

## **ABSTRACT**

**RESEARCH PAPER:** The Optimization of the Number of Paints for Adequate Field Coverage in a Uniform Scanning Proton Beam

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Uniform scanning proton beams work by scanning a pencil-beam of radiation throughout the entire area of the treatment field. Specifically for Princeton Procure Management, LLC in Somerset, NJ (ProCure NJ), the beam is scanned at 30 hertz (Hz) in the vertical direction, and 3 Hz in the horizontal direction. The time it takes for one “paint” in the 30 Hz x 3 Hz scanning pattern is 1/3 of a second ( $3\text{Hz} = 3 \text{ revolutions per second} = 1 \text{ second per } 3 \text{ revolutions}$ ). Currently, the first layer of the treatment field is set to “paint” the entire treatment field 40 times. The number 40 has been chosen somewhat arbitrarily. Field parameters such as the flatness and symmetry need to be checked for patient safety. This hypothesis will be explored through a MATLAB simulation, as well as beam data taken at ProCure NJ. To measure beam data, the IC Profiler<sup>TM</sup> Model 1122 will be used. This IC Profiler<sup>TM</sup> uses 4 simultaneous linear arrays of ion chambers; X and Y axes with 5mm spacing, plus two diagonal axes with 7.07mm spacing. If the number of paints is reduced, it will decrease patient treatment time, leading to less patient movement during beam-on time.