Challenges in Validating High-Resolution In-Hole Geoscience Data in Metalliferous Open Pit Mining

John Jackson[1], Camilo Riquelme[2], Mel Quigley[3]
[1]IMDEX Ltd, Brisbane, Australia, [2]IMDEX Ltd, Santiago, Chile, [3]IMDEX Ltd, Sydney, Australia

Recent technological advances now facilitate the routine acquisition of high-resolution, high-density in-hole geoscience data from blast and grade control holes. Emerging technologies such as FastGrade/OreSight, BLASTDOG, and Iberia complement traditional wireline logging; however, their adoption in metalliferous operations typically remains sporadic and project-specific.

Effective in-field validation of these data systems is critical both at initial deployment and throughout ongoing operations. Validation involves multiple layers—from sensor calibration and data integrity, site objectives to adoption—and each introduces distinct challenges. While deposits within similar geological frameworks may share many attributes, factors such as deposit geology, operational goals, workforce experience, and local site practices can significantly vary, complicating consistent validation approaches.

Here we present insights and practical learnings from validating the BLASTDOG system at porphyry copper and iron ore operations. The in-hole BLASTDOG data acquired at a 1 cm resolution is typically validated against traditional top-of-hole drill-chip sampling, introducing issues related to spatial mismatch, sample representativity, and analytical accuracy. Further complexity arises when comparing measured physical properties (e.g., magnetic susceptibility, gamma, conductivity) to derived top-of-hole parameters such as NIR-based mineralogy, geochemical assays, and geological logging. In an iron ore case study, outputs were validated against laboratory metallurgical test results highlighted additional interpretative and measurement uncertainties.

Moreover, successful technology adoption is influenced by the differences in the knowledge and experience of site personnel. This difference is reflected in variability of the validation data especially relating to the geological logging of drill chips, understanding of the relationships of alteration, veining and mineralisation in the validation areas. The level of knowledge and experience also impact in resistance to changes in process.
Ultimately, while high-resolution downhole tools significantly enhance orebody knowledge, their validation and adoption demand rigorous, site-specific strategies that consider both technological and human factors.