

## Vacuum System Testing for X-band Dielectric-loaded Accelerator Structure

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It is important to have the high power experiments of X-band dielectric-loaded accelerator structure and then we can know the RF break down limit. The ultra-high vacuum testing should be done before the high power experiments.

This ultra-high vacuum system has been built, shown in Fig. 1.

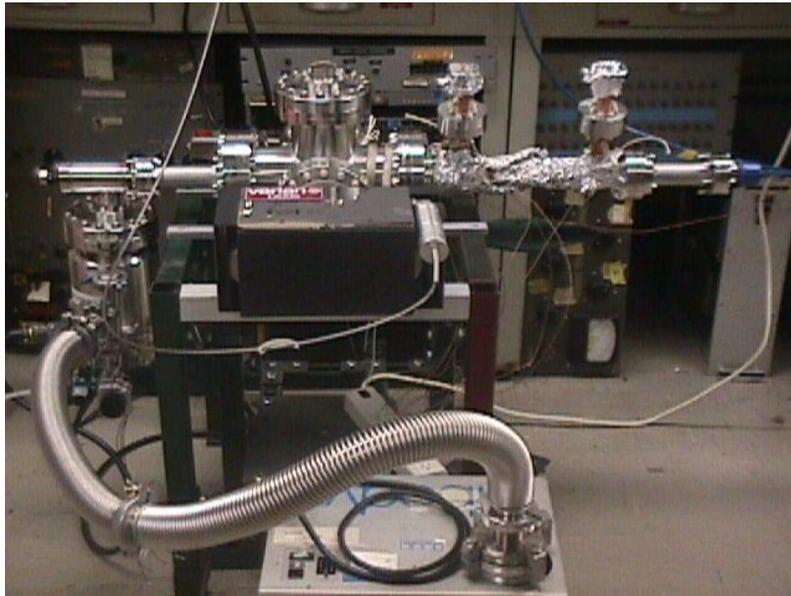


Fig. 1 Dielectric Accelerator Prototype in Ultra-high Vacuum Testing

This vacuum system constitutes of six cross, dielectric accelerator tube, ion pump, ion pump controller, ion gauge, ion gauge controller, turbo pump, turbo pump controller and roughing pump.

The vacuum testing is divided into 2 steps:

1. The vacuum system includes accelerator tube without dielectric.
2. The vacuum system includes accelerator tube with 4 pieces of dielectric.

1. The vacuum system includes accelerator tube without dielectric.

Firstly, we have no dielectric in the accelerator tube and tested the pressure in the tube before, during and after baking out separately, shown in Fig. 2-4.

(1) Before baking out

Vacuum Testing of Accelerating Tube Without Dielectric  
(Before Baking Out)

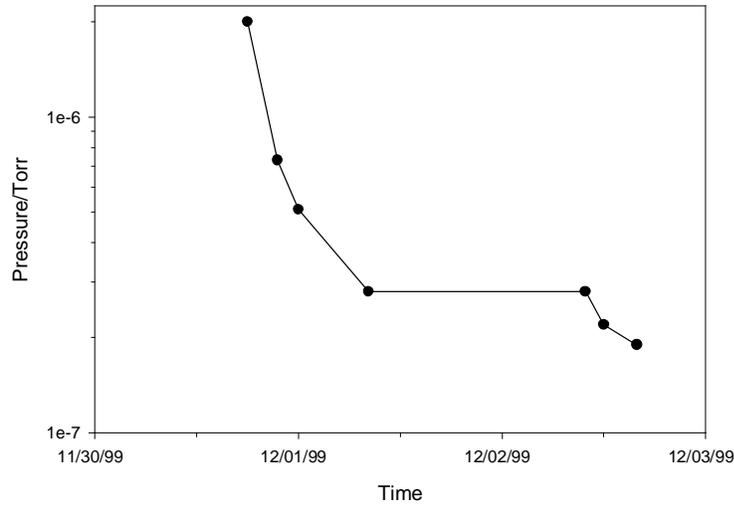


Fig.2 Pressure vs time diagram before baking out (without dielectric).

