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PRESENT STATUS OF THE LOW-OUTPUT IMPEDANCE(LOI) RF SYSTEM

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High power test of the LOI system in a swept mode was ended in February 3, 2003 at KEK by using the ferrite-loaded cavity. The results are summarised briefly in the following:

1. High voltage RF test in a swept mode.
2. On the anode switching scheme.

1. High voltage RF test in a swept mode

The test was performed nearly at the plate-dissipation limit of the final triode, and at the breaker limit of the switch board to the driver tetrode. The experiment was almost stable, and more than 12KVpeak-to-peak was obtained in the middle point of the acceleration period. However, as can be seen in the figs 1-2, the waveforms are distorted at the higher frequencies. We did not have enough time to investigate the reason of distortion (cavity? amplifier? or both?). We probably need some time at ISIS for such investigation.

The experimental conditions of the figures are,
(a) Final triode: plate voltage(13KV), plate current(15Amps), grid voltage(-250V)
(b) Driver tetrode: plate voltage(5.8KV), plate current(18Amps), grid1 voltage(-111V), grid2 voltage(1.24KV)
(c) Cavity: an old R&D cavity loaded with the TDK ferrite-rings. The bias winding-turn is two, and the bias current is swept from 60 to 665Amps at 50Hz.
(d) Control: No provisions with AVC and bias tuning loops. The cavity input current was, however, minimized by adding offsets to the original (sinusoidal) waveform of the cavity bias current. The frequency range is from 2.6 to 6.3MHz.

Occasionally, 200KHz voltage spikes coming from the series resonance at the driver network tripped the buck regulator. These spikes are initiated by the 50Hz harmonics.

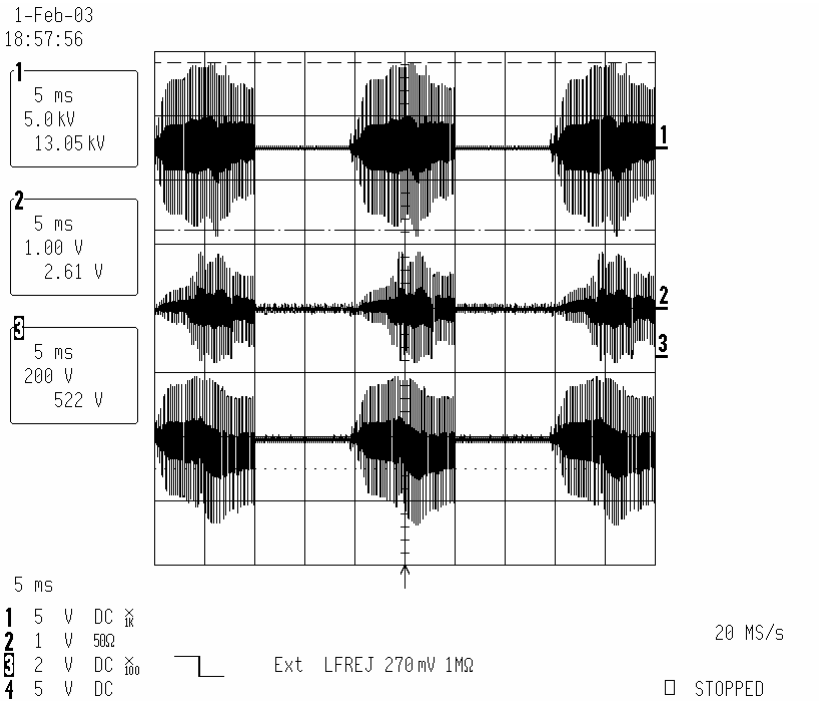

Fig. 1 RF envelopes. upper trace: cavity voltage (5KV/div), middle trace: cavity input current (20Amps/div), and grid input voltage (200V/div).

