

6 USE CASES

[TOPIC – Part to be merged back to 651x2g0- [1-5, 8] -core.docx document]

6.4 COROT – END OF MISSION BULK TRANSFER

6.4.1 CONTEXT AND BENEFITS

This use case deals with the transfer of a full set of science and auxiliary data acquired by the CoRoT space mission. The science data is in an unprocessed form that is referred to as ‘level 0’, or sometimes as ‘raw’ data. The auxiliary data includes data about the spacecraft and instrument status, such as currents and temperatures, that is referred to as ‘housekeeping’ data. It also includes data from instrument calibration runs. The setup of this use case was contemporary to the actual transfer of CoRoT data from the acquisition centers to the long-term archiving center at CNES after the end of the mission. It served as a PAIS demonstration of capabilities for the bulk transfer of medium-large data sets.

CoRoT is a space astronomy mission devoted to the study of the variability with time of a stars brightness, with an extremely high accuracy (100 times better than from the ground), on very long durations (up to 150 days) and a very high duty cycle (more than 90%). The original scientific objectives were focused on the study of stellar pulsations (asteroseismology) and the detection of small exoplanets. However, the data collected are now feeding many domains of stellar physics. The mission was led by CNES in association with four French laboratories, and seven participating countries and agencies (Austria, Belgium, Brazil, Germany, Spain, and the ESA Science Programme). It was launched on December 27, 2006 by a Soyuz Rocket, from Baikonur. The mission lasted almost six years (the nominal three years duration and a three years extension) and has observed more than 160,000 stars. It stopped sending data suddenly on November 2, 2012.

This use case provides an example of PAIS configurations for bulk transfers and highlights the control of sequencing as the housekeeping data must be transferred before the science data.

This use case does not cover the transfer of documents or representational information about the content of the transferred files. That information was to be transferred through a separate means. The transfer of metadata, documentation and the relationships with the actual data is covered by the ISEE and POLDER use cases, see sections 6.1 and 6.2 respectively.

6.4.2 OBJECTS TO BE TRANSFERRED

On the Producer side, the CoRoT repository of Level 0 data and accompanying auxiliary data is composed of about 460,000 files representing a total size of about 3.2 Tb. The file size spans from 1 Kb to 1.2 Gb with an average value of 1.5 Mb.

The logical layout of the repository is depicted in the following **Figure 6-1** below. The logical layout, also known as static layout, represents the hierarchy of directory and file “types” with their cardinalities. It does not represent the full list of directory and file instances.

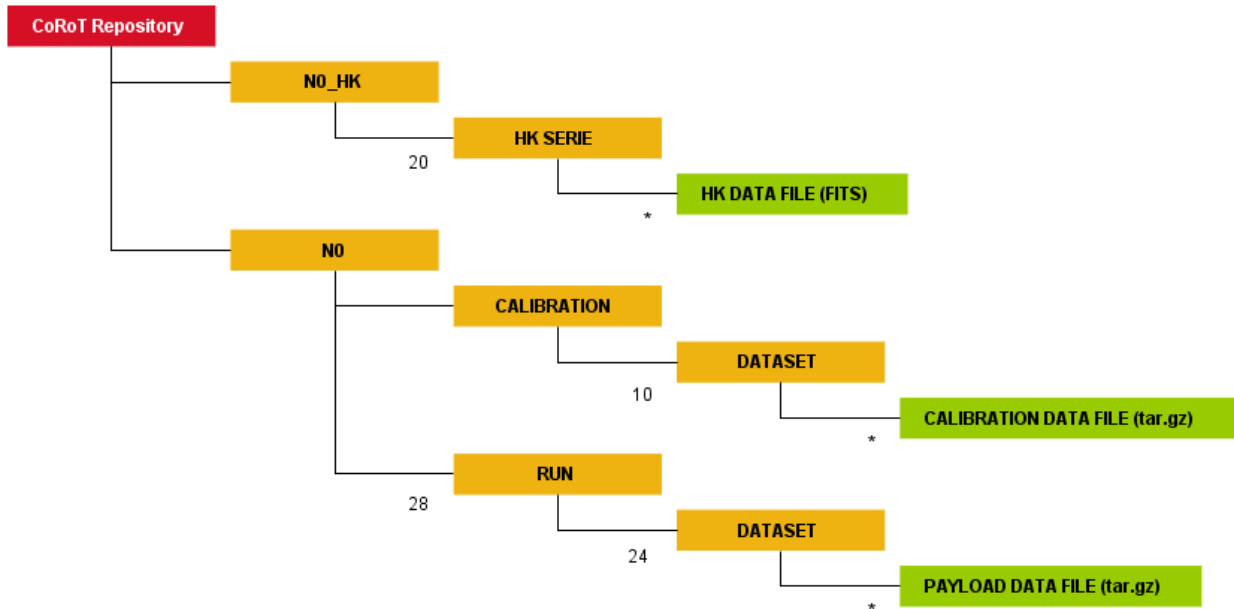


Figure 6-1: CoRoT Repository – Logical Layout

Once again, the CoRoT data to be transferred consists of auxiliary (housekeeping and calibration) and Level 0 data.

The housekeeping data are those dedicated to the Level 0 data only and are filed under an NO_HK folder of the repository. The NO is an abbreviation of “Niveau 0” meaning “Level 0” in French, and the HK stands for Housekeeping. The housekeeping data is then distributed in 20 distinct series of parameters as currents, temperatures, etc. The folders of “HK SERIE” type depicted in the above figure can take the following names: FRACTIOPPS1, FRACTIOPPS2, LATCHEDOBT, Those folders contain a variable number of files formatted according to the Flexible Image Transport System (FITS) specifications (a common space science format).

The Level 0 data is filed in an NO folder containing 28 sub-folders corresponding to the CoRoT observation “runs” that represent continuous observations of 20 to 150 days. The run folder names follow the pattern RUN{NN}_{CODE} where {NN} is a counter and the {CODE} is a non-null string whose definition will not be detailed here e.g. RUN12_LRC03. The counter starts with ‘03’. A separate run named CALIBRATION was used for calibration and validation of the CoRoT telescope. It has the same structure and content types as the other runs.

Each run folder is further subdivided into subfolders called datasets corresponding to different types of data or different processing levels. A dataset is a set of files in FITS format that are

archived and compressed in tar/gz format. A run may not contain all datasets but most of them include a majority of the datasets defined in the following table:

Table 6-1: CoRoT Level 0 Datasets

Dataset	Total Size	Max. File Size	File Number	Title
ANO_BKGROUND	16.8 Gb	392 Mb	190	Asteroseismology Background
ANO_ECARTO_AFPS	6.8 Gb	404 Mb	43	Ecartometry Fine Pointing mode
ANO_ECARTO_ARPS	66.5 Mo	14 Mb	38	Ecartometry Rough Pointing mode
ANO_ECARTO_Undefined	1.1 Mb	0.2 Mb	60	Ecartometry mode non-detected
ANO_FULLIMAGE	549 Mb	29.6 Mb	76	Asteroseismology Full Image
ANO_FULLWINDOW	317.3 Mb	35.8 Mb	36	Asteroseismology Full Window
ANO_IMAGETTE ①	82.80 Gb	1.3 Gb	194	Asteroseismology imagette
ANO_MASK	164 Kb	2 Kb	141	Asteroseismology templates
ANO_OFFSET	6.62 Gb	268 Mb	58	Asteroseismology Offset
ANO_STARWIND	15.85 Gb	185 Mb	216	Asteroseismology channel
ANO_THRESHOLDIMAGE	65.7 Gb	11 Mb	16	Asteroseismology Threshold Image
ENO_BKGROUND_MONOCHROM	1.37 Gb	1.2 Mb	5544	Monochr. Exoplanet Bkgd.
ENO_BKGROUND_SAMPLEM	3.04 Gb	7.6 Mb	1623	Monochr. Oversampled Exoplanet Bkgd.
ENO_BRIGHT_PIX_32	1.64 Gb	5.3 Mb	1372	Exoplanet sky bkg. impacted pixels 32
ENO_BRIGHT_PIX_512	710 Mb	768 Kb	4116	Exoplanet sky bkg. impacted pixels 512
ENO_FULLIMAGE	1.71 Gb	111 Mb	74	Exoplanet Full Image
ENO_FULLWINDOW	282.2 Mb	663 Kb	6898	Exoplanet Full Window
ENO_IMAGETTE	72.64 Gb	168 Mb	1015	Exoplanet imagette
ENO_OFFSET_SAMPLEM	1.08 Gb	32 Mb	74	Offset Exoplanet Oversampled Mono.
ENO_STARWIND_CHROM	17.34 Gb	969 Mb	45987	Chromatic Exoplanet Observation
ENO_STARWIND_MONOCHROM	28.3 Gb	567 Mb	120143	Mono. Exoplanet Observation
ENO_STARWIND_SAMPLEC ②	101.7 Gb	6.5 Mb	41917	Chromatic Overspld. Exoplanet Obs.
ENO_STARWIND_SAMPLEM	9.48 Gb	3.7 Mb	7777	Mono. Oversampled Exoplanet Obs.
ENO_TEMPLATE	6.08 Mb	1 Kb	6658	Exoplanet Templates

The scientific or engineering nature of the datasets will not be further described in this use case. Their understanding could have helped to establish a more detailed model of transfer, for example by describing relationships between the datasets. However, the above table provides the size and count properties that are significant for the design of the transfer model. For example, the total size of the ENO_STARWIND_SAMPLEC ② exceeds 100 Gb and shows that it is probably not a good idea to define CoRoT datasets as the smallest unit for the transfer model. A modeling down to the file level would allow the transfer of packets of more reasonable sizes.

At the file level, the table shows that the maximum size of the individual files is 1.3 Gb for the ANO_IMAGEETTE ① which is the smallest maximum Transfer Object size that the model can impose for this dataset since the PAIS does not allow a file to span over multiple Transfer Objects or SIPs. So the maximum file size is an interesting property used to define the transfer. If this value is not reasonable, it would have been necessary to consider a change, for example by slicing some of the big files into chunks of acceptable sizes.

The following **Figure 6-2** shows a partial view of the physical layout of the CoRoT repository. Due to the large number of files, it is not possible to depict all of them, but the figure provides actual examples of folder and file names for CoRoT runs, datasets, or housekeeping series.

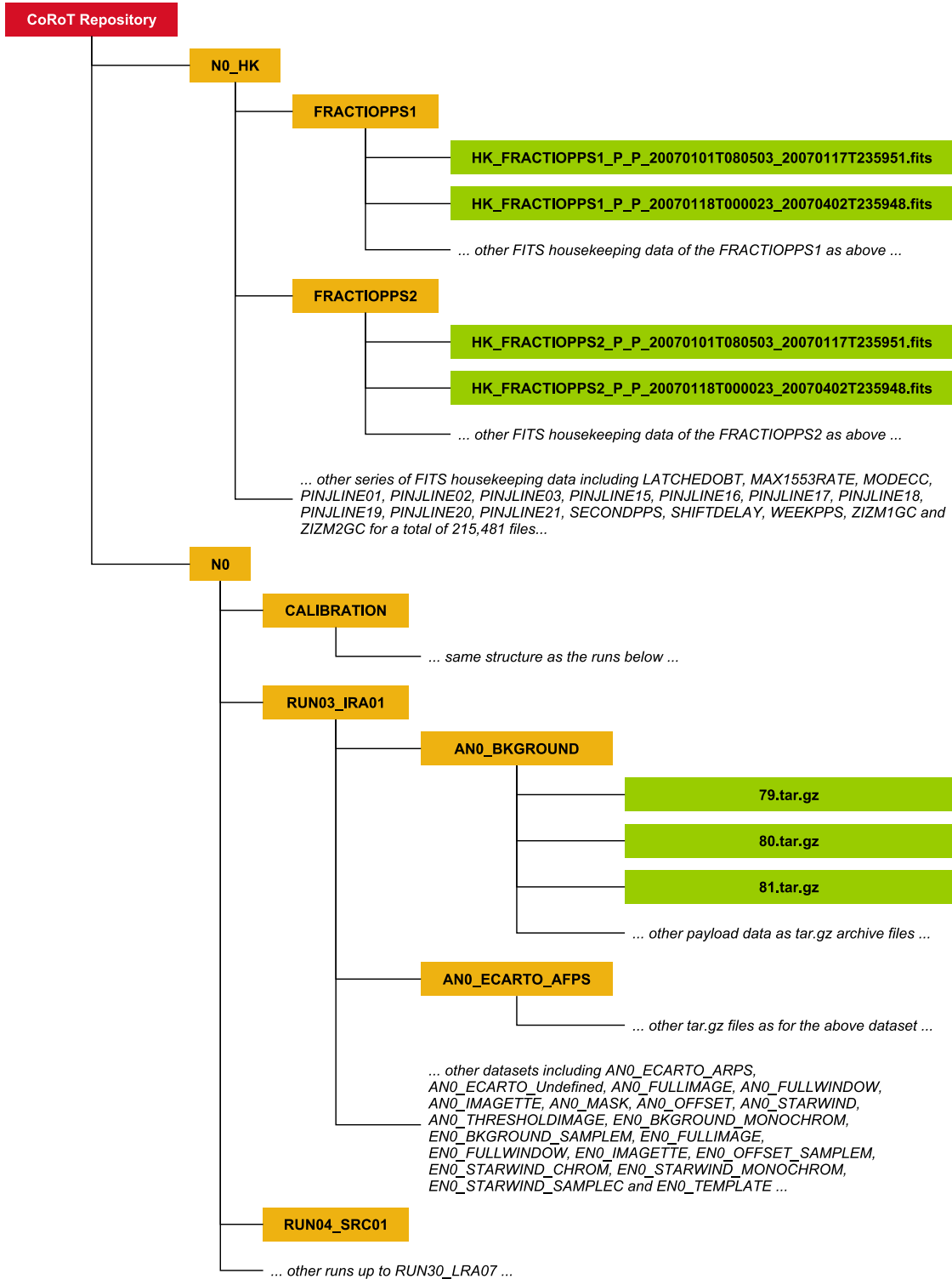


Figure 6-2: CoRoT Repository Physical Layout

6.4.3 MODEL OF OBJECTS FOR TRANSFER AND SIP CONSTRAINTS

The transfer of a full run as a single SIP is not practical because some may exceed 100Gb. The transfer model built splits the runs into subparts of less than 4 Gb, but with the assurance that each transferred SIP deals with only one run and only one type of dataset e.g. RUN01 and AN0_BACKGROUND. However, a single run may require multiple SIPs to be fully transferred, depending of the total size of the dataset.

