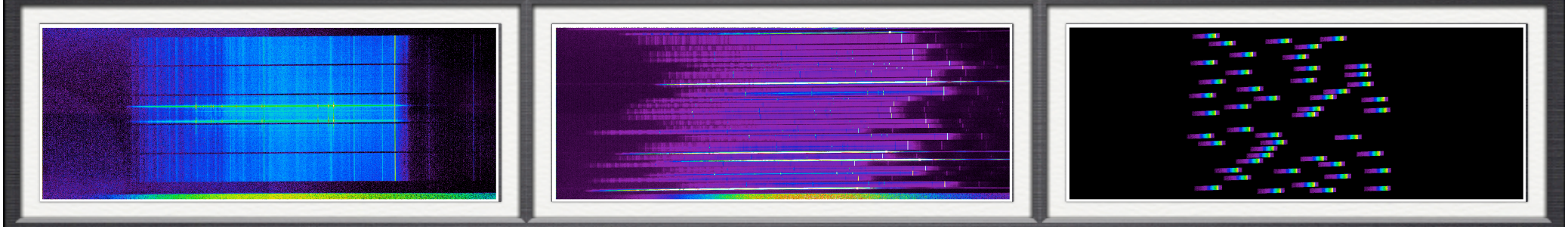
The MODS Pipeline

Reduction and Calibration of MODS Data



Kevin Croxall - OSU

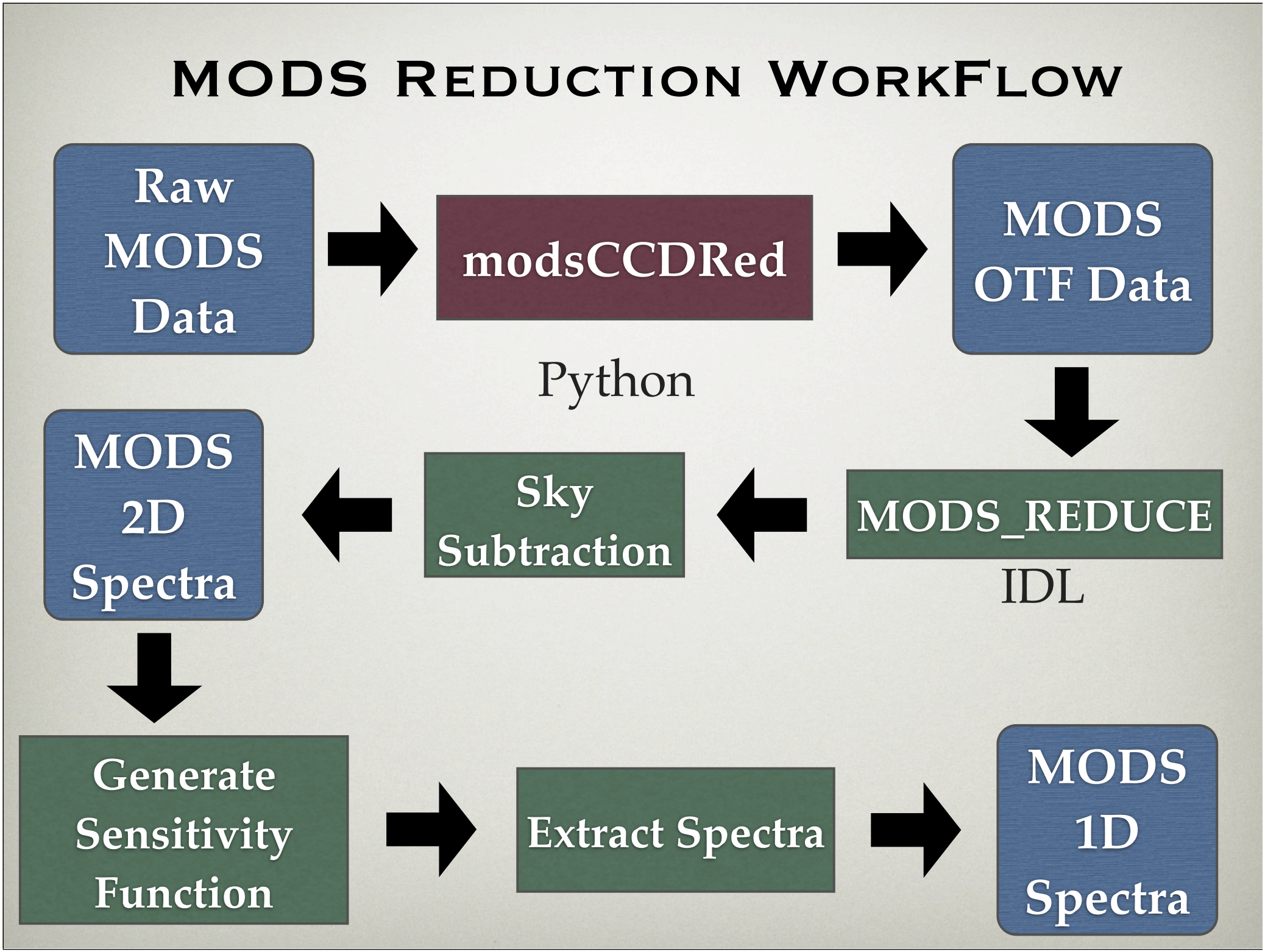
LBT Users Meeting - March 23, 2014

MODS Data Reduction

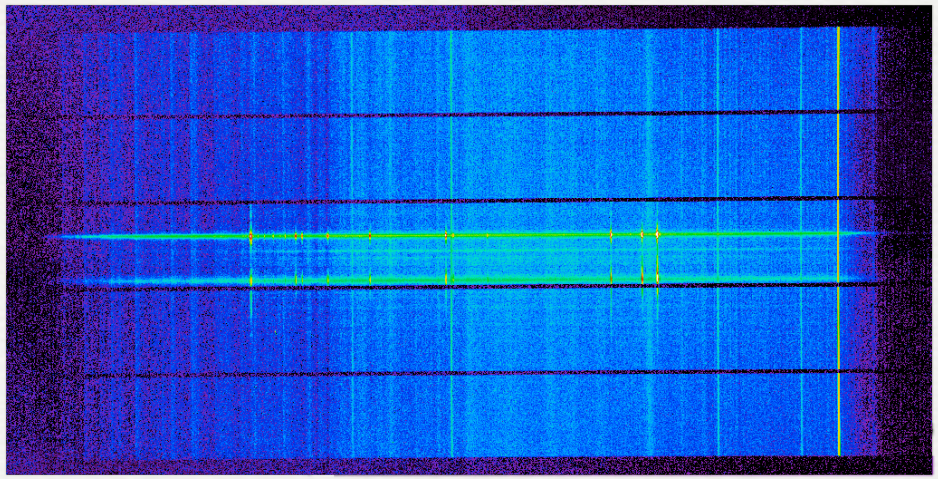
Goals and Vision

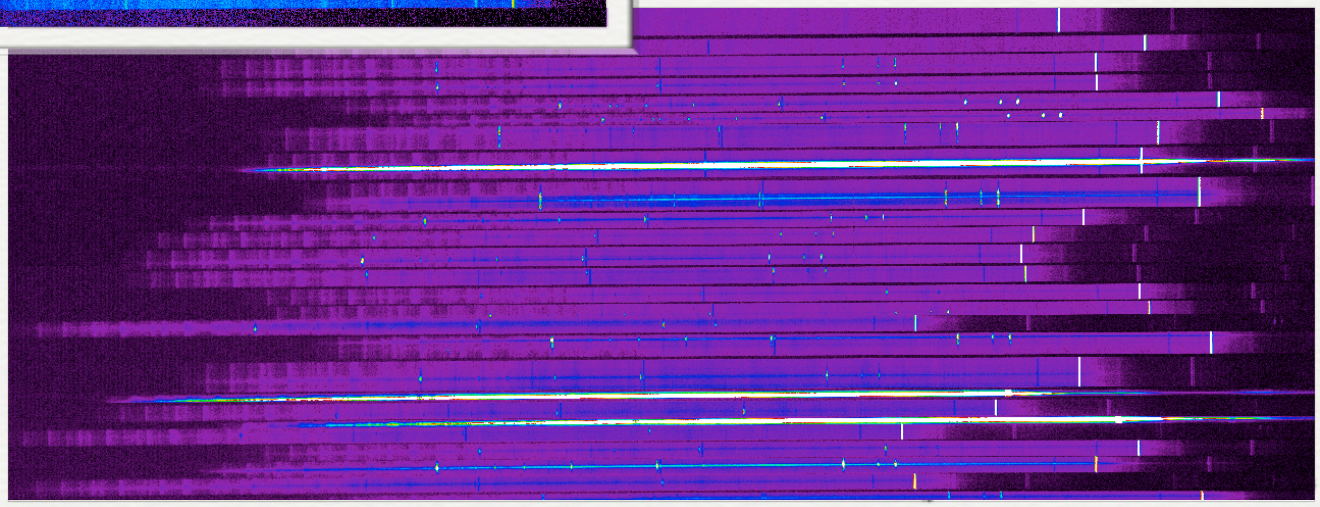
- High Quality Reduced Data Product
- Balance Automation Against Interaction
- Ease of Use
- Efficient & Rapid Execution
- Well Integrated Output Data

