Summary, achievements and major results of the "PRISMA Mission and beyond workshop"

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Outline

The PRISMA mission

- status
- mission overview, key performances, products
- data policy, data exploitation
- International collaborations
- mission statistics
- some images

The PRISMA Workshop results

PRISMA Launch

21st March 2019
02:50 CET

Mission Status

In **Mar 2019 – Jan 2020**, the following activities has been completed:

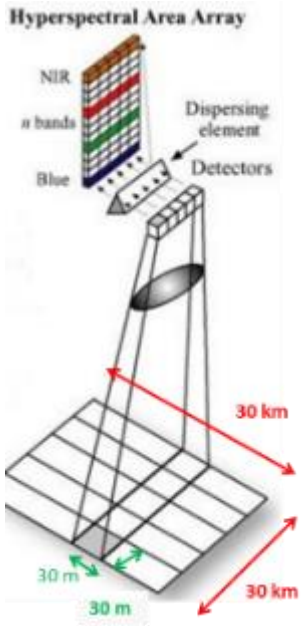
- Satellite & Payload verification
- Sensor calibration with performances demonstrated using in flight data
- Operational qualification of GS

This accomplishments led to opening to users on **21 May 2020**

An independent scientific products validation/verification, has started on Jun 2019 and will continue until end of 2022

Mission Overview

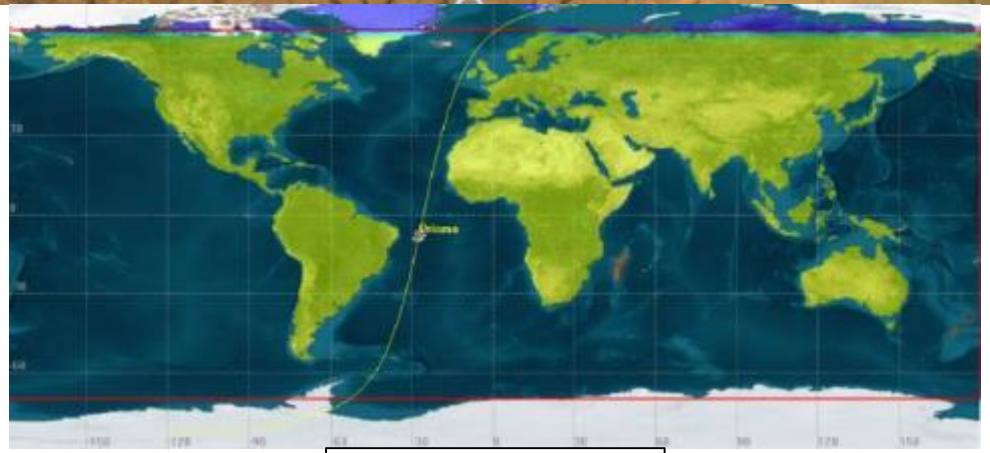
PRISMA: PRecursore IperSpettrale della Missione Applicativa



- EO hyperspectral Mission fully funded by ASI as a National project
- Mission conceived as a
  - Pre-operational and technology demonstrator with a focus on
    - Development and in-flight qualification of HYP/PAN payload
    - Development and Validation of a range of products from Level 1 up to Level 2D

- PRISMA P/L operates with a Pushbroom scanning concept.
- 240 total bands in VNIR (#66, 400–1010 nm) & SWIR (#174, 920–2505 nm), partial spectral overlap
- High spectral Resolution (better of 14 nm)
- Medium spatial resolution (30m) and swath (30km)
- PAN camera offers added capability with 5m resolution

Mission Access



- **Primary mode – Maintain the system & Manage user requests (new acquisitions & archived data products)**
  - CALVAL sites/activities (highest priority)
  - Nominal requests from all registered users, subject to quota and a priority level (depends by the user category)
  - can promote Nominal Requests already Accepted to Very Urgent (just below CALVAL), for insertion (in day N afternoon) in next plan, covering from Day N+1 @12:00 up to Day N+2 @12:00
- **Foreground mission – Routinely acquire sites defined by the MAG, very relevant to science**
  - Acquisitions of #490 sites distributed all over the world, programmed monthly
- **Background mission – Optimize system resources usage**
  - Generated to fill-up resources still available after planning of users requests or for systematic acquisitions

