

# Welcome



# Fermi Data Analysis Workshop

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# Workshop Objectives



- Today we'll cover *Fermi* analysis basics:
  - Data content, selection cuts, caveats
  - Analysis methodologies, synopsis of tools
    - ML method → point source analysis
    - Light curve & pulsar analysis
- Emphasis on hands on analysis
  - roving support staff
- Feedback & discussion
- GI Program: Guidelines for Proposer

# Agenda, Staff

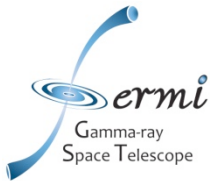


10:00 - 10:10	Overview, Workshop Objectives	Shrader
10:10 - 10:25	Data Selection & Exploration	Ferrara
10:25 - 10:30	Data Selection Caveats	McEnery
10:30 - 10:45	Point Source Analysis	Davis
10:45 - 11:00	Using the Catalog for Analysis	Ferrara
11:00 - 11:30	Hands on Session 1	All
11:30 - 11:40	Q&A, Review	All
11:40 - 12:30	Hands on Session 2	All
12:30 - 14:00	Working Lunch/Lunch Break	
14:30 - 14:50	Fermi Mission Status	Hays
14:50 - 15:10	Catalogs and MW Opportunities	Digel
15:10 - 15:30	Extragalactic Results	Thompson
15:30 - 15:50	Gamma-Ray Bursts	Gehrels
15:50 - 16:10	Results on Galactic Sources	Harding
16:10 - 16:30	GI Program Overview & Q&A	Shrader

# Prerequisites



- Science Tools Installation – hopefully done prior, but we can help as needed
  - Workshop web page is useful resource
- Sample datasets on workshop web page
  - – can substitute alternative data selections, but be cognizant of run-time, S/N issues
- Access to Fermi SSC web site
  - Data analysis documentation sets
    - Threads, Cicerone, Reference (‘fhelp’) docs



