A new compact superconducting gantry is proposed by Huazhong University of Science and Technology (HUST), and this gantry beamline can be configured in the single-room or multi-room PT facility. This SC gantry contains an independent fast energy degrader, three AG-CCT dipoles, seven resistive quadrupoles and a compact downstream scanning nozzle. To reduce the secondary neutrons on the iso-center, a fast degrader. The overall length of this gantry will be less than 3m and the radius is hopefully limited to 3.4m. The schematic layout of HUST SC gantry is shown in Fig.1.

The time for energy change is an important parameter for the beam transport system. Fast energy change will reduce the total treatment time, which are benefit for the volumetric rescanning. To achieve uniform Spread-Out Bragg Peak (SOBP) dose curve.

Benefit from the large momentum acceptance of the beamline, less energy steps can be used to create a compact superconducting gantry employing a fast energy degrader, combined-function AG-CCT magnets and downstream scanning nozzle. This paper presents the design of a fast energy degrader with separate structure, which has lighter weight and higher motion speed. The beam transmission can also be increased nearly 40%~50% in the low energy range compared with a multi-wedge scheme. Benefit from the large momentum acceptance of the beamline, low energy steps can be used to create a uniform Spread-Out Bragg Peak (SOBP) dose curve.

The incident beam energy is 250MeV with energy spread of ±0.15%. Ten millions protons are used for MC simulation, which is carried out in TOPAS. The results are shown in Fig.5-Fig.7.

The relationship between proton range in water and proton beam momentum is approximately expressed as:

$$dR/R = \frac{dP}{P}$$

The maximum accepted change in beam momentum (dp/P ~ 10%) covers a variation water range of almost 10% and the correction factor for 70-120MeV.

CONCLUSIONS

A new fast degrader with separate structure is proposed for the compact superconducting gantry with large momentum acceptance. This degrader has lighter weight and can achieve higher motion speed. Owing to the usage of low Z material, the beam transmission in the lower energy can increased rapidly.

REFERENCE

[1] B. Qin, Z. Liang, K. Liu, B. Qin et al., Comparison of beam apertures for normal conducting and superconducting gantry beamline applied in proton therapy, CPO-10, Key West, Florida, USA.