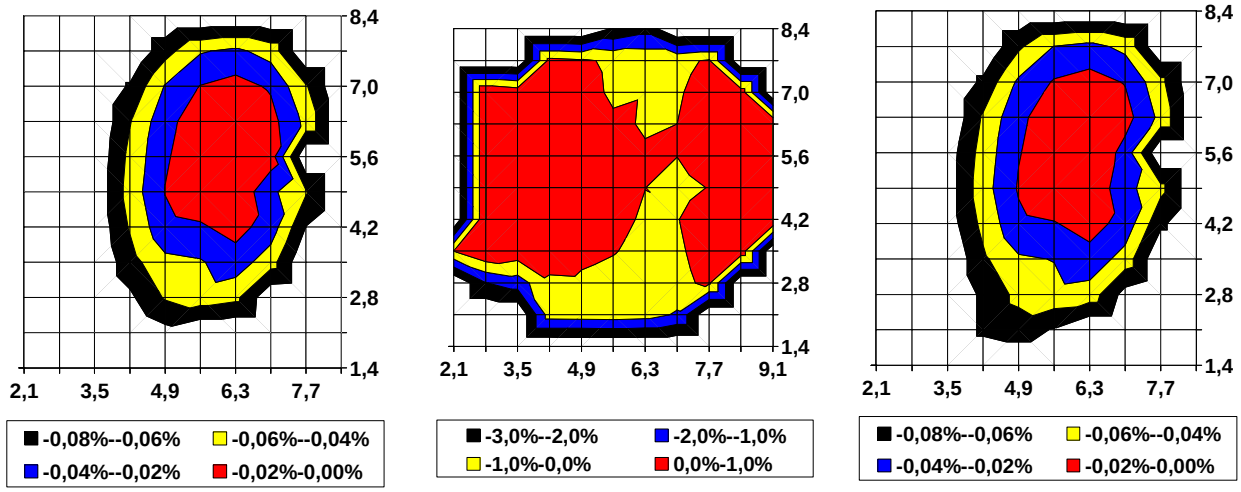
Spatial uniformity of internal quantum efficiency

The characterization of multi-element photodetectors depends critically on its alignment in the measurement set-up. With the help of a lately designed cover of the input/output apertures of our trap detectors, the preliminary visual alignment is further convenient (see figure right). This is especially handy when weak transmitted beams are desired to observe. The transmitted beam measurement could yield, for example, information about spatial variations in internal quantum efficiency (IQE) of a whole photodetector.

In contrary to the reflectance type detectors, the transmittance (ie total reflectance) and its variation over active area can be easily measured in transmission-type detectors. To give an example, the spatial variations in responsivity of 4-element transmission trap detector are shown in the leftmost figure below. The responsivity is uniform to within ±0,1 %. In the middle part of the figure the spatial uniformity map of the transmittance is depicted. The absolute transmittance at the polarization state of measured wavelength 633 nm is about 4 %, while the measured relative spatial variations in transmittance are less than ±2 %. Thus, the absolute variation in transmittance over the active area is approximately of the same order of magnitude as compared to the uniformity of the responsivity.



a) Spatial variation in responsivity *b) Spatial variation in transmittance* *c) Spatial variation in IQE*

The derived variation in the internal quantum efficiency over active area is mapped in the rightmost figure. It can be noticed, that the spatial variations in IQE are determined mostly by uniformity of responsivity of this detector at the accuracy level we obtained.

In brief, when further measurements require full characterization of a photodetector in terms of spatial variations, the transmission-type trap detectors (eg 4-element and 6-element trap detector of our design) are useful. In applications focusing primarily on spatial uniformity of responsivity, the conventional reflection trap detectors (eg our 3-element trap detector) can be safely used.

Hohenheide OÜ Tel.: + 372 740 9343 Õlle maja, Krüüdneri küla
VAT code: EE101230669 e-mail:info@hohenheide.ee Valgjärve vald, Põlvamaa
Estonian Business Reg. code: 11410853 www.hohenheide.ee 63408 ESTONIA