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# JUNO

## *JIRAM Commanding Tool SW Requirements*

OLD CATALOGUE:

JIR-IFSI-UR-003-2011/ INAF/IAPS-2014-05 / ISSUE 1 / REVISION 0

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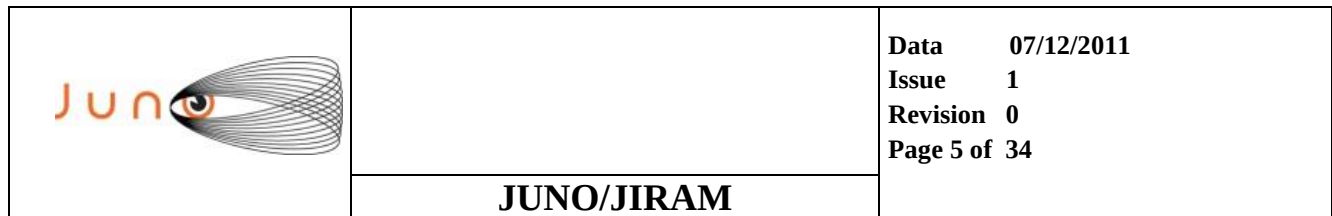
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## ACRONYM & ABBREVIATION LIST

|       |                                                 |
|-------|-------------------------------------------------|
| AD    | Applicable Document                             |
| AI    | Action Item                                     |
| ASI   | Agenzia Spaziale Italiana                       |
| CDR   | Critical Design Review                          |
| C&DH  | Command and Data Handling                       |
| CICD  | Communication Interface Control Document        |
| CIDL  | Configuration Item Data List                    |
| EDAC  | Error Detection And Correction                  |
| EGSE  | Electrical Ground Support Equipment             |
| EM    | Electrical Model                                |
| ESA   | European Space Agency                           |
| FM    | Flight Model                                    |
| FSW   | Flight SW                                       |
| GA    | Galileo Avionica                                |
| HEX   | Hexadecimal format                              |
| HK    | Housekeeping                                    |
| HW    | Hardware                                        |
| HSSL  | High Speed Serial Link                          |
| IF    | Interface                                       |
| IR    | Infrared                                        |
| INAF  | Istituto Nazionale di Astrofisica               |
| ITAR  | International Traffic in Arms Regulations       |
| JSOC  | Juno Science Operations Center (at SwRI, Texas) |
| JPL   | Jet Propulsion Laboratory                       |
| JIRAM | Jovian Infrared Auroral Mapper                  |
| LM    | Lockheed Martin                                 |
| LSSL  | Low Speed Serial Link                           |
| NA    | Not Applicable                                  |
| NASA  | National Aeronautics and Space Administration   |
| PI    | Principal Investigator                          |
| RD    | Reference Document                              |
| RID   | Review Item Discrepancy                         |
| SC    | Spacecraft                                      |
| SCR   | SW Change Request                               |
| SDD   | SW Design Document                              |

|                                                                                   |                                                      |                                                                                                               |
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|      |                          |
|------|--------------------------|
| SP   | Settable Parameter       |
| SRR  | SW Requirements Review   |
| SRD  | SW Requirements Document |
| STR  | String format            |
| SUM  | SW User Manual           |
| SW   | Software                 |
| TBD  | To Be Defined            |
| TBC  | To Be Confirmed          |
| TBW  | To Be Written            |
| TC   | Tele-command             |
| TM   | Telemetry                |
| UDEC | Unsigned Decimal format  |



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## JUNO/JIRAM

## DISTRIBUTION LIST

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## DOCUMENT CHANGE LOG

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|                                                                                   |                   |                                                                                      |
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## APPLICABLE DOCUMENTS

The following documents at the latest issue in effect shall apply. These documents are herein referred as [AD-XX].

| <i>Id</i> | <i>Document Number</i> | <i>Description</i> |
|-----------|------------------------|--------------------|
|           |                        |                    |
|           |                        |                    |
|           |                        |                    |

## REFERENCE DOCUMENTS

The following documents shall be used as reference background and support information. These documents are herein referred as [RD-XX].

| <i>Id</i> | <i>Document Number</i> | <i>Description</i>                                       |
|-----------|------------------------|----------------------------------------------------------|
| [RD-01]   | JIR-IFSI-UR-002-2010   | JIRAM_Operations_Interface_Control_Document_Issue_05.pdf |
| [RD-02]   | JIRAM-GAF-IC-001       | JIRAM-GAF-IC-001_rev6_CICD.pdf                           |
| [RD-03]   | JIRAM-GAF-TN-027       | JIRAM-GAF-TN-027_rev10.pdf                               |
| [RD-04]   | JIRAM-GAF-RP-011       | JIRAM-GAF-RP-011_rev0(CalibrationDataRecord).pdf         |
| [RD-05]   | JIR-IFSI-SY-002-2011   | JIRAM_Uplink_Downlink_Procedures_Issue_02.pdf            |

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## 1 PURPOSE OF THIS DOCUMENT

This document provides the basic requirements for the design and development of the JIRAM Ground Segment Commanding Tool. Additional requirements may be found in annexes (mainly details on the algorithms) and in the applicable and reference documents.

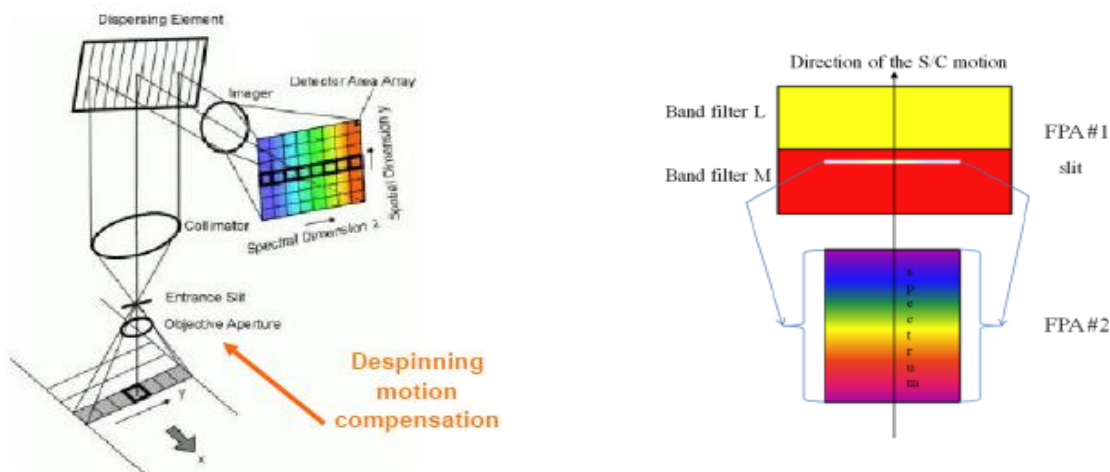
The requirements specified here are subject to revision by GA when required. In the event that a supplier believes that parts of the specified requirements would not apply, or additional requirements are necessary, such recommendations shall be submitted to INAF with substantiating analyses and documentation, for consideration and analysis.

|                                                                                   |                                                      |                                                                                                            |
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## 2 JIRAM INSTRUMENT DESCRIPTION

JIRAM is equipped with a single telescope that accommodates both an infrared camera and a spectrometer to facilitate a large observational flexibility in obtaining simultaneous images in the L and M bands with the spectral radiance over the central zone of the images. Moreover, JIRAM will be able to perform spectral imaging of the planet in the 2.0-5.0  $\mu\text{m}$  interval of wavelengths with a spectral resolution better than 10 nm. Instrument design, modes, and observation strategy will be optimized for operations onboard a spinning satellite in polar orbit around Jupiter. The JIRAM heritage comes from Italian-made, visual-infrared imaging spectrometers dedicated to planetary exploration, such as VIMS-V on Cassini, VIRTIS on Rosetta and Venus Express, and VIR-MS on the Dawn mission.

