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First assessment of new Evaluated Data Libraries for Monte Carlo particle transport

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Evaluated data libraries are the foundation of physics modeling in Monte Carlo particle transport codes, such as Geant4, FLUKA and MCNP, which are used in high energy and nuclear physics experiments, accelerator studies and detector development. They encompass recommended cross sections, nuclear and atomic parameters, which may derive from theoretical calculations, evaluations of experimental data or a combination of both. New versions of major, widely used evaluated data libraries were released in early 2018 by the IAEA (International Atomic Energy Agency) and the NNDC (National Nuclear Data Center, BNL); among them, the new data libraries for electron-photon transport represent substantial evolutions with respect to those currently in use, which date back to more than 20 years ago. The changes concern both the physics content and the data structure, which in turn affect the reliability and the computational performance of simulations. We review the main features of the new data libraries with emphasis on what has changed, and present a first assessment of their physics quality and of their effects on computational performance in the Geant4 environment. These results provide quantitative and objective elements for developers and users of Monte Carlo codes to evaluate the impact of migrating simulations to new data libraries on sound grounds. The assessment also highlights opportunities for improvement in future releases.

Primary authors: KIM, Chan Hyeong (Hanyang Univ.); CHOI, Chansoo (Hanyang Univ.); CATTORINI, Federico (Univ. Milano-Bicocca); HOFF, Gabriela (Univ. of Cagliari); BEGALLI, Marcia (Federal University of of Rio de Janeiro (BR)); PIA, Maria Grazia (INFN e Universita Genova (IT)); BONANOMI, Matteo (Univ. Milano-Bicocca); MARCOLI, Matteo (Univ. Milano-Bicocca); HAN, Min Cheol (INFN Genova, Italy); SARACCO, Paolo (INFN - Genova (Italy)); KIM, Sung Hun (Hanyang Univ.); BASAGLIA, Tullio (CERN)

Presenter: PIA, Maria Grazia (INFN e Universita Genova (IT))

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