Validation of Gaia Alerts at OHP: SSO-ST chain and photometric Alerts

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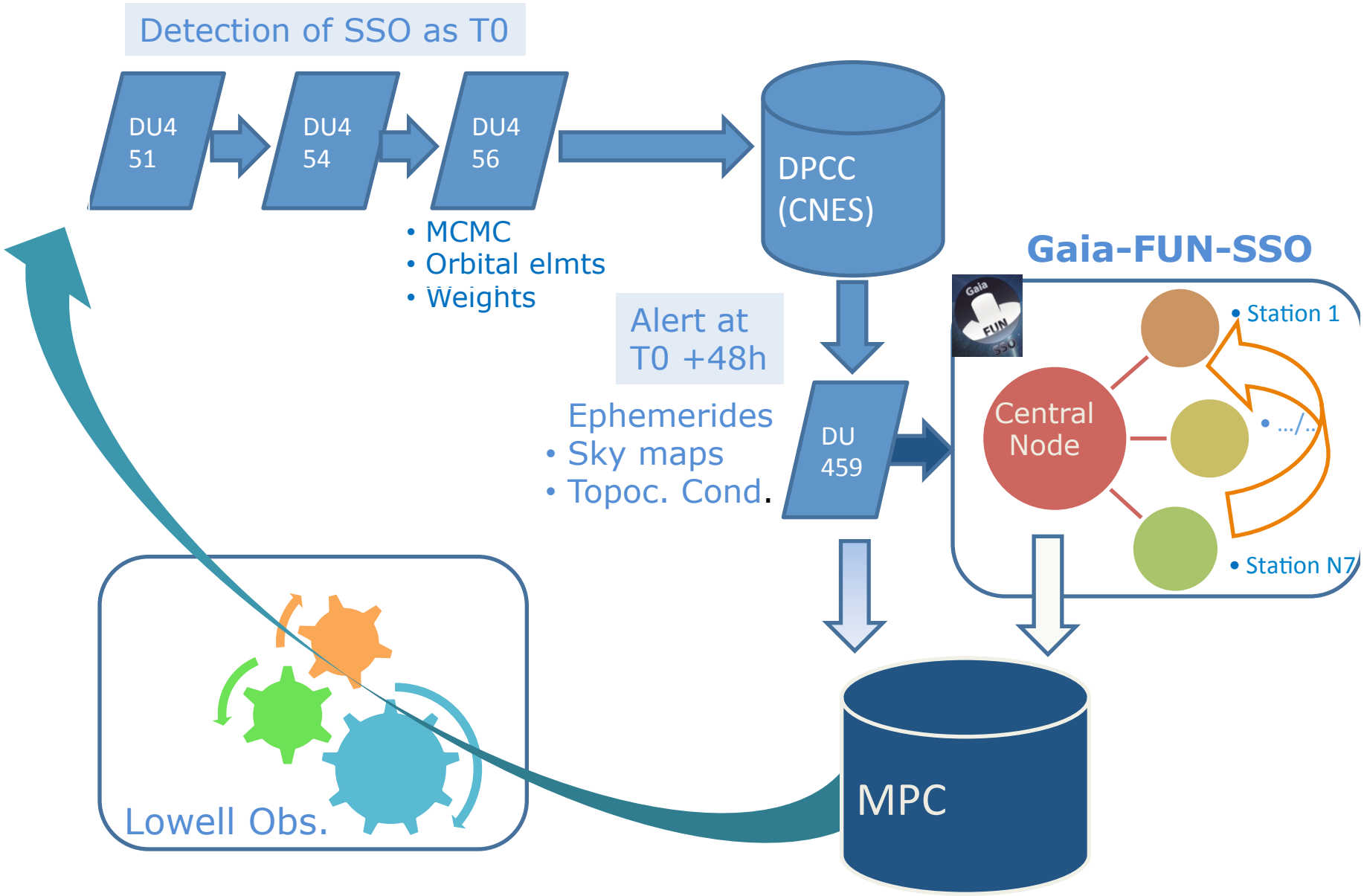
4: Observatoire de Haute-Provence (CNRS)

Further details in the ESA Tech. Note GAIA-C4-TN-IMC-WT-002-02

gaia

Gaia FUN SSO

Solar System Objects - Short Term pipeline



Gaia-FUN-SSO | ★ Gaia alert | ☆ GBOT alert | Settings | Logout | Admin | Thuillot

Gaia Follow-Up Network for Solar System Objects

Goal

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. Its goal is to coordinate ground-based observations on alert triggered by the data processing system during the mission for the confirmation of newly detected moving objects or for the improvement of orbits of some critical targets. Gaia will scan the sky following a pre-defined scanning law and such ground-based observations are required to avoid the loss of newly detected Solar System objects and to facilitate their subsequent identification by the probe.

These pages provide an access to the alerts, including the ephemeris to help finding the targets, for the registered members of the Gaia Follow-up network. The network currently consists in about 80 observers in 27 observing sites, spread all over the world (November 2016).

Alerts:
Topocentric if registered
Geocentric if not

Tuning of the telescope parameters and local conditions

Workshops

Three Gaia-FUN-SSO workshops dedicated to the astrometric follow-up of the Solar System Objects have already been organized in 2010, 2012 and 2014 in Paris Observatory. Discussions has been held about this network and the tasks to be accomplished, the capabilities of the observing sites and the preliminary actions already performed.

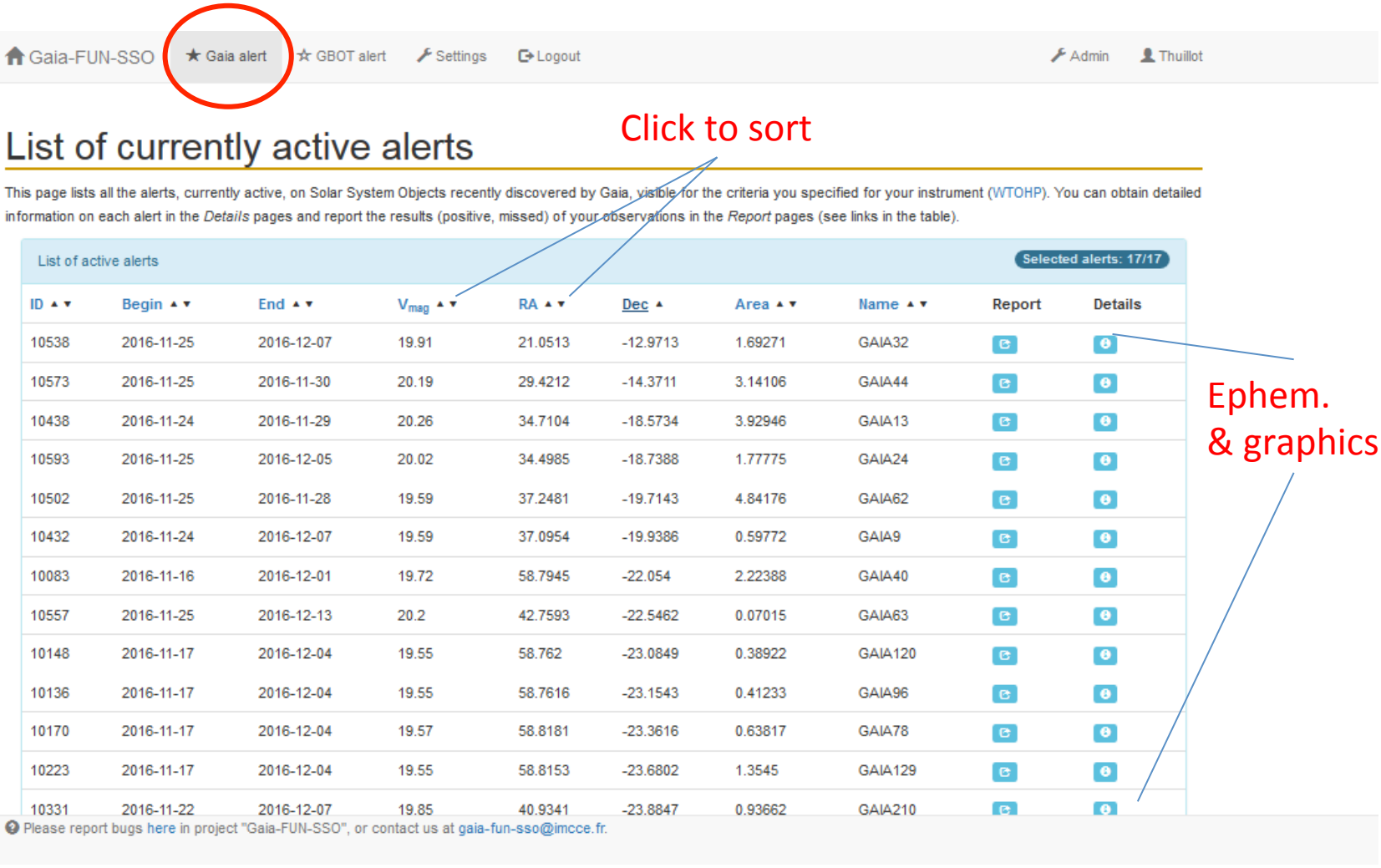
- Proceedings of the 2010 workshop have been published and can be freely downloaded here.
- Proceedings of the 2012 workshop have been published and can be freely downloaded here.
- Proceedings of the 2014 workshop have been published and can be freely downloaded here.

Registration

To get a full access to these pages and to share data, you must be registered as active participant of this observing network. For this registration, please use this form. This network needs to have a large geographical coverage: if you are interested, do not hesitate to contact us!

Please report bugs here in project "Gaia-FUN-SSO", or contact us at gaia-fun-sso@imcce.fr.

https://gaiafunsso.imcce.fr



https://gaiafunsso.imcce.fr

Gaia-FUN-SSO ★ Gaia alert ☆ GBOT alert Settings Logout Admin Thuillot

Detailed information on alert

You will find below detailed information on the target and its probable position on the plane of the sky.

