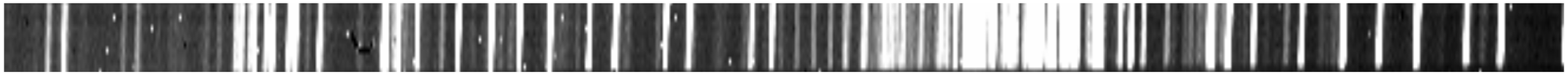
Flame: a Flexible Data Reduction Pipeline for LUCI



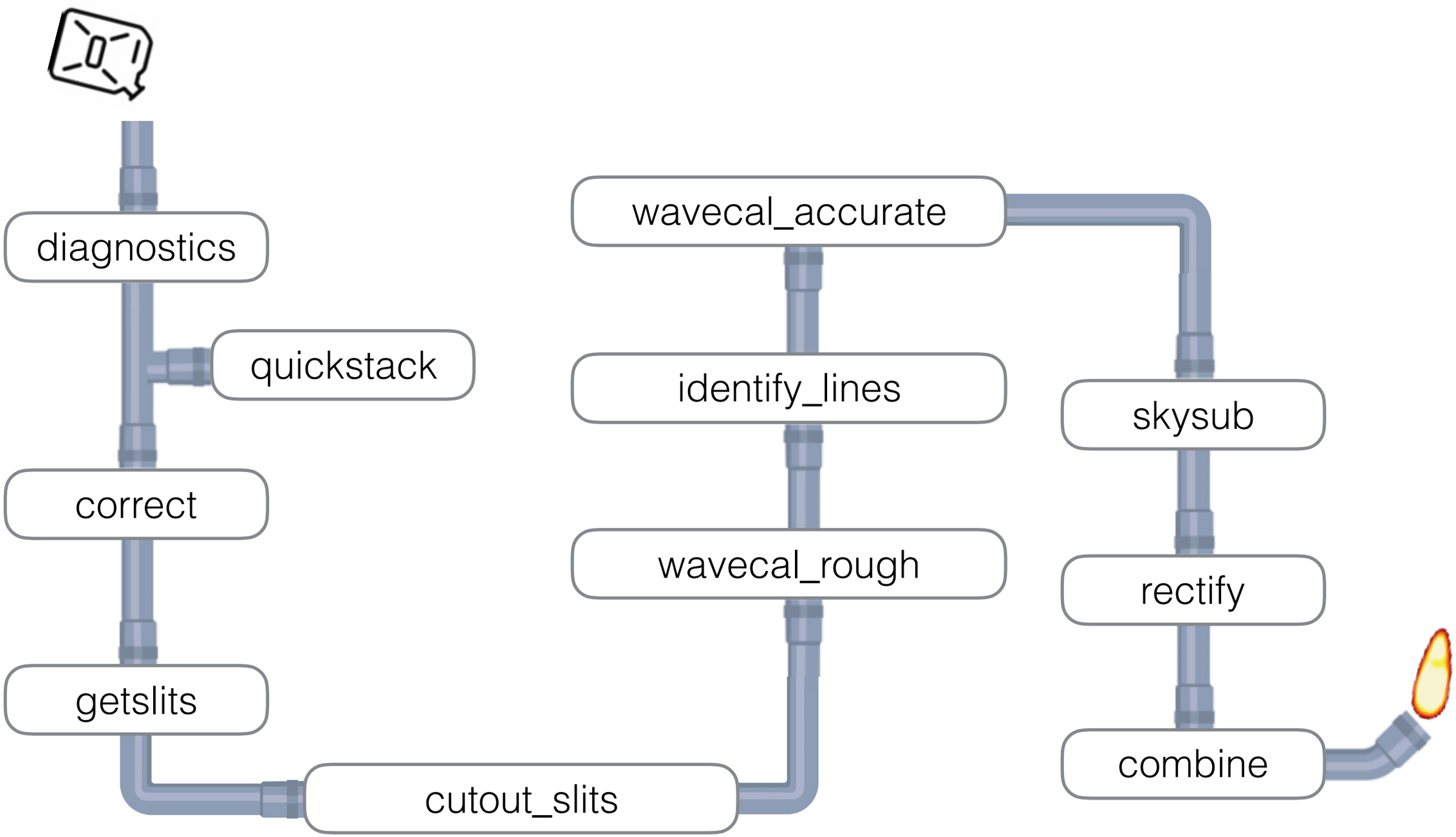
Sirio Belli
with Alessandra Contursi
(MPE)

Flexible

Easy to customize the data reduction

Easy to adapt to other instruments

Structure of the Pipeline



The Driver File

1. inputs

```
input = flame_create_input()
input.science_filelist = 'science.txt'
input.AB_subtraction = 1
input.star_y_A = 1281
input.star_y_B = 1300
input.reduce_only_oneslit = 0
```

2. initialization

```
fuel = flame_initialize_luci(input)
```

3. data reduction

```
flame_diagnostics, fuel
flame_quickstack, fuel
flame_correct, fuel
flame_getslits, fuel
flame_cutout_slits, fuel
flame_wavecal_rough, fuel
flame_identify_lines, fuel
flame_wavecal_accurate, fuel
flame_skysub, fuel
flame_rectify, fuel
flame_combine, fuel
```

Information is carried by only one IDL structure, "`fuel`"

Inputs

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input = flame_create_input()
input.science_filelist = 'science.txt'
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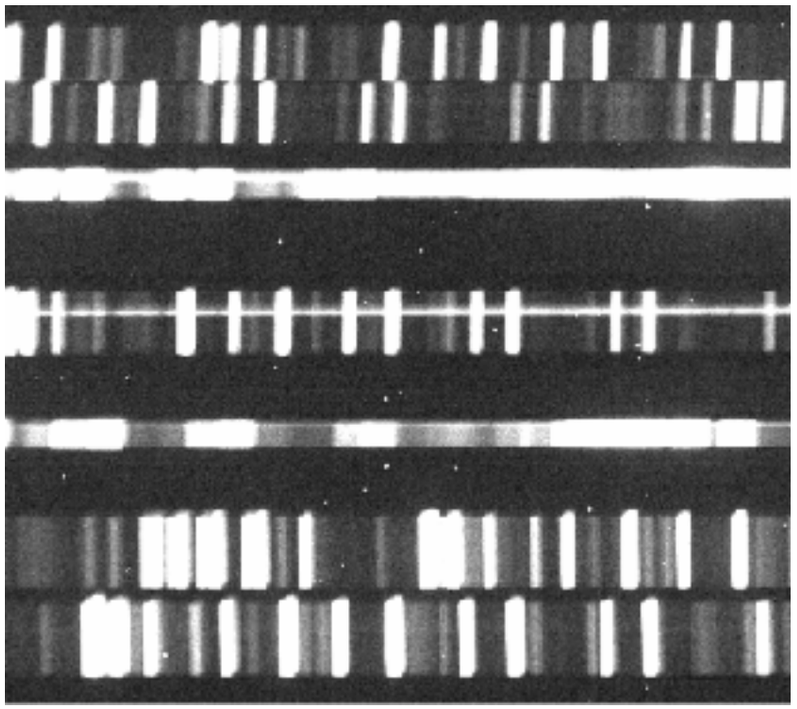
input.star_y_A = 1281
input.star_y_B = 1300
input.reduce_only_oneslit = 0
```

ASCII file

