# SOXS Science Meeting 2020-11-24

## ETC

# Outline

- ETC
  - ETC web-page
  - ETC architecture and description
  - ETC example of output plots
  - Open points

# SOXS @ NTT

SON OF X-SHOOTER NEWS SCIENCE INSTRUMENT TIMELINE TEAM DOCUMENTS MEETINGS INTERNAL DOCS

*SOXS is built by an international consortium led by Italy and involving Israel, Chile, UK, Finland and Denmark.*

## Son Of X-Shooter

SOXS (Son Of X-Shooter) will be a unique spectroscopic facility for the ESO-NTT 3.5-m telescope in La Silla (Chile). The design foresees a high-efficiency spectrograph with a resolution-slit product of ~ 4,500, capable of simultaneously observing the complete spectral range 350 - 2000 nm with a good sensitivity, and with imaging capabilities in the visible band (ugrizY) over a 3.5'x3.5' field of view.

Instrument development page @ ESO (link)

La Silla Instruments page @ ESO (link)

CHECK the NEWS section (last updated Feb 02, 2020)

EXPOSURE TIME CALCULATOR (ETC)

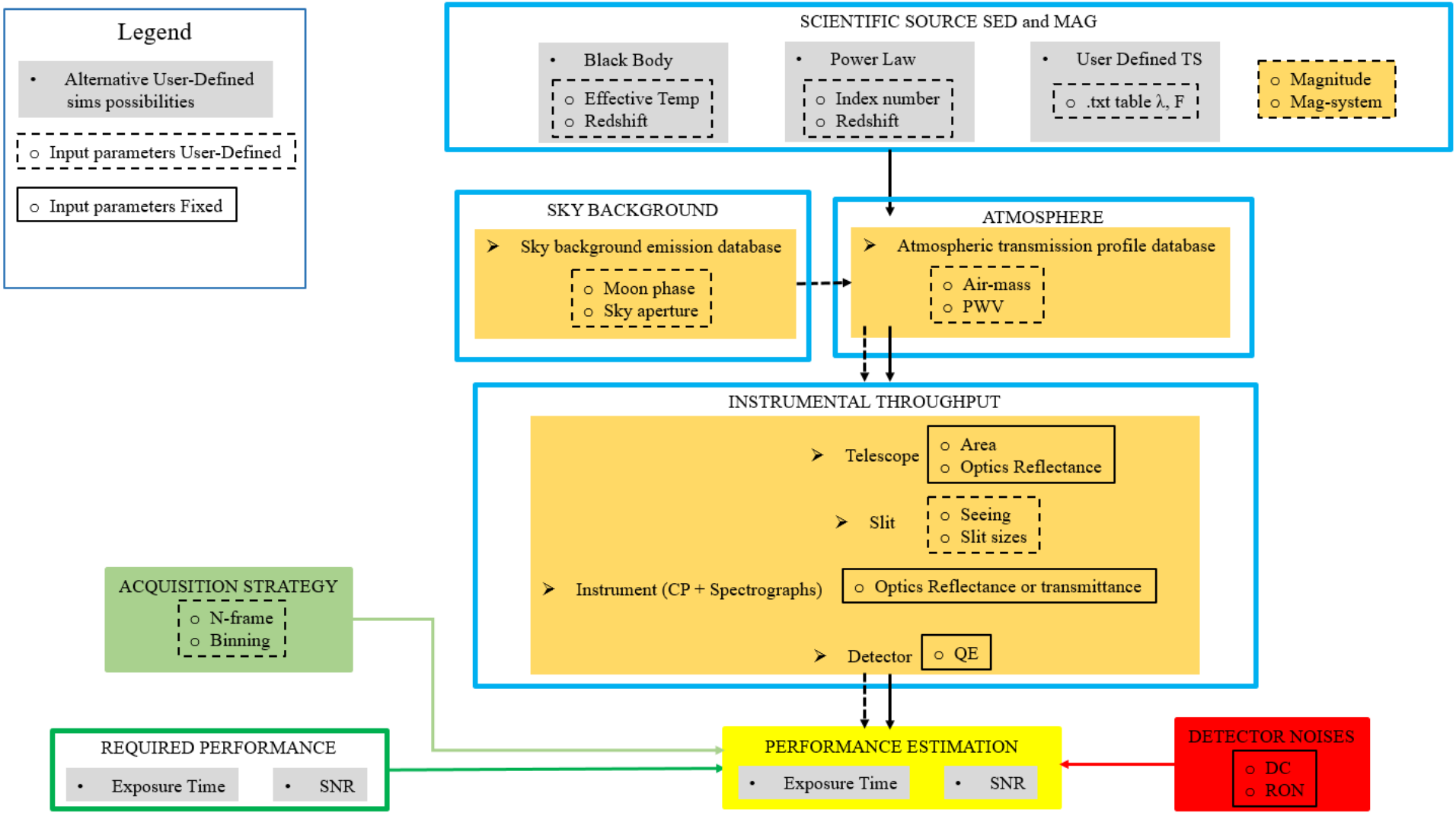
The SOXS logo has been created by a collaborative effort from Laura Ripamonti, Federica Loiacono & Sergio Campana

link here

**ETC web-page how to get there:**

- **From SOXS website (googling SOXS ETC)**
- **http://192.167.38.34/**

# ETC Architecture Schematic and workflow



# ETC web-page layout

**First select the Input flux Distribution, then fill the related fields in the Light gray boxes. Dark gray boxes can not be modified accordingly.**

