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DESCRIPTION OF ESA'S SENSOR PERFORMANCE, PRODUCTS AND ALGORITHMS MONITORING

In response to action WG-II 36.20, this paper describes ESA's approach to product development, verification and implementation into operations.

ANNEX I

esa DOCUMENT

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Sensor Performance, Products and Algorithms Functional Baseline Document

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1 INTRODUCTION

1.1 Background

In order to facilitate the highest-level requirements definition of the various functions of the ESA Earth Observation G/S Infrastructure, this Ground Segment has been divided into the following domains:

- Flight Operations (FO)
- Payload Data Handling (PDH)
- Sensor Performance, Products and Algorithms (SPPA)
- Coordination and Control (CC)
- Standard User Access (UA)
- Exploitation Services (ES)

The present document defines the functional baseline of the Sensor Performance, Products and Algorithms (SPPA) activities and in particular those related to:

- Operational data and product quality control
- Product verification, calibration and Validation
- Instrument Calibration
- Sensor Performance monitoring and Assessment
- Algorithm and processing chains development, verification, maintenance and evolution

The audience of the present document is:

- ESA staff and industry during the definition of Phase B of Earth Observation Missions,
- ESA staff during phase C/D of Earth Observation mission projects as input to the preparation of the specifications for industry,
- ESA staff during the exploitation of the mission for the maintenance and the evolution of the multi-mission infrastructure,
- ESA staff responsible for the preparation and the implementation of phases E1 and E.

It should be noted that the level of definition contained in the present document is aimed at the collection of Earth Observation (EO) mission performance monitoring requirements at the highest level. The Scope is NOT to provide specifications in view of an industrial implementation, for which a further step of refinement is required.

In addition, the information provided in this document is, in principle, applicable to any EO mission. Specific mission requirements are not covered in this technical note and should be described in a mission specific document.

1.2 Scope of the SPPA Activities

The scope of SPPA activities encompasses a wide spectrum of tasks. All these tasks have the same common target: to serve the end user with EO data produced with the best overall system, composed of the flight and ground segment.

The objective is to meet and exceed the scientific and operational mission requirements expressed in the Mission Requirement Document and in the Phase E Management Plan (PEMP).

The SPPA activities are:

- Routine Calibration and Validation - The task consists of the definition and the monitoring of Calibration and Validation activities as well as the reporting. It includes, for example, the management of the transponders for ASAR, the scatterometer, the Radar Altimeter and Rainforest monitoring. It covers also the coordination of Balloon, Aircrafts and Oceanographic Campaigns as well as buoys and the management of the support of ECMWF.
- Algorithm Development, Verification and Maintenance.
- Instrument Processor (IPF) Development, Verification and Maintenance.
- Data Quality Control, including the definition of the procedure, the definition of the requirements, the design and the development of QC Tools and the routine data monitoring and product QC.
- The support to EO Help for technical requests.
- The reporting, including the Mission Status and evolution (e.g. instrument cyclic and monthly reports), the Mission Documentation (e.g. product handbook) and the Functional reporting (e.g. operation monthly report).

1.3 Overview of SPPA Activities

The domain “Sensor Performance, Products and Algorithms” is the element of the Payload Data Ground Segment (PDGS) responsible for the following activities:

- Operational data and Product Quality Control (QC)
- Product verification , calibration and validation
- Instrument calibration
- Sensor performance monitoring and assessment
- Algorithm evolution and prototyping
- Instrument Processing Facilities (IPF) implementation, development, verification, maintenance and evolution
- Product specification definition, maintenance and evolution

The SPPA produces the following data and information:

- Mission and Sensor performance reports – mainly intended to detect any possible instrument or product anomaly in the shortest delay (phase E1 and E).
- Processing configuration settings and auxiliary data validation and generation.
- Data quality flags – Identification of degraded data quality in the data catalogue and in the data inventory (phase E1 and E).

- Product quality disclaimer – to highlight a particular problem identified on a product or set of data, and the special measures to be taken on the user side when using these data (phase E1 and E).
- Product quality anomaly investigation reports – for anomalies raised automatically by the routine end product QC, for anomalies raised by the users via the EOHELP or for anomalies identified during the systematic product QC (phase E1 and E).
- Instrument anomaly reports and investigation results – instrument anomalies are often detected via the analysis of mission products. The investigations triggered by this anomaly detection are performed with the support of the Post-Launch Support Office (PLSO), which is the official interface with the instrument industry.
- Processing Algorithm Baseline.
- Algorithm evolution, implementation requests and Data Processing Model (DPM) maintenance (phases E1 and E), IPF upgrade definition and support to the verification phase (phases C/D, E1 and E).
- Documents and notes to support users in the exploitation of the EO mission products – typically the product handbook (phases D, E1 and E).
- Calibration and Validation activity plan (phases E1 and E).
- Instrument configuration setting.
- Instrument Commanding for Calibration.
- Calibration Algorithm Baseline.
- Support to the mission implementation, phases A, B and C/D – issue of requirements and Technical notes for product QC and mission monitoring, review of documents, participation to project reviews.
- Instrument Commanding for complex background missions.
- Product specification generation and update (phases C/D, E1 and E).

In order to generate the above information, SPPA requires the following systematic input:

- Quality parameters from the screening facility and any auxiliary information produced during screening.
- Data from the instrument simulators and instrument testing, to evaluate the algorithm performances and to test the IPF during the development phases.
- Data from the processor prototypes to assess the evolution of the processing algorithms and to prepare new products.
- EO mission data products – routine or on-demand access to a defined set of EO mission data products is required. This could be either in Near Real Time (NRT) or Off-Line (OFL) according to the defined activity plan and based on the mission characteristics (e.g. systematic product QC, anomaly investigation).
- Specific products like products generated from data acquired while the instrument is in Calibration mode – NRT access to these products is mandatory for a timeliness detection of instrument anomalies and the update of the calibration plan.
- Correlative data for Calibration and Validation acquired by external parties.

A contextual view of the SPPA interfaces with functional entities is given in Figure 1.

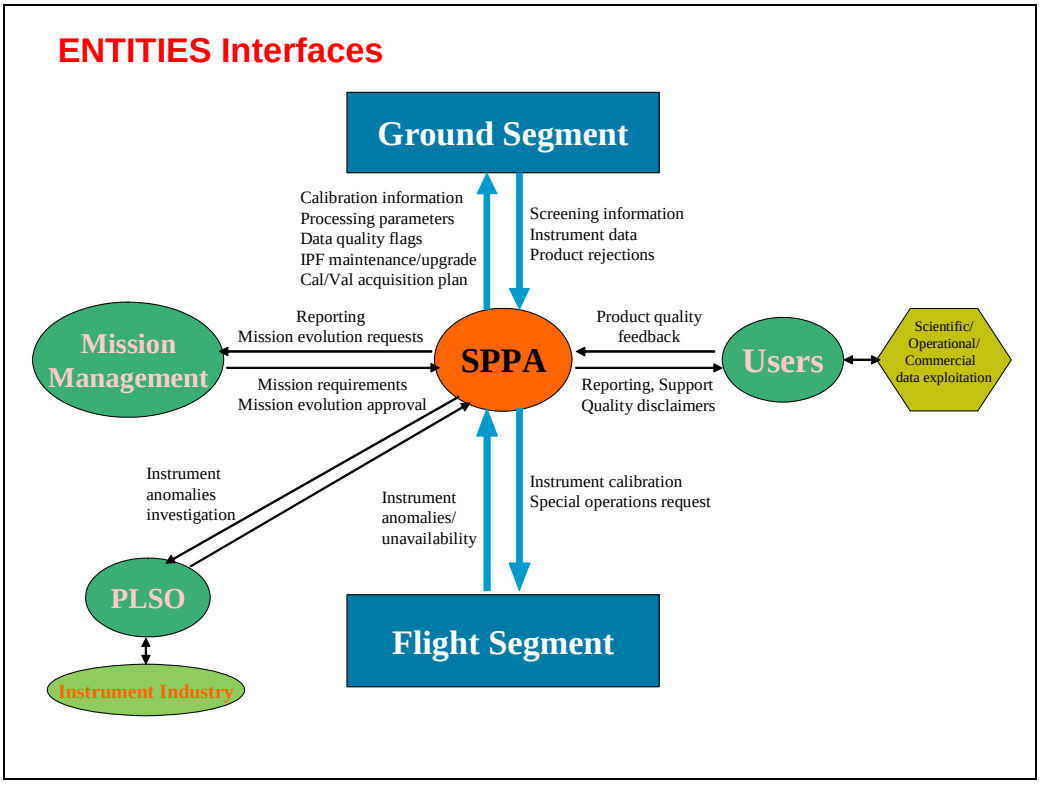


Figure 1. High level overview of SPPA interfaces.

To perform its tasks, the SPPA interacts with the following domains of the Multi-Mission G/S Infrastructure:

- Payload Data Handling (PDH)
  - Distribution of Auxiliary Data File (ADF) after production and access to these ADF when historically archived.
  - Distribution of instrument setting files (called CTI for Envisat).
  - Systematic access to data products for specific and routine quality control.

