

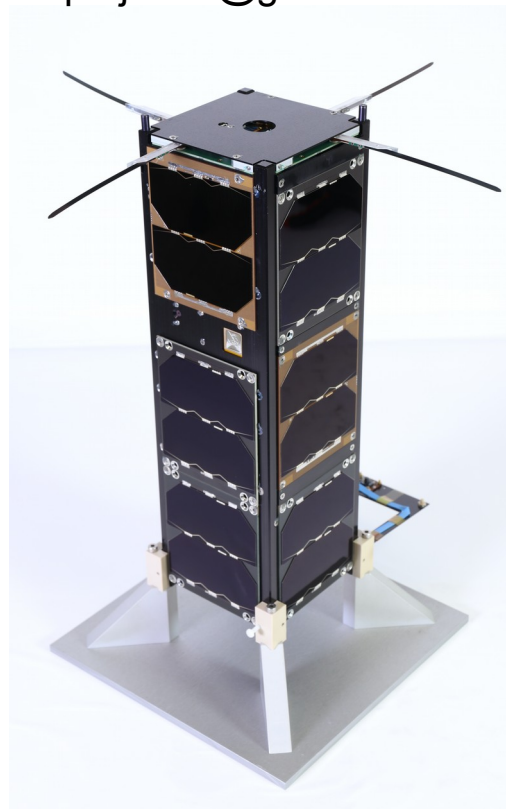
VZLUSAT-2 CubeSat



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MUNI
SCI



広島大学



名古屋大学
NAGOYA UNIVERSITY



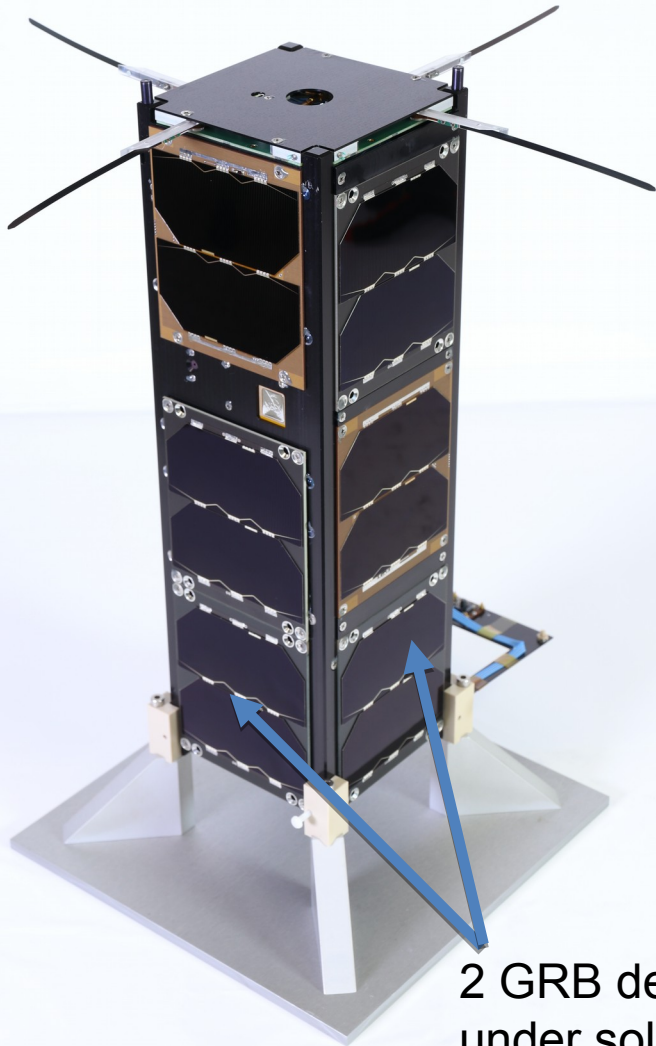
東京大学
THE UNIVERSITY OF TOKYO



SPACEMANIC



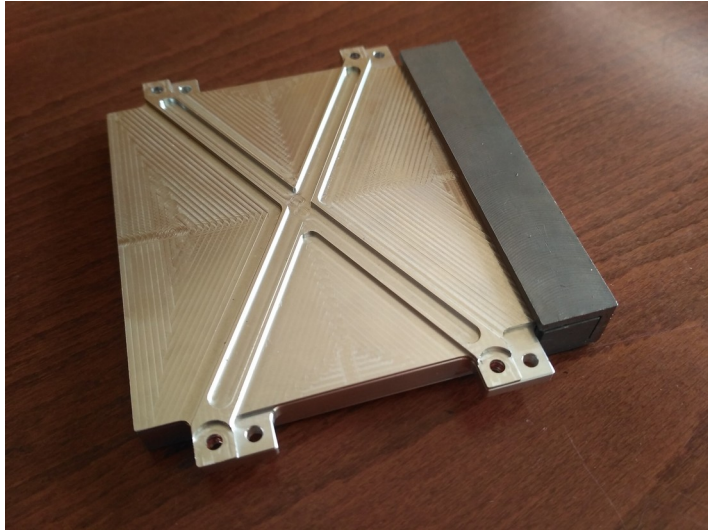
VZLUSAT-2: WITH TWO GRB DETECTORS



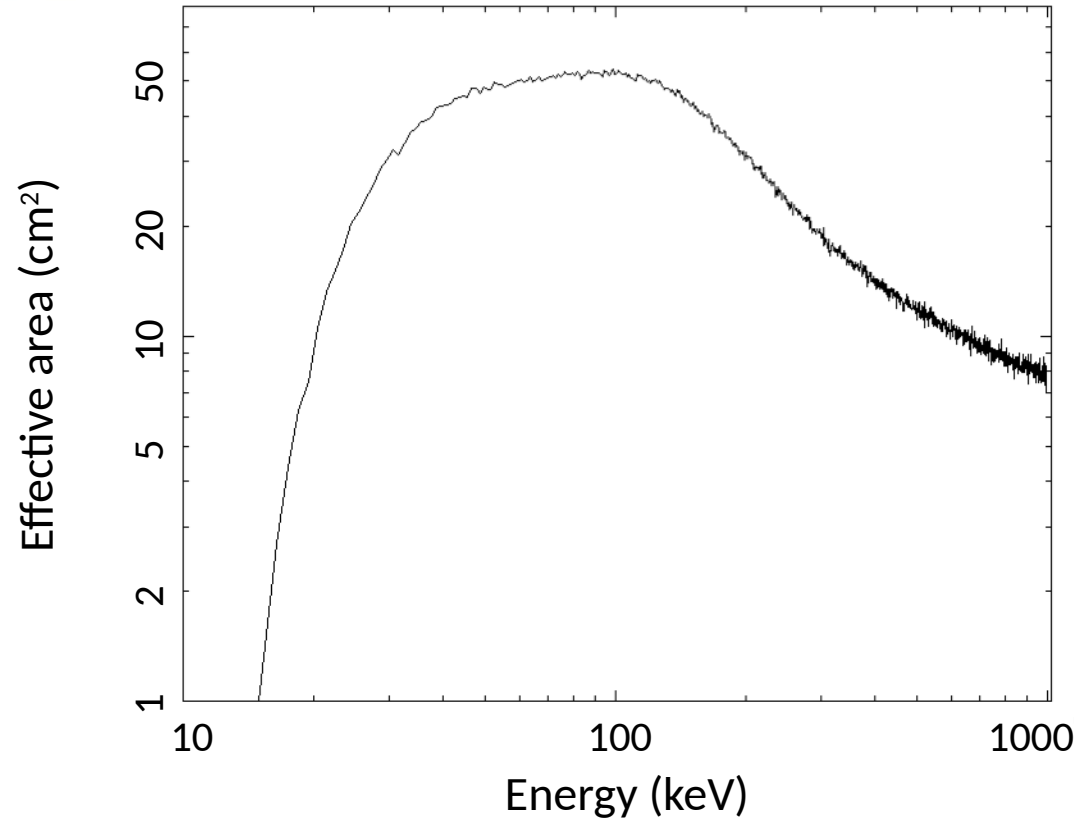
2 GRB detectors
under solar panels

- VZLUSAT-2 is a technology mission (3U size) with an Earth observing camera as a primary payload developed by Czech Aerospace Research Centre
- Two detectors ($75 \times 75 \times 5 \text{mm}^3$) as a secondary payload
- The detector concept, the MPPCs and electronics are the same as on GRBAlpha

