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Modelling of laser-plasma acceleration of relativistic electrons in the frame of ESCULAP project

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Objective of ESCULAP project is the experimental study of laser-plasma acceleration of relativistic electron bunch. LAL photoinjector (PHIL) will be used to inject electron beam in plasma wakefield created by high power laser (LASERX) in the plasma cell. Control of the quality of the accelerated bunch is one of the main difficulties in laser-plasma acceleration. Extensive modelling of the ESCULAP experiment was performed in order to determine optimal parameters of the plasma cell density profile, focalization area, sensitivity to bunch quality etc. Plasma wakefield predicted by linear theory is compared with one obtained from kinetic modelling. We demonstrated that the large part of the initial electrons bunch can be accelerated up to hundreds of MeV in 9 cm length plasma cell where electric field reaches 100 MeV/cm.

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