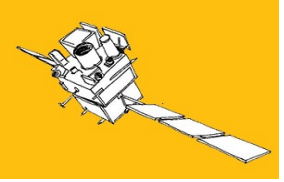


ECLAIRs false triggers study

Wenjin XIE

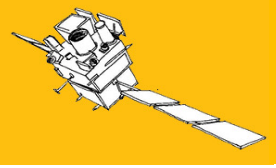
Cooperators: Bertrand CORDIER; Stephane SCHANNE;
Nicolas DAGONEAU; Donghua ZHAO; et.al.

2026.03.26 TA training in Paris

National Astronomical Observatories
Chinese Academy of Sciences

Outlines

- **Trigger summary**
- **Examples of different false trigger**
  - False trigger from bright source: coding noise
  - False trigger from wrong source model bad subtraction (issue of V7.0.3)
  - Earth limb
  - Column effect
  - Many noise pixels in ELS module
  - CRT false trigger in SAA-Extent region
- **False trigger statistical study**



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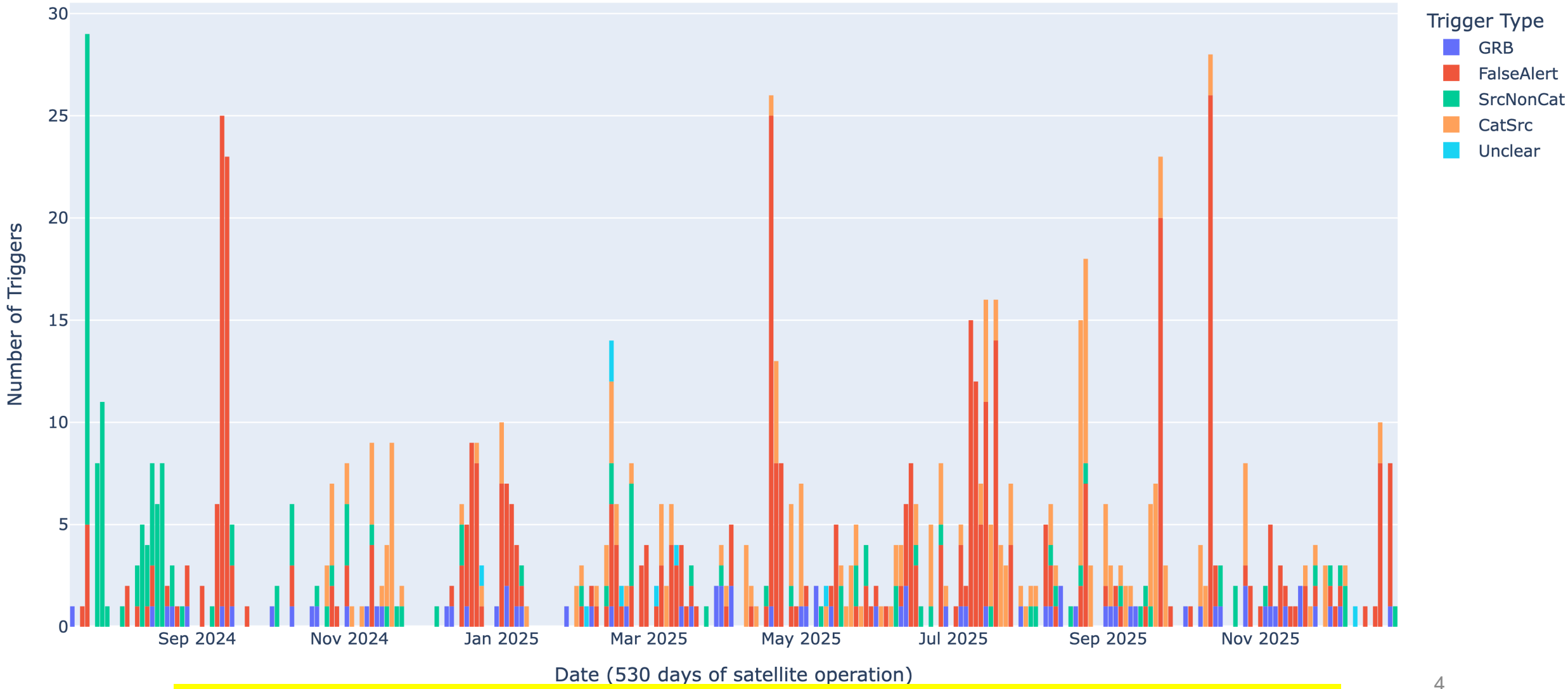
Trigger timelines

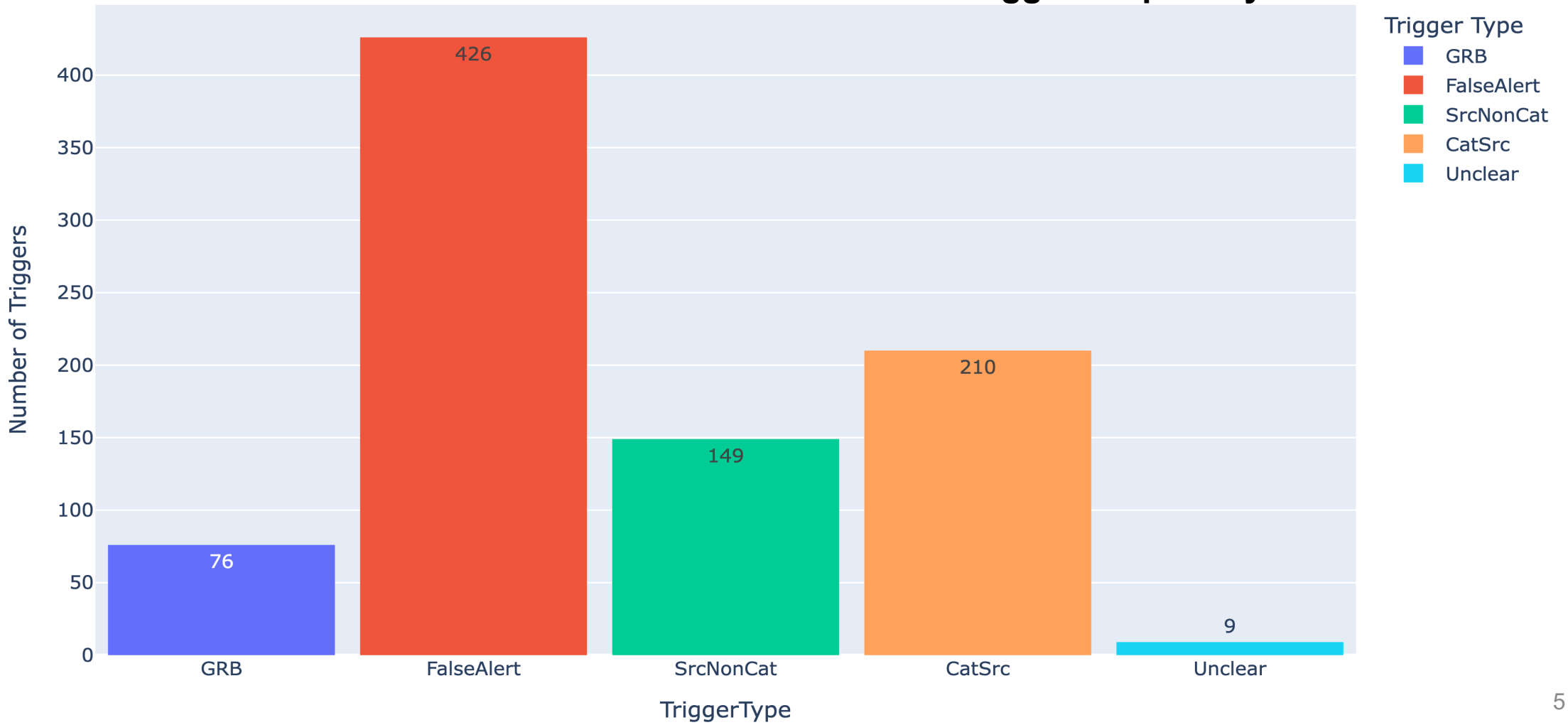
From 2024.7.13 to 2025.12.31, Total 933 Triggers. 76 weeks, 66 GRBs

