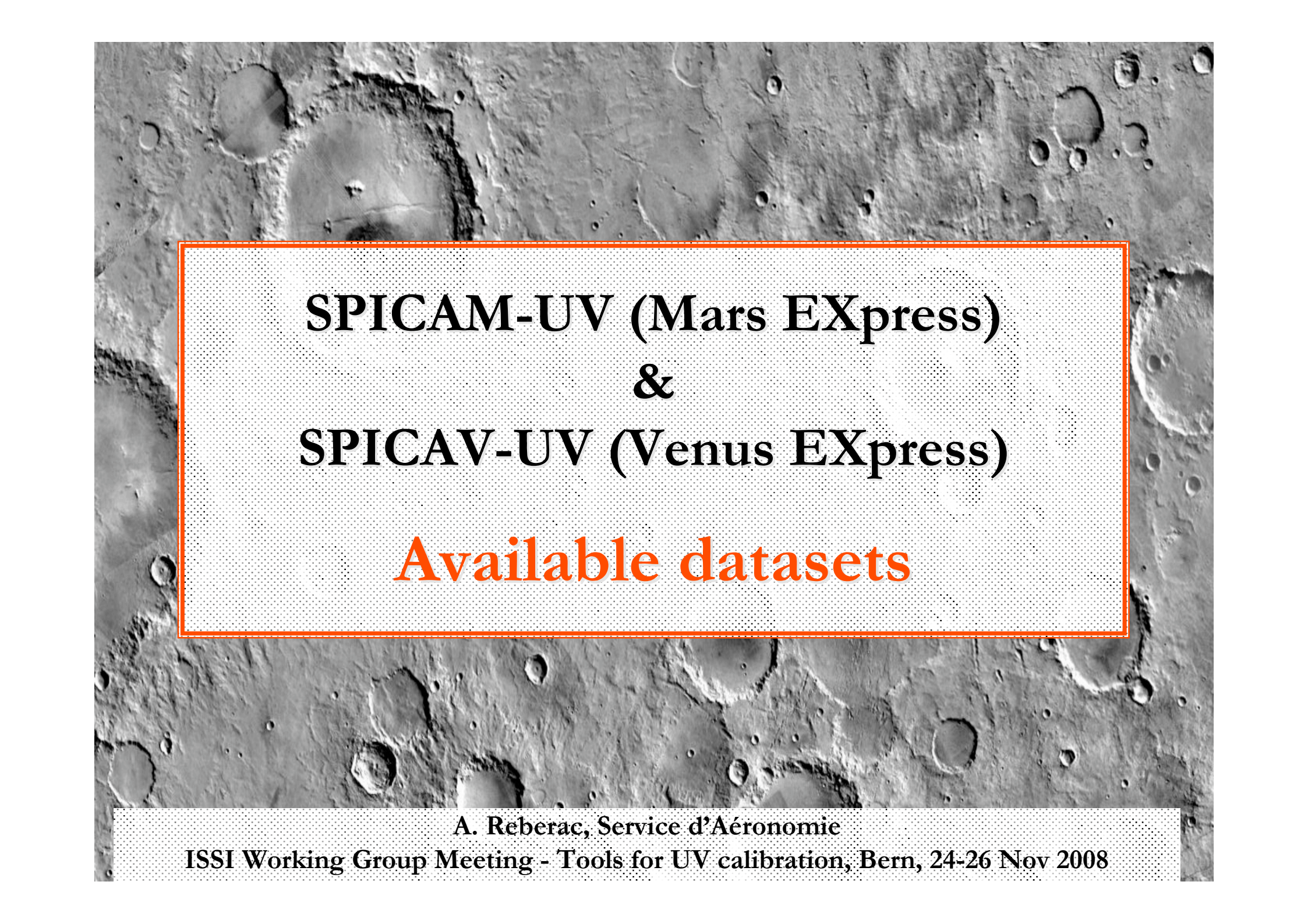


The background of the slide is a grayscale image of the Martian surface, showing numerous impact craters of various sizes and some darker, possibly mineral-rich regions. The terrain is rugged and heavily cratered.

SPICAM-UV (Mars EXpress) & SPICAV-UV (Venus EXpress)

Available datasets

A. Reberac, Service d'Aéronomie

ISSI Working Group Meeting - Tools for UV calibration, Bern, 24-26 Nov 2008

SPICAM-UV (Mars EXpress)

Time coverage = **January 2004 → may 2009** + extension ?

Target = list of **39 stars** (bright UV, flux > 800 at 164 nm)

Available datasets (@SA) = ~1400 obs. → mid-11/2008)

SPICAV-UV (Venus EXpress)

Time coverage = **April 2006 → may 2009** + extension ?

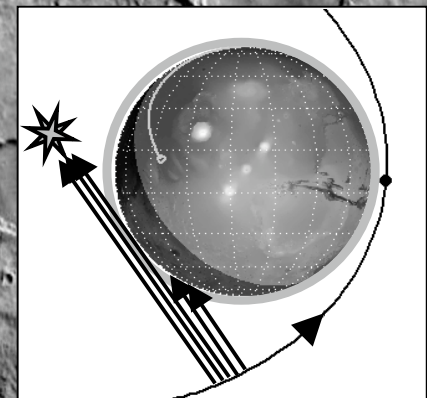
Target = list of **222 stars** (bright UV, flux > 60 at 164 nm)

Available datasets (@SA) = ~300 obs. → mid-09/2008)

Stars observed in the **stellar occultation** mode

↳ stellar reference spectrum

= mean of ~300 spectra above 200 km altitude
(outside atmosphere)



**SPICAM-UV (Mars EXpress)
&
SPICAV-UV (Venus EXpress)**

Calibration on Stars

A. Reberac, Service d'Aéronomie
ISSI Working Group Meeting - Tools for UV calibration, Bern, 24-26 Nov 2008

Introduction

SpecSPICAM = *n* ADU
units

$$SpecSPICAM (photons / cm^2 s.nm) = \frac{SpecSPICAM (nADU)}{\Delta\lambda * Ti * (g * Seff)}$$

