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1. Introduction

1.1 Purpose

This document defines the data files, data formats and data specifications of DESIS data products delivered to the user. The purpose of the document is to specify in detail the information about all data delivered to an user. This document is an excerpt from the DLR Ground Segment internal Products Specification Document PAV-DLR-ICD-002.

1.2 Scope

This document covers in detail the content, format and naming of the DESIS data products which are delivered to the scientific user via the DIMS system. These are

- L1B at-sensor-radiance product
- L1C orthorectified (geo-located) L1B product
- L2A bottom-of-atmosphere reflectance L1C product

This document contains 6 sections:

- Chapters 1-3. These are the usual ECSS prompted introductory chapters.
- Chapter 4: DESIS Data Products. This chapter covers in the contents, data formats and naming conventions used for all DESIS data products in the GS.
- Chapter 5: Reference Information for L1B, L1C, L2A Metadata. This Chapter details all metadata cards acompanying the L1B, L1C and L2A data products which are delivered to the user. Examples and Explanations are given
- Chapter 6: Reference information for L1B, L1C, L2A Product History. This Chapter details all metadata cards acompanying all DESIS data products (L1B, L1C, L2A).

2. References

2.1 Applicable Documents

The following documents contain provisions which, through reference in the document on hand, become applicable to the extent specified herein.

Applicability ID and Document Title	Document ID	Issue or Date
[AD01] Glossary and Abbreviations	PAV-DLR-TN-005	1.0
[AD02] ATBD L1A, L1B, L1C, L2A Processors	PAV-DLR-TN-004	1.2

2.2 Reference Documents

Standards listed below have been used (in the sense of tailoring) to prepare the document on hand. Documents which are recognized best practices are listed for the purpose of information.

Reference ID and Document Title	Document ID	Issue or Date

Table 2-1 Reference Documents

3. Terms and Abbreviations

Terms, definitions, and abbreviations for the DESIS-PAV ground segment are collected in [AD01].

4. DESIS Data Products

This section introduces the data products generated by the DESIS-PAV Ground Segment (GS).

User products are DESIS data products that are delivered to the user (on user request). These products are the L1B processed data, the L1C processed data and the L2A processed data.

The following subsections describe the different aspects of the DESIS data products. Section 4.1 introduces the DESIS product files and their components. Section 4.2 describes the filename convention and directory structure of the DESIS product files.

4.1 Data product files

We distinguish two type of data products. The internal L1A products stored in DIMS and not distributed to DESIS users and the user L1B/L1C/L2A products generated and delivered to DESIS users according to their request.

4.1.1 DESIS user L1B/L1C/L2A product files

A user L1B/L1C/L2A data product is a data product processed by the corresponding processor(s) that, under request, is delivered to the user. Any L1B, L1C or L2A Product file consists of the components shown in Figure 4-1. The Product file is generated from the L1A Earth Internal product (case of L1B product) or the previous user product (L1B or L1C) in the DESIS processing chain. The requested data product is delivered to the user as a single zip file. The zip file contains the product components in the form of individual files accessible by the user after unzipping the product file. For each tile within an Earth datatake a L1B, L1C or L2A product file is generated at the processing level requested by the user.

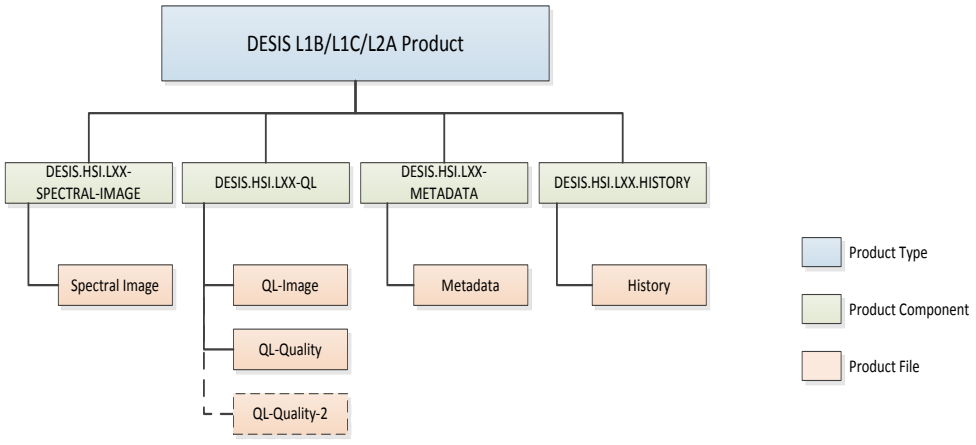

Figure 4-1 L1B, L1C, L2A Product file components. In the figure LXX stands for one of the processing levels L1B, L1C and L2A. The product file shown with a dashed line is only available for L1B data products.

The list of files associated to each product component of the L1B, L1C, and L2A Earth Product is shown in Table 4-1. In addition to the files depicted in Table 4-1 List of files part of an L1B, L1C or L2A Data Product. In the table LXX stands for one of the processing levels L1B, L1C and L2A. The green shaded

row denotes a file delivered only in L2A data products, internal log files are also generated by each processor executed. The log files are not delivered to the user.

Name	Description	File Name	File Format	File Size
DESIS.HSI.LXX-SPECTRAL-IMAGE	Measurement data from Earth datatake	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100-SPECTRAL_IMAGE.geotiff	Geotiff	500 MBytes
DESIS.HSI.LXX-QL	Image Quicklook	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100- QL_IMAGE.geotiff	Geotiff	6 MBytes
	Data Quality Quicklook	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100- QL_QUALITY.geotif	Geotiff	Variable (see 4.2.4)
	Data Quality Quicklook-2	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100- QL_QUALITY-2.geotif	Geotiff	Variable (see 4.2.4)
DESIS.HSI.LXX-METADATA	Metadata provided by the processors executed	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100-METADATA.xml	XML	< 1MByte
DESIS.HSI.LXX-HISTORY	History file for all processors executed	DESIS-HSI-LXX -DTnnnnnnnnnn_nnn-<Date> T<Time>-V0100-HISTORY.xml	XML	<1 MByte

Table 4-1 List of files part of an L1B, L1C or L2A Data Product. In the table LXX stands for one of the processing levels L1B, L1C and L2A. The green shaded row denotes a file delivered only in L2A data products

4.2 Filename and Directory Structure

This section describes the names and directory structure of the files introduced in the previous section. The naming convention for all internal and user files are the following:

DESIS-HSI-<Product_type>-DT<Datatake_ID>_<Tile_ID>-<yyyymmdd>T<hhmmss>-<Version>-<File_identifier>.<Extension>

The meaning of the different items in the file name convention can be found in Table 4-2.