- Standard User Access (UA)
  - Dissemination of planning and processing requests for Calibration and Validation products
  - Access to the Data Catalogue

SPPA also interacts with the Flight Operation Segment (FOS) through the:

- Flight Operation Control Centre (FOCC) located in ESOC

- Reporting on the on-board sensor and platform anomaly
- Distribution of Auxiliary Data Files (ADF)
- Distribution of Configuration Table Interface files (CTI)

In addition SPPA interacts with the following entities:

- Mission Management Office (MMO) – Phase E Management Plan (PEMP)
- Post Launch Support Office (PLSO) – Instrument anomaly investigation
- User Community
- Ground Segment Development team

1.4 High Level SPPA Implementation

1.4.1 SPPA SupPort entities

In order to cover this large spectrum of tasks and to preserve the independence between scientific and operational activities, SPPA has put in place three support entities. Together with the ESA staff responsible for the coordination and the management of the various tasks, three entities have been identified:

- The Expert Support Laboratories (ESL)
- The Quality Centres (QCentres)
- The Validation Teams (PIs)

1.4.1.1 Expert Support Laboratories

The Expert Support Laboratories (ESL) provide scientific support to the mission. In particular, they are responsible for Algorithm Development, Verification and Maintenance. In support to this activity they are responsible for the development and the maintenance of the IPF prototype. The main output of this activity is the delivery of the Detailed Processing Model (DPM), Input Output Data Definition (IODD) and Test Data Sets (TDS), required by the QCentres for the maintenance of the IPF. The ESL support ESA for scientific investigation and in the overall scientific management of the mission.

1.4.1.2 Quality Centres

The Expert Quality Centres are in charge of the long-term monitoring of ESA's EO mission sensor performances and also of the routine product quality control and maintenance for ESA and Third Party Missions. The QC Centres also provide support to ESA, investigate anomalies, ensure the correct monitoring and updating of the ESA Ground Segment configuration, which includes the evolution, analysis and debugging of the operational chains (High Rate/Low Rate) and software facilities, as well as support to calibration and validation activities.

1.4.1.3 Validation Teams

The Validation Teams (for example the Meris and AATSR Validation Team (MAVT), the Atmospheric Chemistry Validation Team (ACVT) and the ESA Stratospheric Aircraft and Balloon Campaigns (ESABC) Team for Envisat) are supporting ESA in the product validation. In

particular, they execute Validation campaigns and provide support for the Validation campaign data analysis.

1.4.1.4 SPPA Activities coordination

The coordination of the SPPA Support Entities is done in the Quality Working Groups (QWG), under the management of SPPA, and is the responsibility of ESA. The work of the QWG is organized in response to the PEMP, which contains the Mission Requirements, and in coordination with the Mission Manager for programmatic and financial matters. The organisation of the SPPA and QWG is shown schematically in Figure 2. Technically, the impact evaluation of the ground segment evolutions is assessed by the Configuration Control Board (CCB) that supervises the PDGS evolutions.

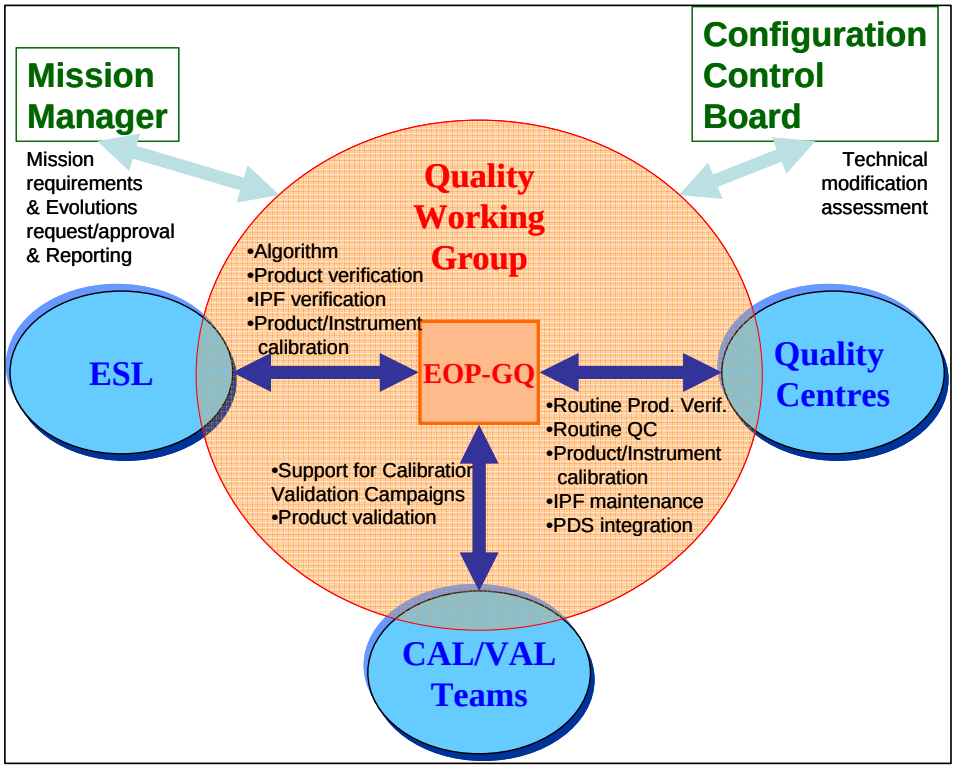


Figure 2. High Level coordination with SPPA support entities and ESA entities.

1.4.2 Facilities

SPPA activities are supported by a set of systems and facilities (see Figure 3). These systems are required for instrument and processor monitoring, data analysis, anomaly detection and investigation, the generation and validation of CTI and ADF, and the validation of prototypes and IPF evolutions.

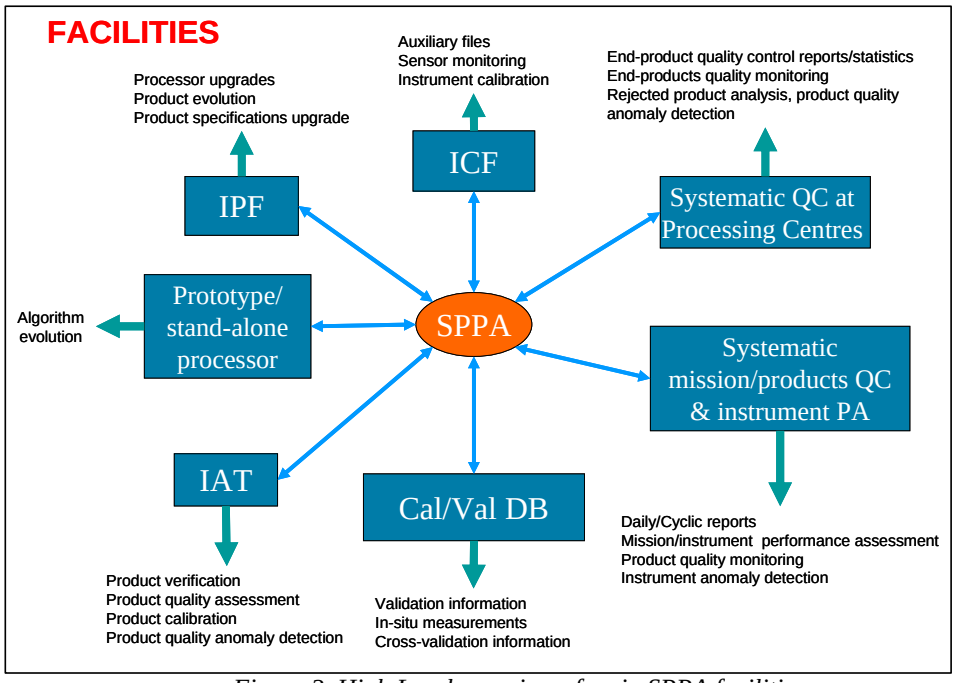


Figure 3. High Level overview of main SPPA facilities

1.5 Supported Missions

Mission and data quality control, as well as instrument performance monitoring, are essentially multi-mission activities. SPPA supports both EO ESA missions and EO Third Party missions; the SPPA activities are tailored to the specific characteristics of each EO mission. The difference between ESA EO missions and Third Party missions resides mainly on the level of control over the mission, including the instrument settings, the processing algorithm, the processor implementation and maintenance, the product specification definitions and maintenance, and the level of control over the quality of data released to users. Therefore, the level of QC and monitoring implemented by SPPA generally differs between ESA and Third Party missions.

The supported in-orbit ESA EO missions are listed below:

- ERS
- ENVISAT

The upcoming ESA EO missions to be supported are:

- Cryosat-2
- GOCE
- Aeolus
- SMOS
- Sentinels
- Earth-Care

and typically any new ESA EO mission.

The supported Earth Observation Third Party missions are:

- LandSat
- SPOT (low level involvement)
- AVHRR-SeaWiFS (low level involvement)
- MODIS (low level involvement)
- ALOS PALSAR
- ALOS PRISM/AVNIR-2
- KOMPSAT (2&5) (upcoming)

Past missions are maintained and these activities are mainly limited to product QC, to new product definition/implementation/verification, to algorithm evolution and corresponding IPF implementation, and to the reprocessing of mission archives.

2 DEFINITIONS, ACRONYMS AND ABBREVIATIONS

2.1 Definitions

These definitions are extracted from the CEOS working Group on Calibration and Validation and ISO 9000 Definitions.

Calibration: The process of quantitatively defining the system (including the instrument) response to known, controlled signal inputs.

Validation: The process of assessing by independent means the quality of the data products derived from the system output.

Geophysical Validation: The process of assessing by independent means the quality of geophysical data products derived from the system.

Verification: The process leading to the confirmation that the specified requirements on a system have been satisfied.

