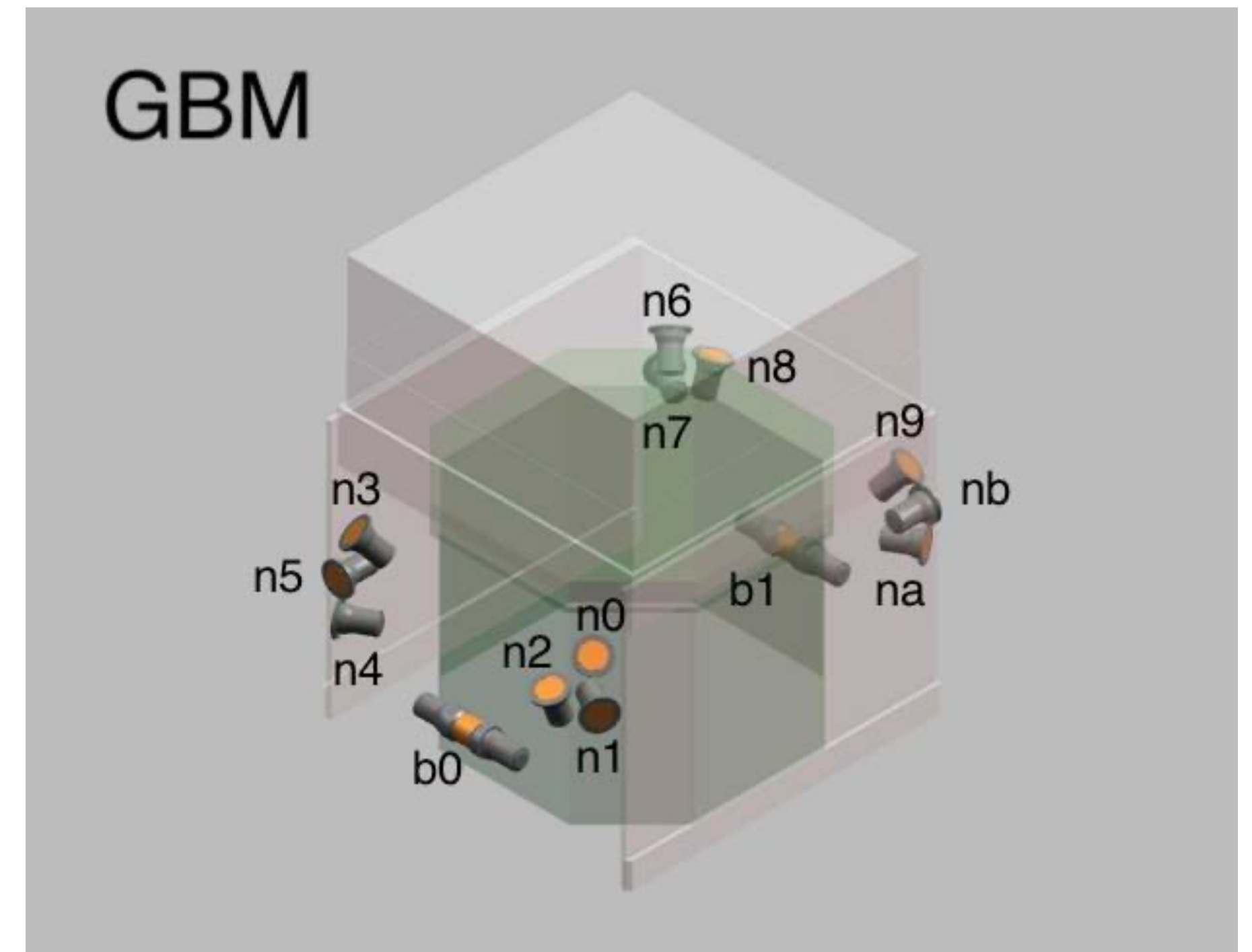


Fantastic Fermi-GBM Data, Where to Find It, How to Use It

Joshua Wood
NASA/MSFC
2022 Fermi Summer School

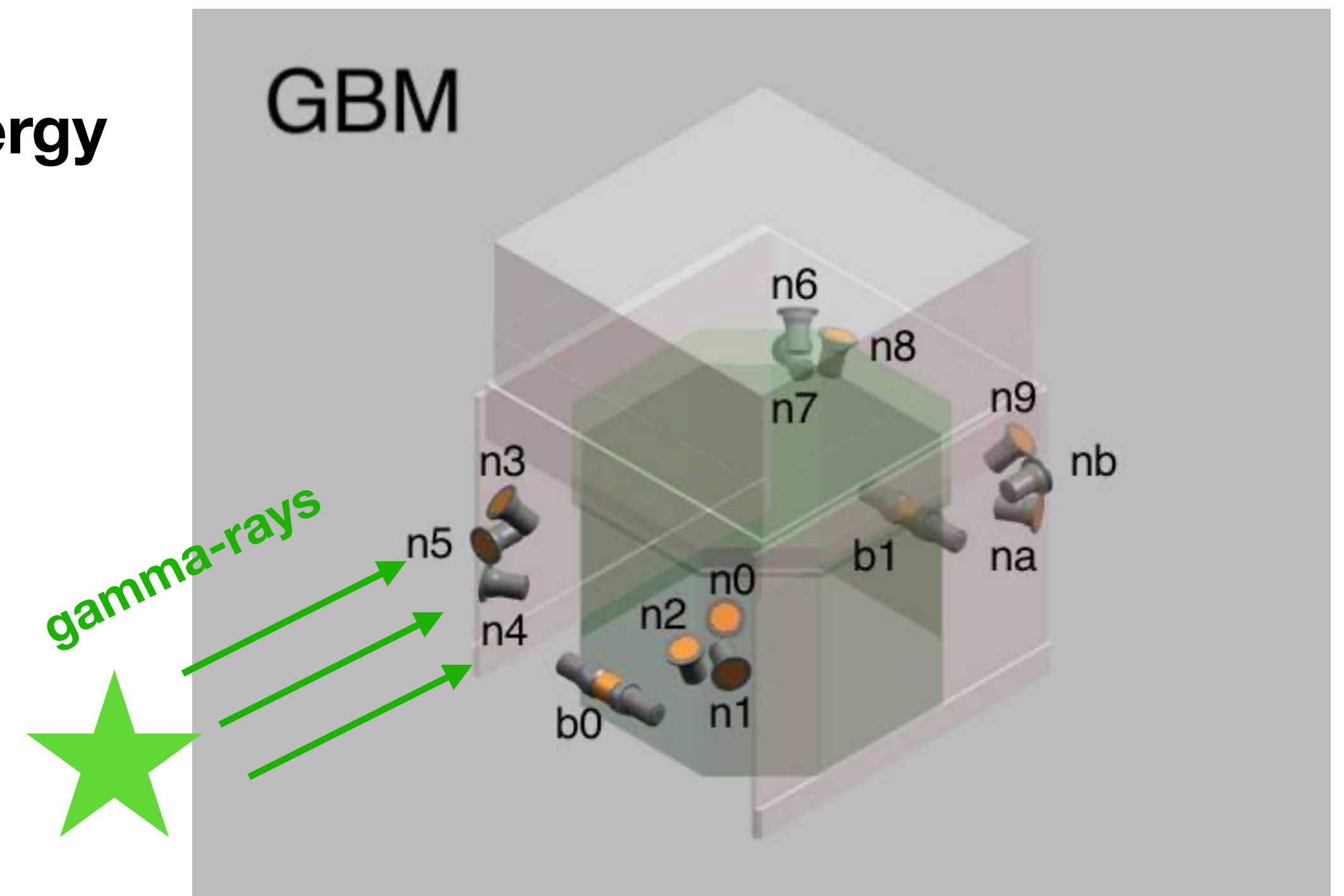
What *is* GBM Data?

- Measured photons in each detector as a function of time
- There are 14 detectors total:
 - 12 NaI(Tl) detectors labeled n0-nb
used for triggering and localizing sources (8 keV - 1 MeV)
 - 2 BGO detectors labeled b0, b1
used for spectral measurements at high energy (200 keV - 40 MeV)
- Each detector gets its own data file
- Data files only contain photon times and energies, no directional information (non-imaging detectors)
- Source direction needs to be reconstructed from the relative counts in each detector using the detector response matrices (DRMs) + spacecraft position



