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Large-scale alternative detection systems for CRNS

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Cosmic-Ray neutron (CRN) sensors are widely used to determine soil moisture on the hectar scale. Precise measurements, especially in the case of mobile application, demand for neutron detectors with high counting rates and high signal-to-noise ratios. For a long time CRNS instruments have relied on helium-3 as an efficient neutron converter. Its ongoing scarcity demands for technological solutions using alternative converters, which are lithium-6 and boron-10. In order to scale up the method and to reduce costs we recently have developed large-scale neutron detectors including readout electronics and data acquisition systems based on Arduino microcontrollers. These boron-lined detectors shall offer an alternative platform to current Helium-3 based systems and allow for modular instrument designs. Individual shieldings of different segments within the detector introduces the capability of gaining spectral information. This opens the possibility for active signal correction during mobile measurements, where the influence of the constantly changing near-field to the overall signal should be corrected. Furthermore, the signal-to-noise ratio could be increased by combining pulse-height and pulse-length spectra to discriminate between neutrons and other environmental radiation. This novel detector therefore combines high-selective counting electronics with large-scale instrumentation technology. The successful implementation of our design allowed also to build the largest up to now existing CRNS detector.