

Introduction to SphinX data format and analysis

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SOTERIA Capacity Building Workshop

http://soteria-space.eu/wiki/index.php/Capacity_Building_Workshop

Royal Observatory of Belgium

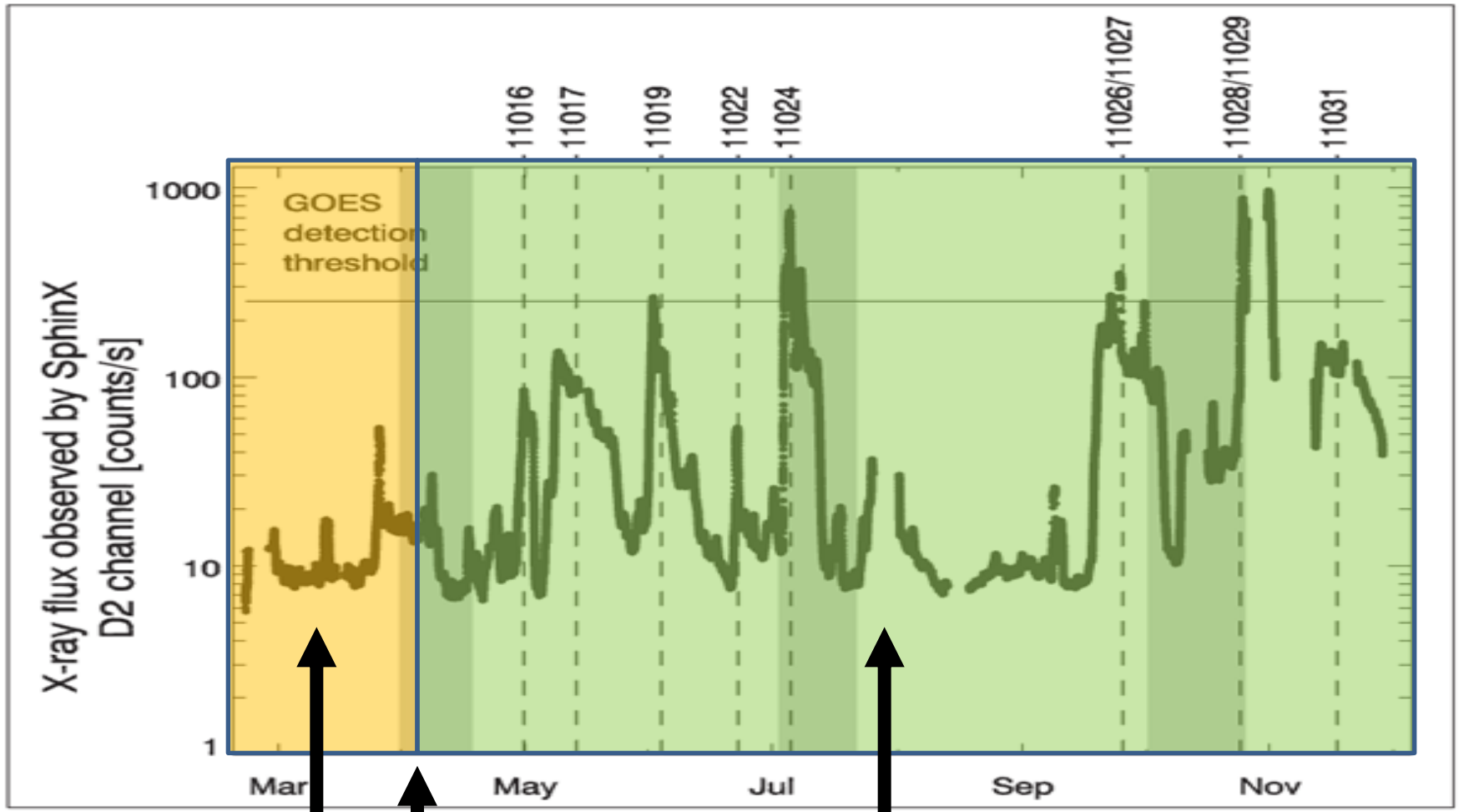
Ringlaan 3, 1180 Brussels

February 15, 2011

SphinX data format and analysis

- *the present status of SphinX database, instrument paper, calibration paper etc.**
- *which data blocks are already pre-prepared for the analysis –with Magdalena & Piotr involvement,**
- *what is the present “distribution” of tasks in the data analysis between groups and individuals including**
 - Harvard group**
 - Palermo group**
 - SOTERIA**
 - Wrocław group**

