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FLUMIAS DEMONSTRATOR: A MINIATURE, FAST-TRACK APPROACH TO LIVE CELL IMAGING MICROSCOPY ON THE ISS

Abstract

How does gravity affect the cells of mammals and plants? What happens to the inner structure of human cells in the absence of gravity? And which role does gravity play for human health and diseases on earth? The ISS is a unique environment to address all these questions. Finding the right experimental approach is one of the most challenging tasks scientists have to undertake when performing research in microgravity. In terrestrial laboratories, a key method used to investigate cellular structures is high-resolution fluorescence microscopy. However, up to now, researchers have had to bring their samples back to earth for such high-resolution analyses limiting the research to fixed cells and a few chosen time points. FLUMIAS was developed by Airbus Defense and Space on behalf of Germanys DLR Space Administration. The FLUMIAS-project provides a novel technology for high-resolution live-cell imaging on ISS. The core of the facility will be a quasi-confocal fluorescence microscope enabling researchers to reconstruct high-resolution pictures, 3D-models and even short videos sequences. As part of the preparations for the facility and to test the new technology, a demonstrator version based on the same microscope type is miniaturized to fit into 7U of the Space-Tango facility. By a fast-track commercial approach, within only one year from kick-off to launch (SpaceX CRS-15), the FLUMIAS-Demonstrator is scheduled to be operating automatically during the HORIZONS mission of the Geman ESA astronaut Alexander Gerst on ISS. One sample selected for the demonstrator mission are primary human macrophages. Using two different excitation wavelengths, the actin cytoskeleton and the nucleus will be imaged over the course of several days in microgravity. In addition, to demonstrate the full capability of the microscope, another sample with fixed cells will be imaged using four different fluorescent dyes marking specific cellular structures. The presentation will feature first data of the experiment, lessons learned from the mission and an outlook on upcoming activities in the FLUMIAS-project on ISS.