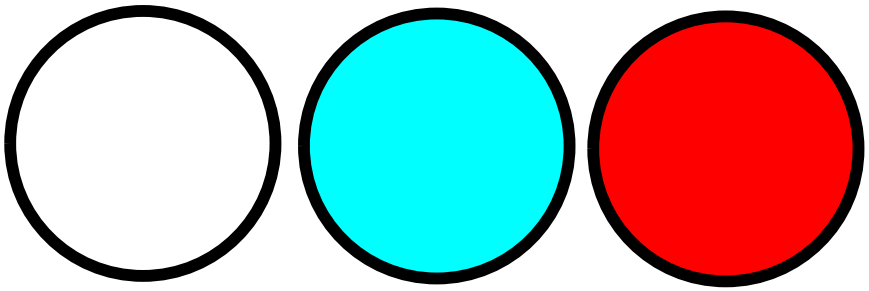
Projet RAPAS
Workshop 2 : 25-26 Novembre 2023
Observatoire de Paris

Les filtres RAPAS et alertes

Thierry Midavaine

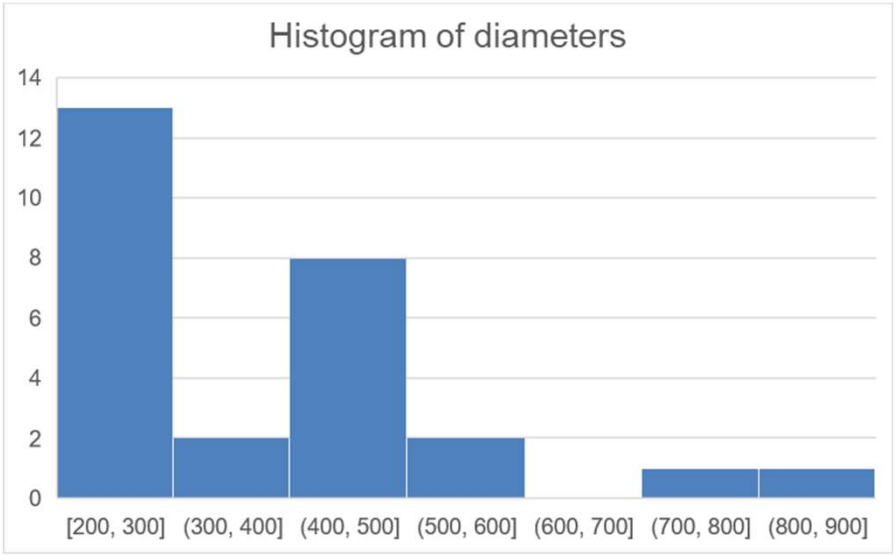
RAPAS : Réseau Amateur Professionnel pour les Alertes Scientifiques
Les filtres RAPAS et alertes

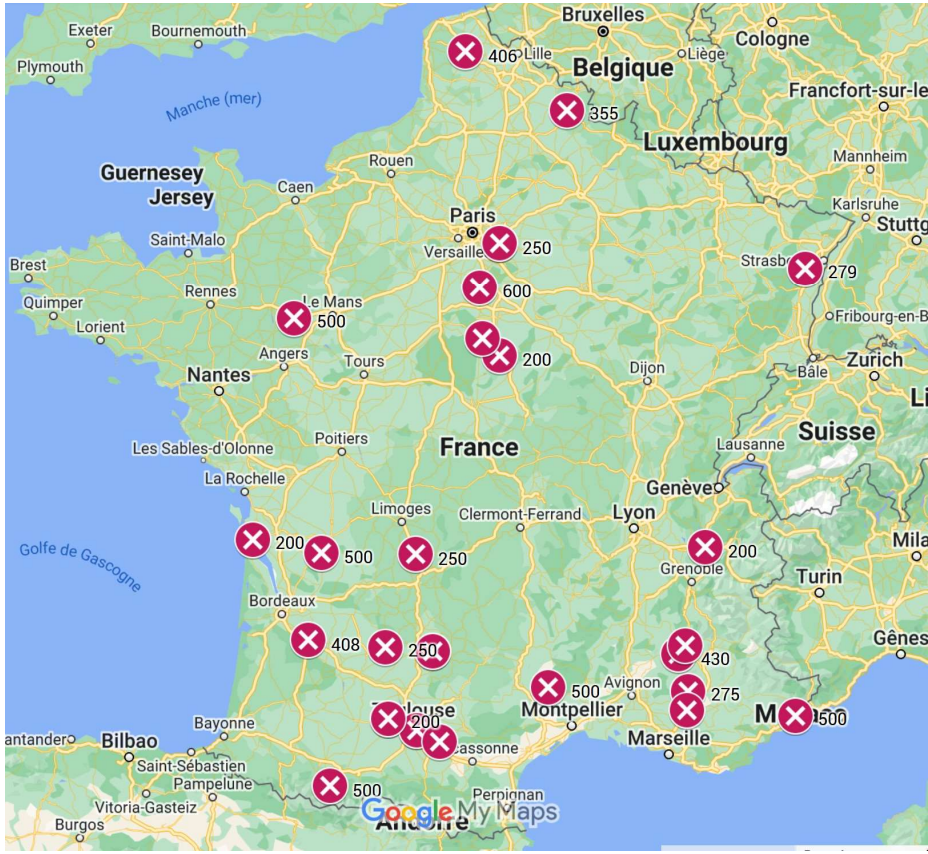


Thierry Midavaine[1], William Thuillot[2], Michel Dennefeld[3], Christian Buil[4], Stéphane Neveu[1], Marc Serrau[1 5 10], Éric Barbotin[13], Pierre Barroy[10], Yannick Delisle[10], Philippe Dupouy[6], Arnaud Leroy[7,10], Jean-Marie Lopez[14], Florent Losse[15], Elisabeth Maris[12], Patrick Martinez[1 8], Christian Pantacchini[11], Anaël Wünsche[9]

[1] Société astronomique de France
[2] Observatoire de Paris IMCCE PSL univ
[3] IAP
[4] ARAS AUDE
[5] Dauban Grappa
[6] Observatoire de Dax
[7] Uranoscope de l'Ile de France
[8] Adagio Observatoire de Belesta
[9] Observatoire des Baronnies Provençales
[10] TJMS Buthiers CPS Planète Sciences
[11] Observatoire de Benayes
[12] CEPHEE73
[13] Astroclub Charantais
[14] Observatoire des Pises
[15] Observatoire de Saint Pardon

The 25 amateur observatories equiped with the RAPAS filter set





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6/3/2022 23:00:44	Yannic	Delisle
6/1/2023 17:48:37	Michel	Rieutord
5/30/2022 8:50:20	Thierry	Midavaine
8/16/2022 15:10:58	Jean-Marie	Lopez
10/6/2022 2:43:32	Philippe	Dupouy
9/20/2022 17:05:52	Hadrien	Dupuis
12/16/2022 13:00:32	Éric	Barbotin
6/28/2022 14:34:58	Matthieu	Conjat
6/21/2022 17:53:48	Anaël	Wünsche
10/5/2022 14:12:17	Florent	Losse
7/2/2022 11:42:13	Arnaud	Leroy
10/10/2022 17:49:04	Philippe	Morel
9/19/2022 18:40:59	Marc	Serrau
11/14/2022 20:25:33	Patrick	Sogorb
11/23/2022 9:21:29	Lisa	Maris
11/16/2022 17:56:42	Roger	Hellot
10/27/2022 0:51:25	Jean-Marie	Vugnon
10/28/2022 0:51:25	Jean-Marie	Vugnon
9/6/2022 16:19:15	Jean-Baptist	Marquette
9/27/2022 2:30:31	Guy	Copin
6/6/2022 8:23:52	Christian	Pantacchini
7/3/2022 11:42:13	Arnaud	Leroy
8/23/2022 17:54:57	Patrick	Wullaert
10/5/2022 2:43:32	Philippe	Dupouy
11/22/2022 9:21:29	Lisa	Maris

Club, affiliation ou observatoire	Longitude d	Latitude de	Dispos	Diamèt	Surface	Focale i	f/D	Camera	Capteur	Taille H	V	pixel µm	Champ °²	F Guidag	D filtres	Logiciels	Commentai	N° du j	Date de livrai	SA51 exp
SAF - ADAGIO - Observatoire d	1.81629	43.44424	A05	820		3100	3.8	Moravian C	CMOS	36	36	9	0.4427177		50			12	11/11/2022	
.fr	5.6	44.5		800		4860	6.1			30	30		0.1250879		50					
CPS TJMS Buthiers	2.438028	48.291778	199	600		2100	3.5	QHY268M M	IMX571	23.5	15.7	3.76	0.1834873		36			5	09/10/2022	
Observatoire Midi-Pyrénées	+00:08:41:9	+42:56:13:00		508		2299	24x36	50.8	C'est le T50 du Pic-d-Midi, CDK Planewave de 20", remplaçant le vieux T60 transféré au n									19	26/06/2023	
Observatoire Salvia	-0.4075	47.9825	i73	500		1400	2.8	ASI6200M M	IMX455	36	24	3.76	0.9647431	0	50			1	31/10/2022	600
SAM- Observatoire des Pises	3.5036111	44.039167	122	500		2200	4.4	ASI6200M M	IMX455	36	24	3.76	0.3906811		50	Prism		14	13/11/2022	
Observatoire de Dax				500		2250	4.5			17.7	13.4		0.1164367		36			22		60
Observatoire Jocelyn Bell de Tou	1.4685°	43.5632°		500		2279	4.6			37	37		0.8652868		50			6	12/11/2022	mars-24
Astroclub charentais	0	45.5	Non	500		3400	6.8			36	24		0.1635724		50			16	01/05/2023	revision mor
Aquila / Observatoire de la Côte	7.2997	43.725	020	500		7500	15.0			22.5	22.5		0.0295453		31.75		Autre instru	10	12/11/2022	nov-23
Observatoire des Baronnies Pro	5.5	44.4	B10	430		1970	4.6			36	24		0.4872314		50			8	11/11/2022	120
St Pardon de Conques (observat	-0.203056	+44.5588	193	408		1500	3.7	ASI2600M M	IMX	23.5	15.7	3.76	0.3596351		36		Très actif su	23	13/11/2022	60
Uranoscope de l'Ile de France	2.7422	48.7422	A07	355		710	2.0			11.25	7.03		0.3218394		50		porte filtes r	11	11/11/2022	
Observatoire Charles Fehrenbac	3.77607346	50.0848398025446		355		3910	11.0			24	36		0.2782895		50.8			2	13/11/2022	Vega
SAF & Planète-Sciences	5.6475	43.9997	B24 et	300		3270	10.9	QHY268M	IMX571	23.5	15.7	3.76	0.0756744		36		Taille capte	18	13/11/2022	600
Club Luberon Sud Astro, Bastidan observatory			D11	280		1530	5.5			16			0		31.75			17		retour des f
@gmail.com				280		1764	6.3	ATIK4000	KAI 04022	16.67	16.05	7.4	0.2717679					25		1200
Observatoire Rosheim-TRBL	7.45937	48.489954	Non	279		2790	10.0			12	9		0.0341603		31.75			4		nov-23
club eclipse	-0.017717	46.811067		260		1220	4.7			36	24		1.2704222		50			21	13/11/2022	
club eclipse	-0.017717	46.811067		200		1000	5.0													
LAB	0.3911	44.2616	N/A	250		1000	4.0			13.19	8.81		0.2547986		31.75		Il manque k	reporté	Non pour le n	dec 2023
GAP 47	44.48333	0.983333	Non	250		1250	5.0			23.2			0		50		Très interre	20	Poste	
Observatoire de BENAYES	1°27'	45°29'	non	250		1358	5.4			25.1	17.64		0.5539147		néant		Nom obs A	7	13/11/2022	
Uranoscope de l'Ile de France				250			0.0						#DIV/0!							720
SAF, Astro-Club d'Ouzouer sur l	2.7401	47.588	non	200		1000	5.0			11.25	7		0.1608575		31.75		Mon club p	15	11/11/2022	nov-23
Observatoire de Dax			958	200		1410	7.1			8.8	6.3		0.0655372		31		Possibilité	22	13/11/2022	1
CEPHEE73	+5 54 38	453341	No	200		2000	10.0			15.3	15.2		0.1896149		31.75				13/11/2022	

Needs

Set up of an amateur network interested by science alerts by using: astrometry, photometry or spectroscopy

The angular designation often requires a large FOV and deep magnitude search mode with limited exposure. The telescope Figure Of Merit in a search mode could be :

telescope FOM = f(upper lim mag) . FOV square degree / exposure mn

Amateurs with their respective observatory spread over wide longitude and latitude ranges and behind independant cloud coverage conditions provide optical search mode to deliver AD and Dec localisation of optical candidates with a classification to allow then photometric or even spectrometric monitoring function. The purpose is then pass the confirmed and characterized alerts to fitted large telescope instruments.

The needs could be summarised in :

- An array of instruments spread over large territory
- Wide Field Of View Instruments 1°² and above
- High magnitude detection limit >20 in 1min exposure or assessed lim mag vs exposure
- Unified methodology and uniform photometric data deliveries and low latency to up load data

This could provide an amateur network meeting several alerts prgm requirements

Les instruments amateurs et leur potentiel pour répondre aux alertes

Les instruments amateurs apportent une disponibilité à différentes latitudes et longitudes et différentes conditions météo. La mise en réseau des instruments dans un même système photométrique permet de proposer une homogénéité des acquisitions et mesures en mode recherche et en mode suivi.

Les caractéristiques clefs des instruments en réseaux en mode recherche :

- X : Champ de vue couvert en une trame en degrés carré (atout des instruments amateurs de courte focale et plan focal classe 24x36)
- Y : La limite de magnitude atteinte ou magnitude pour un SNR donné par trame
- Z : Temps d'exposition de la trame élémentaire en minute

Les paramètres XYZ définissent une figure de mérite :

$$\mathbf{Fdm = X.\ 2{,}5^{(Y-20)}/Z}$$

Exemple : X=1°^{2}, Y=20, Z=1min donne Fdm = 1

The Gaia induced idea :

Gaia mission delivers alerts :

- https://gaiafunsso.imcce.fr/
- http://gsaweb.ast.cam.ac.uk/alerts/home

In addition Gaia provides an updated photometric catalog up to 20-21 magnitude in three wide spectral bands for more than 1.5 Giga objects spread on whole sky. This photometric system may enhance SNR and limiting magnitude of amateur telescopes and allows data reduction with this catalog.

Gaia EDR3 then DR3 are released on June the 13th 2022

Photometric reduction process is made either with :

- Prism V11 with Grappa (EDR3 extracted catalog) and star fitting process Marc Serrau
- Muniwin
- AstroImage J and Gaia EDR3 via Vizier

the Gaia photometric catalog

- Gaia DR3 will be released on June 13, 2022 - info from : https://www.cosmos.esa.int/web/gaia/data-release-3
- 1,46 E9 sources complete astrometry up to mag G 21
- 1,806 E9 sources with G photometry
- 1,54 et 1,55 E9 sources with GBP and GRP bands.

- cross reference with other catalogues :
- Hipparcos-2, Tycho-2 + TDSC merged,
- 2MASS PSC (2MASS XSC merged),
- **SDSS DR13**,
- Pan-STARRS1 DR1, SkyMapper DR2, GSC 2.3, APASS DR9, RAVE DR5, allWISE, URAT-1, et RAVE DR6

- Marc Serrau released Grappa 2 version extract of Gaia EDR3 ready to be plug in Prismv11, CDC, ...

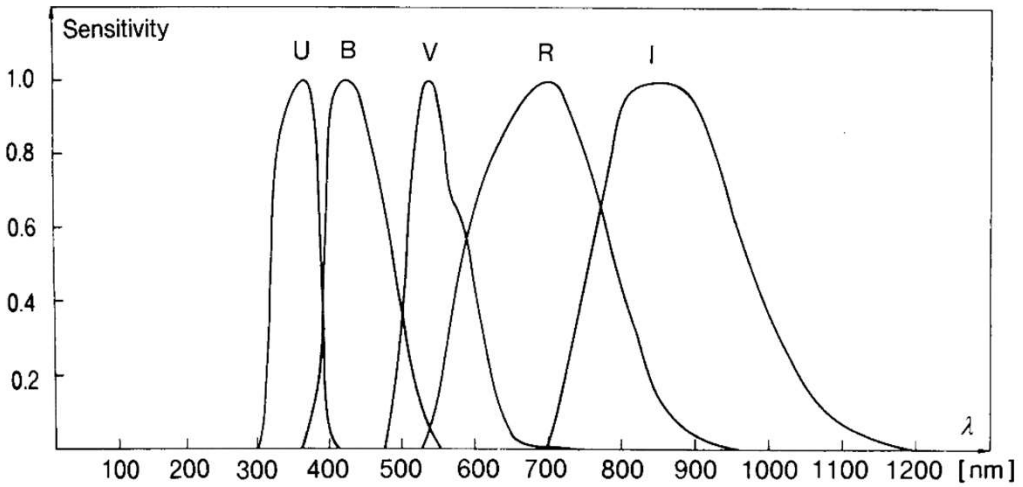
Gaia DR3 catalog accy

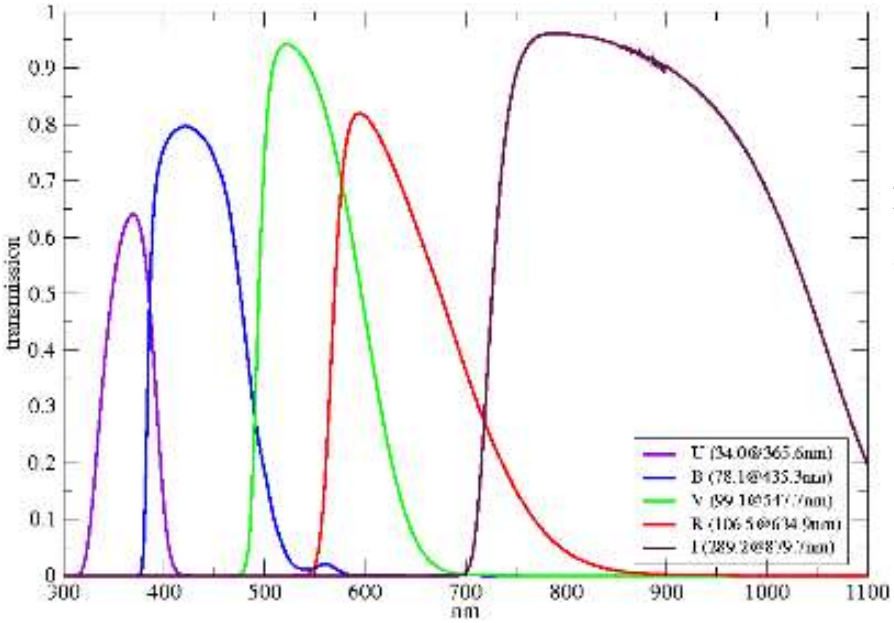
- Photometry (G, GBP, and GRP published as part of Gaia EDR3, OTHER DATA ARE NEW IN GAIA DR3)

- The G-band photometric uncertainties are ~0.3 mmag for G<13, 1 mmag at G=17, and 6 mmag at G=20 mag.
- The GBP-band photometric uncertainties are ~0.9 mmag for G<13, 12 mmag at G=17, and 108 mmag at G=20 mag.
- The GRP-band photometric uncertainties are ~0.6 mmag for G<13, 6 mmag at G=17, and 52 mmag at G=20 mag.
- More information on the properties and limitations of the BP/RP spectra will be published closer to the release of Gaia DR3.

