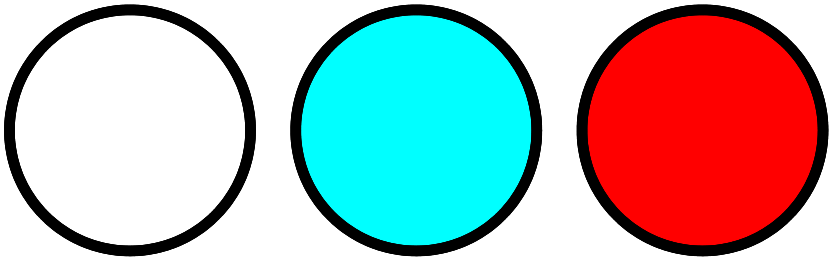

RAPAS

RAPAS project introduction
SNR vs magnitude



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[2] Observatoire de Paris IMCCE

[3] IAP

[4] ARAS

GRANDMA Workshop OCA 30 May-3 June 2022

RAPAS

Réseau Amateurs Professionnels pour les Alertes Scientifiques

Introduction, AIProAm,
Needs

Gaia induced idea
Réduction photometrique
Qualifier le réseau des observateurs RAPAS

1. Introduction : AIProAm

2022 call
by the ProAm Incentive Multi-Year Action
of the Paris Observatory

January 10, 2022

1. Call by the ProAm Incentive Multi-Year Action

The ProAm Incentive Mutli-Year Action (ProAm IMYA) of the Paris Observatory calls for proposals for scientific actions in the frame of Professional-Amateurs collaborations. The goal is to promote collaborations between professional and amateurs astronomers on any astronomical topic and with any technique.

Eligibility criteria are the following :

- the project must be a **collaboration between professional and amateur astronomers, including at least one member of the Paris Observatory.** This includes members of GEPI, IMCCE, LERMA, LESIA, LUTH, SYRTE, USN, UFE as well as the laboratories for which the Paris Observatory is a secondary administrative supervisor (APC, LPP, OSUC). Professional and amateur astronomers from any institute and country are welcome in the proposing team.
- the project must be an **astronomical research project**. This includes direct scientific collaborations as well as citizen science.

The present call concerns funding for 2022, although scientific projects can extend over several years. If the ProAm IMYA office selects a project for 2022 and additional funding is required the following years for the same project, a new proposal will have to be submitted every year showing the results already obtained. The selection of a project in 2022 does not guarantee its selection in future years. **The yearly budget of the ProAm IMYA is of the order of 25000 euros.**

Needs

There is an increasing number of programs delivering astronomical alerts.
These are related to SSO or Galactic objects or extra-Galactic events

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 = lim mag x FOV square degree / min

Amateurs with their respective observatory spread over wide longitude and latitude range and behind independant cloud coverage conditions provide optical search mode to deliver AD and Dec localisation of optical candidates with a classification to allow ther photometric or even spectrometric tracking function with large telescopes.

The needs could be summarised in :

- An array of instruments spread over large territory
- Wide Field Of View Instruments >1°²
- High magnitude detection limit >20 in 1min exposure or asses 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

A new ProAm collaboration :

Le Réseau Amateurs Professionnels pour les Alertes Scientifiques (RAPAS)
Amateurs-Professionnals Network for Scientific Alerts

- RAPAS project is aiming to build such a network
- We are inviting amateurs to register in this network with preliminary data related to their observatory facility.
- A workshop is scheduled on october 8th and 9th 2022 at Paris Observatory
- We will deliver to observers a filter set to unify the photometric data.
- Then the purpose is to assess the photometric accuracy of the network for the end of the year 2022.

Astro-Colibri

Web site and App

The Gaia induced idea :

Gaia mission delivers alerts :

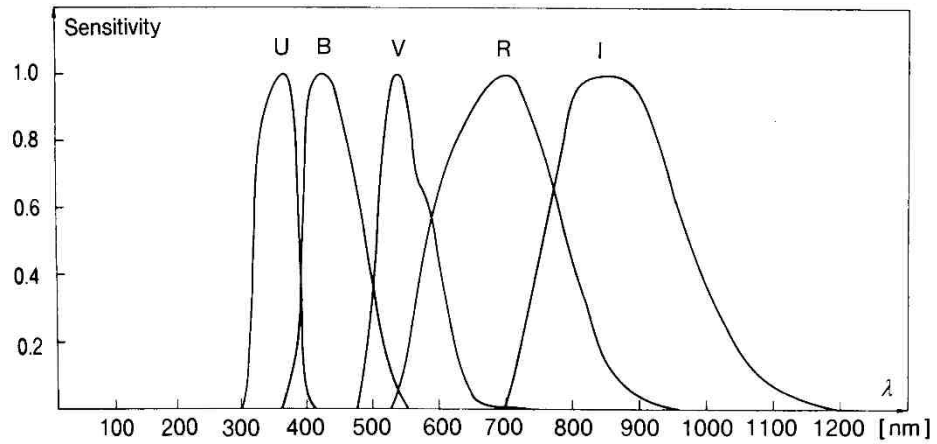
- https://gaiafunsso.imcce.fr/
- http://gsaweb.ast.cam.ac.uk/alerts/home

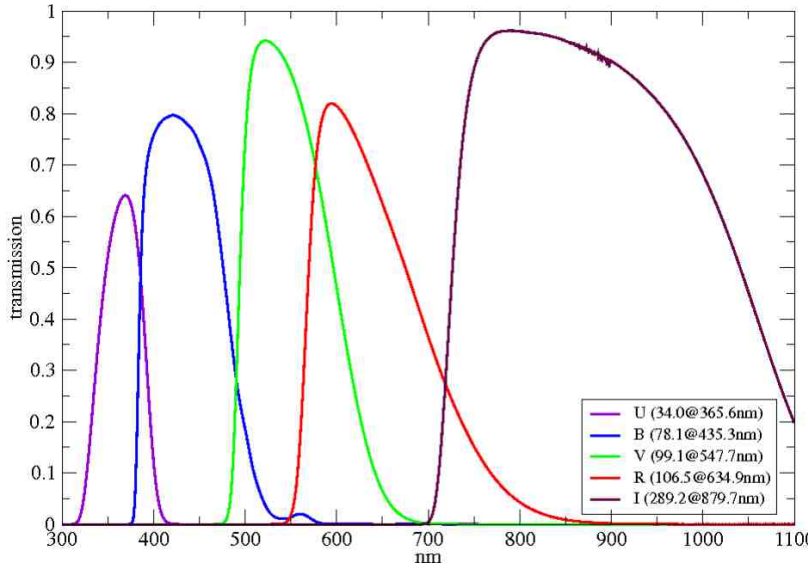
In addition Gaia provides an updated photometric catalog up to 20-21 magnitude in three wide spectral bands. This photometric system may enhance SNR and limiting magnitude of amateur telescopes and allows data reduction with this catalog.

Gaia DR3 is released on June the 13th 2022

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_i	"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

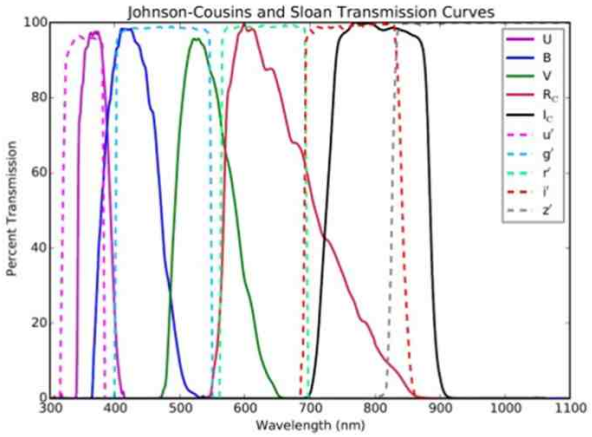
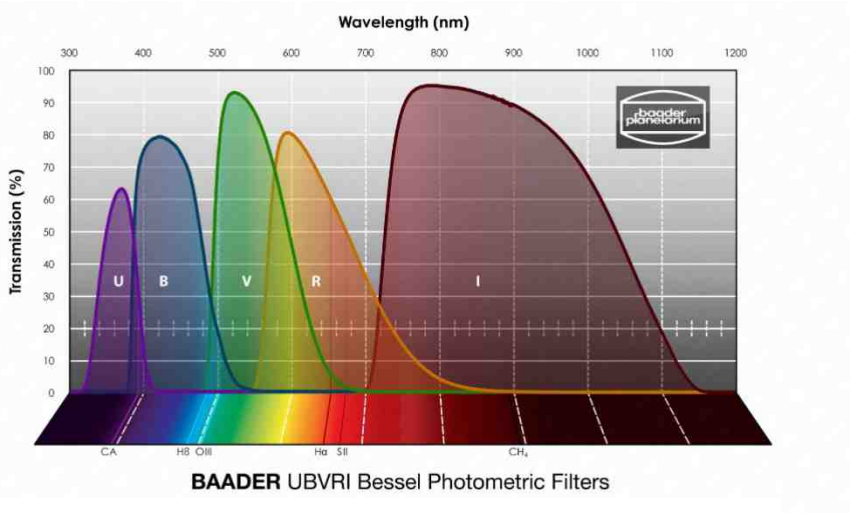
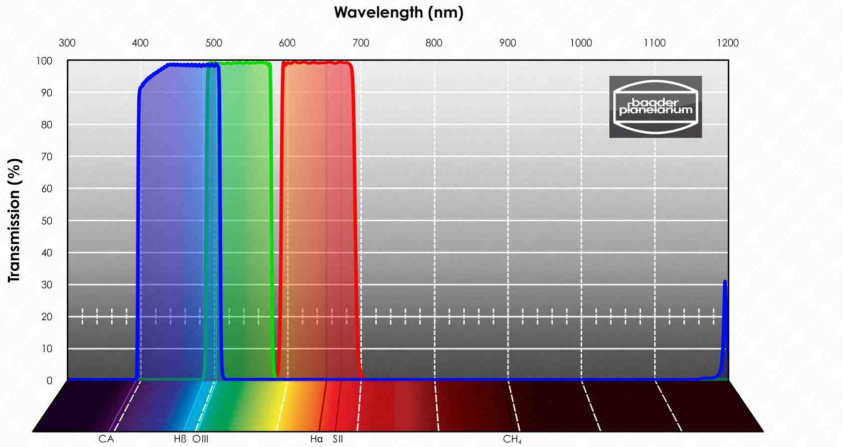


