

EnMAP
Hyperspectral Imager



THE **EnMAP** HYPER SPECTRAL IMAGER – AN ADVANCED OPTICAL PAYLOAD FOR EARTH OBSERVATION

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GFZ
Helmholtz-Zentrum
POTSDAM

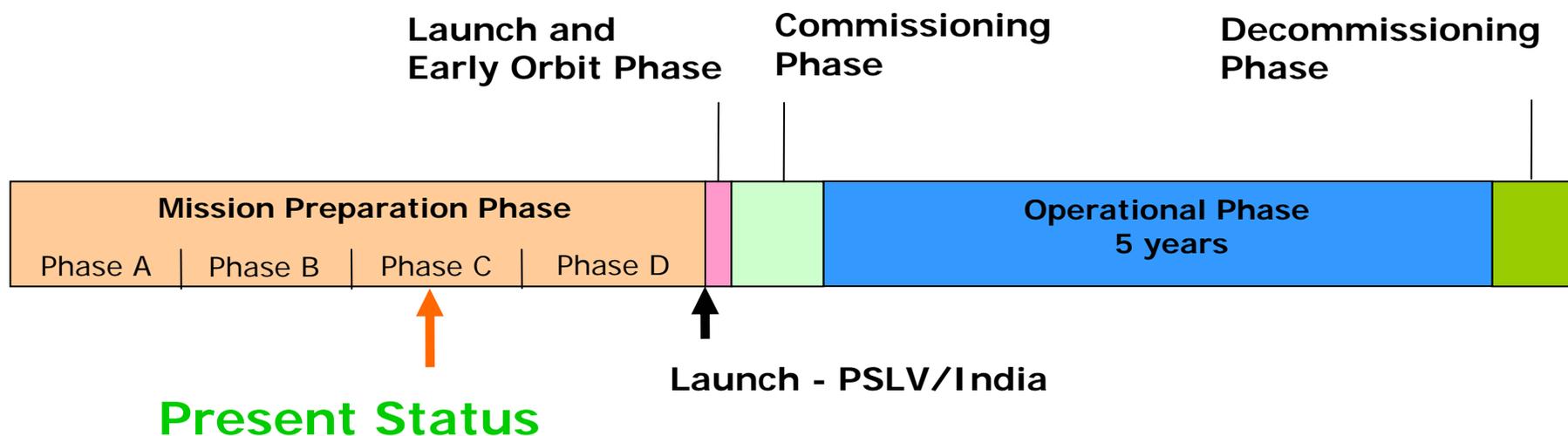


K
KAYSER-THREDE

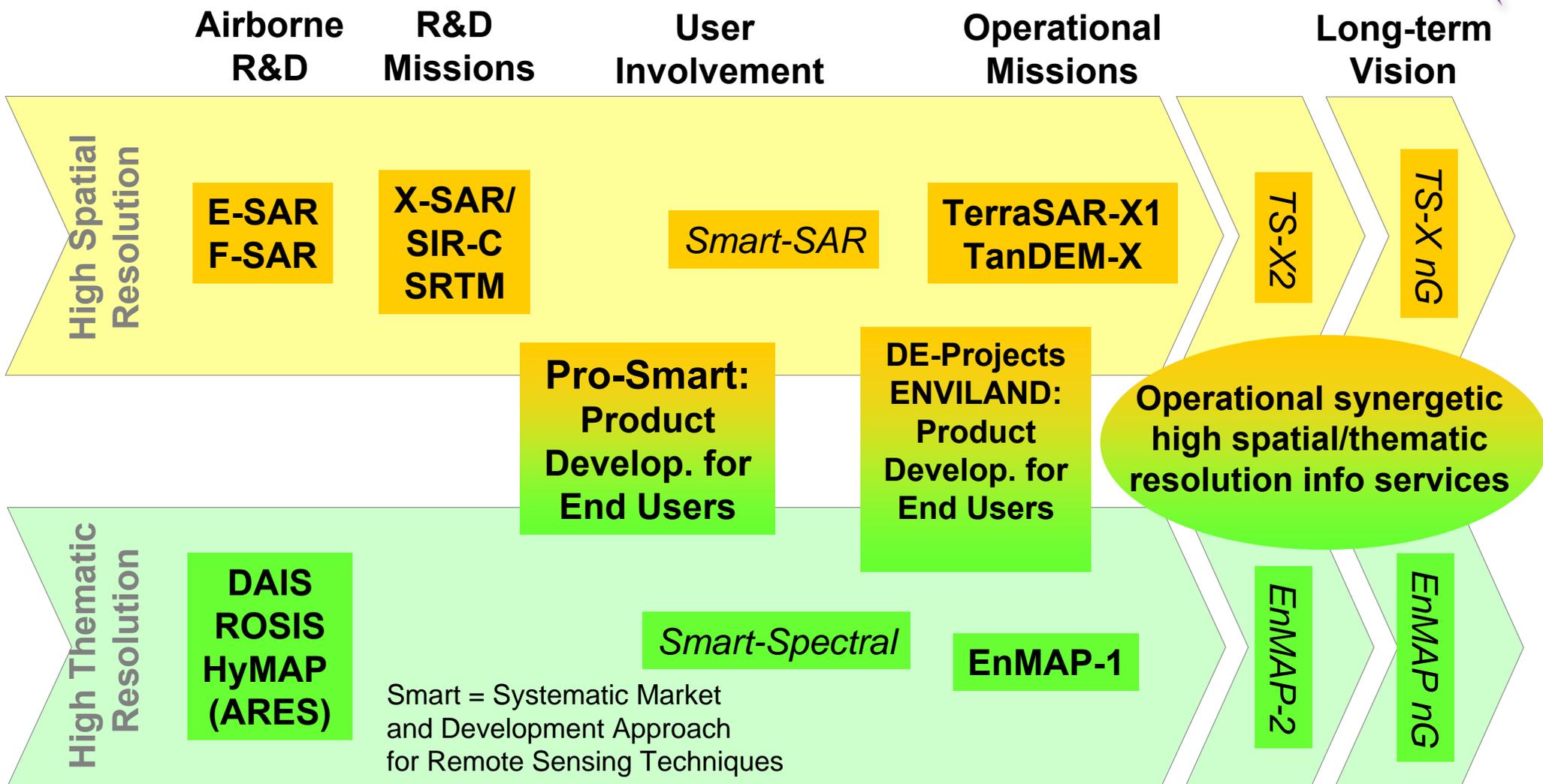
OHB TECHNOLOGY

History and Status

- 2003 National Call (12 competitors)
- 2005 Phase A study accomplished
- 2007 End of phase B
- **2008 Start of phase C/D**
- 2013 Launch date



