



SphinX

aims construction and first results

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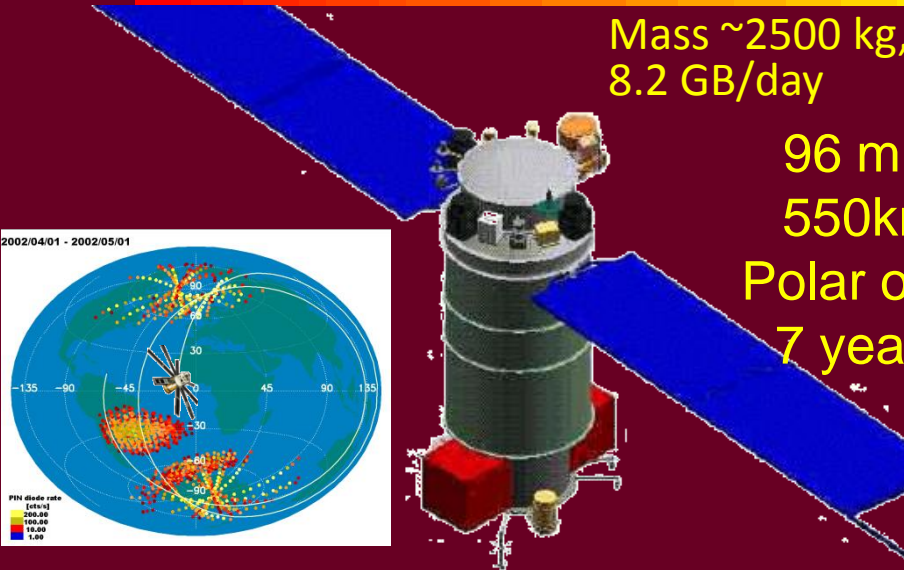
SphinX: Solar Photometer in X-rays, PI-SRC-PAS

FIAN, MEPhI - RU, AI Ondrejov - CZ, Palermo University - I

Mass ~2500 kg,
8.2 GB/day

96 min
550km
Polar orbit
7 years

Launched
30 Jan. 2009 at 13:30 UT
from Plesetsk
Cosmodrome



Pointing
Semi-Three axis stabilised

SphinX



J. Astrophys. Astr. (2008) **29**, 1–5

<http://www.cbk.pan.wroc.pl/body/publikacje/2008/SphinX.pdf>

SphinX: A Fast Solar Photometer in X-rays

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SphinX: Solar Photometer in X-rays

