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Commissioning of a hadron blind detector for dielectron measurement in pA reactions at J-PARC

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The J-PARC E16 experiment measures mass spectra of low-mass vector mesons, ρ, ω, and φ, in a nucleus using p + A ⟶ ρ/ω/φ + X reactions at the J-PARC high-momentum beamline. The invariant mass of vector mesons is reconstructed with the e+e− decay. The branching ratio of e+e− decay is very low and a thin target of 0.5% radiation length must be used to reduce dielectrons from gamma conversion inside the target. Thus, a spectrometer with a large acceptance and high-intensity beam up to 1×1010 protons per 2-sec duration pulse are important to collect a sufficient number of vector mesons. We have developed the spectrometer, which has two types of electron identification detectors. The electron identification detectors comprise a hadron blind detector (HBD) and a lead-glass calorimeter. The goal of the pion rejection is 0.6% with the electron detection efficiency of 63% for the HBD. An HBD is a mirrorless and windowless Cherenkov detector. Our HBD consist of CF4 radiator and 30×30 cm2 GEMs. Three GEMs compose a single GEM stack with a CsI photocathode evaporated on the top surface of the top GEM. For the first physics run, 32 GEM stacks will be installed, resulting in total sensitive area of ~ 2.88 m2. Commissioning runs for the spectrometer have been performed at the J-PARC high-momentum beamline. The HBD successfully observed 11 ± 1 photoelectrons for an incident electron. In this presentation, we will show the obtained perfomance of the HBD.

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