Overall German Programmatic Context



source: DLR-Agency

Project Partners

**Scientific
Principle
Investigator**

GFZ-Potsdam

Project Management
DLR Agency

Space Segment
Kayser-Threde/OHB-Bremen

**Core Science
Team**

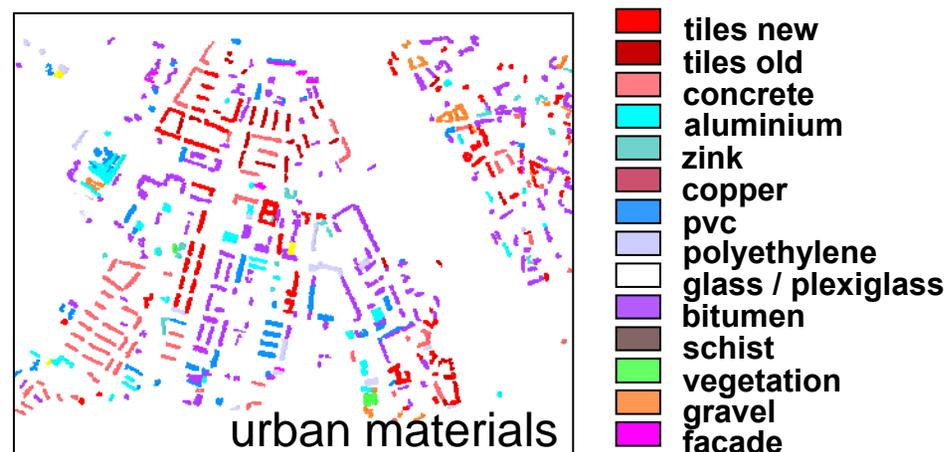
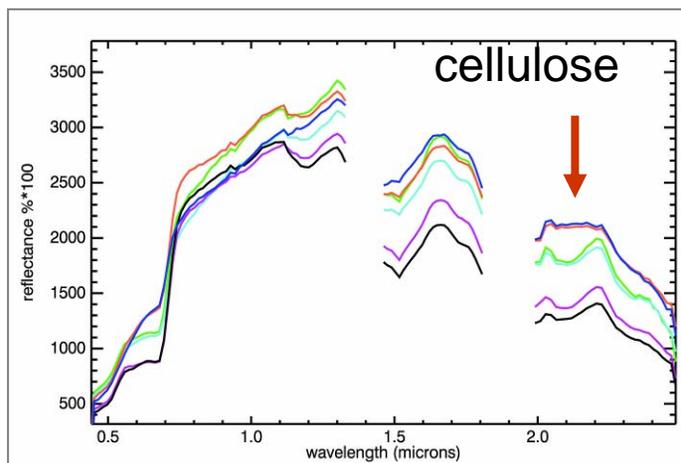
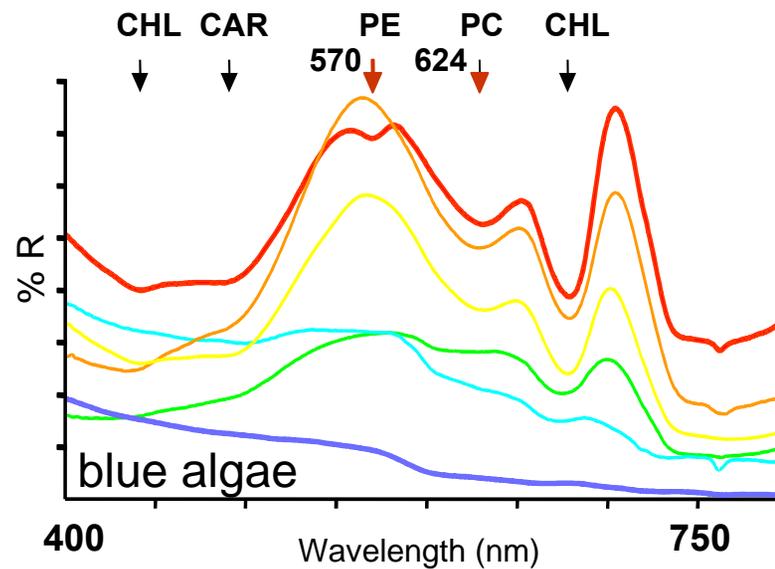
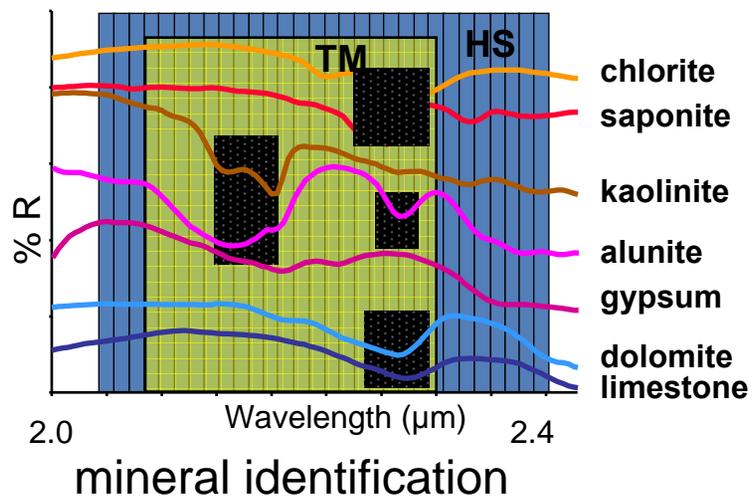
Advisory Group
EnSAG