```
/Users/sirio/data/20160527/luci2.20160527.0050.fits
/Users/sirio/data/20160527/luci2.20160527.0051.fits
/Users/sirio/data/20160527/luci2.20160527.0052.fits
/Users/sirio/data/20160527/luci2.20160527.0053.fits
/Users/sirio/data/20160527/luci2.20160527.0054.fits
/Users/sirio/data/20160527/luci2.20160527.0055.fits
/Users/sirio/data/20160527/luci2.20160527.0056.fits
```



Always reserve a slit for a reference star!

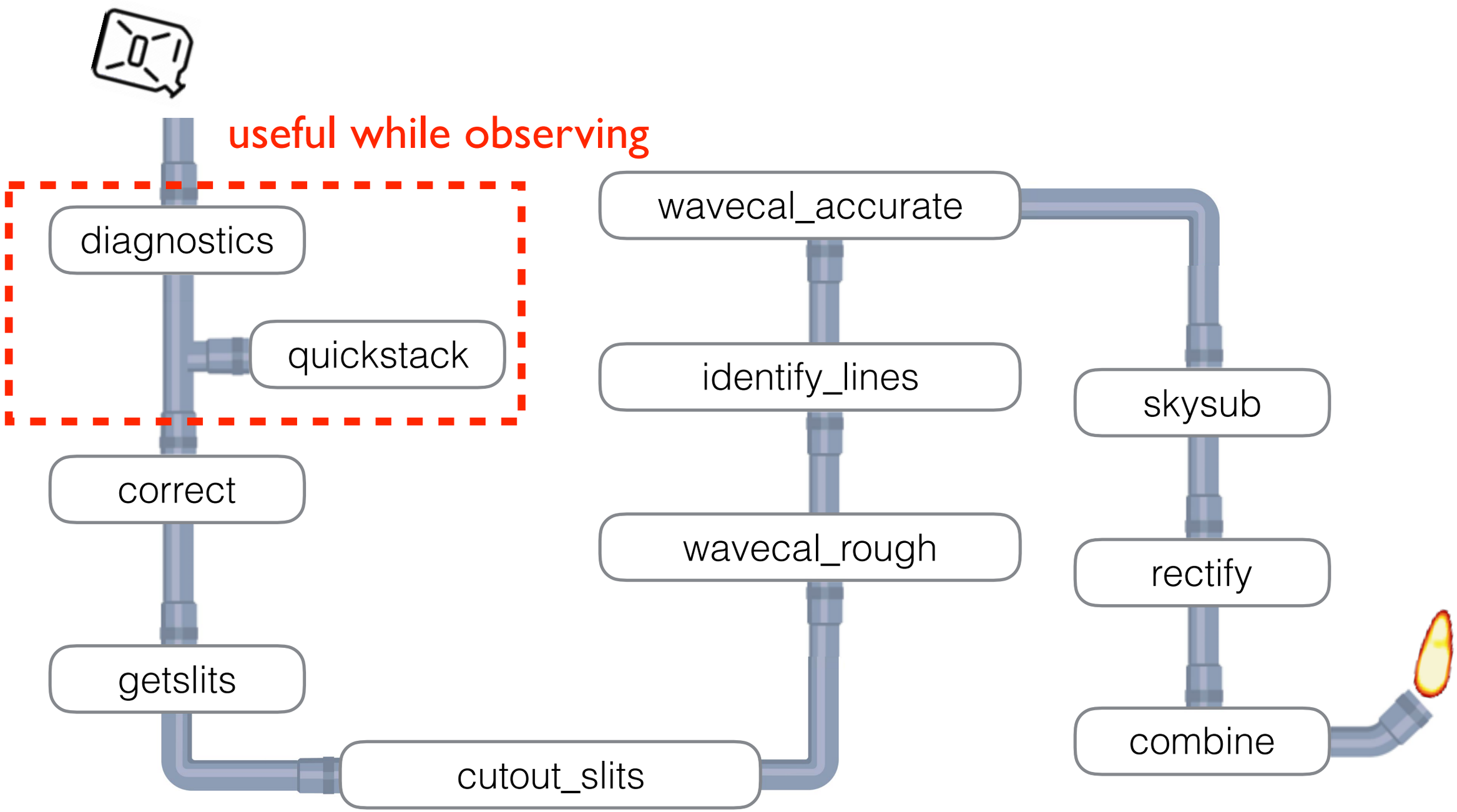
Initialization

