

## MODELING OF LUCE DIODE\*

*A.O. URAZBAYEV<sup>1</sup>, I. PYATKOV<sup>1</sup>, M V ZHURAVLEV,*

*<sup>1</sup>Tomsk Polytechnic University, Tomsk, Russia*

The goal of this work is to simulate process in Luce diode by means of PIC code WARP. We used geometry of real experiments. The anode was a needle 4 mm in diameter with a rounded end. A conducting toroid with an inner aperture 6 mm in diameter was modeled as a cathode and the end of the needle was leveled with the outer surface of the anode. A potential of 250 KEV was applied to the end of the needle

During the modeling, electrons and hydrogen ions were placed at the end of the needle. The number of injected electrons was choose to obtain a current of 15kA, approximately the current we had in the experiments.

The simulation showed that the current is modulated in amplitude, which was already observed in the simulation of vircators [2]. This modulation was observed at area about several centimeters from the end of the needle.

The needle almost immediately absorbed most of the ions, but some of them accelerated away from the needle, reaching a speed of 5e6 meters per second and energy of 200 KEV. Spuriously, they continued to accelerate even at a distance of several centimeters from the end of the needle (Figure 1)

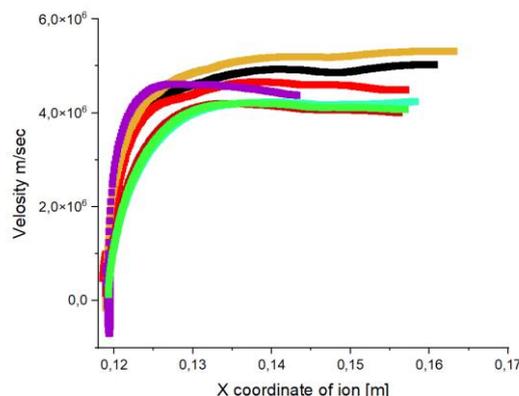


Figure 1. Movement of ions along the x-axis from the speed of the ion. Y axis is speed of ions. X =12 cm is the end of the needle of the Luce diode..

Note that the acceleration occurs in the absence of any accelerating potentials, moreover, it goes in the opposite direction from the potential. We assume that the driving force of ion acceleration in this case is the ponderomotive force. Acceleration occurs in the direction of a weak field, electron clouds lead to the appearance of an oscillating field, which are key factors for the appearance of ponderomotive forces. Ponderomotive force is not related to potentials directly. Therefore, it can be reason why energy of ions can be greater than accelerating potential.

## REFERENCES

- [1] Determination of Energy and Fluences of Protons Collectively Accelerated in a Luce Diode Accelerator, Ryzhkov, V.A., Remnev., (2019) Technical Physics Letters, 45 (7), pp. 718-720
- [2] 3-D PIC Numerical Investigations of a Novel Concept of Multistage Axial Vircator for Enhanced Microwave Generation; S Champeaux, P Gouard, Ieee Transactions On Plasma Science, Vol. 43, No. 11, November 2015

\* The work was supported by...All acknowledgments should be written as footnotes (EFRE Footnote style): 8 pt, justified alignment, spacing 0 pt before and 10 pt after paragraphs, single line spacing.