$\Delta\lambda$	Spectral resolution (0.54 nm)
Ti	Exposure time (s)
Seff	Efficient area (cm ²)
g	gain (nADU/ph) = f(HV)

Seff ?

$$Seff = \frac{SpecrefStar_SPICAM}{SpecrefStar_fromOtherSource} * \frac{1}{g} * \frac{1}{\Delta\lambda * Ti}$$

Ratio $\frac{SpecrefStar_SPICAM}{SpecrefStar_fromOtherSource}$ $\Rightarrow$ need wavelength calibration

$\frac{1}{g}$ $\Rightarrow$ need gain curve = f(HV)

UV Wavelength Assignment

- **Lambda-pixel relation on ground**

given by E. Villard & G. Souchon (30/01/05) :

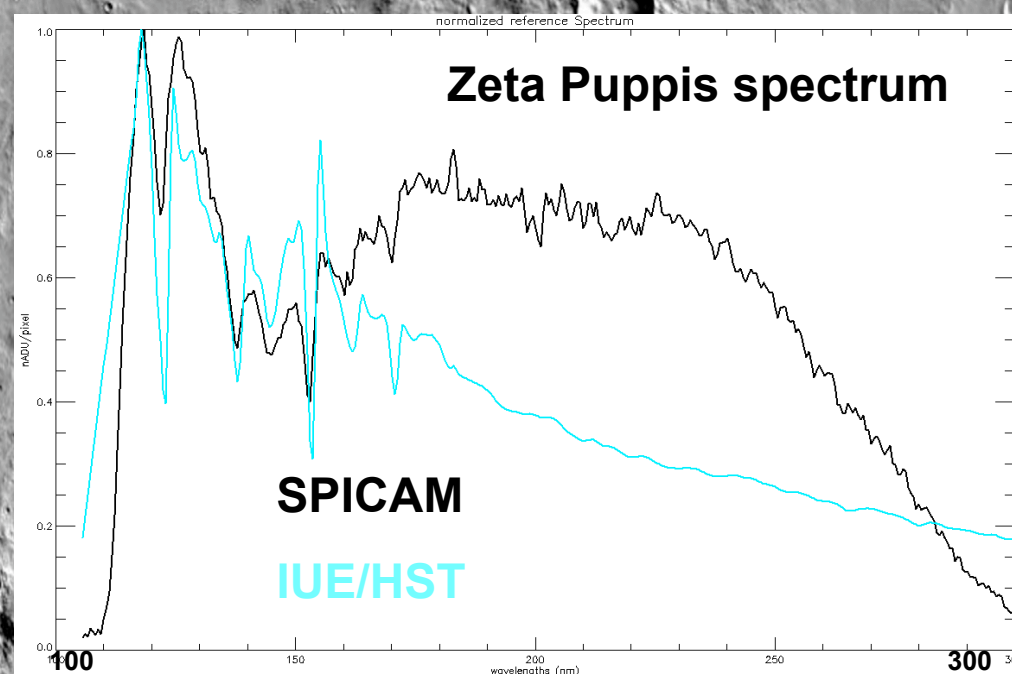
$$\lambda = 317.95 - 0.54011p - 2.6363 \cdot 10^{-5}p^2$$

with p : pixel from 0 to 383 (utils pixels)

- **In flight correction with stars**

Correlation of the Zeta Puppis spectrum measured by SPICAM (black) with the calibrated IUE/HST Zeta Puppis spectrum (cyan).

⇒ **Correction : -1.7 nm**



UV Gain Curve [Nb ADU/photoevents = f(HV)]

Method 1 : Statistical method 1

$$Gp = \frac{\text{var}(S_{ADU})}{(2 * \bar{S}_{ADU})}$$

Sandel & Broadfoot model

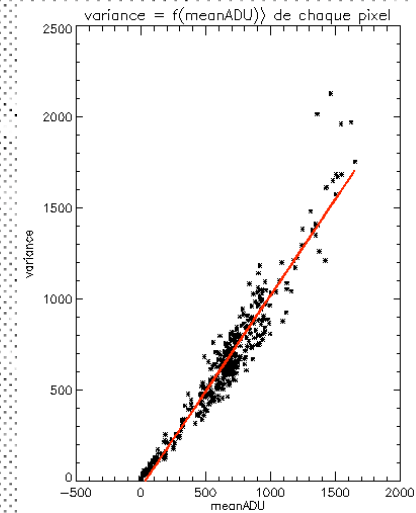
with $\bar{S}_{ADU} = \text{mean}(S_{ADU}(t))$, $S_{ADU}(t) = \sum_{i=1}^{N_{pix}} S_{iADU}(t)$

