Broadband generation of relativistic plasma sources [[1]](#footnote-1)\*)

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Plasma relativistic generators have a record lasing bandwidth and can be confidently classified as ultra-wideband. The broadband is determined by the value η of the ratio of the generation range (νmax – νmin) to the center frequency of the range (νmax + νmin)/2. If this coefficient is η> 0.2, then such a source belongs to ultra-wideband. For plasma devices, η can reach a value of 1. Broadband radiation of plasma relativistic generators with a microwave pulse duration of 300 - 500 ns for the frequency range 1 - 5 GHz is considered. Such a source of ultra-wideband radiation is a noise generator. For noise sources, the "noise quality" is important. We are talking about useful noise generation, when at any time interval of a broadband pulse, the generation bandwidth will be the same. The energy of "noise" will also be approximately the same in this interval. The energy of noise pulses of plasma relativistic sources remains equal to the energy during operation in other modes - in the amplification mode of the external signal and in the conventional generation mode, i.e. reaches 15 - 20 J. To analyze the noise generation of relativistic plasma sources, Fig. 1, the usual Fourier transform and the instantaneous frequency method are used.



Figure 1. Left - an oscillogram of a noise pulse, on the right - Fourier transform for the entire time interval of the pulse recording (800 ns).

These methods make it possible to estimate the stability of the noise generation over time and the change in the amplitude of the noise pulse, the electric field strength. However, these characteristics are not sufficient for comparing the generation of noise pulses from different sources or modes. The application of correlation analysis using the autocorrelation function is demonstrated.



The correlation coefficients and the correlation time are calculated for sections of the waveform of different duration. The graphs of the sliding correlation coefficient (sliding correlation) are built, the mean square of the correlation coefficients is calculated in the sliding correlation graphs. This technique compares broadband pulses of a relativistic electron beam in vacuum and a pulse in the presence of plasma in the system.

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1. \*) [abstracts of this report in Russian](http://www.fpl.gpi.ru/Zvenigorod/XLVIII/Pt/ru/GI-Ivanov.docx) [↑](#footnote-ref-1)