

The Gaia-FUN-SSO network : status and objectives

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Outline

- ❑ Gaia framework and goal
- ❑ the Gaia-FUN-SSO network
- ❑ Past and current actions
- ❑ Future



3 ground-based networks

GBOT
network

✓ « GBOT »: Ground Based Optical Tracking for Gaia observation of the probe itself in order to guarantee the best orbital positioning. No alert but systematic astrometry of the probe

Science
alerts
network

✓ « GREAT »: activity for complementary ground-based observation of transients: photometric & spectroscopic alerts

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. single 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...
 - Scanning law
 - Sparse sampling
 - Limiting magnitude

limiting factors for SSO



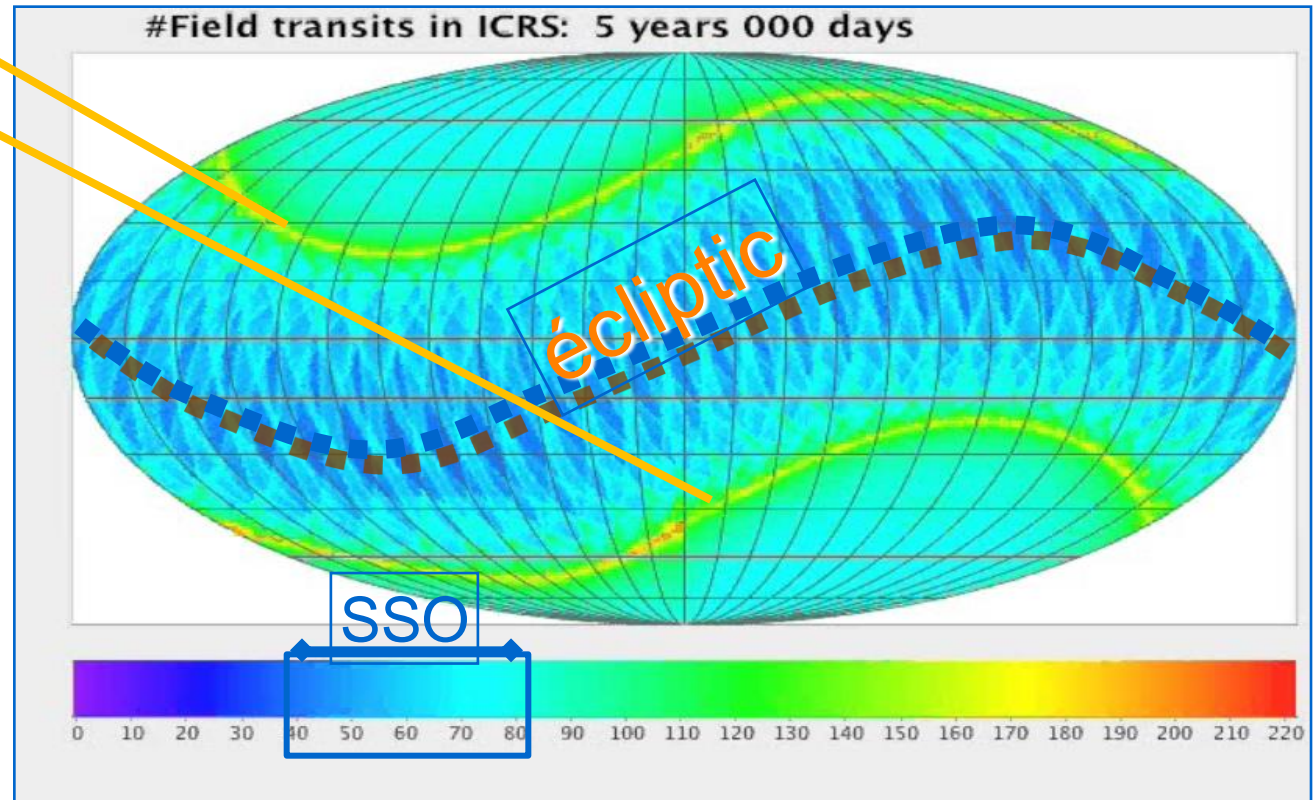
Complementary GB observations required

- 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

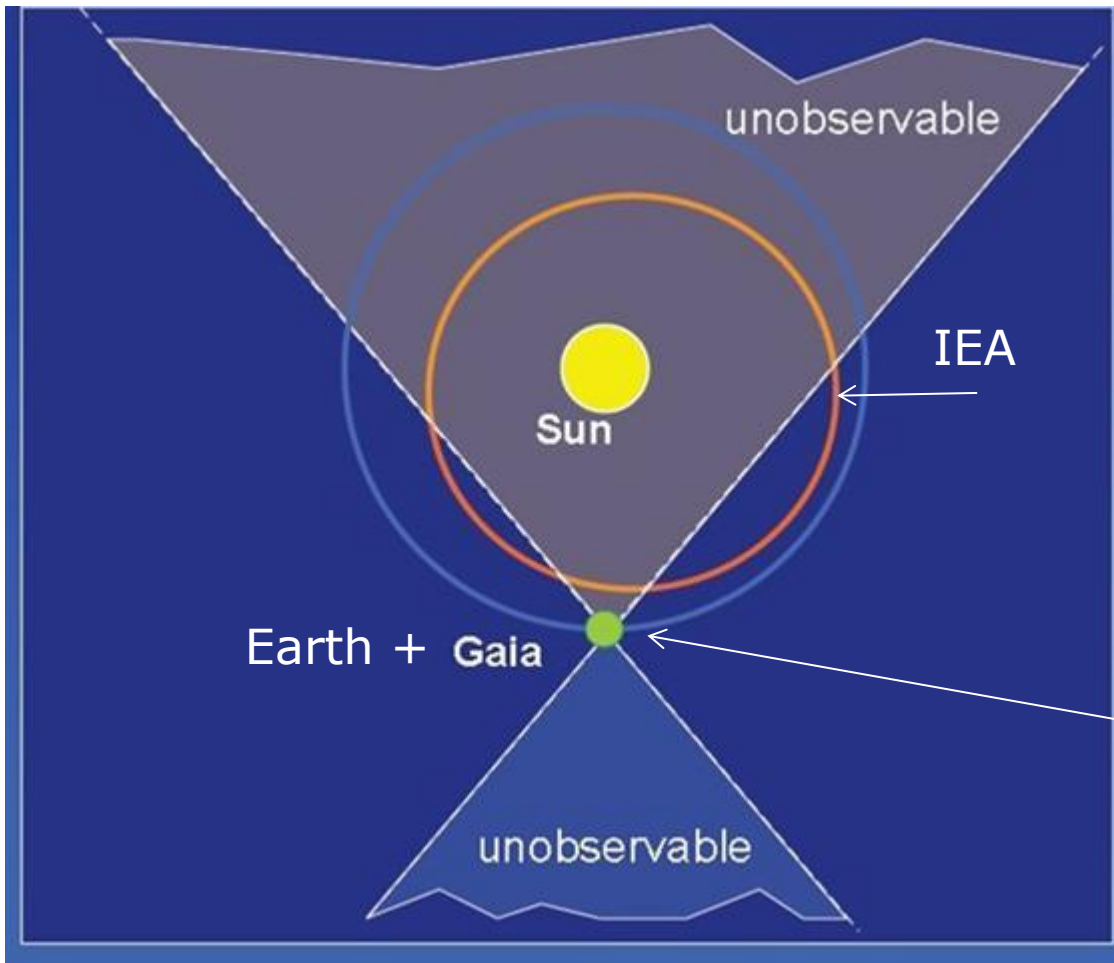
Gaia observations

Detection of New objects?

- 300 000 asteroids
- mag. $V \leq 20$
- scanning law
- around 60 obs./SSO in 5 years
- **New objects = Near Earth Objects / MBA?**



Observable region in ecliptic

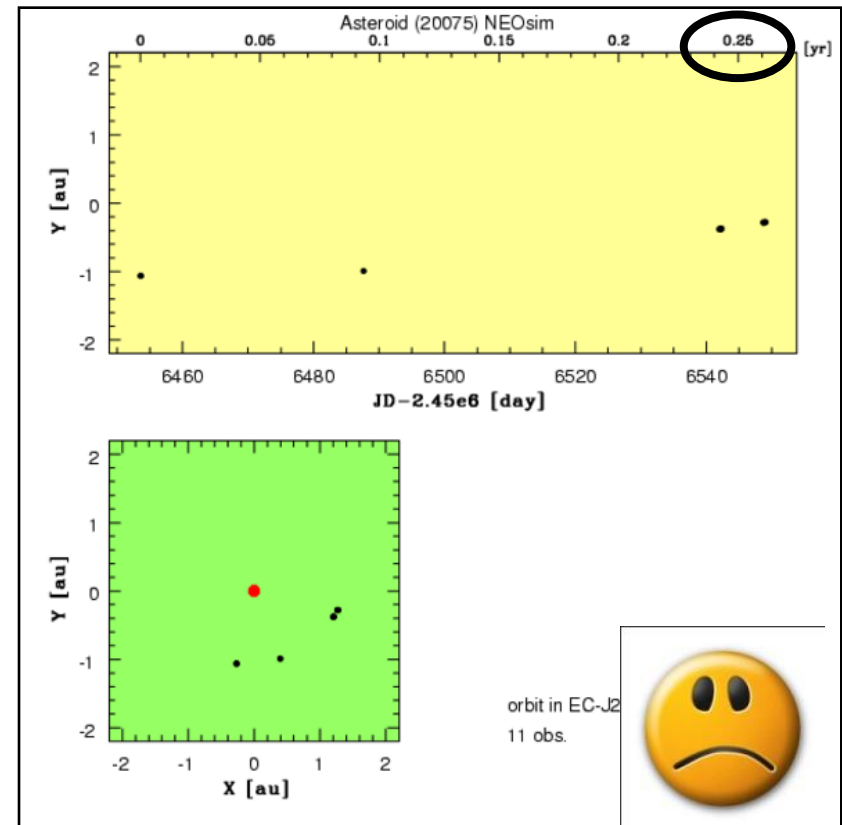
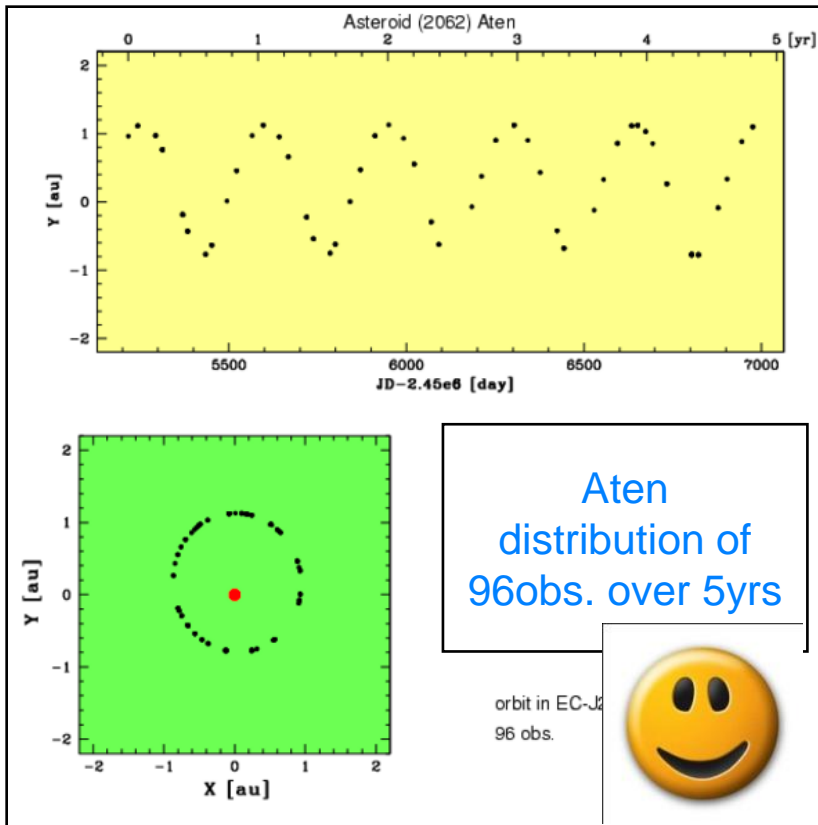


Gaia will observe at low Solar elongation ~ 45 deg.

