Ground segment and products

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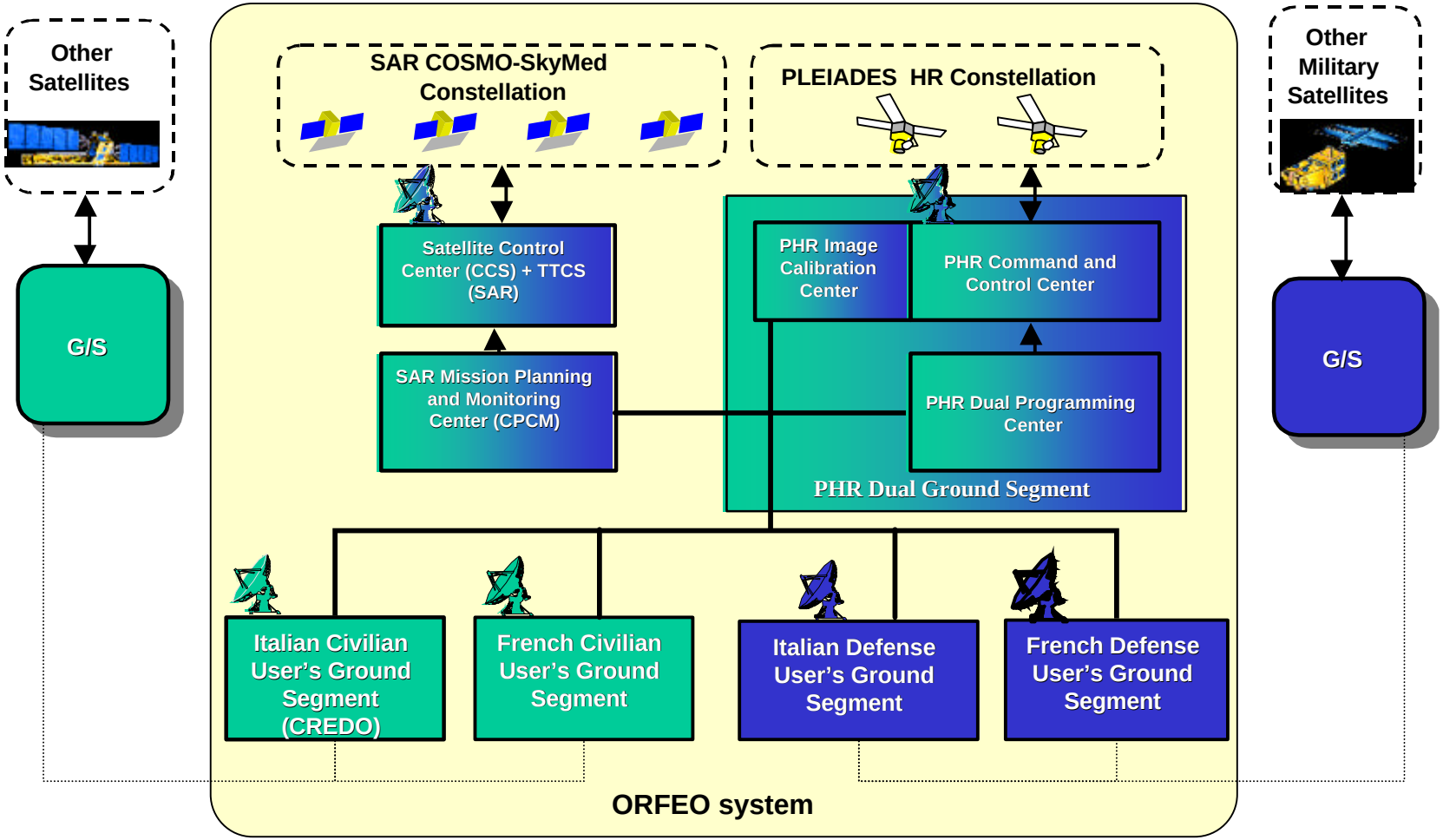
ORFEO

