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Study of the Resonant Cavity for the Low-level RF System at the PBP- CMU Linac Laboratory

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This research aims to investigate the characteristics of the resonant cavity, which is a part of the radio-frequency (RF) power system of the electron linear accelerator (linac) at the at the PBP-CMU Linac Laboratory, Chiang Mai University. A resonant cavity is used to create RF waves of the desired frequency by exploiting the relation between the cavity dimension and the resonant frequency. The resultant RF wave from the resonant cavity is amplified and used to accelerate electron beam in the linac, that has a specific operating frequency. Simulations of the electric and magnetic field patterns inside the resonant cavity, as well as the resonant frequency, were performed by using the SUPERFISH program. Meanwhile, measurements of the resonant frequency for the real cavity were done with a spectrum analyzer. The relation between the cavity length and the resonant frequency was studied. The data from simulation and measurement are compared. The study results showed that our resonant cavity has TM_{112} mode and the resonant frequency has a negative linear correlation to the cavity length. This cavity has an inner radius of 6.89 mm. The resonant frequency of the cavity can be varied by adjusted its length. The optimal cavity length, which produces the RF waves of 2856 MHz, obtained from the measurement was 134.8 mm. However, the simulated optimal length is 3.9% shorter than the measured one. This difference is expected to be an effect of antenna coupling, which was unable to avoid in the experimental setup.

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