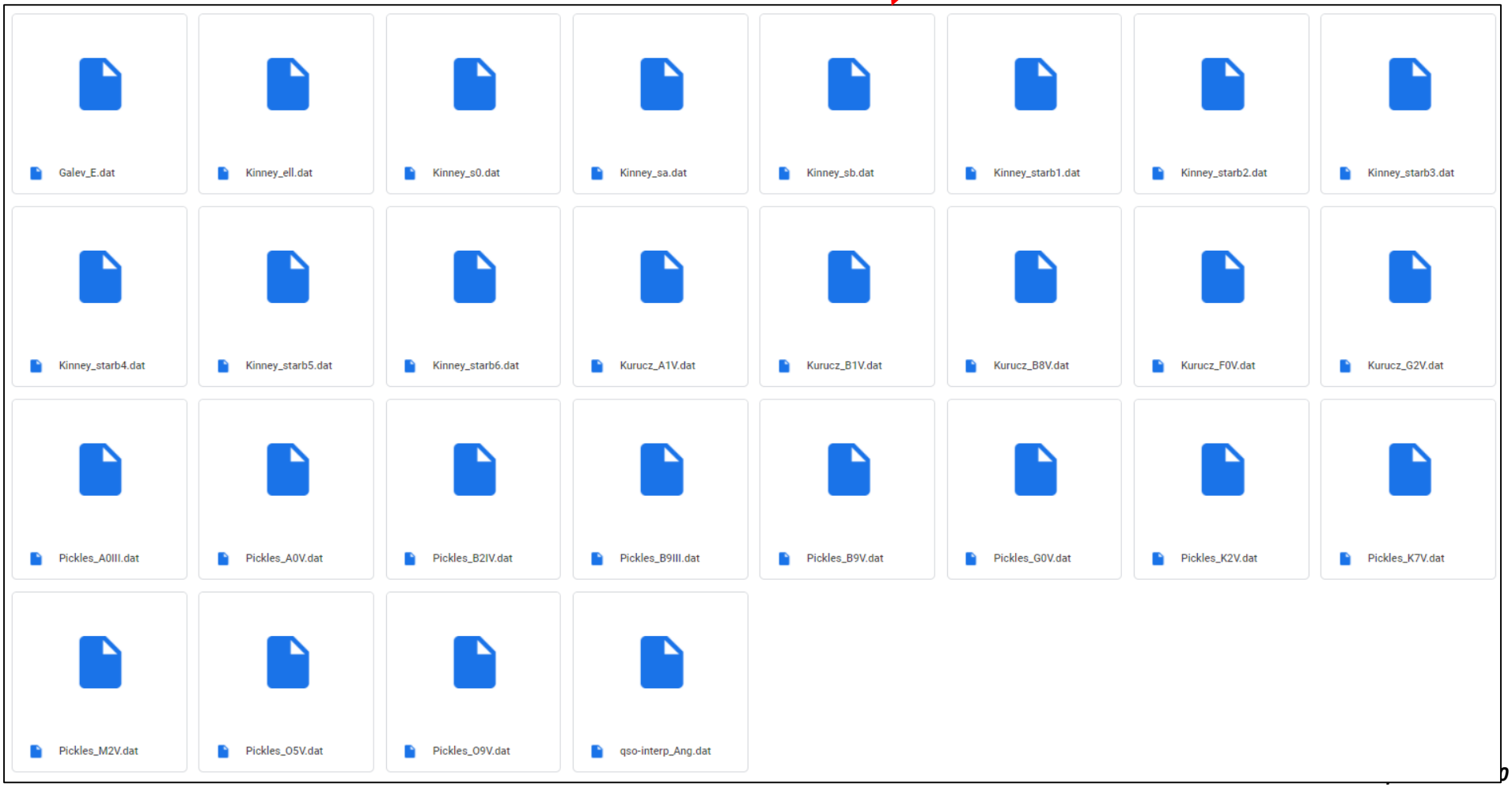
**Science Object**

Target Input Flux Distribution

Attention! If you want to download some template spectrum, which can be loaded as User-Defined Spectrum press here

- Black body
- power-law - $F(\lambda) \propto \lambda^{index}$
- User-defined Spectrum: Table lambda,Flux in [A, erg/s/cm2/A]
- Single emission line

Many of the XSH template spectra



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- ( ) User-defined Spectrum: Table lambda,Flux in [A, erg/s/cm2/A]
- ( ) Single emission line

Spatial distribution:

For explanation on how the extended source case is modeled press Here

- (•) Point source
- ( ) Extended source

Blackbody Temperature [K]:
7000

Power Law Index:
0

User-Defined spectrum - load file:
Scegli file Nessun fil...lezionato

mag: [Magnitudes are given per arcsec$^2$ for extended sources]
11

Redshift :
0

Lambda [A]:
5013

FWHM [A] (warning: min acceptable FWHM for UV-VIS = 0.32 A, for NIR = 0.63 A):
1

Flux [10^-16 erg/cm^2/s]:
2

Band m B

Magsystem Vega

Modeled as a gaussian profile
Centered at Lambda
with total flux Flux
Min FWHM related to the computational Lam-pitch and instrument resolution.

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**First select the Input flux Distribution, then fill the**

**Science Object**

Target Input Flux Distribution

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- (•) Black body
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11

Redshift :
0

Lambda [A]:
5013

FWHM [A] (warning: min acceptable FWHM for UV-VIS = 0.32 A, for NIR =

1

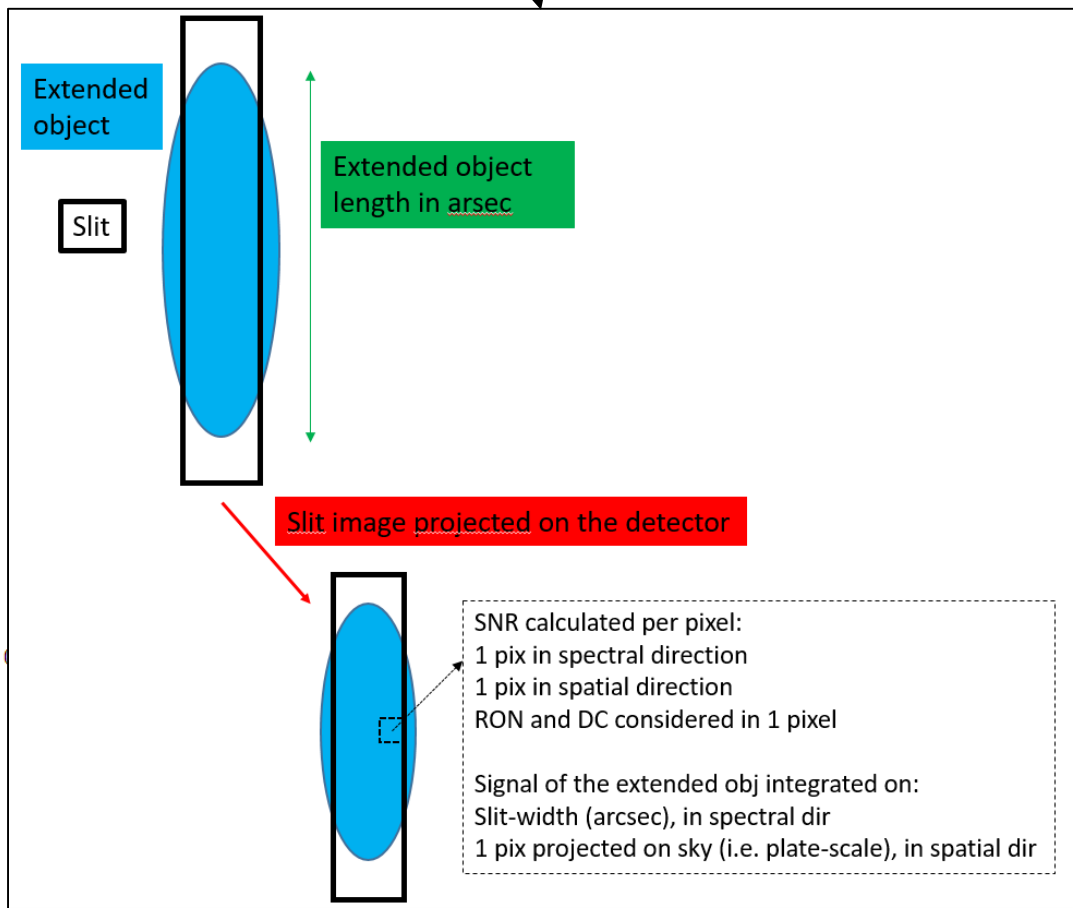
Flux [10^-16 erg/cm^2/s]:
2

Band m B

Magsystem Vega

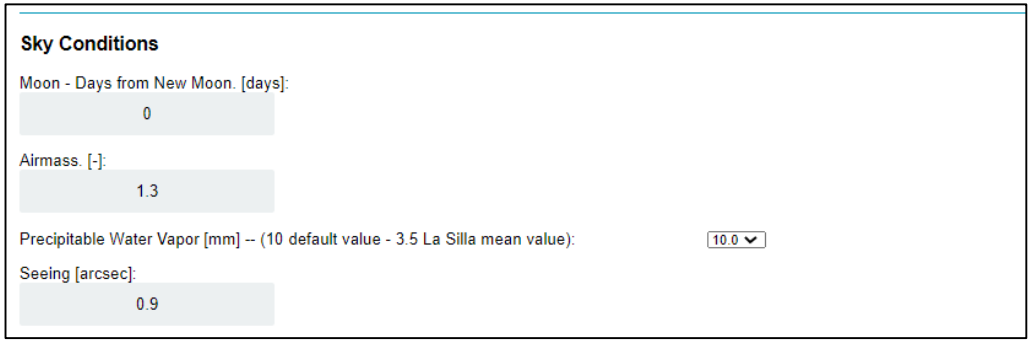
**192.167.38.34 dice**

-The magnitude is given per square arcsecond.
-The detected counts are calculated by integrating the signal over the solid angle determined by the product of slit width (in arcsec) and 1 pixel size in spatial direction (in arcsec)
-The SNR is calculated per pixel, so the flux is integrated in a wavelength pixel-bin.



