Satellite meeting to LCWS14
"Multi-bunch dielectric wake-field accelerator"
October 08, 2014

INVESTIGATIONS OF MULTI-BUNCH DIELECTRIC WAKE-FIELD ACCELERATION CONCEPT

(group of the experiment)

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Group Experimental investigation of the conceptual multi-bunch dielectric wakefield accelerator consisted of 10 people. Experiments were conducted on the excitation of wake fields in dielectric loaded waveguide and resonator of circular waveguide and resonator made of copper with an inner diameter of 8.2 cm and and rectangular cross-section copper waveguide and resonators with dimensions of 72×34 cm and 90 ×50 cm Used dielectric inserts made of fluoroplastic, quartz, aluminum oxide and zirconium dioxide. Also conducted experiments on the excitation wakefield in the presence of varying the plasma density in the channel of dielectric. As a source of electronic banches used modernized accelerator “Almaz", which was fed from the reduced klystron KIU-12. the output pulse power of the klystron 18 MW.

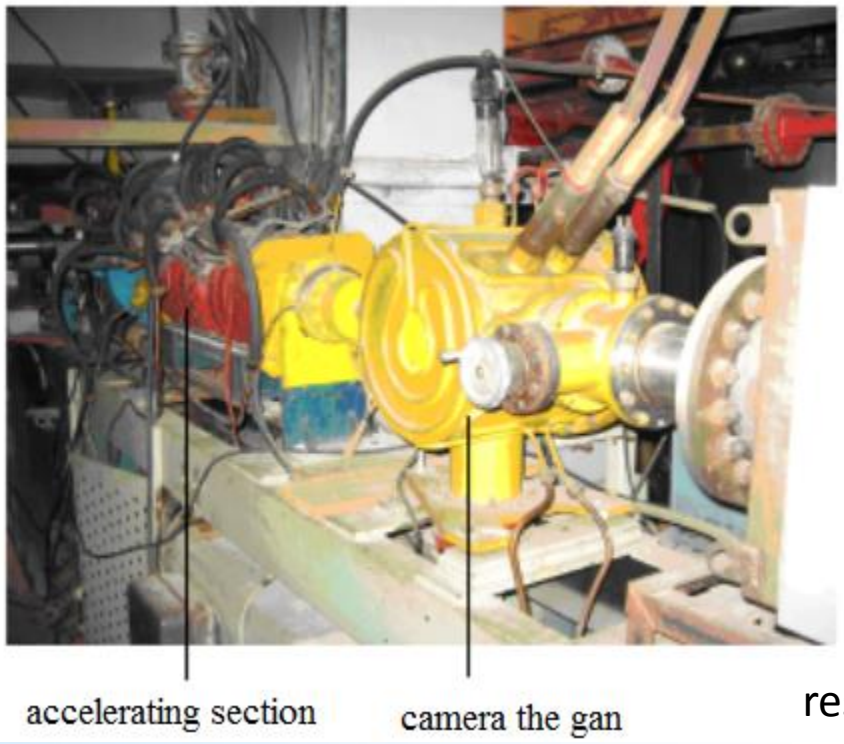
In our experiments we used oscilloscopes TDS6154C (15 GHz), GDS-840C, probes, calibrated made attenuators, the electron energy spectrum analyzers, frequency meters, detectors, microwave radiation power meters the SWR meter and so on. To determine the change in the energy of the electrons were also used prints (darkening) formed by them on glass plates. when you turn 90 degrees to the electron in a constant magnetic field

We used different experimental schemes to study the excitation of wakefield in the mode of the waveguide and resonator.

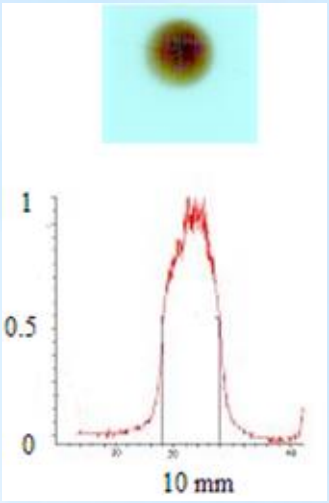
Vacuum in the system was created by titanium pumps and had a value of ten to the minus sixth power Torr.

The width of the energy spectrum of electrons in the bunches can be changed by changing the frequency of bunch repetition using a generator that excites klystron.

