Handling of on-board information for SphinX X-ray spectrophotometer

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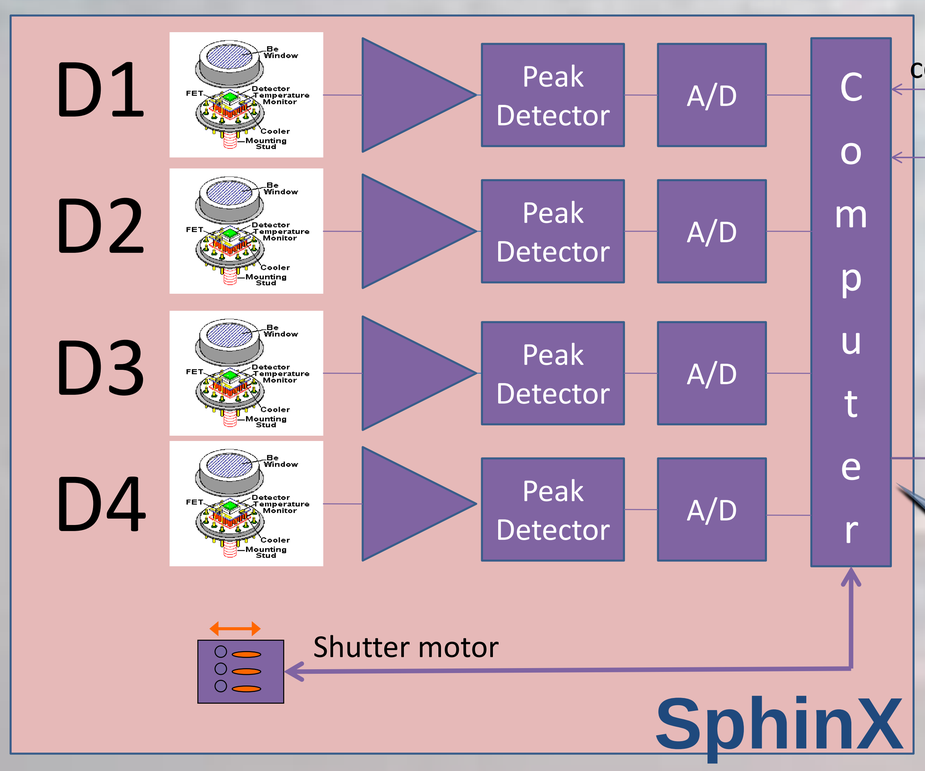
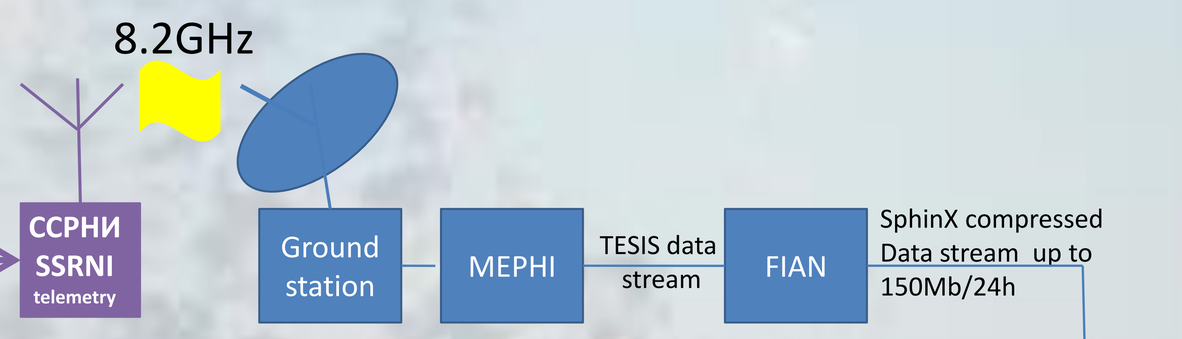
ABSTRACT

The SphinX high-sensitivity soft X-ray spectrophotometer is taking regular measurements of the quiet corona X-ray fluence and spectra with unprecedented sensitivity and spectral resolution. Each incoming photon is being carefully handled by the instrument electronics, with its energy and the time of arrival being determined to within microsecond. In this presentation the organization of the data handling and processing as arranged within the instrument on-board information processing system is presented. Important details are shown which may have a direct relation to the signal processing and respective ground segment, as envisaged for the STIX instrument aboard the SolO, in which the Polish group involvement is substantial.

