Technical Solutions

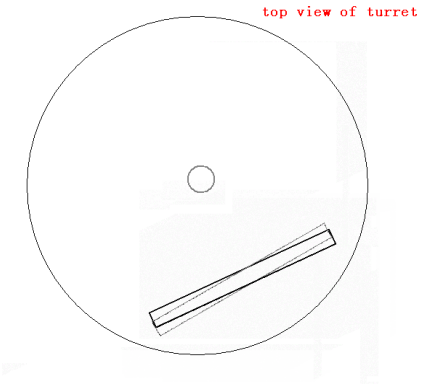
Grating Adjustment on Shamrock Spectrograph Turrets

Products Affected – All Shamrock Spectrographs
Software Affected – SOLIS

Grating fine adjustment may become necessary after your shamrock has been shipped, or otherwise moved. We make every effort to limit the shifting of optical components during shipment, but it is impossible to ensure absolute stability. Even a very small change in tilt of 0.03° will cause a significant image shift of 10 x 26 µm pixels on the sensor. Once your Shamrock spectrograph is securely located no further adjustment will be necessary.

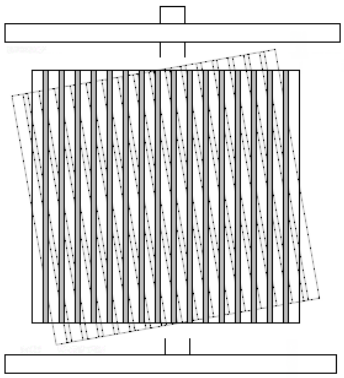
Terms Used

Yaw This is movement of the grating rotating about a vertical axis through its centre – illustrated, right, which affects where the grating zero position lies. The zero position of each grating may change by a small amount during shipping, but this is accounted for using the grating offset utility in the Shamrock control panel and therefore physical adjustment of yaw is not necessary.

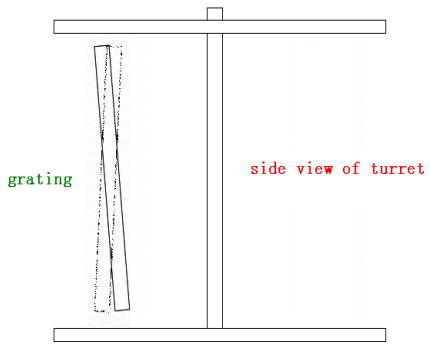


Roll This affects how perpendicular the grating grooves are to the system's horizontal axis. The groves should always be vertical; if they are not, different wavelengths will fall at different heights on the sensor. Typically, roll does not need to be adjusted after moving your Shamrock.

Tilt Tilt is the parameter most commonly found to need adjustment after shipping/moving your Shamrock. A fibre centred at the middle of the entrance slit should produce an image at the vertical middle of your detector. It is sometimes found that the 3 gratings on a turret produce images at 3 different heights. The tolerance required depends on your experimental setup, but during Andor quality control tests the adjustment is made to ± 5 pixels (26 µm pixels).

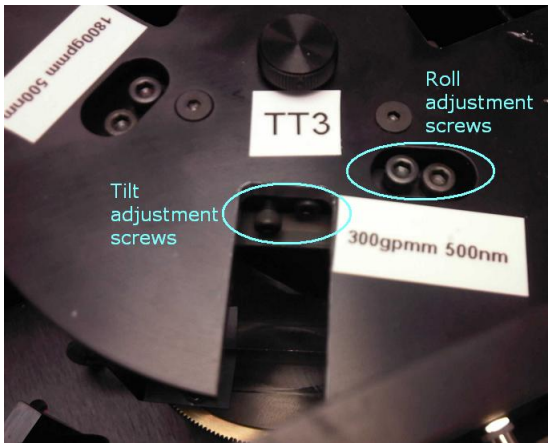


Roll



Tilt

The screws used for grating adjustment are shown here on the right.



Grating adjustment for yaw is not needed as this is accounted for in the software, using the offset adjustment.

The screws are push-pull and for adjustment one should be loosened then the other tightened. When you are happy with the grating position they should be gently tightened against each other. When one screw is tightened the other may become loose, so it is best to go back and forth incrementally tightening them both.

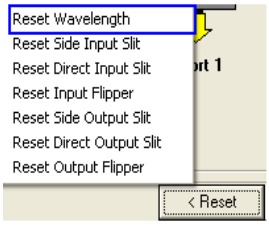
Method

Grating adjustment is an iterative process, and can be done with just a slit and any light source, such as a weak laser – but ideally is performed using a fibre input and a calibration light source. It is best to check the roll before the tilt, because adjusting the roll may affect the tilt.

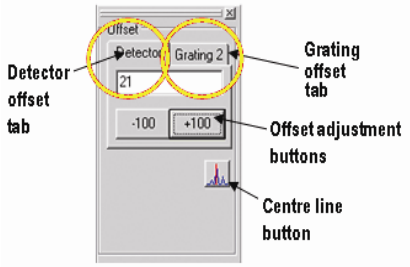
1. Reset the wavelength drive.

2. Acquire an image in real-time mode showing the fibre on the sensor. If your system has a shutter, set it to 'Auto' to acquire a sharp image with no smearing during readout.

3. Use the offset adjustment to move the image to the approximate horizontal centre of the sensor, and make a note of the height.



Step 1.



Step 3.

4. Move to a wavelength, λ, at a high grating angle. The control panel wavelength slider will show a red mark for the maximum operating angle of 60°. For the best roll adjustment accuracy, move to an angle that is greater than half this wavelength. With low density gratings you may need to use higher orders of calibration wavelengths, e.g. when using a 300 gpmm grating you may wish λ to be the 8th order of the 546 nm mercury line, 4368 nm, which is a grating angle of 42°.

5. If the fibre image is at the same height in the centre of the detector at the zero order and at the high wavelength, then you do not need to make any adjustment to your grating. Otherwise, remove the lid, familiarise yourself with the adjustment screws on the grating, and if possible adjust your room lighting and use a piece of blanket to enable real-time adjustment of the grating assembly while the camera is acquiring.

6. If the fibre image height changes between the zero order and the high wavelength, then you need to adjust the roll of the grating. Only make tiny adjustments with the push-pull screws before moving between 0 nm and λ nm to check the effect. If the image is higher at λ than at the zero order, then loosen the inner push screw and tighten the outer pull screw.

7. When the roll of the grating is satisfactory, adjust the tilt of the grating to centre the image. If the image is too high, then loosen the pull screw (on the right of the two screws) and tighten the push screw (on the left of the two screws).

8. Repeat for other gratings on the turret.

If you experience any difficulty with the above process, please contact your local Andor Representative (details of this can be found on our website, www.andor.com).