

# Monte Carlo Simulation of Prompt Gamma Neutron Activation Analysis (PGNAA) for Formation Porosity Measurement in Nuclear Well Logging

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Using the concept of Prompt Gamma Neutron Activation Analysis (PGNAA), we conducted monte carlo simulations (MCNPX) to determine whether measurement of formation porosity can be done using a neutron source and two gamma detectors for the deep borehole disposal (DBD) purpose by using abandoned oil wells. The gamma spectrums in three different simulation conditions then analyzed to measure the sensitivity of the tool. Three variations of condition as mentioned above are, applying different neutron sources, adding wax into the borehole inner layer, and applying boron-lining outside the detector. To validate this research, comparison between the simulation result using MCNPX and the lab result have been conducted. It is possible to measure formation porosity by utilizing two BGO (Bismuth Germanate Oxide) detectors and a neutron source. In conclusion, to gain the best tool's sensitivity, we suggest the use of AmBe (Americium Beryllium) as the neutron source rather than DT (Deutrium Tritium) neutron generator without boron-lining attached to the detector. From the gamma spectrums analysis, defining detector count as the summation of count in all energy ranges provides the most stable sensitivity rather than calculating certain peaks. Whereas wax presence does not significantly affect the sensitivity.

## Technical Track

Nuclear Applications and Radiation Processing

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