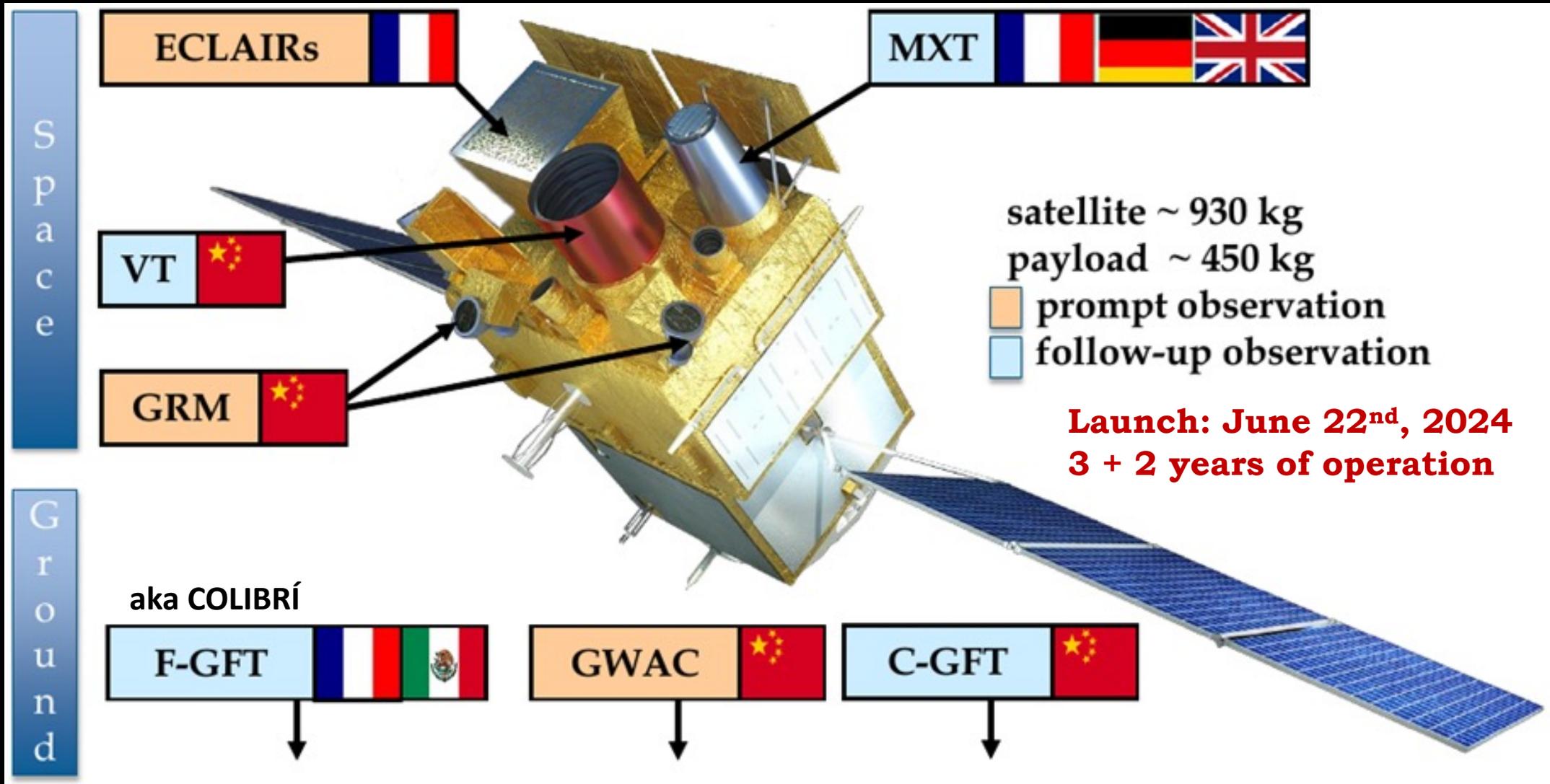


SVOM update

for the 4th TDAMM Workshop

J-L Atteia – IRAP – Toulouse
on behalf of the *SVOM* collaboration

SVOM at a glance, a very complex System...



The Collaboration



27/10/2025 4th TDAMM

- **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
 - GEPI Meudon
 - IAP Paris
 - IRAP Toulouse
 - LAL Orsay
 - LAM Marseille
 - LUPM Montpellier
 - OAS Strasbourg

