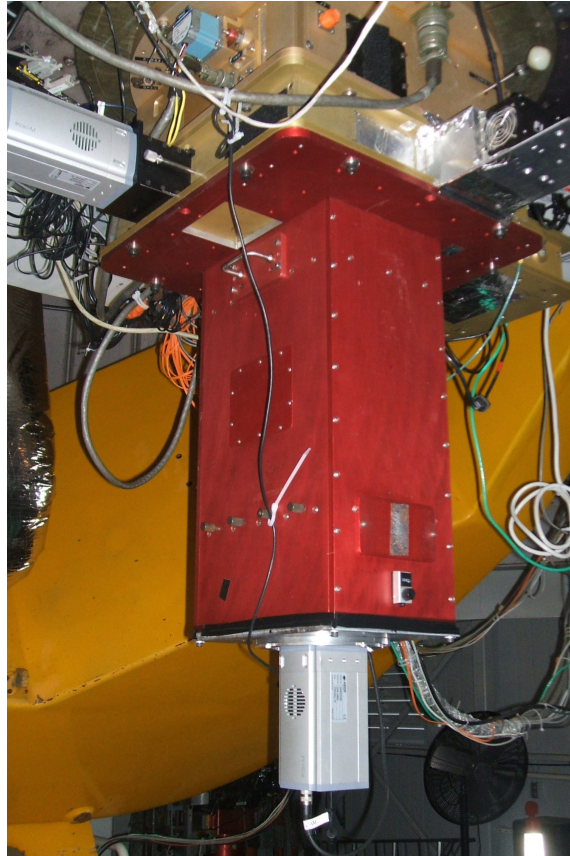


The MkIII Spectrometer



The MkIII Set Up for Imaging with the Andor CCD

This document is based on old information found laying about the Observatory. It is hopeful that all information is accurate. If the project you have in mind requires precise values for any of the quantities listed here, plan on measuring them yourself. Please inform staff if you find real-use experience differs.

The MkIII spectrometer was designed and constructed in 1982. A clone of the spectrometer was constructed in 1986, allowing for one at each telescope. The image-forming optical components consist of a 381mm focal length collimator lens and a Cannon FD 135mm f/2 camera (reimaging) lens. In addition, there is a plano-convex 500mm field lens ($d=45\text{mm}$) situated just below the slit. Mechanically, the spectrometer is quite simple with only two user adjustments: slit width and camera focus.

Dispersion:

Dispersion is provided by choice of grism. Refer to Table 1 for options.

Grism #	Ruling (l/mm)	Blaze Wavelength (Å)
1	150	7300
2	300	8000
3	300	6400
4	300	5400
5	600	4600
6	600	5800

Table 1: Available Grisms

Each grism is held in an aluminum holder that slides into the spectrometer. A grism holder will be in position when the push-pull rod is all the way in. Two hand-tightened screws hold the grism holder in the optical path. It is important to never loosen these screws unless also securely holding the push-pull rod. Failing to do so will result in the grism falling into the spectrometer! Consult with MDM staff if you plan to swap grisms on your own.

Filters:

There are currently two filters (3" square) mounted in holders and ready for use—a Hoya Y-50 yellow filter and a red order-blocking filter. We currently have three unpopulated holders as well, which can hold filters up to a thickness of 7mm.

For red spectra, the order-separating filter is typically necessary.

Filter holders can be removed fairly easily. Again, consult with MDM staff if you plan to swap filters on your own.

The Slit:

Slit width is adjusted with a push/pull rod. Pushing the rod in slowly and completely positions a diaphragm in front of the slit so that the collimator can only see one slit at a time. When the rod is completely in, both the diaphragm and the widest slit will be in position. To go to other slit widths, pull out the rod, one detent at a time. If the rod is pulled out beyond the narrowest slit position, the rod must again be pushed all the way in to reseat the diaphragm. All slit lengths are 27.94mm (5.37' on the 2.4m & 9.65' on the 1.3m). Refer to Table 2 for slit parameters.

Slit Position	W_{slit} Actual (mm)	W_{slit} Projected (mm)	2.4m Projected (")	1.3m Projected (")
1	0.071	0.025	0.824	1.52
2	0.107	0.036	1.17	2.17
3	0.145	0.051	1.68	3.12
4	0.203	0.071	2.36	4.36
5	0.287	0.102	3.34	6.17
6	0.406	0.144	4.72	8.73
7	0.574	0.203	6.67	12.34
8	0.812	0.287	9.44	17.46
9	1.150	0.407	13.4	24.7

Table 2: Slit Information, based on telescope @ f/7.5

In addition to the above slit widths, position 10 contains a series of square holes instead of a continuous slit. This position is useful when calibrating since it gives the entire spatial mapping in a single exposure. It is useful to note that the camera lens has a magnification of 0.354. Linear dispersion is 100 Å/mm.

Direct Imaging:

The slit jaw can be removed, providing a clear aperture of 42mm if you desire to use the instrument as a reducing imager. An alternative field lens is installed to reduce vignetting at the edges of the chip. This configuration allows for a slightly wider field-of-view than when bolting the CCD directly to the filter wheel/MIS. Use of this setup is minimal, although there is some useful application when using the smaller format chip Andor CCD. Using the Andor on the 2.4m, a roughly 12' field (0.4" per pixel) can be expected.

CCDs:

The MkIII can be used in conjunction with any of the MDM Facility CCDs (Templeton, Nellie, Wilbur¹, Echelle) or with the Andor Fast CCD. MDM CCD information can be found at the following link:

http://mdm.kpno.noao.edu/index/MDM_CCDs.html

Andor information can be found here:

<http://mdm.kpno.noao.edu/Manuals/andor/andor as science.html>

MDM facility CCDs are attached to the spectrometer using a tilt plate. This plate provides adjustment for camera translation and tilt (spectral). The tilt plate must be removed in order to obtain focus when using the Andor CCD. This can be an issue for spectroscopy, but shouldn't provide a large impact for direct imaging. If performing spectroscopy, it is advisable to limit your options to the MDM facility CCDs.

Spatial Scale:

Detector	"/pixel, 2.4m	"/pixel, 1.3m
Templeton	0.781	1.41
Wilbur	0.488	0.878
Nellie	0.684	1.23
Echelle	????	????
Andor	0.4	????

Table 3: Spatial Scaling

¹ As of this writing, Wilbur is unavailable for use.

Notes:

1) The off-the-shelf optics show their limitations when observing bluer than roughly 4400 Å. On the other hand, the spectrograph does a good job of staying in focus down to ~ 3900 Å.

2) Since the MkIII bolts directly to the MIS, guiding is available using the Finger Lakes Instrumentation (FLI) camera. Slit-viewing is also obtained, using an Andor CCD. For more information about these systems, check the following link:

<http://mdm.kpno.noao.edu/Manuals/guiderdoc/autoguiding.html>
http://mdm.kpno.noao.edu/Manuals/andor/andor_as_science.html