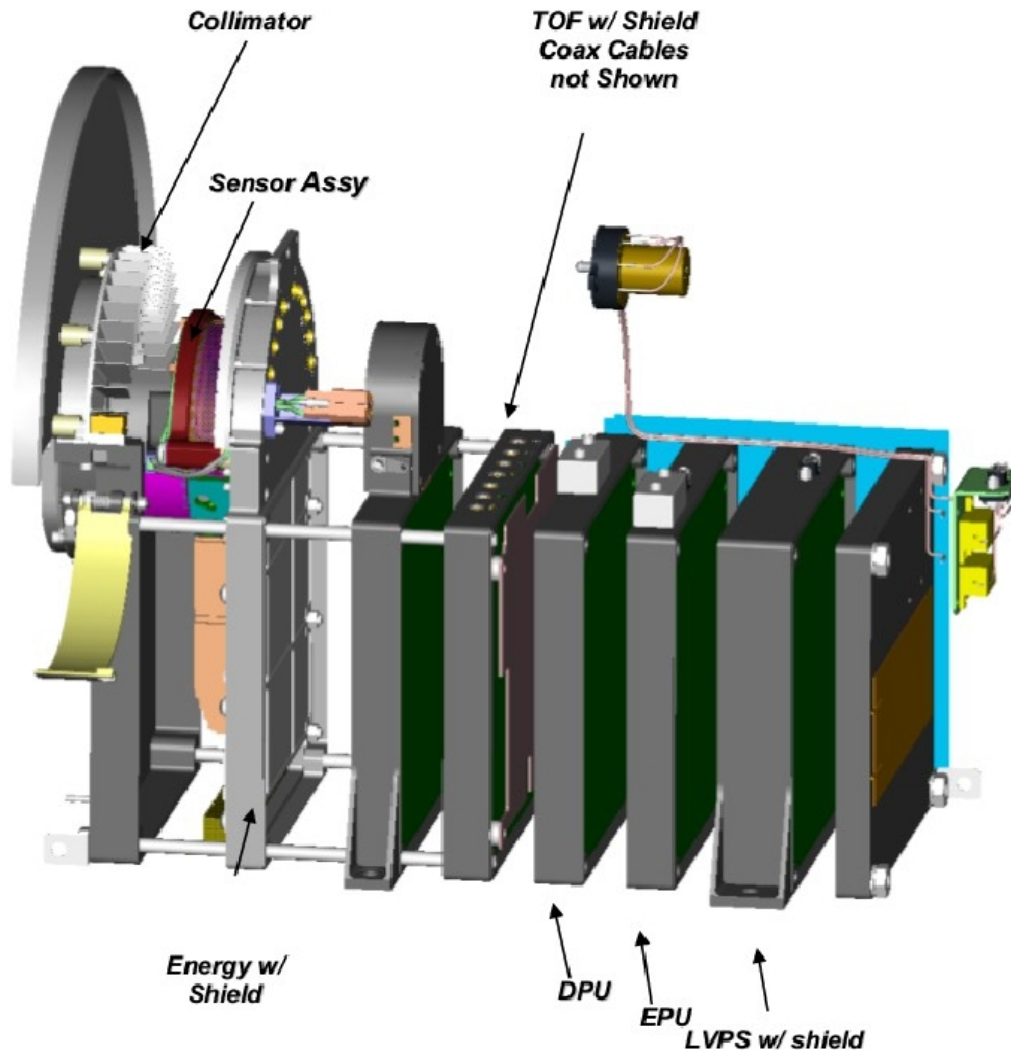


Figure 11-4

This section lists the boards composing the PEPSSI electronics and refers to Figure 11-4. The text then goes on to describe the function of each board. In each subsection, it would help to include the name of the board being discussed which is shown on Figure 11-4 in the text of Section 11.1.3.

Section 11.1.3

The following electronic boards are cited and then discussed:

- 1) Energy board;
- 2) High Voltage Power Supply (HVPS);
- 3) TOF board;
- 4) Digital processing board;
- 5) Common event processor board; and
- 5) Low Voltage Power Supply (LVPS) board.

All Data Sets in the document Directory soc_inst_icd.tbl – 2 of 2

In section 11.3, there should be a reference to
Table 11-1.

