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Coupling of LPA e-beams into Undulators, as a Path Toward LPA-Driven FELs¹

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The recent spectacular development of laser plasma accelerators (LPA) that deliver GeVs electron beams in an extremely short distance make them more and more promising. Applications for free electron laser appear as a way to move from an acceleration concept to an accelerator qualification. Still, the presently achieved divergence and energy spread require some beam manipulations. The electron beam at the plasma exit should be strongly focused. The energy spread, besides specific generation schemes, can be handled by a decompression chicane or a transverse gradient undulator. Various results on the LPA coupling to undulator will be reported, and will be illustrated in more details with the COXINEL test line example. It comprises variable permanent magnet quadrupoles for divergence handling, a magnetic chicane for energy sorting, a second set of quadrupole before an undulator. The transport along the line is controlled. The observed undulator radiation exhibit transverse distributions in agreement with theoretical observation and spatio-spectral moon shape type patterns, with radiation performance close to those achieved with synchrotron radiation light source. Future prospects towards laser Plasma Acceleration based Free Electron Laser will be given.

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