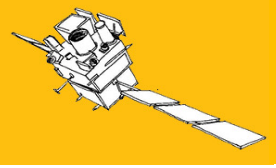


GRB trigger is normally around 1 per week since SVOM Launched

Trigger summary

GRB ~ 1 per week
X-ray source ~ 1 per day
False trigger ~ 1 per day





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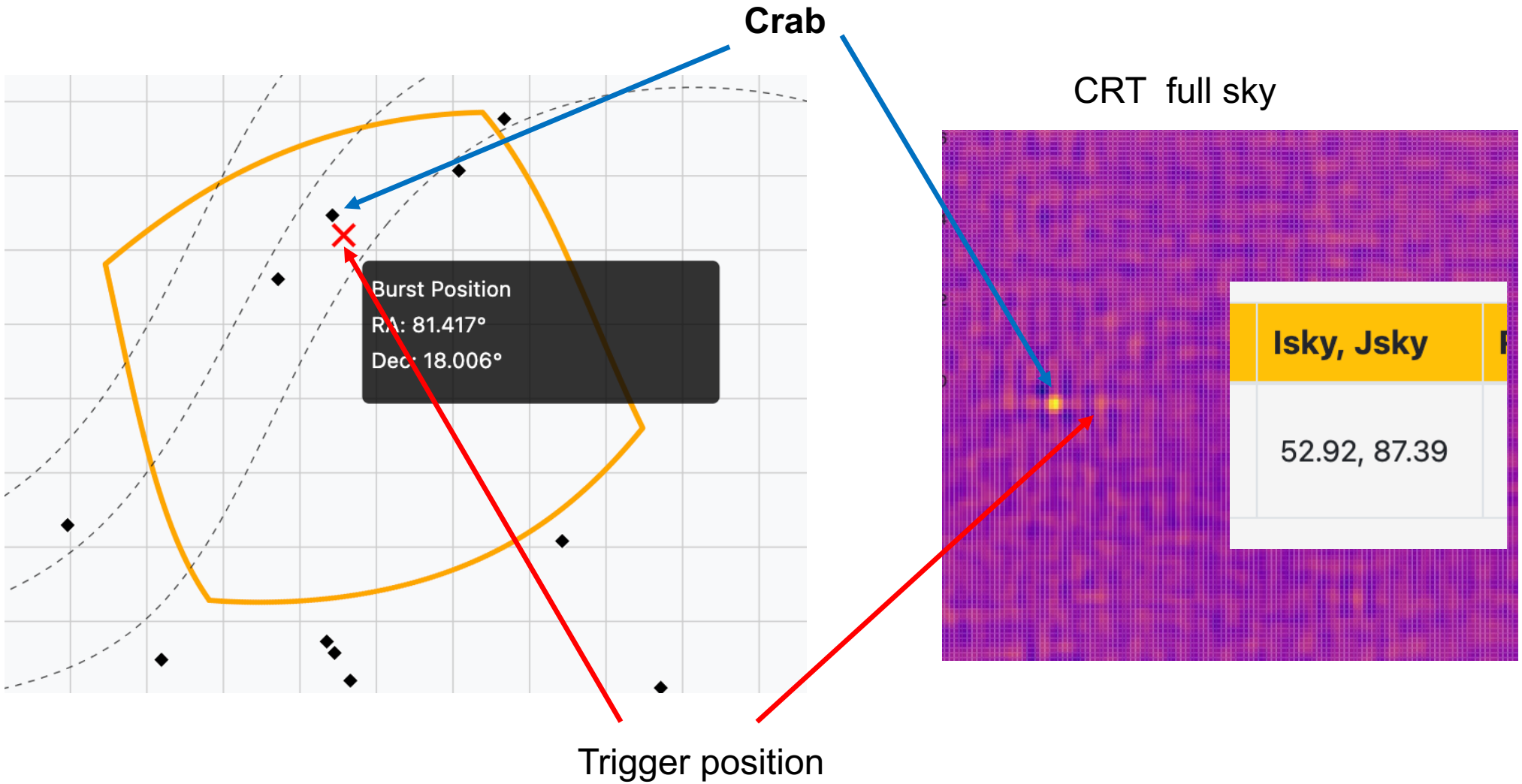
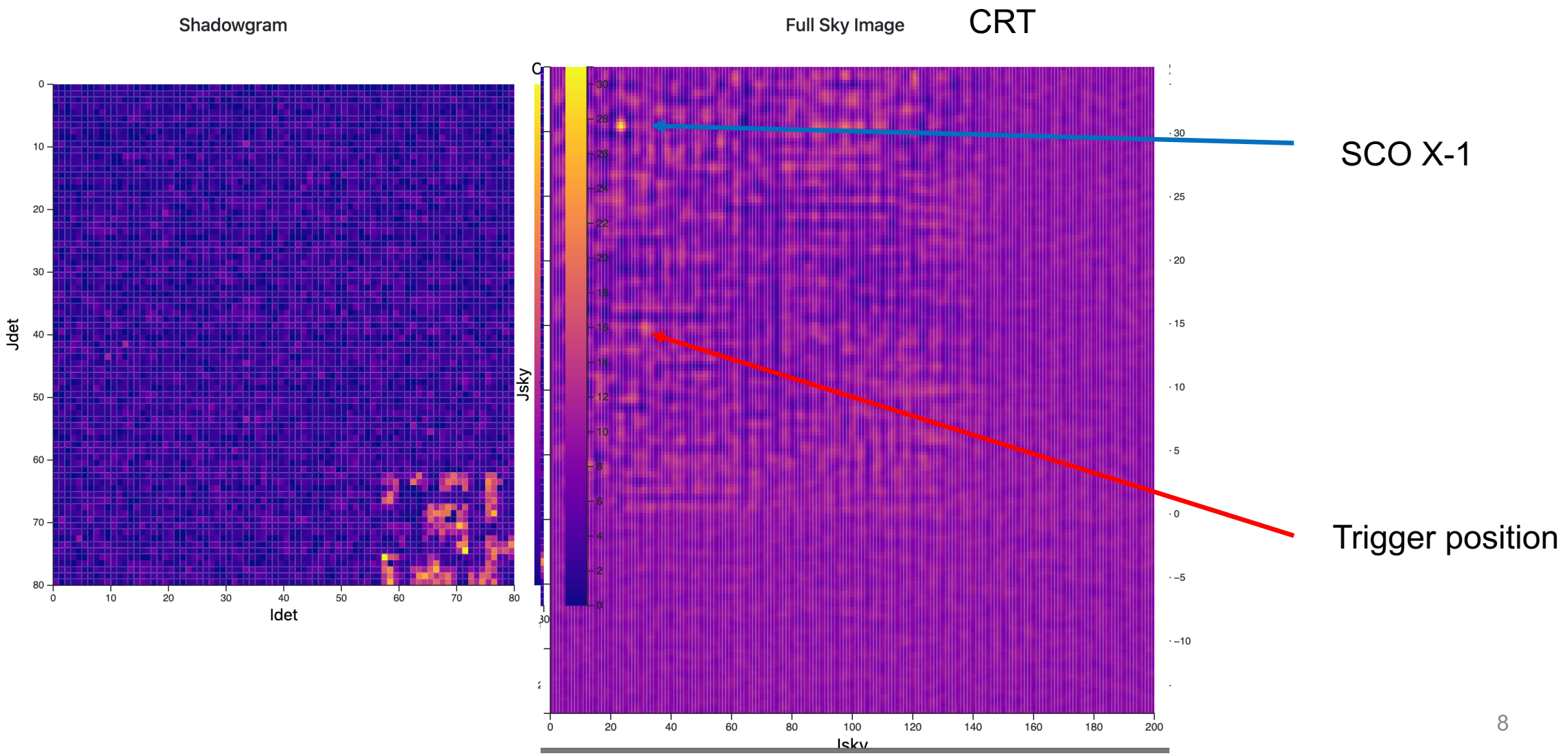
Coding noise from bright source

sb25122305: false trigger to the coding noise from Crab



Coding noise from bright source

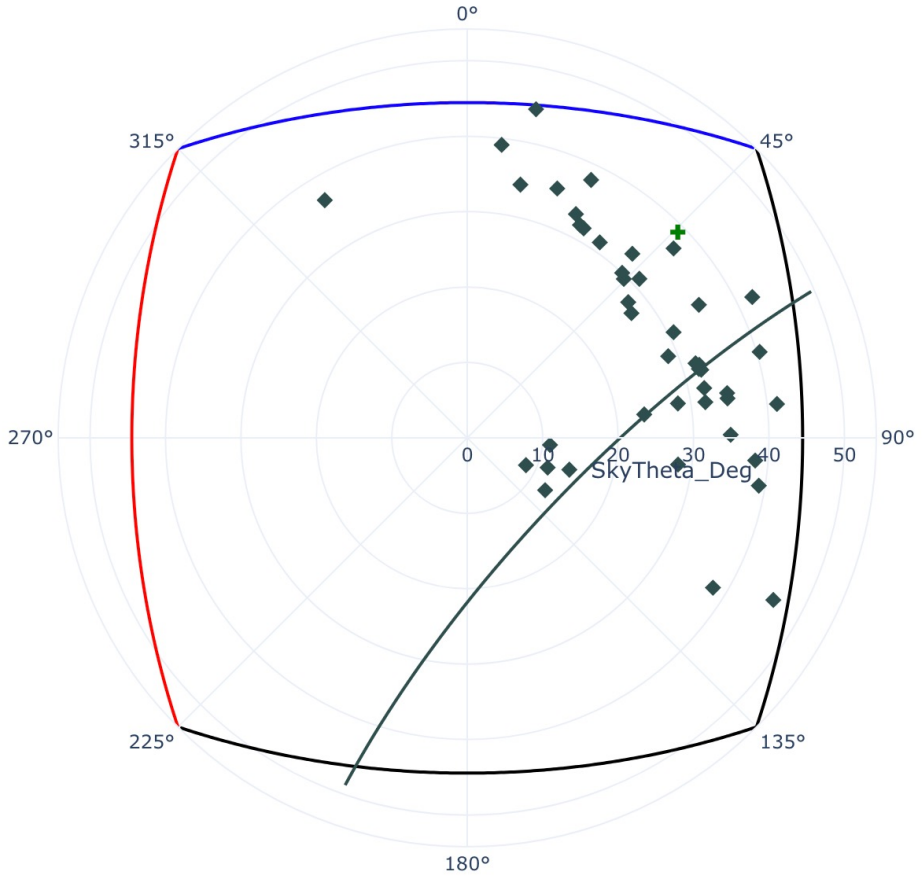
sb25041909: false trigger due to coding noise from **SCO X-1**

