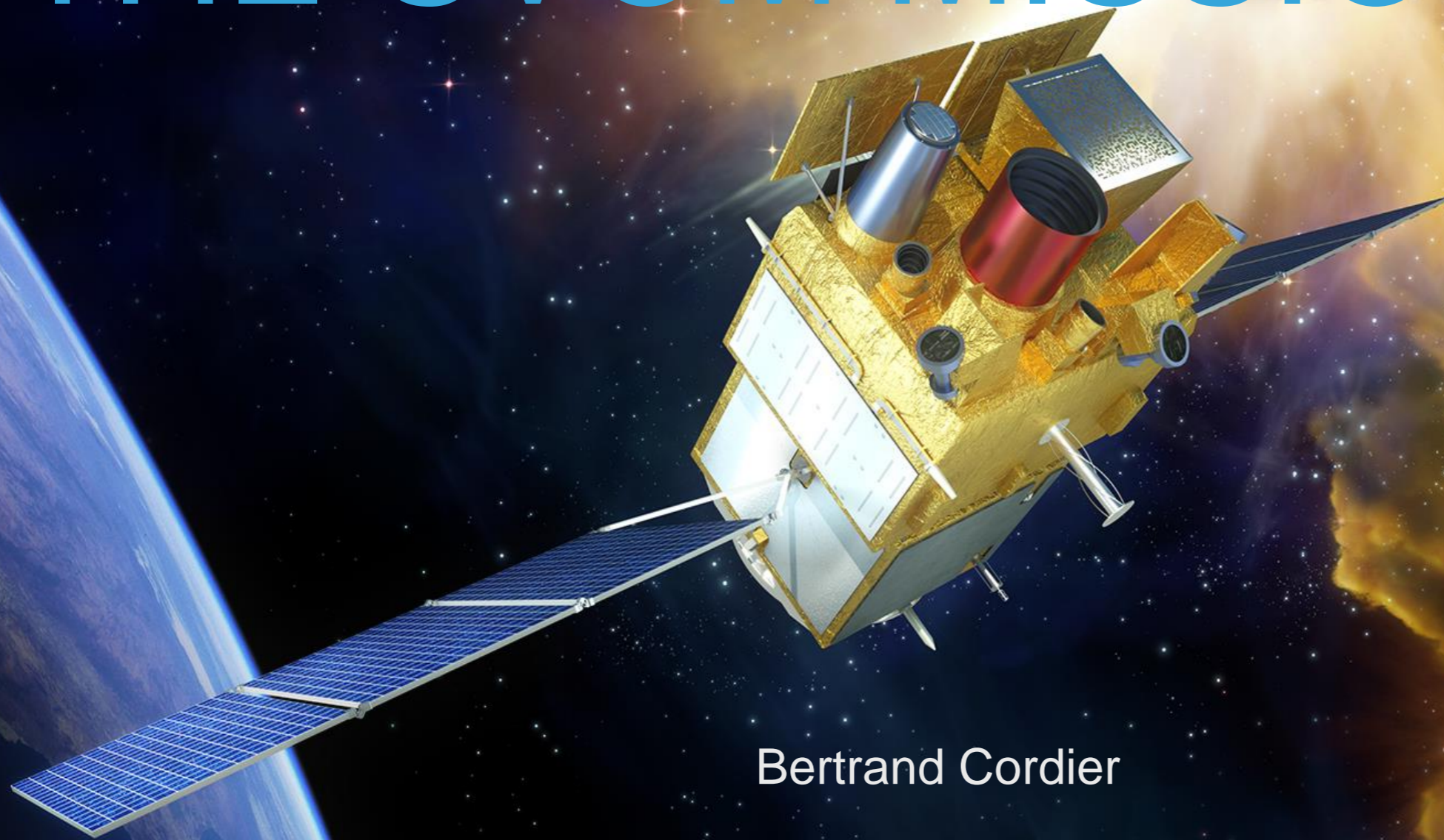




THE SVOM MISSION



Bertrand Cordier

GTAA CNES 9/09/20

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

Taking into account
the feedback from
**Neil Gehrels Swift obs.
& Fermi**
for space observations
TAROT
for ground observations

- **UK** University of Leicester



- **Germany**

- MPE Garching
- IAAT Tübingen



SVOM “Space-based multi-band astronomical Variable Objects Monitor”

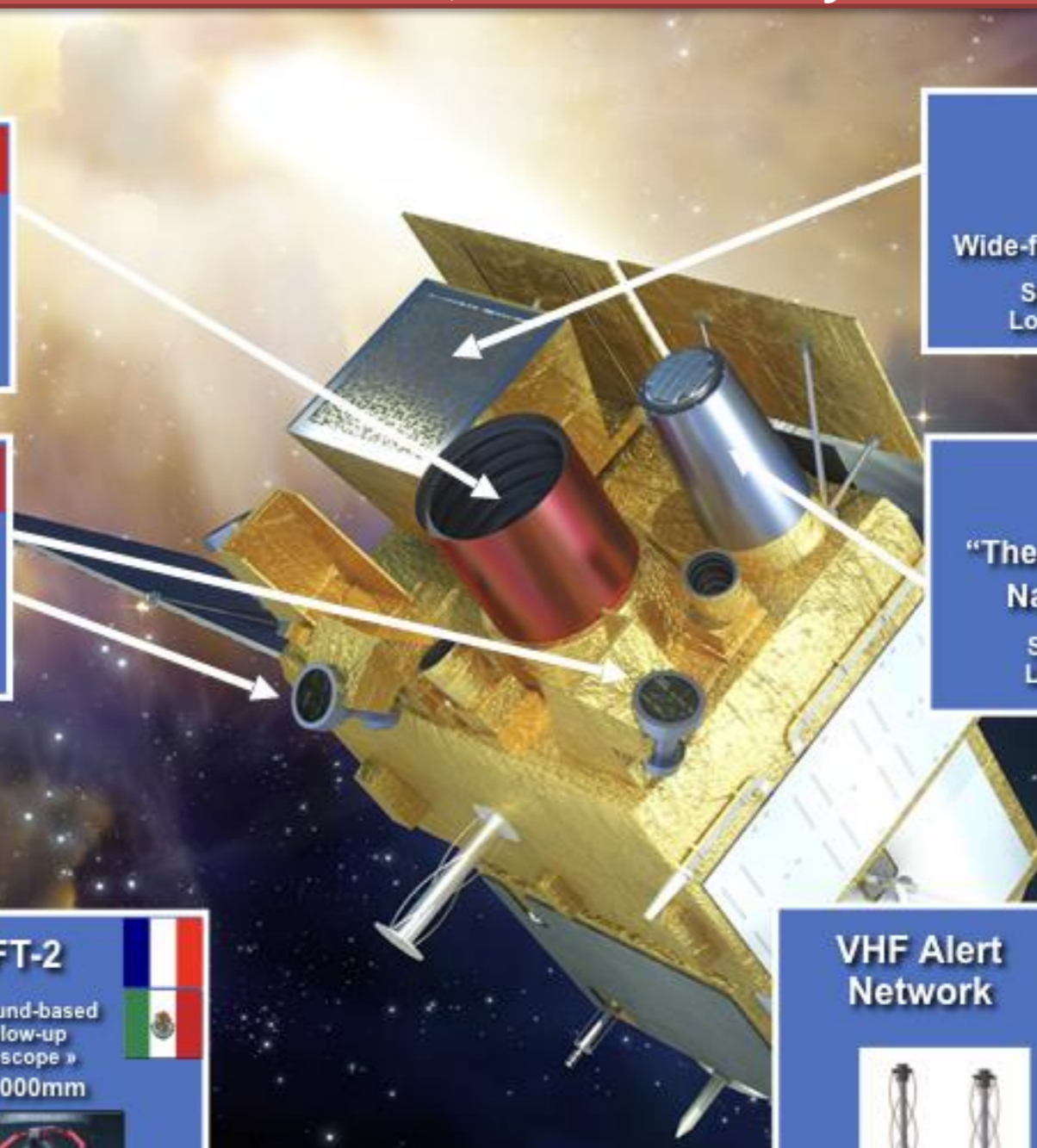
a Sino-French mission dedicated to GRBs and transient sources
to be launched mid 2022, duration 3+2 years