SKY BACKGROUND

- Sky background emission
  - Moon phase
  - Sky aperture




- Sky background input parameters:
  - Moon's phase: any days from new moon (where: 0 = new moon, 14 = full moon)
  - Projected slit size on sky (according to the Y-slit size considered over which the sky signal is integrated → ≅ 1.5*Seeing)

- Online Call to → ESO SkyCalc Radiance Model with components:
  - Scattered Moonlight, Scattered Starlight,
  - Zodiacal light
  - Molecular Emissions of Lower and Upper Atmosphere
  - Airglow

- Sky background radiance/emission output in in [ph/ (s cm2 A)]

ATMOSPHERE

- Atmospheric transmission profile
  - Air-mass
  - PWV

**Sky Conditions**

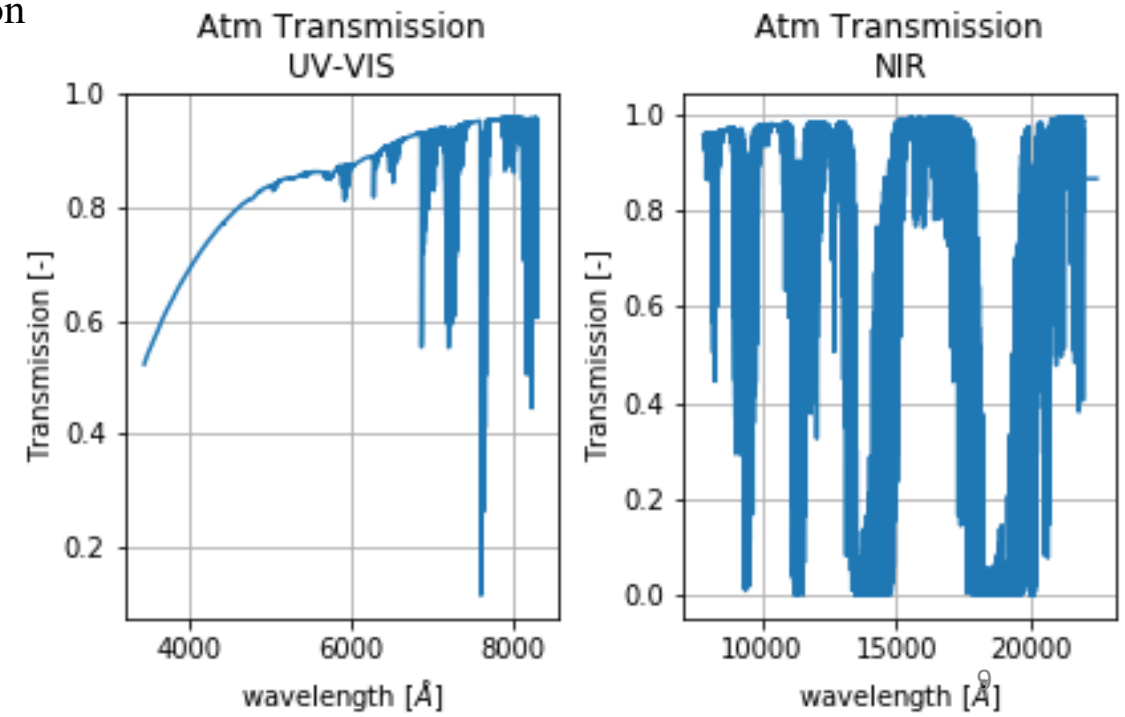
Moon - Days from New Moon. [days]: 0

Airmass. [-]: 1.3

Precipitable Water Vapor [mm] -- (10 default value - 3.5 La Silla mean value): 10.0

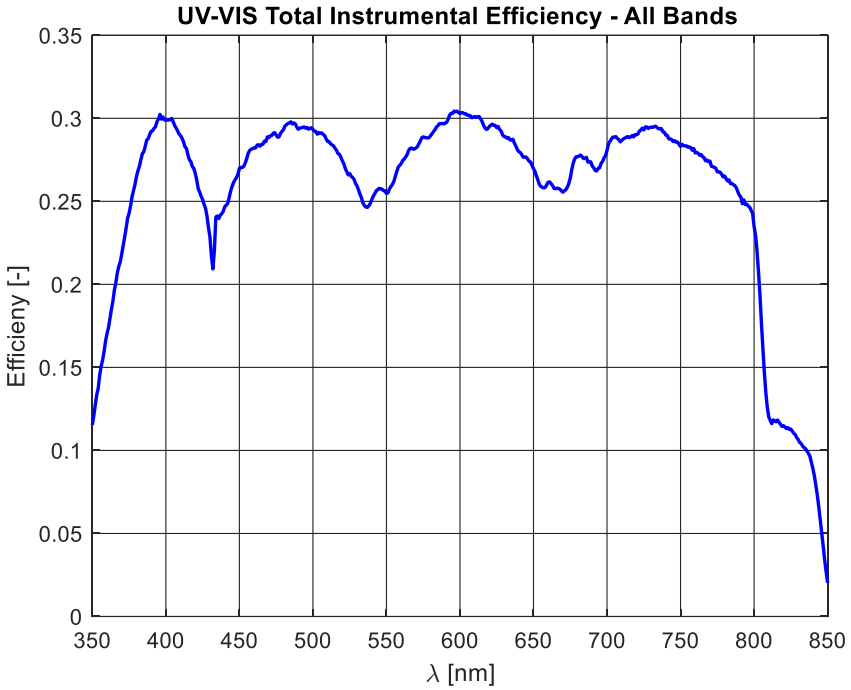
Seeing [arcsec]: 0.9

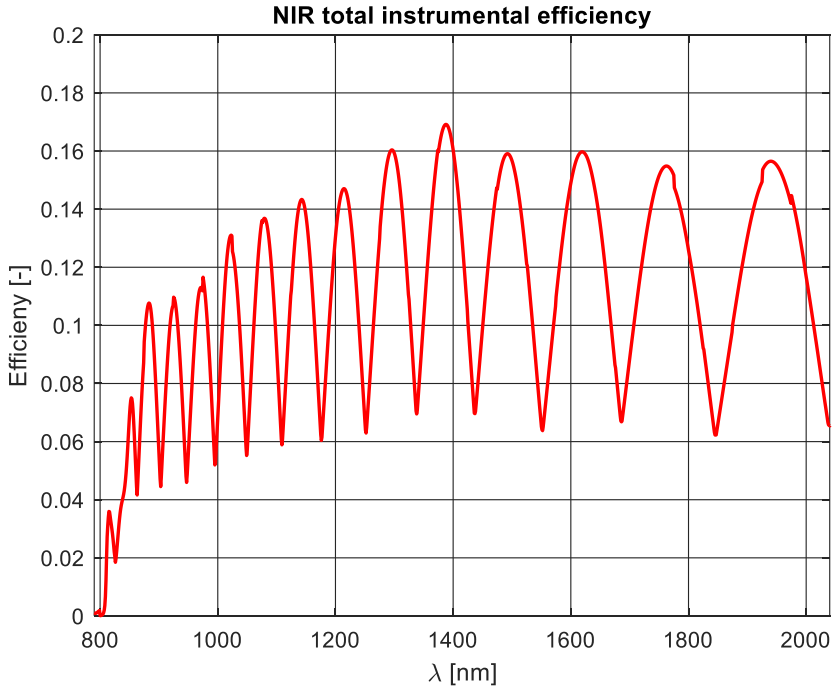
- Online Call to → ESO SkyCalc Transmission Model with components:
  - Rayleight scattering (molecules) + Mie Scattering (Aerosols)
  - Molecular + Aerosols absorption