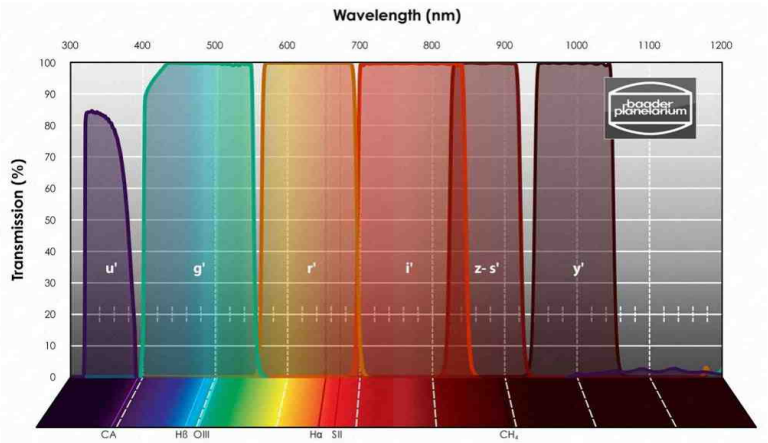
Fig. 4. Astrodon transmission curves for the Johnson-Cousins ($UBVR_CI_C$) and the Sloan ($u'g'r'i'z'$) photometric systems.



BAADER UBVRI Bessel Photometric Filters

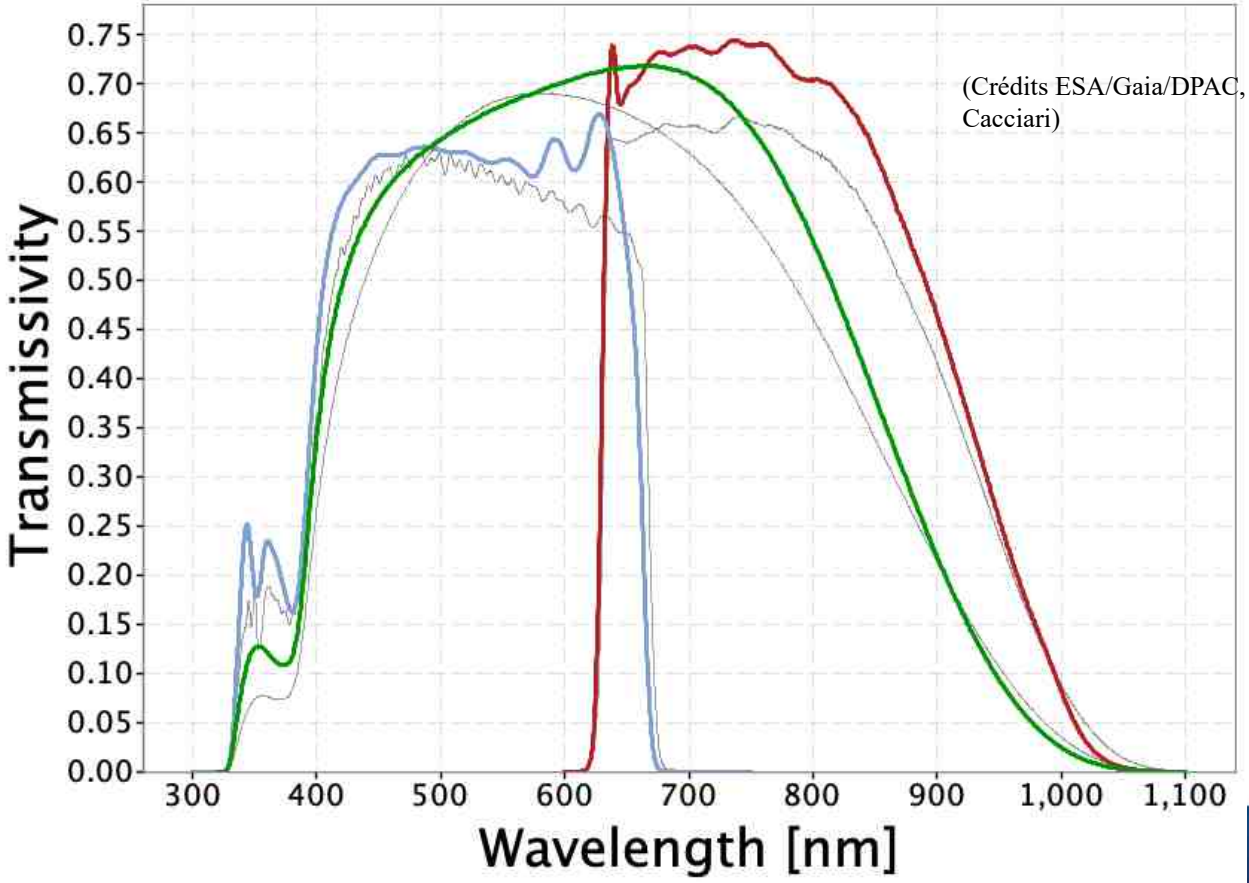


BAADER RGB CMOS Filter – *CMOS-optimized*

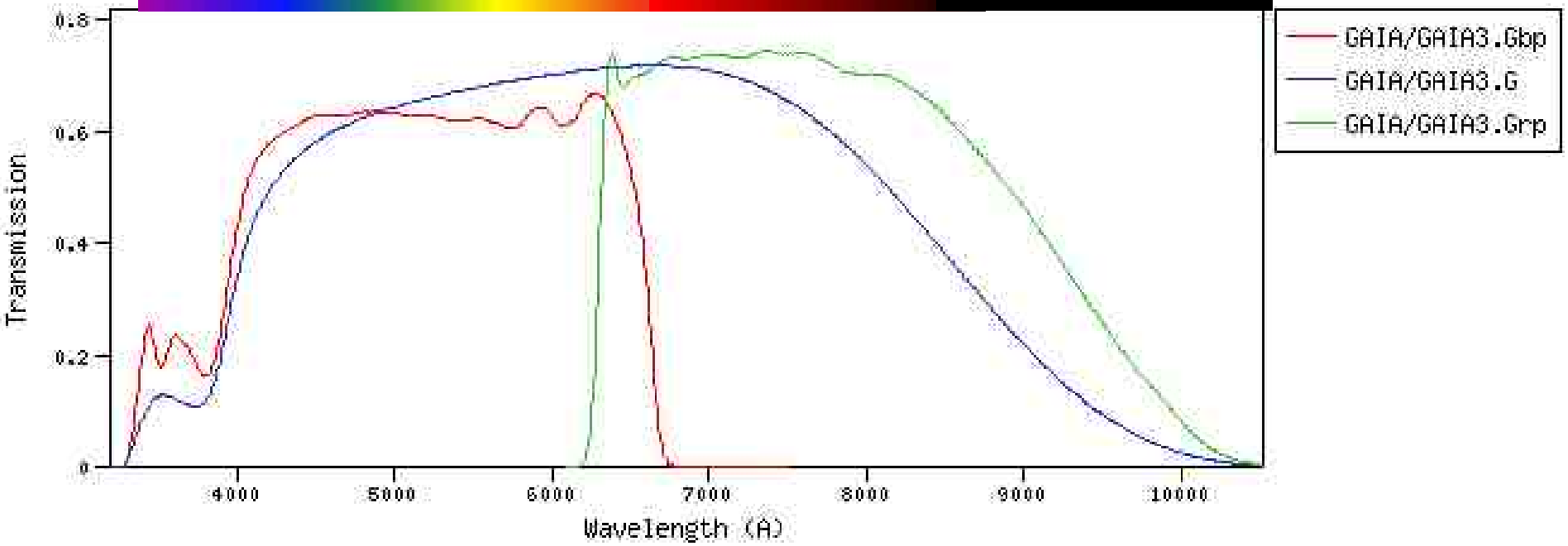


BAADER SLOAN/SDSS (ugriz') Photometric Filters

A more comprehensive description of the photometric and spectral external calibrations will be published in Riello et al. (2020, the paper presenting the EDR3 photometry) and Montegriffo et al. (in preparation, a paper entirely dedicated to the external calibration of the BP/RP spectra). The passbands are shown in the figure above as green, blue, and red solid lines for the G, G_BP, and G_RP bands, respectively. The thin grey lines show the nominal, pre-launch passbands published in Jordi et al. 2010.



