



## AUTOMATED ENVIRONMENTAL TESTS ON LASER COMPONENTS

### Task

To develop innovative mounting techniques for laser optics, directional stability reaching into the  $10 \mu\text{rad}$  range ( $\approx 2''$ ) is required. This stability should also be proven for optics used in space-based laser systems which are subjected to harsh temperature loads. Since tests that simulate such harsh temperature loads can last for several days, a significant increase in capacity was necessary to conduct the required number of qualification tests in the scope of the project's running time.

### Method

The alignment of mirrors can be determined by means of an autocollimator. To investigate the influence of changing temperature loads, a common climatic chamber was provided with windows on the sides so that the alignment of mirrors can be measured externally with an autocollimator; the mirrors are subjected to defined temperature cycles inside the chamber. To automate the measurement process, two autocollimators each were arranged on a linear axis in such a way that measurements could be made over the entire width of the windows of the climatic chamber. This way, each individual autocollimator can measure up to eight mirrors under the prevailing conditions. The process data, to be processed simultaneously, are prepared so that the results can be analyzed both quickly and simply.

### Result

Due to the automation thus performed, up to 32 mirrors can undergo a climate test. This means capacity can be expanded significantly, thus also enabling comprehensive long-term tests to be conducted. The angle resolution of the measuring system currently amounts to about  $2 \mu\text{rad}$ .

### Applications

The climate tests conducted at the Fraunhofer ILT are an essential component of the qualification of laser components for LIDAR systems in the aerospace industry. Furthermore, the system developed here can be used in any situation where the change of the alignment of (reflecting) surfaces has to be investigated under changing temperatures.

### Contact

Dipl.-Ing. Erik Liermann  
Telephone +49 241 8906-8089  
erik.liermann@ilt.fraunhofer.de

Dr. Michael Leers  
Telephone +49 241 8906-343  
michael.leers@ilt.fraunhofer.de

1 Mirror with autocollimator.

2 Mirror in climatic chamber.