

Gaia-FUN-SSO

Network for the observation on alert of Solar System Objects

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Outline

- Gaia framework and goal
- the Gaia-FUN-SSO network
- Actions 2014



Gaia@obspm



Need of ground-based observations

3 ground-based networks

- ✓ **GBOT network**: Ground Based Optical Tracking for Gaia observation of the probe itself in order to guarantee the best orbital positioning. No alert – astrometry of the probe
- ✓ **Science alerts network**: GREAT activity for complementary ground-based observation of transients. Photometric & spectroscopic alerts → 5th GREAT workshop in Worsaw - September 2014

✓ **Gaia-FUN-SSO** : Gaia Follow-Up Network for ground-based observation of peculiar/critical Solar System Objects

→ astrometry alerts for Solar System Objects

Need of ground-based SSO observations

- **Solar System Objects** : important part of the Gaia mission
- Gaia obs. for asteroids : prec. singl meas. $\approx 0.3-3$ mas
- 300 000 asteroids (most known)
- including several NEAs, Trojans, Centaurs
- Other SSO: comets, natural satellites

- **High astrometric accuracy but...**

limiting factors for SSO

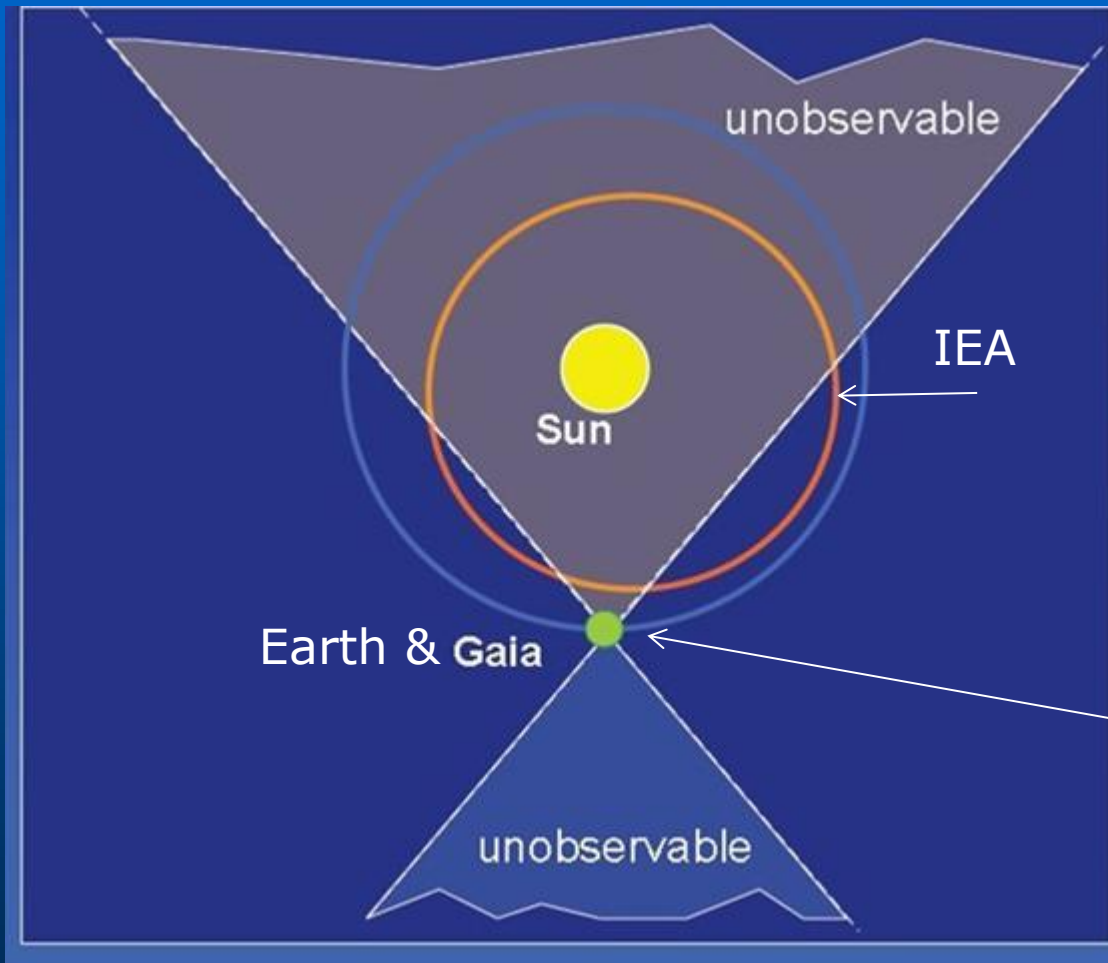
- **Scanning law**
- **Sampling**
- **Limiting magnitude**



Complementary GB observations required

- to validate from the ground new detections by Gaia
- to avoid the loss of (fast) moving objects
- to help for identification of SSO
- to improve orbit poorly observed by Gaia

