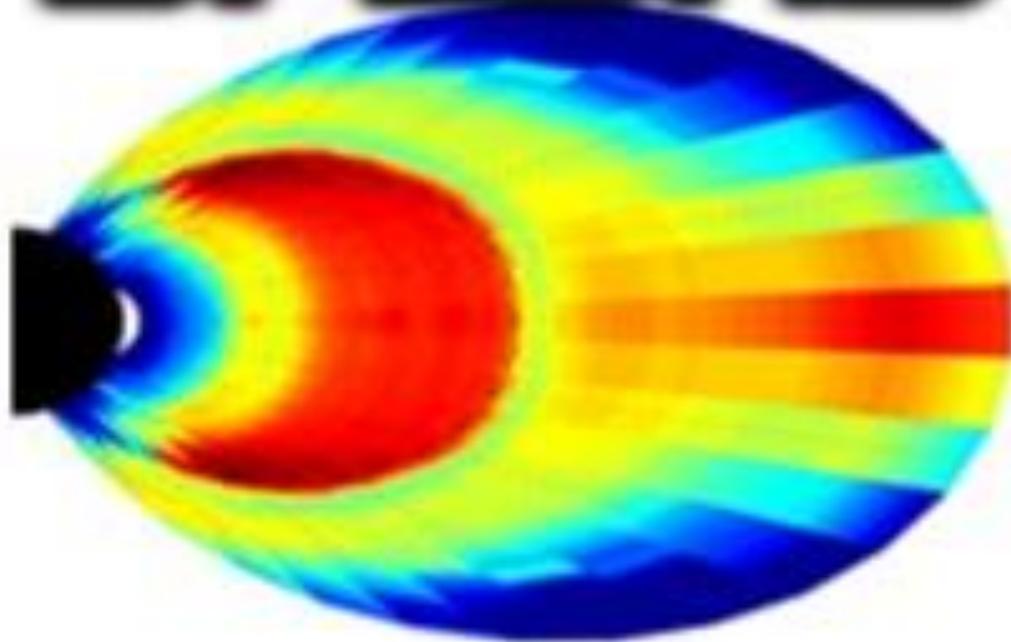


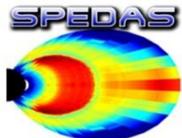


SPEEDAS



SPEEDAS Tutorial

GEM 2017, Portsmouth VA



Agenda



SPEDAS Tutorial

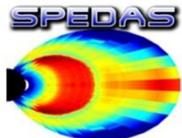
Opening remarks

SPEDAS development status

New features, plugins, and tools

Live demo: typical workflows, most used features

Q&A, discussion



What is SPEDAS?

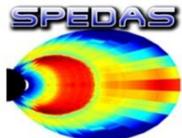


Space Physics Environment Data Analysis Software (SPEDAS)

- Grass-roots data analysis software for Space Physics Community
- SPEDAS is an outgrowth of THEMIS / ARTEMIS code that has been extended to support multiple missions
- Standardizes retrieval of data from distributed repositories
- Science processing and graphics contain powerful set of legacy routines.
- The THEMIS mission is now served through the TDAS plugin

The SPEDAS framework:

- Contains a GUI for ease of use (available through IDL VM freeware)
- Command line provides full access to IDL (paid license only)
- Works with Windows, Linux and Mac OS X.
- Is based on IDL, benefiting from platform independence and software maintenance services.