Discrepancies between photometric systems

- From Johnson and Cousins U B V R I J K L M N...





er Letter	Effective Wavelength Midpoint λ_{eff} For Standard Filter[2]	Full Width Half Maximum[2] (Bandwidth Δλ)	Variant(s)	Description
aviolet				
	365 nm	66 nm	u, u', u*	"U" stands for ultraviolet.
ble				
	445 nm	94 nm	b	"B" stands for blue.
	551 nm	88 nm	v, v'	"V" stands for visual.
			g, g'	"G" stands for green (visual).
	658 nm	138 nm	r, r', R', R_c, R_e, R_j	"R" stands for red.
Near-Infrared				
I	806 nm	149 nm	i, i', I_c, I_e, I_j	"I" stands for infrared.
Z	900 nm[3]		z, z'	
Y	1020 nm	120 nm	y	
J	1220 nm	213 nm	J', J_s	
H	1630 nm	307 nm		
K	2190 nm	390 nm	K Continuum, K', K_s, K_{long}, K^8, nbK	
L	3450 nm	472 nm	L', nbL'	
Mid-Infrared				
M	4750 nm	460 nm	M', nbM	
N	10500 nm	2500 nm		
Q	21000 nm[4]	5800 nm[4]	Q'	

Set of filters used by Am observers

- UBVRI Johnson Cousins, Bessel, Sloan, RGB

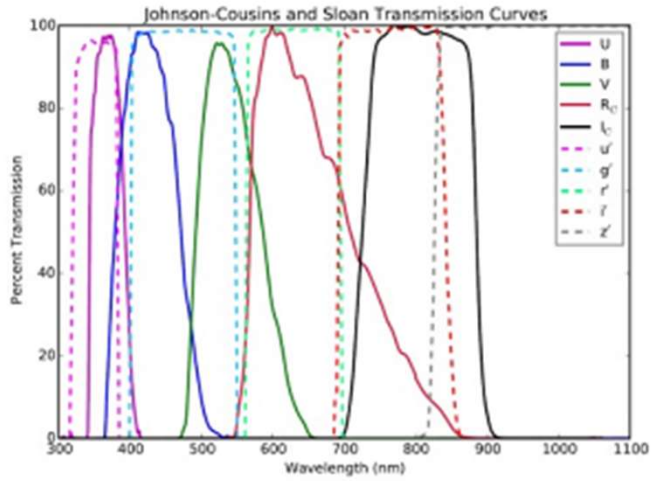
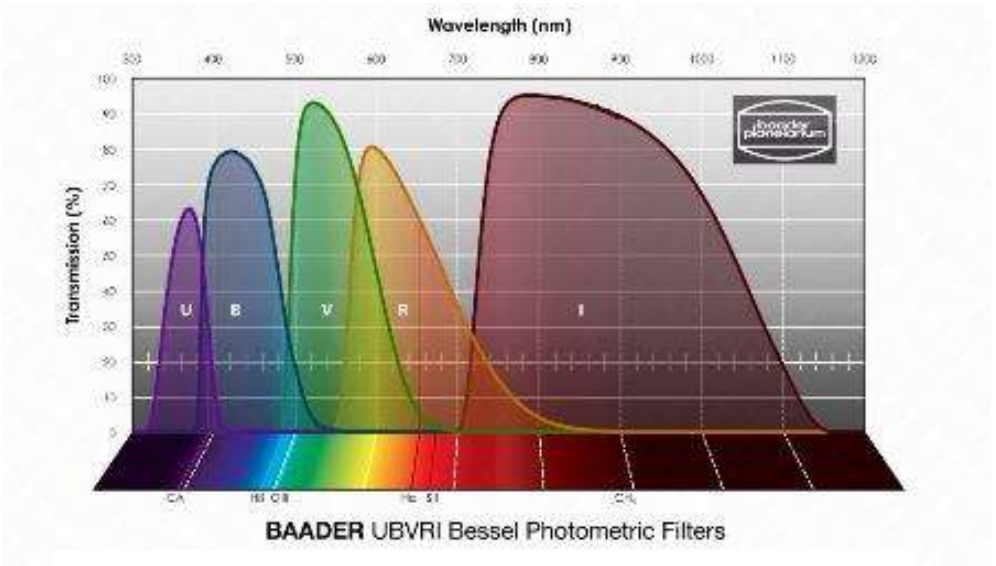
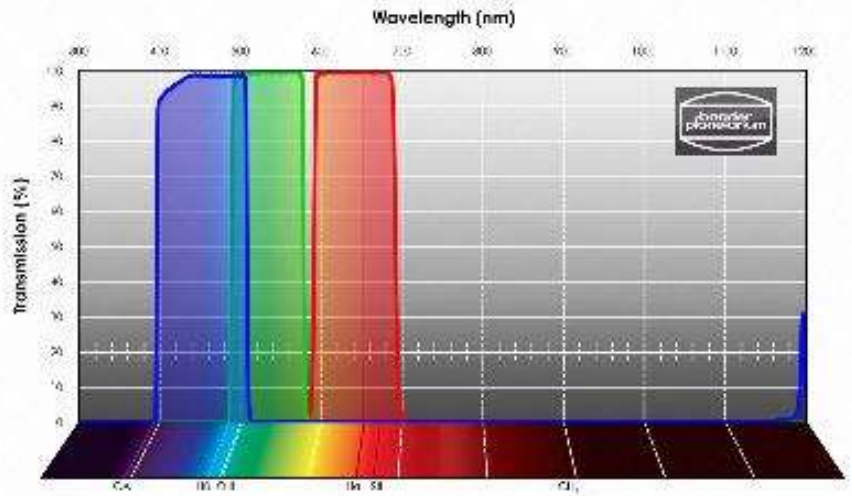


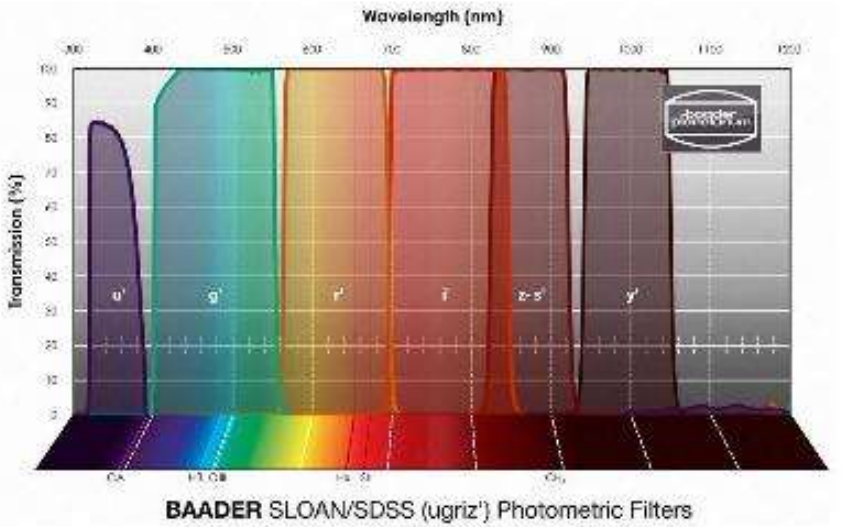
Fig. 4. Astrodon transmission curves for the Johnson-Cousins ($UBVR_CI_C$) and the Sloan ($u'g'r'i'z'$) photometric systems.



BAADER UBVRI Bessel Photometric Filters

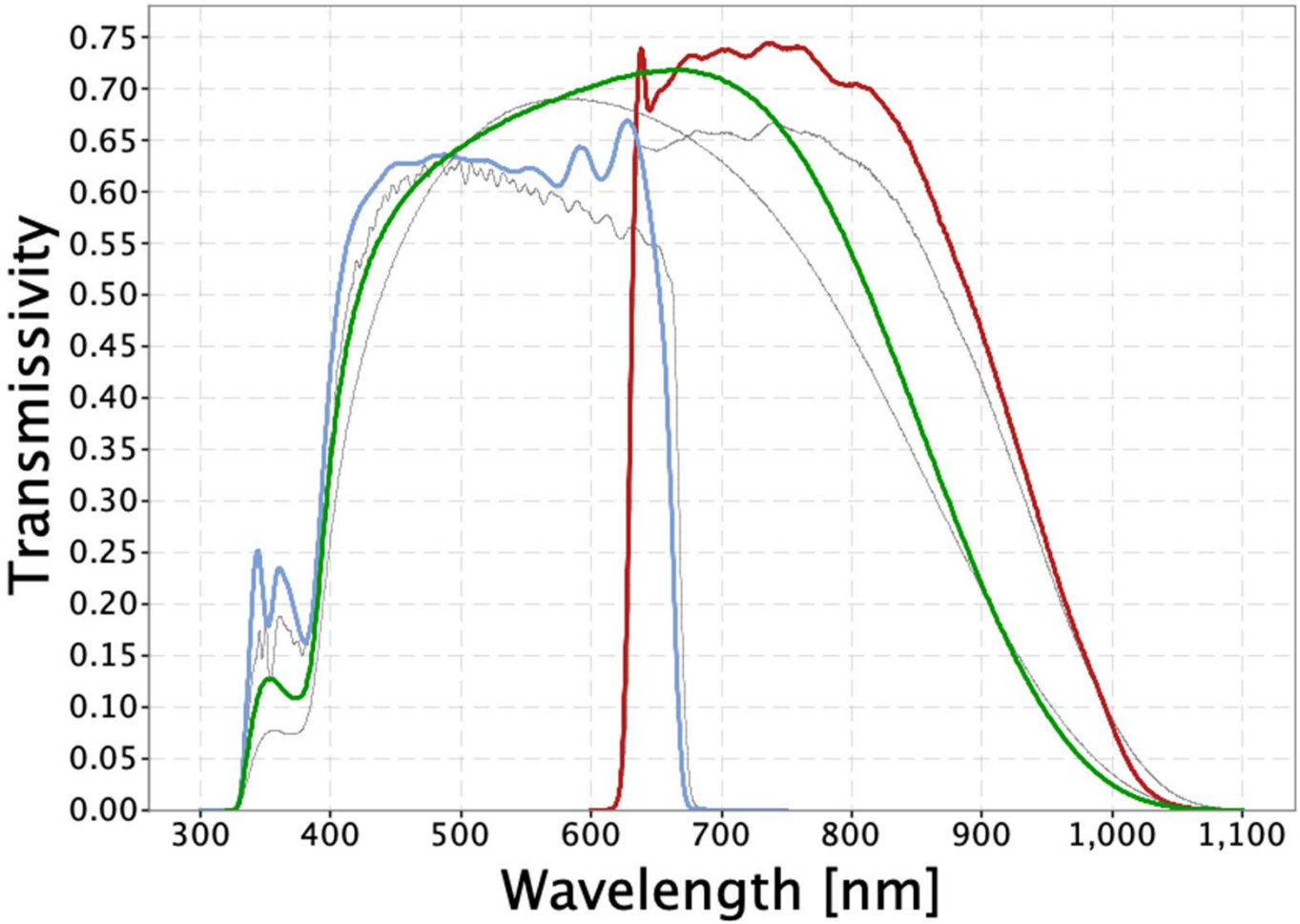


BAADER RGB CMOS Filter – *CMOS-optimized*



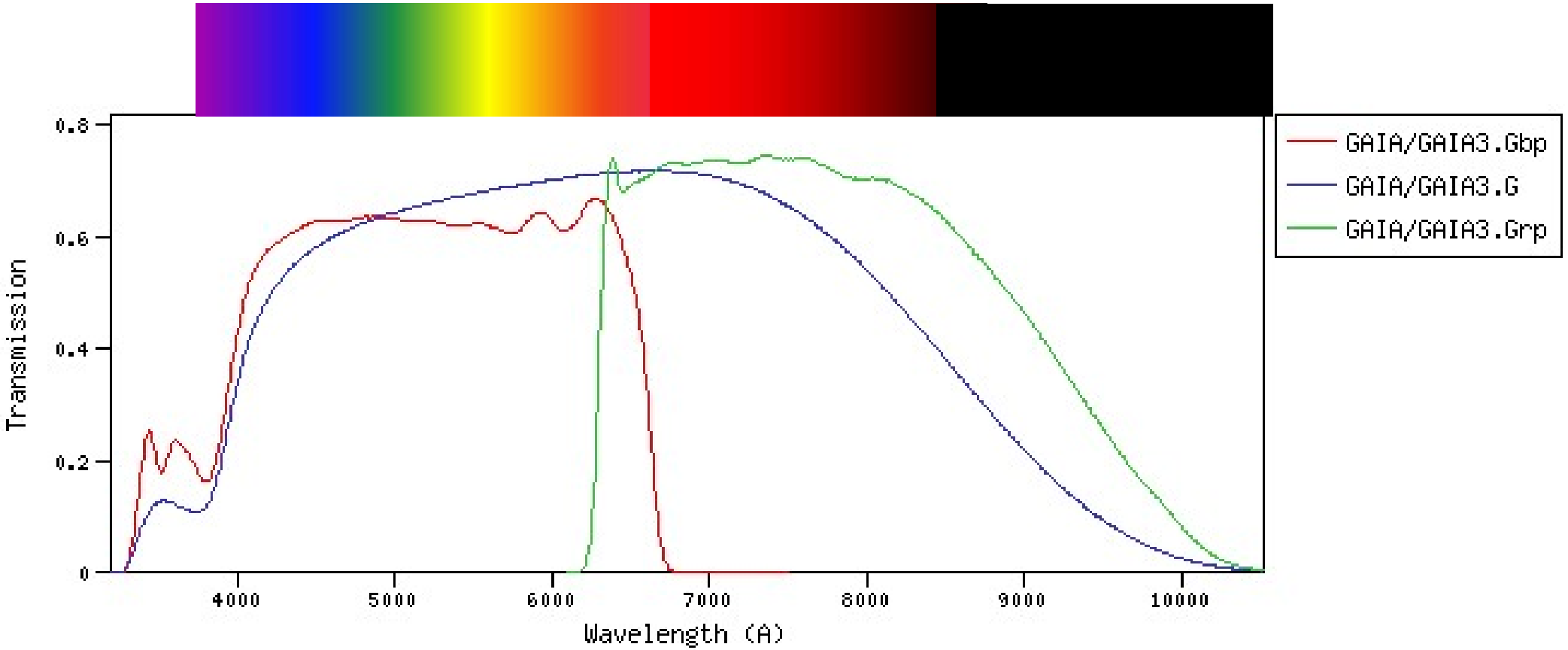
BAADER SLOAN/SDSS (ugriz') Photometric Filters

The 3 Gaia photometric bands : G, Gbp et Grp



(Crédits ESA/Gaia/DPAC, P.Montegriffo, F. de Angeli, C. Cacciari)

Promote the harmonization of the photometric observations

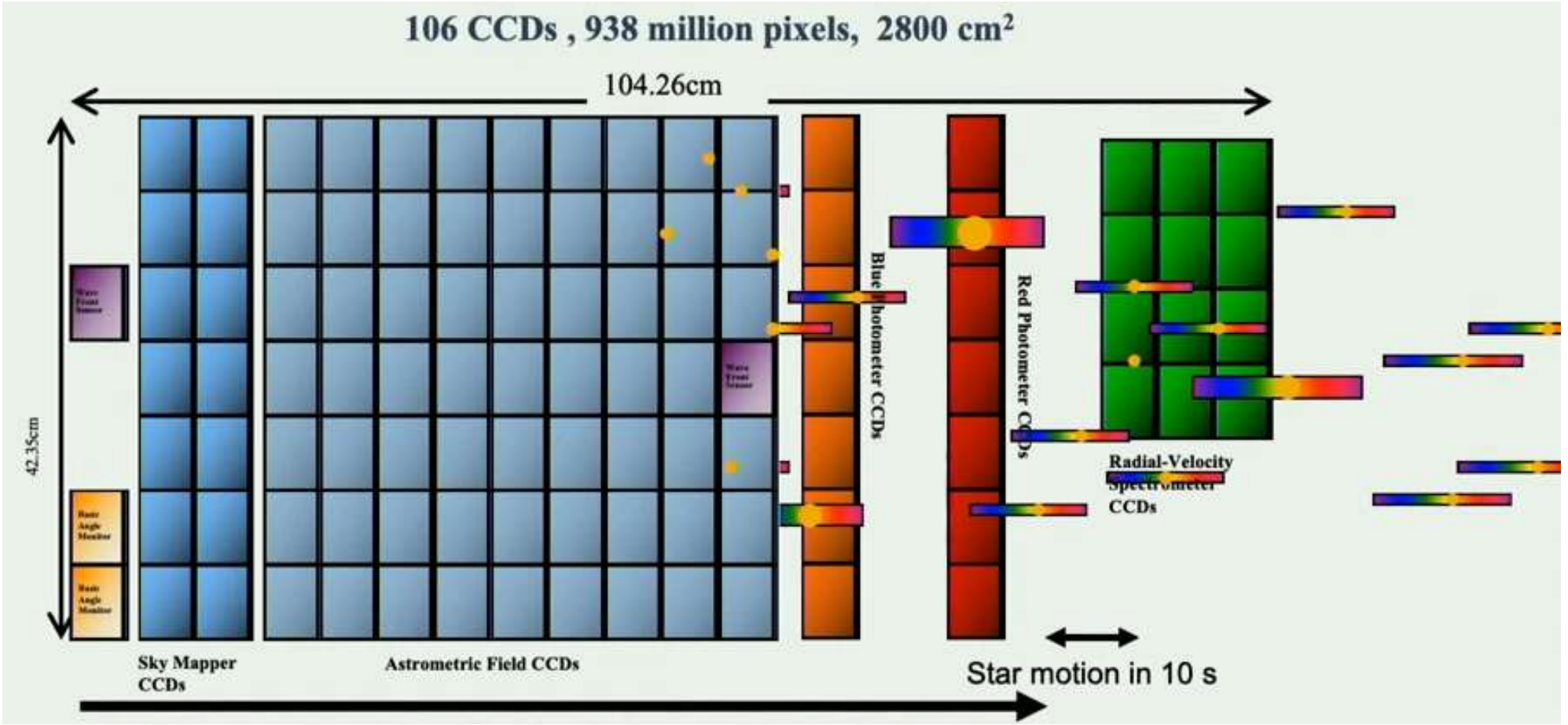


Filter ID		λref	λmean	λeff	λmin	λmax	Weff	ZPv	ZPλ .
GAIA/GAIA3.Gbp	DR3	5109.71	5319.87	5035.75	3292.83	6738.11	2157.50	3552.01	4.08e-9
GAIA/GAIA3.G	DR3	6217.59	6719.55	5822.39	3294.02	10301.96	4052.97	3228.75	2.5e-9
GAIA/GAIA3.Grp		7769.02	7939.10	7619.96	6196.05	10422.96	2924.44	2554.95	1.27e-9

Gaia focal plan array

no filters in front of the fpa

Gbp and Grp are defined by prisms and pixel binning



RAPAS filters specs

- Gaia bands are defined outside atmosphere
- Therefore we have to adapt the filter spectral bands to be less sensitive to air mass
- And reduced the QE diversity of CCD and CMOS arrays in the near IR window

Besoin, étude, spécification, conception et réalisation des filtres

Utiliser des filtres harmonisés avec les catalogues

Avoir des catalogues qui monte en magnitude >20

Avoir une couverture du catalogue sur tout le ciel

Limiter l'impact de la hauteur visée ou de la masse d'air sur la bande spectrale

Limiter la sensibilité à la dispersion de réponses des CCD et des matrices CMOS

Maximiser la largeur des bandes spectrales pour gagner en magnitude limite et S/B

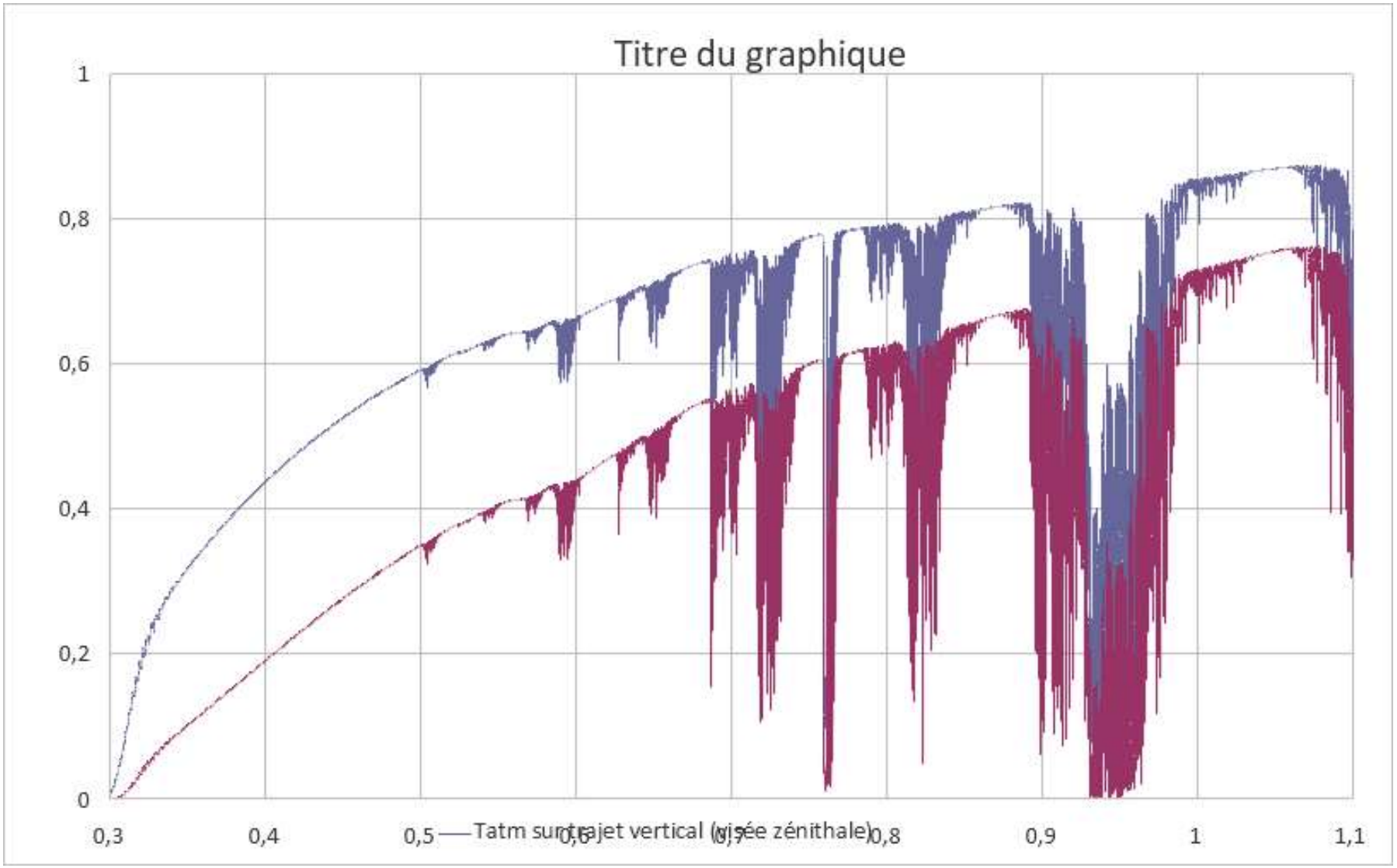
Mesurer un indice de couleur

Limiter le nombre de filtres pour les phases recherches

La définition des bandes spectrales de Gaia et de son catalogue constitue une belle opportunité pour augmenter la performances des instruments amateurs pour délivrer des mesures photométriques et un indice de couleur.

