Soft X-ray spectra obtained using common Czech-Polish Bragg spectrometer Diogeness

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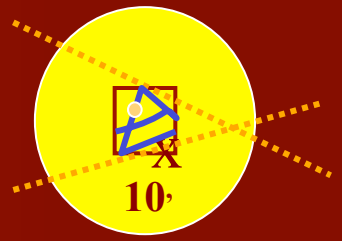
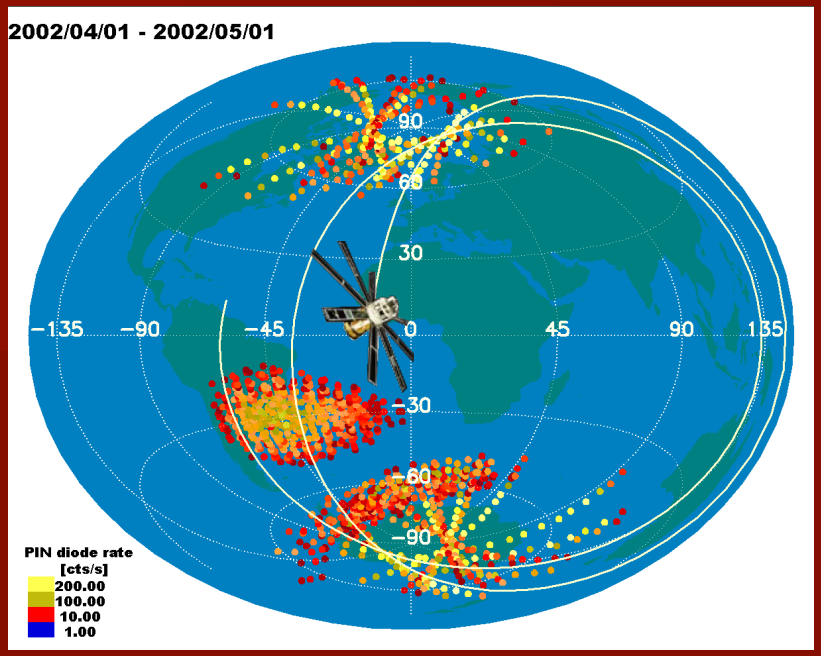
CORONAS-F launch, orbit & pointing

31 July 2001,
polar orbit, 95min,
~500 km
semi-sun-synchronous

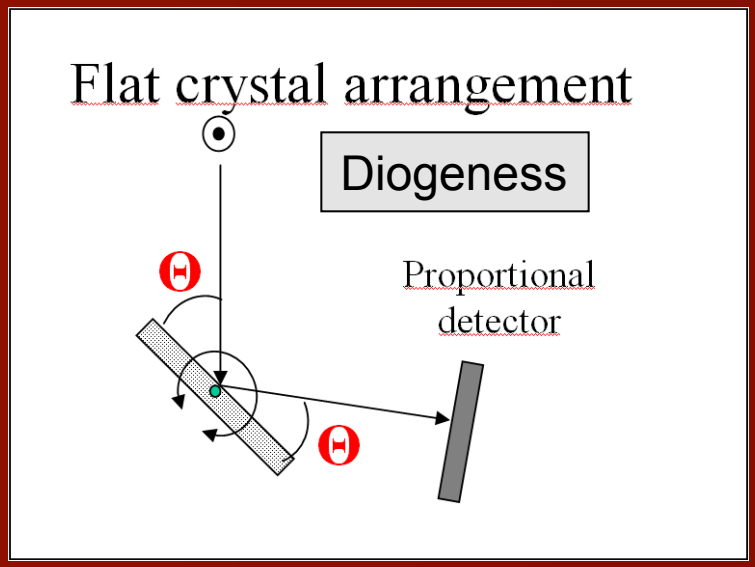


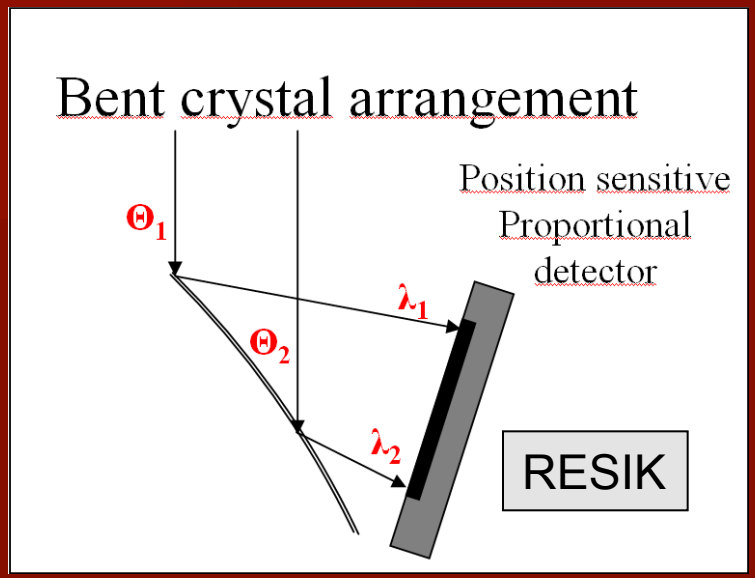


Bragg Spectrometers
perfect crystals used
as diffraction elements

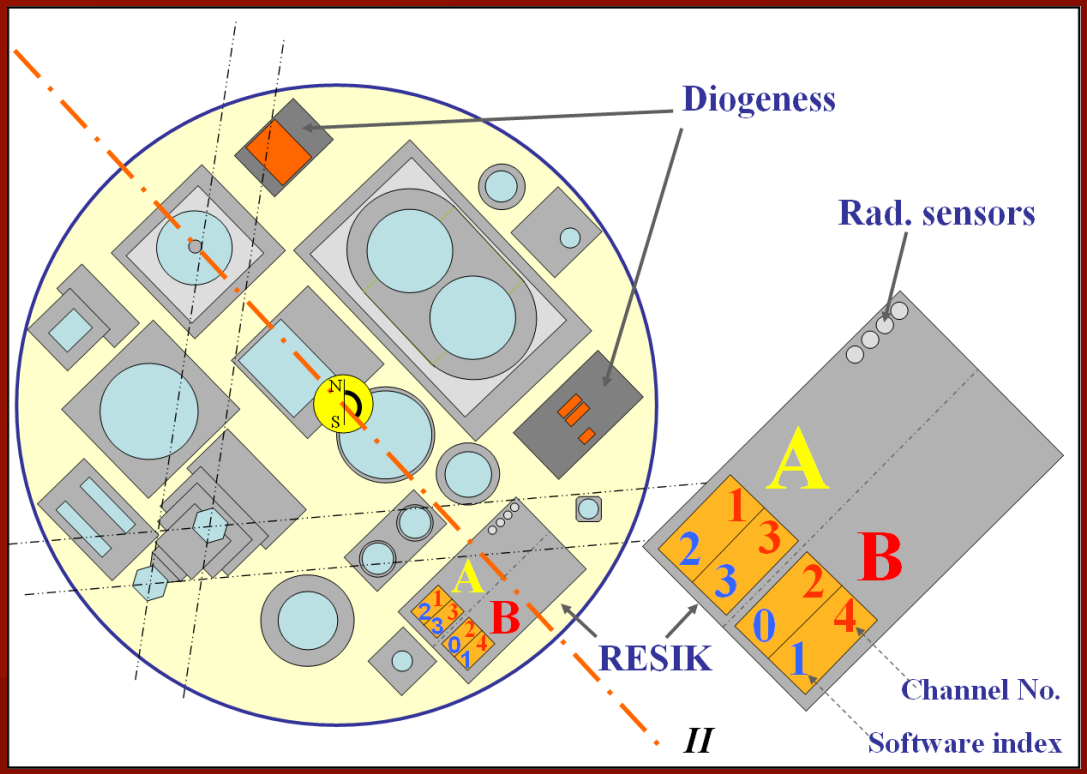
$k\lambda = 2d \sin \Theta$

Θ - angle of incidence
$2d$ - crystal spacing [Å]
λ - 'reflected' wavelength
k - order of reflection





