Modular setup of SLR laser and detection packages

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An increasing demand of facilities capable of doing satellite laser ranging, space debris laser ranging or optical communication pushes the demand to create accurate, cost-efficient, reliable and yet simple components to be integrated. In the framework of the development and upgrade of the new Izaña-1 SLR station located on Tenerife in Spain, IWF Graz created new concepts for modular piggyback laser and detection packages. Optical components are selected based on commercial off the shelf (COTS) components and simulated with ray tracing software.

Laser packages consist of the laser with two separate beam expansion telescopes with a collimated part in between, which can be used for imaging of e.g. the backscattered laser beam or the visualization of stars for alignment purposes. A combination of wave plates and polarizing beam splitters allow for power adjustment and measurement. One of the lenses is mounted on an electronically movable lens holder which gives the possibility of flexible variation of the beam divergence and a tip-tilt mirror enables direction control of the laser beam. Furthermore, start pulse detection is integrated.

Detection packages are mounted in one of the Nasmyth foci of COTS type astronomical telescopes. In the beam path direction the field of view iris is followed by optics to collimate the entering photons to approx. 1 cm with some flexibility to tune the field of view of telescope. Dichroic mirrors separate the incoming light w.r.t. wavelength and distribute it to various sensor modules (e.g. single photon avalanche detectors for green and infrared, single photon light detection, optical guiding cameras and beam adjustment cameras). Both sensor and detection package operate a temperature control system and the necessary interfaces to connect to e.g. event timers, power supply or control pc.