

# 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

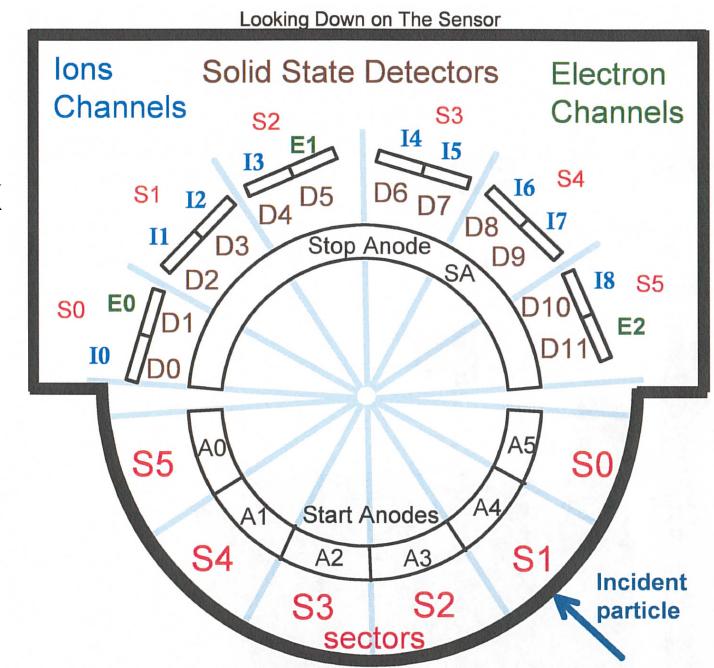
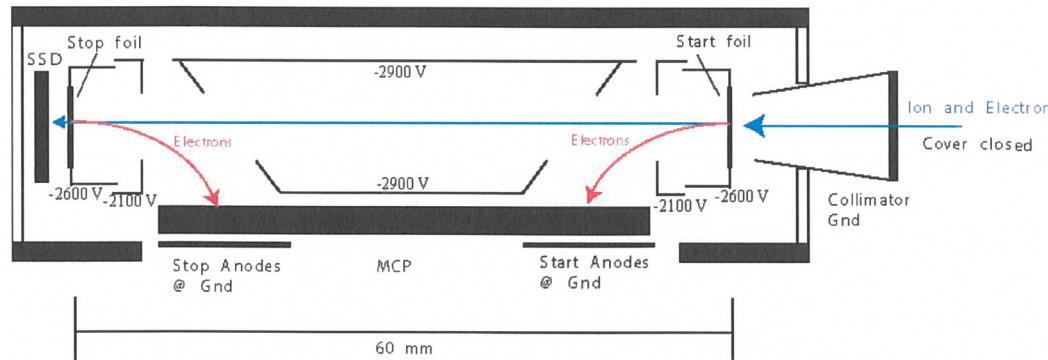
ANGULAR RESOLUTION: 25 deg x 12 deg

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 Data Sets:  
nh-a-pepsi-2-kem1-v6.0

CALIBRATED Data Sets:  
nh-a-pepsi-3-kem1-v6.0

# New Horizons PEPSSI Data Set Evaluation Tools

Staging and Evaluation -

Machine: Dell Precision Tower 5810

Operating System: Rocky-8 linux

Data Processing -

Machine: Sun Ultra-350

Operating System: Sun Solaris OS 5.9

Minor Diagnostics -

Machine: Dell 7520

Operating System: Fedora 33 linux

# **PEPSSI RAW and CALIBRATED Documentation Evaluation**

# nh-a-pepsi-2-kem1-v6.0/catalog

# nh-a-pepsi-3-kem1-v6.0/catalog

## nh\_kem.cat

The KEM Cruise1 Mission Phase has Ended, so why is the Mission Phase not Finalized?

According to the Dates, we are in the KEM 1 Encounter Phase.

### The Extended Voyage

---

#### KEM Cruise1

---

Short phase name (in DSID): KEMCRUISE1  
Formal mission phase name: CRUISE TO FIRST KBO ENCOUNTER  
Mission Phase Start Time - 2016-10-26  
Mission Phase Stop Time - 2018-08-14

Activities during the KEMCRUISE1 mission phase to the first KBO encounter are similar to those for Pluto Cruise phase. They also include post-Pluto encounter calibrations in mid-2016, along with continuing download of data from the Pluto encounter.

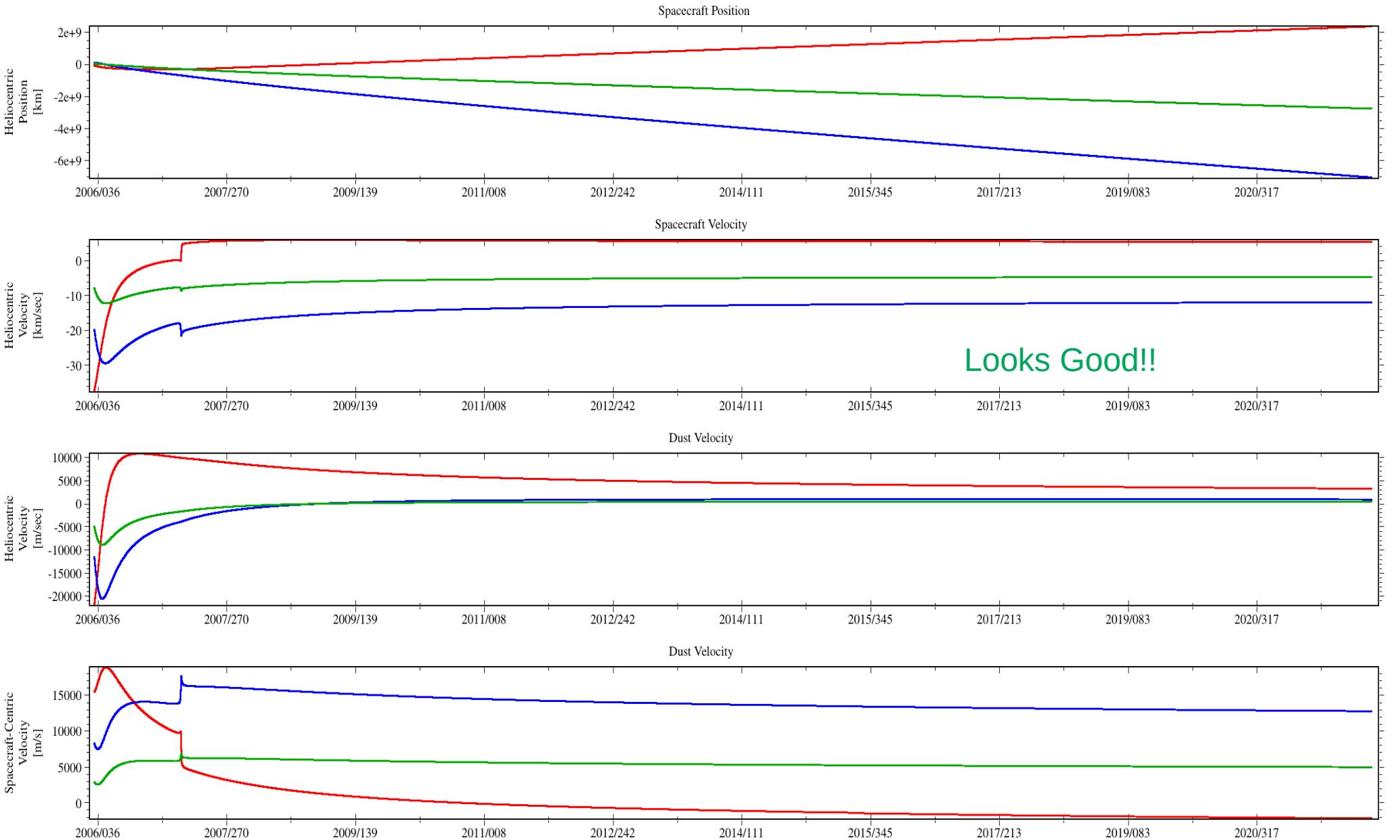
The name and times chosen for this mission phase are still in flux and may change in the future.

#### KEM 1 Encounter

---

Short phase name (in DSID): KEM1  
Formal mission phase name: KEM1 ENCOUNTER  
Mission Phase Start Time - 2018-08-14  
Mission Phase Stop Time - TBD

# nh-a-pepssi-3-kem1-v6.0/document nh\_mission\_trajectory.tab



# nh-a-pepsi-3-kem1-v6.0/document soc\_inst\_icd.pdf

Odd Formatting  
in ICD:

Example of  
changes in  
spacing →  
between  
lines (leading) →  
during a  
paragraph. →

These look like  
Paragraph breaks.

## 11.1.2 PEPSSI Sensor Description

PEPSSI is a compact particle telescope with a time-of-flight (TOF) section and a solid-state detector (SSD) array (see Figure 11-2). A mechanical collimator defines the acceptance angles for the incoming ions and electrons. A cutaway view of the assembly is shown in Figure 11-3. The TOF section is axially symmetric; entrance and exit apertures are 6 mm wide with an azimuthal opening angle of 160°. The entry apertures are covered by a thin polyimide/ aluminum/ polyimide foil. The stop foil is a polyimide/ palladium/ polyimide foil. The foils are mounted on high-transmittance stainless-steel grids. The foil thickness and composition is a compromise to minimize the energy threshold, secondary electron production, and scattering of particles in the foil while blocking UV from the direct Sun and Lyman- $\alpha$  background. PEPSSI measures the ion TOF using secondary electrons generated as the ion passes through the entrance and exit foils in the spectrometer. Total energy is measured by the SSD array. Each of the six SSDs has two pixels, three of the SSDs are dedicated for ion measurement. The other three have one pixel covered with  $\sim 1 \mu\text{m}$  Al absorber, to block low energy ions and permit measurements of electrons. The fan-like collimator together with the internal geometry defines the acceptance angles. The FOV is 160° by 12° with six angular sectors of 25° each; the total geometric factor is  $\sim 0.15 \text{ cm}^2\text{sr}$ . As an ion passes through the sensor, it is first accelerated by the potential of  $\sim 3 \text{ kV}$  on the front foil prior to

produce an eight-point energy spectrum for each of four species for six arrival directions. Energetic electrons are measured simultaneously in the dedicated electron pixels in the range from  $\sim 30\text{keV}$  to 700 keV. Only protons with energies  $> 300 \text{ keV}$  (expected to be very rare at Pluto) can penetrate the absorbers on these pixels, and even those would be eliminated by on-

Example of a page break in the middle of a sentence. →

# nh-a-pepsi-3-kem1-v6.0/document soc\_inst\_icd.pdf

Leading change

$$(\delta f)^2 = \sum_{i=1}^N \left( \frac{\partial f}{\partial x_i} \delta x_i \right)^2$$

Version 6

A “pseudo-code” version of the actual calculation code used is given in *COMMENT* keywords in the FITS header of the Level 3 files. The actual calibration parameters used in the production of a file are also given in the keywords for each flux value. NOTE: At the time of this writing, the constant uncertainties used for calibration are set to zero, so that only the Poisson error is calculated for the FLUX Uncertainty values in the Level 3 files.

Type Set in Different Font

$$(\delta f)^2 = \sum_{i=1}^N \left( \frac{\partial f}{\partial x_i} \delta x_i \right)^2$$

Version 5

A “pseudo-code” version of the actual calculation code used is given in *COMMENT* keywords in the FITS header of the Level 3 files. The actual calibration parameters used in the production of a file are also given in the keywords for each flux value. NOTE: At the time of this writing, the constant uncertainties used for calibration are set to zero, so that only the Poisson error is calculated for the FLUX Uncertainty values in the Level 3 files.

# nh-a-pepsi-3-kem1-v6.0/document soc\_inst\_icd.pdf

Can not tell the difference between a paragraph and a line with an extra carriage return.

Paragraph separation unclear and not consistent with the other text where there is a blank line separating Paragraphs.

sectors can measure. These thresholds differ between the sectors but the calibration accounts for this. The lowest energy of each sector and channel was determined from PHA\_HIGH\_ION event data accumulated through the mission.

The geometry factors are derived based on the formalism described in Sullivan, 1971, Nucl. Instr. and Methods, using a simplified instrument geometry and Monte-Carlo technique.

The PEPSSI flight unit was calibrated pre-launch to convert the measured deposited energy- and TOF-values to physical units. For a long time there were no reliable efficiencies available because there was only time to measure two efficiency points that were of limited use. Significant effort was put into deriving the missing efficiencies.

The current helium efficiencies are based on a combination of in-flight measurements and calibrations with the engineering model (EM). Non helium-efficiencies are based on a combination of in-flight measurements and theory. For the helium calibration, we used a degraded alpha source that was measured both with the PEPSSI EM and an independently calibrated SSD.

The theoretical approach is similar to what is used for other PEPSSI-like “Puck” instruments as RBSPICE or JEDI. It assumes that the efficiency is proportional to the secondary electron yield of ions passing the start and stop foils. This yield is usually proportional to the differential energy loss of the ions in the foil material that faces the MCP. This was confirmed for protons and helium passing the start foil (Smidts et al., 1992, Nucl. Inst. and Methods; Baragiola et al., 1978, Phys. Rev. B).

The second efficiency factor is from particles that scatter after the start foil in a way that they miss the stop foil and/or the SSD. However, intercalibration of RBSPICE with HOPE showed that theory overestimates the scattering factor. Additionally, we found that neglecting the scattering factor makes the theoretical helium efficiency similar to the measured efficiency. The used theoretical efficiency as we use it is therefore only a product of the electron yields in the start and stop foil. This is not critical since we only provide efficiencies for the B channels that have high enough energies that scattering is not important in any case.

Both the theory as the measurements with the EM only provide the energy dependence of the efficiency, not absolute values. This scaling is done based on in-flight measurements in diagnostic