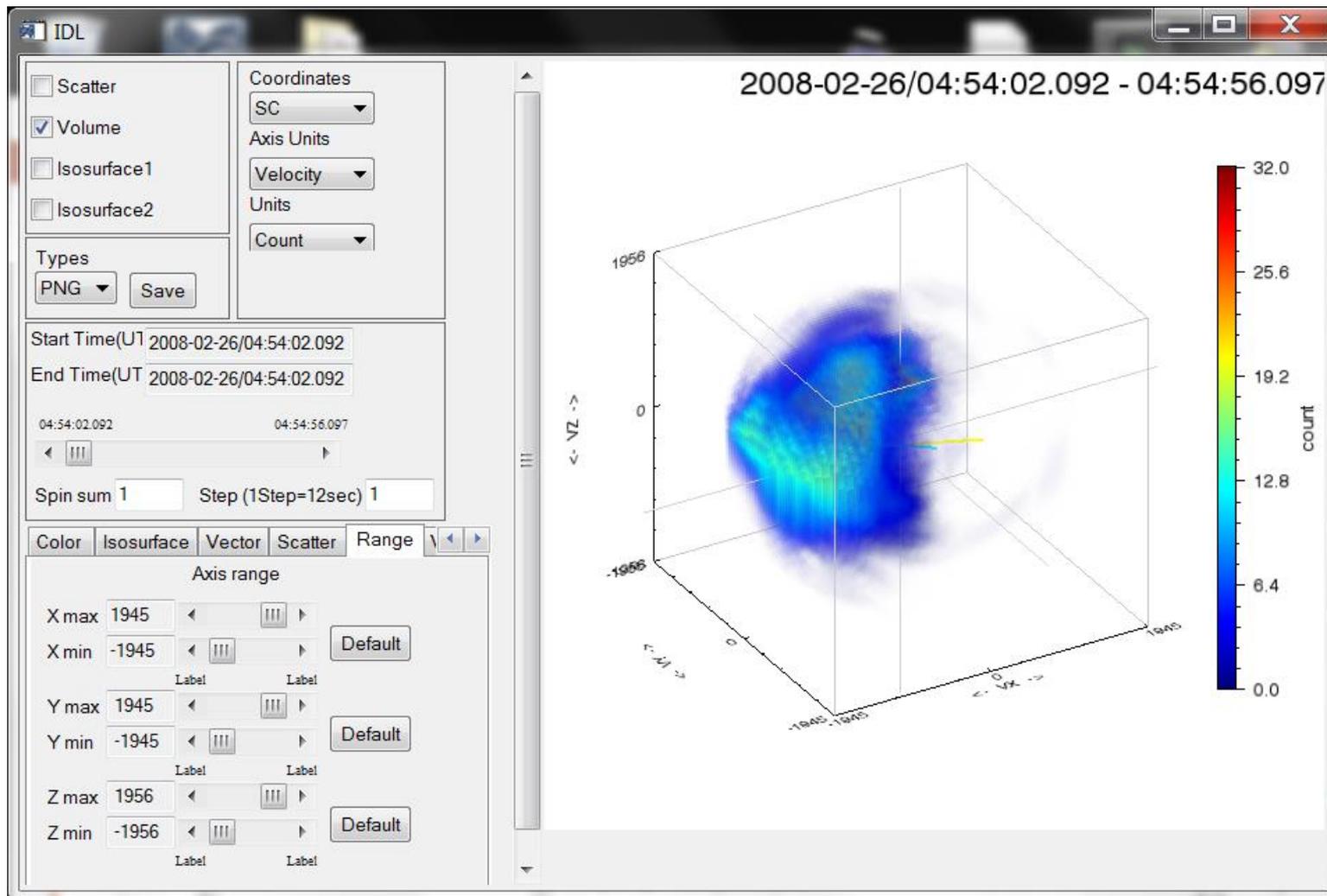
- What is the current status of SPEDAS development?
 - SPEDAS 2.00 (final) was released in June 2017
 - SPEDAS 2.00 includes the new ISEE 3D tool for visualizing particle distributions
 - SPEDAS 2.00 now supports the new Heliophysics API
 - Many load routines have been updated to work with data sources that enforce HTTPS-only downloads (e.g. CDAWeb, NOAA, LASP, etc)
 - The THEMIS, MMS, ERG, IUGONET, and BARREL plugins have been updated with the latest code from each development group.
- SPEDAS 2.00 includes GUI tools for loading data for any mission supported by CDAWEB; support for loading various geomagnetic indices, and an interface to the GEOPACK magnetic field modelling library.



- The interface between plugins and the SPEDAS GUI has been simplified. Formerly, each feature (e.g. the “Load Data” panel, the “Configuration Settings” panel, the “Plugins” menu) required a separate configuration file, with information about all plugins that use that feature. So adding a new plugin required manual edits to several files, which doesn’t scale well as additional “hooks” are added to SPEDAS. The new system uses a single configuration file per plugin, so that installing a plugin is more of a “drag and drop” operation.
- Before SPEDAS 2.00, the “Data Analysis” panel was somewhat specific to THEMIS (especially regarding the set of coordinate transforms supported). We have generalized this panel so that each plugin can use this interface to expose their preferred set of coordinate transforms and other tools.



ISEE 3D settings panel (using THEMIS data)

