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Study of cryogenic bi-periodic accelerating structure with TM02 mode and schematic design of the low temperature system

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With high shunt impedance and expected gradient, cryogenic structure has the ability to reduce accelerators' length and has the potential to operate at a higher repetition rate. In SSRF/SXFEL, the scheme and preliminary experimental studies about the cryogenic RF structure have been developed. Foremost, theoretical and experimental studies of the RF characteristics in cryogenic environments are investigated. Then we designed a cryogenic C-band standing wave bi-periodic accelerating structure. It is a 17-cell structure consisting of 9 accelerating cavities and 8 coupling cavities. To guarantee the symmetry of the field, the structure is doubly-fed. Operating with the pi/2 mode standing wave, it is much less sensitive than the standing-wave structure of pi-mode. Additionally, the microwave mode is TM02 in coupling cavities that are larger and even less sensitive than the traditional bi-periodic structure. The shape of the coupling cavity can be redesigned to make it tunable. In the subsequent study, we will work on the experiment of the cryogenic structure.

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