TECHNICAL NOTE TN-030

Problem	Using VIS optics in IR	Date	26.08.2015
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BACKGROUND

Due to C-mount standard it is possible to use optics manufactured for visible range machine vision application also in the IR region. However, there are some problems associated, namely:

- Achieving good focus may be impossible. VIS objectives are not designed to focus well on longer wavelengths.
- Achieving proper focus at all wavelengths simultaneously. This is due to image plane not being flat but more or less curved and/or tilted – again a problem of basic design.
- Additional stray light due to coatings designed for VIS range only. In fact, coatings start to act as "half-mirrors" causing multiple reflections between surfaces.
- High level of vignetting. Due to coatings being angle sensitive and not designed to IR region there is strong vignetting at the edges of the image plane.

EXAMPLES

We have measured on typical example of lens designed and manufactured for VIS in SWIR spectral region 1000-2500 nm.

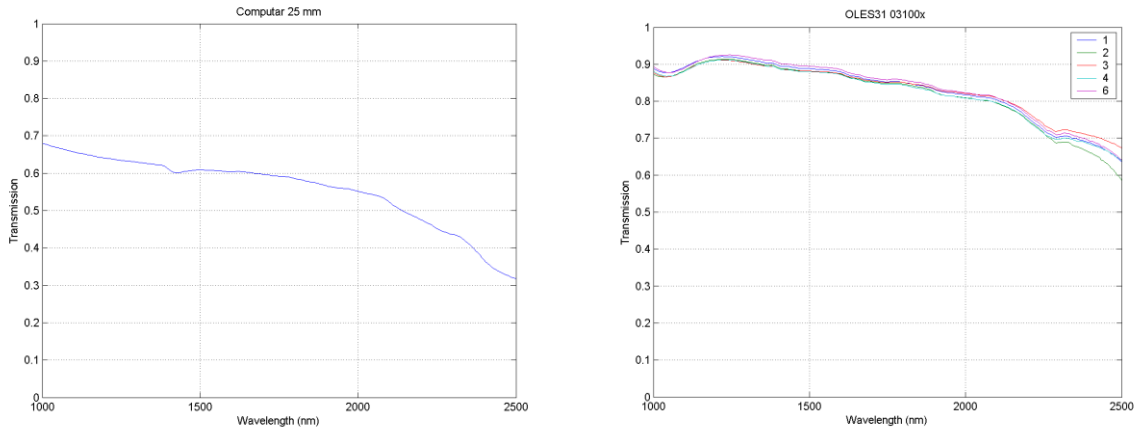

Figure 1. Transmission of the Computar lens in the center of the image field and IR lens OLES31 at different field positions.

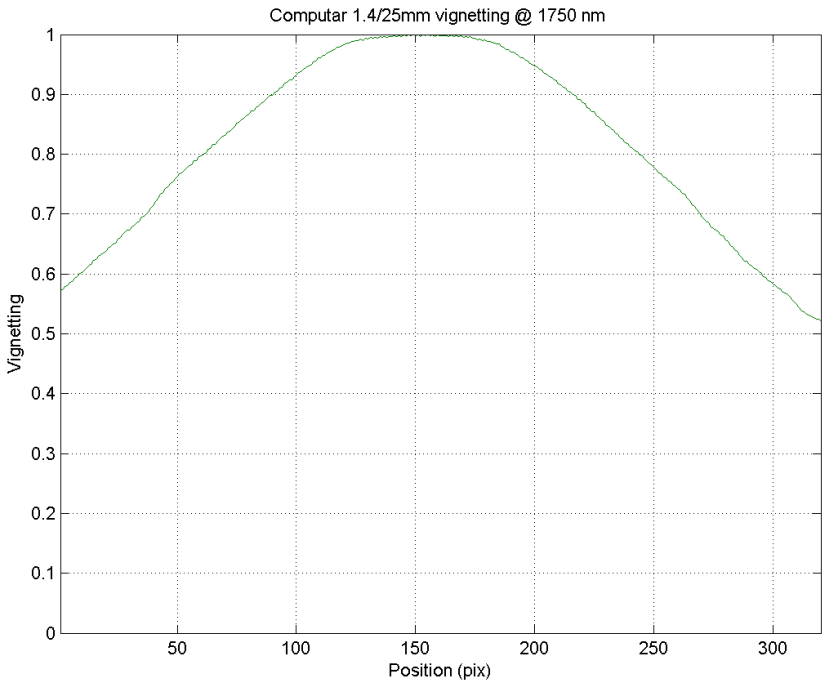

Figure 2. Vignetting of the Computer lens at the edges of the image (measured at center wavelength). OLES31 does not have vignetting.