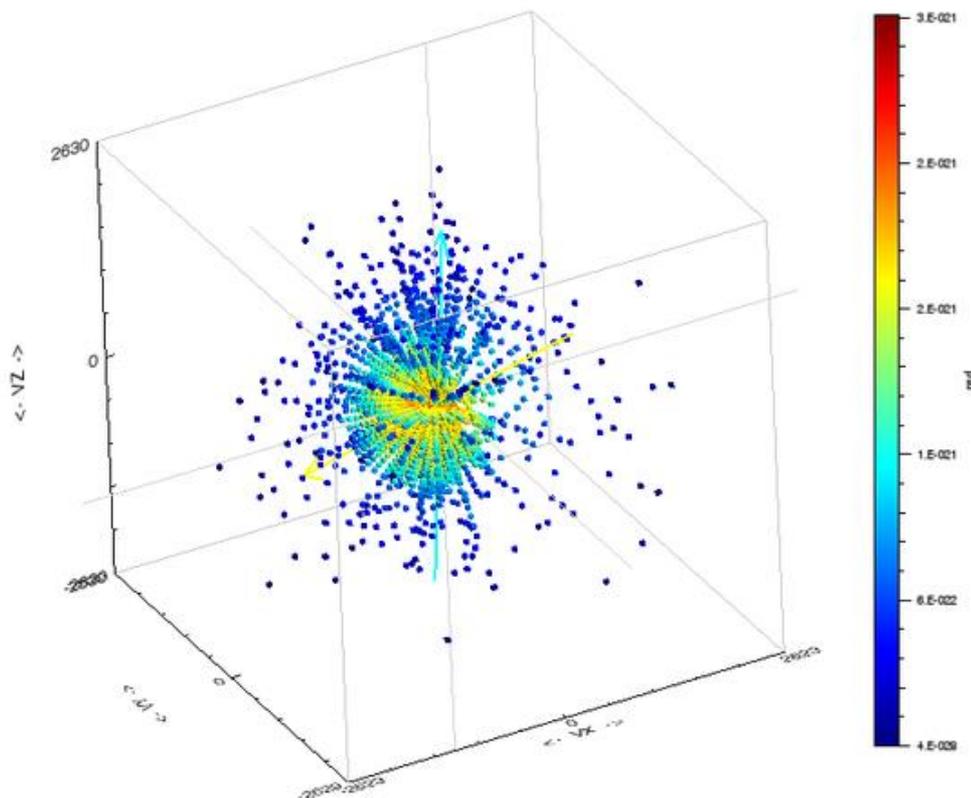




ISEE 3D: MMS FPI ion scatter plot



2015-10-20/05:56:35.957 : velocity

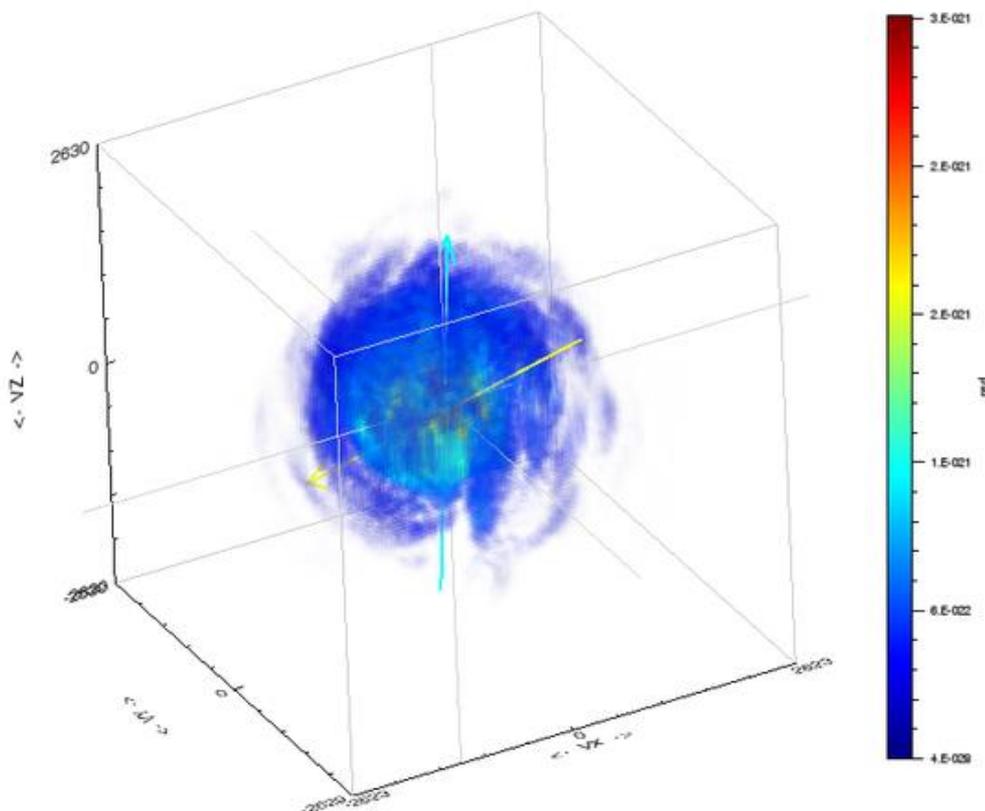




ISEE 3D: MMS FPI ion volume plot



2015-10-20/05:56:35.957 : velocity

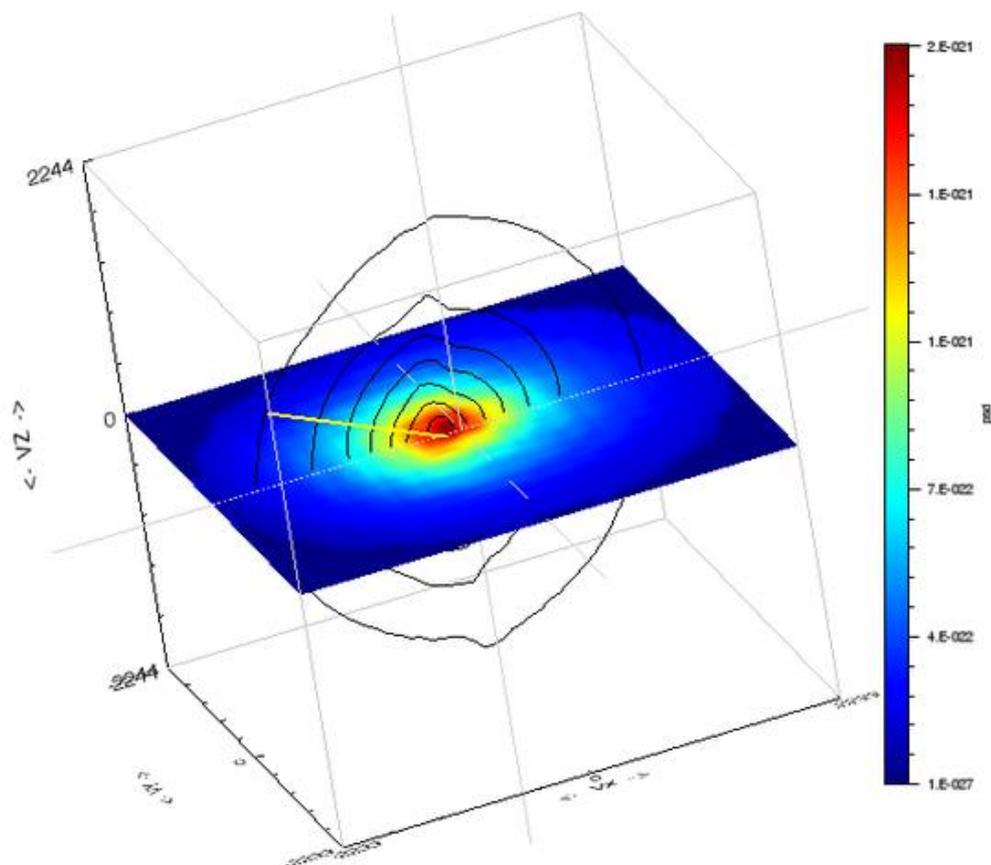


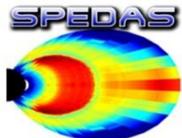


ISEE 3D: MMS FPI ion contours



2015-08-15/12:50:03.923 - 12:50:57.923 (velocity)





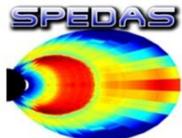
Loading CDAWeb Data