VZLUSAT-2: DETECTORS SIMILAR TO WHAT IS USED ON GRBALPHA

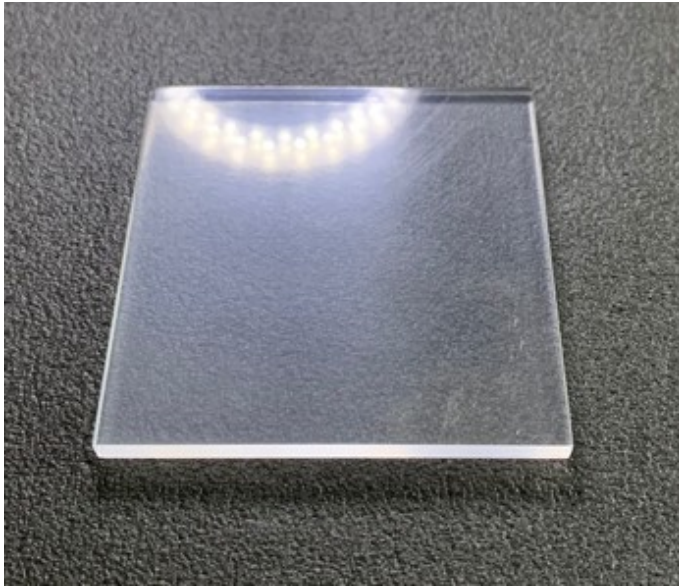


Detector for GRBALpha

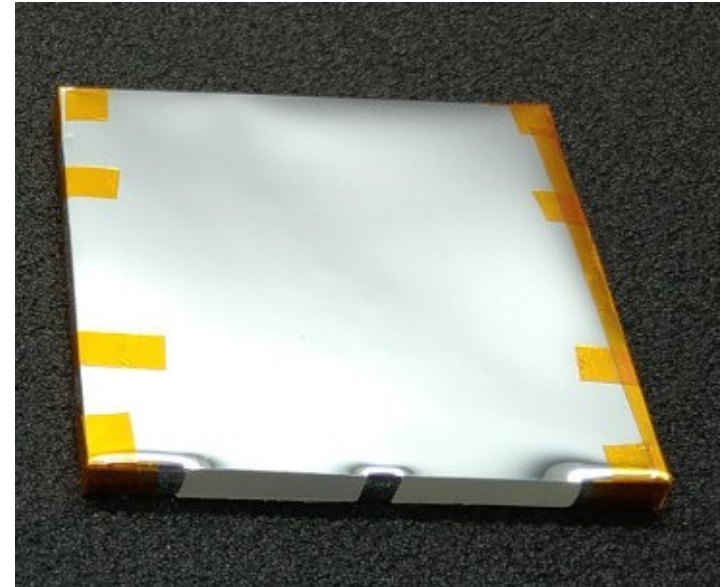


- Size of CsI scintillator is $75 \times 75 \times 5 \text{ mm}^3$ readout by 8 MPPCs
- 2 detectors on VZLUSAT-2
- Each has effective area of 50 cm^2

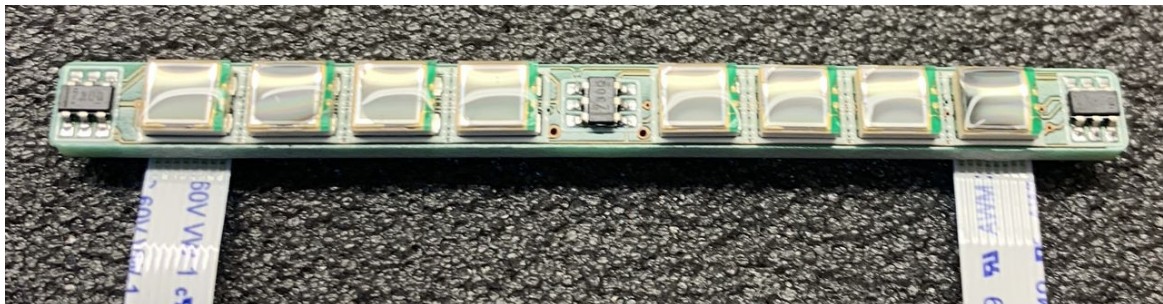
DETECTOR ASSEMBLING FOR GRBALPHA BUT ALMOST THE SAME FOR VZLUSAT-2



CsI(Tl) scintillator
from Kharkiv (Ukraine)



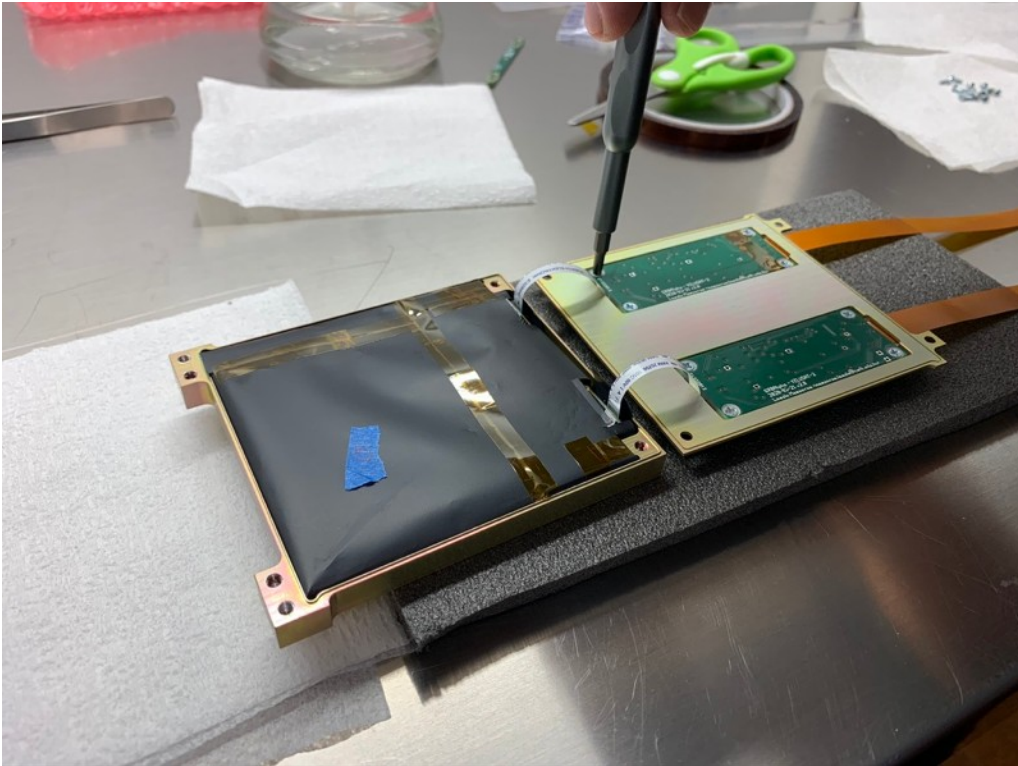
Wrapped in Enhanced
Specular Reflector (ESR)



2 readout channels of 4 MPPCs (S13360-3050 PE) by Hamamatsu

- MPPCs are coupled with crystal with an optical rubber on VZLUSAT-2 and by an optical glue on GRBAAlpha

