Synthetic Radiation Diagnostic in Hybrid LPWFA

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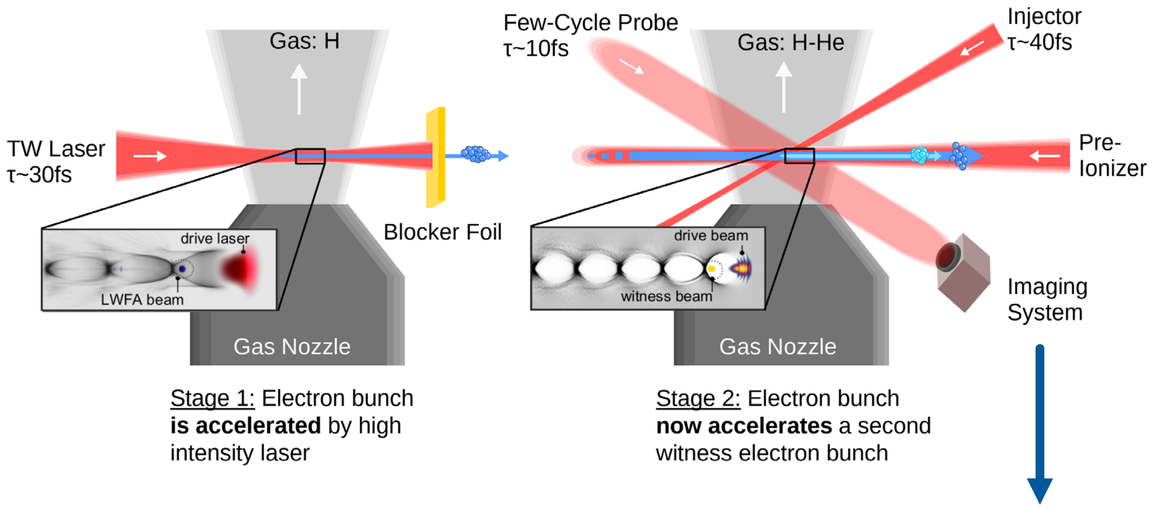
Radiation Signal in Experimental Shadowgrams of Laser Driven Plasma Wakefield Accelerators



Stage 1: Electron bunch **is accelerated** by high intensity laser

Stage 2: Electron bunch **now accelerates** a second witness electron bunch

Talk: Sep 24 10am: *Overview of hybrid LPWFA-driven PWFA* (Susanne Schoebel)

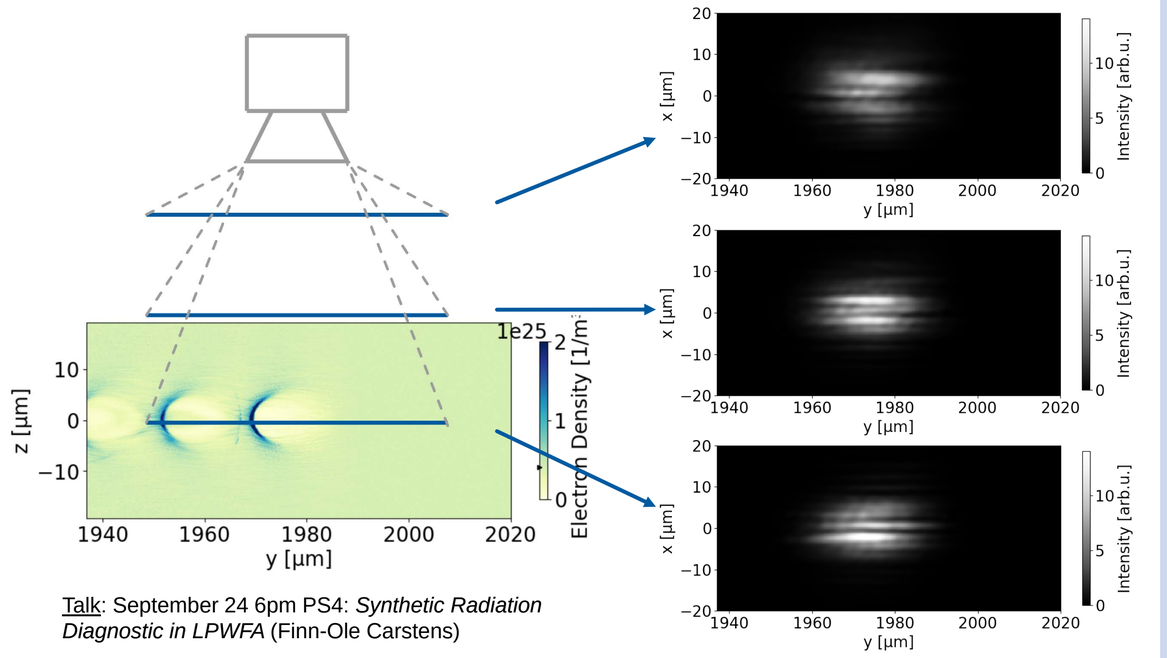
Known properties of radiation signal:

- Appears when injector hits first cavity
- Independent of ionization
- Independent of probe laser
- Dependent of injector polarization
- Shape varies from shot to shot

Hidding, B., *et al.*, Ultracold Electron Bunch Generation via Plasma Photocathode Emission and Acceleration in a Beam-Driven Plasma Blowout, *Phys. Rev. Lett.* **108**, 035001 (2012)

Ufer, P., *et. al.*, Ultra-compact plasma photocathode in a hybrid wakefield accelerator, *submitted*

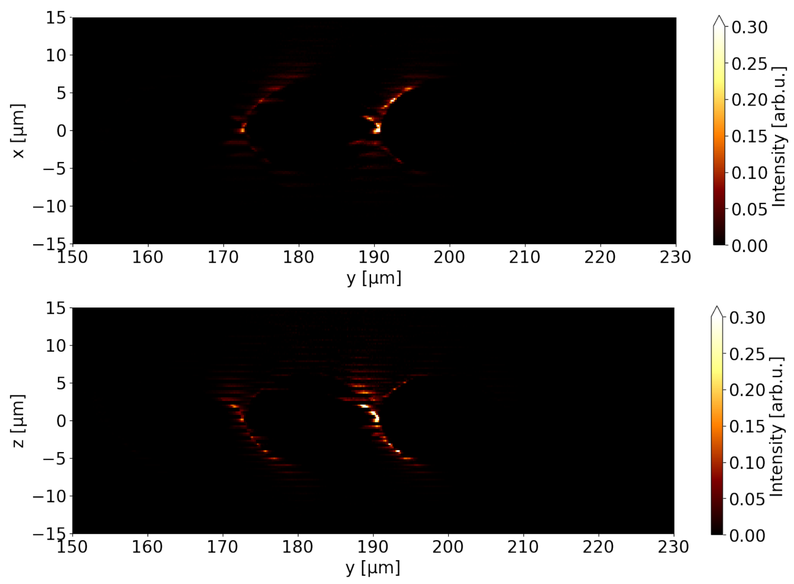
Reproducing the Experimental Signal in Simulations



Talk: September 24 6pm PS4: *Synthetic Radiation Diagnostic in LPWFA* (Finn-Ole Carstens)

Changing the distance between image plane of camera system and plasma wake leads to different radiation signals. This could be used to measure horizontal jitter in experiments.

Signal Origin: Cavity Sheath and Detached Cavity Electrons

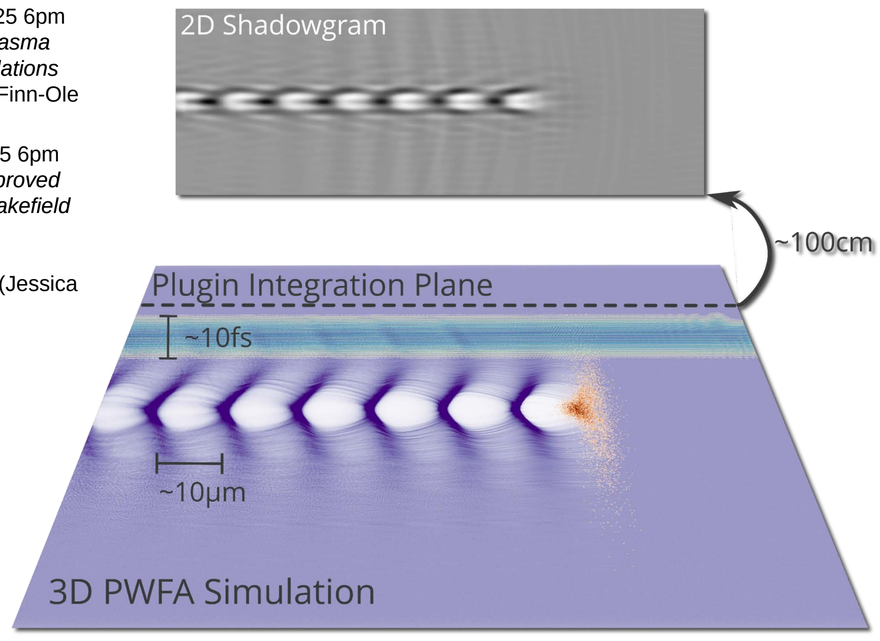


Radiation emitted by electrons in detector direction. The asymmetric radiation source distribution originates from the 30° angle of the injection laser.

Extension of Simulation Box into Far Field onto Virtual Screen with Imaging Plugin

Talk: September 25 6pm PS4: *Exascale Plasma Accelerator Simulations with PIConGPU* (Finn-Ole Carstens)

Talk September 25 6pm PS4: *Towards improved control of laser-wakefield accelerators with multidimensional parameter scans* (Jessica Tiebel)

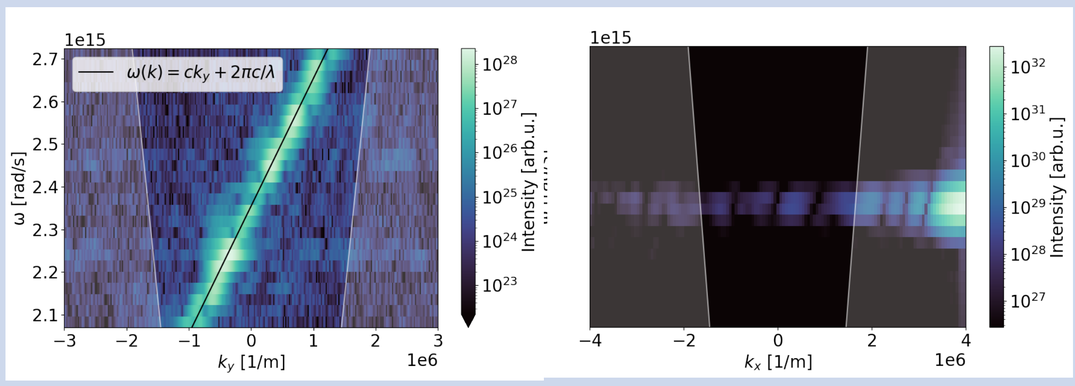


Laser-Plasma interactions of probe and accelerator are fully simulated with PIConGPU, including the full physics, such as relativistic refraction, diffraction, Faraday rotation, and ionization effects.

PIConGPU

https://github.com/ComputationalRadiationPhysics/picongpu

Fourier Domain Characterization: Doppler-Shifted Diffraction Signal



The signal is Doppler-shifted in acceleration direction from the relativistic moving (~2MeV) sheath electrons. In the vertical image direction the signal looks like a diffraction signal in Fourier domain, meaning that for larger observation angles it would too weak to use it for timing calibration anymore.

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