Interface Control Document

C1XS TO PLANETARY SCIENCE ARCHIVE ICD

	Name	Signature
Prepared by	Chris Howe	
Approved by	Brian Maddison	

DISTRIBUTION

Name	1.0 17-2-08	Iss/Rev 18-9-09	Iss/Rev Date	Iss/Rev Date	Iss/Rev Date	Iss/Rev Date
RAL Server	x	x				
C. Howe	x	x				
B. Maddison	x					
M. Grande	x	x				
B. Kellett	x	x				
P. Sreekumar	x	x				
S. Narendranath	x	x				
H. Metselaar	x	x				
D. Heather	x	x				
C. Erd	x					
ISSDC	X	x				
P. Martin		x				

CHANGE RECORD

Date	Iss/Rev	Section	Comments
17 Feb 08	1	all	Created from S1-CIX-RAL-3010 iss. 3
18 Sep 09	2	1.5	Document references updated
		1.6	Archive plan document reference corrected
		2	New section added defining processing levels
		3	Improved instrument description
		3.1	Changed XSM position
		3.2	Added mode/state table
		3.4	Added description of operating modes and data handling
		3.4.1	Referenced Data Handling ICD
		3.4.2.1	Clarified the production of type 6 data, added calibration files to the deliverable data products
		4.2	Changed calibration interval to monthly
		4.4.1	Changed processing levels
		4.4.2	Added level to to level 4 processing section
		4.5	Added reference to Data Handling ICD

Date	Iss/Rev	Section	Comments
		5.1.1	Added delivery schedule
		5.1.2	Moon now designated 'L', each data directory will contain multiple orbits.
		5.1.4	Changed instrument data file naming convention. Added calibration products file naming convention.
		5.2.1	Corrected PDS standard issue/date
		5.2.2	Corrected time format and detailed the method by which the times were created
		Fig 5-1 and Table 5-5	Updated volume set name
		Fig 6-1	Added software directory
		6.3	Corrected filenames in all sub-paragraphs. Updated the various PDS elements. Added processing history object.
		6.4	Updated all data product definitions
8 May 2013	3	4.4.2	Correct C standard
		5.4.2	Added L4 dataset to tables 5-5 and 5-6
		5.4.3	Corrected directory names Changed contents of EXTRAS directory SOFTWARE directory in L4 dataset only CALIB directory in L4 dataset only SOFTWARE.CAT file (L4 only)
		6.4.9	Updated label file

CONTENTS

1. INTRODUCTION....1
1.1 Purpose and Scope....1
1.2 Archiving Authorities....1
1.3 Contents....1
1.4 Intended Readership....1
1.5 Applicable Documents....1
1.6 Reference Documents....2
1.7 Acronyms and Abbreviations....2
1.8 Contact Names and Addresses....2
2. DATA PROCESSING LEVELS....3
3. OVERVIEW OF INSTRUMENT DESIGN, DATA HANDLING PROCESS AND PRODUCT GENERATION....4
3.1 Hardware description....4
3.2 Summary of Instrument Operations....5
3.3 Scientific Objectives....6
3.3.1 'Regional' studies (tolerating a spatial resolution of 40 km) .6
3.3.2 'Local' studies (requiring a spatial resolution of 20 km or better)....6
3.4 Data Handling Process....7
3.4.1 Data Levels....8
3.4.2 Software: 9
4. OVERVIEW OF DATA PRODUCTS....10
4.1 Pre-Flight Data Products....10
4.2 Instrument Calibrations....10
4.3 In-Flight Data Products....10
4.4 Software....11
4.4.1 Level 1 to Level 2....**Error! Bookmark not defined.**
4.4.2 Level 2 to Level 4....**Error! Bookmark not defined.**
4.5 Documentation....11
4.6 Ancillary Data Usage....11
5. ARCHIVE FORMAT AND CONTENT....12
5.1 Format and Conventions....12
5.1.1 Deliveries and Archive Volume Format....12
5.1.2 Data Set ID Formation....12
5.1.3 Data Directory Naming Convention....13

5.1.4 File naming Convention 13
5.2 Standards Used in Data Product Generation....14
5.2.1 PDS Standards....14
5.2.2 Time Standards....14
5.2.3 Reference Systems 15
5.2.4 Other Applicable Standards 15
5.3 Data Validation 15
5.4 Content....15
5.4.1 Volume Set 15
5.4.2 Data Set 16
5.4.3 Directories 17
6. DETAILED INTERFACE SPECIFICATIONS....20
6.1 Structure and Organization Overview....20
6.2 Data Sets, Definition and Content....20
6.3 Data Product Design – Common Information Elements 20
6.3.1 File Characteristics Data Elements 21
6.3.2 Data Object Pointers 21
6.3.3 Identification Data Elements 21
6.3.4 Instrument and Detector Descriptive Data Elements 22
6.3.5 Data Processing History....22
6.4 Data Product Design – Header Data Element Descriptions 22
6.4.1 Product Design – C1XS HK Time Series 22
6.4.2 Product Design – C1XS Time Tagged X-Ray Data Type 1 (Deprecated) 26
6.4.3 Product Design – C1XS X-Ray Spectra Time Series Types 2 and 6 (Deprecated) 27
6.4.4 Product Design – XSM X-Ray Spectra Time Series, Type 4 ...27
6.4.5 Product Design – C1XS X-Ray Spectra Time Series, Type 1228
6.4.6 Product Design – C1XS Time Tagged X-Ray Data Type 10 ..30
6.4.7 Product Design – C1XS Time Tagged X-Ray Data Type 11 ..30
6.4.8 Product Design – Auxiliary Data....32
6.4.9 Product Design – Calibrated C1XS Spectra 40
6.4.10 Product Design – Calibration Products 45
6.4.11 Product Design – Other Products 48

1. INTRODUCTION

1.1 Purpose and Scope

The purpose of this EAICD (Experimenter Archive Interface Control Document) is twofold.

1. It provides users of the C1XS instrument with detailed description of the data products, a description of how they were generated, including data sources and destinations. As part of this information sufficient description of the instrument is provided to help in the interpretation of the data and corresponding caveats.
2. It is the official interface between the C1XS team and the Indian Space Science Data Centre (ISSDC).

1.2 Archiving Authorities

The data will be archived and managed at ISSDC (ISRO).
The Planetary Data System Standard is used as archiving standard by

- NASA for U.S. planetary missions, implemented by PDS
- ESA for European planetary missions, implemented by the Research and Scientific Support Department (RSSD) of ESA

The Indian Space Research Organization (ISRO) has also adopted this standard for Chandrayaan-1, the first Indian lunar mission.
For the purpose of archiving Chandrayaan-1 data, version 3.6 of the PDS standard is applicable.

1.3 Contents

This document describes the data flow of the C1XS instrument on CHANDRAYAAN-1 from the spacecraft through to insertion into the Chandrayaan-1 Science Data Archive (CSDA). It includes information on how data were processed, formatted, labelled and uniquely identified. The document discusses general naming schemes for data volumes, data sets, data and label files. Standards used to generate the product are explained. Software that may be used to access the product is explained further on.
The design of the data set structure and the data product is given.

1.4 Intended Readership

The intended readership for this EAICD is

- The staff of the archiving authority (CSDA, ISRO, ESA, RSSD, design team)
- Any potential user of the C1XS data.

1.5 Applicable Documents

AD1 Planetary Data System Preparation Workbook, February 1, 1995, Version 3.1, JPL, D-7669, Part1

AD2 Planetary Data System Standards Reference, February 27th, 2009, Version 3.8, JPL, D-7669, Part 2

AD3 Navigation and Ancillary Information Facility (NAIF), http://pds-naif.jpl.nasa.gov

AD4 GDP Processor and Manager Software User Manual, January 31, 2008, Draft a, ESA, SOP-RSSD-UM-018

AD5 GDP Processor Software Configuration Language Definition, January 31, Draft a, ESA, SOP-RSSD-TN-050
AD6 Quicklook Browse Tool for Level 1b Datasets, SOP-RSSD-RP-032
AD7 C1XS/XSM Data Handling Interface Control Document, 15 June, 2009, Version 4, C1-CIX-RAL-ICD-0002
AD8 C1XS/XSM Flight Operations Manual, 4 September 2008, issue 1.
AD9 SMART-1 XSM, October 1, 2004, Version 11, S1-CIX-HY-ICD-0001
AD10 C1XS Science Requirements, 5 March 2006, issue 2, C1-C1X-UCL-RS-0002.

1.6 Reference Documents

[RD1] Chandrayaan-1 Archive Plan, December 31, 2007, Version 1.a, ISRO, CH1-SAC-PL-001
[RD2] Chandrayaan-1 Archive Conventions, December 31, 2007, Version 1.a, ISRO, CH1-SAC-PL-002

1.7 Acronyms and Abbreviations

ADC	Analogue to Digital Converter
C1XS	Chandrayaan-1 X-ray Spectrometer
CSDA	Chandrayaan-1 Science Data Archive
DCIXS	Demonstration Compact Imaging X-Ray Spectrometer
DDS	Data Distribution System
DPU	Data Processing Unit
EEPROM	Electrically Erasable Programmable Read-Only Memory
FPGA	Field Programmable Gate-Array
GDP	Generic Data Pipeline
HK	Housekeeping
ISRO	Indian Space Research Organisation
ISSDC	Indian Space Science Data Centre
NPO	Normal Phase Operations
OBDH	On Board Data Handling
OBT	On Board Time
PROM	Programmable Read-Only Memory
PSA	Planetary Science Archive
RAM	Random Access Memory
RSSD	Research and Scientific Support Department
SPICE	Spacecraft, Planet, Instrument, C-matrix, Events
TC	Tele-Commands
TM	Telemetry
XSM	X-ray Solar Monitor

1.8 Contact Names and Addresses

PI: Prof. Manuel Grande, University of Wales, M.Grande@aber.ac.uk, +44 1970 622624

Co-PI: Dr. P. Sreekumar, ISRO
Prof. Juhani Huovelin, University of Helsinki, Finland.
Instrument Manager: Mr Chris Howe, RAL, c.j.howe@rl.ac.uk, +44 1235 44 5016
Instrument Scientist: Mr Barry Kellett, RAL, b.j.kellett@rl.ac.uk, +44 1235 44 6361
Archiving: Dr Chris Perry, RAL, c.h.perry@rl.ac.uk, +44 1235 44 5780
Ms Shyama Narendranath, K.C., ISRO.
GDP Ms Santa Martinez, ESA, S.Martinez@esa.int, +34 91 8131 118

2. DATA PROCESSING LEVELS

This document uses the CODMAC level definitions, **Error! Reference source not found.** shows the relationship between the NASA, ISRO and CODMAC levels.

Table 2-1 Data Processing Levels

Type	Description	NASA Level	ISRO Level	CODMAC Level
Raw Data	Telemetry data with data embedded.			1
Edited Data	Corrected for telemetry errors and split or decommutated into a data set for a given instrument. Sometimes called Experimental Data Record. Data are also tagged with time and location of acquisition.	0	0	2
Calibrated Data	Edited data that are still in units produced by instrument, but that have been corrected so that values are expressed in or are proportional to some physical unit such as radiance. No resampling, so edited data can be reconstructed.	1A	1	3
Resampled Data	Data that have been resampled in time or space domains in such a way that the original edited data cannot be reconstructed. Could be calibrated in addition to being resampled.	1 B	2	4
Derived Data	Derived results such as maps, reports, graphics, etc	2-5	3 and above	5

3. OVERVIEW OF INSTRUMENT DESIGN, DATA HANDLING PROCESS AND PRODUCT GENERATION

C1XS is a compact X-ray fluorescence spectrometer which uses CCD based detectors. The instrument performs limited processing on the data before creating the CCSDS telemetry packets and automatically alters the detector operating parameters and telemetry. In order to correctly utilise the data products for science analysis it is vital to have an understanding of the operation of the instrument and of the associated caveats provided with the data. This section provides a basic description of the instrument hardware and operation.

3.1 Hardware description

A block diagram of the system configuration is shown in Figure 3-1. The instrument consists of two units:

C1XS unit – The electronics unit including the C1XS detectors. The main instrument detector head consists of a matrix of 24 X-ray sensitive Swept Charge Devices (SCDs), integrated collimators to define and limit the field of view (FOV), and filters to inhibit background UV and solar wind ions and electrons.

XSM – X-ray Solar Monitor on the MIP deck. The ***XSM*** provides direct observation of the Sun over a full range of phase angles and solar luminosities. The XSM has a wide spectral range (0.8 up to 20 keV) and good spectral resolution (about 200 eV at 6 keV obtainable).