Object Information

- **Gaia ID:** -4194967176
- **Database ID:** 10148
- **Name:** GAIA120
- **Magnitude (V):** $19.6^{+0.6}_{-0.3}$
- **Date of observation:** 11/13/2016

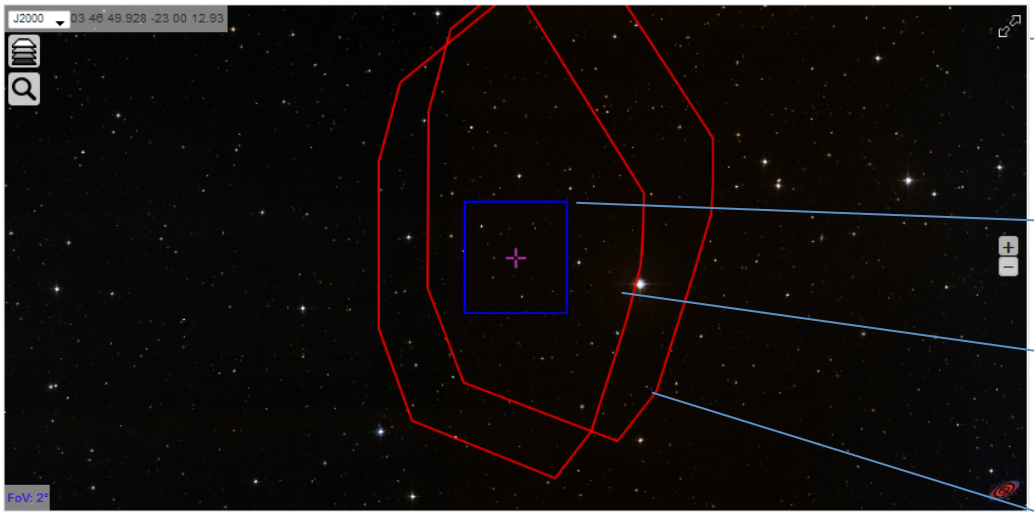
Report observation | Back to Gaia alerts

Instrument and Field of View

	Field of View	RA	Dec
☑	13x13 arcmin^2	03:55:02.880	-23:05:05.640

Information on the alert

Sky view with Aladin -- Object expected magnitude V= $19.6^{+0.6}_{-0.3}$



Sky map

Field of View 12x12 arcmin OHP

Most probable zone (blue)

Zone to explore if not in the FoV (red) on date 1

and on date 2

Footprints of areas to search for (in red) and the field of view (in blue, 13x13 arcmin^2) of your device (**WTOHP**).
You can change your device and its parameters in your settings.

Available epochs 28

Check all | Uncheck all | Invert selection

Show?	Epoch	RA	Dec	V_{mag}	Area (deg^2)
☑	2016-11-28 01:17:05	03:55:02.880	-23:05:05.640	$19.6^{0.6}_{0.3}$	0.38922
☐	2016-11-28 07:17:05	03:54:47.448	-23:02:15.720	$19.6^{0.6}_{0.3}$	0.41358
☑	2016-11-28 13:17:05	03:54:32.568	-23:09:03.240	$19.6^{0.6}_{0.3}$	0.43921
☐	2016-11-28 19:17:05	03:54:17.400	-23:13:15.240	$19.6^{0.6}_{0.3}$	0.46539
☐	2016-11-29 01:17:05	03:54:01.776	-22:45:01.080	$19.6^{0.6}_{0.3}$	0.49262
☐	2016-11-29 07:17:05	03:53:46.488	-23:08:16.800	$19.6^{0.6}_{0.3}$	0.52176

Ephemerides

Observations at Haute-Provence Observatory, France

Obs. de Haute-Provence (OHP-CNRS)

- SE of France, IAU 511
- Altitude 650m
- Several telescopes

(1.93m, 1.52m, 1.20m,….)
+ 50cm remote controlled

- + Geophysics station (atmosph. profile, O3,…)

Combined observations at OHP (IAU 511)

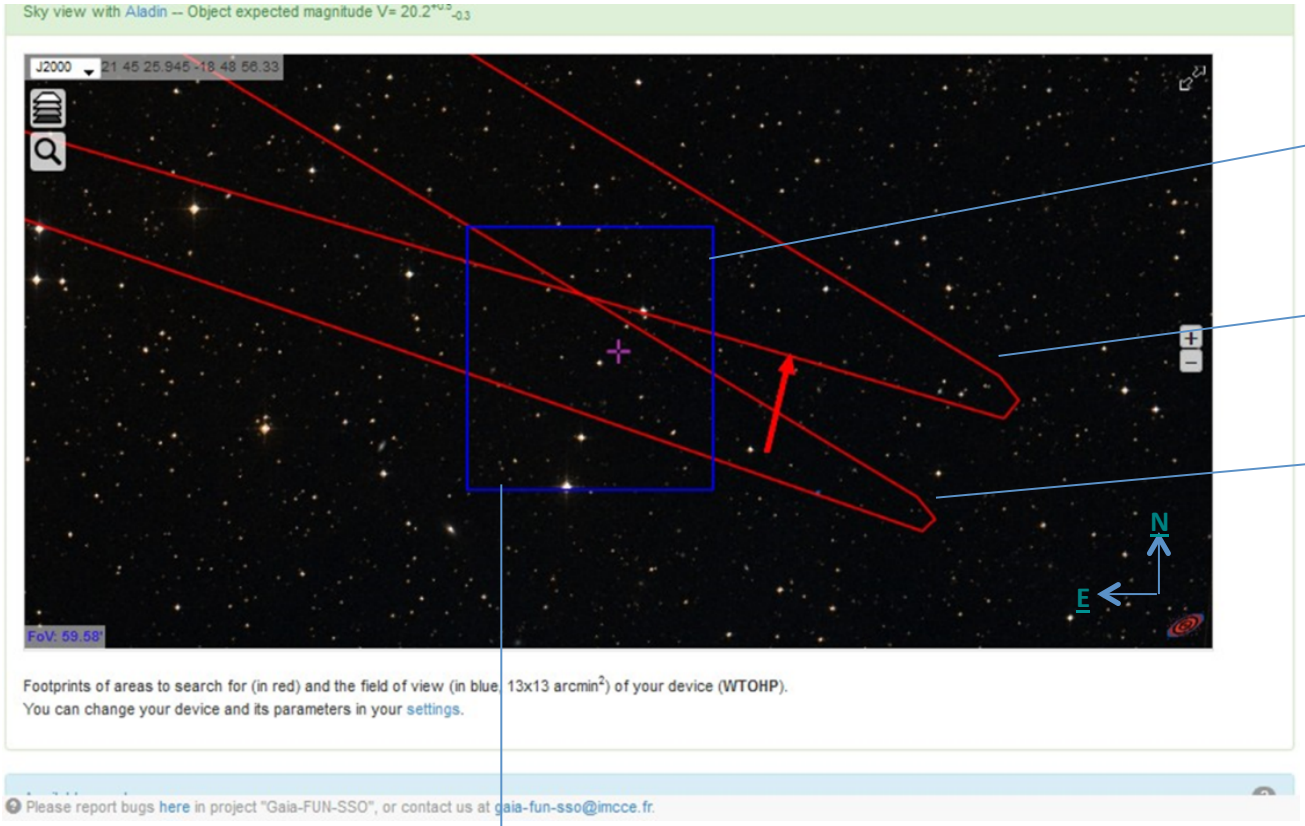
- Gaia-FUN-SSO (W. Thuillot, B. Carry, P. Tanga, M. Delbo,…)
- GBOT & QSO's (S. Bouquillon, F. Taris)
- Photometric Sc. Alerts (M. Dennefeld, …)

- Newton tel. at OHP (Haute-Provence Observatory)
- 1.2m 2k Andor Ikon L936 1024x1024 pixels of 0.67 arcsec (bin 2)
- Observing runs ~4 nights / month
- 2 validation runs for SSO' s in October, 1 in November

