

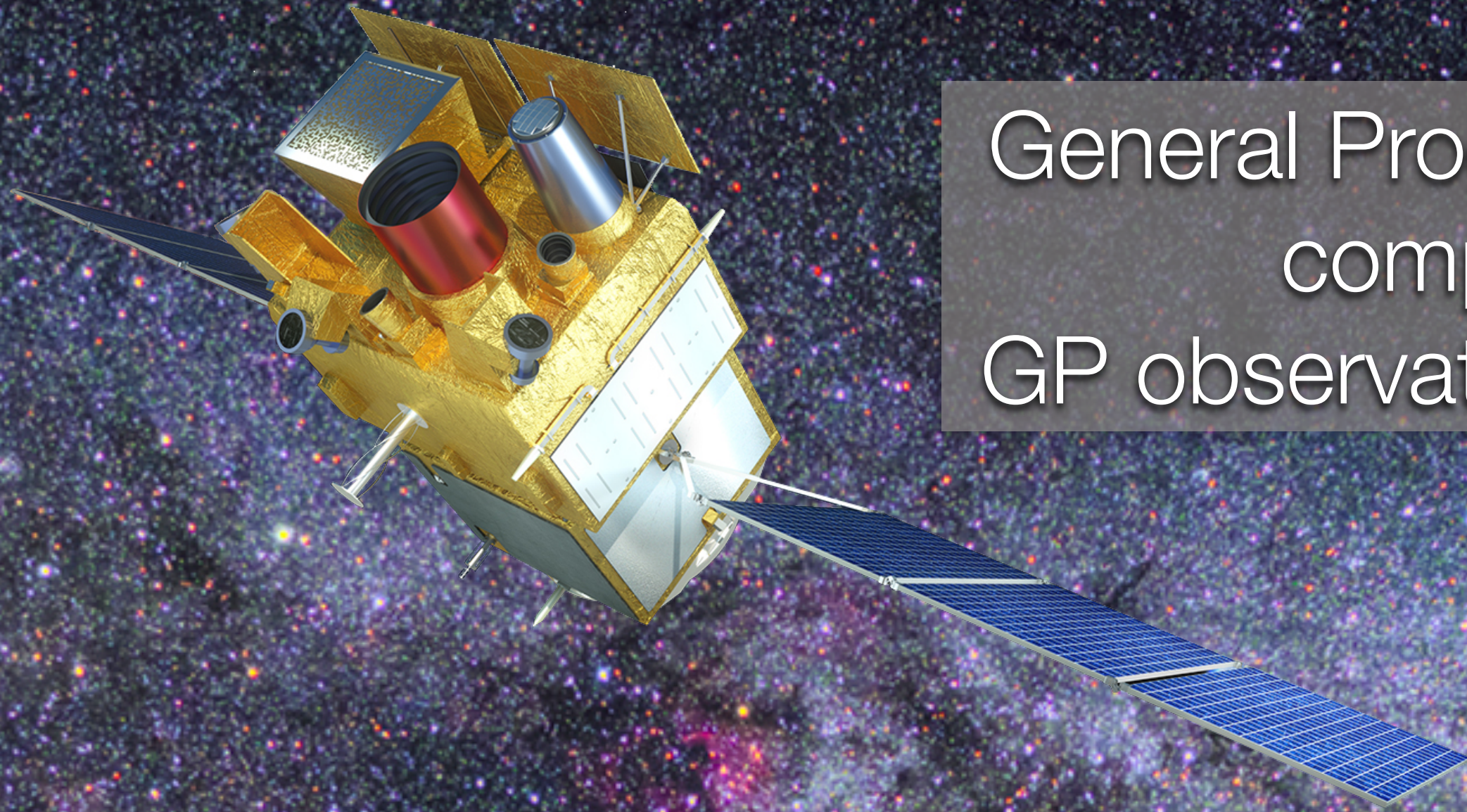


SVOM Target of Opportunity (ToO) :

