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A virtual testbed for optimizing the performance of a new type of accelerators

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The concept of a “virtual testbed”, namely the creation of problem-oriented environment for full-featured modeling for the investigated phenomenon or behavior of a complex technical object, has now acquired a finished look. The design of this concept contributed to the development of complex mathematical models suitable for full-fledged computational experiments and improvement of a computer platform capable of providing the expected results.

The traditional type of “virtual testbed” is the computing environment for modeling of complex processes, the physics of which is fully known. In this case, based on the first principles, it is possible to carry out full simulation of the investigated phenomena. However, there is another type of “virtual testbed” when versatile modeling allows get closer to understanding the phenomena, the physics of which is not yet fully clear, and which require various experiments to understand the essence of phenomena. For this, it is necessary to create experimental installations, that are expected to receive new results. There is still other option, the solution of inverse problem, that can be mathematically incorrect and need a lot of direct simulations for optimization.

The concept of a “virtual accelerator” emerged for quite some time now. Its key idea is to simulate dynamics of a beam using several software packages (COZY Infinity, MAD and others), compiled in the form of pipelines and running on distributed computing resources. The main application of such a virtual accelerator is simulation of beam dynamics with various packages with the possibility of comparing the results and the ability to create pipelines of tasks when the results of one stage of processing based on a specific software package can be sent as initial data for another processing step. However, this approach for a new type of accelerators (such as NICA) is no longer meets all the requirements for a virtual accelerator.

The report presents the results of building a prototype of a virtual accelerator on the example of NICA with a description of methods for accelerating of computational procedures.

Summary

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