nh-a-pepsi-3-kem1-v6.0/document  
soc\_inst\_icd.pdf

Southwest Research Institute

05310-SOCINST-01

Rev 0 Chg 0

**New Horizons SOC to Instrument Pipeline ICD**

Page 110

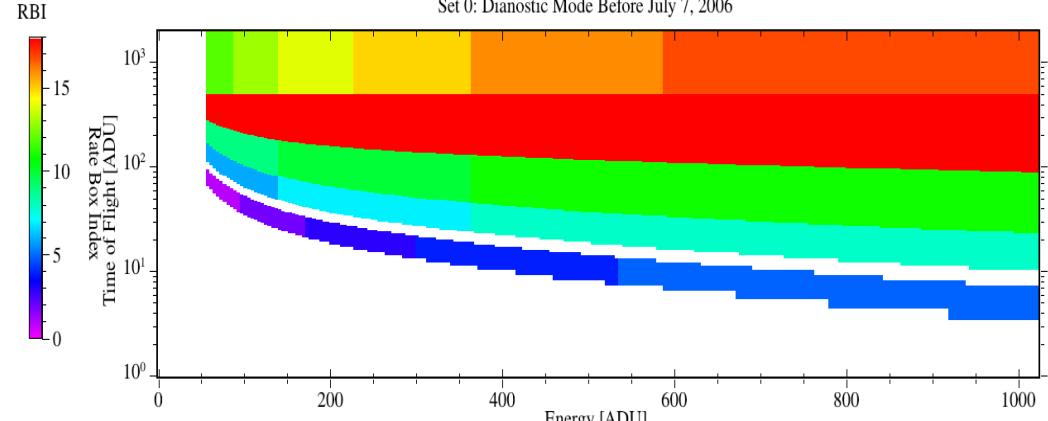
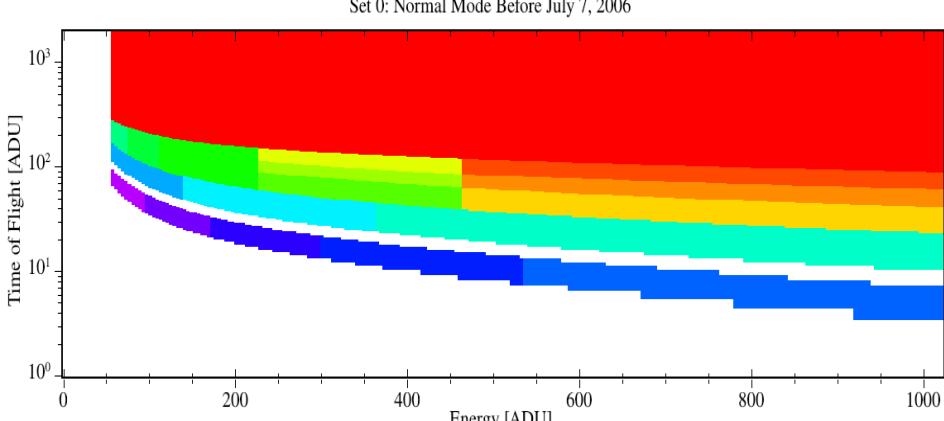
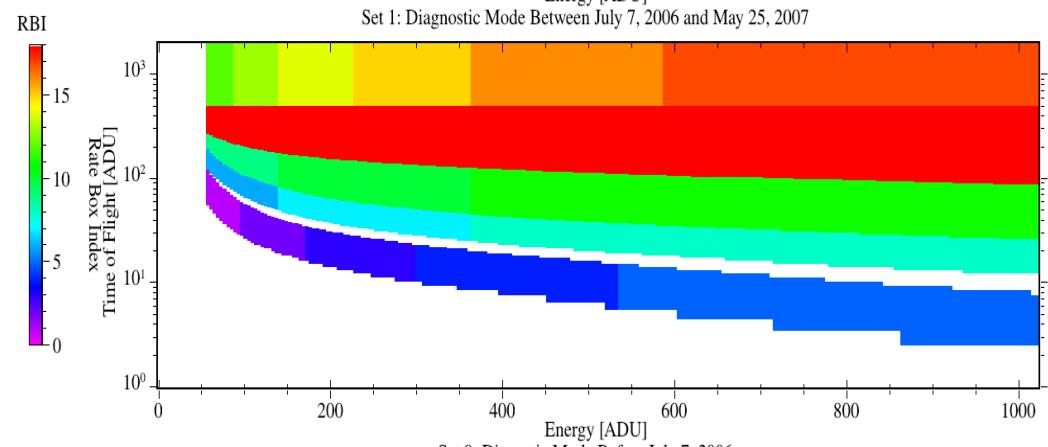
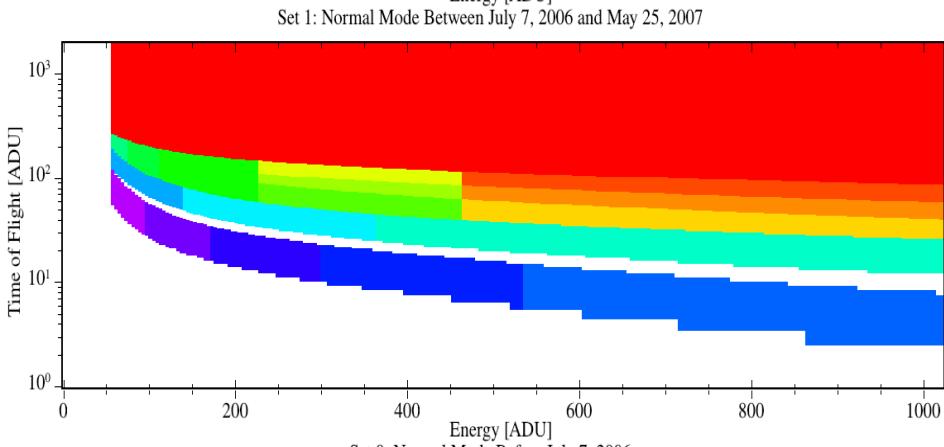
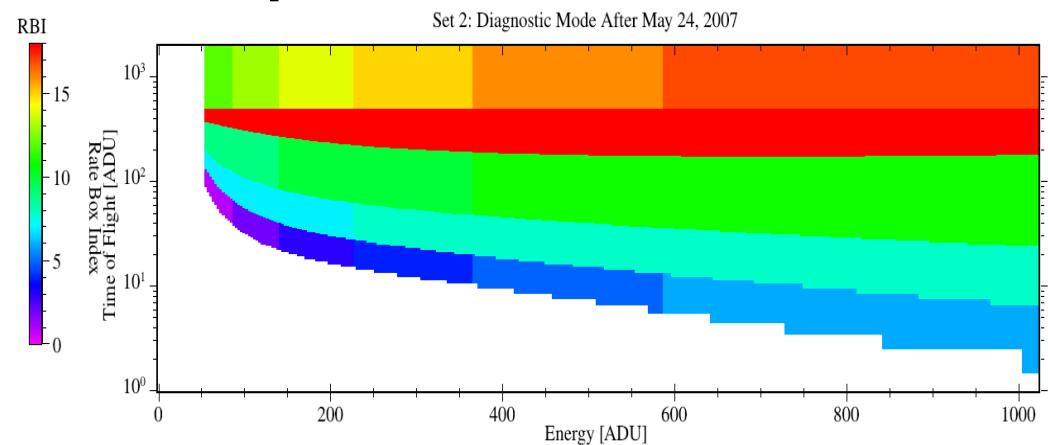
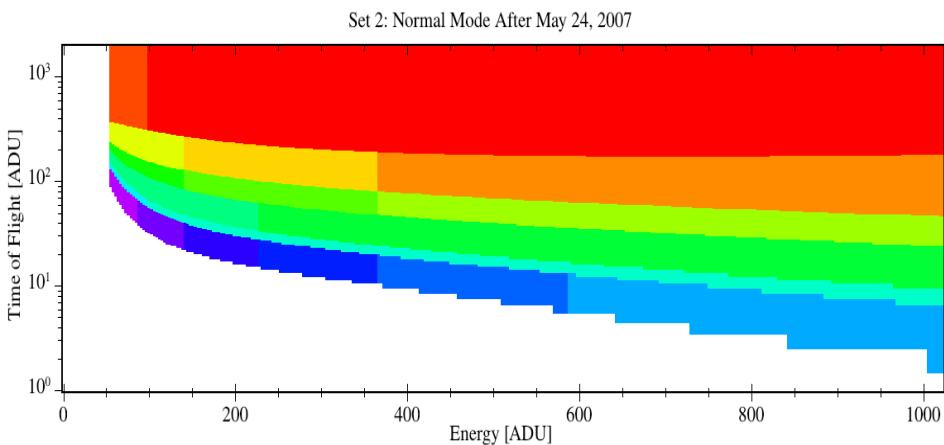
---

Extra Blank Page inserted between a sentence break across a page boundary.

It is unclear why this is included.

# nh-a-pepsi-3-kem1-v6.0/calib rateboxdefinitionplanes.fit

Looks Good!!



# **PEPSSI RAW and CALIBRATED Data Evaluation**

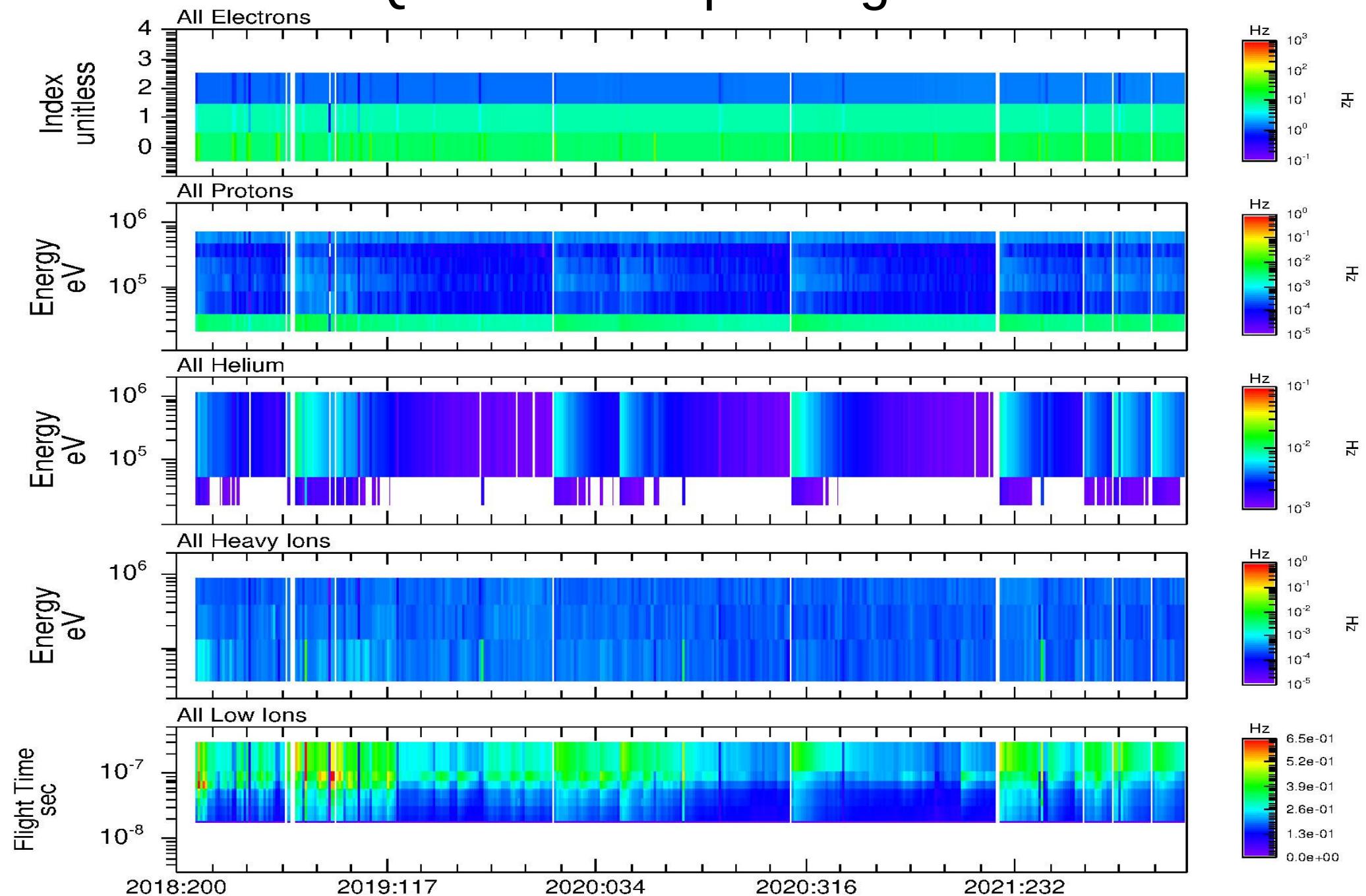
# nh-a-pepsi-3-kem1-v6.0/data PEPSSI FIT File Structure

fv: Summary of pep\_0437205117\_0x691\_sci.fit...-a-pepsi-3-kem1-v6.0/data/20191128\_043720/

| File  | Edit           | Tools  | Help                |        |       |       |     |        |
|-------|----------------|--------|---------------------|--------|-------|-------|-----|--------|
| Index | Extension      | Type   | Dimension           | View   |       |       |     |        |
| 0     | Primary        | Image  | 1017 X 614          | Header | Image | Table |     |        |
| 1     | SPEC_Protons   | Image  | 1440 X 6            | Header | Image | Table |     |        |
| 2     | SPEC_Helium    | Image  | 1440 X 2            | Header | Image | Table |     |        |
| 3     | SPEC_Heavies   | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 4     | SPEC_Electrons | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 5     | SPEC_Lowlon    | Image  | 1440 X 8            | Header | Image | Table |     |        |
| 6     | FLUX           | Binary | 832 cols X 960 rows | Header | Hist  | Plot  | All | Select |
| 7     | FLUXN1A        | Binary | 502 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 8     | FLUXN1B        | Binary | 440 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 9     | PHA_ELECTRON   | Binary | 9 cols X 25552 rows | Header | Hist  | Plot  | All | Select |
| 10    | PHA_LOW_ION    | Binary | 25 cols X 1777 rows | Header | Hist  | Plot  | All | Select |
| 11    | PHA_HIGH_ION   | Binary | 23 cols X 1711 rows | Header | Hist  | Plot  | All | Select |

# nh-a-pepsi-3-kem1-v6.0/data Quick Look Spectrograms

14



# nh-a-pepsi-3-kem1-v6.0/data PEPSSI FIT File Structure

fv: Summary of pep\_0437205117\_0x691\_sci.fit...-a-pepsi-3-kem1-v6.0/data/20191128\_043720/

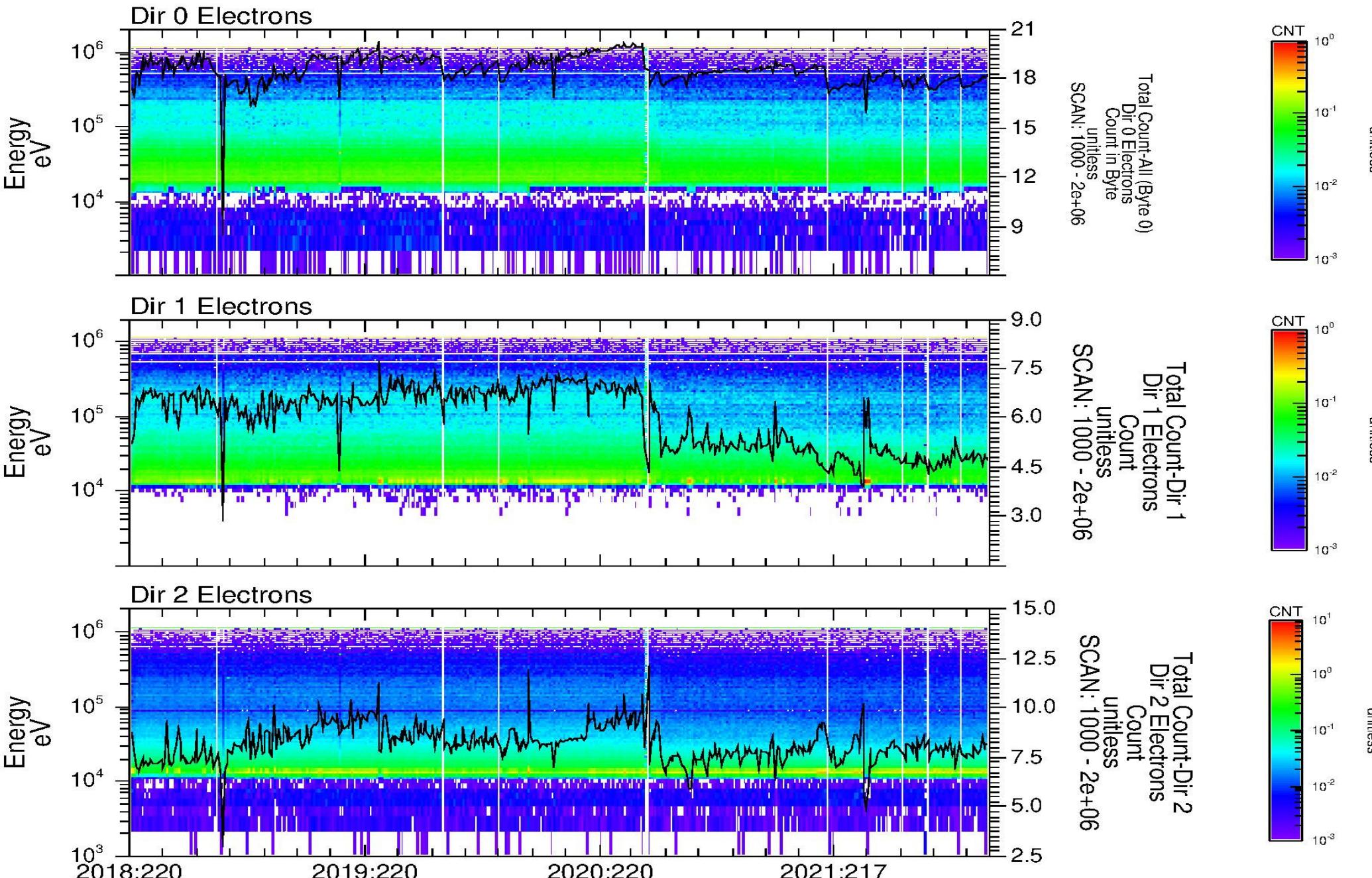
File Edit Tools Help

| Index | Extension      | Type   | Dimension           | View   |       |       |     |        |  |
|-------|----------------|--------|---------------------|--------|-------|-------|-----|--------|--|
| 0     | Primary        | Image  | 1017 X 614          | Header | Image | Table |     |        |  |
| 1     | SPEC_Protons   | Image  | 1440 X 6            | Header | Image | Table |     |        |  |
| 2     | SPEC_Helium    | Image  | 1440 X 2            | Header | Image | Table |     |        |  |
| 3     | SPEC_Heavies   | Image  | 1440 X 3            | Header | Image | Table |     |        |  |
| 4     | SPEC_Electrons | Image  | 1440 X 3            | Header | Image | Table |     |        |  |
| 5     | SPEC_Lowlon    | Image  | 1440 X 8            | Header | Image | Table |     |        |  |
| 6     | FLUX           | Binary | 832 cols X 960 rows | Header | Hist  | Plot  | All | Select |  |
| 7     | FLUXN1A        | Binary | 502 cols X 24 rows  | Header | Hist  | Plot  | All | Select |  |
| 8     | FLUXN1B        | Binary | 440 cols X 24 rows  | Header | Hist  | Plot  | All | Select |  |
| 9     | PHA_ELECTRON   | Binary | 9 cols X 25552 rows | Header | Hist  | Plot  | All | Select |  |
| 10    | PHA_LOW_ION    | Binary | 25 cols X 1777 rows | Header | Hist  | Plot  | All | Select |  |
| 11    | PHA_HIGH_ION   | Binary | 23 cols X 1711 rows | Header | Hist  | Plot  | All | Select |  |