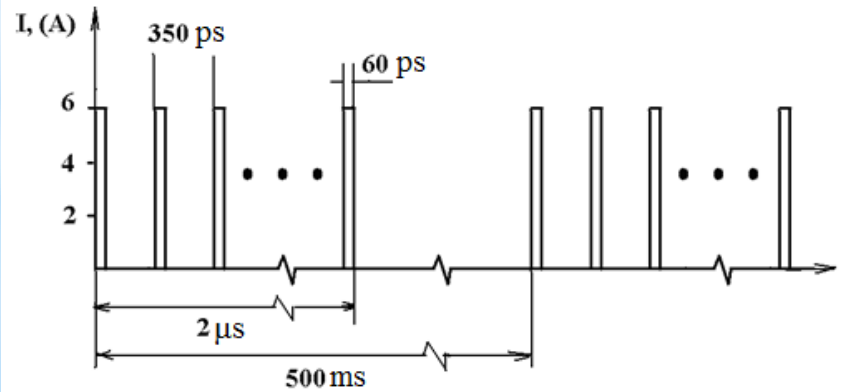
Linac “Almaz”



restored klystron КИУ-12



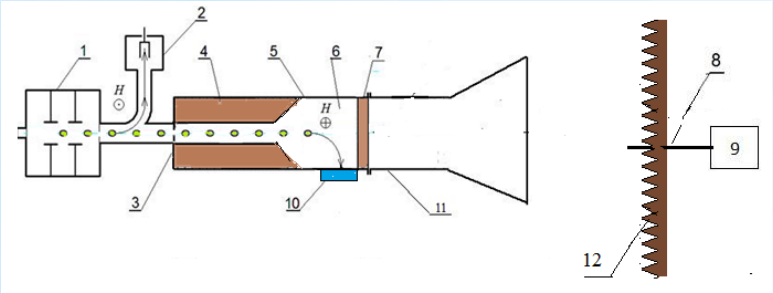
of the beam footprint on a glass plate

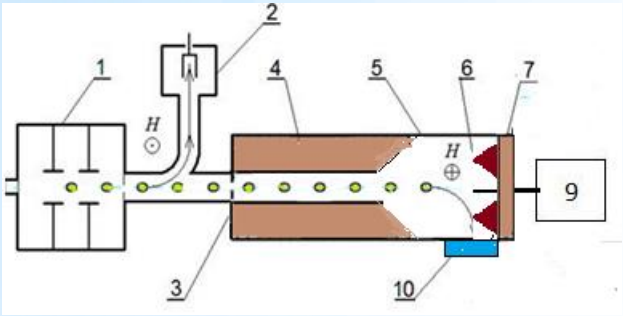


sequence of 6000 bunches

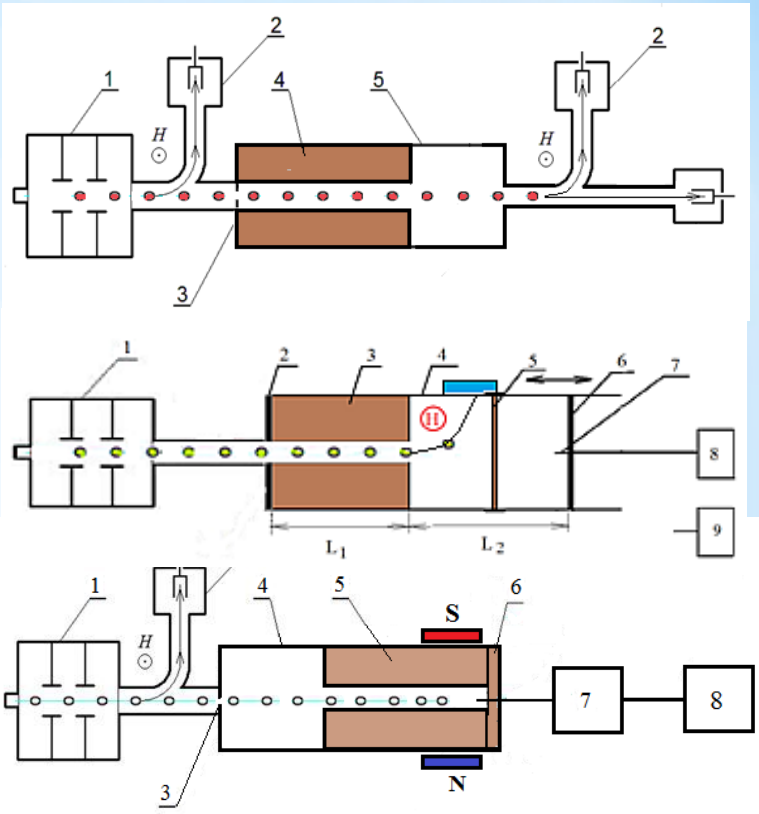
the output part of the setup with a magnetic analyzer

