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Low-energy electron source to characterise Micromegas/InGrid and study of dE/dx for low energy electrons

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Large area single-electron sensitive gaseous detector consisting of Micromegas/InGrid as gas multiplication device and integrated CMOS ASIC as a replacement of the conventional pad/strip readout, is a promising candidate for comprehensive tracking systems serving also the trigger for future HEP projects.
Challenges for the InGrid concept for TPC detector systems are the large number of pixels, the readout speed, and the robust and safe integration of the silicon CMOS chips with the Micromegas amplification system. The MPGDs integrated with the pixel technology may also play a prominent role in significantly improving the dE/dx resolution. Direct cluster counting of the primary ionization would also eliminate fluctuations in charge measurements because of the gas gain instabilities (assuming single electron efficiency close to 100%). Moreover, it could provide an unprecedented potential for pattern-track recognition and track fitting in the high-rate environments, improved double hit/track resolution and a possibility to minimize γ-rays contributions. More studies are needed to prove the capability of the InGrid concept to perform cluster counting and to attain an ultimate resolution of about 2%.
LEETECH facility at the PHIL photoinjector at LAL has been developed, which will provide low multiplicity samples of quasi monochromatic electrons with the energy adjustable in the range from almost non-relativistic values of several hundred keV to 3-5 MeV.
PHIL photoinjector provide short (a few picoseconds) bunches of monoenergetic electrons with energy 3-5 MeV and intensity 108 electrons per bunch. Beam electrons pass through thin aluminum target, thus acquiring continuous energy and angular distribution. The set of collimators at the entrance to the LEETECH spectrometer selects unique direction of the electrons entering the uniform magnetic field area provided by the dipole magnet. Electrons make a half-turn in the magnetic field, inside the vacuum chamber. The set of collimators at the exit of the spectrometer adjusts the number of delivered electrons and their energy spread.
Before construction detailed GEANT4 simulation was performed to define the LEETECH design. First data from LEETECH are compared to the simulation results. Control and performance of the dipole magnet, automated collimator systems using compact piezo motors, vacuum chamber with integrated complementary collimating inserts are addressed. Main characteristics of LEETECH, commissioning and first delivered data are discussed.
Proposal of using the technique of single cluster counting using Micromegas/InGrid to measure dE/dx for low-energy electrons in the energy range, where limited precision has been achieved so far, is finally presented.

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