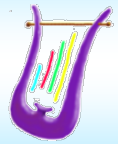


LYRA

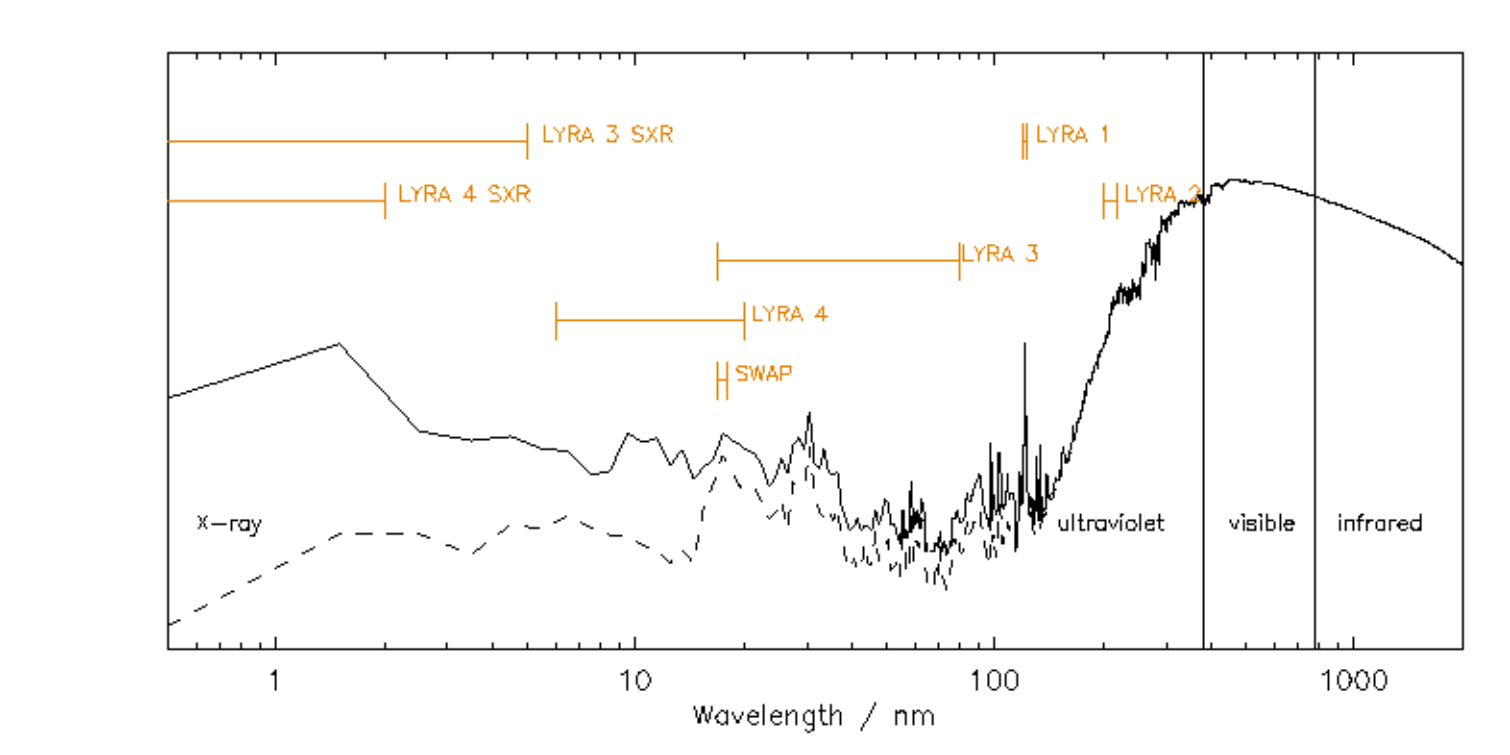
the **L**arge-**Y**ield **Ra**diometer onboard PROBA2

Long-term variability of LYRA data

I. E. Dammasch, M. Dominique, A. BenMoussa (ROB)

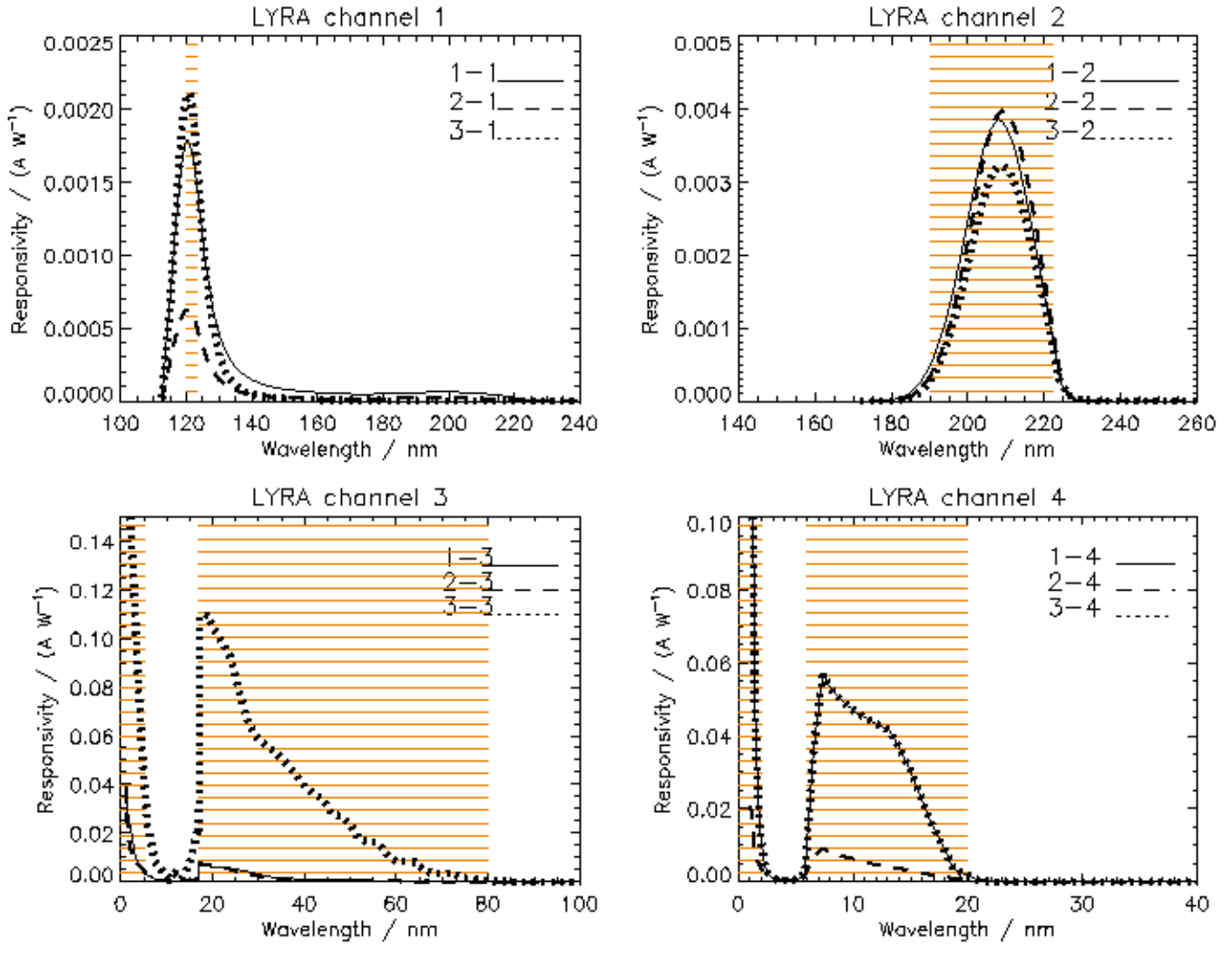
Solar Metrology, Needs and Methods II
Brussels, Belgium, 21-23 Sep 2015

