Heavy-ion collisions in the fluka monte carlo event generator: present and perspectives

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The incorporation of models which simulate heavy-ion collisions into the FLUKA Monte Carlo transport code is in progress [1]. While the DPMJET module [2] has been successfully employed at energies of several GeV/A, at lower energies, ranging from a few hundreds MeV/A up to a few GeV/A, preliminary results were obtained using a modified version of the Sorge relativistic RQMD code [3], coupled with specific FLUKA evaporation/fragmentation/fission routines [4]. Furthermore, a QMD code written from scratch by the authors, is under development. As a starting project, this code is designed to cover the energy range of a few hundreds of MeV/A, planning its extension to relativistic energies as a further step. Particular effort is devoted to the study of the nucleon-nucleon interaction potential, connecting it to the mean single-particle nuclear potential, inferred from experimental data. The effect of various terms is shown, and in particular the role of the so-called surface term in creating the potential dip at the nuclear surface and in preserving a reasonable phase-space occupation around each nucleon is underlined. A connection with the nucleon gaussian width choice is established. A few comments regarding the surface-symmetry correction, recently included in the ImQMD-II model [6], are also made. Specific methods to take into account antisymmetrization effects in QMD models, such as the inclusion of a Pauli potential or the implementation of the phase-space CoMD constraint [5], are critically reviewed, showing their advantages and their shortcomings.

1. A. Fassò, A. Ferrari, S. Roesler et al., Proceedings of CHEP03, Conference for Computing in High Energy and Nuclear Physics, March 24-28 2003, La Jolla, California.
2. J. Ranft, hep-ph/9911232
3. H. Sorge, H. Stöcker, W. Greiner, Ann. of Phys. **192** (1989) 266.
4. F. Ballarini, G. Battistoni, F. Cerutti et al., Proceedings of the 10-th International Conference on Nuclear reaction Mechanisms, June 9-19 2003, Varenna, E. Gadioli Edt., Ricerca Scientifica ed Educazione Permanente Suppl. 122, 579, Univ. degli Studi di Milano, 2003.
5. M. Papa, T. Maruyama, A. Bonasera, Phys. Rev. C **64** (2002) 024612.
6. N. Wang, Z. Li, X. Wu, nucl-th/0402066.