Quality Control: The set of activities or techniques whose purpose is to ensure that all quality requirements are being met. In order to achieve this purpose, processes are monitored and performance problems are solved.

2.2 Acronyms

ACVT	Atmospheric Chemistry Validation Team
ACD	ADF Configuration Document
ADF	Auxiliary Data File
ATBD	Algorithm Theoretical Baseline Document
CC	Coordination and Control
CCB	Configuration and Control Board
CEOS	Committee on Earth Observation Satellites
CIF	Configuration Implementation Form
CRD	Computational Resource Document
CTI	Configuration Table Interface
DPM	Detailed Processing Model
DPQC	Data Processing and Quality Control
EO	Earth Observation
ES	Exploitation Services
ESABC	ESA Stratospheric Aircraft and Balloon Campaigns
ESL	Engineering Support Laboratories
FO	Flight Operations
FOCC	Flight Operation Control Centre
FOS	Flight Operation Segment
GMES	Global Monitoring for Environment and Security
IAT	Interactive Analysis Tool
ICF	Instrument Calibration Facility
IECF	Instrument Engineering Calibration Facility – Envisat ICF
IODD	Input Output Data Definition
IPF	Instrument Processing Facility
ISP	Instrument Source Packet
MAVT	Meris and AATSR Validation Team
MMO	Mission Management Office
NRT	Near Real Time
OAR	Observation Anomaly Report
OFL	Off Line
PDGS	Payload Data Ground Segment
PDH	Payload Data Handling
PEMP	Phase E Management Plan
PLSO	Post-Launch Support Office
QC	Quality Control
QWG	Quality Working Groups

SCR	Software Change Requests
SPPA	Sensor Performance, Products and Algorithms
SPR	Software Problem Reports
TDD	Test Data Definition
TDS	Test Data Sets
TPD	Test Procedure Document
UA	Standard User Access

3 REFERENCE DOCUMENTS

3.1 Generic Reference document

N/A

3.2 Mission Requirements Documents and Implementation Plans

- Sentinel-1 Mission Requirements Document
- Sentinel-2 Mission Requirements Document
- Sentinel-3 Mission Requirements Document
- MIP SMOS
- MIP AEOLUS

3.3 Other Mission specific reference documents

- Phase-E ENVISAT Cal/Val Plan
- ERS Cal/Val Plan
- Sow for the AMALFI Multi-Mission Facility, MM, PGSI-GSEV-EOPG-SW-05-0001
- Development of an operational Quality Control Tool: QCC – Quality Control Cryosat, XCRY-GSEG-EOPG-SW-04-0001
- Quality Analysis and Reporting Computer Statement of Work, PO-SW-ESR-GS-0022
- Statement of Work for Quarc DIMs development, ENVI-CLVL-EOAD-SW-02-0007

4 FUNCTIONAL BASELINE REQUIREMENTS

4.1 SYSTEMATIC QUALITY CONTROL

Systematic Quality Control refers to quality control activities performed on a routine basis on a large percentage (or on the complete set) of generated data products for a mission. They are classified here as expert QC activities performed at the QC centres and as basic systematic QC activities performed in real-time at the processing centres. In the first case, the result of the analysis is not necessarily available in NRT and there may be no feedback to the PGS. In the second case, the analysis is performed right after the product generation and the outcome can provided to the PGS through a clearly defined interface for taking appropriated actions depending on the QC result. The scope of both types of systematic QC is also different, as described in the next sections.

4.1.1 Basic Systematic NRT Product Quality Control at Processing Centres

Scope: The purpose of this quality control is to perform a basic QC in real-time on all products generated by the PGS in order to identify any potential product anomaly.

The scope can be extended, depending on the mission requirements, to: stopping the product dissemination if necessary, ensuring the consistency between the user order and the generated product and providing a feedback to the ground segment for taking the right actions depending on the result of the quality check.

Output: The main result of this QC activity is the NRT identification of basic quality anomalies.

Depending on the mission requirements, this activity interfaces with the PGS elements, through a well defined ICD, to provide a quality statement (e.g. “Passed” / “Failed”), which determines whether the product is to be sent to disseminated to the final user (the final user being an actual user, the rolling archive or the LTA). In addition, a QC feedback is sent to the PGS and a QC report, together with a product label, are generated.

Timeliness: This QC should be performed right after the product generation. Depending on the mission requirements, this QC can be performed before product archiving (LTA or rolling archive for NRT products) or product dissemination (for on-demand products).

Mission time interval: This QC shall be performed at from the start of Phase E at least. A pre-operational QC analysis (i.e. QC check is performed but the result is not used to prevent the product distribution, it is only to refine the inspections to be applied and the evolution of the results during Phase E1) during Phase E1 is highly desirable.

Data Applicability: This QC shall be applied to all products generated by the PGS, both for systematic and on-demand products and for NRT and off-line processing. This QC should be able to handle products from different missions/sensors and apply appropriated quality checks to each one of them.

Mission applicability: The PGS integrated QC analysis should be performed on data generated by any ESA mission. Requirements for the PGS integrated QC are expected to be mission-independent. The product inspection definition is instead expected to be mission- / instrument-dependent. Specific interfaces with the PGS are expected to be mission-dependent and can be adapted as necessary with no impact on the facility design.

Location: This QC should be performed at all processing centres, including both the stations and the PACs (for the Envisat case). A reference facility, gathering the results of the facilities operating at the different processing centres, will be available at ESRIN.

Operation: This QC is performed by the processing centres operators.

Requirements: The main requirements for this QC activity are provided hereafter. More details can be found in [ ] and [ ].

- Any generated product should be quality checked by the systematic QC facility:
- Failed products should not be distributed to the users and will be flagged in the inventory/catalogue.
- The QC facility should interface with the PGS to provide a timely feedback on QC results and allow the PGS to take appropriate action regarding the product dissemination.
- The QC facility should be able to handle products from different missions/sensors and apply appropriate quality checks to each one of them.
- The systematic QC operations should have a minimum impact on the PGS's overall performance.
- The systematic QC should be as automatic as possible as it shall require minimum operator intervention. Operator intervention might be needed only in the case of image products.
- Minimum time delay should be introduced in cases where problems are detected by the end-user quality check and there is a need for a detailed product analysis before distribution (if possible) to the user.
- It should be possible to re-configure the specific analysis (QC checks) performed by the quality check facility at any time. Configuration control of applied quality checks should be maintained.
- It should be possible to retrieve statistical information on the quality of products from the QC facility. An automatic reporting on failure/success statistics should be produced.
- In the case of multiple processing facilities in the PGS, the QC facility should be operated in all centres. Results from each centre should be available to users with appropriate privileges.
- Resulting product quality reports should be made available to the users. As far as possible, QC results should be delivered to the user together with the product.

4.1.2 Expert Systematic Quality Control

The expert systematic quality control corresponds to the short and long-Term mission, instrument and product performance monitoring.

Scope: The purpose of this QC analysis is:

- to identify any potential anomaly arising from the instrument down to the processing chain as soon as possible after data acquisition,
- to perform a short- and long-term mission performance monitoring, which includes the consistency verification between expected mission products, generated mission products and auxiliary information usage,
- to perform a long-term instrument performance monitoring, which includes the monitoring of key instrument performance parameters annotated on or derived from the mission data products (it is assumed here that TLLM monitoring is performed at ESOC),
- to perform a long-term product quality monitoring, which includes the monitoring of the product quality key parameters annotated on or derived from the mission data products,
- to ensure that product quality requirements are systematically met,
- to perform systematic data validation and cross-comparison with external references (in this context, this activity is mission dependent, and applies particularly to altimetry missions).

The scope of the systematic quality control is illustrated in Figure 4, which shows the main steps of this activity as well as the major outcomes. Access to mission data products and extraction of required information is a generic activity which can be considered as mission independent. The analysis to be performed is very much mission-dependent and this may be reflected in the final reporting. The analysis of mission performance is, however, considered to be mission-independent. Even if the actual interfaces with mission planning and other auxiliary information may vary from mission to mission, the outcome and requirements will be generic.
Monitoring of mission and instrument performance and product quality is a routine activity, which should be performed throughout the entire mission, from the start of the Commissioning Phase and continuing during Phase E.

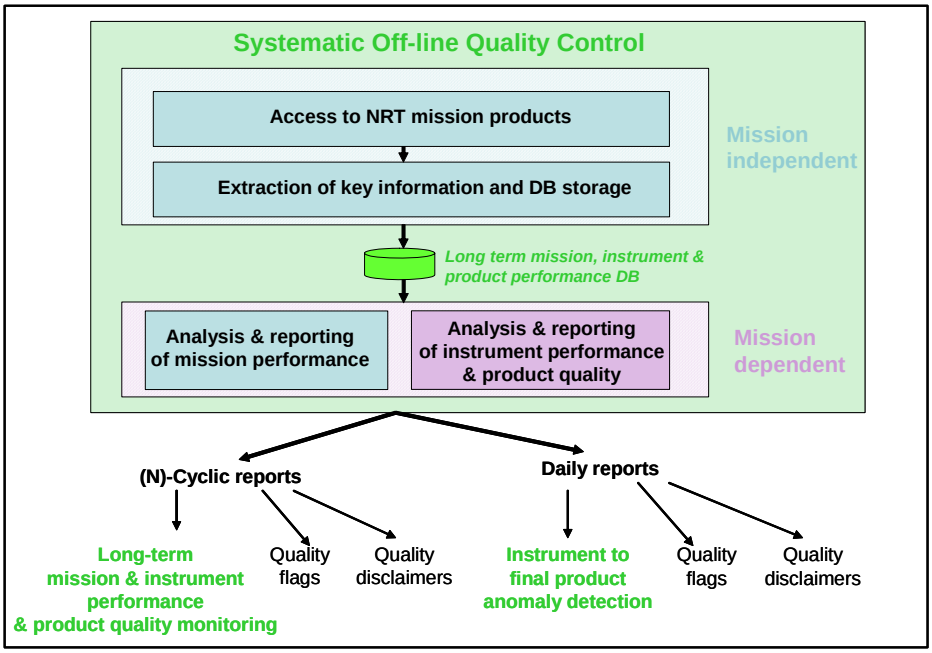


Figure 4. Steps involved in the systematic off-line QC and the main outcomes of the activity.