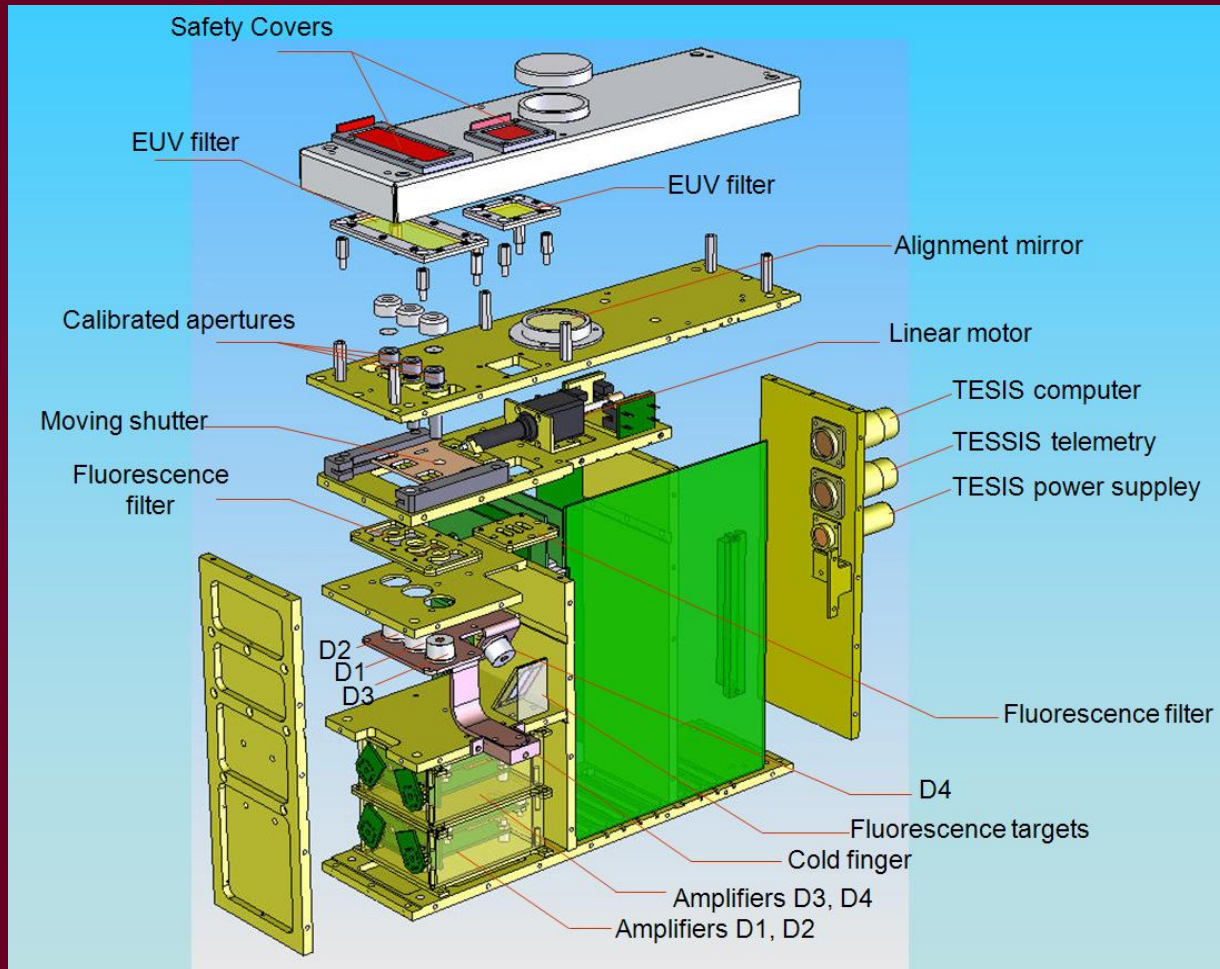
Polish concept, design & manufacture



Measure the X-ray fluence of the Sun
0.8 – 15 keV with
unprecedented

- Time resolution
~0.00001 s
- Sensitivity 100 x
better than GOES
XRM
- Energy resolution 3x
RHESSI

