The Gamma-ray Transients Monitor (GTM) on board FS-8B

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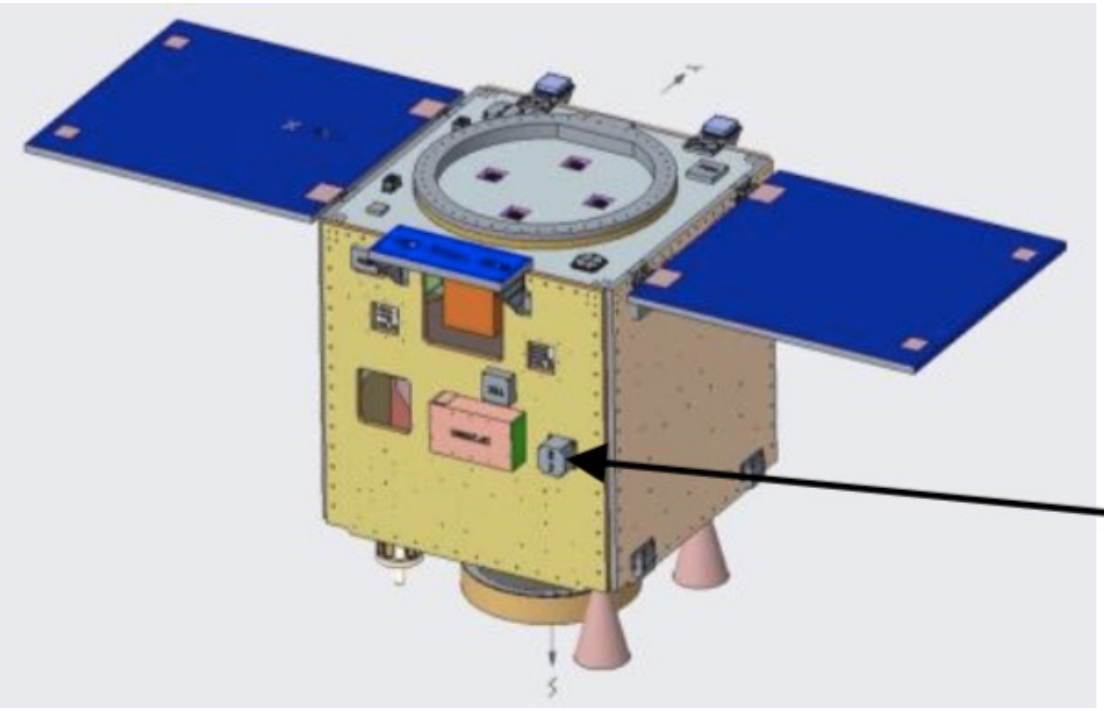
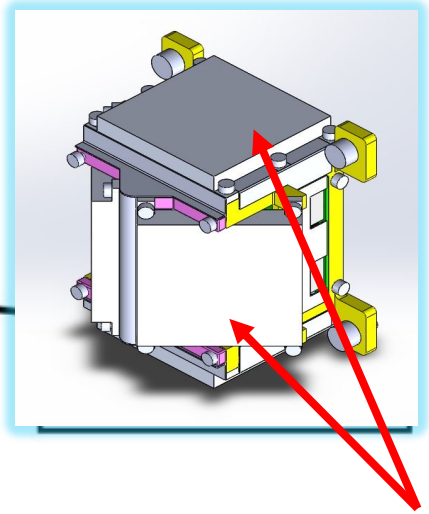
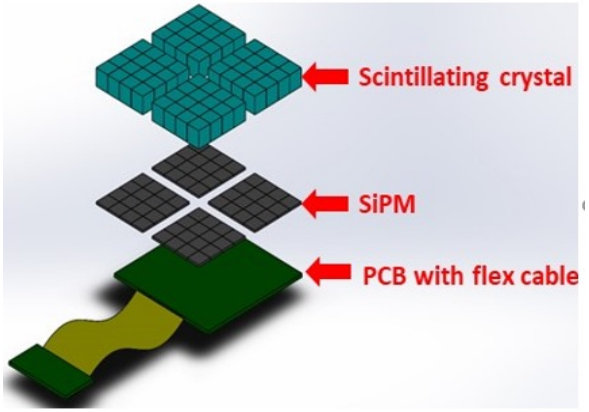
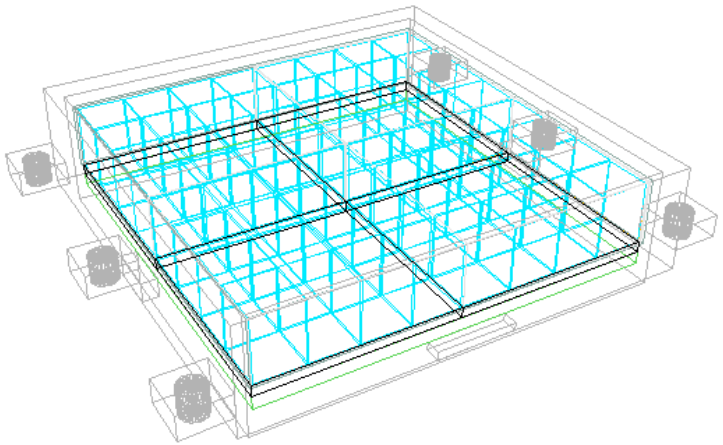
GTM on board Formosat-8B

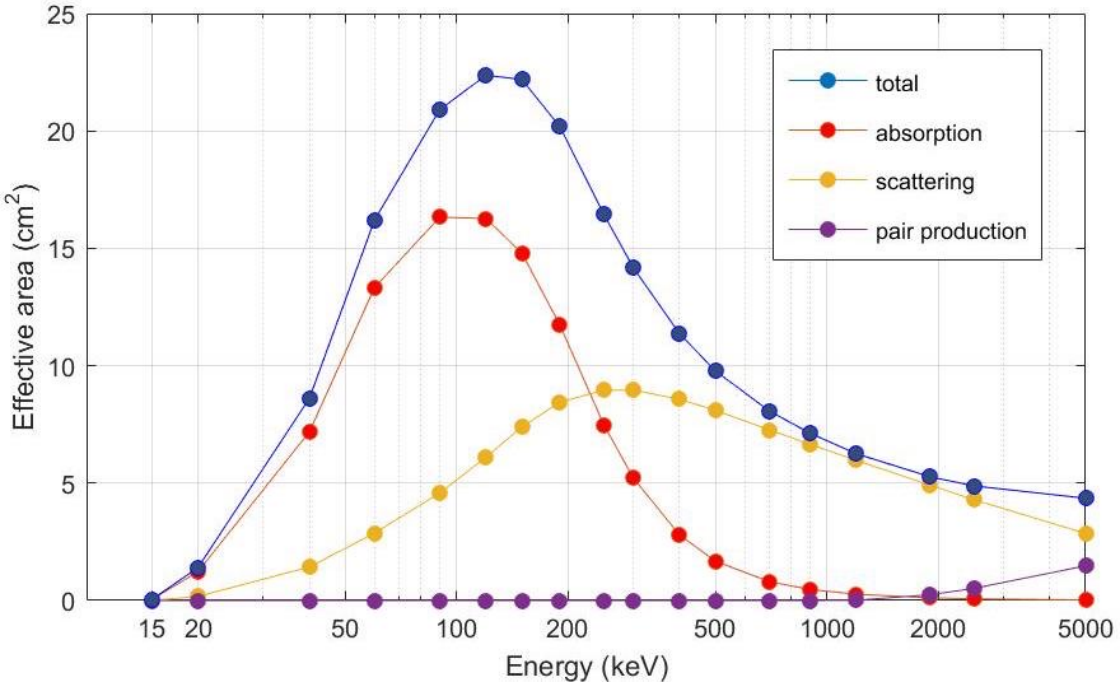




GTM consists of two identical modules located on two opposite sides of FS-8B. Each module has four sensor units facing different directions to cover the whole sky. Each sensor unit is composed of a GAGG (Gadolinium Aluminum Gallium Garnet) scintillator array (51 mm x 51 mm x 8 mm) and SiPM of corresponding pixel size for readout.

