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Study on beam orbit shift due to synchrotron radiation

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The beam orbit stability is the crucial indicator to evaluate the performance of the synchrotron radiation source. In order to obtain higher beam quality, higher stability requirements are placed on the beam orbit. The stability can be improved through accurate measurement of beam orbit by beam position monitors (BPMs) and appropriate feedback system. However, due to radiation of the synchrotron beams on the vacuum chamber, the thermal effect of synchrotron radiation causes the thermal deformation of the vacuum chamber. The thermal deformation drives the BPM fixed on the vacuum chamber to move, which will induce error to the beam orbit. We analyze the effect of beam current on the vacuum chamber movement and the effect of vacuum chamber movement on the beam orbit. We also built an online vacuum chamber displacement measurement system on Hefei Light Source II (HLS II), which is used to validate and correct our analysis. After analysis and verification, the vacuum chamber moves with the change of current. The larger the change of current, the larger the vacuum chamber displacement. The vacuum chamber displacement has a hysteresis compared to the current change.

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Footnotes

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Yes

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