

SVOM First results after a year in orbit

Einstein Probe's contribution

Bertrand Cordier on behalf of the SVOM Collaboration

Site [SVOM](https://www.svom.eu/) <https://www.svom.eu/>

ATPEM 2025 – Paris
October 1st, 2025



The SVOM Consortium

- **China (PI J. Wei)**



- SECM Shanghai
- Beijing Normal University
- Central China University Wuhan
- Guangxi University Nanning
- IHEP Beijing
- KIAA Peking University
- Nanjing University
- NAOC Beijing
- National Astronomical Observatories
- Purple Mountain Observatory Nanjing
- Shanghai Astronomical Observatory
- Tsinghua University Beijing

- **Mexico** UNAM Mexico



- **France (PI B. Cordier)**



- CNES Toulouse
- APC Paris
- CEA Saclay
- CPPM Marseille
- LUX Meudon
- IAP Paris
- IRAP Toulouse
- IJCLab Orsay
- LAM Marseille
- LUPM Montpellier
- OAS Strasbourg

- **UK** University of Leicester



- **Germany**



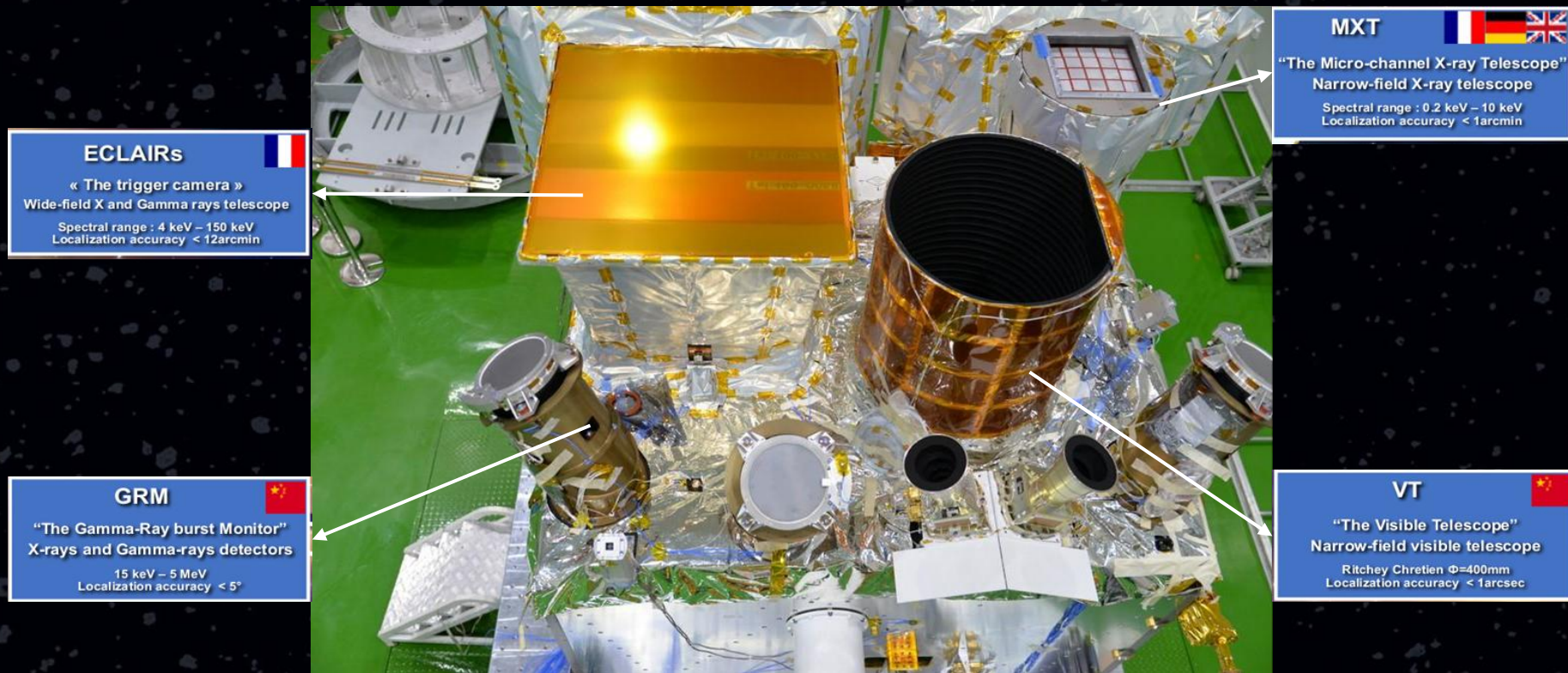
- MPE Garching
- IAAT Tübingen

<https://fsc.svom.org/home/collaboration/collaborators>

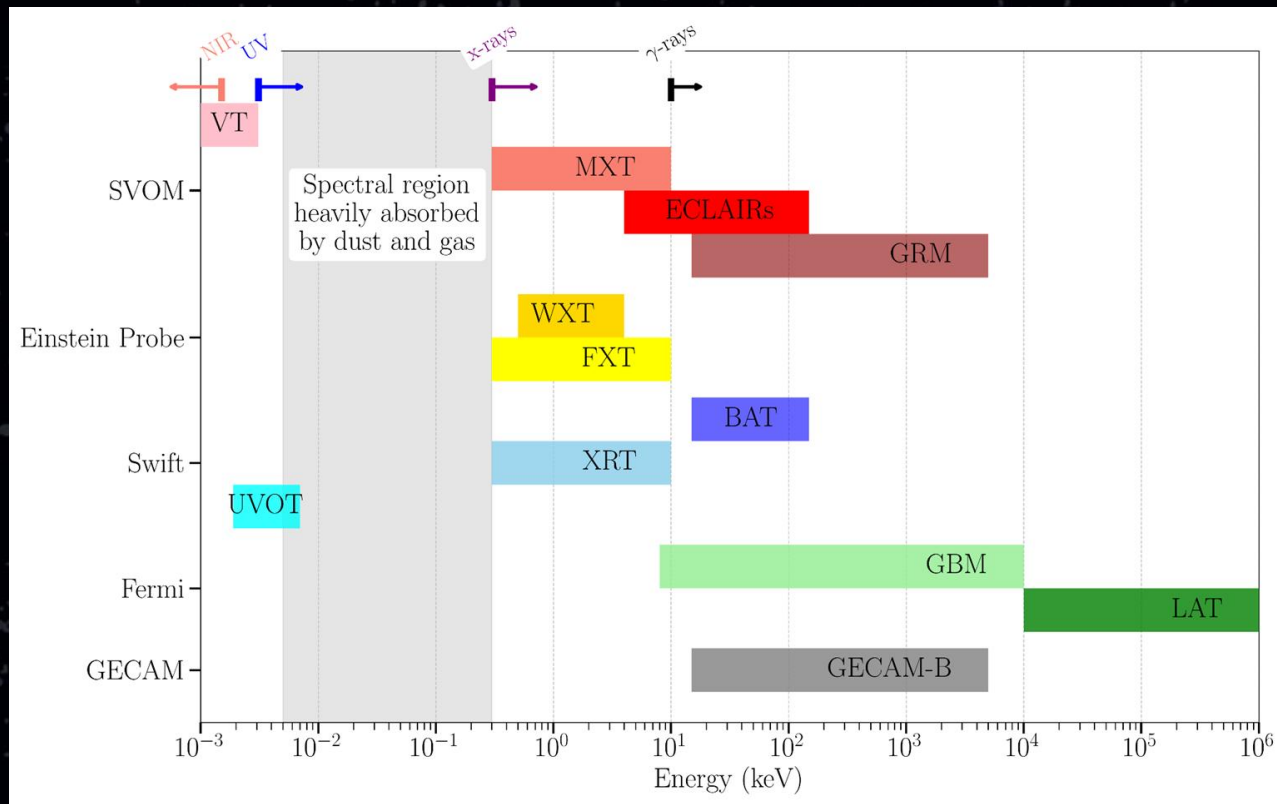
ATPEM 2025 – Paris
October 1st, 2025



The Space Variable Objects Monitor (SVOM)



SVOM: a unique spectral range to study the high-energy transients



They (except GRM) localize
(<10 arcmin)

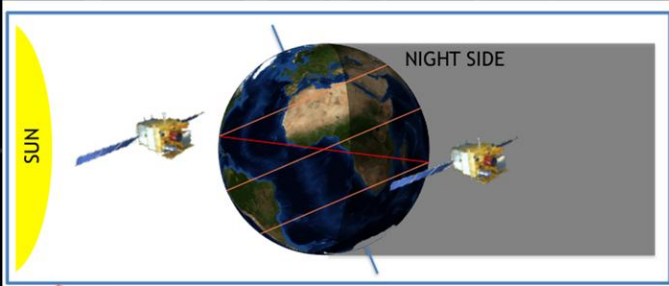
+

onboard auto
follow-up of
sources

SVOM is placed in a Low Earth Orbit (LEO)

