SphinX mission results

S. Gburek, J. Sylwester, M. Kowalinski, M. Siarkowski, W. Trzebinski, S. Plocieniak, J. Bakala, P. Podgorski, M. Gryciuk,

Space Research Centre PAS,

Solar Physics Division

51-622 Wrocław, Kopernika 11

Czech-Polish-Slovak Consultation on Solar Physics (CoSP)

May 19 - 21, 2011, Ondřejov, Czech Republic

OUTLINE

About SphinX

SphinX data

SphinX data analysis

SphinX – team

SRC PAS:
Principal Investigator: **Janusz Sylwester**
Project Manager: **Mirek Kowalinski**
Project Constructor: **Jarek Bąkała**
Project Scientist: **Szymon Gburek**
Co-I: **Marek Siarkowski, Barbara Sylwester, Zbigniew Kordylewski, Piotr Podgórski, Witold Trzebiński, Stefan Płocieniak, Anna Kępa**

FIAN:
Sergey Kuzin, TESIS PI, SphinX Co-I

MEPhI:
Yury Kotov, CORONAS-Photon Project Manager, SphinX Co-I

AI CzAS:
Franta Farnik, SphinX Co-I

INAFA, Palermo University:
Fabio Reale, SphinX Co-I

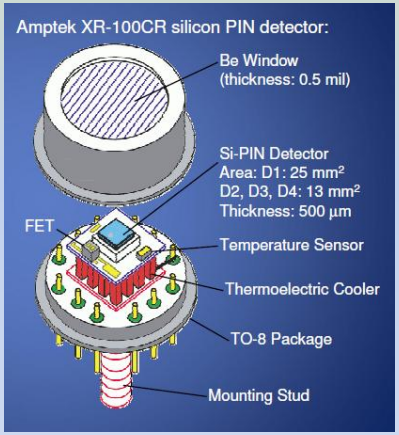
UCL, London:
Ken Phillips, SphinX Scientist Co-I

NASA GSFC:
Brian Dennis, SphinX Scientist Co-I

SphinX **S**olar **Ph**otometer **in X**-rays

~4kg/~10W (peak)
~1 keV - ~15 keV
Time resolution ~6 μs

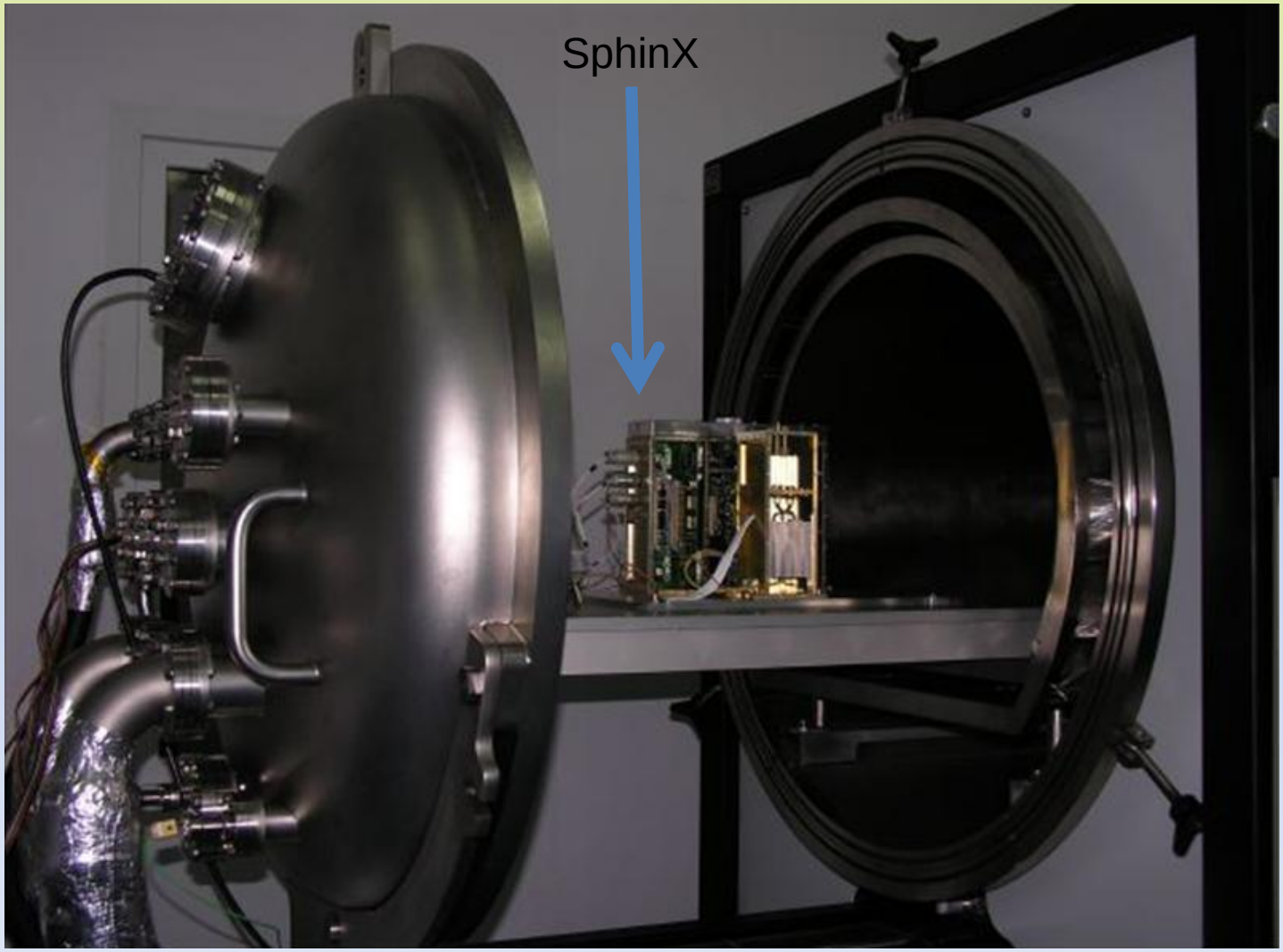
DETECTORS



AMPTEK
Si PIN-DIODES
XR-100CR

Launch: January 30, 2009 at 13:30 UT, Plesetsk, Russia
Mission duration: February 20, 2009 – November 29, 2009
CORONAS-Photon satellite