9

1st test: Alert Gaia-142 on 2016/10/4 23:58 UT

sourceID -4194967154, detected by Gaia on October 1 at 0h



Nominal FoV
On 2016/10/4

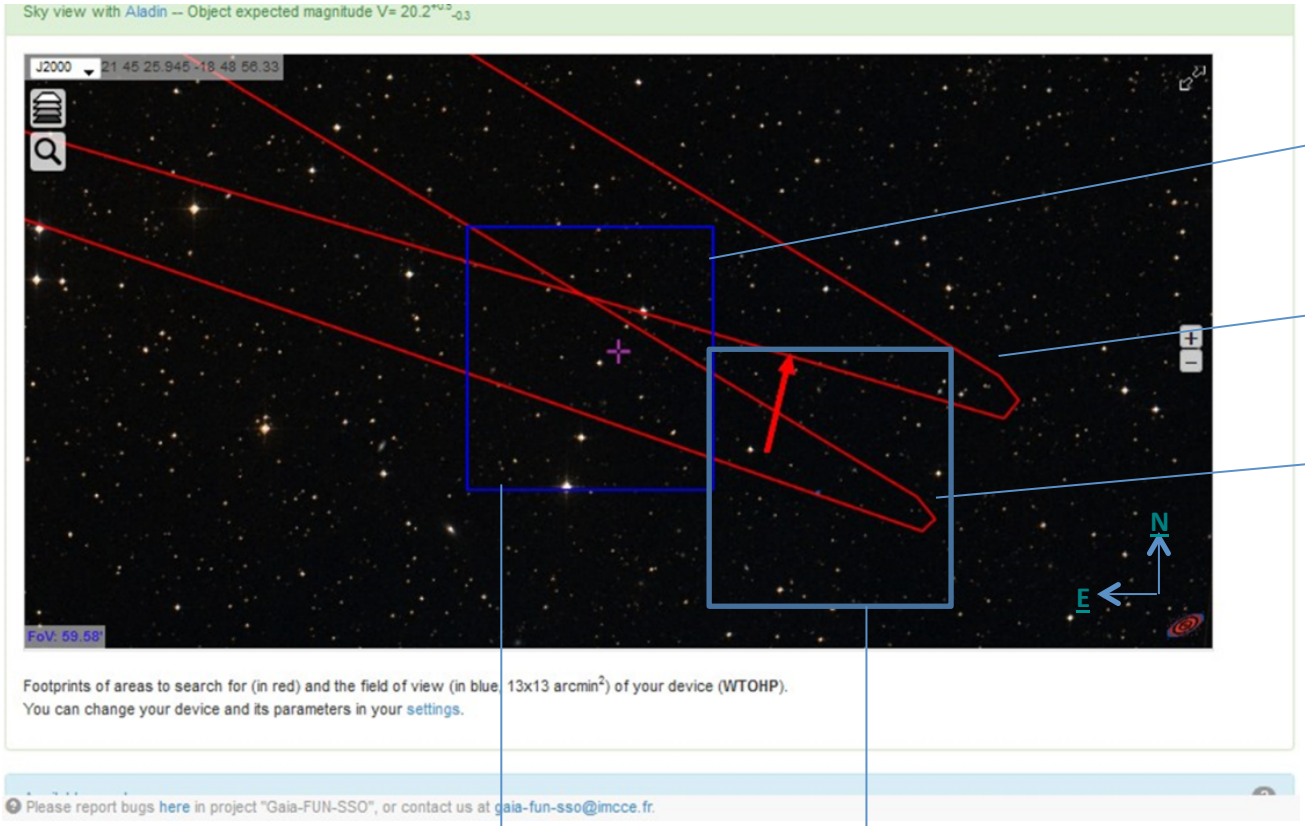
Zone to explore
On Oct. 5 23h59

Zone to explore
On Oct. 4 23h59

Nothing here…

1st test: Alert Gaia-142 on 2016/10/4 23:58 UT

sourceID -4194967154, detected by Gaia on October 1 at 0h



Nominal FoV
On 2016/10/4

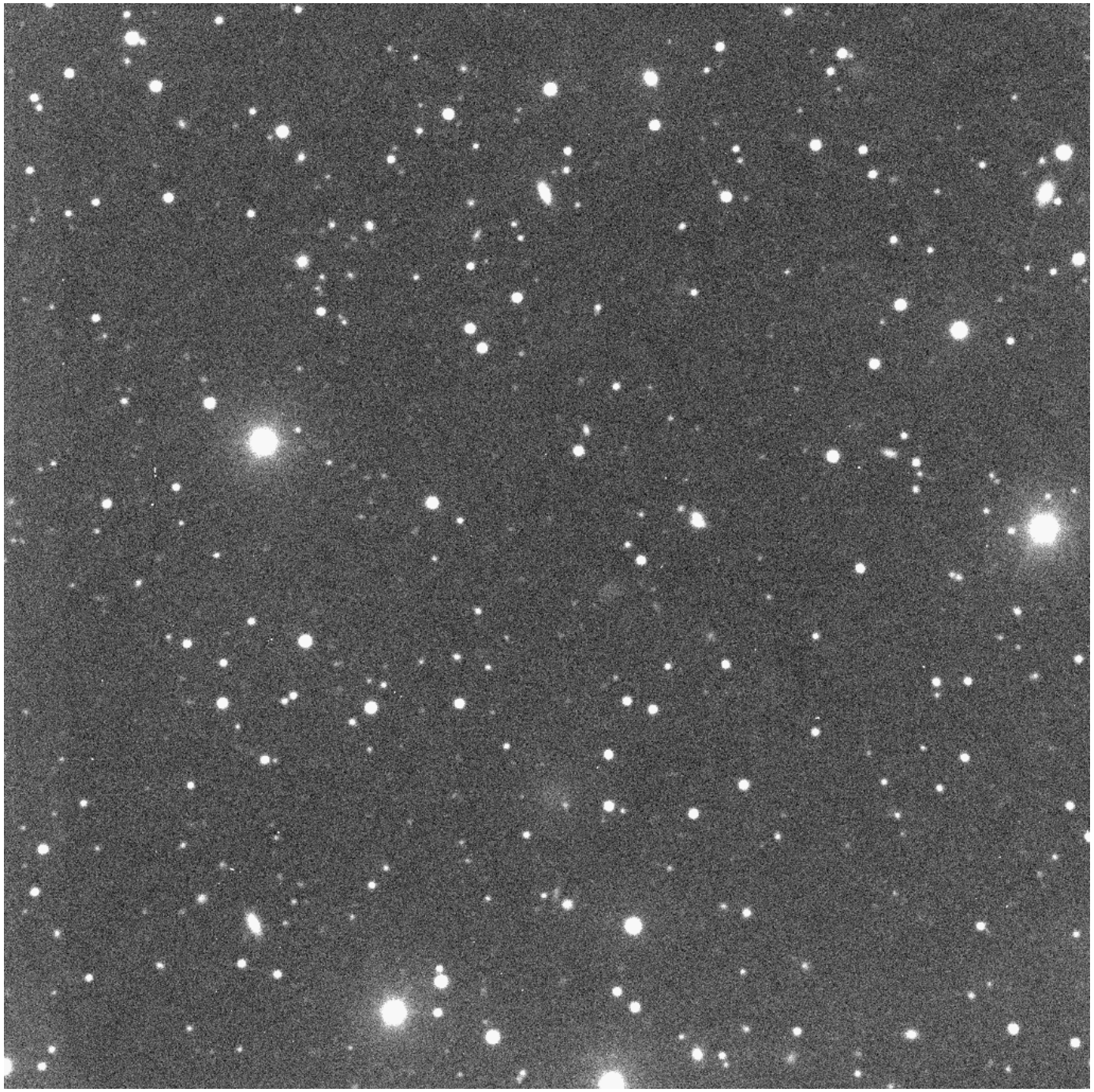
Zone to explore
On Oct. 5 23h59

Zone to explore
On Oct. 4 23h59

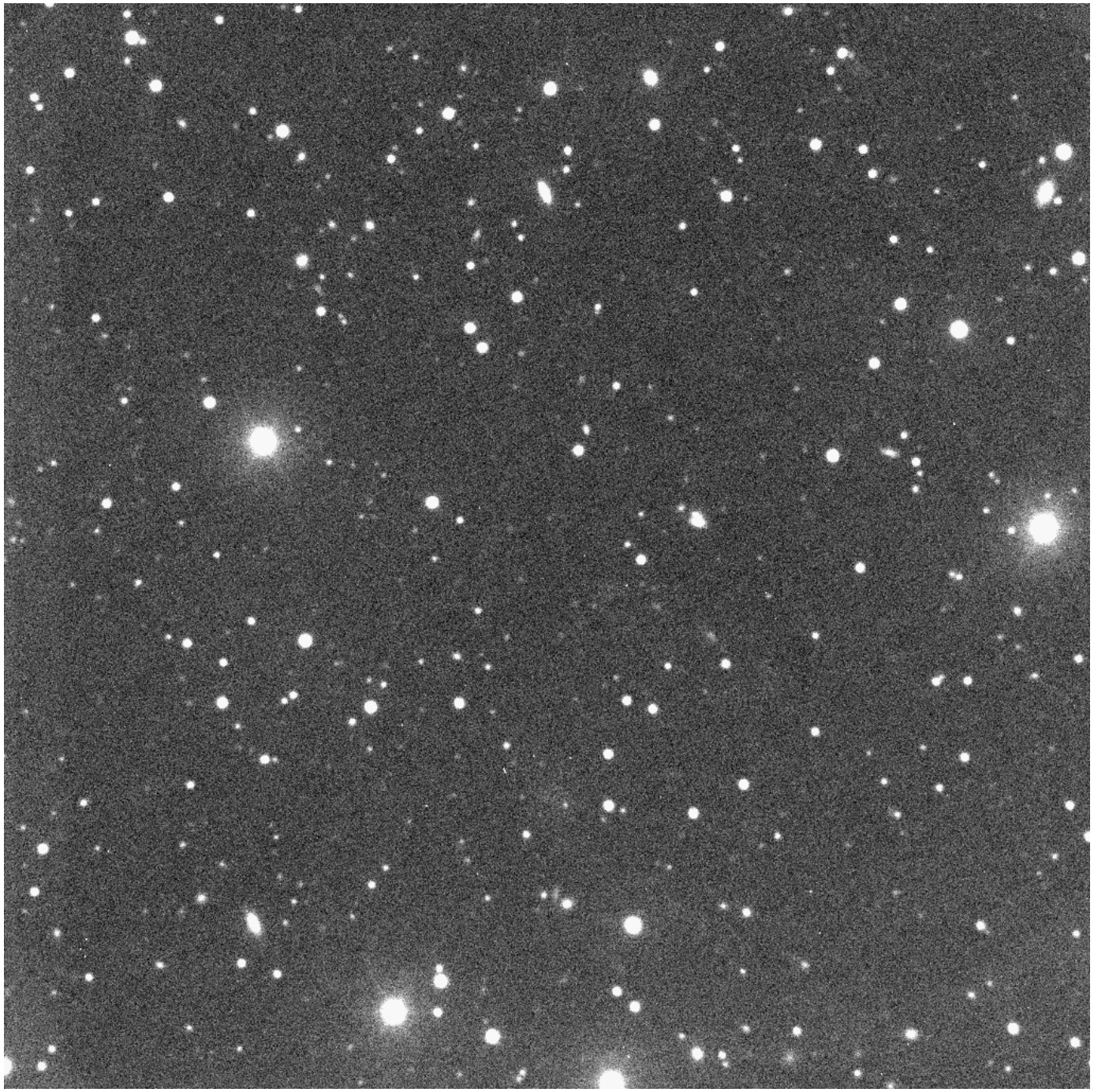
Nothing here…

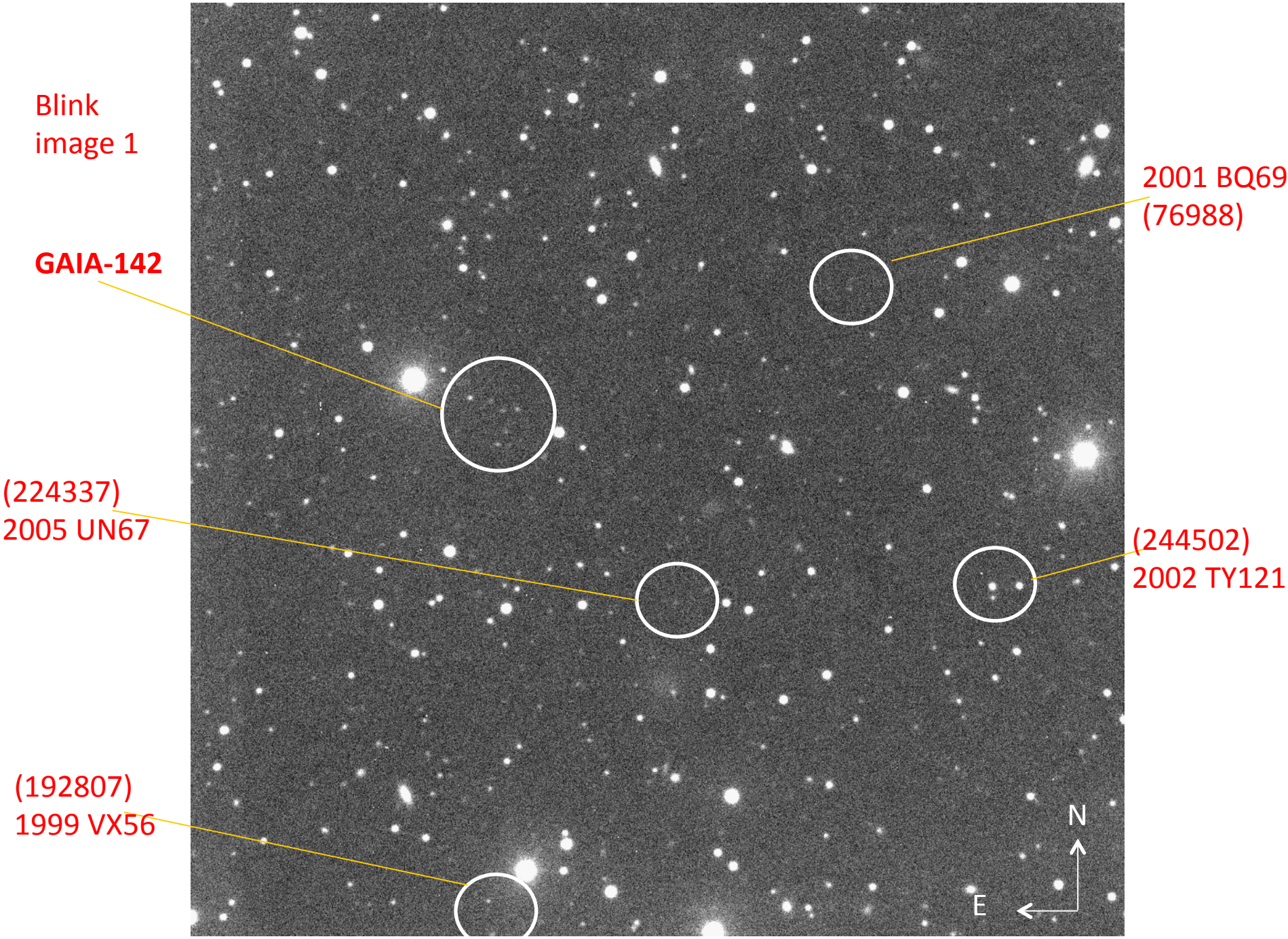
But something there!

