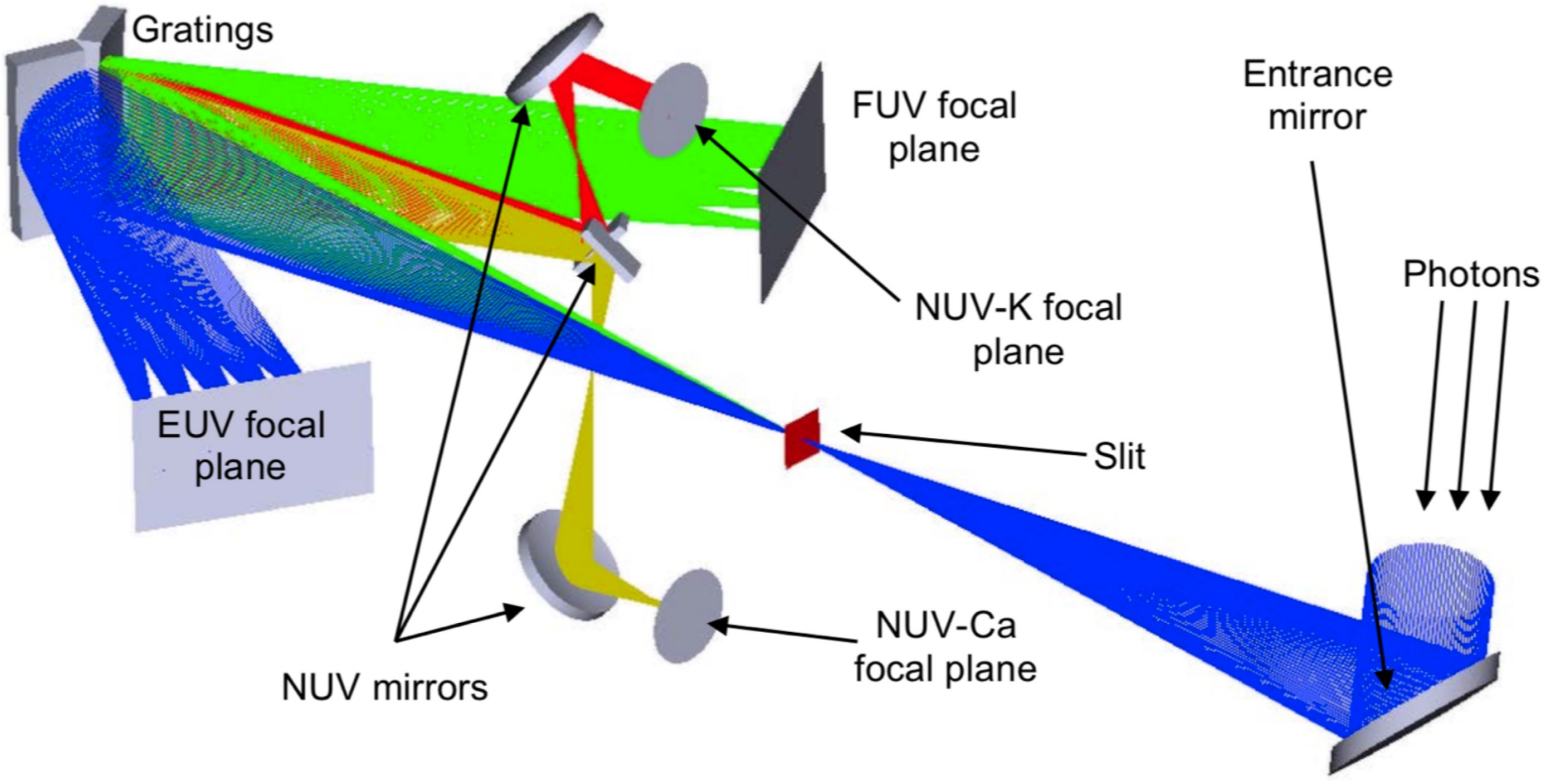
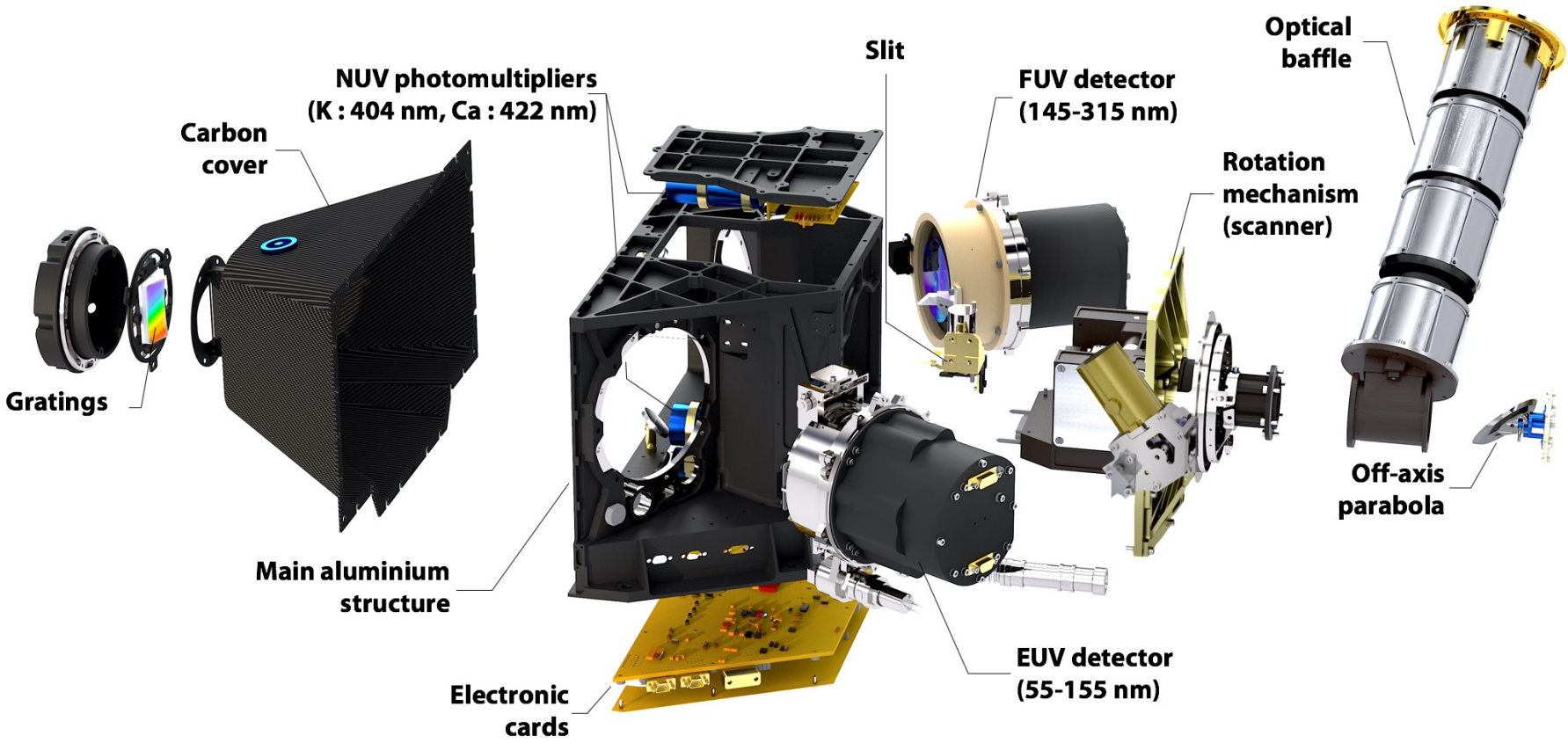
# UV detector calibration

Eric Quémerais

# Optical scheme



# Instrumental concept



# Performance based on ground measurements

| EUV | | FUV | | NUV | |
|---|---|---|---|---|---|
| Wavelength | Brightness | Wavelength | Brightness | Wavelength | Brightness |
| **H 121.6 nm** | 10 – 300 R | *C 156.1 nm* | 0.1 - 6R | K 404 nm | < 2R |
| H 102.5 nm | 0.03 – 1 R | *C 165.7 nm* | 0.4 – 28 R | **Mn 403 nm** | 50 – 100 R |
| H 97.2 nm | 0.003 – 0.1R | *S 180.7 nm* | 0.05 R | **Ca 422 nm** | 100 – 1000R |
| **He 58.4 nm** | 10 – 100R | Al 220.9 nm | 0.5 – 1.2 R | | |
| *O 130.4 nm* | < 2R | Fe 248.4 nm | 10-50 R | | |
| | | Fe 252.9 nm | 8-30 R | | |
| | | Si 251.9 nm | 0.1 – 6R | | |
| | | Na 268.1 nm | 0.5 – 8R | | |
| | | Mn 279.9 nm | 10 – 30 R | | |
| | | **Mg 285.2 nm** | 200 – 5000R | | |
| | | Al 309.3 nm | 2 – 4 R | | |

