Contribution ID: **110** Type: **talk**

Laser-Driven Proton Acceleration at POLARIS with SHG and nm thin Foils

Tuesday, September 15, 2015 3:40 PM (20 minutes)

To investigate laser-driven ion acceleration in the regime of Light-Sail Radiation Pressure Acceleration it is essential to use foils of few nm thickness. Therefore an extremely high temporal intensity contrast is required to avoid destruction of the target by the prepulse. An ion acceleration experiment was performed at the fully diode pumped laser system POLARIS at the Helmholtz-Institute Jena. POLARIS has been developed and improved within the last two decades and was commissioned for experiments in 2012. It has a very high temporal intensity contrast by using an XPW stage in a double CPA setup. However, to use few nm thin diamond-like-carbon or plastic foils a further enhancement of the contrast was necessary. A KDP crystal has been used to generate the second harmonic of the laser at 515 nm wavelength which significantly enhances the ns- and ps-contrast by several orders of magnitude. These pulses were focused on targets with thicknesses in the range between 5 nm and 800 nm. The results showing the influence of different laser polarizations on the maximum proton energies as well as the investigation of the proton beam profile will be presented.

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Session Classification: WG2 - Ion beams from plasmas

Track Classification: WG2 - Ion beams from plasmas