SWAP and LYRA spectral intervals for solar flares, space weather, and aeronomy

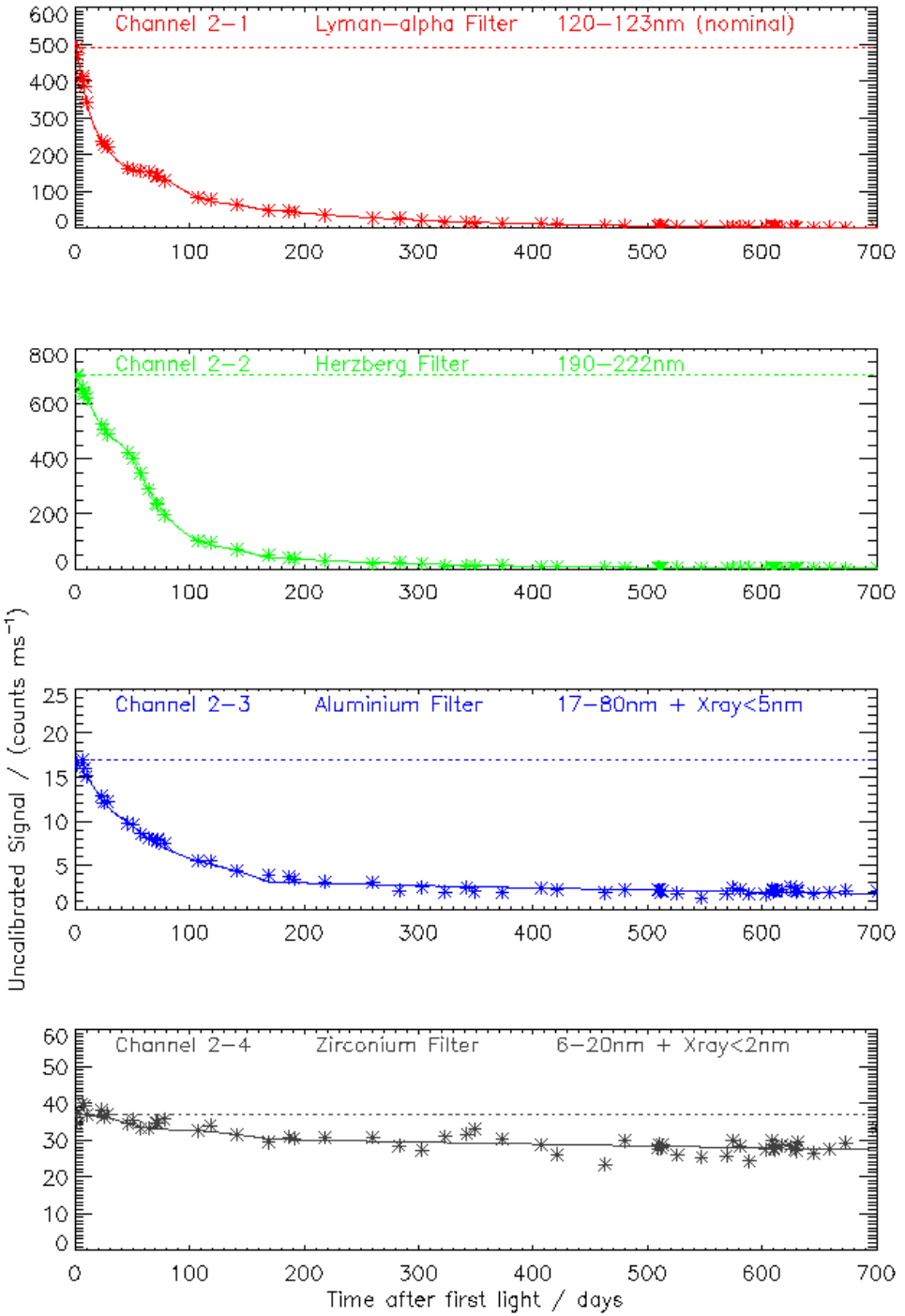


LYRA channel 1: the H I 121.6 nm Lyman-alpha line (120-123 nm)
LYRA channel 2: the 200-220 nm Herzberg continuum range (now 190-222 nm)
LYRA channel 3: the 17-80 nm Aluminium filter range incl the He II 30.4 nm line (+ <5nm X-ray)
LYRA channel 4: the 6-20 nm Zirconium filter range with highest solar variablility (+ <2nm X-ray)
SWAP: the range around 17.4 nm including coronal lines like Fe IX and Fe X

LYRA spectral response



LYRA nominal unit degradation …



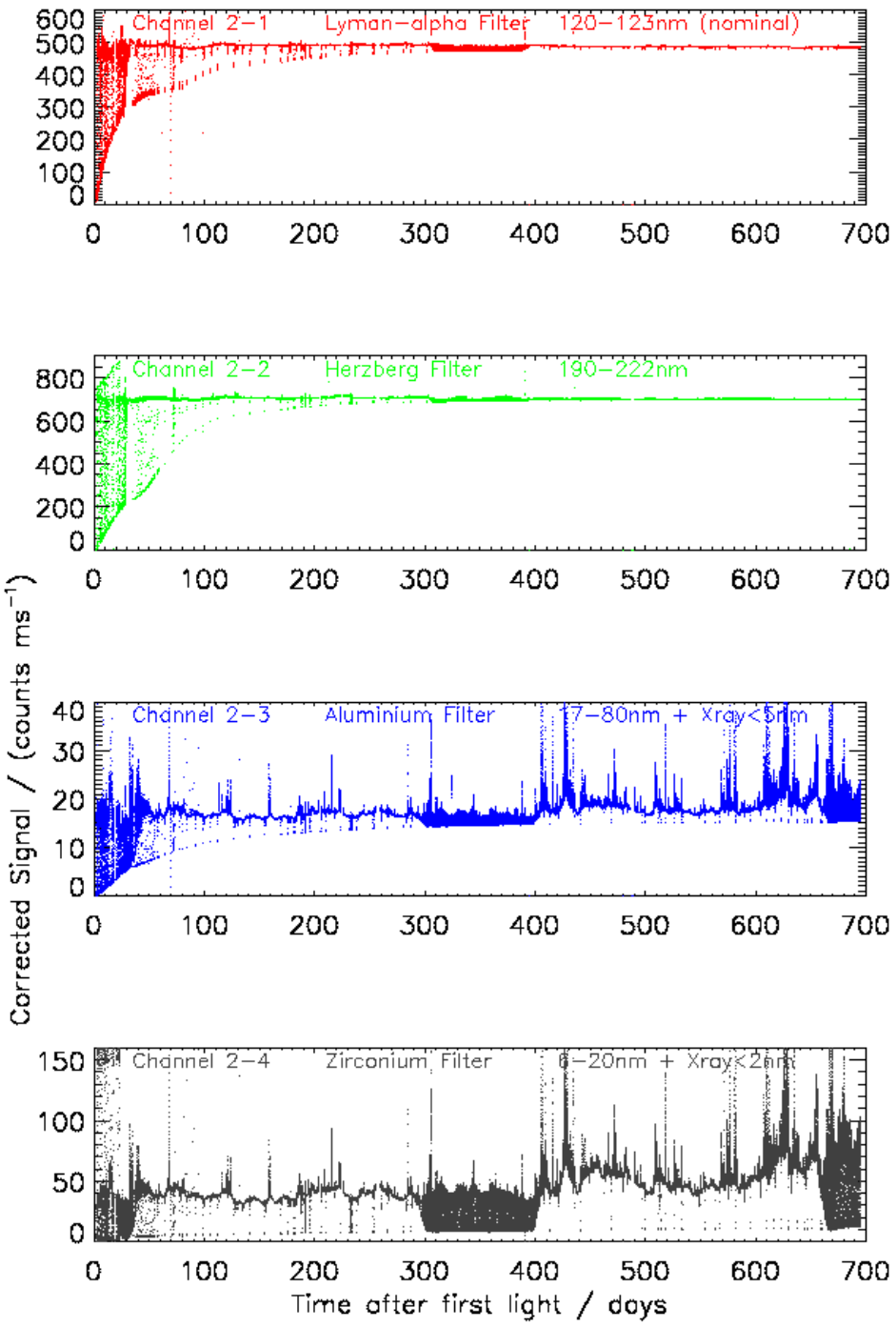
… and correction

Plausibility of additive correction:

- Artifacts in channels 1 and 2
- Non-degraded SXR in channels 3 and 4

Disadvantages:

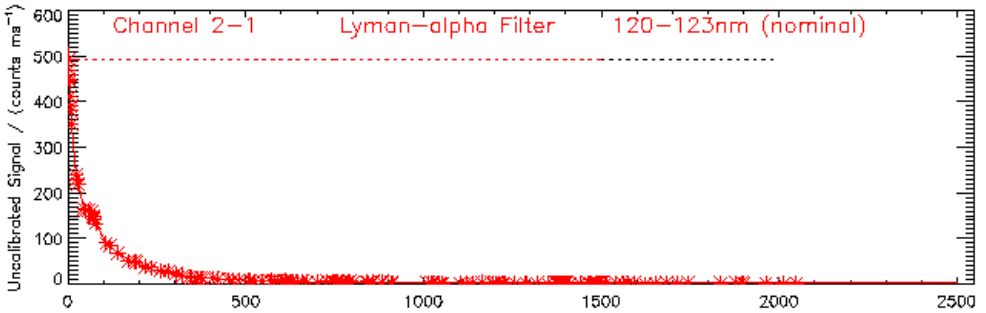
- Underestimate EUV in channels 3 (and 4)
- Distortion of occultations

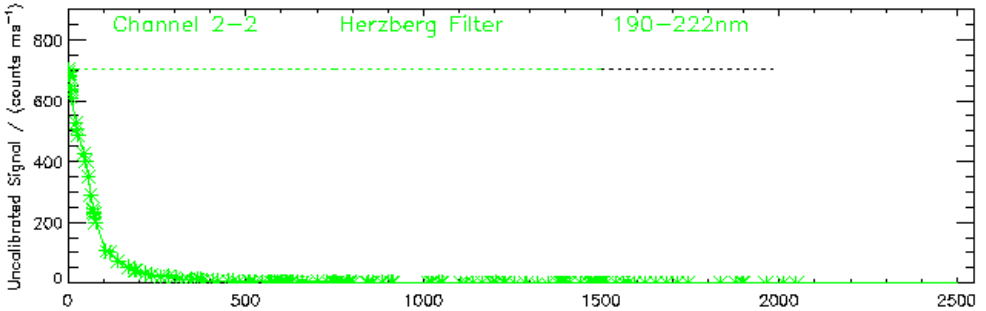


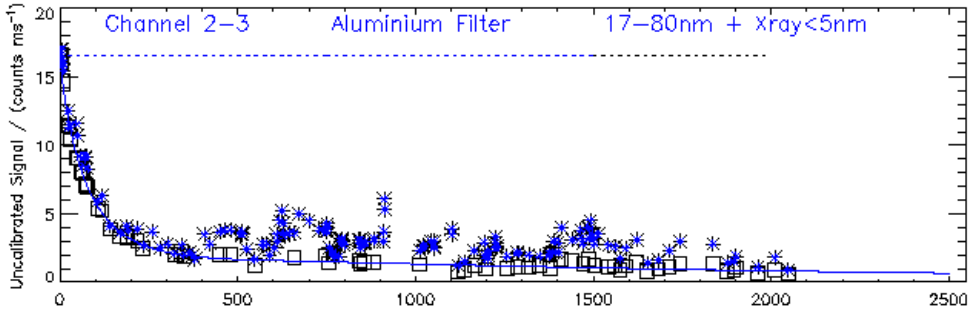
LYRA nominal unit status mid-2015

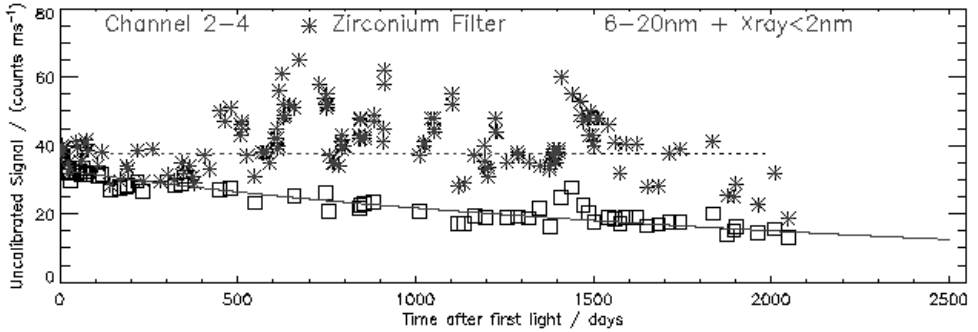
Percentage of remaining response relative to First Light Day:

ch2-1 (Ly)	< 0.5%
ch2-2 (Hz)	< 0.5%
ch2-3 (Al)	5%
ch2-4 (Zr)	45%

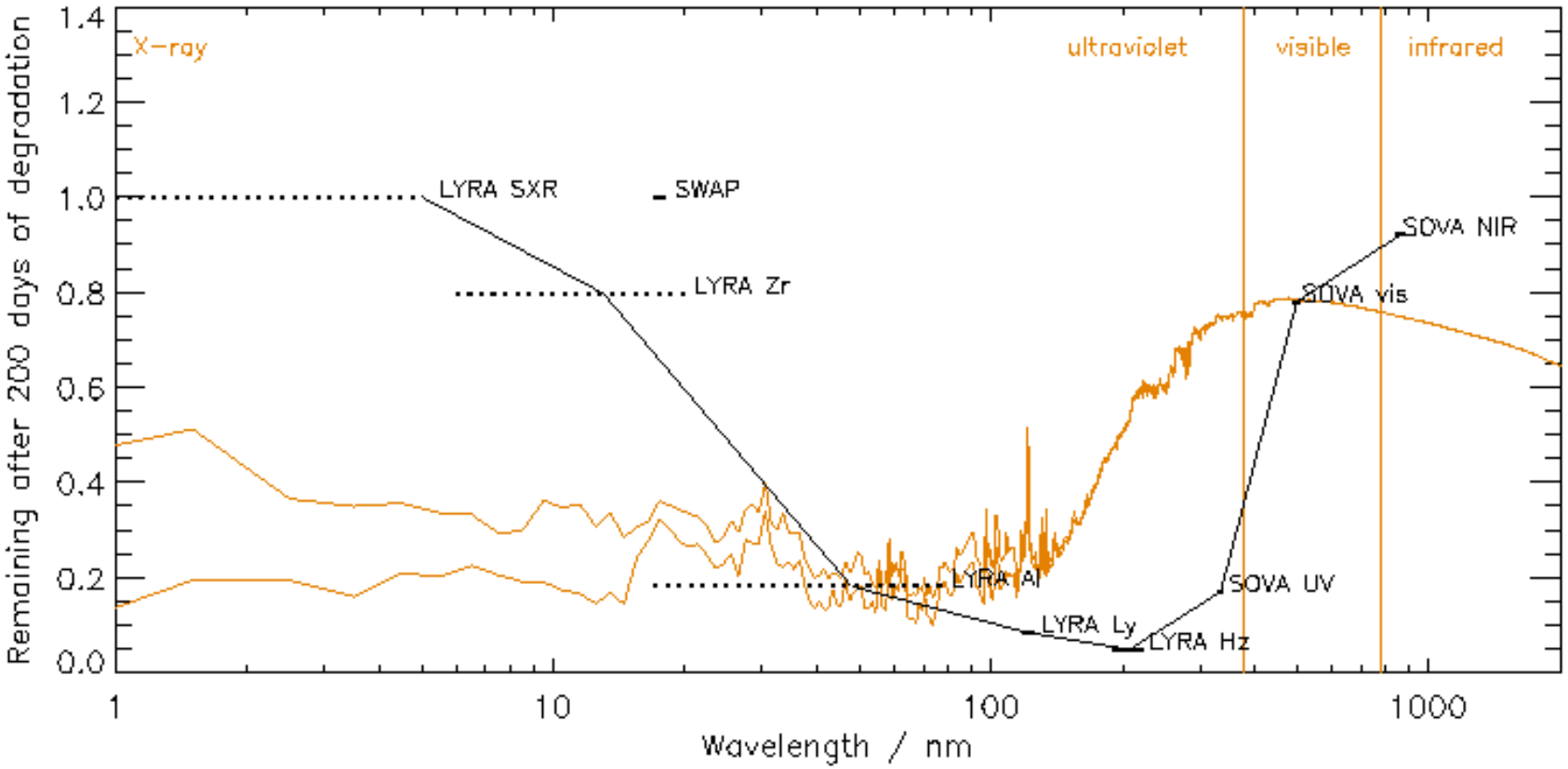






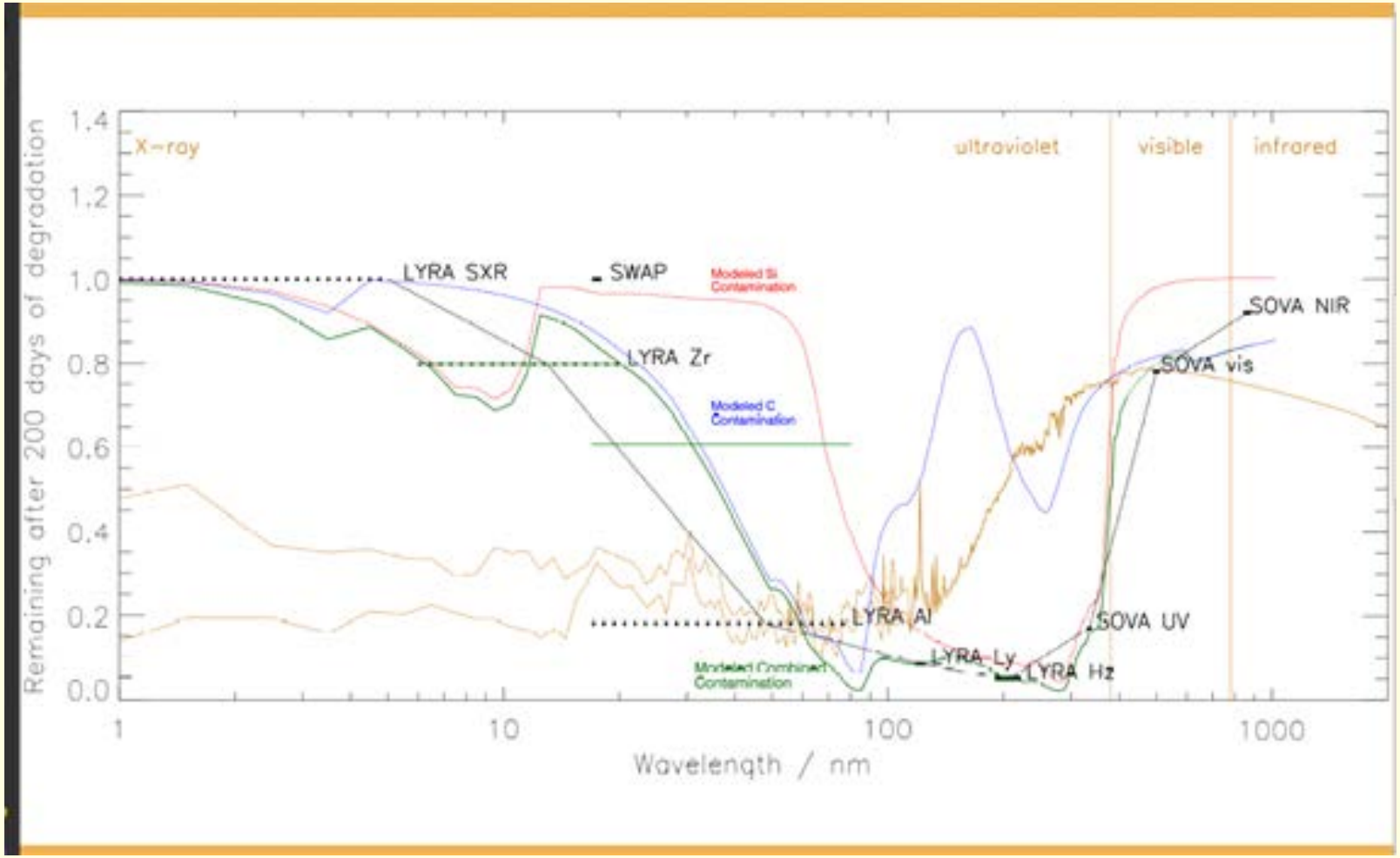


LYRA vs. SOVA spectral degradation



"Solar Oscillation and Variability" instrument on EURECA: **335nm, 500nm, 862nm**.
(1992-1993, launched and retrieved by Shuttle)
Degradation results also confirmed (?) by PICARD/PREMOS.

Explanation attempt: C + Si contamination



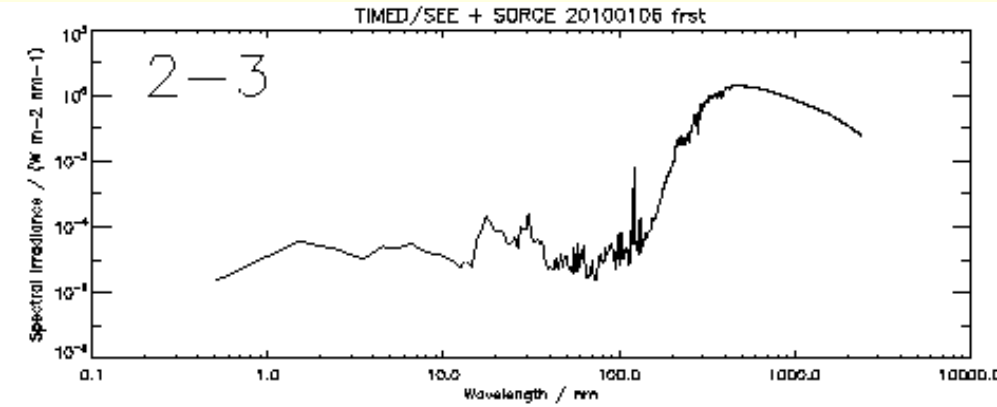
Or better C + O? Depending on exposure time, or solar dose?