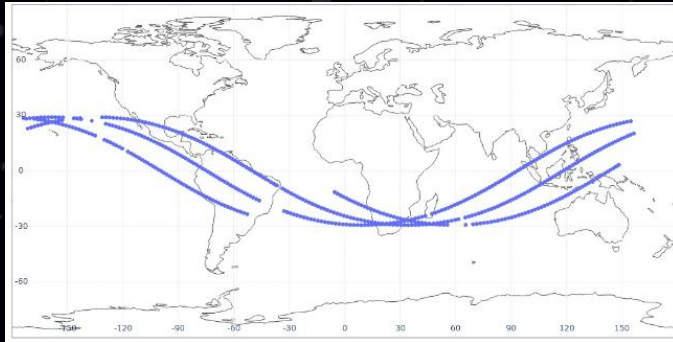
Anti-Solar pointing strategy

~625 km, ~29° inclination angle, 1 orbit ~ 96min



The satellite track on Earth

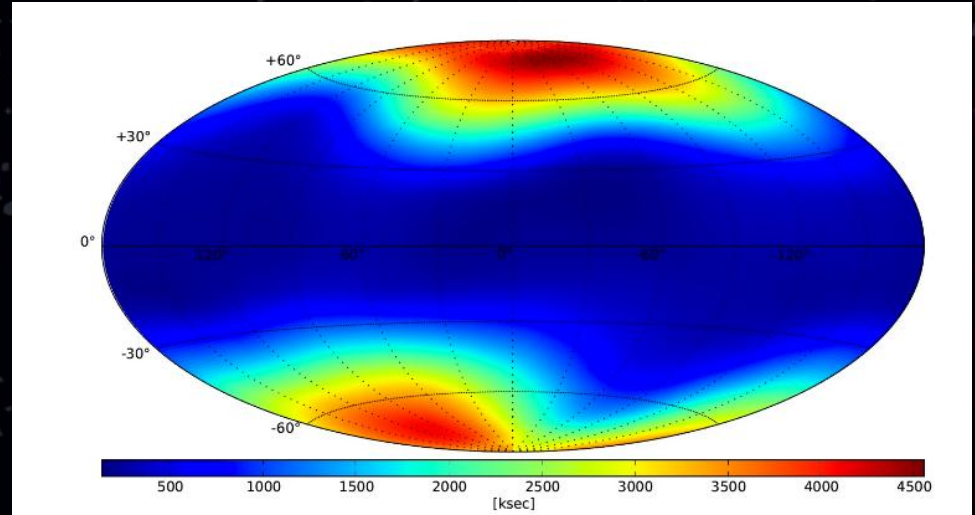
+/- 30° latitude



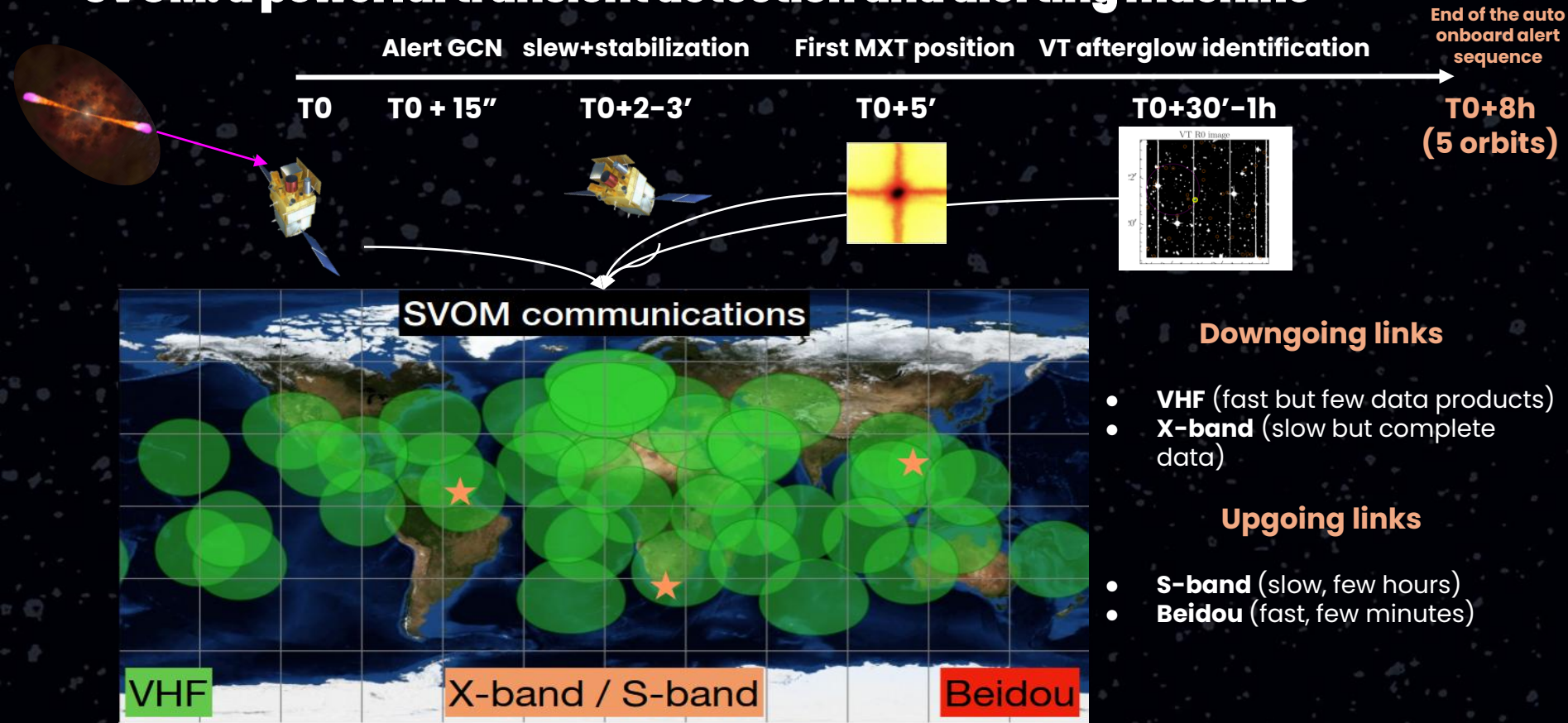
ECLAIRs exposure map simulation (over a year)

Initial Hypothesis: 65 GRBs/year, 1 ToO per day

- 4 Ms in the direction of the galactic poles
- 500 ks on the galactic plane

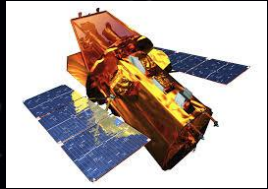


SVOM: a powerful transient detection and alerting machine



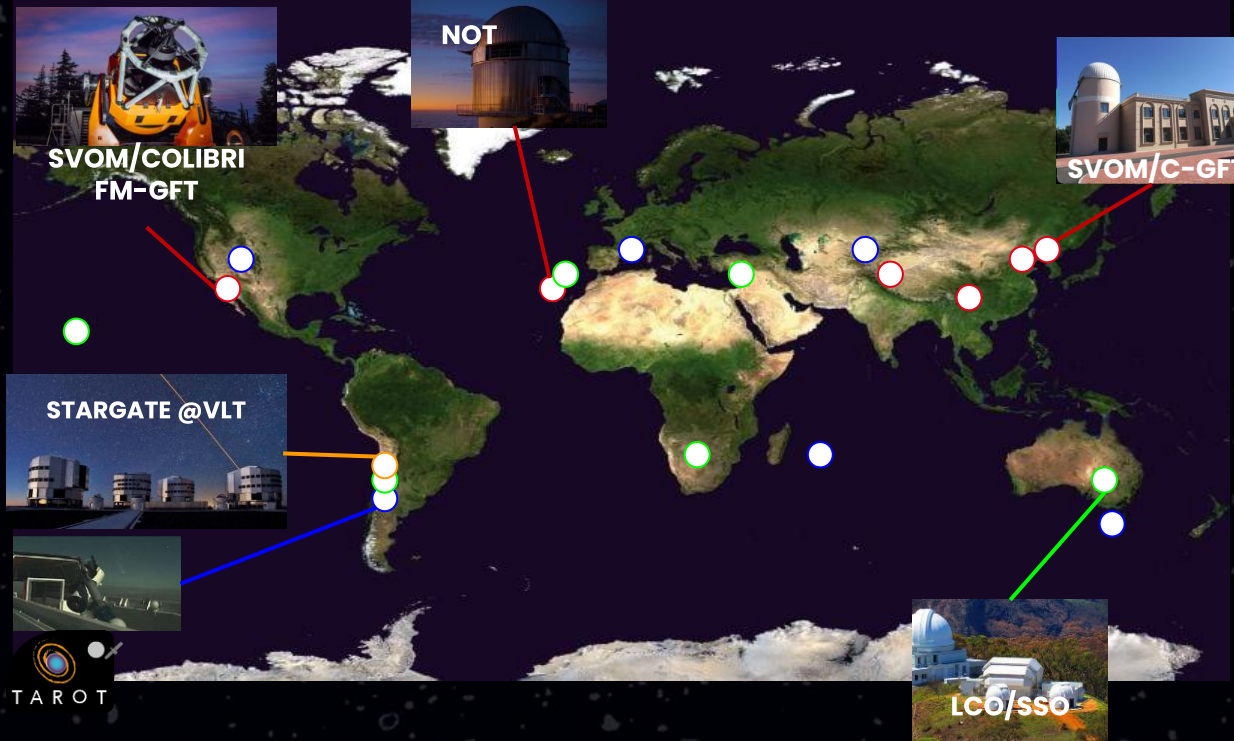
SVOM: Boosting the space and ground-based telescope synergies

**Great synergies
with Einstein Probe
and Swift teams**



**Automatic ToO
request to
EP-FXT
(since April 2025)
and
Swift-XRT
(since Feb. 2025)**

**A dedicated ground-based follow-up segment
from 25 cm to the 8m class telescopes**



**Official
Partners**

**Associate
Partners**

**Purchase of
time
(LCOGT time
coming 2025B)**

**Close
collaboration**

ATPEM 2025 – Paris
October 1st, 2025



SVOM: the scientific programs



The SVOM Core program

reserved to SVOM Co-Is

Two SVOM science groups :
GRB science : F. Daigne
Observatory Science : A. Coleiro

ToO scientist : Cyril Lachaud

Gamma-ray bursts

The General & ToO programs

GP obs (known sources): Observation proposals awarded by a TAC (your proposal has to include a SVOM co-I).