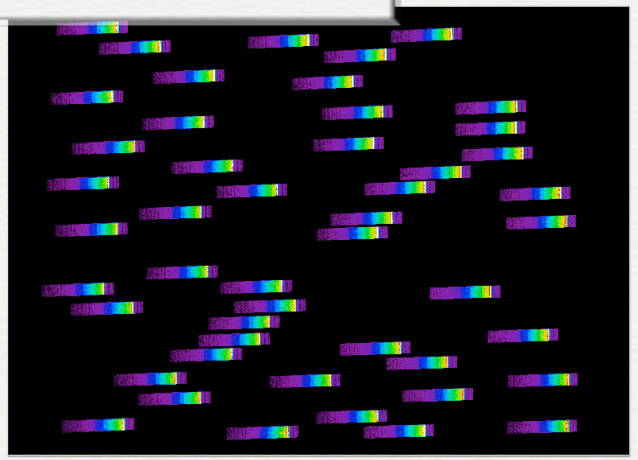
MODS Reduction WorkFlow



All Data flow through the same Pipeline

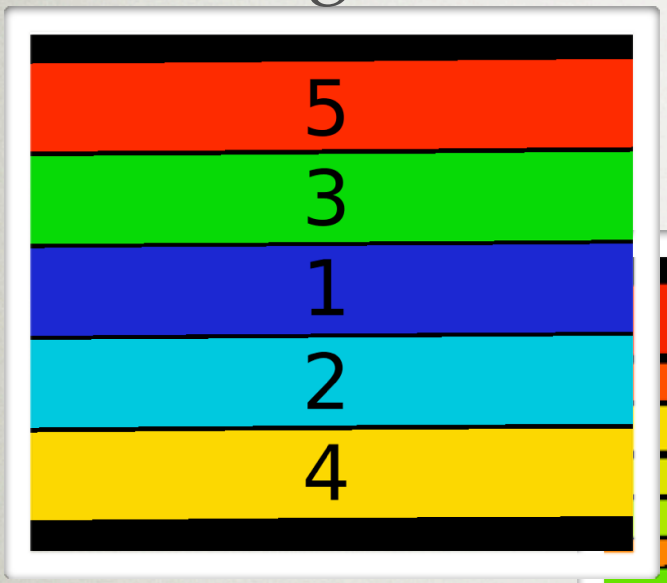




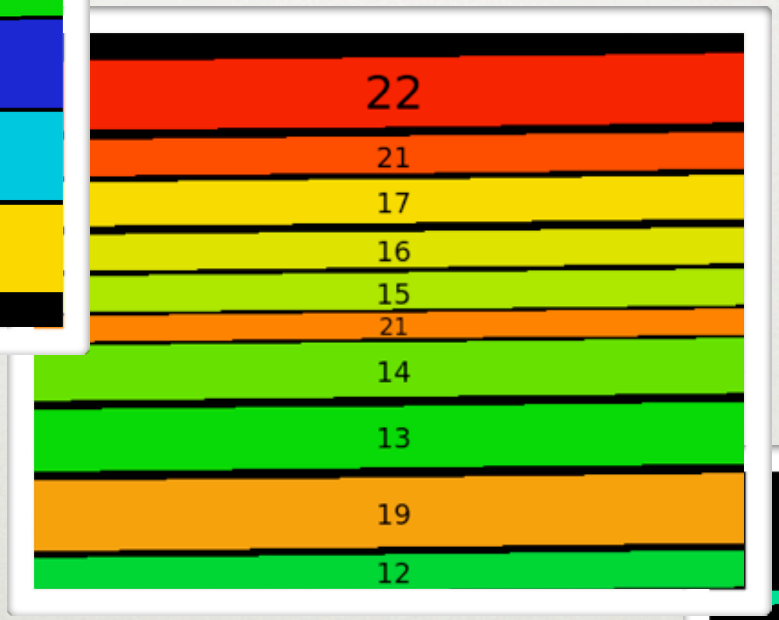


Identify Slit Locations

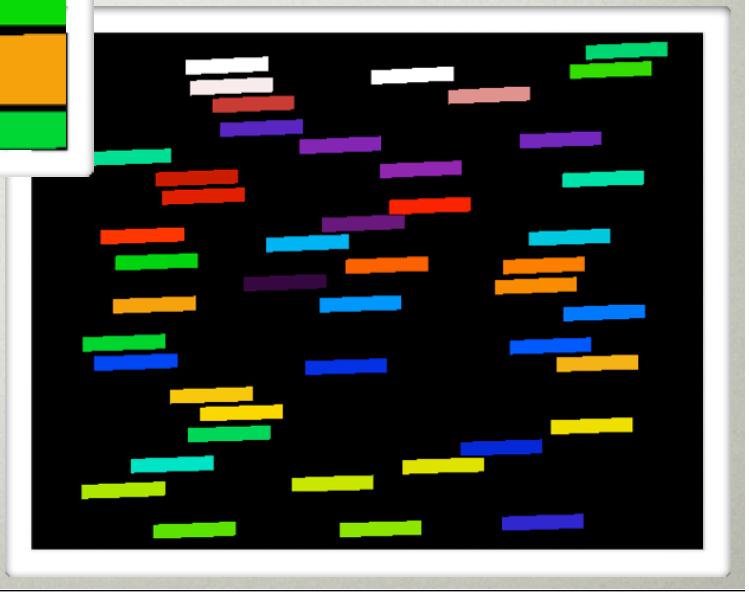
Long-Slit



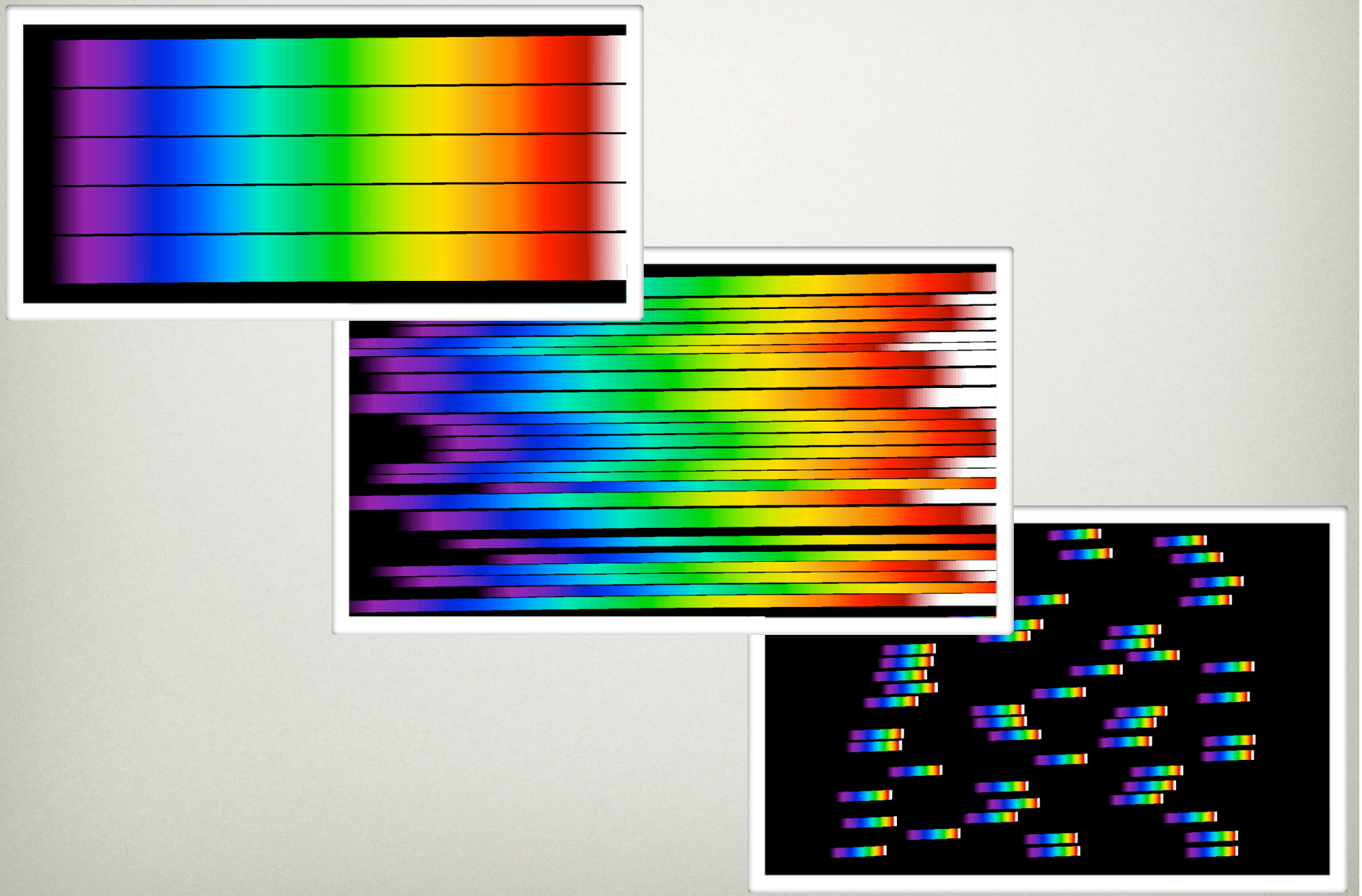
MOS Mask



Prism Mode



Wavelength Calibration Maps



B-Spline Sky Subtraction

```
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```
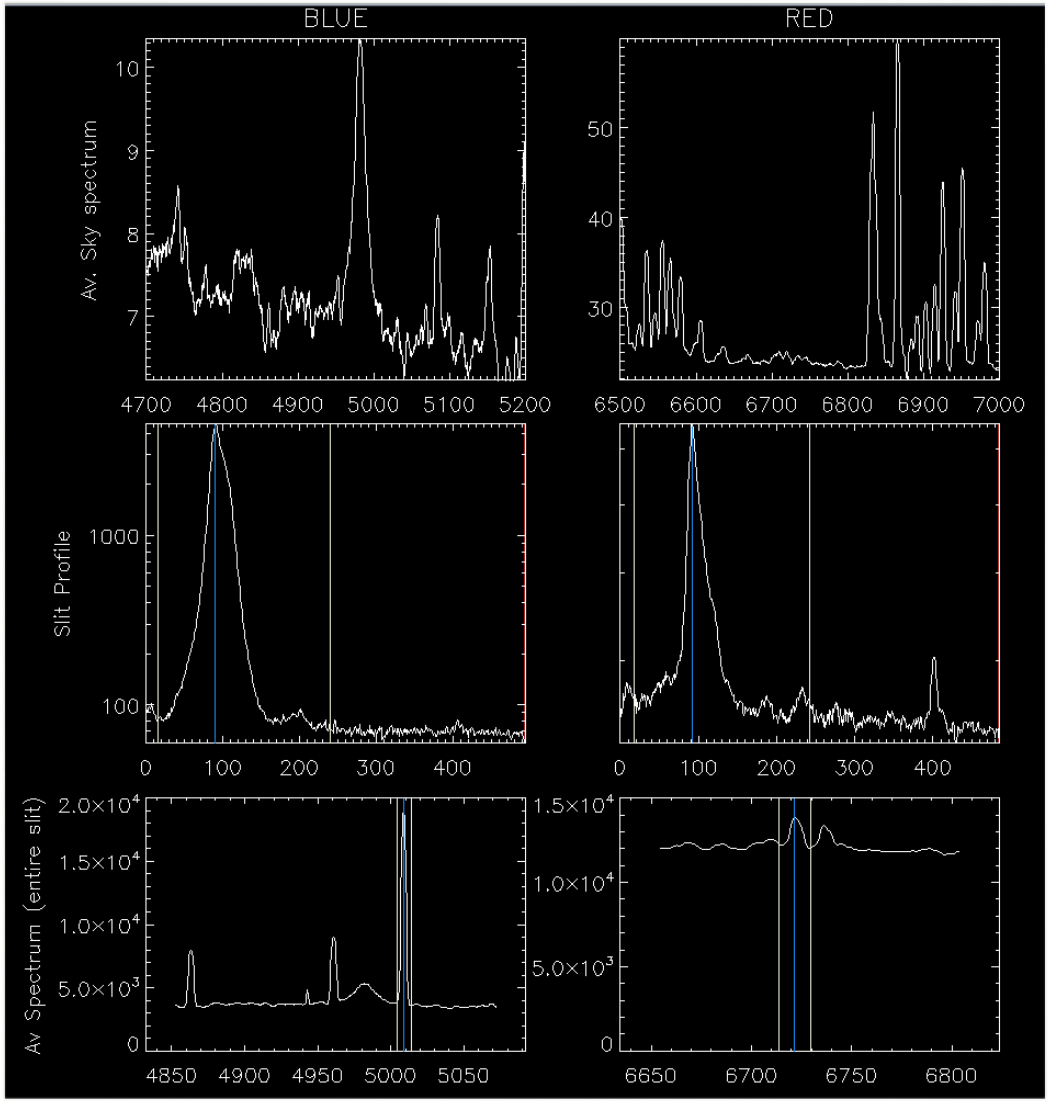
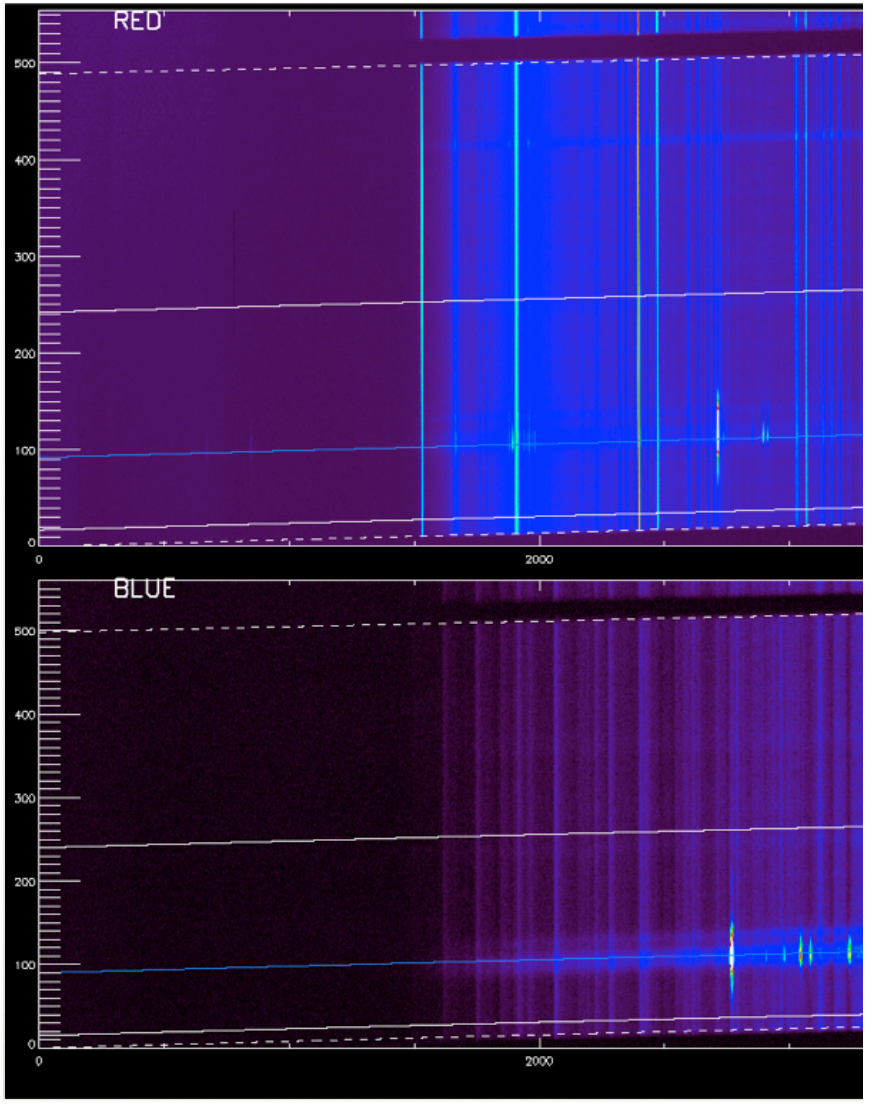
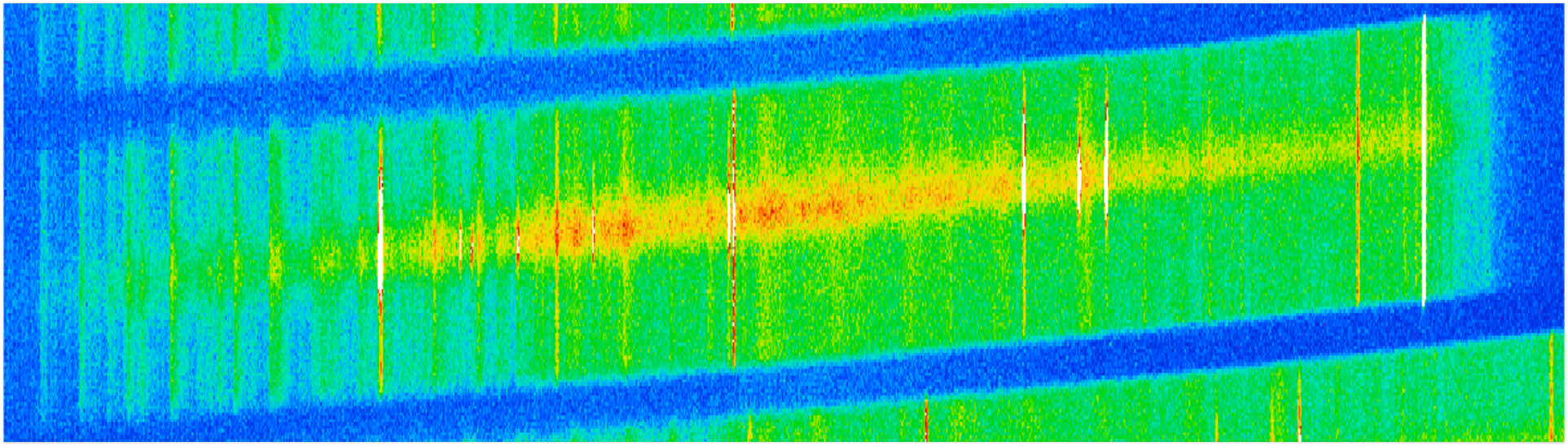
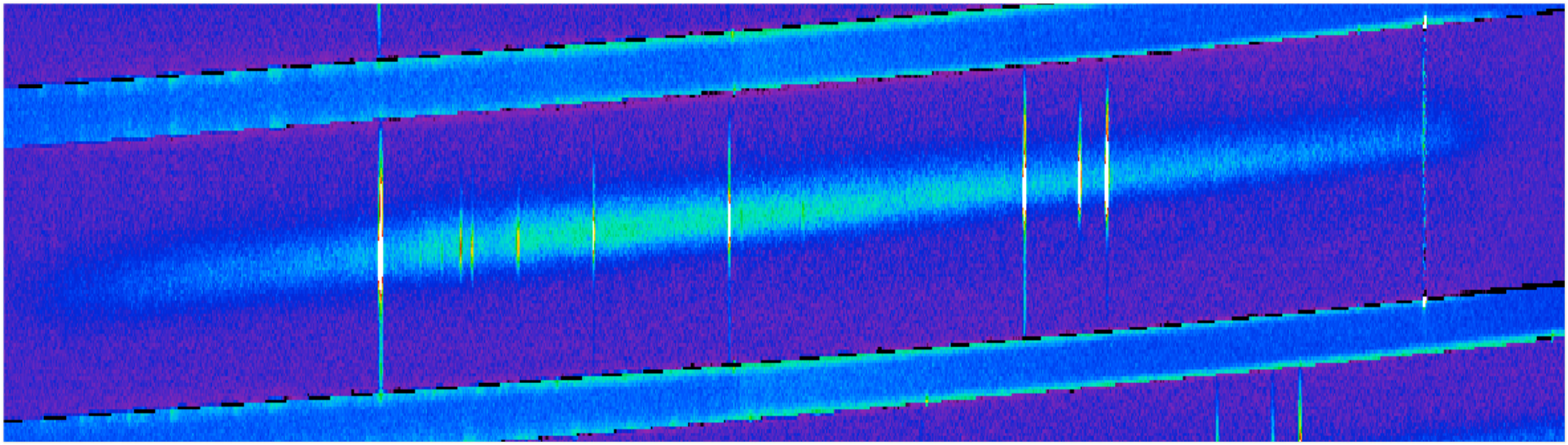





B-Spline Sky Subtraction

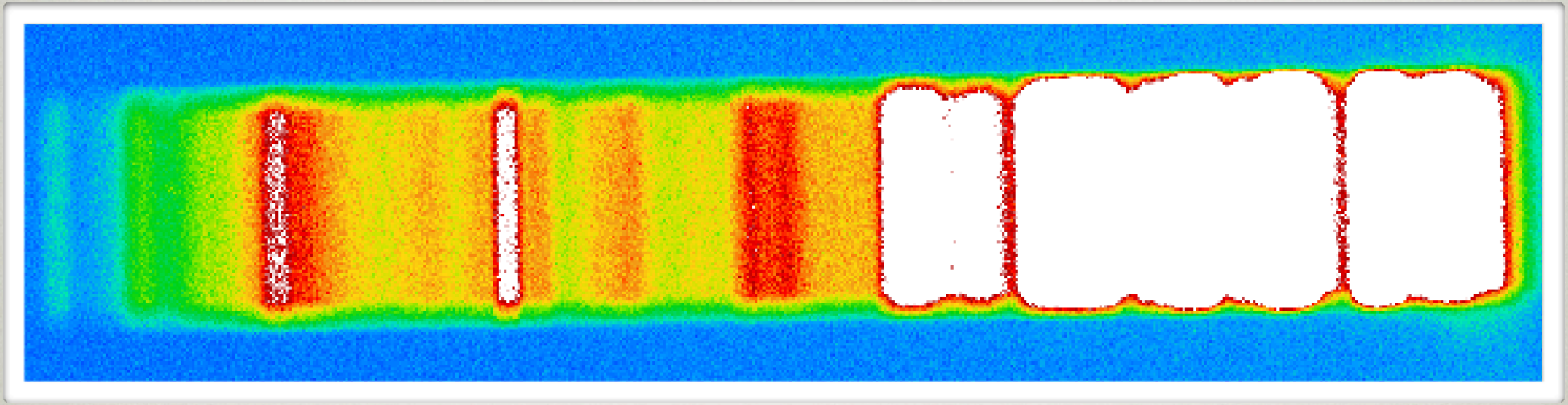
Grating Mode

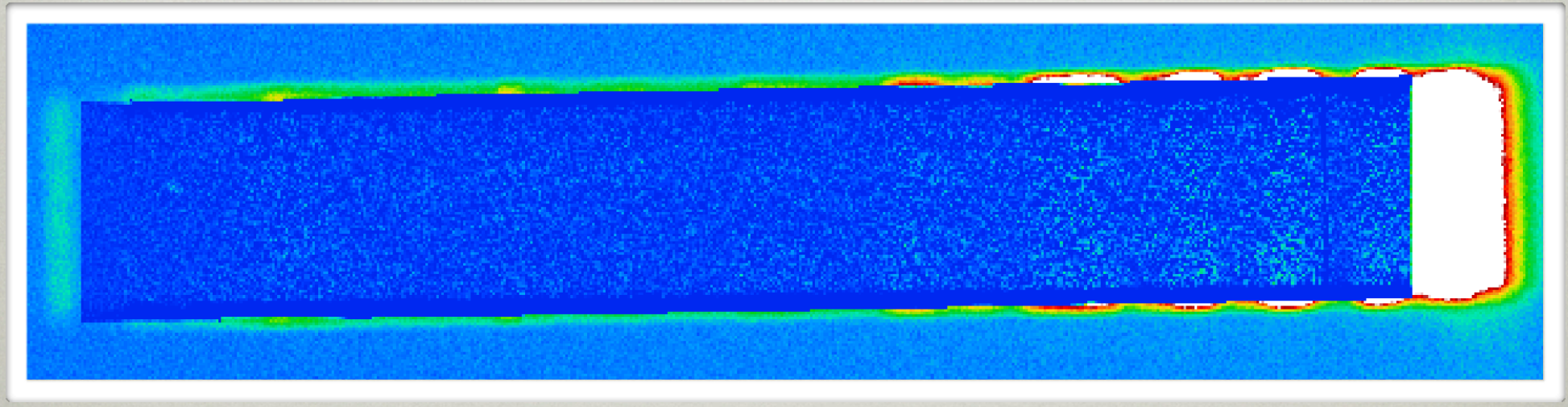




B-Spline Sky Subtraction

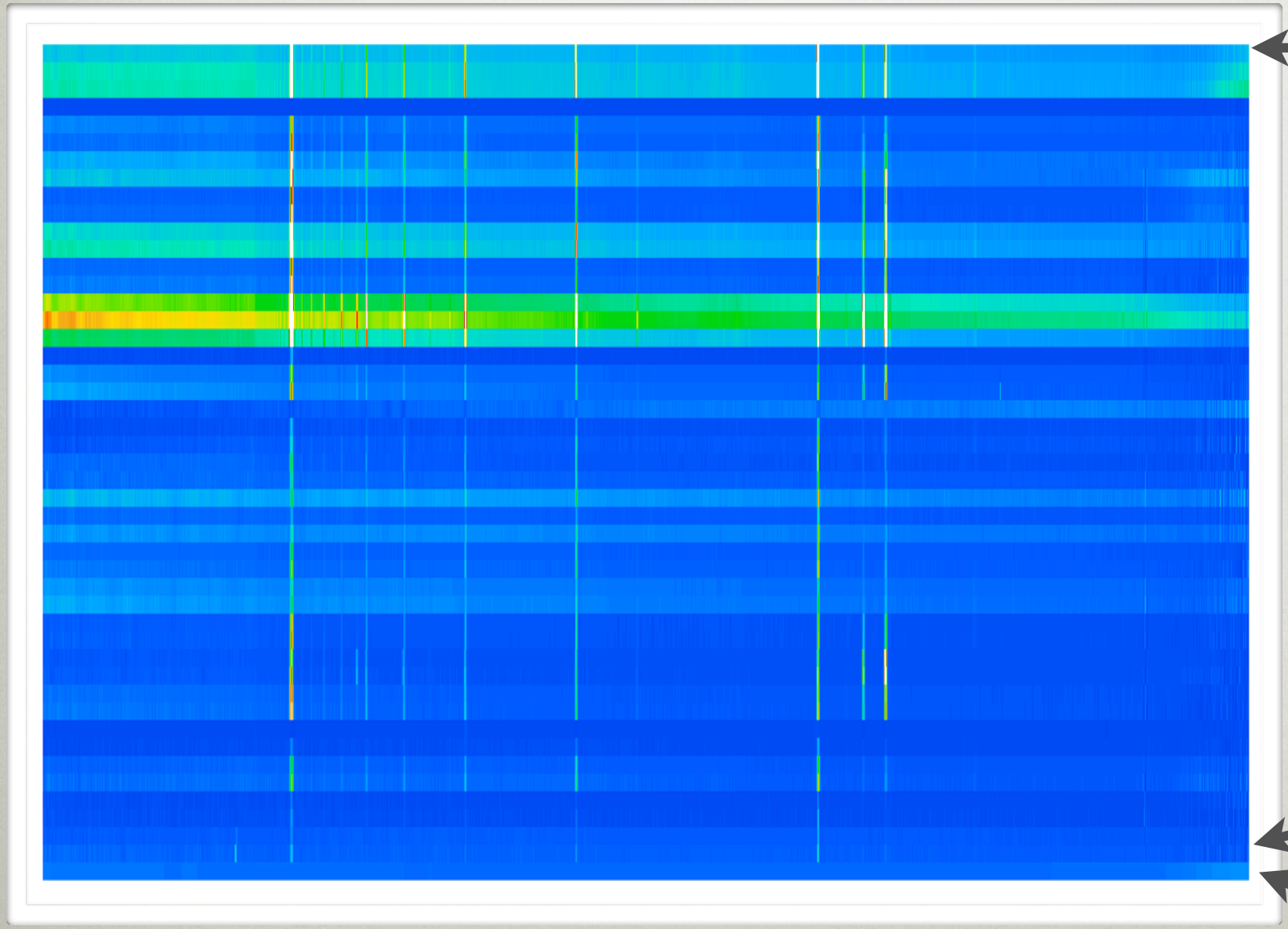
Prism Mode