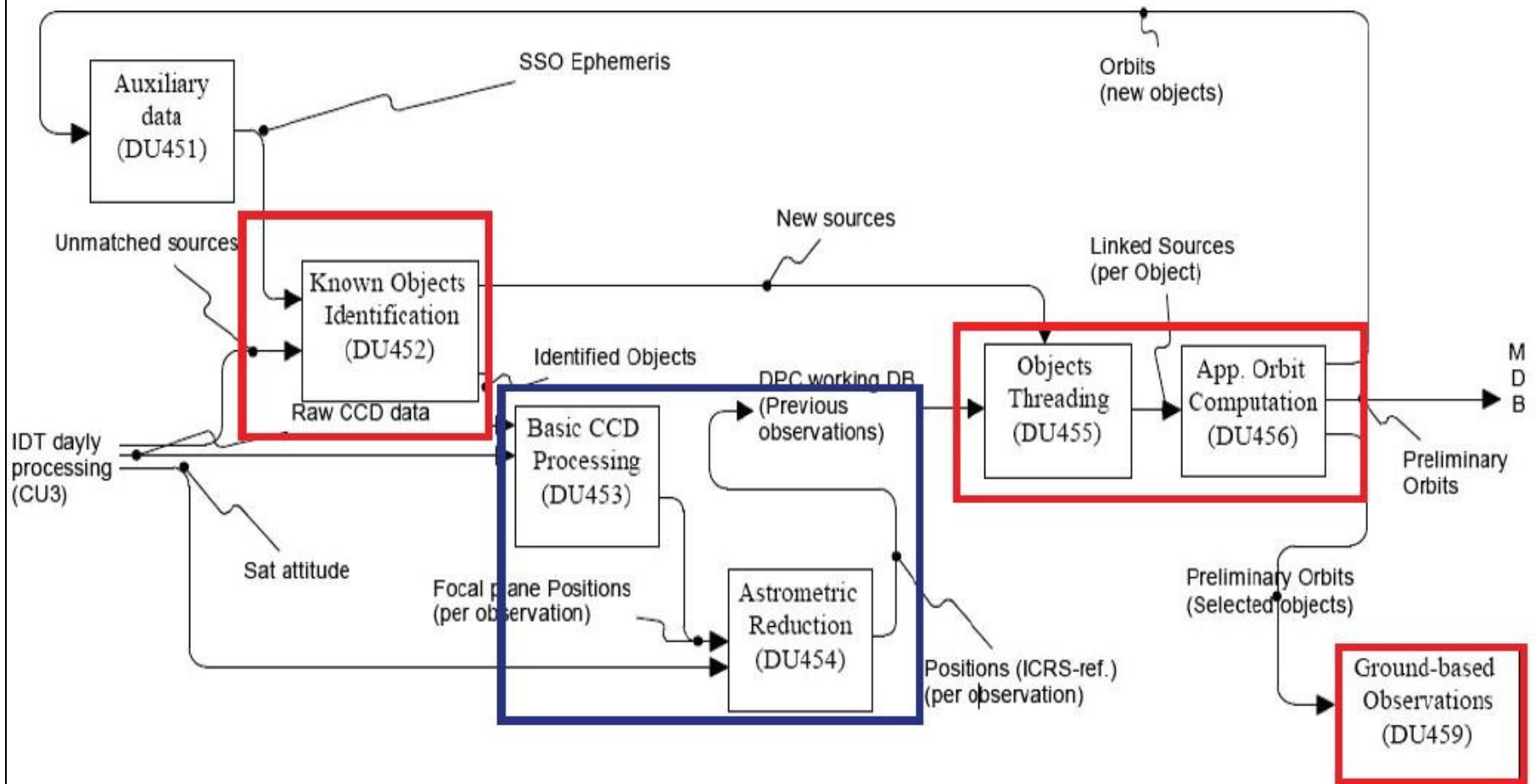
Detection of Inner Earth Asteroids possible

Earth + Gaia at L2 (1.5 Mkm)