SphinX mission phases



April 6, 2009 optimum on-board operation and data collection strategy achieved

SphinX data – summary

February 20, 2009 – November 29, 2009

Low solar activity

Data from D1 and D2 detectors only

$\sim 5 \times 10^9$ EVENTS registered

EVENT = (T_{phot}, E_{phot})

Dissemination of SphinX data

SphinX dedicated
data servers
at PI, Co-is institutions
All data

Moscow LPI

SRC PAS, Wrocław, Poland

AI ASCR Ondrejov,
Czech Republic

UNIGRATZ, Austria
SphinX event catalog

DSFA, University of Palermo
2010

2010

http://156.17.94.1/sphinx_catalogue/SphinX_cat_main.html

http://147.231.104.188/catalog/SphinX_cat_main.html

<http://www-sphinx.astroa.unipa.it/>

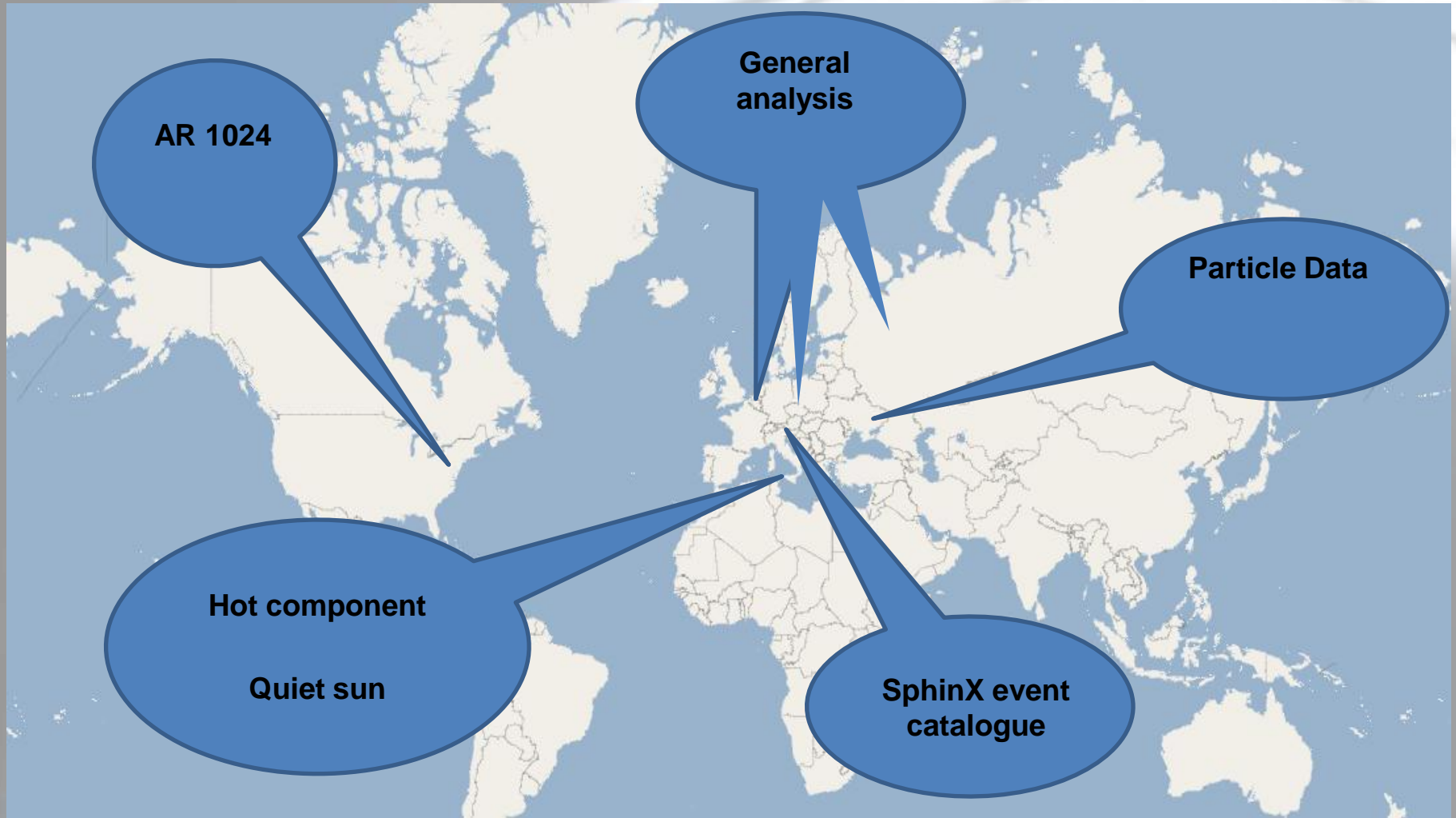
in Wrocław, Poland

in Ondrejov, Czech Republic

in Palermo, Italy

VSO, SODA Level 1 data (FITS)

SphinX data user needs ...



Reasonable compromise – event lists + filtering by flags

P. Podgorski talk

SphinX event FITS Format

OGIP 93/003 or higher

http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/docs/general/ogip_93_012/

http://heasarc.gsfc.nasa.gov/docs/heasarc/ofwg/docs/rates/ogip_93_003/ogip_93_003.html#tth_sEc4.8

SphinX events FITS content

PRIMARY HEADER

EVENT HEADER

EVENT BINARY TABLE

EXPOSURE HEADER

EXPOSURE BINARY TABLE

GTI HEADER

GTI BINARY TABLE

SphinX data catalogue

