

An unbiased assessment
of EPIC-pn Burst mode
calibration

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Tasks:

- ◆ Define the optimal calibration sample, by systematically analysing the whole XMM archive
- ◆ Assess the energy reconstruction accuracy in burst mode through comparison of spectra with
 - ◆ theoretical models
 - ◆ exposures taken in other EPIC-pn modes
 - ◆ simultaneous observations with other payloads
- ◆ Estimate the impact of X-ray loading
- ◆ Evaluate the performances of different possible rate-dependent energy corrections

Source sample:

- ◆ 95 observations available in burst mode (3 of them public soon)
- ◆ 19 different objects

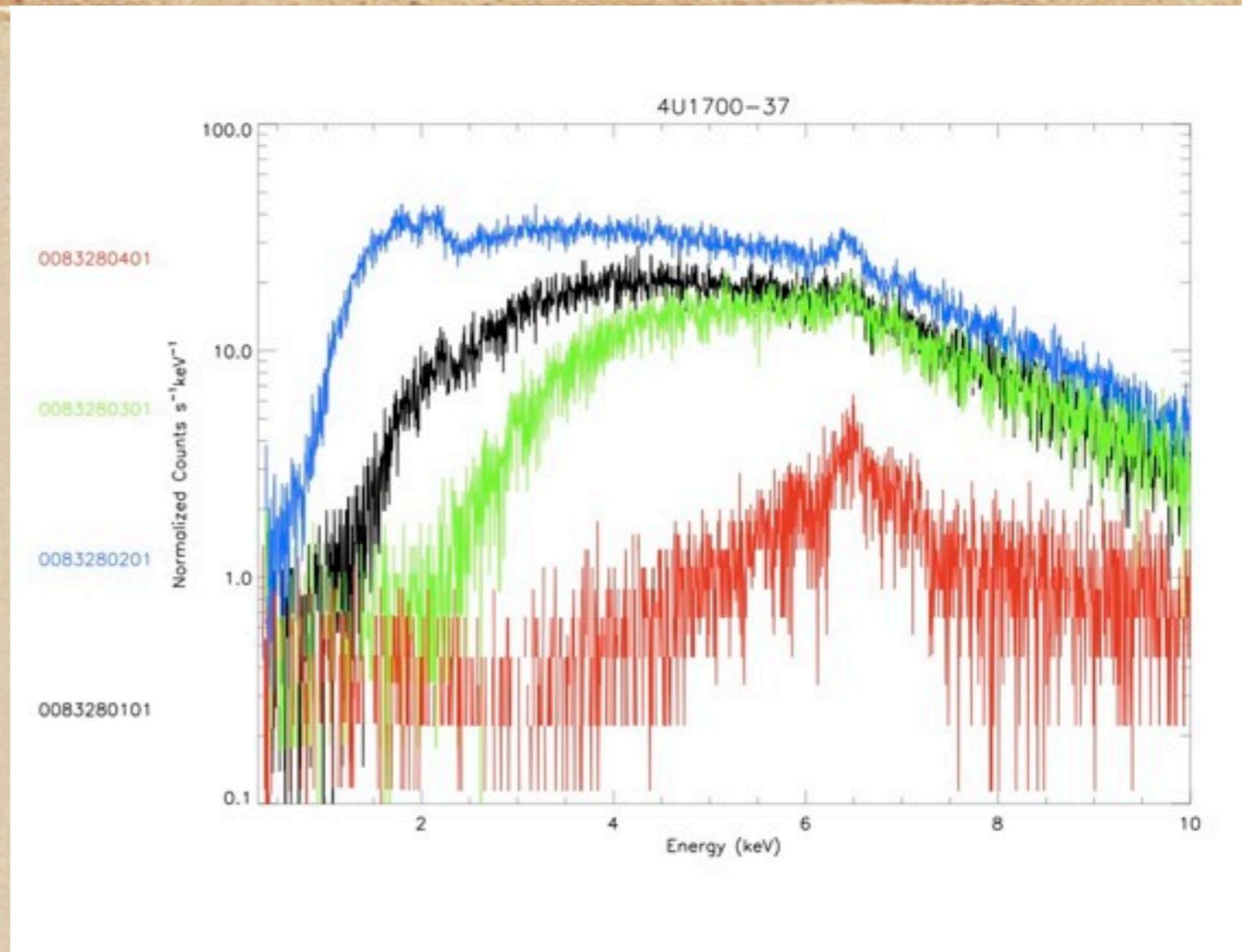
Type	Name (+number of observ.)
SNRs	Crab (36), Cas-A (1), N132D (2: only 400 sec)
X-ray binaries	Cygnus X-1 (4), Cygnus X-2 (8), GRS 1915+105 (11), GX 339-4 (5), GRO J1655-40 (6), Aql X-1 (4), PSR 0540 (3: too weak), 4U 1700-37 (4), MAXI J0556-332 (2), IGR J17091-3624 (1), XTE J17520-223 (1), XTE J1817-330 (1), XTE J650-500 (1) and GX 17+2 (3: soon public)
GRB	GRB 110328A (1, too weak)
Quasar	3C273 (1, too weak)