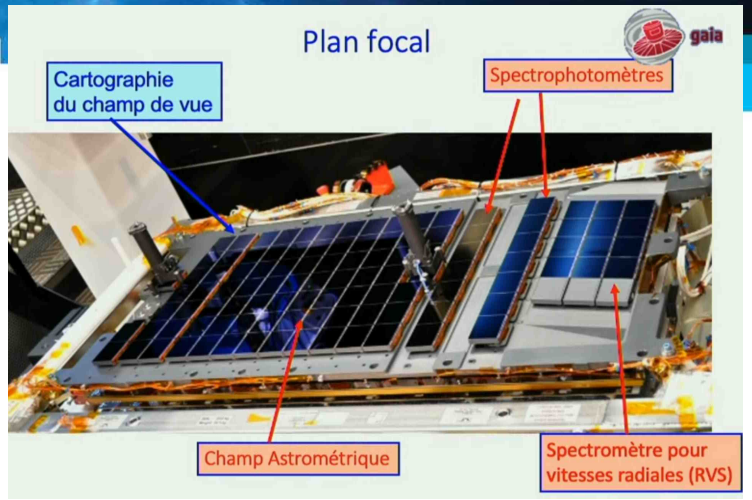
(Crédits ESA/Gaia/DPAC, P.Montegriffo, F. de Angeli, C. Cacciari)

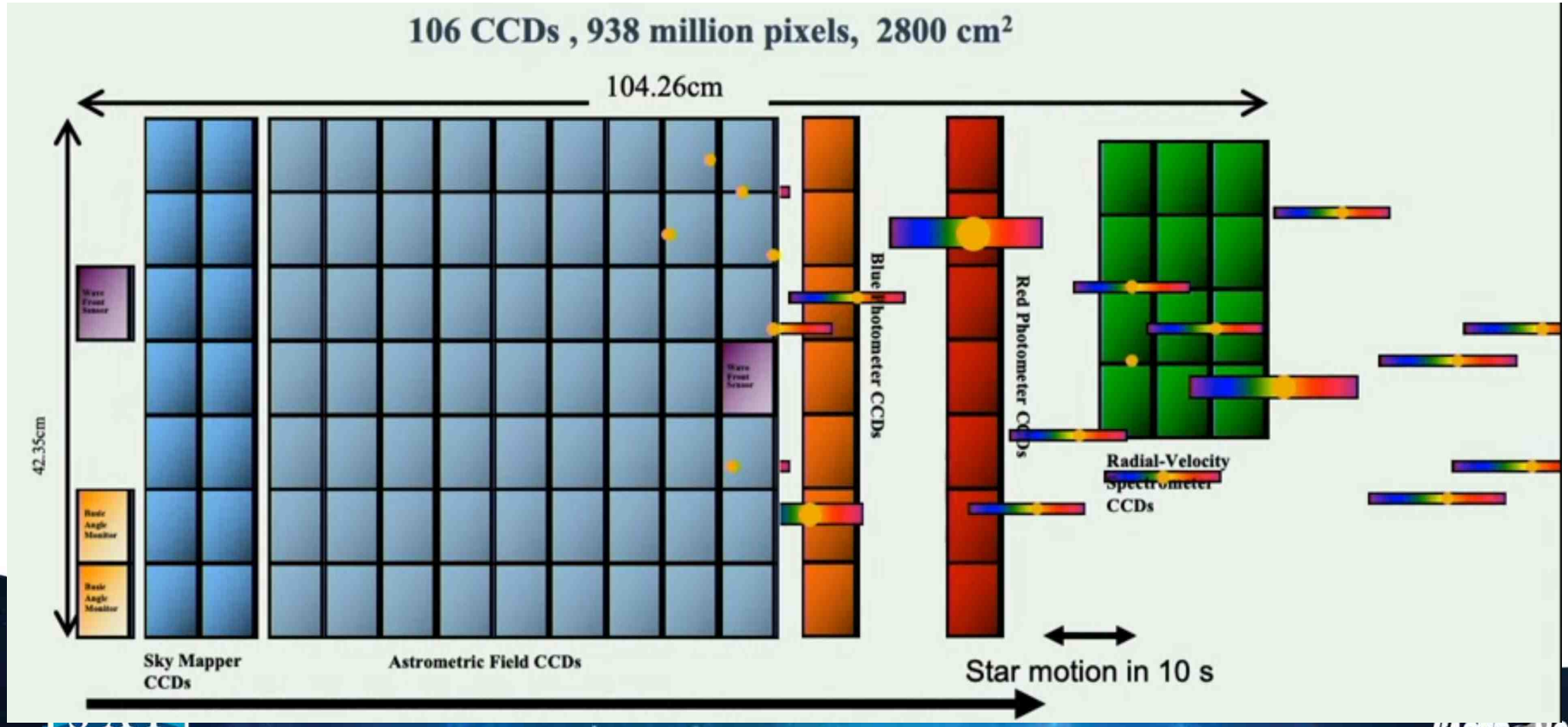


Filter ID		λref	λmean	λeff	λmin	λmax	Weff	ZPv	ZPλ .
GAIA/GAIA3.Gbp	DR3	5109.71	5319.87	5035.75	3292.83	6738.11	2157.50	3552.01	4.08e-9
GAIA/GAIA3.G	DR3	6217.59	6719.55	5822.39	3294.02	10301.96	4052.97	3228.75	2.5e-9
GAIA/GAIA3.Grp		7769.02	7939.10	7619.96	6196.05	10422.96	2924.44	2554.95	1.27e-9

http://svo2.cab.inta-csic.es/svo/theory/fps3/index.php

Gaia focal plan array





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 will release Grappa version of Gaia DR3 as Gaia EDR3 ready to be plug in Prismv11, CDC, ...

Gaia DR3 catalog accy

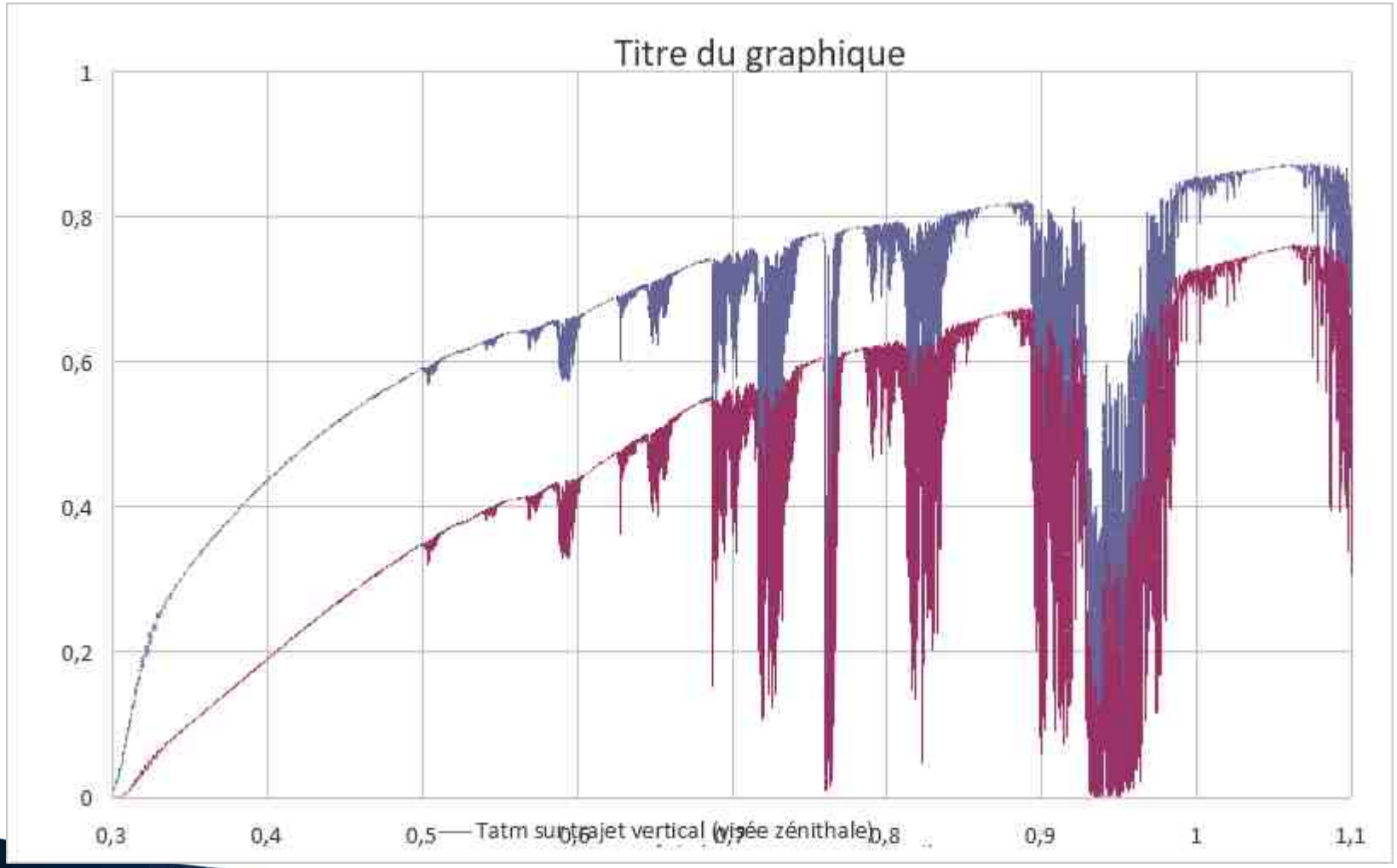
- Photometry (G, GBP, and GRP published as part of Gaia EDR3, OTHER DATA ARE NEW IN GAIA DR3)

