

# Agency report from the BELGIAN INSTITUTE FOR SPACE AERONOMY under mandate of the BELGIAN FEDERAL SCIENCE POLICY (BELSPO)

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Federaal Wetenschapsbeleid  
Politique scientifique fédérale  
Föderalen Wissenschaftspolitik  
Belgian Science Policy



ORB/KSB



IRM/KMI



IASB/BIRA



PLANETARIUM

# Agency report from BELSPO/BIRA-IASB

1. Belgian federal EO activities in brief
2. Review of satellite missions
3. NDACC (and synergies with AC&C satellites)
4. Activities relevant to GEO Tasks



# BELGIAN FEDERAL SCIENCE POLICY

## EO ACTIVITIES IN BRIEF

- National EO federating programmes
  - Belgian Platform on Earth Observation [<http://eo.belspo.be>]
  - STEREO, TELSAT, VEGETATION: atmosphere , bathymetry, disasters, food, hydro-ecology, land cover, support to African and tropical projects, topography... by space, airborne and ground-based remote sensing
- International and bilateral cooperation
  - ESA, EUMETSAT and ECMWF membership
  - ProDEX programme
  - EU Global Monitoring of Environment and Security (GMES)
  - CEOS, COPUOS, COSPAR, ECSL, IISL ...
  - Bilateral agreements: Argentina, Bulgaria, Canada, China, France, Germany, Netherlands, Poland, Russia, Vietnam

# BELGIAN FEDERAL SCIENCE POLICY

## EO ACTIVITIES IN BRIEF

### ■ Federal Space Pole



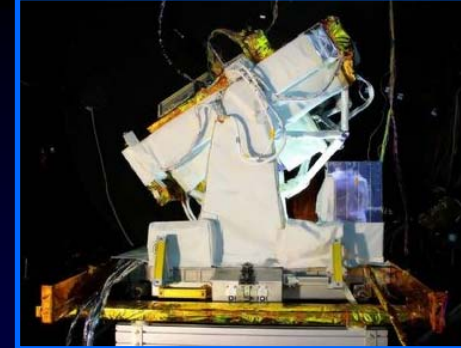
- Belgian Institute for Space Aeronomy (BIRA-IASB)
  - Belgian Royal Meteorological Institute (IRM-KMI)
  - Belgian Royal Observatory (KSB-ORB)
  - Planetarium
- ### ■ "Hardware" participation in EO satellite missions
- IVOS: Pléiades, PROBA, SPOT...
  - Atmosphere: ORA, MIRAS, SCIAMACHY, ACE...
  - Solar: DIARAD, SOLCON, SOLSPEC, SOVA 1, SOVAP, SOVIM

### ■ Ground segment

- User Support and Operation Centre (B-USOC) at BIRA-IASB
- ESA ground receiving station in Redu

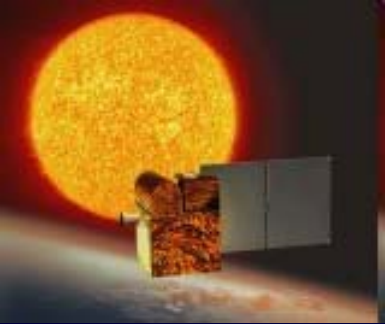


# ISS / COLUMBUS SOLAR

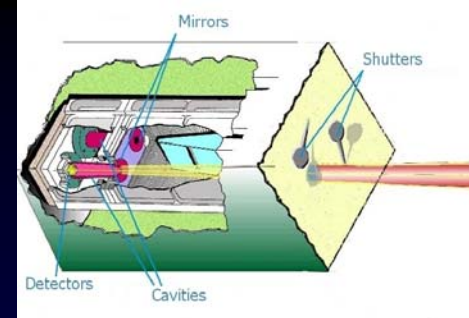


- Three instruments covering solar spectral irradiance from 17 nm to 100  $\mu\text{m}$  (99% of solar energy)
  - **SOVIM** (SOlar Variable and Irradiance Monitor): near-UV, visible and thermal (200 nm - 100  $\mu\text{m}$ ); developed by PMOD/WRC (Davos, Switzerland) with one instrument's radiometers provided by IRM-KMI (Belgium)
  - **SOLSPEC** (SOlar SPECtral Irradiance measurements): 180 nm - 3 000 nm; developed by CNRS (France) in partnership with BIRA-IASB (Belgium) and LSW (Germany)
  - **SOL-ACES** (SOlar Auto-Calibrating Extreme UV/UV Spectrophotometers): EUV/UV; developed by IPM (Germany)
- Facility Support Centre: Belgian USOC at BIRA-IASB





