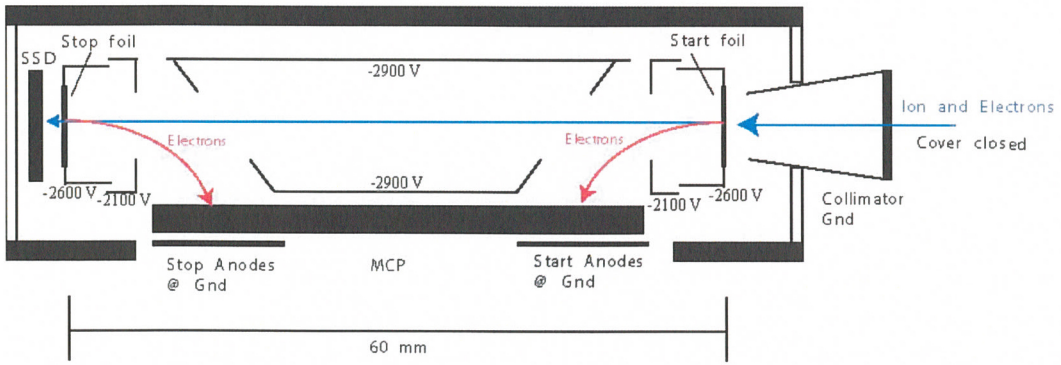
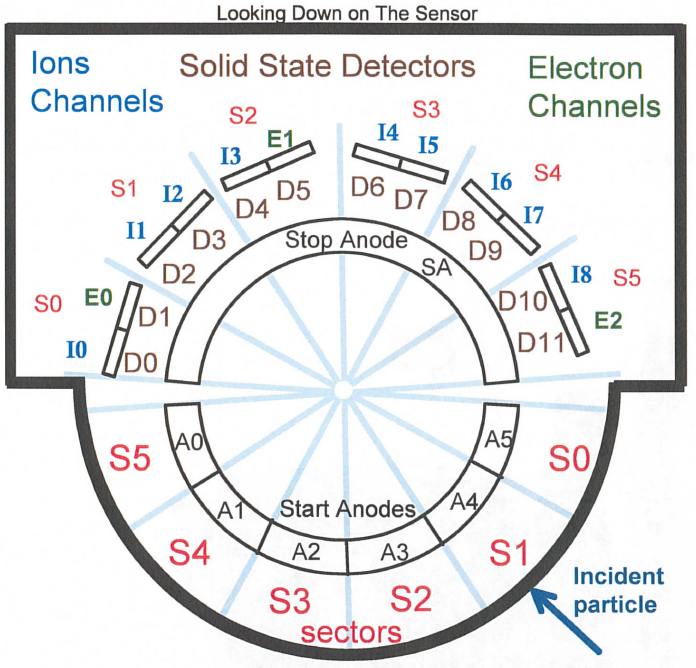
# New Horizons Pluto Energetic Particle Spectrometer Science Investigation (PEPSSI)

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 Collections

1) Mission Documents v3.0
   PDS4 ID: urn:nasa:pds:nh_documents:mission::3.0
2) New Horizons Documents for the PEPSSI Instrument v2.0
   PDS4 ID: urn:nasa:pds:nh_documents:pepssi::2.0
3) New Horizons PEPSSI KEM1 Encounter Raw Data v2.0
   PDS4 ID: urn:nasa:pds:nh_pepssi:kem1_raw::2.0
4) New Horizons PEPSSI KEM2 Raw Data
   PDS4 ID: urn:nasa:pds:nh_pepssi:kem2_raw::1.0
5) New Horizons PEPSSI Reference Files Used in Calibrating Data v2.0
   PDS4 ID: urn:nasa:pds:nh_pepssi:calibration_files::2.0
6) New Horizons PEPSSI KEM1 Encounter Calibrated Data v2.0
   PDS4 ID: urn:nasa:pds:nh_pepssi:kem1_cal::2.0
7) New Horizons PEPSSI KEM2 Calibrated Data
   PDS4 ID: urn:nasa:pds:nh_pepssi:kem2_cal::1.0

# New Horizons PEPSSI Data Set Evaluation Tools

Machine: Dell Precision Tower 5810
Operating System: Rocky-8 linux

# 1) Mission Documents v3.0

# collection.lblx

NASA PDS Validate v3.6.3: PASS

# inventory.csv



GOOD

# nh_mission_trajectory.lblx

```
<Field_Character>
  <name>UTC_CAL</name>
  <field_number>2</field_number>
  <field_location unit="byte">18</field_location>
  <data_type>ASCII_Date_Time_YMD</data_type>
  <field_length unit="byte">19</field_length>
  <field_format>%-19s</field_format>
  <description>UTC in ISO Calendar format; conversion from ET uses NAIF/SPICE LEAPSECOND kernel naif0010.tls</description>
</Field_Character>
<Field_Character>
  <name>UTC_DOY</name>
  <field_number>3</field_number>
  <field_location unit="byte">38</field_location>
  <data_type>ASCII_Date_Time_DOY</data_type>
  <field_length unit="byte">17</field_length>
  <field_format>%-17s</field_format>
  <description>UTC in ISO Day Of Year (DOY) format; conversion from ET uses NAIF/SPICE LEAPSECOND kernel naif0010.tls</description>
</Field_Character>
```

```
<geom:SPICE_Kernel_Files>
  <geom:SPICE_Kernel_Identification>
    <geom:spice_kernel_file_name>naif0012.tls</geom:spice_kernel_file_name>
  </geom:SPICE_Kernel_Identification>
```

Jet Propulsion Laboratory
California Institute of Technology

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- Training
- Support

| Name | Last modified | Size |
|---|---|---|
| Parent Directory | | - |
| lskinfo.txt | 2021-03-03 17:28 | 4.6K |
| naif0009.lbl | 2009-02-26 13:43 | 1.3K |
| naif0009.tls | 2009-01-09 17:10 | 6.0K |
| naif0010.lbl | 2014-11-04 20:45 | 2.6K |
| naif0010.tls | 2014-11-04 20:45 | 6.1K |
| naif0011.lbl | 2016-05-02 13:15 | 2.6K |
| naif0011.tls | 2016-05-02 13:15 | 6.3K |
| naif0012.lbl | 2017-04-04 15:14 | 2.6K |
| naif0012.tls | 2017-04-04 15:14 | 6.5K |

Why is the v12 leap sec kernel referenced, yet the comments say v10 is used? NAIF says New Horizons had v10 published in 2014, but v12 was published by New Horizons in 2017?

# nh_mission_trajectory.tab


Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Fri Jan 31 11:21:12 2025.

# soc_inst_icd.lblx

NASA PDS Validate v3.6.3: PASS

# soc_inst_icd.pdf
# PEPSSI Section - 1 of 2



c. For ease of use, we have added a column giving the deduced "Rate Box" of High-Ion PHA and Electron PHA events to the Level 2 PHA data. While this can, in principle, be calculated from the Level 2 quantities and the RATEBOXDEFINITIONPLANES.FIT file available in the CALIB/ directory of the PDS archive, the procedure is complex enough that we have found it convenient to perform this calculation in advance and include the information in the Level 2 files.

Not a PDS4 Designation

# soc_inst_icd.pdf
# PEPSSI Section - 2 of 2



**R Rates**:

R rates nominally represent electron events. Far from Jupiter they measure cosmic rays. The ADU ranges defining the R Rates are given in the header of the Level 2 files.

#### 11.4.1.7.1 Rate Box Definitions

For Electrons and Low-Ions, the rate box definitions are simple ranges in Energy and TOF in ADUs which can be found in the Level 2 headers. For Hi-Ions, the Rate Boxes are regions in the TOF-Energy plane (see Figure 11-6). The precise specification of the rate boxes is complex and this is why we include rate box classifications in the Level 2 PHA data. However, we also provide the file RATEBOXDEFINITIONPLANES.FIT in the CALIB/ directory of PDS data sets.

Not a PDS4 Designation

# PREVIOUSLY_RELEASED_FOR_REFERENCE

Remove this directory for PDS4 submission.

However, note that the Previously Released version of pluto_ao.lblx failed under NASA PDS Validate v3.6.3:

```
Product Level Validation Results

  FAIL: file:/mnt/usb/PDS/Reviews/NH/SWAP_2024/2nd/mission/PREVIOUSLY_RELEASED_FOR_REFERENCE/pluto_ao.lblx
      ERROR  [error.pdf.file.not_pdfa_compliant]   Validation failed for flavour PDF/A-1b in file pluto_ao_original.pdf.
        1 product validation(s) completed
```

# Collection Certification for Mission Documents v3.0



The documented in this release had a minor issue that the SPICE Leap Second kernel was specified differently in various places in the text. Although for PEPSSI, the leap second will not make a difference, the project should determine which was actually used to produce the trajectory data and make them consistent.

Recommendation: Certified after the project corrects the documentation

2) New Horizons Documents for the PEPSSI Instrument v2.0

# collection.lblx

NASA PDS Validate v3.6.3: PASS

# inventory.csv

GOOD

# pep_bti.lblx

NASA PDS Validate v3.6.3: PASS

Doesn’t this need a comma separator definition?

# pep_bti.tab

GOOD, but why is this not a comma delimited table (csv)?

# seq_pepssi_kem1.lblx

NASA PDS Validate v3.6.3: PASS

Doesn’t this need a comma separator definition?

# seq_pepssi_kem1.tab

GOOD, but why is this not a comma delimited table (csv)?

# seq_pepssi_kem2.lblx

NASA PDS Validate v3.6.3: PASS

Doesn’t this need a comma separator definition?

# seq_pepssi_kem2.tab

GOOD, but why is this not a comma delimited table (csv)?

# PREVIOUSLY_RELEASED_FOR_REFERENCE

Remove this directory for PDS4 submission.

# Collection Certification for New Horizons Documents for the PEPSSI Instrument v2.0

There is a question about the designation of the delimited file type, tab vs. csv. If the tab file types is correct, then no descrepency is found. If the cvs file type is correct, the file name extensions need updating and the appropriate changes made to the label files are needed. The project should consult with PDS if necessary. The data contained within the tab files is good.

Recommendation: Certified if tab type is correct; however, if the csv type is correct, update file names and label context before certification

3) New Horizons PEPSSI KEM1 Encounter Raw Data v2.0

# collection.lblx

NASA PDS Validate v3.6.3: PASS

# collection_inventory.csv

Why are there 13 file descriptors not version 2?

# overview.lblx

NASA PDS Validate v3.6.3: PASS

# overview.txt – 1 of 6

```
PDS4 Version History
====================

  This is VERSION 2.0 of this data set.
```

According to collection_inventory.csv, this is version 1.0 and it should be version 2.0

So why are these superseded files not marked as version 2.0?

```
Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
the KEM1 mission phase are superseded, due to new data.
```

```
Superseded KEM1 files
=====================================================================

  Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
  the KEM1 mission phase were incomplete until newer data was received
  from the spacecraft. New versions of these files are included in the
  raw and calibrated PEPSSI datasets.
```

# overview.txt – 2 of 6

```
On April 10, 2022 at 10:17 UTC, the PEPSSI flight software was updated
to version 5 (FSW5). The changes to the data are small, but the way the
instrument is operated has changed. Refer to section 11.3.6 (Flight
Software Version 5 Changes to Operations) in the SOC Instrument ICD
(/DOCUMENT/SOC_INST_ICD.*) for a brief description of the changes.
```

Not a PDS4 designation

```
This dataset corresponds to New Horizons NAIF SPICE distribution v0008.
```

```
Releases 0005, 0006, 0007, and 0008 were produced by Brian Enke, Southwest
Research Institute, Solar System Science & Exploration Division,
Boulder, Colorado, USA.
```

```
OBJECT                          = DATA_SET_RELEASE
  DATA_SET_ID                     = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                      = "0008"
  RELEASE_DATE                    = 2024-08-06
  RELEASE_MEDIUM                  = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                  = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT          = "&RELEASE_ID=0008"
  PRODUCT_TYPE                    = "SPICE KERNELS"
  DISTRIBUTION_TYPE               = "NH-SPICE"
  DATA_PROVIDER_NAME              = "SWRI"
```

Note that this is V0008 and it is consistent. So why is V0007 used for kem2 and not V0008?

# overview.txt – 3 of 6

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

Not a PDS4 designation

What is <95>?

```
  DOCUMENTS

  <95>    New Horizon PEPSSI instrument overview: urn:nasa:pds:nh_documents:lorri:pepssi_inst_overview
          <95>    PEPSSI Space Science Review (SSR) paper: urn:nasa:pds:nh_documents:pepssi:pepssi_ssr
          <95>    SOC Instrument ICD: urn:nasa:pds:nh_documents:mission:soc_inst_icd
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti


Other sources of information useful in interpreting these Data
--------------------------------------------------------------

  Refer to the following files for more information about these data

      NH Mission Trajectory Table: urn:nasa:pds:nh_documents:mission:nh_mission_trajectory
          <95>    Field of View Illustration: urn:nasa:pds:nh_documents:mission:nh_fov
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti
```

# overview.txt – 4 of 6

```
Ancillary Data
==============

  The geometry items included in the data labels were computed
  using the SPICE kernels archived in the New Horizons SPICE
  data set, NH-J/P/SS-SPICE-6-V1.0.
```

Why is this file name say it is version 1 when there are multiple versions of the same file?

```
Every observation provided in this data set was taken as a part of a
particular sequence.  A list of these sequences has been provided in
file DOCUMENT/SEQ_PEPSSI_*.TAB.  In addition, the
```

Not a PDS4 designation.

```
for every observation.  N.B. While every observation has an associated
sequence, every sequence may not have associated observations.  Some
sequences may have failed to execute due to spacecraft events (e.g.
safing).  No attempt has been made during the preparation of this data
set to identify such empty sequences, so it is up to the user to
compare the times of the sequences to the times of the available
observations from INDEX/INDEX.TAB to identify such sequences.
```

File Does Not Exist

# overview.txt – 5 of 6

```
The leapsecond adjustment (DELTA_ET = ET - UTC) was 65.184s at
NH launch, and the first four additional leapseconds occurred
at the ends of 12/2009, 06/2012, 06/2015, and 12/2016.
Refer to the NH SPICE data set, NH-J/P/SS-SPICE-6-V1.0, and the
SPICE toolkit documentation, for more details about leapseconds.
```

Since there are multiple versions of the same file, how do you know in which version to look?

```
The PEPSSI Time Of Flight only (TOF-only) Pulse Height Analysis (PHA)
event data may show differences in the 'N2 data' and 'N3 data' taken
simultaneously but using different collection algorithms.  Refer to
the instrument description in the PEPSSI instrument catalog
(PEPSSI.CAT) under 'Data sampling and priority for TOF-only data'
in the 'Operational modes' section.
```

File Does Not Exist

```
Please see the 'Data Validity' section of PEPSSI.CAT for details
regarding information on channels which should be excluded from
analysis.
```

# overview.txt – 6 of 6

```
Observation descriptions in this data set catalog
=================================================

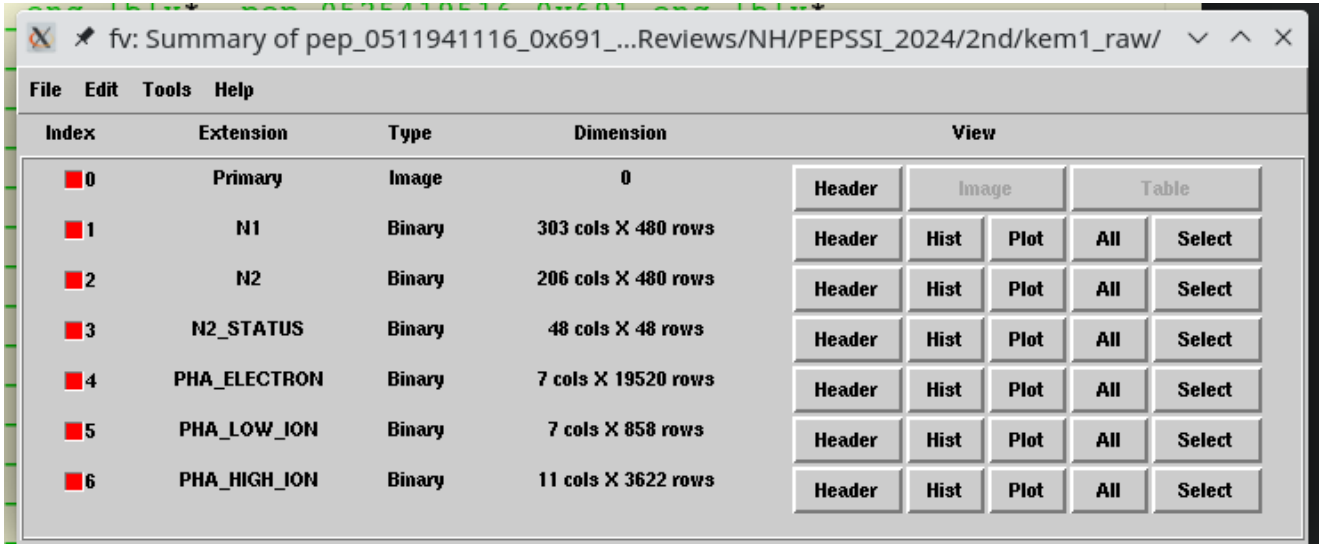
  Some users will expect to find descriptions of the observations
  in this data set here, in this Confidence Level Note.  This data
  set follows the more common convention of placing those
  descriptions under the Data Set Description (above, if the user is
  reading this in the DATASET.CAT file) of this data set catalog.
```

File Does Not Exist

# pep_*_0x691_eng.lblx

NASA PDS Validate v3.6.3: PASS

# Science Raw Data (pep_*_0x691_eng.fit)




Data Looks Good

# Collection Certification for New Horizons PEPSSI KEM1 Encounter Raw Data v2.0

There are issues with the overview.txt document relating to versioning, non-existent files, and PDS4 file specifications. These issues do not interfere with interpretation of the data. In addition, it is not clear which set of SPICE kernels were used since there are multiple releases with different files under the same collection name which includes the same version number.

Recommendation: Certify with a lien to correct the overview file and the PDS/project should review the versioning (this includes identifying the SPICE collection so the same is used throught the project).

4) New Horizons PEPSSI KEM2 Encounter Raw Data v1.0

# overview.lblx

NASA PDS Validate v3.6.3: PASS

# overview.txt – 1 of 6



```
PDS4 Version History
====================

  This is VERSION 2.0 of this data set.
```

This is version 1.0

So why are these superseded files not marked as version 2.0?
These files are not identified either in the kem1 or kem2 collections.

```
Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
the KEM1 mission phase are superseded, due to new data.
```

```
Superseded KEM1 files
=====================================================================

  Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
  the KEM1 mission phase were incomplete until newer data was received
  from the spacecraft. New versions of these files are included in the
  raw and calibrated PEPSSI datasets.
```

# overview.txt – 2 of 6

```
On April 10, 2022 at 10:17 UTC, the PEPSSI flight software was updated
to version 5 (FSW5). The changes to the data are small, but the way the
instrument is operated has changed. Refer to section 11.3.6 (Flight
Software Version 5 Changes to Operations) in the SOC Instrument ICD
(/DOCUMENT/SOC_INST_ICD.*) for a brief description of the changes.
```

Not a PDS4 designation

```
  This dataset corresponded to New Horizons NAIF SPICE distribution v0007.
```

```
Releases 0005, 0006, 0007, and 0008 were produced by Brian Enke, Southwest
Research Institute, Solar System Science & Exploration Division,
Boulder, Colorado, USA.
```

```
OBJECT                          = DATA_SET_RELEASE
  DATA_SET_ID                     = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                      = "0008"
  RELEASE_DATE                    = 2024-08-06
  RELEASE_MEDIUM                  = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                  = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT          = "&RELEASE_ID=0008"
  PRODUCT_TYPE                    = "SPICE_KERNELS"
  DISTRIBUTION_TYPE               = "NH-SPICE"
  DATA_PROVIDER_NAME              = "SWRI"
```

So why is this not V0008?

Why is version 7 used in kem2, but version 8 used for kem1?

# overview.txt – 3 of 6

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

Not a PDS4 designation

What is <95>?

```
  DOCUMENTS

  <95>    New Horizon PEPSSI instrument overview: urn:nasa:pds:nh_documents:lorri:pepssi_inst_overview
          <95>    PEPSSI Space Science Review (SSR) paper: urn:nasa:pds:nh_documents:pepssi:pepssi_ssr
          <95>    SOC Instrument ICD: urn:nasa:pds:nh_documents:mission:soc_inst_icd
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti


Other sources of information useful in interpreting these Data
--------------------------------------------------------------

  Refer to the following files for more information about these data

      NH Mission Trajectory Table: urn:nasa:pds:nh_documents:mission:nh_mission_trajectory
          <95>    Field of View Illustration: urn:nasa:pds:nh_documents:mission:nh_fov
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti
```

# overview.txt – 4 of 6



```
Ancillary Data
==============

  The geometry items included in the data labels were computed
  using the SPICE kernels archived in the New Horizons SPICE
  data set, NH-J/P/SS-SPICE-6-V1.0.
```

Why is this file name say it is version 1 when there are multiple versions of the same file?

```
Every observation provided in this data set was taken as a part of a
particular sequence.  A list of these sequences has been provided in
file DOCUMENT/SEQ_PEPSSI_*.TAB.  In addition, the
```

Not a PDS4 designation.

```
for every observation.  N.B. While every observation has an associated
sequence, every sequence may not have associated observations.  Some
sequences may have failed to execute due to spacecraft events (e.g.
safing).  No attempt has been made during the preparation of this data
set to identify such empty sequences, so it is up to the user to
compare the times of the sequences to the times of the available
observations from INDEX/INDEX.TAB to identify such sequences.
```

File Does Not Exist

# overview.txt – 5 of 6

```
The leapsecond adjustment (DELTA_ET = ET - UTC) was 65.184s at
NH launch, and the first four additional leapseconds occurred
at the ends of 12/2009, 06/2012, 06/2015, and 12/2016.
Refer to the NH SPICE data set, NH-J/P/SS-SPICE-6-V1.0, and the
SPICE toolkit documentation, for more details about leapseconds.
```

Since there are multiple versions of the same file, how do you know in which version to look?

```
The PEPSSI Time Of Flight only (TOF-only) Pulse Height Analysis (PHA)
event data may show differences in the 'N2 data' and 'N3 data' taken
simultaneously but using different collection algorithms.  Refer to
the instrument description in the PEPSSI instrument catalog
(PEPSSI.CAT) under 'Data sampling and priority for TOF-only data'
in the 'Operational modes' section.
```

File Does Not Exist

```
Please see the 'Data Validity' section of PEPSSI.CAT for details
regarding information on channels which should be excluded from
analysis.
```

# overview.txt – 6 of 6

```
Observation descriptions in this data set catalog
=================================================

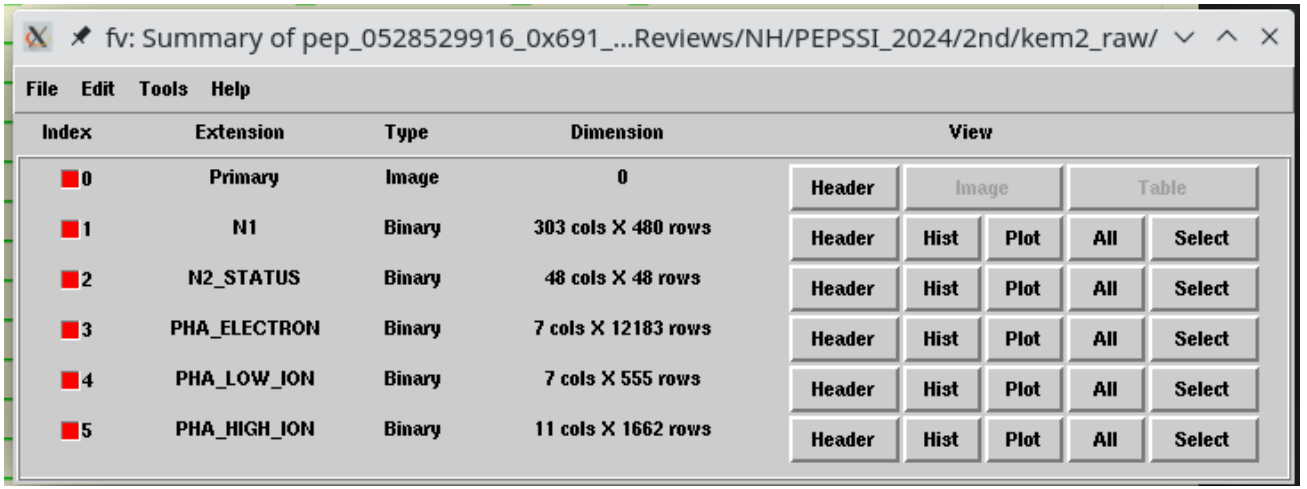
  Some users will expect to find descriptions of the observations
  in this data set here, in this Confidence Level Note.  This data
  set follows the more common convention of placing those
  descriptions under the Data Set Description (above, if the user is
  reading this in the DATASET.CAT file) of this data set catalog.
```

File Does Not Exist

# pep_*_0x691_eng.lblx

NASA PDS Validate v3.6.3: PASS

# Science Raw Data (pep_*_0x691_eng.fit)




Data Looks Good

# Collection Certification for New Horizons PEPSSI KEM2 Encounter Raw Data v1.0

There are issues with the overview.txt document relating to versioning, non-existent files, and PDS4 file specifications. These issues do not interfere with interpretation of the data. In addition, it is not clear which set of SPICE kernels were used since there are multiple releases with different files under the same collection name which includes the same version number.

Recommendation: Certify with a lien to correct the overview file and the PDS/project should review the versioning (this includes identifying the SPICE collection so the same is used throught the project).

5) New Horizons PEPSSI Reference Files Used in Calibrating Data v2.0

# collection.lblx



NASA PDS Validate v3.6.3: PASS

# collection_inventory.csv

GOOD, note that there is text to explain that the collection is version 2, but the data files are version 1

# overview.lblx

NASA PDS Validate v3.6.3: PASS

# overview.txt

```
Some products may appear in multiple versions as a result of improvements
in calibration algorithms and pipline processing over the course of
the missions. For these product lines, the calibrated data will reference
the specific version of the product in this collection that was used in
its production. So while some of these files were "superseded" in terms
of what was used in later versions of the pipeline, they are not
"superseded" in an archival sense because they are applicable to the
data produced using them.
```

It is not clear how the project handles “superseded” data files. As a user of archived data, how do they know what “superseded” version to apply? One can not find any information about this in the text documents.

