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BC-SIM-TN-014

SIMBIO-SYS Compatibility rules for correct Science TC commanding

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1 Introduction

1.1 Scope

This document, in accordance with the Spectrometers and Imagers for MPO BepiColombo Integrated Observatory SYStem (SIMBIO-SYS) Technical Note, Layout and Data flow agreement detailed in [RD.1], reports all the interdependence rules between the parameters (i.e., PSSxxx) in a single SIMBIO-SYS TeleCommand (TC) to make it compatible with respect to the Main Electronics (ME) Application SoftWare (ASWv2.7) and so being executable. These rules are fundamental in building correct Flight Operation Procedures (FOPs) and all other higher-level commanding sequences as Payload Direct Operation Request (PDOR), Payload Operation Request (POR), Memory Operation Request (MOR) and Instrument TimeLine (ITL) that use FOPs with open (i.e., formal) parameters.

This is a sort of “living document” since present version describes two rules which are considered, for the time being, the most important ones:

1. Compatibility between commanded windows size and Compression settings of the Compression Unit (CU) in the ME
2. Definition of the lower limit of the Repetition Time (RT)
3. On-board processing for data refinement

As a consequence, it will be possible to compute the real Data-Rate of the instrument (see Section 6).

1.2 Reference Document

[RD.1] BC-SIM-TN-003 Reports_And_Notes_Layout, 10.20371/INAF/TechRep/179

[RD.2] BC-SIM-GAF-IC-002_rev14 _ SICD_Software_Interface_Contral_Document

[RD.3] BC-SIM-GAF-MA-002 10 001 USER MANUAL.

[RD.4] BC-SIM-TN-009_STC_GM_Observation_Strategy_Optimization, 10.20371/INAF/TechRep/173

1.3 Acronyms

ASW	Application SoftWare
BSW	Boot SoftWare
CRP	CRitical Procedures
CU	Compression Unit
ENG	ENGineering procedure
FCP	Flight Control Procedure
FOP	Flight Operation Procedures
FPGA	Field Programmable Gate Array
HRIC	High spatial Resolution Imaging Channel
ME	Main Electronics
OBCP	On-Board Control Procedure
PE	Proximity Electronics
SIMBIO-SYS	Spectrometers and Imagers for MPO BepiColombo Integrated Observatory SYStem
SPW	SpiceWire
SSMM	Solid State Mass Memory
STC	STereo imaging Channel
RT	Repetition Time
TC	TeleCommand
TM	TeleMetry
TST	TeST procedures
VIHI	VIsible and Hyper-spectral Imaging channel

1.4 Document organization

This document is organized in sections whose topics are listed as follows:

- Section 2 – some definitions are reported
- Section 3 – reports the on-boards processing capabilities of the instrument that act on the data acquired for their refinement
- Section 4 refers to the correct compression parameters which means the IBR and the CBOX dimensioning with respect to the desired area (i.e., window) of the detector to be read for each channel
- Section 5 – refers to the correct RT between science acquisitions with respect to the commanded operation modes
- Section 6 – reports the Data-Rate computation for each channel

2 Definitions

In the following table the Science TC structure for all SIMBIO-SYS channels is reported; the key parameters indispensable for the purpose of this note are also highlighted in red.

HRIC Science TC: ZSS17102 / ZSS171B2	
TC Parameter name	**TC Parameter definition**
PSS01501 / PSS015B1	integration time
PSS01601	repetition time
PSS01602	NbrAcq
PSS00202	binning factor w2
PSS00201	binning factor w1
PSS00301	number of windows
PSS00204	binning factor w4
PSS00203	binning factor w3
PSS01101	start row pixel w1
PSS00501	start strip pixel w1
PSS01102	end row pixel w1
PSS00502	end strip pixel w1
PSS01103	start row pixel w2
PSS00503	start strip pixel w2
PSS01104	end row pixel w2
PSS00504	end strip pixel w2
PSS01105	start row pixel w3
PSS00505	start strip pixel w3
PSS01106	end row pixel w3
PSS00506	end strip pixel w3
PSS01107	start row pixel w4
PSS00507	start strip pixel w4
PSS01108	end row pixel w4
PSS00508	end strip pixel w4
PSS00205	Compression box dimension
PSS00601	Compression ratio w1
PSS00602	Compression ratio w2
PSS00603	Compression ratio w3
PSS00604	Compression ratio w4
PSS00101	LS bit1 PE mode LS bit1 PE mode
PSS08008	Priority

Table 1: HRIC Science TC parameters definition.