On the payload

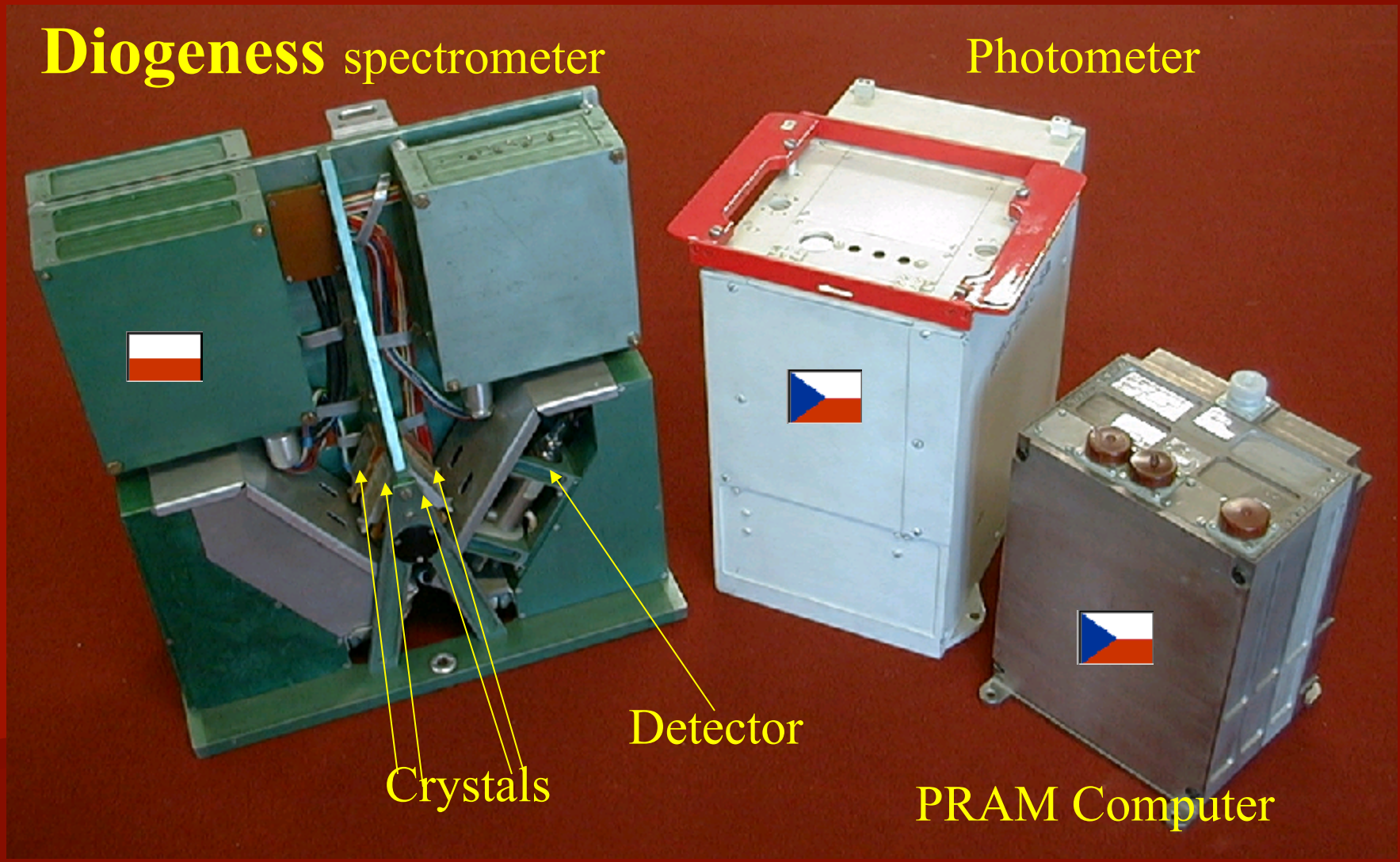


Diogeness: scanning Flat Crystal Spectrometer
like on *P78*

RESIK: Bent Crystal Spectrometer
like on *SMM* and *Yohkoh*

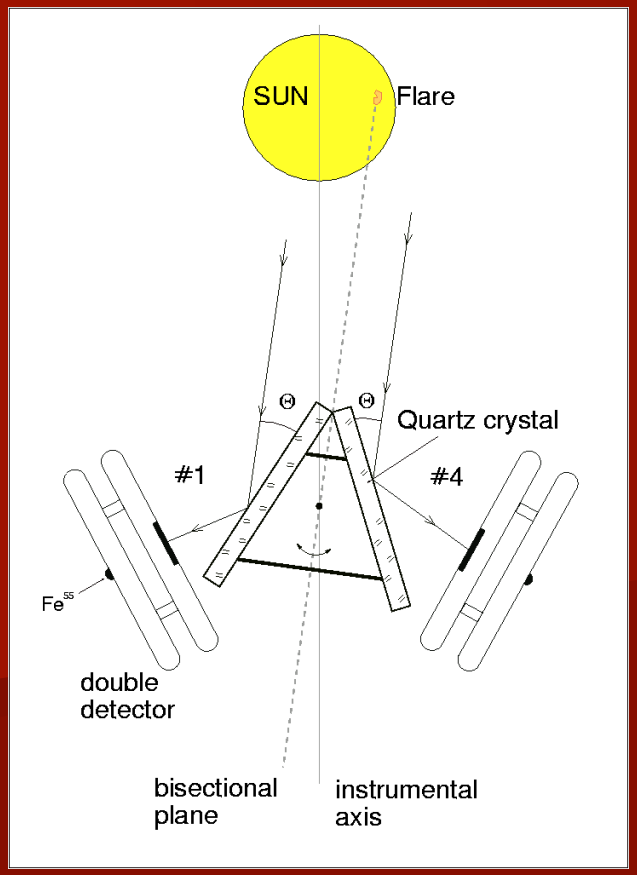
Diogeness objectives

- Obtain high-resolution spectra in „wider vicinity" of strong He-like triplets (to extend spectral database of Intercosmos-4,-7,-11 & 16, P79-1, and more recent: *SMM* & *Yohkoh*) owing to their diagnostic importance
- Study X-ray Dopplershifts in „absolute terms"
  - previous velocity measurements were defined relative to the decay phase line positions
  - increase the accuracy of Doppler-shift measurements substantially