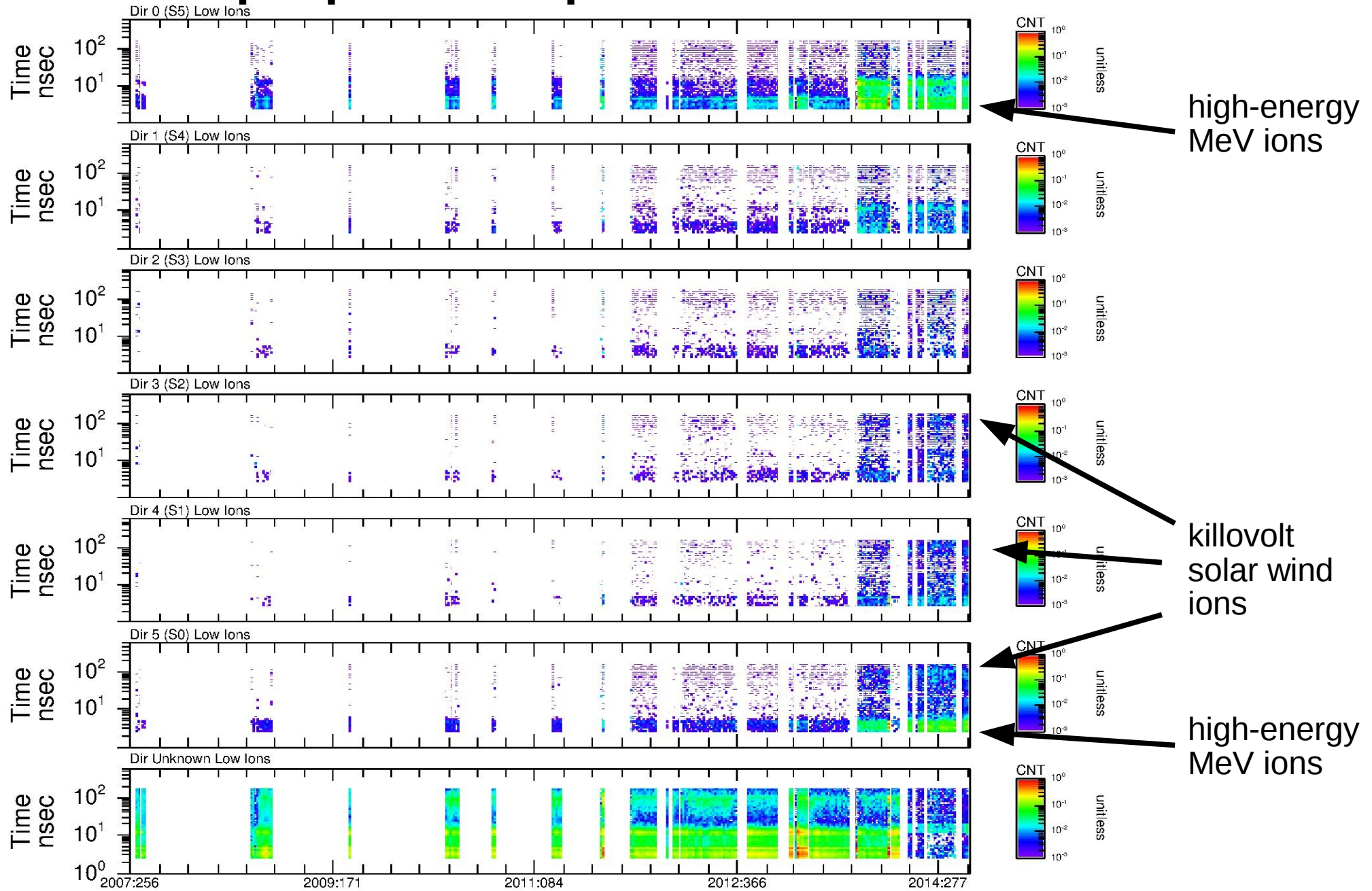
Data Evaluation

Useful Table for PEPSSI

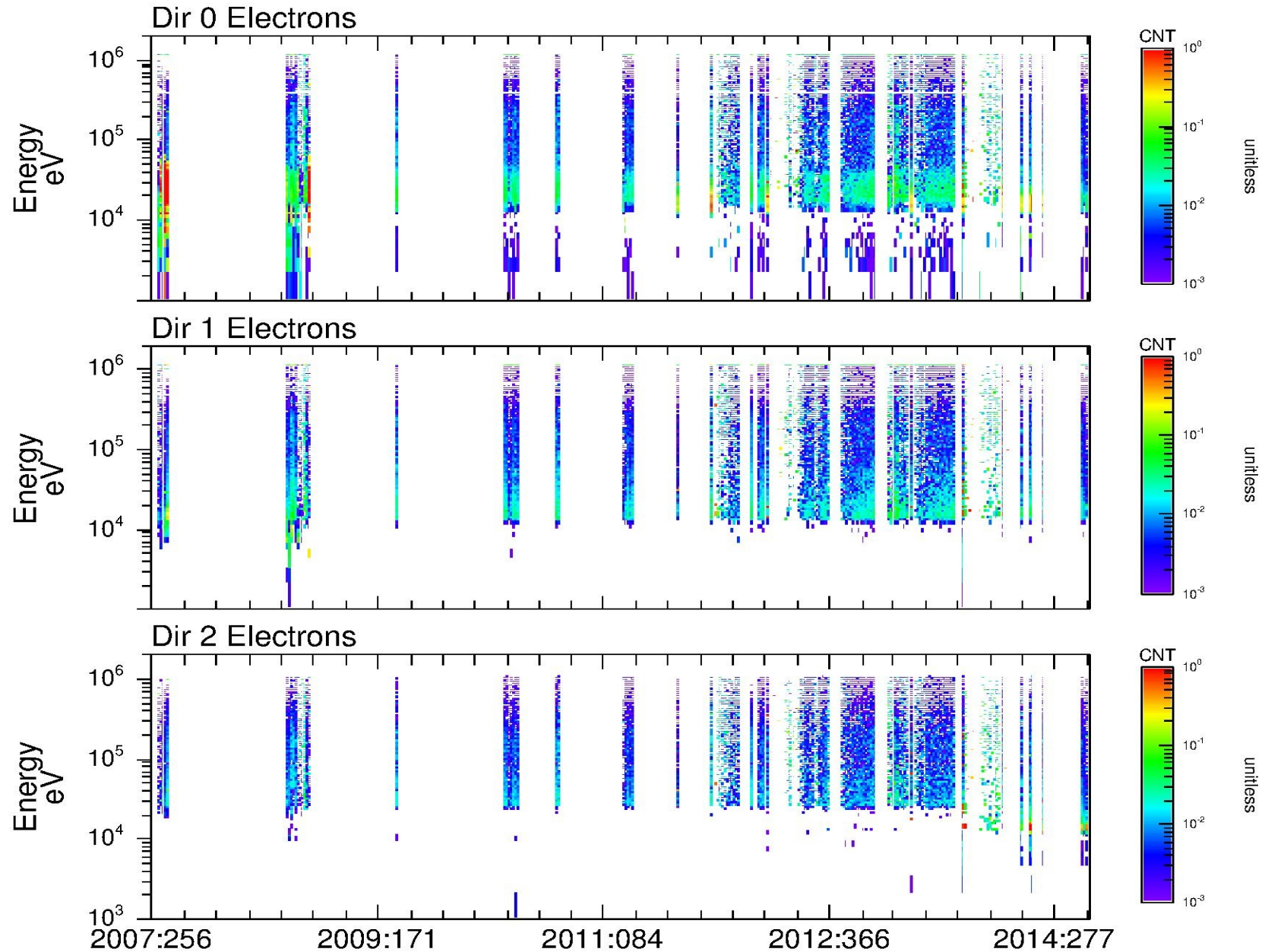
Flight Distance is 6 cm (ICD Section 11.4.5.4)

Time	Velocity	H+ Energy
1 ns	60,000 km/s	18.76 MeV
2 ns	30,000 km/s	4.69 MeV
5 ns	12,000 km/s	750.6 keV
10 ns	6,000 km/s	187.6 keV
20 ns	3,000 km/s	46.9 keV
50 ns	1,200 km/s	7.506 keV
100 ns	600 km/s	1.876 keV
200 ns	300 km/s	469 eV
500 ns	120 km/s	75 eV