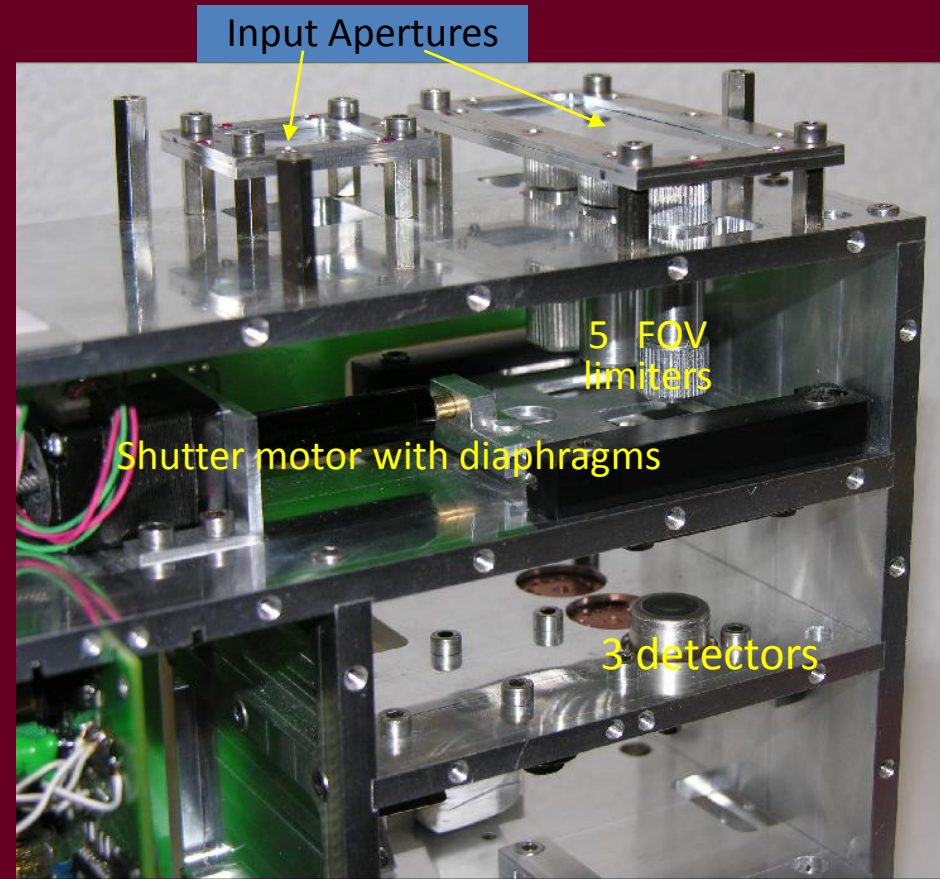
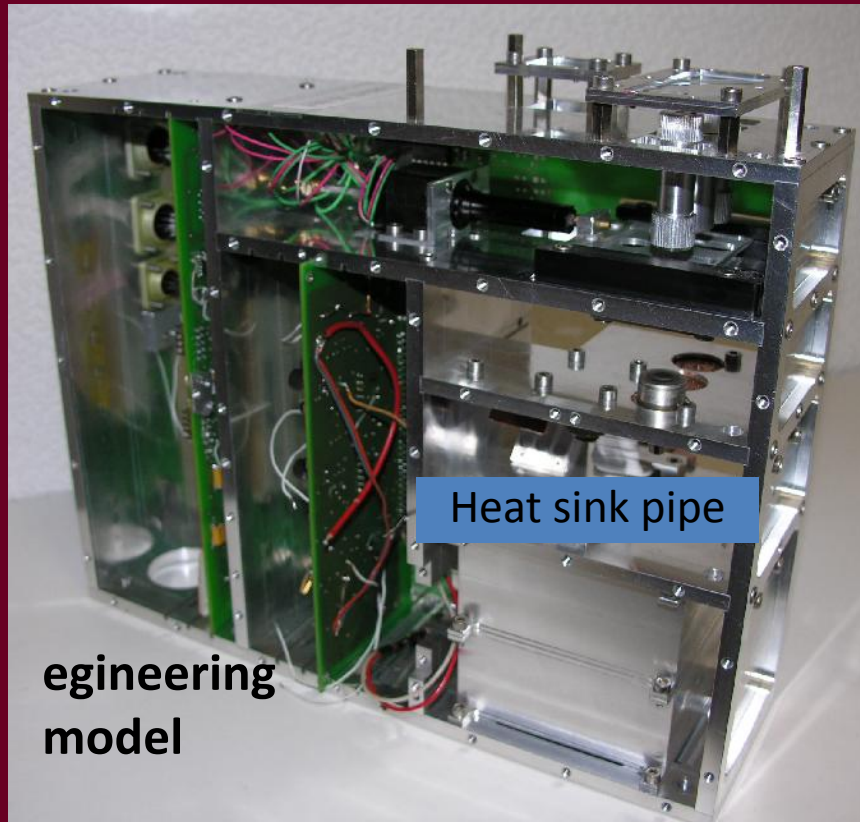
The construction



- EUV filters (doubly aluminized Mylar)
- Photometer
 - Collimators (+-2.5 deg)
 - Three apertures
 - D1, D2, D3
- Shutter
 - Stepper motor
- FFU
 - Filters
 - Targets
 - D4
- Electronics
 - Front end Amptek
 - Digital „our”
- Controller
 - Software
 - reprogramming
- Heat sink
- Alignment mirror

Total cost of the project ~1 mln Euro

SphinX construction details



SphinX characteristics:
Mass ~ 3.7 kg, Power ~10 W,
Telemetry: ~ 60 MB/24hours of (10x) compressed
data → 0.5 GB/day

