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OBSERVATORY

12/2021

Long signal flag report

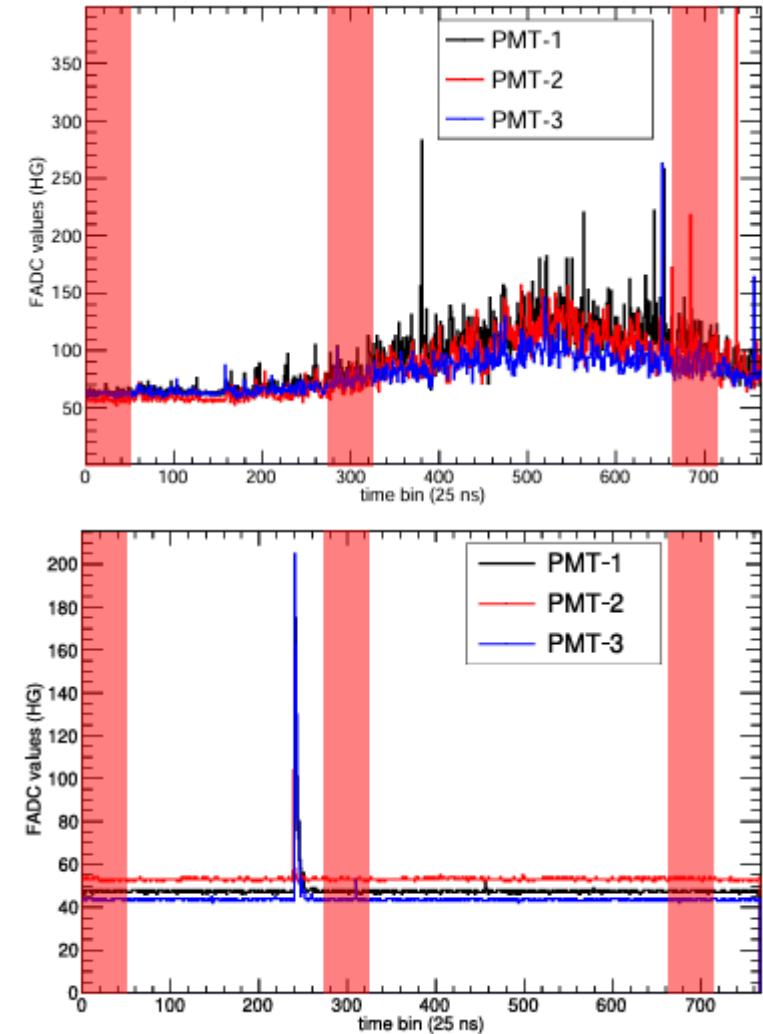
Meeting Auger Italia,
3-5 febbraio 2025

Matteo Tambone, Matteo Rumolo
INFN Napoli & Università degli studi di Napoli Federico II

Recap

- In november 2021, a new algorithm, aimed to the detection of long signals obtained from TGF events, was implemented
- This new algorithm is identified by the flag '15' in Auger SD trigger since software version V0R9B6P12 (identified by number 3)
- Building on Martin Schimmasek's codes, we were able to study all the registered events for december 2021

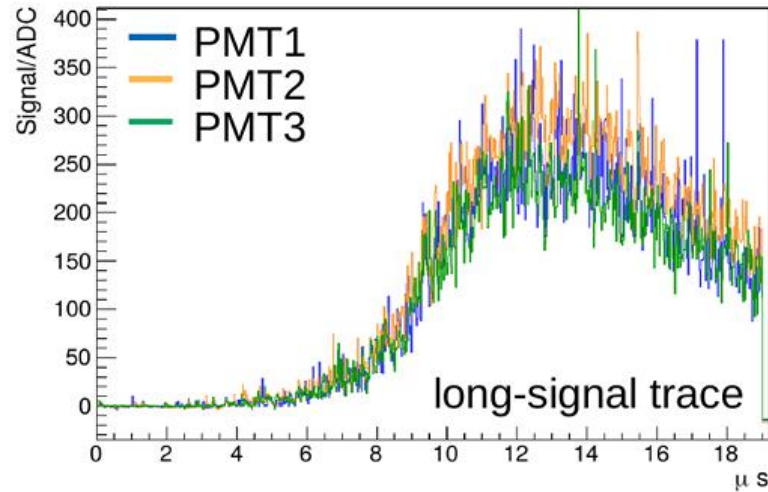
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66231480 (gps 1324064960): [282, 884828, 15, 3 | Error = 0] [280, 884829, 10, 3 | Error = 0] [284, 884829, 9, 3 | Error = 0] [357, 884829, 10, 3 | Error = 0] [292, 884830, 10, 3 | Error = 0] [297, 884831, 9, 3 | Error = 0] [326, 884831, 10, 3 | Error = 0]
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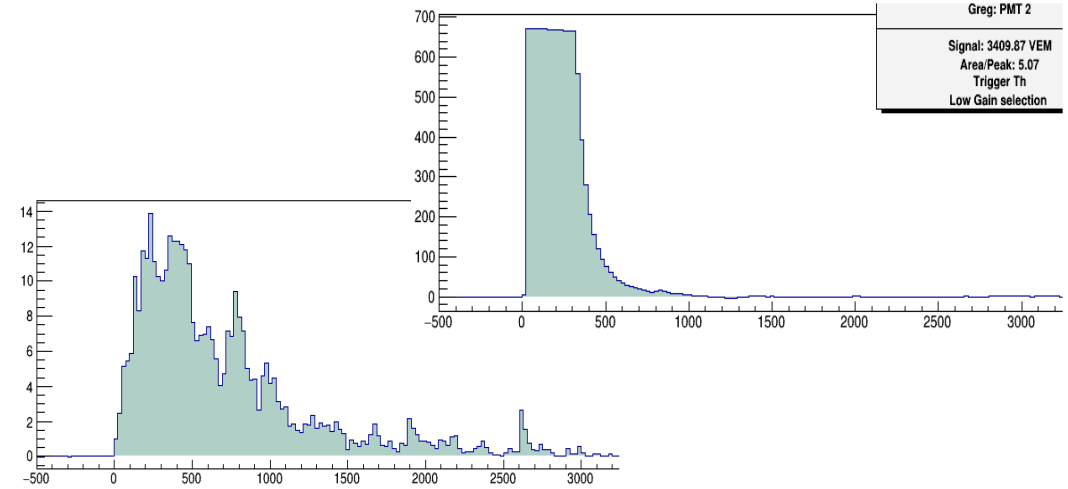
Terrestrial Gamma-Ray Flashes at the Pierre Auger Observatory,
Martin Schimmasek and for the Pierre Auger Collaboration 2022

Database categories

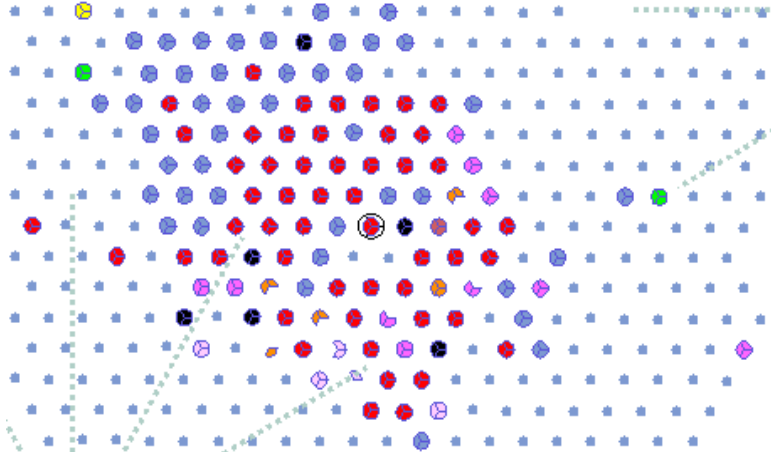
F1: Long signal associated with '15' flag



