

WROCŁAW SOLAR PHYSICS DIVISION REPORT FOR 2013

(RAPORT ZFS CBK)

JANUSZ SYLWESTER

- Staff: increase of the group, now 19 + ZK
- Projects: new collaboration NASA + LASP Boulder
- Main results:
 - AbuOpt,
 - Location of hotter plasma in non-active corona
 - Properties of particle environment
- Plans for 2014 and forward: SOLPEX

Staff: 19 on permanent positions (av. 46 y)
4 below 35 y, 2 phd (SRC, IAUwr)
+ one PhD opened Warsaw Technical U.

Scientists: 2 x dr. hab., 4 x dr, 1 assistant,
1 phd student + 1 full professor

Engineering staff: 1 physicist, 1 mech.
Constructor, 4
electronic/software + 2
modellers

Support: 2 (one hired last March only,
after 2y negotiations with
headquarters...)

Running grants:

ChemiX (Interhelioprobe) NCN funded,
lead: **Marek Siarkowski**, ends 2014

STIX (Solar Orbiter) NCN funded,
lead: **Tomek Mrozek** formally Janusz Sylwester, ends 2014

STIX PECS :

Wroclaw lead: **Mirek Kowalinski**, engineering part funded in collaboration with SRC main body

RESIK (Coronas-F) NCN funded,
lead: **Barbara Sylwester**, ends, 2014

eHeroes (7FP),
lead: **Szymon Gburek** formally Janusz Sylwester, ends 2014
+ respective SPUB ends 2015 March

ISSI (Bern): Non-Equilibrium Processes in the Solar Corona and their Connection to the Solar Wind **Team 276**,
lead: **Barbara & Janusz Sylwester**

New grant application submitted:

konkurs	kierownik projektu	tytuł	okres realizacji	ogółem	w tym 1 rok	liczba wykonawców	status
Preludium 5, ST9, ID 215432	M.Gryciuk	Badanie rozbłysków słonecznych na podstawie obserwacji wykonanych za pomocą polskiego spektrofotometru Sphinx	24 miesiące	96 326	51 658	2	Zakwalifikowany do finansowania
Opus 5, ST 9, ID 216648	A.Kępa	Badanie obfitości pierwiastków w koronie słonecznej oraz innych gwiazd późnych typów widmowych na podstawie ich widm rentgenowskich	36 miesiące	480 900	190 800	9	NIEZAKWALIFIKOWANIE WNIOSKU DO II ETAPU OCENY MERYTORYCZNEJ:
Opus 5, ST 9, ID 220611	M.Stęślicki	Rentgenowski polarymetr SOLPEX: zdefiniowanie szczegółowych celów naukowych, opracowanie i testowanie unikalnych węzłów pomiarowych oraz sposobu prowadzenia obserwacji na podstawie modelowania matematycznego przyrządu.	18 miesiące	592 704	419 986	8	NIEZAKWALIFIKOWANIE WNIOSKU DO II ETAPU OCENY MERYTORYCZNEJ:
Opus 6, ST 9, ID 237693	J.Sylwester	Rentgenowski polarymetr SOLPEX: zdefiniowanie szczegółowych celów naukowych, opracowanie i testowanie unikalnych węzłów pomiarowych oraz sposobu prowadzenia obserwacji na podstawie modelowania matematycznego przyrządu.	36 miesiące	1 032 700	517 926	9	rozstrzygnięcie do 16.06.2014
Sonata BIS 3, ST 9, ID 230838	M.Stęślicki	Rentgenowski satelitarny spektrometr obrazujący CubIXSS: zdefiniowanie szczegółowych celów naukowych i sposobu prowadzenia obserwacji.	60 miesiące	1 495 840	418 020	7	rozstrzygnięcie do 16.03.2014
Opus 6, ST 9, ID 241466	M.Siarkowski	Badanie obfitości pierwiastków w koronie słonecznej oraz innych gwiazd późnych typów widmowych na podstawie ich widm rentgenowskich	36 miesiące	480 900	112 100	9	rozstrzygnięcie do 16.06.2014

Data under present analysis:

- Our:
 - **RESIK** – 20 % of good flare spectra analysed (out of 2mln)
http://www.cbk.pan.wroc.pl/experiments/resik/RESIK_Level2/index.html
 - **DIOGENESS**- FITS database created (**Eheroes**)
 - **SphinX** – list of events (**Eheroes**)
- NASA:
 - **Messenger** XRS, soft X-ray spectra
 - **Hinode** XRT, soft x-ray images
 - **RHESSI** hard x-ray spectra & images (good understanding)
- Russian measurements of particle environment
 - **Skobeltsyn Institute** (MGU)

International collaborations:

- Russia:
 - **IZMIRAN**: Coronas-F: **RESIK**, **CHEMIX**
 - **FIAN**:
 - Coronas-F data,
 - **RESPECT Spectrophotometr**,
 - **SOLPEX-KORTEZ**,
 - **Skobeltsyn Institute (MGU)**, **RESIK** particle data
- Czech Rep.:
 - **AI CAS**: Diogeness
- Italy
 - **AO Palermo**: SphinX data analysis, **PH** modelling
- Ukraine:
 - **Kharkiv University**: SphinX particle data interpretation, **ChemiX** particle detector unit
- UK,
 - **UCL** :RESIK data interpretation
- Poland:
 - **AI WrU**: common data interpretation, **PH** modelling
STIX collaboration
- CERN (**Patras Consortium**): SphinX & XRT in **Axion** detection context