Ground Segment
DLR-Oberpfaffenhofen

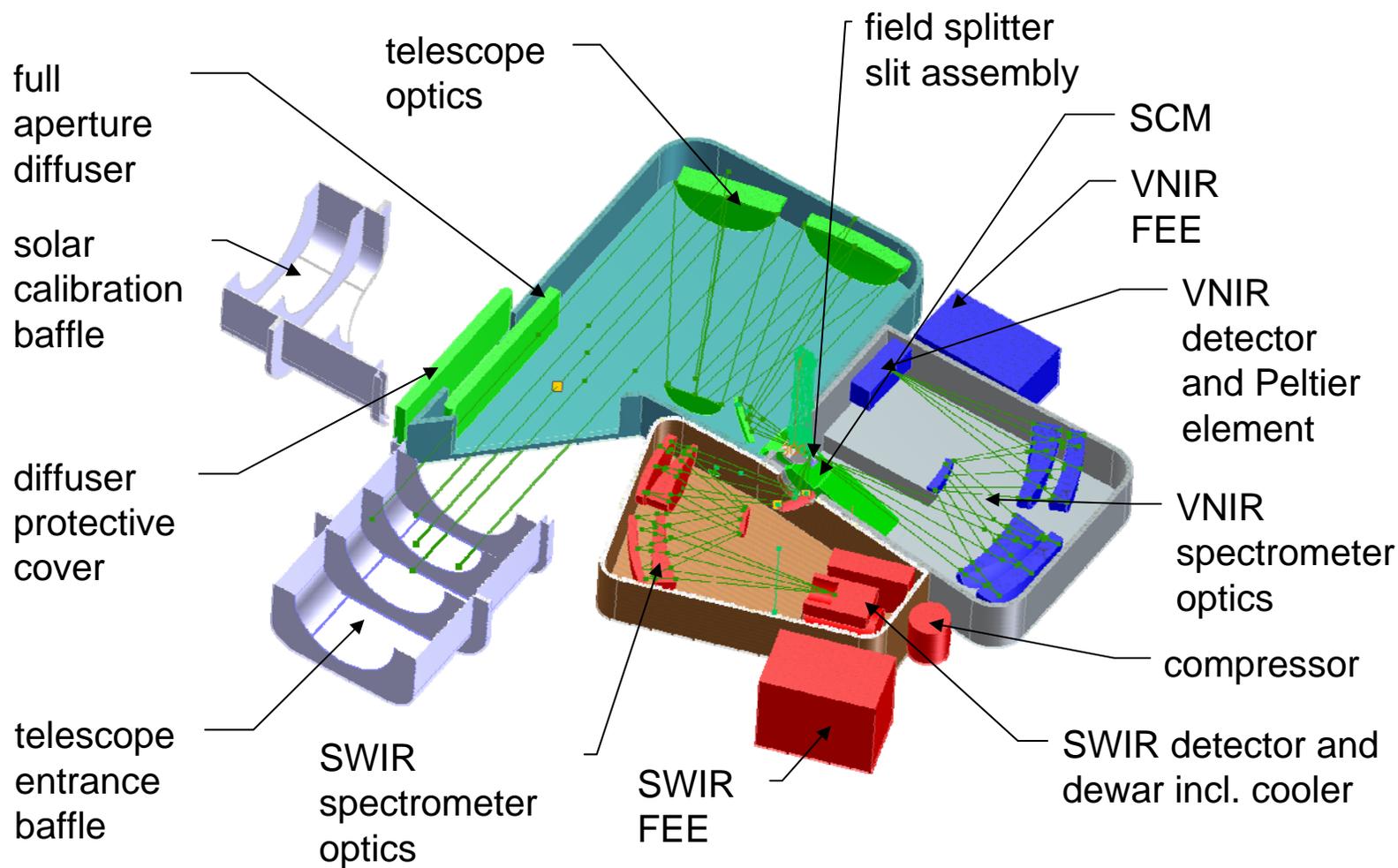
Primary Variables to be Measured

| Materials of Interest | Absorption Bands [nm] |
|--|--|
| Green/Dry Vegetation | |
| chlorophyll a + b water content cellulose lignin | 430-450, 650-660, 680-685 970, 1200, 1480 2100, 2270/2280 1680, 2050-2150 |
| Case-II Water Constituents | |
| chlorophyll-a carotinoide phycoerythrin phycocyanin dissolved organic carbon | 440, 680 460-495 570 624 maximum in the blue |
| Minerals in Rocks/Soils | |
| Fe ²⁺³⁺ Al-OH Mg-OH C-O | VNIR 2200 window 2300 window 2300 window |

