

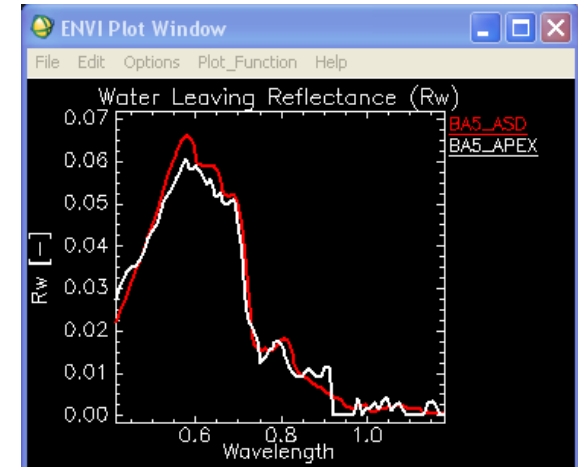
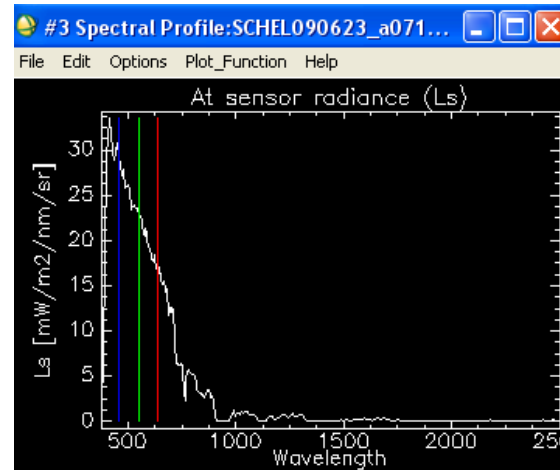
19/07/2012

PROCESS: Processing workflows for thermal and fluorescence sensors

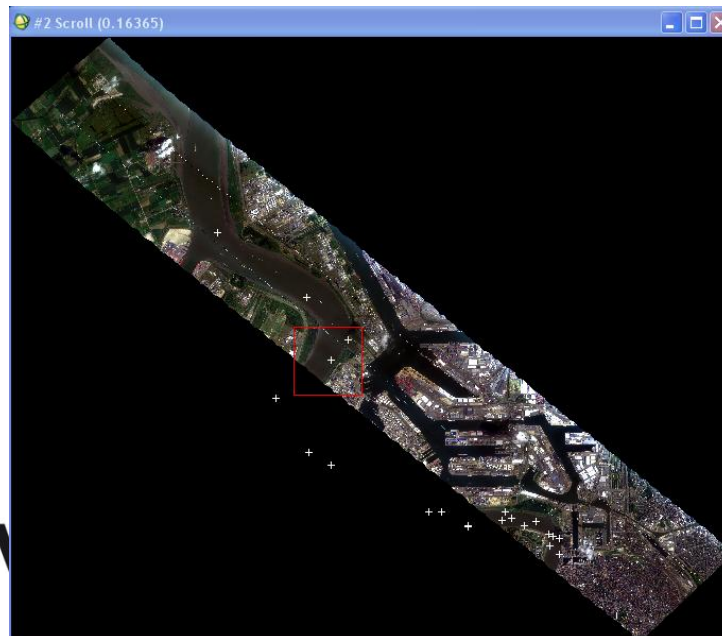
Dries Raymaekers, Jan Biesemans, Koen Meuleman ,Thomas Udelhoven, Gilles Rock, Uwe Rascher, Andre Erler

Processing workflow

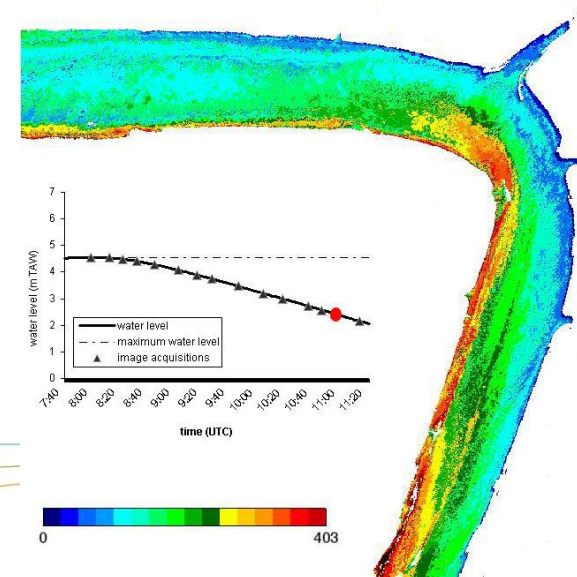
Radiometric correction Atmospheric contribution



Geometric correction



Level 3/4 products



General objective

- » Extend the current processing chain with two new sensors and provide a **Quality Service** to the international user community
 - » a **Thermal sensor**, owned and operated by the **Gabriel Lippman Institute**
 - » the **HYPLANT sensor**, a hyperspectral sensor for retrieval of sun-induced fluorescence , owned and operated by the **Research Centre Jülich**.

