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RF characterization of a cryogenic X-band cavity beam position monitor for superconducting undulator applications at SLAC

Monday 11 August 2025 16:00 (2 hours)

Superconducting undulators (SCUs) have gained significant interest due to their advantages over permanent magnet undulators, including the ability to achieve higher magnetic fields and shorter periods, leading to enhanced photon energy gain. As part of the SCU project at SLAC, an X-band cavity beam position monitor (BPM) has been designed and fabricated. This BPM plays a crucial role in the SCU assembly ensuring precise beam alignment with sub-micron resolution. The BPM incorporates two rectangular cavities for X- and Y-position measurements and a cylindrical reference cavity, all housed within a single copper block. Each cavity is separated by approximately 30 mm, which eliminates crosstalk between channels. The design of each cavity includes a single WR-75 waveguide port with a ceramic window as vacuum-air interface for out-coupling the EM field from the cavity to the external circuit. Additionally, each cavity is equipped with a tuner pin for resonant frequency adjustments. In this work, we report on the RF characterization of the BPM cavities conducted at both room and cryogenic temperatures. A consistent resonant frequency shift of approximately 37 MHz was observed when cooling the cavities from room temperature to 40 K, which is the nominal operating temperature within the undulator cryomodule. These measurements validate the predictions made during the BPM design phase through simulations. We also discuss future plans and possible applications beyond the SCU project.

Please consider my poster for contributed oral presentation

Yes

Would you like to submit this poster in student poster session on Sunday (August 10th)

No

Footnotes

Funding Agency

I have read and accept the Privacy Policy Statement

Yes

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