STC Science TC: ZSS17202 / ZSS172B2	
TC Parameter name	**TC Parameter definition**
PSS01501 / PSS015B1	integration time
PSS01629	repetition time
PSS01602	NbrAcq
PSS00301	number of windows
PSS01101	start row pixel w1
PSS00501	start strip pixel w1
PSS01102	end row pixel w1
PSS00502	end strip pixel w1
PSS01103	start row pixel w2
PSS00503	start strip pixel w2
PSS01104	end row pixel w2
PSS00504	end strip pixel w2
PSS01105	start row pixel w3
PSS00505	start strip pixel w3
PSS01106	end row pixel w3
PSS00506	end strip pixel w3
PSS01107	start row pixel w4
PSS00507	start strip pixel w4
PSS01108	end row pixel w4
PSS00508	end strip pixel w4
PSS01109	start row pixel w5
PSS00509	start strip pixel w5
PSS01110	end row pixel w5
PSS00510	end strip pixel w5
PSS01111	start row pixel w6
PSS00511	start strip pixel w6
PSS01112	end row pixel w6
PSS00512	end strip pixel w6
PSS00205	Compression box dimension
PSS00601	Compression ratio w1
PSS00602	Compression ratio w2
PSS00603	Compression ratio w3
PSS00604	Compression ratio w4
PSS00605	Compression ratio w5
PSS00606	Compression ratio w6
PSS00101	LS bit1 PE mode LS bit1 PE mode
PSS08008	Priority

Table 2: STC Science TC parameters definition.

VIHI Science TC: ZSS17302	
TC Parameter name	**TC Parameter definition**
PSS01630	VIHI integration time
PSS01631	VIHI Repetition time
PSS01632	VIHI starting row pixel
PSS01633	VIHI Starting column pixel
PSS01634	VIHI End row pixel
PSS01635	VIHI End colum pixel
PSS00104	Dark substraction status
PSS00105	Dark_Acquisition
PSS00207	Spatial binning
PSS00208	Binning sequence of fram
PSS00209	Spectral editing
PSS00205	Compression box dimensio
PSS00601	Compression ratio w1
PSS00106	Dark Macro
PSS00101	LS bit1 PE mode
PSS08008	Priority Priority

Table 3: VIHI Science TC parameters definition.

For the VIHI channel, there is another Science TC (i.e., ZSS173B2) which is identical with respect to the above one but where the Integration Time (IT) parameter (i.e., PSS01630 is not editable and fixed to 2 in raw and equivalent to 137 µs).

3 On-board data processing

This Section describes, when present, the procedures implemented at Proximity Electronics (PE) or Main Electronics (ME) level that automatically operate on acquired data for their refinement (see [RD.2] for details).

3.1 HRIC channel windows dimensioning

When commanding a Science acquisition (Table 1), the following parameters, together with PSS00301, define the number of pixels read from the detector:

Variable name	Win1	Win2	Win3	Win4
StartRowPixel	PSS01101	PSS01103	PSS01105	PSS01107
EndRowPixel	PSS01102	PSS01104	PSS01106	PSS01108
StartStripPixel	PSS00501	PSS00503	PSS00505	PSS00507
EndStripPixel	PSS00502	PSS00504	PSS00506	PSS00508

Table 4: Science TC parameters for windows definition for HRIC.

For each window w the horizontal (i.e., wX_{size}) and vertical (i.e., wY_{size}) dimensions can be computed as follows:

$$\begin{cases} wY_{size} = (EndRawPixel - StartRowPixel + 1) \\ wX_{size} = (EndStripPixel - StartStripPixel + 1) * 64 \end{cases}$$

To note that one strip corresponds to 64 pixels.

