

Multi-instrument campaigns to observe the off-limb corona

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General remarks about campaigns

- A single instrument/satellite provides only a piece of the puzzle
- Interpretations based on single instruments can turn out to be wrong
- Fundamental for science to combine different datasets
- Have you ever found the dataset which contains all the information you need to solve a problem ? (No)
- Why bother observing the 'same' feature ? (the Sun changes and often does not cooperate)
- Why is still so time consuming and complicated to coordinate campaigns ?

- A big **THANK YOU** to all the instrument's teams
TRACE, Hinode, SOHO/CDS, SUMER, UVCS

2007 May 7-10 Ulysses quadrature Hinode HOP 7

G. Del Zanna, V. Andretta, G. Poletto, H. Mason, Y.K. Ko,
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- In May 2007 Ulysses was in quadrature with SOHO
- Measure T, N, abundances in active regions as function of height from 1 to 1.7 R_{\odot}
- Link them with in-situ measurements by Ulysses.

We needed

- 1- an active region at the right time (planning constraints!) and place (around 45-60° s)
- 2- Co-spatial and co-temporal measurements from

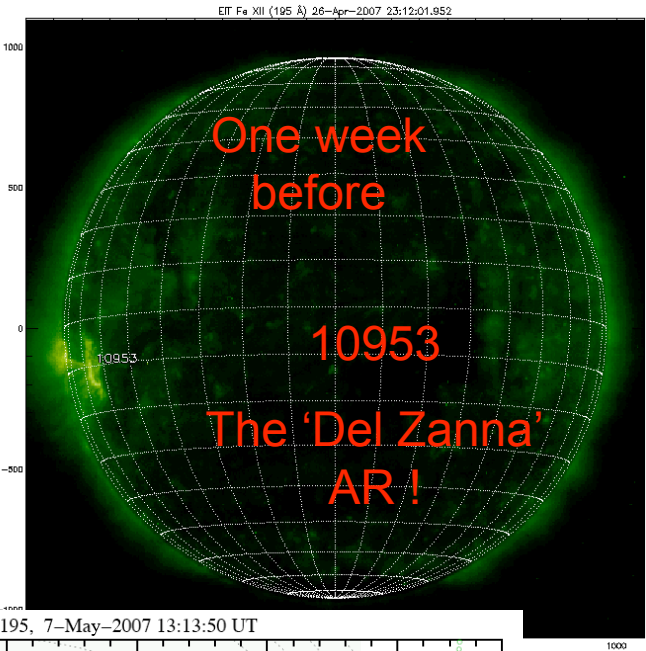
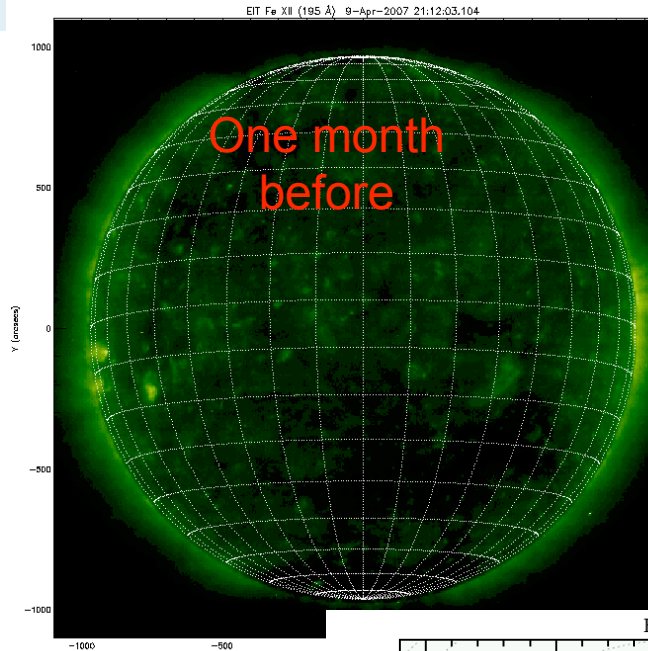
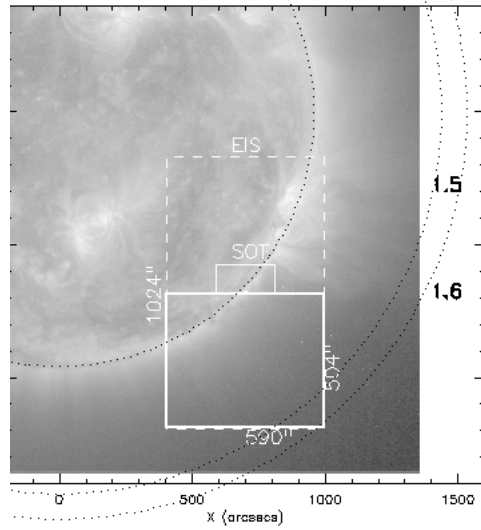
Hinode, SOHO (UVCS, CDS), TRACE, STEREO/EUVI

Long shot !

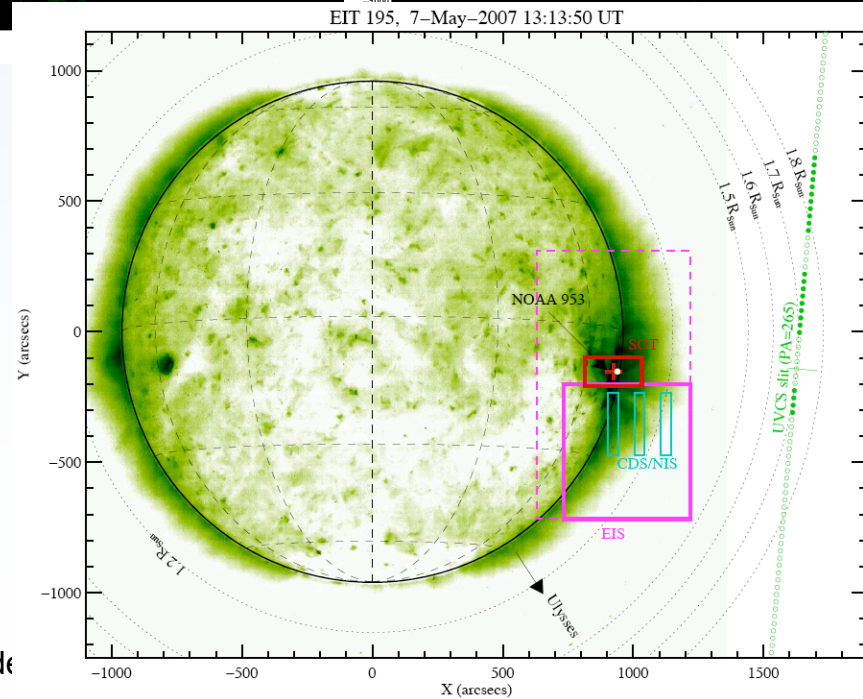
(see talk from A. Bemporad on the filament eruption)