Le catalogue Gaia est idéal par le fait qu'il est constitué hors de l'atmosphère terrestre.

Atmospheric transmission 1 and 2 air mass



Conception des filtres RAPAS

Les bandes des filtres sont ajustées pour :
- Limiter la sensibilité à la masse d'air : de 1 à 2

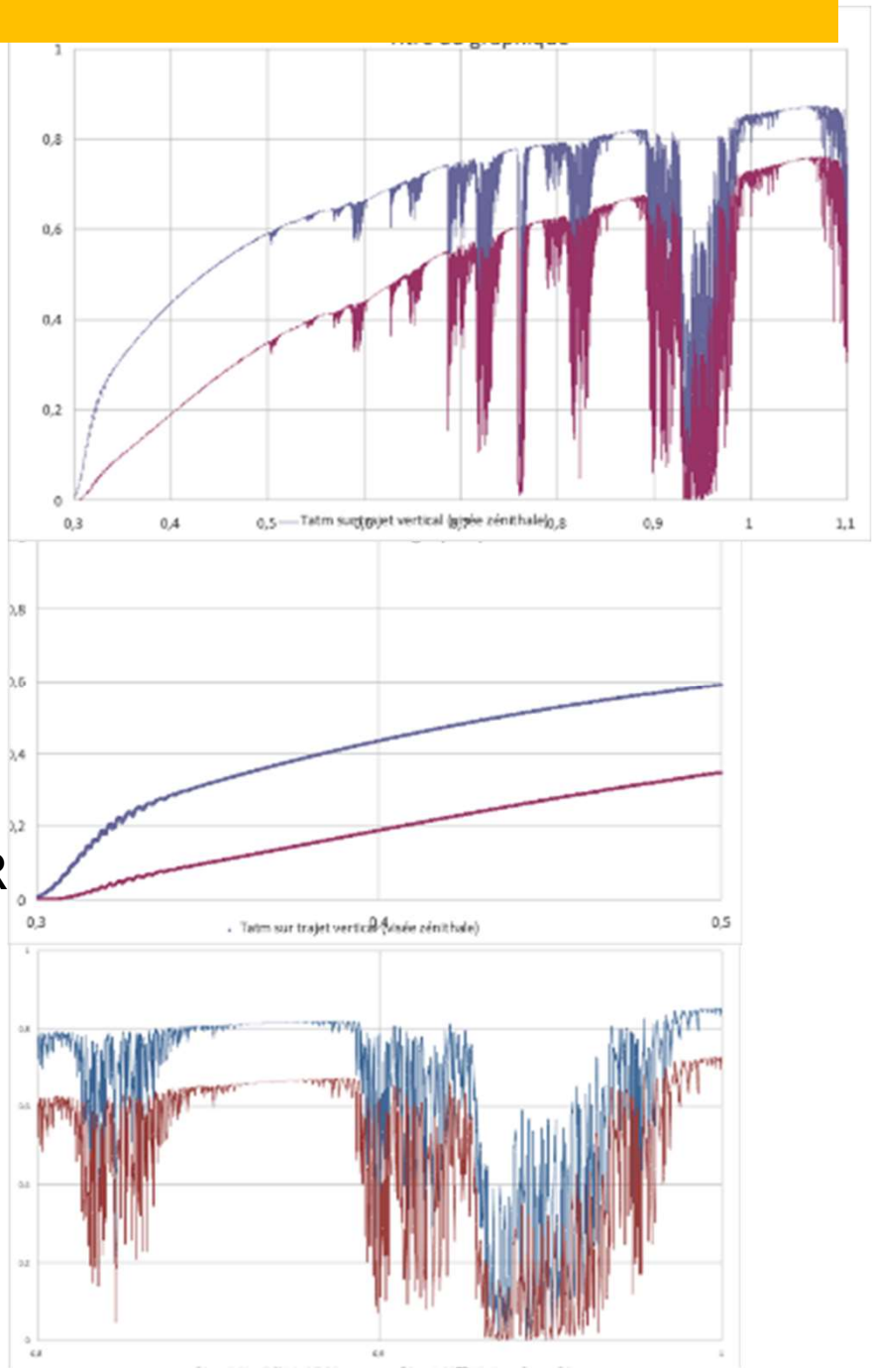
- Filtre G un AR large bande rejectant le proche UV
- Filtre Gbp transmission nominale qui débute à 400nm
- Filtre Gbp qui rejecte la raie Hα

- Filtre Grp transmission nominale qui débute avec la raie Hα

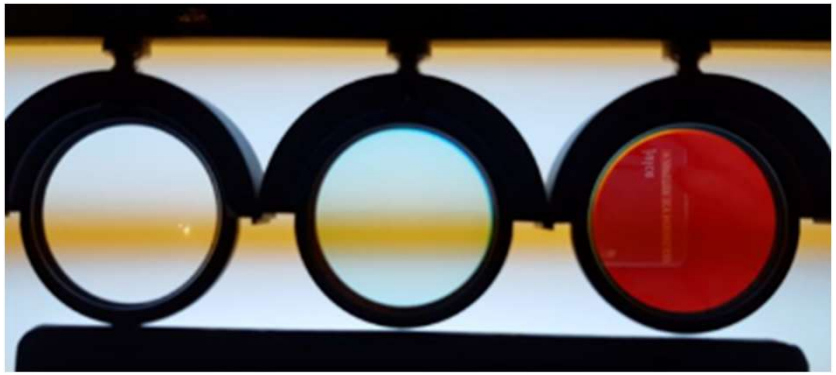
- Filtre Grp qui se termine dans les bandes atmosphériques à 950nm

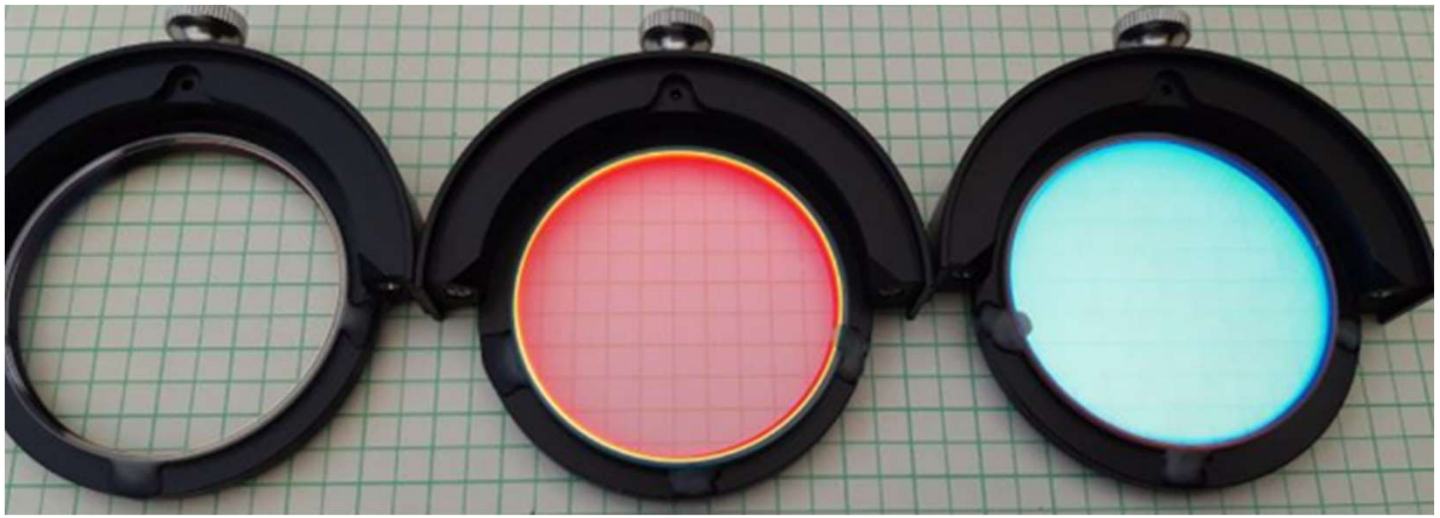
- Filtre Grp qui arrête sa transmission dans le proche IR pour borner la diversité des réponses des CCD et des capteurs CMOS

- Les trois filtres ont la même épaisseur optique



The three RAPAS filters : A, B, C

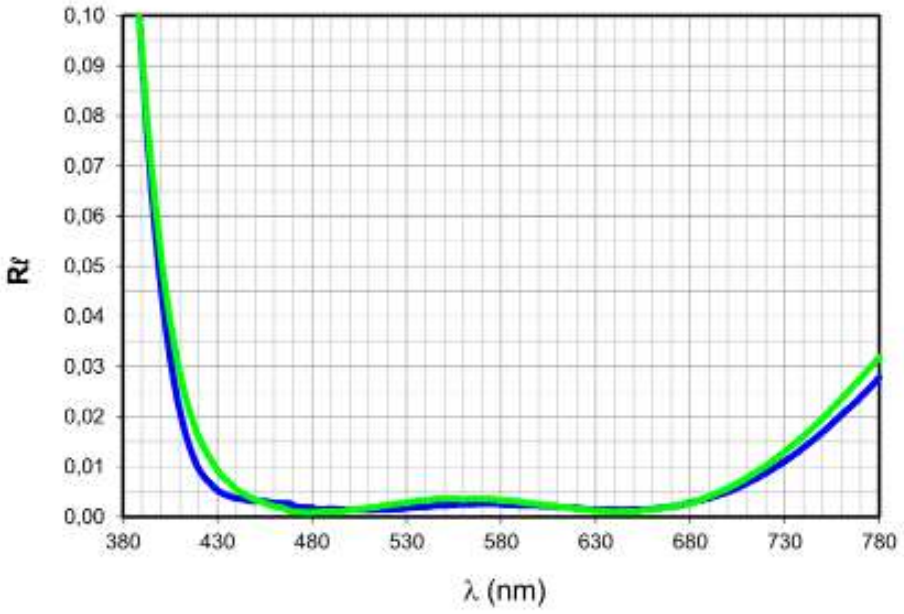


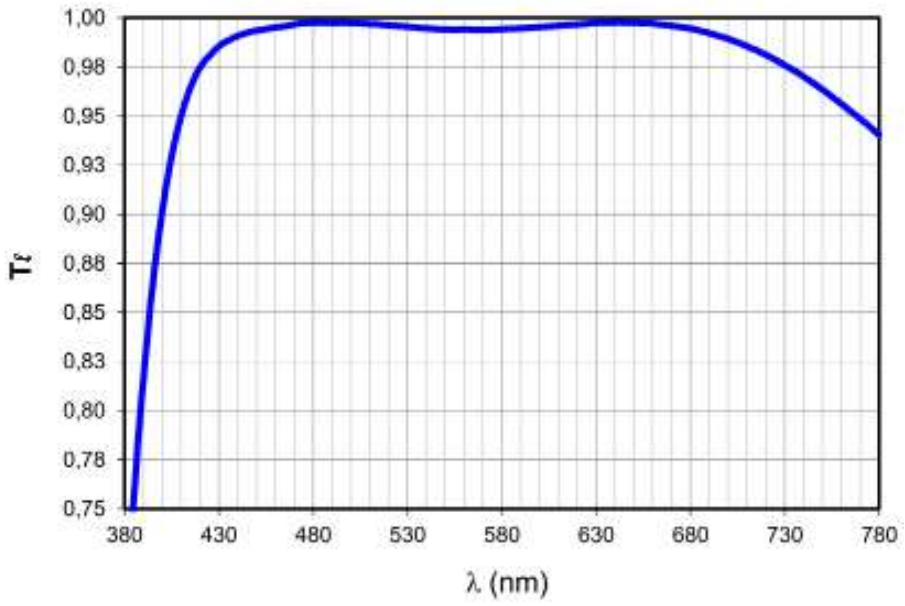


Pictures of the three filters A, B, C set : in 2022 a first batch of 25 filters set was released

- Packing
- Normal transmission
- Aspect angle transmission
- Reflexion

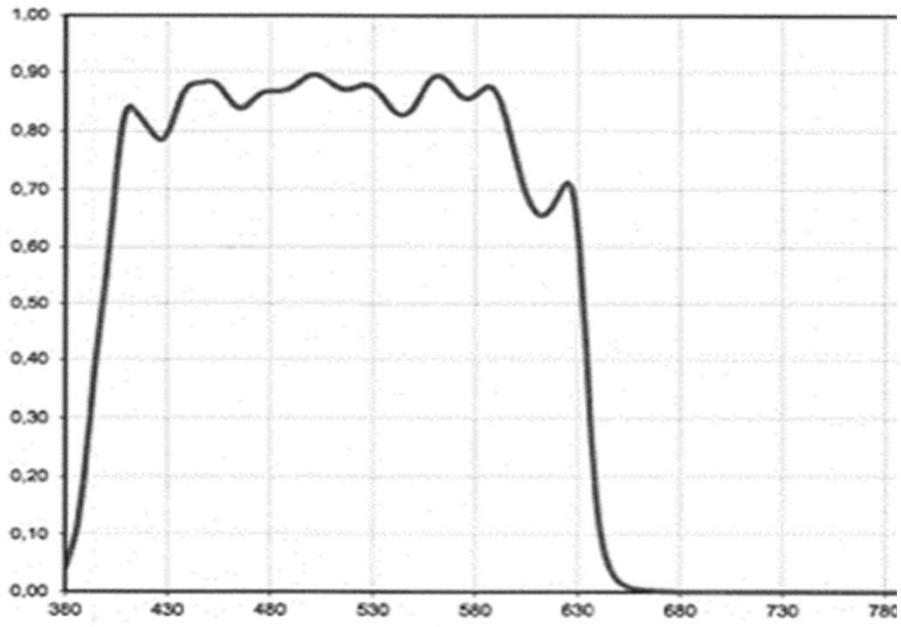
A Filter (G like)



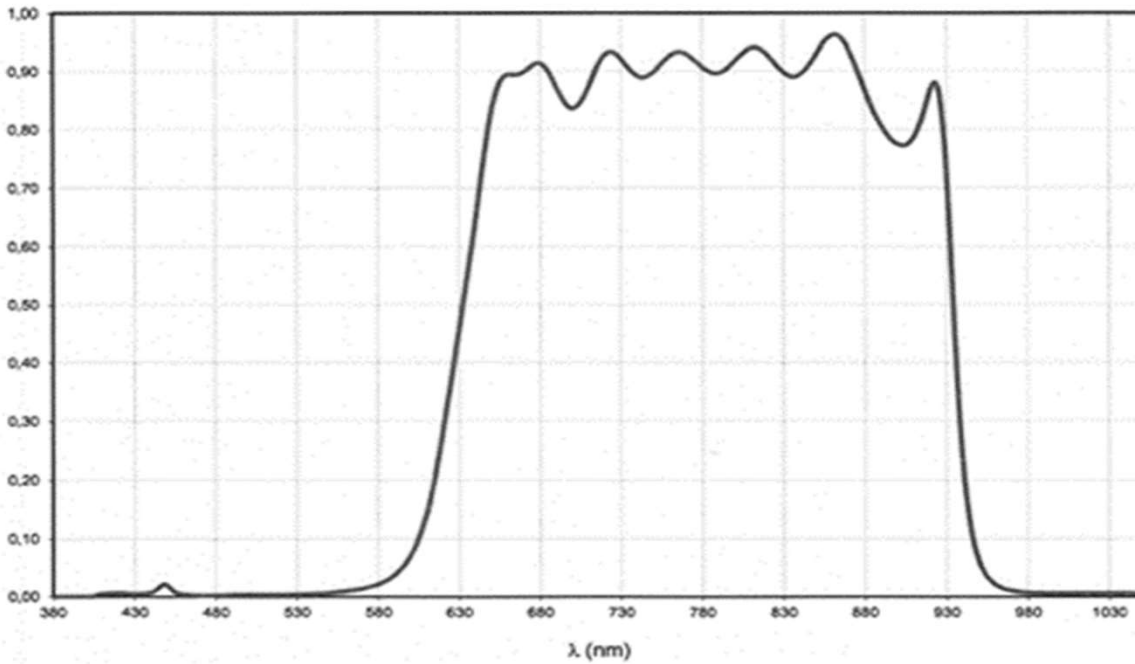


Courbe spectrale i = 5° mesure témoin n=1.51

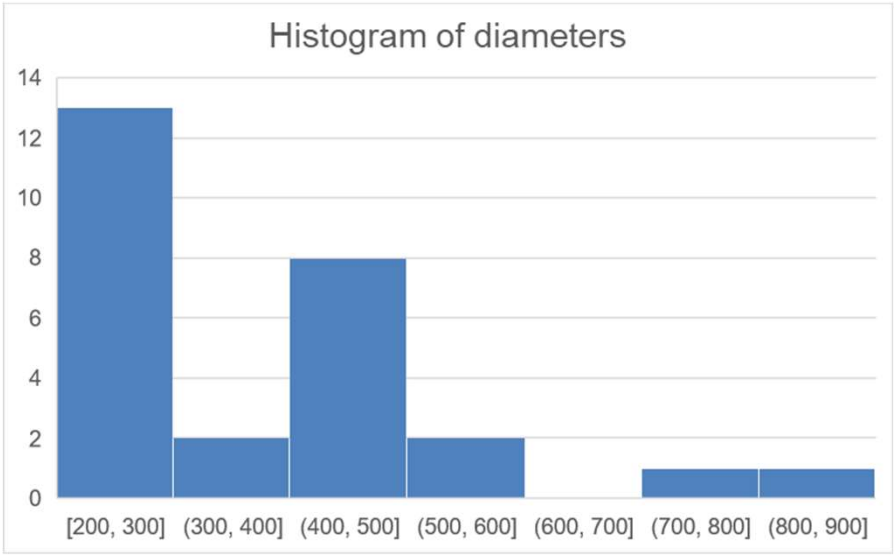
B Filter (Gbp like)



C filter (Grp like)



