

# Physics

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## Application of the pulsed fast/thermal neutron method for soil elemental analysis

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Soil science is a research field where physical concepts and experimental methods are widely used, particularly in agro-chemistry and soil elemental analysis. Different methods of analysis are currently available. The evolution of nuclear physics (methodology and instrumentation) combined with the availability of commercial products (portable pulse neutron generators, high efficiency gamma detectors, reliable electronics, and measurement processing software) and the current understanding of neutron interactions with nuclei, has recently made it possible for neutron-gamma analyses of soil elemental content for routine field measurements (cropland, forest, desert etc.) as well as in the laboratory. Neutron-gamma analyses are based on the registration of gamma lines which appear due to neutron-nuclei interactions. These methods have great advantage over traditional chemical (dry combustion) and physical-chemical methods which are labor extensive and time consuming. Neutron-gamma analyses are non-destructive multi-elemental analyses of large soil volumes that require no sample preparation, and are conducted in situ. We will discuss physical principals, apparatus design, and application of an advanced of neutron-gamma approach [i.e., Pulsed Fast/Thermal Neutron Method (PFTNA)] for soil elemental analysis. Using examples of this method for soil carbon, nitrogen, and chlorine determination, we will demonstrate the main features and possible use of PFTNA for the analyses of nuclei having characteristic gamma lines issued due to inelastic neutron scattering and for nuclei having characteristic gamma lines issued due to thermal neutron capture.

### Biography

Galina Yakubova has experience in the field of Applied Nuclear Physics during 20 years. She has completed her PhD in 2009 from University of Illinois at Urbana-Champaign, and Post-doctoral studies from Brookhaven National Laboratory. She is a Soil Nuclear Scientist at NSDL and works at application of nuclear physics methods for soil elemental analysis. She has published 4 papers on present topic in reputed journals, and had 3 presentations on national and regional conferences.

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