Completion of the Diogeness instrument

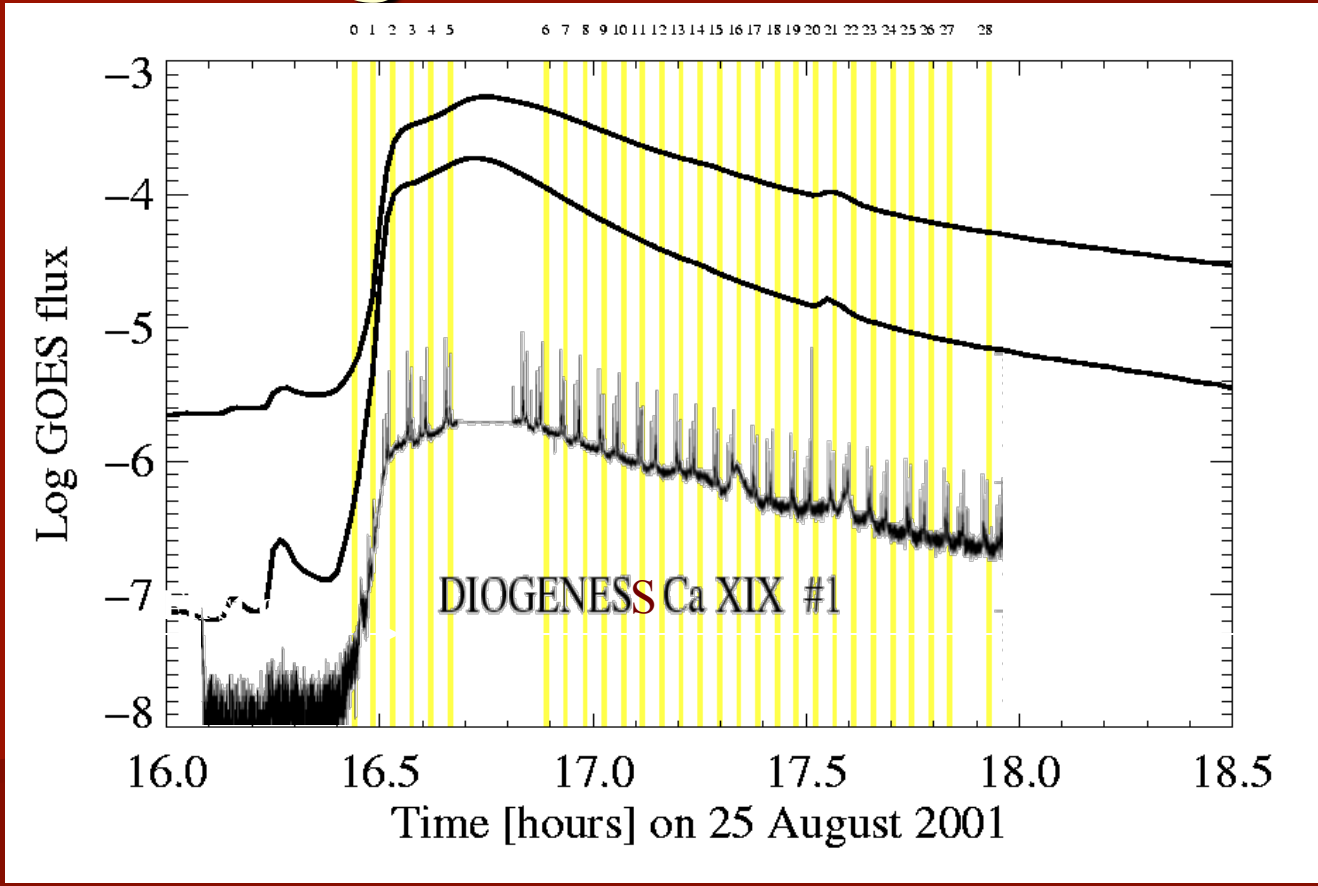
Characteristics of Diogeness



Channel	1	2	3	4
Crystal	Quartz	ADP	Beryl	Quartz
Plane	$10\bar{1}1$	101	$10\bar{1}0$	$10\bar{1}1$
$2d_1$ Å	6.6855	10.5657	15.9585	6.6875
λ_{obs} [Å]	3.1779	5.0348	6.6492	3.1779
λ_{theor} [Å]	3.1781	5.0374	6.6488	3.1781
Line	Ca XIX	S XV	Si XIII	CaXIX
λ_{min} [Å]	3.1436	4.9807	6.1126	2.9601
λ_{max} [Å]	3.3915	5.3721	6.7335	3.2123
R_C [μrd]	91	91	15	90
FWHM [arcsec]	24.1	68.1	94.1	25.6

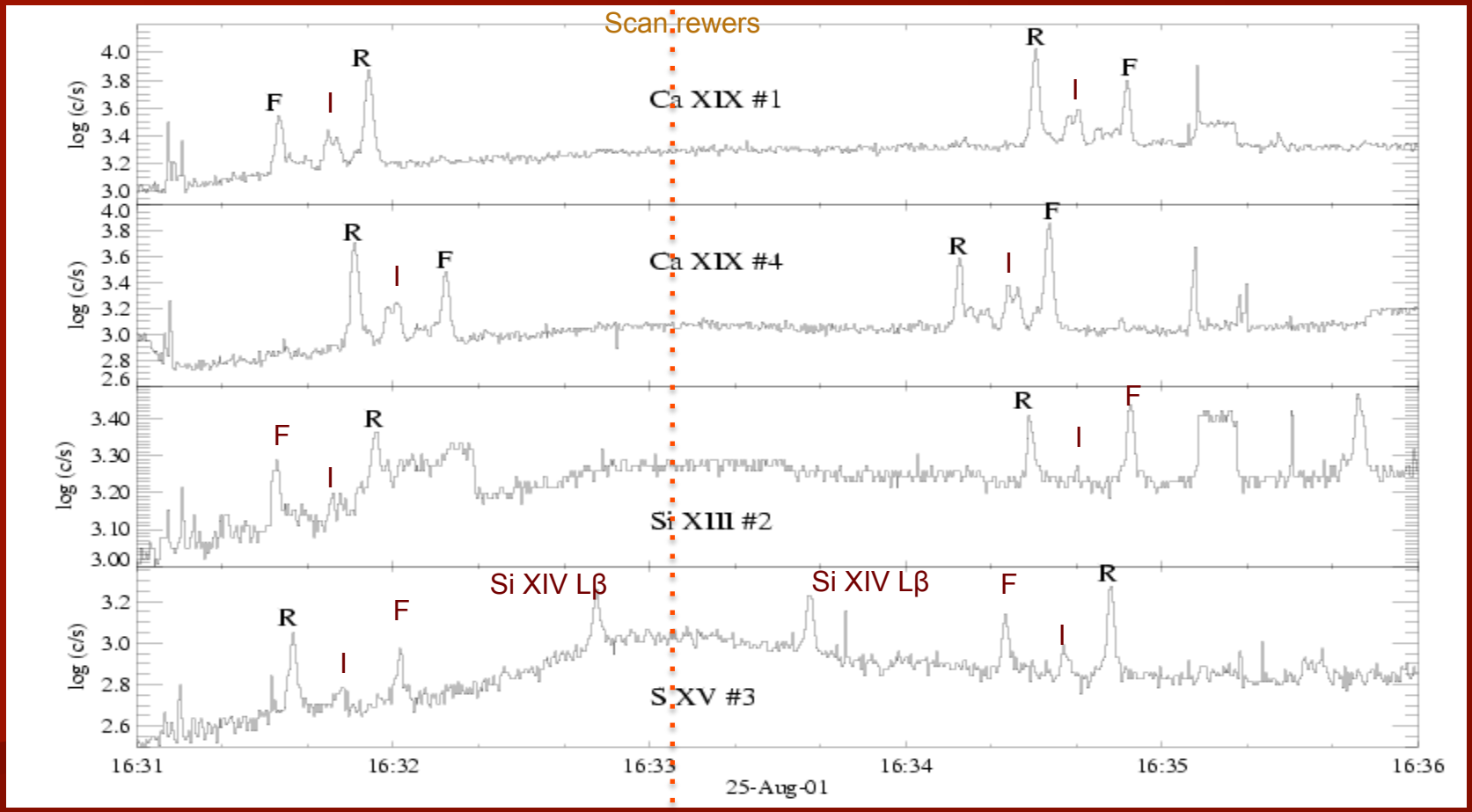
$\mathbf{R_C}$ - The total reflection coefficient.

25 Aug 2001 X5.5 flare



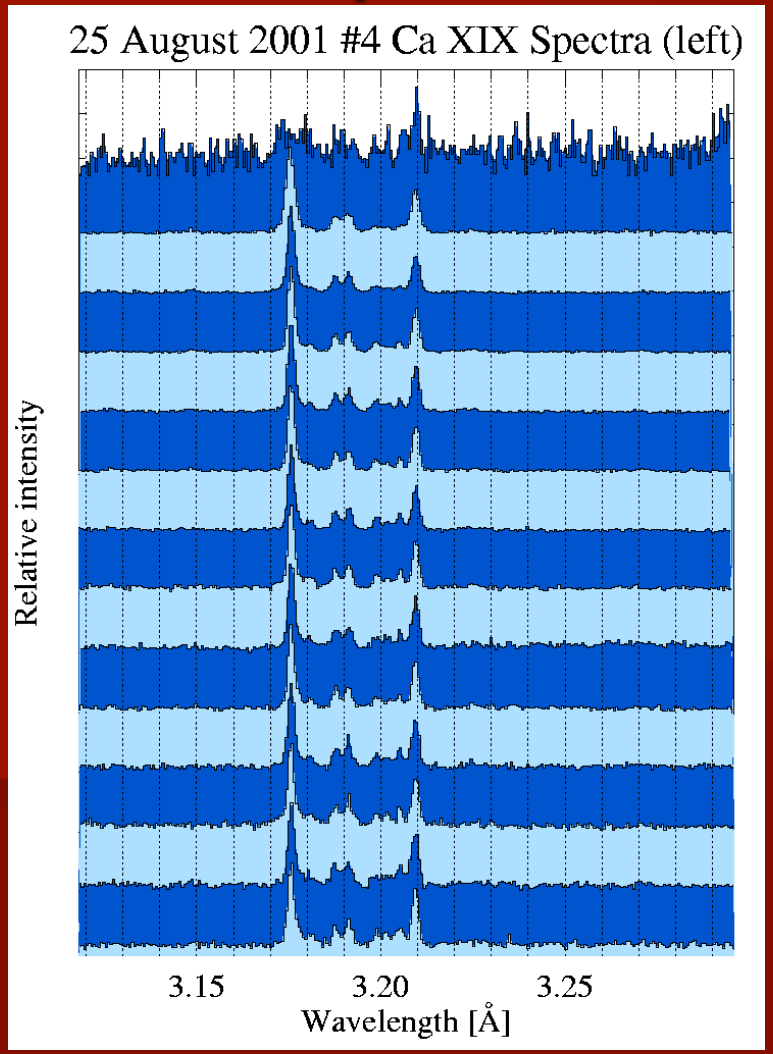
Each strip represents a pair of forward and backward scans