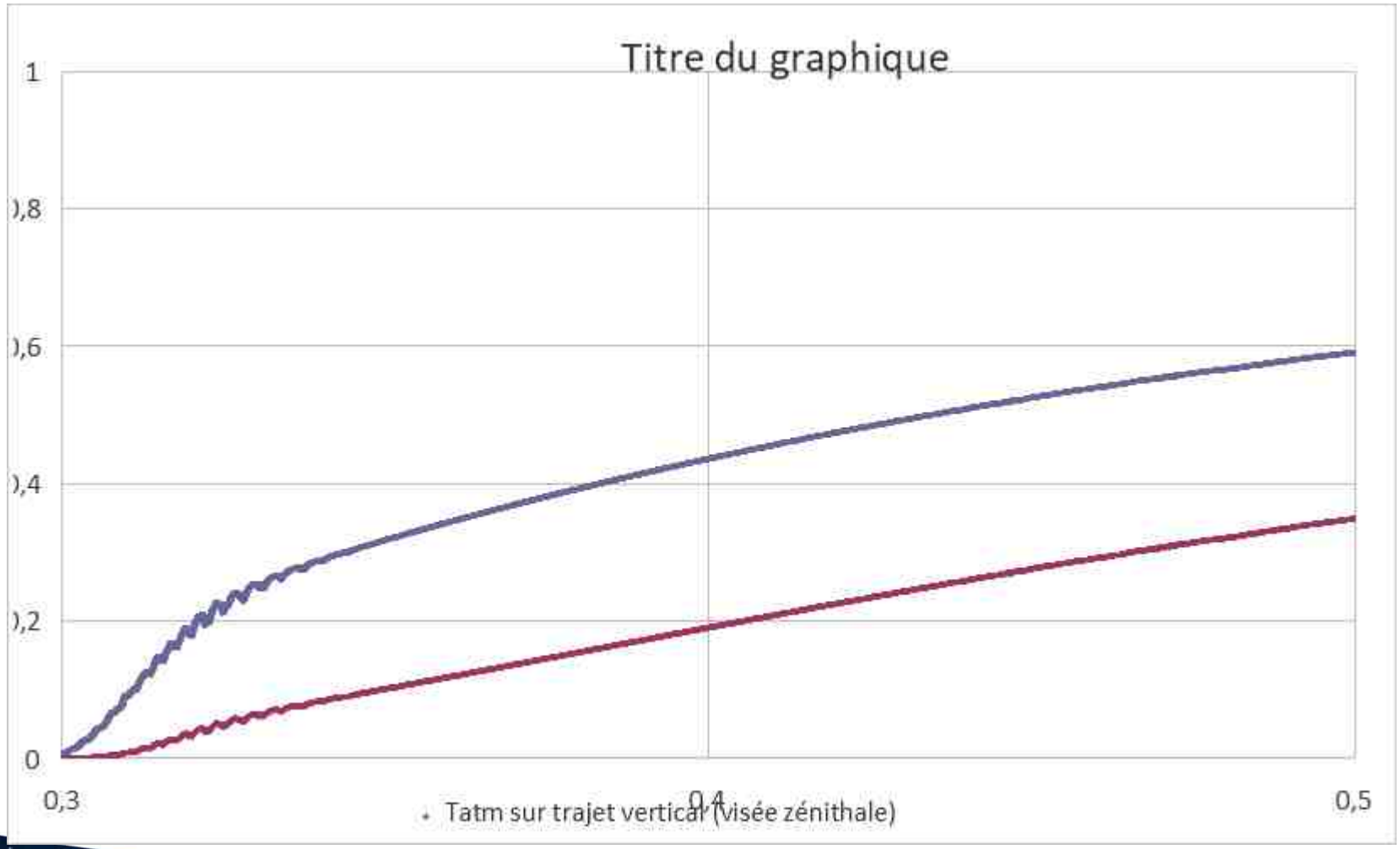
- The G-band photometric uncertainties are ~0.3 mmag for G<13, 1 mmag at G=17, and 6 mmag at G=20 mag.
- The GBP-band photometric uncertainties are ~0.9 mmag for G<13, 12 mmag at G=17, and 108 mmag at G=20 mag.
- The GRP-band photometric uncertainties are ~0.6 mmag for G<13, 6 mmag at G=17, and 52 mmag 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.

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

Atmospheric transmission 1 and 2 air mass




Titre du graphique
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),2
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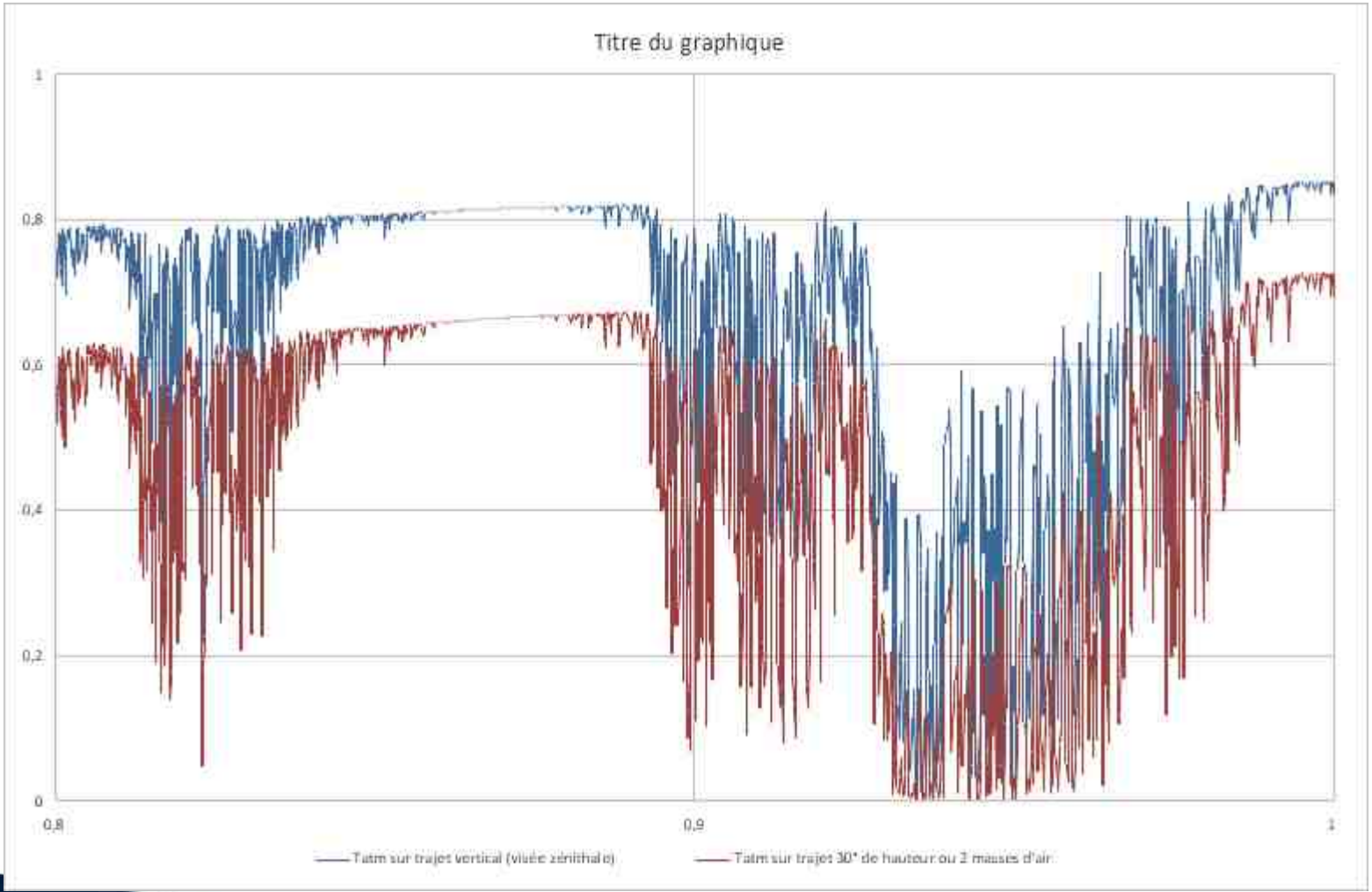
0,4
0,5
Tatm sur trajet vertical (visée zénithale)