Looking for narrow emission/absorption lines

- ◆ 4U 1700-37: bright emission line at 6.4 keV
- ◆ Cas-A: 10 emission lines within 0.8-7.5 keV.
Identification of lines complex → comparison with full-frame and timing mode
- ◆ GRO J1655-40 and GRS 1915+105:
absorption lines from Fe in [6.6-7.0] keV but identification not easy

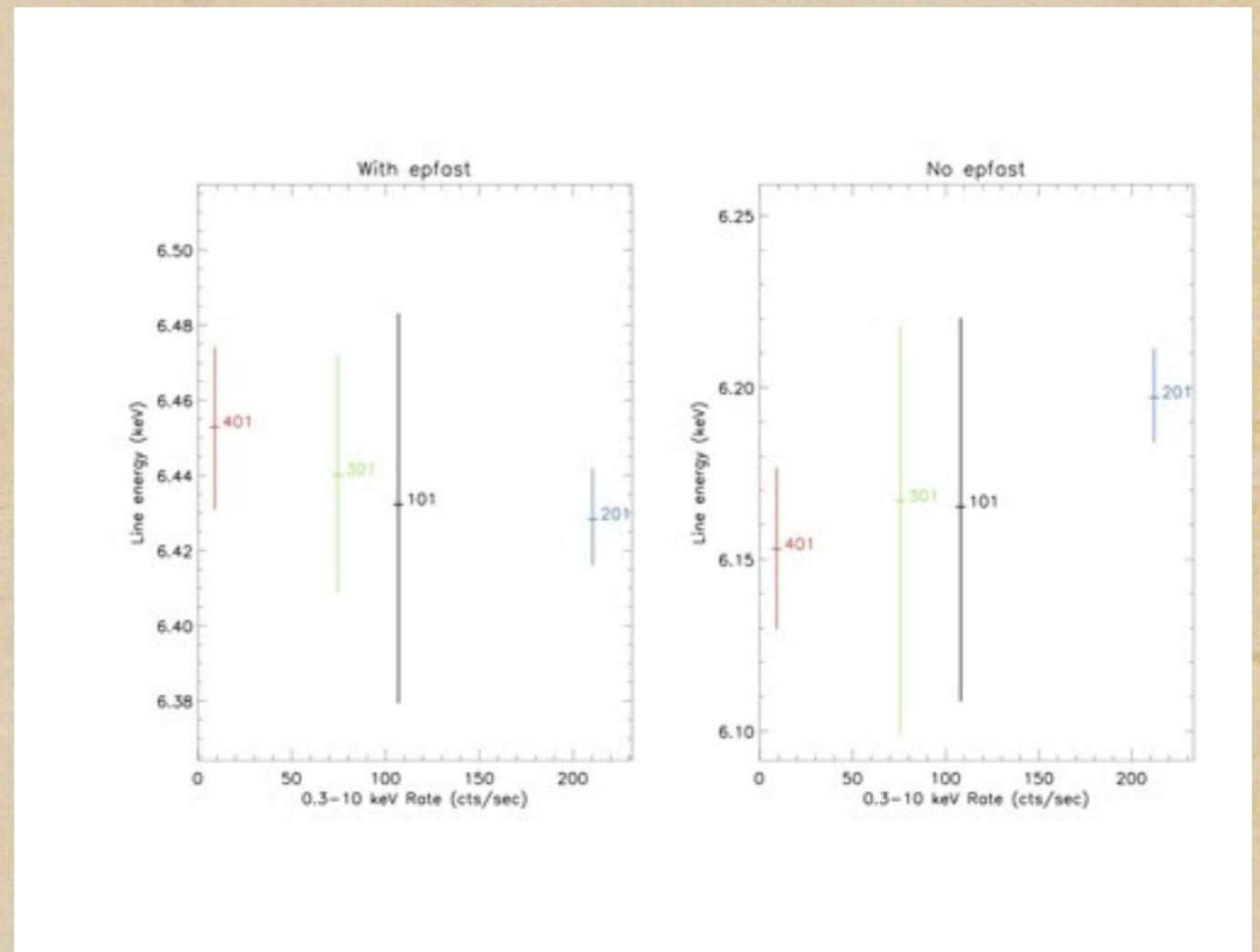
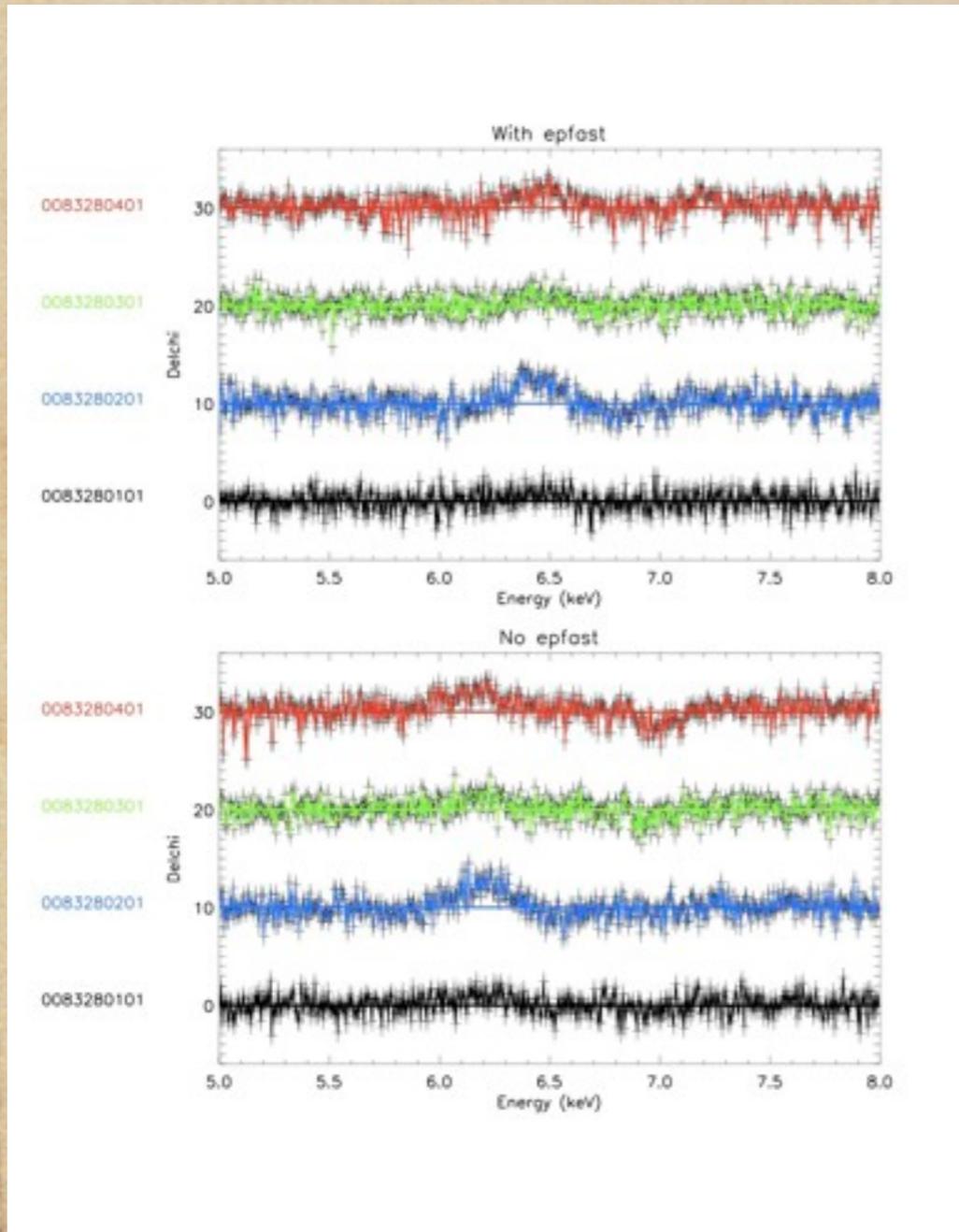
4U 1700-37

