gaia

esa

Poster Presentation

SCIOPS 2017, 17-20 October, ESAC

Poster - Gaia cyclic processing: Operating the Astrometric Global Iterative Solution (AGIS)

Mercedes Ramos-Lerate, Vitrociset Belgium for ESA/ESAC
Jose Hernandez, Uwe Lammers, ESA

SCIOPS 2017, 17-20 October, ESAC

Operating the Astrometric Global Iterative Solution (AGIS)

- The complexity of the Gaia data reduction has implied that each processing system are managed by Coordination Units (CU), each responsible for a particular aspect of data processing. CU3 is in charge of the core processing of Gaia data. It consists in various systems as the Initial Data Treatment system (IDT), the Intermediate Data Updating (IDU) and the Astrometric Global Iterative Solution (AGIS).

- AGIS is developed and operated in ESAC as part of the Data Processing Center (DPCE). It is the software that retrieves all the Gaia observations in cycles of Gaia segments and computes the astrometric solution that will feed later the Gaia Catalogue. The processing and scientific operations of AGIS is a challenge, not only because of the volume of data to be processed (growing with the MDB size), but also because of the final accuracy and precision that we need to achieve.

- AGIS, IDU and PhotPipe are some of the cyclic processing systems responsible to achieve high accuracies envisaged for the final Gaia catalogue gaia esa

Preprocessor
Retrieves all necessary cycle data from Gaia Main Data Base (MDB) and convert them into AGIS Elementaries.
Inputs: Gaia Catalogue (integrated with photometry data) + AstroElementaries (uses the outputs of IDU) + AuxiliaryData (Gaia orbit, calibration inputs, etc)

AGIS 2.2 PRODUCTION
Distributed processing in 20 Gaia cluster nodes (each node 20 cores x 1200.000MHz/25600KB)
Output AgisAstroElementaries 40,732,695,738
Output AgisSources 2,499,374,508

Secondary
Perform a first estimation of the astrometry and quality for ALL source, this first step is needed for the selection of "Primary Sources"

AGIS 2.2 PRODUCTION
Distributed processing in 20 Gaia cluster nodes.
Output AgisSources 2,499,374,508

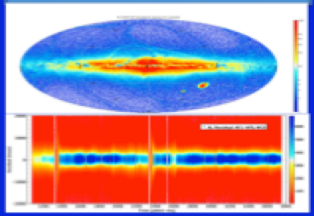
Primaries Selection
Select 16M sources based on astrometry quality and photometry availability

Primaries runs
This phase consists on the determining 1) the astrometry of the sources which were selected as primaries, 2) the spacecraft attitude and 3) the instrument calibration parameters all with the best possible accuracy for the given models and observations available. When the solution has been computed the primary sources and the attitude are aligned to the ICRF

AGIS 2.2 PRODUCTION
Distributed processing in 20 Gaia cluster nodes.
Outputs: AstroCalibration, Oga3

INTERNAL SCIENTIFIC VALIDATION
In this stage, AGIS actively interacts with its scientific core by providing selection of relevant data for preliminary analysis.
Such analysis might have an impact in the configuration of the Primary run.
Examples are:
1. Analysis of QSOs, validate rotation vectors
2. Residual analysis of high density regions as LMC, TGAS, high proper motion stars etc, which are used to "tune" calibration model , add Attitude gaps, etc

AGIS 2.2 PRODUCTION
Validation tools were mainly topcat and spark Jupiter notebooks, python



Final Secondary
In this phase the astrometry of all sources that were preprocessed is calculated by considering the Attitude and Calibration obtained in the Primaries run.

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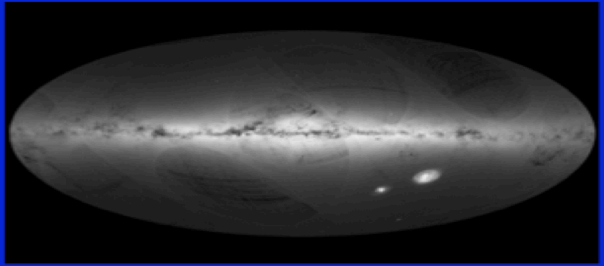

Regenerate Attitude and Calibration Postprocessing
Before sending the data downstream, the Attitude and Calibration are regenerated to include the gap periods (decontamination etc..). Such periods were removed to achieve a best fit to the Attitude and Calibration models.
Finally, the AGIS products are converted into Gaia MDB format, ready for distribution to MDB and the different Data Processing Centers

AGIS 2.2 PRODUCTION
1 Gaia cluster node. Output AgisSources 2,499,374,508 , Oga3, AstroCalibration +Auxiliary data (inputdataused, residuals, excluded intervals etc)

DPCs Distribution
Distribution of new catalogue and AGIS outputs to the Data Processing Centers

MDB
The AGIS sources are integrated in the MDB by the MDB Integrator composing the new CompleteSource catalogue

CU9 Validation
The AGIS sources are ingested into the Gaia archive and the data available to CU9 for deeper scientific inspection.
All CU9 entities execute their test cases, in case of findings, JIRA Issues are reported and further investigated.

Summary of processing steps and operational interfaces for the last cyclic production of AGIS

Gaia Data Transfer System

Pilar Esquej on behalf of the Gaia SOC

SCIOPS 2017, October 18th 2017

Gaia Data Transfer System

E. Salguero[1], E. Anglada[1], R. Guerra[2], E. Fraile[3], P. Esquej[3], N. Cheek[4], M. Ramos-Lerate[5] and N. Bach[6]

[1]ATG-Europe for ESA, [2]ESA, [3]Rhea for ESA, [4]SERCO for ESA, [5]Vitrociset for ESA, [6]Aurora for ESA

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To this end, Gaia has implemented a fast distribution system based upon Aspera and the Data Transfer System (DTS), an in-house developed software in charge of handling the automatic transfer of data.

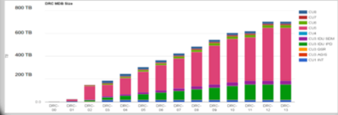
Transfer Types

Daily processing starts with the reception of the spacecraft housekeeping and science data as delivered by the **M**ission **O**perations **C**entre (MOC) in ESOC. A data driven approach is employed at the **D**ata **P**rocessing **C**entre **E**SAC (DPCE) to ensure a prompt start to the processing of all received data. The average daily volume of data varies from 35GB to 90GB depending upon the density of the sky being scanned by the spacecraft. First level data products generated each day are consequently between 300GB and 500GB and are delivered to all DPCs that require them as soon as they are available. Daily data volume produced in the mission so far is in excess of 250TB.

The main processing in DPAC is iterative. During a cycle each DPC produces an improved and more complete version of its products. The total size of **cyclic** data products generated and received at DPCE so far, is greater than 100TB, this is expected to rise to 700TB at mission end.

Re-processing, a recent addition to the responsibilities of DPCE is run on a per need basis and has generated 35TB of data since its start in early 2017.

To ensure data recoverability in case of a disaster scenario at DPCE, all daily and cyclic data is stored as a **back-up** at another DPC.



Data Flow

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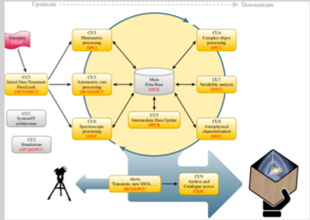

Distribution of products

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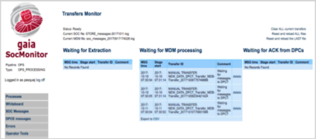

Transfer management is provided by DTS, and Aspera is used for the actual data distribution. An IBM product using both UDP and SSH protocols, Aspera offers a secure and robust transfer mechanism. Since the start of routine operations in July 2014 its failure rate has been negligible.

The current configuration allows a maximum bandwidth of 2.5Gbps at DPCE and 1Gbps at all other DPCs. This is currently enough for typical data volumes. In future cycles the data volumes will increase, and this upper limit will need to be revised accordingly. With the current network topology at ESAC, Aspera could be re-configured up to 10Gbps.

