Contribution ID: **151** Type: **poster**

The evolution of the laser pulse in the quasistatic model of Plasma Wakefield Accelerator

Wednesday, 16 September 2015 20:00 (30 minutes)

Performance of a newly developed quasistatic model of a laser pulse is studied. The code solves the envelope equation for the vector-potential with the five-point Thomas algorithm. The finite-difference scheme has the second order by the transverse coordinate, the third order by the longitudinal coordinate, and the first order by the time step. The stability region of the scheme is studied experimentally; operational points of the algorithm are found.

The numerical solution precisely agrees with the available analytics. The calculated group velocity of the pulse is correct for different laser wavelengths. Tests with parabolic plasma density profiles correspond to the «channel-guided regime»; the calculated matched radius of the Gaussian pulse and the period of spot size oscillations agree with theoretical predictions.

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Session Classification: Poster Session 2 (WG5-WG6-WG7) and Wine

Track Classification: WG6 - Theory and simulations