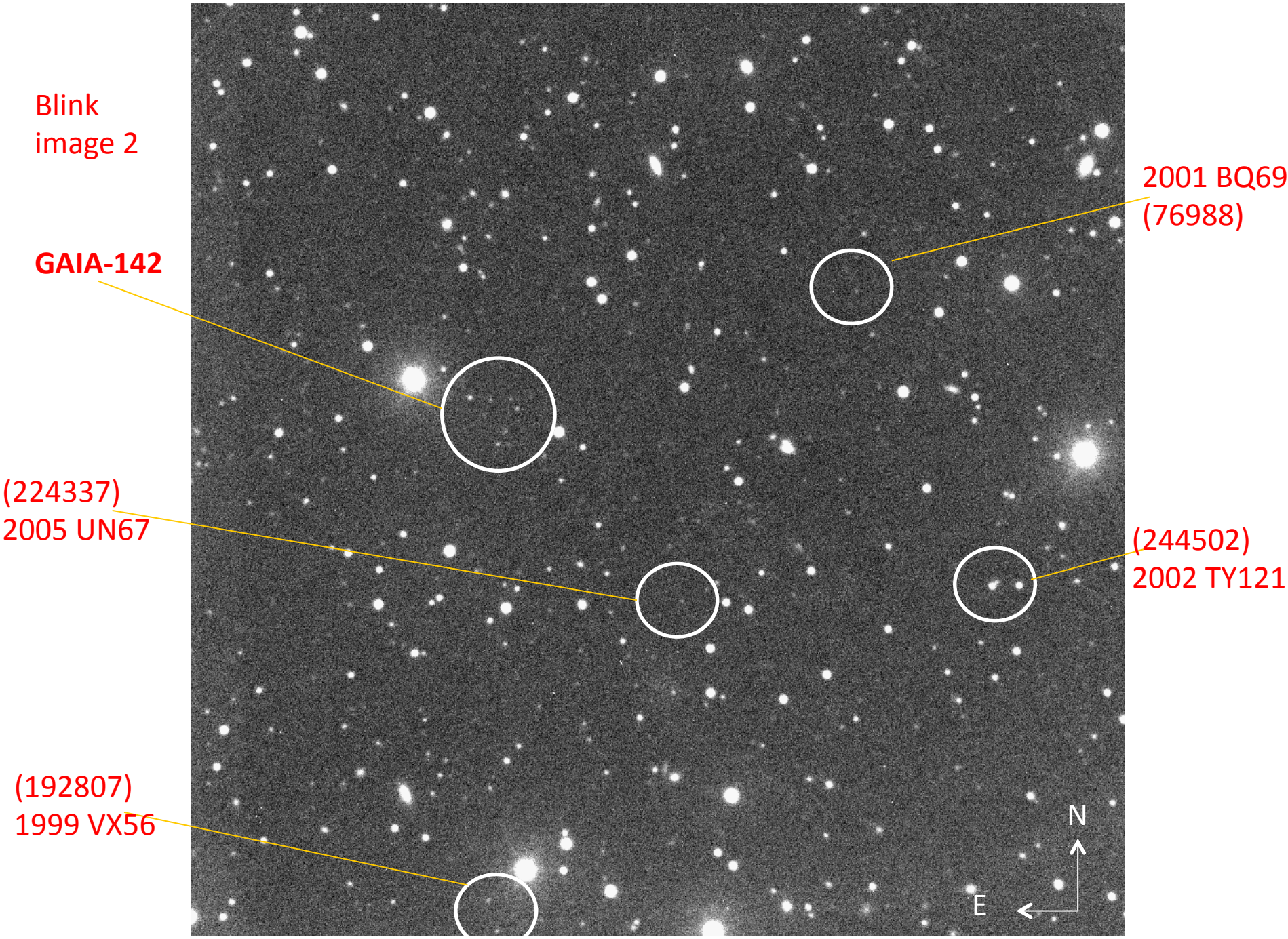
Blink
image 1



Blink
image 2

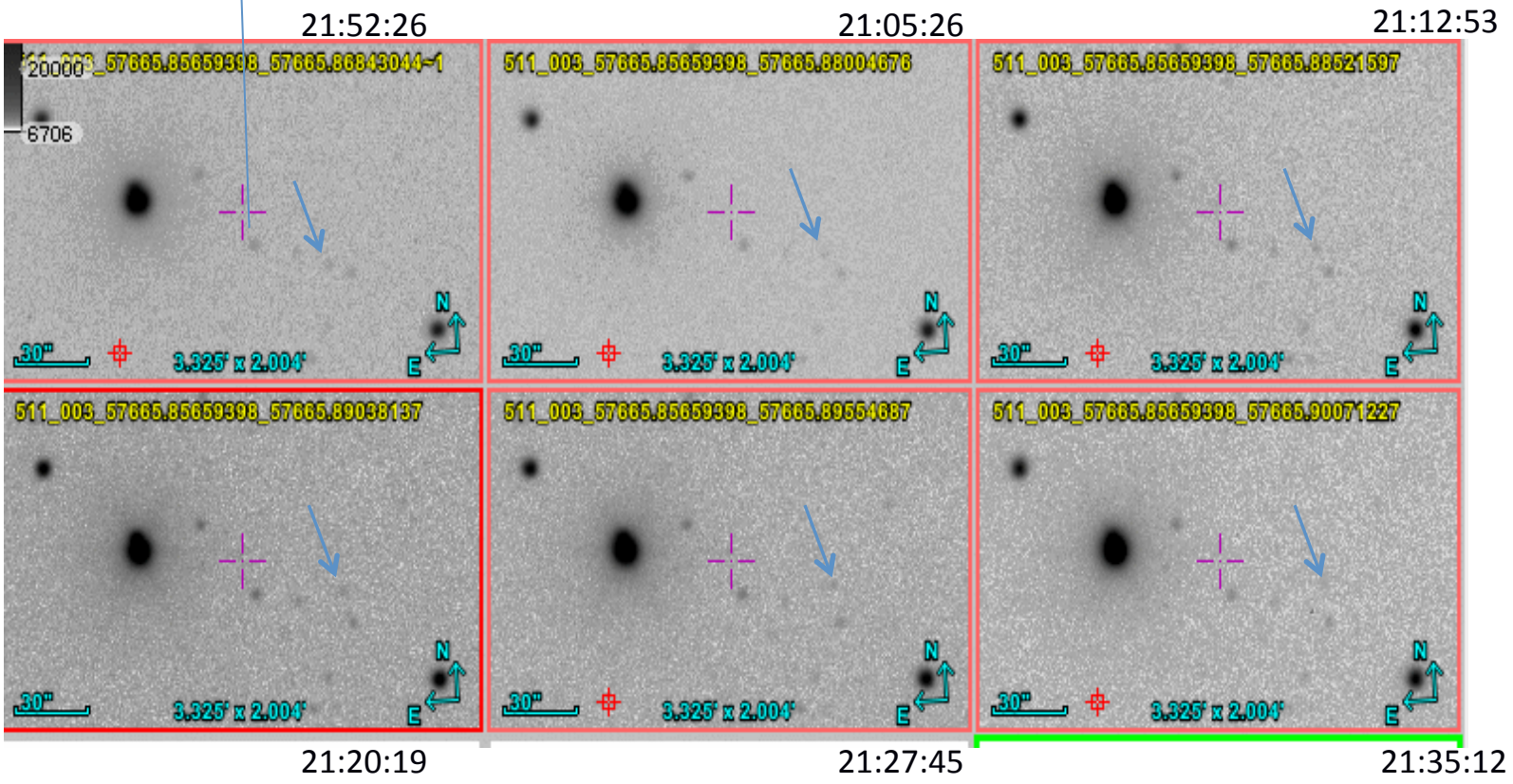



Blink
image 1
2001 BQ69
(76988)
GAIA-142
(224337)
2005 UN67
(244502)
2002 TY121
(192807)
1999 VX56
N
E

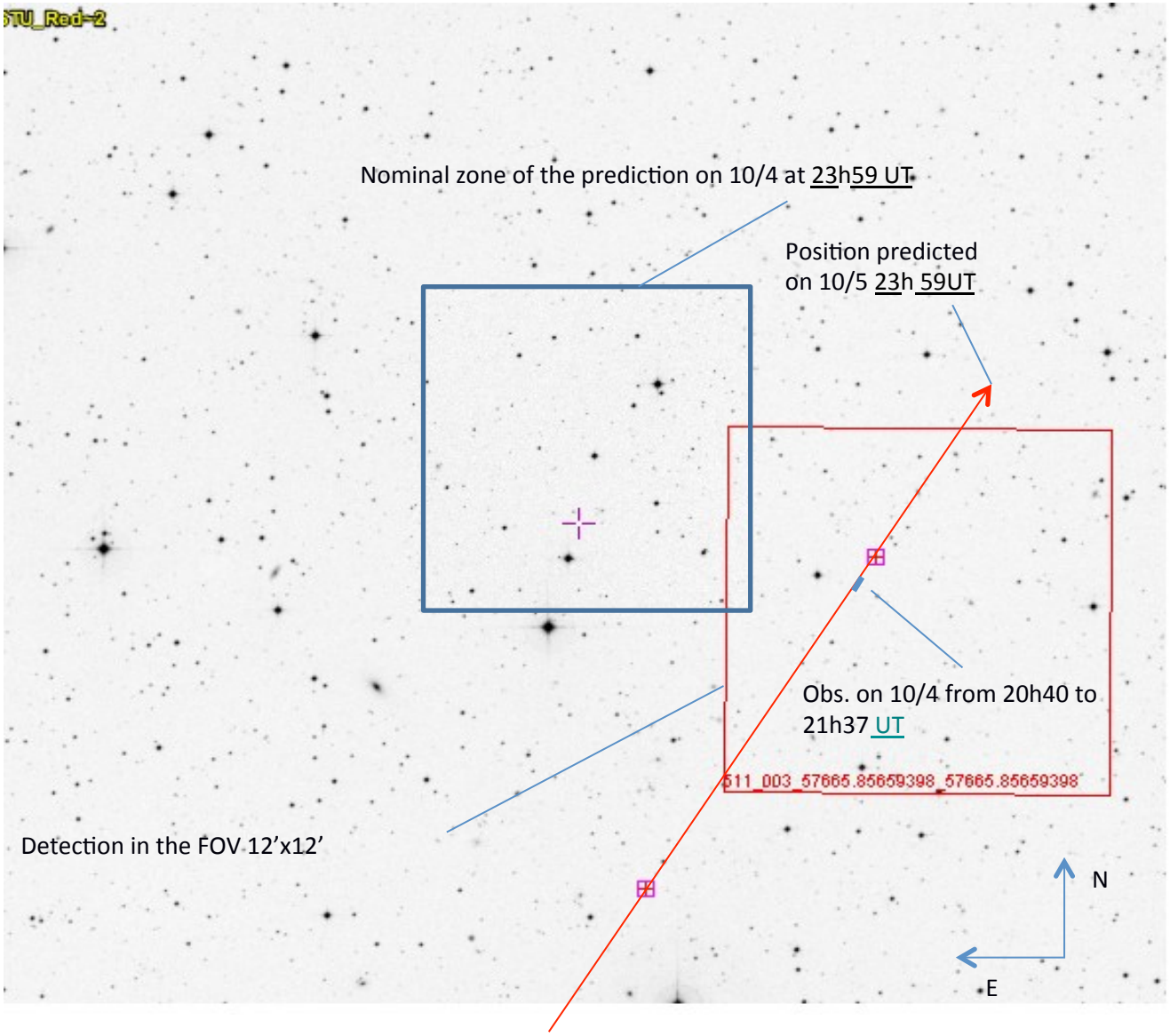

Blink
image 2
GAIA-142
2001 BQ69
(76988)
(224337)
2005 UN67
(244502)
2002 TY121
(192807)
1999 VX56
N
E

Alert Gaia-142 on 2016/10/4

USNO-A2.0 0675-36632675 (R=18.1)



No known object at this place according to the MPC Checker (http://www.minorplanetcenter.net/cgi-bin/checkmp.cgi)


STU_Red-2
Nominal zone of the prediction on 10/4 at 23h59 UT
Position predicted
on 10/5 23h 59UT
Obs. on 10/4 from 20h40 to
21h37 UT
511_003_57665.85659398_57665.85659398
