Patches to UrQMD Model Code

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Аннотация

Представлены поправки к программе UrQMD 1.3, значительно улучшающие ее работу. Наиболее серьезные исправления были произведены в подпрограмме ANNDEC.F.

Ultra-relativistic Quantum Molecular Dynamics Model (UrQMD [1, 2]) is one of the models applied for analysis of high energy hadron-nucleus and nucleus-nucleus interactions. Quite clear physical ideas put in its ground and their good program implementation leads to its large popularity in high energy physics. There are a lot of various applications of the model (see for example [3]). The most important ones are applications of the UrQMD model code by the CBM and PANDA collaborations for planning of new experiments at future FAIR facilities (GSI, Darmstadt, Germany). The code is the main event generator in the CBM and PANDA computing frameworks. Thus it is very important to have a correct and self-consistence version of the code. Below we describe shortly our modifications of the UrQMD 1.3 package made during our work with the code.

Changes in the file URQMD.F: The main program is presented in the file. There the Pauli-blocking is switched off at the end of an event generation to perform unstable particle decays, but it is not switched on before the next event processing. Thus all calculations were performed with no the Pauli-blocking. To improve the code operation, we made corresponding changes.

Changes in the file PROPPOT.F: Function ERF is declared as REAL*8 ERF in various subroutines collected in the file PROPPOT.F At the same time in file ERF.F, it is described as REAL*4, and its argument is REAL*4 too. Thus, we had at a compilation many warring messages. To protect the inconsistency, we made needed replacements.

Changes in the file STRING.F We had a warring diagnostic at compilation of the file when calling the procedure GETMAS. Thus we changed the call in order to protect inconsistency.

Changes in the file ANNDEC.F In file "tabinit.f", in "subroutine mkwtab", it is checked that the probability of decay channel of a resonance is not zero ("bran.gt.1d-9"). If it is zero, the spline coefficients are not determined. At the same time, in the file anndec.f, in subroutine anndex, it is not checked that the probability is zero. Thus a call of "fbrancx" was performed for a channel which was not described for the spline interpolation. To improve the situation, we have added many lines in the subroutine anndex.

Change in the file BLOCKRES.F: We had a problem with decay of $\Delta(1950)$. Thus we have changed probabilities of the decay channels given in BLOCKRES.F.

Change in the file INIT.F: In order to trace the code operation, we changed the value of parameter ("nnuc=11"), and put it to "1". In the corresponding subroutine, the

coordinates and momentum components of nuclear nucleons are sampled for 1, 11, 22, 33 and so on events. For other events with intermediate numbers, the quantities are obtained by randomly rotation of the sampled coordinates and momenta. With the new value of "nnuc" the quantities are sampled for each event.

Saving of local variables: Many fortran users believe that the variables initiated in a program unit with the help of DATA operators are stored during the full time of program work. It is true only for a first usage of the variables at some computers. After that the values are changed in an unpredictable manner. Thus FORTRAN standard requires to save the variables with the help of SAVE operator. There are a lot of such variables in the UrQMD code. We were trying to save most of them.

More details of the changes are presented in [4].

References

[1] S.A. Bass et al.., Prog. Part. Nucl. Phys., **41**, 225 (1998); nucl-th/9803035.

[2] M. Bleicher et al.., J. Phys. **G25**, 1859 (1999); hep-ph/9909407.

[3] http://hepweb.jinr.ru/urqmd1_3/validation/urqmd_model_validation.htm

[4] A. Galoyan, J. Ritman, V. Uzhinsky, hep-ph/0605021.