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Front-End Electronics for Verification Measurements: Performance Evaluation and Viability of Advanced Tamper Indicating Measures

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The International Atomic Energy Agency (IAEA) continues to expand its use of unattended, remotely monitored measurement systems. An increasing number of systems and an expanding family of instruments create challenges in terms of deployment efficiency and the implementation of data authentication measures. A collaboration between Pacific Northwest National Laboratory (PNNL), Idaho National Laboratory (INL), and Los Alamos National Laboratory (LANL) is working to advance the IAEA's capabilities in these areas. The first objective of the project is to perform a comprehensive evaluation of a prototype front-end electronics package, as specified by the IAEA and procured from a commercial vendor. This evaluation begins with an assessment against the IAEA's original technical specifications and expands to consider the strengths and limitations over a broad range of important parameters that include: sensor types, cable types, and the spectrum of industrial electromagnetic noise that can degrade signals from remotely located detectors. A second objective of the collaboration is to explore advanced tamper-indicating (TI) measures that could help to address some of the long-standing data authentication challenges with IAEA's unattended systems. The collaboration has defined high-priority tampering scenarios to consider (e.g., replacement of sensor, intrusion into cable), and drafted preliminary requirements for advanced TI measures. The collaborators are performing independent TI investigations of different candidate approaches: active time-domain reflectometry (PNNL), passive noise analysis (INL), and pulse-by-pulse analysis and correction (LANL). The initial investigations focus on scenarios where new TI measures are retrofitted into existing IAEA UMS deployments; subsequent work will consider the integration of advanced TI methods into new IAEA UMS deployments where the detector is separated from the front-end electronics. In this paper, project progress on both the prototype evaluation and the exploration of advanced TI measures are described.

Country or International Organization

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