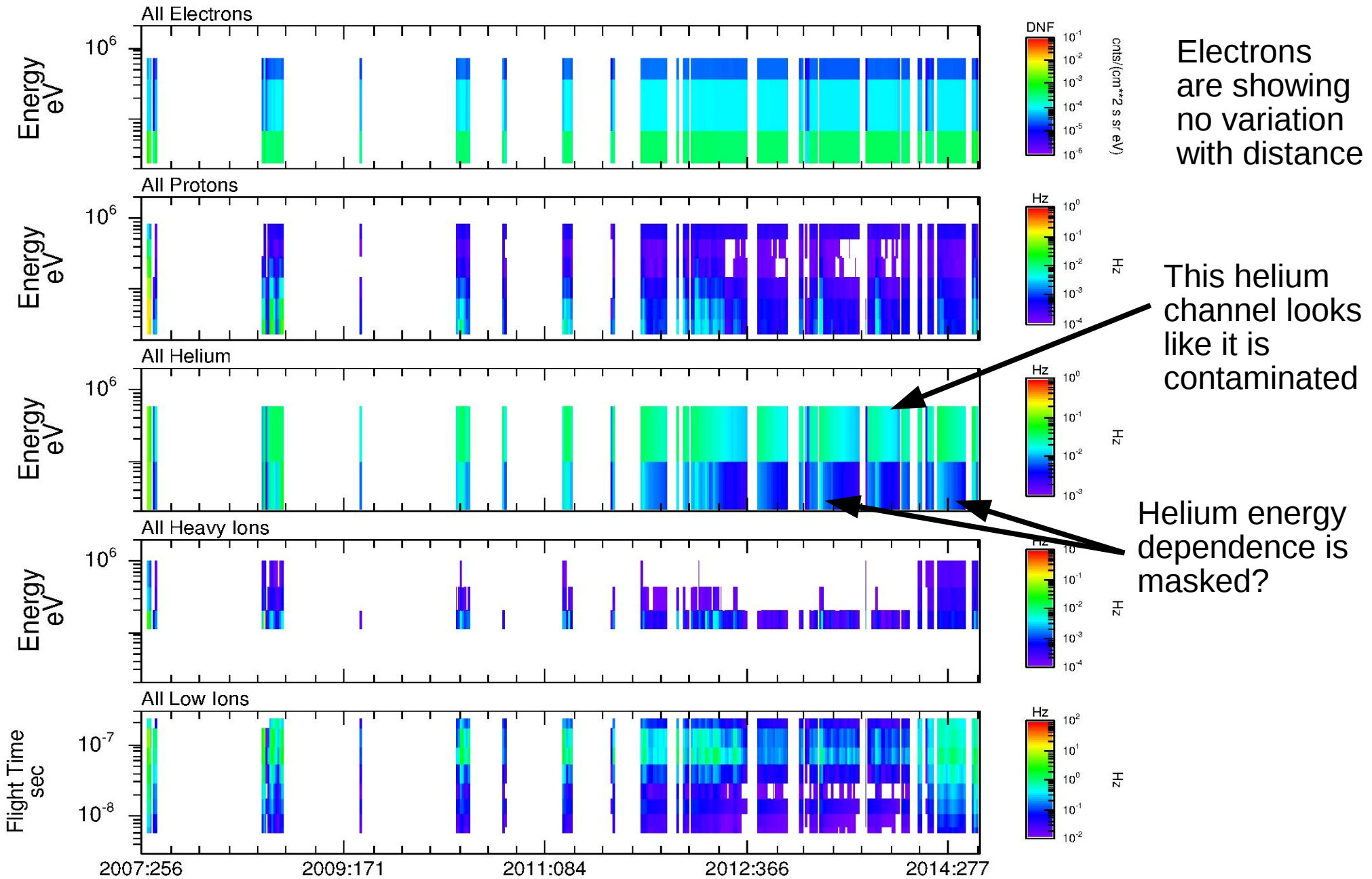
nh-x-pepssi-3-plutocruise-v2.0/data



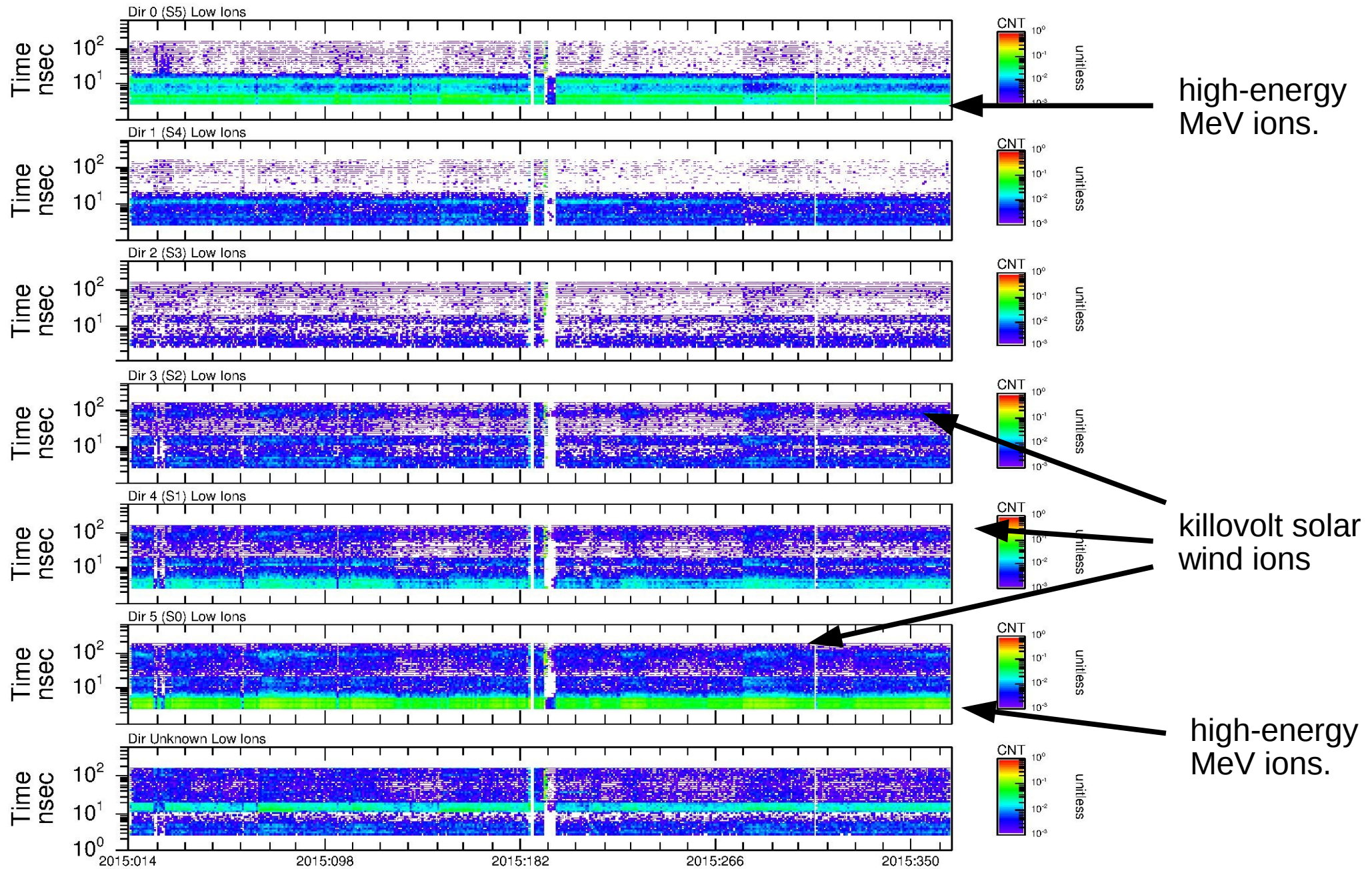
nh-x-pepssi-3-plutocruise-v2.0/data



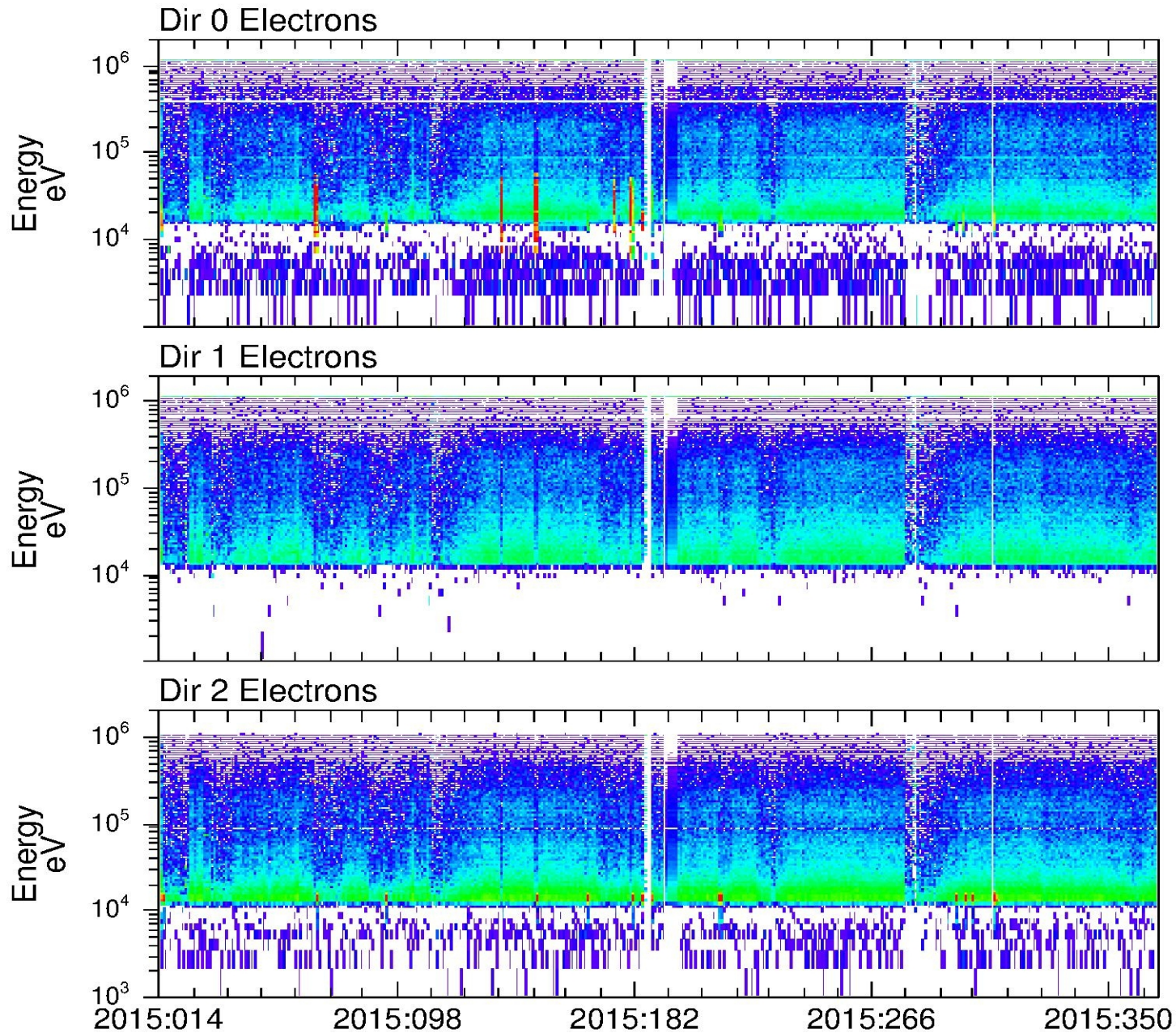
nh-x-pepsi-3-plutocruise-v2.0/data



nh-p-pepssi-3-pluto-v2.0/data



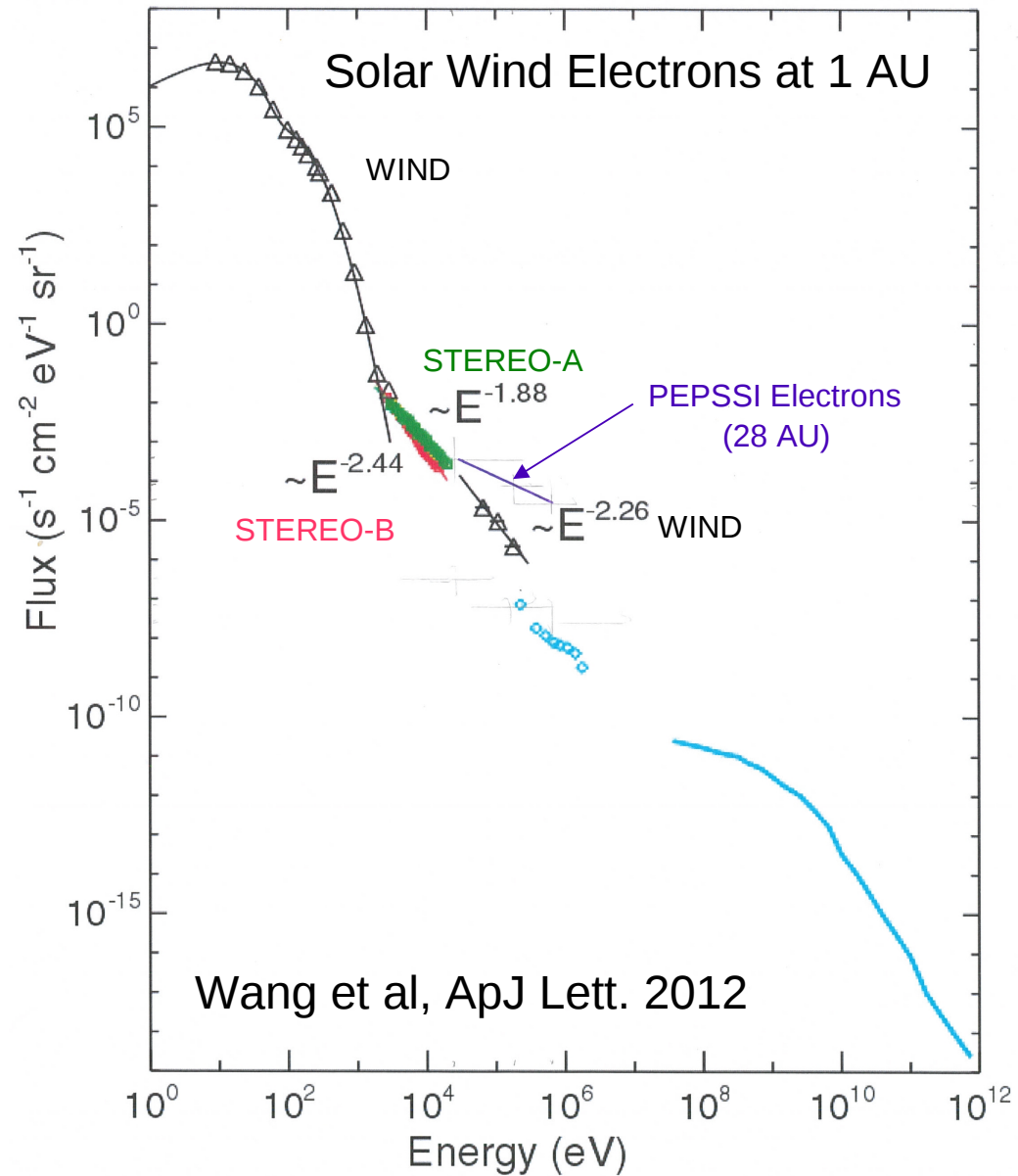