# MYRIADE PICARD



- CNES Myriade microsatellite that will precisely measure the Sun's diameter and its variations, as well as solar irradiance, with the twofold aim of learning more about how the Sun affects Earth's climate and studying its physics and inner structure
  - **SODISM**: an imaging telescope (developed in France by SA/CNRS) capable of measuring the Sun's shape and diameter to within a few milliarcseconds
  - **SOVAP**: a differential radiometer (developed in Belgium by IRM-KMI) to measure total solar irradiance
  - **PREMOS 2**: a suite of three photometers and radiometers (Swiss instrument) to study ozone and solar oscillations
- PICARD Mission Centre: Belgian USOC at BIRA-IASB

# SPACE POLE STCoE

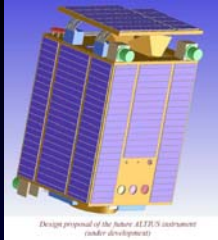
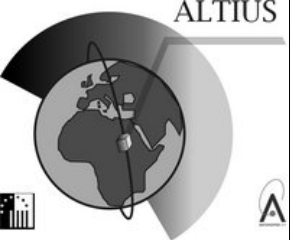
(Solar Terrestrial Centre of Excellence)

- To combine expertise available at Federal Space Pole (observatory, aeronomy, and meteo institutes) to develop a CoE dedicated to the Sun-Earth relations
- at KSB-ORB : solar monitoring and Space Weather predictions at the SIDC (Solar Influences and Data analysis Centre), PI of the PROBA-2 instruments
- at BIRA-IASB : modelling the radiation environment of the Earth: SPENVIS and other projects, CLUSTER observations
- at IRM-KMI : solar constant monitoring and its impact on climate: SOVIM, SOVAP

# ATMOSPHERIC COMPOSITION AND CLIMATE SATELLITES

- **The GOME series**
  - ERS-2 GOME, Envisat SCIAMACHY, MetOp GOME-2
  - BIRA-IASB member of SAGs and GOME Data Processor team
  - Prototype and operational trace gas retrieval; validation
- **Envisat GOMOS, MIPAS and SCIAMACHY**
  - SCIAMACHY funded by Germany, Netherlands and Belgium
  - BIRA-IASB member of SAGs, SCIAVALIG, ESLs, QWGs ...
  - Validation: algorithm, delta, geophysical, and multi-mission
- **SCISAT-1 ACE imager**
  - Bilateral agreement between CSA and BELSPO
  - Detection of PSCs and PMCs, pointing capabilities
  - Coordination of validation for several species





# ALTIUS

## ■ PROBA heritage

- 94 kg spacecraft mass, 25 kg EO payload
- Small and agile gyro-less LEO platform, whose attitude determination is based on autonomous star tracker only
- Prime contractor: Verhaert Design and Development (Belgium)
- Ground segment in Redu (Belgium), partnership ESA/BELSPO

## ■ ALTIUS concept (entering Phase B studies at BIRA-IASB)

- Entire detector used as an atmospheric limb imager to solve the tangent altitude registration problem
- Acousto-optical tunable filters (AOTF)
- Limb spectra in the UV-vis-NIR
- Tomography capabilities
- O<sub>3</sub>, trace gases, aerosols, clouds...