VT 
“The Visible Telescope”
Narrow-field visible telescope
Ritchey Chretien $\Phi=400\text{mm}$
Localization accuracy $< 1\text{arcsec}$

GRM 
“The Gamma-Ray burst Monitor”
X-rays and Gamma-rays detectors
30 keV – 5 MeV
Localization accuracy $< 5^\circ$

ECLAIRs 
« The trigger camera »
Wide-field X and Gamma rays telescope
Spectral range : 4 keV – 150 keV
Localization accuracy $< 12\text{arcmin}$

MXT 
“The Micro-pore X-ray Telescope”
Narrow-field X-ray telescope
Spectral range : 0.2 keV – 10 keV
Localization accuracy $< 1\text{arcmin}$



GFT-1 
« Ground-based Follow-up Telescope »
 $\Phi>1000\text{mm}$


GWAC 
« Ground Wide-Angle Cameras »
 $\Phi=180\text{mm}$


GFT-2 
« Ground-based Follow-up Telescope »
 $\Phi>1000\text{mm}$


VHF Alert Network 

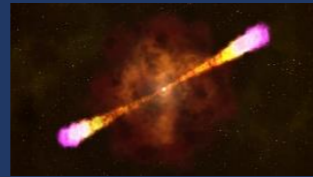
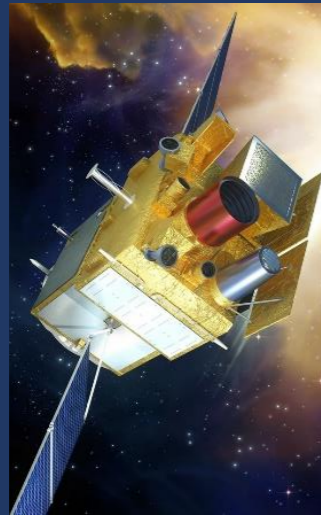

... and more!

Tracking antennas 




OPERATIONAL SCENARIO FOR GRB DETECTION

SVOM Satellite



ECLAIRs detects a new gamma-ray burst

Automatic slew and observation start



VHF Band



X & S Band



Tracking antennas



Robotics & Large Ground Telescopes



SVOM users



VHF alert data

Science and HK data

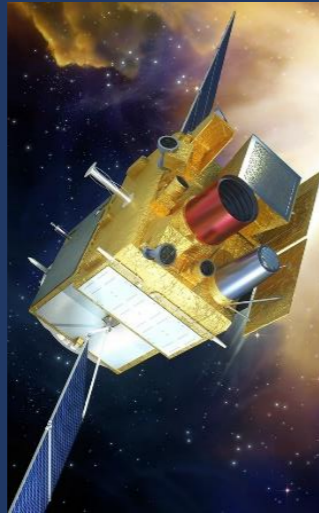
Alert data processing by French Science Center

Science data processing by French and Chinese Science Centers



OPERATIONAL SCENARIO FOR T₀O-MM

SVOM Satellite



Object detected by other observatories (space or ground)

Slew and observation start (several tiles)

SVOM users

VHF Band



X Band



S Band



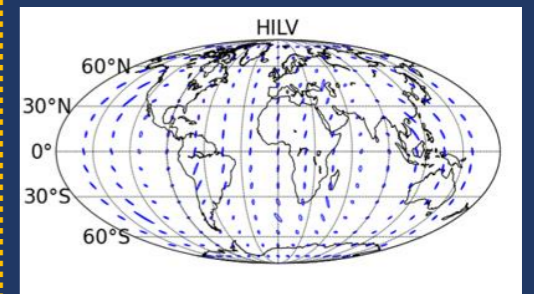
Tracking antennas



Tracking antennas



Observation requests (tiling strategy)