Titre du graphique
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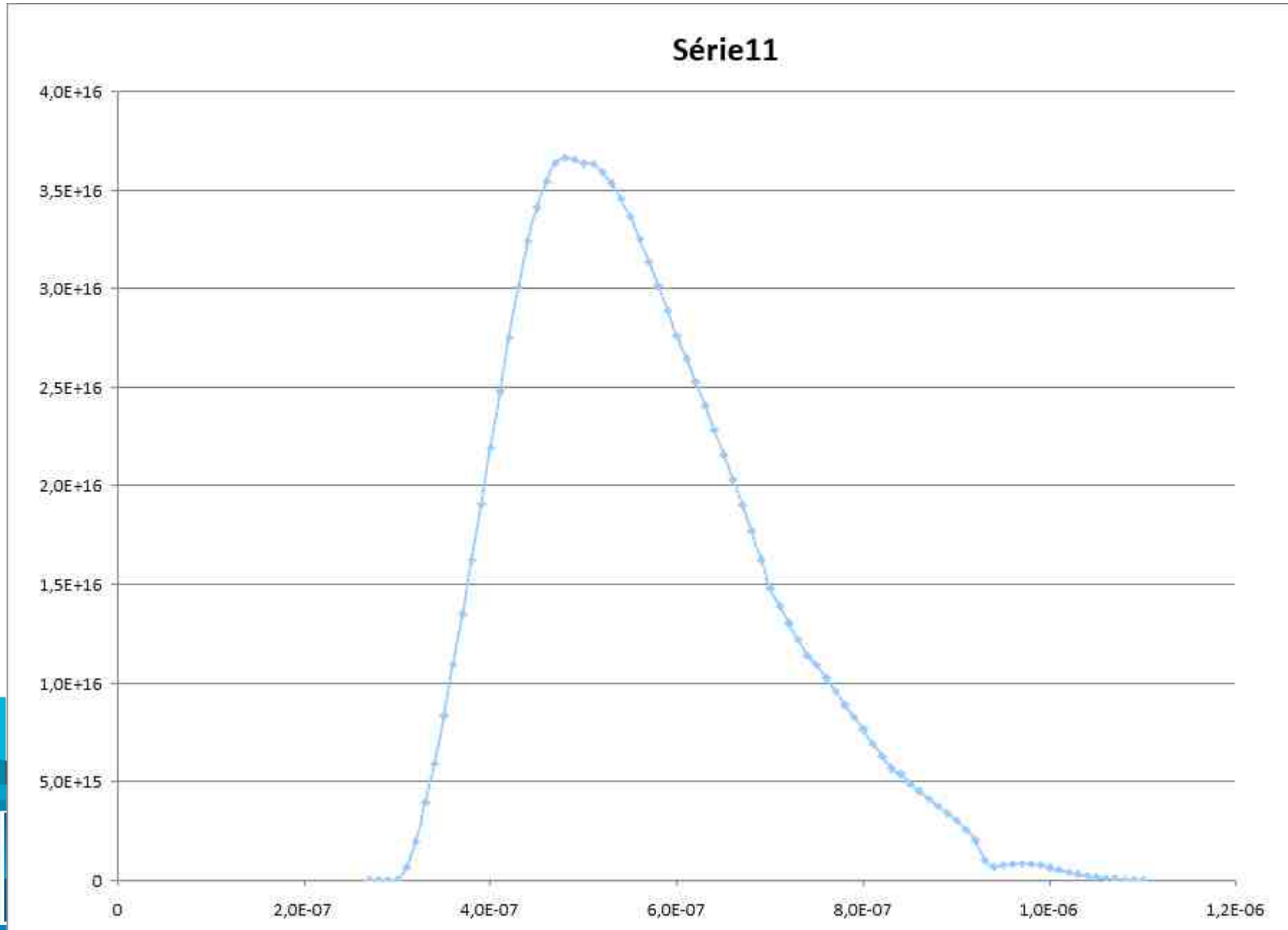
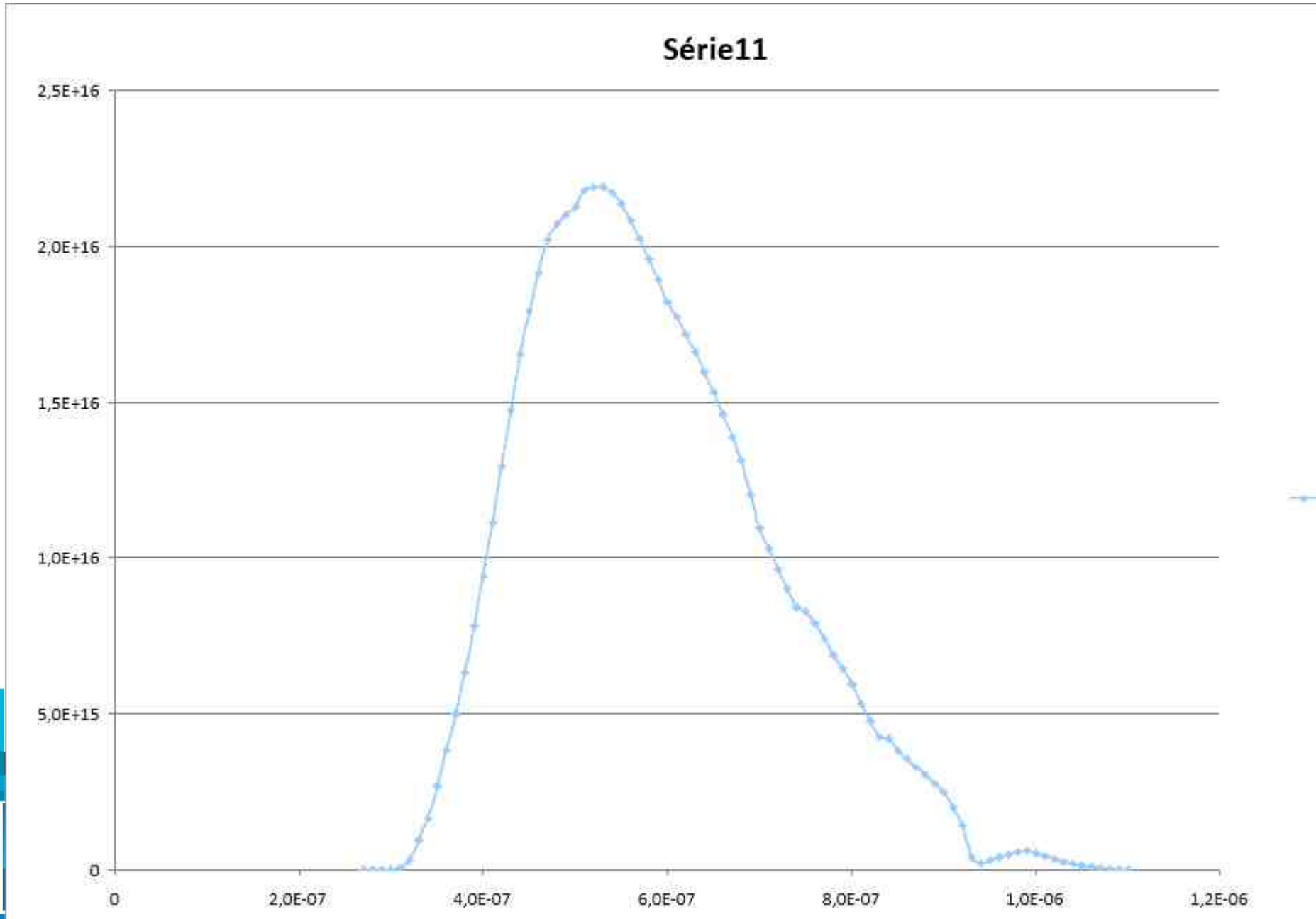
1
Tatm sur trajet vertical (visée zénithale)
Tatm sur trajet 30° de hauteur ou 2 masses d'air


Série11
4,0E+16
3,5E+16
3,0E+16
2,5E+16
2,0E+16
1,5E+16
1,0E+16
5,0E+15
0
0
2,0E-07
4,0E-07
6,0E-07
8,0E-07
1,0E-06
1,2E-06