EIS + CDS + UVCS

The plan

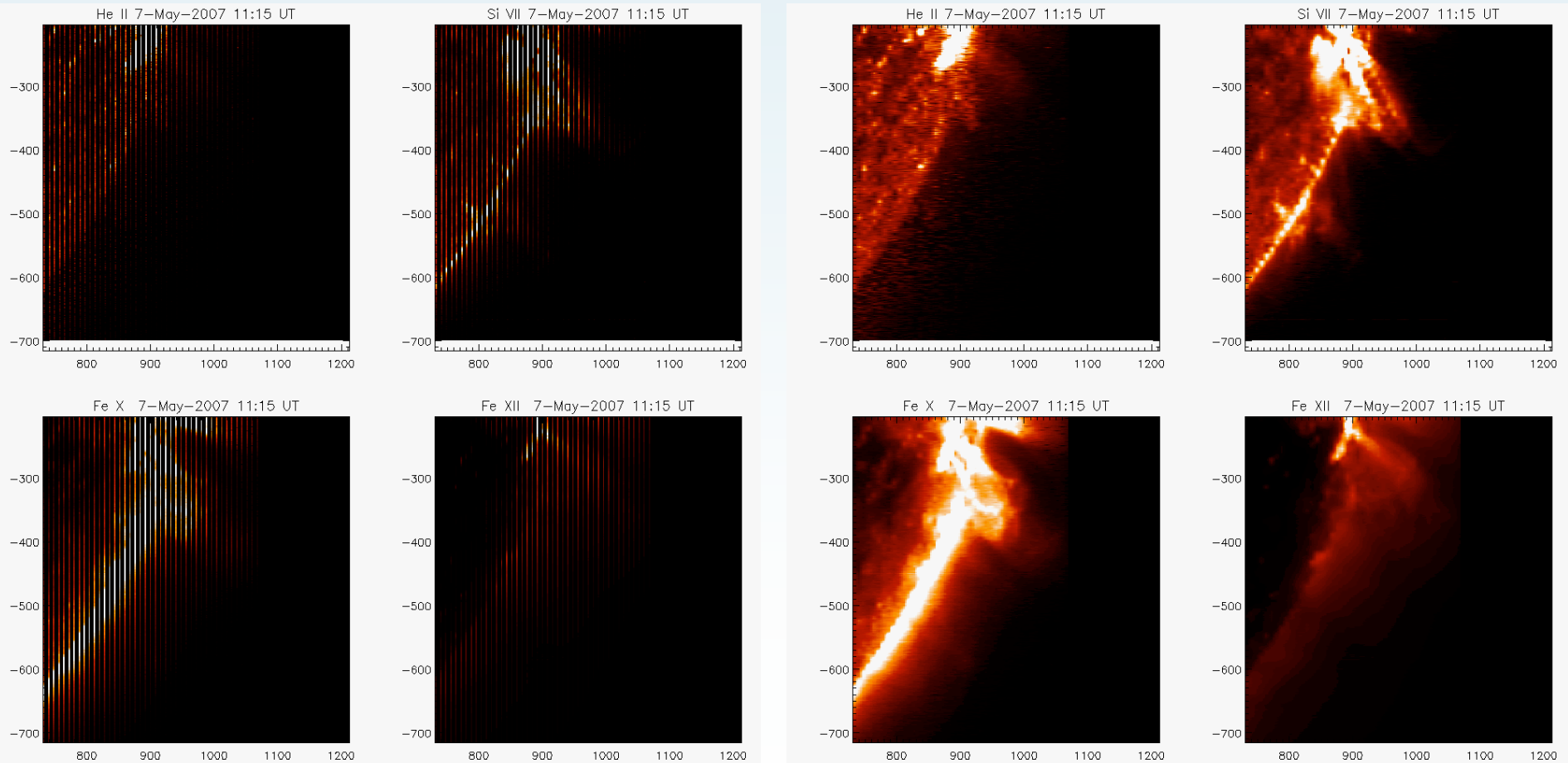


The actual pointings



The EIS sparse raster

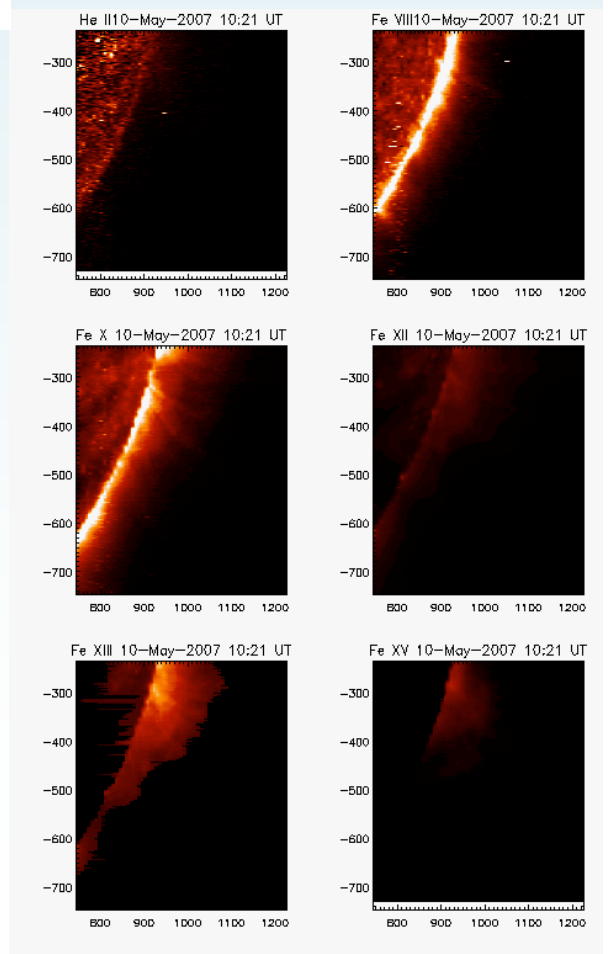
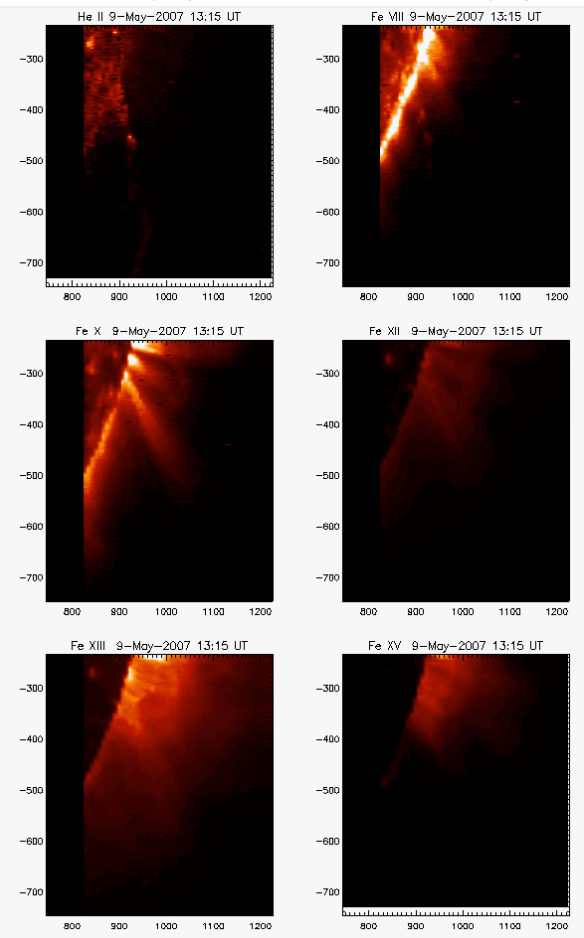
