



**Data Services and  
Analysis Tools for SEP Events and  
Related EM Emissions**

# Comparison of SEP measurements within the SEPServer project

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for the  
SEPServer Consortium



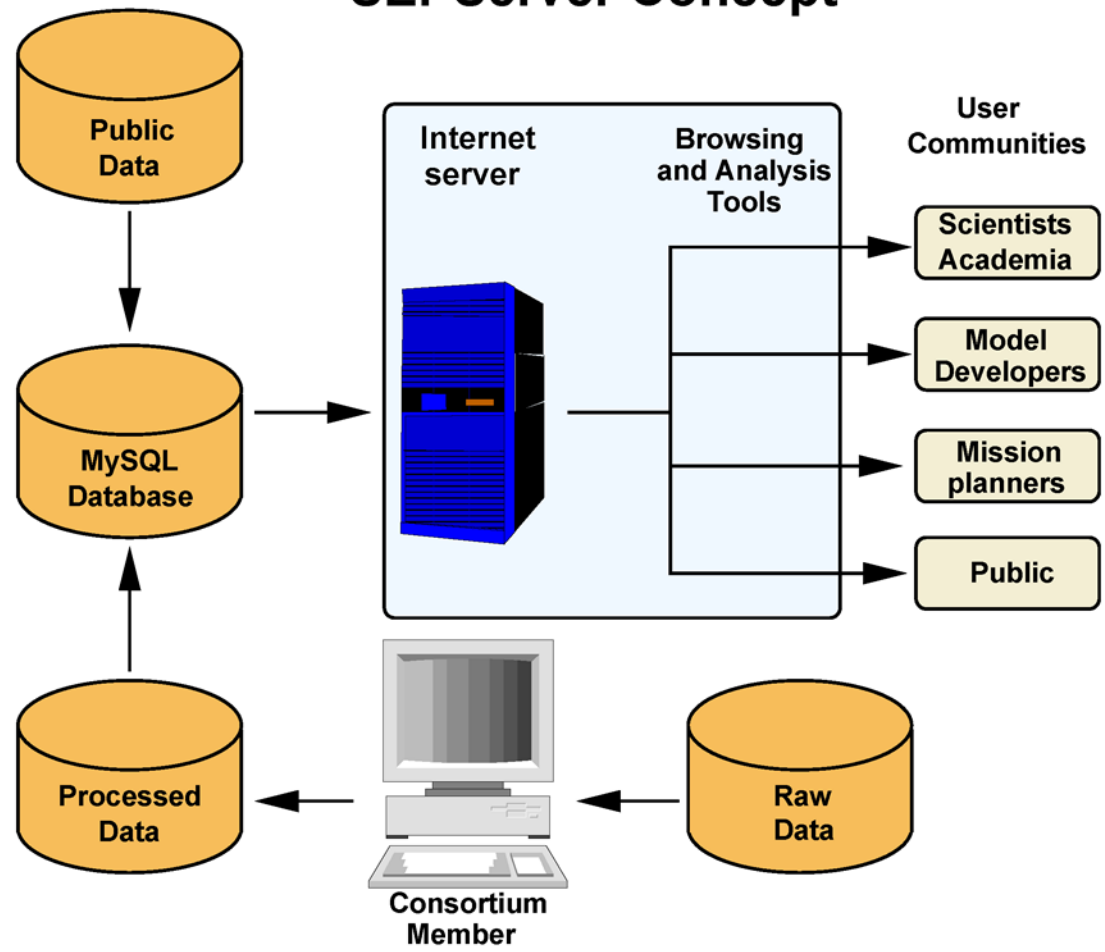
# Project overview

- A three-year FP-7 Collaborative Project to Develop a Server for Delivery of Data and Models for Solar Energetic Particle Events.
- European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no 262773.
- Consortium of 11 teams: University of Helsinki (Finland), Christian Albrechts Universität zu Kiel (Germany), Centre National de la Recherche Scientifique (France), Universitat de Barcelona (Spain), University of Turku (Finland), University of Oulu (Finland), Julius Maximilians Universität Würzburg (Germany), National Observatory of Athens (Greece), University of Ioannina (Greece), Astrophysikalisches Institut Potsdam (Germany), DH Consultancy (Belgium).
- Time frame: December 2010–November 2013. EU budget: ~2M€.
- Project web site: <http://www.sepserver.eu/>
- Data server: <http://server.sepserver.eu/>



# Data server

## SEPServer Concept



The SEPServer application server uses the ESA Open Data Interface (ODI) to store and manage the various datasets.

