



CHARACTERISTICS OF ELEMENTARY SOFT X - RAY FLARE PROFILES BASED ON SphinX OBSERVATIONS

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Outline

- SPHINX INSTRUMENT
- SPHINX OBSERVATIONS
- ELEMENTARY SXR LIGHTCURVE FLARES PROFILE
- FLARES CHARACTERISTICS
- SIMPLE FLARES OBSERVATIONS
- EXAMPLES OF FITTING
- BLENDED FLARES
- FUTURE PLANS

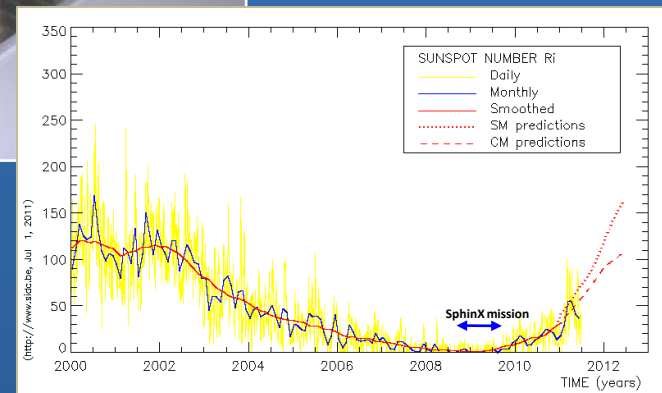
SphinX: Solar Photometer in X-ray

SphinX

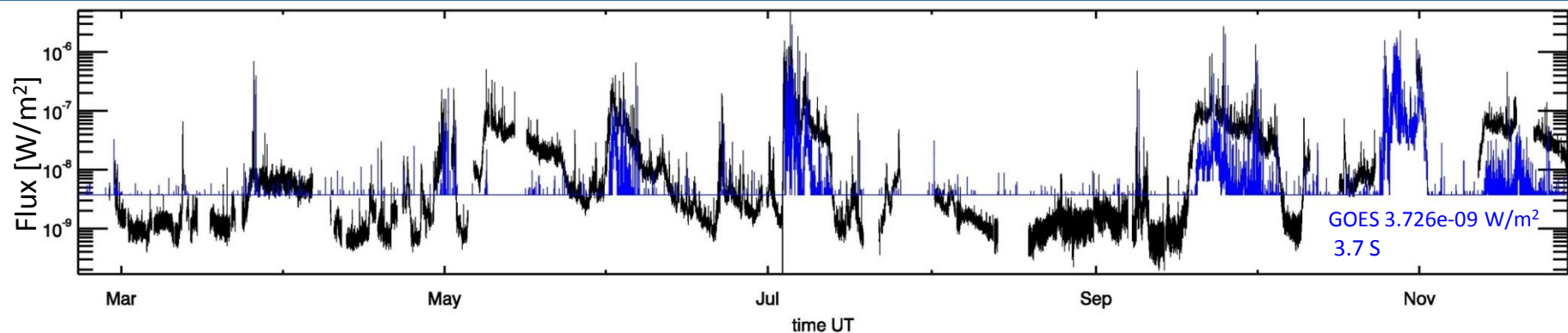
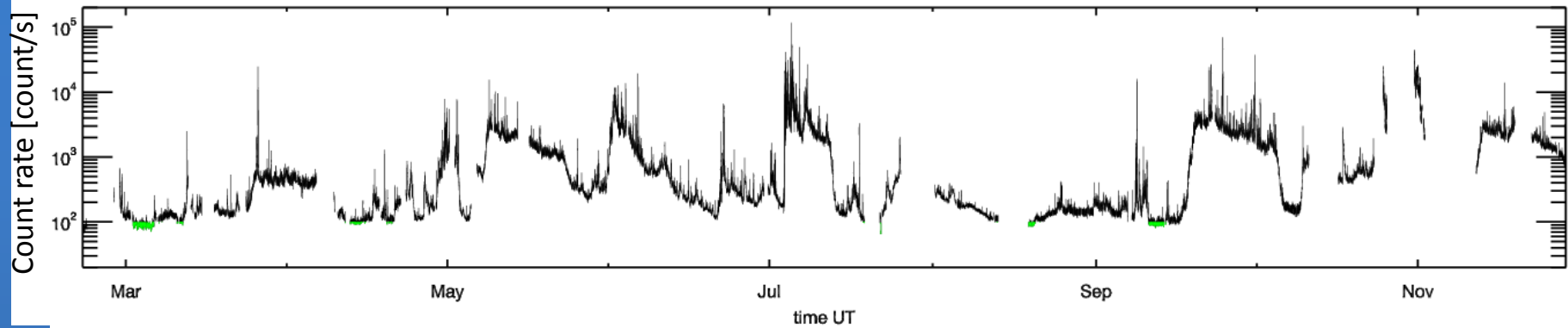
BASIC INFORMATION