All SphinX data available here are Level_1 data.



2009																															
January	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
February	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28			
March	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
April	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
May	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
June	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
July	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
August	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
September	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
October	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
November	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
December	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31

Last update: Fri Jan 14 20:23:36 2011 (UTC+1)

contact

[Szymon Gburek](#) - Any questions concerning content of data from SphinX catalogue.

[Piotr Podgorski](#) - Report any technical problems with SphinX data catalogue.

http://156.17.94.1/sphinx_l1_catalogue/SphinX_cat_main.html

Obsolete from 23 March 2011

SphinX DRM for spectral analysis

$$\text{OUT} = \text{DRM}\#(\text{IN} * \text{DE})$$

SphinX
observed
Spectrum

[counts/s]

Matrix
multiplication

Input real
spectrum
Model

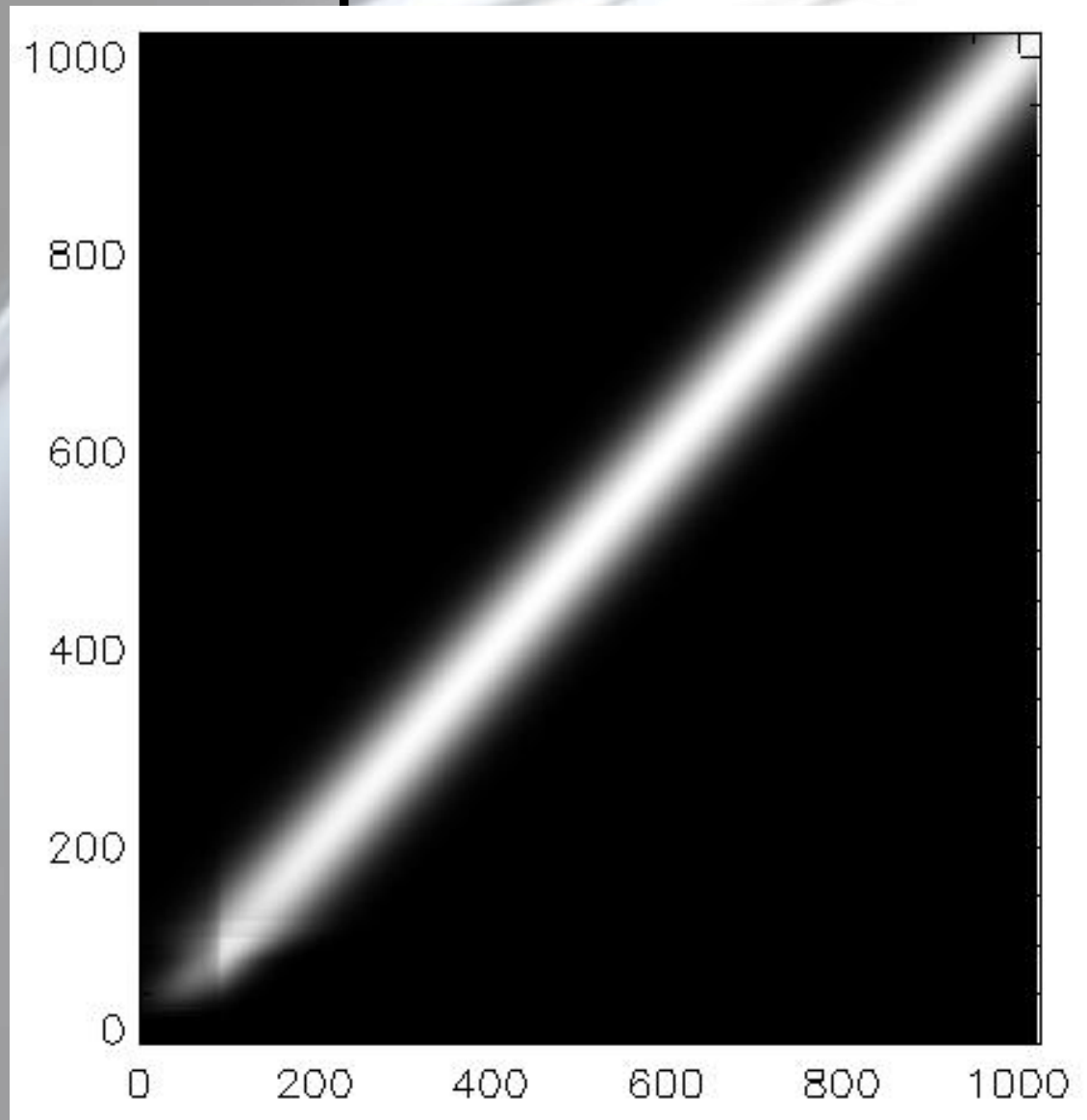
[photons/s/cm²/keV]