Observable region in ecliptic



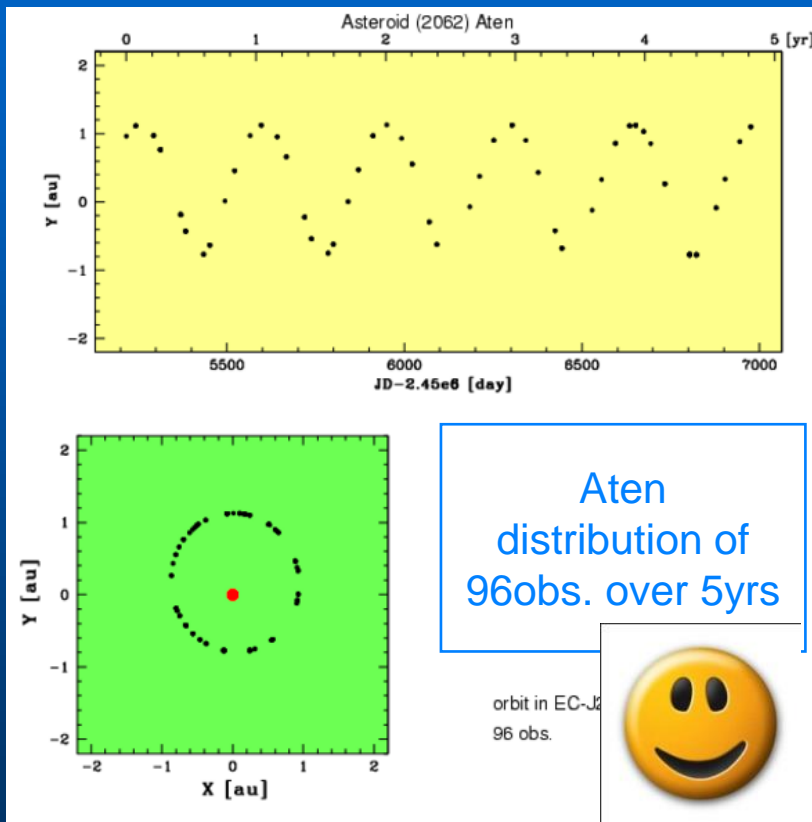
Gaia will observe at low Solar elongation ~ 45 deg.

Detection of Inner Earth Asteroids possible

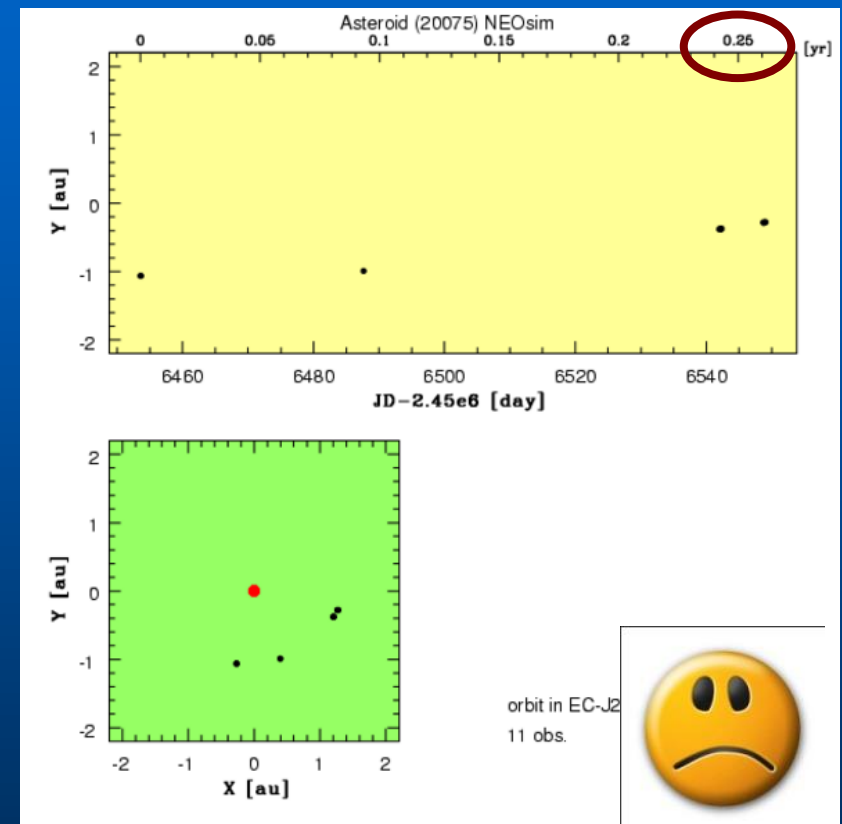
Earth
+ Gaia at L2
(1.5 Mkm)

Need of ground-based observations

5 years



0.25 years



Gaia observations

Detection of New objects?

