Online Analysis for STEREO's IMPACT Investigation: Lessons Learned

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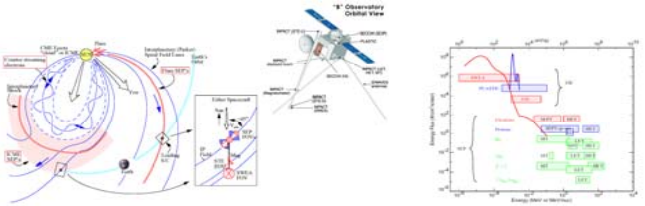
STEREO Mission Goals

Understand the causes and mechanisms of CME initiation

Characterize the propagation of CMEs through the heliosphere

Discover the mechanisms and sites of energetic particle acceleration in the low corona and the interplanetary medium

Develop a 3D time-dependent model of the magnetic topology, temperature, density, and velocity structure of the ambient solar wind



IMPACT (In-situ Measurements of Particles and CME Transients) Basic Science Measurements:

Experiment	Instrument	Measurement	Energy or Mag. field range	Time Res.	Beacon Time Res. (*)	Instrument provider
SW	STE	Electron flux and anistropy	2-100 keV	10 s	5E, 60s	UCB (Lin)
	SWEA	3D electron distrib., core & halo density, temp. & anisotropy	~0-3 keV	3D=30 s 2D=8s Mom.=2s	60s	CESR (Sauvaud) + UCB (Lin)
MAG	MAG	Vector field	±500nT, ±65536 nT	1/8 s	10s	GSFC (Acuna)
SEP	SIT	He to Fe ions	0.03-5 MeV/nuc	30 s	4E, 60s	U. of Md. (Mason) + MPAE (Korth) + GSFC (von Rosenvinge)
		^{3}He	0.3-0.8 MeV/nuc	30 s	----	
	SEPT	Diff. electron flux	30-400 keV	1 min	3E, 60s	U. of Kiel (Mueller-Mellin) + ESTEC (Sanderson)
		Diff. proton flux	60-7000 keV	1 min	3E, 60s	
		Anistropies of e,p	As above	1 min	----	
	LET	Ion mass numbers 2-28 & anisotropy	2-40 MeV/nuc	1 min.	3E, 60s	Caltech (Mewaldt) + GSFC (von Rosenvinge) + JPL (Wiedenbeck)
		^{3}He ions flux & anistropy	2-15 MeV/nuc	1 min.	2E, 60s	
		H ions flux & anistropy	2-13 MeV	1 min.	2E, 60s	
	HET	Electrons flux	1-6 MeV	1 min.	1E, 60s	GSFC (von Rosenvinge) + Caltech (Mewaldt) + JPL (Wiedenbeck)
		H	13-100 MeV	1 min.	3E, 60s	
		He	13-100 MeV	1 min.	3E, 60s	
		^{3}He	15-60 MeV/nuc	1 min	----	
	SEP Common	----	----	----	----	Caltech (Mewaldt) + GSFC (von Rosenvinge)
IMPACT Common	IDPU (+Mag Analog)	----	----	----	----	UCB (Curtis)

Some Lessons Learned the Hard Way

- **Overarching Theme: New missions often plan data management strategies and form realistic plans after instruments are delivered. This is typically too late. Data management must be thought through and accounted for early in the design process to be effective. Similar issues are true for existing missions who are overhauling their systems.**
- **A huge variety of web based tools have made it relatively easy to automate sophisticated data delivery systems. Yet pitfalls remain.**
- **Serve data locally or remotely? If your system depends upon data from another site you are faced with the decision of linking to the offsite source or copying the data you need.**
- **Referring to offsite data: Sadly, web links (URLs) tend to be ephemeral. It is all too easy for an institution to change the name of a server or modify the data organization on a server.**
- **Different organizations in a single mission can come up with wildly different file hierarchies and naming protocols.**
- **Another option is to copy data from the remote site and then serve it from a local server that you control. This can easily lead to copyright or intellectual property issues.**
- **Scientific data is often refined over the course of a mission and by taking a snapshot of the data you may inadvertently be serving an outdated copy of the data.**
- **Static or dynamic pages? Web tools (such as PHP) can parse a user's data request, scan the available data, and serve up web pages that are customized for that user. Such systems are often nice in that a single set of source code can be modified and it will reflect any changes over the entire available data set. A disadvantage is that they can turn into a maintenance problem if the internal algorithms aren't properly designed.**
- **Data availability. Some missions produce large blocks of data at relatively infrequent intervals. Others produce smaller blocks of data at more frequent intervals. Automated tools provide a relatively easy mechanism to check for the availability of new data.**
- **A mission can greatly simplify this process by carefully designing naming and file archiving conventions to ease the web designers task of checking data availability.**