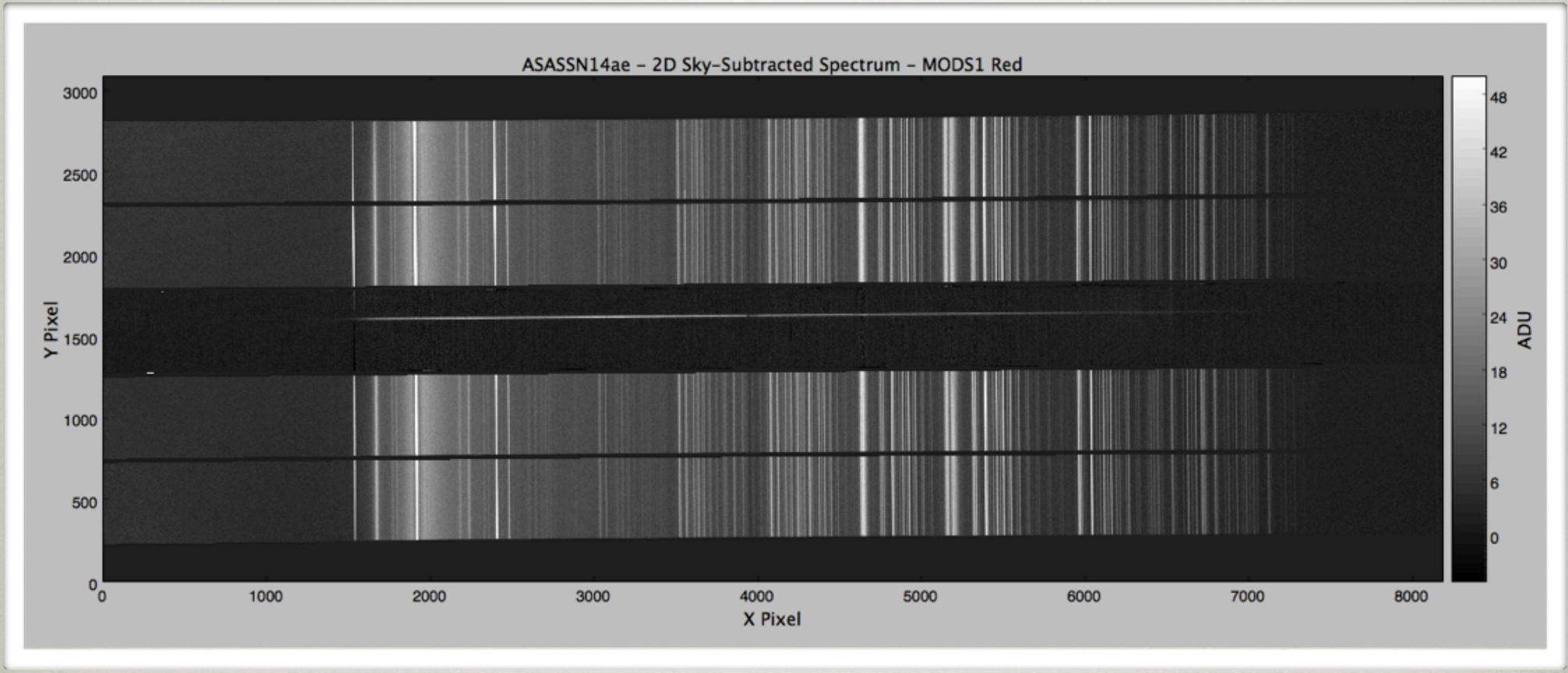
Extracted 1D Spectra

Traditional Row-Stacked Spectra Format



We plan on having MODS Quick Look Tools release at LBT starting in the 2014B semester

Longslit 1 slit ~70s / Longslit 5 slits ~380s / MOS ~40 slits ~1000s



Final on-site testing in April.

Manual

Available April 15th

4 Basic MODS Reduction Procedures

4.1 Prepare for CCD Reduction

Preparation for data reduction is somewhat dependent on user preferences. Some of the recommendations here given are simply what I have found to be the clearest path in organization. I find that creating two directories, RAW and PROC, for sorting data keeps things a bit more clear. The XIDL scripts will parse the data within a directory and create a reduction parameter file. By separating out the Raw data from data you wish to Process you can maintain a clean parameter file and minimize processing time.