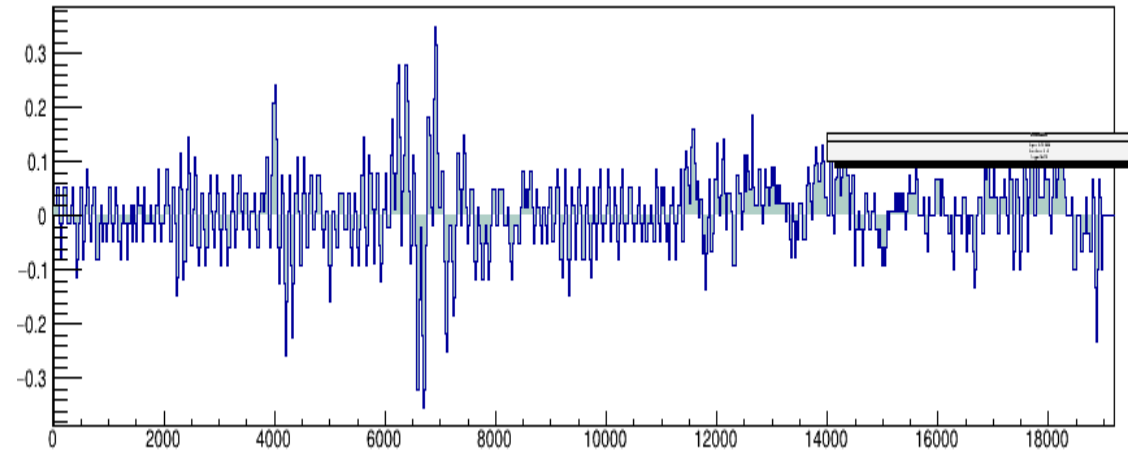
F2: «background» signal associated with '15' flag



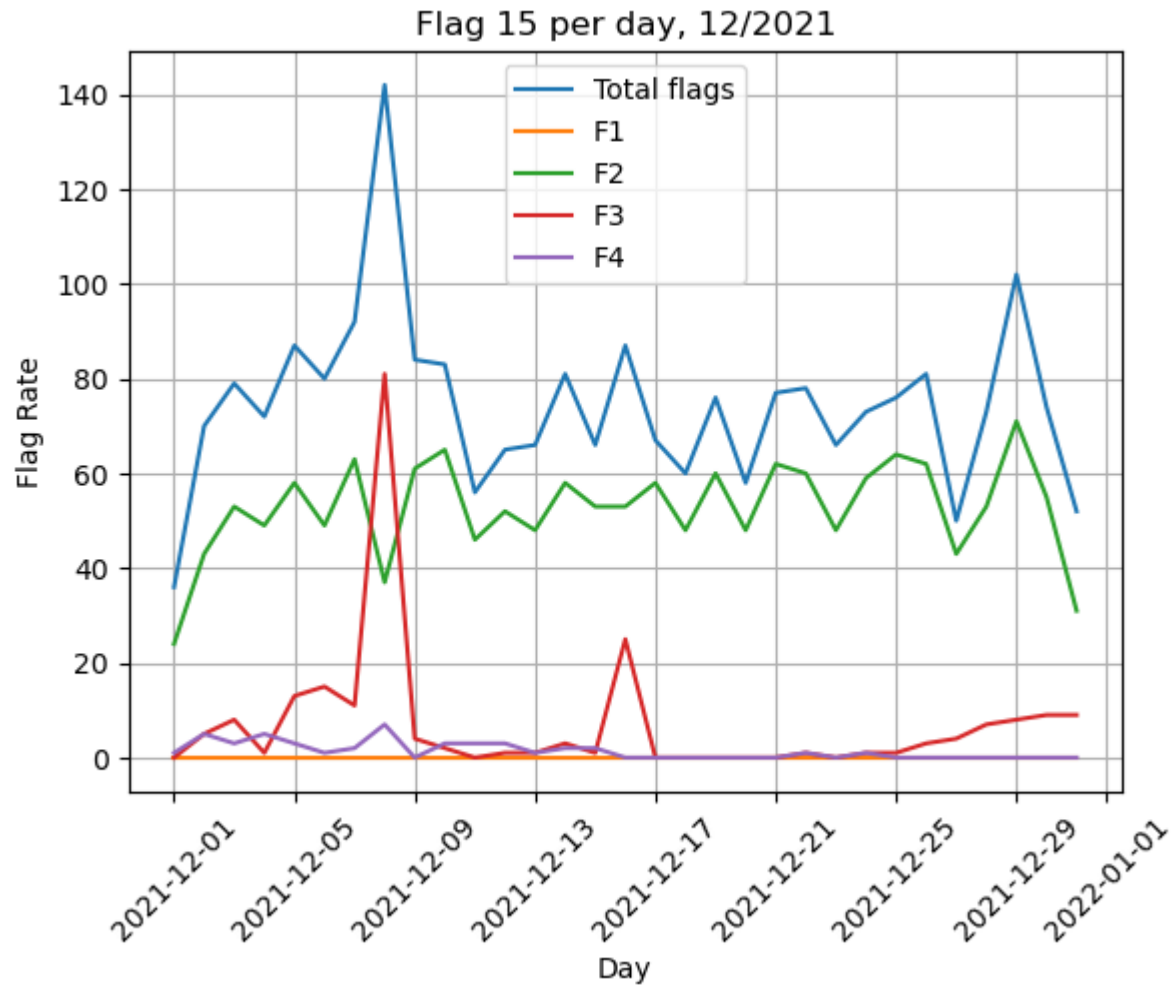
F3: '15' flag associated with signal lost at T3 event