Detection in the FOV 12'x12'
N
E

Prediction DU 459: GAIA-142 on 2016/10/4
RA 21h47m36s.144 and DE: -18°43'08".400 at 23h 59m 0s UT mag. 20.2.

Astrometry NOT sent to MPC: 10 positions

Only 1 night

No follow-up possible (weather)

	Date	*RA*	*DE*			*mag filt.*	*obs.*
	yyyy mm dd.ddd	*hh m ss.s*	° ' "				*code*
gaia142	C2016 10	4.86130	21 46 56.69	-18	48 05.3	20.2 R	511
gaia142	C2016 10	4.86843	21 46 56.57	-18	48 02.6	20.3 R	511
…/…							
gaia142	C2016 10	4.89813	21 46 56.08	-18	47 51.6	20.6 R	511
gaia142	C2016 10	4.90071	21 46 56.08	-18	47 51.6	20.3 R	511

- **Provisional ephemeris gives offset on 2016/10/4 23:58 UT**

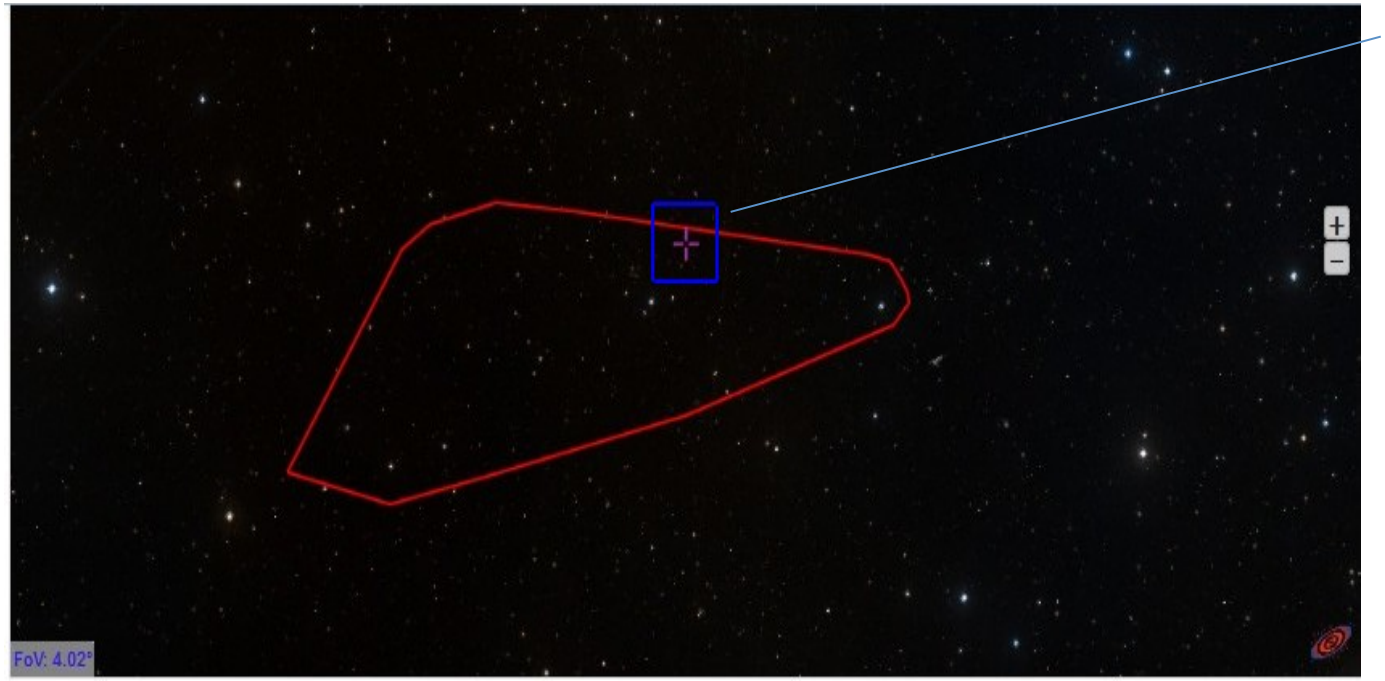
$RA_{eph} - RA_{pred.} = -10'.4$
$DE_{eph} - DE_{pred.} = -4'.1$