- ◆ eclipsing HMXB in a 3.41-d orbit
- ◆ observed 4 times in burst mode on the 17-18-19-20 February 2001
- ◆ obs. 0083280401 performed during eclipse and egress
- ◆ Shows different flaring states



- ◆ in burst mode continuum can be described with an absorbed power-law or disk blackbody + soft excess
- ◆ bright Fe K α is visible at 6.4 keV

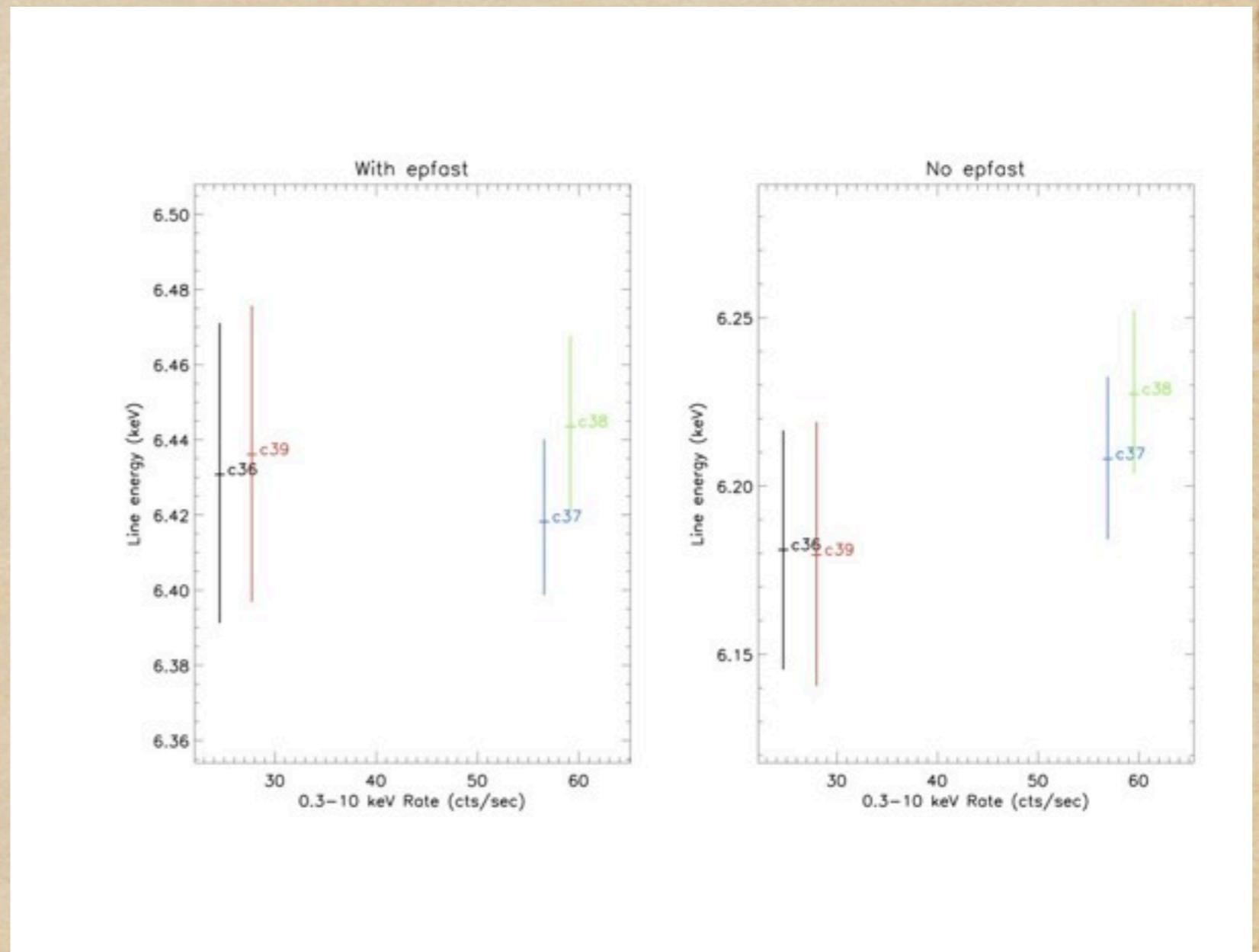
4U 1700-37: line energy with/without epfast correction