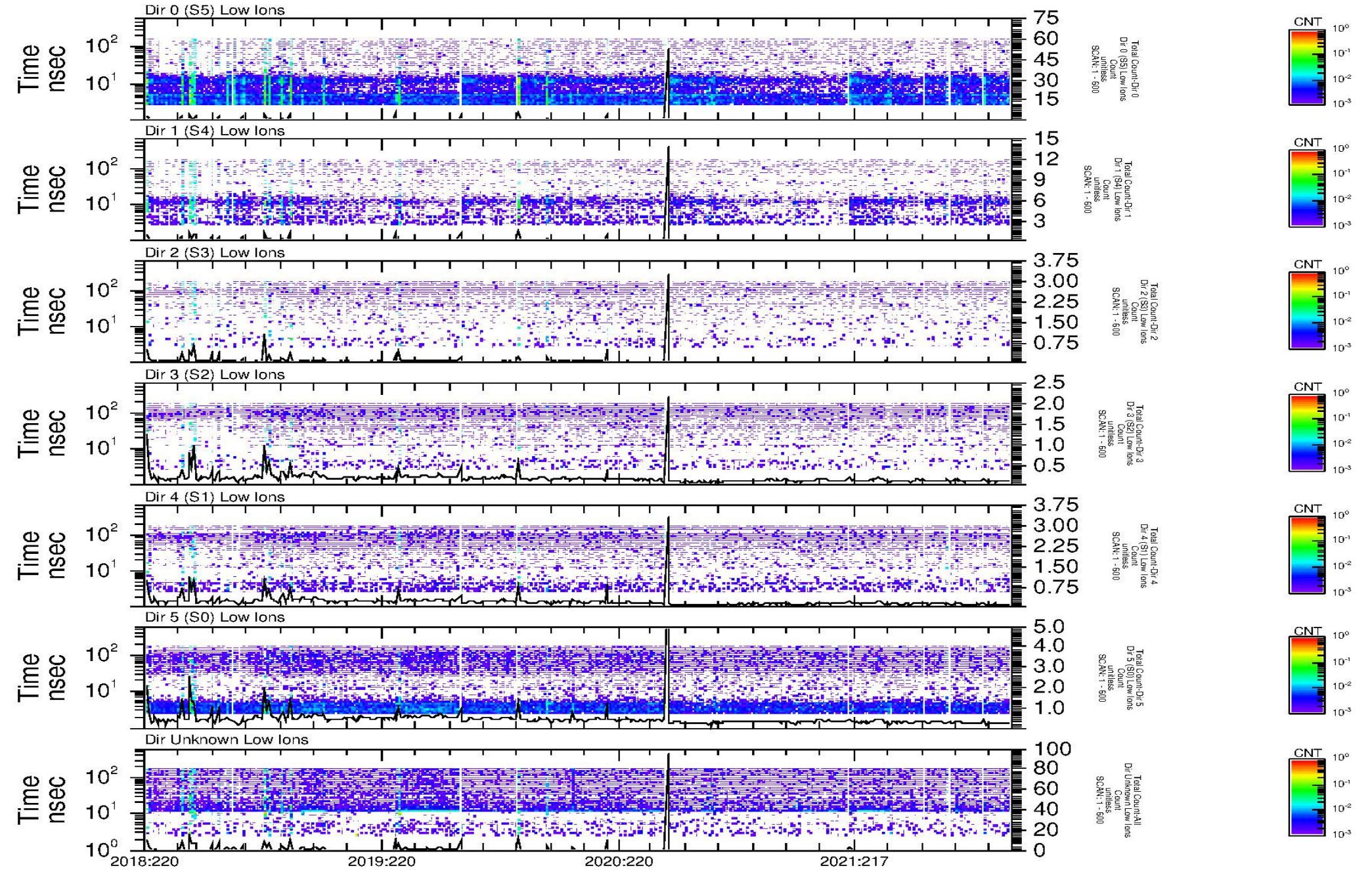
# nh-a-pepsi-3-kem1-v6.0/data

## Electron PHA

16



# nh-a-pepsi-3-kem1-v6.0/data Low Ion PHA

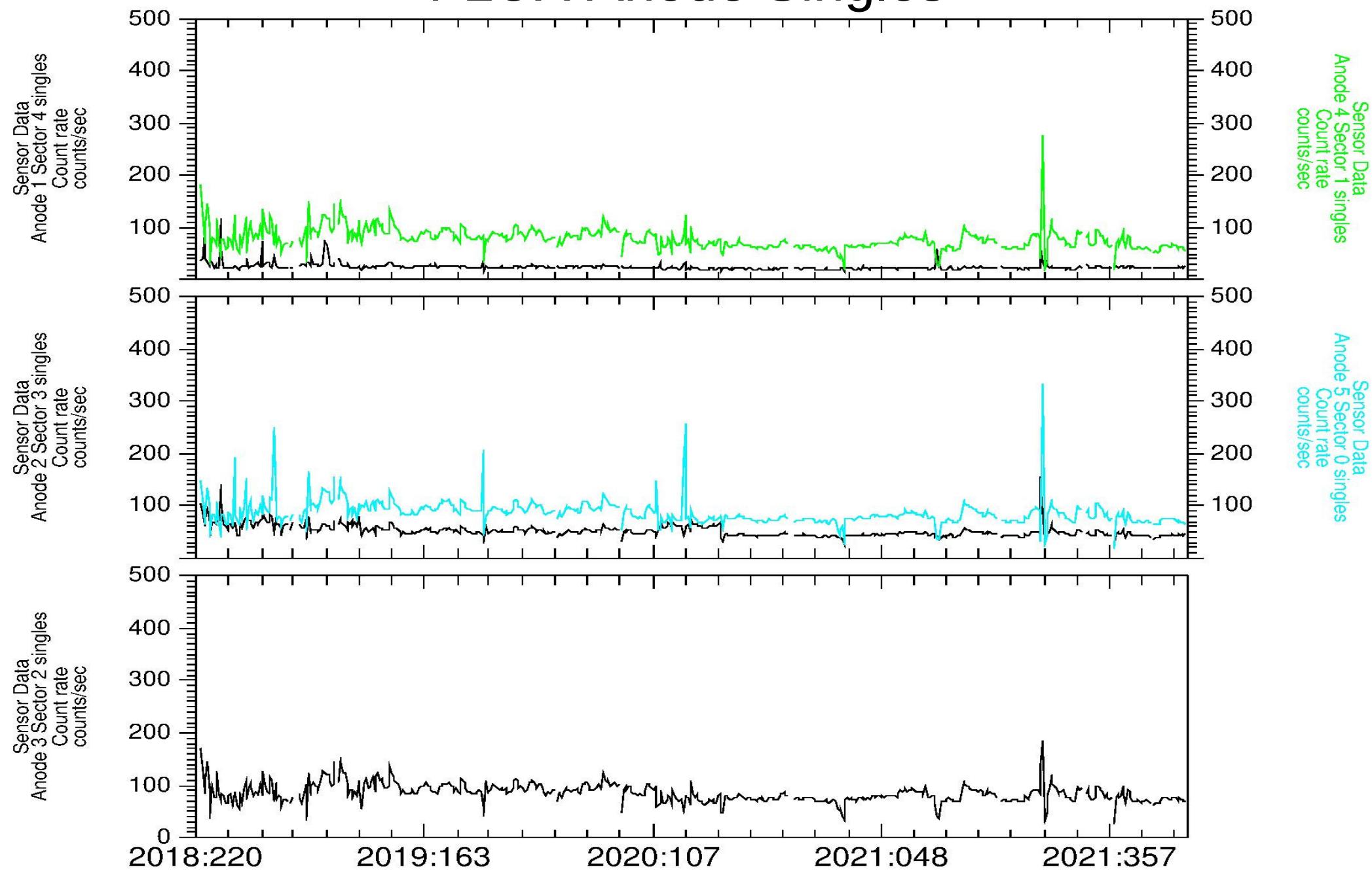


# nh-a-pepsi-3-kem1-v6.0/data PEPSSI FIT File Structure

fv: Summary of pep\_0437205117\_0x691\_sci.fit...-a-pepsi-3-kem1-v6.0/data/20191128\_043720/

| File  | Edit           | Tools  | Help                |        |       |       |     |        |
|-------|----------------|--------|---------------------|--------|-------|-------|-----|--------|
| Index | Extension      | Type   | Dimension           | View   |       |       |     |        |
| 0     | Primary        | Image  | 1017 X 614          | Header | Image | Table |     |        |
| 1     | SPEC_Protons   | Image  | 1440 X 6            | Header | Image | Table |     |        |
| 2     | SPEC_Helium    | Image  | 1440 X 2            | Header | Image | Table |     |        |
| 3     | SPEC_Heavies   | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 4     | SPEC_Electrons | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 5     | SPEC_Lowlon    | Image  | 1440 X 8            | Header | Image | Table |     |        |
| 6     | FLUX           | Binary | 832 cols X 960 rows | Header | Hist  | Plot  | All | Select |
| 7     | FLUXN1A        | Binary | 502 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 8     | FLUXN1B        | Binary | 440 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 9     | PHA_ELECTRON   | Binary | 9 cols X 25552 rows | Header | Hist  | Plot  | All | Select |
| 10    | PHA_LOW_ION    | Binary | 25 cols X 1777 rows | Header | Hist  | Plot  | All | Select |
| 11    | PHA_HIGH_ION   | Binary | 23 cols X 1711 rows | Header | Hist  | Plot  | All | Select |

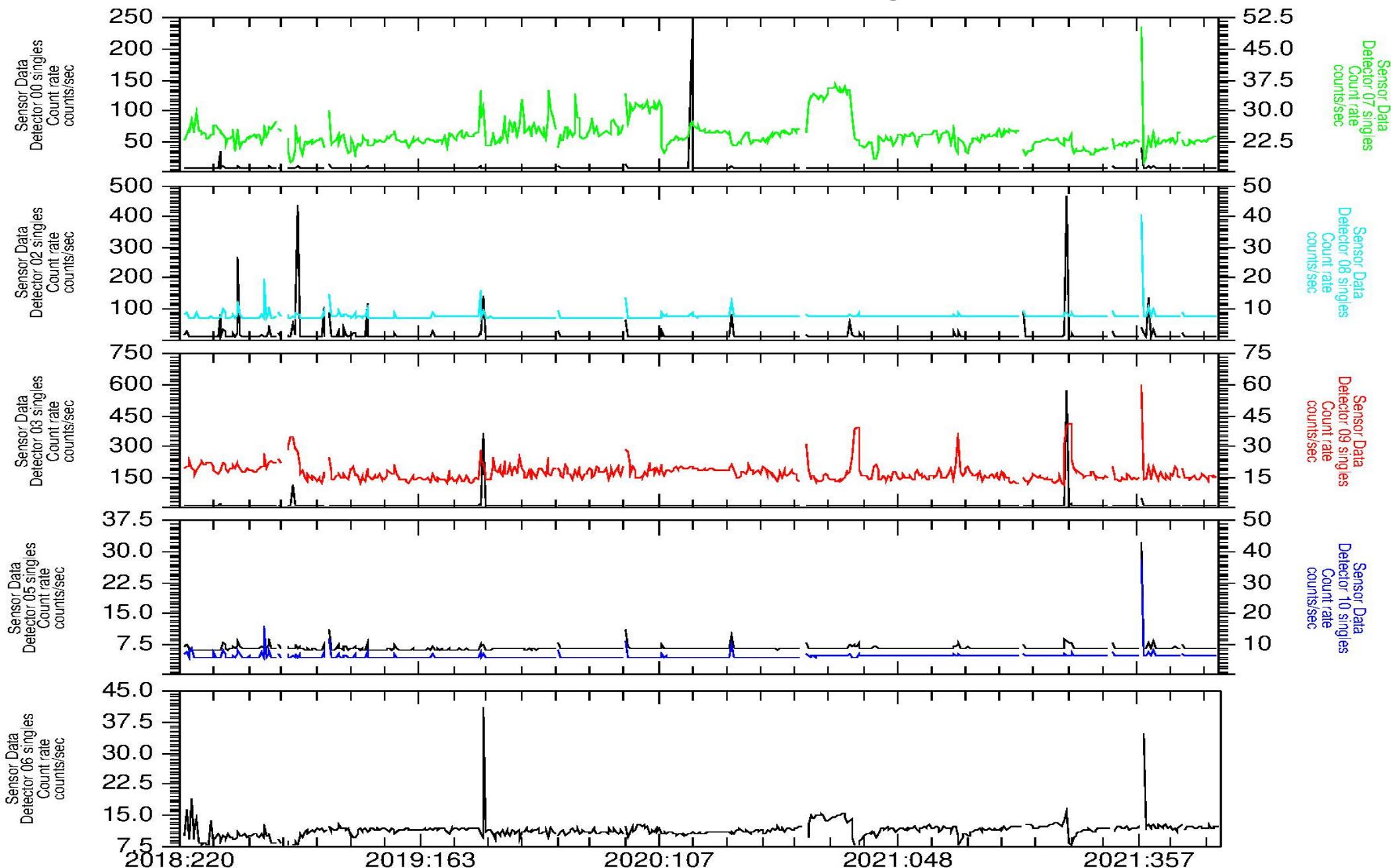
# nh-a-pepsi-3-kem1-v6.0/data FLUX Anode Singles