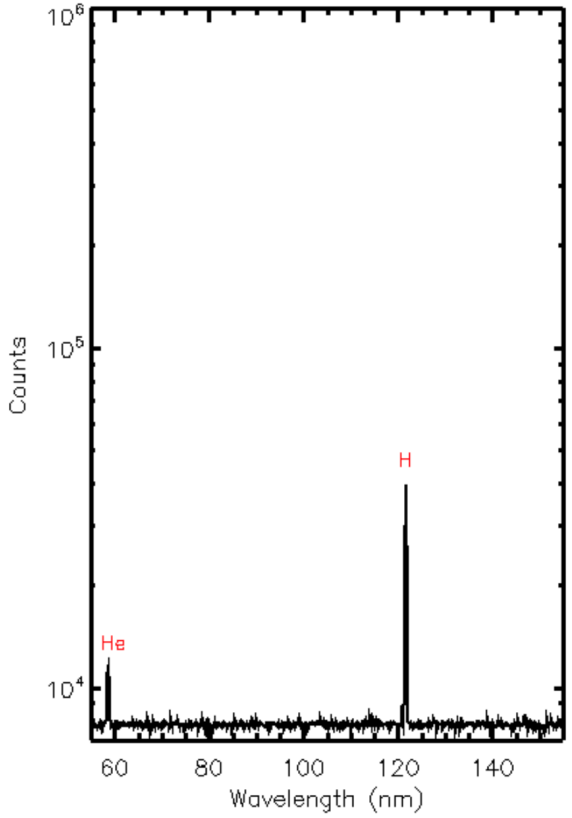
From Chassefière et al. (2009)

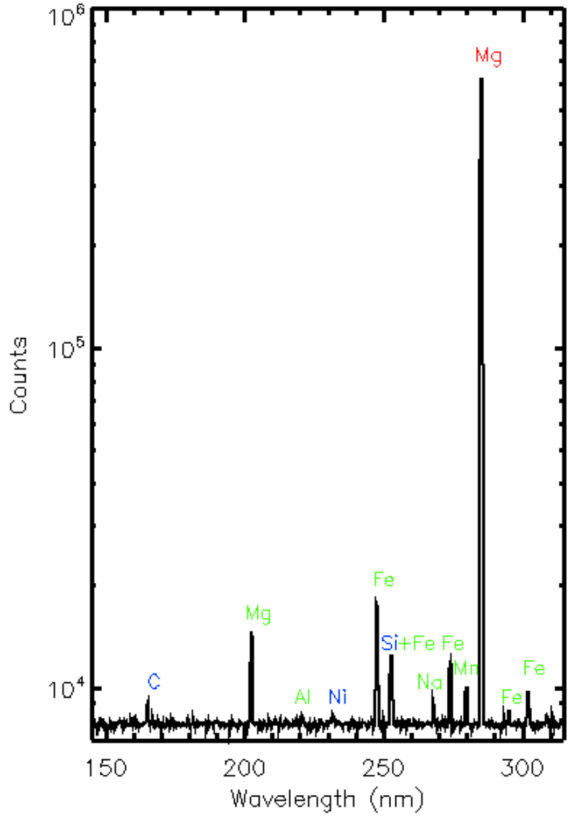
# Model - Ti = 10 000 sec (10 orbits cumulated)

**Previously Observed**
**He (EUV), H (EUV), Mg (EUV)**
**Ca (NUV)**

**Previously Observed but at other wavelengths**
**Mg, Fe, Na, Al, Mn**
**Mn (NUV)**

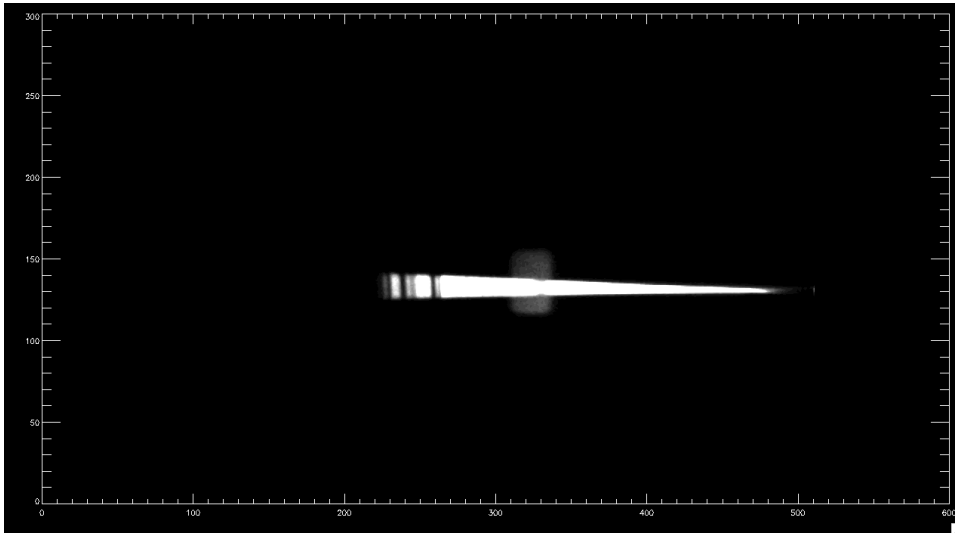
**Not previously Observed**
**C, Ni, Si**