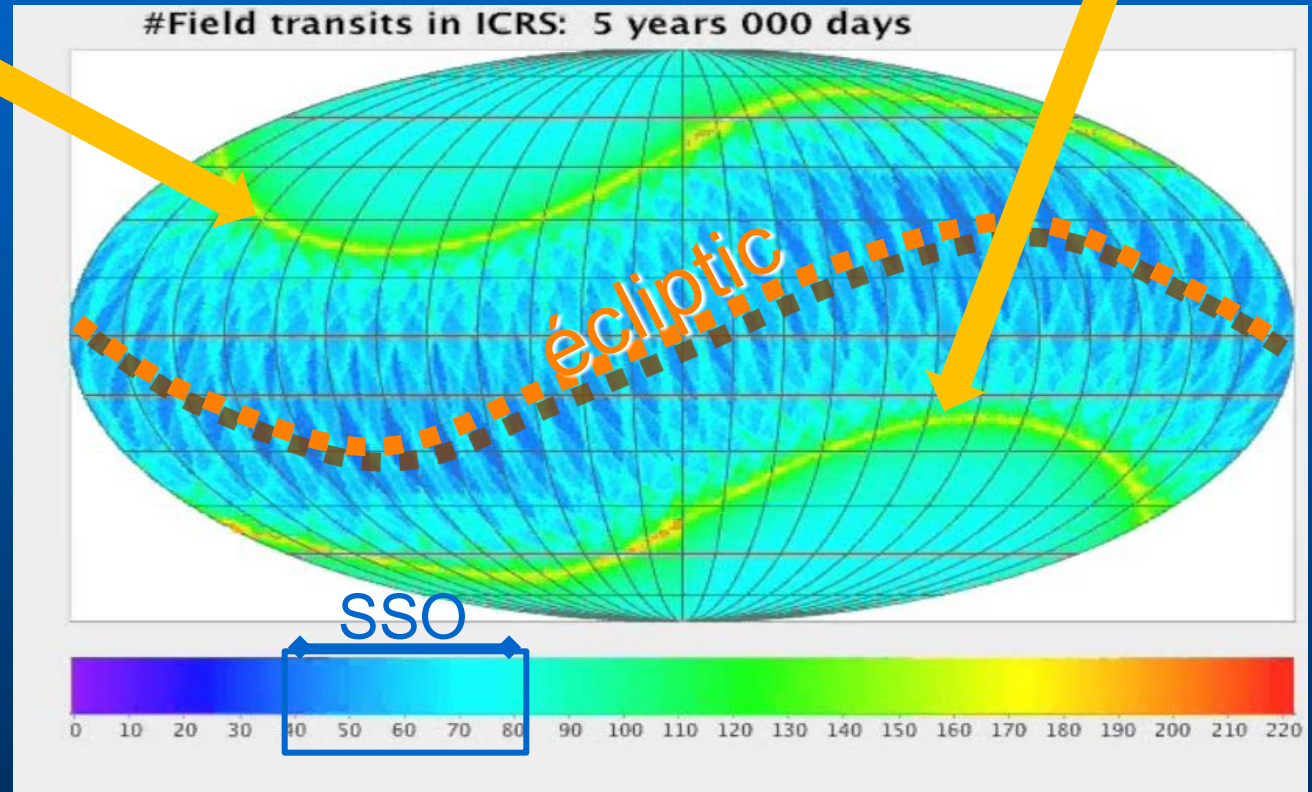
Detection of New objects?