# SEP Server SEP particle data

- Data from eleven instruments on six missions



- Data types dependent on mission and instrument
  - Electron, proton, helium, heavy ion intensities
  - Omnidirectional or sectorized intensities



# Data quality assessment

- Documentation: Data Delivery Report

- Mission and spacecraft descriptions
- Detailed instrument descriptions
- Summaries of delivered data sets
- Quality assessment of the data of each individual instrument
- Comparisons of data from various instruments



SEP Data Delivery Report

SEPSERVER-010-00-CAU-WP2  
Issue 1; Rev. 1  
Date: 24.9.2013  
Page: 1 (70)

## SEPServer

### Solar Energetic Particle Data Delivery Report

#### Mission description and data comparison

Deliverable D2.2

	Name	Signature	Date
Prepared by	B. Heber, E. Valtonen, O.E. Malandraki, A. Papaioannou, P. K. Marhavidas, W. Dröge		24.9.2013
Checked by	E. Valtonen and A. Afanasiev		24.09.2013
Approved by	R. Vainio		

#### DISTRIBUTION

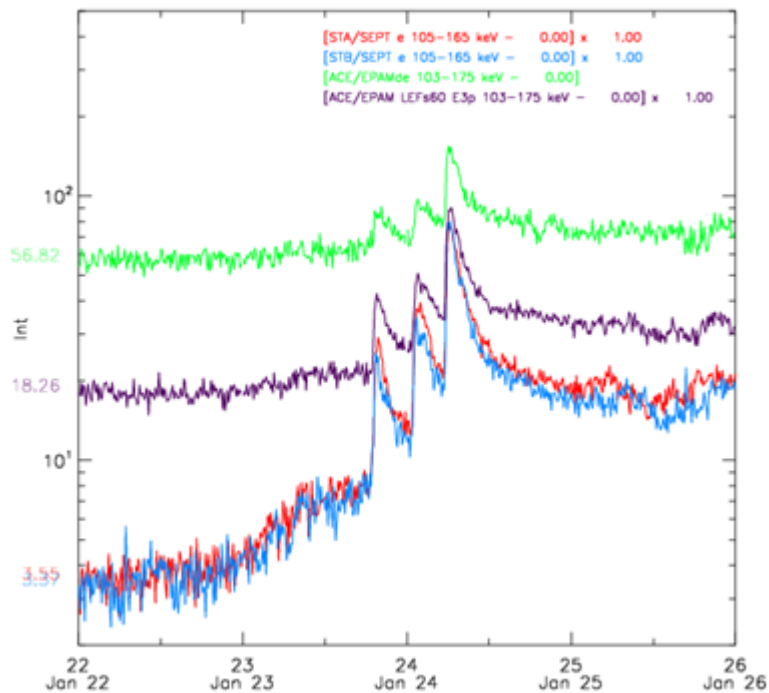
Name	Organisation



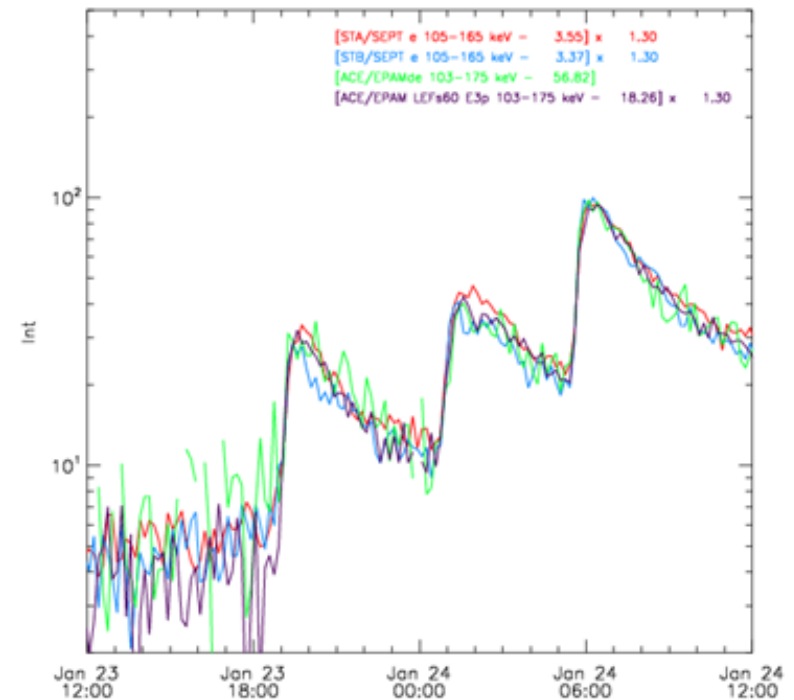
# Comparison of data available from SEP Server

- Comparison of electron intensities measured by STEREO/SEPT and ACE/EPAM
  - SEP events in January 2007

STEREO SEPT LEVEL2 DATA - 10min - omni / ACE EPAM  
Jan 22, 2007 00:00:00 - Jan 26, 2007 00:00:00



