process4EO

image processing chain

Creating image products
from satellite raw data

Acquisition

Radiometric calibration,
de-noising and contrast
enhancement

Accurate inter-band
registration

Precise
geolocation

Automatic or supervised
ortho-rectification

Products

Working operationally in Deimos-2 mission

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deimos

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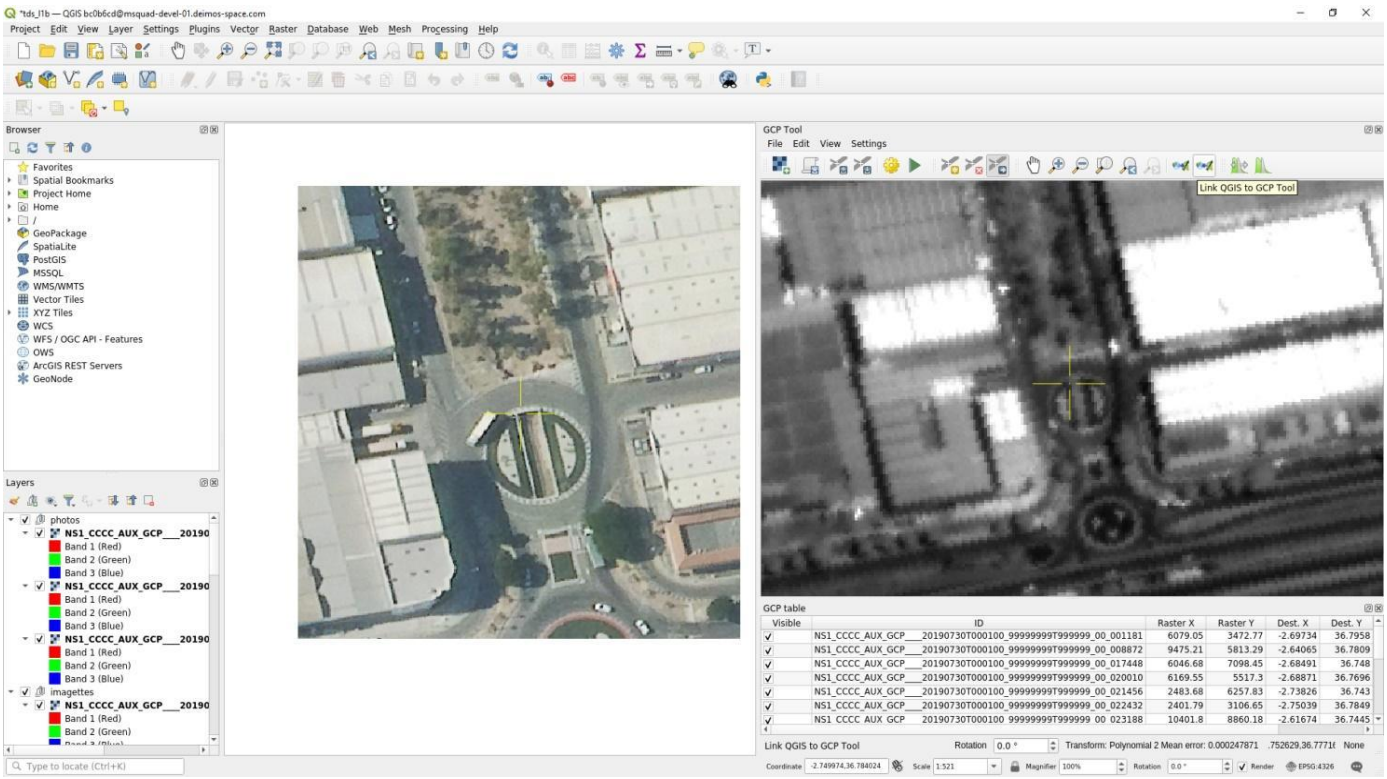
process4EO
image processing chain

process4EO is Deimos' self-developed data processing module, currently **in operations in the mission Deimos-2**, and soon to be used in other EO missions. It implements an efficient and flexible generation of image products from the satellite payload raw data, allowing the user to specify how the processing functionality shall be arranged in processing levels. The available functionality includes:

- **Radiometric calibration** to convert the pixel values from instrument digital counts into radiance units with PRNU correction and cosmetic filling of dead and saturated pixels
- **Noise reduction** by wavelet shrinkage, with the possibility to select among different wavelet bases and orders.
- **Image sharpening** by deconvolution with user-defined kernels to remove diffraction, jitter and motion-related blurring effects
- **Accurate inter-band co-registration** by mapping all the bands to the reference one with feature matching algorithms and configurable transforms
- **Precise geolocation of images in the sensor geometry** by estimating custom deformation models on top of RPCs, which preserves the radiometric fidelity and makes products suitable for geophysical retrieval applications
- **Flexible ortho-rectification** allowing the user to choose among (a) a fully automatic process based on the extraction and matching of features from reference ortho-images or (b) a manual pinpointing of Ground Control Points in QGIS with a free DEIMOS plugin as illustrated in the screenshot below

process4EO also generates quality-related figures of merit that are made available in product metadata, as the CE90 for rectified products. Moreover, and in line with industry standards, the product processors generate metadata to facilitate the cataloguing, filtering and browsing of the product image collection.