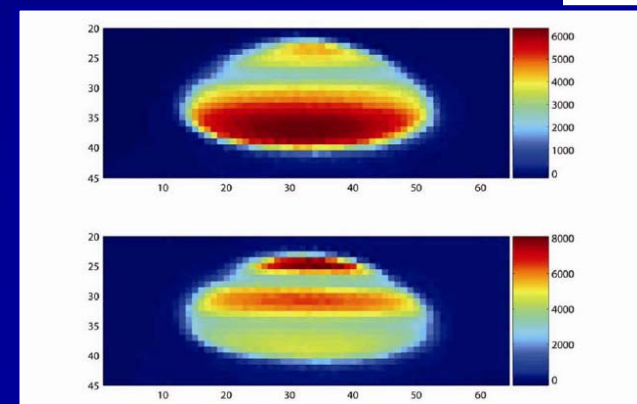
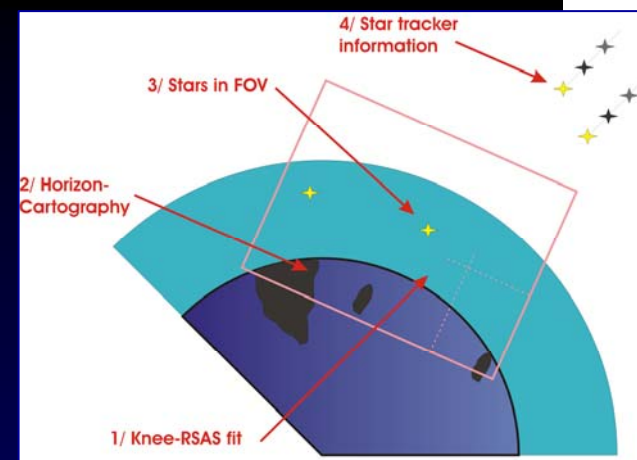
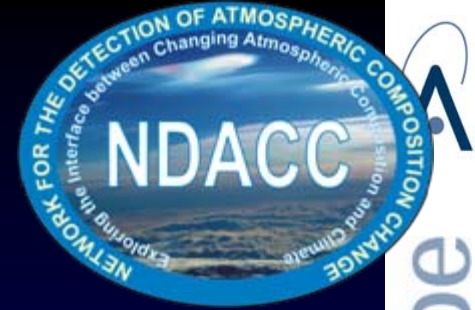


Figure 6. Imager data at 1.020  $\mu\text{m}$ . (top) PSC layer, 9 July 2004 at lat = 61°S; (bottom) PSC double layer, 2 August 2004 at lat = 65°S.

# NETWORK FOR THE DETECTION OF ATMOSPHERIC COMPOSITION CHANGE



- Sustained Belgian support since commissioning (1980s)
- Operation of NDACC instruments (BIRA, KMI and ULg)  
[CL-06-01, CL-09-01/02/03, DA-09-01]
  - FTIR in Switzerland since 1950s + Reunion Isl. + mobile FTIR
  - Uccle (Brussels): ozonesondes and Brewer since 1970s, CIMEL
  - UV-visible DOAS in Norway, Haute Provence and Reunion Isl.
  - All EC campaigns, SAUNA, Cabauw, Beijing 2008, CINDI...
- Support to satellite missions
  - Close link between NDACC Satellite WG and WGCV ACSG
  - Coordination of NDACC-based validation for GOME, SCIAMACHY, GOMOS, MIPAS, OMI, GOME-2
  - Various types of support to many other missions
  - GOSAT: CO<sub>2</sub> FTIR (TCCON) in Reunion Island

[CL-09-03]

# NDACC SATELLITE WORKING GROUP



aeronomie.be





## Network for the Detection of Atmospheric Composition Change (NDACC) Satellite Working Group

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ERS-2/Envisat tandem flight (from pictures kindly provided by ESA)

Welcome to the NDACC Satellite Working Group Homepage!

The objective of the Satellite Working Group is to foster collaboration among atmospheric scientists involved in the NDACC and in satellite missions. This website is a guide to ground-based researchers, space agencies and other interested parties to practical information on atmospheric chemistry satellite missions.

Enjoy your visit!