VZLUSAT-2: DETECTOR ASSEMBLING



Placed into a 1 mm thick Al casing together with two analogue boards

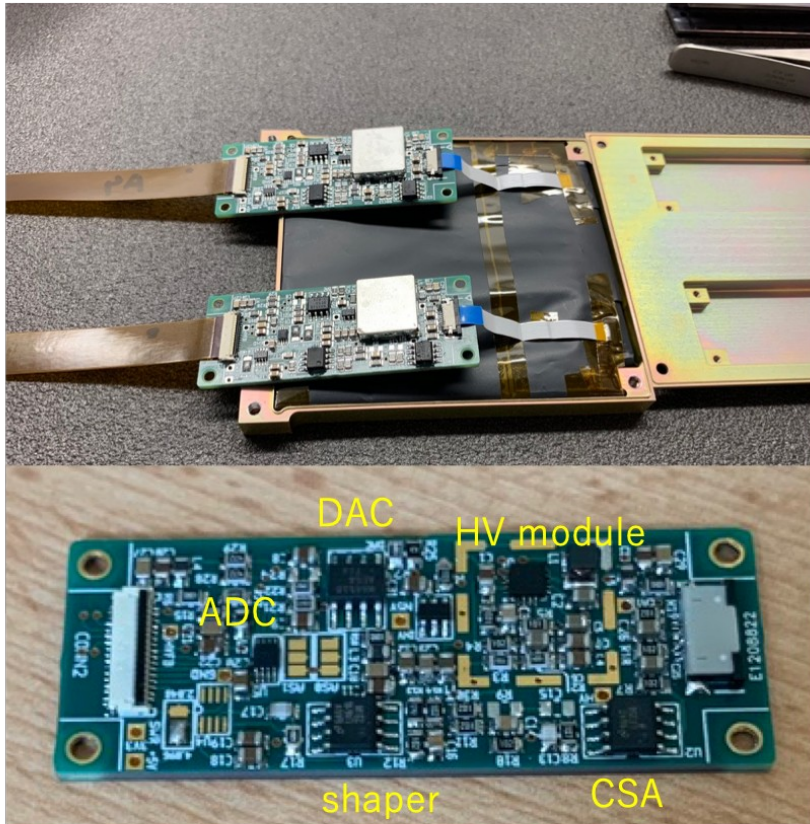


Additional wrapping around the MPPC board

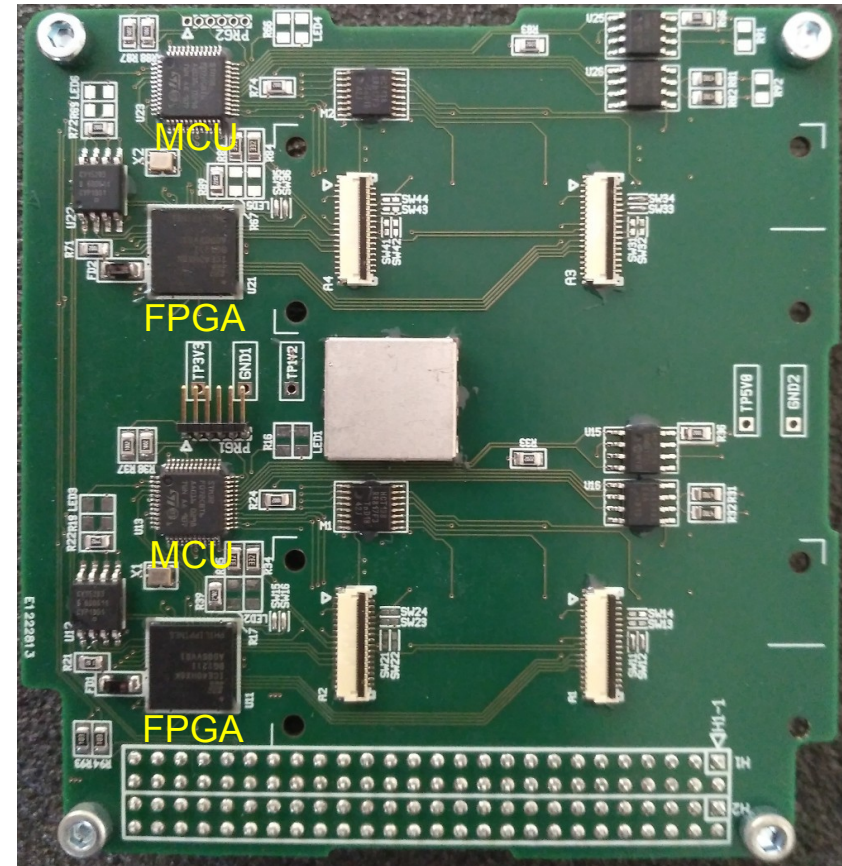
- Detector is wrapped by optically thick DuPont TCC15BL3 polyvinyl fluoride (PVF) tedlar to prevent light leakage from outside

VZLUSAT-2: ELECTRONICS

Compact analog electronics



Digital board



- A simple CSA (LF356)+ shaping amplifier (LM6142)
- 12-bit sampling ADC (LTC2315-12)
- HV supply module (LT3482) controlled by DAC

- FPGA - iCE40HX8K-BG121
- MCU - STM32F072CBT7 ARM Cortex-M0

VZLUSAT-2: DETECTORS READY



Weight: $2 \times 280 + 50$ g

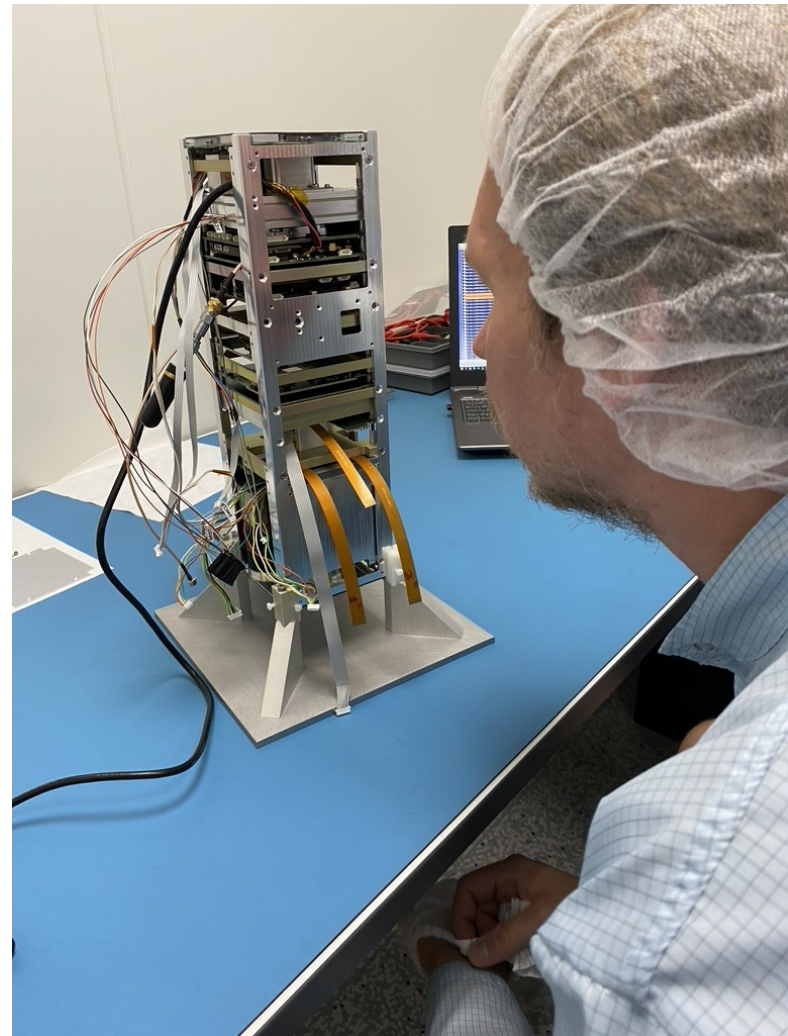
Power: 0.7 W

- Assembled detectors with Pb-Sb alloy shield to reduce degradation of MPPCs by protons in SAA

