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Optimal laser focusing for positron production in laser-electron scattering[1] OSCAR AMARO, MARIJA VRANIC, Instituto Superior Tecnico, University of Lisbon, Portugal — Laser-electron beam collisions that aim to generate electron-positron pairs require laser intensities $I \sim 10^{21}$ W/cm^2, which can be obtained by focusing a 1-PW optical laser to a spot smaller than 10 μm. Spatial synchronization is a challenge, because of the Poynting instability that can be a concern both for the interacting electron beam (if laser-generated) and the scattering laser. One strategy to overcome this problem is to use an electron beam coming from an accelerator (e.g. the planned E-320 experiment at FACET-II). However, this configuration brings other challenges - the electron beam is long and wide and there is a trade-off between using a short focal length to obtain the highest conceivable laser intensity, and having a wider interaction volume where more seed electrons participate in the interaction. This work extends analytical scaling laws for pair production in laser-electron beam scattering, previously derived for the case of a plane wave and a short electron beam. We investigate positron yield in a focused laser beam, considering an electron beam with an arbitrary distribution function. We take the spatial and temporal synchronization of the interaction into account and prescribe the optimization strategies for near-future experiments.

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