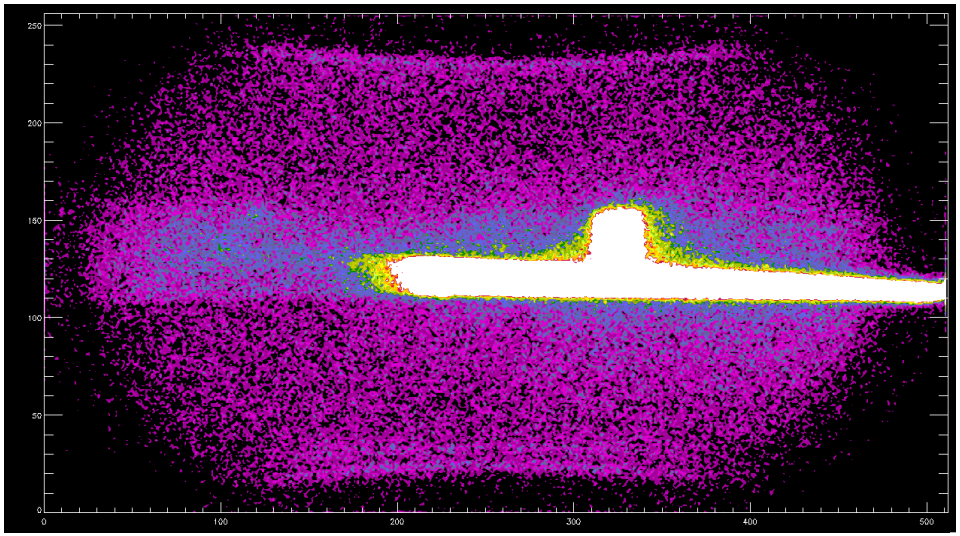


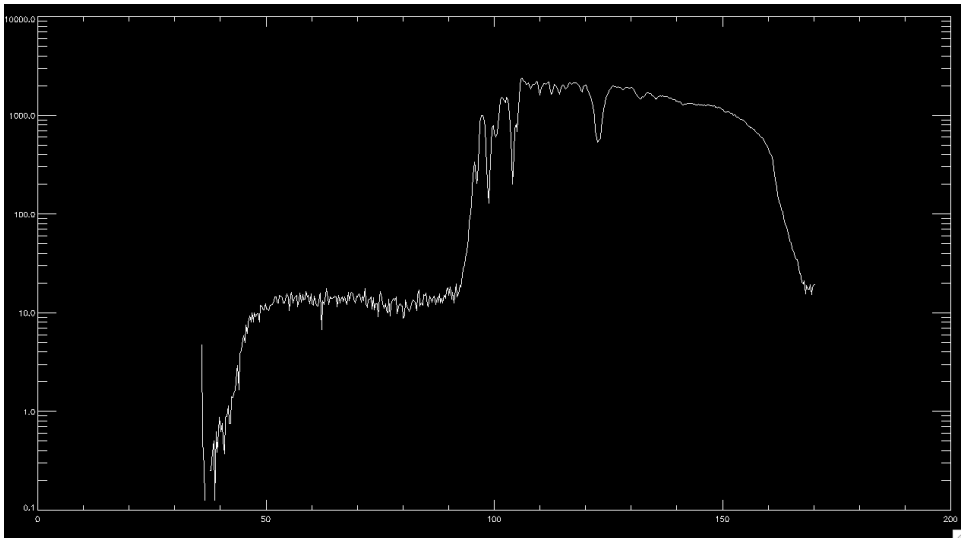



# EUV calibration

# Beta centauri 26-11-2020







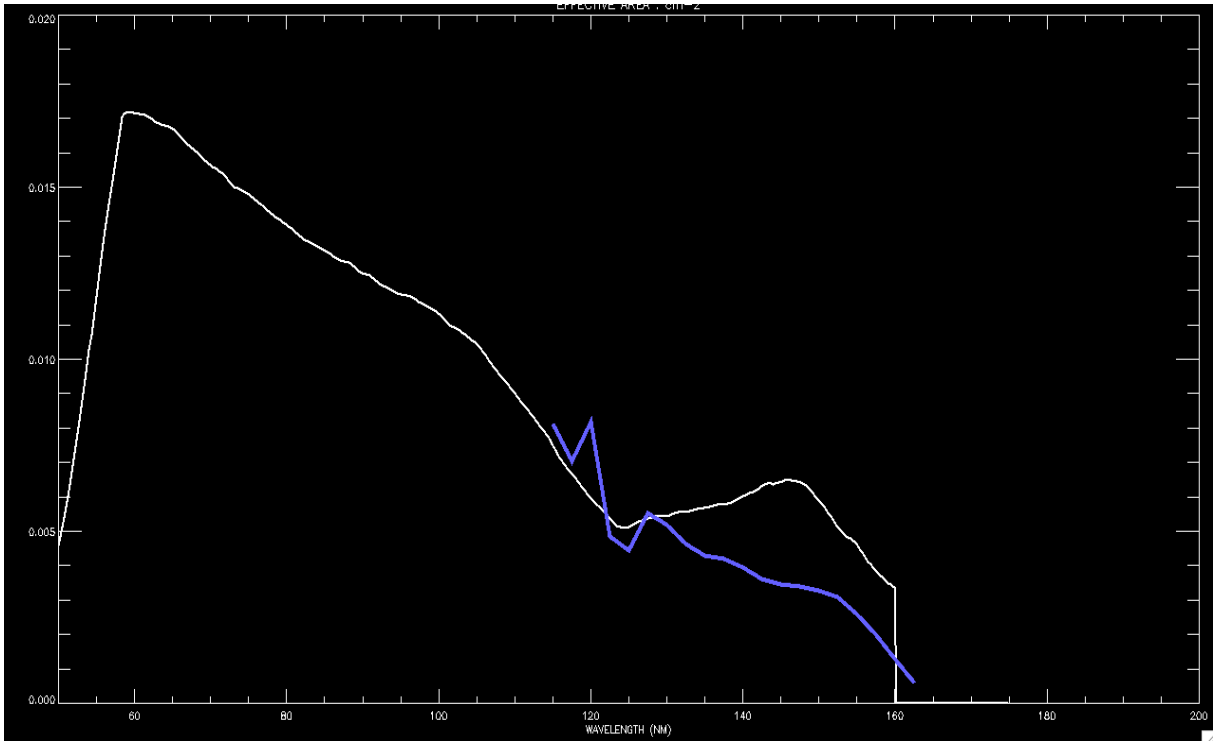
# Beta centauri 26-11-2020

- $\mathbf{C}(px) = I(\lambda) \,.\, S_{eff}(\lambda, HV) \,.\, d\lambda$

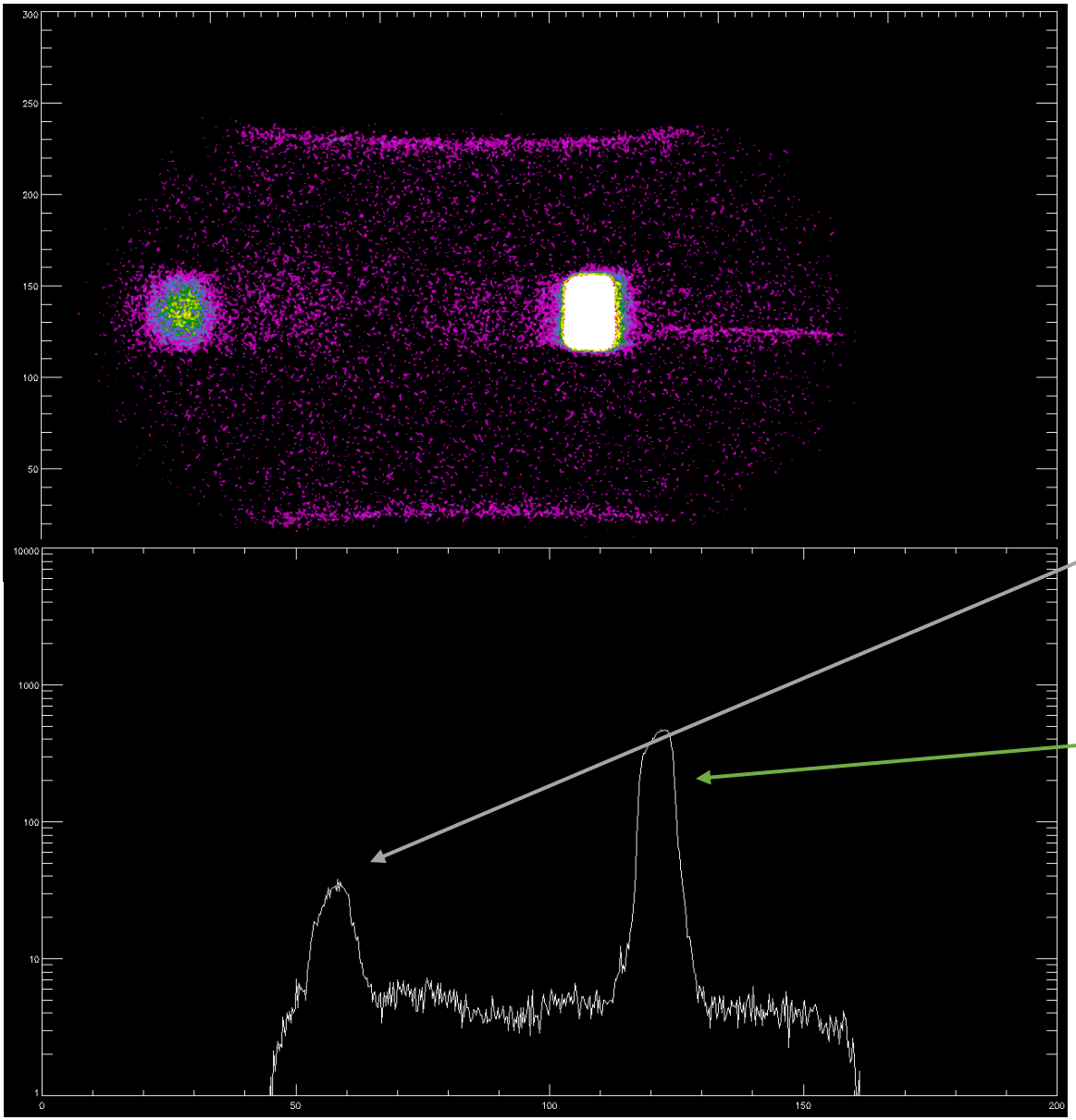
$\mathrm{C}(px) = coups \,/\, \mathrm{sec}/\, pixel$