```
fuel = flame_initialize_luci(input)
```

- check input
- create directories
- read FITS header
- calculate expected wavelength, slit position, etc.

<u>This is the only instrument-dependent part of the pipeline</u>

Structure of the Pipeline



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Identify the star trace in each frame and measure its properties

# frame	offset	FWHM	flux	position
0050	A	1.11	89.4	559.1
0051	B	1.21	87.8	546.9
0052	A	1.35	108	558.8
0053	B	1.19	92.4	546.9
0054	A	1.26	93.7	559.0
0055	B	1.46	97.2	547.3
0056	A	1.32	99.2	559.3
0057	B	1.21	83.8	547.0
0058	A	1.37	104	559.0
0059	B	1.37	97.0	546.7
0060	A	1.42	98.4	558.7
0061	B	1.54	87.8	546.4
0062	A	1.32	93.3	558.4
0063	B	1.42	93.6	546.5
0064	A	1.36	97.8	558.9

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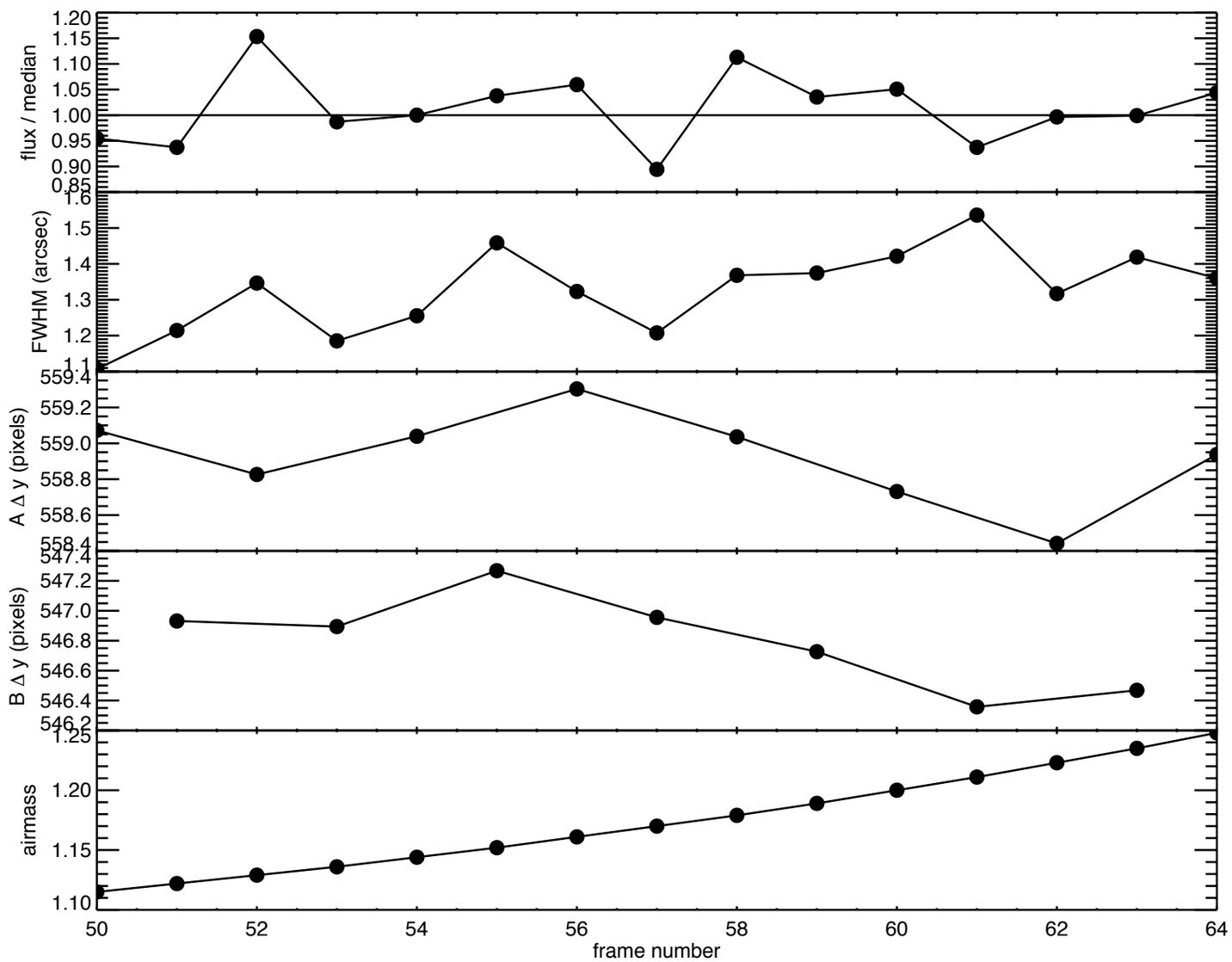

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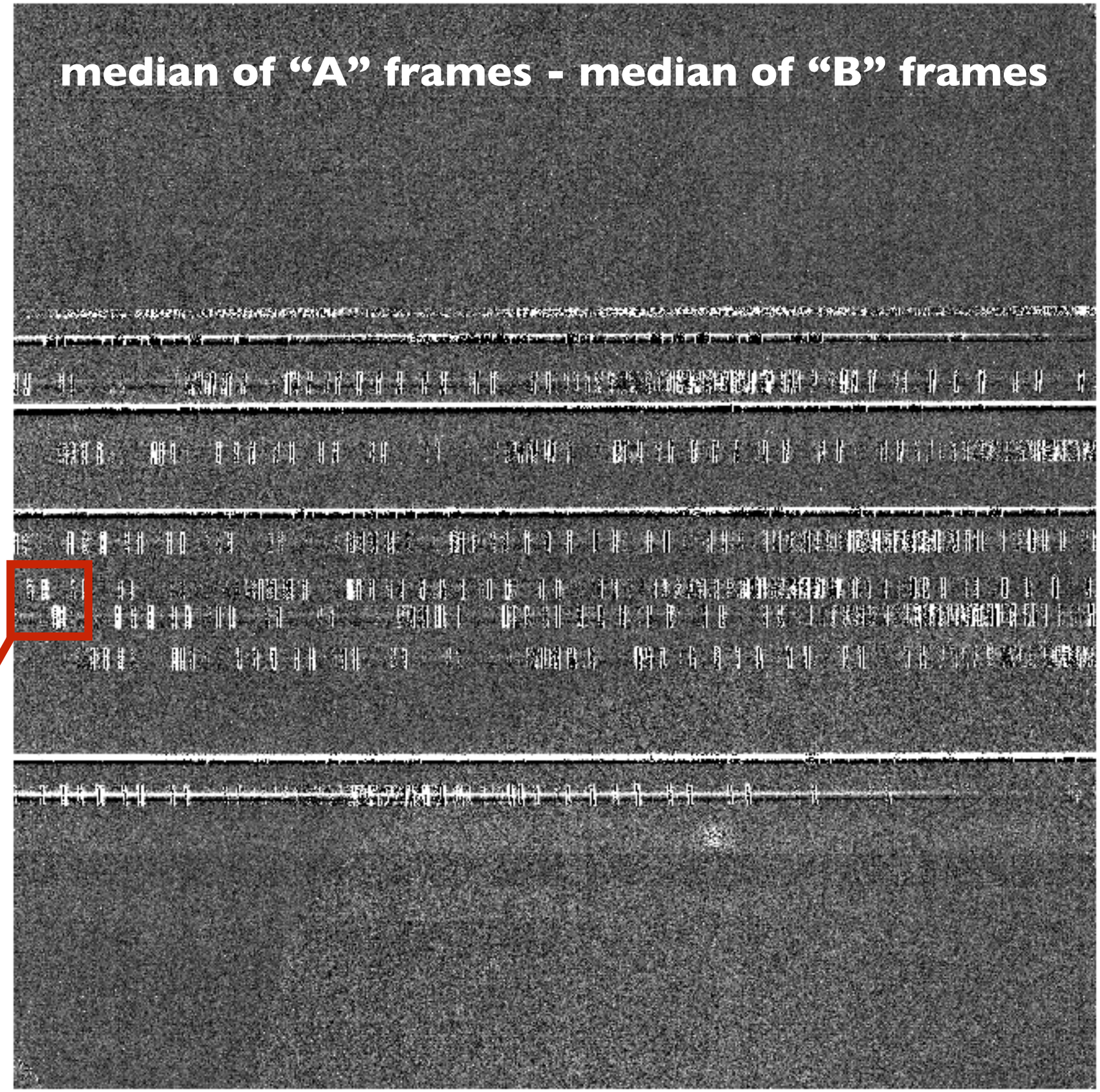

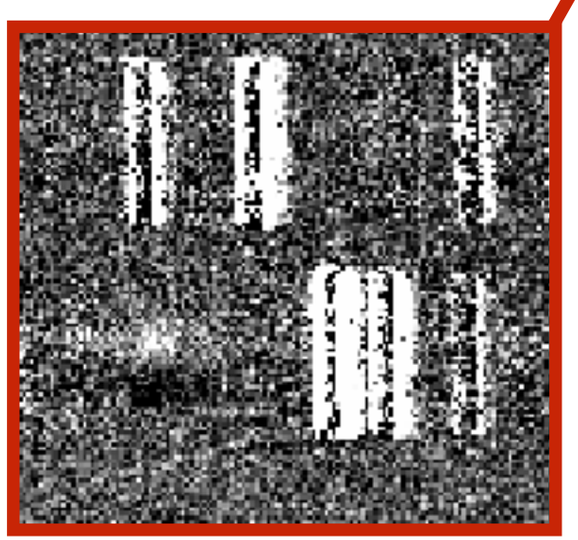

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```

- bad pixel masking
- (cosmic ray detection)