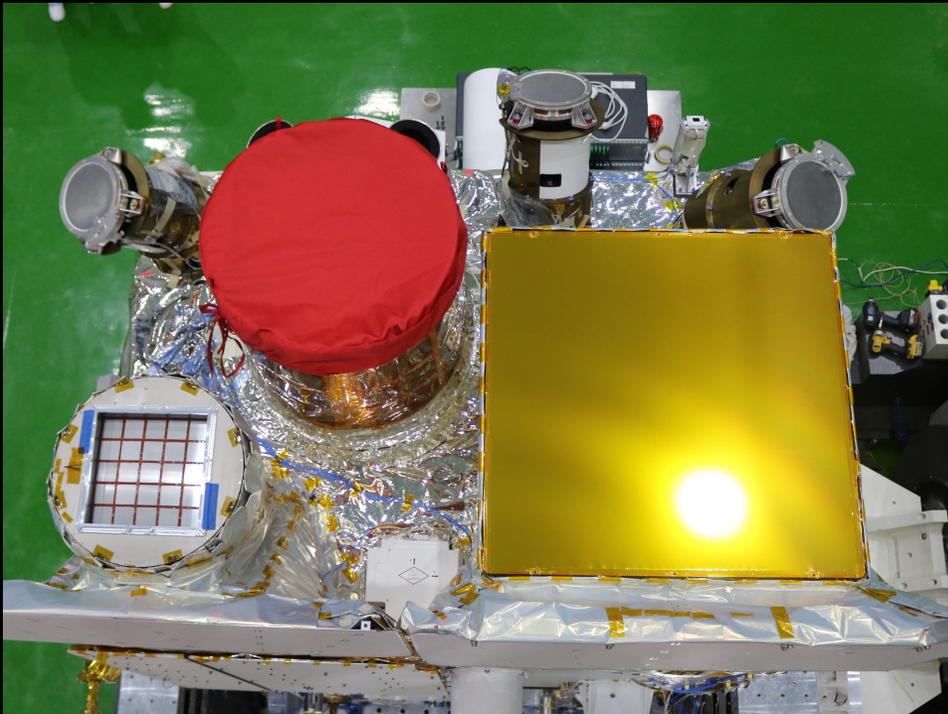
- **UK** University of Leicester 

- **Germany** 
 - MPE Garching
 - IAAT Tübingen

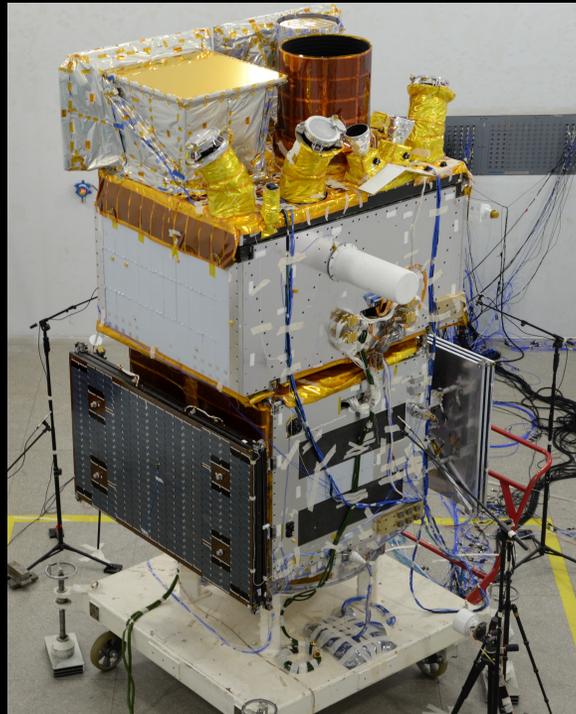
<https://www.svom.eu/en/le-consortium-2-en/>

Some Pictures

Top view of the instruments



SVOM during acoustic tests



SVOM launch – Saturday June 22, 2024



On-board Instruments

ECLAIRs (CNES, IRAP, CEA, APC) - not an acronym

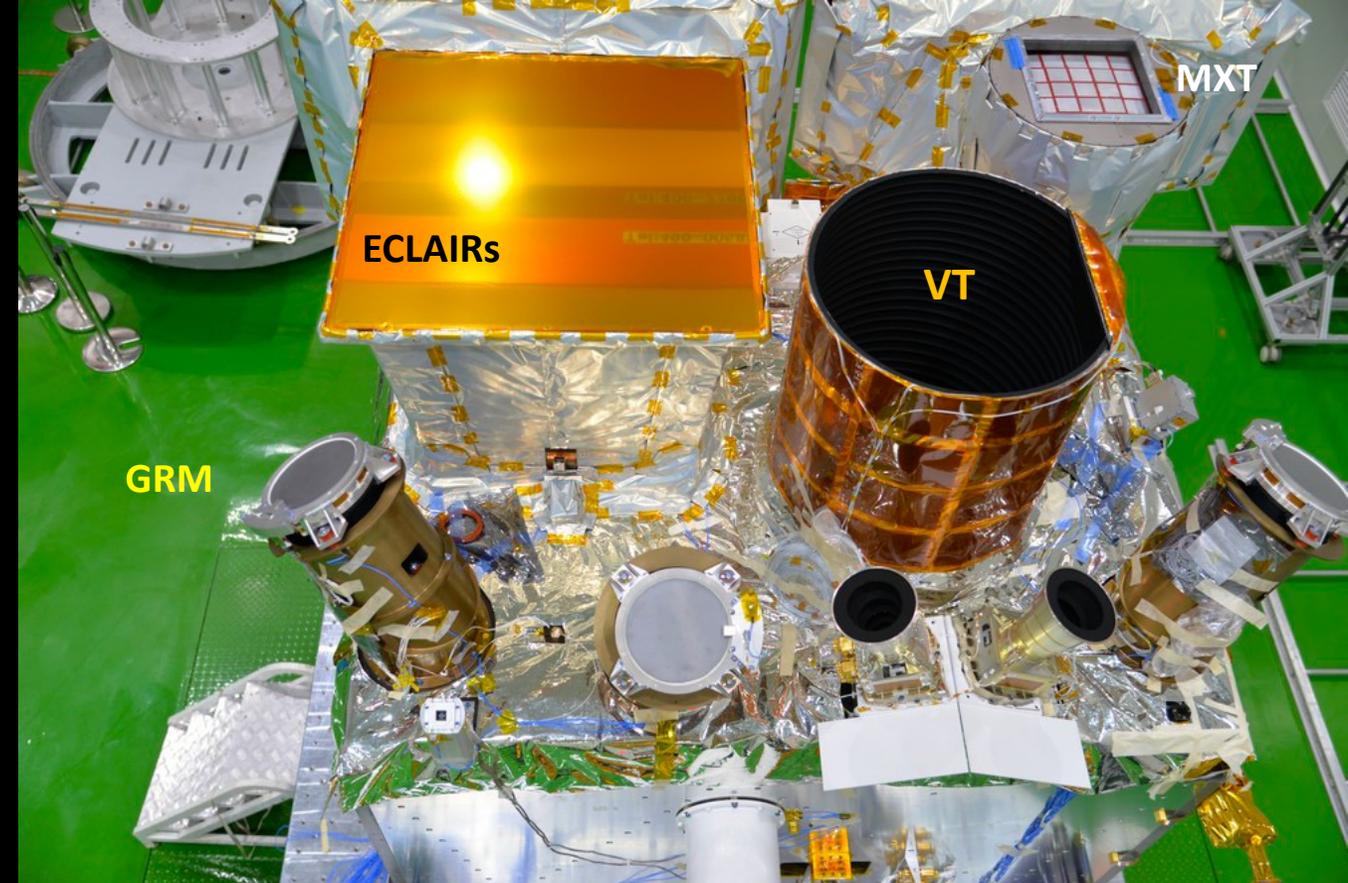
- **40% open fraction**
- Detection area: **1000 cm² - 6400 CdTe pixels** (4x4x1 mm³)
- **FoV: 2 sr** (zero sensitivity)
- Energy range: **4 - 150 keV**
- **Localization accuracy <12 arcmin** at detection limit
- Onboard trigger and localization: **~50 GRBs/year**
Well suited to detect long GRBs with low E_{PEAK}