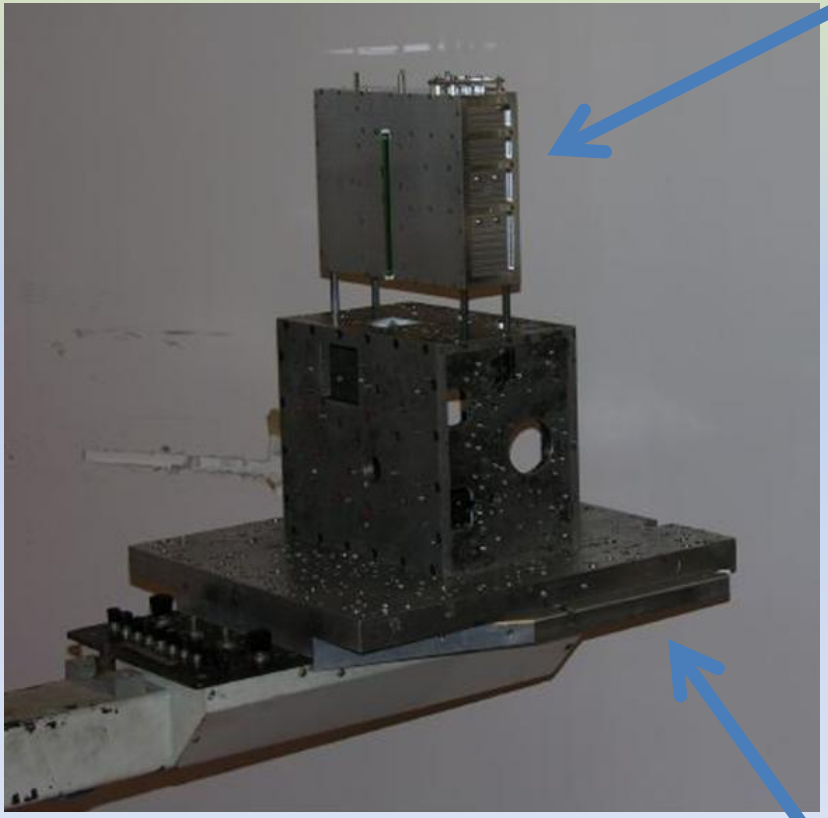
SphinX calibration - TV tests in Warsaw

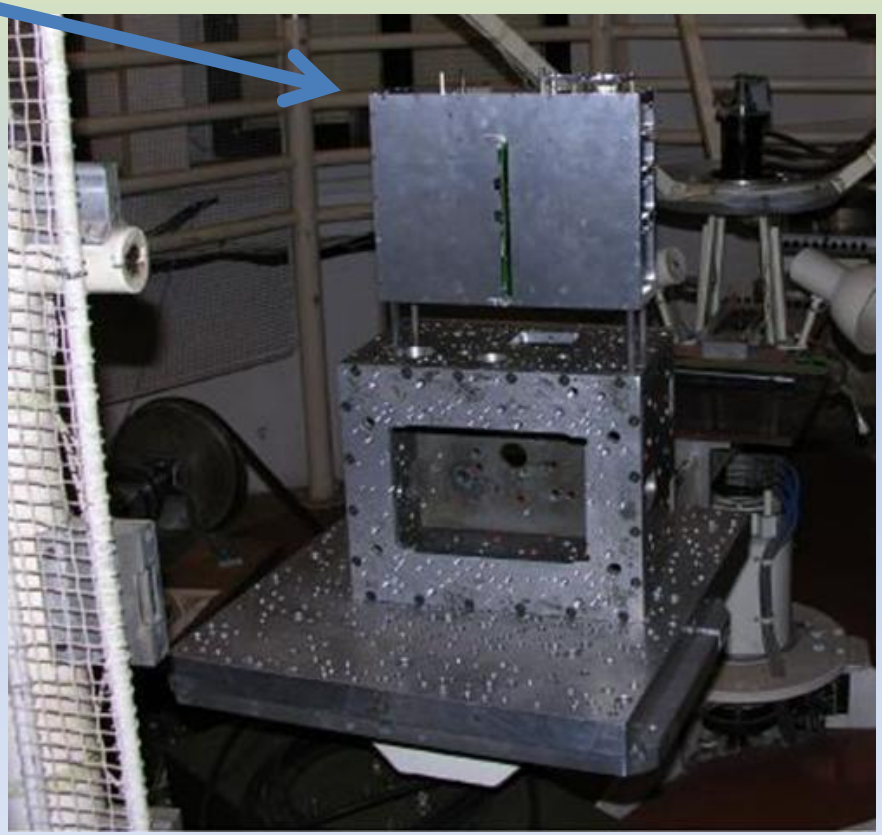


SphinX calibration/tests

Vibration/Acceleration/Acoustic tests in Prague

SphinX





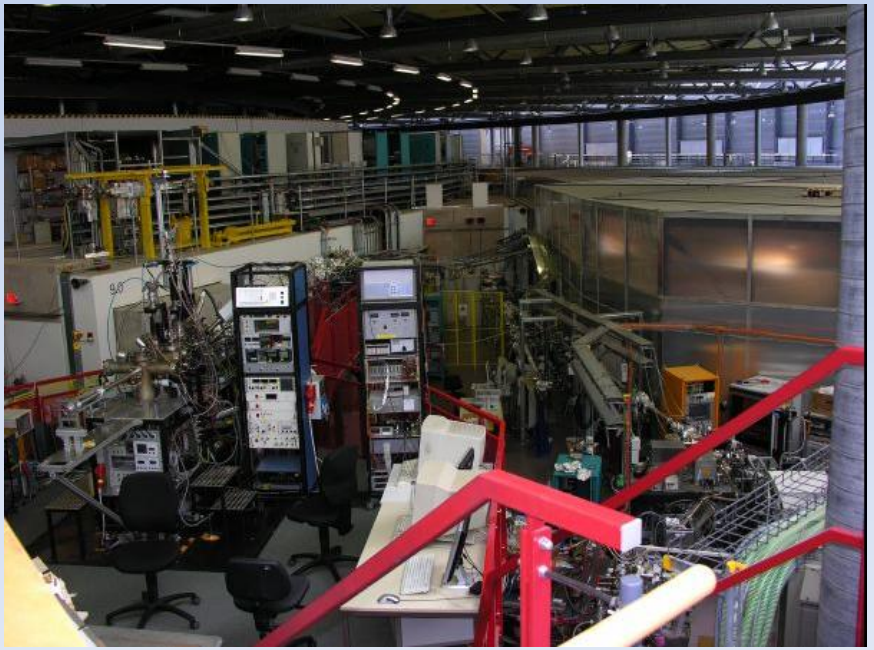
Big help from F. Farnik

Centrifuge arm

SphinX
X-ray response calibration

XACT, Palermo
October 2007

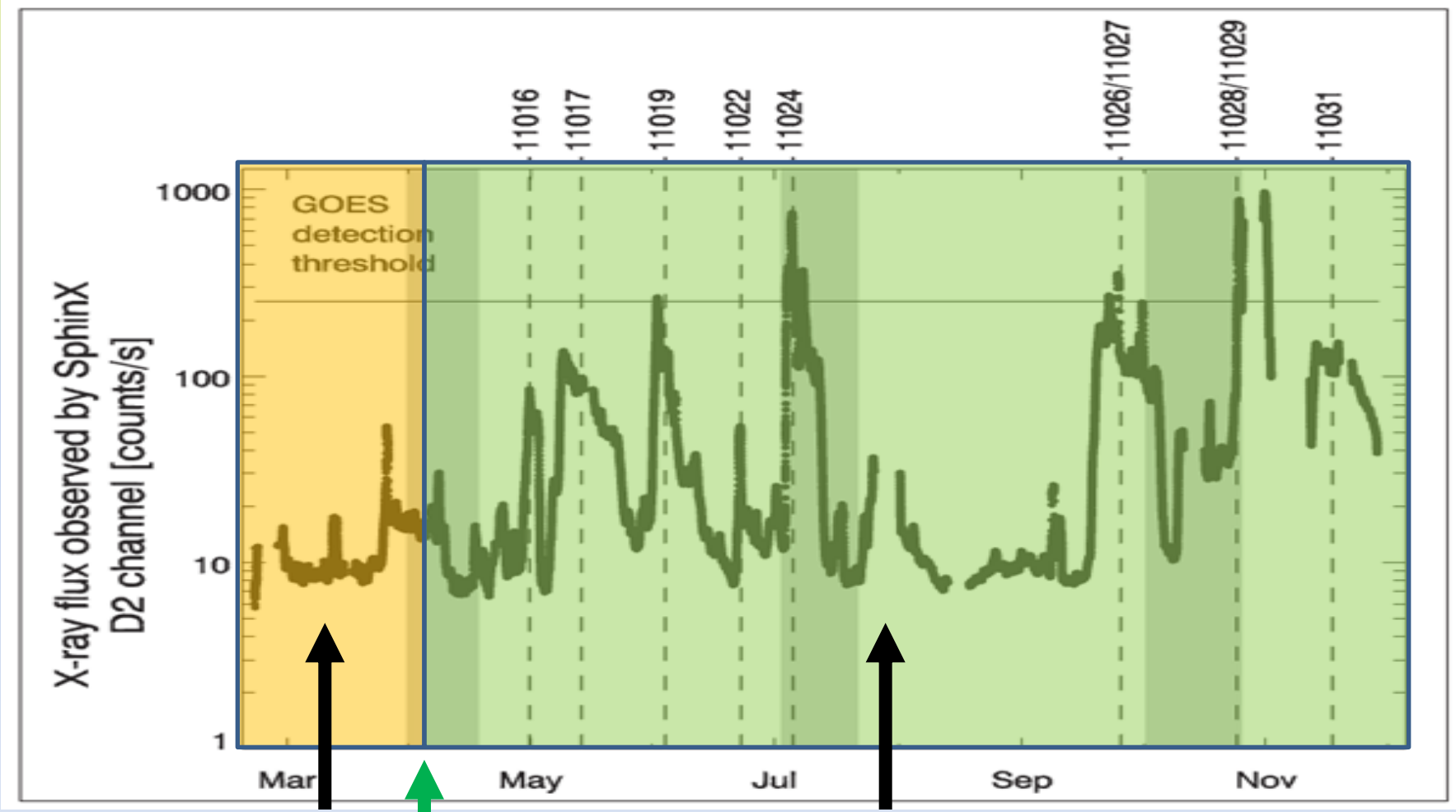
BESSY II, Berlin,
Feb/Mar 2008



SphinX

The first fully
tested and calibrated
