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Simulation of Dark Current in Resistive Plate Chambers

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The dark current characteristic of an RPC is often simplistically represented by the current flown in an electrical circuit of diode and resistance. It follows mainly from the variation of electrical conductivity of the gas medium with the applied voltage. We have developed a detailed model to simulate the dark current from the first principle considering the electrical properties of all the device components. The conductivity of the gas medium has been introduced as a function of the first Townsend coefficient of the gas mixture used. The simulation has been carried out using COMSOL Multiphysics with the gas transport properties calculated by MAGBOLTZ. The model is expected to predict the V-I characteristic
curve for any gas mixture in any RPC geometry. For verification, the simulation results have been compared to the experimental measurement carried out with a Bakelite RPC filled with Freon and isobutane (95:5 by volume).

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Primary authors: DATTA, Jaydeep; TRIPATHY, SRIDHAR (SAHA INSTITUTE OF NUCLEAR PHYSICS); Ms ROY, Promita (Saha Institute of Nuclear Physics, HBNI); MAJUMDAR, Nayana (Saha Institute of Nuclear Physics); MUKHOPAD-HYAY, Supratik (Saha Institute of Nuclear Physics (IN))

Presenters: DATTA, Jaydeep; TRIPATHY, SRIDHAR (SAHA INSTITUTE OF NUCLEAR PHYSICS); MAJUM-DAR, Nayana (Saha Institute of Nuclear Physics)

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