

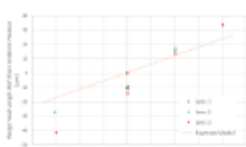
PHOTONICS spectra®

WHITE PAPERS & APPLICATION NOTES

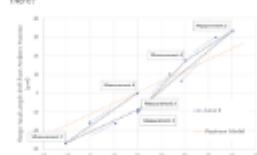
Why We Test Lenses Over Temperature: Model Validation, Focus Hysteresis, and Other Unusual Failure Modes

Written by Kevin Swanson, Senior Optical Engineer, Optikos Corporation

Many applications require high quality imaging over a wide temperature range. This may be due to an uncontrolled environment (e.g. outdoor security cameras), or the intended environment may be regulated to something other than room temperature (e.g. body temperature for endoscopes). However, with temperature variation comes thermal expansion, which introduces an opportunity for the flange focal length (FFL) of a lens to change. This shift defocuses the lens from the sensor plane, resulting in a blurry image. If the optomechanics are not designed to account for this effect in use cases like those mentioned above, the drop in resolution (MTF) of the imaging system can be dramatic. In egregious cases, total mechanical failure (cracking of lenses) has been known to occur.



Lenses 1 and 2 both exceed the model by 50% at 80 µmV/C. Lens 3 deviates further at 1.07 µmV/C. System engineers will not be surprised by a discrepancy like this between modeled and field test data (ask a lens or design engineer how to be achieving best-in-class software validation).



At Optikos, we are interested not only in these complex design challenges, but also in understanding how well our predictions match our model predictions. For thermal characterization of lens assemblies, the OpTest Thermal Module is an excellent technology platform. In the data below, we used the OpTest Thermal Module to track the flange focal length of three lenses over a range of -10 to +60°C. Overlaid is a line representing the expected FFL with no permission as predicted by a thermal model built in Zemax OpticStudio. The slope of the model line is 0.5 µmV/C.

Learn more at optikos.com

Why We Test Lenses Over Temperature: Model Validation, Focus Hysteresis, and Other Unusual Failure Modes

Athermalization of imaging assemblies is a common challenge in optomechanical lens design. A prototype that achieves the thermal performance predicted by raytracing software is far less common. This is often due to behavior that is unforeseeable before characterization of as-built hardware. This article details how temperature-controlled metrology using the OpTest Thermal Module can uncover such undesirable effects so that they can be quantified, understood, and ultimately solved.

[DOWNLOAD WHITE PAPER](#)



Visit [Photonics Media](#) to download other white papers and learn more about the latest developments in lasers, imaging, optics, biophotonics, machine vision, spectroscopy, microscopy, photovoltaics and more.

www.photonics.com/WhitePapers.aspx

We respect your time and privacy. You are receiving this email because you are a Photonics Spectra magazine subscriber. You may use the links below to manage your subscriptions or contact us.

Questions: info@photonics.com

[Unsubscribe](#) | [Subscribe](#) | [Subscriptions](#) | [Privacy Policy](#) | [Terms and Conditions of Use](#)

Photonics Media, 100 West St., PO Box 4949, Pittsfield, MA 01202-4949

© 1996 - 2021 Laurin Publishing. All rights reserved. Photonics.com is Registered with the U.S. Patent & Trademark Office. Reproduction in whole or in part without permission is prohibited.



LAURIN PUBLISHING

PHOTONICS MEDIA