Série11
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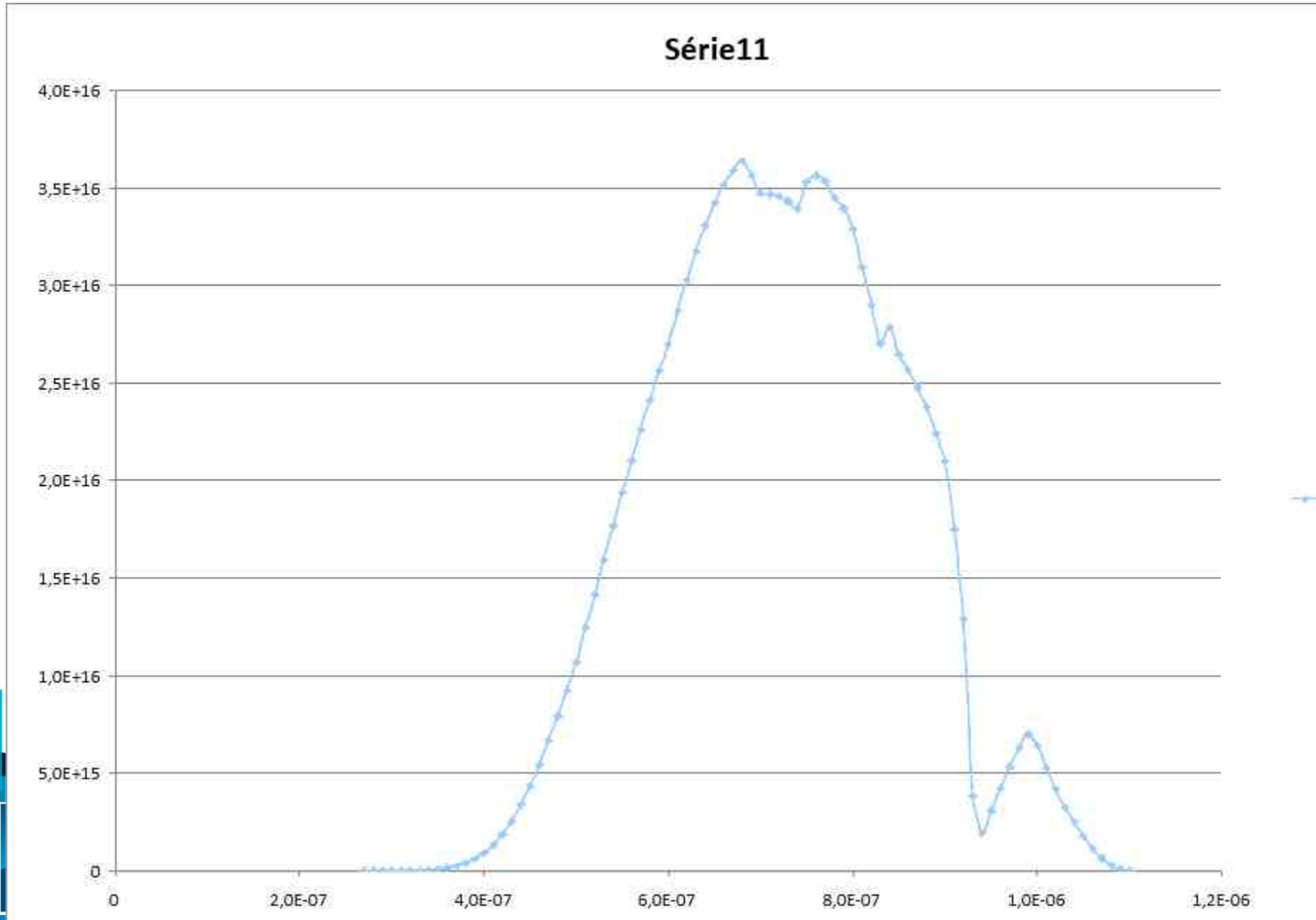
6,0E-07
8,0E-07
1,0E-06
1,2E-06


Série11
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3,5E+16
3,0E+16
2,5E+16
2,0E+16
1,5E+16
1,0E+16
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2,0E-07
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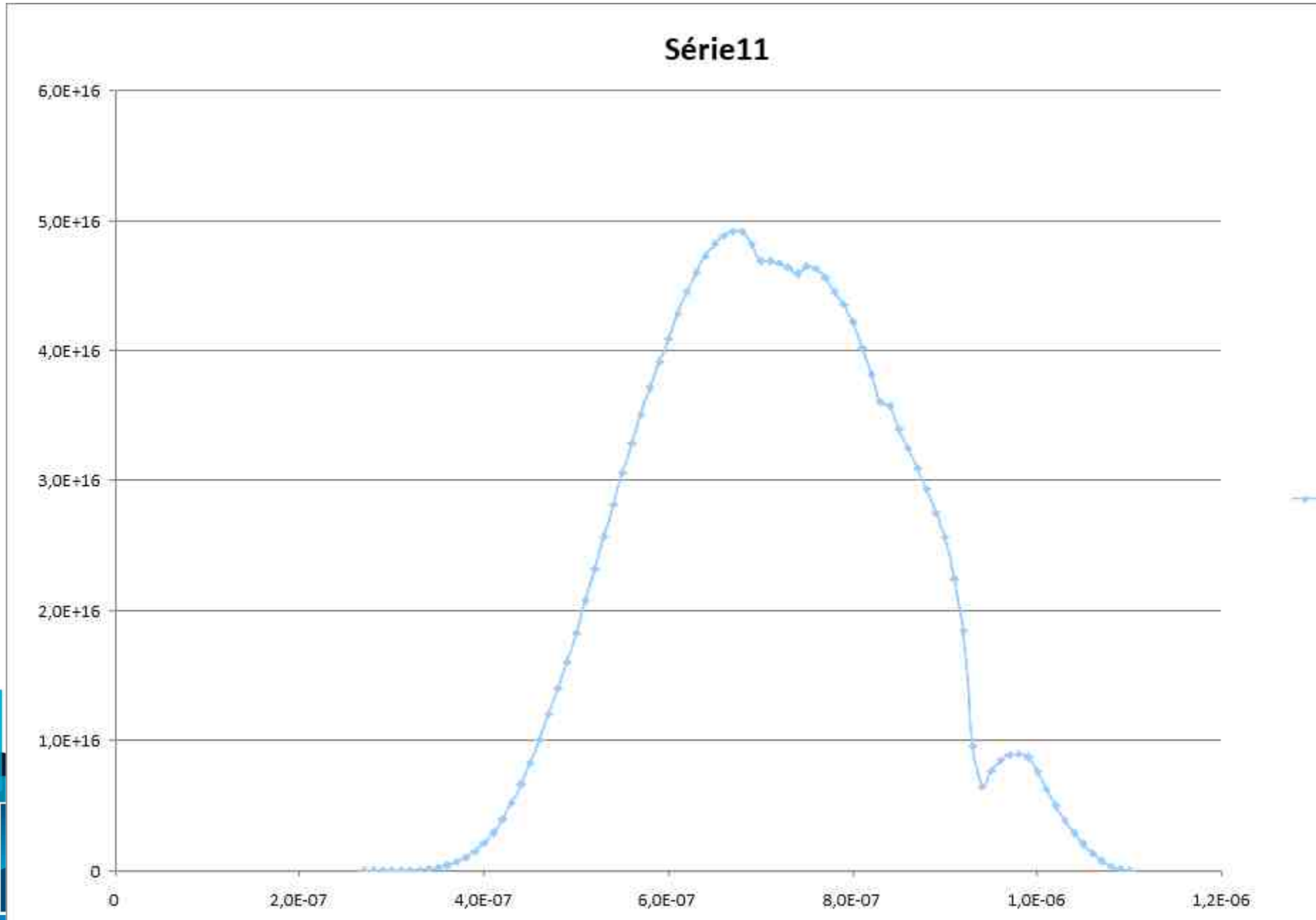
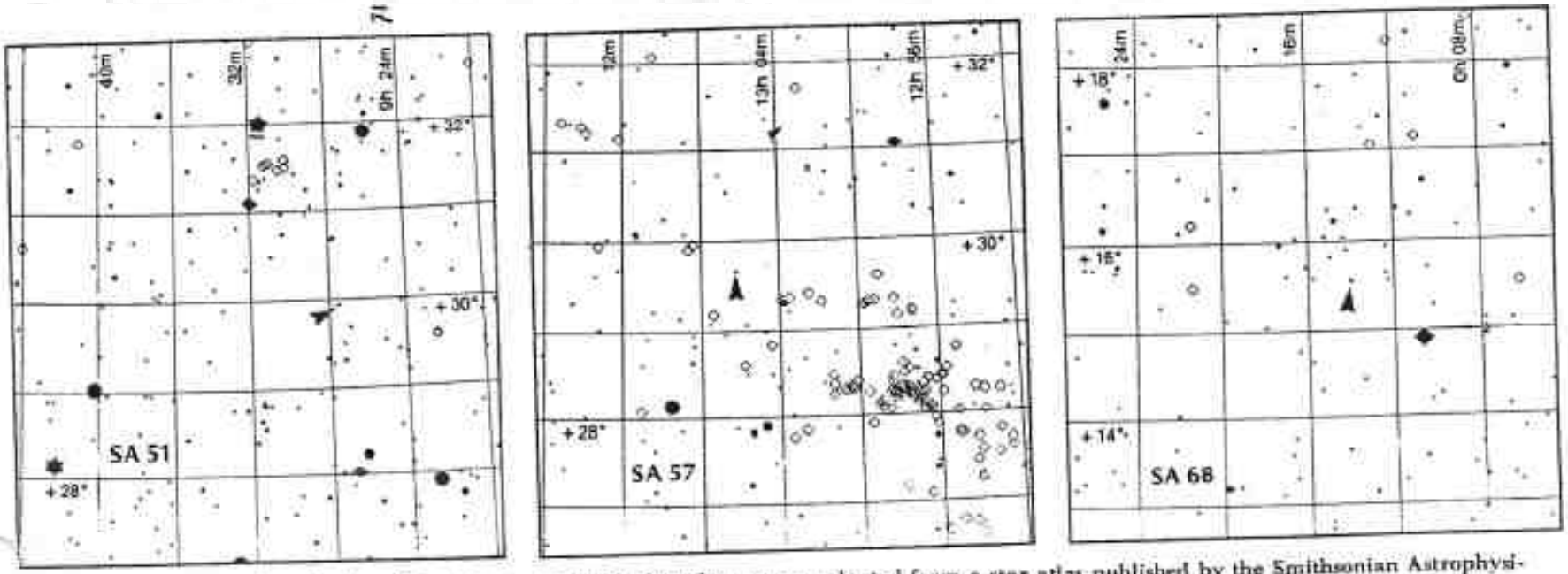
6,0E-07
8,0E-07
1,0E-06
1,2E-06