Field	Description
Product_type	One of the possible products delivered to the user (L1B, L1C, L2A)
Datatake_ID	Unique number generated by the DESIS instrument when the data are taken (10 digits)
Tile_ID	A 3 digit number (starting at 001) corresponding to the sequential tiles resulting from the tiling process of the L1A processor on the original datatake raw file (Earth datatakes
yyyymmdd	Date when the datatake was started as provided by the DESIS instrument. The format uses 4 digits for the year, 2 digits for the month and 2 digits for the day of the month
hhmmss	Time when the datatake was started according to the timezone used by the DESIS instrument. The format is 2 digits for the hour (24 hours format), 2 digits for the minutes and 2 digits for the seconds
Version	Four digit number specifying the global version of the processing chain used for the generated product (first two digits correspond to the major version number and the last two numbers the minor version number)
File_identifier	Field that identifies the type of file within a given data product. The file identifier can take the values: "SPECTRAL_IMAGE",, "QL_IMAGE", "QL_QUALITY", "QL_QUALITY-2", "METADATA", "HISTORY"
Extension	File extension associated to each product component file. The allowed values are: "bil", "tgz", "bin", "geotiff", "xml" and "txt"

Table 4-2 Description of the different fields in the name of a data product and associated files

4.2.1 DESIS User L1B, L1C, L2A product directories and filenames

For user products all product files are delivered as a single zip file, for example:

DESIS-HSI-L1B-DT010357991_003-20171013T035442-V0100.zip

After unzipping the file, all products file components are uncompressed under a directory with same name as the original zip file (without the filename extension). The contents of the directory are the file components of the user product listed in Table 4-3.

L1B/L1C/L2A User Product	User delivery
DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100	
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-SPECTRAL_IMAGE.geotiff	Yes
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-QL_IMAGE.geotiff	Yes
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-QL_QUALITY.geotiff	Yes
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-QL_QUALITY-2.geotiff	Yes (only L2A)
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-METADATA.xml	Yes
├DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-HISTORY.xml	Yes

Table 4-3 Directory name and filenames of L1B/L1C/L2A Earth Product component files (LXX denotes one of these 3 possibilities). The file in the in the green shaded row is delivered only for L2A data products.

In addition to the files listed in the previous table, the user's product zip file may contain additional files with support information and documentation or a copyright notice.

4.2.2 User Product L1B, L1C, L2A Image

The product Image file is a binary file in geotiff format. The data from each spectral channel are stored in 16 bit unsigned integer format using one image layer per band. The image size is 1024×1024 pixels for L1B data products. After L1C processor the image is geolocated and the size is different from the original 1024×1024 pixel size. The number of channels in the image corresponds to the number of bands in the original DESIS data. L2A processor image product has the BOA reflectances with the same size, projection and number of bands as L1C.

4.2.3 Product L1B, L1C, L2A Quicklook-image

The quicklook image file is a geotiff file with the same size as the data image and three 8-bit channels. Values from the original image are transformed to 8-bit pixel values and radiometrically adjusted for optimal display. For the quicklook generation the following channels will be used: 500nm (blue), 650 nm (red), and 850nm (infrared).

The quicklook image in L1B data products is generated by the L1A processor. The quicklook image of L1C and L2A products is generated by the L1C processor or the L2A processor using the georeferenced main image data.

4.2.4 Product L1B, L1C, L2A Quality-quicklook

Quality layers are generated during each processing task and added to the quality-quicklook file in order to complement the output image with pixel-level quality information of the output product. The Quicklook-quality information is delivered in one or more geotiff image files with different number of layers. The number of layers, format and description of the content changes for each processing stage.

L1B Data Product:

After the execution of the L1B processor, a quality quicklook file is generated, which is an image in geotiff format that defines the location of the degraded quality pixels.

The quality file ("QL_QUALITY") contains N_{bands} 8 bit layers with a size of 1024×1024 pixels. The value 1024 comes from the number of spatial pixels and the number of lines (frames) included in the image tile. The value N_{bands} corresponds to the number of bands used in the datatake and it is 235 when no binning is used to acquire the data. Each layer of the QL_QUALITY file corresponds to one of the acquisition bands and contains information about the quality of the image pixels in that band encoded as a 8-bit mask. All the pixels flagged with any of the monitored quality indicators, see [AD02], will be set to 1. Quality analysis is performed right after radiometric correction. Therefore, in order to ensure the fidelity of the quality cube to the final L1B spectral image, it is necessary that Smile and Rolling shutter corrections are applied on it. The performed pixel interpolations might extend the effect of the flagged pixels, in which case, surrounding pixels might be also flagged. The association from pixel problems to mask bits is given inTable 4-4. Not used bits will provide the opportunity to implement in the future more complex degraded quality pixel definition policies.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Not Used	Unreliable Calinration	Manufaturing defects	No data	Low Radiance	High Radiance	Suspicious	Dead

Table 4-4 Description of the bits in the bit mask used in quicklook file "QL_QUALITY" of L1B

Table 4-4 shows how to interpret the values contained in the quality file “QL_QUALITY”.

Layer	Value definition	Remark
Layer-1 (8 bits)	Pixel quality mask, the value of a pixel in position "i-j" in layer "1" indicates: − 0 : Pixel in line "i", row "j" in band "1" of the image tile is marked as good − 1 : Pixel in line "i", row "j" in band "1" of the image tile has degraded quality	Only the first bit is used.
…	…	…
Layer-N_{bands} (8 bits)	Pixel quality mask, the value of a pixel in position "i-j" in layer "N_{bands}" indicates: − 0 : Pixel in line "i", row "j" in band "N_{bands}" of the image tile is marked as good − 1 : Pixel in line "i", row "j" in band "N_{bands}" of the image tile has degraded quality	Only the first bit is used.

Table 4-5 Interpretation of the mask values in quality file "QL_QUALITY" of L1B products

More details on the method used to derive the values written in the quality layers of the L1B data products can be found in .[AD02].

L1C Data Product:

The quality quicklook of L1C data products consists of one file in geotiff format. This file, "QL_QUALITY", contains the same information as the "QL_QUALITY" file of L1B product, previously described, but resampled to the new grid resulting from the orthorectification process of the L1C product. The resampling is done using by building a logical OR operation of the bit patterns of the nearest neighbours.. In this case the mask of a pixel can't be directly interpreted as a pixel affected by the problems reported in the mask, but as a pixel resulting from the interpolation of pixels affected by the problems reported in the mask. The mask is provided as an indication of the pixel reliability.

The interpretation of the values in the masks of QL_QUALITY is shown in Table 4-6.

Layer	Value definition	Remark
Layer-1 (8 bits)	Pixel quality mask, the value of a pixel in position "i-j" in layer "1" indicates: − 0 : L1C resampled pixel in line "i", row "j" in band "1" of the image tile is marked as good − 1 : L1C resampled pixel in line "i", row "j" in band "1" of the image tile is affected by pixels with degraded quality	Only the first bit is used.
…	…	…
Layer-N_{bands} (8 bits)	Pixel quality mask, the value of a pixel in position "i-j" in layer "N_{bands}" indicates: − 0 : L1C resampled pixel in line "i", row "j" in band "N_{bands}" of the image tile is marked as good − 1 : L1C resampled pixel in line "i", row "j" in band "N_{bands}" of the image tile is affected by pixels with degraded quality	Only the first bit is used.

Table 4-6 Interpretation of the mask values in quality file "QL_QUALITY" of L1C products

L2A Data Product:

L2A data products have two geotiff files as part of the quality quicklook. The first one is a copy of the "QL-QUALITY-1" file from the L1C product and it is already described in Table 4-7.

The second quality file (“QL_QUALITY-2”) contains new mask layers added by the L2A processor. For the first file, the complete list of quality layers contained in the geotiff file is shown in Table 4-7. Each of the layers of the geotiff quality quicklook is a 8-bit layer.