6.4.3.1 MOT

The XML descriptors are provided in annex **XX**.

The Model of Objects for Transfer, which is a hierarchical tree, can be summarized as follows:

- One root collection “CoRoT-N0”.
- A first Transfer Object Type “COROT-N0-RUN-PRODUCT-SET” represents the payload stream of CoRoT N0 products. There can be an unlimited number of objects of this type in the transfer project but each has a limited size of 4 Gb. It is made up of:
 - A “COROT-N0-Run” Group Type. This Group Type assures that a “COROT-N0-RUN-PRODUCT-SET” object contains data dealing with one and only one RUN.
 - A “COROT-N0-Product-Type” Group Type. This Group Type assures that a “COROT-N0-RUN-PRODUCT-SET” object contains data of the same set e.g. AN0_BACKGROUND.

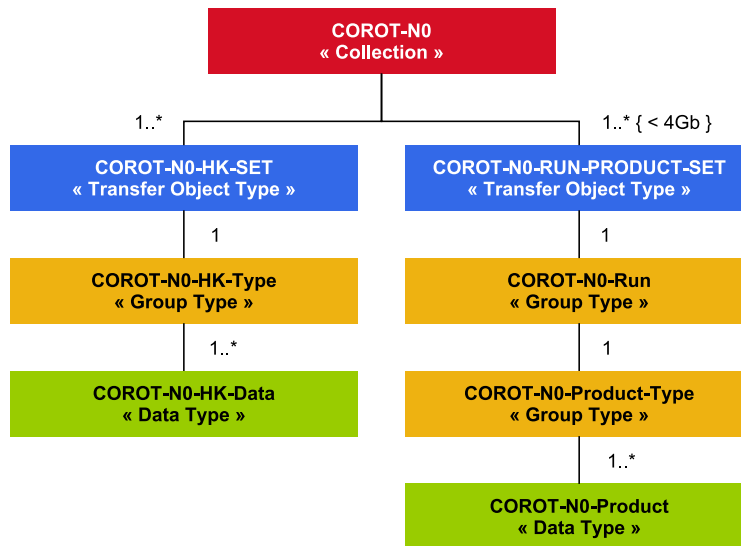


Figure 6-3: CoRoT Model of Objects For Transfer

- A second Transfer Object Type “COROT-N0-HK-SET” represents the payload stream of CoRoT HK auxiliary data. There can be an unlimited number of objects of this type in the transfer project with no constraint on size. It contains;

- A “COROT-N0-HK-Type” Group Type. This Group Type assures that a “COROT-N0-HK-SET” object contains data dealing with one and only one series e.g. FRACTIOPPS1.

Figure 6-4 below is a snapshot of the MOT viewed through the CNES prototype. It shows the Collections and the Transfer Objects levels as described in this section.

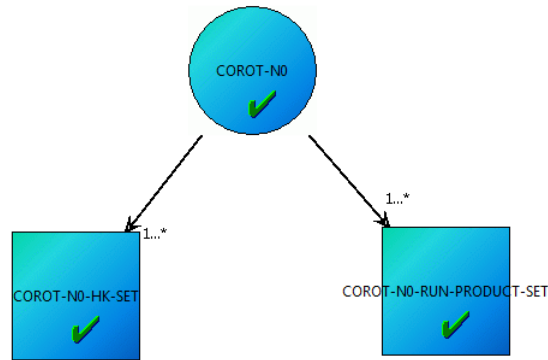


Figure 6-4: CoRoT Model of Objects For Transfer

6.4.3.2 SIP Constraints

The SIP Constraints XML document is provided in [Annex D4](#).

This test case defines two SIP Content Types, one for each of the categories of data:

- **SIP-COROT-N0-PRODUCT-SET**: authorizing only one COROT-N0-RUN-PRODUCT-SET Transfer Object per SIP of this type. It corresponds to one homogeneous set of dataset of the same type accumulated up to a maximum of 4 Gb;
- **SIP-COROT-N0-HK-SET**: authorizing only one COROT-N0-HK-SET Transfer Object per SIP of this type. It corresponds to one homogeneous set of FITS files accumulated without limit of count or size.

This test case also defines a sequence order imposing the housekeeping data to be transferred first or at least before any N0 product.

Currently SIP Constraints are created manually via an XML editing tool or a text editing tool.