ToO obs (not anticipated flaring sources): If you want a ToO, please contact the SVOM PIs



Magnetar Giant flares



CVs, x-ray
binaries



Flaring stars



AGNs/Blazars



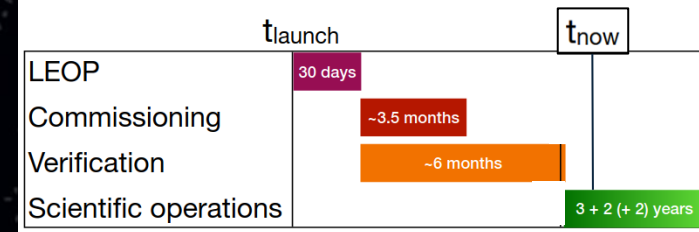
Supernovae

TDE, FRB, etc.

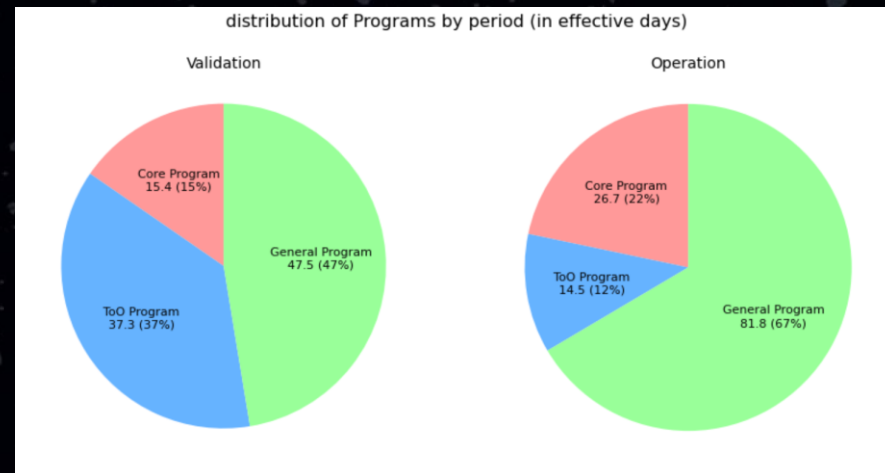
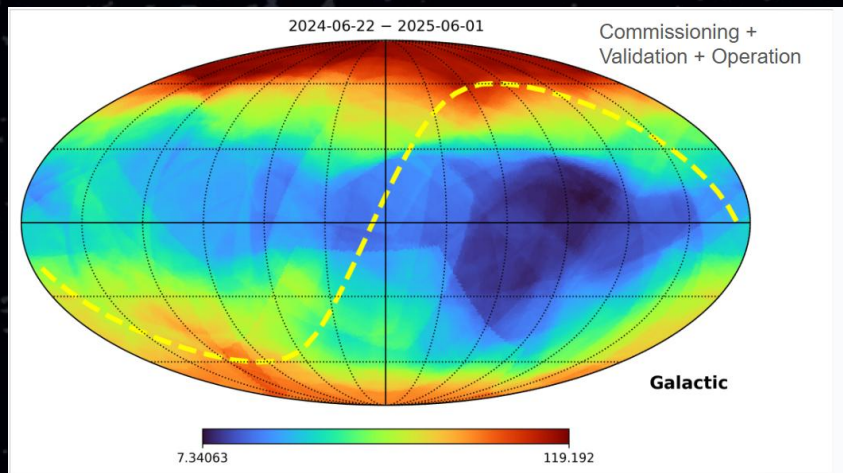
2024 June, 22nd when the SVOM story began



Post-launch phases



A year of observations

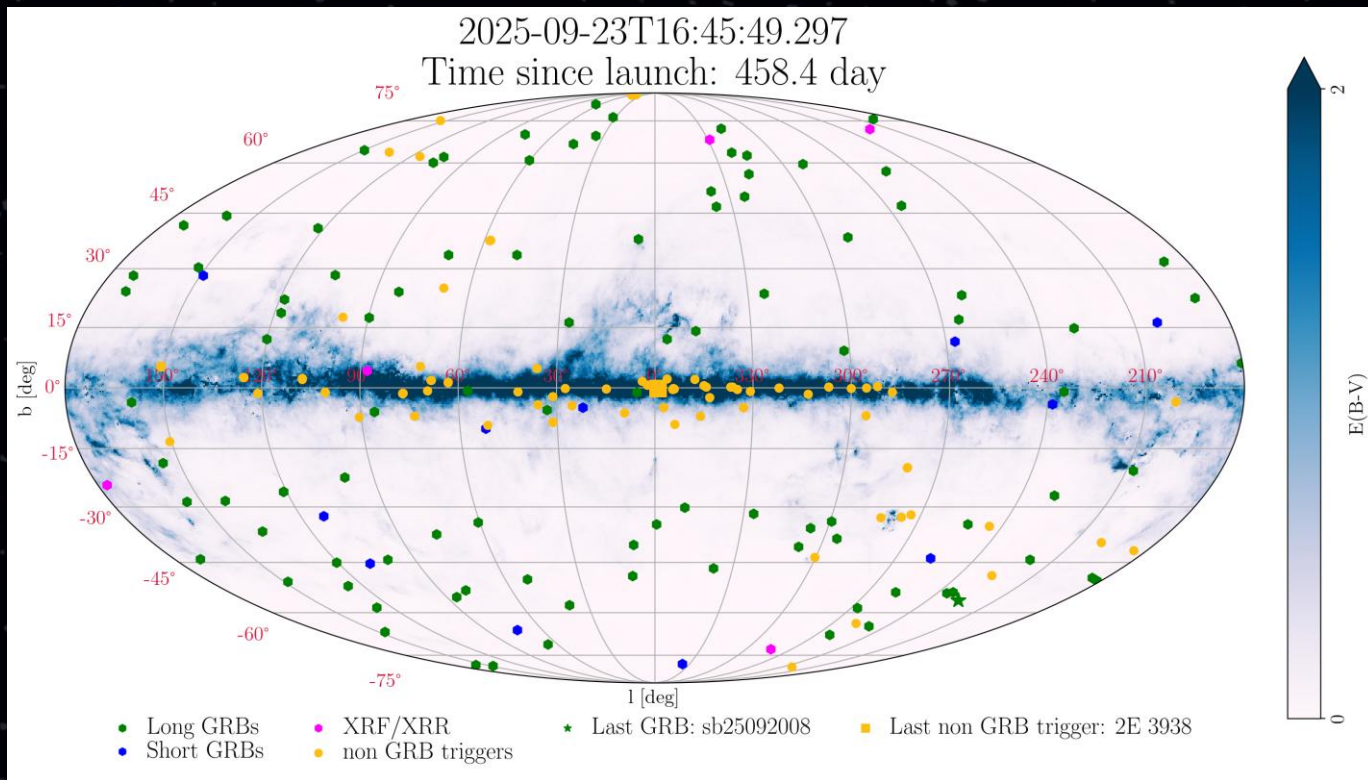


Commissioning : 22/06/2024 - 01/10/2024

Validation : 10/01/2024 - 15/01/2025

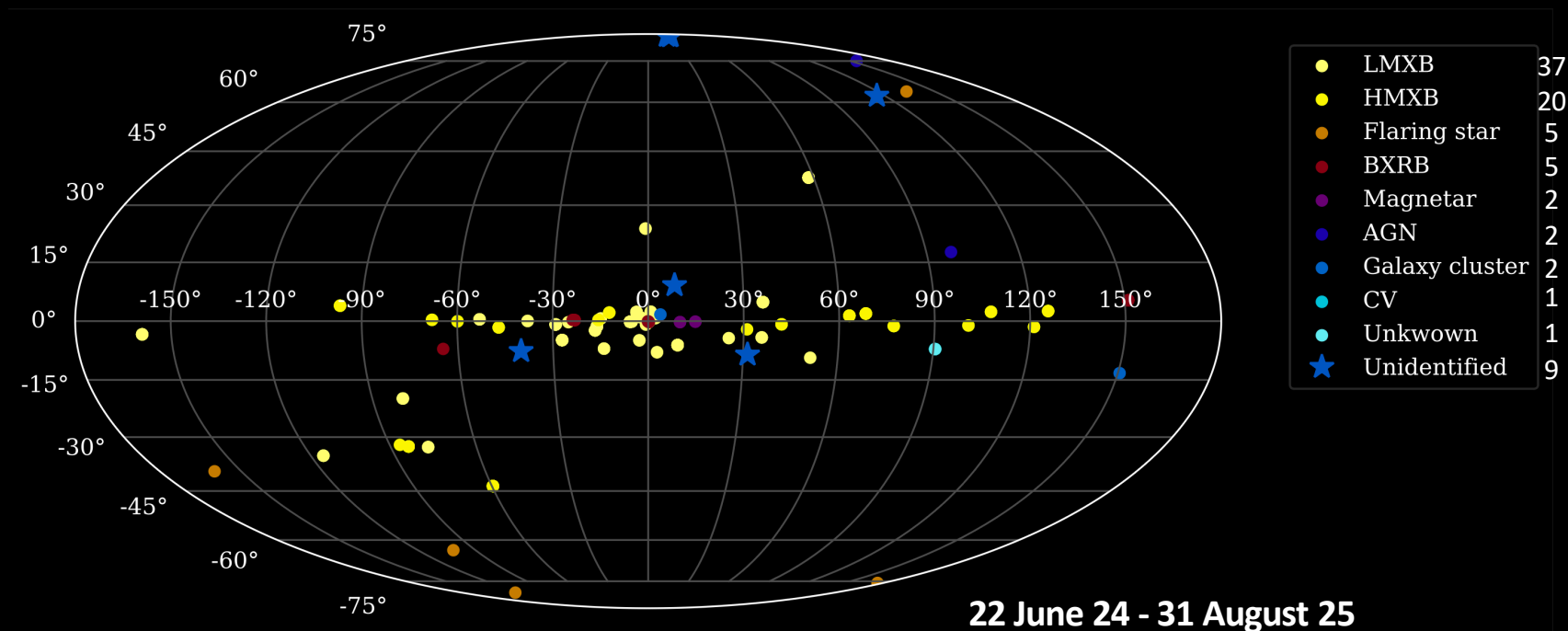
Scientific exploitation : 15/01/2025 - 01/10/2025 -> Nominal scientific operation