MXT Micro-channel X-ray Telescope (CNES, CEA, UL, MPE)

- **Micro-pores optics: square 40 μm pores** in a "Lobster Eye" config.
- pnCCD based camera
- **FoV: 64x64 arcmin² - Focal length: 1 m**
- **Energy range: 0.2 - 10 keV**
- A_{eff} = 27 cm² @ 1 keV - Energy resolution: ~80 eV @ 1.5 keV
- **Loc. accuracy <13 arcsec** within 5 min from trigger for bright GRBs
Observes X-ray afterglows promptly - Innovative X-ray optics

VT Visible Telescope (XIOMP, NAOC)

- Ritchey-Chretien telescope, **40 cm Ø, f=9**
- **FoV: 26x26 arcmin²**, covering ECLAIRs error box
- **2 channels: blue (400-650 nm) and red (650-1000 nm)**, with 2k * 2k CCD detector each
- **Sensitivity M_V=23 in 300 s**
- Detects ~80% of ECLAIRs GRBs
- **Localization accuracy <1 arcsec**
Two photometric channels - Able to detect GRBs up to z~6.5,



GRM Gamma-Ray Monitor (IHEP)

- **3 Gamma-Ray Detectors (GRDs)**
- **Nal(Tl)** (16 cm Ø, 1.5 cm thick)
- Plastic scintillator (6 mm) to monitor particle flux and reject particle events
- **FoV: 2.6 sr per GRD**
- **Energy range: 15-5000 keV - A_{eff} = 200 cm² at peak**
- Expected rate: **~90 GRBs / year**
Measures E_{PEAK} + Detects short & long GRBs out of the ECLAIRs FOV

Two Follow-up Telescopes and a set of Wide-Field Cameras on the Ground



Colibri at OAN in San Pedro Mártir

Diameter : 1300 mm
FOV: 26 x 26 arcmin
400 - 1700 nm



The Chinese GFT at Jilin Observatory

Diameter : 1200 mm
FOV: 90 x 90 arcmin
400 - 900nm

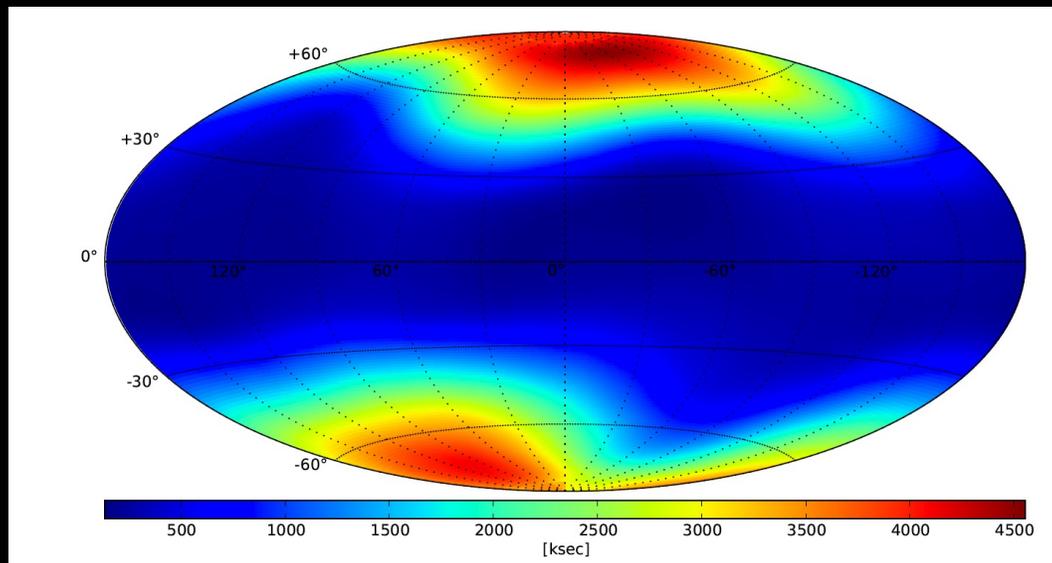
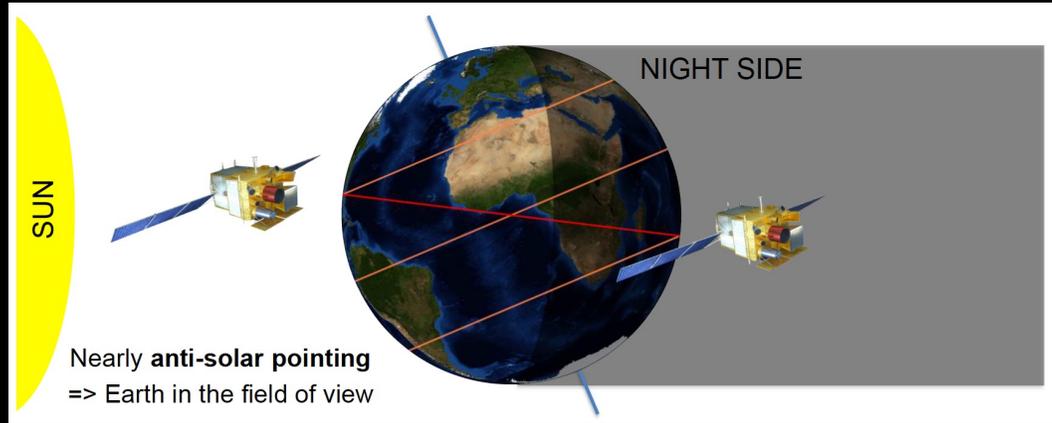