Detector Response Matrix

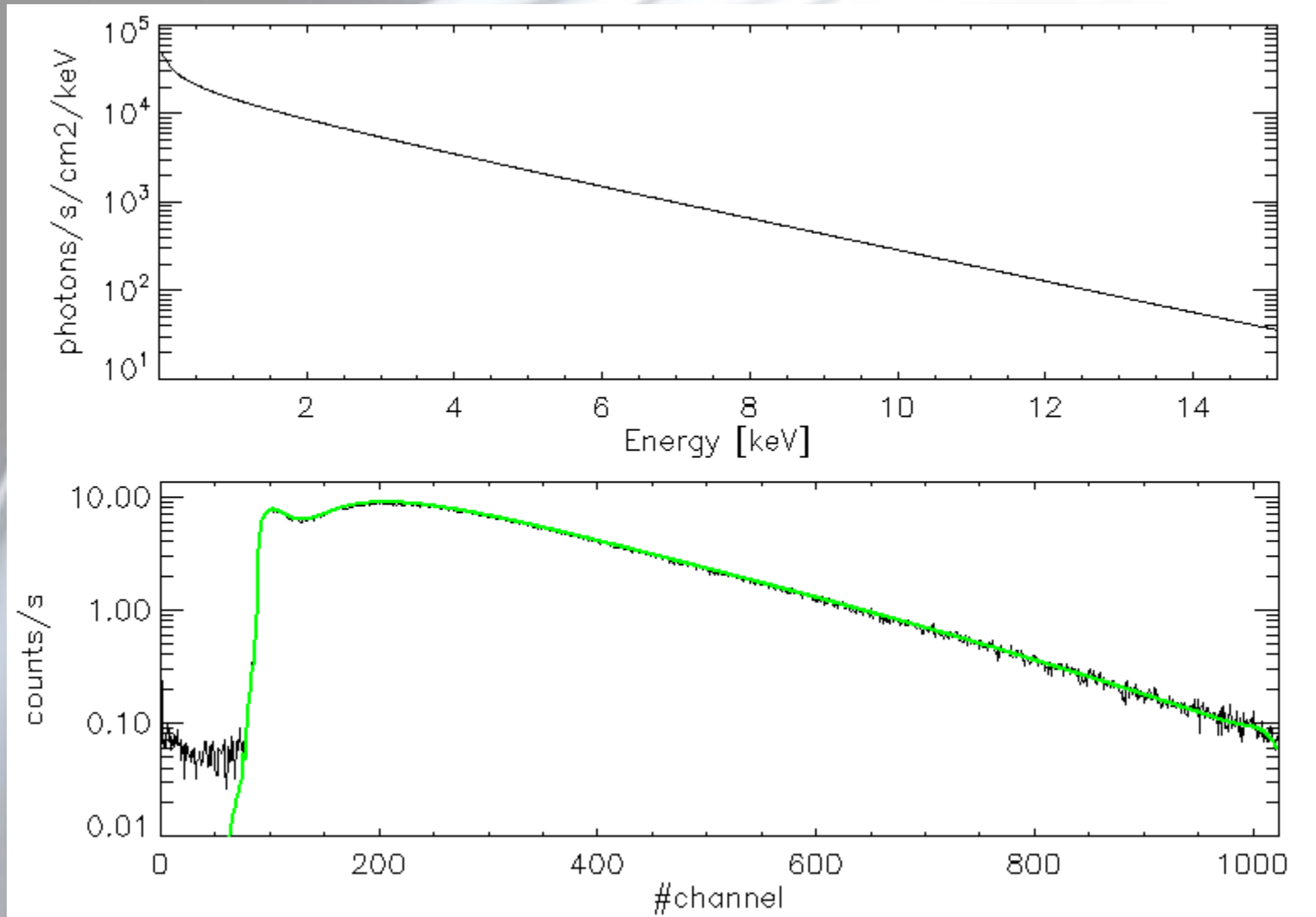
DE – IN spectrum energy bins

DRM is known from calibration – Palermo/Bessy

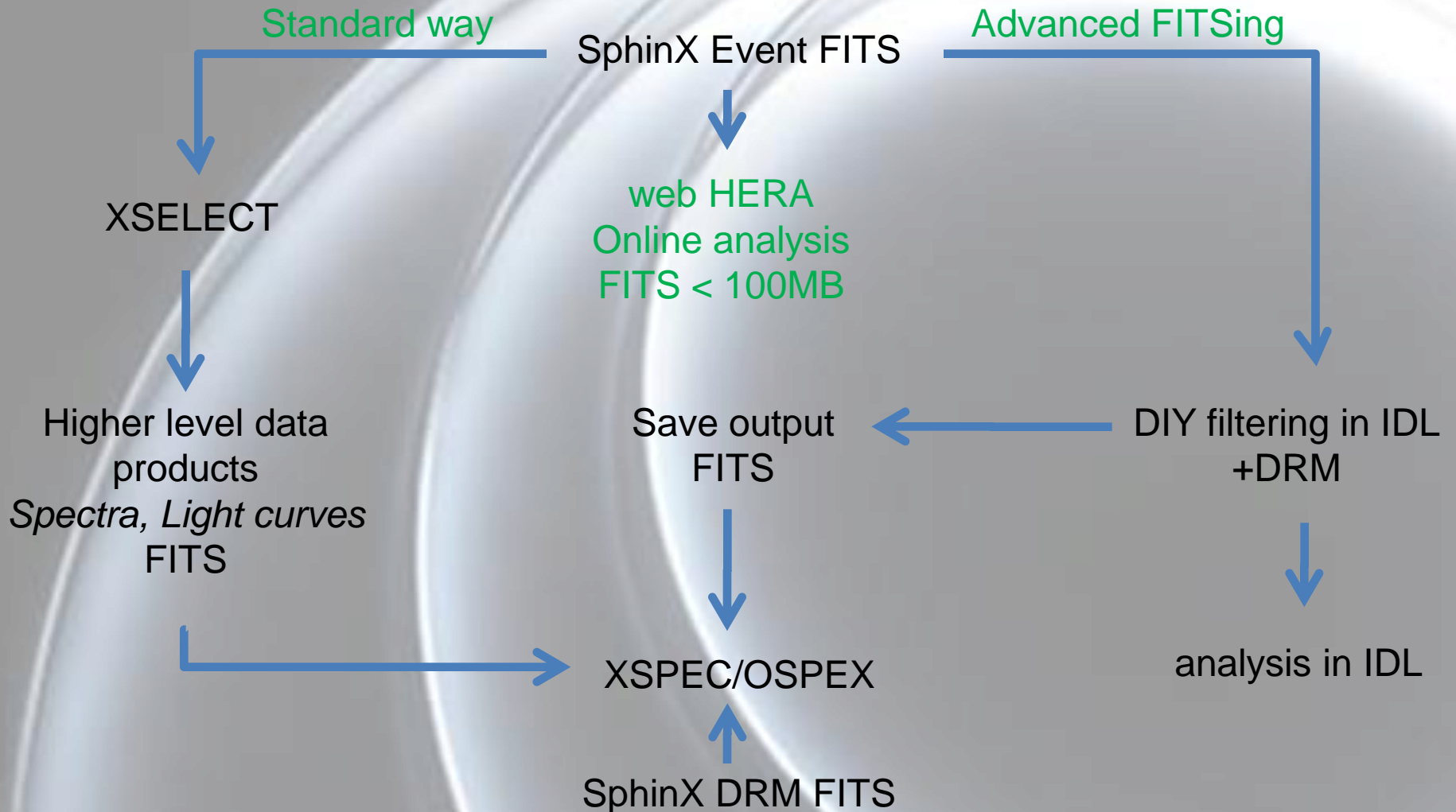
SphinX DRM



SphinX DRM



SphinX data analysis strategies mission phase 2



FITS tools and more

<http://heasarc.gsfc.nasa.gov/docs/software.html>

The screenshot shows the HEASARC website interface. At the top left, it features the NASA logo and the text "GODDARD SPACE FLIGHT CENTER" and "Smithsonian Astrophysical Observatory". To the right, there are links for "Help/FAQ", "What's New", "Site Map", and "NASA Homepage". A search bar is located in the top right corner with the text "Search enter search terms" and "Advanced Search". Below the search bar is a "HEASARC Quick Links" dropdown menu. A horizontal navigation bar contains the