1 year after launch: the SVOM x-ray/ γ -ray transient sky



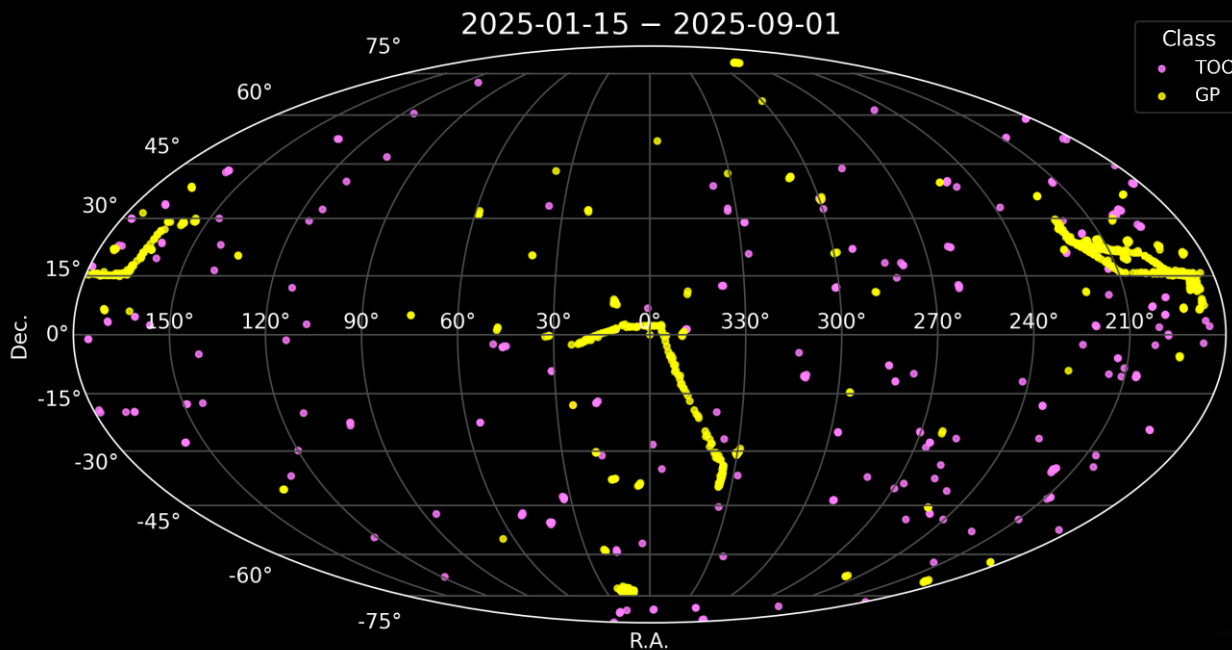
Observatory science

Serendipitous High-Energy Source detection by ECLAIRs

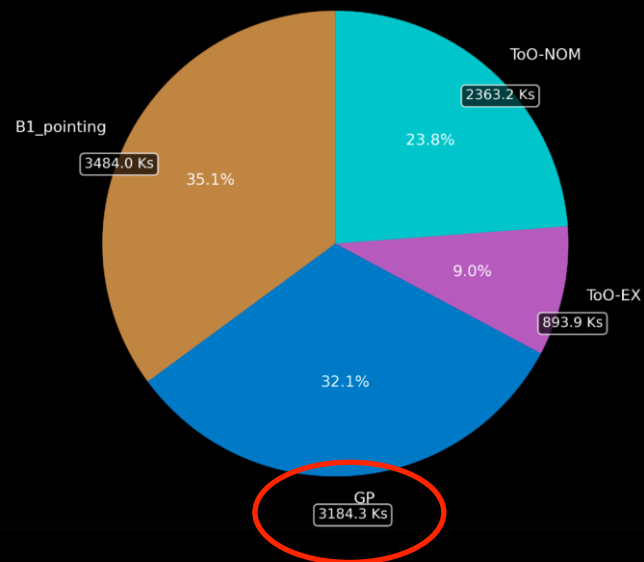


Observatory science

SVOM General Program (pointed observations driven by MXT and VT)



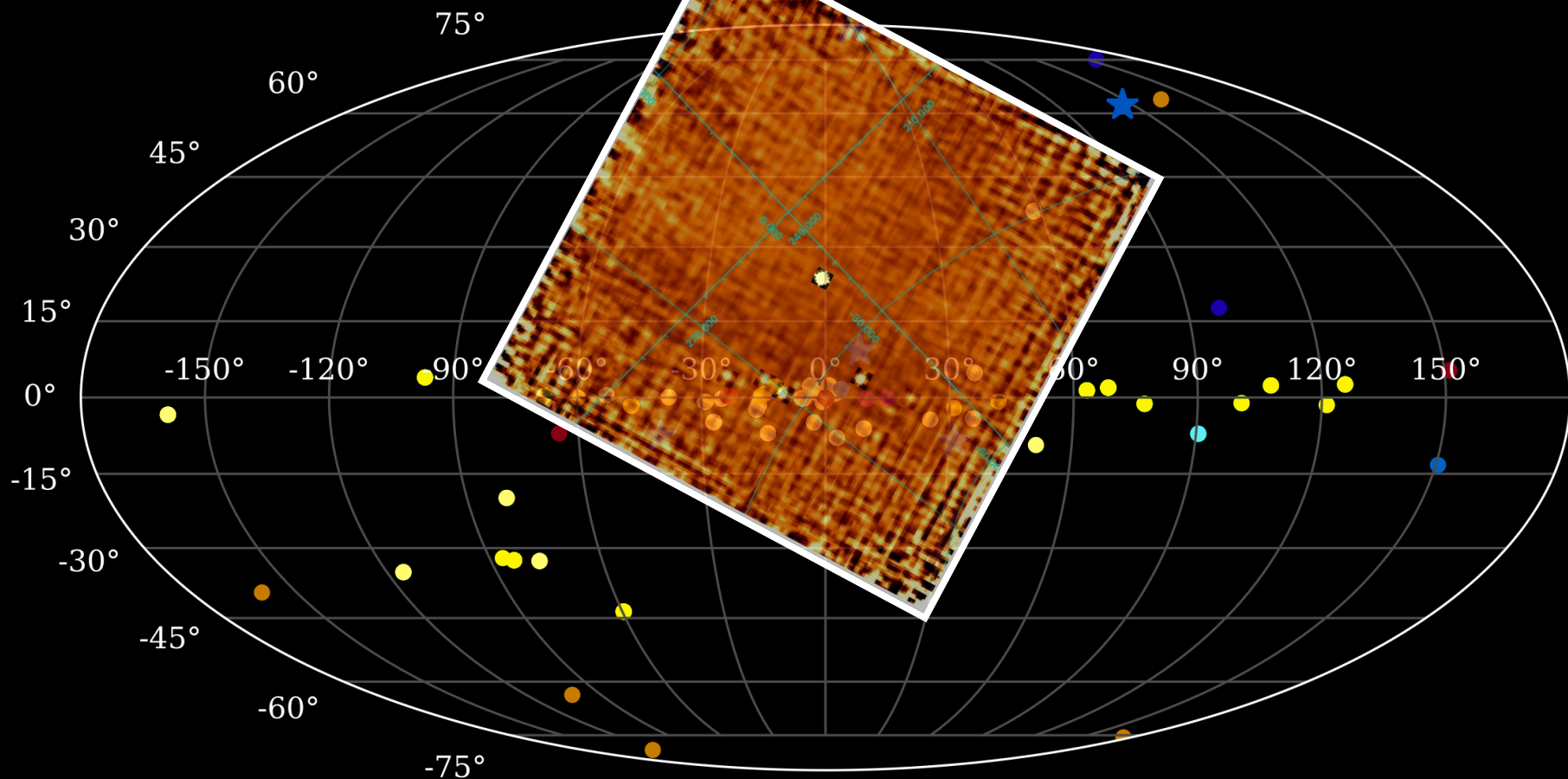
Sept. 2024 - Sept. 2025 Observing
Time distribution



- Call for proposals for 2026 (open to SVOM co-Is and affiliate scientists) - circulated on ATPEM newsletter in June