VHF alert data



Science data



Science data processing by French and Chinese Science Centers

Tele-commands

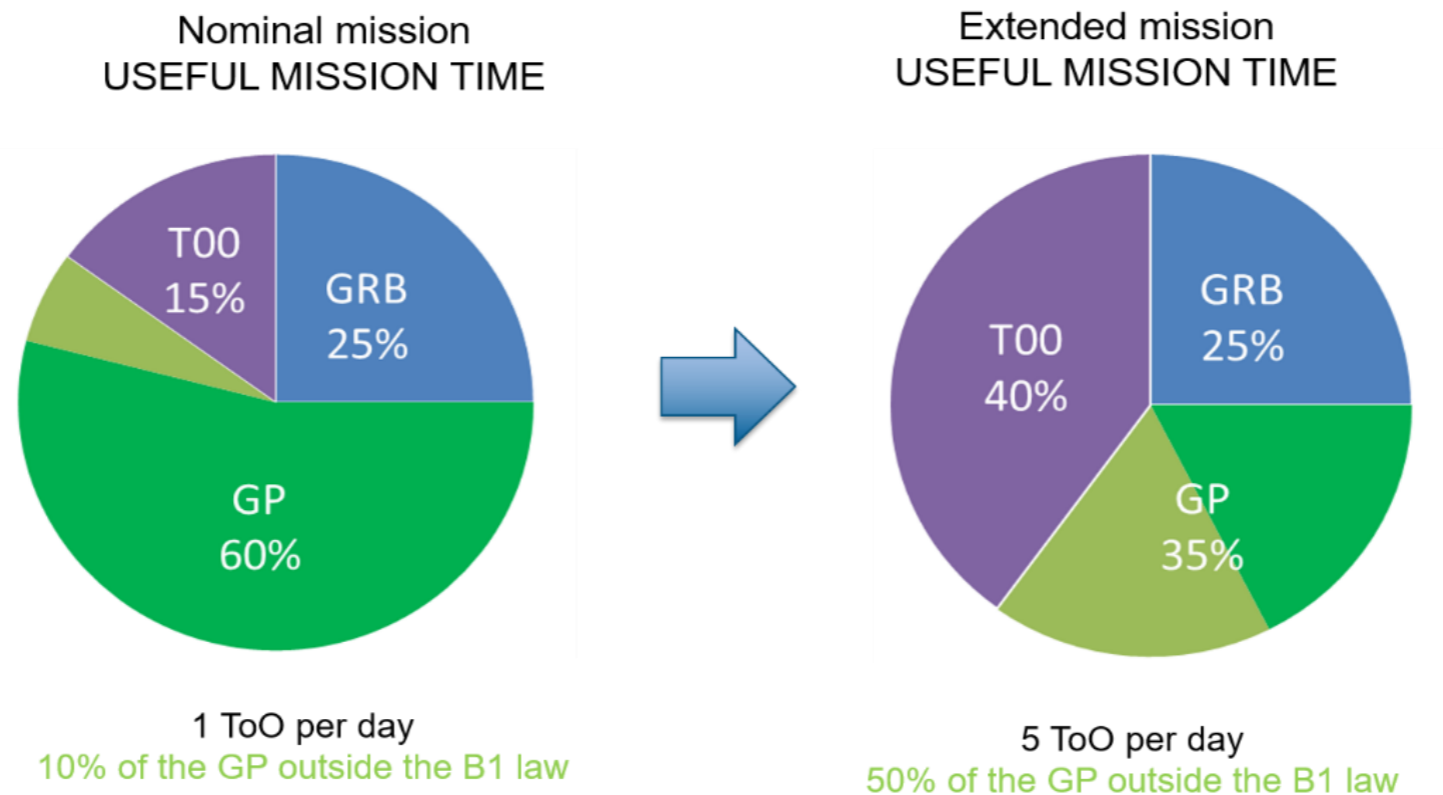


Chinese Control Center

Preparation of satellite TC plan by Mission Center



- # SVOM mission requirements



The SVOM mission is organized into three scientific programs:

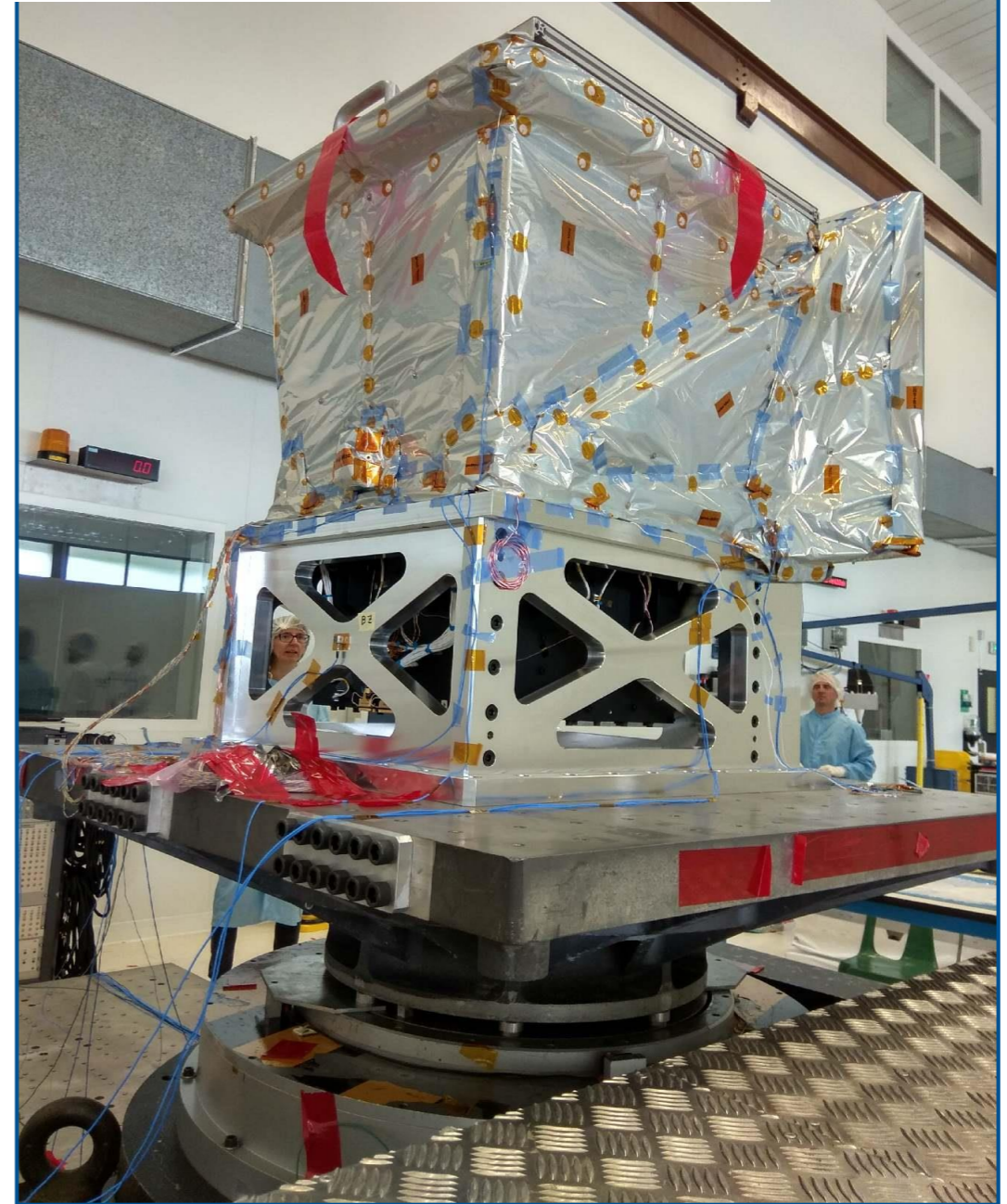
- The Core Program dedicated to the study of gamma-ray bursts, triggered by SVOM itself.
 - **11 requirements**
- The Target of Opportunity program dedicated to the study of transient sources, triggered by another observatory and reprogrammed on the satellite in a few hours.
 - **6 requirements**
- The General Program, classic observatory science, selected by caal for observation and programmed over 15 days
 - **11 requirements**