To Load CDAWeb Data:

- Select 'Load Data using CDAWeb' under the File menu
- Select Mission Group (i.e., TWINS, Cluster, RBSP, etc.)
- Select the Instrument Type
- Click 'Find Datasets'
- Select variable or dataset to download
- Click 'Get CDAWeb Data'

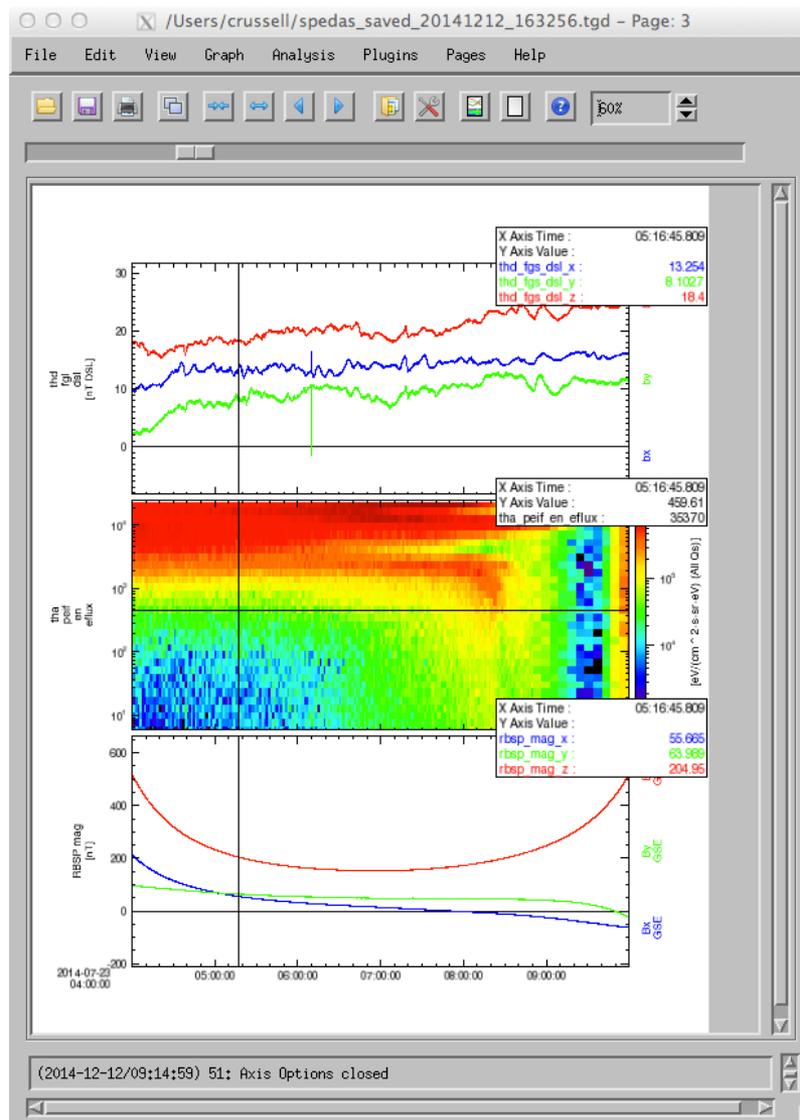


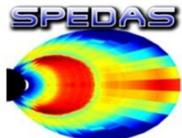


THEMIS and RBSP Plots



- With a few clicks of the button the user can load, analyze, and plot data.
- Interactive Capabilities