RESIK data analysis results (Barbara & Janusz Sylwester)

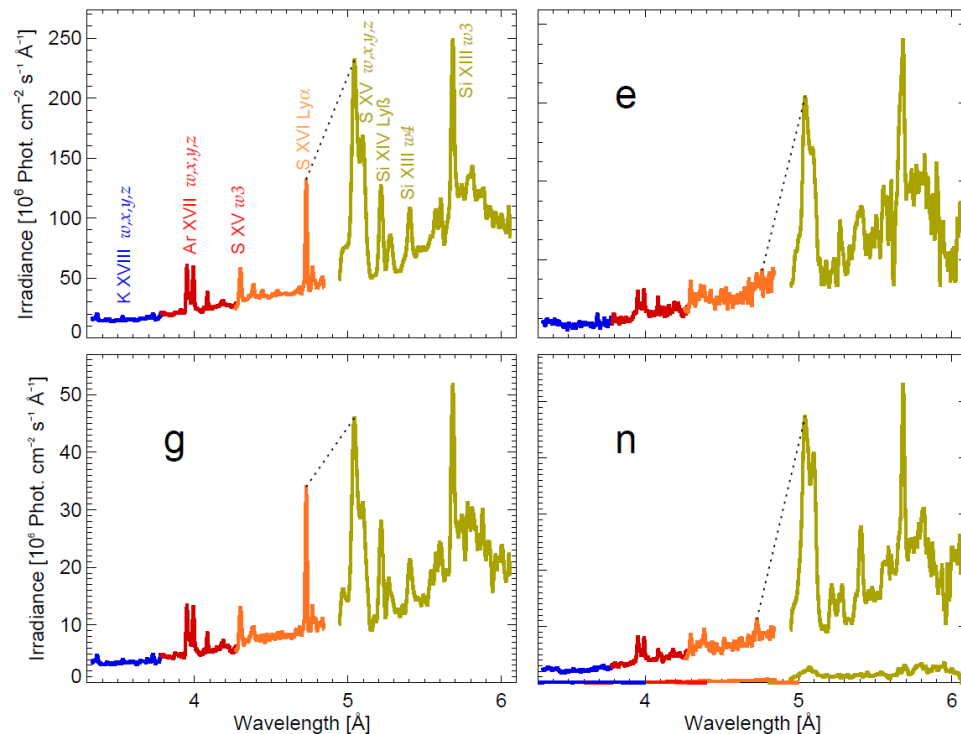


Fig. 1.— (Top left:) Averaged RESIK spectrum for the SOL2002-11-14T22:26 flare over the period 22:22:45–22:53:31 UT (total exposure time 26.5 minutes). Different colors are used for the four RESIK channels. Principal line identifications of the chief features are given; the notation used is for the He-like ions (K XVIII, S XV, Si XIII) are $w = 1s^2\ ^1S_0 - 1s2p\ ^1P_1$, $w_3 = 1s^2\ ^1S_0 -$

AbuOpt essentially new approach & tool

$$F_i = A_i \int_{T=0}^{\infty} f_i(T) \varphi(T) dT$$

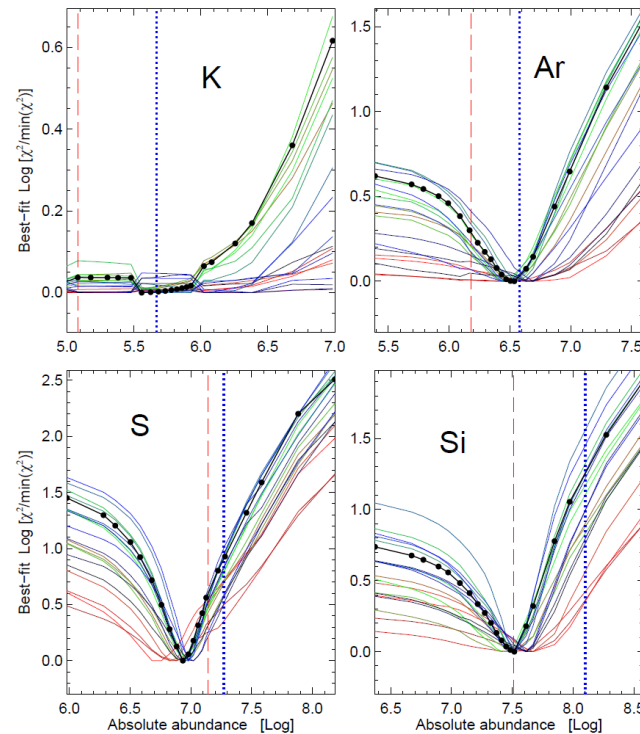


Fig. 4.— Plot of the quality of the fit, expressed as the ratio of normalized χ^2 over the minimum value of χ^2 , of the observed and theory fluxes for all 19 time intervals during the flare (colored to distinguish them: blue for rise phase spectra, red, orange, or yellow for decay phase) as a function of assumed element abundance for K, Ar, S and Si. The black curve with dots is derived from the average spectrum over the 19 time intervals. The vertical dotted lines correspond to the CHIANTI coronal abundance (Feldman 1992), and the dashed lines to the CHIANTI photospheric abundances (Asplund et al. 2009).

