Advances in Downhole Assay Measurements and Calibration Techniques

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Keywords: blast hole, assay, neutron, calibration, spectroscopy

ABSTRACT

Downhole Assay tools were introduced in the Pilbara in 2011 and have been implemented in a steadily growing numbers of sites. The increase in the volume of data has led to advances in the measurements and significant improvements to the efficiency of the calibration process.
PFTNA (Pulsed Fast and Thermal Neutron Activation Analysis) downhole assay tools collect gamma photon spectra which are characteristic of elemental signatures. One of the key components of the technique is calibrating the spectral signatures to lab assays. Each tool is slightly different due to the organic nature of the crystals of the detector and thus responds slightly differently. Environment and hole conditions as well as ore characteristics are among other external influencing factors. Thus, a unique calibration is required for each tool. In addition, not all elements are measured directly, but some are actually characterized by proxy, meaning that if the signal-to-noise ratio for an element is small, it may be easier to identify the mineral or geology in which that element is found and thus infer the concentration of the element. These proxies may differ for different sites or geological bodies within a site. Thus, sometimes unique calibrations are needed for each site rather than a universal one for a region.
Early work with the tool requires several thousand metres of calibration data and several weeks of analysis to build each calibration. This process has been streamlined to significantly reduce the amount of data required and the analysis time to make it much easier to introduce new tools to a site with an existing model or to create new models.
This paper details the calibration process, illustrating the increasing accuracy of the models as training data are acquired as well as the methods for transferring a calibration from one tool to another.