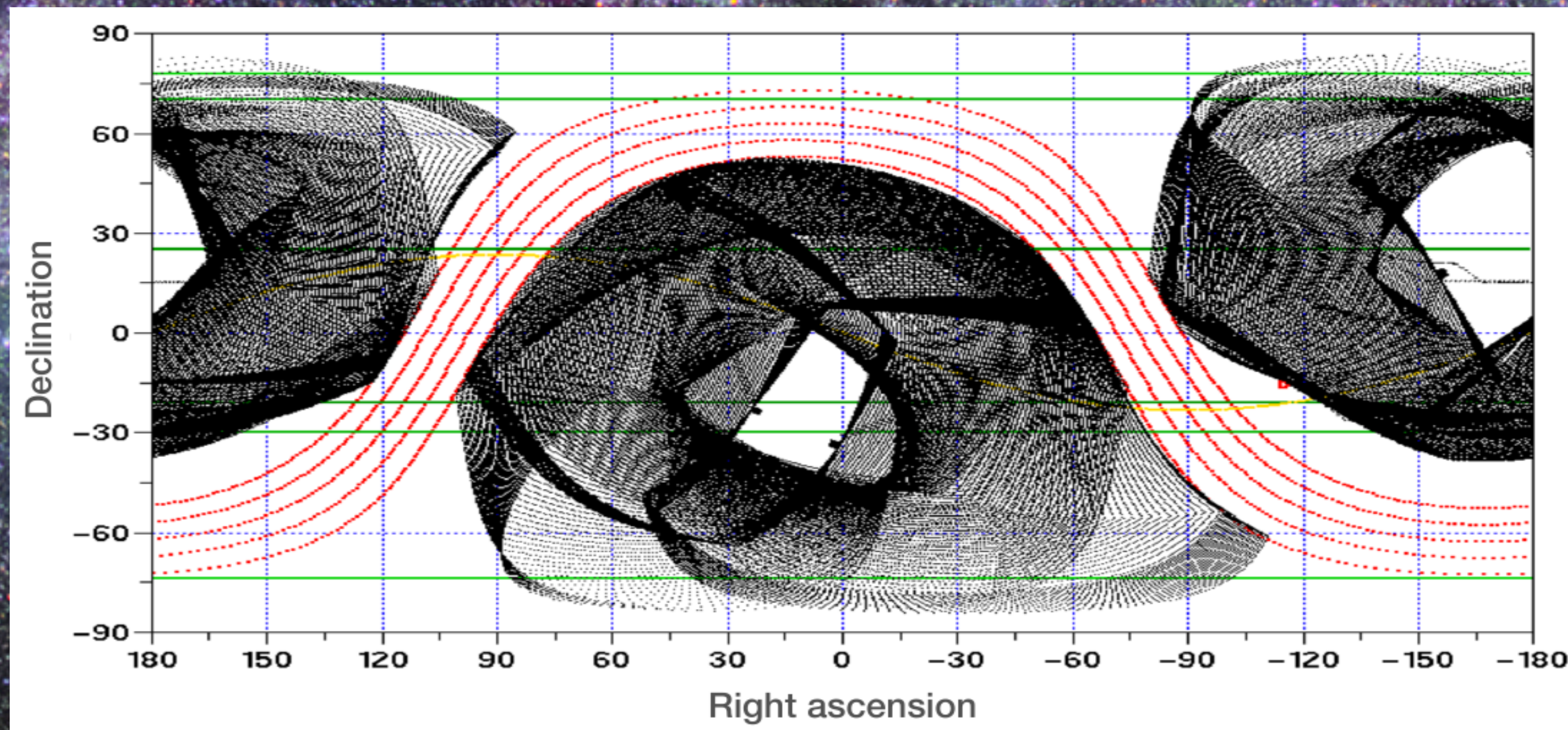
a user approach

C. Lachaud & J. Wang

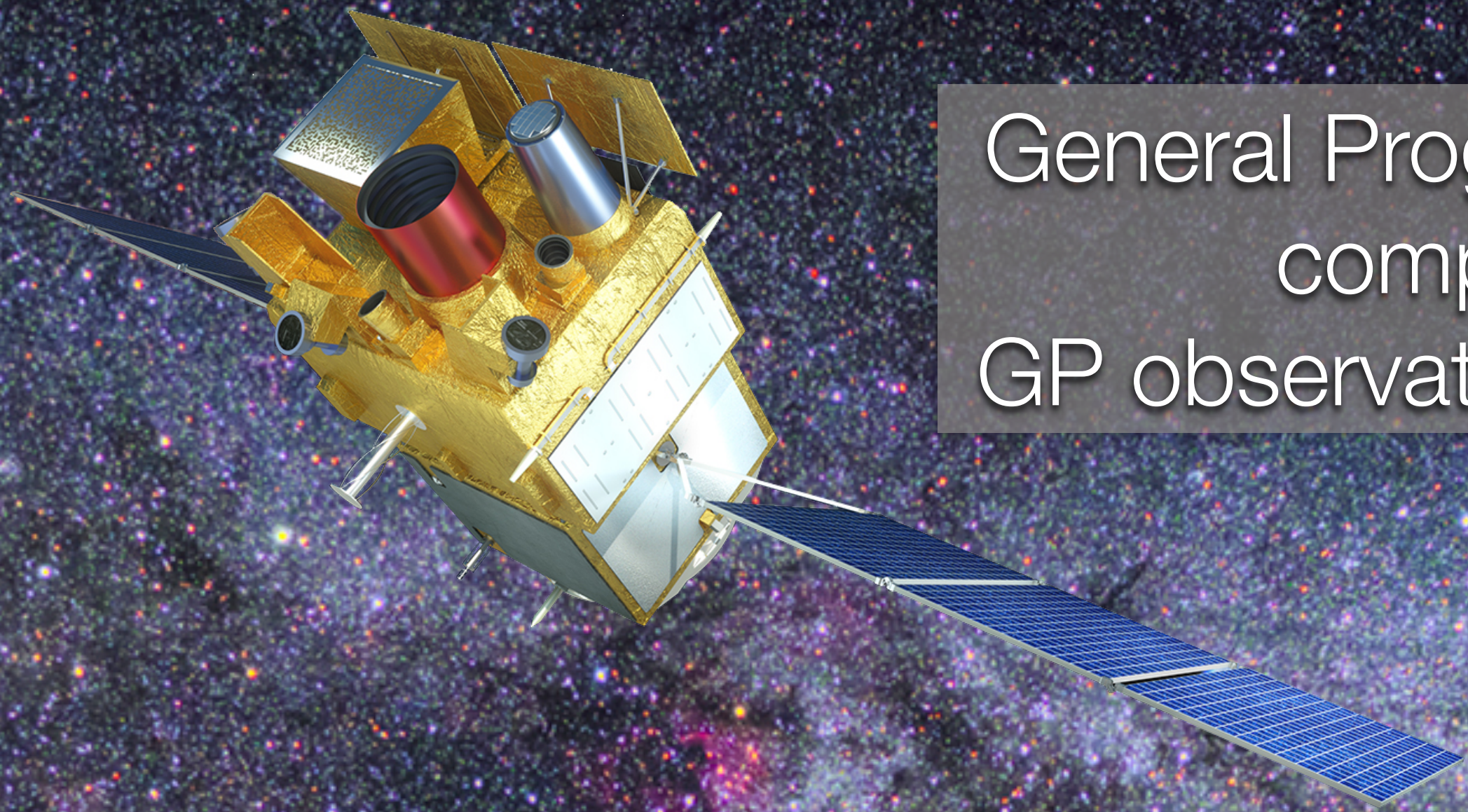
The SVOM observation programs



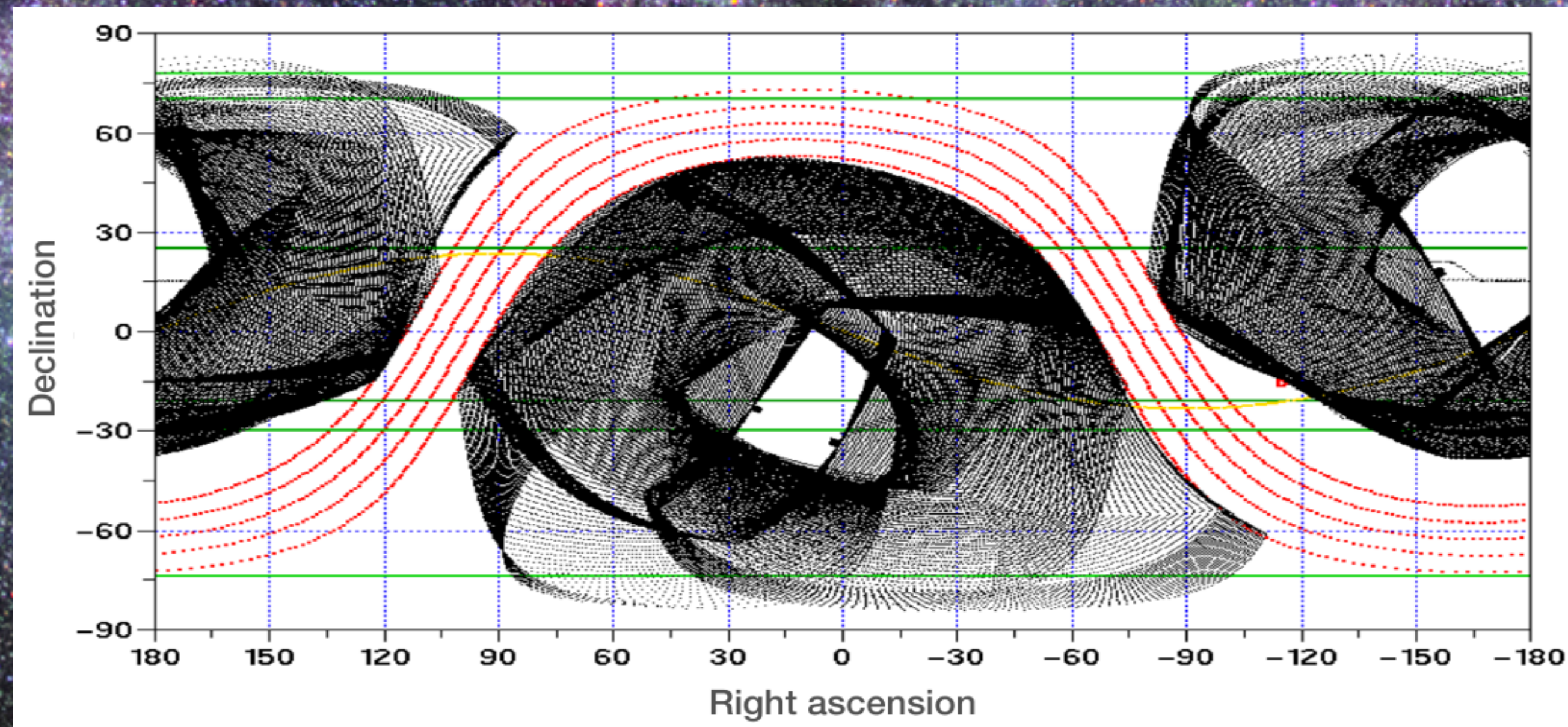
General Program (GP) : astrophysical targets of interest mostly compliant with the B1 law (satellite attitude law).
GP observation plan is uploaded to the satellite every 2 weeks.



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How to apply ?

Call for observation proposals once per year. Selection by a TAC.

Example : survey of the Virgo cluster
(TDEs, AGNs)
See C.Motch talk.

The SVOM observation programs

- Autonomous transient detection by ECLAIRs :
- known source (repointing only if above a given threshold)
 - unknown source : GRB (Core Program : CP) or other astrophysical transient (GP)

All transients will be notified in short time scales ($<30s$ for 65% of alerts) to the FSC and then to the community.

SVOM has been designed for autonomous detection, fast repointing, short timescales alert and follow-up

The SVOM observation programs



Transient/event detected by other facilities

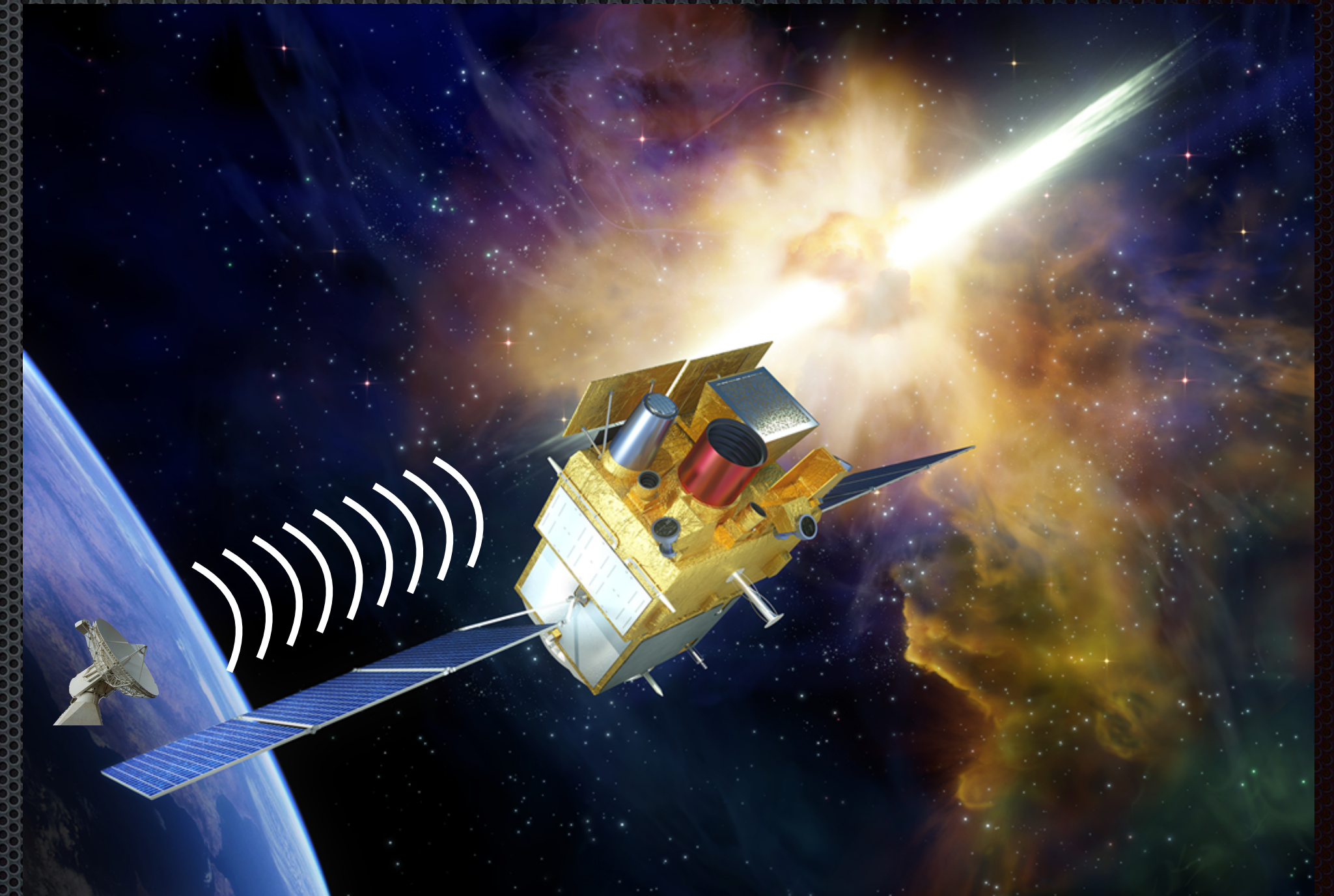


The SVOM observation programs

Transient/event detected by other facilities

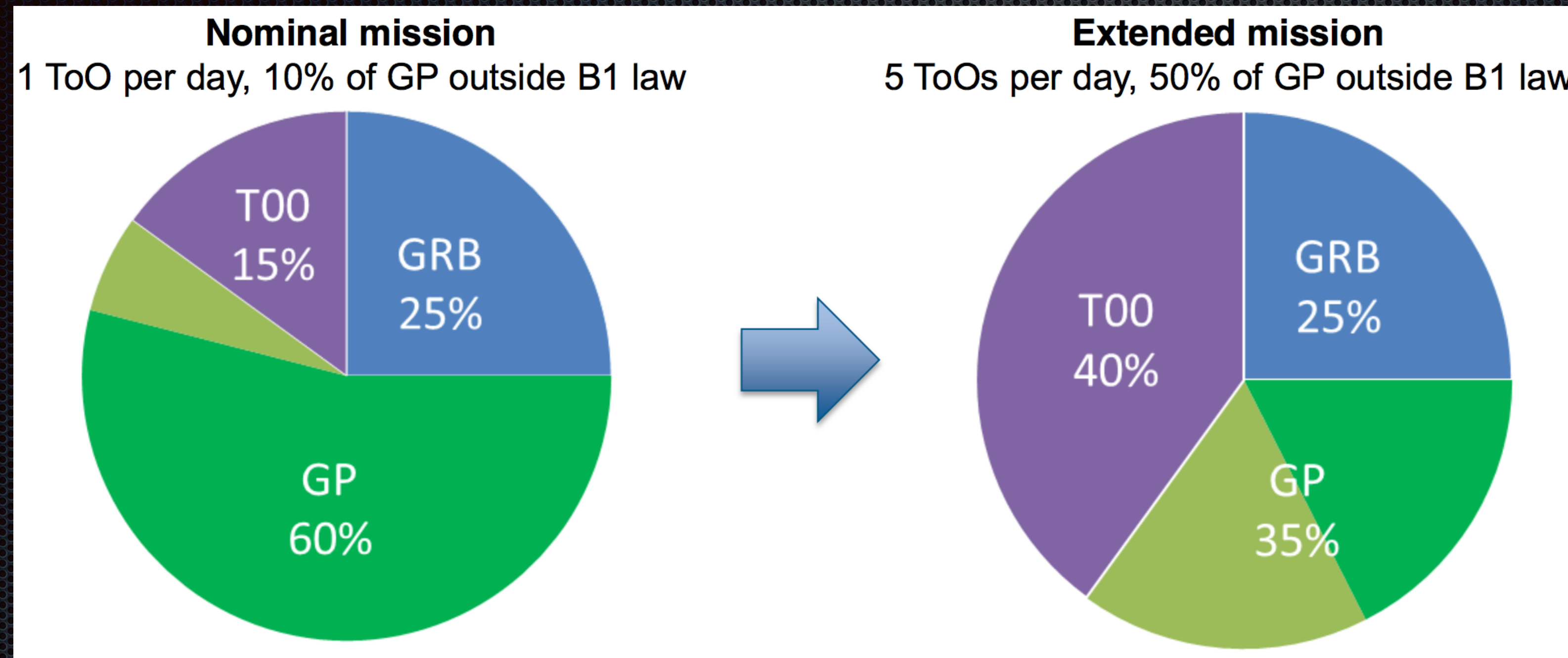
Target of Opportunity program

=> send commands to the satellite to trigger observations from the ground



Complex operations at system level

The SVOM observation programs



From 1 ToO/day and as much as 5 ToO/day in the extended mission.