JIRAM combines two data channels in one instrument: the **imager** and the **spectrometer**, which are housed in the same optical subsystem (fig. 1). The instrument is composed of the Optical Head (OH) and the Main Electronic (ME). The ME contains the electronics to drive the Focal Plane Arrays (FPAs) and compensating mirror, and perform the acquisition and conversion of the science and housekeeping data. It also manages the operation of the two channels, gathers data and housekeeping information from them, stores the data, performs data compression, and interfaces the instrument with the spacecraft.



**Fig. 1: the two FPAs**

|                                                                                   |                   |                                                                                       |
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## 2.1 *SCIENCE OBJECTIVES*

The Jovian InfraRed Auroral Mapper (JIRAM) will explore the dynamics and the chemistry of Jovian auroral regions by high contrast imaging and spectroscopy. It will also analyze the Jovian hot spots to determine their vertical structure and infer possible mechanisms for their formation. JIRAM will sound the Jovian meteorological layer to map moist convection and determine water abundance and other constituents at depths that correspond to several bars pressure.

### 2.1.1 *ACTIVITY DESCRIPTION*

The JIRAM Ground Segment Commanding Tool “**JCoT**” implements procedures, algorithms and data formats in such a way to permit a user to perform tasks related to the Planning activities of the instrument mission. This activity leads to the generation of parameter values to be used, in automated processes, to command the instrument.

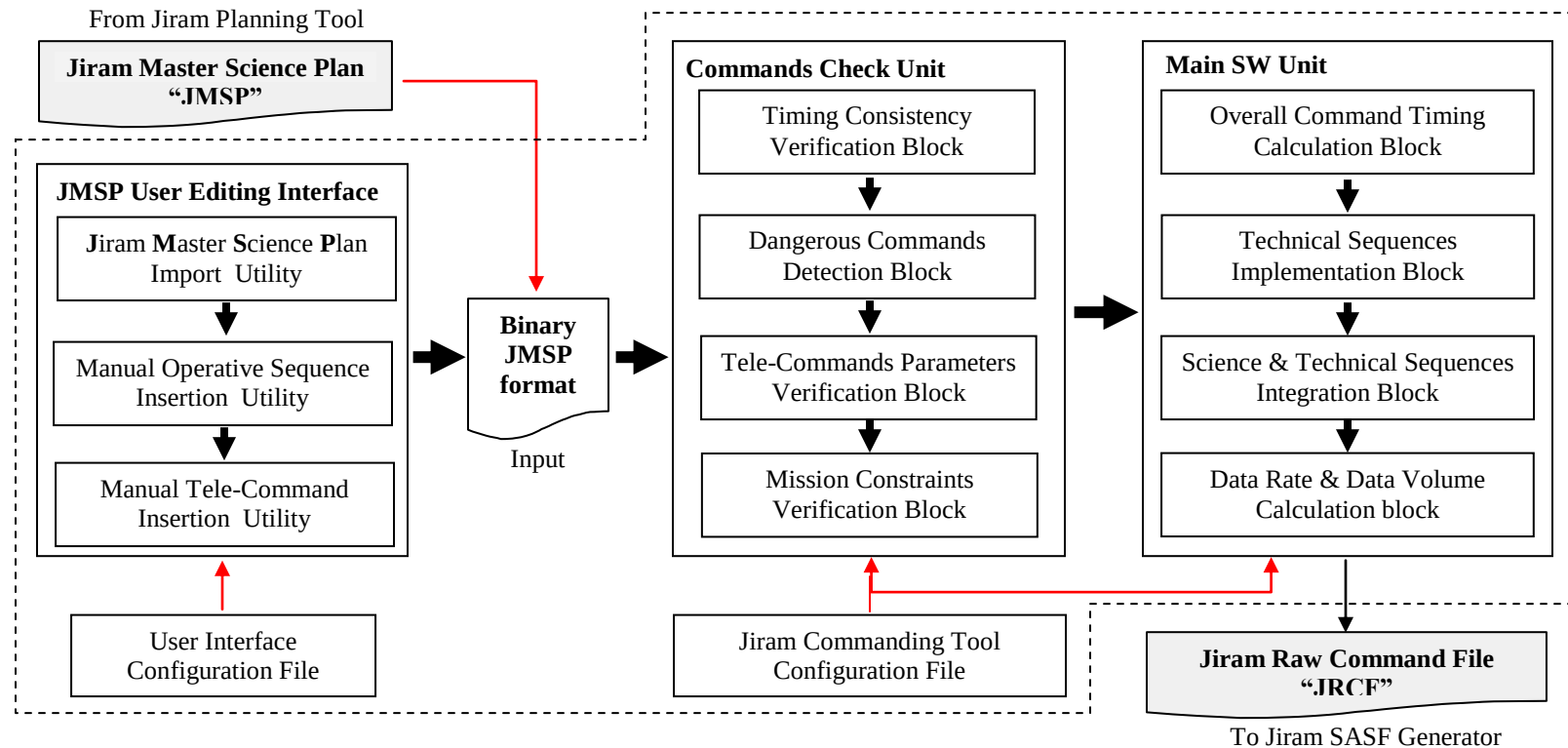
Nominal input to the Commanding Tool are instrument Timelines generated by the JIRAM Planning Tool “**JPlaT**”, validated within the Science Activity Plan file “**SAP**”. Alternatively, timelines can be manually defined or command parameters can be, again manually, selected.

Outputs of the Commanding Tool are a set of commands rows and a set of SP values to be used for instrument programming and formalized in the JIRAM Raw Command File “**JRCF**”. The Jiram raw command file will be translated into SASF format (JPL requirement) with the SASF Generator Tool.

### 3 JIRAM COMMANDING TOOL BLOCKS DIAGRAM

In nominal operations, the main Jiram Commanding Tool input is an Observation Timeline, Jiram Master Science Plan (**JMSP**) which defines the succession of operational sequences to be programmed, starting from a given absolute or relative reference time. For each operative sequence, details are provided to define the Tele-Commands and Settable Parameters (**SP**) that will be loaded/updated into the instrument.

The Jiram Commanding Tool provides also means to manually define the operative sequences, in case the **JMSP** file is not available, or even to generate a sequence of instrument Tele-Commands for special purposes, like for example to manage the submission of memory patch and dump request



|                                                                                   |                   |                                                                                       |
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## 4 JIRAM COMMANDING TOOL MODULES DESCRIPTION

The Jiram Commanding Tool functional architecture can be partitioned in modules as described in the following paragraph.

### 4.1 JIRAM USER EDITING INTERFACE

Basic Commanding Tool usage foresees the user to manage the task of “commanding” the instrument in different ways.