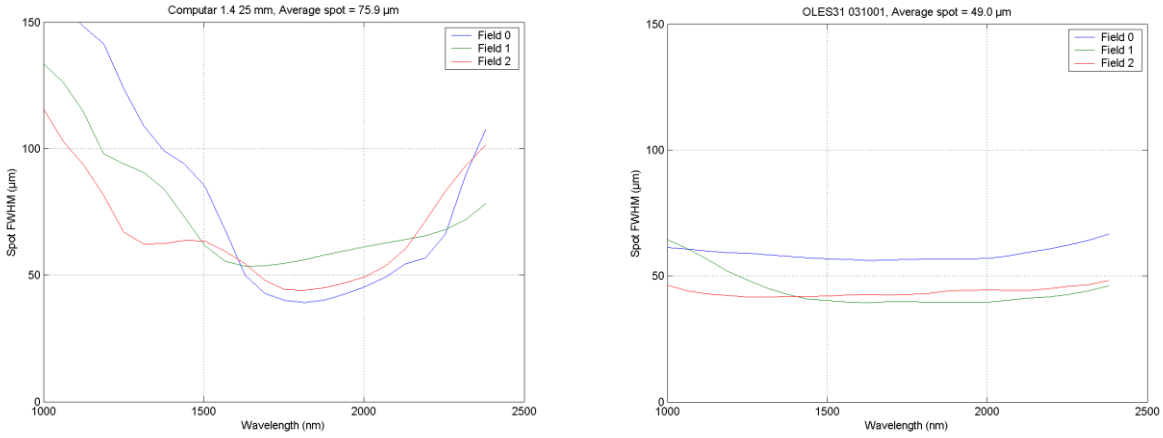

Figure 3. Spot size of the lenses in different image positions. Computar has been focused to give smallest spot size at the center wavelengths.

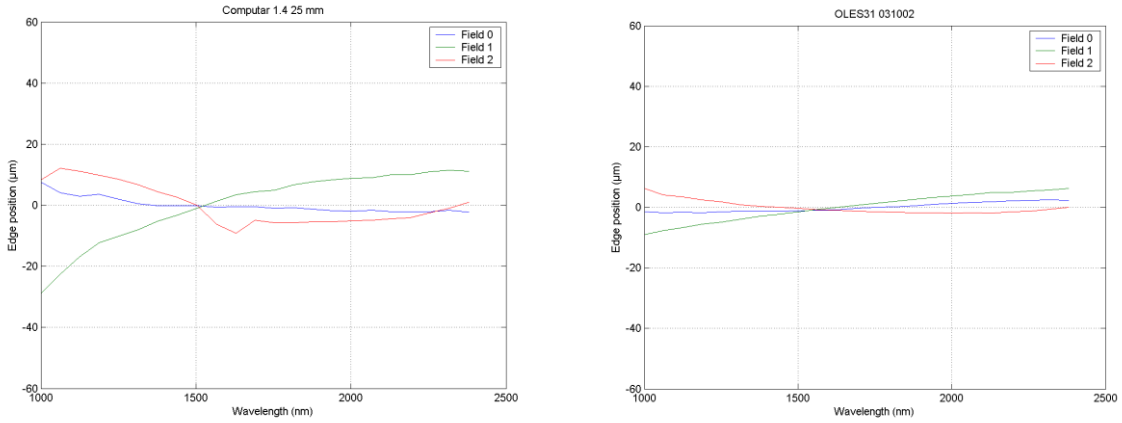

Figure 4. Keystone aberration measured at different image fields for Computar and OLES3 lenses.

EFFECTS IN MEASUREMENT

1. Spatial mixing of spectral features
    - Reflections at fore optics lens surfaces are actually mixing spatial positions (and their spectral features).
2. Reduces signal levels
    - The losses at longer wavelengths and at the edge areas (vignetting) are causing both low signal levels but also dynamic range problems at different field positions.
3. Straylight
    - Straylight is introduced by the fore optics is only in spatial axis.