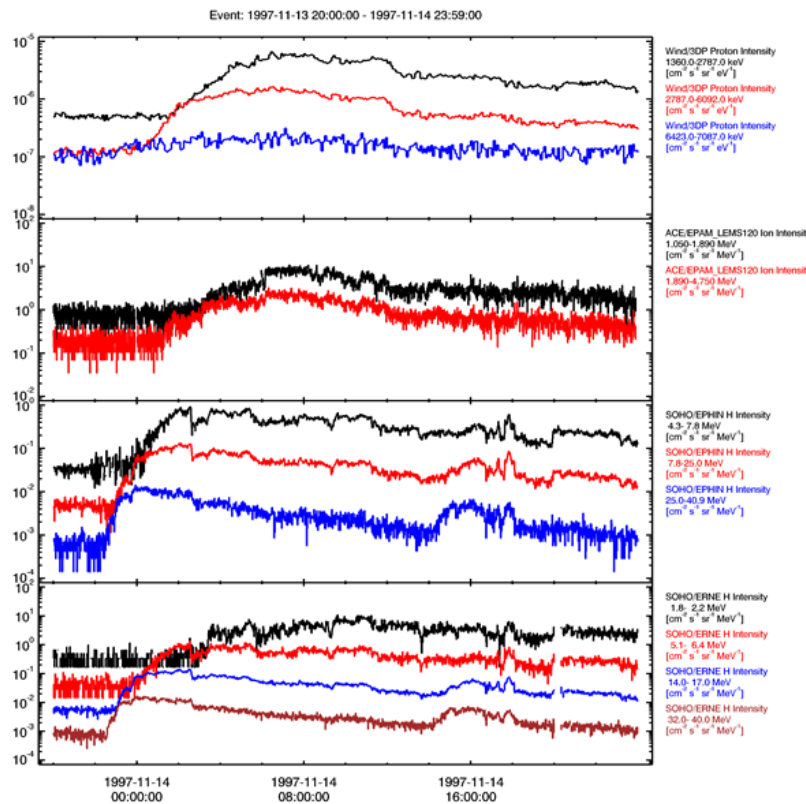
STEREO SEPT LEVEL2 DATA - 10min - omni / ACE EPAM  
Jan 23, 2007 12:00:00 - Jan 24, 2007 12:00:00





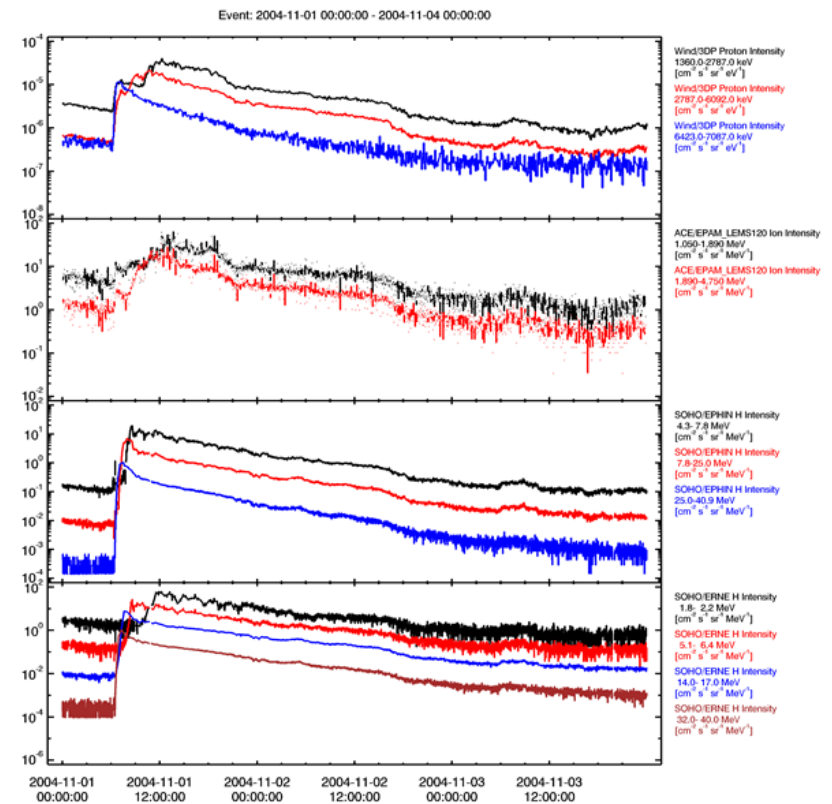
# Comparison of proton energy spectra

- SOHO/EPHIN, SOHO/ERNE, and ACE/EPAM
- Sample of different sizes of events: 13 November 1997, 27 May 1999, 01 November 2004, 14 July 2005



13 November 1997

©SEPServer



01 November 2004

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# Panel plot interface

**Add a new panel of type:** particle intensity ▾

**Plot panel 1**

**Optional axis label:**

**Plot scale:** logarithmic ▾

**Current content**

	Time Averaging	Data Filtering	
		Low	High
✗ ACE/EPAM 12s LEMS30 ion data: Ion Intensity (0.047-0.065 MeV)	<span>1 minute ▾</span>	<input type="text"/>	<input type="text"/>
✗ Wind/3DP 5m omnidirectional proton data: Proton Intensity (1360.0-2787.0 keV)	<span>no averaging ▾</span>	<input type="text"/>	<input type="text"/>
✗ SOHO/EPHIN 1m corrected data: H Intensity ( 4.3- 7.8 MeV)	<span>no averaging ▾</span>	<input type="text"/>	<input type="text"/>

**Select channels from dataset:** SOHO/ERNE 1m H, He data ▾

**H Intensity**

1.6- 1.8 MeV  
  1.8- 2.2 MeV  
  2.2- 2.7 MeV  
  2.7- 3.3 MeV  
  3.3- 4.1 MeV  
  4.1- 5.1 MeV  
 5.1- 6.4 MeV  
  6.4- 8.1 MeV  
  8.1- 10.0 MeV  
  10.0- 13.0 MeV  
  14.0- 17.0 MeV  
  17.0- 22.0 MeV  
 21.0- 28.0 MeV  
  26.0- 32.0 MeV  
  32.0- 40.0 MeV  
  40.0- 51.0 MeV  
  51.0- 67.0 MeV  
 64.0- 80.0 MeV  
  80.0-101.0 MeV  
 101.0-131.0 MeV

