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Intra-pulse transition between ion acceleration mechanisms in intense laser-foil interactions HERSIMERJIT PADDA, MARTIN KING, ROSS GRAY, HAYDN POWELL, BRUNO GONZALEZ-IZQUIERDO, Univ. of Strathclyde, LUCA STOCKHAUSEN, Centro de Laseres Pulsados, ROBBIE WILSON, Univ. of Strathclyde, DAVID CARROLL, Central Laser Facility, RACHEL DANCE, DAVID MACLELLAN, Univ. of Strathclyde, XIAOHUI YUAN, Shanghai Jiao Tong Univ. , NICK BUTLER, Univ. of Strathclyde, REMI CAPDESSUS, Univ.of Strathclyde, MARCO BORGHESI, Queens Univ. Belfast, DAVID NEELY, Central Laser Facility, PAUL MCKENNA, Univ. of Strathclyde — Laser-driven sheath acceleration of ions has been widely studied and the recent move to ultra thin foil interactions enables promising new acceleration mechanisms. However, the acceleration dynamics in this regime are complex and over the course of the laser-foil interaction multiple ion acceleration mechanisms can occur, resulting in the dominant mechanism changing throughout the interaction. Measuring the spatial intensity distribution of the accelerated proton beam we investigate the transition from radiation pressure acceleration to transparency-driven processes. Using PIC simulations, the radiation pressure drives an increased expansion of the target ions, which results in a radial deflection of low MeV protons to form an annular distribution. By varying the thickness of the target, the opening angle of the ring is shown to be correlated to the point in time that transparency occurs and is maximised at the peak of the laser intensity profile. Measurements of the ring size as a function of target thickness are found to be in good agreement with the simulation results.

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