# A Few Fermi Analysis Basics

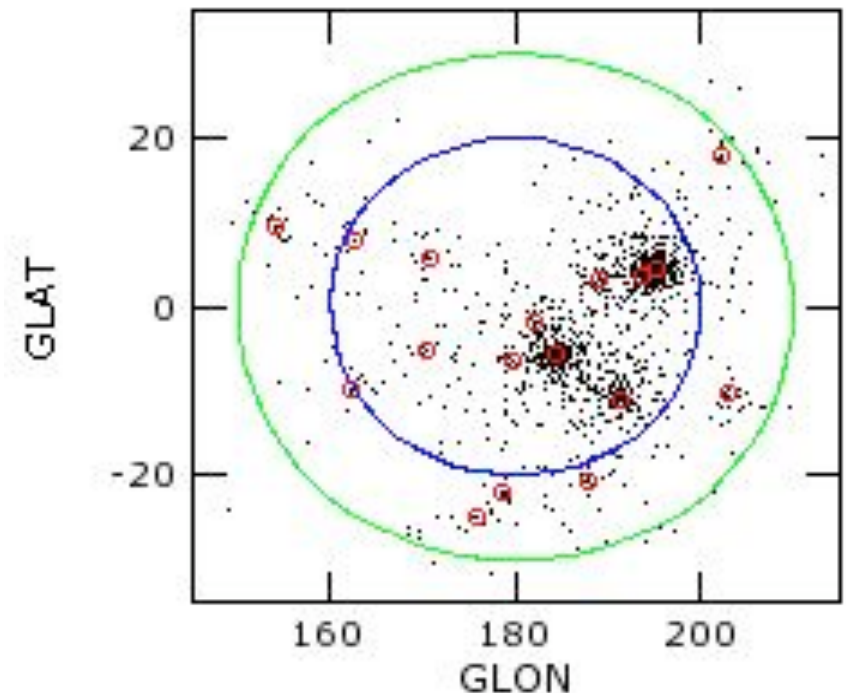


## *What's different about Fermi data analysis?*

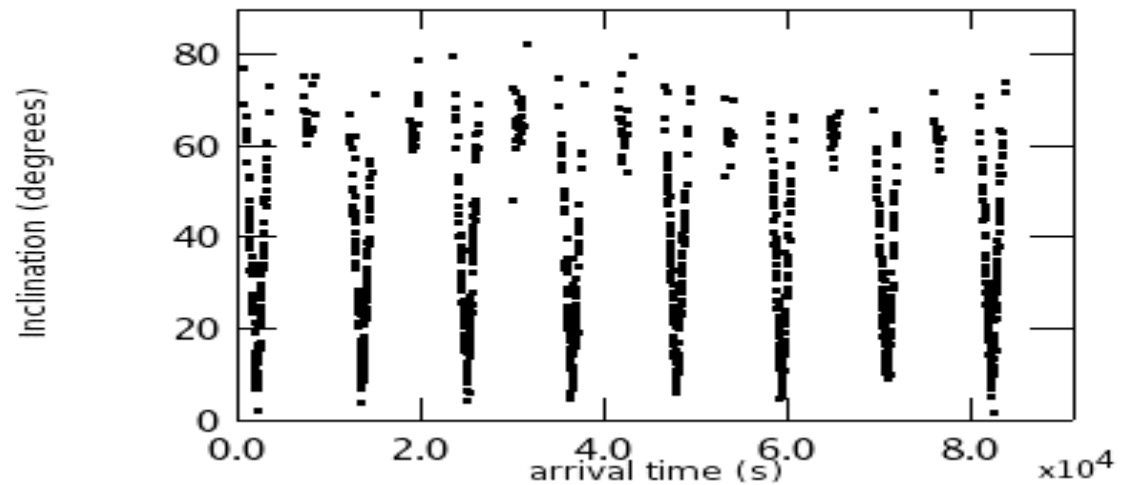
- Structured sky backgrounds
- Energy-dependent point spread function
- Instrument response function(s) IRFs
  - Multiple dependencies: instrument design, event reconstruction, background & quality selections
- Wide field of view, continuously variable aspect

- **Sources must be fit simultaneously.**
  - Broad and energy-dependent PSFs:  $\sigma_{68} < 3.5^\circ$  for 100 MeV (on axis) and  $< 0.1^\circ$  for 10 GeV
  - Emission from nearby point sources overlap.
  - Intrinsic source spectrum affects the degree of source confusion.
  - “**Source region**” must be significantly larger than the “**region-of-interest**” (ROI).

- Anticenter region:

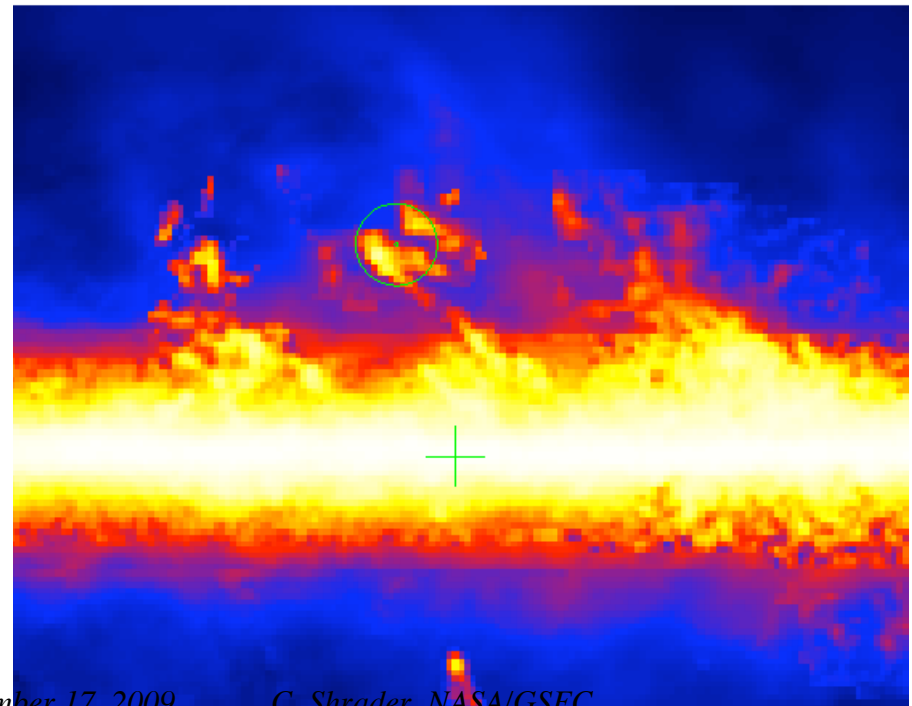


- Each event effectively has its own response function:
  - Large FOV,  $\sim 2.4$  sr
  - Strong variation of response as a function of photon incident angle,  $A_{\text{eff}} \propto \cos \theta$
  - Scanning mode of operation: 95 min orbit  $\Rightarrow$  continuous aspect changes of  $4^\circ/\text{min}$ .



# Diffuse Emission

- Emission results from cosmic ray interactions with interstellar gas.
- Models rely on HI & CO observations for the gas distribution
- These observations reveal structures on angular scales similar to the PSF:

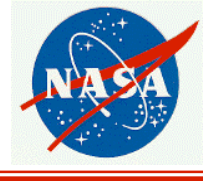




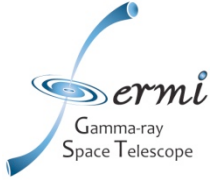
- Web URLs:

- [http://fermi.gsfc.nasa.gov/workshops/data\\_analysis\\_dec09/](http://fermi.gsfc.nasa.gov/workshops/data_analysis_dec09/) Workshop web site
- <http://fermi.gsfc.nasa.gov/ssc/> FSSC home
- <http://fermi.gsfc.nasa.gov/ssc/data/access/> Data access
- <http://fermi.gsfc.nasa.gov/ssc/data/analysis/> Data analysis page
- <http://fermi.gsfc.nasa.gov/cgi-bin/ssc/faq/glastfaq.cgi> FAQs

# Cycle-3 Timeline



Announcement (as part of ROSES 2008)	September, 2009
Release online proposal aids & documentation	November 5, 2009
Notices of Intent (optional)	November 16, 2009
<b>Proposals Due</b>	<b>February 5, 2010</b>
Proposal Peer Review	April, 2010
Stage-II (budget proposal) solicitation	May 2010
Budget deadline, processing & grants administration	June-July 2010
Fermi Cycle 3 Begins	Mid August, 2010

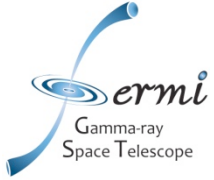


# *Fermi* Data Analysis Workshop

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# Let's get started ...



# *Fermi* Data Analysis Workshop

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# Extra Slides



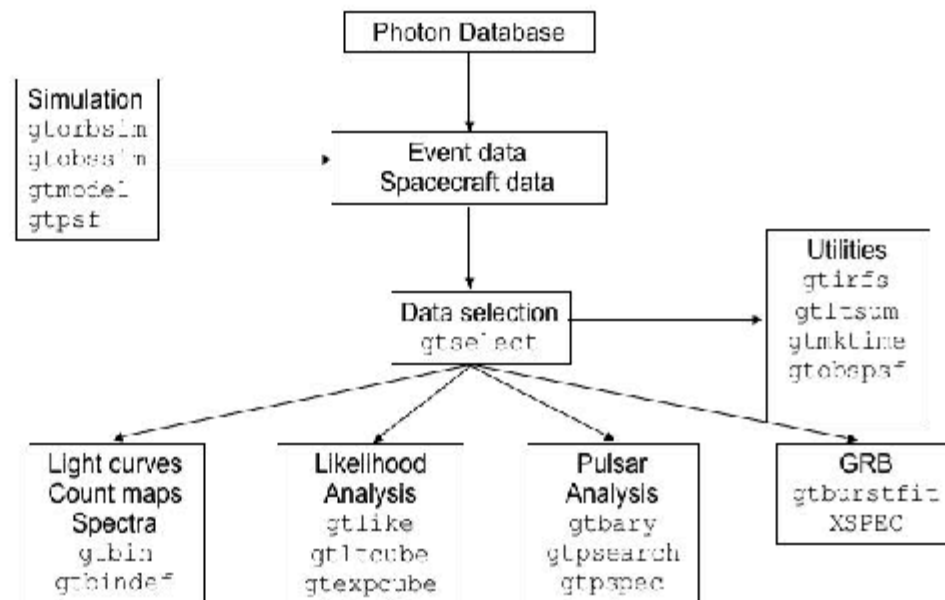
Important resource:  
FSSC data analysis web page