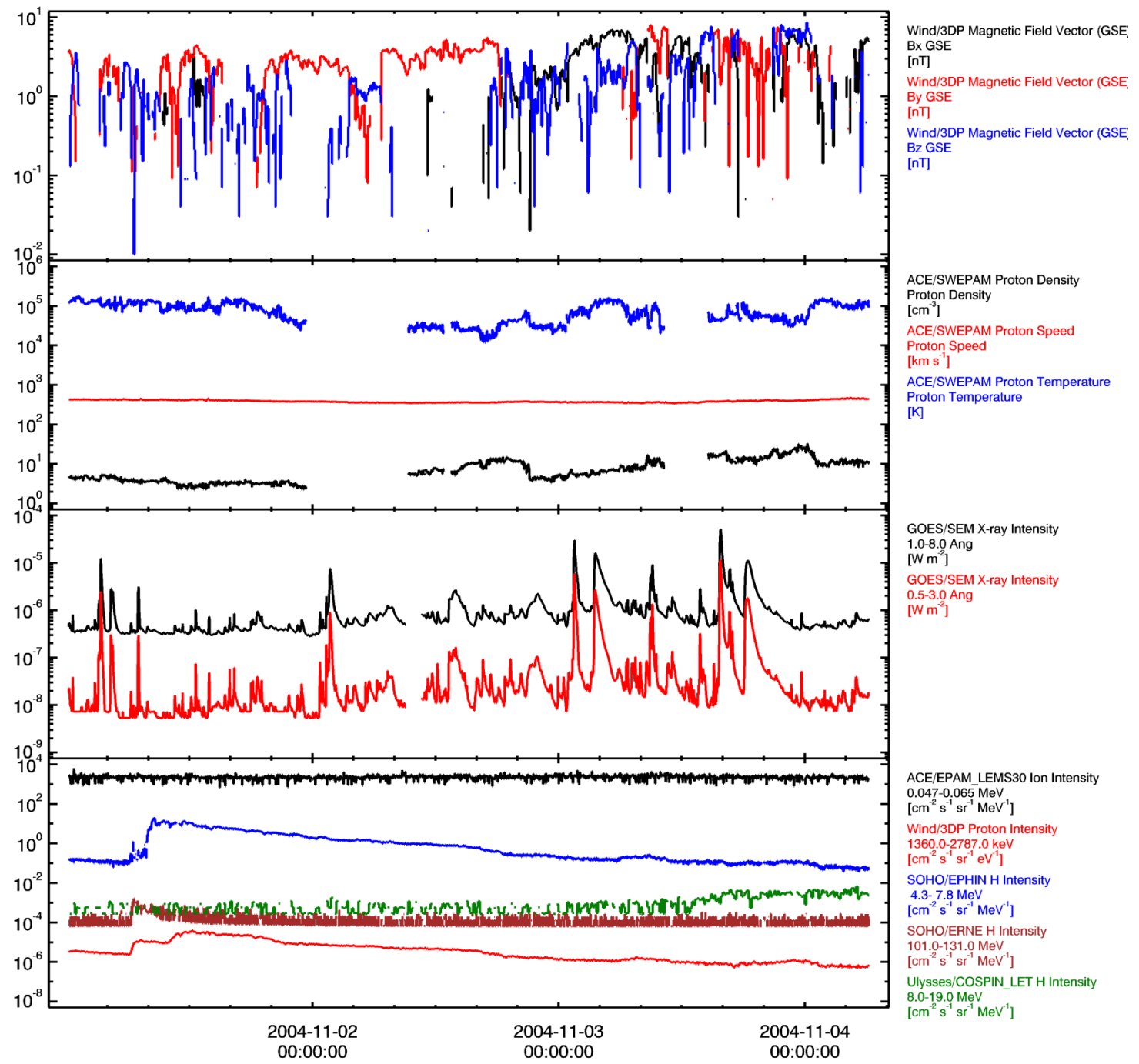
**He Intensity**

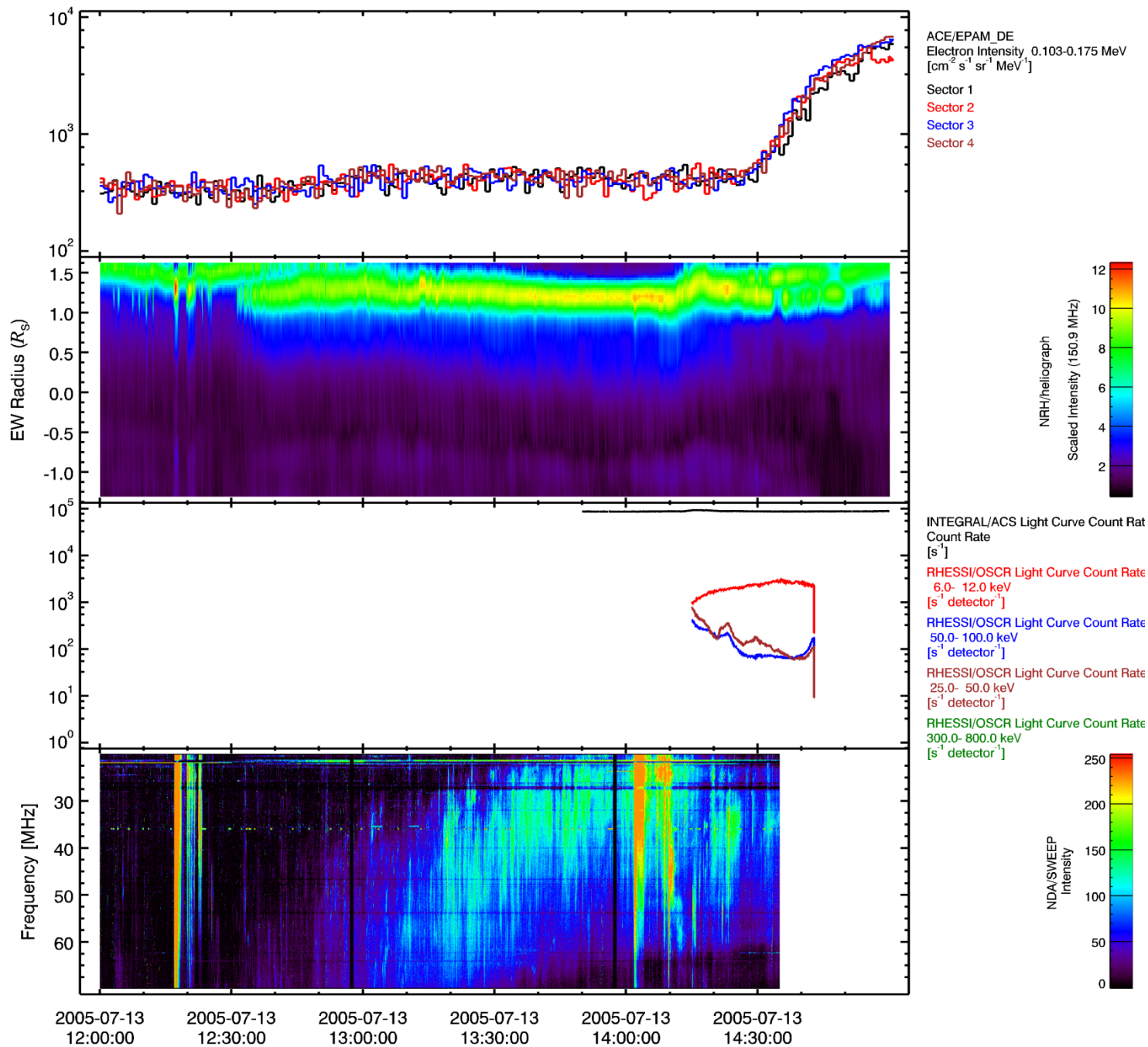
1.6- 1.8 MeV/nuc  
  1.8- 2.2 MeV/nuc  
  2.2- 2.7 MeV/nuc  
  2.7- 3.3 MeV/nuc  
  3.3- 4.1 MeV/nuc  
 4.1- 5.1 MeV/nuc  
  5.1- 6.4 MeV/nuc  
  6.4- 8.1 MeV/nuc  
  8.1- 10.0 MeV/nuc  
  10.0- 13.0 MeV/nuc  
 14.0- 17.0 MeV/nuc  
  17.0- 22.0 MeV/nuc  
  21.0- 28.0 MeV/nuc  
  26.0- 32.0 MeV/nuc  
 32.0- 40.0 MeV/nuc  
  44.0- 51.0 MeV/nuc  
  51.0- 67.0 MeV/nuc  
  64.0- 80.0 MeV/nuc  
 80.0-101.0 MeV/nuc  
  101.0-131.0 MeV/nuc