Agenda



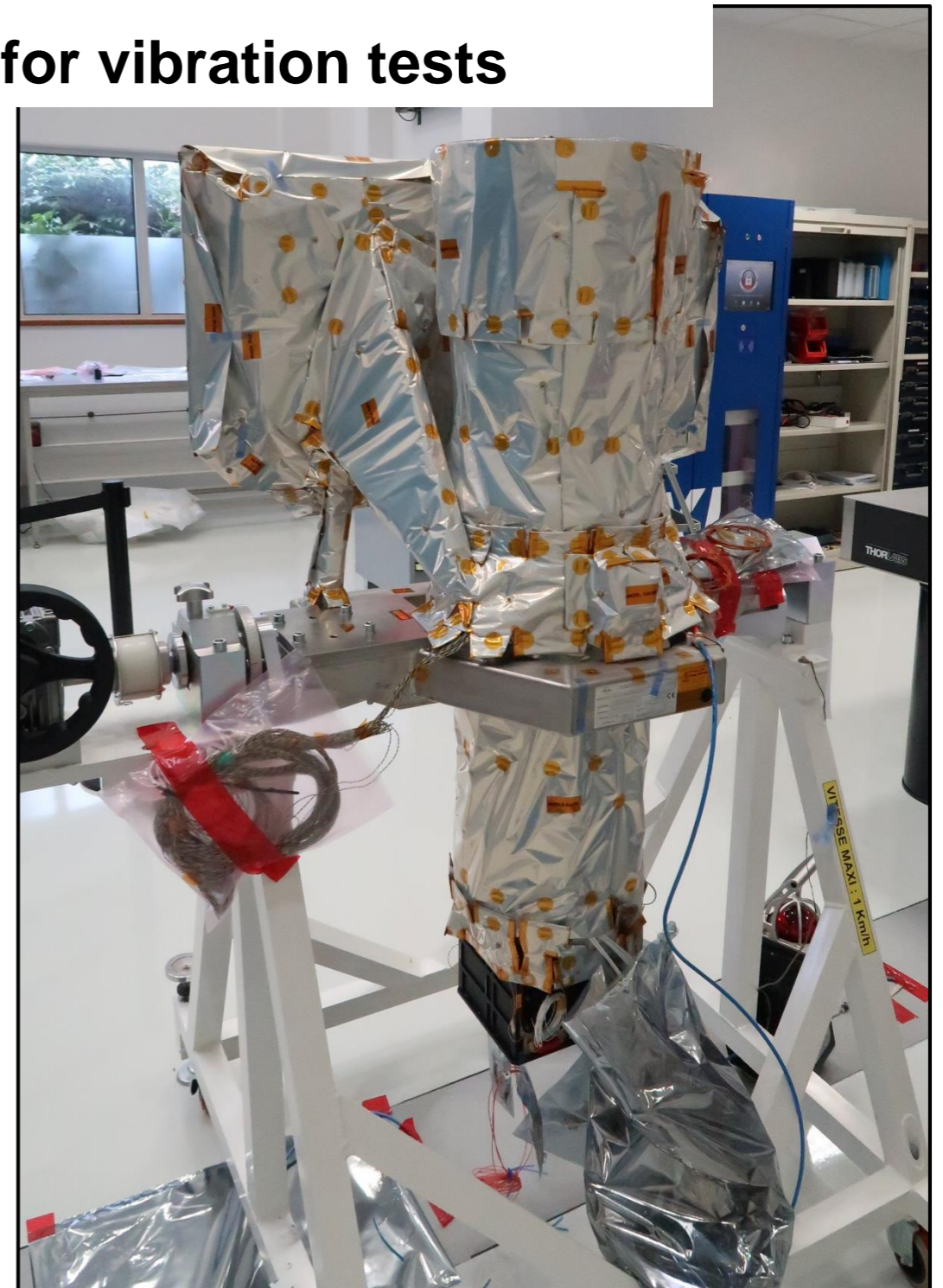
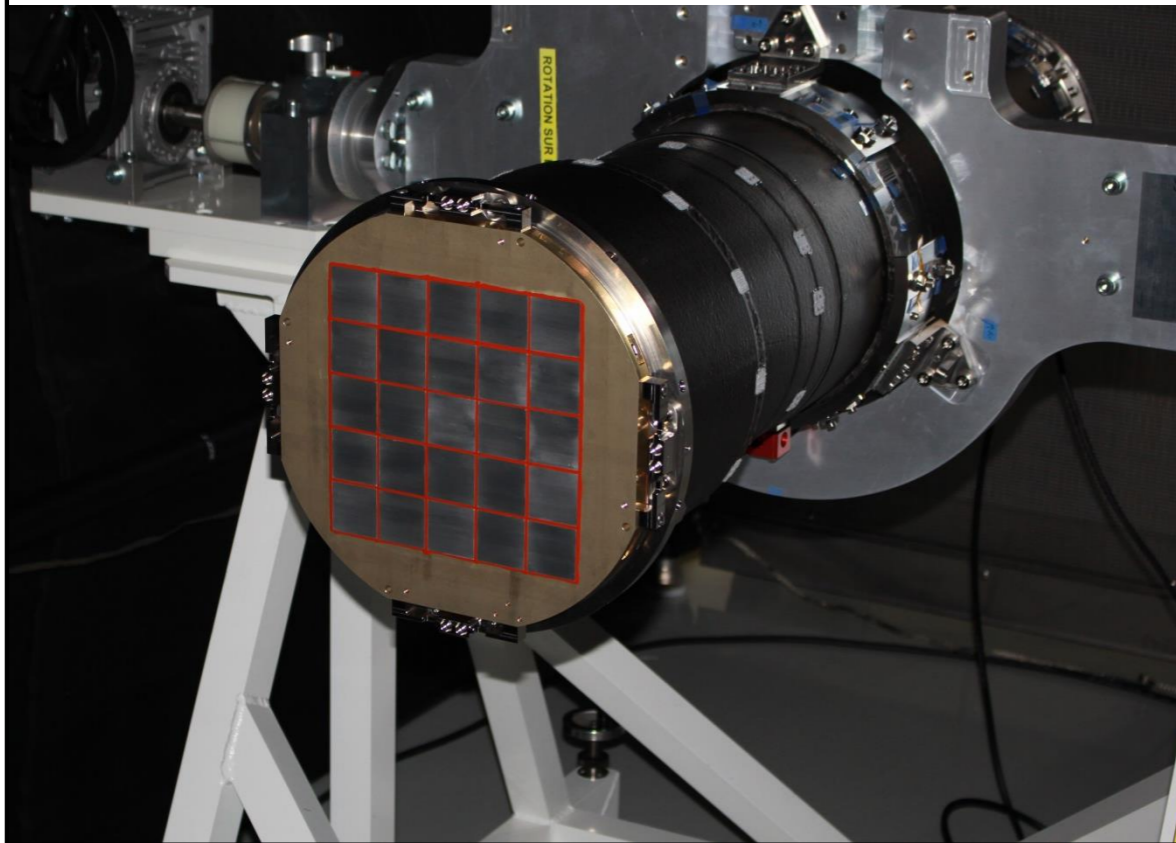
- Mise en contexte scientifique (Jean-Luc – 15 minutes)
- Présentation des trois programmes scientifiques et politique des données associée
 - Core PROGRAM : Frédéric D. - 15 minutes
 - ToO PROGRAM: Cyril -15 minutes
 - GP PROGRAM: Andrea - 15 minutes
- Organisation de l'exploitation scientifique en France : Frédéric P., 15 minutes
- Organisation du Follow-up en France : Stéphane et Susanna, 15 minutes
- Conclusions (Bertrand – 5 minutes)