Basic scheme of experiments

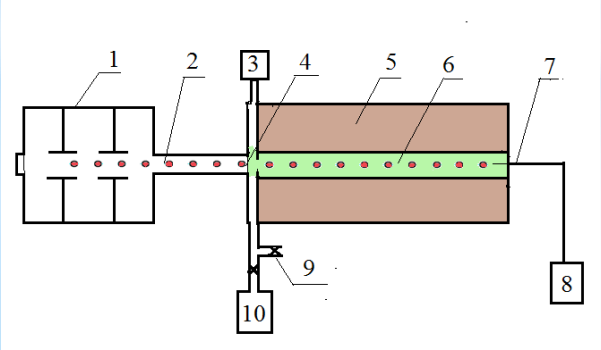




Schemes that were used during the study of the waveguide. In that cases used the microwave absorber to avoid reflections

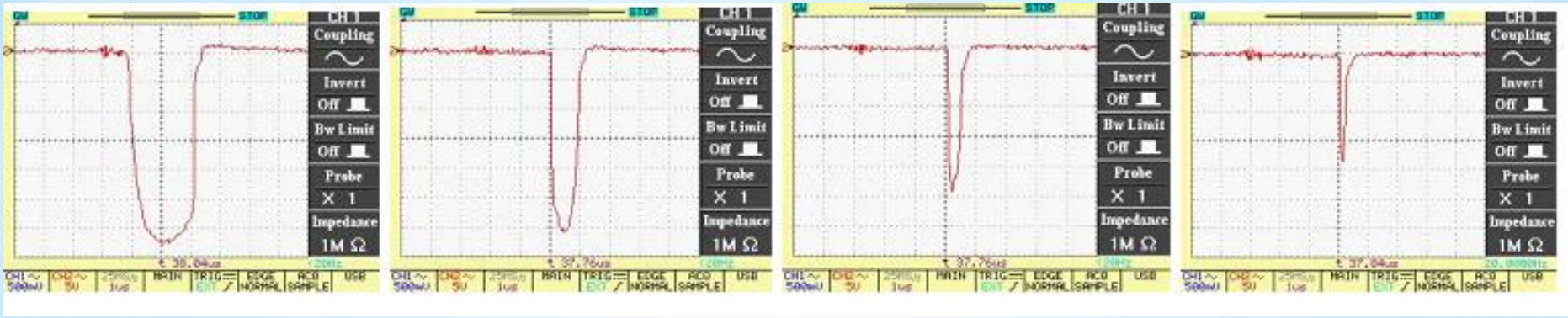


Schemes have been used in research settings resonator concept. In all schemes of the external magnetic field does not apply



The scheme which was used during research plazma-dielrctric structure in this case, the accelerator is separated titanium foil thicknesses of 30 microns

Pulse beam current at different number of bunches

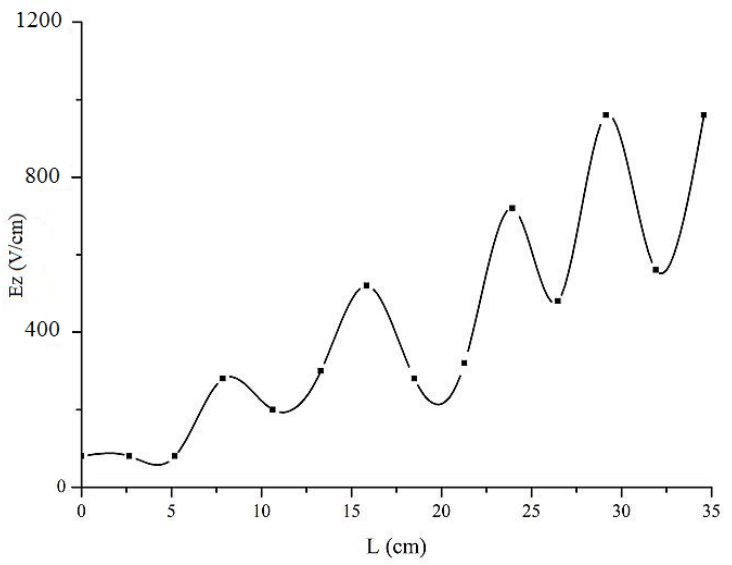


τ=2 μs; (6000 bunches) *τ=1 μs; (3000)* *τ=0.5 μs; (1500)* *τ=0.1 μs (300)*

current pulse duration was varied by shifting between the microwave generator that drives the klystron and a high voltage pulse which is applied to the klystron

