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ATLID INSTRUMENT SOURCE PACKETS (ISP) DEFINITION

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Summary

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This document describes the content of the Instrument Source Packets delivered by the Atlid instrument to the Data Handling subsystem of the EarthCare Satellite. It is an input to the ACDM unit specification requirements document for the definition of the packetization function inside the instrument, and to the Atlid Products Definition document for science data exploitation and simulation (ECGP & ESSS).

This present issue is especially written for ATLID CDR. It aims identifying all known modifications of ISP definition for the next SW specification. In particular it adds the instrument configuration register, giving the equipment redundancy used, in the Low Rate part. All these modifications will be introduced in the next issue of ASW (V2.0).

Document change log

ISSUE/ REVISION	DATE	MODIFICATION NB	MODIFIED PAGES	OBSERVATIONS
1.0	07.01.09			
1.1	22.04.09			Insertion of the High Rate telemetries of the N Laser Shots for each DRD packet
2.0	07.09.10			Bistatic configuration – Addition of coalignement functions.
2.1	25.11.10		§ 6, § 1.1	ESSS TRR RID 51 Accomodation
3.0	30.06.11			Update of AD1, modification of Atlid PRF, ACDM PDR, IDE PDR.
				PRF changed to 51Hz
				URD for Coalignment loop at V4.0
				Detailed correspondence of pixel position wrt rank in DRD
4.0	03.11.2014		See change bars	Addition of instrument configuration register in the LR packet
				Update with the last mode definition
				Take into account of last ICD: - TMTC ICD IDE Issue 6.0 - TMTC TxA issue 6.0 - ASW ICD issue 3.5
4.1	22.07.2015	1	Figure 3.2	Take into account of ESA/ASD revue (July 2015) :Take into account of ESA/ASD revue (July 2015) : Correction of typo in table

ISSUE/ REVISION	DATE	MODIFICATION NB	MODIFIED PAGES	OBSERVATIONS
				SH-04 : replace INS-OPE by INS-NOM in figure 3.2
		2	§4.3	Comment from TAS-UK/Scisys : Correction of misleading sentence : Measurement Validity Bit is provided by IDE inside the DAD.
		3	Investigation packet	Comment from TAS-UK/Scisys : Removal of unavailable element
		4	Typo in table §5.3	Index of CEI MAX DATA and CEI VA DATA corrected
		5	§ 3 See change bars	Clarification : HKTM packets (226,2) are emitted during HWU-RDY transition

Page issue record

This document includes the following pages to the edition indicated

PAGE	ISSUE/ REV.	PAGE	ISSUE/ REV.	PAGE	ISSUE/ REV.	PAGE	ISSUE/ REV.	PAGE	ISSUE/ REV.	PAGE	ISSUE/ REV.
All	1.0										
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All	4.1										

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1 INTRODUCTION

1.1 Scope

This document describes the content of the Instrument Source Packets delivered by the Atlid instrument to the Data Handling subsystem of the EarthCare Satellite. It is an input to the Atlid Control and Data Management (ACDM) unit specification requirements document for the definition of the packetization function inside the instrument, and to the Atlid Products Definition document for science data exploitation and simulation.

The detailed description of the ISP content is summarised in a dedicated core spreadsheet file. This file is the reference description of the ATLID ISP streaming. The name of this spreadsheet file can be found in the § 6 (Annex 2 : Reference core spreadsheets).

1.2 Related data

Atlid is one of the four instruments of the EarthCare Atmospheric Monitoring Mission.

When in operational mode, the instrument will deliver atmospheric profiles representing the backscatter level of Lidar UV pulses sent in the Nadir direction, in function of the echo time (altitude) and of the spectral and polarization information measured on three detection channels. The measures are sampled horizontally by the shots at 51 Hz under the satellite trace, corresponding to a minimum interval of about 145 m at ground level, and vertically by the detection channels for light echoes corresponding to altitudes from 40 to 20 km at 500 m resolution, and 20 to -0.5 km at 100 m. These sampled and numerized data are transmitted from the Instrument Detection Electronics (IDE) unit to the ACDM after the acquisition and accumulation of a complete profile, with some additional information relative to the acquisition channel.

The ACDM is in charge of bufferization and packetization of these science data, adding timing and localization information, and some housekeeping data in order to build the Atlid Instrument Source Packets (ISP), that will be memorized on board in the satellite Mass Memory and Formatting Unit (MMFU), and then sent to the ground to be processed along with auxiliary ground data in order to obtain the Atlid Data Products.

On board, the Atlid ISP are transmitted from the ACDM to the MMFU on the “LBR” data link. The housekeeping telemetry that is acquired by the satellite through the payload 1553-MIL Bus is not in the scope of this document, and is defined in the “TM/TC ICD” (see annex 6 of [RD10]). However, the Atlid ISP will contain all the housekeeping data (called ancillary data) necessary for products exploitation.

1.3 Applicable documents

[AD1]	EC Packet Utilization Standard	EC.STD.ASD.SY.0001
[AD2]	Packet Telemetry Blue Book	CCSDS 102.0-B-5

1.4 Reference documents

[RD1]	ACDM Technical Requirements	EC.SP.ASF.ATL.00029
[RD2]	ACDM/IDE Electrical I/F specification	EC.SP.ASF.ATL.00022
[RD3]	TLE Requirements specification	EC.RS.GAL.AT.006
[RD4]	ACDM/TXA Electrical I/F specification	EC.SP.ASF.ATL.00021
[RD5]	ACDM/BSME Electrical I/F specification	EC.SP.ASF.ATL.00057
[RD6]	Atlid Control Loop URD	EC.RS.ASF.ATL.00058
[RD7]	IDE Requirements specification	EC.SP.ASF.ATL.00007
[RD8]	TXA TM/TC ICD	EC.IF.GAL.AT.005
[RD9]	IDE TM/TC ICD	EC-ICD-CRS-ATL-00002
[RD10]	ATLID User Manual	EC.UM.ASF.ATL.00003
[RD11]	EarthCARE ATLID ICU OBSW Application Software Interace Control Document	EC.IC.SSL.ATL.0001

2 DATA FLOWS

A simplified diagram shows the generation and circulation of data inside the Atlid instrument :