(2) During baking out

Vacuum Testing of Accelerating Tube Without Dielectric  
(During Baking Out)

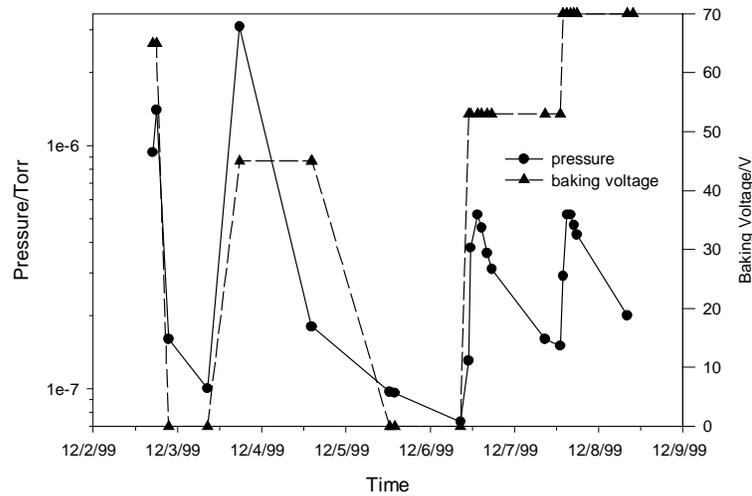


Fig.3 Pressure vs time diagram during baking out (without dielectric).

(3)After baking out

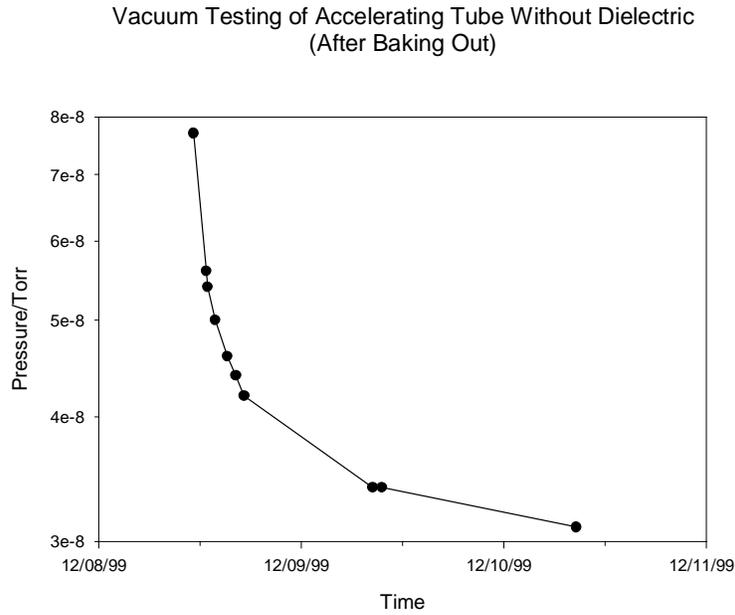


Fig.4 Pressure vs time diagram after baking out (without dielectric).

2. The vacuum system includes accelerator tube with 4 pieces of dielectric.

We put 4 pieces of dielectric into the accelerator tube and tested the pressure in the tube before, during and after baking out separately, shown in Fig. 5-7.