Data Products and Data Browsers Designed For a Wide User Community

URLs for Data Access

Main IMPACT Portal: http://sprg.ssl.berkeley.edu/impact
Level 1 Data Access: http://stereo.ssl.berkeley.edu
Level 2 Data Access: http://www-ssc.igpp.ucla.edu/forms/stereo/plot_PLASTIC.html
MAG ASCII/Plot Site: http://www-ssc.igpp.ucla.edu/ssc/stereo/
LET ASCII Site: http://www.srl.caltech.edu/STEREO/Level1/LET_public.html

Currently Available Level 1 Data Holdings

- **STE – Data through 9/30/08**
- **SWEA – Data through 9/30/08**
- **MAG – Data through 9/30/08**
- **LET – Data through 10/31/08**
- **SEPT – Data through 5/31/08**
- **SIT – Data through 5/31/08**
- **HET – Level 2 Data through 1/31/08**

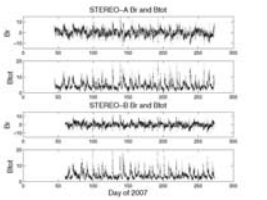
IMPACT Data Products Include:

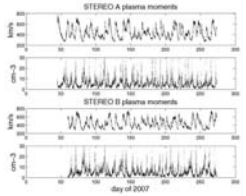
- **Beacon - 24/7 Near Real Time Data available in many formats (CDF, ASCII, FITS, netCDF, CDFML) thru interfaces at UCB/SSL and the STEREO Science Center at GSFC**
- **Level 1 - Highest Time Resolution Data available in many formats (same as for Beacon) thru interface at UCB/SSL**
- **Level 2 - Key Parameter Data available in ASCII format thru interface at UCLA/IGPP and merged with data from PLASTIC**
- **Level 3 - Event Lists in ASCII format thru UCLA/IGPP**

IMPACT Data Browsers Include:

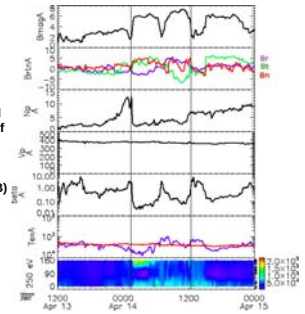
- **Integrated in-situ and imaging Beacon browser thru STEREO Science Center at GSFC**
- **Level 1 "static plots" with contextual linkages to images, models, S/WAVES, and GOES data at UCB/SSL**
- **Level 1 and In-situ specific Beacon browsers at UCB/SSL including IMPACT and PLASTIC and SWAVES data and complementary data sets from the Wind and ACE missions based on a CDAWeb-like design allowing for on-the-fly plotting and file translation using ION Script and UCB's TPLOT package**
- **Level 2 browser based on existing interface at UCLA/IGPP designed for quick and easy data browsing**

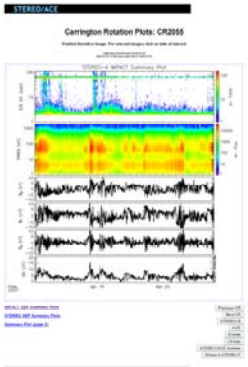
Level 2 (Merged) Data Set at UCLA



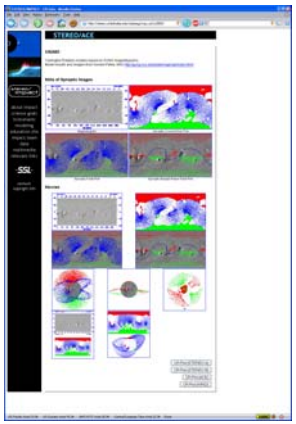


IMPACT TPLOT extensions used in the analysis of ejecta in the solar wind (courtesy of E. Huttunen at UCB)



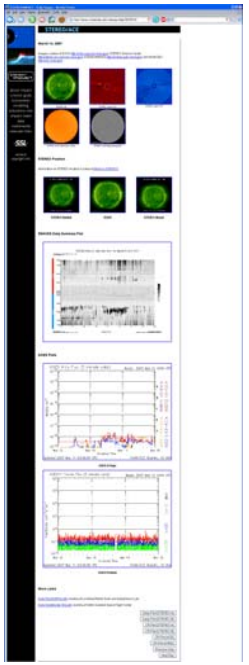


Level 1 Data Browser Sample Basic Plot



Level 1 Data Browser GONG/Models Connection (Courtesy of Gordan Petrie, NSO)

Level 1 Data Browser Recently Upgraded!
Carrington Rotations 2051 – 2077 available through Level 1 data browser



Level 1 Data Browser Solar Data Connection

For more information, contact Peter Schroeder at peters@ssl.berkeley.edu or visit http://sprg.ssl.berkeley.edu/impact