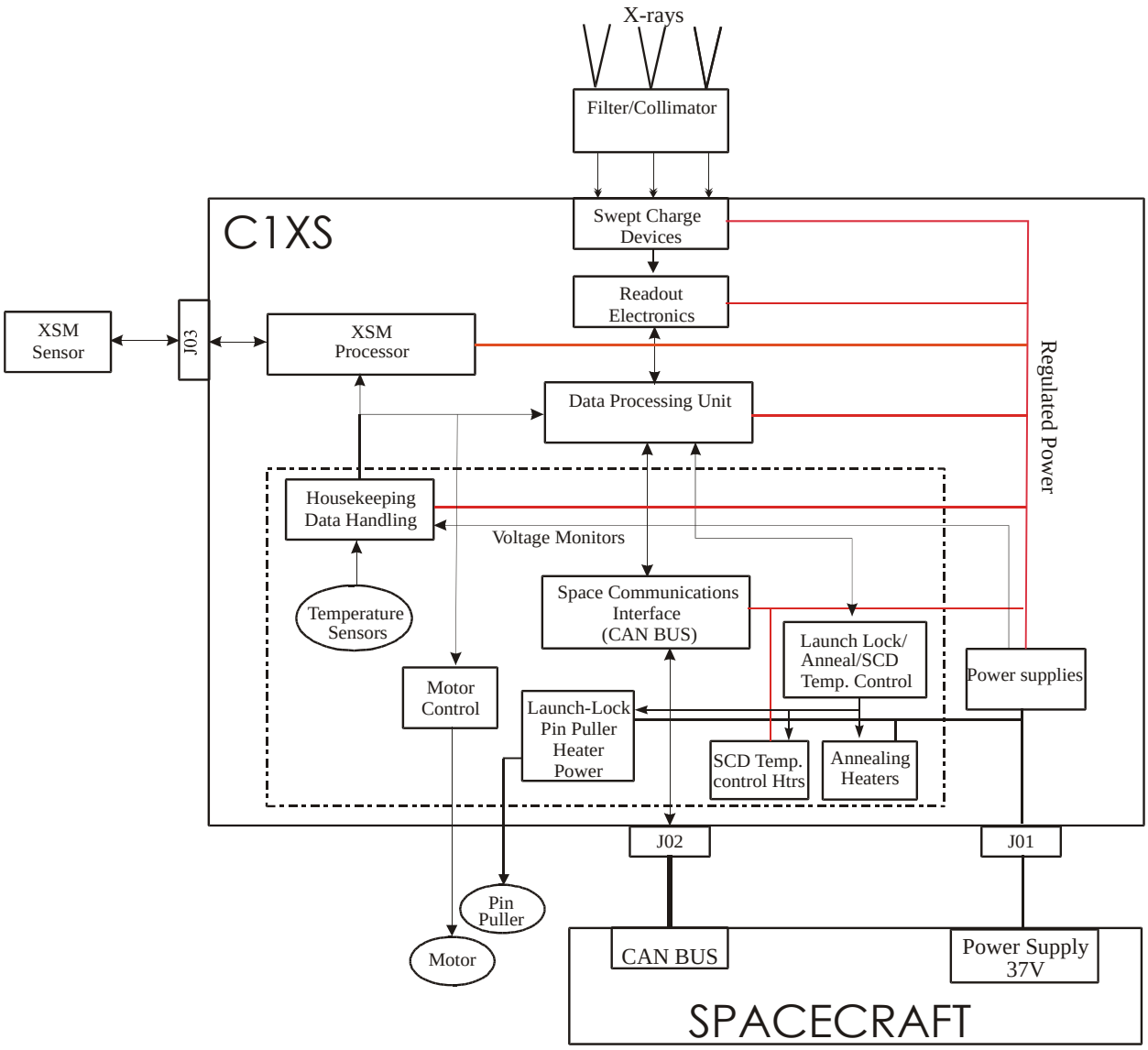

Figure 3-1 System Block Diagram

3.2 Summary of Instrument Operations

The C1XS instrument has three basic conditions OFF, STANDBY and 'Operating' which includes a RESTING mode in addition to the OPERATIONAL mode. In STANDBY and RESTING modes the detectors are not being clocked or powered and the solar monitor peltier cooler is off - hence the power is reduced. The transition between OPERATIONAL and RESTING modes is carried out autonomously by the software dependent on the temperature of the SCD.

The OPERATIONAL mode has 7 sub-modes which correspond to variations in data collection. The contents of the telemetry packets will vary according to mode and state selected.

The modes/states which are likely to be used in the Spacecraft modes are summarised in Table 3-1.

Table 3-1 Experiment/Spacecraft Mode Correlation

Instrument Mode	Spacecraft Mode / Instrument Data Format	Pre-Launch	LEOP	Safe	De-tumble	Observation Lunar Nadir Pointing
OFF		X	X	X	X	X
EMERGENCY	Memory dumps by command only	X				X
STANDBY	Housekeeping	X				X
	Auxiliary Data	X				X
OPERATIONAL	C1XS formats	X				X
	XSM	X				X
	Housekeeping	X				X
	Auxiliary Data	X				X

3.3 Scientific Objectives

A summary of the C1XS science objectives is given in AD10 and described in the following sub-sections.

The X-rays from the sun are absorbed by the lunar surface which in turn is stimulated to emit fluorescence X-rays characteristic of the elements which comprise the surface. The C1XS instrument will simultaneously measure the solar X-ray flux, using XSM, and the emissions from the moon and will therefore able to produce a quantitative survey of the lunar surface materials as the spacecraft orbits the moon.

3.3.1 'Regional' studies (tolerating a spatial resolution of 40 km)

Major element geochemistry (and especially Mg/Si and/or Mg/Fe) in the main lunar terrain types (i.e. Procellarum KREEP Terrain (PKT), South Pole-Aitken Basin (SPA), and the Farside Highlands).

Large-scale stratigraphy of lower crust (and possibly crust/mantle boundary region) by measuring the major element geochemistry of the floor material of large basins not obscured by mare basalts (e.g. SPA and other farside basins), and the central rings and/or ejecta material of large basins.

Farside Mare basalt composition (e.g. Mare Moscoviense) - how do they compare to nearside compositions, implying geochemically similar mantle source regions.

Comparison of major element geochemistry of stratigraphically distinct large-scale lava flows in the same geographical region.

3.3.2 'Local' studies (requiring a spatial resolution of 20 km or better)

Probing the stratigraphy of the lunar crust by determining the major element geochemistry of the central peaks and/or ejecta blankets of impact craters in the diameter range 50-200 km. Such craters will have excavated crustal materials from depths of 5 to 30 km

respectively, and materials from just below these depths will be exposed in the re-bounded central peaks, providing a unique opportunity to determine the vertical composition of the crust and its implications for magma ocean evolution.

Resolve the ejecta of large craters in mare basalts which may have punched through the basaltic fill to expose underlying pre-mare materials.

Search for, and geochemical characterisation of, lunar cryptomaria. Cryptomaria are ancient (>3.8Ga) mare basalt deposits that are hidden or obscured by superposed higher albedo material (impact ejecta).

Determine the major element geochemistry of presumed pyroclastic (volcanic) dark halo craters (e.g. those observed in the floors of Alphonsus and Schroedinger), which may be due to the pyroclastic of picritic glasses whose chemical composition most closely resembles that of the original mantle partial melts, and which those provide important windows into lunar mantle evolution.

Use of major element geochemistry to constrain mineralogical determinations made by multi-spectral imaging and near IR spectroscopy (Clementine, SIR and other Chandrayaan-1 instruments).

3.4 Data Handling Process

In the normal operating mode the C1XS telemetry data format depends on the X-ray count rate, one of three possible science formats will be chosen. If the total X-ray rate for all 24 detectors is <320 events/sec then the science telemetry packet produced contains the event time and the 3 energy values (3-pixel time tagged data). Above 320 events/sec the telemetry packet contains the event time and the energy value (single pixel time tagged data). When the count rate exceeds 800 events/sec an optimised 512 channel spectrum is produced every 8 seconds (high resolution low count spectral mode). For compatibility with the previous instrument, the three D-CIXS science modes (simple time tagged mode, low count spectral mode or compressed low count spectral mode) can be used.

The data packets accumulated by the instrument are initially passed to the Chandrayaan-1 on-board data handling system where they are stored in a central solid state recorder in preparation for download to the ground. Contact with the ground station and down link of the science telemetry from occurs approximately every 6 orbits. The instrument data packets together with spacecraft data and various auxiliary datasets (such as orbit, attitude, command logs and event files) are processed, catalogued and stored at the ISSDC.

The data is then processed to give level 2 data using the ESA provided GDP.

3.4.1 Data Levels

The C1XS raw data (level 1) consists of a set of fixed length telemetry packets. There are 11 packet types defined which are listed in the following table. The packet types are described in the C1XS/XSM Data handling ICD, C1-C1X-ICD-0002.

Table 3-2 Level 1 Packet Types

Data Type No	Data Format	Packets /Format
0	Housekeeping	1
1	C1XS Time tagged events	1 = 64 events
2	C1XS Low Count Spectrum	24 = 1 spectrum for each detector
3	Not used	
4	XSM sensor	4 = 1 spectrum
5	Memory Dump	1
6	C1XS Compressed Low Count Spectra	24 = 1 spectrum for each detector (poor compression) 10 = 1 spectrum for each detector (typical compression)
7	Not used	
8	C1XS Auxiliary Data – 3D+ Gain and Offset	1
9	C1XS Auxiliary Data – FPGA Thresholds	1
10	Time Tagged, summed pixel data	24 = 3096 events (129 events per detector)
11	Time Tagged, 3 pixel event data	24 = 1224 events (51 events per detector)
12	High resolution Low Count Spectrum	48 = 1 spectrum for each detector

The C1XS Level 2 data shall consist of reformatted Level 0 data in PDS format. Where appropriate data shall be converted to engineering units using the conversion information specified in C1-C1X-ICD-0002 but will otherwise be uncalibrated.
In the case of the Level 2 data the Type 6 packets will be decompressed prior to archival, the resulting output files resemble the existing Type 2 low count spectrum data, except for the binning of the data which is different. Therefore the decompressed Type 6 data will be archived as a product in its own right.
The Level 4 data shall consist of calibrated X-ray events in spectral format with time and position information.
The Level 5 data shall consist of lunar elemental abundance maps. This shall require deconvolution of the incident solar X-ray spectrum as measured by the XSM.

3.4.2 Software:

In the following sections the software used for data processing is detailed.

3.4.2.1 Calibration Data Software

The software used to create calibration data products will not be delivered to the CSDA.

3.4.2.2 Telemetry Data Processing Pipeline

ESA has made their Generic Data Pipeline (GDP) available to process the telemetry data and is described hereunder. See [AD5] for details. The GDP will be used to:

- Read the level 1 telemetry files retrieved from the ISSDC
- Extract engineering parameters from the telemetry packets and convert to engineering units
- Re-package science data into PDS format

The GDP software is designed for the processing of telemetry data from instruments on board of ESA planetary spacecrafts. Telemetry data can be processed (selection, conversion, calibration, etc.) and converted into PDS compatible output data. The GDP supports the automated or manual processing of payload telemetry data files. It is not designed to be used as a real time tool. The software provides the following functionalities:

<u>GDP processor</u>

This program allows extracting data from a single telemetry data file, process the extracted data, and export the result in the form of one or more PDS compatible data file(s). The contents (structure) of the telemetry file, as well as the data which shall be extracted, and the structure of the PDS product are described in user-defined configuration files, see [AD5] for details. The GDP is started via the IDL or UNIX command line. Diagnostic output is produced in the command window and/or the IDL status window. Status and error messages are also saved in a log file.

<u>GDP manager</u>

This program is provided for the automated GDP processing of multiple telemetry data files in a UNIX/Linux environment. Selection criteria and processing parameters for the telemetry files are defined in a dedicated main configuration file. For each telemetry data file that meets the selection criteria, a dedicated GDP process is created. This process generated the desired PDS products in a specified directory. After successful process execution the telemetry file is moved to the destination directory.

While the GDP processor can be used standalone for the manual processing of small numbers of data files, the combination of the GDP manager and processor allows for automatic processing of telemetry data in a SOC environment.

3.4.2.3 Data Calibration Pipeline

The level 2 data is converted to level 4 by the following processes:

- Conversion of data to 1024-bin spectra and 16 s integration times.