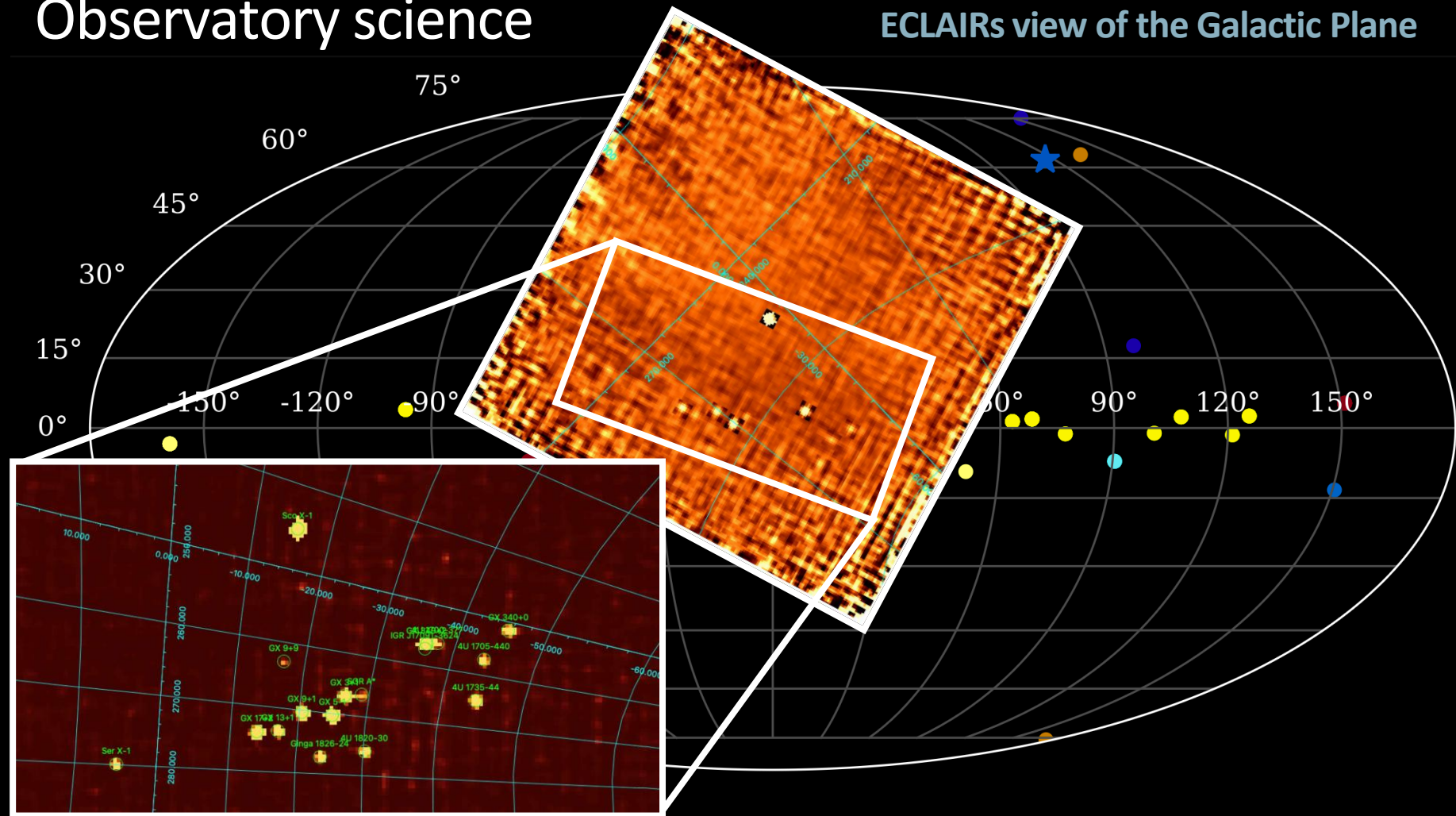
Observatory science

ECLAIRs view of the Galactic Plane



Observatory science

ECLAIRs view of the Galactic Plane

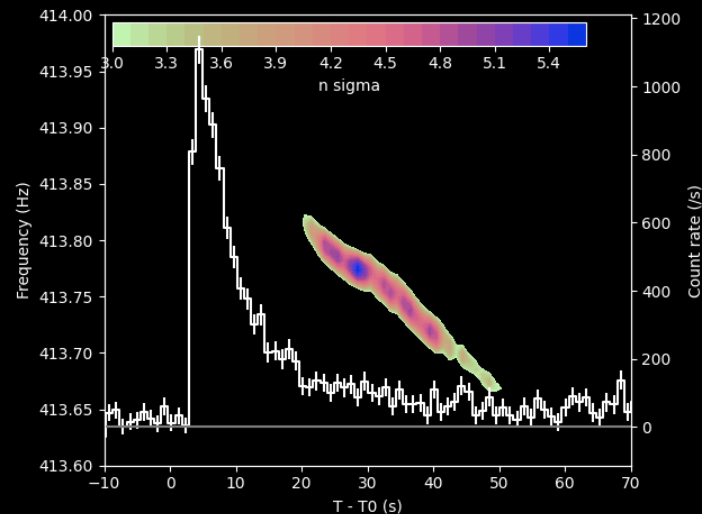
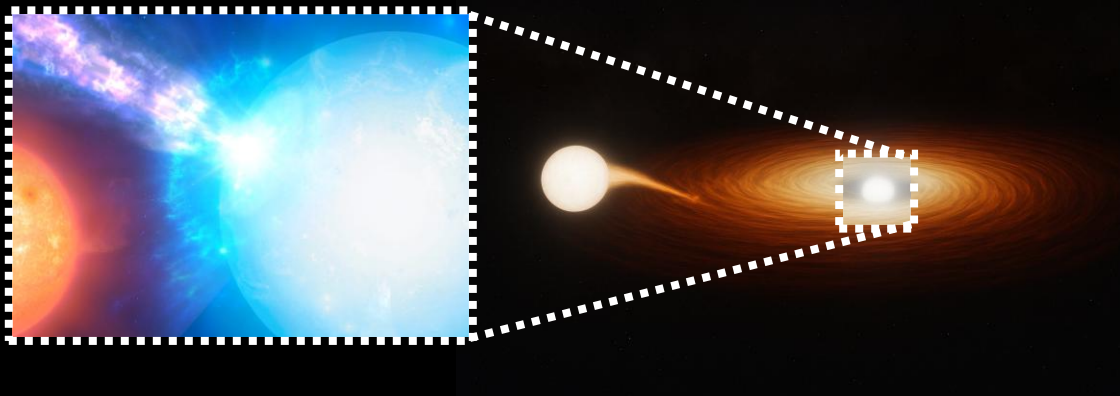


Observatory science

ECLAIRs: a Type I X-ray burst hunter !

~150 bursts from 37 different sources detected so far

Le Stum et al. (In prep)



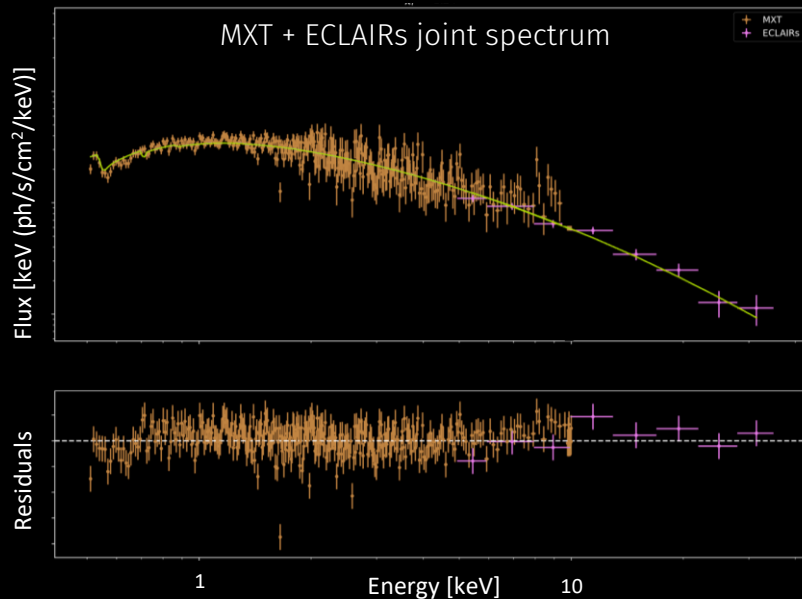
ECLAIRs detection of a **type I burst** of 4U 0614+014 on **January 10 at 15:58:02 (UTC)** - *Cangemi et al. (2025)*

- Detection of the **neutron star pulsation** at **413.69 Hz**
- **Decrease of the oscillation frequency** observed during the burst (rare behavior still to be explained)
- **First SVOM observatory science article** to be submitted (S. Le Stum et al.)