Layer	Value definition	Remark
Layer-1 (8 bits)	Shadow pixel, a 0/1 value for each pixel in the quicklook with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Shadow pixel − 0: Pixel "i-j" is a Non shadow pixel	1 bit used (lowest significance bit)
Layer-2 (8 bits)	Clear land pixel, a 0/1 value for each pixel in the quicklook with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a visible land pixel − 0: Pixel "i-j" is a Non visible land pixel	1 bit used (lowest significance bit)
Layer-3 (8 bits)	Snow pixel, a 0/1 value for each pixel in the quicklook with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Snow pixel − 0: Pixel "i-j" is a Non snow pixel	1 bit used (lowest significance bit)
Layer-4 (8 bits)	Haze over land pixel, a 0/1 value for each pixel in the quick-look with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Thin haze over land pixel − 0: Pixel "i-j" is a Non thin haze over land pixel	1 bit used (lowest significance bit)
Layer-5 (8 bits)	Haze over water pixel, a 0/1 value for each pixel in the quick-look with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Thin haze over water pixel − 0: Pixel "i-j" is a Non thin haze over water pixel	1 bit used (lowest significance bit)
Layer-6 (8 bits)	Cloud over land pixel, a 0/1 value for each pixel in the quick-look with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Cloud over land pixel − 0: Pixel "i-j" is a Non clound over land pixel	1 bit used (lowest significance bit)
Layer-7 (8 bits)	Cloud over water pixel, a 0/1 value for each pixel in the quicklook with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a Cloud over water pixel − 0: Pixel "i-j" is a Non clound over water pixel	1 bit used (lowest significance bit)
Layer-8 (8 bits)	Clear water pixel, a 0/1 value for each pixel in the quicklook with spatial "i" and "j" coordinates indicating: − 1: Pixel "i-j" is a visible water pixel − 0: Pixel "i-j" is a Non visible water pixel	1 bit used (lowest significance bit)
Layer-9 (8 bits)	Aerosol optical thickness value computed during L2A processing	Value is encoded in a 8-bit unsigned integer value (0-255 range)
Layer-1010 (8 bits)	Perceptible water vapour value computed during L2A processing	Value is encoded in a 8-bit unsigned integer value (0-255 range)

Table 4-7 Quality layers of the L2A quality quicklook file-2 ("QL_QUALITY-2")

4.2.5 Product Metadata L1B, L1C, L2A

The Product Metadata is part of every data product of the L1B, L1C and L2A processors. It is written using XML format and it contains information on file metadata, job processing and product specific parameters. The structure of the Product Metadata file consists of 5 information blocks:

- File Metadata information, containing general information about the metadata file itself and copyright notice
  Processing parameters (only L1B, L1C, L2A products), containing general information about the processing parameters of the product (e.g. product format, type, resampling, map projection)
- Base parameters, containing basic information about the data (e.g. location, time, processing level)Specific parameters, containing DESIS mission specific parameters
- Product specific parameters (only L1B, L1C, L2A products), containing parameters which are specific of a particular product level

For L1B, L1C and L2A data products (see section 5.1)contains the full description of all fields in the metadata file, section 5.2 contains a sample product metadata file and section 5.3 explains in detail some of these metadata values.

4.2.6 Product History L1B, L1C, L2A

The Product History file is a file acompanying every L1B, L1C or L2A data product and it contains information about the executed processing steps and the items that were used to produce the data product. The file is written in XML format and contains a nested structure where each data product description contains the description of the data products used for its generation.

Section 6.1 contains the full description of all fields in the Product History file and section 6.2 a sample Product History file.

5. Reference Information for L1B, L1C, L2A Product Metadata

5.1 Metadata Cards

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
				L1B	L1C	L2A
hsi_doc	metadata processing base specific		Root of xml doc	X	X	X
metadata	name comment copyright license		General information about the metadata file itself and copyright notice	X	X	X
name		DESIS-<product_type>-DT<datatake_ID>_<tile_ID>-<yyyymmdd>T<hhmmss>-<version>_METADATA.xml	Type: string Name of the product metadata file	X	X	X
comment			Type: string Free text field	X	X	X
copyright		DLR	Type: string Copyright information	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
license		DLR internal usage	Type: string Constant value	X	X	X
processing	coRegistration mapProjection imageResampling backgroundValue versionDEM versionREF terrainCorrection ozoneValue productType test		General information about the processing parameters to generate the product (e.g. product format, type, resampling, map projection)	X	X	X
coRegistration		{Yes, No, none}	Type: string In case of rolling shutter the L1B product can be resampled in order to achieve co-registration of the channels. None is used if no active selection is performed	X	X	X
mapProjection		{UTM_Zone_of_Center, UTM_Zone_of_Center(-1), UTM_Zone_of_Center(+1), Geographic, none}	Type: string none if not selected (e.g. for L1B product)	X	X	X
imageResampling		{Nearest_Neighbour, Bilinear_Interpolation, Cubic_Convolution, none}	Type: string none if not selected (e.g. for L1B product)	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
backgroundValue		Example: -32768	Type: short Used to set the background value of the spectral image	X	X	X
versionDEM		Examples SRTM-C-X_vv.rr, best-of-DEM_vv.rr, ASTER-GDEM_vv.rr, none}	Type: string Used DEM for geometric processing internal processing parameter	X	X	X
versionREF		{Image2006_vv.rr, Image2009_vv.rr ,USGS-ETM+LandCover_vv.rr, GLS2010, none	Type: string Used Reference for GCP extraction internal processing parameter currently always "none". None is used if no active selection is performed	X	X	X
terrainCorrection		{Yes, No, none}	Type: string none if not selected	X	X	X
ozoneValue		[200,…,500] or 0 (zero)	Type: integer 0 (zero) if not selected	X	X	X
productType		{L1B, L1C, L2A}	Type: string Product level coming with this metadata file	X	X	X
test		{true, false}	Type: Boolean Marks the product as test	X	X	X
base	version revision		Contains basic information about the data (e.g. location, time, processing level)			

