BL31LEP
(Laser-Electron Photon II)

1. Activity in FY 2018

BL31LEP (LEPS2 beamline) injects 355-nm UV-laser light to the 8-GeV electron storage ring to obtain a γ-ray beam (laser electron photon) up to 2.4 GeV by backward Compton scattering between the laser photons and the electron beam. We deliver this γ-ray beam to the LEPS2 experimental building, which is located beyond the storage ring, irradiate the γ-rays to targets, and measure the hadron photoproduction.

We plan to study exotic hadrons such as a pentaquark candidate composed of five quarks, meson–baryon molecule candidates, and deeply bound anti-kaonic nuclei. For these experiments, a solenoid magnet with a 3-m diameter and a magnitude of 1 T was shipped from Brookhaven National Laboratory, the United States. We are developing detectors that can detect both photons and charged particles.

The LEPS2 solenoid spectrometer consists of start counters (SCs), time projection chamber (TPC), drift chambers (DCs), barrel resistive plate chambers (BRPCs), forward resistive plate chambers (FRPCs), barrel γ counters (Bγ's), and aerogel Cherenkov counters (ACCs). Figure 1 schematically depicts the solenoid spectrometer. A liquid hydrogen or a deuterium target is installed in the TPC. Charged particles scattered at forward angles and sideways are detected with the DCs and the TPC, respectively. These particles are momentum-analyzed. SCs, which are located close to the target, measure the timing when charged particles are produced using RF information of the electron storage ring. FRPCs detect charged particles scattered at forward angles about 4-m downstream from the target, and BRPCs detect charged particles in large scattering angle regions at 0.9 m in the radial coordinate. FRPCs and BRPCs provide the time-of-flight information of charged particles with a resolution below 100 ps. From the momentum and velocity of a charged particle, the particle mass is determined. For high-momentum particles, we use ACCs to identify the particle. In FY2018, we performed detector commissioning tests of the solenoid spectrometer.

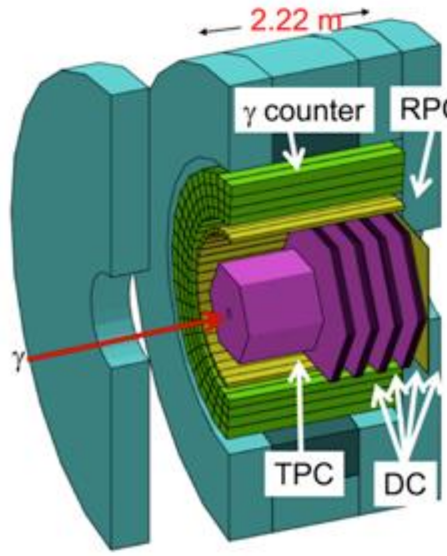

Fig. 1. Schematic of the LEPS2 solenoid spectrometer.

2. Status of detector development in 2018

In FY2018A, we performed a commissioning test to operate part of the TPC, Bγ's and FRPCs. We injected a γ-beam to the CH_2 target. We successfully observed trajectories of charged particles with TPC in two sectors (Fig. 2), and we evaluated the performance of TPC, including the spatial

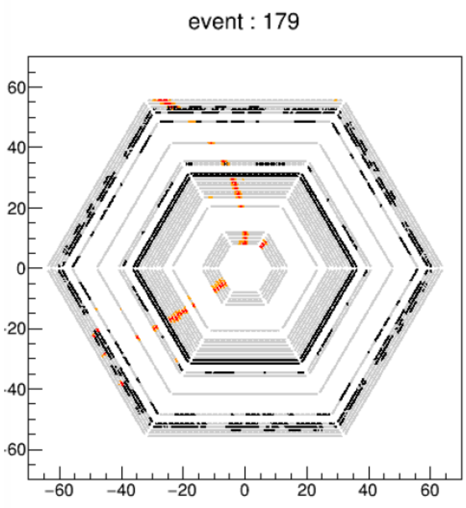

Fig. 2. Red points: Trajectories of charged particles measured with TPC. Gray points: Activated readout pads of the TPC.

resolution and the detection efficiency. The Bγ's were operated with the TPC for the first time, and we analyzed the charged particles and photons in order to reconstruct the two-γ decay of neutral pions. In 2018B, we had trouble with the TPC drift cage, and sent it to a manufacturing company for repair. During the repair, we performed test experiments using DCs and FRPCs. Because FRPCs had not been used in five years, we repaired the chambers and evaluated the detection efficiency and time resolution. The performances of FRPCs are consistent with the previous results after fixing a gas leak. In addition to the detectors, we developed the data acquisition system to read out signals from all detectors stably. We continue to analyze the momentum reconstruction with DCs and reconstruct the mass of the charged hadrons.

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