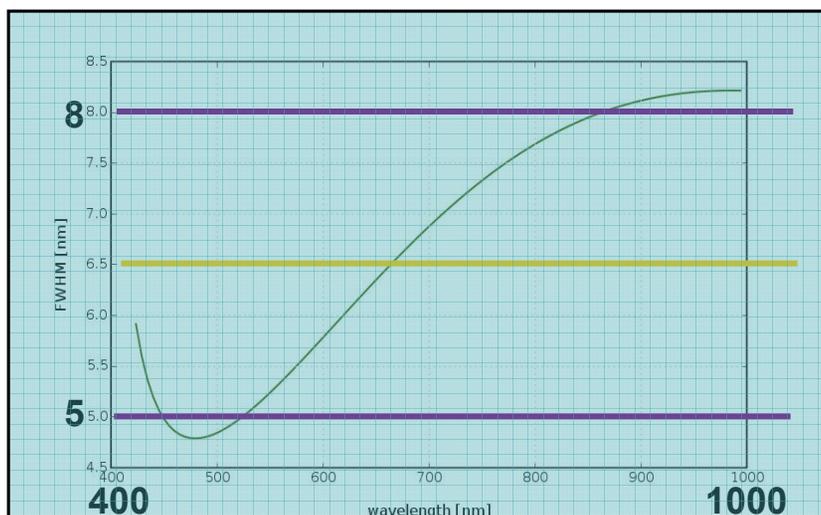
Hyperspectral only



Instrument Optics Unit - Main Elements



Spectral Design

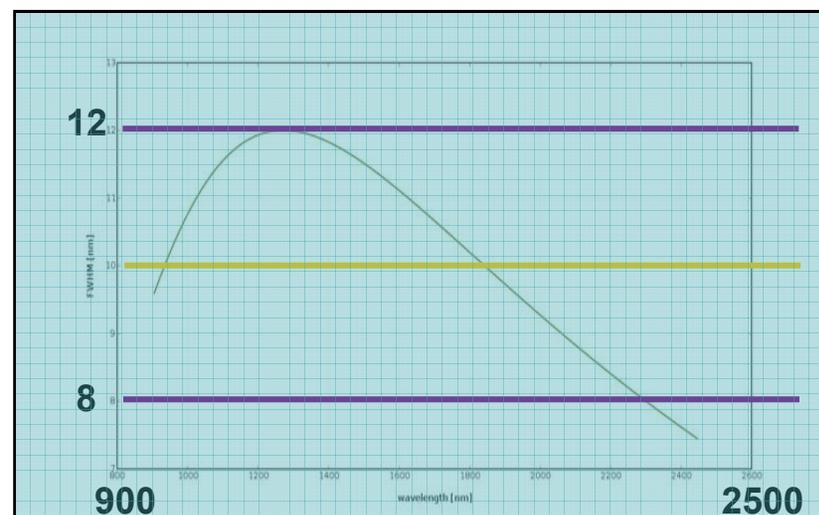


VNIR

Detector: Fairchild (CCD)
 Nominal band width: **6.5 nm**
 Range: **423.7 nm – 994.4 nm**
 Total number of bands: 89

SWIR

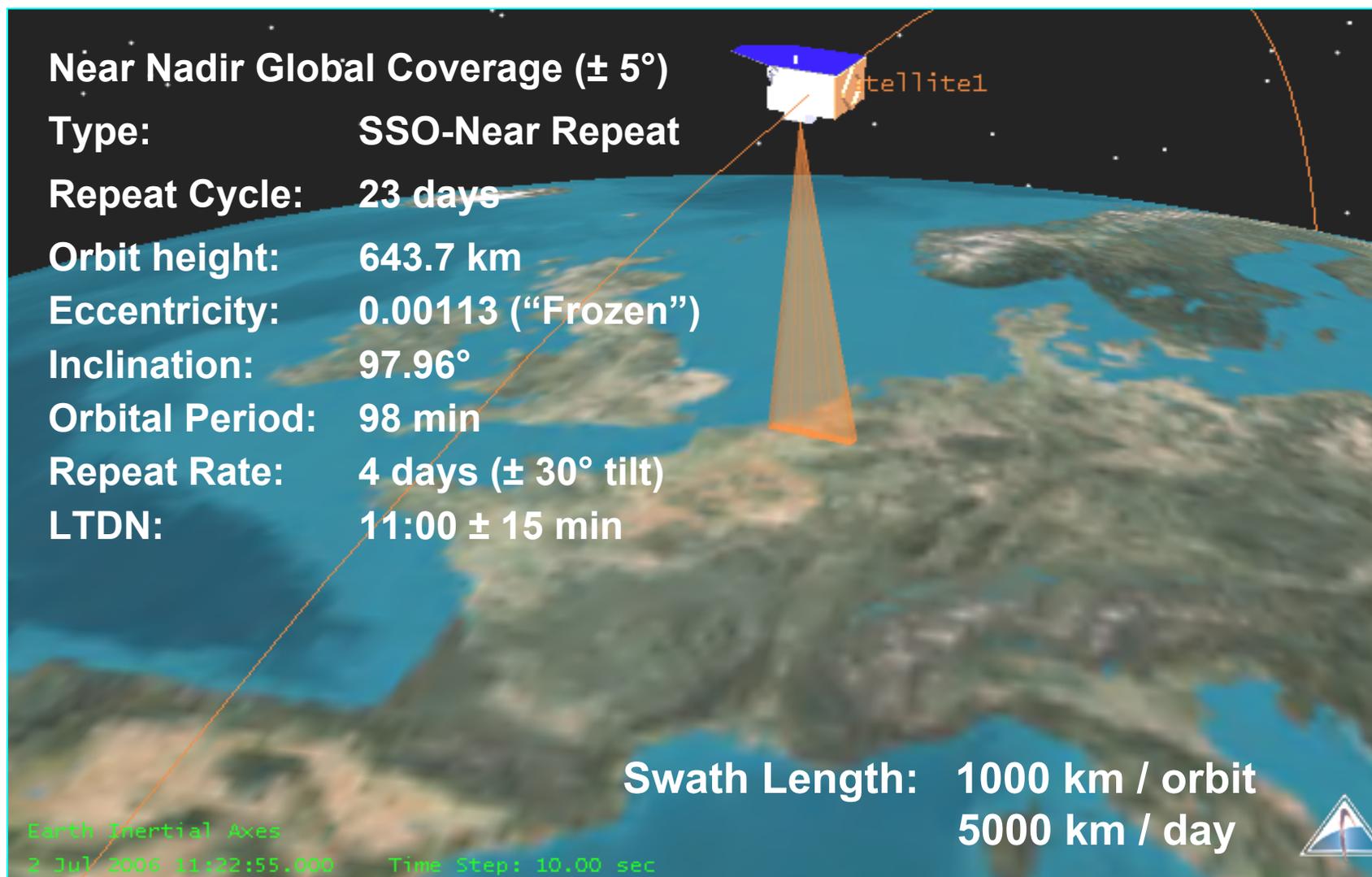
Detector: AIM (MCT)
 Nominal band width: **10 nm**
 Range: **905 nm – 2446 nm**
 Total number of bands: 155