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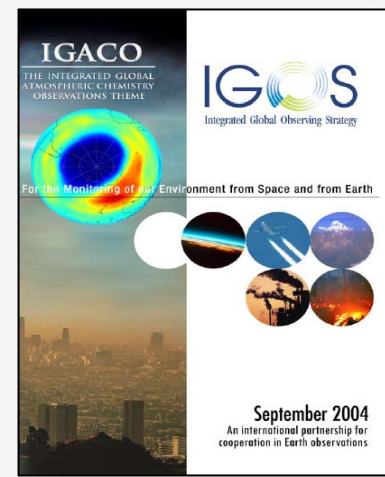


<http://accsatellites.aeronomie.be>  
or via <http://www.ndacc.org>



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# Trace gases measured by atmospheric sensors

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- [Oxygen compounds](#)
- [Nitrogen compounds](#)
- [Sulfur compounds](#)
- [Hydrogen compounds](#)
- [Water vapour](#)
- [Carbon and hydrocarbon](#)
- [Halogen compounds](#)
- [Tropospheric clouds](#)
- [Aerosols](#)
- [Temperature](#)
- [Compounds recommended by international strategies, but not measured](#)













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BIRA-IASB

Contact: [Webmaster](#)  
Last update: Oct. 2007

	Trace Gases	Sensors
Oxygen compounds	Ozone column (O <sub>3</sub> )	AIRS, <a href="#">GOME-1</a> , <a href="#">GOME-2</a> , <a href="#">IASI</a> , <a href="#">OMI</a> , <a href="#">OMPS</a> , <a href="#">SBUV</a> , <a href="#">SBUV/2</a> , <a href="#">SCIAMACHY</a> , <a href="#">SSBUV</a> , <a href="#">TOMS</a> , <a href="#">TOVS</a>
	Ozone profile (O <sub>3</sub> )	<a href="#">ACE-FTS</a> , <a href="#">ATMOS</a> , <a href="#">CRISTA</a> , <a href="#">CLAES</a> , <a href="#">GOME-1</a> , <a href="#">GOME-2</a> , <a href="#">GOMOS</a> , <a href="#">GRILLE</a> , <a href="#">HALOE</a> , <a href="#">HIRDLS</a> , <a href="#">HIRS-2</a> , <a href="#">IASI</a> , <a href="#">ILAS</a> , <a href="#">ILAS-II</a> , <a href="#">IMG</a> , <a href="#">ISAMS</a> , <a href="#">LIMS</a> , <a href="#">MAESTRO</a> , <a href="#">MAS</a> , <a href="#">MIPAS</a> , <a href="#">MLS/EOS Aura</a> , <a href="#">MLS/UARS</a> , <a href="#">OMI</a> , <a href="#">OMPS</a> , <a href="#">OSIRIS</a> , <a href="#">ORA</a> , <a href="#">OZONE/ISTOK</a> , <a href="#">POAM II</a> , <a href="#">POAM III</a> , <a href="#">SABER</a> , <a href="#">SAGE I</a> , <a href="#">SAGE II</a> , <a href="#">SAGE III</a> , <a href="#">SBUV</a> , <a href="#">SBUV/2</a> , <a href="#">SCIAMACHY</a> , <a href="#">SME</a> , <a href="#">SMR</a> , <a href="#">SOFIE</a> , <a href="#">SOLSE/LORE</a> , <a href="#">SSBUV</a> , <a href="#">STEAM</a> , <a href="#">TES</a> , <a href="#">UVISI</a>

<b>Status January 2008</b> <b>Compiled by CEOS ACSG and NDACC Satellite WG</b> <b>Details via <a href="http://www.ndacc.org">http://www.ndacc.org</a> ⇨ Satellite WG</b>										<b>Sounding strategy:</b> <div> <div></div> nadir         <div></div> limb         <div></div> nadir/limb       </div> <div> <div></div> Sun/Moon occultation         <div></div> stellar occultation         <div></div> multi-target       </div>										<b>Spectral range:</b> <div> <div></div> UV         <div></div> UV/VIS/NIR       </div> <div> <div></div> IR         <div></div> VIS/IR       </div> <div> <div></div> MW         <div></div> multi-sensor       </div>									
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# Data Quality Strategy [DA-06-02] for the GMES ATMOSPHERIC SERVICE (GAS)

