

Web Service Model for Plasma Simulations with Automatic Visual Diagnostics Generation

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We present our design and initial implementation of a web service model for running, both in parallel and serial, two Particle-In-Cell (PIC) codes for plasma simulations, VORPAL and OOPIC Pro (<http://www.techxhome.com/products/oopic>), together with automatic post processing of the results and generation of visual diagnostics.

PIC codes have significantly grown in complexity over the past ten years and now often require parallel execution on multi processor computers for modern problems of interest. The post processing and data analysis of their results represent another major problem. For a researcher to gain mastery of this level of complexity, a significant amount of time is required at the expense of reducing the time for doing physics research. Moreover, extensive parameter studies require systematic management of the results with an efficient way to communicate them among a group of remotely located collaborators.

Here, we will describe a model for submitting PIC jobs for parallel/serial execution with subsequent automatic post processing via a simple web page. The only requirement from a user of the service is to be able to construct input files for the corresponding codes. However, our design does include a markup language based validator to help in the process of developing proper input files. The system then automatically handles the job submission, monitoring, post processing, automatic visual diagnostics generation, and data management. We will briefly discuss approaches for access restrictions, job scheduling, and security.

In our initial implementation using the OOPIC Pro code, the web service system is based on the freely available tools: Linux, Apache, MySQL, Python, and on the Interactive Data Language application for visualization. Once a PIC simulation and subsequent post processing is completed, the user of the service will be notified by email and pointed to a web page to view the generated visual diagnostics and other relevant results. This model also enables all collaborators on a project to access the results from such runs regardless of their geographic location.