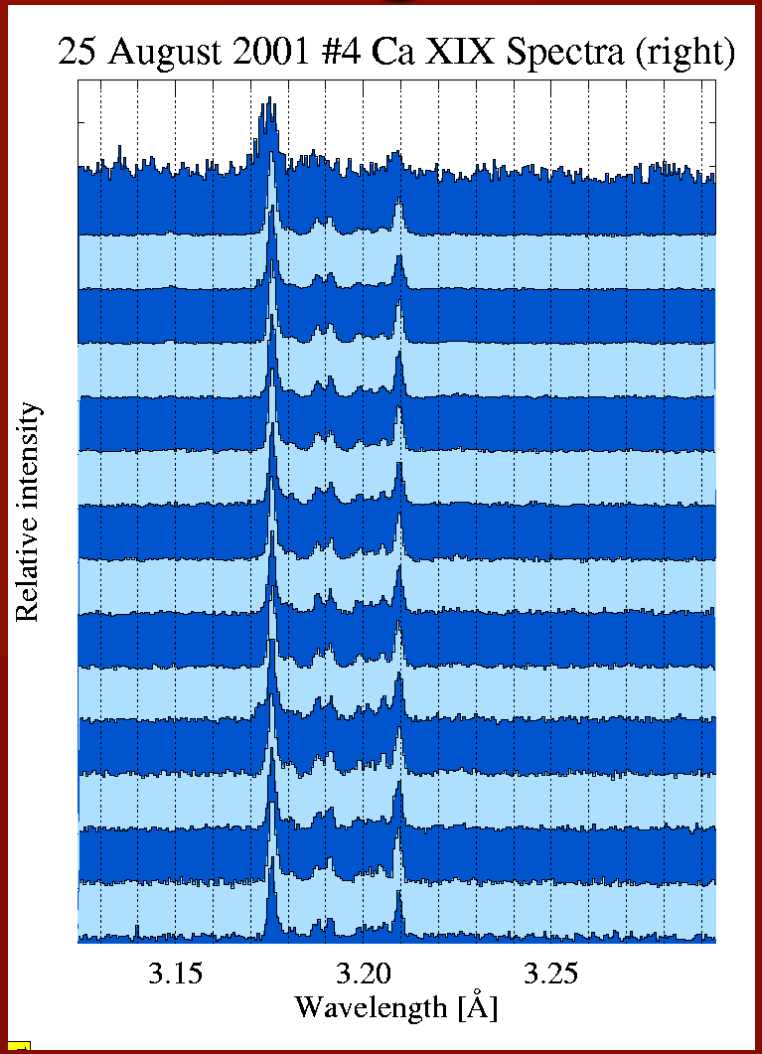
Details of scans in four channels



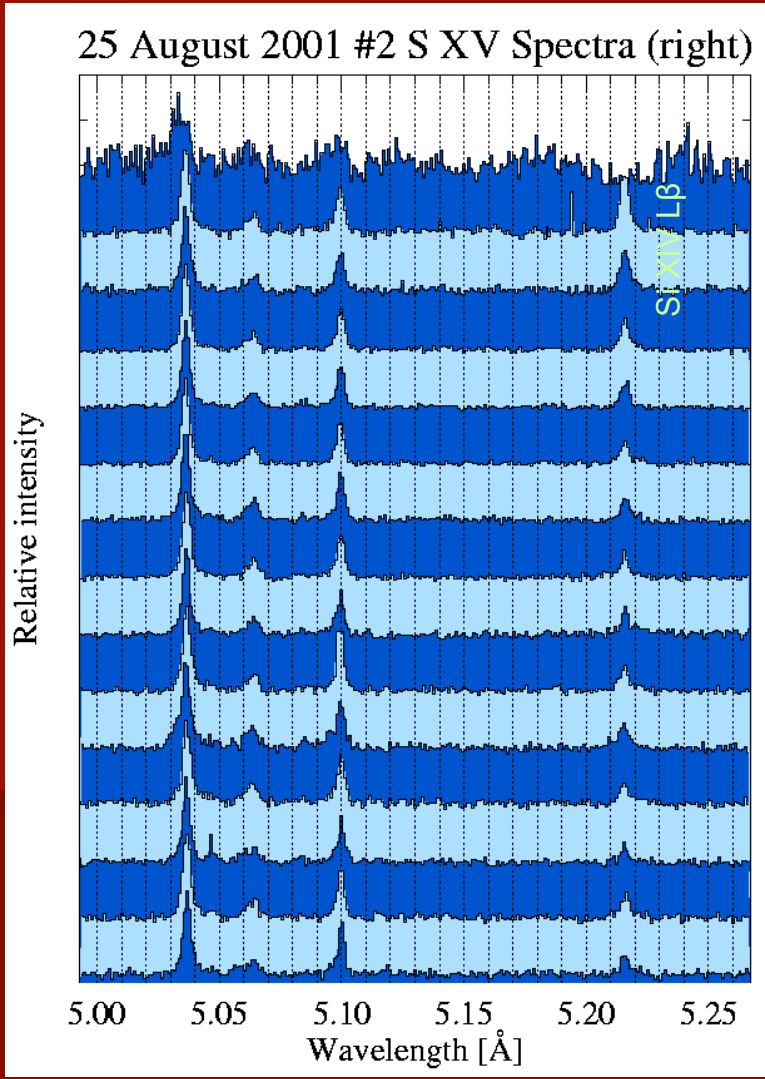
Scanning ranges: ~140 arcmin back/forward mode, duration ~120 s
Contain: triplet lines (Resonance, Intercombination, Forbidden + satellites) in He-like ions of Ca, S and Si