F4: '15' flag associated with lightning station

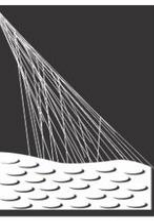


Flags in december 2021

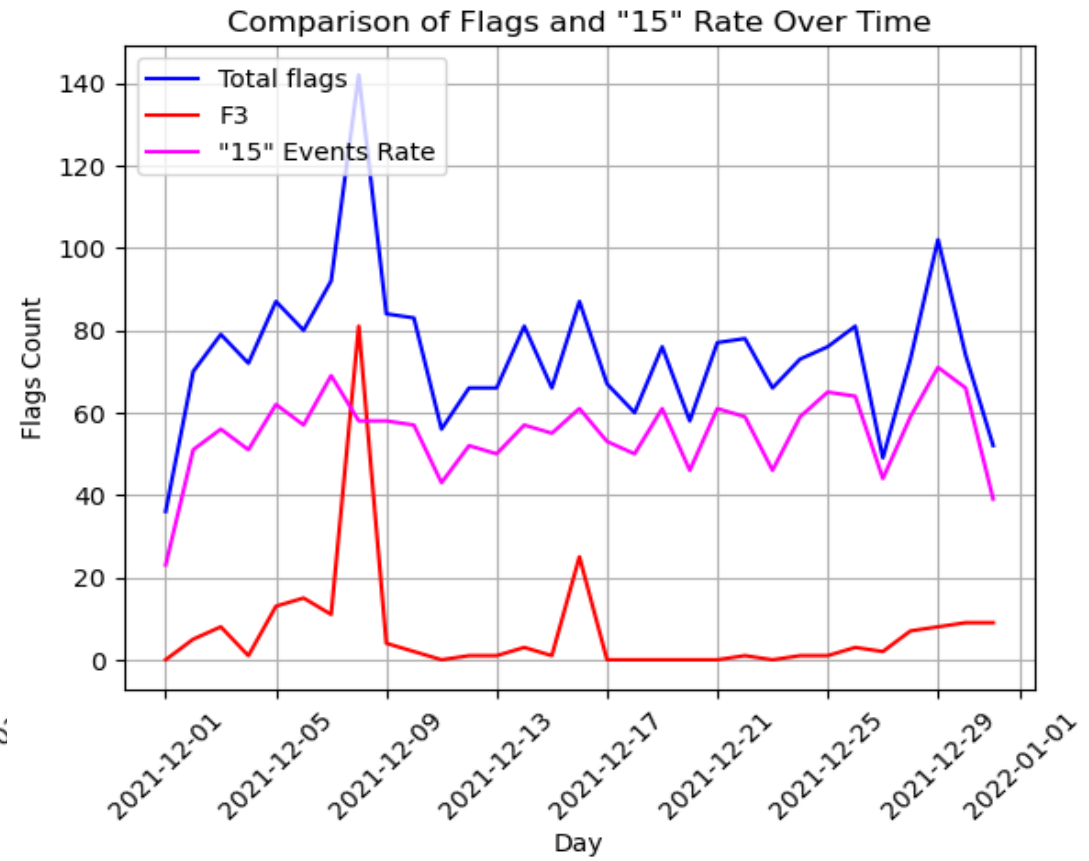
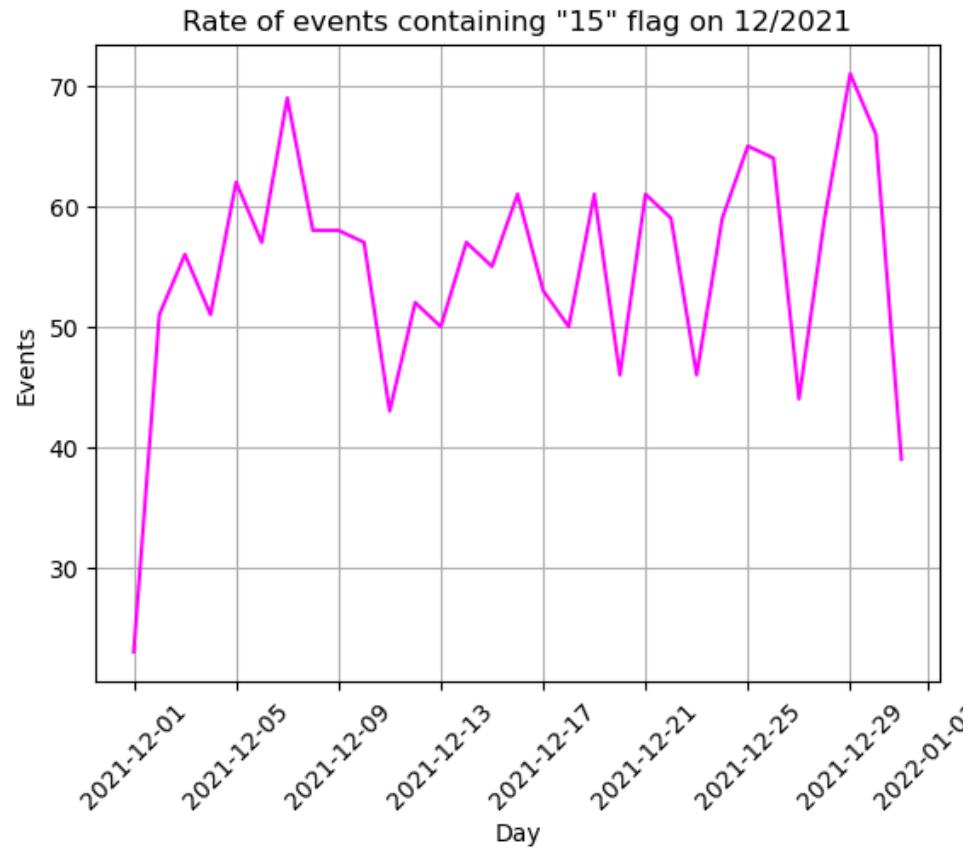


- Total number of '15' flags
- F1: possible long signal associated with '15' flag
- F2: «background» signal associated with '15' flag
- F3: '15' flag associated with T3 lost station
- F4: '15' flag associated with lightning station

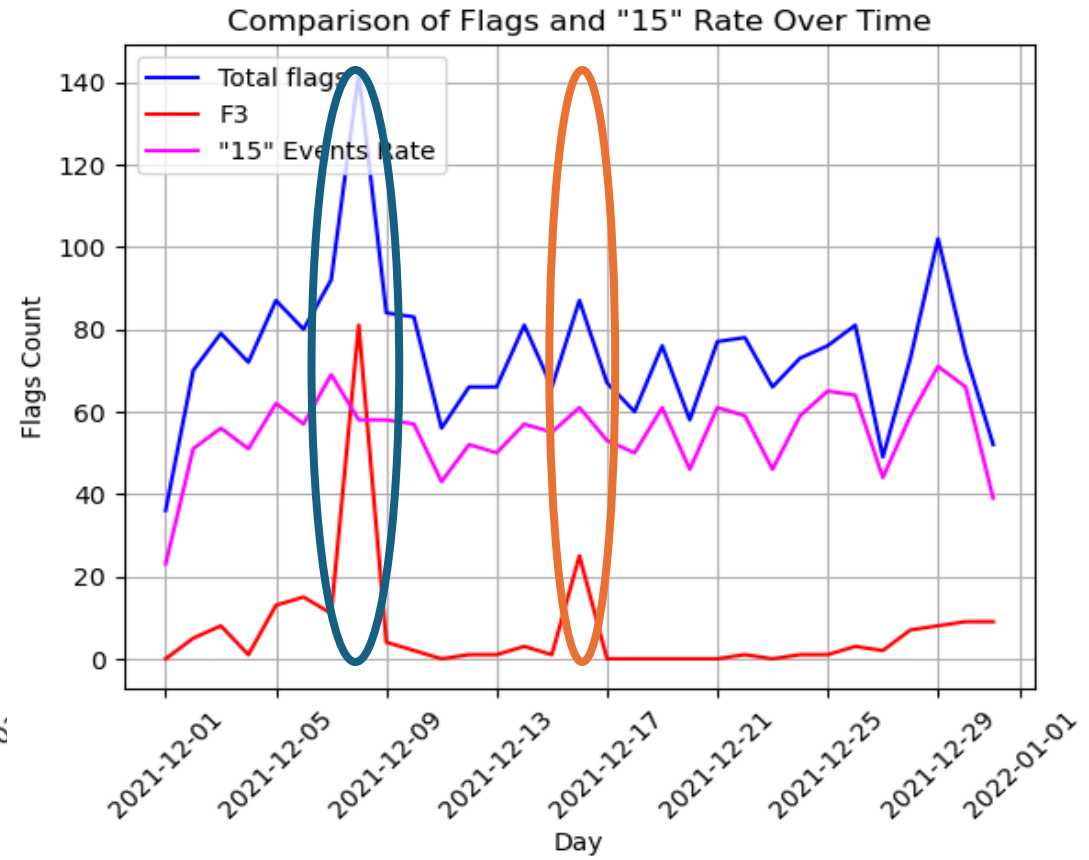
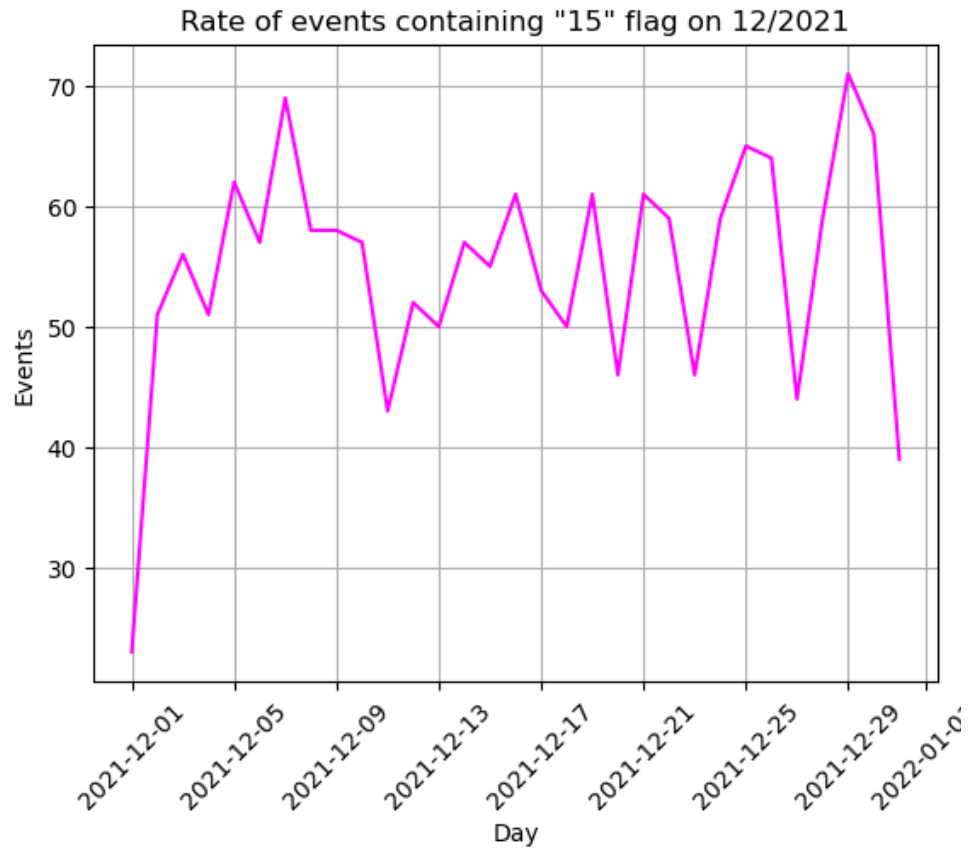
Rate of events & comparison