- Calibration of energy scale using spacecraft housekeeping and auxiliary data and gain correction calibration data.
- Conversion of count rate to flux using detector efficiency calibration data.
- Calculation of spacecraft position, attitude and field of view using the SPICE libraries.

The level 4 data will not have the particle background subtracted, although the pipeline will have the functionality. This is because the particle background is dependent on solar variation and the spacecraft's position within Earth's magnetic field. A range of particle background spectra will be provided with the data to aid further processing.

The data calibration pipeline is written in ISO C (conforming to the C99 standard). Additional components, such as the 'configure' script and pipeline verification test scripts, require a POSIX-compatible environment.

The data calibration pipeline will be included in the level 4 volume.

3.4.2.4 Scientific Analysis Software

No scientific analysis software is part of the delivery to ISSDC. The QBTool is available for taking a quick look at the data. See [AD6] for details.

4. OVERVIEW OF DATA PRODUCTS

This section provides an overview of the C1XS products that are to be included in the submission to the PDS.

4.1 Pre-Flight Data Products

No deliveries of pre-flight data are planned.

4.2 Instrument Calibrations

The data collected during the instrument calibration campaign will not be provided to the CSDA.

Instrument calibration data is included as part of the standard datasets that are delivered to the PDS. During operations the C1XS door (radiation shield) will be closed on a monthly basis to allow the detectors to view the ^{55}Fe radioactive sources fitted to the inside of the door. These data are returned in the normal science data packet types.

The XSM also has its own ^{55}Fe calibration source and this is viewed at the beginning and end of each observation period. These data are returned in the normal science data format.

4.3 In-Flight Data Products

The in-flight data products that shall be provided as the initial delivery to the CSDA shall consist of PDS formatted level 2 data products. These are raw or engineering level data that have been unpacked from the telemetry packets, time tagged, converted to engineering

units and output in an easily readable form together with the necessary labels and auxiliary information required for ingestion into the CSDA system.
The science data has not been calibrated either for energy or for instrument efficiency factors so should not be directly used for science analysis without the application of the necessary calibration factors and algorithms.
The level 2 data represents the full data set returned from the C1XS instrument.
Descriptions of the individual products that are included in the level 2 submission to the CSDA are provided in section 6.4 of this document.

4.4 Software

The only software that will be supplied to the CSDA is the C1XS Data Calibration Pipeline which will be included in the SOFTWARE directory of the level 4 volume. See section 3.4.2.3 for details.

The data files conform to the standard PDS ASCII conventions and so can be read by software such as READPDS, and NASAVIEW.

4.5 Documentation

The following documentation shall be provided in the DOCUMENT directory.

- This EAICD
- Instrument papers
- Science papers
- The User Manual
- The Data Handling ICD

Summary documentation shall be provided in simple ASCII.
Detailed documentation that includes complex formatting and diagrams shall only be provided as PDF.

4.6 Ancillary Data Usage

The C1XS processing software requires timing information (e.g. time correlation) for production of any archived products.
The analysis of the C1XS data requires pointing information (orbit and attitude). This information is not required for the production of the level 2 data products but is needed for any subsequent processing or analysis of these data (e.g. production of level 4 data and lunar elemental abundance maps).
The production of lunar elemental abundance information is dependent on the incident X-ray solar spectrum as measured by the XSM.

5. ARCHIVE FORMAT AND CONTENT

5.1 Format and Conventions

5.1.1 Deliveries and Archive Volume Format

The initial delivery shall consist of CSDA level 1 data. During the "normal phase operations" mission phase (NPO), the CSDA level 1 data sets for C1XS/XSM are to be delivered to the CSDA. The delivery schedule is every 6 months from the start of the mission with the final delivery being 9 months after mission completion, see [RD1].
One archive volume is produced containing a single data set covering the NPO phase observations. The data set will consist mainly of science observations and housekeeping data from the sensor(s).

5.1.2 Data Set ID Formation

Each PDS data set must have a unique identifier, DATA_SET_ID, formed from up to seven components and cannot exceed 40 characters in length. Each component of the DATA_SET_ID is an acronym, components are separated by hyphens. The components for each mission phase are listed in the table below.

Table 5-1 Data Set ID Formation

	Value	Explanation
Instrument host	CH1ORB	Chandrayaan-1 Orbiter
Target	L	Moon
Instrument	C1XS	
Data processing level number	2 / 4	CODMAC level
Data set type (optional)	EDR / REFDR	Experiment Data Record / Reformatted Data Record
Description (optional)	NPO	Mission phase abbreviation
Version number	V1.0	

This gives the following DATA_SET_IDs:

- CH1ORB-L-C1XS-2-EDR-NPO-V1.0
- CH1ORB-L-C1XS-4-REFDR-NPO-V1.0

5.1.3 Data Directory Naming Convention

The scheme to be used shall use a top level DATA directory with sub-directories for a range of orbits, the subdirectories will then contain the individual data files, i.e.

/DATA/<orbit number>_TO_<orbit number>/<data filename>

The data file naming scheme is described in section 5.1.4.

5.1.4 File naming Convention

The instrument PDS data product files conform to the following convention:

<instr. name>_<mission phase><data type><instr. mode>_Rnnnnn_nnn.<extension>

Example

C1XS_NEHKD_R00218_001.TAB

The variables are detailed in the following table.

Table 5-2 Instrument Data Filename Parameters

	Value	Explanation
Instr. name	C1XS	
Mission phase	N	NPO
Data type	E	EDR
Instr. mode	nnn	Data type, see Table 5-3 for possible values.
Revolution	Rnnnnn	Nnnnn is the consecutive orbit number padded with leading zeroes if required, e.g. R00218
Consecutive number	nnn	Consecutive number on that day within that orbit, e.g. 000.
extension		File extension, one of the following values: LBL = PDS label TAB = PDS table file

Table 5-3 Types used in data products

Packet Type	Data Type	Description	Remarks
0	HKD	Housekeeping	
4	XSM	XSM Spectrum	
8	CAX	C1XS Auxiliary Data	
	XAX	XSM auxiliary data	
9	CZD	C1XS Zero Data	
10	TTS	Time Tagged, summed pixel data	

11	TT3	Time Tagged, 3 pixel event data	
12	HRS	High resolution Low Count Spectrum	
	CCS	C1XS calibrated spectrum	Level 4 PDS data

The calibration data products use the following file naming convention:
<instr. name>_<mission phase><data type><data product>_<date>_<time>.<extension>

Example:
C1XS_NACDE_090214_134254.TAB

The various parts are explained in the table below.

Table 5-4 Calibration Data Filename Convention

	Value	Explanation
Instr. name	C1XS	
Mission phase	N	NPO
Data type	A	Auxiliary data
Data product	xxx	3 characters, one of the following values: CDE = c1xs detector efficiency CPB = c1xs particle background CGC = c1xs gain correction
date	YYMMDD	UTC date
time	hhmmss	UTC time
extension		File extension, one of the following values: LBL = PDS label TAB = PDS table file

5.2 Standards Used in Data Product Generation

5.2.1 PDS Standards

PDS standard version 3.8 (February, 27th, 2009) are used for the C1XS data archive production, see [AD1] and [AD2] for details.

5.2.2 Time Standards

All time information in the data is in UTC format and uses the PDS formation rules:

YYYY-MM-DDThh:mm:ss.fff

YYYY	year (0000-9999)
MM	month (01-12)
DD	day of month (01-31)
T	date/time separator
hh	hour (00-23)

mm	minute (00-59)
ss	second (00-59)
fff	fractions of second (000-999) (restricted to 3 digits)

The UTC times are generated using the ISRO provided '.time' files which convert from the time in the raw telemetry packets (32-bit of unit seconds followed by 16-bit of fractional seconds) to UTC using linear interpolation.

The time standard for all SPICE related processing (e.g. attitude data), see [AD3] for details, is ET (Ephemeris Time), which is a double precision number of seconds. The starting point for this time is the J2000 epoch. This epoch is Greenwich noon on January 1, 2000 Barycentric Dynamical Time. The ephemeris time is calculated from the UTC time using the appropriate SPICE routines and the time correlation packages which are provided by ISSDC as a SPICE Clock Kernel.

5.2.3 Reference Systems

The reference systems used for orbit, attitude, and target body follow the SPICE standards and are defined in the different SPICE kernels. Please, see [AD3] for details. All latitudes and longitudes are given in degrees, latitudes are planetocentric. All geographical information in labels and index files will be given as follows: Sinusoidal projection, R= 1737.4, centre latitude = 0, centre longitude will be determined automatically using an integer value

5.2.4 Other Applicable Standards

N/A

5.3 Data Validation

The archive validation is described in section 7.2.3 of the Chandrayaan-1 Archive Plan, see [RD1].

5.4 Content

This section provides a description of the initial data volumes to be provided to the CSDA and their content. The initial CSDA delivery consists of reformatted level 1 data.

5.4.1 Volume Set

The volume set constitutes two volumes as depicted below. For details on the naming conventions see the subsequent sections.

The discipline within the branch (ISRO) that is producing the volumes.

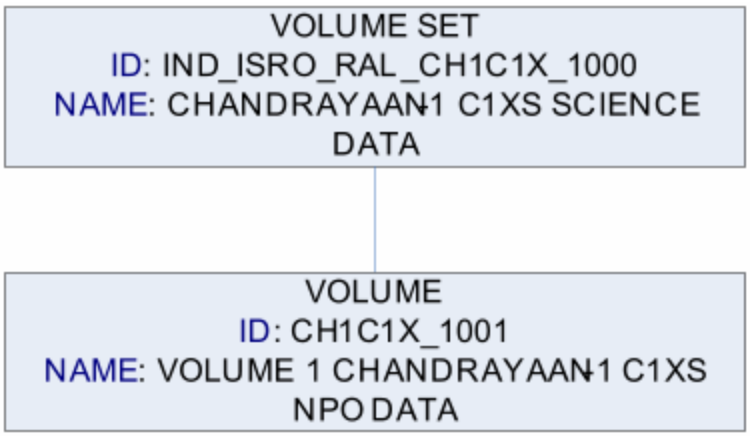

Figure 5-1 Volume Set

One data volume shall be provided for each level of data.
The NPO volume shall include all observations taken during NPO phase of the mission. This will include lunar nadir pointing data as well as celestial calibration observations made to assess the ongoing performance and aging of the instrument sub-systems. Depending on planning observations in the lunar wake during eclipse may be undertaken in which case these data shall also be included in this volume.
It should be noted that observations by the XSM (solar X-ray monitor) part of C1XS are archived in a separate volume provided by the XSM PI, although the uncalibrated EDR data shall also be included in the C1XS level 2 product.

Table 5-5 Volume ID's and Names

Volume Set ID	Volume Set Name	Volume Name	Volume ID	Data Set ID
GB_STFC_RAL_ CH1C1XS_1000	CHANDRAYAAN-1 C1XS SCIENCE DATA	CHANDRAYAAN-1 VOLUME-1 RAW C1XS DATA	CH1C1XS_1001	CH1ORB-L-C1XS-2-EDR-NPO-V1.0
GB_STFC_RAL_ CH1C1XS_1000	CHANDRAYAAN-1 C1XS SCIENCE DATA	CHANDRAYAAN-1 VOLUME-2 CAL C1XS DATA	CH1C1XS_1002	CH1ORB-L-C1XS-4-REFDR-NPO-V1.0

5.4.2 Data Set

Each volume consists of a single data set. See section 2 for a description of the different processing levels.

Table 5-6 Data Set ID's and Names

Data Set ID	Data Set Name
CH1ORB-L-C1XS-2-EDR-NPO-V1.0	CHANDRAYAAN-1-ORBITER C1XS LEVEL 2 NPO V1.0
CH1ORB-L-C1XS-4-REFDR-NPO-V1.0	CHANDRAYAAN-1-ORBITER C1XS LEVEL 4 NPO V1.0

5.4.3 Directories

This section describes the organisation and structure of the data volume to be delivered to the CSDA.

5.4.3.1 Root Directory

The contents of the ROOT directory shall follow the PDS specification. In addition to the standard directories (DOCUMENT, CATALOG, LABEL, SOFTWARE, CALIB, GEOMETRY, INDEX, DATA and EXTRAS) described in the following sections, the ROOT directory shall contain the files AAREADME.TXT, VOLDESC.CAT and ERRATA.TXT.

5.4.3.2 Calibration Directory *[CODMAC level 4 dataset only]*

The calibration data is archived in the CALIB directory below the root directory, as:

/CALIB/<filename>

This shall include the PDS formatted calibration data used to convert the level 2 data to level 4 data.