Observatory science

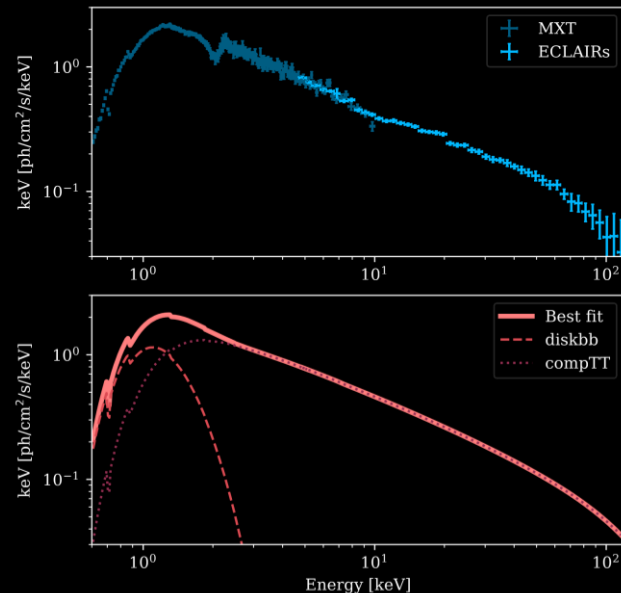
Detection and monitoring of accretion/ejection sources

X-ray outburst of the blazar 1ES 1959+650



- X-ray outburst detected by ECLAIRs on Dec. 06, 2024
- Joint monitoring with Swift/XRT - A. Foisseau et al. (to be submitted)

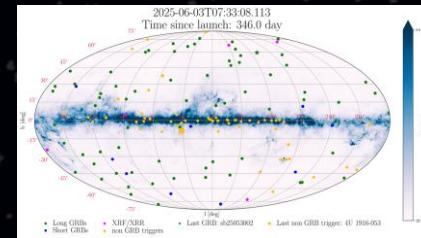
Joint MXT-ECLAIRs spectrum of Cyg X-1



- Weekly monitoring with SVOM (F. Cangemi et al.).
- Joint spectrum typical of the source hard state

Gamma-ray burst science

Gamma-ray Burst general statistics (on 1 October 2025)

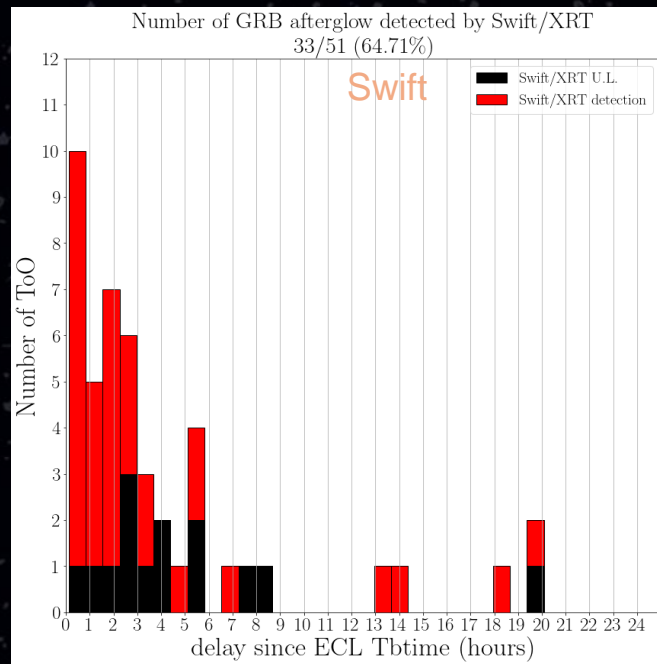
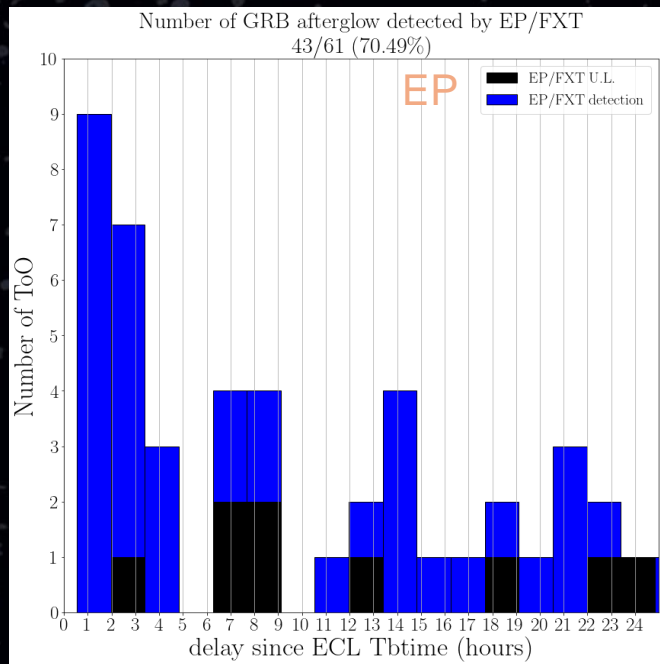


GRM detection	ECL detection	Total ECL+GRM Detection	Jointly detected by other missions	# z_{GRM}	# z_{ECL}
144	62	169 129 Long (76%), 25 Short (15%), 15 XRF (9%)	115 (68%)	11 (8%)	24 (39%)

	ECL median loc.	MXT median loc.	x-ray afterglows	Optical afterglows	Radio afterglows	$z > 4$
	$\sim 7'$	$\sim 40''$	67 (48 ECL)	49 (37 ECL)	5	4/35 (12%)

Gamma-ray burst science

X-ray follow-up, EP and Swift contribution

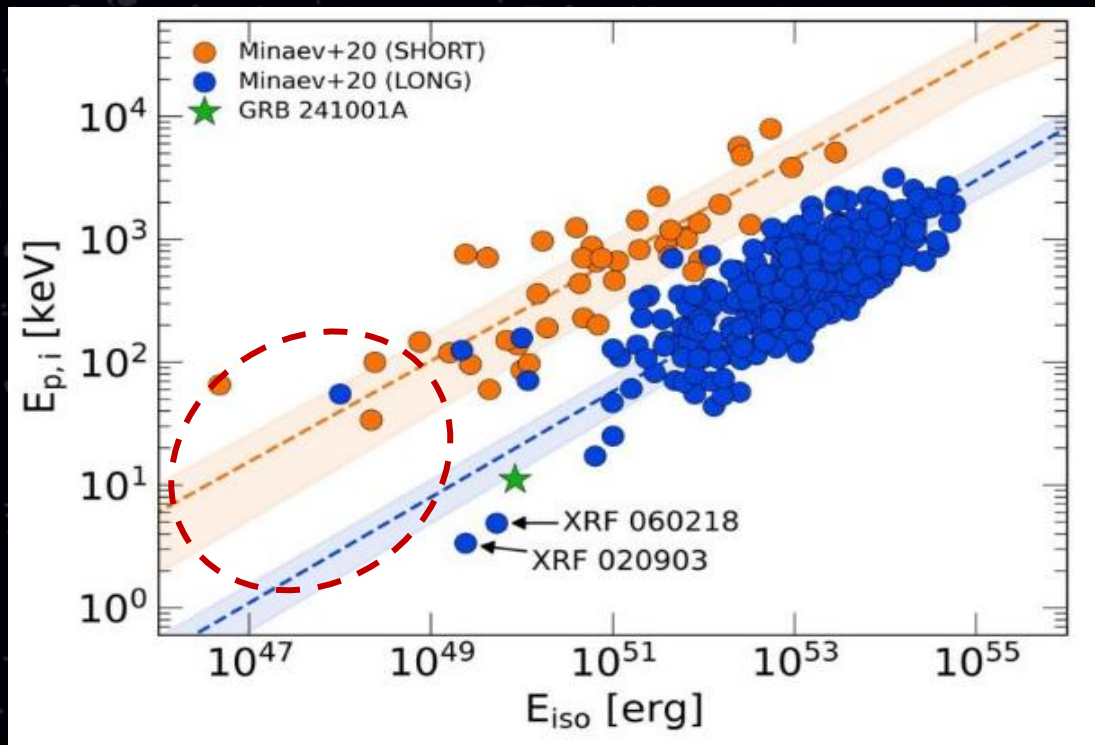


Gamma-ray burst science

SVOM to explore the poorly known XRR/XRF burst population

Our goal: bring a complete physical interpretation of the poorly known population of **very soft x-ray burts**

- connection between classical collapsar GRBs and “failed” or low-luminosity GRB collapsars?
- Shock breakout emission?
- geometry effect \rightarrow off-axis jet?
- Low Γ jets?
- High- z redshift effect?

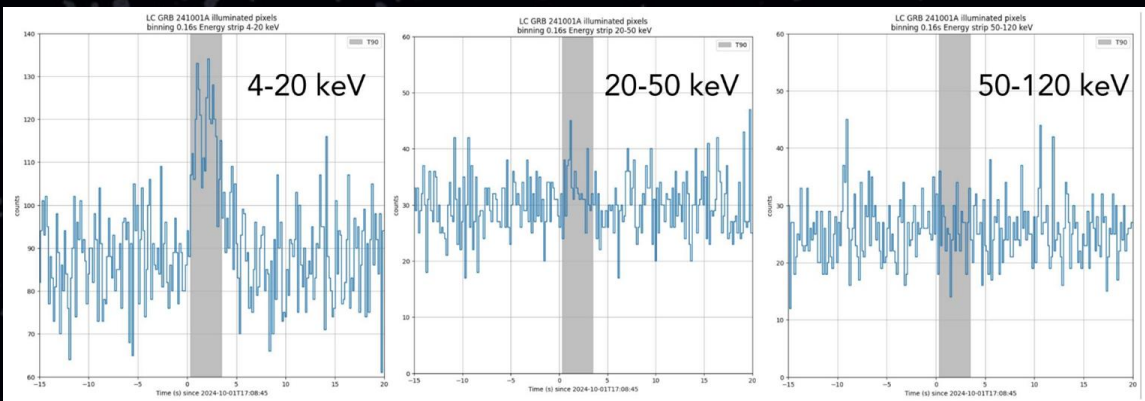


Gamma-ray burst science

SVOM to explore the poorly known XRR/XRF burst population

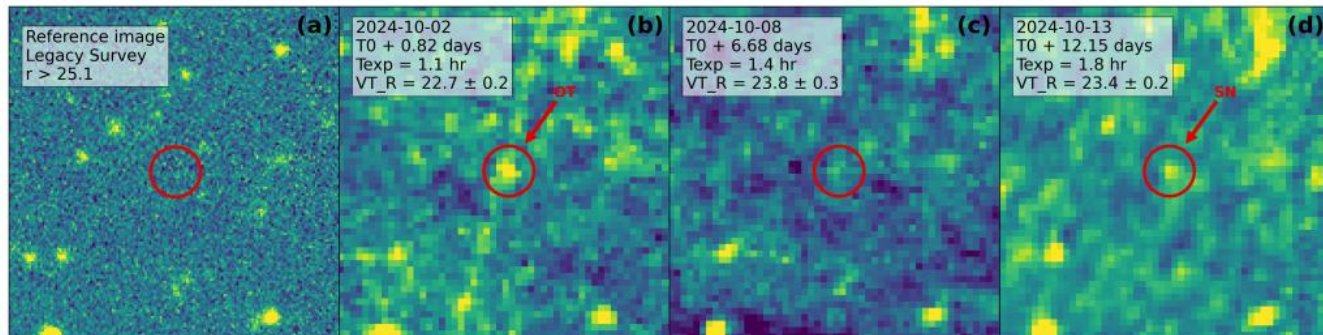
GRB 241001A (SVOM) : a very soft x-ray burst associated with a type Ic supernova (seen by JWST)

