Docket #: S19-188

Quick and robust LINAC commissioning and beam data modeling

Researchers at Stanford University have developed a quick, robust, machine learning based method for linear accelerator (LINAC) commissioning and beam data modeling. High precision LINAC commissioning data is crucial for the safe setup of new LINACs, verification of proper operation, continuing quality assurance, and as input to treatment planning software. Current commissioning is a laborious process that lacks operational standards and commercial validation tools. Stanford's fast and accurate method uses a few sampling points to generate accurate percentage depth dose (PDD) and depth dose profile (DDP) for the LINAC beam. It was developed and tested on three medical LINACs with 1000s of data points. This approach greatly simplifies the tedious linac commissioning procedure and provides a robust and safe way of introducing new LINACs into the clinic.

Stage of Development – Software Tool in use with Clinical LINAC

Applications

- LINAC commissioning, calibration and quality assurance verification
- LINAC output predictions and verification
- Radiation therapy treatment planning

Advantages

- Accurate, clinically sound, and reproducible generation of high precision data for LINAC commissioning - Both PDD and profiles were accurately predicted at different beam energies and field sizes with percentage relative error (pRE) of

less than 0.8%
- High accuracy in predicting small field output factors
- Quicker and more efficient
- Robust and safe

Publications

- Zhao, W., E. Schueler, I. Patil, B. Han, Y. Yang, and L. Xing. "Harnessing the Power of Machine Learning for Accurate and Efficient Linear Accelerator Beam Data Commissioning." *International Journal of Radiation Oncology• Biology• Physics* 105, no. 1 (2019): E687-E688. https://doi.org/10.1016/j.ijrobp.2019.06.920
- Schueler, E., W. Zhao, I. Patil, B. Han, Y. Yang, and L. Xing. "Machine Learning Modeling of Beam Data of Multiple Linear Accelerators (LINACs) From Different Institutions and Its Practical Application in Fast and Robust LINAC Commissionin." *MEDICAL PHYSICS*, vol. 46, no. 6, pp. E263-E263. 111 RIVER ST, HOBOKEN 07030-5774, NJ USA: WILEY, 2019.

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