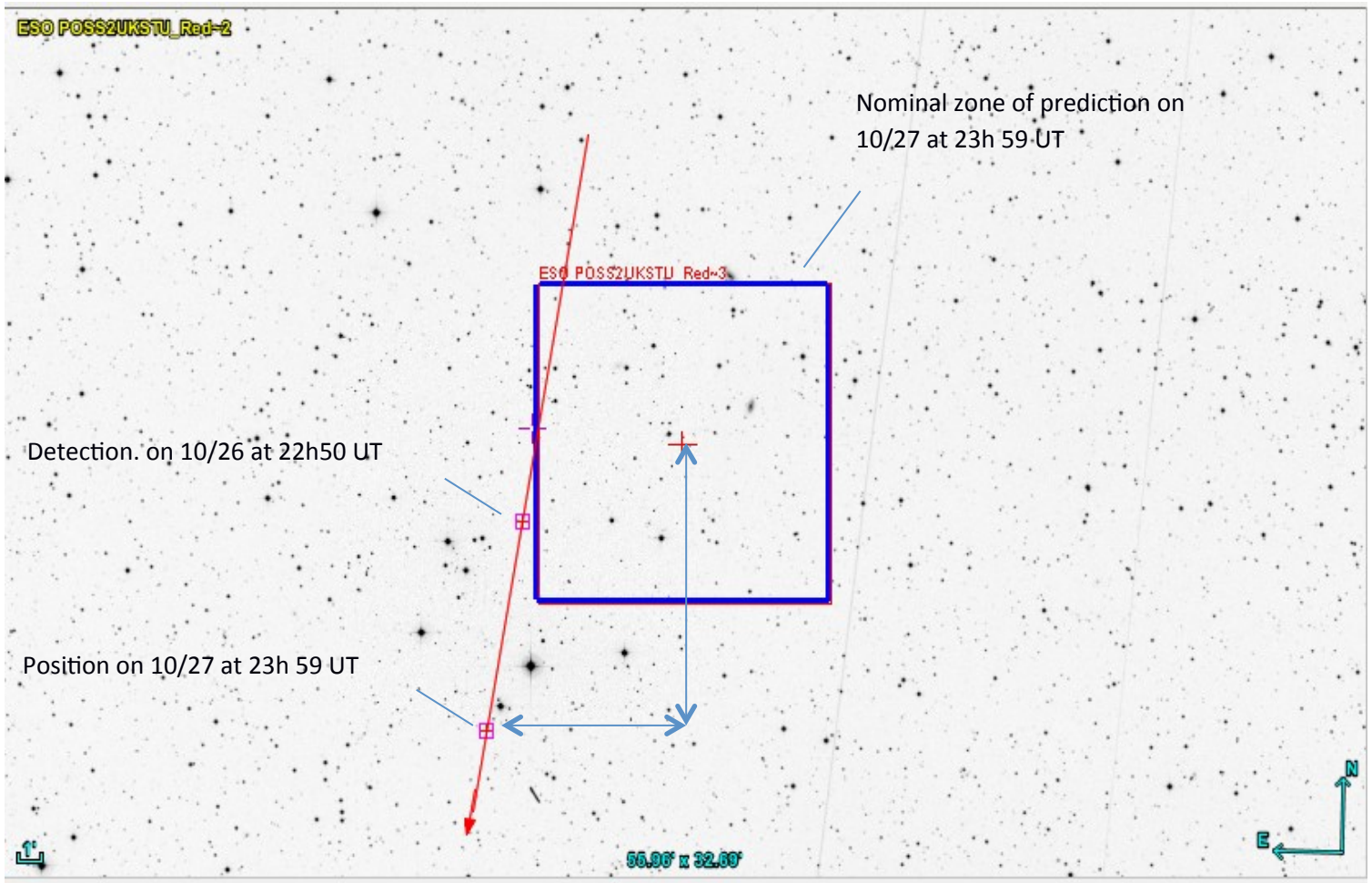
- **4 days elapsed since the detection by Gaia**

2nd test: Alert Gaia-606 on 2016/10/26 23h59 UT

sourceID -4194966690

detected by Gaia on October 10 at 17h 46 UT




ESO POSS2UKSTU_Red-2
Nominal zone of prediction on
10/27 at 23h 59 UT
ESO POSS2UKSTU Red-3
Detection. on 10/26 at 22h50 UT
Position on 10/27 at 23h 59 UT
N
E
55.06' x 32.60'

Prediction DU 459: GAIA-606 on 2016/10/27
RA: 22h 22m 54s.528 and DE: 29°40'20".280 at 23h 59m 0s UT mag. 19.3

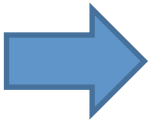
Astrometry sent to MPC: 33 positions

3 nights

```
     GAIA606   C2016 10 26.95139 22 23 24.53 +29 37 18.1 19.7 R      511
     GAIA606   C2016 10 26.95351 22 23 24.53 +29 37 16.5 19.8 R      511
../...
     GAIA606   C2016 10 27.88637 22 23 30.59 +29 29 35.7 18.3 R      511
     GAIA606   C2016 10 27.88850 22 23 30.60 +29 29 34.7 18.2 R      511
.../...
     GAIA606   C2016 10 28.78286 22 23 38.09 +29 22 13.5 19.3 R      511
     GAIA606   C2016 10 28.78498 22 23 38.11 +29 22 12.5 19.2 R      511
```

- **Provisional ephemeris**

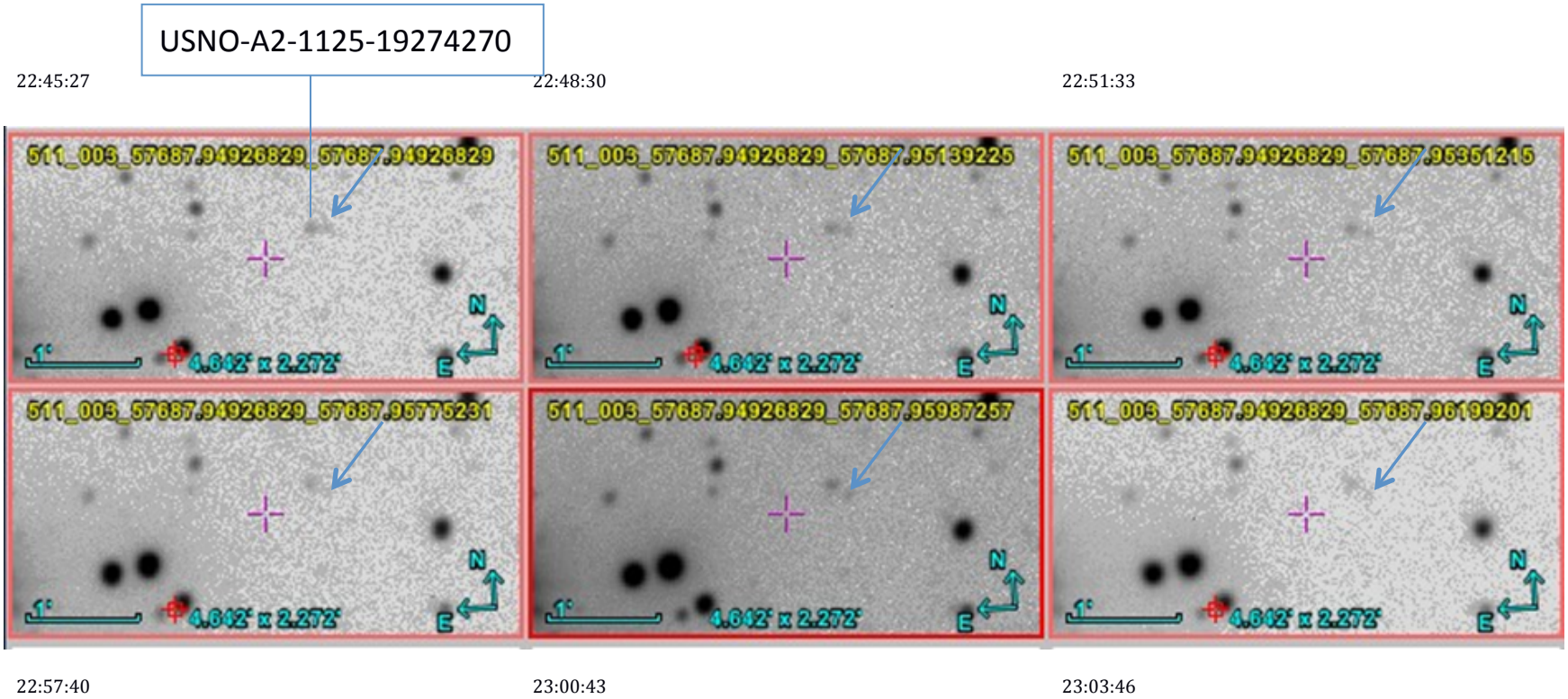
Offset on 2016/10/27 23:58 UT



$RA_{eph} - RA_{pred.} = 9'.2$
$DE_{eph} - DE_{pred.} = -11'.7$

- **17 days elapsed since the detection by Gaia**

Alert Gaia-606 on 2016/10/26



October 26: No known object at this place according to the MPC Checker
but
November 4: MPC published former observations done in July → GAIA-606 = 2016 UV56