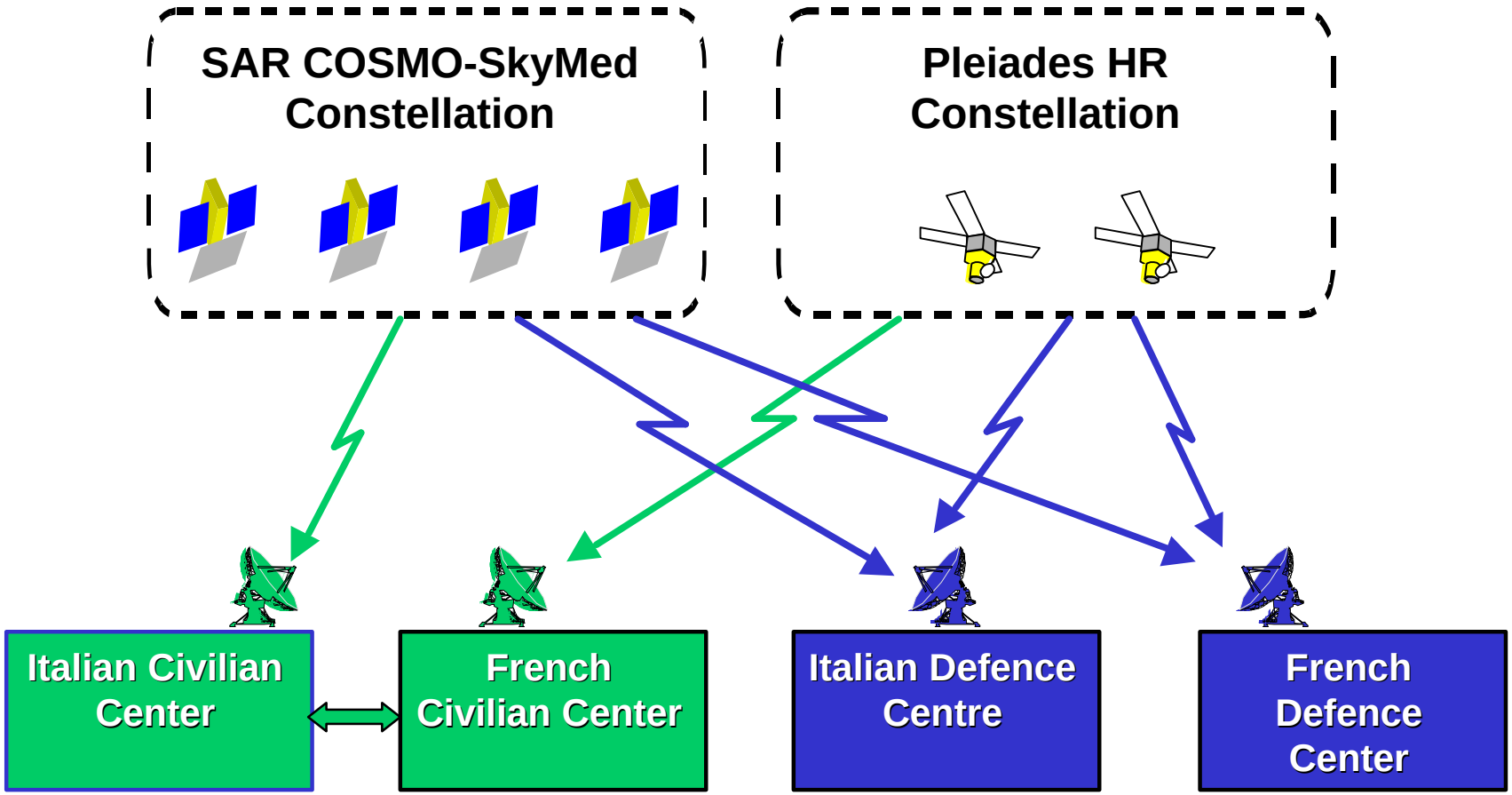
- ORFEO stands for:
  - Optic and Radar Federated Earth Observation system
- ORFEO is:
  - Dual: it offers services to Defense and civilian users,
  - Multi-sensors:
    - it includes two components:
      - COSMO-SKYMED SAR
      - PLEIADES HR optic (PHR)
    - it allows the users to see a federated system, users can:
      - deposit multi-sensor requests simultaneously on SAR an PHR components (mixed, coupled …)
      - Browse a meta-catalog,
      - Receive PHR and SAR products
  - International: the cooperation is between France and Italy. The MoA foresees entry of new partners.