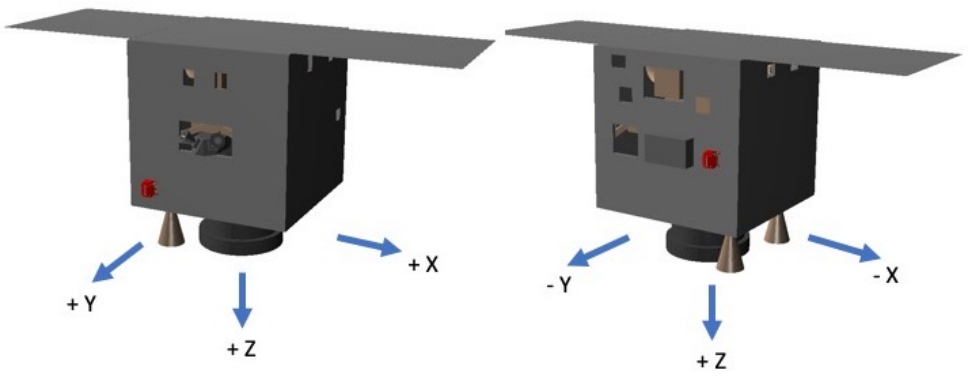






The effective area of one GTM GAGG (Gadolinium Aluminum Gallium Garnet) sensor unit.

FS-8B/GTM, Source and Background Models



MEGAlib (Zoglauer et al. 2008)

Background:

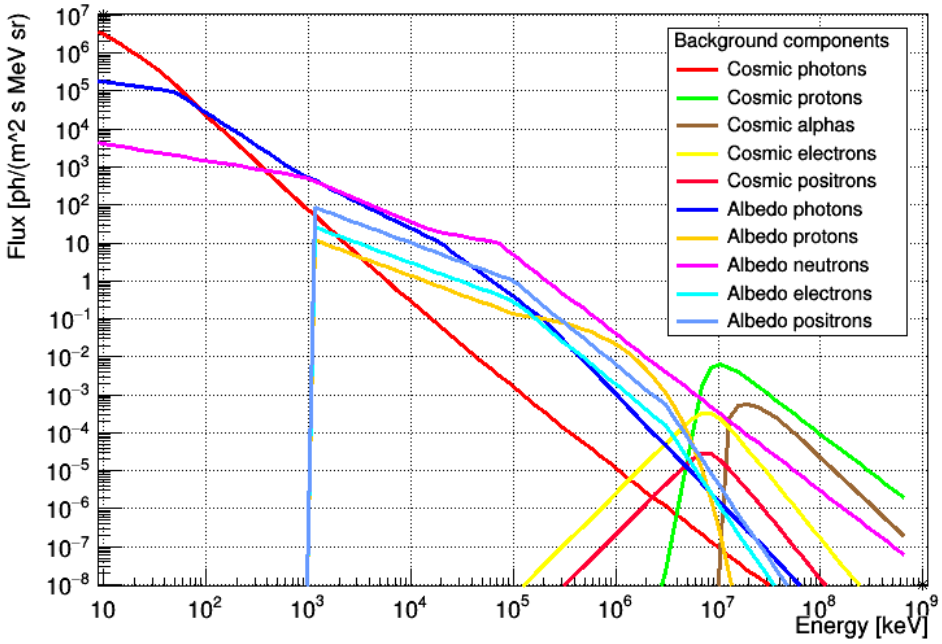
A polar (97°), low-altitude (560 km) Earth orbit; embedded in MEGAlib.

Source spectral model:

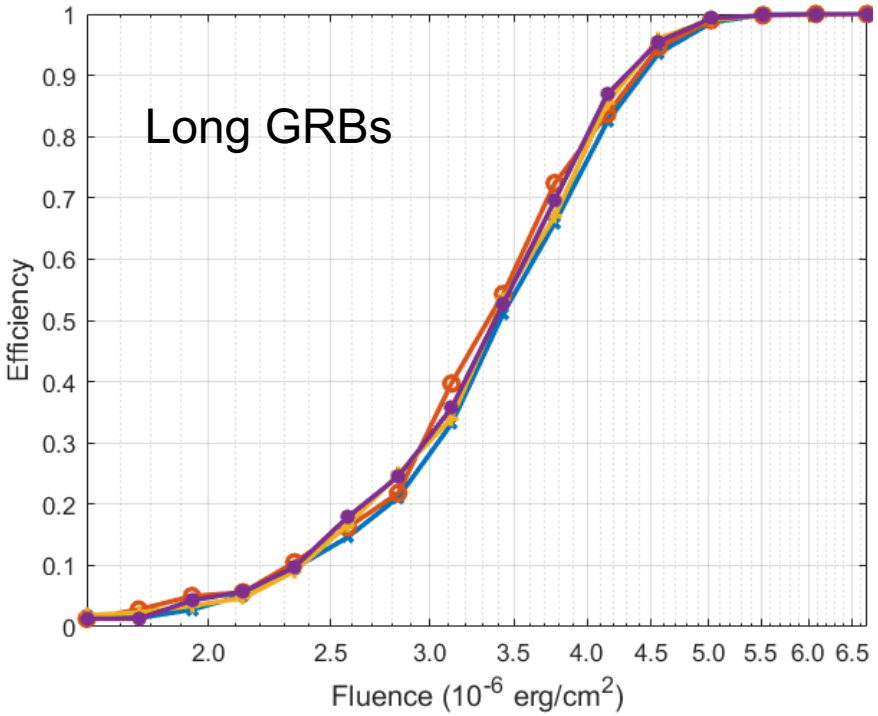
$$N_E \propto E^{\alpha}\, e^{(-E(2+\alpha)/Ep)}$$

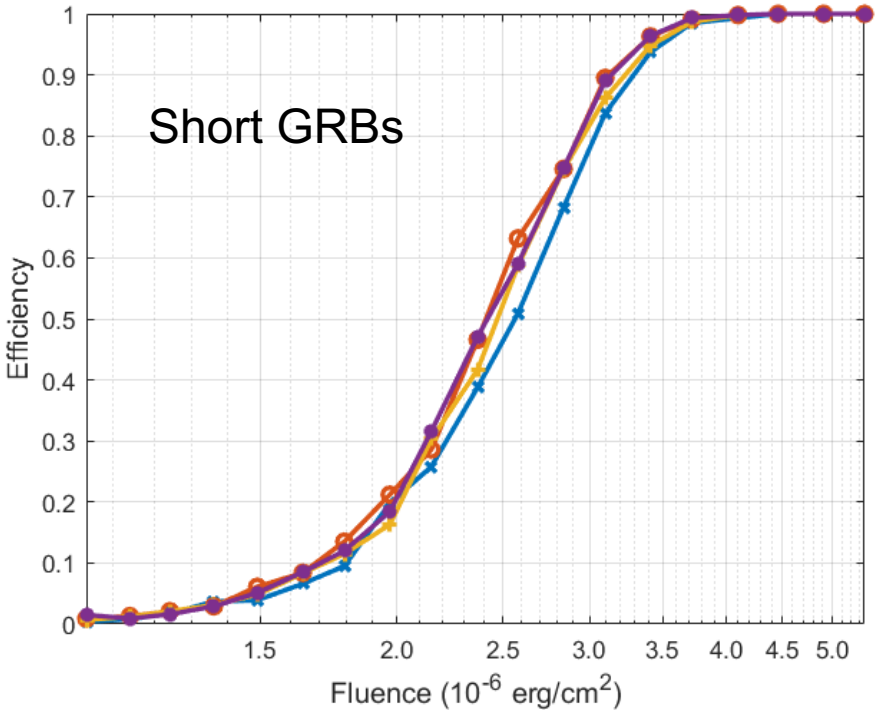
Long GRBs:
α = −1, E_p = 300keV, duration 10 sec
Short GRBs:
α = −0.5, E_p = 500keV, duration 0.5 sec

These numbers are the median of t_{50} and corresponding spectral parameters of Konus-WIND-detected GRBs (Svinkin et al., 2016; Tsvetkova et al., 2017).