following items: "HEASARC HOME", "OBSERVATORIES", "ARCHIVE", "CALIBRATION", "SOFTWARE", "TOOLS", and "STUDENTS / TEACHERS / PUBLIC". The "SOFTWARE" item is highlighted in blue. Below the navigation bar is a banner for "NASA's HEASARC: Software" featuring a table of fit parameters and the word "Xanadu" in a stylized font. At the bottom, a row of buttons lists various software tools: "FITSIO", "FTOOLS", "FV", "HEASOFT", "HERA", "MAKI", "PIMMS", "PROFIT", "XANADU", "XSELECT", "XSTAR", "ASTRO-Update", and "FITS". Four blue arrows point upwards to the "FITSIO", "FTOOLS", "HEASOFT", and "XSELECT" buttons.

GODDARD SPACE FLIGHT CENTER
Smithsonian Astrophysical Observatory

[Help/FAQ](#)
[What's New](#)
[Site Map](#)
[NASA Homepage](#)

Search enter search terms
[Advanced Search](#)

[HEASARC Quick Links](#)
--Quick Links--

HEASARC HOME | OBSERVATORIES | ARCHIVE | CALIBRATION | **SOFTWARE** | TOOLS | STUDENTS / TEACHERS / PUBLIC

Chi-Squared	Lvl	Fit param #	1	2	3
924.178	-2	5.087	5.076	0.4056	
305.507	-2	4.525	3.791	0.1249	
140.460	-2	2.930	3.367	6.5553E-02	
			2.243	1.4635E-02	
				2.243	1.4635E-02
					2.243

NASA's HEASARC: Software

Xanadu

FITSIO | **FTOOLS** | FV | HEASOFT | HERA | MAKI | PIMMS | PROFIT | XANADU | XSELECT | XSTAR | ASTRO-Update | FITS

FITS #1Tool – fv visualisation of FITS content

7% fv

- New File...
- Open File...
- SkyView...
- Catalogs...
- VizieR...
- Connect to Hera...
- Display Device
- Hide All Windows
- File Summary
- Header
- Table
- Image Table
- Vector Table
- Preference
- Clipboard
- Help
- Quit

7% fv: Summary of SPHINX_090615_032930_073159_evn_D1_L1_test.fits in C:/Users/Emilia/Desktop/SphinX/SPHINX_FIT...

