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Steering efficiency and dechanneling of a Sub-GeV Electron Beam as a Function of Curvature and Energy

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We report the observation of efficient steering of sub GeV electrons at MAMI (MAinzer MIkrotron) facilities by means of planar channeling and volume reflection in a bent silicon crystal. A 15 μm thick plate of (211) oriented Si was bent to cause quasi-mosaic deformation of the (111) crystallographic planes, which were used for coherent interaction with the electron beam.
The plate bending was obtained thanks to a remotely controlled device that allows for a fine tuning of the bending and the torsion by means of piezo-step motors. Remote adjustment of the bending allowed to record data in a wide range of deflection angles from 0.3 up to 1.5 mrad. Moreover the device guarantee a soft bending procedure "stitching before bending"making possible to manage fragile thin slabs bringing them to impressive curvature (about 3mm primary curvature was reached), close to the breaking limit of the material.
The data allow studying the deflection efficiency and dechaneling-rechanneling phenomena as a function of the curvature. Moreover at the higher curvature data was collected in the energy range between 195 and 855 MeV.
These results allow a deep understanding of the dynamics of electrons subject to coherent interactions in a bent silicon crystal in the sub-GeV energy range, which is relevant for realization of innovative x-ray sources based on channeling in periodically bent crystals.

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