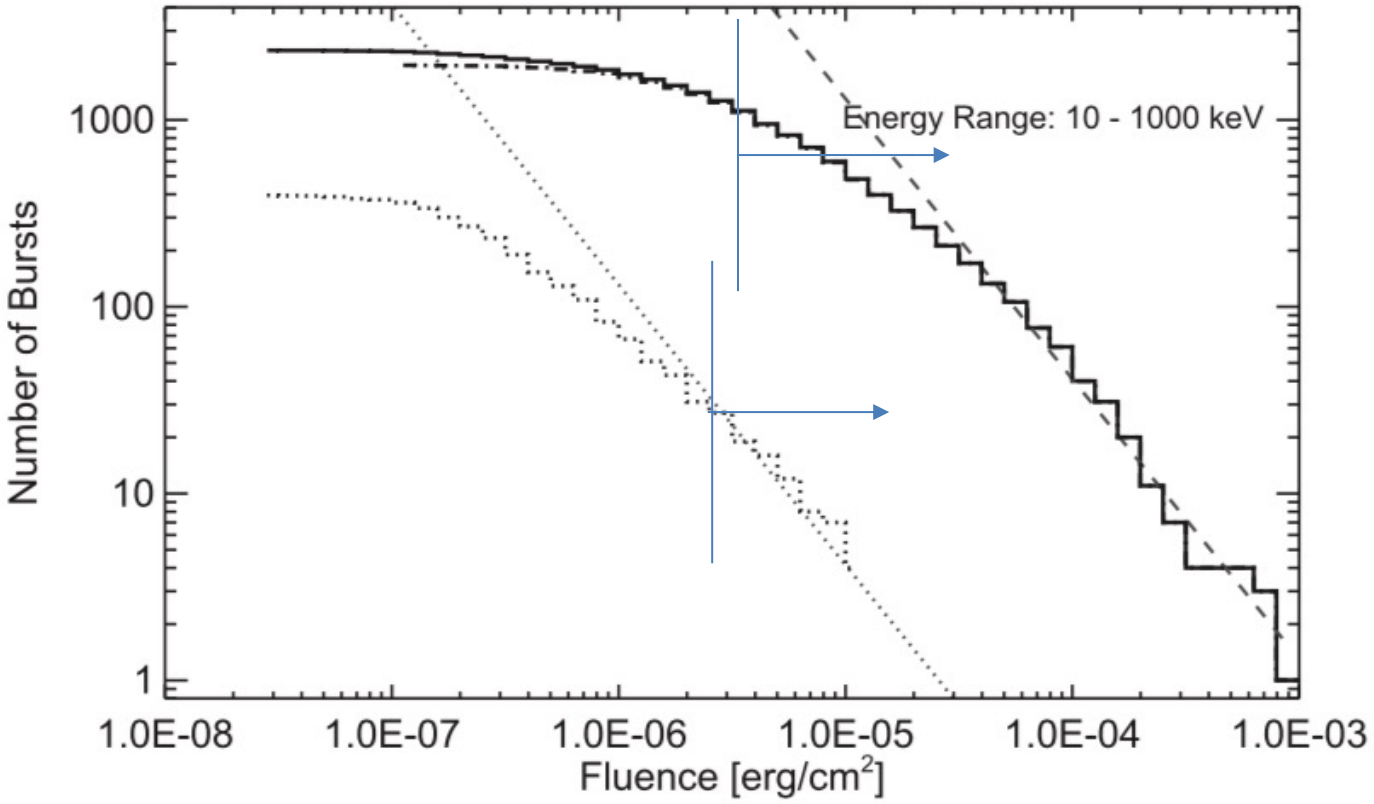


GTM's GRB detection efficiency





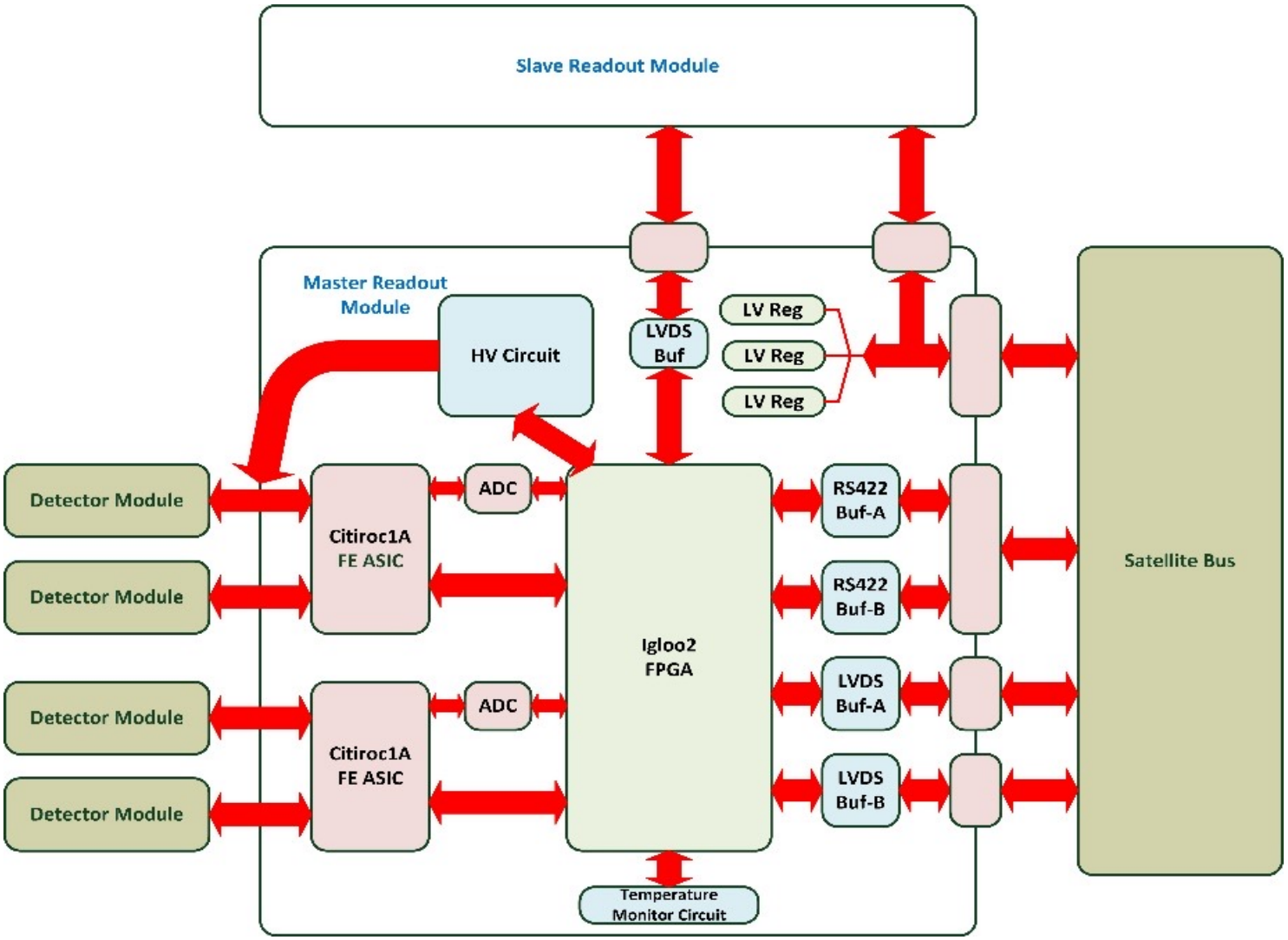
(Chang et al. 2022, AdSR 69, 1249)



