# Project of compact plasma maser with continuous spectrum within 2 octaves

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***Abstract*— Numerical model shows that plasma relativistic maser can operate as noise amplifier with HPM energy output ratio ~ 10% and emission power of 100 MW during 2 ns. Continuous spectrum within 4 to 16 GHz band may be obtained after ~ 20 repetitive pulses.**

***Keywords- microwave; high-power; broadband; plasma***

The project is oriented to demonstrate advantages of plasma masers driven by modern generators of high-voltage pulses. The accelerator [1] generates 270-kV pulses with the current 2 kA, about 2 ns long, it may operate with the rep-rate up to 3.5 GHz. Relativistic electron beam (REB) from an explosive cathode propagates in longitudinal magnetic field 2 T, see Fig.1. Plasma is preformed between plasma source and an electrode installed at the cathode by helical support. The helix inductivity prevents a short-cut of the cathode through plasma.

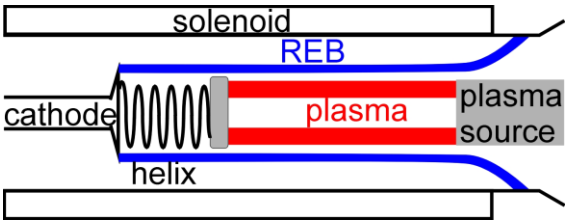


Figure 1. Layout of HPM source

The REB pulse of ~ 2 ns is shorter than time necessary for a distortion to propagate forth and back along the plasma waveguide 20 cm long. The device operates as plasma maser but unlike plasma HPM oscillators [2] it has no feedback, hence, its spectrum does not depend on longitudinal oscillation modes.

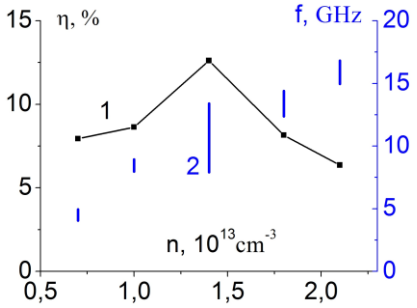


Figure 2 Efficiency η (1) and the frequency f (2) vs plasma concentration n

The main feature of powerful plasma masers is the ability of their emission frequency variation in broad band. Plasma concentration may be set arbitrarily before every pulse, therefore, emission frequency may be changed. Fig.2 shows that emission frequency may be varied within 2 octaves from 4 to 16 GHz, approximately the same band was experimentally demonstrated by rep-rated plasma HPM oscillator [2]. Efficiency ~ 10% of HMP emission provides power up to 100 MW, see Fig.3.

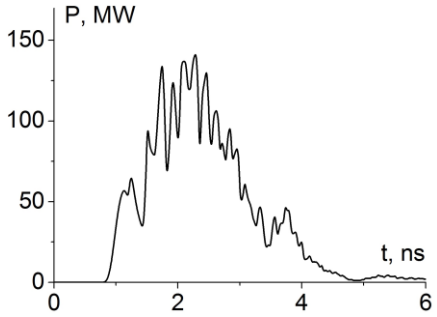


Figure 3. HPM pulse power vs time.

The absence of feedback allows generation of continuous spectrum and plasma variation can change emission frequency. Fig.4 shows that a train of 20 pulses can overlap frequency band from 4 to 16 GHz

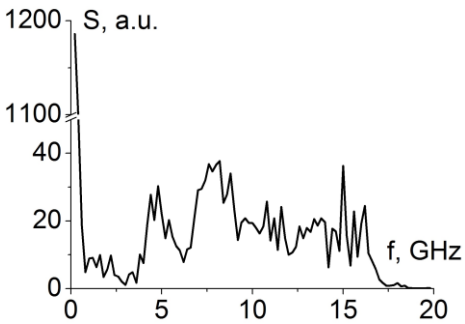


Figure 4. Spectrum of a train of 20 repetitive pulses.

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