≈ 300.000 asteroids

▶ mag. $V \leq 20$

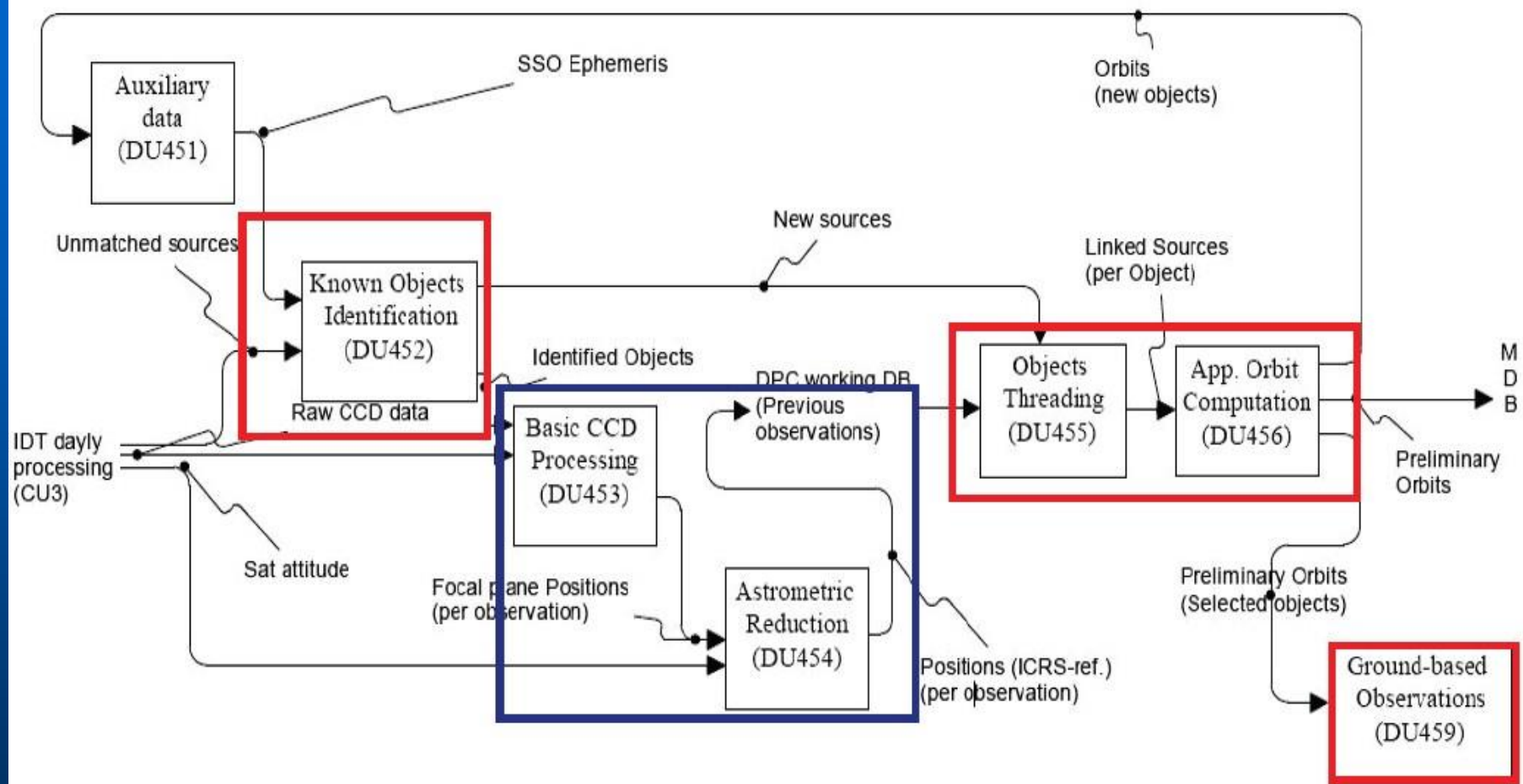
▶ scanning law

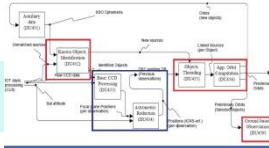
▶ ≈ 60 obs./ SSO



- ❑ Gaia framework and goal
- ❑ the Gaia-FUN-SSO network
- ❑ Actions 2014

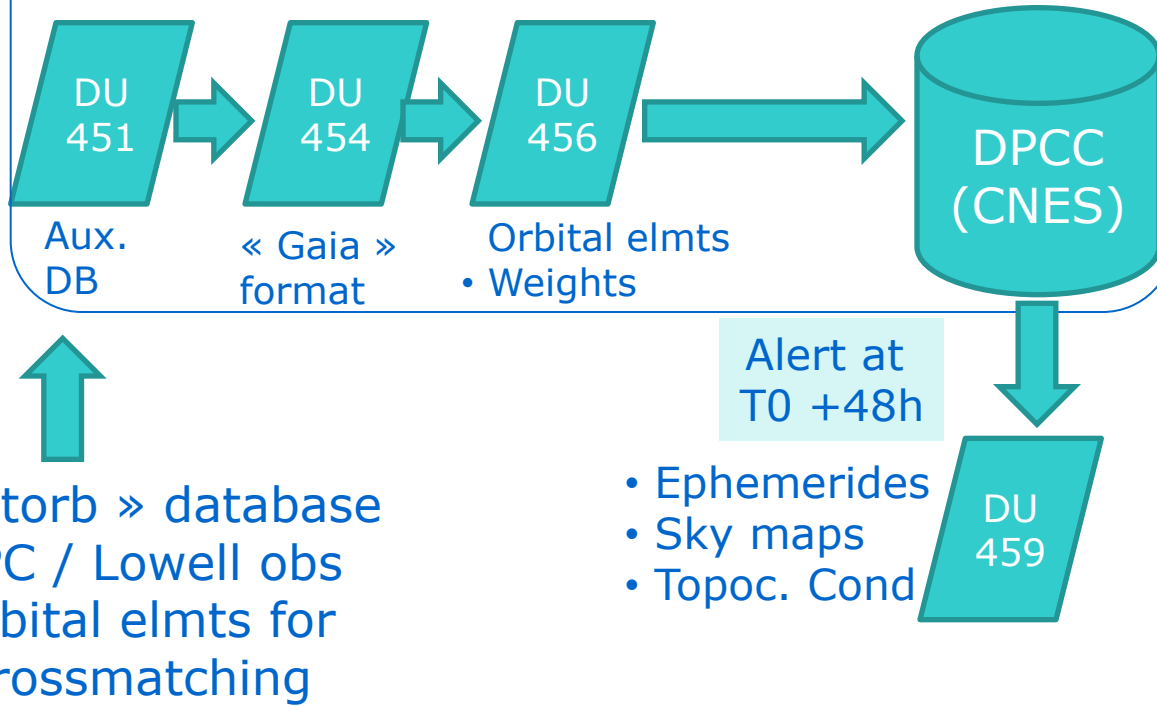
CU4 SSO: data flow (daily processing)