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
	l1aVesrion sphere size level format spatialCoverage altitudeCoverage temporalCoverage					
version		{nn.nn}	Type: string Global Version of the processing chain	X	X	X
revision		{nn.nn}	Type: string Version of the processor being executed	X	X	X
l1aVersion		{nn.nn}	Type: string Version of the L1A processor, which produced the L1A product stored in the database	X	X	X
sphere		{earth, none}	Type: string Should be always "earth" for DESIS products. None is used for future expansion.	X	X	X
size		[0,…,-]	Type: non-negative integer Size of product in GiB of the unzipped product	X	X	X
level		{L1B,L1C,L2A}	Type: string Product Level	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
format		{GeoTIFF}	Type: string Image Format of product	X	X	X
spatialCoverage	boundingPolygon		Contains information on the spatial coverage of the product w.r.t. the WGS84 geodatic datum.	X	X	X
boundingPolygon	point		The bounding polygon is a list of points starting with the most starboard pixel of the first scanline and followed by a counter-clockwise sequence of four points, whereas the last point is identical with the first point. See Figure 5-3	X	X	X
point	frame latitude longitude		Type: string (for frame) The frame can be element from {center, point_1, point_2, point_3, point_4, point_5} Type: double (for latitude and longitude) longitude can be [-180° west of Greenwich,…,+180 east of Greenwich] latitude can be [-90° south of equator,…,+90° north of equator]	X	X	X
altitudeCoverage			Type: double Mean platform height above WGS84 ellipsoid during data acquisition given in kilometer	X	X	X
temporalCoverage	startTime endTime		Contains the time of the first scanline acquistion and the last scanline acquistion given in UTC	X	X	X
startTime endTime		2017-04-15 T01:45:11.123456Z	Type: DateTime startTime: time of first scanline in UTC (e.g. 2017-04-15T01:45:11.123456Z) endTime: time of last scanline in UTC (e.g. 2017-04-15T01:46:05.123456Z) for an acquistion with rolling shutter the time is related to first channel of the	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			image			
specific	mission satelliteID sensor sensorMaxBands acquisitionMode requestID datatakeID imageID tileID numberOfTiles numberOfBands bandCharacterisation pixelSize widthOfScene heightOfScene missionPhase orbitDirection orbitType processingDateTime processingCenter processingNode processible			X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
	qualityFlag meanGroundElevation meanSlope meanWaterVapour qualityWV stripingBanding generalArtifacts defectivePixels smileIndication orthoRMSE_x orthoRMSE_y orthoRe meanVisibility qualityVIS meanAerosolOpticalThickness percentageHazequalityHaze percentageClouds qualityCloud percentageCloudShadow qualityCloudShadow percentageTopoShadow qualityTopoShadow					

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
	aerosolType season sunAzimuthAngle sunZenithAngle sceneAzimuthAngle sceneIncidenceAngle qualitySZA sceneAzimuthAngle qualityIndicator auxDataVersion lowGainFactor highGainFactor configFPA pointingMirrorAngle boresightAngles interiorOrientation orbit attitude					
mission		DESIS	Type: string Mission name is constant	X	X	X
satelliteID		ISS	Type: string satelliteID is constant	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
sensor		HSI	Type: string Sensor is constant	X	X	X
sensorMaxBands		[0-235]	Type:integer Ideally constant as 235 along all the mission.	X	X	X
acquisitionMode		{image_strip_mode, image_stereo_mode}	Type: string Defines the acquistion mode. The image_strip_mode is the normal earth imaging mode, whereas the image_stereo_mode is an experimental mode with up to 3 images of the same ground target area in one datatake for stereo and BRDF evaluations.	X	X	X
requestID			Type: string Unique request identifier generated by TBE	X	X	X
datatakeID		[0000000001,…,9999999999]	Type: string (10 digits) Unique datatake ID. Example: 1234567890	X	X	X
imageID		[0010000001,…,9909999999]	Type: string (13 digits) The unique imageID is composed of the datatakeID and the tileID by imageID = string(datatakeID)+string(tileID) Example: 1234567890003	X	X	X
tileID		[001,…,999]	Type: string (3 digits) Tile number within a datatake increasing timely starting from 001. Example: 003	X	X	X
numberOfTiles		[1,…999]	Type: integer	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			Total number of tiles of the datatake			
numberOfBands		[1,…,235]	Type: integer Number of spectral channels of the tile	X	X	X
bandCharacterisation	band					
band	bandNumber wavelengthCenterOfBand wavelengthWidthOfBand response wavelength gainOfBand offsetOfBand deadPixels suspiciousPixel		Contains information valid for each spectral band of the image	X	X	X
bandNumber		[1,…,235]	Type: integer Sequence of increasing spectral band numbers corresponding to increasing wavelengths as stored sequential in the image data cube	X	X	X
wavelengthCenterOfBand		[350,…,1050]	Type: double Center wavelength in [nm] of spectral band. See Figure 5-1	X	X	X
wavelengthWidthOfBand		[0,…,20]	Type: double FWHM in [nm] of band. See Figure 5-1	X	X	X
response			Type: double	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			Tabulated spectral response values			
wavelength			Tabulated wavelength for the response values	X	X	X
gainOfBand offsetOfBand		[0,…,-]	Type: double For L1B and L1C products From the pixel values (DN = digital number) in the specific band the Top-of-Atmosphere Radiance given in [mW/cm2/sr/µm] can be calculated by L=OffsetOfBand+GainOfBand*DN For L2A products From the pixel values (DN = digital number) in the specific band the reflectance with a value between 0 and 1.0 can be calculated by L=OffsetOfBand+GainOfBand*DN	X	X	X
deadPixels		[0,…,100]	Type: double Percentage of dead pixels in the band derived from calibration.	X	X	X
suspiciousPixel		[0,…,100]	Type: double Percentage of suspicious pixels in the band derived from data screening	X	X	X
pixelSize		[30,..,50]	Type: float This element has an attribute (unit = m for meter in case of not Geographic Map Projection and unit = d for decimal degree in case of Geographic Map Projection) which defines the resolution of the pixel. For L1B products this is an approximate value.	X	X	X
widthOfScene		1024 (default)	Type: integer Number of spectral pixels in a scanline (across direction)	X	X	X
heightOfScene		1024 (default)	Type: integer	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			Number of pixels in alongtrack direction			
missionPhase		{pre-launch, leop, commissioning, routine}	Type: string Phase where the datatake is acquired	X	X	X
orbitDirection		{ASCENDING, DESCENDING}	Type: string Ascending or descending mean orbit direction within an image tile	X	X	X
orbitType		{predicted, precision}	Type: string Defines the orbit type	X	X	X
processingDateTime		2013-04-15 T01:45:11.123456Z	Type: dateTime Processing date and time in UTC	X	X	X
processingCenter		{NZ, OP,TBE}	Type: string Name of processing center OP = DLR@Oberpfaffenhofen and NZ = DLR@Neustrelitz TBE = Teledyne Brown Engineering	X	X	X
processingNode			Type: string Provided by command ‘hostname’	X	X	X
processible		{-1,0,1}	Type: integer Specifies if a data set was processible =0 or not =1 or suspicious 1	X	X	X
terrain	meanGroundElevation meanSlope				X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
meanGroundElevation			Type: double Mean ground elevation given in meter above WGS84		X	X
meanSlope			Type: double Mean slope value given in decimal degree		X	X
waterVapour	meanWaterVapour qualityWV					X
meanWaterVapour		[0.01,…,6.00]	Type: double Mean water vapour column (WV) in centimeter.			X
qualityWV		{reduced, normal}	Type: string If WV > 4cm: reduced quality, WV > 5cm: low quality			X
visibility	meanVisibility qualityVIS					X
stripingBanding		{0-100, 255}	Type: byte Value in percent of affected pixels in dataset; {255}: not produced see [AD02]	x	x	x
generalArtifacts		{0-100, 255}	Type: byte Value in percent of affected pixels in dataset; {255}: not produced see [AD02]	x	x	x
defectivePixels		{0-100, 255}	Type: byte Value in percent of affected pixels in dataset; {255}: not produced see [AD02]	x	x	x
smileIndication		{0-100, 255}	Type: byte Probability of detected smile. {0-100}: low vales indicate a low probability for spectral smile, high values indicate a high probability of spectral smile}; {255}:	x	x	x

