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Title: Overview and Validation of the CEM03.03 and
LAQGSM03.03 Event Generators for the
MCNP6, MCNPX, and MARS15 Transport Codes

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Intended for: Abstract of the invited seminar to be presented in the Nuclear
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Overview and Validation of the CEM03.03 and LAQGSM03.03 Event Generators for the MCNP6, MCNPX, and MARS15 Transport Codes

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Reliable models of intermediate and high energy nuclear reactions are important to a number of applications at Los Alamos National Laboratory, including such projects as the Accelerator Transmutation of nuclear Wastes (ATW), Accelerator Production of Tritium (APT), Spallation Neutron Source (SNS), Rare Isotope Accelerator (RIA), Proton Radiography (PRAD) as a radiographic probe for the Advanced Hydro-test Facility, NASA needs, and others. The US Department of Energy had supported during the last decade our work on the development of improved versions of the Cascade-Exciton Model (CEM) and of the Los Alamos version of the Quark Gluon String Model (LAQGSM) which has led to our intermediate- and high-energy event generators CEM03.03 and LAQGSM03.03 for the transport codes MCNP6, MCNPX, and MARS15.

I shall discuss some recent research at Los Alamos to improve our nuclear reaction models. Namely, I will present a description of the IntraNuclear Cascade (INC), preequilibrium, evaporation, fission, coalescence, and Fermi breakup models used by the latest versions of our CEM03.03 and LAQGSM03.03 event generators, with a focus on our most recent developments of these models. The recently developed "S" and "G" versions of our codes, that consider multifragmentation of nuclei formed after the preequilibrium stage of reactions when their excitation energy is above 2A MeV using the Statistical Multifragmentation Model (SMM) code by Botvina *et al.* ("S" stands for SMM) and the fission-like binary-decay model GEMINI by Charity ("G" stands for GEMINI), respectively, will be briefly described as well. Examples of benchmarking our models against a large variety of experimental data on particle-particle, particle-nucleus, and nucleus-nucleus reactions will be presented. Open questions on reaction mechanisms and future necessary work will be outlined.

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