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Sustaining IAEA Neutron Coincidence Counting, Past, Present and Future

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Los Alamos National Laboratory's IAEA Neutron Coincidence Counting (INCC) code is the standard tool for neutron coincidence counting measurements. INCC software and its'predecessors were originally implemented in the 1970s. The measurement and analysis techniques perfected in the code arise from many years of laboratory and field experience by nuclear engineers and physicists. Covering the full arc of INCC's lifecycle, we discuss the engineering approaches used for conception, original development, worldwide deployment of the stand-alone Windows application, more than a decade of sustained maintenance support, and our recent work to carry INCC successfully into future applications.

We delve into the recent re-architecture of the INCC code base, an effort to create a maintainable and extensible architecture designed to preserve the existing INCC code base while adding support for new analyses and instruments (e.g. List Mode PTR-32 and the List Mode Multiplicity Module). INCC now consists of separate modules implementing attended instrumentation control, data file processing, statistical and Pu mass calculation and analyses, list mode counting and analyses, reporting functions, and a database support library. Separating functional capabilities in this architecture enables better testing, isolates development risk and enables the use of INCC features in other software systems. We discuss our approach to handling divergent data and protocol support as a result of this re-architecture. INCC has complex testing requirements; we show how the testing effort was reduced by breaking the software into separate modules.

This new architecture enables integration of INCC analysis into the IAEA's new Integrated Review and Analysis Program (iRAP) data review system. iRAP is based on the respected Euratom Comprehensive Review Inspector Software Package (CRISP) software framework, and is expected to be the future data review system for IAEA and Euratom inspectors and analysts. Neutron measurement data collected from fielded instrumentation is processed and analyzed by iRAP's INCC plug-in and the results are preserved in a relational database for inspection reporting. Isolating the functionality of the INCC analyses libraries allows iRAP to customize the user interface of its software while still using the time-tested algorithmic core of the INCC software. The INCC iRAP integration is the first substantial external algorithmic and feature addition to iRAP, and its software interface implementation will be used as a guide for future integration of other algorithms.

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