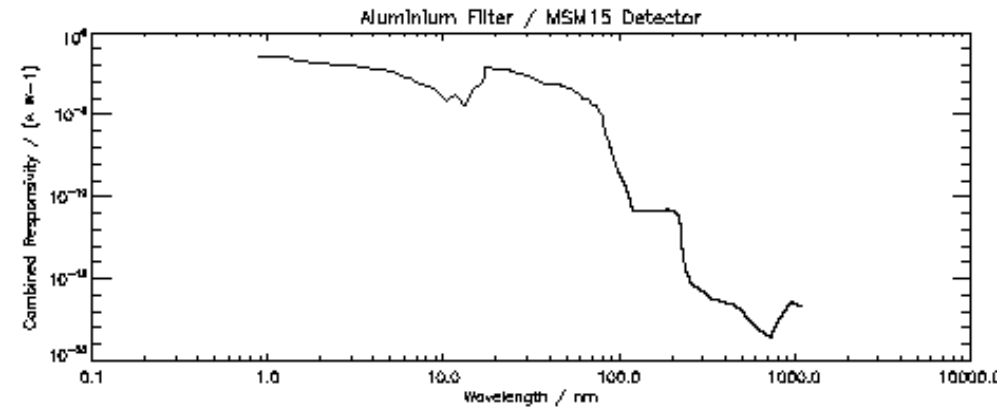
LYRA
Radiometric Model

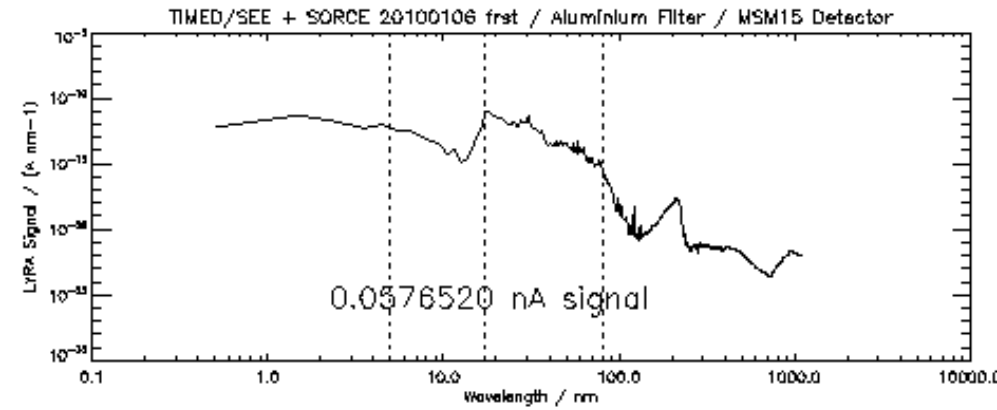
log scale

ch2-3 (Al)
First Light Day

nominal:
SXR<5nm
& 17-80nm



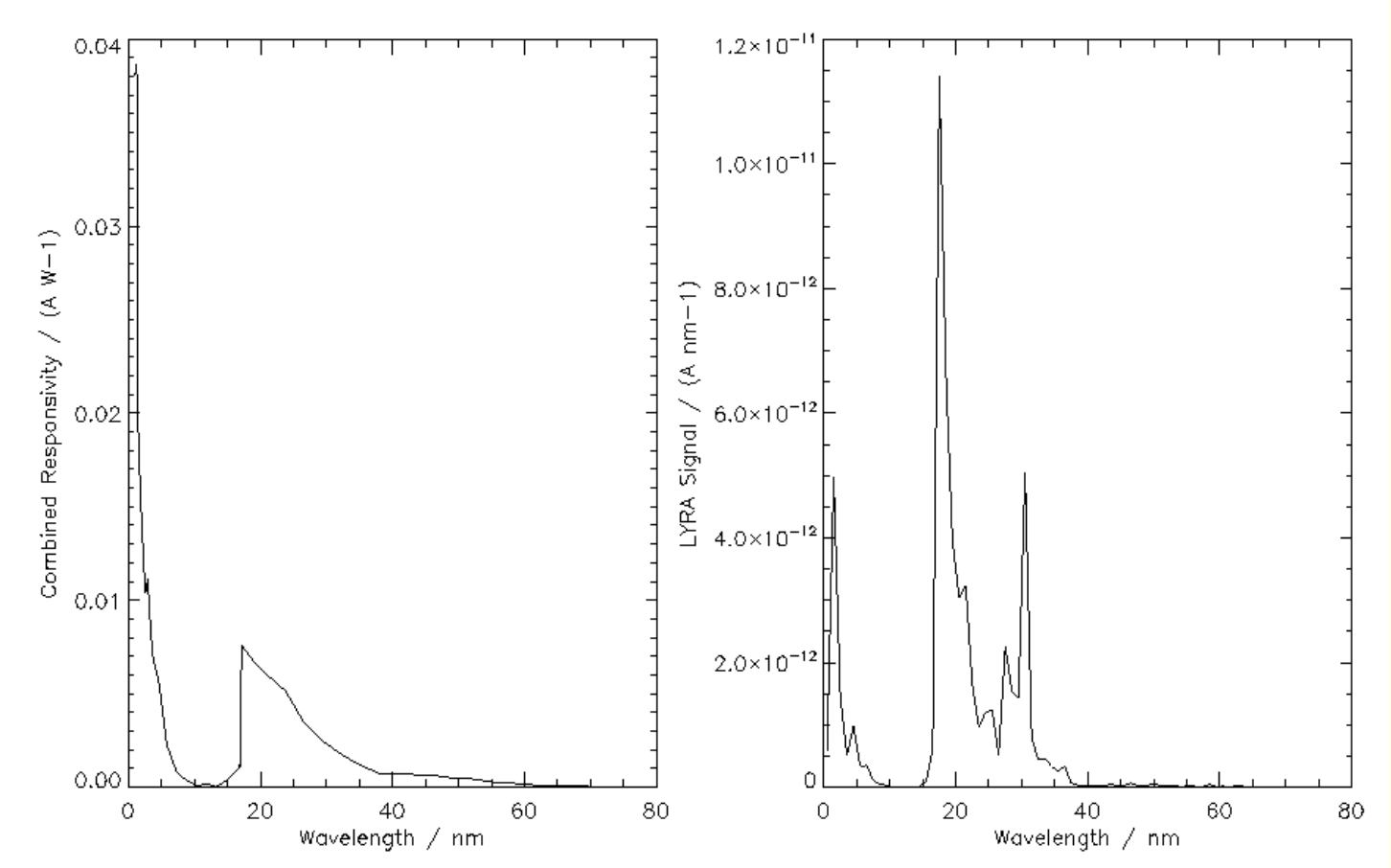




LYRA Radiometric Model: Effect of spectral degradation?

