ROSETTA Standard Radiation Environment Monitor

Detectors:	three silicon
Mass:	2.5 kg
Size:	96 x 122 x 217 mm
Angular Resolution:	±20°
Power:	2.5 Watts
Detector 3:	0.7 mm Al Window
Minimum Energy	
Electrons:	~0.5 MeV
Protons:	~10 MeV
Detectors 1/2:	2.0 mm Al Window
Separator:	1.7 mm Al & 0.7 mm Ta
Minimum Energy	
D1 Electrons:	1.5 MeV
D1 Protons:	20 MeV
D2 Electrons:	Blocked
D2 Protons:	~39 MeV

15 Discriminator Channels

PRINCIPAL INVESTIGATOR
Hugh Evans & Petteri Nieminen

Data Set Evaluation Tools

Evaluation -

Machine: IBM Ienovo T60p ThinkPad

Operating System: Fedora 25 Linux

Evaluation -

Machine: Dell Precision T3400

Operating System: Fedora 19 Linux

Data Processing -

Machine: Sun Ultra-350

Operating System: Sun Solaris OS 5.9

SREM Data Sets

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0

Documentation Evaluation

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
catinfo.cat

```
*********************************   File CATINFO.TXT   *****************************

CATINFO.TXT             This file.

DATASET.CAT             Description of the NAVCAM data for the mission phase
                        PRL: PRELANDING    .

INSTHOST.CAT            Information about the Rosetta S/C (the instrument
                        host) as provided by ESA.

MISSION.CAT             Information about the Rosetta Mission as provided
                        by ESA.

NAVCAM_INST.CAT         Instrument description for the Rosetta NAVCAM.

NAVCAM_PERS.CAT         NAVCAM contact catalog.

REF.CAT                 Catalog of NAVCAM related documents and publications
                        provided by ESA.

SOFTWARE.CAT            Information regarding S/W accompanying NAVCAM data.

TARGET.CAT              Detailed Rosetta Targets as provided by ESA.

*******************************************************************************
```

This is not NAVCAM data, it is SREM data!

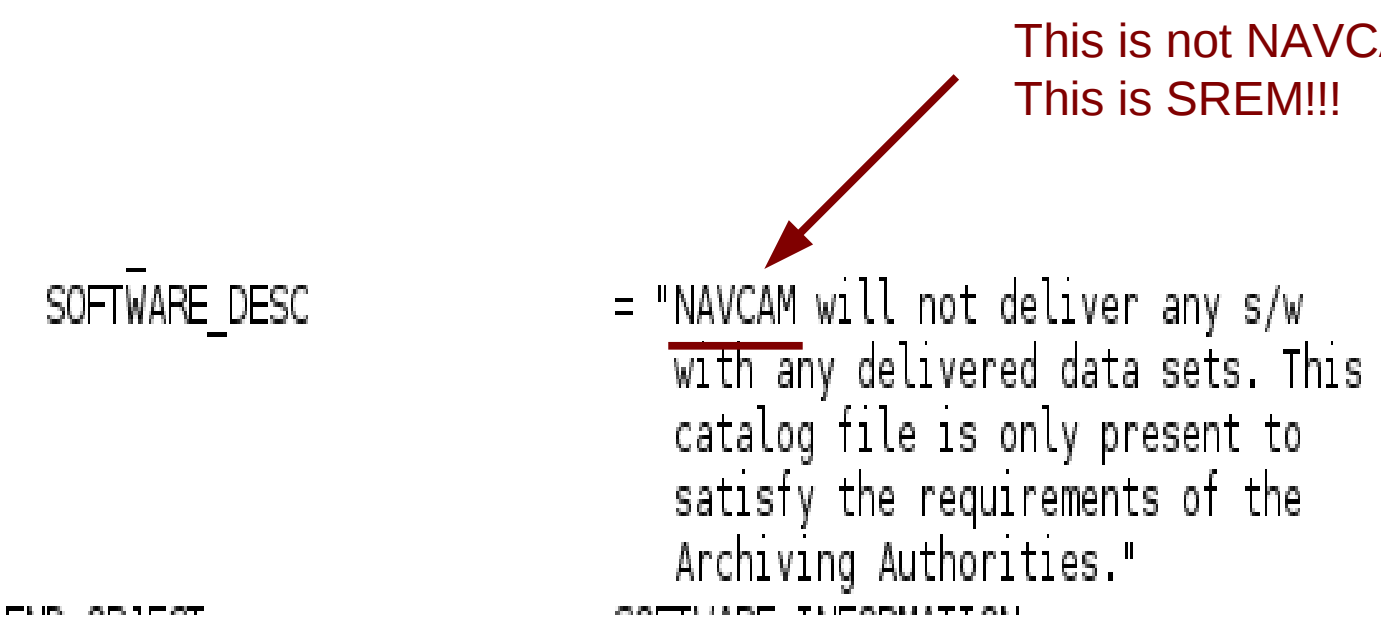
This file looks like it was taken from NAVCAM and not updated. NAVCAM instrument and personal files are not included in this directory. TARGET.CAT file is not included in this directory. SREM Instrument and Personal file is included.