and $\text{var}(S_{ADU}) = \frac{1}{N} \sum_t (S_{ADU}(t) - \bar{S}_{ADU})^2$

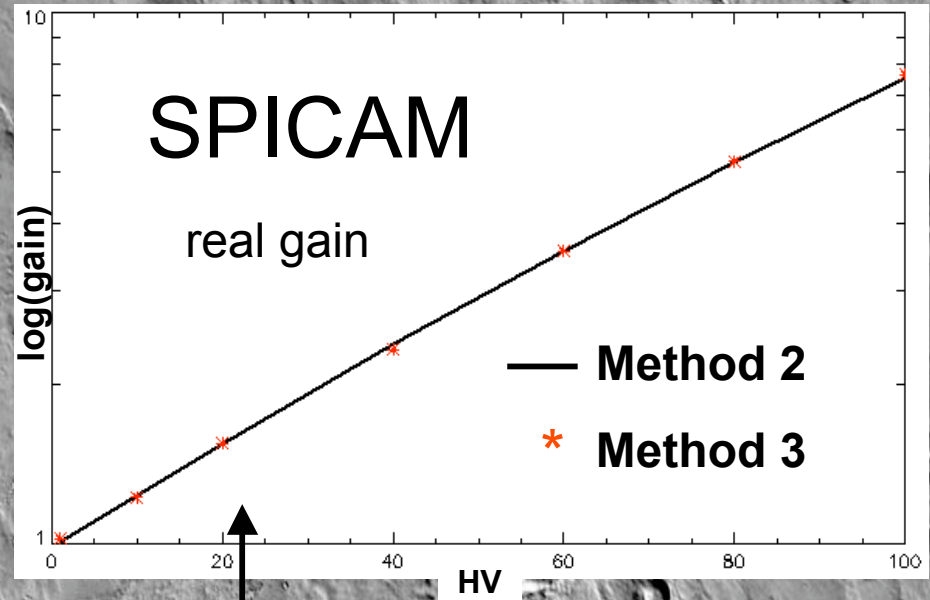
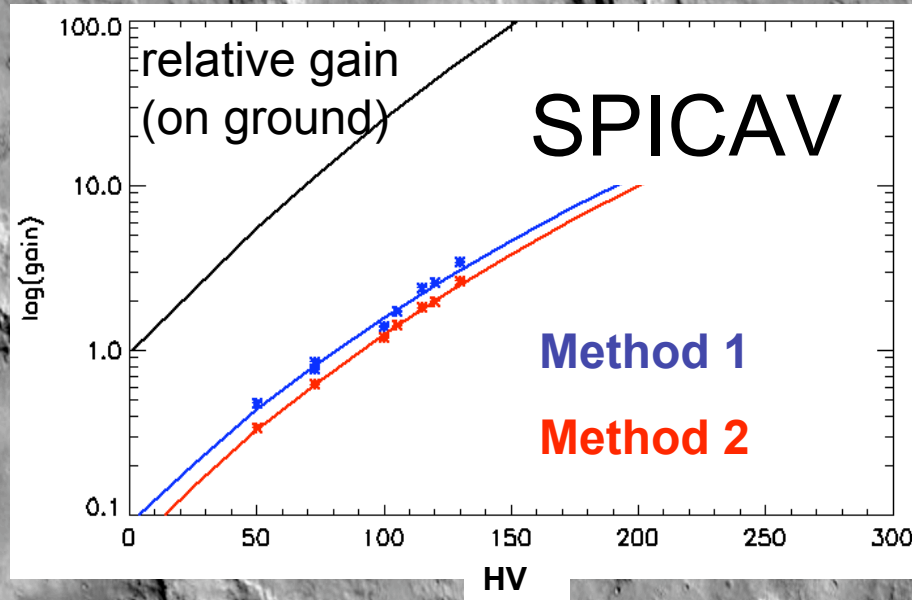
Method 2 : Statistical method 2 (photon transfer curve):

- Compute $\text{var}(S_{pADU})$ and $\bar{S}_{pADU}$ for each pixel
- Plot $\bar{S}_{pADU}$ versus $\text{var}(S_{pADU})$
- Linear fit $y = p x$ gives $p = 2 * Gp$

Assumption : an electron pulse spreads on only one pixel

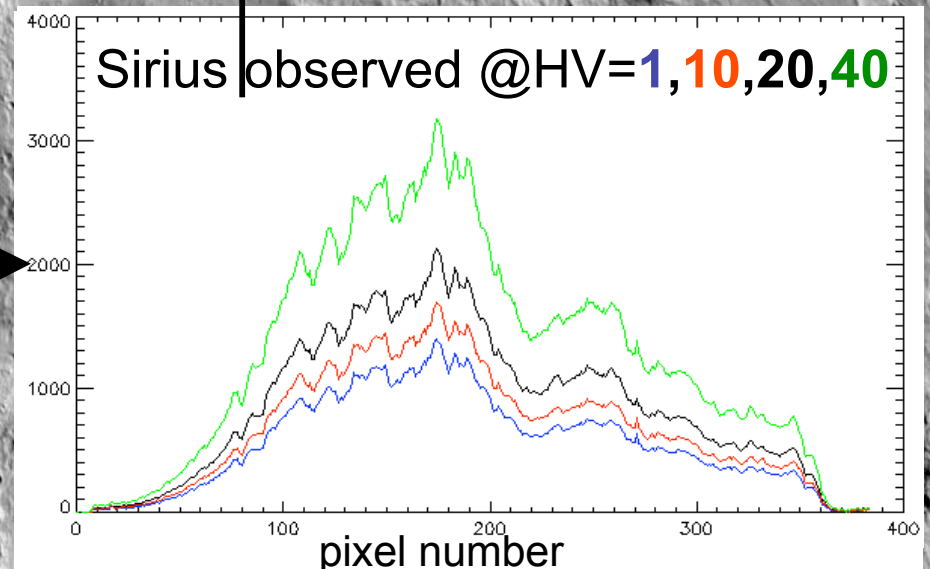


UV Gain Curve [Nb ADU/photoevents = $f(\text{HV})$]