# Collection Certification for New Horizons PEPSSI Reference Files Used in Calibrating Data v2.0



There is only a question as to how the project is handling “superseded” data files.

Recommendation: Certify

6) New Horizons PEPSSI KEM1 Encounter Calibrated Data v2.0

# overview.lblx



NASA PDS Validate v3.6.3: PASS

# overview.txt – 1 of 5

So why are these superseded files not marked as version 2.0?

```
Superseded KEM1 files
=====================================================================

  Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
  the KEM1 mission phase were incomplete until newer data was received
  from the spacecraft. New versions of these files are included in the
  raw and calibrated PEPSSI datasets.
```

```
Refer to the document/superseded files *.tab file for the affected
filenames and product IDs for KEM1 and KEM2 datasets.
```

Can not locate, not a PDS4 designation

# overview.txt – 2 of 5



```
On April 10, 2022 at 10:17 UTC, the PEPSSI flight software was updated
to version 5 (FSW5). The changes to the data are small, but the way the
instrument is operated has changed. Refer to section 11.3.6 (Flight
Software Version 5 Changes to Operations) in the SOC Instrument ICD
(/DOCUMENT/SOC_INST_ICD.*) for a brief description of the changes.
```

Not a PDS4 designation

```
This dataset corresponds to New Horizons NAIF SPICE distribution v0008.
```

```
Releases 0005, 0006, 0007, and 0008 were produced by Brian Enke, Southwest
Research Institute, Solar System Science & Exploration Division,
Boulder, Colorado, USA.
```

```
OBJECT                          = DATA_SET_RELEASE
  DATA_SET_ID                     = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                      = "0008"
  RELEASE_DATE                    = 2024-08-06
  RELEASE_MEDIUM                  = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                  = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT          = "&RELEASE_ID=0008"
  PRODUCT_TYPE                    = "SPICE_KERNELS"
  DISTRIBUTION_TYPE               = "NH-SPICE"
  DATA_PROVIDER_NAME              = "SWRI"
```

Note that this is V0008 and it is consistent. So why is V0007 used for kem2 and not V0008?

# overview.txt – 3 of 5

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

Not a PDS4 designation

What is <95>?

```
  DOCUMENTS

  <95>    New Horizon PEPSSI instrument overview: urn:nasa:pds:nh_documents:lorri:pepssi_inst_overview
          <95>    PEPSSI Space Science Review (SSR) paper: urn:nasa:pds:nh_documents:pepssi:pepssi_ssr
          <95>    SOC Instrument ICD: urn:nasa:pds:nh_documents:mission:soc_inst_icd
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti


Other sources of information useful in interpreting these Data
--------------------------------------------------------------

  Refer to the following files for more information about these data

      NH Mission Trajectory Table: urn:nasa:pds:nh_documents:mission:nh_mission_trajectory
          <95>    Field of View Illustration: urn:nasa:pds:nh_documents:mission:nh_fov
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti
```

# overview.txt – 4 of 5

```
Ancillary Data
==============

  The geometry items included in the data labels were computed
  using the SPICE kernels archived in the New Horizons SPICE
  data set, NH-J/P/SS-SPICE-6-V1.0.
```

Why is this file name say it is version 1 when there are multiple versions of the same file?

```
Every observation provided in this data set was taken as a part of a
particular sequence.  A list of these sequences has been provided in
file DOCUMENT/SEQ_PEPSSI_*.TAB.  In addition, the
```

Not a PDS4 designation.

```
for every observation.  N.B. While every observation has an associated
sequence, every sequence may not have associated observations.  Some
sequences may have failed to execute due to spacecraft events (e.g.
safing).  No attempt has been made during the preparation of this data
set to identify such empty sequences, so it is up to the user to
compare the times of the sequences to the times of the available
observations from INDEX/INDEX.TAB to identify such sequences.
```

File Does Not Exist

# overview.txt – 5 of 5

```
The leapsecond adjustment (DELTA_ET = ET - UTC) was 65.184s at
NH launch, and the first four additional leapseconds occurred
at the ends of 12/2009, 06/2012, 06/2015, and 12/2016.
Refer to the NH SPICE data set, NH-J/P/SS-SPICE-6-V1.0, and the
SPICE toolkit documentation, for more details about leapseconds.
```

Since there are multiple versions of the same file, how do you know in which version to look?

```
channel. See the SOC Instrument ICD (/DOCUMENT/SOC_INST_ICD.*)
for details.
```

Not a PDS4 specification

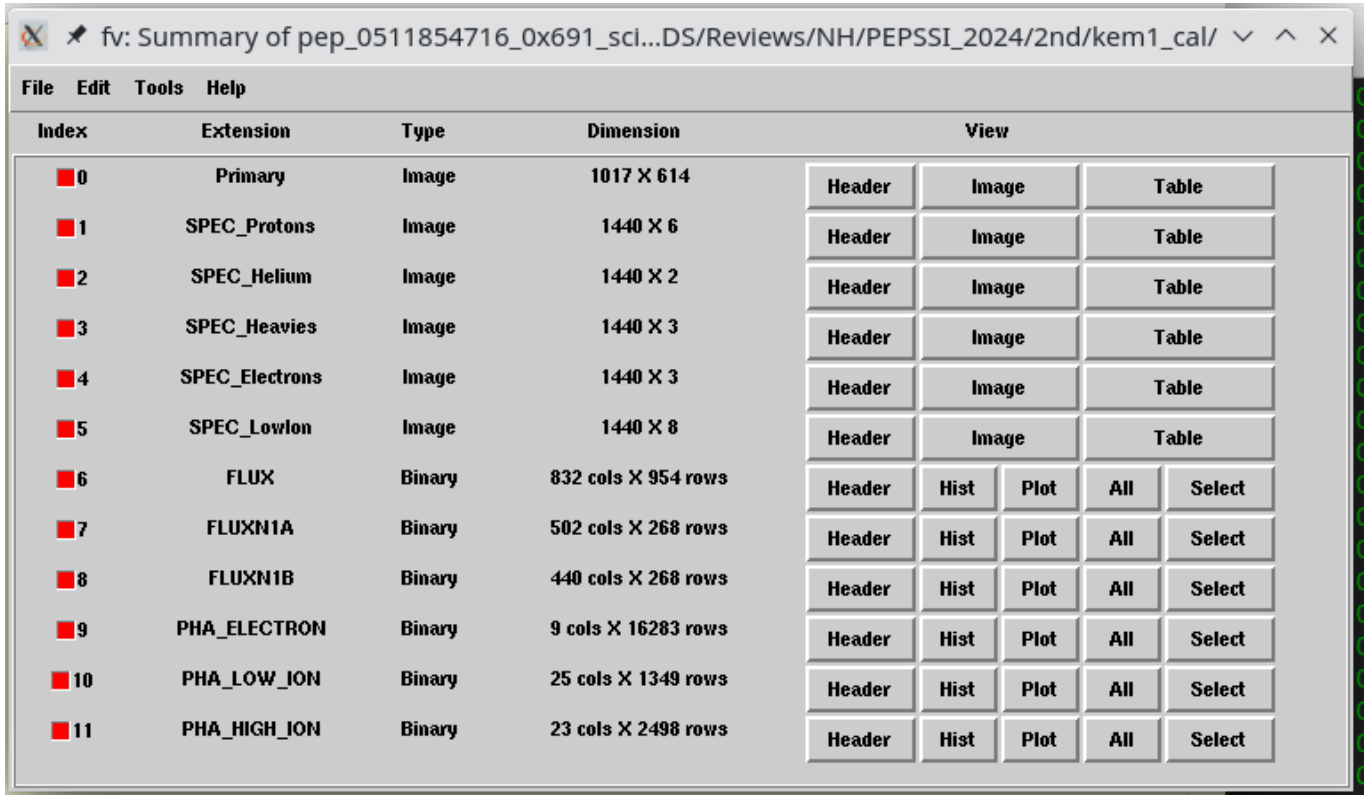
File Does Not Exist

```
Please see the 'Data Validity' section of PEPSSI.CAT for details
regarding information on channels which should be excluded from
analysis.
```

# pep_*_sci.lblx

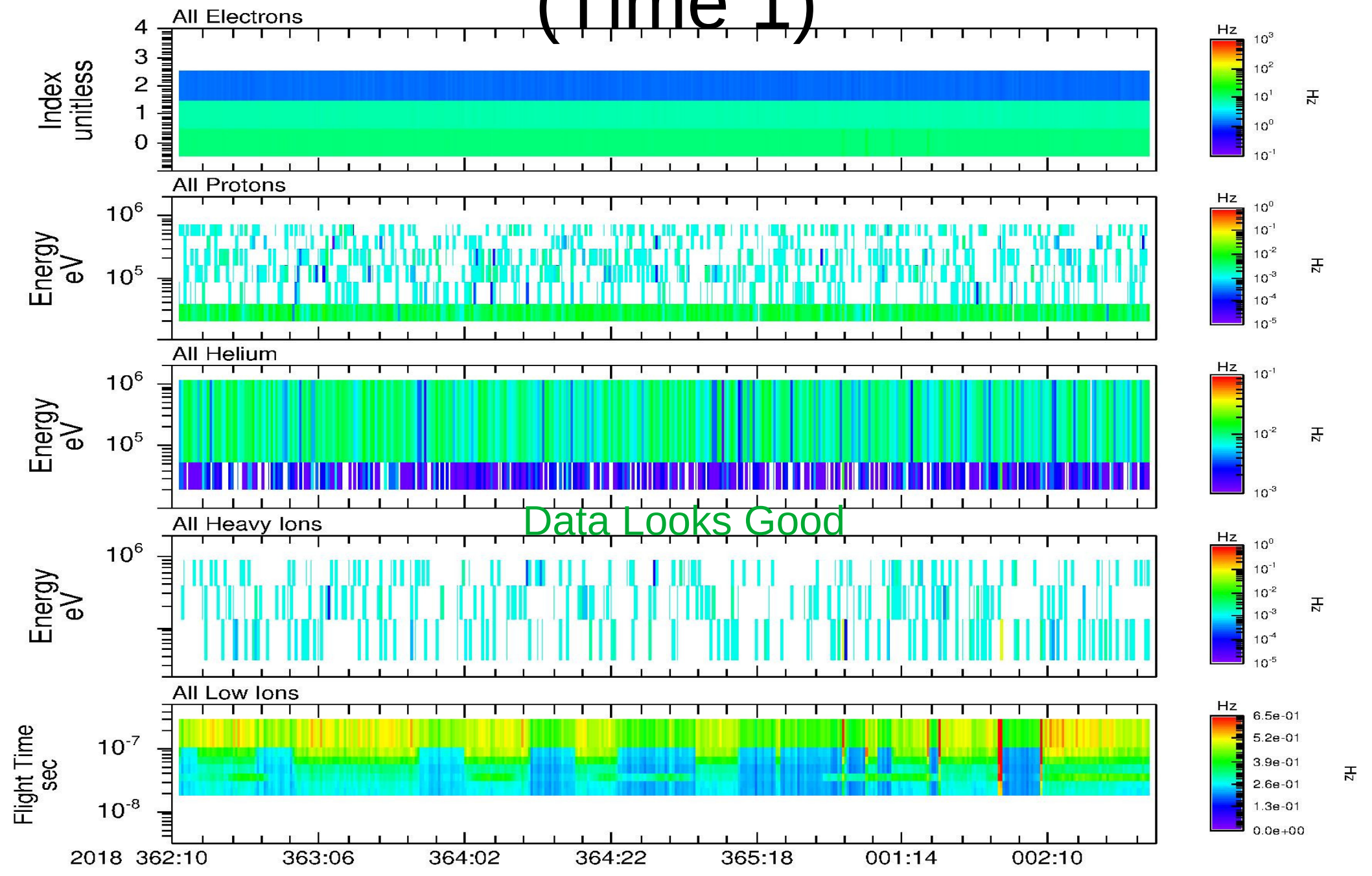
NASA PDS Validate v3.6.3: PASS

# pep_*_0x691_sci.fit



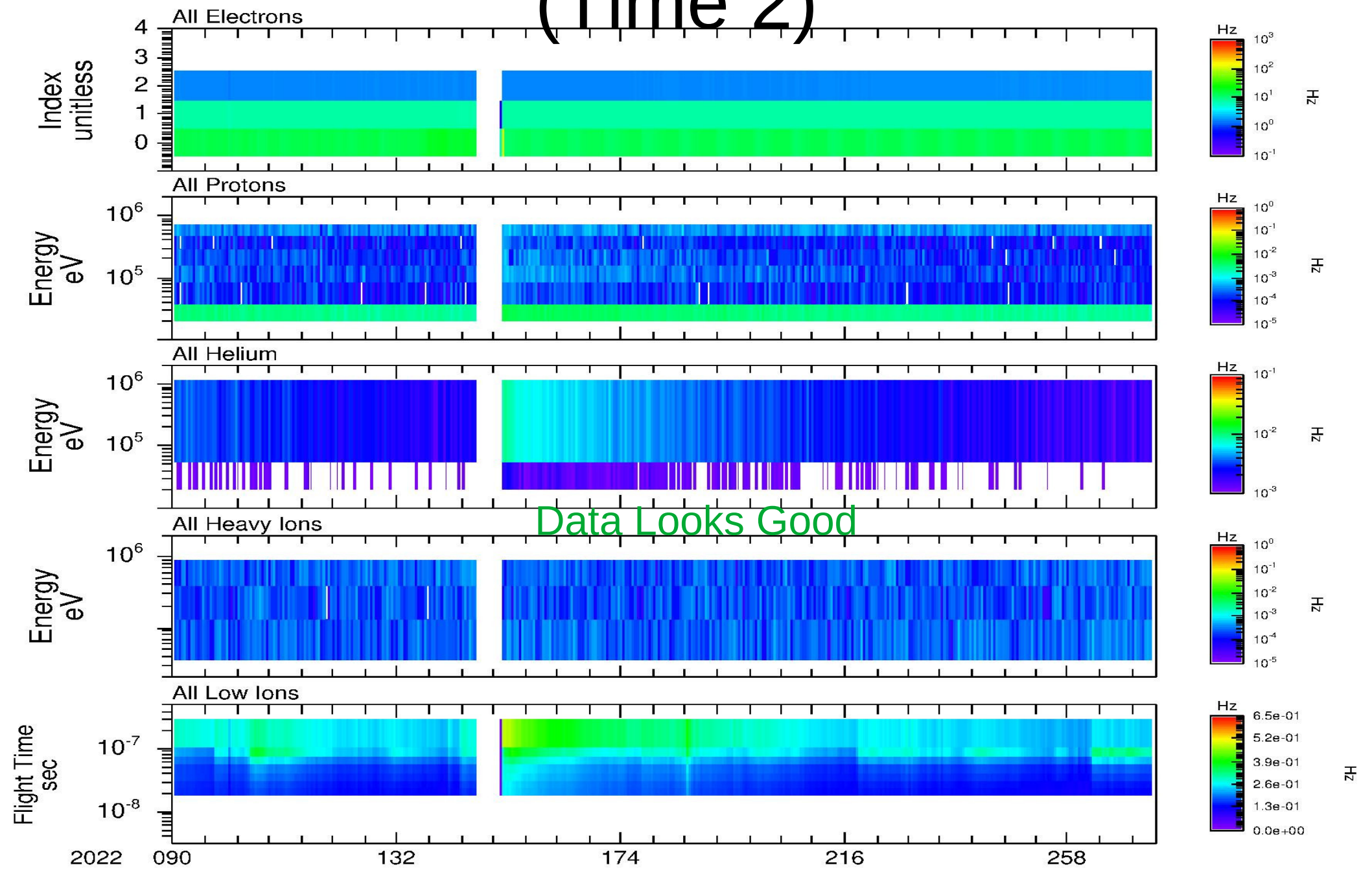
# HDU (Index+1): 2, 3, 4, 5, 6 (Time 1)





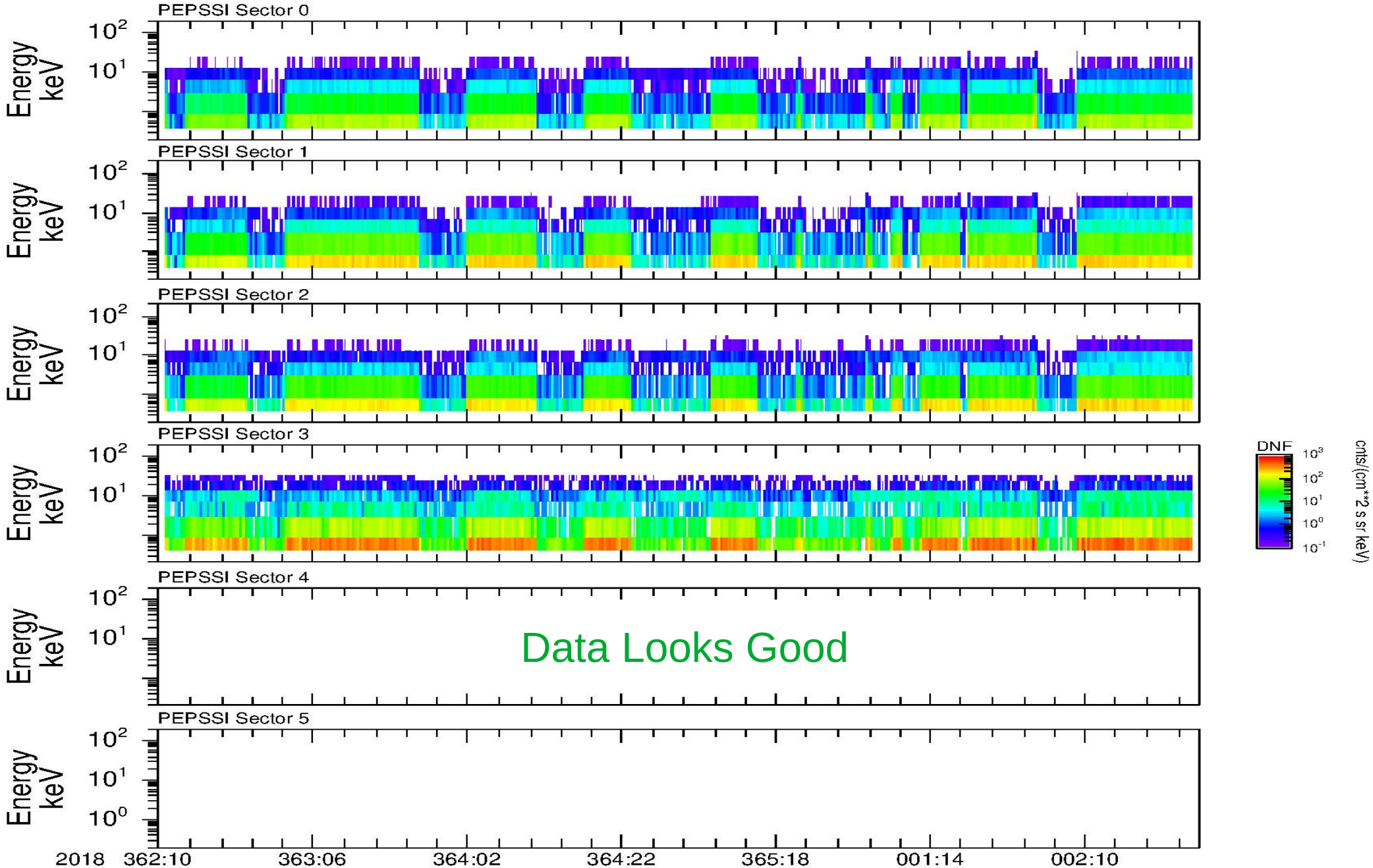

Data Looks Good

# HDU (Index+1): 2, 3, 4, 5, 6 (Time 2)

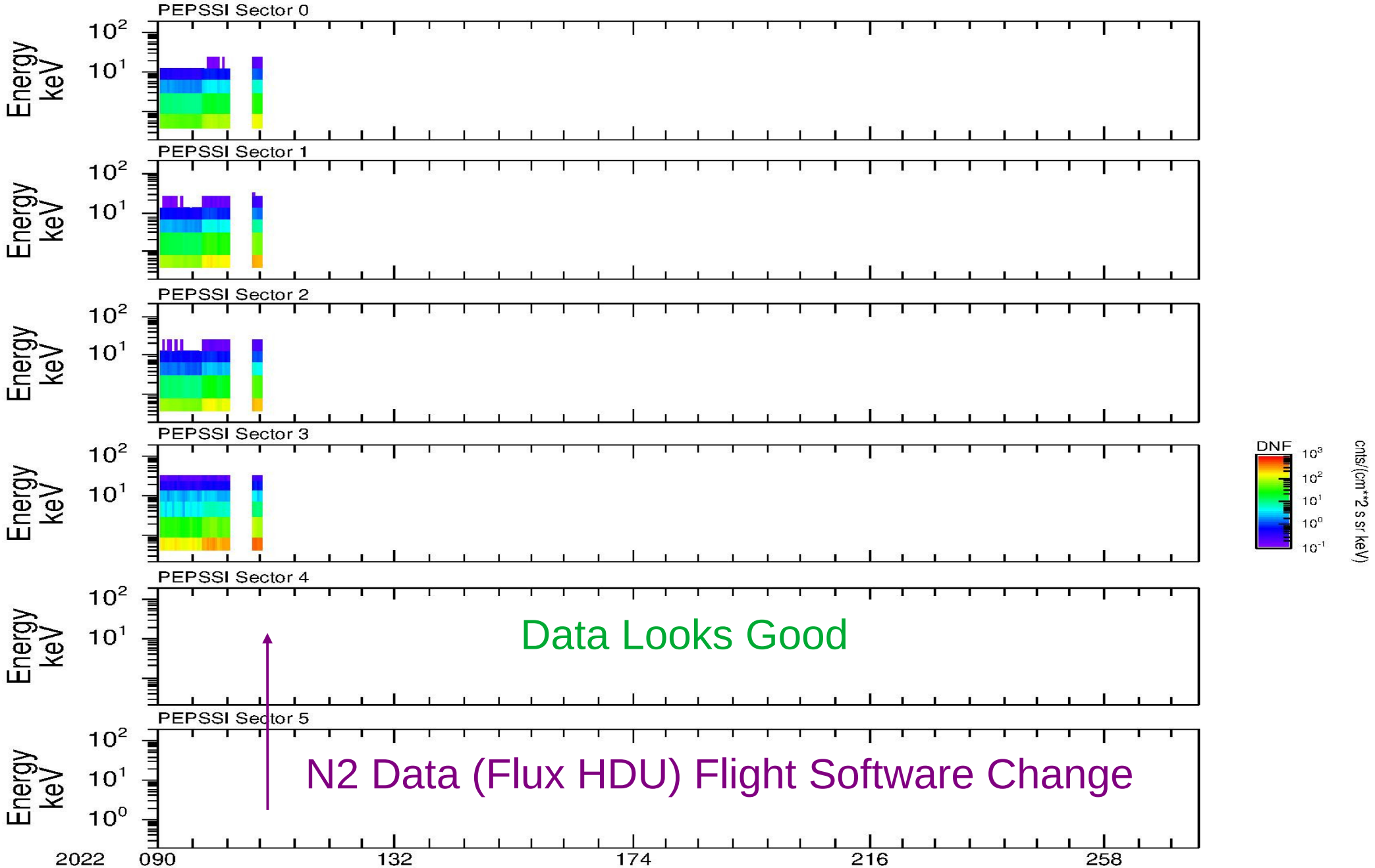



Data Looks Good

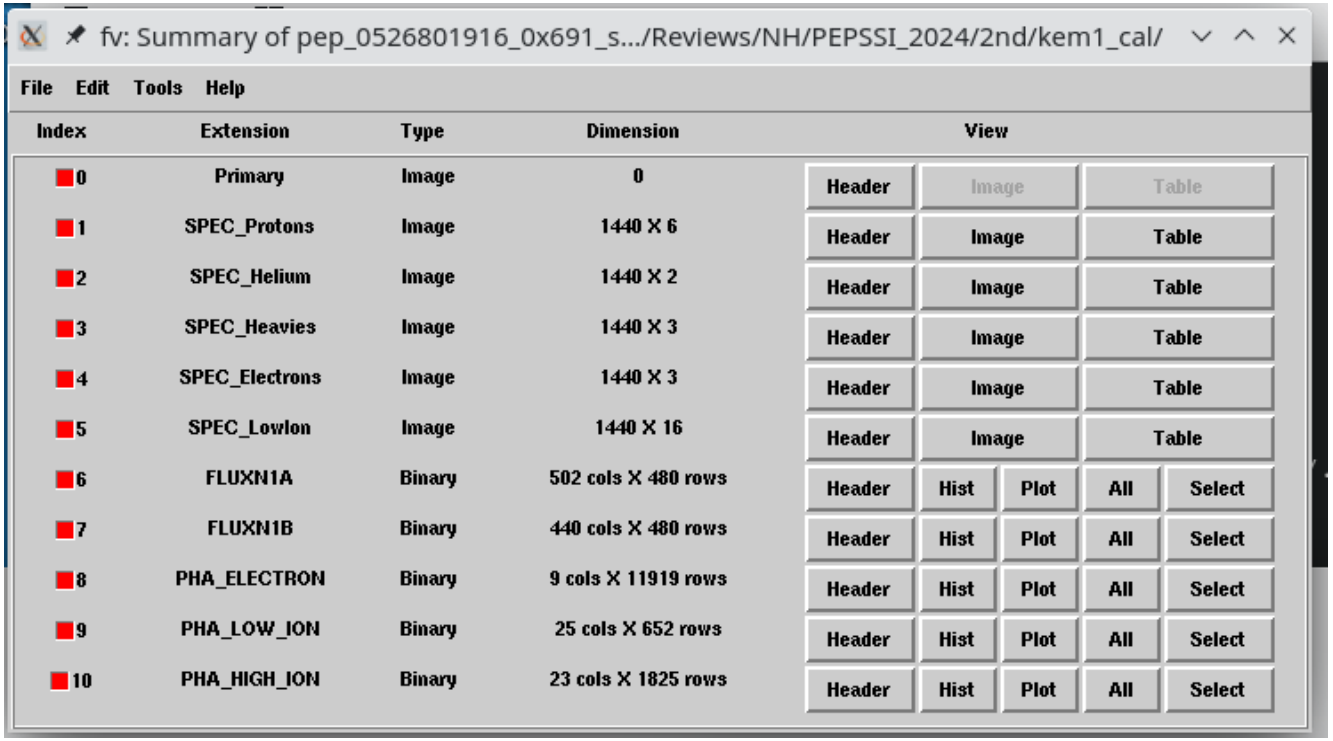
# HDU (Index+1): 7 (N2 Data Time 1)
# “L” Proton Number Flux



