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P24 - A segmented detector for airborne gamma-ray spectroscopy

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The Airborne Gamma-Ray Spectrometry (AGRS) allows to measure the radioactivity content of large areas of topsoil. The results of surveys are exploited in many fields like homeland security and geological, mining and hydrocarbon explorations.
Following the IAEA guidelines the first Italian prototype for AGRS has been recently developed and extensively tested for many investigations. In [Guastaldi et al., Remote Sens. Environ., 2013] a detailed radiometric survey of Elba Island (Italy) performed with an autogyro is reported. The energy spectrum information is analyzed offline using the Full Spectrum Analysis (FSA) technique with the Non-Negative Least Square (NNLS) constraint to achieve the concentration of potassium, uranium, and thorium in the topsoil. A multivariate estimation method for interpolating the primary under-sampled airborne gamma-ray data considering the well-sampled geological information as ancillary variables (Collocated Cokriging) is applied for the first time. The maps of U, Th and K distribution with relative uncertainties are the final products.
These experiences encouraged to develop a segmented instrument for investigating airborne gamma ray directionality. The great innovation is the new layout of sixteen NaI detectors, which work independently. The peculiar configuration is set in order to generate asymmetries in the signal acquisition, that can be used to study the anisotropy of radioactivity distribution. The potential identification of orphan sources with respect to the natural background has been confirmed by Monte Carlo simulations, specifically developed for modeling the expected signals.
The communication focuses on the mechanical layout, the main electronic features and the performances of the segmented detector for airborne gamma-ray spectroscopy. We show how the constituents can be easily and rapidly mounted by a single operator on most common helicopters. The acquisition system can manage the charge integration and multi-channel analysis of the signals from each detector. Data registration is flexible: both list-mode and full energy spectra can be selected as recording modes. Preliminary feasibility studies have been performed to test the mechanics and the hardware of the whole system, which is designed to work without any human attendance. The first flights are planned in 2014, with the aim to detect the artificial point sources having intensities on the order of 10^8 Bq and natural enriched fields already monitored.

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