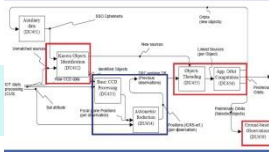


Detection of SSO at T0

Gaia SSO CU4 short term processing

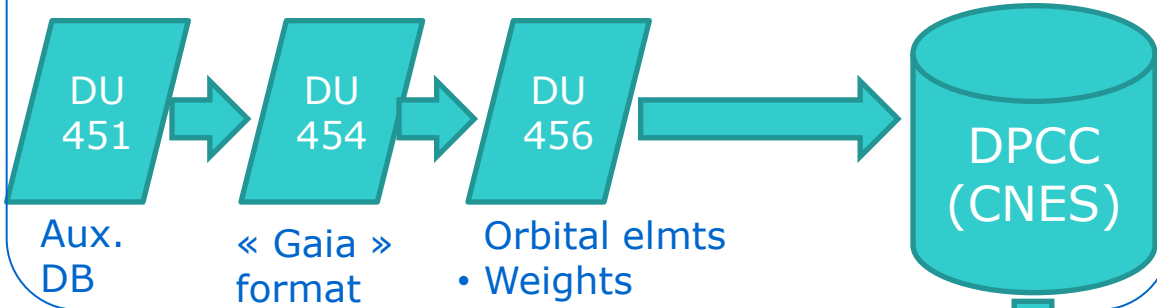


- Ephemerides
- Sky maps
- Topoc. Cond



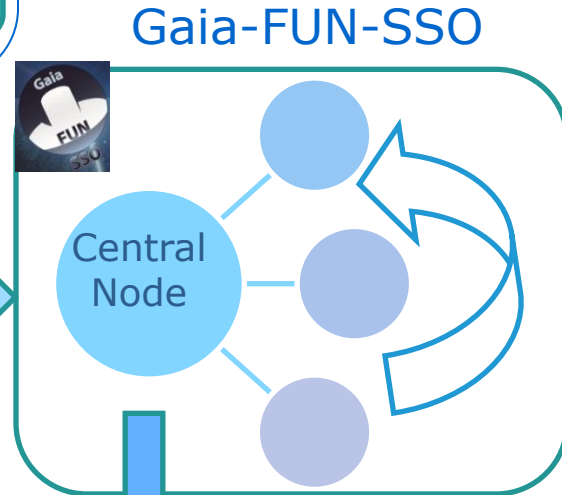
Detection of SSO at T0

Gaia SSO CU4 short term processing



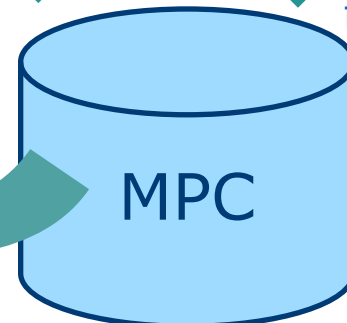
Alert at T0 +48h

- Ephemerides
- Sky maps
- Topoc. Cond

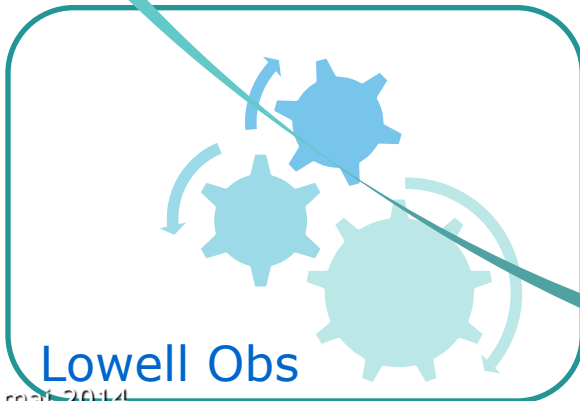


« Gaia » format

MPC format



ASTORB Data base



Central node activity: Data to diffuse

➤ Role of DU459:

- receive alerts
- change Gaia data (gbins) in **data useful for GB observations**
 - focusing a **sky zone of interest**
 - providing **ephemerides** (center of FOV) in topo. coord.
 - for **campaigns** duration: 10 to 30 days
 - **providing vizualisation** of this zone with known objects and target possible positions (snapshot / URL for a link)



- deliver these data to the central node for **diffusion in Gaia-FUN-SSO**
- **automatic** dissemination + monitoring and control
- keep **archives (on wiki presently)**



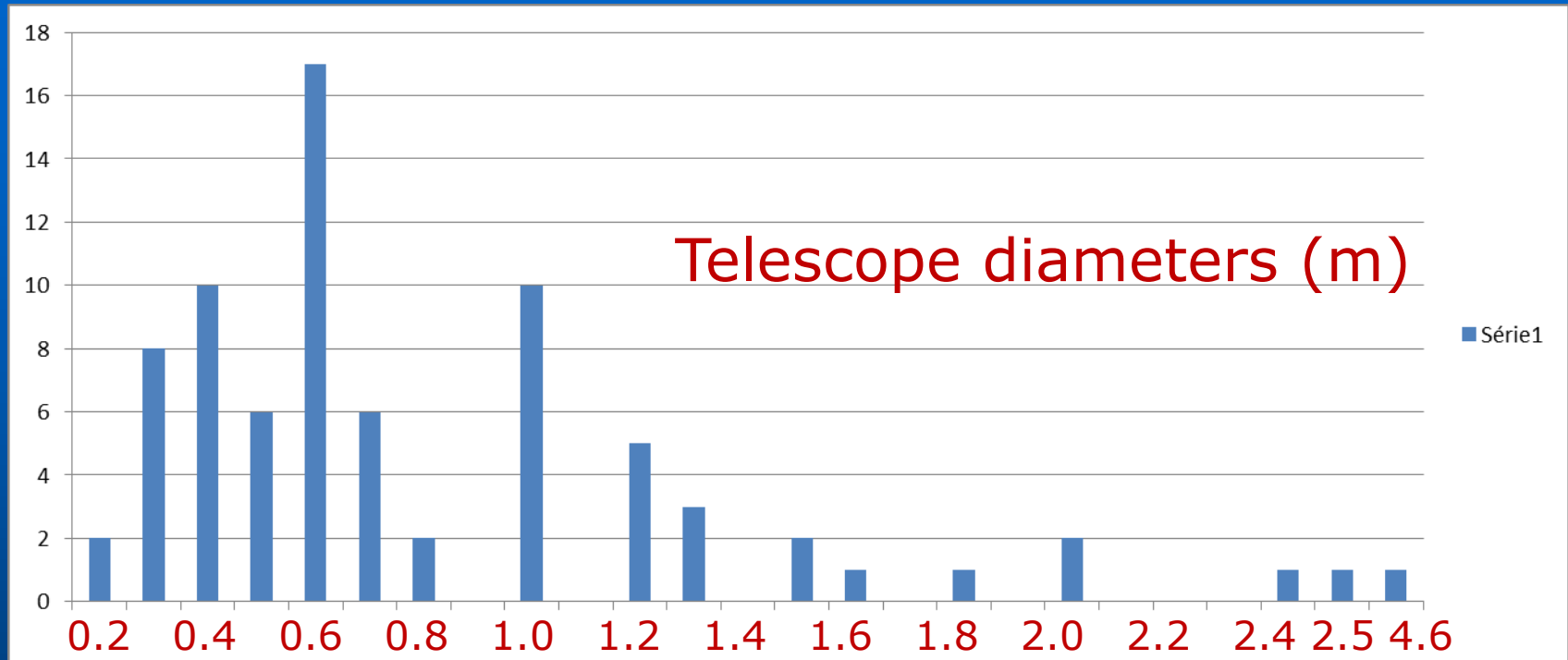
- Send data to MPC + link to SSA ESA program on NEAs

