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Ultra fast timing detector systems to probe exotic properties of nuclei using RIB facility

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Recent RIB facilities combined with advance detector systems provides us unique opportunity to probe the exotic properties of the nuclei with unusual neutron to proton ratio. The studies of these properties enlighten new directions in understanding fundamental laws of quantum many body systems. In this presentation, we want to discuss the unique utilization of three different types of ultra fast timing detector systems to probe exotic properties of nuclei using radioactive ion beam facilities. These three different types of ultra fast timing detectors (⊠t≤150 ps) are plastic scintillators array, inorganic scientillators (viz., LaBr3) and special type of gas detector (multi-gap resistive plate chamber, MMRPC [1]). First two types of detector systems are commercially available and detector response mechanism is similar. Though depending upon light output and its decay constant, the utilities are different for optimum uses. Ultra fast timing plastic scintillators array are used in many large scale experiments for charge, time of flight and position measurements of charged particles or nuclei. However, these detectors are also used for detecting neutrons.
Due to fast decay time and high light output inorganic scintillators, like LaBr3 etc. are very useful for detecting gamma-rays. These detectors are unique solution with good timing (dt~150-250ps) and energy resolution (de~3%) [2]. We have studied the response of the charge particle of this type detector [1]. Thus, these types of detector can be utilized to explore rare processes for physics beyond standard models.
The response mechanism of MMRPC is different than other two ultra fast timing detectors and this detector was developed with specific design at SINP, Kolkata [1]. These types of detector systems are better economical solution than commercially available ultra fast scientillators with PMT or photodiode. This MMRPC detector can be used for both TOF and position of both charge particle and neutrons (dt<100ps).
In this presentation, the response, limitation of the detectors systems and particular utilities will be discussed. In addition to that, the some specific physics experiment using those detectors with results will be discussed.

1. U.Datta Pramanik et al., NIMA661, 149, (2012)
2. U.Datta Pramanik et al., Proce. Of DAE, vol. 52, 655 (2007)
3. U.Datta Pramanik et al., communicated

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