AbstractID: 12788 Title: Domain-division Monte Carlo dose calculation method for particle therapy

Purpose: To enable dose calculations with huge voxel data a limited amount of memory. To accomplish this, we develop a Monte Carlo method using domain division. **Method and Materials:** We divide the entire geometry into several domains whose data size is such that Monte-Carlo simulations can be performed with a given amount of memory. We first perform a simulation for the domain to which the particle beam is incident and dump the information of exiting particles to files. Then, we perform simulations for the neighboring domains using the dump files as a source and, again, dump the information of exiting particles. Then, again, we perform simulations for the neighboring domains using the dump files as a source. We repeat similar procedures till there are no dumped particles left. We developed and parallelized an external module to the Monte Carlo particle and heavy ion transport code PHITS that tallies the dose by repeating these procedures. **Results:** We are evaluating the performance of the domain-division Monte Carlo method using human voxel phantoms. We have confirmed that the present method obtains the same results as the conventional Monte Carlo method for the entire geometry. The increase in calculation time due to dumping and re-reading is only 8 %, which is acceptably small. We have also obtained excellent scaling up to 200 processors so far. **Conclusion:** The method we have developed is expected to open a way to the realization of large-scale Monte Carlo dose calculations with huge voxel data on general-purpose supercomputers and in a grid environment, where only a limited amount of memory is available, instead of on specialized large-memory machines.