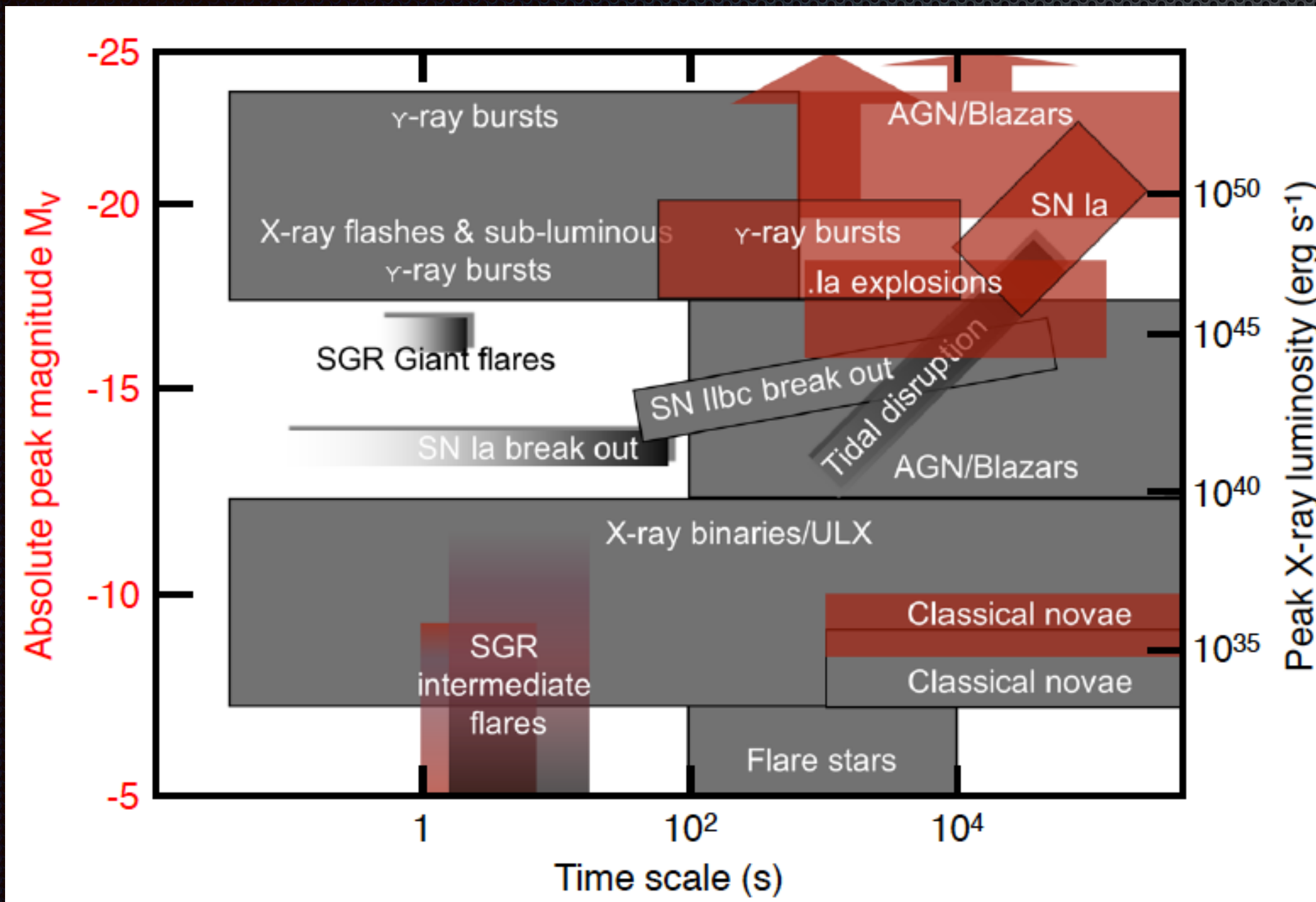
GP reduced but more tolerance to escape the B1 law.

ToO-NOM

ToO-NOM is the nominal ToO which covers the basic needs for efficient transient follow-up.

Scientific target :

- GRB revisit (CP; user : BA)
- Pre-planned observations through a GP proposal waiting for a known source to flare (AGN,...)
- New transient



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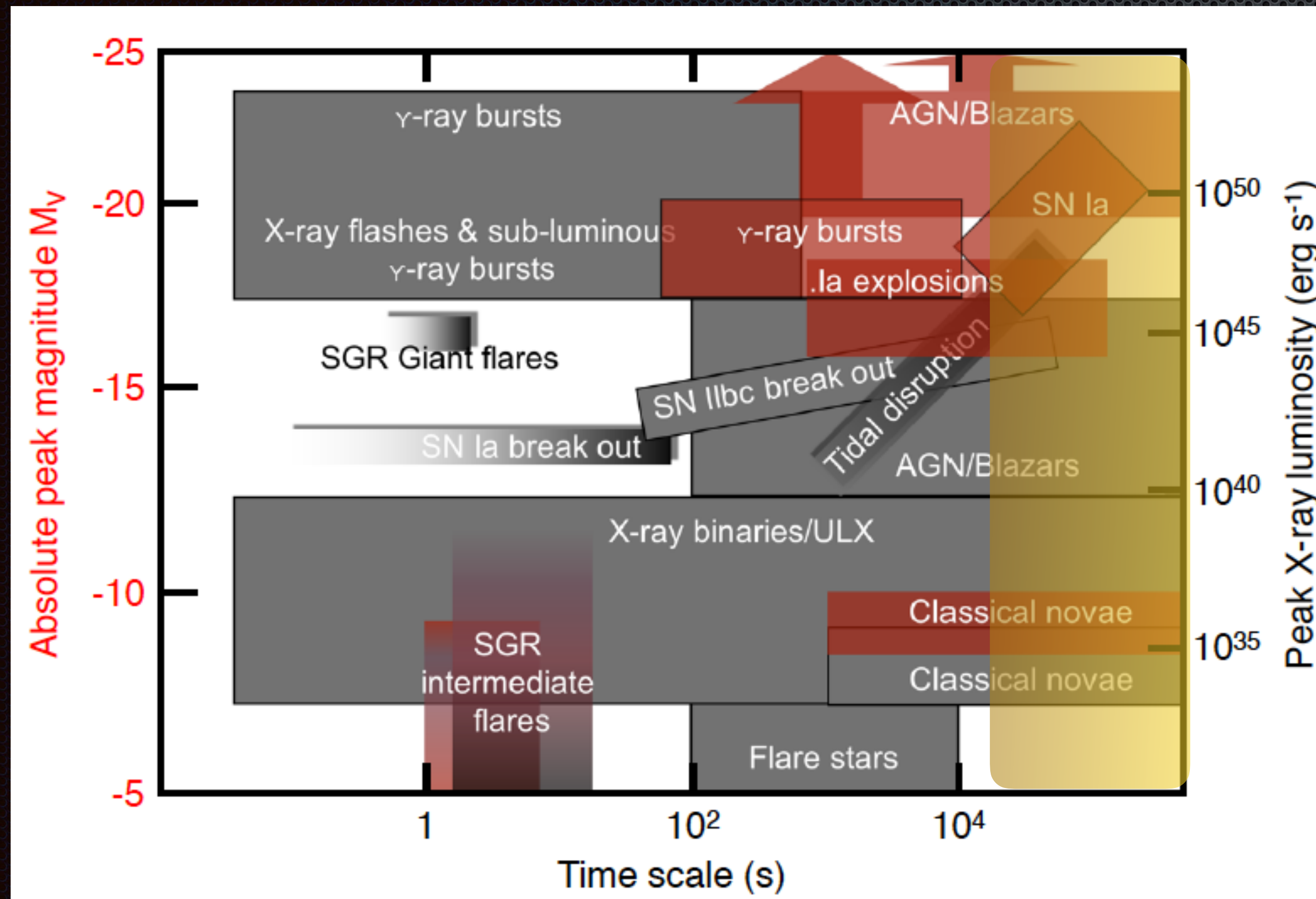
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Main characteristics :

Frequency : 1/day

Standard delay : < 48h

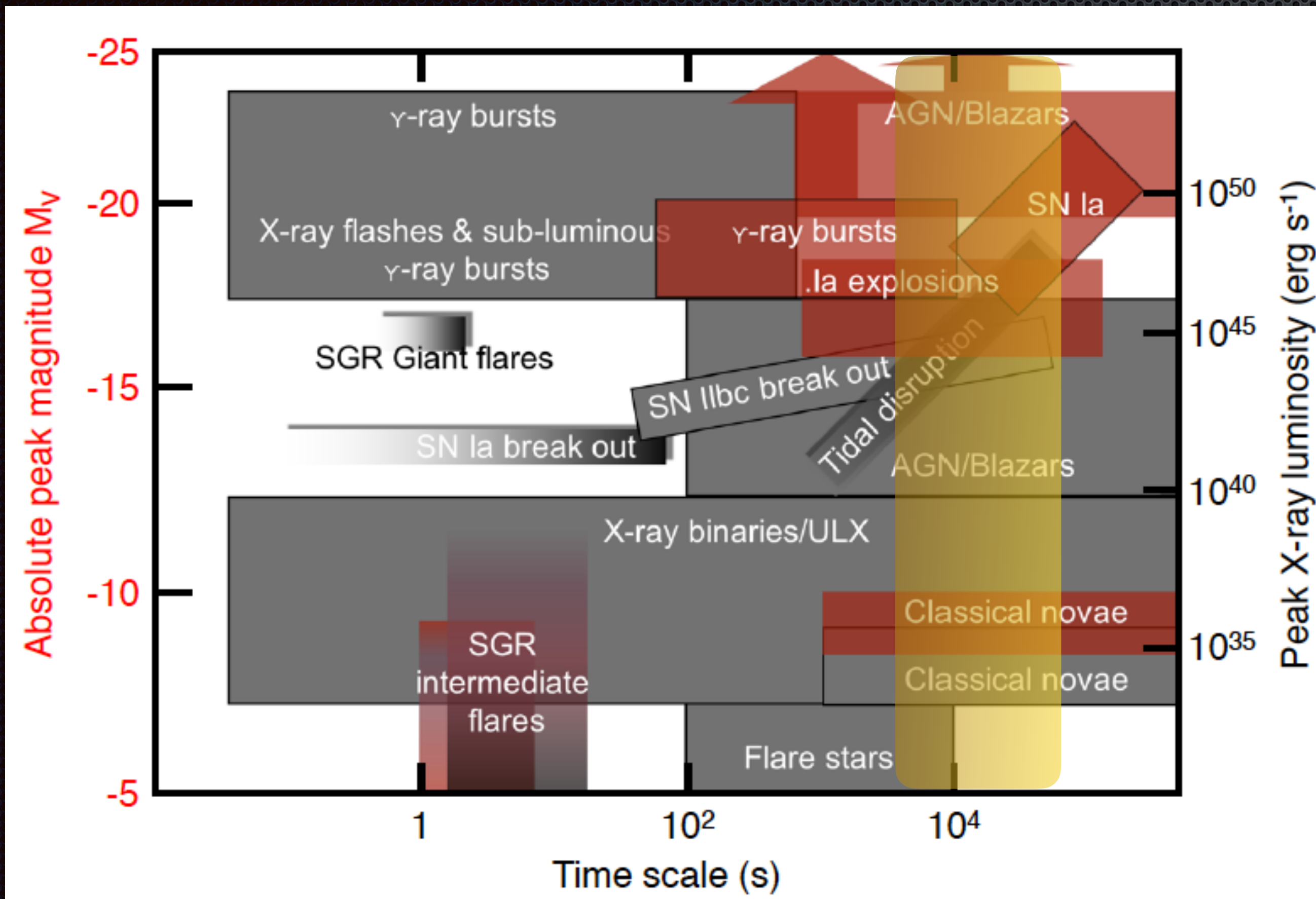
Duration : 1 orbit (or more)



ToO-EX

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.