LAUNCHED:	30 January 2009 at 13:30 UT from Plesetsk Cosmodrom
SATELLITE:	CORONAS – Photon
ORBITS PARAMETERS:	orbit duration- 96min altitude - 550km near polar orbit
MASS:	3.7 kg
POWER:	10 W
ENERGY RANGE:	1.2 keV - 15 keV in 256 energy bins
LIFESPAN OF THE MISSION:	20 February - 29 November 2009

CORONAS - Photon



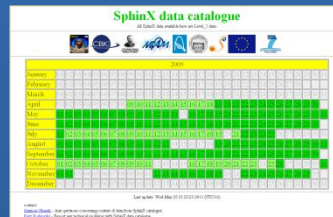
SphinX Mission Observations, 2009



NEW SXR FLARES CLASSES

S CLASS - $S1 = 1. \text{e-}09 \text{ W}/\text{m}^2$

Q CLASS - $Q1 = 1. \text{e-}10 \text{ W}/\text{m}^2$



SphinX level1 data catalogue

- The catalog contains data from D1 SphinX detector
- All available data files are stored in FITS format (OGIP-93/003 format)

http://156.17.94.1/sphinx_l1_catalogue/SphinX_cat_main.html

Elementary Soft X-ray Flare Profile

Convolution of two functions

Gauss function

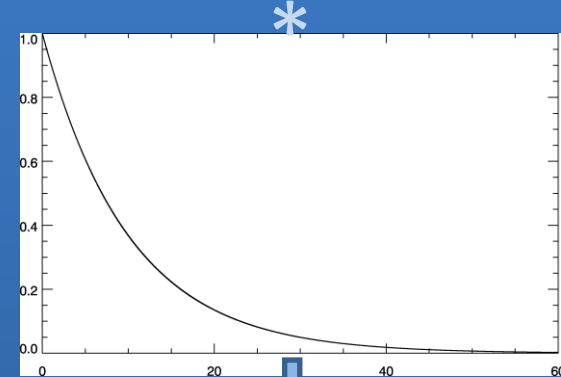
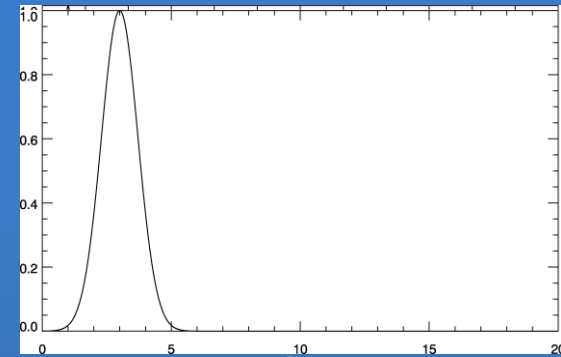
$$f(t) = Ae^{-(t-B)^2/C^2}$$

Exponential function

$$f(t) = e^{(-Dt)}$$

FLARE PROFILE FORMULA:

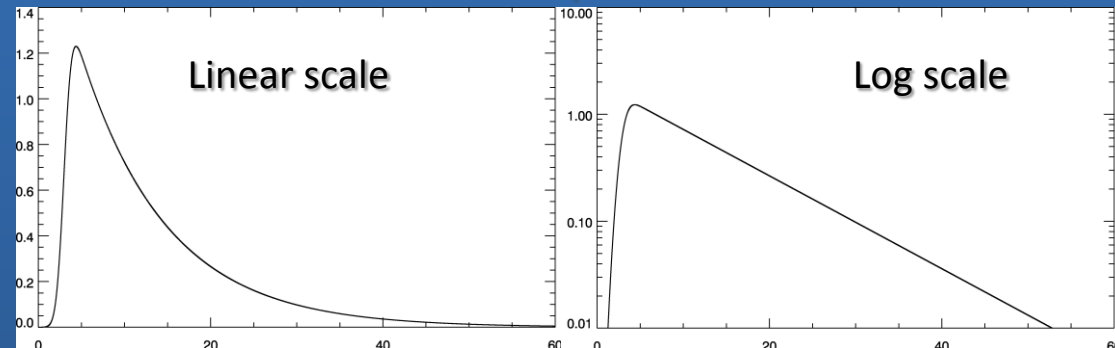
$$F(t) = 0.5 \sqrt{\pi} A C \exp(D(B-t) + (C^2 D^2)/4) \cdot \\ [erf((2B + C^2 D)/2C) - erf((2(B-t) + C^2 D)/2C)] + \\ + Et + F$$



Linear background

$$f_{bg}(t) = Et + F$$

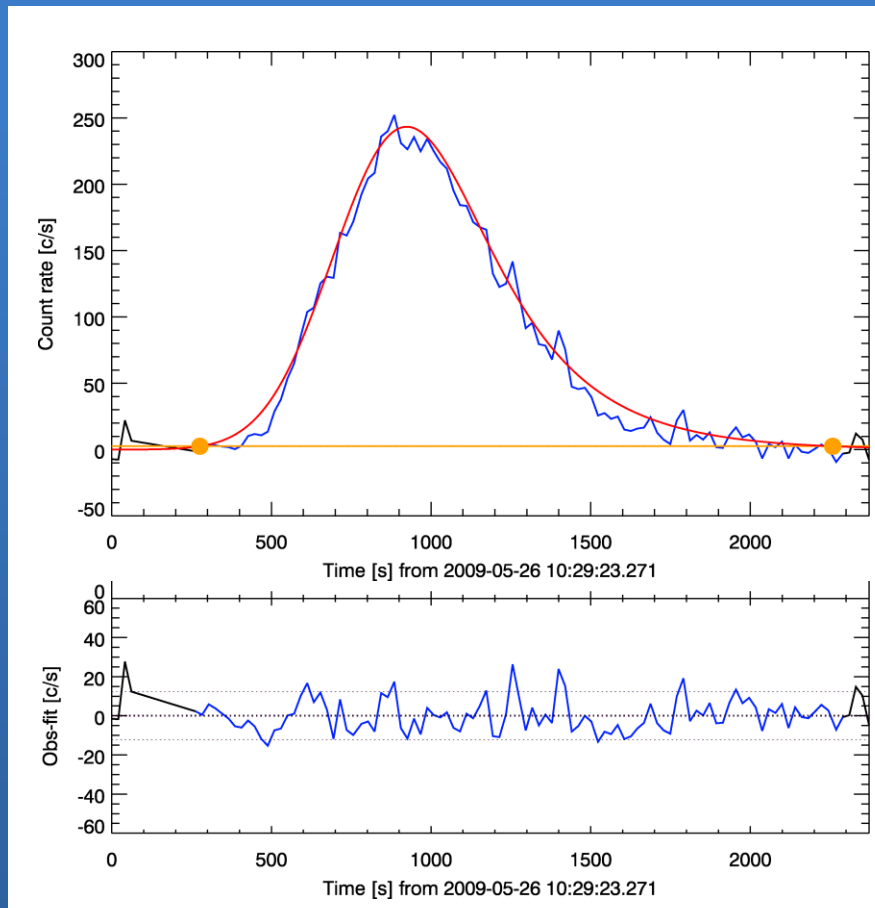
4 parameters (flare) +
2 parameters (linear background-
attributable) = 6 PARAMETERS



