AbstractID: 10172 Title: Impact of Pulse Forming Network (PFN) and Injection Current (IC) Parameters on Output and Energy Variations of Helical TomoTherapy

Purpose: To quantity evaluate the impact of pulse forming network (PFN) and injection current (IC) parameters on the output and energy variations of a helical TomoTherapy (HT) unit. **Method and Materials:** Tomotherapy quality assurance (TQA^{TM}) platform, especially the step wedge phantom and step wedge static module, was used for the whole measurement. PFN and IC voltage values were coarsely sampled from 3.0 to 5.0 V in 0.2 V increments, and finely sampled ($4.0<=V_{PFN}<=4.1$ and $3.5<=V_{IC}<=3.7$) in 0.02 V increments. **Results:** Five working zones were found for different combination of PFN and IC voltage values: *low dose rate zone, normal dose rate zone, dose rate failure during treatment zone, high dose rate zone, inoperable dose rate zone.* It was noted that a 1.0% increase in V_{IC} yields an average 1.4% increase in the average dose rate. Additionally, a 0.02 V increase in V_{PFN} yields an average 1.0% increase in the average dose rate. A 1.0% increase in the V_{IC} value yielded an average 0.3% decrease in the energy ratio. Furthermore, changes in the energy ratio were more dependent on V_{IC} than V_{PFN} based on the fact that only a 0.5% variation in energy was noted when varying the V_{PFN} from 4.00 to 4.10 V while a 2.0% change was noted when varying the V_{IC} from 3.5 to 3.7 V. **Conclusions:** In this study, several working zones based on the V_{PFN} and V_{IC} parameter setting were found to exist for a HT unit. Inside the normal dose rate zone, the output and energy vary linearly with V_{IC} and V_{PFN} parameter values. The results of this study may provide a quick guide for physicists to adjust their HT unit V_{PFN} and V_{IC} values in order to reset the radiation beam output and energy back to within the tolerance of the commissioned baseline.