The GWAC Network at Xinglong Observatory

≥ 10 units with 4 wide-field + 1 very wide-field cameras
Diameter: 150 to 280 mm
FoV: ≈ 100 sq. deg. per camera
 V_{lim} : 15 - 17 in 10 s
Several small telescopes: 300 to 600 mm

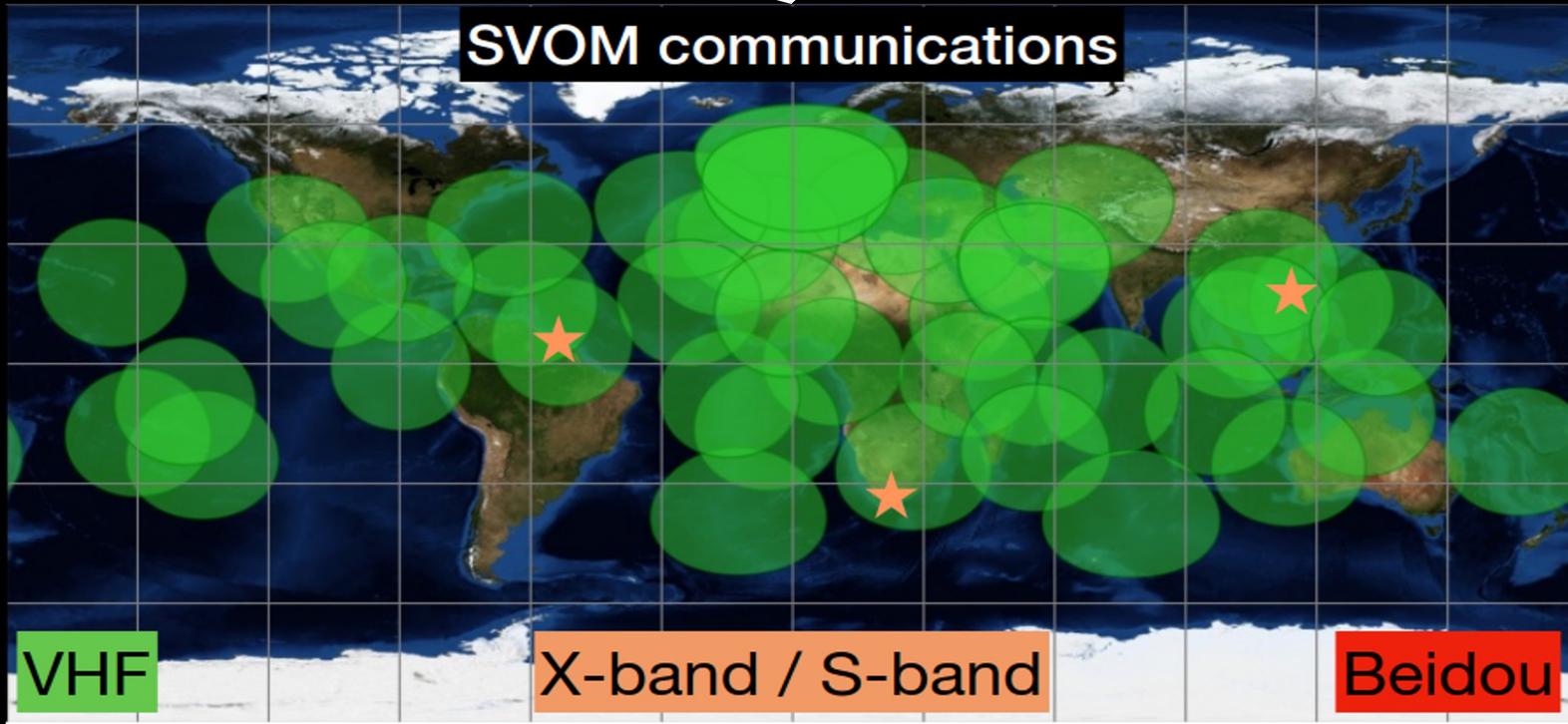
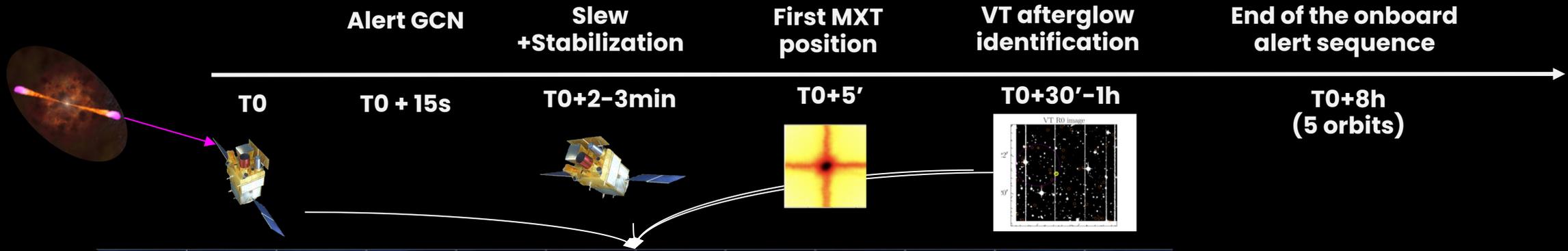
Pointing Strategy, Monitoring & Alert Dissemination

