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Key issues in the high intensity beam commissioning for the CSNS RCS

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For the China Spallation Neutron Source (CSNS), the rapid cycling synchrotron (RCS) accumulates and accelerates the injection beam to the design energy of 1.6 GeV and then extracts the high energy beam to the target. The CSNS design beam power is 100 kW, with the capability to upgrade to 500 kW. By February 2020, the beam power had reached 100 kW, and through improvements, the beam power was increased to 170 kW. During the beam commissioning process, the beam loss caused by space charge effects was the most significant factor limiting the increase in beam power. Additionally, unexpected collective effects were observed, including coherent oscillations, when the beam power higher than 50 kW. Through a series of improvements, the space charge effects and collective instabilities causing beam loss were effectively controlled. In this paper, the key beam issues during the beam commissioning for the CSNS RCS will be studied in detail and their suppression methods will be given.

Footnotes

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