Total instrumental efficiency: *from Telescope to Detectors QE included*

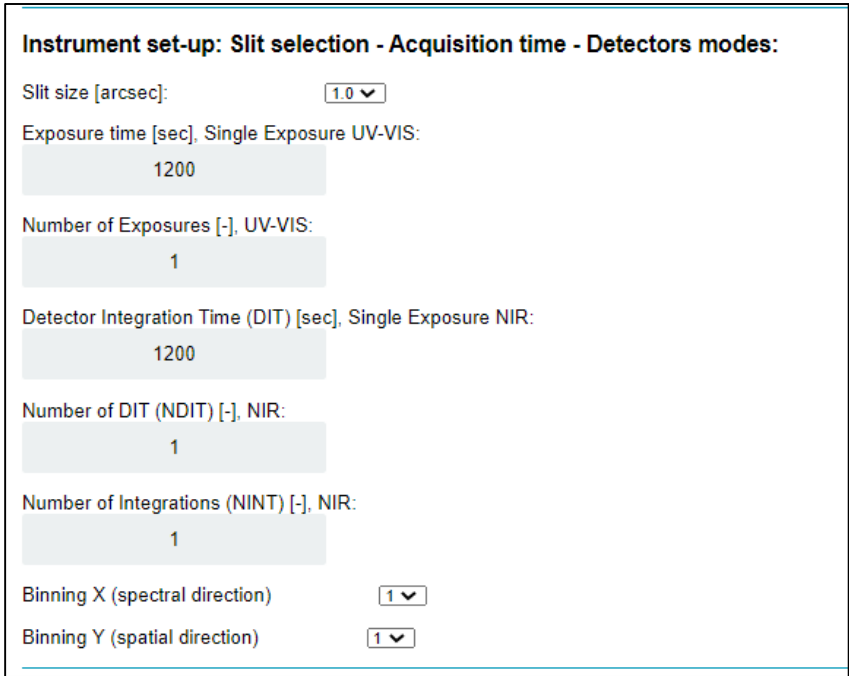
The atmospheric transmission and slit-throughput are added according to the simulations



- Detector noises: from detector datasheet and test report from manufacturers
  - Dark current:
    - UV-VIS: 0.1 e-/pix/h @ 140K
    - NIR: 1.5*(10^-3) e-/pix/h @ 40K
  - RON
    - UV-VIS: 2.5 rms e-
    - NIR: 10 rms e-

- Acquisition strategy:
  - Number of Frames to be acquired
    - Number of exposures in UV-VIS
    - DIT, NDIT, NINT in IR
  - Binning: 1X1, 1x2, 2x2 (UV-VIS)



## Sky Conditions

Moon - Days from New Moon. [days]:

0

Airmass. [-]:

1.3

Precipitable Water Vapor [mm] -- (10 default value - 3.5 La Silla mean value): 10.0

Seeing [arcsec]:

0.9

## Instrument set-up: Slit selection - Acquisition time - Detectors modes:

Slit size [arcsec]: 1.0

Exposure time [sec], Single Exposure UV-VIS:

1200

Number of Exposures [-], UV-VIS:

1

Detector Integration Time (DIT) [sec], Single Exposure NIR:

1200

Number of DIT (NDIT) [-], NIR:

1

Number of Integrations (NINT) [-], NIR:

1

Binning X (spectral direction) 1

Binning Y (spatial direction) 1

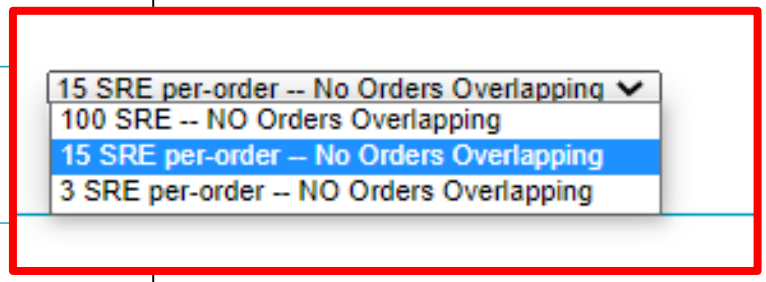
## Input for Calculation Database

Calculation-Plots: Wavelengths DataBase (Default DB is 15 SRE per order) 15 SRE per-order -- No Orders Overlapping