For geometrical/radiometrical reasons, but also to reduce the data throughput towards the ME, it is possible to apply at PE level a spatial binning, to each window, which value is identified by the following parameter:

Variable name	Win1	Win2	Win3	Win4
Binning	PSS00201	PSS00202	PSS00203	PSS00204

which operates as follows:

$$\begin{cases} \widetilde{wY_{size}} = \dfrac{wY_{size}}{2^{binning}} \\ \widetilde{wX_{size}} = \dfrac{wX_{size}}{2^{binning}} \end{cases}$$

As a result, for each window, the number of pixels sent to the ME can be computed as follows:

$$Nbit_w = \widetilde{wY_{size}} * \widetilde{wX_{size}}$$

3.2 STC channel windows dimensioning

Differently from HRIC, on STC no binning processing is applied in the PE and so, when commanding a Science acquisition (Table 2), the following parameters, together with PSS00301, define the number of pixels read from the detector:

Variable name	Win1	Win2	Win3	Win4	Win5	Win6
StartRowPixel	PSS01101	PSS01103	PSS01105	PSS01107	PSS01109	PSS01111
EndRowPixel	PSS01102	PSS01104	PSS01106	PSS01108	PSS01110	PSS01112
StartStripPixel	PSS00501	PSS00503	PSS00505	PSS00507	PSS00509	PSS00511
EndStripPixel	PSS00502	PSS00504	PSS00506	PSS00508	PSS00510	PSS00512

Table 5: Science TC parameters for windows definition for STC.

For each window w the horizontal (i.e., wX_{size}) and vertical (i.e., wY_{size}) dimensions can be computed as follows:

$$\begin{cases} wY_{size} = & (EndRawPixel - StartRowPixel + 1) \\ wX_{size} = & (EndStripPixel - StartStripPixel + 1) * 64 \end{cases}$$

To note that one strip corresponds to 64 pixels.

As a result, for each window, the number of pixels sent to the ME can be computed as follows:

$$Nbit_w = wY_{size} * wX_{size}$$

3.3 VIHI channel

3.3.1 Windows dimensioning

When commanding a Science acquisition (Table 3), the following parameters define the number of pixels read from the detector:

Variable name	Parameter name
StartRowPixel	PSS01632
EndRowPixel	PSS01634
StartColPixel	PSS01633
EndColPixel	PSS01635

Table 6: Variable definition for the VIHI window.

The horizontal (i.e., wX_{size}) and vertical (i.e., wY_{size}) dimensions can be computed as follows:

$$\begin{cases} wY_{size} = & EndRawPixel - StartRowPixel + 1 \\ wX_{size} = & EndStripPixel - StartStripPixel + 1 \end{cases}$$

For geometrical/radiometrical reasons it is possible to apply at PE level the following operations:

a) Spatial Binning: this operation is defined through the parameter PSS00207 and it is used to reduce the window size in the horizontal (i.e., spatial) direction as follows:

$$\widetilde{wX_{size}} = \frac{wX_{size}}{2^{binning}}$$

b) Spectral Editing: this operation is defined through the parameter PSS00209 and it is used to reduce the window size in the vertical (i.e., spectral) direction as follows:

$$\widetilde{wY_{size}} = \begin{cases} SpecEd = 0 & wY_{size} \\ SpecEd = 1 & 128\ (see\ note) \\ otherwise & \frac{wY_{size}}{2^{SpesEd-1}} \end{cases}$$

Note:
In case the SpecEd parameter is equal to 1 the commanded window shall have 192 rows in size so:

- the StartRawPixel and EndRowPixel parameters must be fixed properly (EndRowPixel-StartRawPixel+1=192);
- after acquisition from PE and delivery to the ME, the ME itself will discard the central 64 rows leaving a window size of 128.