That allows to study **time-dependence** of plasma composition

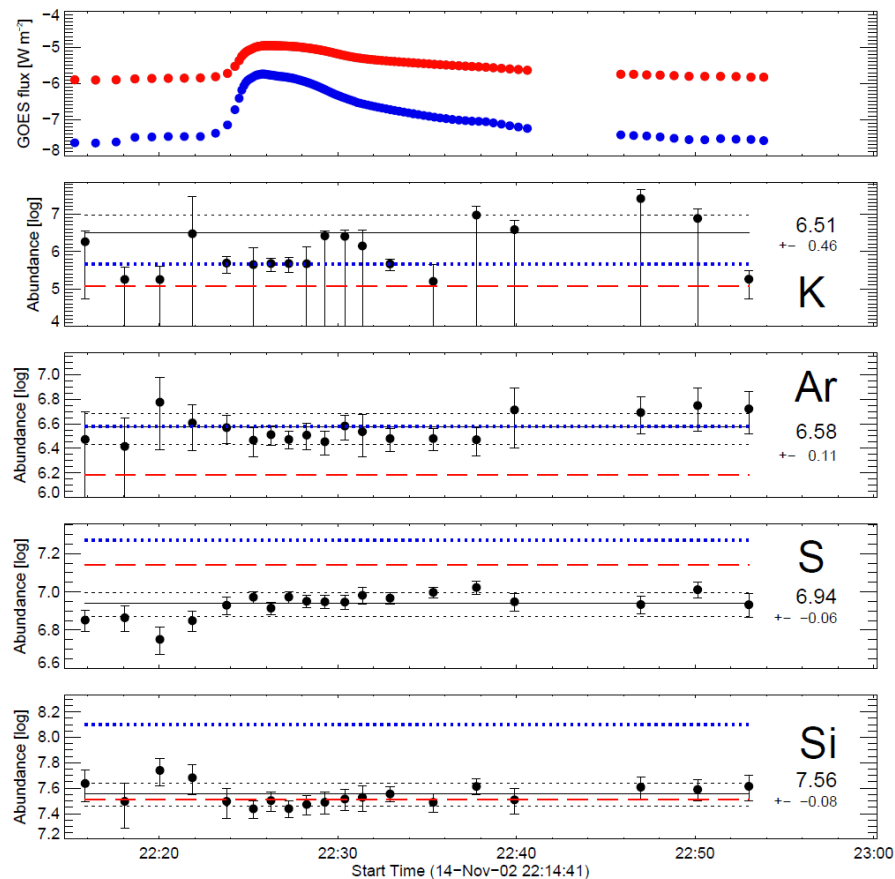


Fig. 5.— The time variations of derived absolute abundance of K, Ar, S and Si. The abundances were determined using the abundance–optimization approach described in the text. The error bars

SphinX: zapis poziomu pr. rentgenowskiego w głębokim minimum aktywności ~2 mln widm

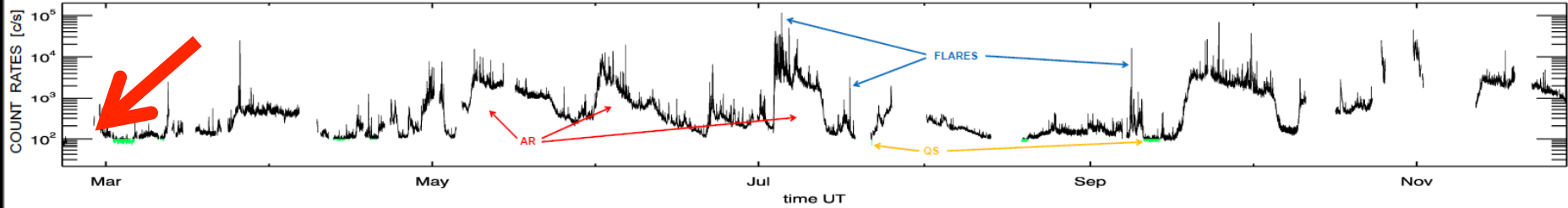
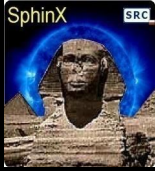


FIGURE 3 SphinX D1 detector count rate during entire mission (from 20 February to 29 November). Green color indicates time intervals for which count rate was less than 100 counts per sec. We call these quiet Sun levels (QS).

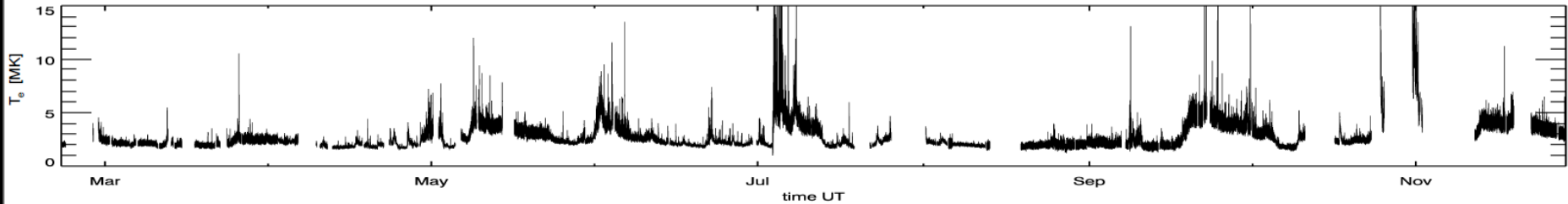


FIGURE 4 Solar mean temperature variations for mission long time period as calculated from SphinX spectra using isothermal approximation. All but few of flares observed by SphinX have temperatures below 10 MK.

