AbstractID: 2990 Title: Study of Truncated Cone Filters using GEANT4

Purpose:
A ridge filter has been used for proton therapy to form a spread-out Bragg peak (SOBP). As the SOBP width becomes larger and the distal falloff becomes smaller, more number of ridge elements is required for the ridge filter. Then extremity of the ridge filter becomes too sharp to machine for large SOBP widths. Since an aperture collimator shapes the proton beam, beam mixing by adjacent ridges is affected by scattering in the ridge elements in the peripheral region. Namely, the proximal part of the SOBP begins to fall at depth deeper than the expected depth. A purpose in this study is to achieve uniformities of both the SOBP and the lateral dose distribution by improving a conventional ridge filter.

Method and Materials:
We have designed a two-dimensional array of truncated cone filters (TCF) in honeycomb structure. Since extremity of the TCF is moderate compared with a conventional ridge filter (CRF), manufacturing the TCF is relatively easy. Thus the TCF enables selection of lighter material with smaller scattering effect. In this study, a CRF (aluminum alloy) and a TCF (Lucite) with a SOBP width of 60mm were designed for a 155MeV proton beam. We simulated dose distribution in water for a therapeutic beam with GEANT4 to investigate the influence of both ridge filters.

Results:
While a few% dose decrease is observed in the proximal part of the SOBP region for the CRF, the dose distribution is more uniform in entire of SOBP region for the TCF.

Conclusion:
We designed a two-dimensional array of TCF. It is easier to machine the TCF for SOBP filters with large SOBP widths especially for low-energy protons. Overall dose uniformity of the SOBP region in the TCF was improved as compared with the CRF.