As a result the number of pixels sent to the ME can be computed as follows:

$$Nbit_w = \widetilde{wY_{size}} * \widetilde{wX_{size}}$$

3.3.2 Frame binning

This operation is defined through the parameter PSS00208 and it is used to reduce the Dark Current (DC) effect on acquired data. It operates by means of subsequent acquisitions as reported in the following table:

PSS value	Frames binned
0	No binning
1	2
2	4

Even this processing operates in time (and not on a single acquisition), in terms of number of pixels transferred to the ME, the following equation can be used:

$$Nbit_w = \widetilde{wY_{size}} * \widetilde{wX_{size}}$$

3.3.3 Dark subtraction mode

When VIHI operates in Dark subtraction mode, the bits Dark subtraction (PSS00104) and Dark Acquisitions (PSS00105) Science TC parameters shall not have 1 raw value at the same time. The VIHI PE does not send any science data if both bits are set.

3.3.4 Dark Macro

If the flag "Dark macro" in the VIHI Science TC is set to 1, the ME performs the following operations:

- Shutter closure
- Acquisition of two dark frames (i.e. with flag Dark_acquisition=1) with the same parameters contained in the Science Start TC (integration time, repetition time, binning) and with the following (fixed) limits
  - Starting row: 8
  - Starting column: 4
  - End row: 263
  - End column: 259
- Shutter opening
- Start acquisition of science as per the Science Start TC with dark subtraction activated (i.e. Flag Dark subtraction status = 1).

4 Compression box

This Section explains how to execute the controls on the parameters involved in the compression, as the CBOXs ones for all the channels of the SIMBIOSYS suite (see [RD.2] for details) and the Inverse BitRate (IBR) for the HRIC and STC channels.

For all channels (i.e., HRIC, STC and VIHI) we define:

NameVariable	Values	Case
$CBOX_y$	64	ComprBox<3
	128	ComprBox=3
$CBOX_x$	64	ComprBox=1
	128	ComprBox>1

Table 7: ComprBox definition.

where the ComprBox variable will be defined in the following sections.
Notes:

- The compression box ($CBOX_y$, $CBOX_x$) = 128 x 64 is forbidden

For all channels (i.e., HRIC, STC and VIHI) we define:
IBR values as the formal parameters PSS0060X (see Table 1 and Table 2) with X from 1 to 4 for HRIC and from 1 to 6 for STC (one for each window).

4.1 HRIC/STC channels

With reference to what described in Section 3.1 and 3.2, it is possible to compute the multiple of CBOX in both row (i.e., nCB_y) and column (i.e., nCB_x) direction as follows:

$$\begin{cases} nCB_y = {wY_{size}}/{CBOX_y} \\ nCB_x = {wX_{size}}/{CBOX_x} \end{cases}$$

The check on each window size should return an error when:

- <u>*Windows dimensions not coherent with CBOX Dimension*</u>*: in this case nCB_y and/or nCB_x is not an integer number*
- <u>*Windows boxes not coherent with CU settings*</u>*: in this case nCB_y and/or nCB_x is greater than 16.*
- <u>*Nb of strips in windows is lower than the minimum allowed of 2*</u>*.*
- <u>*nCB_y and nCB_x shall be >0*</u>
- <u>*The total number of pixels from the required windows is greater than 2097152 which is the max allowable (2Mp)*</u>

Finally, in case of multiple windows acquisitions (PSS01602>1), if different IBR are commanded the first window shall be in lossy mode. If not then the compression software is not well initialized for lossy compression.

4.2 VIHI channel

With reference to what described in Section 3.3.1, it is possible to compute the multiple of CBOX in both row (i.e., nCB_y) and column (i.e., nCB_x) directions as follows:

$$\begin{cases} nCB_y = {wY_{size}}/{CBOX_y} \\ nCB_x = {wX_{size}}/{CBOX_x} \end{cases}$$

The check on window dimension should return an error when:

- *<u>Windows dimensions not coherent with CBOX Dimension</u>*: in this case nCB_y and/or nCB_x is not an integer number
- *<u>Windows dimensions less than accepted</u>*: in this case *<u>nCB_y and nCB_x</u>* are equal to 0.
- *<u>Windows dimensions not coherent with Spectral editing mode::</u> ComprBox 128 x 128 is not compatible with Spectral Editing*

5 Repetition Time

This Section explains how to evaluate the minimum RT that shall be used in a Science TC of each SIMBIO-SYS channel. It is an update of Section 8.3.1.7, for STC/HRIC, and 8.3.1.8, for VIHI, of [RD.3].