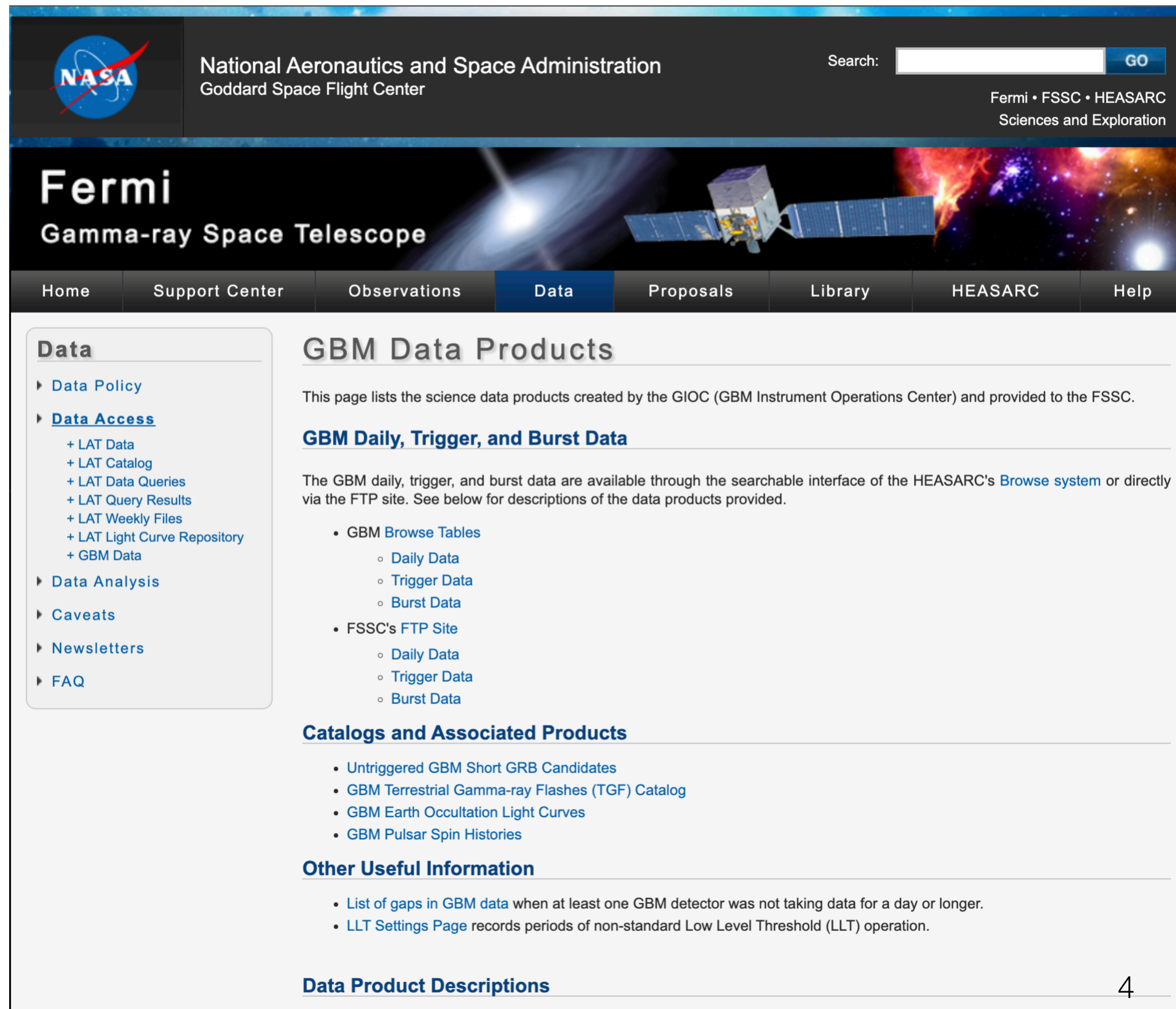
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Where to Find GBM Data?

<https://fermi.gsfc.nasa.gov/ssc/data/access/gbm/>



The screenshot shows the NASA Fermi Gamma-ray Space Telescope website. At the top left is the NASA logo and the text "National Aeronautics and Space Administration Goddard Space Flight Center". To the right is a search bar with a "GO" button and the text "Fermi • FSSC • HEASARC Sciences and Exploration". Below this is a banner for "Fermi Gamma-ray Space Telescope" with an image of the satellite. A navigation menu includes "Home", "Support Center", "Observations", "Data" (highlighted), "Proposals", "Library", "HEASARC", and "Help".

Data

- ▶ Data Policy
- ▶ **Data Access**
 - + LAT Data
 - + LAT Catalog
 - + LAT Data Queries
 - + LAT Query Results
 - + LAT Weekly Files
 - + LAT Light Curve Repository
 - + GBM Data
- ▶ Data Analysis
- ▶ Caveats
- ▶ Newsletters
- ▶ FAQ

GBM Data Products

This page lists the science data products created by the GIOC (GBM Instrument Operations Center) and provided to the FSSC.

GBM Daily, Trigger, and Burst Data

The GBM daily, trigger, and burst data are available through the searchable interface of the HEASARC's [Browse system](#) or directly via the FTP site. See below for descriptions of the data products provided.

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Catalogs and Associated Products

- [Untriggered GBM Short GRB Candidates](#)
- [GBM Terrestrial Gamma-ray Flashes \(TGF\) Catalog](#)
- [GBM Earth Occultation Light Curves](#)
- [GBM Pulsar Spin Histories](#)

Other Useful Information

- [List of gaps in GBM data](#) when at least one GBM detector was not taking data for a day or longer.
- [LLT Settings Page](#) records periods of non-standard Low Level Threshold (LLT) operation.

Data Product Descriptions

Where to Find GBM Data?

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National Aeronautics and Space Administration
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Search: GO

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Other Useful Information

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- LLT Settings Page records periods of non-standard Low Level Threshold (LLT) operation.

Data Product Descriptions

- **Full Daily Data** for people who want *everything* → all photon events in every detector, every hour of the day:

Example Link

<https://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/daily/2022/06/03/current/>

	glg_ctime_n8_220603_v00.pha	04-Jun-2022 01:09	11M
	glg_ctime_n9_220603_v00.pha	04-Jun-2022 01:09	11M
	glg_ctime_na_220603_v00.pha	04-Jun-2022 01:09	11M
	glg_ctime_nb_220603_v00.pha	04-Jun-2022 01:09	11M
	glg_poshist_all_220603_v00.fit	03-Jun-2022 21:47	8.8M
	glg_spechist_b0_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_b1_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_n0_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n1_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n2_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n3_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n4_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n5_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_spechist_n6_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_n7_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_n8_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_n9_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_na_220603_v00.fit	04-Jun-2022 01:10	14K
	glg_spechist_nb_220603_v00.fit	04-Jun-2022 01:10	17K
	glg_tte_b0_220603_00z_v00.fit.gz	02-Jun-2022 22:25	39M
	glg_tte_b0_220603_01z_v00.fit.gz	03-Jun-2022 00:18	57M
	glg_tte_b0_220603_02z_v00.fit.gz	03-Jun-2022 00:18	38M
	glg_tte_b0_220603_03z_v00.fit.gz	03-Jun-2022 02:30	47M
	glg_tte_b0_220603_04z_v00.fit.gz	03-Jun-2022 02:30	32M

Useful if you want to look for something we haven't found with an on-board trigger

Where to Find GBM Data?

