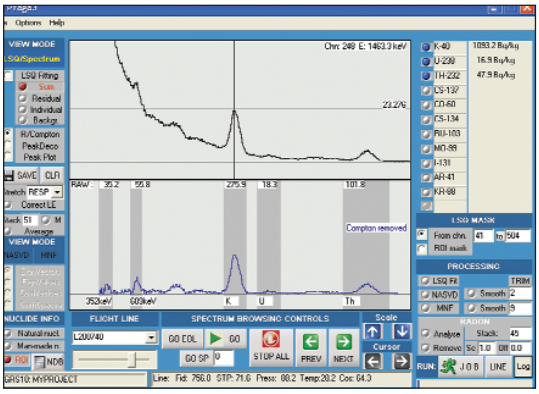
montaj plus Praga3 Radiometrics

Feature Sheet

Praga3 Radiometrics provides an advanced solution for the mapping and processing of airborne and ground gamma-ray spectrometry data acquired by modern spectrometers using NaI(Tl) detectors.

This feature-rich, GUI-oriented software was specifically developed to perform whole spectrum gamma-ray data processing. The use of whole-spectrum information is consistent with the latest developments in the theory and instrumentation of gamma-ray spectrometry. The full-spectrum technique includes a complete system of spectrum background removal. Aircraft, cosmic and radon background components can be separately adjusted by the user with the control of experimental calibration constants.



The integration of Praga3 within Oasis montaj provides geoscientists with a complete solution, and a seamless workflow for principle component analysis and advanced full-spectrum processing.

Use of Praga3 Radiometrics

Praga3 Radiometrics is suited for high quality mineral or soil mapping applications as well as for environmental studies where monitoring of man-made radiation is required.

As Praga3 is a full-spectrum processing system, it is especially well-suited for the processing of man-made (artificial) radiation data. It uses a weighted least-squares fitting algorithm to find the contributions of individual radionuclides to the input spectra. The algorithm uses model detector responses derived by the Monte Carlo photon transport simulation code.

Key Functionality

- Spectrum browser with tools for peak identification
- Window (ROI) based processing following IAEA standards
- Advanced full-spectrum processing using least-squares fitting technique
- Principal component (NASVD or MNF) analysis and spectrum processing
- Advanced support for radon removal including extended spectral-ratio and full-spectrum techniques

Spectrum Browser

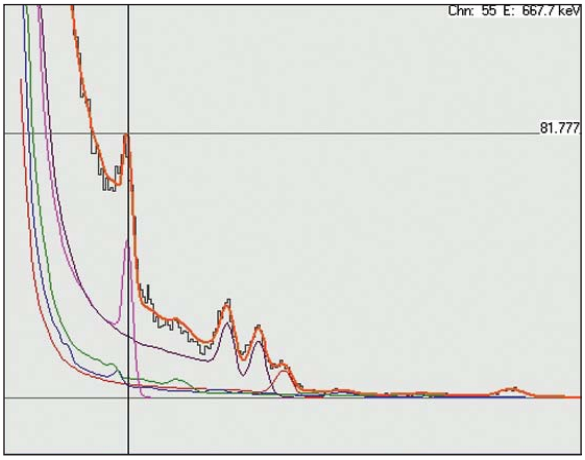
Visual control over various spectrum operations is an important feature of Praga3 Radiometrics. Using the spectrum browser, the user can view spectra, advance one spectrum at a time or to go quickly through a range of spectra. Spectra can be stacked or averaged to reduce statistical noise. Peak identification tools include Compton continuum removal, identification of individual peak positions and scatter-plot of peak positions for the selected range of spectra. Residual spectra can be displayed to assess the quality of input spectra approximation by model responses or by principal components.

Window based processing

Praga3 Radiometrics provides window based processing functionality for: background removal, stripping, live-time, altitude and sensitivity corrections. The user is required to enter correct experimental calibration constants for the actual project using a dedicated program dialog. Processing methodology adheres to industry standards recommended by the IAEA .

Advanced full-spectrum processing

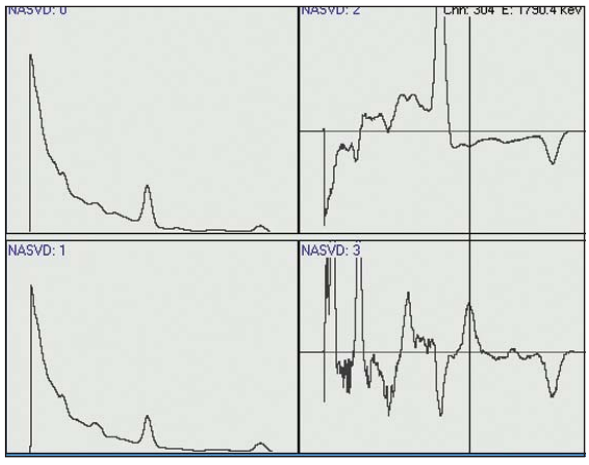
The software's full-spectrum processing was specifically designed for the processing of man-made (artificial) radiation data. It uses weighted least-squares fitting algorithm to find contributions of individual radionuclides into input spectra. The Praga3 technique uses model detector responses derived by the Monte Carlo photon transport simulation code.