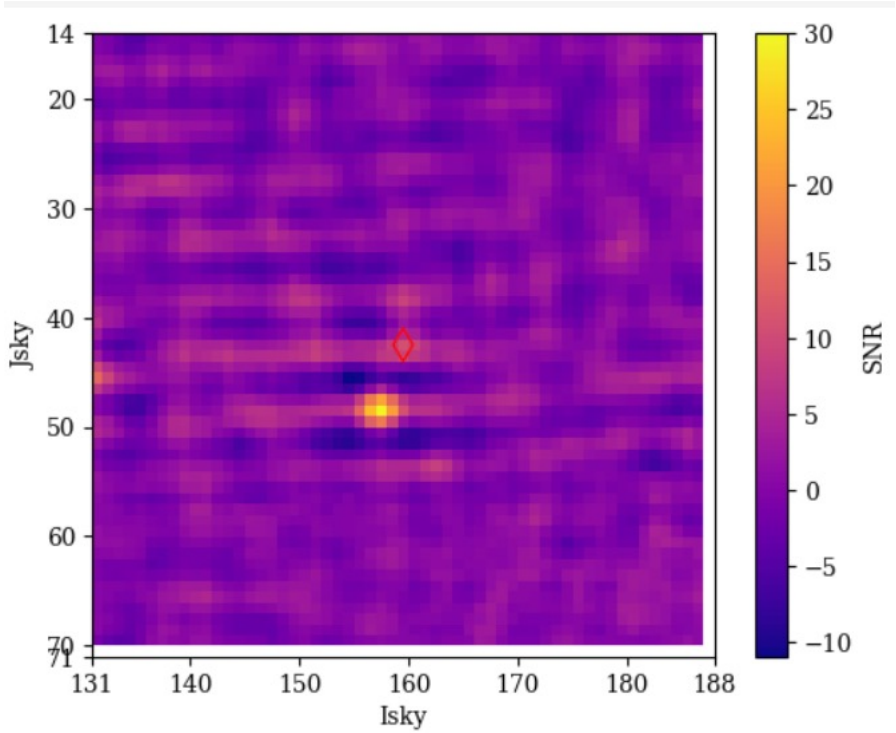


Coding noise from bright source

- During the deconvolution process, the bright source could generate coding noise like side waves in the sky image
- The brighter source, the bigger noise will exist after the deconvolution.
- The noise may produce SNR>6.5 in the sky image, which will induces false triggers
- Pay attention for the bright source when they are in the FoV: Sco X-1, Crab, Cyg X-1. This could happen for IMT and CRT.

Subtraction residuals from bright source





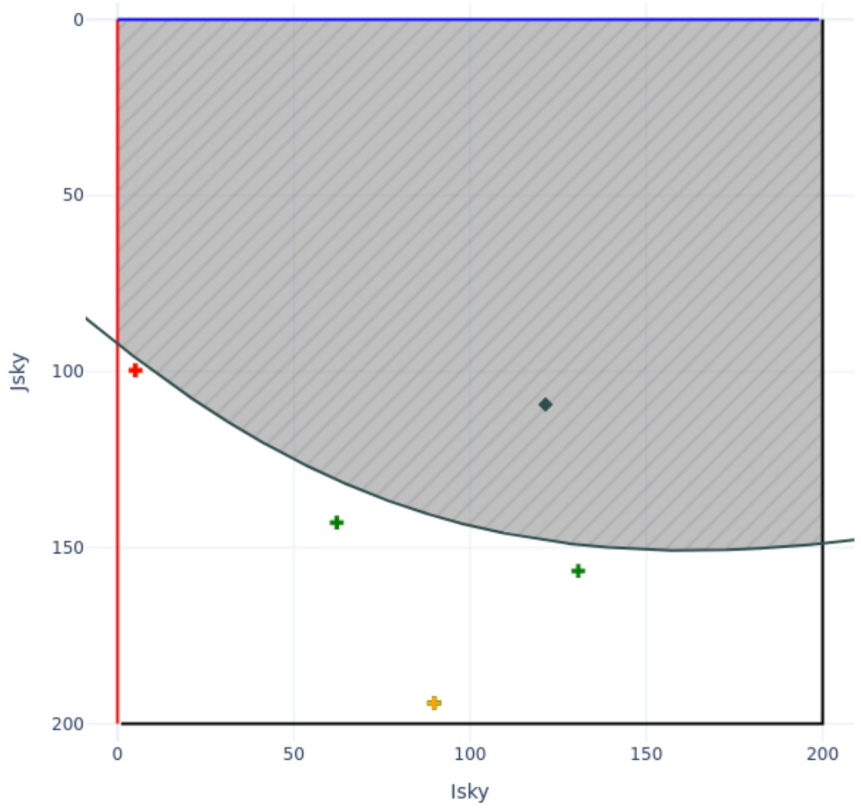
sb25050203: false trigger due to the Sco X-1 uncorrected fit after slew.

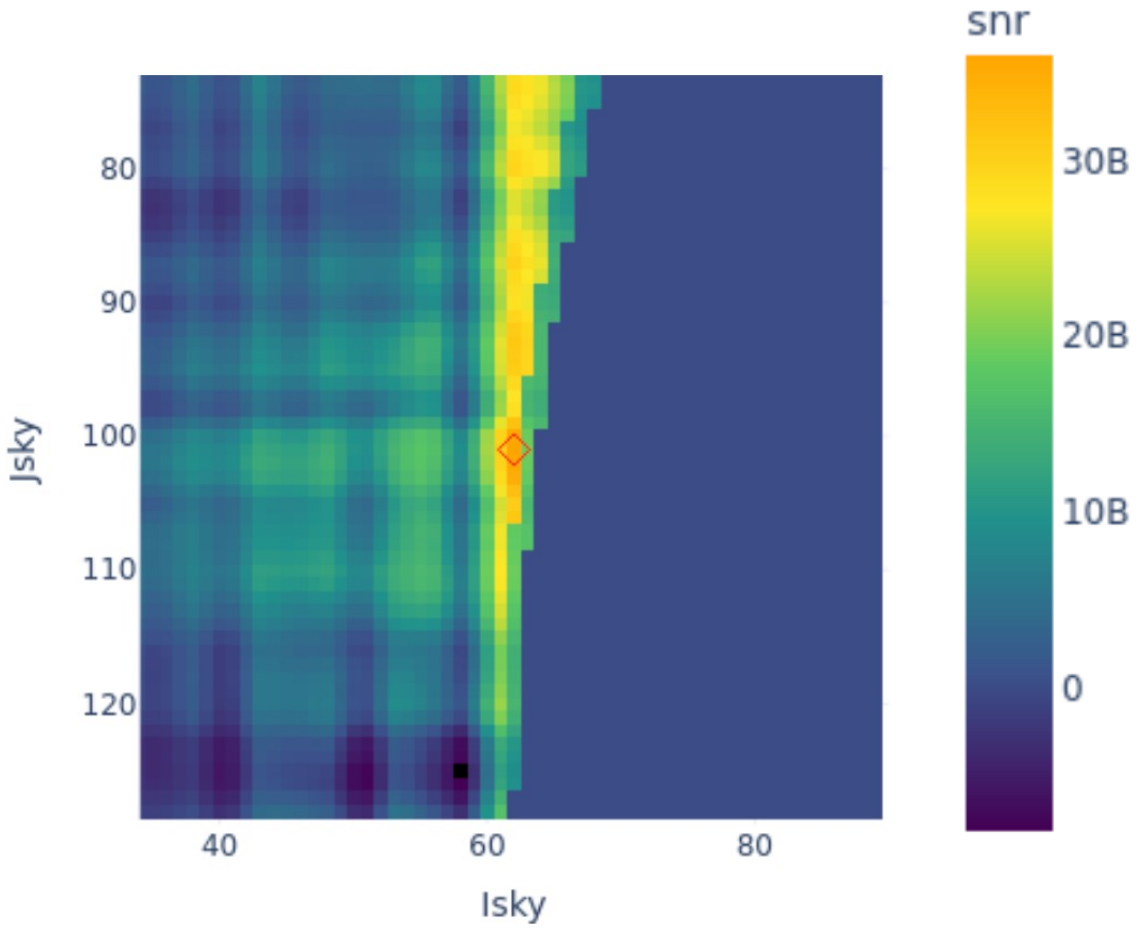
Subtraction residuals from bright source

- In the IMT process, during the subtraction of the brightest sources of the on-board catalog, in some cases, there are some residuals.
- The brighter source, the bigger residuals will exist after the subtraction.
- The residuals may produce the SNR>6.5 in the sky image, which will induces the false triggers
- Pay attention for the bright source when they in the FoV: Sco X-1, Crab, Cyg X-1 in the IMT trigger. Should be solved after update the software V7.1.1