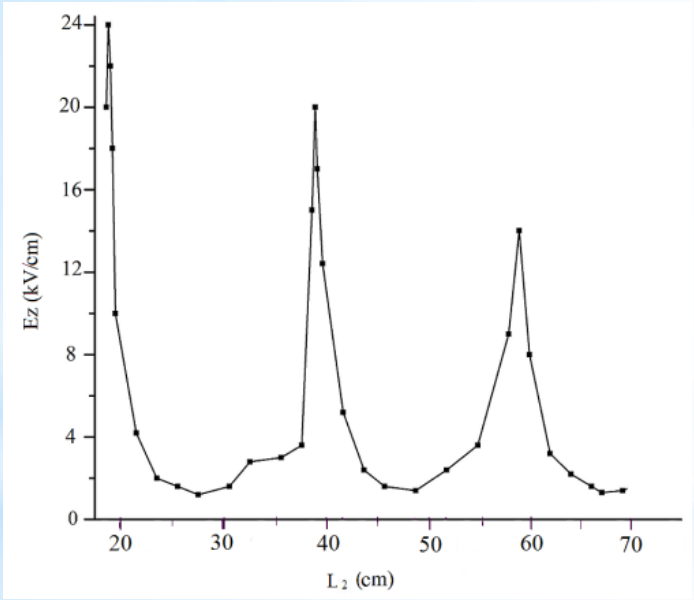
some of the results

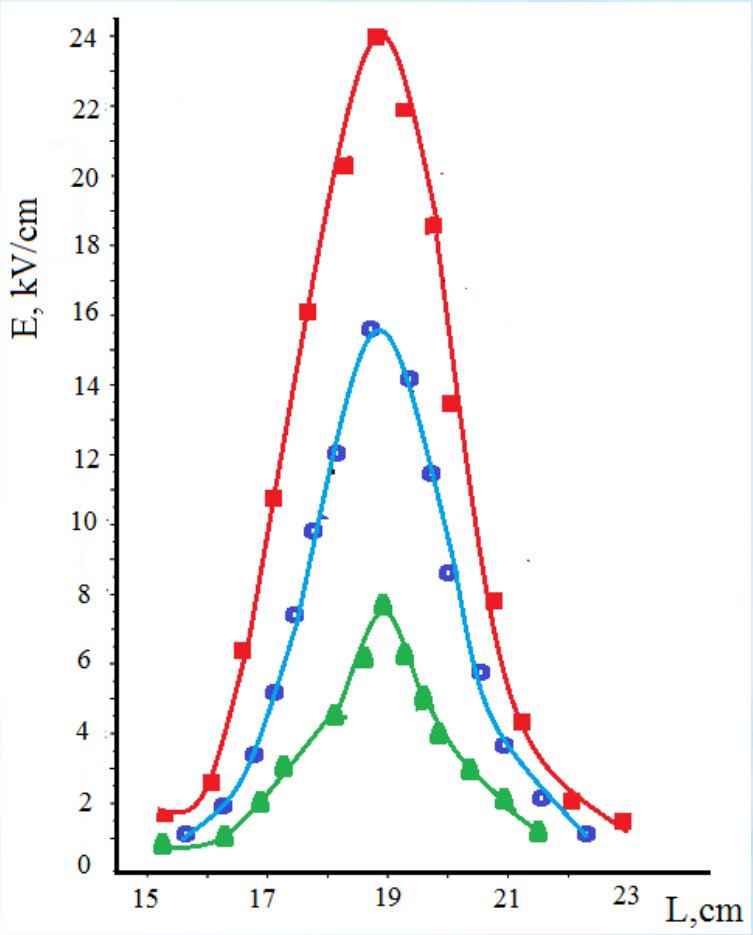
The dependence of the amplitude of excited wakefield on the length of the dielectric waveguide small reflection from the elements of the waveguide leads to the unevenness of the output signal



