FRONTIERS OF HYPERSPECTRAL IMAGING INSTRUMENTS

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Since Goetz *et all* [1] first published their article on spectral imaging for earth remote sensing it has been clear that this measurement technology and its application are strongly connected to technical development of detectors, optics and computer processing power. Most important, however, being detector due to applicable wavelength range being dictated by it. There are currently several interesting instrument technologies like push-broom, linear variable filters (LVF), tuneable filters and Fabry-Perot interferometer, to name a few. These show potential for many yet unforeseen applications in environmental monitoring, agriculture, industrial production control and quality assurance as well as in various research fields.

Presentation shows three example instruments and related applications showing current status of technological development. First is Fenix 1K double spectrometer instrument with one thousand co-registered swath pixels throughout whole spectral region from 380-2500nm. Wide swath improves remote sensing collection efficiency and contiguous high S/N -spectra makes sub-pixel detection of target objects possible. Second example is high spectral resolution and S/N –ratio sCMOS detector based spectral camera for plant fluorescence measurement. This *HyPlant* instrument has been used by Julich Forschungszentrum [2] and ESA to produce maps of top-of canopy reflectance and sun-induced chlorophyll fluorescence from agricultural areas in Germany and forest areas in Czech Republic and North Carolina, US. Finally SisuROCK drill-core scanning workstation is described with combination of several spectral cameras from VIS to LWIR spectral region and RGB camera for visualization. Scanning of drill cores to digital form makes consistent and accurate structural and mineralogical information available to geologists to assist decision making in mine exploration and planning. Geological survey of Sweden has been the first one to use this in large scale project [3].

Future in spectral imaging is forecasted to be in small, compact and portable instruments used by various professionals in their everyday work.

[1] A. Goetz *et al.*, Imaging spectrometry for earth remote sensing, Science, Vol.228, pp.1147-1153 (1985)
[2] U. Rasher *et al.*, Sun-induced fluorescence – a new probe of photosynthesis: First maps from the imaging spectrometer *HyPlant*, Global Change Biology 21, pp. 4673-4682 (2015)
[3] Drill core scanning at SGU, Geologial Survey of Sweden, (Retrieved February 2016) http://www.sgu.se/en/mineral-resources/geological-information-for-mineral-exploration/