CALINFO.TXT
This file identifies and describes the function of each file in the CALIB subdirectory

5.4.3.3 Catalogue Directory

The catalogue template objects providing high-level information about the data set shall be stored in the CATALOG directory.

The catalogue directory shall include the following required files. These are based on the templates provided by the PSA

CATINFO.TXT	Identifies and describes the function of each file in the CALIB subdirectory.
INST.CAT	Brief description of instrument, one file for each instrument providing data to this delivery.
DATASET.CAT	Description of the data set currently being submitted, one file for each data product.
INSTHOST.CAT	Brief description of spacecraft and instrument's mounting relationship to spacecraft.
MISSION.CAT	Description of mission and a summary of significant events during the mission.
REF.CAT	Bibliography. Other catalogues provide reference to these using keywords. PSA will produce central list for whole mission based on this information.
SOFTWARE.CAT	Description of the software included in the volume (if any).

5.4.3.4 Index Directory

All the standard INDX entries in this directory can be created by the PSA PVV tool.

5.4.3.4.1 Dataset Index File, INDEX.LBL and INDEX.TAB

The dataset index files shall provide a full list of all files within the given data set.

INDXINFO.TXT list of files in the INDEX directory

5.4.3.4.2 Geometric Index File, geoindex.lbl and geoindex.tab

It is anticipated that the geoindex files shall be used to identify the data set(s) containing geometric information corresponding to the period covered by a particular C1XS observation. Since observations consist of time series data taken over prolonged periods, the geometric information for a given data file may not be considered constant.

5.4.3.4.3 Other Index Files

No other index files are envisaged.

5.4.3.5 Browse Directory and Browse Files

No browse products are currently envisaged. No BROWSE directory will be included.

5.4.3.6 Geometry Directory

The GEOMETRY directory shall contain the ancillary data sets that are needed to reconstruct the C1XS pointing information. This information shall be derived from inputs provided by the ISSDC, e.g. SPICE files.

5.4.3.7 Document Directory

The DOCUMENT directory contains detailed documentation describing the instrument, datasets and software related to the volume. The documentation will be in PDF format and ASCII versions of the documentation shall also be provided.

5.4.3.8 Extras Directory

In this directory will be 'value added' elements included by the data preparer but outside the scope of the PDS archive requirements. A range of particle background spectra will be provided here.

5.4.3.9 Data Directory

See section 5.1.3 for information on the proposed directory-naming scheme.

This directory should contain the data files corresponding to the products specified in section 4. Files shall be split into sub-directories based on year and month of observation.

5.4.3.10 Label directory

The LABEL directory contains additional PDS labels and include files that were not packaged with the data products or in the data subdirectories. No LABEL directory is envisaged currently.

5.4.3.11 Software directory *[CODMAC level 4 dataset only]*

This directory contains the software for converting the level 2 data to level 4 data.

6. DETAILED INTERFACE SPECIFICATIONS

This section describes the detailed specification of each of the level 2 products to be supplied to the PSA. As described in the previous section the products contained within the different observation datasets are essentially identical so no distinction has been made in this section between the different datasets.

6.1 Structure and Organization Overview

A schematic overview of a dataset is given in Figure 6-1 below. For a description of the individual components see section 5.4.

Figure 6-1 Data Set

6.2 Data Sets, Definition and Content

As described in sub-sections under section 5.4.

6.3 Data Product Design – Common Information Elements

This section provides the description of the PDS product labels that are used to describe each of the PDS datasets that will be supplied to the CSDA.
In the following sub-sections we describe the different label elements that are common to all the supplied PDS labels. These include the PDS version label, the file characteristic elements, data object pointers, identification information, instrument and detector descriptive information and positional data. The data object descriptions which are the part of the label that are unique to each product within a dataset are described in section 5.4.
Most of the labels have been given example values. Some of the labels have additional explanatory comments which are prefixed by a pound/number sign ("#"), and are not part of the data definition.

```
PDS_VERSION_ID                = PDS3
```

6.3.1 File Characteristics Data Elements

```
/***      FILE CHARACTERISTICS                                          ***/
FILE_NAME                     = "C1XS_NECCS_R00218_001.TAB"
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 1060
FILE_RECORDS                  = 179
INTERCHANGE_FORMAT            = ASCII
```

6.3.2 Data Object Pointers

```
/***      POINTERS TO DATA OBJECTS                                      ***/
^TABLE                        = ("C1XS_NECCS_R00218_001.TAB",1)
```

This indicates that the TABLE object (see for example section 6.4.1) points to the file C1XS_NECCS_R00218_001.TAB. Pointers to data objects are always required to be located in the same directory as the label file, so the file in this example can be found the same directory as the detached label file.

6.3.3 Identification Data Elements

```
/***      IDENTIFICATION DATA ELEMENTS                                  ***/
RELEASE_ID                     = 1
REVISION_ID                    = 0
DATA_SET_ID                    = CH1ORB-L-C1XS-2-EDR-NPO-V1.0
DATA_SET_NAME                  = "CHANDRAYAAN-1-ORBITER C1XS LEVEL 2 NPO V1.0"

PRODUCT_ID                     = C1XS_NECCS_R00218_001
PRODUCT_CREATION_TIME          = 2008-11-28T10:19:41
PRODUCT_TYPE                   = REFDR

MISSION_ID                     = CH1
MISSION_NAME                   = "CHANDRAYAAN-1"
MISSION_PHASE_NAME             = "NORMAL PHASE OPERATIONS"
INSTRUMENT_HOST_ID             = CH1ORB
INSTRUMENT_HOST_NAME           = "CHANDRAYAAN-1-ORBITER"

TARGET_NAME                    = MOON
TARGET_TYPE                    = SATELLITE
```

```
START_TIME                    = start_utc
STOP_TIME                     = stop_utc
ORBIT_NUMBER                  = 218
START_ORBIT_NUMBER            = 217
STOP_ORBIT_NUMBER             = 218

PRODUCER_ID                   = C1XS_TEAM
PRODUCER_INSTITUTION_NAME     = "RUTHERFORD APPLETON LABORATORY"
PROCESSING_LEVEL_ID           = 4
PROCESSING_LEVEL_DESC         = "C1XS SPECTRAL DATA CORRECTED FOR
                                 GAIN, OFFSET AND BACKGROUND"
```

6.3.4 Instrument and Detector Descriptive Data Elements

```
/***      INSTRUMENT RELATED PARAMETERS                                  ***/
INSTRUMENT_ID                 = C1XS
INSTRUMENT_NAME               = "LOW ENERGY X-RAY SPECTROMETER"
INSTRUMENT_TYPE               = "SPECTROMETER"
DATA_QUALITY_ID               = 1
DATA_QUALITY_DESC             = "1=NORMAL 2=POOR"
```

6.3.5 Data Processing History

```
/***      PROCESSING HISTORY OBJECT              ***/

^ASCII_DOCUMENT               = "C1XS_NECCS_R00218_001.TXT'<<"

OBJECT                        = ASCII_DOCUMENT
DOCUMENT_NAME                 = "DATA PROCESSING INFORMATION"
PUBLICATION_DATE              = 2008-11-28T10:19:41
DOCUMENT_TOPIC_TYPE           = "CALIBRATION DESCRIPTION"
INTERCHANGE_FORMAT            = ASCII
DOCUMENT_FORMAT               = TEXT
DESCRIPTION                   = "LISTS THE NAMES OF THE INPUT, CALIBRATION
                                 AND OTHER FILES TOGETHER WITH THE VERSION
                                 NUMBERS OF THE PROCESSING SOFTWARE."

END_OBJECT                    = ASCII_DOCUMENT
```

6.4 Data Product Design – Header Data Element Descriptions

Values in the tables shall be separated by a "," the START_BYTE and BYTES value should not include this within the column definition.

6.4.1 Product Design – C1XS HK Time Series

The C1XS HK product consists of a time series of over one hundred housekeeping parameters that describe the state of the instrument operation. The information contained in the PDS data file shall contain each of the parameters extracted from the C1XS HK telemetry packet, and where appropriate converted to engineering units using the conversion tables defined in the C1XS data handling ICD (C1-C1X-RAL-ICD-0002).

```
OBJECT               = TABLE
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 293
  ROW_BYTES          = 738
  COLUMNS            = 121
  NAME               = "C1XS HK"
  DESCRIPTION        = "C1XS HOUSEKEEPING DATA IN ENGINEERING UNITS"

  OBJECT             = COLUMN
    NAME             = TIME
    BYTES            = 23
    DATA_TYPE        = TIME
    START_BYTE       = 1
    DESCRIPTION      = "TIME OF OBSERVATION (UT)"
    FORMAT           = A23
    UNIT             = UT
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = <see Table 6-1 HK Parameter List>
    DATA_TYPE        = < see Table 6-1 HK Parameter List>
    START_BYTE       =
    BYTES            =
    DESCRIPTION      = < see Table 6-1 HK Parameter List>
    FORMAT           = < see Table 6-1 HK Parameter List>
    UNIT             = < see Table 6-1 HK Parameter List>
    VALID_MAXIMUM    =
    VALID_MINIMUM    =
  END_OBJECT         = COLUMN

END_OBJECT           = TABLE

END
```

Table 6-1 HK Parameter List

NAME	DESCRIPTION	UNITS	FORMAT
TC_FLAGS	TC error flags	-	I3
SW_VER	Software Version (divide by 10 to get version e.g. 43 = version 4.3)	-	F3.1
TC_OK	TCs Accepted Count	-	I3
TC_REJ	TCs rejected Count	-	I3
TC_ECODE	TC Error Code	-	I3
SW_FLAGS_LB	Character string, length 8. Character definitions: 0 - XSM processing 1= enabled 1 - C1XS processing 1 = enabled 2 - Door radiation status 1=Shut 3 - Door radiation movement 1= Moving 4 - XSM shutter status 1= closed 5 - XSM entering annealing 1= annealing 6 - XSM on for >1s 1= true 7 - XSM switched on 1 = true	-	A8
CRC_BAD_R	Received CRC from last TC packet with bad CRC	-	I5
CRC_BAD_C	Calculated CRC from last TC packet with bad CRC	-	I5
DOOR_STATE	Door State string “S E”	-	A2

	S – Door state (from software) 0 = OPEN 1 = CLOSING 2 = OPENING 3 = CLOSED 4 = SWITCH_FAIL E – Door state (from EEPROM) 0 = OPEN 1 = CLOSING 2 = OPENING 3 = CLOSED		
MODE	Mode/Sub-mode string “MS” M – Mode 0 = STANDBY 1 = OPERATING 2 = TEST 3 = CALIBRATE 4 = RESTING F = EMERGENCY S – Sub-mode 0 = TIME_TAGGED 1 = LC_SPECTRUM 2 = HC_SPECTRUM 3 = LUNAR 4 = COMPRESSED_LC 5 = TT_3PIX 6 = TT 7 = HRLCS 8 = AUTO2	–	A2
MAX_CAN	Max CAN packets in Output queue this HK period	–	I4
TIME_ADJ	Last calculated time adjustment	s	I10
TIME_ADJF	Last calculated time adjustment (fraction)	–	I5
TIME_WBG	Worst background elapsed time this HK period	–	I5
TIME_WIDL	Worst idle loop count this HK period	–	I5
CAN_NOT_READY	Count of times CAN TX not ready	–	I5
LOST_PUS	Count of lost TM PUS packets	–	I5
RET_STACK	Return Stack pointer	–	I3
PAR_STACK	Parameter stack pointer	–	I3
EEW_RETRY	EEPROM write retries	–	I5
EEW_FAIL	EEPROM write failures	–	I5
DOOR_CLS_DT	Seconds remaining of minimum door closed interval	s	I10
SW_FLAGS_HB	Character string, length 4. Character definitions: 0 – XSM Cal sequence (1 = started) 1 – XSM annealing heater (1=selected) 2 – TC XSM anneal start Rxd (1= true) 3 – TC XSM anneal stop Rxd (1=true)	–	A4
DOOR_INT_CNT	Door close integrator count	–	I3
TIME_SINCE_CAL	Seconds since last calibration	–	I5
LAST_TC	Last TC Type, qualifier, function, data	–	I7
LAST_TC1	Last but 1 TC Type qualifier, function, data	–	I7
SCD1623_OFF	Character string, length 8. Detectors 16 to 23, a ‘1’ indicates detector inhibited	–	A8
SCD0815_OFF	Character string, length 8. Detectors 8 to 15, a ‘1’ indicates detector inhibited	–	A8
SCD0007_OFF	Character string, length 8. Detectors 0 to 7, a ‘1’ indicates detector inhibited	–	A8