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			not produced see [AD02]			
orthoRMSE_x		[0,…,-] or -1	Type: double Linear RMSE in x direction (west-east) in meter -1 if no matching is performed. The value is a worst case estimation, because - the outlier detection within the sensor model is not performed - the tie points with lower quality measure are used (the best ones are used for the GCPs)		X	X
orthoRMSE_y		[0,…,-] or -1	Type: double Linear RMSE in y-direction (north-south) in meter -1 if no matching performed The value is a worst case estimation, because - the outlier detection within the sensor model is not performed - the tie points with lower quality measure are used (the best ones are used for the GCPs)		X	X
numPointsGCP		[0,…,-]	Type: integer Number of GCP to improve sensor model		X	X
numPointsICP		[0,…,-]	Type: integer Number of ICP used to derive orthoRMSE		X	X
matchingMethod		{LLSQ, BRISK, SIFT,none}	Type: string		X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			Image matching method that produced the GCP/ICP point set *LLSQ: Local Least Squares* *BRISK: Binary Robust Invariant Scalable Keypoints* *SIFT: Scale-invariant feature transform* Note: In case matching is “none” the L2A processing switches off the parameter “terrain correction” automatically			
percentageCloudShadow		[0,…100]	Type: double Percentage of cloud shadow in the image			X
qualityCloudShadow		{reduced, normal}	Type: string If percent of cloud shadow >10%: reduced quality			X
topoShadow	percentageTopoShadow qualityTopoShadow					X
percentageTopoShadow		[0,…100]	Type: double Persentage of topographic shadow in the image			X
qualityTopoShadow		{reduced, normal}	Type: string If percent of topographic shadows > 10%: reduced quality			X
meanAerosolOpticalThickness		[0,…,1.0]	Type: double Mean aerosol optical thickness at 550 nm			X
aerosolType		{rural, urban, maritime, desert}	Type: string Aerosol type used for atmospheric correction			X
season		{summer, winter}	Type: srtring			X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
			Season used type for atmospheric correction			
sunAzimuthAngle			Type: double The value is derived at the scene center and counted positive from north clockwise. The value is given in decimal degree.	X	X	X
sunZenithAngle		[0,…90]	Type: double The value is derived w.r.t. WGS84 at the center of scene. The value is given in decimal degree.	X	X	X
sceneAzimuthAngle		[0,…,360]	Type: double The value is derived from the mean path w.r.t. north direction and counted positive clockwise. The value is given in decimal degree. (see 5.3.4)	X	X	X
sceneIncidenceAngle		[0,…,90]	Type: double The angle between normal at the scene center and the lock direction of the sensor. The value is given in decimal degree. (see 5.3.4)	X	X	X
qualitySZA		{reduced, low, normal}	Type: string If SZA >55: reduced quality, SZA > 65: low quality			X
qualityIndicator	screeningStatus screeningResult darkBeforeQuality darkAfterQuality		Type: structure; required Includes the screening results of housekeeping parameters in the virtual channel and the quality of the dark current measurements	X	X	X
screeningStatus		{-1,0,1}	Type: integer; required Screening result status can be a WARNING (-1), an ERROR (0), or FAULTLESS (1)	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
screeningResult	parameter		Type: structure; required, one or more sets Container for one tested housekeeping parameter in the virtual channel	X	X	X
parameter	status name type description info value units		Type: structure Information about a tested physical or (device or command) status parameter, includes description of properties and test results	X	X	X
status		{-1, 0, 1}	Type: integer; required Test status: WARNING = -1, ERROR = 0, FAULTLESS = 1	X	X	X
name			Type: string; required Unique name code of the parameter	X	X	X
type		{temperature, voltage, current, power, status}	Type: string; required Predefined parameter type description, list can be extended	X	X	X
description			Type: string; optional Human readable parameter description as free text	X	X	X
info			Type: string; optional Information in case of failure or limit violation	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
value			Type: string; required one value or a list of values, separated by comma or space	X	X	X
units			Type: string; optional Physical unit of <value> or '1'	X	X	X
darkBeforeQuality	available status		Type: structure; required Contains screening results of dark current measurements before datatake	X	X	X
available		{yes, no}	Type: string; required Dark current measurement before earth data take exists (yes) or not (no)	X	X	X
status		{-1, 0, 1}	Type: integer; required Test status: WARNING = -1, ERROR = 0, FAULTLESS = 1	X	X	X
darkAfterQuality	available status		Type: structure; required Contains screening results of dark current measurements after datatake	X	X	X
available		{yes, no}	Type: string; required Dark current measurement after earth data take exists (yes) or not (no)	X	X	X
status		{-1, 0, 1}	Type: integer; required Test status: WARNING = -1, ERROR = 0, FAULTLESS = 1	X	X	X
lowGainFactor		{1,2}	Type:integer Gain setting of the sensor for low gain	X	X	X
highGainFactor		{5,10}	Type:integer Gain setting of the sensor for high gain	X	X	X

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
configFPA		{rolling_shutter, global_shutter}	Type: string Shutter mode of the focal plane array	X	X	X
pointingMirrorAngle		[-7.5,…,7.5]	Type: double Angle of the pointing mirror measured in decimal degree. Forward looking is positive and backward looking is negative. The angle is given in decimal degree. In case of fail save the angle -0.0 is written and different geometric calibration tables will be used according to the mounting of the second fixed mirror. The value “-0.0” should be checked on a string basis.	X	X	X
deltaOmegaFM		[-180,…,180]	Fixed mirror mounting angle X (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
deltaPhiFM		[-180,…,180]	fixed mirror mounting angle Z (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
betaFM		[-180,…180]	fixed mirror mounting angle Y (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
deltaOmegaPOI		[-180,…180]	POI mounting angle X (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
deltaPhiPOI		[-180,…180]	POI mounting angle Z (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
betaPOI		[-180,…180]	POI mounting angle Y (see [AD02] for the definition of the calibrated angle). The angle is given in decimal degree.	X		
boresightAngles	rotX rotY rotZ		Contains information on sensor mounting angles.The boresight angles define the rotation of the sensor coordinate frame to the coordinate frame of the attitude measurment system (Startracker, Gyro)	X		

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
rotX rotY rotZ			Type: double Sensor mounting angles. The angles are given in decimal degree.	X		
interiorOrientation	band		Contains information on the calibrated object sided look angles	X		
band	bandNumber calAngles			X		
bandNumber		[0,1,…235]	Type: integer Number of the band for which the calibration value is valid If bandNumber=0 only one calAngles structure is defined and the measurment values are valid for each band, which means no keystone is present.	X		
calAngles	pixelNumber phiX phiY		Contains information on the object sided look angles at specific pixel positions. The angles are given in decimal degree. See 5.3.2	X		
pixelNumber phiX phiY			Type: integer for pixelNumber Type: double for phiX and phiY For each pixel in the band the two object sided look angles are given. The angles are given in decimal degree. See Figure 5-2 Definition of object sided angles of the interior orientation	X		
orbit	leapSeconds origin stateVector		Contains information for geometric processing	X		

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
leapSeconds		[0,…,-]	Type: integer Leap seconds between GPS time and UTC time	X		
origin			Type: string Origin of data stream (e,g. BAD)	X		
stateVector	timeUTC timeGPS point		Contains information on satellite position and velocity	X		
timeUTC			Type: dateTime UTC time of position / velocity	X		
timeGPS			Type: double GPS time of position / velocity with microsecond resolution	X		
point	location velocity		Contains location and velocity of the satellite	X		
location	X Y Z		Contains position of the satellite Origin: Mass center of Earth defined by WGS84 X points to Greenwich Z points to Earth rotation axes Y complements right handed Cartesian frame	X		
X		[-,-]	Type: double	X		

