HIRDLS

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Originator: Charles Cavanaugh

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Subject/Title: **The Requirements of the HIRDLS Level 2 Preprocessor**

Description/Summary/Contents:

The purpose of this document is to capture the requirements of the High Resolution Dynamics Limb Sounder (HIRDLS) Level 2 Preprocessing System, and correctly and comprehensively catalog those requirements in an unambiguous form.

The goal of this document is to detail those requirements at a level that allows system architectural analysis to create a blueprint for construction.

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Oxford University
Atmospheric, Oceanic &
Planetary Physics
Parks Road
OXFORD OXI 3PU
United Kingdom

University of Colorado, Boulder Center
for Limb Atmospheric Sounding
3450 Mitchell Lane, Bldg. FL-0
Boulder, CO 80301

EOS

The Requirements of the HIRDLS Level 2 Preprocessor

Charles Cavanaugh

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1 Document Purpose and Goal

The purpose of this document is to capture the requirements of the High Resolution Dynamics Limb Sounder (HIRDLS) Level 2 Preprocessing System, and correctly and comprehensively catalog those requirements in an unambiguous form. The goal of this document is to detail those requirements at a level that allows system architectural analysis to create a blueprint for construction.

2 Functionality of the System

The HIRDLS Level 2 (L2) Preprocessing System, hereby known as the L2 Preprocessor, is to ingest a HIRDLS L1 Hierarchical Data Format (HDF) file (known as a HIRDLS1C file), FFT filter and adjust the HIRDLS radiances in the file, spline the data to the HIRDLS altitude grid, and create a HIRDLS1R HDF file that contains the filtered, adjusted and splined data, as well as other ancillary data needed in subsequent processors. Those subsequent processors, when combined with the L2 Preprocessor and any preceding processor(s), form a Product Generation Executive (PGE) that creates the required HIRDLS standard data products. The L2 Preprocessor creates a standard data product known as the HIRDLS1R file, and the details of that file will be enumerated later in this document.

3 External Interfaces

The L2 Preprocessor is to interact with the EOSDIS Core System (ECS) Project Science Data Production (SDP) Toolkit to perform certain required tasks, including time conversion, process control file interaction, and metadata writing. The SDP Toolkit is a suite of functions, written in the C language, with C language primitives and Toolkit-specific data types as arguments in their contracts. The Toolkit is provided as a dynamic-link UNIX-specific library. For further information on the Toolkit, please see the ECS document 333-CD-004-001, Release B.0 SCF Toolkit Users Guide for the ECS Project.

The L2 Preprocessor is also to interact with the HIRDLS Science Investigator-Led Processing System (SIPS). The SIPS creates the environment for the L2 Preprocessor to run, invokes the L2 Preprocessor, and also post-processes the L2 Preprocessor output. The SIPS was created to be a mini-EDOS (EOS Data and Operations System), and because of that, certain conventions must be followed, including using a Process Control File (PCF) to envelope all processor systems run in SIPS, including the L2 Preprocessor. Other interactions with SIPS are negotiable with the SIPS team, including ancillary data ingestion by processors, post-processing status handling, and hardware requirements.

4 Constraints

Certain constraints (HDF file generation, interacting with a C-written library) have already been introduced, but beyond those, the only constraint is hardware-oriented, which are ever-changing, as CPUs get faster (and more plentiful) and memory gets cheaper, and therefore those constraints are to be negotiated with the SIPS team and the HIRDLS Project Manager.

5 Interaction

There need be no graphical interface to the L2 Preprocessor, nor does there need to be interaction during the execution of the L2 Preprocessor. The system is considered to be a stand-alone scientific application, capable of running in the environment and on the platform chosen via negotiation with the HIRDLS Program Manager.

6 Overview

Given the information in the preceding sections, a visual overview of the system is as follows in Figure 1. SIPS and SDP Toolkit have been introduced in Section 3, and any further discussion of these is beyond the scope of this document. The input HIRDLS1C File and the output HIRDLS1R File, while introduced in Section 2, will be discussed in further sections.