Before entering in the detailed discussion on the RT computation for each SIMBIO-SYS channel, it is important to consider the limit on the data transfer between the SIMBIO-SYS ME and the S/C. In particular:

the max theoretical transmission speed of useful data is 80Mbps. This value is almost reached when ME and S/C SpW nodes are at 100Mbps. In case of SIMBIO-SYS, the S/C transmission link is at only 10Mbps. This reduces the useful bandwidth because the S/C needs to send FCT token to SIMBIO-SYS to allow data transfer. As a result, 50-55Mbps is the best estimation of data transmission from SIMBIO-SYS to S/C (see Figure 1 – cfr. Vincent's email of 10/11/2022).

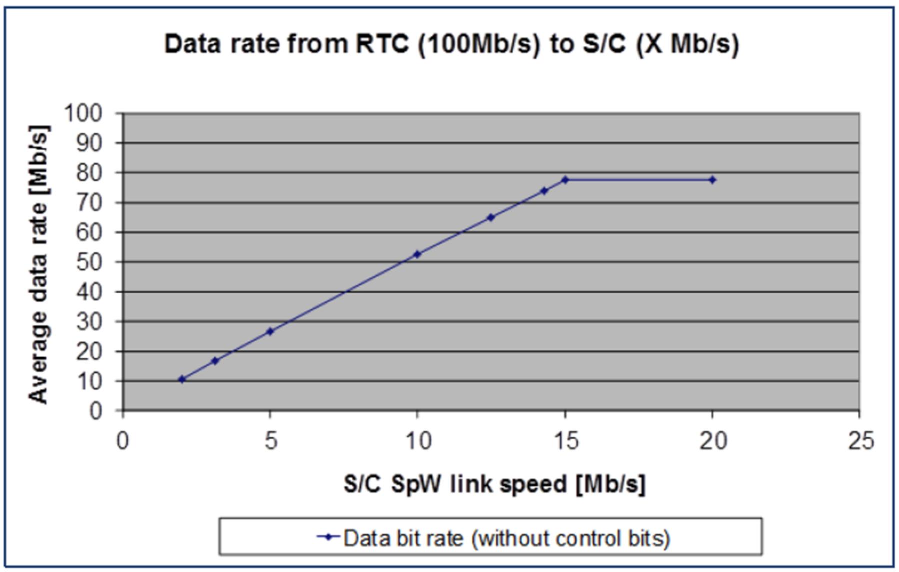

Figure 1: SIMBIO-SYS Data rate results obtained by test for the design.

5.1 HRIC/STC channels

In the case of the two cameras, the minimum RT for an acquisition can be evaluated considering the following three quantities:

Values	Description
RT_{min}	Minimum Repetition Time which can be Commanded for each channel (100 ms for HRIC, 150 ms for STC and 40 ms for VIHI). This means a minimum RT of 20(RAW) for HRIC,30 (RAW) for STC.
$(T_{RO} + IT)$	The sum of the Read-Out (RO) and the Integration Time (IT)
CU	The Compression Unit (CU) Time

and the following equation shall be considered:

$$commanded\ RT \ \geq RT_{min} = max\{RT_{min}, \quad (T_{RO} + IT), \quad CU\}$$

These values are defined in following sections.

Notes:

- The RT parameter in a Science TC correspond to PSS01629 for STC and to PSS01601 for HRIC
- The ENG value (in seconds) corresponds to 5E-3 RAW data.

