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Calorimetry at CMD-3 detector

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CMD-3 is a general purpose detector designed to study e^+e^- annihilation in hadrons in the wide energy range, $E_{c.m.s} = 0.3 \div 2$~GeV. Since 2010 CMD-3 collected data at the e^+e^- collider VEPP-2000 in the Budker Institute of Nuclear Physics. VEPP-2000 collider with $10^{32} cm^{-2} s^{-1}$ luminosity is the only present collider which covers its energy range. The calorimetry at the detector is based on three subsystems: closest to the beam pipe barrel Liquide Xenon calorimeter, outer barrel calorimeter based on CsI scintillation crystals and endcap calorimeter made of BGO scintillation crystals. We will describe the structure of the calorimeters along with its electronics. The energy calibration procedures with cosmic particles and using e^+e^- scattering events will be described. The calorimeters characteristics will also be reported.

Collaboration

CMD-3 collaboration

Summary

The CMD-3 detector is equipped with the barrel calorimeter and endcap calorimeter.
The barrel electromagnetic calorimeter of the detector consists of two subsystems: closest to the beam pipe is the Liquid Xenon calorimeter (LXe) and the outer one is based on CsI scintillation crystals (CsI). LXe calorimeter covers a solid angle $0.8 \times 4\pi$ and has a thickness equals to $5.4X_0$. Finely segmented strip structure of the calorimeter electrodes provides the possibility to analyse energy deposition profile through the shower direction, reconstruct tracks of charged particles and measure total energy deposition.
The CsI calorimeter consists of 8 octants, located around the LXe calorimeter, and contains 1152 counters. Each counter is based on CsI(Tl) or CsI(Na) crystal of $6 \times 6 \times 15 cm^3$ size that corresponds to $8.1X_0$ in the direction transverse to the beam.
The total thickness of the barrel calorimeter is equal to $13.5X_0$.
The main advantage of the combined barrel calorimeter is that the LXe calorimeter allows to measure the coordinates of gamma conversion point with spatial resolution of about 2~mm, and additional $8X_0$ of crystal CsI provides the total energy resolution of combined calorimeter of about 4.5\%/1GeV.
The energy calibration procedures using cosmic rays for CsI calorimeter and using elastic e+e- scattering process for the LXe calorimeter along with the CsI calorimeter will be presented in this report.
The BGO calorimeter consists of 680 crystals of $2.5 \times 2.5 \times 15$~cm^3 arranged in two edentical endcaps. It covers angles from 17° to 50°. The thickness of the calorimeter is 13.5~X_0. The structure, electronics, calibration procedures will be described. The energy and spacial resolutions of the calorimeter will be reported.
Also the gamma energy reconstruction algorithm in the whole calorimeter system will be described.

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