UVa Focus Analysis: cd 3

TLH: 01-Mar-08
cd3: Focus Analysis Summary

- Fit 2D gaussian to a set of lines for the top of slit.
  - Output is FWHM for major and minor axis (called x_FWHM & y_FWHM) and orientation (theta).
  - Lines chosen to be (mostly) unsaturated and representative across the array.
- Result: Center of array is indeed in focus.
  - “Turndown” near the edges (increase in FWHM) is expected due to field curvature
  - Recommend leaving focus unchanged.
Focus Image: cd 3, argon lamp
Top: Series of model calculations by Joe Adams showing image changes vs. back focal distance. These plots are convolved over a pixel but not over the slit.

Note: For cd3, focus is near optimal for the center of the array.
**cd3: FWHM changes across array**

**Left:** $x_{FWHM}$ (major axis of fit) variation across the array for the top of the slit.

**Right:** $x_{FWHM}$ vs. $x$. This gives the key to the plot on left. Symbol changes are 0.20 pixels apart. Note the focus is close to optimal in the center of the array.
cd3: FWHM changes across array

**Left:** $x_{FWHM}$ (major axis of fit) variation across the array for the top of the slit.

**Right:** $x_{FWHM}$ vs. $x$ along which gives key plot on left. Symbol changes are 0.05 pixels apart, a finer gradation than the previous plot.
cd3: fit angle changes across array

**Left:** Variation in orientation (theta) of 2D fit across the array for the top of the slit. **Right:** theta vs. x along which gives key plot on left. Symbol changes are 45 degrees apart. Note the change near the center of the array indicating that these points are inside best focus. Ignore two points in lower left (irrelevant and no ZEMAX data).
cd3: x_FWHM and fit angle

**Left**: x_FWHM (major axis of fit) variation across the array for the top of the slit. Symbol changes are 0.05 pixels apart, a finer gradation than the previous plot.

**Right**: Variation in orientation (theta) of 2D fit across the array for the top of the slit. Symbol changes are 45 degrees apart.
Focus shift based on cd 3

Residuals before (left) and after (right) fit. Note: points for y < 200 have been excluded. Gauge block settings on left are arbitrary. New gauge block settings are given in right hand plot. The assumed corner locations are indicated on the figure at upper right.

Note: The movement is 61 microns inward averaged over the array while the standard deviation is 50 microns. So I don’t recommend doing this.
Full data

- The next two slides show the variation in the major axis and position angle of the PSF across the array for a large number of the argon lines. All positions along the slit are included.

- Note that these results confirm that the center of the array is at best focus.
cd3: FWHM changes – many points

**Left:** $x_{\text{FWHM}}$ (major axis of fit) variation across the array for the top of the slit.

**Right:** $x_{\text{FWHM}}$ vs. $x$. This gives the key to the plot on left. Symbol changes are 0.20 pixels apart. Note the focus is close to optimal in the center of the array.
cd3: fit angle changes – many points

**Left:** Variation in orientation (theta) of 2D fit across the array for the top of the slit.  **Right:** theta vs. x along which gives key plot on left. Symbol changes are 45 degrees apart. Note the change near the center of the array indicating that these points are inside best focus. Ignore two lines in lower left (irrelevant and no ZEMAX data).