<https://fermi.gsfc.nasa.gov/ssc/data/access/gbm/>

National Aeronautics and Space Administration
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Other Useful Information

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- LLT Settings Page records periods of non-standard Low Level Threshold (LLT) operation.

Data Product Descriptions

- **Trigger Data** for people who want data for any *trigger* issued by GBM

Example Link

<https://heasarc.gsfc.nasa.gov/FTP/fermi/data/gbm/triggers/2017/bn170817529/current/>

	glg_lc_all_bn170817529_v00.gif	17-Aug-2017 08:49	19K
	glg_lc_chan12_bn170817529_v00.pdf	17-Aug-2017 08:49	305K
	glg_lc_chan34_bn170817529_v00.pdf	17-Aug-2017 08:49	297K
	glg_lc_chan567_bn170817529_v00.pdf	17-Aug-2017 08:50	302K
	glg_lc_chantot_bn170817529_v00.pdf	17-Aug-2017 08:50	421K
	glg_lc_hires12_bn170817529_v00.gif	17-Aug-2017 08:50	7.9K
	glg_lc_hires34_bn170817529_v00.gif	17-Aug-2017 08:50	6.9K
	glg_lc_hires567_bn170817529_v00.gif	17-Aug-2017 08:51	7.1K
	glg_lc_lores12_bn170817529_v00.gif	17-Aug-2017 08:51	9.3K
	glg_lc_lores34_bn170817529_v00.gif	17-Aug-2017 08:51	8.4K
	glg_lc_lores567_bn170817529_v00.gif	17-Aug-2017 08:52	7.5K
	glg_lc_medres12_bn170817529_v00.gif	17-Aug-2017 08:52	9.8K
	glg_lc_medres34_bn170817529_v00.gif	17-Aug-2017 08:52	8.7K
	glg_lc_medres567_bn170817529_v00.gif	17-Aug-2017 08:52	8.2K
	glg_lc_tot_bn170817529_v00.pdf	17-Aug-2017 08:53	316K
	glg_lc_zxradec_bn170817529_v00.gif	17-Aug-2017 08:53	7.7K
	glg_loclist_all_bn170817529_v02.txt	17-Aug-2017 12:11	6.6K
	glg_locplot_all_bn170817529_v02.png	17-Aug-2017 12:11	204K
	glg_locprob_all_bn170817529_v02.fit	17-Aug-2017 12:12	2.0M
	glg_scatt_all_bn170817529_flnc_band_v00.fit	16-Oct-2017 07:35	28K
	glg_scatt_all_bn170817529_flnc_comp_v00.fit	16-Oct-2017 07:35	28K
	glg_scatt_all_bn170817529_flnc_plot_v00.fit	16-Oct-2017 07:35	28K

GRB triggers tend to have more trigger data products

Where to Find GBM Data?

<https://fermi.gsfc.nasa.gov/ssc/data/access/gbm/>

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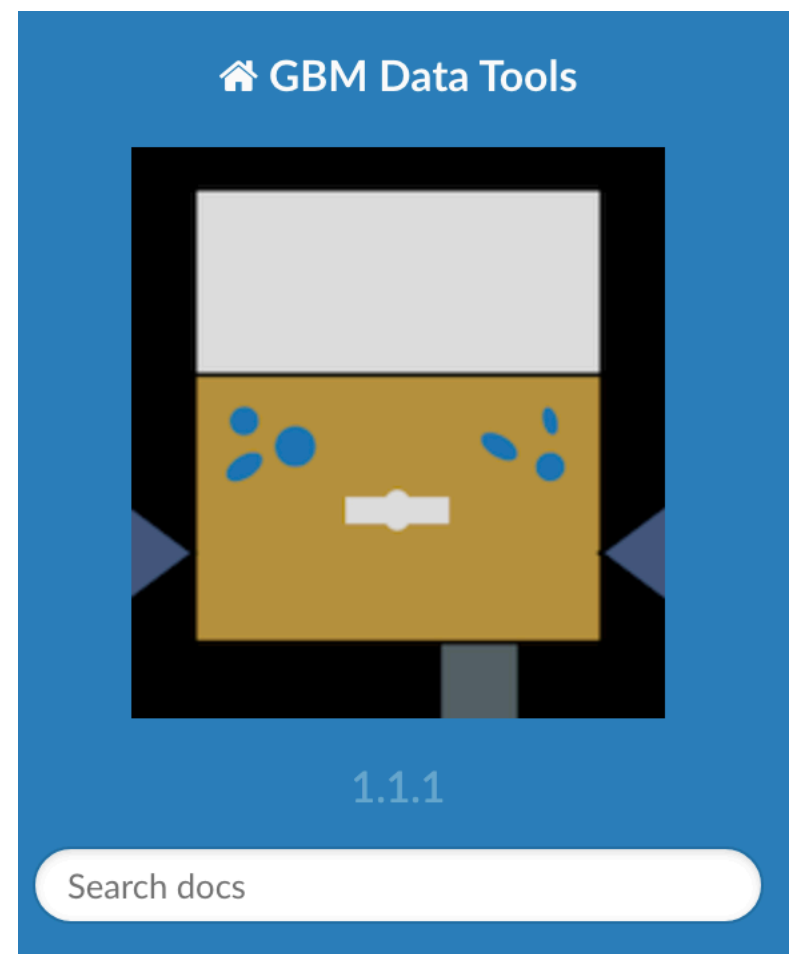
- Burst Data** for people who only want data for GRB triggers issued by GBM and their associated data products (T90, spectral fits, etc)

