

Radiation Effect Modeling: Status, Uncertainties and Benchmarking Needs

Nikolai Mokhov

Fermilab, Batavia, Illinois 60510, USA

Feasibility and performance of the Mu2e, COMET and Muon Collider experiments is critically dependent on understanding and mitigation of radiation effects in components of their target stations based on superconducting solenoids. Predictive power and reliability of the modern Monte-Carlo codes used in this field are analyzed with respect to

- Useful and background particle production
- Superconductor quench and component integrity/lifetime: power density and integrated dose in critical components
- Radiation damage to superconducting and stabilizing materials: DPA, helium gas production, integrated particle flux
- ES&H aspects: shielding, nuclide production, residual dose, and impact on environment.

Based on comparisons of the code's results with experimental data and between each other, the calculation uncertainties are revealed to be from a few percent to a factor of two to three, strongly dependent on the value and phase space of interest. The directions requiring further model and code developments are identified. The lists of experimental data needs for the model/code benchmarking in the above four areas are presented.