# HDU (Index+1): 7 (N2 Data Time 2)
# “L” Proton Number Flux



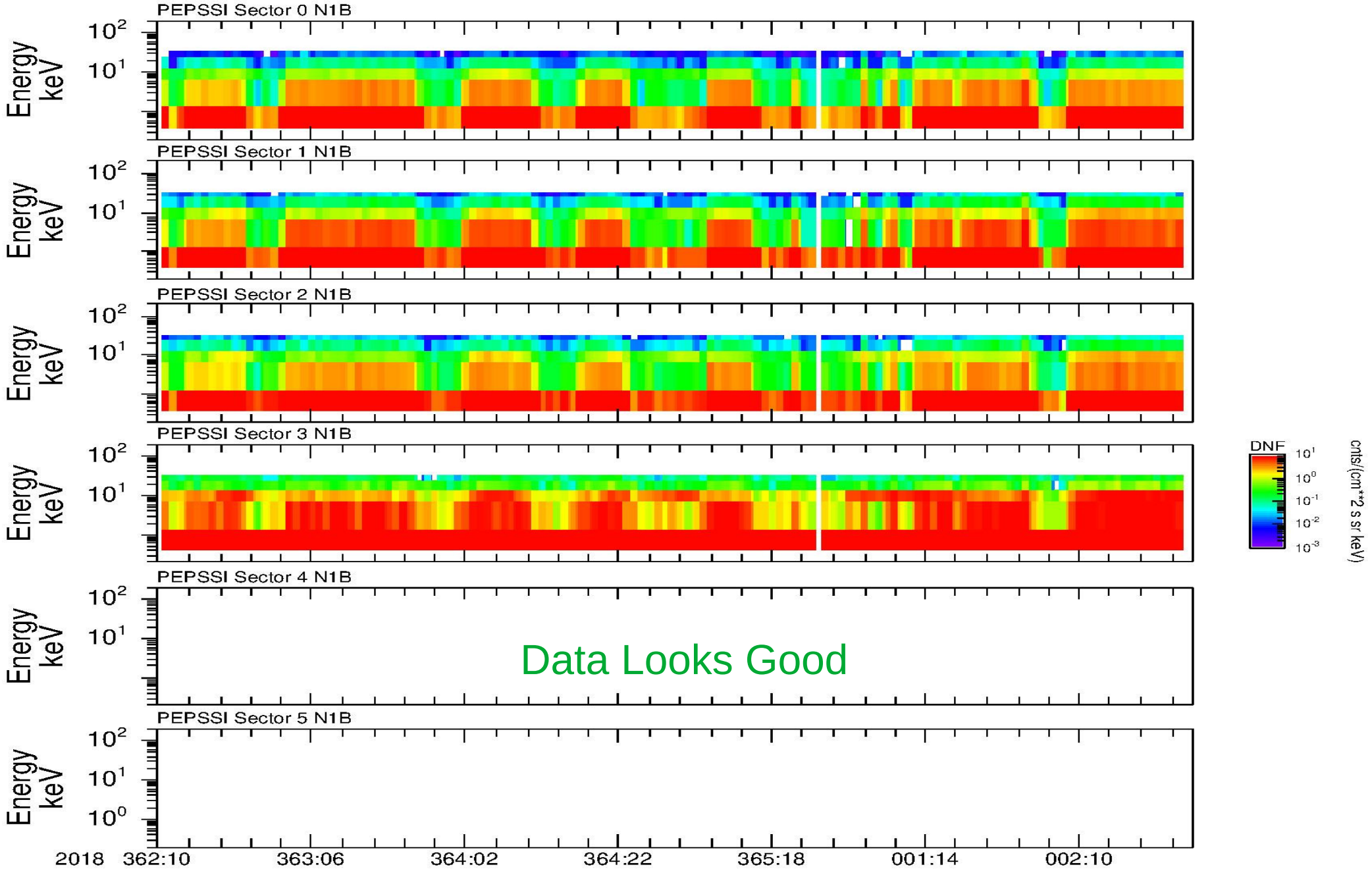
# pep_*_0x691_sci.fit



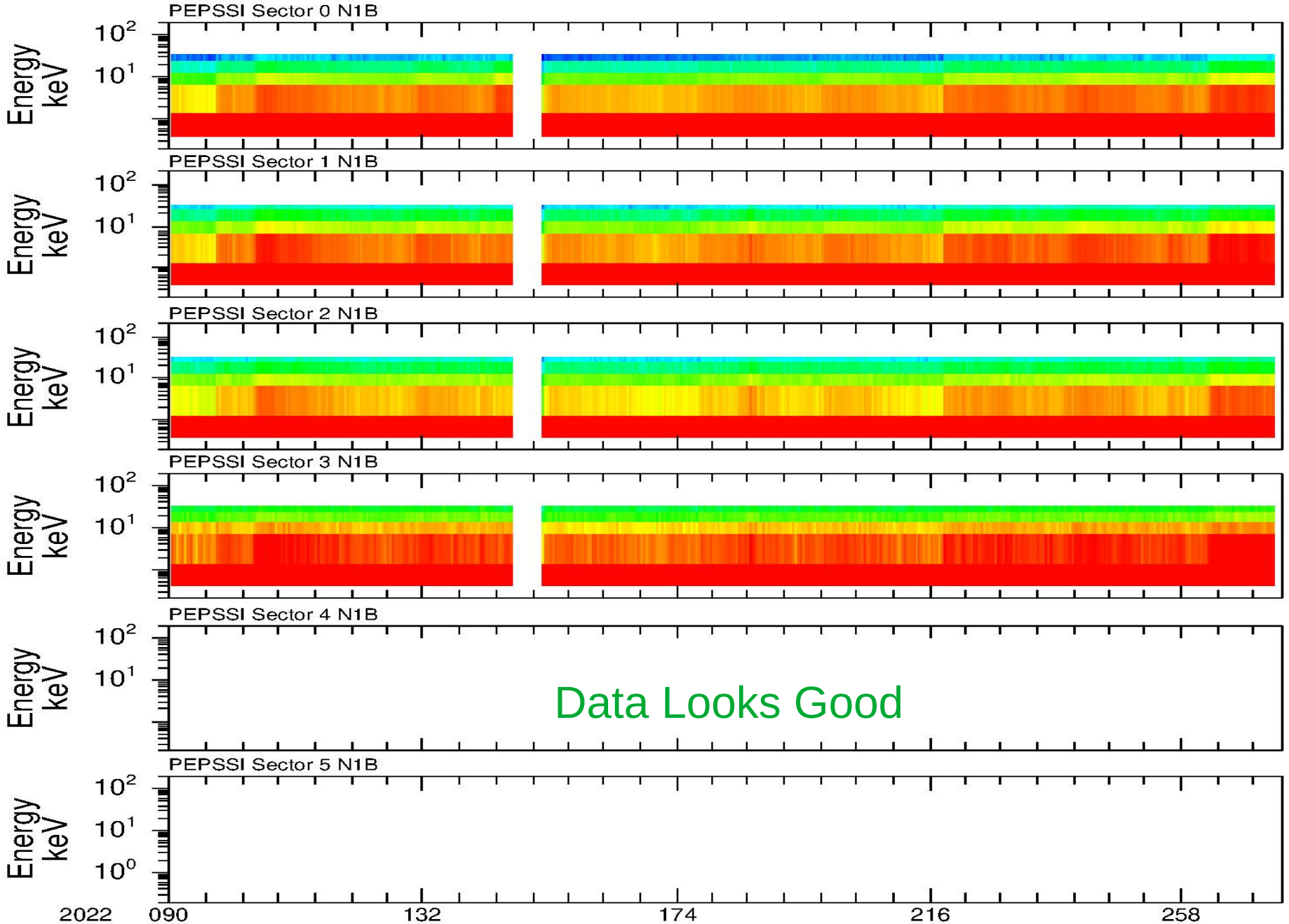

After Flight Software Update

# HDU (Index+1): 8 (N1 Data Time 1)
# “L” Proton Number Flux



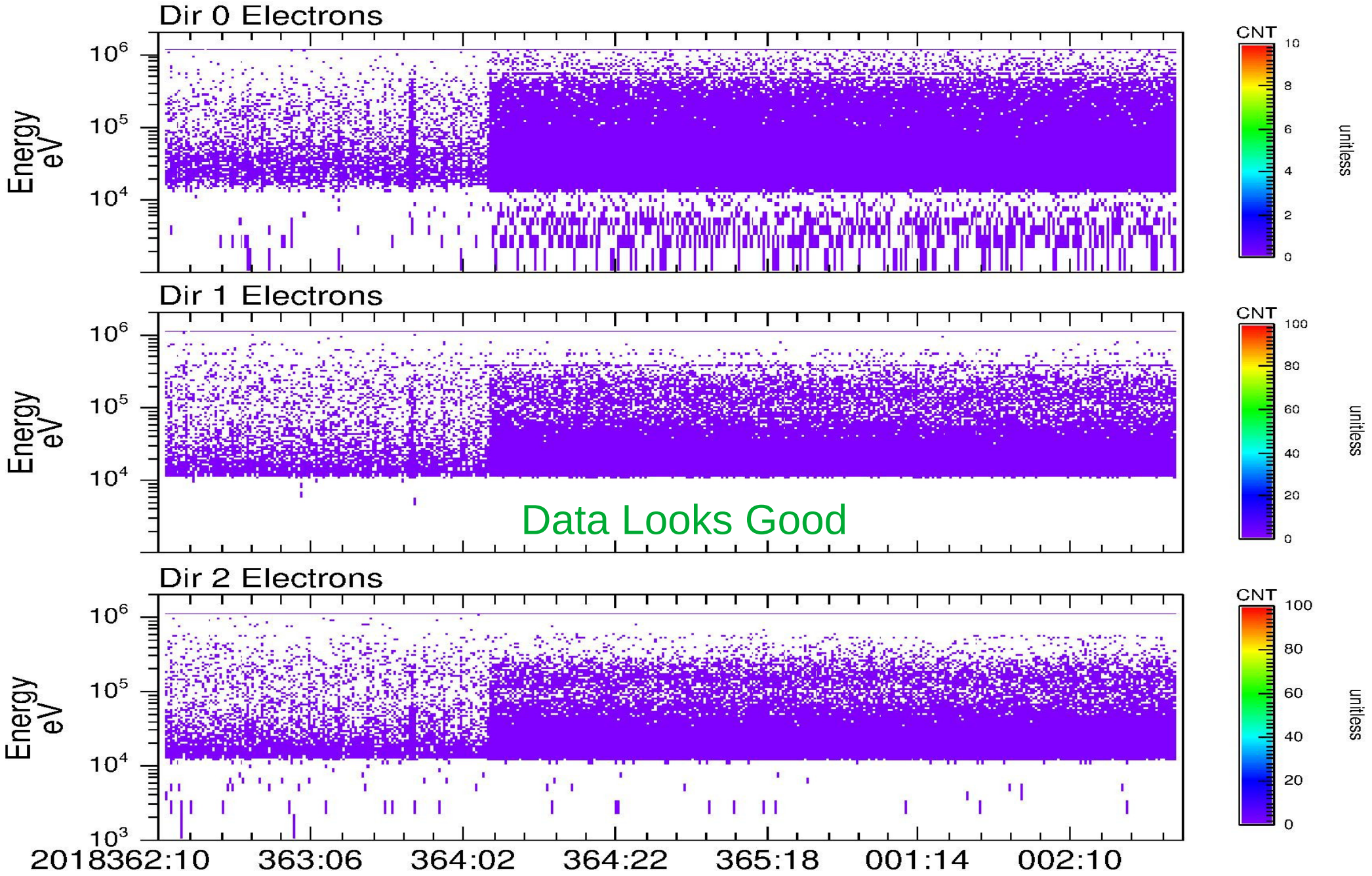


# HDU (Index+1): 7/8 (N1 Data Time 2)
# “L” Proton Number Flux

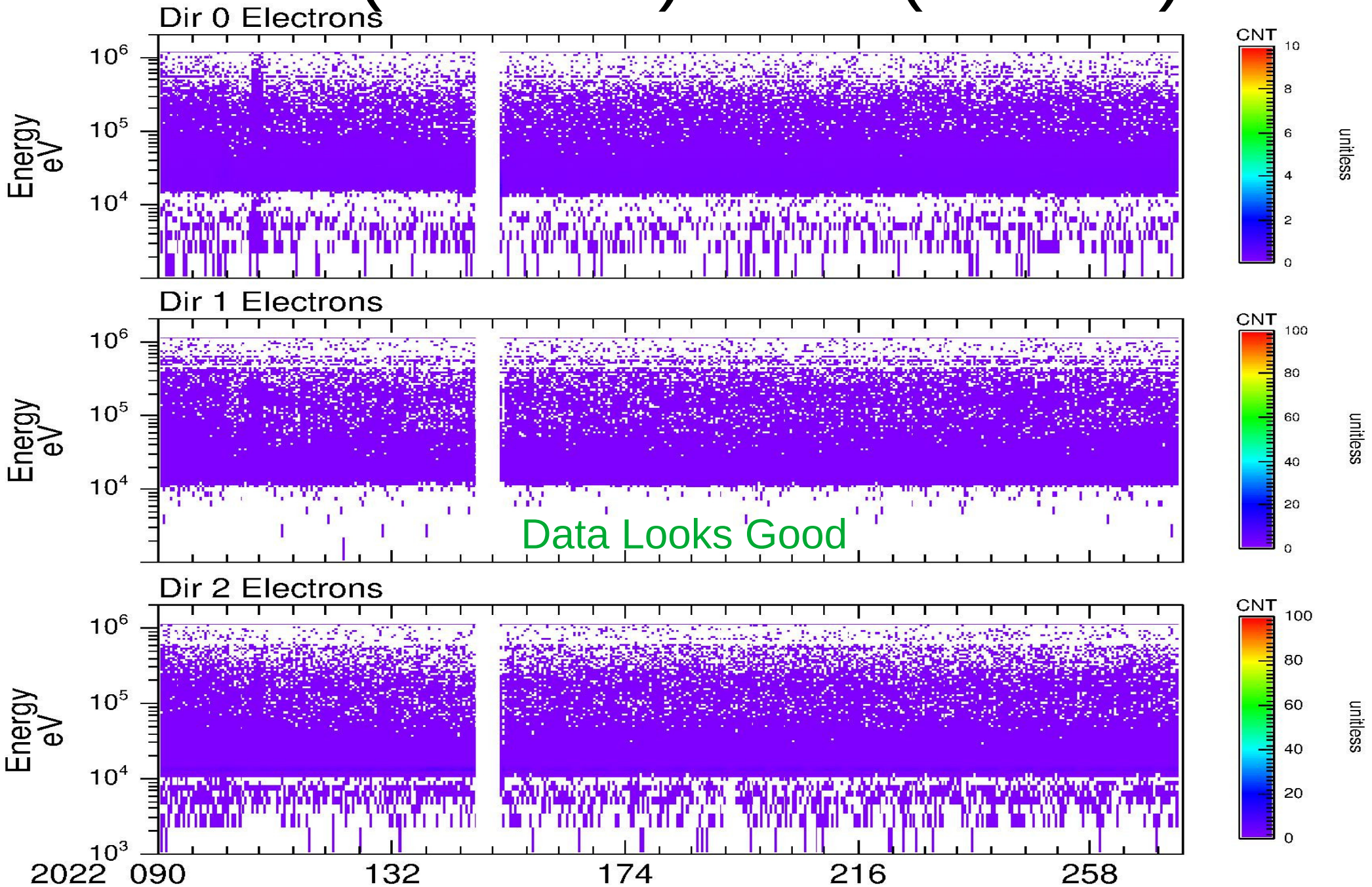


# HDU (Index+1): 10 (Time 1)





# HDU (Index+1): 9/10 (Time 2)



# Collection Certification for New Horizons PEPSSI KEM1 Encounter Calibrated Data v2.0

The it is not clear how “superseded” data files are handled with respect to PDS4 versioning. SPICE data files have the same delivery file name but contain different versions of data and it is not clear which version of data is used. There are some incorrect PDS4 referenced names, references to files which do not exist, and incorrect ASCII characters. The data in the fit files all look good. Data can be released without causing user confusion.

Recommendation: Certify with a lien to fix the overview.txt file

7) New Horizons PEPSSI KEM2 Calibrated Data

# overview.lblx

NASA PDS Validate v3.6.3: PASS

# overview.txt – 1 of 5

```
PDS4 Version History
====================

  This is VERSION 2.0 of this data set.
```

According to the collections_inventory.csv file, all of the data files in this data set are Version 1 (in addition to the PDS4 ID).

Can not find these files within the kem2 data set...are they supposed to be here?

```
Superseded KEM1 files
=====================================================================

  Thirteen PEPSSI data files in the NH-A-PEPSSI-2-KEM1-V6.0 dataset from
  the KEM1 mission phase were incomplete until newer data was received
  from the spacecraft. New versions of these files are included in the
  raw and calibrated PEPSSI datasets.
```

```
Refer to the document/superseded files *.tab file for the affected
filenames and product IDs for KEM1 and KEM2 datasets.
```

Can not locate, not a PDS4 designation

# overview.txt – 2 of 5

Since this is v1.0

```
On April 10, 2022 at 10:17 UTC, the PEPSSI flight software was updated
to version 5 (FSW5). The changes to the data are small, but the way the
instrument is operated has changed. Refer to section 11.3.6 (Flight
Software Version 5 Changes to Operations) in the SOC Instrument ICD
(/DOCUMENT/SOC_INST_ICD.*) for a brief description of the changes.
```

Not a PDS4 designation

```
This dataset corresponded to New Horizons NAIF SPICE distribution v0007.
```

```
Releases 0005, 0006, 0007, and 0008 were produced by Brian Enke, Southwest
Research Institute, Solar System Science & Exploration Division,
Boulder, Colorado, USA.
```

```
OBJECT                          = DATA_SET_RELEASE
  DATA_SET_ID                     = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                      = "0008"
  RELEASE_DATE                    = 2024-08-06
  RELEASE_MEDIUM                  = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                  = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT          = "&RELEASE_ID=0008"
  PRODUCT_TYPE                    = "SPICE_KERNELS"
  DISTRIBUTION_TYPE               = "NH-SPICE"
  DATA_PROVIDER_NAME              = "SWRI"
```

Note that this is V0007.
So why is V0007 used for kem2 and not V0008?

# overview.txt – 3 of 5



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

Not a PDS4 designation

What is <95>?

```
  DOCUMENTS

  <95>    New Horizon PEPSSI instrument overview: urn:nasa:pds:nh_documents:lorri:pepssi_inst_overview
          <95>    PEPSSI Space Science Review (SSR) paper: urn:nasa:pds:nh_documents:pepssi:pepssi_ssr
          <95>    SOC Instrument ICD: urn:nasa:pds:nh_documents:mission:soc_inst_icd
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti


Other sources of information useful in interpreting these Data
--------------------------------------------------------------

  Refer to the following files for more information about these data

      NH Mission Trajectory Table: urn:nasa:pds:nh_documents:mission:nh_mission_trajectory
          <95>    Field of View Illustration: urn:nasa:pds:nh_documents:mission:nh_fov
          <95>    PEPSSI SPICE Instrument Kernel: urn:nasa:pds:nh_documents:pepssi:nh_pepssi_ti
```

# overview.txt – 4 of 5

```
Ancillary Data
==============

  The geometry items included in the data labels were computed
  using the SPICE kernels archived in the New Horizons SPICE
  data set, NH-J/P/SS-SPICE-6-V1.0.
```

Why is this file name say it is version 1 when there are multiple versions of the same file?

```
Every observation provided in this data set was taken as a part of a
particular sequence.  A list of these sequences has been provided in
file DOCUMENT/SEQ_PEPSSI_*.TAB.  In addition, the
```

Not a PDS4 designation.

```
for every observation.  N.B. While every observation has an associated
sequence, every sequence may not have associated observations.  Some
sequences may have failed to execute due to spacecraft events (e.g.
safing).  No attempt has been made during the preparation of this data
set to identify such empty sequences, so it is up to the user to
compare the times of the sequences to the times of the available
observations from INDEX/INDEX.TAB to identify such sequences.
```

File Does Not Exist

# overview.txt – 5 of 5

```
The leapsecond adjustment (DELTA_ET = ET - UTC) was 65.184s at
NH launch, and the first four additional leapseconds occurred
at the ends of 12/2009, 06/2012, 06/2015, and 12/2016.
Refer to the NH SPICE data set, NH-J/P/SS-SPICE-6-V1.0, and the
SPICE toolkit documentation, for more details about leapseconds.
```

Since there are multiple versions of the same file, how do you know in which version to look?

```
channel. See the SOC Instrument ICD (/DOCUMENT/SOC_INST_ICD.*)
for details.
```

Not a PDS4 specification

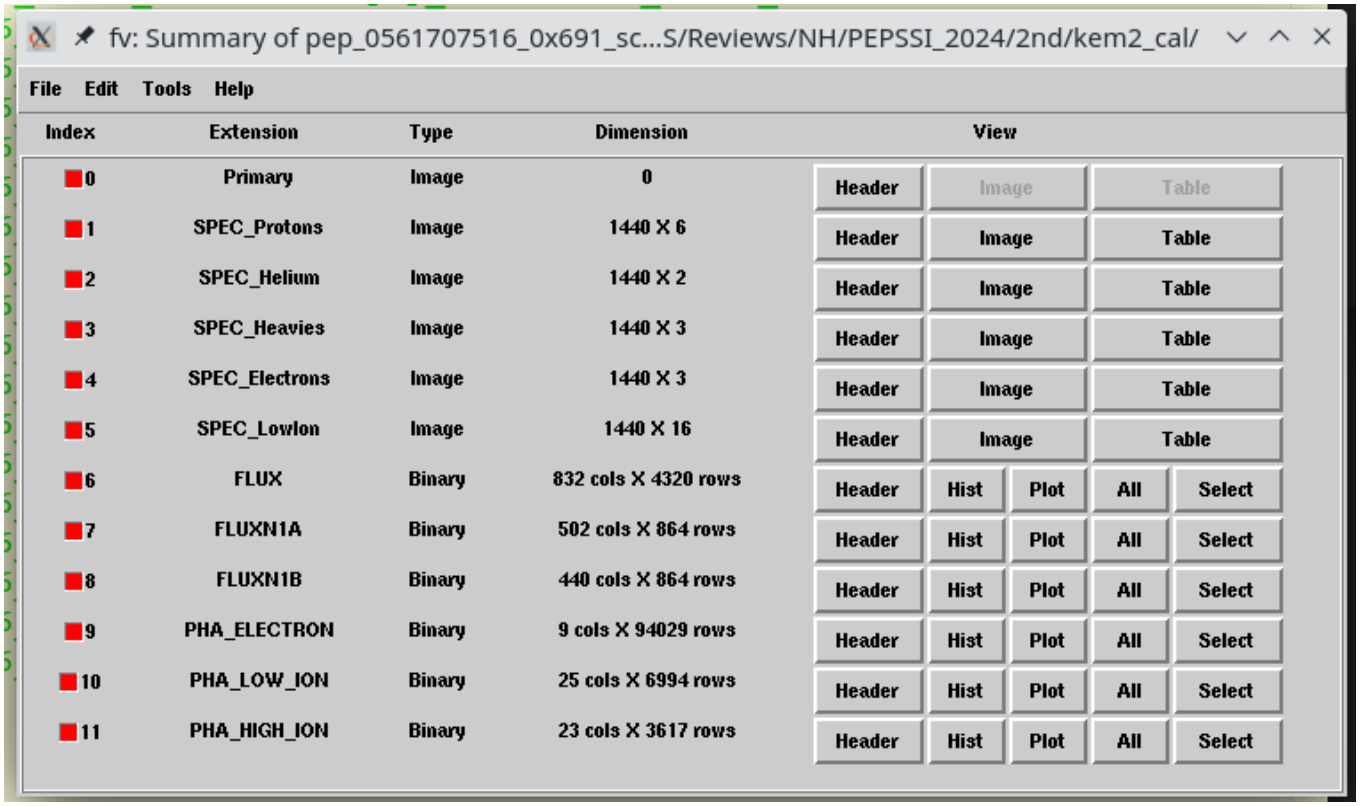
File Does Not Exist

```
Please see the 'Data Validity' section of PEPSSI.CAT for details
regarding information on channels which should be excluded from
analysis.
```

