Progress in laser-ion acceleration for medical applications

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Recent experiments demonstrated for the first time lasesr-ion acceleration to medically relevant energies. Specifically, > 160 MeV protons, with indications of up to 200 MeV energies, have been measured in multiple experiments at the LANL Trident laser. The results are in good agreement with published models of acceleration in relativistically transparent plasmas, aka “Break-Out Afterburner (BOA) acceleration”. This same mechanism has by now also been observed on other facilities, e.g. the Texas Petawatt Laser and GSI’s Phelix laser. The theory is shown to be both robust and predictive allowing scaling calculations for future systems.

At the same time we are addressing the main bottle neck of the high energy Nd:Glass laser systems required, i.e. there repetition rate, which is typically 1 shot per hour. AT UT , we are currently developing a Trident class, few hundred TW, ~100J system glass laser system with a repetition rate of ~3Hz. The implications of this recent progress in both mechanism understanding and laser systems for the target technology required for a medically relevant prototype are discussed.