VIDEO_PWR_STATUS	Power monitor	-	I3
BANK1A_CNT	BANK 1 Channel A Event Count	-	I5
BANK1B_CNT	BANK 1 Channel B Event Count	-	I5
BANK1C_CNT	BANK 1 Channel C Event Count	-	I5
BANK1D_CNT	BANK 1 Channel D Event Count	-	I5
BANK1E_CNT	BANK 1 Channel E Event Count	-	I5
BANK1F_CNT	BANK 1 Channel F Event Count	-	I5
BANK1G_CNT	BANK 1 Channel G Event Count	-	I5
BANK1H_CNT	BANK 1 Channel H Event Count	-	I5
BANK1I_CNT	BANK 1 Channel I Event Count	-	I5
BANK1J_CNT	BANK 1 Channel J Event Count	-	I5
BANK1K_CNT	BANK 1 Channel K Event Count	-	I5
BANK1L_CNT	BANK 1 Channel L Event Count	-	I5
BANK2A_CNT	BANK 2 Channel A Event Count	-	I5
BANK2B_CNT	BANK 2 Channel B Event Count	-	I5
BANK2C_CNT	BANK 2 Channel C Event Count	-	I5
BANK2D_CNT	BANK 2 Channel D Event Count	-	I5
BANK2E_CNT	BANK 2 Channel E Event Count	-	I5
BANK2F_CNT	BANK 2 Channel F Event Count	-	I5
BANK2G_CNT	BANK 2 Channel G Event Count	-	I5
BANK2H_CNT	BANK 2 Channel H Event Count	-	I5
BANK2I_CNT	BANK 2 Channel I Event Count	-	I5
BANK2J_CNT	BANK 2 Channel J Event Count	-	I5
BANK2K_CNT	BANK 2 Channel K Event Count	-	I5
BANK2L_CNT	BANK 2 Channel L Event Count	-	I5
XSM_V_5	XSM +5V monitor	V	F5.1
XSM_V_12	XSM +12V monitor	V	F5.1
XSM_V_M12	XSM -12V monitor	V	F5.1
XSM_T_PIN	XSM PIN detector temperature	C	F5.1
XSM_T_BOX	XSM Detector Box temperature	C	F5.1
XSM_HV	XSM HV Bias Voltage	V	F5.1
XSM_LEAK	XSM Leakage Current	pA	F5.1
T_PSU	DC Converter Temperature	C	F5.1
T_CANPCB	CAN/ HK PCB Temperature	C	F5.1
T_BOX	-Y plate Temperature	C	F5.1
T_VIDPCB	Video Digital PCB temperature	C	F5.1
T_3DP1	Bank 1 3D+ temperature	C	F5.1
T_3DP2	Bank 2 3D+ temperature	C	F5.1
T_SCDB	SCD column B temperature	C	F5.1
T_SCDE	SCD column E temperature	C	F5.1
V_12	12V regulated supply	V	F5.1
V_5	5V regulated supply	V	F5.1
V_3_3	3. 3V regulated supply	V	F5.1
XSM_V_PELT	XSM Peltier supply voltage	V	F5.1
V_M12	-12V regulated supply	V	F5.1
V_M5	-5V regulated supply	V	F5.1
V_MOTOR_P1	Motor Phase 1 voltage	V	F5.1
V_MOTOR_P2	Motor Phase 2 voltage	V	F5.1
V_SCD_SS	SCD Substrate Voltage Monitor	V	F5.1
V_SCD_OG	SCD Output Gate Voltage Monitor	V	F5.1
V_SCD_RD	SCD Reset Drain Voltage Monitor	V	F5.1
V_SCD_OD	SCD Output Drain Voltage Monitor	V	F5.1
V_39	39V supply voltage [39V_ VMON]	V	F5.1
V_0	0V	V	F5.1
DOOR_MECH_STATUS	Character string, length 5. Character definitions:	-	A5

	1 - Launch Lock Latch Enable '1' = enabled 2 - Launch Lock Bypass Enable '1' = enabled 3 - Launch Lock Latch Open [SW1] '1' = true 4 - Launch Lock Latch Closed [SW2] '1' = true 5 - Door Motor Running '1' = true		
DOOR_STEP	Door Motor Step Count	-	I5
XSM_CONTROL	Character string, length 5. Character definitions:	-	A5
XSM_CMD_PELT	1 - Peltier Supply 1 = On, 0 = Off		
XSM_PELT_MODE	2 - Peltier Control 1 = Heat, 0 = Cool		
XSM_CMD_BIAS	3 - HV Bias on/ off : 1= on 0 = off		
XSM_CMD_HVOVER	4 - HV Override Enable: '1' = enabled		
XSM_CMD_FIFO	5 - LSB FIFO write Enable: '1' = enabled		
XSM_STATUS	Character string, length 2. Character definitions: 1 -Detector Overtemp 2 - HV bias overvoltage	-	A2
XSM_DAC0	XSM DAC 0 (last value written to DAC)	-	I3
XSM_DAC1	XSM DAC 1 (last value written to DAC)	-	I3
XSM_STATE	XSM State	-	I2
XSM_COUNT	XSM second counter	sec	I5
SW+PATCH	Software Patch ID	-	I3
BOOT_PG	Boot Page Number	-	I3
SS_DAC_AV	SS DAC Monitor Average	-	I5
OG_DAC_AV	OG DAC Monitor Average	-	I5
RD_DAC_AV	RD DAC Monitor Average	-	I5
OD_DAC_AV	OD DAC Monitor Average	-	I5
SS_DAC_REQ	SS DAC demand	-	I3
OF_DAC_REQ	OG DAC demand	-	I3
RD_DAC_REQ	RD DAC demand	-	I3
OD_DAC_REQ	OD DAC demand	-	I3
EVENTS_SEC	Most events per second this period	-	I5
CK_SUMS	Memory checksums	-	I10
T6PAR55	Contents of address in Table 6 param 55	-	I5
ITL_ID	ITL identity	-	I5
XSM_Spectra	XSM Spectra Count	-	I5
XSM_FIFO_2	XSM RICA FIFO port 2 register contents	-	I5
XSM_FIFO_3	XSM RICA FIFO port 3 register contents	-	I5
XSM_RICA	XSM RICA software control register contents	-	I5
XSM_FIFO_ERR1	XSM FIFO error register 1 contents	-	I10
XSM_FIFO_ERR2	XSM FIFO error register 2 contents	-	I10
C1XS_DOOR_POSN	C1XS door position	V	F5.1
RAD_MON_VLG	Radiation monitor very low gain	V	F5.1
RAD_MON_LG	Radiation monitor low gain	V	F5.1
RAD_MON_MG	Radiation monitor med. gain	V	F5.1
RAD_MON_HG	Radiation monitor high gain	V	F5.1
RAD_MON_SUPPLY	Radiation monitor +12V	V	F5.1
RAD_MON_VHG	Radiation monitor very high gain	V	F5.1

6.4.2 Product Design – C1XS Time Tagged X-Ray Data Type 1 (Deprecated)

The C1XS time tagged science mode returns information on individual events detected by the sensors. For the PDS product, the events shall be unpacked and the spacecraft and time offset information used to calculate an absolute time for each event. The detector number, event signal (ADC bin number) and error flag information shall also be included.

The PDS label information will only be provided in this document if the data type is used during the mission.

6.4.3 Product Design – C1XS X-Ray Spectra Time Series Types 2 and 6 (Deprecated)

The C1XS energy spectrum object shall be used for data retrieved in both low count and compressed low count spectra modes. The spectra consist of 256 energy levels (0 to 255) containing the number of events detected in the corresponding energy range within each integration period. The count information contained in the PDS data shall be decompressed from the internal compression scheme used within the telemetry format.
Each spectrum shall have an associated start time and integration interval.

The PDS label information will only be provided in this document if the data type is used during the mission.

6.4.4 Product Design – XSM X-Ray Spectra Time Series, Type 4

XSM data product is solar X-ray spectra at 1-20 keV (512 spectral bins) with 16 sec time resolution and 250 eV energy resolution at 6 keV. The product also contains some status information.

```
/*  DATA OBJECTS DEFINITION */

OBJECT                          = TABLE
   INTERCHANGE_FORMAT           = ASCII
   ROWS                         =
   ROW_BYTES                    = 3621
   COLUMNS                      = 6
   NAME                         = "XSM SCIENCE DATA"
   DESCRIPTION                  = "XSM SCIENCE AND DIAGNOSTIC DATA"

   OBJECT                       = COLUMN (UTCTime)
      NAME                      = "START TIME"
      BYTES                     = 23
      DATA_TYPE                 = TIME
      START_BYTE                = 1
      UNIT                      = UT
      DESCRIPTION               = "START TIME OF OBSERVATION"
   END_OBJECT                   = COLUMN

   OBJECT                       = COLUMN (Integration)
      NAME                      = "INTEGRATION TIME"
      BYTES                     = 5
      DATA_TYPE                 = ASCII_INTEGER
      START_BYTE                = 25
      UNIT                      = "SECONDS"
      DESCRIPTION               = "INTEGRATION TIME"
      VALID_MAXIMUM             = 9999
      VALID_MINIMUM             = 0008
   END_OBJECT                   = COLUMN

   OBJECT                       = COLUMN (OvertempHVVar)
      NAME                      = "OVERTEMP HV"
```

```
      BYTES                    = 1
      DATA_TYPE                = ASCII_INTEGER
      START_BYTE               = 31
      UNIT                     = "N/A"
      DESCRIPTION              = "OVERTEMP HV"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN (OvervoltageHVVar)
      NAME                     = "OVERVOLTAGE HV"
      BYTES                    = 1
      DATA_TYPE                = ASCII_INTEGER
      START_BYTE               = 33
      UNIT                     = "N/A"
      DESCRIPTION              = "OVERVOLTAGE HV"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN (ADCConversionVar)
     NAME                      = "ADC CONVERSION"
      BYTES                    = 1
      DATA_TYPE                = ASCII_INTEGER
      START_BYTE               = 35
      UNIT                     = "N/A"
      DESCRIPTION              = "ADC CONVERSION"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN (Spectra)
      NAME                     = "XSM SPECTRUM"
      START_BYTE               = 37
      UNIT                     = "N/A"
      ITEMS                    = 512
      ITEM_BYTES               = 6
      BYTES                    = 3583
      DATA_TYPE                = ASCII_INTEGER
      ITEM_OFFSET              = 7
      VALID_MAXIMUM            = 65535
      VALID_MINIMUM            = 0
      DESCRIPTION              = "XSM SPECTRUM"
   END_OBJECT                  = COLUMN

END_OBJECT                     = TABLE
```

6.4.5 Product Design – C1XS X-Ray Spectra Time Series, Type 12

The C1XS high resolution energy spectrum object shall be used for data retrieved in high resolution low count spectra mode. The spectra consist of 512 energy levels (0 to 511) containing the number of events detected in the corresponding energy range within each integration period. Each spectrum shall have an associated start time and integration interval.

```
/***      DATA CALIBRATION RELATED PARAMETERS                    ***/

/***      OBJECT DESCRIPTION                                     ***/
OBJECT                         = TABLE
```

```
   INTERCHANGE_FORMAT          = ASCII
   ROWS                        = 179
   ROW_BYTES                   = 2595
   COLUMNS                     = 4
   NAME                        = "C1XS HR SPECTRA"
   DESCRIPTION                 = "C1XS HIGH RESOLUTION SPECTRA"

   OBJECT                      = COLUMN
      NAME                     = "START TIME"
      BYTES                    = 23
      DATA_TYPE                = TIME
      START_BYTE               = 1
      UNIT                     = UT
      DESCRIPTION              = "START TIME OF OBSERVATION"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN
      NAME                     = "INTEGRATION TIME"
      BYTES                    = 5
      DATA_TYPE                = ASCII_INTEGER
      START_BYTE               = 25
      UNIT                     = "SECONDS"
      DESCRIPTION              = "INTEGRATION TIME"
      VALID_MAXIMUM            = 9999
      VALID_MINIMUM            = 0008
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN
      NAME                     = "DETECTOR"
      BYTES                    = 3
      DATA_TYPE                = ASCII_INTEGER
      START_BYTE               = 31
      UNIT                     = "N/A"
      DESCRIPTION              = "DETECTOR NUMBER"
      VALID_MAXIMUM            = "23"
      VALID_MINIMUM            = "00"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN
      DESCRIPTION              = "NUMBER OF X-RAY EVENTS in EACH OF THE 512 X-RAY
                                  SPECTRUM ELEMENTS"
      NAME                     = "EVENTS IN EACH X-RAY SPECTRUM ELEMENT"
      START_BYTE               = 35
      UNIT                     = "N/A"
      ITEMS                    = 255
      ITEM_BYTES               = 4
      DATA_TYPE                = ASCII_INTEGER
      ITEM_OFFSET              = 5
      VALID_MAXIMUM            = 255
      VALID_MINIMUM            = 0
   END_OBJECT                  = COLUMN

END_OBJECT                     = TABLE

END
```