The 25 amateur observatories equiped with the RAPAS filter set



Horodateur	Prénom	Nom	e-mail	Club, affiliation ou observatoire	Longitude d	Latitude de	Dispos	Diamètı	Surface	Focale i	f/D	Camera	Capteur	Taille H	V	pixel µm	Champ °²	F Guidag	D filtres	Logiciels	Commentai	N° du j	Date de livrais	SA51 exp
7/4/2022 15:30:23	Patrick	Martinez	patrick.martinez264@or	SAF - ADAGIO - Observatoire d	1.81629	43.44424	A05	820		3100	3.8	Moravian C3	CMOS	36	36	9	0.4427177		50			12	11/11/2022	
6/22/2022 17:53:48	Anaël	Wünsche	anael.wunsche@obs-bp.fr		5.6	44.5		800		4860	6.1			30	30		0.1250879		50					
6/3/2022 23:00:44	Yannic	Delisle	delislehatte@yahoo.fr	CPS TJMS Buthiers	2.438028	48.291778	199	600		2100	3.5	QHY268MM	IMX571	23.5	15.7	3.76	0.1834873		36			5	09/10/2022	
6/1/2023 17:48:37	Michel	Rieutord	michel.rieutord@irap.or	Observatoire Midi-Pyrénées	+00:08:41:9	+42:56:13:00		508		2299	24x36	50.8	C'est le T50 du Pic-d-Midi, CDK Planewave de 20", remplaçant le vieux T60 transféré au n									19	26/06/2023	
5/30/2022 8:50:20	Thierry	Midavaine	thierrymidavaine@sfr.fr	Observatoire Salvia	-0.4075	47.9825	i73	500		1400	2.8	ASI6200MM	IMX455	36	24	3.76	0.9647431	0	50			1	31/10/2022	600
8/16/2022 15:10:58	Jean-Marie	Lopez	skyciel34@gmail.com	SAM- Observatoire des Pises	3.5036111	44.039167	122	500		2200	4.4	ASI6200MM	IMX455	36	24	3.76	0.3906811		50	Prism		14	13/11/2022	
10/6/2022 2:43:32	Philippe	Dupouy	obsdax@orange.fr	Observatoire de Dax				500		2250	4.5			17.7	13.4		0.1164367		36			22		60
9/20/2022 17:05:52	Hadrien	Dupuis	observatoire-jbt@upsins	Observatoire Jocelyn Bell de Tou	1.4685°	43.5632°		500		2279	4.6			37	37		0.8652868		50			6	12/11/2022	mars-24
12/16/2022 13:00:32	Éric	Barbotin	ebarbotin@sfr.fr	Astroclub charentais	0	45.5	Non	500		3400	6.8			36	24		0.1635724		50			16	01/05/2023	revision mor
6/28/2022 14:34:58	Matthieu	Conjat	mconjat@free.fr	Aquila / Observatoire de la Côte	7.2997	43.725	020	500		7500	15.0			22.5	22.5		0.0295453		31.75		Autre instru	10	12/11/2022	nov-23
6/21/2022 17:53:48	Anaël	Wünsche	anael.wunsche@obs-bp	Observatoire des Baronnies Pro	5.5	44.4	B10	430		1970	4.6			36	24		0.4872314		50			8	11/11/2022	120
10/5/2022 14:12:17	Florent	Losse	florent_losse@yahoo.fr	St Pardon de Conques (observa	-0.203056	+44.5588	I93	408		1500	3.7	ASI2600MM	IMX	23.5	15.7	3.76	0.3596351		36		Très actif su	23	13/11/2022	60
7/2/2022 11:42:13	Arnaud	Leroy	uranoscopeidf@gmail.c	Uranoscope de l'Ile de France	2.7422	48.7422	A07	355		710	2.0			11.25	7.03		0.3218394		50		porte filtes r	11	11/11/2022	
10/10/2022 17:49:04	Philippe	Morel	Morel.Philippe@wanadc	Observatoire Charles Fehrenbac	3.77607346	50.0848398025446		355		3910	11.0			24	36		0.2782895		50.8			2	13/11/2022	Vega
9/19/2022 18:40:59	Marc	Serrau	marc.serrau2@free.fr	SAF & Planète-Sciences	5.6475	43.9997	B24 et	300		3270	10.9	QHY268M	IMX571	23.5	15.7	3.76	0.0756744		36		Taille capte	18	13/11/2022	600
11/14/2022 20:25:33	Patrick	Sogorb	patrick.sogorb@gmail.c	Club Luberon Sud Astro, Bastidan observatory			D11	280		1530	5.5			16			0		31.75			17		retour des fi
11/23/2022 9:21:29	Lisa	Maris	elisabeth.maris.froelich@gmail.com					280		1764	6.3	ATIK4000	KAI 04022	16.67	16.05	7.4	0.2717679					25		1200
11/16/2022 17:56:42	Roger	Hellot	roger.hellot@gmail.fr	Observatoire Rosheim-TRBL	7.45937	48.489954	Non	279		2790	10.0			12	9		0.0341603		31.75			4		nov-23
10/27/2022 0:51:25	Jean-Marie	Vugnon	jm-v@sfr.fr	club eclipse	-0.017717	46.811067		260		1220	4.7			36	24		1.2704222		50			21	13/11/2022	
10/28/2022 0:51:25	Jean-Marie	Vugnon	jm-v@sfr.fr	club eclipse	-0.017717	46.811067		200		1000	5.0													
9/6/2022 16:19:15	Jean-Baptist	Marquette	jean-baptiste.marquette	LAB	0.3911	44.2616	N/A	250		1000	4.0			13.19	8.81		0.2547986		31.75		Il manque le	reporté	Non pour le m	dec 2023
9/27/2022 2:30:31	Guy	Copin	guycopin@orange.fr	GAP 47	44.48333	0.983333	Non	250		1250	5.0			23.2			0		50		Très interes	20	Poste	
6/6/2022 8:23:52	Christian	Pantacchini	christ.panta@gmail.con	Observatoire de BENAYES	1°27'	45°29'	non	250		1358	5.4			25.1	17.64		0.5539147		néant		Nom obs A/	7	13/11/2022	
7/3/2022 11:42:13	Arnaud	Leroy	uranoscopeidf@gmail.c	Uranoscope de l'Ile de France				250			0.0						#DIV/0!							720
8/23/2022 17:54:57	Patrick	Wullaert	wullaert_chatillon@hotn	SAF, Astro-Club d'Ouzouer sur l	2.7401	47.588	non	200		1000	5.0			11.25	7		0.1608575		31.75		Mon club p	15	11/11/2022	nov-23
10/5/2022 2:43:32	Philippe	Dupouy	obsdax@orange.fr	Observatoire de Dax			958	200		1410	7.1			8.8	6.3		0.0655372		31		Possibilité	22	13/11/2022	1
11/22/2022 9:21:29	Lisa	Maris	elisabeth.maris.froelich(	CEPHEE73	+5 54 38	453341	No	200		2000	10.0			15.3	15.2		0.1896149		31.75				13/11/2022	

Phase de test de son instrument dans le réseau RAPAS

Réaliser des acquisitions des mêmes champs de référence

1. Acquisition de champs de références sans filtre et avec les trois filtres RAPAS A, B et C
    1. en 60s d'exposition
    2. et avec l'exposition la plus longue
    3. Ou en stacking d'images
2. Extraction, localisation et mesure des flux des étoiles par exemple avec Prism V11
3. Utilisation de l'utilitaire de Marc Serrau
4. Comparaison des flux collectés et des magnitudes du catalogue Gaia G pour connaitre sa linéarité, magnitude limite et dispersion des mesures

Histogramme du nombre d'étoiles

Construction du nuage de la magnitude extraite des images vs magnitude du catalogue Gaia pour chaque filtre A avec G, B avec Gbp, C avec Brp, mesure des résidus par telescope et de tout le réseau RAPAS

Calculer sa figure de mérite effective

Renseigner l'entête FITS

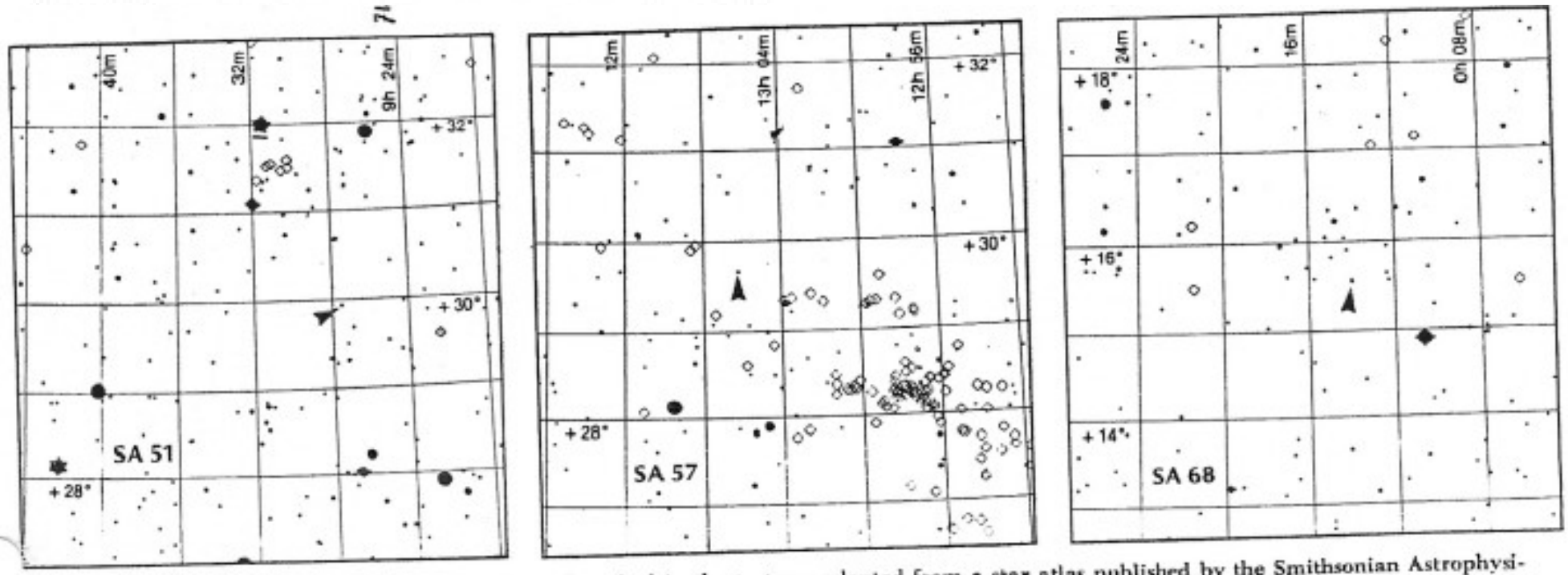
L'entête FITS est à renseigner au moins partiellement sans erreur :

- Origine : le nom de l'observatoire
- La date de l'observation, du début de la pose
  - Pour les astéroïdes datation avec 1s de précision
  - Pour les géo croiseurs datation avec <1s de précision
- La durée de l'exposition en s
- Le filtre RAPAS est à dénommer :
  - G Gaia RAPAS V1
  - Gbp Gaia RAPAS V1
  - Grp Gaia RAPAS V1
- RA et Dec dans le champs de l'image
- Pixel en µm et focale

Utiliser fits verify éventuellement

PRIMARY STAR IN EACH SELECTED AREA

Area	*Star*	*Mag.*	*1950.0*	*2000.0*
SA 51	SAO 79445	9.1	7h 27.5m, +29° 56′	7h 30.6m, +29° 50′
SA 57	SAO 82672	8.1	13h 6.3m, +29° 39′	13h 8.6m, +29° 23′
SA 68	SAO 91810	8.2	0h 14.0m, +15° 34′	0h 16.6m, +15° 50′



These finder charts for the three Selected Areas described in the text are adapted from a star atlas published by the Smithsonian Astrophysical Observatory. North is up, and each field is 5° square. Arrows denote the bright star near the center of each of the author's photographs. The finder chart for SA 51 contains Gemini's bright stars Castor at top center and Pollux at lower left. The brightest star in the SA 57 finder is 4th-magnitude Beta Comae Berenices at lower left. SA 68 is located just northeast of 3rd-magnitude Gamma ~~Persei~~ Pegasi.

Phase de test sur le ciel sur 5 champs :

Champs	Alpha	Delta J2000	passage au méridien
SA68	0h 16m 36s	15°50’	du 3 août au 3 janvier
SA 51	7h 30m 36s	29°50’	du 24 octobre au 24 mars
SA 57	13h 08m36s	29°23’	du 30 décembre au 25 juin
Vega	18h36m56s	38°47'	du 25 avril au 25 septembre
Pôle Nord J2000		90°00’	toute l’année

Selectionnez votre configuration instrumentale (réducteur de champ, capteur et camera...) permettant de délivrer le plus grand champ (1°x 1°ou plus souhaité pour les recherches ou 15 arc min de coté au minimum), avec une exposition unique de 60s, et pour des expositions plus longues ou avec une accumulation de trames permettant d’atteindre votre magnitude limite.

Pour Vega il s’agit de réaliser trois expositions non saturées pour vérifier les paramètres photométriques pour un indice de couleur nul dans le système A0.

Selected areas to assess magnitude upper limit
Edgar Everhart Sky&Telescope Jan 1984

Finding Your Telescope's Magnitude Limit

EDGAR EVERHART, *Chamberlin Observatory, University of Denver*

HOW FAINT will it reach? This is a question that often comes to mind when considering a telescope or camera to be turned toward the heavens. While there are numerous tables that cite the limiting stellar magnitude for a given telescope aperture (see, for example, page 193 of the March, 1980, issue), in practice this limit is affected by many factors.

The condition and number of optical surfaces in a system will affect performance, as will light pollution and other atmospheric effects. For the observer, the physical condition of the eye is important, while photographers must consider such factors as film, filters, exposure times, and developing methods.

Therefore, in order to determine the limiting magnitude of a particular instrument, it is best to observe or photograph the sky directly. This calls for some type of star atlas or chart showing the magnitudes of selected stars. But herein lies problem: Even binoculars and short exposures with small cameras will reveal stars fainter than those plotted in Wil Tirion's *Sky Atlas 2000.0* (limiting magnitude 8 or *The AAVSO Variable Star Atlas* (limiting about 9.0).

For fainter magnitudes there are Vehrenberg *Atlas of the Selected Areas* and charts for certain variable stars prepared by the American Association of Variable Star Observers. Both include stars to about 16th magnitude — adequate for visual observers working with instruments up to nearly 30-inch aperture. But photographers can reach even fainter stars with surprisingly modest equipment.

Sixty years ago, the famous 16-inch (0.4-meter) Metcalf camera at Harvard Observatory was recording stars to magnitude 16. Today, however, advances in emulsions and hypersensitizing techniques make it possible for the same size telescope to photograph stars of 21st magnitude. Smaller telescopes can easily reach beyond the 16th-magnitude limit of the charts mentioned above.

Large observatories have special methods for calibrating photographic plates and determining the magnitudes of faint stars on them. The photographs described and reproduced here will be useful for smaller observatories and advanced amateurs, as they contain accurate star brightnesses down to 21st magnitude.

The magnitudes marked on the photographs are from a paper by L.-T. G. Chiu published in the *Astrophysical Journal Supplement* for September, 1980. Chiu was studying the structure of our galaxy as determined by proper motions of stars. For this work he used numerous photographs made in blue, yellow, and red light with the giant reflectors at Lick, Kitt Peak, and Palomar observatories. Chiu credits I. R. King and co-workers at the University of California, Berkeley, for the photovisual magnitudes of the stars. They used an iris photometer calibrated with photoelectric sequences. Photovisual magnitudes do not correspond exactly with what the eye sees but are reasonably close.

Chiu studied stars in Selected Areas (SA) 51, 57, and 68, each nearly centered on an 8th- or 9th-magnitude star listed in the Smithsonian Astrophysical Observatory *Star Catalog*. These areas are fairly well distributed in right ascension, and at least one field is accessible on most nights in the Northern Hemisphere.

Although the magnitudes listed in Chiu's tables are quite accurate, he did not include charts. I remedied this by photographing all three areas with the 16-inch f/5.5 astrographic reflector at Chamberlin Observatory's Dick Mountain Field Station near Bailey, Colorado. The exposures, made between December, 1980, and July, 1981, were 75 to 100 minutes in duration on nights of good seeing. I used Kodak's Technical Pan Film 2415, which was hypersensitized before exposure by soaking in forming gas (8 percent hydrogen, 92 percent nitrogen) at atmospheric pressure for five hours at 60° C. The 4 x 5 film sheets were processed in D-19 developer for five minutes at 21° C.

My negatives were enlarged 24 times and made into reverse prints (black stars on a white background). The exact scale as reproduced here can be found from the line 400 arc seconds long on the right side of each print.

Within the borders of the photograph of SA 51, Chiu's list contains 235 stars to photovisual magnitude 20.5. Of these, seven stars are covered by the image of a brighter one. Six of magnitude 20.5 are shown on the photograph, but another of the same brightness is not.

For the photograph of SA 57, Chiu's list contains 65 stars. Of these, two were covered by other images and three were not found. Among the 60 stars marked are five with magnitudes from 21.0 to 21.2

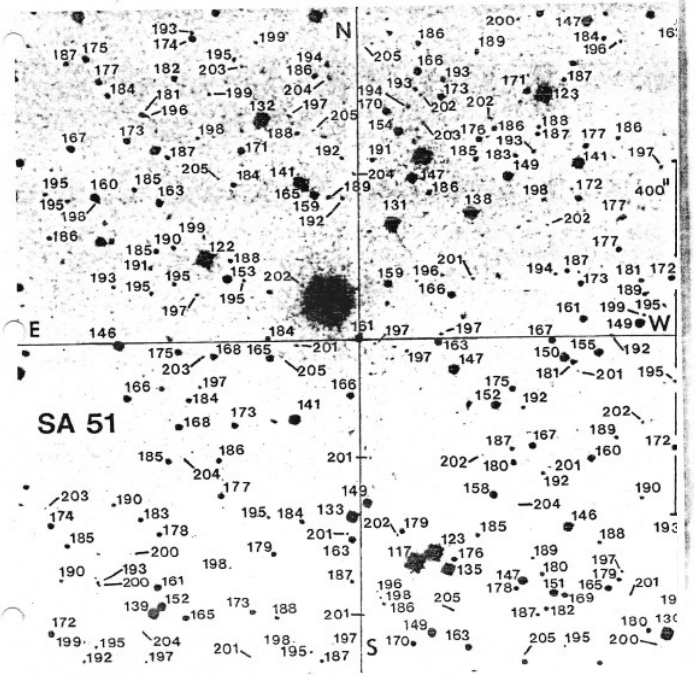
(the basis for my earlier statement
day a 16-inch telescope can rea
magnitude stars). The photograp
68 should contain 89 stars from Ch
but one was not found. The remai
some as faint as magnitude 20.5
visible.

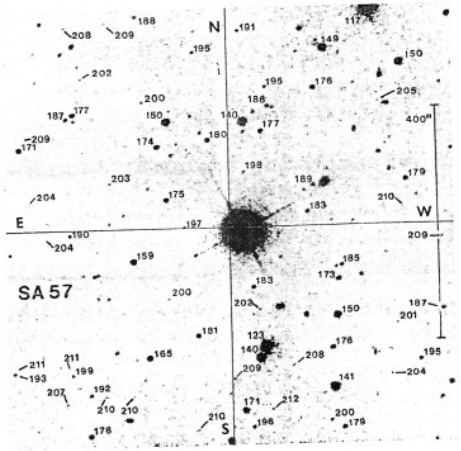
I wish to thank Elizabeth Roem
University of Arizona for calling n
tion to Chiu's original paper, and
Hoag at Lowell Observatory for his
and suggestions while I was work
on this project.

*Edgar Everhart is the director of t
lin Observatory at the University of
where he teaches physics and astronom
currently active in astrometry, particu
determination of accurate positions of*

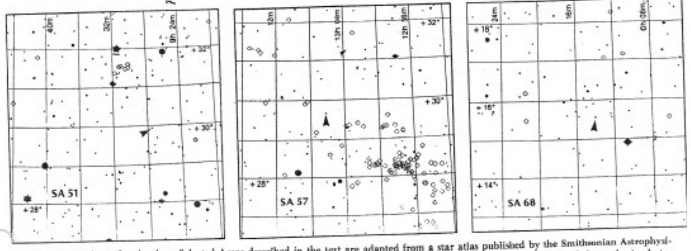
PRIMARY STAR IN EACH SELECTED AREA

Area	Star	Mag.	1950.0	2000.0
SA 51	SAO 79445	9.1	7h 27.5m, +29° 56′	7h 30.6m, +29° 50′
SA 57	SAO 82672	8.1	13h 6.3m, +29° 39′	13h 8.6m, +29° 23′
SA 68	SAO 91810	8.2	0h 14.0m, +15° 34′	0h 16.6m, +15° 50′