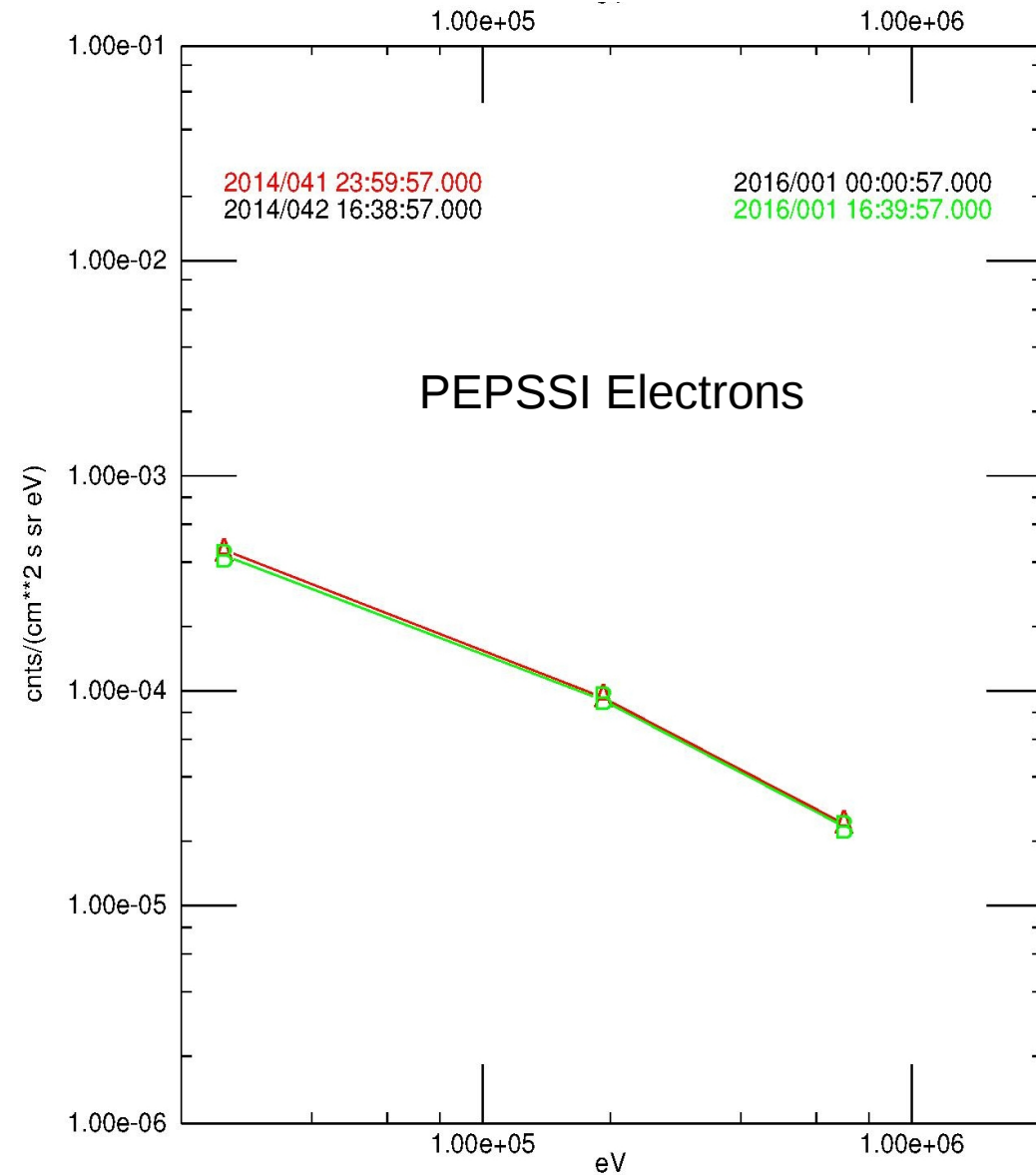
nh-p-pepssi-3-pluto-v2.0/data



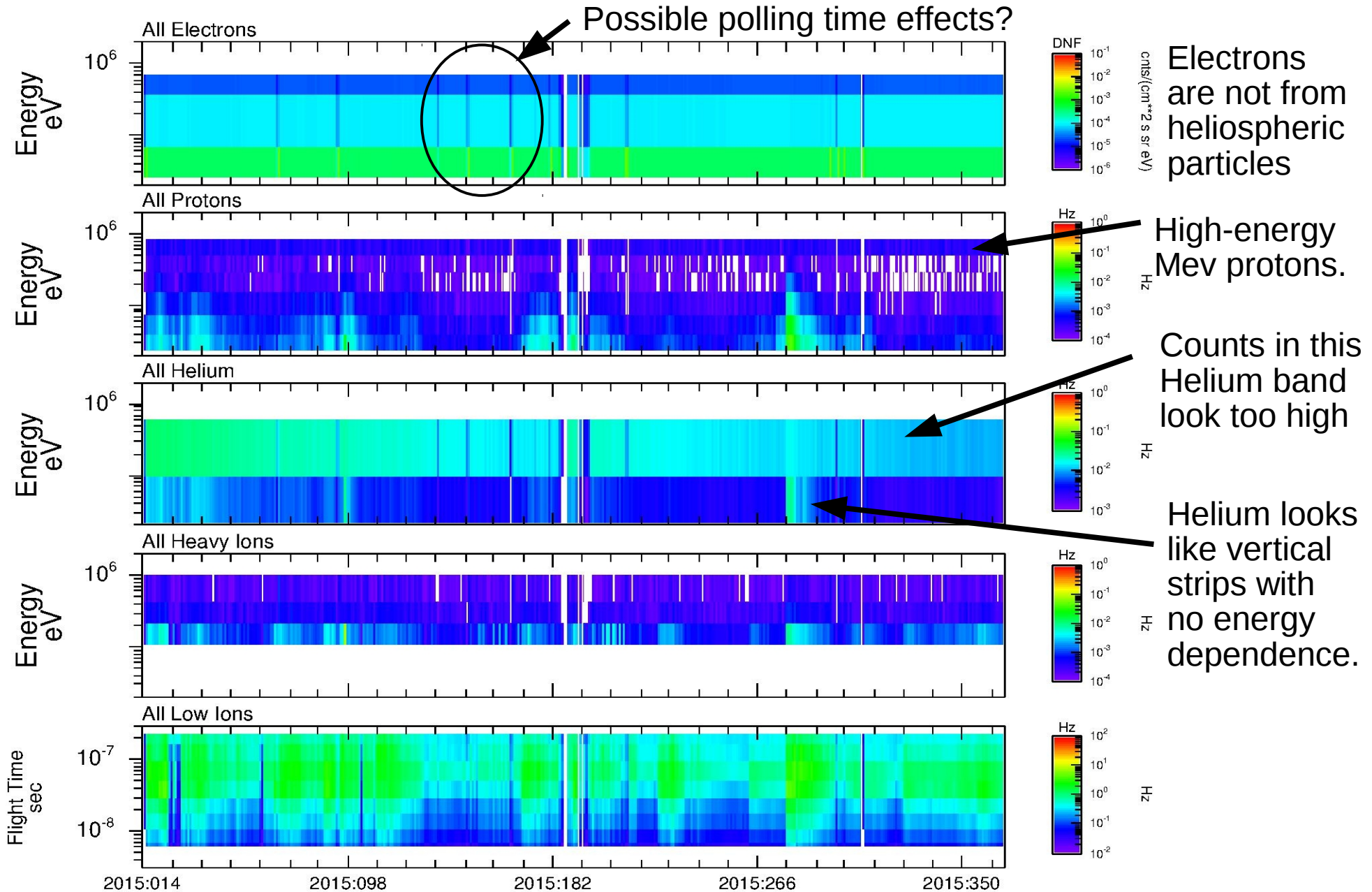
The electron PHA data signifies the spectral shape, but not its Intensity. The electrons here could have the same shape, but the variation could be in the sampling rate.