Main characteristics :
Frequency : 1/month
Standard delay : < 12h
Duration : 7-14 orbits

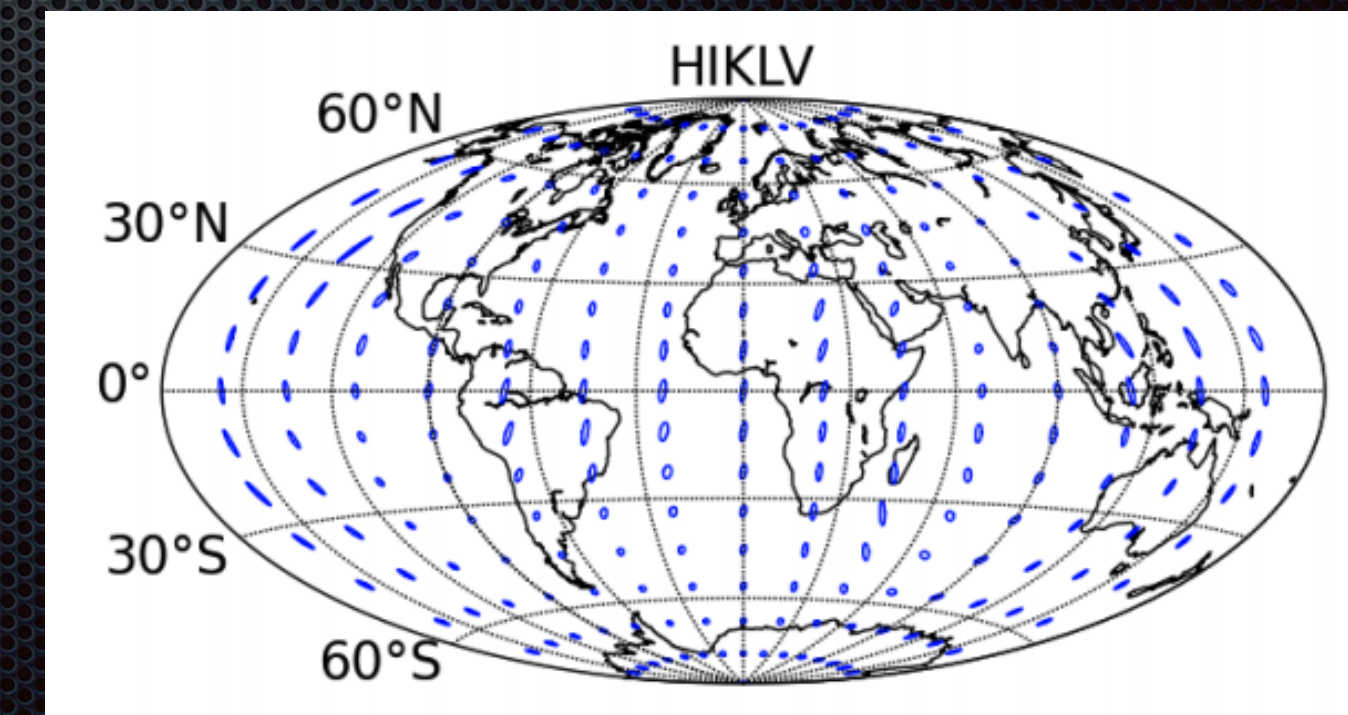
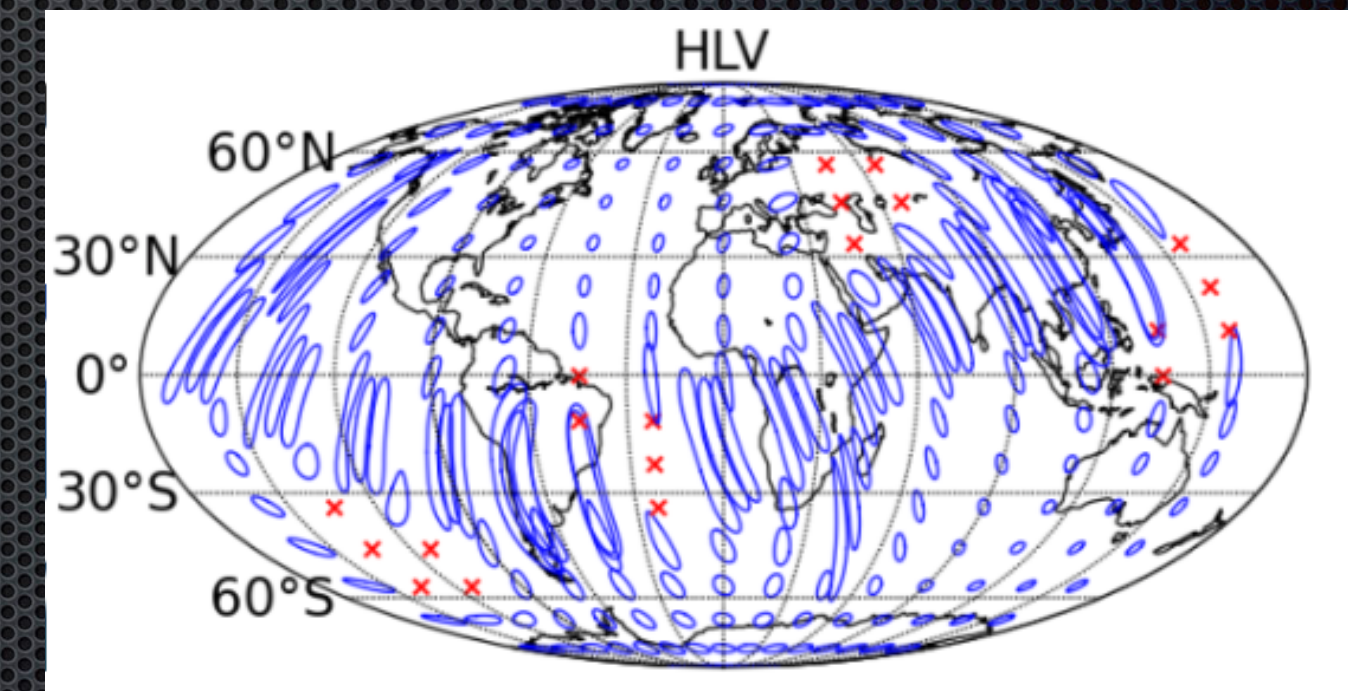
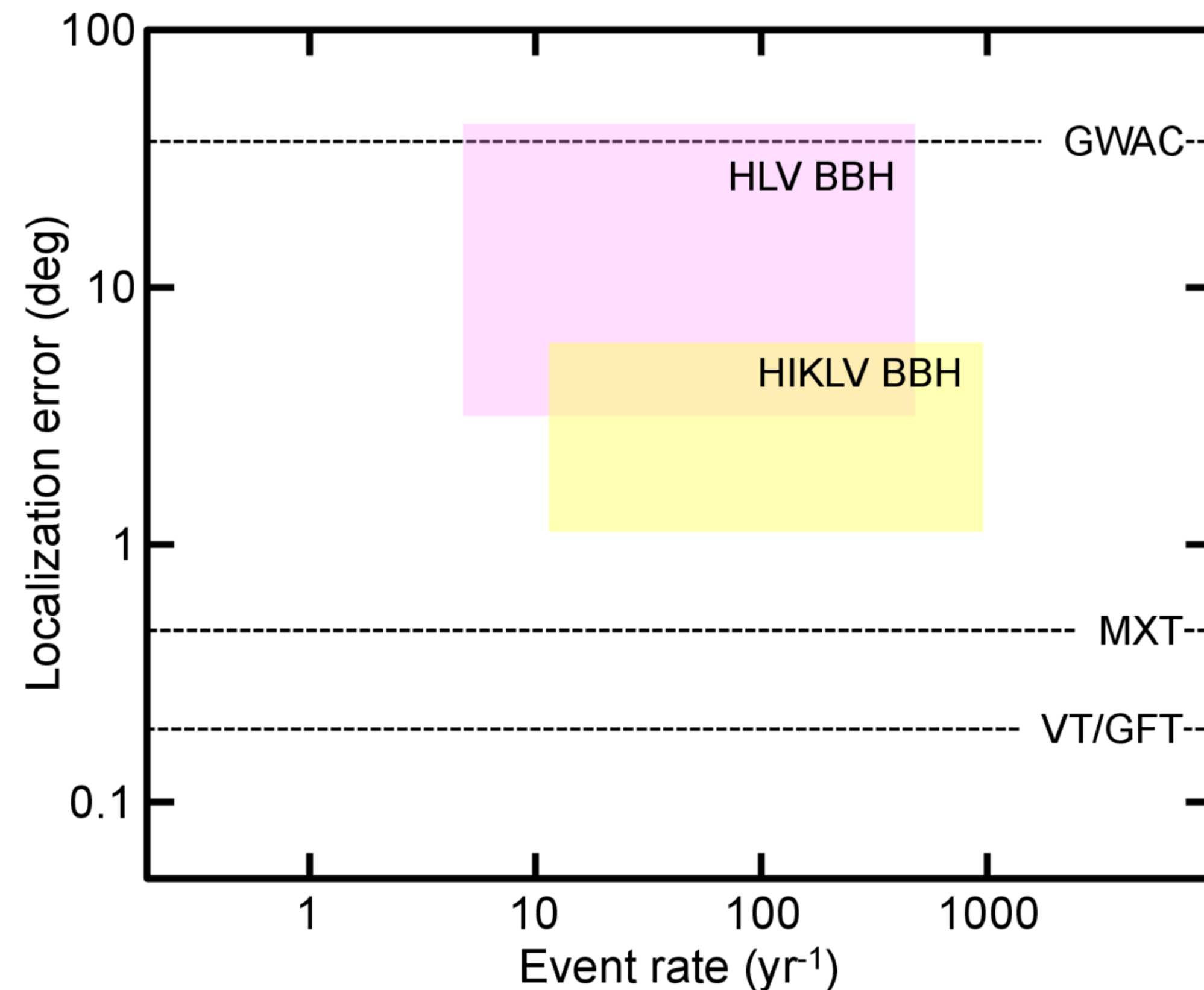


ToO-MM

ToO-MM is the ToO 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...

