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Simulation study on fast beam-based alignment for commissioning of light sources

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Beam based alignment (BBA) plays an important role in the commissioning of the light sources. To speed up the BBA, a BBA method using AC excitation, called fast BBA (FBBA), has been proposed and is tested in several existing light sources. In the FBBA, the beam orbit is sinusoidally modulated at around 10Hz by AC correctors, and the change in the beam response when a target quadrupole magnet strength is changed is measured using fast beam position monitors (BPM) at about 10kHz. To apply FBBA to light source commissioning, a simulation study of FBBA using random variables as response functions was performed to calculate the optimal corrector strength and variation of the strength of a quadrupole as a function of the BPM noise. We also improved the FBBA and found that a new FBBA scheme using two AC correctors of different frequencies separated by $1/2\pi$ betatron phase for one plane (horizontal or vertical) can suppress the BPM offset error by up to 10.

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