Nominal Performances

MISSION	
Orbit	LEO SSO, 620km, 10.30 LTDN
Lifetime	5 years
Coverage	Worldwide
Primary Mission mode	User driven (on-demand)
SYSTEM CAPACITY	
Swath	30 km, GSD: 30 m HYP, 5 m PAN
Data volume	daily > 200.000 km2 on all the 430/29 orbits/day
Daily products generation	daily processing of 200 hyperspectral scenes (30 km x 30 km) up to level 2D product.
SYSTEM LATENCIES	Nominal values (MRD requirements)
Revisit time	< 29 days
Re-look time	< 7 days
Response time	< 14 days

Performances

Specification	Design Value
Absolute geolocation	<200 m CE90
Geolocation with GCPs.	<0.5 HYP GSD CE90
PAN MTF at Nyquist	>0.2 (Payload>0.53)
VNIR MTF at Nyquist	>0.3 (Payload>0.65)
SWIR MTF at Nyquist	>0.3 (Payload>0.65)
HYP bands coregistration	<0.1 pixels

Specification	Design Value
accuracy of SWIR calibrated TOA radiance for unpolarized light	< 5%
accuracy of VNIR calibrated TOA radiance for unpolarized light	< 5%
Accuracy of the At-surface Reflectance	$\frac{\Delta\rho}{\rho} < 5\%$

Performances

- The system, when fully exploiting its resources, allows planning acquisition and download of **at least 223 spot** (30x30 Km) images per day, but
- **#296** images acquired on a single day (April, 10th 2020)
- The system allows processing 223 spot images per day up to Level 0 and generating corresponding quicklooks
- The system allows processing **at least 200 Hyperspectral scenes** (30x30 Km) up to level 2D per day starting from archived L0 products
- The system allows archiving vital data (downloaded data, L0 products and support data) for a minimum of **10 years**
- Average response time (from user order to product ready) is **7.5 days** (measured along a half year time period)

Products

Level 0 (Hyperspectral / PAN)
- formatted data product with appended metadata, including ancillary data and file formatting information (Archived data) in proprietary format (non disseminated)

Level 1 (Hyperspectral / PAN) radiometrically corrected and calibrated radiance data in physical units, including:
- Cloud mask
- Sun-glint Mask
- Classification Mask
- Calibration and characterization data

Level 2B Geolocated at Ground Spectral Radiance Product (Hyperspectral / PAN)

Level 2C Geolocated At-surface Reflectance Product (Hyperspectral / PAN), including:
- Aerosol Characterization Product (VNIR)
- Water Vapour Map Product (Hyperspectral)
- Cloud Characterization

Level 2D Geocoded version of the level 2D products (Hyperspectral / PAN)

L1 and L2 product are disseminated in HD5 EOS format

PRISMA Data Policy

- A simple policy has been approved by ASI: Free of charge & quasi-Open data to all for the 2020-21 years (renewable)
- This will allow
  - to lower the PRISMA data access barriers (to new acquisitions and archived data too)
  - to expand the PRISMA user community
  - to simplify the data exploitation
  - to build customer loyalty to PRISMA data
  - to gather a feedback from users, unbiased by external factors like user nationality, data price, etc

- A «quasi-Open» policy
  - Full support to National security rules: products **cannot be redistributed**
  - User Registration and Licence explicit acceptance **is required**
  - Each User will be allowed to use only a portion of the system resources, through **Priority and Quota** mechanisms
  - Products use is allowed for scientific research, R&D of new applications, prototype services **but NOT yet for commercial purposes (will soon change!)**
  - Products are **costless** for the users