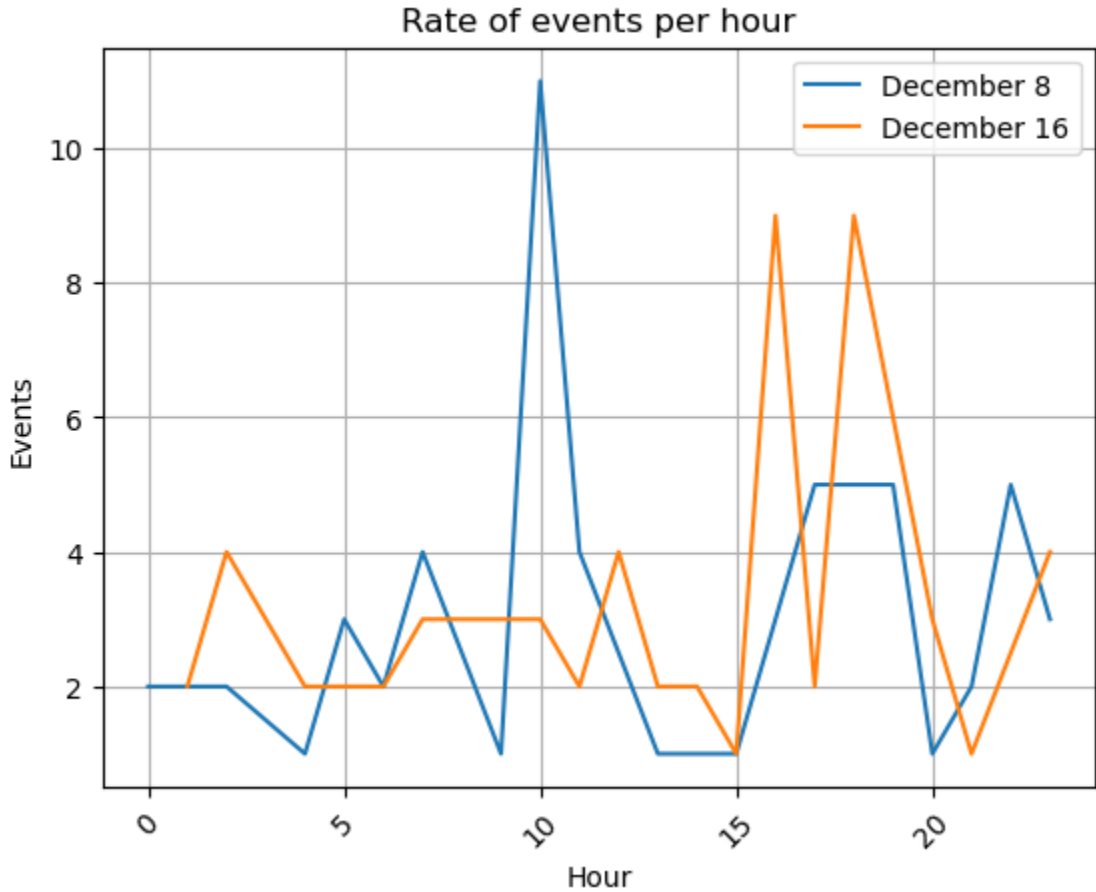
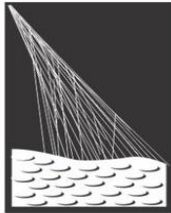
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Rate of events & comparison



Rate of events on december 8-16



		Coverage	CHB	
1322985617	13229892...	0	-999	-999
1322989217	13229928...	0	-999	-999
1322992817	13229964...	0.71	2.459	0.326