The XIDL scripts that perform the data reduction will create a 'Science' directory within your working directory. Reduced science data and standard stars will be stored in this directory. Calibration frames, such as the slit mask and the wavelength images will be stored in the working directory. In the working directory you will need copies of the MMS files associated with your observations. When using the Long-slit mask of wide-slit masks, IDL scripts exist to create mms files for the observations. These can be run calling:

Long-slit: `IDL> mkmms_ls,'[image name]'`

Wide-slit: `IDL> mkmms_ws,'[image name]'`

This will create an mms file with the coordinates taken from the header of the image given to the script.

http://www.astronomy.ohio-state.edu/MODS/

Distribution

Available April 15th

The MODS pipeline will be available for Beta testing on the MODS webpage after April 15th.

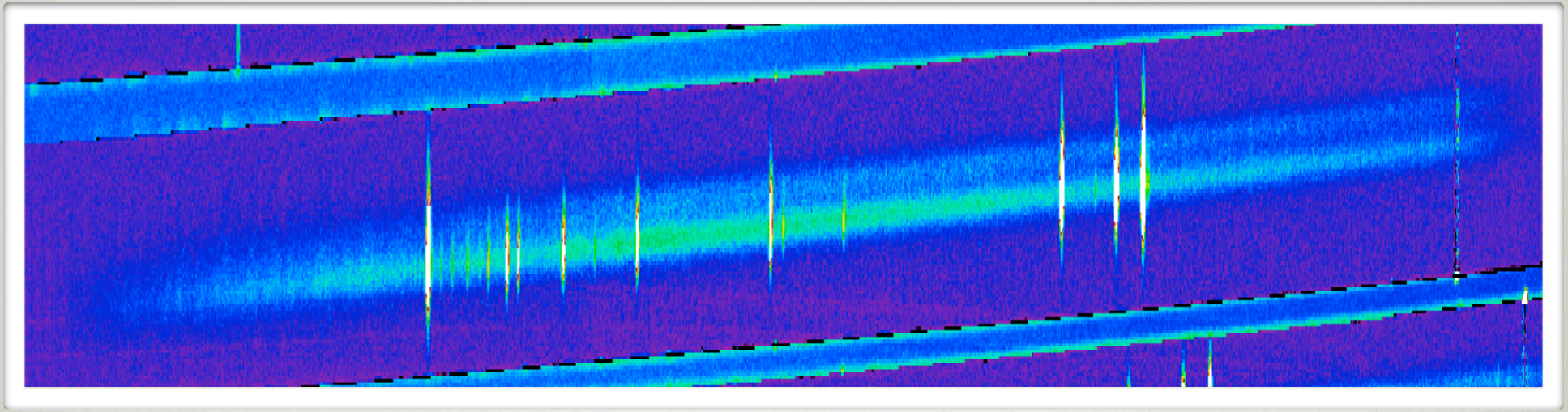
It requires XIDL which can be obtained from the UCOLICK site (linked from MODS webpage).

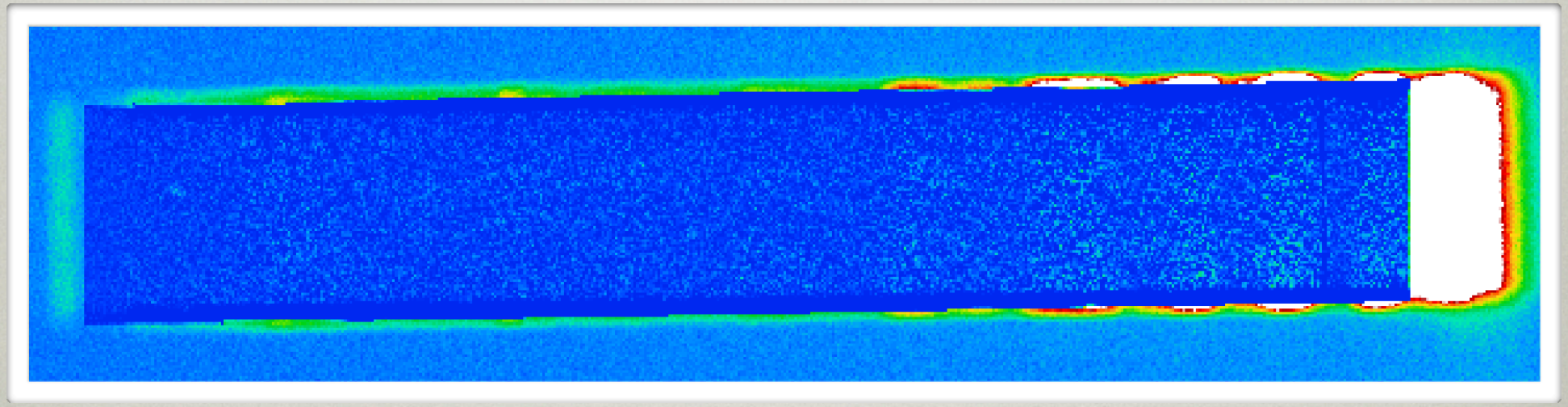
Please report any bugs you find or other feedback.

http://www.ucolick.org/~xavier/IDL/

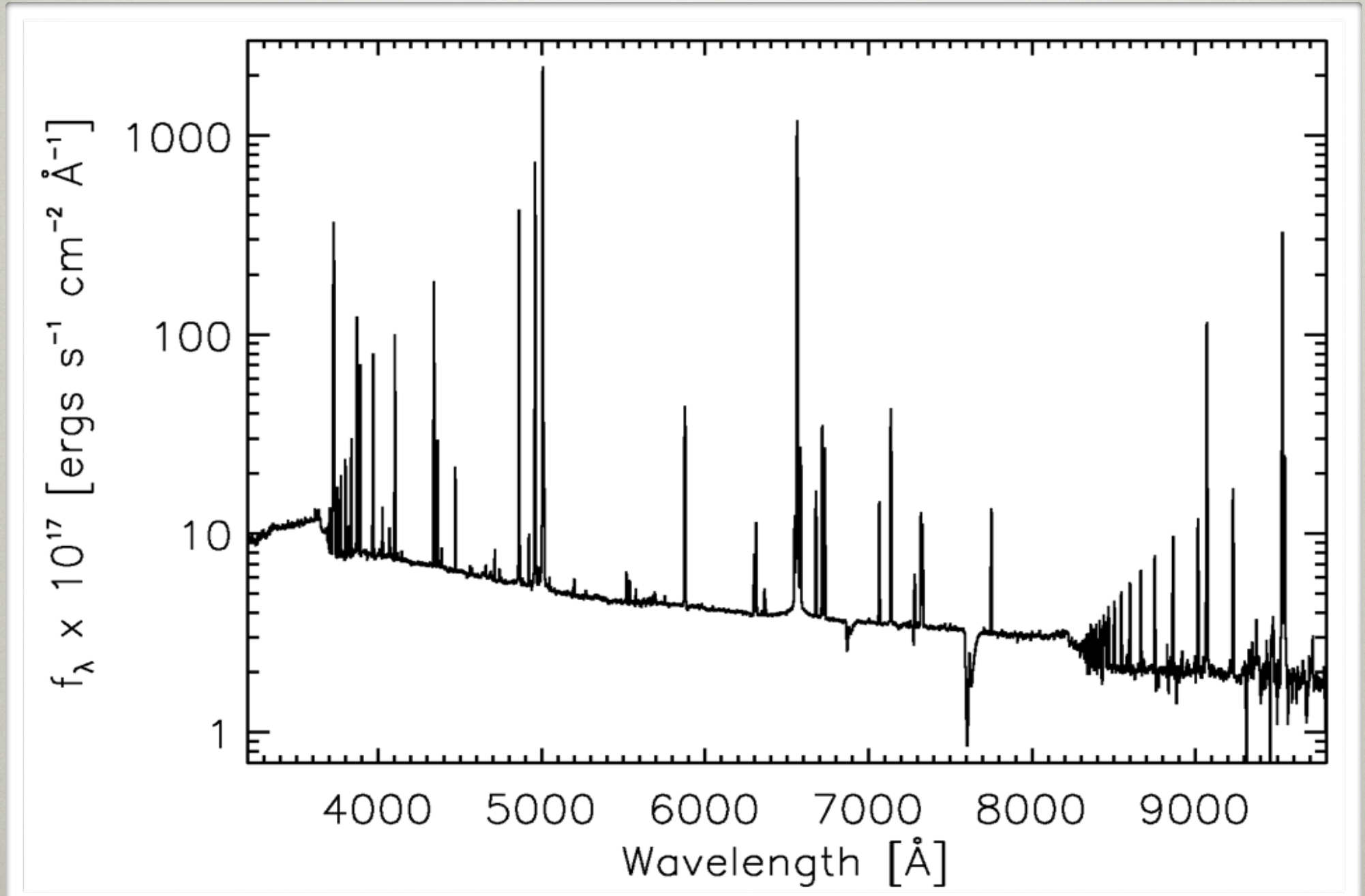
http://www.astronomy.ohio-state.edu/MODS/

Summary - 2D



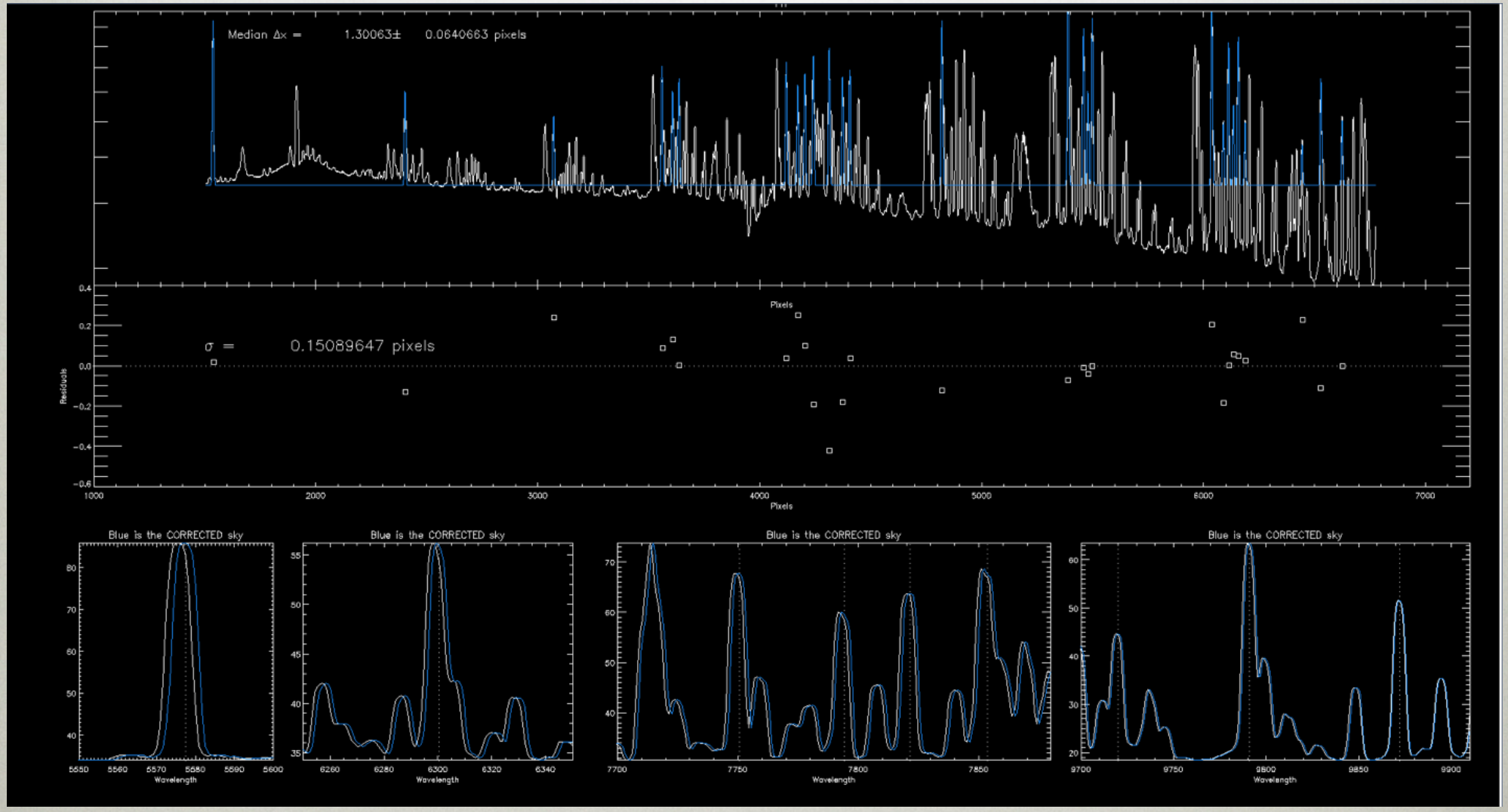


Summary - 1D


1000
100
10
1
f_λ x 10^{17} [ergs s^{-1} cm^{-2} $Å^{-1}$]
4000
5000
6000
7000
8000
9000
Wavelength [Å]

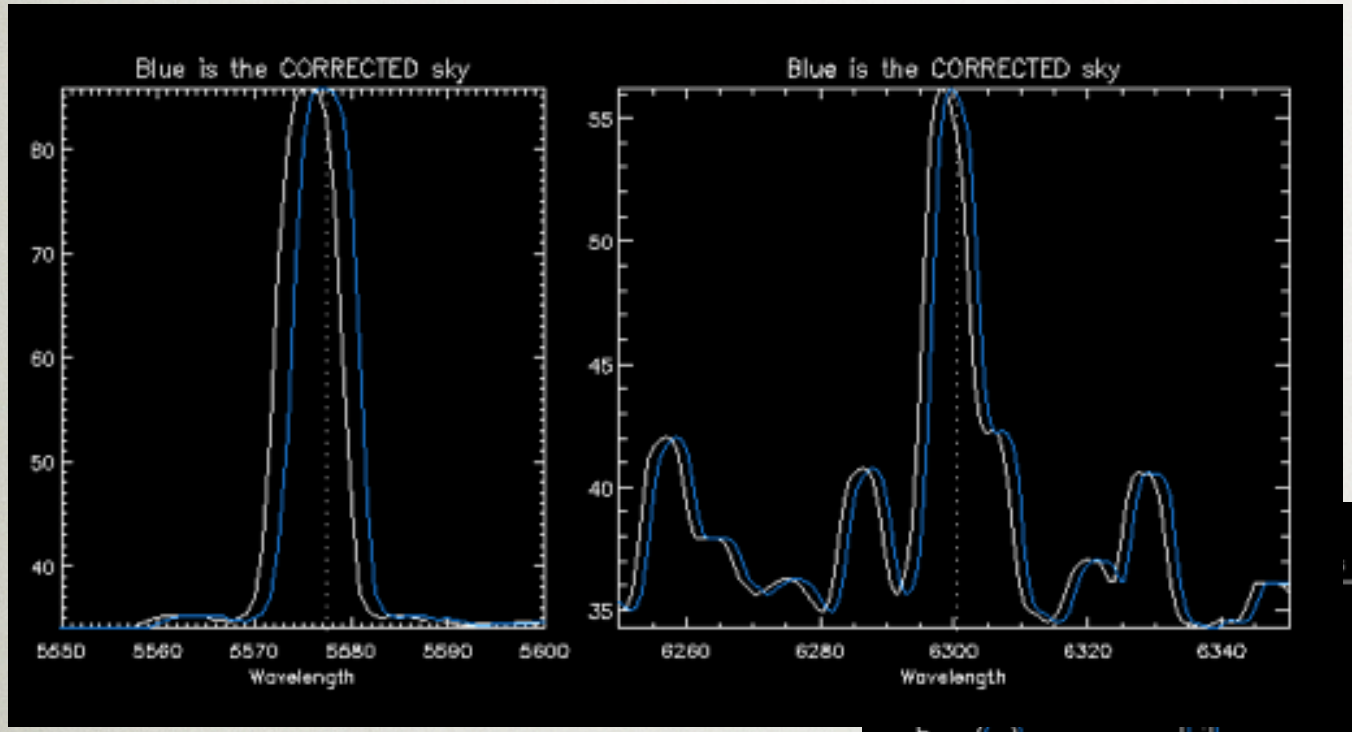
Wavelength Zero-Point

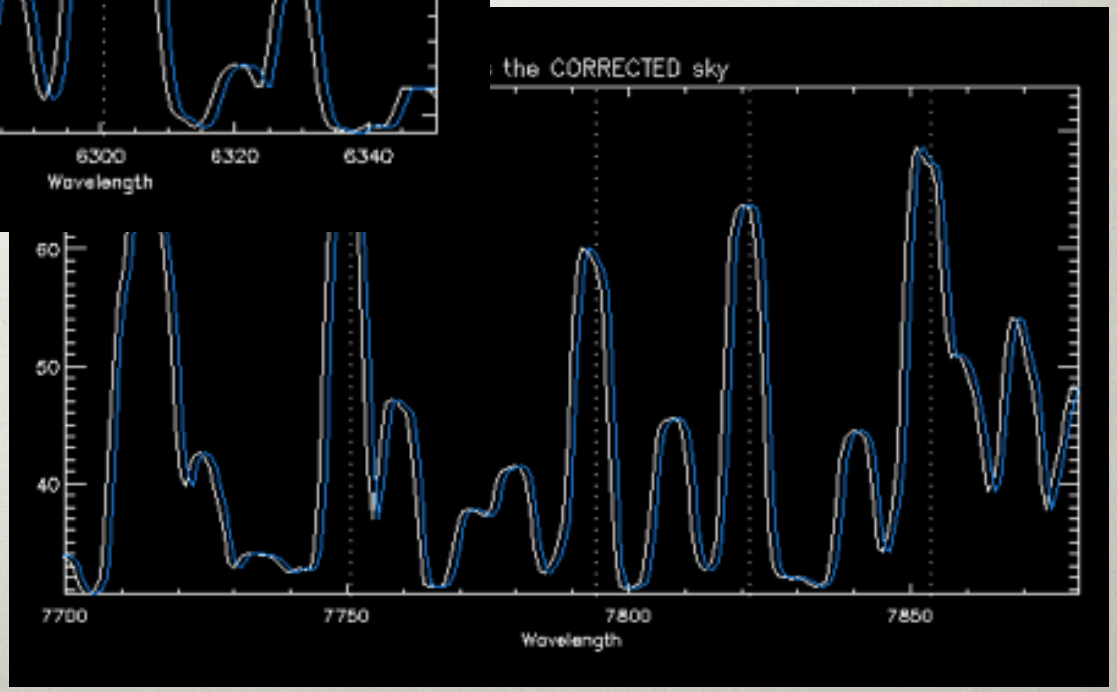
A.K.A. Flexure Correction



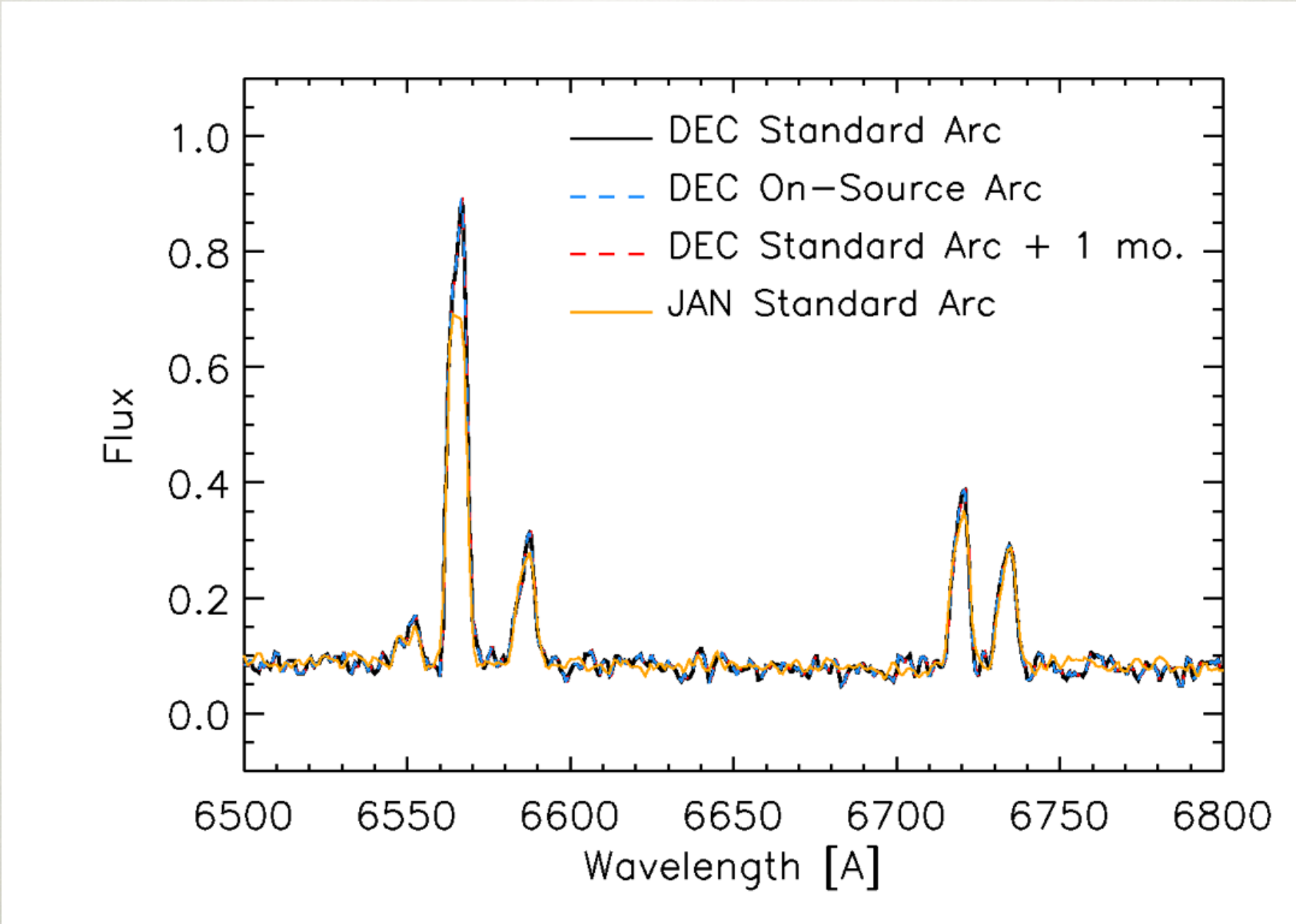
Wavelength Zero-Point

A.K.A. Flexure Correction