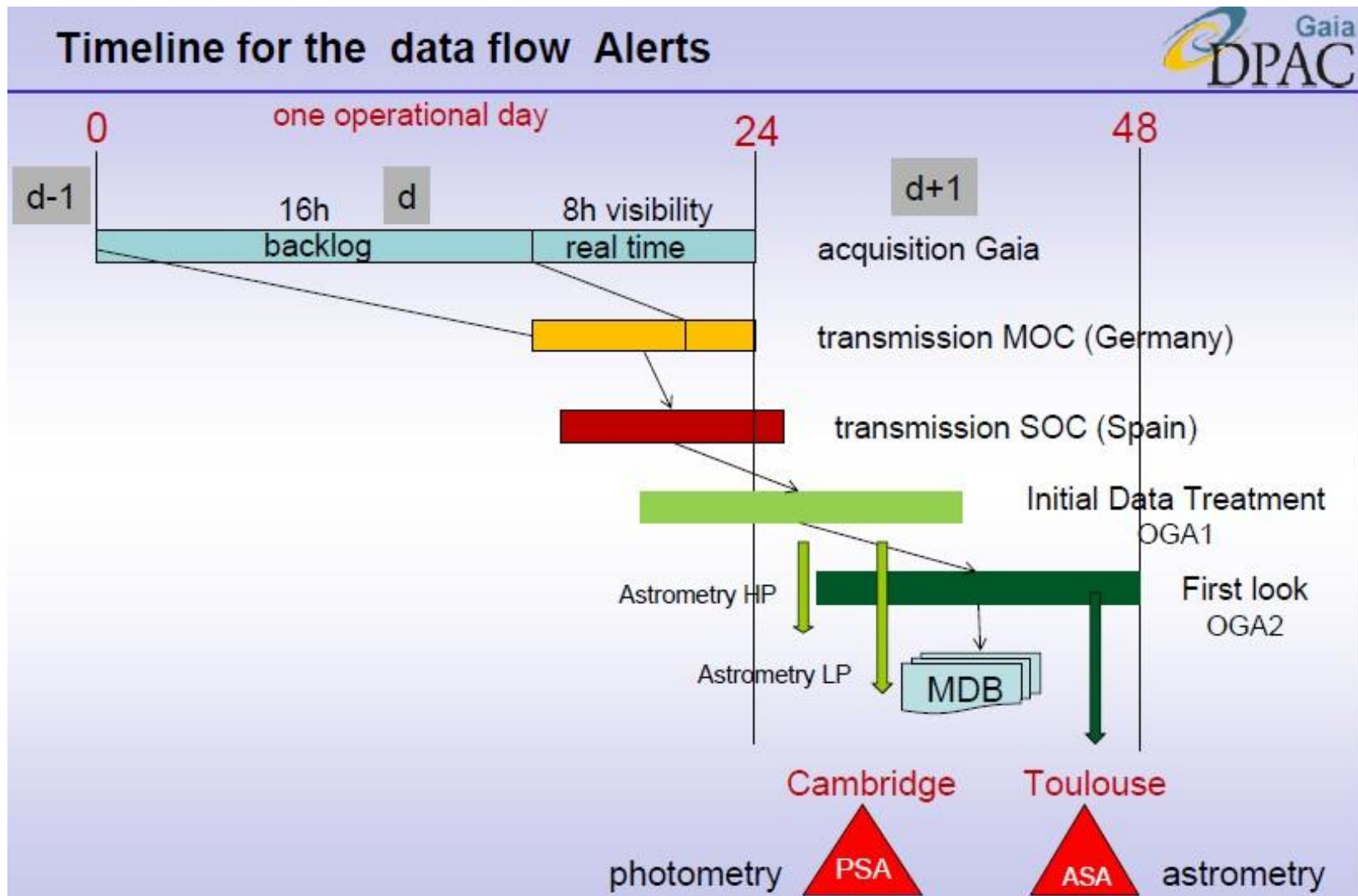
Need of ground-based observations



CU4 SSO: data flow (daily processing)

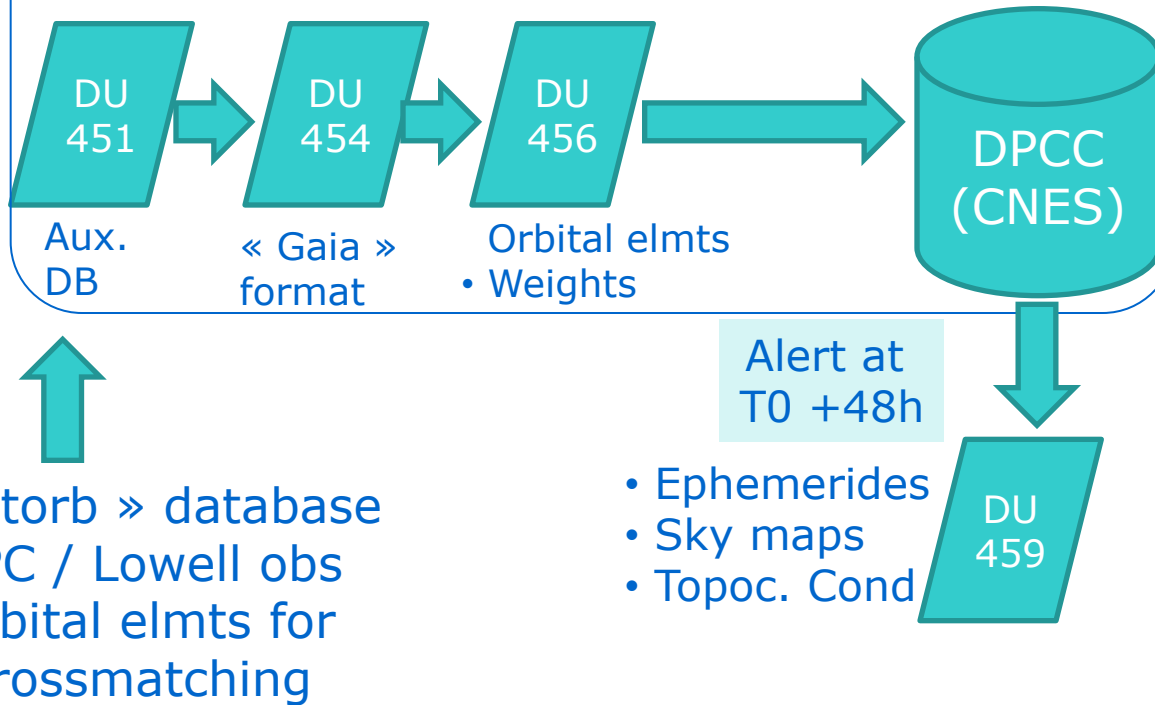


Alert timeline showing that after detection from the space and after the data processing, the astrometric alerts will be received by DU459 at least 24 to 48 hours later (Mignard, 2012)



