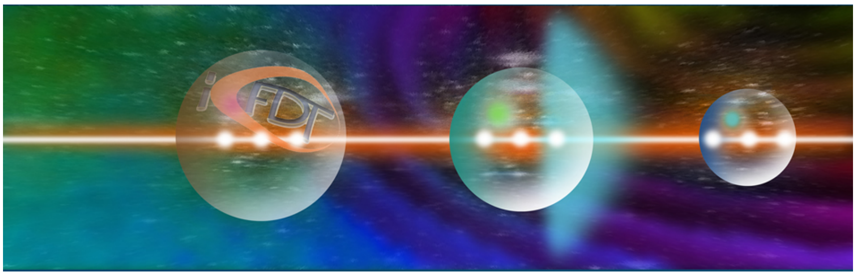

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TOF diagnosis of laser accelerated high-energy protons using diamond detector

Thursday, 4 October 2018 14:30 (1h 30m)

Significant challenges in the detection of laser-accelerated ions result from the high flux (10^{10}-10^{12} ions/pulse) and the short bunch duration (0.1 - 1 ns near the source), which are intrinsic to laser-driven sources. While the progress towards the stringent requirements of such applications (higher energies, repeatable generation, mono-chromaticity) will be facilitated by the on-going development of next generation laser drivers and target technology, present limitations in the ability to fully characterize the beams on a shot-by-shot, real time basis also need to be overcome in order to provide optimized and controllable beams for applications.
The use of a real time diagnosis based on Time of Flight (TOF) technique coupled with diamond detectors for full characterization of high-energy laser-driven proton beams will be reported in the present contribution. The TOF detection system will be used as the main diagnostics to monitor on a shot-by-shot basis the main ion beam features up to a repetition rate of 10 Hz, and to optimize ion beam transport and selection tuning in real-time the particle beam transport optics along the unique user beam line ELIMAIA (ELI Multidisciplinary Applications of laser-Ion Acceleration), which will be installed at the ELI- Beamlines facility in Prague (Czech Republic) within 2018.
Real time diagnosis of the main beam parameters for high-energy protons generated by the VULCAN-PW laser system at RAL (UK) has been performed using the on line diagnostics based on the TOF technique and on the use of diamond detectors. Results on the characterization of a proton source generated from the interaction of the PW- class laser and a solid hydrogen ribbon will be also discussed
High yield proton energy spectra were measured for energies exceeding 50 MeV in both directions (forward and backward with respect to the incoming laser beam). The result shows that, employing diamond detectors, the TOF method is a robust real-time diagnostics offering the possibility to monitor on a shot-by-shot basis the main beam parameters MeV level and this diagnostic approach is particularly attractive for the characterization of sources of single species ion beams, e.g. as emerging from cryogenic hydrogen target experiments.

Summary

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