Mission Phase is not Correct.

RID: SREM-US-RF-001

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
software.cat

This is not NAVCAM,
This is SREM!!!



RID: SREM-US-RF-002

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
pers_srem.cat

Missing Contact Information for SREM
PRINCIPAL INVESTIGATORS
Hugh Evans & Petteri Nieminen

RID: SREM-US-RF-003

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 1 of 6

RID: SREM-US-RF-004

SREM is a particle detector, developed for space applications. It measures high energy electrons and protons with a fair angular and spectral resolution and provides the host spacecraft with radiation information.

What does “fair” mean? Why is the angular resolution Not quoted? The spectral resolution needs to be discussed.

SREM is an integral instrument. As such, there needs to be more description of What SREM actually measures and how the integral measurements are turned Into a differential measurement. Since each detector measures both protons and electrons, it is not clear how these are separated.

Rosetta specific information is missing!

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 2 of 6

SREM	Proton Energy	[MeV]	Electron Energy	[MeV]
Bin	E_{min}	E_{max}	E_{min}	E_{max}
TC1	27	∞	2.00	∞
S12	26	∞	2.08	∞
S13	27	∞	2.23	∞
S14	24	542	3.20	∞
S15	23	434	8.18	∞
TC2	49	∞	2.80	∞
S25	48	270	–	–
C1	43	86	–	–
C2	52	278	–	–
C3	76	450	–	–
C4	164	∞	8.10	∞
TC3	12	∞	0.80	∞
S32	12	∞	0.75	∞
S33	12	∞	1.05	∞
S34	12	∞	2.08	∞

From Sanberg et al, 2012

NR	BIN	LOGIC	PARTICLE	E Min.	E Max.
1	TC1	D1	proton	20	Inf.
2	S12	D1	proton	20	550
3	S13	D1	proton	20	120
4	S14	D1	proton	20	27
5	S15	D1	proton	20	34
6	TC2	D2	proton	39	Inf.
7	S25	D2	Ions	150	185
8	C1	D1*D2	c.proton	40	50
9	C2	D1*D2	c.proton	50	70
10	C3	D1*D2	c.proton	70	120
11	C4	D1*D2	c.proton	130	Inf.
12	TC3	D3	electron	0.5	Inf.
13	S32	D3	electron	0.55	2.3
14	S33	D3	proton	11	90
15	S34	D3	proton	11	30
16	PL1	D1	Dead Time		
17	Pl2	D2	Dead Time		
18	PL3	D3	Dead Time		

From Mohammadzadeh et al., 2003

SEM instrument performance does not agree Between the cited SREM documents. What are the channel energy ranges for this, the Rosetta SREM?

What is Dead Time and why is it not presented and discussed?

RID: SREM-US-RF-004

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 3 of 6

According to Sanberg et al, 2012, the spacecraft mass model of the corresponding host spacecraft (this means Rosetta) is used to determine the response matrix in order to determine the radiation spectrum. Where is this information for Rosetta? Figures of the response function shown in Sanberg et al, 2012 for the INTEGRAL spacecraft seem not to agree with those shown at http://srem.web.psi.ch; however, this is not expected since these are probably different spacecraft.