ECLAIRs Structural and Thermal model ready for vibration tests



- ECLAIRs Structural and Thermal model delivered to SECM (June 2019)
- Instrument CDR in February 2020
- Flight Model sub-systems on-going...

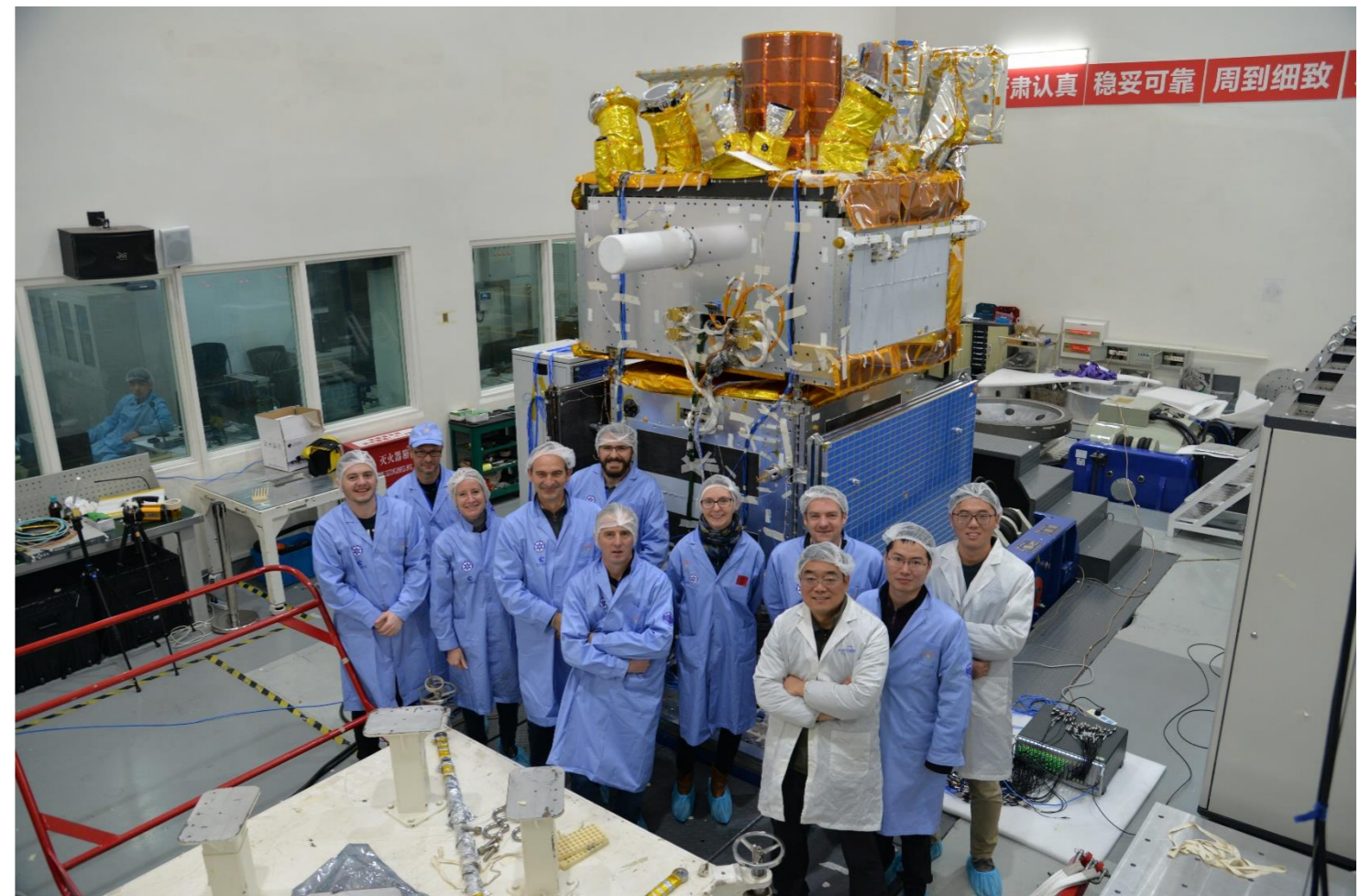
MXT Structural and Thermal model ready for vibration tests