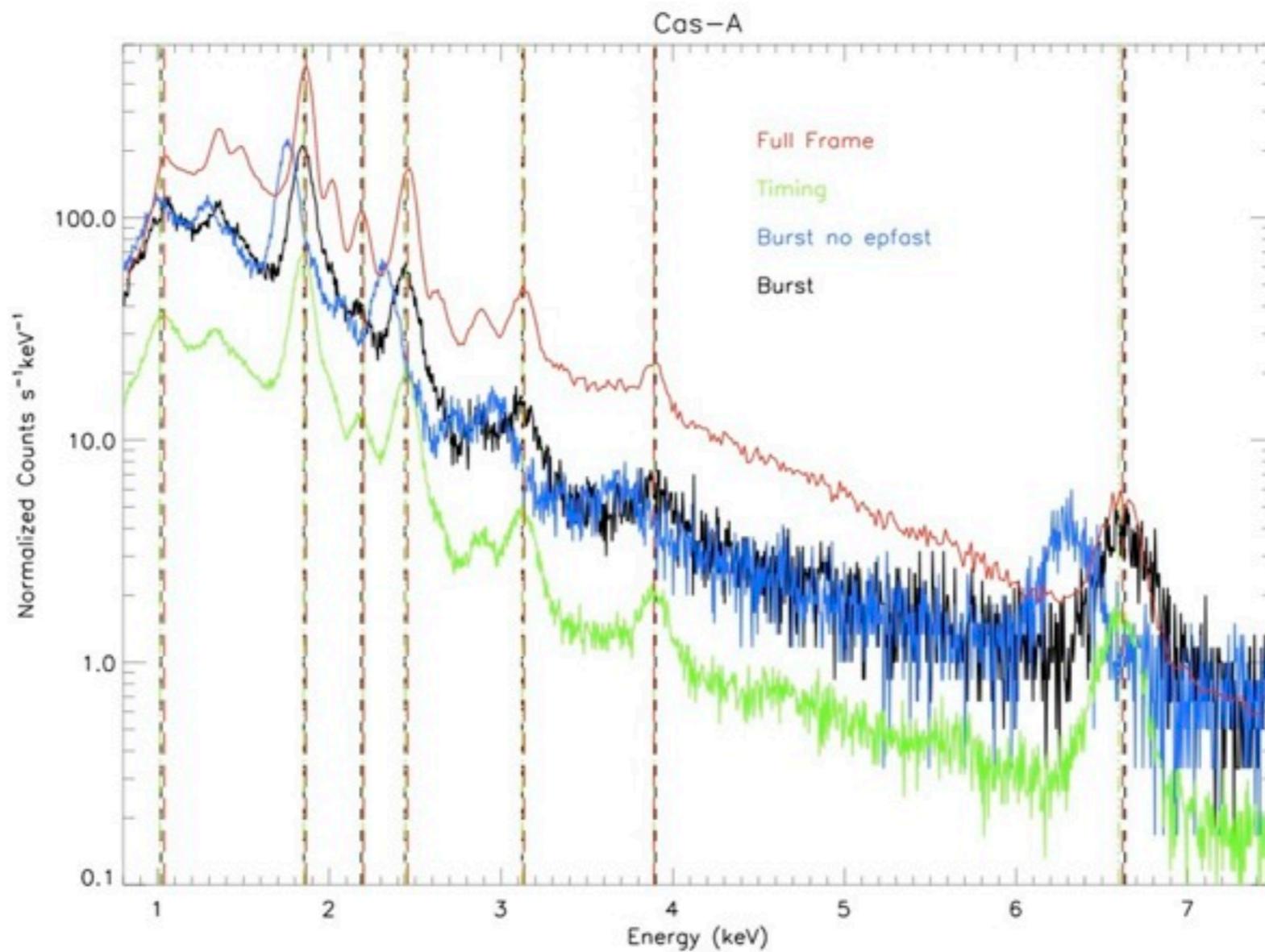
model in 5.-8. keV:
phabs * (diskbb + gauss)

4U 1700-37, obs. 0083280201: line shift from column to column

Spectra extracted
for the 4th brightest
columns separately
(c36-c39)

