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Design and Beam Commissioning of Dual Harmonic RF System in CSNS RCS

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CSNS was designed with an average power of 100 kW, which was achieved in February 2020 and 125 kW in March 2022. On this basis, CSNS plans to increase the average beam power to 200 kW, which is to double the current strength of the circulating beam of RCS, with the injection energy unchanged. The main means is to add a second harmonic RF cavity to the RCS.

The space charge effect is an important factor to limit the current intensity in high power particle accelerators, especially for low- and middle-energy proton synchrotrons. In order to reduce emittance increase and beam loss caused by space charge effect, CSNS has added a magnetic alloy cavity in 2022 summer to provide a second harmonic RF cavity with harmonic number of 4, and form a dual harmonic RF system together with the original cavity with harmonic number of 2, so as to optimize the longitudinal beam distribution.

This talk will focus on the beam commissioning and simulation results after the installation of magnetic alloy cavity.

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