Measurement channels

Photometric

FFU

D1

ϕ : 5 mm

A: 13.0 mm²

8 μ s

Up to

60 000 cts/s

FWHM: 490 eV

D2

ϕ : 4 mm

A: 0.26 mm²

25 μ s

Up to

20 000 cts/s

FWHM: 290 eV

D3

ϕ : 4 mm

A: 0.0052 mm²

25 μ s

Up to

20 000 cts/s

FWHM: 290 eV

D4

ϕ : 4 mm

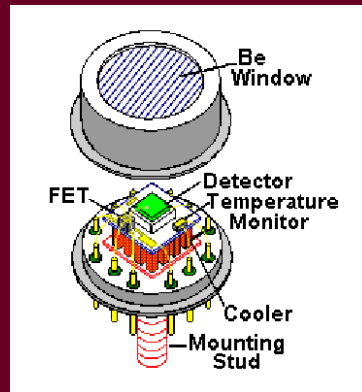
A: 13.0 mm²

25 μ s

Up to

20 000 cts/s

FWHM: 290 eV

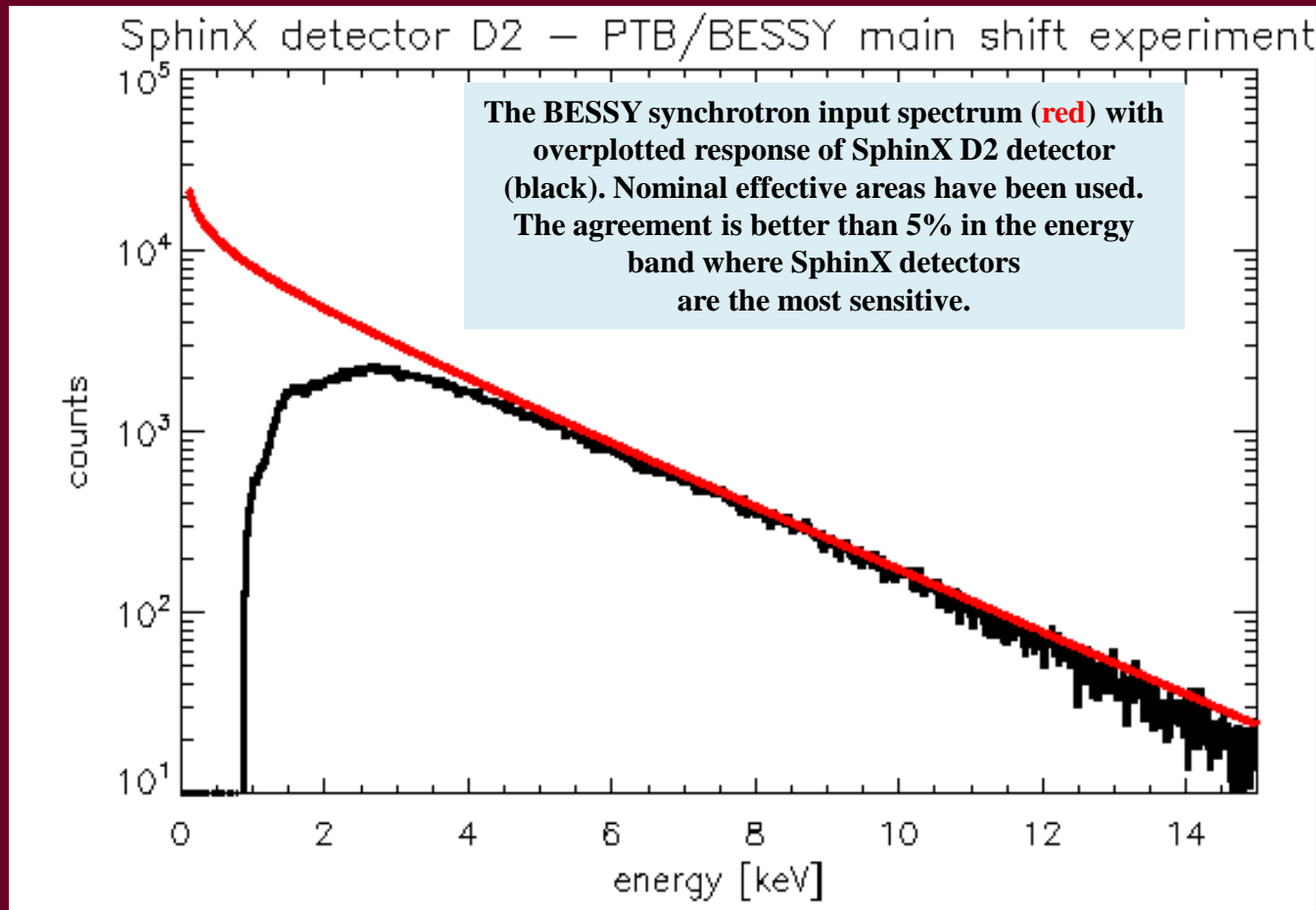


Detectors (four units): **256**/₁₀₂₄ energy bins
Amptek, Peltier cooled (-50 deg C below
the support T) Si PIN diodes.

Detectors' support plate passively
cooled through the heat sink pipe to
external radiator

Photon arrival time measured to within 2 μ s
(in Time Stamping Mode)