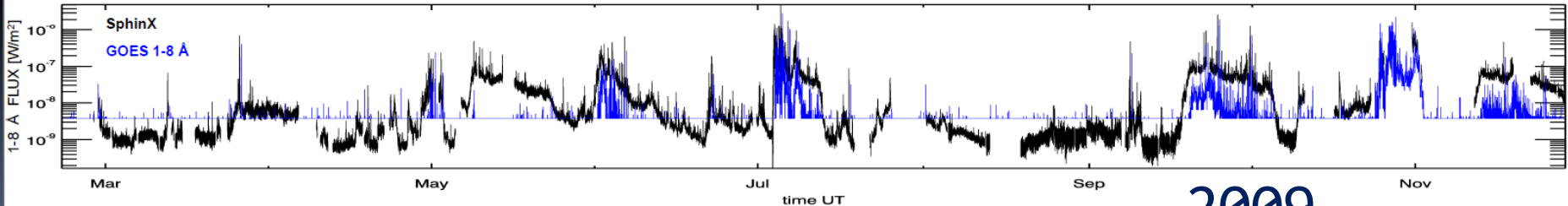
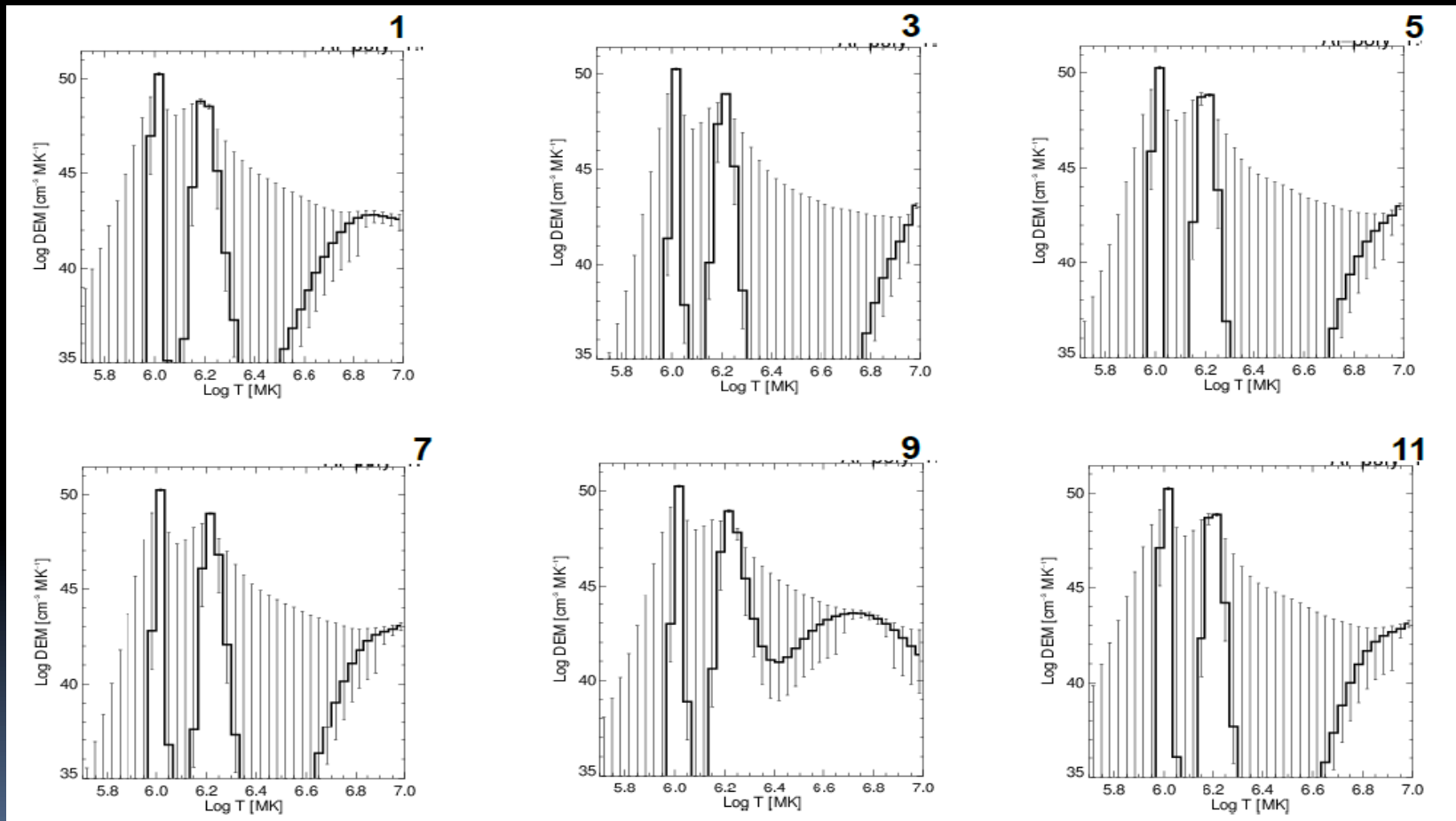
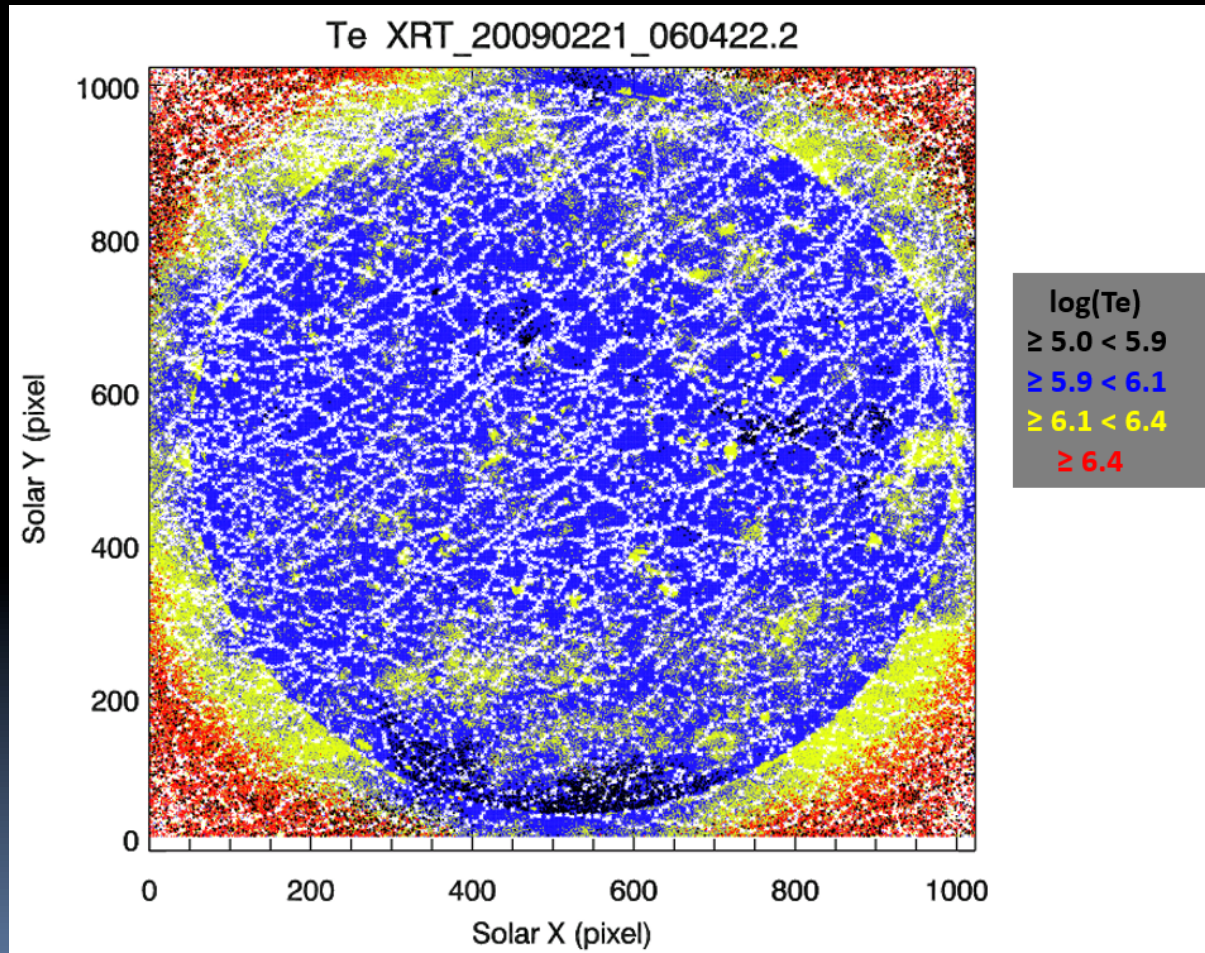