Gaia-FUN-SSO

- 54 observing Sites
- 75 operating instruments
- Volunteering base
 - Major part : 1m-class
 - 6 Schmidt tel. :
Rozhen / Xuyi / Konkoly / Tatenburg / Kourovskaya / Xinlong
 - 4 robotic tel. : Tarot 1 & 2 / Zadko / ESA-OGS
 - 2 remote tel. : NM-Mayhill / Tubitak

- Training campaigns
 - 2005 YU55: 15 nov. 15 dec. 2011
 - 1996 FG3: Feb. – March 2012
 - 99 942 Apophis: Feb.-March 2012 & Dec. 2012- Apr. 2013
 - 2012 DA14: Feb. – March 2013
 - 2002 GT June -Aug. 2013
 - 2013 TV135: oct. 2013 –Jan. 2014
 - 2007 HB15 : Apr. 2014

Gaia-FUN-SSO



Tarot 1 & 2

5 mai 2014

- MPC 071-NAO Rozhen,
Smolyan, (Bulgaria)

- MPC B18 Terskol Russia
Gaia@obspm

MPC 044
Yunnan Observatory
Lijiang station (China)

+ Target of Opportunity on:
ING-WHT/IAC
Roque de los Muchachos Obs.,
Isaac Newton Group
+ 2.5m
+ 4.2m

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Gaia-FUN-SSO



WIKI access at <https://www.imcce.fr/gaia-fun-ss0>

The GAIA-FUN-SSO Collaborative space

GAIA FUN

You are here: The GAIA-FUN-SSO Collaborative space

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Search

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 - Alerts
 - Data Policy
- Papers and Communications
 - Links
 - Acknowledgements

The GAIA-FUN-SSO Collaborative space

News Edit

- Workshop : a Gaia-FUN-SSO workshop is foreseen in 2012 (first announcement). It will be held in Paris Observatory on September 19, 20 and 21. Registration are open. Further information is available at http://www.imcce.fr/hosted_sites/gaiafun2012/

Goals Edit

The GAIA Follow Up Network for Solar System Objects (Gaia-FUN-SSO) has been set up in the framework of a task (DU459) of the Coordination Unit 4 (Object processing) of the DPAC Gaia consortium. The goal is to coordinate ground-based observations on alert triggered by the data processing system during the mission for the confirmation of some new detected moving objects or for the improvement of orbits of some critical ones. The gaia probe is a scanning machine and such ground-based observations are necessary to avoid the loss of newly detected Solar System objects and to facilitate their subsequent monitoring by the probe.

A Gaia-FUN-SSO workshop had been organized in 2010 in Paris Observatory. Discussions has been held about this network and the tasks to be accomplished. Proceedings have been published and can be freely download from the web site of this 2010 workshop: gaia-fun-ss0.imcce.fr.

A new workshop is organized on 19-21 September 2012. Registration is possible on the web pages http://www.imcce.fr/hosted_sites/gaiafun2012/

Before the launch of Gaia, we must set up the work chain for data processing and check the capacity of the network Gaia-FUN-SSO (central node and observing sites) to react on alert. For this goal we are organizing two main steps during the prelaunch period: a first period for several campaigns of observation of specific objects on rather long term, a second one for triggering of alerts for observation on short term. Further information is available for the registered teams.

Pre-launch period Edit

Since August 2011, the Gaia-FUN-SSO network has been sollicitated for training observations. Four campaigns of observation have been organized. We will also sent alerts for fast reactions in order to be in similar conditions than during the mission.

This wiki Edit

The purpose of this wiki is :

- fostering interactions between teams involved in the Gaia follow-up for Solar System Objects
- providing guidelines to succeed in observing those objects
- disseminating ephemerides and all necessary information for these observations
- providing links to useful tools and data
- gathering results of this collaboration
- disseminating their analysis and interpretation

Registration of observing sites Edit

In order to have a full access to these pages and to share data, you must be registered as active participant of this observing network. For this registration you can contact us at gaia-fun-ss0@imcce.fr, you will be asked to fill in an information form. This network needs to have a large geographical coverage: if you are interested, do not hesitate to contact us!