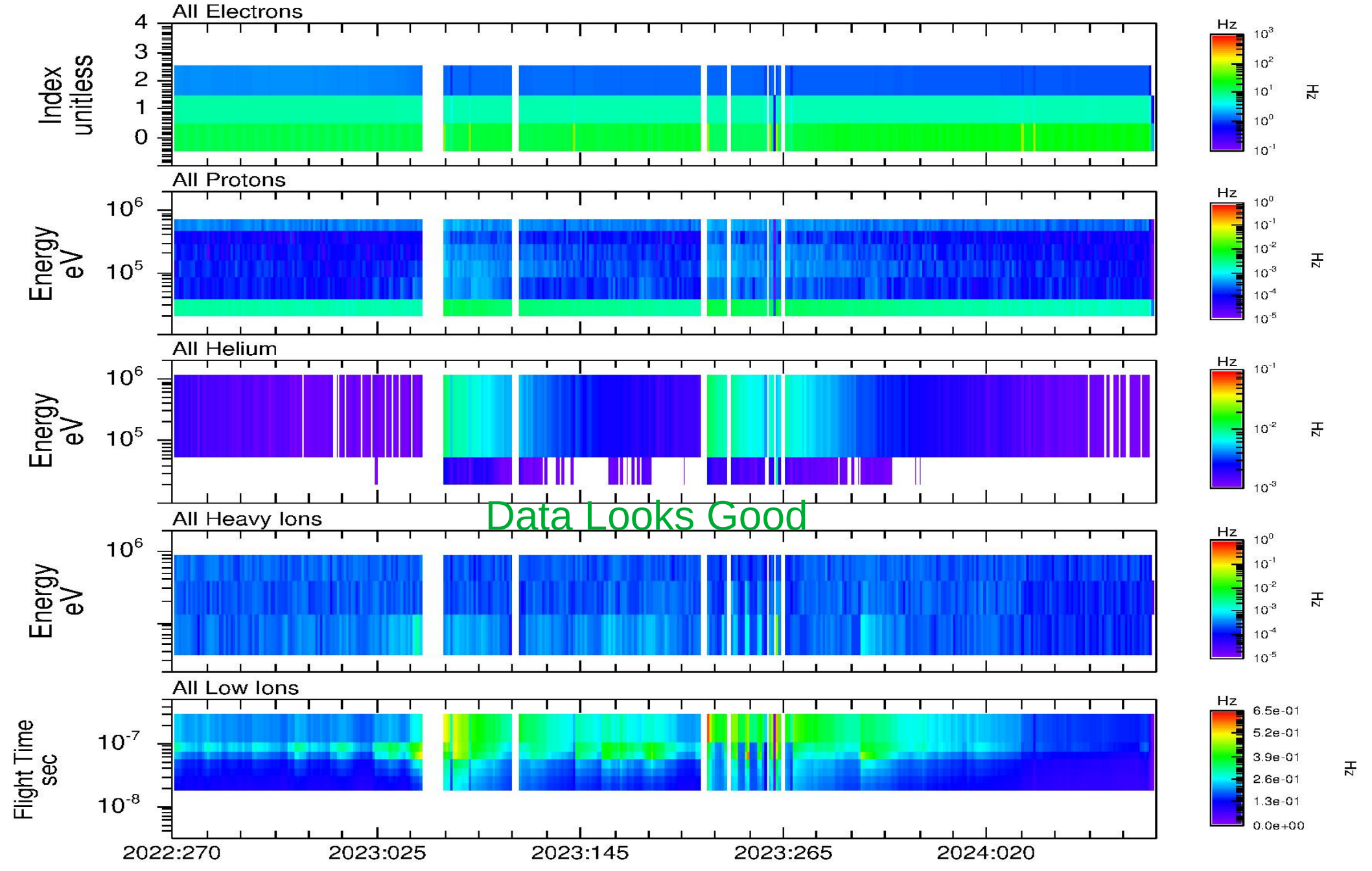
# pep_*_sci.lblx

NASA PDS Validate v3.6.3: PASS

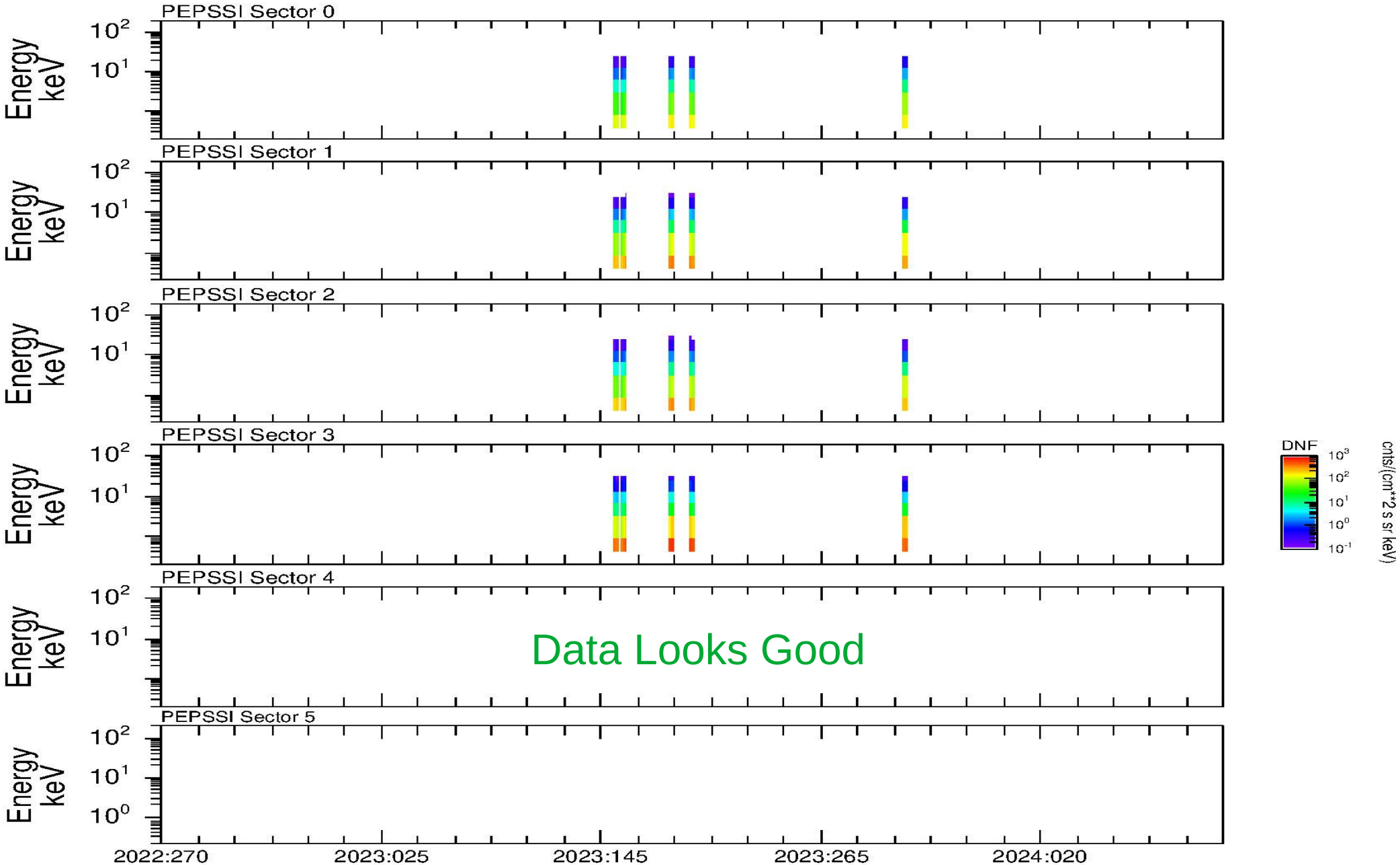
# pep_*_0x691_sci.fit (form A)



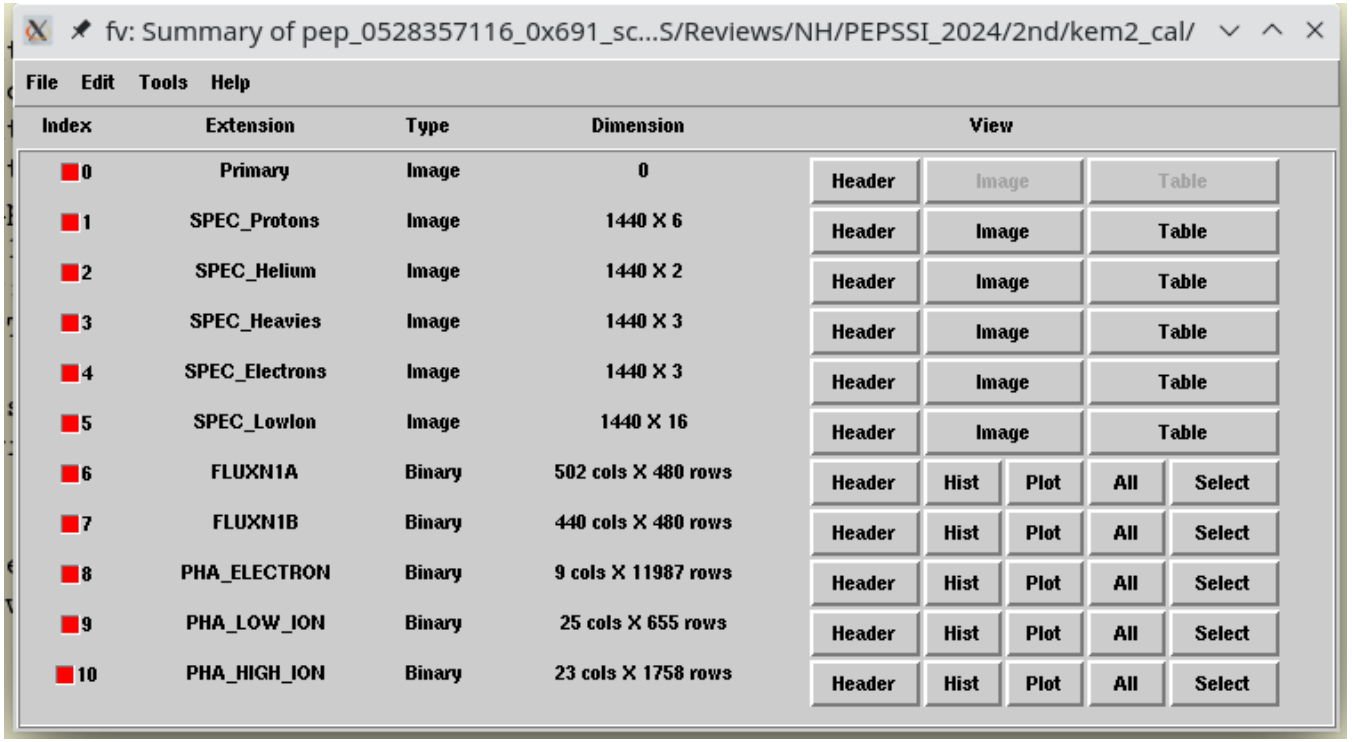
# HDU (Index+1): 2, 3, 4, 5, 6



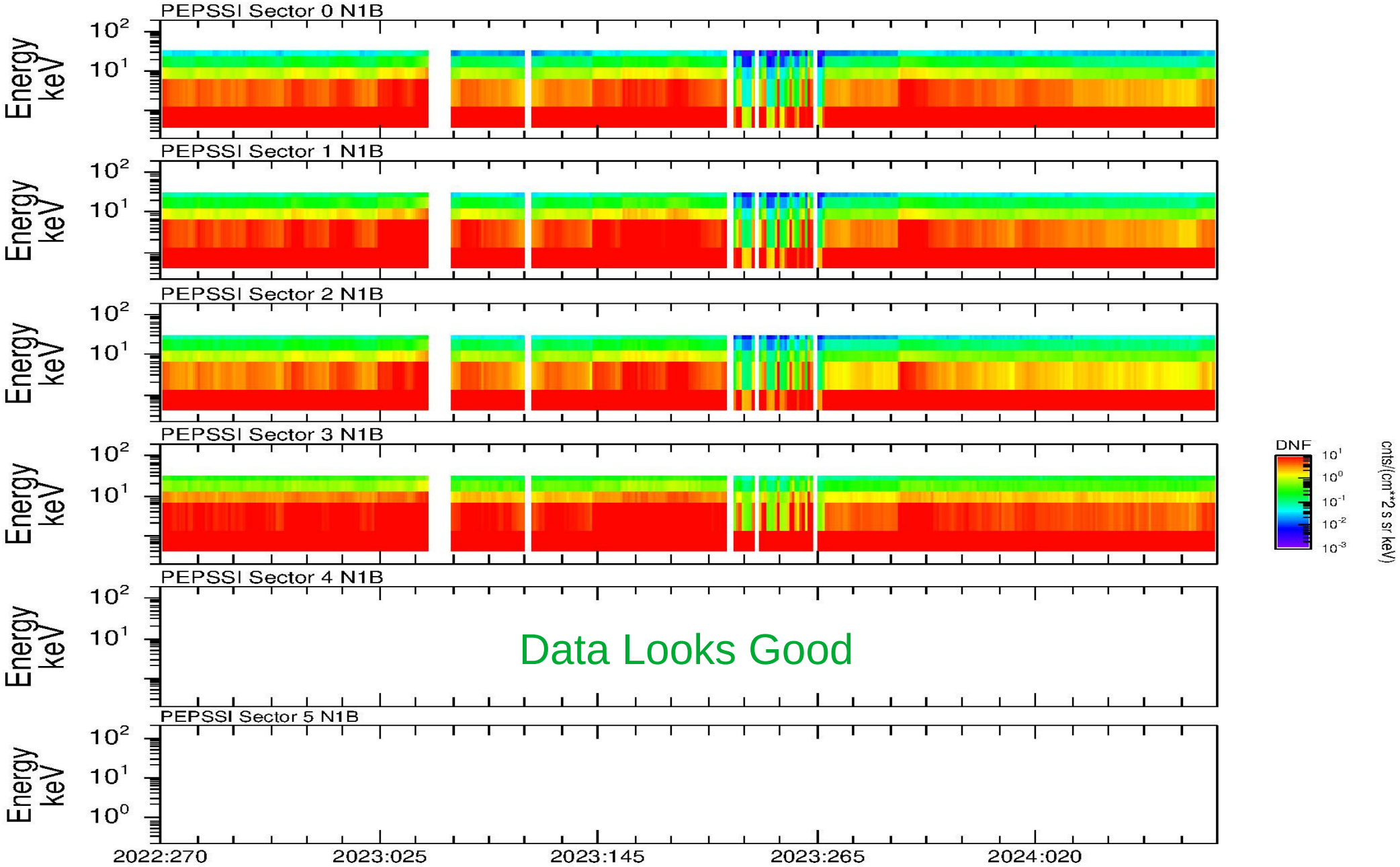
# HDU (Index+1): 7
# ”L” Proton Number Flux



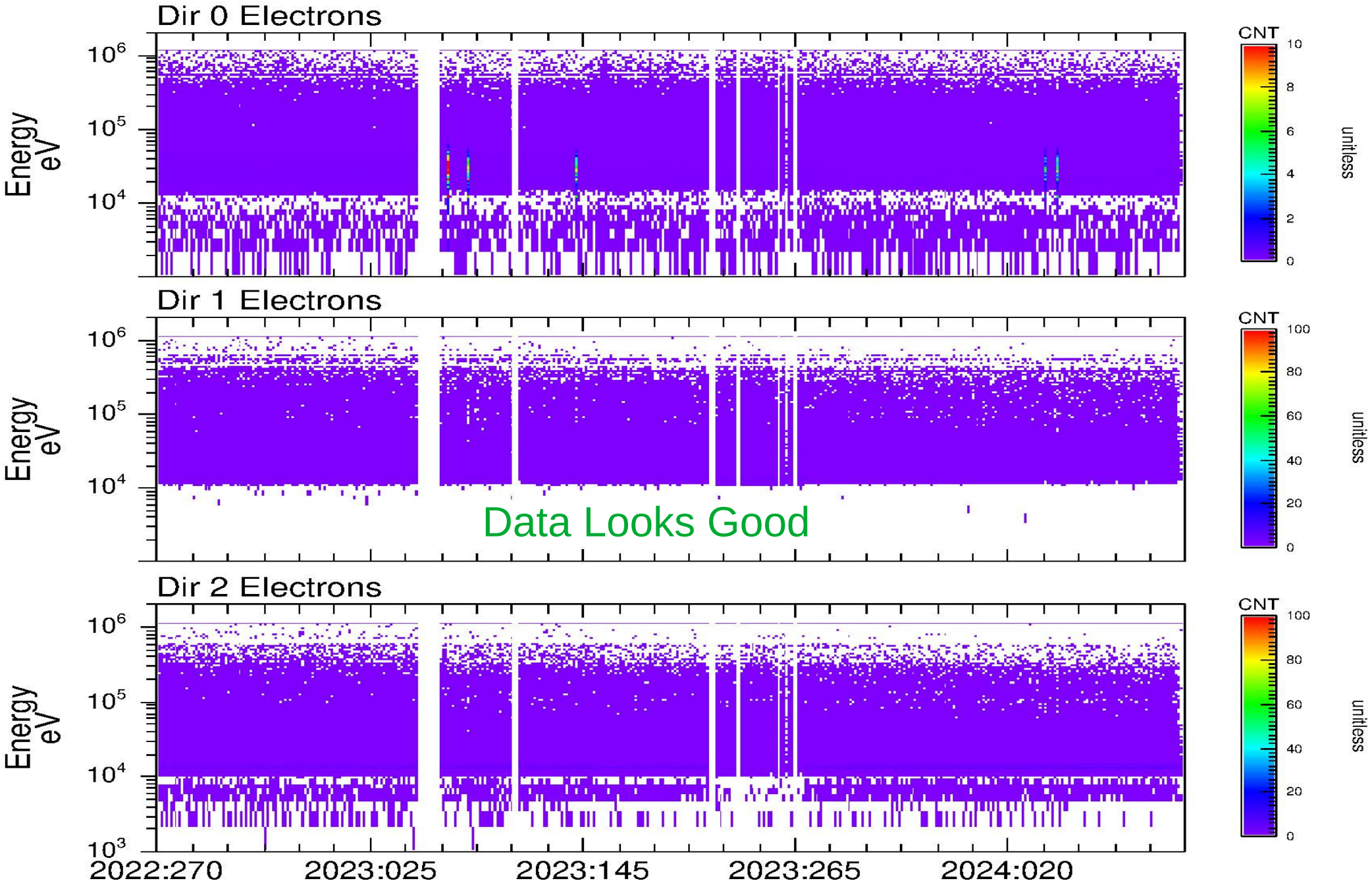
# pep_*_0x691_sci.fit (form B)



# HDU (Index+1): 8/9
# ”L” Proton Number Flux



# HDU (Index+1): 9/10



# Collection Certification for New Horizons PEPSSI KEM2 Calibrated Data v1.0

Version is 1.0, but overview.txt says is is version 2.0. The it is not clear how “superseded” data files are handled with respect to PDS4 versioning. SPICE data files have the same delivery file name but contain different versions of data and it is not clear which version of data is used. There are some incorrect PDS4 referenced names, references to files which do not exist, and incorrect ASCII characters. The data in the fit files all look good. Data can be released without causing user confusion.

Recommendation: Certify with a lien to fix the overview.txt file

# New Horizons PEPSSI Collections Certification Summary

1) Mission Documents v3.0
    ?
2) New Horizons Documents for the PEPSSI Instrument v2.0
    ?
3) New Horizons PEPSSI KEM1 Encounter Raw Data v2.0
    ?
4) New Horizons PEPSSI KEM2 Raw Data
    ?
5) New Horizons PEPSSI Reference Files Used in Calibrating Data v2.0
    ?
6) New Horizons PEPSSI KEM1 Encounter Calibrated Data v2.0
    ?
7) New Horizons PEPSSI KEM2 Calibrated Data
    ?