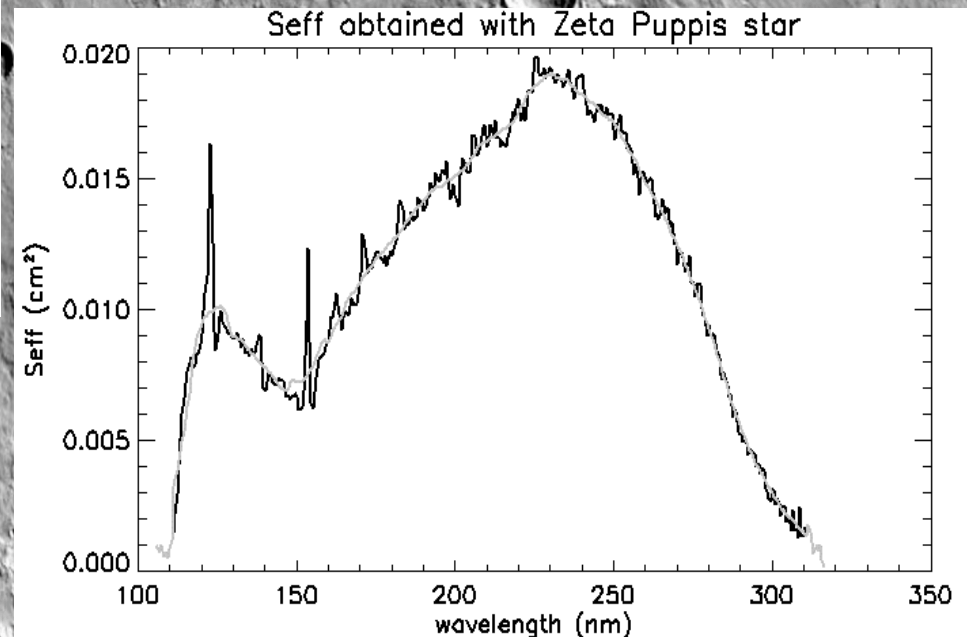
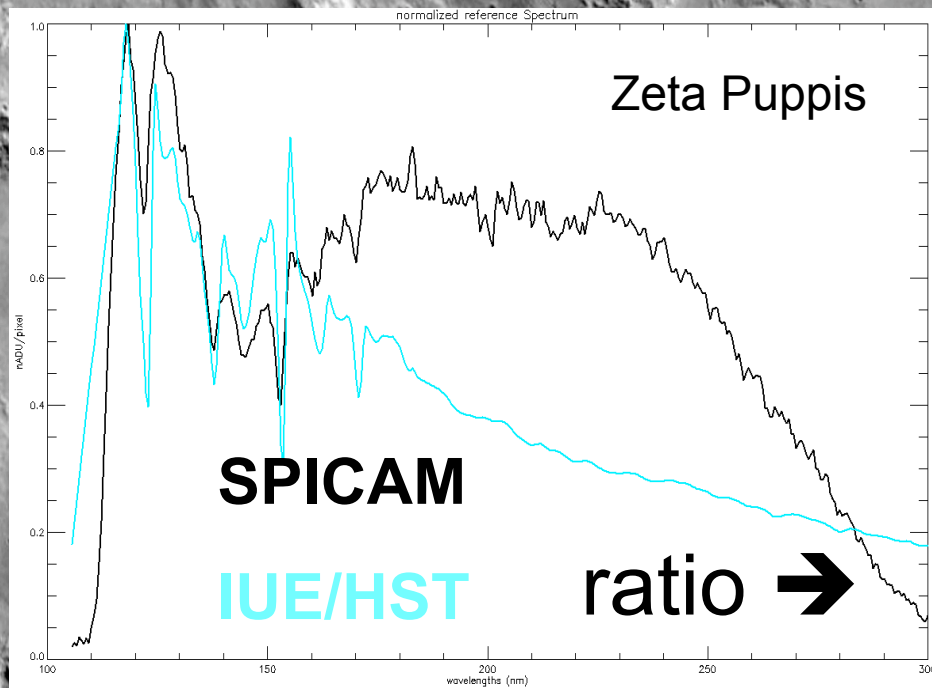
Method 3 :

Ratio of stellar fluxes
measured with different
HV (= relative gain)

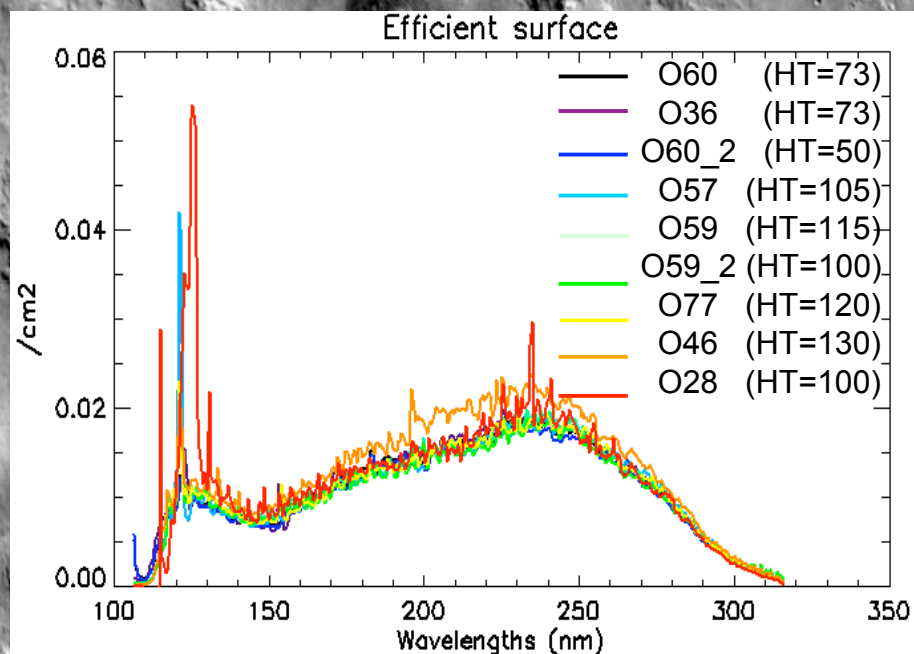


Efficient Surface (cm₋) (1/3)

$$Seff = \frac{SpecrefSPICAMStar}{SpecrefStar_fromOtherSource} * \frac{1}{g} * \frac{1}{\Delta\lambda * Ti}$$



Efficient Surface (cm_) (2/3)