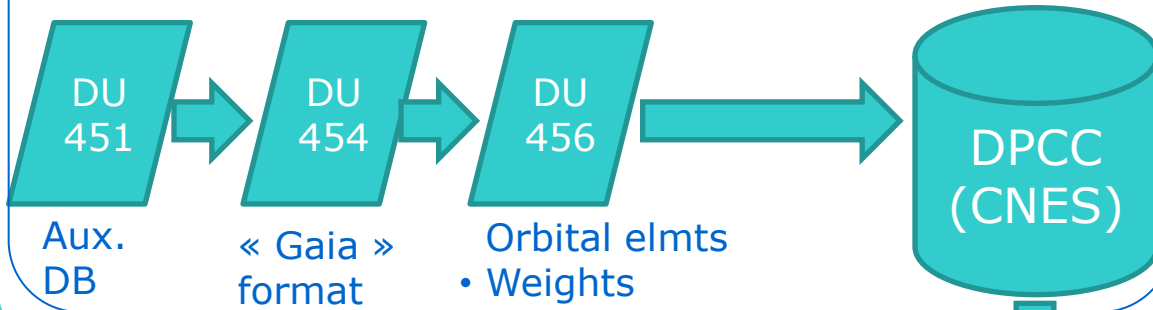
Detection of SSO at T0

Gaia SSO CU4 short term processing



Detection of SSO at T0

Gaia SSO CU4 short term processing

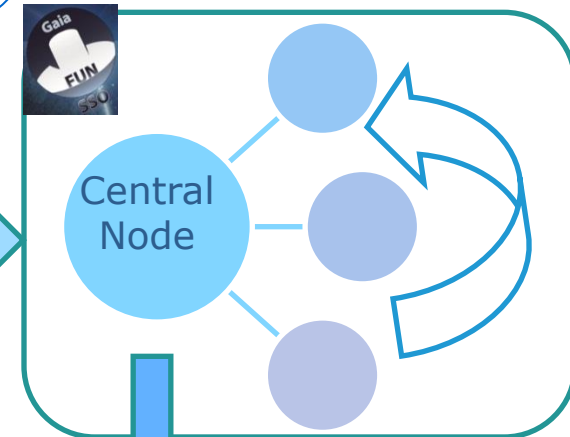


Alert at T0 +48h

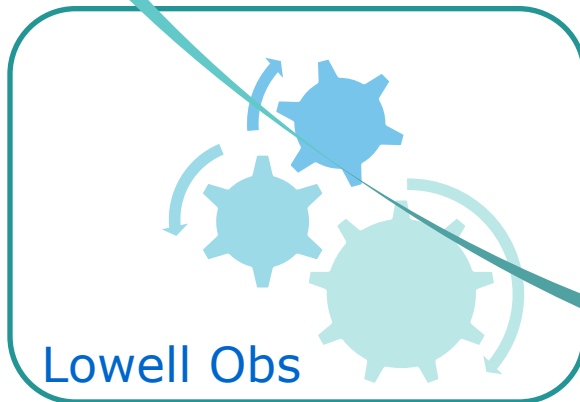
- Ephemerides
- Sky maps
- Topoc. Cond



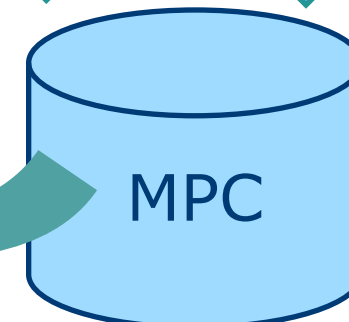
Gaia-FUN-SSO



ASTORB Data base



« Gaia » format



- ❑ Gaia framework and goal
- ❑ the Gaia-FUN-SSO network
- ❑ Past and current actions
- ❑ Future

- ❑ 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.

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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 - Data Policy
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 - Acknowledgements

The GAIA-FUN-SSO Collaborative space

News

- 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

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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

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

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

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

gaia OCA Observatoire de Paris IMCCE Observatoire de Paris

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Data repository :

- Goals
- Observing method
- Tools
- Publications
- Links

Campaigns:

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

Registration form



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gaia OIFs Observatoire de Paris IMCCE Observatoire de la Côte d'Azur

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Campaigns:

- Targets ephemerides
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See.
B. Carry's talk

Registration form

Nov. 2014
Registration on
New pipeline

Gaia-FUN-SSO

Requirements

- Worldwide coverage
- Quite fast reaction on alert (less than 24 hours)
- Astrometry => UT time scale (better than 1 sec.)
- Reference stars => Field of view ~ 15 arcmin
- Limiting mag 20 => Diameter ~ 1 m

Gaia-FUN-SSO

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Network (Nov. 2014)

- Major part : 0.6-1m-class
- 6 Schmidt tel. :
Rozhen / Xuyi / Konkoly / Tatenburg / Kourouvsкая / Xinlong
- 4 robotic tel. : Tarot 1 & 2 / Zadko / ESA-OGS
- 2 remote tel. : NM-Mayhill / Tubitak