# BACK-UP Slides

# collection.lblx

NASA PDS Validate v3.6.3: PASS

# collection_inventory.csv



GOOD

# hk_n1_input_20050228.lblx

NASA PDS Validate v3.6.3: PASS

# hk_n1_input_20050228.tab

GOOD

# hk_stat_input_20041016.lblx

NASA PDS Validate v3.6.3: PASS

# hk_stat_input_20041016.tab

GOOD

# collection.lblx

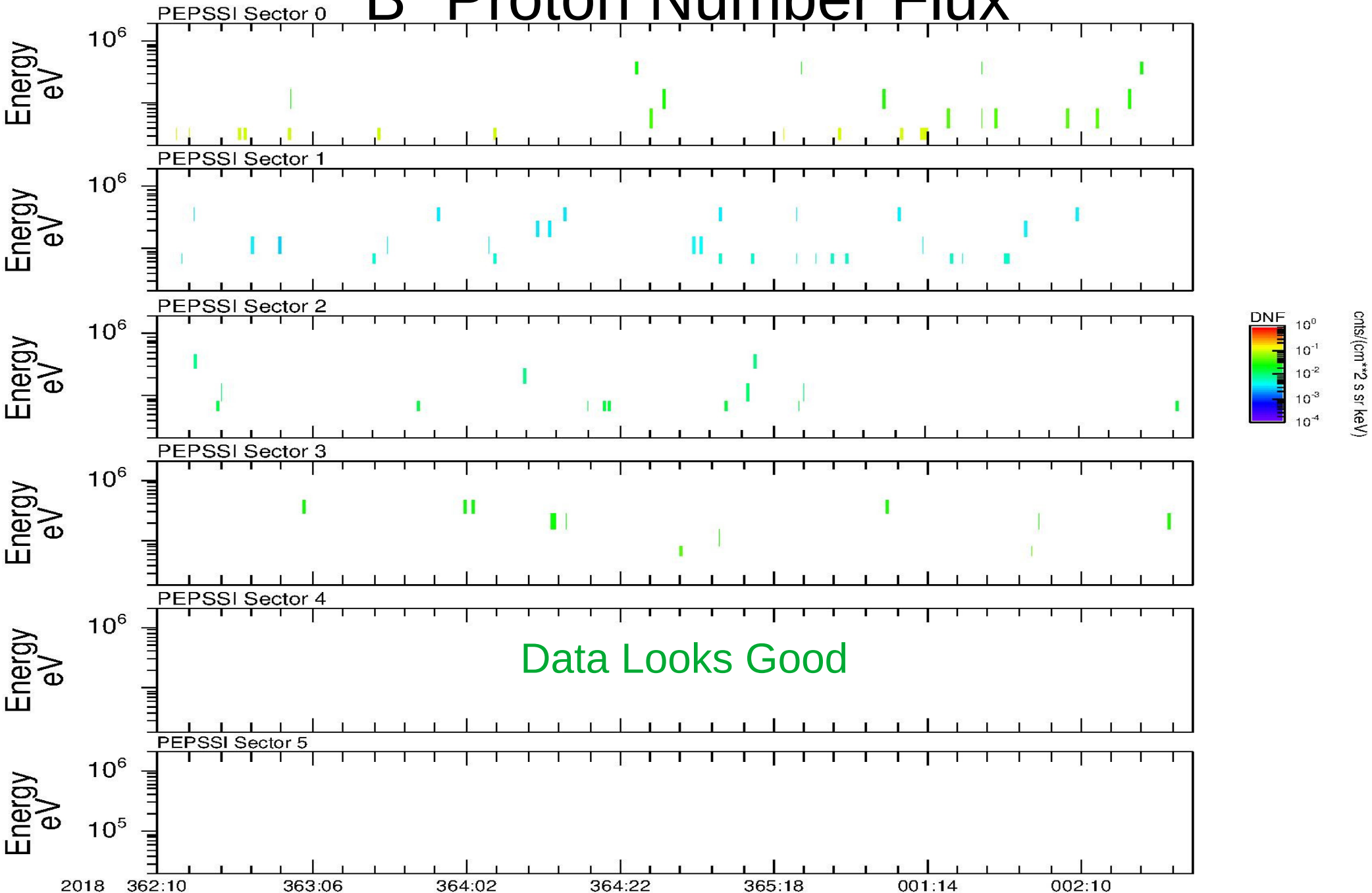
NASA PDS Validate v3.6.3: PASS

# collection_inventory.csv



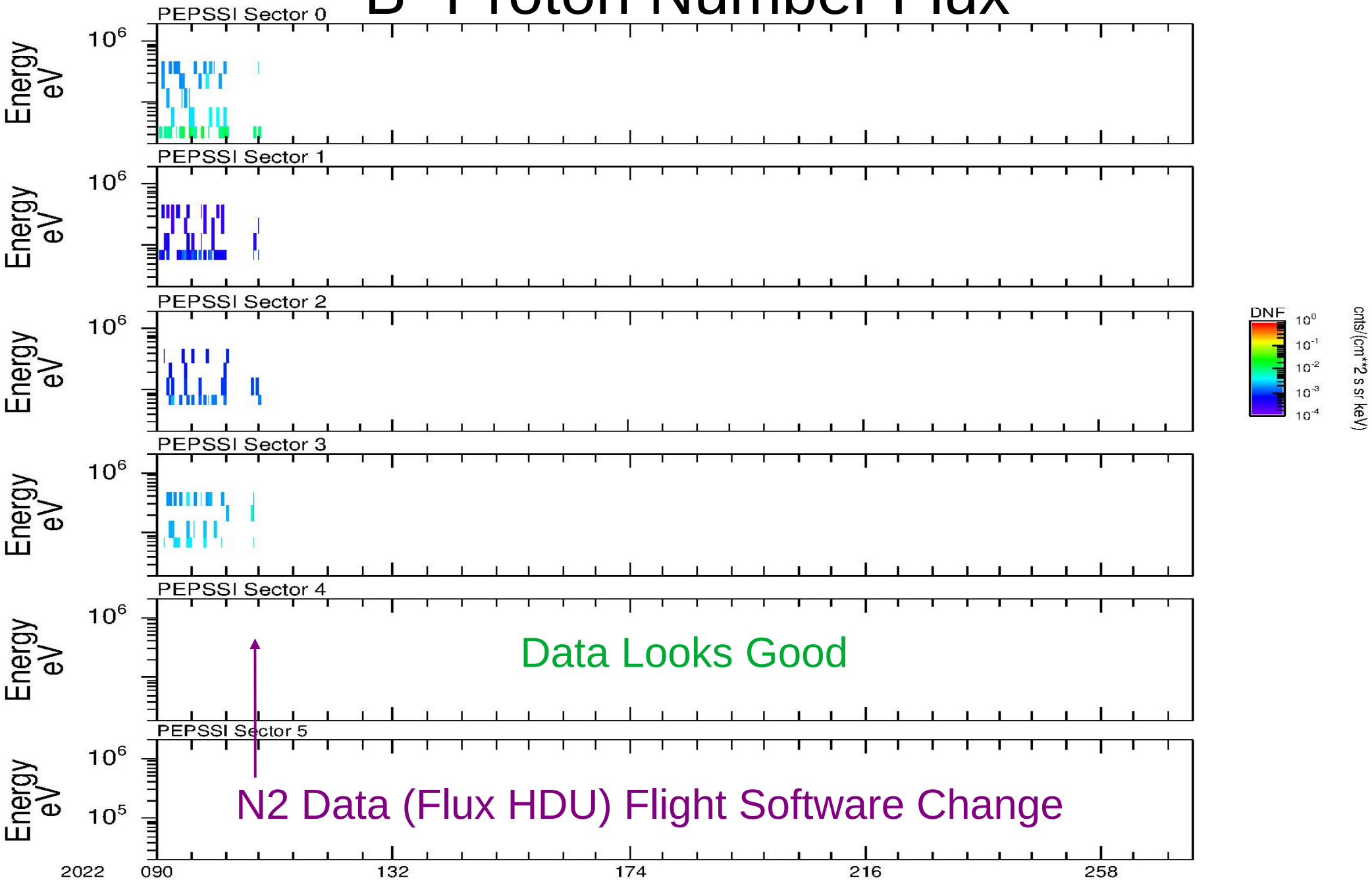
GOOD

# HDU (Index+1): 7 (N2 Data Time 1)
# "B" Proton Number Flux

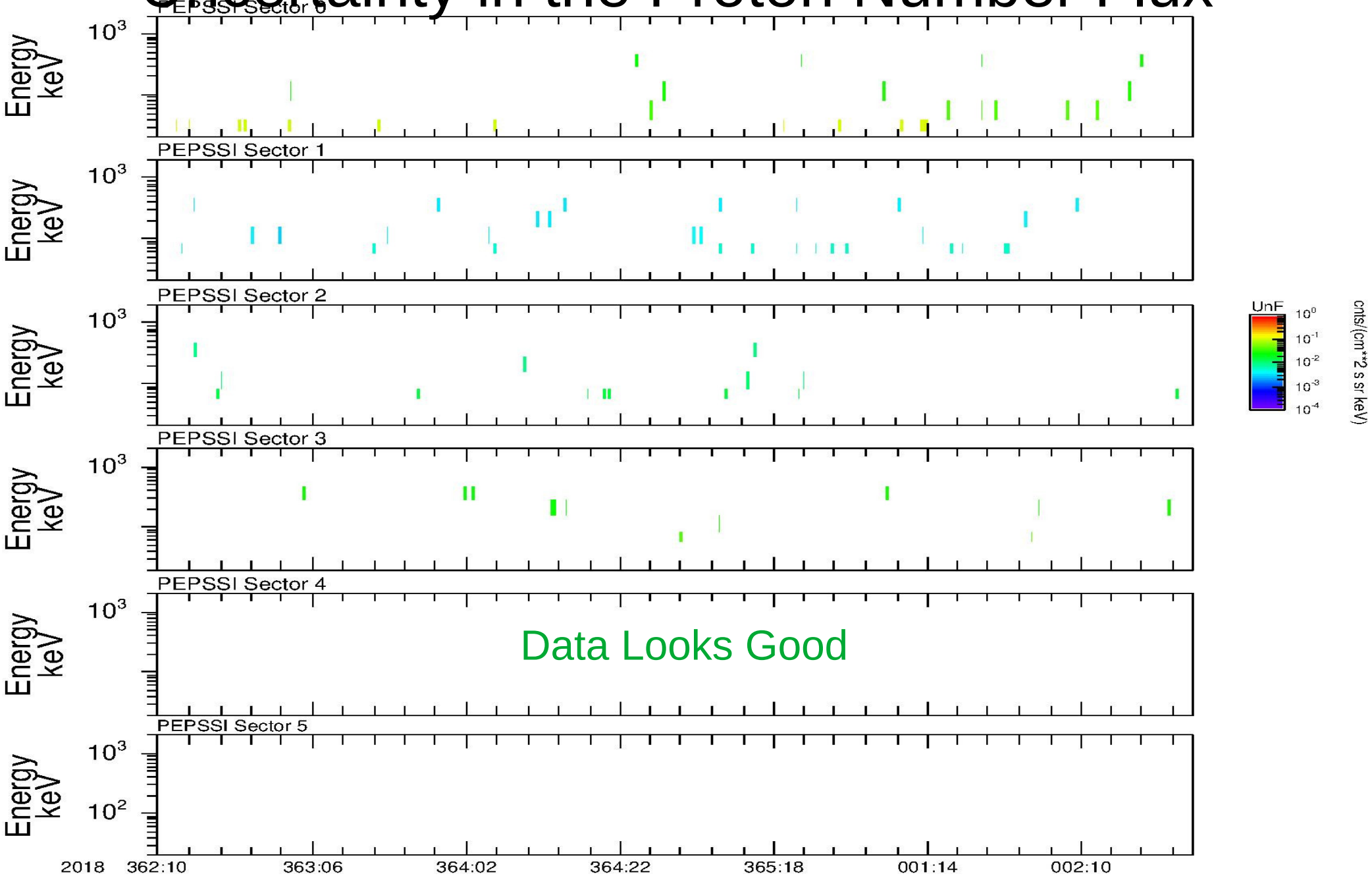



Data Looks Good

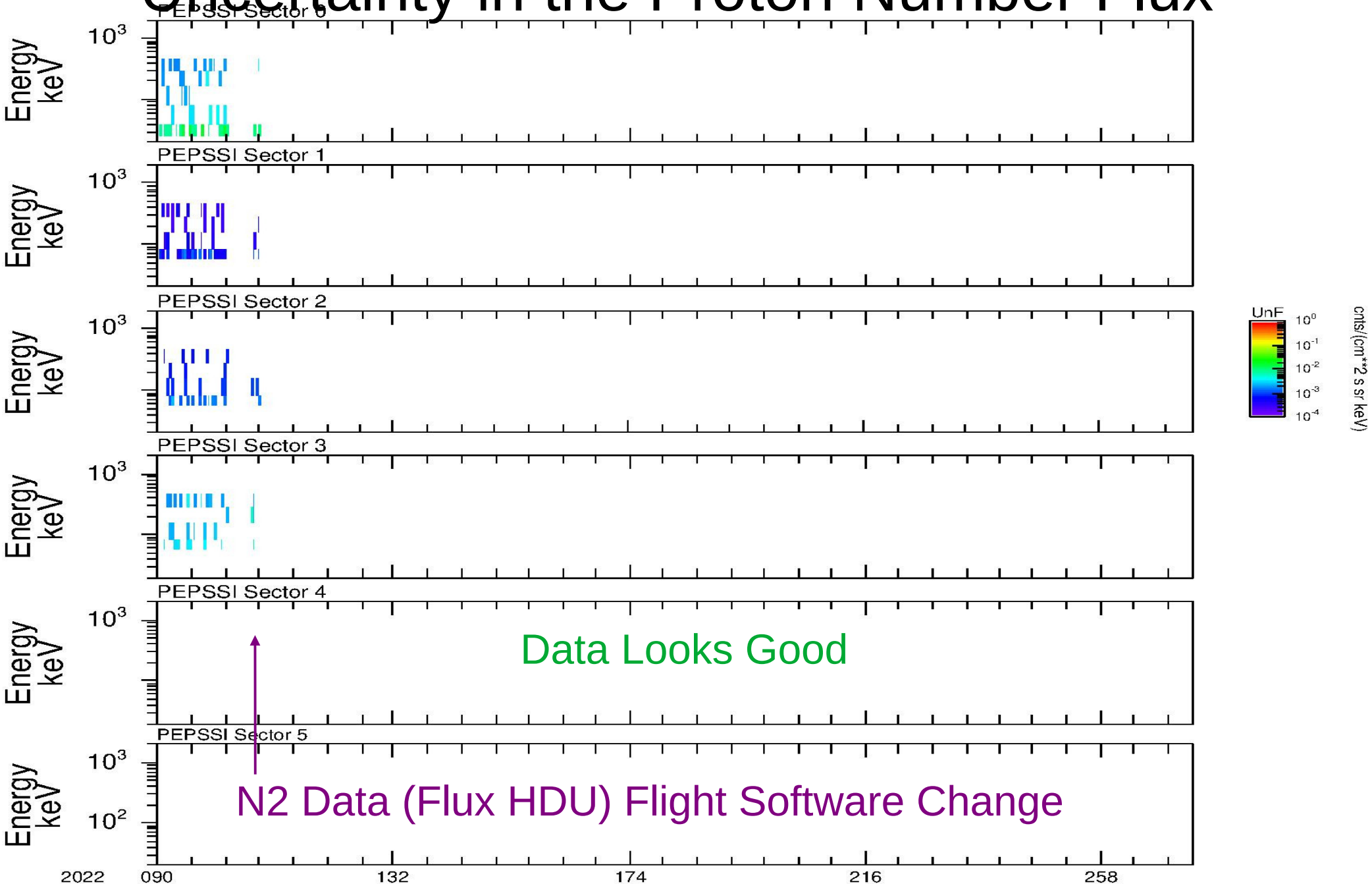
# HDU (Index+1): 7 (N2 Data Time 2)
# "B" Proton Number Flux



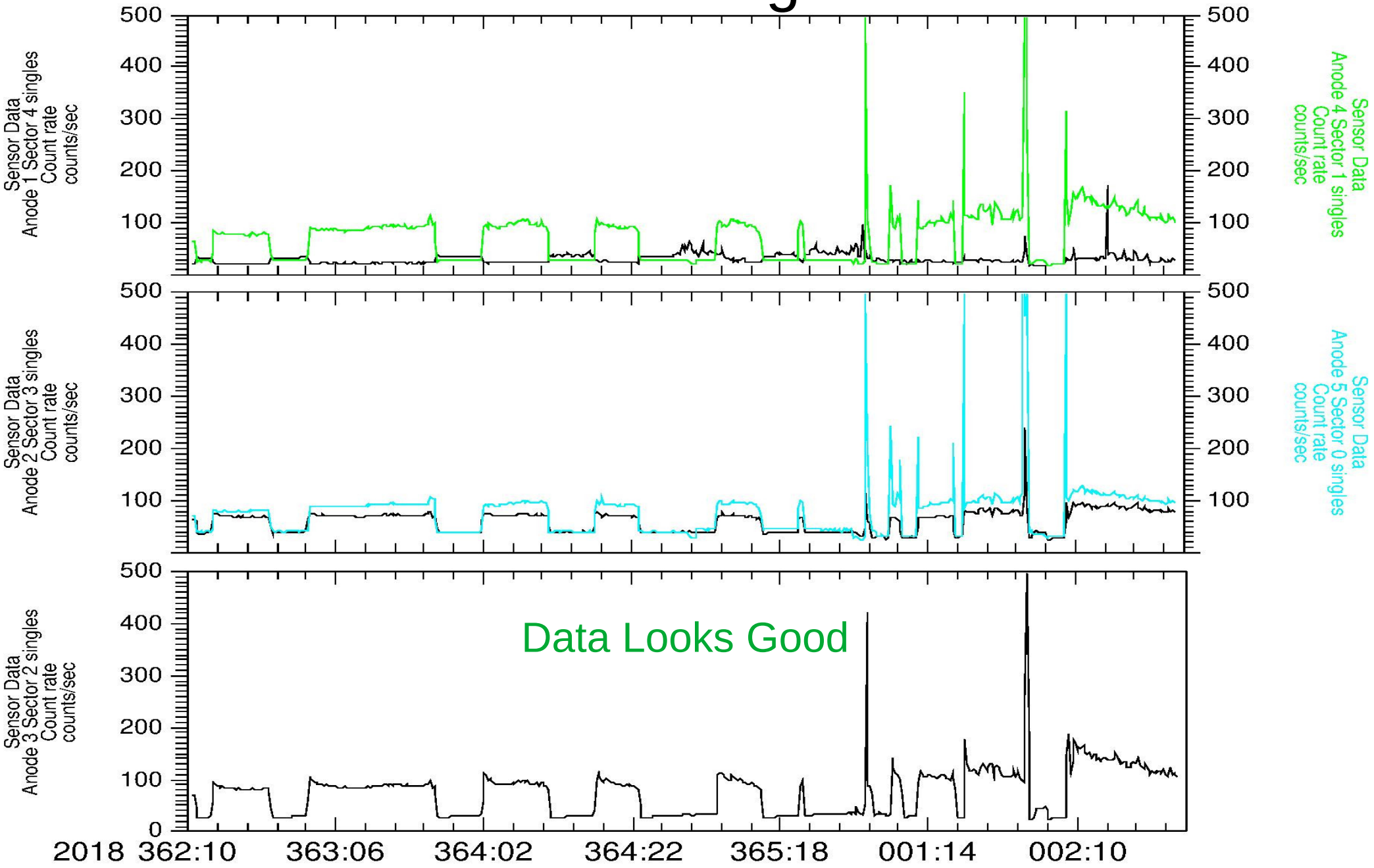
# HDU (Index+1): 7 (N2 Data Time 1) Uncertainty in the Proton Number Flux



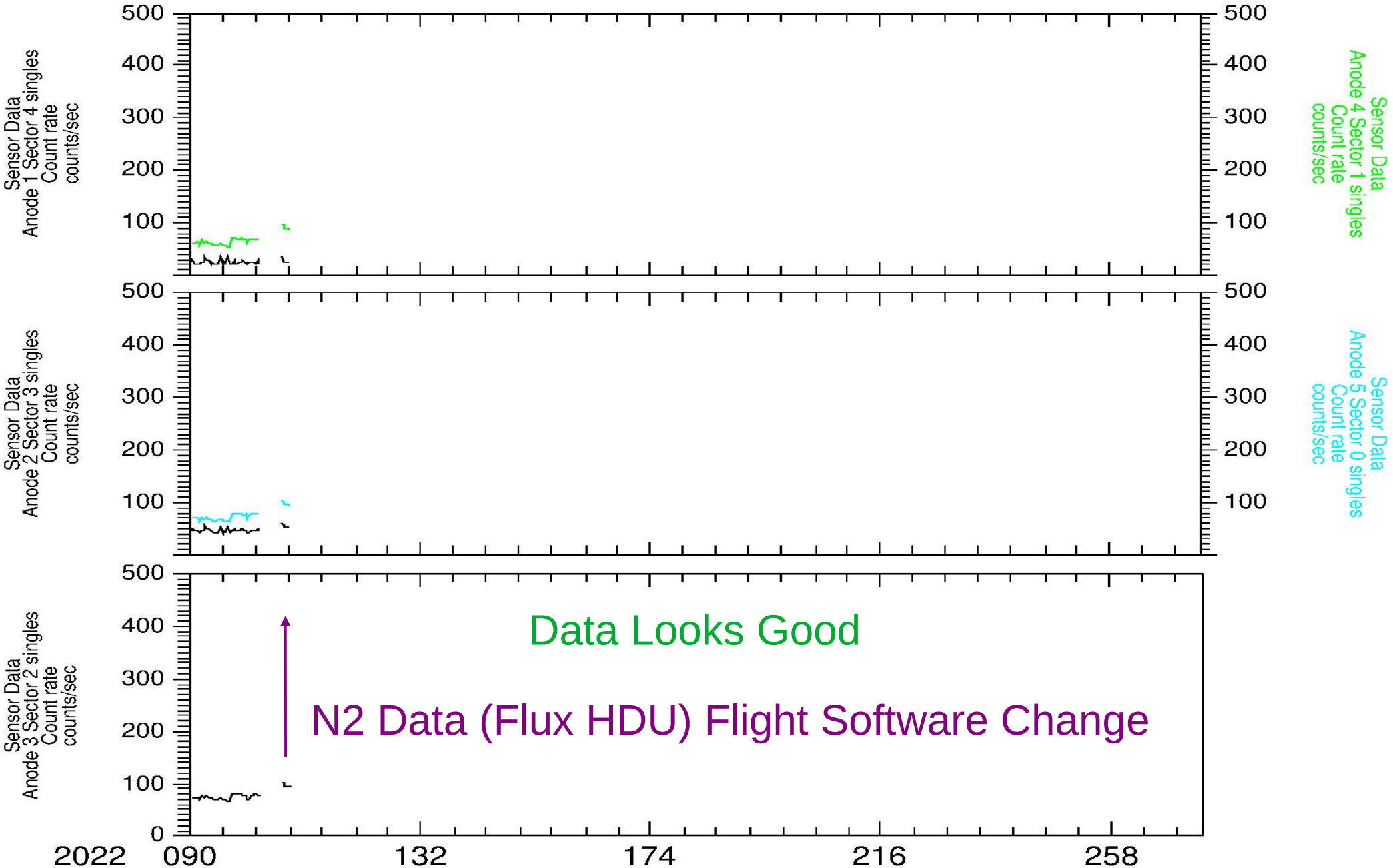
# HDU (Index+1): 7 (N2 Data Time 2) Uncertainty in the Proton Number Flux



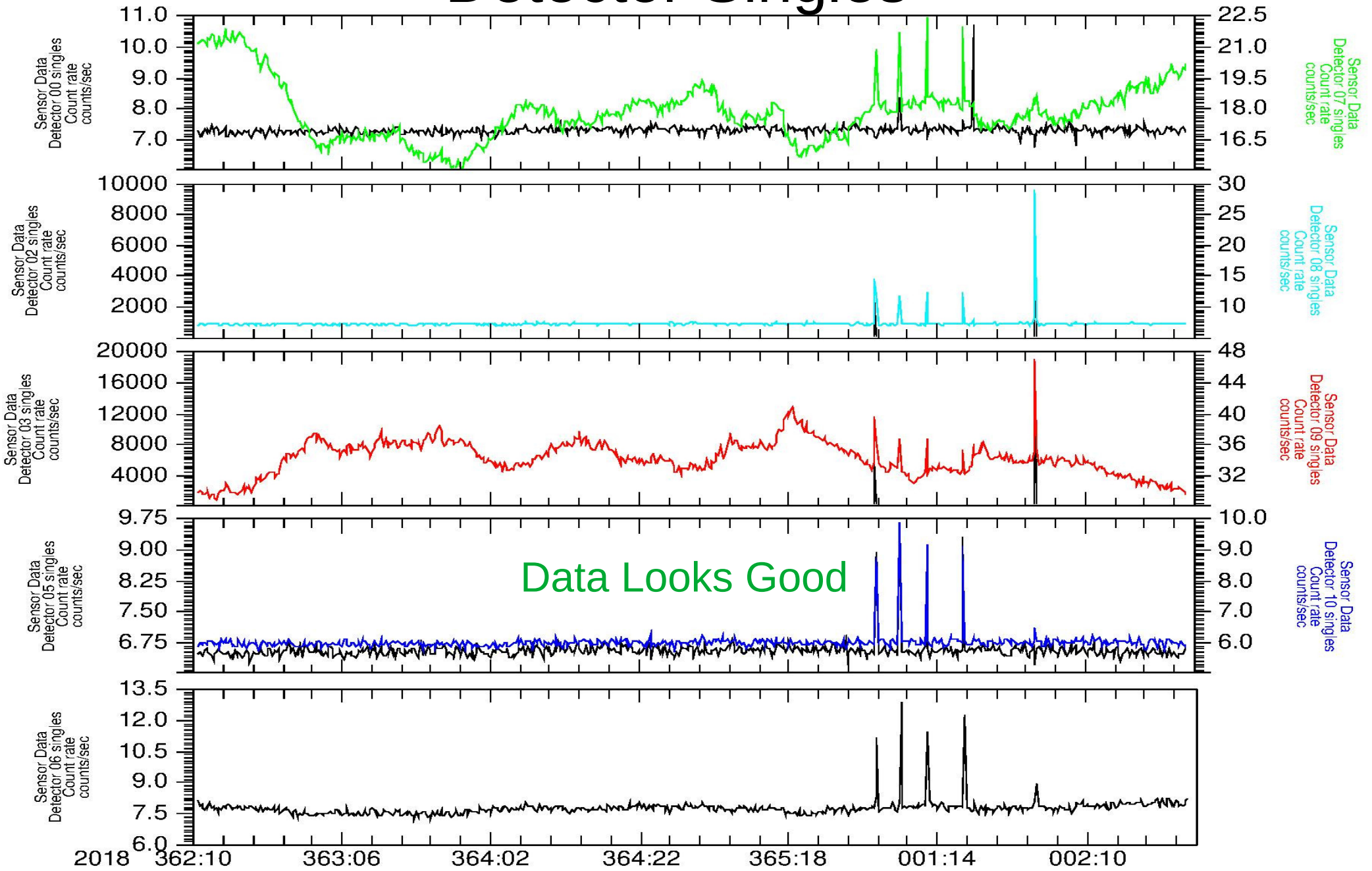
# HDU (Index+1): 7 (N2 Data Time 1)
# Anode Singles



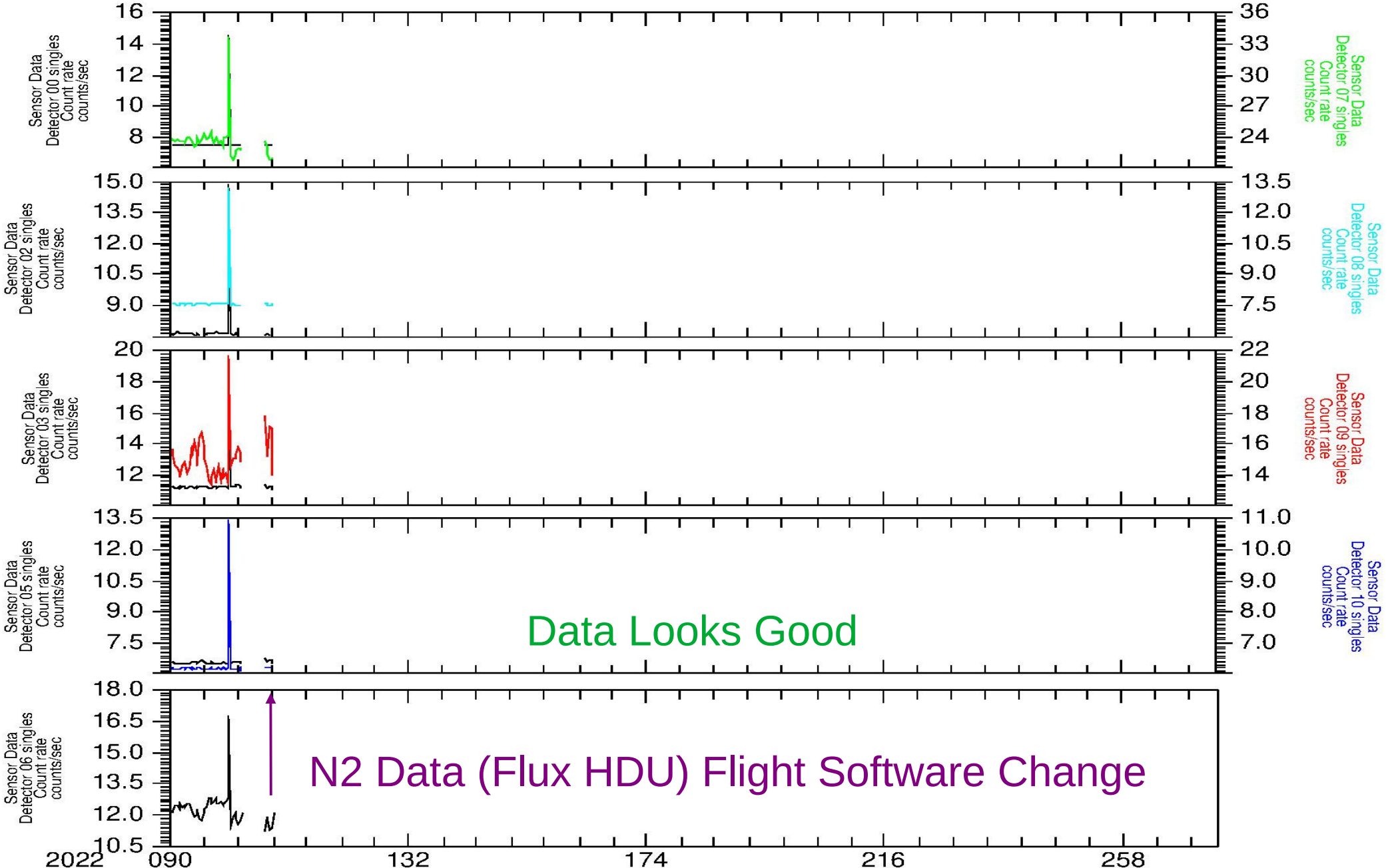
# HDU (Index+1): 7 (N2 Data Time 2)
# Anode Singles



