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## Interaction of Degenerate Higher Order Modes in Periodic Accelerating Structures

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Some of the higher order mode (HOM) passbands in multi-cell accelerating structures may become “flat”, i.e., having a very narrow bandwidth, due to very weak coupling between cells. In the presence of misalignments, this passband disintegrates into individual cell resonances that are not coupled to the beam pipes and, therefore, have a high quality factor and  $R/Q$ . These resonances can lead to beam instabilities, emittance growth, and excessive cryogenic losses. Such an effect was observed in a high-beta 5 cell 650 MHz (HB650) prototype cavity for the PIP-II project. An analytical theory developed to explain the effect and methods to eliminate it are presented in this paper. The HB650 cavity was successfully redesigned to eliminate the flat passband.

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