linear scale

ch2-3 (Al) First Light Day



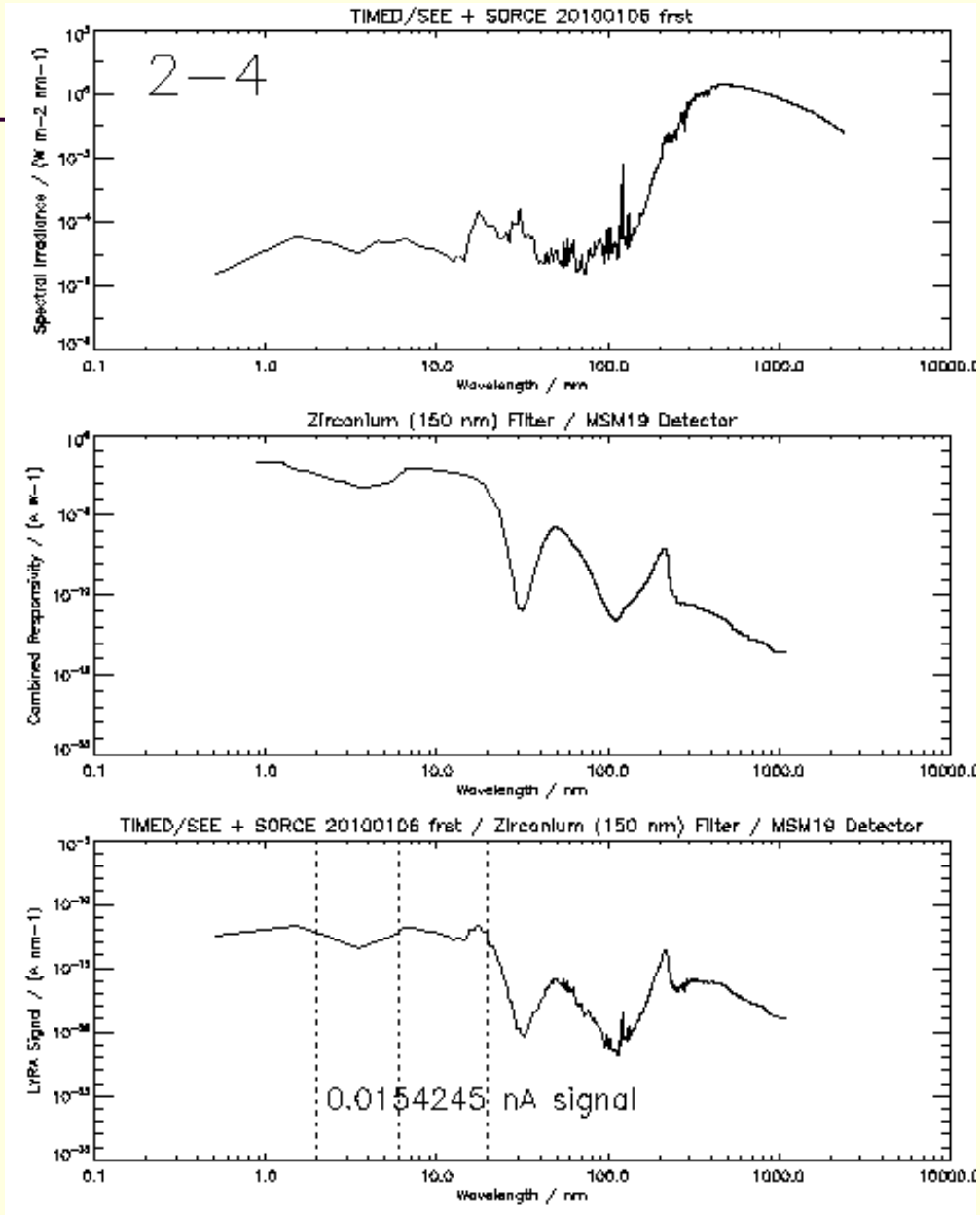
What's left: probably SXR<5nm & ??

LYRA
Radiometric Model

log scale

ch2-4 (Zr)
First Light Day

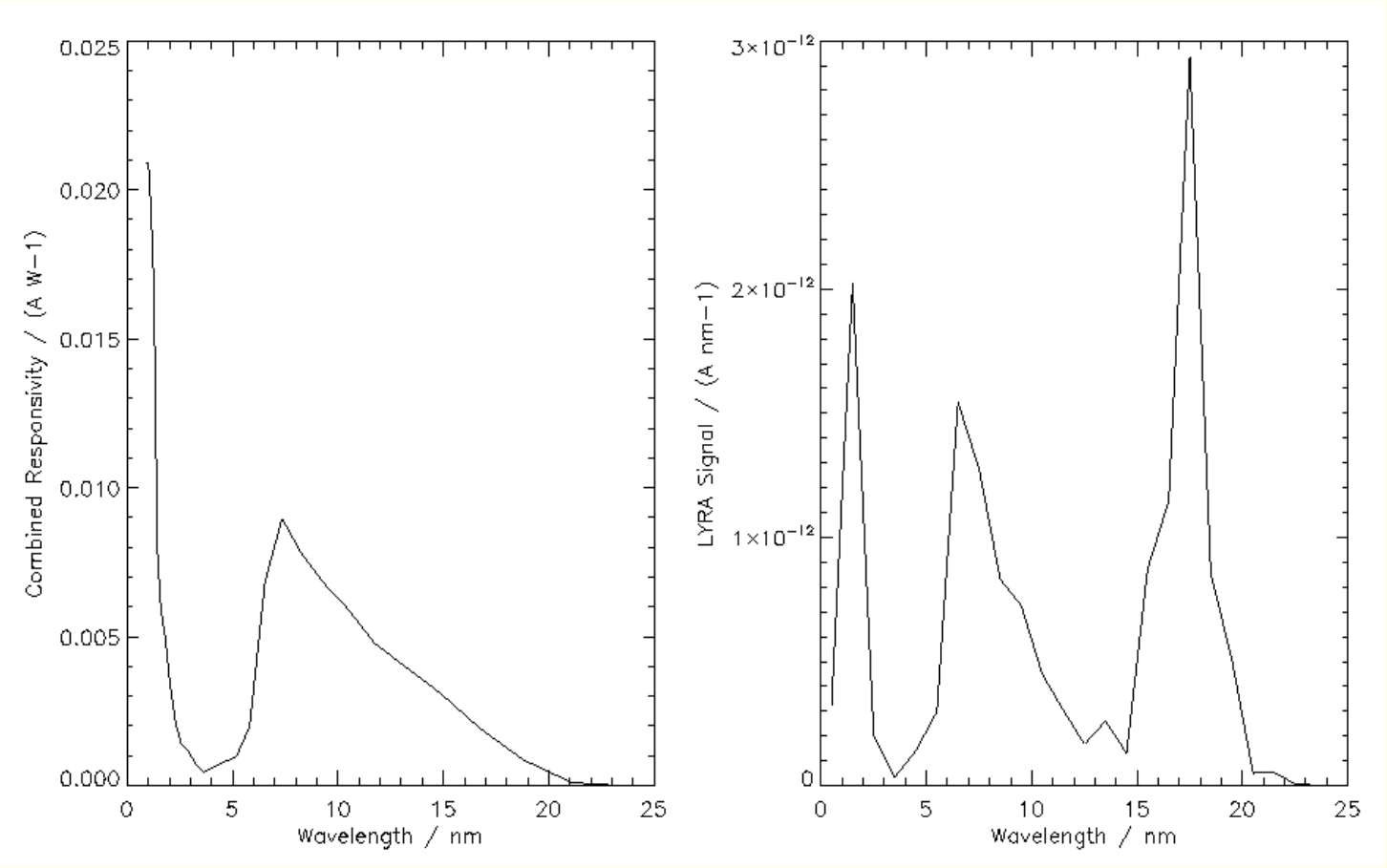
nominal:
SXR<2nm
& 6-20nm



LYRA Radiometric Model: Effect of spectral degradation?