6.4.4 SIPS

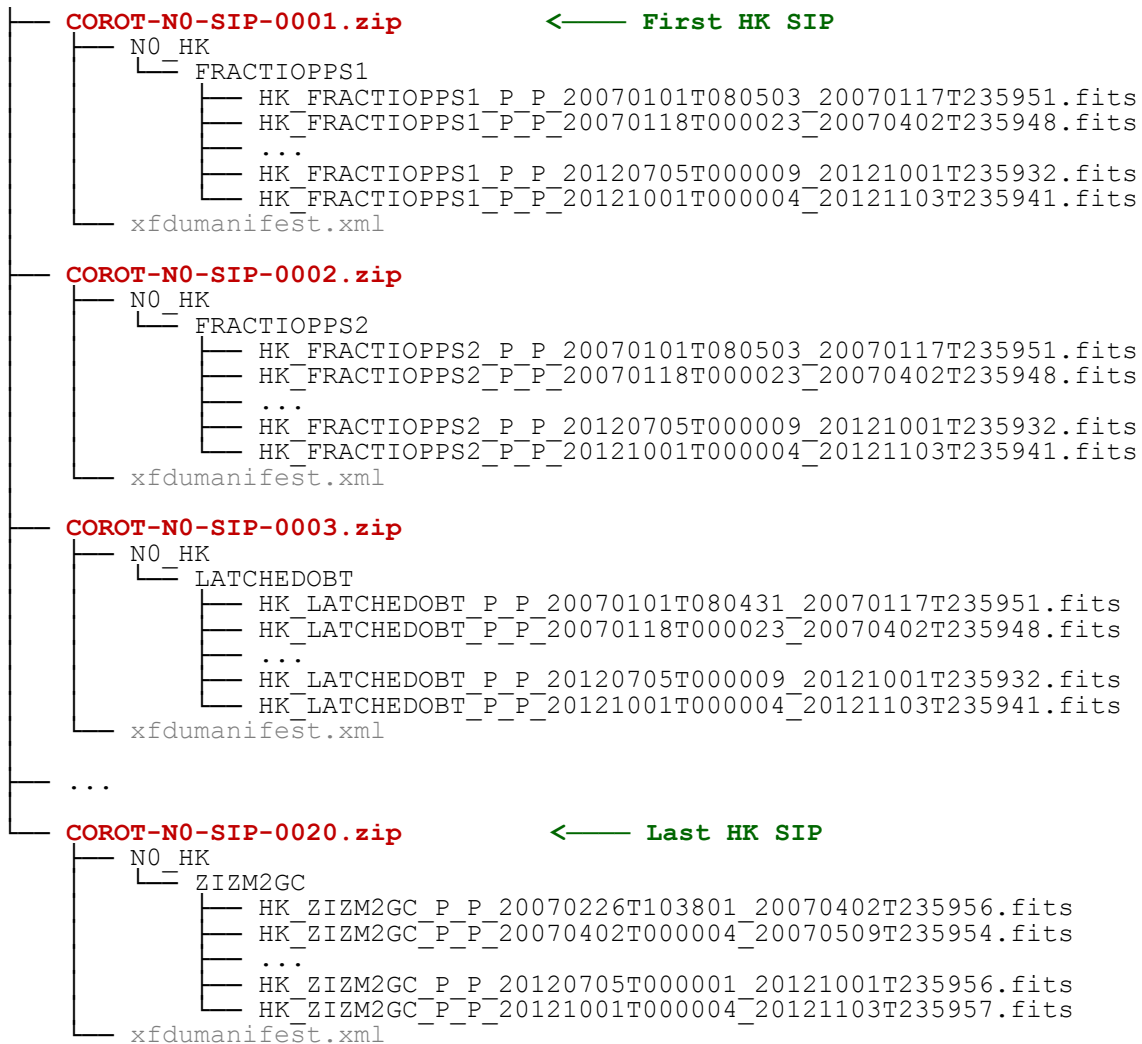
6.4.4.1 SIPs Generation

In this case, the SIPs are generated from the CoRot repository via the SIP Builder software, see section [7.2](#), with a configuration file provided in Annex [XX](#). The generated SIPs are 'XFDDU PAIS SIP Conformant' as defined in the PAIS BB.

173 SIPs have been generated with the first 20 SIPs conveying Housekeeping auxiliary data followed by 153 packages of N0 products. More SIPs should have been generated from the CoRoT repository but for the demonstration the process has been voluntarily limited to the first nine runs i.e. RUN01 to RUN09.

6.4.4.2 SIPs Contents

The first series of SIPs are, as expected, of SIP-COROT-N0-HK type illustrated by the abstract tree below:



The following tables show snippets of the Manifest `xfdumanifest.xml` file of the first SIP containing the first housekeeping series. The extracts are focused on the PAIS extension elements and are generally stripped of XFDU elements. These latter are reported only when they bring value to the example and are explicitly prefixed by `xfdu` to avoid confusion, although that may not be the case in the actual manifest file. The complete Manifest document is provided in section **E1 of Annex E**.

Table 6-2: SIP-COROT-N0-HK SIP Manifest – Header

Element	Content
sipGlobalInformation ①	
sipID	COROT-N0-SIP-0001
producerSourceID	CNES
producerArchiveProjectID	COROT-N0
sipContentTypeID	SIP-COROT-N0-HK
sipSequenceNumber	1

The Header contains general information associated to the whole package: identifier of SIP (created during SIP construction , unicity to be checked among the Producer-Archive Project), type of SIP (checked against the SIP constraints where it has been defined). The Producer Source ID and the Producer-Archive Project ID make links with the MOT where they have been defined (the Producer-Archive Project ID is the ID of the root node in the MOT).

Table 6-3: SIP-COROT-N0-HK SIP Manifest – Information Package Map

sipTransferObject ②	
descriptorID	COROT-N0-HK
transferObjectID	COROT-N0-HK-0001
lastTransferObjectFlag	FALSE
sipTransferObjectGroup ③	
associatedDescriptorGroupTypeID	COROT-N0-HK-GROUP
transferObjectGroupInstanceName	FRACTIOPPS1
sipDataObject	
associatedDescriptorDataID	COROT-N0-HK-DATA
xfdu:dataObjectPointer	
④ @dataObjectID	DO-COROT-N0-HK-DATA-0001
////////////////////////////////////	
sipDataObject	
associatedDescriptorDataID	COROT-N0-HK-DATA
xfdu:dataObjectPointer	
@dataObjectID	DO-COROT-N0-HK-DATA-0029
////////////////////////////////////	

The Information Package Map describes the hierarchical content of the package by making links with the MOT through the Descriptor, Descriptor Group Types, Descriptor Data IDs. These IDs are checked against the MOT for conformity with the expected Data Objects. The Transfer Object ID is inserted during SIP building, and identifies the Transfer Object. This ID should be kept in a log, for potential update or deletion (this is the lowest delivery granule). Transfer

Object Group Instance Name is the instantiated name of the Transfer Object Group Type Structure specified in the MOT (without path information).

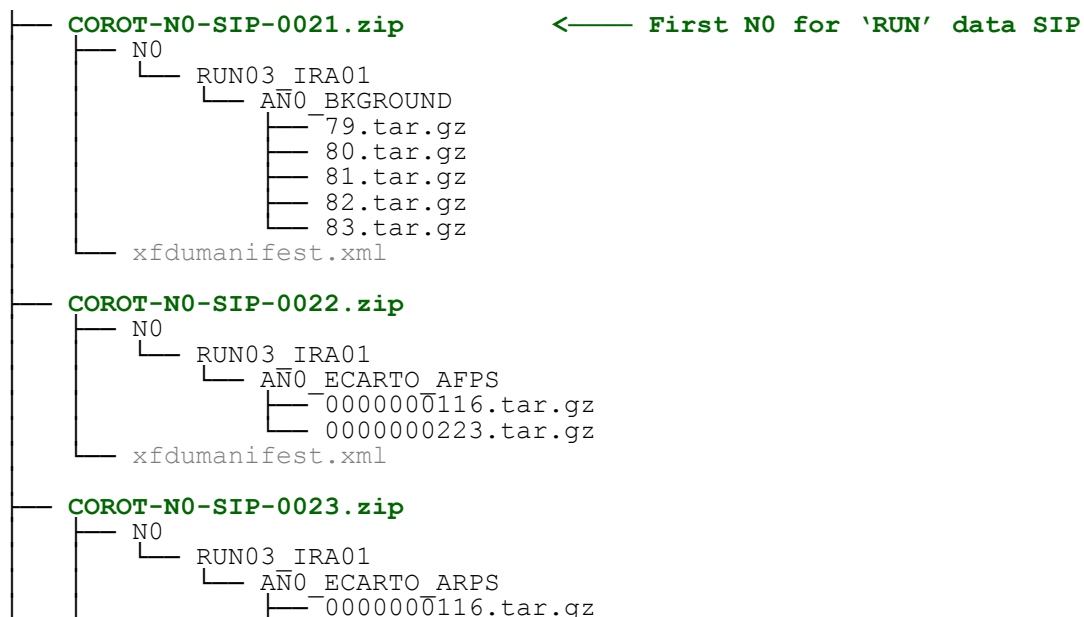
The Information Package Map also points towards the physical Data Objects in the Data Object section through the Data Object Pointers.