False trigger due to the Earth limb effect

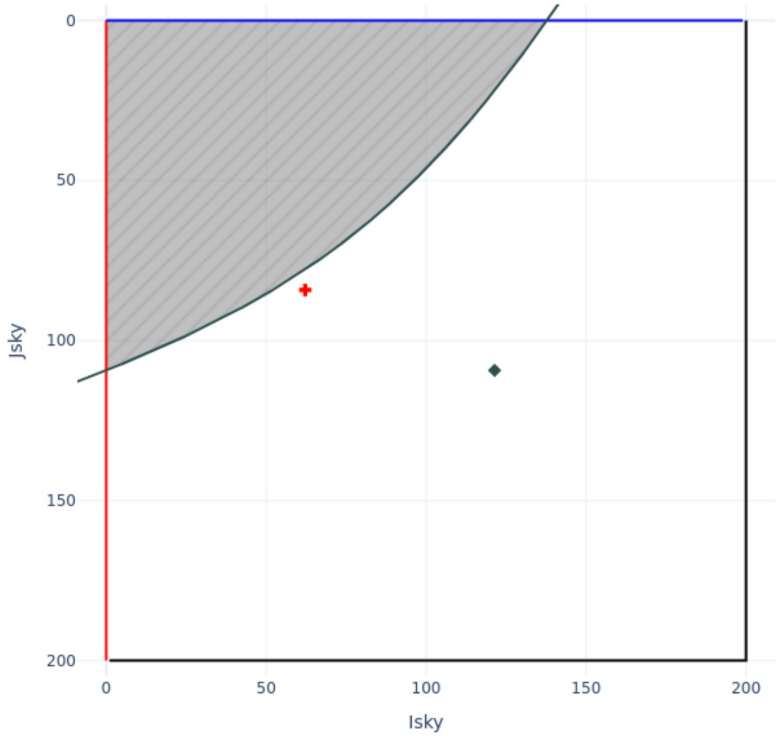
sb25121803: false trigger due to the ELFA

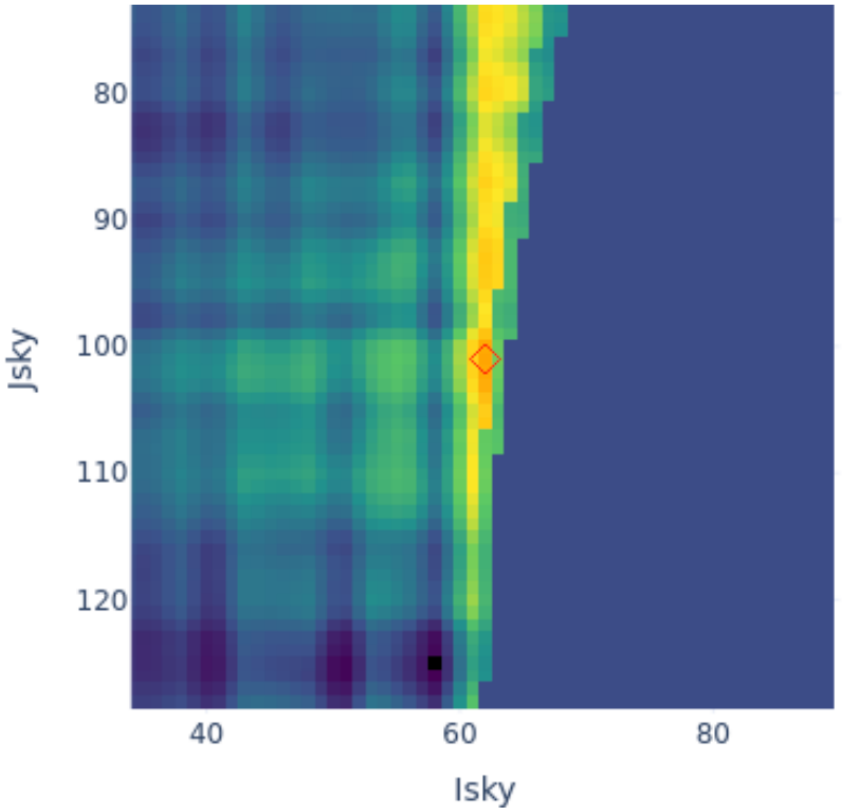


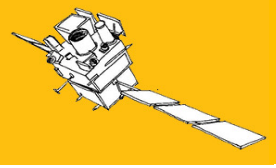


False trigger due to the Earth limb effect

sb25121804: false trigger due to the ELFA







False trigger due to the Earth limb effect

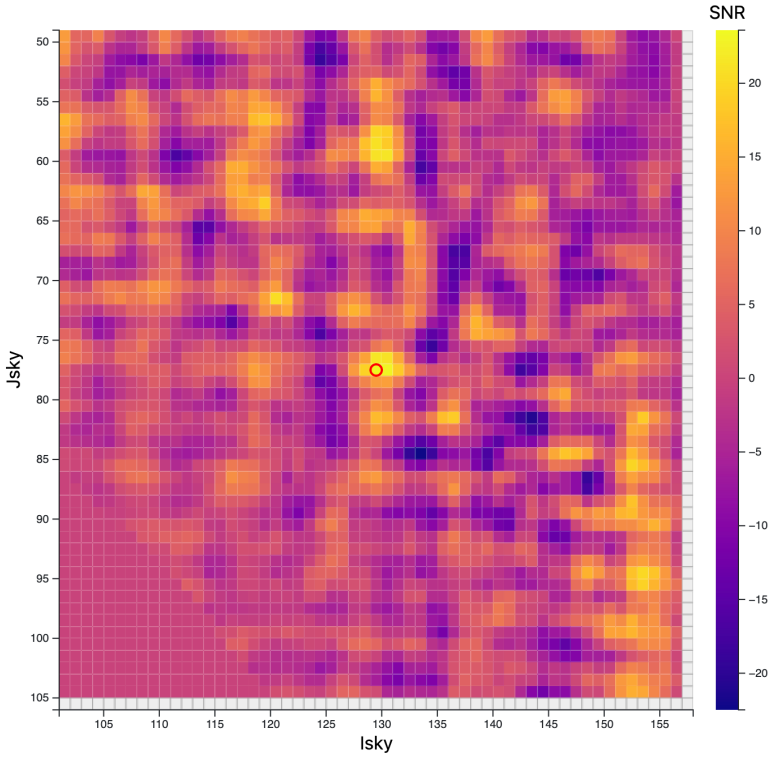
- The reason of Earth Limb False Alert (ELFA) maybe due to :

- Solar active → more particles in SAA region + more X-ray photons around the Earth atmosphere (like aurora) --> make the bright limb around the Earth

- We correct by enlarge the size of the Earth in the software.

