Modification of electrons trajectory using dielectrics

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The trajectory of charged particles can be modified using dielectrics. This phenomenon has been discovered during the transmission of Ne^{7+} ions throw capillaries by Stolterfoht et all [1]. From that moment, several experimental and theoretical works were devoted to the study of the guiding effect using ions and electrons [2]–[4].

However, in the case of the guiding of electrons, some questions remain open, for example, the role of the charged particles' initial energy in the transmission process. In this work, we study the trajectory manipulation of sub-10 keV electrons using a 10 cm square borosilicate plate. The plate dimensions were selected to avoid the influence of border effects on the results. During the experiment, the orientation of the plate was changed regarding the direction of the electron beam. The modifications of the electron beam trajectory were measured.

Figures 1 and 2 show the electron beam profile for two orientations of the borosilicate plate. The results show that in the studied energy range, the energy of the incident beam is not an important parameter to determine the deflection of the beam. Besides, figure 3 confirms that the trajectory of the initial beam is modified during the interaction with the target. We also developed a 3D Monte-Carlo simulation to describe the interaction of the electrons with the target.

References

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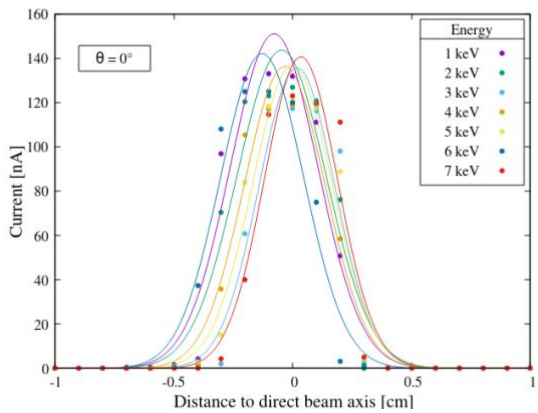

Figure 1 – Spatial distribution of the electron beam measured for different beam energies. The current reaches its maximum around 0 cm for each energy. The borosilicate plate is parallel to the electron beam $\theta = 0°$.

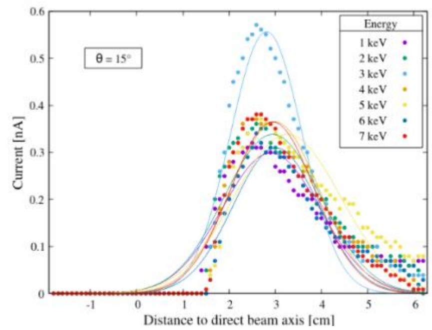

Figure 2 – Spatial distribution of the electron beam measured for different beam energies. The current reaches its maximum at around 3 cm from its initial position for every energy. The borosilicate plate surface forms an angle of $\theta = 15°$ regarding the initial direction of the electron beam.

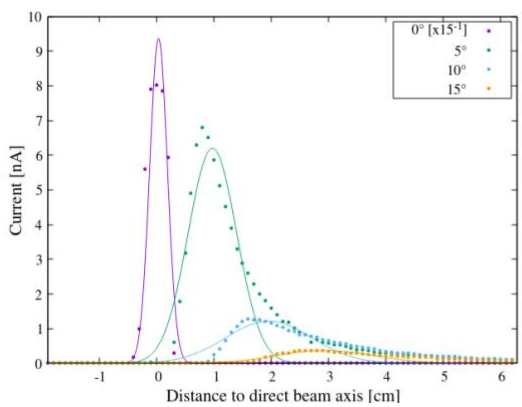

Figure 3 - Spatial distribution of the electron beam measured for different tilt angles θ of the borosilicate plate surface regarding the initial direction of the electron beam.