Contribution ID: **1896** Contribution code: **WEPA131** Type: **Poster Presentation**

In-Situ Pulse-to-Pulse Evaluation Method on Cavity Parameters of the RF Pulse Compressor

Wednesday, 10 May 2023 16:30 (2 hours)

RF pulse compressors are used for higher acceleration gradient in the KEK electron positron injector linac. S-band spherical-cavity type pulse compressors (SCPC) with a high quality factor Q of 100,000 have been newly developed, and one of them was installed in the linac. The performance of the compressor is characterized by its cavity parameters such as resonant frequency and Q-value. Although these parameters are usually measured at low power, analyzing them during high-power operation is difficult. In addition, the ohmic heating modulates them. Therefore, obtaining cavity parameters in-situ is important especially in the developing stage of the new compressors. We developed an evaluation method to determine the cavity parameters by analyzing pulse-to-pulse output waveforms from the compressor based on its equivalent circuit model. The method gives resonant frequency with an accuracy of less than 0.4 kHz, which corresponds to the frequency shift caused by the bulk temperature change of 0.01℃. The method also gives Q-value with a relative accuracy of less than 3%, the effect of which is smaller than energy multiplication factor changes of 0.3%.

Funding Agency

This work was supported by JST, the establishment of university fellowships towards the creation of science technology innovation, Grant Number JPMJFS2136.

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Session Classification: Wednesday Poster Session

Track Classification: MC7: Accelerator Technology and Sustainability: MC7.T06: Room Temperature RF