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# Bead-Pull Measurement and Re-tuning of SNS RFQ02

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To support the reliable operation, there have been three RFQs developed at SNS. SNS RFQs are 4-vane type structures designed to accelerate H- beam from 65 keV to 2.5 MeV with estimated transmission efficiency above 90%. The RFQ02 was installed to the SNS Front End and started operating for beam production in 2018. After a few years of operation, field tilts were observed in all four quadrants with pickup probe measurements, and beam transmission reduced by about 20%. It was swapped out from SNS Front End with the new RFQ (RFQ03) in March 2023. Bead-pull measurements and re-tuning were performed on the RFQ02 before it was moved to the Beam Test Facility (BTF) as a ready spare. A bead-pull system with Arduino UNO was developed at SNS for the RFQ tuning at low RF power. The tuning algorithm was developed utilizing the superposition of the perturbations caused by the slug tuners to minimize the field profile difference as well as the frequency deviation compared to the designed value. The bead-pull was performed with the RFQ02 in air, so frequency corrections for the effects of air permittivity and atmospheric pressure were considered in the retuning based on CST Microwave Studio calculations. The final bead-pull measurement after re-tuning shows the magnetic field difference between quadrants is less than 0.6%. The resonance frequency under vacuum was 402.525 MHz (target value 402.5 MHz). The detailed results of the re-tuning will be presented.

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