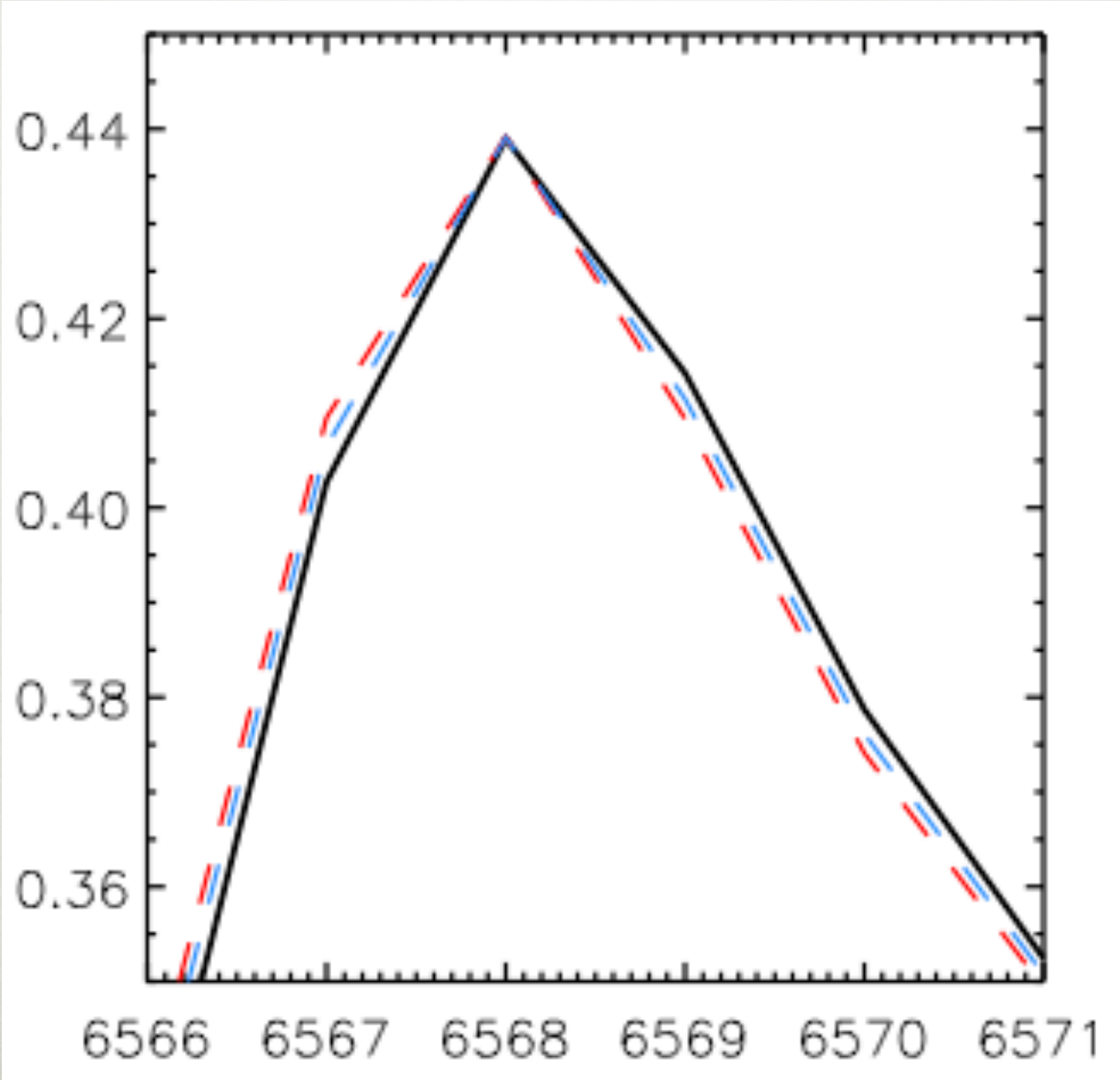




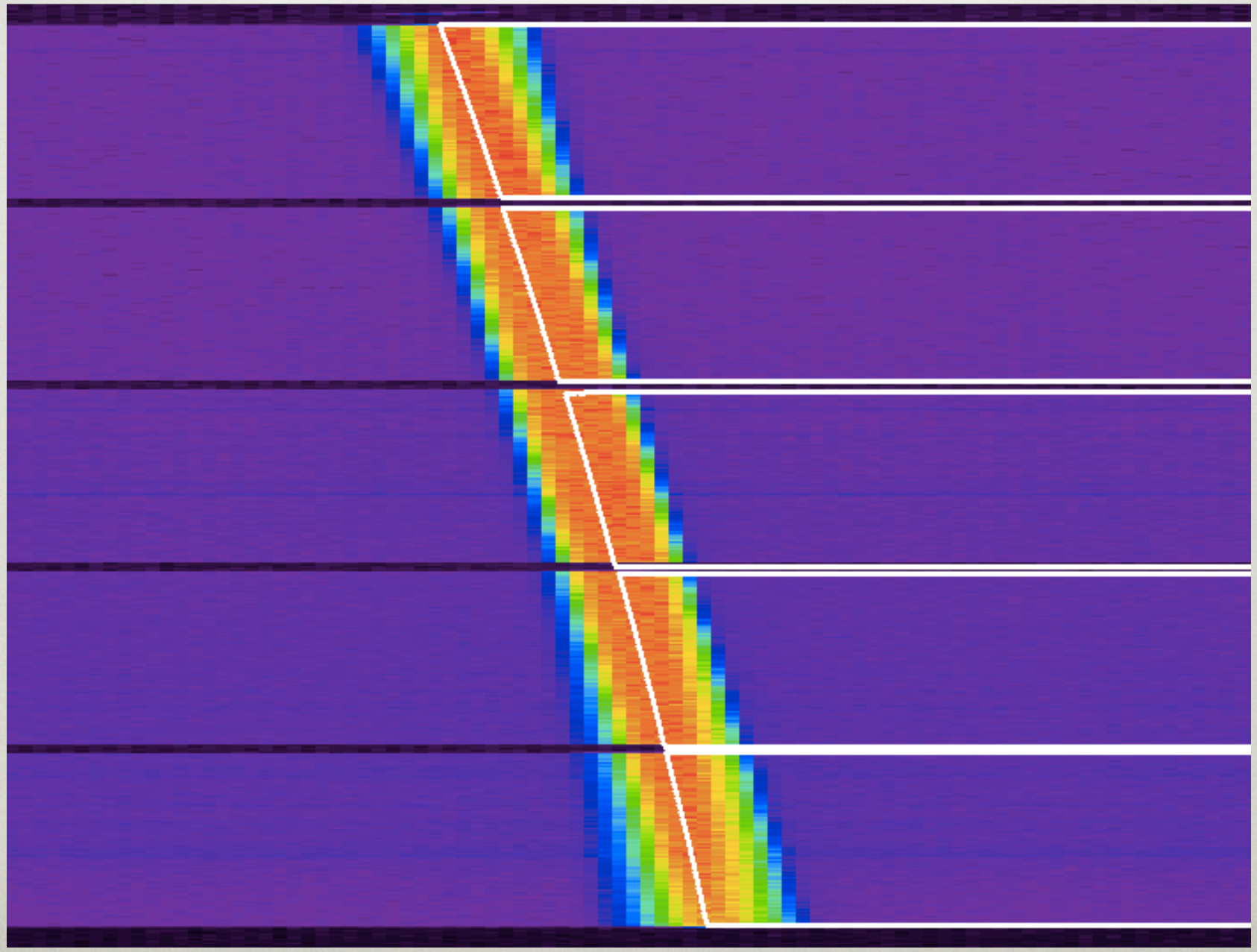
Wavelength Calibration

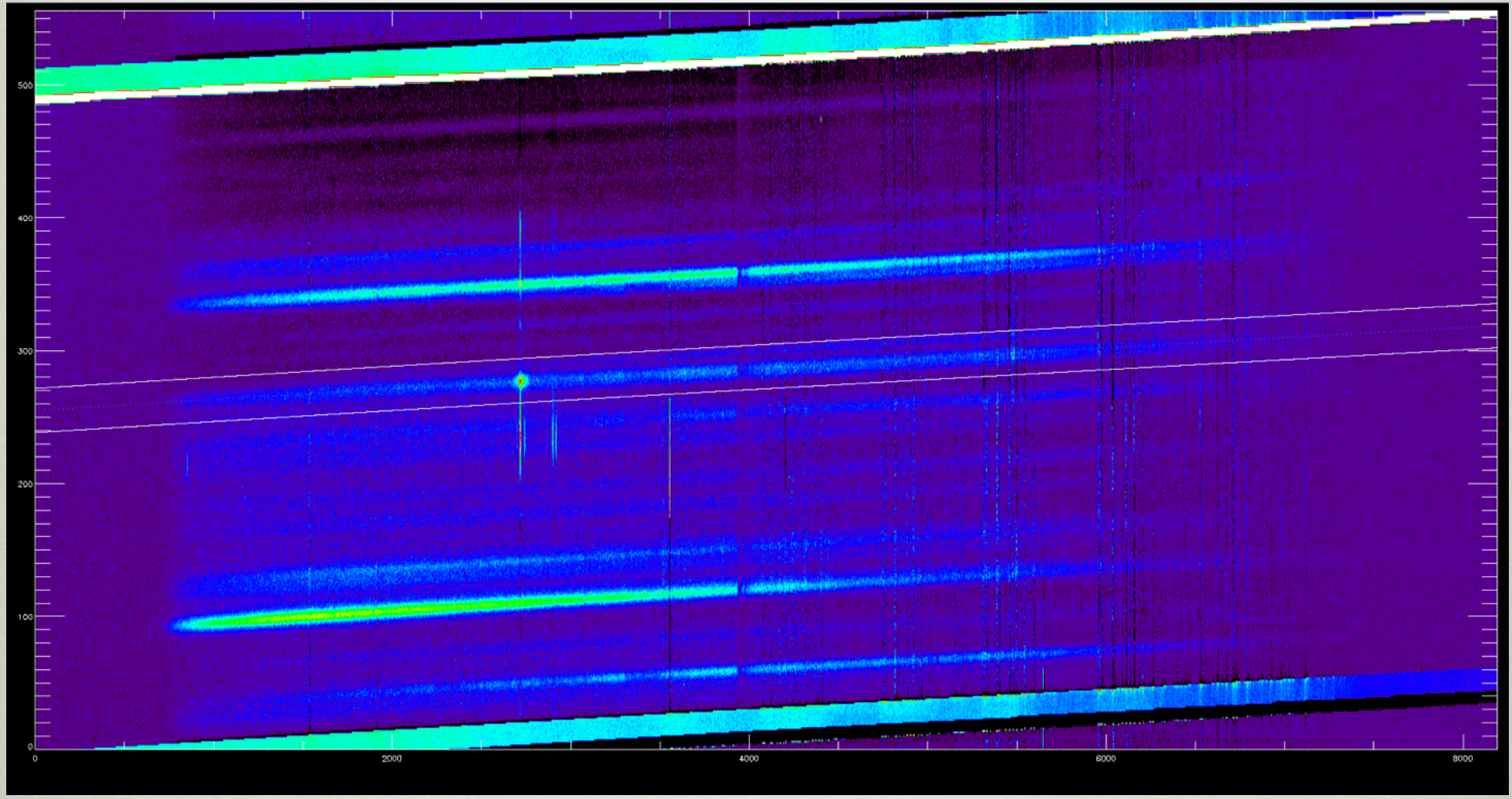


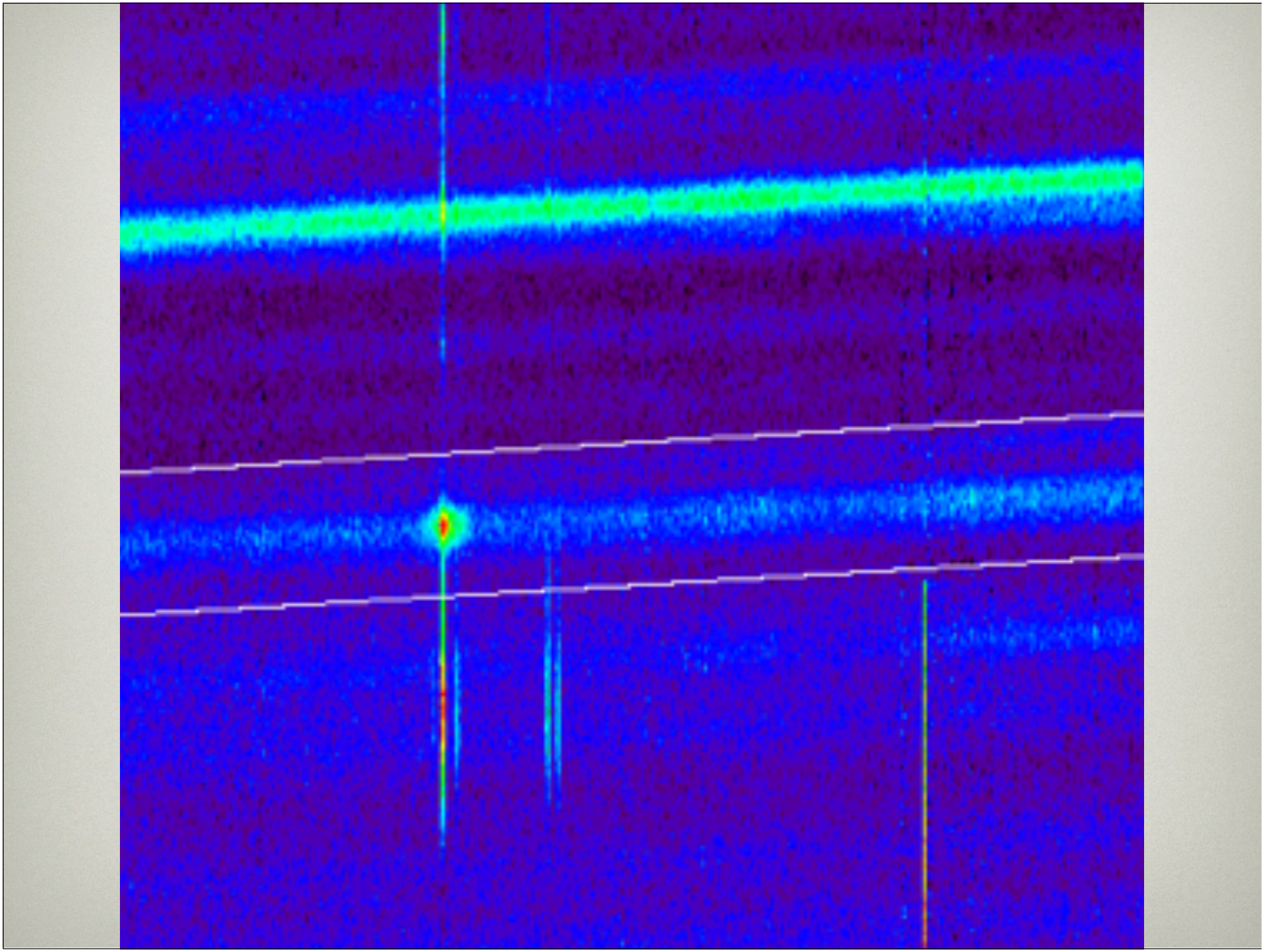
Wavelength Calibration

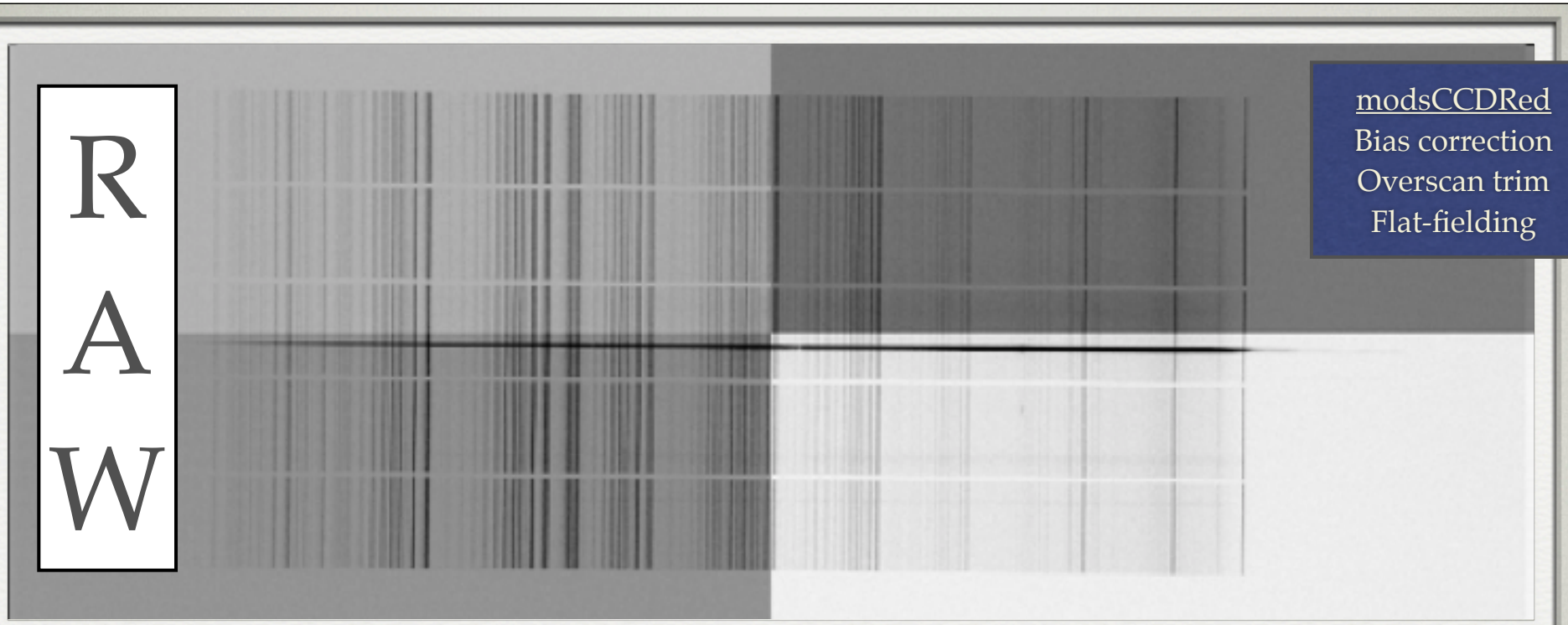


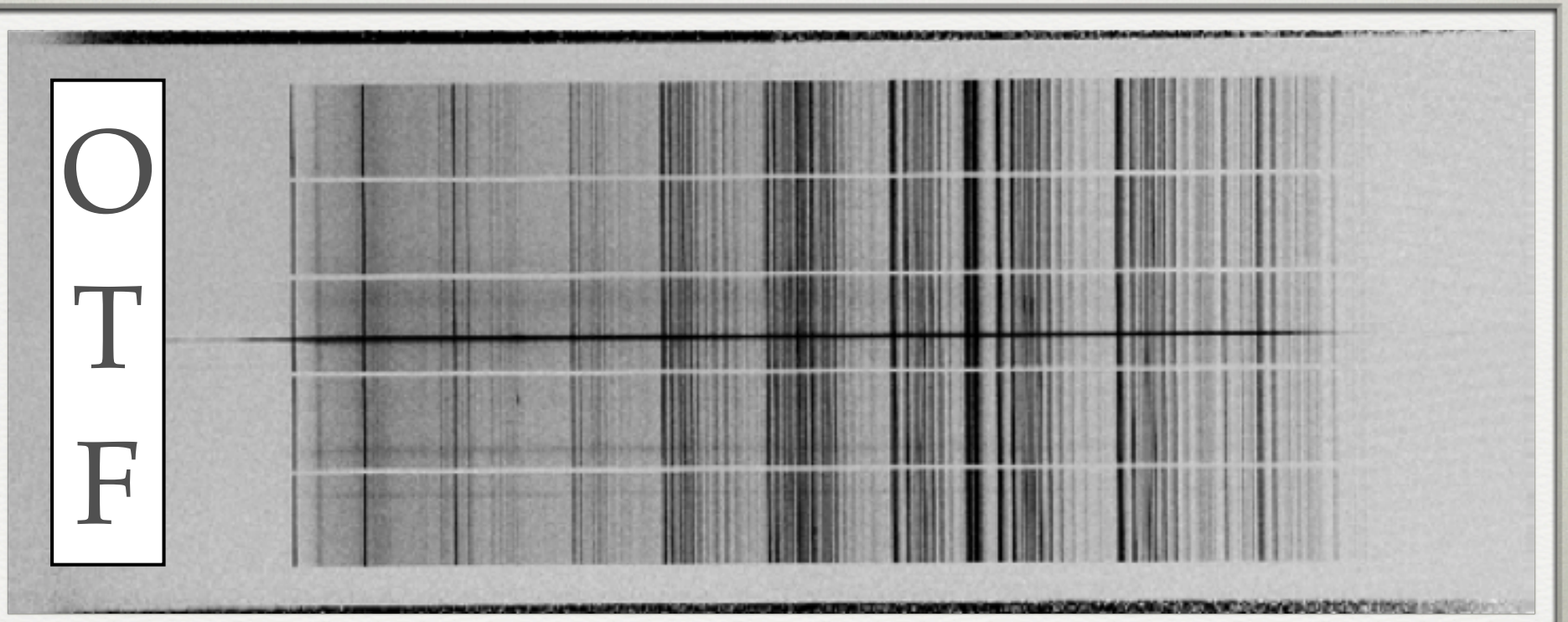
Contours: 5577.34 + Shift

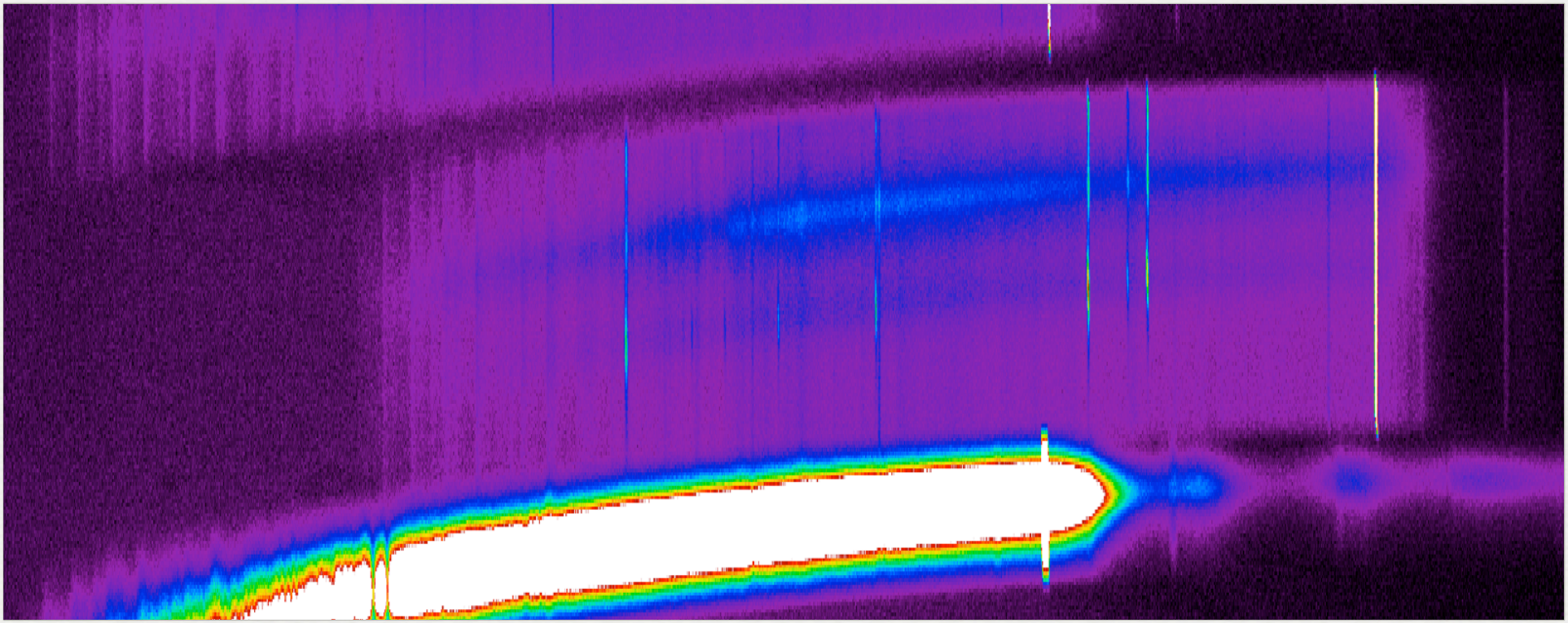



500
400
300
200
100
0
0
2000
4000
6000
8000




RAW
modsCCDRed
Bias correction
Overscan trim
Flat-fielding

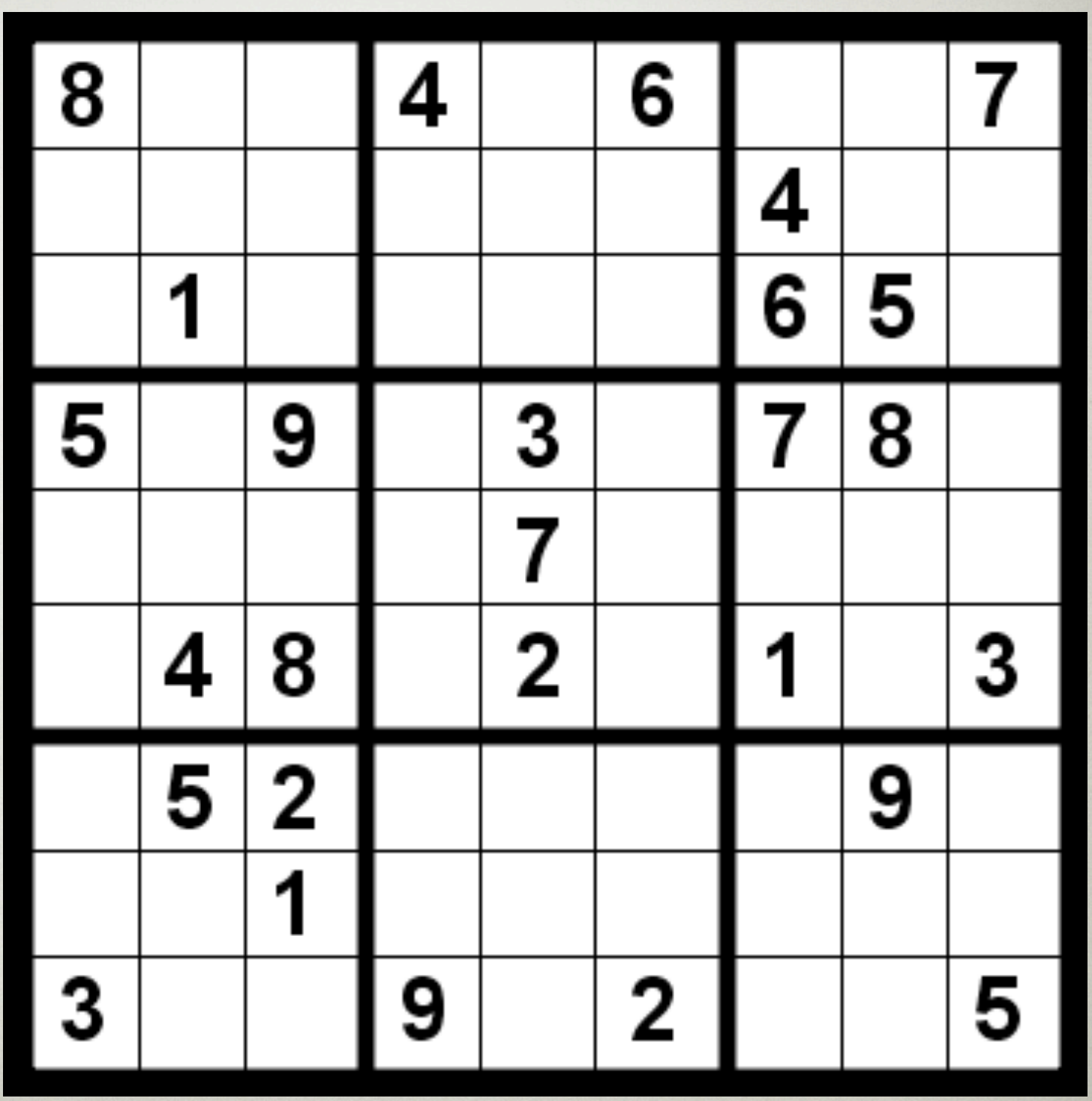

OTF



We need to have a robust trace of each slit irregardless of position on the mask.

We mapped the system using an innovative Sudoku mask.

Sudoku

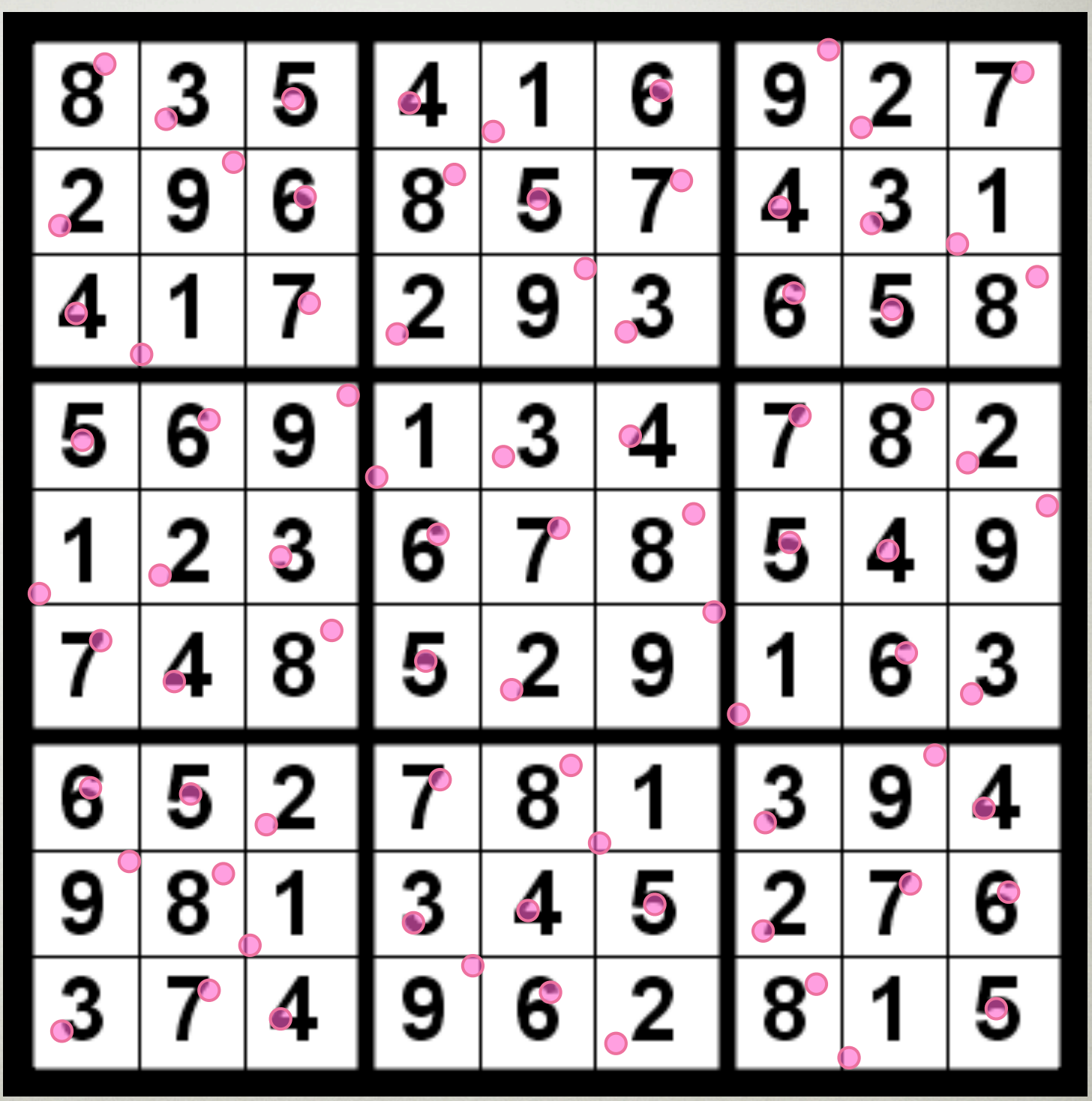


8			4		6			7
						4		
	1					6	5	
5		9		3		7	8	
				7				
	4	8		2		1		3
	5	2					9	
		1						
3			9		2			5

Sudoku

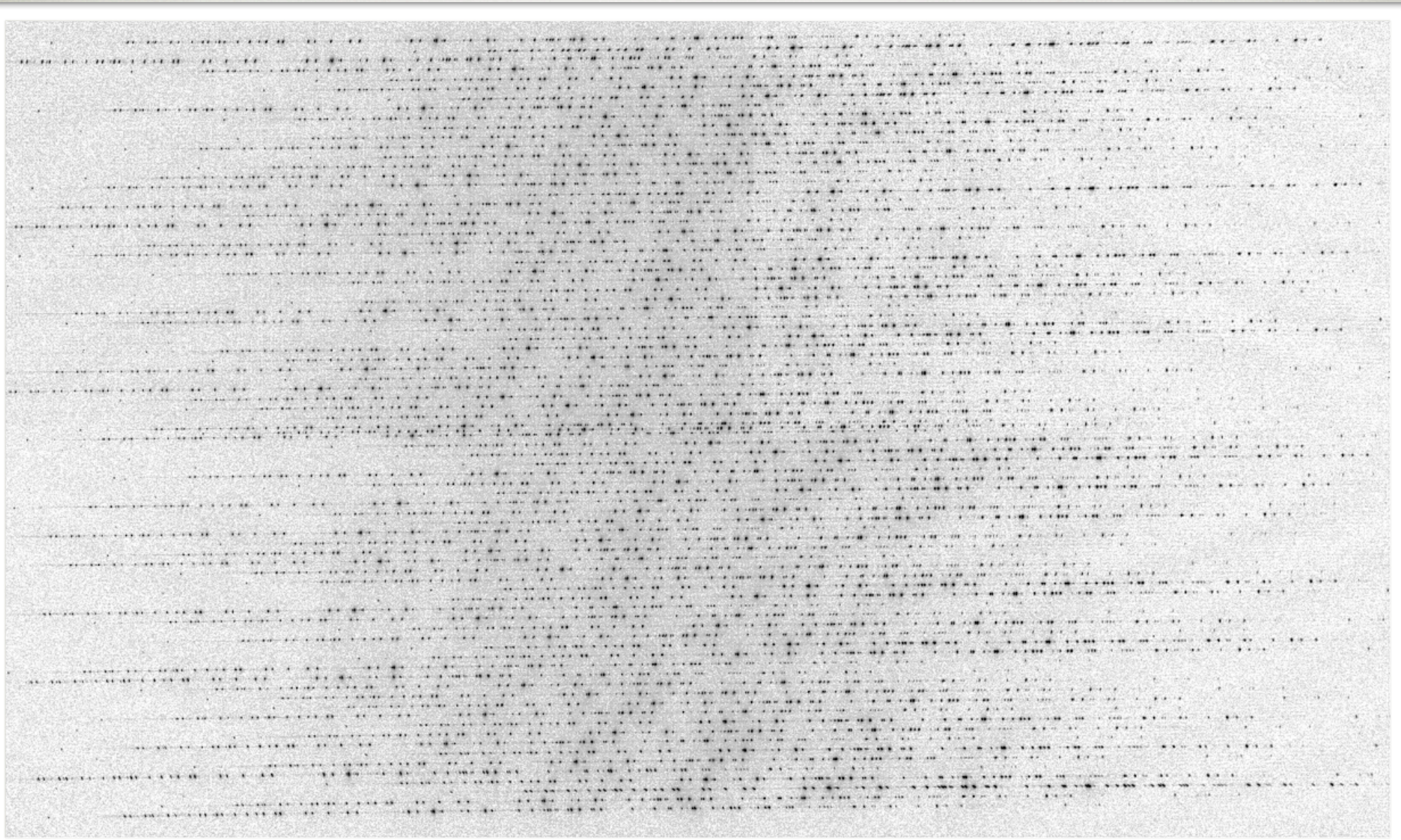
