AbstractID: 4329 Title: Initial Study on the Dose Evaluation of Boron Neutron Capture Synovectomy Using THOR Epithermal Neutron Beam

Purpose: To evaluate the feasibility of Boron Neutron Capture Synovectomy by Tsing Hua Opening-pool Reactor (THOR) in Taiwan and to determine the optimal treatment parameters with epithermal neutron beam.

Method and Materials: MCNP5 was used to model the THOR epithermal neutron beam interactions with knee and finger phantom. The phantom was established according to the structure of human joints with different boron concentration. The treatment parameters were used to model the optimum treatment assembly, such as different thickness of reflectors and beam orientations. The Figure of merits (FOMs) such as total treatment time, total maximum skin dose and synovium to bone treatment ratio were used to evaluate the effect of the treatment parameters.

Results: Monte Carlo calculations predict a total therapy time of BNCS between 5 and 15 min for the human knee by optimum THOR beam assembly. The treatment parameters of BNCS vary with joint sizes. The optimum treatment condition for different joint size can be achieved by using the opposed parallel beam, placing the inflamed joint near the source, and adding 10cm side and rear graphite reflectors. To compare with BNCS using the neutron beam produced by accelerator, the THOR epithermal beam will reduce the total skin dose from 205 RBEcGy to 130.24 RBEcGy and increase the TR_{bone} from 72 to 74.28.

Conclusion: This study predicts the optimum THOR beam assembly for BNCS. The result shows the quality and overall clinical efficacy of THOR epithermal neutron beam for BNCS is more suitable than the beam produced by accelerator. It provides the potential application of BNCS by epithermal neutron beam.

Conflict of Interest (only if applicable):