- **"Upstream"**
  - ACC, CAPACITY and CAMELOT needs/gap assessments [CB-09-04]
  - "Operational" validation for ESA and EUMETSAT satellites
  - ESA's Generic Env. for Cal/Val Analysis (GECA) [DA-06-01/02]
- **Implementation**
  - Metadata : NDACC metadata WG, EVDC/AVDC/NOAA/WMO board
  - Core service : GEMS ⇒ MACC
  - Downstream services : PROMOTE ⇒ PASODOBLE, EVOSS, ...
- **Legal issues: INSPIRE Implementing Rules** [DA-06/09-01]
- **Research:** EC FP6 IP GEOmon and ProDEX SECPEA on concepts, methods and tools for data management, site classification, integrated use of network and satellite data, observation operators for "collocations" in validation and data assimilation and for interpretation, trends based on multi-mission data analysis etc.  
[DA-06-01, DA-09-01/02/03, CB-09-03, ST-09-02, CL-06-01, CL-09-03]

# EC GEOmon and ProDEx SECPEA

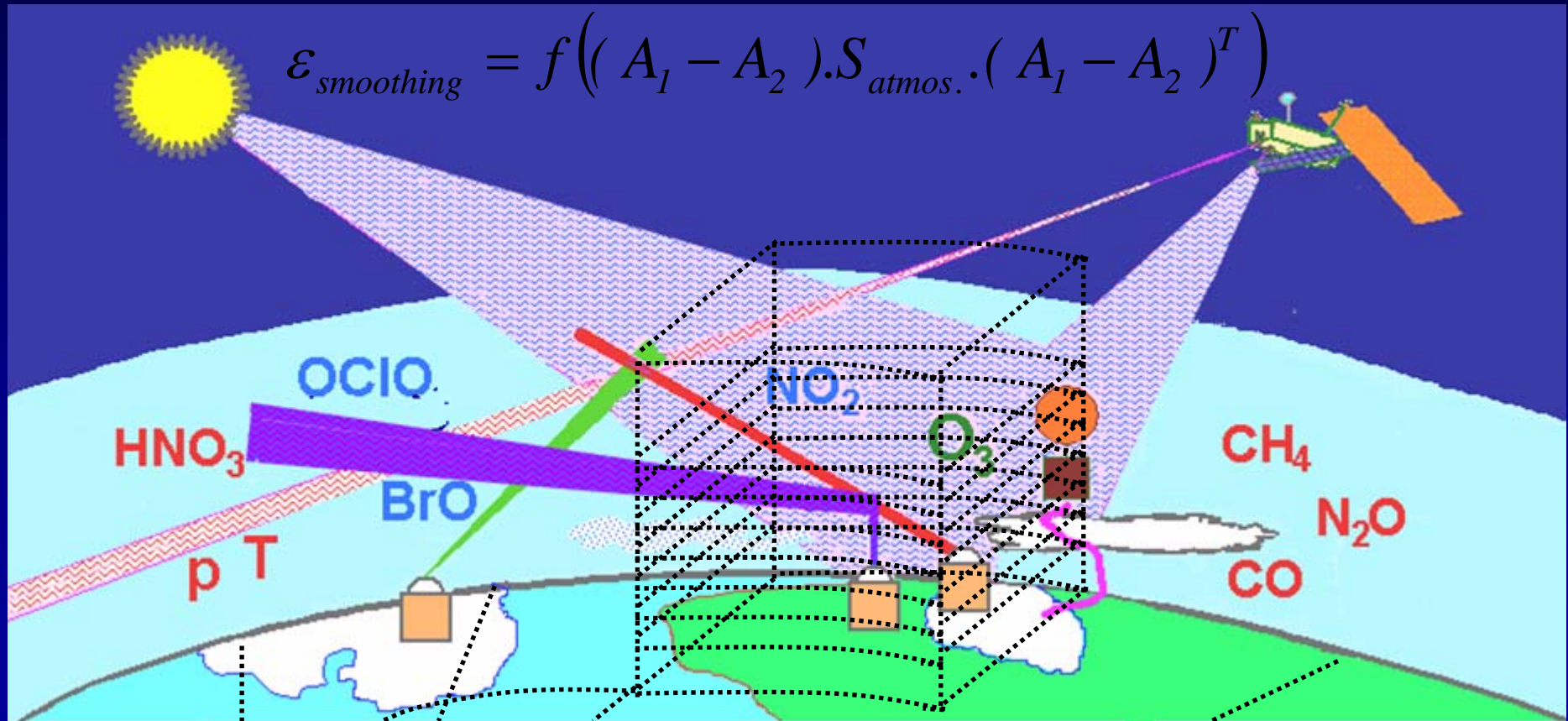
## What is a "valid" collocation?