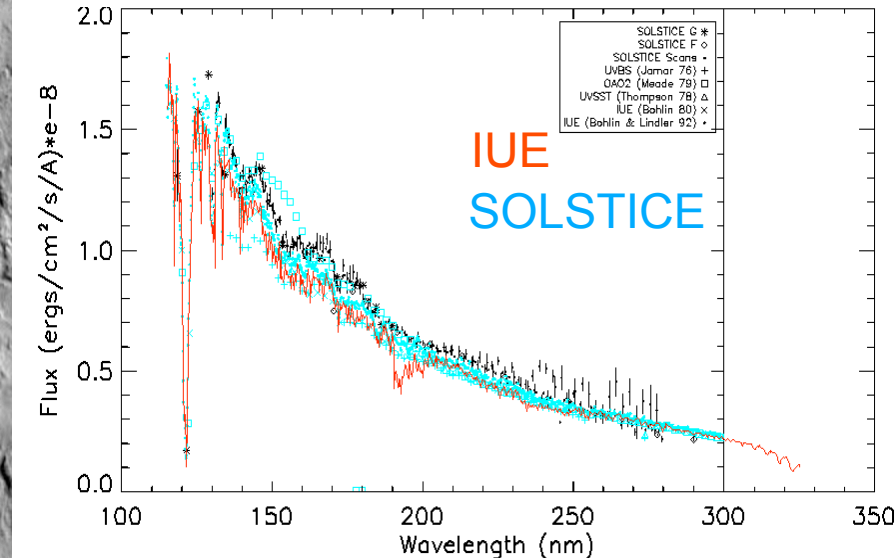
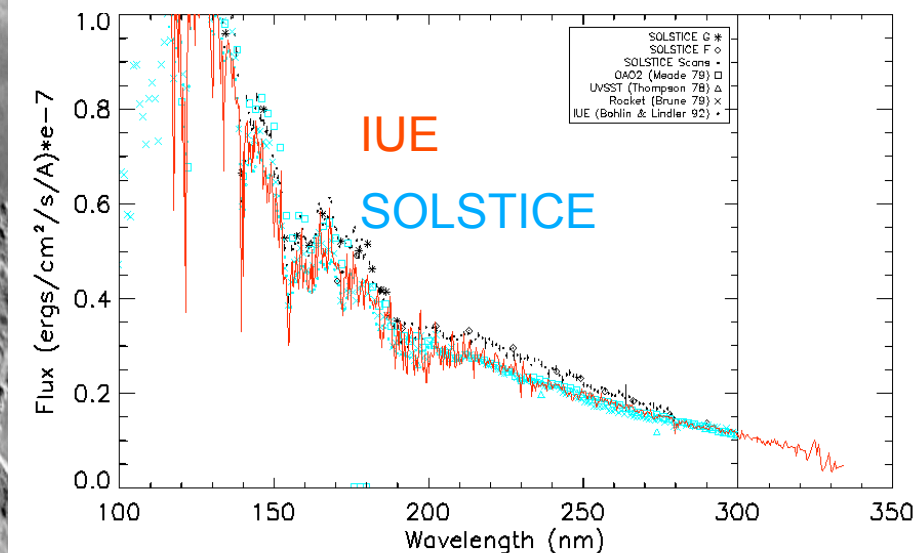
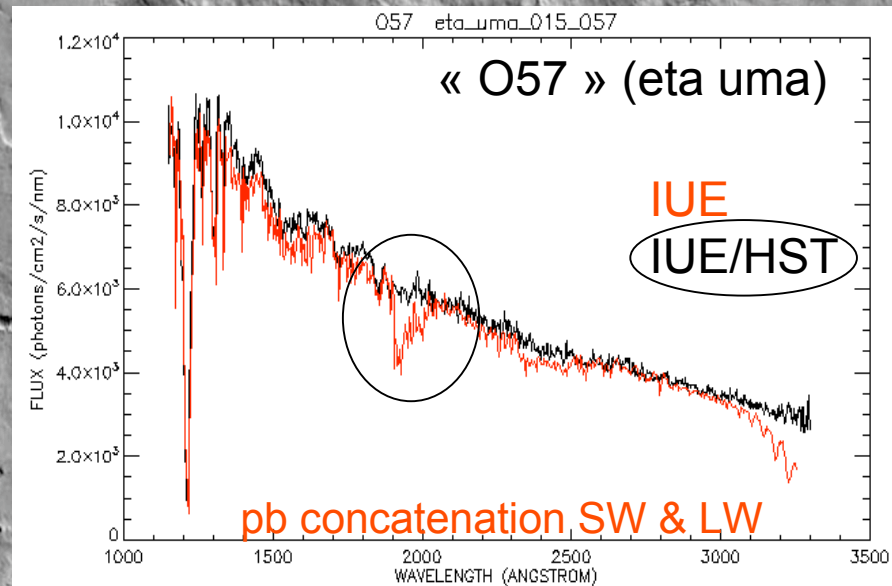
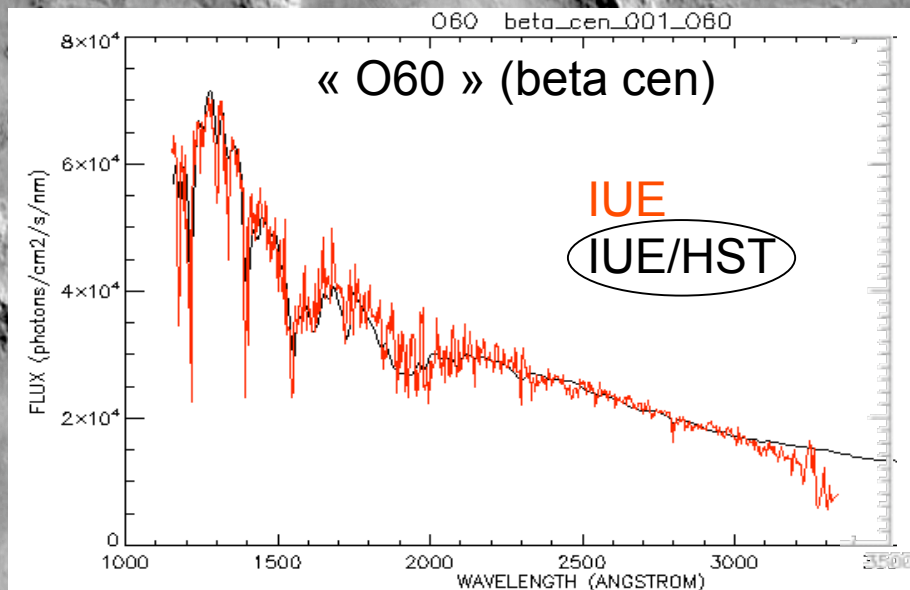
O60 : Beta Cen
O36 : Zeta Pup
O57 : Eta UMa
O59 : Zeta Cen
O77 : Zeta Oph
O46 : Delta Cen
O28 : Alp CMa(Sirius)