solar spectrometer

SphinX mission phases



Phase 1

Phase 2

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

SphinX data – summary

February 20, 2009 – November 29, 2009

Measurements during very low solar activity

SphinX data – status

All data reduced to Level -1

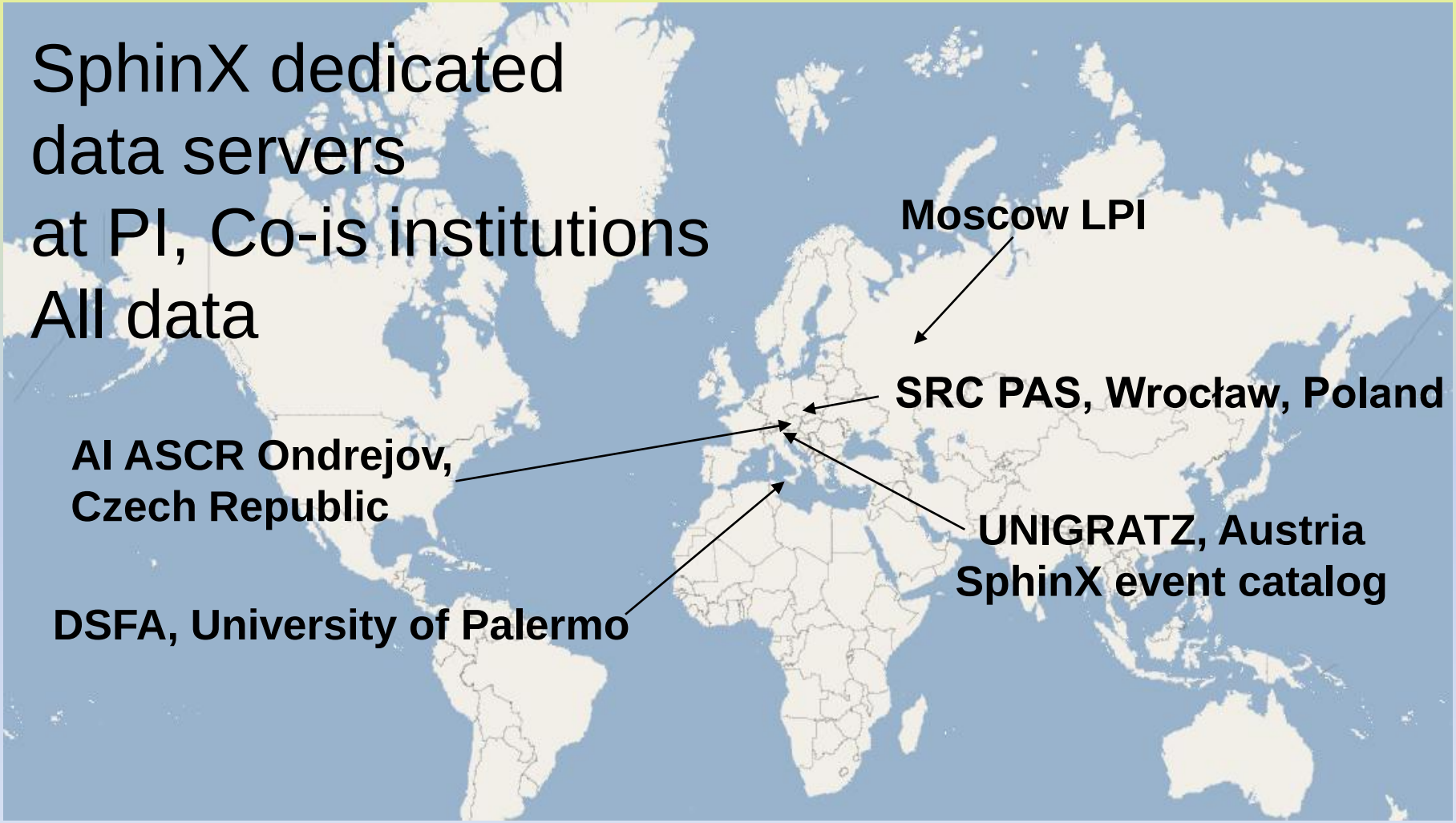
Level -1 data available in FITS format

All data available as event lists

EVENT = (Tphot, Ephot)

~5×10^9 EVENTS registered

SphinX data distribution map



Synchronized Sphinx data servers

http://156.17.94.1/sphinx_catalogue/SphinX_cat_main.html	in Wrocław, Poland
http://147.231.104.188/catalog/SphinX_cat_main.html	in Ondrejov,Czech Republic
http://www-sphinx.astropa.unipa.it/	in Palermo, Italy

SphinX data catalog

SphinX data catalogue

All SphinX data available here are Level_1 data.

2009	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
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