Output: The main results of the expert systematic QC are:

- a daily QC report, which includes the necessary information to identify, with the minimum delay, any mission, instrument, processing or PGS anomaly that is impacting data quality.
- inputs to the cyclic report, which includes all the necessary information to monitor the long-term mission performance, instrument performance and product quality.
- quality flags, to mark corrupted data in the data inventory (and finally on the data catalogues).
- quality disclaimers, to provide information to the users on quality anomalies affecting data already distributed (e.g. for NRT disseminated products).
- validation reports (this is mission dependent in this context)

Timeliness: The extraction of key parameters should be performed in NRT, as soon as the mission products are available. The result of the analysis may be available in NRT or off-line, depending on the type of result and on the mission requirements. The analysis and reporting shall be performed:

- between a few hours and 1 day after data acquisition for the identification of potential anomalies, based on daily performance reports.
- between 1 day and 1 or more cycles after data acquisition for the long-term instrument performance and product quality monitoring, based on cyclic performance reports.

Mission time interval: The expert QC analysis should be performed from the start of Phase E1 and continue during the Phase E period.

Data Applicability: The expert QC analysis should be performed on systematic products (typically Level-1 and Level-2, but not necessarily restricted to these) generated in NRT.

Mission applicability: The expert QC analysis should be performed on data generated by any ESA mission. Applicability to Third Party Missions depends on the TPM requirements. Detailed requirements for expert QC are expected to be:

- Mission independent regarding the data access and mission monitoring requirements
- Mission dependent regarding the key parameters to be monitored and the required analysis and reporting information.

Location: The expert systematic product quality control shall be performed at the QC centres.

Operation: The expert QC operations should be performed by the expert at the QC centres.

Main requirements: The expert systematic QC is based on the assumption that all acquired data are systematically processed (e.g. to Level-0/1/2/or higher products) and that these data are made available in NRT to the expert systematic QC facility. The main high level requirements for this QC facility are:

- The routine product quality control activity requires to:
  - systematically retrieve/have access to:
    - any NRT mission products systematically generated
    - the restituted mission planning, instrument configuration and logs from the ground segment for any interval during the mission history
    - any on-board anomaly and special on-board activity (such as uploading of CTI table, maneuvers, AOCS configuration changes, etc) and keep track of this information (in an electronic form)
    - include functionalities for the DB query, analysis and reporting, both automatic reporting (e.g. daily report) and on-request reporting (this is mission dependent)
  - systematically perform:
    - the extraction of selected key parameters from generated products (sets of parameters that are mission-dependent)
    - the storage of these key quality parameters in a QC database
    - the background and automatic analysis of selected sets of on-line NRT products (this is mission-dependent)
  - produce:
    - results in the form of daily/cyclic reports, which should be available on-line
    - a detailed and comprehensive comparison of acquired data with respect to the acquisition plan
    - quality flags and quality disclaimers
    - separate QC results per mission and per instrument.

- be:
  - flexible to configure different and new types of analysis and expected results
  - configurable in terms of parameters to be monitored, their frequency and their averaging in time/around orbit
  - able to automatically generate the main content of the reports. The result of the systematic QC is one of the inputs to the daily/cyclic reports but not necessarily the only one[1] (content of the reports is mission dependent).
  - under configuration control to ensure the traceability of any sensor parameters and changes through the mission.

- In addition:
  - All sensor anomalies shall be analyzed and logged in a specific anomaly management tool.
  - The investigation of any anomaly should lead to the delivery of a report and the definition of corrective actions if applicable.

4.2 PRODUCT AND INSTRUMENT CALIBRATION

Scope: The first objective of this activity is the monitoring of product calibration and the estimation of updated calibration information as required achieving the expected product quality. The scope of the instrument calibration activity is to ensure the optimum instrument settings are applied on-board.

For some instruments (particularly for imaging instruments), the product calibration activity is closely related with the in-deep product analysis and verification that mission data products meet the expected quality requirements. In this case, this activity allows also the investigation of instrument and/or processing anomalies affecting data quality and it supports the instrument calibration and performance monitoring activities for the check on instrument drift and degradation.

In both cases, for the product/instrument calibration and the product quality verification, an expert interactive analysis is required, based on instrument/mission type specific tools.

A "Product Calibration Plan" should be defined for phases E1 and E, and applied throughout the complete mission lifetime. The calibration plan shall describe the calibration requirements applicable to each product type and to each mission phase.

[1] Note: For Envisat, these are the daily reports from QUARC and the specific daily reports per instrument, implemented by dedicated tools.

Background: Product calibration is based on one of the following approaches, depending on the instrument characteristics and mission requirements:

Use of on-board calibration devices for product calibration: For specific applications, like ocean colour or vegetation monitoring, the requirements in term of absolute becomes more and more stringent. In order to achieve it, well characterised on-board devices shall be used. Following the calibration plan, during calibration mode, products are generated. The analyses of those products allow to derive calibration parameters or to verify calibration model.

External calibration: The in-flight product calibration is performed on products acquired over defined calibration sites (particularly for imaging instruments, such as SAR instruments) or on global data sets (particularly for global missions such as altimetry). Calibration sites are specific and well-characterized observation zones (e.g. the Amazon rainforest for the SAR and Scatterometer, Antarctica and Ocean coldest zone for Hyper-Frequency Radiometry) or areas with specific ground equipment. In some cases, on-ground measurements are replaced by measurements derived from models or performed by other sensors (in this case calibration becomes inter-calibration). Although this in-flight product calibration concept is generic, it is not applicable to some missions, like Goce and Swarm for example, as there are no means to compare on-ground and data derived measurements.

Cross-calibration: Cross-calibration between sensors is nominally performed to calibrate one sensor with respect to the others, but also to support instrument performance monitoring by the quantification of existing differences (biases, drifts, degraded behavior, etc.).

Output: The main results of the product/instrument calibration are:

- Short- and Long-term product calibration monitoring
- Updated calibration information, to be used as input for auxiliary file generations (used finally by the processing facility to produce improved quality products)

For instruments for which this activity includes as well an in-deep product verification against the quality requirements, the additional outputs are available:

- A long-term database of detailed product quality measurements and calibration results
- Detailed product quality analyses and anomaly investigation reports
- Short- and Long-term detailed product quality monitoring

Mission time interval: The product quality verification and product calibration activity should be performed from the start of Phase E1 and continue throughout the Phase E period. Ideally, the activity should start before launch, using simulated products and instrument test data.

Timeliness: The product quality verification and product calibration is mostly performed off-line, usually taking between a few hours and several days from data acquisition (this delay being

mission-dependent). Although the analysis is performed off-line it may be based for some instruments on NRT, therefore the access to all NRT products is essential.

Data applicability: The product quality verification and product calibration may be performed on different types of mission products, depending on the instrument type:

- data acquired over specific calibration sites (this is particularly the case for imaging instruments (SAR and optical) but less applicable to other types of instruments such as atmospheric chemistry instruments).
    - on-demand products over the calibration sites.
    - systematic products over calibration sites.
- global NRT systematic products (for global type of missions) and of-line consolidated products.

Mission applicability: The product calibration and instrument characterisation activity shall be performed for any ESA mission. The applicability to Third Party Missions will be mission dependent and can be adapted to the TPM requirements as necessary. Detailed product calibration and instrument characterisation requirements are expected to be highly instrument/mission dependent.

Location: The product verification and calibration facilities for existing operational missions shall be performed at the QC centres or ESL (mission dependant). ESRIN is a reference location, although not necessarily operational.

Operation: The product verification and calibration activity shall be performed by the experts at the QC centres or ESL (mission dependant), with ESA support, and results shall be endorsed by the QWG.

Main requirements: The main requirements for the product calibration and instrument characterisation are listed hereafter:

- It should be possible to plan dedicated acquisitions over calibration sites
- It should be possible to access the acquired data in NRT after the overpasses.
- It should be possible to interface with the on-ground equipment (e.g. transponders) for calibration operations.
- It should be possible to generate control information based on the foreseen acquisition/calibration plan and send it to the ground equipment.
- Feedback information from the ground equipment should be recovered and stored for analysis.
- It should be possible to keep all calibration measurements, including ground campaign and other sensors information, in a calibration database [e.g. NILU]
- Specific product calibration algorithms and procedures are sensor dependent and should be performed using dedicated interactive analysis tools (IATs).
- A configuration control should be maintained for the calibration parameters, which can evolve throughout the mission life-time [e.g. IECF for Envisat]
- When applicable, regular instrument cross-calibration should be performed for the characterisation of the instrument performances.

