Volumetric Laser Ion Acceleration

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Mass-Limited Targets (MLT) represent an interesting option for many applications, based on laser-plasma interactions. Various theoretical studies investigated MLT's extensively. Experimental verification of these schemes is extremely demanding, due to the technological challenges on targetry and requirements on the laser system. In this talk, we present a target system for MLT. By the use of a Paul Trap we levitate targets of spherical geometries and position these targets with submicron precision. This target system can handle a range of target masses from 0.5 femtogram to 5 nanogram, corresponding to plastic spheres with radii ranging from 500 nm to 50 µm. In this talk we present experimental evidence on volumetric ion acceleration of plastic spheres with 1 µm diameter. Target pre-expansion was measured via an inline holography. It was found that the target density drops to near critical values. These microscopically small near critical plasmas enable the volumetric acceleration of protons beams with mono-energetic features. 3D-particle in cell simulations reproduced the experimental results. The simulations helped to gain insight into the acceleration mechanism from these small under-critical plasmas. Routes for future optimizations are shown.