Calculation-SNR: SNR per SRE (0) -- SNR per PIX (1) 0

## RUN ETC:

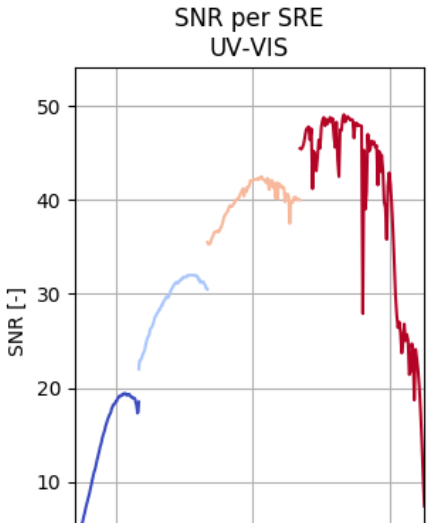
CALCULATE

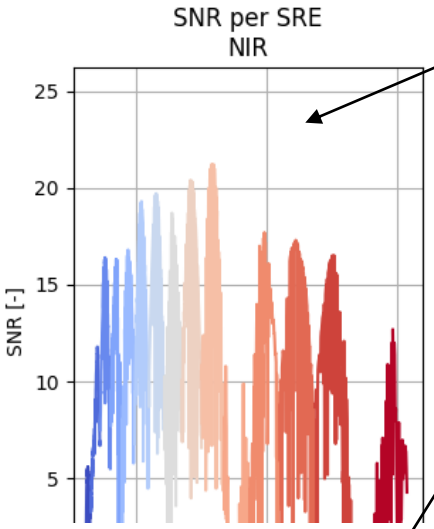


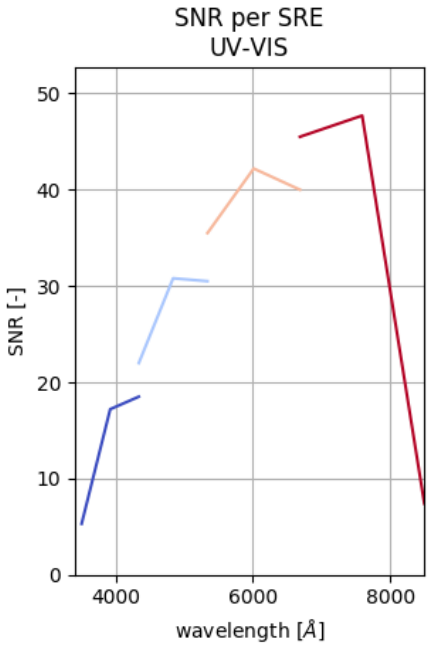
**Input for Calculation Database**

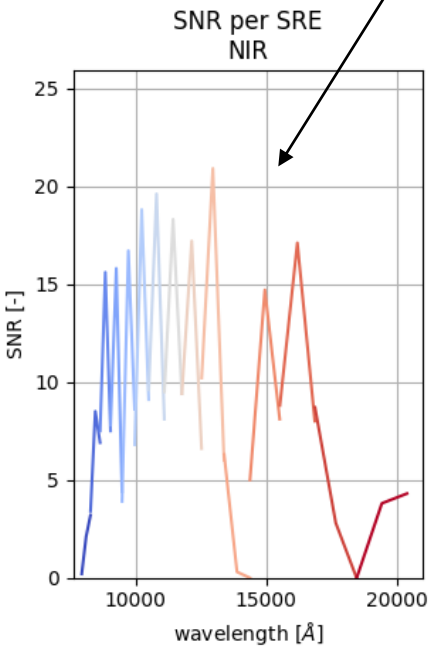
Calculation-Plots: Wavelengths DataBase (Default DB is 15 SRE per order) [15 SRE per-order -- No Orders Overlapping]

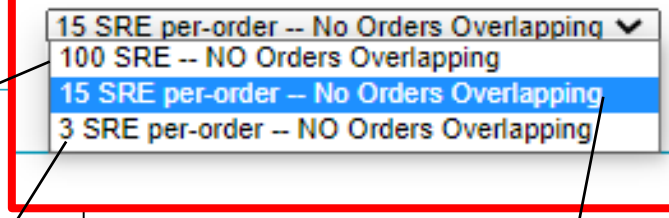
Calculation-SNR: SNR per SRE (0) -- SNR per PIX (1) [0]

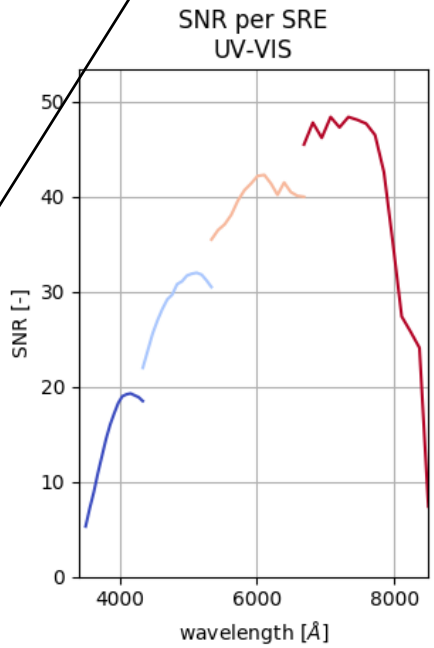


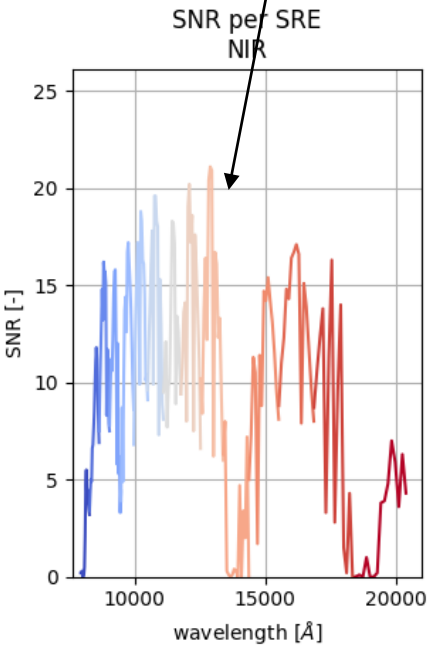



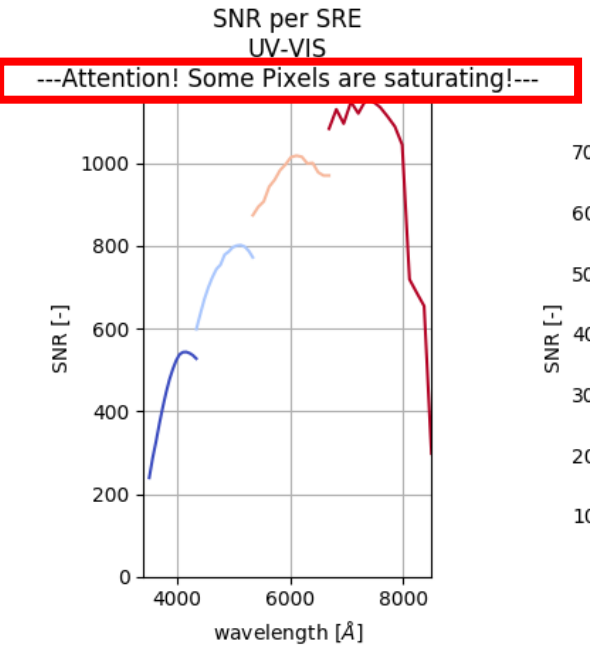



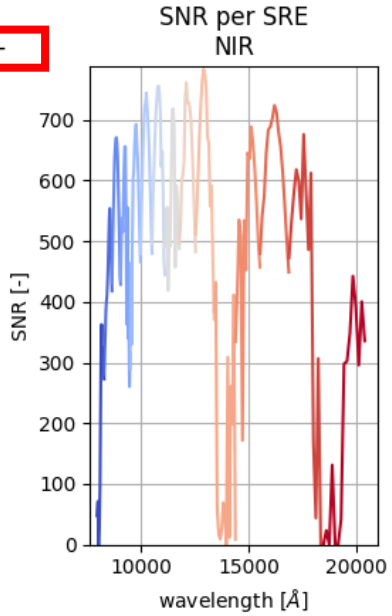



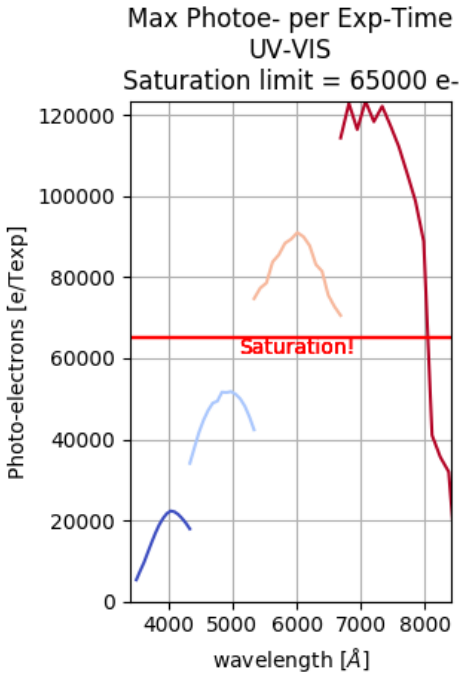



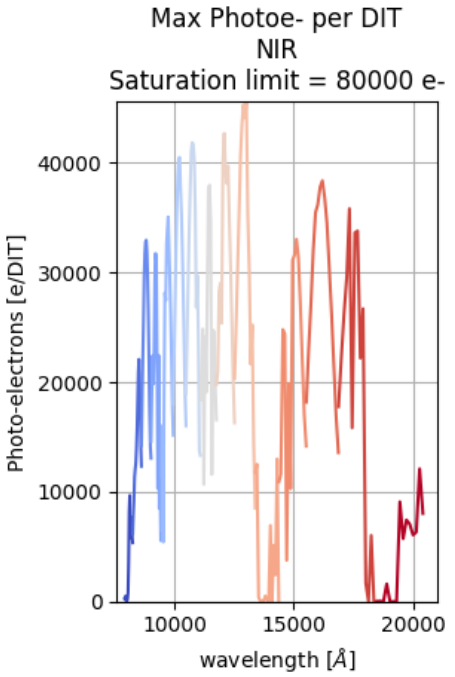
Saturation Warnings → when the max photoe- (per Exp-T or DIT) > detectors saturation limits.