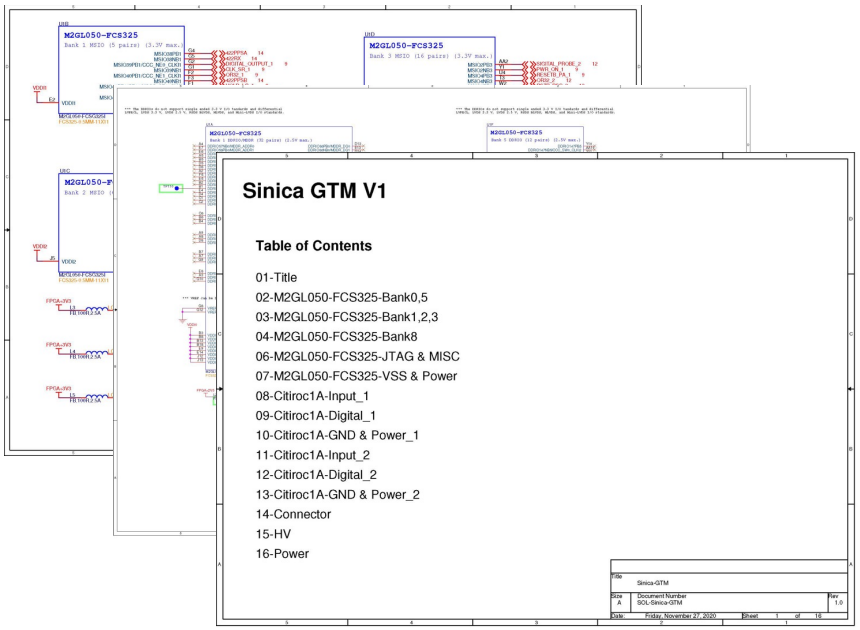
Fermi/GBM 10-year GRB fluence distribution (von Kienlin et al. 2020)

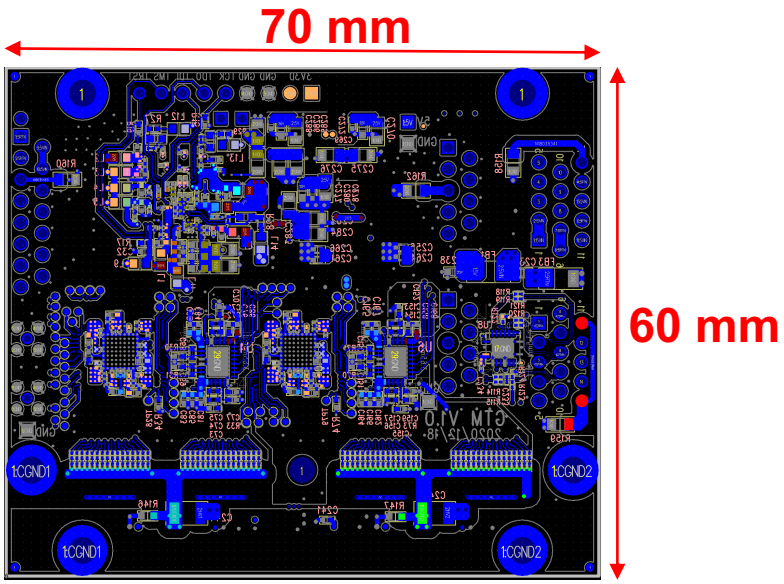
Assuming a 36% duty cycle,
FS8B/GTM will detect about 40 GRBs per year.