SPEDAS Mini Language



- Simple scripting language has been written in IDL.
- This language allows access to some data analysis functionality in the IDL virtual machine and eases manipulations of time series (tplot) data
- This language allows composition of statements and functions with order of operations to give significant flexibility in statement construction

Examples:

1: Position to RE:

```
calc,"tha_pos_re" = "tha_state_pos"/6374.4'
```

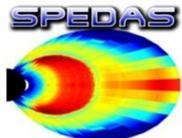
2: Natural log of total esa density:

```
calc,"tha_density_log"  
=ln("tha_peir_density"+"tha_psif_density")'
```

3: Average magnetic pressure:

```
calc,'Pb_avg = mean(0.01*total("tha_fgs_dsl"^2,2)/25.132741)'
```

Additional examples can be found in [general/examples/crib_calc.pro](#)



Data Analysis



Available Data

Active Data

Loaded Data

- G15
 - FGM
 - g15_BTSC_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_BTSC_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsc_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsc_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsens_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_Bsens_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_HT_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_HT_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_2 [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_x_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_y_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - g15_H_enp_1_z_dpwrsp [2014-07-23/2014-07-24/00:00:00]
 - MAGED
 - POES/MetOp
 - NOAA15
 - NOAA19

Active Data

- g13_H_enp_1: 2014-07-23/00:00:00 to 2014-07-24/00:00:00
- g15_H_enp_1: 2014-07-23/00:00:00 to 2014-07-24/00:00:00

Common Functions

- Subtract Average
- Subtract Median
- Smooth Data...
- High Pass filter...
- Block Average...
- Clip...
- Deflag...
- Degap...
- Interpolate...
- Clean Spikes...
- Time Derivative...
- Wavelet Transform...
- Power Spectrum...
- Coordinate Transform...
- Split Variable
- Join Variables...

Clear Active Done

(2014-12-12/07:24:48) 10: Bad Selection, Please try again

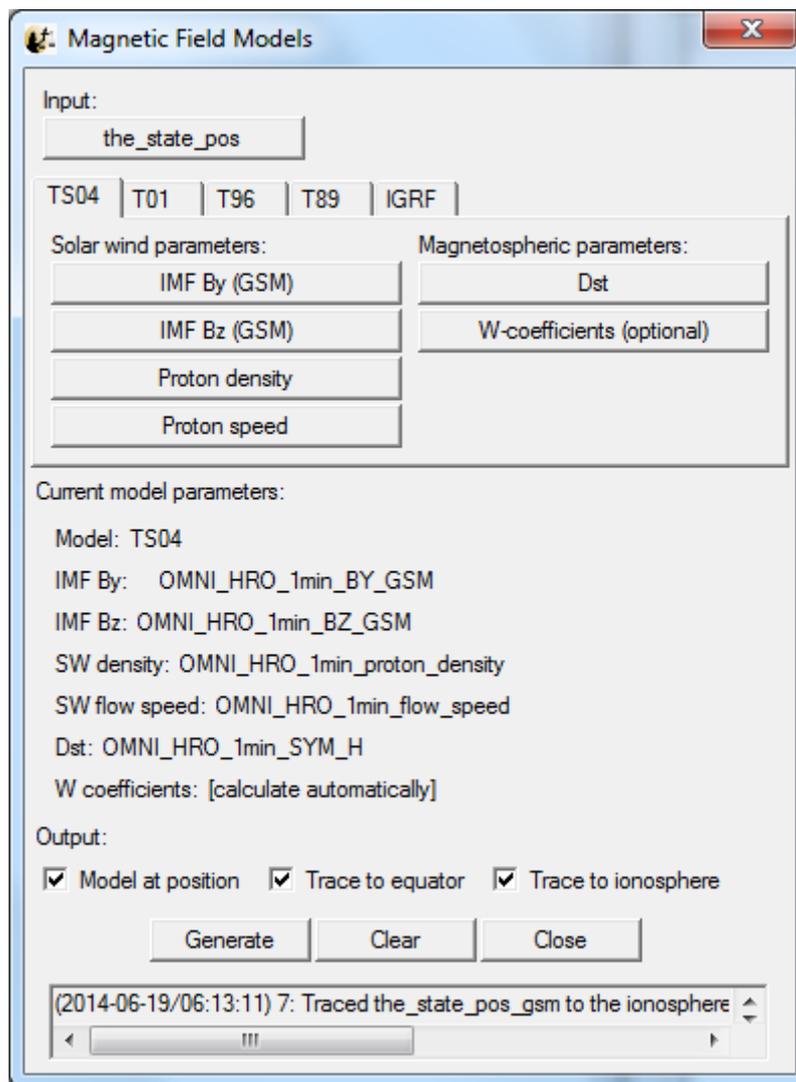


Magnetic Field Models



The GUI is now able to:

- Model the field at the spacecraft position
- Trace field from position to the ionosphere and equator





Load Data panel (MMS plugin tab)



MMS

POES THEMIS THEMIS Derived Products WIND

ACE BARREL ELFIN Lomo FAST GOES Geomagnetic Indices IUGONET MAVEN_PFP MMS OMNI

MMS Data Selection:

Start Time: 2007-03-23/00:00:00

Stop Time: 2007-03-24/00:00:00

Use Single Day

Instrument Type: FGM

| Probe: | Data Rate: | Level: | Data Type: |
|--------|------------|--------|------------|
| MMS 1 | svvy | L2 | |
| MMS 2 | brst | | |
| MMS 3 | | | |
| MMS 4 | | | |

Clear Probe Clear Rate Clear Levels Clear Type

Data Loaded:

- Geomagnetic Indices
 - Kyoto
 - WDC
 - kyoto_dst [2007-03-23/00:00:00 to 2007-03-24/00:00:00]

Delete All Data

Done

0: Status information is displayed here.



Configuration settings panel (THEMIS plugin tab)



Configuration Settings

SPEEDAS | BARREL | GOES | Geomagnetic Indices | MAVEN_PFP | OMNI | POES | **THEMIS** | WIND

Local data directory:

Remote data directory:

Download Data: Automatically Use Local Data Only

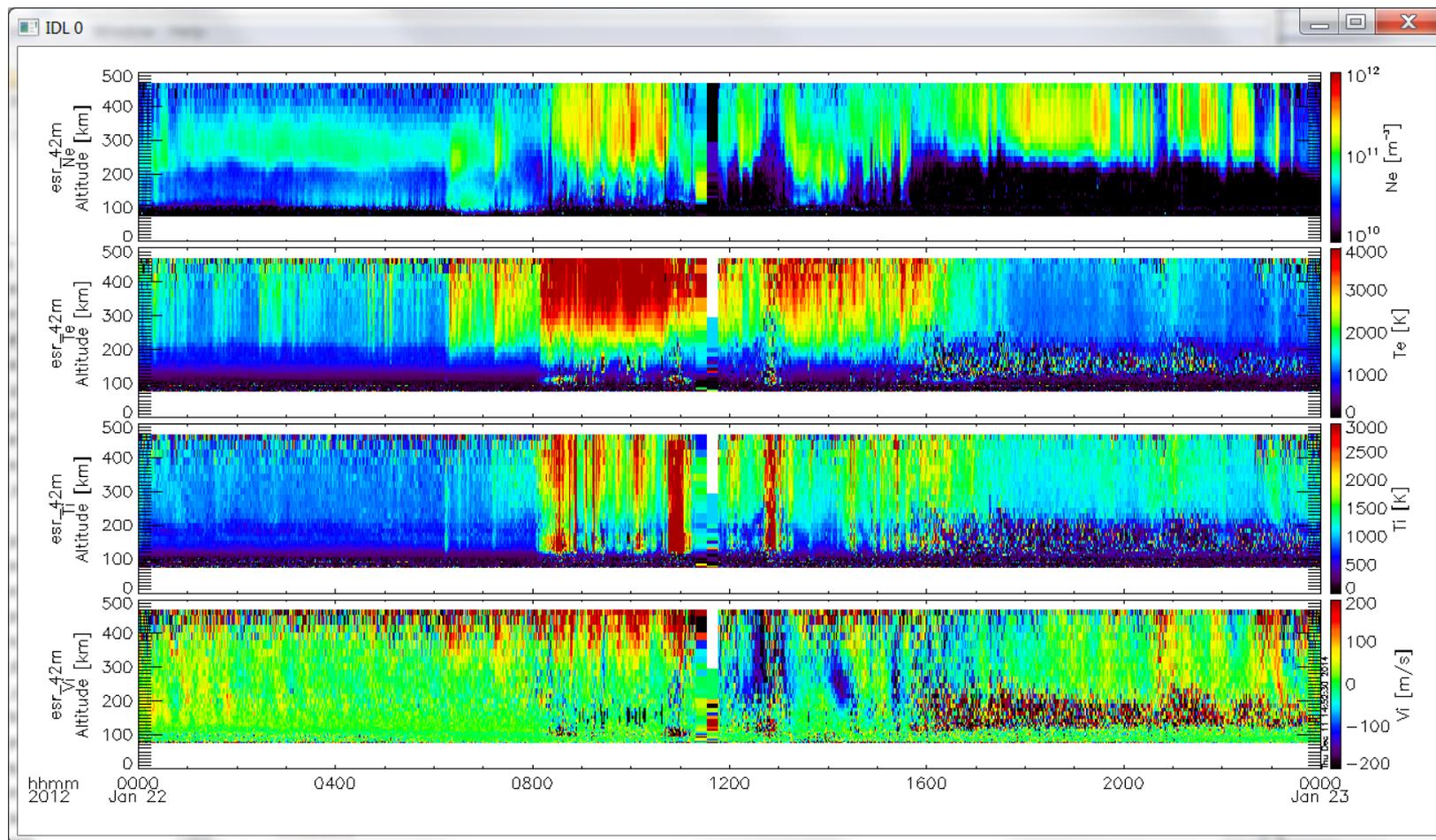
Update Files: Update if Newer Use Local Data Only

Load into GUI: Load data Download Files

Verbose (higher value = more comments):

0: Status information is displayed here.