glg_locplot_all_bn170817529_v02.png	17-Aug-2017 12:11	204K
glg_locprob_all_bn170817529_v02.fit	17-Aug-2017 12:12	2.0M
glg_scatt_all_bn170817529_flnc_band_v00.fit	16-Oct-2017 07:35	28K
glg_scatt_all_bn170817529_flnc_comp_v00.fit	16-Oct-2017 07:35	28K
glg_scatt_all_bn170817529_flnc_plaw_v00.fit	16-Oct-2017 07:35	28K
glg_scatt_all_bn170817529_flnc_sbpl_v00.fit	16-Oct-2017 07:36	28K
glg_scatt_all_bn170817529_pflx_band_v00.fit	16-Oct-2017 07:36	28K
glg_scatt_all_bn170817529_pflx_comp_v00.fit	16-Oct-2017 07:36	28K
glg_scatt_all_bn170817529_pflx_plaw_v00.fit	16-Oct-2017 07:37	28K
glg_scatt_all_bn170817529_pflx_sbpl_v00.fit	16-Oct-2017 07:37	28K
glg_tcat_all_bn170817529_v03.fit	16-Oct-2017 07:37	5.6K
glg_trigdat_all_bn170817529_v01.fit	17-Aug-2017 11:07	107K
glg_tte_b0_bn170817529_v00.fit	17-Aug-2017 11:45	3.8M

fits specific
to GRB triggers

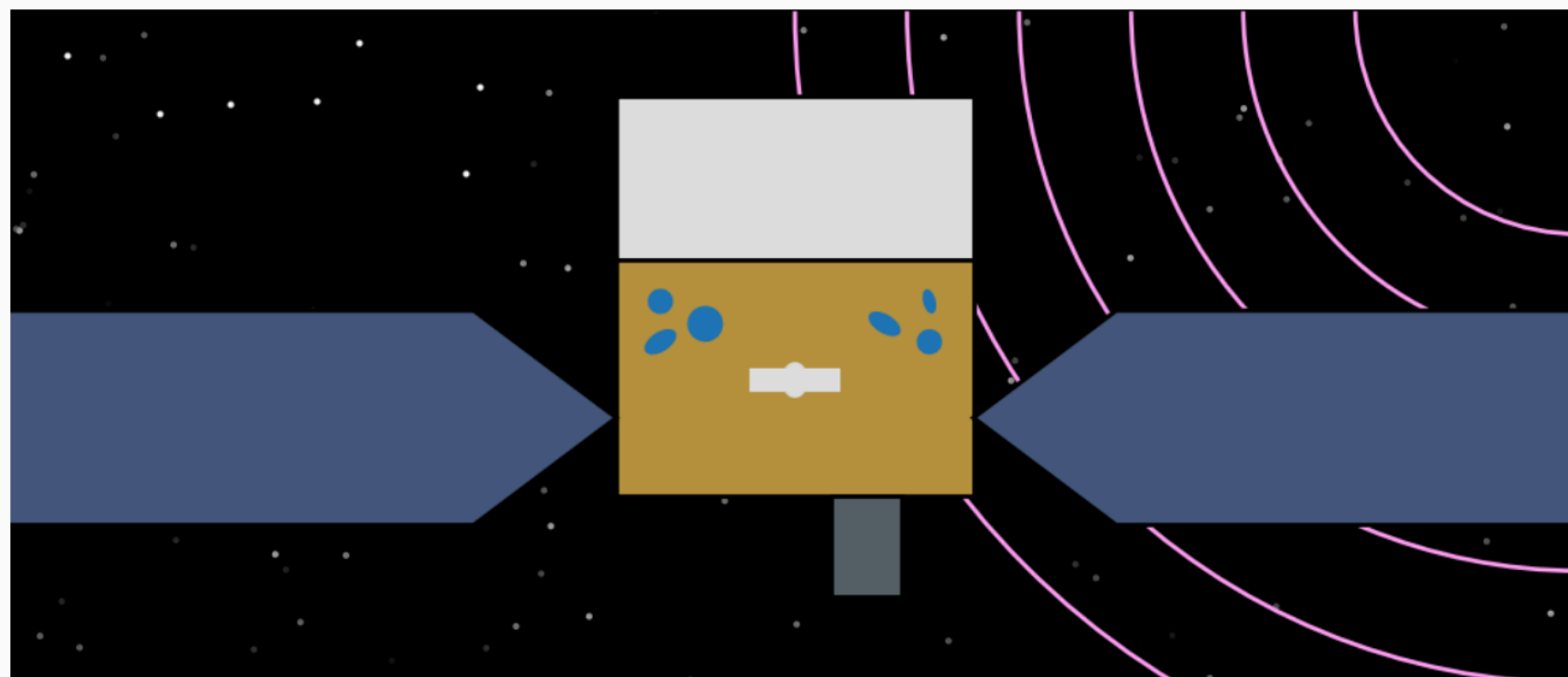
How to Use GBM Data?