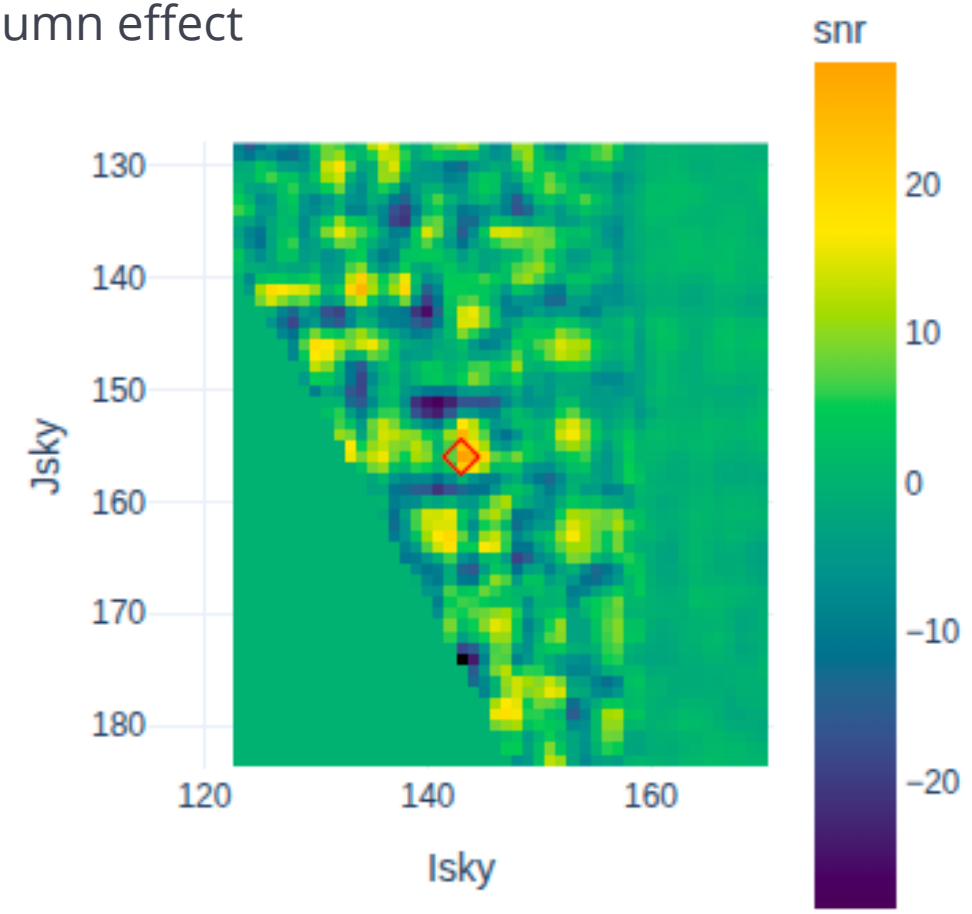
False trigger due to the column effect

False trigger due to a column effect



sb25070714

Normally occur for long duration time scale in IMT trigger



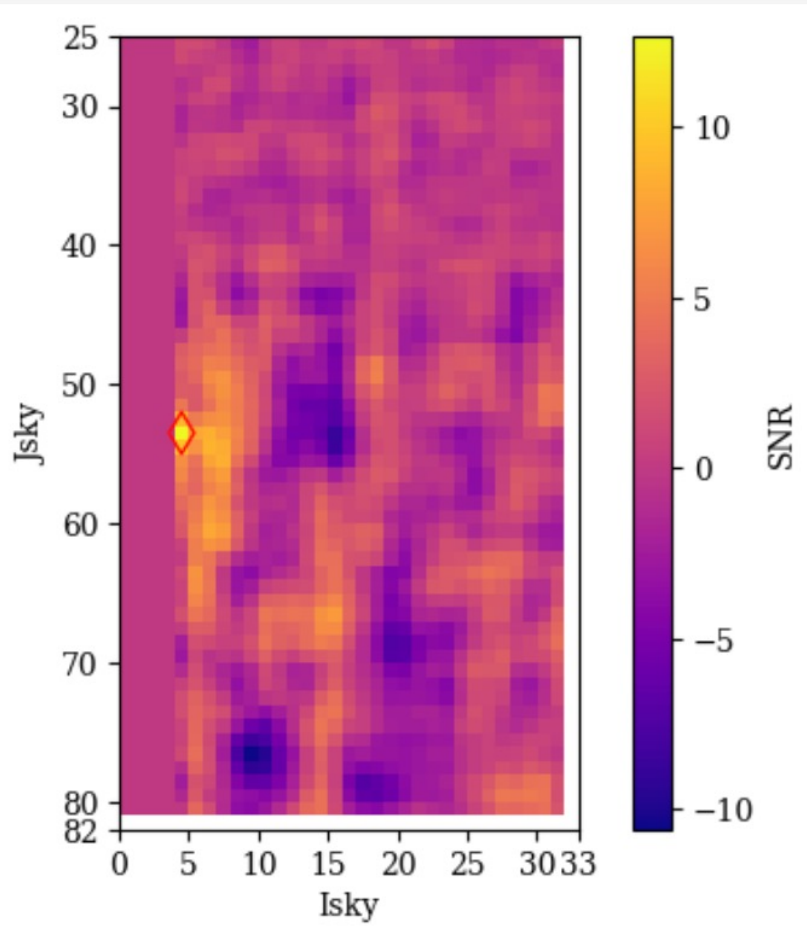
sb25070713

False trigger due to the column effect

- Some columns of pixels were noisy during the ground test
- The noisy pixels will be automatically disable by the onboard algorithm. But still some noisy.
- Those noisy counts will impact the deconvolution process then will make false triggers.
- These false triggers will persist for a period of time until the satellite re-enters the SAA core region and the detector is restarted.

False trigger due to the noisy modules

sb25080707



Noisy modules E6X24

The same position for the same noisy pixels

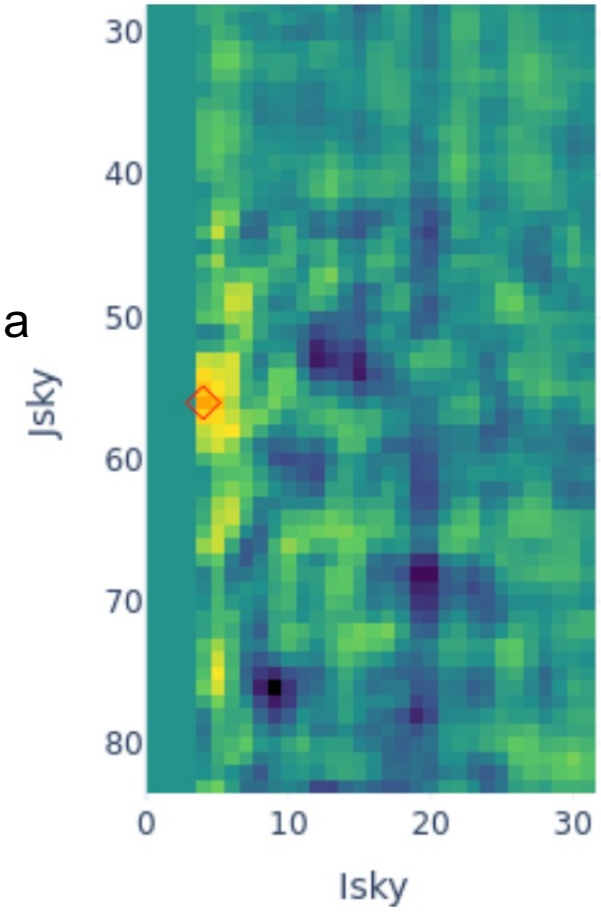
Trigger
IMT

The shape of the source is not like a point source

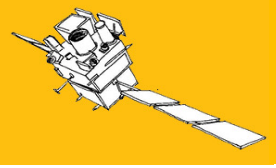
High SnrStd

SnrMax	SnrStd	SnrMax/Std
12.65	1.38	9.18

sb25080704



Noisy modules E6X24 & E3X10
(several noisy pixels disabled)



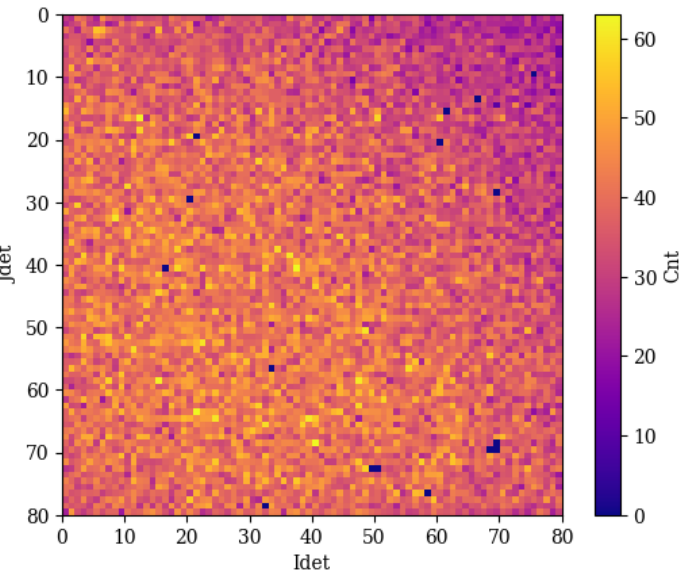
False trigger due to the noisy modules

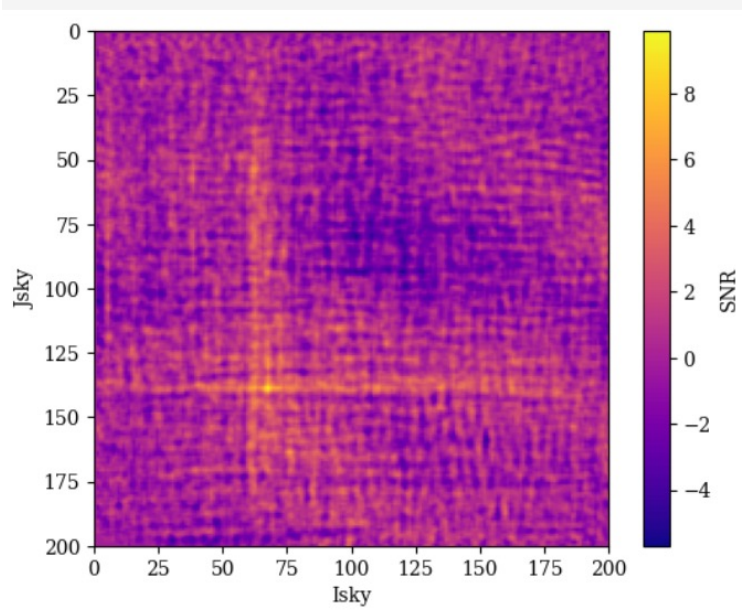
- Some noisy modules were found during the ground test
- It may become noisy again in space
- There have the automatically algorithm to disable the noisy pixels
- But still some noisy pixels are not disable. On the other side, the disable pixel **also impact the deconvolution process**. Combine both effect could induces false trigger.

CRT false trigger in SAA-EXT region

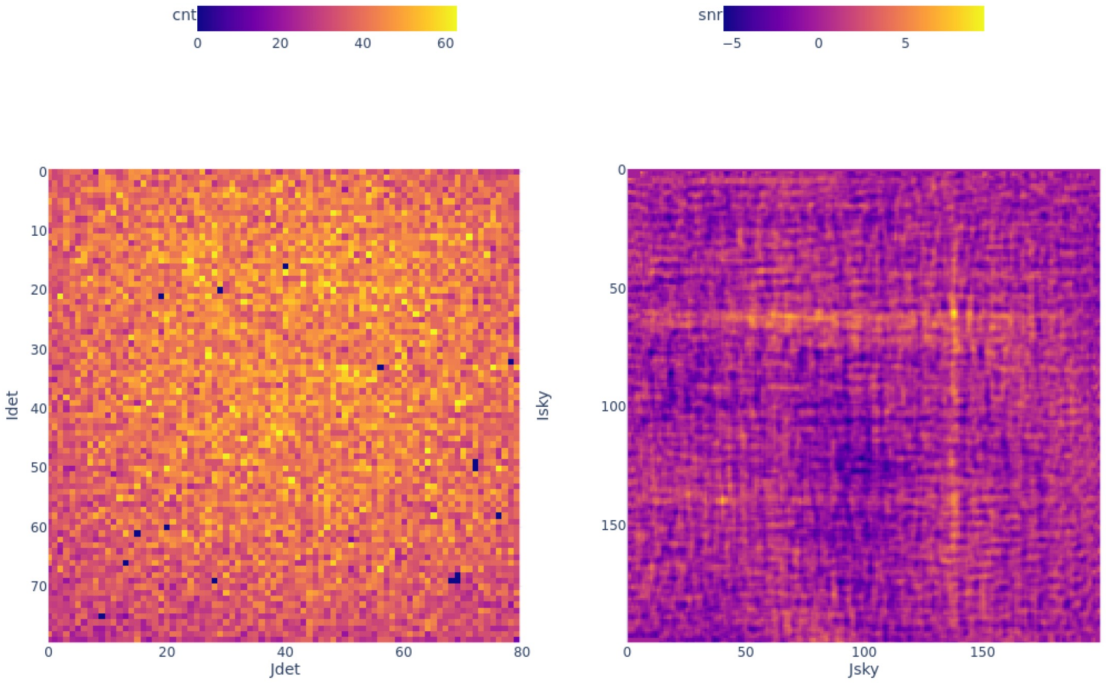
20 s CRT trigger, Satellite in the SAA-Ext region.