Low Earth Orbit with $i = 29^\circ$; nearly anti-sun pointings



UPF Papeete French Polynesia	METEO FRANCE Rikitea French Polynesia	IRD Ouagadougou Burkina Faso	BSC Malindi Kenya	OUKAIMEDEN OBSERVATORY Morocco	CARNARVON S&T MUSEUM Australia
SURE Diego Garcia	AST. OBSERVATORY Maidenak Uzbekistan	TRISTAN DA CUNHA UK	NSSTC Al Ain UAE	SMA Mahe Seychelles	GUANGXI UNIVERSITY Nanning China

Detection, Alerts & ToOs



Downlink

- **VHF** (fast but few data products)
- **X-band** (slow but complete data)

Uplink

- **S-band** (slow, few hours)
- **Beidou** (fast, few minutes)

Three observing programs



The SVOM Core program
reserved to SVOM Co-Is

Gamma-ray bursts

The General & ToO programs

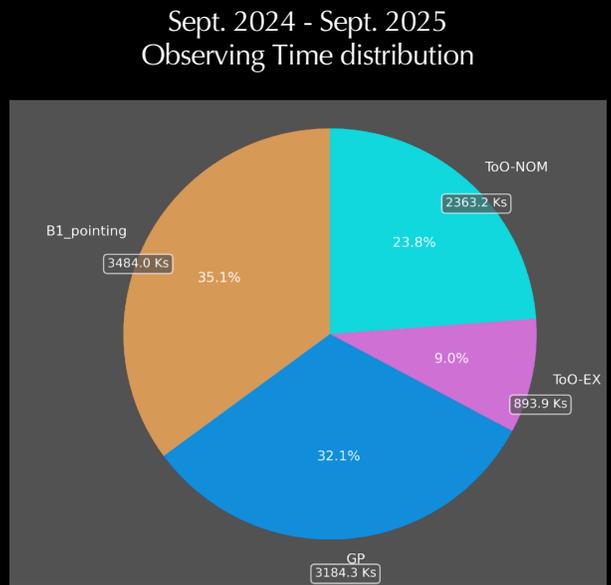
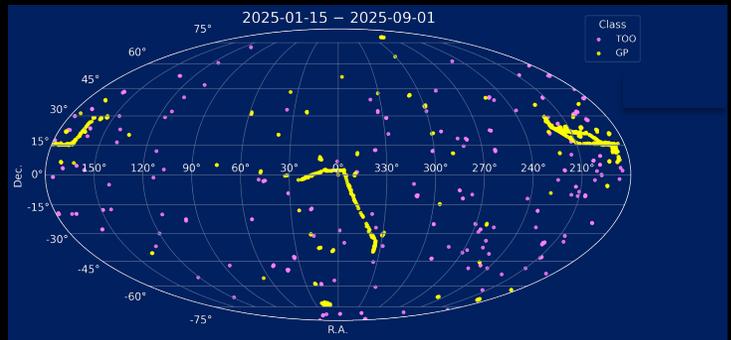
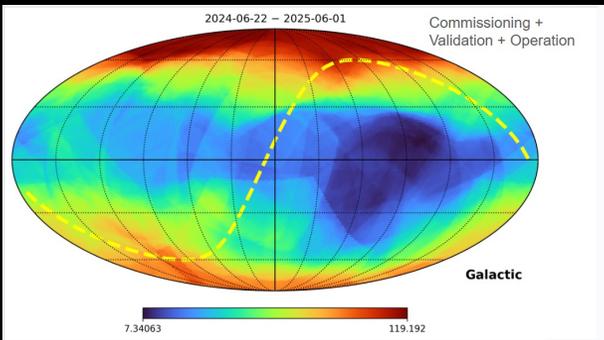
GP obs (known sources): Observation proposals awarded by a TAC (your proposal has to include a SVOM co-I).
ToO obs (not anticipated flaring sources): If you want a ToO, please contact the SVOM PIs





