



独立行政法人理化学研究所 仁科加速器研究センター  
第172回 RIBF核物理セミナー  
RIKEN Nishina Center for Accelerator Based Science  
The 172<sup>nd</sup> RIBF Nuclear Physics Seminar

Charged Particle Transport Simulations for Radiotherapy and Space Dosimetry

\*This seminar is co-organized with iTHS, RIKEN.

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There is increased interest in proton and carbon therapy worldwide and more and more patients, incl. paediatric, are treated. The need to in detail study the normal tissue complication probability (NTCP), including secondary cancer, is therefore growing. To be able to estimate the NTCP, correct information about the created secondary particles, including neutrons are needed. However, particle and heavy ion transport includes many complex processes, and measurements for all possible systems, including critical organs, are not feasible. To be able to calculate complex treatment geometries, including the production and transport of protons, neutrons, and  $\alpha$  particles, 3-D MC transport techniques must be used. The total reaction cross section and the lifetime of the particle for decay, are essential quantities when determining the mean free path of a transported particle. To generate the secondary particles, we also need information about the final states of the collision. It is therefore very important that reliable data of total non-elastic and elastic cross sections is used.

A different topic is space exploration, during which the astronauts are exposed to high levels of ionizing radiation. To characterize the complex radiation field in the human tissues and organs when exposed to cosmic radiation, MC particle and heavy ion transport calculations are also needed.

Sihver will present the main advantages with charged particle therapy, as well as the need for MC transport simulations and reliable total reaction cross section models. A short introduction to the Particle and Heavy Ion code Transport code System (PHITS) will be given and examples of simulations of experiments to measure organ doses in a human phantom inside and outside the international space station will be presented.

February 6 (Thu.) 2014 13:30 ~  
RIBF Hall (rm.201), RIBF bldg., RIKEN

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