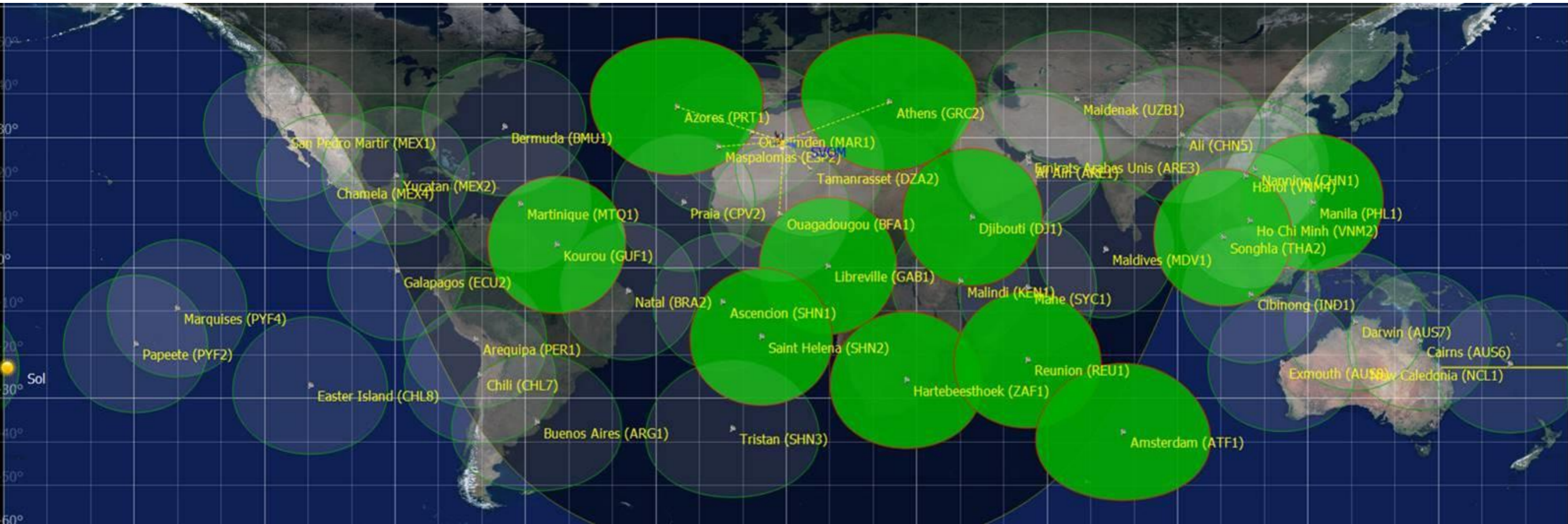
- ❑ MXT Structural and Thermal model delivery to SECM (June 2019)
- ❑ Instrument CDR in November 2019
- ❑ Performance Test Campaign at Panter (February 2020)
- ❑ Flight Model sub-systems on-going...

La campagne de Qualification du satellite SVOM

La campagne de qualification du satellite SVOM s'est déroulée de manière très intense depuis septembre 2019 jusqu'à mars 2020; elle s'est terminée sur le mode « travail à distance » à cause de la crise sanitaire.



VHF Ground Network – current status



14 stations deployed, 2020 September 1st

Major Deadlines

- Mission Critical Design Review - 2020 July
- End to End test on the QM satellite (QM) – 2020 October
- FM delivery ECLAIRs and MXT (FM) – 2021 October
- Launch – 2022 June

Agenda



- Mise en contexte scientifique (Jean-Luc – 15 minutes)
- Présentation des trois programmes scientifiques et politique des données associée
 - Core PROGRAM : Frédéric D. - 15 minutes
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Conclusions



- SVOM est une mission sol-espace qui sera opérationnelle mi-2022. Elle est entièrement dédiée au ciel transitoire, pendant l'âge d'or du «time domain astronomy ».
- SVOM est un laboratoire qui va permettre de former une nouvelle communauté autour des questions scientifiques du ciel transitoire
- Cette science en quasi temps réel est très compétitive et nécessite de sortir des résultats fiables rapidement.
- En France une communauté scientifique importante (10 laboratoires) se préparent activement à relever le défi.
- Le budget d'accompagnement scientifique n'était clairement pas à la hauteur pendant la phase de développement (compte tenu du nombre de scientifiques investis 40 à50)
- Pour être compétitif pendant la phase d'exploitation, une augmentation de l'accompagnement serait souhaitable ainsi qu'un support conséquent en postdoc.

