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Control of undulator radiation using a Laser Plasma Acceleration Source

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Spontaneous undulator radiation emission, after the COXINEL line using a Laser Plasma acceleration (LPA) source, has been observed. The line enables to manipulate the electron beam phase space such as emittance, dispersion and energy spread along a 10 m long transport. The large divergence is handled at a very early stage to mitigate the chromatic emittance, using high gradient permanent magnet based quadrupoles mounted on translation tables to enable Beam Pointing Alignment Compensation that allows for a dispersion free focused beam. The operating energy is between 161-180 MeV focused in a 2-m long cryo-ready undulator with a period of 18 mm emitting light in the Ultra-Violet range. The spectral flux is characterized using a spectrometer and the angular flux is captured by a CCD camera. The wavelength is tuned by either changing the electron beam energy or by adjusting the undulator gap. We show that the angular-spectral moon shape type pattern of the undulator radiation provides an insight on the electron beam quality and its transport. The radiation pattern signature is illustrated alongside its dependence on the energy spread that is modified by introducing a slit in a magnetic chicane where a small relative bandwidth of 2% has been achieved.

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