VZLUSAT-2: TESTING OF OUR DETECTORS WITH EM OF SATELLITE

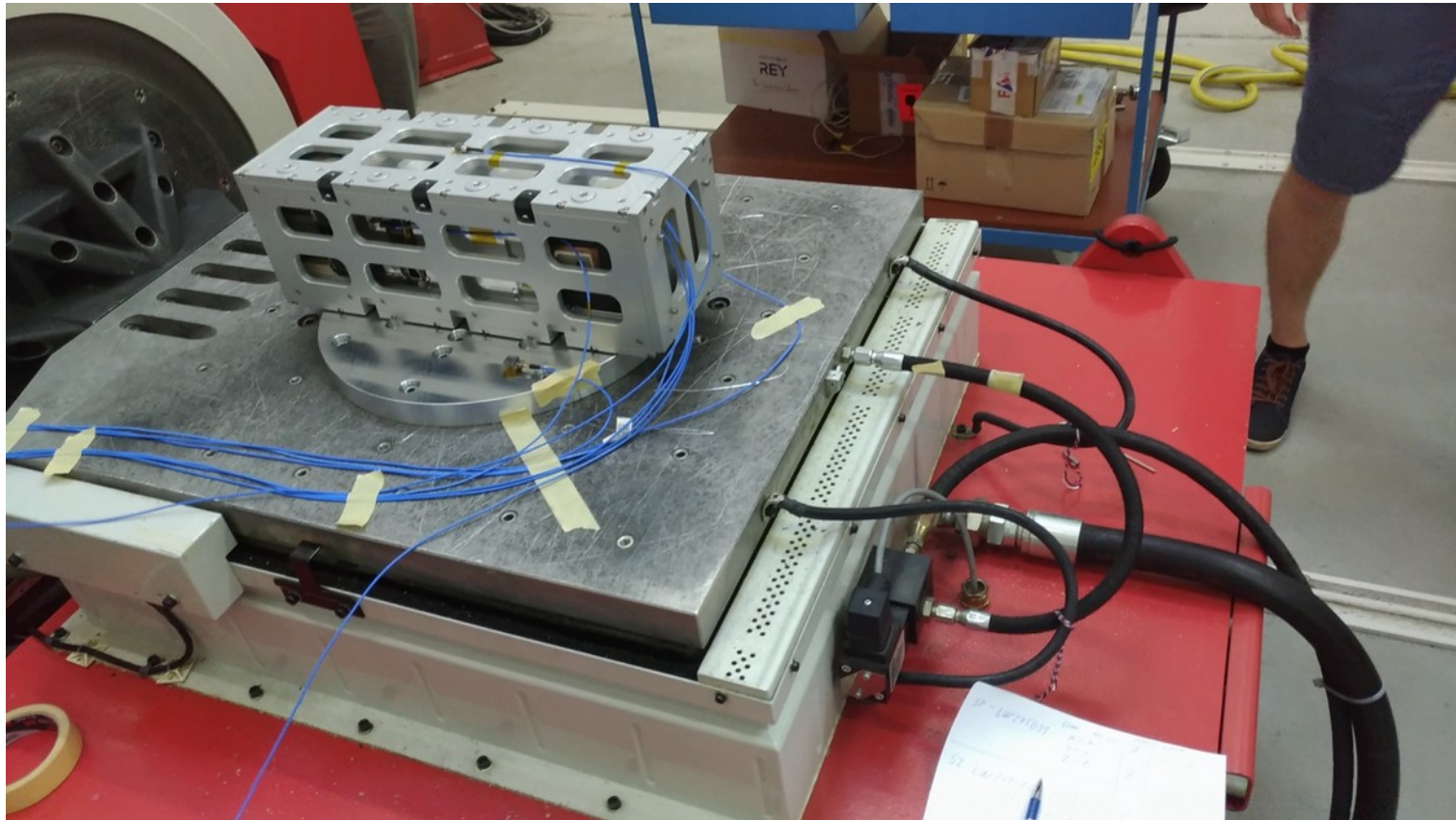


Tested that it operates on
the satellite bus



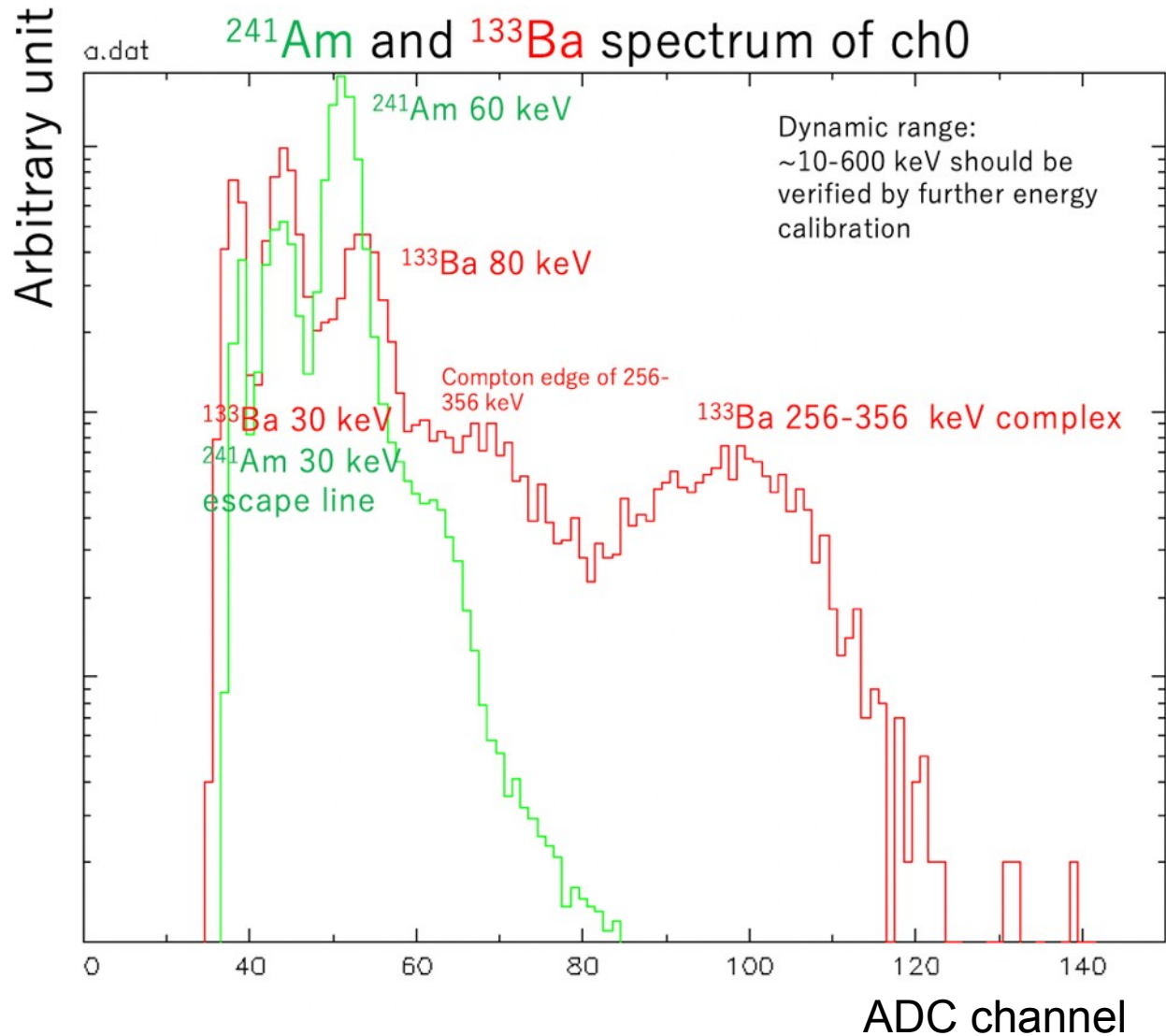
Integrated into the EM of the satellite

VZLUSAT-2: ENVIRONMENTAL TESTS IN CZECH AEROSPACE RESEARCH CENTRE (VZLU)