New model responses allow for the contribution of the secondary radiation and for the peak resolution to fit characteristics of the real spectrometer system. Using these detector responses, **Praga3** is able to process spectrum information from 0.2 to 3.0 MeV. Background removal for aircraft, cosmic and radon background components can be separately adjusted by the user with the control of experimental calibration constants.

Principal component (NASVD and MNF) analysis

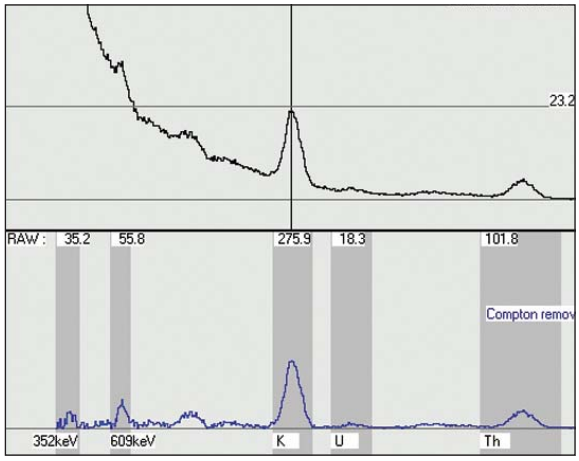
Praga3 Radiometrics provides principal component analysis tools for the investigation of spectrum signatures included in the actual dataset. The spectrum dataset is converted into a limited set of spectrum components (eigenvectors) which are ordered by variance (NASVD) or by signal to noise ratio (MNF). NASVD expects noise to be Poisson distributed, while MNF computes a noise model directly from the data.



Higher order components can be explained as mixed nuclide responses collected at average survey altitude. They are followed by components that account for the altitude changes.The remaining components contain statistical and instrumental noise.

Principal components can be used for gamma-ray data processing. The approach is very similar to the spectrum fitting technique. However, instead of model responses, a subset of spectrum components, derived directly from data, is used to replace the input spectrum.

Using Praga3 Radiometrics, the eigenvalue plot can be displayed. Users can browse through the individual components (eigenvectors) to investigate their shape. Covariance matrices can be displayed as well. Spectra can be interactively composed from the selected number of components and compared with input spectra or alternatively, residual spectra can be displayed. Once the eigenvectors are computed, there is no need to compute them again, for subsequent re-processing of data with another subset of components.



Advanced support for radon removal

Radon removal can be completed using the extended 'spectral-ratio' or full spectral technique. The window based, 'spectral-ratio' method compares count rates of low and high-energy uranium peaks. The full-spectrum technique uses the full spectrum difference in responses of the radon and ground uranium sources. The window based 'spectral-ratio' method has the option to use low-energy ^{214}Pb (0.352 MeV) photopeak instead of commonly used ^{214}Bi (0.609 MeV) photopeak. This approach is beneficial in areas with substantial ^{137}Cs fall-out (Northern hemisphere) or for data with extreme Th/U ratio.

Interactive mode

Praga3' Radiometric's GUI oriented software enables analysis and interactive control of the dataset prior the final processing. Using the spectrum browser, spectra can be investigated on spectrum-by-spectrum basis, and the proper function of the spectrum-fitting or principal component process can be assessed. Spectra displayed can be saved in an ASCII file.

Processing mode

Actual processing is done using a special processing mode where the spectrum display is disabled to speed-up processing tasks. All tasks needed for a given project including standard window, full-spectrum fitting, principal component analysis and processing can be done within the single processing run. Data output has range of options, there is a choice of relative (window count rate) or absolute (activity, exposure and dose rates) units for all, window, spectrum-fitting and principal component/window techniques. In addition, results can be multiplied and offset by user defined constants if it is required. Output is currently provided in the form of ASCII delimited files.

The Pico-Radiation-Air-to-Ground-Algorithm (PRAGA3) software was developed by Pico Envirotec and Spectronica. Geosoft licenses Praga3 Radiometrics as a montaj plus™ extension to Oasis montaj.