The main option is that to select one, timeline from the Planning schema “**JMSP file**”(these timelines are a product of the Jiram Planning Tool) and commit them for a standard processing..

As an alternative the user may bypass the standard generation process and perform an assisted manual input of Operative Sequences.

Other options include the possibility to perform a guided compilation of the Jiram Tele-Commands.

It is considered a fourth utility a third usage alternative, that to manage the submission of memory patch requests.

#### 4.1.1 JIRAM MASTER SCIENCE PLAN (JMSP) FORMAT FILE

The following diagrams shows a graphical representation of a generic operative timeline. In the JMSP product, will be represented only Science and Calibration sequences, with the respective timing (T1/T2 & T3/T4) in UTC format.

The Commanding Tool will add to the final timeline, Jiram Raw Command File (**JRCF**), the technical sequences necessary for the operation of the instrument, like for example: “POWER ON” , “STB”, “SAFE” and “POWER OFF”.

The Commanding Tool will also calculate the overall timing in different format and the internal timing of each single Sequence.

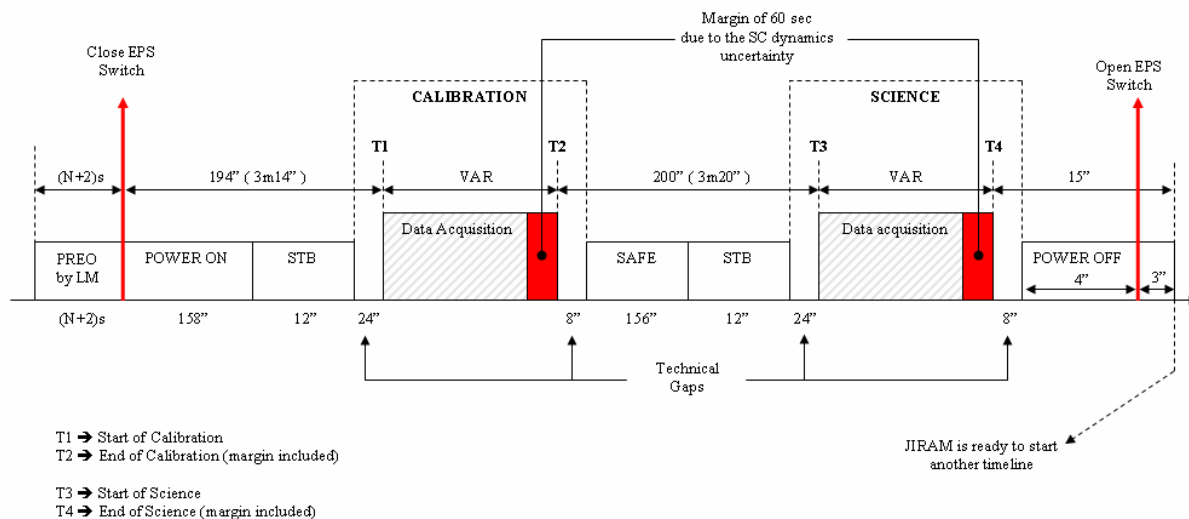


Figure 2

## CALIBRATION SEQUENCE SPECIFICS & FORMAT

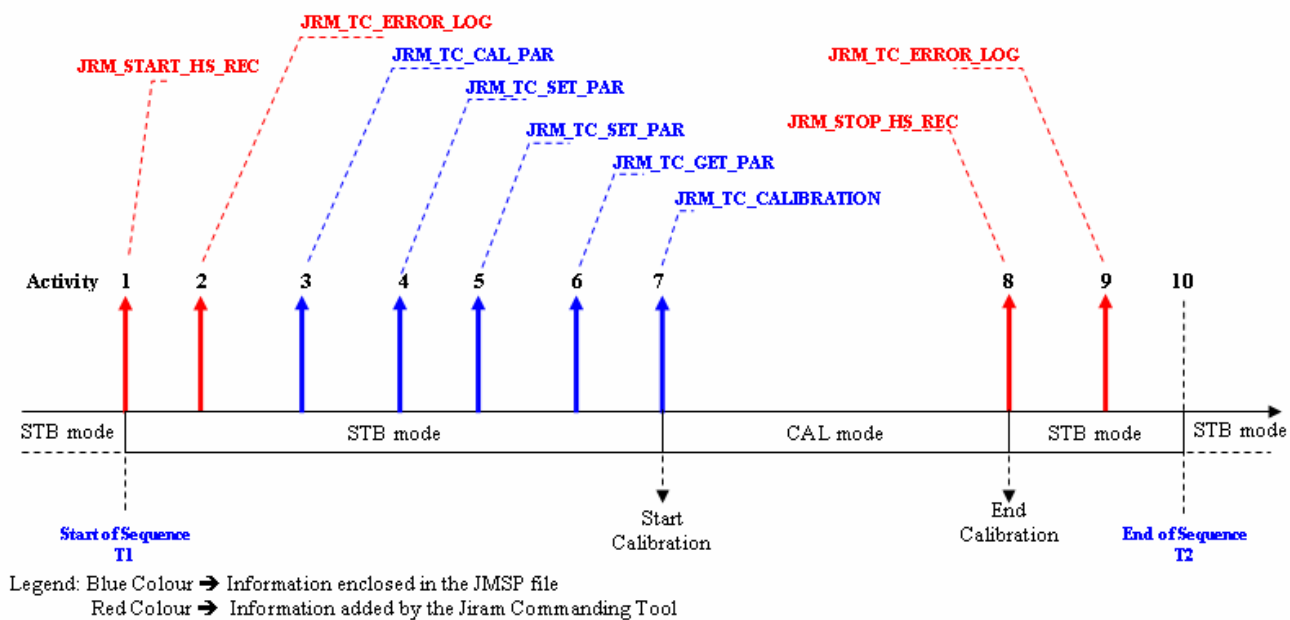


Figure 3

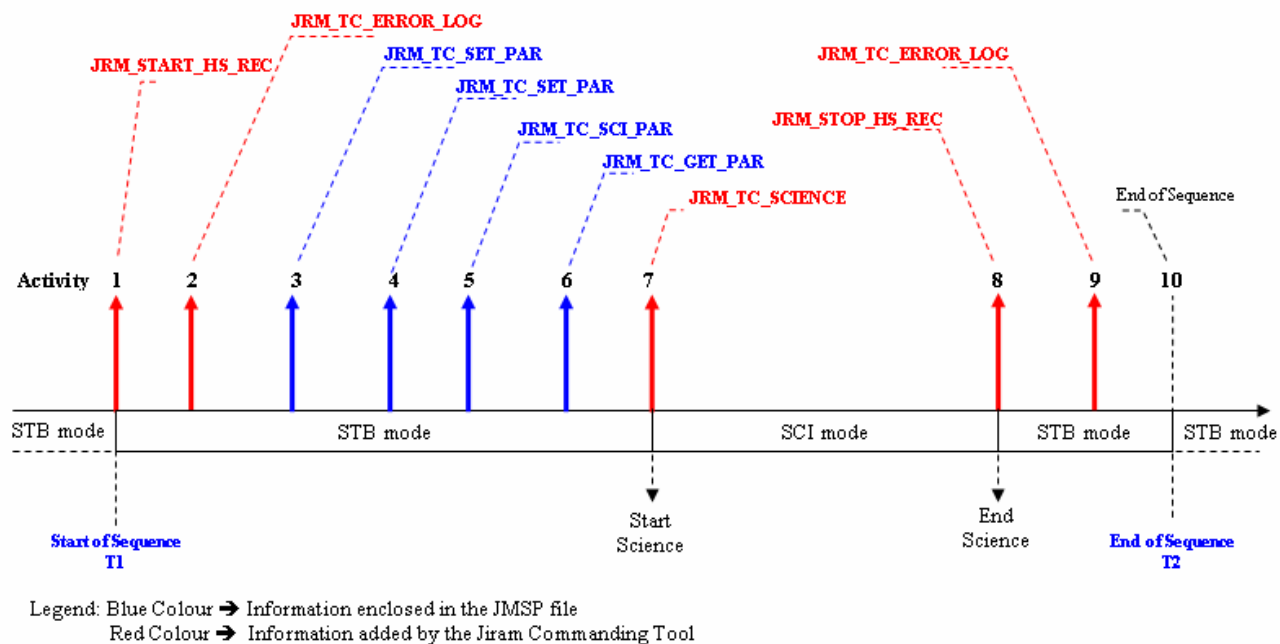
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| Field Description     | File Field Naming Convention | Unit | Range                |
|-----------------------|------------------------------|------|----------------------|
| Activity              | JIRAM_CALIB                  | STR  | NA                   |
| Start Execution Time  | Start_Execution_Time         | STR  | YY-DDDTHH:MM:SS.SSSZ |
| End Execution Time    | End_Execution_Time           | STR  | YY-DDDTHH:MM:SS.SSSZ |
| <b>JRM_TC_CAL_PAR</b> | SP_I_GAIN1_LAMP1             | UDEC | 0<br>15              |
|                       | SP_I_GAIN2_LAMP1             | UDEC | 0<br>15              |
|                       | SP_I_GAIN1_LAMP2             | UDEC | 0<br>15              |
|                       | SP_I_GAIN2_LAMP2             | UDEC | 0<br>15              |
|                       | SP_T_EXPO_BACK_IMG           | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_BACK_SPE           | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP1_G1_IMG       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP1_G1_SPE       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP1_G2_IMG       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP1_G2_SPE       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP2_G1_IMG       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP2_G1_SPE       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP2_G2_IMG       | UDEC | 0<br>40000           |
|                       | SP_T_EXPO_LAMP2_G2_SPE       | UDEC | 0<br>40000           |
|                       | SP_T_STAB_LAMP1              | UDEC | 0<br>300             |
| <b>JRM_SET_PAR</b>    | SP_ID                        | UDEC | 0<br>65535           |
|                       | SP_VAL                       | UDEC | 0<br>4294967295      |
| <b>JRM_SET_PAR</b>    | SP_ID                        | UDEC | 0<br>65535           |
|                       | SP_VAL                       | UDEC | 0<br>4294967295      |

|                                                                                   |                   |                                                                                       |
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|                        |                     |             |              |
|------------------------|---------------------|-------------|--------------|
| <b>JRM_GET_PAR</b>     | <b>SP_ID</b>        | <b>UDEC</b> | 0            |
|                        |                     |             | 65535        |
| <b>JRM_CALIBRATION</b> | SUB_MODE            | STR         | "CAL_I0_S1"  |
|                        |                     |             | "CAL_I0_S2"  |
|                        |                     |             | "CAL_I0_S3"  |
|                        |                     |             | "CAL_I1_S0"  |
|                        |                     |             | "CAL_I1_S1"  |
|                        |                     |             | "CAL_I1_S2"  |
|                        |                     |             | "CAL_I1_S3"  |
|                        |                     |             | "CAL_I2_S0"  |
|                        |                     |             | "CAL_I2_S1"  |
|                        |                     |             | "CAL_I2_S2"  |
|                        |                     |             | "CAL_I2_S3"  |
|                        |                     |             | "CAL_I3_S0"  |
|                        |                     |             | "CAL_I3_S1"  |
|                        |                     |             | "CAL_I3_S2"  |