International Collaborations

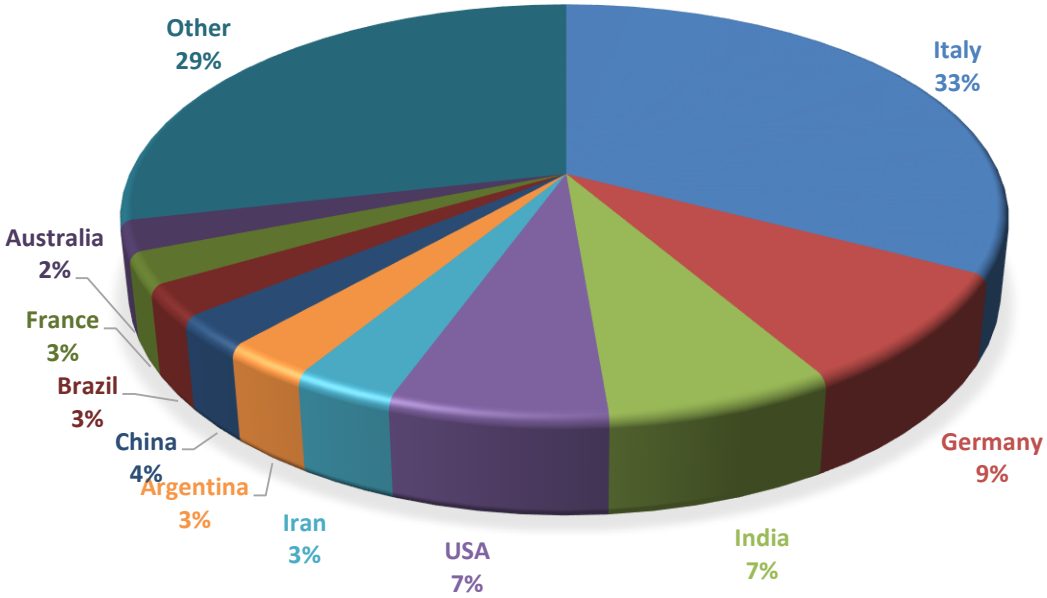
ASI is fully open to define agreements with international bodies, in order to develop joint research projects, use the PRISMA system capacity, collaborate on CALVAL of the PRISMA sensor + products and in general exploit potential synergies between respective EO assets

We are currently pursueing agreements with:

- CNES
  - ✓ Exchange of technical and scientific data over calibration sites managed by CNES and over CEOS-PICS (Pseudo Invariant Calibration Sites)
  - ✓ Support to CALVAL activities
- DLR
  - ✓ Support to CAL/VAL by sharing test sites data, strategies, methodologies, results
  - ✓ Visibility about activities and results (thematic EO applications, L3/L4 product developments, etc)
  - ✓ Mission exploitation platforms/Toolboxes
  - ✓ Coordination of data acquisitions in support of joint scientific objectives
- ESA: Support to CHIME (2020 and **2021** PRISMA4CHIME project), study of a HYP+HR/VHR CALVAL site, participation to joint scientific events
- Contacts for cooperation agrements with NASA/JPL, NOAA, ASA, NZSA, ….

Mission Statistics – User amount & nationality

- **739** Licenses to Use activated ➡ **1460 users**: 739 main users, 679 affiliated, 43 contractors
- The Italian users are **33%**
- 10 nations covers **70%** of the users



Mission Statistics

87k images (including those from the background mission) all over the world @April 2021

The PRISMA workshop

At the turn of one year of PRISMA in operations, a workshop about PRISMA and his context has been organized by ASI:

Hyperspectral Remote Sensing Workshop 2021: PRISMA Mission and beyond

The present and the future of Hyperspectral Earth Observation from Space

April 2021, 13th (14:00-20:00) - 14th (14:00-20:00)

The WS has been a big success:

- 850 registrations
- (on average) 570 participant on the first day, 250 on the second day
- 7 session:
  - Welcome, Workshop objectives, Agenda, Institutional/Industrial talks
  - PRISMA Mission and beyond (Characteristics, status and results)
  - Other Hyperspectral missions (characteristics / status / results)
  - User needs and requirements
  - Thematic exploitation
  - Prototype applications and End Users Experience
  - Final Round table

The PRISMA workshop

- 40 talks, ranging from
  - PRISMA deep technical details on products, CALVAL
  - international HYP technology context
  - PRISMA applicative algorithms and developments
  - concluding Round Table with Italian space industries, institutions and Copernicus EC about the future of PRISMA, roadmap for next HYP technologies, user needs, economy of HYP data, new algorithms

portal:
https://prisma.asi.it

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