AbstractID: 1988 Title: A High Spatial Resolution Imaging System based on Photon Diffraction

Construction of a new system for diagnostics in nuclear medicine and molecular imaging is underway at Argonne National Laboratory. This system will consist of an array of photon diffraction lenses each coupled to a specific solid state detector, and tuned to detect gamma rays from a common source. This system will be capable of detecting gamma rays in the energy range of 100 to 200 keV typically associated with radiopharmaceuticals. Incoming gamma rays that fall within the solid angle of one of the lenses will be redirected onto a small focal point where a detector is placed. This process is analogous to a magnifying glass focusing sunlight into a small focal spot. Since this system relies on photon diffraction, gamma rays of a specific energy will be detected at a time reducing the background contribution from scattering. This system can be set to focus gamma rays of a specific energy by simply adjusting the distance between the radioactive source and a lens and the distance between a lens and its detector. Also, this system is expected to be sufficiently sensitive to detect small concentrations of radioactivity and be able to reveal potential tumor sites by exploiting the radiopharmaceutical remaining in the patient's body from a prior full-body scan, thereby eliminating the necessity of re-injecting the patient with radioactivity. In preliminary studies, a spatial resolution of 3 mm has been achieved with a prototype lens and this response signal shows little background contribution from scattering.