(1)Before baking out

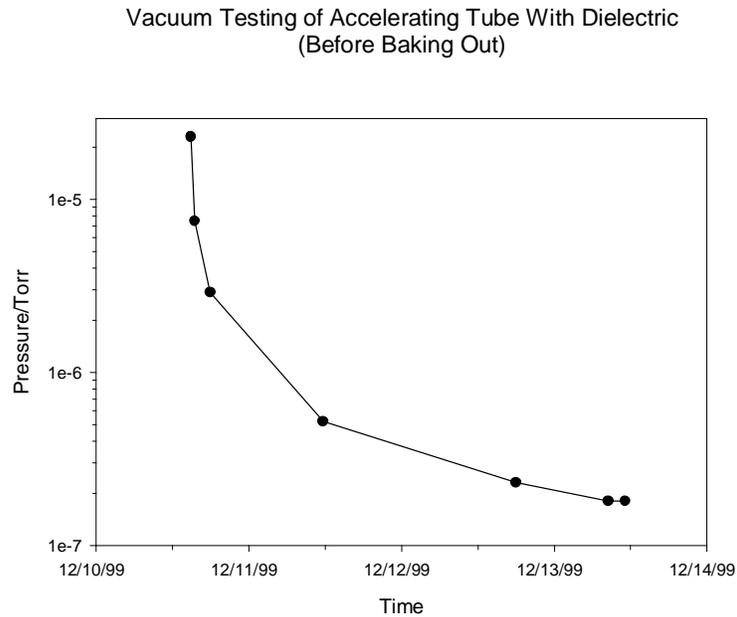


Fig.5 Pressure vs time diagram before baking out (with dielectric).

(2) During baking out

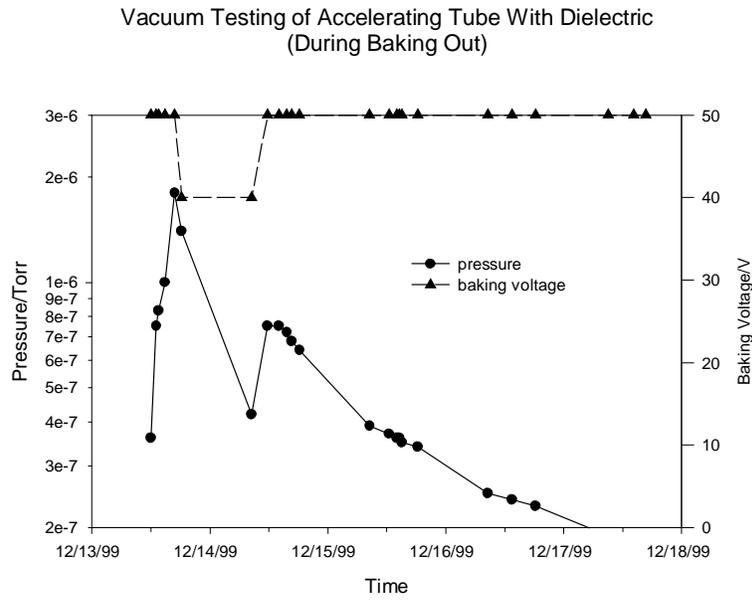


Fig. 6 Pressure vs time diagram during baking out (with dielectric).

(3) After baking out

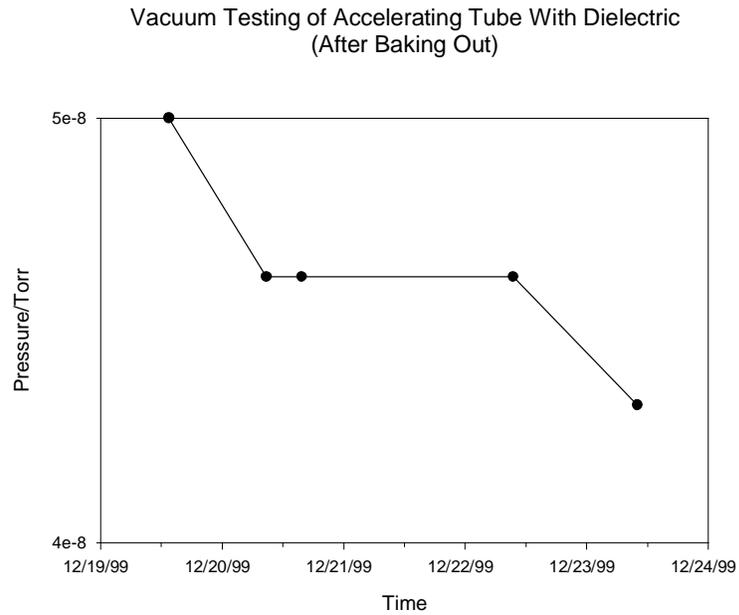


Fig. 7 Pressure vs time diagram after baking out (with dielectric).

## Summary

The pressure reading of the accelerating tube with dielectric has reached  $4.3 \times 10^{-8}$  Torr after baking out. Lower pressure level can be expected after longer pumping time. This vacuum testing has verified that the dielectric loaded structure can satisfy the required vacuum level for high power testing. The ceramic has no influence on the vacuum system.