How it looks from the tests

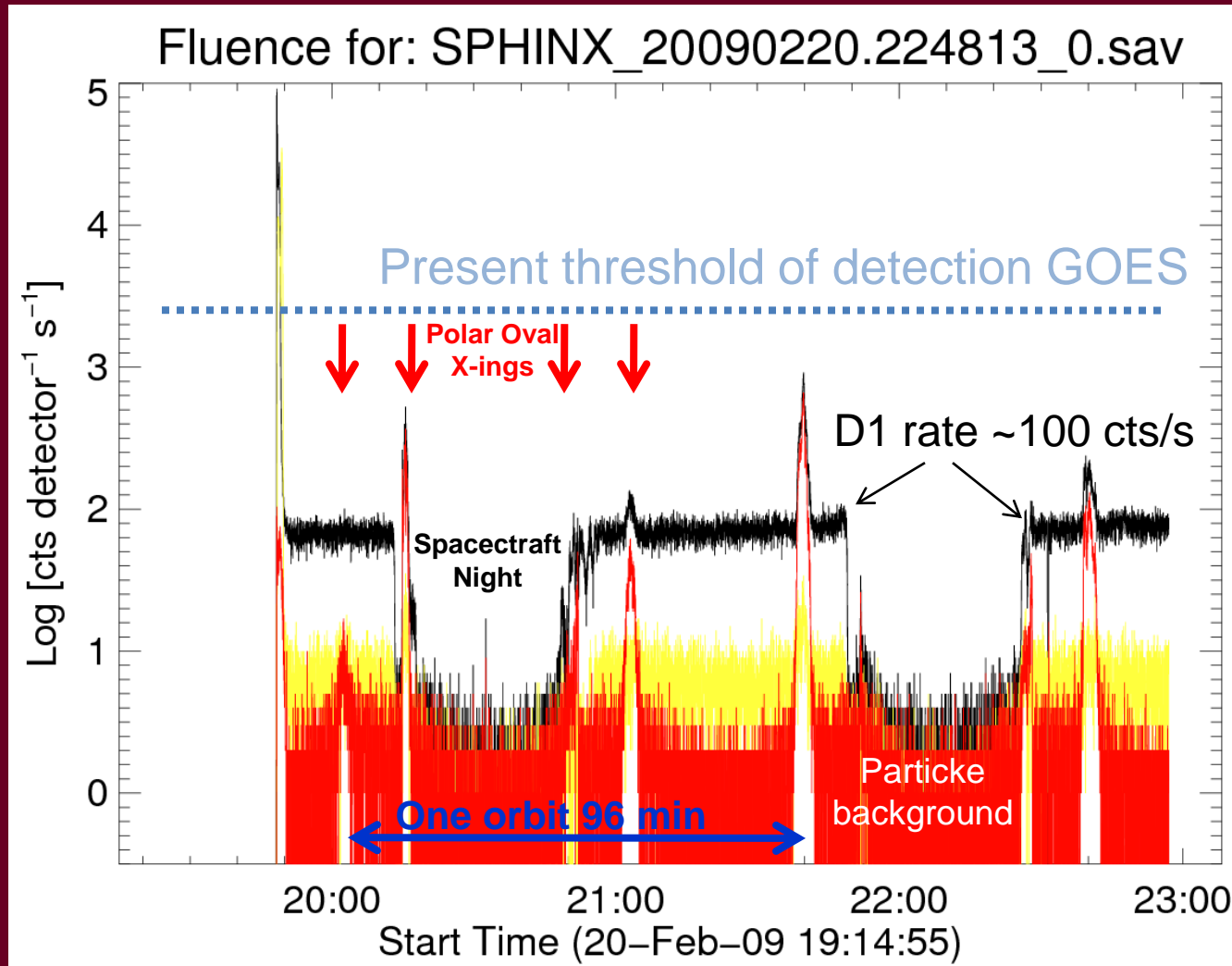


**BESSY
Berlin
Synchrotron:**

- **All detector linearity: perfect (0.1%) over 0.8-14.5 keV; dynamic range 10^4 .**
- **absolute response known to better than 5% against reference synchrotron source.**
- **pile-up matrices known as measured from X-ray 4 crystal monochromator spectra obtained at 8 energies between 1.5 and 8 keV**

