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FB5 Generation of ultra-wideband radiation from high T_C superconductor devices

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We have demonstrated the generation and radiation of an ultra-wideband (UWB) radiation using a high T_C superconductor (HTS) laser triggering fast opening switch, a transmission line pulse forming network, and conical monopole transmitting and receiving antennas. The HTS serves as almost ideal opening switch. It has zero on-resistance, and when triggered by a picosecond laser pulse, is converted to the high resistance off-state on a picosecond time scale. A Tl-based HTS is employed in a current charged transmission line (CCTL) as shown in Fig. 1(a) to generate a square pulse. When used to drive a short conical monopole (CMA) transmitting antenna and received by a short CMA a set of pulses approximating the third derivative of the pulse is received as shown in Fig. 1 (b).

A single step function is sometimes more desirable than a square pulse for practical application. A single step function was generated and drove to radiate using H-type coplanar microstrip line or a T-type coplanar wave guide $YBa_2Cu_3O_{7-x}$ HTS device as shown in Fig. 2.

The superconductor devices were refrigerated by liquid nitrogen and dc biased with a 75 mA current. A diode pump YLF laser was employed to generated a 5 mJ, 125 ps (FWHM), 500 Hz pulse train. When triggered by the laser pulses, a train of electrical pulses was generated as monitored by a Tektronix sampling oscilloscope 11802. These pulses have a rise time limited by laser and a fall time of ~100 ns.

The fast rising edge of the electrical pulse behaves like a single step functions as shown in Fig. 3(a). These step function was fed into a CMA transmitting and receiving system. The received pulse which was viewed by the same sampling oscilloscope is shown in Fig. 3(b).

One of the authors, Y. S. Lai, is supported by the Center for Superconductivity Research at University of Maryland, at College Park, MD. We also want to acknowledge Bruce Geil of the Army Research Laboratory for fabricating the mask.

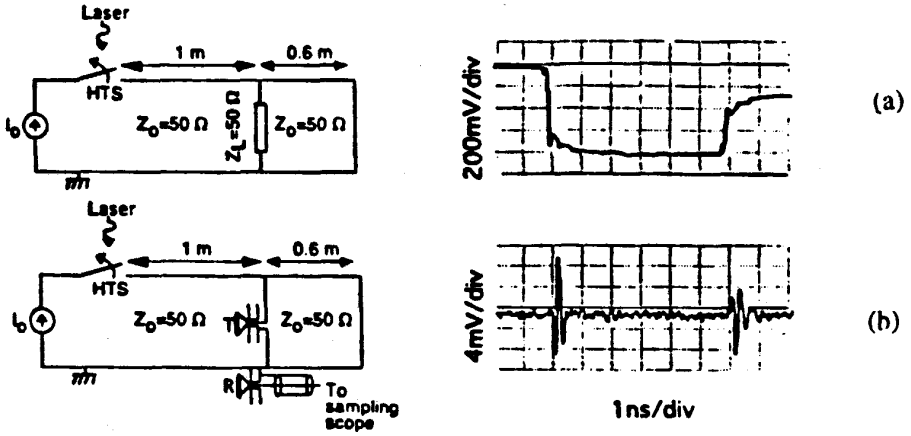

Fig. 1 (a) the generation of a square pulse and (b) the radiation asscciated with (a).

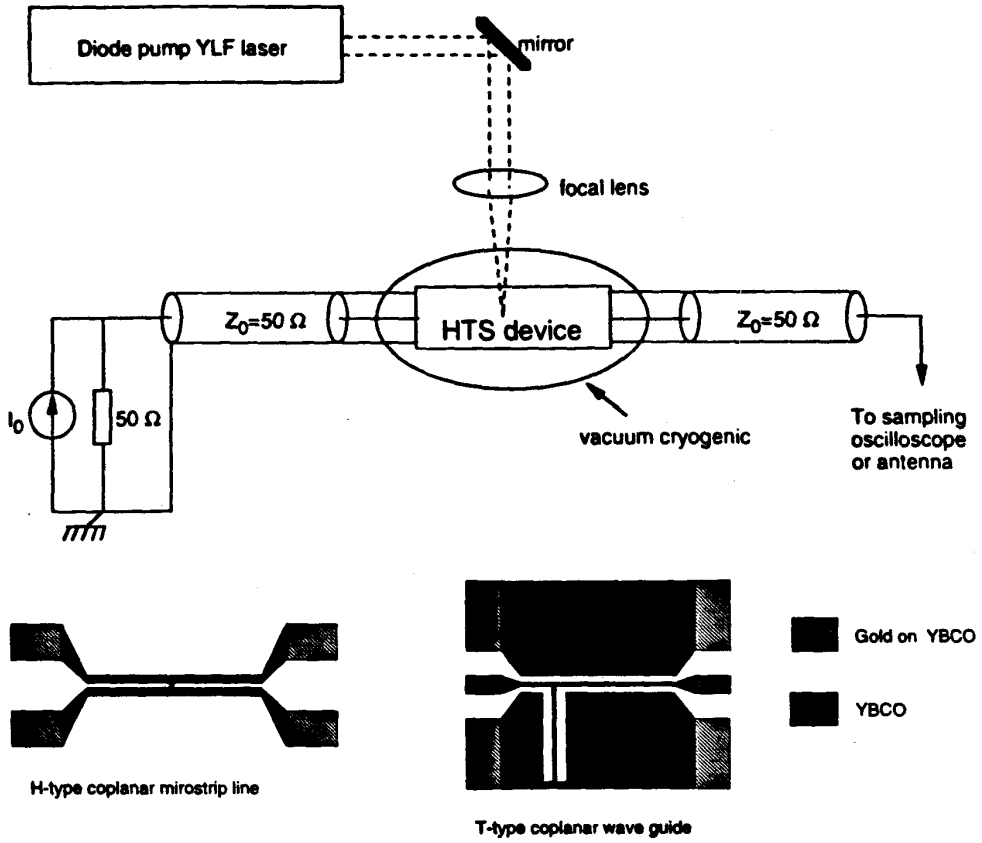

Fig. 2 Experimental setup for generating a single step function and the radiation associated with it.

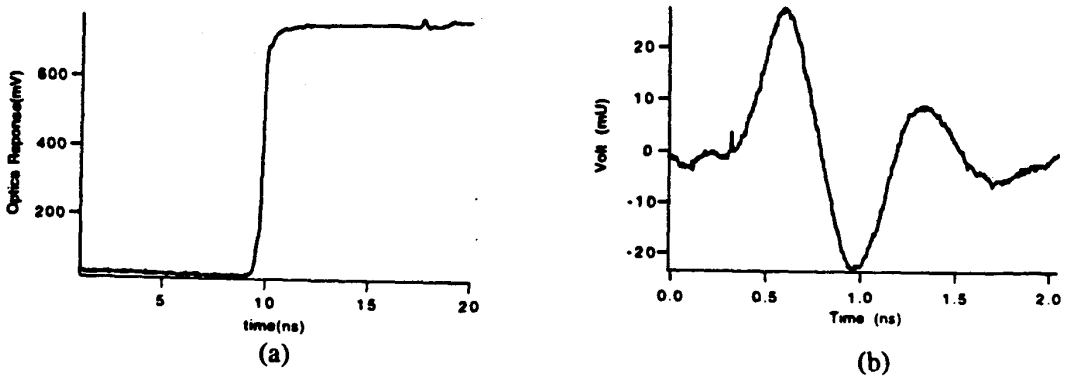

Fig. 3(a) The generated single step function and (b) the radiation associated with (a).