FIGURE 5 Solar fluxes in 1-8 Å energy band calculated from SphinX data compared with those observed by GOES (blue colour).

Combination of **SphinX** & **XRT** observation: 3 components on EM @ various times at the minimum level of activity

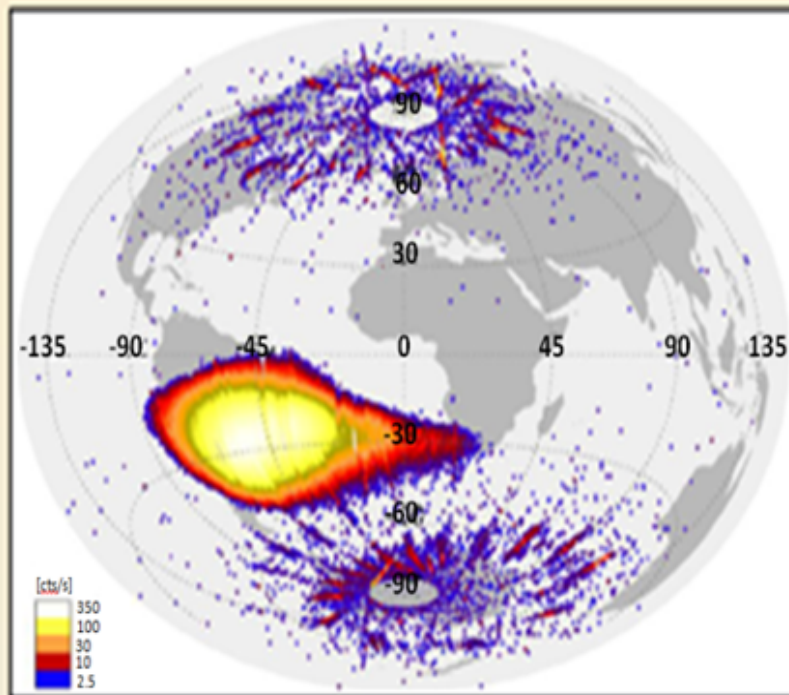


XRT filter ratio analysis results (Marek Siarkowski) under consideration for Nature