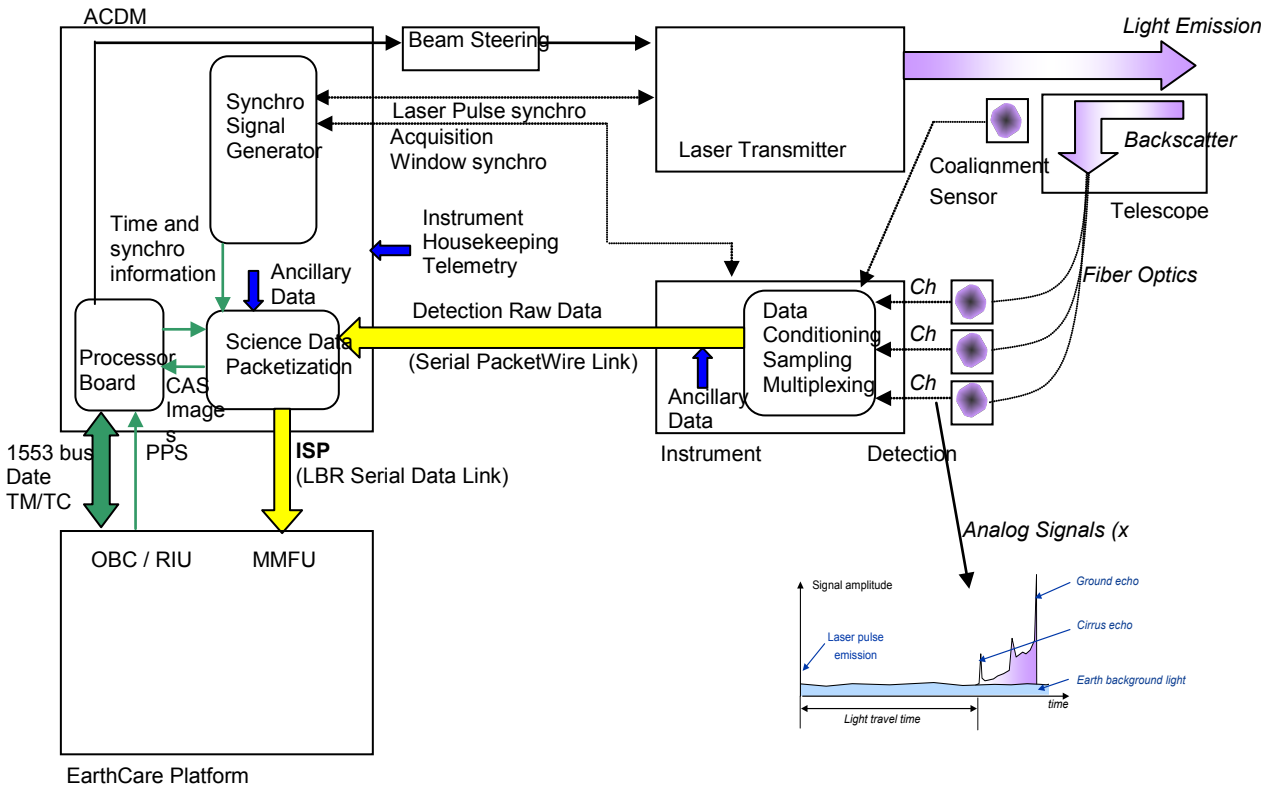

Figure 1.4-1. Atlid Data Flow

When Atlid is in operational measurement mode, the internal clock inside the ACDM generates the Laser pulse synchro signal at a nominal rhythm of 51 Hz (Pulse Repetition Frequency or PRF). For each Laser shot, the transmitter sends back a confirmation to the synchro signal generator, that will trigger the Detection unit after a delay depending on satellite altitude parameter.

Upon triggering, the IDE stops flushing the science channels detectors and begin integration of the vertical samples, as well as the background acquisitions, one before the acquisitions (corresponding to an altitude of 100/110 km) and one after the acquisitions (-2/-12 km). Depending on the number N of accumulations programmed by telecommand in the IDE, a raw data packet is produced for each N laser shots : if N=1, the IDE will generate a Detection Raw Data (DRD) packet for each laser shot at 51 Hz. If N > 1, the IDE will accumulate inside the detectors buffers the data corresponding to N laser shots and

will issue a unique DRD packet in which each altitude sample is the accumulation of N corresponding samples. The accumulation process improves the S/N ratio of the measurements, to the detriment of the horizontal resolution. The nominal accumulation foreseen is N=2, that means that a DRD packet will be generated by the IDE at 25.5 Hz, with a maximum value of 51 Hz if N=1.

The ACDM has to buffer the incoming DRD packets to build the ISP. A serial Packet Wire data link with acknowledgement between IDE and ACDM insures that no data from IDE can be ignored by ACDM.

For each Laser Shot Telemetry packet and DRD packet received, the ACDM will add related timing and date information, and ancillary data necessary for the ground processing of the instrument products. When the buffer contains an amount of data corresponding to the ISP size, the source packet is sent to the MMFU on the LBR link. As soon as the ISP is ready, the packet is sent without request from MMFU.

In addition to the 3 measurement channels, a CoAlignment Sensor (CAS) on the focal plane is dedicated to acquiring the position of the signal return in the optical field. The matrix images produced are transmitted to the ACDM software for processing and calculating the correction to send to the Beam Steering Mechanism in order to compensate the pointing errors between emission and return pathes.

The CAS images are transmitted to the ACDM each 32 PRFs. The ACDM SW may send on request the raw and processed images along with coalignment information.

For investigation, a TM packet may be assembled by the ACDM on request through the PUS services to transmit to ground additional observables. It is called “Investigation Packet”.

2.1 Instrument Modes

For the instrument modes detailed definition, refer to RD1 ACDM specification. The mode diagram is recalled here :

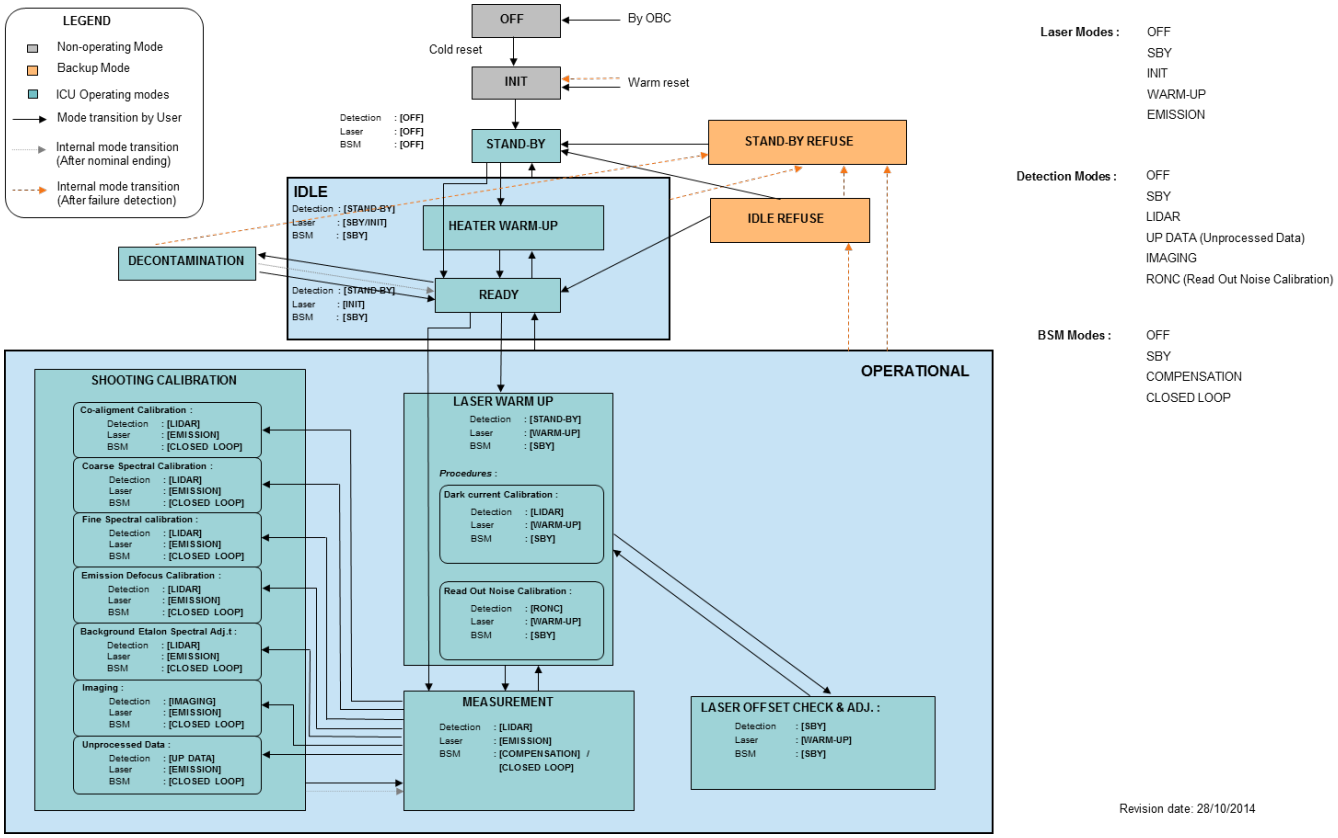

Figure 2.1-1. Atlid Modes

No acquisition is produced until the instrument is put in Operational mode. In Laser Warm-Up submode, the IDE is still in stand-by mode, so no DRD packet is produced, unless a Dark Current or a Read-Out Noise Calibration is started. Nominally the IDE begins to produce DRD packets when in Lidar mode, entering the instrument measurement mode.

The ACDM will not generate the ISP until receiving DRD from IDE, in order to avoid filling the Mass Memory with invalid data.

As soon as DRD packets are sent to ACDM, it will buffer these packets along with high rate ancillary data, and when the amount of data corresponds to the ISP size, the additional information and low rate ancillary data is added to the buffered data to issue the ISP. The ISP is compliant with the TM instrument science source packet formats as specified in [AD1] and [AD2].

At the beginning of a data transmission, the ACDM buffers are flushed to build the ISP with the new incoming DRD packets. At the end of a measurement or calibration session (transition to Warm-Up or Idle mode), the current ISP in the ACDM buffer is transmitted with the last DRD packet received.

2.2 IDE Sub-Modes

According to RD2, the IDE can generate 4 types of DRD packets. The size of the packets is intentionally fixed for all the modes, but the signification of the raw data will change in function of this mode and will lead to different instrument products. A DRD packet will always have a size of 10 ancillary data (called detection auxiliary data) and 780 measurement data coded on 16 bits (total 1580 bytes). The 10 auxiliary data are fixed.