# nh-a-pepsi-3-kem1-v6.0/data

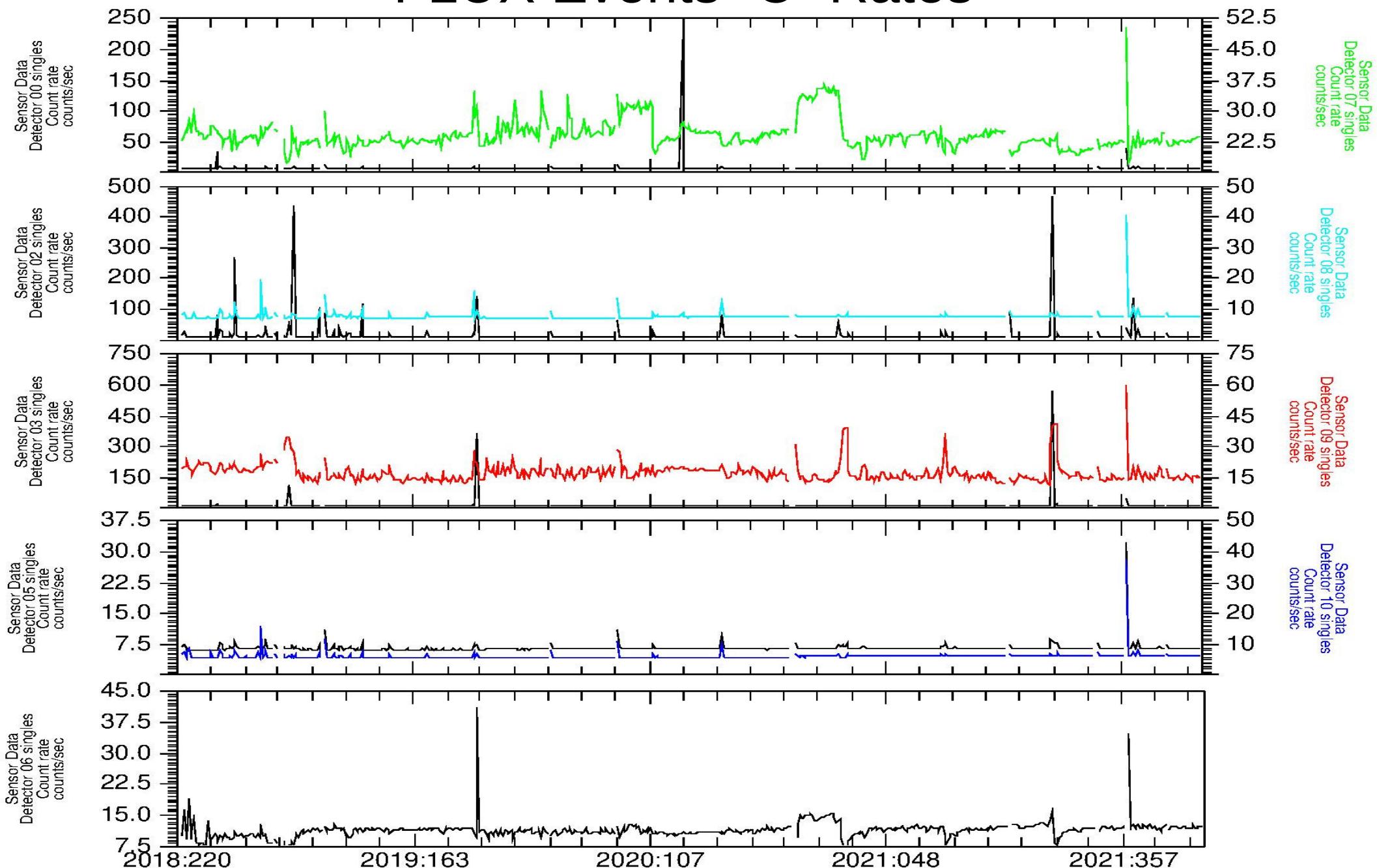
## FLUX Detector Singles

20



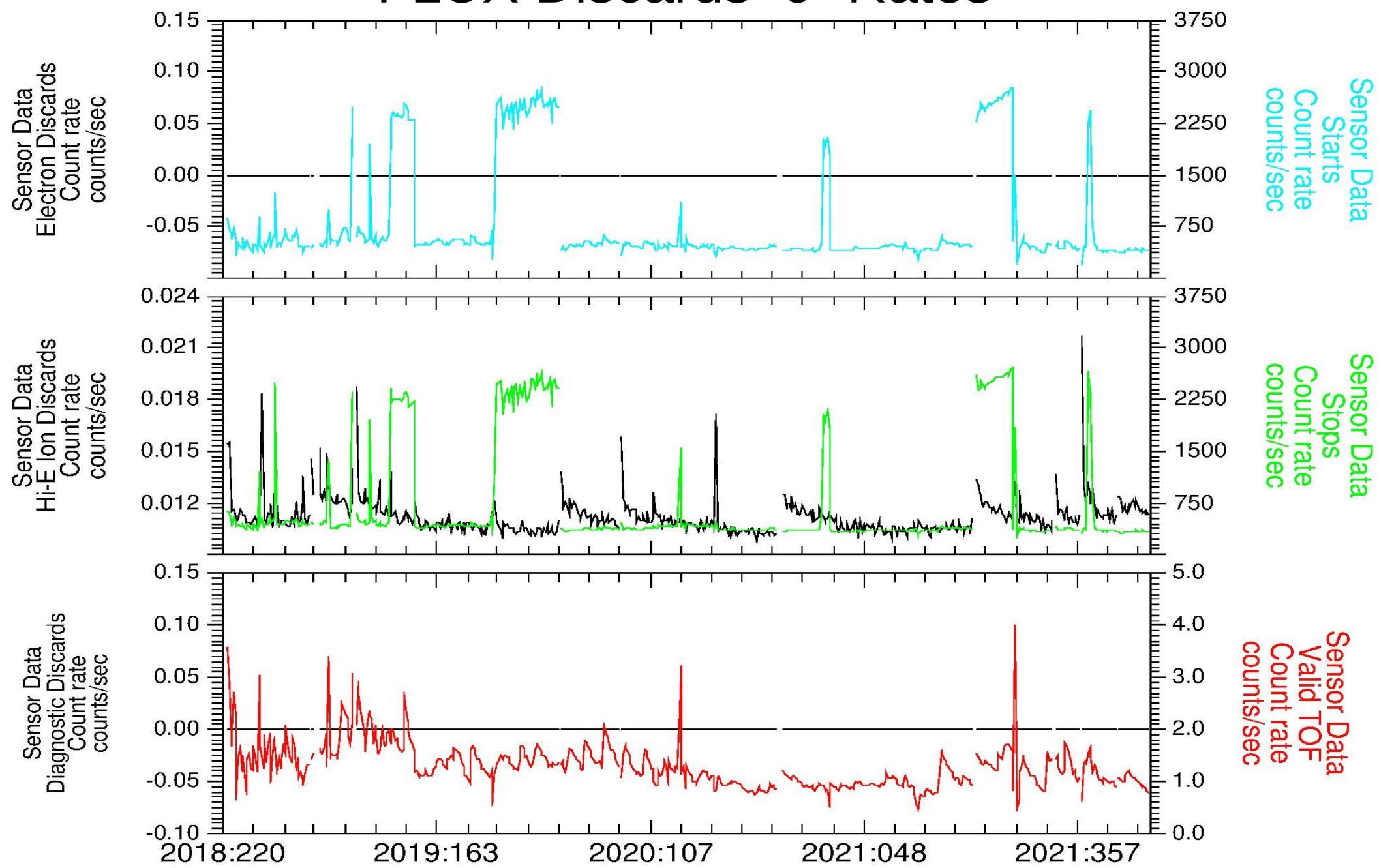
# nh-a-pepsi-3-kem1-v6.0/data

## FLUX Events "C" Rates



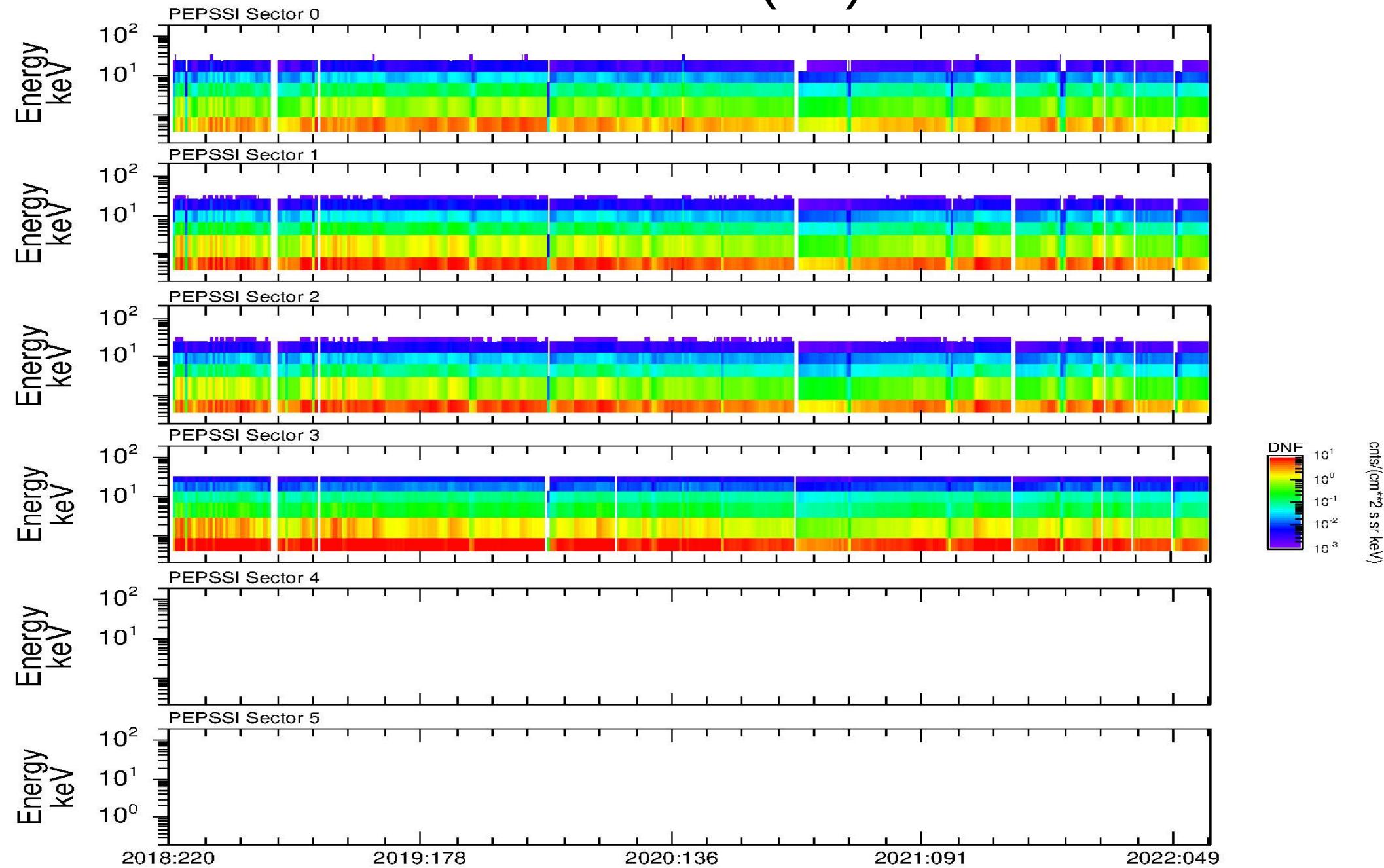
# nh-a-pepsi-3-kem1-v6.0/data

## FLUX Discards “J” Rates

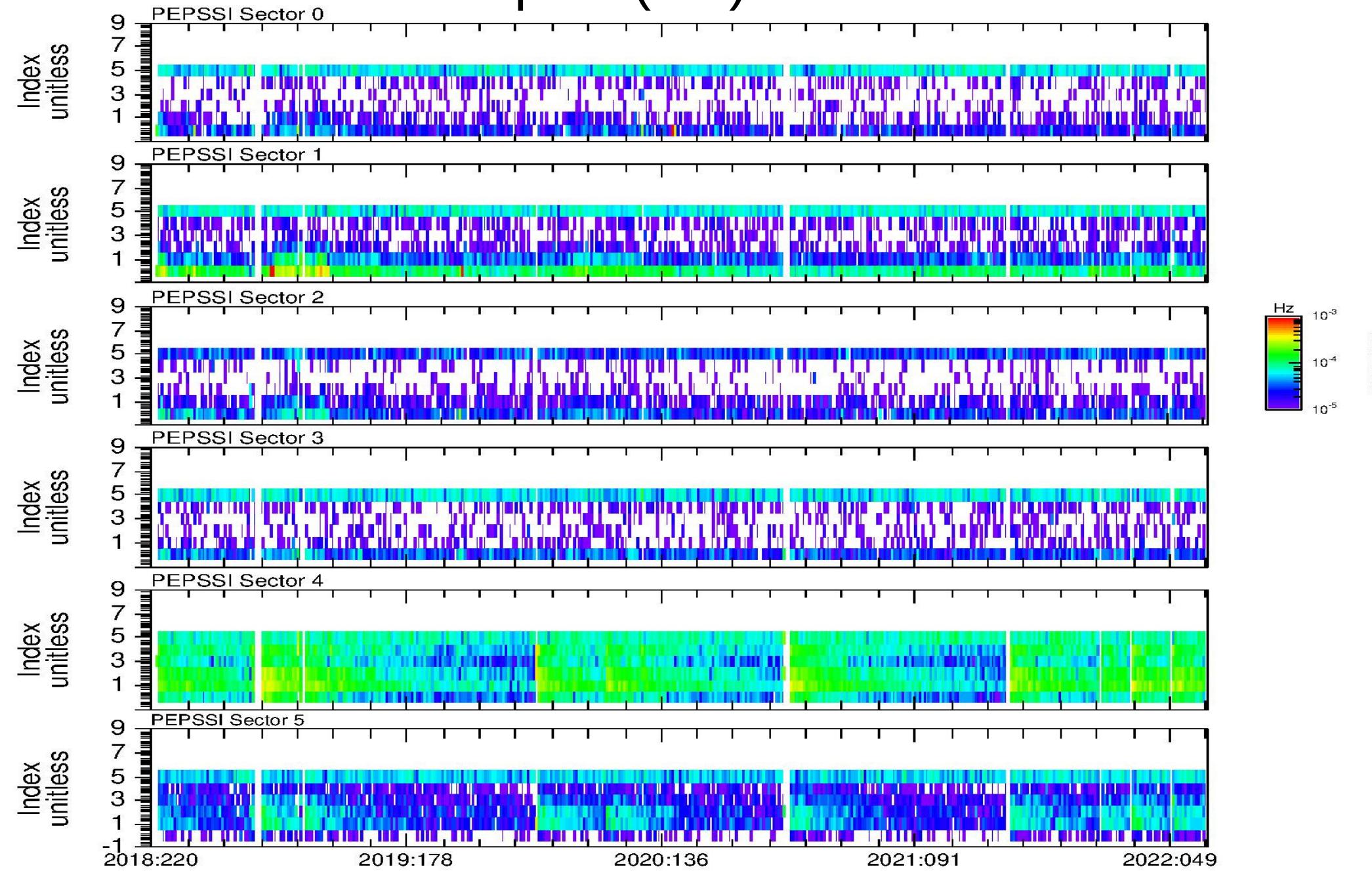


# nh-a-pepsi-3-kem1-v6.0/data FLUX Doubles ("L") DNF

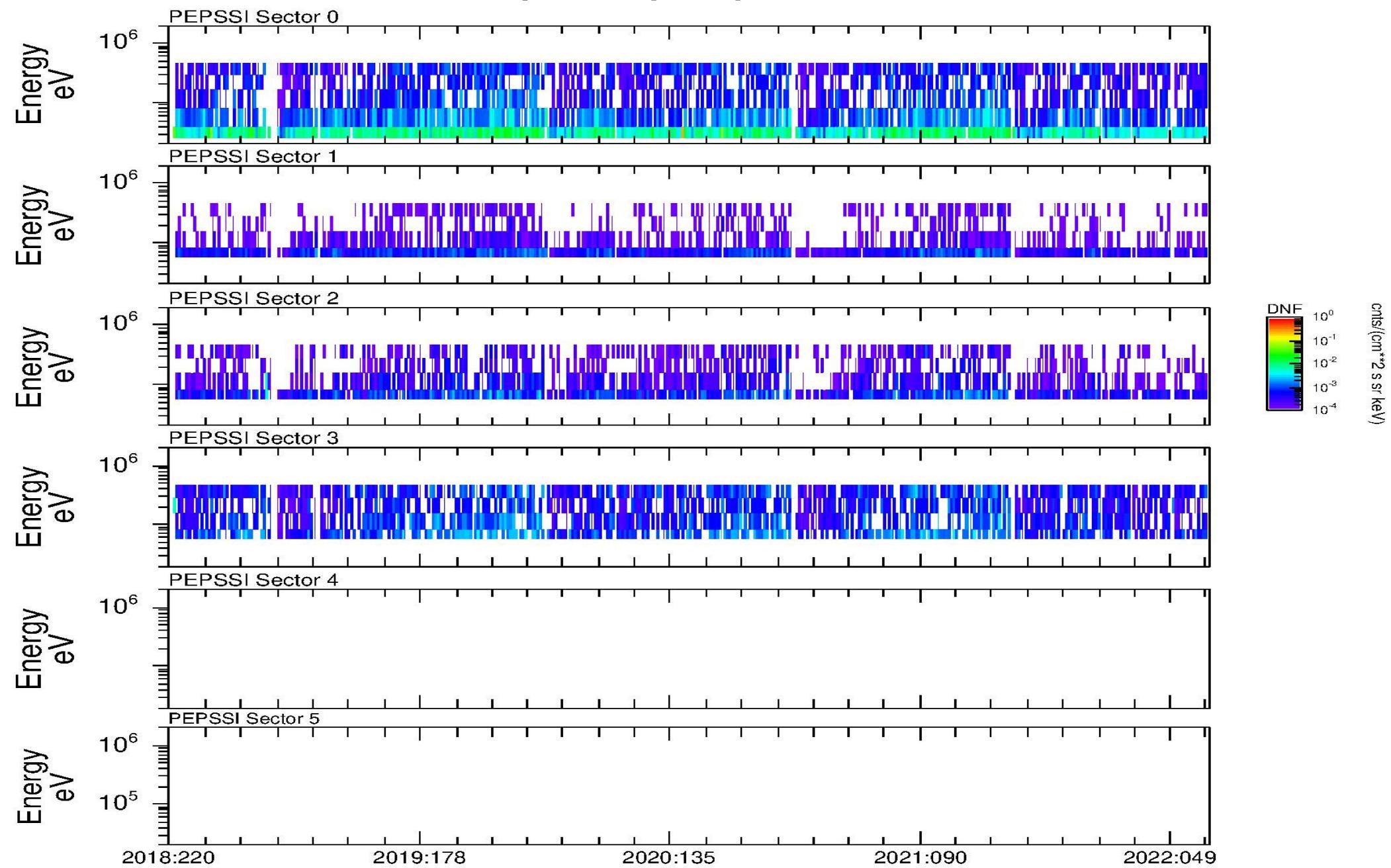
23



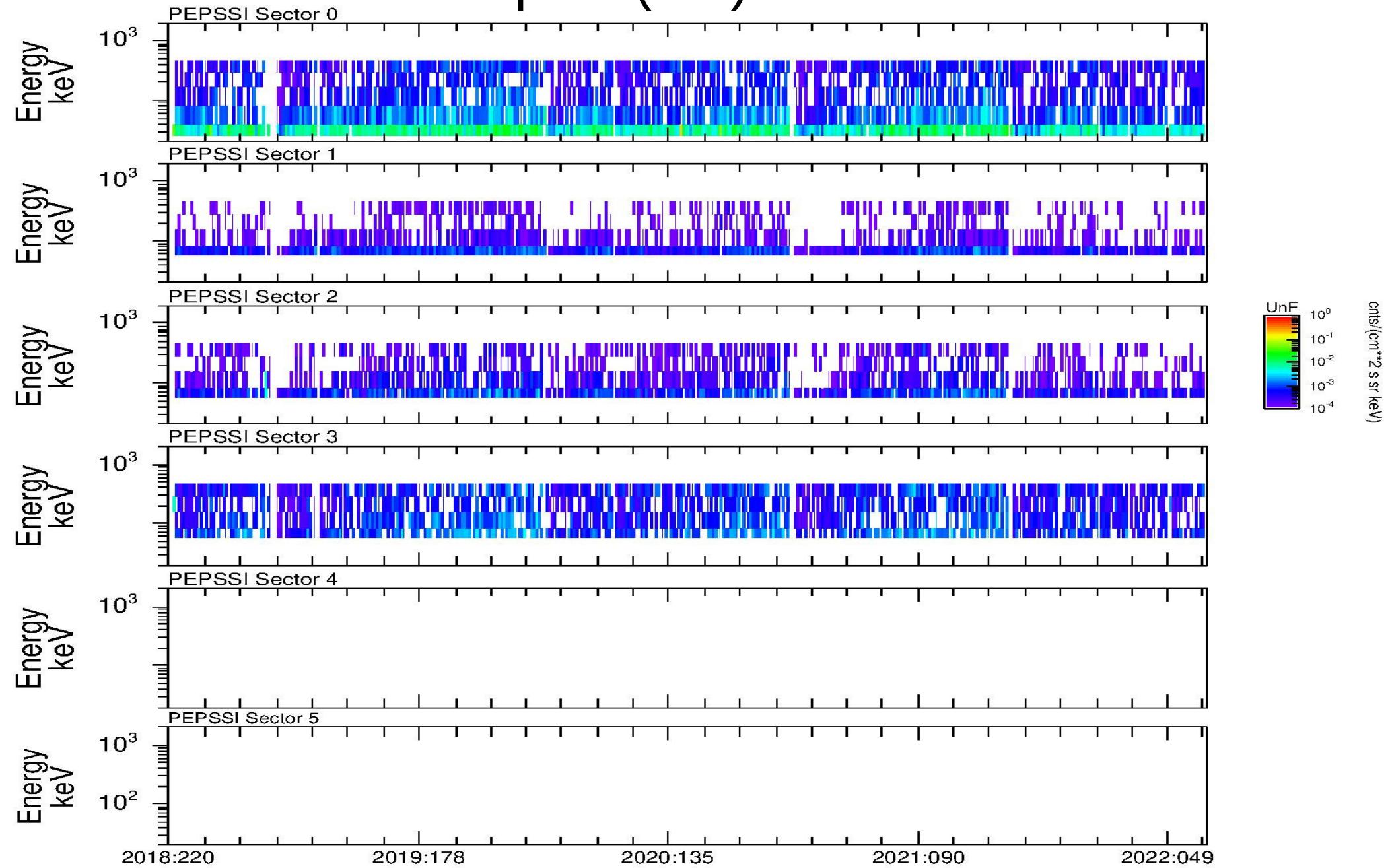
# nh-a-pepsi-3-kem1-v6.0/data FLUX Triples ("D") CPS Protons