RID: SREM-US-RF-004

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 4 of 6

Timing: The SREM instrument paper says that the SREM can process up to 100 kHz; however, no where in any documentation does it say what the actual accumulation rate is for the instrument on Rosetta. This file needs to include a discussion of instrument timing for the Rostetta spacecraft. 15 channels running at the 100 kHz rate would swamp Rosetta telemetry, so telemetry accommodation needs to be discussed.

RID: SREM-US-RF-004

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 5 of 6

Placement: The SREM instrument placement on the Rosetta is not described and should be mentioned here. SREM placement on the Rosetta spacecraft is not shown on the upper level ESA web site at http://sci.esa.int/rosetta/35061-instruments and is also not shown on the fact sheet as an instrument on the Rosetta spacecraft.

RID: SREM-US-RF-004

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
inst_srem.cat – 6 of 6

Housekeeping: As with all instruments, the SREM must contain housekeeping data. This data determines the health and safety of the instrument. Typically there are temperature monitors to ensure the instrument is operating is the correct temperature range. So to, voltages and currents are typicall monitored for their stability. Sanberg et al, 2012 states that there is an electric field used to extract conduction band electrons from the Si crystal. The stability of this electric field would seem to be critical, so one would expect that this value is monitored.

RID: SREM-US-RF-004

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
Calibration Directory

The Calibration Directory is missing. The calibration directory should contain at least the energy levels, timing levels, telemetry rate levels, Geometric Factors, adjustment factors, detector efficiency for the particular unit on the Rosetta spacecraft. This information must have been used in order to submit data from this SREM unit. Where is the calibration document?

RID: SREM-US-RF-005

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
docinfo.txt

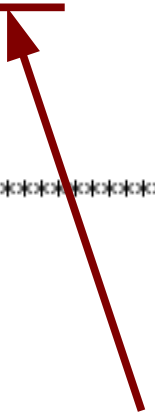
```
**********************************   DOCINFO.TXT   **********************************

DOCINFO.TXT                            This document.

EAICD_SREM.PDF                        Control Interface document for the
                                          Rosetta NavCam instrument.


EAICD_SREM.LBL                        EAICD label.

**************************************************************************************
```



Again, not NavCam!!!

RID: SREM-US-RF-006

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 1 of 7

The timing label given in the data files is not adequately described in sections 4.1.1 and 4.1.2. Only one time stamp is produced in the data files; however, the document (or in the label files) does not state if this time label is a center time, start time, or end time of the accumulation intevral. The document also needs to include the duration of the measurement.

RID: SREM-US-RF-007

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 2 of 7

Section 4.1.1 needs to include the unit of measure. The term “count rate” is not adequate to understand the level 2 data. “count rate” could be counts/hour, counts/minute, counts/time interval, etc. The time base on which the unit is based must be clearly specified.

RID: SREM-US-RF-008

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 3 of 7

Section 4.1.2 needs to include the unit of measure. The term “flux” is not adequate to understand the level 3 data. “flux” could be energy/(cm**2 s sr eV), counts/(m**2 s), counts/(m**2 s sr), etc. The flux unit clearly specified.

RID: SREM-US-RF-009

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 4 of 7

The Level 3 data product as described can not be generated by the instrument without modeling and assumptions about the parent spectrum. The data produced from the process described in Sanberg et al, 2012 can not be defined as CODMAC Level 3 since the resulting data is not described in a reversible manner. Sanberg et al, 2012 state that the result of the model is not unique and they pick a solution which yields a smooth result. This product is CODMAC Level 5 data and not CODMAC Level 3. All of the documents should be updated.

RID: SREM-US-RF-010

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 5 of 7

Level 2 file naming convention described in section 3.1.2 does not agree with either the Level 2 data product nor the Level 3 data product. Level 2 data is labeled as “L0” instead of “L2” and Level 3 data is labeled as “L2” instead of “L3”.

RID: SREM-US-RF-011

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 6 of 7

All files under both data sets do not conform to the example shown under 3.1.1. Version numbers are 3 digits with a leading zeros.