Main Sensor Parameters

| | |
|--|---|
| Signal-to-noise ratio (SNR) at 30% reflectance; 30° sun zenith angle; visibility 21 km; target 500 m a.s.l. | VNIR: > 500:1 (at 495 nm) SWIR: > 150:1 (at 2200 nm) |
| Spectral calibration accuracy | 0.5 nm |
| Spectral stability | 0.5 nm |
| Radiometric calibration accuracy | < 5 % |
| Quantification / Radiometric stability | 14 bit / < 2.5 % |
| Spectral smile and keystone effect | < 20 % of detector element both |
| Ground sampling distance (GSD) | 30 m x 30 m (at nadir; sea level) |
| Swath width | 30 km |
| Geometric co-registration | ≤ 0.2 x GSD |
| Data Rate / Compression factor | 860 Mbit/s / loss less ~1.8 |
| Downlink rate (X-band) / Daily downlink (5000 km) | 300 Mbit/s / 389 Gbit |
| Mass memory | 512 Gbit |
| Weight Instrument / incl. Bus | ≤ 250 kg / ~ 800 kg |

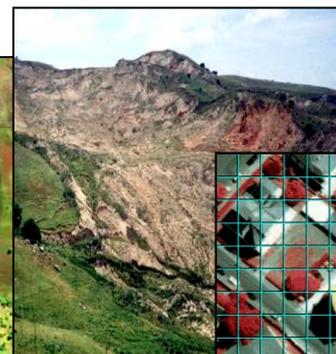
Main Orbit Parameters



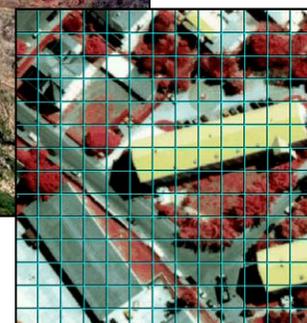
Science Program / Fields of Applications

**Co-operative
(inter)national
Networks**

*management of
agricultural
and forest
ecosystems*



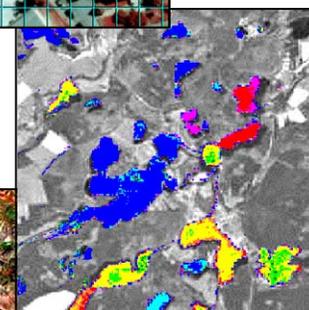
*hazard
assessment*



*urban
develop-
ment*

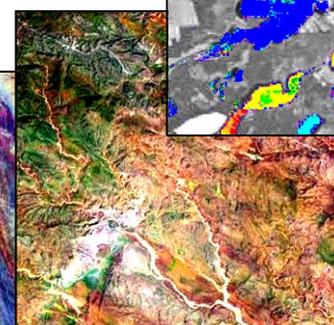
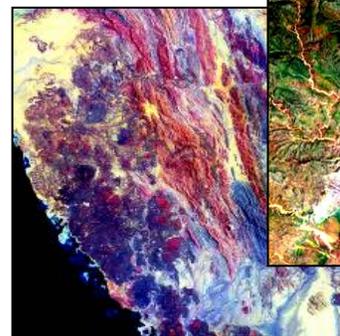
**Retrieval of
bio-geochemical and
geophysical variables**

*inland
water*



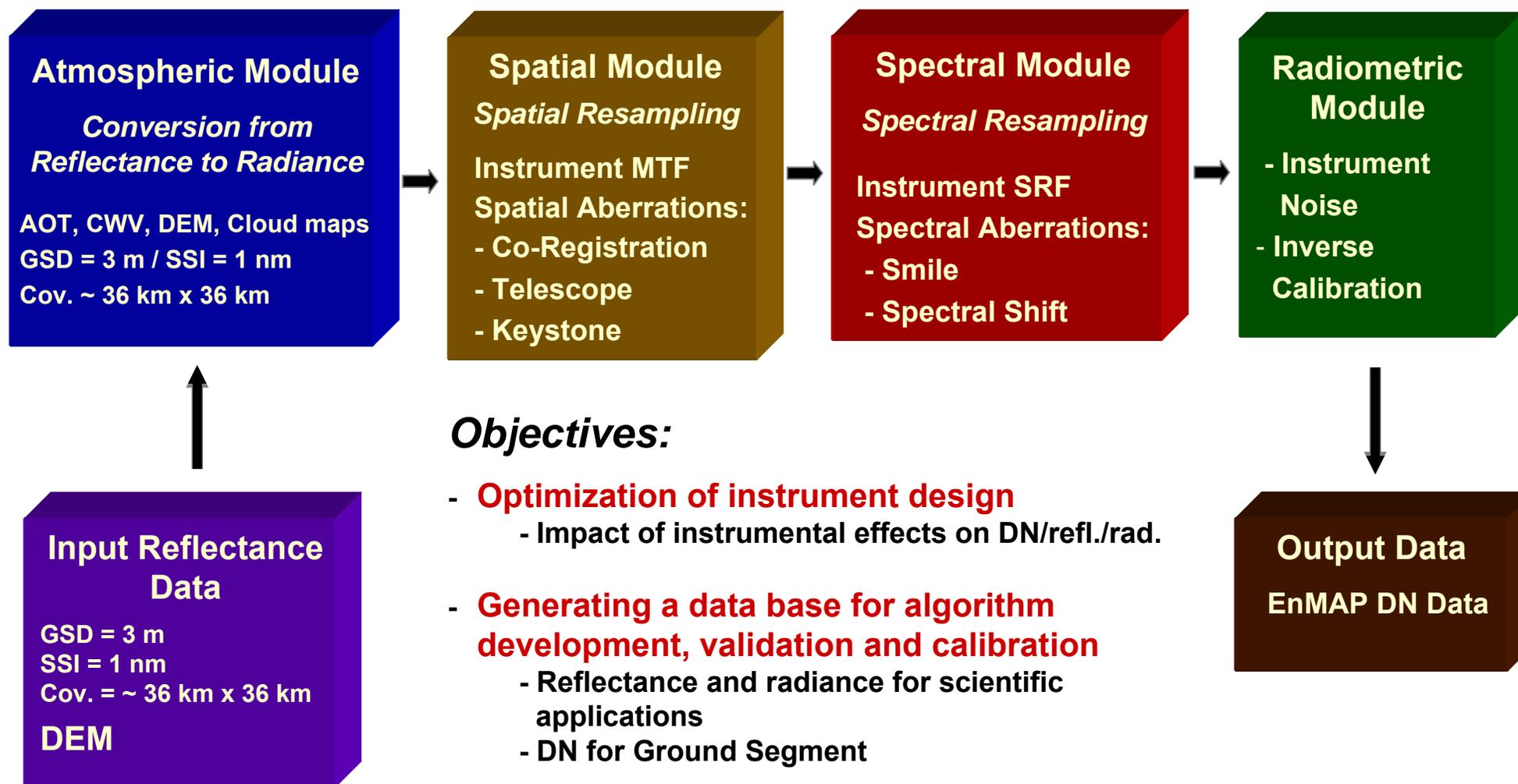
*- methodological
development
- synergies to
xs and radar
(InSAR)*