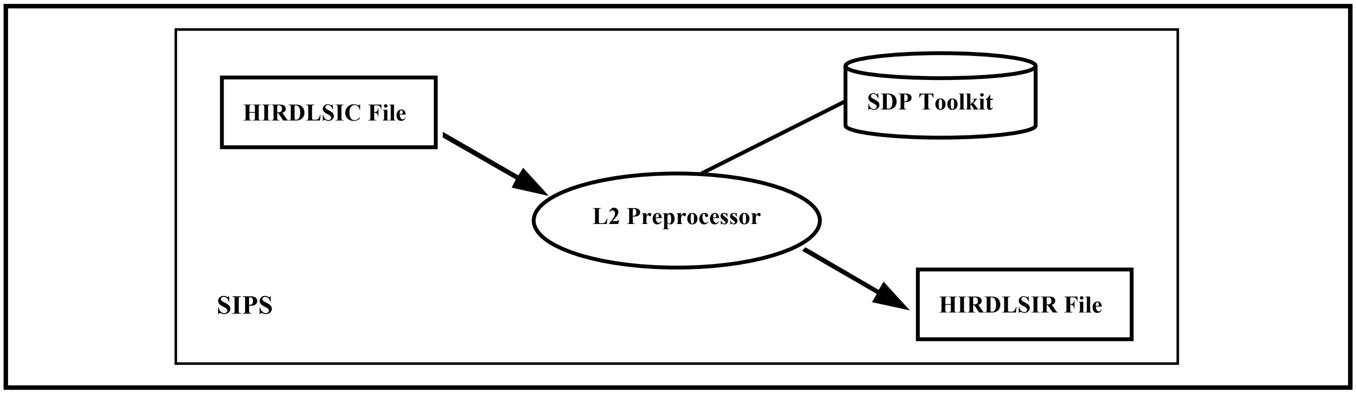

Figure 1 L2 Preprocessor Overview

7 Input

As first noted in Section 2, the L2 Preprocessor takes one HIRDLS1C file as input. The exact structure and contents of the HIRDLS1C file is referenced in the HIRDLS L1C Processor Requirements document, and detailed in the HIRDLS L1 Processor Requirements document.

Also input to the L2 Preprocessor is various files that contain information to: 1) configure the FFT filter; 2) characterize the channel vertical response functions; and 3) describe the metadata content necessary for delivery to EDOS. These files are considered part of the L2 Preprocessor, and are to be included in its deliveries. The format and content of these files is negotiable with the HIRDLS science team (in the case of 1 and 2), and with the HIRDLS Program Manager and EDOS Liaison (in the case of 3). As the L2 Preprocessor progresses through development, this list of system input files could grow or shrink.

8 Output

As first noted in Section 2, the L2 Preprocessor generates one HIRDLS1R file as output. This file's content and structure are enumerated in Table 1. The format of the file is to be HDF & HDF-EOS (Earth Observing System). The data in the file ancillary to the HIRDLS data (and required by EDOS) is to be determined by HIRDLS' EDOS Data System Working Group representative. The extent of the data in the HIRDLS1R file is to span not more than one day's worth of HIRDLS data.

9 Algorithms

The form of the output HIRDLS1R file is different than that of the input HIRDLS1C file, and therefore much of the data from the input file will undergo at least one transformation as it passes through the system. Also, some input data will be combined to derive new output data. Any enumeration of these algorithms is beyond the scope of this document, but will be introduced in the HIRDLS L2 Preprocessor Architecture document.