Vibration tests, shock tests, and thermo-vacuum tests

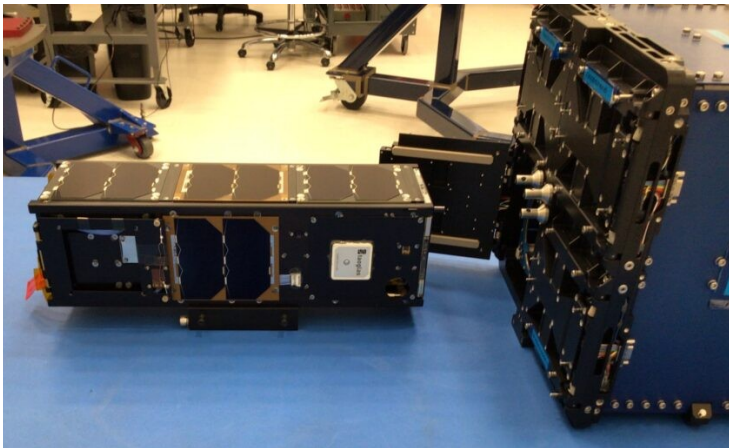
VZLUSAT-2: RADIOISOTOPE SPECTRA



- Test with radioisotope sources showed lines from ^{241}Am and ^{133}Ba

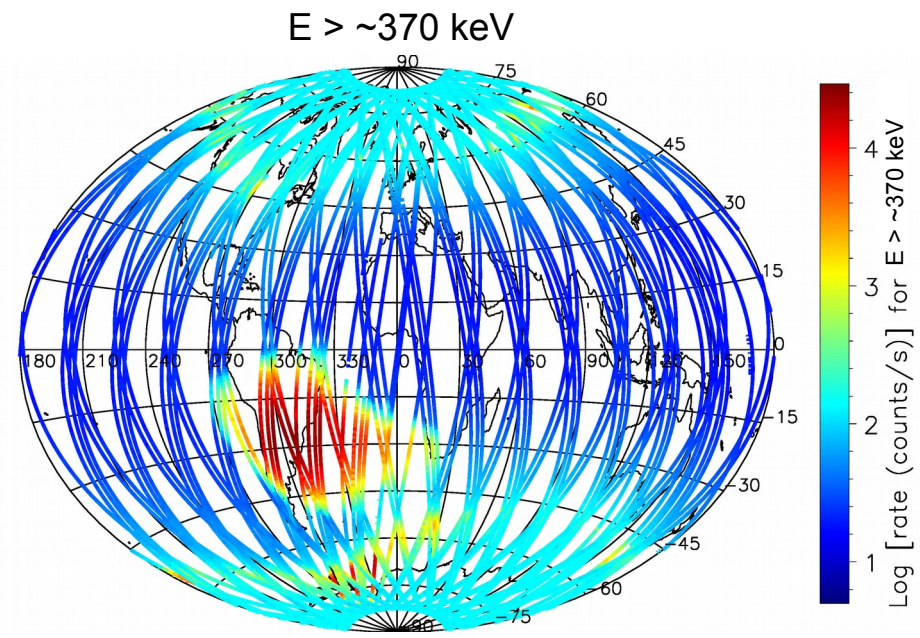
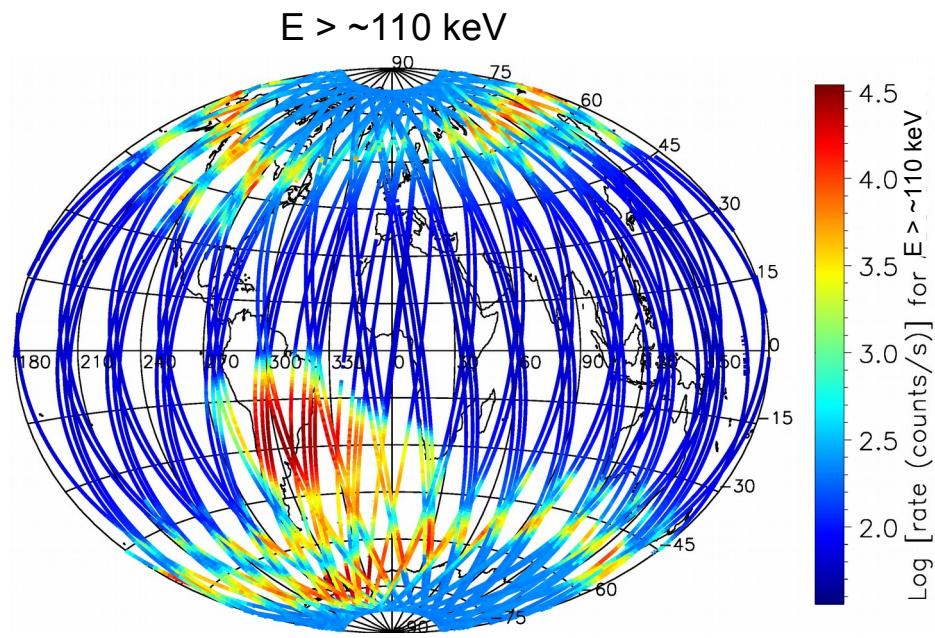
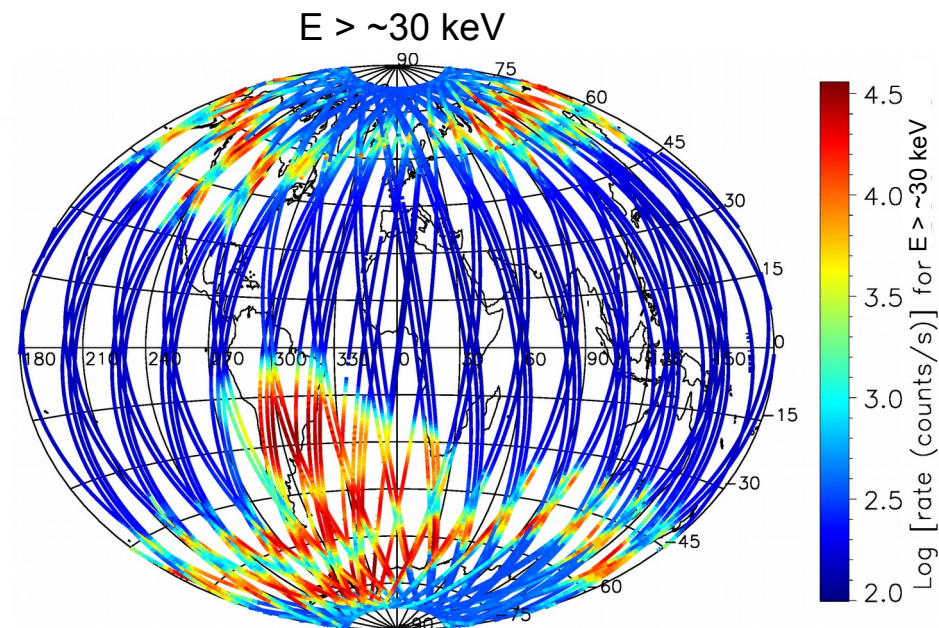
VZLUSAT-2: SATELLITE FINISHED AND LAUNCHED

- Satellite was assembled, went through environmental tests and was shipped to USA in Sep 2020
- It was launched to 550 km SSO by Falcon 9 is on Jan 13th 2022