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
Y Z			Position of satellite w.r.t. WGS84 frame. The position is given in meter.			
velocity	X Y Z		Contains velocity of satellite	X		
X Y Z		[-,-]	Type: double Velocity of satellite w.r.t. WGS84 frame. The velocity is given in meter per second.	X		
attitude	referenceFrame leapSeconds origin stateVector		Contains information on the attitude	X		
referenceFrame		{ECR,ECI,ORBIT}	Type: string Defines the coordinate frame against the attitude is measured	X		
leapSeconds		[0,…,-]	Type: integer Leap seconds between GPS time and UTC	X		
origin			Type: string Origin of data stream	X		
stateVector	timeUTC timeGPS angle		Contains the list of MUSES attitude values	X		

Parameter	Unordered list of sub-elements	Value Range	Remarks	Availability		
timeUTC			Type: dateTime UTC time of attitude measurement	X		
timeGPS			Type: double GPS time of attitude measurement with microsecond resolution	X		
angle	q1 q2 q3 q4		Contains attitude of the satellite	X		
q1 q2 q3 q4		[-,-]	Type: double Quaternions (w,x,y,z)	X		

Table 5-1 Metadata for L1B, L1C, and L2A products

5.2 Example of Metadata file

The following example contains all metadata cards and is not a real example for a specific product (see Availability column in section 8.1). This example shows the metadata for a L2A product

```
<?xml version="1.0" encoding="UTF-8"?>
<hsi_doc xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance" xsi:noNamespaceSchemaLocation="DESIS_schema_L2A_02.xsd">
 <metadata>
  <name>DESIS-HSI-L2A-DT2019010803_001-20190108T103952-V0201-METADATA.xml</name>
  <comment>DESIS_Hyperspectral_Image_atmospheric_corrected_data</comment>
  <copyright>DLR</copyright>
  <license>DLR_internal_usage</license>
 </metadata>
 <processing>
  <coRegistration>none</coRegistration>
  <mapProjection>UTM_Zone_of_Scene_Center</mapProjection>
  <imageResampling>Bilinear_Interpolation</imageResampling>
  <backgroundValue>-32768</backgroundValue>
  <swBinning>false</swBinning>
  <versionDEM>ASTGTM2</versionDEM>
  <versionREF>GMB</versionREF>
  <terrainCorrection>Yes</terrainCorrection>
  <ozoneValue>330</ozoneValue>
  <productType>L2A</productType>
  <test>true</test>
 </processing>
 <base>
  <version>02.01</version>
  <l1aVersion>02.00</l1aVersion>
  <sphere>earth</sphere>
  <size>534</size>
  <level>L2A</level>
  <format>TIF</format>
  <spatialCoverage>
   <boundingPolygon>
    <point>
     <frame>point_1</frame>
     <latitude>14.8650599</latitude>
     <longitude>-24.2342545</longitude>
    </point>
    <point>
     <frame>point_2</frame>
     <latitude>15.2795625</latitude>
     <longitude>-24.2288903</longitude>
    </point>
    <point>
     <frame>point_3</frame>
     <latitude>15.2839530</latitude>
     <longitude>-24.6096293</longitude>
    </point>
    <point>
     <frame>point_4</frame>
     <latitude>14.8693260</latitude>
     <longitude>-24.6142583</longitude>
    </point>
    <point>
     <frame>point_5</frame>
     <latitude>14.8650599</latitude>
     <longitude>-24.2342545</longitude>
    </point>
    <point>
     <frame>center</frame>
```

```
      <latitude>15.074475</latitude>
      <longitude>-24.421758</longitude>
     </point>
    </boundingPolygon>
   </spatialCoverage>
   <altitudeCoverage>405902.1</altitudeCoverage>
   <temporalCoverage>
    <startTime>2019-01-08T10:41:39.780712Z</startTime>
    <endTime>2019-01-08T10:41:44.126172Z</endTime>
   </temporalCoverage>
  </base>
  <specific>
   <mission>DESIS</mission>
   <satelliteID>ISS</satelliteID>
   <sensor>HSI</sensor>
   <sensorMaxBands>235</sensorMaxBands>
   <acquisitionMode>image_strip_mode</acquisitionMode>
   <requestID>0000</requestID>
   <datatakeID>2019010803</datatakeID>
   <imageID>2019010803001</imageID>
   <tileID>001</tileID>
   <numberOfTiles>2</numberOfTiles>
   <numberOfBands>235</numberOfBands>
   <bandCharacterisation>
    <band>
     <bandNumber>1</bandNumber>
     <wavelengthCenterOfBand>402.0</wavelengthCenterOfBand>
     <wavelengthWidthOfBand>2.4</wavelengthWidthOfBand>
     <response>5.54e-05, 8.13e-05, 1.18e-04, 1.69e-04, 2.40e-04, 3.36e-04, 4.66e-04,
6.38e-04, 8.65e-04, 1.16e-03, 1.53e-03, 2.01e-03, 2.60e-03, 3.33e-03,
4.22e-03, 5.28e-03, 6.54e-03, 8.02e-03, 9.71e-03, 1.16e-02, 1.38e-02,
1.62e-02, 1.88e-02, 2.15e-02, 2.45e-02, 2.75e-02, 3.06e-02, 3.38e-02,
3.70e-02, 4.01e-02, 4.33e-02, 4.66e-02, 5.08e-02, 6.34e-02, 5.18e-02,
4.73e-02, 4.38e-02, 4.07e-02, 3.75e-02, 3.43e-02, 3.12e-02, 2.81e-02,
2.50e-02, 2.20e-02, 1.92e-02, 1.66e-02, 1.42e-02, 1.20e-02, 1.00e-02,
8.30e-03, 6.79e-03, 5.49e-03, 4.39e-03, 3.48e-03, 2.72e-03, 2.10e-03,
1.61e-03, 1.22e-03, 9.11e-04, 6.74e-04, 4.93e-04, 3.56e-04, 2.55e-04,
1.80e-04, 1.26e-04, 8.68e-05, 5.93e-05, 4.00e-05, 2.67e-05, 1.76e-05,
1.15e-05</response>
     <wavelengths>395.00, 395.20, 395.40, 395.60, 395.80, 396.00, 396.20, 396.40, 396.60,
396.80, 397.00, 397.20, 397.40, 397.60, 397.80, 398.00, 398.20, 398.40,
398.60, 398.80, 399.00, 399.20, 399.40, 399.60, 399.80, 400.00, 400.20,
400.40, 400.60, 400.80, 401.00, 401.20, 401.40, 401.60, 401.80, 402.00,
402.20, 402.40, 402.60, 402.80, 403.00, 403.20, 403.40, 403.60, 403.80,
404.00, 404.20, 404.40, 404.60, 404.80, 405.00, 405.20, 405.40, 405.60,
405.80, 406.00, 406.20, 406.40, 406.60, 406.80, 407.00, 407.20, 407.40,
407.60, 407.80, 408.00, 408.20, 408.40, 408.60, 408.80, 409.00</wavelengths>
     <gainOfBand>0.0001</gainOfBand>
     <offsetOfBand>0.0</offsetOfBand>
     <deadPixels>29.0</deadPixels>
     <suspiciousPixel>29.0</suspiciousPixel>
    </band>
    <band>
     <bandNumber>2</bandNumber>
     <wavelengthCenterOfBand>404.3</wavelengthCenterOfBand>
     <wavelengthWidthOfBand>3.6</wavelengthWidthOfBand>
     <response>1.31e-05, 2.08e-05, 3.27e-05, 5.07e-05, 7.75e-05, 1.17e-04, 1.74e-04,
2.56e-04, 3.71e-04, 5.30e-04, 7.48e-04, 1.04e-03, 1.43e-03, 1.94e-03,
2.59e-03, 3.42e-03, 4.44e-03, 5.71e-03, 7.23e-03, 9.03e-03, 1.11e-02,
1.35e-02, 1.62e-02, 1.92e-02, 2.24e-02, 2.58e-02, 2.93e-02, 3.28e-02,
3.61e-02, 3.93e-02, 4.21e-02, 4.45e-02, 4.63e-02, 4.75e-02, 4.80e-02,
4.78e-02, 4.69e-02, 4.53e-02, 4.32e-02, 4.06e-02, 3.76e-02, 3.43e-02,
3.08e-02, 2.74e-02, 2.39e-02, 2.06e-02, 1.75e-02, 1.47e-02, 1.22e-02,
9.93e-03, 8.00e-03, 6.35e-03, 4.98e-03, 3.85e-03, 2.94e-03, 2.21e-03,
1.64e-03, 1.20e-03, 8.69e-04, 6.19e-04, 4.36e-04, 3.03e-04, 2.07e-04,
```

