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Signal response of diamond detectors in intense proton beams and at high temperature

In extreme radiation environments like monitoring intense proton beams, or at high temperature in a nuclear reactor, semiconductor charged particle detectors made of synthetic diamond provide a promising solution due to their high radiation tolerance and thermal properties.
We present new test results on the charge collection performance of diamond detectors tested in intense proton beams at JPARC with bunched 8 GeV beams at the level of 10^{12} protons/bunch with 1 microsec pulse repetition rateas expected in the COMET experiment.
In addition, for monitoring applications in neutron rich reactor environment where the temperature can be very high, we have studied the charge collection properties at temperature up to 600K, and found surprising trends for devices made with poly and single crystal diamond.
The experiment methodology and results will be presented.

Summary

We are developing diamond detectors for proton beam monitoring in the COMET experiment at JPARC. The aim of the experiment is to detect charged lepton flavor violation. To achieve this goal, the input 8 GeV proton beam must be monitored both for integrated flux and bunch wise extinction. The unprecedented challenge of measuring extinction of 10^{12} protons/bunch at a repetion rate of 1 μsec can only be met by diamond detectors. First results from ptototype detectors will be presented.
In parallel, monitoring a neutron rich environment inside a nuclear reactor poses a challenge because of the high temperature in addition to the intense radiation fluence. We have studied the properties of charge collection in diamond at temperature up to 600K - prelimnary results from the high temperature measurement will be presented.

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