Using Colibrí

during ECLAIRs commissioning

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◎ **SVOM in-flight verification phase**

◎ **ECLAIRs verification phases**

◎ **The role of the GFTs**

Blocks & Phases

◎ **After LEOP, _SVOM_ commissioning activities are structured in blocks**

Prog Routine (GP/ToO Nom, visi GSP…)	PERF1	BIAS	TRIG/GRB/CAT	ToO Ex	ToO MM	PERF2

◎ **ECLAIRs activities are organized in phases with well-defined goals**

→ We present the ECLAIRs phases and their objectives

→ We propose a way to fit the ECLAIRs phases into the commissioning blocks

◎ **Phase 0 is done during LEOP, it includes the following activities:**

→ Pwr ON

→ Outgassing

→ Camera Health Check at nominal T.

◎ **Adjust the configuration of the detection plane and measure the background, with no bright source in the FoV**

→ Tune the configuration tables of the detection plane: energy thresholds, noisy pixels, energy bands…

→ Strategy: start with nominal energy thresholds (4 keV) and gradually raise the threshold of noisy pixels.

→ Conditions: several orbits without SAA, no bright X-ray source in the field of view (=B1, avoid SCO X1 and the galactic plane)

→ Duration: several orbits (TBD)

◎ **At the end of Phase 1, the detection plane is properly configured (energy thresholds, bad pixels...) and the background has been measured, allowing the acquisition of reliable data and the configuration of basic trigger parameters.**

◎ Adjust SAA boundaries

→ There are 9 – 10 SAA crossings per day, inside the SAA ECLAIRs HVPS are switched off

→ Use pre-computed SAA boundaries, and check the counts increase close to the boundaries. If the count increase is too large (TBD) adjust the times that define the SAA boundaries.

→ Conditions: several orbits with SAA passages

→ Duration: several orbits (≈2 days)

◎ At the end of Phase 2, conservative SAA boundaries have been defined, allowing the reliable operation of the instrument outside the SAA boundaries.

630 km - Jan 2010

630 km - Jun 2006
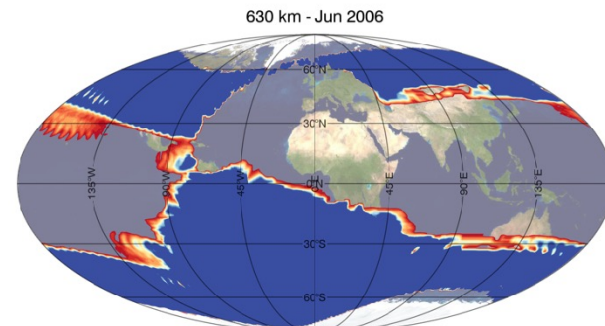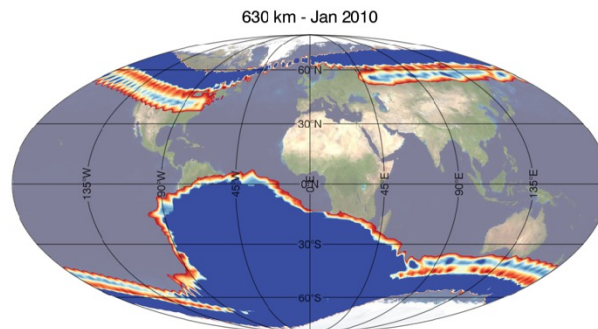
◎ **Activate a simple, safe trigger (VHF alerts?), with no bright source in the FoV.**

- → Strategy: start with high trigger thresholds and energies ≥ 15 keV to avoid false alerts. Minimal trigger configuration (e.g. 1 energy band).
- → Goal, verify various features of the trigger & operation at ECLAIRs level:
  - ‣ Management of Earth occultation & SAA.
  - ‣ Ability of ECLAIRs to trigger, validation of basic trigger parameters.
- → ECLAIRs triggers will be validated through:
  - ‣ The analysis of ECLAIRs photons on the ground (X-band data).
  - ‣ The comparison with other GRB detectors (GRM, Fermi, KONUS, GECAM…).
  - ‣ *Ground-based follow-up telescopes looking for the optical afterglow. This provides a first opportunity to check the accuracy of on-board positions.*
- → Conditions: no bright source in the FoV.
- → Duration: several days. ECLAIRs is mostly passive during this phase, Other instruments may drive the activity.