Gaia-FUN-SSO: on November 2014

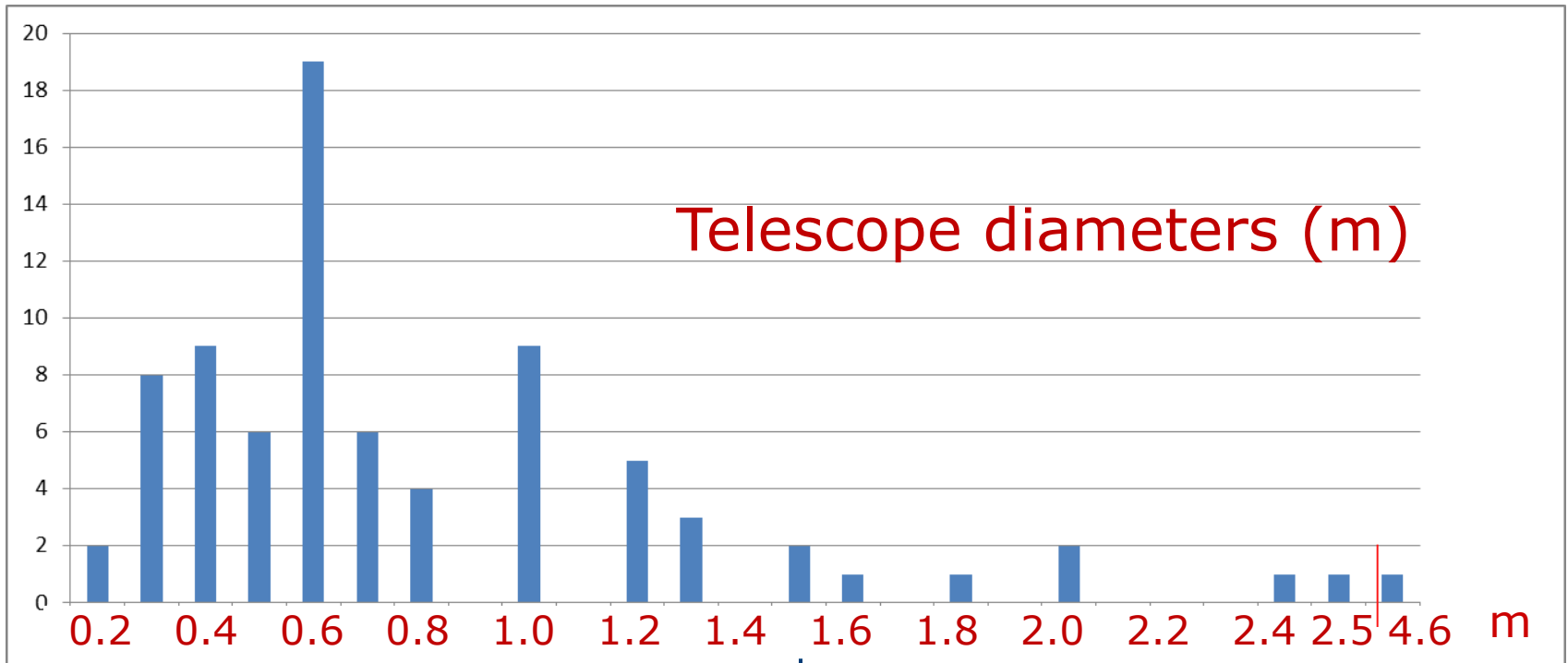


First period: 2010-2014
On the base of registration forms
(WIKI access)

- 57 observing Sites
- 80 operating instruments
- Volunteering base

Gaia-FUN-SSO

Telescope diameters (m)



MPC 10
 Tarot 1
 MPC 809
 Tarot 2
 MPC 84
 94
 104
 181
 188
 193
 204
 327
 345
 461
 557
 B18
 C01
 C89
 C95
 X-Ist.
 X-Hels.
 MPC 10
 94
 300
 461
 586
 A84
 D20
 D39
 MPC 33
 J04
 X-India
 MPC 119
 511
 809-Euler
 D29
 Z20
 MPC 188
 809
 MPC 874
 Itajuba
 Brazil
 MPC 290
 VATT
 USA
 MPC 071
 NAO Rozhen,
 Smolyan,
 (Bulgaria)
 MPC B18
 Terskol Russia
 MPC O44
 Yunnan Obs.
 Lijiang station
 China
 MPC 950 Target of Opp.
 ING-WHT/IAC Roque
 de los Muchachos Obs.,
 Isaac Newton Group
 Spain

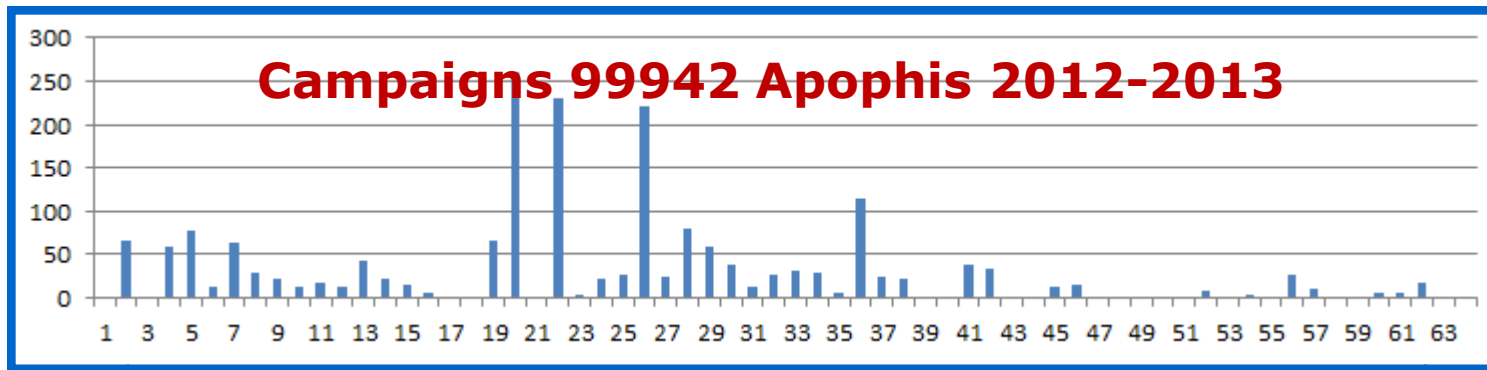
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Gaia-FUN-SSO: 10 training campaigns