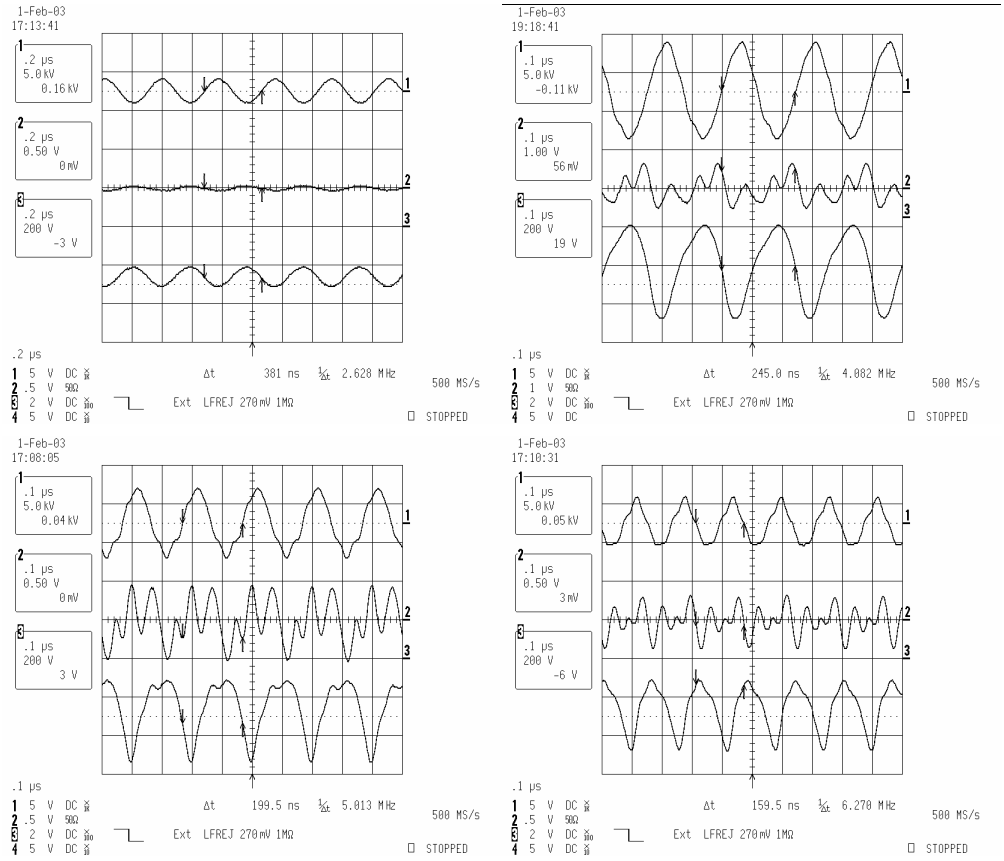

Fig. 2 Detailed waveforms at 2.6, 4.1, 5.0 and 6.3MHz.

2. On the anode switching scheme

We now think anode switching scheme for the final triode may not be appropriate. This system was proposed at the collaboration meeting in 2000 in order to save the plate dissipation of the triode. It utilises the opening switch function of the buck regulator. However, it was found the voltage drop after switch-off is too big to switch on again after 10msec later, because the triode is still in the conduction state at the timing of switch-off and the charge across plate and cathode decays very rapidly through the triode. Eventually, the plate voltage goes down to 6KV as seen in Fig.3. Our design plate voltage is 16KV, and then 10KV difference is too big: otherwise, inrush current will trip the buck regulator. We need to design the switching scheme at the grid circuit, or at the cathode.

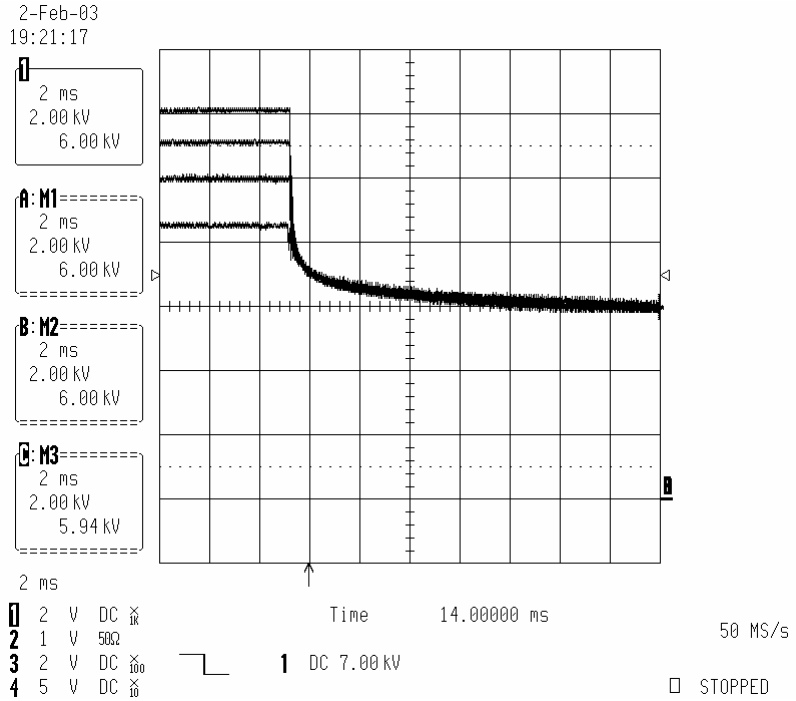

Fig. 3 Rapid decay of the plate voltage of the final triode at the switch opening of the buck regulator. From top to bottom traces, initial plate voltages are 12, 11, 10 and 8.5KV, respectively.