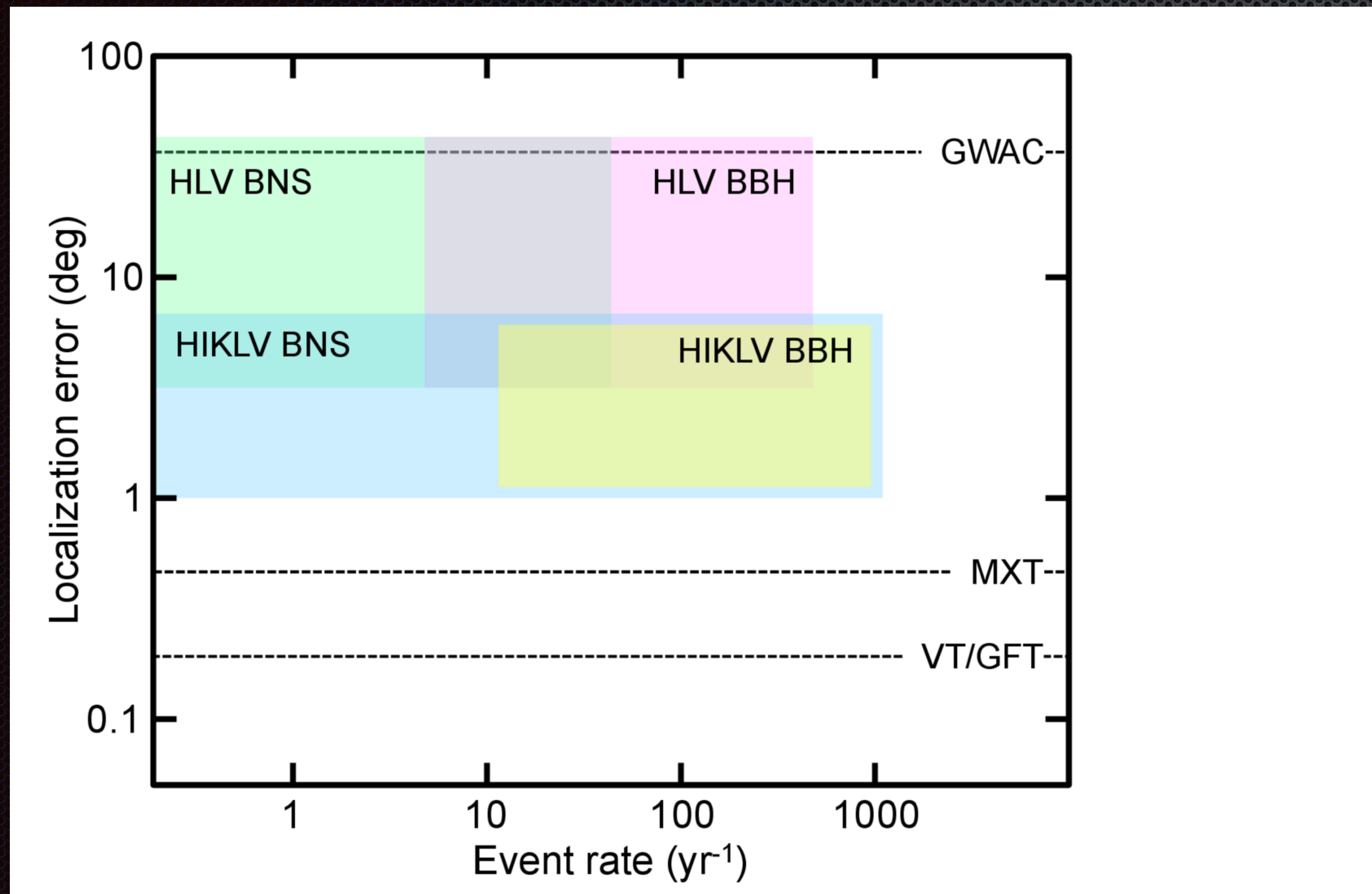
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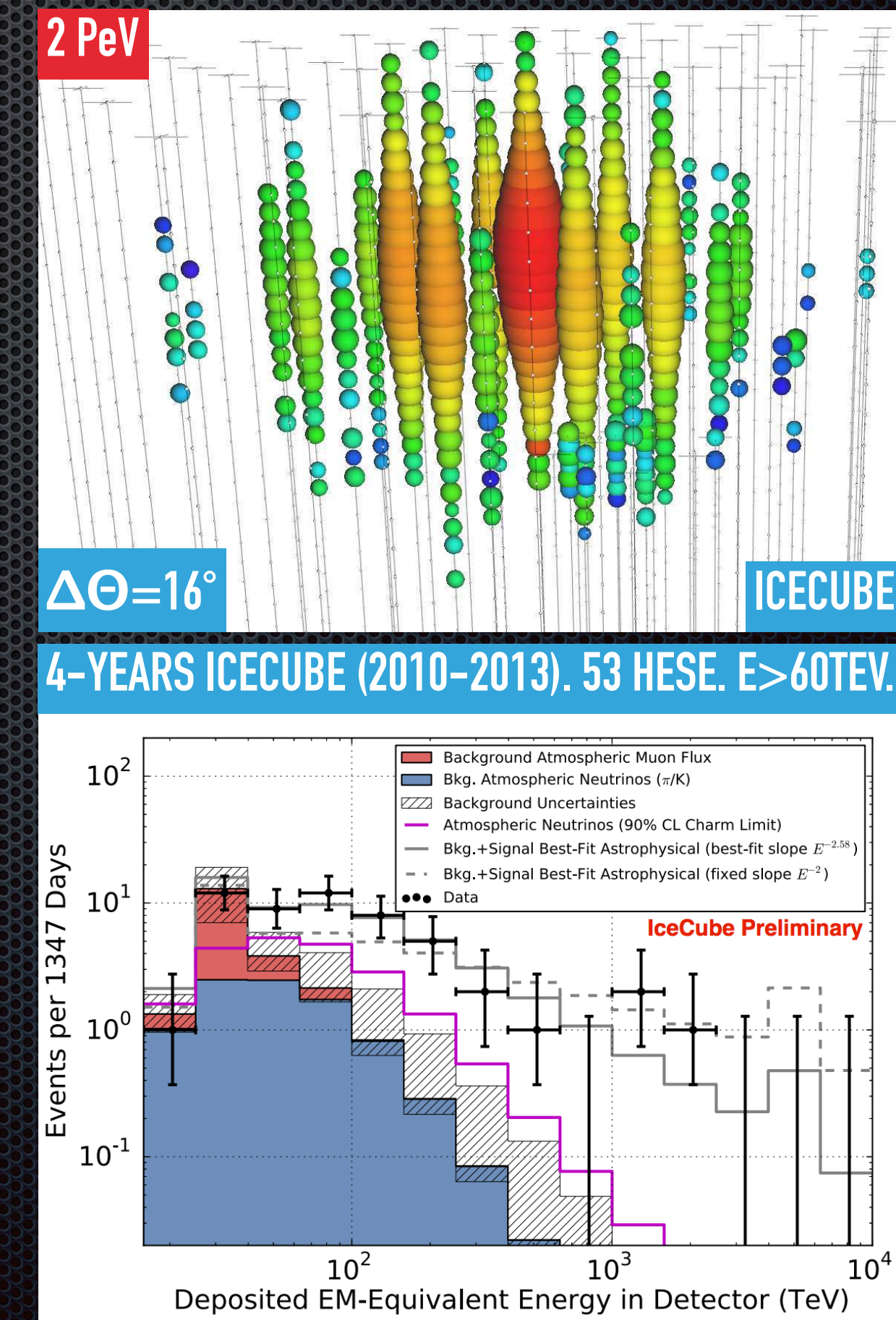
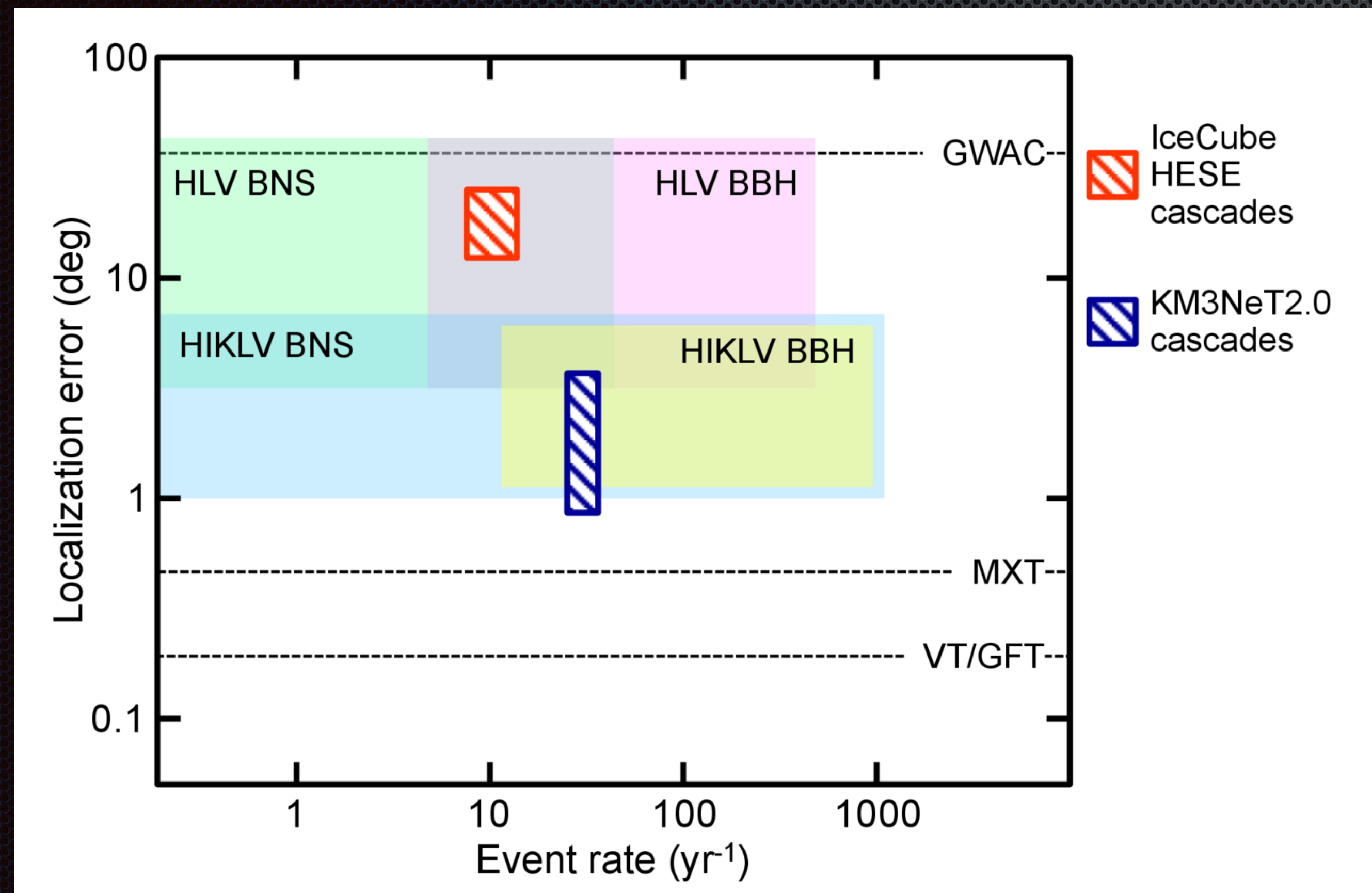
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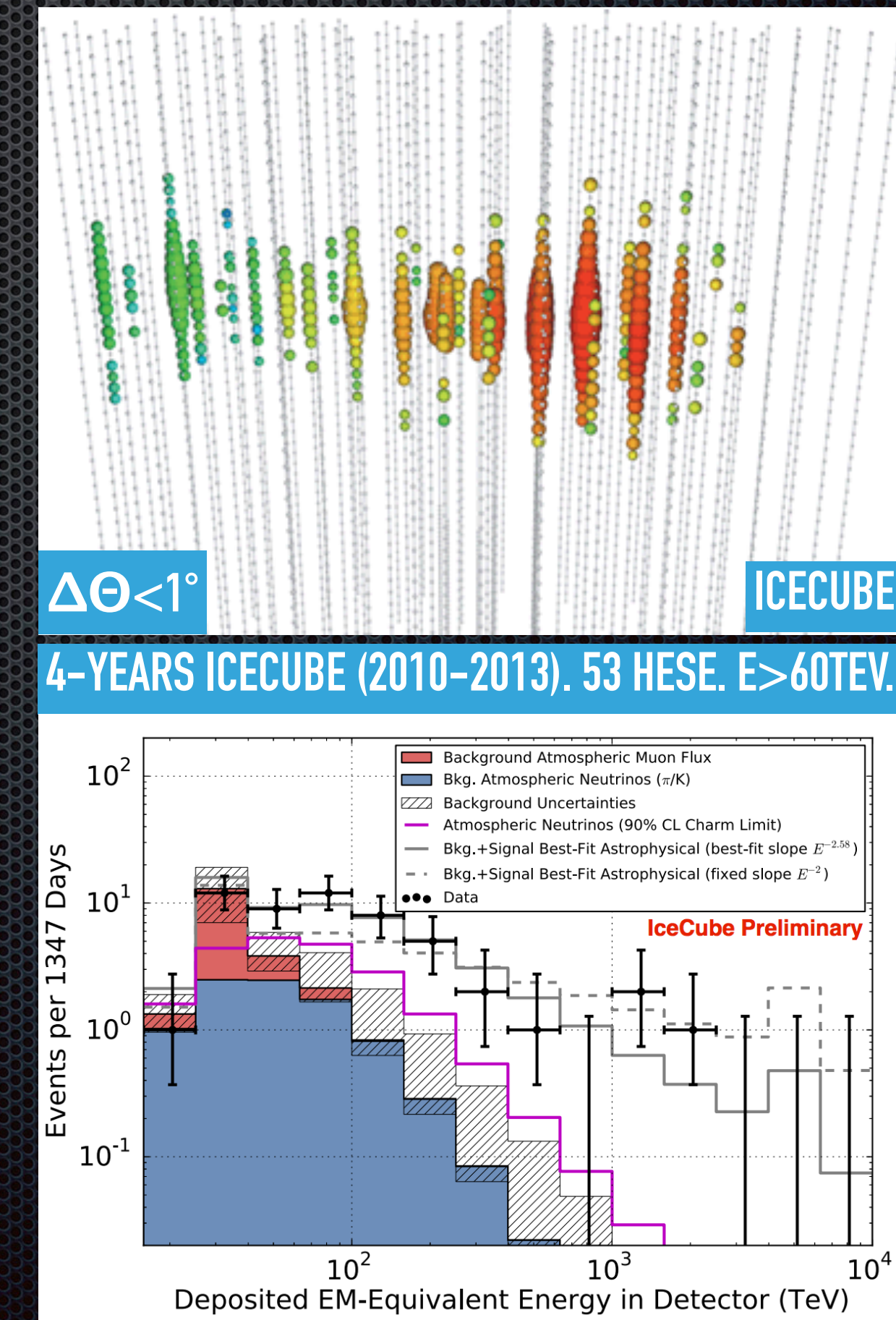