$S_{eff}\ (\lambda, HV)$ = effective area

$d\lambda$ = in nm



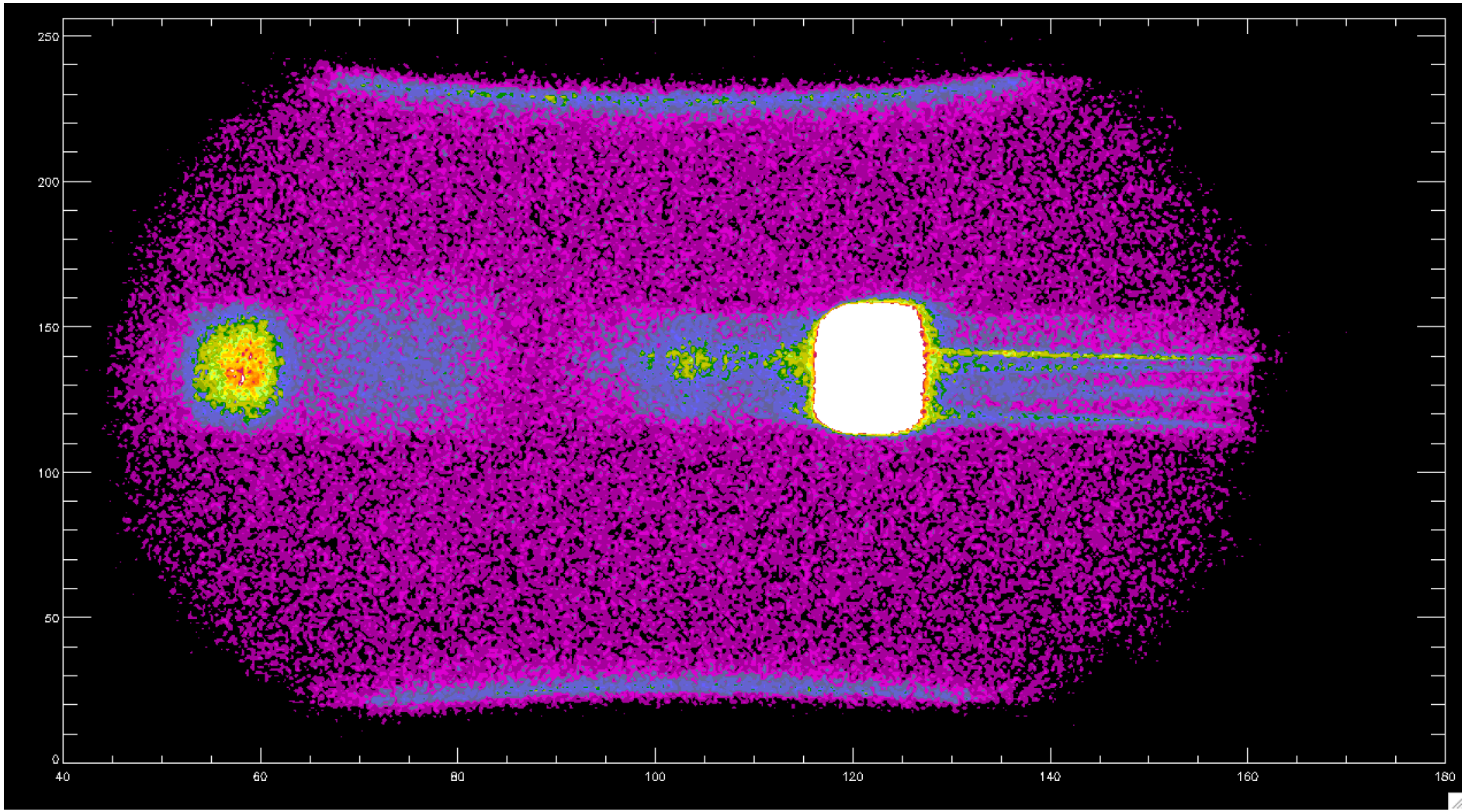
# Beta centauri 26-11-2020



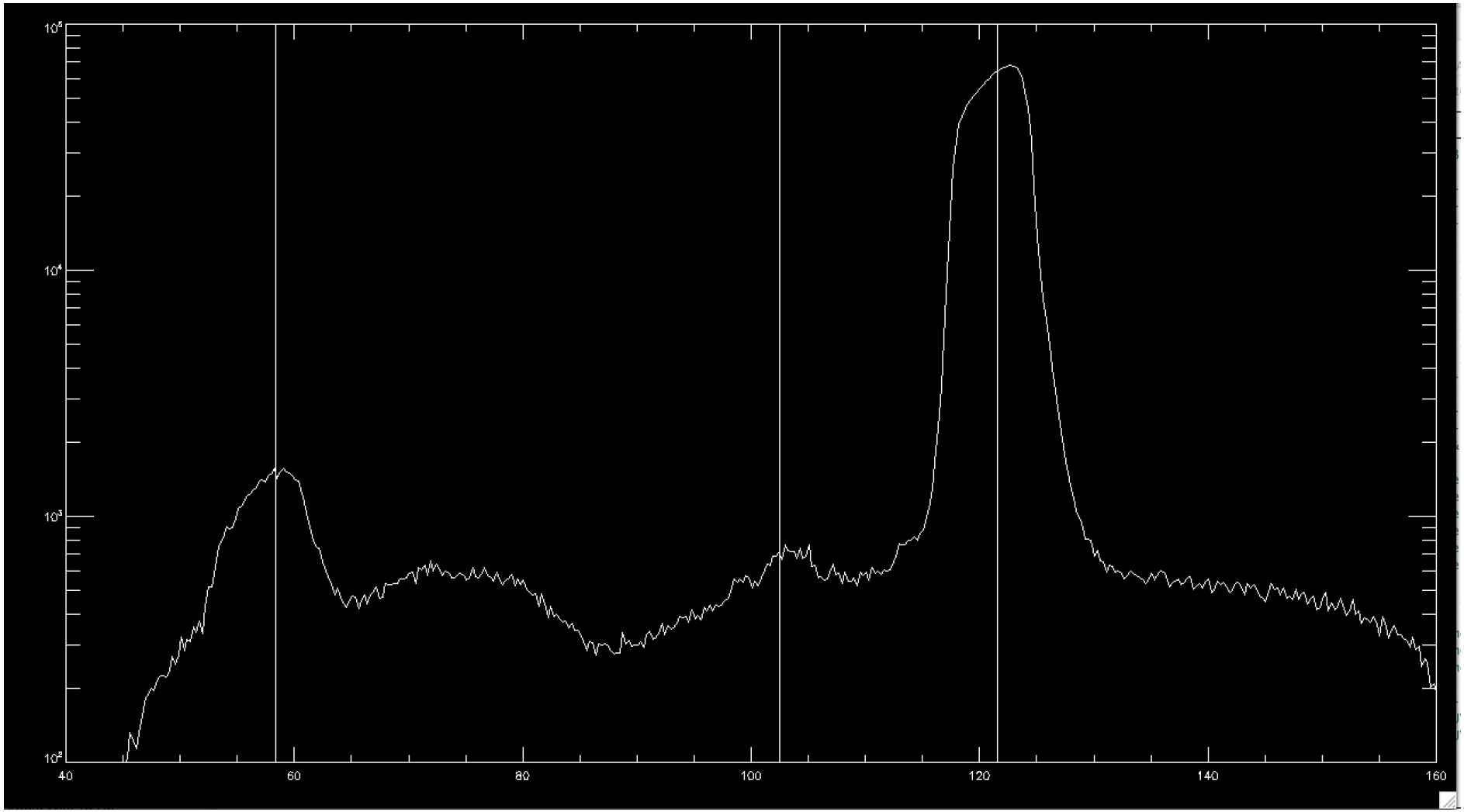

Interplanetary Background @ 58.4 nm (50 R)

Interplanetary Background @ 121.6 nm (<300 R)

