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Ion channel formation for advanced betatron emission

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A long ion channel has been proposed as a possible way to reduce the bandwidth of betatron radiation emitted in a plasma due to its wakeless nature; this allows to exclude longitudinal momentum variations from the photon energy dispersion, only retaining the transverse oscillations as plasma induced energy spreads. Although the concept of ion channel laser was proposed back in the nineties, no studies were published about the channel formation itself. In this contribution, we address the issue of depleting from electrons an already formed plasma column by means of a relativistic electron bunch, deriving some useful scaling laws supported by an extensive simulation campaign. Our studies aim at defining possible working points for a monochromatic betatron source in the framework of EuPRAXIA and the SL_betatest experiment at SPARC_LAB.

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