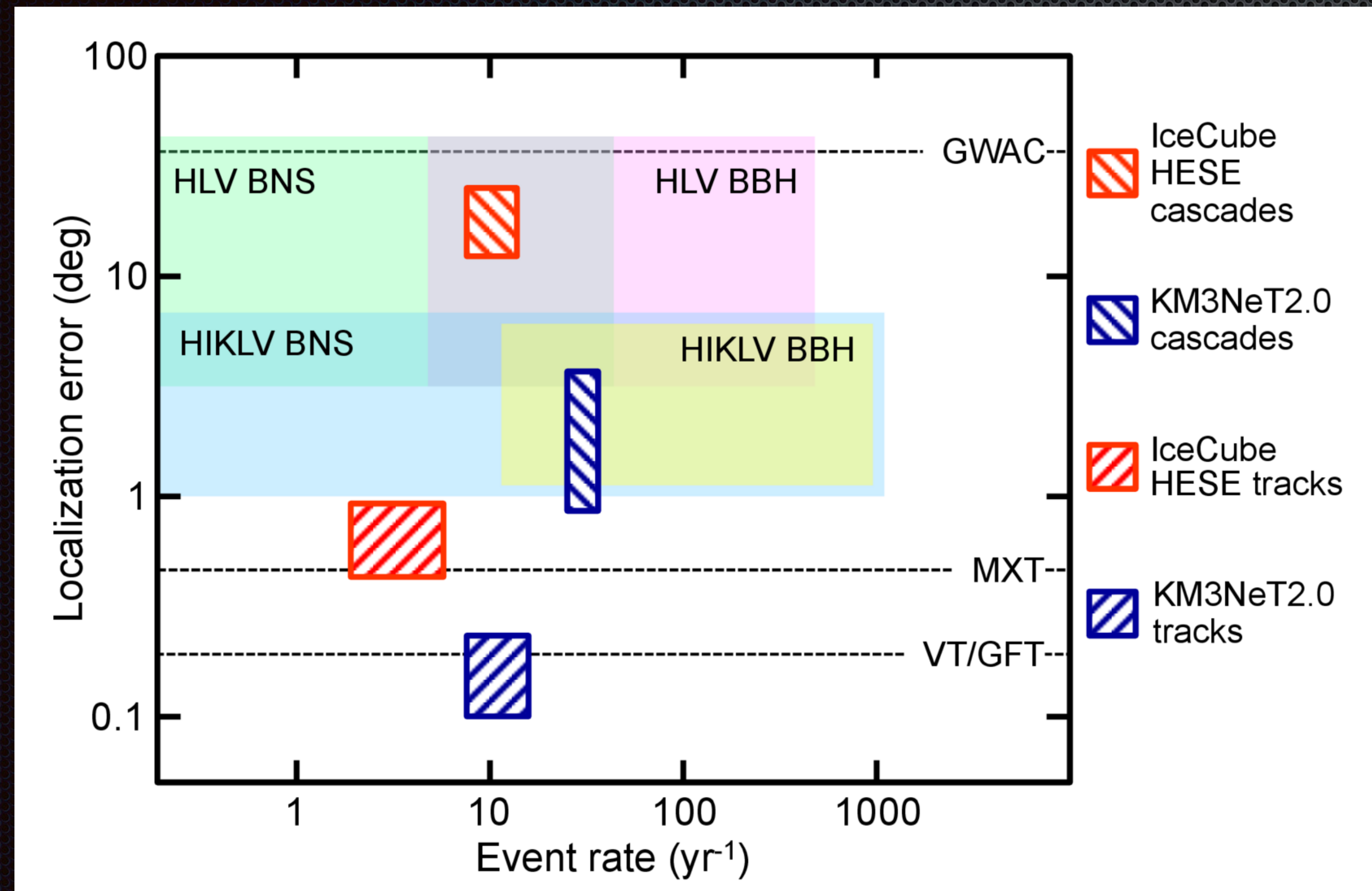
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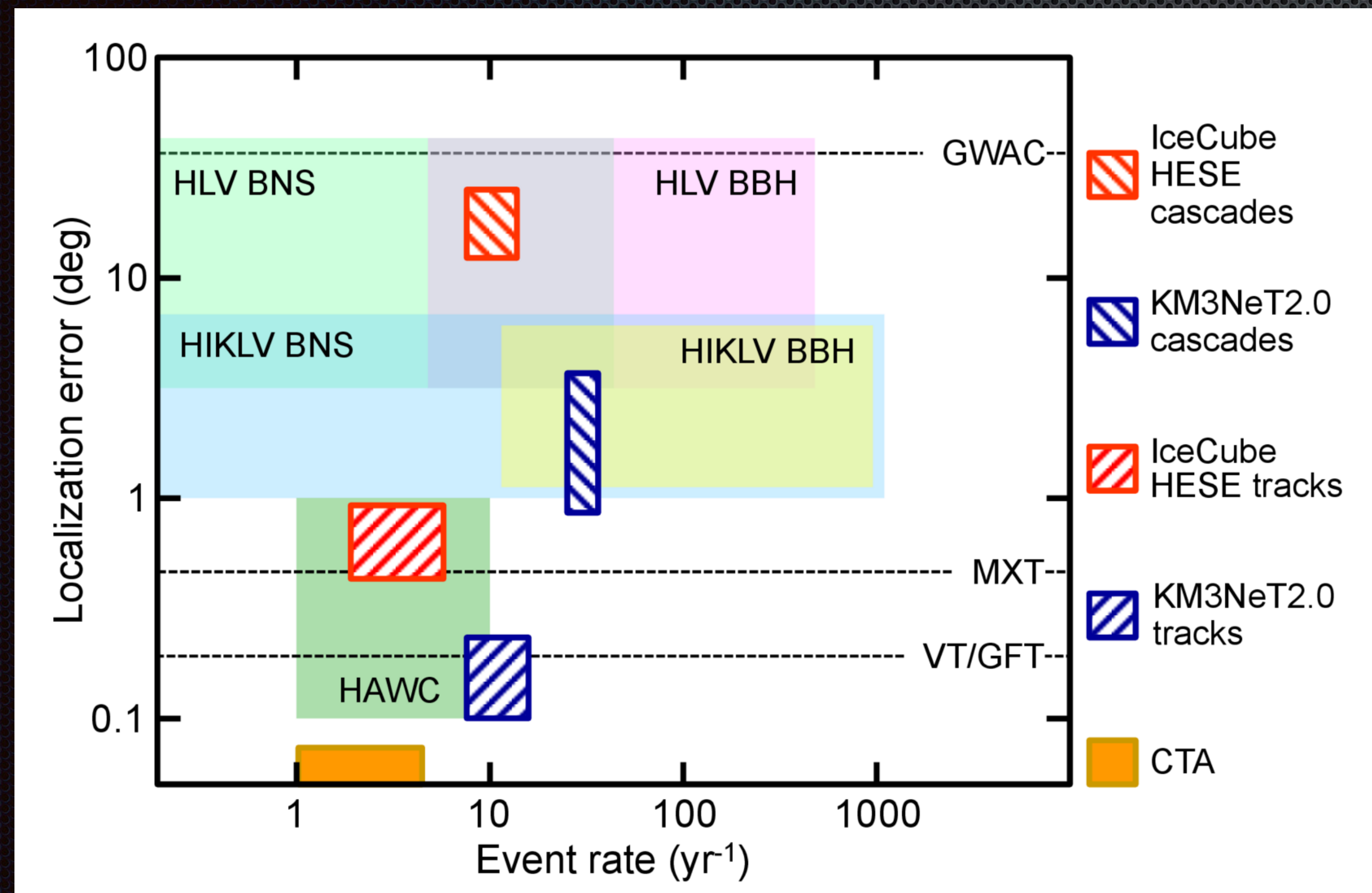
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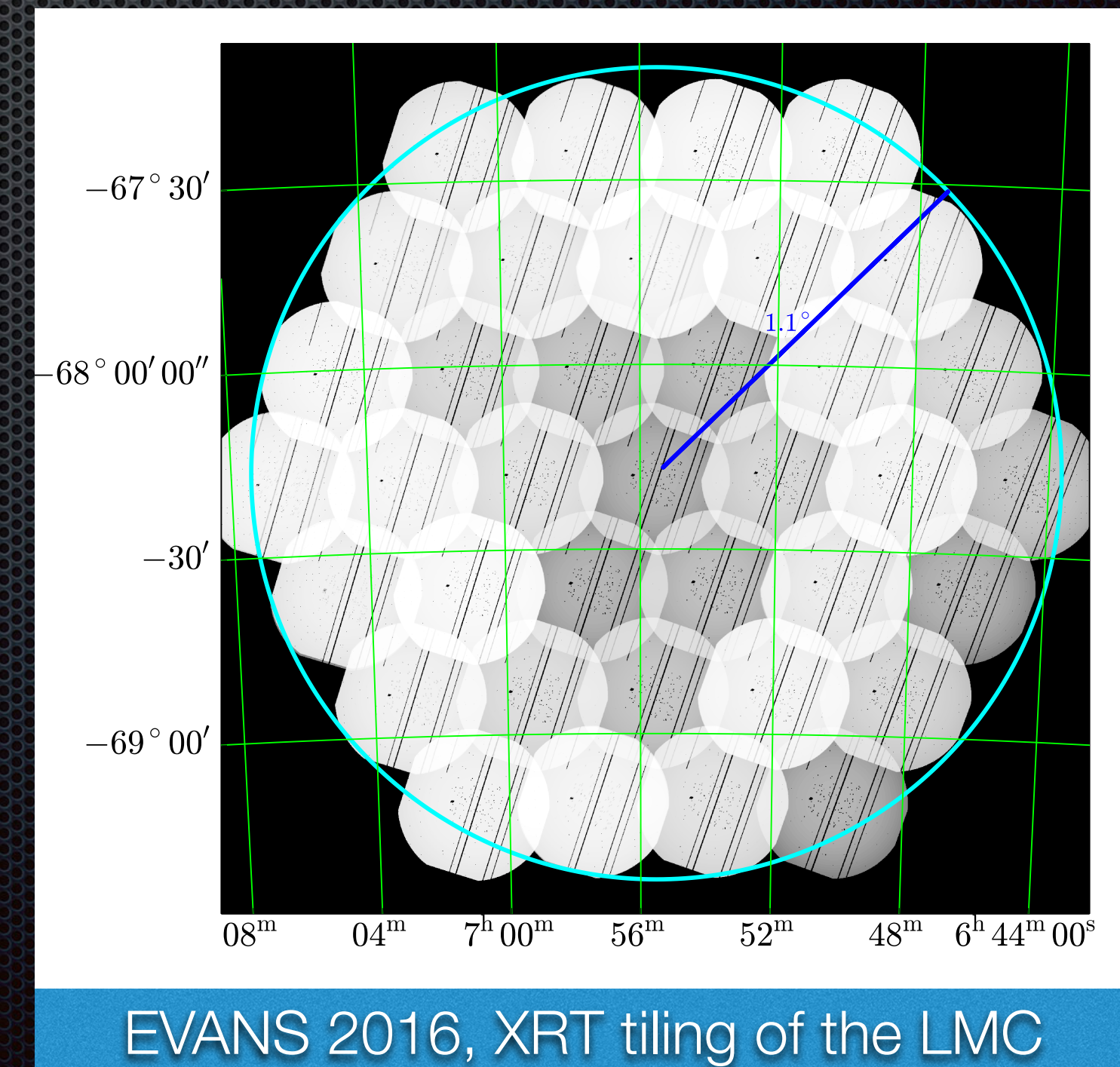