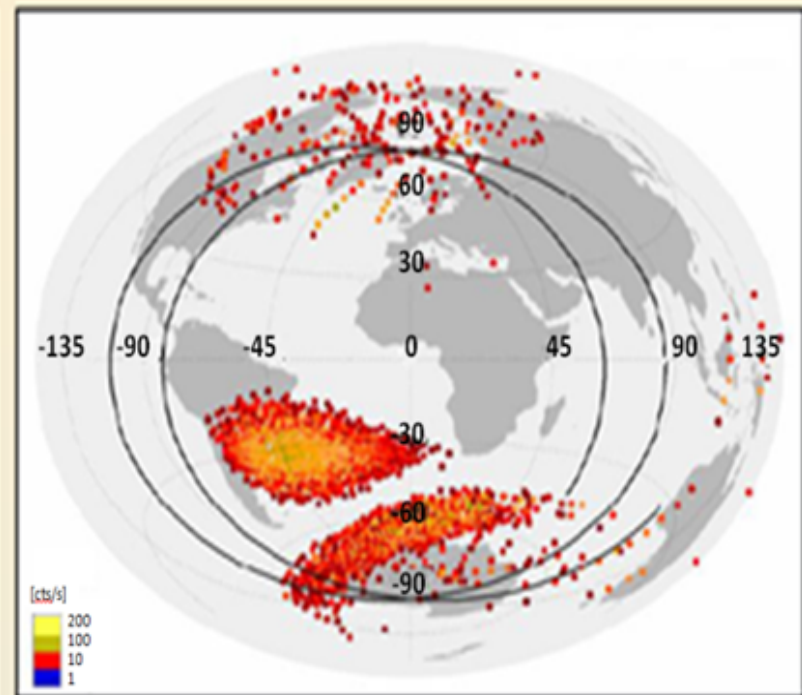
Particle environment on polar orbits (Kowalinski, Podgorski, Gburek)