PEPSSI Electrons - Updated

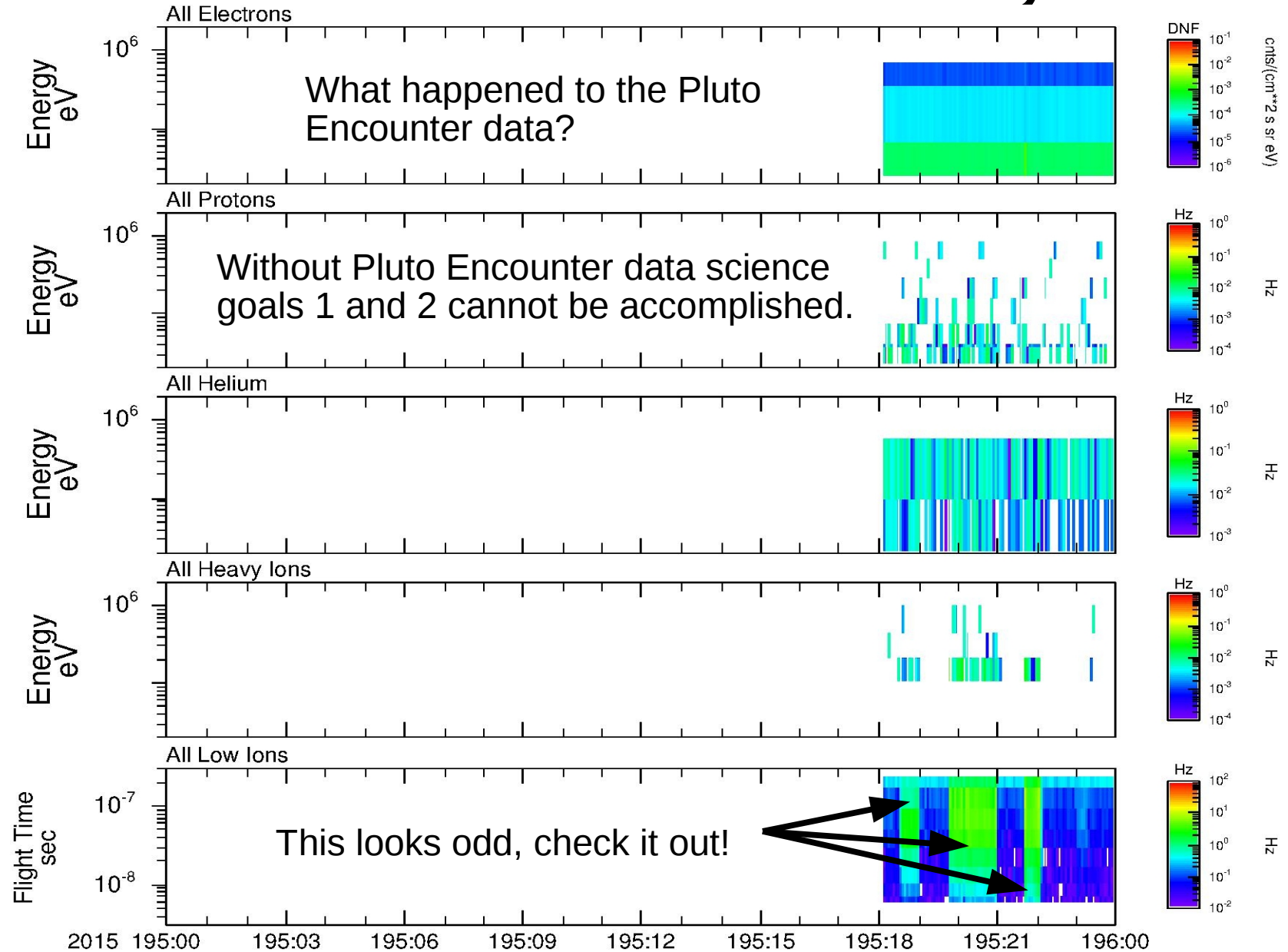
Why are the fluxes from PEPSSI abnormally high?