Série11
6,0E+16
5,0E+16
4,0E+16
3,0E+16
2,0E+16
1,0E+16
0
0
2,0E-07
4,0E-07
6,0E-07
8,0E-07
1,0E-06
1,2E-06

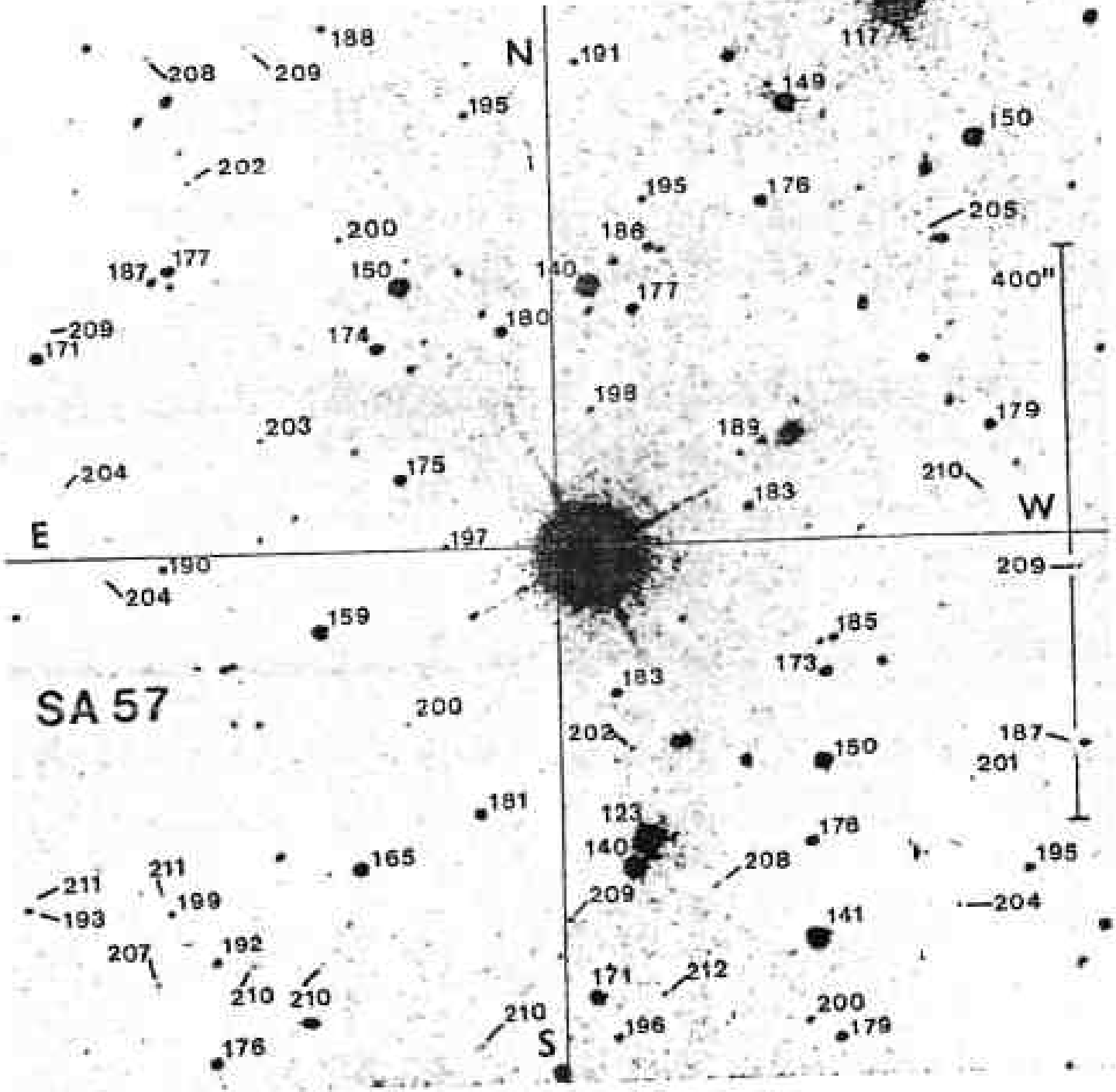
Selected areas to assess limiting mag

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 Pegasi.


SA 57
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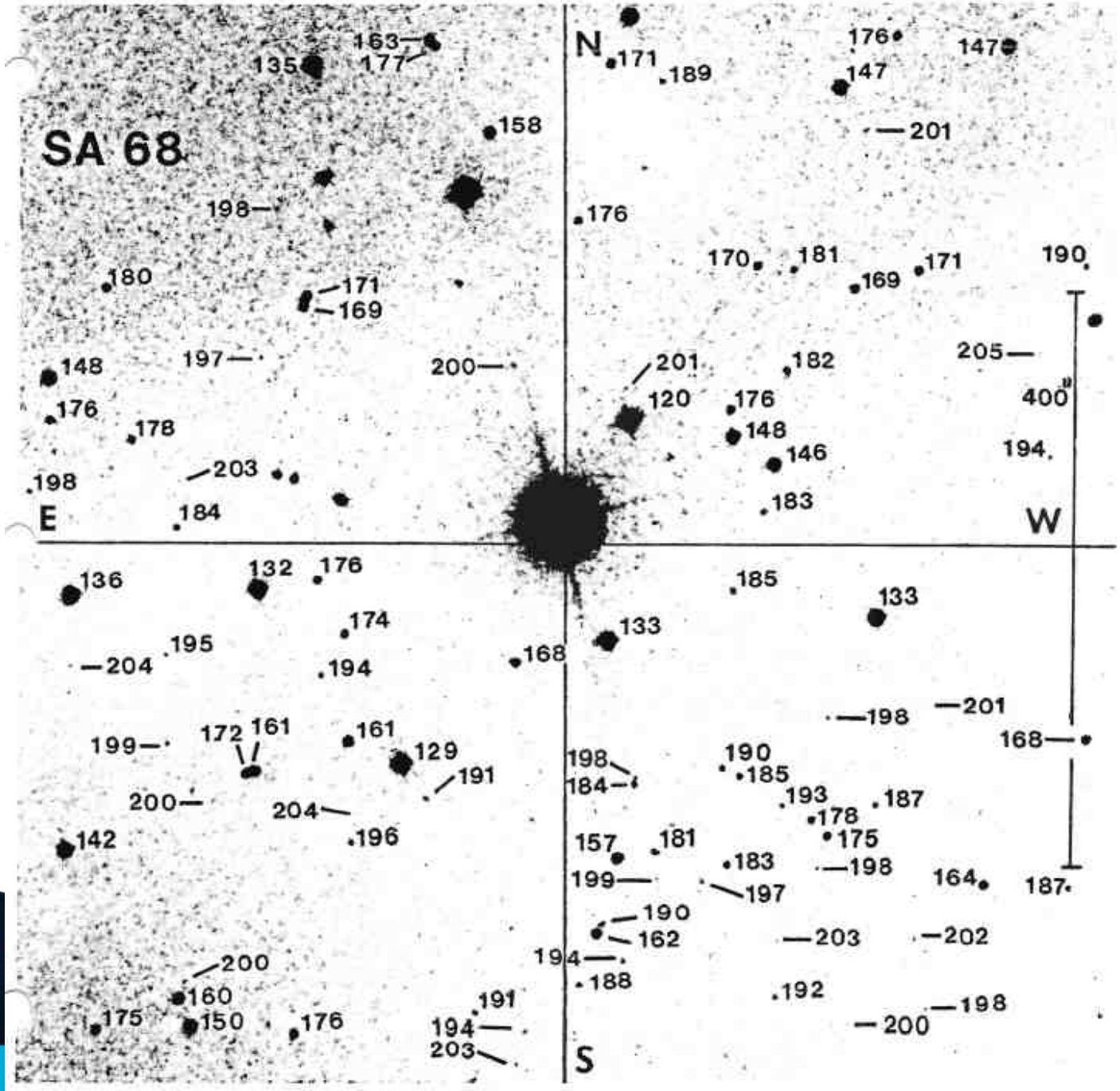
SA 68
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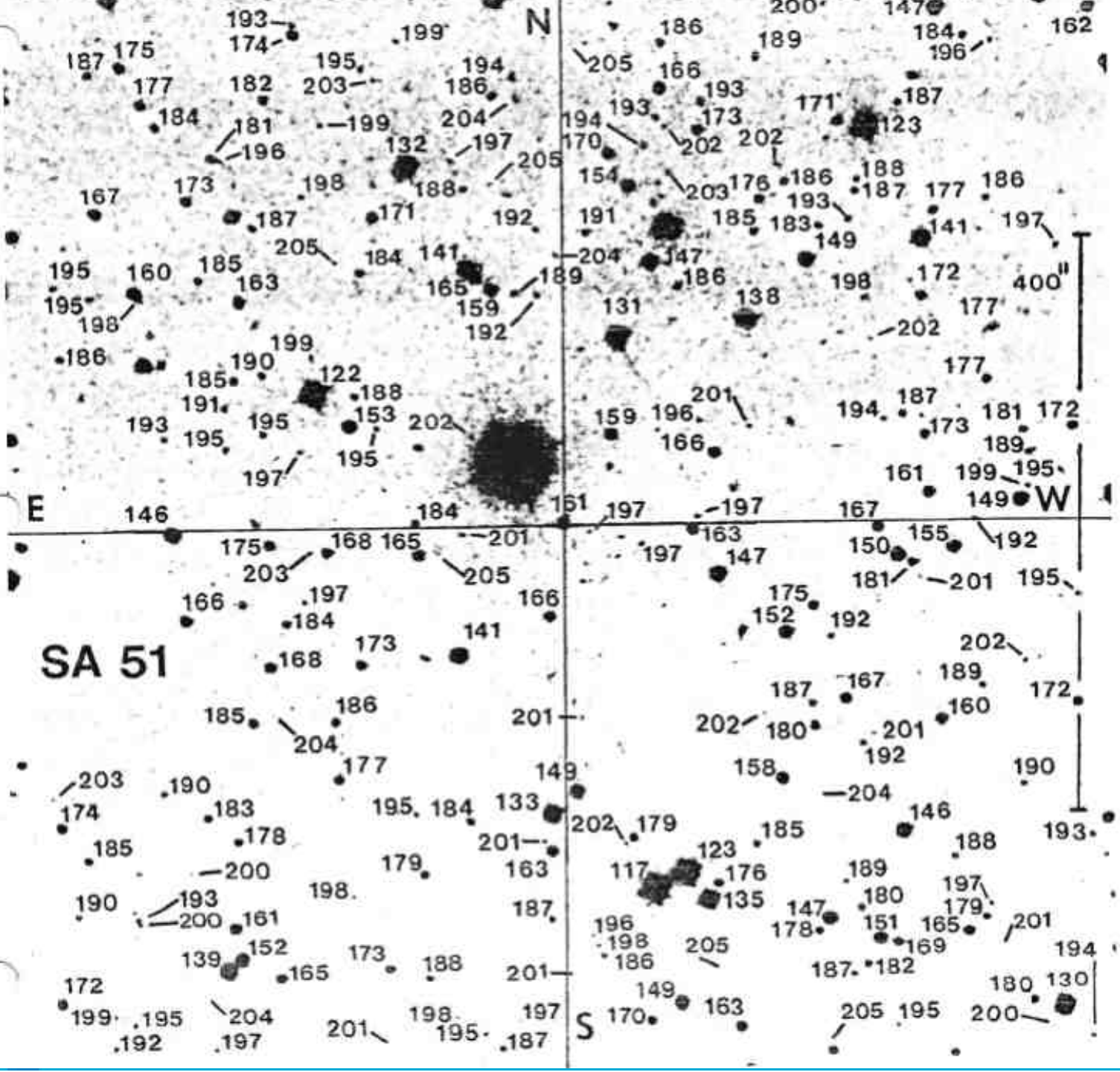