- (dark subtraction)
- linearization correction
- flat fielding
- convert from ADU to e^-/s
- create error spectrum

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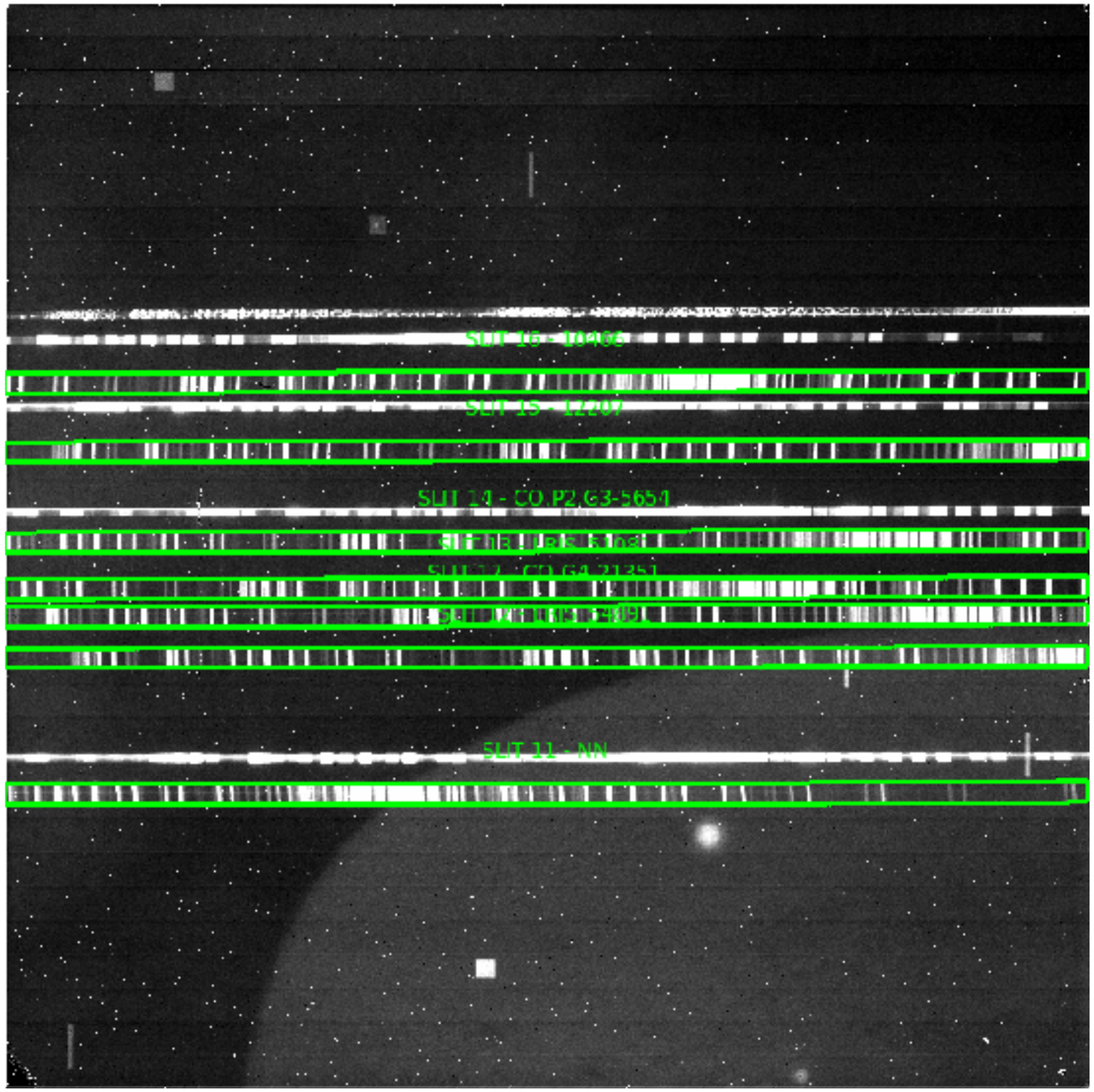

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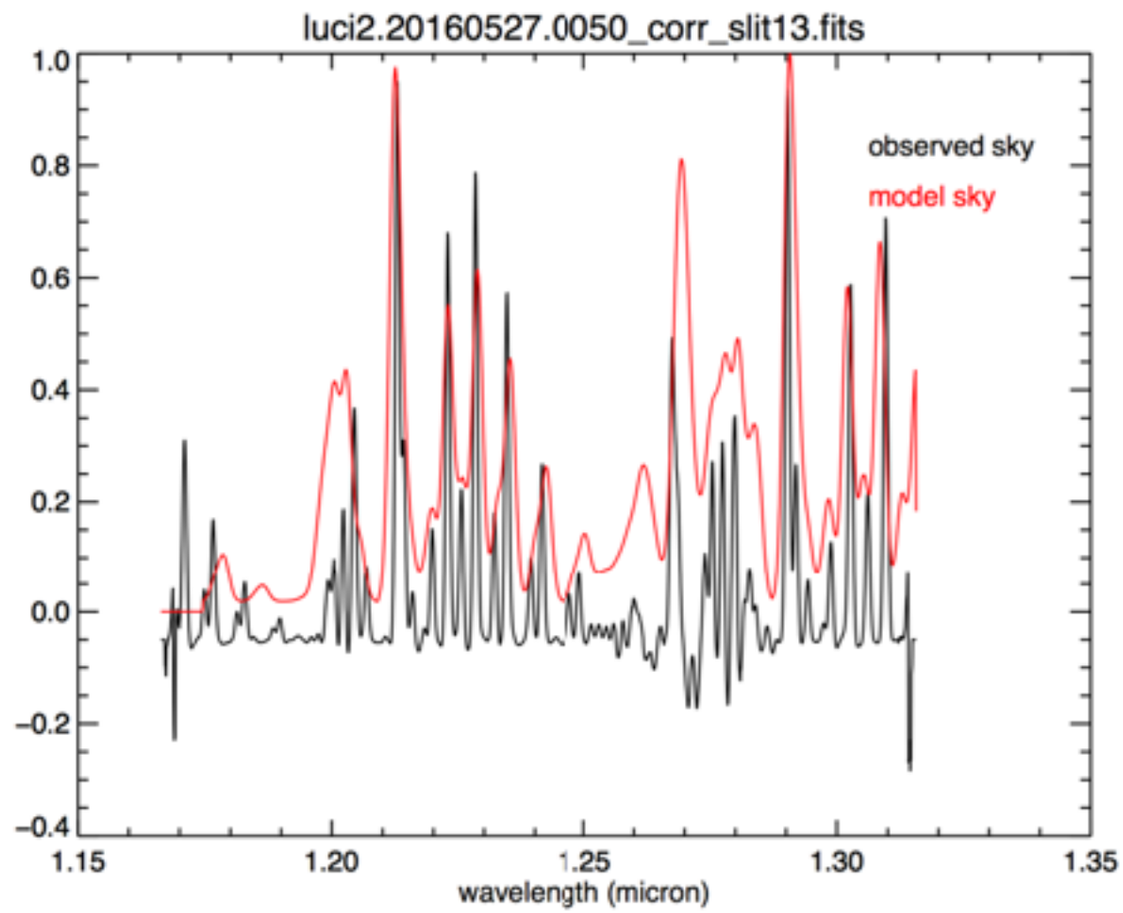

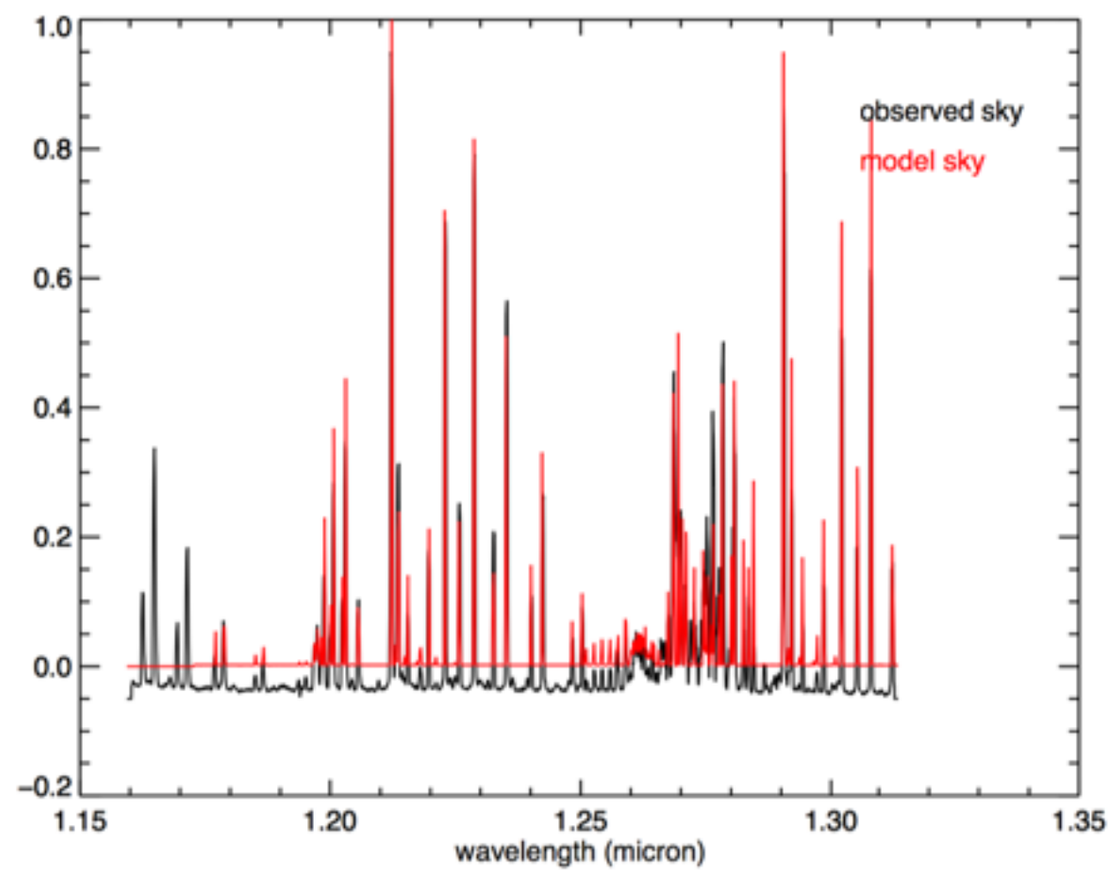

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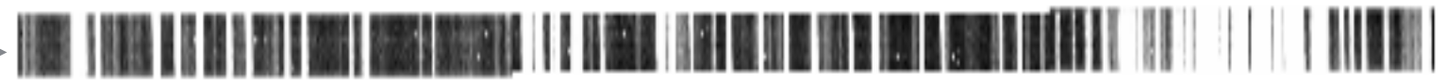
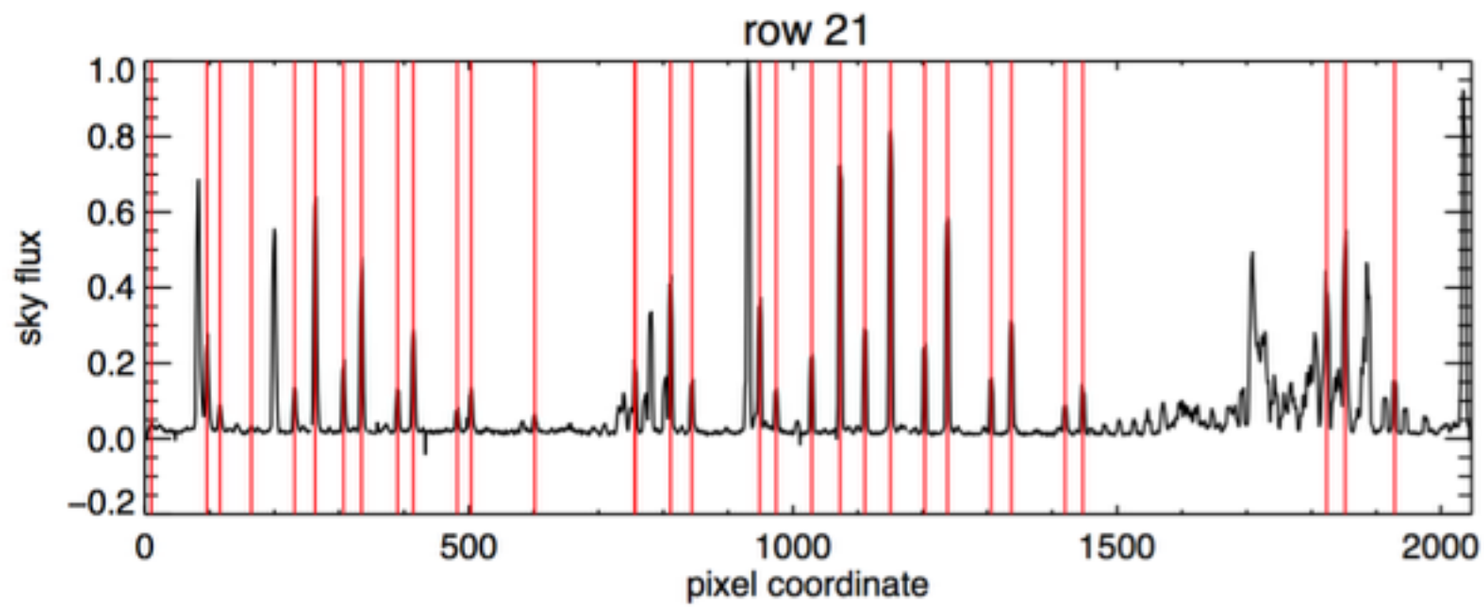
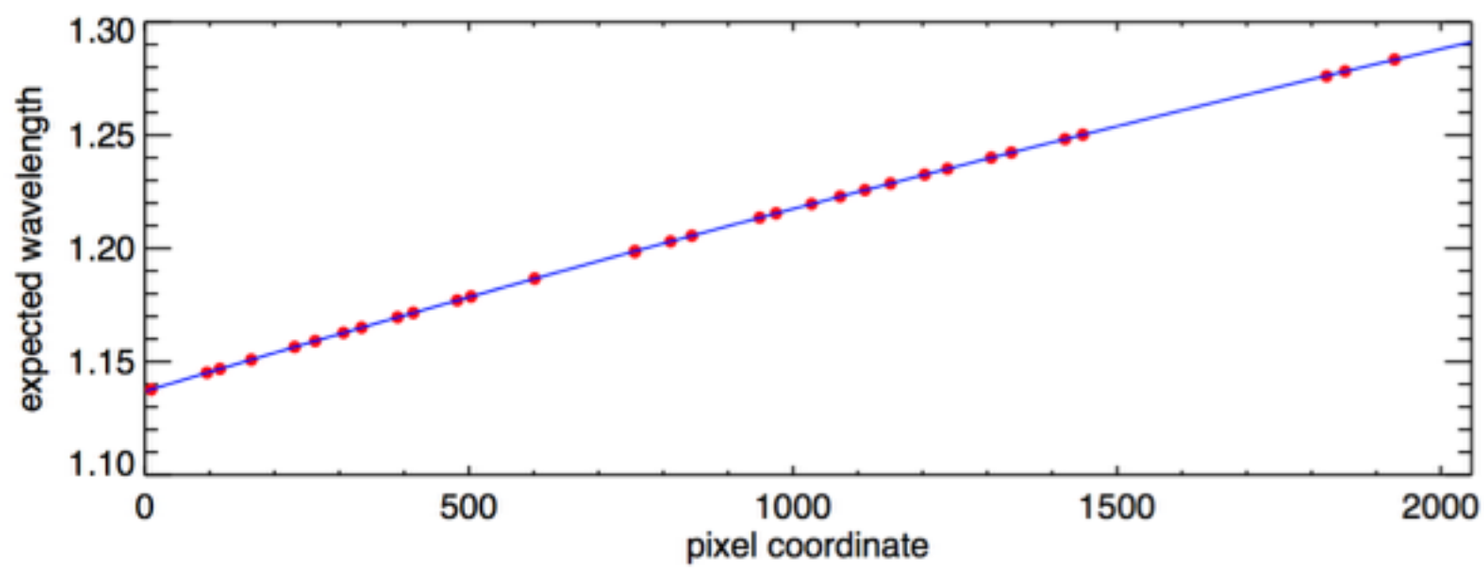
```