# nh-a-pepsi-3-kem1-v6.0/data FLUX Triples ("D") DNF Protons



# nh-a-pepsi-3-kem1-v6.0/data FLUX Triples ("D") UNC Protons

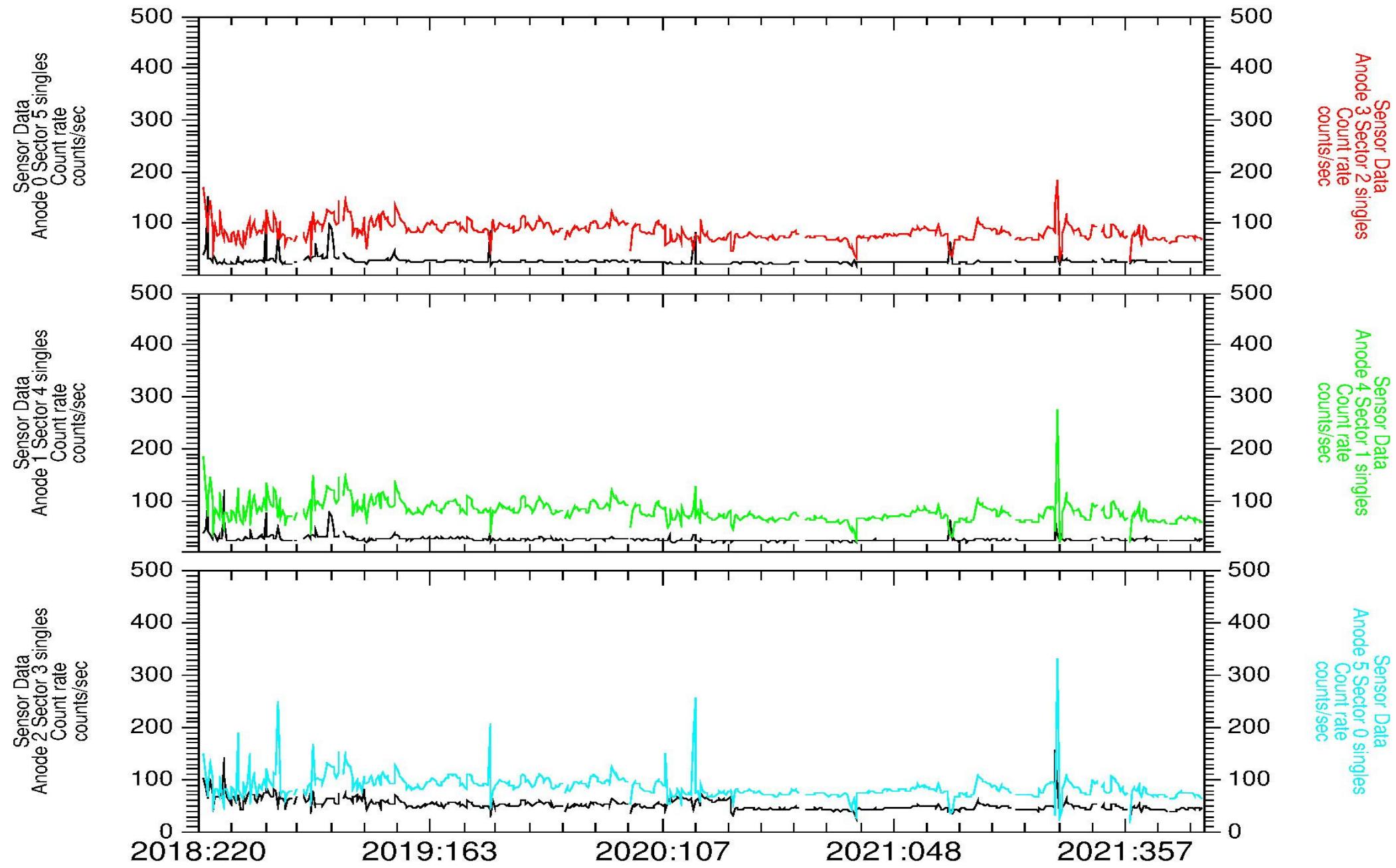


# nh-a-pepsi-3-kem1-v6.0/data PEPSSI FIT File Structure

fv: Summary of pep\_0437205117\_0x691\_sci.fit...-a-pepsi-3-kem1-v6.0/data/20191128\_043720/

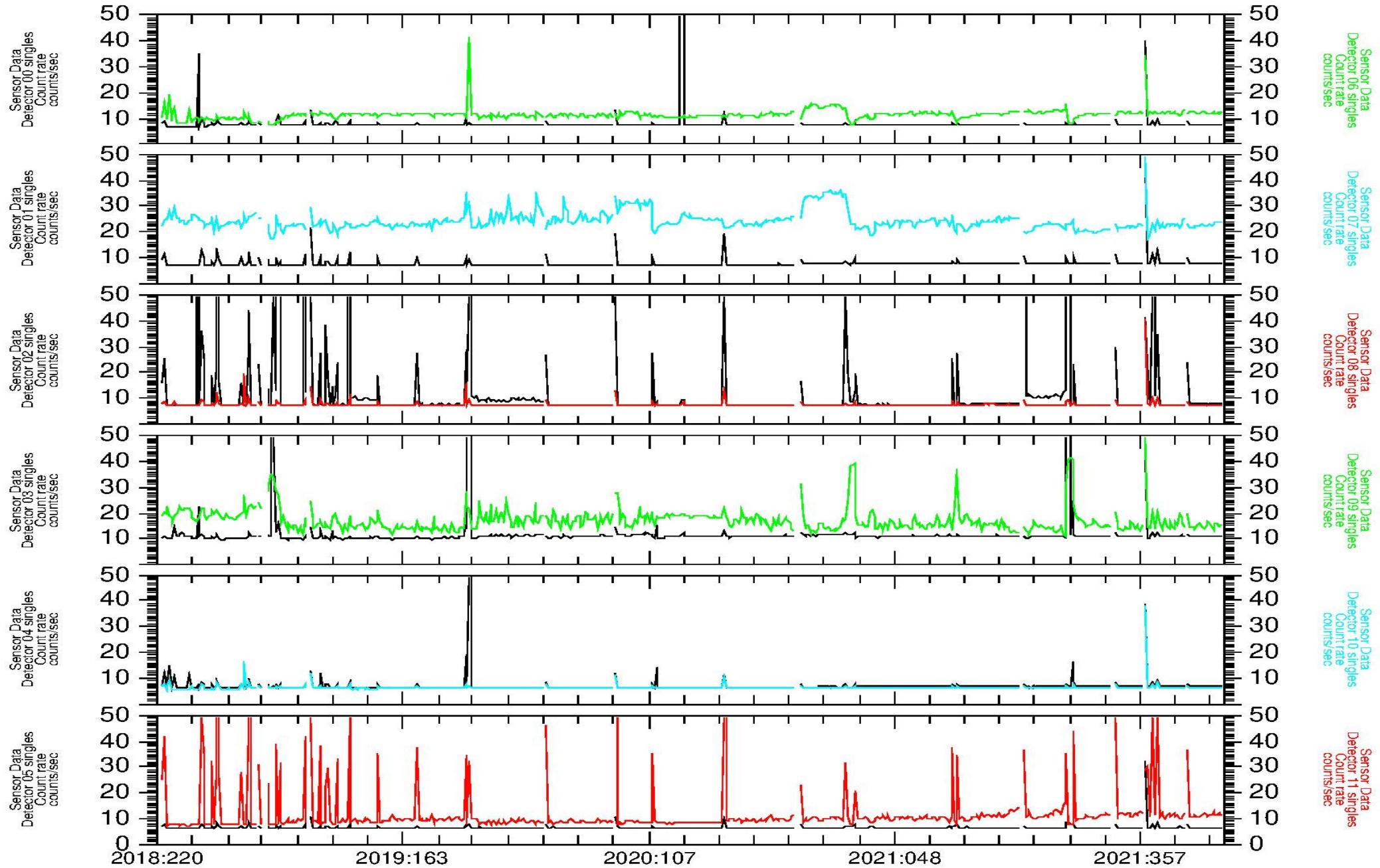
| File  | Edit           | Tools  | Help                |        |       |       |     |        |
|-------|----------------|--------|---------------------|--------|-------|-------|-----|--------|
| Index | Extension      | Type   | Dimension           | View   |       |       |     |        |
| 0     | Primary        | Image  | 1017 X 614          | Header | Image | Table |     |        |
| 1     | SPEC_Protons   | Image  | 1440 X 6            | Header | Image | Table |     |        |
| 2     | SPEC_Helium    | Image  | 1440 X 2            | Header | Image | Table |     |        |
| 3     | SPEC_Heavies   | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 4     | SPEC_Electrons | Image  | 1440 X 3            | Header | Image | Table |     |        |
| 5     | SPEC_Lowlon    | Image  | 1440 X 8            | Header | Image | Table |     |        |
| 6     | FLUX           | Binary | 832 cols X 960 rows | Header | Hist  | Plot  | All | Select |
| 7     | FLUXN1A        | Binary | 502 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 8     | FLUXN1B        | Binary | 440 cols X 24 rows  | Header | Hist  | Plot  | All | Select |
| 9     | PHA_ELECTRON   | Binary | 9 cols X 25552 rows | Header | Hist  | Plot  | All | Select |
| 10    | PHA_LOW_ION    | Binary | 25 cols X 1777 rows | Header | Hist  | Plot  | All | Select |
| 11    | PHA_HIGH_ION   | Binary | 23 cols X 1711 rows | Header | Hist  | Plot  | All | Select |