Schneider et al. (in prep)



ECLAIRs light curve in different energy bands

credits: collaboration SVOM/IRAP, Marius Brunet



Time series of VT obs.

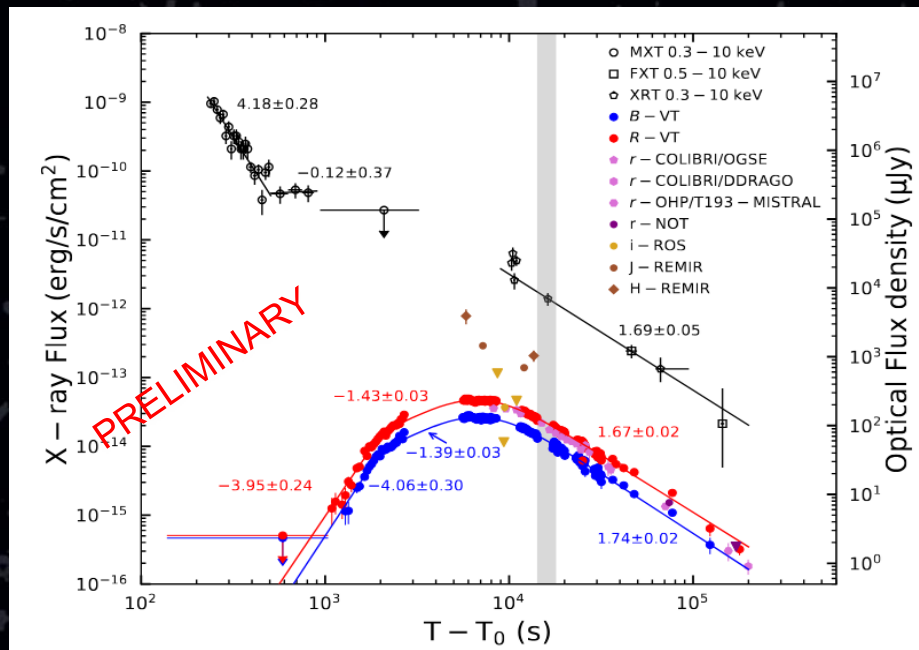
From $T_{\text{GRB}} + 0.82\text{d}$ (afterglow) -
 $T_{\text{GRB}} + 12.15\text{d}$ (supernova rise)

credits:SVOM/VT, Huali li et Benjamin Schneider

Gamma-ray burst science

SVOM to explore the poorly known XRR/XRF burst population

GRB 250317B: An X-Ray Flash from Off-Axis Observation to a Magnetar-Driven Gamma-Ray Burst



Zhao et al. (in prep)

A good example of:

Triggered in the 5-8 keV band

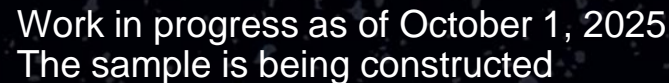
synergies between SVOM, Swift and EP in space

synergies between the space and ground-based follow-up instruments

redshift = 3.44 (GTC/OSIRIS)

Discoveries to come in the field of Low-Luminosity and X-ray rich GRBs

Population study of soft x-ray burst jointly detected by EP/WXT and SVOM Adrien et al. (in prep)

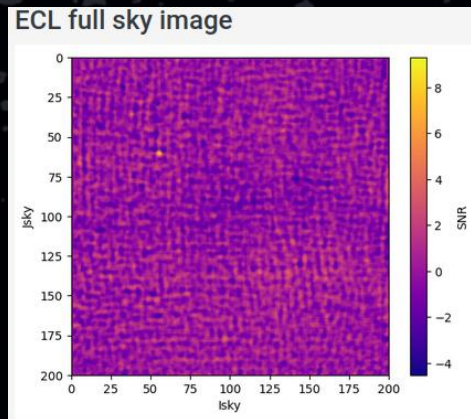


- 7/15 EP/WXT and SVOM/ECLAIRs bursts
- 12/15 EPWXT and SVOM/GRM bursts
- 4/15 EP/WXT, SVOM/ECLAIRs and GRM bursts
- 14/15 have a detected afterglow (X and/or Optical)
- 8/15 Bursts with redshift

Gamma-ray burst science

SVOM to explore the high- z GRB population

GRB 250314A at $z \sim 7.3$! : detected by ECLAIRs ($T_{90} \sim 20$ s) and GRM ($T_{90} \sim 10$ s) (Cordier & Wei et al., accepted)



Any afterglow then ?

- MXT/VT quick follow-up ($T_{\text{GRB}} + 177$ s)
 $F_{0.5-10\text{keV}} < 5.10^{-11} \text{ erg/cm}^2/\text{s}$ / ($T_{\text{GRB}} + 2.2$ h) $VT_R > 23.3 \rightarrow$ **GCN#39728**
- NIR afterglow discovered by the NOT
($T_{\text{GRB}} + 12.3$ h) $J = 20.85 \rightarrow$ **GCN#39727**
- VLT/X-shooter redshift ($T_{\text{GRB}} + 16.5$ h) \rightarrow **GCN#39732**

GCN Circular 39732

Subject GRB 250314A: VLT/X-shooter dropout, redshift $z \sim 7.3$
Date 2025-03-15T12:45:58Z (3 months ago)
Edited On 2025-03-15T20:14:19Z (3 months ago)
From Daniele B. Malesani at IMAPP / Radboud University <d.malesani@astro.ru.nl>
Edited By Vidushi Sharma at NASA GSFC/UMBC <vidushi.sharma@nasa.gov> on behalf of Daniele B. Malesani at IMAPP / Radboud University <d.malesani@astro.ru.nl>
Via Web form

D. B. Malesani (DAWN/NBI and Radboud), G. Pugliese (API-UvA), J. P. U. Fynbo (DAWN/NBI), B. Schneider (LAM), V. D'Elia (SSDC and INAF-OAR), A. de Ugarte Postigo (LAM), L. Izzo (INAF-OACn and DARK/NBI), P. G. Jonker (Radboud), A. J. Levan (Radboud and Warwick), J. T. Palmerio (CEA/Irfu), N. A. Rakotondrainibe (LAM), A. Saccardi (CEA/Irfu), N. R. Tanvir (U. Leicester), A. L. Thakur (INAF-IAPS), S. D. Vergani (CNRS, Obs. Paris/LUX), D. Xu (NAOC), Z. P. Zhu (NAOC) report on behalf of the Stargate collaboration:

We observed the near-infrared candidate counterpart (Malesani et al., GCN 39727) of the long SVOM/ECLAIRs GRB 250314A (Wang et al., GCN 39719) at the ESO VLT, using the HAWK-I near-infrared imager (on UT4, Kueyen) and the X-shooter spectrograph (on UT3, Melipal).

The object is well detected in the Y, J and H filters. HAWK-I observations started on 2025 Mar 15 at 05:23:28 UT (about 16.5 hr after the GRB). We measure preliminary AB magnitudes:

Y = 23.2 \pm 0.15
J = 22.4 \pm 0.1
H = 22.5 \pm 0.1

For the spectra, the observation mid time was 2025 Mar 15.26 UT (about 17.4 hr after the GRB). The data cover the wavelength range 3000-21,000 Å and consist of 4 exposures of 1200 s each.

In a preliminary reduction of the spectra, a faint continuum is confidently detected all across the NIR arm (down to 10,300 Å). Tentative signal is also seen in the very red end of the VIS arm, with a drop around 10,090 Å. While the S/N is too low to confidently identify individual metal absorption features, the break in the VIS is consistent with the onset of the Lyman forest (with possible contribution from damped Lyman-alpha absorption in the GRB host galaxy). The implied redshift is $z \sim 7.3$.

The HAWK-I photometry is consistent with a break, rather than with a generically red shape of the continuum, given the red Y-J vs blue J-H color, consistent with the Y filter being partly dropped out. Assuming a power law model (no dust extinction), a fit to the available photometry provides a redshift $z = 7.21 \pm 0.18 \pm 0.38$ (1 sigma c.l.), fully consistent with the spectroscopic value.

We acknowledge expert support from the ESO staff in Paranal, in particular Cedric Ledoux, Enrico Congiu, Francisco Nogueras-Lara, Pascale Hibon, Rodrigo Romero, and Susana Cerda.