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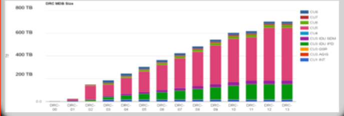

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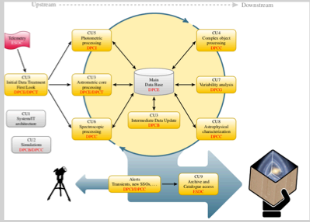

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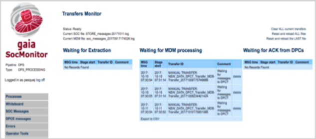

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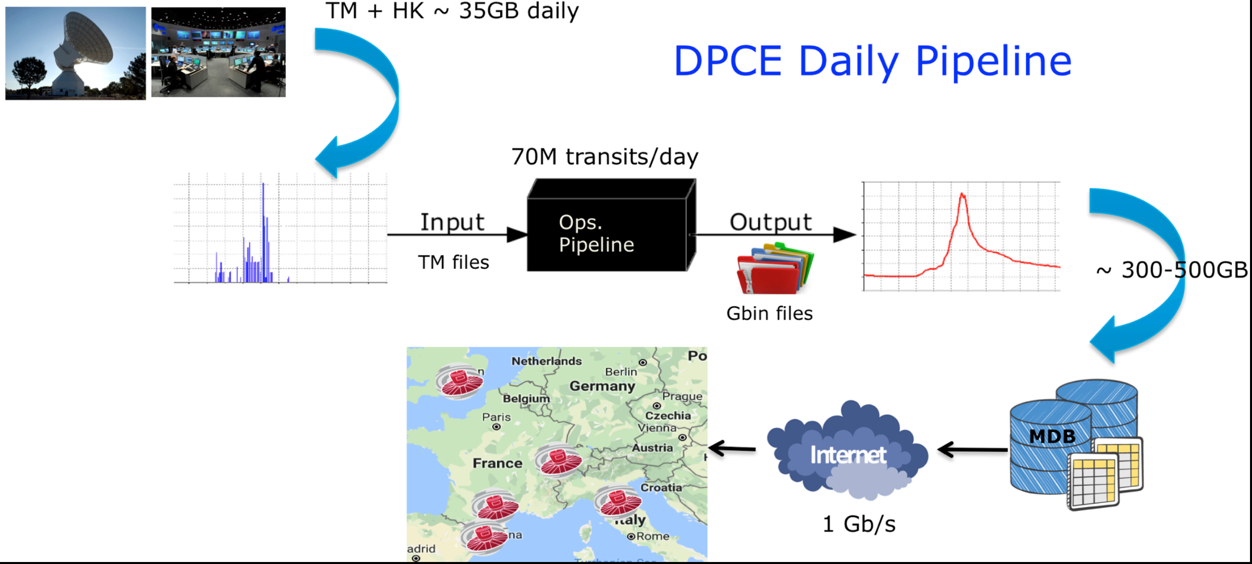
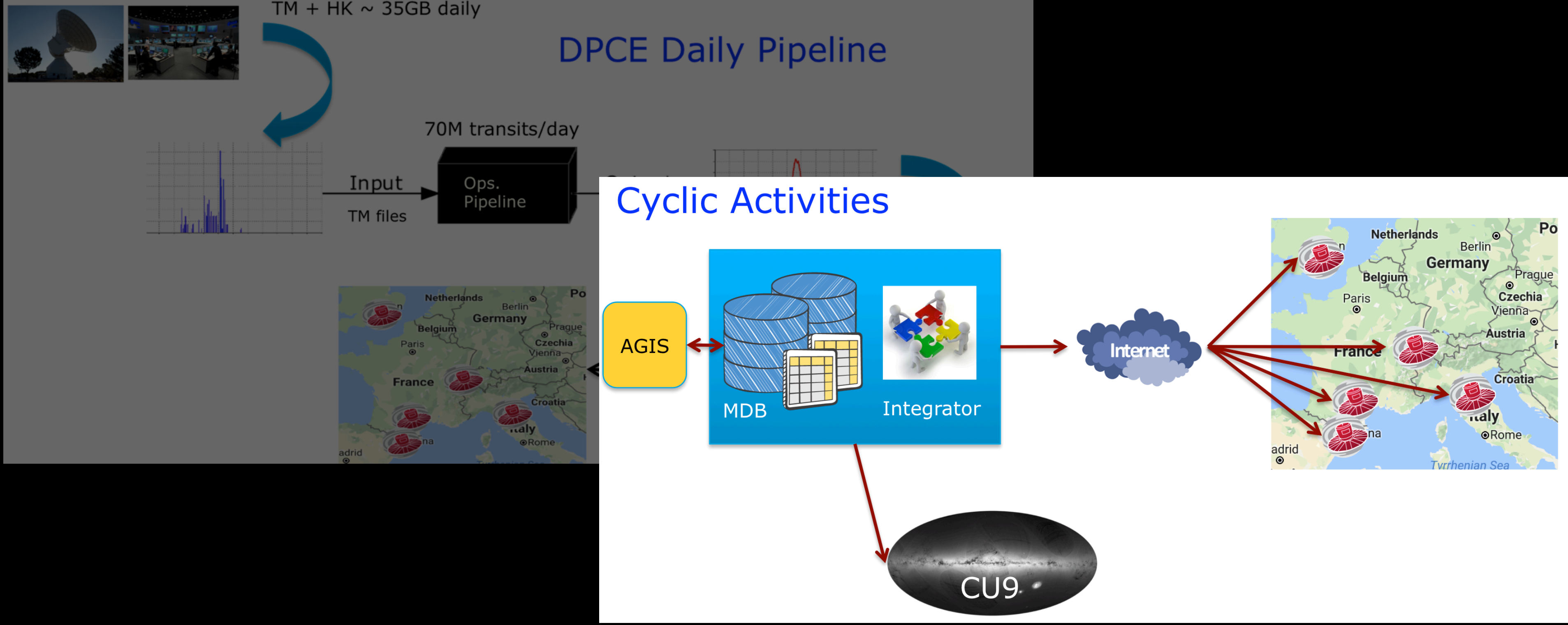
DPCE Daily Pipeline




