§19. Development of the Interface to the Magnetic Force Line and Magnetic Surface Visualization Program

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The Magnetic Surface Visualization Program has been developed by Watanabe. This program enables users to investigate the interference between devices installed in the LHD vacuum vessel and magnetic surfaces. This program was written by Fortran 90 and it runs in the calculation servers hosted by Kaiseki Group. The specifications of the calculation servers are listed in table.1. In these calculation servers, necessary applications to handle LHD experimental data and Data Visualization tools are installed in advance, and the visitors can begin to view and analyze the experimental data soon after their arrival at NIFS.

The execution time of this program is shown in Table.1. Calculation time increases as the number of grids increases, and it takes about 1.5 hours on the condition that the number of grids is 500. Therefore, the user has to wait more than one hour if he wants to obtain enough accuracy. Until the calculation ends, the user has to wait without closing their network session to the calculation servers. Furthermore, during the calculation, the program consumes CPU power, and it affects other users in the computers.

To improve the situation, the authors have developed a new interface to run this program. The new system is a batch based system. The system accepts requests from the users. If the server cannot allocate enough CPU resource, the request is in queue until the resource is available. When the calculation is done, the system notifies the user that the job is finished. Therefore, it can minimize the influences to the other users and it can use CPU resource more efficiently. Furthermore, the user doesn't need to watch his program running during the calculation. In addition, this system is scalable; even if the number of users increases in the future, it is easy to meet the demand by adding calculation servers.

The Figure 2 shows the overview of this system. The jobs are managed by PBS (Portable Batch System)[1]. The PBS is a flexible batch system developed for NASA. It can use various computers in the same way. PBS consists of three main components; PBS server, scheduler, and pbs mom or, a execution server. The PBS server accepts user requests, and the scheduler manages the job and asks pbs mom to do the job. These components are loosely linked, and they can be replaced with other components. For example, the scheduler can be replaced with another to fit their computer environments. The author adopted TORQUE[2] as the main PBS system and MAUI[3] as the scheduler. Input parameters are given by the web server, and the user submits the job request to the PBS server by Web browsers (Fig.2). The PBS servers ask one of the two execution servers to do this job. When the calculation finishes, the execution server stores the data into the file sever, and notifies the user that the program finished by e-mail. The results are saved as PostScript file or PNG file into the file server.

CPU	Opteron 280 x 2 (4way)
OS	Fedora Core 4 (x86_64)
Memory	8GB
HDD	1.5TB

Table 1. Specification of Calculation Server

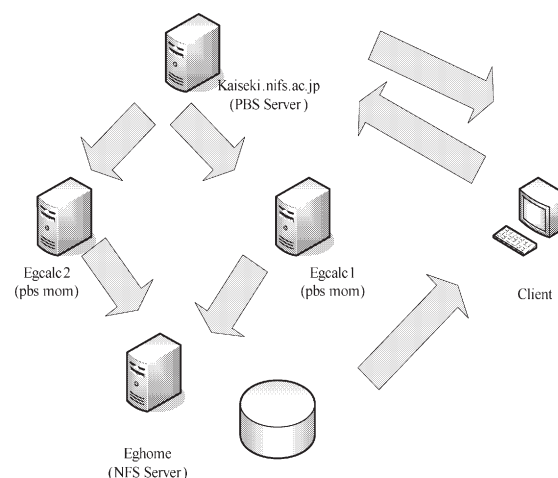| Number of Grids in the radius direction	Total Execution Time (sec)
50	1329
100	1802
250	3264
500	5684

Table 2. Calculation Time

Fig1. System Overview
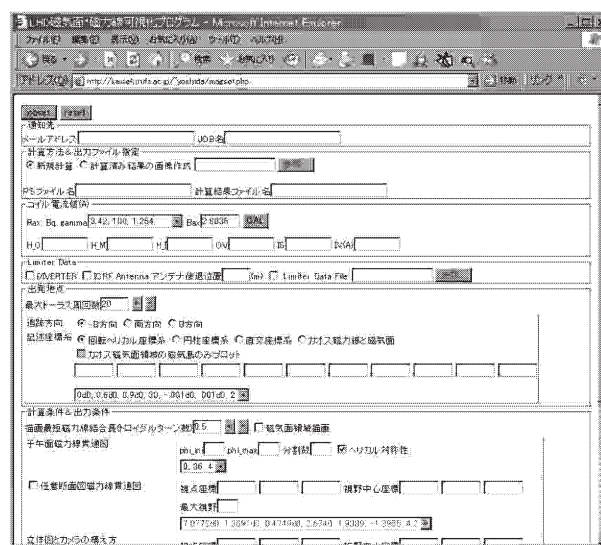

Fig 2. Parameter Setting Window

Reference
1) http://pbs.mrj.com
2) http://www.clusterresources.com/pages/products/torque-resource-manager.php
3) http://www.clusterresources.com/pages/products/maui-cluster-scheduler.php