# HDU (Index+1): 7 (N2 Data Time 1)
# Detector Singles

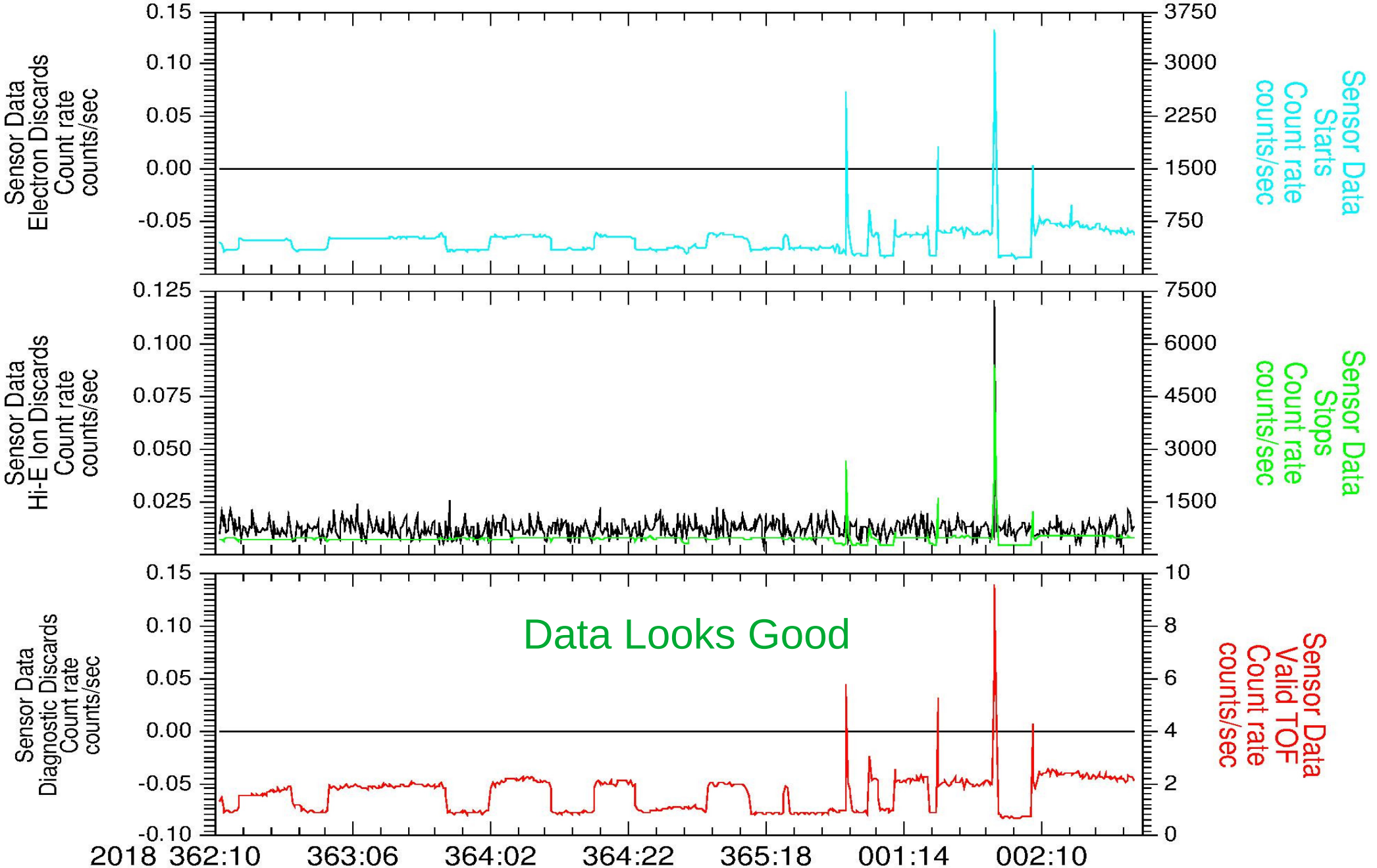


# HDU (Index+1): 7 (N2 Data Time 2)
# Detector Singles



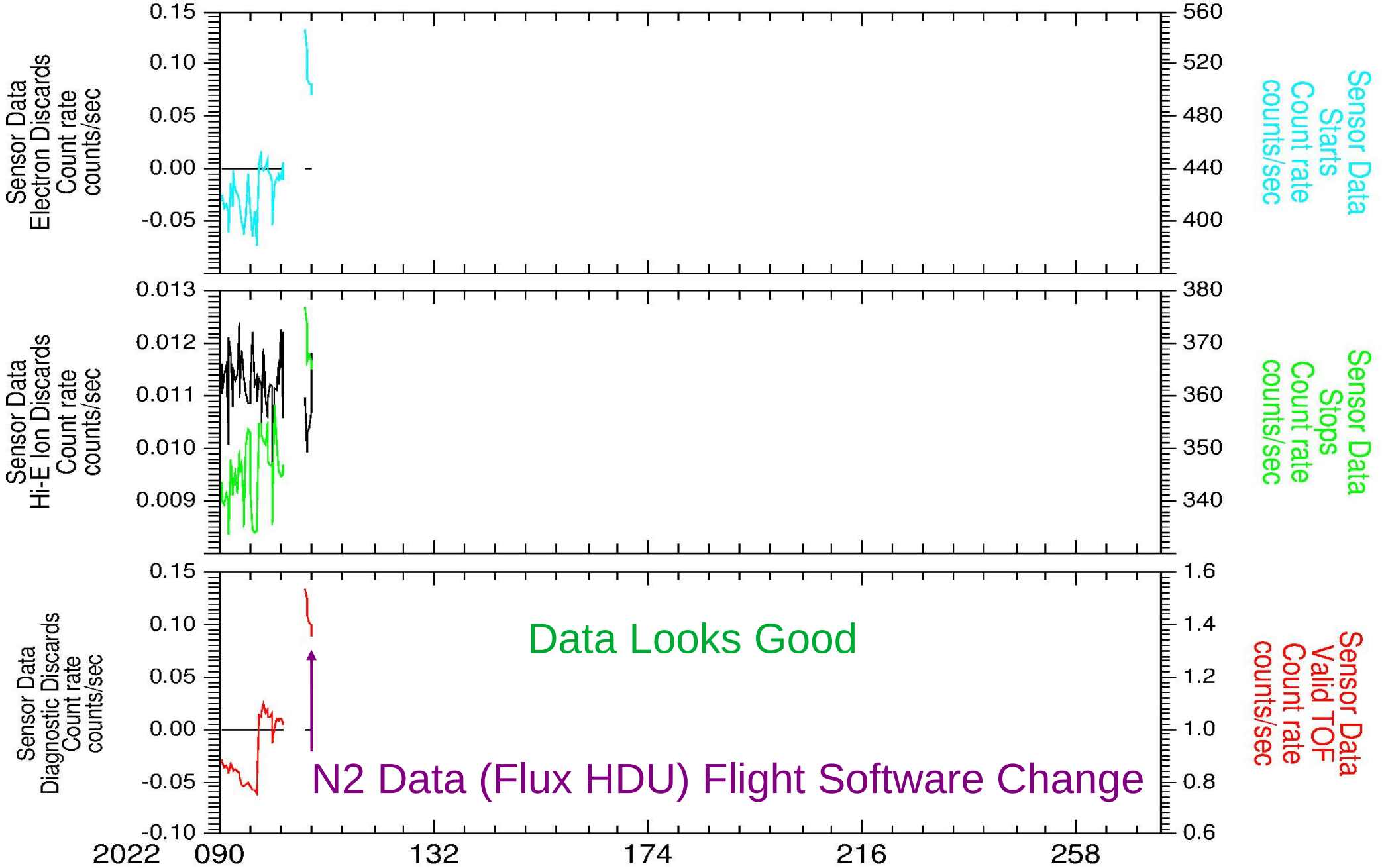
# HDU (Index+1): 7 (N2 Data Time 1) Discards



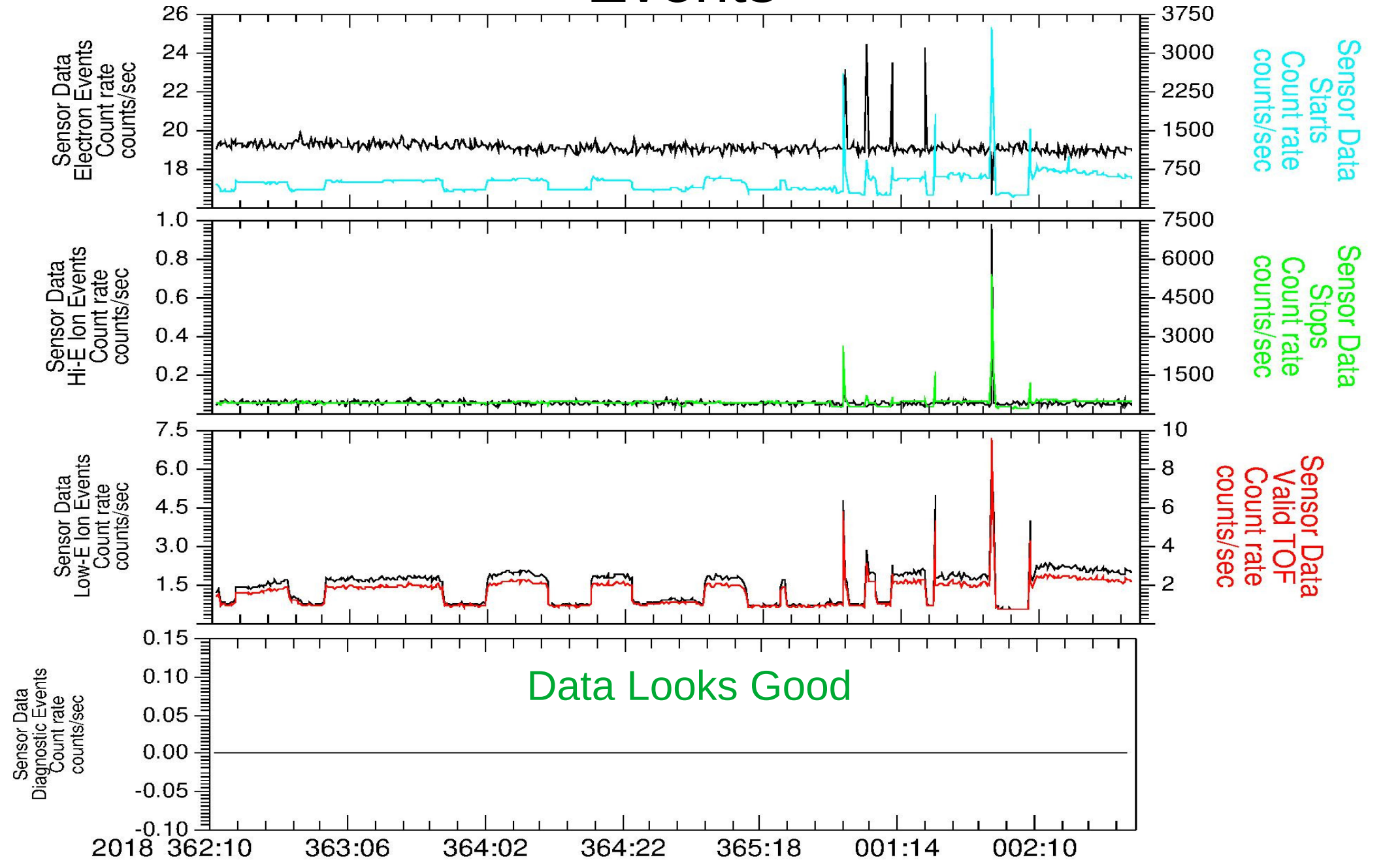


# HDU (Index+1): 7 (N2 Data Time 2) Discards



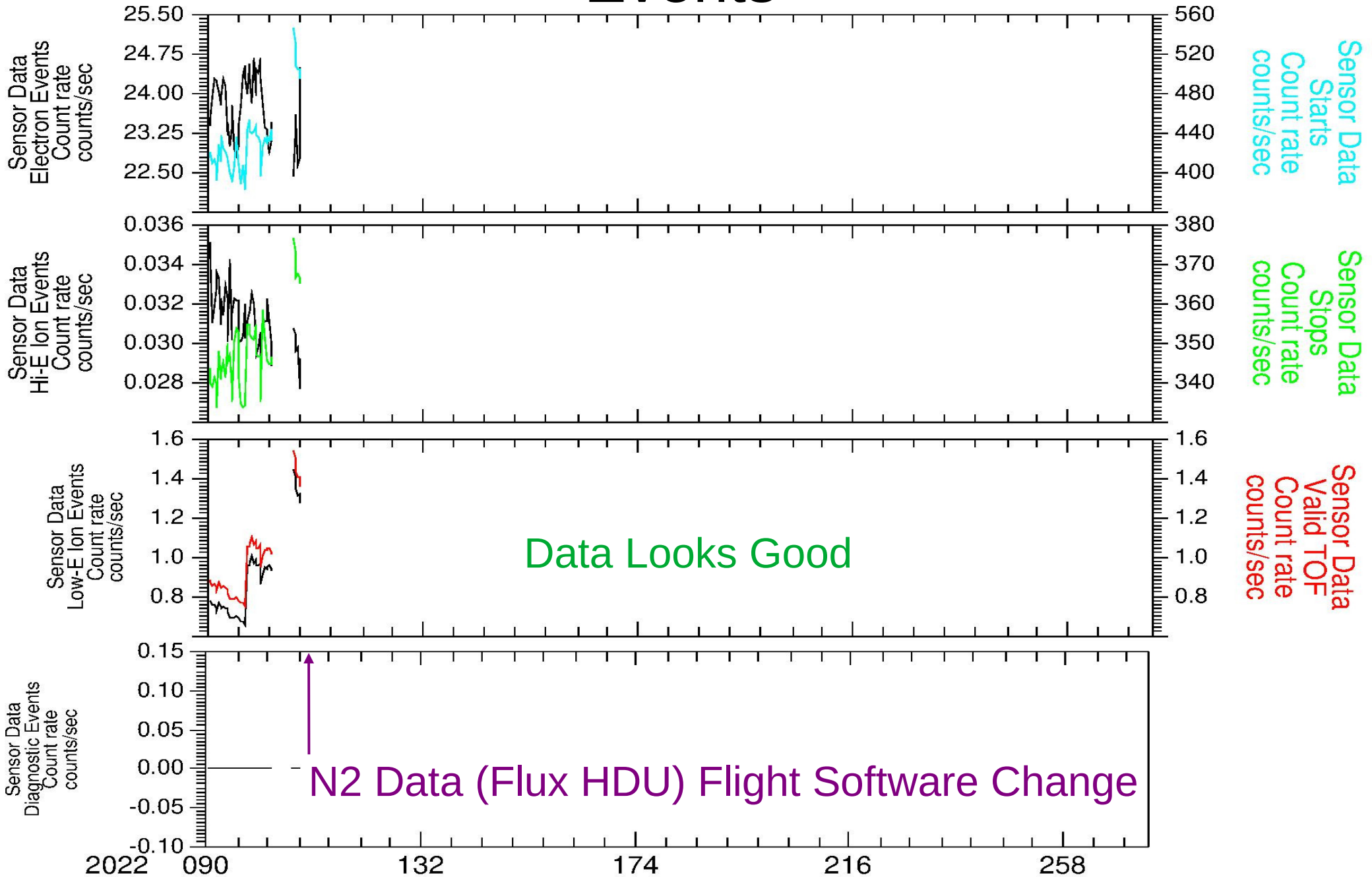


# HDU (Index+1): 7 (N2 Data Time 1) Events

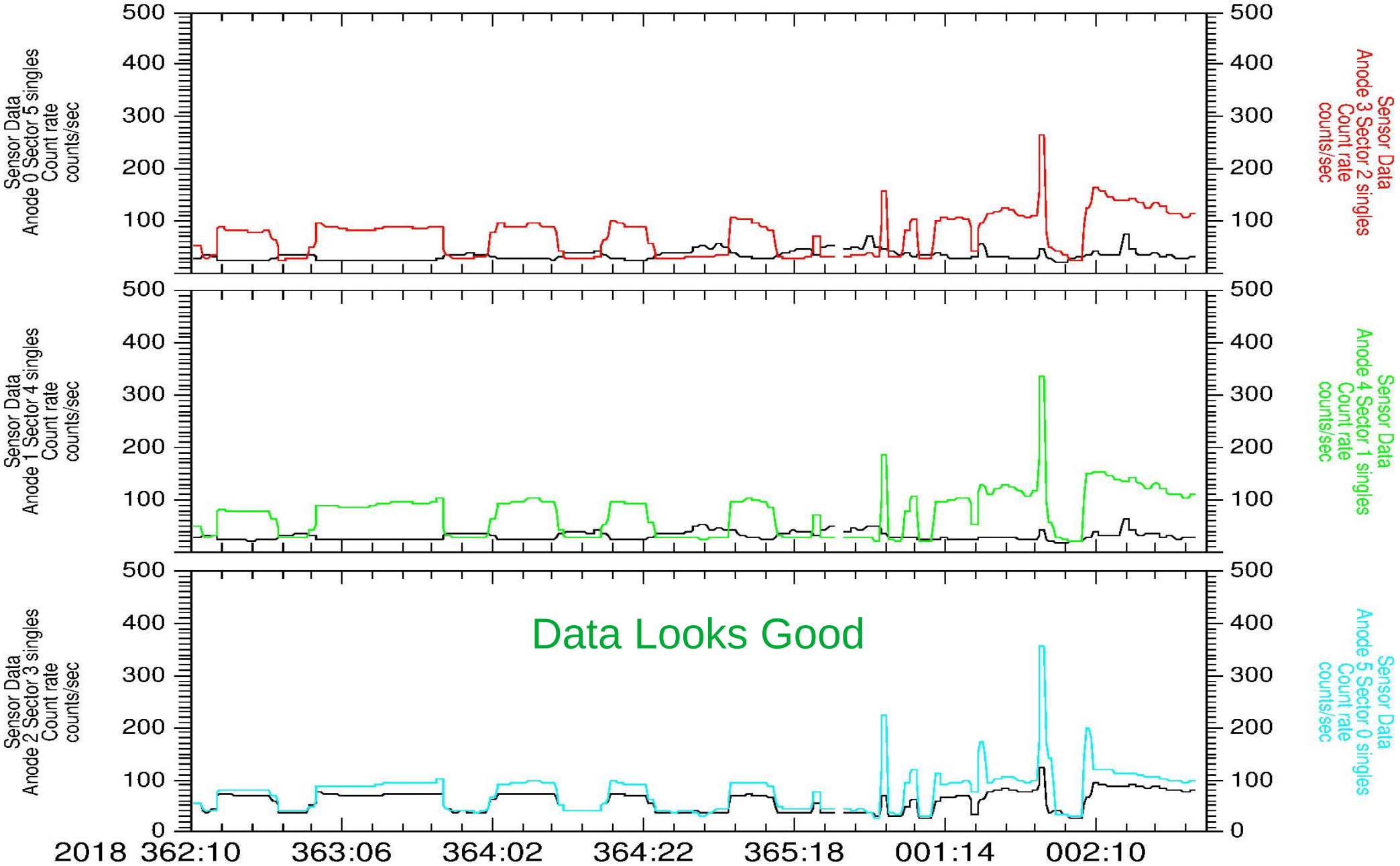


# HDU (Index+1): 7 (N2 Data Time 2) Events

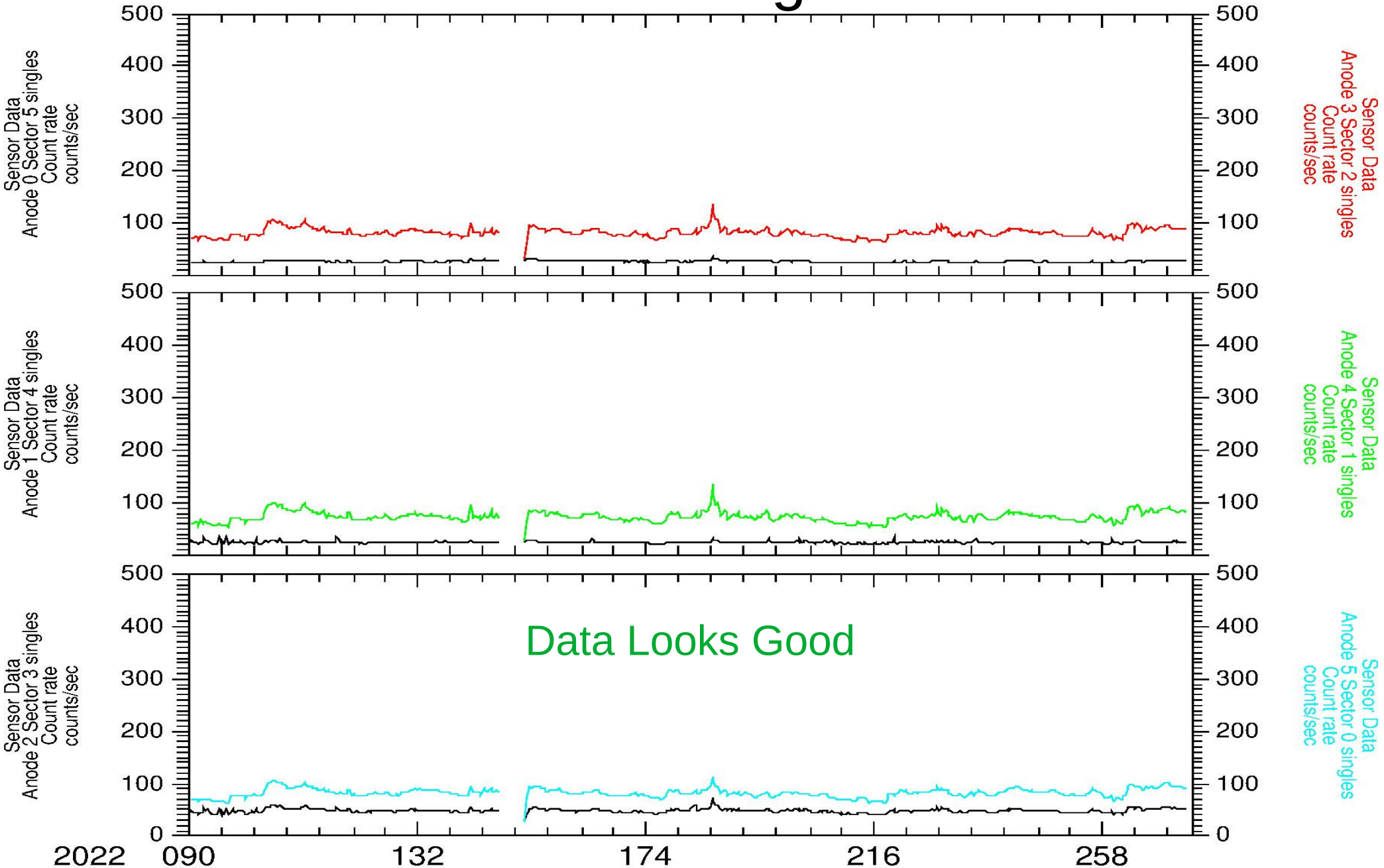




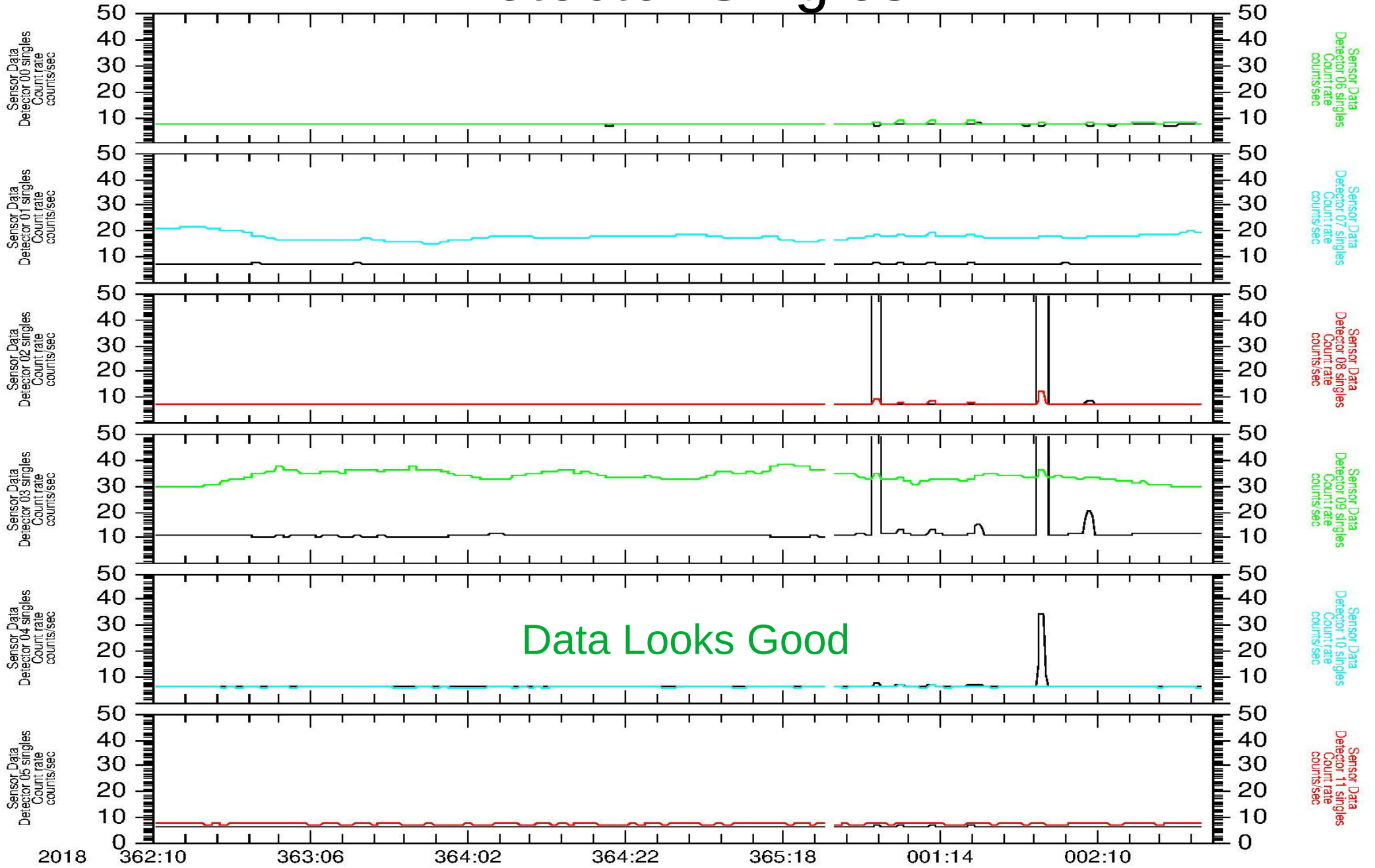
# HDU (Index+1): 8 (N1 Data Time 1)
# Anode Singles