TM + HK ~ 35GB daily
DPCE Daily Pipeline
70M transits/day
Input
TM files
Ops.
Pipeline
Netherlands
Berlin
Germany
Belgium
Prague
Paris
Czechia
Vienna
France
Austria
Croatia
Rome
Cyclic Activities
AGIS
MDB
Integrator
Internet
Netherlands
Berlin
Germany
Belgium
Prague
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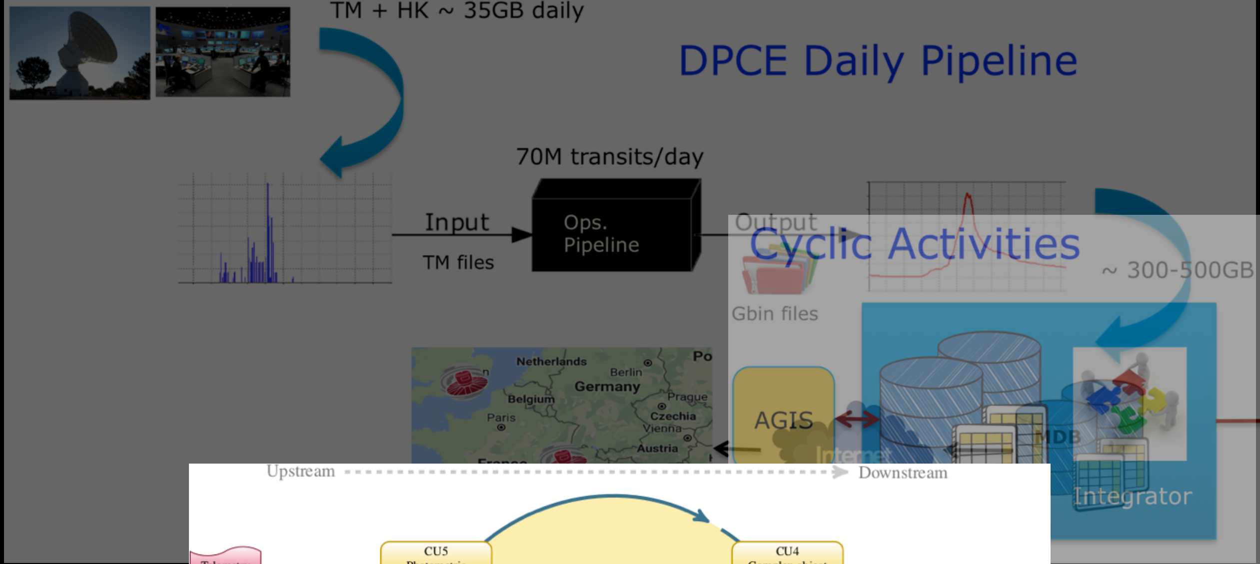
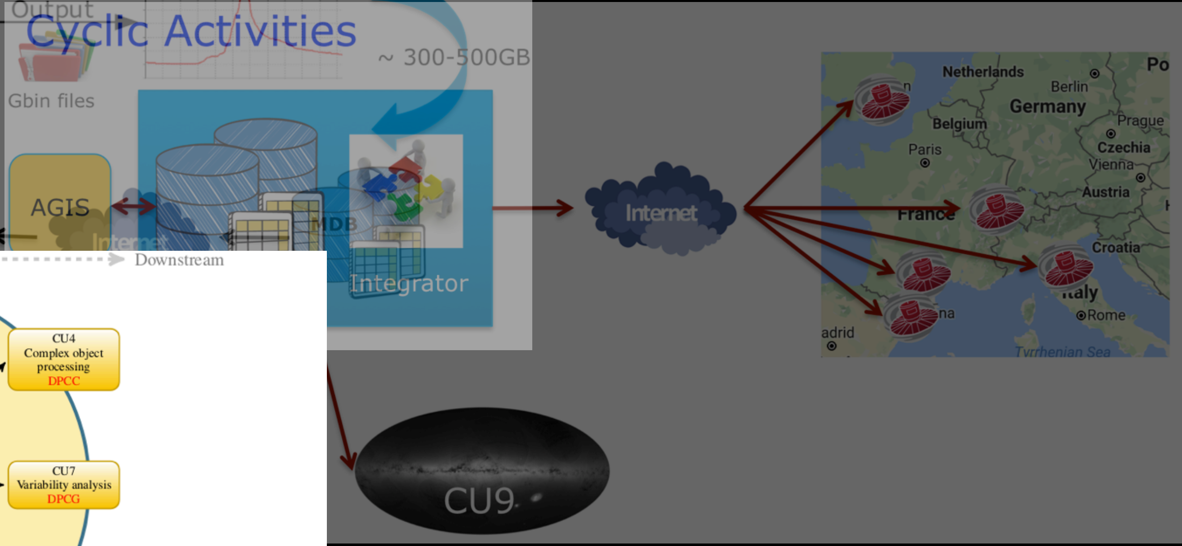
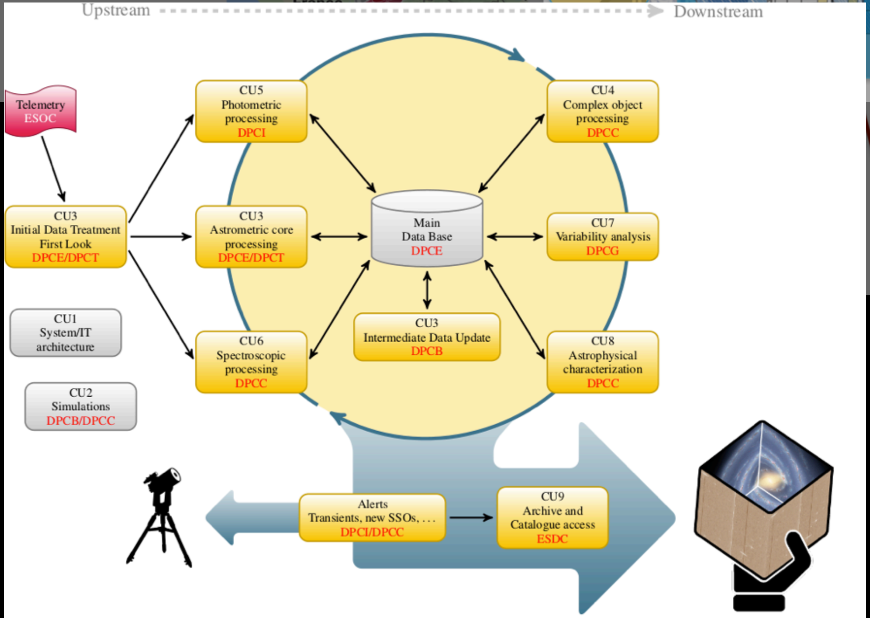
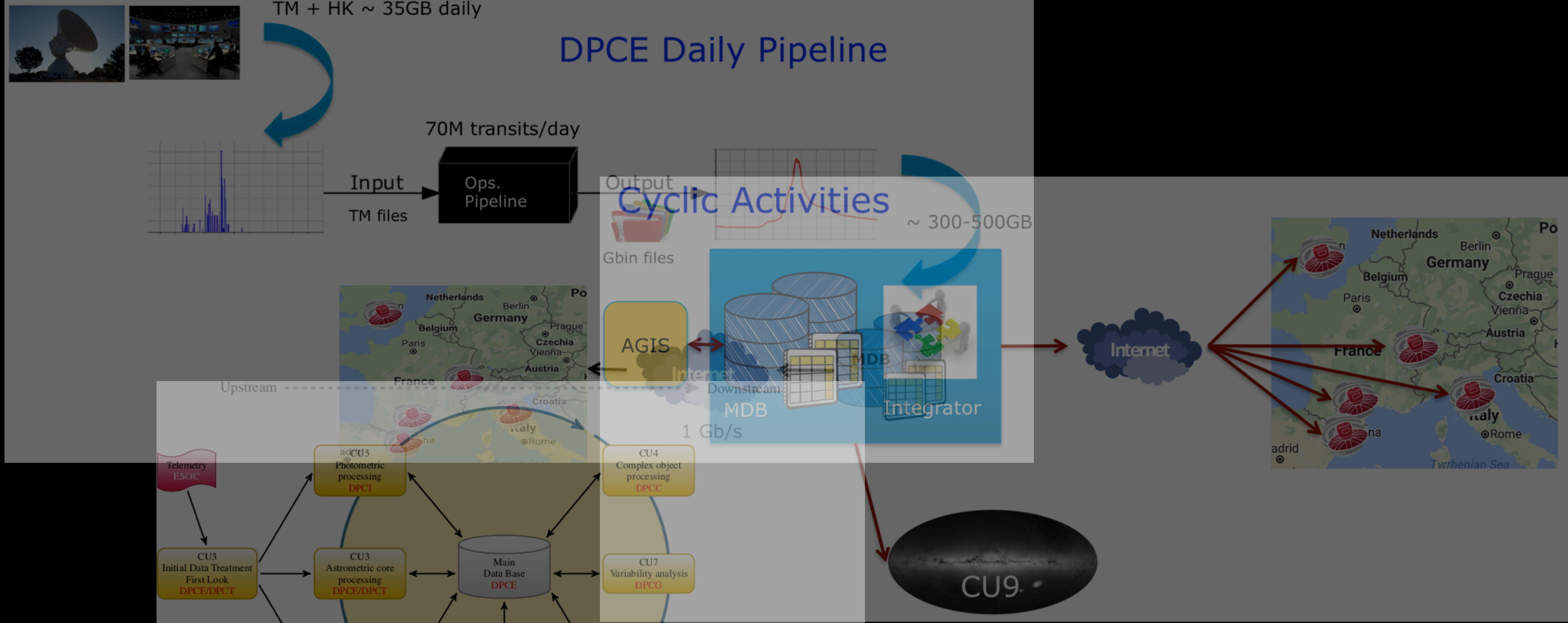
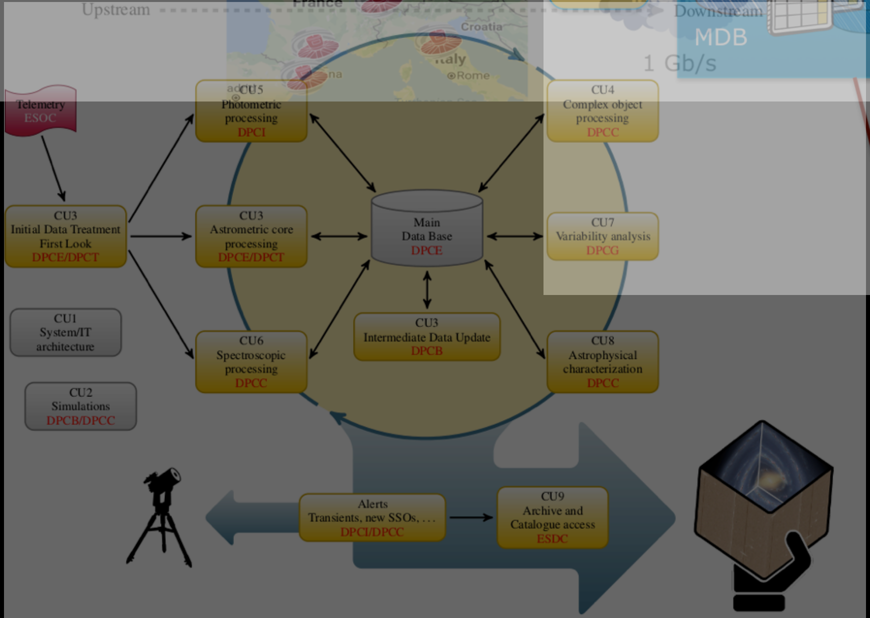
Czechia
Vienna
Austria
France
Croatia
Rome
Tyrrhenian Sea
CU9


TM + HK ~ 35GB daily
DPCE Daily Pipeline
70M transits/day
Input
TM files
Ops.
Pipeline
Output
Gbin files
~ 300-500GB
Netherlands
Berlin
Germany
Belgium
Paris
Prague
Czechia
Vienna
Austria


Cyclic Activities
AGIS
MDB
Integrator
Internet
Netherlands
Berlin
Germany
Belgium
Paris
Prague
Czechia
Vienna
Austria
France
Croatia
Italy
Rome
Tyrrhenian Sea
CU9