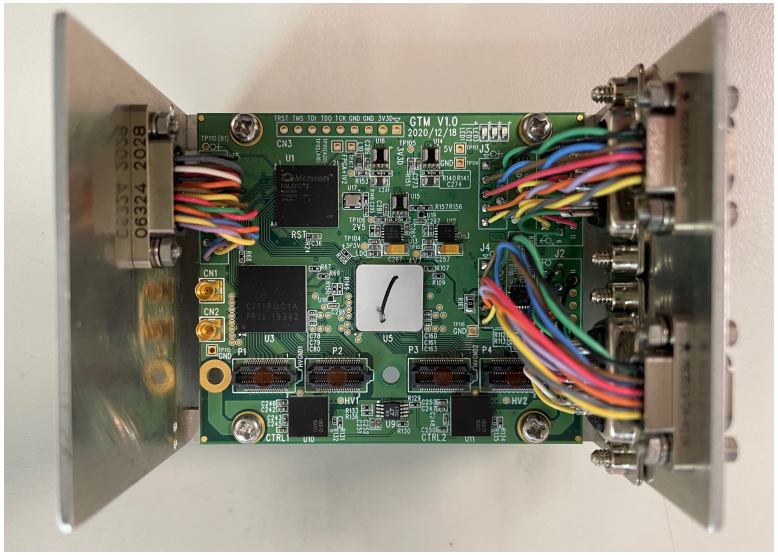
Readout system

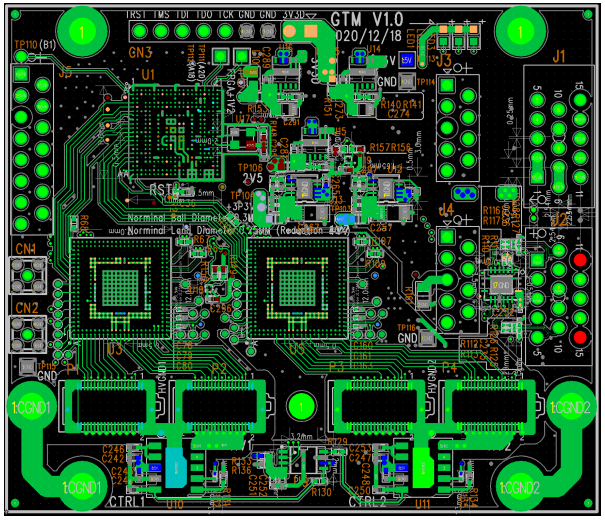


Readout system

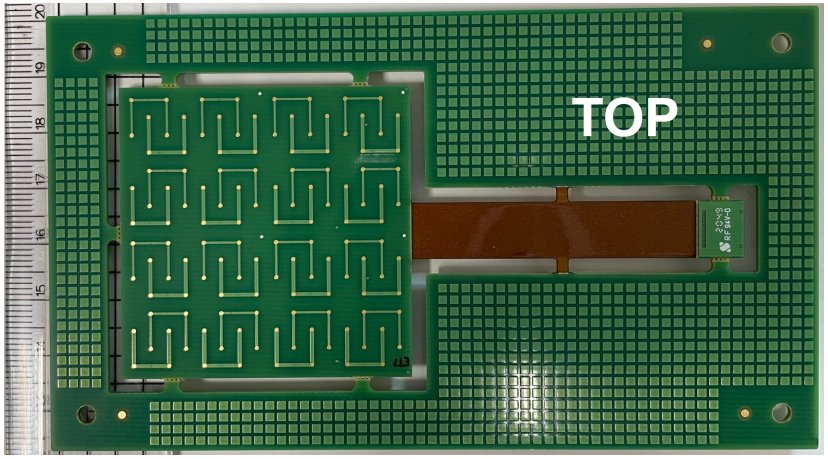


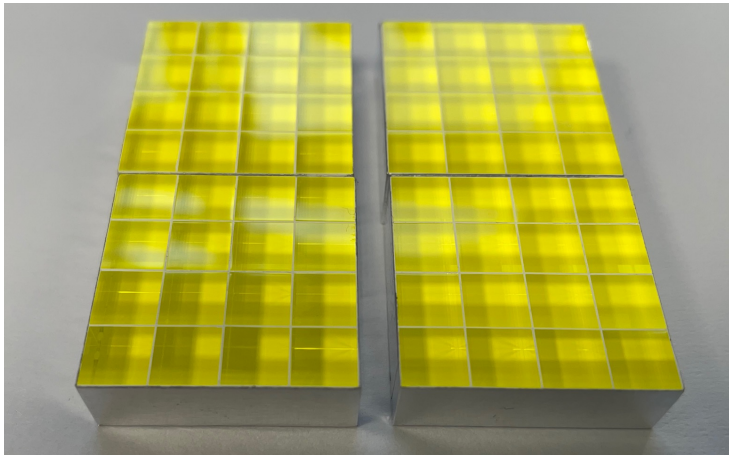