GAIA-606 renamed 2016 UV56 by MPC

The data Base Search at MPC
http://www.minorplanetcenter.net/db_search
Gives:

75 Observations :

- 2001 01 02: 7 from 704 Lincoln
- 2010 05 03: 13 from C51 Wise

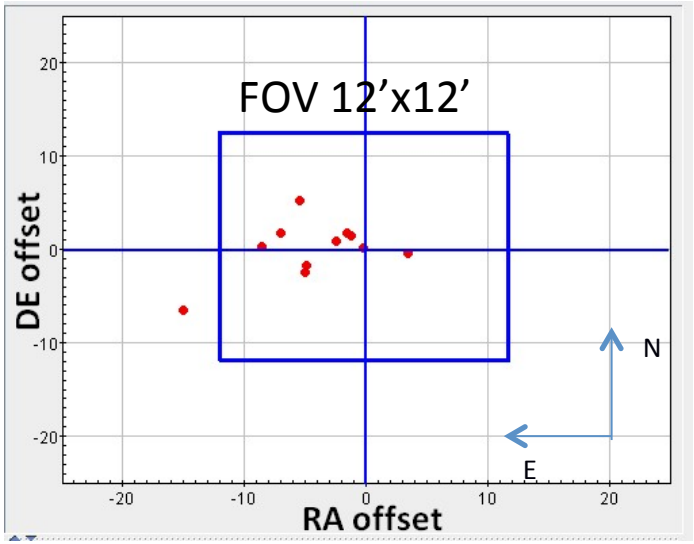
Recently added

- 2016 07 18 : 3 from F51 Pan-STARRS
- 2016 08 24: 12 from D29 Purple Mountain
- 2016 10 11: 4 from F51 Pan-STARRS
- 2016 10 26: 33 from 511 Haute Provence Obs.
- 2016 11 03: 3 from F51 Pan-STARRS

Published on Nov. 4

3rd test:
Alerts for known objects

- No need of observation
- Possible during the validation phase
- Known objects + unknown objects
- Comparison with ephemerides



Object designation	R.A.	Decl.	V	Offsets arcmin	arcmin
(2319) Aristides	09 54 05.3	+13 33 30	18.0	3.4W	0.4N
(12189) Dovgyj	21 51 44.5	-12 08 30	17.7	5.5E	5.2S
(8632) Egleston	21 47 34.3	-09 47 17	18.4	4.9E	1.7N
(3731) Hancock	21 55 31.6	+16 12 42	16.5	8.6E	0.3S
(2428) Kamenyar	21 46 32.0	-19 18 38	16.5	1.2E	1.4S
(7965) Katsuhiko	21 49 39.8	+12 10 24	17.0	0.2E	0.2S
(1175) Margo	21 48 30.0	+07 59 03	15.1	1.6E	1.8S
(7616) Sadako	21 44 37.4	-01 14 56	16.6	7.0E	1.7S
(8074) Slade	21 43 00.6	-02 58 58	17.7	5.0E	2.4N
(16736) Tongariyama	21 47 48.9	-13 24 03	18.6	15.0E	6.5N
(11427) Willemkolff	21 43 15.1	-11 31 03	18.0	2.4E	0.8S

Conclusions for SSO's:

- With the present conditions of strong filtering in SSO-ST…

- Validation =
  - ✓Discrimination of moving objects / false alerts
    this seems OK…further checks to confirm

  - ✓positionning
    OK up to 17 days after the alert triggering

- Circular Ready to be sent
  to reanimate the observer network Gaia-FUN-SSO

Photometric alerts
(latest run: Nov. 28-30)

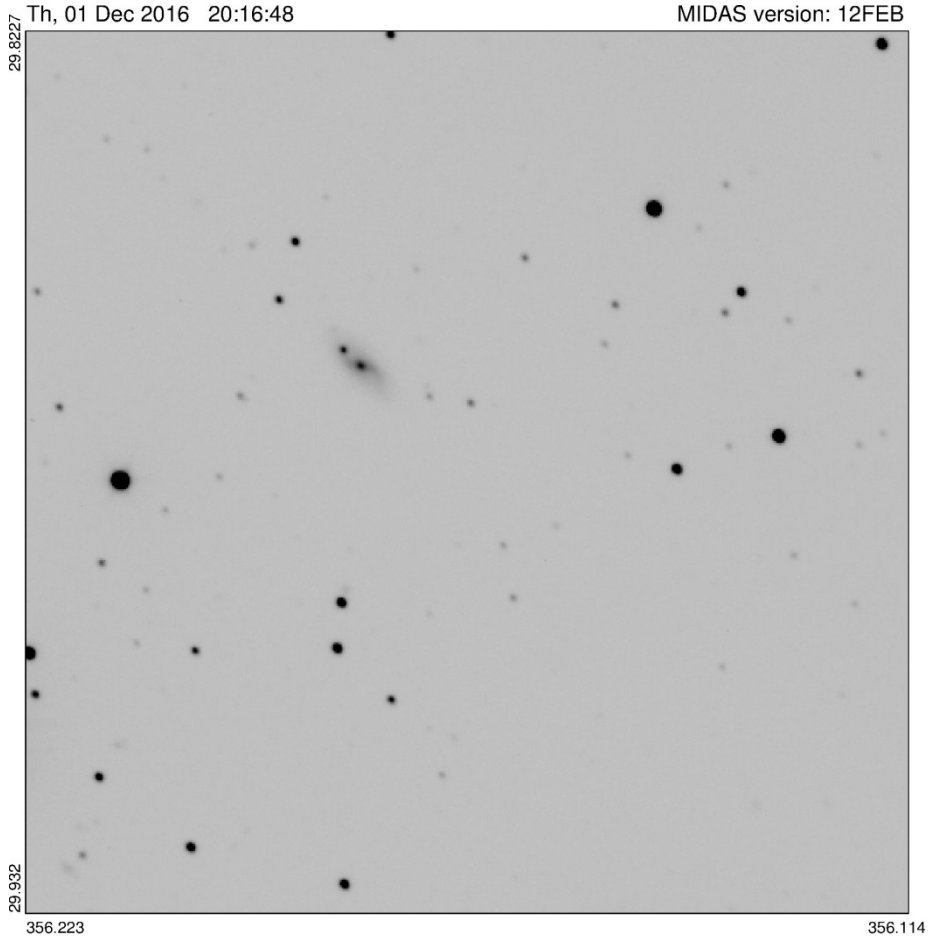
- Only one SSO available,

Gaia 32, not found…(but many NEO' s …)

- Gaia 16aye: TDE
- Other latest alerts:

e.g. 16byu, 16byl,…

- Classifications needed…



Frame : 511_003_57722.79367384_57722.79367384.fits
Identifier :
ITT-table : none...
Coordinates : 356.223, 29.932 : 356.114, 29.8227

Today, many ground-based surveys…

- Not dedicated to SNe only… (e.g. lensing, planets)
- Mainly Near-Earth Orbiting asteroids…(fear!)
- Only partial sky coverage (contrary to Gaia)
- Some data are public, others not
- CRTS, PTF, PanStarrs, SN Factory, MASTER, OGLE, LaSilla Quest, SkyMapper, Asas-SN, etc…

- **But all need a large amount of telescope time for follow-up !**

No need to wait for LSST…

- There is a lot to do with present surveys…
- Training, and refining the strategy
- Define specific science topics
- Organise/coordinate the follow-up
- Mobilise smaller communities
- Modernise equipment
- Involve amateurs and public?

Ground-based classification/follow-up: Need 1-2-4m class telescopes

Various observatories interested: what are the needs?

For photometry:

- Asteroids, SNe… follow-up (+GBOT)
- FOV ~~10 arcmin or more, ideal
- CCD Pixel : 1/3 seeing
- Large infrastructure preferable

to allow flexibility (several telescopes)

For spectroscopy:

- Low dispersion for classification
- Large spectral range (3500-10000+)
- Single set-up adequate for most targ
- Teams agreements
- Select topics of interest
- Can expect a few alerts/week

Most telescopes interested in GAIA could join similar process combining SSO and Phot. Alerts

How to operate?

