

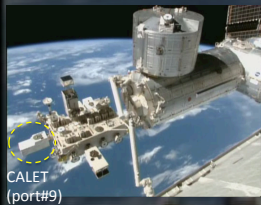
The First Year Observation of CALET Gamma-ray Burst Monitor (CGBM観測の現状)



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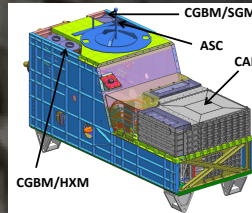
The Calorimetric Electron Telescope (CALET) was successfully launched and attached to the International Space Station (ISS) at the end of August 2015. After the initial checkout, the scientific operation began in October 2015. Currently observations by the main instrument CALorimeter (CAL) covers 99% of the ISS orbit time with sensitivity to gamma-rays above 1 GeV or 8 GeV depending on operational mode; mostly 1 GeV during the time when the CALET Gamma-ray Burst Monitor (CGBM) is available, while CGBM covers about 50% of the orbit with roughly from 10 keV to 20 MeV. We will present the operational status of the CGBM and scientific results during the first year of its successful operation.

CALET (CALorimetric Electron Telescope)



Observatory of high energy electrons and gamma-rays

- Observations of high energy cosmic-rays
- All sky gamma-ray survey (> 10 GeV)
- High energy transients (GRBs, SGRs, ..)



Scientific instruments:

CALorimeter (CAL)

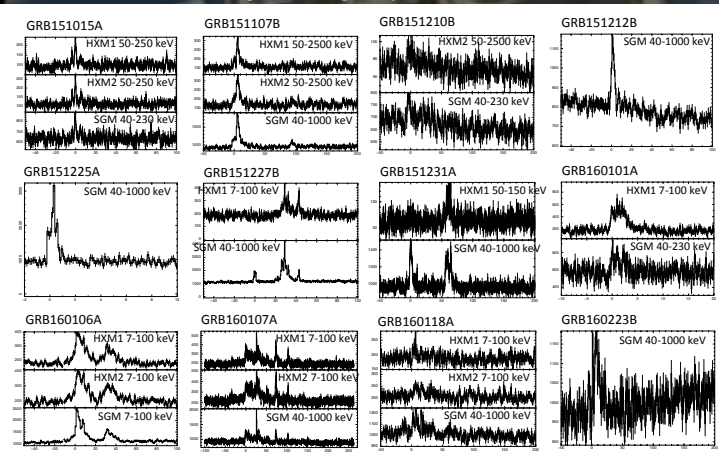
- Electrons: 1 GeV – 20 TeV
- Gamma-rays : 10 GeV – 10 TeV
- Protons and heavy ions: ~10 GeV – 1 PeV

CALET Gamma-ray Burst Monitor (CGBM)

- Hard X-ray Monitor (HXM):
LaBr₃(Ce)+PMT 7 keV – 1 MeV
- Soft Gamma-ray Monitor (SGM):
BGO+PMT 100 keV – 20 MeV

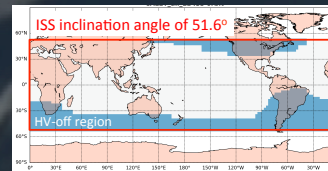
Gamma-ray Bursts

CGBM detected GRB light curve gallery



CGBM In-orbit Operation

HV-on time



We turn off high voltages of CGBM at the high latitude area and SAA to protect PMTs and to reduce a false on-board trigger. The observation efficiency of CGBM is **about 60 %** (HV-on time).

On-board Trigger

CGBM has the on-board trigger system which calculates a signal to noise ratio of the light curve every 1/4s (using one side background).