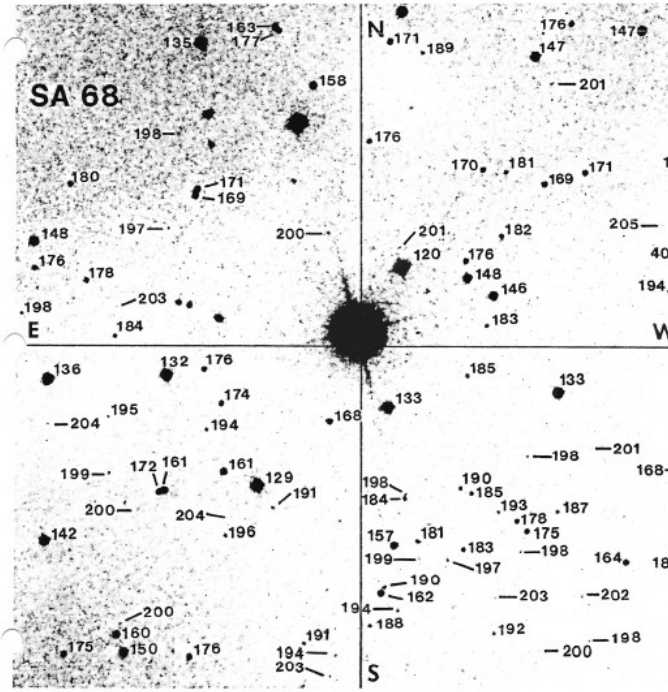




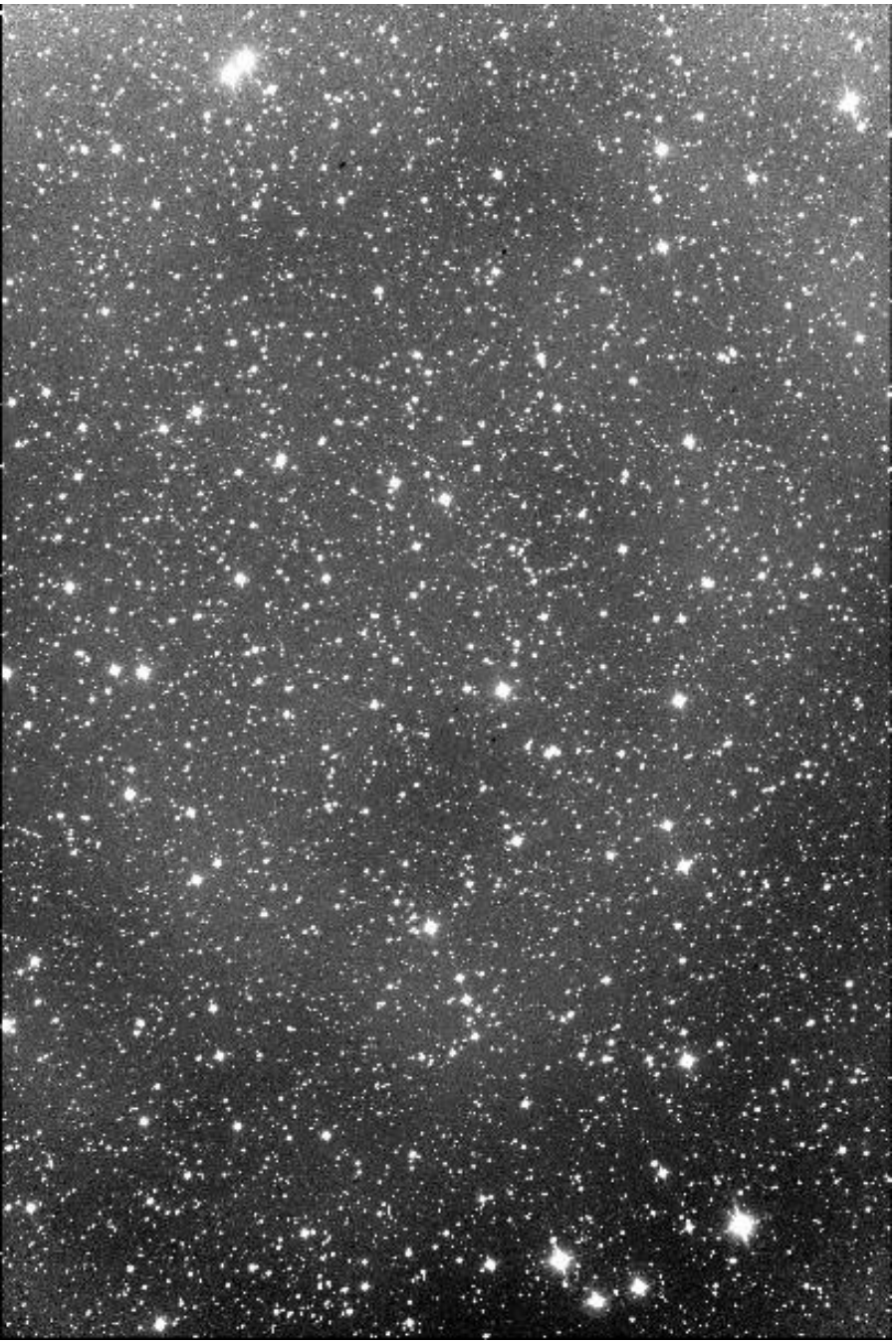
The photographic charts with this article were prepared by the author and are more fully described in the text. Each is nearly centered on a bright star listed in the table on page 30, while finder charts for the fields are below. Photovisual magnitudes are shown for selected stars with decimal points omitted (for example, 184 indicates a star of magnitude 18.4). All photographs have north up, and each field is about ¼° wide.

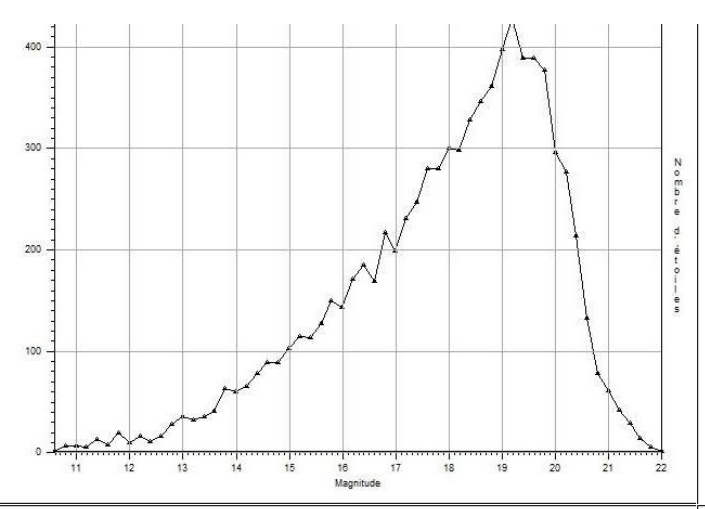


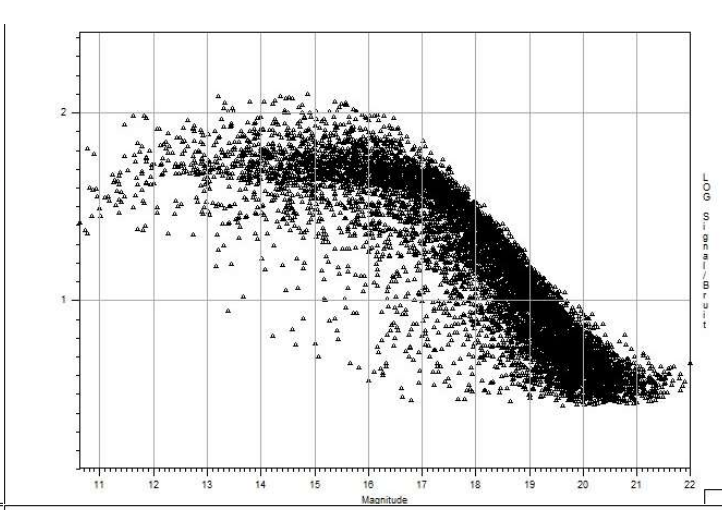
These finder charts for the three Selected Areas described in the text are adapted from a star atlas published by the Smithsonian Astrophysical Observatory. North is up, and each field is 5° square. Arrows denote the bright star near the center of each of the author's photographs. The finder chart for SA 51 contains Gemini's bright stars Castor at top center and Pollux at lower left. The brightest star in the SA 57 finder is 4th-magnitude Beta Comae Berenices at lower left. SA 68 is located just northeast of 3rd-magnitude Gamma Pegasi.

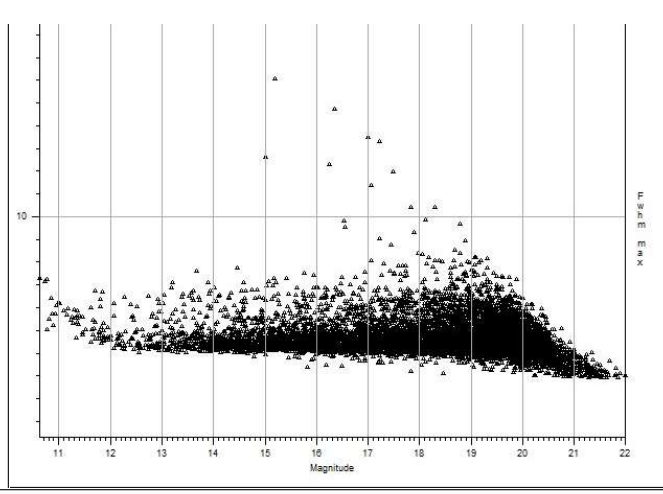


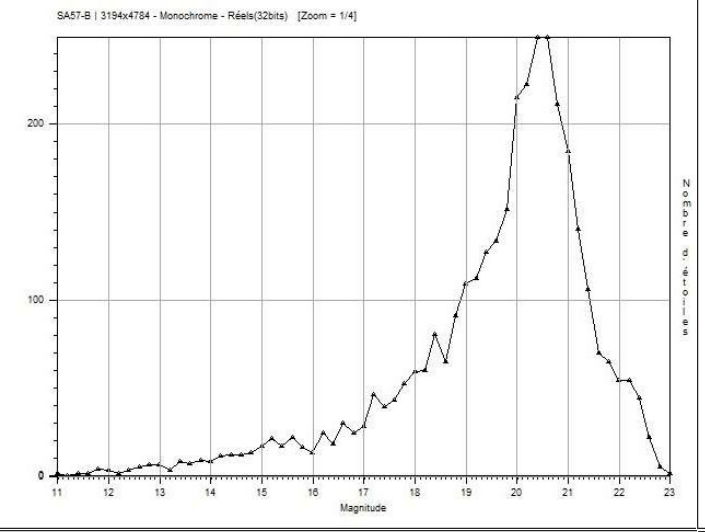
Thierry SA51 10x60s G

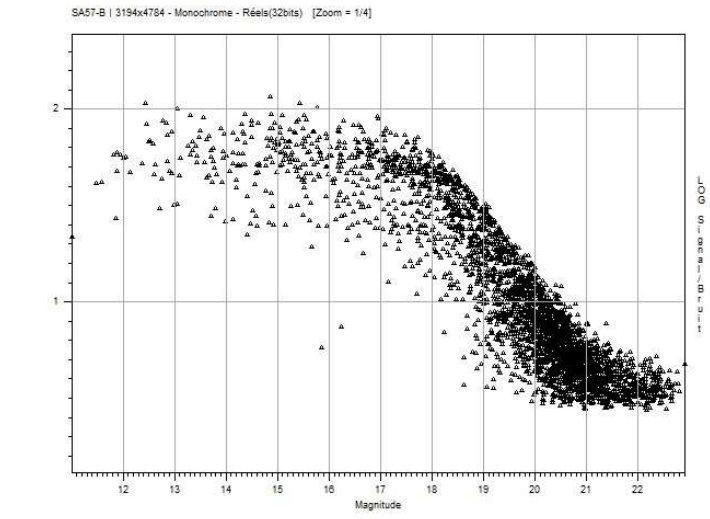


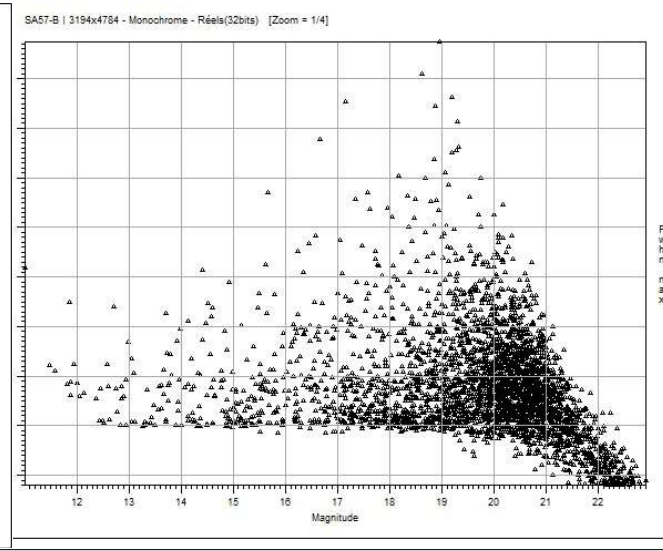

Nombre d'étoiles
Magnitude

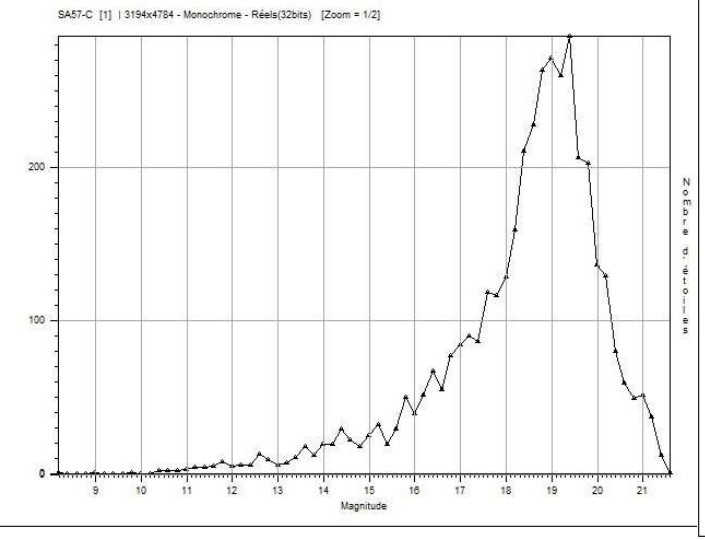

LOG Signal/Bruit
Magnitude

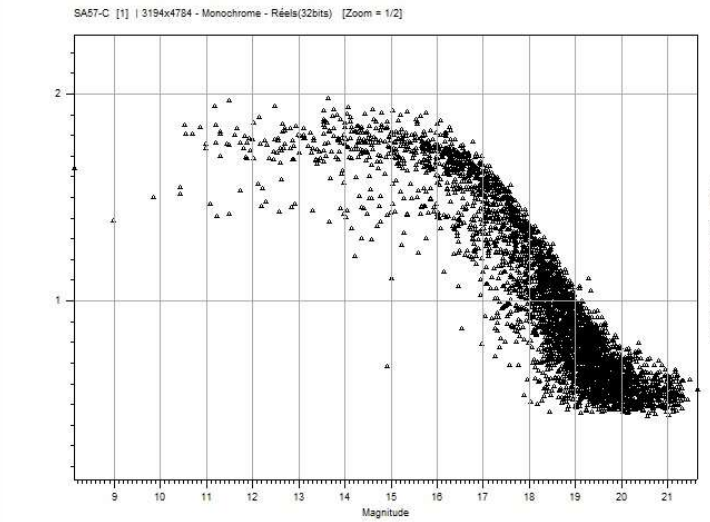

Fwhm max
Magnitude

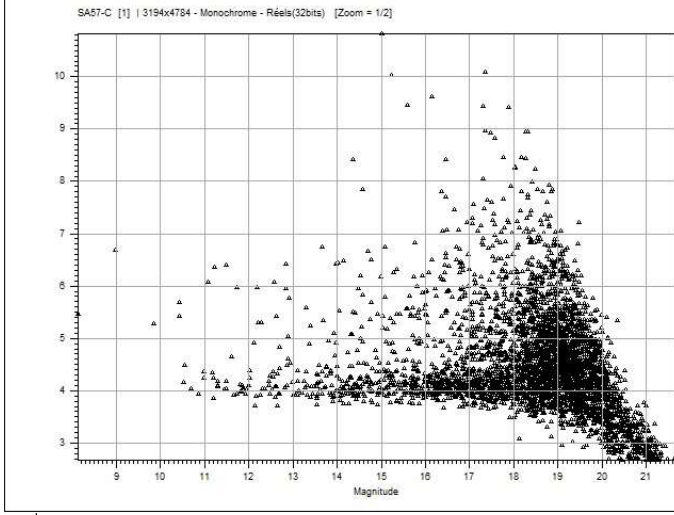

SA57-B | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/4]
Nombre d'étoiles
Magnitude


SA57-B | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/4]
LOG Signal/Bruit
Magnitude

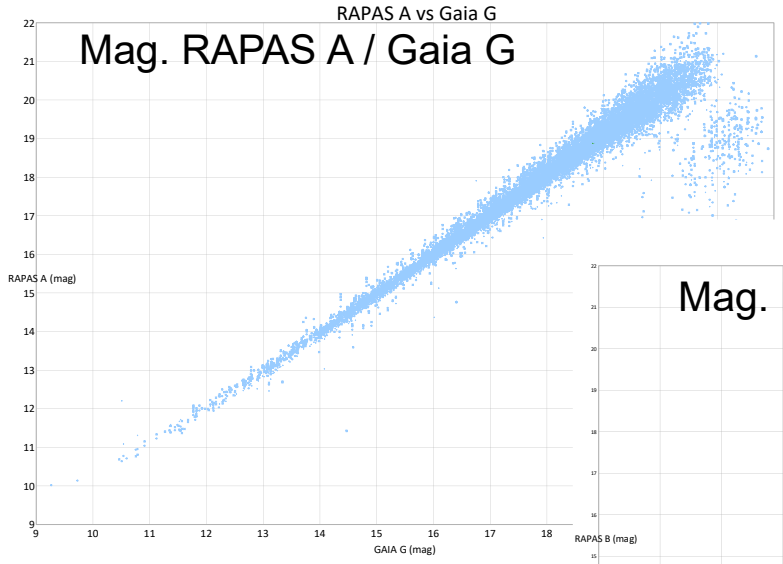

SA57-B | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/4]
Magnitude

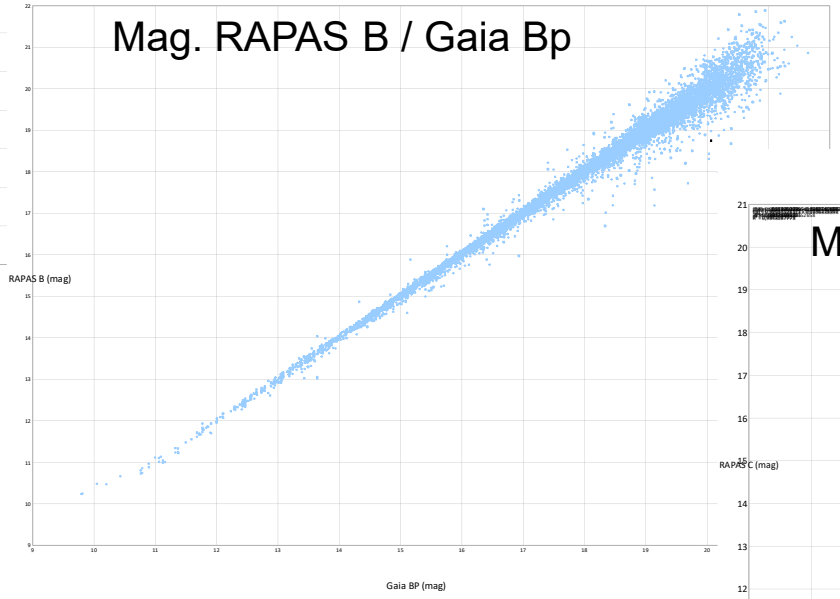

SA57-C [1] | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/2]
Nombre d'étoiles
Magnitude

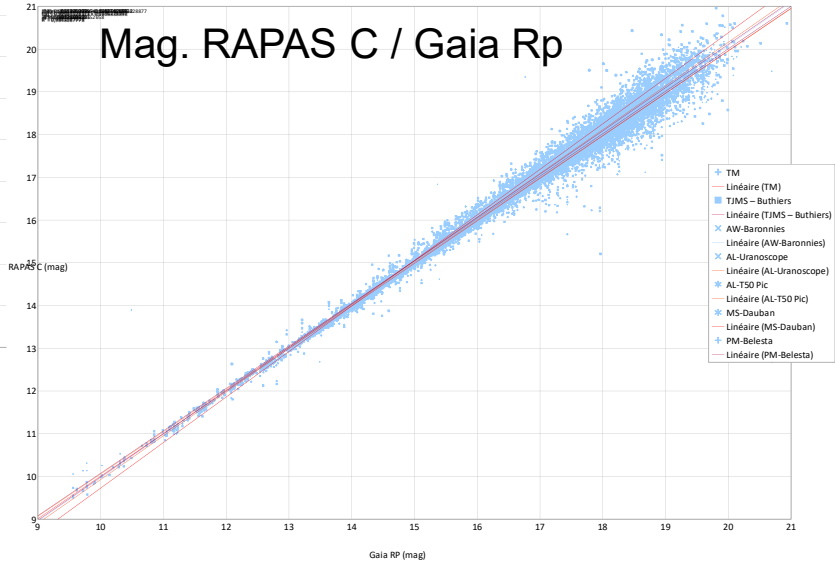

SA57-C [1] | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/2]
LOG Signal/Bruit
Magnitude

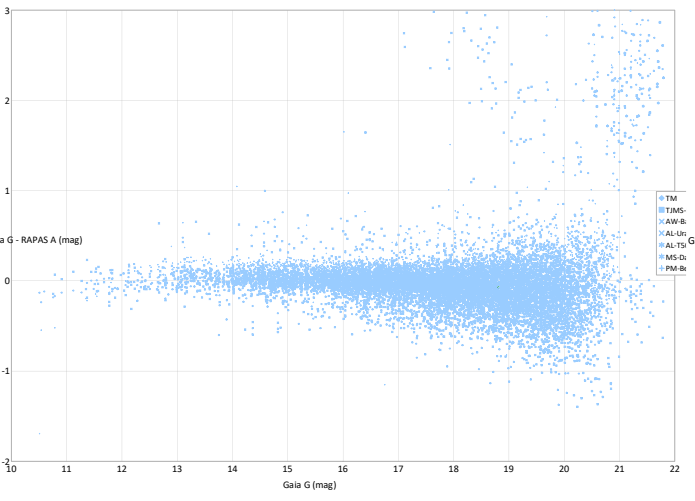

SA57-C [1] | 3194x4784 - Monochrome - Réels(32bits) [Zoom = 1/2]
Magnitude

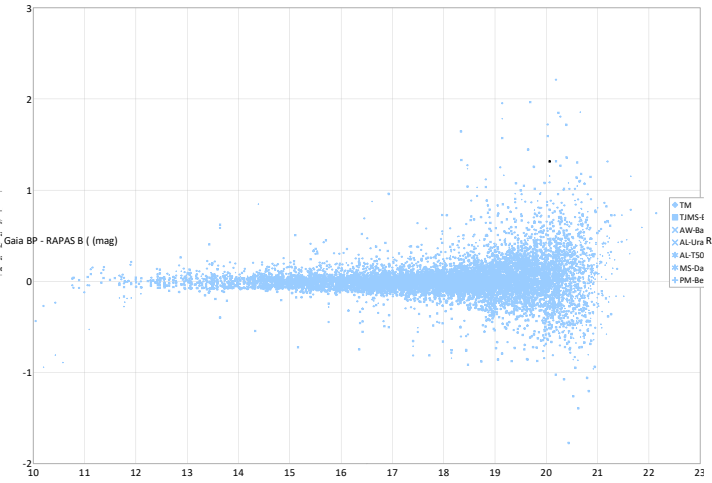
Première synthèse des réponses et dispersions Préparées par Marc Serrau