Dates	SSO	Stations	Nbr. Obs.
2011 Nov-Dec.	2005 YU55	16: 071, 084, 089, 181, 345, 461, 585, 586, A84, B04, B17, C20, D20, D39, G96, O44	1792
2012 Jan. 17-28 (on alert from MPC012)	2012 BS667	4: 461, A84, H15, C20 (H15 reaction time 1.4 day after detec.)	35
2012 Feb.-March	1996 FG3	3: B04, H15, O44	18
2012 Feb.-March	99 942 Apophis	2: B04, H15	51
2012 Dec.2013 Apr.	99 942 Apophis	19: 010, 071, 089, 119, 188, 300, 511, 585, 586, 950, A84, B04, B17, B18, C01, C20, D20, O44, Z20	4000
2013 Feb.-March	2012 DA14	8: 071, 084, 300, B04, C60, Istanbul, C20, O44	1465
2013 Aug.	2002 GT	7: 010, 971, 089, 300, 585, B04, C01	1331
2013 Oct.2014 Jan.	2013 TV135	13: 071, 089, 119, 121, 168, 981, A84, B04, B18, C01, C20, H15, O44	810
2014 Apr. (on alert from ESA SSA)	2007 HB15	0	0
2014 June (triangulation)	2014 HQ124	3: 089, 585, C20	217

Apophis campaigns : new results

PHA (2004 MN4 / 99 942) Diam.: 325 m Albedo 0.22
Much surveyed for assessment of impact prob.



14/12/2012

13/3/2013

19 observing sites (Dec. 12 – Apr. 2013)
~2700 astrometric measures

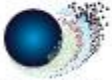
Paper1 : Bancelin et al. A&A 544, A15 (2012)

Paper2 : to be submitted to A&A

see D. Bancelin's and A. Ivantsov's talks



Aix-Marseille
université



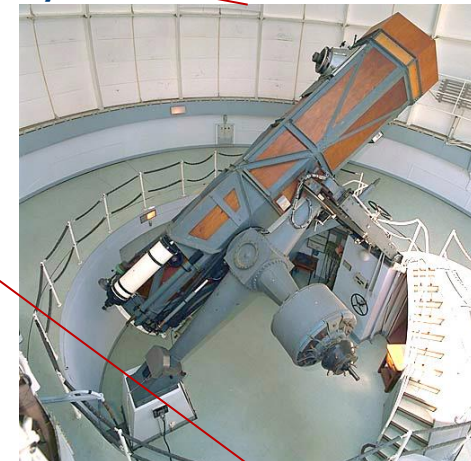
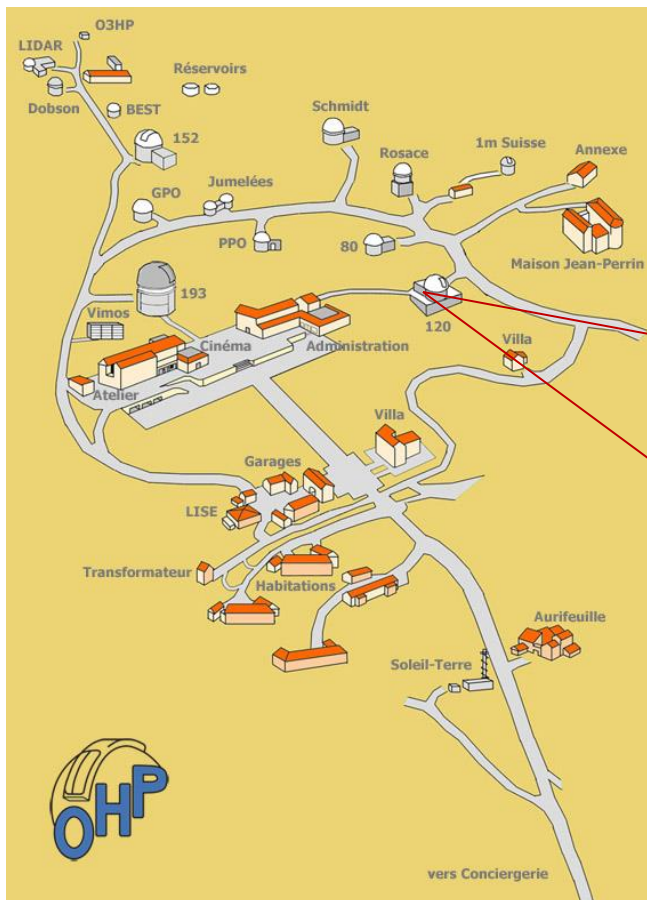
Institut
PYTHEAS



Observatoire de Haute-Provence

T120 will contribute to the Gaia follow-up

- Diameter: 1.2m
- Focal length: 7.2m
- Andore IKON-L 2048*2048
- FOV 13 arcmin 0.33 arcsec/pix
- Spectro Shelyak R \sim 600-1000





Combined observations at OHP (IAU code 511)

3 teams, 3 programs

- Gaia-FUN-SSO (W. Thuillot, B. Carry, P. Tanga, L. Jorda)
- Photometric Sc. Alerts (M. Dennefeld, J.-B. Marquette)
- QSO (S. Bouquillon, F. Taris)

T120 contributes to the Gaia follow-up:

- Observing runs 1 week/month
- 2014A: April – August 2014
- 2014B: Sept 2014- Feb. 2015



The Gaia-FUN-SSO workshops

Opportunity to exchange and initiate actions

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



Proceedings on-line:

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

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



http://www.imcce.fr/hosted_sites/gaiafun2012/

- Paris Obs.,
- **24-26 November 2014**
- 48 attendees
- 12 countries
- 28 communications

Group photo
To be done!