CRT trigger





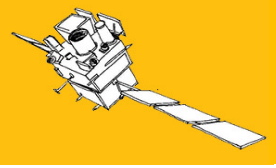
sb25031901



sb25041603

CRT false trigger in SAA-EXT region

- CRT trigger do not perform background subtraction in the shadowgram
- When the Satellite enter SAA-EXT region, there are more particles, increasing the background, and changing the spatial shape of the background.
- This may make false triggers after deconvolution



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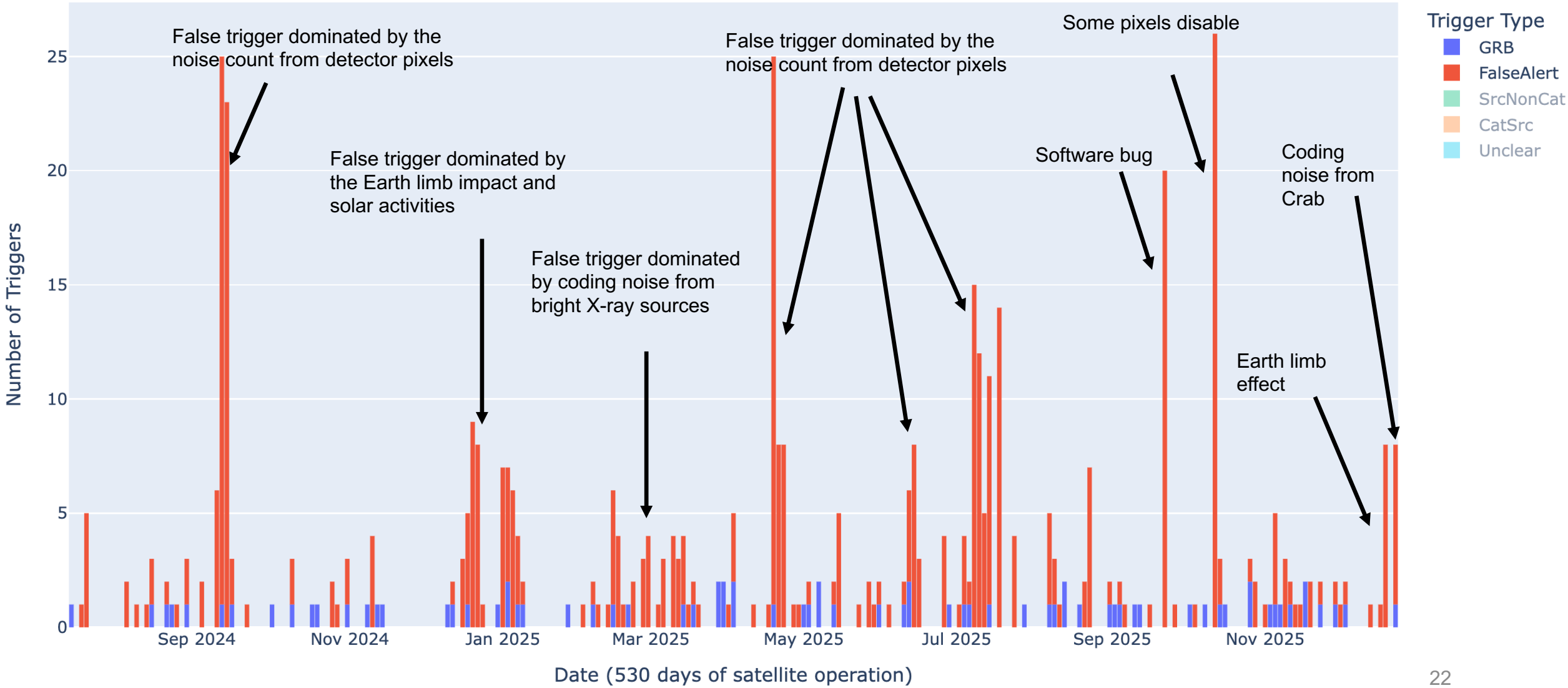
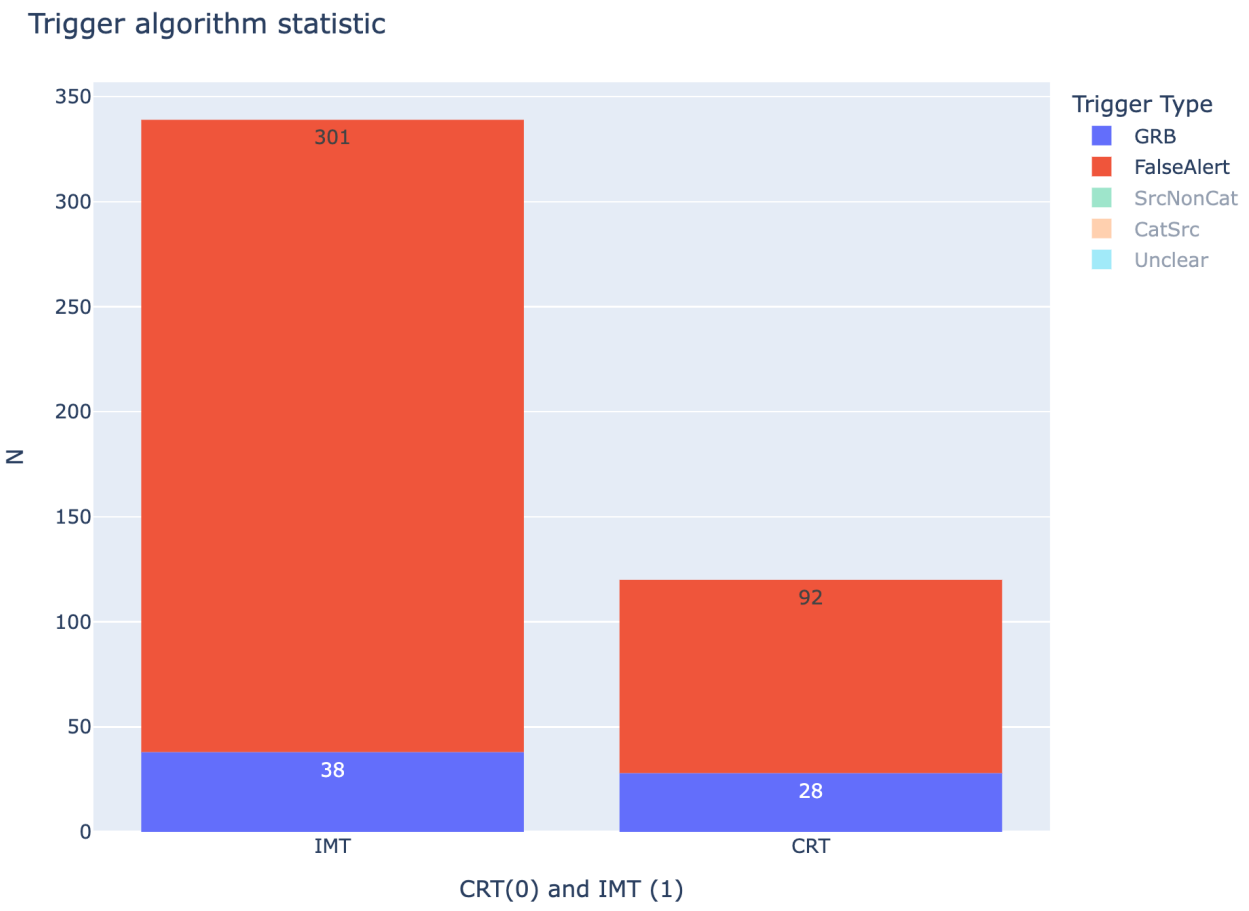
False trigger distribution