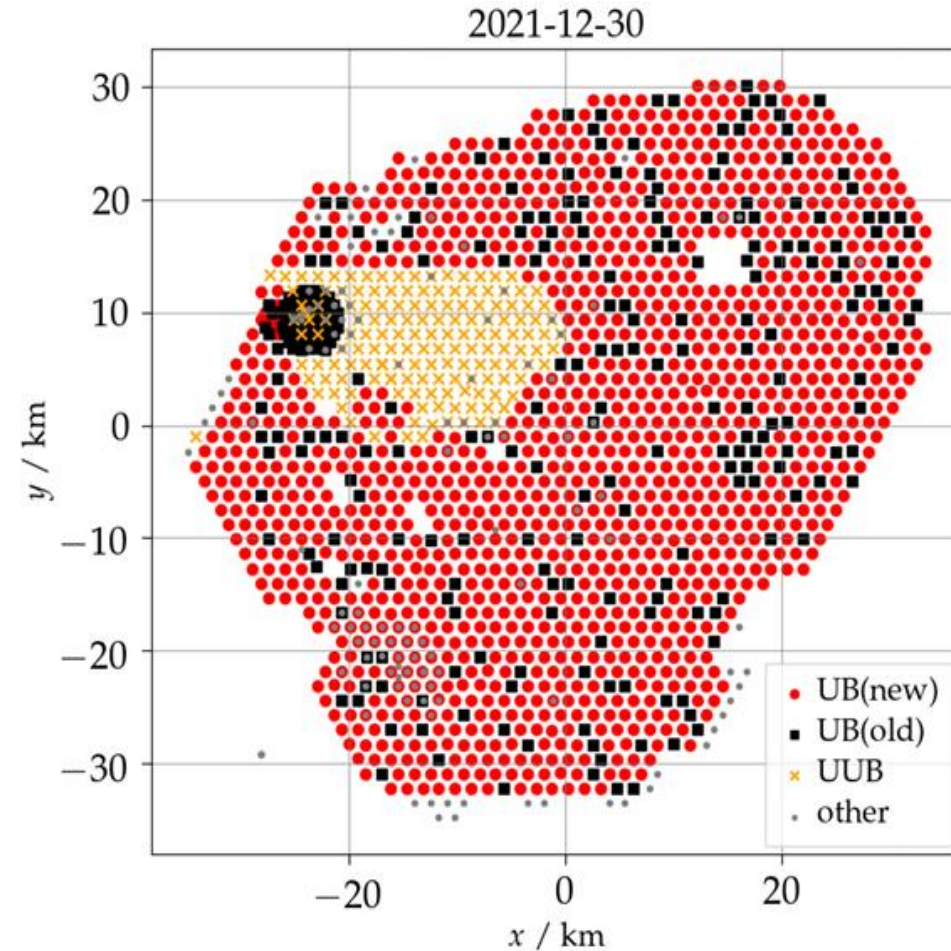
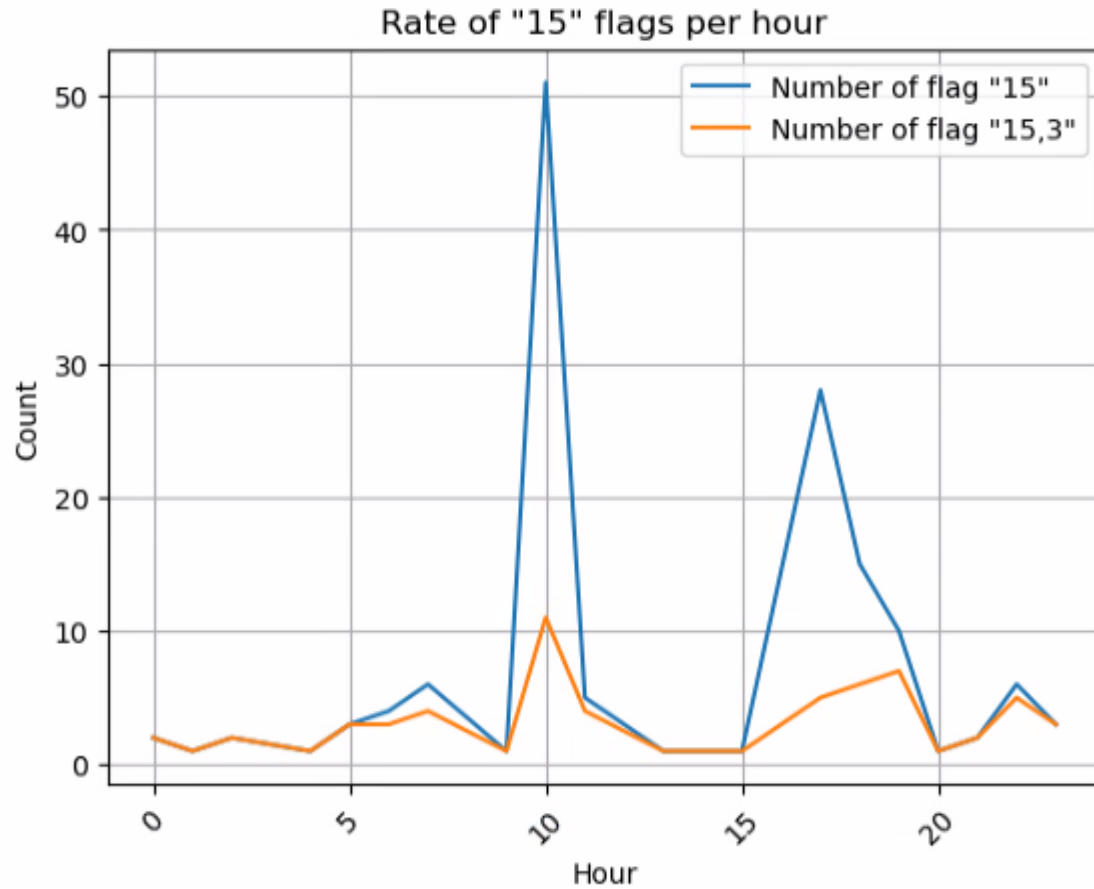
UTC	Dec 08, 2021	09:59:59	UTC
Central	Dec 08, 2021	03:59:59	CST
Pacific	Dec 08, 2021	01:59:59	PST

Information obtained from Lidar of Loma Amarilla

From my analysis, the only days with storms in December were the 16th, 18th, 24th, 28th, 29th, and 30th. Many of these storms were primarily nocturnal and lasted into the early hours of the following day.

Information provided by Gabriela Nicora

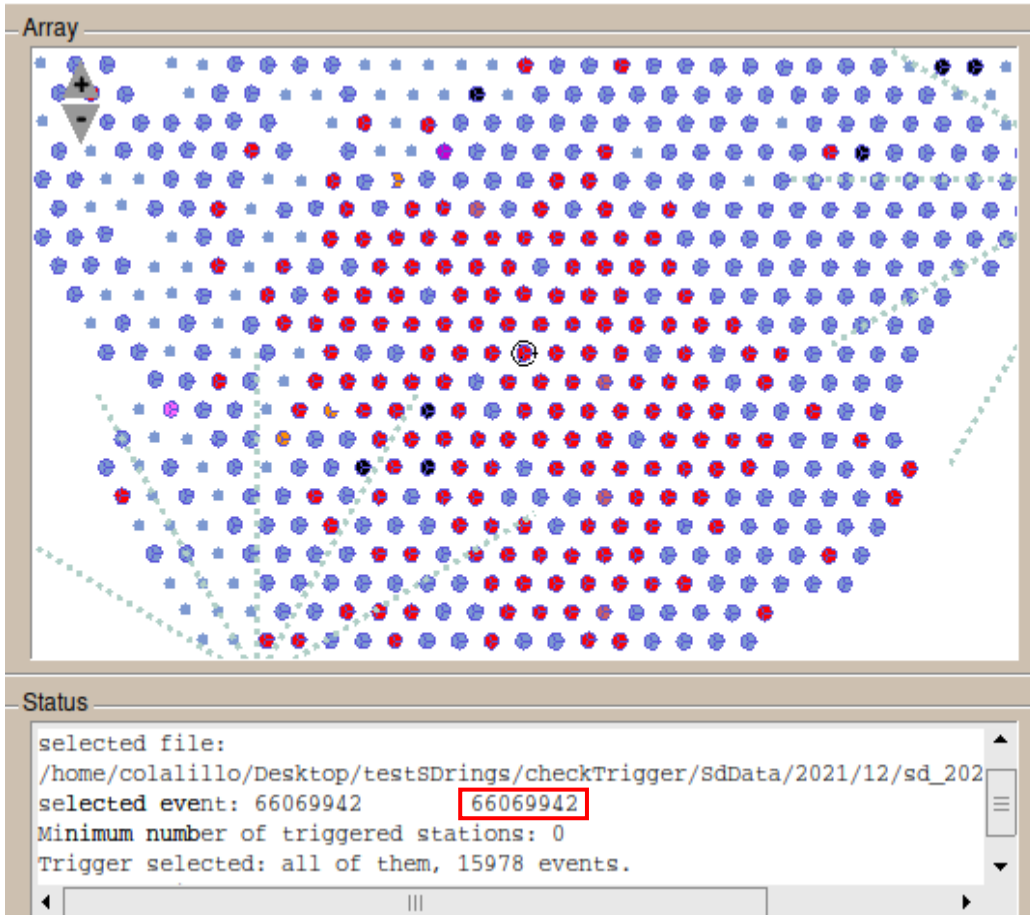
True 15 flags



- Not all stations were upgraded with software version 3
- In analysed events, high number of [...,15,2] stations
- Before version 3, '15' flag was associated with ToTd & MoPS