Microwave radiation in the case of the dielectric resonator

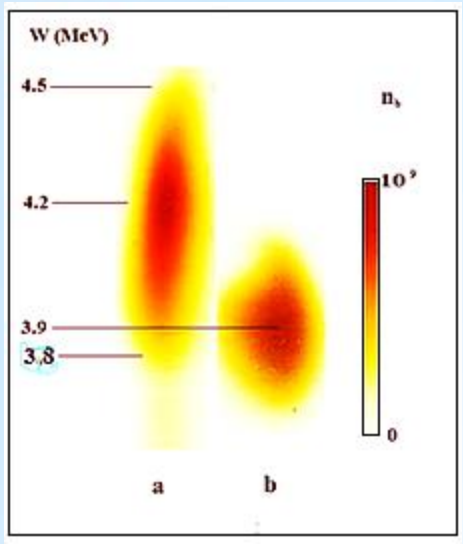
Dependence of the amplitude of the excited field on the length of the dielectric insert in the cavity of the red curve for the case when the length of the insert is three waves length main excited mode, two blue and one green length of the main excited mode



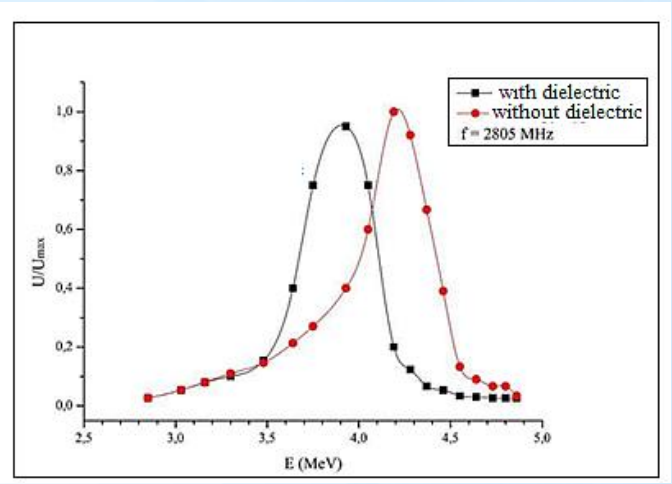


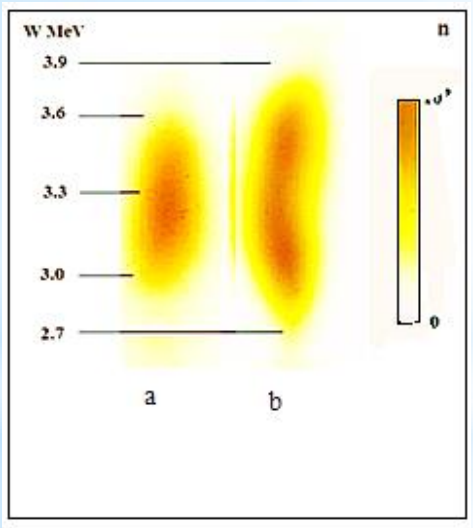
changing the amplitude of the microwave radiation with an increase in an empty part of the compound resonator

Energy spectra obtained on the glass plate, and using a magnetic analyzer

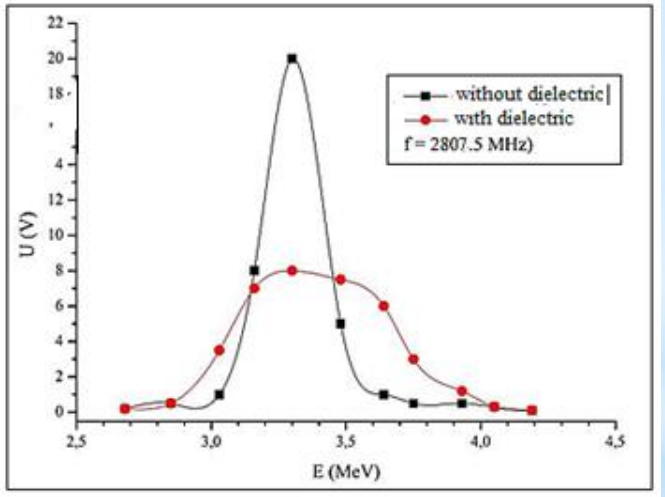


2805 MHz





2807,5 MHz



Prints of the electron beam on glass plates: a - without dielectric, b – with dielectric.

Beam energy spectra measured with the magnetic analyzer.