“Example: RO-C-SREM-3-EXT3-MTP34-V1.0”

RID: SREM-US-RF-012

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
eaicd_srem.pdf 7 of 7

Missing Information

1.3 Contents

This document describes the data flow of the [your instrument name] instrument on [mission name] from the s/c until the insertion into the PSA for ESA. It includes information on how data were processed, formatted, labeled and uniquely identified. The document discusses general naming

RID: SREM-US-RF-013

Data Evaluation

ro-c-srem-2-ext3-mtp034-v1.0

```
OBJECT                         = SREM_COUNTS_TABLE
  ROWS                         = 528
  COLUMNS                      = 1
  ROW_BYTES                    = 226
  INTERCHANGE_FORMAT           = ASCII
  DESCRIPTION                  = "SREM counts table"
  OBJECT                       = COLUMN
    NAME                       = "COUNTS"
    DATA_TYPE                  = ASCII_REAL
    START_BYTE                 = 1
    BYTES                      = 224
    ITEMS                      = 15
    ITEM_BYTES                 = 14
    ITEM_OFFSET                = 15
    FORMAT                     = "E14.7"
    MISSING_CONSTANT           = -1.0E31
  END_OBJECT                   = COLUMN
END_OBJECT                     = SREM_COUNTS_TABLE
```

LBL files suggest the values are in counts, contrary to the EICD which said count rates. Values in the data files show 6 digits after the decimal, suggesting that they are not from a digital counting system. The values in the data files are probably normalized in some way.