ORFEO system overview

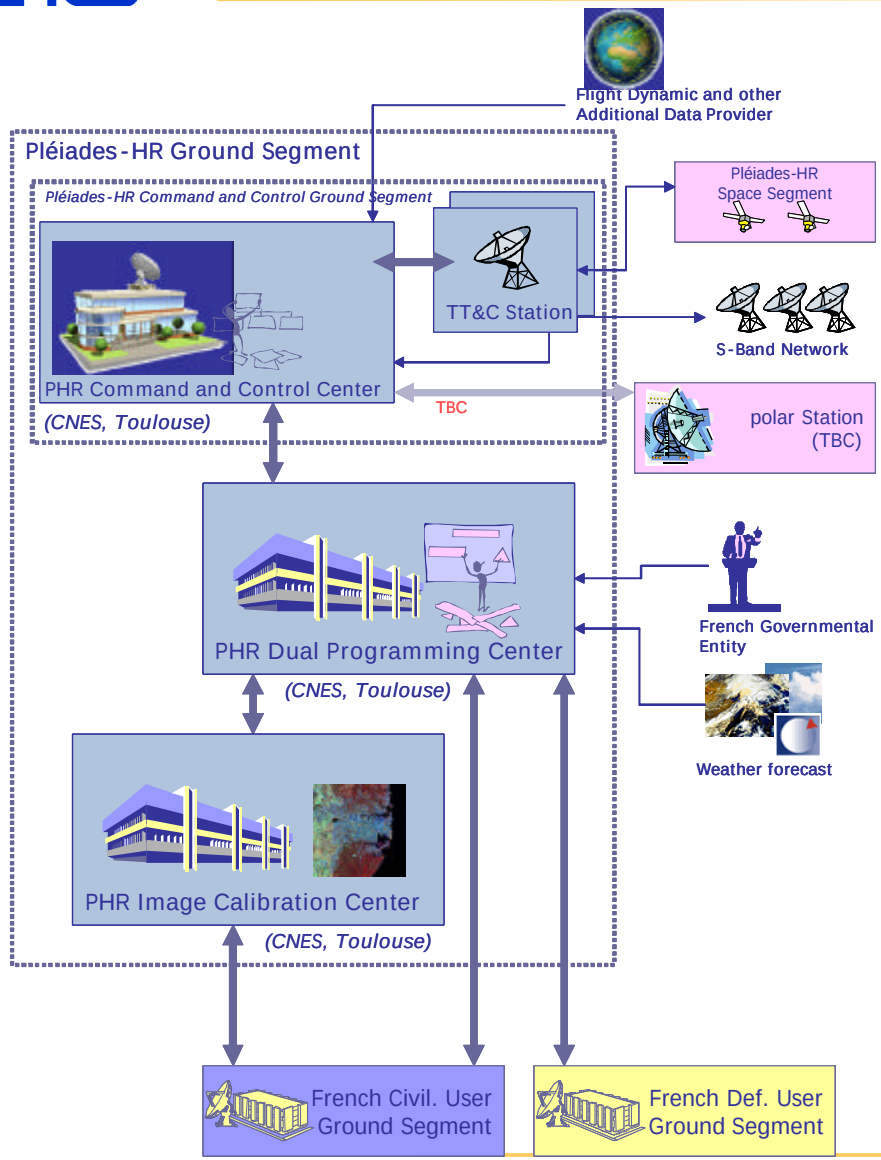
PLEIADES



Data Reception on main centers

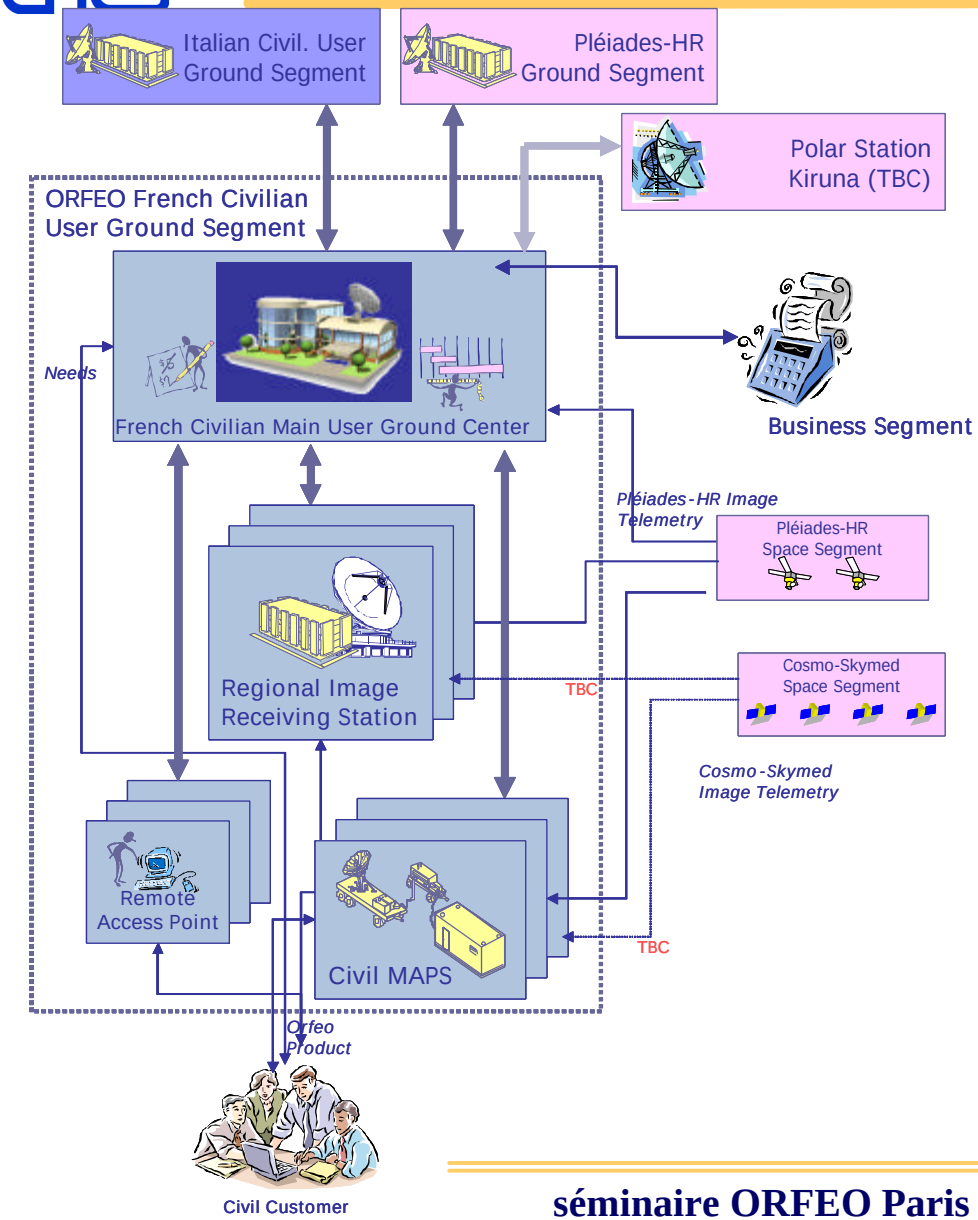


PHR dual ground segment



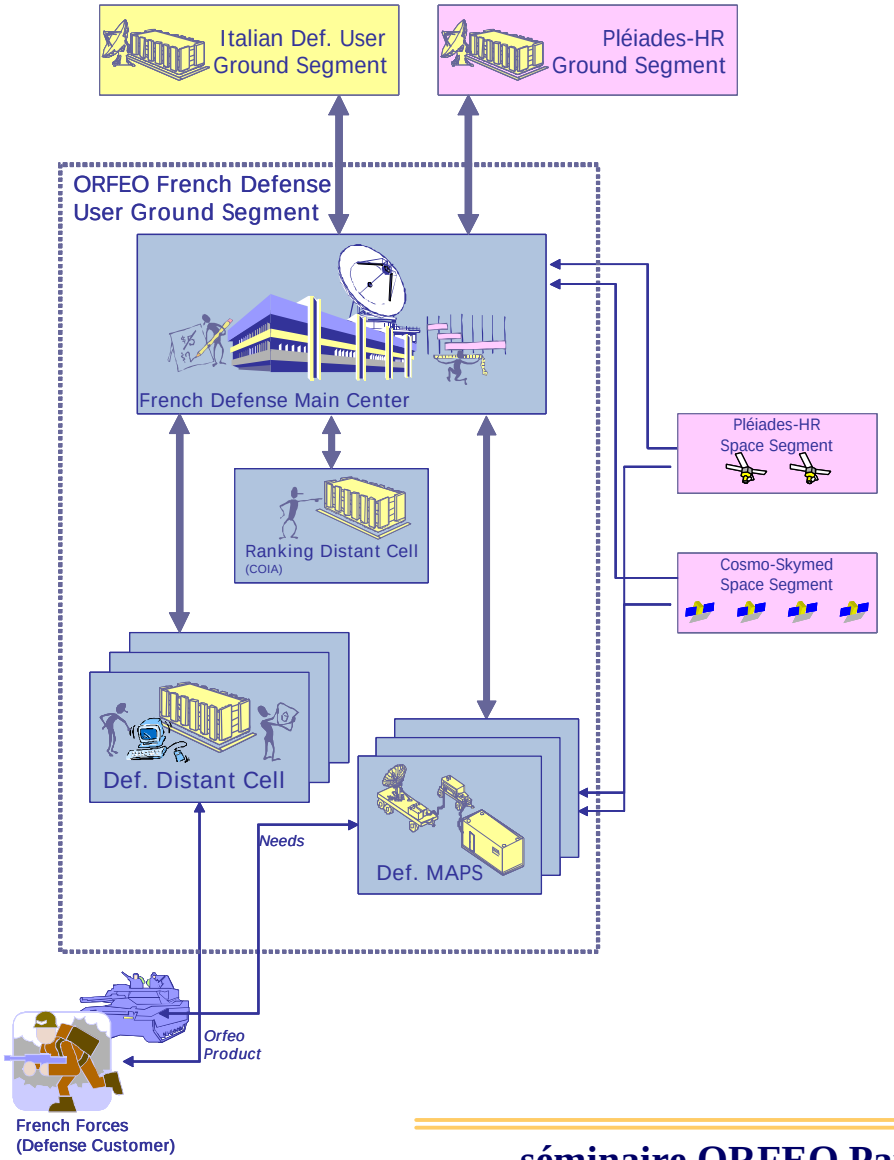
- A command and control ground segment
  - Control center
  - TT&C S band Stations
- A PHR dual programming center
- A PHR Image Calibration Center

French Civilian UGS



- A main center located in Toulouse
  - Centralizes all the civilian requests
  - Interfaces the business segment
  - Reveives and process PHR ITM
  - Maintains a central civilian catalog and archive
- A secondary main center in polar area (Kiruna TBC)
- Option to locate a polar store and forward station in Svalbard
- Several regional Image Receiving Stations with access points
  - Programming needs are forwarded to the main center
  - Reveive and process PHR ITM
  - Update the central catalog
- A possibility to connect civilian Mobile Acquisition Stations
  - Number TBD
  - Development TBD
- Multi-sensors aspects in RIRS and MAPS is TBD

