Development of a High Power 1.2MW CW L-band Klystron

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ABSTRACT

The high power CW L-band klystron has been developed as the RF source of the PNC high power CW electron linac (10MeV, 100mA). CW power of 1.2 MW at 1.249135GHz and efficiencies over 65% were the design goals. RF analysis of the windows using high-frequency simulation codes provided information about power loss distribution in the ceramic and optimizing properties of the RF structure. The prototype klystron window was replaced with a long pill-box type beryllia window as a result of the simulation and hardware tests. The klystron has reached CW power of 885kW with efficiency above 45%. This paper describes key points of the designs and results of the high power RF tests.

I. INTRODUCTION

The development of a high power CW electron linac was started in 1989 to study the feasibility of nuclear waste transmutation [1]. Figure 1(a) shows the prototype klystron with the original pill-box type beryllia window (standard window). The maximum power of the prototype klystron was limited to 330 kW with CW operation because the temperature of the window increased by 53 degrees, reaching near the critical point of destruction by thermal stress. The results of high power tests of the prototype klystron indicated that the maximum RF output power was limited by the heating of the klystron RF window. A long pill-box type beryllia window (long window) was designed and measured using an L-band resonant ring in KEK (National Laboratory for High Energy Physics) [2]. The transmission RF power through the test window in the resonant ring is thirty-six times the RF input power. Surface temperature changes were observed in the beryllia disk with the RF window. The temperature of the window increased by 51 degrees at 1.7 MW CW RF power.

The standard window of the prototype klystron was replaced with the long window. High power tests were carried out for the klystron with the long window (shown in Figure 1(b)) in a factory of the klystron's manufacturer.

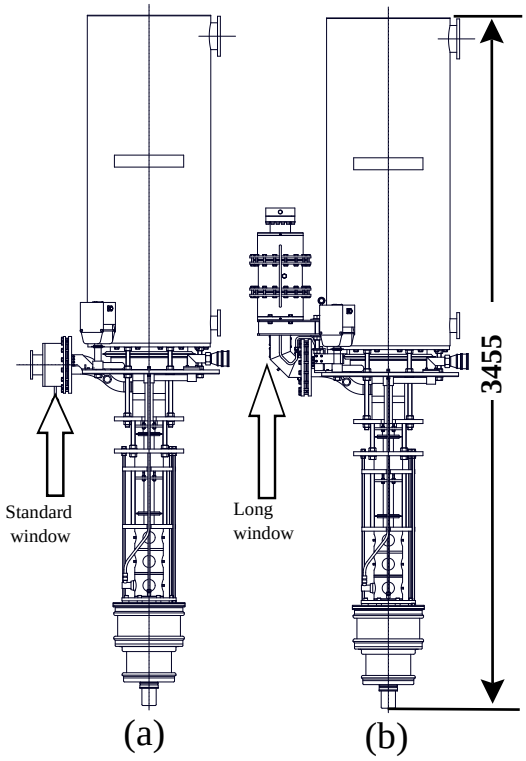

Figure 1. (a) Prototype klystron with the standard window. (b) Klystron with the long window

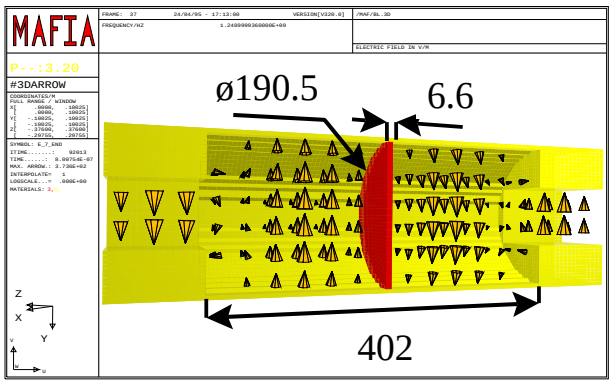

Figure 2. Dimension and electric field of the long window.

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