*mineral
exploration*



*dry-
land
degradation*

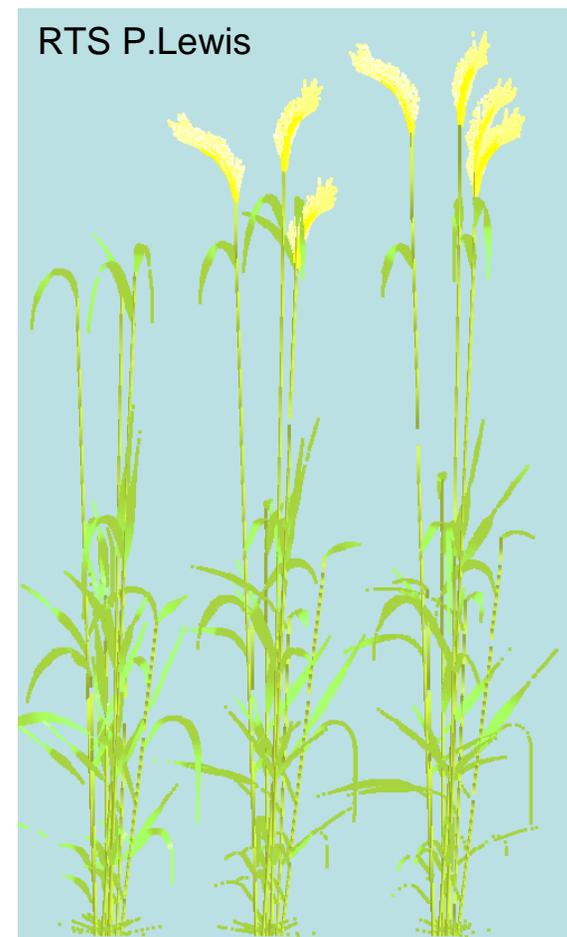
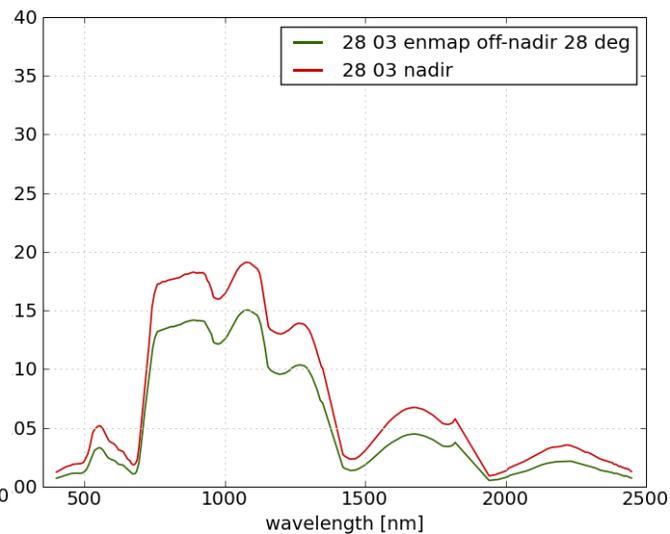
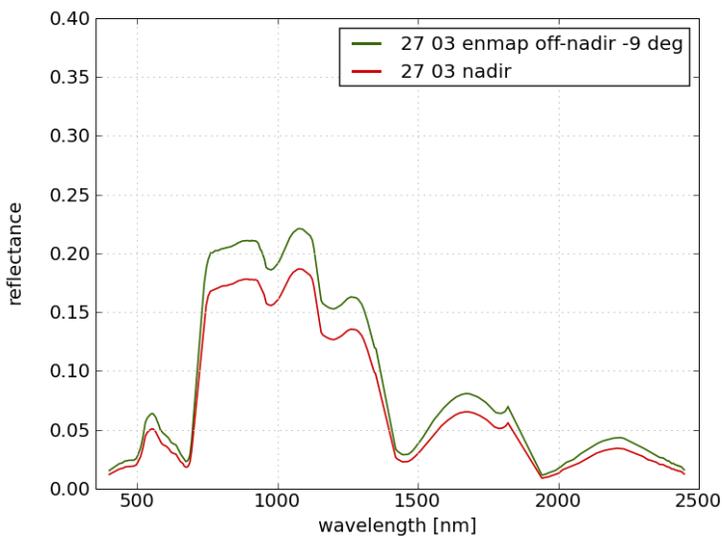
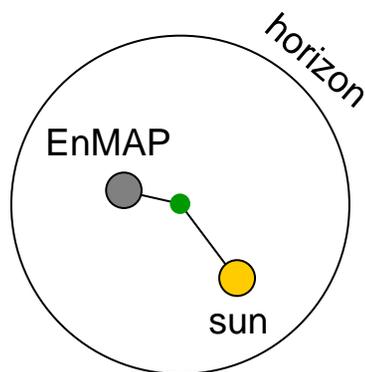
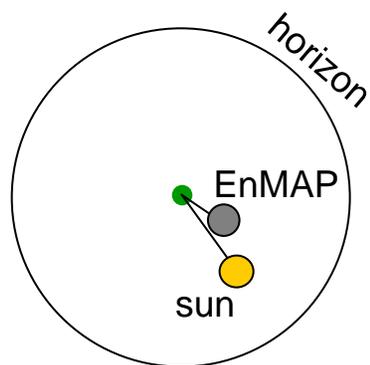
EnMAP – Spectral Forward Simulator