5.1.1 Integration Time

The integration time can be evaluated by the following equations:

TC	Rule
ZSS17102(HRIC) or ZSS17202 (STC)	IT_{ms} = PSS01501 * 9.6e-3
ZSS171B2 (HRIC) or ZSS172B2 (STC)	IT_{ms} = (PSS015B1 - 33096) * 0.96 + 314.88

5.1.2 Read out Time

The RT depends in turn on the detector clock frequency, as well as on the number of pixels/windows in the frame plus some internal time delay terms. In summary, the following formula can be used to evaluate readout time in seconds:

$$T_{RO} = \frac{4364}{F_{ro}} + \frac{1}{F_{ro}} \sum_{i=1}^{N_{win}} [176 + (X_i + 8)(Y_i + 1)]$$

where:

- N_{win} is the number of windows to be acquired (i.e., PSS00301 for both HRIC and STC)
- X_i is the number of pixels along a row (i.e., columns) in window i
- Y_i is the number of pixels along a column (i.e., rows) in window i

- F_{RO} is the detector readout frequency (pix/s). This speed can be evaluated through the value of the content of the ROIC_FREQUENCY in the PE memory address as follows:

$$F_{ro} = 5\frac{10^6}{2^{ROIC\ FREQ}}[\frac{pix}{s}]$$

with ROIC_FREQUENCY=0, 1 or 2 (default value 0).

The couple (X_i, Y_i) can be computed from the PSSXXX in a Science TC as follows:

Channels	Columns		Rows	
STC, HRIC	X_1	(PSS00502 - PSS00501 + 1)*64	Y_1	PSS01102 - PSS01101 + 1
STC, HRIC	X_2	(PSS00504 - PSS00503 + 1)*64	Y_2	PSS01104 - PSS01103 + 1
STC, HRIC	X_3	(PSS00506 - PSS00505 + 1)*64	Y_3	PSS01106 - PSS01105 + 1
STC, HRIC	X_4	(PSS00508 - PSS00507 + 1)*64	Y_4	PSS01108 - PSS01107 + 1
STC	X_5	(PSS00510 - PSS00509 + 1)*64	Y_5	PSS01110 - PSS01109 + 1
STC	X_6	(PSS00512 - PSS00511 + 1)*64	Y_6	PSS01112 - PSS01111 + 1

Table 8: Science parameters to compute read window size.

5.1.3 Compression Unit Time

The CU time associated to the acquisition of a window (CU_i) can be evaluated as:

$$\boldsymbol{CU_i = \frac{N}{B} * \left[\frac{1}{D_R} + \left(\frac{1}{n_{cb}} - \frac{1}{D_R\ E}\right) * \mathbf{SLOWEST}_i\right]}$$

Where:

- N is the number of read pixels evaluable by means of the couple (X_i, Y_i) as defined in Table 8.
- B is the binning factor applied to each read window and it correspond to $2^{2*BinningValue}$ (i.e., for *BinningValue* = 2 the binning factor is equal to 16). The *BinningValue* is defined differently for each channel:
  - HRIC: each read window can have its own *BinningValue* and it is specified with the parameter PSS0020X with x from 1 to 4
  - STC: for the stereo channel the *BinningValue* is equal to 0 for each window
- D_R is the data rate over SpW from the PE to the CU and it is equal to 4.5E6 [px/s]
- n_{CB} is the total number of pixels of the compression box in the CU: It is defined by PSS00205 and correspond to:

PSS00205 value	CB definition	n_{CB}
0	CB(64, 64)	4096
1	CB(64, 128)	8192
2	CB(128, 128)	16384

Table 9: Compression Box number computation.

- E is the extraction time which is:

PSS00205 value	CB definition	EXT time [s]

0	CB(64, 64)	2.46E-3
1	CB(64, 128)	4.92E-3
2	CB(128, 128)	9.38E-3

Table 10: Extraction Time computation.