2.2.1 Lidar Sub-Mode

This is the nominal submode in measurement mode : the 780 measurement data are 260 samples on the 3 detector channels, corresponding to the backscatter samples and the two background acquisitions. In all the instrument calibration modes other than the IDE specific calibration modes (Imaging, RNC and UPD), the IDE will be in Lidar Submode, sending standard DRD packets.

(see Figure 5.2-1)

2.2.2 Imaging (IMG) Sub-Mode

In this mode, for each detector, two images (Background and Sample) are transmitted at each shot, along with 4 offset pixels. The total of transmitted data is 3 x (48 (BKG = background) + 4 + 48 (SMP = sample)) + 480 (spare) = 780 Detection Raw Data.

(see Figure 5.2-2)

2.2.3 Read Out Noise Calibration (RNC) Sub-Mode

The packet is the same as in lidar mode, the sample values are representative of the detector output stages noise.

(see Figure 5.2-4)

2.2.4 Unprocessed Data (UPD) Sub-Mode

The 260 data of each channel represent 130 time values of 2 selected pixels from the associated detector.

(see Figure 5.2-5)

The reference for the DRD packet description is RD2. These tables are listed here in annex as an information.

Note : the DRD samples are values coded with 14 significant bits. They are transmitted on 16 bits words, which two most significant bits have a 0 value.

3 ISP STRUCTURE

Two services are defined for Atlid :

i. Service 225 that delivers a packet containing Measurement Data (called DRD-M)

ii. Service 226 that delivers investigation data : a packet containing the CAS acquisition data along with coalignment information (subservice 1), and a packet containing instrument telemetry (subservice 2)

The high level structure of the private science data packet is described in AD1 at § 2.3.3 “Private Science data Header” and AD2 at § 3 “Source Packet”.

The Time inserted in this header is the date corresponding to the generation of the packet.

Code	Service Type
225	Meas Data (DRD-M)
226/1	CAS Data (DRD-C)
226/2	Invest TM

Figure 3-1. Atlid Services generating ISP

ATLID Mode description	Instrument Mode	ATLID mode	Acronym
OFF (used for Launch)	INS_LAU	OFF	OFF
OFF	INS_OFF	OFF	OFF
INIT	INS_INI	INIT	INI
Standby	INS_SBY	STAND_BY	SBY
Standby-refuse	INS_SBR	STAND_BY_R	SBR
Heater Warm-up	INS_IDL	HWU	HWU
Ready	INS_IDL	RDY	RDY
Idle-refuse	INS_IDR	IDLE_R	IDR
Decontamination	INS_DEC	DECONTAM	DEC
Laser Warm-up	INS_NOM	LWU	LWU
Dark Current Calibration	INS_NOM	LWU	DCC
Read-out noise calibration	INS_NOM	LWU	RNC
Measurement	INS_NOM	MEAS	MES
Offset Check calibration (laser)	INS_NOM	OCKA	OCK
Background Etalon Spectral calibration	INS_NOM	SHOOTING_CAL	BEC
Emission Defocus calibration	INS_NOM	SHOOTING_CAL	EDC
Coarse Co-alignment calibration	INS_NOM	SHOOTING_CAL	COC
Coarse Spectral calibration	INS_NOM	SHOOTING_CAL	CSC
Fine Spectral calibration	INS_NOM	SHOOTING_CAL	FSC
Imaging	INS_NOM	SHOOTING_CAL	IMG
Un-processed data	INS_NOM	SHOOTING_CAL	UPD

Figure 3-2. Atlid Modes and procedures

	Science Packet	CAS Packet	HK Packet
Code	225	226	226
Service type	1, 2, 3 or 4	1	2
OFF	-	-	-
INI	-	-	-
SBY	-	-	-
SBR	-	-	-
HWU	-	-	(*)
RDY	-	-	(*)
IDR	-	-	-
DEC	-	-	-
LWU	-	-	-
DCC	x	x	x
RNC	x	x	x
MES	x	x	x
OCK	-	-	-
BEC	x	x	x
EDC	x	x	x
COC	x	x	x
CSC	x	x	x
FSC	x	x	x
IMG	x	x	x
UPD	x	x	x

(*) HK Packets (service 226/2) are emitted during the transition from HWU to RDY in order to downlink RLH switch-on chronogram for CSC calibrations

Figure 3-3. Atlid Modes with ISP generation

TM SOURCE PACKET 65542 bytes (Max) 1786 - 2452 Bytes	Packet Header 6 Bytes	Version		3 bits : 000	
		Packet Identification	Type indicator	1 bit : 0	
			Packet Sec Hdr Flag	1 bit : 1	
			PRID	7 bits : 40h	
			PCAT	4 bits : 12d	
		Packet Sequence Control	Grouping flags	2 bits : 11b	
			Source sequence count	14 bits : 0	
		Packet Data Length		2 bytes	
	Packet Data Field 65536 bytes (Max) 1780 - 2446 Bytes	Data Field Header 12 Bytes	Filler	1 bit : 0	
			PUS Version Nb	3 bits : 001	
			Filler	4 bits : 0000	
			Service Type (225-229)	1 byte : 225	
			Service Sub-Type	1 byte : 1 to 4	According to detection submode :
			Destination ID	1 byte : 0	
			Time (CUC) coarse	4 bytes	1 : Lidar
			Time (CUC) fine	3 bytes	2 :RONC
			Sync/Time Quality	1 byte	3 : Imaging
		Private Science Data Header 6 Bytes	S/C State Vector Quality 4 Bytes	4 Bytes	4 : UpData
			ISP Structure Version Nb 2 Bytes	2 Bytes	
		Telemetry Data 1760 - 2426 Bytes	Ancillary data repetition count N_PRF_IDE 2 Bytes	1 to 10	
			n/N : Instrument Ancillary Data (High Rate)	0001 74 Bytes	repeated N_PRF_IDE times
			Instrument Ancillary Data (Low Rate)	104 Bytes	
			Detection Raw Data Auxiliary Data	20 Bytes	
			Detection Raw Data Pixel arrangement depending on service subtype	1560 Bytes	
		Packet Error Control CRC		2 bytes	

Figure 3-4. Instrument Source Packet Type 225 : Measurement Data (N=1..10)

Note : Nacc is the number of accumulation N_PRF_IDE, limited to the ceiling value 10 in the ISP (in the software, it may reach 255, only the first 10 HR packets are transmitted)

TM SOURCE PACKET 65542 bytes (Max) 1374 Bytes	Packet Header 6 Bytes	Version		3 bits : 000
		Packet Identification	Type indicator	1 bit : 0
			Packet Sec Hdr Flag	1 bit : 1
			PRID	7 bits, 40h
			PCAT	4 bits, 12d
		Packet Sequence Control	Grouping flags	2 bits : 11b
			Source sequence	14 bits : 0
			count	
		Packet Data Length		2 bytes
	Packet Data Field 65536 bytes (Max) 1368 Bytes	Data Field Header 12 Bytes	Filler	1 bit : 0
			PUS Version Nb	3 bits : 001
			Filler	4 bits : 0000
			Service Type (225-229)	1 byte : 226
			Service Sub-Type	1 byte : 1
			Destination ID	1 byte : 0
			Time (CUC) coarse	4 bytes
			Time (CUC) fine	3 bytes
			Sync/Time Quality	1 byte
		Private Science Data Header 6 Bytes	S/C State Vector Quality 4 Bytes	4 Bytes
			ISP Structure Version Nb 2 Bytes	2 Bytes
		Coalignment Data 1348 Bytes	Control loop Ancillary Data	100 Bytes
			CAS images: - CAS_Image_Background1, 52 pxs x4 bytes - CAS_Image_Echo, 52 pxs x4 bytes - CAS_Image_Background2, 52 pxs x4 bytes - CAS_Image_Min, 52 pxs x4 bytes - CAS_Image_Max, 52 pxs x4 bytes - CAS_Image_SD, 52 pxs x4 bytes	1248 Bytes
		Packet Error Control CRC		2 Bytes