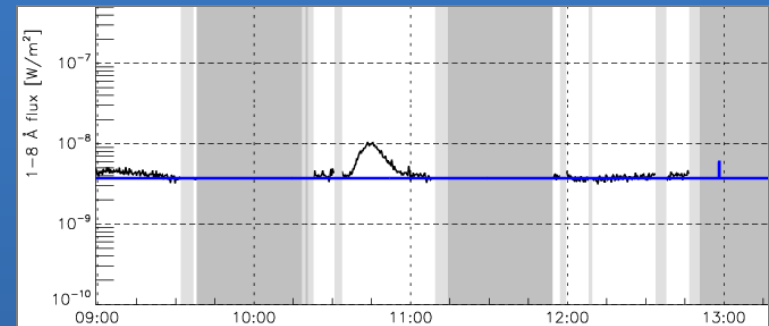
Simple Flares Observed by SphinX

Date	Time _{start}	Time _{max}	Time _{end}	GOES Class	SphinX Class
26 May 2009	10:34:04	10:44:47	11:06:42	< GOES threshold	A 1.01
04 June 2009	17:56:10	18:00:56	18:21:12	< GOES threshold	A 8.40
07 July 2009	10:06:43	10:08:38	10:22:08	< GOES threshold	A 9.95
11 October 2009	01:41:25	01:51:52	02:42:43	< GOES threshold	A 3.16

