

## AbstractID: 5392 Title: The Production of Ultrafast Bright K-alpha X-rays from Laser Produced Plasmas for Medical Imaging.

**Purpose:** To show the potential of improving image quality with a cleaner, brighter, quasi-monochromatic X-ray micro-source via laser produced plasmas (LPP).

**Method and Materials:** First generation targets consisting of ten micron thick gold formed into free-standing pyramids have been built. PIC (Particle-In-Cell) simulations have been performed in order to validate this target geometry. Preliminary experiments with a Ti-Sapphire CPA laser have been achieved with these targets. Second generation parabolic cone targets with an optimal angle for electron transport have also been built. This new nano-fabricated target could optimize X-ray source characteristics.

**Results:** PIC (Particle-In-Cell) simulations show that conical targets optically guide laser light resulting in a higher density of hot electrons at the apex. These simulations show a possible ten times augmentation in hot electron density and a three times increase in electron temperature with a conical versus flat target. This increase in collimated suprathermal electrons boosts total photon yield as well as possibly enhancing line emission versus the bremsstrahlung continuum. Preliminary experiments demonstrate a three-fold higher X-ray yield and a two-fold reduction in focal spot with the pyramidal versus the flat target. Furthermore, the geometry of the conical targets not only reduces focal spot size to a few microns and pulse duration to a couple picoseconds, but allows the particles to escape the target perpendicular to the surface resulting in a particle-free, ultra-short X-ray micro-beam.

**Conclusion:** Comparing LPP X-ray source parameters to that of a standard X-ray tube shows substantial improvements in focal spot size, photon flux, spectral range and emission duration. Focusing on target design can provide a cleaner, brighter, quasi-monochromatic X-ray source that could improve image quality in any medical diagnostic regime. Such advancements show promising applications in mammography and angiography.

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