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Life and Microgravity Sciences on board ISS and beyond (Part II) (7)

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FLUMIAS - A CONFOCAL FLUORESCENCE MICROSCOPE FOR THE OBSERVATION OF INNER
CELLULAR PROCESSES UNDER ADJUSTABLE ARTIFICIAL GRAVITY IN THE RANGE
BETWEEN ZERO AND ONE G

Abstract

The DLR Space Management is planning to provide a facility to perform biological and medical science on gravitational effects of inner cellular processes of mammalian and plant cells in space. Airbus Defence and Space is the prime contractor of the development of this facility.

The core instrument of this facility is a confocal fluorescence microscope, where the microscope and the sample container will rotate on a centrifuge. The radius of the sample and the maximum speed are designed such that the range between g and $1g$ can be applied. Up to six individual experiments can be conducted one by one within each mission. This is ensured by a individually equipped experiment containers, which are installed on the facility own storage Magazine, providing power to each experiment container, and a Transfer Mechanism, which moves the experiment hardware from the Magazine to the centrifuge and back. Goal of this ability is to limit the crew activity to loading and unloading of the experiment hardware. As soon as an experiment container has been set on the centrifuge, the microscope is able to produce stacks of up to four fixed wavelengths. The pre-programmed rotational speed of the centrifuge allows any kind of artificial acceleration profile between microgravity and $1g$. Although the experiment is nominally conducted by a pre-defined experiment specific Parameter Set the scientist will be able to modify the experiment parameter as reaction of the downloaded and compressed near real-time pictures. The raw data of the microscope camera will be stored on an exchangeable mass memory. After download of the mass memory high resolution pictures and stacks will be available. In cooperation with the Russian Space Agency the FLUMIAS-ISS shall be launched in 2020 and installed in one of the Russian modules of the ISS.

Currently a "FLUMIAS Space Demonstrator" is also developed and will fly within the mission "Horizons" onto the ISS in June 2018. The demonstrator will be able to observe one living and one fixed sample under microgravity. Compared to FLUMIAS-ISS microscope the demonstrator was downsized again and fits together with the sample cell into a 7 l volume. In cooperation with the Space Tango Inc. the demonstrator will be launched with SpaceX-15 and installed in the TangoLab 2 of the ISS.