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Silicon Sensors Irradiation Study for ILC Extreme Forward Calorimetry

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We are working on the proposed "BeamCal" project. Its goal is to detect scattered incoming beams at ILC at small angles, to prevent the background from two-photon processes to mimic signatures of new discoveries. The detector, which is envisioned as a tungsten sandwich calorimeter, will be subject to high fluences EM radiation that will shower in the tungsten radiator. We are exploring the effects of radiation damage on candidate sensors at shower-max within the induced shower. As well as electrons, positrons and photons, these showers will contain a flux of neutrons from the de-excitation of the giant dipole resonance that may significantly contribute to radiation damage. The anticipated fluence of the order of 100 MRad/year instigated studies of exotic sensor materials, such as GaAs. Instead, we are studying conventional silicon sensors as an alternative.

A major part of our efforts is test beam at SLAC electron beam facility in June of 2013. The beam setup features tungsten pre- and post-radiators for the purposes of modeling the shower maximum, spreading the beam and capturing neutron component of the radiation. Silicon strip sensors of different types will be irradiated. Sensor handling is designed for a quick connection to the charge measuring station to avoid annealing effects during wirebonding. This will allow us to study the same sensors repeatedly during the dose accumulation over up to four weeks of running time. We will run with the radiator both surrounding and remote from the sensor sample, in order to separate the effects of the ballistic EM shower from those of the isotropic neutron flux. We will describe the test run and show first results.

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