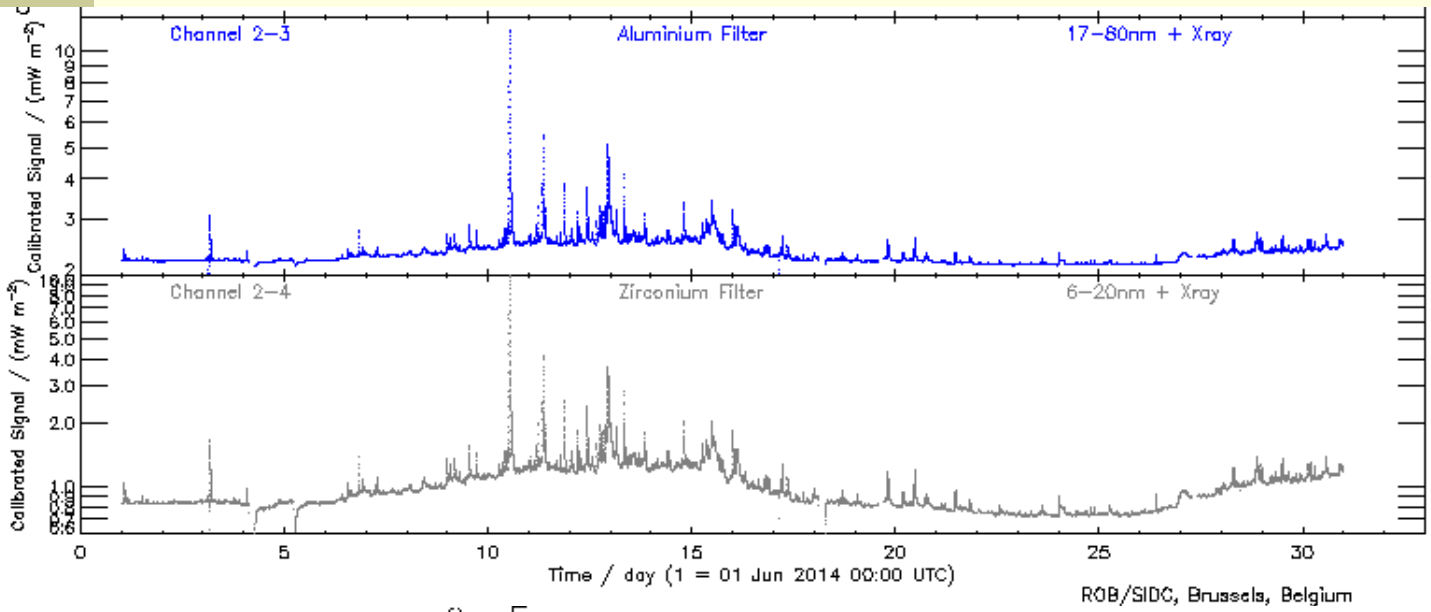
linear scale

ch2-4 (Zr) First Light Day



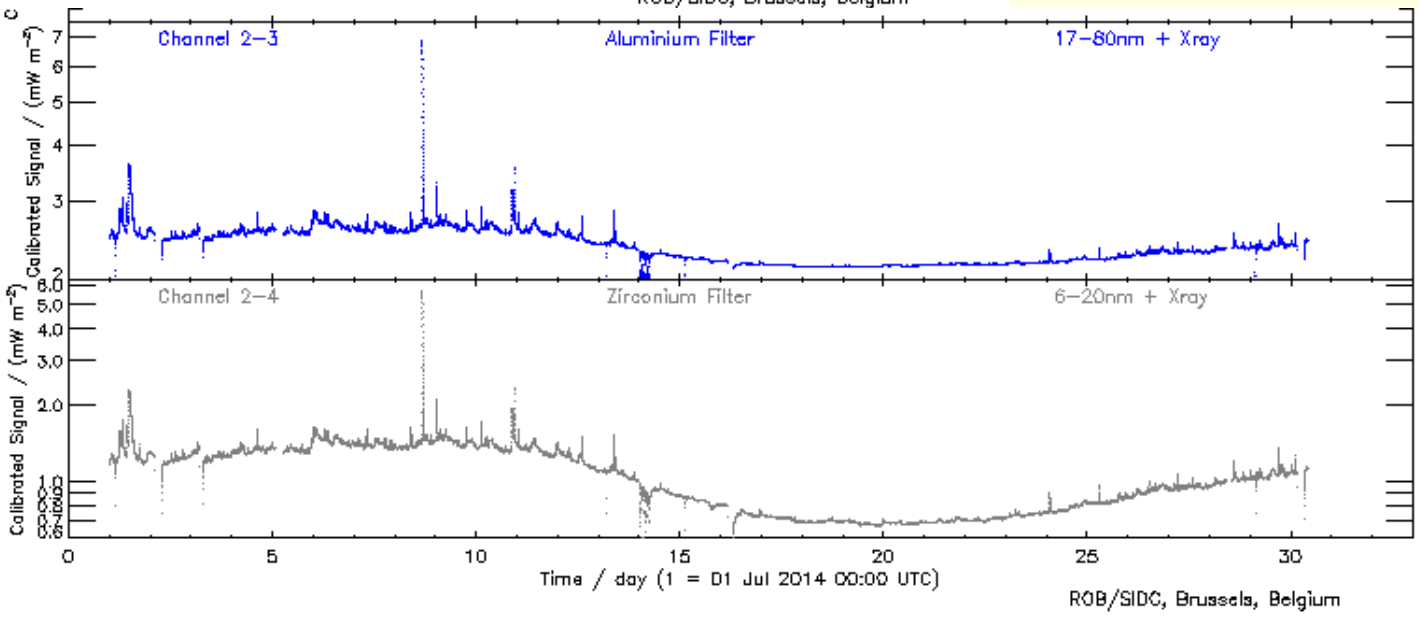
What's left: probably SXR<2nm & 6-15nm & ??