https://fermi.gsfc.nasa.gov/ssc/data/analysis/gbm/gbm_data_tools/gdt-docs/



» Welcome to the Fermi GBM Data Tools documentation! [View page source](#)

Welcome to the Fermi GBM Data Tools documentation!



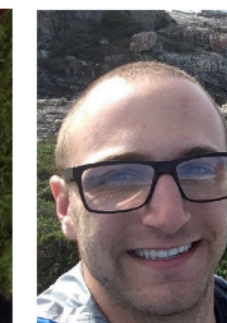
Hello, I'm Fermi. Pleased to meet you!

The Fermi GBM Data Tools is an Application Programming Interface (API) for GBM data. The fundamental purpose of the Data Tools is to allow general users to incorporate GBM analysis into their scripts and workflows without having to sweat very many details. To this end, the Data Tools have a fairly high-level API layer allowing a user to read, reduce, and visualize GBM data with only a few lines of code. For expert users, and users who want fine control over various aspects of their analysis, the Data Tools exposes a lower-level API layer, which can also be used to generalize the GBM Data Tools to data from other like instruments.

Architecture

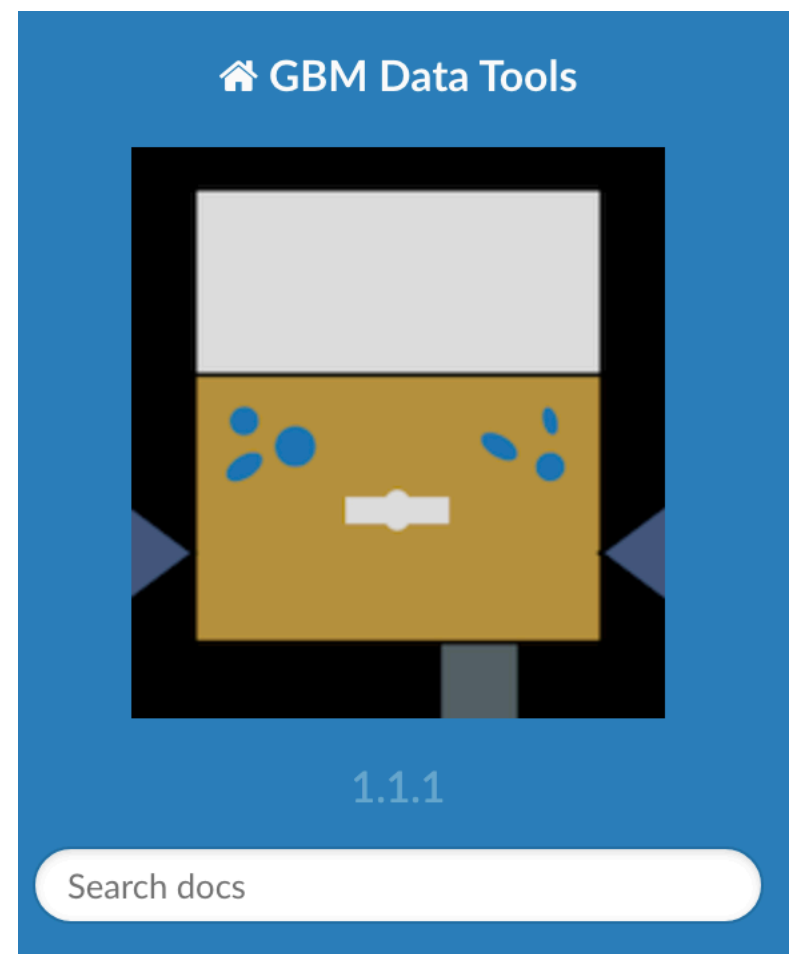
The Data Tools are designed with generalization in mind. Underlying the science data

