HEFTI
High-Energy Frequency Tesla Inc.

10 GHz BWO
Driven by 24-stage Marx Generator

Figure 1. Photograph of 10 GHz BWO driven by 24-stage Marx generator

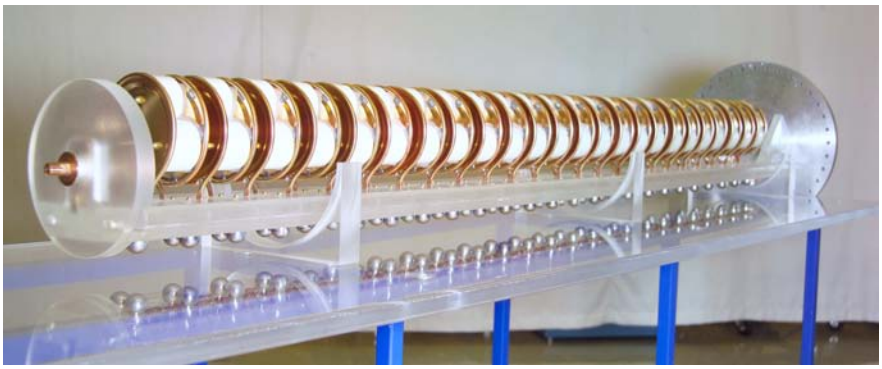

Figure 2. Photograph of the 24-stage assembly

Specifications of the Marx generator

- 24-stage Marx generator
- Capacitance per stage is 8.1 nF
- Charging voltage varies from 15 to 40 kV
- With 100 Ω load, the maximum output current is 4.8 kA
- Maximum stored energy in the system is 150 J
- Peak power supplied to the load of 100 Ω is 2.3 GW
- With peaking circuit the voltage waveform can be made to be of double exponential shape and/or the semi-square shape as indicated in Figure 3
- Meets STANAG 4145 (NATO) – EMP criteria

Applications

- To drive high (100 Ω) impedance HPM source. See Figure 1.

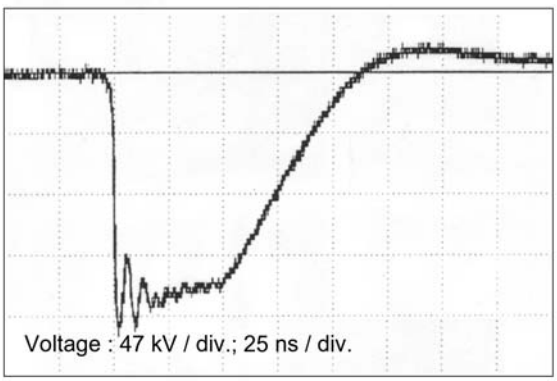

Figure 3. Five superimposed waveforms produced by the Marx generator. Capacitive probe was used to measure the waveform prior to the application of the peaking circuit. The charging voltage is 13.7 kV/stage. 100 Ω loads is used.

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Pulsed magnetic field supply

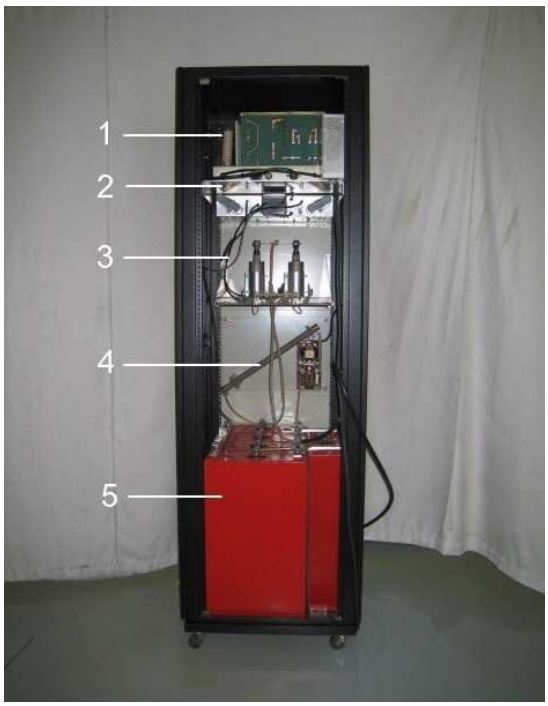

Figure 4. The pulsed power system is used to produce the magnetic field. The magnetic field is needed to facilitate the operation of the BWO. 1 is the d.c. power supply. 2 is the ignitron triggering circuit. 3 is the bank switch. It incorporates two ignitrons (: GL-3171 by General Electric). 4 is the dump safety resistor. The system has the dump safety command. 5 is the 5 capacitors of the bank. Each capacitor is 370 μF, 4 kV. The system is activated by 15-70 V trigger pulse.