May 2009



Sphix D1 particle rate

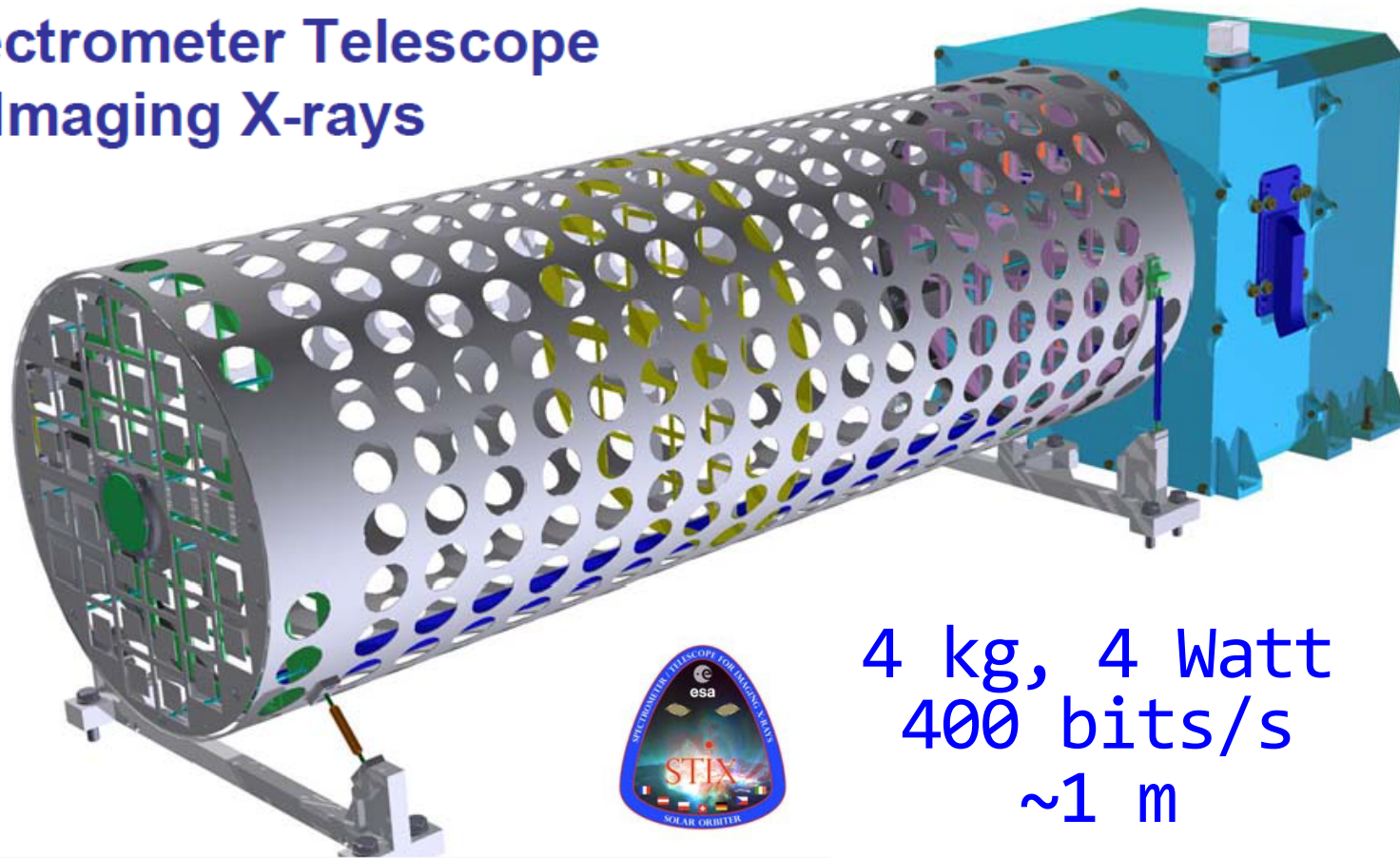
May 2002



RESIK PIN particle rate

STIX for Solar Orbiter

STIX Spectrometer Telescope for Imaging X-rays

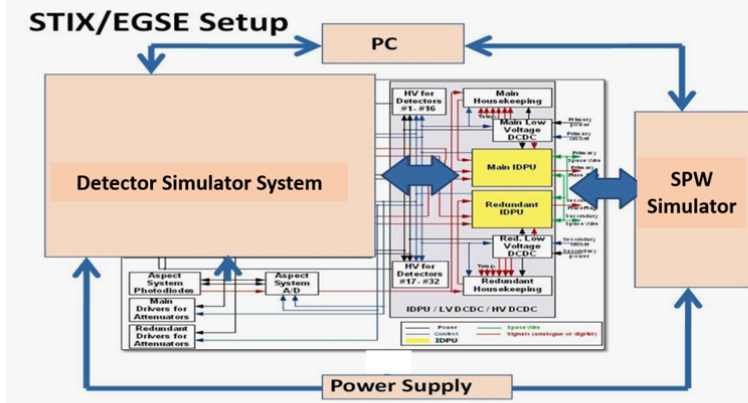


Enineering & Hardware modelling

- STIX:
 - **EGSE** – to be used for testing at various test places and test beds, contains cold finger simulator & power supply
 - **DSS (data simulator system)**- to be used for IDPU & overall response tests- the most advanced simulator designed for X-ray studies: 320 channels, will access collection of data generated for a number of artificial sources
 - **Geant4** modelling of detectors → important upgrade of the software environment for STIX:
the instrument matrix response

EGSE for STIX (ESA) (Mirek Kowalinski)

rowaniez wandaaja oprogramowania dla tego urzqdzenia.



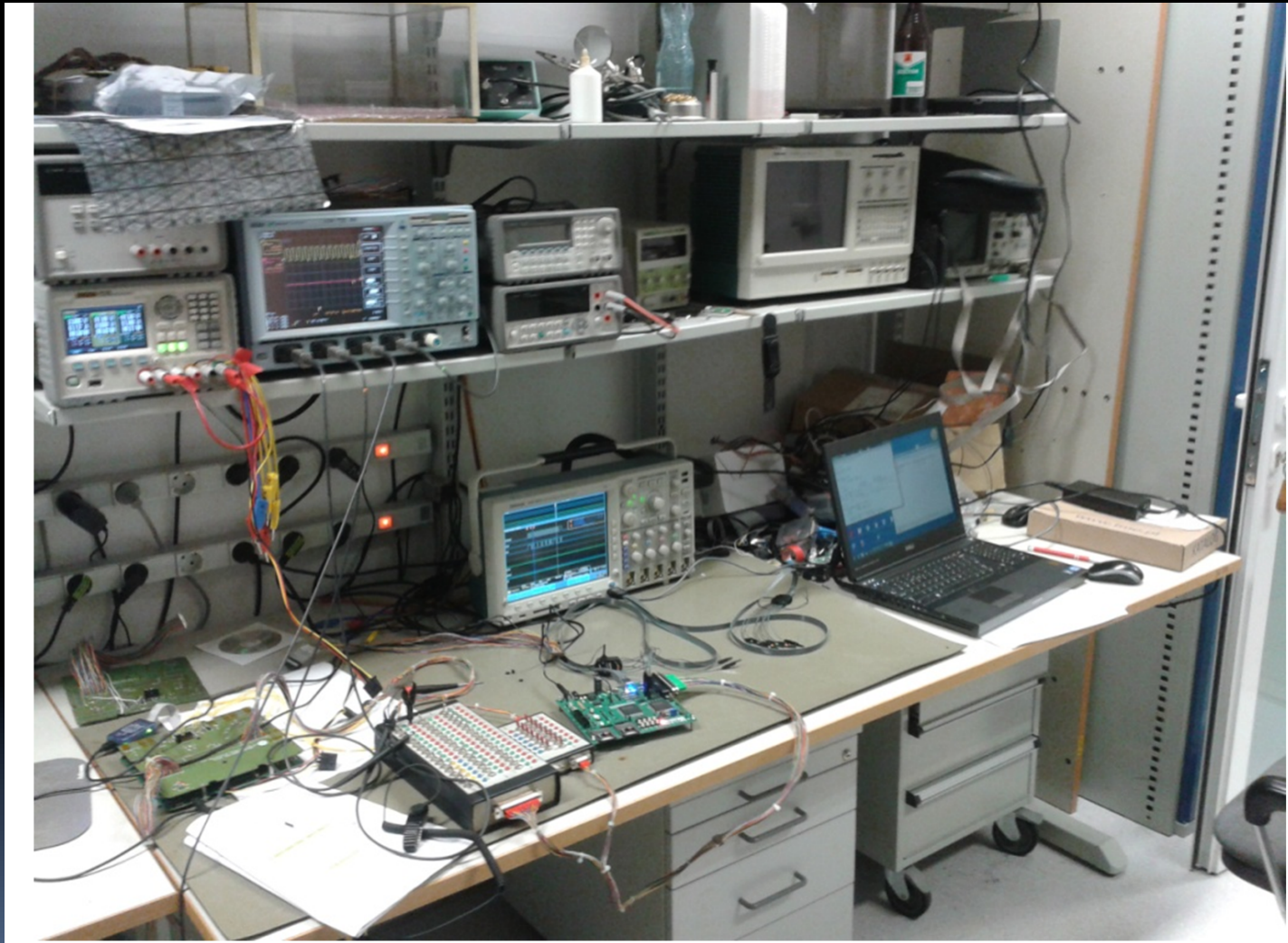
Schemat blokowy EGSE STIX (MK)



Symulator złącza SpaceWire, termoregulator (Cold Finger Simulator).