**Save Panel**

**Add/Update Selection**

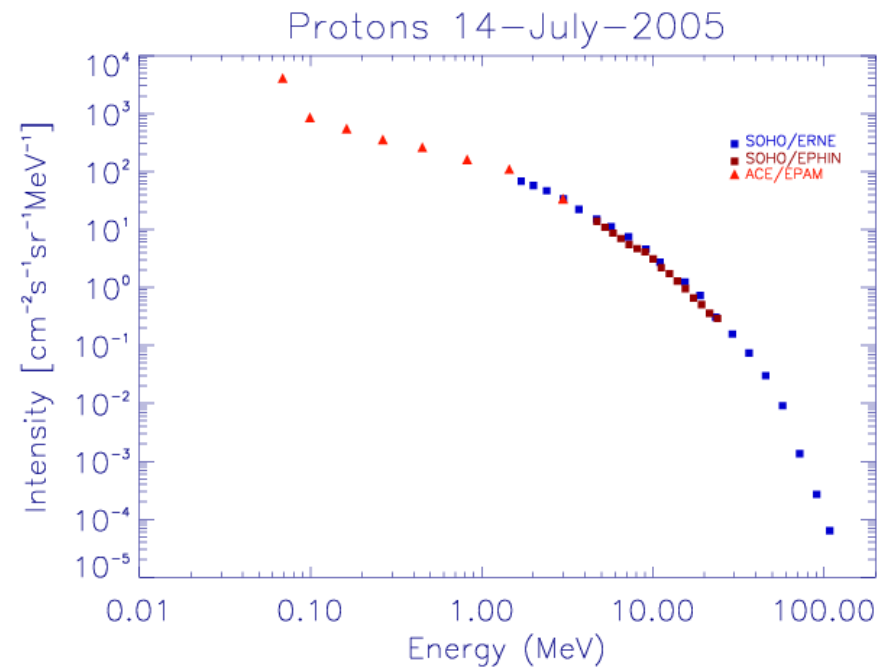
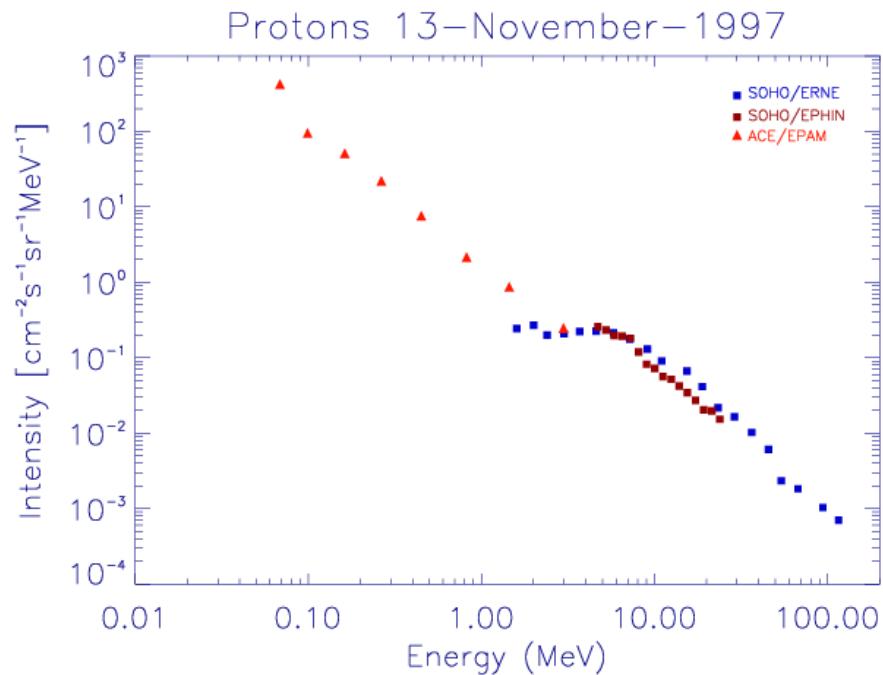






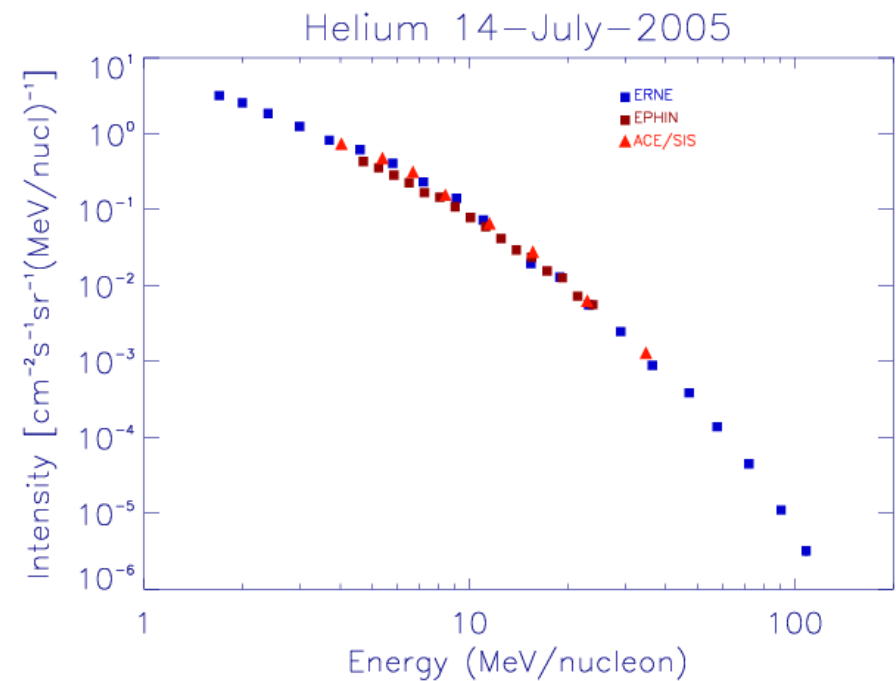
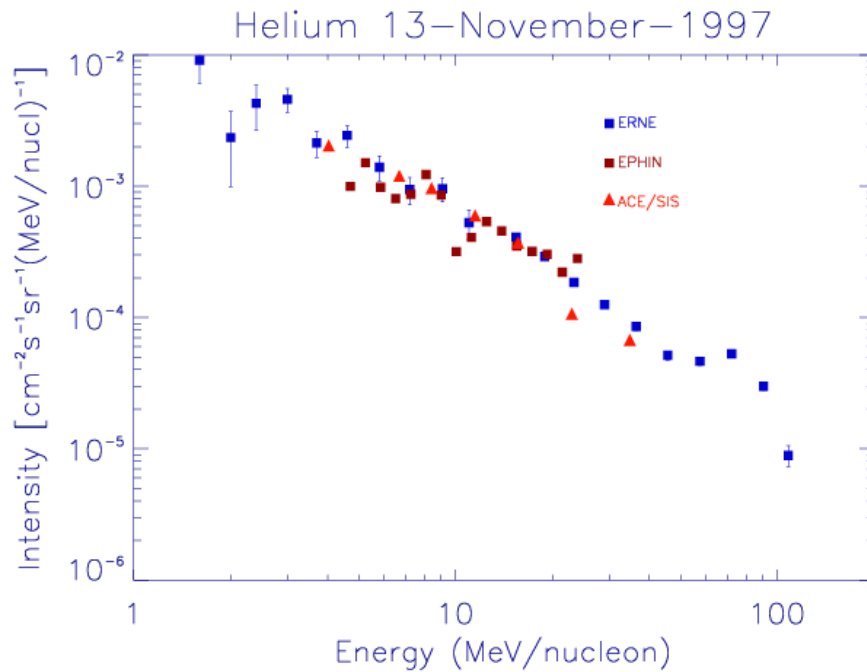