- Instrument cross-calibration should be performed, where applicable, to ensure the continuity of the long term record.
- Instrument models (e.g. antenna model for SAR) developed pre-launch (usually by the instrument manufacturer) should be integrated and exploited during Phase E1 and Phase E calibration activities
- External calibration sites should be characterised and calibrated when applicable.
- Product quality requirements should be verified against the product specifications. This should be interactively performed using specific IAT facilities. (Note that product quality requirements to be verified are strongly sensor dependent as they are the IATs.)
- Product quality requirements verification needs access to specific products (e.g. over calibration sites). These products should be defined in the Cal/Val plan (Commissioning Phase plan during the C.P. and in the Phase-E Cal/Val plan for the routine phase).
- Products required to perform the product quality verification should be made available to the IAT in NRT.
- Product verification results (in terms of quality requirements) should be stored by the IATs on dedicated databases and should be used in routine product quality reporting.
- The results of the Product verification activity should be stored by the IATs on dedicated long-term databases in preparation for long-term instrument and product monitoring.
- Any calibration product should be available to ESL & QC Centres in NRT.

4.3 GEOPHYSICAL VALIDATION

Scope: As defined by the CEOS, geophysical validation is: “The process of assessing by independent means the quality of geophysical data products derived from the system”.

A “Product Validation Plan” should be defined for phases E1 and E, and applied through the complete mission lifetime. The validation plan shall describe the validation requirements applicable to each product type and to each mission phase.

Background: Usually, product validation corresponds to the geophysical validation applied to Level-2 (or higher) products. A Product Validation Plan should be defined and applied through the complete mission lifetime.

Generally, product validation requires comparison to external references and this could be models, remote sensing or *in situ* data (e.g. buoys). Hereafter, the terminology “Correlative Data” covers these three sources of data used for comparison. This definition includes other satellite datasets required for validation.

Timeliness: Product geophysical validation is a complex and lengthy process and results are not available in NRT. Preliminary product validation results are obtained at the end of the “Validation Phase” and refined/reviewed /upgraded as required during the mission lifetime. Depending on the instrument type and product type, the validation requirements (including the time required for

achieving the validation results) evolve through the mission life time. The "timeliness" evolution through the mission shall be documented in the "Product Validation Plan".

Data applicability: Product validation is by definition performed on Level-2 or higher level mission data products. Product validation is basically performed on global data, processed NRT and/or on off-line consolidated and also on re-processed data.

Mission applicability: Product validation should be performed for any mission for which Level-2 or higher level products are available.

Output: The main result of the product validation activity are the validation results, which may confirm the suitability of the mission data for use as an input into operational models (e.g. into meteorological weather forecast models) or which may highlight improvements in terms of quality and calibration before the sufficient level of validation has been reached. The required validation level is defined by the mission requirements.

Location: Product validation is performed at the validation groups premises.

Operation: Product validation is an expert operation and it is mostly performed by validation groups coordinated by ESA.

Requirements: The main high-level requirements related to product validation are provided below:

- Product validation algorithms and processes are sensor dependent and they should be applied through dedicated validation tools.
- Correlative Data information should be collocated with sensor measurements [collocation system].
- Correlative Data measurements to be used for validation should be maintained in a dedicated validation database [e.g. the Envisat Validation Data Centre managed by NILU for Envisat campaign data].
- Correlative Data should be free and easily accessible to the user validation community.
- Validation may require the use of on-ground radiometers or other instruments. As far as possible, those instruments should be properly characterised and their calibration should be traceable to SI standards.
- Satellite sample data over international validation sites should nominally be extracted and be made available in a common format agreed at international level.
- *In situ* measurements associated with international validation sites should nominally be made available and accessible when they exist.
- Information on the sensor of interest in the validation process should be made available to the user community in a standard format agreed by the international community.
- The validation group should nominally have access to similar information (methodology, satellite data, *in situ* data, and sensor information) from other agencies through standard protocol when possible (interoperability). The Group on Earth Observations (GEO)'s Global Earth Observation System of Systems (GEOSS) is working towards improving

harmonisation and standardisation across agencies to assist such groups in their in calibration and validation work.
- When applicable, Level-3 geophysical products should be systematically generated for quality control and validation purposes.
- *In situ* information from validation campaigns should be collected and archived. Note that the quantity of *in situ* information is particularly high during the commissioning phase and decreases during the rest of the sensor life-time.
- Acquisition & processing of data during validation campaigns should have the highest priority (after instrument safety).

Validation database: High quality *in situ* measurements are a prerequisite for satellite data product validation, algorithm development and many climate-related inquiries. Regarding the validation databases, the following requirements can be identified:
- *In situ* measurements to be used for validation should be maintained in a dedicated validation database [e.g. NILU].
- The validation data should be fully traceable.
- The database should be easily accessible and free to the validation user community.
- Protocols for validation data archiving, database population and data access should be standardised as far as possible.
- Validation data processes should follow standard protocols defined at an international level.

Validation campaigns: Specific validation campaigns are required to gather *in situ* information, particularly during the commissioning phase and with a lower frequency during the rest of the sensor life-time.

The validation campaigns can be classified as:
- permanent campaigns over defined sites,
- occasional campaigns (cruise, field measurements),
- campaigns requiring different instrument or satellite settings.

Regarding the validation campaigns, the following requirements can be identified:
- The satellite data acquired in a specific mode during a validation campaign should be clearly identified in the PGS (e.g. flagged).
- In specific cases Satellite Data should be removed from the PGS Mission data catalogue or at least made non-visible to the common user community (i.e. to those outside the Calibration and Validation Teams).
- The validation may require the use of on-ground radiometers or other instruments. As far as possible, those instruments should be properly characterised and their calibration should be traceable to SI standards. The relative instrument Characterisation document should be made available.
- The identified sites relative to a specific validation plan should be well characterised and the relative information be made available.
- Protocols for ancillary measurements should be standardised as far as possible.

4.4 AUXILIARY DATA HANDLING

Scope: The scope of this activity is the generation of instrument control tables and auxiliary files, and the configuration control of this information.

Background: Instrument control files are required for the upload of instrument calibration parameters. Auxiliary files are required by the ground segment for the correct generation of mission data products with expected quality and calibration accuracy. The content of the instrument and auxiliary files is often the results of detailed data analyses and/or long-term performance monitoring.

Output: The outputs of this activity are instrument control tables and auxiliary files, which are properly formatted, and their dissemination to the FOS in the case of the instrument tables and to the PGS in the case of the auxiliary files.

Timeliness: The generation of instrument tables and auxiliary files is performed off-line.

Mission time interval: For most instruments (but this is mission- / instrument-dependent), the generation of new instrument tables and auxiliary files is performed frequently during the commissioning phase period, the frequency decreasing throughout phase E.

Mission applicability: The generation of instrument control files and auxiliary files should be performed for any ESA mission for which instrument operations are ESA responsibility. For third party missions operated by ESA, only the auxiliary files may be required.

Location: The generation and dissemination of instrument tables and auxiliary files may be located at ESRIN/at the Quality Centres/at the Processing Centers. This should be mission configurable.

Operation: The generation and dissemination of instrument control files and auxiliary files is performed by the Quality Centres after endorsement by the QWG.

Main requirements: The main high level requirements are summarised hereafter:

- It should be possible to ingest and generate instrument calibration information in the appropriate format/structure for the on-board up-load (these are CTI files in the case of Envisat).
- Generated instrument control files and auxiliary files should be automatically checked and validated before dissemination to the PGS and to the FOS.

- It should be possible to maintain the configuration control of the instrument calibration information (creation of new files, handling of previous versions of the files, upgrading new versions to become operational).
- All the instrument parameters changes, from the beginning of Phase 1 throughout the mission lifetime, should be traceable, logged and made available through the instrument calibration facility.
- The interfaces for the CTI handling and dissemination should be described in an Interface Control Document and tested during the GSOV for new missions.
- Calibration information required for operational data processing should be inserted in the appropriated calibration files (ADF in the case of Envisat) and disseminated to the processing facilities. A strong configuration control should be maintained on the disseminated files, contents and validity. [e.g. IECF for Envisat]
- It should be possible to update the calibration files used in the PGS, also for a specific time period.
- Creation of calibration files covering a specific time period should not require the modification of any previous file version.

4.5 PROCESSING ALGORITHMS AND INSTRUMENT DATA PROCESSING

Scope: The scope of this activity is to define and maintain the processing algorithms for each mission data products and to implement and maintain the processing facility. The implementation and maintenance of the product specifications is also part of this activity. The activities required to maintain the algorithm definition and the data processor are similar to those required for the initial implementation. This section is focused on the maintenance activity. A more detailed description of the requirements related to the development can be found in ANNEX A.

Background: The activity related with the processing algorithm specifications, processor implementation and their maintenance through the mission life-time requires particular coordination. It involves the Scientific Community, usually at the origin of new/improved algorithms, the Expert Support Laboratories, usually in charge of the algorithm definition/maintenance, industry, usually in charge of the operational processor implementation/maintenance, the QWG, usually in charge of identifying quality anomalies and proposing corrective updates with the support of the ESLs.

The overall algorithm and processing facility maintenance can be considered as a continuous evolving cycle, as depicted in the graph below. The dashed steps are optional and may be required depending on the mission characteristics and requirements, the other steps are mandatory for any mission.