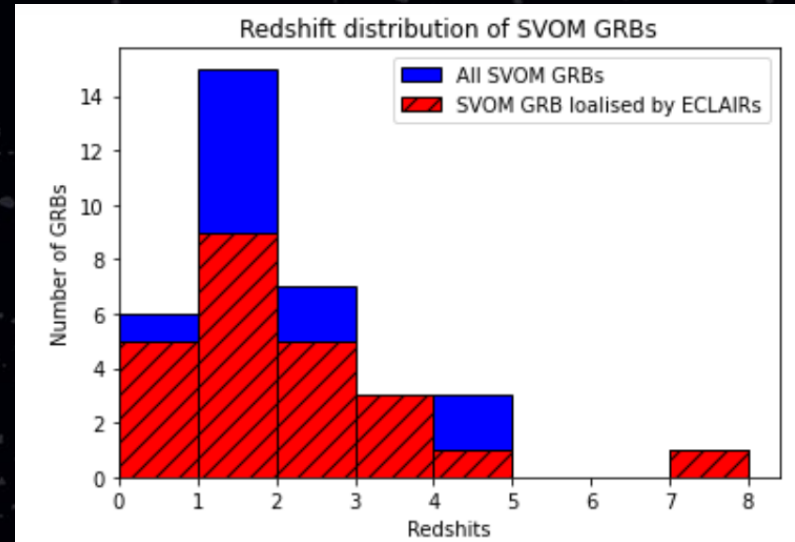
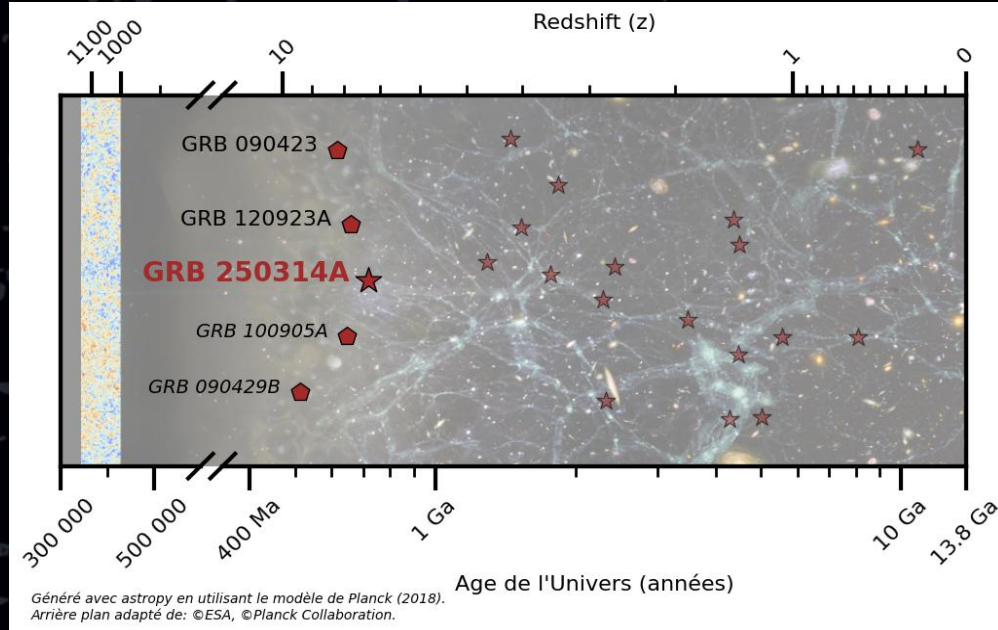
See details in A. Saccardi talk



Gamma-ray burst science

SVOM to explore the high- z GRB population

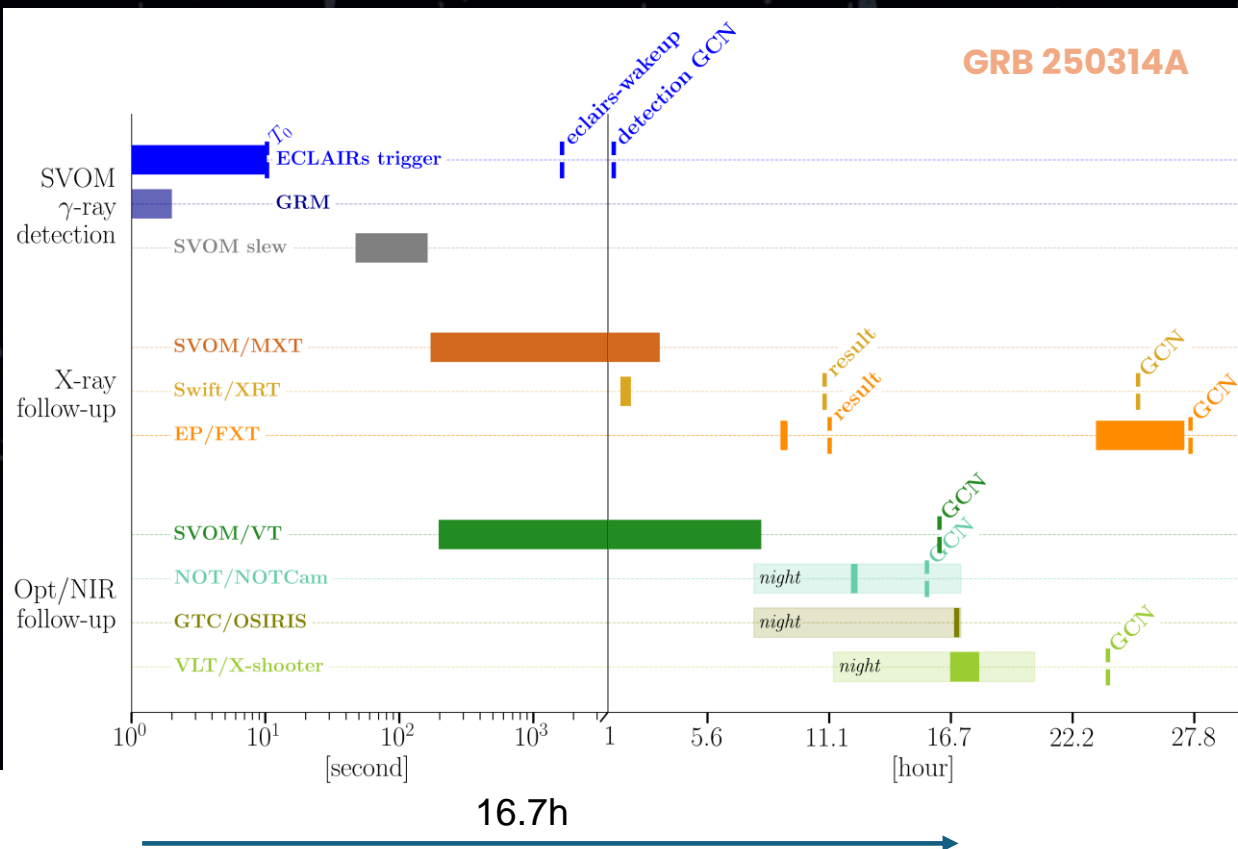
GRB 250314A at $z \sim 7.3$! : 5th most distant burst, 3rd with a spectroscopic measurement



Gamma-ray burst science

SVOM to explore the high- z GRB population

How to optimize the redshift measurement?



5 other bursts for which we suspect a high redshift...but no NIR observation.

Failed to mobilize a large telescope because of the delay between the trigger and the possibility of observation.

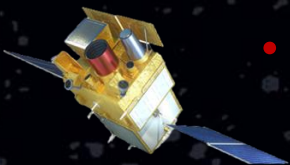
The arrival of CAGIRE on COLIBRI and SOXS should increase our efficiency.
See S. Basa talk

Take home messages: SVOM first results in a nutshell

- **A 4 keV low energy band and a clear impact to better explore the**
 - soft GRBs: XRR/XRF population? Shock break-out signatures? (multiple publications under preparation)
 - High-z GRB: GRB 250314A at high redshift @ $z = 7.3$ (the 1st high-z GRB detected for the past 12 years)
- **A full spectral coverage of the burst's emission from 4 keV - 5 MeV**
 - characterization of the soft γ -ray spectrum by ECLAIRS+GRM
 - SVOM is indeed sensitive to all types of GRBs (129 LGRB, 25 SGRB, 15 XRR/XRF)
- **A large FoV ($1^\circ \times 1^\circ$) MXT x-ray telescope & a sensitive 40 cm VT telescope**
 - afterglow transition in X-rays and optical with MXT and VT for some bursts
 - several cases of well characterized events during the prompt/early + late afterglow phases
 - Already one high-z GRB identified
- **A pointing strategy optimised to coordinate fast follow-up observations during night time + network of robotic telescopes (0.2 - 1.3 m)**
 - already high Opt. AG detection/redshift measurement rate (still increasing, to come in a few month: JH filters on SVOM COLIBRI FM-GFT + better operating system now since the commissioning phase)
- **Already fruitful Collaboration with other missions and groups**
 - We have established an efficient ToO link between **SVOM, Einstein Probe & Swift** to systematically catch the x-ray and optical counterparts of respective triggers
 - A productive collaboration with the **Stargate, NOT/GTC/GEMINI-GRB** groups very responsive in taking spectra of SVOM localized GRBs

25 single GRB papers
under review

A SVOM special issue
under preparation



Thanks for your attention!



Follow the news on www.svom.eu

Save the date : organisation of a SVOM day for the French scientific community
Wednesday 10 December 2025, IAP, Paris

ATPEM 2025 - Paris
October 1st, 2025