Simple Flares Observed by SphinX



26 May 2009
A 1.01

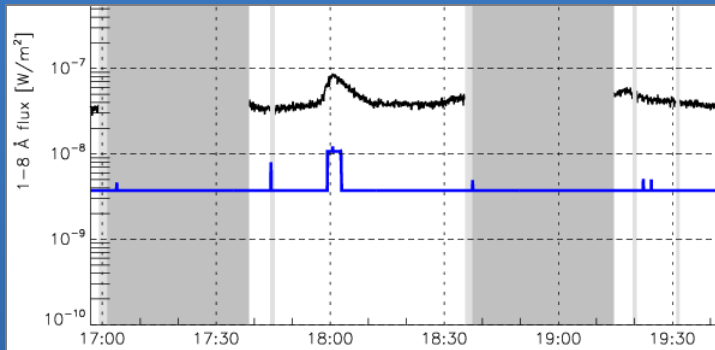


$\text{Time}_{\text{start}}$	Time_{max}	Time_{end}
10:34:04	10:44:47	11:06:42

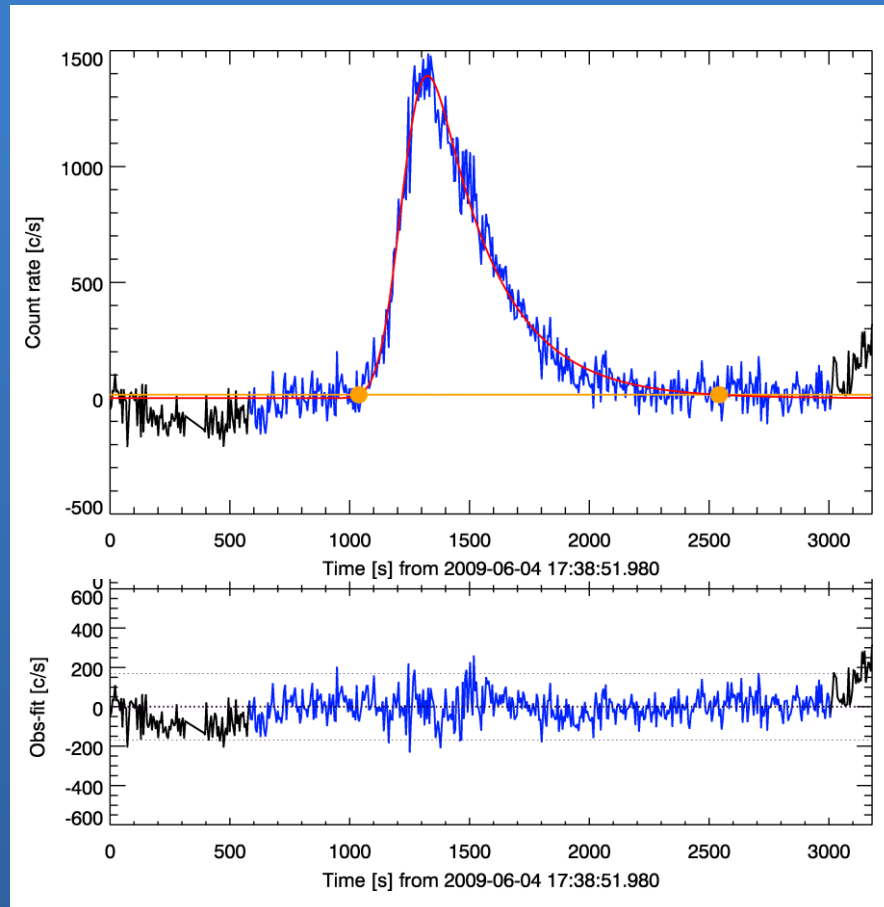
Simple Flares Observed by SphinX

04 June 2009

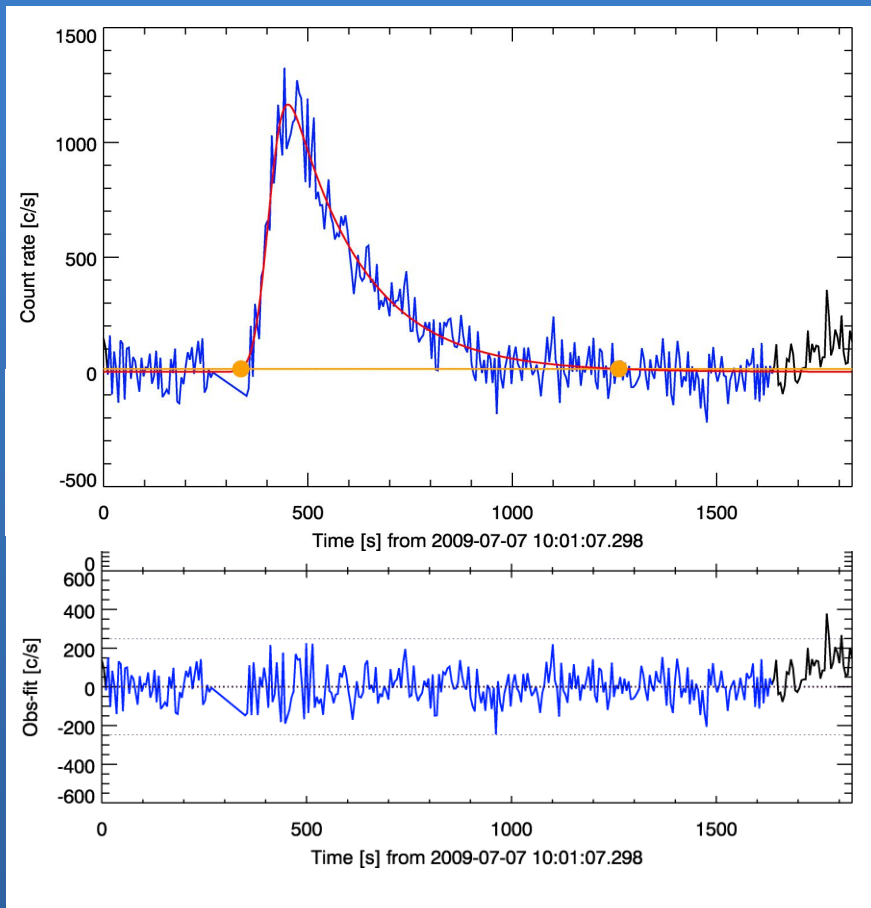
A 8.40



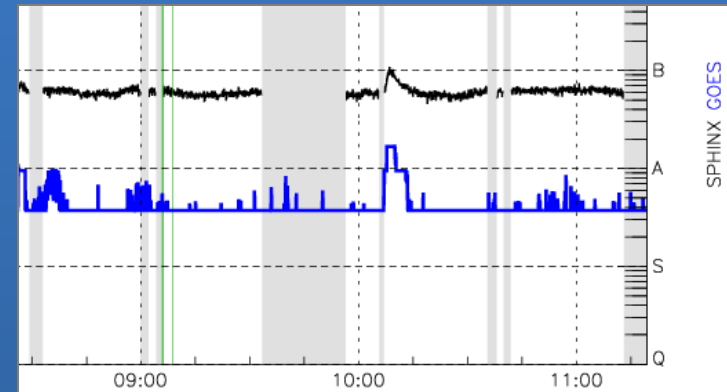
$\text{Time}_{\text{start}}$	Time_{max}	Time_{end}
17:56:10	18:00:56	18:21:12



