

## USE OF ORDER BLOCKING FILTER (OBF) WITH *ImSpector*

### Why should the filter be used ?

The ImSpector spectrograph is based on a transmission diffraction grating where the different wavelengths are diffracted to angle  $\beta$  according to the grating equation:

$$m\lambda = d(\sin \alpha + \sin \beta) ,$$

where  $m$  is the diffraction order ( $0, \pm 1, \pm 2 \dots$ ),  $\lambda$  is the wavelength,  $d$  is the groove spacing and  $\alpha$  is the incoming angle to grating.

It can be seen that there are more than one wavelength that satisfy this equation for a particular set of values of  $d$ ,  $\alpha$  and  $\beta$ . In practise this means that there are overlapping orders of spectra which go to the same place on the detector surface.

#### Example 1.

Let us assume that the spectrograph is designed so that it produces the first order ( $m=1$ ) spectrum in the range of 430 - 900 nm across a specified detector surface. From equation (1) it can be seen that the second order ( $m=2$ ) spectrum in the range of 430-450 nm is now diffracted to the same angle range as the first order spectrum in the range of 860-900 nm. This superposition would lead to ambiguous spectroscopic data if suitable filtering is not applied that prevented the overlapping situation.

Spectral Imaging Ltd. can supply a special OBF filter to avoid this spectral overlapping. In this filter 50% of the surface is coated to block wavelengths below 550 nm and transmit wavelengths in the band of 550-1000 nm. Standard size of the filter substrate is 14 mm diam., but it can also be cut to custom sizes.

The filter should be positioned after the spectrograph close to the detector and should be oriented so that the OBF coated half of the filter is in the higher wavelength side of the detector (see Fig. 1). In this way it prevents wavelenths below 550 nm from overlapping with the higher wavelengths.

There are two possibilities to install the filter:

1. by mechanical holder or
2. by gluing the filter substrate onto the detector window. The substrate should be glued on the OBF side. The other side of the substrate is AR coated.

In both cases the OBF should be as close as possible to the detector surface, in practice the distance should be less than 6 mm. We recommend testing the system by using a mechanical holder before gluing the filter permanently to the detector window. For a suitable glue, please consult Spectral Imaging Ltd.

### Placing of the OBF

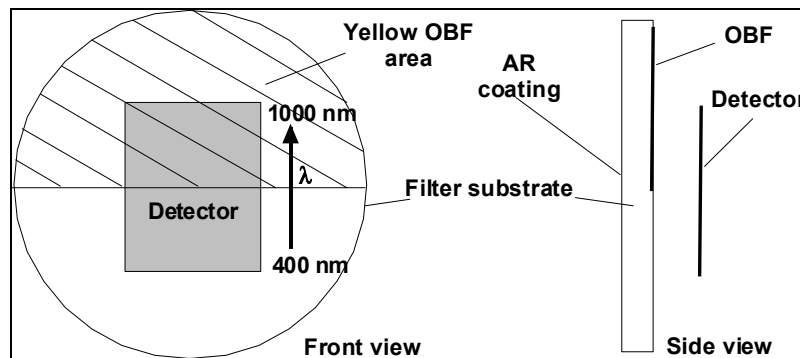


Figure 1. Installation of the order blocking filter.