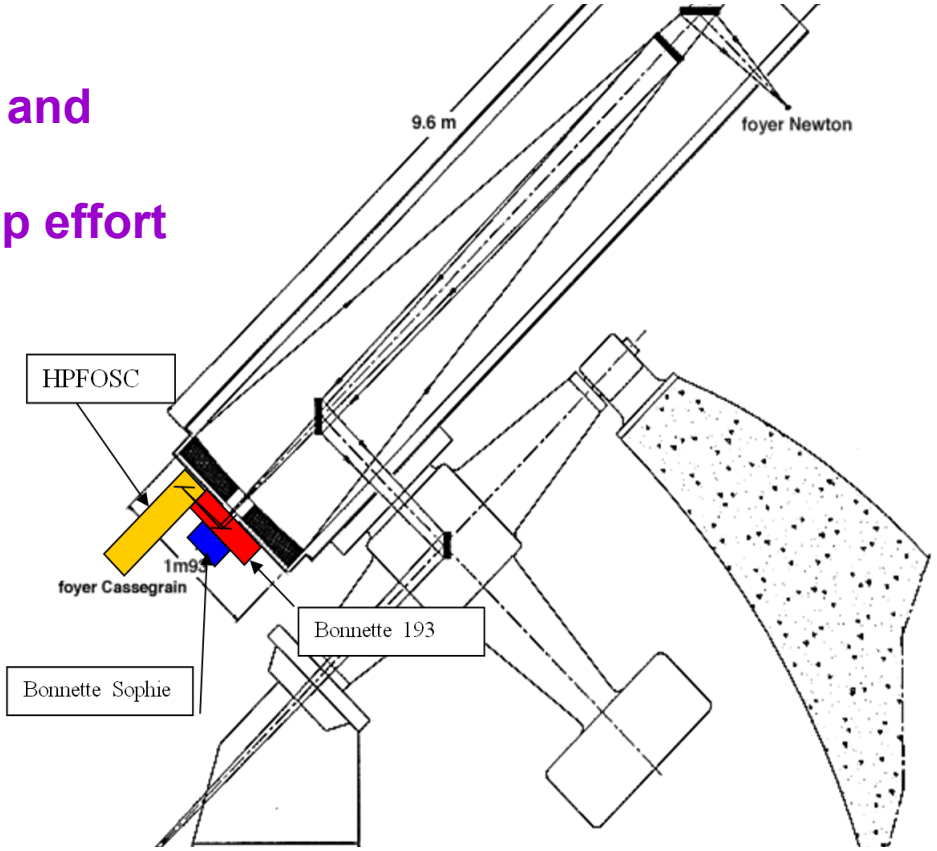
- Alerts = Targets of Opportunity, but not only…
- Not all objects need a fast response…(24h +)
- Combine regular runs (e.g. 1 week per month) with ToO mode inbetween runs?
- Team agreements to **choose/combine topics**
- Photometric alerts: a few frames only…
- SSO's: maybe 10 per week?
- Alerts: One classification spectrum to start with…
- To contribute, one needs to provide observing time!
- **Good opportunity for European collaborations**
- **What is the future of/at OHP ??**

New low-disp.Spectrograph at OHP: 'EFOSC' type: MISTRAL at T193

New Spectro-imager, multi-purpose and versatile...
Fits well in the coordinated follow-up effort at the european level.

Concept allows future innovations in the parallel beam.
or entrance plate.

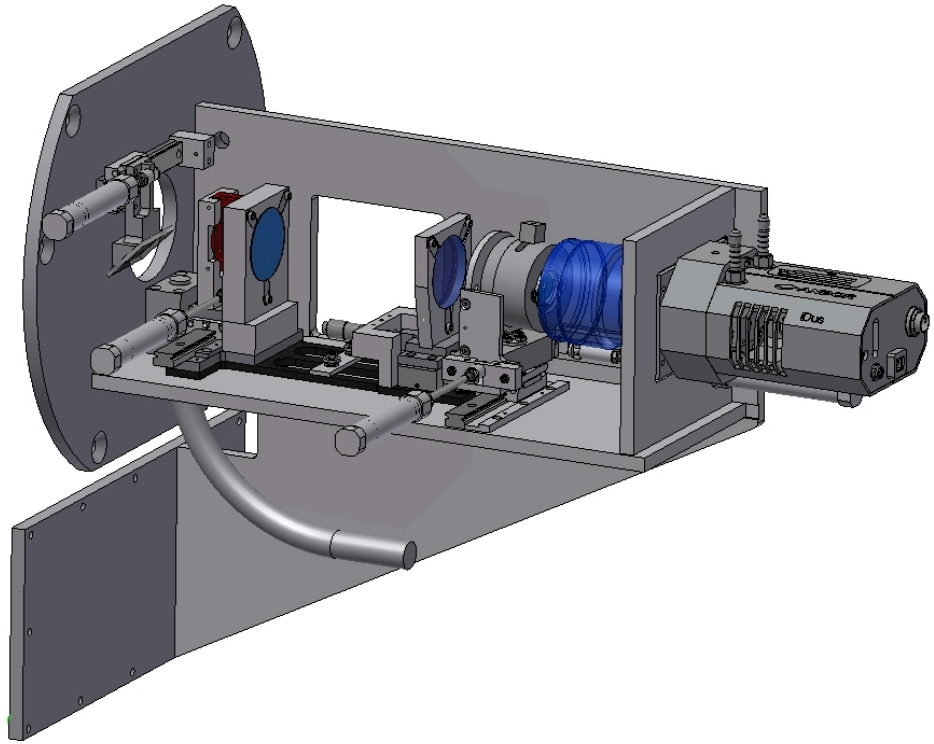
International support most welcome!



Rapid changes /Sophie, no dismounting
Large versatility (filters, , FP, multi-object,...)
R ~500 à 2000, λ~3 600-10 000 Å
Deep-Depletion CCD, Research AND Teaching

Simpler concept: Mistral/Sprat 2016

Inspired from LT Telescope
Imaging and long slit
~ 4000-8000 Å
VPH grating R ~ 700
Andor camera 2k x 2k
FOV ~ 5’
Design close to finished
First light end 2018
Mag ~20 in 1h, S/N ~10



Conclusions

- We need a lot of observing time for follow-up!
- 2-3m class telescopes become rare as general purpose telescopes…we need to preserve them!
- We need also manpower…good projects for students!

- OHP is ready to contribute…we are awaiting eagerly the new low-dispersion spectrograph!
- The site is exquisite for long-term stays…

+ a post-Scriptum from A. Ederoclite & J. Cenarro (Teruel/Spain)

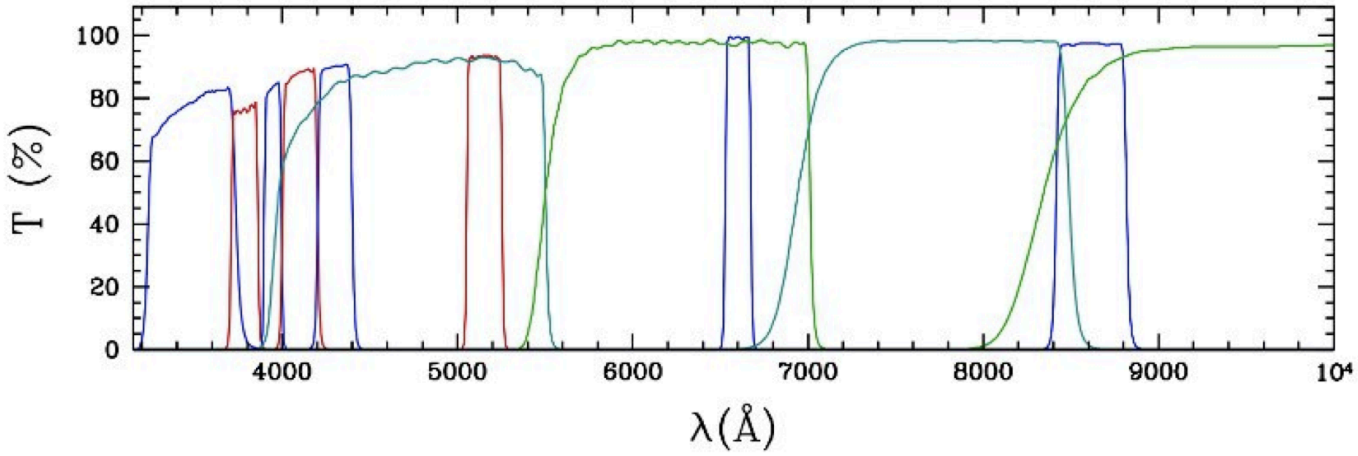
Observatorio Astrofísico de Javalambre

Observatorio Astrofísico de Javalambre

Javalambre Auxiliary Survey Telescope

80cm aperture Ritchey-Chrétien

Equatorial mount



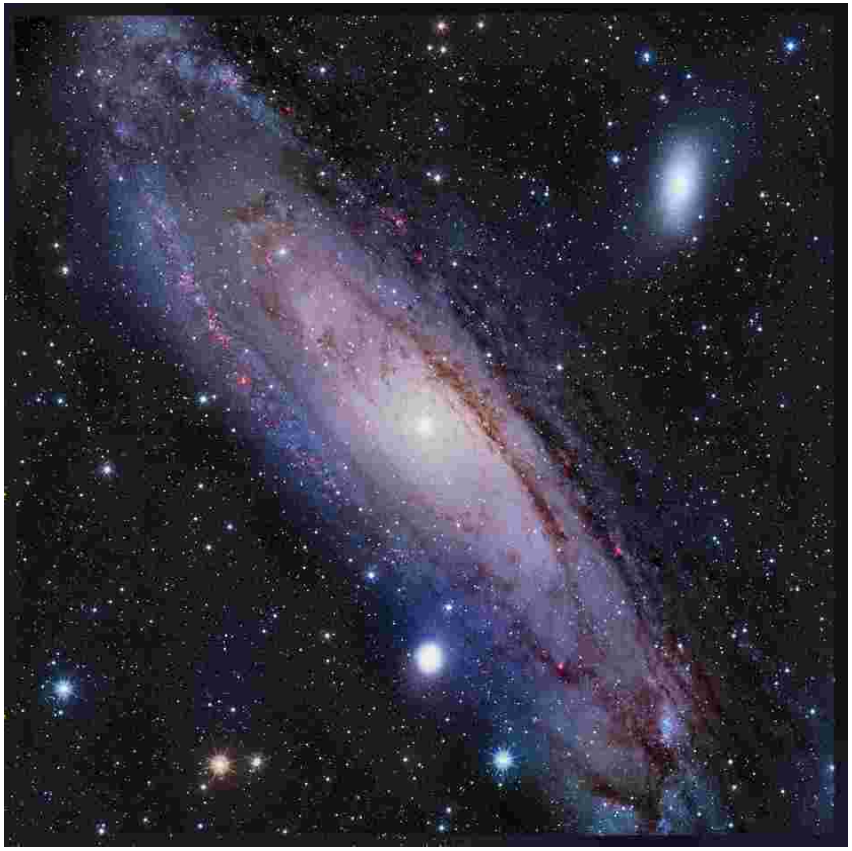
T80Cam

12 Filters

1.4º Ø FOV

Observatorio Astrofísico de Javalambre

2 square degrees field of view; 0.55”/px



SDSS gri and Halpha