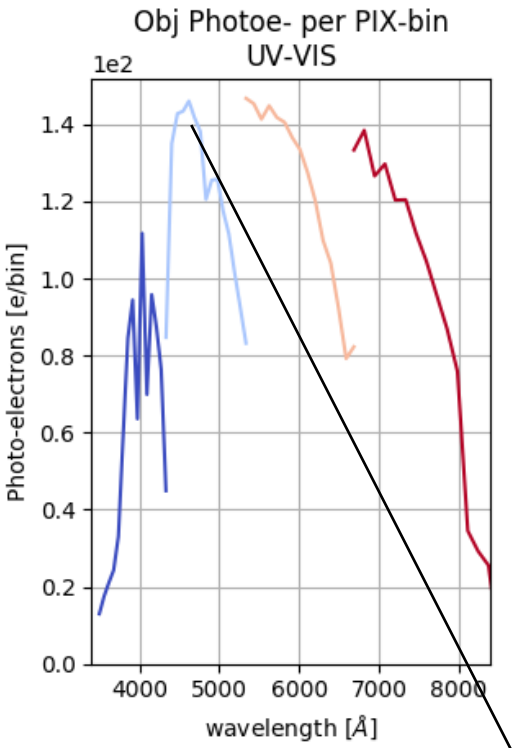



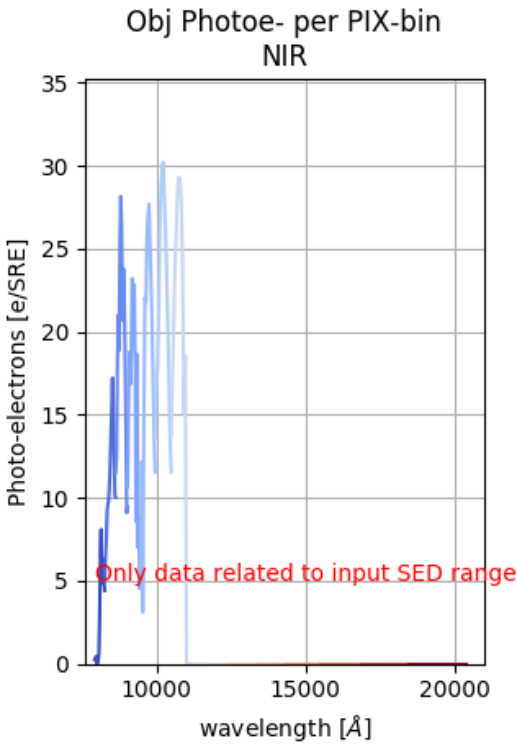

This is treated like in ESO-XSH ETC,
the SNR anx max photoe- number
are calculated anyway,
But warnings are shown



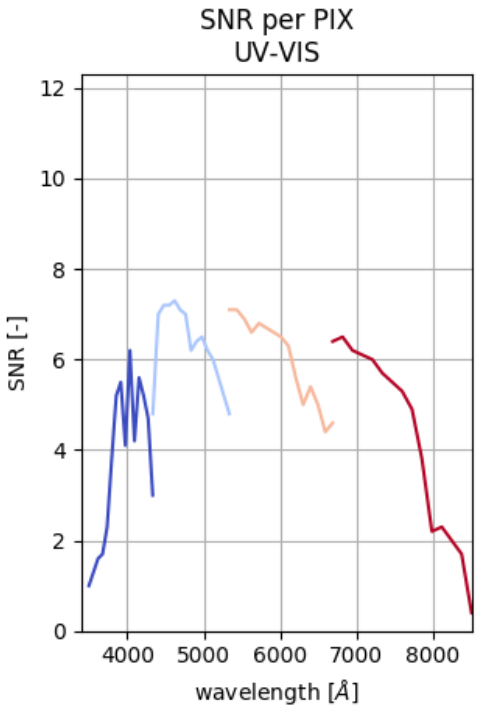



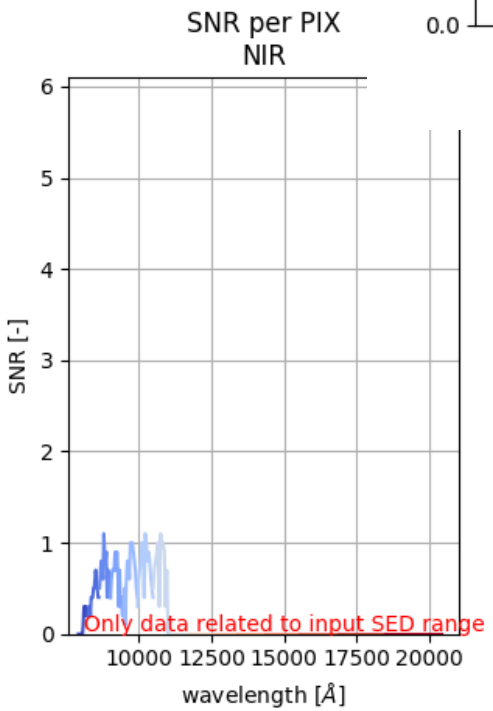
Kurucz-A1V, mag 19.9
7 d from NM, AM 1.16, PWV=10
0.9 asec seeing, 1 asec slit,
**1800 sec exposure, 1 Exposures**
**DIT = 1800 sec, NDIT = 1, NINT = 1**
1x1 binning