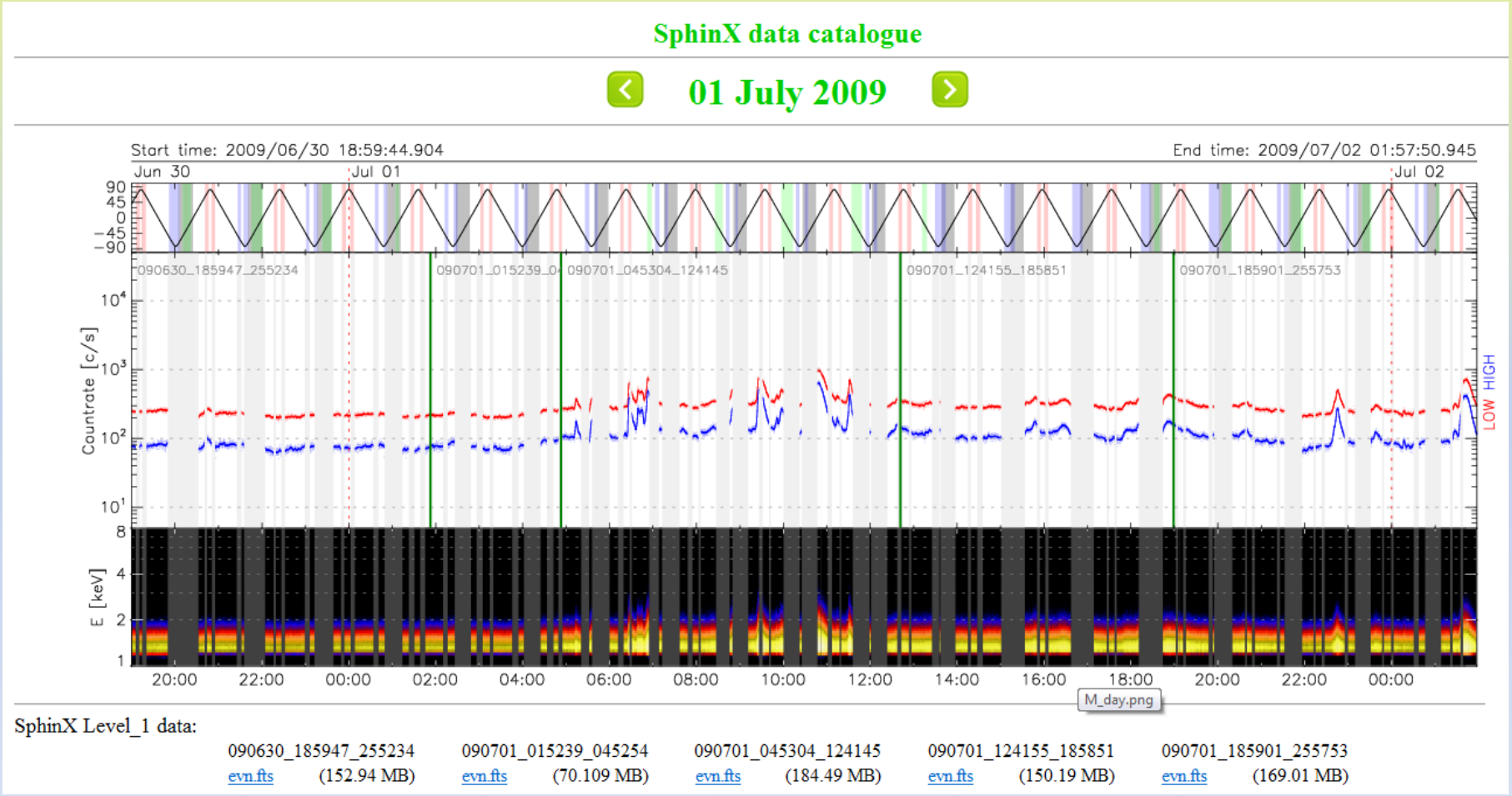
Last update: Tue Mar 22 22:29:55 2011 (UTC+1)

contact:

Szymon Gburek - Any questions concerning content of data from SphinX catalogue.

Piotr Podgorski - Report any technical problems with SphinX data catalogue.

Example of SphinX daily summary page



Download FITS files (OGIP format)

SphinX data goes to Virtual Observatories

SODA – European VSO SphinX Level-1 FITS

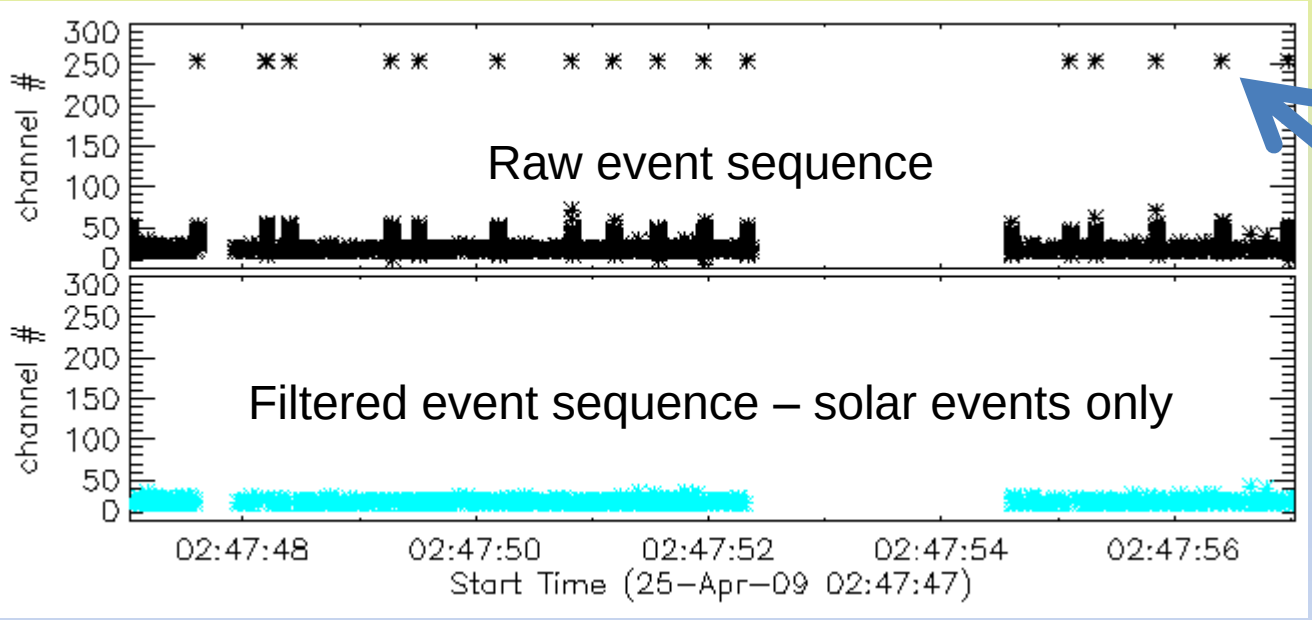
developed under SOTERIA
SOlar-TERrestrial Investigations and Archives – FP7 Space Science project
SODA is maintained at ROB

VSO – in preparation

EvolvSys – Prague

- help with SphinX Servers maintenance and security
- help with instalation of software component for SODA VSO

SphinX data analysis strategy



Paticle events

- Filter out/select events of interest using **FLAGS**
- Construct higher level data products (spectra, lightcurves)
- Add calibration information (detector response matrix)
- Perform analysis with spectral analysis packages.