N
E
W
S
SA 51
400"

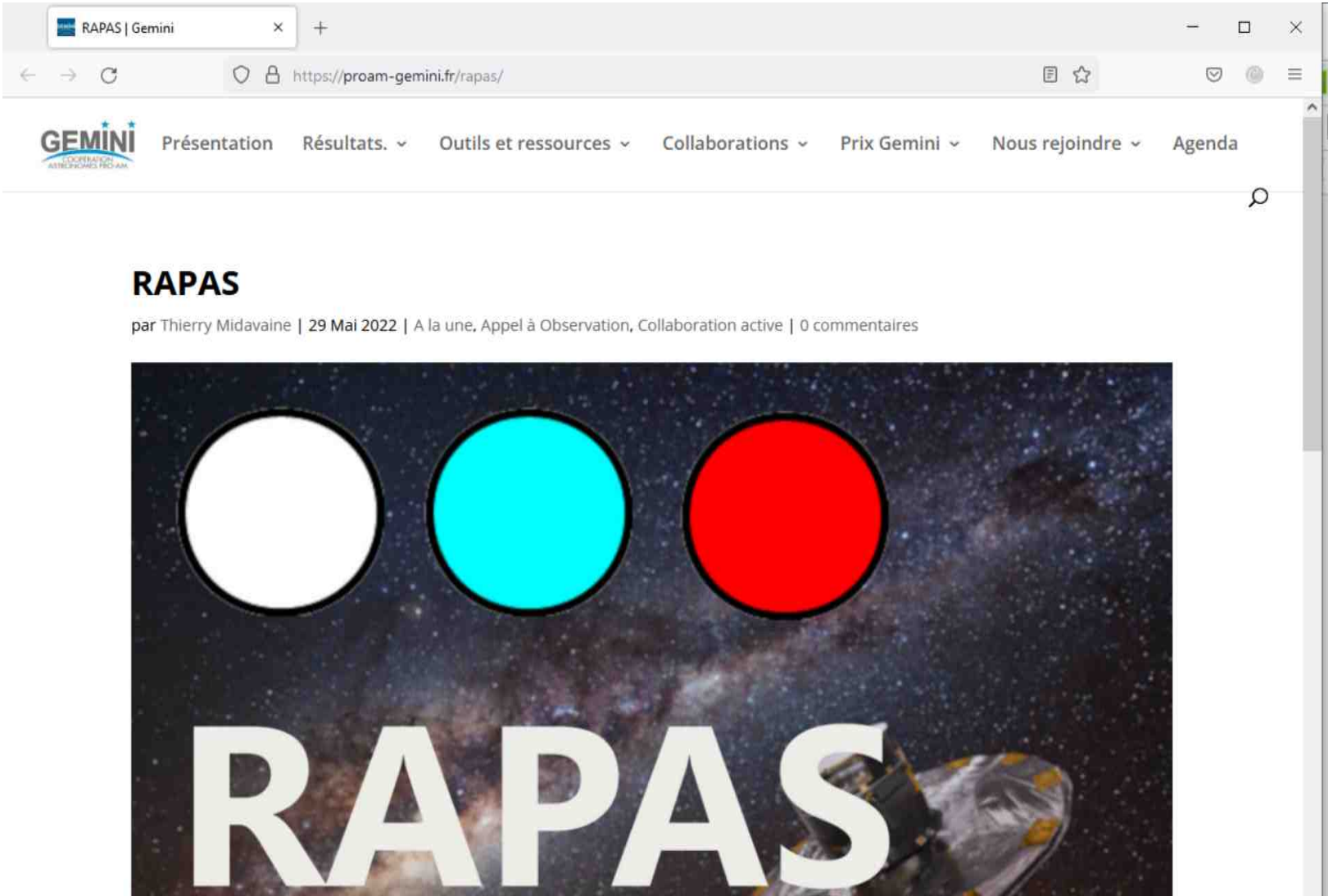
5 stacked 60s exposures
500 mm aperture
1400 mm focal length
IMX455 CMOS detector
less than 1,5^{e} rms noise

FOM = 30
1,5 x 1°²
20
1min

Thierry Midavaine

Registration to the RAPAS network

- Web Gemini: https://proam-gemini.fr/rapas/



RAPAS workshop 8-9th octobre Paris obs

- Registration to the workshop :

https://centre-janssen.observatoiredeparis.psl.eu/-Kick-Off-meeting-of-the-ProAm-RAPAS-activity-215-?lang=en

Salle Denisse Observatoire de Paris

Workshop Agenda preliminary

- Alert Session
  - William Thuillot Michel Dennefeld : Alertes Gaia et autres alertes
  - William Thuillot : Alertes astrometriques
  - Lukasz Wyrzykowski : pour alertes astrophys.
  - Michel Dennefeld IAP : réponses aux alertes photometriques
  - Astro Colibri
- Filters specifications and design
  - Riello Gaia photometric system
  - Thierry Midavaine, Michel Dennefeld : specifications, conceptions et réalisations des filtres
- Instrument photometric model
- Photometric data reduction
  - Marc Serrau : Catalogue Gaia DR3 Grappa, Réduction photometrique automatique avec Prism V11
  - Livraison des données, entete FITS
  - Mesure de sa precision individuelle, mesure de la precision du reseau, dispersion residuelle
  - Conversion et ratachement dans le systeme SDSS
- Next steps
  - Michel Dennefeld : reponses aux alertes spectroscopiques
  - Christian Buil Michel Dennefeld : alertes spectroscopiques, aspects materiels (spectro)

RAPAS 2023 - 2024 on the way

- Qualify the photometric accy of the network
- Perform search and photometric data deliveries to prgm alerts

- Study enhanced filter set grade 2
- Production of filters set 2nd batch

- Study high efficiency low dispersion spectroscopic device