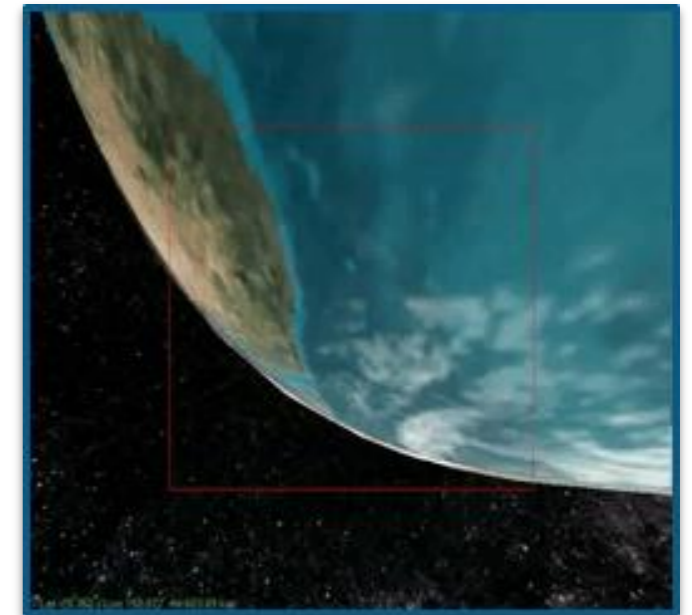
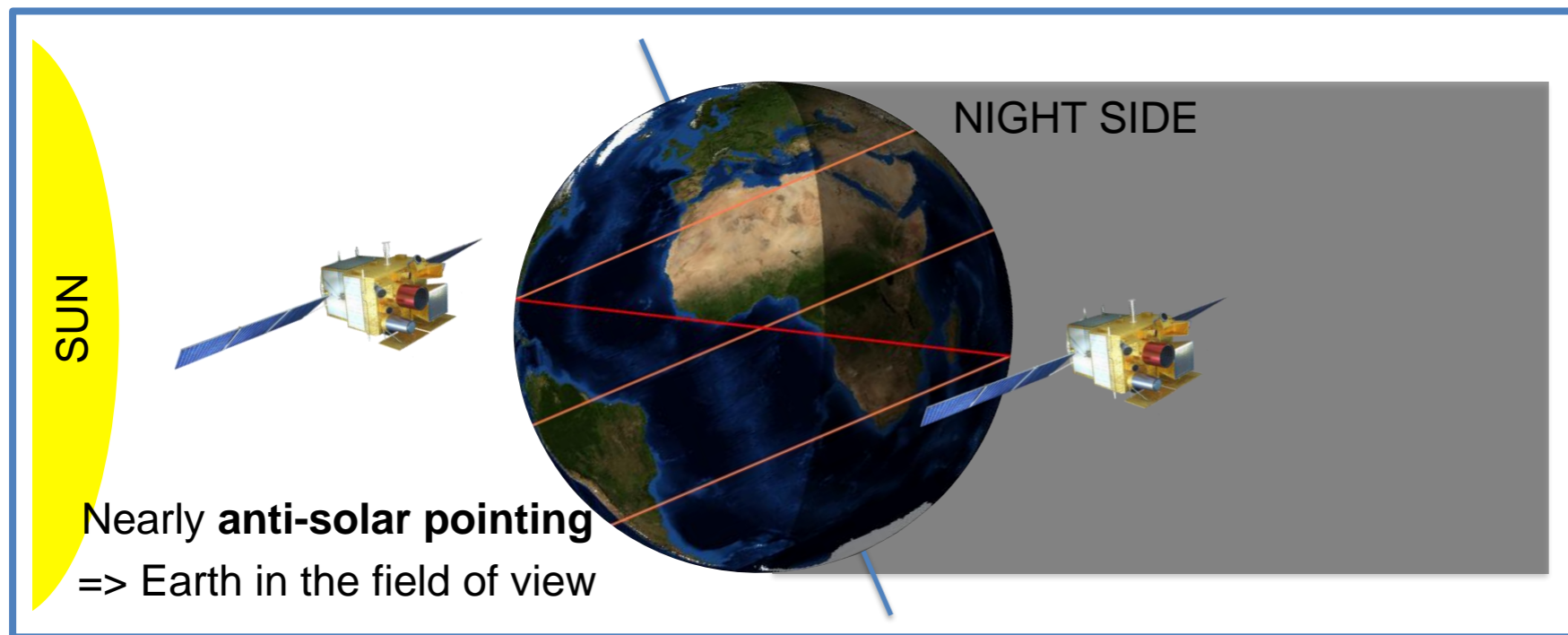
THAT'S ALL



launch 2022 !

ORBIT AND POINTING STRATEGY

Optimizing the ground follow-up of GRB candidates (should increase the success of the ground redshift measurement)



65% of duty cycle for ECLAIRs
about 50% for MXT and VT

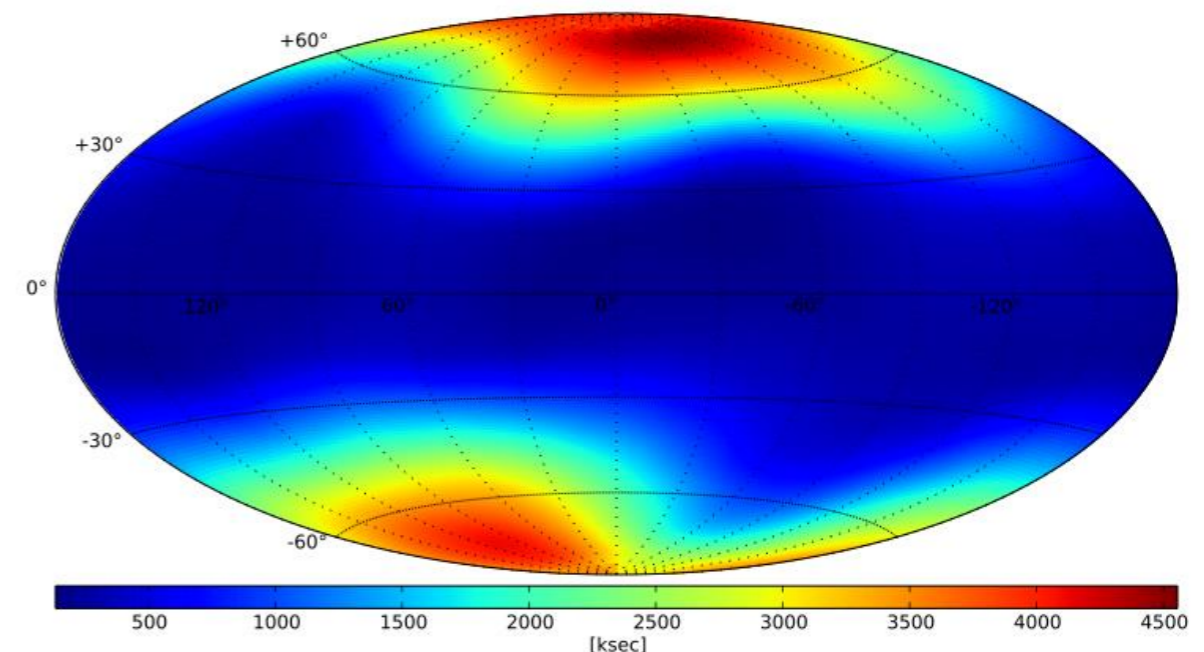
Waiting between the detection of two GRB candidates...

Avoidance of the galactic plane (most of the time)
and also intense sources such as **Sco X-1**

ECLAIRs exposure map

(65 GRBs/year, 1 ToO per day)