French Defense UGS for PHR

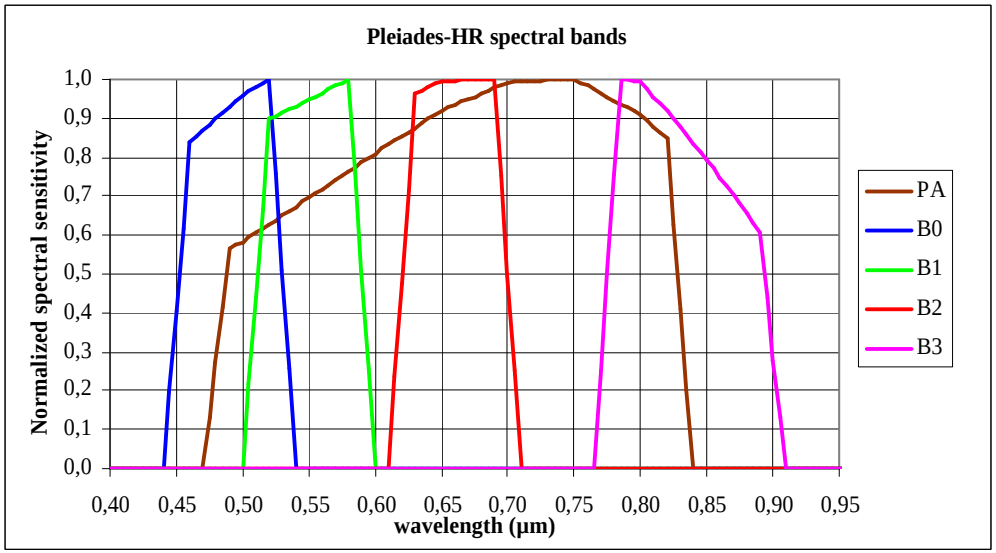


- A main center located in Creil
  - National zone
    - Handling of PHR F Def requests
    - Receive and processes French Def PHR data (idem for SAR)
    - Maintains a French Def central PHR archive and catalog (idem for SAR)
  - International zone in charge of PHR Defense/Defense international programming coordination (PCME)
- A set of « distant cells »
  - ORFEO entry point for Defense users in each French Def organism
  - (multi sensor requests management, catalog browsing, product deleivery requests …)
- The COIA distant cell
  - French national programming requests ranking
- A set of Mobile Acquisition Stations (not yet studied …)

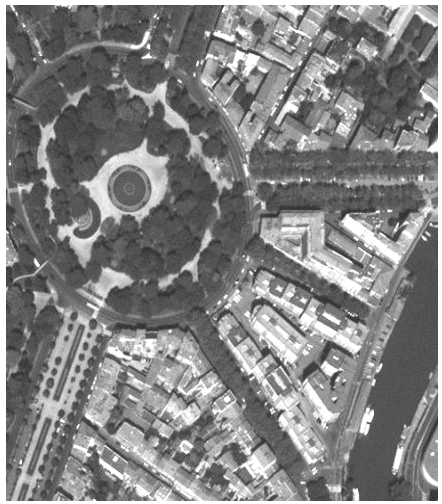
PLEIADES-HR SYSTEM PRODUCTS

System products

- PA+ XS pictures:



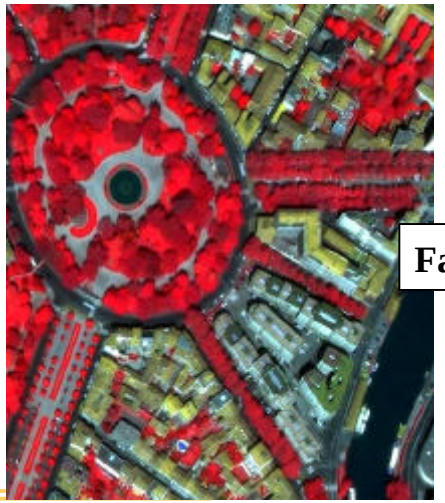
Panchromatic



blue **green** **red**

True color

green **red** **Near infrared**



False colors

System performances

- Radiometric image quality:
  - SNR > 90 for medium-range radiance
  - 12 bits quantization, coding maximum reflectance on 4095 LSB.
  - Absolute calibration : better than 20 % for a single band, 10 % for inter-band
  - No overflow in case of high radiance
  - System MTF better than 0.20 at Nyquist frequency MTF:
    - 0,2 at system level,
    - 0,08 at satellite level (FTM x SNR > 8)

- Geometric image quality:
  - location accuracy : 12 m (CE 90) without GCP
  - planimetric accuracy : 0.5 PA pixel (CE 90)
  - multispectral PA/XS registration : 2 PA pixel (CE 90)