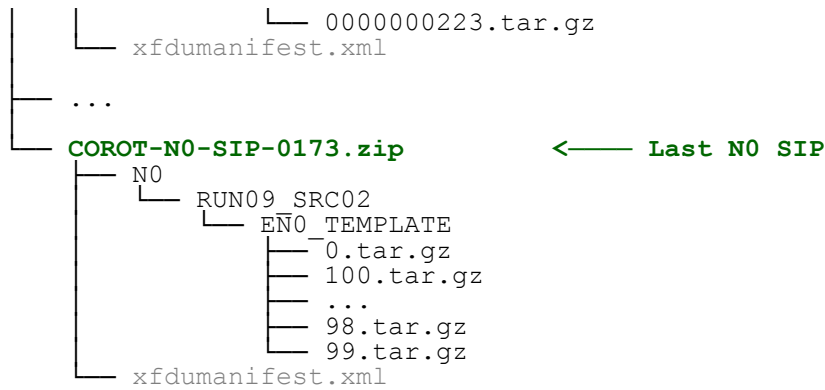
Table 6-4: SIP-COROT-N0-HK SIP Manifest – Data Object Section

xfdu:dataObject	
@ID	DO-COROT-N0-HK-DATA-0001
byteStream	
fileLocation	
@locatorType	URL
@href	N0_HK/FRACTIOPPS1/HK_FRACTIOPPS1_P_P_20070101T080503_20070117T235951.fits
Checksum	d41d8cd98f00b204e9800998ecf8427e
@checksumName	MD5
////////////////////////////////////	
xfdu:dataObject	
@ID	DO-COROT-N0-HK-DATA-0029
byteStream	
fileLocation	
@locatorType	URL
@href	N0_HK/FRACTIOPPS1/HK_FRACTIOPPS1_P_P_20121001T000004_20121103T235941.fits
Checksum	d41d8cd98f00b204e9800998ecf8427e
@checksumName	MD5

The Data Object Section contains the physical location of the Data Objects as described in the Information Package Map. This is also the place to indicate checksums or file sizes.

The second series of SIPs are, as expected, of SIP-COROT-N0-RUN type illustrated by the abstract tree below:



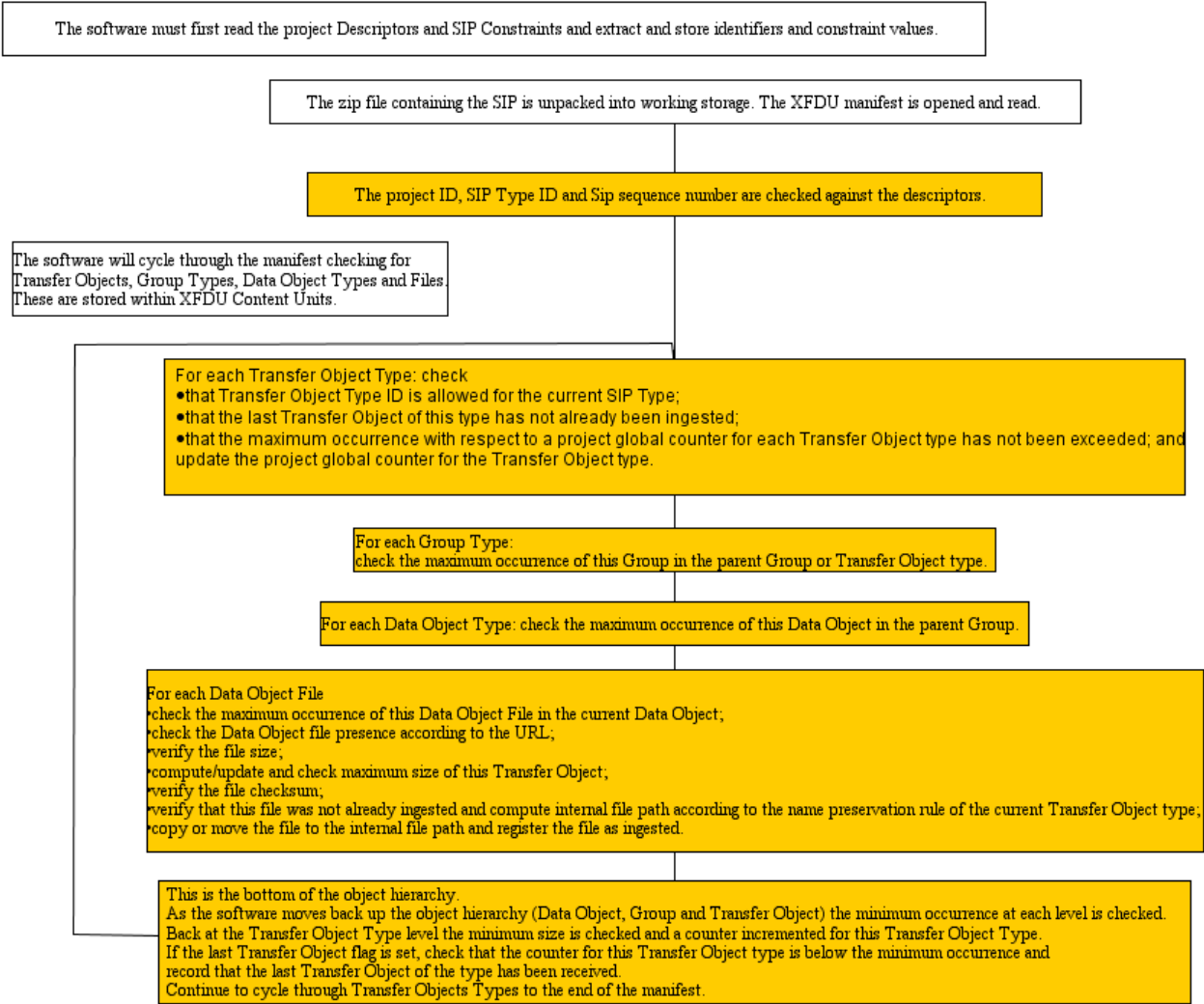


SIP-021 to SIP-0173 contains the scientific level 0 data. The tabulated snippets represent the 3 nested repositories containing the data grouped in the form of tar limited in size (as specified in the MOT).

6.4.4.3 SIPs Ingestion

In this case, the SIPs are submitted and ingested by the CNES Prototype, see section 7.2.

The CNES Prototype main validation and ingestion steps are:



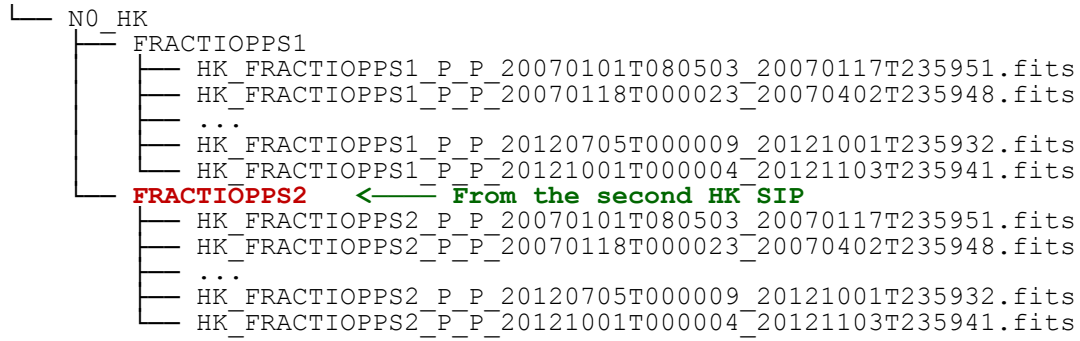
In this case the Archive internal repository is a reconstruction of the original CoRoT repository on the Producer side. The 3 examples below show the progressive construction of the repository on the Archive side after ingestion.

Example of Archive internal repository after ingestion of the first SIP of CoRoT Housekeeping data.