|                        |                     |             | "CAL_I3_S3"  |
|                        | EN_DIS_COMP         | STR         | "IEN_SEN"    |
|                        |                     |             | "IDIS_SEN"   |
|                        |                     |             | "IEN_SDIS"   |
|                        |                     |             | "IDIS_SDIS"  |
|                        | EN_DISABLE_SUB      | STR         | "DISABLE"    |
|                        |                     |             | "ENABLE"     |
|                        | NUM_CYCLE_PER_PHASE | UDEC        | 1            |
|                        |                     |             | 16           |
|                        | LAMP_ID             | STR         | "LAMP_1"     |
|                        |                     |             | "LAMP_2"     |
|                        |                     |             | "BOTH_LAMPS" |

## SCIENCE SEQUENCE SPECIFICS & FORMAT



**Figure 4**

| Field Description    | File Field Naming Convention | Unit | Range                |
|----------------------|------------------------------|------|----------------------|
| Activity             | JIRAM_CALIB                  | STR  | NA                   |
| Start Execution Time | Start_Execution_Time         | STR  | YY-DDDTHH:MM:SS.SSSZ |
| End Execution Time   | End_Execution_Time           | STR  | YY-DDDTHH:MM:SS.SSSZ |
| JRM_SET_PAR          | SP_ID                        | UDEC | 0<br>65535           |
|                      | SP_VAL                       | UDEC | 0<br>4294967295      |
| JRM_SET_PAR          | SP_ID                        | UDEC | 0<br>65535           |
|                      | SP_VAL                       | UDEC | 0<br>4294967295      |

|                                                                                   |                   |                                                                                       |
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|                    |                    |      |                 |
|--------------------|--------------------|------|-----------------|
| <b>JRM_SCI_PAR</b> | SP_EN_DIS_DOUC_SCI | STR  | "DISABLE"       |
|                    |                    |      | "ENABLE"        |
|                    | SP_ACQ_DURATION    | UDEC | 0               |
|                    |                    |      | 255             |
|                    | SP_NADIR_DELTA     | UDEC | 0               |
|                    |                    |      | 3186            |
|                    | SP_I_EXP_1         | UDEC | 0               |
|                    |                    |      | 50000           |
|                    | SP_S_EXP_1         | UDEC | 0               |
|                    |                    |      | 50000           |
|                    | SP_I_GAIN_1        | STR  | "LOW"           |
|                    |                    |      | "HIGH"          |
|                    | SP_S_GAIN_1        | STR  | "LOW"           |
|                    |                    |      | "HIGH"          |
|                    | SP_M_MODE_1        | STR  | "POINT"         |
|                    |                    |      | "SPIN"          |
|                    | SP_NADIR_OFFSET_1  | SDEC | -57343          |
|                    |                    |      | 57343           |
|                    | SP_I_EXP_2         | UDEC | 0               |
|                    |                    |      | 50000           |
|                    | SP_S_EXP_2         | UDEC | 0               |
|                    |                    |      | 50000           |
|                    | SP_I_GAIN_2        | STR  | "LOW"           |
|                    |                    |      | "HIGH"          |
|                    | SP_S_GAIN_2        | STR  | "LOW"           |
|                    |                    |      | "HIGH"          |
|                    | SP_M_MODE_2        | STR  | "POINT"         |
|                    |                    |      | "SPIN"          |
|                    | SP_NADIR_OFFSET_2  | SDEC | -57343          |
|                    |                    |      | 57343           |
|                    | SP_SUMMED_SCIENCE  | STR  | "NO_SUMMED_SCI" |
|                    |                    |      | "SUMMED_SCI"    |
| <b>JRM_GET_PAR</b> | SP_ID              | UDEC | 0               |
|                    |                    |      | 65535           |

|                                                                                   |                   |                                                                                       |
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#### 4.1.2 “OPERATIVE SEQUENCES “MANUAL INSERTION UTILITY “

This module permit the generation of the Operative Timeline, without the ingestion and processing of the JMSP file produced by the Planning Tool.

