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Numerical reconstruction of fusion-origin carbon structures using refactored GIF portal

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Two developed technologies are shown. The top one is a method for the massive modelling of X-ray propagation in carbon films found in fusion devices as well as numerical reconstruction of such films composition. The basic technology is the strongly re-factored GIF portal that allows the development of high-level logics and user web interface for such grid applications.

Detailed analysis

In this paper we present a grid application for the numerical modelling of X-ray beams diffraction on various targets made of nanostructures like nanotubes, graphens, e.t.c., to determine the structural constitution of the films found in plasma confinement devices. Every variant of the target is defined by a set of scalar parameters and is computed in a single grid job. Every variadic parameter is computed for a specific node in a user-defined mesh and by a user-defined formula that depends on that node. A re-factored GIF web portal is used for running this application. The portal's core operations are re-written in C++. Their data is stored in a fast embedded database. A special Lua interpreter was developed (instead of the previously used Python) to fulfill security, performance and language simplicity requirements of the UI declaring and jobs driving scripts. The interpreter stores all it's objects as DB records, and so there is zero overhead on referencing large objects like file bodies. It also allows reading and writing jobs sandbox files as language objects concurrently with interpreting.

Conclusions and Future Work

The application to be presented is a building block for a scientific conveyor for structural analysis of films found in fusion devices as well as other targets. It could be extended to a comprehensive tool for numerical reconstruction of films constitution by different optimisation methods. A re-factored GIF portal is used for running application scripts. It provides a minimalistic development and execution environment for abstract user interface and grid jobs manipulation scripts.

Impact

Carbon films found in plasma confinement devices are a subject of intensive research. These films consist of different carbon structures. The determination of the presence and quantity of such structures may help to reveal these structures formation mechanisms. The film could be X-rayed in a special source of tightly focused radiation. Such X-raying would give a photograph of photon rays diffracted by the film's atoms. In the simplest model, the diffraction processes on different structures are independent, so this photograph could be linearly decomposed to a set of pictures, each of them caused by the appropriate structure, by methods of linear programming. Each picture could be obtained by numerical simulation of photons propagation and diffraction on the appropriate structure, which is described in the detailed analysis above.

Keywords

fusion, portal, workflow, user interface

URL for further information

http://vo.nfi.kiae.ru

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