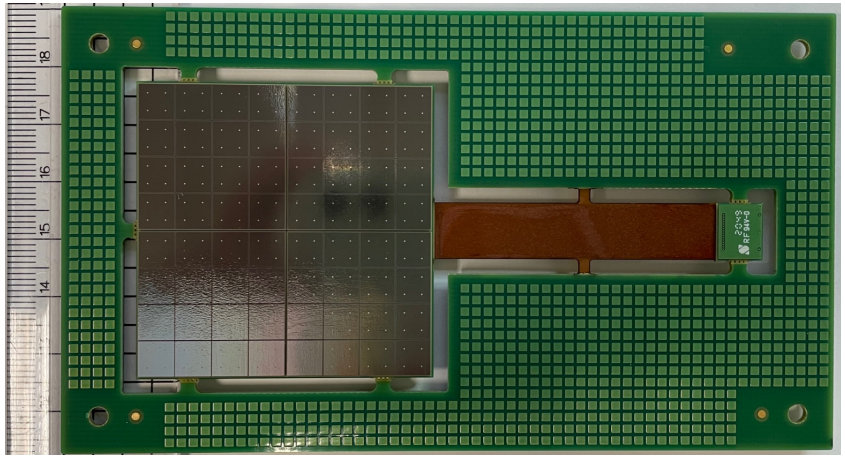


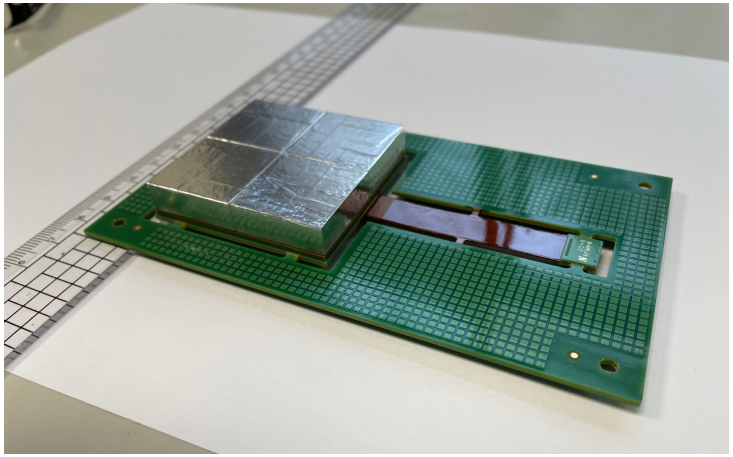


Sensor module

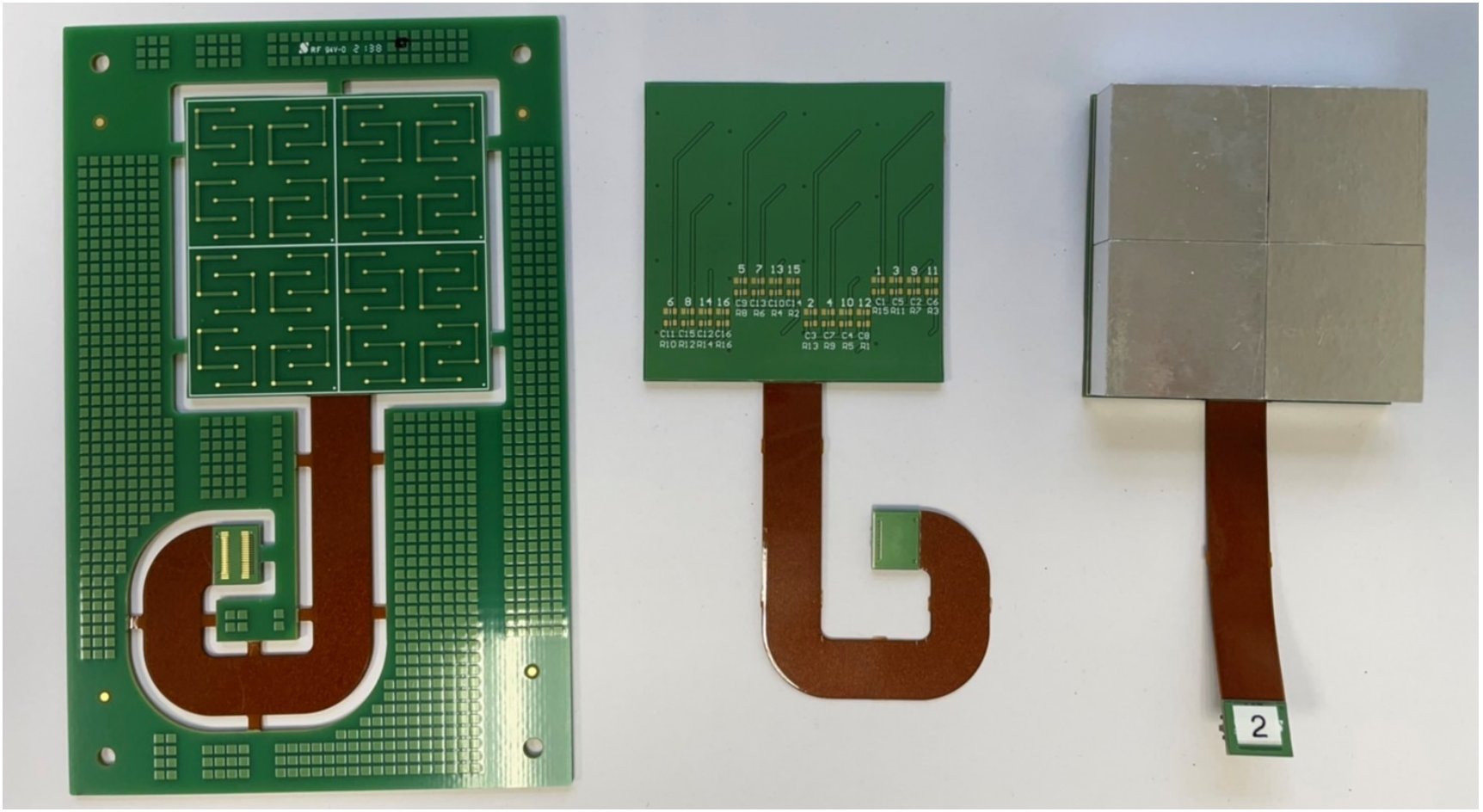




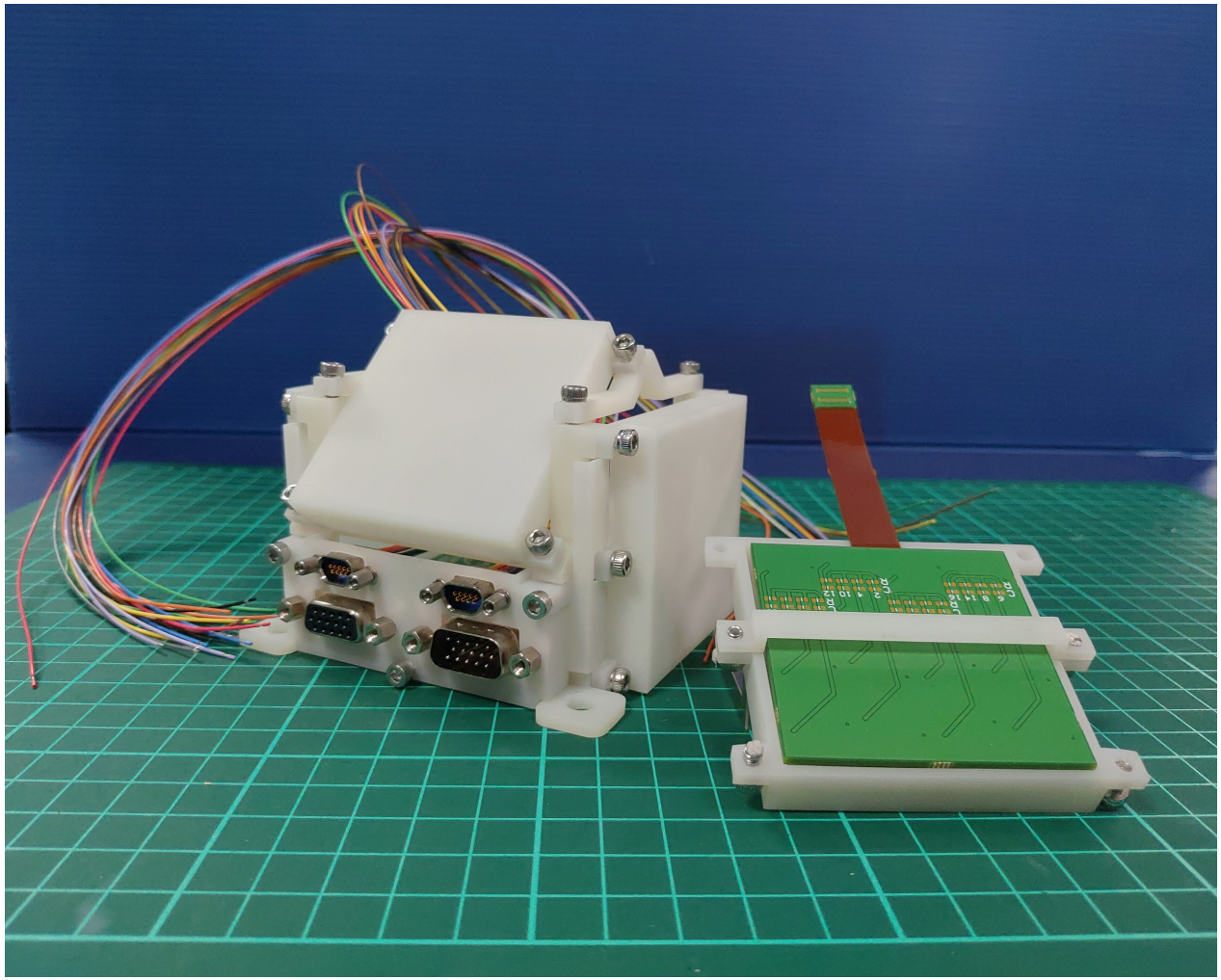




Sensor Module Assembly (QM)