Upstream
Downstream
Telemetry
ESOC
CU3
Initial Data Treatment
First Look
DPCE/DPCT
CU1
System/IT
architecture
CU2
Simulations
DPCB/DPCC
CU5
Photometric
processing
DPCI
CU3
Astrometric core
processing
DPCE/DPCT
CU6
Spectroscopic
processing
DPCC
Main
Data Base
DPCE
CU3
Intermediate Data Update
DPCB
CU4
Complex object
processing
DPCC
CU7
Variability analysis
DPCG
CU8
Astrophysical
characterization
DPCC
Alerts
Transients, new SSOs, . . .
DPCI/DPCC
CU9
Archive and
Catalogue access
ESDC





Anthony Brown’s talk
Rocio Guerra’s talk
Mercedes Ramos’ poster

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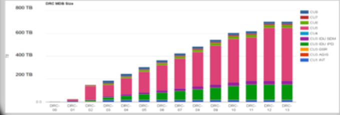

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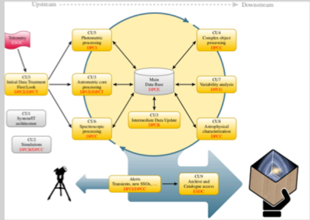

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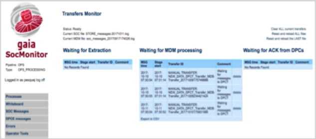

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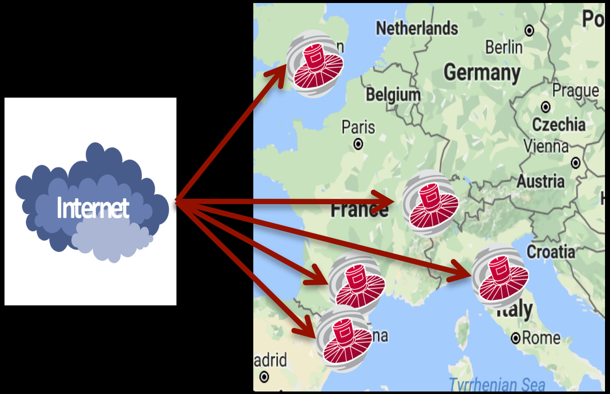

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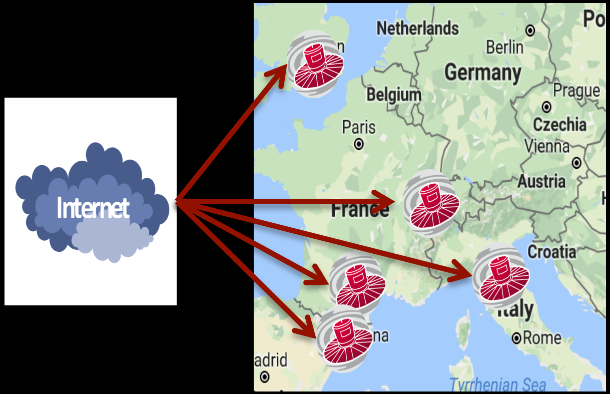

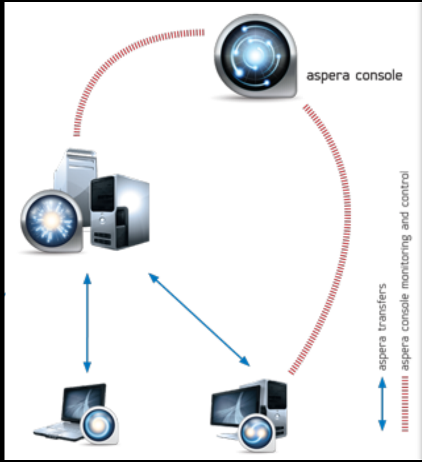

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an IBM® company
+ DTS

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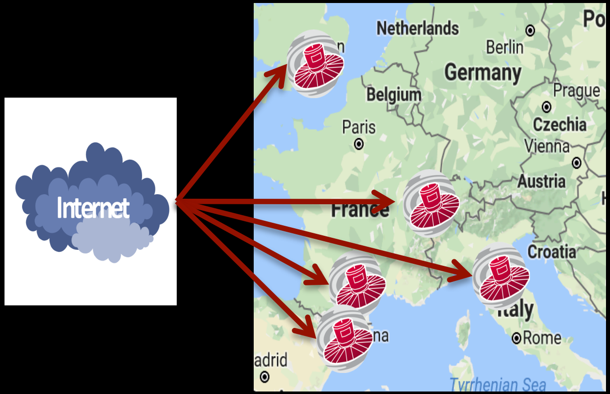

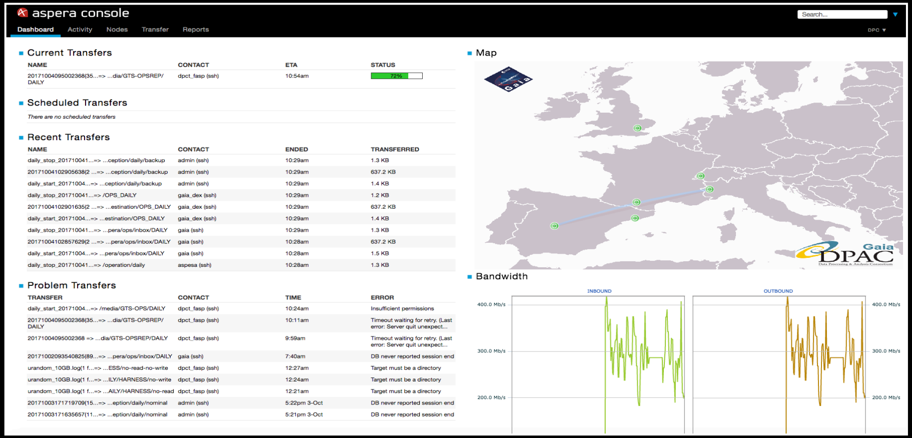

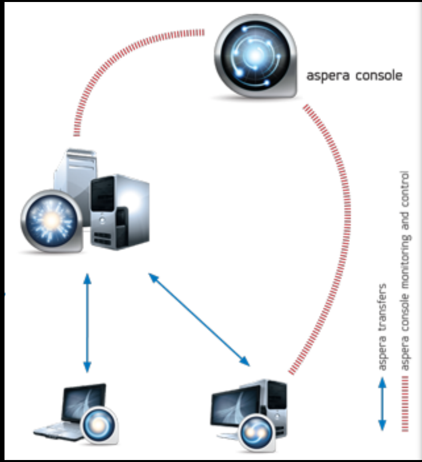

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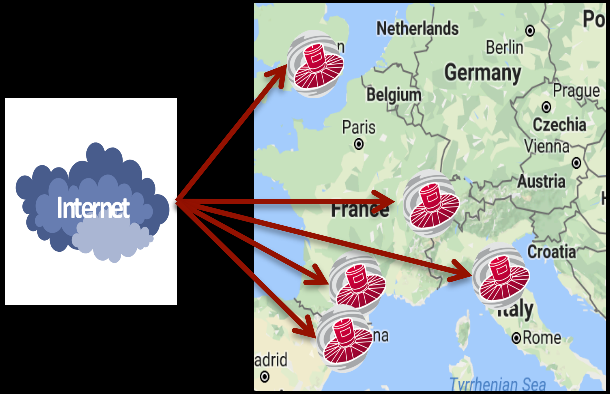

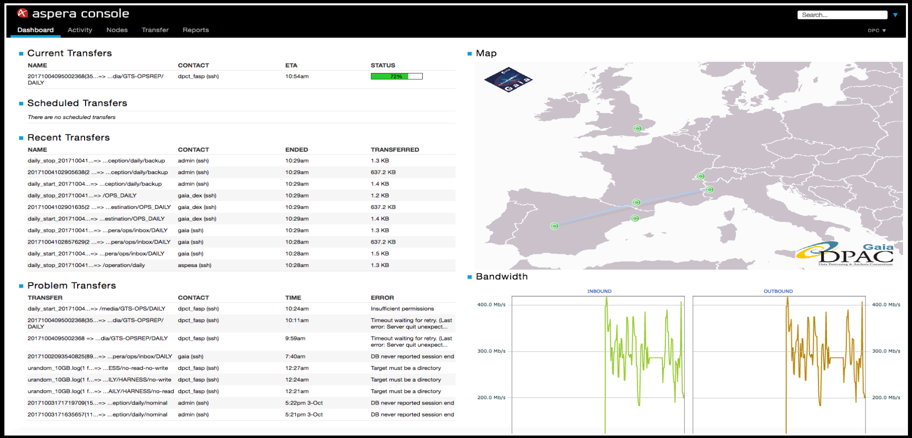

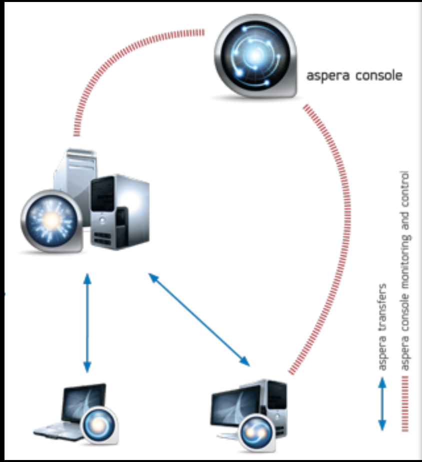

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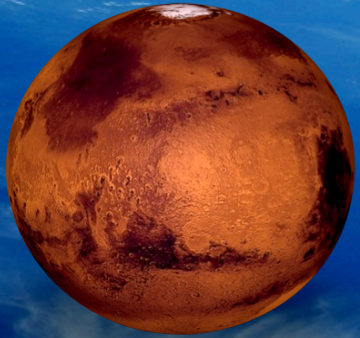
gaia

mars express

esa

Mars Express Science Ground Segment overview: the mission's evolution, new challenges and future perspectives