Simple Flares Observed by SphinX



07 July 2009
A 9.95

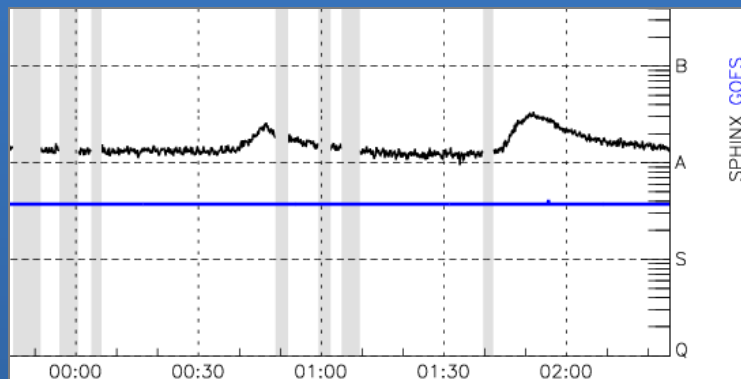


Time _{start}	Time _{max}	Time _{end}
10:06:43	10:08:38	10:22:08

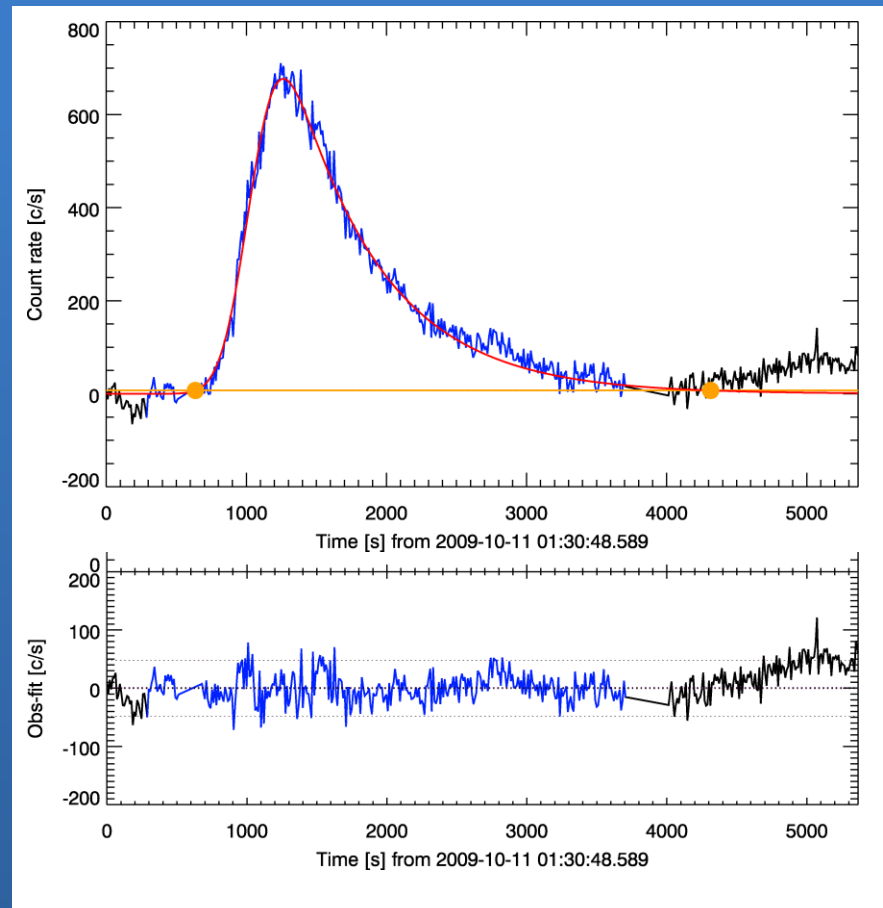
Simple Flares Observed by SphinX