Figure 3-5. Instrument Source Packet Type 226/1 : Coalignment Data

TM SOURCE PACKET 65542 bytes (Max) 794 Bytes	Packet Header 6 Bytes	Version		3 bits : 000
		Packet Identification	Type indicator	1 bit : 0
			Packet Sec Hdr Flag	1 bit : 1
			PRID	7 bits, 40h
			PCAT	4 bits, 12d
		Packet Sequence Control	Grouping flags	2 bits : 11b
			Source sequence count	14 bits : 0
		Packet Data Length		2 bytes
	Packet Data Field 65536 bytes (Max) 788 Bytes	Data Field Header 12 Bytes	Filler	1 bit : 0
			PUS Version Nb	3 bits : 001
			Filler	4 bits : 0000
			Service Type (225-229)	1 byte : 226
			Service Sub-Type	1 byte : 2
			Destination ID	1 byte : 0
			Time (CUC) coarse	4 bytes
			Time (CUC) fine	3 bytes
			Sync/Time Quality	1 byte
		Private Science Data Header 6 Bytes	S/C State Vector Quality 4 Bytes	0 if OK
			ISP Structure Version Nb 2 Bytes	2 Bytes
		Telemetry Data	Instrument Investigation Data	768 Bytes
		Packet Error Control CRC		2 Bytes

Figure 3-6. Instrument Source Packet Type 226/2 : Investigation Data (HK Telemetry)

4 DETAIL OF PACKETS FIELDS

To avoid repetition of constant data, and thus optimise the data rate, the ancillary data section was divided into 2 zones called High Rate and Low Rate ancillary. The HR data are linked to PRF and may change from one laser shot to another, like the TXA TM5 block content, or the delays inside the synchro generator of the ACDM. These data are repeated N_PRF_IDE times in an ISP (if N_PRF_IDE > 1).

The other LR data are data that may change at a lower rate (typically 1 Hz), and will be transmitted at the ISP rate (PRF / N_PRF). This kind of data may also be put inside the investigation packet through the PUS services.

	Position (Bytes)	Length (Bytes)	Description (High Rate)	Origin
	1	2	Pos in the Cycle "n/N_PRF_IDE"	
	3	7	Laser Shot Date (7 byte)	CUC date
x	10	1	SPARE	Due to ACDM FPGA design
x	11	2	RLH_Frequency	TXA anc. Data (TM5 packet at PRF rate)
x	13	2	TXA status	
x	15	2	PD_En_UV	
x	17	2	TLE status	
x	19	2	RLH Status	
x	21	2	PD_En_Amp	
x	23	2	PD_CL_CL_Max	
x	25	2	PD_En_MO	
x	27	2	Multimode_Ratio	
x	29	2	MO_I sampled	
x	31	2	Amp_1_I sampled	
x	33	2	Amp_2_I sampled	
x	35	2	Command Rejection Status Word	
x	37	2	Failure_status_word_1	
x	39	2	Failure_status_word_2	
x	41	2	LCLK_Counter	
x	43	4	delay “dt0”	Synchro TM BRCSYN
x	47	4	delay “dt3_Fixed”	
x	51	4	delay “dt3_Variable”	
x	55	4	delay “dt5”	
x	59	4	delay “dt6”	
x	63	2	Synchro enable (TXA, IDE,OGSE)	
x	65	2	AUTOCOL	
x	67	**8**	SPARE	

Figure 4-1. Instrument Ancillary Data (High Rate)

	Position (Bytes)	Length (Bytes)	Description (Low Rate)	Origin	
	1	1	SID ID	ACDM status	
	2	7	OBT		
	9	2	TXA Mode		
	11	2	IDE Mode		
	13	2	INS Mode		
	15	2	Atlid Mode		
	17	2	BSA Mode		
x	19	1	"Valid1" : ACDM Instrument configuration : gives the redundancy (*) (**)		
	20	1	Spare		
x	21	1	ModeTranSta "mode transition status": 0/In_transition 1/Stabilising 2/Steady		
x	22	2	Status (LLS - Fail TXA - Fail IDE)		
x	24	2	Current procedure		
x	26	1	Calibration step		
x	27	2	Calibration setpoint 1		
x	29	2	Calibration setpoint 2		
x	31	2	Last Event ID		
x	33	2	Spare		
x	35	2	M1 Mirror Temp	Main temp. Status	
x	37	2	BKGE Temp		
x	39	2	E-BEX-A Temp		
x	41	2	E-BEX-B Temp		
x	43	2	BSM Command X	BSM	
x	45	2	BSM Command Y		
x	47	2	Spare		
x	49	2	Spare		
x	51	4	Centroid X	COAL	
x	55	4	Centroid Y		
x	59	1	Image SNR estimator status		See URD Coalignment
x	60	4	Estimated SNR		
x	64	4	Control Error Norm		
x	68	1	Image Quality Status		
x	69	1	Duration Out Status		
x	70	1	Control Error Out Status		
x	71	1	Control Error Spec Status		
x	72	2	Frequency Compensation	fcomp	
x	74	3	PPS_fine_time : LOBT fine time at PPS arrival		
x	77	2	F_cmd (*) : working laser frequency f_1		
x	79	16	Spare		
	95	7	Date of DRD packet Reception	DRD info	
	102	3	DRD packet counter		

(*) : Spare for V1.1, to be added for V2.0

Figure 4-2. Instrument Ancillary Data (Low Rate)

(**) : definition of the register :

Bits	0	1	2	3	4	5	6	7
Meaning	**PpsStaOkity** PPS Status Validity	**SrcOkity** PPS Source Validity	**InstConf** Instrument Configuration	**ResRegOkity** Reset Register Validity	**AcdmRedSel** ACDM Redundancy Selection	**TleRedSel** TLE Redundancy Selection	**IdeRedSel** IDE Redundancy Selection	**EqSolCtrl** EQ SOL Control

Info : '1' for B (Redundant), '0' for A (Nominal).

Figure 4-3. Instrument configuration register meaning ("Valid1")

Please note the Low Rate part is built from a TM HK (3,25) SID 71, which offers the flexibility to be redefined dynamically thanks to the PUS service 3. This present document describes the default definition.

4.1 CAS Telemetry

The following figure gives the current implementation of the TM CAS with ASW V1.1.

	Position (Bytes)	Length (Bytes)	Parameter name	Description	
	1	1	SID	Packet ID	
	2	7	OBT	On Board Time for HK acquisition	
x	9	1	NumSummdImage	CAS images counter [1..Mav] : The number of received CAS images which have been summed	
x	10	1	M_{av}	Number of images which must be received from IDE to be averaged by ACDM before applying the centroiding algorithms	
x	11	2	CAS temp	Detector temperature	Thermal Control Heater Temperature Monitor 25
x	13	4	Centroid X	Coordinate Estimation	Laser echo centroid (sub-pixel) position X
x	17	4	Centroid Y	Coordinate Estimation	Laser echo centroid (sub-pixel) position Y
x	21	2	Bsmsetpcomndx	Calculated LOS X	Saturated command to BSM (X axis) after conversion
x	23	2	Bsmsetpcomndy	Calculated LOS Y	Saturated command to BSM (Y axis) after conversion
x	25	2	Detection_Saturation_Status	Indication whether or not saturation has occurred in the echo images (for last received CAS image)	16-bit word output by CAS IDE. provides information of potential saturation of the data present in the following DRD packet, during their generation at IDE level. From Detection Auxiliary Data
x	27	2	Background_Saturation_Status	Indication whether or not saturation has occurred in the background images (for last received CAS image)	16-bit word output by CAS IDE. provides information of potential saturation of the background data present in the following DRD packet, during their generation at IDE level. From Detection Auxiliary Data
x	29	1	Image quality indicator	Image processing quality	Indication whether or not enough images have been summed for averaging
x	30	1	CentrdQualFail	CentrdQualFail	centroid quality failure duration exceeded. Excessive duration with low SNR centroid images
x	31	4	SNR_est	Estimated SNR	Indication whether or not the image signal-to-noise ratio is high enough for centroiding
x	35	1	AtlConfCtrReg : bit 7 : TLE/BSM redundancy selection (0 for nominal, 1 for redundant) bit 6 : IDE Redundancy selection (0 for nominal, 1 for redundant)	ATLID Configuration Control Register : Allows to know the chosen BSM (bit 0)	Flag that indicates which BSM mechanism is selected (i.e. 0 = redundant, 1 = nominal)
x	36	4	Ctl_err_X	Calculated control error on X axis	Control error along X
x	40	4	Ctl_err_Y	Calculate control error on Y axis	Control error along Y
x	44	4	Ctl_err_norm	Root sum square control error	Root sum square control error
x	48	1	CtrlErrQual	Control error threshold duration has been exceeded	ctrl_err_spec_status : Loop control error in its specification range
x	49	1	ContrlQualFail	Control error quality failure duration exceeded	ctrl_err_out_status : Excessive duration with a continuous out-of-range loop control error
x	50	4	Transbsmsetpx	Calculated BSM pointing Setpoint X	Calculated BSM pointing Setpoint X
x	54	4	Transbsmsetpy	Calculated BSM pointing Setpoint Y	Calculated BSM pointing Setpoint Y
x	58	2	PosModeBsa : BSA mode : 0 = Stand By 5 = Compensation 10 = Closed Loop 15 = Open Loop	Current BSA Mode: copy of loaded mode	
x	60	40	Spare	up to 100 bytes overall length	
			Note : Nav is a fixed element (=32) and doesn't need to be put in the ancillary data)		