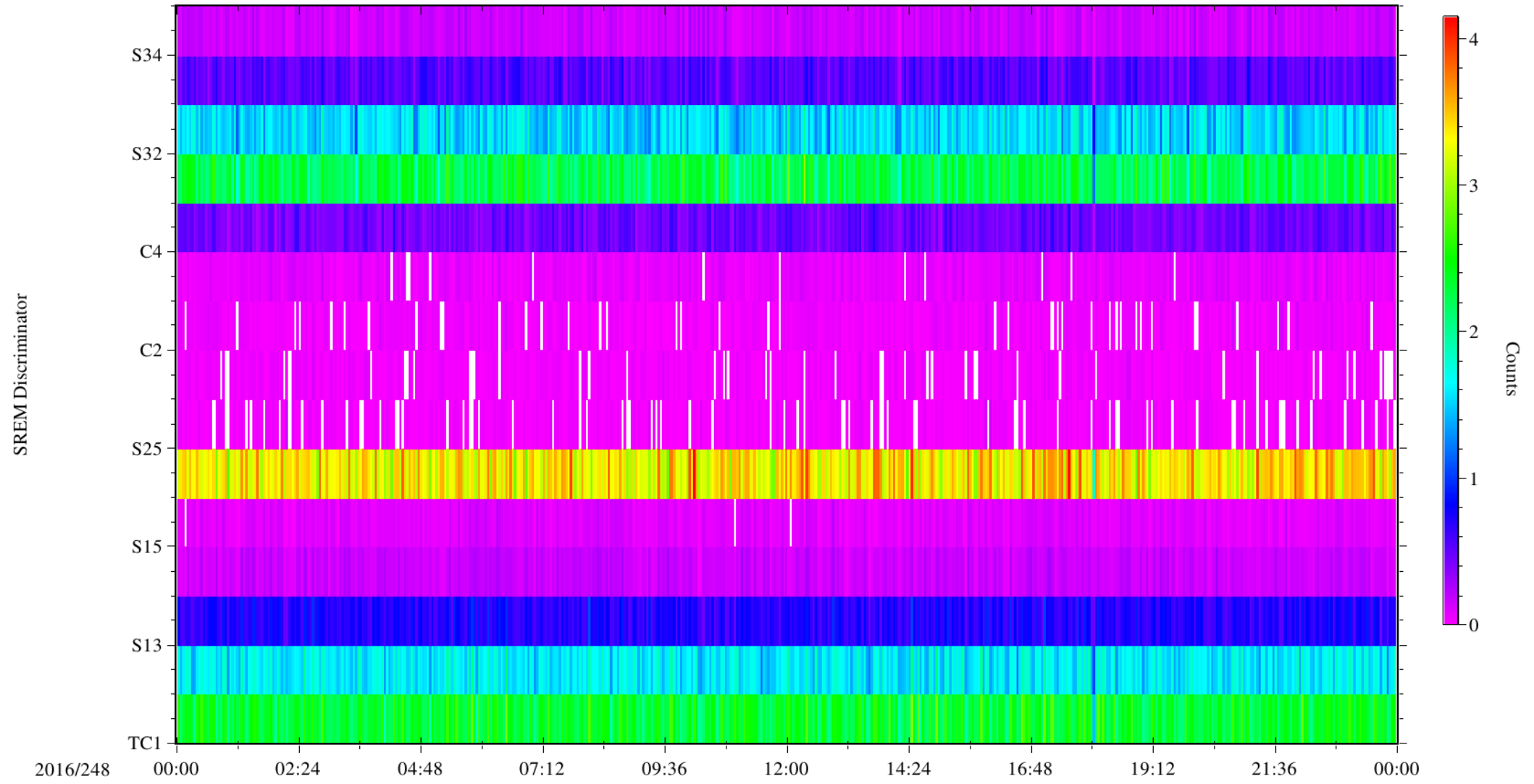
RID: SREM-US-RF-014

ro-c-srem-2-ext3-mtp034-v1.0

No timing duration was given in the documents. In order to examine these data, I set the duration of the accumulation to zero. This meant that each data value is an instantaneous measure. Although this is not correct, it allows me to process and plot these data. The following is an example of the Level 2 data.