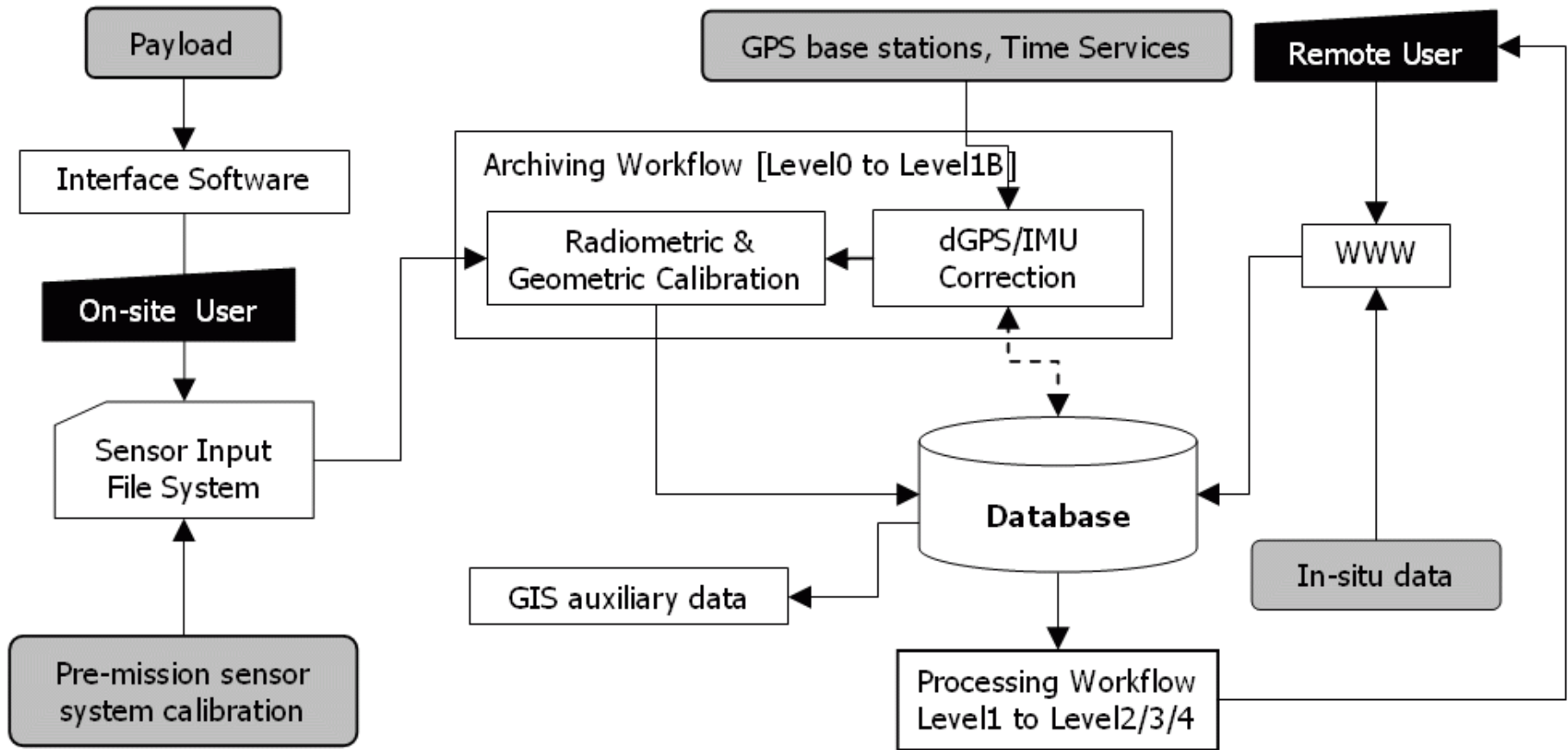


AisaEAGLE sensor
L: 146 mm
W: 145,5 mm
H: 347 mm
Mass: 6,5 kg

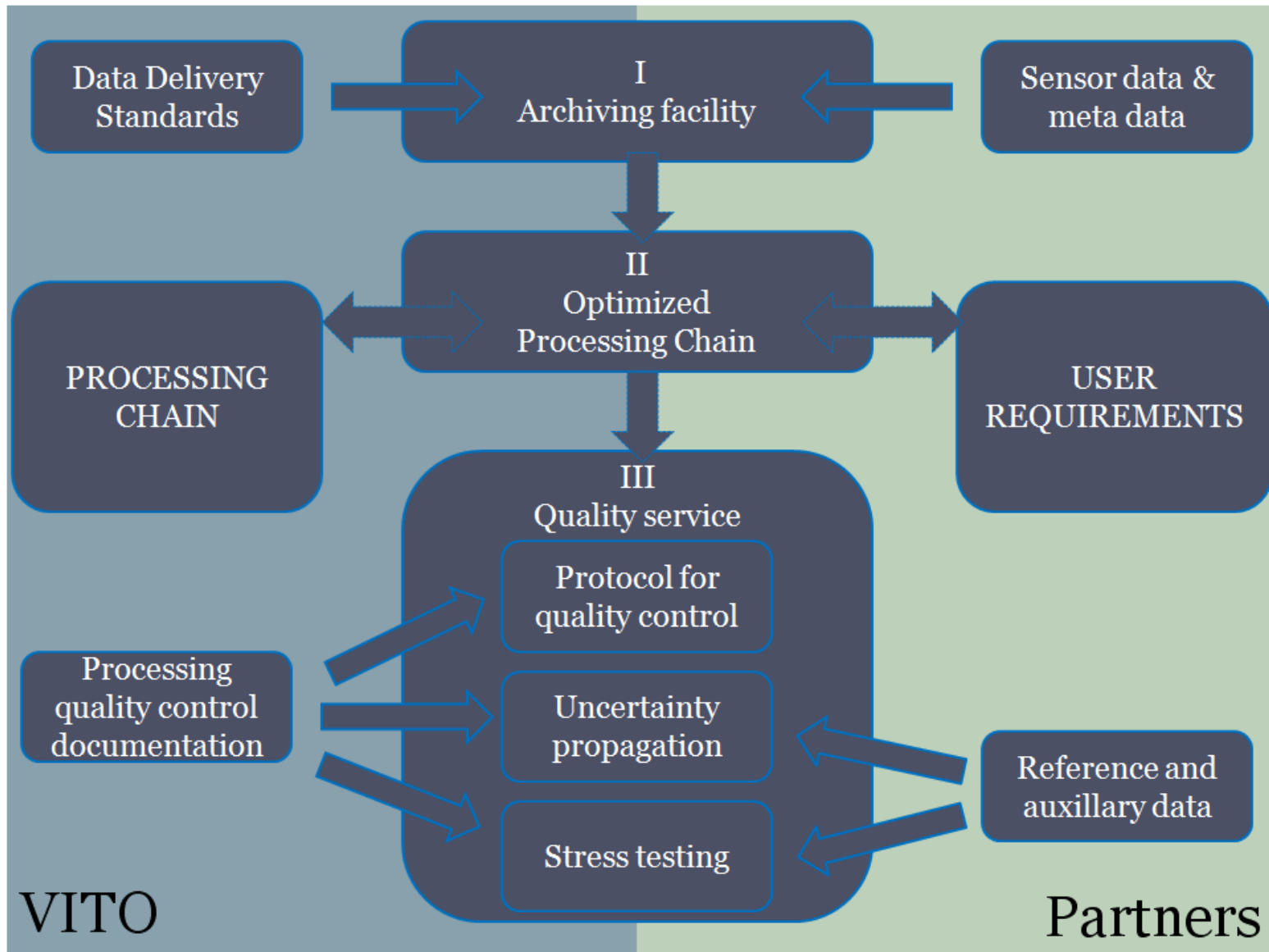
| Sensor | Fluorescence Imager | Dual-Channel Imager |
|-----------------------------|---------------------|---------------------------------------|
| wavelength range (nm) | 670 - 780 | 380 - 2500 |
| Spectral resolution (nm) | 0.2 | 3 (380 – 1000nm) / 10 (1000- 2500 nm) |
| Number of spectral bands | 1024 | 560 |
| spatial resolution (pixels) | 384 | 384 |
| field-of-view (degrees) | 32.2 | 32.2 |

Figure 3. HYPLANT sensor: Specifications

VITOs Processing chain



Methodology



More information ...