The user has the possibility, through a graphical interface, to select the desired Macro Sequences, already packed and stored into the Commanding Tool local database and edit each available editable filed of the various Tele-Commands.

The following tables show all the available Macro Sequences that should be implemented into the Local Archive:

##### JIRAM POWER ON SEQUENCE

Not editable Inputs

##### JIRAM SW MAINTENANCE DOWNLOAD MEMORY

| Tele-Command          | Editable Fields | Type | Range      |
|-----------------------|-----------------|------|------------|
| JIRAM_TC_RESET        | RESET_LEVEL     | STR  | "HW_RESET" |
|                       |                 |      | "SW_RESET" |
| JIRAM_TC_DOWNLOAD_MEM | START_ADD       | HEX  | 0X00000000 |
|                       |                 |      | 0XFFFFFFFF |
|                       | SIZE            | UDEC | 0          |
|                       |                 |      | 4294967295 |
|                       | EEPROM_EDAC     | STR  | "DISABLE"  |
|                       |                 |      | "ENABLE"   |

##### JIRAM SW MAINTENANCE CHECK MEMORY

| Tele-Command       | Editable Fields | Type | Range      |
|--------------------|-----------------|------|------------|
| JIRAM_TC_RESET     | RESET_LEVEL     | STR  | "HW_RESET" |
|                    |                 |      | "SW_RESET" |
| JIRAM_TC_CHECK_MEM | START_ADD       | HEX  | 0X00000000 |
|                    |                 |      | 0XFFFFFFFF |
|                    | SIZE            | UDEC | 0          |
|                    |                 |      | 4294967295 |
|                    | EEPROM_EDAC     | STR  | "DISABLE"  |
|                    |                 |      | "ENABLE"   |

|                                                                                   |                   |                                                                                       |
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### JIRAM STANDBY

| Tele-Command     | Editable Fields | Type | Range      |
|------------------|-----------------|------|------------|
| JIRAM_TC_RESET   | RESET_LEVEL     | STR  | "HW_RESET" |
|                  |                 |      | "SW_RESET" |
| JIRAM_TC_STANDBY | I_IR_ON_OFF     | STR  | "OFF"      |
|                  |                 |      | "ON"       |
|                  |                 |      | "AUTO"     |
|                  | S_IR_ON_OFF     | STR  | "OFF"      |
|                  |                 |      | "ON"       |
|                  |                 |      | "AUTO"     |
|                  | M_MOTOR_ENABLE  | STR  | "OFF"      |
|                  |                 |      | "ON"       |

### JIRAM SAFE

| Tele-Command         | Editable Fields | Type | Range              |
|----------------------|-----------------|------|--------------------|
| JIRAM_TC_SET_PAR     | SP_ID           | UDEC | 0                  |
|                      |                 |      | 65535              |
|                      | SP_VAL          | UDEC | 0                  |
|                      |                 |      | 4294967295         |
| JIRAM_TC_EEPROM_LOAD | LOAD            | STR  | "USE_DEF_PARAMS"   |
|                      |                 |      | "USE_PARAMS_IN_TC" |
|                      | EEPROM_EDAC     | STR  | "DISABLE"          |
|                      |                 |      | "ENABLE"           |
|                      | EEPROM_ADD      | HEX  | 0X00000000         |
|                      |                 |      | 0xFFFFFFFF         |
|                      | RAM_ADD         | HEX  | 0X00000000         |
|                      |                 |      | 0xFFFFFFFF         |
|                      | SIZE            | UDEC | 0                  |
|                      |                 |      | 4294967295         |
|                      | START_ADD       | HEX  | 0X00000000         |
|                      |                 |      | 0xFFFFFFFF         |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

## JIRAM CALIBRATION

| Tele-Command     | Editable Fields        | Type | Range           |
|------------------|------------------------|------|-----------------|
| JIRAM_TC_CAL_PAR | SP_I_GAIN1_LAMP1       | UDEC | 0<br>15         |
|                  | SP_I_GAIN2_LAMP1       | UDEC | 0<br>15         |
|                  | SP_I_GAIN1_LAMP2       | UDEC | 0<br>15         |
|                  | SP_I_GAIN2_LAMP2       | UDEC | 0<br>15         |
|                  | SP_T_EXPO_BACK_IMG     | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_BACK_SPE     | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP1_G1_IMG | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP1_G1_SPE | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP1_G2_IMG | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP1_G2_SPE | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP2_G1_IMG | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP2_G1_SPE | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP2_G2_IMG | UDEC | 0<br>40000      |
|                  | SP_T_EXPO_LAMP2_G2_SPE | UDEC | 0<br>40000      |
|                  | SP_T_STAB_LAMP1        | UDEC | 0<br>300        |
| JIRAM_SET_PAR    | SP_ID                  | UDEC | 0<br>65535      |
|                  | SP_VAL                 | UDEC | 0<br>4294967295 |
| JIRAM_SET_PAR    | SP_ID                  | UDEC | 0<br>65535      |
|                  | SP_VAL                 | UDEC | 0<br>4294967295 |
| JIRAM_TC_GET_PAR | SP_ID                  | UDEC | 0<br>65535      |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

|                  |                     |      |              |
|------------------|---------------------|------|--------------|
| JIRAM_TC_CAL_PAR | SUB_MODE            | STR  | "CAL_I0_S1"  |
|                  |                     |      | "CAL_I0_S2"  |
|                  |                     |      | "CAL_I0_S3"  |
|                  |                     |      | "CAL_I1_S0"  |
|                  |                     |      | "CAL_I1_S1"  |
|                  |                     |      | "CAL_I1_S2"  |
|                  |                     |      | "CAL_I1_S3"  |
|                  |                     |      | "CAL_I2_S0"  |
|                  |                     |      | "CAL_I2_S1"  |
|                  |                     |      | "CAL_I2_S2"  |
|                  |                     |      | "CAL_I2_S3"  |
|                  |                     |      | "CAL_I3_S0"  |
|                  |                     |      | "CAL_I3_S1"  |
|                  |                     |      | "CAL_I3_S2"  |
|                  |                     |      | "CAL_I3_S3"  |
|                  |                     |      | "CAL_I0_S1"  |
|                  | EN_DIS_COMP         | STR  | "IEN_SEN"    |
|                  |                     |      | "IDIS_SEN"   |
|                  |                     |      | "IEN_SDIS"   |
|                  |                     |      | "IDIS_SDIS"  |
|                  | EN_DISABLE_SUB      | STR  | "DISABLE"    |
|                  |                     |      | "ENABLE"     |
|                  | NUM_CYCLE_PER_PHASE | UDEC | 1            |
|                  |                     |      | 16           |
|                  | LAMP_ID             | STR  | "LAMP_1"     |
|                  |                     |      | "LAMP_2"     |
|                  |                     |      | "BOTH_LAMPS" |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