6.4.6 Product Design – C1XS Time Tagged X-Ray Data Type 10

The C1XS time tagged type 10 science mode returns information on individual events detected by the sensors, each sensor is allocated a separate packet. For the PDS product, the events shall be unpacked to give an event time (calculated from the spacecraft and time offset information), the detector number and event signal magnitude.

```
OBJECT                = TABLE
  INTERCHANGE_FORMAT  = ASCII
  ROWS                = 25439
  ROW_BYTES           = 33
  COLUMNS             = 3
  NAME                = "C1XS TYPE 10 TIME TAGGED EVENTS"
  DESCRIPTION         = "C1XS SINGLE PIXEL TIME TAGGED EVENTS"

  OBJECT              = COLUMN
    BYTES             = 23
    DATA_TYPE         = "TIME"
    NAME              = "TIME"
    START_BYTE        = 1
    UNIT              = "UT"
    DESCRIPTION       = "TIME OF OBSERVATION"
  END_OBJECT          = COLUMN

  OBJECT              = COLUMN
    BYTES             = 2
    DATA_TYPE         = "ASCII_INTEGER"
    NAME              = "DETECTOR"
    START_BYTE        = 25
    UNIT              = "N/A"
    DESCRIPTION       = "DETECTOR NUMBER"
    VALID_MAXIMUM     = 23
    VALID_MINIMUM     = 0
  END_OBJECT          = COLUMN

  OBJECT              = COLUMN
    BYTES             = 4
    DATA_TYPE         = "ASCII_INTEGER"
    NAME              = "X_RAY_SIGNAL"
    START_BYTE        = 28
    UNIT              = "N/A"
    VALID_MAXIMUM     = 4095
    VALID_MINIMUM     = 0
  END_OBJECT          = COLUMN

END_OBJECT            = TABLE

END
```

6.4.7 Product Design – C1XS Time Tagged X-Ray Data Type 11

The C1XS time tagged type 11 science mode returns three data values from a single X-ray event and stores these data in a packet for each detector. For the PDS product, the events

shall be unpacked to give an event time (calculated from the spacecraft and time offset information), the detector number and three event signal magnitudes.

```
OBJECT               = TABLE
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 25439
  ROW_BYTES          = 43
  COLUMNS            = 5
  NAME               = "C1XS TYPE 11 TIME TAGGED EVENTS"
  DESCRIPTION        = "C1XS THREE PIXEL TIME TAGGED EVENTS"

  OBJECT             = COLUMN
    BYTES            = 23
    DATA_TYPE        = TIME
    NAME             = "TIME"
    START_BYTE       = 1
    UNIT             = UT
    DESCRIPTION      = "TIME OF OBSERVATION"
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    BYTES            = 2
    DATA_TYPE        = ASCII_INTEGER
    NAME             = "DETECTOR"
    START_BYTE       = 25
    UNIT             = "N/A"
    DESCRIPTION      = "DETECTOR NUMBER"
    VALID_MAXIMUM    = 23
    VALID_MINIMUM    = 0
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    BYTES            = 4
    DATA_TYPE        = ASCII_INTEGER
    NAME             = "X_RAY_SIGNAL_PIXEL0"
    START_BYTE       = 28
    UNIT             = "N/A"
    VALID_MAXIMUM    = 4095
    VALID_MINIMUM    = 0
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    BYTES            = 4
    DATA_TYPE        = ASCII_INTEGER
    NAME             = "X_RAY_SIGNAL_PIXEL1"
    START_BYTE       = 33
    UNIT             = "N/A"
    VALID_MAXIMUM    = 4095
    VALID_MINIMUM    = 0
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    BYTES            = 4
    DATA_TYPE        = ASCII_INTEGER
    NAME             = "X_RAY_SIGNAL_PIXEL2"
    START_BYTE       = 38
```

```
    UNIT              = "N/A"
    VALID_MAXIMUM     = 4095
    VALID_MINIMUM     = 0
  END_OBJECT          = COLUMN
END_OBJECT            = TABLE

END
```

6.4.8 Product Design – Auxiliary Data

The detector readout electronics configuration and signal thresholds are transmitted in C1XS telemetry packet types 8 and 9. The type 8 packet is transmitted on transition to Operating mode from Standby or Resting. The type 9 packet is transmitted whenever a threshold adjustment is performed (default configuration is every 256s).

The type 8 packet data shall be used to generate the following data products.

DCIXS operating parameters

XSM operating parameters

The type 9 packet data shall be used to generate the data product giving the calculated energy zero position and the event detection thresholds.

6.4.8.1 Zero Position and Threshold Data (Type 9 packet).

```
OBJECT                = TABLE
  INTERCHANGE_FORMAT  = ASCII
  ROWS                =
  ROW_BYTES           = 385
  COLUMNS             = 73
  NAME                = "C1XS ZERO POSITION DATA"
  DESCRIPTION         = "C1XS ZERO POSITION AND THRESHOLD PARAMETERS"

  OBJECT              = COLUMN
    BYTES             = 23
    DATA_TYPE         = "TIME"
    NAME              = "TIME"
    START_BYTE        = 1
    UNIT              = "UT"
    DESCRIPTION       = "TIME OF OBSERVATION"
  END_OBJECT          = COLUMN
```

The following column object is repeated for all the lines in Table 6-2

```
  OBJECT              = COLUMN
    NAME              = <see Table 6-2>
    DATA_TYPE         = ASCII_INTEGER
    START_BYTE        = <see Table 6-2>
    BYTES             = 4
    DESCRIPTION       = <see Table 6-2>
    UNIT              = N/A
    VALID_MAXIMUM     = 8192
    VALID_MINIMUM     = 0
  END_OBJECT          = COLUMN

END_OBJECT            = TABLE
```

END

Table 6-2 Video Circuit Parameter List

NAME	DESCRIPTION	Start Byte
SCD0_ZERO_POSITION	Detector #0 Smoothed noise-zero	25
SCD1_ZERO_POSITION	Detector #1 Smoothed noise-zero	30
SCD2_ZERO_POSITION	Detector #2 Smoothed noise-zero	35
SCD3_ZERO_POSITION	Detector #3 Smoothed noise-zero	40
SCD4_ZERO_POSITION	Detector #4 Smoothed noise-zero	45
SCD5_ZERO_POSITION	Detector #5 Smoothed noise-zero	50
SCD6_ZERO_POSITION	Detector #6 Smoothed noise-zero	55
SCD7_ZERO_POSITION	Detector #7 Smoothed noise-zero	60
SCD8_ZERO_POSITION	Detector #8 Smoothed noise-zero	65
SCD9_ZERO_POSITION	Detector #9 Smoothed noise-zero	70
SCD10_ZERO_POSITION	Detector #10 Smoothed noise-zero	75
SCD11_ZERO_POSITION	Detector #11 Smoothed noise-zero	80
SCD12_ZERO_POSITION	Detector #12 Smoothed noise-zero	85
SCD13_ZERO_POSITION	Detector #13 Smoothed noise-zero	90
SCD14_ZERO_POSITION	Detector #14 Smoothed noise-zero	95
SCD15_ZERO_POSITION	Detector #15 Smoothed noise-zero	100
SCD16_ZERO_POSITION	Detector #16 Smoothed noise-zero	105
SCD17_ZERO_POSITION	Detector #17 Smoothed noise-zero	110
SCD18_ZERO_POSITION	Detector #18 Smoothed noise-zero	115
SCD19_ZERO_POSITION	Detector #19 Smoothed noise-zero	120
SCD20_ZERO_POSITION	Detector #20 Smoothed noise-zero	125
SCD21_ZERO_POSITION	Detector #21 Smoothed noise-zero	130
SCD22_ZERO_POSITION	Detector #22 Smoothed noise-zero	135
SCD23_ZERO_POSITION	Detector #23 Smoothed noise-zero	140
SCD0_H_THRESHOLD	Detector #0 High Threshold	145
SCD1_H_THRESHOLD	Detector #1 High Threshold	150
SCD2_H_THRESHOLD	Detector #2 High Threshold	155
SCD3_H_THRESHOLD	Detector #3 High Threshold	160
SCD4_H_THRESHOLD	Detector #4 High Threshold	165
SCD5_H_THRESHOLD	Detector #5 High Threshold	170
SCD6_H_THRESHOLD	Detector #6 High Threshold	175
SCD7_H_THRESHOLD	Detector #7 High Threshold	180
SCD8_H_THRESHOLD	Detector #8 High Threshold	185
SCD9_H_THRESHOLD	Detector #9 High Threshold	190
SCD10_H_THRESHOLD	Detector #10 High Threshold	195
SCD11_H_THRESHOLD	Detector #11 High Threshold	200
SCD12_H_THRESHOLD	Detector #12 High Threshold	205
SCD13_H_THRESHOLD	Detector #13 High Threshold	210

SCD14_H_THRESHOLD	Detector #14 High Threshold	215
SCD15_H_THRESHOLD	Detector #15 High Threshold	220
SCD16_H_THRESHOLD	Detector #16 High Threshold	225
SCD17_H_THRESHOLD	Detector #17 High Threshold	230
SCD18_H_THRESHOLD	Detector #18 High Threshold	235
SCD19_H_THRESHOLD	Detector #19 High Threshold	240
SCD20_H_THRESHOLD	Detector #20 High Threshold	245
SCD21_H_THRESHOLD	Detector #21 High Threshold	250
SCD22_H_THRESHOLD	Detector #22 High Threshold	255
SCD23_H_THRESHOLD	Detector #23 High Threshold	260
SCD0_L_THRESHOLD	Detector #0 Low Threshold	265
SCD1_L_THRESHOLD	Detector #1 Low Threshold	270
SCD2_L_THRESHOLD	Detector #2 Low Threshold	275
SCD3_L_THRESHOLD	Detector #3 Low Threshold	280
SCD4_L_THRESHOLD	Detector #4 Low Threshold	285
SCD5_L_THRESHOLD	Detector #5 Low Threshold	290
SCD6_L_THRESHOLD	Detector #6 Low Threshold	295
SCD7_L_THRESHOLD	Detector #7 Low Threshold	300
SCD8_L_THRESHOLD	Detector #8 Low Threshold	305
SCD9_L_THRESHOLD	Detector #9 Low Threshold	310
SCD10_L_THRESHOLD	Detector #10 Low Threshold	315
SCD11_L_THRESHOLD	Detector #11 Low Threshold	320
SCD12_L_THRESHOLD	Detector #12 Low Threshold	325
SCD13_L_THRESHOLD	Detector #13 Low Threshold	330
SCD14_L_THRESHOLD	Detector #14 Low Threshold	335
SCD15_L_THRESHOLD	Detector #15 Low Threshold	340
SCD16_L_THRESHOLD	Detector #16 Low Threshold	345
SCD17_L_THRESHOLD	Detector #17 Low Threshold	350
SCD18_L_THRESHOLD	Detector #18 Low Threshold	355
SCD19_L_THRESHOLD	Detector #19 Low Threshold	360
SCD20_L_THRESHOLD	Detector #20 Low Threshold	265
SCD21_L_THRESHOLD	Detector #21 Low Threshold	370
SCD22_L_THRESHOLD	Detector #22 Low Threshold	375
SCD23_L_THRESHOLD	Detector #23 Low Threshold	380

6.4.8.2 C1XS Operating Parameters (Type 8 packet)

```
OBJECT               = TABLE
  INTERCHANGE_FORMAT = ASCII
  ROWS               =
  ROW_BYTES          = 286
  COLUMNS            = 66
  NAME               = "C1XS OPERATIONAL PARAMETERS"
  DESCRIPTION        = "C1XS OPERATIONAL PARAMETERS"

  OBJECT             = COLUMN
```

```
    BYTES              = 23
    DATA_TYPE          = "TIME"
    NAME               = "TIME"
    START_BYTE         = 1
    UNIT               = "UT"
    DESCRIPTION        = "TIME OF OBSERVATION"
  END_OBJECT           = COLUMN
```