T3 lost events

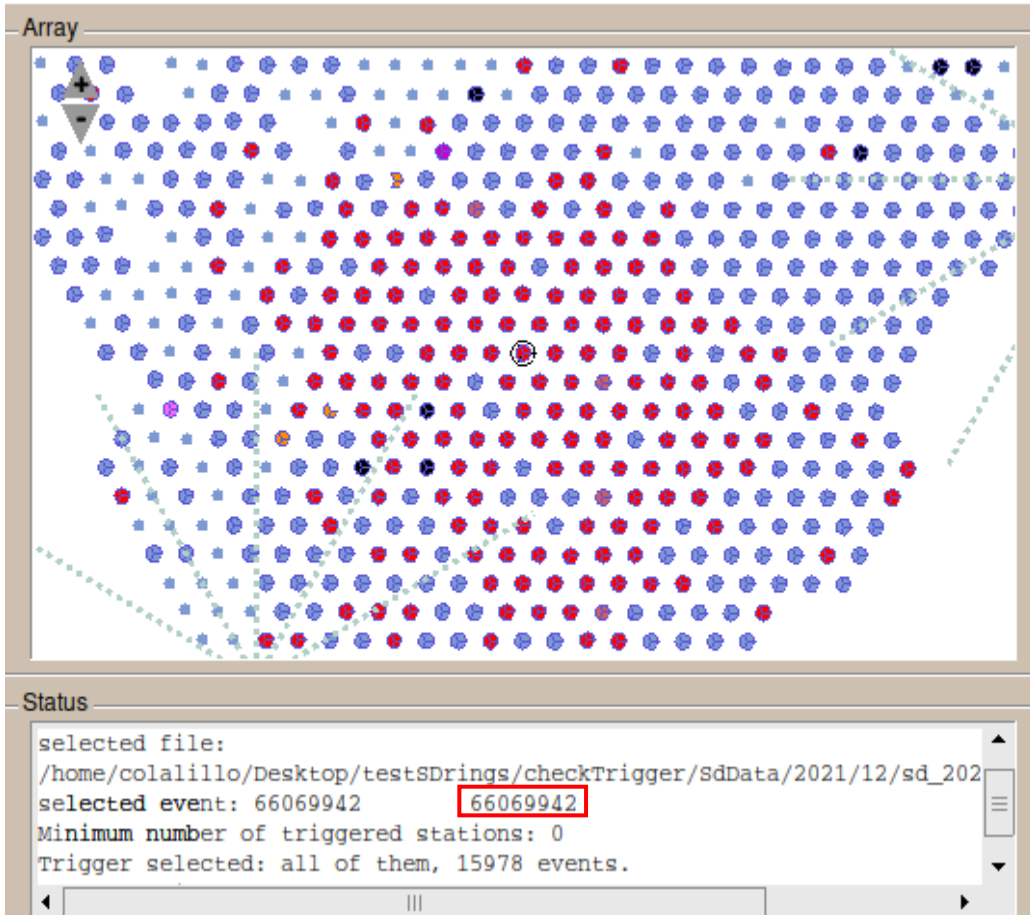
Event with '15' stations lost at T3



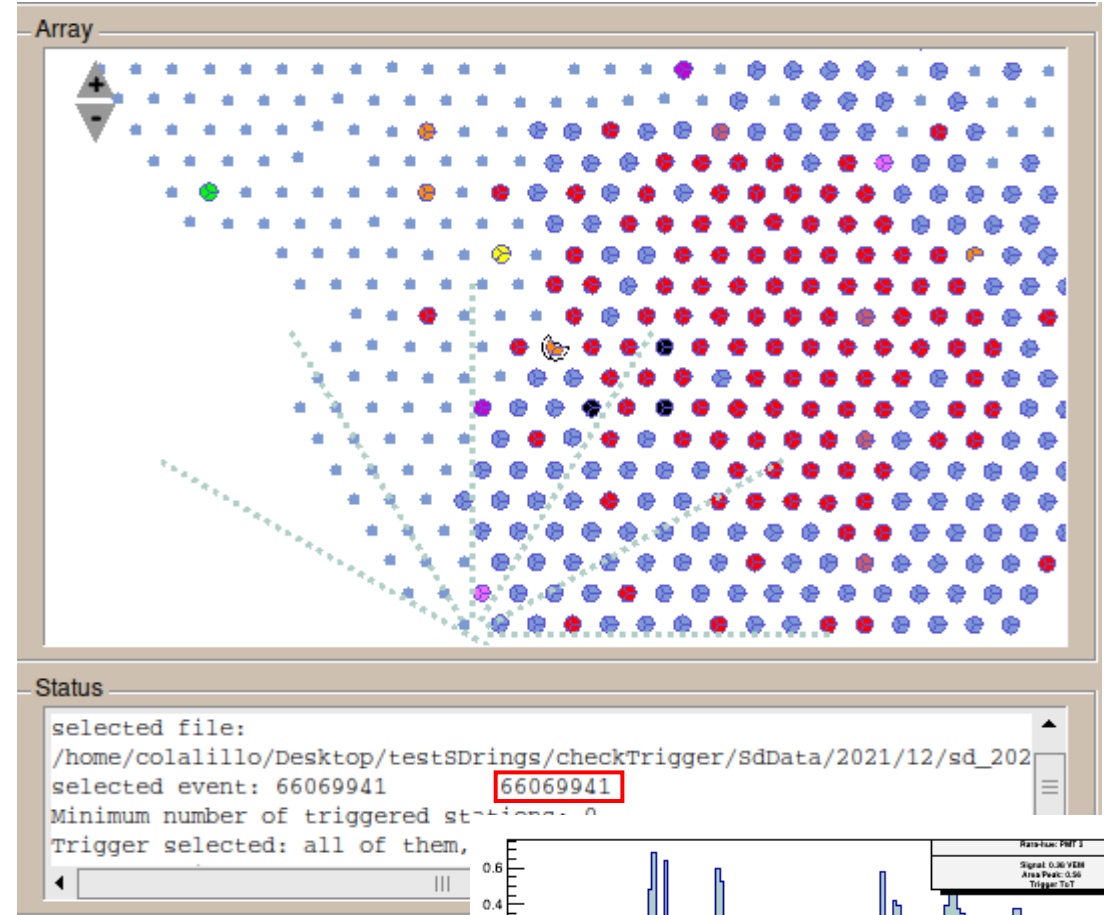
- 1703 events containing at least one '15' flag
- 103 events with '15' flag linked to T3 lost station

