High power RF tests on Prototype RFQ at IUAC

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Abstract

The 48.5MHz RFQ is designed to accelerate ions with A/q of 6 from 8keV/A to 180keV/A. An initial modulated 1.17m section of the RFQ is designed and constructed to determine the specifications for final RFQ accelerator which will be 2.5m in length. The material of electrodes, electrodes supporting posts and base plate is all copper while chamber is of stainless steel. To improve the quality factor the inner surface of the chamber is copper plated with a plating thickness of 70 microns. The low power and high power RF measurements have been done. Low power RF tests give intrinsic quality factor of 4226 and shunt impedance of 80k-ohms. With this quality factor the power required to generate 70kV inter-vane voltage is 29.85kW. High power RF test has been done to check the frequency and the temperature stability of the RFQ. An air cooled RF power coupler is designed to feed power into the cavity. To maintain the temperature stability of the cavity during high power run, independent cooling water channels are allocated for the RFQ electrodes and posts. A 35kW commercial RF amplifier of operating frequency 48.5MHz with ±1MHz bandwidth has been used. Base pressure of 1.6×10^{-7}Torr was maintained before feeding RF power. 18kW of power has been fed in the cavity in small steps. In the beginning due to degassing vacuum fluctuation was observed. The resonant frequency was found to decrease with increasing RF power. The resonant frequency was tuned from 48.3389MHz to 48.33342MHz at 18kW power. The temperature of the cooling water rises marginally from 20^0C to 24^0C while the temperature of the RF coupler increased from 21.8^0C to 58^0C.

References

[1] Paul J. Petersan and Steven M. Anlage, “Measurement of resonance frequency and quality factor of microwave resonators: comparison methods”, J. appl. Phys. 84 (1998) 3392.
[2] Hiroshi Fujisawa, “A cw 4-rod RFQ linac”, NIM A 345 (1994) 23.