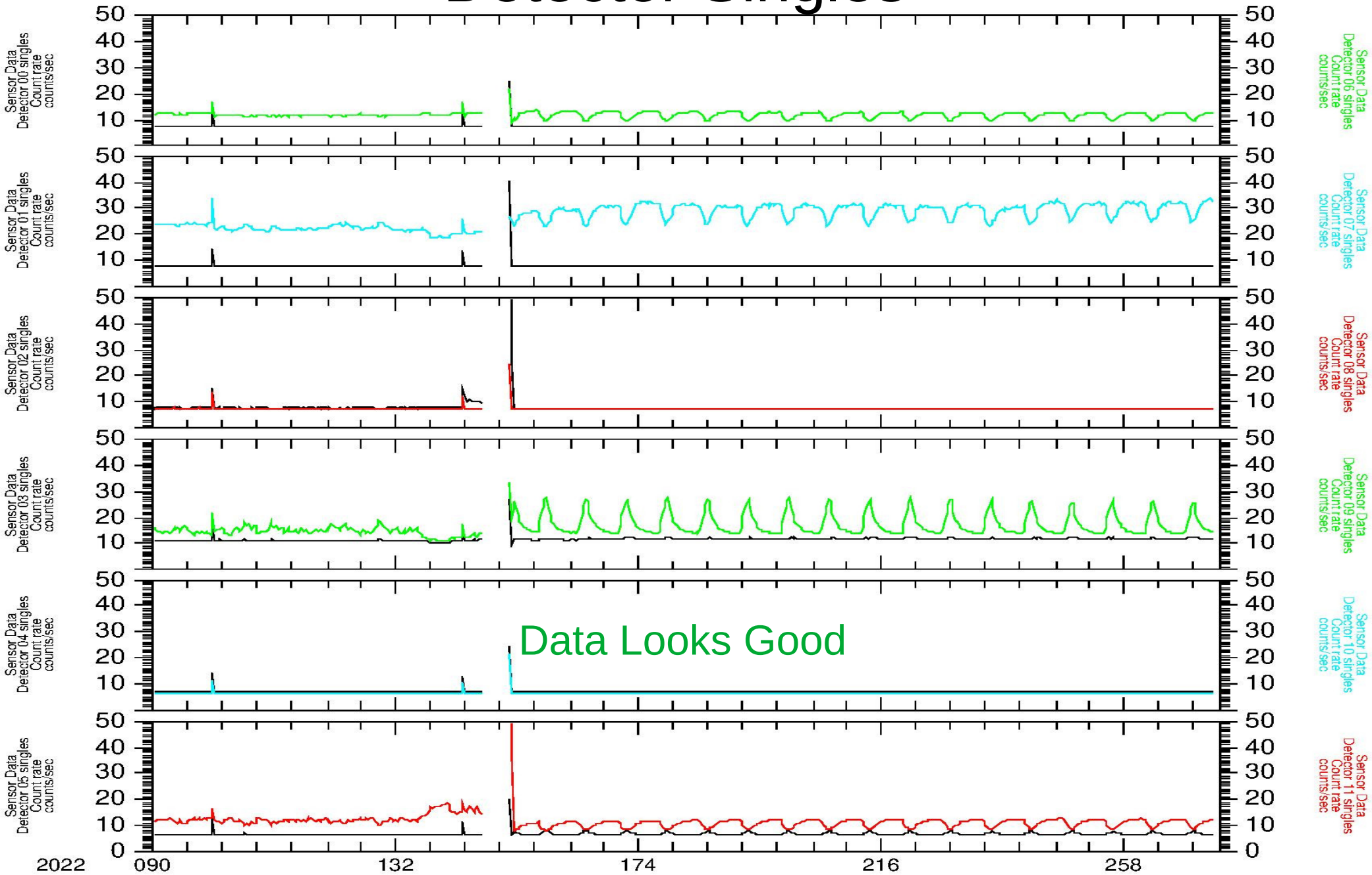
# HDU (Index+1): 7/8 (N1 Data Time 2)
# Anode Singles



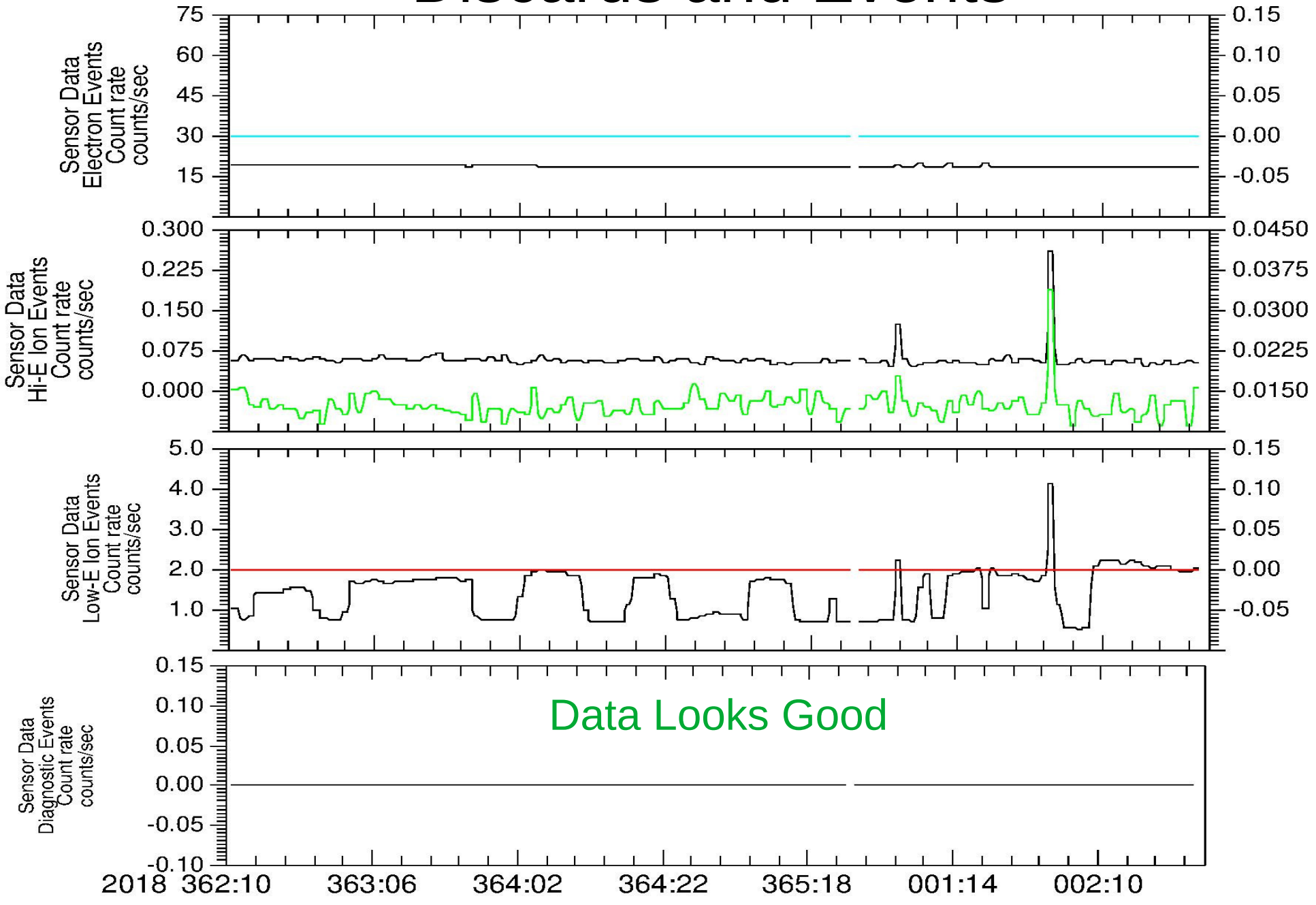
# HDU (Index+1): 8 (N1 Data Time 1) Detector Singles



# HDU (Index+1): 7/8 (N1 Data Time 2) Detector Singles

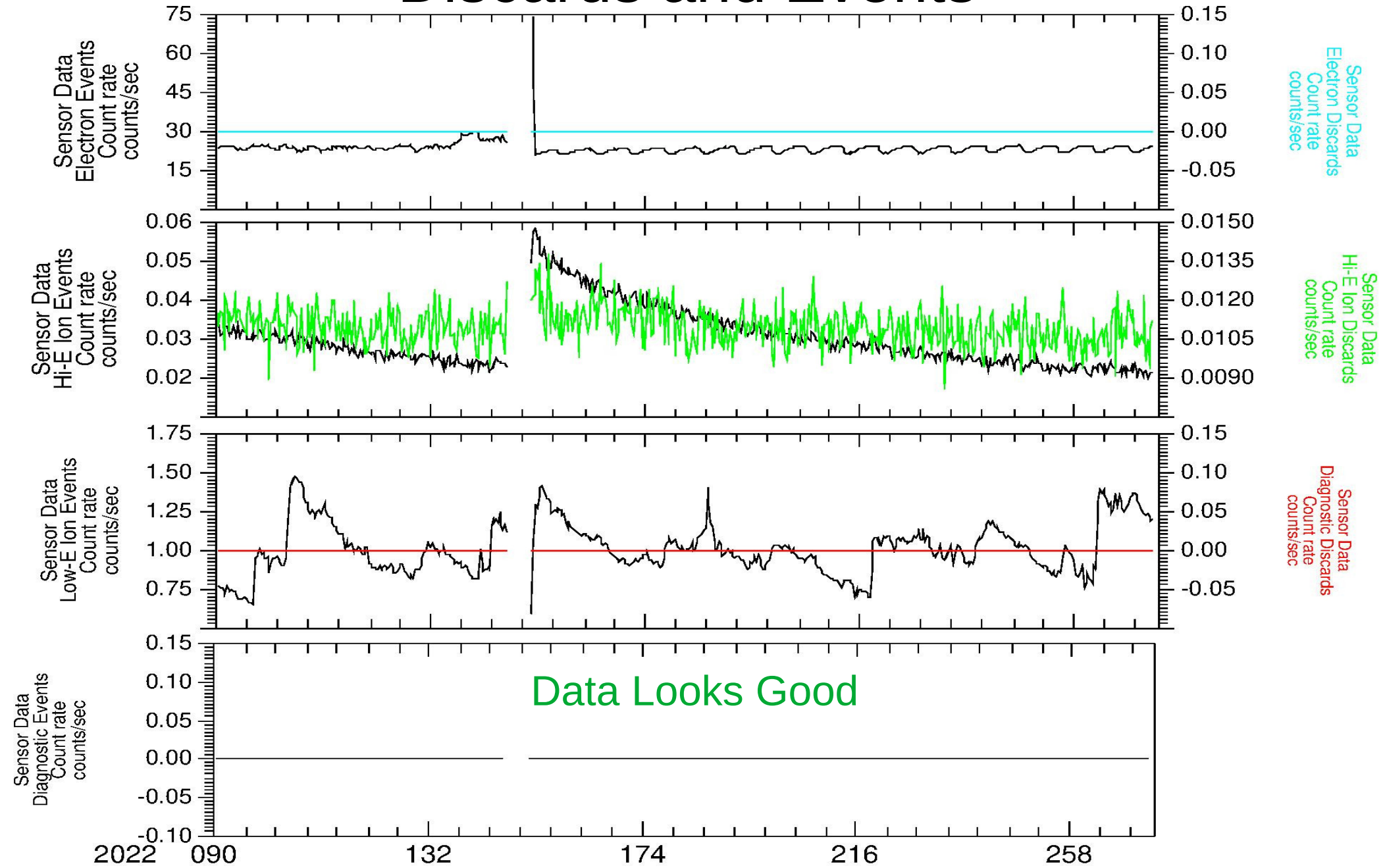


# HDU (Index+1): 8 (N1 Data Time 1) Discards and Events



# HDU (Index+1): 7/8 (N1 Data Time 2) Discards and Events





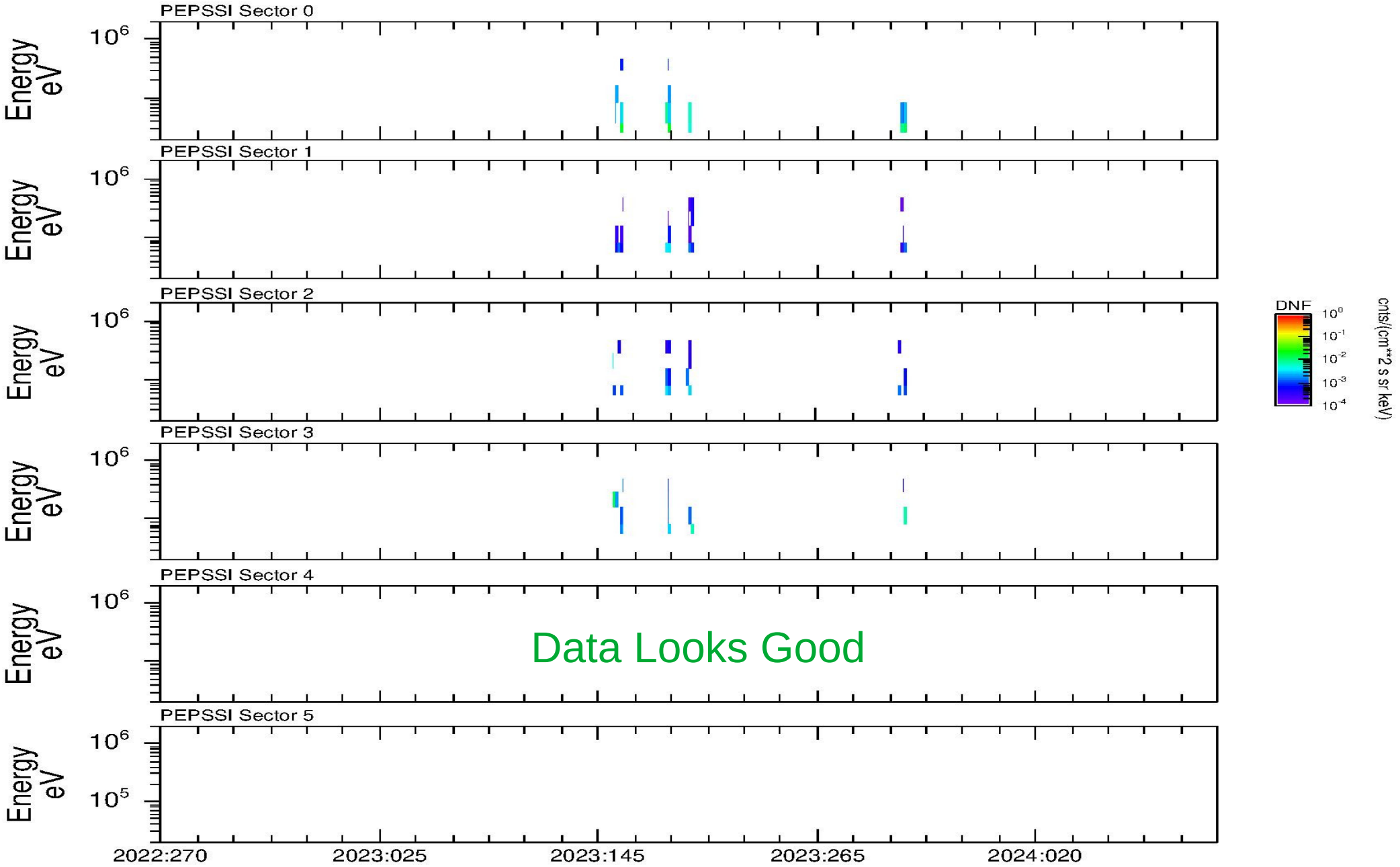
# collection.lblx

NASA PDS Validate v3.6.3: PASS

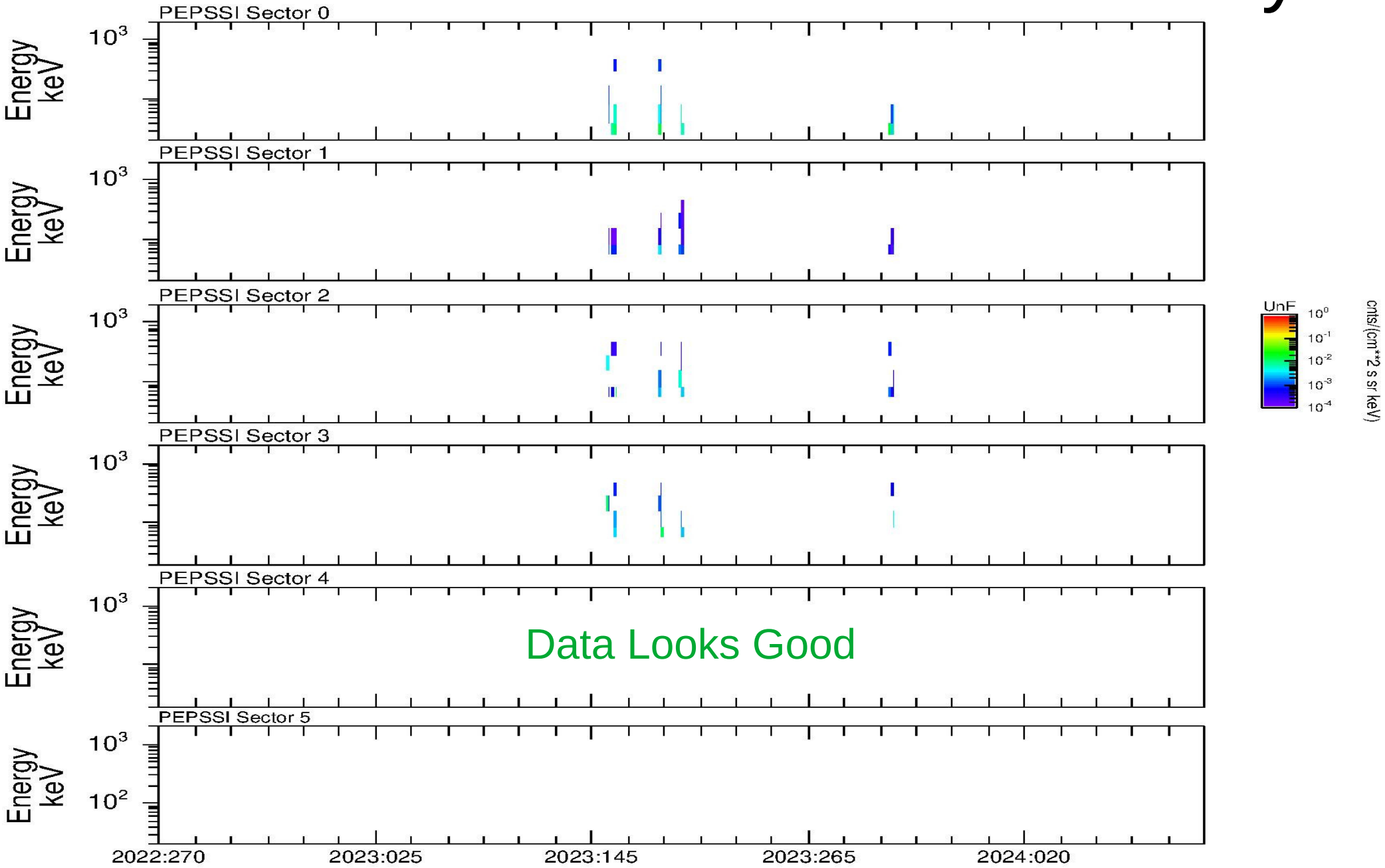
# collection_inventory.lblx

GOOD

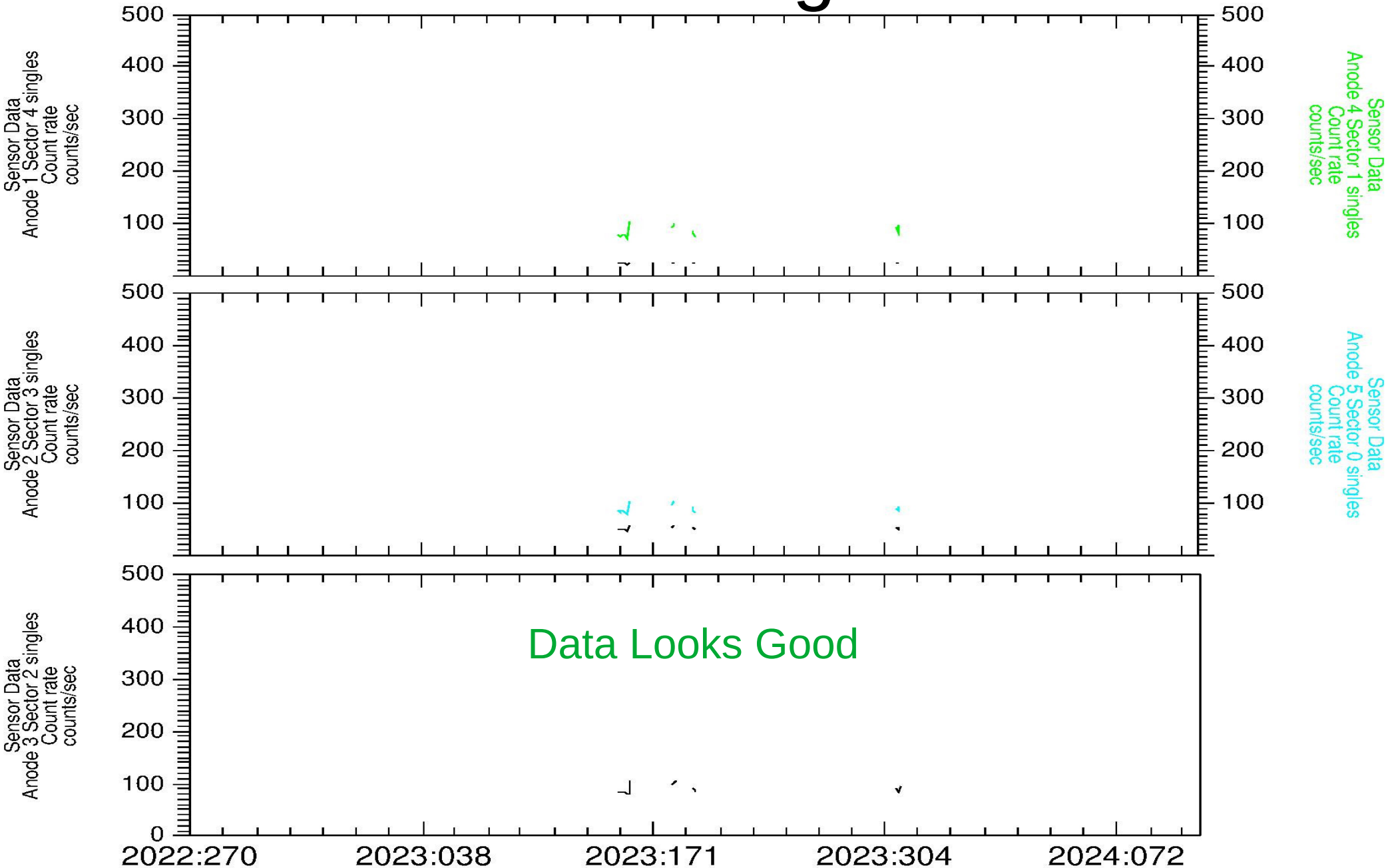
# HDU (Index+1): 7
# ”B” Proton Number Flux



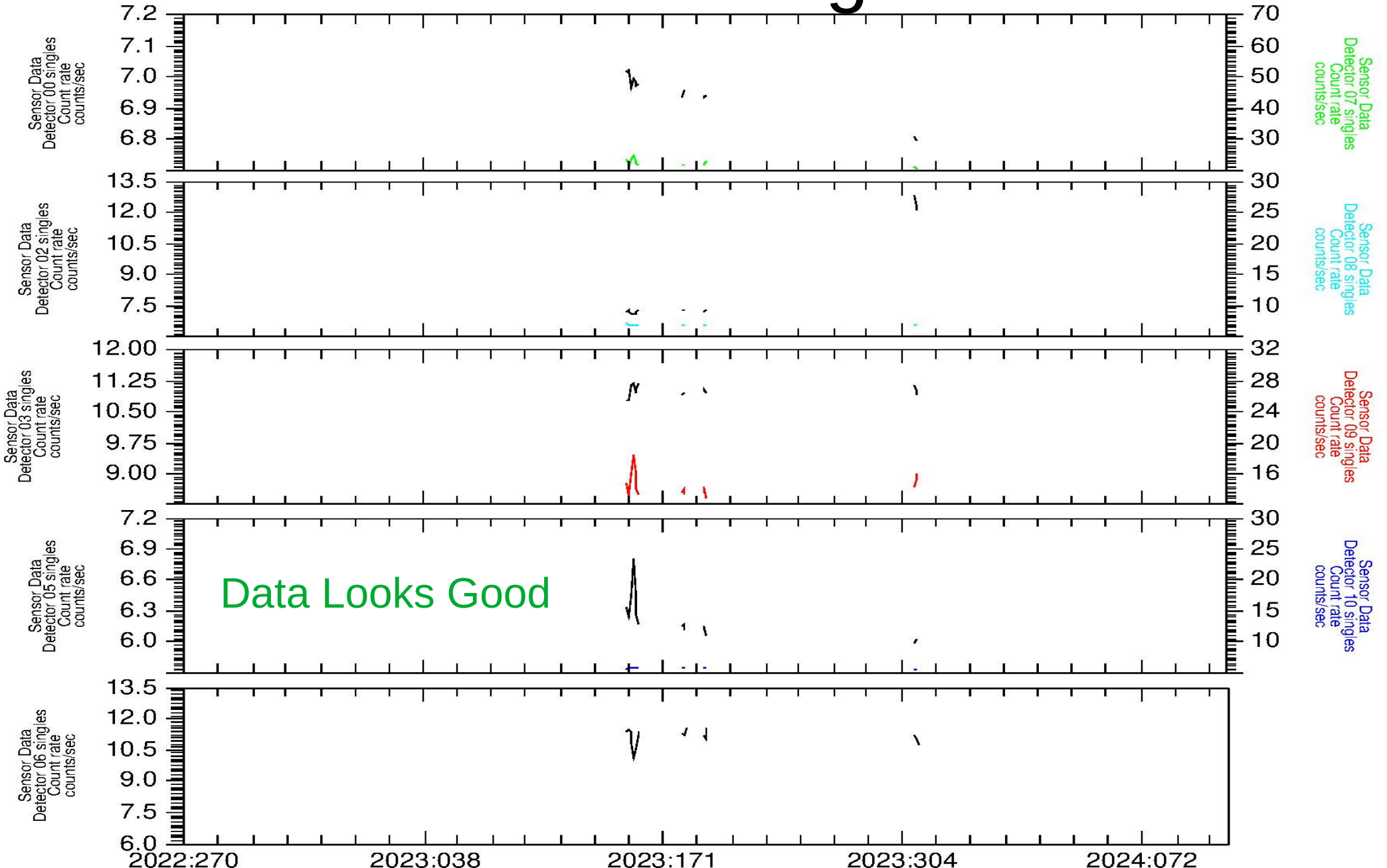
# HDU (Index+1): 7
# ”B” Proton Number Flux Uncertainty