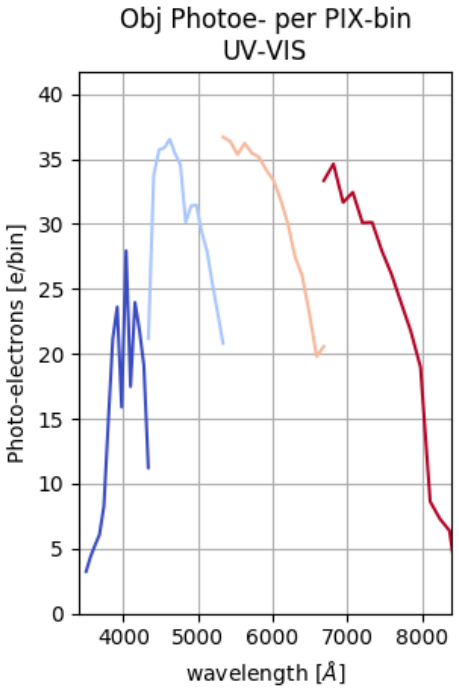



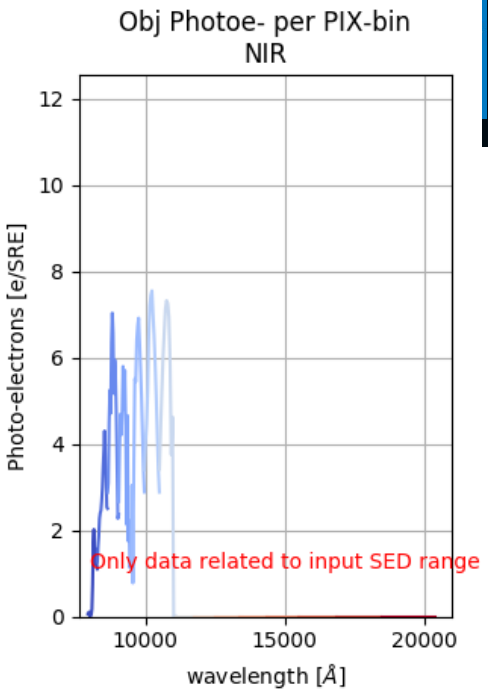

In the g band
the peak counts/bin ≈145 phe-
Is close to the RON ≈130 e-

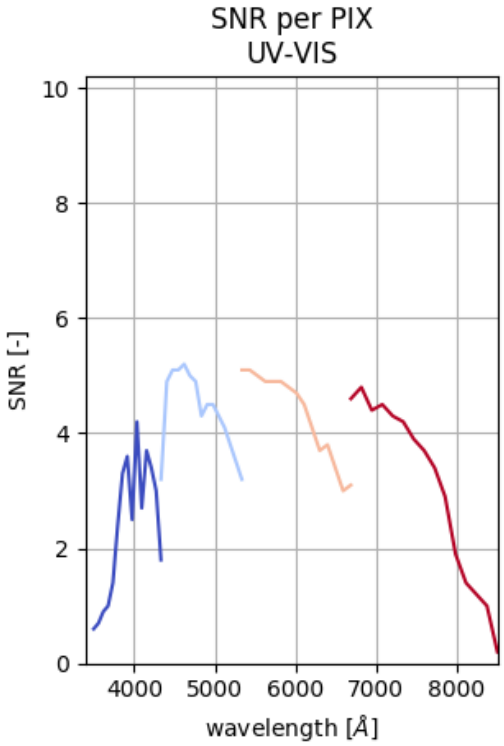


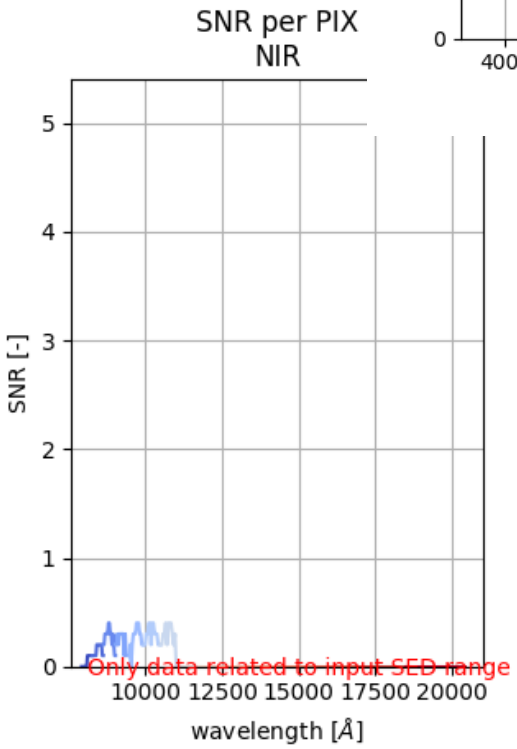



Kurucz-A1V, mag 19.9
7 d from NM, AM 1.16, PWV=10
0.9 asec seeing, 1 asec slit,
**450 sec exposure, 4 Exposures**
**DIT = 450 sec, NDIT = 4, NINT = 1**
1x1 binning