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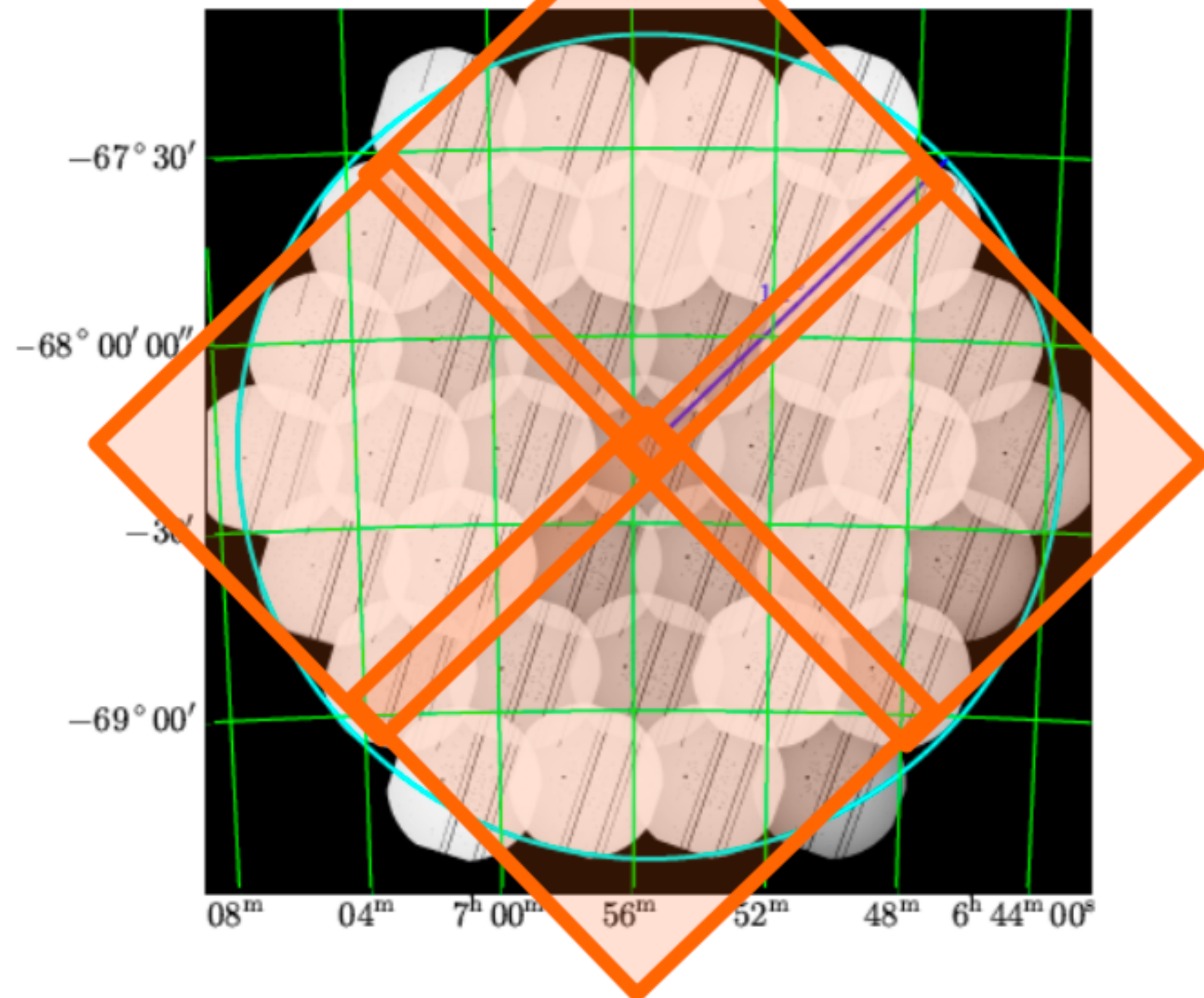
Even if MXT has a larger fov than XRT, tiling is required.