J. Marín-Yaseli de la Parra, A. Cardesín Moinelo, D. Merritt, M. Breitfellner, M. Castillo, R. Blake, E. Grotheer, D. Titov, P. Martin, and the MEX MOC team

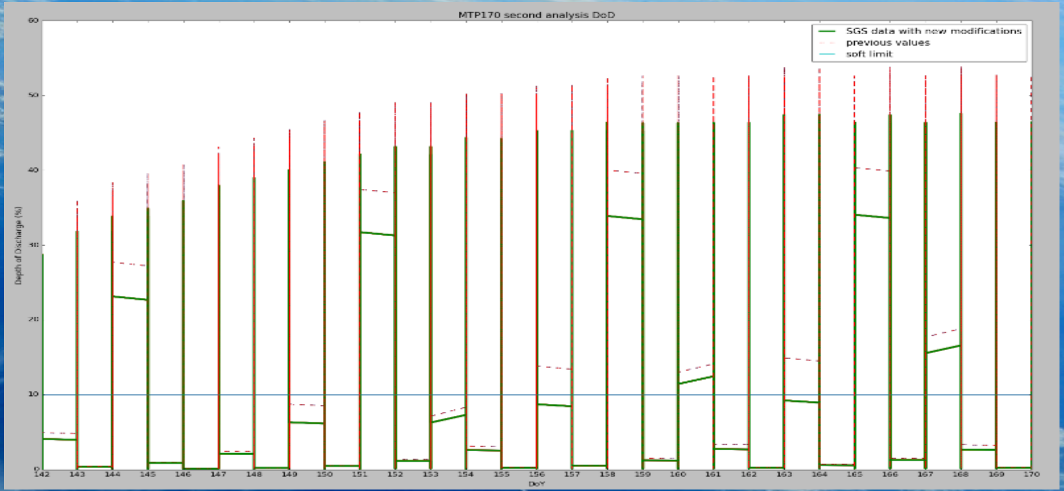


Operations Department, Directorate of Science,
European Space Astronomy Center (ESAC), European Space Agency,
Camino bajo del Castillo s/n, Urb. Villafranca del Castillo P.O. Box 78, 28691 Villanueva de la Cañada, Madrid, Spain

mars express

esa

2017 eclipses and solar conjunction: new challenges



Mars Express (MEX) Operational Highlights

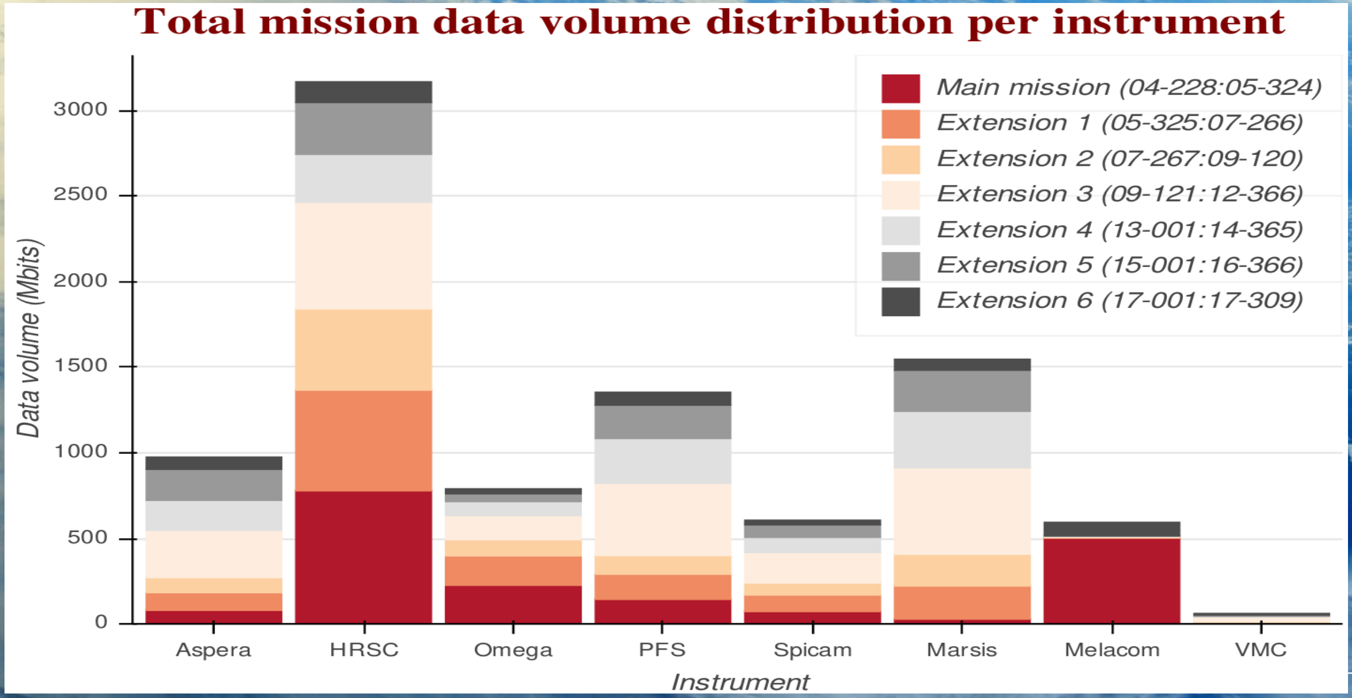
17360 orbits, more than 5000 days of operations

First time an ESA mission is coexisting with its successor mission (TGO)

Approved 2017-18 extended mission at the moment

Adaptability

Downlink statistics

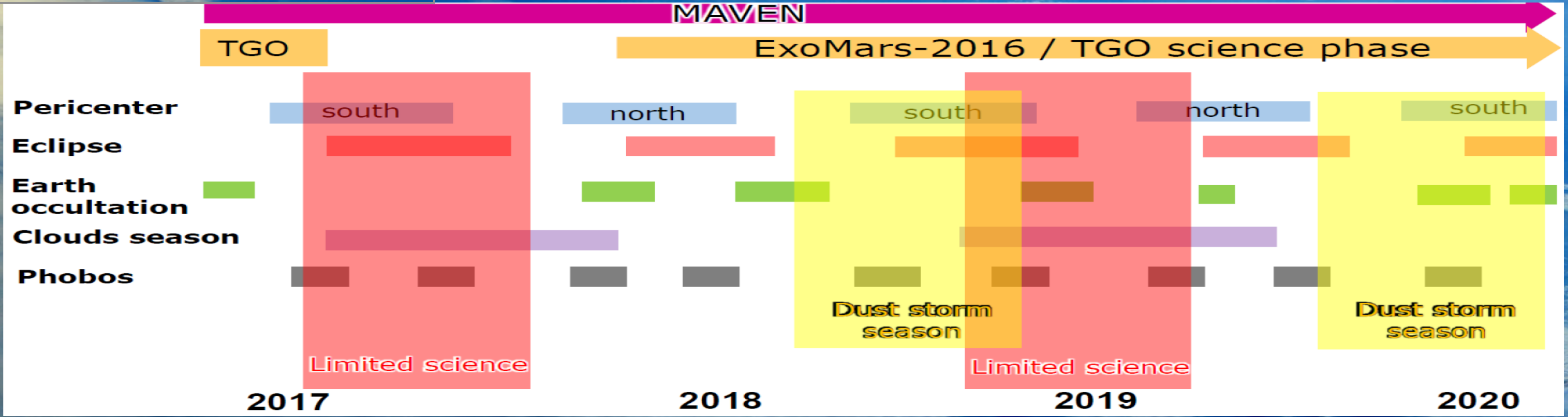


Versatility

Future activities

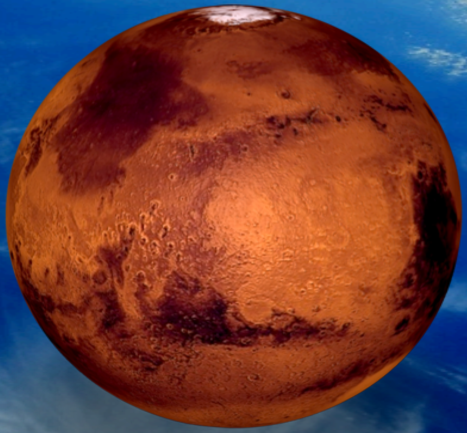
- TGO
- Phobos & Deimos
- High-res stereo coverage
- Landing sites
- Trends

