Contribution ID: **19** Type: **Poster Presentation**

A Study of Heavy-Ion Beam Simulation using Geant4 on KISTI-5 Supercomputer

We introduce the result of heavy ion beam simulation using Geant4 version 11.0.2. There has been relatively little focus on accelerator-based study of secondary particles in the nuclear physics, biophysics, and dark matter research. In this study, we have compared our simulation result with experimental data on collisions between the liquid hydrogen target and uranium beams which take the energy of 1 GeV per atomic mass. Since the Geant4 is more accurate than any other simulation packages for particle-matter interaction, we have used it for this study. We examine the validity of the Geant4 model with the comparison between simulation and experiment result. Next, we examined the various physics models built in Geant4 to determine the optimized model. We checked how each physics model describes the expected physical phenomena. We checked the cost of CPU time to find what the best cost-effective physics model is. As a result, we have found the optimized physics model for our study. Finally, we simulated the interaction between particle and matter to study the secondary ions created by beam-target collision. The uranium plate target with thickness 1~10mm is used for simulations. The proton beam with energy range 0.1~1 GeV per atomic mass is used for simulations. We execute Geant4 simulations to determine the characteristics of secondary heavy-ion beams.
We have used the KISTI-5 supercomputer [Nurion Knight Landing (KNL)] to run the simulation. Nurion KNL is equipped with 8,305 nodes and 68 cores per node. To find the cost-effective physics model on uranium beam to liquid hydrogen target, the CPU time of calculation is measured by using 64 nodes. Same condition is used to study the secondary beam from proton beam to uranium target. These results will help the experiments for secondary particle at RAON, which is an upcoming facility for heavy-ion collision experiments in Korea.

This research was supported by the National Research Foundation of Korea (NRF) grant fund by the Korean government (MSIT) (No. 2021R1F1A1064008). This research is also supported by the National Supercomputing Center with supercomputing resources including technical support (KSC-2022-CHA-0003).

Primary authors: Dr KIM, Kyungho (KISTI); Prof. CHO, Kihyeon (KISTI/UST)

Presenters: Dr KIM, Kyungho (KISTI); Prof. CHO, Kihyeon (KISTI/UST)

Track Classification: Track 1: Physics and Engineering Applications