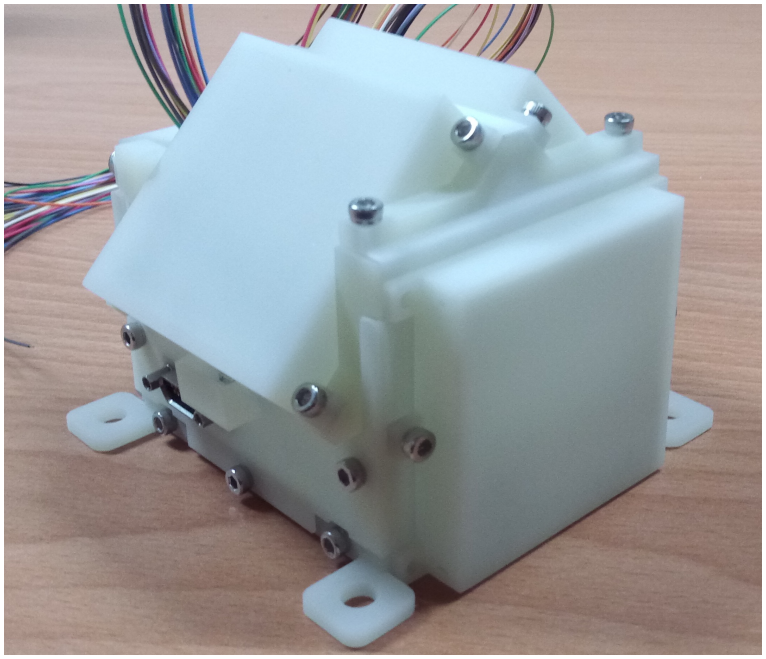


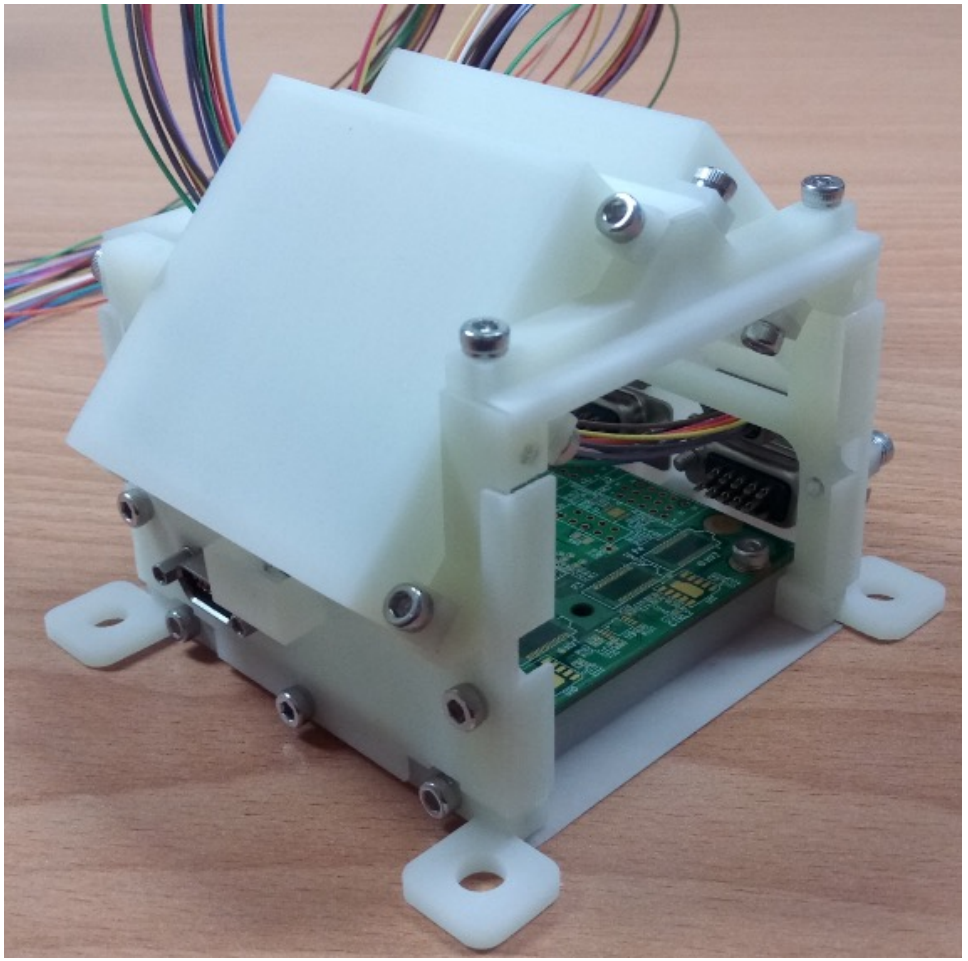
Mechanical structure



GTM mechanical structure, a 3D-printed model

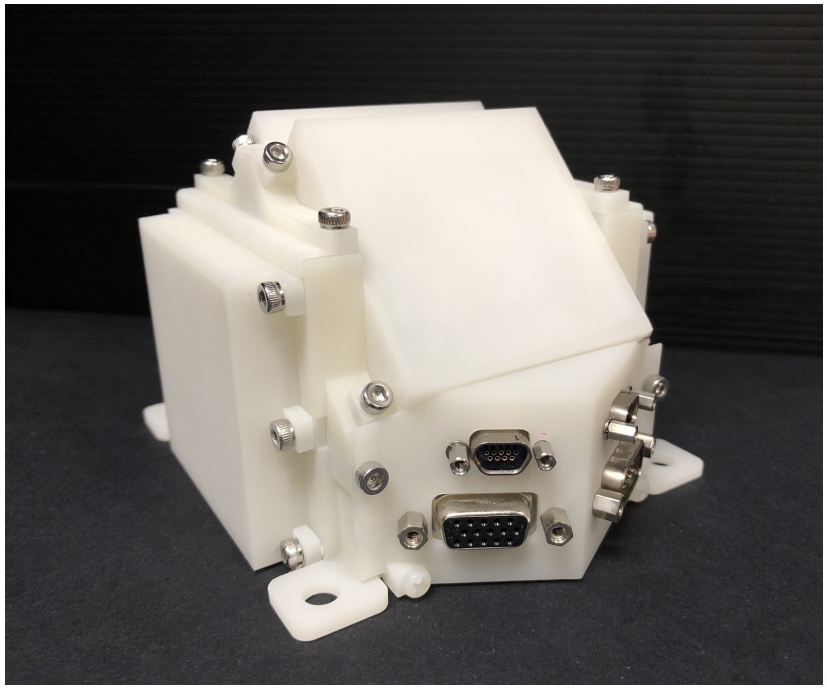
Mechanical structure

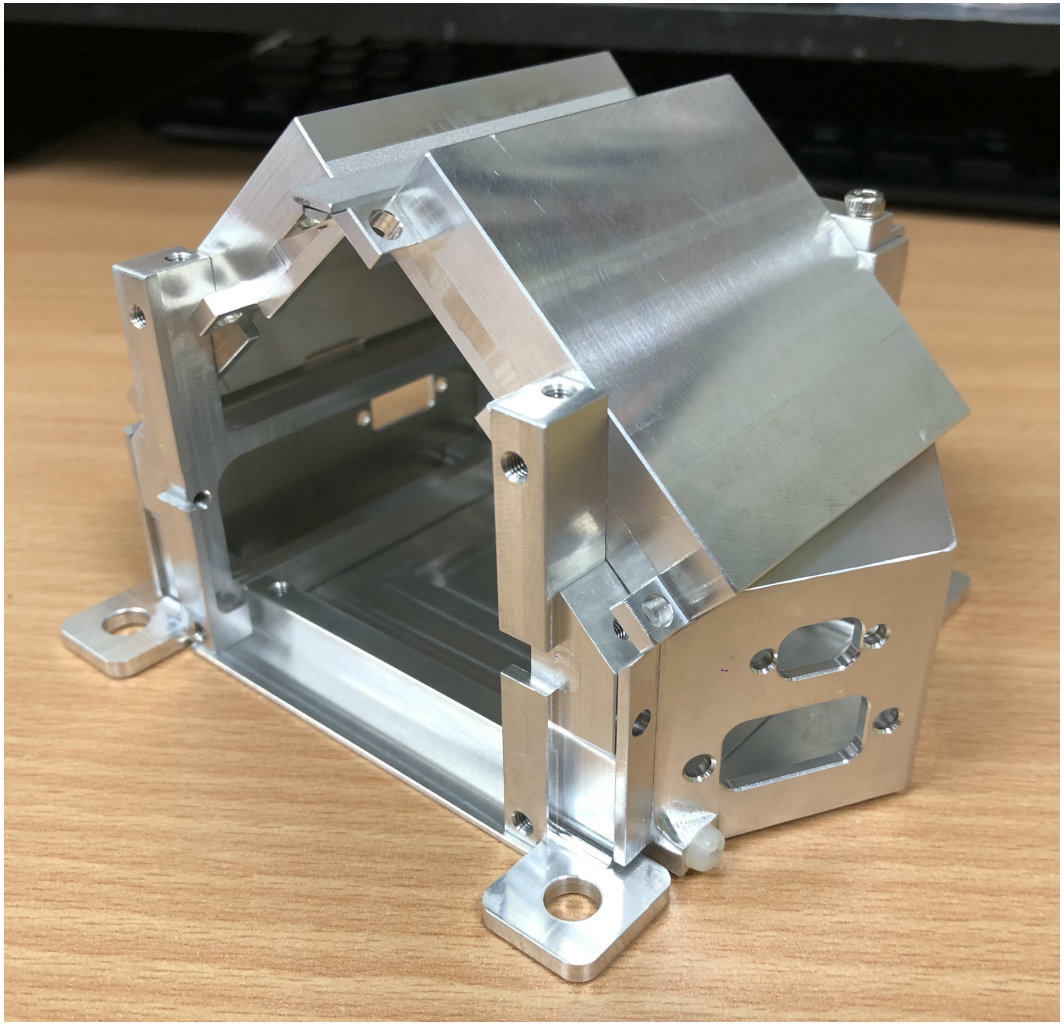




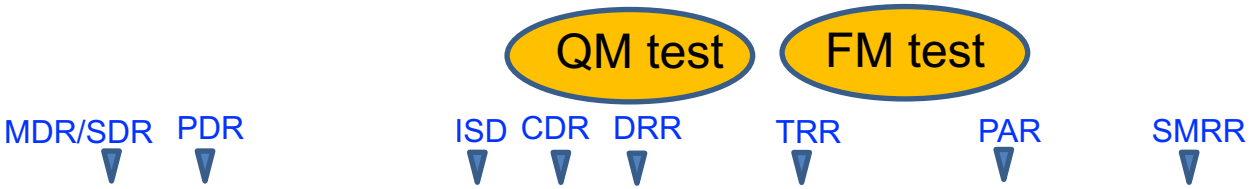
Mechanical structure 3D print

Revised mechanical Structure (EM)





GTM schedule



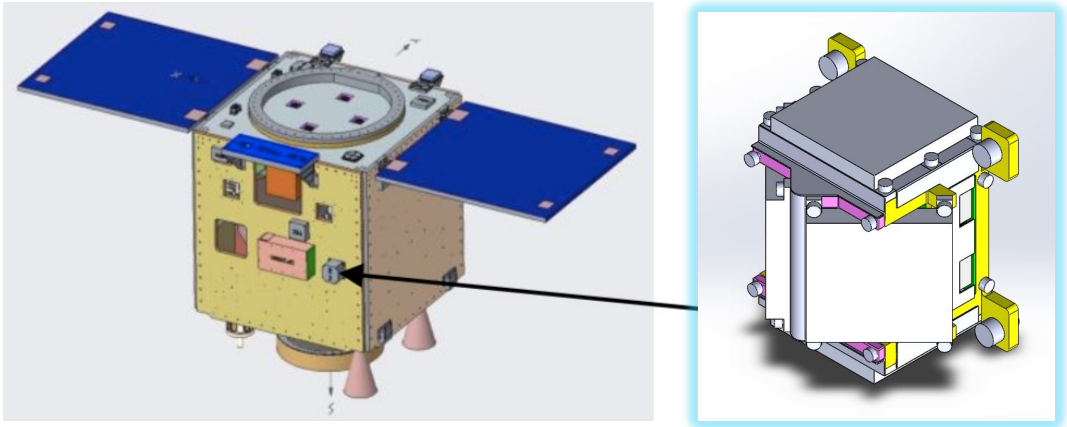
Task Name	2020				2021				2022				2023			
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
Readout Electronics – EM																
Readout Electronics - QM																
Readout Electronics FM																
ISD Delivery																
Mechanical Design - EM																
Mechanical Design - QM																
Mechanical Design - FM																
Science Data Center (SDC)																