Knowledge transfer



Thank you

jmarin@sciops.esa.int



Knowledge transfer

Versatility

Adaptability

Data Management in the Euclid Scientific Archive System

Poster for Sciops 2017 @ESAC

ESAC Science Data Centre (ESDC) Team

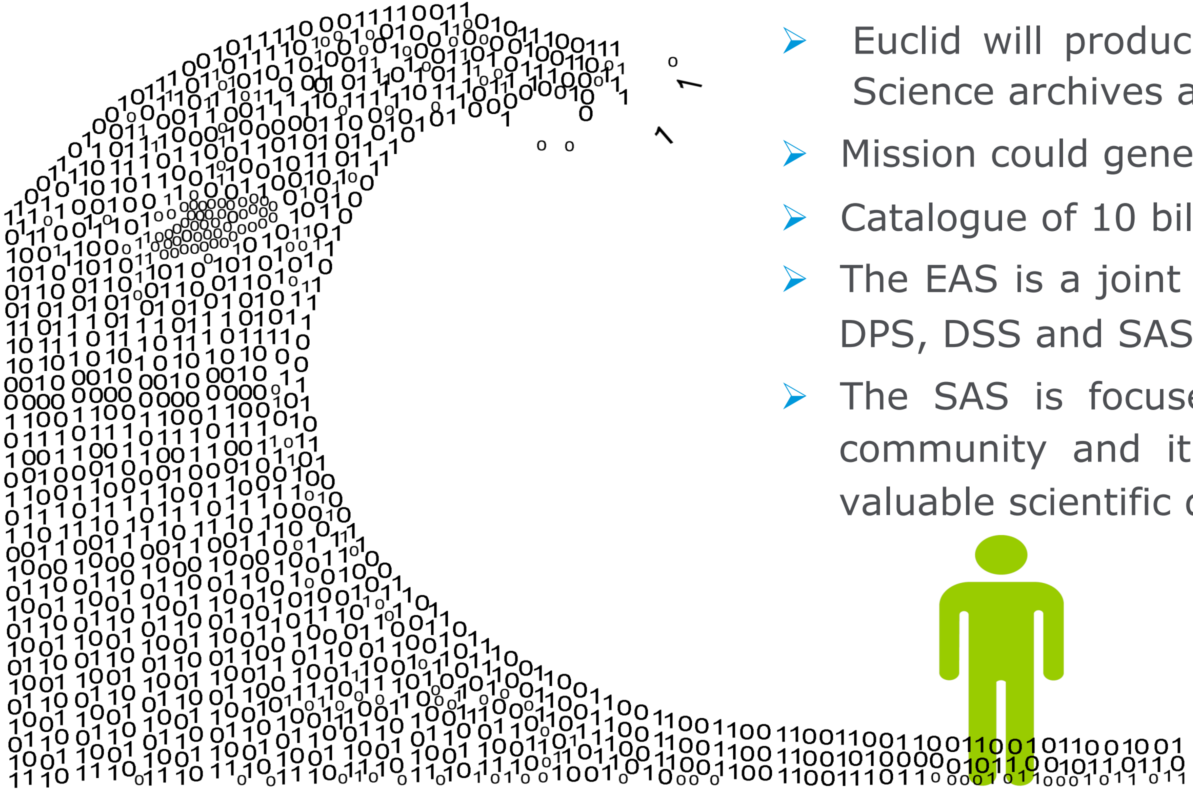
S. Nieto, P. de Teodoro, F. Giordano, J. Salgado, B. Altieri, B. Merin and C. Arviset

Issue/Revision: 1.0

Reference: SAS Poster for Sciops @ESAC – 18 October2017

Status: Issued

Euclid Science Archive System



- Euclid will produce the largest data volume for the Science archives at ESAC.
- Mission could generate 26 PB/year
- Catalogue of 10 billions objects
- The EAS is a joint effort between SDC-NL and ESDC: DPS, DSS and SAS
- The SAS is focused on the needs of the scientific community and it will provide access to the most valuable scientific data from the mission.

EUROPEAN SPACE AGENCY SCIENCE & TECHNOLOGY (snieto)

Euclid Science Archive System

J2000 00 33 37.877 -20 39 44.94 5 -18

Sky:KiDS Maps

Main SAS capabilities

- Single access portal to Euclid Science
- Metadata Parametric Search
- X-match Analysis
- Online Results Exploration
- Download Euclid Data
- L2 Maps Visualization
- Catalogues Overlay on Euclid Maps
- Cut-out service
- Spectra Analysis
- Tools to enable interactive computing
- Sharing Capabilities with Scientific Community
- Private storage area

and others…

Skies | Catalogues | Imaging | Spectra | Misc

-	name	wavelength
	DES-G-SC3	Optical
	DES-I-SC3	Optical
	DES-R-SC3	Optical
	DES-Z-SC3	Optical
	VIS-SC3	Optical
	SIM-VIS-R2	Optical
	DECAM XXL Maps	Optical
	KiDS Maps	Optical
	NIR SIM Maps	Optical
	VIS SIM Maps	Optical
	SC3-NISP-Y	Near-Infrared
	SC3-NISP-J	Near-Infrared
	SC3-NISP-H	Near-Infrared

Sort skies by: wavelength name science survey

HiPS name: SC3-NISP-Y
HiPS creator: Bruno Altieri
HiPS generation date: 2017-07-08T12:48Z
wavelength: 900 and 1200 nm, 18 micron
color palette: Native
available formats: png jpg
opacity: *(GWT Wrapper for the JQuery UI Slider)*

FoV: 26.49'

ALADIN

Visiting Astronomer Travel Office
A vital ancillary to ESO's Observing Model

L. Ruiz[1], S. Mysore[2], S. Marteau[2] *(European Southern Observatory)*

1 Visiting Astronomer Travel Office 2 Operations Support Group *(User Support Department)*

Abstract: The Visiting Astronomer Travel (VAT) office is an important interface between ESO and its user community. The VAT office is a part of the *User Support Department* and is responsible for organizing all aspects of travel for astronomers on observing missions to ESO observatories. The VAT office is the first point of contact for the Visiting Astronomer (VA) and continues to be the central source of information until all travel arrangements are made. Thus, the VAT office provides a high level of individual service to each traveller while ensuring that ESO financial regulations and Observatory policies are strictly adhered to at all times. There are multiple steps in a chain of events that must take place in order to ensure that the VAs make the best use of their allocated telescope time. Bringing over 550 VAs to La Silla, Paranal, and APEX observatories each year requires excellent coordination among all parties including travel and logistics teams distributed over multiple ESO sites. We present here the central role played by the VAT office in making for a straightforward preparation process and hassle-free travel for the astronomer on an ESO observing mission.

