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Correction of nu_r-nu_z=1 Resonance in TRIUMF Cyclotron

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The second order linear coupling resonance $nu_r - nu_z$=1 is driven by an asymmetry in the median plane of the cyclotron due to presence of the first harmonic in B_r. In TRIUMF cyclotron, this resonance is encountered at about 166\,MeV and 291\,MeV, where $\nu_r \simeq 1.2$ and $\nu_z \simeq 0.2$. When the beam is off-centered radially to pass through this resonance, the radial oscillation gets converted into vertical oscillation, which can cause beam loss to occur, though these loss modes do not reduce the machine transmission under normal operation. In this paper, we present the results of simulations and measurements that we have performed to correct this resonance by using the existing harmonic coils.

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