Note : The table above reflects current ASW V1.1 implementation, and it will be updated after ATLID EEM test campaign for V2.0

Figure 4.1-1 : CAS Telemetry (V1.1)

Note: The pointing setpoint coordinates X/Y or Angular Alpha/Beta are expressed in the frame of the coalignment algorithm. The setpoints for the actuator (BSM) are expressed in the mechanism frame. The tracking point is expressed in the frame of the CAS detector.

The following figure gives the current implementation of the TM CAS proposed for ASW V2.0, i.e. the same description of the table above, added with the missing information requested by ISP ICD V3.0 :

	Position (Bytes)	Length (Bytes)	Parameter name	Description	
	1	1	SID	Packet ID	
	2	7	OBT	On Board Time for HK acquisition	
	9	1	NumSummdImage	CAS images counter [1..Mav] : The number of received CAS images which have been summed	
	10	1	M_{av}	Number of images which must be received from IDE to be averaged by ACDM before applying the centroiding algorithms	
	11	2	CAS temp	Detector temperature	Thermal Control Heater Temperature Monitor 25
	13	4	Centroid X	Coordinate Estimation	Laser echo centroid (sub-pixel) position X
	17	4	Centroid Y	Coordinate Estimation	Laser echo centroid (sub-pixel) position Y
	21	2	Bsmsetpcomndx	Calculated LOS X	Saturated command to BSM (X axis)
	23	2	Bsmsetpcomndy	Calculated LOS Y	Saturated command to BSM (Y axis)
	25	2	Detection_Saturation_Status	Indication whether or not saturation has occurred in the echo images (for last received CAS image)	16-bit word output by CAS IDE. provides information of potential saturation of the data present in the following DRD packet, during their generation at IDE level. From Detection Auxiliary Data
	27	2	Background_Saturation_Status	Indication whether or not saturation has occurred in the background images (for last received CAS image)	16-bit word output by CAS IDE. provides information of potential saturation of the background data present in the following DRD packet, during their generation at IDE level. From Detection Auxiliary Data
	29	1	Image quality indicator	Image processing quality	Indication whether or not enough images have been summed for averaging
	30	1	CentrdQualFail	CentrdQualFail	centroid quality failure duration exceeded
	31	4	SNR_est	Estimated SNR	Indication whether or not the image signal-to-noise ratio is high enough for centroiding
	35	1	AtlConfCtrReg	ATLID Configuration Control Register : Allows to know the chosen BSM (bit 0)	Flag that indicates which BSM mechanism is selected (i.e. 0 = redundant, 1 = nominal)
	36	4	Ctl_err_X	Calculated control error on X axis	Control error along X
	40	4	Ctl_err_Y	Calculate control error on Y axis	Control error along Y
	44	4	Ctl_err_norm	Root sum square control error	Root sum square control error
	48	1	CtrlErrQual	Control error threshold duration has been exceeded	
	49	1	ContrlQualFail	Control error quality failure duration exceeded	
	50	4	Transbsmsetpx	Calculated BSM pointing Setpoint X	Calculated BSM pointing Setpoint X
	54	4	Transbsmsetpy	Calculated BSM pointing Setpoint Y	Calculated BSM pointing Setpoint Y
	58	2	PosModeBsa	Current BSA Mode: copy of loaded mode	
x	60	2	Accumulation_Threshold	summed image threshold (minimum average image number)	
x	62	2	Tracking Point X	Copy of the Tracking point TC (X)	(Copy of TC)
x	64	2	Tracking Point Y	Copy of the Tracking point TC (Y)	(Copy of TC)
x	66	1	Ctl_err_out_status	Control Error Status	Flag to detect erroneous or too important control error
x	67	1	Ctl_err_spec_status	Control Error Spec Status	Current flag to detect when the pointing shall fulfil the specification
x	68	2	Co-alignment function mode		Active co-alignment function mode
	70	30	Spare	up to 100 bytes overall length	

Figure 4.1-2. CAS Telemetry (V2.0)

Please note the CAS TM part is built from a TM HK (3,25) SID 72, which offers the flexibility to be redefined dynamically thanks to the PUS service 3. This present document describes the default definition.

4.2 Investigation Data

⇨ This packet enables to transmit via the science data, some ancillary data from the ACDM datapool. These data are normally transmitted through the EC HK telemetry. Due to the low data rate allocation for Atlid, it may be useful to transmit some HK telemetry through the science data link to be recorded inside the MMFU or transmitted to ground during satellite visibility. The content of the packet will be modifiable through the PUS services, a default definition of the packet will be configured for Atlid CDR. The allocated size for this packet is 768 words.

Pos (Bytes)	*Low Rate Ancillary Data Description*	*Type*
1-7	Time of TM generation	LOBT
8-9	Packet Counter	
10	ACDM MCLK (48 MHz) Counter	
12 185	HK TM SID 31 : Block TM1 and Block TM2 TLE HK TM SID 32 : Block TM1 and Block TM2 TLE	All laser TM
358	HK TM SID 61 : Default Acdm thermistor housekeeping	Thermistors acquisitions
572	HK TM SID 51 : Block TM BSM	All BSM TM
659 661 663 665 667 669 671 673 675 677 679 681 683 685 687 689 691 693 695 697 699 701 703 705 707 709	TleNomTMon PlhNomTMon RlhNomTMon TleNomVMon TleNomIMon TleRedTMon PlhRedTMon RlhRedTMon TleRedVMon TleRedIMon BsmNomTMon BsmeNomTMon BsfeNomTMon BsmNomVMon BsmNomIMon BsmRedTMon BsmeRedTMon BsfeRedTMon BsmRedVMon BsmRedIMon CveNomTMon CveNomVMon CveNomIMon CveRedTMon CveRedVMon CveRedIMon	All Direct acquisitions
711	57 Words spare	
Note : this reflects what is proposed for the SW V2.0		
For ATLID EEM test campaign with ASW V1.1, the packet will be defined dynamically if needed thanks to the PUS service 3.		

Figure 4.2-1 Investigation data

4.3 Validity Word Detail

	Value	Status
	0	Not Initialised
	1	Laser Warm-Up
	2	DCC-Init
	3	DCC-Valid
	4	RNC-Init
	5	RNC-Valid
X	6	NOT USED
	7	MES-Init
	8	MES-Stab
	9	MES-Valid
X	10	CSC-Init
X	11	CSC-Valid
X	12	FSC-Init
X	13	FSC-Valid
X	14	BEC-Init
X	15	BEC-Valid
X	16	COC-Init
X	17	COC-Valid
X	18	IMG-Init
X	19	IMG-Valid
X	20	UPD-Init
X	21	UPD-Valid
X	22	EDC-Init
X	23	EDC-Valid

This word is written from the instrument procedures to flag the periods at which time the data is valid for exploitation. It is inserted by IDE inside the DAD. It gives the status of the different conditions that allow to consider the Detection Raw Data in the ISP as valid for exploitation.

The following annexes describe the internal Atlid information used to build the ISP :

5 ANNEX 1 : INTERNAL ATLID

5.1 Internal ATLID TXA information

These tables is extracted from the TXA TM/TC ICD ([RD8]).