- + FSSC Home
- Data
  - Data Policy
  - Data Access
  - Data Analysis
    - + System Overview
    - + Caveats
    - + Software Download
    - + Documentation
    - + Analysis Threads
    - + User Contributions
- Newsletter
- FAQ

### Overview: LAT Data Analysis Tools

Through a collaborative effort between the Fermi Science Support Center and the LAT instrument team a suite of instrument specific science analysis tools has been developed for public release. This software will be distributed and maintained by the FSSC. It has been designed within the framework of the HEADAS FTOOLS methodology, to ensure cross-mission compatibilities wherever possible and to minimize the learning curve for users of other high-energy astrophysics mission data sets. The general analysis flow is illustrated in this graphic:





# Fermi Data Analysis Workshop



Sample data sets posted online:

Vela Pulsar,  
3C 454.3

The screenshot shows the Fermi Data Analysis Workshop website. At the top, there is a header with the NASA logo, the text 'GODDARD SPACE FLIGHT CENTER', and links to 'NASA Homepage', 'GSFC Homepage', and 'Fermi Homepage'. A search bar is also present. Below the header is a banner for the 'Fermi Gamma-ray Space Telescope' featuring an image of the satellite. A navigation menu includes 'MISSION HOME', 'SCIENCE', 'FSSC', and 'STUDENTS · TEACHERS · PUB'. The main content area is titled 'Fermi Data Analysis Workshop - Downloads' and contains a list of links: 'Welcome', 'Agenda', 'Register', 'Directions', 'Downloads', 'Links', and 'Contacts'. Under the 'Workshop Data' section, there is a list of data sets: '3c453' and 'Vela'.

## Science Tools Download Page:

Hopefully this  
has already  
been done(?)  
but if not, refer  
to this page for  
supported  
platforms,  
installation  
instructions



The screenshot shows the Fermi Science Support Center website. The header features the text "Fermi Science Support Center" and a navigation menu with links for HOME, RESOURCES, PROPOSALS, DATA (highlighted), HEASARC, HELP, and SITE MAP. A sidebar on the left contains a menu with "Data Analysis" selected, listing options like System Overview, Caveats, Software Download, Documentation, Analysis Threads, and User Contributions. The main content area is titled "Installing the Femi Science Tools" and provides instructions on how to install the tools, including a terminal command to check the machine type and a list of supported binary distributions.

## Fermi Science Support Center

HOME RESOURCES PROPOSALS DATA HEASARC HELP SITE MAP

+ FSSC Home

### Data

Data Policy  
Data Access

### Data Analysis

- + System Overview
- + Caveats
- + Software Download
- + Documentation
- + Analysis Threads
- + User Contributions

Newsletter  
FAQ

### Installing the Femi Science Tools

You can install the Fermi Science Tools using either a source distribution or using a precompiled binary. The preferred method is to use the **binary** distribution. If you are unsure which distribution to select contact your system administrator. On a unix command line you can find your machine type with the command

```
uname -m
```

and you should see something like i686, x86\_64, or powerpc.

To determine the version of libc you can try

```
ls /lib/libc-*
```

and you should see something like

```
/lib/libc-2.3.4.so
```

where the 2.3.4 is the libc version.

We have binary distributions for:

- Scientific Linux 4.4 32 bit libc 2.3.4
- Scientific Linux 5 32 bit libc 2.5
- Scientific Linux 4 64 bit libc 2.3.4
- Scientific Linux 5 64 bit libc 2.5
- MAC OS X 10.4 powerpc