Daily significant minimum, plus flares



June 2014

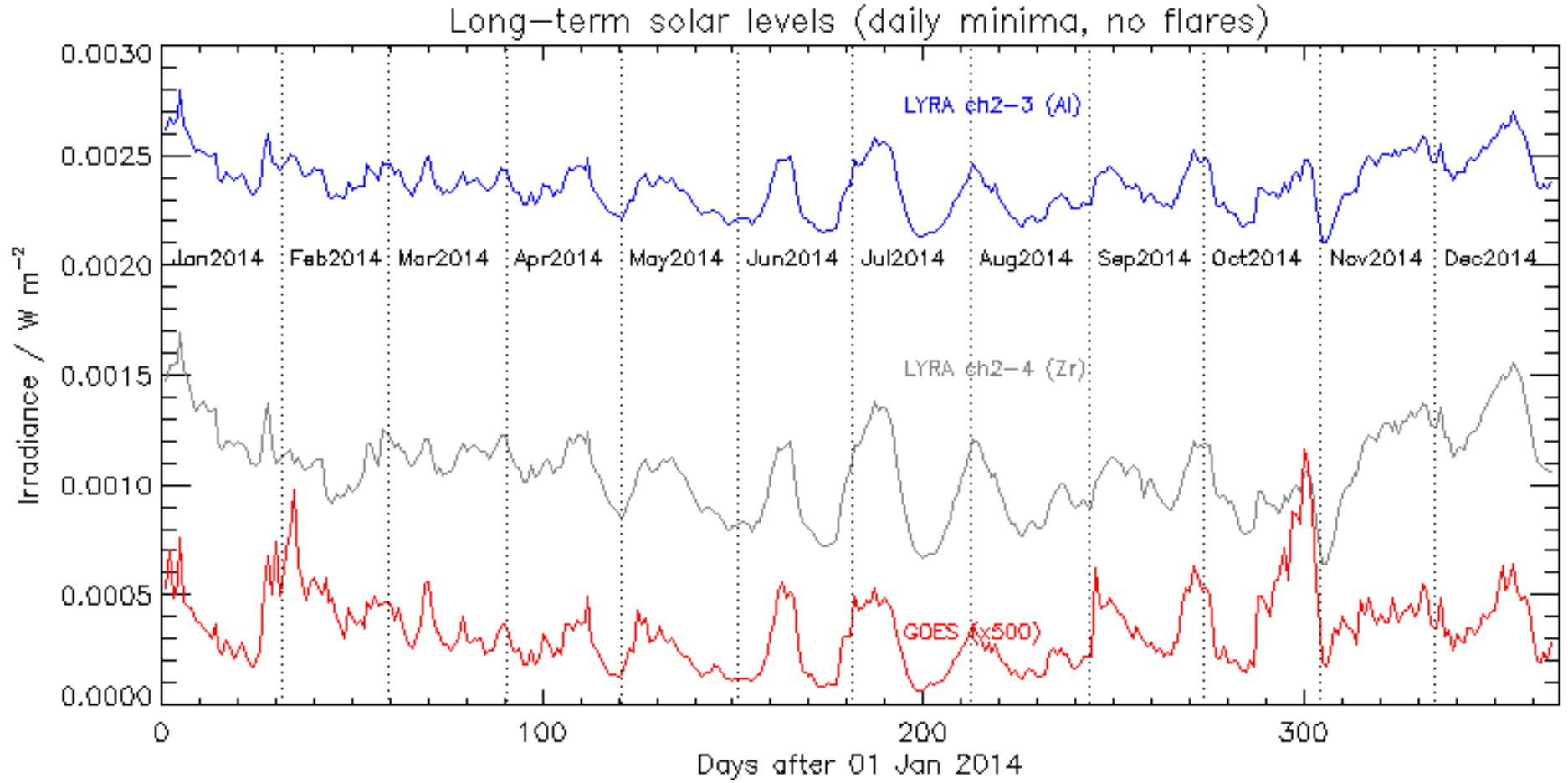
July 2014



Flares: stronger in ch2-3

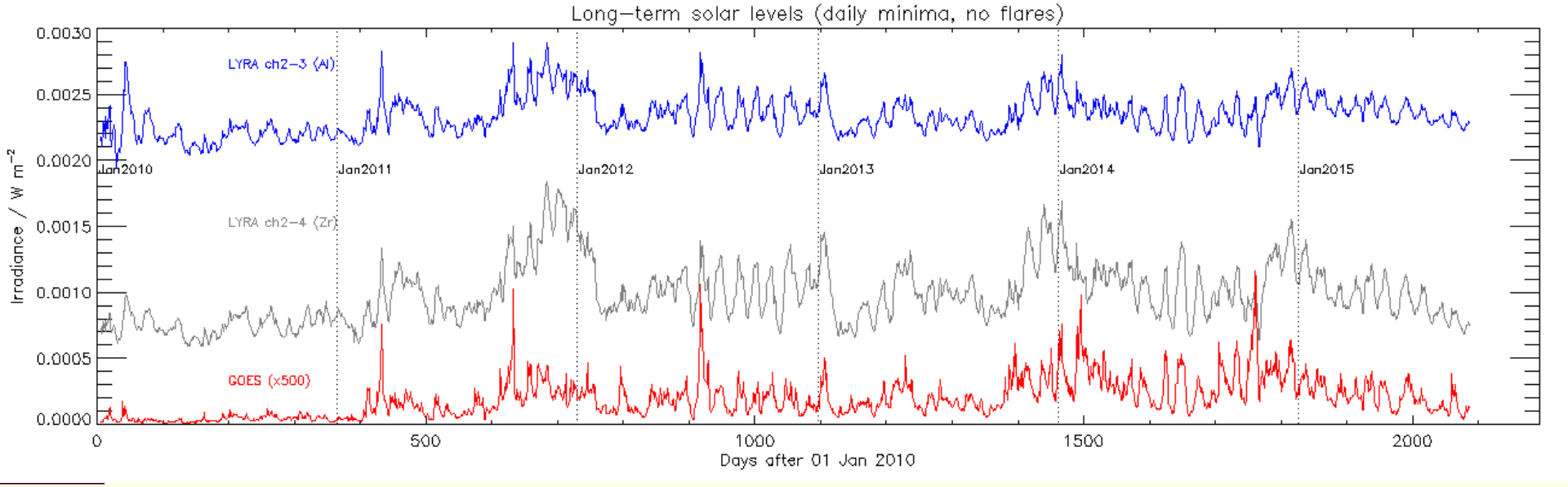
Variability: stronger in ch2-4

Jan – Dec 2014



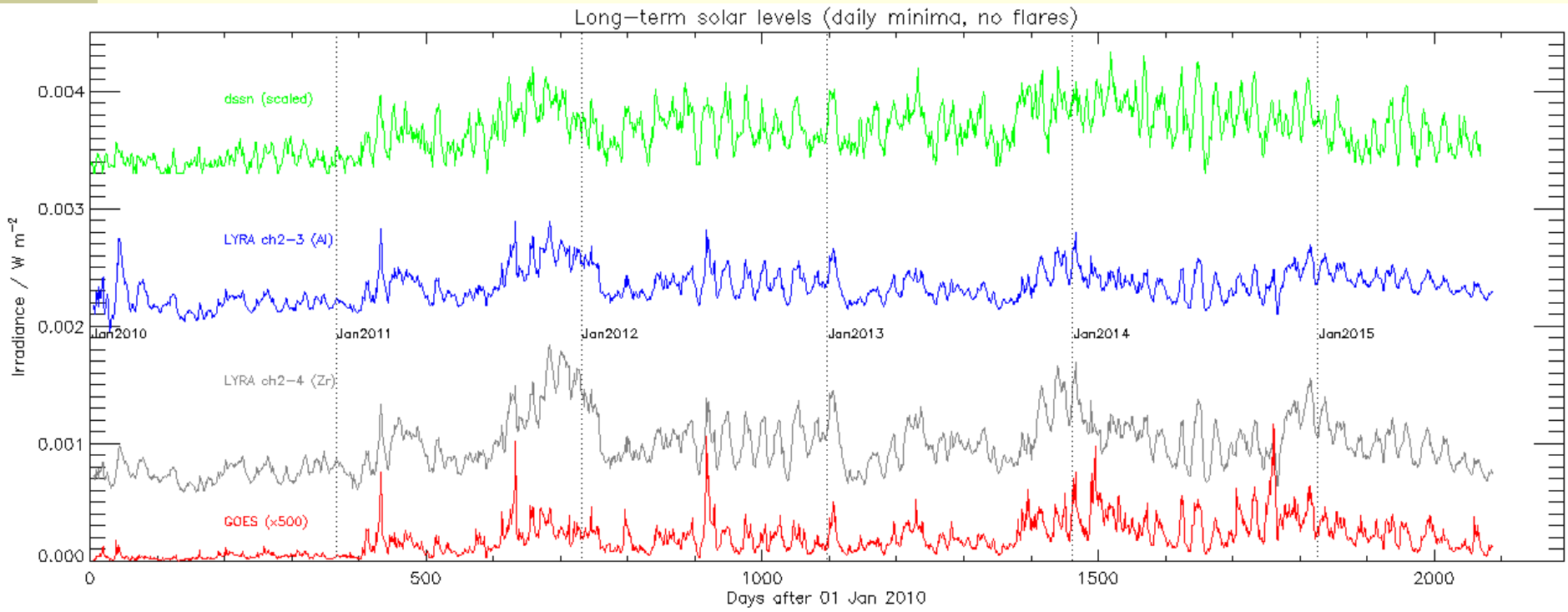
ch2-3 (Al) variability between ch2-4 (Zr) and GOES

Jan 2010 – Sep 2015



- Initially ch2-3 shows more variability => additive correction insufficient
- ch2-3 and ch2-4 correlated but different from GOES (X-ray)
- => more EUV, cooler, smoother (AR development)

Jan 2010 – Sep 2015



- ch2-3 and ch2-4 correlated but different from sunspot number (visible, groups)
- => more EUV, hotter, smoother (AR development)
- Note info on solar variability:
- Phases dominated by maxima, phases dominated by rotations

Consequences

For cross-calibration, compare separately:

- cooler EUV level (additive correction)
- hotter EUV variability (active regions)
- SXR (flares)

Improve ch2-3 correction ?

Solve problem with spectral degradation around 17nm