Simultaneous Imaging and ID of Radioactive Materials and Devices . . . From Plasma Physics and Fusion to National Security

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Abstract: X-ray detection systems are one of the most common diagnostics used in plasma physics to probe and study core dynamics of thermonuclear plasmas (T>106 ℃). Compact multi-energy soft (2<E<30 keV) and hard (20<E<200 keV) x-ray pin-hole cameras have recently been developed for time, energy and space-resolved measurements of the x-ray emissivity which naturally stem from magnetically confined fusion-grade plasmas. The development of this novel capability can be easily applied for simultaneous imaging and identification of radioactive materials and devices. The goal of this new endeavor is to develop a 6D imaging capability to identify the position, time-evolution and nature of active radio-nuclei which can be found or used in the medical field, physical and chemical sciences, military bases, decontamination sites, nuclear reactors and nuclear proliferation probes. We have successfully tested a 4D option identifying the location of radioactive sources, probing their physical and energy-dependent characteristics as well as developed a custom visualization tool to locate and identify the nature of their unstable radio-nuclei. Future efforts will consider the use of hard x-ray imagers fielded with CdTe detectors working with Americium and Cobalt sources, as well as depleted and enriched Plutonium and Uranium samples.