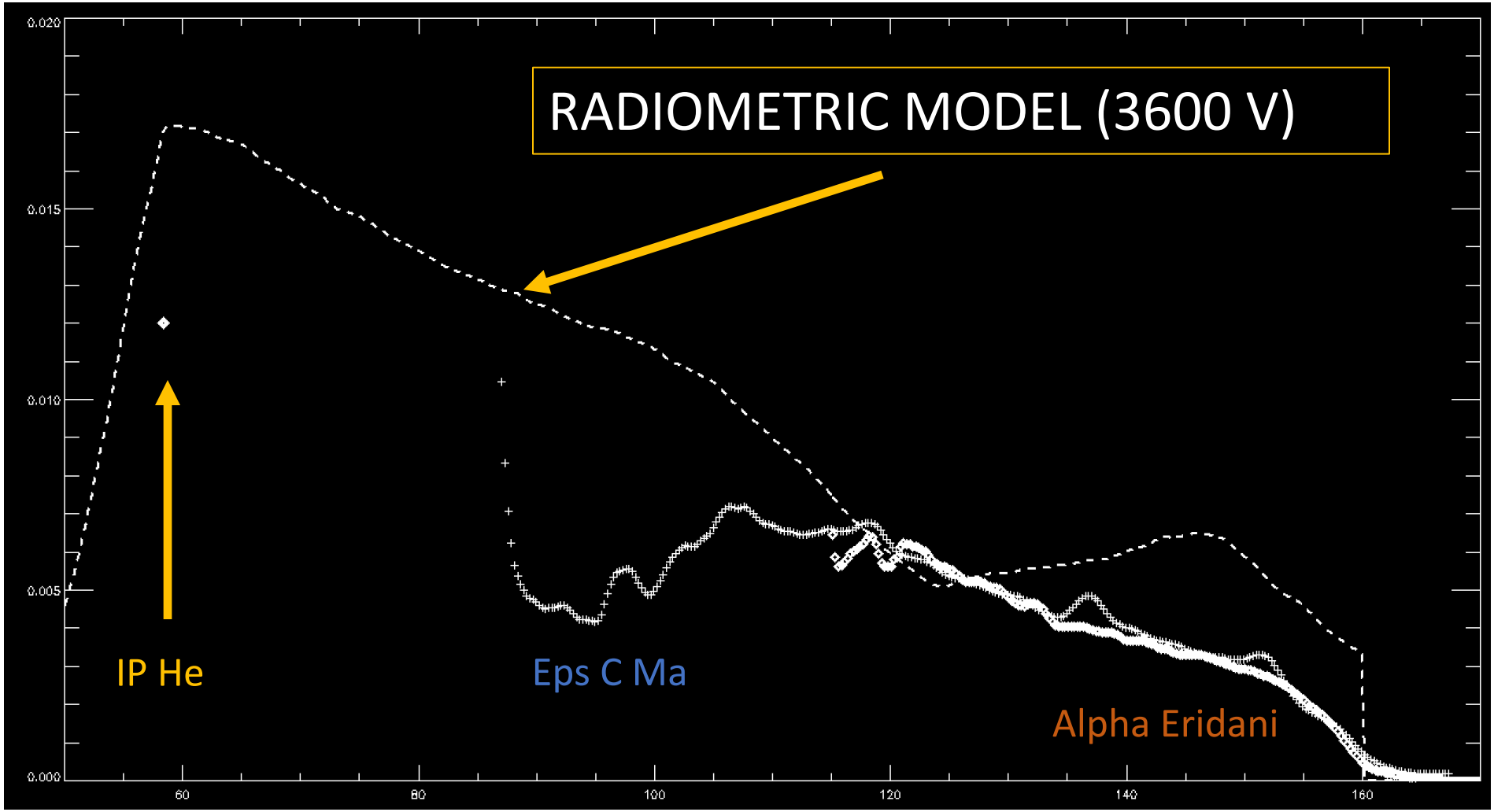
# Cumulation of all IP observations



# Cumulation of all IP observations



# EUV calibration @ 3400 V



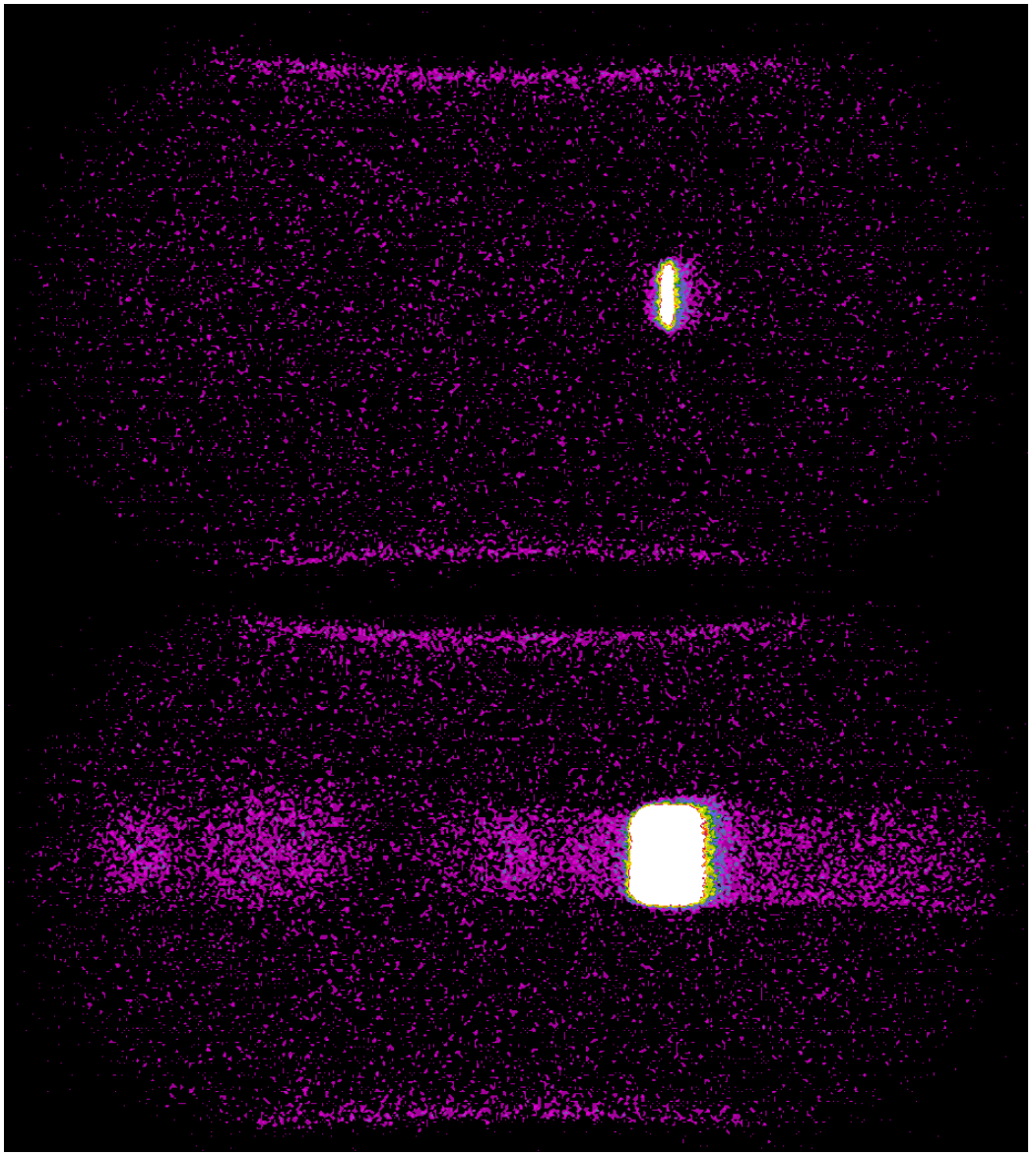
# Spectral Resolution

FWHM @121.56 nm
~ 1 nm
(4 binned pixels)