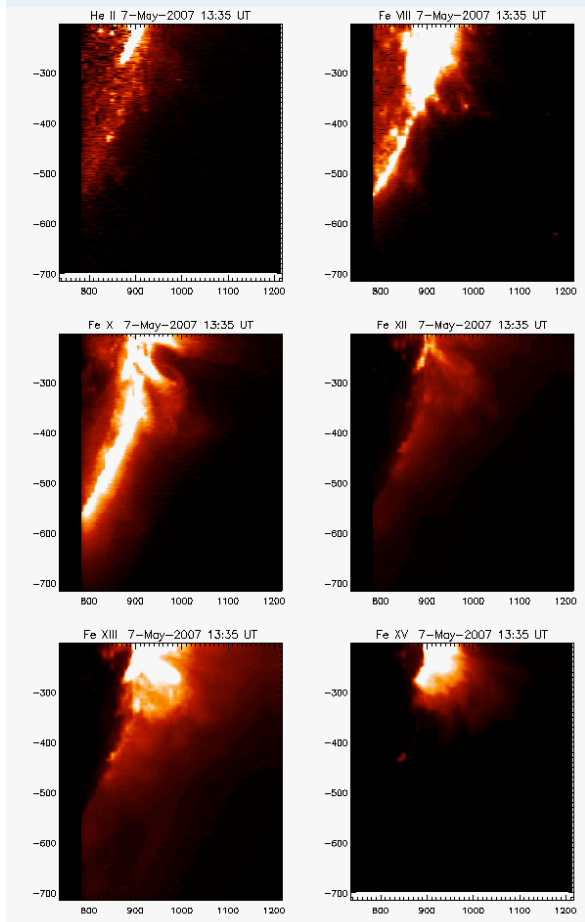
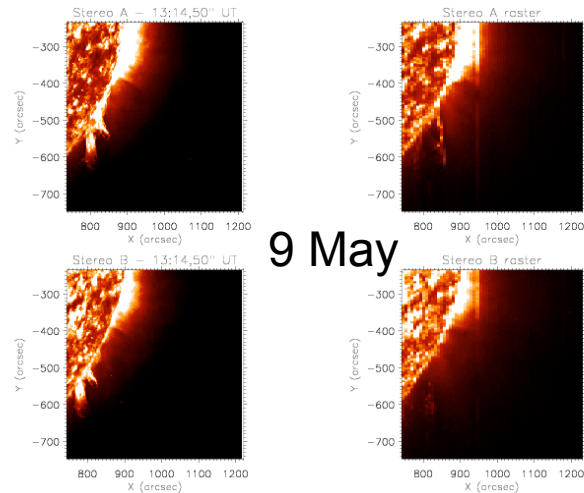
- 2" slit - 60s exposure
- designed a sparse raster (8" step) to cover a large FOV in 1h (bottom CCD)
- problems with Eclipses - Good signal in most lines