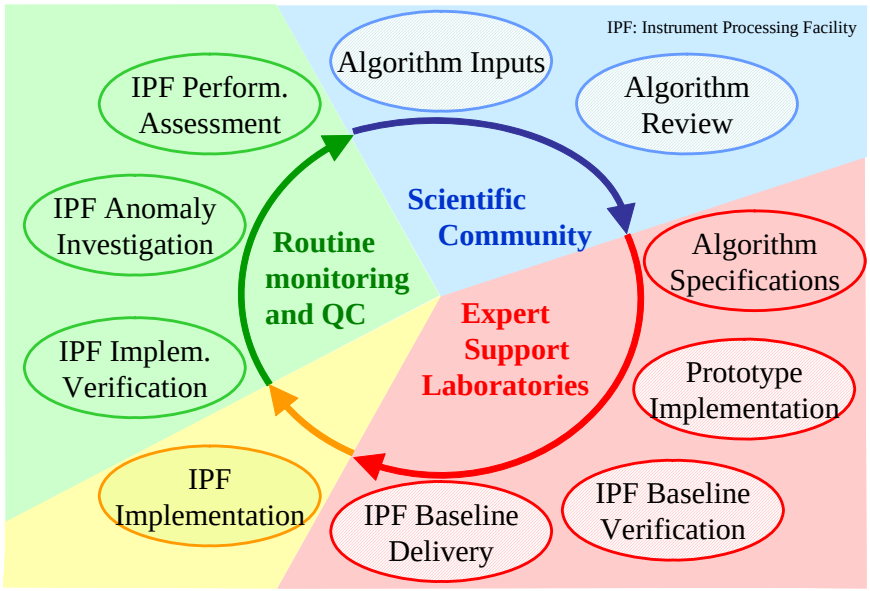


Figure 5. IPF evolution cycle, including all potential steps. The applicability of the different steps is instrument, mission dependent and it depends as well on the critically of the modifications. Applicability of shadow steps may be mission dependent while other steps shall be applicable to any cases.

The figure above provides a global overview of the activities potentially involved, which may or may not be required based on the instrument/mission requirements and depending on the criticality of the changes introduced.

The main potential variations from mission to mission are summarised below:

- Prototype processor / stand-alone processor:
  - for some instruments (particularly for new instruments), a prototype processor is implemented by the ESL and used as a reference platform during the mission lifetime, Any upgrades are first implemented in the prototype and then on the operational processor, based on the detailed algorithm definition. Acceptance of the operational processor is based on the comparison with the prototype results. This has the advantage of checking twice he correct implementation of the algorithm but may introduce a significant delay in the global cycle.
  - For some instruments (particularly for instruments with a longer history), there is no need for a prototype processor. The role of a reference platform is replaced by a stand-alone version of the operational processor. This has the advantage of shortening the evolution cycle in time and the disadvantage that errors may be harder to detect.

In both cases, however, a testing environment as similar as the operational one is necessary to perform a complete testing before integration in the operational environment. This allows the testing of any new processor update in a nearly-operation environment (GAMME is the foreseen test environment for the MMFI operational environment).

Outputs: The outputs of this activity are summarised below:

- Processing algorithm detailed definition
- Prototype processor/Stand-alone processor
- Testing environment, with characteristics similar to the operational time

Requirements: The requirements provided below are organised by different activity within the complete evolution cycle.

Data processing model or algorithm detailed definition:

For each mission, the generation of detailed processing models (DPM) according to the mission objectives are required.

- The DPM should address all the processing aspects from the instrument data stream up to the highest processing level envisaged by the mission plan.
- The DPM should address specific processing cases like specific calibration conditions (if any), and contingency handling.
- The DPM should address the computation of quality parameters derivable from the data processing
- The DPM should define all the necessary input and output data content and format, including auxiliary and external information needed.
- The DPM should define, in line with mission requirements and instruments characteristics, the precision boundary for the computed parameters to be used in testing and in the subsequent QC activities
- The DPM should be kept under configuration control during all the relevant mission phases, namely, C/D, E1, E

Processor prototype and reference test data

Depending on the mission characteristics and requirements, a data processing simulator aimed at prototyping and testing the processing algorithms and performance, following the DPM definition, should be implemented and used as a reference platform for the operational processor implementation and verification. This is particularly applicable for new instruments and for missions where a consolidated and proved algorithm is not yet available.

- The processing prototype should be able to produce reference test data sets to be used in the validation and testing activities of the mission operational processing facilities.
- The reference test data format and content should be aligned to the product specifications baseline and updated according to its evolution
- The processing prototype should be kept aligned to the DPM evolutions and put under configuration control for all the concerned phases

- The processing prototype should be integrated with the instrument simulator if this one is envisaged in the mission development plan
- The processing prototype should be able to ingest the envisaged mission data both simulated and real ones

Stand-alone processor and reference test data

Depending on the mission characteristics and requirements, testing the processing algorithms may not be necessary. This is particularly applicable for continuity missions, for which consolidated and proven algorithms are available. In this case, the role of a reference/testing platform is anyway required and implemented with a stand-alone processor.

- The stand-alone processor shall be the same as the operational processor with different interfaces, to allow running it in a stand-alone environment. It may include a emulator of the control processor interface in the PGS environment.
- Data products generated by the stand-alone processor shall be the same as for the operational processor, both in terms of content and format.
- The stand-alone processor shall offer the flexibility to easily modify as many processing parameters as possible, including those flexible in the operational version and others which cannot be modified in the operational version.
- The stand-alone processor shall be kept aligned to the operational processor and to the product specifications baseline and updated according to its evolution.
- The stand-alone processor should be able to ingest the envisaged mission data both simulated and real ones.
- The role of the stand-alone processor is particularly important for the analysis of quality anomalies and the optimisations of product quality.

Product specifications

- All the mission data products generated and/or used as input for the PDGS processing activities should be described in the Products Specification documents
- The mission data products specification should be derived from the DPM and from the mission specific format guidelines (phase C/D, E1, E)
- The product specification should be updated following the DPM evolution and format evolution and kept under configuration control during the phase C/D, E1, E

IPF testing environment

The IPF processing reference environment is a copy of the operational environment, including the IPF interfaces, which can be operated in stand-alone mode, outside the PGS environment.

- A processing reference environment should include the same interfaces as the operational environment and be maintained in line with the PGS elements.
- The processing reference environment is required to perform the integration test of the operational data processors.

The reference environment will be used in phase E1, E for:

- Testing and verification activities
- To support calibration and validation activities
- To support problem investigation
- To support QC activities

This is a different scope than for the IPF PDH integration environment.

Maintenance of Processing Facilities

- The maintenance of the Processing facility (IPF) shall be driven by the availability of Software problem reports or technical notes
- Data set scenario affected by the problem whenever relevant to the problem shall be checked and corrected.

4.6 SPECIAL OPERATIONS

4.6.1 Reprocessing

The need for the homogeneous reprocessing of mission data is mission dependent. Reprocessing should be performed in the operational ground segment, being SPPA responsible to define the reprocessing guidelines (data to be reprocessed, auxiliary files to be used for each data sets, etc).

The purpose of the reprocessing is to bring past data products at the same level of quality and format of the current data set or better. In that sense, the reprocessing of an EO data set can be:

- Partial (identified time periods: specific mission phases, cycles, etc)
- Complete (whole mission)
- Reprocessing of Level-1 products shall start from archive Level-0 data.
- Reprocessing of Level-2 products may start from Level-1 archive data.
- Reprocessed data shall replace the previous products version in the data catalogue.

Reprocessing exercises nominally should take place after the end of the Commissioning Phase and after a major processor upgrade (or a major change in the processing setting or auxiliary data information). The scope of the reprocessing exercise is the harmonization of EO Mission Data Set for the maintenance of the long term record. The long term record provides then the ability to monitor long term geophysical variations through maintenance of required levels of accuracy, continuity, calibration, stability, and documentation.

In the satellite area, reprocessing of long term record is a prerequisite for the study of long-standing phenomena (e.g. climate studies).

The EO Mission reprocessing exercise nominally occurs after:

- Shortly after the end of the commissioning phase, as initial calibration, characterisation and validation feedback is converted in a first product improvement
- After important changes to the processing algorithms (including changes to file formats and Auxiliary Data File). During the exploitation phase, the algorithm evolution process results in regular major updates at a frequency of once per 1 to 1.5 years
- After a peculiar on-board or on-ground anomaly/event (usually short reprocessing period)

The maximum completion and availability of input data set required (satellite data and ADF, etc) for the reprocessing exercise shall be guarantied.

An exhaustive database of historical events (missing data, Anomaly reports, on-board anomalies, etc) shall be maintained and will support the QC of the reprocessed data products.

4.6.2 Special instrument operations

- As far as possible, the special instrument operations shall be planned long time in advance.
- The users shall be warned (messages on the web, private email or email distribution list) when applicable about special instrument operations.
- The data acquired in a special mode shall be clearly identified (flagged). In certain cases, the data acquired and processed in a special mode shall be removed from the catalogue or at least made non visible to the user community.

APPENDIX A- IPF DEVELOPMENT AND MAINTENANCE

Instrument Processing Facility implementation and verification

This activity is initiated in two instances, for the implementation of a new Instrument Processing Facility (IPF) and for maintenance and evolutions. In principle the same requirements are applicable to both instances.