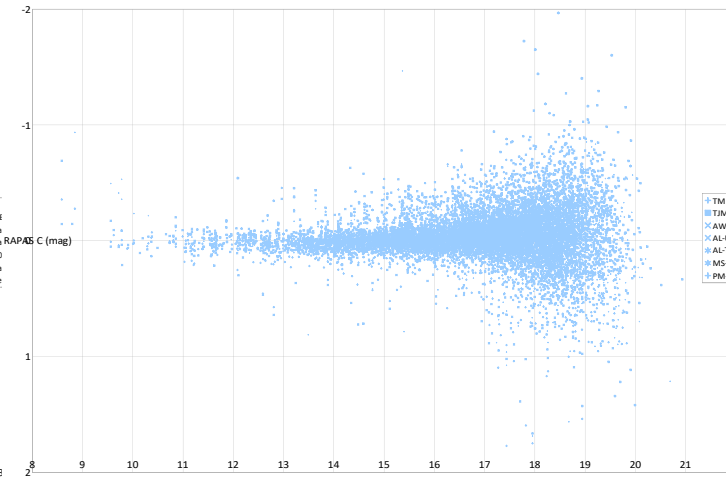


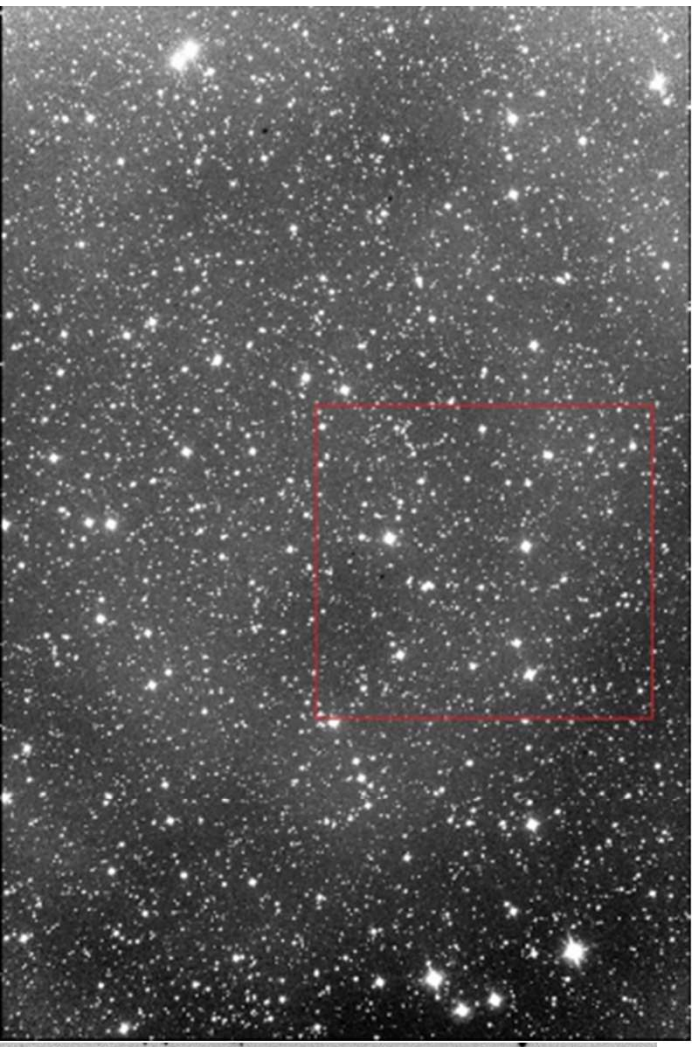






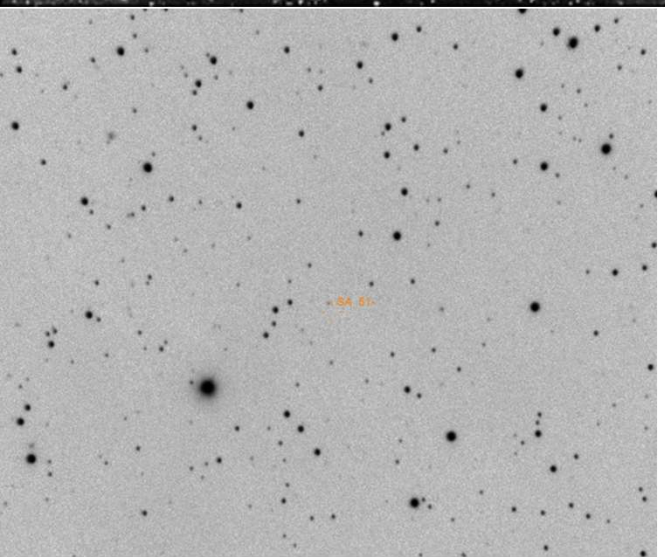


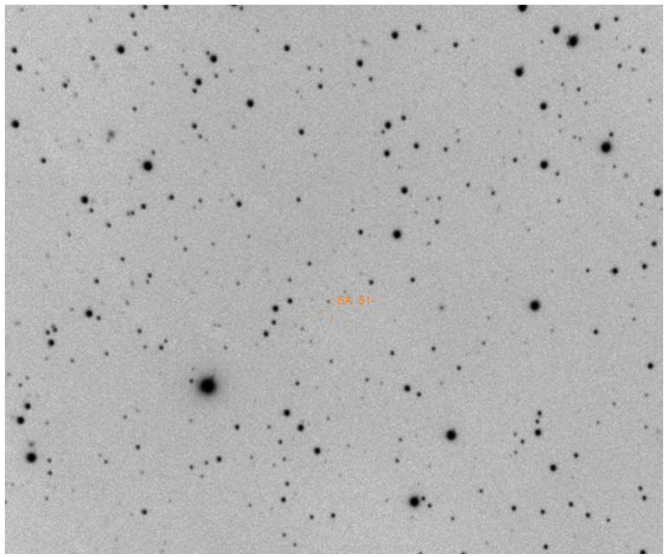


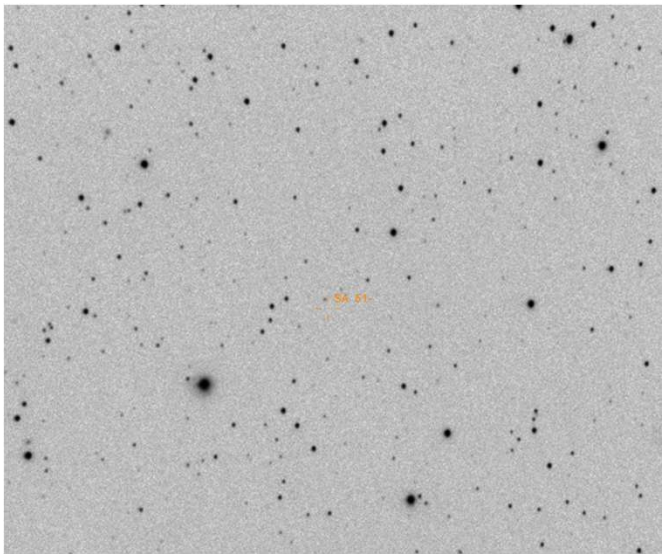


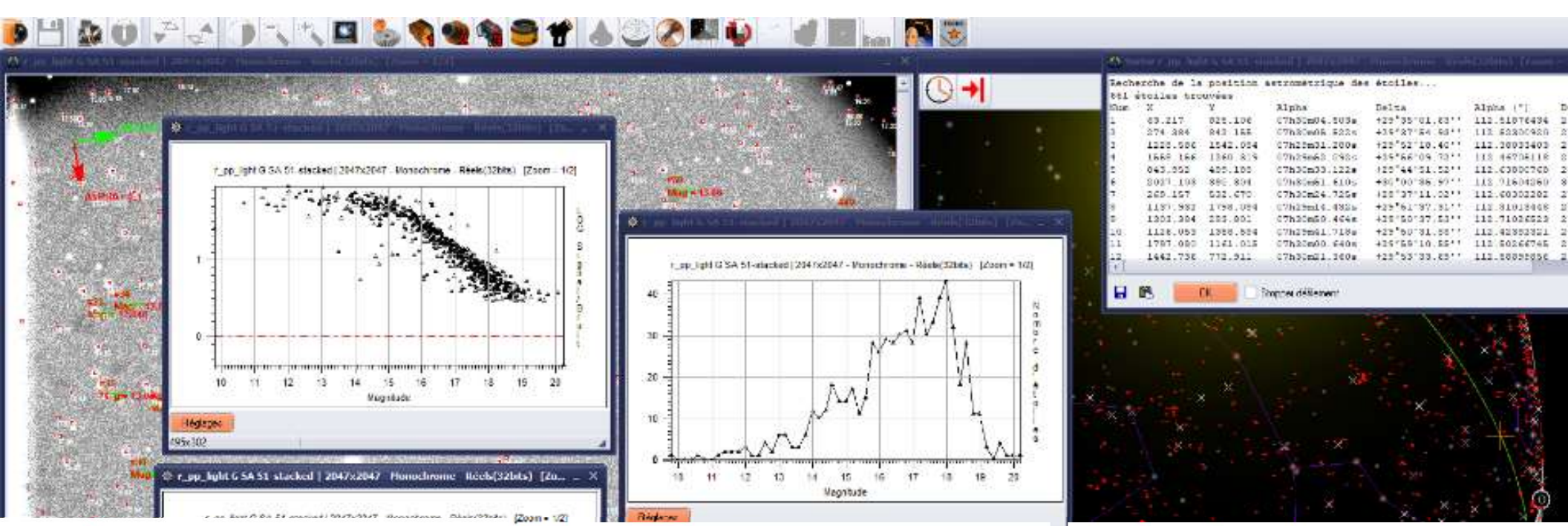
Lisa Maris : Champ d'étoiles SA 51

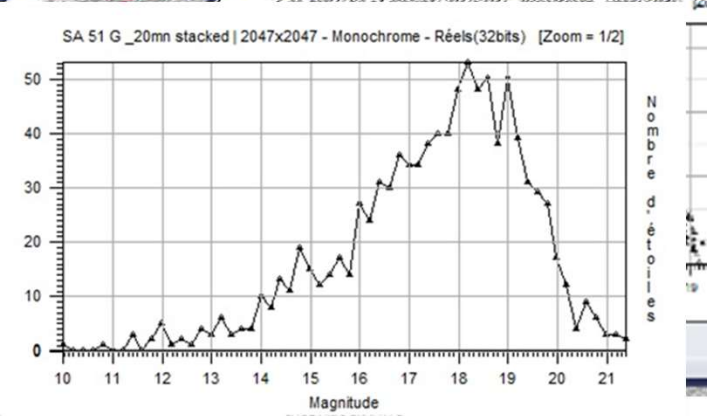
- Station Atlas Chambéry Savoie
- Télescope C11, D=0,280m, f=1,764m,
- CCD ATIK 4000, capteur CCD - Kodak KAI 04022, dimensions 16.67mm x 16.05mm, pixels 7.4 µm, refroidie Δ=-20 T_{ext}=0°C
- Acquisitions: pose 60s, nb x20
- logiciel pilotage et acquisition KSTAR
- 3 Filtres RAPAS ABC
- Traitement photo: SIRIL
- Traitement astrométrique et photométrique: PRISM
- Application du catalogue GRAPPA Gaia EDR3 G, Gbp, Grp

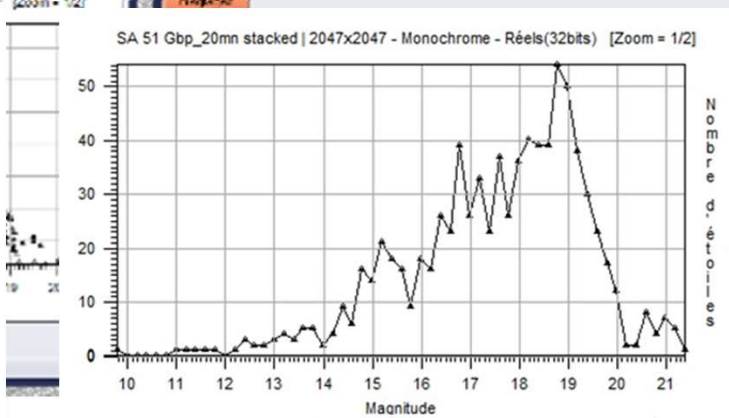


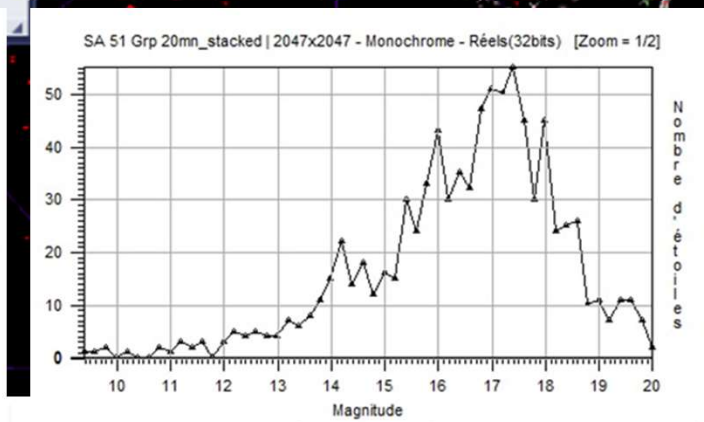


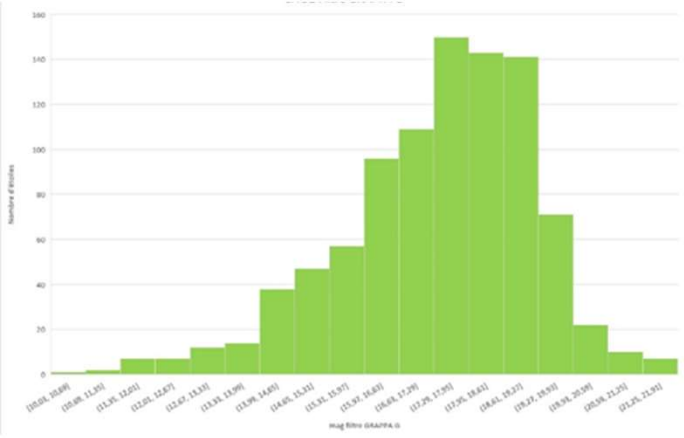


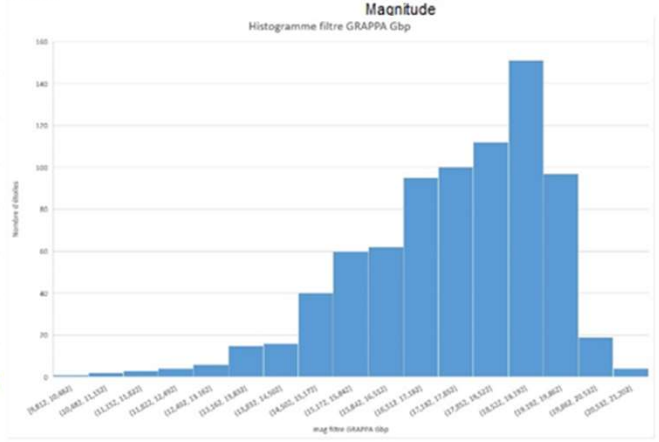


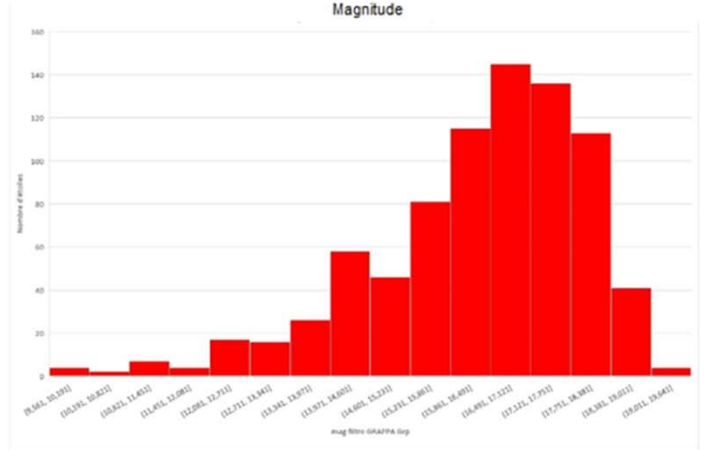

SA 51 G _20mn stacked | 2047x2047 - Monochrome - Réels(32bits) [Zoom = 1/2]
Nombre d'étoiles
Magnitude


SA 51 Gbp_20mn stacked | 2047x2047 - Monochrome - Réels(32bits) [Zoom = 1/2]
Nombre d'étoiles
Magnitude

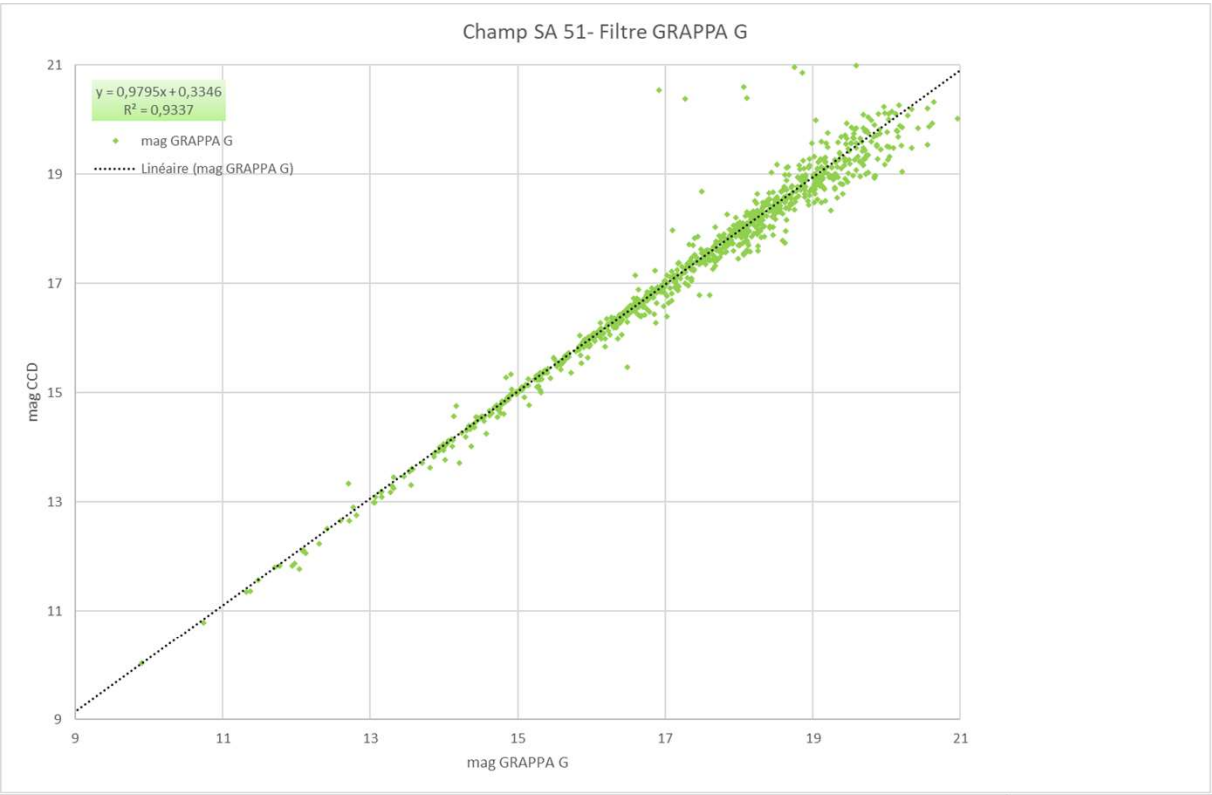

SA 51 Grp 20mn_stacked | 2047x2047 - Monochrome - Réels(32bits) [Zoom = 1/2]
Nombre d'étoiles
Magnitude