The following column object is repeated for all the lines in Table 6-3

```
  OBJECT               = COLUMN
    NAME               = <see Table 6-3>
    DATA_TYPE          = ASCII_INTEGER
    START_BYTE         = <see Table 6-3>
    BYTES              = <see Table 6-3>
    DESCRIPTION        = <see Table 6-3>
    UNIT               = "N/A"
    VALID_MAXIMUM      = <see Table 6-3>
    VALID_MINIMUM      = <see Table 6-3>
  END_OBJECT           = COLUMN

END_OBJECT             = TABLE

END
```

Table 6-3 Video Configuration Data

NAME	DESCRIPTION	Start Byte	Bytes	Max	Min
VIDEO_CONFIG1	SCD 0, 4 & 8 configuration	25	3	255	0
VIDEO_CONFIG2	SCD 1, 5 & 9 configuration	29	3	255	0
VIDEO_CONFIG3	SCD 2, 6 & 10 configuration	33	3	255	0
VIDEO_CONFIG4	SCD 3, 7 & 11 configuration	37	3	255	0
VIDEO_CONFIG5	SCD 12, 16 & 20 configuration	41	3	255	0
VIDEO_CONFIG6	SCD 13, 17 & 21 configuration	45	3	255	0
VIDEO_CONFIG7	SCD 14, 18 & 22 configuration	49	3	255	0
VIDEO_CONFIG8	SCD 15, 19 & 23 configuration	53	3	255	0
SCD0_GAIN	SCD 0 video system gain	57	2	31	0
SCD1_GAIN	SCD 1 video system gain	60	2	31	0
SCD2_GAIN	SCD 2 video system gain	63	2	31	0
SCD3_GAIN	SCD 3 video system gain	66	2	31	0
SCD4_GAIN	SCD 4 video system gain	69	2	31	0
SCD5_GAIN	SCD 5 video system gain	72	2	31	0
SCD6_GAIN	SCD 6 video system gain	75	2	31	0
SCD7_GAIN	SCD 7 video system gain	78	2	31	0
SCD8_GAIN	SCD 8 video system gain	81	2	31	0
SCD9_GAIN	SCD 9 video system gain	84	2	31	0
SCD10_GAIN	SCD 10 video system gain	87	2	31	0
SCD11_GAIN	SCD 11 video system gain	90	2	31	0
SCD12_GAIN	SCD 12 video system gain	93	2	31	0
SCD13_GAIN	SCD 13 video system gain	96	2	31	0
SCD14_GAIN	SCD 14 video system gain	99	2	31	0
SCD15_GAIN	SCD 15 video system gain	102	2	31	0
SCD16_GAIN	SCD 16 video system gain	105	2	31	0
SCD17_GAIN	SCD 17 video system gain	108	2	31	0

SCD18_GAIN	SCD 18 video system gain	111	2	31	0
SCD19_GAIN	SCD 19 video system gain	114	2	31	0
SCD20_GAIN	SCD 20 video system gain	117	2	31	0
SCD21_GAIN	SCD 21 video system gain	120	2	31	0
SCD22_GAIN	SCD 22 video system gain	123	2	31	0
SCD23_GAIN	SCD 23 video system gain	126	2	31	0
SCD0_OFFSET	SCD 0 video system offset	129	4	1023	0
SCD1_OFFSET	SCD 1 video system offset	134	4	1023	0
SCD2_OFFSET	SCD 2 video system offset	139	4	1023	0
SCD3_OFFSET	SCD 3 video system offset	144	4	1023	0
SCD4_OFFSET	SCD 4 video system offset	149	4	1023	0
SCD5_OFFSET	SCD 5 video system offset	154	4	1023	0
SCD6_OFFSET	SCD 6 video system offset	159	4	1023	0
SCD7_OFFSET	SCD 7 video system offset	164	4	1023	0
SCD8_OFFSET	SCD 8 video system offset	169	4	1023	0
SCD9_OFFSET	SCD 9 video system offset	174	4	1023	0
SCD10_OFFSET	SCD 10 video system offset	179	4	1023	0
SCD11_OFFSET	SCD 11 video system offset	184	4	1023	0
SCD12_OFFSET	SCD 12 video system offset	189	4	1023	0
SCD13_OFFSET	SCD 13 video system offset	194	4	1023	0
SCD14_OFFSET	SCD 14 video system offset	199	4	1023	0
SCD15_OFFSET	SCD 15 video system offset	204	4	1023	0
SCD16_OFFSET	SCD 16 video system offset	209	4	1023	0
SCD17_OFFSET	SCD 17 video system offset	214	4	1023	0
SCD18_OFFSET	SCD 18 video system offset	219	4	1023	0
SCD19_OFFSET	SCD 19 video system offset	224	4	1023	0
SCD20_OFFSET	SCD 20 video system offset	229	4	1023	0
SCD21_OFFSET	SCD 21 video system offset	234	4	1023	0
SCD22_OFFSET	SCD 22 video system offset	239	4	1023	0
SCD23_OFFSET	SCD 23 video system offset	244	4	1023	0
BANK1_REJECT	SCD 0 to 11 event reject level	249	5	65535	0
BANK1_PIXEL_MODE	SCD 0 to 11 pixel processing mode	255	2	15	0
SCD_VOD_DAC	SCD OD voltage DAC	258	3	255	0
SCD_VRD_DAC	SCD RD voltage DAC	262	3	255	0
BANK1_PWR	Bank1 power control	265	2	15	0
BANK2_REJECT	SCD 12 to 23 event reject level	271	5	65535	0
BANK2_PIXEL_MODE	SCD 12 to 23 pixel processing mode	274	2	15	0
SCD_VOG_DAC	SCD OG voltage DAC	278	3	255	0
SCD_VSS_DAC	SCD SS voltage DAC	282	3	255	0
BANK2_PWR	Bank2 power control	286	2	15	0

6.4.8.3 XSM Operating Parameters

```
OBJECT              = TABLE
  INTERCHANGE_FORMAT = ASCII
  ROWS              =
  ROW_BYTES         = 106
  COLUMNS           = 16
  NAME              = "XSM OPERATING PARAMETERS"
  DESCRIPTION       = "XSM OPERATING PARAMETERS IN ENGINEERING UNITS"

  OBJECT            = COLUMN
    NAME            = TIME
    BYTES           = 23
    DATA_TYPE       = TIME
    START_BYTE      = 1
    UNIT            = "UT"
```

```
  DESCRIPTION      = "TIME OF OBSERVATION"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_PELTIER_DAC
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 25
  BYTES            = 3
  DESCRIPTION      = "XSM DEFAULT PELTIER TARGET TEMPR DAC O/P"
  FORMAT           = I3
  UNIT             = "N/A"
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "0"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_DATA_THRSHLD
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 29
  BYTES            = 3
  DESCRIPTION      = "XSM DEFAULT DISCRIMINATOR THRESHOLD"
  FORMAT           = I3
  UNIT             = "N/A"
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_HVBIAS_OFFTEMP
  DATA_TYPE        = ASCII_REAL
  START_BYTE       = 33
  BYTES            = 5
  DESCRIPTION      = "XSM MAX. DETECTOR TEMPERATURE TO KEEP
                      HV BIAS ON"
  FORMAT           = F5.1
  UNIT             = degC
  VALID_MAXIMUM    = "5"
  VALID_MINIMUM    = "-15"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_PKTGEN_THRSHLD
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 39
  BYTES            = 3
  DESCRIPTION      = "XSM TOTAL COUNT THRESHOLD FOR
                      SPECTRUM TRANSMISSION"
  FORMAT           = I3
  UNIT             = "N/A"
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_DELTA_I
  DATA_TYPE        = ASCII_INTEGER
```

```
  START_BYTE       = 43
  BYTES            = 7
  DESCRIPTION      = "XSM DELTA LEAKAGE CURRENT THRESHOLD TO
                      SHUT SHUTTER (pA = COUNT * 0.78125)"
  FORMAT           = F7.3
  UNIT             = pA
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_I
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 51
  BYTES            = 7
  DESCRIPTION      = "XSM MAX EXPECTED LEAKAGE CURRENT AT END OF
                      CALIBRATION (pA = COUNT * 0.78125)"
  FORMAT           = F7.3
  UNIT             = pA
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_I_SETTLE
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 59
  BYTES            = 3
  DESCRIPTION      = "XSM LEAKAGE CURRENT SETTLING TIME IN SECONDS"
  FORMAT           = I3
  UNIT             = "N/A"
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_SHTR_PULSES
  DATA_TYPE        = ASCII_INTEGER
  START_BYTE       = 63
  BYTES            = 2
  DESCRIPTION      = "XSM NUMBER SHUTTER PULSES FOR
                      AUTONOMOUS ACTIVATION"
  FORMAT           = I2
  UNIT             = "N/A"
  VALID_MAXIMUM    = "N/A"
  VALID_MINIMUM    = "N/A"
END_OBJECT         = COLUMN

OBJECT             = COLUMN
  NAME             = XSM_HVBIAS_ONTEMP
  DATA_TYPE        = ASCII_REAL
  START_BYTE       = 66
  BYTES            = 5
  DESCRIPTION      = "XSM MAX SAFE PIN TEMPERATURE FOR BIAS
                      SWITCH-ON"
  FORMAT           = F5.1
```

```
  UNIT              = degC
  VALID_MAXIMUM     = "0"
  VALID_MINIMUM     = "N/A"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = XSM_CALTIME
  DATA_TYPE         = ASCII_INTEGER
  START_BYTE        = 72
  BYTES             = 4
  DESCRIPTION       = "XSM CALIBRATION INTEGRATION TIME IN SECONDS"
  FORMAT            = I4
  UNIT              = "N/A"
  VALID_MAXIMUM     = "N/A"
  VALID_MINIMUM     = "N/A"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = XSM_SHTR_TRIES
  DATA_TYPE         = ASCII_INTEGER
  START_BYTE        = 77
  BYTES             = 2
  DESCRIPTION       = "XSM NUMBER OF TIMES TO TRY SHUTTER OPEN/CLOSE"
  FORMAT            = I2
  UNIT              = "N/A"
  VALID_MAXIMUM     = "N/A"
  VALID_MINIMUM     = "N/A"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = XSM_NOANNEAL_I
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 80
  BYTES             = 7
  DESCRIPTION       = "DELTA LEAKAGE CURRENT IN NO ANNEALING CASE
                       (pA = COUNT * 0.78125)"
  FORMAT            = F7.3
  UNIT              = pA
  VALID_MAXIMUM     = "N/A"
  VALID_MINIMUM     = "N/A"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
  NAME              = XSM_CAL_DELTA_I
  DATA_TYPE         = ASCII_REAL
  START_BYTE        = 88
  BYTES             = 7
  DESCRIPTION       = "XSM MARGIN FOR EXCESS LEAKAGE CURRENT
                       IN CALIBRATION (pA = COUNT * 0.78125)"
  FORMAT            = F7.3
  UNIT              = pA
  VALID_MAXIMUM     = "N/A"
  VALID_MINIMUM     = "N/A"
END_OBJECT          = COLUMN

OBJECT              = COLUMN
```

```
    NAME              = XSM_ANNEAL_TIME
    DATA_TYPE         = ASCII_INTEGER
    START_BYTE        = 96
    BYTES             = 5
    DESCRIPTION       = "XSM ANNEALING PERIOD IN SECONDS"
    FORMAT            = I5
    UNIT              = "N/A"
    VALID_MAXIMUM     = "N/A"
    VALID_MINIMUM     = "N/A"
  END_OBJECT          = COLUMN

  OBJECT              = COLUMN
    NAME              = XSM_ANNEAL_I_SETTLE
    DATA_TYPE         = ASCII_INTEGER
    START_BYTE        = 102
    BYTES             = 3
    DESCRIPTION       = "XSM LEAKAGE CURRENT SETTLING TIME
                         BEFORE ANNEALING"
    FORMAT            = I3
    UNIT              = "N/A"
    VALID_MAXIMUM     = "N/A"
    VALID_MINIMUM     = "N/A"
  END_OBJECT          = COLUMN

END_OBJECT            = TABLE
```

