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RF DESIGN OF A SPOKE RESONATOR FOR HIGH POWER FREE-ELECTRON LASERS

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Abstract

We are investigating spoke resonators that originally were proposed for moderate energy proton acceleration for application in high-average-current free-electron lasers (FEL). This structure holds the promise of alleviating the BBU limitations of conventional rf structures. Spoke resonator have several advantages: 1) strong coupling simplifies the access to higher order modes (HOM), 2) at the same frequency a spoke resonator is about half the size of an elliptical resonator, 3) the spokes provide additional mechanical stability and stiffening, 4) the power and HOM couplers can be attached to the cavity body and do not take up additional space along the length of the accelerator, 5) the presence of the spokes limits the polarizations of the HOMs to two orientations which facilitates the selection of HOM coupler positions. The rf performance of a spoke resonator specifically designed for high-current electron applications ($\beta=1.0$) will be presented and compared with the expected performance of elliptical resonators designed for such applications. Besides the structure's effectiveness for acceleration also HOM properties will be presented.

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