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



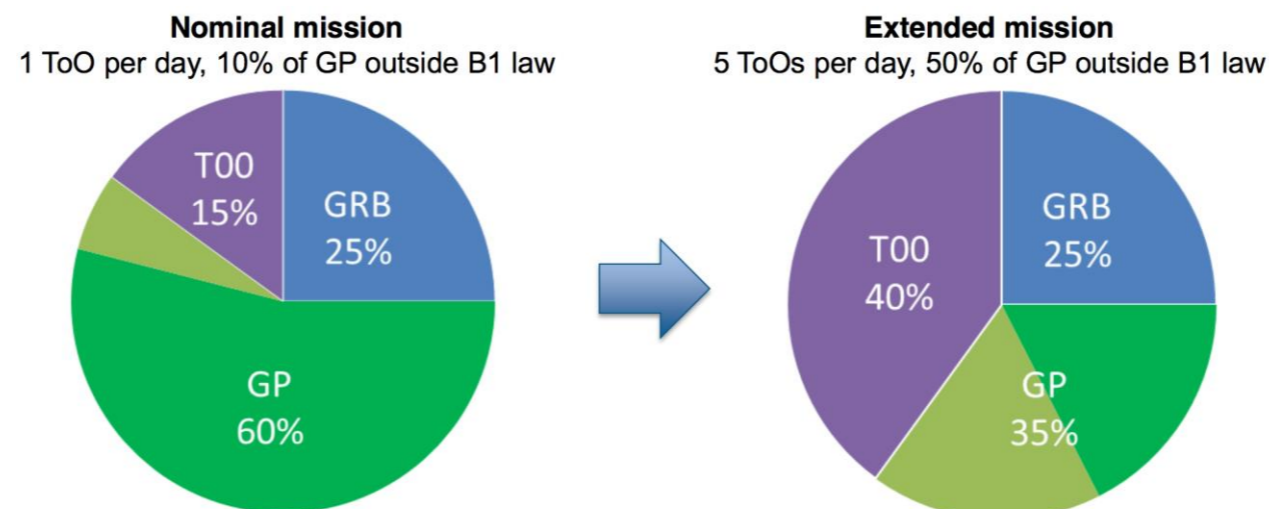
BESIDES GRBs ...SVOM AS AN OPEN OBSERVATORY

The general program (GP)

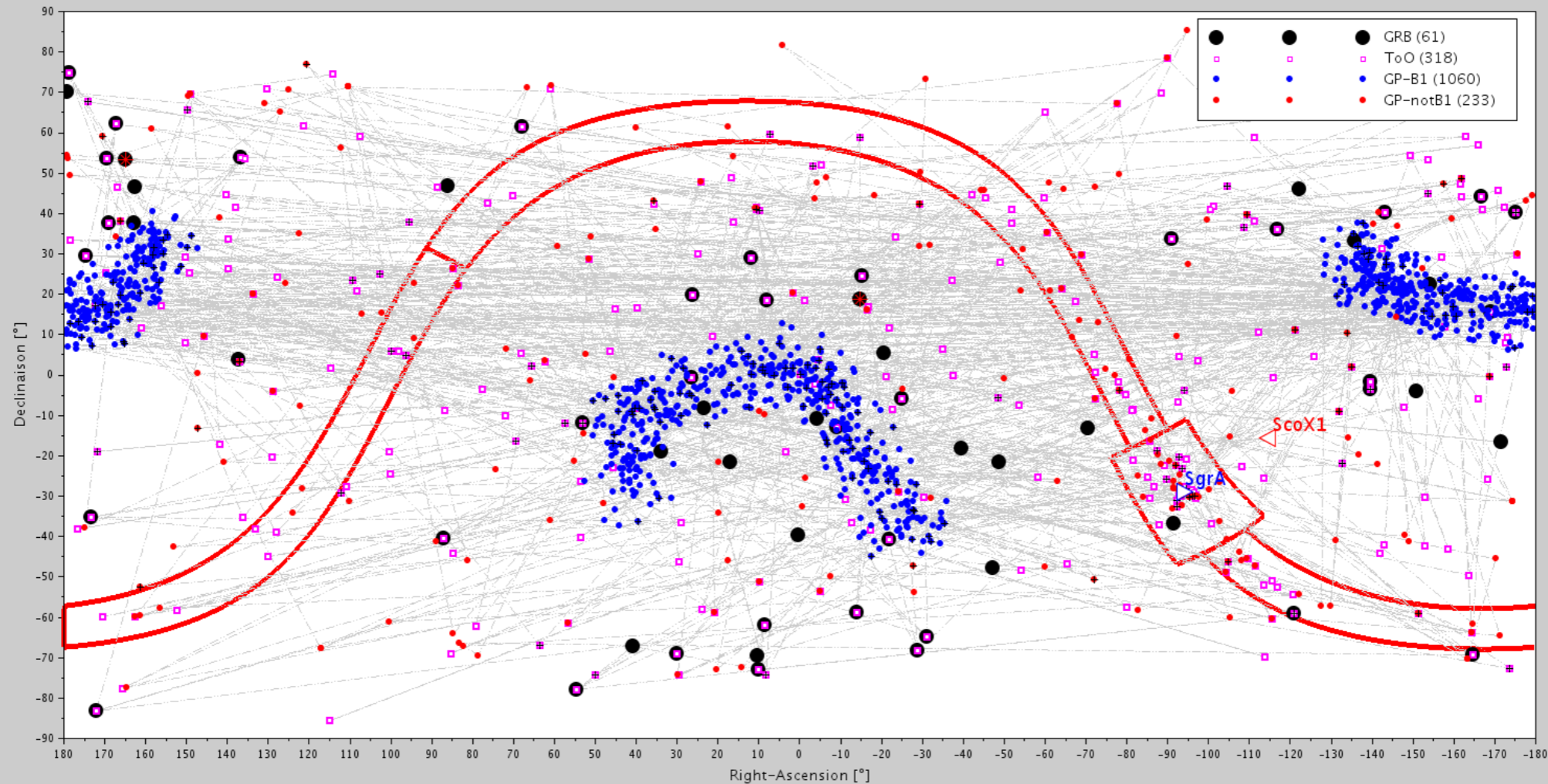
- Observation proposals being awarded by a TAC (a SVOM co-I needs to be part of your proposal) for astrophysical targets of interest mostly compliant with the satellite attitude law
- Only 10% of the time can be spent on low Galactic latitude sources during the nominal mission, up to 50% during the extended mission

Target of Opportunity (ToO) programs

- **ToO-NOM** is the nominal ToO which covers the basic needs for efficient transient follow-up alerts sent from the ground to the satellite (GRB revisit, known source flaring, new transient)
- **ToO-EX** is the exceptional ToO which covers the needs for a fast ToO-NOM in case of an exceptional astrophysical event we want to observe rapidly.
- **ToO-MM** is the ToO-EX dedicated to EM counterpart search in response to a multi-messenger alert. What differs from the ToO-NOM and ToO-EX is the unknown position of the source within a large error box...
- Initially 1 ToO/day focussed on time domain astrophysics, will increase during the extended mission



One year of SVOM Observation



Core Program GRBs 61 pointings,

ToOs Program 318 pointings

General Program 1293 pointings