## JIRAM SCIENCE

| Tele-Command  | Editable Fields   | Type | Range       |
|---------------|-------------------|------|-------------|
| JIRAM_SET_PAR | SP_ID             | UDEC | 0           |
|               |                   |      | 65535       |
|               | SP_VAL            | UDEC | 0           |
|               |                   |      | 4294967295  |
| JIRAM_SET_PAR | SP_ID             | UDEC | 0           |
|               |                   |      | 65535       |
|               | SP_VAL            | UDEC | 0           |
|               |                   |      | 4294967295  |
| JIRAM_SCI_PAR | SUB_MODE          | STR  | "SCI_I0_S0" |
|               |                   |      | "SCI_I0_S1" |
|               |                   |      | "SCI_I0_S2" |
|               |                   |      | "SCI_I0_S3" |
|               |                   |      | "SCI_I1_S0" |
|               |                   |      | "SCI_I1_S1" |
|               |                   |      | "SCI_I1_S2" |
|               |                   |      | "SCI_I1_S3" |
|               |                   |      | "SCI_I2_S0" |
|               |                   |      | "SCI_I2_S1" |
|               |                   |      | "SCI_I2_S2" |
|               |                   |      | "SCI_I2_S3" |
|               |                   |      | "SCI_I3_S0" |
|               |                   |      | "SCI_I3_S1" |
|               |                   |      | "SCI_I3_S2" |
|               |                   |      | "SCI_I3_S3" |
|               | SP_ACQ_N          | UDEC | 1           |
|               |                   |      | 65535       |
|               | SP_ACQ_REPETITION | UDEC | 1           |
|               |                   |      | 255         |
|               | SP_BKG_REPETITION | UDEC | 0           |
|               |                   |      | 50          |
|               | SP_EN_DIS_COMP    | STR  | "IEN_SEN"   |
|               |                   |      | "IDIS_SEN"  |
|               |                   |      | "IEN_SDIS"  |
|               |                   |      | "IDIS_SDIS" |
|               | SP_SCI_LINK       | STR  | "HSSL"      |
|               |                   |      | "LSSL"      |
|               | SP_EN_DIS_SUB     | STR  | "DISABLE"   |
|               |                   |      | "ENABLE"    |
|               | SP_BKG_RN         | STR  | "BKG"       |
|               |                   |      | "RN"        |
|               |                   |      | "DARK"      |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

|                  |                    |      |                 |
|------------------|--------------------|------|-----------------|
| JIRAM_SCI_PAR    | SP_EN_DIS_DOUC_SCI | STR  | "DISABLE"       |
|                  |                    |      | "ENABLE"        |
|                  | SP_ACQ_DURATION    | UDEC | 0               |
|                  |                    |      | 255             |
|                  | SP_NADIR_DELTA     | UDEC | 0               |
|                  |                    |      | 3186            |
|                  | SP_I_EXP_1         | UDEC | 0               |
|                  |                    |      | 50000           |
|                  | SP_S_EXP_1         | UDEC | 0               |
|                  |                    |      | 50000           |
|                  | SP_I_GAIN_1        | STR  | "LOW"           |
|                  |                    |      | "HIGH"          |
|                  | SP_S_GAIN_1        | STR  | "LOW"           |
|                  |                    |      | "HIGH"          |
|                  | SP_M_MODE_1        | STR  | "POINT"         |
|                  |                    |      | "SPIN"          |
|                  | SP_NADIR_OFFSET_1  | SDEC | -57343          |
|                  |                    |      | 57343           |
|                  | SP_I_EXP_2         | UDEC | 0               |
|                  |                    |      | 50000           |
|                  | SP_S_EXP_2         | UDEC | 0               |
|                  |                    |      | 50000           |
|                  | SP_I_GAIN_2        | STR  | "LOW"           |
|                  |                    |      | "HIGH"          |
|                  | SP_S_GAIN_2        | STR  | "LOW"           |
|                  |                    |      | "HIGH"          |
|                  | SP_M_MODE_2        | STR  | "POINT"         |
|                  |                    |      | "SPIN"          |
|                  | SP_NADIR_OFFSET_2  | SDEC | -57343          |
|                  |                    |      | 57343           |
|                  | SP_SUMMED_SCIENCE  | STR  | "NO_SUMMED_SCI" |
|                  |                    |      | "SUMMED_SCI"    |
| JIRAM_TC_GET_PAR | SP_ID              | UDEC | 0               |
|                  |                    |      | 65535           |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

### JIRAM UPLOAD SP PARAMETER

| Tele-Command     | Editable Fields | Type | Range      |
|------------------|-----------------|------|------------|
| JIRAM_TC_SET_PAR | SP_ID           | UDEC | 0          |
|                  |                 |      | 65535      |
|                  | SP_VAL          | UDEC | 0          |
|                  |                 |      | 4294967295 |

### JIRAM GET SP PARAMETER

| Tele-Command     | Editable Fields | Type | Range |
|------------------|-----------------|------|-------|
| JIRAM_TC_GET_PAR | SP_ID           | UDEC | 0     |
|                  |                 |      | 65535 |

### JIRAM RESTORE SP PARAMETER

| Tele-Command | Editable Fields | Type | Range |
|--------------|-----------------|------|-------|
| JRM_DEF_PAR  | SP_ID           | UDEC | 0     |
|              |                 |      | 65535 |

### JIRAM COMMAND MOTOR MODE

| Tele-Command   | Editable Fields         | Type | Range              |
|----------------|-------------------------|------|--------------------|
| JIRAM_TC_MOTOR | MOTOR_MODE              | STR  | "DESPIN"           |
|                |                         |      | "POINT"            |
|                | MOTOR_START_PT_POSITION | UDEC | 0                  |
|                |                         |      | 8190               |
|                | MOTOR_MIRROR_SPEED      | UDEC | 0                  |
|                |                         |      | 65535              |
|                | MOTOR_MIRROR_DIRECTION  | STR  | "CLOCKWISE"        |
|                |                         |      | "COUNTERCLOCKWISE" |
|                | MOTOR_SPIN_TIME         | UDEC | 0                  |
|                |                         |      | 65535              |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

### JIRAM COMMAND CALIBRATION SOURCE

| Tele-Command    | Editable Fields | Type | Range        |
|-----------------|-----------------|------|--------------|
| JRM_CALIBSOURCE | ID_LAMP         | STR  | "LAMP_1"     |
|                 |                 |      | "LAMP_2"     |
|                 |                 |      | "BOTH_LAMPS" |
|                 | ACTION          | STR  | "OFF"        |
|                 |                 |      | "ON"         |
|                 | CURRENT         | STR  | "CURRENT_01" |
|                 |                 |      | "CURRENT_02" |
|                 |                 |      | "CURRENT_03" |
|                 |                 |      | "CURRENT_04" |
|                 |                 |      | "CURRENT_05" |
|                 |                 |      | "CURRENT_06" |
|                 |                 |      | "CURRENT_07" |
|                 |                 |      | "CURRENT_08" |
|                 |                 |      | "CURRENT_09" |
|                 |                 |      | "CURRENT_10" |
|                 |                 |      | "CURRENT_11" |
|                 |                 |      | "CURRENT_12" |
|                 |                 |      | "CURRENT_13" |
|                 |                 |      | "CURRENT_14" |
|                 |                 |      | "CURRENT_15" |
|                 |                 |      | "CURRENT_16" |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