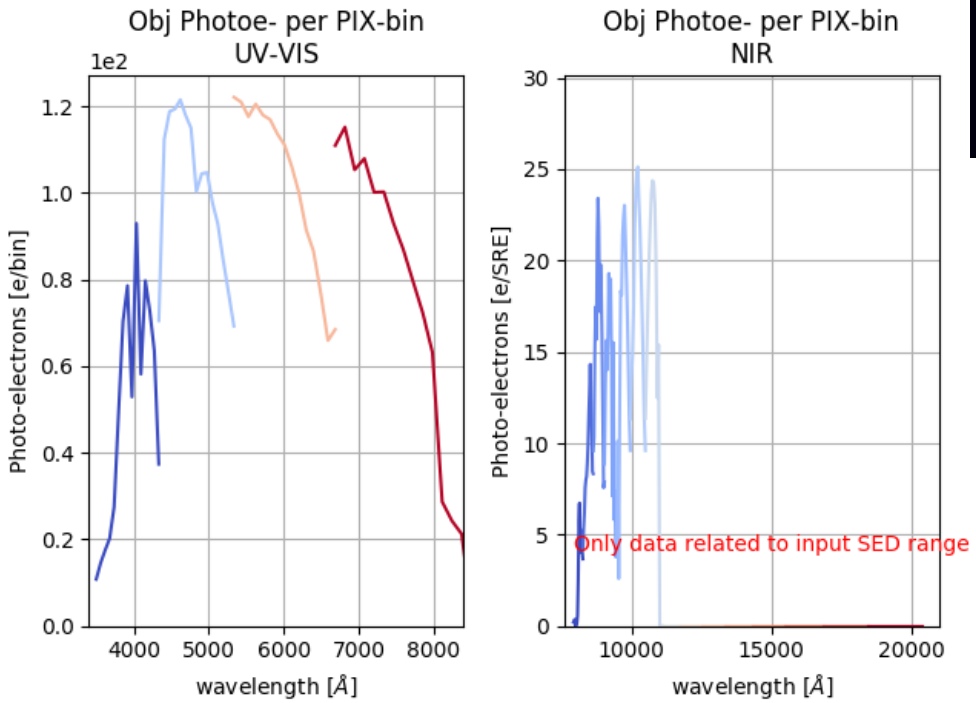



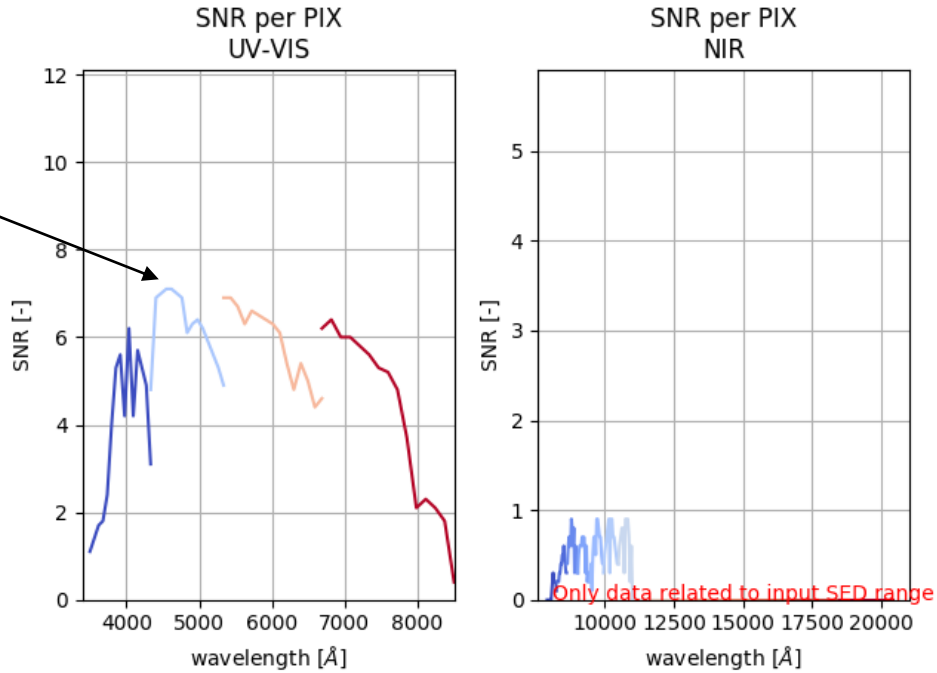




The SNR at the g-band peak decrease
From ≈ 7 to ≈ 5

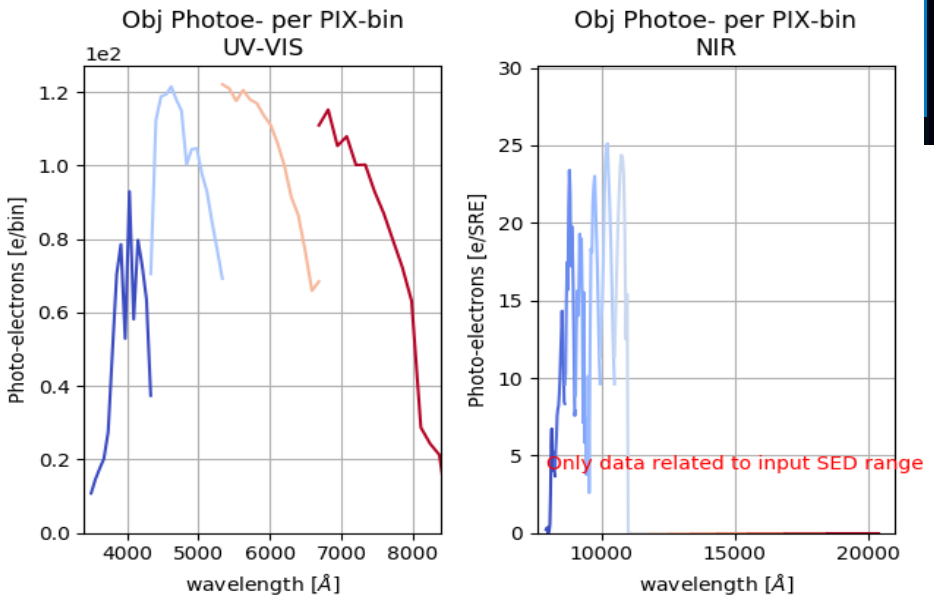
Kurucz-A1V, mag 19.9
7 d from NM, AM 1.16, PWV=10
0.9 asec seeing, 1 asec slit,
**1500 sec exposure, 1 Exposures**
**DIT = 1500 sec, NDIT = 1, NINT = 1**
**1x2 (in spatial direction) binning**



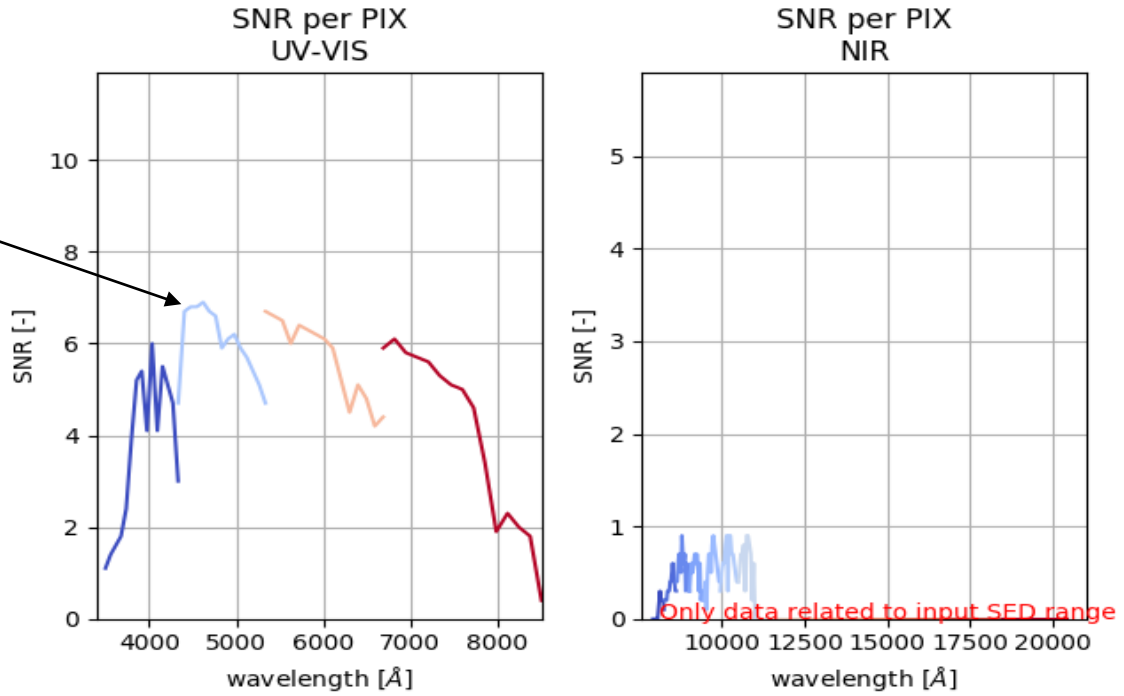

The SNR at the g-band peak
Is again ≈ 7



Kurucz-A1V, mag **20.1**
7 d from NM, AM 1.16, PWV=10
0.9 asec seeing, 1 asec slit,
**1800 sec exposure, 1 Exposures**
**DIT = 1800 sec, NDIT = 1, NINT = 1**
**1x2 (in spatial direction) binning**




The SNR at the g-band peak
Is again ≈ 7



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- ○ power-law - $F(\lambda) \propto \lambda^{index}$
- ○ User-defined Spectrum: Table lambda,Flux in [A, erg/s/cm2/A]
- ◉ Single emission line

Spatial distribution:

For explanation on how the extended source case is modeled press Here

- ◉ Point source
- ○ Extended source

Blackbody Temperature [K]:
5600

Power Law Index:
1

User-Defined spectrum - load file:
Scegli il file Nessun file scelto

mag: [Magnitudes are given per arcsec$^2$ for extended sources]
20

Redshift :
0

Lambda [A]:
6500

FWHM [A] (warning: min acceptable FWHM for UV-VIS = 0.32 A, for NIR = 0.63 A):
1

Flux [10^-16 erg/cm^2/s]:
2

6500 A → r-band (it is given the order id=3)

**Single emission line:**

| Order | Lambda [A] | Lam-bin [A] | Eff [%] | Obj [e-/Texp] | Sky [e-/Texp] | Imax [e-/Texp] | SNR |
|---|---|---|---|---|---|---|---|
| 3.0 | 6500.0 | 0.37 | 19.22 | 492.92 | 94.15 | 159.15 | 14.2 |

# Open Points/ Next implementations

- Imaging Mode for the Acquisition Camera
- Suggestion for improvements and possible debuggin from science teams