SphinX tools

Existing data analysis tools. For example FTOOLS …

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

SphinX IDL dedicated software provided by the instrument team

SphinX IDL software components

sphinx_select.pro – filtering tool

sphinx_lightcurve– event list to lightcurve conversion tool

sphinx_spectrum – event list to spectra conversion tool

Detector Response Matrix DRM is provided in a FITS file

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

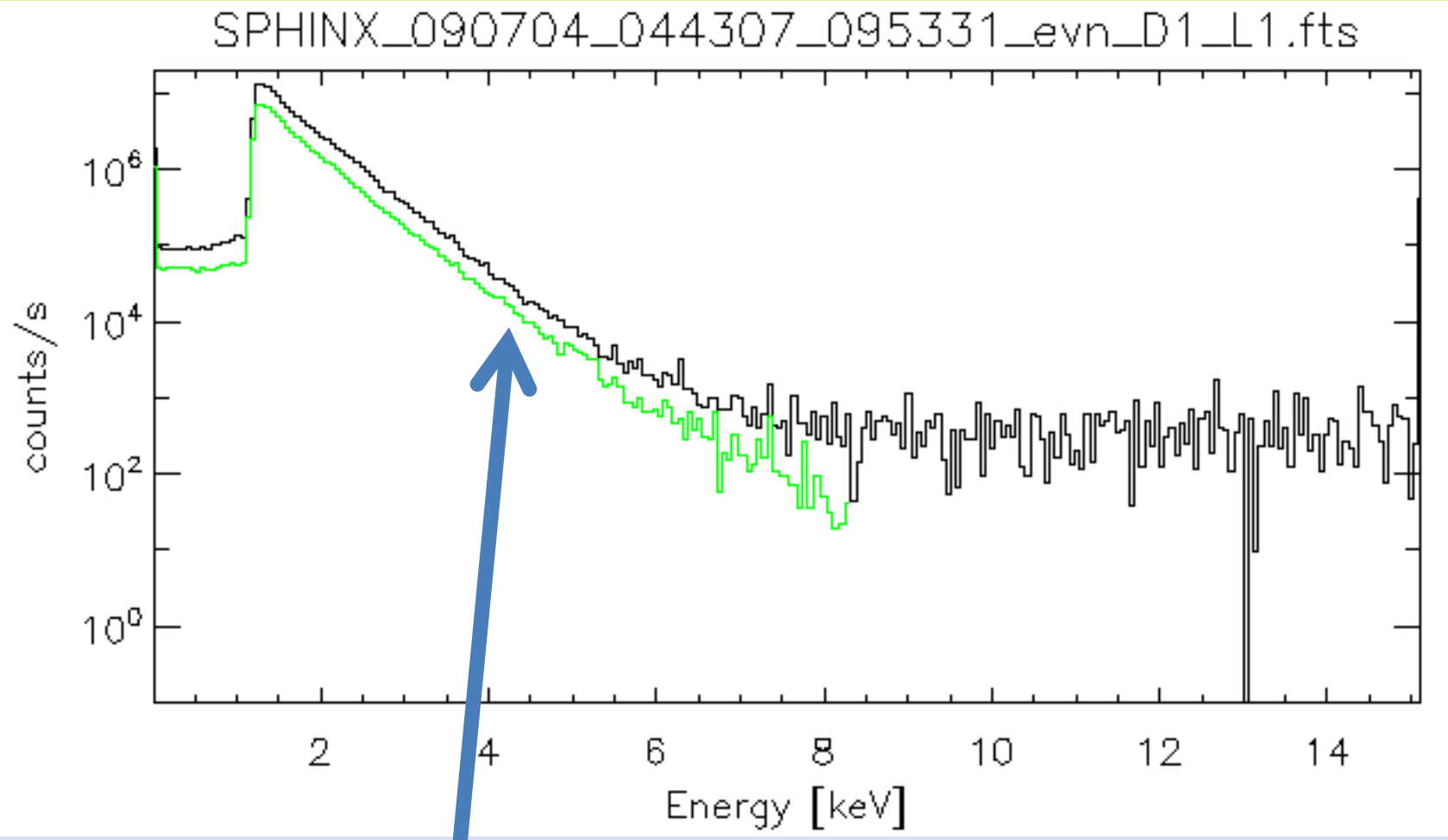
IDL structure

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

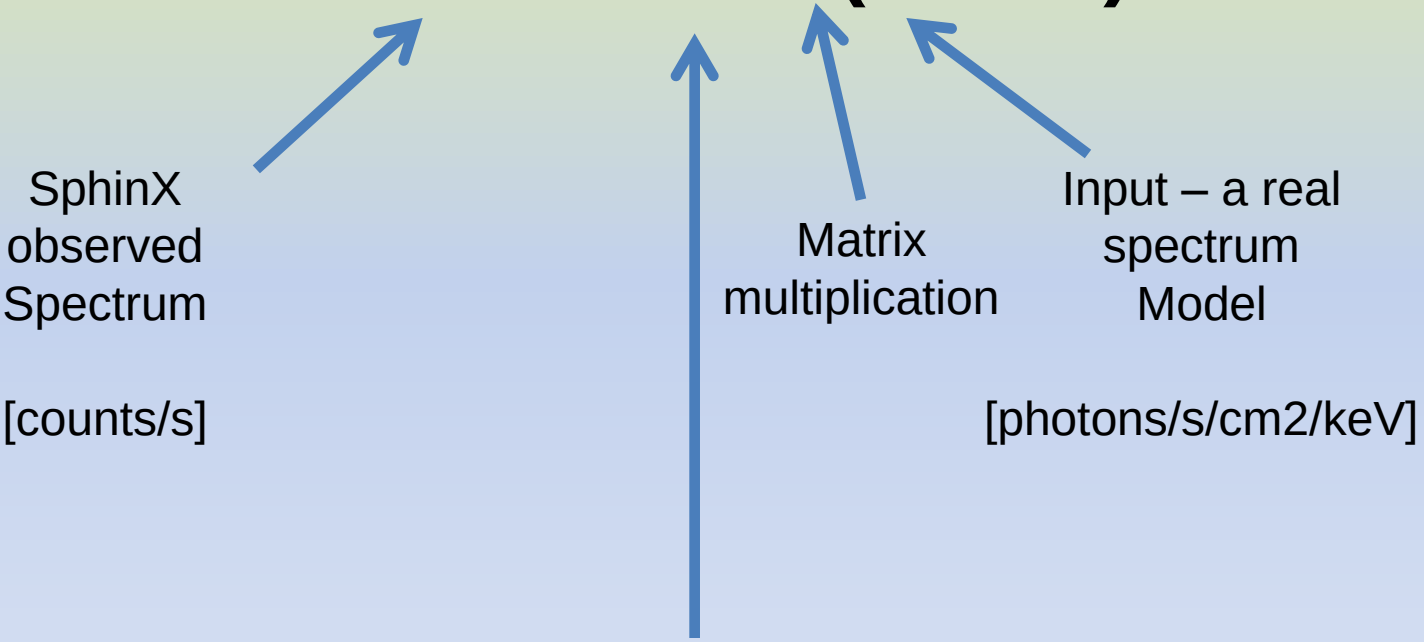
SphinX data filtering and analysis - example