◎ **At the end of phase 3 the basic trigger functions are validated, but the full trigger parameters must still be adjusted and optimized.**

◉ Observation with source(s) in the FoV

→ Validate ECLAIRs positions and adjust the correction tables (bias)

→ Validate the spectral response

→ Validate the crude timing (e.g. with source occultation)

→ Strategy : place known source(s) at various (TBD) positions in the FoV.

→ Inter-calibration with the MXT can take place during this phase.

→ Duration ~ few days

→ *Not clear if the trigger will remain active during this phase.*

◉ At the end of phase 4, the correction tables for the localization are constructed and uploaded onboard.
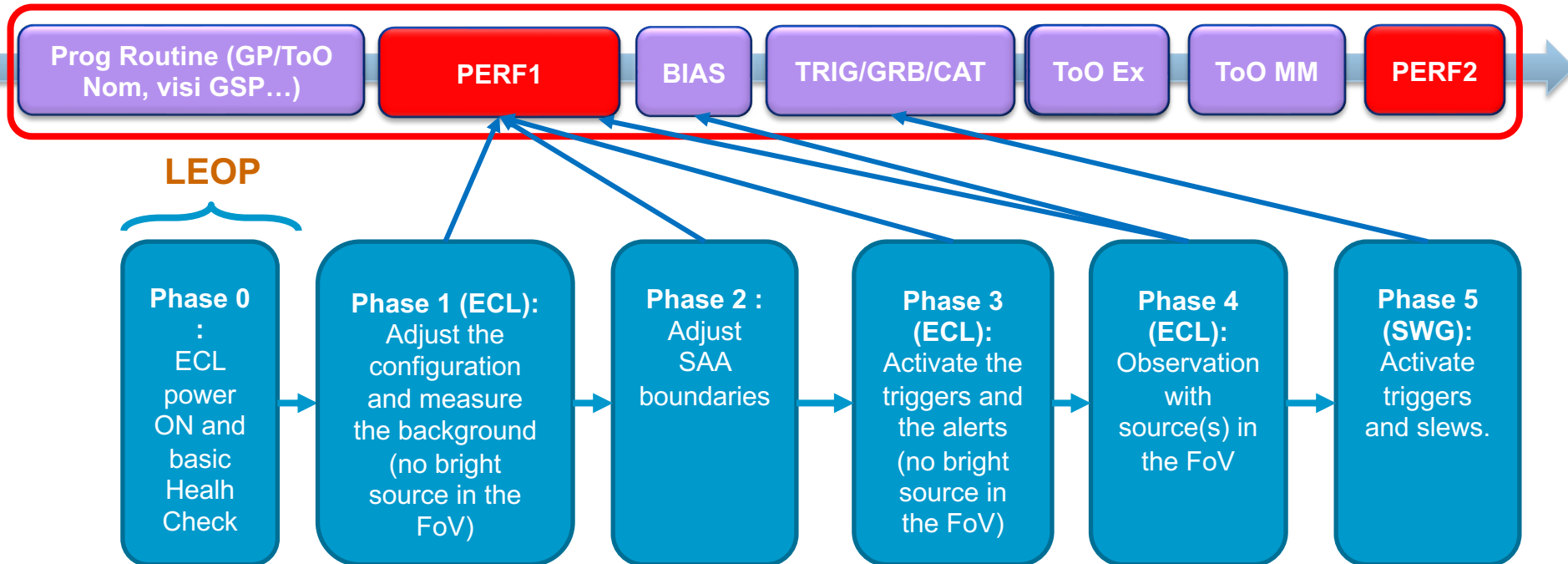
Phase 5

◎ Activate triggers and slews

→ Verification of the trigger sequence.

→ Verification of the localization bias with the VT and the MXT.

→ Optimization of trigger parameters, activation of the low energy strip.

→ Duration: probably few weeks, but this is "normal operation"

→ These are activities at the system level, not just ECLAIRs.

→ TC AlertOnRequest is used in this phase to validate the full alert process, including slews.

→ *During phase 5, the GFTs will be crucial to check the validity of low-SNR triggers, that do not trigger a slew.*

◎ At the end of phase 5, ECLAIRs is fully operational: operations in orbit (Earth, SAA), triggers, localization, alerts…

Assigning ECL phases to commissioning blocks

| Prog Routine (GP/ToO Nom, visi GSP…) | PERF1 | BIAS | TRIG/GRB/CAT | ToO Ex | ToO MM | PERF2 |

LEOP

| Phase 0 : ECL power ON and basic Healh Check | Phase 1 (ECL): Adjust the configuration and measure the background (no bright source in the FoV) | Phase 2 : Adjust SAA boundaries | Phase 3 (ECL): Activate the triggers and the alerts (no bright source in the FoV) | Phase 4 (ECL): Observation with source(s) in the FoV | Phase 5 (SWG): Activate triggers and slews. |

Notes:

→ ECLAIRs is in CONF/STANDBY during routine blocks (GP / ToO NOM).