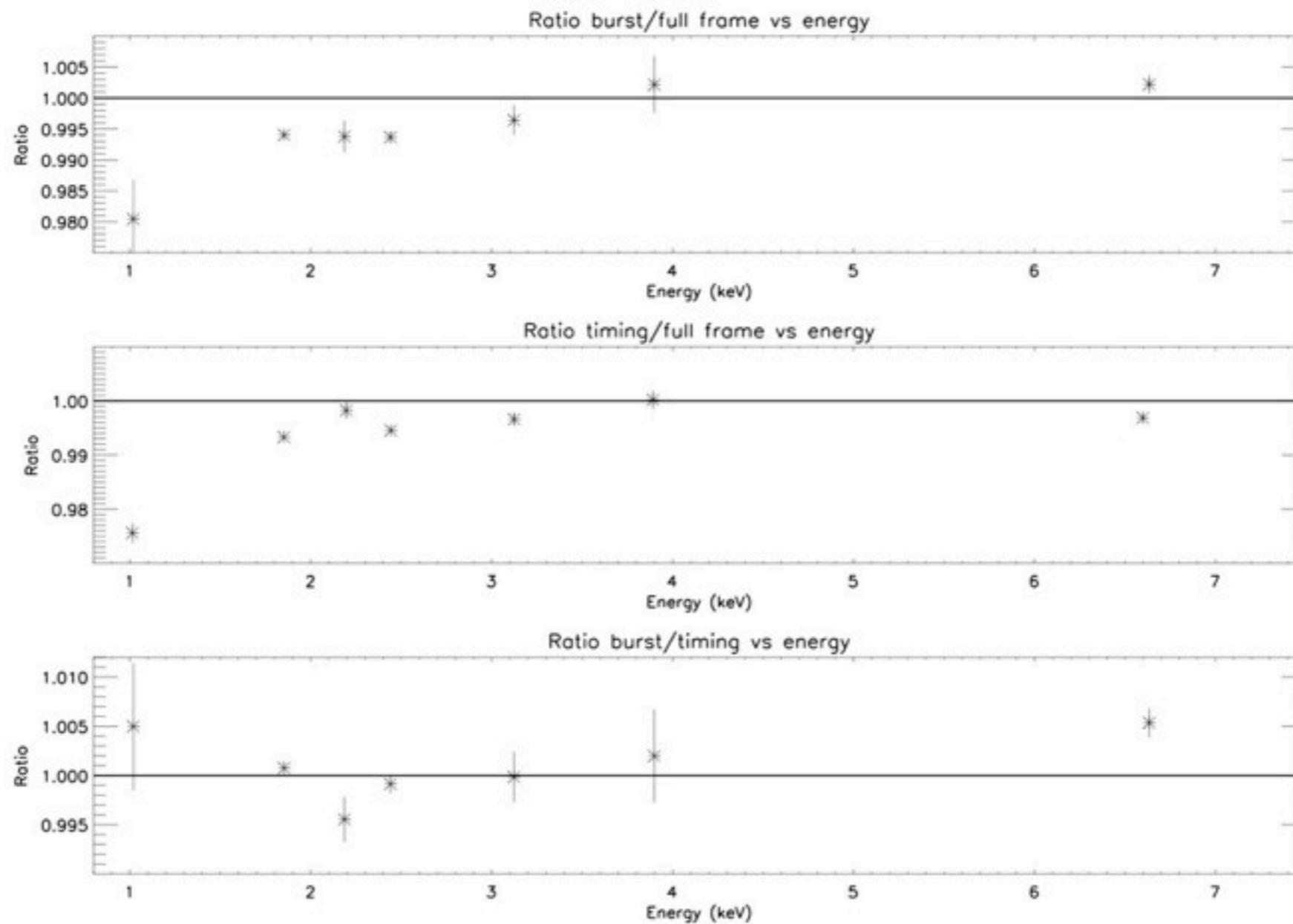


Cas-A: comparison with timing and full-frame mode

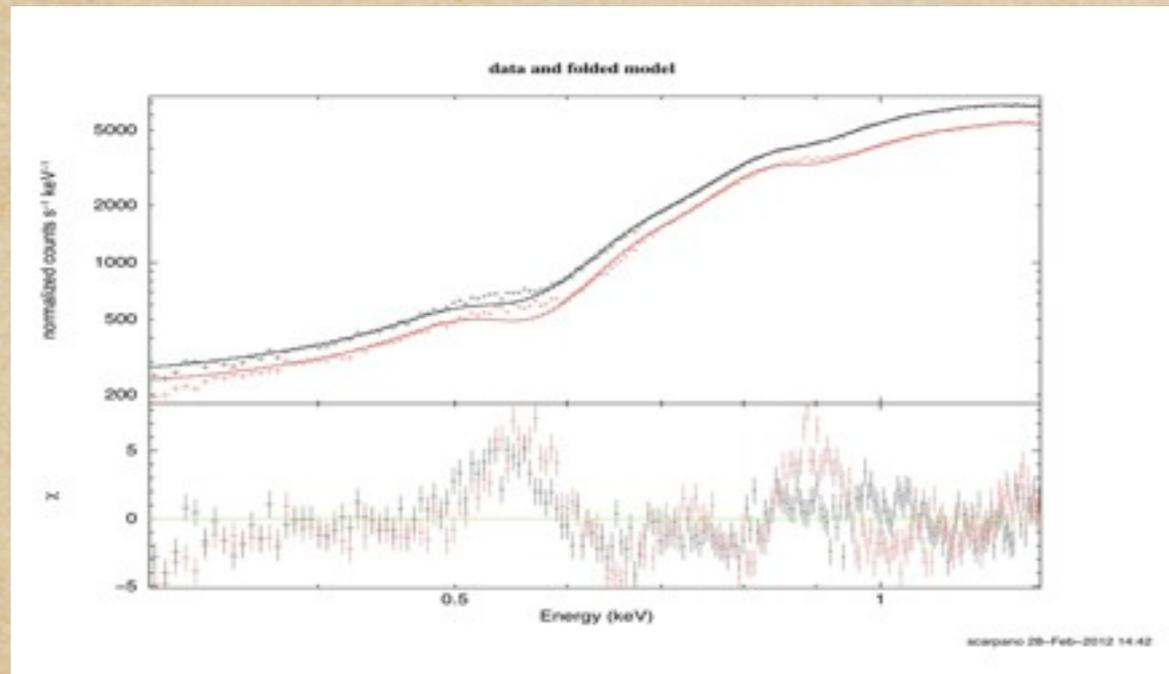


Note: MOS2 spectrum
in full-frame mode,
multiplied by 2