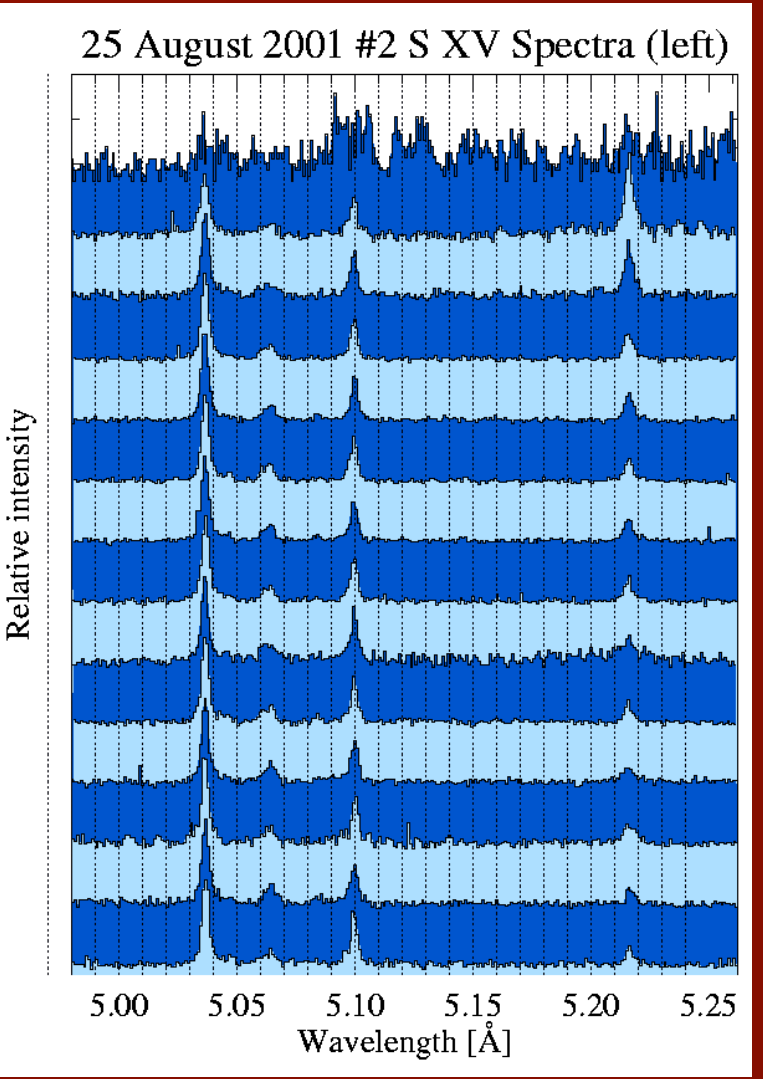
Time Sequence of left & right scans



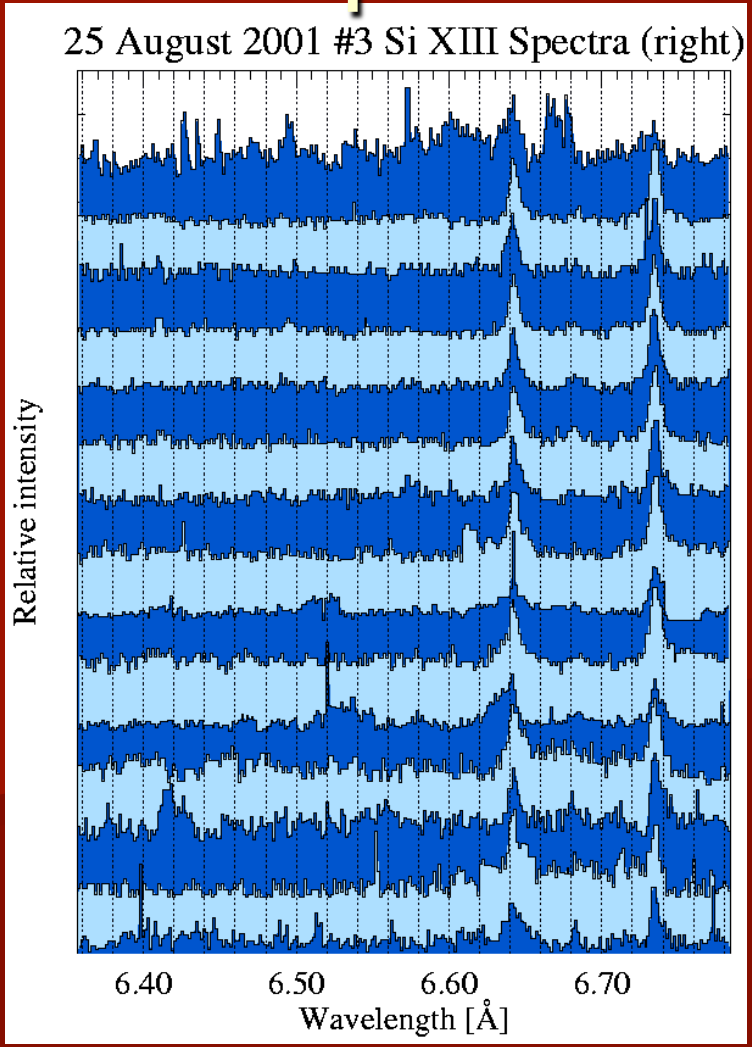


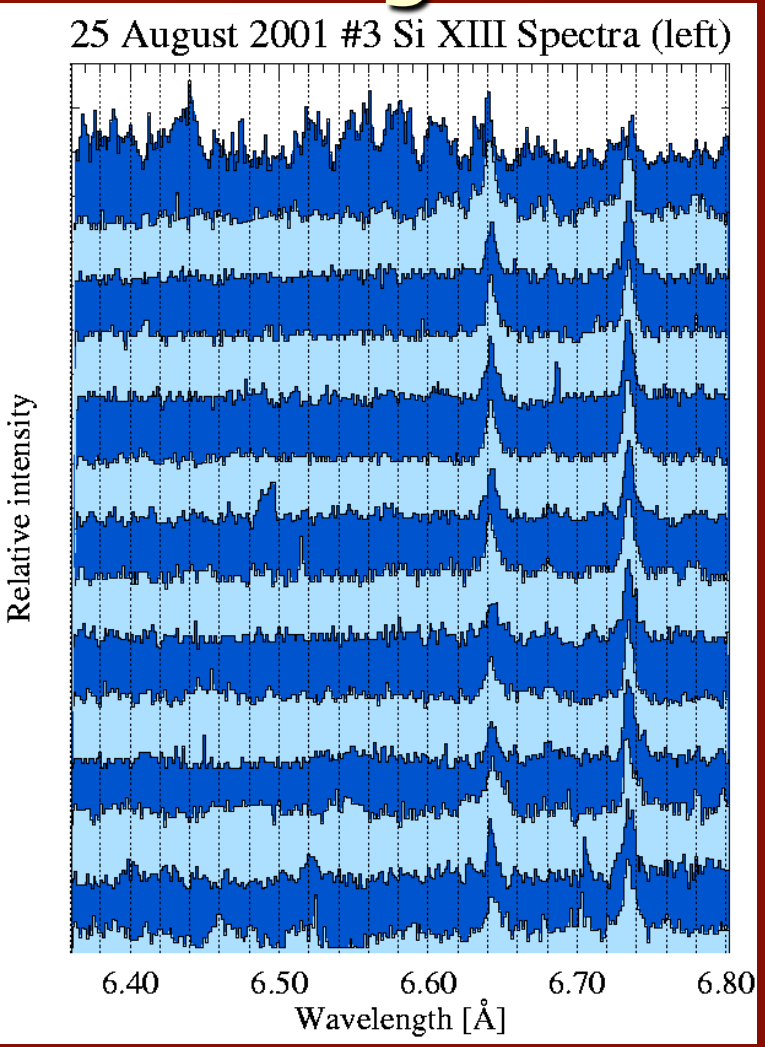
Time sequence of left & right scans