→ No trigger in Phase 1.

→ No slew on alert in Phase 3.

→ Phase 4 is divided into 4.1 (for internal biases and spectral response), performed in PERF1 block, and 4.2 (for inter-instrument biases), performed in BIAS block.

→ At the end of block TRIG/GRB/CAT, the triggers are safe, the alerts are validated, and the slews are permitted.

→ During block PERF2, the trigger will be optimized, especially at low energies.

◎ **During SVOM in-flight verification phase, the trigger detection will be activated before the slew**

↳ **During phase 3, the GFTs will contribute to validate ECLAIRs triggers.**

↳ **During phase 5, the GFTs will contribute to validate low SNR triggers (without slew).**

◎ **It will be necessary to send trigger alerts restricted to the GFTs, possibly from the ground, depending on the status of the inflight alert generation.**

Comments & Questions…
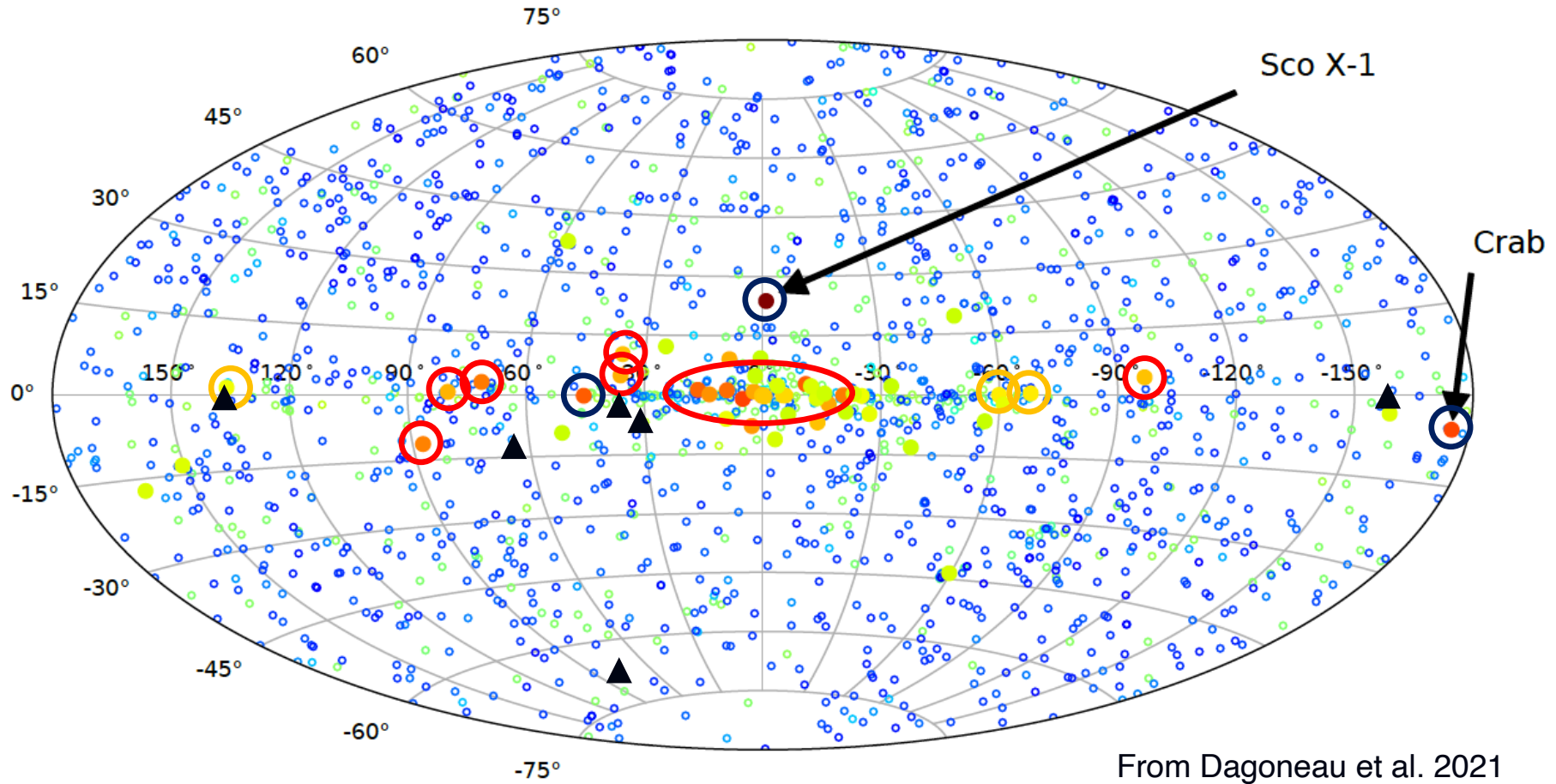
Thank you for your attention