# nh-a-pepsi-3-kem1-v6.0/data FLUXN1B Anode Singles



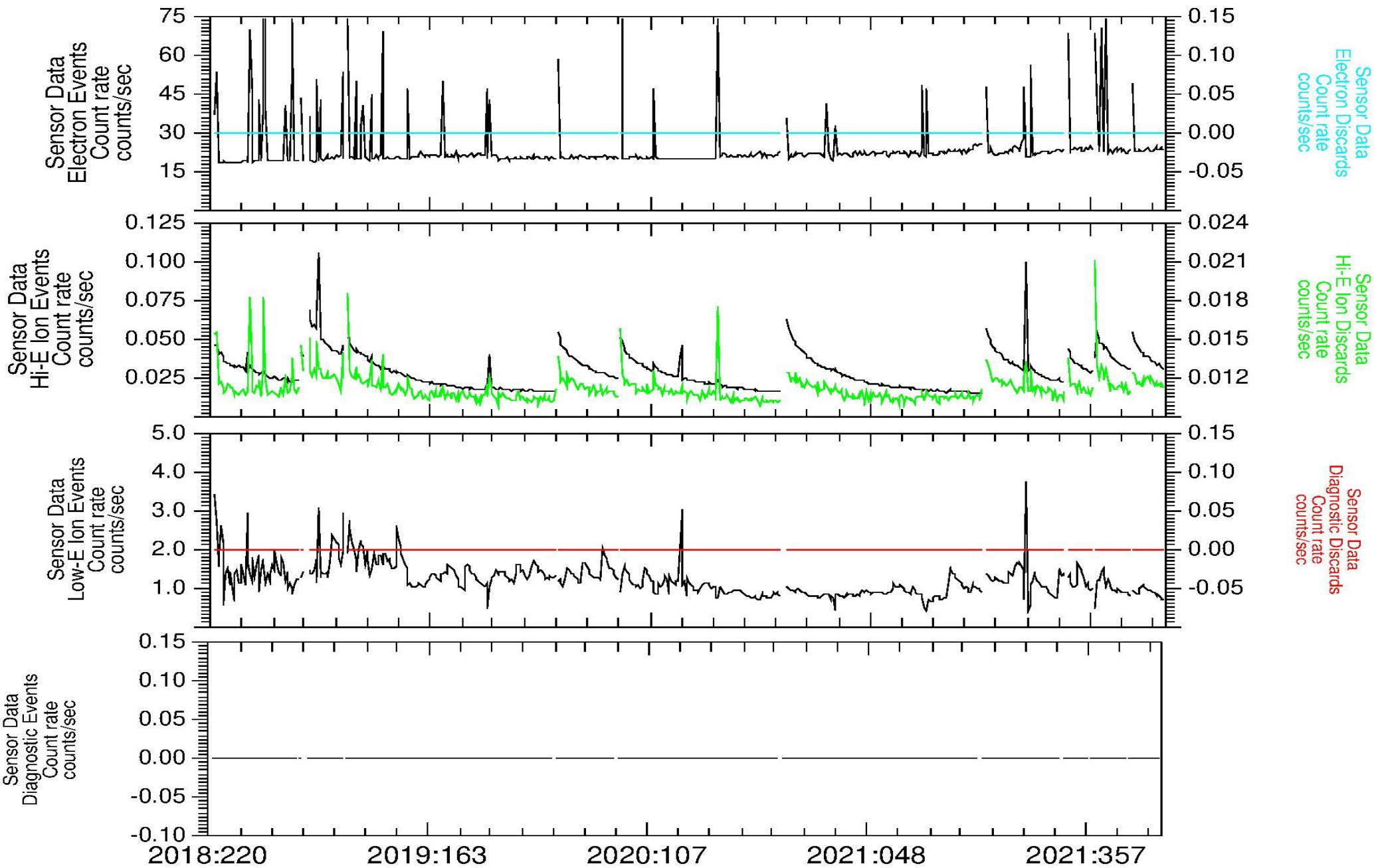
# nh-a-pepsi-3-kem1-v6.0/data

## FLUXN1B Detector Singles

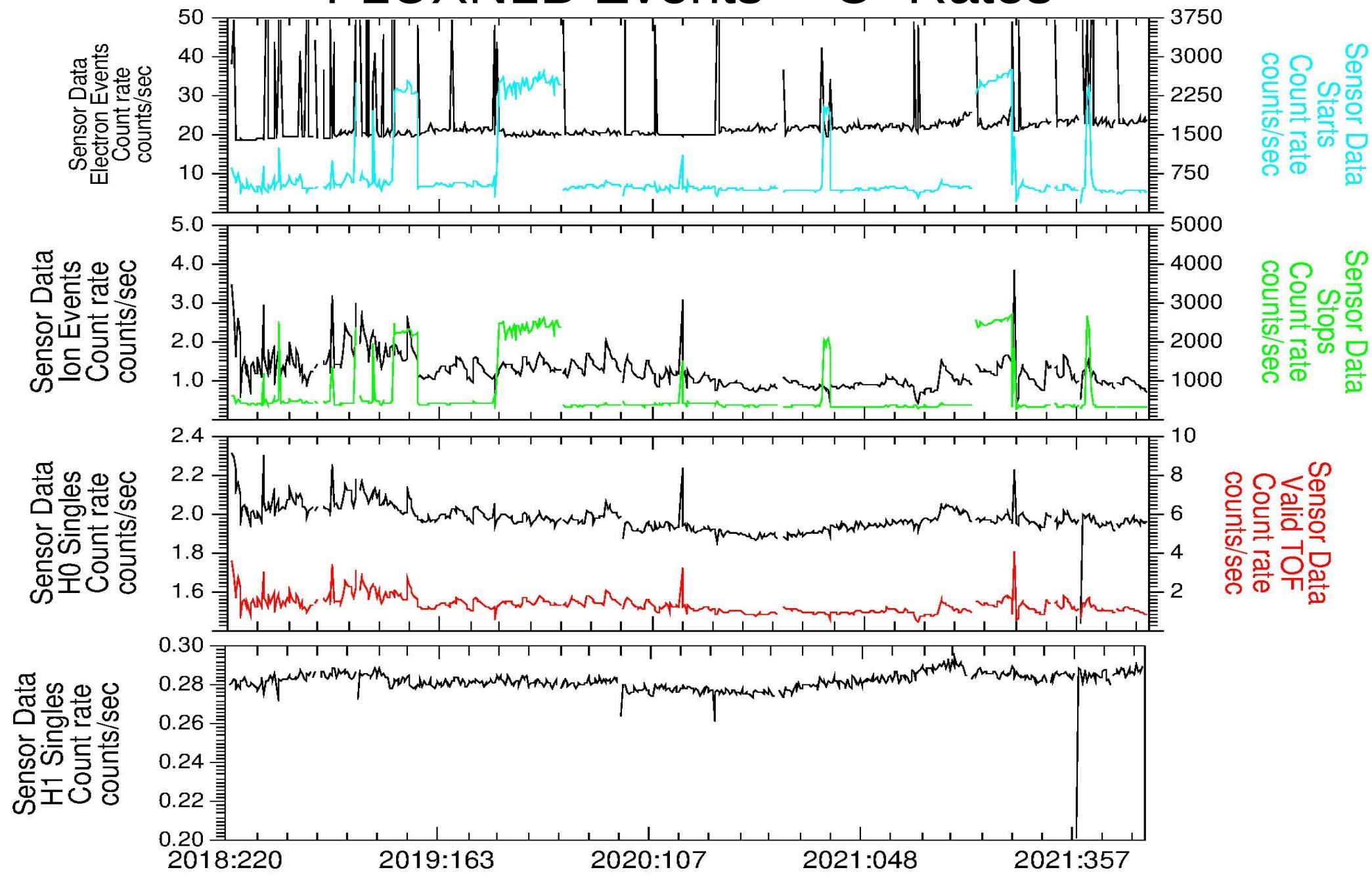


# nh-a-pepsi-3-kem1-v6.0/data

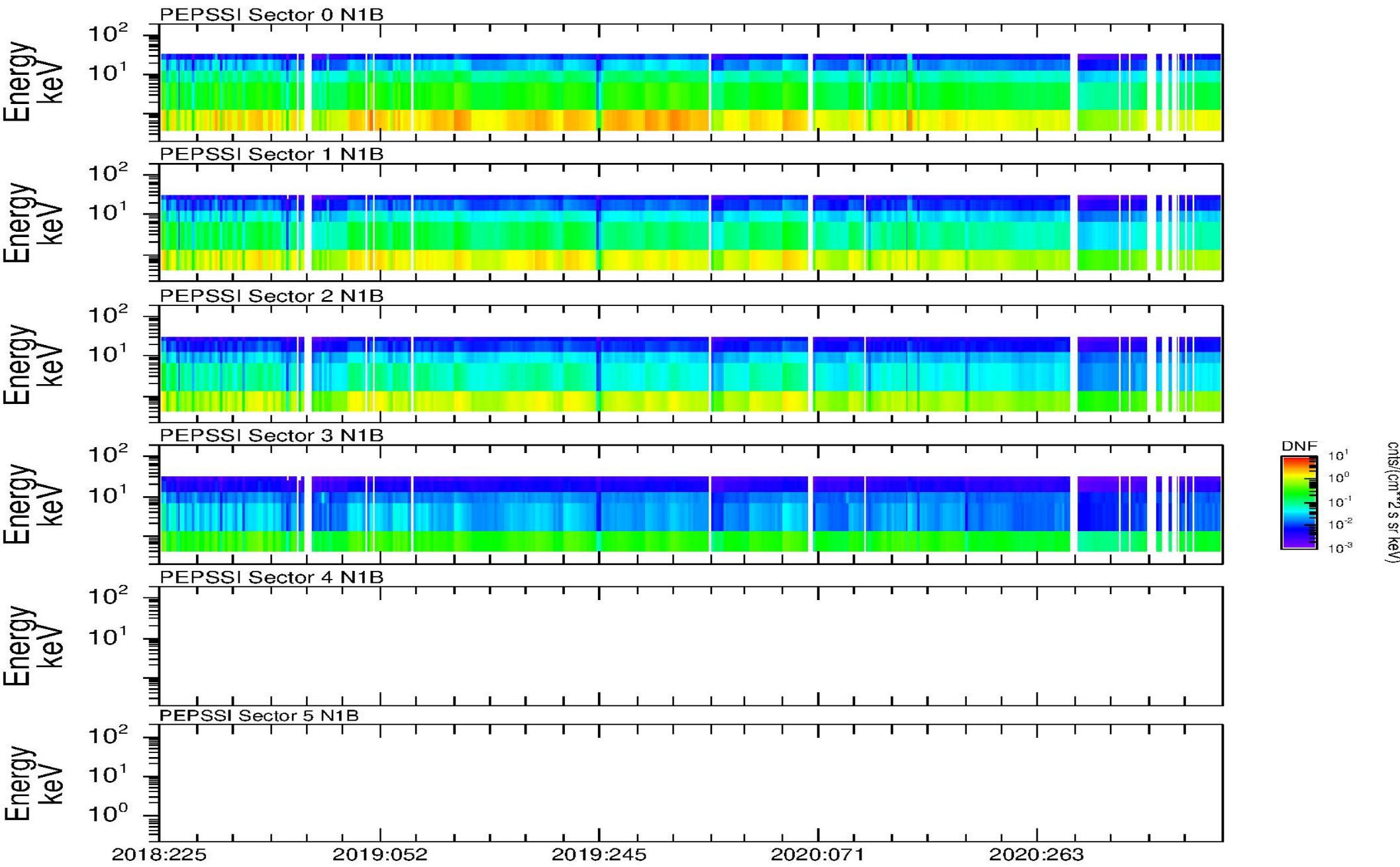
## FLUXN1B Events & Discards - "J" Rates