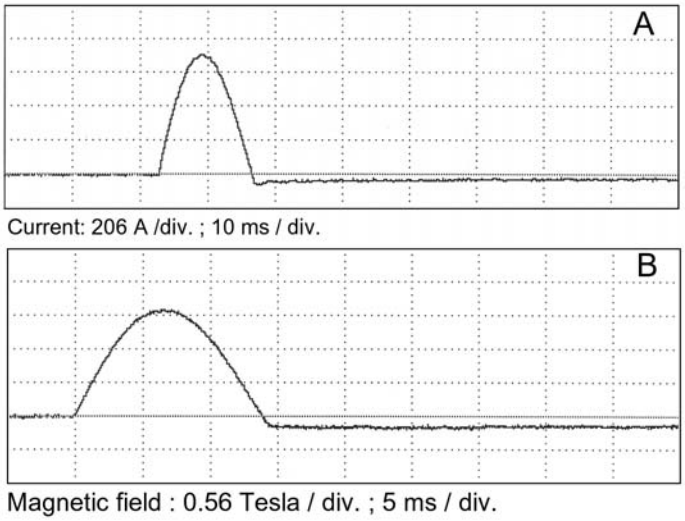

Figure 5. Frame A is the current supplied to 9 coils. Each coil has 51 mH. **Frame B** is the corresponding magnetic field measured inside the BWO structure. The bank is charged to 2.6 kV to get the data given in frames A and B. The graph of the magnetic field vs the charging voltage forms the straight line.

Experimental data

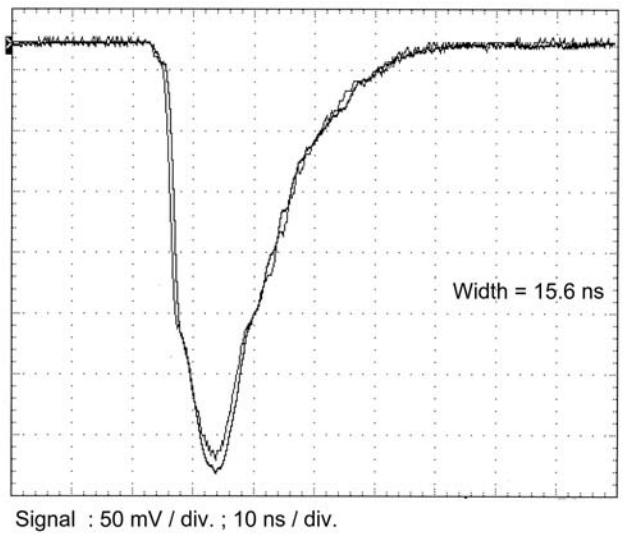

Figure 6. Four superimposed BWO radiation pulses are recoded using the detector antenna (a short, open section of WR 90 waveguide), 20 m long cable, 40 dB attenuator (placed at the output of the cable), and the HP diode, Model 8474 B. The oscilloscope is set to read 50 mV/div. The input impedance of the oscilloscope is 50 Ω. The voltage applied to 24-stage Marx generator is 21 kV/stage and the generator stores 43 J.

The peak power is estimated to exceed 50 MW. When the system is charged to 40 kV/stage and when the system is fully optimized, the radiated power should be in the range of a couple of hundreds megawatts. The TM_{01} radiated mode is expected

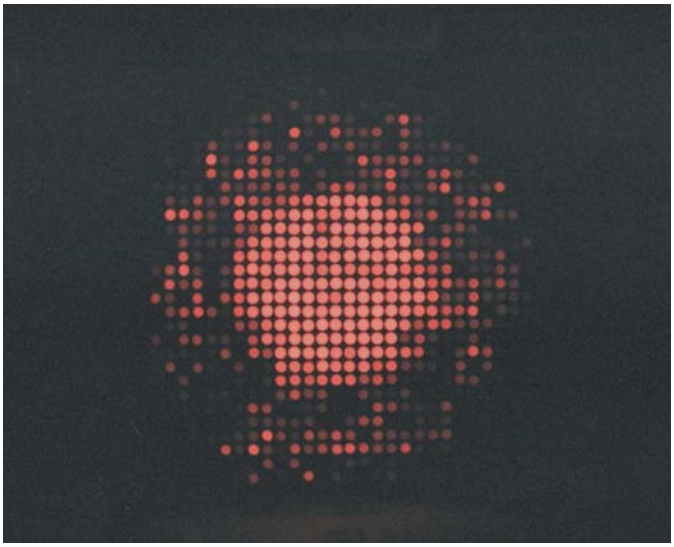

Figure 7. The BWO radiation pulse ignites the neon bulbs. A single shot is applied. The bulbs are placed on 1" thick plywood across the radiation beam to get the radiation pattern. The separation between the bulbs is 1 inch (=2.54 cm). The board is placed at 40 cm away from the horn.