Quality Control Report Product Definition

Herschel-HSC-DOC-0660, draft 0.5, 15 Jan 2007

E. Verdugo

1 Introduction

1.1 Purpose and scope

The purpose of this note is to define the Quality Control Report (QCR) Product. The QCR will be the main tool to gather, combine and distribute information on the quality of the observation science data. Quality Control will include, per observation, the assessment of the execution of the observation by the spacecraft and the instruments, the evaluation of the success of the data processing, the outcome of the systematic inspection of the Quick Look product and, if required, the instrument specialist and community support astronomer analysis. Quality information which is generic to the observing mode, calibration and processing accuracies and general caveats will not be part of the QCR, but will be addressed elsewhere in dedicated documents.

1.2 References

1.2.1 Applicable Documents

- HCSS User Requirements Document, issue 2.1.5, 15 September 2005, Herschel-HSC-DOC-0115
- Herschel Science Implementation Requirements Document (SIRD), Issue 1.2, 28 April 2003, PT-03646
- Herschel Space Observatory Operations Scenario Document, Issue 1.2, 17 March 2003, Herschel-HSC-DOC-0114
- Herschel Science Centre Science Implementation Plan (SIP), draft 0.9, 31 May 2002, Herschel-HSC-DOC-0249
- Herschel Ground Segment Interface Requirements Document, issue 2.3, 4 October 2004, FIRST-FSC-DOC-0117 (IRD)

1.2.2 Reference Documents

RD-1 HCSS Data Processing Use Case Definitions, issue 1.1, 31 Augusts 2005, Herschel-HSC-DOC-0480

RD-2 HCSS Glossary of Terms, issue 1.1, 15 March 2001, FIRST-FSC-DOC-0120

RD-3 FIRST Ground Segment Design Description, issue 1.4, 4 October 2004, FIRST-FSC-DOC-0146

RD-4 HCSS Actor Descriptions, issue 2.2, 14 January 2005, FIRST/FSC/DOC/0157

RD-5 HCSS Open Issues document, issue 4.0, 8 July 2005, HERSCHEL-HSC-DOC-0536

2 Software and operational environment

The QCR will serve quality information to several actors in the system, and will provide answers to the following questions:

- Scientific Product Analyst (SPA): Can the observation be flagged as successful? Does it need further inspection by instrument experts?
- Mission Planner: Does the observation need to be rescheduled?
- Instrument Engineer and Calibration Scientist: Is this an anomalous observation? What is precisely the problem?
- Astronomer and Archive user: Was the observation executed with problems that could affect my science?

The QCR will be generated per observation as part of the Quality Control Pipeline in the Data Processing environment. The first input for the production of the QCR will be the list of observations scheduled in the POS and the information generated at the MOC on the uplink and execution of the daily schedule, that will be transferred to the HSC as defined and agreed in AD-1.2.1. If the MOC logs show that the observation has not been executed, or partially below a certain percentage, a flag will be set in the QCR to indicate that the observation has failed and should be rescheduled. If the observation has been executed, the Quality Control Pipeline and the Standard Product Generation will be run with the raw telemetry that has been transferred to the HSC, and their output will automatically be added to the QCR. In case of data processing failure, the SPA may edit the QCR to register the problem. The Quality Control Pipeline will generate a Quick Look Product that will be linked to the QCR and inspected visually by the SPA. He/she will write any findings in the QCR. A possible outcome is that further analysis by an instrument expert and/or a community support astronomer is required to determine the precise nature of the anomaly and to judge whether the observation must be flagged for rescheduling. All relevant information resulting from this exercise will be compiled in the QCR.

The scenario depicted above intends to provide a general view for the QCR definition framework. The detailed operational interactions in the HSC and between the HSC and the ICCs will be described in the Herschel Operational Procedure documents that are in preparation.

The QCR that will be distributed to the Astronomer and that will be made available to the Archive user will be a subset of the QCR used in the HSC. Not all human input and expert discussions entered in the QCR need to be distributed to the general observers. (TBC)

3 Requirements

The requirements for the quality control of products are defined in the HCSS URD (AD-1), section 3.1.4.3. The contents of the QCR are specified in the following:

3.1 Initial input

HCSS-QCR-010 The QCR shall contain an extract of the “spacecraft general information” provided by the MOC (see AD-1.2.1) which is relevant to the quality of the observation.

HCSS-QCR-020 The QCR shall contain an extract of the “instrument malfunctions or operations problems information” provided to the MOC (see AD-1.2.1), which is relevant to the quality of the observation.

HCSS-QCR-030 The QCR shall list instrument telecommand verification errors.

HCSS-QCR-040 The QCR shall list instrument parameter Out of Limits information.

HCSS-QCR-050 The QCR shall indicate whether TM is missing in the observation and the corresponding times.

HCSS-QCR-060 The QCR shall contain pointing problems information: Achieved vs. intended pointing and pointing errors.

HCSS-QCR-070 The QCR shall specify whether an intense solar particle event affected the satellite at the time of the observation.

HCSS-QCR-080 The QCR shall contain links to operational reports that contain problems that affect the quality of the observation or the data processing.