11 October 2009

A 3.16



Time _{start}	Time _{max}	Time _{end}
01:41:25	01:51:52	02:42:43



Flares Characteristics

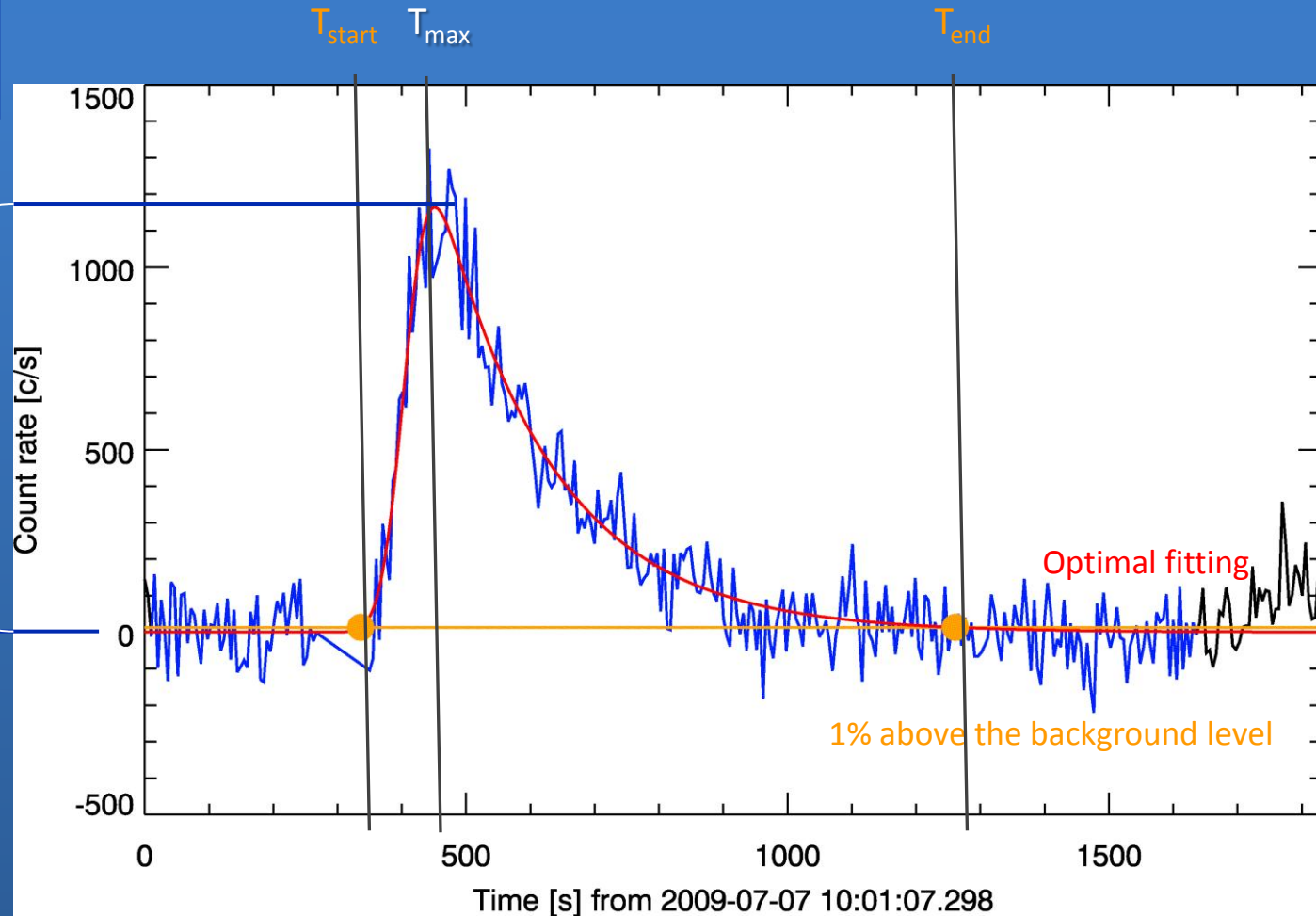
T_{start} time of start
 T_{end} time of end
 T_{max} time of maximum
Flare magnitude