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Deimos Space ground segment systems are built using a combination of gs4EO **products** working in a coherent and synchronized way, although all of them can also be used as **independent systems.**

control4EO
mission control system

archive4EO
archive & catalogue

plan4EO
mission planning

chain4EO
processing orchestration

fly4EO
flight dynamics

process4EO
image data processing

track4EO
ground station control

calval4EO
calibration & validation

contact4EO
ground stations scheduling

monitor4EO
monitoring & control

auto4EO
operations automation

user4EO
user services

identity4EO
authentication & authorisation

These products are already **being used in multiple Earth Observation Missions**, within complete GS setups, like **DEIMOS-1, DEIMOS-2, SAT4EO** or **NAOS**, or as standalone subsystems, as plan4EO, used by **Sentinel-2**, **AEOLUS** and **BIOMASS**, archive4EO, used in **PAZ, SEOSAT, CHEOPS** and **AWS,** fly4EO, used in **Amazônia-1, ...**

All of them are the basis for gs4EO, your Ground Segment solution from DEIMOS

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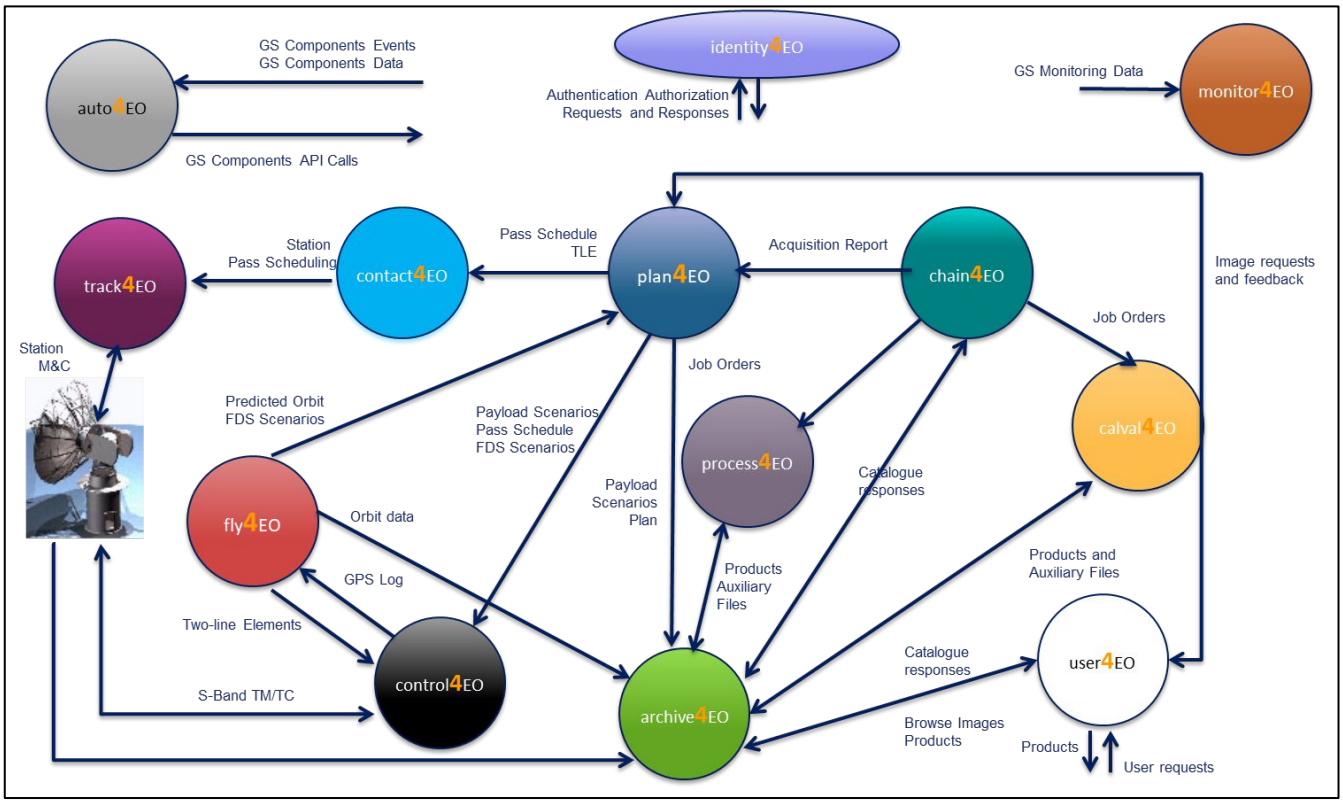
Thanks to its **modular design**, the gs4EO suite of products can be used to **customize any ground segment according to each customer's requirements**.

The various individual products can be assembled in different ways to implement **different deployment configurations**, from a complete Ground Segment to a Direct Receiving Station or just a single subsystem supporting a specific mission need. This modularity and interoperability also provides extraordinary flexibility in order to accommodate **more than one Earth Observation mission** in the ground segment, with different levels of integration that can be offered.



The figure above outlines the most typical GS set-up using all gs4EO elements, providing full ground segment capabilities required by any EO mission. With this solution, customers would mainly access the S/C resources via the User Services, and all tasking, data downlink and processing would be performed autonomously by the remaining elements, ensuring complete user feedback throughout every step.

Each application communicates with the remaining Ground Segment through well defined interfaces, following open standards, easing its integration with other external solutions. All applications are controlled by means of **advanced user interfaces**, mainly web-based, that enable **remote operation** capabilities.

Moreover, all gs4EO components have **multi-mission capabilities** that allow their integration within the GS of third party missions. The archive component allows the storage of data from different satellites and follows well adopted standards to facilitate the integration process.

gs4EO solutions are cloud friendly allowing a variety of deployments, from customer's private infrastructure, to hybrid solutions or fully cloud based.

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