- Proton spectra measured by ACE/EPAM, SOHO/EPHIN and SOHO/ERNE: Worst and best case match





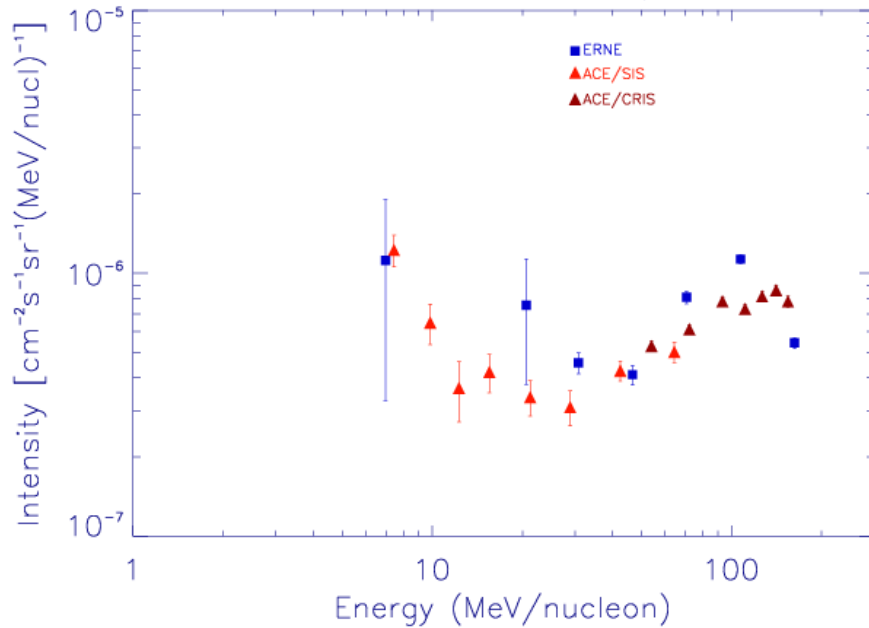
- Helium spectra for the events of 13-Nov-97 and 14-Jul-05 measured by SOHO/EPHIN, SOHO/ERNE, and ACE/SIS



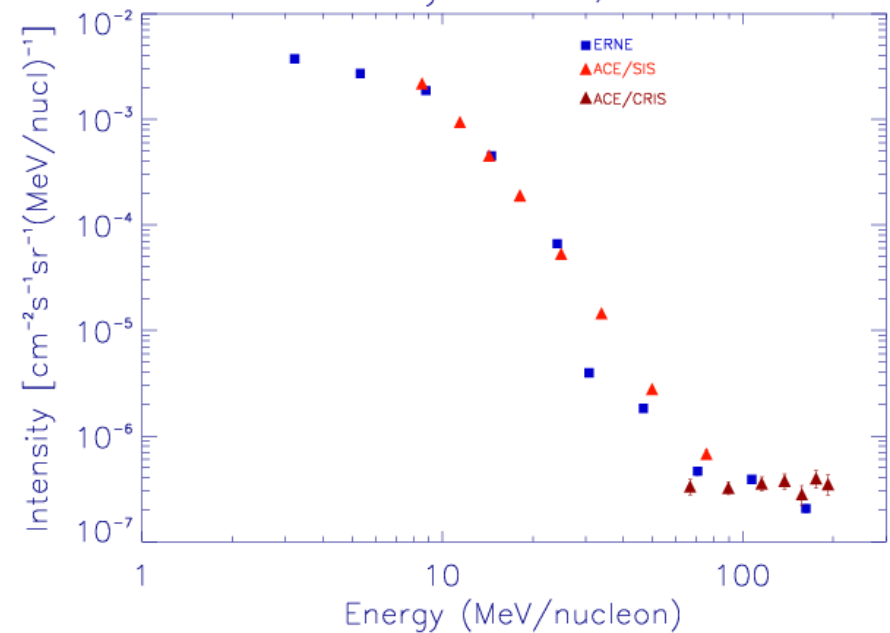


- Heavy ions measured by SOHO/ERNE, ACE/SIS, and ACE/CRIS
  - Carbon spectrum covering the event of November 13, 1997
  - Oxygen spectrum for the events of July 13-14, 2005