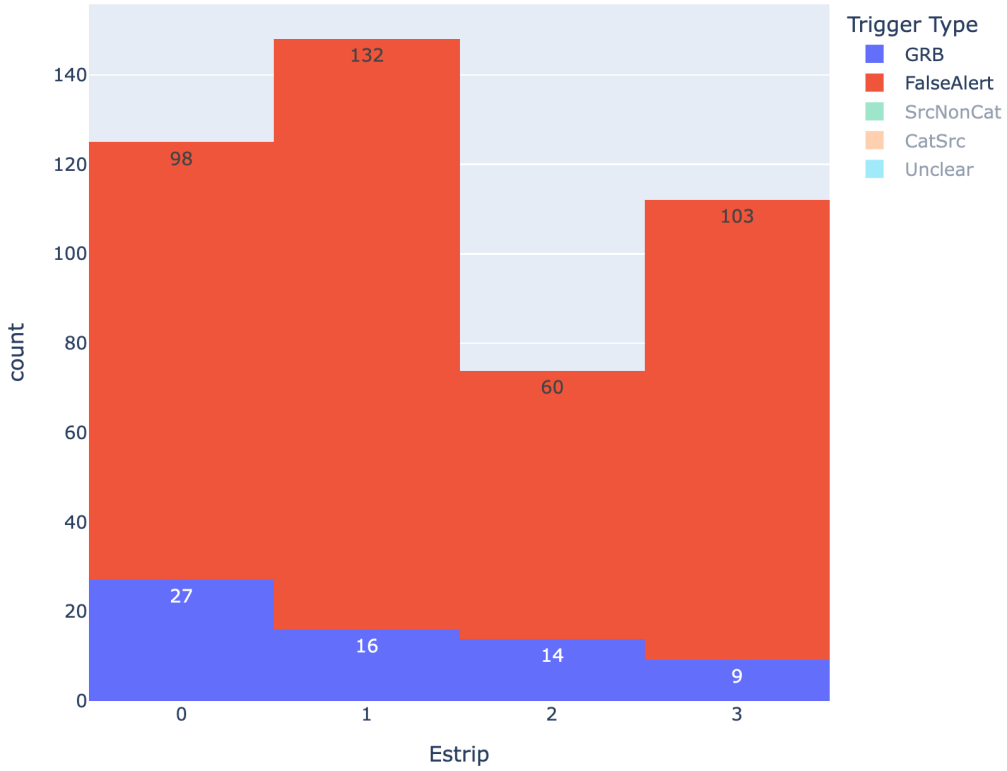


trigger algorithm and exposed time



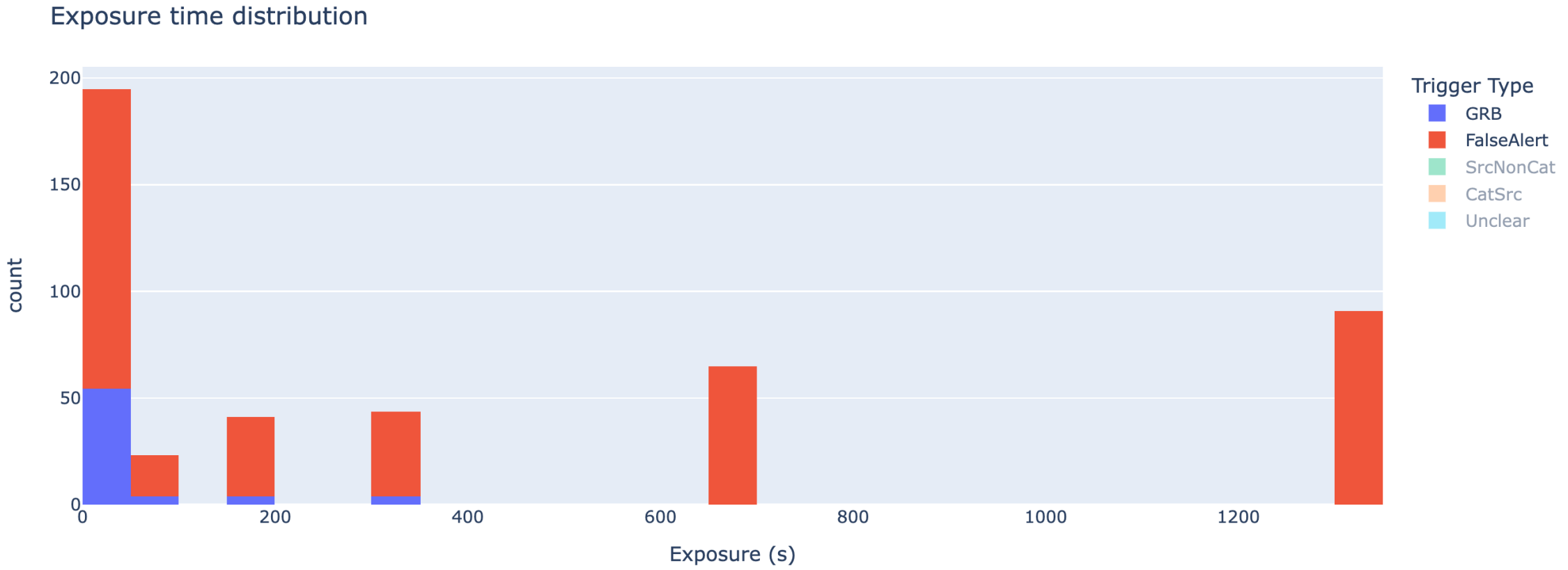
~ 75% false triggers happened in IMT

```
iEstrip0: 8.0–120.0 keV (1110)
iEstrip1: 8.0–50.0 keV (0110)
iEstrip2: 20.0–120.0 keV (1100)
iEstrip3: 5.0–8.0 keV (0001)
```



