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A lightweight library prototype for Monte-Carlo simulation of relativistic nucleus-nucleus collisions based on pipeline architecture

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The integration of different high-energy collision Monte Carlo models into a unified simulation process is inherently time-consuming, largely due to the fact that they are typically developed as monolithic applications. Diverse data formats of the aforementioned models often necessitate the use of numerous converters and supplementary scripts, which can significantly impede the modelling process and potentially introduce unforeseen errors. With this in mind, a lightweight library for organising disparate models was developed with the aim of streamlining future development. The library is based on the principles of modularity and dependency injection (DI) [1]. By organizing models representing different stages of modelling into self-contained modules, it is possible to subsequently combine them into a single program that encompasses the entire modelling pipeline. The resulting program is highly flexible, as the replacement of a module can be completed in a matter of minutes. The standardisation of data format facilitates the troubleshooting of separate modules and eliminates the necessity for converter scripts, which may consequently reduce the prevalence of bugs. A significant proportion of contemporary Monte Carlo code for modelling high-energy collisions is written in C++, largely due to the availability of comprehensive libraries such as ROOT [2] and Geant4 [3]. Accordingly, C++ was selected as the language for the development of this library.

A C++ framework with analogous objectives, JETSCAPE [4], has been in development for several years. In contrast to JETSCAPE, our library does not encapsulate any specific model; rather, it provides interfaces and data objects that are useful for constructing a high-energy collisions model. The installation of modules is fully separated from the library, and therefore, it has no dependencies.

At this point in time, the AAMCC-MST [5] model has been split into several modules to demonstrate the possibilities of this library.

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