Radiation effects in microelectronic device under the action of laser accelerated protons

Gilev O N[@], Safronov K V, Flegentov V A, Shamaeva N N, Tishenko A S, Zamuraev D O, Shamraev A L, Kovaleva S F, Fedorov N A, Dubrovskih S M, Pilipenko A S, Kustov A S and Shibakov E A

Federal State Unitary Enterprise "Russian Federal Nuclear Center—Academician Zababakhin All-Russian Research Institute of Technical Physics", Vasilieva 13, Snezhinsk, Chelyabinsk Region 456770, Russia

[@] dep5@vniitf.ru

Exposure to high energy charged particles is one of the main hazards for spacecrafts. Even single particle can provoke failures in microelectronic devices of onboard equipment. Continuing reduction of microelectronic components scale leads to aggravation of the problem. We report on experiments at 100 TW femtosecond laser facility where single event effects in 180-nm microcontroller were observed after irradiation by laser accelerated protons. Protons with energies up to 6 MeV were generated on a back side of 6 um Al foils by TNSA mechanism. Errors in microcontroller internal memory were detected at proton flux densities less than fault level threshold. Single event effects cross-section constituted 5×10^{-10} cm^2/bit at nominal supply voltage. When the supply voltage is reduced number of errors per laser shot grows exponentially. Our experiments demonstrate that laser accelerators can be applied for investigation of single event effects in microelectronic devices.