Objectives:

- **Optimization of instrument design**
 - Impact of instrumental effects on DN/refl./rad.
- **Generating a data base for algorithm development, validation and calibration**
 - Reflectance and radiance for scientific applications
 - DN for Ground Segment

Off-nadir Simulations on Crops



Growing stages May

EnMAP Cal/Val Activities

Objectives

- Data quality check and incidence reporting
- Assurance of L1 & L2 products traceability to international standards

Monitoring and calibration

- Periodic evaluation of instrument radiometric, spectral and spatial performance

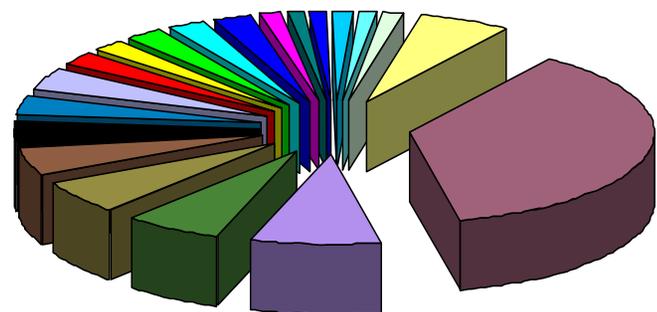
Validation

- Image-based analysis: image processing techniques to assess EnMAP instrument performance and data quality (e.g. SRFs, PSF, MTF assessment..)
- Field-based validation:
 - In-situ measurements of atmospheric and surface parameters for the validation of L1 and L2 products.
 - In parallel to science-oriented field-based activities.

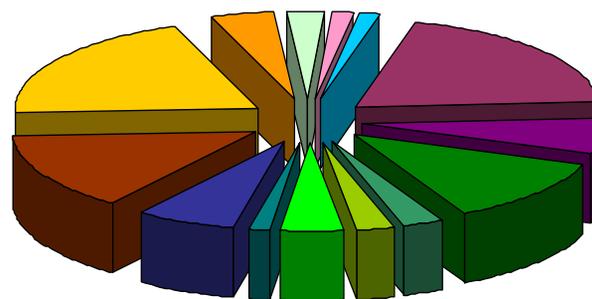
-> Validation plan being framed in the internat. Cal/Val scenario (CEOS/WGCV)

-> Establishment of external partnerships and Cal/Val selection in progress

Interested Parties / Disciplines



Interested Parties



Related Disciplines



User Categories / Priorities of Requests

| Priority | Request | Condition |
|-----------------|--|--|
| 1 | Internal user | |
| 2 | Support for catastrophic events | Independent of category or contingent |
| 3 | Registered users (Cat.1) | till contingent is fulfilled |
| 4 | Non-registered users (Cat. 2) | # |
| 5 | Requests beyond fulfilled contingents | |
| 6 | Background mission | |