ro-c-srem-2-ext3-mtp034-v1.0

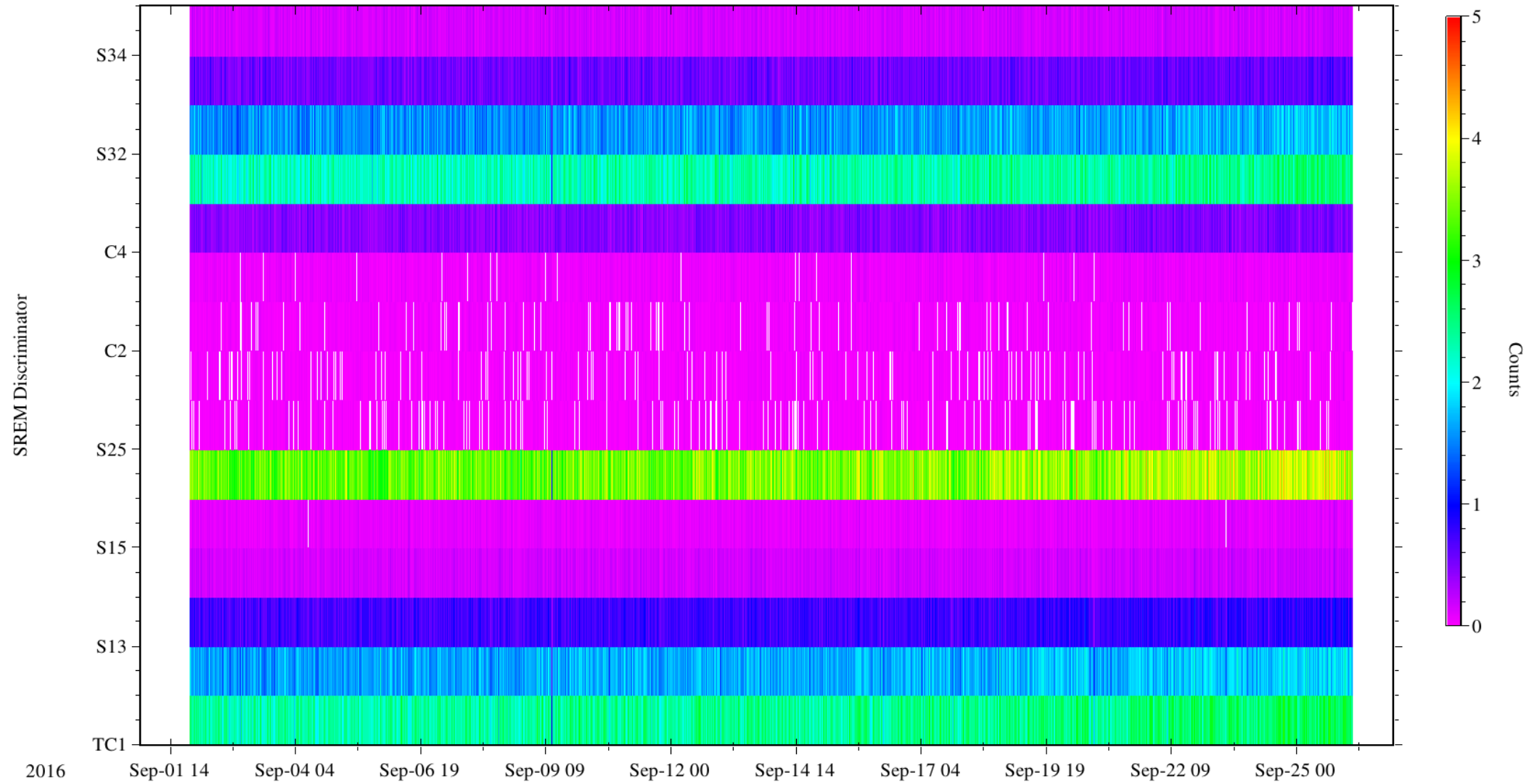
4 September (248) 2016



Plot created by SDDAS/gPlot - J. Mukherjee, et al. Generated on Tue Sep 18 20:17:39 2018.