SpecrefStar _ from Other Source = IUE/HST or IUE/SPICAM

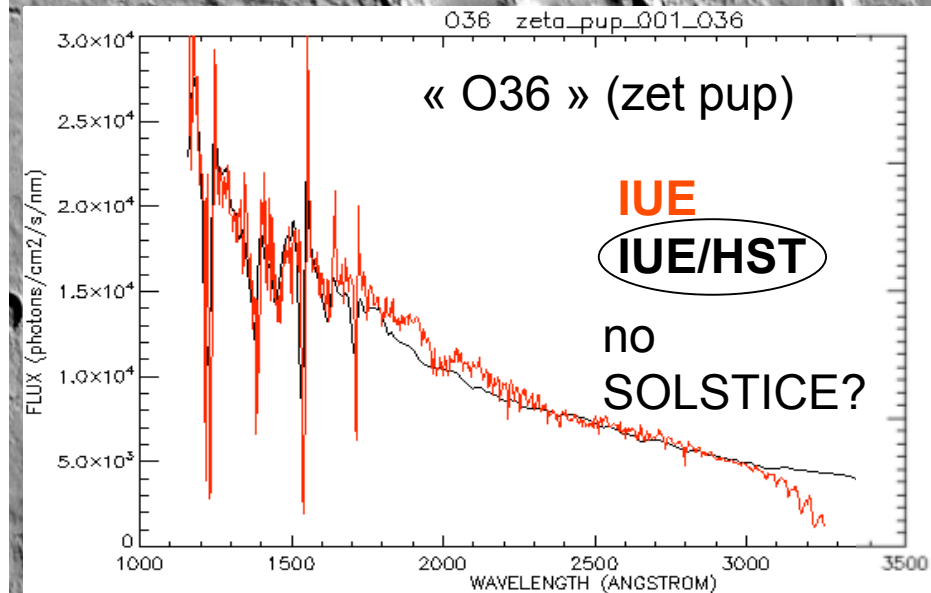
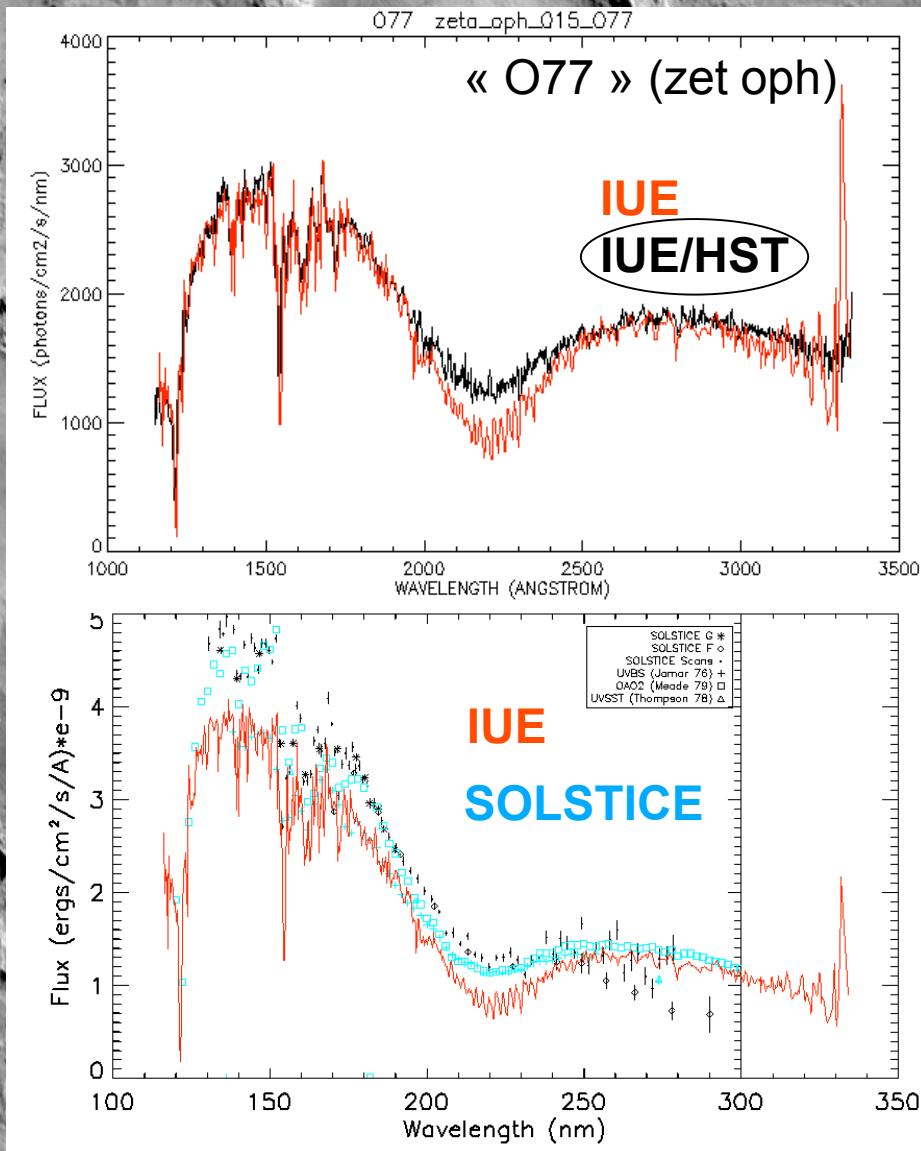
IUE/HST : O60, O36, O57, O77

