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High performance modular, compact and ruggedized processing system for airborne and balloon remote sensing instruments

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Observations from aircraft and balloons with remote sensing instruments are an important method to investigate processes within the Earth environment. These applications require powerful computing systems that must be developed or adapted for the measurement task and requirements. In particular, imaging spectrometers generate high data rates by almost 10,000 pixels at about 4,000 frames per second. Accordingly, high performance is needed to provide operational control and data processing with high data bandwidth and the capability to store this data also during long duration flights.

A modular processing system architecture based on modified industrial grade board components has been developed to meet these high requirements for processing power and storage capacity. The major advantages of this approach are flexibility, (re)programmability, modularity and module re-use in order to attain lower development time and costs. However, it is a challenge to design this processing system to be suitable for the harsh environments of aircraft or balloon applications in terms of temperature range, humidity and vibration.

With an efficient approach ruggedized characteristics are achieved using a conduction cooled design in combination with components based on VPX standard and customized backplane transition modules in order to reduce operational risk with necessary measures of mitigation techniques. This approach results in a processing system that combines hardware and software redundancies to assure system availability and reliability for long duration flights.

In this presentation the compact flight proven system design is presented that has been used in recent years for high spectral resolution limb-observations by the GLORIA (Gimballed Limb Observer for Radiance Imaging of the Atmosphere) spectrometer aboard the HALO and Geophysica high-altitude aircrafts. Various system configurations and performance results will be shown, which have been achieved in the current design and will be applied in future balloon campaigns.