Fig. 4 is the comparison of electric field on axis and on insulator surface for low frequency. The amplitude of electric field on axis is similar to that on insulator surface, which is close to the theoretical analysis.

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6 - 31 RF Power Supplies for RFQ Cooler and Buncher RFQ1L

Sun Yuliang, Huang Wenxue, Tian Yulin, Zhao Jianming, Wang Junying
Wang Yongshen, Zhu Zhichao and Wang Yue

For the purpose of matching directly the beams from the gas-filled recoil separator, the RFQ cooler and buncher RFQ1L[1] has been designed to have a large radius (r_0 = 60 mm), thus the RF power supply becomes not a trivial problem. We have successfully solved this problem by two different methods, and the RF power supplies specific to the RFQ1L have been developed and tested.

The first solution is a so-called wide-band RF power supply. The RF signal is generated by a generator, and its frequency and amplitude can be easily adjusted as our need. The RF amplitude is then amplified by a power amplifier and a home-made air-core transformer. To give two outputs with a phase difference of 180°, the transformer has been grounded at the center point and the turn ratio of the two parts has been controlled very carefully.

Although the wide-band RF power supply has advantages such as easy adjustment of RF amplitude and frequency, the rapid decrease of the RF amplitude for frequencies higher than 250 kHz becomes a real problem for the normal operation of the RFQ1L. We solve this problem by using series resonance circuits. A sinusoidal wave is generated by a signal source and sent to a power amplifier. A home-made phase splitter is used to produce two outputs with the same amplitude and frequencies, and with 180° phase difference. Each channel can make a resonance with a home-made inductance L, and capacitance C. The resonant state can be obtained by adjusting L and the RF frequency. While for high RF voltages at frequencies of more than 250 kHz, the RF power supply with series resonant circuits will be used at the RFQ1L although the change in RF frequency is not as flexible.

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