1.40e-04, 9.33e-05, 6.14e-05, 3.98e-05, 2.55e-05, 1.61e-05, 1.00e-05</response>
<wavelengths>397.40, 397.60, 397.80, 398.00, 398.20, 398.40, 398.60, 398.80, 399.00,
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401.00, 401.20, 401.40, 401.60, 401.80, 402.00, 402.20, 402.40, 402.60,
402.80, 403.00, 403.20, 403.40, 403.60, 403.80, 404.00, 404.20, 404.40,
404.60, 404.80, 405.00, 405.20, 405.40, 405.60, 405.80, 406.00, 406.20,
406.40, 406.60, 406.80, 407.00, 407.20, 407.40, 407.60, 407.80, 408.00,
408.20, 408.40, 408.60, 408.80, 409.00, 409.20, 409.40, 409.60, 409.80,
410.00, 410.20, 410.40, 410.60, 410.80, 411.00, 411.20</wavelengths>
<gainOfBand>0.0001</gainOfBand>
<offsetOfBand>0.0</offsetOfBand>
<deadPixels>23.24</deadPixels>
<suspiciousPixel>23.24</suspiciousPixel>
</band>
<band>
<bandNumber>3</bandNumber>
<wavelengthCenterOfBand>406.8</wavelengthCenterOfBand>
<wavelengthWidthOfBand>3.8</wavelengthWidthOfBand>
<response>1.07e-05, 1.33e-05, 1.71e-05, 2.27e-05, 3.08e-05, 4.26e-05, 5.97e-05,
8.45e-05, 1.20e-04, 1.71e-04, 2.42e-04, 3.42e-04, 4.80e-04, 6.68e-04,
9.21e-04, 1.26e-03, 1.70e-03, 2.27e-03, 2.99e-03, 3.90e-03, 5.02e-03,
6.38e-03, 8.01e-03, 9.91e-03, 1.21e-02, 1.46e-02, 1.74e-02, 2.04e-02,
2.36e-02, 2.69e-02, 3.03e-02, 3.36e-02, 3.68e-02, 3.97e-02, 4.22e-02,
4.43e-02, 4.59e-02, 4.68e-02, 4.71e-02, 4.67e-02, 4.57e-02, 4.41e-02,
4.20e-02, 3.94e-02, 3.64e-02, 3.32e-02, 2.99e-02, 2.65e-02, 2.32e-02,
2.00e-02, 1.70e-02, 1.43e-02, 1.18e-02, 9.67e-03, 7.80e-03, 6.21e-03,
4.88e-03, 3.78e-03, 2.90e-03, 2.19e-03, 1.64e-03, 1.21e-03, 8.87e-04,
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5.3 Explanations

5.3.1 wavelengthCenterOfBand & wavelengthWidthOfBand

The center of a spectral band (wavelengthCenterOfBand) and the width of a spectral band (wavelengthWidthOfBand) is illustrated in Figure 5-1

