AbstractID: 14447 Title: Scintillation dosimetry: from plastics to liquids and from photons/electrons to protons

Development of plastic scintillation detector systems for dosimetry has been evolving for more than a decade. Scintillation materials (plastic, scintillating fibers and liquid) have many properties that make them ideal for dosimetry including water equivalence and energy independence for MV photons, linearity with dose, dose rate independence, and high spatial resolution. Therefore, these detectors do not require the usual conversion and/or correction factors used for other commonly used detectors to convert the dosimeter reading to absorbed dose. This evolution started with point detectors and has led to matrix arrays to respond to the ever-increasing complexity of radiotherapy treatment fields such as IMRT. Small fields, high dose gradients and other challenging conditions could soon require the development of commercial scintillation detectors. The liquid scintillators also show promise for use in proton therapy. While offering excellent treatment conformity, proton therapy is also posing new challenges in terms of treatment verification and quality assurance. This is especially true with intensity modulated proton therapy (IMPT) with scanned proton beams where a single treatment may use several thousands proton spots. We will show how liquid scintillators can be used to quickly and accurately verify such complex treatments and to measure parameters such as the range, the position and the intensity of individual proton beams.

This lecture will provide an overview of the dosimetric characteristics and properties of plastic scintillation detectors when exposed to high-energy photon, electron as well as proton beams. We will discuss all forms of scintillation detector materials: plastic scintillators, plastic scintillating fibers and liquid scintillators. We will present few applications for plastic scintillation detectors in clinical radiotherapy: stereotactic radiosurgery, quality assurance and in vivo dosimetry applications. Finally, we will describe how liquid scintillators can be used for routine verification of proton treatments.

Educational Objectives**:**

1. Review the underlying physics of scintillation materials.
2. Review the properties of plastic scintillation materials used in radiation dosimetry.
3. Understand the principles of this method and recent innovations in scintillation dosimetry.
4. Identify potential applications that could benefit from scintillation detectors.