Index	Extension	Type	Dimension	View				
0	Primary	Image	0	Header	Image	Table		
1	EVENTS	Binary	6 cols X 1426992 rows	Header	Hist	Plot	All	Select
2	EXPOSURE	Binary	3 cols X 19197 rows	Header	Hist	Plot	All	Select
3	GTI	Binary	2 cols X 19197 rows	Header	Hist	Plot	All	Select

7% fv: Header of SPHINX_090615_032930_073159_evn_D1_L1_test.fits[...]

```

File Edit Tools Help
Search for: [ ] Find Case sensitive? No
SIMPLE = T /Written by IDL: Fri May
BITPIX = 8 /Number of bits per data
NAXIS = 0 /Number of data axes
EXTEND = T /File contains extensions
DATE = '2009-01-06T15:02:49' /File creation date (YYY
ORIGIN = 'PAS SRC SPD Wroclaw' /Origin of the file
SATELITE= 'CORONAS-Photon' /Satellite name
OBSERVER= 'Unknown ' /Usually the name of
TELESCOP= 'SPHINX ' /Name of the Telesco
INSTRUME= 'SPHINX ' /Name of the instrum
OBJECT = 'Sun ' /Object being observ
DATE_OBS= '2008-11-29T03:46:41.000' /nominal U.T. date w
DATE_END= '2008-11-29T14:59:59.989' /nominal U.T. date w
TIMESYS = '1979-01-01T00:00:00' /Reference time in Y
TIMEUNIT= 'd ' /Unit for TIMEZERO,
AUTHOR = 'SpX2OGIP.pro' /Program name that produc
RA = 0.000000 /Source right ascension i
DEC = 0.000000 /Source declination in de
RA_NOM = 0.000000 /r.a. nominal pointing in
DEC_NOM = 0.000000 /dec. nominal pointing in
EQUINOX = 2000.00 /Equinox of celestial cod
RADECSYS= 'FK5 ' /Coordinate frame used fo
TIMVERSN= 'OGIP/93-003' /OGIP memo number where the co
XENDIAN = 'BIG ' /Byte order
    
```

7% fv: Binary Table of SPHINX_090615_032930_073159_evn_D1_L1_test.fits[1] in C:/Users/Emilia/Desko...

Select	TIME	PHA	PI	ENERGY	FLAG	NRM
<input type="checkbox"/> All	D	I	I	E	J	J
<input type="checkbox"/> Invert	s	chan	chan	keV		
	Modify	Modify	Modify	Modify	Modify	Modify
922694	2.195074803336E+004	28	29	1.662771E+000	0	10326
922695	2.195075212944E+004	21	22	1.248236E+000	0	10326
922696	2.195075266545E+004	21	22	1.248236E+000	0	10326
922697	2.195076358867E+004	22	23	1.307456E+000	0	10326
922698	2.195076691674E+004	27	28	1.603552E+000	0	10326
922699	2.195077263985E+004	24	25	1.425894E+000	0	10326
922700	2.195077953399E+004	22	23	1.307456E+000	0	10326
922701	2.195078072201E+004	28	29	1.662771E+000	0	10326
922702	2.195079849037E+004	22	23	1.307456E+000	0	10326
922703	2.195080559651E+004	24	25	1.425894E+000	0	10326
922704	2.195080654353E+004	22	23	1.307456E+000	0	10326
922705	2.195081746175E+004	25	26	1.485114E+000	0	10326
922706	2.195081902278E+004	24	25	1.425894E+000	0	10326
922707	2.195082059181E+004	22	23	1.307456E+000	0	10326
922708	2.195082252285E+004	21	22	1.248236E+000	0	10326
922709	2.195084139222E+004	37	38	2.195745E+000	0	10326
922710	2.195085240745E+004	43	44	2.551060E+000	0	10326
922711	2.195085528250E+004	56	57	3.320911E+000	0	10326
922712	2.195086717274E+004	51	52	3.024815E+000	0	10326
922713	2.195086921578E+004	37	38	2.195745E+000	0	10326

Go to: [] Edit cell: []

Try on CBW3

SphinxX FITS reading in IDL

```
data = mrdfits(filename, i, hdr, status=status)
```

↑
IDL structure

Header – string array with
description of data

↑
i=0 - primary header, data =0
i=1 – events HDU
i=2 – exposure HDU
i=3 – GTI HDU

```
IDL> pm, hdr
```

```
IDL> help, data, /st
```

Useful links

HERA

<http://heasarc.gsfc.nasa.gov/webHera/index.html>

FTOOLS/XANADU

<http://heasarc.gsfc.nasa.gov/docs/software.html>

FITS I/O IDL routines

<http://idlastro.gsfc.nasa.gov/fitsio.html>

FITS I/O IDL routines in SolarSoft

<http://www.lmsal.com/solarsoft/>

IDL Sphinx specific software (TBD)

http://156.17.94.1/sphinx_l1_catalogue/Sphinx_cat_main.html