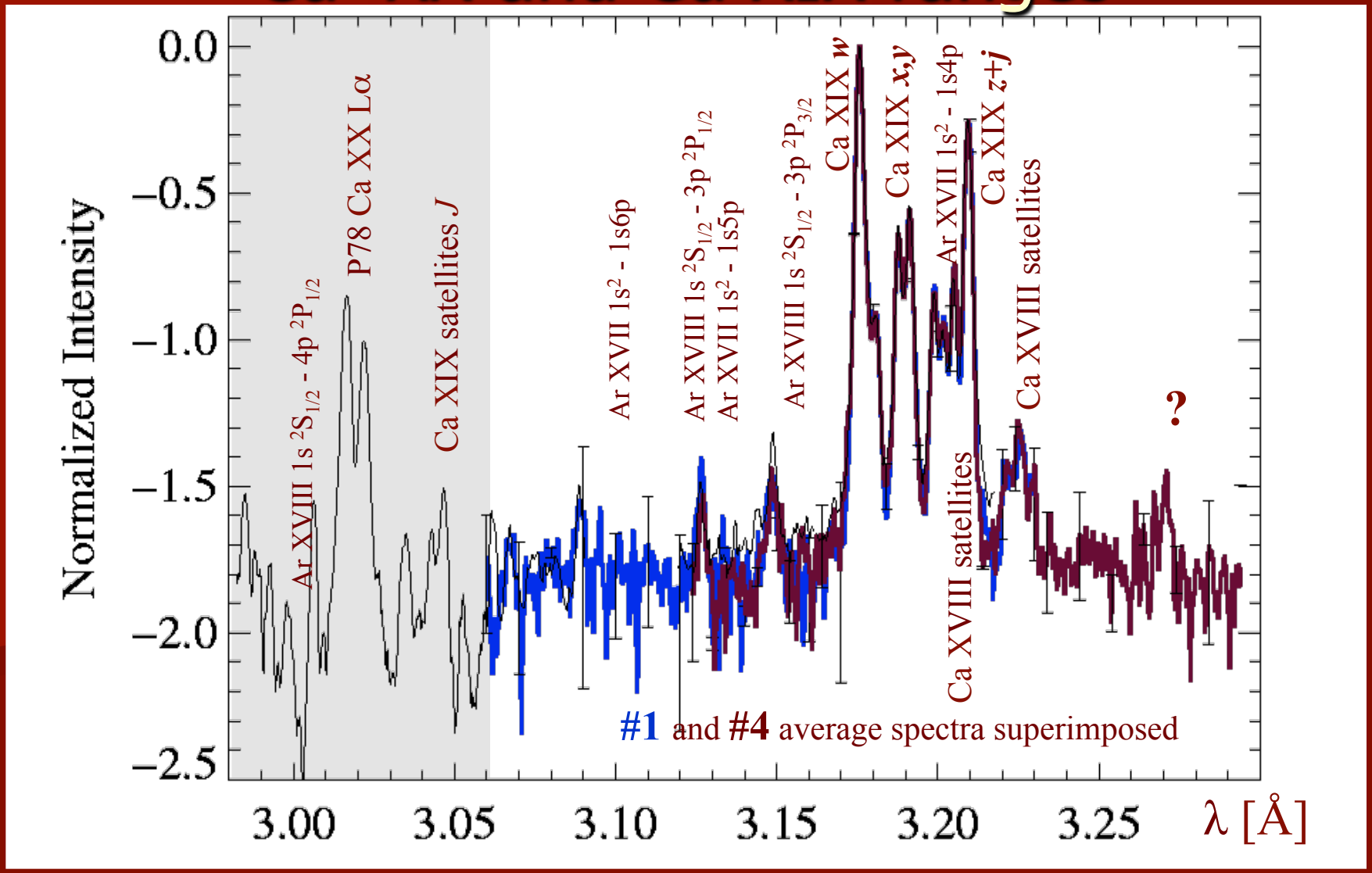


Time Sequence of left & right scans

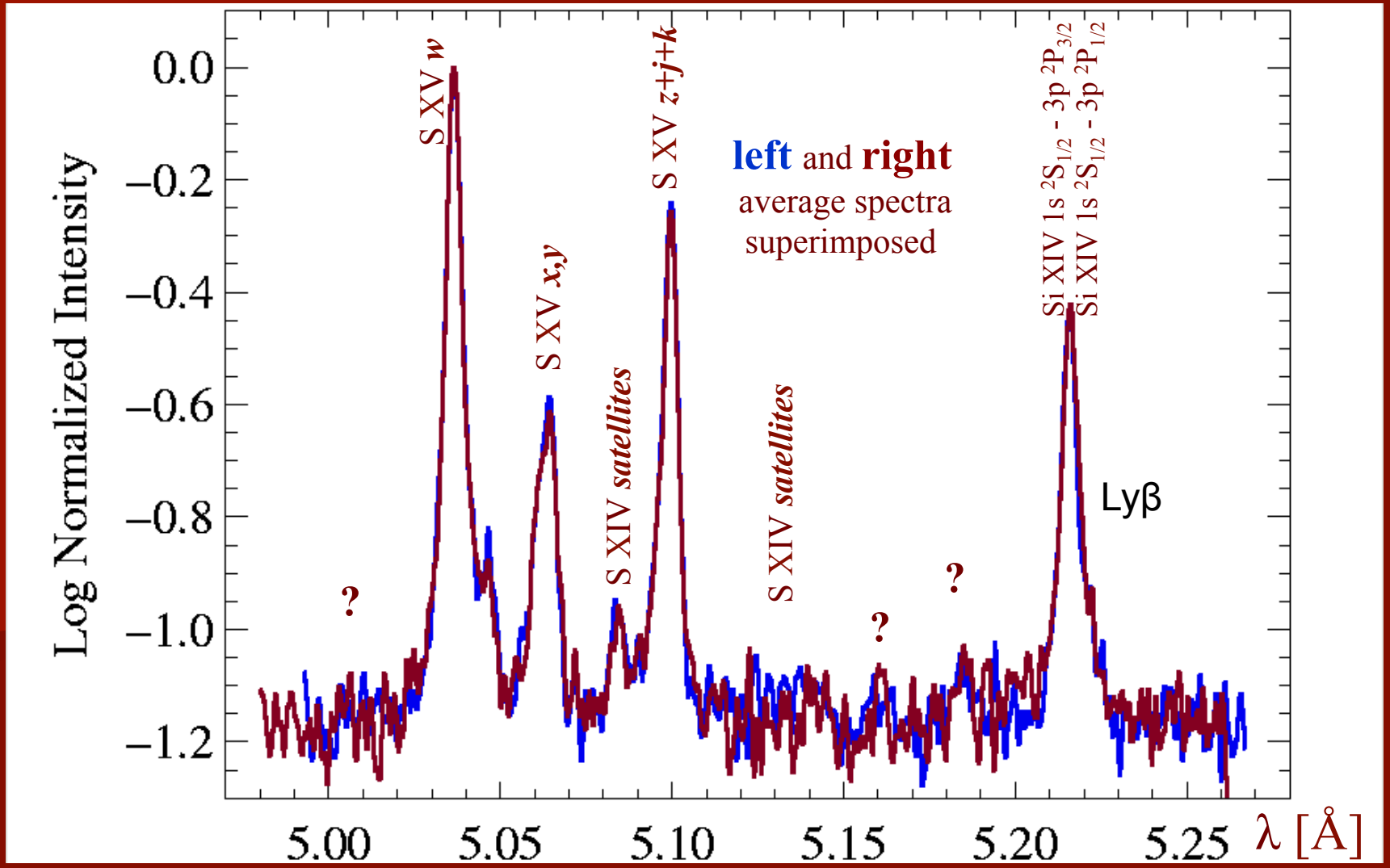




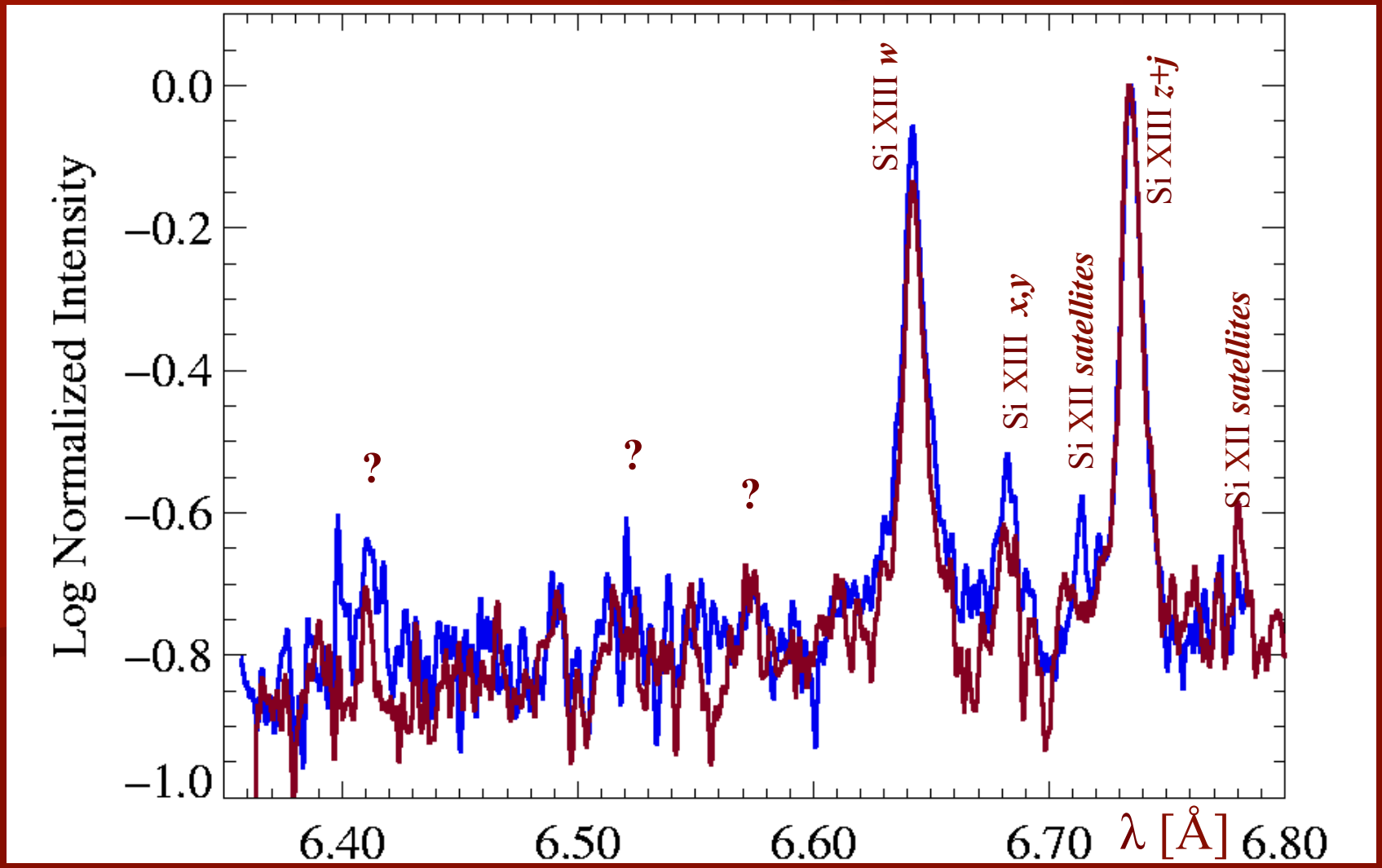
Composite of P78-1 and Diogeness Ca XX and Ca XIX ranges