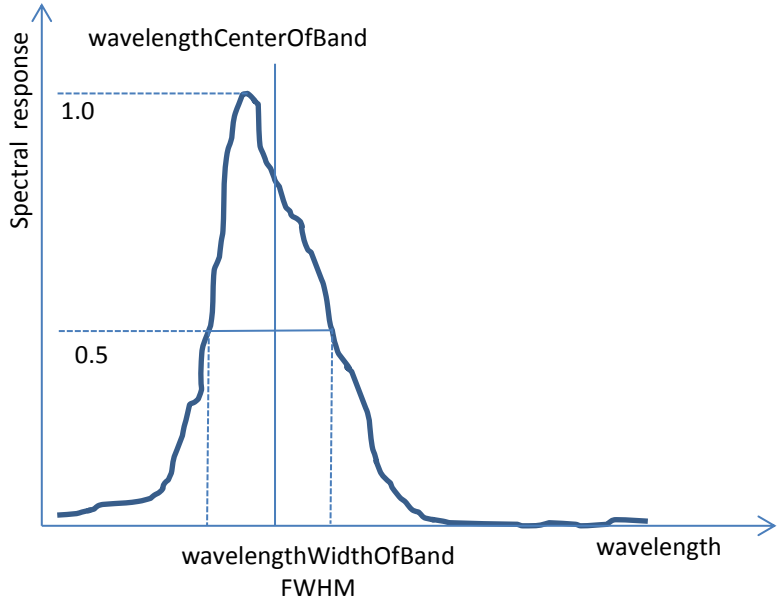

Figure 5-1 Ilustration of center wavelength and FWHM

5.3.2 calAngles

The geometric calibration angles are illustrated in Figure 5-2

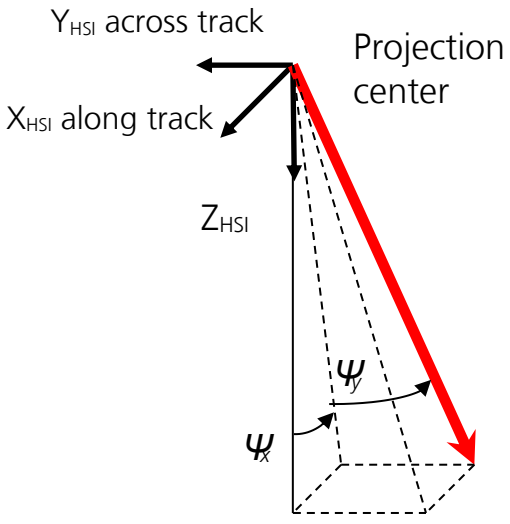

Figure 5-2 Definition of object sided angles of the interior orientation

5.3.3 boundingPolygon

The bounding polygon is illustrated in Figure 5-3

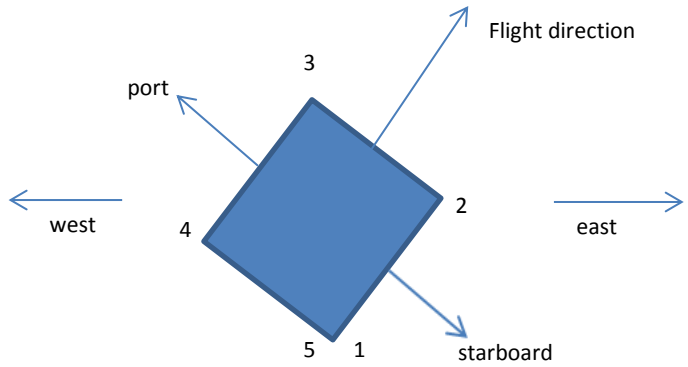

Figure 5-3 Example of an image bounding polygon with ascending ISS orbit direction

sing a sphere model of the Earth. The

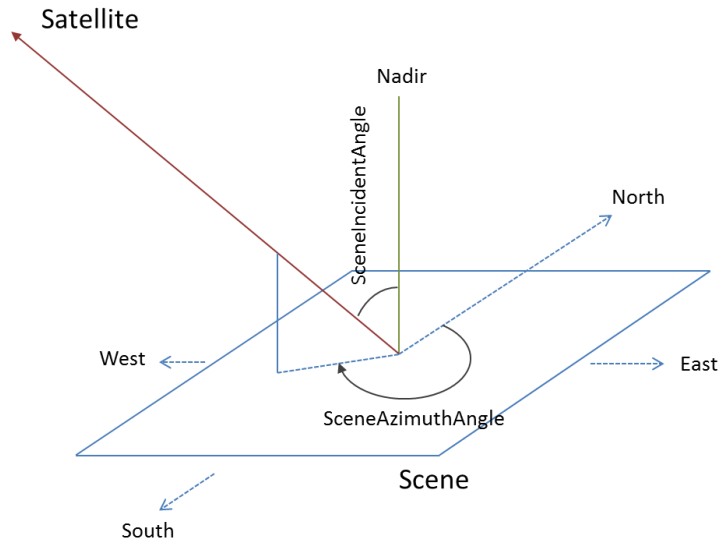

Figure 5-4 Definition of scene angles

6. Reference Information for L1B, L1C, L2A Product History

6.1 History Cards Description

Parameter	Unordered list of sub-elements	Data Type	Value Range	Description	Mandatory
base	- mission - instrument - source - destination - productType - productParameter - productFile - productOperations - status - remark	Root parameter		Define a history block within the history file, enclosing all history parameters within a deeper level for every data product. The parameter <base> must exist at least once and it can occur multiple times	Yes
base/mission	(none)	String of maximum 256 characters	DESIS	Identify mission that produced the data. It is a fixed string	Yes
base/instrument	(none)	String of maximum 256 characters	01	Identify the DESIS instrument that produced the data	Yes
base/source	- name - revision - time	Root parameter		Identify a block in the XML file describing the source of the data product or data component which was needed to produce a data product	Yes
base/source/name	(none)	String of maximum 256 characters	- TBE - Ground Data System XX - Data and Information Management System XX - Processing System XX	Name of the source program/system that generated the product	Yes
base/source/version	(none)	String of maximum 256 characters	VV.VV	Version of the source program/system that generated the product	Yes
base/source/time	(none)	DateTime	YYYY-MM-DD HH:MM:SS	Timestamp for source data creation	Yes
base/destination	- name	Root parameter		Identify a block in the XML file describing the destination of the data	No

Parameter	Unordered list of sub-elements	Data Type	Value Range	Description	Mandatory
	- version - time			product	
base/destination/name		String of maximum 256 characters	- Ground Data System XX - Data and Information Management System XX - Processing System XX - User XX	Name of the destination program/system that receives the product	No
base/destination/version	(none)	String of maximum 256 characters	VV.VV	Version of the source program/system that receives the product	No
base/destination/time	(none)	DateTime	YYYY-MM-DD HH:MM:SS	Timestamp for destination data creation	No
base/productType	(none)	String of maximum 65536 characters		Describes the type of product exchanged	Yes
base/productParameter	(none)			Specifies the parameters used to generate the product	Yes
base/productFile	- name - hash	Root parameter		Specifies details about the product file exchanged	Yes
base/productFile/name		String of maximum 256 characters		Specifies the product file name	Yes
base/productFile/hash	- algorithm - value	Root parameter		Optional hash value computed for the product file using one of the available hash algorithms	No
base/productFile/hash/algorithm	(none)	String of maximum 256 characters	CRC32, SHA256	Algorithm used to compute the hash value of the data product file	No
base/productFile/hash/value	(none)	String of maximum 256 characters		Hash value computed for the product file using the algorithm given by base/productFile/hash/name	No
base/productOperations	(none)	String of maximum 65536 characters		Operations performed by the source for the exchanged product	No
base/status	(none)	String of maximum 256 characters	ERROR, WARNING, FAULTLESS	Specifies the output status flag after execution of the process	Yes
base/remark	(none)	String of maximum		Includes possible remarks relevant for the data product that shall be	No

Parameter	Unordered list of sub-elements	Data Type	Value Range	Description	Mandatory
		65536 characters		part of the product history	

6.2 Example of History file

```
<base>
    <mission>DESIS</mission>
    <instrument>01</instrument>
    <source>
        <name>DESIS L1A Processor</name>
        <revision>01.02</ revision >
        <time>2017-11-25 13:57:11</time>
    </source>
    <destination>
        <name>DESIS L1B Processor</name>
        <revision>01.03</revision>
    </destination>
    <productType>Level 1B Earth</productType>
    <productParameter>tile 001 of datatake 10003219 at 2017-11-13 07:21:03</productParameter>
    <productFile>
        <name>DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-METADATA.xml</name>
        <hash>
```

<algorithm>CRC32</algorithm>
<value> accf8b33</value>
</hash>
</productFile>
<productFile>
<name> DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-SPECTRAL_IMAGE.geotiff </name>
<hash>
<algorithm> SHA256 </algorithm>
<value>2a94a200762a30cc332703c4ef4b1c6af40e76e1a9214e3bfc6d2049878f6c9e</value>
</hash>
</productFile>
<productFile>
<name> DESIS-HSI-LXX-DT0010357991_003-20171013T035442-V0100-HISTORY.xml </name>
</productFile>
<status>FAULTLESS</status>
<base>
<mission>DESIS</mission>
<instrument>01</instrument>
<source>
<name>TBE</name>
<revision>01.00</revision>
<time>2017-11-14 21:58:35</time>
</source>
<destination>
<name>L1A Processor</name>
<revision>01.02</revision>
<time>2017-11-14 01:58:11</time>

```
            </destination>
            <productType>Level 1A Earth</productType>
            <productParameter> tile 001 of datatake 0010357991 at 2017-11-13 07:21:03</productParameter>
              . . .
            <status>FAULTLESS</status>
        </base>
    </base>
```