In order to initiate the implementation of a new version of an IPF in the ground segment, a complete description of the algorithm, the interfaces and the test data and procedure has to be completed by the ESL and approved by ESA. The following documentation and deliverables have to be provided in order to proceed[2]:

- Algorithm Theoretical Baseline Document (ATPD)
- Detailed Processing Model (DPM)
- Computational Resource Document (CRD)
- Prototype Processor
- Input Output Definition Document (IODD)
- ADF Configuration Document (ACD)
- Test Data Definition and Test Procedure Document (TDD and TPD)
- Test Data Set (TDS)
- Product Handbook and Product Disclaimer[3]

In case of Algorithm and/or IPF maintenance, the following items are also required:

- Software Change Requests (SCR) reflecting the,
- Software Problem Reports (SPR) reflecting the changes in the processor and the corresponding Configuration Implementation Forms (CIF)

It is the responsibility of the ESA SPPA technical officer to check these deliverables for completeness and correctness and to forward it to the Mission Manager for approval.

- If necessary and in particular during phase E1 and E of the EO mission, the Configuration Control Board (CCB) shall review the justification of the proposed changes and assess their impact on the Ground System, in particular in case of computation resources changes outlined in the CRD.

[2] Note: In some occasion this list of documentation is summarized by DPM, IODD and TDS. Even in these occasions the full set of documents listed hereafter is required.

[3] Note: During the development of a new algorithm and IPF, typically during the phase C/D, the product Handbook is produced independently of the initials version of that IPF. These items are often aligned at the end of the Phase C/D or during the phase E1. The Product Disclaimers are issued in addition to the Product Handbook to inform the users on specific deviations between the real product characteristics and the Product Handbook.

Once approved by the Mission Manager, with the potential support of the CCB, the set of documents are forwarded to the entity responsible for the coding and the configuration of the IPF. This activity is in principle based on the DPM and the IODD.

- The correctness of the completed IPF shall be demonstrated during the Factory Acceptance Test (FAT) against the TDD and TPD and the TDS.

It is in the scope of the FAT to confirm that the algorithm was implemented correctly in the IPF.

- Differences between these two processors, the prototype and the IPF, shall to be clarified by raising Non Conformance Reports (NCR), either on one or the other.

- In parallel to the IPF development process, the provision of the ADF environment based on the ACD shall be prepared, and any further computational requirements that have been accepted by the CCB, have to be prepared to allow the IPF integration.

Following a successful FAT the new IPF is integrated in the PDGS for operational implementation.

- In order to check the correct integration in the PDGS environment, the new IPF has to undergo an On-Site Acceptance Test (OSAT).

The scope of the OSAT is more to test the integration and the interfaces, rather than the functionality of the IPF itself.

The last step of that process is to perform a final verification of the IPF implementation (also called IPF validation). This activity can be scheduled either in parallel or following to the OSAT and the IPF implementation in the PDGS, a verification dataset has to be chosen to be a representative sample of historic data files.

- An IPF validation shall be performed in parallel or following the OSAT
- The Validation dataset shall cover a significantly wider set of observations than the one defined in the TDS.
- The processed data shall be analysed in order to confirm that the IPF fulfils the requirements set during the algorithm definition and therefore that the IPF is accepted.

In case there are discrepancies an investigation has to identify if these are related to

- the IPF integration in the Ground Segment,
- the implementation of the DPM and IODD in the IPF,
- the prototype,
- an incorrect translation of the scientific or technical requirements in the DPM
- an unjustified or incorrect assumptions in the scientific or technical targets

This analysis shall be then used to define actions to be taken depending on the severity of the problem.

As summary the following steps have to be performed:

1. Collection of the input document (DPM, IODD and TDS)

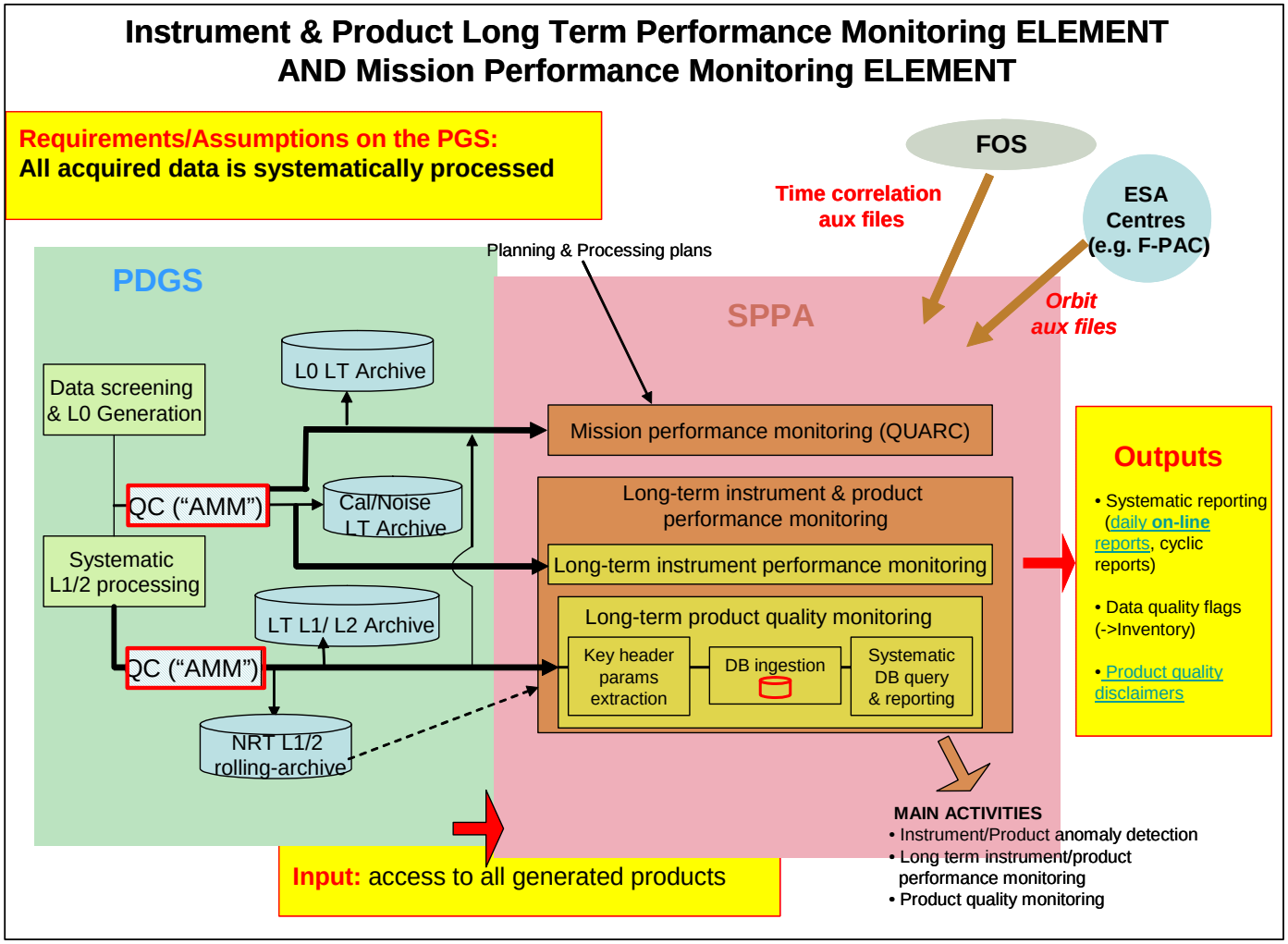
2. CCB review if necessary
3. IPF Software Coding
4. PDGS Configuration change if necessary
5. Preparation of the new processing environment (ADF, resources)
6. FAT
7. OSAT
8. IFP Verification