### JIRAM DETECTORS SETTABLE PARAMETERS

| Tele-Command | Editable Fields | Type | Range      |
|--------------|-----------------|------|------------|
| JRM_DET_PAR  | SP_I_VDETADJ    | UDEC | 0<br>4095  |
|              | SP_S_VDETADJ    | UDEC | 0<br>4095  |
|              | SP_IR_STAB_TIME | UDEC | 0<br>500   |
|              | SP_I_DELAY      | UDEC | 0<br>65535 |
|              | SP_S_DELAY      | UDEC | 0<br>65535 |
|              | SP_I_X_L_BAND   | UDEC | 0<br>6     |
|              | SP_I_Y_L_BAND   | UDEC | 0<br>7     |
|              | SP_I_X_M_BAND   | UDEC | 0<br>6     |
|              | SP_I_Y_M_BAND   | UDEC | 135<br>142 |
|              | SP_S_X_WIN      | UDEC | 0<br>102   |
|              | SP_S_Y_WIN      | UDEC | 0<br>14    |

### JIRAM POWER OFF SEQUENCE

Not editable Inputs

#### 4.1.3 MANUAL TELE-COMMAND INSERTION UTILITY

This module permit the generation of the Operative Timeline, without the ingestion and processing of the JMSP file produced by the Planning Tool.

The user has the possibility, through a graphical interface, to select the desired Tele-Command. The following paragraphs describe the format

##### *JIRAM POWER ON SEQUENCE*

There are not editable Tele-Commands by the user. The Switch-On block has been implemented on board. The user can only insert the complete Power on block.

##### *JIRAM\_TC\_DOWNLOAD\_MEM*

| Tele-Command field<br>Name Convention | Type | Range      | Default    |
|---------------------------------------|------|------------|------------|
| START_ADD                             | HEX  | 0X40000000 | 0X40000000 |
|                                       |      | 0XFFFFFFFF |            |
| SIZE                                  | UDEC | 0          | 0          |
|                                       |      | 4294967295 |            |
| EEPROM_EDAC                           | STR  | "DISABLE"  | "ENABLE"   |
|                                       |      | "ENABLE"   |            |

Note: The default value of the START\_ADD corresponds to the first row of the EEPROM block

##### *JIRAM\_TC\_CHECK\_MEM*

| Tele-Command field<br>Name Convention | Type | Range      | Default    |
|---------------------------------------|------|------------|------------|
| START_ADD                             | HEX  | 0X00000000 | 0X40000000 |
|                                       |      | 0XFFFFFFFF |            |
| SIZE                                  | UDEC | 0          | 0          |
|                                       |      | 4294967295 |            |
| EEPROM_EDAC                           | STR  | "DISABLE"  | "DISABLE"  |
|                                       |      | "ENABLE"   |            |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

### ***JIRAM\_TC\_EEPROM\_LOAD***

| Tele-Command field<br>Name Convention | Type | Range              | Default          |
|---------------------------------------|------|--------------------|------------------|
| LOAD                                  | STR  | "USE_DEF_PARAMS"   | "USE_DEF_PARAMS" |
|                                       |      | "USE_PARAMS_IN_TC" |                  |
| EEPROM_EDAC                           | STR  | "DISABLE"          | "DISABLE"        |
|                                       |      | "ENABLE"           |                  |
| EEPROM_ADD                            | HEX  | 0X00000000         | 0X00000000       |
|                                       |      | 0xFFFFFFFF         |                  |
| RAM_ADD                               | HEX  | 0X00000000         | 0X00000000       |
|                                       |      | 0xFFFFFFFF         |                  |
| SIZE                                  | UDEC | 0                  | 0                |
|                                       |      | 4294967295         |                  |
| START_ADD                             | HEX  | 0X00000000         | 0X00000000       |
|                                       |      | 0xFFFFFFFF         |                  |

Note: The default parameters of the Tele-Command are the same parameters of the on board Power On block. This Tele-Command could be used to Power on the instrument in case of an anomaly of the onboard Power on block.

### ***JIRAM\_TC\_STANDBY***

| Tele-Command field<br>Name Convention | Type | Range  | Default |
|---------------------------------------|------|--------|---------|
| I_IR_ON_OFF                           | STR  | "OFF"  | "ON"    |
|                                       |      | "ON"   |         |
|                                       |      | "AUTO" |         |
| S_IR_ON_OFF                           | STR  | "OFF"  | "ON"    |
|                                       |      | "ON"   |         |
|                                       |      | "AUTO" |         |
| M_MOTOR_ENABLE                        | STR  | "OFF"  | "ON"    |
|                                       |      | "ON"   |         |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

### *JIRAM\_TC\_CALIBRATION*

| Tele-Command field<br>Name Convention | Type | Range        | Default     |
|---------------------------------------|------|--------------|-------------|
| SUB_MODE                              | STR  | "CAL_I0_S1"  | "CAL_I1_S1" |
|                                       |      | "CAL_I0_S2"  |             |
|                                       |      | "CAL_I0_S3"  |             |
|                                       |      | "CAL_I1_S0"  |             |
|                                       |      | "CAL_I1_S1"  |             |
|                                       |      | "CAL_I1_S2"  |             |
|                                       |      | "CAL_I1_S3"  |             |
|                                       |      | "CAL_I2_S0"  |             |
|                                       |      | "CAL_I2_S1"  |             |
|                                       |      | "CAL_I2_S2"  |             |
|                                       |      | "CAL_I2_S3"  |             |
|                                       |      | "CAL_I3_S0"  |             |
|                                       |      | "CAL_I3_S1"  |             |
|                                       |      | "CAL_I3_S2"  |             |
|                                       |      | "CAL_I3_S3"  |             |
| EN_DIS_COMP                           | STR  | "IEN_SEN"    | "IDIS_SDIS" |
|                                       |      | "IDIS_SEN"   |             |
|                                       |      | "IEN_SDIS"   |             |
|                                       |      | "IDIS_SDIS"  |             |
| EN_DISABLE_SUB                        | STR  | "DISABLE"    | "DISABLE"   |
|                                       |      | "ENABLE"     |             |
| NUM_CYCLE_PER_PHASE                   | UDEC | 1            | 1           |
|                                       |      | 16           |             |
| LAMP_ID                               | STR  | "LAMP_1"     | "LAMP_1"    |
|                                       |      | "LAMP_2"     |             |
|                                       |      | "BOTH_LAMPS" |             |

### *JIRAM\_TC\_SET\_PAR*

| Tele-Command field<br>Name Convention | Type | Range      | Default |
|---------------------------------------|------|------------|---------|
| SP_ID                                 | UDEC | 0          |         |
|                                       |      | 65535      |         |
| SP_VAL                                | UDEC | 0          |         |
|                                       |      | 4294967295 |         |

|                                                                                   |                   |                                                                                       |
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