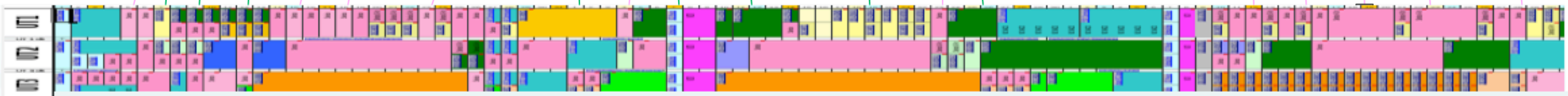
ESO Observing Model

VM

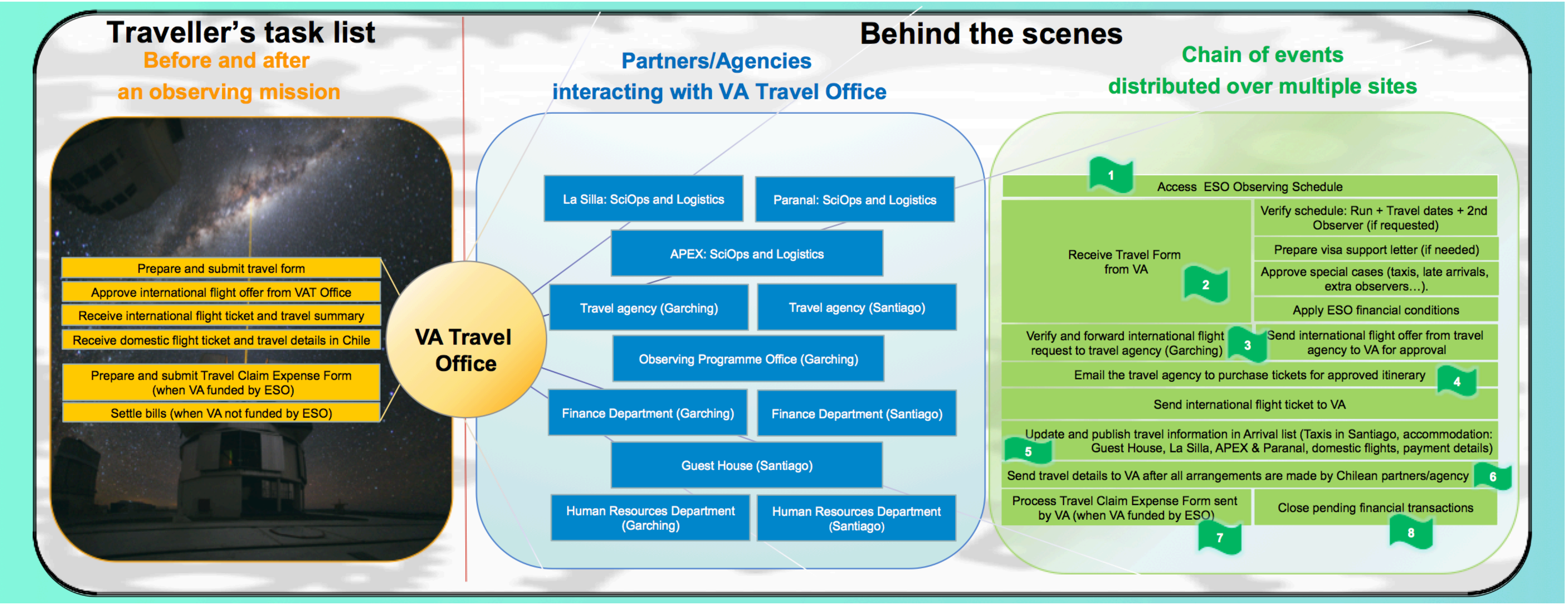
SM

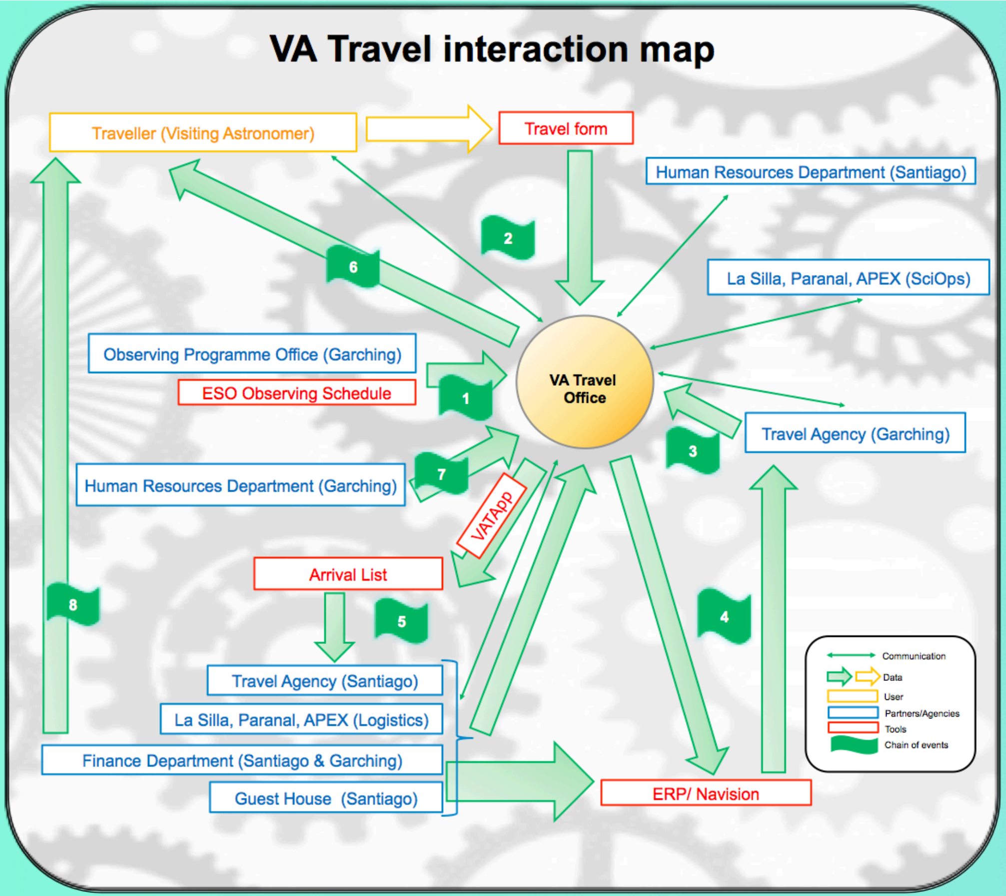
Visitor Mode (VM): classical observing mode where the astronomer is physically present at the observatory to conduct observations. Programmes needing real-time decisions to be taken for their scientific success are allocated time in VM. Each approved VM run is allocated specific calendar nights during the observation period of a semester.

Service mode (SM): queue observing mode where the lineup of observations to be conducted is continuously updated to optimize the use of available time and the prevailing observing conditions. SM slots in the schedule are allocated per telescope for the semester. During these time slots, observations belonging to SM programmes with highest scientific priority and under the required observing conditions are carried out first by ESO staff astronomers and instrument operators.



VLT/VLTI telescopes on Paranal have VM nights and SM slots interspersed through the duration of the observing period. La Silla is fully operated in VM.


Traveller's task list
Before and after
an observing mission
Prepare and submit travel form
Approve international flight offer from VAT Office
Receive international flight ticket and travel summary
Receive domestic flight ticket and travel details in Chile
Prepare and submit Travel Claim Expense Form (when VA funded by ESO)
Settle bills (when VA not funded by ESO)
VA Travel Office
Behind the scenes
Partners/Agencies
interacting with VA Travel Office
La Silla: SciOps and Logistics
Paranal: SciOps and Logistics
APEX: SciOps and Logistics
Travel agency (Garching)
Travel agency (Santiago)
Observing Programme Office (Garching)
Finance Department (Garching)
Finance Department (Santiago)
Guest House (Santiago)
Human Resources Department (Garching)
Human Resources Department (Santiago)
Chain of events
distributed over multiple sites
1
Access ESO Observing Schedule
Verify schedule: Run + Travel dates + 2nd Observer (if requested)
Prepare visa support letter (if needed)
Approve special cases (taxis, late arrivals, extra observers…).
Apply ESO financial conditions
Receive Travel Form from VA
2
Verify and forward international flight request to travel agency (Garching)
3
Send international flight offer from travel agency to VA for approval
Email the travel agency to purchase tickets for approved itinerary
4
Send international flight ticket to VA
Update and publish travel information in Arrival list (Taxis in Santiago, accommodation: Guest House, La Silla, APEX & Paranal, domestic flights, payment details)
5
Send travel details to VA after all arrangements are made by Chilean partners/agency
6
Process Travel Claim Expense Form sent by VA (when VA funded by ESO)
7
Close pending financial transactions
8



Tools

ESO Observing Schedule

Telescope time for VM and SM observing on Paranal, La Silla and APEX (ESO time only) is allocated twice per year by the Observing Programme Office.

Travel Form

A web interface used for submitting all details necessary for travel to Paranal, La Silla, or APEX, for the sole purpose of conducting observations for a scheduled programme. This is accompanied by supporting documentation covering general instructions, financial support information, and guidelines for the VA.

Arrival List

The only complete source of information about VAs traveling to Chile that the travel and logistics teams rely upon. The information in the list signals the start of arrangements to be made for the VA in Chile e.g. continental ticket booking, lodging in Santiago and the observatories, ground transportation for all legs of the trip and in sync with the flight times, etc. The list is published every week and contains up to date information of upcoming VA trips.

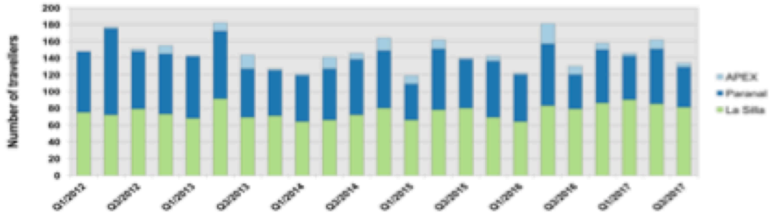
VATApp

A web application developed for the VAT office that collects incoming travel requests, and presents data in a consolidated editable and searchable view. It is used to generate the Arrival List.

ERP/NAVISION

An "Enterprise Resource Planning" suite of applications central to ESO's administrative workflow, used extensively by the VAT office for recording, managing, and closing all approved financial transactions associated with any given trip.