Field Name	***Rate***	***Form***	***Mbytes***	***Units***	***Description***
Azimuth	#Scans x #Altitudes	F 32	2.904	Degrees	Line-of-sight azimuth angle
ChannelList	#Channels	I 32	.000	n/a	Listing of channel numbers
CloudContamination	#Scans x #Channels x #Altitudes	I 8	15.246		*< placeholder for L2CLD >*
CloudTopAltitude	#Scans	F 32	.024		*< placeholder for L2CLD >*
CloudTopLatitude	#Scans	F 32	.024		*< placeholder for L2CLD >*
CloudTopLongitude	#Scans	F 32	.024		*< placeholder for L2CLD >*
ColdFilterTemperature	#Scans	F 32	.024	K	Cold filter temperature assigned to scan
Elevation	#Scans x #Altitudes	F 32	2.904	Degrees	Line-of-sight elevation angle
IFCBBTemperature	#Scans	F 32	.024	K	Temperature of the IFC Blackbody
JitterError	#Scans x #Channels x #Altitudes	F 32	60.984		
Latitude	#Scans	F 32	.024	Degrees N	Latitude assigned to scan
LocalSolarTime	#Scans	F 32	.024	Hours	Local solar time assigned to scan
Longitude	#Scans	F 32	.024	Degrees E	Longitude assigned to scan
LOSUnitVector	#Scans x #Altitudes x #LOS	F 64	11.616		Normalized line-of-sight unit vectors
OrbitAscendingFlag	#Scans	I 8	.006	n/a	Node flag. 0-descending; 1-ascending
OrbitNumber	#Scans	I 32	.024	n/a	Aura orbit number assigned to scan
ProfileID	#Scans	I 32	.024	n/a	Scan number
PsiTopOfTheAtmosphere	#Scans x #Altitudes	F 64	5.808		Angular coordinate of TOA intersection
Radiance	#Scans x #Channels x #Altitudes	F 32	60.984	$W/m^2/sr$	Scan radiances
RadianceError	#Scans x #Channels x #Altitudes	F 32	60.984	$W/m^2/sr$	Error in scan radiances
RadiusOfCurvature	#Scans	F 64	.048	Kilometers	Radius of curvature assigned to scan
RTopOfTheAtmosphere	#Scans	F 64	.048	Kilometers	Polar coordinate of TOA intersection, assigned to scan
ScanAzimuthAtNominalAltitude	#Scans	F 32	.024	Degrees	Line-of-sight azimuth assigned to scan
ScanElevationAtNominalAltitude	#Scans	F 32	.024	Degrees	Line-of-sight elevation assigned to scan
Scan Table	#Scans	I 16	.012	n/a	Scan table assigned to scan
ScanUpFlag	#Scans	I 8	.006	n/a	Scanning up flag. 0-no; 1-yes
ScienceScanMode	#Scans	I 32	.024	n/a	Scan mode assigned to scan
ShaftElevation	#Scans x #Channels x #Altitudes	F 32	60.984	Degrees	Hardware (shaft) elevation angle
SmoothedTangentHeightAtNominalAltitude	#Scans	F 32	.024	Kilometers	Tangent height assigned to scan, smoothed
SolarZenithAngle	#Scans	F32	.024	Degrees	Solar zenith angle assigned to scan
SpacecraftAltitude	#Scans	F 32	.024	Meters	Spacecraft altitude assigned to scan
SpacecraftDayFlag	#Scans	I 32	.024	n/a	Aura in Earth's shadow flag. 0-no; 1-yes

Table 1 HIRDLS1R File Structure and Contents

Field Name	*Rate*	*Form*	*Mbytes*	*Units*	*Description*
SpacecraftLatitude	#Scans	F 32	.024	Degrees N	Spacecraft latitude assigned to scan
SpacecraftLongitude	#Scans	F 32	.024	Degrees E	Spacecraft longitude assigned to scan
TangentHeight	#Altitudes	F 32	.000	Kilometers	Altitude at each altitude point
TangentHeightAtNominal Altitude	#Scans	F 32	.024	Kilometers	Tangent height assigned to scan
Time	#Scans	F 64	.048	Seconds	TAI time assigned to scan
ViewDirectionAtNominal Altitude	#Scans	F 32	.024	Degrees	Boresight bearing assigned to scan
WarmFilterTemperature	#Scans	F 32	.024	K	Warm filter temperature assigned to scan
XTopOfTheAtmosphere	#Scans x #Altitudes	F 64	5.808	Kilometers	X Cartesian coordinate of TOA intersection
YTopOfTheAtmosphere	#Scans x #Altitudes	F 64	5.808	Kilometers	Y Cartesian coordinate of TOA intersection
ZenTopOfTheAtmosphere	#Scans x #Altitudes	F 64	5.808		

Table 1 HIRDLS1R File Structure and Contents (cont.)

Notes on Table 1:

The Rate field describes the data rate of the field. #Scans means one data point for each scan; #Altitudes means one data point for each altitude (which is nominally 1 – 120 Kilometers, at 1 Km delta); #Channels means one data point per channel (nominally 21, since there are 21 channels).

The Form field describes the IEEE format of the data. “F” means floating point, and “I” means integer (or fixed point). The number after either of these letters is the bit width.