# nh-a-pepsi-3-kem1-v6.0/data FLUXN1B Events - "C" Rates

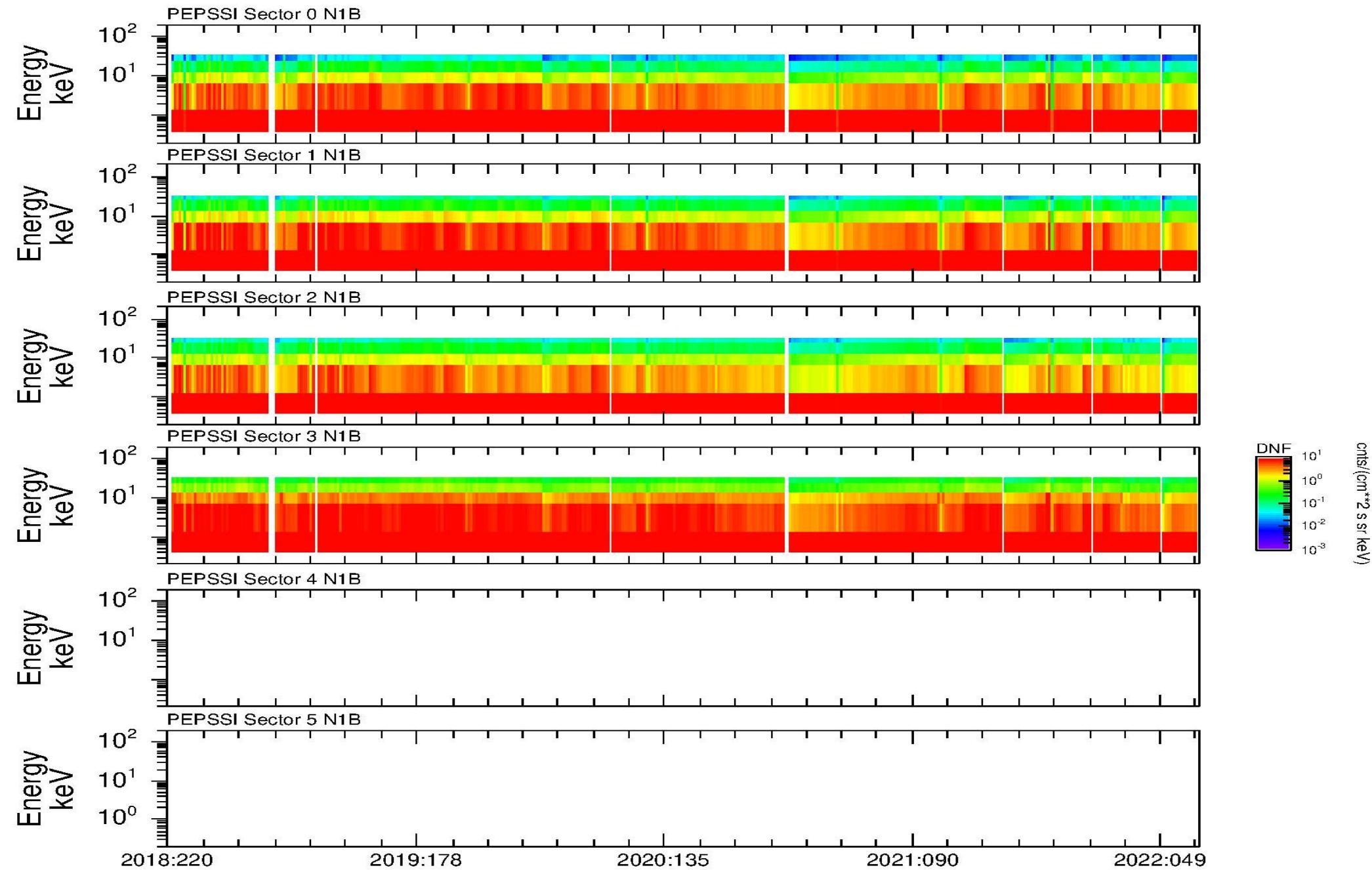


# nh-a-pepsi-3-kem1-v5.0/data FLUXN1B Proton Flux

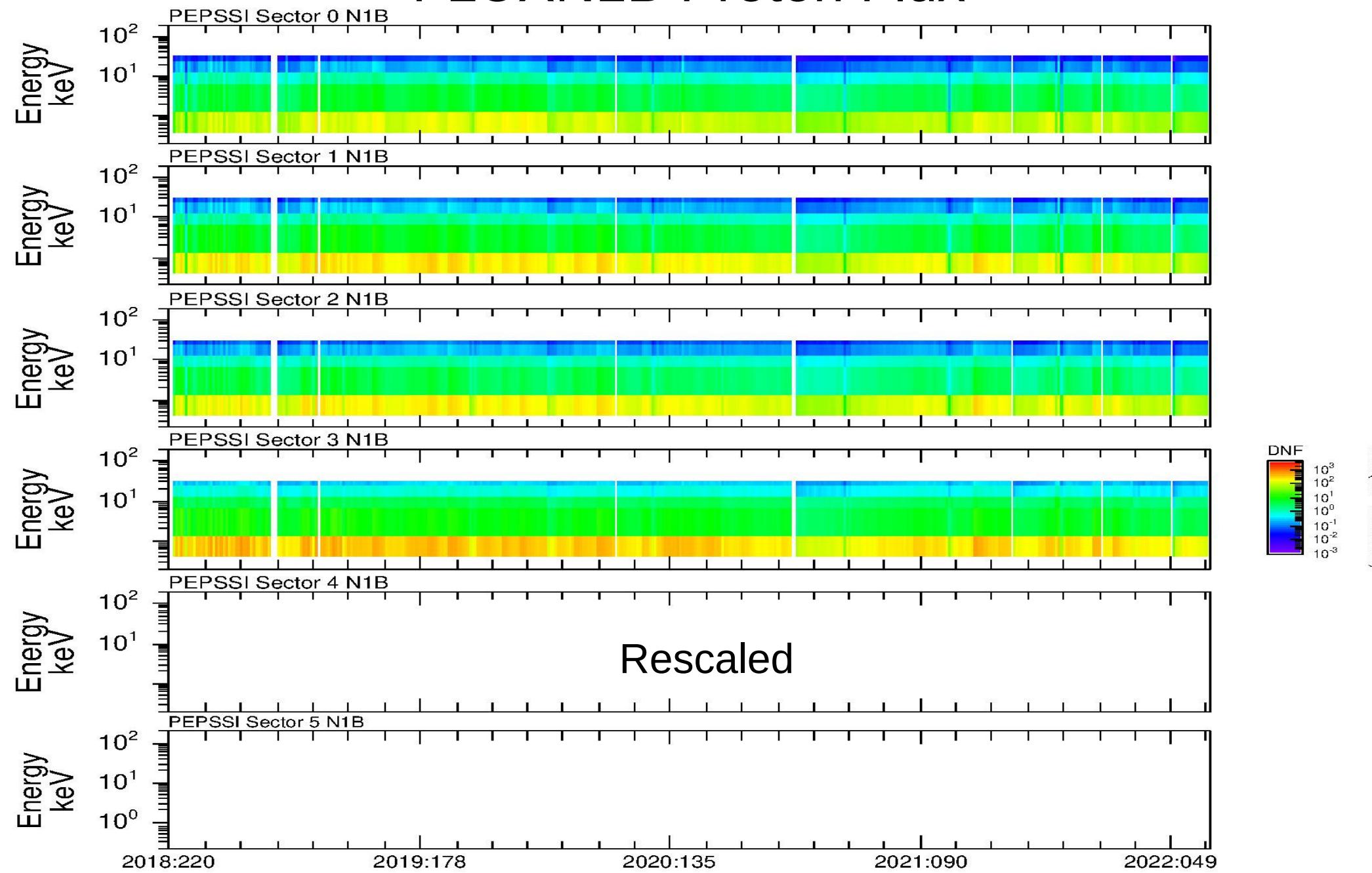


# nh-a-pepsi-3-kem1-v6.0/data FLUXN1B Proton Flux

33

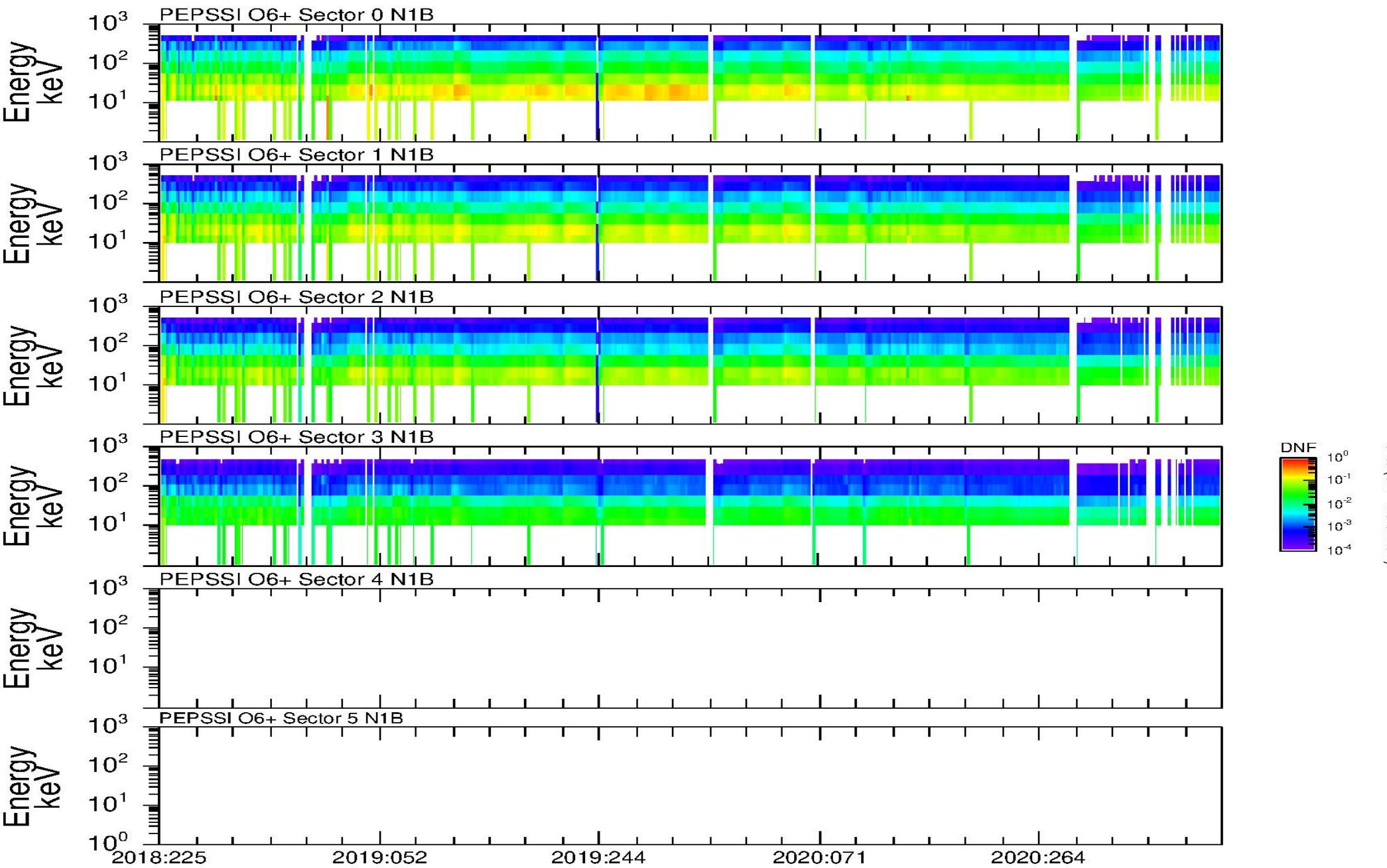


# nh-a-pepssi-3-kem1-v6.0/data FLUXN1B Proton Flux



# nh-a-pepsi-3-kem1-v5.0/data FLUXN1B Oxygen Flux

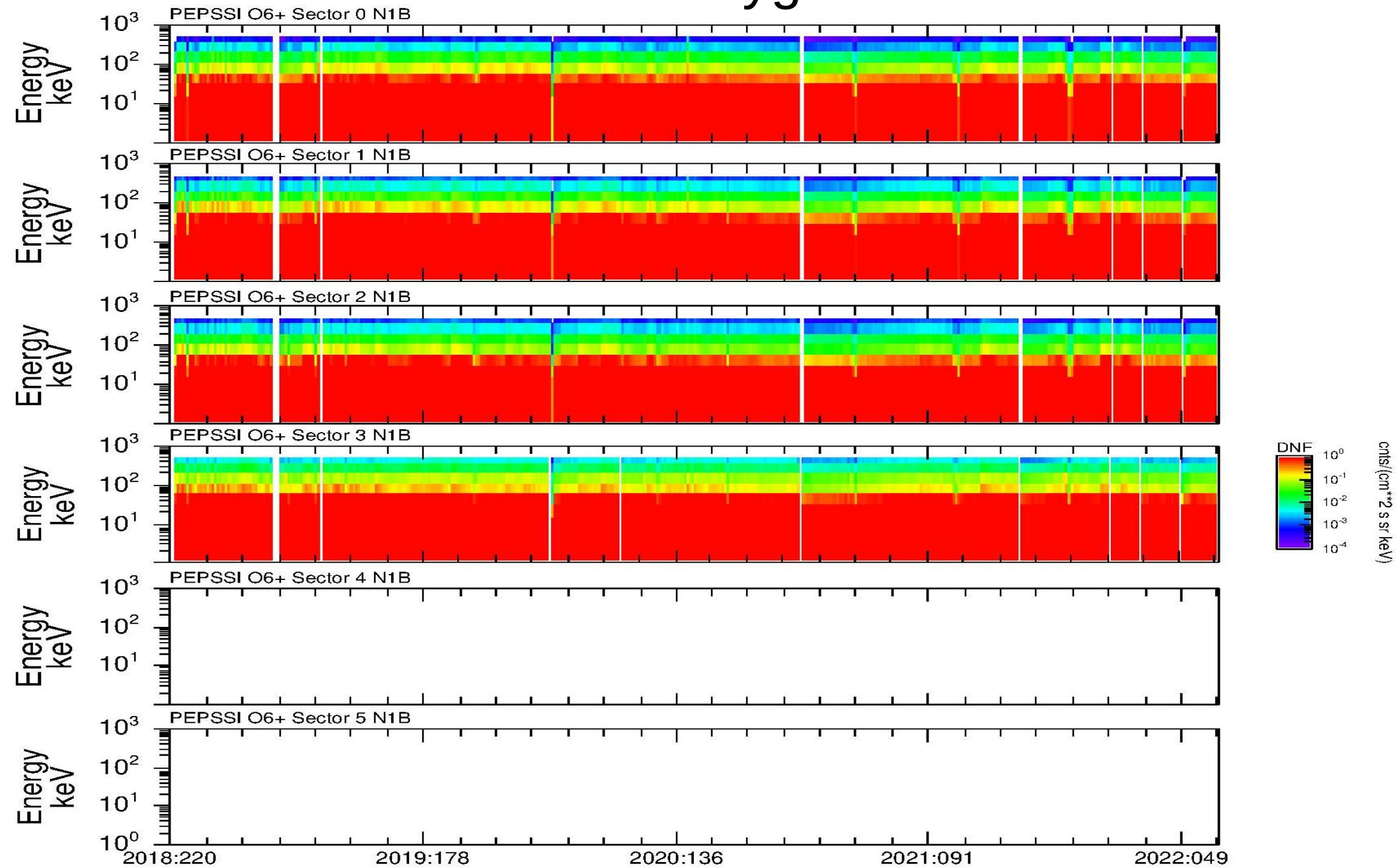
35



# nh-a-pepsi-3-kem1-v6.0/data

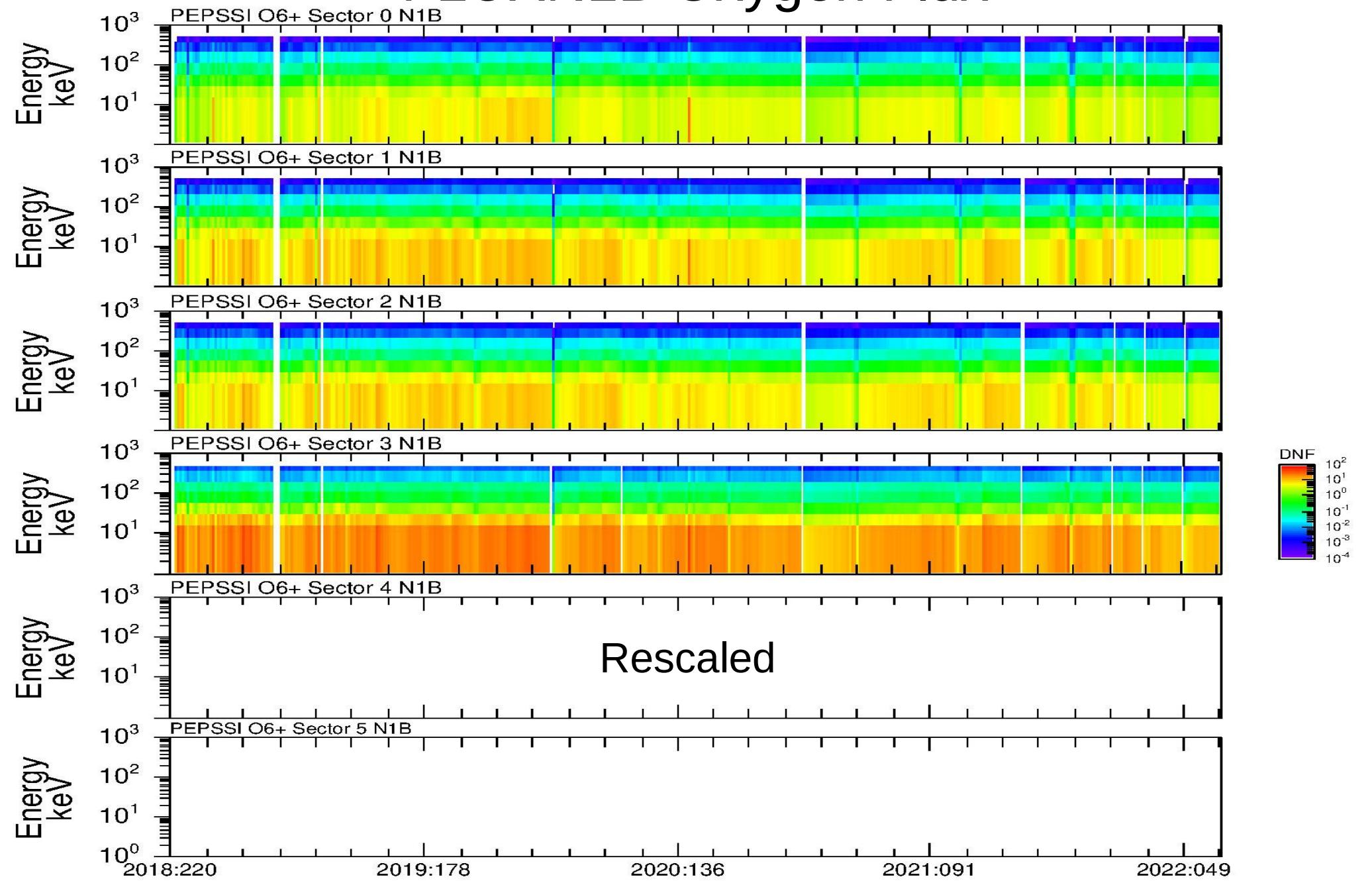
## FLUXN1B Oxygen Flux

36



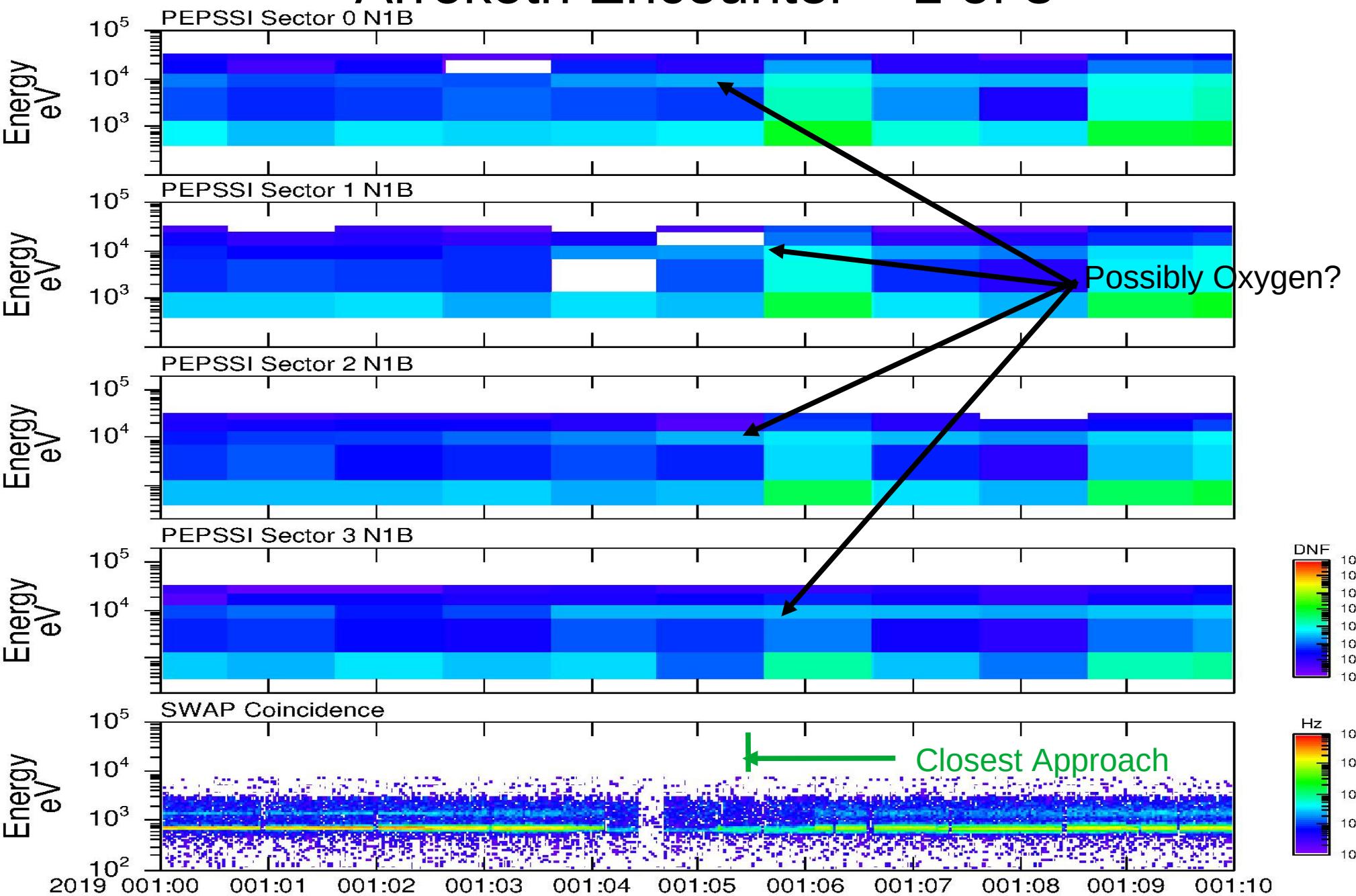
# nh-a-pepsi-3-kem1-v6.0/data FLUXN1B Oxygen Flux