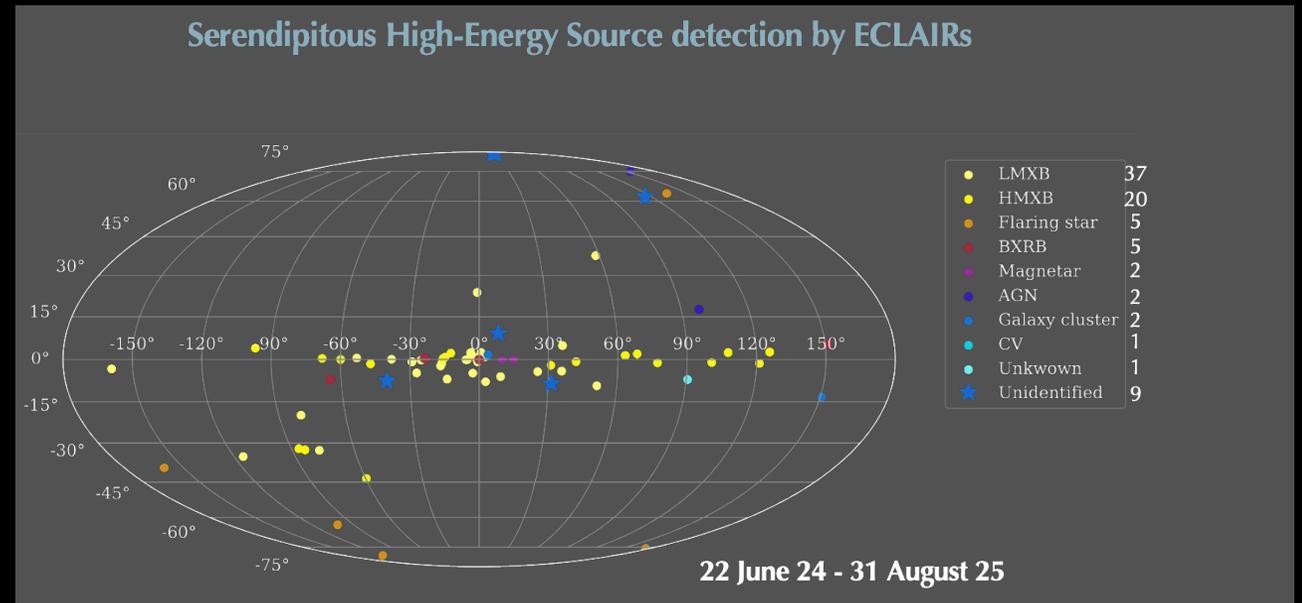
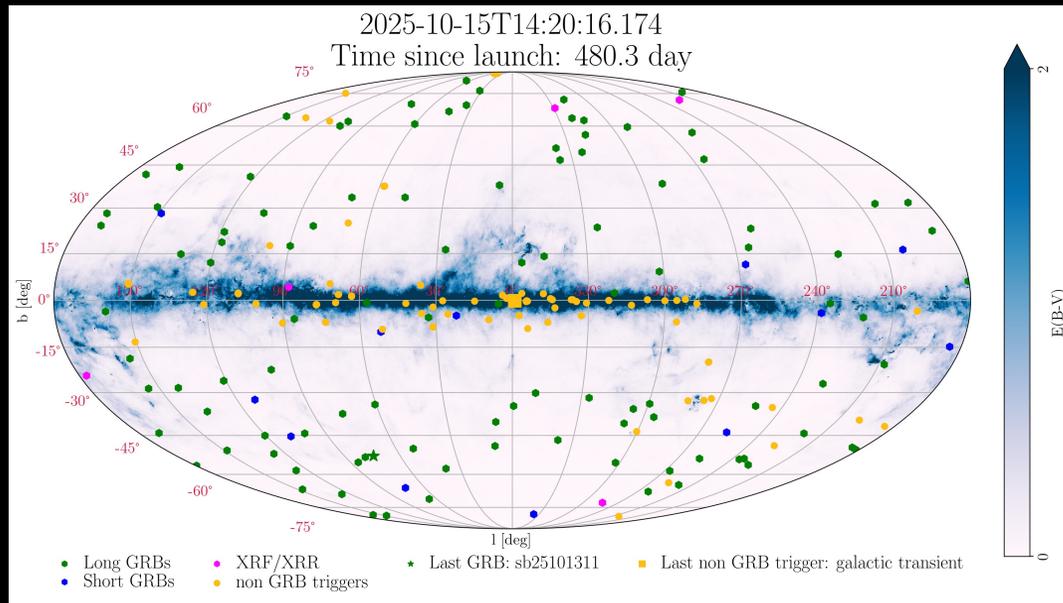


Magnetar Giant flares CVs, x-ray binaries Flaring stars AGNs/Blazars Supernovae TDE, FRB, etc.



Current status

- All mission components are working nominally
- All instruments are functioning well
- SVOM has detected 184 GRBs (onboard) & dozens of X-Ray Bursts from galactic sources (offline).
- SVOM has performed hundreds of ToO observations (VT).