Clean filtered spectrum of solar origin

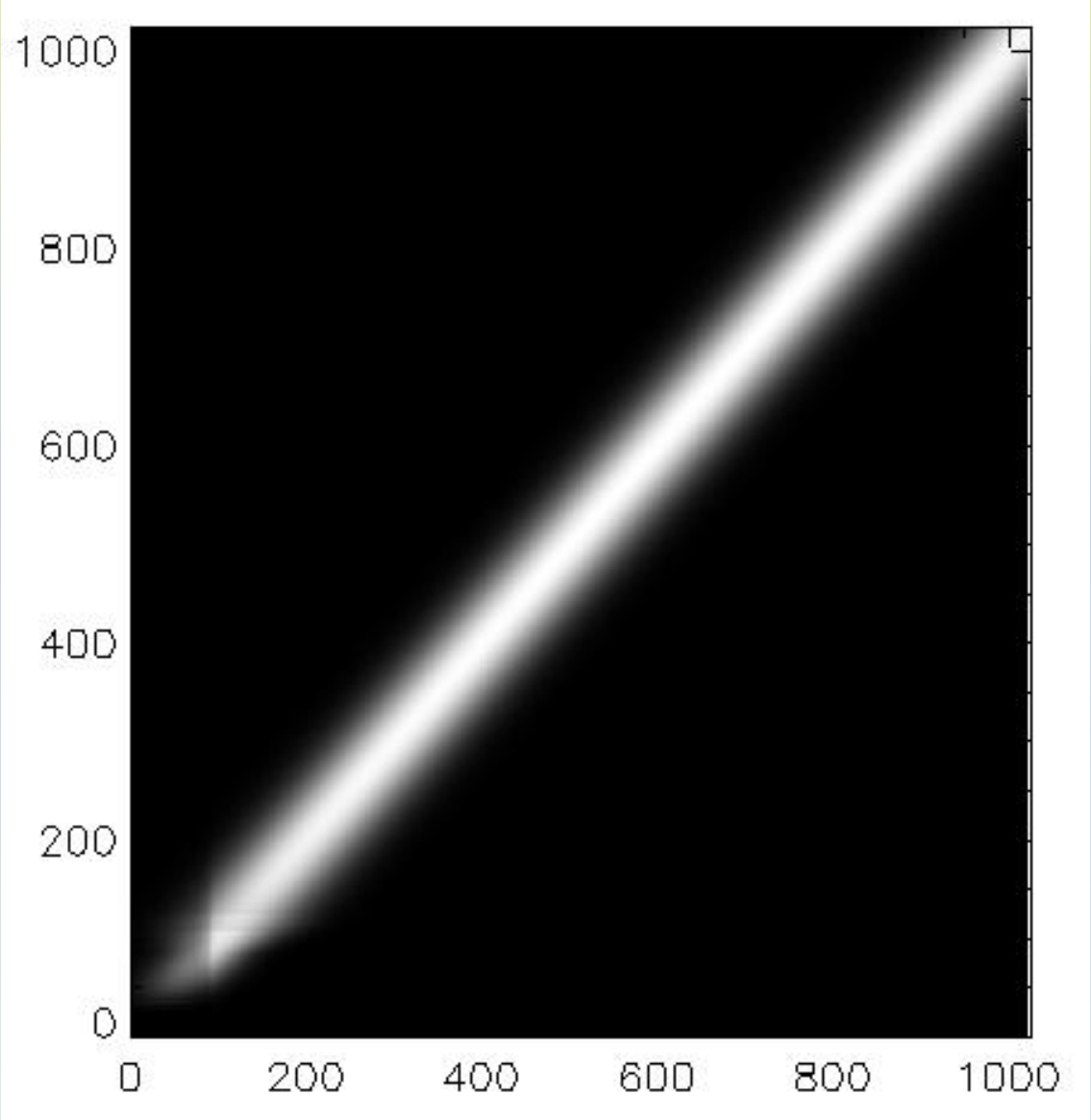
SphinX DRM for spectral analysis

OUT = DRM#(IN*DE)