- Python based data analysis software written by the GBM team



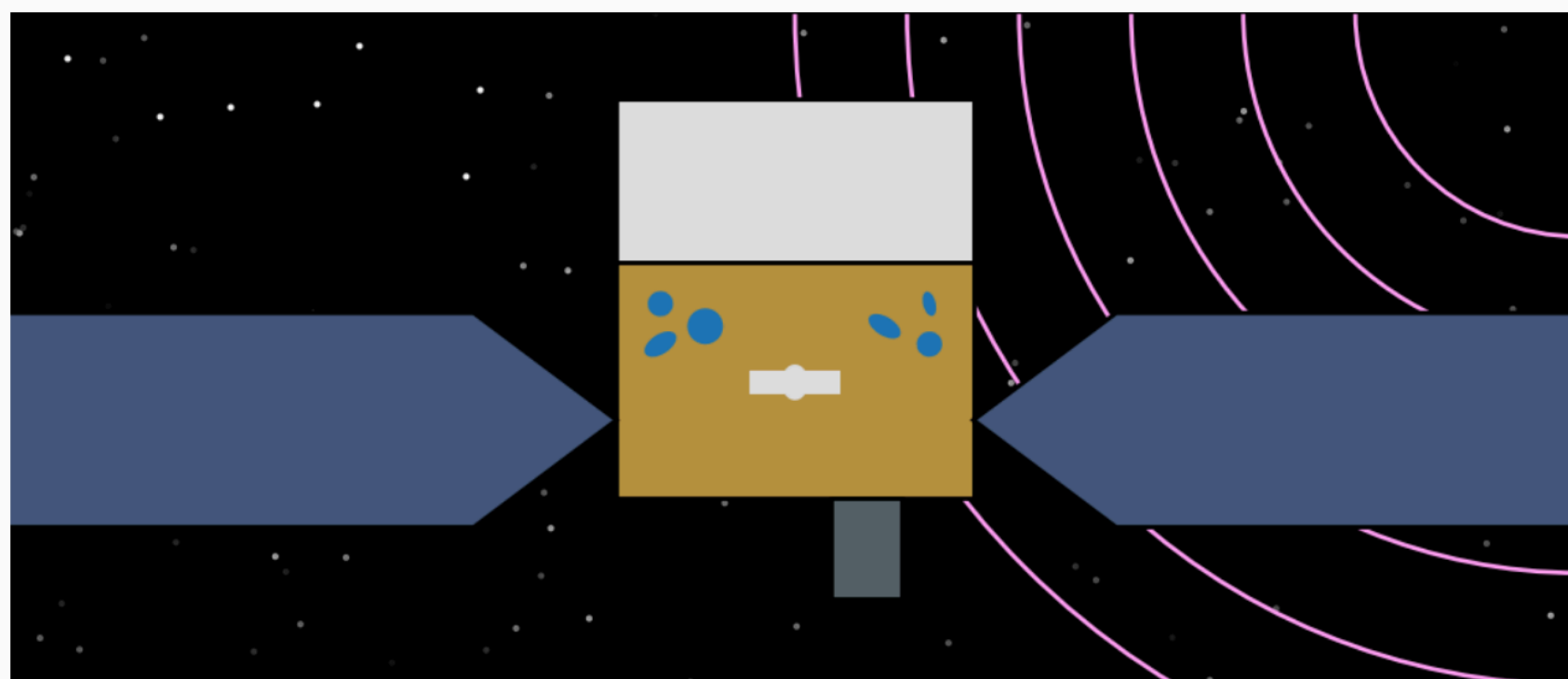
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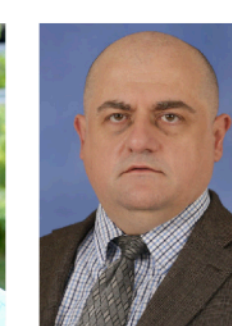
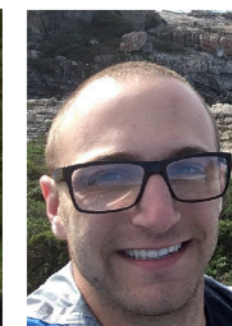
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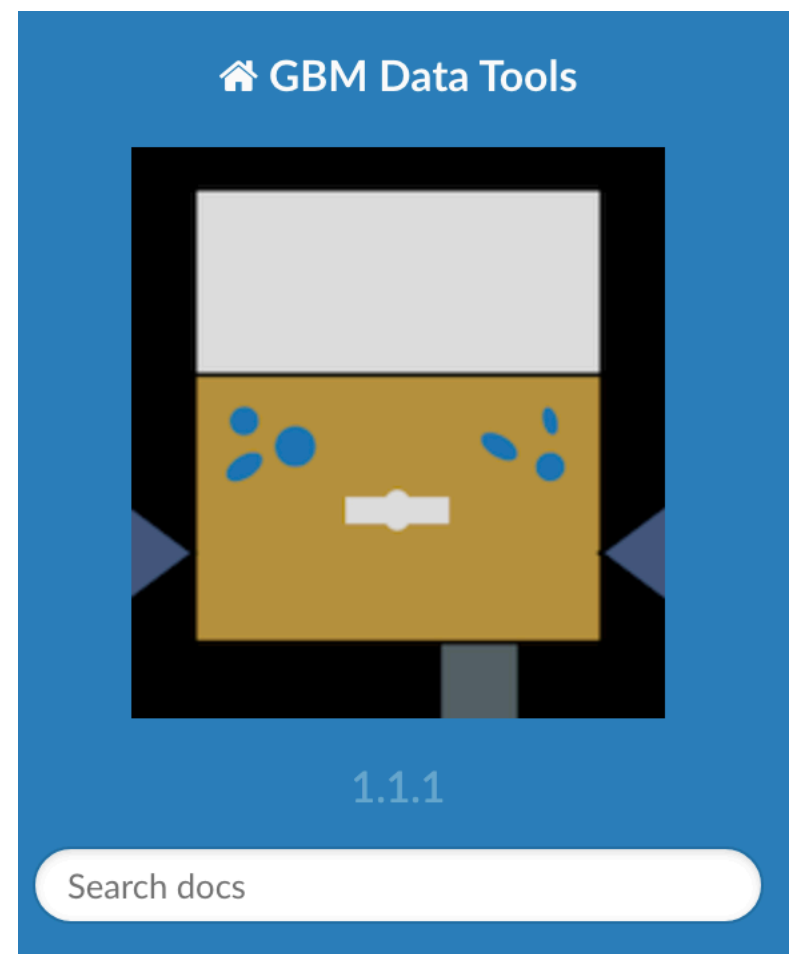
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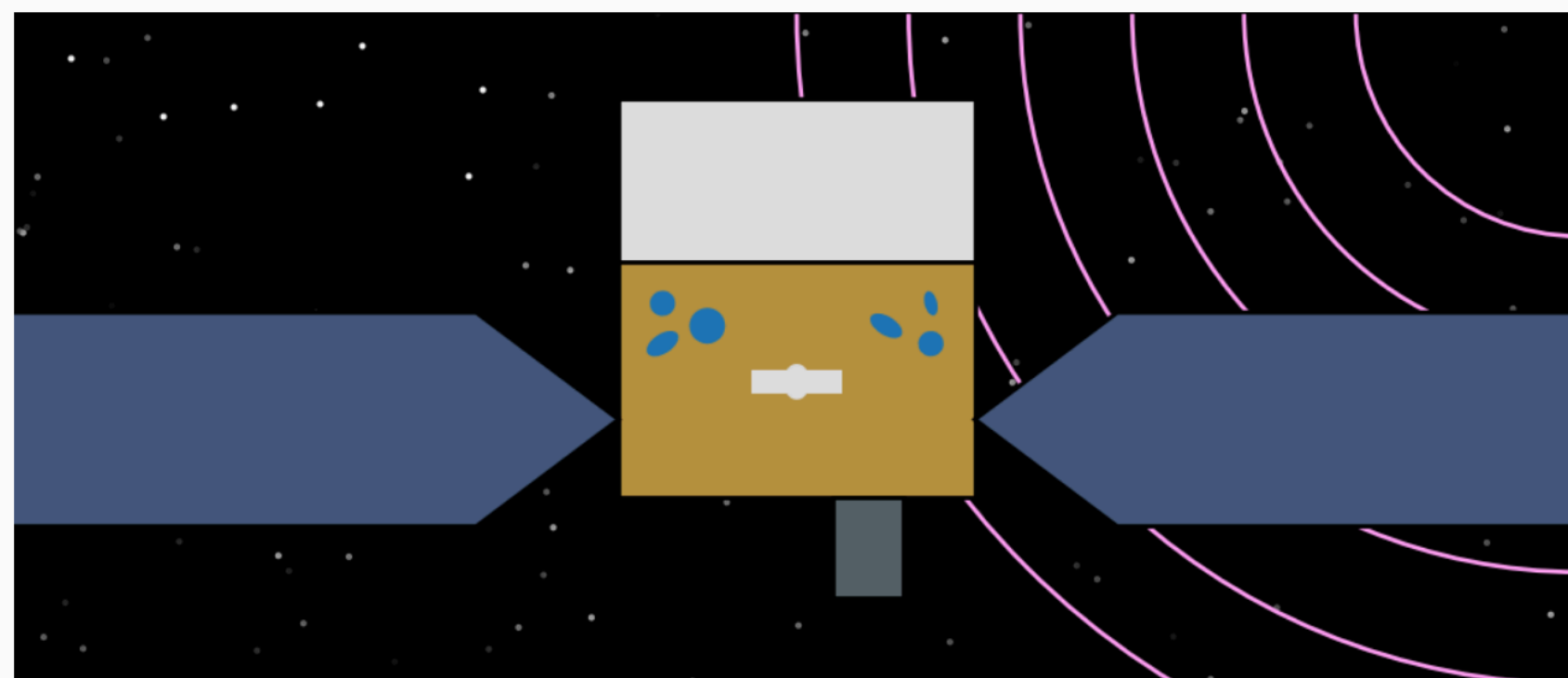
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- Available to download on the web
note: sometimes Chrome unzips the .tar.gz if you have issues installing, try renaming as .tar
- Available in the Fermi Bottle with
*conda activate fermigbm
pip3 install matplotlib==3.2.1*
- Will work for the tutorials we're going to run today, with some warning messages from basemap, a very outdated dependency that we're still working to replace. Only matters for certain sky plots, data is analysis unaffected

*sudo chmod -R g+w /opt/anaconda/envs/fermigbm
conda install -n fermigbm -c conda-forge basemap*

if you want to add basemap for later ^

Tutorial: a famous trigger GRB 170817A

<https://drive.google.com/file/d/1NFyfb8gzWwRjiXMJ2h4QuMe32tRcErPp/view?usp=sharing>

