

On-Ground Calibration of DESIS – DLR’s Earth Sensing Imaging Spectrometer for the International Space Station ISS

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ABSTRACT

The DLR Earth Sensing Imaging Spectrometer (DESI) is a new space-based hyperspectral instrument developed by DLR and operated under collaboration between the German Aerospace Center (DLR) and Teledyne Brown Engineering (TBE). DESI will be mounted on the International Space Station on the MUSES platform in 2018 and will provide hyperspectral Earth Observation in the wavelength range from visible to near-infrared with high resolution and near global coverage. TBE provides the platform and infrastructure on the ISS. DLR developed the instrument, while the optical system was fabricated and pre-aligned by the Fraunhofer Institut für Angewandte Optik und Feinmechanik (IOF). This paper presents the on-ground adjustment, focusing and calibration approach for DESI done at the optical lab of the Institut für Optische Sensorsysteme (DLR). The optical lab set-up will be described in detail. Selected calibration results like detector Modulation Transfer Function (MTF) and linearity, optics MTF and wave front, focus position, smile and keystone measurement, instrument spatial and spectral MTF, and absolute radiometric calibration will be presented. The spectral and radiometric in-flight calibration approach of the DESI calibration unit (CAL) based on stabilized Light Emitting Diode (LED) arrays will be demonstrated. In addition, the innovative pointing unit (POI) in front of the instrument and its pointing accuracy will be introduced. Finally imaging quality and accuracy of the sensor calibration will be evaluated with respect to foreseen applications.

Keywords: DESI, ISS, MUSES, hyperspectral, MTF, keystone, smile, calibration, in-flight, LED array