IUE/SPICAM : O59, O46, O28

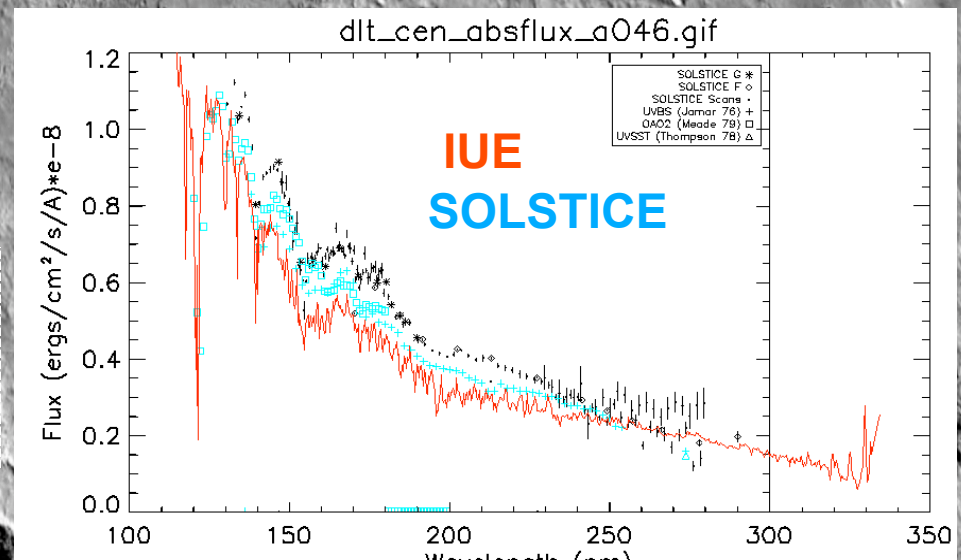
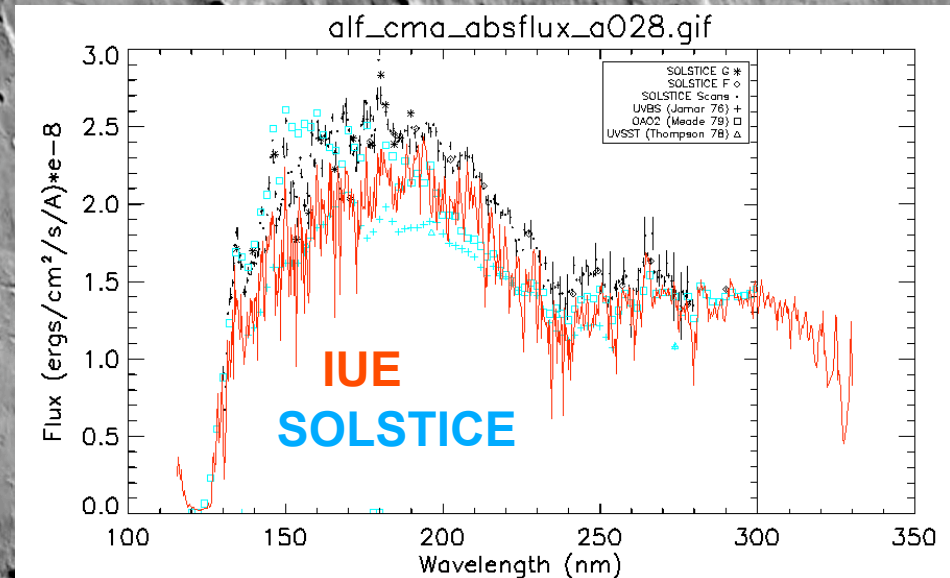
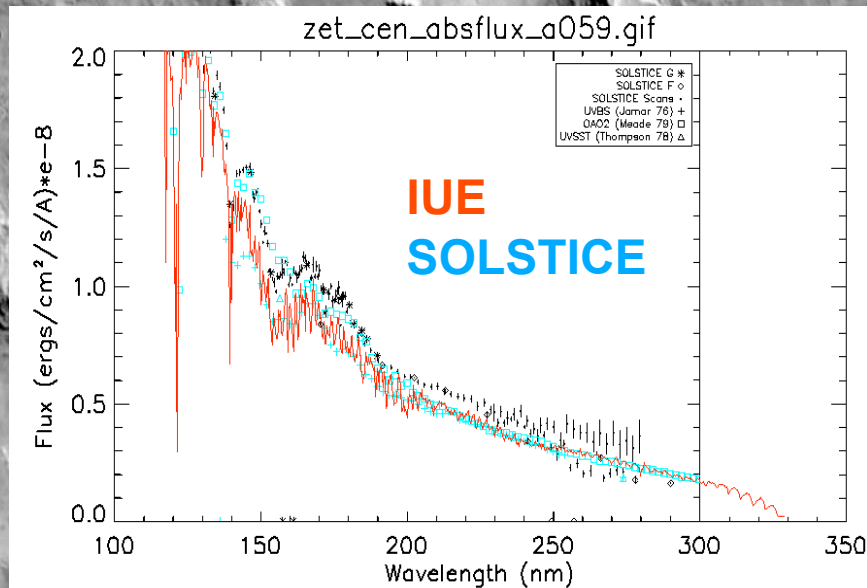
Other Source : IUE, IUE/HST, SOLSTICE?



Other Source : IUE, IUE/HST, SOLSTICE?