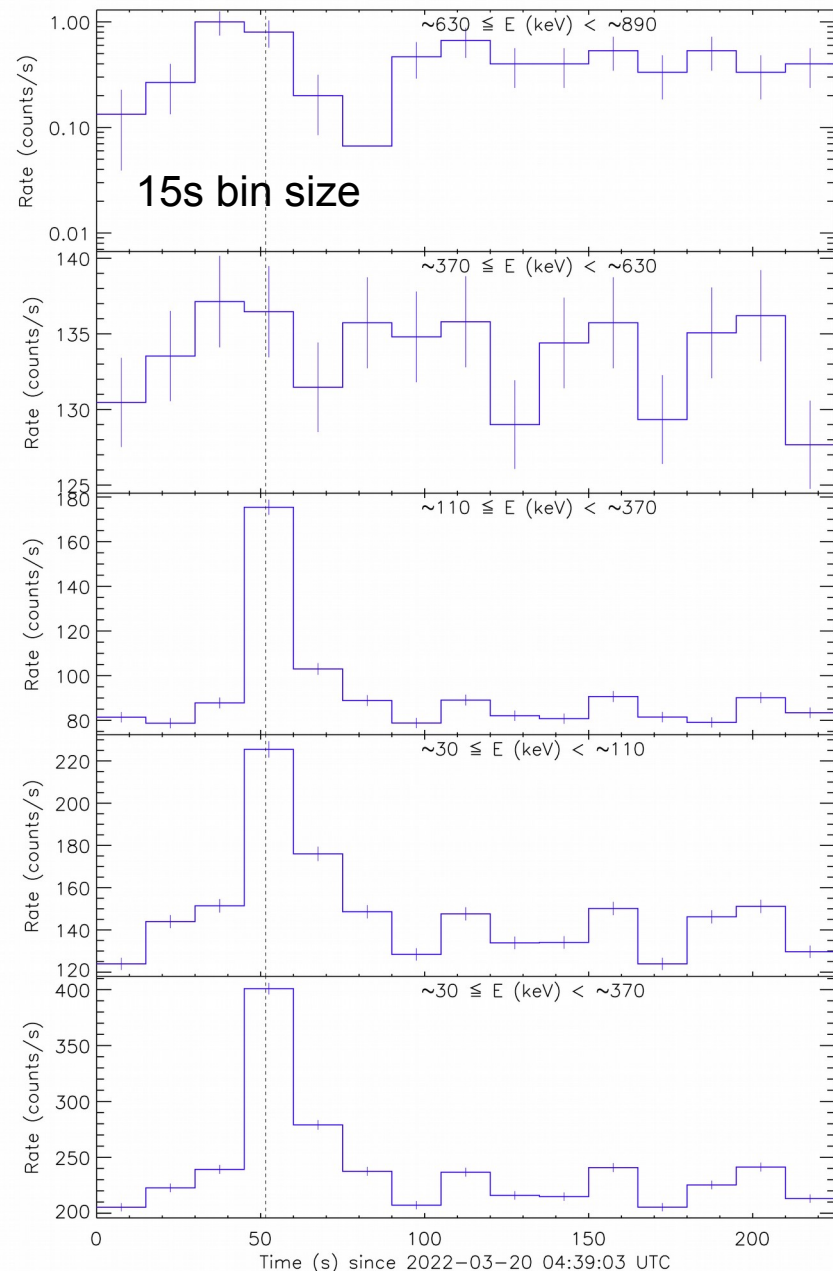
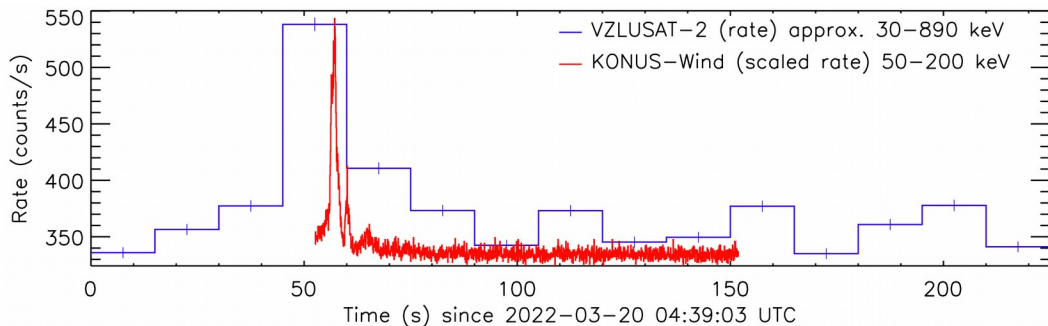
VZLUSAT-2: MEASURED BACKGROUND MAPS

- Commissioning of the satellite's systems and payloads just finished.
- These are background maps collected from detector unit 1 during commissioning of our payload.

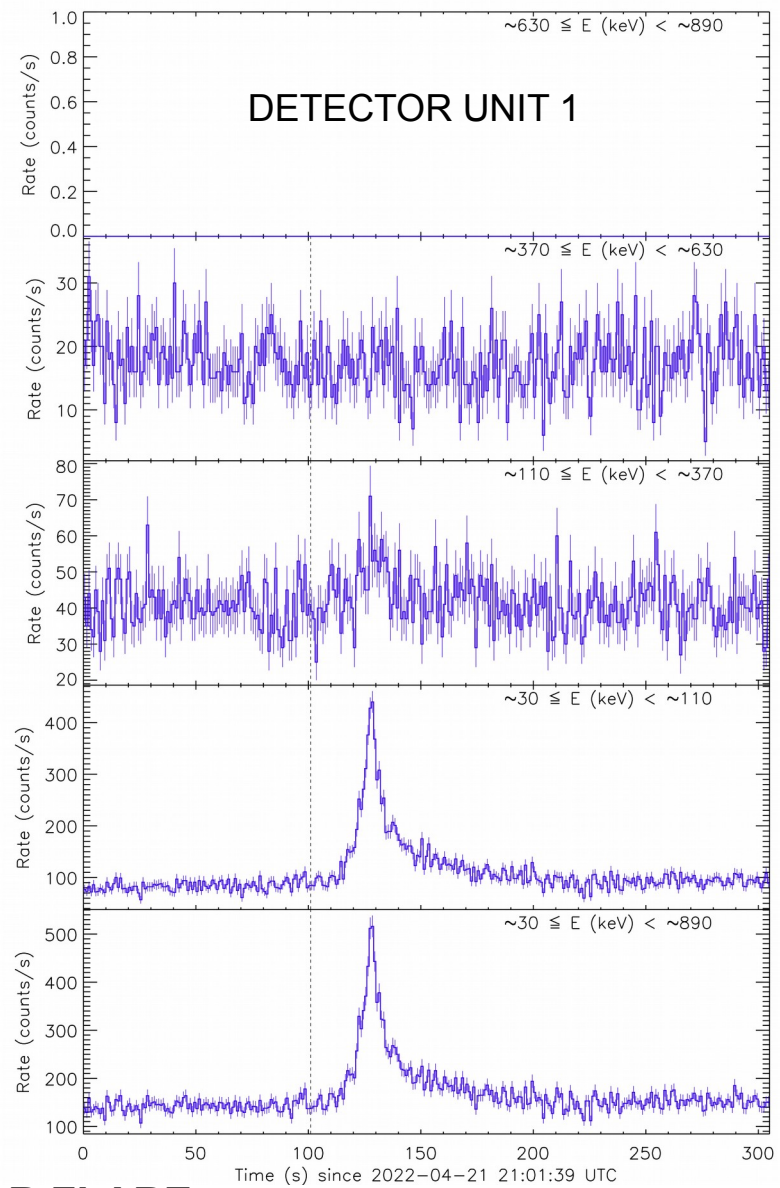
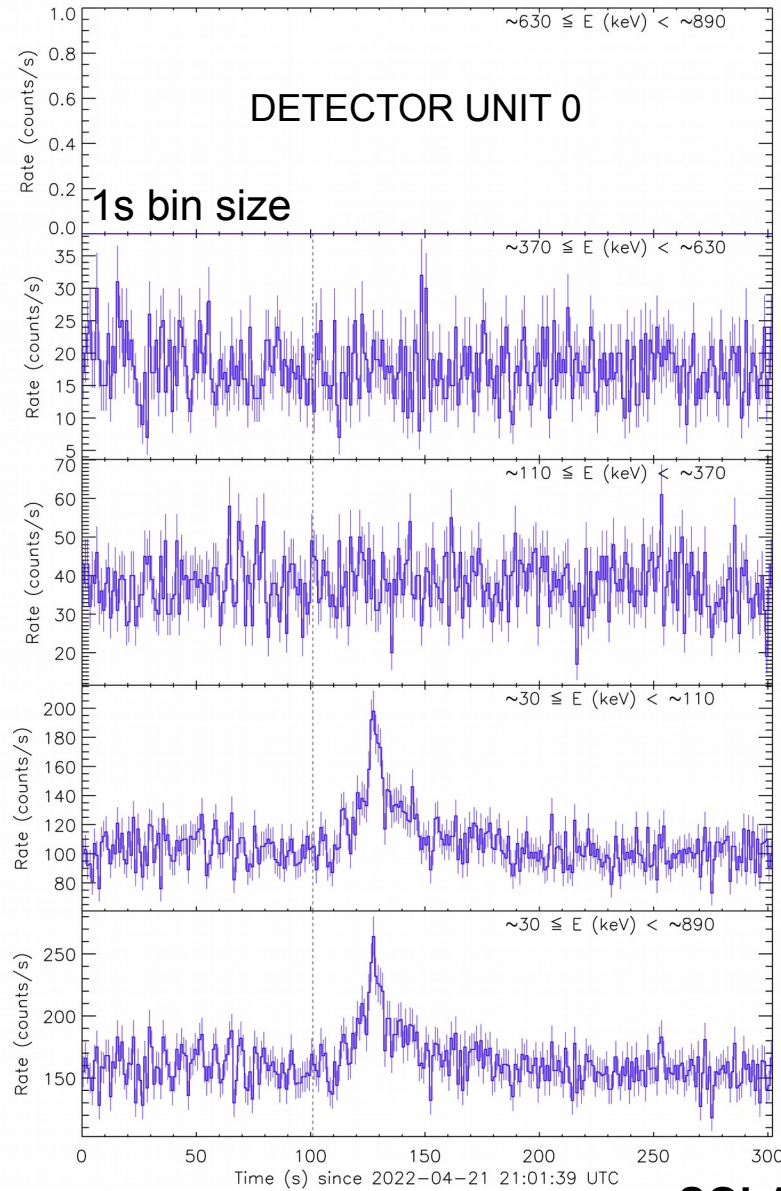


