Diamond detector's response to intense high-energy electron pulses

15th Pisa Meeting on Advanced Detectors, La Biodola, Isola d'Elba, Italy, 22-28 May 2022

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- Owing to their excellent radiation hardness, diamond crystals have been widely used as solid-state particle detectors, beam loss monitors and dosimeters in high-radiation environments;
- Our diamond sensors are characterised using different radiation sources, and all the procedures are validated using a silicon diode as a reference. The calibration with two different radiation sources (β and X) covers a dose rate range from hundreds of nrad/s to tens of rad/s;
- To study the transient response of diamond detectors, we designed an experimental setup that uses a collimated, sub-picosecond, 1 GeV electron beam, with a bunch charge of tens of pC, provided by the FERMI electron linac in Trieste;
- We interpret the experimental results with a two-step numerical approach (TCAD + LTspice), validated using TCT measurements;
- The diamond sensors show a predictable response to these high intensity electron bunches. Measurements and preliminary simulations are in fair agreement, assuming that diamond resistance changes as a function of the charge carrier density in the diamond bulk.