SphinX Data Flow Diagram



Ground Sector Data Flow



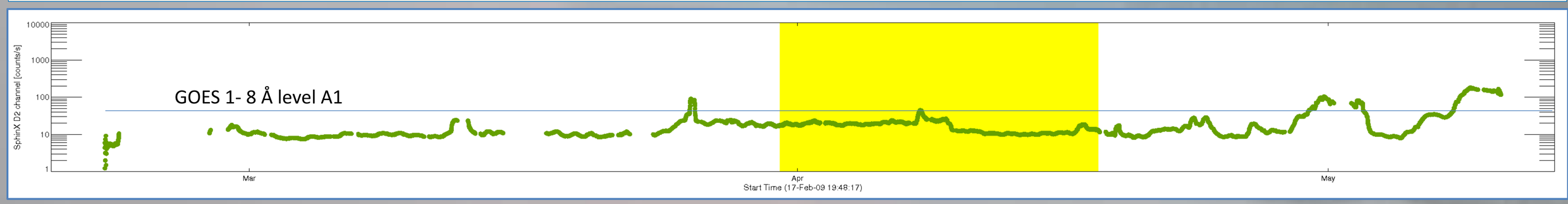
Modes of operation

Basic: In each of D1, D2 , D3 detector four channels are taken in each data gather interval (DGI =1 or 5 s duration) . These channel comprise: detector thermal noise, background flux and two solar X-ray fluxes in broader bands corresponding to: E_{low}=1 - 9 keV and E_{high}> 9 keV bands
In D4 six levels (thermal noise, background flux and the four selected energy bands covering characteristic fluorescence emission lines of the target materials)

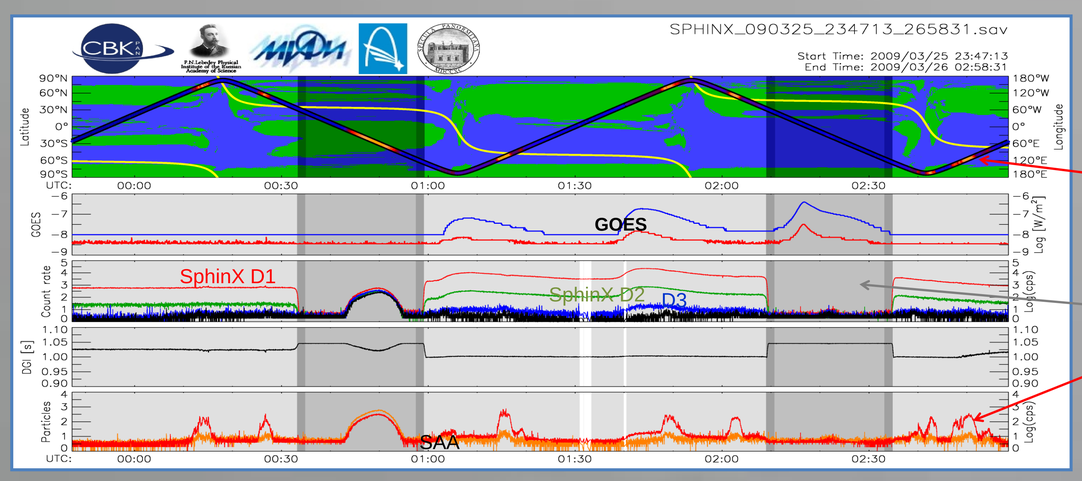
Time Stamping: The arrival times of each detector event (photon or particle), as measured to within 2μs against processor clock

Spectra: D1, D2, D3, D4 energy (amplitude) histograms in 256 energy channels for 0 - 15 keV range.

↓ Plot of the Solar Activity as seen using SphinX detector D2 Energy range: 0.8 – 15 keV, aperture 0.49 mm²



Thanks to the measurements taken by SphinX, it is possible for the first time to study behaviour of solar X-ray fluence at the time of very low activity. The lowest fluxes have been recorded early in the operation, this last February (see the plot above). During the period marked in yellow, the CORONAS-PHOTON spacecraft has not encountered occultations, therefore continuous measurements were possible. A full data reduction needs to take into account detailed knowledge of the instrument health & particle environment. These data are available from a number of sensors located within the instrument and directly in the detectors.
In the panels below, example page from the SphinX catalogue is shown and the meaning of individual plots is given. Approximately 500 of such pages cover the period of active SphinX operations at present. The volume of acquired information is already ~ 50 GB, increasing each day by 0.5 GB.



←Example of SphinX Technical Data Visualization of particular telemetry dump.
Time plot of *CORONAS-PHOTON* orbital position.
Brighter colors of the line indicate passages through regions of increased particle background - polar ovals and SAA.
Spacecraft optical nights are shaded in light gray.
X-ray nights extend over enitre light/dark gray aeras.
GOES X-rays as measured in 0.5 – 4 Å and 1 – 8 Å bands are presented for the comparison

Acknowledgement

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