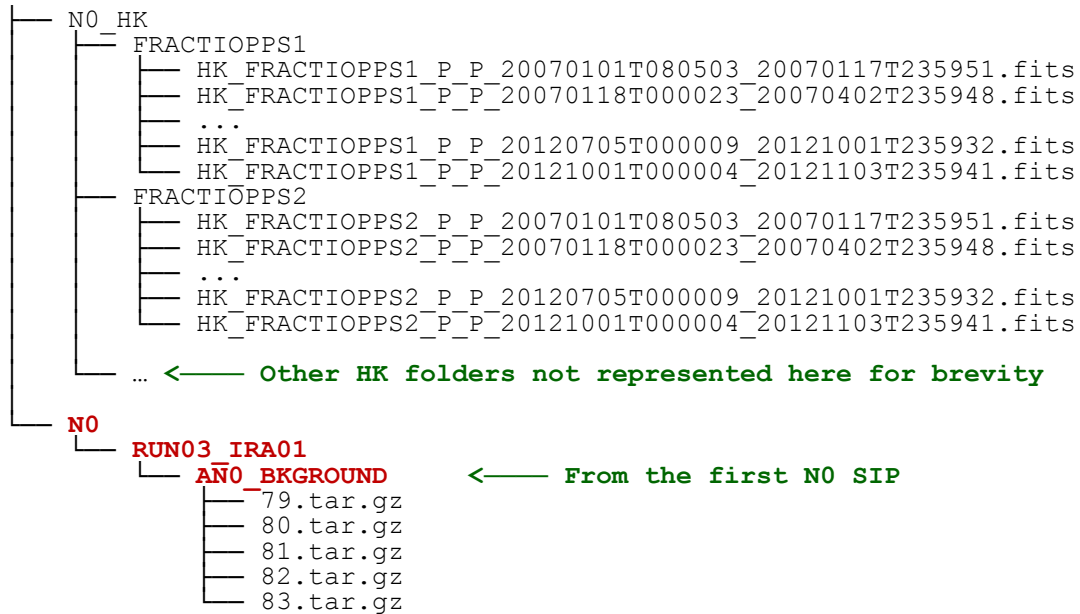
```

├── NO HK
│   └── FRACTIOPPS1 ← From the first HK SIP
│       ├── HK_FRACTIOPPS1_P_P_20070101T080503_20070117T235951.fits
│       ├── HK_FRACTIOPPS1_P_P_20070118T000023_20070402T235948.fits
│       ├── ...
│       ├── HK_FRACTIOPPS1_P_P_20120705T000009_20121001T235932.fits
│       └── HK_FRACTIOPPS1_P_P_20121001T000004_20121103T235941.fits
  
```

Example of Archive internal repository after ingestion of second SIP of CoRoT Housekeeping data.



Example of Archive internal repository after ingestion of first SIP of CoRoT Level 0 data.



ANNEX D

COROT USE CASE – DESCRIPTORS

This annex contains the PAIS XML descriptors of the CoRoT use case (see section 6.4.3).

D1 COROT N0 – COLLECTION DESCRIPTOR

```
<?xml version="1.0" encoding="UTF-8"?>
<collectionDescriptor xmlns="urn:ccsds:schema:pais:1">
  <identification>
    <descriptorModelID>CCSD0015</descriptorModelID>
    <descriptorModelVersion>1.0</descriptorModelVersion>
    <descriptorID>COROT-N0</descriptorID>
  </identification>
  <description>
    <collectionTitle>CoRoT N0 Collection</collectionTitle>
    <collectionDescription>
      Collection of CoRoT N0 data
    </collectionDescription>
  </description>
  <relation>
    <parentCollection>NONE</parentCollection>
  </relation>
</collectionDescriptor>
```

D2 COROT N0 PRODUCTS – TRANSFER OBJECT DESCRIPTOR

```
<?xml version="1.0" encoding="UTF-8"?>
<transferObjectTypeDescriptor xmlns="urn:ccsds:schema:pais:1">
  <identification>
    <descriptorModelID>CCSD0014</descriptorModelID>
    <descriptorModelVersion>V1.0</descriptorModelVersion>
    <descriptorID>COROT-N0-RUN </descriptorID>
    <producerSourceID>CNES</producerSourceID>
  </identification>
  <description>
    <transferObjectTypeTitle>
      CoRoT N0 RUN
    </transferObjectTypeTitle>
    <transferObjectTypeDescription>
      A set of CoRoT N0 Dataset of the same type and belonging
      to a single Run.
    </transferObjectTypeDescription>
  </description>
</transferObjectTypeDescriptor>
```

```

</transferObjectTypeDescription>
<transferObjectTypeOccurrence>
  <minOccurrence>1</minOccurrence>
  <maxUnknown/>
</transferObjectTypeOccurrence>
<transferObjectTypeSize>
  <maxSize>4</maxSize>
  <unitsType>GB</unitsType>
</transferObjectTypeSize>
</description>

<relation>
  <parentCollection>COROT-N0</parentCollection>
</relation>

<groupType>

  <groupTypeID>COROT-N0-RUN</groupTypeID>
  <groupTypeDescription>
    A group denoting a single Run.
  </groupTypeDescription>
  <groupTypeStructureName>directory</groupTypeStructureName>
  <groupTypeOccurrence>
    <minOccurrence>1</minOccurrence>
    <maxOccurrence>1</maxOccurrence>
  </groupTypeOccurrence>

  <groupType>

    <groupTypeID>COROT-N0-DATASET-GROUP</groupTypeID>
    <groupTypeDescription>
      A group of CoRoT N0 Dataset of the same type.
    </groupTypeDescription>
    <groupTypeStructureName>directory</groupTypeStructureName>
    <groupTypeOccurrence>
      <minOccurrence>1</minOccurrence>
      <maxOccurrence>1</maxOccurrence>
    </groupTypeOccurrence>

    <dataObjectType>
      <dataObjectTypeID>COROT-N0-DATASET</dataObjectTypeID>
      <dataObjectTypeDescription>
        A CoRoT N0 Dataset
      </dataObjectTypeDescription>
      <dataObjectTypeOccurrence>
        <minOccurrence>1</minOccurrence>
        <maxUnknown/>
      </dataObjectTypeOccurrence>
    </dataObjectType>

  </groupType>
</groupType>
</transferObjectTypeDescriptor>