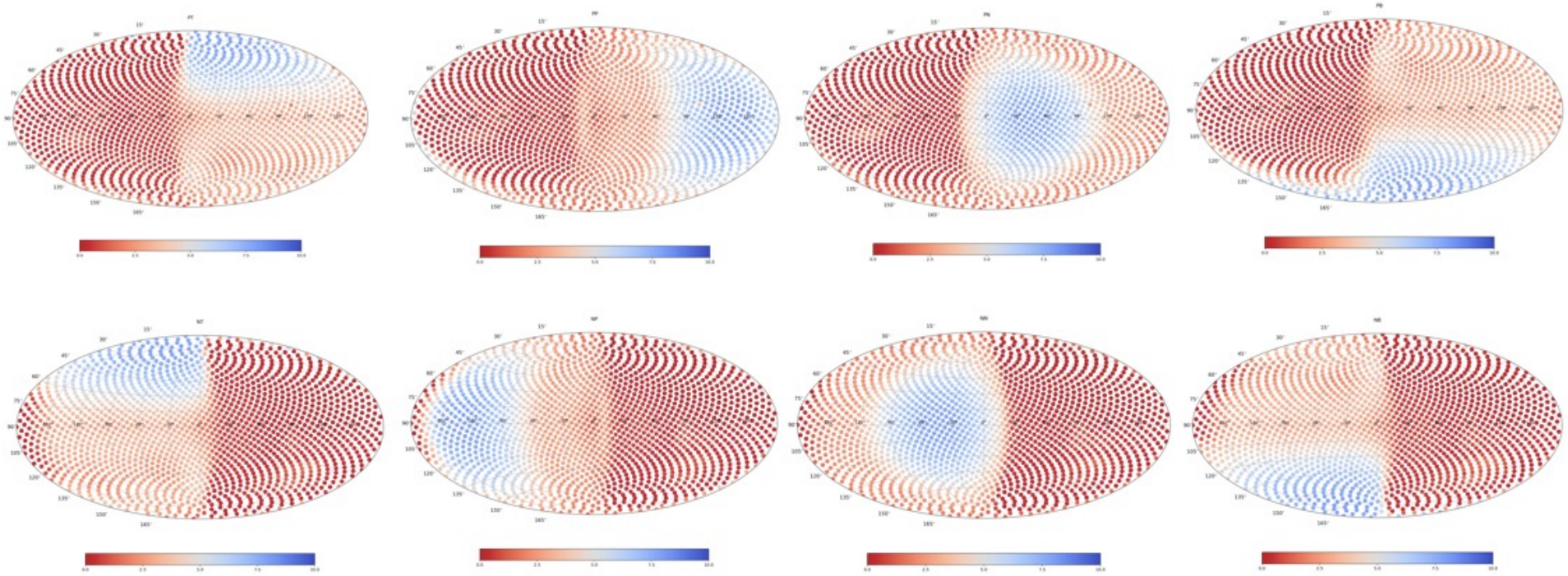
now

FM delivery in May 2023, launch in 2025

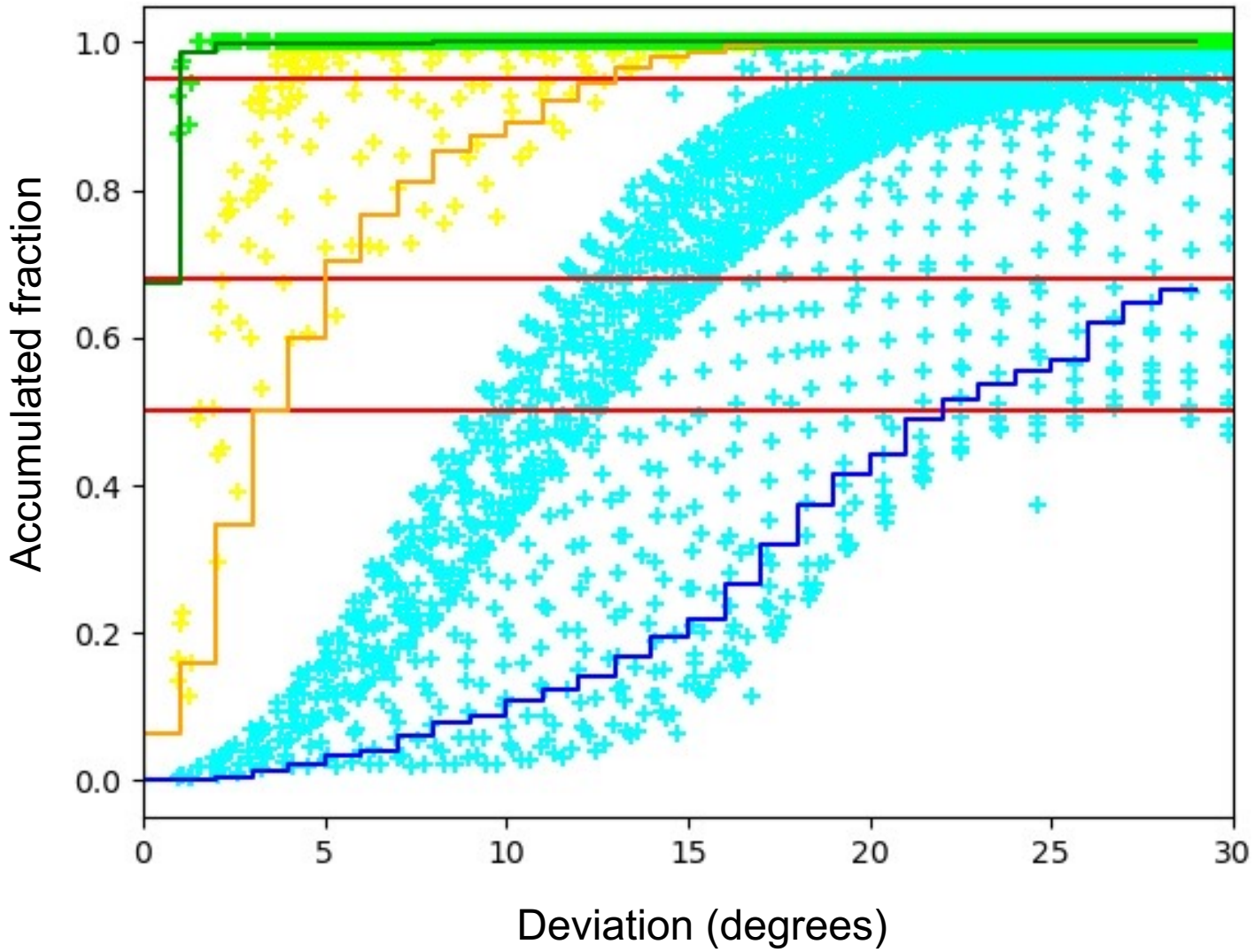
Detector response (50-300 keV) of the 8 sensors in different directions in the sky

($\alpha = -1$, $E_p = 300$keV)





GTM ‘quick’ localization accuracy



(GRB: $N_E \propto E^{\alpha}\, e^{(-E(2+\alpha)/Ep)}$, $\alpha = -1$, E_p = 300 keV, duration 10 sec)

(Fluence = 4×10^{-4}, 4×10^{-5}, 4×10^{-6} erg/cm^2 in 10-1000 keV)

$(\theta, \phi) = (57^o, 46^o)$