37



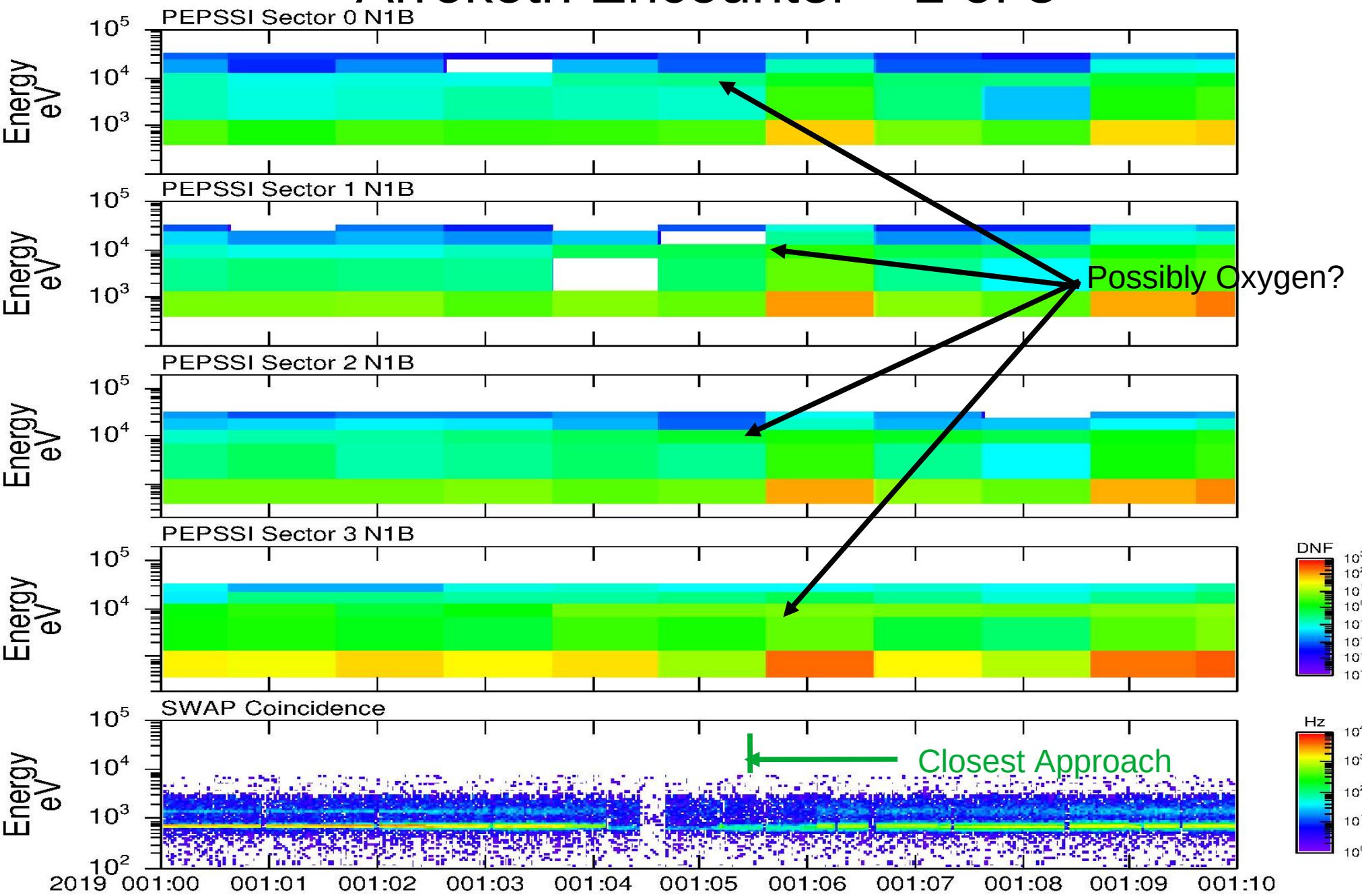
# PEPSSI-SWAP V5

## Arrokoth Encounter – 1 of 3



# PEPSSI-SWAP V6

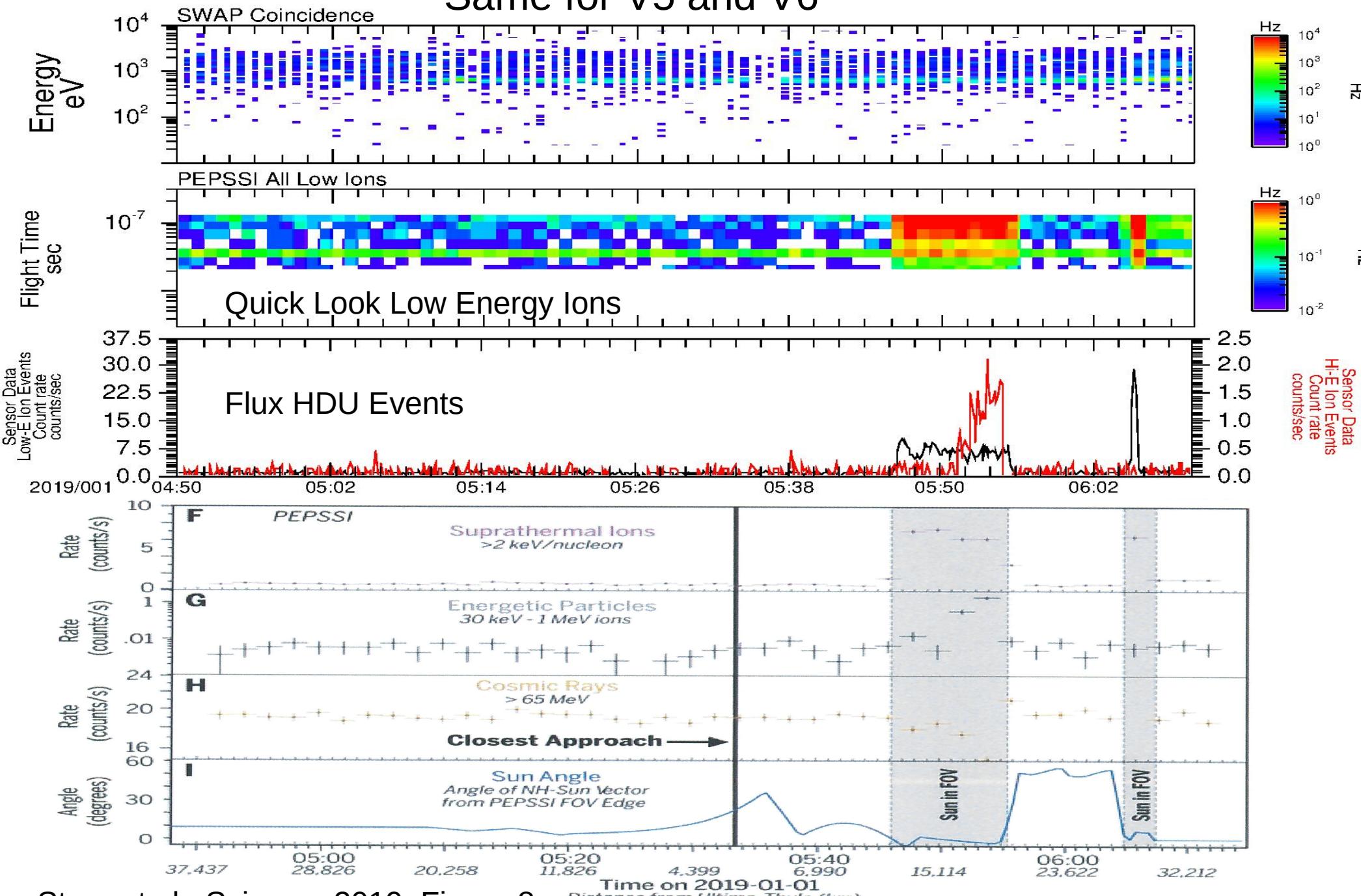
## Arrokoth Encounter – 2 of 3



# PEPSSI-SWAP Arrokoth Encounter – 3 of 3

Same for V5 and V6

40



# Certification Raw and Calibrated

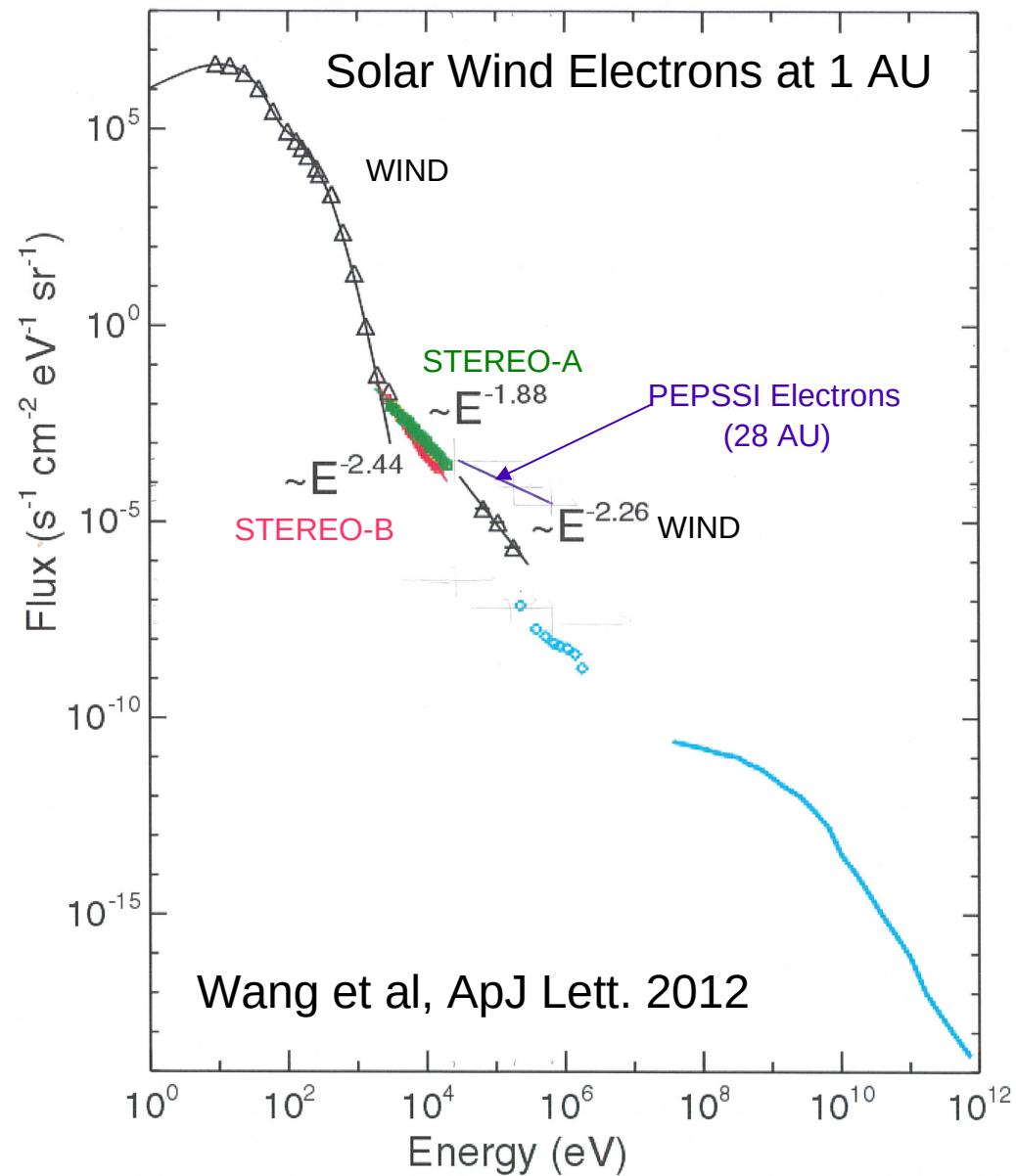
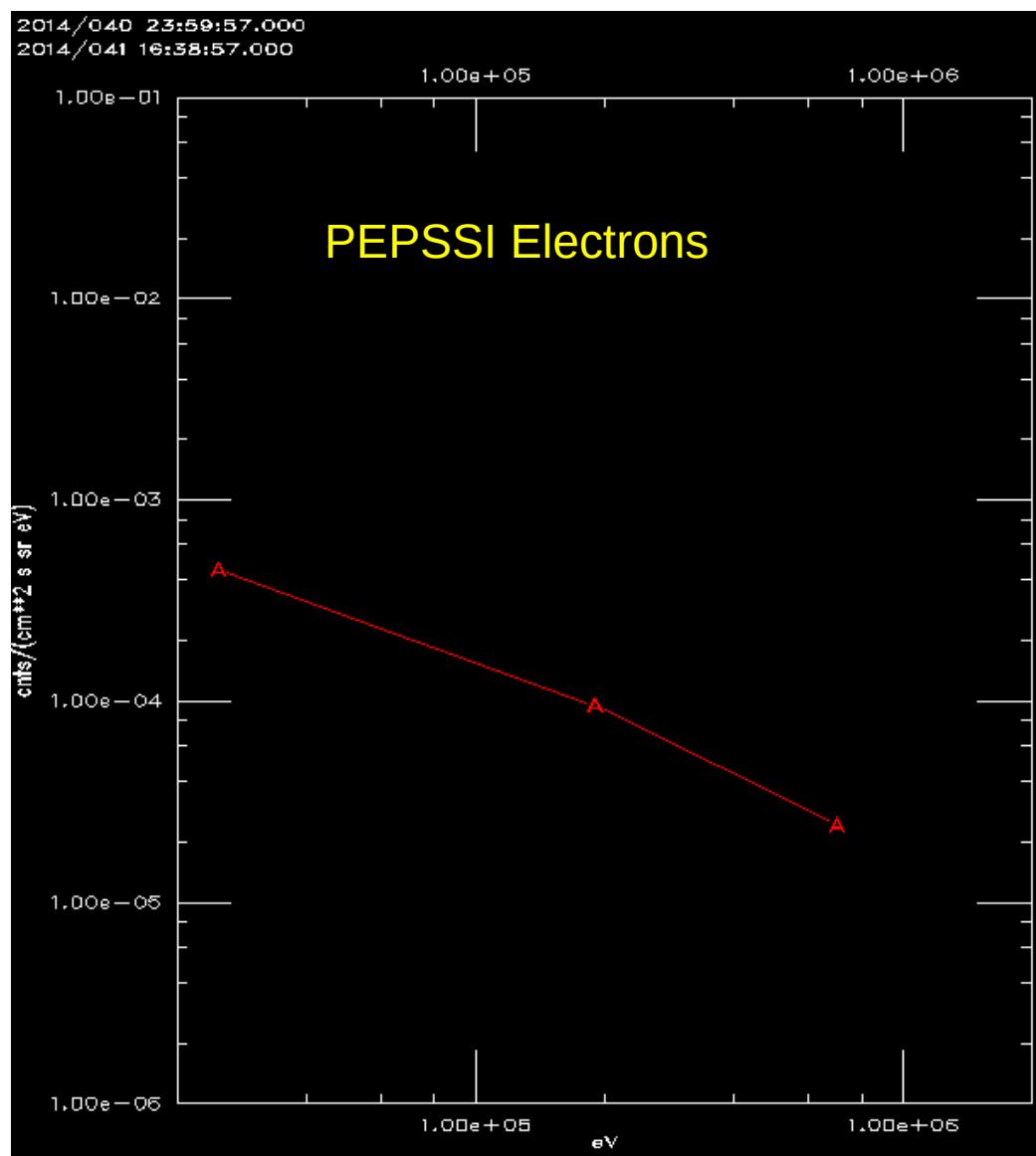
41

?

# BACK-UP Slides

# PEPSSI Electrons - 3

Why are the fluxes from PEPSSI abnormally high?



nh-a-pepsi-2-kem1-v6.0  
nh-a-pepsi-3-kem1-v6.0  
aareadme.txt

GOOD

nh-a-pepsi-2-kem1-v6.0  
nh-a-pepsi-3-kem1-v6.0  
voldesc.txt

GOOD

nh-a-pepsi-2-kem1-v6.0/catalog  
nh-a-pepsi-3-kem1-v6.0/catalog  
catinfo.txt

GOOD

nh-a-pepsi-2-kem1-v6.0/catalog  
nh-a-pepsi-3-kem1-v6.0/catalog  
dataset.cat

GOOD

nh-a-pepsi-2-kem1-v6.0/catalog  
nh-a-pepsi-3-kem1-v6.0/catalog  
nhsc.cat

GOOD

nh-a-pepsi-2-kem1-v6.0/catalog  
nh-a-pepsi-3-kem1-v6.0/catalog  
pepsi.cat

GOOD

nh-a-pepsi-2-kem1-v6.0/catalog  
nh-a-pepsi-3-kem1-v6.0/catalog  
ref.cat

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
docinfo.txt

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
codmac\_level\_definitions.lbl  
codmac\_level\_definitions.pdf

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
lunineetal1995.lbl & lunineetal1995.pdf

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
nh\_fov.lbl & nh\_fov.pdf

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
nh\_met2utc.lbl

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
nh\_met2utc.tab

GOOD, updated

nh-a-pepsi-3-kem1-v6.0/document  
nh\_mission\_trajectory.lbl

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
nh\_pepsi\_v110\_ti.txt

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
payload\_ssr.lbl & payload\_ssr.pdf

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
pep\_bti.lbl

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
pep\_bti.pdf

GOOD, updated

nh-a-pepsi-3-kem1-v6.0/document  
pepsi\_ssr.lbl & pepsi\_ssr.pdf

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
quat\_axyz\_instr\_to\_j2k.lbl  
quat\_axyz\_instr\_to\_j2k.asc

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
seq\_pepsi\_kem1.lbl

GOOD

nh-a-pepsi-3-kem1-v6.0/document  
seq\_pepsi\_kem1.tab

GOOD, updated

nh-a-pepsi-3-kem1-v6.0/document  
soc\_inst\_icd.lbl

GOOD

**nh-a-pepsi-3-kem1-v6.0/calib  
calinfo.txt**

**GOOD**

nh-a-pepsi-3-kem1-v6.0/calib  
hk\_n1\_input\_20050228.lbl  
hk\_n1\_input\_20050228.tab

GOOD

nh-a-pepsi-3-kem1-v6.0/calib  
hk\_stat\_input\_20041016.lbl  
hk\_stat\_input\_20041016.tab

GOOD

nh-a-pepsi-3-kem1-v6.0/calib  
rateboxdefinitionplanes.lbl

GOOD

nh-a-pepsi-3-kem1-v6.0/calib/calpars  
calpinfo.txt

GOOD

nh-a-pepsi-3-kem1-v6.0/calib/calpars  
calpar\_columns(fmt

GOOD

nh-a-pepsi-3-kem1-v6.0/calib/calpars  
pep\_0510817916\_0x691\_calpar.tab

GOOD

nh-a-pepsi-3-kem1-v6.0/index  
idxinfo.txt

GOOD

nh-a-pepsi-3-kem1-v6.0/index  
checksum.lbl & checksum.tab

GOOD

nh-a-pepsi-3-kem1-v6.0/index  
slimidx.lbl & slimidx.tab

GOOD

nh-a-pepsi-3-kem1-v6.0/index  
index.lbl & index.tab

GOOD

# nh-a-pepsi-3-kem1-v6.0/data pep\_0437205117\_0x691\_sci.lbl

```
OBJECT      = COLUMN
NAME        = "L01S00FLUX"
BYTES       = 8
COLUMN_NUMBER = 528
DATA_TYPE   = "IEEE_REAL"
START_BYTE  = 4213
DESCRIPTION  =
               L01S00H Helium (125.650 to 213.850 keV) 1 / (cm^2 ster keV sec)
```

Additional calibration information:

```
SPEC528= 'Helium ' / assumed particle species
ELO528 = 125.65 / Minimum channel energy keV
ELOU528= 0.0 / Uncertainty in minimum channel energy (keV)
EHI528 = 213.85 / Maximum channel energy keV
EHIU528= 0.0 / Uncertainty in maximum channel energy (keV)
GF528  = 0.057098 / Geometry Factor (cm^2 sr)
GFU528 = 0.0 / Uncertainty in the Geometry Factor
EFF528 = 0.10945 / Efficiency (geometric mean)
EFFU528= 0.0 / Relative error in efficiency
"
INVALID_CONSTANT = -1.0E38
UNIT           = "efficiency/(cm^2 sr s keV)"
END_OBJECT     = COLUMN
OBJECT         = COLUMN
NAME          = "L01S00HFLUX"
BYTES         = 8
COLUMN_NUMBER = 529
DATA_TYPE     = "IEEE_REAL"
START_BYTE    = 4221
DESCRIPTION   =
               L01S00H Helium (125.650 to 213.850 keV) 1 / (cm^2 ster keV sec)
```

Additional calibration information:

```
SPEC529= 'Helium ' / assumed particle species
ELO529 = 125.65 / Minimum channel energy keV
ELOU529= 0.0 / Uncertainty in minimum channel energy (keV)
EHI529 = 213.85 / Maximum channel energy keV
EHIU529= 0.0 / Uncertainty in maximum channel energy (keV)
GF529  = 0.057098 / Geometry Factor (cm^2 sr)
GFU529 = 0.0 / Uncertainty in the Geometry Factor
EFF529 = 0.10945 / Efficiency (geometric mean)
EFFU529= 0.0 / Relative error in efficiency
"
INVALID_CONSTANT = -1.0E38
UNIT           = "efficiency/(cm^2 sr s keV)"
END_OBJECT     = COLUMN
```

What is the difference  
between these two objects  
Besides the name?

Answer on Page 85 of the  
ICD.

This is the lbl

# nh-a-pepsi-3-kem1-v6.0/data pep\_0437205117\_0x691\_sci\_h6.txt

```
TTYPE528= 'L01S00FLUX' / L01S00H Helium (125.650 to 213.850 keV) 1 / ( cm^2 ster
TUNIT528= 'efficiency/(cm^2 sr s keV)' / Efficiency Times Flux Units
TSPEC528= 'Helium ' / assumed particle species
TEL0528 = 125.65 / Minimum channel energy keV
TELOU528= 0.0 / Uncertainty in minimum channel energy (keV)
TEHI528 = 213.85 / Maximum channel energy keV
TEHIU528= 0.0 / Uncertainty in maximum channel energy (keV)
TGF528 = 0.057098 / Geometry Factor (cm^2 sr)
TGFU528 = 0.0 / Uncertainty in the Geometry Factor
TEFF528 = 0.10945 / Efficiency (geometric mean)
TEFFU528= 0.0 / Relative error in efficiency
TFORM528= '1D ' / column data format
TTYPE529= 'L01S00HFLUX' / L01S00H Helium (125.650 to 213.850 keV) 1 / ( cm^2 ste
TUNIT529= 'efficiency/(cm^2 sr s keV)' / Efficiency Times Flux Units
TSPEC529= 'Helium ' / assumed particle species
TEL0529 = 125.65 / Minimum channel energy keV
TELOU529= 0.0 / Uncertainty in minimum channel energy (keV)
TEHI529 = 213.85 / Maximum channel energy keV
TEHIU529= 0.0 / Uncertainty in maximum channel energy (keV)
TGF529 = 0.057098 / Geometry Factor (cm^2 sr)
TGFU529 = 0.0 / Uncertainty in the Geometry Factor
TEFF529 = 0.10945 / Efficiency (geometric mean)
TEFFU529= 0.0 / Relative error in efficiency
TFORM529= '1D ' / column data format
```

What is the difference between these two fields besides the name?

Answer on Page 85 of the ICD.

This is the FIT header For HDU 6 (FLUX)