Calibration of a slimehole density sonde using MCNPX

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The density log is a well logging tool that can continuously record bulk density of the formation. This is widely applied for a variety of fields such as the petroleum exploitation, mineral exploration, and geotechnical survey and so on. The density log is normally applied to open holes. But there are frequently difficult conditions such as cased boreholes, the variation of borehole diameter, the borehole fluid salinity, and the stand-off and so on. So we need a density correction curves for the various borehole conditions. The primary calibration curve by manufacturer is used for the formation density calculation. In case of density log used for the oil industry, the calibration curves for various borehole environments are applied to the density correction, but commonly used slim-hole density logging sonde normally have a calibration curve for the variation of borehole diameter. In order to correct the various borehole environmental conditions, it is necessary to make the primary calibration curve of density sonde using numerical modeling. Numerical modeling serves as a low-cost substitute for experimental test pits. We have performed numerical modeling using the MCNP based on Monte-Carlo methods can record average behaviors of radiation particles. In this study, the work for matching the primary calibration curve of FDGS (Formation Density Gamma Sonde) for slime borehole with a 100 mCi 137 Cs gamma source was performed. On the basis of this work, correction curves in various borehole environments were produced.