NO SLIT / SLIT CR ratio ~ 22

No Slit FWHM ~ 10 nm

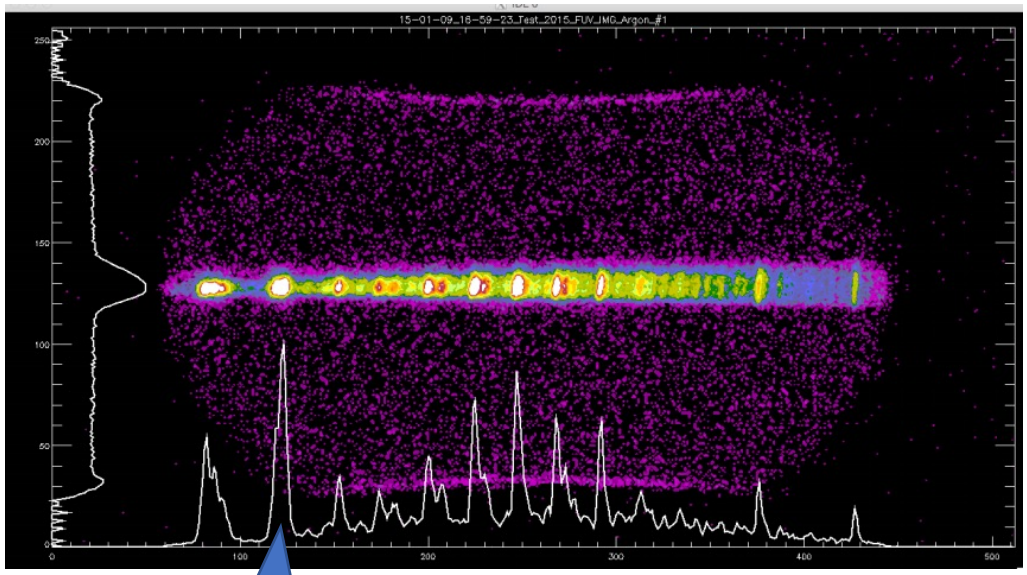
Slit FWHM ~ 2 nm



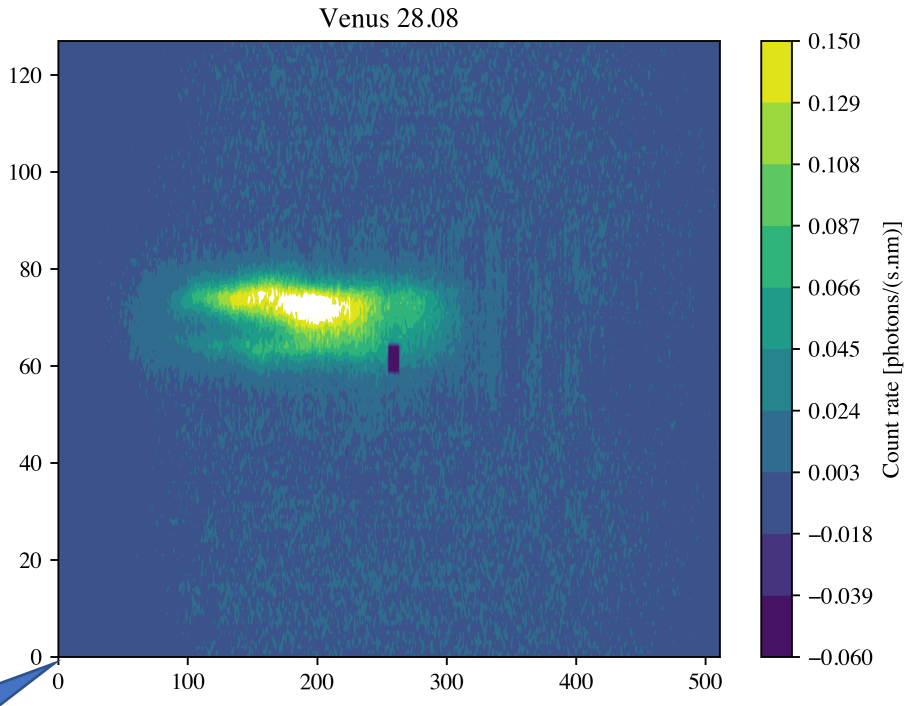
# FUV calibration

# FUV status

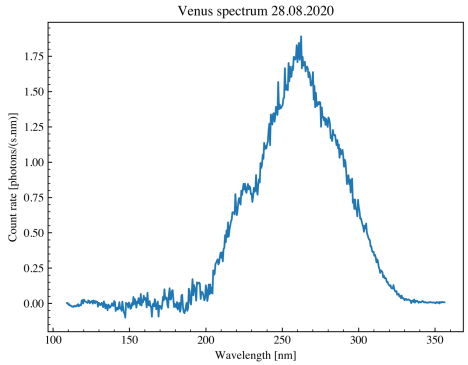
- **Ground measurement (left) and in-flight (right)**

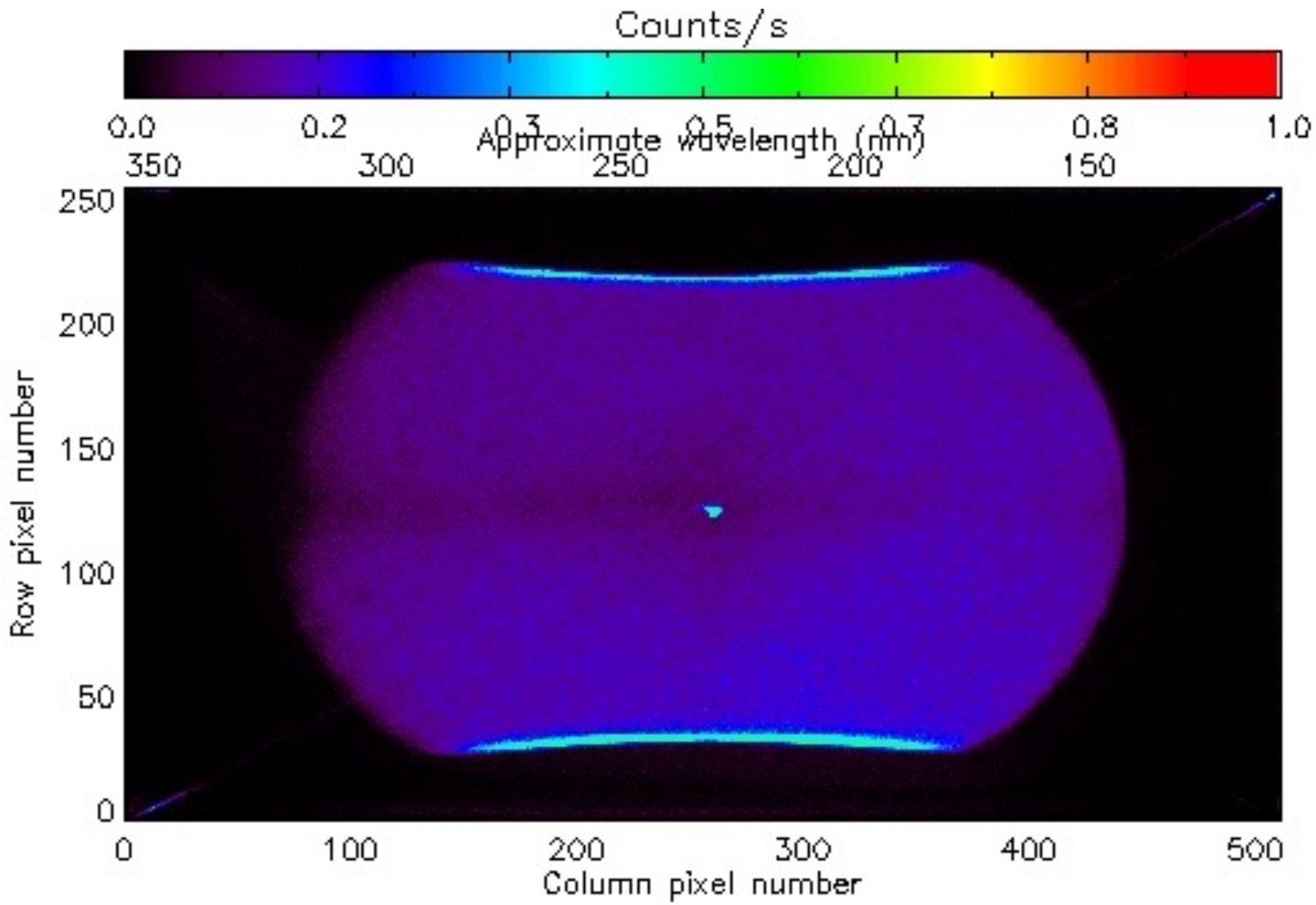



Argon spectrum
(2015, ground calibration)
Res : 1,6-1,7 nm (FWHM)

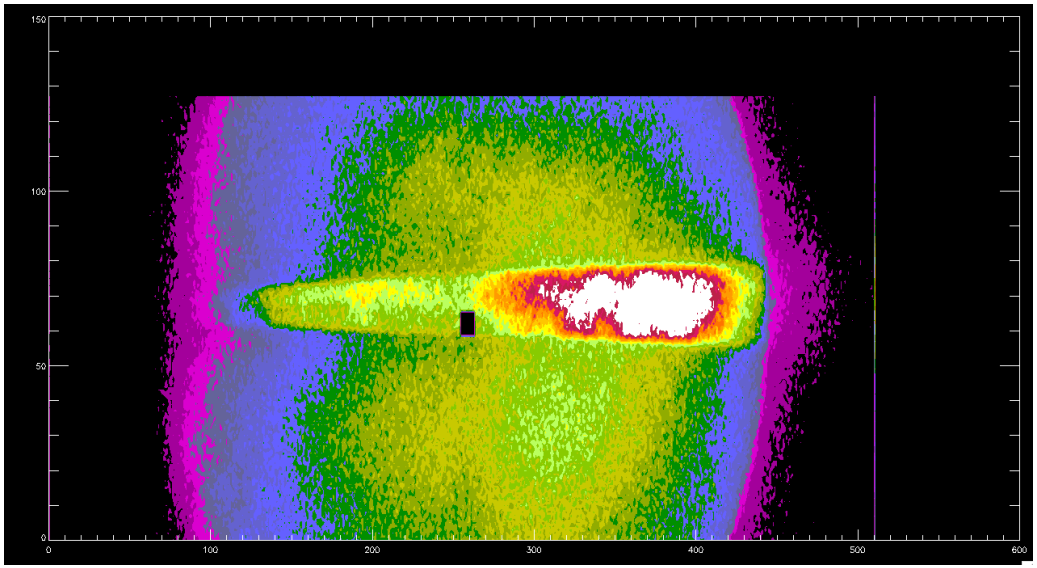



Venus (28/08/2020),
Res. : ~30 nm @ 4550V
TBC




Counts/s
0.0
0.2
0.3
0.5
0.7
0.8
1.0
Approximate wavelength (nm)
350
300
250
200
150
Row pixel number
250
200
150
100
50
0
0
100
200
300
400
500
Column pixel number

