

## **Investigation of the Hyperscint<sup>TM</sup> Plastic Scintillation Dosimetry System Performance in a 15 MeV electron beam at FLASH dose rates**

**Purpose:** The performance of the Hyperscint<sup>TM</sup> (MedScint Quebec, Canada) plastic scintillation dosimetry system in a 15 MeV electron beam operating at FLASH dose rates was investigated.

**Methods:** The Varian iX linac was operated using the 15 MV x-ray beam-generating parameters, however, the target and flattening filter were removed and the 12 MeV scattering foil was in place. Optically Stimulated Luminescence Dosimeters (OSLDs), (Landauer, USA), CC01 ionization chamber (IBA, Germany) and the Hyperscint<sup>TM</sup> were calibrated in a 15 MeV electron beam at 600 cGy/minute and then used to estimate dose in the FLASH beam. The Hyperscint sampling rate was 400 Hz, enabling pulse counting and pulse height comparison in addition to spectral analysis and dosimetry.

**Results:** The linac produced a 15 MeV electron FLASH beam with an average dose rate of ~250 Gy/s and dose per pulse between 1 Gy and 1.7 Gy, at the level just above the multi-leaf collimator. The Hyperscint reported dose agreed with OSLDs within 3.5% for 10 to 20 pulse FLASH beam deliveries, but was 15 to 36% higher than that reported by the CC01 ion chamber, depending on the number of delivered linac FLASH pulses. Degradation in the Hyperscint<sup>TM</sup> response occurred after an estimated cumulative dose of ~1000 Gy in the FLASH beam and thereafter, signal loss of  $0.017\% \pm 0.0005\%$  per Gy was observed.

**Conclusion:** The Hyperscint<sup>TM</sup> plastic scintillator detector system agreed with OSLDs within 3.5% for 10 to 20 pulse FLASH deliveries using the standard dose rate calibration for both dosimeters.