1ST GRB DETECTION BY VZLUSAT-2

- During the commissioning and background mapping we already caught one GRB which was observed also by several other missions: Fermi/GBM, INTEGRAL/SPI-ACS, Konus-Wind, AstroSat/CZTI ...
- The temporal resolution was set only to 15s (for background mapping)
- For nominal operation for GRB search resolution of 1s is used
- Announced in NASA's circular GCN 31803



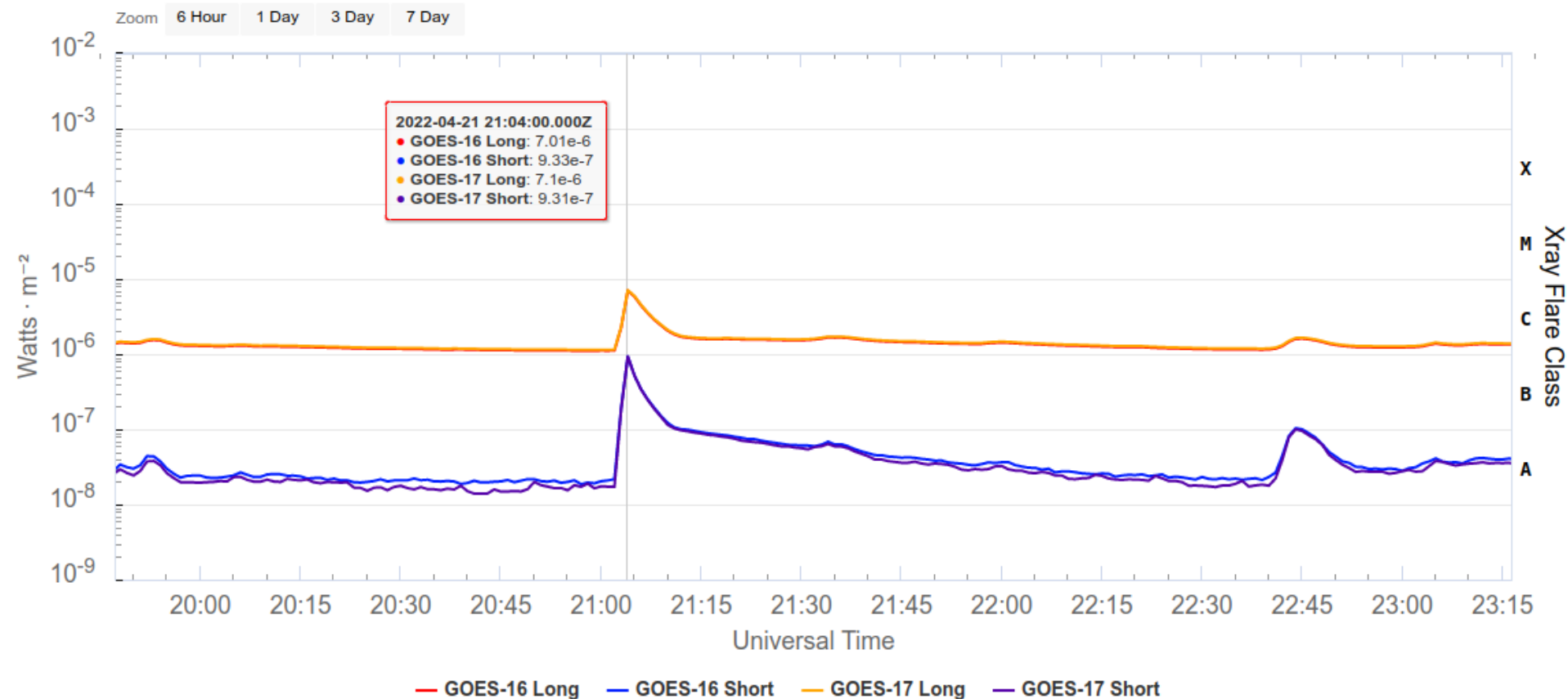
SOLAR FLARE DETECTION BY VZLUSAT-2 AT 2022-04-21 21:03:47 UTC



SOLAR FLARE
GCN 31937, GCN 31949

SOLAR FLARE DETECTION BY VZLUSAT-2

GOES X-Ray Flux (1-minute data)