```


D3 COROT HOUSKEEPING DATA (HK) – TRANSFER OBJECT DESCRIPTOR

```

<?xml version="1.0" encoding="UTF-8"?>
<transferObjectTypeDescriptor xmlns="urn:ccsds:schema:pais:1">
  <identification>
    <descriptorModelID>CCSD0014</descriptorModelID>
    <descriptorModelVersion>V1.0</descriptorModelVersion>
    <descriptorID>COROT-N0-HK </descriptorID>
    <producerSourceID>CNES</producerSourceID>
  </identification>
  <description>
    <transferObjectTypeTitle>CoRoT N0 - HK </transferObjectTypeTitle>
    <transferObjectTypeDescription>
      A set of CoRoT N0 Housekeeping data
    </transferObjectTypeDescription>
    <transferObjectTypeOccurrence>
      <minOccurrence>1</minOccurrence>
      <maxUnknown/>
    </transferObjectTypeOccurrence>
  </description>
  <relation>
    <parentCollection>COROT-N0</parentCollection>
  </relation>
  <groupType>
    <groupTypeID>COROT-N0-HK-GROUP</groupTypeID>
    <groupTypeDescription>
      A group type for CoRoT N0 Housekeeping data
    </groupTypeDescription>
    <groupTypeStructureName>directory</groupTypeStructureName>
    <groupTypeOccurrence>
      <minOccurrence>1</minOccurrence>
      <maxOccurrence>1</maxOccurrence>
    </groupTypeOccurrence>
    <dataObjectType>
      <dataObjectTypeID>COROT-N0-HK-DATA</dataObjectTypeID>
      <dataObjectTypeDescription>
        A CoRoT N0 housekeeping data
      </dataObjectTypeDescription>
      <dataObjectTypeOccurrence>
        <minOccurrence>1</minOccurrence>
        <maxUnknown/>
      </dataObjectTypeOccurrence>
    </dataObjectType>
  </groupType>
</transferObjectTypeDescriptor>

```

D4 COROT – SIP CONSTRAINTS

```

<?xml version="1.0" encoding="UTF-8"?>
<sipConstraints xmlns="urn:ccsds:schema:pais:1">
  <producerArchiveProjectID>COROT-N0</producerArchiveProjectID>
  <!-- SIPs of COROT N0 RUNs -->
  <sipContentType>
    <sipContentTypeID>SIP-COROT-N0-RUN</sipContentTypeID>
    <authorizedDescriptor>
      <descriptorID>COROT-N0-RUN </descriptorID>
      <occurrence>
        <minOccurrence>1</minOccurrence>
        <maxOccurrence>1</maxOccurrence>
      </occurrence>
    </authorizedDescriptor>
  </sipContentType>
  <!-- SIPs of COROT N0 housekeeping (HK) data -->
  <sipContentType>
    <sipContentTypeID>SIP-COROT-N0-HK </sipContentTypeID>
    <authorizedDescriptor>
      <descriptorID>COROT-N0-HK </descriptorID>
      <occurrence>
        <minOccurrence>1</minOccurrence>
        <maxOccurrence>1</maxOccurrence>
      </occurrence>
    </authorizedDescriptor>
  </sipContentType>
  <!-- Constraints: force HK before RUNs -->
  <sipSequencingConstraintGroup>
    <groupName>CoRoT N0</groupName>
    <constraintItem>
      <sipContentTypeID>SIP-COROT-N0-HK </sipContentTypeID>
      <constraintSerialNumber>1</constraintSerialNumber>
    </constraintItem>
    <constraintItem>
      <sipContentTypeID>SIP-COROT-N0-RUN</sipContentTypeID>
      <constraintSerialNumber>2</constraintSerialNumber>
    </constraintItem>
  </sipSequencingConstraintGroup>
</sipConstraints>

```

ANNEX E

COROT USE CASE – EXAMPLES OF XFDU MANIFESTS

This annex contains examples of SIP XFDU Manifests extracted from the CoRoT use case (see section 6.4.3).

E1 FIRST SIP OF HOUSEKEEPING SERIES

```
<?xml version="1.0" encoding="UTF-8"?>

<xfdu:XFDU xmlns:pais="urn:ccsds:schema:pais:1"
           xmlns:xfdu="urn:ccsds:schema:xfdu:1">

  <packageHeader ID="COROT-N0-SIP-0001">
    <volumeInfo>
      <specificationVersion>1.0</specificationVersion>
    </volumeInfo>
    <environmentInfo>
      <extension>
        <pais:sipGlobalInformation>
          <pais:sipID>COROT-N0-SIP-0001</pais:sipID>
          <pais:producerSourceID>CNES</pais:producerSourceID>
          <pais:producerArchiveProjectID>COROT-N0</pais:producerArchiveProjectID>
          <pais:sipContentTypeID>SIP-COROT-N0-HK</pais:sipContentTypeID>
          <pais:sipSequenceNumber>1</pais:sipSequenceNumber>
        </pais:sipGlobalInformation>
      </extension>
    </environmentInfo>
  </packageHeader>

  <informationPackageMap>

    <xfdu:contentUnit>
      <extension>
        <pais:sipTransferObject>
          <pais:descriptorID>COROT-N0-HK</pais:descriptorID>
          <pais:transferObjectID>COROT-N0-HK-0001</pais:transferObjectID>
          <pais:lastTransferObjectFlag>
            FALSE</pais:lastTransferObjectFlag>
        </pais:sipTransferObject>
      </extension>

    <xfdu:contentUnit>
      <extension>
        <pais:sipTransferObjectGroup>
          <pais:associatedDescriptorGroupTypeID>
            COROT-N0-HK-
            GROUP</pais:associatedDescriptorGroupTypeID>
          <pais:transferObjectGroupInstanceName>
            FRACTIOPPS1</pais:transferObjectGroupInstanceName>
```

```

    </pais:sipTransferObjectGroup>
  </extension>
  <xfdu:contentUnit>
    <extension>
      <pais:sipDataObject>
        <pais:associatedDescriptorDataID>␣
          COROT-N0-HK-DATA</pais:associatedDescriptorDataID>
        </pais:sipDataObject>
      </extension>
      <dataObjectPointer dataObjectID="DO-COROT-N0-HK-DATA-0001"/>
    </xfdu:contentUnit>

    <xfdu:contentUnit>
      <extension>
        <pais:sipDataObject>
          <pais:associatedDescriptorDataID>␣
            COROT-N0-HK-Data</pais:associatedDescriptorDataID>
          </pais:sipDataObject>
        </extension>
        <dataObjectPointer dataObjectID="DO-COROT-N0-HK-DATA-0029"/>
      </xfdu:contentUnit>

    </xfdu:contentUnit>
  </xfdu:contentUnit>
</informationPackageMap>

<dataObjectSection>

  <dataObject ID="DO-COROT-N0-HK-DATA-0001">
    <byteStream size="0">
      <fileLocation locatorType="URL"
        href="file:N0_HK/FRACTIOPPS1/␣
          HK_FRACTIOPPS1_P_P_20070101T080503_20070117T235951.fits"/>
      <checksum checksumName="MD5">␣
        d41d8cd98f00b204e9800998ecf8427e</checksum>
    </byteStream>
  </dataObject>

  <dataObject ID="DO-COROT-N0-HK-DATA-0029">
    <byteStream size="0">
      <fileLocation locatorType="URL"
        href="file:N0_HK/FRACTIOPPS1/␣
          HK_FRACTIOPPS1_P_P_20121001T000004_20121103T235941.fits"/>
      <checksum checksumName="MD5">␣
        d41d8cd98f00b204e9800998ecf8427e</checksum>
    </byteStream>
  </dataObject>

</dataObjectSection>

</xfdu:XFDU>