Data 1	RLH_Frequency
Data 2	TXA status
Data 3	PD_En_UV
Data 4	TLE status
Data 5	RLH Status
Data 6	PD_En_Amp
Data 7	PD_CL_CL_Max
Data 8	PD_En_MO
Data 9	Multimode_Ratio
Data 10	MO_I sampled
Data 11	Amp_1_I sampled
Data 12	Amp_2_I sampled
Data 13	Command Rejection Status Word
Data 14	Failure_status_word_1
Data 15	Failure_status_word_2
Data 16	LCLK_Counter

Figure 5.1-1. TXA TM5 Packet

5.2 Internal ATLID IDE information

5.2.1 Lidar mode

		Order	Name	Size	Comment
DRD aux. Data	x	1	IDE Packet Header (IPH)	16 bits	Packet Counter (16 bits)
		2	IDE Sub-Mode (ISM)	16 bits	LIDAR sub-mode
		3	N_PRF_IDE (NPI)	16 bits	
	x	4	IDE PRF Number (ISN)	16 bits	PRF counter (8 bits)
		5	Pixel Index in UPD (PIU)	16 bits	Only in UnProcessed Mode
		6	Measurement Validity bits (copy of ACDM TC content) (MVB)	16 bits	EC data provided by ACDM
		7	CAS Data Indicator (CDI)	16 bits	
		8	Background Saturation Status (BSS)	16 bits	
		9	Detection Saturation Status (DSS)	16 bits	
		10	Background Integration Time (BIT)	16 bits	
DRD		11	Data n° 1 for **MIE Co-polar**	16 bits	
		12	Data n° 2 for **MIE Co-polar**	16 bits	
		13	Data n° 3 for **MIE Co-polar**	16 bits	
		14	Data n° 4 for **MIE Co-polar**	16 bits	
			.....	.....	
		264	Data n° 254 for **MIE Co-polar**	16 bits	
		265	Data n° 255 for **MIE Co-polar**	16 bits	
		266	Data n° 256 for **MIE Co-polar**	16 bits	
		267	Data n° 257 for **OFS_1_MIE Co-polar**	16 bits	
		268	Data n° 258 for **OFS_2_MIE Co-polar**	16 bits	
		269	Data n° 259 for **OFS_3_MIE Co-polar**	16 bits	
		270	Data n° 260 for **OFS_4_MIE Co-polar**	16 bits	
		271	Data n° 1 for **MIE Cross-polar**	16 bits	
		272	Data n° 2 for **MIE Cross-polar**	16 bits	
		273	Data n° 3 for **MIE Cross-polar**	16 bits	
		274	Data n° 4 for **MIE Cross-polar**	16 bits	
			.....	.....	
		524	Data n° 254 for **MIE Cross-polar**	16 bits	
		525	Data n° 255 for **MIE Cross-polar**	16 bits	
		526	Data n° 256 for **MIE Cross-polar**	16 bits	
		527	Data n° 257 for **OFS_1_MIE Cross-polar**	16 bits	
		528	Data n° 258 for **OFS_2_MIE Cross-polar**	16 bits	
		529	Data n° 259 for **OFS_3_MIE Cross-polar**	16 bits	
		530	Data n° 260 for **OFS_4_MIE Cross-polar**	16 bits	
		531	Data n° 1 for **Rayleigh**	16 bits	
		532	Data n° 2 for **Rayleigh**	16 bits	
		533	Data n° 3 for **Rayleigh**	16 bits	
		534	Data n° 4 for **Rayleigh**	16 bits	
			.....	.....	
		784	Data n° 254 for **Rayleigh**	16 bits	
		785	Data n° 255 for **Rayleigh**	16 bits	
		786	Data n° 256 for **Rayleigh**	16 bits	
		787	Data n° 257 for **OFS_1_Rayleigh**	16 bits	
		788	Data n° 258 for **OFS_2_Rayleigh**	16 bits	
		789	Data n° 259 for **OFS_3_Rayleigh**	16 bits	
		790	Data n° 260 for **OFS_4_Rayleigh**	16 bits	

Figure 5.2-1. IDE DRD-M Packet in LIDAR Sub Mode

The data called “data n°# for Mie channel” have the following meaning in terms of science data acquisition (this information is not used by ACDM):

Data number	Correspondance
1	BKG1
2	500m Sample n° 01
3	500m Sample n° 02
41	500m Sample n° 40
42	500m Sample n° 41
43	100m Sample n° 01
44	100m Sample n° 02
253	100m Sample n° 211
254	100m Sample n° 212
255	transition sample acquisition
256	BKG2
257	Offset n° 1
258	Offset n° 2
259	Offset n° 3
260	Offset n° 4

5.2.2 Imaging mode

		Order	Name	Size	Comment
DRD aux. Data	x	1	IDE Packet Header (IPH)	16 bits	Packet Counter (16 bits)
		2	IDE Sub-Mode (ISM)	16 bits	IMAGING sub-mode
		3	N_PRF_IDE (NPI)	16 bits	
	x	4	IDE PRF Number (ISN)	16 bits	PRF Counter (8 bits)
		5	Pixel Index in UPD (PIU)	16 bits	
		6	Measurement Validity bits (copy of ACDM TC content) (MVB)	16 bits	
		7	CAS Data Indicator (CDI)	16 bits	
		8	Background Saturation Status (BSS)	16 bits	
		9	Detection Saturation Status (DSS)	16 bits	
		10	Background Integration Time (BIT)	16 bits	
DRD		11	Data n° 1 for **BKG_MIE Co-polar**	16 bits	
		12	Data n° 2 for **BKG_MIE Co-polar**	16 bits	
			.....	.....	
		57	Data n° 47 for **BKG_MIE Co-polar**	16 bits	
		58	Data n° 48 for **BKG_MIE Co-polar**	16 bits	
		59	Data n° 1 for **SMP_MIE Co-polar**	16 bits	
		60	Data n° 2 for **SMP_MIE Co-polar**	.....	
		.....		16 bits	
		106	Data n° 48 for **SMP_MIE_Co-polar**	16 bits	
		107	Data n° 1 for **OFS_MIE Co-polar**	16 bits	
			.....	.....	
		110	Data n° 4 for **OFS_MIE Co-polar**	16 bits	
		111	Data n° 1 for **BKG_MIE Cross-polar**	16 bits	
		112	Data n° 2 for **BKG_MIE Cross-polar**	16 bits	
			.....	.....	
		157	Data n° 47 for **BKG_MIE Cross-polar**	16 bits	
		158	Data n° 48 for **BKG_MIE Cross-polar**	16 bits	
		159	Data n° 1 for **SMP_MIE Cross-polar**	16 bits	
		160	Data n° 2 for **SMP_MIE Cross-polar**	.....	
		.....	.....	16 bits	
		206	Data n° 48 for **SMP_MIE Cross-polar**	16 bits	
		207	Data n° 1 for **OFS_MIE Cross-polar**	16 bits	
				.....	
		210	Data n° 4 for **OFS_MIE_Cross-polar**	16 bits	
		211	Data n° 1 for **BKG_ Rayleigh**	16 bits	
		212	Data n° 2 for **BKG_ Rayleigh**	16 bits	
			.....	.....	
		257	Data n° 47 for **BKG_ Rayleigh**	16 bits	
		258	Data n° 48 for **BKG_ Rayleigh**	16 bits	
		259	Data n° 1 for **SMP_ Rayleigh**	16 bits	
		260	Data n° 2 for **SMP_ Rayleigh**	.....	
		.....	.....	16 bits	
		306	Data n° 48 for **SMP_ Rayleigh**	16 bits	
		307	Data n° 1 for **OFS_ Rayleigh**	16 bits	
				.....	
		310	Data n° 4 for **OFS_ Rayleigh**	16 bits	
		311	Spare n° 1	16 bits	
			.....	.....	
		790	Spare n° 480	16 bits	

Figure 5.2-2. IDE DRD-M Packet in IMAGING Sub Mode

In the table, BKG stands for “background” (reference image acquired before echo arrival time), SMP stands for “sample” (echo image), OFS stands for “offset” (4 additional samples aiming at estimating the line offset).

The picture below shows the physical accommodation of the pixels on the CCD, from 1 to 48. Note that pixels from #1 to #6 can be partially masked by the aluminium shielding mask.

