***Ultra-Fast Transmissive (UFT™) Real-Time Beam Monitor for FLASH-RT and Patient QA*: Tracking Beam Position, Movement, Intensity Profile, Dosimetry in Real-Time, Upstream & Downstream from Nozzle or Collimator**

July 2, 2021 – Integrated Sensors, LLC of Ottawa Hills, Ohio ("I-S") announces the development of its ultra-fast transmissive (**UFT™**) beam monitor technology for ionizing *particle and photon* external beam radiotherapy (RT) including **FLASH-RT** (e.g., protons, photons, carbon & helium ions, neutrons, etc.). UFT™ devices can monitor both spot and raster pencil-beam scanning and can operate either upstream or downstream from the nozzle or collimator providing exceptional performance with self-calibration and high resistance to radiation damage. Results show order-of-magnitude advantages over ionization chambers for beam profile readout with true 2D position resolution, ultra-high dose rate operation, and beam hardening. In addition to I-S, the project development team includes scientists from Loma Linda Univ. Medical School (Biomedical Engineering) and Univ. of Michigan (Physics & Radiation Oncology), with funding provided to I-S from the NIH/National Cancer Institute and the U.S. Dept. of Energy (Office of Nuclear Physics). Prototypes for radiotherapy are being designed to demonstrate a ***26 cm x 30 cm*** active detection area. Smaller *upstream* prototypes are being developed for vacuum beamline operation with micron-level position resolution and intensity/shape distributions out to at least three sigma's from the beam center, and with minimal beam energy straggling. High resolution, ***10 µs images for proton beams have been demonstrated for FLASH therapy***. Preliminary specifications are:

Real-Time UFT™ Monitor Streaming Readout/Analysis: ~***0.1 ms***, continuous tracking of downstream ***beam position, intensity profile, movement, fluence/external dosimetry & angular divergence***.

Downstream UFT™ Monitor External Enclosure Depth (in beam direction): ***~ 4-5 inches***

"True" 2D-Position & Ultra-High Beam Profile Resolution: <***10 µm*** *(depending on readout/update time)*

Proton Beam Energy Loss through UFT™ Monitor:

< ***0.30 MeV*** *(downstream)* at 70 MeV*, and ≤ ***0.03 MeV*** *(upstream, in vacuum)* at 70 MeV
< ***0.18 MeV*** *(downstream)* at 140 MeV*, and ≤ ***0.02 MeV*** *(upstream, in vacuum)* at 140 MeV
< ***0.14 MeV*** *(downstream)* at 210 MeV*, and ≤ ***0.01 MeV*** *(upstream, in vacuum)* at 210 MeV

*Proton Beam Gaussian profile, **σ = 3.500 mm**. Lateral Spread (σ) 70-cm downstream from nozzle due to monitor materials (1st column); due to air (2nd column); and due to monitor + air (3rd column)*:

at 70 MeV*:	≤ ***0.024 mm*** (monitor);	***3.875 mm*** (70-cm air);	***3.899 mm*** (monitor + 70-cm air)
at 140 MeV*:	≤ ***0.006 mm*** (monitor);	***3.612 mm*** (70-cm air);	***3.618 mm*** (monitor + 70-cm air)
at 210 MeV*:	≤ ***0.003 mm*** (monitor);	***3.550 mm*** (70-cm air);	***3.553 mm*** (monitor + 70-cm air)

**Calculated beam energy loss & lateral spread via TOPAS/Geant4 (http://www.topasmc.org/) simulations*.

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