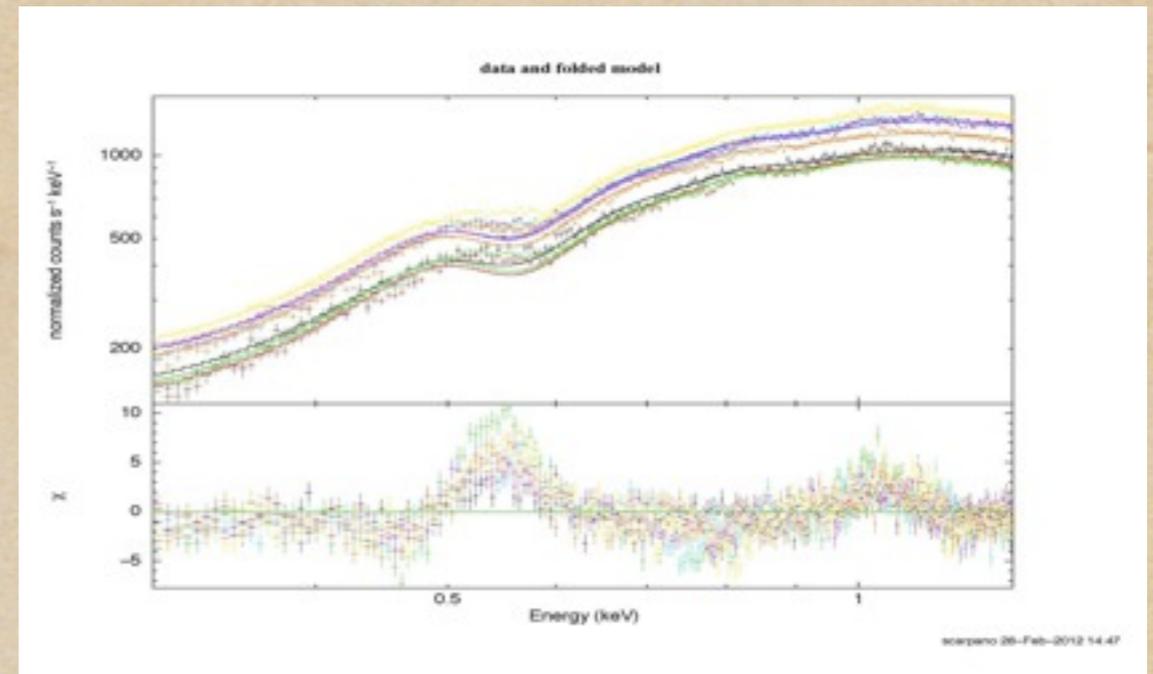
Cas-A: lines energy ratio



Energy redistribution in low part of the spectrum

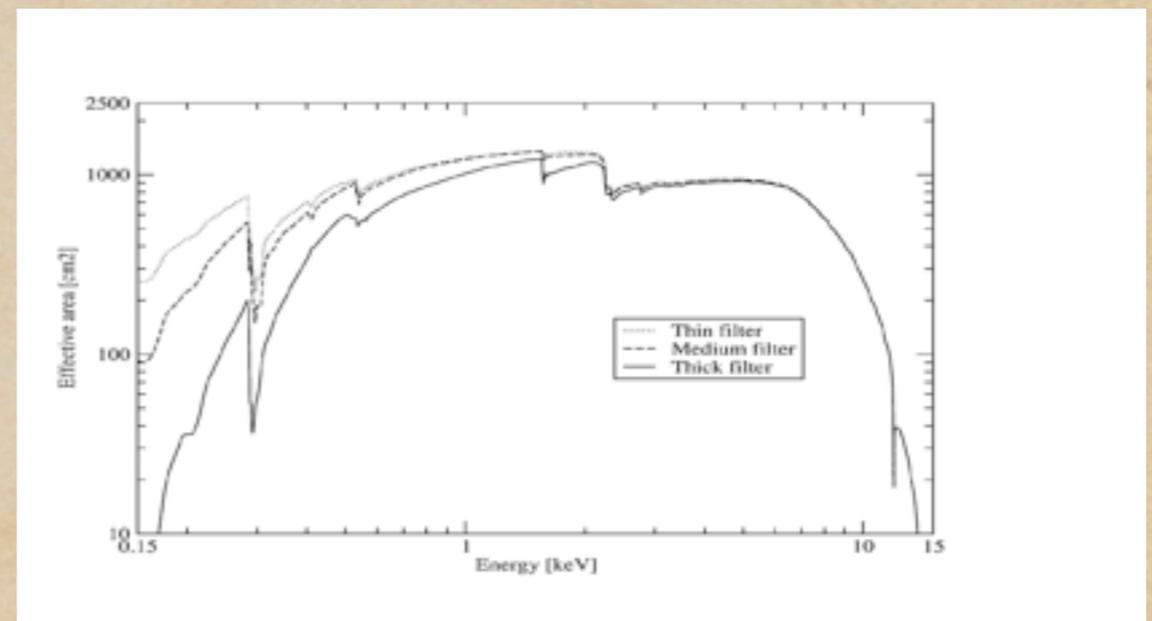


Cygnus X-1 (medium filter)