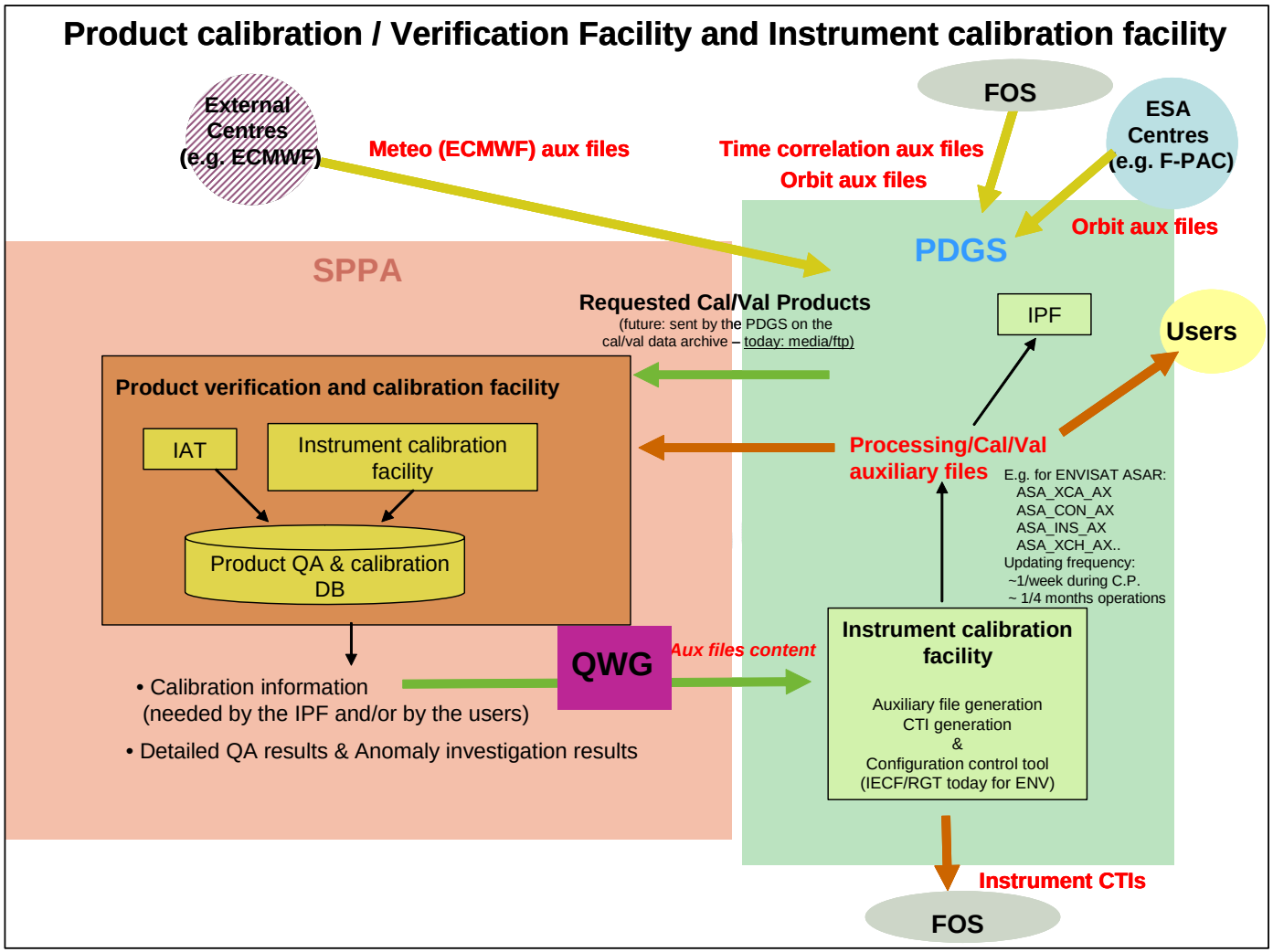
Instrument Processing Facility maintenance and evolution

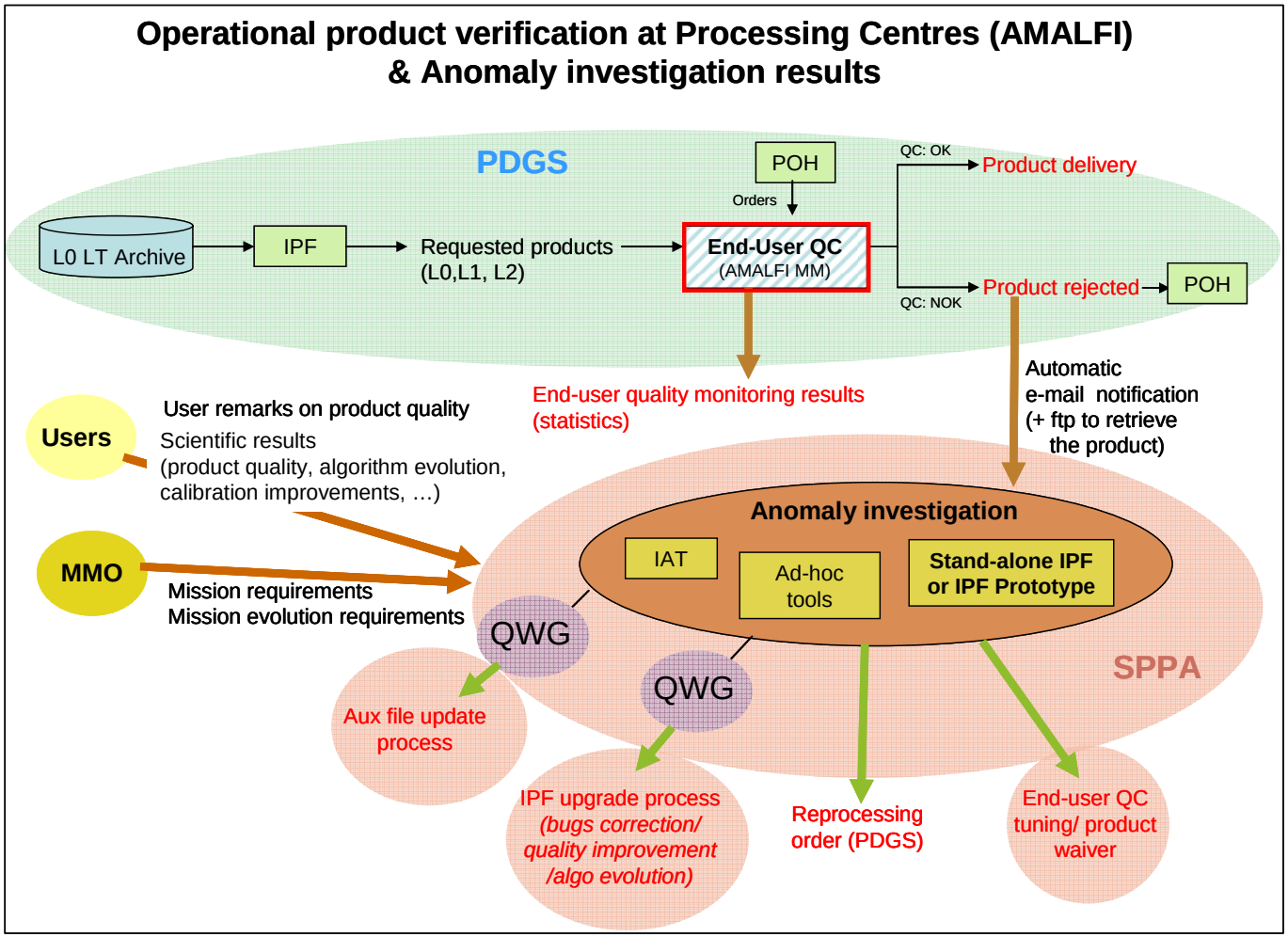
- The development and/or of the processing facility shall be driven by the availability of following elements:
    - PDGS Interface requirements that define the processing facility interface to be implemented for the specific mission.
    - The DPM for the implementation of the core processing
    - The Products Specifications for the implementation I/O processing
    - The test data set, aligned to the DPM and/or the Product Specification to implement the processor acceptance test plan and procedures.

APPENDIX B- MAIN INTERFACES FOR THE SSPA ACTIVITIES

The following graphs illustrate the main interfaces related to some of the SPPA activities.


Instrument & Product Long Term Performance Monitoring ELEMENT
AND Mission Performance Monitoring ELEMENT
Requirements/Assumptions on the PGS:
All acquired data is systematically processed
FOS
Time correlation aux files
ESA Centres (e.g. F-PAC)
Orbit aux files
Planning & Processing plans
PDGS
SPPA
Data screening & L0 Generation
L0 LT Archive
Mission performance monitoring (QUARC)
QC ("AMM")
Cal/Noise LT Archive
Long-term instrument & product performance monitoring
Long-term instrument performance monitoring
Systematic L1/2 processing
LT L1/ L2 Archive
Long-term product quality monitoring
QC ("AMM")
Key header params extraction
DB ingestion
Systematic DB query & reporting
NRT L1/2 rolling-archive
Outputs
• Systematic reporting (daily on-line reports, cyclic reports)
• Data quality flags (->Inventory)
• Product quality disclaimers
MAIN ACTIVITIES
• Instrument/Product anomaly detection
• Long term instrument/product performance monitoring
• Product quality monitoring
Input: access to all generated products


Product calibration / Verification Facility and Instrument calibration facility
External Centres (e.g. ECMWF)
Meteo (ECMWF) aux files
FOS
Time correlation aux files
Orbit aux files
ESA Centres (e.g. F-PAC)
Orbit aux files
PDGS
SPPA
Requested Cal/Val Products
(future: sent by the PDGS on the cal/val data archive – today: media/ftp)
IPF
Users
Product verification and calibration facility
IAT
Instrument calibration facility
Product QA & calibration DB
Processing/Cal/Val auxiliary files
E.g. for ENVISAT ASAR:
ASA_XCA_AX
ASA_CON_AX
ASA_INS_AX
ASA_XCH_AX..
Updating frequency:
~1/week during C.P.
~ 1/4 months operations
QWG
Aux files content
Instrument calibration facility
Auxiliary file generation
CTI generation
&
Configuration control tool
(IECF/RGT today for ENV)
• Calibration information
(needed by the IPF and/or by the users)
• Detailed QA results & Anomaly investigation results
Instrument CTIs
FOS


Operational product verification at Processing Centres (AMALFI)
& Anomaly investigation results
PDGS
POH
QC: OK
Product delivery
Orders
L0 LT Archive
IPF
Requested products
(L0,L1, L2)
End-User QC
(AMALFI MM)
QC: NOK
Product rejected
POH
End-user quality monitoring results
(statistics)
Automatic
e-mail notification
(+ ftp to retrieve
the product)
Users
User remarks on product quality
Scientific results
(product quality, algorithm evolution,
calibration improvements, …)
Anomaly investigation
IAT
Ad-hoc
tools
Stand-alone IPF
or IPF Prototype
MMO
Mission requirements
Mission evolution requirements
QWG
QWG
SPPA
Aux file update
process
IPF upgrade process
(bugs correction/
quality improvement
/algo evolution)
Reprocessing
order (PDGS)
End-user QC
tuning/ product
waiver