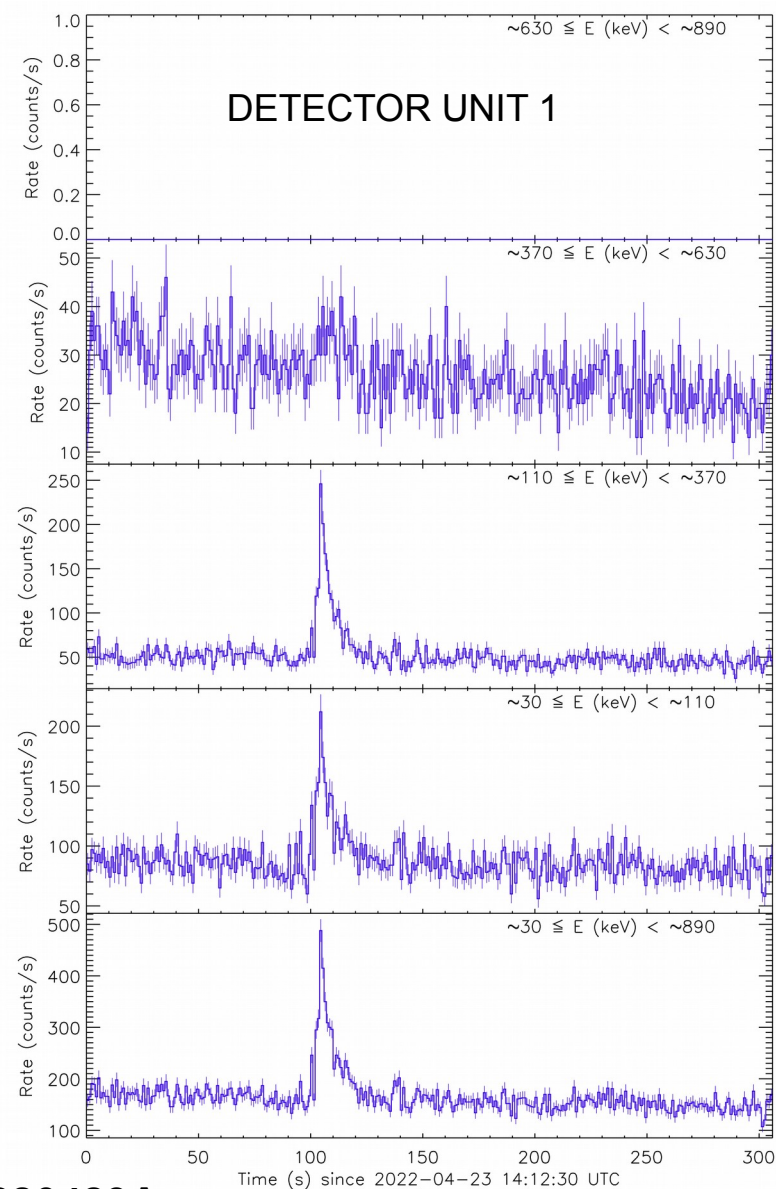
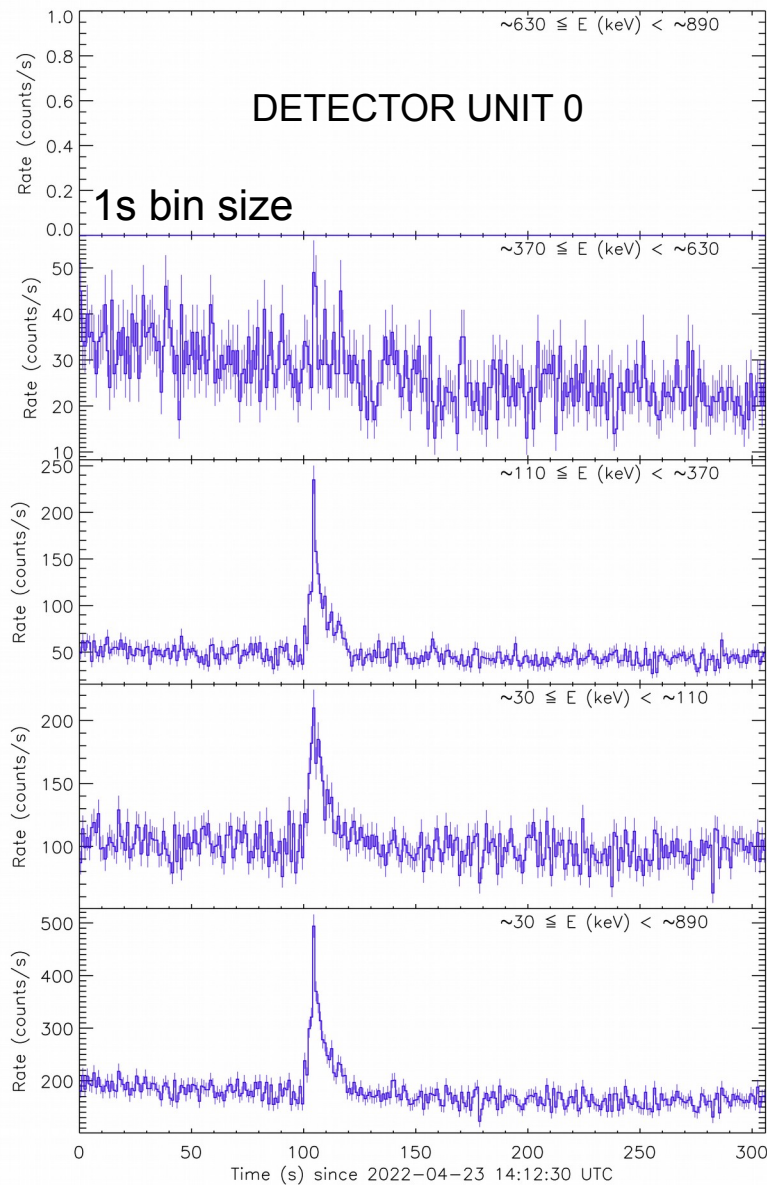


Updated 2022-04-24 00:54 UTC

Space Weather Prediction Center

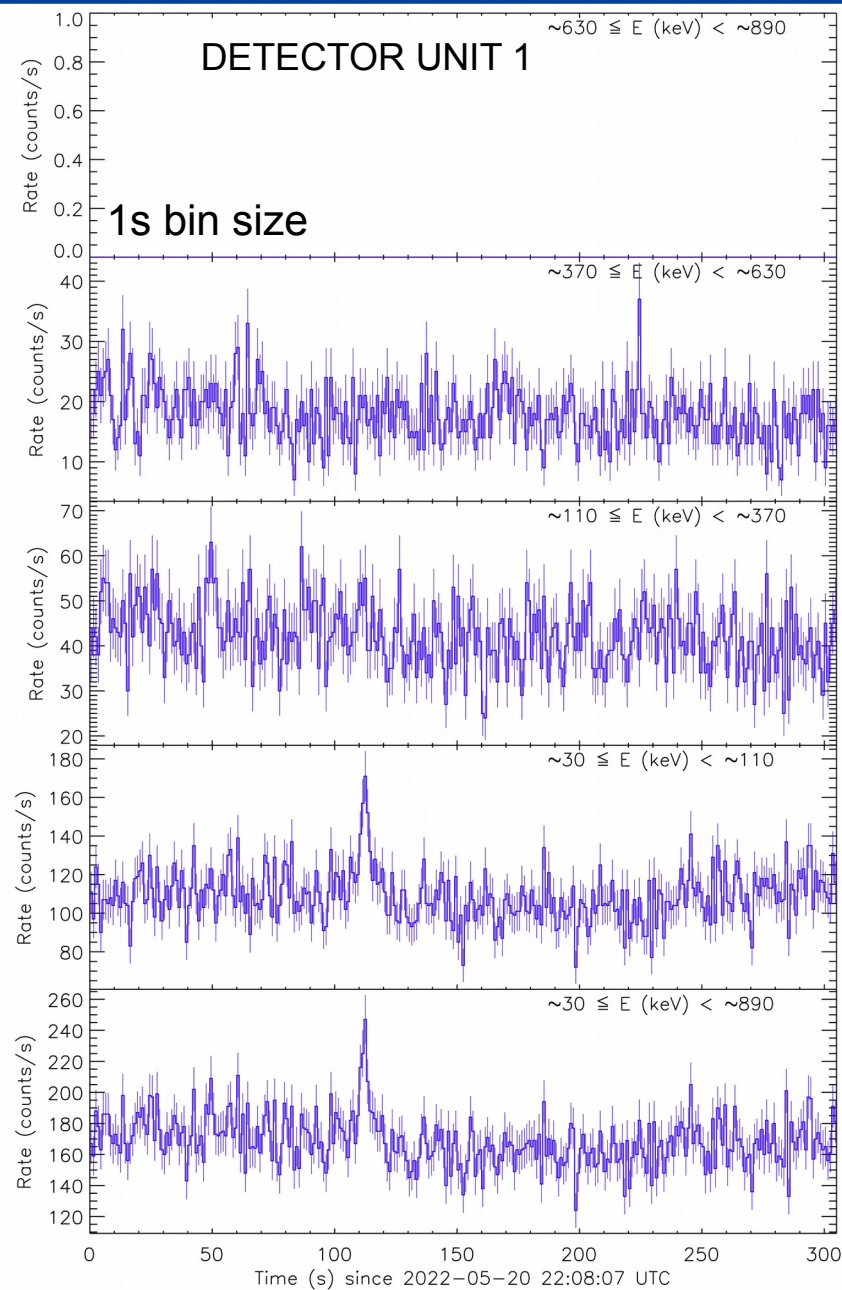
SOLAR FLARE
GCN 31937, GCN 31949

2ND GRB DETECTION BY VZLUSAT-2



GRB 220423A
GCN 31965

ANOTHER SOLAR FLARE DETECTION BY VZLUSAT-2 AT 2022-05-20 22:10 UTC



SUMMARY

- VZLUSAT-2 finished commissioning after the launch
- Monitors background
- Detected its 2 GRBs and 2 solar flares so far

THANK YOU