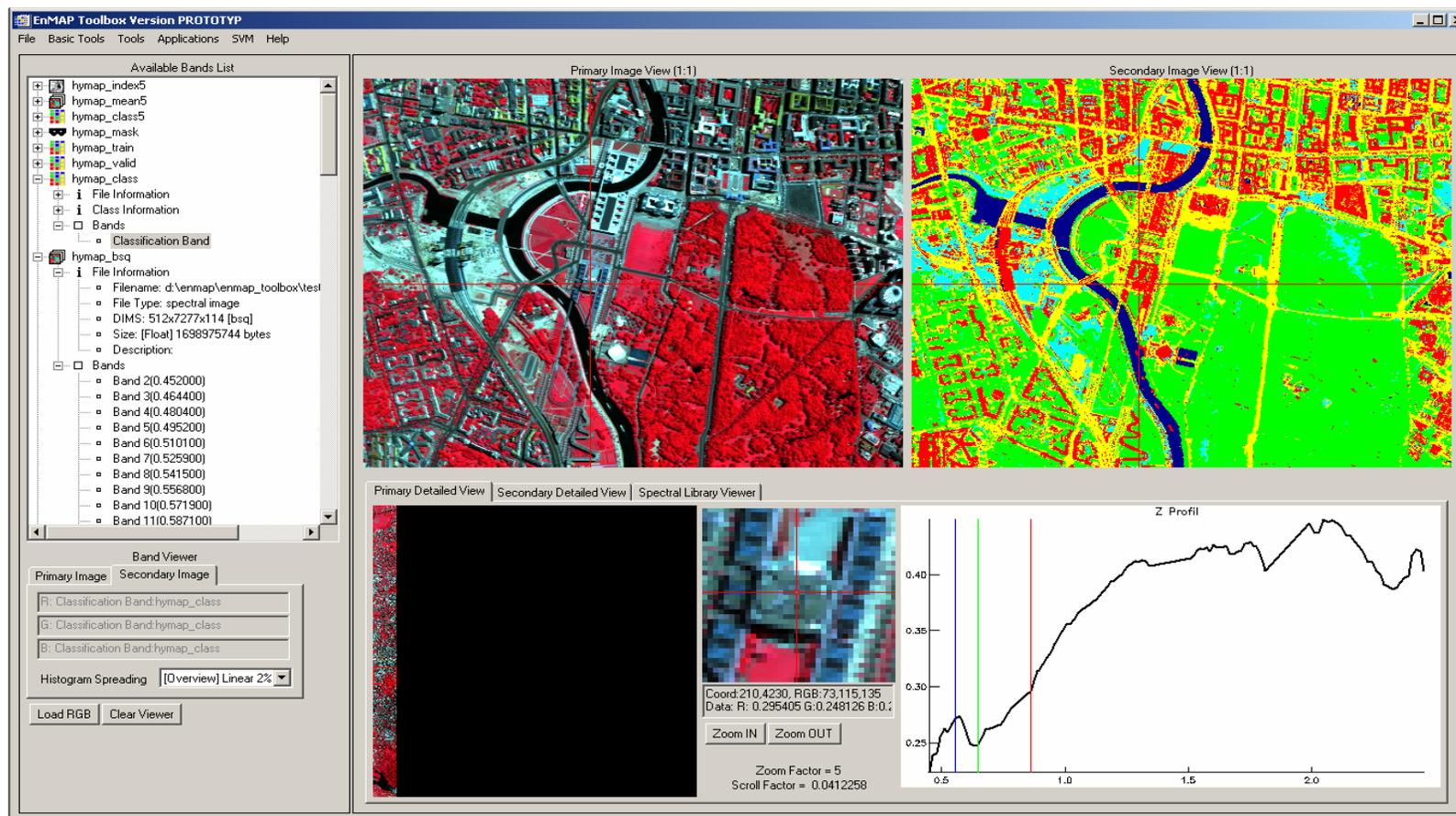
Category 1: registered scientists

Category 2: non registered scientists; commercial applications

Data Products

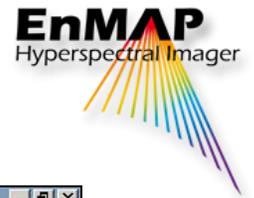
| <i>Product</i> | <i>Processor</i> | <i>Comment</i> |
|-----------------------|---|--|
| Level 0 | Transcription | Stored in DIMS (no delivery) |
| Level 1 | Co-registration + Keystone + Radiance | Processing on Demand; Meta Data updated for User Proc. |
| Level 2a | Co-Registration + Keystone + Georectification + Radiance | Geometric Correction |
| Level 2b | Co-Registration + Keystone + Reflectance | Atmospheric Correction |
| Level 2 | Co-Registration + Keystone + Georectification + Reflectance | Geometric and Atmospheric Correction |

EnMAP Toolbox/Applicationbox



- IDL-based, license free and platform independent processing environment
- optimized for EnMAP/hyperspectral processing

User Portal

A screenshot of a web browser displaying the EnMAP homepage. The browser's address bar shows "http://www.enmap.org/". The page features a navigation menu with links for Home, Imprint, Links, Contact, and News. The main content area is titled "ENMAP PORTAL" and contains a section for "EnMAP - German Hyperspectral Satellite Mission" with a detailed description and a "Mission Outline" section. The left sidebar contains a menu with categories like Mission, Applications, Mission Elements, and Consortium. The right sidebar contains a menu with categories like EnMAP Data, Glossary & Abbr., Science, Press, and Project Area. A large white box with a black border is overlaid on the bottom of the page, containing the URL "http://www.enmap.org/".

EnMAP Hyperspectral Imager

Home Imprint Links Contact News

Mission

- Home
- Mission Objective
- Mission Organization
- Mission Status

Applications

- Agriculture
- Coastal Zones
- Land Degradation
- Geology
- Forest

Mission Elements

- Sensor
- Platform
- Ground Segment

Consortium

- Consortial Members

ENMAP PORTAL

EnMAP - German Hyperspectral Satellite Mission

EnMAP (Environmental Mapping and Analysis Program) is a German hyperspectral satellite mission providing high quality hyperspectral image data on a timely and frequent basis. Main objective is to investigate a wide range of ecosystem parameters encompassing agriculture, forestry, soil and geological environments, coastal zones and inland waters. This will significantly increase our understanding of coupled biospheric and geospheric processes and thus, enable the management and ensure the sustainability of our vital resources. The envisaged launch of the EnMAP satellite is 2012.

Mission Outline:

- > Dedicated imaging pushbroom hyperspectral sensor mainly based on modified existing or pre-developed technology
- > Broad spectral range from 420 nm to 1000 nm (VNIR) and from 900 nm to 2450 nm (SWIR) with high radiometric resolution and stability in both spectral ranges
- > Swath width 30km at high spatial resolution of 30 m x 30 m and off-nadir (30°) pointing feature for fast target revisit (4 days)
- > Sufficient on-board memory to acquire 1.000 km swath length per orbit and a total of 5.000 km per day

NEWS

<http://www.enmap.org/>

EnMAP Data

- Access
- Tools
- Data Products

Glossary & Abbr.

- Glossary
- Abbr.

Science

- Science Team
- Events
- Publications
- Announcements

Press

- Press Releases

Project Area

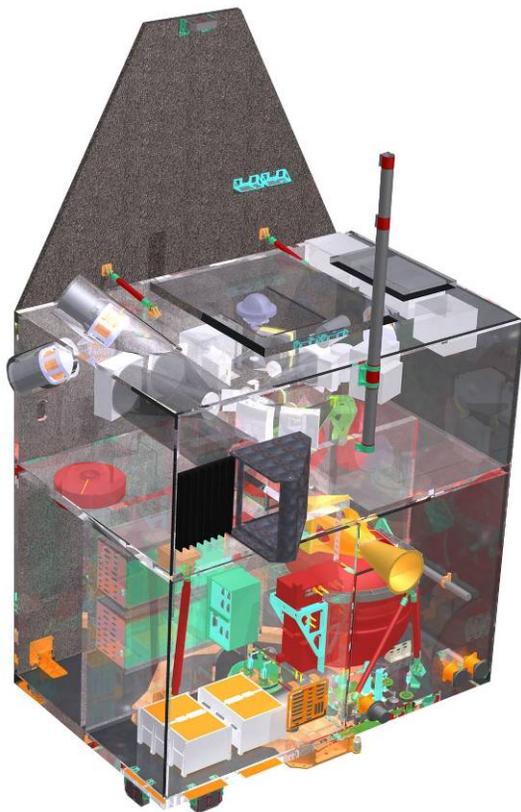
- EnMAP Teamsite
- EnMAP PMS Tool

Login

Username

Password

Remember me



Thank you for listening

Contact:

charly@gfz-potsdam.de

<http://www.gfz-potsdam.de>