# HDU (Index+1): 7
# Anode Singles



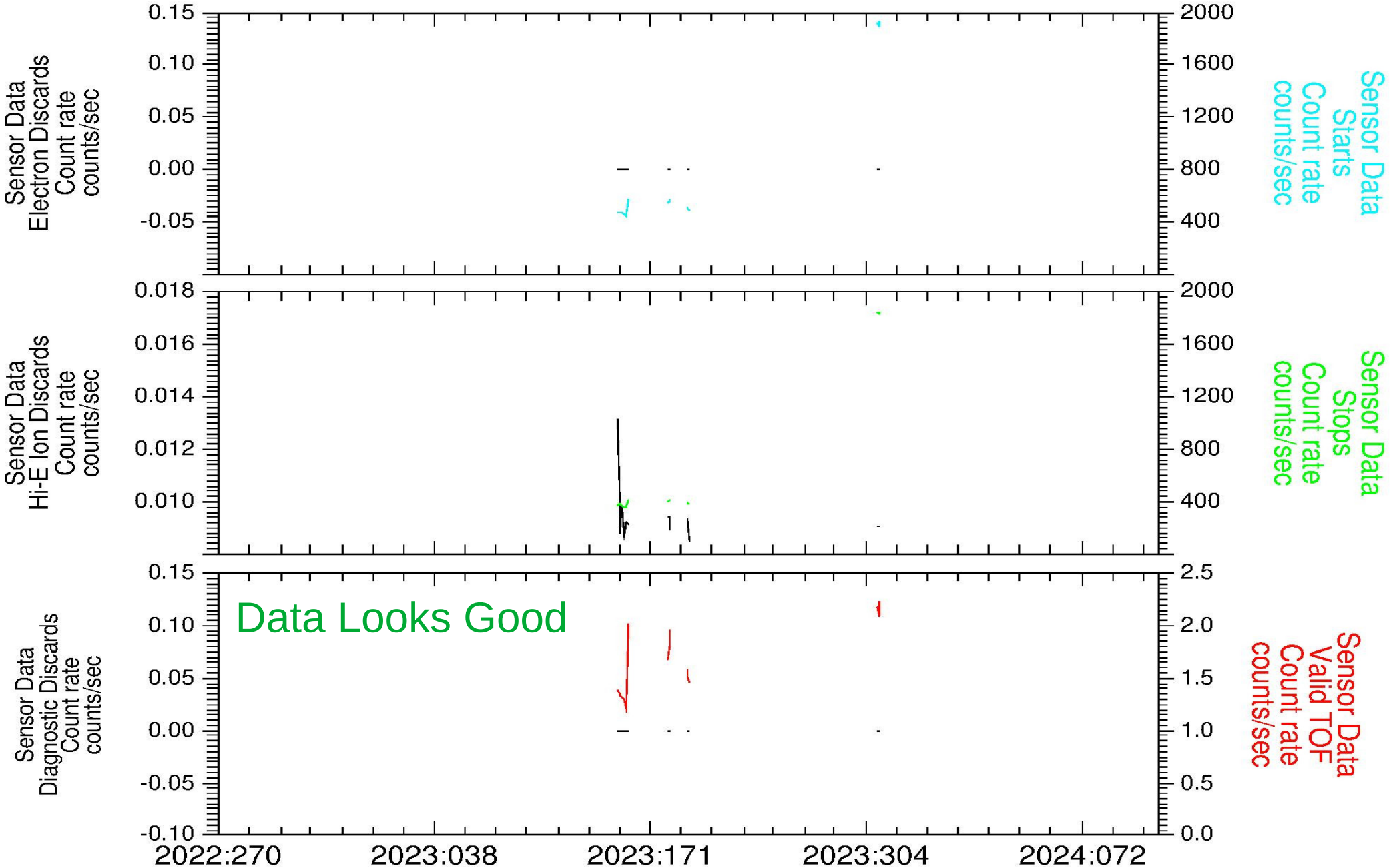
# HDU (Index+1): 7
# Detector Singles




Data Looks Good

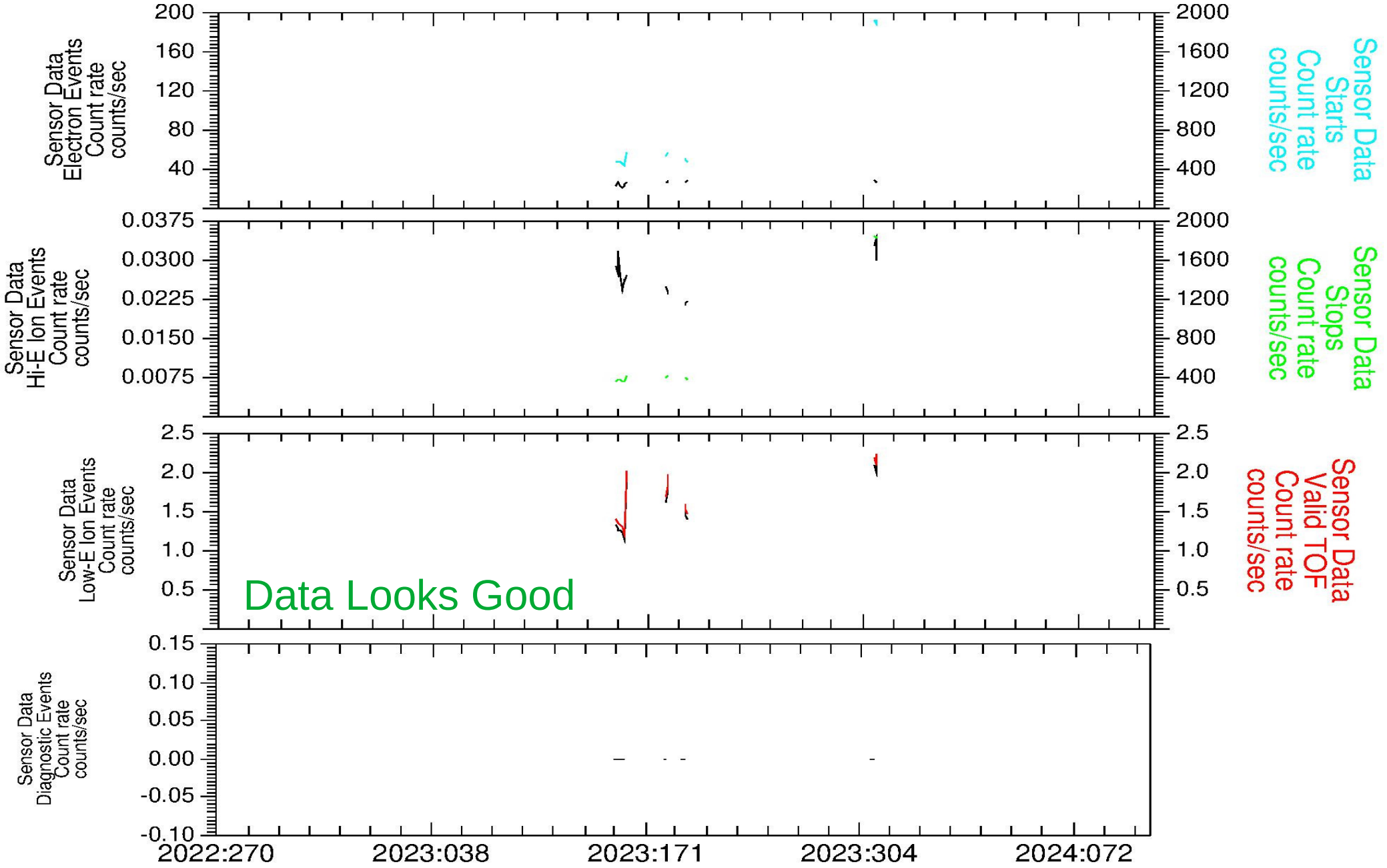
# HDU (Index+1): 7 Discards



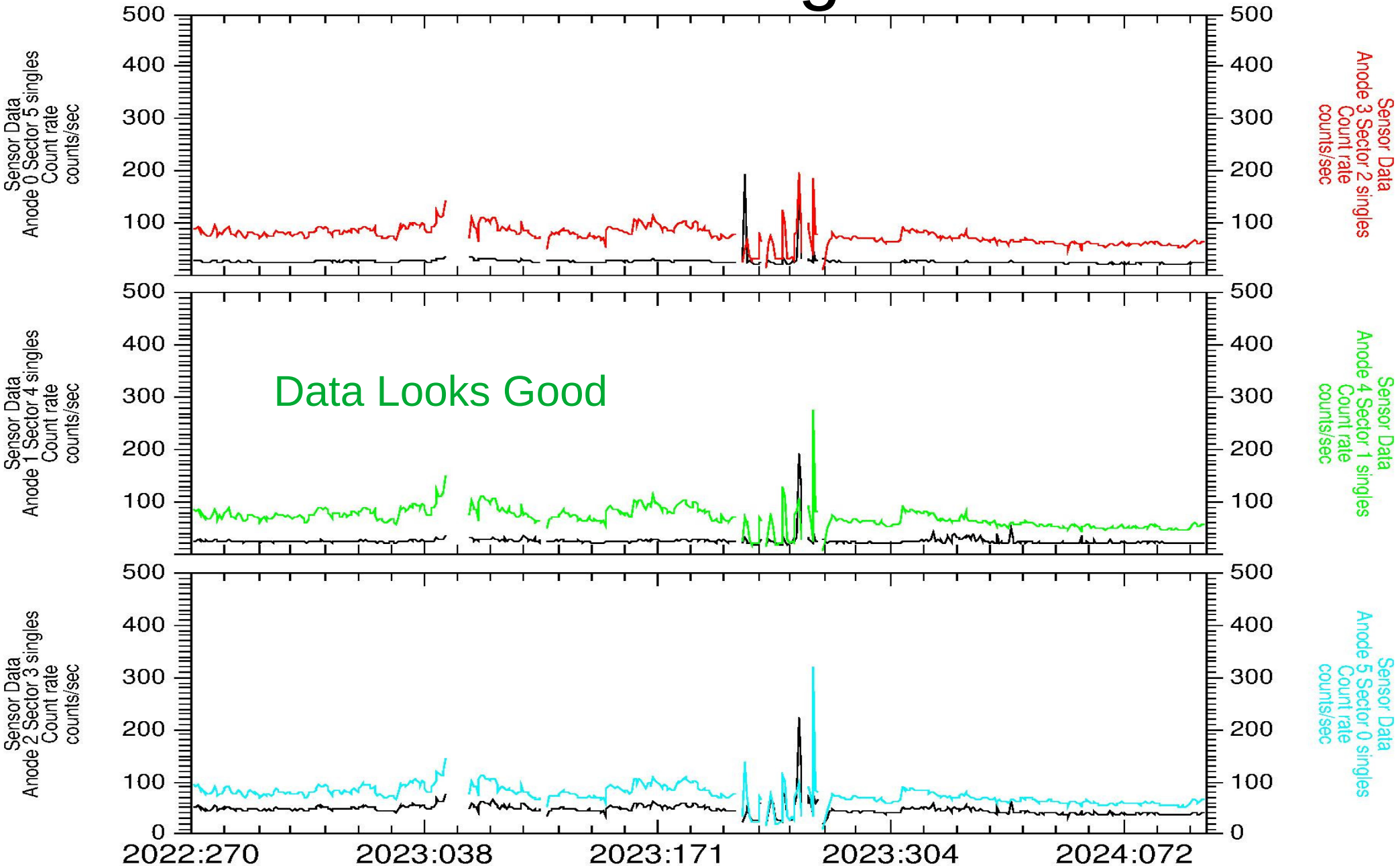


# HDU (Index+1): 7 Events



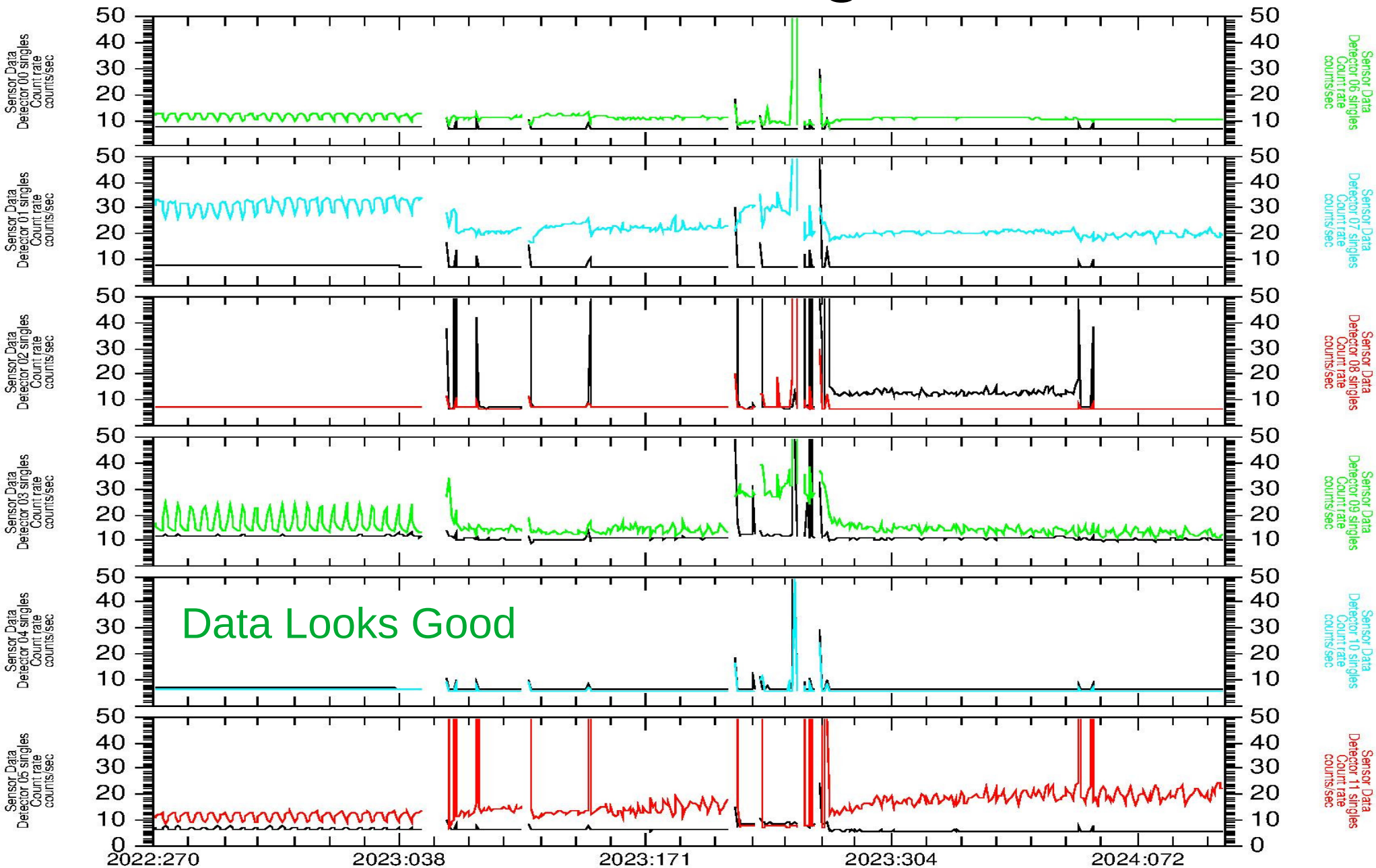


# HDU (Index+1): 8/9
# Anode Singles

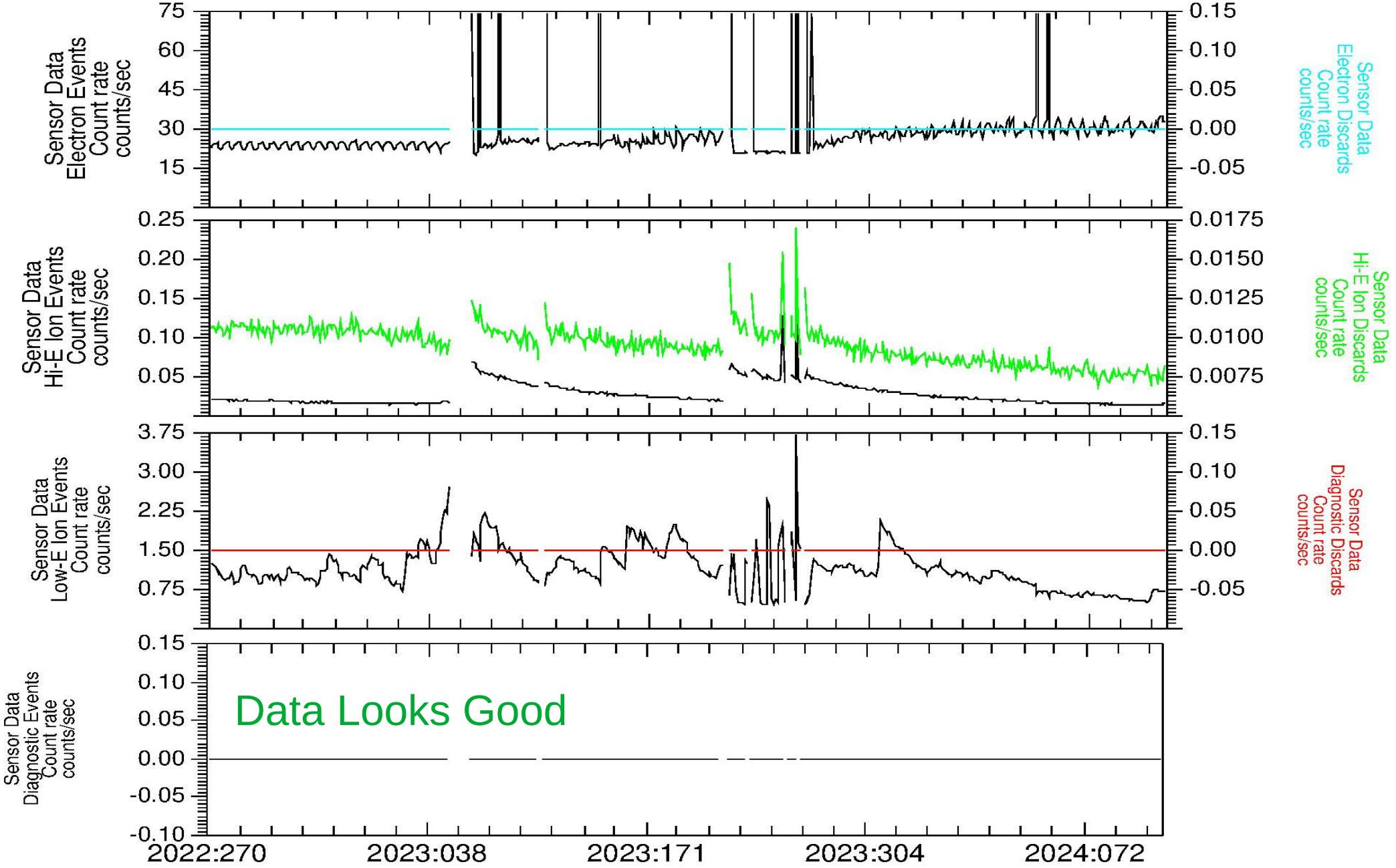



Data Looks Good

# HDU (Index+1): 8/9
# Detector Singles



# HDU (Index+1): 8/9
# Discards and Events



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PDS_VERSION_ID                = PDS3
LABEL_REVISION_NOTE           = "
  2007-09-25 SwRI:Steffl original;
  2009-03-09 NAIF:Semenov changed ARCHIVE_STATUS for release 0001;
  2009-05-12 NAIF:Semenov quoted RELEASE_ID value;
  2014-06-24 SwRI:Carcich Added archive Release 0002;
  2016-04-14 SwRI:Carcich Added archive Release 0003;
  2017-04-30 SwRI:Carcich Added archive Release 0004;
  2020-04-30 SwRI:Enke Added archive Release 0005;
  2021-04-15 SwRI:Enke Added archive Release 0006;
  2024-03-14 SwRI:Enke Added archive Release 0007;
  2024-08-06 SwRI:Enke Added archive Release 0008;
  "
RECORD_TYPE                   = STREAM

OBJECT                        = DATA_SET_RELEASE
  DATA_SET_ID                   = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                    = "0001"
  RELEASE_DATE                  = 2008-02-28
  RELEASE_MEDIUM                = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT        = "&RELEASE_ID=0001"
  PRODUCT_TYPE                  = "SPICE_KERNELS"
  DISTRIBUTION_TYPE             = "NH-SPICE"
  DATA_PROVIDER_NAME            = "SWRI"
  DESCRIPTION                   = "
  This release contains the complete set of New Horizons (NH) SPICE kernels
  for the launch and Jupiter phases of the mission."
END_OBJECT                    = DATA_SET_RELEASE

OBJECT                        = DATA_SET_RELEASE
  DATA_SET_ID                   = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                    = "0002"
  RELEASE_DATE                  = 2014-12-31
  RELEASE_MEDIUM                = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT        = "&RELEASE_ID=0002"
  PRODUCT_TYPE                  = "SPICE_KERNELS"
  DISTRIBUTION_TYPE             = "NH-SPICE"
  DATA_PROVIDER_NAME            = "SWRI"
  DESCRIPTION                   = "
  This release contains the complete set of New Horizons (NH) SPICE kernels
  for the Launch (Commissioning) mission phase, the Jupiter Encounter phase,
  and the eight Annual Checkouts (ACOs) of the Pluto Cruise phase of the
  mission, i.e. through August, 2014"
END_OBJECT                    = DATA_SET_RELEASE

OBJECT                        = DATA_SET_RELEASE
  DATA_SET_ID                   = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                    = "0003"
  RELEASE_DATE                  = 2016-04-30
  RELEASE_MEDIUM                = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT        = "&RELEASE_ID=0003"
  PRODUCT_TYPE                  = "SPICE_KERNELS"
  DISTRIBUTION_TYPE             = "NH-SPICE"
  DATA_PROVIDER_NAME            = "SWRI"
  DESCRIPTION                   = "
  This release contains the complete set of New Horizons (NH) SPICE kernels
  for the Launch (Commissioning) mission phase, the Jupiter Encounter phase,
  the eight Annual Checkouts (ACOs) of the Pluto Cruise phase, and the first
  year of the Pluto Encounter mission phase, i.e. through the end of 2015."
END_OBJECT                    = DATA_SET_RELEASE
OBJECT                        = DATA_SET_RELEASE
  DATA_SET_ID                   = "NH-J/P/SS-SPICE-6-V1.0"
  RELEASE_ID                    = "0004"
  RELEASE_DATE                  = 2017-04-30
  RELEASE_MEDIUM                = "ONLINE DISK STORAGE"
  ARCHIVE_STATUS                = "LOCALLY ARCHIVED"
  RELEASE_PARAMETER_TEXT        = "&RELEASE_ID=0004"
  PRODUCT_TYPE                  = "SPICE_KERNELS"
  DISTRIBUTION_TYPE             = "NH-SPICE"
  DATA_PROVIDER_NAME            = "SWRI"
```

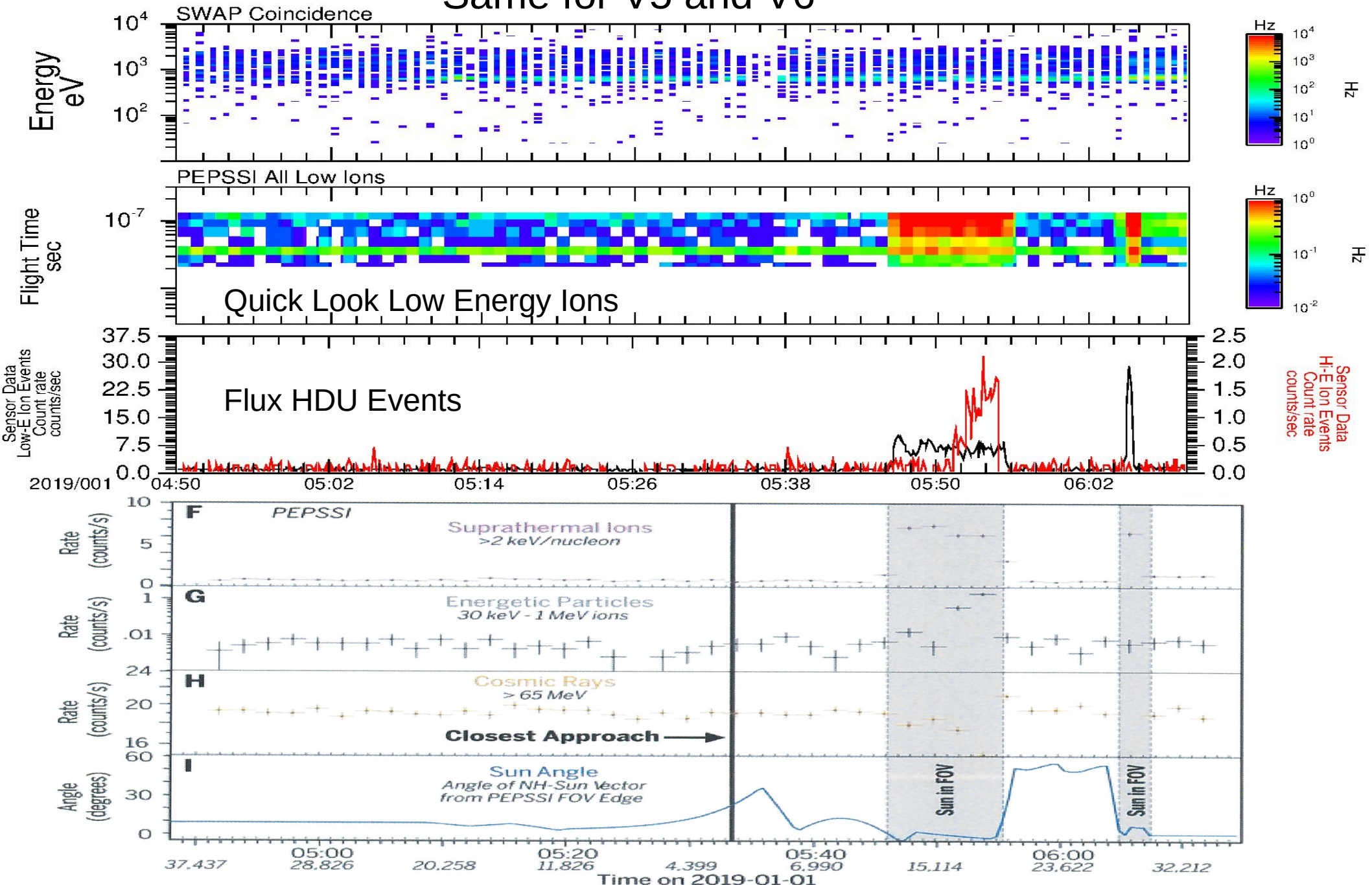
/nh_k7_2025/nh-j_p_ss-spice-6-v1.0/catalog/release.cat

Notice that the version in the file name does not change even through the release ID changes. During this time, SPICE versions have changed upon each release and it is not clear which versions are used to process New Horizons orbit and attitude data.

Since each release contains different file versions, so its contents are not the same. Since the contents are not the same, why is the version number in the data set ID not incremented? It is a different data set.

# PEPSSI-SWAP Arrokoth Encounter – 3 of 3

## Same for V5 and V6




Stern et al., Science, 2019, Figure 8

# PEPSSI Electrons - 3

Why are the fluxes from PEPSSI abnormally high?