Updated on 2011, November 19 - This wiki site is maintained by IMCCE in collaboration with OCA

Data repository :

- Goals
- Observing method
- Tools
- Publications
- Links

Campaigns:

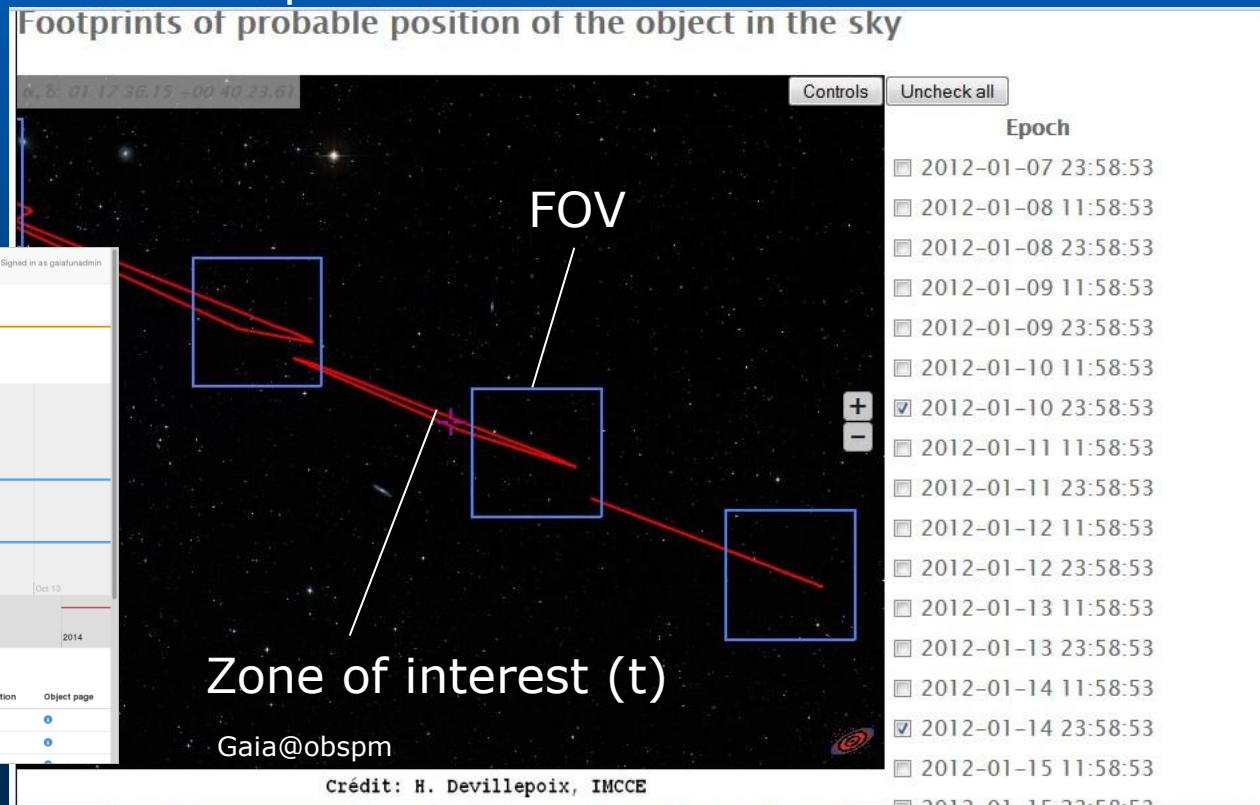
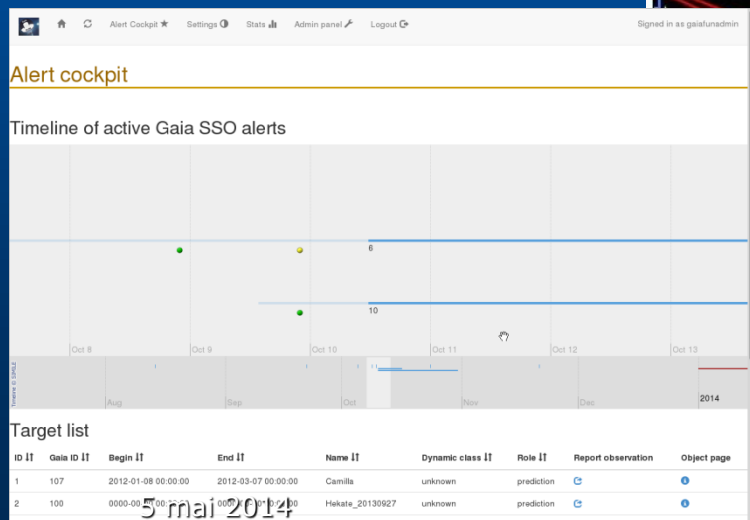
- Targets ephemerides
- Measurements
- Results (O-C)