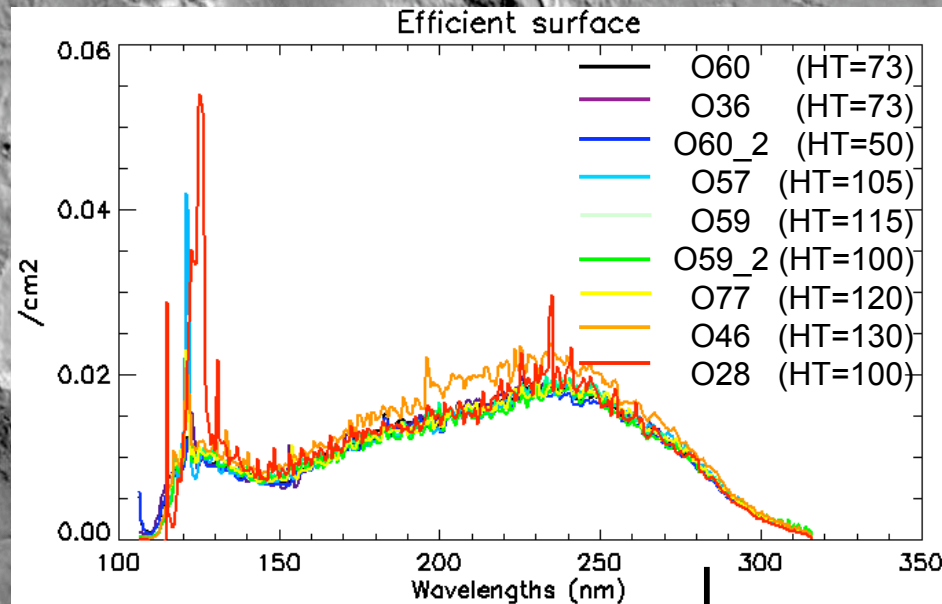
Other Source : IUE, IUE/HST, SOLSTICE?



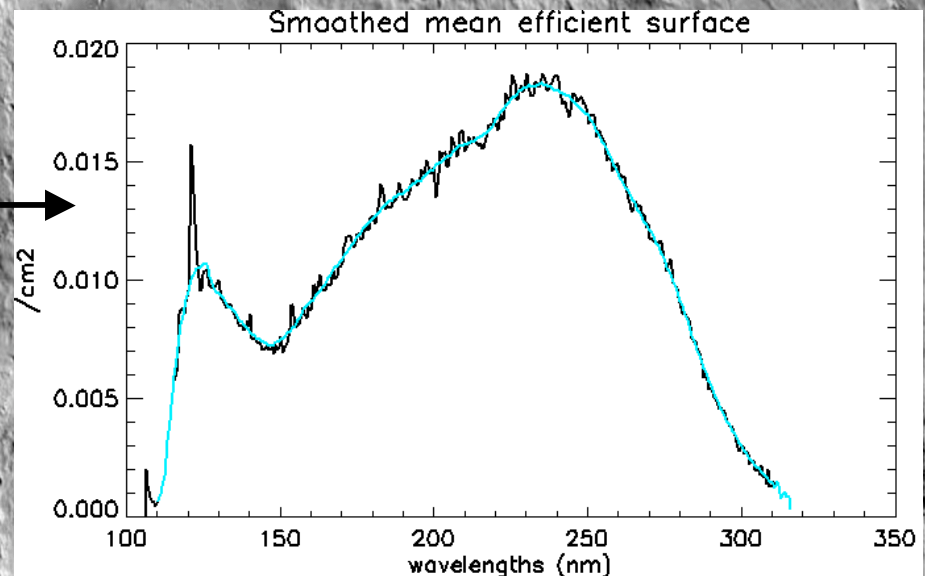
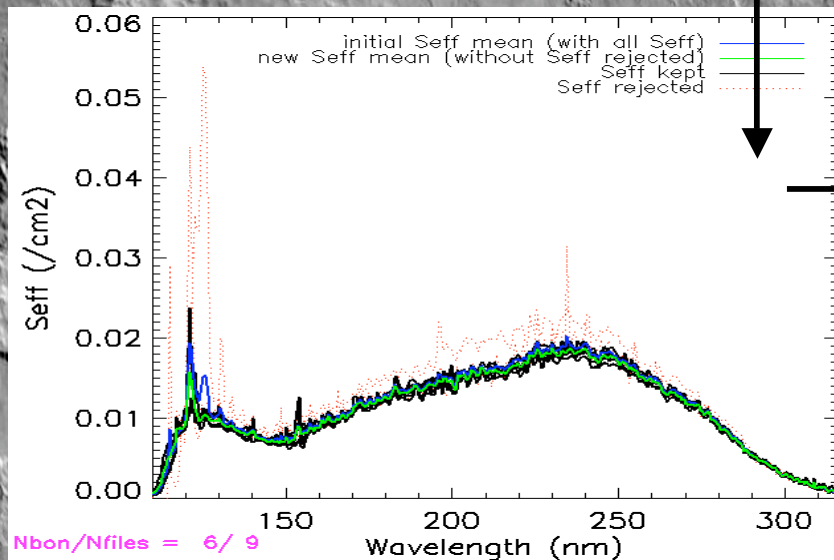
IUE fluxes underestimated in the
range 150-270 nm? →

Use SOLSTICE data?

Efficient Surface (cm₂) (3/3)



O60 : Beta Cen
 O36 : Zeta Pup
 O57 : Eta UMa
 O59 : Zeta Cen
 O77 : Zeta Oph
 O46 : Delta Cen
 O28 : Alp CMa (Sirius)



To be done...

(Mea Wedlund, A. Reberac, E. Quémerais)

- **Better correction for spectral resolution (modify PSF)**
- **Study of the instrument sensitivity with time**
- **Study of the gain curve variation with time with the different methods**
- **Produce stellar spectra for the database**

SPICAM Efficient Surface...