Flare after background subtraction

Flare magnitude

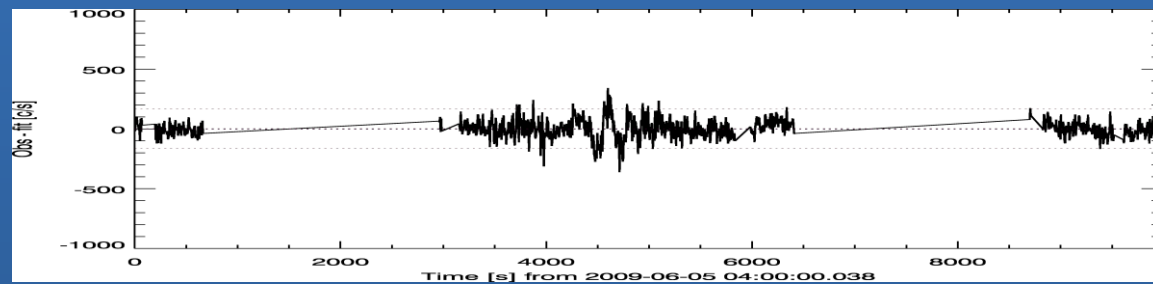
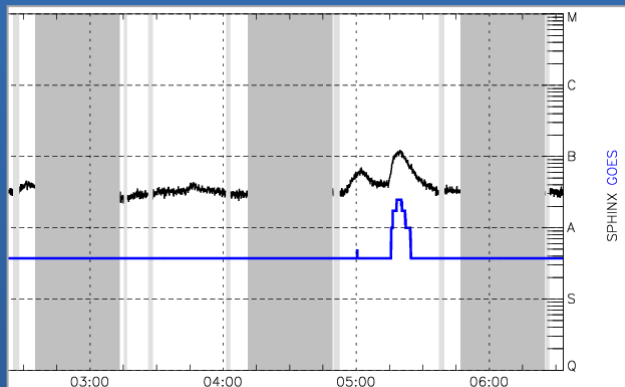
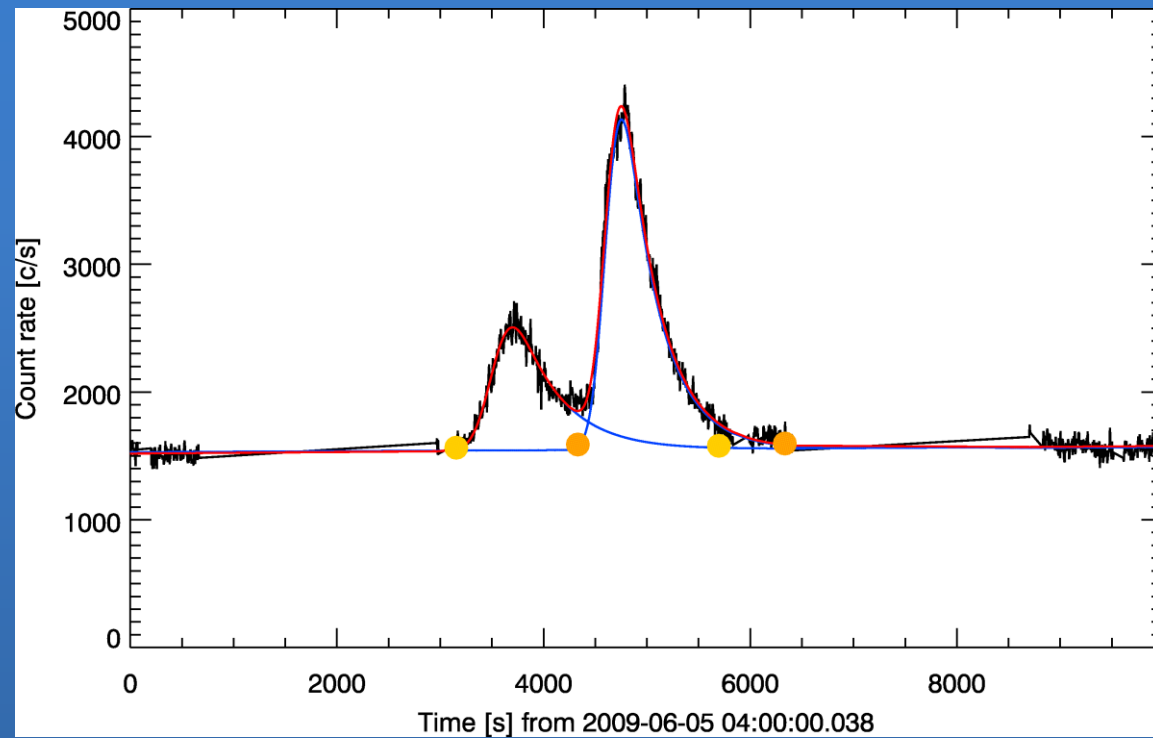
Linear background

$$f_{\text{backg}}(t) = E t + F$$



Blended Flares

05 June
2009



Future Plans

- Work on SphinX flaring events catalogue:
FLARE ID , Time_{start} , Time_{max} , Time_{end} , Flare magnitude
- Flare characteristics analysis
- Extended catalogue (Temperatures, Fluxes, ...)
- Analysis of flare flux observation in 1-8 Å wavelength range

Thank You