7 May

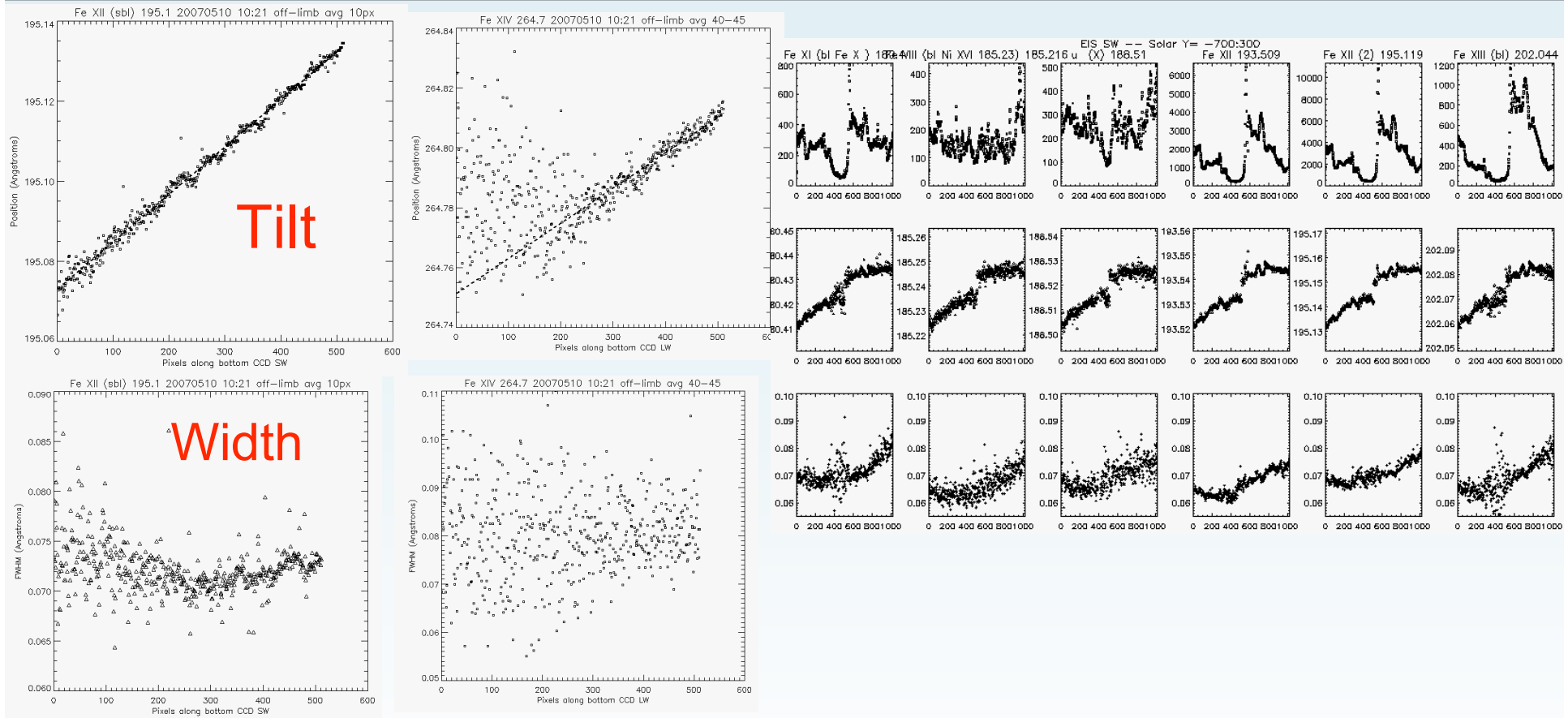
9 May

10 May



ice me

Line widths and tilt in the bottom EIS CCD

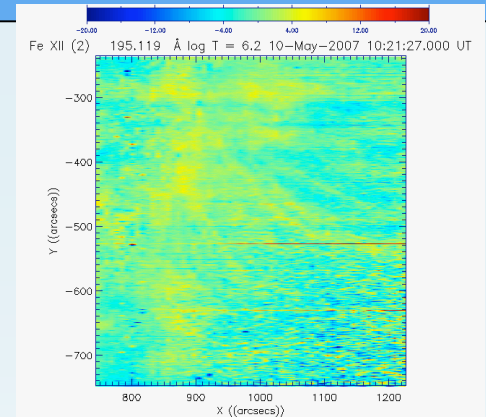
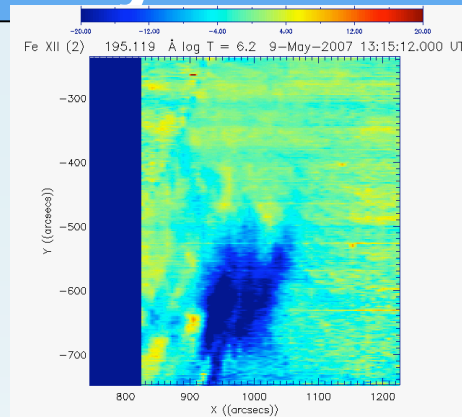
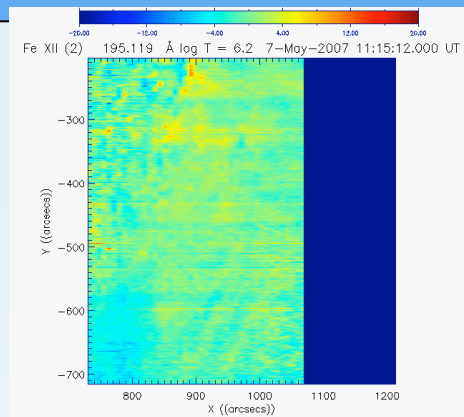


The bottom of the CCD is the best
(in terms of line widths)!

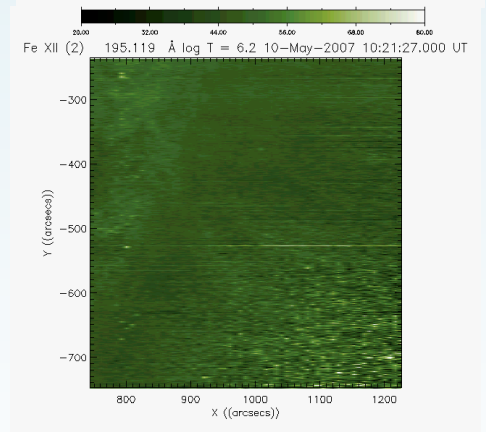
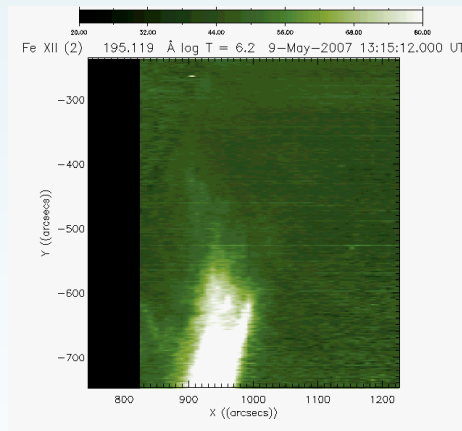
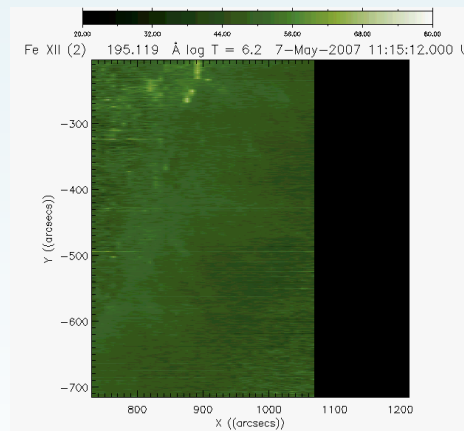
7 9 10 May 2007

EIS Fe XII

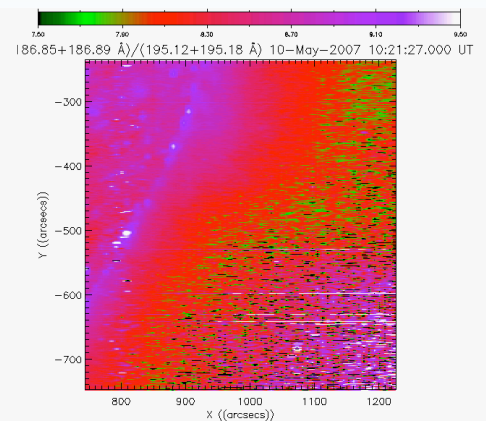
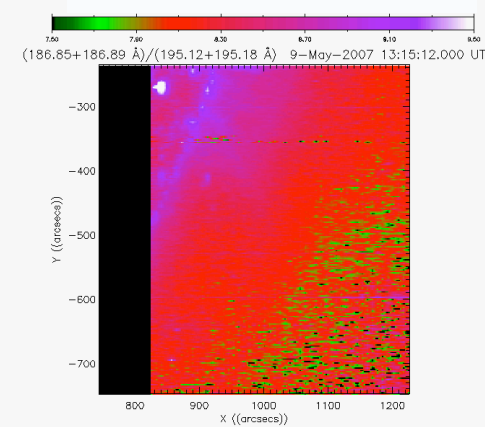
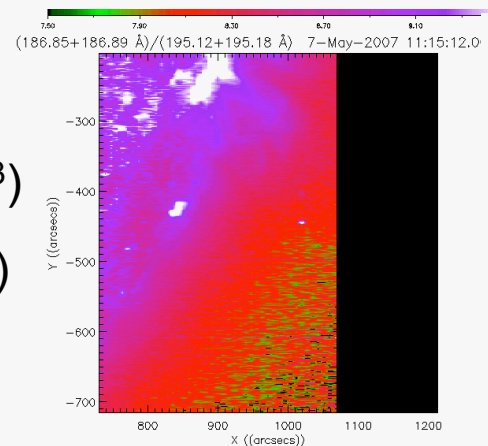
Doppler shift
(± 20 km/s)