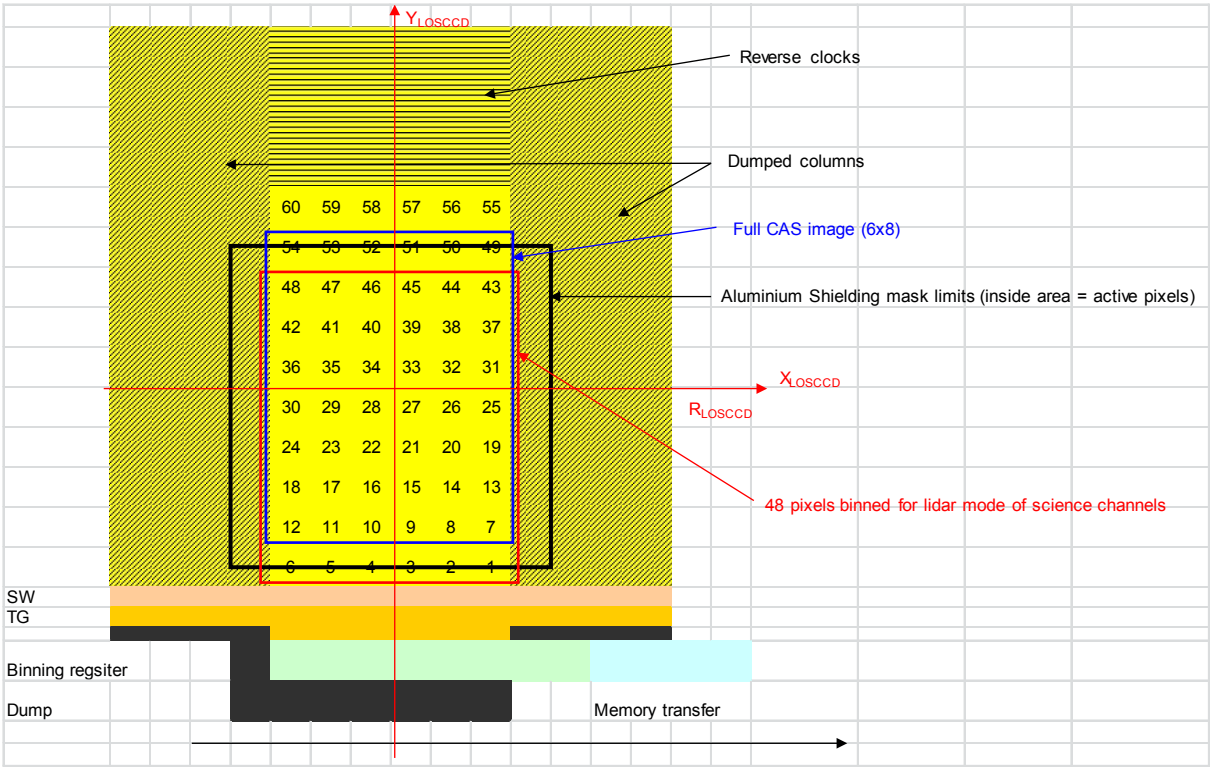

Figure 5.2-3: Physical arrangement of pixel on the CCD for Imaging mode

5.2.3 RONC mode

		Order	Name	Size	Comment
DRD aux. Data	x	1	IDE Packet Header (IPH)	16 bits	Packet Counter (16 bits)
		2	IDE Sub-Mode (ISM)	16 bits	RONC sub-mode
		3	N_PRF_IDE (NPI)	16 bits	N PRF = 1 for RONC sub-mode
	x	4	IDE PRF Number (ISN)	16 bits	PRF counter (8 bits)
		5	Pixel Index in UPD (PIU)	16 bits	Only in UnProcessed Mode
		6	Measurement Validity bits (copy of ACDM TC content) (MVB)	16 bits	EC data provided by ACDM
		7	CAS Data Indicator (CDI)	16 bits	
		8	Background Saturation Status (BSS)	16 bits	
		9	Detection Saturation Status (DSS)	16 bits	
		10	Background Integration Time (BIT)	16 bits	
DRD		11	Data n° 1 for **MIE Co-polar**	16 bits	RONC data
		12	Data n° 2 for **MIE Co-polar**	16 bits	RONC data
		13	Data n° 3 for **MIE Co-polar**	16 bits	RONC data
		14	Data n° 4 for **MIE Co-polar**	16 bits	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
	x		.....	.....	RONC data
	x		.....	.....	RONC data
			.....	16 bits	RONC data
	x	270	Data n° 260 for **MIE Co-polar**	16 bits	RONC data
		271	Data n° 1 for **MIE Cross-polar**	16 bits	RONC data
		272	Data n° 2 for **MIE Cross-polar**	16 bits	RONC data
		273	Data n° 3 for **MIE Cross-polar**	16 bits	RONC data
		274	Data n° 4 for **MIE Cross-polar**	16 bits	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
	x		.....	.....	RONC data
	x		.....	.....	RONC data
			.....	16 bits	RONC data
	x	530	Data n° 260 for **Mie Cross-polar**	16 bits	RONC data
		531	Data n° 1 for **Rayleigh**	16 bits	RONC data
		532	Data n° 2 for **Rayleigh**	16 bits	RONC data
		533	Data n° 3 for **Rayleigh**	16 bits	RONC data
		534	Data n° 4 for **Rayleigh**	16 bits	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
			.....	.....	RONC data
	x		.....	.....	RONC data
	x		.....	.....	RONC data
			.....	16 bits	RONC data
	x	790	Data n° 260 for **Rayleigh**	16 bits	RONC data

Figure 5.2-4. IDE DRD-M Packet in Read-Out Noise Calibration Sub Mode

5.2.4 Unprocessed data mode

The unprocessed data packet provides for each science channel the raw values of oversampling (130 sample per atmospheric sample) for pixels p and p+1.

		Order	Name	Size	Comment
DRD aux. Data	x	1	IDE Packet Header (IPH)	16 bits	Packet Counter (16 bits)
		2	IDE Sub-Mode (ISM)	16 bits	UP-DATA sub-mode
		3	N_PRF_IDE (NPI)	16 bits	N PRF = 1
	x	4	IDE PRF Number (ISN)	16 bits	PRF Counter (8 bits)
		5	Pixel Index in UPD (PIU)	16 bits	p value (1<p<259)
		6	Measurement Validity bits (copy of ACDM TC content) (MVB)	16 bits	
		7	CAS Data Indicator (CDI)	16 bits	
		8	Background Saturation Status (BSS)	16 bits	
		9	Detection Saturation Status (DSS)	16 bits	
		10	Background Integration Time (BIT)	16 bits	
DRD		11	Data n° 1 for **MIE Co-polar pixel p**	16 bits	
		12	Data n° 2 for **MIE Co-polar pixel p**	16 bits	
		..	.	..	
		..	.	..	
		139	Data n° 129 for **MIE Co-polar pixel p**	16 bits	
		140	Data n° 130 for **MIE Co-polar pixel p**	16 bits	
		141	Data n° 1 for **MIE Co-polar pixel p+1**	16 bits	
		142	Data n° 2 for **MIE Co-polar pixel p+1**	16 bits	
		..	.	..	
		..	.	..	
		269	Data n° 129 for **MIE Co-polar pixel p+1**	16 bits	
		270	Data n° 130 for **MIE Co-polar pixel p+1**	16 bits	
		271	Data n° 1 for **MIE Cross-polar pixel p**	16 bits	
		272	Data n° 2 for **MIE Cross-polar pixel p**	16 bits	
		..	.	..	
		..	.	..	
		399	Data n° 129 for **MIE Cross-polar pixel p**	16 bits	
		400	Data n° 130 for **MIE Cross-polar pixel p**	16 bits	
		401	Data n° 1 for **MIE Cross-polar pixel p+1**	16 bits	
		402	Data n° 2 for **MIE Cross-polar pixel p+1**	16 bits	
		..	.	..	
		..	.	..	
		..	.	..	
		529	Data n° 129 for **MIE Cross-polar pixel p+1**	16 bits	
		530	Data n° 130 for **MIE Cross-polar pixel p+1**	16 bits	
		531	Data n° 1 for **Rayleigh pixel p**	16 bits	
		532	Data n° 2 for **Rayleigh pixel p**	16 bits	
		..	.	..	
		..	.	..	
		..	.	..	
		659	Data n° 129 for **Rayleigh pixel p**	16 bits	
		660	Data n° 130 for **Rayleigh pixel p**	16 bits	
		661	Data n° 1 for **Rayleigh pixel p+1**	16 bits	
		662	Data n° 2 for **Rayleigh pixel p+1**	16 bits	
		..	.	..	
		..	.	..	
		..	.	..	
		789	Data n° 129 for **Rayleigh pixel p+1**	16 bits	
		790	Data n° 130 for **Rayleigh pixel p+1**	16 bits	

Figure 5.2-5. IDE DRD-M Packet in Unprocessed Data Sub Mode

5.3 CAS pixels arrangement

The following information **shall be used to interpret the CAS raw data in terms of pixel arrangement**, before applying the image processing algorithms defined in Co-alignment loop URD[RD6].

