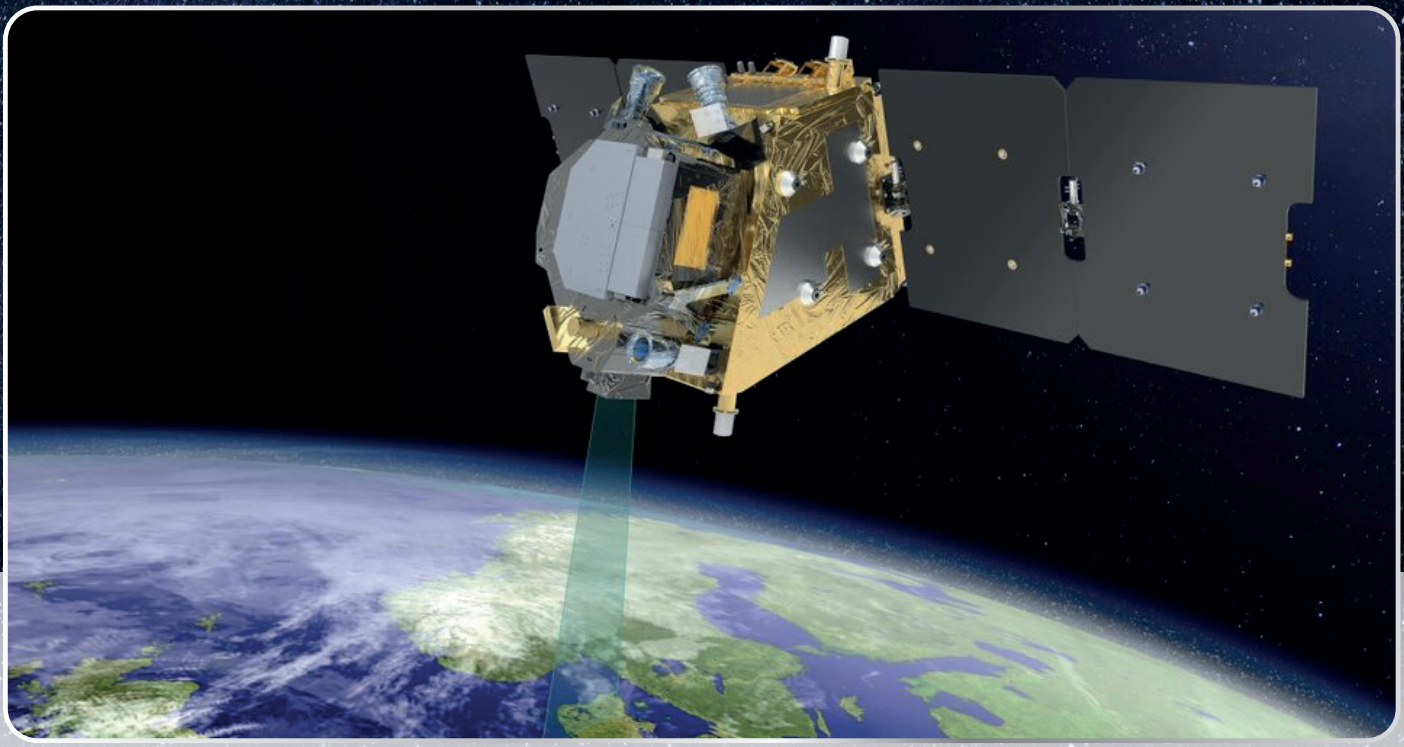
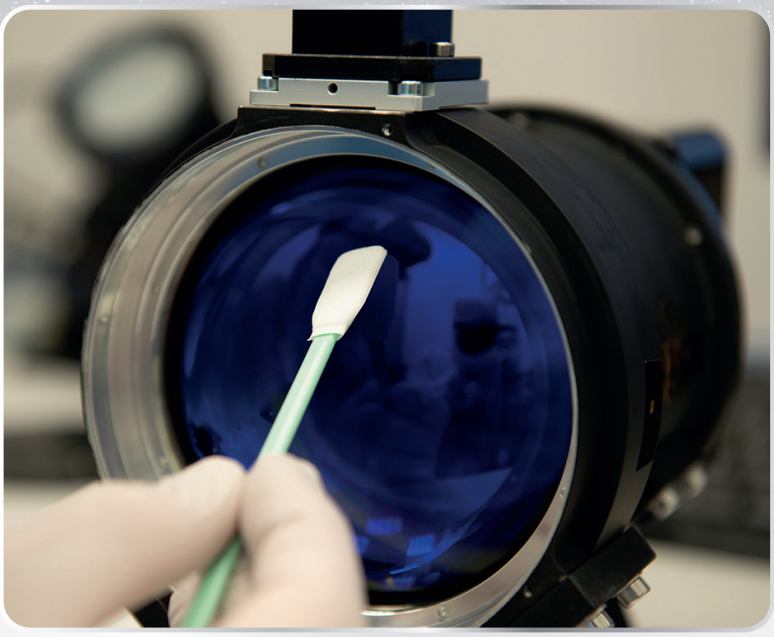
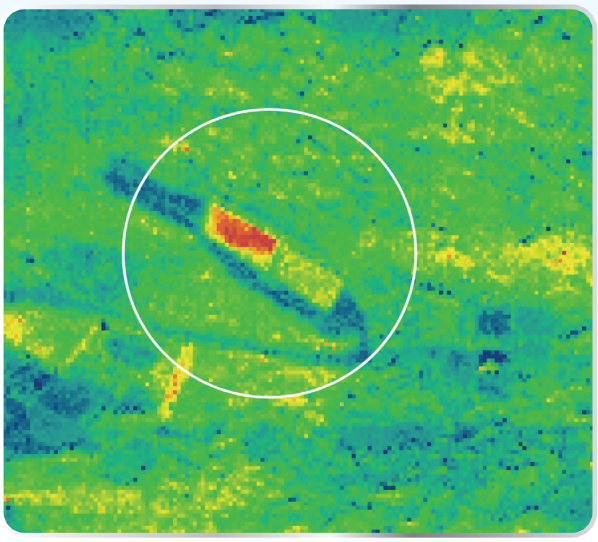
Optical elements of FLORIS telescope for FLEX (FLuorescence EXplorer) mission





