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Linearity and rate capability measurements of RPC with semi-insulating crystalline electrodes operating in avalanche mode

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The intrinsic rate capability and the ageing properties of the Resistive Plate Chambers are closely related to the electrodes material and to the front-end electronics threshold. Thanks to the development of a low noise pre-amplifier, the intrinsic rate capability of High Pressure Laminate (bakelite) RPC has been improved up to $\sim 10 \text{ kHz/cm}^2$, nevertheless the effective rate capability is significantly limited by the electrodes ageing. To further improve the effective rate capability new materials are investigated.

A Resistive Plate Chamber with crystalline semi-insulating Gallium Arsenide electrodes has been characterized with high energy electrons beam at the Beam Test Facility (INFN National Laboratory of Frascati, Italy). The response of the Resistive Plate Chamber to multiple bunched electrons was measured operating the detector in avalanche mode. The linearity limit it is expected to increase up to $\sim 8 \times 10^5 \text{ particles/m}^2$. The prompt charge and the time resolution have been studied as a function of the beam intensity up to $\sim 22 \times 10^6 \text{ particles/m}^2$.

The intrinsic rate capability has been also measured operating the detector in a uniform gamma radiation field.

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