→ crib_iugonet_20120122sc.pro



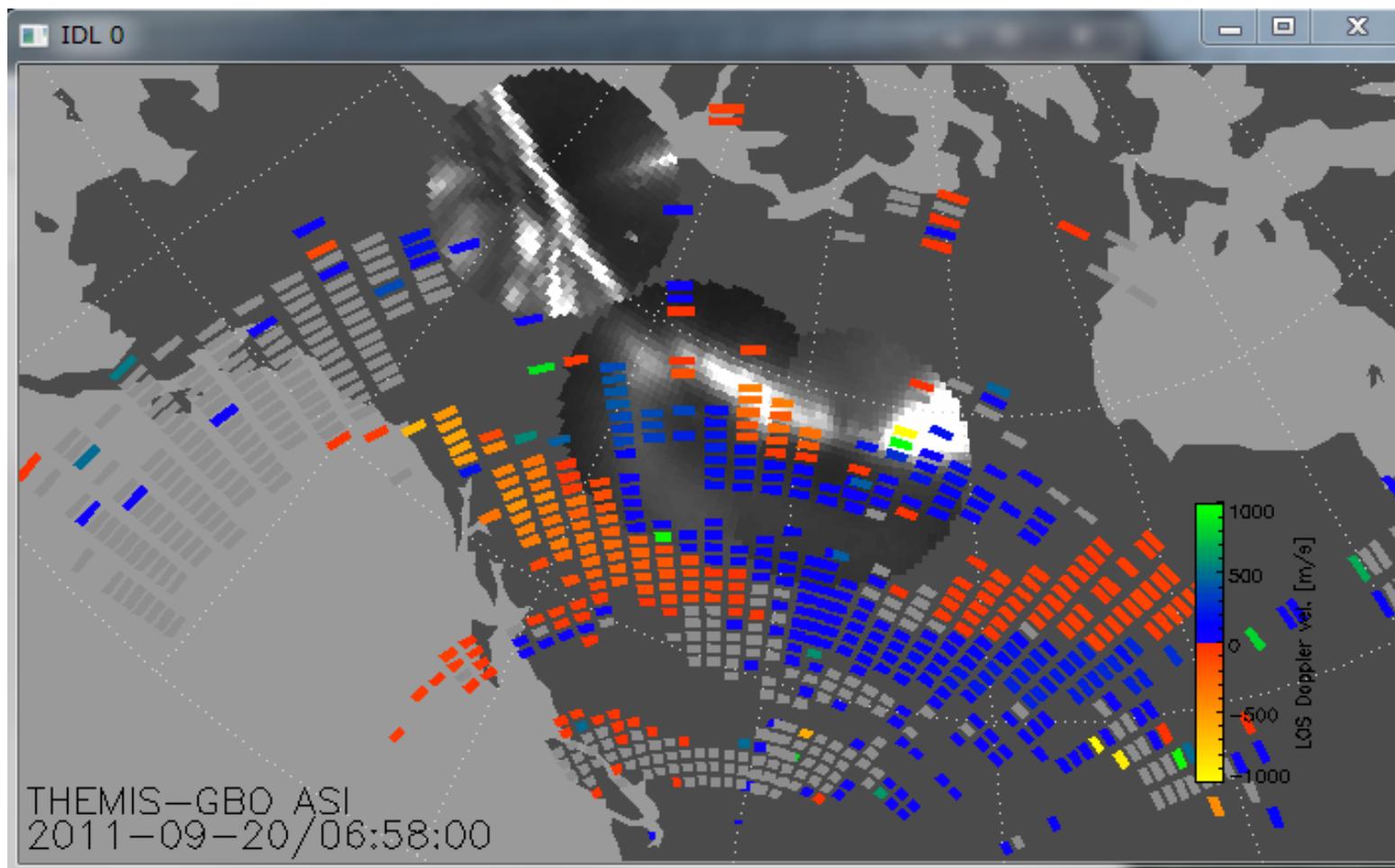
Yoshimasa Tanaka



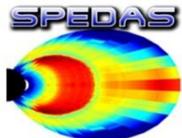
THEMIS ASI / SuperDarn Radar



→ `erg-sc_crib_thmasi_sd_sample`

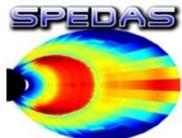


Tomo Hori



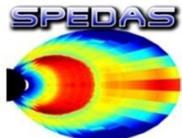
• SPEDAS Development Roadmap

- SPEDAS 2.00 was released in June 2017
- It includes the latest versions of the THEMIS, MMS, IUGONET, ERG, and BARREL plugins.
- Future SPEDAS versions will include expanded support (including a GUI panel) for downloading via the new Heliophysics API
- Our QA procedures, release schedule, and set of deliverables need a bit more flexibility to keep up with new plugins as they are released or updated.
- In future releases, we hope to expand the scope of some mission-specific tools (for example, particle moments, 2-D and 3-D visualization tools, spectrograms, pitch angle distributions) to more generic solutions that can be applied to multiple missions.
- We continue to work closely with other projects, to support integrating their software tools into SPEDAS as plugins or core capabilities.
- We plan to include support for additional missions and data sets: ICON, GOLD, DSCOVR, LANL-GEO
- We are looking into the possibility of porting some SPEDAS capabilities to Python