System products

- Raw image: → ***System characterization***
  - 5 bands of decompressed data
  - detector normalization performed on board
  - system-level location performance
- Perfect Sensor : → ***Value-added ground processing***
  - Straight (no distortion) and regularly sampled PA/XS lines of sight
  - Perfectly registered PA and XS retina
  - System-level MTF for PA
  - Polynomial attitude fitting the mean estimated attitude
  - Estimated actual orbital ephemeris + perfect datation
- Orthoimage : → ***GIS***
  - single orthoimage
  - mosaics

PA restoration

Raw PA image MTF(fe/2) = 0.08

Restored PA image MTF(fe/2) = 0.20

Pleiades-HR

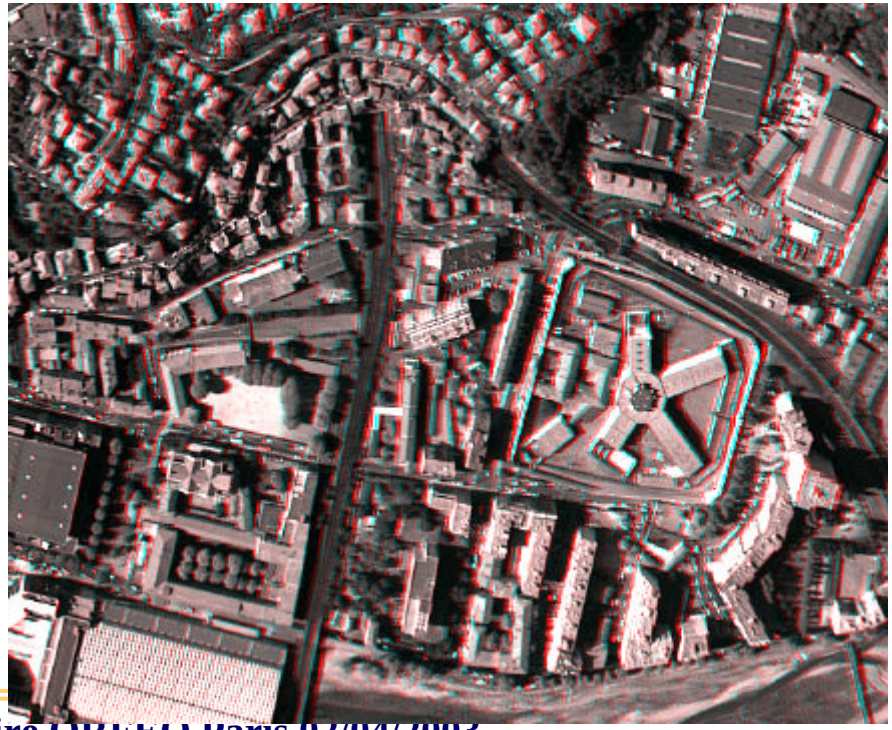
PA/XS Fusion

Raw XS image
GSD=2.80m

PA/XS image
GSD=0.70 m

Stereo pairs and triplets

- Single-pass stereoscopy :
  - low B/H for easy visual analysis in urban contexts
  - DTM production with perfect sensor level stereo pairs
  - Improved orthos thanks to triplets (reduced hidden areas)
- Visual example



PHR System Formats

- 3 levels of processing
  - Raw level, Perfect Sensor Level, Orthoimage Level
- Perfect Sensor output product
  - Data-strip, extract of
  - PA GSD 70 cm, XS GSD 2.8 m + NC/ FCC 70 cm
- Orthoimage output product
  - Data-strip, extract of, mosaic (TBC)
- Format
  - DIMAP (Raw BIL or GeoTIFF)
  - STANAG 4545 (TBC for PAIPSY)

Image Figures

- Perfect Sensor ‘scene’ volume
  - *scene = 20 km x 20 km*
  - PA volume (GSD 70 cm) *16 bits* 1.8 Gbytes
  - XS volume (GSD 2.80 m) *16 bits* 0.45 Gbytes
  - Nat. Color/ False Color bands *8 bits* 2.7 Gbytes
    16 bits 5.4 Gbytes
- Orthoimage ‘scene’ volume
  - close to Perfect Sensor volumes