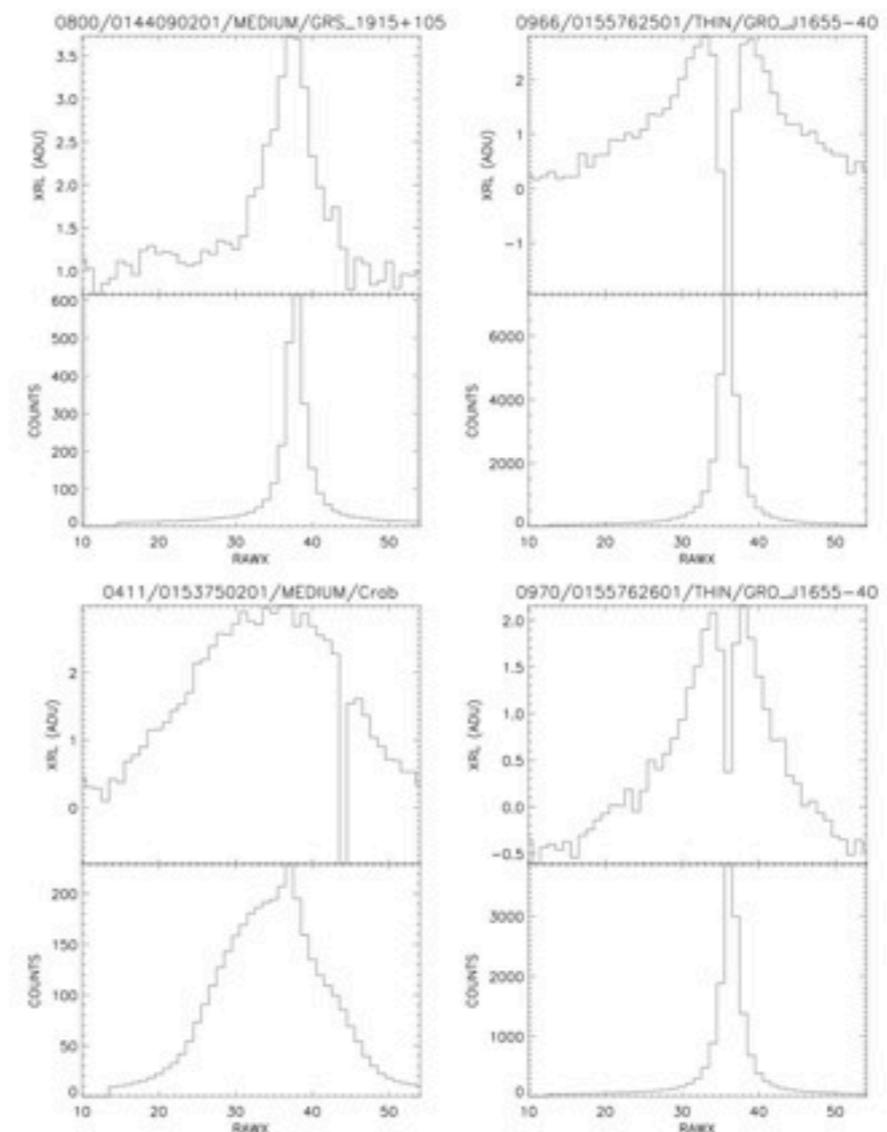
Cygnus X-2 (medium and thin filter)

Spectrum around SiO₂ edge at 528eV not properly described



X-ray loading

- ◆ X-ray loading: inclusion of X-ray events in the PN offset map
- ◆ Occurs when too many X-ray events are detected per pixel during the offset map calculation
- ◆ Effect of X-ray loading: spectra are displaced towards lower energies
- ◆ Spectral impact in Timing Mode: XMM-SOC-CAL-TN-0094 using Crab spectra with offset map calculated with CLOSED filter.
- ◆ Burst mode: Crab observation with offset map in CLOSED filter, performed in February. Analysis of data soon.



Example: X-ray loading vs X-ray intensity

On-going work

- ◆ Continue to assess the energy reconstruction accuracy and the rate-dependent energy correction in burst mode, by analysing the source sample and compare spectra with other payloads or other observing modes
- ◆ Assess the impact of X-ray loading by analysing the data of the Crab with offset map taken with CLOSED filter