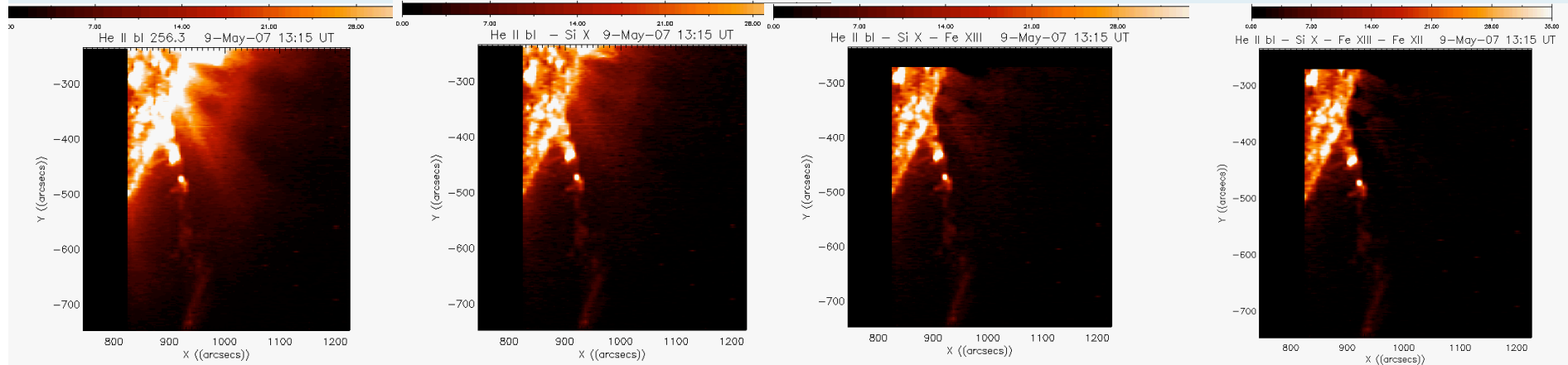
Non-thermal
width
(20-80 km/s)



Density (cm^{-3})
(7.5-9.5 log)



He II - yet another complex blend



Blend

Bl -Si X

Bl -Si X - Fe XIII

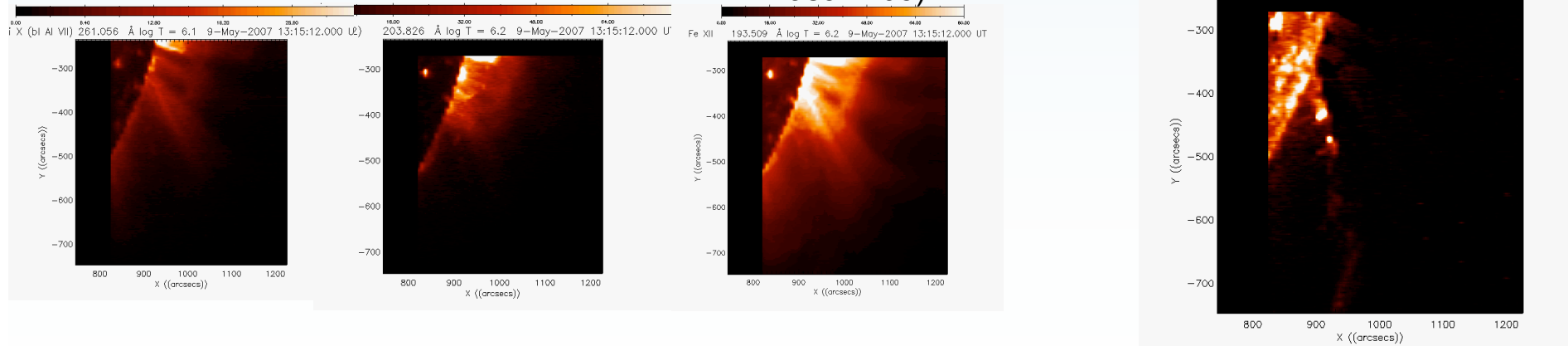
Bl -Si X - Fe XIII - Fe XII

Si X BR

Fe XIII dd

Fe XII dd
(Del Zanna & Mason 205)

Bl -Si X - Fe XIII - Fe XII - Fe X



Polar plume campaign Oct-Nov 2007

V. Andretta, L.Teriaca, G. Poletto, Y-K, Ko

Objectives:

- 1) **On-disc**: relate changes of the photospheric magnetic fields to corona study quasi-periodic oscillations at base of plumes with EIS (**Not possible**)
- 2) **Off-limb**: measure T,N, flows, abundances
 - 1) Direct T: **need to combine** forbidden [Fe XII] 1242 A and [Fe XI] 1467 A (SUMER/UVCS) with allowed Fe XI,XII (EIS/CDS), and Mg IX.
 - 2) Ne: CDS, SUMER, EIS
 - 3) Chemical abundances: **need to combine** CDS, SUMER, UVCS with EIS

Hinode HOP 44: Oct 30 -Nov 3 2007 SOHO/CDS,SUMER, UVCS, TRACE, STEREO

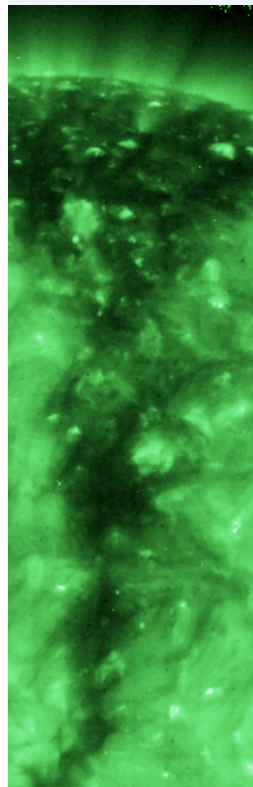
'Unfortunately', our campaign was mistaken for the SUMER campaign

Off-limb

Hinode/EIS: GDZ_PLUME1_2_300_50s 50s exp. , 2" slit step size 4"
FOV=298"x512" in 1h 8m; 23 spectral windows.
Run 4 times on 31/10, 1/11 and 34 times on 2-3/11 during SUMER campaign.

