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FLASHForward P-9: An X-band transverse deflection cavity for femtosecond-scale longitudinal phase space diagnostics

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The FLASHForward project at DESY is an innovative beam-driven plasma-wakefield acceleration experiment, aiming to accelerate electron beams to GeV energies over a few centimetres of ionised gas. These accelerated beams must be of sufficient quality to demonstrate exponential free-electron laser gain; achievable only through rigorous analysis of both the driver and witness beam's longitudinal phase space. The pulse duration of these witness beams is typically in the few-fs range and thus difficult to resolve with traditional diagnostic methods. In order to longitudinally resolve these very short bunch lengths it is necessary to utilise the properties of a transverse RF deflector operating in the X-band frequency regime. This X-band Transverse Deflection Cavity (XTDC) will be introduced to the FLASHForward beam line in order to perform fs- level single-shot longitudinal phase space measurements. The initial investigations into the implementation and operation of this device, as well as the international collaborative efforts required to realise it, are outlined.

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