Table A.1. 89 sources in the catalogue, which are the brightest according to their "typical S/N" de

Sources outside the Galactic bulge are indicated in red. They are shown in the map next page.

Crab is our favorite calibration source

Name	Ra deg	Dec deg	F_{4-120} ph s^{-1} cm^{-2}	α	β [a]	E_{break} [a] keV	Type [b]	Class [c]
Sco X-1	244.98	−15.64	21.157	−1.74	−5.89	10.59	LMXB	V
GX 5-1	270.29	−25.08	1.853	−1.49	−6.88	11.11	LMXB	V
Crab	83.63	22.01	1.793	−2.19			SNR	S
GX 349+2	256.44	−36.42	1.304	−1.48	−6.56	11.33	LMXB	V
GRS 1915+105	288.8	10.95	1.287	−2.61			LMXB	V
GX 17+2	274.01	−14.04	1.167	−1.44	−5.78	10.95	LMXB	V
GX 9+1	270.38	−20.53	1.022	−1.43	−7.67	11.66	LMXB	S
Cyg X-1	299.59	35.2	0.832	−1.97			HMXB	V
GX 340+0	251.45	−45.61	0.822	−1.08	−6.11	10.43	LMXB	V
Cyg X-2	326.17	38.32	0.724	−1.87	−5.84	10.29	LMXB	V
GX 13+1	273.63	−17.16	0.574	−1.52	−6.71	10.63	LMXB	V
Sgr X-4	275.92	−30.36	0.51	−1.62	−5.45	11.74	LMXB	V
GX 3+1	266.98	−26.56	0.415	−1.51	−6.81	11.82	LMXB	V
4U 1705-440	257.23	−44.1	0.405	−1.42	−5.99	10.45	LMXB	V
Ser X-1	279.99	5.04	0.362	−3.03	−6.44	17.47	LMXB	S
GX 9+9	262.93	−16.96	0.36	−1.74	−7.09	12.16	LMXB	S
Cyg X-3	308.11	40.96	0.346	−1.68	−3.22	18.7	HMXB	V
MAXI J1820+070	275.09	7.19	0.274	−1.46			LMXB	
H 1735-444	264.74	−44.45	0.272	−2.34	−5.97	17.27	LMXB	V
Vela X-1	135.53	−40.55	0.269	−0.84	−3.34	20.09	HMXB	V
SAX J1747.0-2853	266.76	−28.88	0.269	−2.74			LMXB	O
Sgr A*	266.42	−29.01	0.265	−2.51			X	S
1A 1742-294	266.52	−29.51	0.253	−0.92	−5.59	9.37	LMXB	V
H 1730-333	263.35	−33.39	0.202	−1.27	−6.87	10.04	LMXB	O
GX 354-0	262.99	−33.83	0.199	−1.3	−3.09	8.1	LMXB	V
Cen X-3	170.31	−60.62	0.147	−1.23	−4.8	18.33	HMXB	V
GX 301-2	186.66	−62.77	0.138	−0.33	−3.27	18.46	HMXB	P
SWIFT J0243.6+6124	40.92	61.43	0.11	−1.06			Pulsar	
4U 1624-490	247.02	−49.21	0.107	−0.86	−7.74	11.51	LMXB	S
GS 1826-238	277.37	−23.8	0.104	−1.99			LMXB	V

Which sources for the calibration?

N. Dagoneau et al.: Onboard catalogue of known X-ray sources for SVOM/ECLAIRs

From Dagoneau et al. 2021

Flux in 4-120 keV (ph/cm^2/s)