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Beam position monitors (BPMs), using their charge information at SLAC

Thursday 29 August 2024 16:00 (2 hours)

BPMs have been used for decades since their easy-to-use absolute transverse position capability. Left signal minus right signal divided by the sum times the radius gives the beam position. The charge is "just"a relative measurement and has to be calibrated (or ironed) against a toroid signal. Even when the incoming charge variation is high (like 3% rms for the superconducting LCLS2), the relative variations are only 0.1%. This opens up quite some uses. Besides even small charge losses at beam restrictions like collimators or septum magnets it has been found that this signal is very useful in quantifying the charge loss during a wire scan since losses of around 2% are observed. By taking the difference of a few BPMs before and after the wire scanners signal-to-noise levels of up to 5000 are observed, making this method compatible to the typical scintillator plus photomultiplier setup. This is especially helpful where the first beam loss is hundreds of meters downstream since most of the scattered electron make it down the relatively wide bore of the superconducting cavities. An SVD method to analyze the data independent by human judgement is discussed.

Footnotes

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