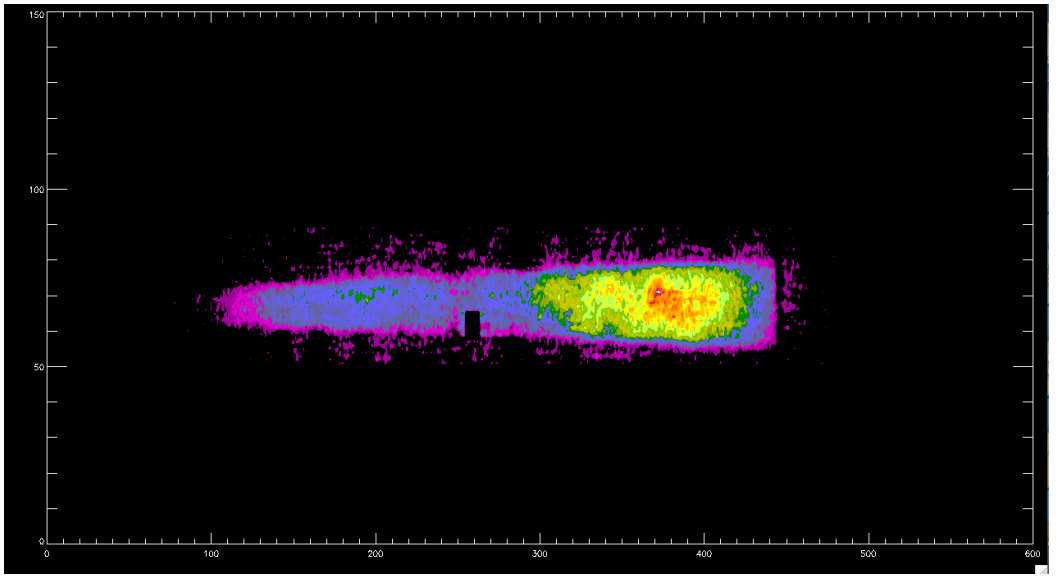
# FUV calibration



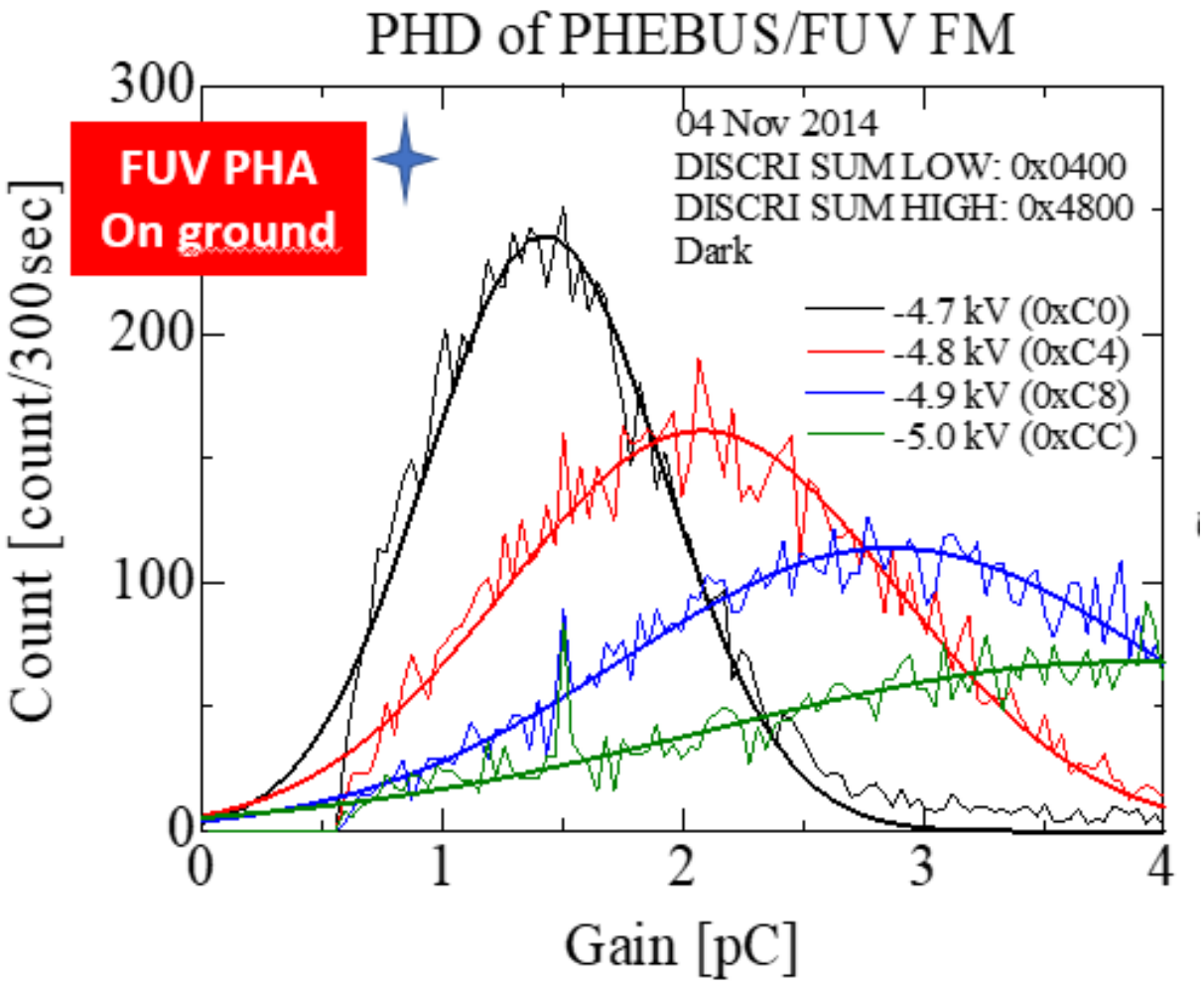

Star observed with FUV:
Alpha Eridani – 14-2-2021

Before correction of the « dark »

After correction



# Using the discriminator

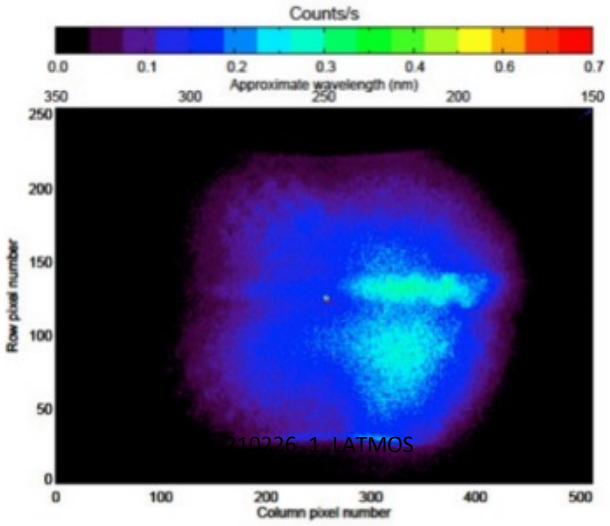


# FUV : Discri/HV (2/2)

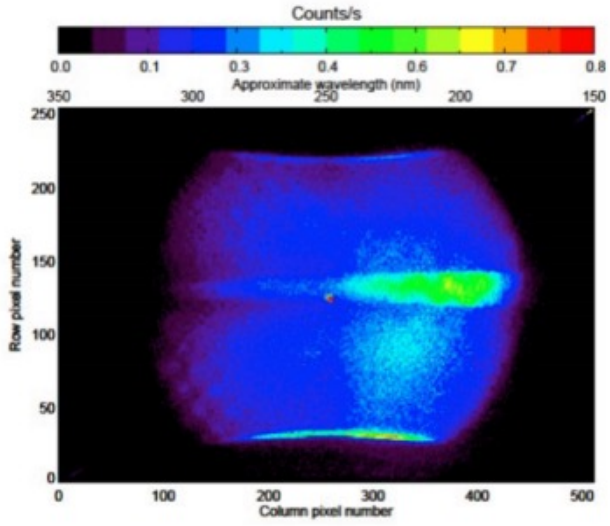
PHEB_TN_OPS_210226_1_LATMOS >>>

- **Observations of Alpha Eridani (02-2021) :**
- **Best SNR obtained for 4.8kV and discri = 14.**