• SPEDAS Development Roadmap

- Currently, all crash reports and help requests are routed to the THEMIS science support address, even if the crash or problem occurs in some other plugin. Future releases should allow each plugin to define its own error handlers and reporting policy.
- We have conducted several WebEx tutorial sessions covering various capabilities of the SPEDAS software and plugins. These sessions allow us to go into far greater detail into the nuts and bolts of using SPEDAS for realistic data processing tasks.
- We will be looking into implementing more tools to support exporting data as CDFs with standard metadata (ISTP, SPASE).



Spedas.org is now live!

SPEDAS and plugin downloads

Documentation wiki

Mailing list

Blog

Google group (<https://groups.google.com/forum/#!forum/spedas>)

We welcome plugin developers to contribute content and participate in discussions on the SPEDAS site! (Registration required for wiki and blog edit privileges; please contact Jim Lewis (jwl@ssl.Berkeley.edu) to gain access).



SPEDAS Wiki

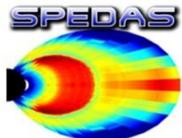


Introduction:

- You Tube Channel
- SPEDAS video
- Introductory Examples
- Screen shots

The screenshot shows the SPEDAS Wiki main page. The browser address bar is spedas.org/wiki/index.php?title=Main_Page. The page has a sidebar with navigation links like 'Main page', 'Community portal', and 'Recent changes'. The main content area has a 'Main Page' heading and a 'Contents' table of contents with links to 'Introduction', 'Downloads', 'Missions', 'Documentation', and 'External Resources'. Below this is a 'Welcome to SPEDAS' section with a paragraph of introductory text, a bulleted list of features, and a screenshot of the 'SPEDAS Graphical User Interface' showing multiple data plots. At the bottom, there is an 'Introduction' section with a list of links to introductory videos and examples.

spedas.org/wiki



SPEDAS Downloads



Select:
1.2 Downloads
From Main
Page

File Edit View History Bookmarks Tools Help

Zimbra: Inbox x cindy.russell@rocketmail.c... x Google Calendar x Downloads - SPEDAS Wiki x +

spedas.org/wiki/index.php?title=Downloads

Most Visited Zimbra Yahoo Maps THEMIS GMAG UCLA Bank Dictionary BBB Travelocity Spanish Weather Gmail AmEx Google Calendar GMAT User Guide

Version 1.00, August 2014

- Source code.** This is a zip file with all the SPEDAS IDL source code. To use it you need to have IDL installed. This is the only distribution that provides full access to the command line tools. If you have used TDAS in the past, this is probably the option you should use.
[* Download SPEDAS 1.00 source code \(13 MB\)](#)
- Save file.** This is suitable for users without an IDL license. It requires the IDL Virtual Machine (VM) which has to be downloaded for free from Exelis. There are limitations using the VM compared to the full IDL. This distribution only provides access to the GUI, and not the command line tools.
[* Download the SPEDAS 1.00 savefile \(14 MB\)](#)
- Executable files.** These zip files contain executable files that can be run directly without installing anything else. They include a Virtual Machine (VM) version of IDL and they open the SPEDAS GUI but they do not include a command line tool, nor the SPEDAS IDL source code. They also include Geopack. (Note: If you have downloaded a zip file before Dec 5th, 2014, then you should download it again. The new version contains small fixes.)
 - IDL 8.3**
 - [* Download SPEDAS 1.0 Executable, Windows 64bit, IDL 8.3, Geopack 9.3 \(52 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, MacOS 64bit, IDL 8.3, Geopack 9.3 \(60 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, Linux 64bit, IDL 8.3, Geopack 9.3 \(70 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, Linux 64bit, IDL 8.3, Geopack 7.6 \(70 MB\)](#)
 - IDL 7.1**
 - [* Download SPEDAS 1.0 Executable, Windows 64bit, IDL 7.1, Geopack 9.3 \(34 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, MacOS 64bit, IDL 7.1, Geopack 9.3 \(48 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, Linux 64bit, IDL 7.1, Geopack 9.3 \(53 MB\)](#)
 - [* Download SPEDAS 1.0 Executable, Linux 64bit, IDL 7.1, Geopack 7.6 \(53 MB\)](#)

The Enhancement Lists for SPEDAS Version 1.00 can be found [here](#).

Installation on a Mac

Newer Mac OS X versions do not include the Y11 libraries. YQuartz (Y11) has to be downloaded and installed, or IDL will not work.

Firefox automatically sends some data to Mozilla so that we can improve your experience. [Choose What I Share](#)

spedas.org/wiki/index.php?title=Downloads