Travellers per quarter



THE ESA SPACE COLLABORATIVE OBSERVATION PLATFORM (SCOOP), OBJECTIVES AND FUNCTIONALITIES

ESA/ESO SCIOPS Workshop

October 17-20, 2017

ESA/ESAC, Madrid, Spain

N. Sánchez-Ortiz, M.J. Enriquez-Pavón, B. Murcia, Matteo Di Paolantonio, *Deimos Space*
S. Müller, J. Lorenz, *Institute of Space Systems / Technische Universität Braunschweig*
V. Braun, *IMS Space Consultancy at ESA/ESOC Space Debris Office*
T. Flohrer, *ESA/ESOC Space Debris Office*

@ElecnorDeimos

SCOOP: THE ESA SPACE COLLABORATIVE OBSERVATION PLATFORM

Developed by Deimos Space and the Institute of Space Systems / Technische Universität Braunschweig in the frame of an ESA-funded activity

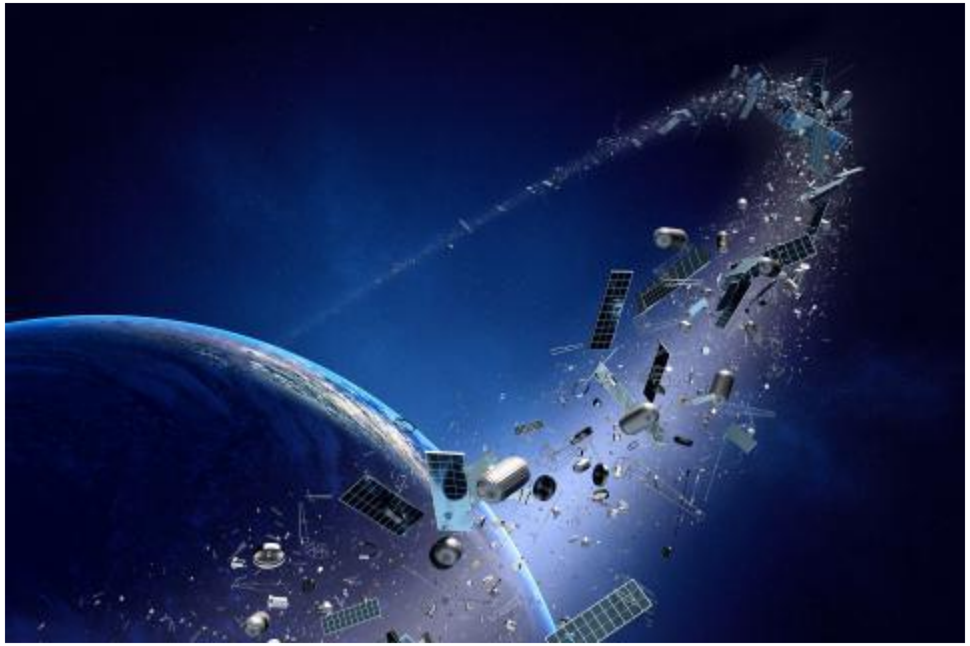
Objectives

- To facilitate collaborative and coordinated space object observation campaigns
  - Among ESA, IADC, SLR community, but also loosely connected sensor operators
- To improve the characterization of space objects, attitude motion, and special events related to the space debris population
- To act as a platform where new techniques and algorithms can be tested

OVERVIEW

Intended end-users

- Scientific observers of space objects
- Orbit providers
- Space debris analysts
- Satellite operators



Fostering collaboration

Among the end-users, computing:

- User Figures of Merit (FoM)
- User Karma

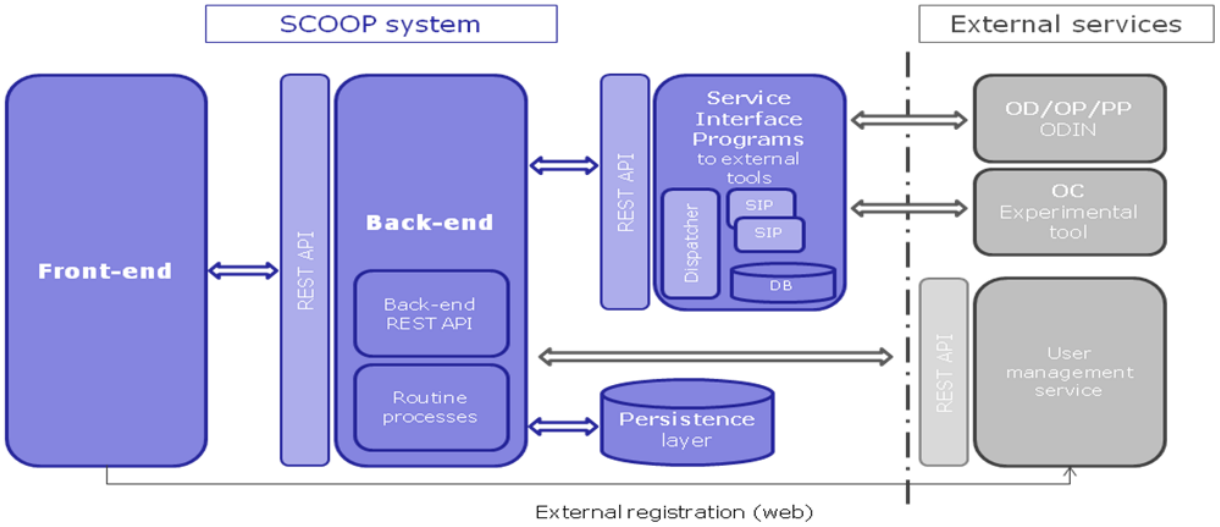
FUNCTIONALITIES

SCOOP functionalities were selected after a dedicated User Workshop (>20 considered)

- Engineering functionalities:
  - Pass prediction
  - Orbit determination
  - Correlation
- Supporting functionalities:
  - Data retrieval
  - Booking object passes
  - Data upload
  - Back-end process to keep information updated
- Observation data handled:
  - Passive optical sensors
  - SLR sensors
  - Radar Systems

HIGH-LEVEL ARCHITECTURE

- Service Oriented Architecture (SOA)
- Based on web services (REST API)



Two main elements are out of the SCOOP system:

- Service Programs, tools provided by ESA integrated in the SCOOP system as services
- User Management Service, integrated into ESA's active directory

deimos
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EXPANDING FRONTIERS

www.deimos-space.com

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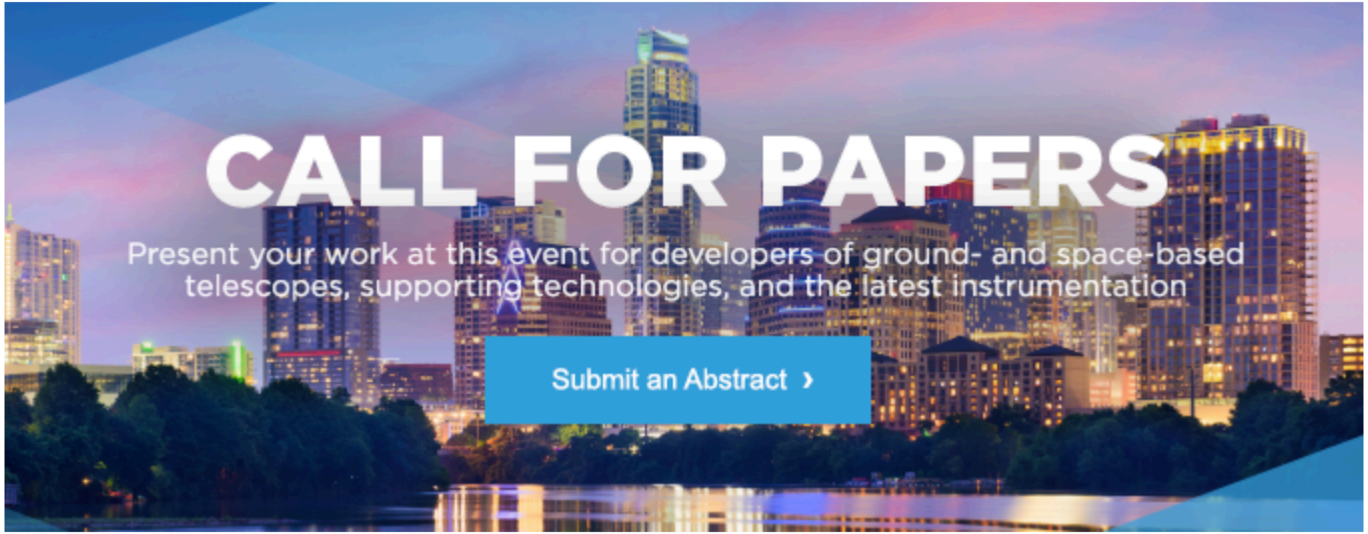
SPIE Astronomical Telescopes + Instrumentation



10-15 June 2018
Austin Convention Centre,
Austin, Texas

Abstract Due:
13 November 2017

Author Notification:
23 February 2018

Manuscript Due Date:
14 May 2018

Observatory Operations: Strategies, Processes, and Systems VII

This conference has an open **call for papers:**

SUBMIT AN ABSTRACT
(SIGN IN REQUIRED)

Topics:
Optimising Ops Management
Big Data
Time Domain

http://spie.org/AS/conferencedetails/observatory-operations

see Beth Willman and/or Antonio Chrysostomou at this meeting if you have any questions.