MXT vs. XRT comparison

XRT observation of the LMC (Evans+,2016) following GW150914 : 4 deg²

Evans+16



Raw sensitivity of XRT is 4.3 larger than MXT
(130cm² vs. 30cm² on-axis @1.5keV)

To cover the LMC (4deg²)

XRT : 37 tiles of ~50s each (i.e. 1831s
observing time without the slew, which
typically takes 1min)

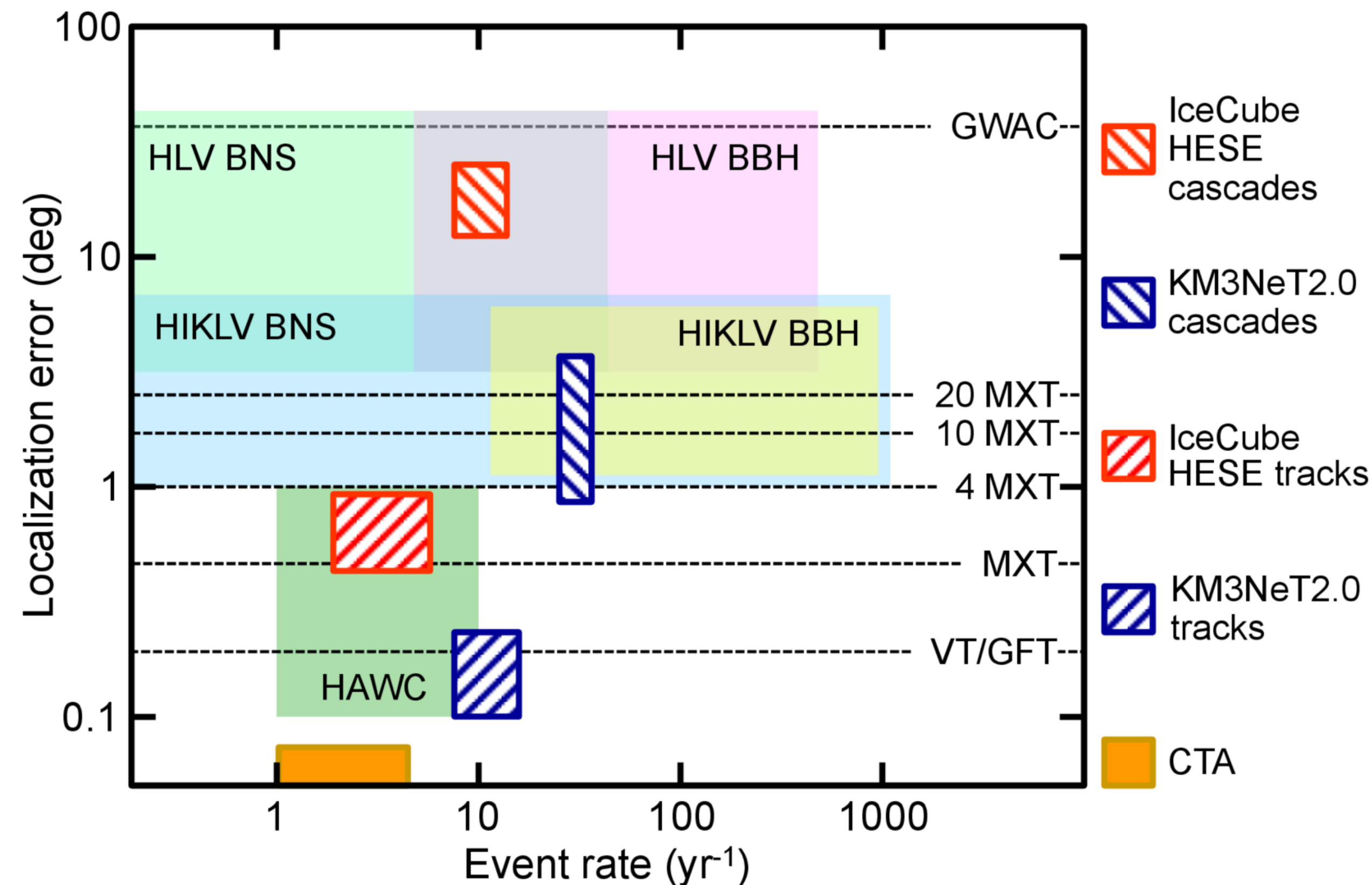
MXT : 4 tiles of 500s (2ks)

MXT recovers a $\sqrt{10}$ factor in sensitivity

XRT slightly better than MXT (35%), but MXT is very competitive !

ToO-MM

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Main characteristics :

Frequency : 1/month

Standard delay : $< 12\text{h}$

Duration : 7-14 orbits

Max : 3 tiles/orbit

MXT photons sent through the VHF network for an immediate analysis on the ground

Why delays ?

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OCG (Operation and Control Group) will check that the ToO can be performed given the constraints related to satellite health.

The OCG meets once per day (5d/7).

For ToO-EX or ToO-MM a special OCG meeting is requested (24h/24).

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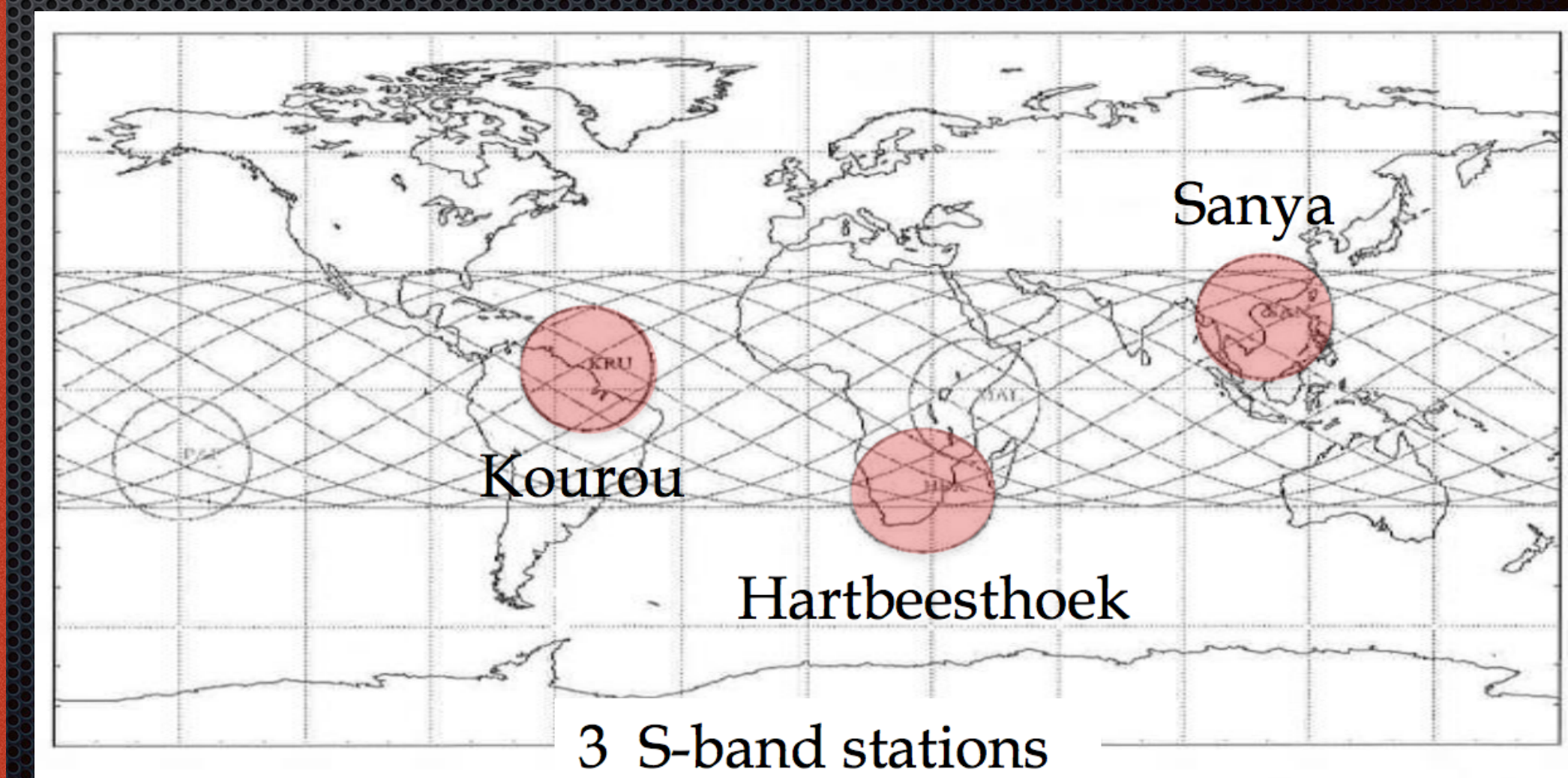
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The new Work Plan is sent to the CCC (Chinese Control Center) to build the Telecommands and upload them to the satellite using the S-band antennas available in Sanya (for ToO-EX and ToO-MM, the CNES provides the antennas in Kourou and Hartbeesthoek)



User application to request a ToO

See details in 'SVOM ToO Program Support System User Requirement Document And Architecture Design'

ToO proposal support :

- Proposal preparation
 - Feasibility
 - Observation strategy
 - Instrument health
- Approval
- Progress monitoring
- Data acquiring

External interfaces :

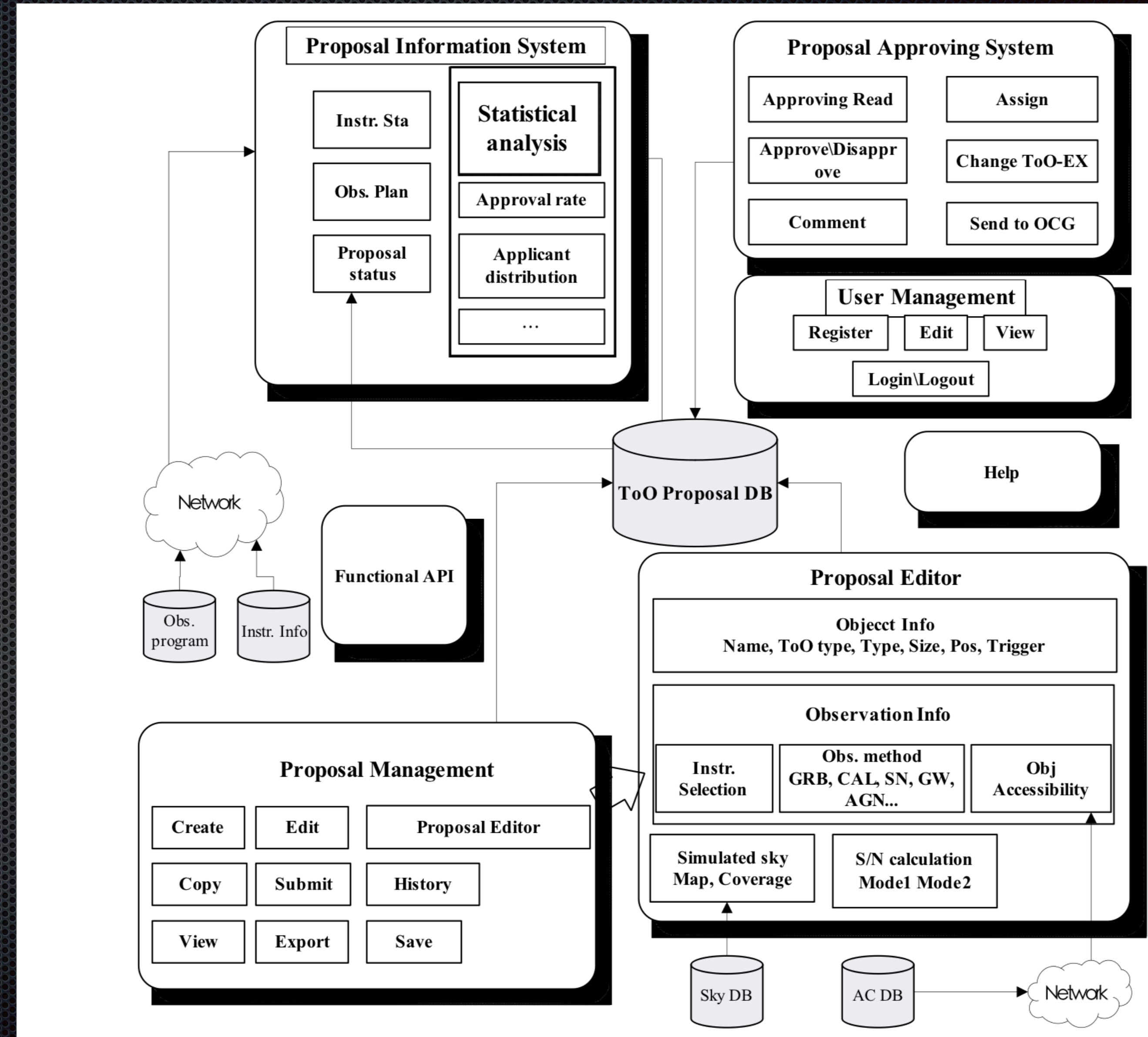
External accessibility server

Satellite and instrument status server

Observation status database

User interface

APIs for ToO-MM



Conclusion

The importance of the ToO program has been pointed to us by Neil Gehrels (thank you !).

We started after the CP and GP, but thanks to the effort of everybody we made good progress (ToO-EX and ToO-MM)

Now, with the time domain and multi-messenger astronomy in strong developments, SVOM is ready to play an important role in the future...