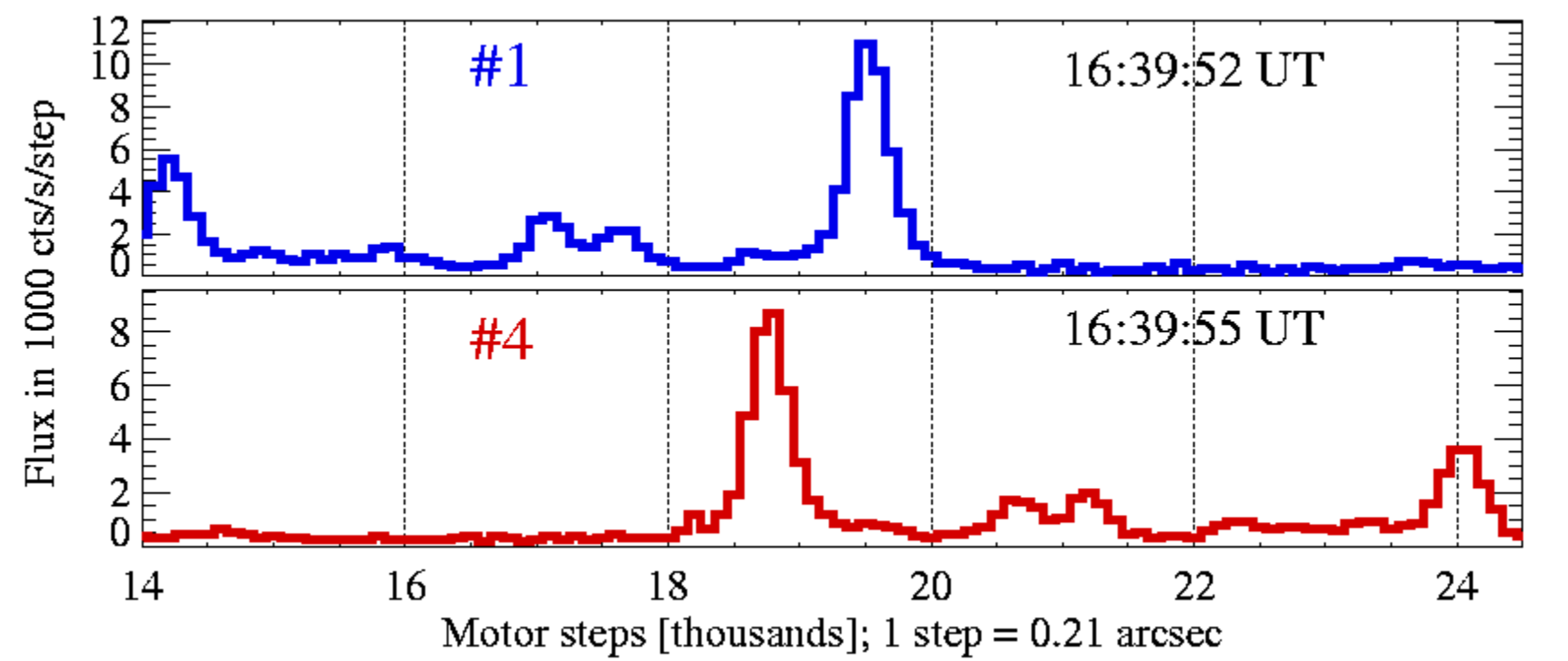
Composite of Diogeness S XV and Si XIV ranges



Composite of Diogeness
Si XIII range

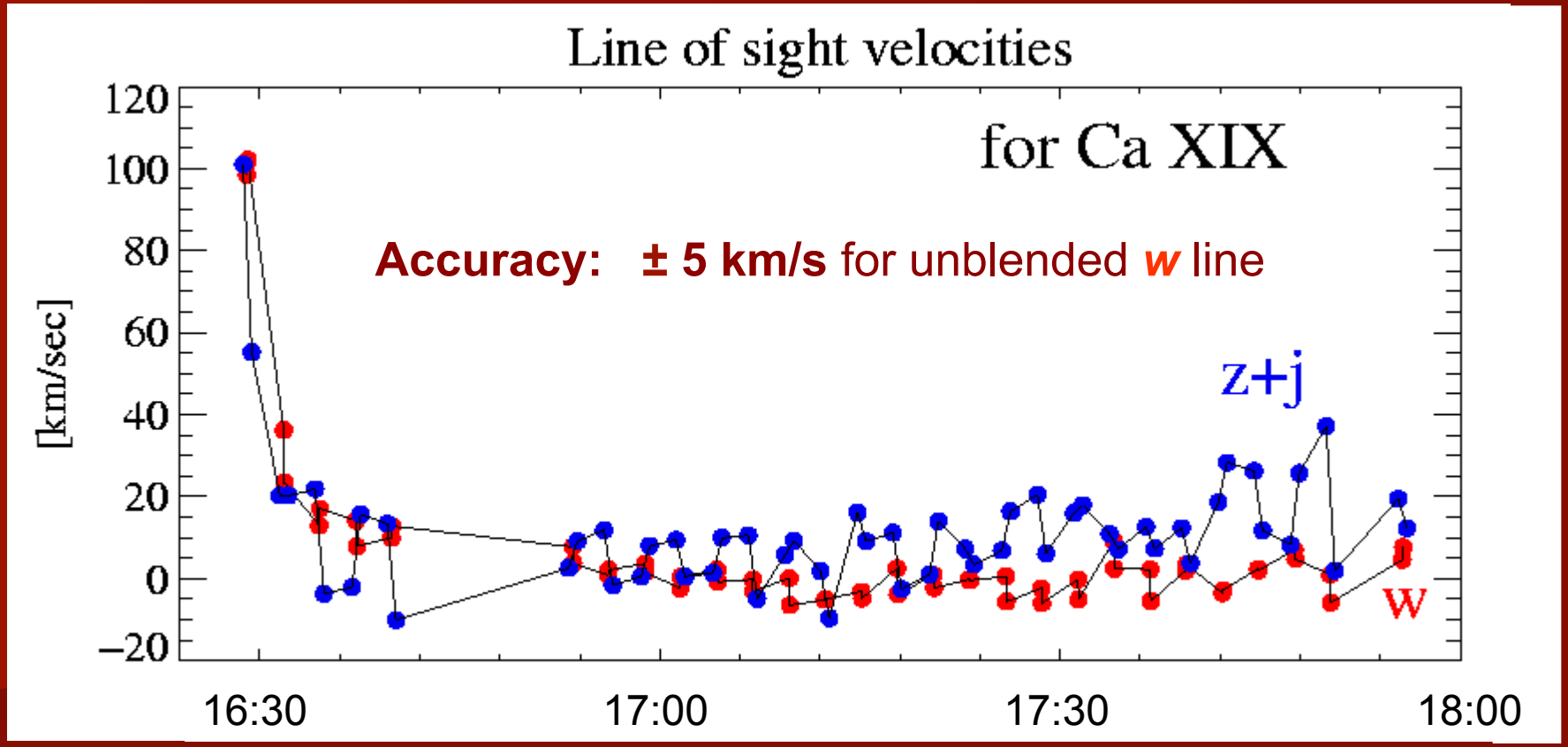


X-ray Dopplerometer results



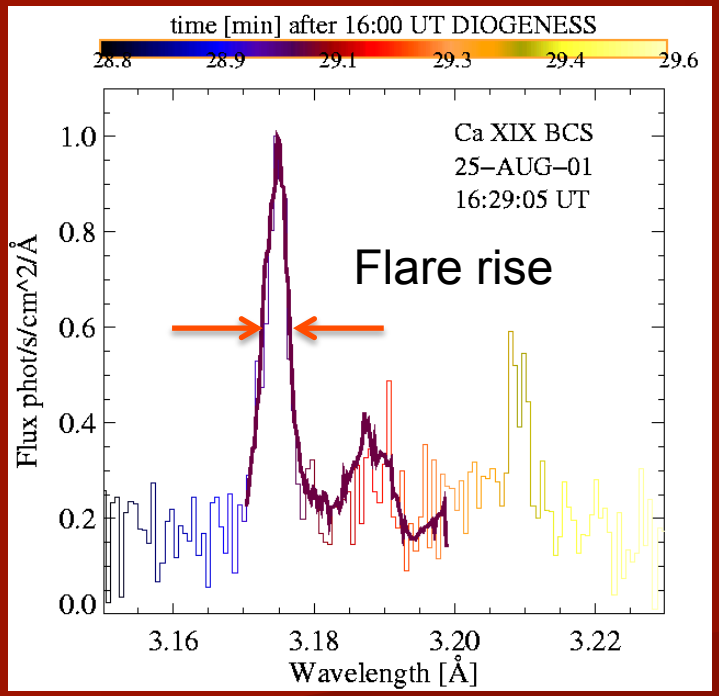
An example of measured spectra recorded nearly simultaneously in Channels #1 and #4 of Diogeness during the maximum phase of X5.3 flare on 25 Aug. 2001. The scanning in both channels is made in the opposite wavelength sense. Thus the intercombination and forbidden lines comprising the Ca XIX triplet are seen on the opposite sides of the presented range (recorded 20 s apart in time).