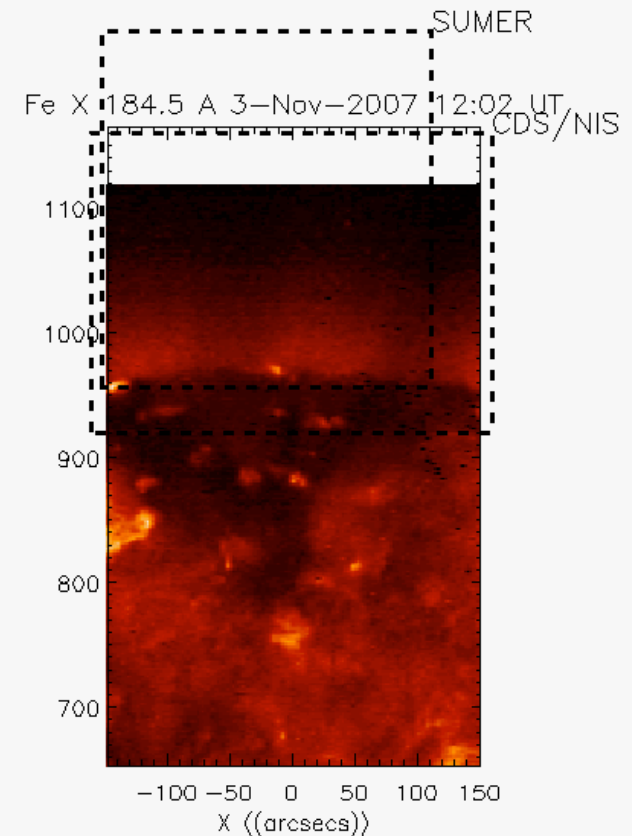
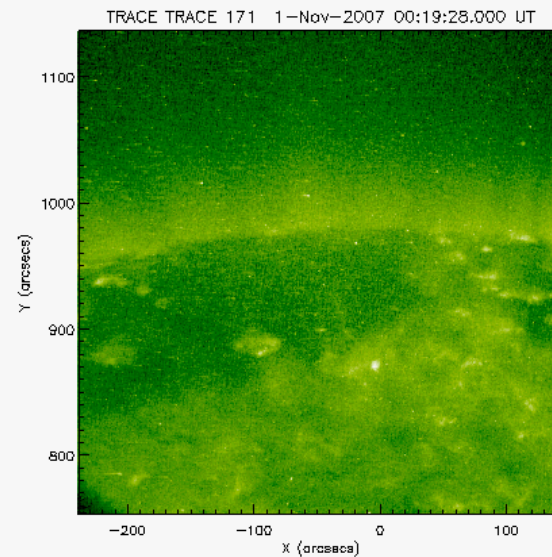
**The Sun did not cooperate.
Where were the plumes?**

SOHO/UVCS: Lya, O VI
from 1.7 to 5.5 R_o



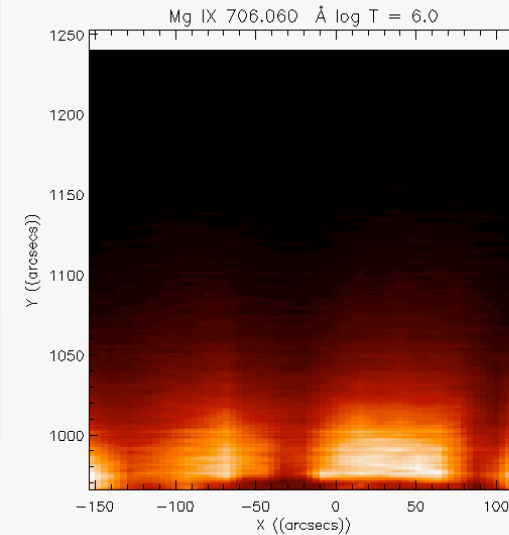
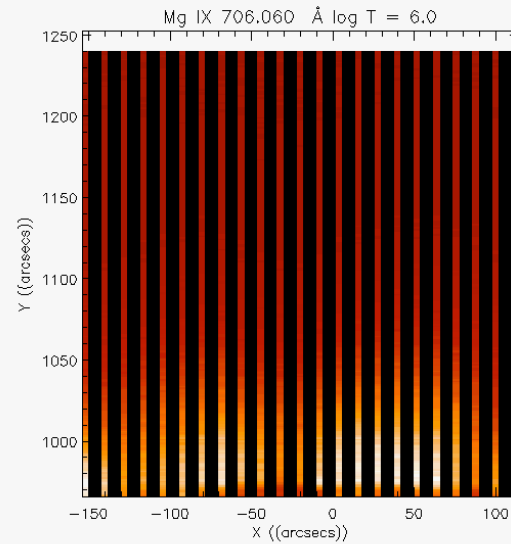
SOHO/EIT
Aug 96
(Del Zanna
et al. 1999)

TRACE: 171 A

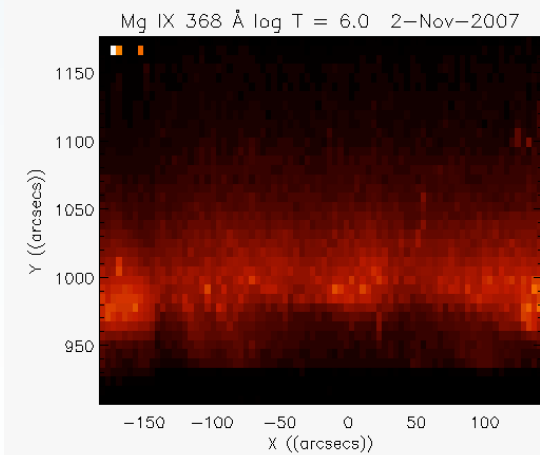
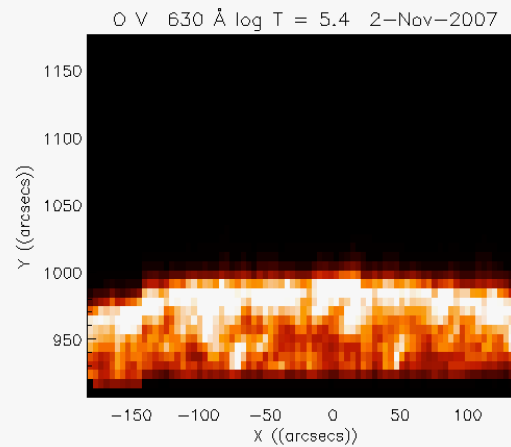


SUMER and CDS radiances

SOHO/SUMER:
large (280"x300")
raster in 30h
4" slit step 12.5"



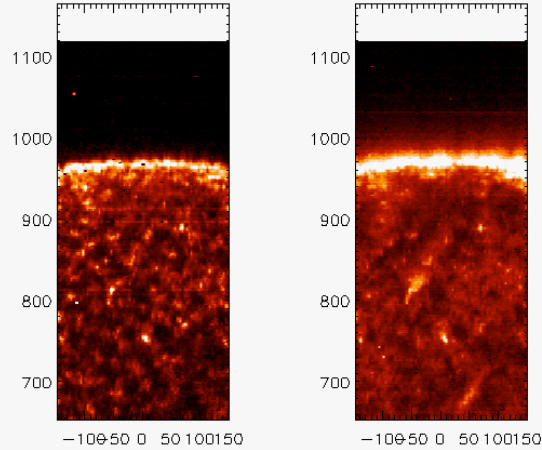
SOHO/CDS 4h
4" slit 120s exp.
O V, Mg IX