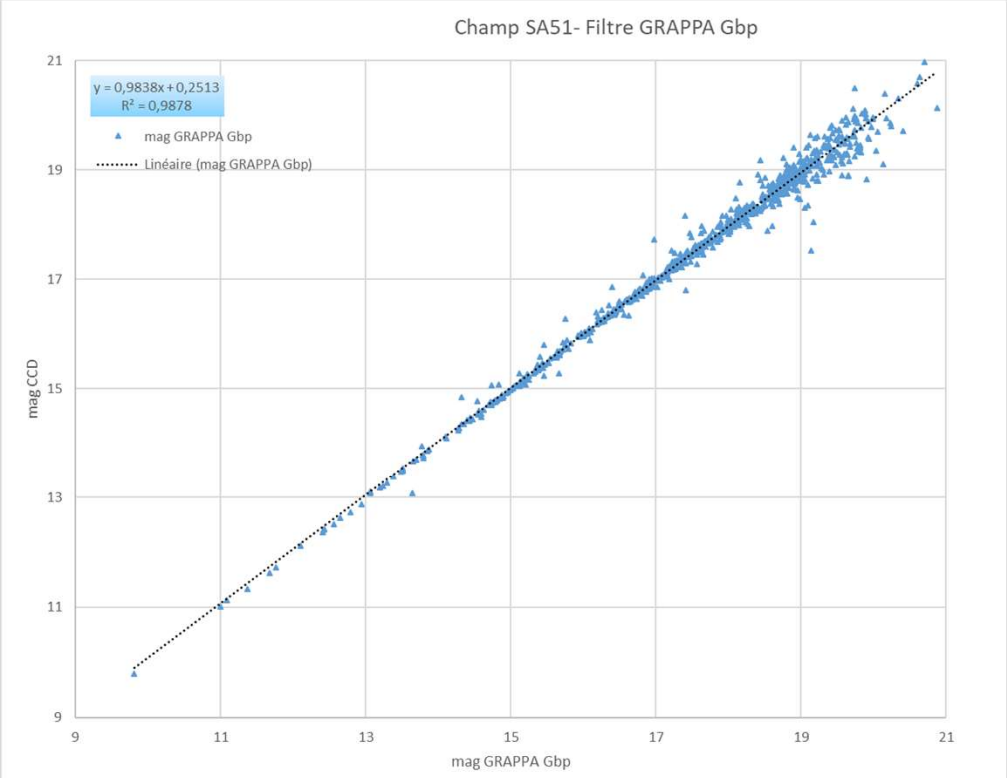


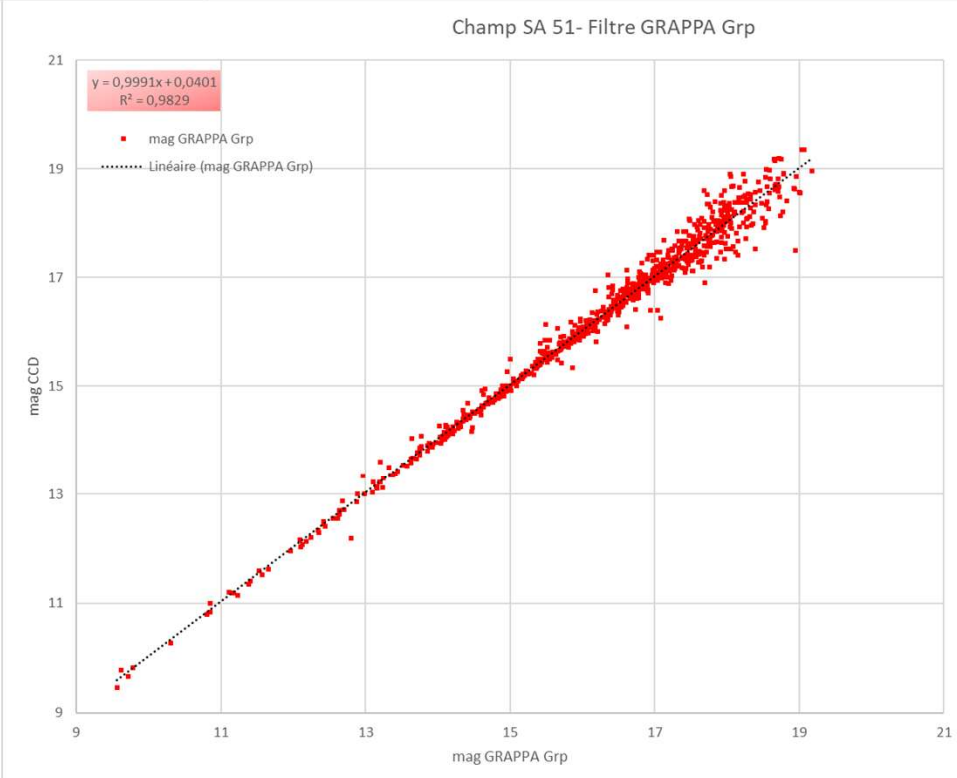

Histogramme filtre GRAPPA Gbp



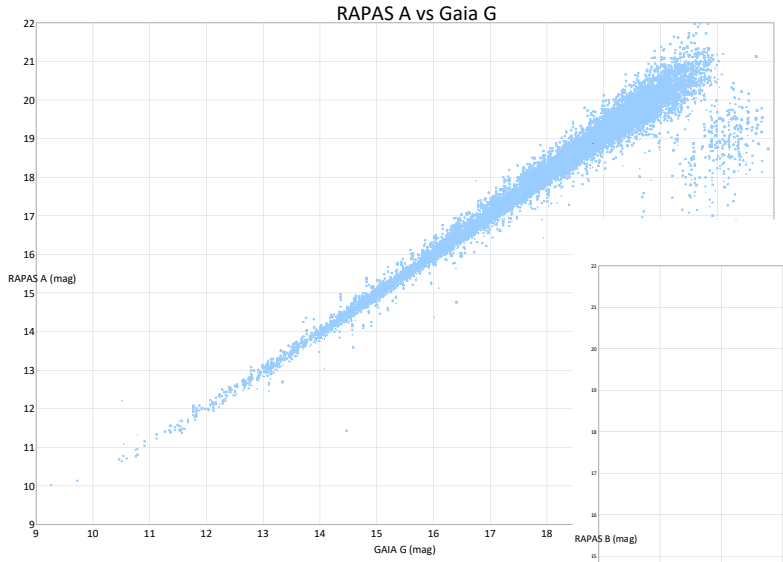
Synthèse des résultat SA 51- Filtres GRAPPA- Station Atlas Chambéry Lisa Maris

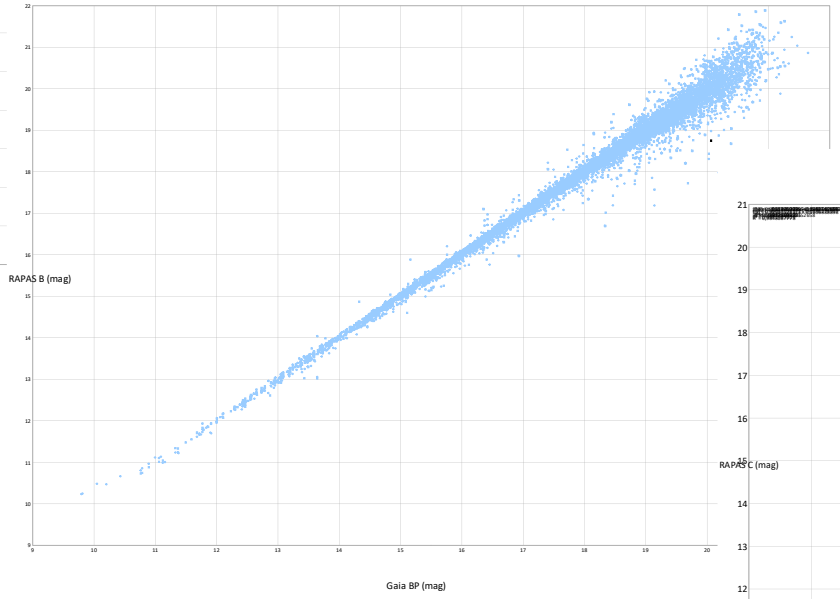


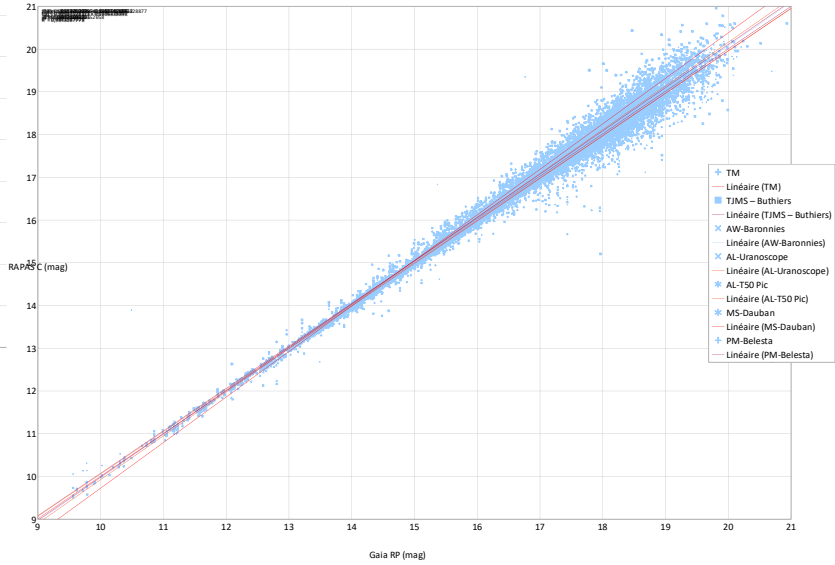


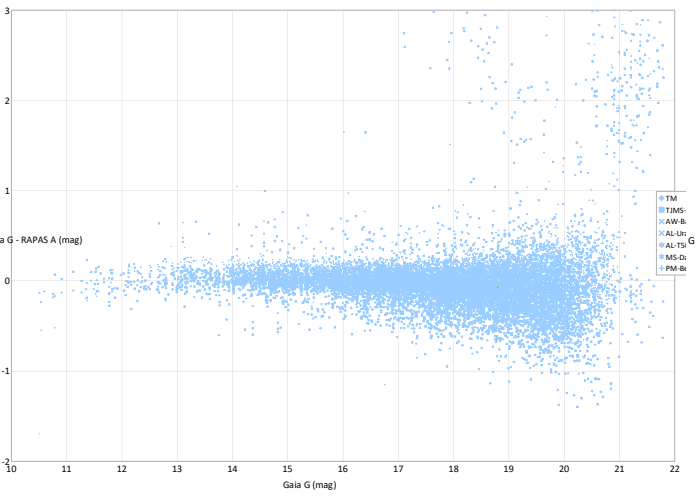


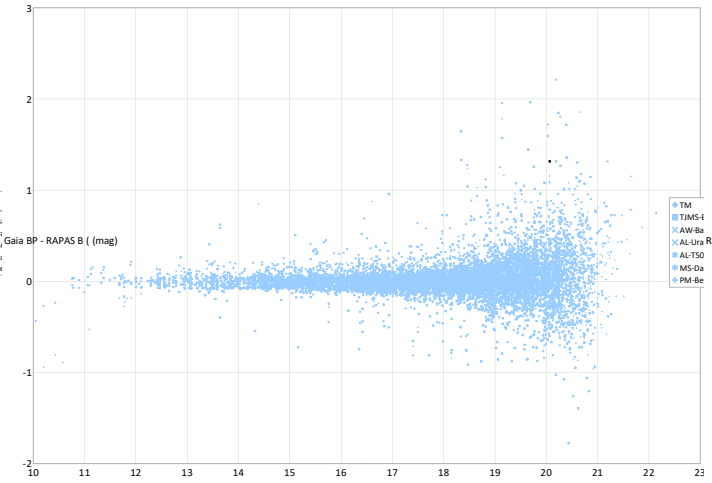
Première synthèse des réponses et dispersions Préparées par Marc Serrau

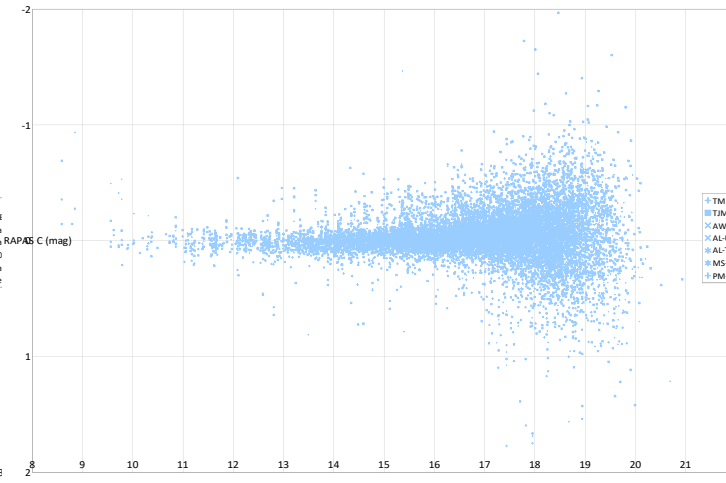




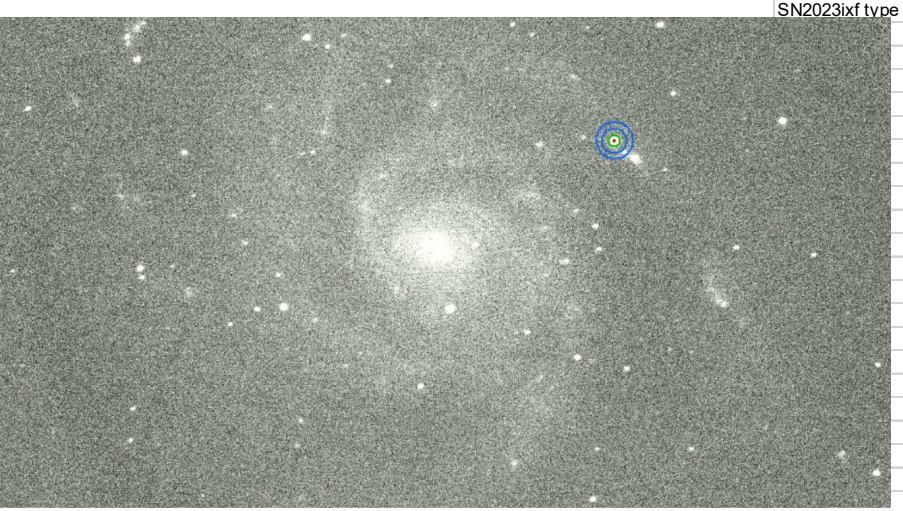




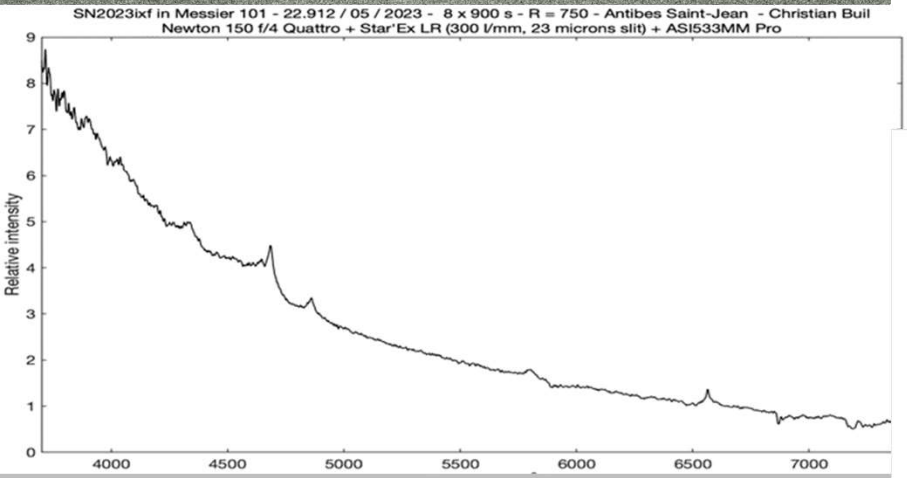


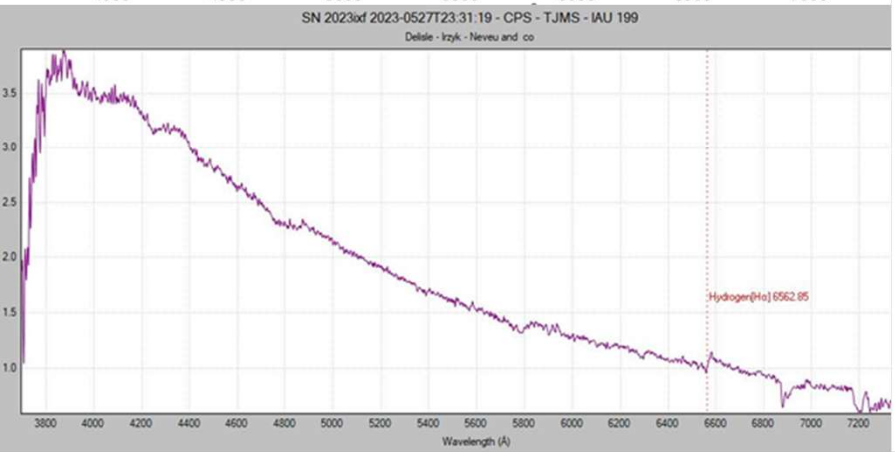


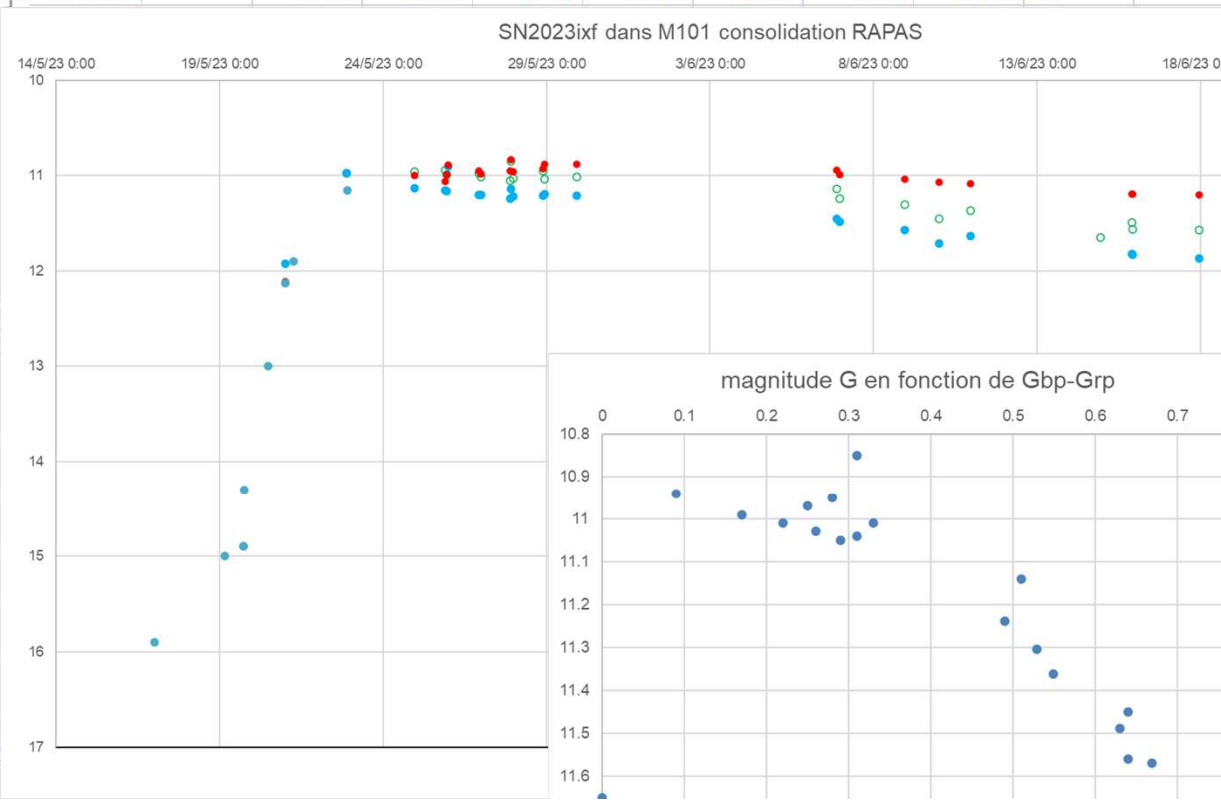
Premiers tests de mobilisation de RAPAS :
SN2023ixf dans M101 découverte le 19 mai 2023 à m=14,90