[DA-09-02]

[DA-06-02]

[CL-06-01]

Air masses actually probed by Envisat and by NDACC instruments:  
FTIR, UVVIS DOAS, balloon-sonde, lidar, MWR



Typical model/assimilation grid 1° x 1°

# The PROMOTE laboratory

## Towards operational atmospheric services

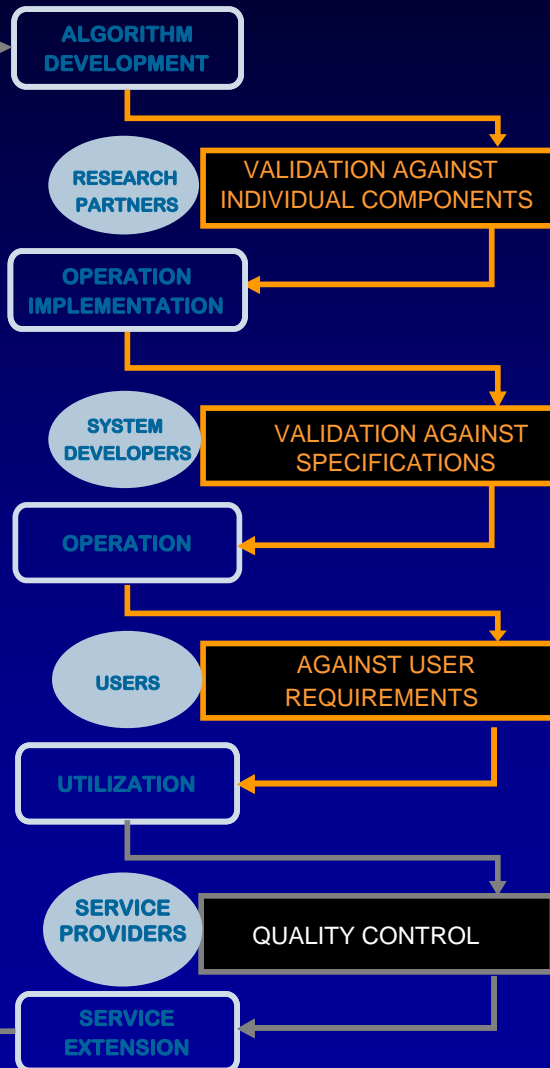


### ESA GMES Service Element [\[www.gse-promote.org\]](http://www.gse-promote.org)

- Networks of atmospheric services [\[DA-09-01/02/03, CB-06-04, CL-06-01\]](#)
- Federation of SLA-committed users [\[US-09-01/03, CL-09-01, ST-09-02, HE-09-02\]](#)

### Central QA/Validation Office (at BIRA-IASB)

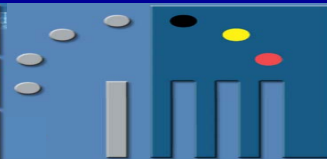
- Fitness for purpose of validation
- Establishment and enforcement of PROMOTE Service Validation Protocol: General standards and working practices for validation of services



# THANK YOU !



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