First ever seen: X-ray lightcurve of extremely quiet corona

<http://www.cbk.pan.wroc.pl/js/lightcurves/> 150 preliminary plots

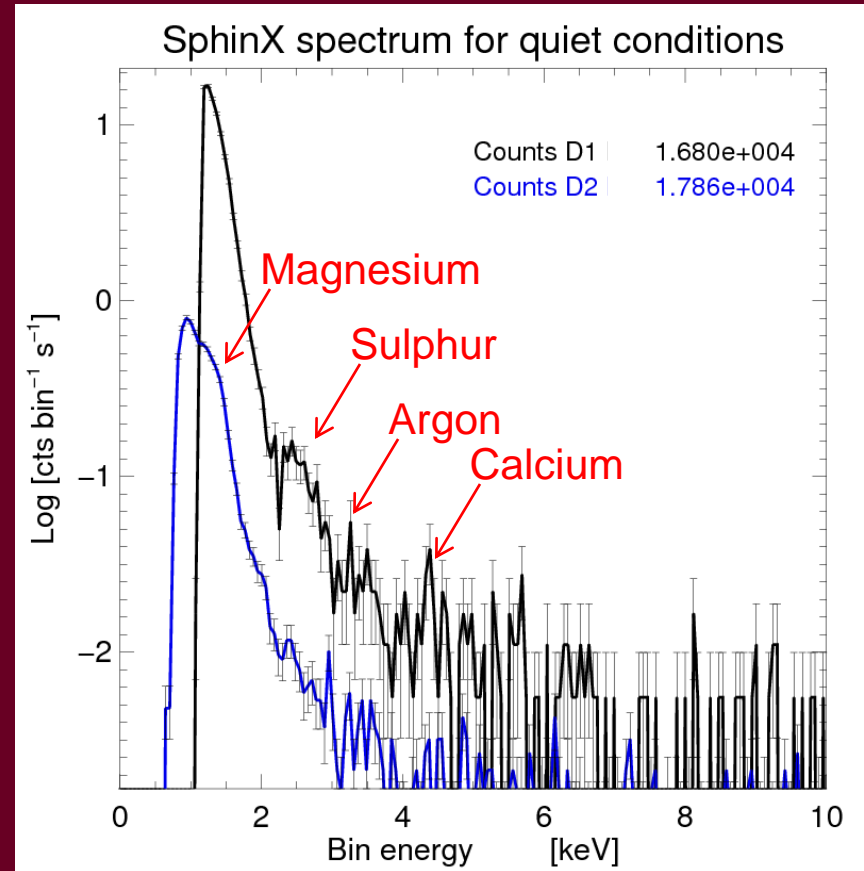
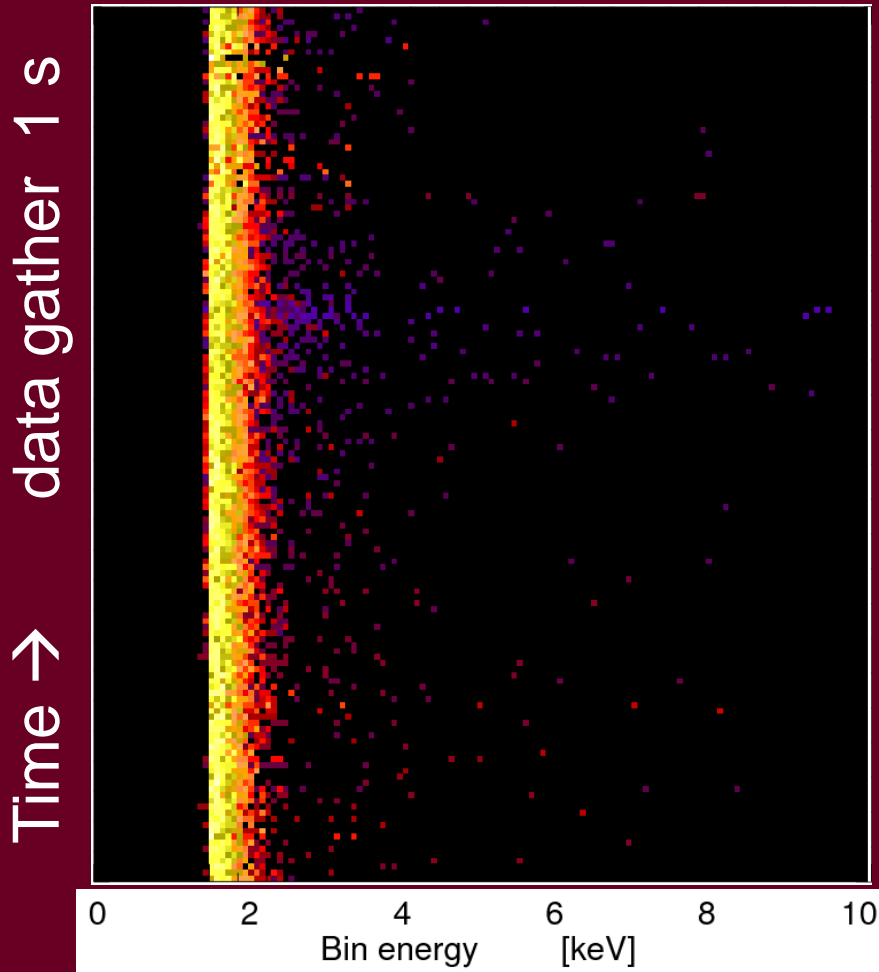