FLEX, one of ESA's new missions, examines the Earth's vegetation. The Fluorescence Explorer (FLEX) will map vegetation fluorescence to quantify its photosynthetic activity. The conversion of atmospheric carbon dioxide and sunlight into energy-rich carbohydrates through photosynthesis is one of the most fundamental processes on Earth—and one on which all life depends. Information from FLEX will improve our understanding of the way carbon moves between plants and the atmosphere and of the way photosynthesis affects the carbon and water cycles. In addition, this information will lead to a better insight into plant health and stress. This is of particular relevance since the growing global population is placing increasing demands on the production of food and fodder. The FLEX satellite will orbit in tandem with one of the Copernicus

Sentinel-3 satellites, taking advantage of its optical and thermal sensors to provide an integrated package of measurements.



The main instrument of FLEX is called FLORIS (Fluorescence Imaging Spectrometer). It is a high-resolution imaging spectrometer, which will acquire data in the 500–780 nm spectral range, with a sampling of

- 0.1 nm in the oxygen bands O2-A (759–769 nm) and O2-B (686–697 nm); and
- 2.0 nm in the chlorophyll absorption band (600–677 nm) and Photochemical Reflectance Index band (500–600 nm).

In order to feed the spectrometer, a dedicated telescope is needed. This telescope has been designed, manufactured, and assembled at TOPTEC (IPP ASCR, v.v.i.). It is a compound of five very delicate 100 mm-class lenses made with surface form precision higher than lam/20 RMS and surface roughness as low as 0.3 nm. Only such high-level optics can enable observation of the weak signal from the vegetation. The lenses need to be housed in a mechanical system whose individual mecha-nical elements are realized with micrometers precision. During the satellite takeoff, the fragile optics will face an enormous stress caused by the rocket vibrations; hence, a dedicated gluing technique enabling the isolation of the optics from the vibrations has been developed and applied. Last but not least, TOPTEC has developed a unique compensation technique allowing the system to achieve a perfect optical performance.