False triggers happen in different energy band

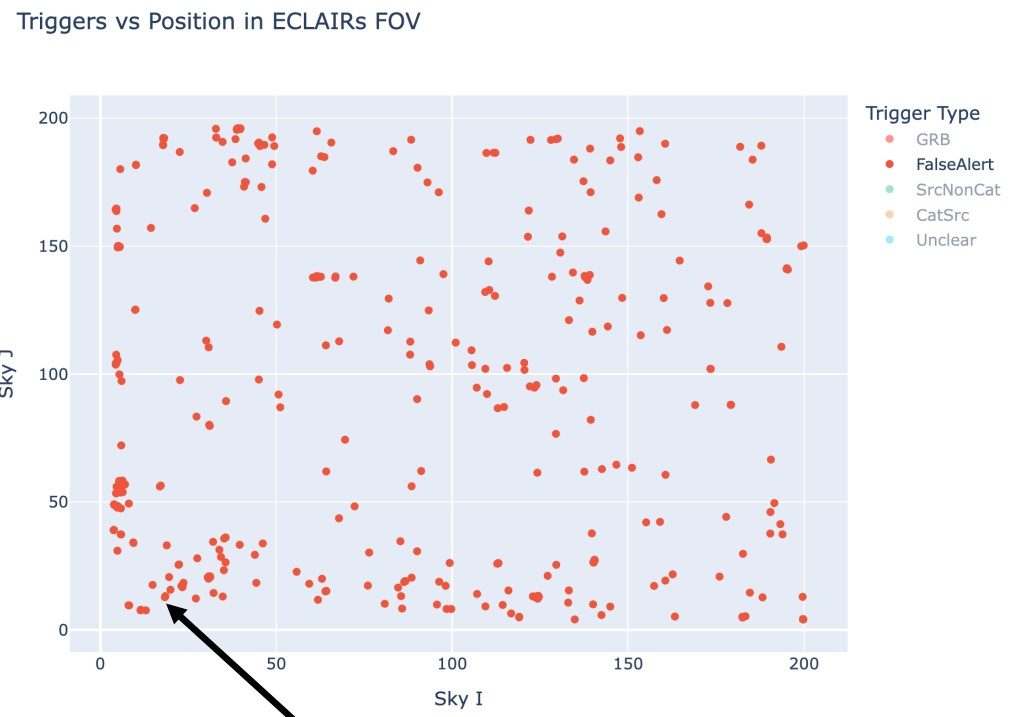
trigger time window distribution

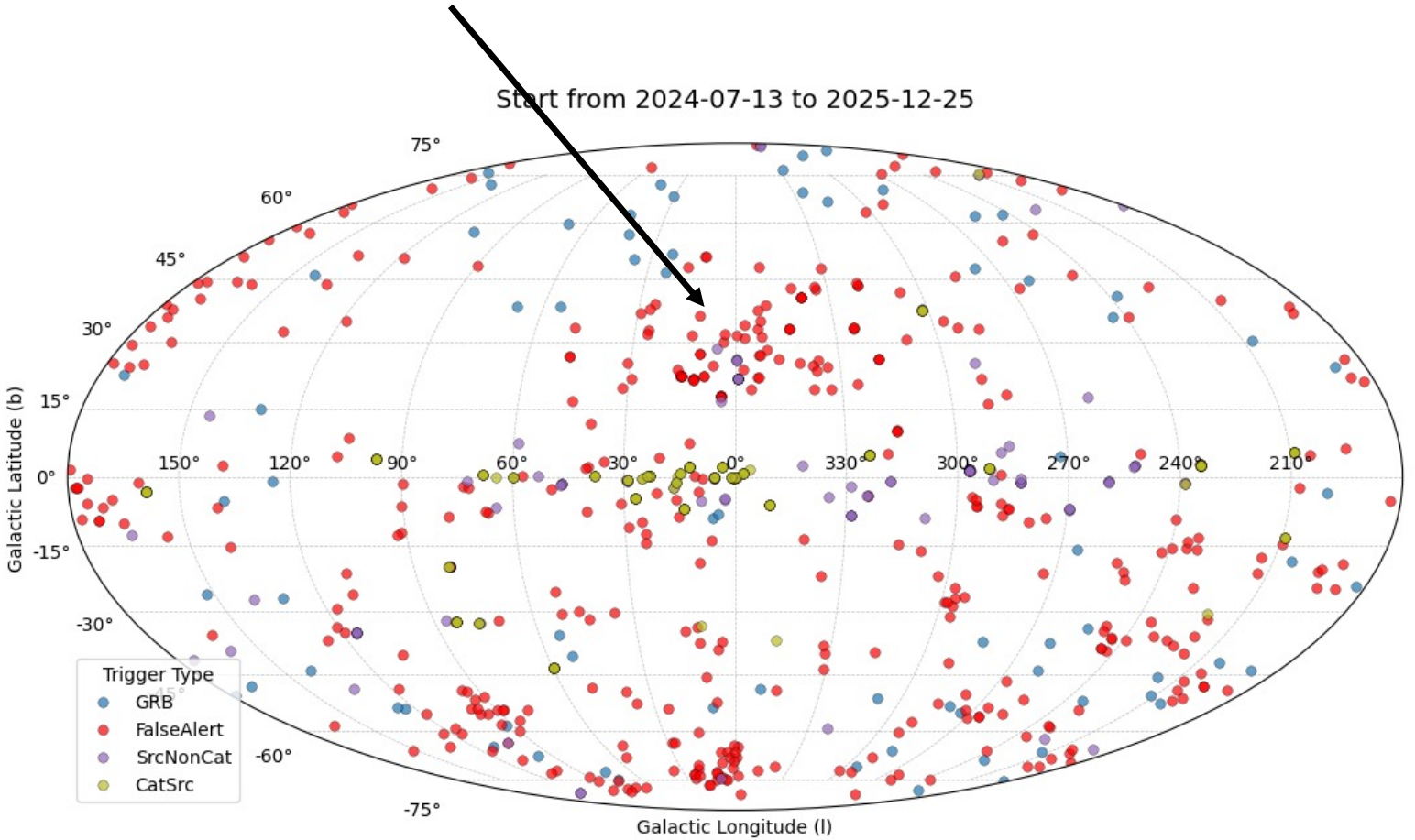


False triggers tend to occur in long time window

False trigger distribution

This region have the Sco X-1,
the brightest known X-source

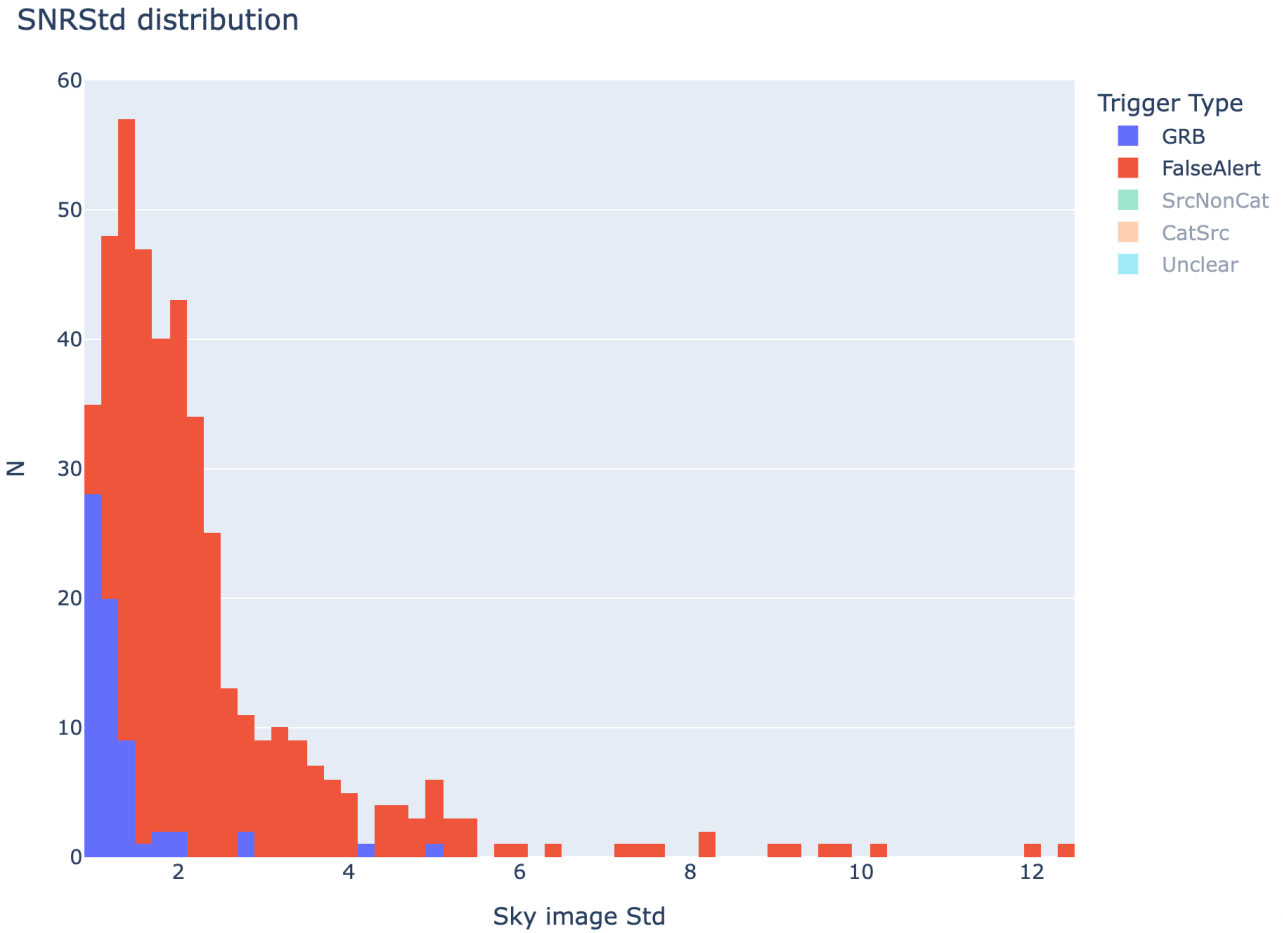


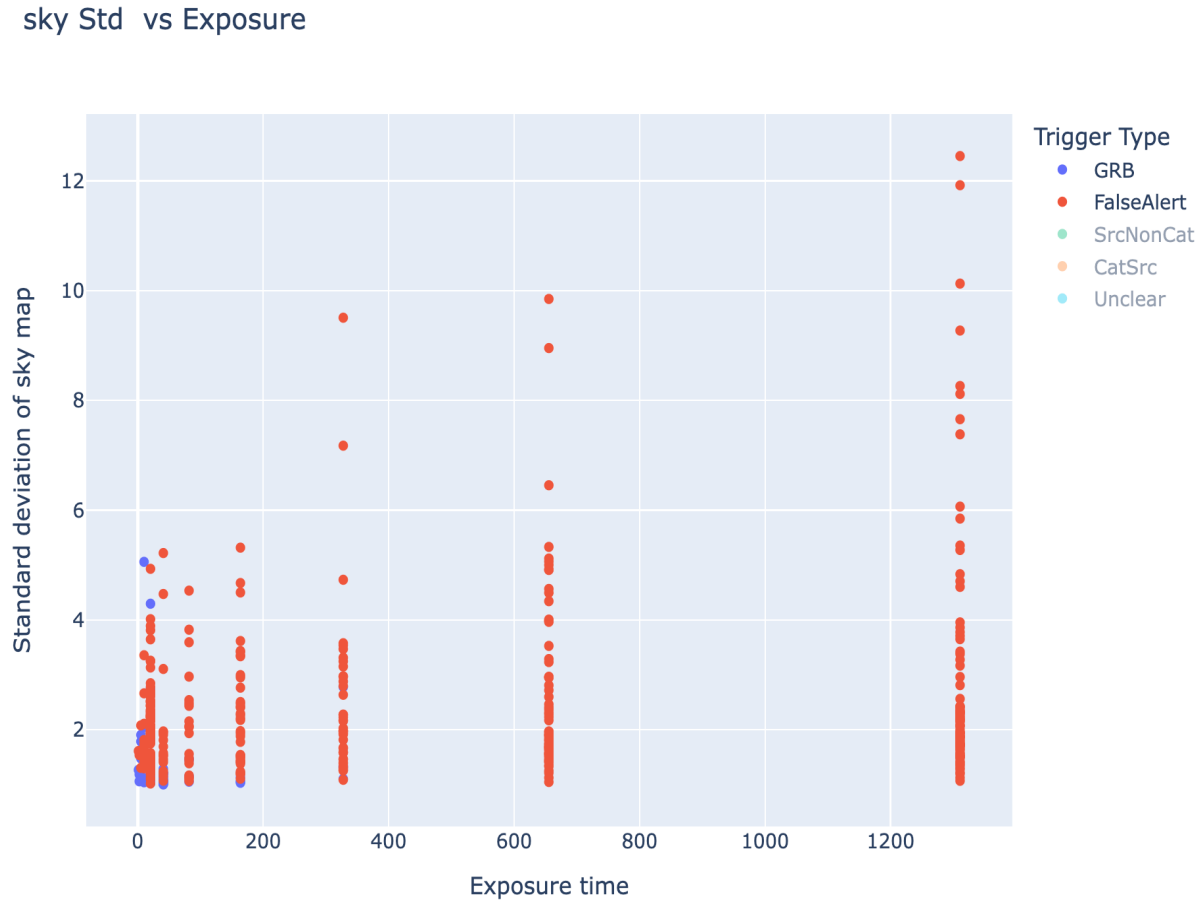


some false trigger local at the same position in the edge of ECLAIRs FoV

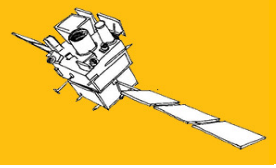
sky SNR Over Standard deviation

SNR: Signal noise ratio
Std: Standard deviation





The sky map of false trigger usually with an higher fluctuation, which indicate by an higher Std value



Summary

- There are different kinds of false trigger due to： Noisy pixels, bright source impact, background disturbance et.al.

- False triggers tend to occur in relatively concentrated periods. On average ~ 1 false trigger/day. Tend to happen in long time windows and higher Std of sky map.

- The primary indicator for determining whether a false trigger has occur is : **whether the sky image depicts a point shape and close the bright X-ray sources**.

Thanks !!