- SLOWESTi is the minimum time between WT and TC (whose values are reported in Table 11) for the window i as function of the IBR values. IBR values correspond to the formal parameters PSS0060X with X from 1 to 6 (one for each window)

As a result, for an acquisition of N_{win} (= PSS00301) windows the CU time is evaluated as the sum of all CU_W time:

$$CU_{time} = \sum_{i=1}^{N_{win}} CU_i$$

CB	(128, 128)	(64, 128)	(64, 64)
IBR=0	4.96e-03	2.48e-03	1.24E-03
IBR=1	8.02e-03	4.01e-03	2.00E-03
IBR=32	7.91e-03	3.96e-03	1.98E-03
Otherwise	7.91e-3+0.0375e-3*(IBR -32)	3.96e-3+0.0375e-3*(IBR-32)	1.98e-3+0.0375e-3*(IBR-32)

Table 11: The Tree coding time (T_c in s) as function of IBR (PSS0060X, x=1,…,6) and Compression Box Dimension(PSS00205). For IBR different from 1 at 32 it can be considered as a linear function of the IBR as reported in the last table line. Times are expressed in seconds/subframe.

5.2 VIHI channel

For the VIHI channel the commanded RT shall be:

$$commanded\ RT \geq max\{RT_{min}, \quad (T_{RO} + IT)\}$$

Where the minimum Repetition Time (RT_{min}= 40msec corresponding to 8 RAW) duration takes into account also the CU time.

In the case of the spectrometer not all values of the RT are allowed (see Section 8.3.1.8 of [RD.3] for details) and the following equation shall be used to verify the correctness/validity of the commanded Repetition Time:

$$k * IT + (k-1) * T_{ro} < commanded\ RT < k * (IT + T_{ro})$$

where:

- k = integer ≥ 1
- IT = Integration Time
- T_{ro} = Read out time = 18.152 ms (see Section 8.3.1.8 of [RD.3] for details)

Notes:

- The RT parameter in a Science TC correspond to PSS01631
- The RT ENG value (in seconds) is obtained by multiplying PSS01631 by 5e-3.

5.2.1 Integration Time

The integration time is called in two different science TCs where the parameter PSS01630 has different values:

TC	PSS01630	Rule
ZSS173B2	2	IT_s = PSS01630 * 68.5e-6
ZSS17302	3-65535	IT_s = (PSS01630 - 3) * 68.5e-6 + 205.5e-6

Where IT is expressed in seconds

5.2.2 Read out Time

As indicated above, for the spectrometer the detector readout time is fixed and equal to 18.152 ms.

6 Data-Rate

This Section, considering the details reported above, reports the rules for computing the Data-Rate for each channel of SIMBIO-SYS (see Section 6 of [RD.4] for more details.)

6.1 HRIC/STC channels

The cameras bitrate (BR) can be evaluated as:

$$BR = \frac{\sum_{w=1}^{N} Nbit_w}{RT}$$

Where:

- RT is the Repetition Time (see Section 5.1)
- $Nbit_w$ is the number of compressed bit generated by each single acquisition of the single window w that be computed as follows:

$$Nbit_w = Npix_w * Bpp_w$$

where $Npix_w$ is the number of compressed bit generated by each single acquisition of the single window w (see Sections 3.1, 3.2 and 4.1) and Bpp_w is the bits per pixel commanded which depends on the IBR value as reported in the table below.

Case	IBR (PSS value)	Bpp_w
Bit-packing	0	14
Lossless	1	10
Lossy	Otherwise (≤ 63)	$\frac{IBR_w}{16}$

To consider that:

- for HRIC: N=1…4
- for STC: N=1…6

6.2 VIHI channel

VIHI bitrate can be calculated by:

$$BR = F_B * \frac{Nbit}{RT}$$

where RT is the Repetition Time (see Section 5.2) and Nbit is the number of compressed bit generated by the acquisition that can be computed as follows:

$$Nbit_w = Npix_w * Bpp_w$$

where $Npix_w$ is the number of compressed bit generated by each single acquisition of the single window w (see Sections 3.3 and 4.2) and Bpp_w is the bits per pixel commanded which depends on the IBR value as reported in the table below.

Case	IBR (PSS value)	Bpp_w
Bit-packing	0	16
Lossless	1	11
Lossy	otherwise	$IBR_w/16$