Post trigger automatic responses:

- Event data capture
- Decrease the gamma-ray energy threshold of CAL from 10 GeV to 1 GeV.
- Capture two optical images by ASC (FOV: 18.4° x 13.4°)
- Send alert to the GCN notice

CGBM GRB Statistics

- 52 GRBs (including 4 possible GRBs)
- ~48 GRBs/yr
- 41 long GRBs (87%), 6 short GRBs (13%)
- 4 GRBs are simultaneously observed with MAXI
- 3 known redshift GRBs (160509A: $z=1.17$, 160623A: $z=0.367$, 160625B: $z=1.406$)

CGBM Flight Lightcurve (GCN Notice)

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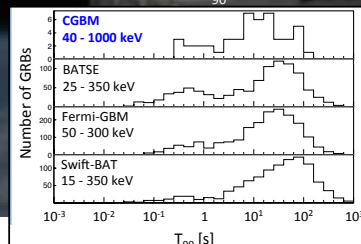
FILE: GCN/CALET NOTICE
NOTICE_DATE: Tue 04 Oct 16 23:08:14 UT
NOTICE_TYPE: CALET GBM Flight Lightcurve
POINT_RA: 28.84d (+01h 55m 23s) (J2000),
POINT_DEC: +24.64d (+24d 38' 06") (J2000),
TRIGGER_NUM: 1159657616
TRIGGER_DATE: 17465.729 278 DOY: 16/10/04
TRIGGER_TIME: 83272.64 SOD (23:07:52.64) UT
TRIGGER_DET: 0 0 1 (HXM1 HXM2 SGM)
SIGNIFICANCE: 4.00 [sigma]
FOREGOING_DUR: 14.90 [sec]
BACKGROUND_DUR: 16.00 [sec]
ENERGY_BAND: 40-230 [keV]
SC_LONG_LAT: -28.03,24.70 [deg]
LC_URL: http://cgbm-calet.jp/cgbm_trigger/flight/1159657616/index.html
COMMENTS: CGBM-GBM Flight Lightcurve
COMMENTS:
COMMENTS:

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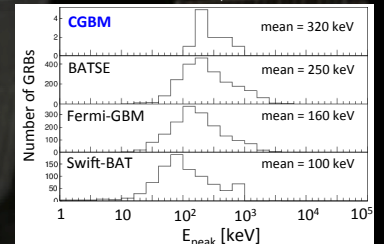
CGBM light curve plots (0.125 s, 1 s, 10 s binning) are available in real time at http://cgbm-calet.jp/cgbm_trigger/flight

NOTE: This CALET_GBM_FLT_LC event is temporally(2.0x10sec) coincident with the FERMI_GBM event (trignum=497315278). The LC_URL file will not be created until ~15 min after the trigger.

Distribution of T_{90} duration



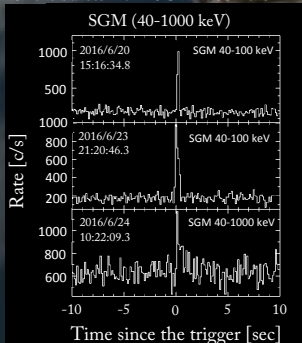
(preliminary) Distribution of E_{peak} for bright 10 GRBs



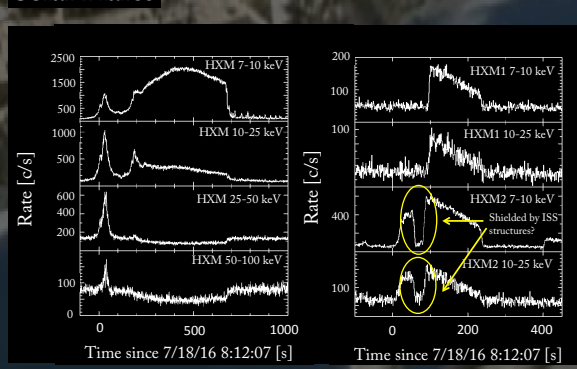
- Both **short** and **long GRBs** are detected by CGBM.
- The **shorter** T_{90} for long GRBs is probably due to smaller sensitivity than the other GRB instruments (tip of the iceberg effect).
- The E_{peak} distribution is **similar** to that of BATSE.

Soft Gamma-ray Repeaters

Short bursts from SGR 1935+2154



Solar Flares



Summary

- CALET has been successfully operated since October 2015.
- The GRB detection rate of CGBM is ~50 GRBs/yr.
- 15% of them are short GRBs.
- CGBM trigger alert and the light curve are available to the public through GCN.
- The short bursts from soft gamma-ray repeaters and bright solar flares are also detected by CGBM.
- CALET signed the MoU with LIGO-Virgo collaboration. Based on this collaboration, the upper limits of the electromagnetic counterpart for the gravitational event GW 151226 are published (Asaoka et al., poster P-008).