8	3	5	4	1	6	9	2	7
2	9	6	8	5	7	4	3	1
4	1	7	2	9	3	6	5	8
5	6	9	1	3	4	7	8	2
1	2	3	6	7	8	5	4	9
7	4	8	5	2	9	1	6	3
6	5	2	7	8	1	3	9	4
9	8	1	3	4	5	2	7	6
3	7	4	9	6	2	8	1	5

Sudoku



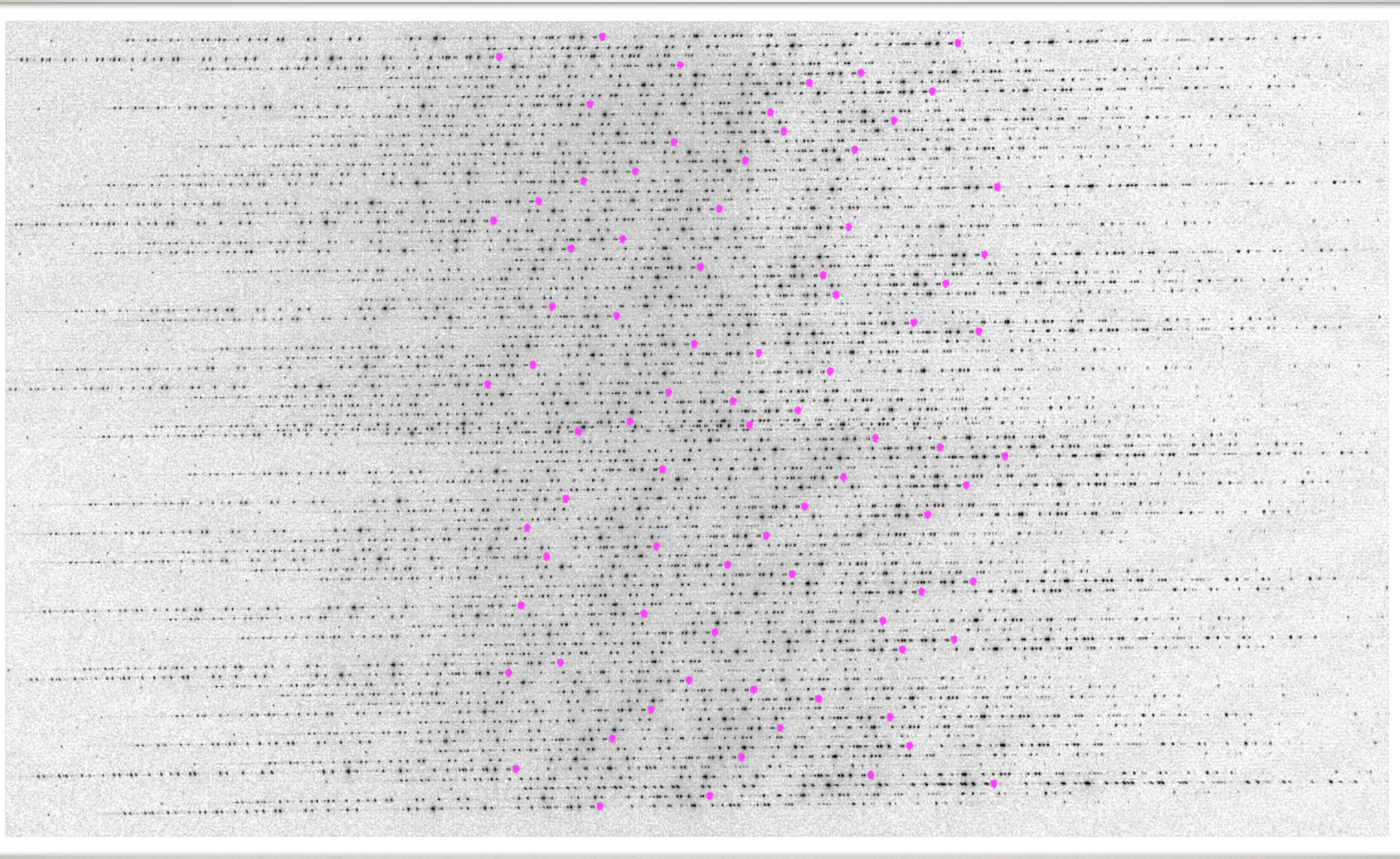
8	3	5	4	1	6	9	2	7
2	9	6	8	5	7	4	3	1
4	1	7	2	9	3	6	5	8
5	6	9	1	3	4	7	8	2
1	2	3	6	7	8	5	4	9
7	4	8	5	2	9	1	6	3
6	5	2	7	8	1	3	9	4
9	8	1	3	4	5	2	7	6
3	7	4	9	6	2	8	1	5

Mapping .MMS Files



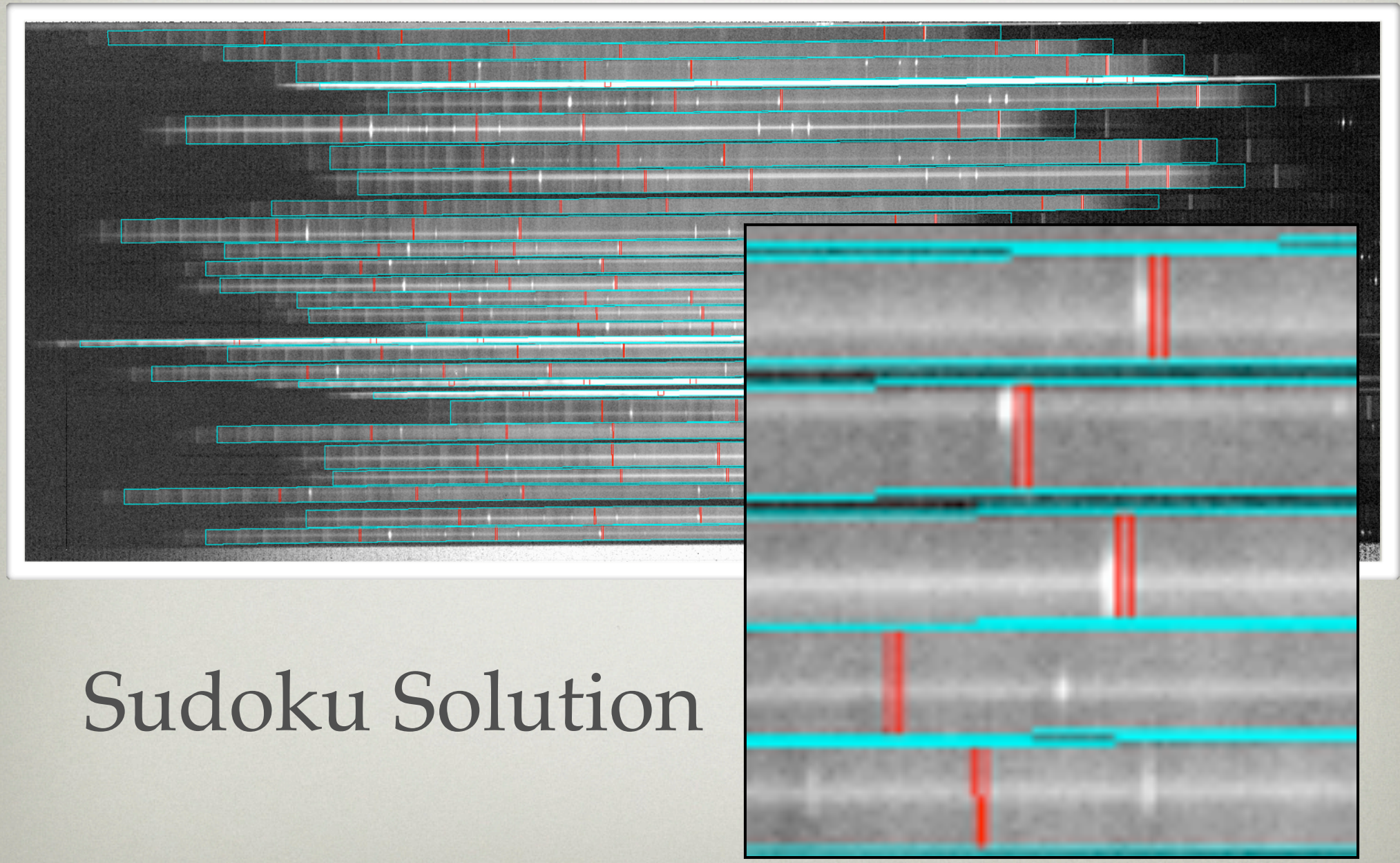
Sudoku Mask

Mapping .MMS Files



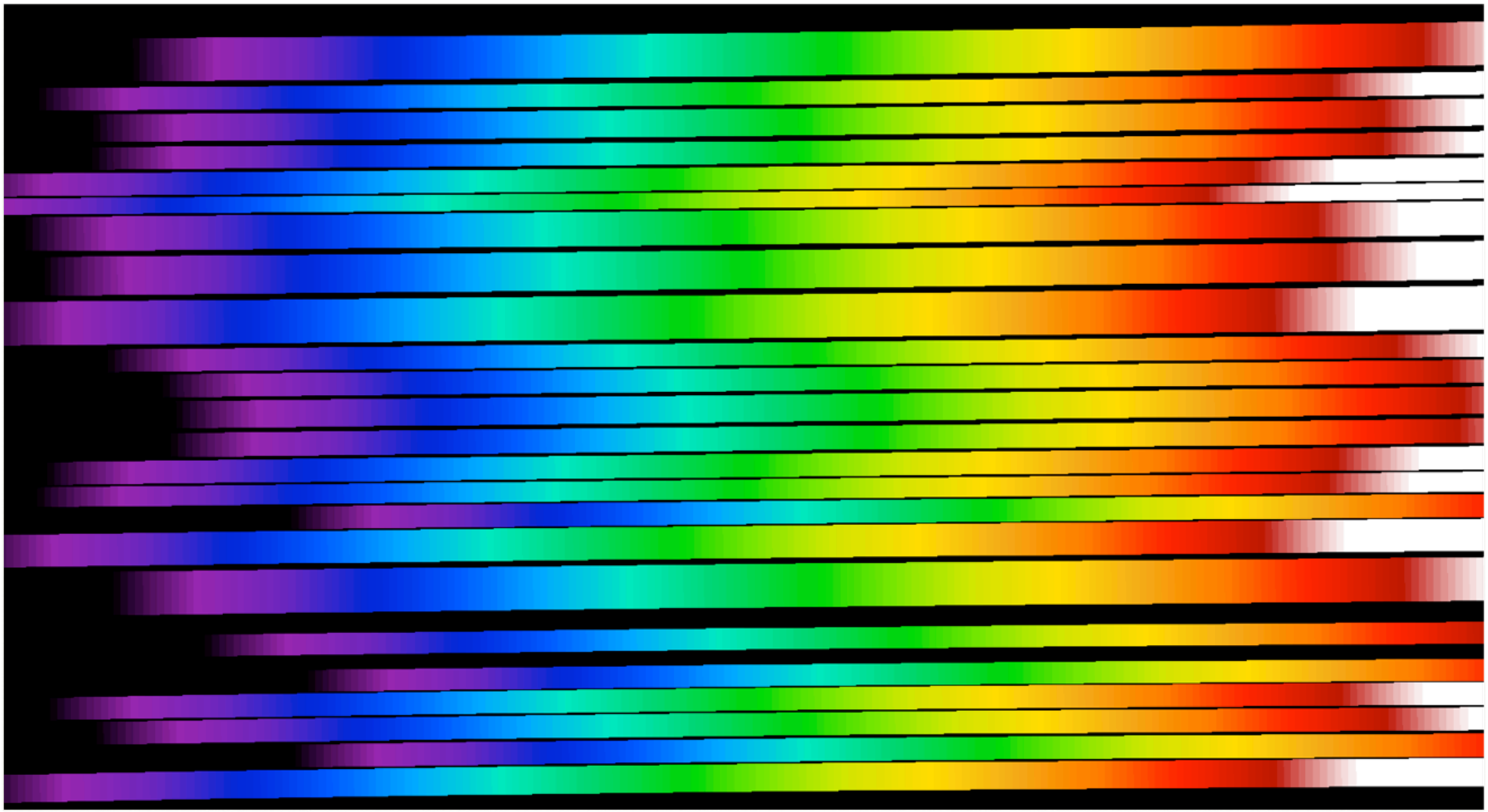
Sudoku Mask

Wavelength Calibration

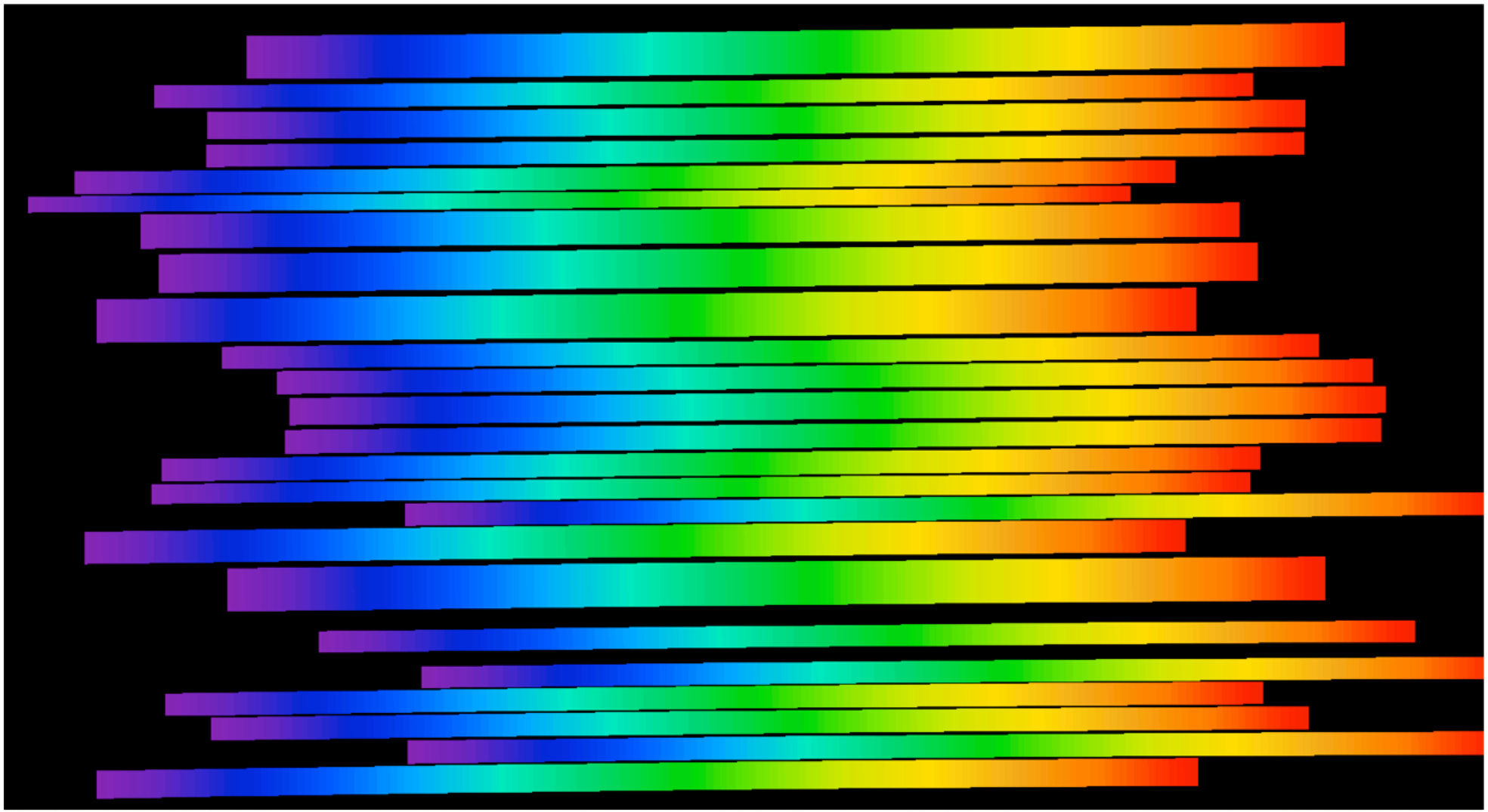


Sudoku Solution

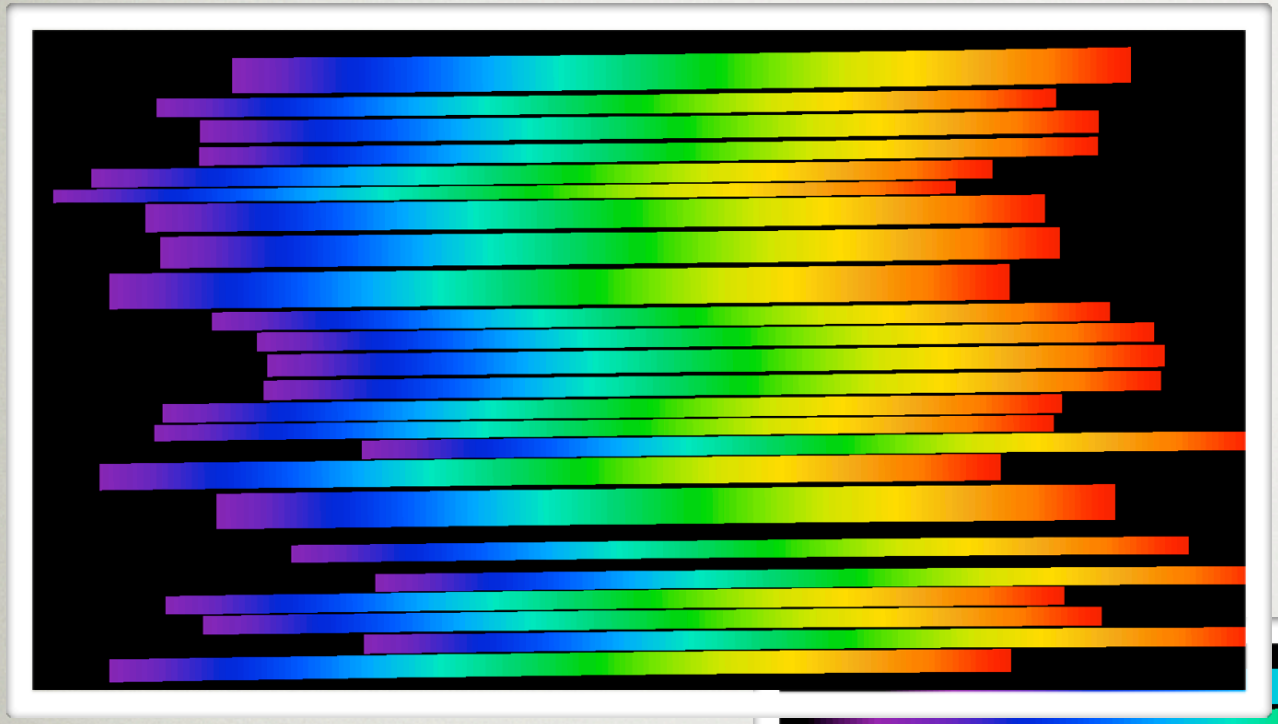
Wavelength Calibration



Wavelength Calibration

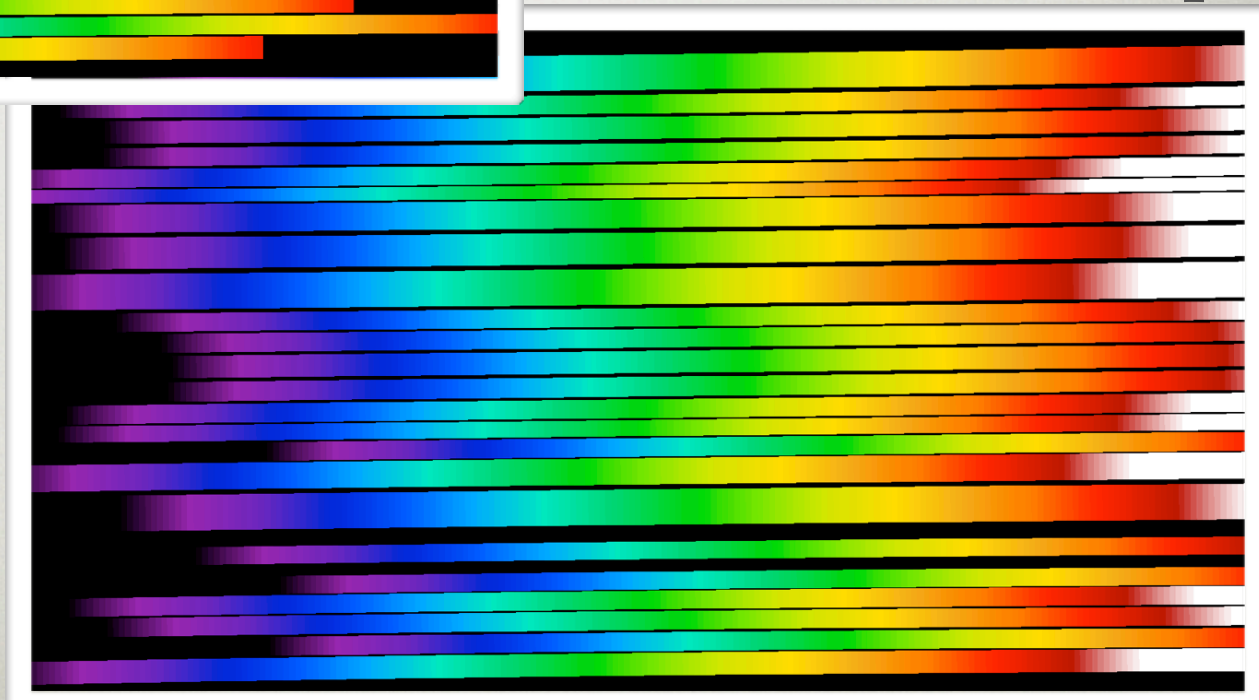


Wavelength Calibration Maps

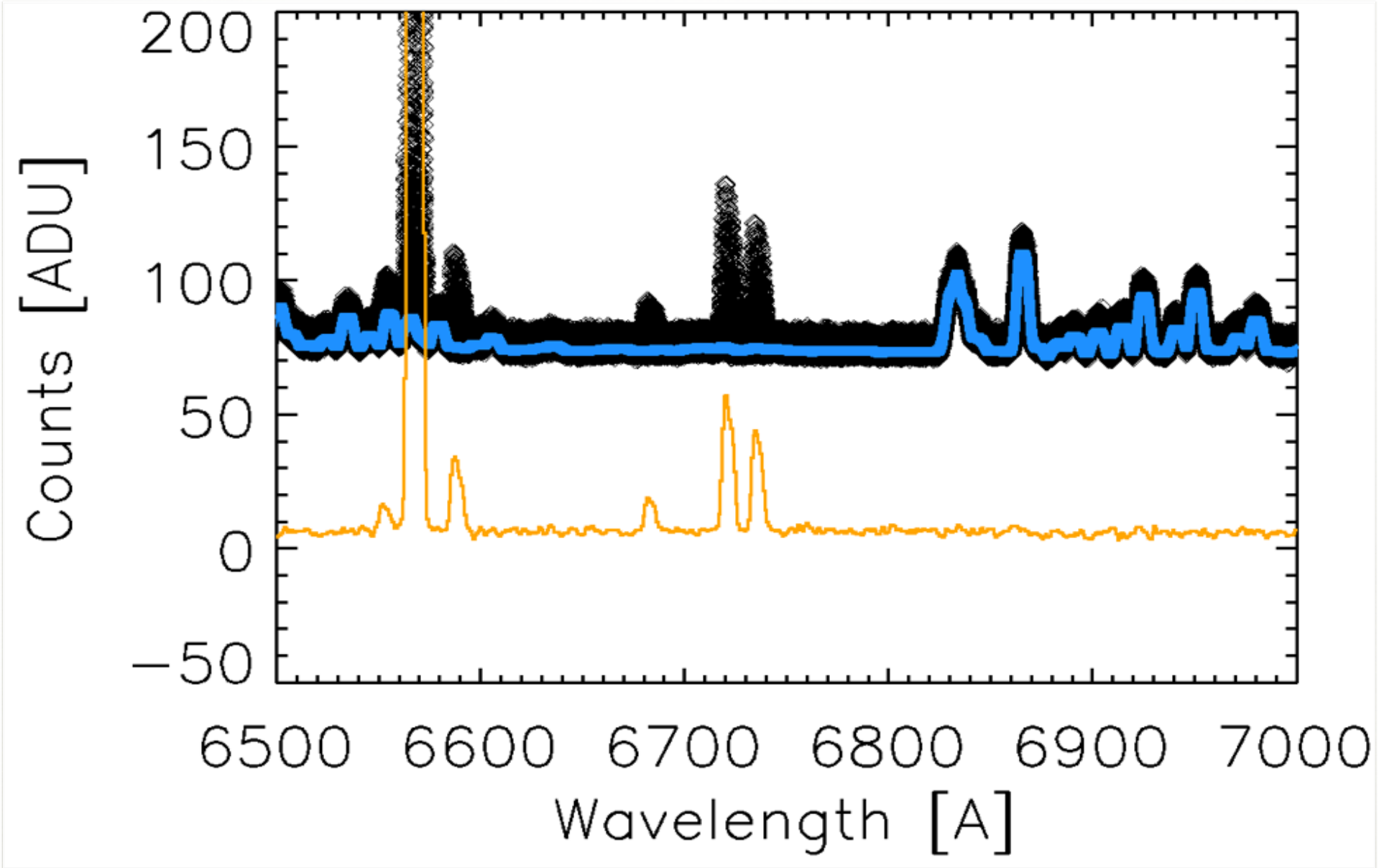


Measured Map
from arc Lamps

