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DESIGNING AND SIMULATION OF A LOW-ENERGY SINGLE ION IRRADIATION SYSTEM FOR BIOLOGICAL SAMPLE BOMBARDMENT

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In our previous experiments, biological samples of naked DNA were bombarded by decelerated low energy ion beams (< 100 eV). The results found that the DNA could be damaged to induce single strand breaks (SSBs) and double strand breaks (DSBs). However, mechanisms of the low energy ion beam interaction with biological samples are unclear yet, particularly on the hot spot issue, namely what and where the most vulnerable spots of DNA are. As relevant mechanisms need deep understanding, we have planned and prepared to develop a low-energy single ion irradiation system for highly localized and does-controlled ion bombardment of DNA. In the system, the ion beam energy is decreased by the existing deceleration lens, then the low-energy ion beam passes through μm slits and finally, low energy single ions are obtained by beam scanning from scanner plates and detected by a single ion detection device, as shown in Fig 1. Conceptual designing, calculation and simulation of the low-energy single ion system are presented in this report. The significance of developing such a system is not only in studying fundamentals of the ion-DNA interaction but also in investigation of ion irradiation fabrication and effects on microelectronics.
Keywords: Designing and simulation; Low-energy single ion; Deceleration lens; Beam scanning.

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