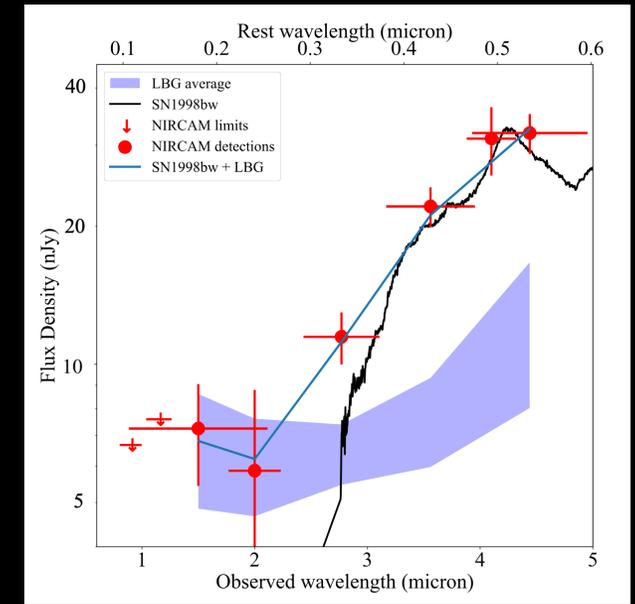
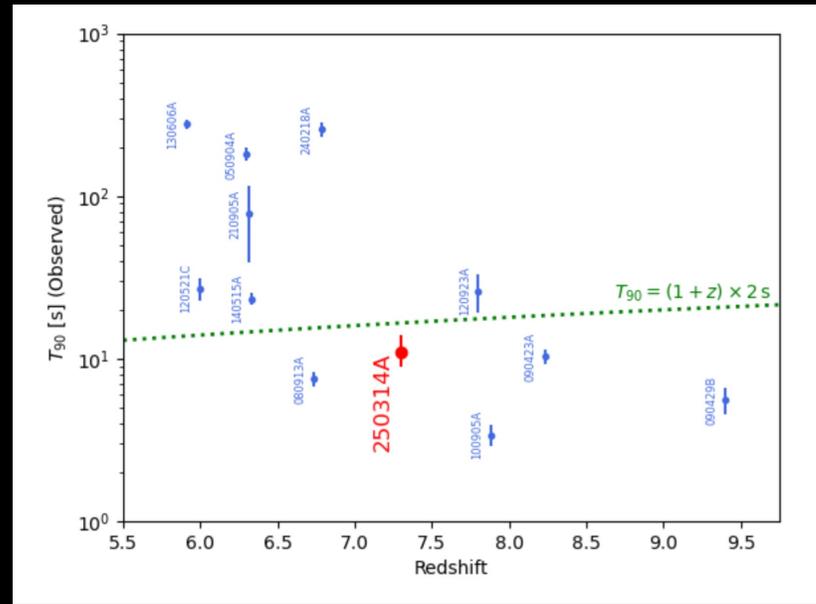
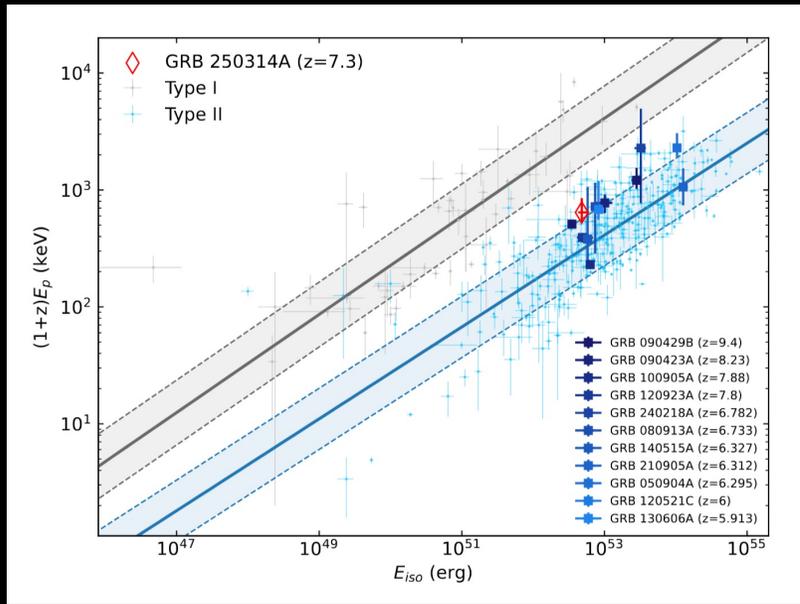


Gamma-Ray Bursts

- *SVOM* has detected **184** GRBs:
 - **159** with **GRM** & **65** with **ECLAIRs** (~1/week)
 - Most ECL GRBs benefit from immediate slew of the satellite.
 - All types of GRBs: Short GRBs – Long GRBs – XRFs
 - Some very soft GRBs have a blackbody spectrum
- Thanks to the very efficient X-ray followup of *Swift*/XRT and *EP*/FXT, the X-ray afterglows of all but a few ECLAIRs GRBs have been identified.
- Several ECLAIRs GRBs benefit from excellent optical followup with the VT + GFTs + partner telescopes.
- ~8% of GRM GRBs and ~40% of ECLAIRs GRBs have a measured redshift.
- These redshifts range from $z = 0.238$ (GRB 240821A) to $z = 7.3$ (GRB 250314A)
- The isotropic equivalent energy ranges from 10^{50} erg (GRB 241001A) to $4.8 \cdot 10^{53}$ erg (GRB 250327B)
- The **SVOM system** aims at providing complete information on ECL detected GRBs...

GRB 250314A

- SVOM **GRB 250314A** at $z \approx 7.3$: an exploding star in the era of reionization (B. Cordier et al., A&A 2025, [arxiv.2507.18783](https://arxiv.org/abs/2507.18783))
- JWST reveals a supernova following a gamma-ray burst at $z \approx 7.3$ (Levan et al. A&A 2025, [arxiv.2507.18784](https://arxiv.org/abs/2507.18784))