ro-c-srem-2-ext3-mtp034-v1.0

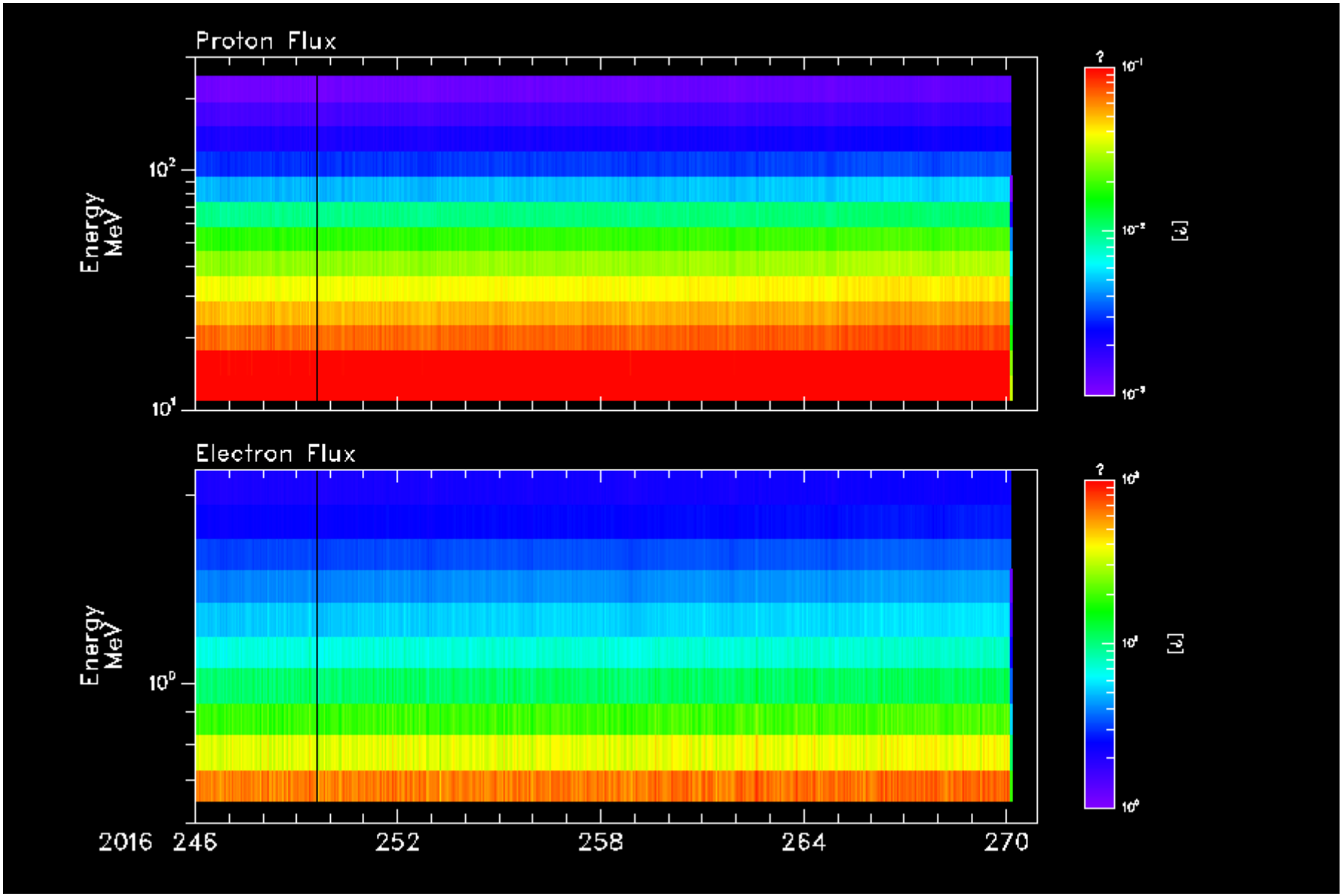
Entire Time Period



ro-c-srem-3-ext3-mtp034-v1.0

No timing duration was given in the documents. In order to examine these data, I set the duration of the accumulation to 1 sec, parallel acquisition, and defined an unknown flux so that a spectrum could be generated. Although this is not correct, it allows me to process and plot these data. The following is an example of the Level 3 data.

ro-c-srem-3-ext3-mtp034-v1.0



Certification

The documentation does not describe the data in the data sets. It is too confusing for a reasonable interpretation of the data. It is not clear that the data is described by the documentation. There are too many unknowns in the documentation so that the recommendation is not to certify this data.

Backup Slides

NASA and CODMAC Processing Levels for Science Data Sets

NASA	CODMAC	Description
Packet data	Raw Level 1	Telemetry data stream as received at the ground station, with science and engineering data embedded.
Level 0	Edited Level 2	Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.
Level 1A	Calibrated Level 3	NASA Level 0 data that have been located in space and may have been transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied).
Level 1B	Resampled Level 4	Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the NASA Level 1A, or possibly Level 0, instrument measurements (e.g., radiances, magnetic field strength).
Level 1C	Derived Level 5	NASA Level 1A or 1B data that have been resampled and mapped onto uniform space-time grids. The data are calibrated (i.e., radiometrically corrected) and may have additional corrections applied (e.g., terrain correction).
Level 2	Derived Level 5	Geophysical parameters, generally derived from NASA Level 1 data, and located in space and time commensurate with instrument location, pointing, and sampling.
Level 3	Derived Level 5	NASA Level 2 geophysical parameters mapped onto uniform space-time grids.

Source: Lunar Reconnaissance Orbiter, Lunar Orbiter Laser Altimeter, Reduced Data Record and Derived Products, Software Interface Specification; Version 2.6; Mar 11, 2016; Gregory A. Neumann; http://pds-geosciences.wustl.edu/lro/lro-l-lola-3-rdr-v1/lrolol_1xxx/document/rdrsis.htm.

- PDS data set ID, from which this source reference was taken, is LRO-L-LOLA-2-EDR-V1.0.
- URL is current as of December, 2016, but may become out of date in the future; in any case it will not be updated here.

Abbreviations

CODMAC	Committee On Data Management And Computation
ID	IDentifier
NASA	National Aeronautics and Space Administration
PDS	Planetary Data System
URL	Uniform Resource Locator

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
aareadme.txt

GOOD

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
voldesc.cat

GOOD

ro-c-srem-2-ext3-mtp034-v1.0
ro-c-srem-3-ext3-mtp034-v1.0
ref.cat

GOOD