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Optimization and development of the CBPM system for the SHINE

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Beam-based alignment and feedback systems are essential for the operation of the Free Electron Lasers (FELs). Cavity BPMs having the advantage of high position resolution are widely used in the field of accelerators. Systematically analyze the impact of the key parameters of each subsystem on the performance of the whole system, so that the key technical indicators of each subsystem can achieve the optimal and balanced allocation, is the primary issue to be considered when designing a CBPM system. In this paper, the relationship between the relative amplitude extraction uncertainty of the CBPM system and the key parameters of each subsystem is proposed based on theoretical analysis. And this method has also been applied in the development of the CBPM system for the Shanghai High repetition rate X-ray Free Electron Laser and Extreme Light facility (SHINE). Based on the beam test bench in the Shanghai Soft X-ray FEL facility (SXFEL), the position measurement uncertainty of the CBPM system can reach 40 nm at the bunch charge of 100 pC, which is consistent with the theoretical analysis results and better than the requirements of the SHINE.

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Footnotes

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