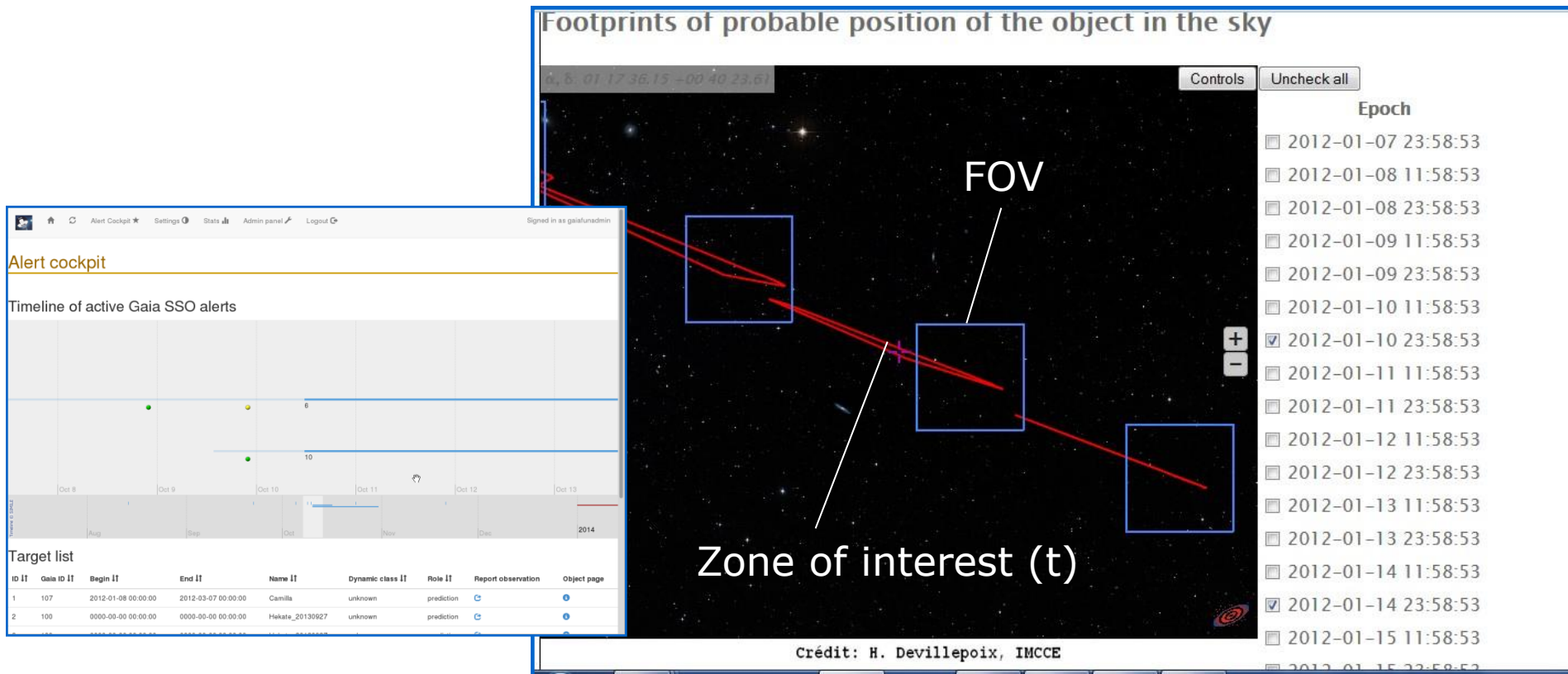
http://www.imcce.fr/hosted_sites/gaiafun2014/

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Entering a second phase: Pipeline & web interface

- Automatic dissemination of alerts
- Topocentric/local conditions
- Public but on registration
- To monitoring the network

See B. Carry's talk



What about for the next future?

- Gaia-FUN-SSO ready to work
- Core of ground-based stations
- Public alerts through the new pipeline
- How many alerts ? => tuning phase
- Validation phase at first : role of OHP + some stations
- Public dissemination in a second step
- Operating mode as long as there will be SSO alerts...

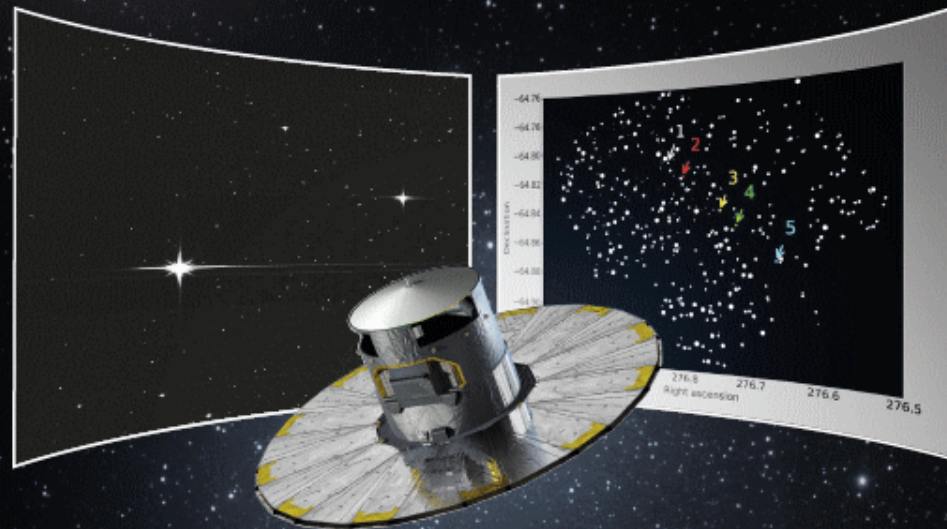
Conclusion

- 2011-2014: set-up of the Gaia-FUN-SSO network
- Preliminary activities : satisfying results
- Waiting now for a validation phase (known objects)
- 2015: phase for tuning the alert flow
- Stations must stay ready to react
- Discussions during this meeting





Welcome to the third Gaia-Fun-SSO Workshop



GAIA

FOLLOW-UP NETWORK FOR THE SOLAR SYSTEM OBJECTS

3



IMCCE · Paris Observatory
From November 24 to November 26, 2014
77, avenue Denfert-Rochereau, 75014 Paris



Action Spécifique
GAIA

