

## Gigabit-Network Parallel Processing for Radiation Treatment Planning

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### INTRODUCTION

To provide a more accurate radiation treatment plan, we need to accept a longer calculation time. This elongated time can be minimized if the calculation is performed by parallel processors. For photon Monte Carlo calculation, Peregrine project was launched using 24 Pentium processors connected by fast Ethernet. We have made a more advanced network parallel processing system including 10 Digital Alpha CPUs. Initial implementation was done with fast Ethernet switch and cards; however, we are targeting Giga Ethernet configuration for maximum data transfer inside the cluster. In this paper preliminary benchmark results are presented.

### METHOD

The network parallel processing system consisting of 10 Digital Alpha boxes is shown in Figure 1, one of which is a server having two Ethernet cards and connected to an outside LAN. The others work as clients. Parallel calculations are performed as follows: (1) The server distributes jobs to 9 clients. (2) All machines execute the same program on the server using network file system with different parameters. (3) The calculated results are transferred to the server based on parallel virtual machine (PVM) interface. (4) The calculated results are combined in the server.

As a benchmark test, proton beam was employed to irradiate a sphere water phantom from 10 directions. The dose distribution was calculated using a ray-tracing method.

### RESULTS AND DISCUSSION

Figure 2 shows the processing time versus the number of CPUs. It was found that the CPU time was reduced to about 1/5 for 10 CPUs compared to the results for a single CPU. The reason is that the data transfer time is relatively long compared to the dose calculation time. It is anticipated that more time-consuming job such as pencil beam or Monte Carlo dose calculation will facilitate this problem.

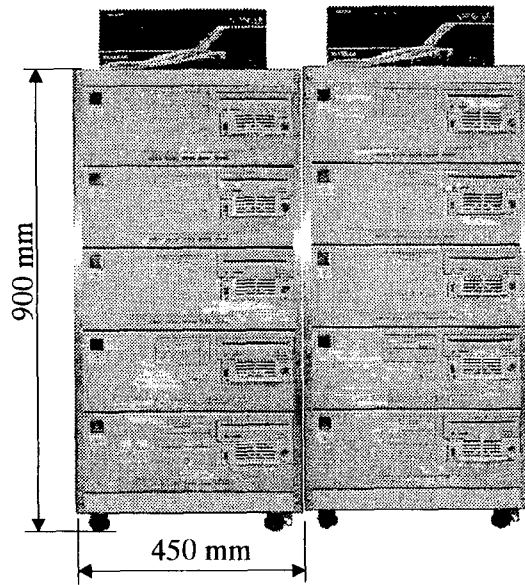


Fig 1 Network parallel processing system

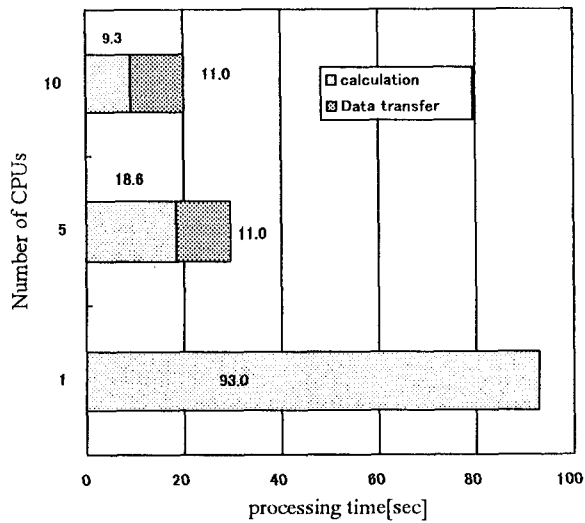


Fig 2 Processing time versus Number of CPUs

## CONCLUSION

We have made a network parallel cluster system including 10 Digital Alpha CPUs, and have shown its basic performance for ray tracing proton dose calculation. We are planning to use this system for fast pencil beam proton dose calculation as well as real time DRR calculation.