Boosting the space and ground-based telescope synergies

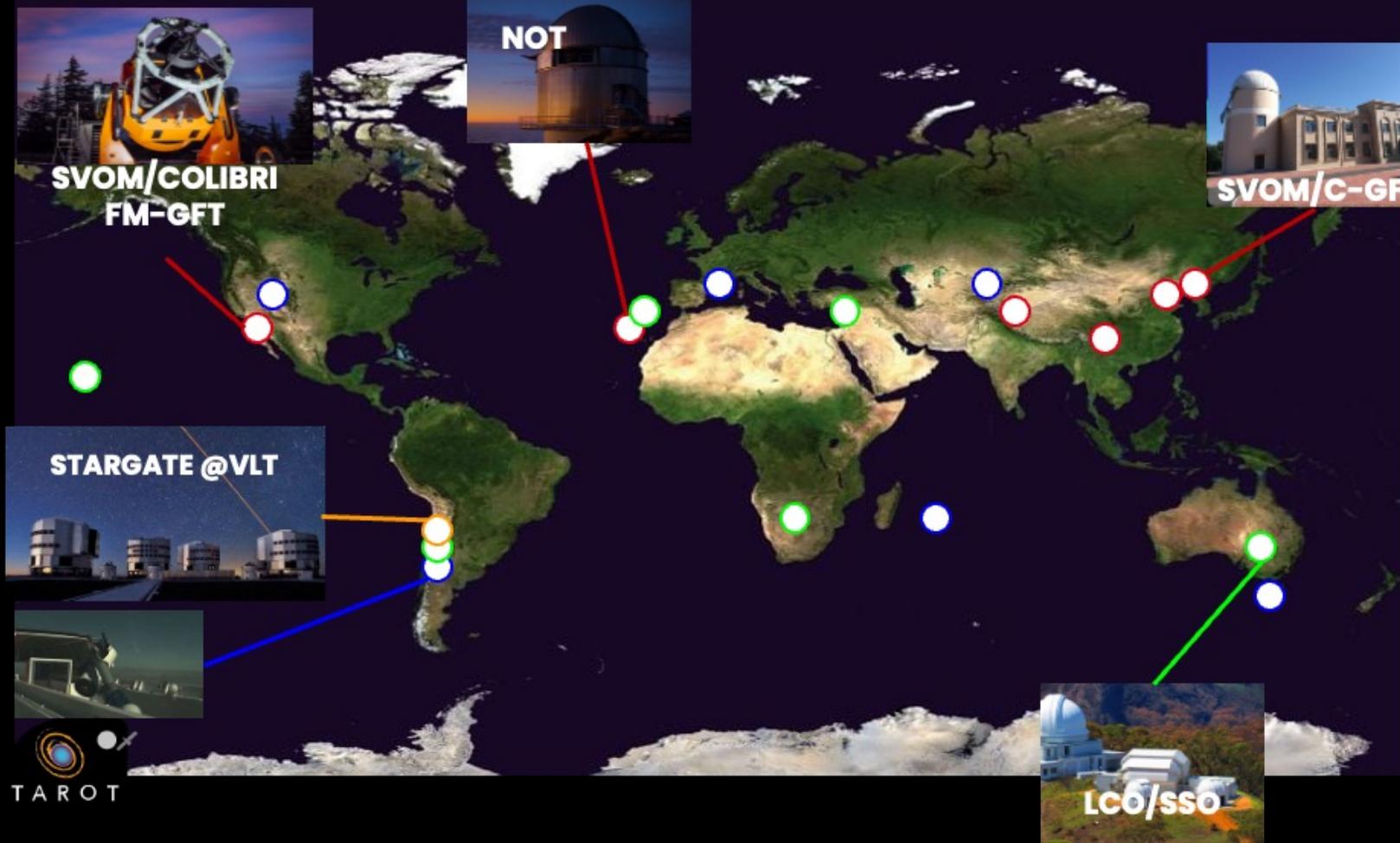


Great synergies with Einstein Probe and Swift teams



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

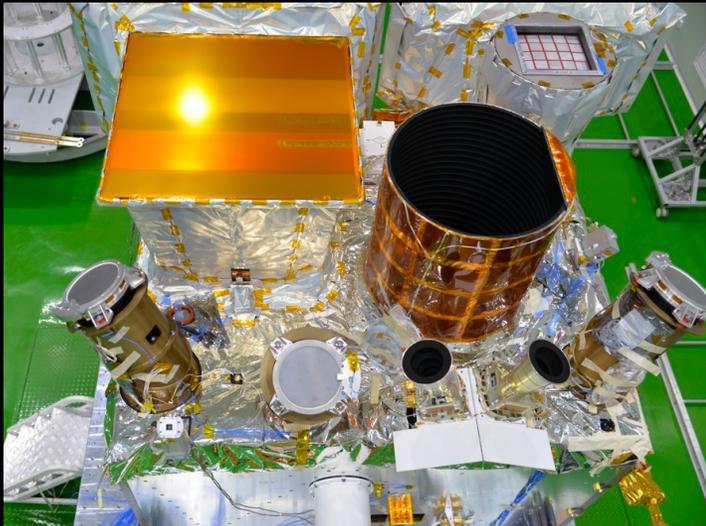


- Official Partners
- Associate Partners
- Purchase of time (LCOGT time coming 2025B)
- Close collaboration

Take Home Messages

- The whole SVOM system works nominally
 - Alert notices are distributed in real time
 - ToO can be uploaded in ~1 hour with Beidou
 - All HE photons are available on the ground with a delay of few hours (offline triggers, targeted searches and monitoring of known sources).
 - Improvements of the operations are still ongoing.
- Agreements with *Swift* and *Einstein Probe* ensures...
 - The fast X-ray followup of SVOM/ECLAIRs GRBs, and
 - The optical followup of *Swift* or *EP* GRBs with SVOM VT
- SVOM General Program is opened to the community (1 AO/yr, anyone can propose but the proposal has to include a SVOM co-I).
- The SVOM collaboration will pursue and improve its cooperation with other teams to foster TDAMM Astrophysics.

Thank you for your attention



Info & Contacts

- Bibliography:
 - *SVOM* Special Issue (Research in Astronomy & Astrophysics, to be submitted by the end of the year)
 - SVOM web site: <https://www.svom.eu/>
- Contacts:
 - **PIs:** B. Cordier (bertrand.cordier@cea.fr) & J. Wei (wjy@nao.cas.cn)
 - **Core Program Science Leads:** F. Daigne (daigne@iap.fr) & B. Zhang (bing.zhang@unlv.edu)
 - **Observatory Science Leads:** A. Coleiro (coleiro@apc.in2p3.fr) & L. Tao (taolian@ihep.ac.cn)
 - **ToO Scientists:** C. Lachaud (cyril.lachaud@in2p3.fr) & J. Wang (wj@bao.ac.cn)

Outline

- Short presentation of the mission
- Current status & first results
- SVOM in the broader context of the TDAMM community

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%)

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

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

X-ray follow-up, EP and Swift contribution