Processing workflows for thermal and fluorescence sensors

Dries Raymaekers¹, Jan Bleesemans¹, Koen Meuleman¹, Thomas Udelhoven², Gilles Rock³, Uwe Rascher⁴, Andie Ertel⁵
¹VITO, Flemish Institute for Technological Research, Melle, Belgium
²DFP, Centre de Recherche Public- Développement, Luxembourg
³Geo-2, Paris Sciences et Lettres, Paris, France
⁴DFP, Centre de Recherche Public- Développement, Luxembourg
⁵DFP, Centre de Recherche Public- Développement, Luxembourg

INTRODUCTION

With the increased interest of the scientific and public community in high resolution remote sensing products and the advent of newly developed (groundborne) sensors, the need for a reliable processing chain which is able to produce a variety of qualitative data products is pertinent in the framework of the VITO/DFP High Airside (HA) sensor. (DFP) sensor development and yearly hyperspectral campaigns. VITO has developed a processing chain for airborne data, termed VITO/DFP/HA CDCP (Central Data Processing Centre). Currently the CDCP is able to process data from video, hyperspectral pushbroom and whiskbroom and frame cameras. The PROCCO3 project is aimed at adding the CDCP processing chain with two new sensors and provide a processing service for a large variety of airborne datasets to the international user community.

AIRBORNE PROCESSING WORKFLOW

The overall CDCP is capable of processing raw incoming airborne imagery up to Level 4 information products. These processes are subdivided in three major groups:
 □ Group 1: camera system calibration, verification and archiving. This group of processes results in standardized Level 1 products. The process throughput time of this group activities varies from 6 weeks (in discussion about image calibration data) up to 4 months (a lot of calibration conflicts and uncertainties).
 □ Group 2: all processes involved in the Level 1 to Level 4 image production (geometric and radiometric correction). Most often this is a straightforward phase here, the throughput time is dependent on the number of CPU worker nodes, the processing settings and the amount of images selected.
 □ Group 3: all processes involved in the production of higher level image or information products. Also here the throughput time is dependent of the number of worker nodes, the processing settings and the amount of images selected.

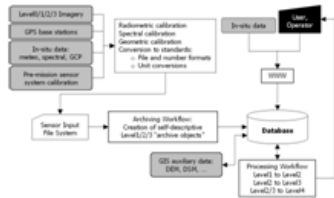


Fig. 1. Overview overview of VITO/DFP/HA Central Data Processing Centre (CDCP)

THE SENSOR

The sensors for which the CDCP will be extended are (i) a thermal near, owned and operated by the German Air Force Institute and (ii) the 'HYPERLITE' near or a hyperspectral sensor for retrieval of sun-induced fluorescence, owned and operated by the Research Center Jülich.
 The sensor products will be used as additional data layers in support of quality assessment of the physical environment.
 The 'HYPERLITE' sensor consisting of both dual-channel imager and fluorescence imager from manufactured by SPCCM, will study fluorescence of land ecosystems and will support the upcoming Fluorescence Explorer (FLX) sensor in the framework of Earth Earth Explorer mission.

METHODOLOGY



Fig. 2. PROCESS overview overview of the methodology

The approach to reach the objective is structured as follows:
 □ The first step is to customize the data and metadata of the 2 new sensors in such a way that they can be integrated in the CDCP in a smooth way. To achieve this, the 2 external partners will be involved in every step of the sensor integration in the archiving facility of the CDCP. Sensor (meta) data will be required to be delivered according to VITO's data delivery standards.
 □ The second step is to optimize the current CDCP towards the user specific requirements. To ensure that future software development activities are in line with the expectations of image processing capabilities, it was decided to use the CDCC (Data Control for Software Standardization and Control) to guide the reasoning and development process. This implies that during the project, the following non-occurrences shall be defined: the USD (User Requirements Document and SDD (Software Specification Document), enabling to address the requirements topics such as: functional, performance, interface, operational, resource, design and implementation, security, privacy, usability, quality, reliability, maintainability, safety, configuration and delivery data definition and database, human factors, adaptation and installation, validation.
 □ The third step is to setup a quality service for the image processing. For the validation of the image processing a procedure will be compiled, including the necessary tools for its implementation. The validation will be conducted by the external partners, who will need to supply the necessary reference data and follow the procedure with the assistance of VITO. To ensure that the CDCP can handle the large amount of data which is inherent to airborne, hyperspectral or -temporal data, a dedicated processing stream that will be organized. The statistics derived from this exercise will be valuable input for the reliability issues on future service developments.



| Sensor | Resolution range | Full Channel range |
|--------------------------|------------------|--------------------|
| HyperLITE (DFP) | 0.75 - 100 | 200 - 2500 |
| Thermal sensor (DFP) | 10 | 3000 - 10000 |
| Number of spectral bands | 128 | 1000 - 2000 |
| SWIR resolution (DFP) | 30 | 30 |
| Resolution (DFP) | 10 | 10 |

Fig. 2. HYPERLITE sensor Specifications

EXPECTED RESULT

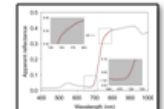
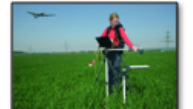
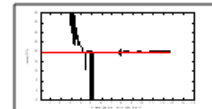


Fig. 4. Example of spectral response to thermal (DFP) or fluorescence (DFP) applications