T3 lost events

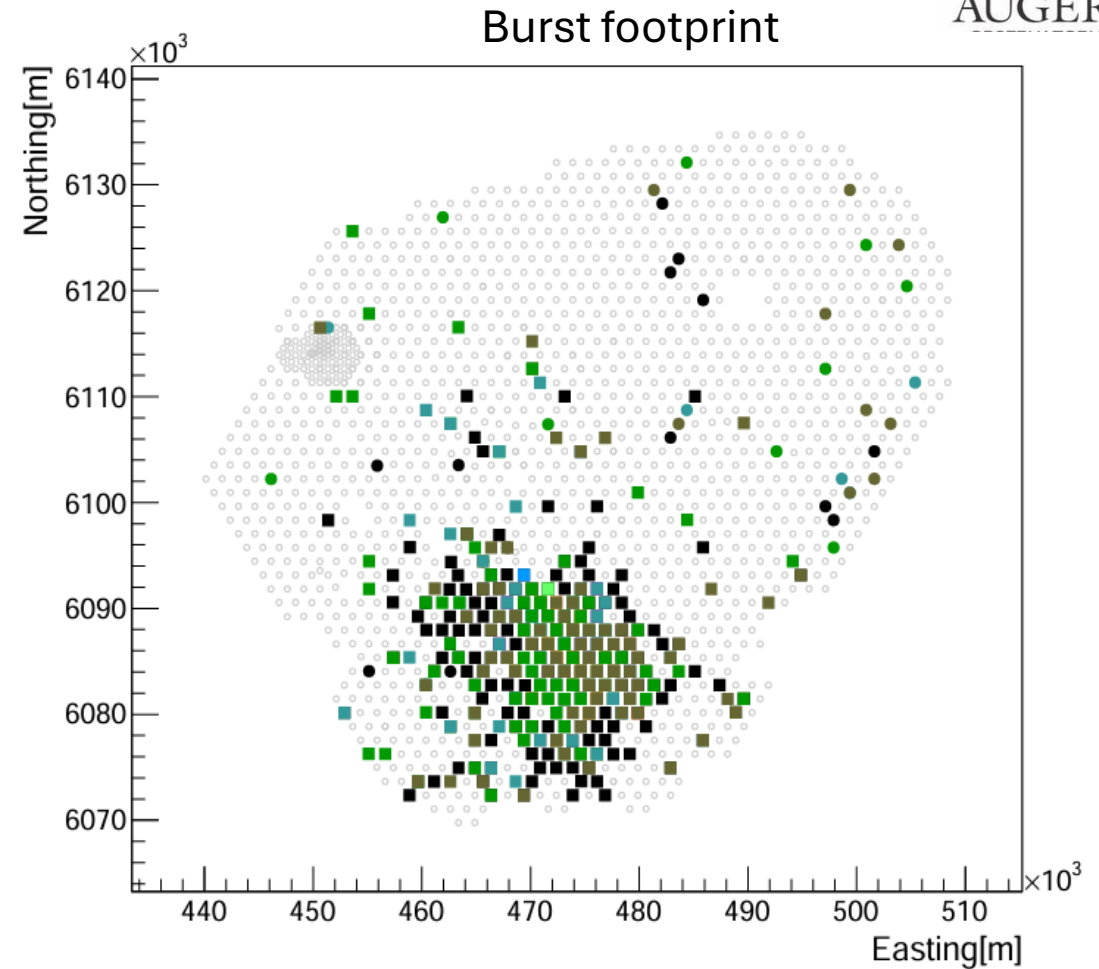
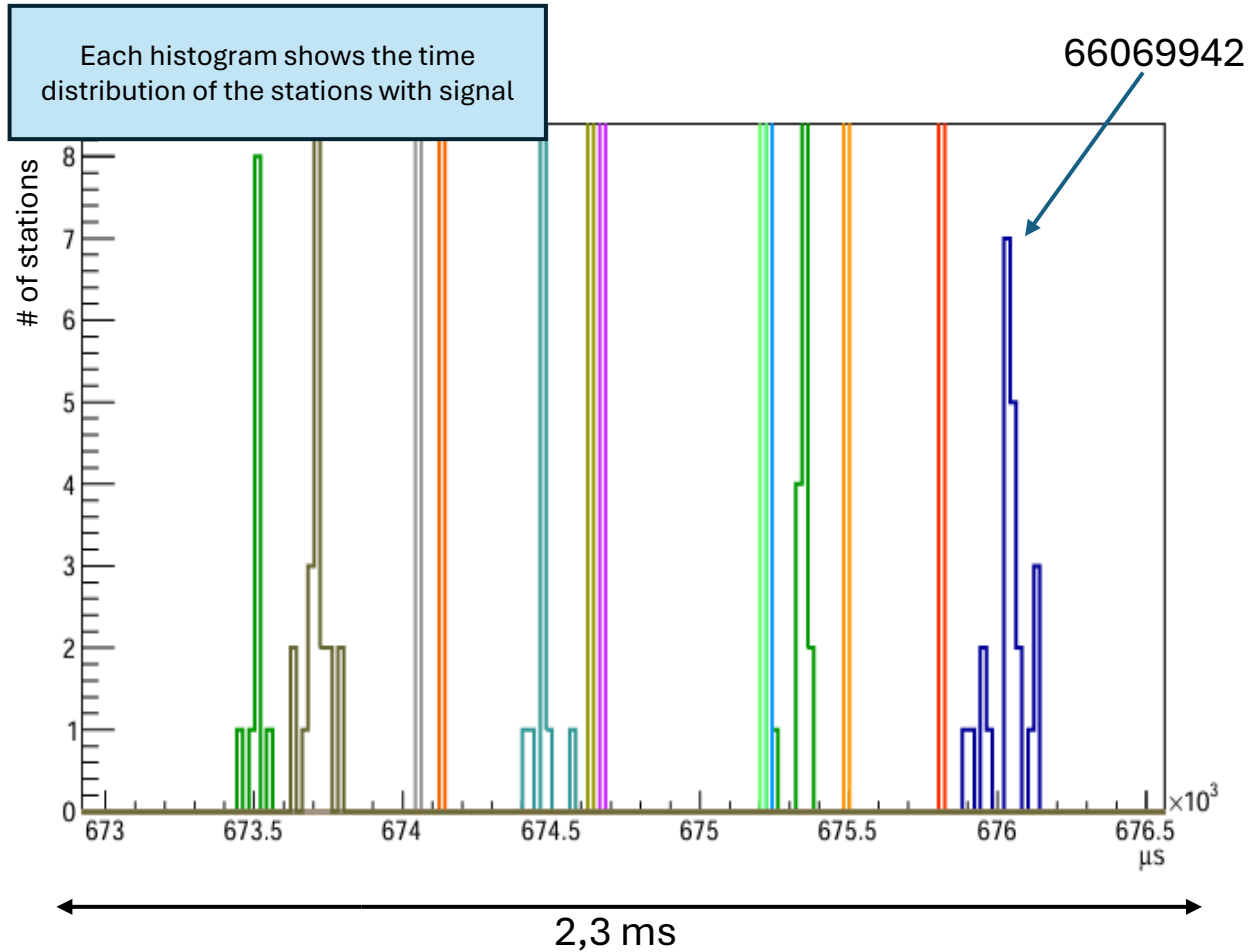
Event with '15' stations lost at T3



Precursor event with lightning station

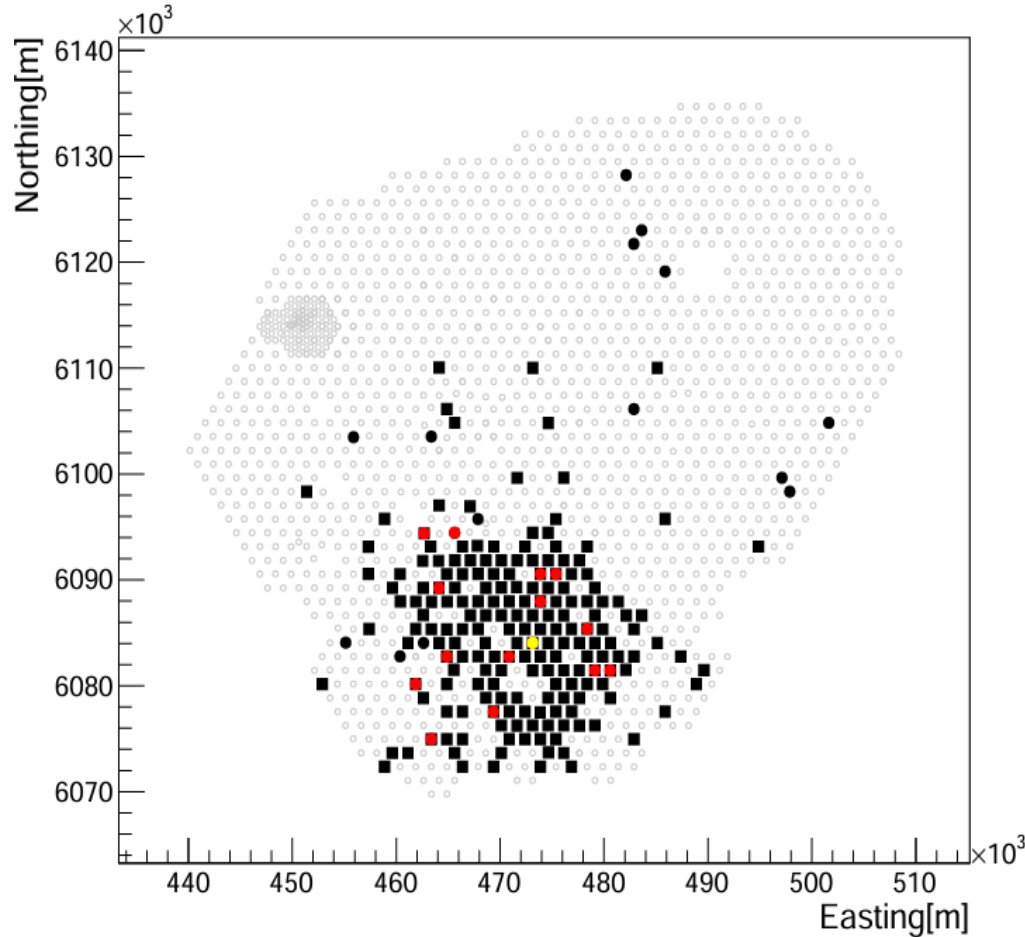


December 8, 66069942 burst timetable



December 8, 66069442 event and burst

Sd Id: 66069442



Geostationary Lightning Mapper (GLM) - GOES Satellite

,id,latitude,longitude,energy,datetime,parent_flash_id,quality_flag
4291301,381149690,-35.338066,-69.36062,3.1481403e-14,2021-12-08 10:35:57.676054+00:00,32706,0.0
4291302,381149691,-35.33606,-69.37932,8.184202e-15,2021-12-08 10:35:57.689786+00:00,32706,0.0
4291303,381149692,-35.30984,-69.38155,3.9847056e-15,2021-12-08 10:35:57.695890+00:00,32706,0.0
4291304,381149693,-35.33423,-69.36103,1.178377e-14,2021-12-08 10:35:57.705808+00:00,32706,0.0

