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Design of a QWR cavity for the new ISIS MEBT

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The quarter wave resonator (QWR, a.k.a. $\lambda/4$ resonator) for the new ISIS MEBT is a bunching cavity that longitudinally compresses the H- beam into smaller bunches. It has 2 gaps with a distance of $\beta\lambda/2$ between mid-gaps, and works in π mode at the resonant frequency of 202.5 MHz, with a phase angle of -90 degrees. The maximum voltage per gap (E0L) is set to 55 kV. A detailed RF model has been developed to tune the main dimensions to the required frequency and to estimate the Kilpatrick ratio and the RF power dissipation. The cavity is designed to be made of copper plated stainless steel, which has a considerable effect on the design of the cooling system; the thermal calculations include a thermo-mechanical analysis to estimate the dynamic tuning requirements. The cavity has two tuners to allow for a fine and a coarse tuning of the resonant frequency. The manual tuner coarsely adjusts the frequency to cope with the manufacturing tolerances. The automatic tuner finely tunes the frequency within a range of working temperatures. The tuners are heavily coupled both in terms of frequency resolution and tuning range, which presents some challenges to the design. The design of the power coupler was adapted to the QWR from another project and the coupling coefficient was adjusted to the new cavity. A sensitivity analysis for the critical dimensions was also developed, but is not presented here.

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Footnotes

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Yes

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