To be used on every important step of subsystem and instrument tests. (PL, CH, DE, CZ) Provide access/control to subsystems & data as coming from telemetry

Hardware: Detector Simulator system (STIX)



Testy integracyjne DSS –IDPU, Warszawa CBK 2-3 grudnia 2013

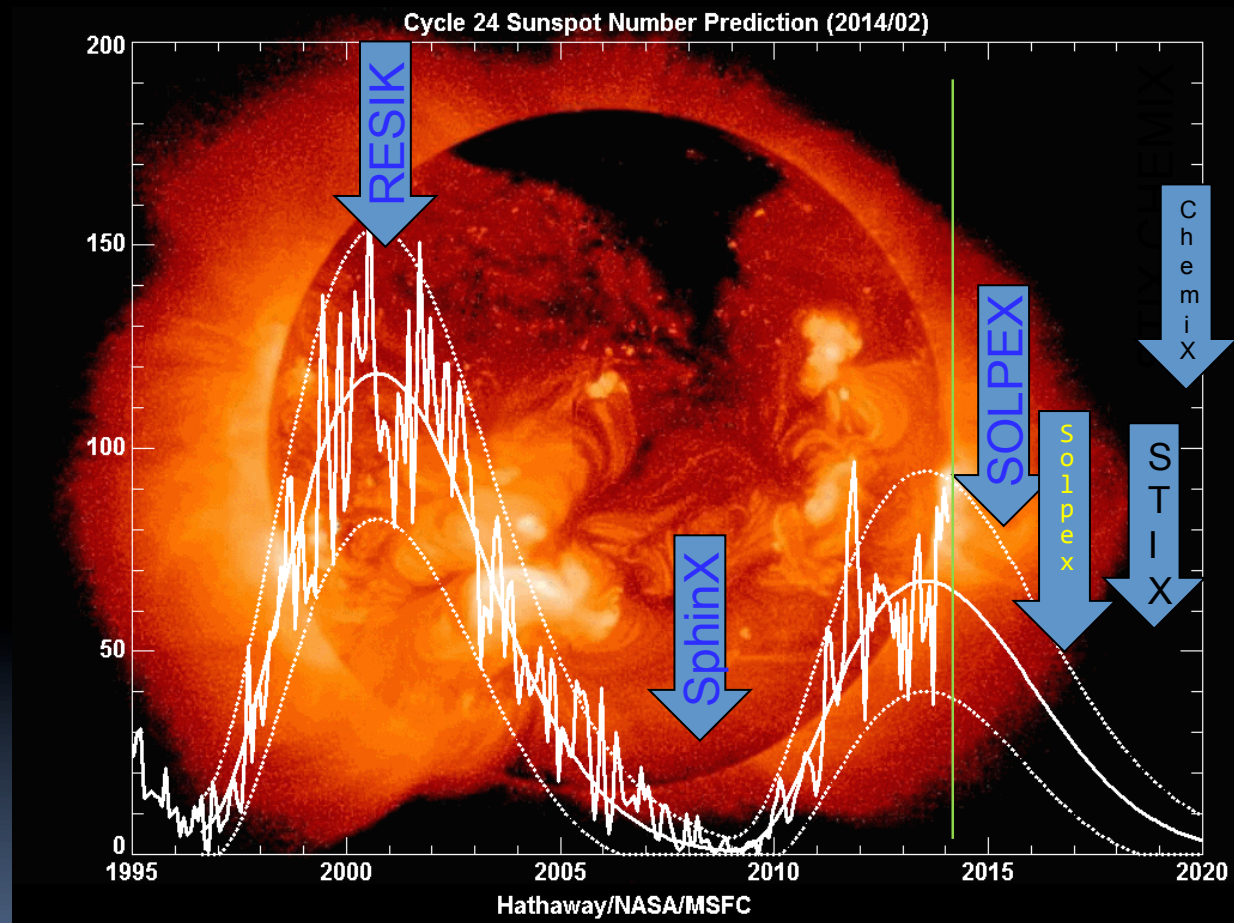
Overall summary for 2013

- Papers Published:
 - **Ranked journals (filadelfijskie) – 12**
 - **Other international – 3**
 - **Submitted - 5**
- Presentations:
 - **Invited: 5**
 - **Oral: ~30**
 - **Posters: see outside**
- International Conferences – 2
- Technical documentation – 7 (Eng. Rus. 500 pages)

Plans:

- **STIX (2017)** and **ChemiX (2020)** as the most important activity of the Wroclaw Team in **strong collaboration** with Warsaw engineering staff
- **Diogeness & RESIK + HXT & RHESSEI** data interpretation as a main source of publications (ApJ class):
- **SOLPEX** on **ISS** as a testbed of science principle and new technology (2015): **X-ray polarisation & non-equilibrium effects**
- **RESPECT** (FIAN collaboration, 2015) – unusual use of CCD's for X-ray event timing
- **CubiXSS**- prospective collaboration with US GSFC and LASP (Boulder) laboratories
- **AI UW**r- flare hydrodynamic modelling using PH code

Rozkład jazdy



Podsumowanie

Dziękuję za uwagę