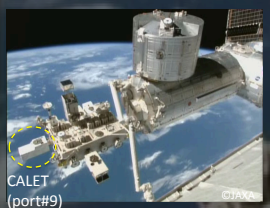
In-flight Performance and First Results of CALET Gamma-ray Burst Monitor

T. Sakamoto, A. Yoshida, I. Takahashi, Y. Kawakubo, K. Senuma, M. Moriyama, Y. Yamada, K. Yamaoka,
S. Nakahira, Y. Asaoka, S. Ozawa, S. Torii, Y. Shimizu, T. Tamura, M. Cherry, S. Ricciarini, P. Marrocchesi

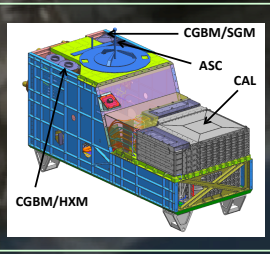
Calorimetric Electron Telescope (CALET) is performing scientific observations after a successful launch and attachment to the exposed platform of the Japanese experimental module "Kibo" on August 2015. CALET completed all the initial in-orbit checkout at the end of September, and since then, the scientific observations are on-going including various in-orbit instrumental calibration. CALET Gamma-ray Burst Monitor (CGBM) is a secondary instrument to support an X-ray and a gamma-ray observations of the main instrument, CALorimeter (CAL). The main objective of CGBM is to detect gamma-ray bursts (GRBs) and bright known transients. There is no significant difference in gain and energy resolutions of the CGBM instrument between the pre-launch ground data and the in-orbit data. The CGBM on-board trigger system is detecting GRBs simultaneously observed by other GRB instruments such as Swift-BAT, Fermi -GBM, Konus-Wind and INTEGRAL-ACS. We present the in-orbit performance and the GRB observations of CGBM.

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, ..)

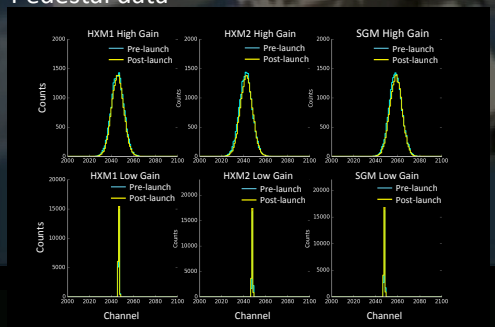


Scientific instruments:

- **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): $LaBr_3$(Ce)+PMT 7 keV – 1 MeV
  - Soft Gamma-ray Monitor (SGM): BGO+PMT 100 keV – 20 MeV

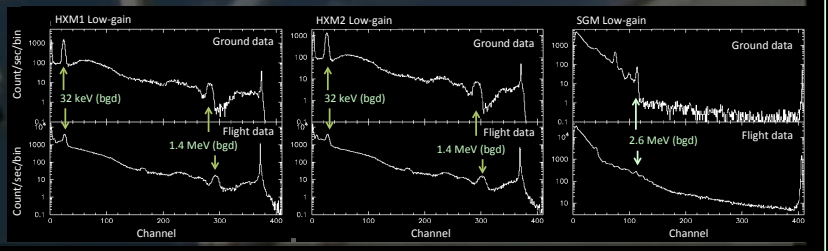
In-orbit calibration

Pedestal data



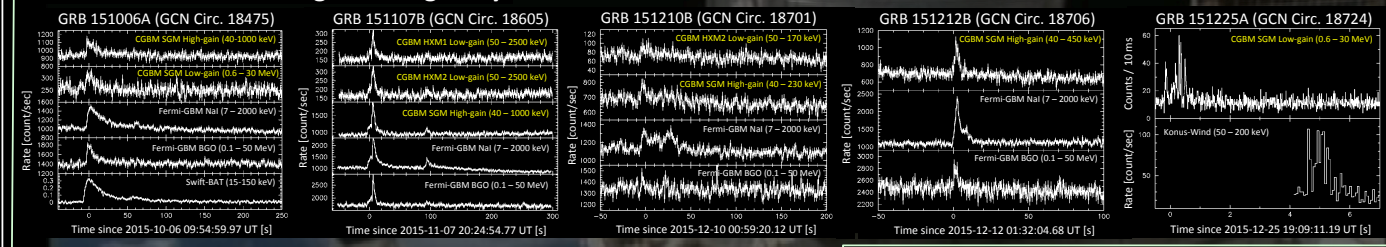
The peak channel and the width of the pedestal data for all data modes are consistent between a pre-launch and a post-launch data.

Background spectrum

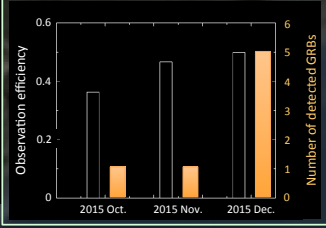


Comparison of the background spectrum between the ground data collected on March 12, 2015 and the flight data on September 22, 2015. Some internal background lines are seen in both data set. We confirmed by measuring the energy resolutions of those background lines that there is no degradation in performace between the ground and the flight data.

CGBM Confirmed GRB lightcurve gallery

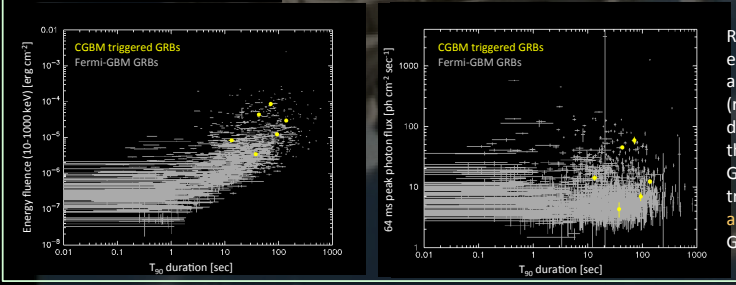


Observation efficiency



Histograms of the observation efficiency of CGBM and number of detected GRBs on October, November and December 2015 are shown. The observation efficiency has been gradually increasing (current efficiency is ~50%). The first tuning of on-board trigger was conducted around the middle of October.

CGBM GRB Properties



Relationship between the energy fluence and T_{90} (left) and the peak flux and T_{90} (right) for the CGBM detected GRBs (yellow) and the Fermi-GBM detected GRBs (light gray). CGBM is triggering a high fluence and a peak flux GRB of the Fermi-GRB population.

Summary

- CGBM is detecting GRBs in a rate of 40 GRBs/yr. We are working on tuning the on-board trigger setup parameters to be able to detect a weak GRB.
- CGBM trigger alert delivered via GCN notice will be available to the public within a few months (we are currently doing an end-to-end test).
- The data analysis of CAL and ASC for CGBM detected GRBs are on-going.