row 21 →







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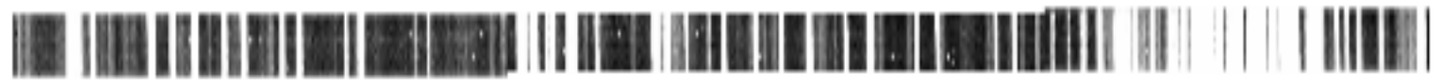

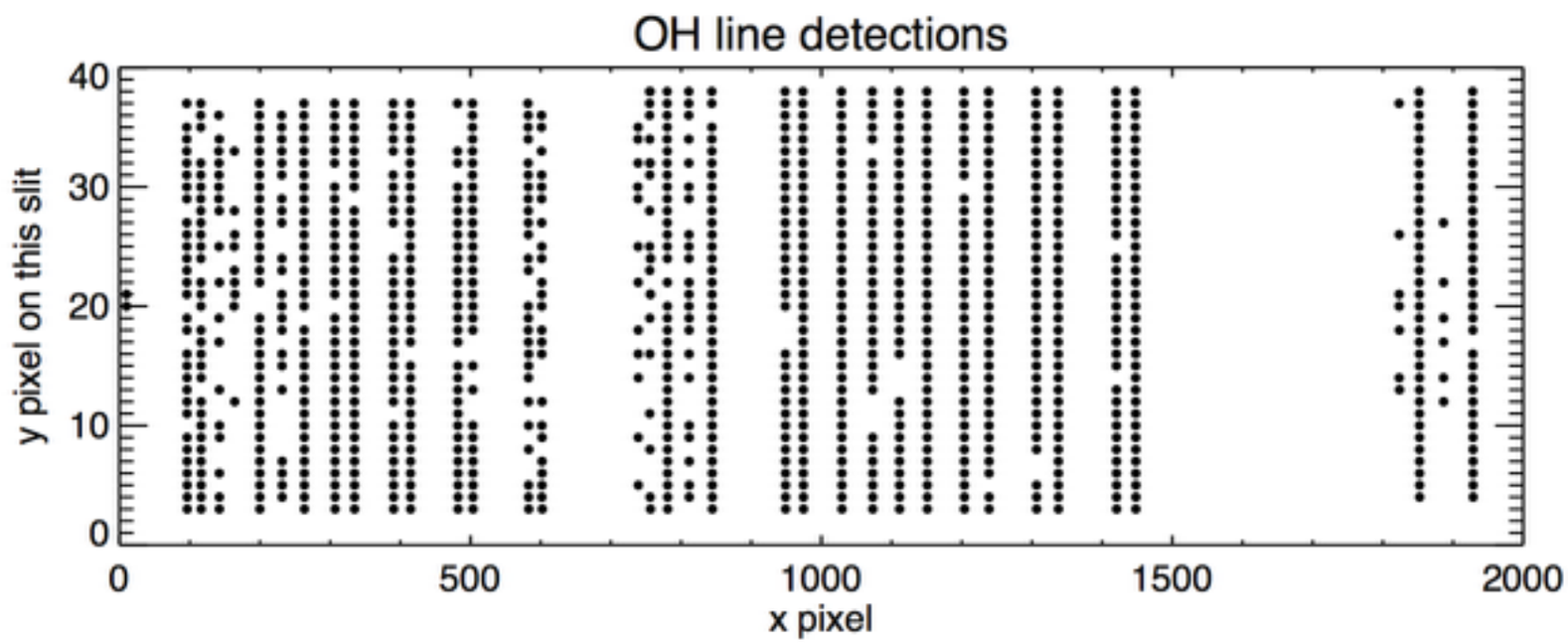

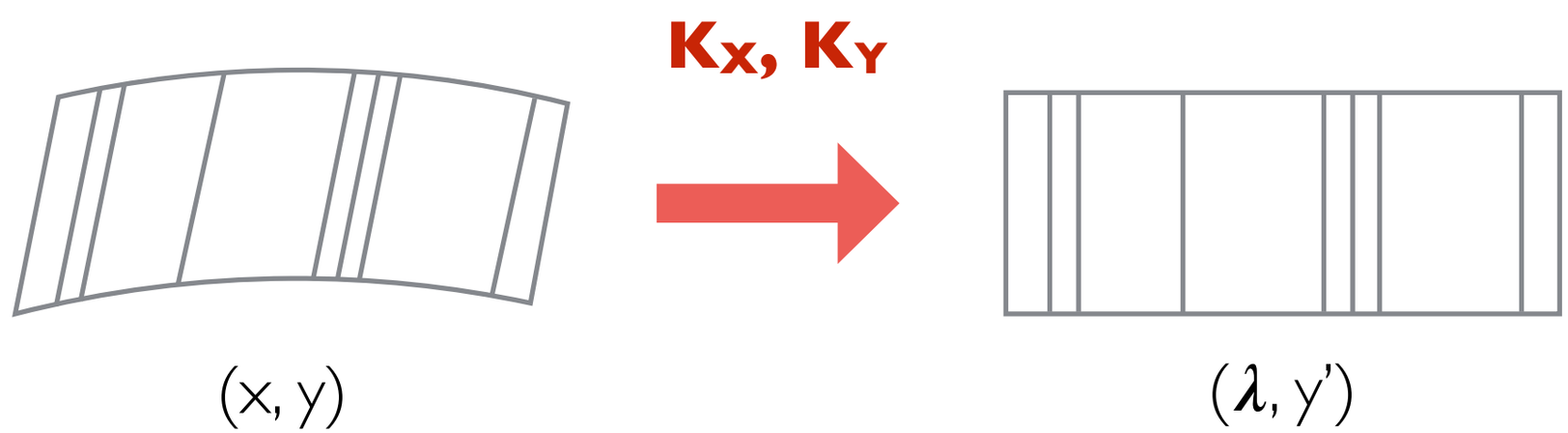

calculate transformation matrices

```
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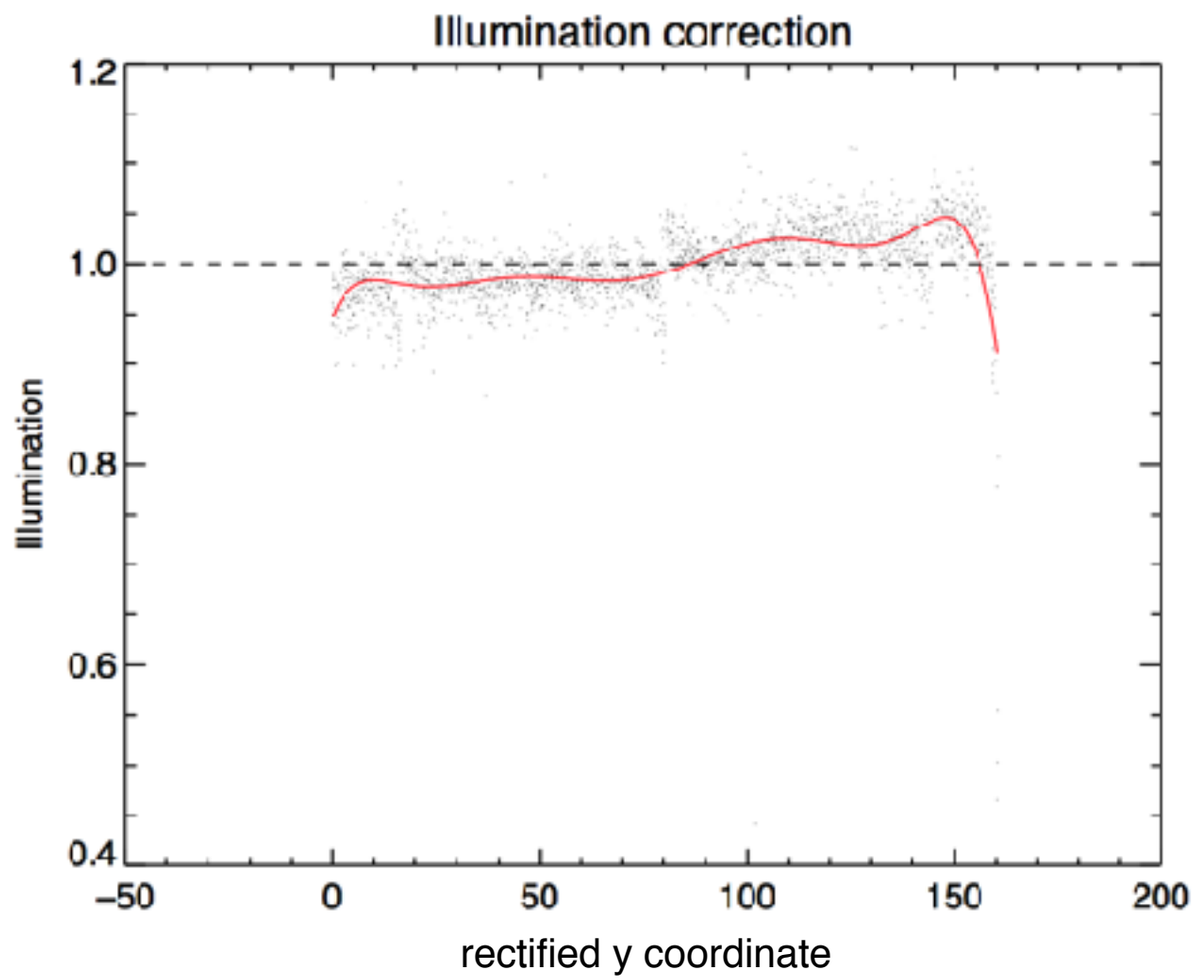

Use OH lines to calculate illumination correction

no need for "slit" flat field

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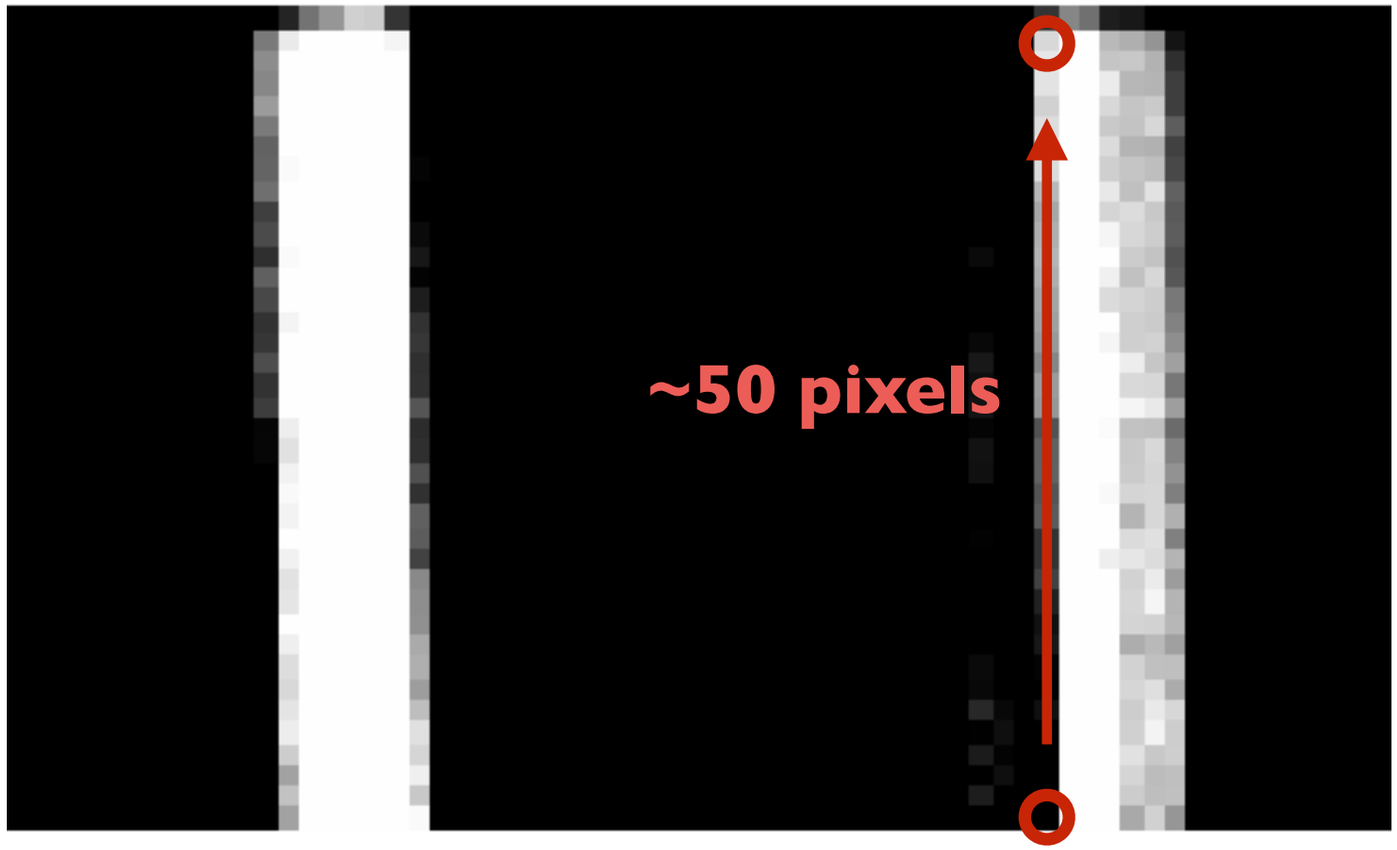
Kelson (2003) optimal sky subtraction



~50 measurements at slightly different wavelengths