Earth Networks Total Lightning Network (ENTLN) Global Network

,latitude,longitude,datetime,peakCurrent,ic_height
61588,-35.3539,-69.3182,2021-12-08 10:35:57.675996+00:00,-129394.0,0.0
61591,-35.247,-69.12954,2021-12-08 10:35:58.021119456+00:00,3397.0,20185.0
61592,-35.332359999999994,-69.19985,2021-12-08 10:35:58.046318205+00:00,-7283.0,12988.0
61593,-35.37939,-69.29385,2021-12-08 10:35:57.728037961+00:00,-43294.0,0.0

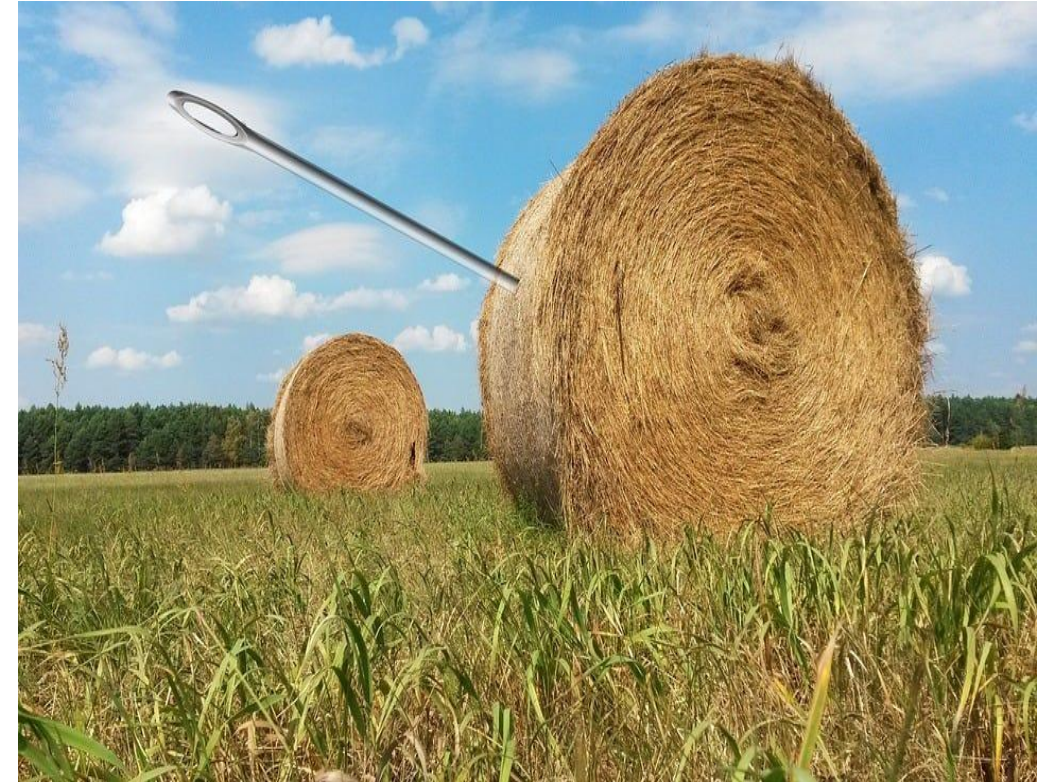
Negative cloud to ground lightning

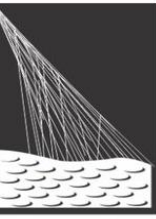
Conclusions & Next steps

- Analysis will be corrected to have the right statistic identifying only [15,3] flags
- Looking for long signals not lost at T3 level

NEXT STEPS

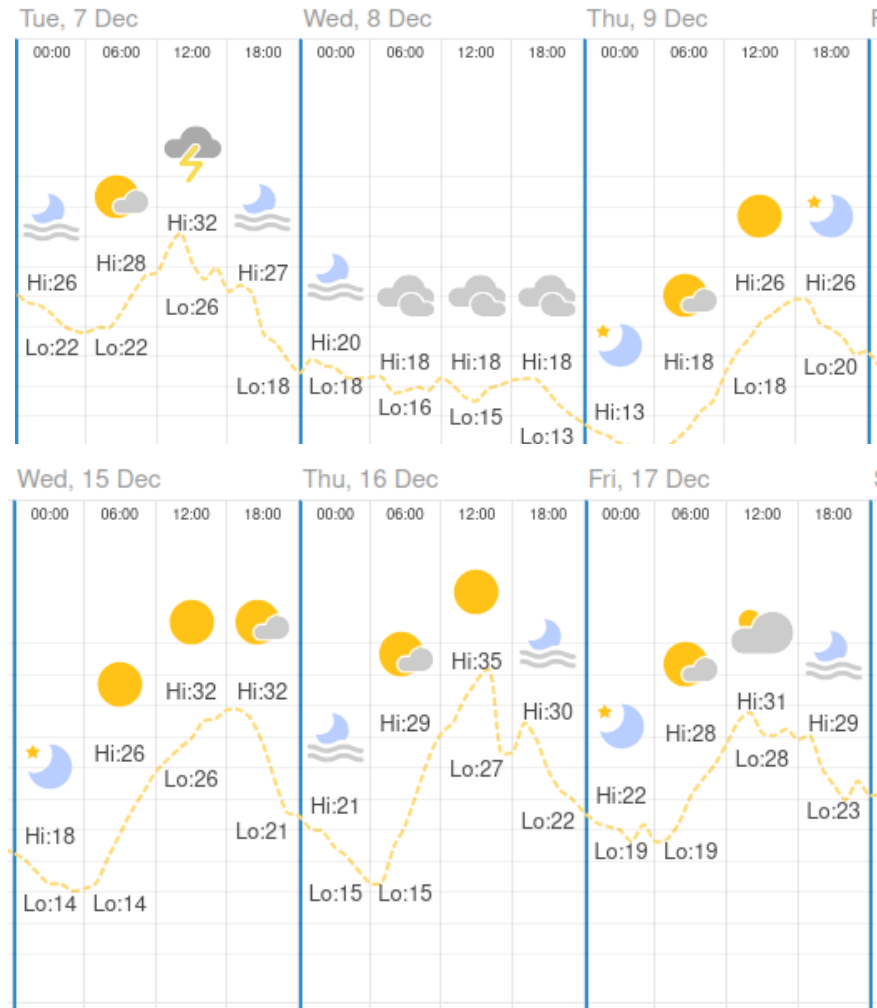
- Analysis will be performed on months of lightning season at the beginning of 2022 (January to April)
- Will push the analysis up to October-December 2022 (before UUB total upgrade)
- Starting the discussion on possible ways to enhance the trigger logic and future implementation in UUB stations





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Agua Nueva



Malargue