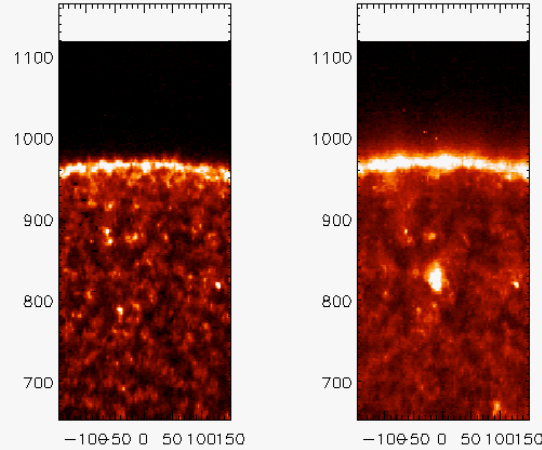
Composite of 9 NIS slit rasters

EIS radiances 2-3 Nov 2007

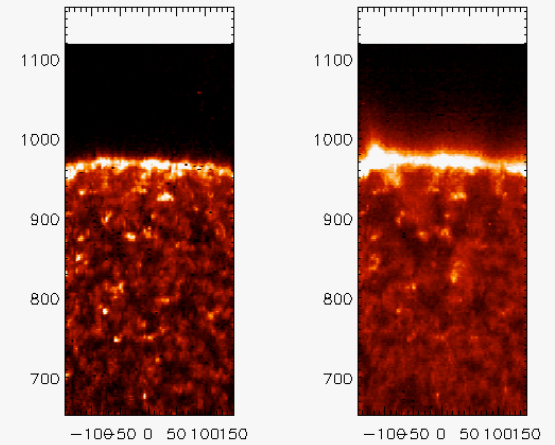
O V 2-Nov-2007 13:53 UFe VIII 2-Nov-2007 13:53



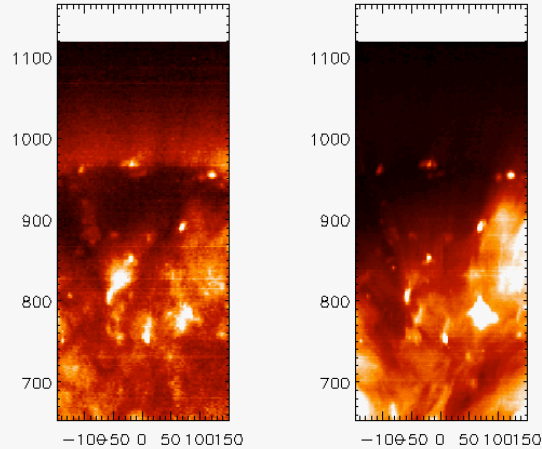
O V 3-Nov-2007 00:09 UFe VIII 3-Nov-2007 00:09



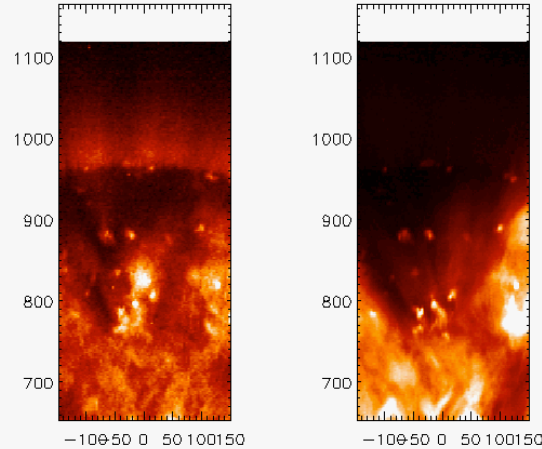
O V 3-Nov-2007 12:01 UFe VIII 3-Nov-2007 12:01



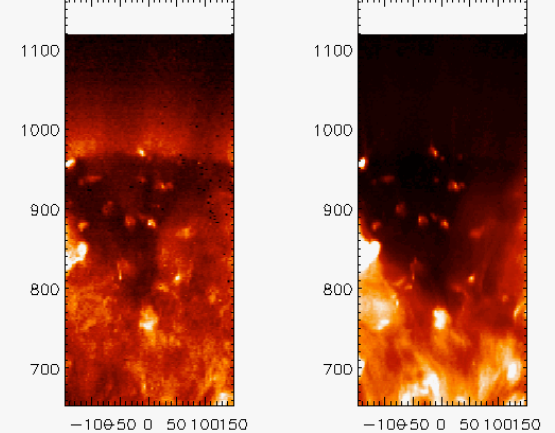
Fe X 2-Nov-2007 13:53 UFe XII 2-Nov-2007 13:53



