

# SPRAT\_LHS6328\_Hilt102

October 2, 2019

```
[1]: import sys
import numpy as np
from astropy.io import fits
from aspired import aspired
import plotly.io as pio
pio.renderers.default = 'notebook+jpg'
```

WARNING: AstropyDeprecationWarning: astropy.extern.six will be removed in 4.0, use the six module directly if it is still needed [astropy.extern.six]

```
[2]: science_frame = aspired.ImageReduction('examples/lhs6328.list')
science_frame.reduce()
#science_frame.inspect()
#science_frame.savefits(overwrite=True)

standard_frame = aspired.ImageReduction('examples/hiltner102.list')
standard_frame.reduce()
#standard_frame.inspect()
```

/Users/marcolam/git/ASPIRED/aspired/aspired.py:265: UserWarning:

No bias frames. Bias subtraction is not performed.

/Users/marcolam/git/ASPIRED/aspired/aspired.py:275: UserWarning:

No flat frames. Field-flattening is not performed.

```
[3]: # Example data from SPRAT
# LHS6328 companion WD
science_data = science_frame.fits_data.data

# Example data from SPRAT
# Hiltner102
standard_data = standard_frame.fits_data.data
```

```
[4]: # Set the spectral and spatial direction
Saxis = 1
```

```

Waxis = 0

# spec mask
spec_mask = np.arange(science_frame.fits_data.header['NAXIS1'])
spatial_mask = np.arange(40, science_frame.fits_data.header['NAXIS2'])

# initialise the two aspired.TwoDSpec()
lhs6328 = aspired.TwoDSpec(
    science_data,
    spatial_mask=spatial_mask,
    spec_mask=spec_mask,
    rn=2.34,
    cr=False,
    gain=2.45,
    seeing=1.2
)
hilt102 = aspired.TwoDSpec(
    standard_data,
    spatial_mask=spatial_mask,
    spec_mask=spec_mask,
    rn=2.34,
    cr=False,
    gain=2.45,
    seeing=1.2
)

```

```

[5]: # automatically trace the spectrum
lhs6328.ap_trace(nsteps=20, fittype='spline', bigbox=8, display=True,
↳renderer='default')
hilt102.ap_trace(nsteps=20, fittype='spline', bigbox=8, display=True,
↳renderer='default')

```

Tracing Aperture using nsteps=20

Step 3 of 20 of spectrum 1 of 1 has a poor fit. Initial guess is used instead.

Spectrum 1 : Trace gaussian width = [0.62386191 0.26132169 0. 1.34726453

1.44325993 1.55227841

1.48498931 1.45153484 1.44985531 1.44101176 1.41174052 1.39552287

1.38963013 1.39080515 1.38125338 1.3753703 1.38674186 1.32418218

1.23241782 0. ] pixels

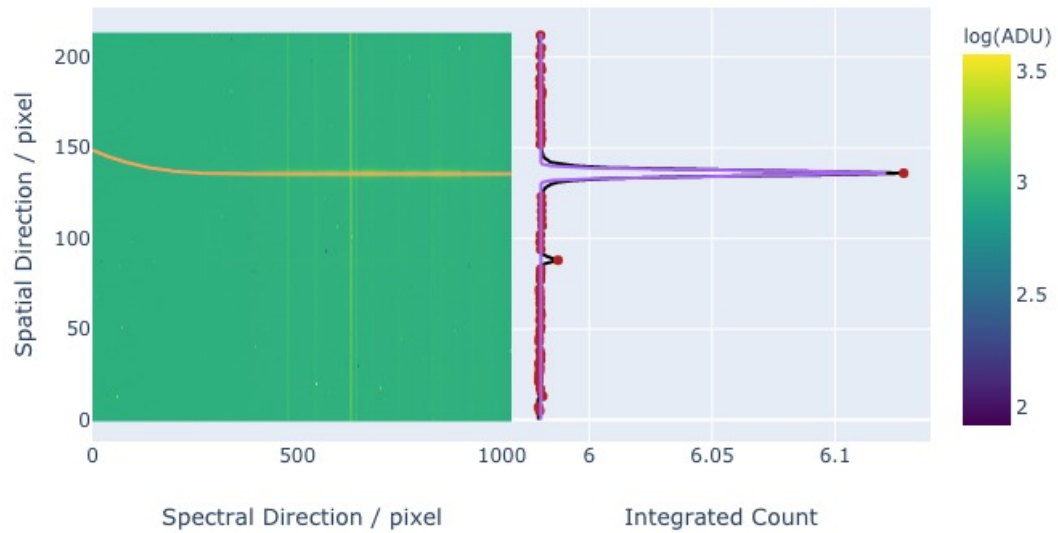
/Users/marcolam/git/ASPIRED/aspired/aspired.py:689: RuntimeWarning:

invalid value encountered in log10

/usr/local/lib/python3.7/site-packages/scipy/optimize/minpack.py:795:

OptimizeWarning:

Covariance of the parameters could not be estimated



Tracing Aperture using nsteps=20

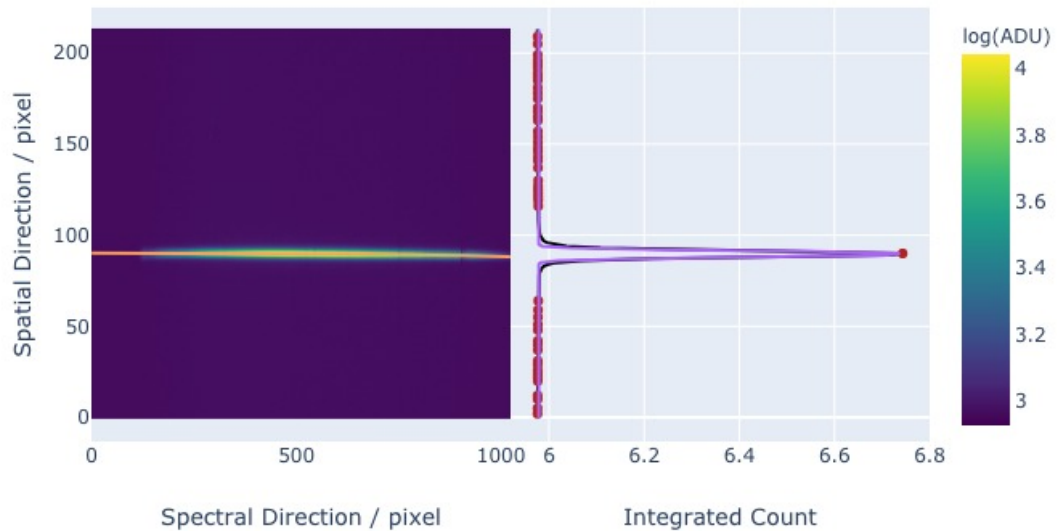
Spectrum 1 : Trace gaussian width = [0.01204678 2.69951126 1.90635725 1.49453735

1.3013829 1.22968109

1.20013513 1.18278048 1.17835079 1.17293229 1.1807976 1.18837918

1.2009496 1.21668759 1.237217 1.26093305 1.28901669 1.36933244

1.37095872 0. ] pixels



```
[6]: # Optimal extracting spectrum by summing over the aperture along the trace
lhs6328.ap_extract(
    apwidth=20,
    display=True,
    renderer='default',
    verbose=False)
hilt102.ap_extract(
    apwidth=20,
    display=True,
    renderer='default',
    verbose=False)
```

/Users/marcolam/git/ASPIRED/aspired/aspired.py:1088: RuntimeWarning:

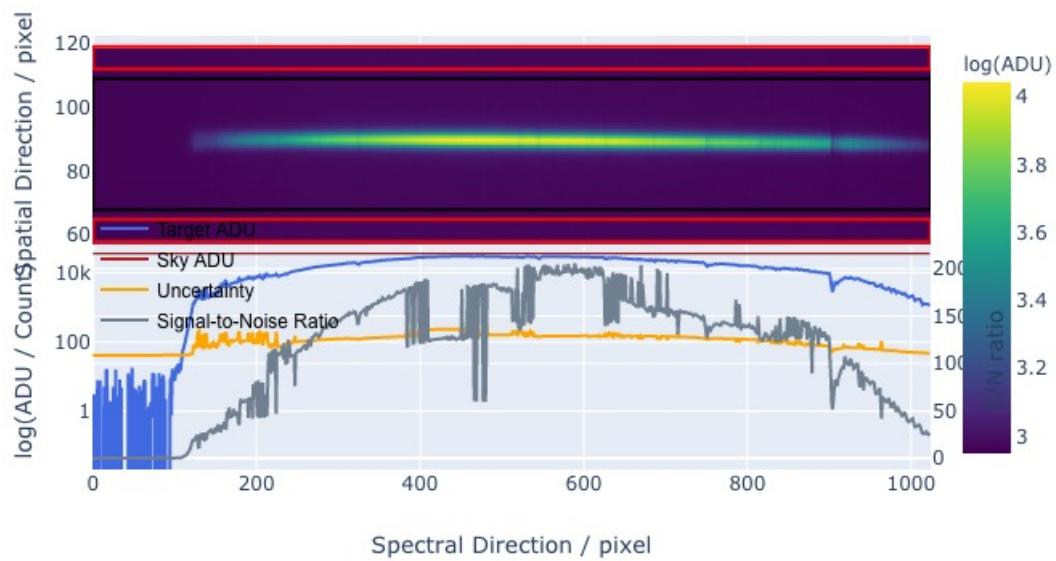
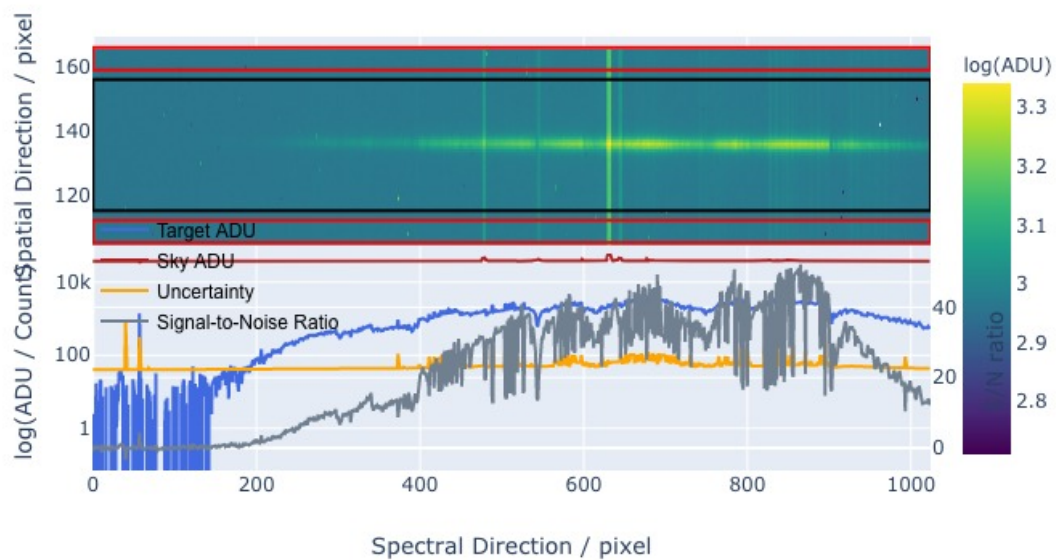
invalid value encountered in log10

/Users/marcolam/git/ASPIRED/aspired/aspired.py:1200: RuntimeWarning:

invalid value encountered in log10

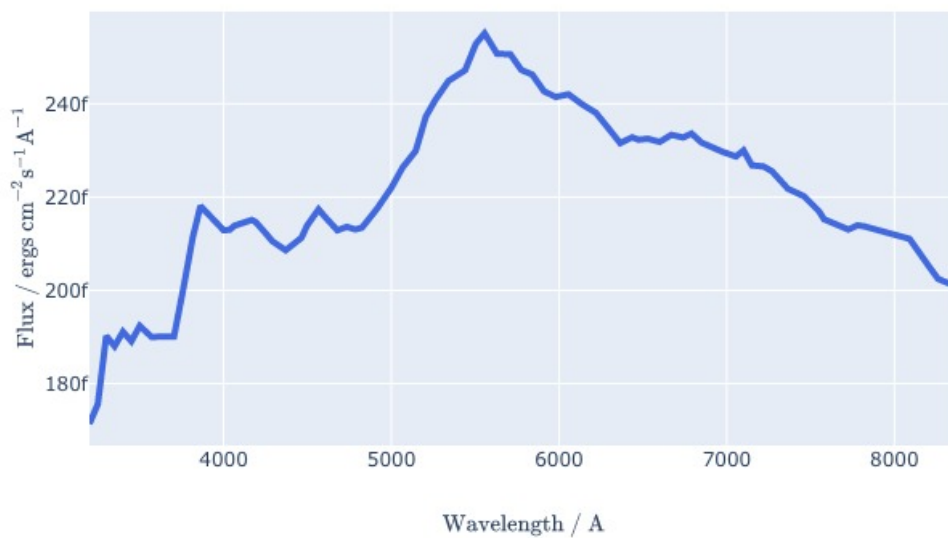
/Users/marcolam/git/ASPIRED/aspired/aspired.py:1201: RuntimeWarning:

invalid value encountered in log10



```
[7]: fluxcal = aspired.StandardFlux(
    target='hiltner102',
    group='irafirs',
    cutoff=0.4,
    ftype='flux'
)
fluxcal.load_standard()
fluxcal.inspect_standard(renderer='default')
```

irafirs : hiltner102 flux



```
[8]: # Placeholder of wavelength calibration
wavecal = type('', (), {}).()
wavecal.pfit_type = 'poly'
wavecal.pfit = [3.17707768e-07, -6.15874242e-04, 5.13807283e+00, 3.
↪ 22724313e+03]
```

```
[9]: # Get the sensitivity curves
lhs6328_reduced = aspired.OneDSpec(
    lhs6328,
    wavecal,
    standard=hilt102,
    wave_cal_std=wavecal,
    flux_cal=fluxcal
)
lhs6328_reduced.apply_wavelength_calibration('all')
```

```
lhs6328_reduced.compute_sencurve(kind='cubic')
lhs6328_reduced.inspect_sencurve(renderer='default')
```

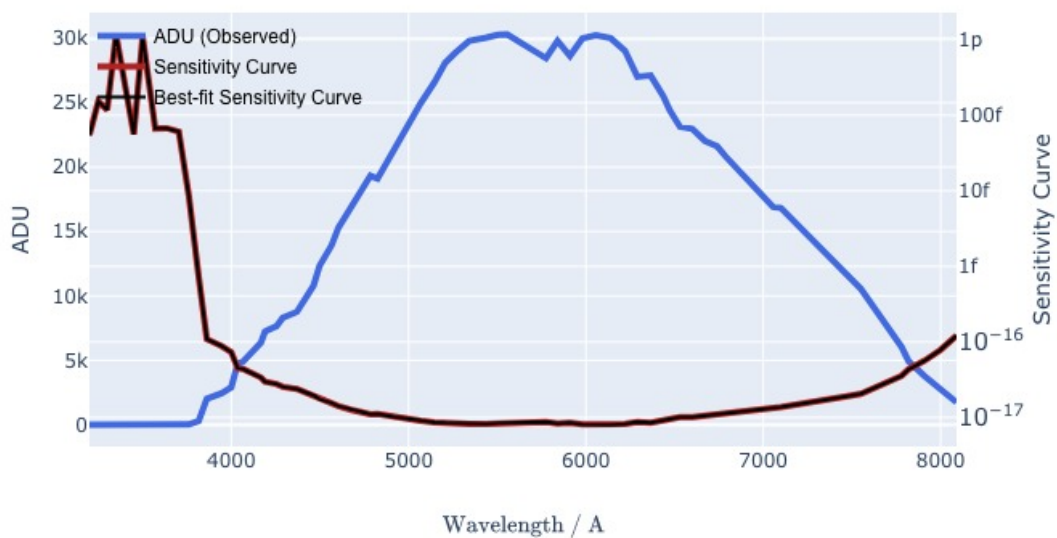
/usr/local/lib/python3.7/site-packages/spectres/spectral\_resampling.py:74:  
UserWarning:

spectres: Part of the new wavelengths specified is outside the range of the  
input data, they are filled with zeros.

/Users/marcolam/git/ASPIRED/aspired/aspired.py:1649: RuntimeWarning:

divide by zero encountered in true\_divide

irafirs : hiltner102



```
[10]: lhs6328_reduced.apply_flux_calibration('all')
lhs6328_reduced.inspect_reduced_spectrum('all', renderer='default')
```