3.2 Input from QCP

HCSS-QCR-090 The QCR shall contain all information required to identify the observation (e.g. Obsid, time of the observation)

HCSS-QCR-100 The QCR shall contain the versions of the QCP and SPG used to generate the data products.

HCSS-QCR-110 The QCR shall record the output messages of the Quality Control Pipeline.
Although the Quality Control Pipelines will be instrument specific, some common checks are expected:

- *Saturation of the detectors*
- *High glitch rates*

HCSS-QCR-120 The QCR shall register software warning or error messages originated during the QCP and SPG processing.

HCSS-QCR-130 The QCR shall contain links to existing SPRs for the QCP and SPG versions used in generating the QCR.

HCSS-QCR-140 The QCR shall be linked to the Quick Look Product.

HCSS-QCR-150 A new version of the QCR shall be created when new versions of the QCP or SPG are available.

HCSS-QCR-160 All versions of the QCR shall be retained to allow the analysis of regression problems.
The version(s) of the Quick Look product used by the SPA for the visual inspection shall also be retained.

3.3 Human input

HCSS-QCR-170 The QCR shall compile human input corresponding to three quality control

levels: (1) Science Product Analyst, who looks at the quick look product, QC1 (2) Instrument Expert, who checks the quality related to instrument performance, QC2, and (3) Community Support Astronomer, who assesses the quality in relation with the science case, QC3.

HCSS-QCR-180 For each quality control level, the name of the operator or expert making the analysis and the date shall be obligatory fields to enter in the QCR.

HCSS-QCR-190 For each quality control level, the QCR will contain a standard form to be filled in by the operator or expert.

HCSS-QCR-200 As part of quality control levels 2 and 3, the following fields shall be specified in the QCR standard form:

- Exceptions with respect to science goals (e.g. technically OK observation, but scheduled at wrong time).
- Achieved pointing vs. “true” source location.
- Achieved vs. intended science goals (e.g. S/N).
- Serendipitous other science quality issues (like big glitch on source or on line).

HCSS-QCR-210 It shall be possible to link documents to a QCR, as input to the quality control levels 2 and 3.

HCSS-QCR-220 It shall be possible to automatically generate notifications (e.g., by E-mail) to the corresponding experts to require further analysis of QCRs.

3.4 Quality flags

HCSS-QCR-230 The QCR shall include an automatically generated quality flag.

HCSS-QCR-240 It shall be possible to manually modify the automatically generate flag.

HCSS-QCR-250 The quality control flag in the QCR shall be queriable.

4 Product definition

4.1 Introduction

All the quality information for a giving observation will be stored into a unique Product named QualityContext (aka Quality Report). This product will be stored into the database under the observation it depends on and will be accessible to the user through the “quality” observation's field.

4.2 Content

The QualityContext will contain the following fields:

Field	Comments
Observation Id	Reference to the observation this instance belongs to
Software version	HCSS version, pipeline's version, ... (TBD)
State	Possible states are: ● PENDING ● PASSED ● FAILED
Action	Legal actions depend on the value of the QualityContext's state. When the state value is "PENDING" the possible actions are: ● DELIVERED FOR QCL1 ● DELIVERED FOR QCL2 ● DELIVERED FOR QCL3 When the state value is "FAILED" the possible actions are: ● DELIVERED FOR RESCHEDULING ● DELIVERED FOR REPROCESSING ● DISCARD When the state value is "PASSED" the only possible action is NONE.
Quality Flags	Most of the quality information generated during the SPG processing should fall under this category. A pre-defined list of quality flags should be defined per instrument. These flags will be stored as METADATA into the QualityContext as they should be composed of simple types (strings, numbers and booleans), but also allowing them to be part of the searching fields in any possible query. Two possible solutions are proposed: First proposal: ● All the quality flags are defined as string METADATA parameters. ● The METADATA tag constitutes the actual quality flag, ie: "SAT_TEMP_OUT_OF_RANGE" ● The METADATA value will be a string with an optional comment., ie: "temp value X for a range of [a, b]" Second proposal: ● Quality flags can be declared of any of the legal METADATA types ● The METADATA tag is just a flag identifier, ie: "SAT_TEMPERATURE" ● Quality information is included as a string, number or boolean into the METADATA value., in this example: LongParameter(18). Also common to the two proposals (TBC): ● Only the flags that are meaningful for the current observation are included into the QualityContext. ● Quality flags can be declare public or private.

Field	Comments
Pipeline's logs	A table containing all the logs produced during the pipeline's execution, including those in the pre and post-processing SPG phases. The HCSS framework provides also additional categories to use into the Loggin subsystem. This gives the developer the means to filter the information available through a new criterion apart from the source or the log's level: the log type (quality/others).
Previews	Previews or snapshots of the scientific data. TBD
Users' comments	Comments on the quality data written by the different actors involved into the Quality Control of the observation. As the unique actor allowed to modify the QualityContext, the SPA is the responsible of updating the QualityContext whenever a new input must be included. The fields stored for every comment are: ● Time stamp: when the comment was created ● User: Identifier of the person writing the comment ● Text: the comment itself as a string As for the quality flags, these comments can be tagged as public or private.