6.4.9 Product Design – Calibrated C1XS Spectra

```
/***      DATA OBJECT                              ***/
OBJECT                          = TABLE
   INTERCHANGE_FORMAT           = ASCII
   ROWS                         =
   ROW_BYTES                    = 45277
   COLUMNS                      = 24
   NAME                         = "C1XS PROCESSED SPECTRA"
   DESCRIPTION                  = "C1XS SPECTRA"

   OBJECT                       = COLUMN
      NAME                      = "START TIME"
      BYTES                     = 23
      DATA_TYPE                 = TIME
      START_BYTE                = 1
      UNIT                      = UT
      DESCRIPTION               = "START TIME OF OBSERVATION"
   END_OBJECT                   = COLUMN

   OBJECT                       = COLUMN
      NAME                      = "DETECTOR_NUMBER"
      BYTES                     = 2
      DATA_TYPE                 = ASCII_INTEGER
      START_BYTE                = 25
      UNIT                      = "N/A"
      DESCRIPTION               = "SCD NUMBER"
      VALID_MAXIMUM             = 23
      VALID_MINIMUM             = 0
   END_OBJECT                   = COLUMN
```

```
OBJECT                      = COLUMN
   NAME                     = "INTEGRATION TIME"
   BYTES                    = 5
   DATA_TYPE                = ASCII_INTEGER
   START_BYTE               = 28
   UNIT                     = "SECONDS"
   DESCRIPTION              = "INTEGRATION TIME"
   VALID_MAXIMUM            = 128
   VALID_MINIMUM            = 8
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "SUB_SPACECRAFT_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 34
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF POINT BENEATH THE SPACECRAFT"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "SUB_SPACECRAFT_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 45
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LATITUDE OF POINT BENEATH THE SPACECRAFT"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "BORESIGHT_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 56
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF POINT C1XS IS POINTING AT"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "BORESIGHT_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 67
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LATITUDE OF POINT C1XS IS POINTING AT"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V0_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 78
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF +Y+Z VERTEX OF THE INTERSECTION
                               BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
```

```
                              SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V0_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 89
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LATITUDE OF +Y+Z VERTEX OF THE INTERSECTION
                              BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                              SURFACE"
END_OBJECT                  = COLUMN

OBJECT                    = COLUMN
   NAME                     = "V1_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 100
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF -Y+Z VERTEX OF THE INTERSECTION
                              BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                              SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V1_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 111
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LATITUDE OF -Y+Z VERTEX OF THE INTERSECTION
                              BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                              SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V2_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 122
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF -Y-Z VERTEX OF THE INTERSECTION
                              BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                              SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V2_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 133
   UNIT                     = "N/A"
   DESCRIPTION              = "LATITUDE OF -Y-Z VERTEX OF THE INTERSECTION
                              BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                              SURFACE"
```

```
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V3_LONGITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 144
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LONGITUDE OF +Y-Z VERTEX OF THE INTERSECTION
                               BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                               SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "V3_LATITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 155
   UNIT                     = "DEGREES"
   DESCRIPTION              = "LATITUDE OF +Y-Z VERTEX OF THE INTERSECTION
                               BETWEEN THE C1XS FOV RECTANGLE AND THE LUNAR
                               SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "ALTITUDE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 166
   UNIT                     = "km"
   DESCRIPTION              = "SPACECRAFT ALTITUDE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "TRACK_ANGLE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 177
   UNIT                     = "N/A"
   DESCRIPTION              = "ANGLE BETWEEN C1XS Y AXIS AND THE SPACECRAFT
                               TRACK OVER THE MOON'S SURFACE"
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "PHASE_ANGLE"
   BYTES                    = 10
   DATA_TYPE                = REAL
   START_BYTE               = 188
   UNIT                     = "DEGREES"
   DESCRIPTION              = "ANGLE BETWEEN SUB-SAT. POINT/SC VECTOR AND
                               SUB-SAT. POINT/SUN VECTOR "
END_OBJECT                  = COLUMN

OBJECT                      = COLUMN
   NAME                     = "SOLAR_ANGLE"
   BYTES                    = 10
```

```
   DATA_TYPE               = REAL
   START_BYTE              = 199
   UNIT                    = "DEGREES"
   DESCRIPTION             = "ANGLE BETWEEN SURFACE NORMAL VECTOR AT
                              SUB-SAT. POINT AND SUB-SAT POINT/SUN VECTOR"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "EMISSION_ANGLE"
   BYTES                   = 10
   DATA_TYPE               = REAL
   START_BYTE              = 210
   UNIT                    = "DEGREES"
   DESCRIPTION             = "ANGLE BETWEEN SURFACE NORMAL VECTOR AT
                              SUB-SAT. POINT AND SUB-SAT. POINT/SC VECTOR"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   NAME                    = "SUN_EARTH_SPACECRAFT_ANGLE
   BYTES                   = 10
   DATA_TYPE               = REAL
   START_BYTE              = 221
   UNIT                    = "DEGREES"
   DESCRIPTION             = "ANGLE BETWEEN THE EARTH-SUN VECTOR AND THE
                              EARTH-SPACECRAFT VECTOR"
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   DESCRIPTION             = "X-RAY ENERGY VALUE OF EACH BIN"
   NAME                    = "ENERGY_VALUE"
   START_BYTE              = 232
   UNIT                    = "eV"
   ITEMS                   = 1024
   ITEM_BYTES              = 10
   BYTES                   = 10240
   DATA_TYPE               = REAL
   ITEM_OFFSET             = 11
   VALID_MAXIMUM           = 10000
   VALID_MINIMUM           = 0
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
   DESCRIPTION             = "ERROR IN X-RAY ENERGY VALUE FOR EACH BIN"
   NAME                    = "ENERGY_VALUE_ERROR"
   START_BYTE              = 11496
   UNIT                    = "eV"
   ITEMS                   = 1024
   ITEM_BYTES              = 10
   BYTES                   = 10240
   DATA_TYPE               = REAL
   ITEM_OFFSET             = 11
   VALID_MAXIMUM           = 100
   VALID_MINIMUM           = -100
END_OBJECT                 = COLUMN

OBJECT                     = COLUMN
```

```
      DESCRIPTION              = "NUMBER OF X-RAY EVENTS WITHIN EACH BIN"
      NAME                     = "EVENT_VALUE"
      START_BYTE               = 22760
      UNIT                     = "N/A"
      ITEMS                    = 1024
      ITEM_BYTES               = 10
      BYTES                    = 10240
      DATA_TYPE                = REAL
      ITEM_OFFSET              = 11
      VALID_MAXIMUM            = 1000
      VALID_MINIMUM            = 0
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN
      DESCRIPTION              = "ERROR IN NUMBER OF X-RAY EVENTS WITHIN
                                  EACH BIN"
      NAME                     = "EVENT_VALUE_ERROR"
      START_BYTE               = 34024
      UNIT                     = "N/A"
      ITEMS                    = 1024
      ITEM_BYTES               = 10
      BYTES                    = 10240
      DATA_TYPE                = REAL
      ITEM_OFFSET              = 11
      VALID_MAXIMUM            = 1000
      VALID_MINIMUM            = -1000
   END_OBJECT                  = COLUMN

END_OBJECT                     = TABLE
```

6.4.10 Product Design – Calibration Products

6.4.10.1 C1XS detector efficiency (CDE)

```
OBJECT                         = TABLE
   INTERCHANGE_FORMAT          = ASCII
   ROWS                        = >>number of records<<
   ROW_BYTES                   = 540
   COLUMNS                     = 3
   NAME                        = "C1XS DETECTOR EFFICIENCY"
   DESCRIPTION                 = "C1XS DETECTOR EFFICIENCY DATA"

   OBJECT                      = COLUMN
      NAME                     = "ENERGY"
      BYTES                    = 10
      DATA_TYPE                = REAL
      START_BYTE               = 1
      UNIT                     = "N/A"
      DESCRIPTION              = "X-RAY ENERGY VALUE"
   END_OBJECT                  = COLUMN

   OBJECT                      = COLUMN
      DESCRIPTION              = "SCD EFFICIENCY AT SPECIFIED ENERGY VALUE"
      NAME                     = "EFFICIENCY_VALUE"
```

```
      START_BYTE              = 12
      UNIT                    = "N/A"
      ITEMS                   = 24
      ITEM_BYTES              = 10
      BYTES                   = 240
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      DESCRIPTION             = "ERROR IN SCD EFFICIENCY AT SPECIFIED
                                 ENERGY VALUE"
      NAME                    = "EFFICIENCY_VALUE_ERROR"
      START_BYTE              = 276
      UNIT                    = "N/A"
      ITEMS                   = 24
      ITEM_BYTES              = 10
      BYTES                   = 240
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
   END_OBJECT                 = COLUMN

END_OBJECT                    = TABLE
```

6.4.10.2 C1XS particle background (CPB)

```
OBJECT                        = TABLE
   INTERCHANGE_FORMAT         = ASCII
   ROWS                       = >>number of records<<
   ROW_BYTES                  = 551
   COLUMNS                    = 4
   NAME                       = "C1XS PARTICLE BACKGROUND"
   DESCRIPTION                = "C1XS PARTICLE BACKGROUND DATA"

   OBJECT                     = COLUMN
      NAME                    = "ENERGY"
      BYTES                   = 10
      DATA_TYPE               = REAL
      START_BYTE              = 1
      UNIT                    = "N/A"
      DESCRIPTION             = "X-RAY ENERGY VALUE"
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      NAME                    = "INT_TIME"
      BYTES                   = 10
      DATA_TYPE               = REAL
      START_BYTE              = 12
      UNIT                    = "N/A"
      DESCRIPTION             = "INTEGRATION TIME USED TO CALCULATE
                                 BACKGROUND COUNT RATE"
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      DESCRIPTION             = "BACKGROUND_COUNTS AT SPECIFIED ENERGY VALUE"
      NAME                    = "BACKGROUND_COUNTS"
      START_BYTE              = 12
```

```
      UNIT                    = "N/A"
      ITEMS                   = 24
      ITEM_BYTES              = 10
      BYTES                   = 240
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      DESCRIPTION             = "ERROR IN BACKGROUND_COUNTS AT SPECIFIED
                                 ENERGY VALUE"
      NAME                    = "BACKGROUND_COUNTS_ERROR"
      START_BYTE              = 287
      UNIT                    = "N/A"
      ITEMS                   = 24
      ITEM_BYTES              = 10
      BYTES                   = 240
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
   END_OBJECT                 = COLUMN

END_OBJECT                    = TABLE
```

6.4.10.3 C1XS gain correction (CGC)

```
OBJECT                        = TABLE
   INTERCHANGE_FORMAT         = ASCII
   ROWS                       = >>number of records<<
   ROW_BYTES                  = 11290
   COLUMNS                    = 5
   NAME                       = "C1XS GAIN CORRECTION"
   DESCRIPTION                = "C1XS GAIN CORRECTION DATA"

   OBJECT                     = COLUMN
      NAME                    = "SCD_NUMBER"
      BYTES                   = 2
      DATA_TYPE               = REAL
      START_BYTE              = 1
      UNIT                    = "N/A"
      DESCRIPTION             = "DETECTOR NUMBER"
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      NAME                    = "START_TEMP"
      BYTES                   = 10
      DATA_TYPE               = REAL
      START_BYTE              = 4
      UNIT                    = "N/A"
      DESCRIPTION             = "TEMPERATURE VALUE OF FIRST ELEMENT IN
                                 THE GAIN CORRECTION TABLE"
   END_OBJECT                 = COLUMN

   OBJECT                     = COLUMN
      NAME                    = "TEMPERATURE_STEP"
      BYTES                   = 10
      DATA_TYPE               = REAL
```

```
      START_BYTE              = 15
      UNIT                    = "N/A"
      DESCRIPTION             = "TEMPERATURE INCREMENT FOR EACH SUCCESSIVE
                                 VALUE IN THE GAIN CORRECTION TABLE"
    END_OBJECT                = COLUMN

    OBJECT                    = COLUMN
      DESCRIPTION             = "GAIN CORRECTION AT SPECIFIED TEMPERATURE"
      NAME                    = "GAIN_CORRECTION"
      START_BYTE              = 26
      UNIT                    = "N/A"
      ITEMS                   = 512
      ITEM_BYTES              = 10
      BYTES                   = 5120
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
    END_OBJECT                = COLUMN

    OBJECT                    = COLUMN
      DESCRIPTION             = "ERROR IN GAIN_CORRECTION AT SPECIFIED
                                 TEMPERATURE"
      NAME                    = "GAIN_CORRECTION_ERROR"
      START_BYTE              = 5658
      UNIT                    = "N/A"
      ITEMS                   = 512
      ITEM_BYTES              = 10
      BYTES                   = 5120
      DATA_TYPE               = REAL
      ITEM_OFFSET             = 11
    END_OBJECT                = COLUMN

  END_OBJECT                  = TABLE
```

6.4.11 Product Design – Other Products

Memory Dump – This C1XS telemetry product provides dumps of the onboard DPU memory (Type 5). This is only useful for instrument engineering operations and shall not be delivered to the CSDA.