100 x better
Time resolution

Present X-ray fluence
20 X below
GOES
Sensitivity
threshold

Precise
control
of orbital
background

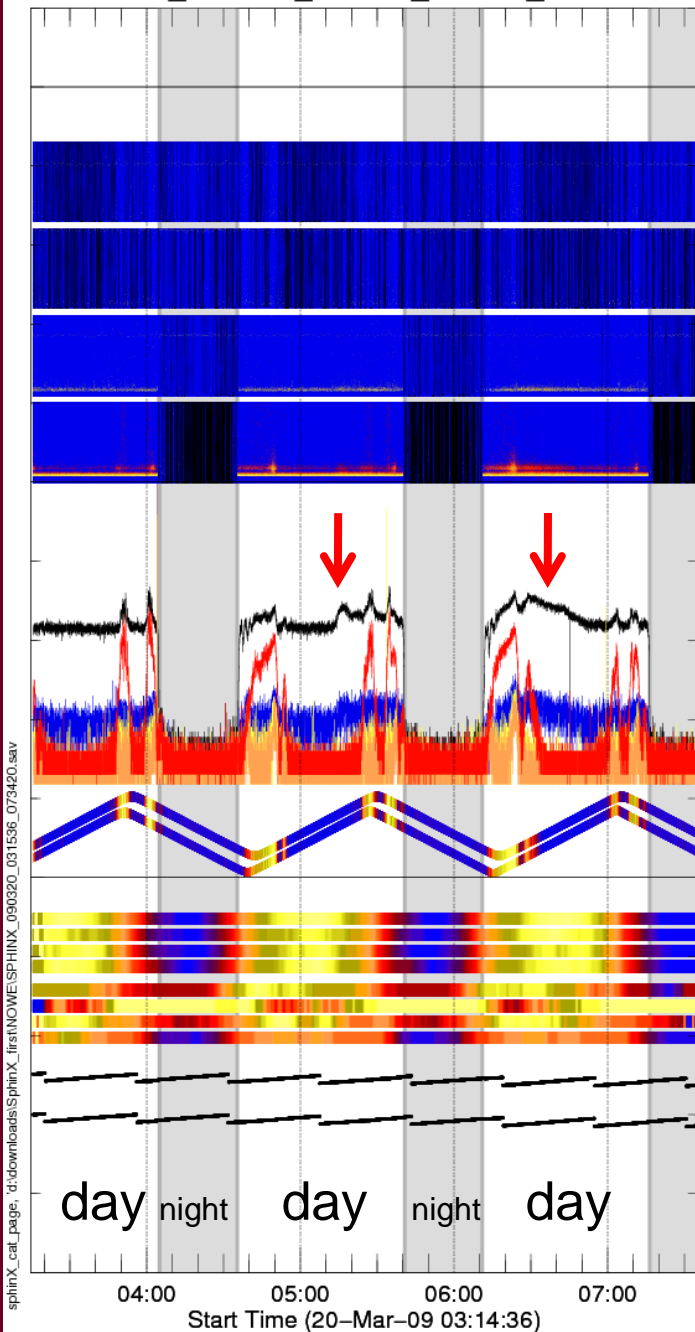
Never seen before: X-ray spectrum of extremely quiet corona



5 GB collected at ~400 MB/24h

100 x better spectral resolution (*GOES*)
3 x better spectral resolution (*RHESSI*)

Soteria Workshop, 23-24 March 2009, Saariselkä, Finnish Lapland J. Sylwester



Typical catalogue page out of
~200 already in preparation

D4 X-ray spectra in four detectors
D3 available each second
D2
D1 form 1 -15 keV vertically

Fluence, each second D1- black
D2- blue, D3- yellow, D4-magenta
In red is orbital background