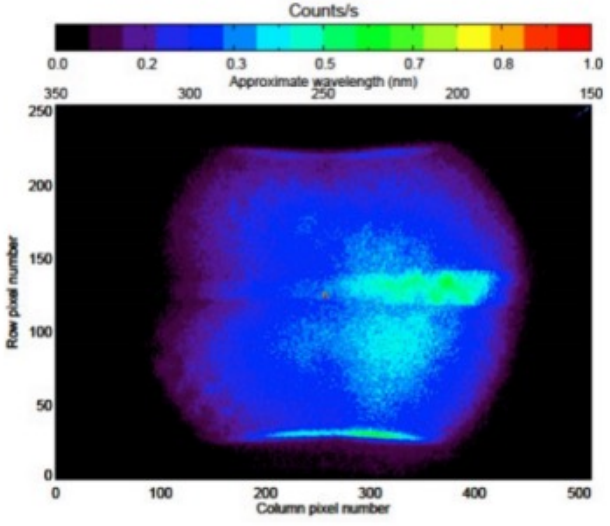
**Observation at 4550V, discri 8**



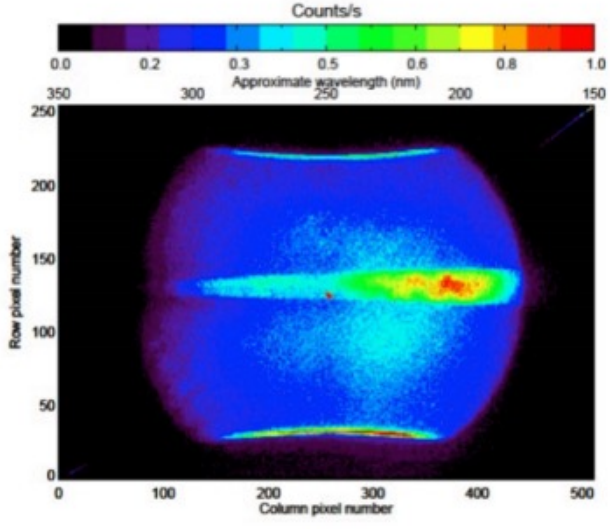

**Observation at 4700 V, discri = 12**




**Observation at 4600 V, discri = 8**

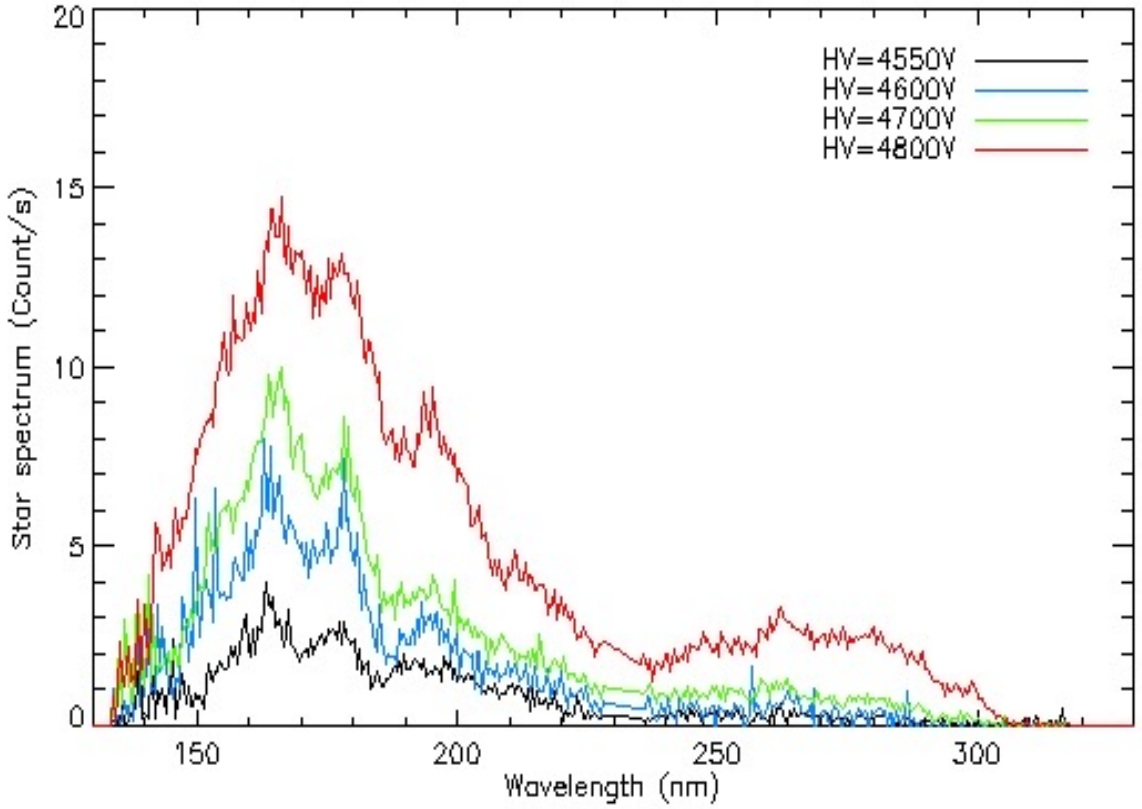



**Observation at 4800V, discri = 14**



# Performances FUV

## Sum over the lines between 110 - 155




$$\lambda(nm) = 356.125 - 0.4835 * pixel$$

Max Count Rate = 32000

HV = 4600 V & Discri = 8

HV = 4700 V & Discri = 12

HV = 4800 V & Discri = 14

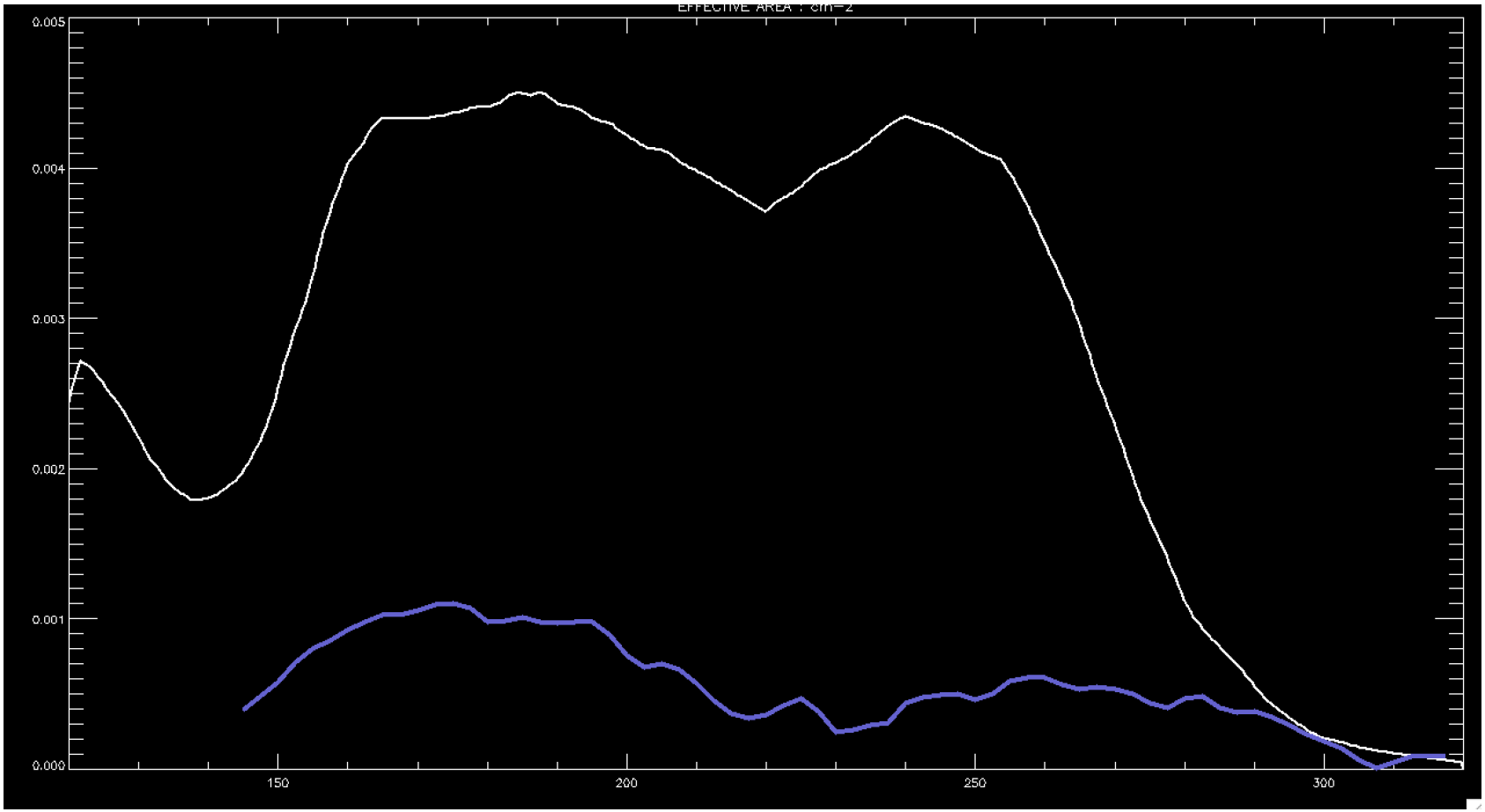
Useful CR:

HV 4800 / 4700 = 1.5

HV 4700 / 4600= 1.4

# FUV calibration

HV 4800 (discri 14) = 20% nominal  (comparaison avec les mesures au sol).



# Conclusion

- **EUV performance (50-155 nm)**
  - At 3400 V (instead of 3600 V), performance is nominal
  - Flashes/discharges do not seem to decrease the performance
  - EUV resolution ~ 1 nm
- **FUV performance is not nominal**
  - CR is limited to approximately an order of magnitude below values measured on the ground.
    - HV = 4800 V (D 14) -> 20 %
    - HV = 4700 V (D 12) -> 15 %
    - HV = 4600 V (D 8) -> 10 %
  - Dark background is variable (and temperature dependent)
    - Correction is not straightforward
- **FUV resolution = 30 nm !**