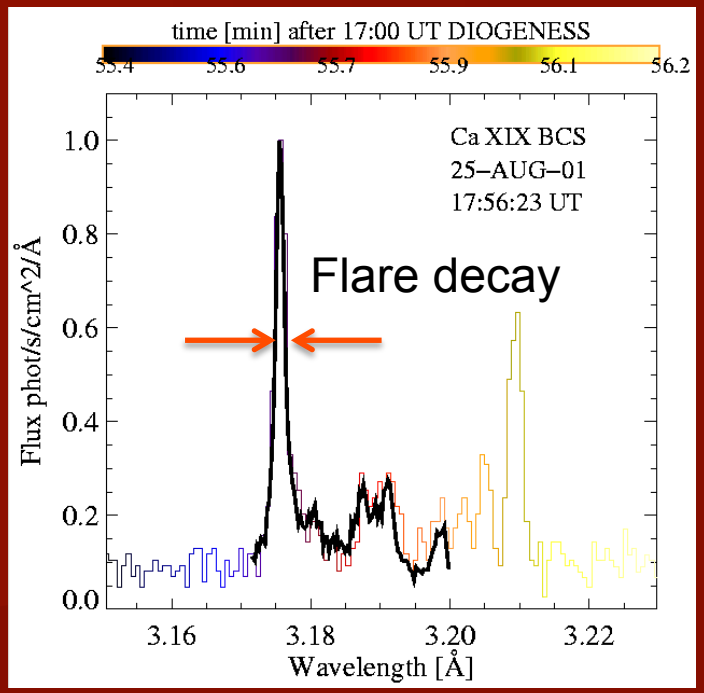
Velocities: the concept proven



Velocities as determined for the resonance (*w*) and forbidden lines (*z*) of the Ca XIX triplet. The forbidden line is blended with a strong dielectronic satellite line (*j*) which might account for slightly different pattern of behaviour later in the flare decay.

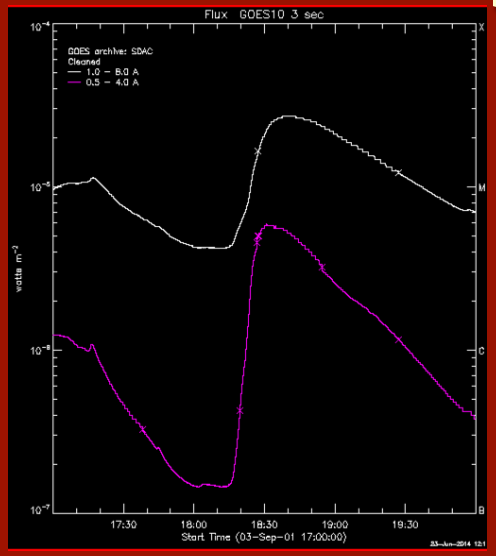
Diogenes spectra compare well with Yohkoh BCS

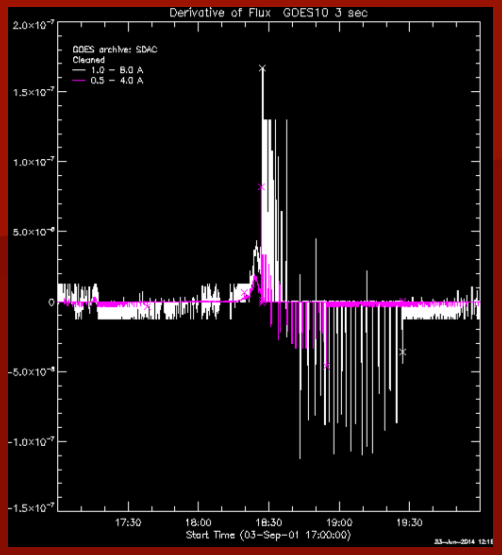


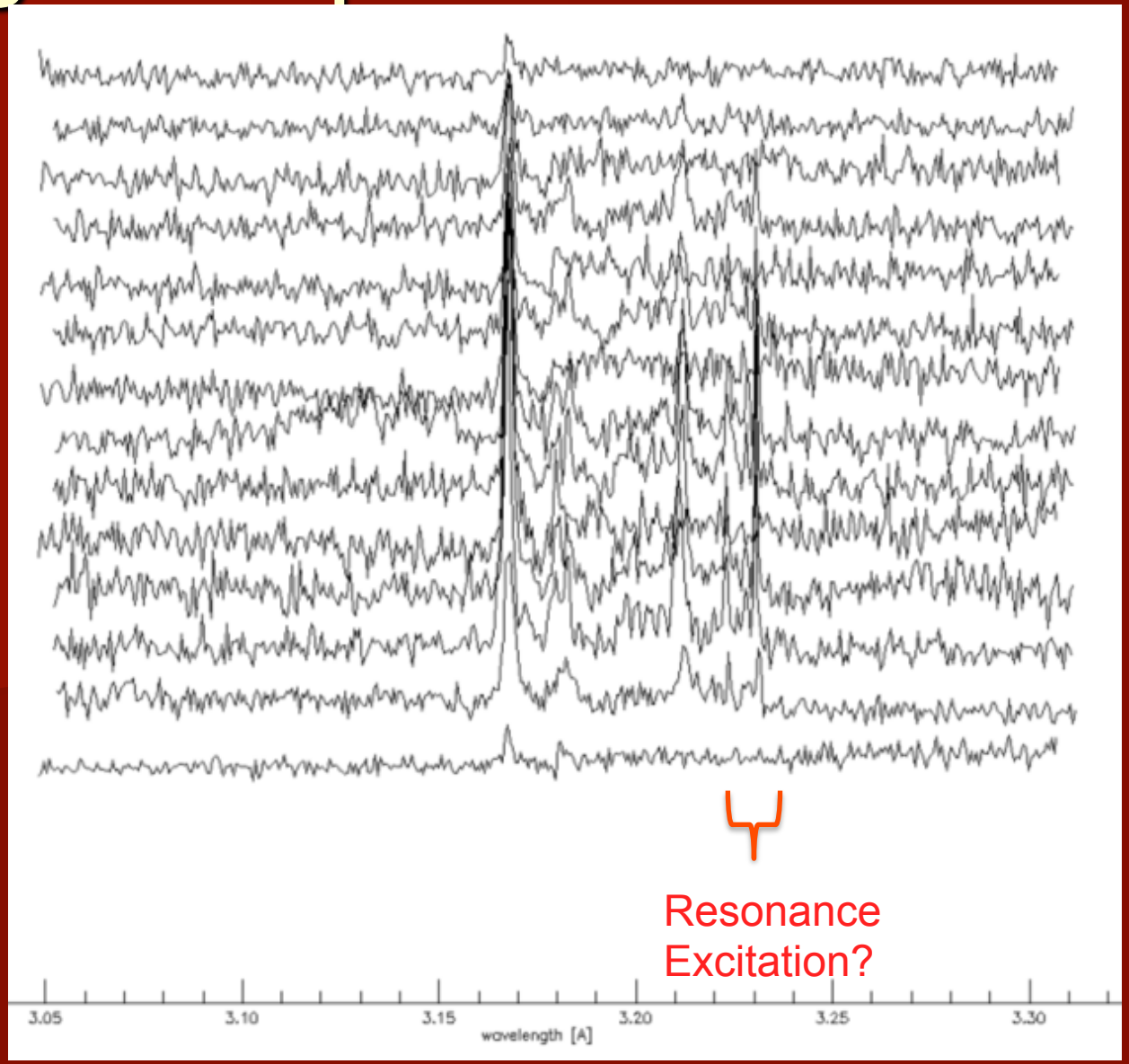


Variation in line widths is due to changing plasma turbulentce The colours correspond to times at which particular wavelength has been scanned by Diogeness. The *Yohkoh* BCS spectra have been observed close in time.

Diogeness peculiarities







Diogeness Summary

- X-ray Dopplerometer concept worth further experimenting→ ChemiX on IHP
- More than 200 spectral scans available for the analysis – analysis under EHeroes
- Absolute calibration of spectra done
- Mechanical scanning is a general problem for flat crystal spectrometers (*SMM* FCS)

The end

Thanks the Organizers for invitation

Thanks Zdeněk for setting the collaboration 50y from now