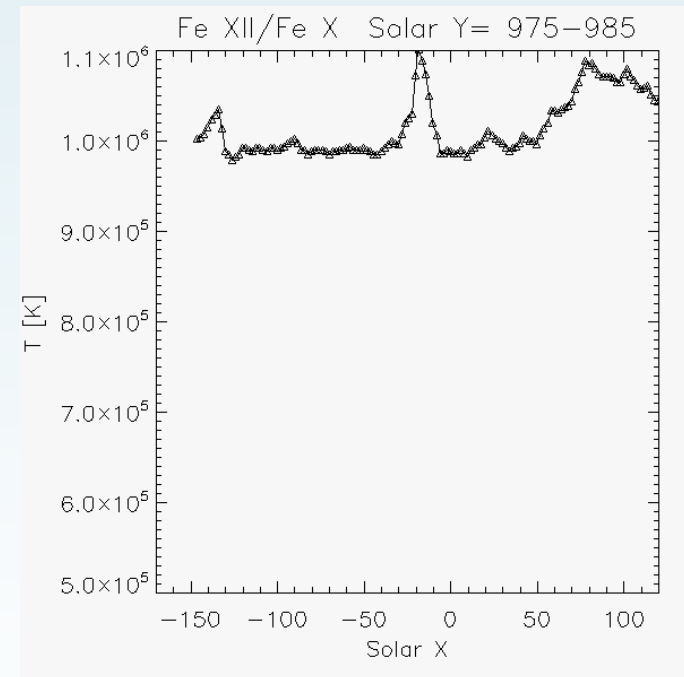
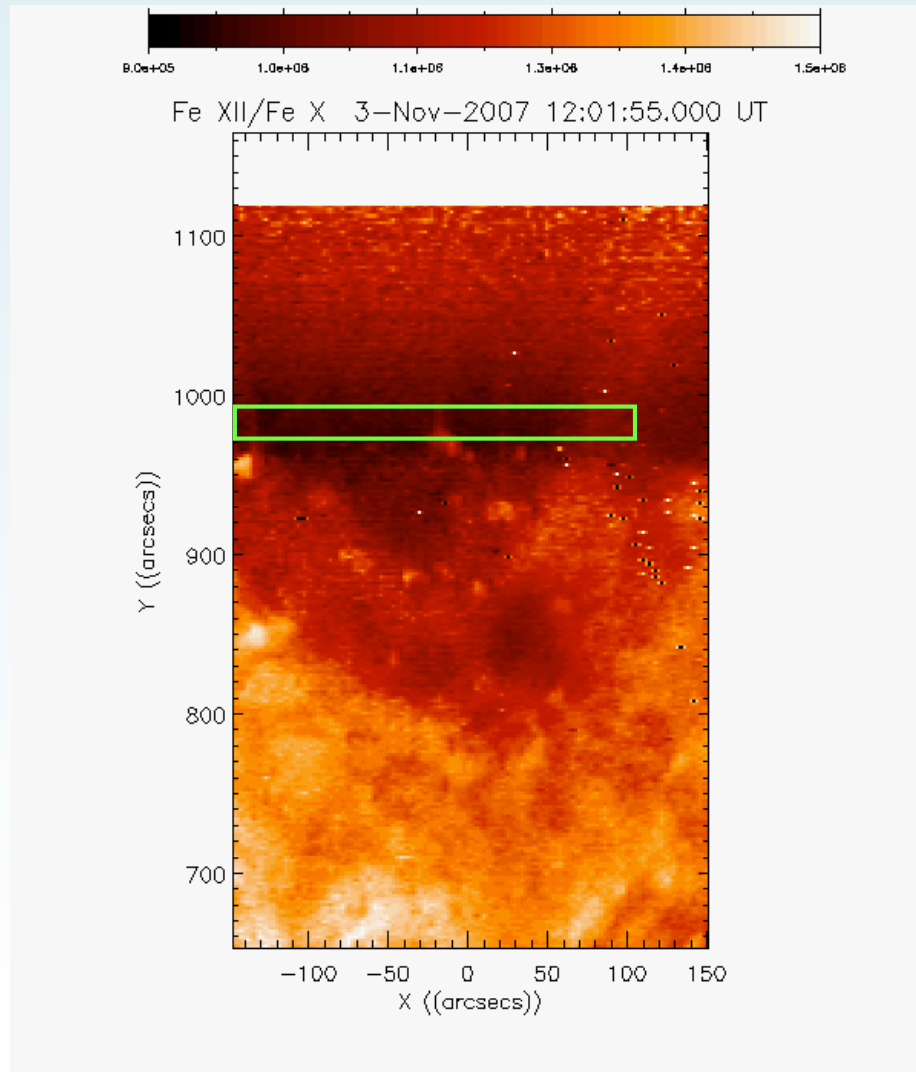
Fe X 3-Nov-2007 00:09 UFe XII 3-Nov-2007 00:09



Fe X 3-Nov-2007 12:01 UFe XII 3-Nov-2007 12:01



Isothermal T from EIS Fe XII/Fe X



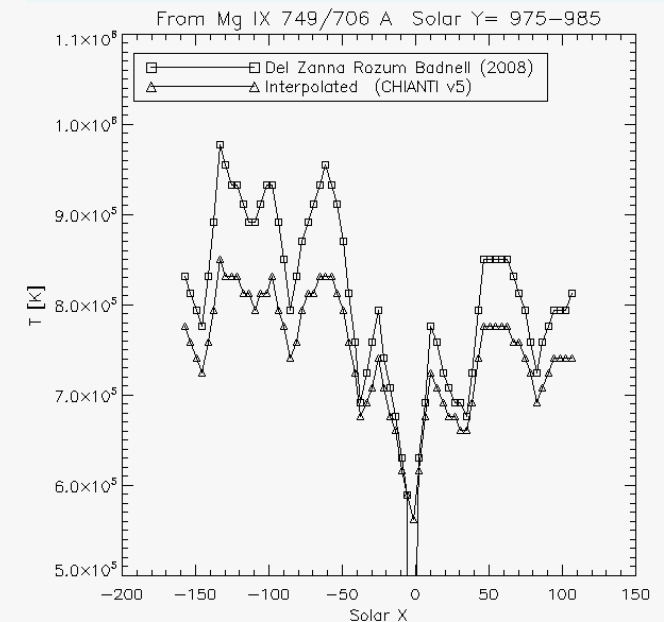
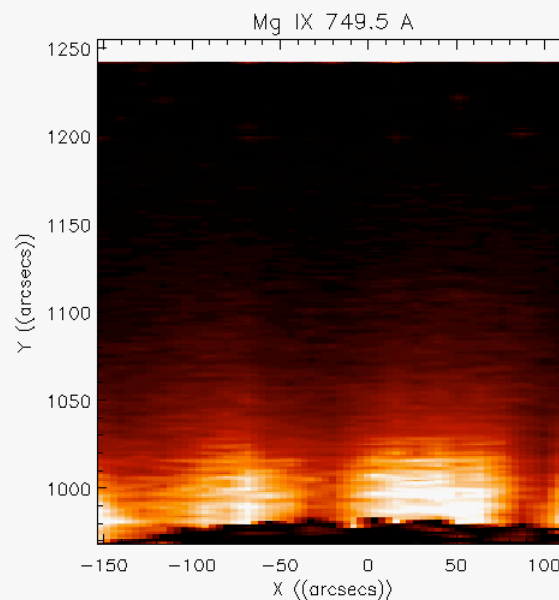
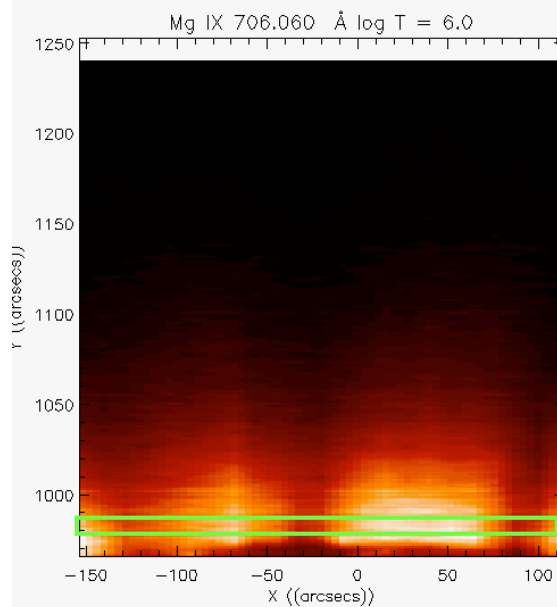
Direct measurement of T from Mg IX

First R-matrix calculation for Be-like Mg (Del Zanna Rozum Badnell 2008).

Significant differences with the previous interpolated values (Keenan et al 1986).

An inter-plume measurement at 1.3 Ro of **850 000** K by Wilhelm et al. (1998)

revised to **1 160 000** K.



END

- Despite the various limitations (e.g. telemetry), there is a potential for very good science in combining Hinode observations with those from other satellites.
- Hinode EIS off-limb observations are promising, in particular for QS,AR

Thank you