**JIRAM\_TC\_SCI\_PAR**

| Tele-Command field<br>Name Convention | Type | Range       | Default     |
|---------------------------------------|------|-------------|-------------|
| SUB_MODE                              | STR  | "SCI_I0_S0" | "SCI_I1_S1" |
|                                       |      | "SCI_I0_S1" |             |
|                                       |      | "SCI_I0_S2" |             |
|                                       |      | "SCI_I0_S3" |             |
|                                       |      | "SCI_I1_S0" |             |
|                                       |      | "SCI_I1_S1" |             |
|                                       |      | "SCI_I1_S2" |             |
|                                       |      | "SCI_I1_S3" |             |
|                                       |      | "SCI_I2_S0" |             |
|                                       |      | "SCI_I2_S1" |             |
|                                       |      | "SCI_I2_S2" |             |
|                                       |      | "SCI_I2_S3" |             |
|                                       |      | "SCI_I3_S0" |             |
|                                       |      | "SCI_I3_S1" |             |
|                                       |      | "SCI_I3_S2" |             |
|                                       |      | "SCI_I3_S3" |             |
| SP_ACQ_N                              | UDEC | 1<br>65535  | 1           |
| SP_ACQ_REPETITION                     | UDEC | 1<br>255    | 1           |
| SP_BKG_REPETITION                     | UDEC | 0<br>50     | 0           |
| SP_EN_DIS_COMP                        | STR  | "IEN_SEN"   | "IDIS_SDIS" |
|                                       |      | "IDIS_SEN"  |             |
|                                       |      | "IEN_SDIS"  |             |
|                                       |      | "IDIS_SDIS" |             |
| SP_SCI_LINK                           | STR  | "HSSL"      | "HSSL"      |
|                                       |      | "LSSL"      |             |
| SP_EN_DIS_SUB                         | STR  | "DISABLE"   | "ENABLE"    |
|                                       |      | "ENABLE"    |             |
| SP_BKG_RN                             | STR  | "BKG"       | "DARK"      |
|                                       |      | "RN"        |             |
|                                       |      | "DARK"      |             |



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|                    |      |                 |                 |
|--------------------|------|-----------------|-----------------|
| SP_EN_DIS_DOUC_SCI | STR  | "DISABLE"       | "DISABLE"       |
|                    |      | "ENABLE"        |                 |
| SP_ACQ_DURATION    | UDEC | 0               | 30              |
|                    |      | 255             |                 |
| SP_NADIR_DELTA     | UDEC | 0               | 0               |
|                    |      | 3186            |                 |
| SP_I_EXP_1         | UDEC | 0               | 10              |
|                    |      | 50000           |                 |
| SP_S_EXP_1         | UDEC | 0               | 750             |
|                    |      | 50000           |                 |
| SP_I_GAIN_1        | STR  | "LOW"           | "LOW"           |
|                    |      | "HIGH"          |                 |
| SP_S_GAIN_1        | STR  | "LOW"           | "LOW"           |
|                    |      | "HIGH"          |                 |
| SP_M_MODE_1        | STR  | "POINT"         | "POINT"         |
|                    |      | "SPIN"          |                 |
| SP_NADIR_OFFSET_1  | SDEC | -57343          | -57343          |
|                    |      | 57343           |                 |
| SP_I_EXP_2         | UDEC | 0               | 10              |
|                    |      | 50000           |                 |
| SP_S_EXP_2         | UDEC | 0               | 750             |
|                    |      | 50000           |                 |
| SP_I_GAIN_2        | STR  | "LOW"           | "LOW"           |
|                    |      | "HIGH"          |                 |
| SP_S_GAIN_2        | STR  | "LOW"           | "LOW"           |
|                    |      | "HIGH"          |                 |
| SP_M_MODE_2        | STR  | "POINT"         | "SPIN"          |
|                    |      | "SPIN"          |                 |
| SP_NADIR_OFFSET_2  | SDEC | -57343          | 0               |
|                    |      | 57343           |                 |
| SP_SUMMED_SCIENCE  | STR  | "NO_SUMMED_SCI" | "NO_SUMMED_SCI" |
|                    |      | "SUMMED_SCI"    |                 |

|                                                                                   |                   |                                                                                       |
|-----------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

***JIRAM\_TC\_DET\_PAR***

| Tele-Command field<br>Name Convention | Type | Range | Default |
|---------------------------------------|------|-------|---------|
| SP_I_VDETADJ                          | UDEC | 0     | 2194    |
|                                       |      | 4095  |         |
| SP_S_VDETADJ                          | UDEC | 0     | 2194    |
|                                       |      | 4095  |         |
| SP_IR_STAB_TIME                       | UDEC | 0     | 200     |
|                                       |      | 500   |         |
| SP_I_DELAY                            | UDEC | 0     | 0       |
|                                       |      | 65535 |         |
| SP_S_DELAY                            | UDEC | 0     | 0       |
|                                       |      | 65535 |         |
| SP_I_X_L_BAND                         | UDEC | 0     | 2       |
|                                       |      | 6     |         |
| SP_I_Y_L_BAND                         | UDEC | 0     | 1       |
|                                       |      | 7     |         |
| SP_I_X_M_BAND                         | UDEC | 0     | 2       |
|                                       |      | 6     |         |
| SP_I_Y_M_BAND                         | UDEC | 135   | 139     |
|                                       |      | 142   |         |
| SP_S_X_WIN                            | UDEC | 0     | 50      |
|                                       |      | 102   |         |
| SP_S_Y_WIN                            | UDEC | 0     | 12      |
|                                       |      | 14    |         |

|                                                                                   |                   |                                                                                       |
|-----------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------|
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|                                                                                   | <b>JUNO/JIRAM</b> |                                                                                       |

# JIRAM\_TC\_DET\_PAR

| JIRAM_TC_CAL_PAR (JRM_CAL_PAR )         |                                    |      |       |                               |
|-----------------------------------------|------------------------------------|------|-------|-------------------------------|
| JRM Team, Tc's field<br>Name Convention | JPL, Tc's field<br>Name Convention | Type | Range | Tc Field<br>Raw<br>Conversion |
| SP_I_GAIN1_LAMP1                        | jrm_sp_i_gn1lmp1                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 15    | NA                            |
| SP_I_GAIN2_LAMP1                        | jrm_sp_i_gn2lmp1                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 15    | NA                            |
| SP_I_GAIN1_LAMP2                        | jrm_sp_i_gn1lmp2                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 15    | NA                            |
| SP_I_GAIN2_LAMP2                        | jrm_sp_i_gn2lmp2                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 15    | NA                            |
| SP_T_EXPO_BACK_IMG                      | jrm_sp_tex_bking                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_BACK_SPE                      | jrm_sp_tex_bkspe                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP1_G1_IMG                  | jrm_sp_tex_l1g1i                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP1_G1_SPE                  | jrm_sp_tex_l1g1s                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP1_G2_IMG                  | jrm_sp_tex_l1g2i                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP1_G2_SPE                  | jrm_sp_tex_l1g2s                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP2_G1_IMG                  | jrm_sp_tex_l2g1i                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP2_G1_SPE                  | jrm_sp_tex_l2g1s                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP2_G2_IMG                  | jrm_sp_tex_l2g2i                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_EXPO_LAMP2_G2_SPE                  | jrm_sp_tex_l2g2s                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 40000 | NA                            |
| SP_T_STAB_LAMP1                         | jrm_sp_t_stblmp1                   | UDEC | 0     | NA                            |
|                                         |                                    |      | 300   | NA                            |



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