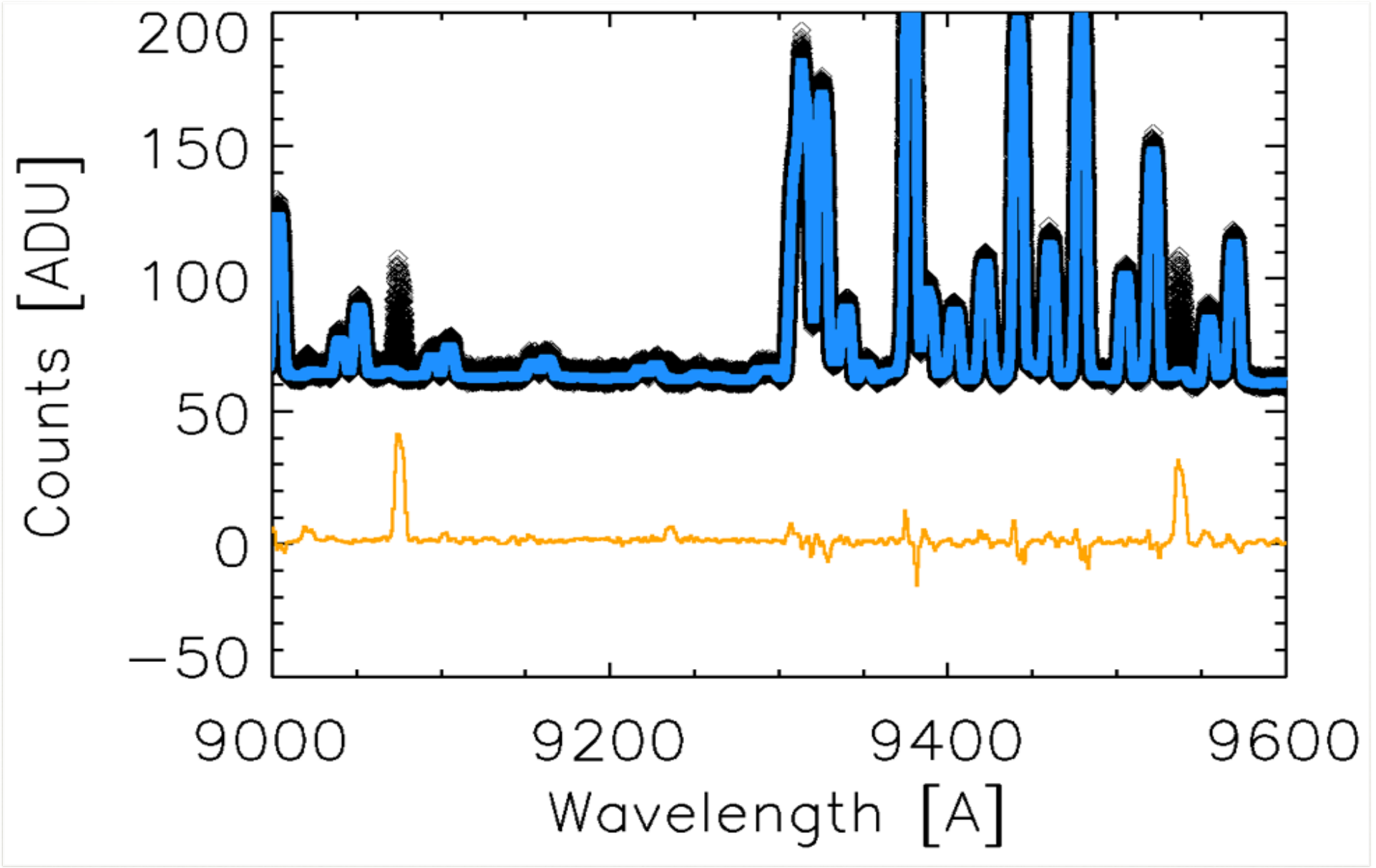
Empirical Map
derived from
Sudoku transforms



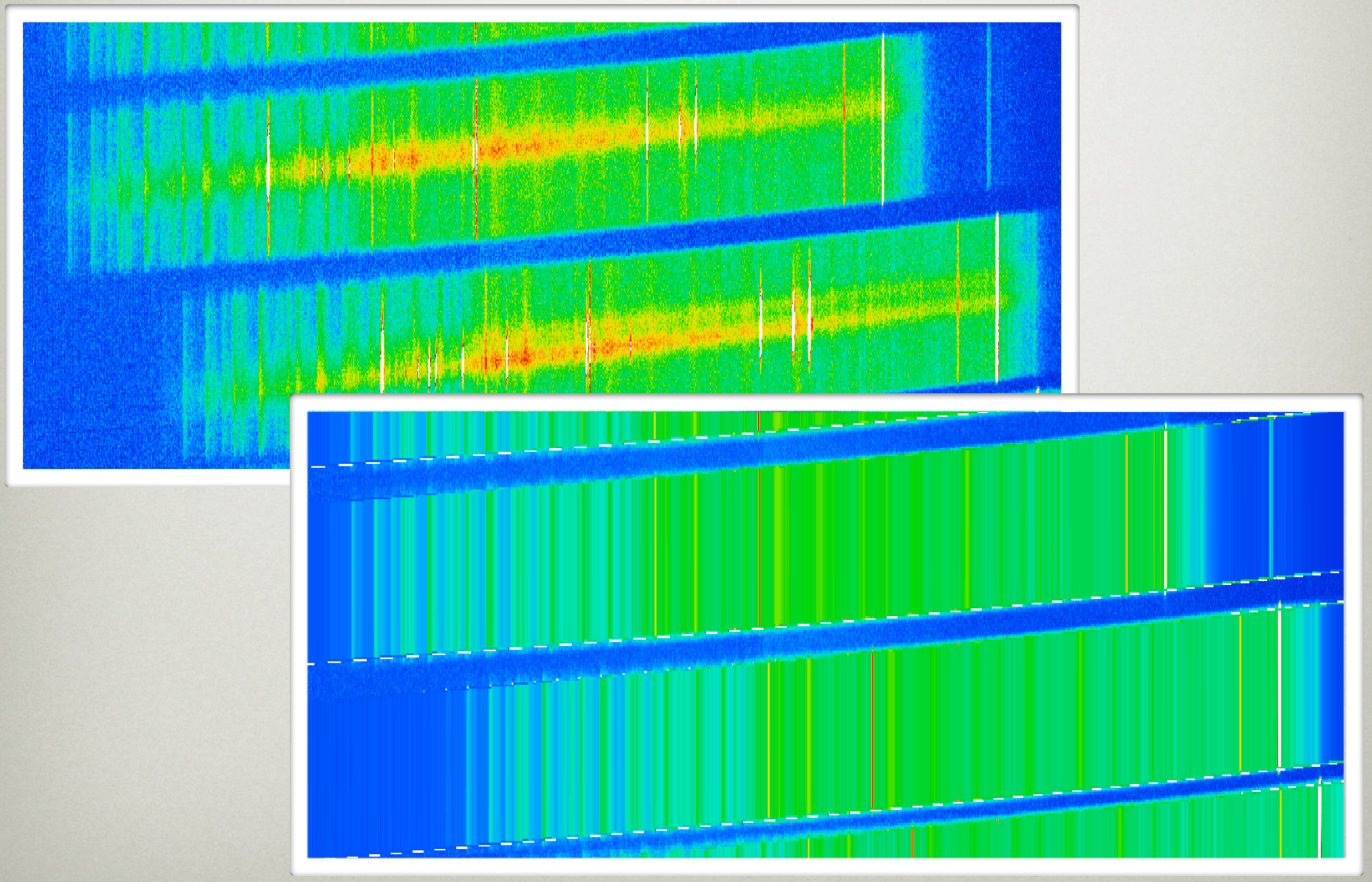
B-Spline Sky Subtraction



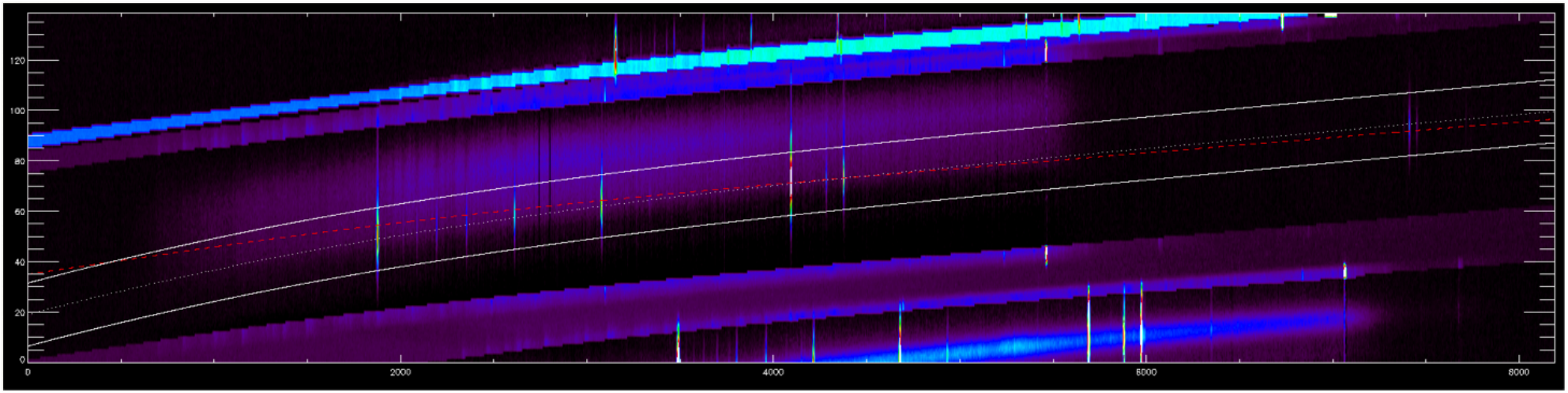
B-Spline Sky Subtraction

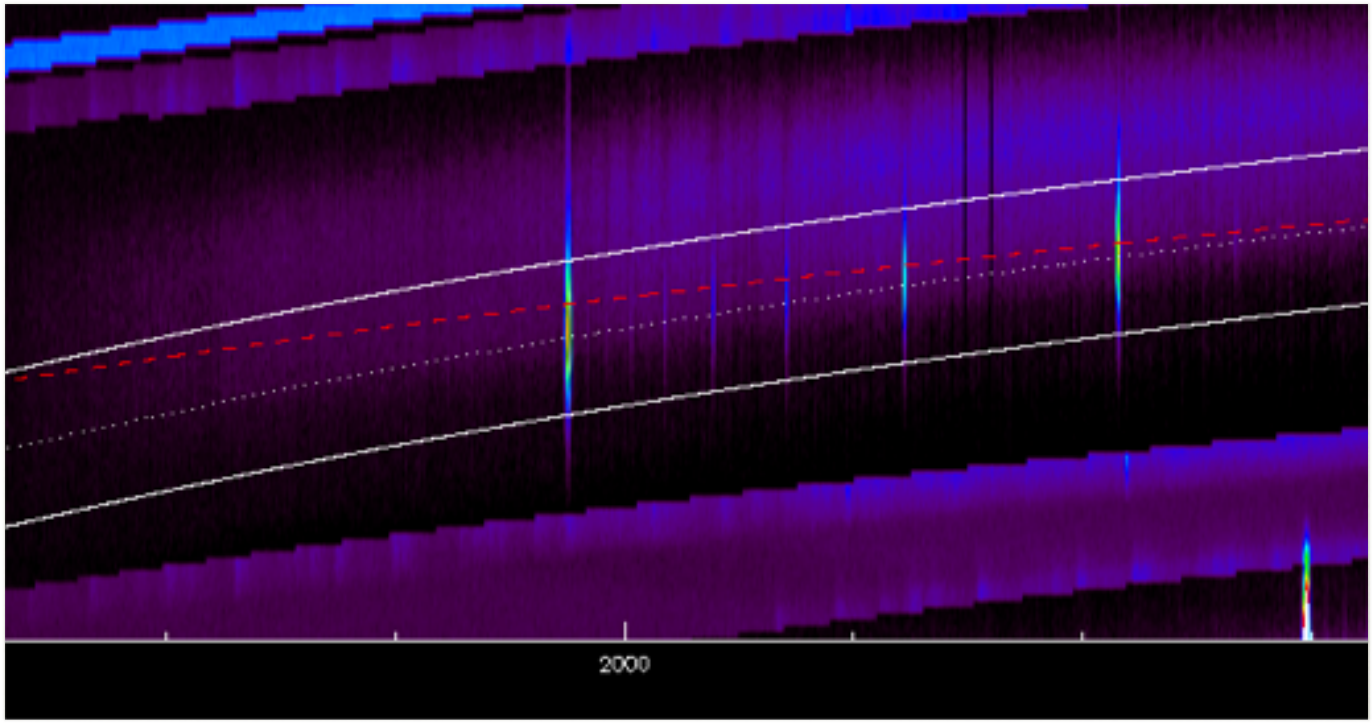


B-Spline Sky Subtraction

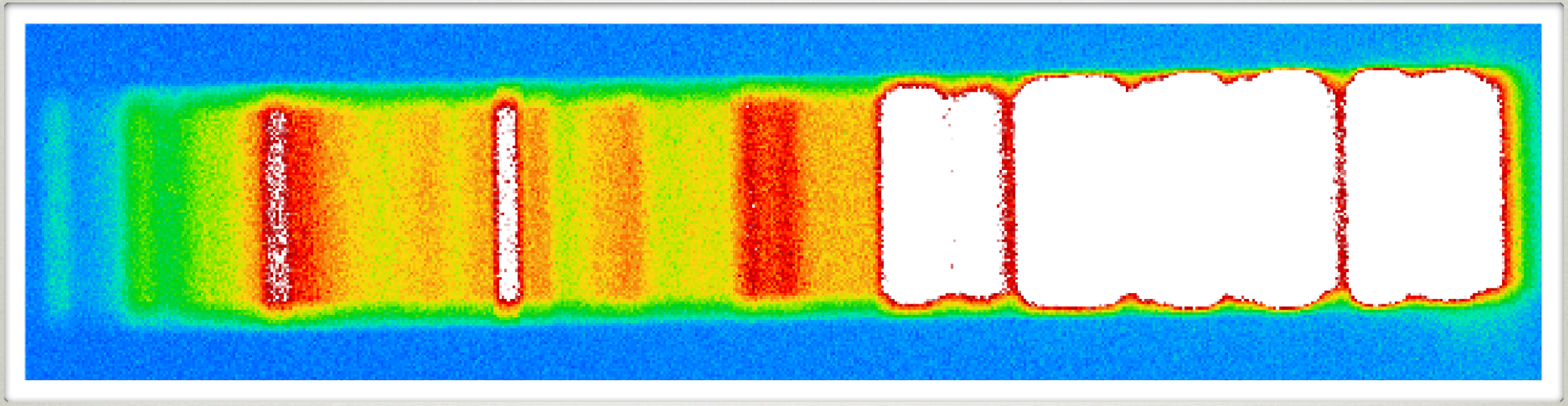


Dispersion Correction

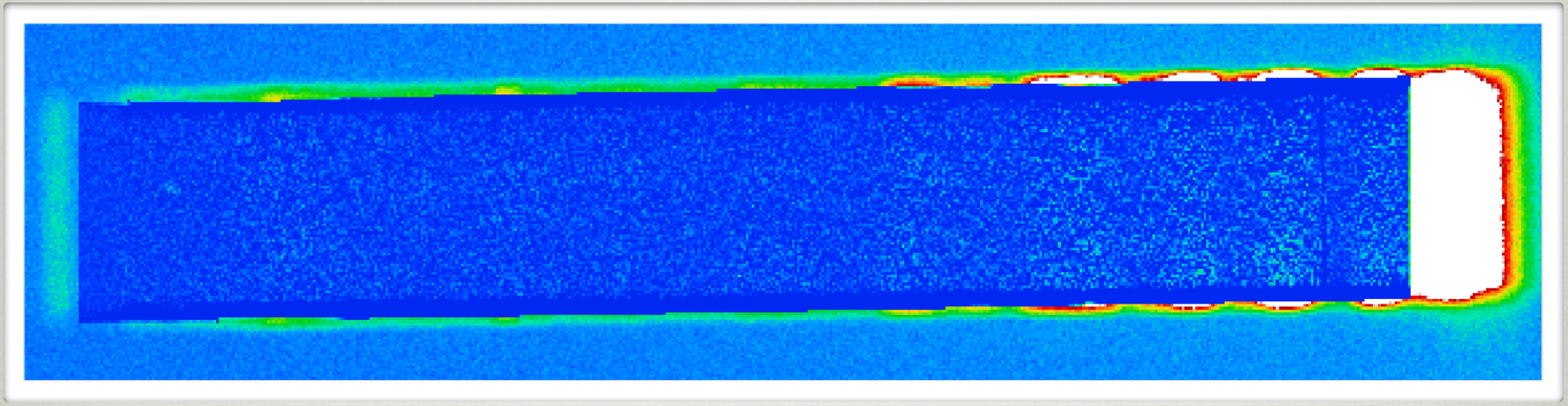




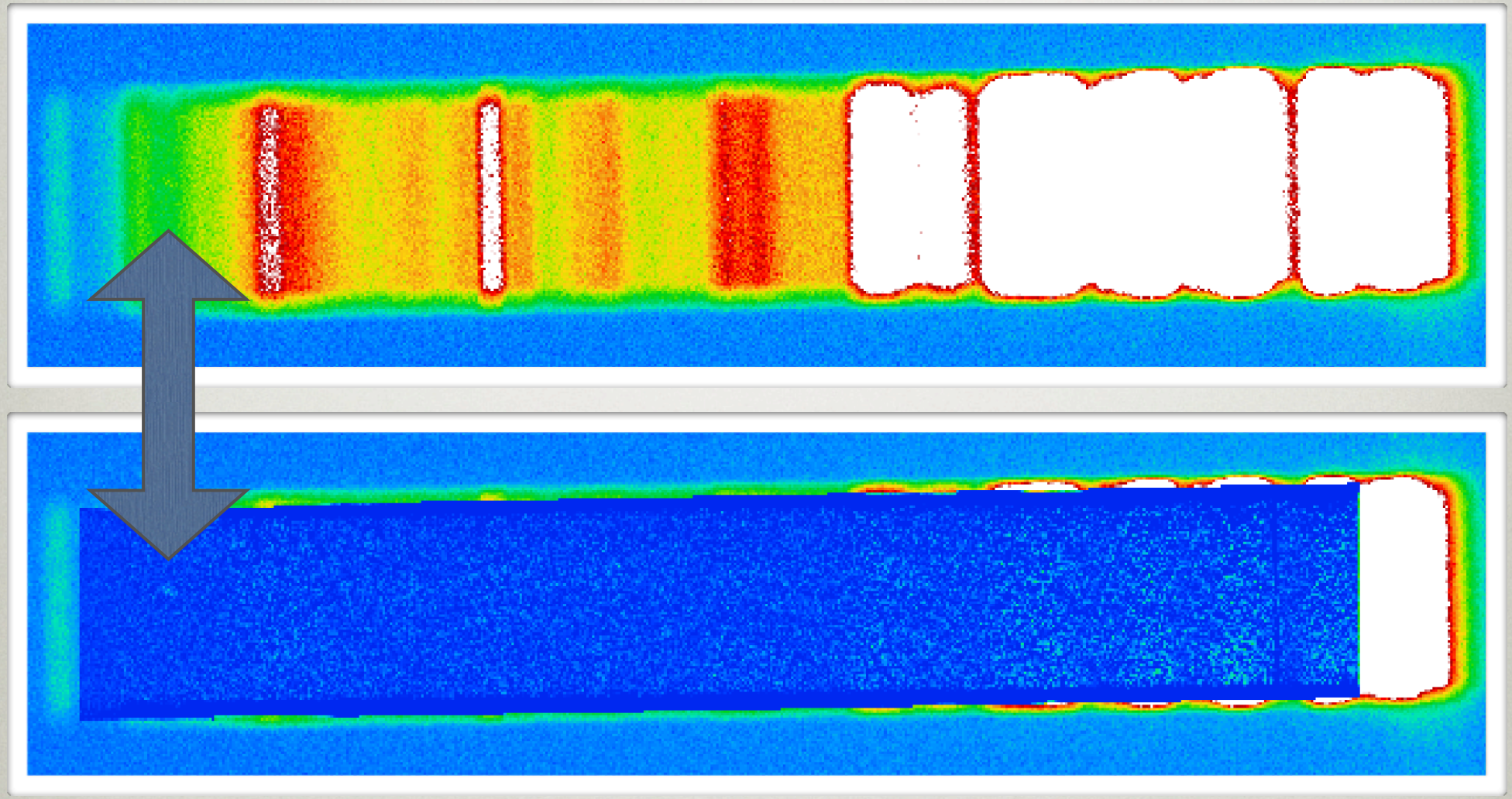
B-Spline Sky Subtraction



B-Spline Sky Subtraction

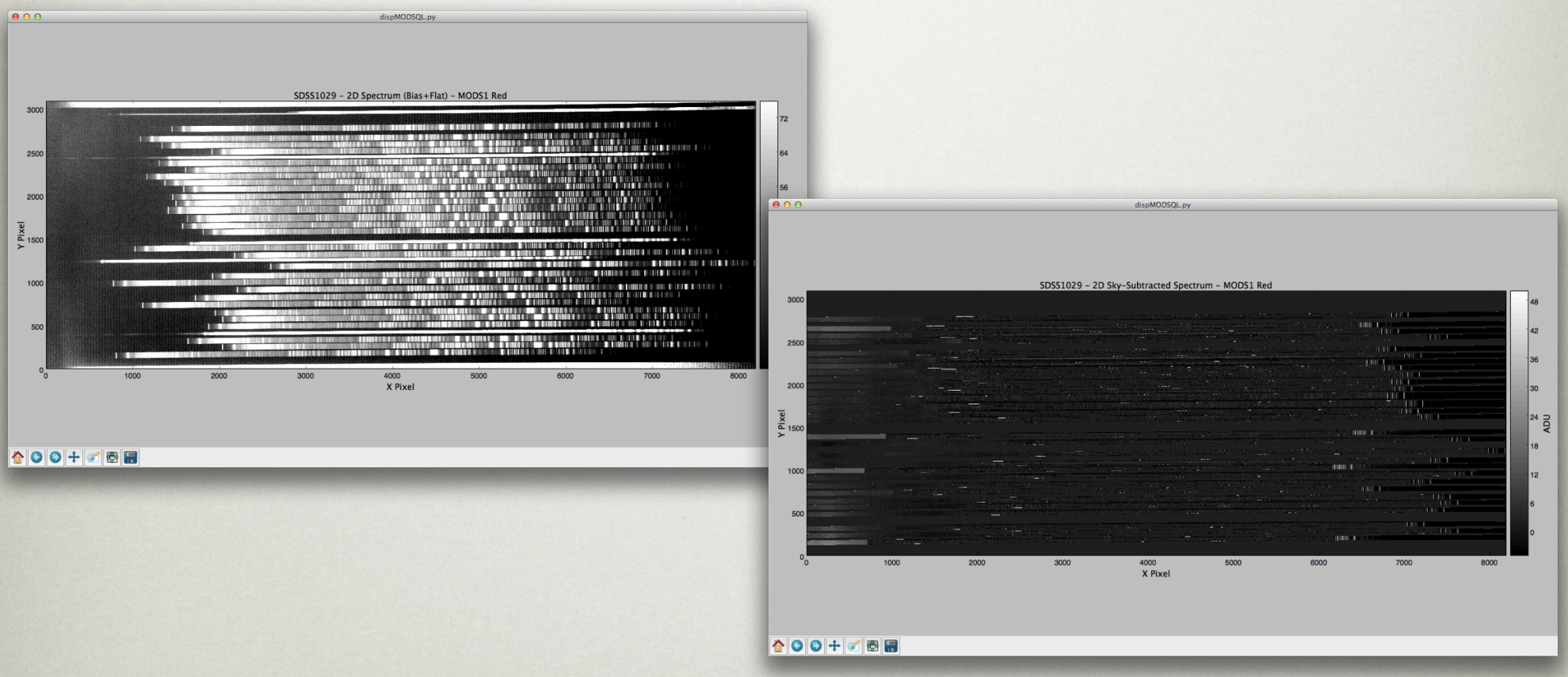


B-Spline Sky Subtraction



Quick Look Tools

We plan on having MODS Quick Look Tools release at LBT starting in the 2014B semester



Final on-site testing in April.

Future Plans

- Better Documentation
- Bug Fixes
- Overall Wrapper
- Onsite Implementation of QuickLook for 2014B
- Your Input is Welcome