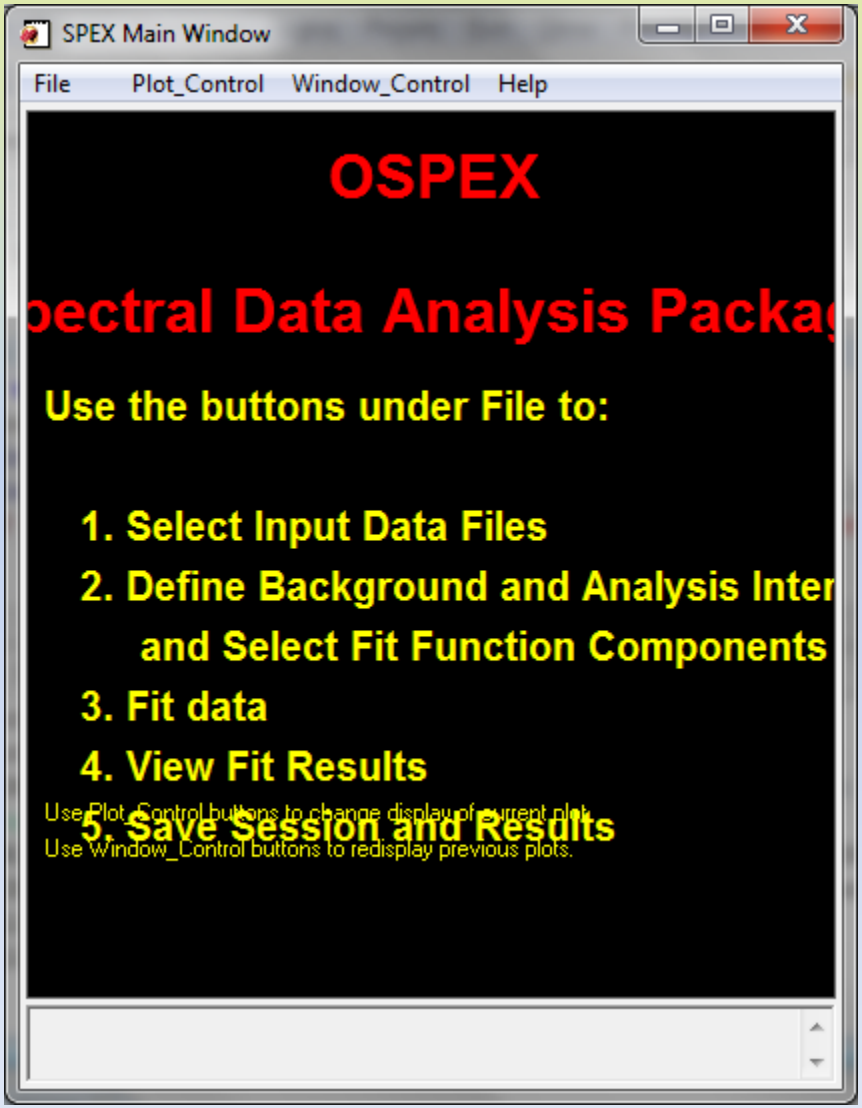


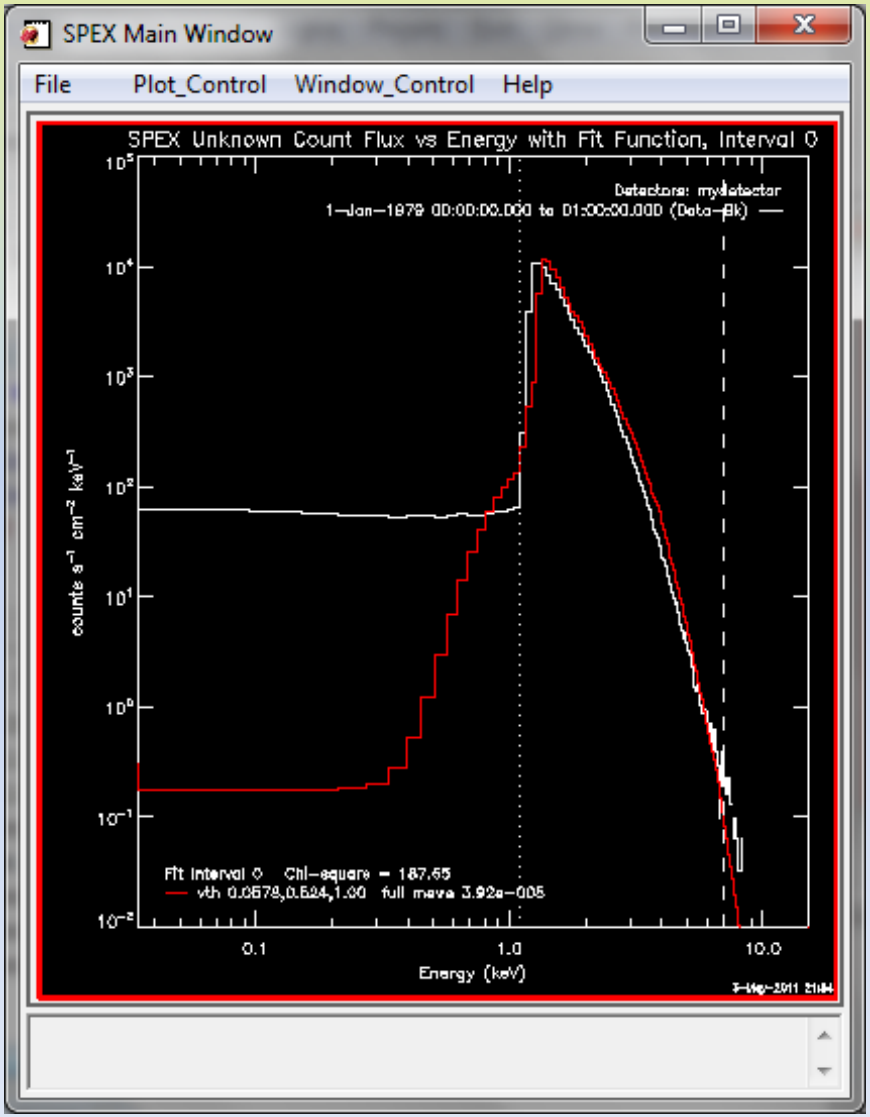
DRM was determined from calibration data – Palermo/Bessy

SphinX DRM



Analysis in OSPEX





SphinX – scientific analysis areas

Quiet Sun analysis in X-rays (observed as a star)

Investigations of active regions

Small events investigations (GOES A-C class)

Determination of T, EM

Relationship between solar X-ray flux variability and CME

Identification and analysis of very small solar flares/brightenings

Monitoring of Earth energetic particle distribution

Cross-comparison with other instruments measurements

Determine upper limits for coupling constant - Axions

THANK YOU

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

Try on CBW3