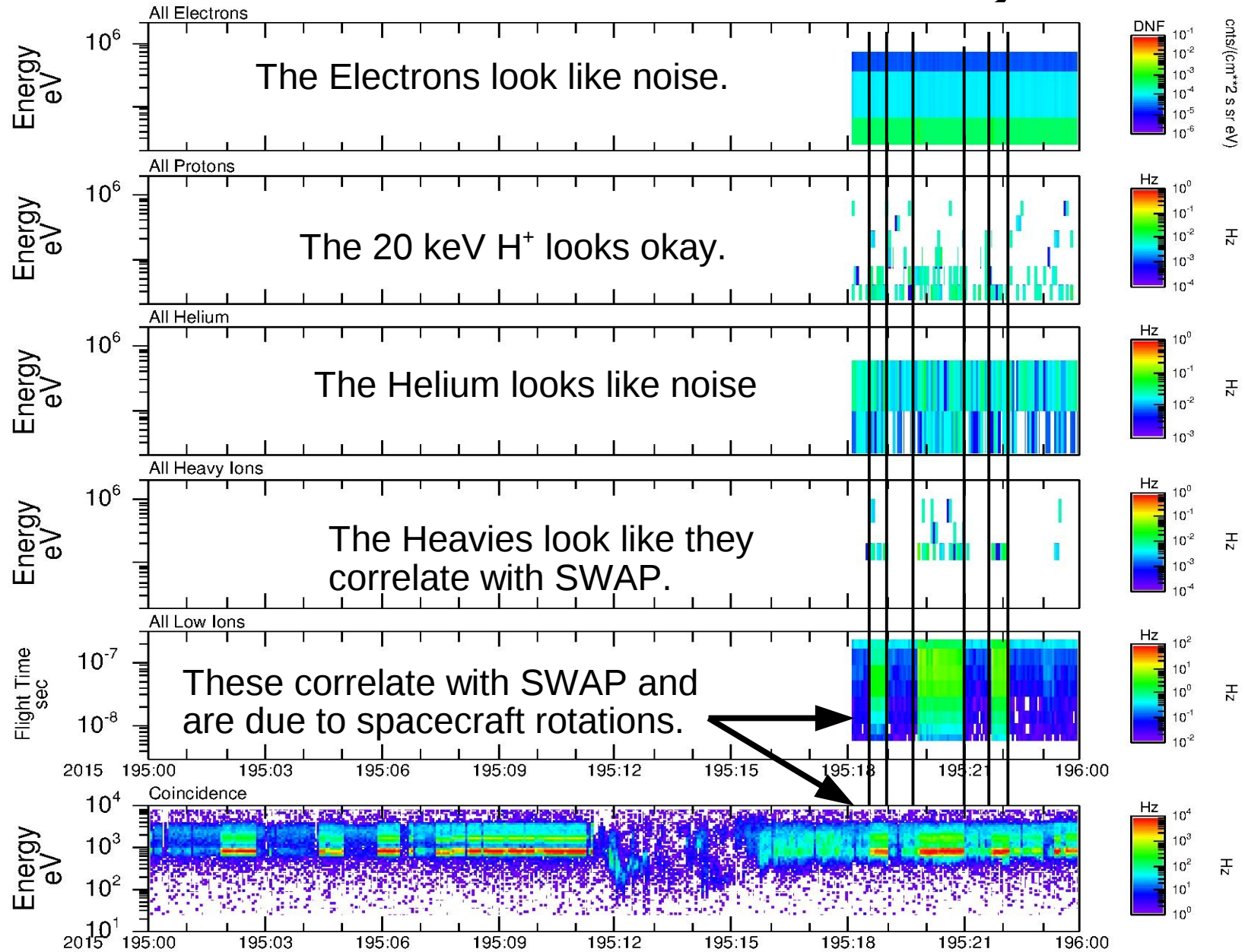
nh-p-pepssi-3-pluto-v2.0/data



nh-p-pepssi-3-pluto-v2.0/data Pluto Encounter Day



nh-p-pepssi-3-pluto-v2.0/data Pluto Encounter Day



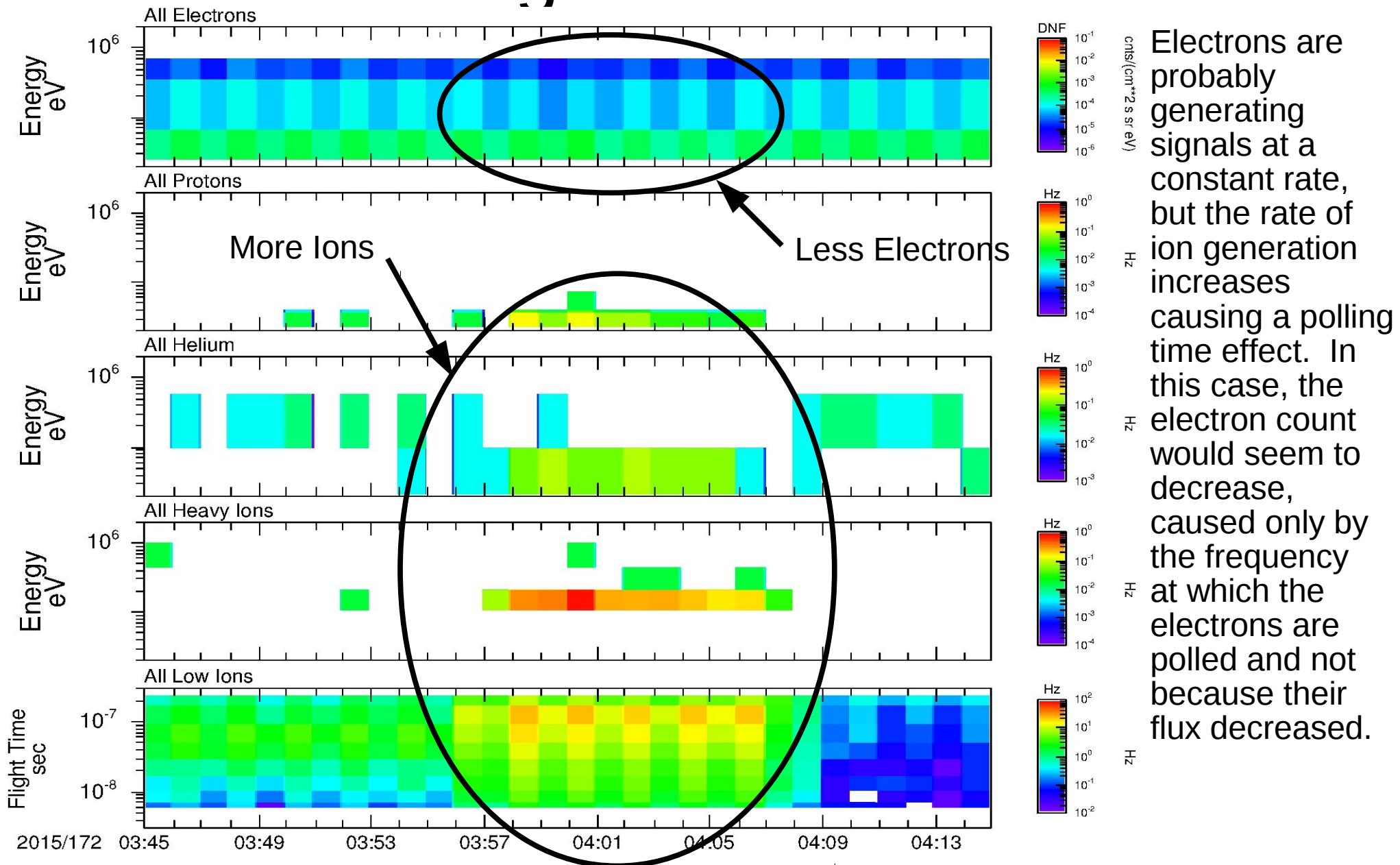
nh-p-pepssi-3-pluto-v2.0/data

Polling Time Effect?

A polling time effect could be caused when counts for multiple species become disjointed so that the ability to statistically sample is influenced by the count. If you have two input sources with both generating a number at a constant rate, then the probability of polling is constant. However, if the rate of one source increases, then the polling will find that the increased source occurs more frequently due to the increased rate. During this time, the constant source count would look depressed if this is not taken into account.

nh-p-pepssi-3-pluto-v2.0/data

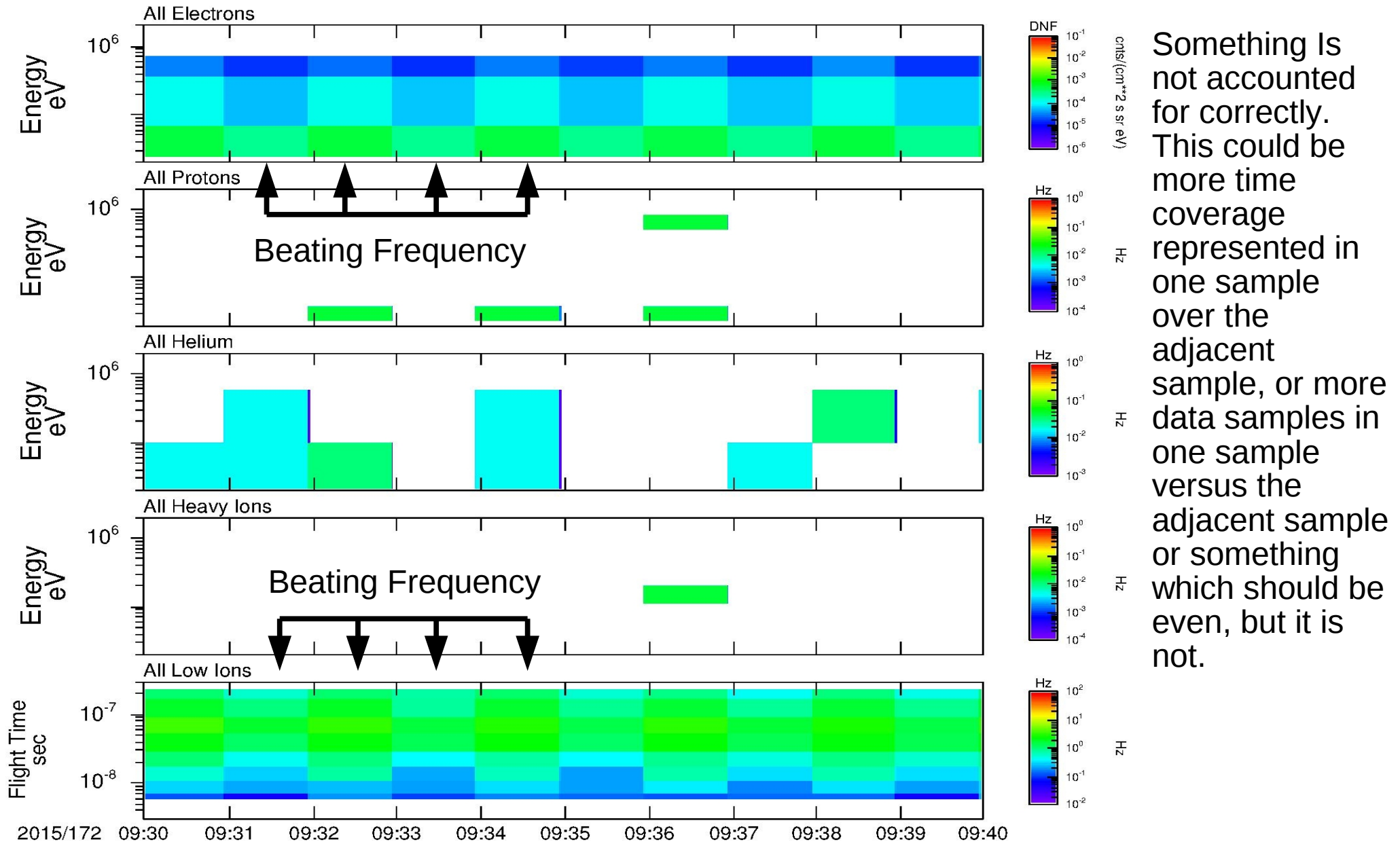
Polling Time Effect?



Electrons are probably generating signals at a constant rate, but the rate of ion generation increases causing a polling time effect. In this case, the electron count would seem to decrease, caused only by the frequency at which the electrons are polled and not because their flux decreased.

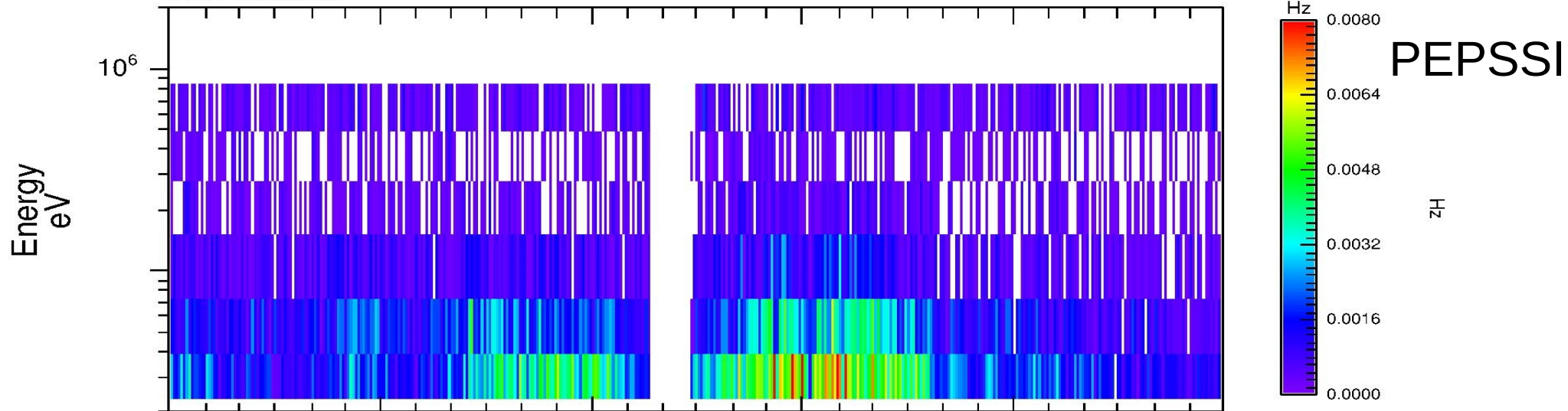
nh-p-pepssi-3-pluto-v2.0/data

Unequal Sampling Time Effect?

