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Author: Dr. Olivier Saint-Pé
Airbus Defence and Space - Space Systems, France, olivier.saintpe@airbus.com

Mr. Nicolas LIO SOON SHUN
Commissariat à l'énergie atomique et aux énergies alternatives (CEA), France, nicolas.liosoonshun@cea.fr

HOLDON: DEVELOPMENT AND CHARACTERIZATION OF STATE OF THE ART DETECTION MODULES FOR FUTURE GREENHOUSE GASES SPACE LIDAR MISSIONS

Abstract

Thanks to their capability to provide accurate direct and unbiased access to physical parameters, space lidar measurements are becoming an essential tool for Earth observation, as in-flight demonstrated by US (ICEsat, Calipso) and European (Aeolus) missions. Lidar has notably been identified as a powerful complementary tool to passive spectrometers in order to sense greenhouse gases involved in climate changes. Developing lidar operational missions will however ask for the availability of small and affordable high performances instruments, requiring the development of nearly perfect detectors able to exploit every useful photon at very high speed from UV up to extended SWIR.

While none of the regular detection technologies selected for in-flight or under development lidar missions simultaneously offers all those qualities, MCT APD technology has the ability to meet these needs thanks to high quantum efficiency, low excess noise factor, large electrical bandwidth and large spectral range, as recently demonstrated in the scope of European and US RD and pre-development studies.

With the aim of developing first in class lidar detection chains based on MCT APD technology, a European team has specified, designed, manufactured and characterized versatile lidar detection modules in the frame of HOLDON H2020 study, coupling together CEA/LETI state of the art MCT APD detectors with a high dynamics, high bandwidth and low noise pre amplifier optimized for lidar missions.

Following the delineation of conventional lidar optical detection technologies including corresponding advantages and drawbacks, the presentation will outline MCT APD unique features and present related HOLDON detection modules requirements answering most of future scientific space lidar missions. The technical characteristics of key building blocks developed in the scope of HOLDON will be introduced, including custom pre-amplifier containing features fully devoted to lidar applications, development of associated electronics and lidar echo simulator as well as passive and active cooling systems. HOLDON detection modules characterization results will be presented and compared with regular lidar detection technologies ones. Finally, the future prospects for such MCT APD lidar detection modules will be outlined.

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