```

E2 FIRST SIP OF LEVEL 0 DATASETS

```

<?xml version="1.0" encoding="UTF-8"?>

<xfdu:XFDU xmlns:pais="urn:ccsds:schema:pais:1"
  xmlns:xfdu="urn:ccsds:schema:xfdu:1">

  <packageHeader ID="COROT-N0-SIP-0021">
    <volumeInfo>
      <specificationVersion>1.0</specificationVersion>
    </volumeInfo>
    <environmentInfo>
      <extension>
        <pais:sipGlobalInformation>
          <pais:sipID>COROT-N0-SIP-0021</pais:sipID>
          <pais:producerSourceID>CNES</pais:producerSourceID>
          <pais:producerArchiveProjectID>COROT-N0</pais:producerArchiveProjectID>
          <pais:sipContentTypeID>SIP-COROT-N0-RUN</pais:sipContentTypeID>
          <pais:sipSequenceNumber>21</pais:sipSequenceNumber>
        </pais:sipGlobalInformation>
      </extension>
    </environmentInfo>
  </packageHeader>

  <informationPackageMap>

    <xfdu:contentUnit>
      <extension>
        <pais:sipTransferObject>
          <pais:descriptorID>COROT-N0-RUN</pais:descriptorID>
          <pais:transferObjectID>COROT-N0-RUN-0001</pais:transferObjectID>
          <pais:lastTransferObjectFlag>FALSE</pais:lastTransferObjectFlag>
        </pais:sipTransferObject>
      </extension>

    <xfdu:contentUnit>
      <extension>
        <pais:sipTransferObjectGroup>
          <pais:associatedDescriptorGroupTypeID>COROT-N0-RUN</pais:associatedDescriptorGroupTypeID>
          <pais:transferObjectGroupInstanceName>RUN03_IRA01</pais:transferObjectGroupInstanceName>
        </pais:sipTransferObjectGroup>
      </extension>

    <xfdu:contentUnit>
      <extension>

```

```

    <pais:sipTransferObjectGroup>
      <pais:associatedDescriptorGroupTypeID>
        COROT-N0-DATASET-GROUP
      </pais:associatedDescriptorGroupTypeID>
      <pais:transferObjectGroupInstanceName>AN0_BKGROUND
      </pais:transferObjectGroupInstanceName>
    </pais:sipTransferObjectGroup>
  </extension>

<xfdu:contentUnit>
  <extension>
    <pais:sipDataObject>
      <pais:associatedDescriptorDataID>COROT-N0-DATASET
      </pais:associatedDescriptorDataID>
    </pais:sipDataObject>
  </extension>
  <dataObjectPointer
    dataObjectID="DO-COROT-N0-DATASET-0001"/>
</xfdu:contentUnit>

<xfdu:contentUnit>
  <extension>
    <pais:sipDataObject>
      <pais:associatedDescriptorDataID>COROT-N0-DATASET
      </pais:associatedDescriptorDataID>
    </pais:sipDataObject>
  </extension>
  <dataObjectPointer
    dataObjectID="DO-COROT-N0-DATASET-0002"/>
</xfdu:contentUnit>

<xfdu:contentUnit>
  <extension>
    <pais:sipDataObject>
      <pais:associatedDescriptorDataID>COROT-N0-DATASET
      </pais:associatedDescriptorDataID>
    </pais:sipDataObject>
  </extension>
  <dataObjectPointer
    dataObjectID="DO-COROT-N0-DATASET-0003"/>
</xfdu:contentUnit>

<xfdu:contentUnit>
  <extension>
    <pais:sipDataObject>
      <pais:associatedDescriptorDataID>COROT-N0-DATASET
      </pais:associatedDescriptorDataID>
    </pais:sipDataObject>
  </extension>
  <dataObjectPointer
    dataObjectID="DO-COROT-N0-DATASET-0004"/>
</xfdu:contentUnit>

<xfdu:contentUnit>
  <extension>
    <pais:sipDataObject>
      <pais:associatedDescriptorDataID>COROT-N0-DATASET

```

```

        </pais:associatedDescriptorDataID>
        </pais:sipDataObject>
    </extension>
    <dataObjectPointer
        dataObjectID="DO-COROT-N0-DATASET-0005"/>
    </xfdu:contentUnit>
</xfdu:contentUnit>
</xfdu:contentUnit>
</xfdu:contentUnit>
</informationPackageMap>

<dataObjectSection>

    <dataObject ID="DO-COROT-N0-DATASET-0001">
        <byteStream size="0">
            <fileLocation locatorType="URL"
                href="file:N0/RUN03_IRA01/AN0_BKGROUND/79.tar.gz"/>
            <checksum
                checksumName="MD5">d41d8cd98f00b204e9800998ecf8427e</checksum>
            </byteStream>
        </dataObject>

    <dataObject ID="DO-COROT-N0-DATASET-0002">
        <byteStream size="0">
            <fileLocation locatorType="URL"
                href="file:N0/RUN03_IRA01/AN0_BKGROUND/80.tar.gz"/>
            <checksum
                checksumName="MD5">d41d8cd98f00b204e9800998ecf8427e</checksum>
            </byteStream>
        </dataObject>

    <dataObject ID="DO-COROT-N0-DATASET-0003">
        <byteStream size="0">
            <fileLocation locatorType="URL"
                href="file:N0/RUN03_IRA01/AN0_BKGROUND/81.tar.gz"/>
            <checksum
                checksumName="MD5">d41d8cd98f00b204e9800998ecf8427e</checksum>
            </byteStream>
        </dataObject>

    <dataObject ID="DO-COROT-N0-DATASET-0004">
        <byteStream size="0">
            <fileLocation locatorType="URL"
                href="file:N0/RUN03_IRA01/AN0_BKGROUND/82.tar.gz"/>
            <checksum
                checksumName="MD5">d41d8cd98f00b204e9800998ecf8427e</checksum>
            </byteStream>
        </dataObject>

    <dataObject ID="DO-COROT-N0-DATASET-0005">
        <byteStream size="0">
            <fileLocation locatorType="URL"
                href="file:N0/RUN03_IRA01/AN0_BKGROUND/83.tar.gz"/>
            <checksum
                checksumName="MD5">d41d8cd98f00b204e9800998ecf8427e</checksum>
            </byteStream>
        </dataObject>

```

```
</dataObjectSection>  
</xfdu:XFDU>
```


ANNEX F

COROT USE CASE – SIP BUILDER CONFIGURATION FILE

This annex contains an example of SIP Builder software configuration file for the generation of XFDU PAIS Conformant SIPs as described in output of CoRoT use case (see section 6.4.4.1).

```
<?xml version="1.0" encoding="UTF-8"?>

<project xmlns="urn:fr:gael:schema:ccsds:pais:sip-builder:1">

  <descriptors>
    <descriptor file="corot-pais-transfer-object-run.xml"/>
    <descriptor file="corot-pais-transfer-object-hk.xml"/>
    <descriptor file="corot-pais-sip-constraints.xml" />
  </descriptors>

  <collectors baseDirectory="../../../../test-data/cnes-corot-tds-20140506">

    <!-- N0 Products -->
    <collector typeId="COROT-N0-RUN">
      <include>N0/RUN0.*</include>
    </collector>
    <collector typeId="COROT-N0-DATASET-GROUP">
      <include>(A|E)N0.*</include>
    </collector>
    <collector typeId="COROT-N0-DATASET">
      <include>.*tar.gz</include>
    </collector>

    <!-- N0 HK Data -->
    <collector typeId="COROT-N0-HK-GROUP">
      <include>N0_HK/.*</include>
    </collector>
    <collector typeId="COROT-N0-HK-DATA">
      <include>.*fits</include>
    </collector>

  </collectors>

</project>
```