APPLICATION OF DIAMOND DETECTORS IN TRACKING OF HEAVY ION SLOWED DOWN RADIOACTIVE BEAMS.

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Radioactive beams (RIB) produced in flight by a heavy projectile fragmentation or fission is an important tool in nuclear spectroscopy of very exotic nuclei, exploited recently in the world leading laboratories as: GSI, GANIL, MSU or RIEKEN. However, at present the RIBs are mainly used to induce a nuclear reaction at relativistic energies, thus allowing studies of nuclear excitation induced by a one step Coulomb interaction or a secondary fragmentation. Using a RIB slowed down to the Coulomb barrier will open a new perspective in a high resolution gamma spectroscopy of nuclei far off stability accessible by transfer reactions, deep inelastic collisions and in some cases a fusion-evaporation.

In GSI, collaborations as RISING[1] and HISPEC[2] develop beam tracking setups for radioactive HI beams at Coulomb barrier energies of 5-20 A\(\cdot\)MeV. Within this energy range, precise information about a velocity vector of incoming projectile has to be collected in order to determine a nuclear reaction kinematics at a secondary target. Use of a radiation hard and efficient HI detection system is essential. Therefore, application of thin diamond detectors [3] is considered.

We will report on the first results obtained with thin CVD diamond detectors irradiated by low energy \(p, \alpha\) and \(^{7}\text{Li}\) beams delivered by the CNA-Seville 3MV tandem accelerator [4]. Despite a very high beam flux of about \(10^9\) particles/s\(\cdot\)cm\(^2\) the tested diamond detectors shown a satisfactory radiation hardness. A very good energy resolution below 1% of a single crystal SC CVD detector was confirmed. A time correlation measurement performed with a telescope consisted of two diamond detectors revealed a time resolution of the order 100 ps. Perspectives of applying thin SC CVD detectors for a radioactive HI beam tracking at the Coulomb energy will be discussed.

References: