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Achieve a record dynamic range of halo diagnostics with a novel fluorescence wire scanner

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Achieving sustainable beam operation in high-power accelerators requires careful control and minimization of halo-particle-induced beam loss. To accomplish this, it is important to have a clear understanding of the halo-particle distribution. While state-of-the-art instruments can achieve a dynamic range of $\sim 10^6$ with counting readout schemes, a novel fluorescence wire scanner combined with a conventional metal wire has recently been proposed and demonstrated at CSNS. This new approach has achieved a sensitivity at the single-particle level and a dynamic range of over 10^8 . A $100 \times 1 \times 0.15 \text{ mm}^3$ Chromox fluorescence wire has been prepared at CSNS, which has demonstrated excellent light yield and radiation hardness. By capturing fluorescence images with a CMOS camera in a dark environment, a new record dynamic range of about 6×10^8 has been achieved. Continue efforts on optimizing the fluorescence wire, observation system, and sensor hold promise for further improvements in dynamic range and sensitivity.

Footnotes

Funding Agency

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Yes

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