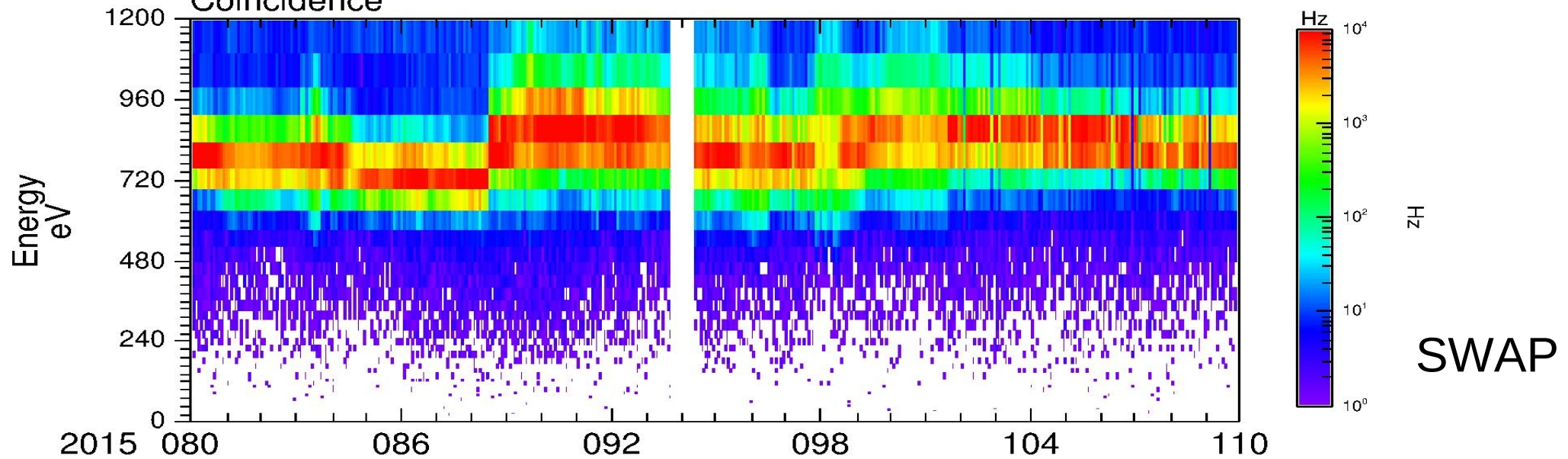


Heliospheric Shock or Heated Region in the Solar Wind - Updated

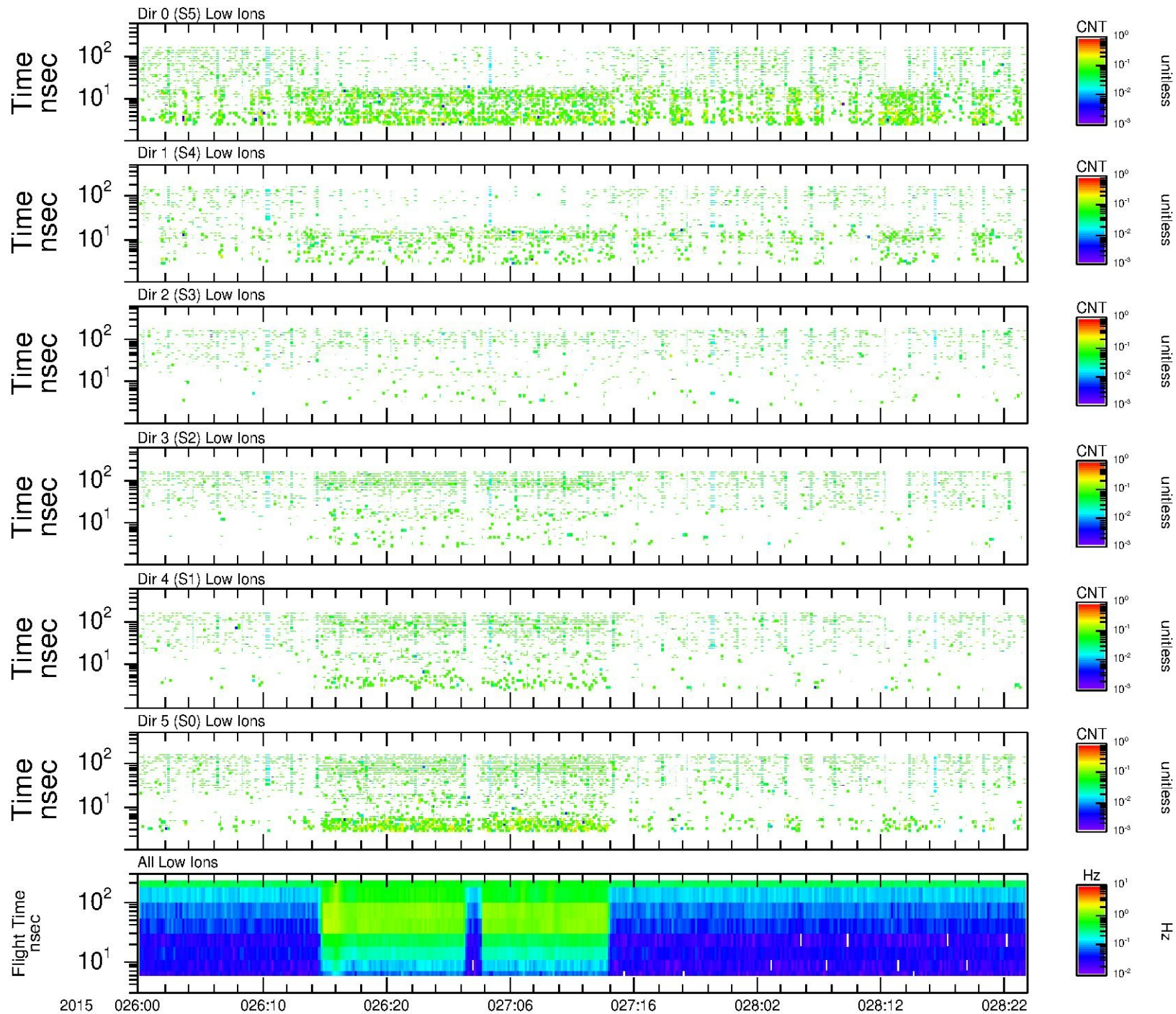
All Protons

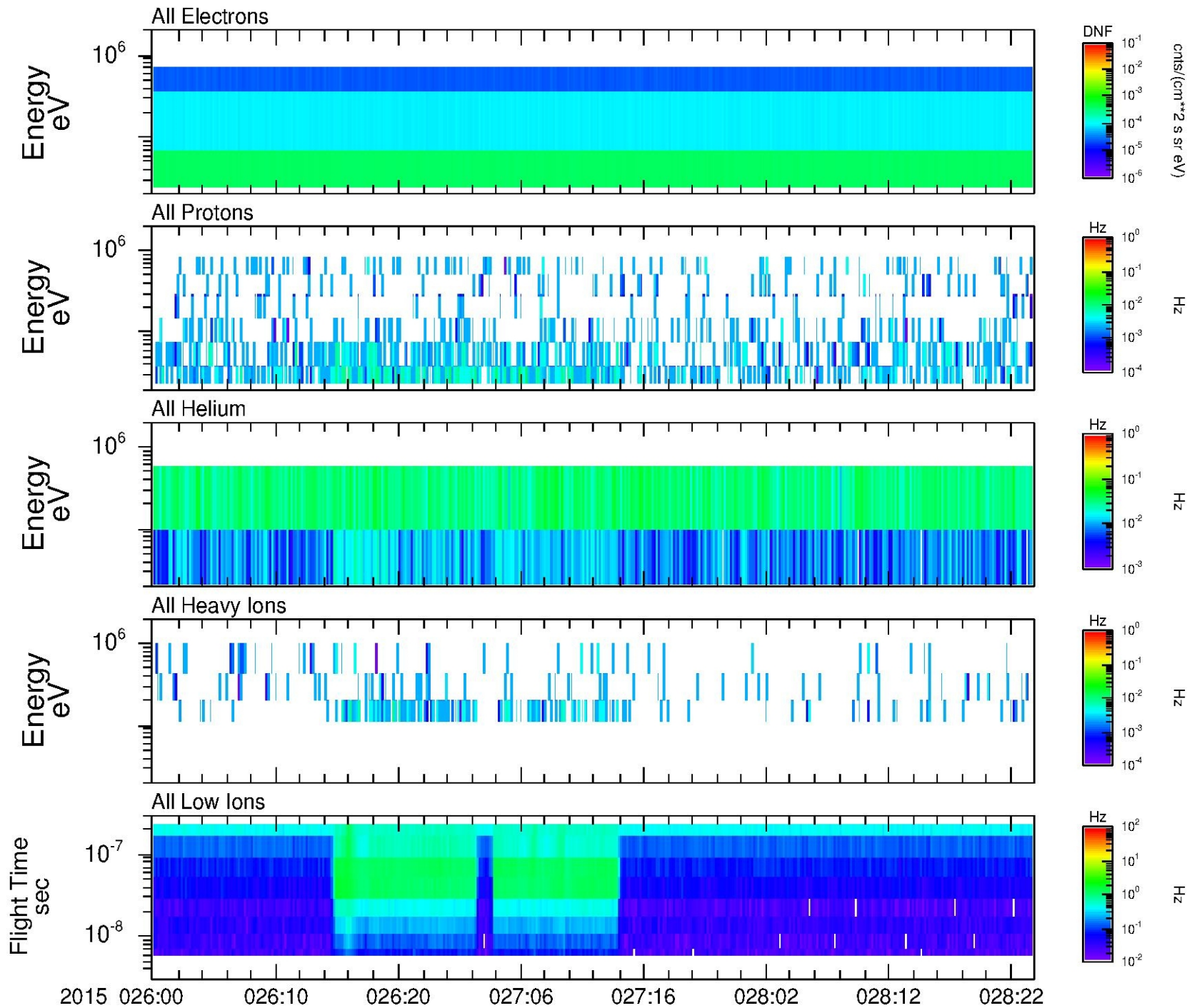


Coincidence



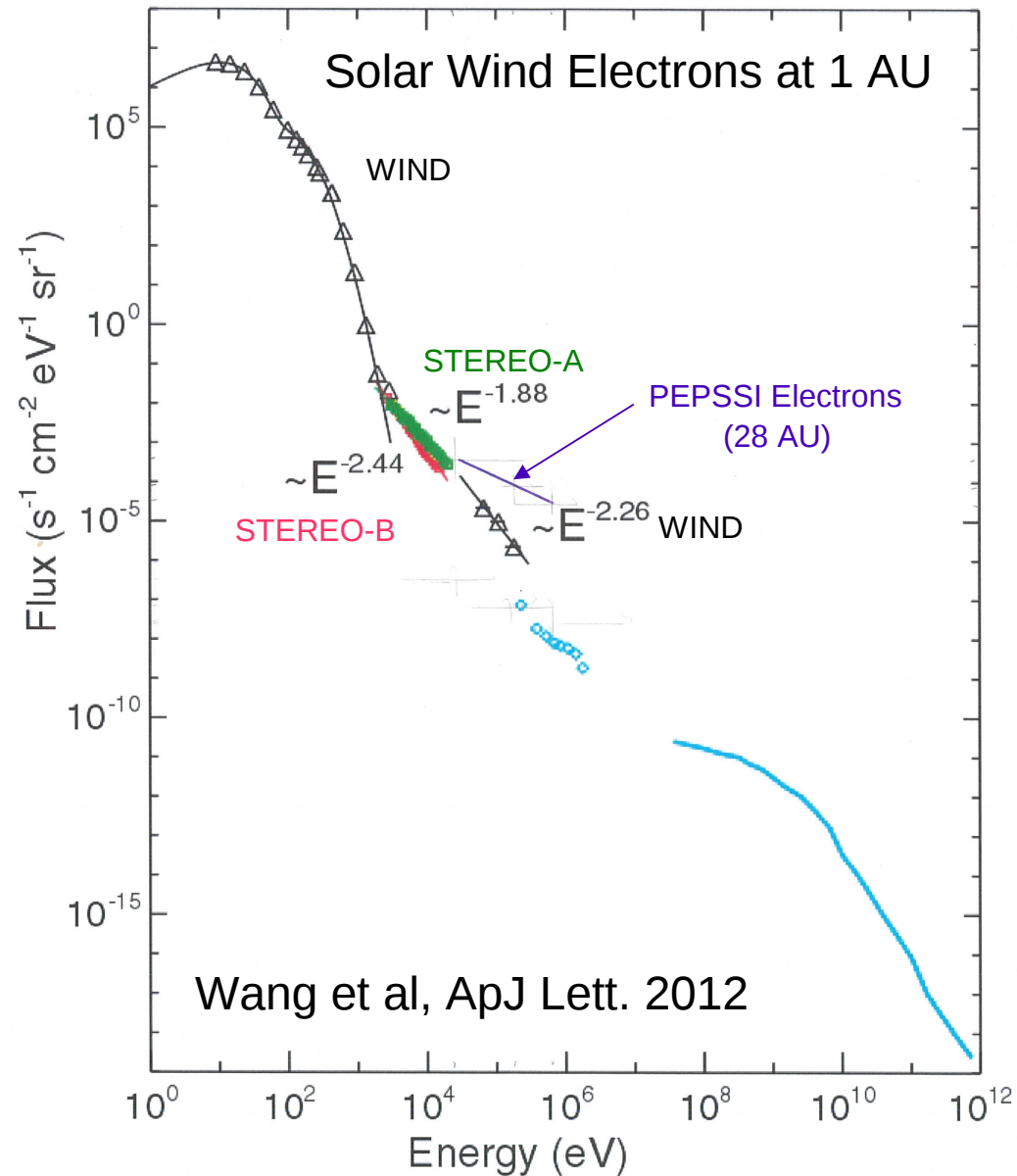
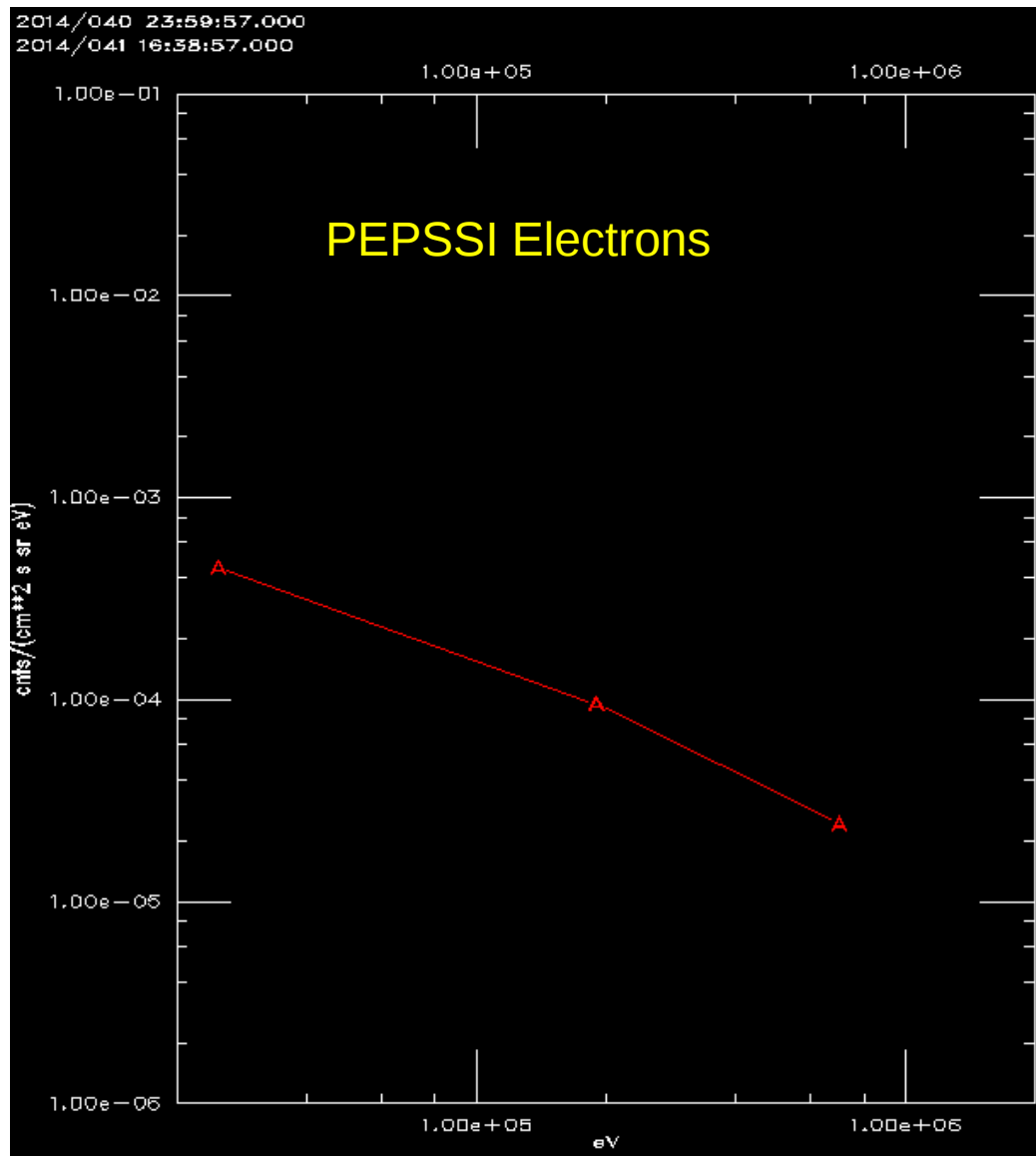
Back-Up Slides





PEPSSI Electrons - 3

Why are the fluxes from PEPSSI abnormally high?



Heliospheric Shock or Heated Region in the Solar Wind

So is this really a heliospheric shock or just heated plasma from the Sun. Attached is a blow-up on the SWAP H⁺ region on a linear scale. The PEPSSI data resembles more of an extension of the SWAP H⁺.