we can measure the sky line profile with ~50x higher spectral resolution

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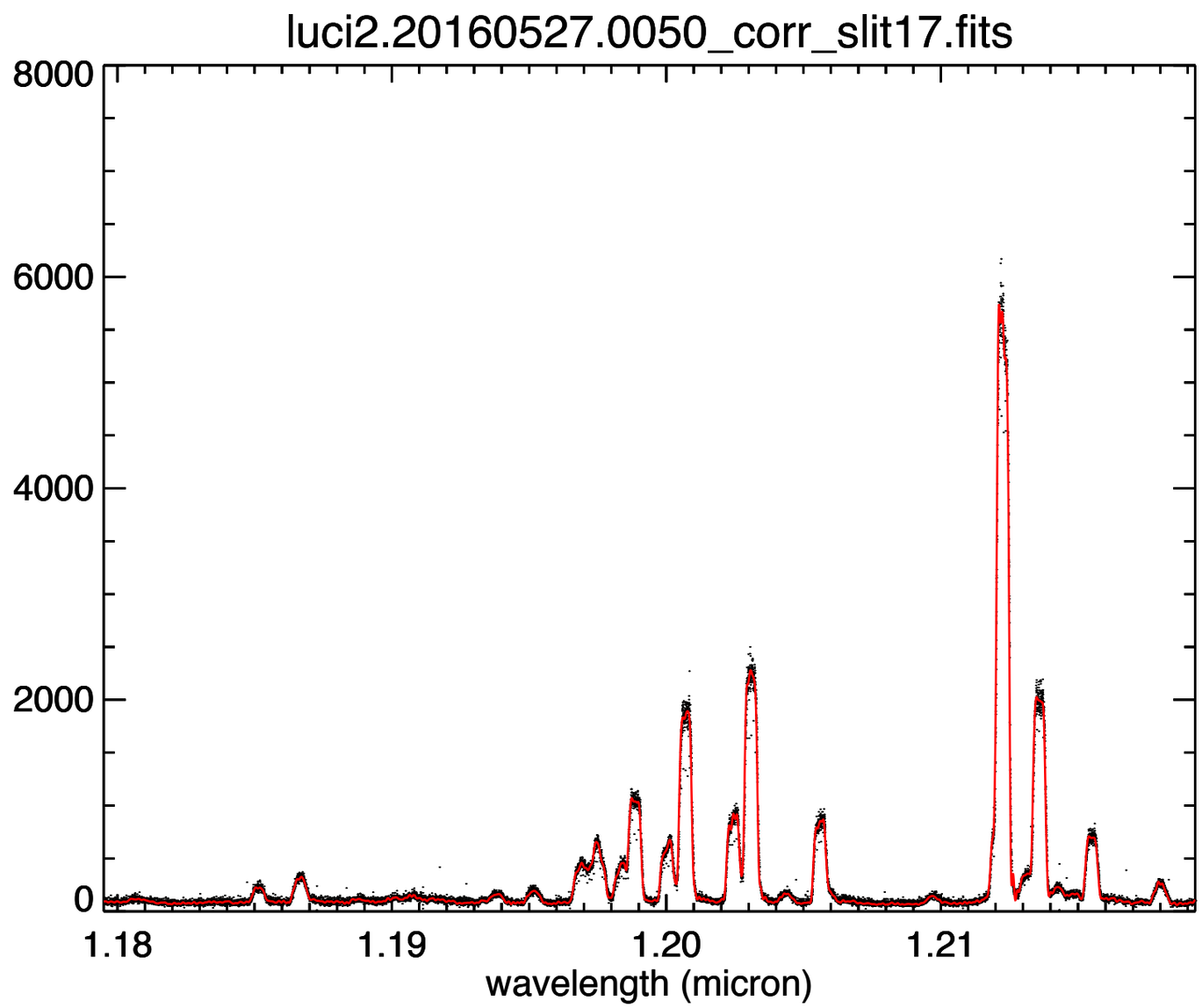

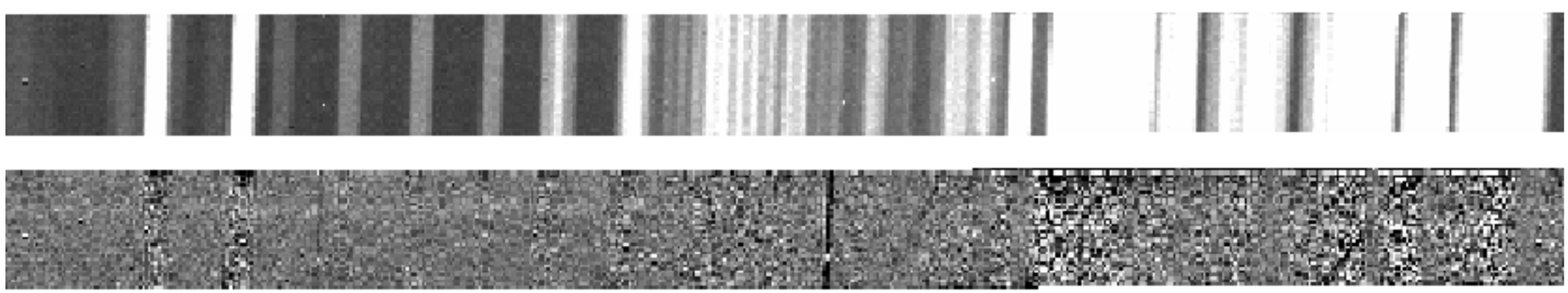

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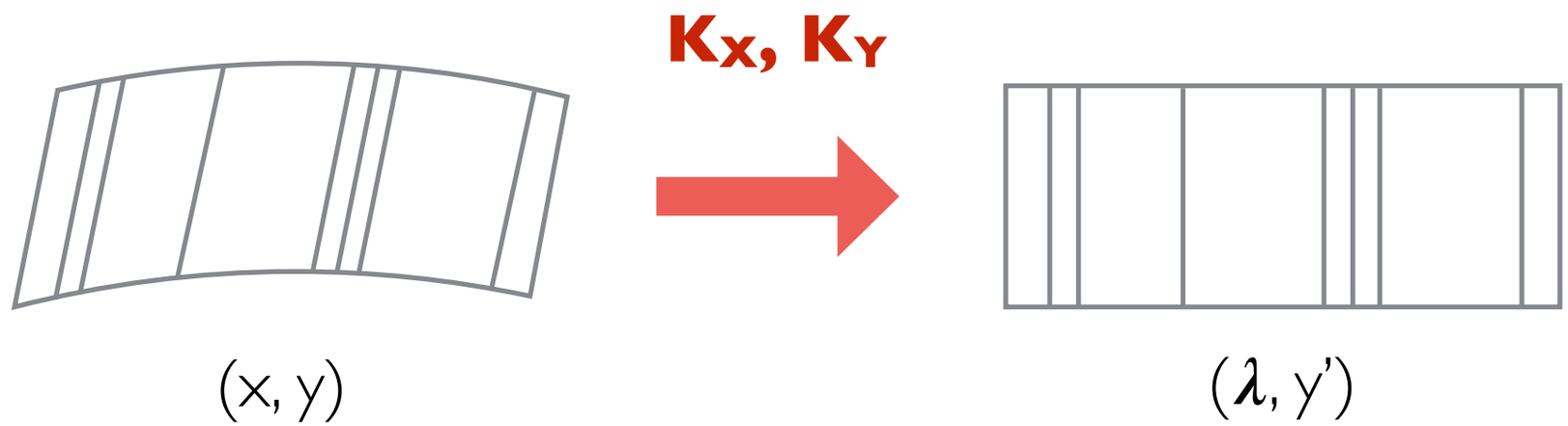
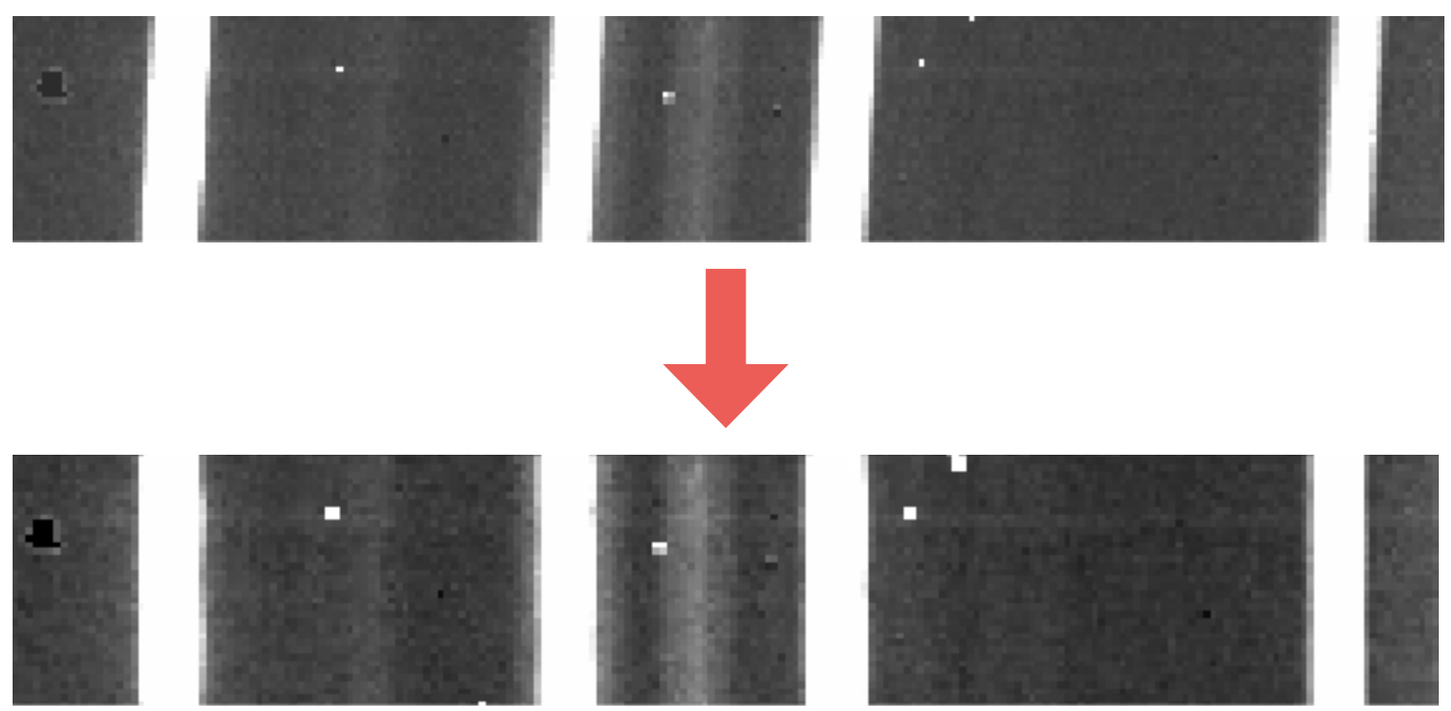


<u>only</u> step with interpolation of data

takes care of distortion, vertical drift, and wavelength calibration



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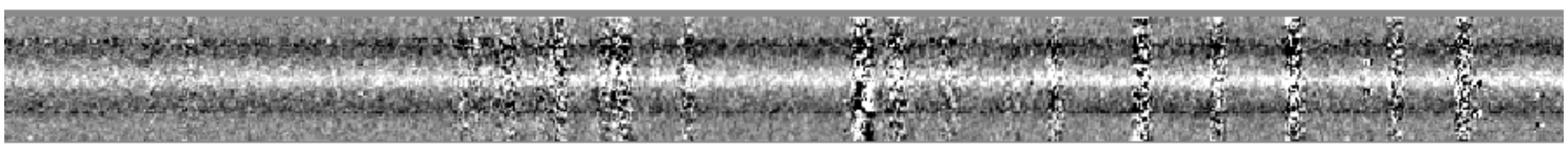
```