The following table provides the definition of the samples at IDE/ACDM interface. The data correspond to 32 images average (averaging performed inside IDE). The physical accommodation of the pixel numbers is presented in the figure after (Figure 5.3-2).

The first series of pixels, called CBI_1, correspond to the “background 1” image (acquired just before laser echo) ; then, the pixels called CEI correspond to the “echo image” ; finally, the pixels called CBI_2 are listed, corresponding to the “background 2” image (acquired just after laser echo).

CEI_MIN (respectively MAX and VA) data is the 48 pixels of the image of the minimum (respectively maximum and variance) values of the 32 images acquired by IDE in the period.

ACDM / IDE interface (after averaging of 32 successive complete acquisitions)

Pixel at IDE output	Signification
1	Av_Pixel n°1 CBI_1
2	Av_Pixel n°2 CBI_1
3	Av_Pixel n°3 CBI_1
47	Av_Pixel n°47 CBI_1
48	Av_Pixel n°48 CBI_1
49	Av_Offset CBI_1 n° 1
50	Av_Offset CBI_1 n° 2
51	Av_Offset CBI_1 n° 3
52	Av_Offset CBI_1 n° 4
53	Av_Pixel n°1 CEI
54	Av_Pixel n°2 CEI
55	Av_Pixel n°3 CEI
99	Av_Pixel n°47 CEI
100	Av_Pixel n°48 CEI
101	Av_Offset CEI n° 1
102	Av_Offset CEI n° 2
103	Av_Offset CEI n° 3
104	Av_Offset CEI n° 4
105	Av_Pixel n°1 CBI_2
106	Av_Pixel n°2 CBI_2
107	Av_Pixel n°3 CBI_2
151	Av_Pixel n°47 CBI_2
152	Av_Pixel n°48 CBI_2
153	Av_Offset CBI_2 n° 1
154	Av_Offset CBI_2 n° 2
155	Av_Offset CBI_2 n° 3
156	Av_Offset CBI_2 n° 4
157	(CEI_MIN_DATA)
209	(CEI_MAX_DATA)
261	(CEI_VA_DATA)
312	

Figure 5.3-1. Data definition of CAS packet at IDE output

As said before, the picture below provides the physical arrangement of CAS pixels on the image zone. This picture shall be used to interpret the CAS data before applying the image processing algorithms of [RD6].

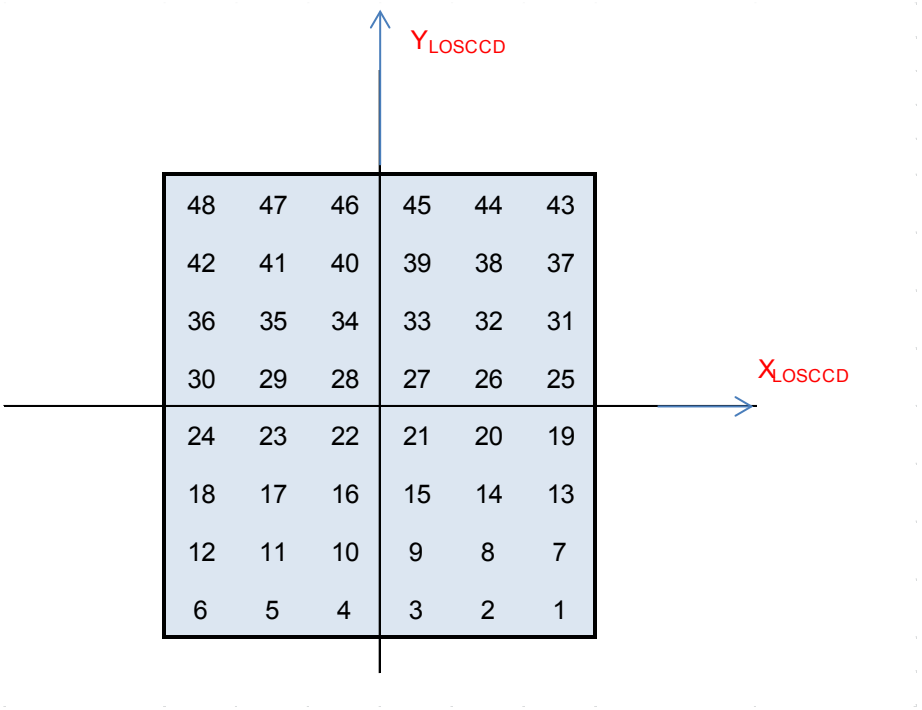

Figure 5.3-2. Definition of pixel numbering at detector level for CAS sequence

5.4 Timeline of packet transmission

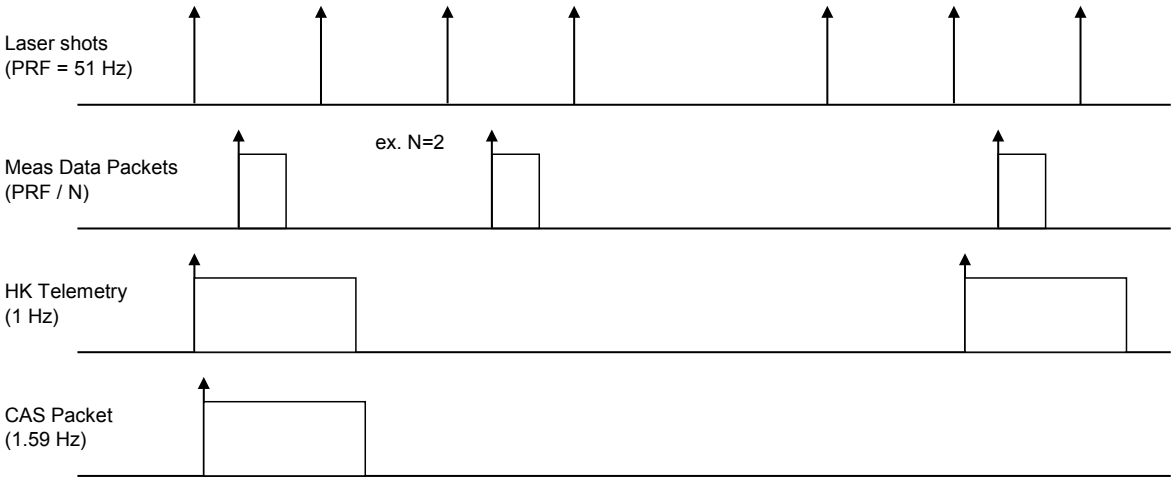

Figure 5.4-1. Time Line of Packets Transmission

5.5 Data rate estimate on science data link

Measurement data packet size calculation

Size of the packet (service 225) :	Bytes	
Packet Header	6	
Data Field Header	12	
Private Data Header	6	
Ancillary Data Repetition C(	2	
Ancillary Data HR	74	X Nacc
Ancillary Data LR	104	
DRD	1580	
CRC	2	
	1786	(for Nacc = 1)

Measurement data packet data rate

		Data Rate (bps)
N	Packet Size	51Hz
1	1786	**728 688**
2	1860	**379 440**
3	1934	**263 024**
4	2008	**204 816**
5	2082	**169 891**
6	2156	**146 608**
7	2230	**129 977**
8	2304	**117 504**
9	2378	**107 803**
10	2452	**100 042**

Total data rate on science data link :

Packets per second	Data rate (Worst Case) : type	size (bytes)	bps		
51	225	1786	728688	=>	Nacc= 1
1,59	226/1	1374	17519		Nav= 32
1	226/2	794	6352		Mav= 8
			752559		Mav * Nav= 256

Packets per second	Data rate (Nominal Case) : type	size (bytes)	bps		
25,5	225	1860	379440	=>	Nacc= 2
1,59	226/1	1374	17519		Nav= 32
1	226/2	794	6352		Mav= 88
			403311		Mav * Nav= 2816

Figure 5.5-1. ISP Data rate budget

6 ANNEX 2 : REFERENCE CORE SPREADSHEETS

The reference description of the content of the ATLID ISP can be found in the core spreadsheet file named :

ISP_Structure_4.1_22.07.15.xls

[AD 1] attached to the current document.

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