$^{12}\text{C}$  November 12–17, 1997



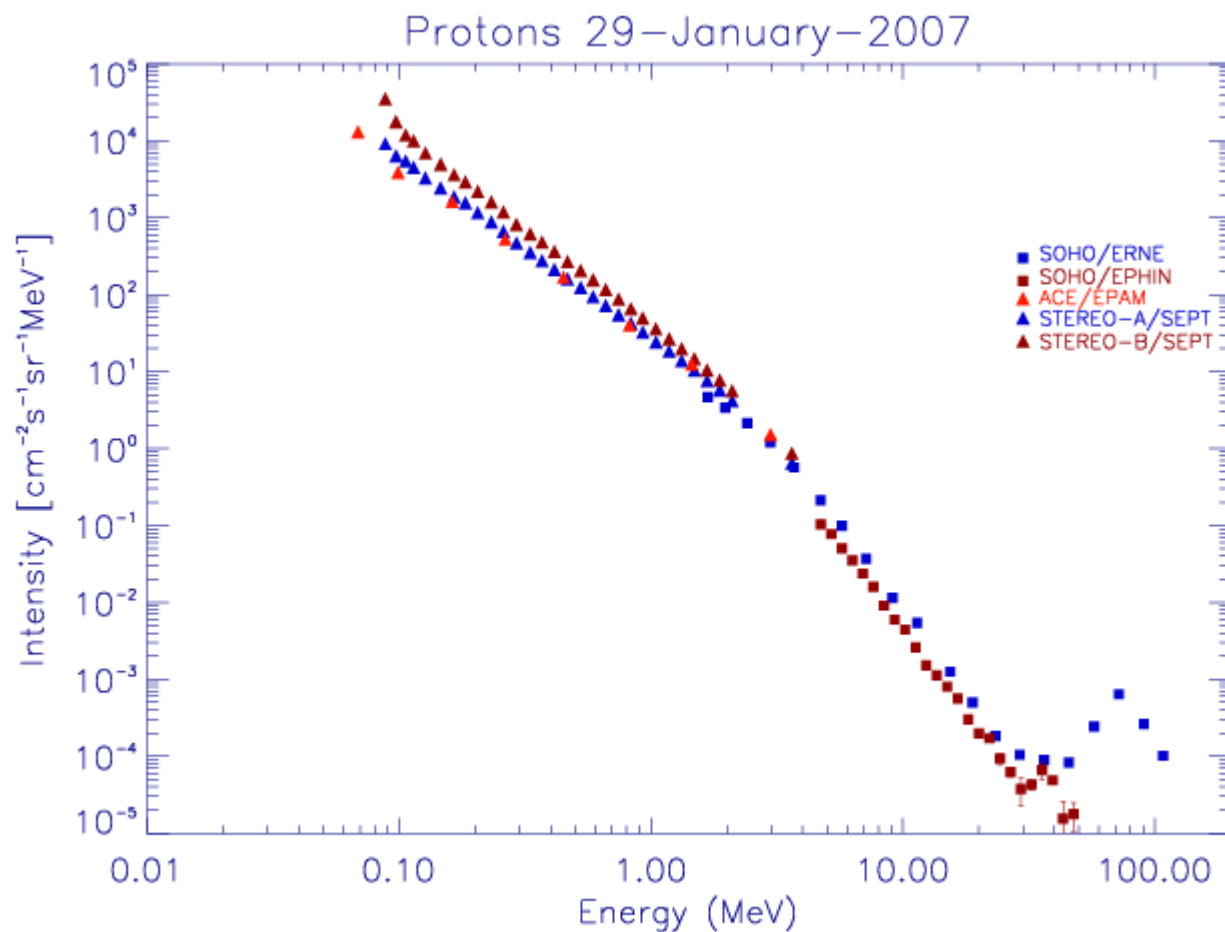
$^{16}\text{O}$  July 13–18, 2005



ACE/CRIS data from [http://www.srl.caltech.edu/ACE/ASC/level2/lvl2DATA\\_CRIS.html](http://www.srl.caltech.edu/ACE/ASC/level2/lvl2DATA_CRIS.html)



- CIR event of January 29, 2007
- Proton energy spectra of SOHO/ERNE, SOHO/EPHIN, ACE/EPAM, and STEREO/SEPT





# Conclusions

- SEPServer provides SEP data from 11 instruments on 6 missions
- Documentation on the instruments with data quality assessments will be available at the server
- We have carried out an initial comparison of data from various instruments
- When comparing electron intensities from STEREO/SEPT and ACE/EPAM the need for pre-event background subtraction became evident in order to achieve good agreement
- For the four SEP events and one CIR event studied, proton helium and heavy ion spectra measured by instruments on SOHO, ACE, and STEREO are in qualitative agreement
  - Comparison was done for the data now available from SEPServer
  - The degree of agreement varies from event to event
  - Achieving a general agreement between the measurements of various instruments with differences below 25-30 % may require additional data cleaning