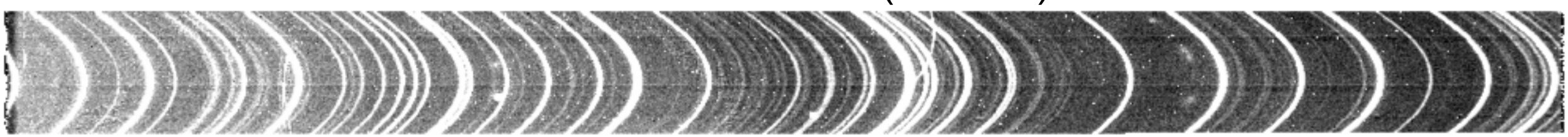
Sigma-clipped,
mean-combined
(A-B) + (B-A) stack



Example

ARGOS+LUCI, H band, curved slit on a gravitational arc

one raw frame (150 s)



reduced data set (12 frames)

To Do

- wavelength solution using lamp arcs
- 1-D extraction
- testing
- detailed comparison with INAF pipeline

Google flame data reduction pipeline

https://github.com/siriobelli/flame

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Flame data reduction pipeline

235 commits 4 branches 3 releases 1 contributor

Branch: master New pull request Clone or download

siriobelli cleanup Latest commit cc2753a a day ago

data	added lines in the K band measured from a model of the sky spectrum	21 days ago
docs	updated manual	a day ago
lib	added la_cosmic	2 months ago
pro	cleanup	a day ago
README.md	added manual	11 months ago