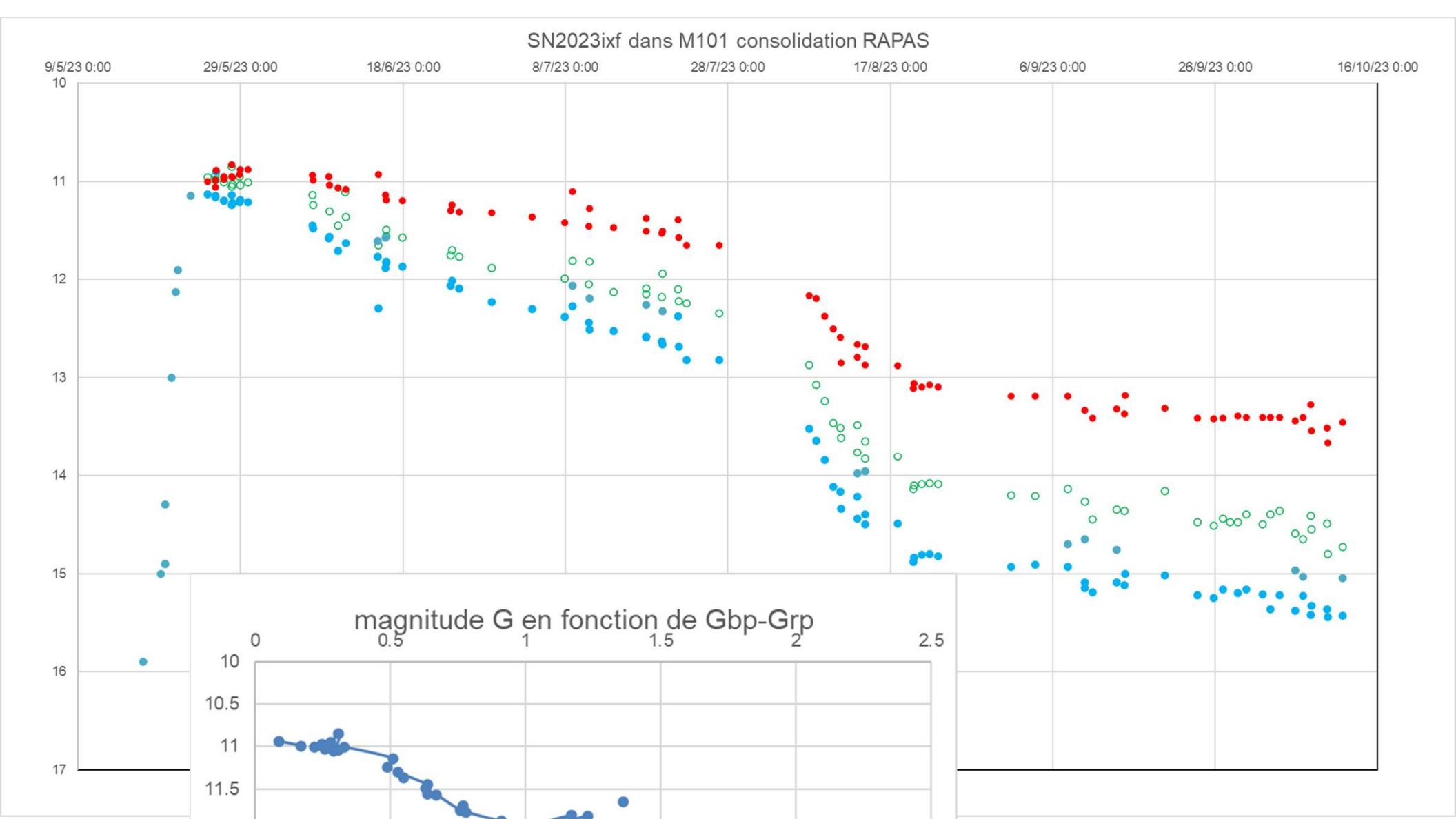


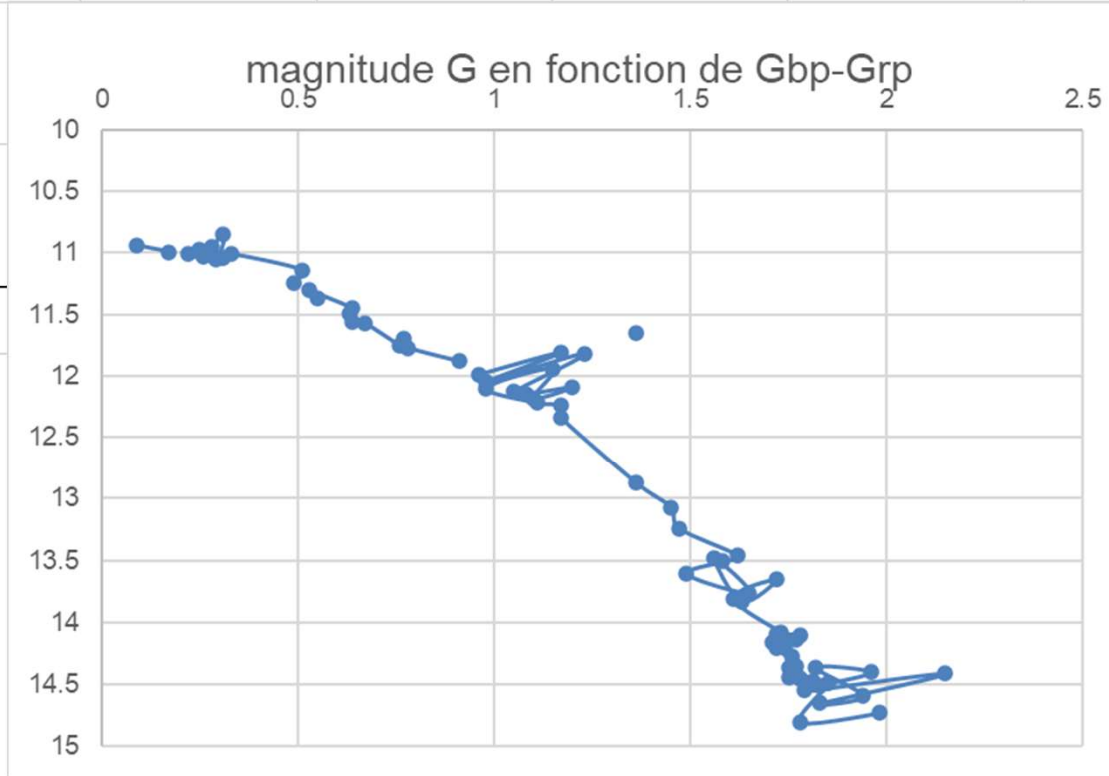
SN2023ixf type II	V	G	delta G	Gbp	delta Gbp	Grp	delta Grp	Gbp-Grp		
2023-05-17	15.9								ZTF	
2023-05-19	15								S. Limeburner	
2023-05-19	14.9								Koichi Itagaki	
2023-05-19	14.9								S. LaRiccia	
2023-05-19	14.3								S. Korotkiy	
2023-05-20	13								Koichi Itagaki	
2023-05-21	*12.13*			*11.92*		12.11			E. Broens	BVR
2023-05-21									Marc	
2023-05-21	11.9								Jean-Claude Merlin	
2023-05-22	*11.15*			*10.98*		*11.15*			E. Broens	BVR
2023-05-23									Anaël	
2023-05-24		10.96	0.02	11.13	0.02	11	0.04		Florent	
2023-05-25		10.94	0.05	11.15	0.06	11.06	0.08	0.09	Arnaud	
2023-05-25		10.99		11.16		10.99		0.17	Florent	
2023-05-26				10.9	0.03	10.89	0.06	0.01	Eric	
2023-05-26		10.97	0.04	11.2	0.04	10.95	0.07	0.25	Arnaud	
2023-05-26		11.01		11.2		10.98		0.22	Florent	
2023-05-27		11.05	0.03	11.24	0.04	10.95	0.04	0.29	Patrick	
2023-05-27		10.85	0.06	11.14	0.06	10.83	0.06	0.31	TJMS Stéphane, Yannic	
2023-05-27		11.03		11.22		10.96		0.26	Florent	
2023-05-28		10.95	0.03	11.21	0.02	10.93	0.02	0.28	Arnaud	
2023-05-28		11.04	0.04	11.19	0.06	10.88	0.04	0.31	Christian	
2023-05-29		11.01	0.04	11.21	0.05	10.88	0.05	0.33	Christian	
2023-06-06		11.14	0.04	11.45	0.02	10.94	0.03	0.51	Arnaud	
2023-06-06		11.24		11.48		10.99		0.49	Florent	
2023-06-08		11.30505	0.00231	11.5681	0.00257	11.03868	0.0039	0.52942	Anaël	

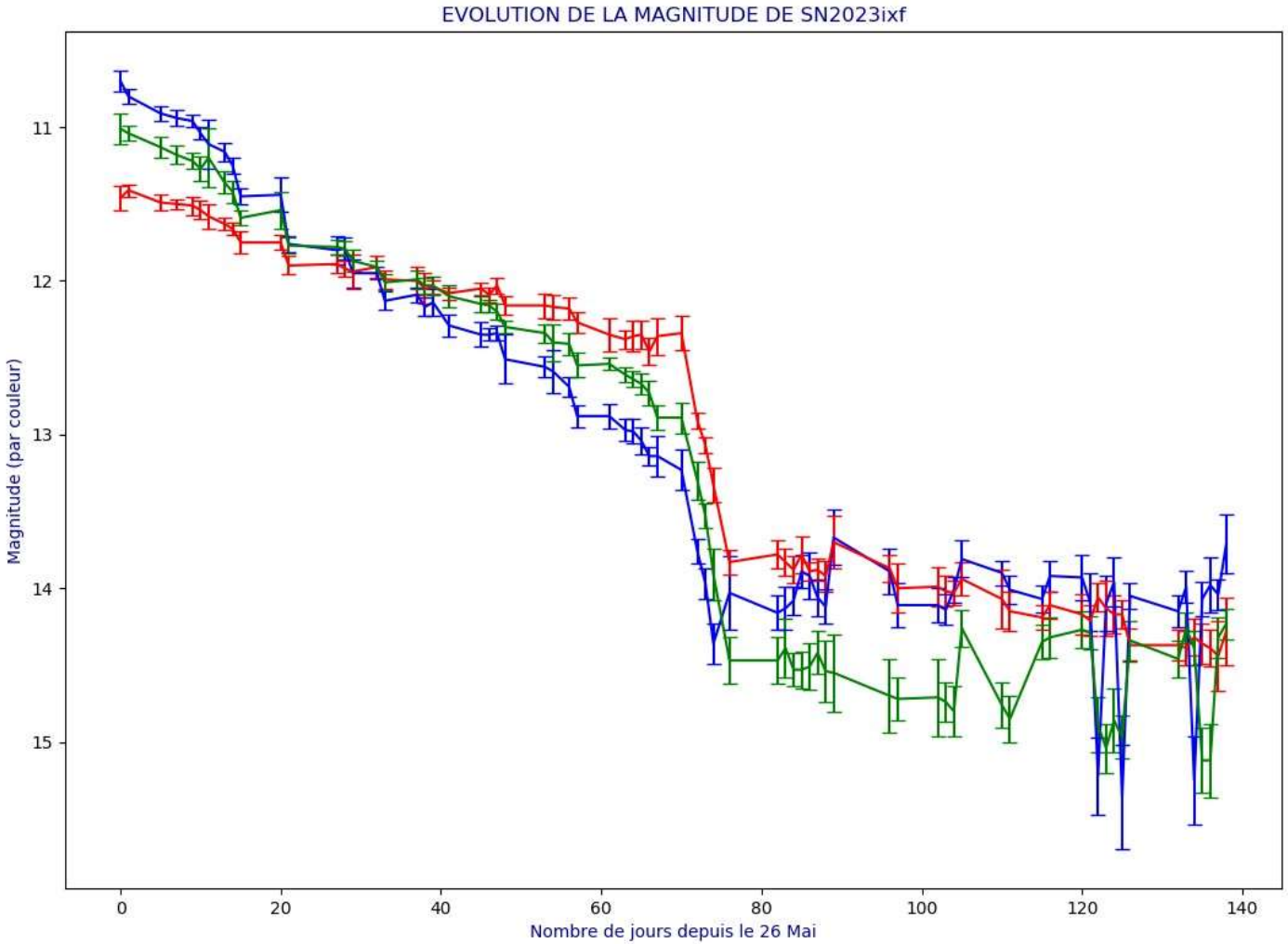




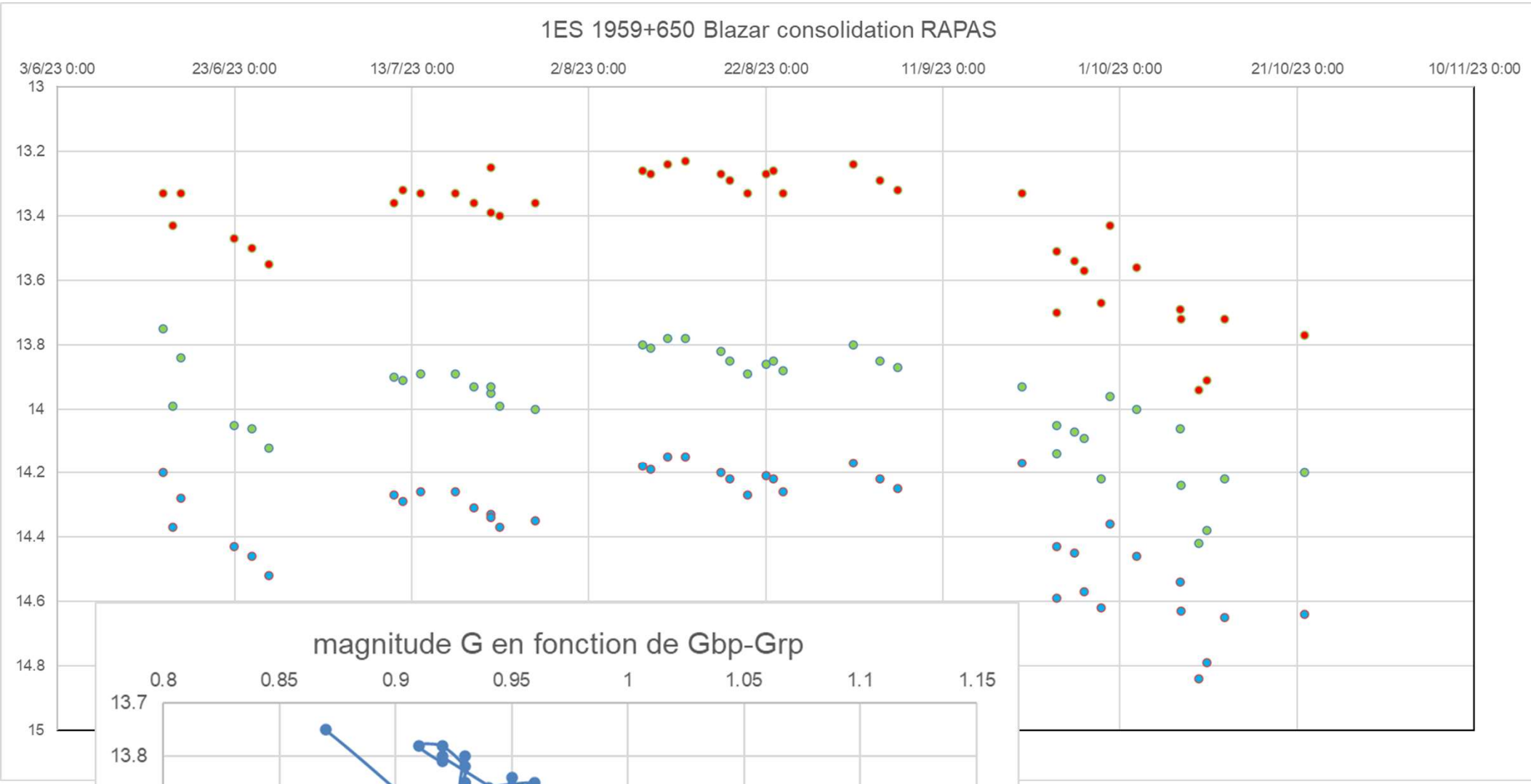


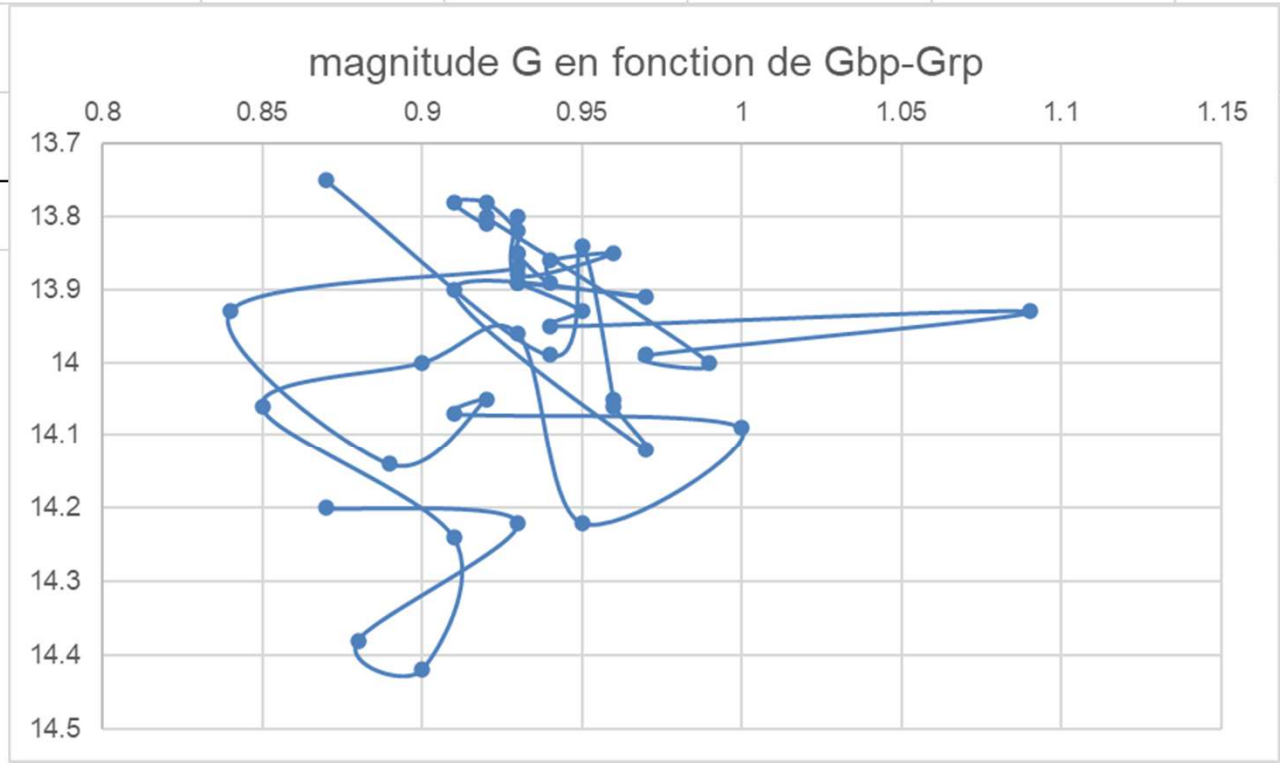

SN2023ixf dans M101 consolidation RAPAS
9/5/23 0:00
29/5/23 0:00
18/6/23 0:00
8/7/23 0:00
28/7/23 0:00
17/8/23 0:00
6/9/23 0:00
26/9/23 0:00
16/10/23 0:00
10
11
12
13
14
15
16
17


magnitude G en fonction de Gbp-Grp
0
0.5
1
1.5
2
2.5
10
10.5
11
11.5
12
12.5
13
13.5
14
14.5
15



Cette SN a été suivie un maximum de temps avec un LX 200 (TGS) et filtres RVB (ZWO), les traitements et réductions ont été faits par le jeune Jeremy Bernede (13 ans) qui ne maitrise pas encore bien Excel, reprendre éventuellement les valeurs de dates pour une autre présentation. Les dernières mesures plus erratiques sont dues principalement à la qualité du ciel le soir au dessus de la ville.
Mais je pense qu'il a fait du très bon travail pour son âge :-)) N'hésites pas a demander des précisions si besoin.
Philippe Dupouy


1ES 1959+650 Blazar consolidation RAPAS
3/6/23 0:00
23/6/23 0:00
13/7/23 0:00
2/8/23 0:00
22/8/23 0:00
11/9/23 0:00
1/10/23 0:00
21/10/23 0:00
10/11/23 0:00
13
13.2
13.4
13.6
13.8
14
14.2
14.4
14.6
14.8
15


magnitude G en fonction de Gbp-Grp
0.8
0.85
0.9
0.95
1
1.05
1.1
1.15
13.7
13.8
13.9
14
14.1
14.2
14.3
14.4
14.5

Conclusion les suites sur les filtres

Photométrie

- Qualifier la précision photométrique de chaque observateur RAPAS avec l'exploitation des acquisitions sur les Selected Area
- Qualifier la précision du réseau

- Lancer des suivis photométriques : la SN M101, Blazar
- Lancer des phases de recherches de GaiaFUN SSO
- Lancer des phases de recherches de contreparties optiques

- Délivrer des données : Alertes Gaia, Télégrammes, GCN, KNC,…
- Publier notre système photométrique

2024

- Etude et réalisation d'un nouveau lot de filtres ABC ?
  - Meme conception
  - Second design
- Réponse aux demandes à l'international pour les filtres et développement du réseau
- Organiser le pipeline des livraisons des mesures