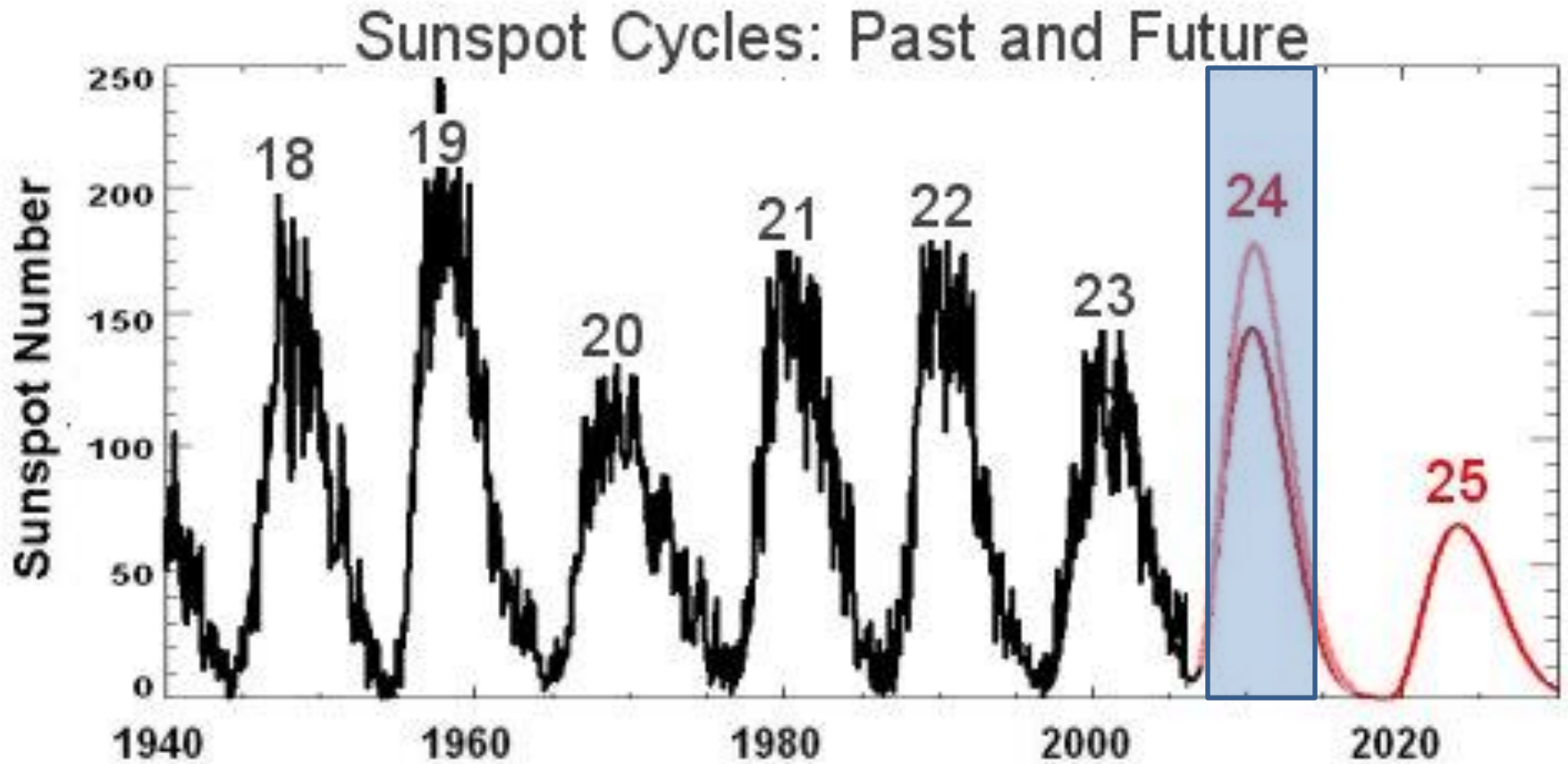
the orbital background fluence atop the position of
the Koronas-Foton In geographic and magnetic
coord.

Temperatures on Peltier coolers
and amplifiers

Clock of the processor against UT
~0.5 s difference

Will be improved (Szymon)

Predicted behaviour of activity during operation of Koronas-Foton



http://science.nasa.gov/headlines/y2006/10may_longrange.htm

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What SphinX data are available for Space Weather

- Solar X-ray luminosity 5% absolute level for GOES classes: $\leftarrow S_{\text{(new class)}}$, A, B, C, M, X, $\rightarrow X30$
- Time variability from 0.00001 s \rightarrow 25 min, each orbit during heavily occulted portions
- Uninterrupted solar fluence up to 20 days (except for polar ovals & SAA crossings) during the non-shadow portions (this March 31-April 18 will be the first)
- Particle flux densities while crossing ovals & SAA (monthly images)
- General background flux mapping in geomagnetic coordinate system (each month maps)

What would be welcomed from SOTERIA

- Support for manpower to do
 - Data reduction, reformatting, archiving
 - Data visualization (environment maps)
- Support for LAN upgrade
 - Routers, switches, cabling up to 1 Gb/s from 10 Mb/s
 - New workstations
- Access to auxiliary data (through the SOTERIA database) for physical interpretation

SphinX & TESIS

Great Thanks to TESIS
team for „letting us in” to
their fantastic instrument

