Contribution ID: **1422** Contribution code: **TUPA099** Type: **Poster Presentation**

Optimization of 200 MeV laser-plasma electron injector target using massive particle-in-cell simulation combined with fluid simulation

Tuesday, 9 May 2023 16:30 (2 hours)

As part of the EuPRAXIA project[1], the objective of the PALLAS project is to produce an electron beam at 200 MeV, 30 pC with less than 5% energy spread and lower than 2µm normalised emittance using the IJCLAB-LaseriX laser driver at 10 Hz, 1.5 J and 35 fs. Based on available publications[2,3], we propose a two-chamber gas plasma target with a dopant localised in the first chamber. We then perform on-bench calibrated compressible simulations with the code OpenFOAM to predict the density profile. The result is then used as input for two massive random scans and a Bayesian optimisation with SMILEI fast Particle-in-Cell (PIC) simulation varying four input parameters: focal position, laser intensity, dopant concentration and inlet pressure. We further investigate the stability of the optimal working points. The massive amount of PIC results is left as open-source data for further investigation by the scientific community. Such a process can serve as the basis for any input parameters optimisation of a laser-plasma electron source target.

Funding Agency

ANR/PIA3-PACIFICS, CNRS/IN2P3, Université Paris Saclay

Footnotes

[1] Assmann *et al.* Eur. Phys. J. Spec. Top. **229**, (2020)
[2] Lee *et al.* PRAB **19** 112802 (2016); Golovin *et al.* PRAB **18**, 011301 (2015)
[3] Jalas *et al.* PRL **126**, 104801 (2021); Kirchen *et al.* PRL **126**, 174801 (2021)

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Session Classification: Tuesday Poster Session

Track Classification: MC3: Novel Particle Sources and Acceleration Techniques: MC3.A22: Plasma Wakefield Acceleration