Registration form

- ❑ Gaia framework and goal
- ❑ the Gaia-FUN-SSO network
- ❑ Actions 2014

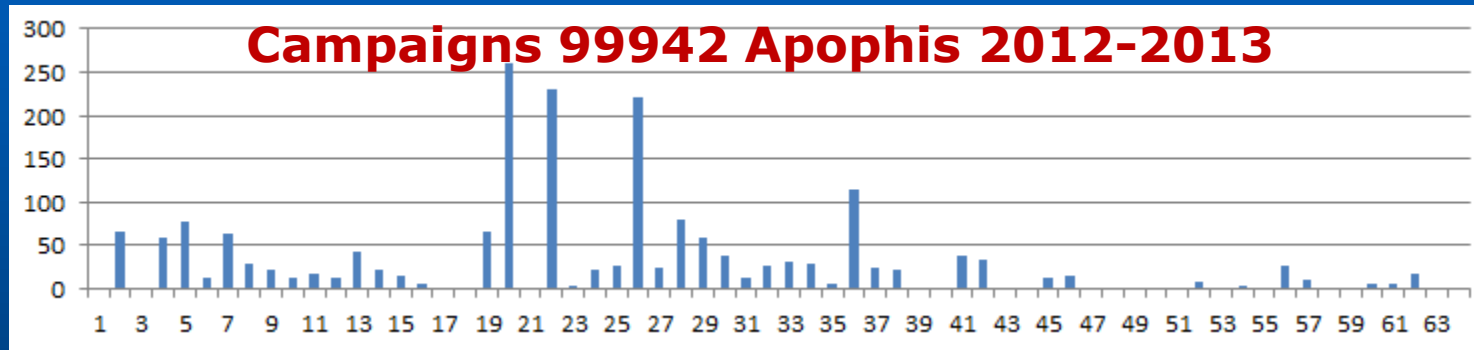
New tool: Pipeline & web interface

- Public but on registration
- To monitoring the network
- Automatic dissemination of alerts
- Topocentric/local conditions
- Training engineer: H. Devillepoix



Apophis campaigns : new results

PHA (2004 MN4 / 99 942)
Diam.: 270m => 325 m (Herschel)
Albedo 0.33 => 0.22
Impact risks ~~2029~~ / ~~2036~~ ? / 2068



14/12/2012

13/3/2013

19 observing sites (Feb-March 2012 + Dec. – Apr. 2013)
>2700 astrometric measures (4000 in MPC database)

Paper to be submitted to A&A, May 2014

Workshops Gaia-FUN-SSO

3rd Workshop: 24-26 November 2014, Paris Observatory

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- Kick-off meeting
- Paris Obs.,
- 29 Nov. – 1 Dec. 2010
- Web server

<https://www.imcce.fr/langues/en/publications/colloques/gaiafun/>

2

- Paris Obs.,
- 19-21 September 2012
- 38 attendees
- 12 countries
- 26 communications
- Web server

5 mai 2014

<http://host.imcce.fr/gaiafun2012/>



Gaia@obspm

A screenshot of the Gaia-FUN-SSO website. The page features a navigation menu with links for Home, Program, Registration, Sessions, Proceedings, and Information. The main content area includes an abstract about the observation of Solar System Objects (SSO) by the Gaia mission, a registration link, and contact information. The footer contains logos for CNRS, Gaia, Observatoire de Paris, and the European Science Foundation, along with the page number 19.

International Workshop

**Gaia-FUN-SSO-2
Paris Observatory,
19-21 September 2012**

Home | Program | Registration | Sessions | Proceedings | Information

Observatoire de Paris

Abstract

The observation of the Solar System Objects (SSO) by the Gaia space astrometry mission will be centralised by a scanning law. Several detections of interesting objects may be done with the possibility of further observations by the probe. These objects will then require complementary ground based observations. Among them, previously unknown Near Earth Objects, fast moving towards the Earth or going away from it could be found. Several objects discovered by Gaia can also be 'Inner Earth' Objects, as the probe will observe at rather low Solar elongations.

In order to confirm from the ground the discoveries made in space and to follow interesting targets, a dedicated network is organized, the Gaia Follow-Up Network. This task is performed in the frame of the Coordination Unit 4 of the Gaia Data Processing and Analysis Consortium, devoted to data processing of specific objects. The goal of the network will be to improve the knowledge of the orbit of poorly observed targets by astrometric observations on alert. This activity will be coordinated by a central node interacting with the Gaia data reduction pipeline all along the mission.

Two years after a kick-off workshop, we organize this year a second Gaia-FUN-SSO workshop in Paris in September 2012 in order to discuss further the coordination of the network of observing stations, to discuss the relevant training observations which have been performed. During this workshop, the participants will have the opportunity to be informed about the status of the Gaia mission, about the alert process for SSO and the ground-based data processing, but they will also be invited to present their advices in relation with this program, or their equipment, instruments and observing sites. Large time slots will be reserved for discussions.

To register click [here](#) or on the Item Registration.

Contact: gaia_fun@imcce.fr

The best fare for your airline ticket: AIRFRANCE / KLM
Advance discounts on a wide range of fares on all Air France and KLM flights worldwide Event ID Code to keep for the booking: 16371AF. More details [here](#).

Last update: WT 16/9/2012

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CNRS | gaia | Observatoire de Paris | EUROPEAN SCIENCE FOUNDATION



Observatoire de Haute-Provence

Application for combined observations at OHP (MPC 511)

- Gaia-FUN-SSO (W. Thuillot, B. Carry)
 - GBOT & QSO (S. Bouquillon, F. Taris, D. Souami)
 - Photometric Sc. Alerts (M. Dennefeld, J. B. Marquette, P. Tisserand)
- T120 (OHP / Haute Provence Observatory)
 - Observing runs 1 week/month
 - 2014A: April – August 2014
 - 2014B: Sept 2014- Feb. 2015
 - funding...



