

Experimental study of spectral change of vector mesons in nuclear medium at J-PARC

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The chiral symmetry is dynamically broken in the QCD vacuum. Hadrons as elementary excitations of the vacuum reflect its property and a large portion of their mass is generated due to the symmetry breaking. The order parameter of the chiral symmetry such as $\langle \bar{q}q \rangle$ is expected to change as a function of temperature and density of the medium thus the in-medium hadron spectra are also expected to change. The in-medium hadron spectra in the hot medium produced by high-energy heavy-ion collisions and in a nucleus have intensively been studied. Our experiment, J-PARC E16, will measure mass spectra of low-mass vector mesons, ρ , ω , and ϕ in a nucleus using $p + A \rightarrow \rho/\omega/\phi + X$ reactions. The invariant mass of vector mesons is reconstructed with ee decay in order to avoid the distortion of the spectra due to the final state interaction. The branching ratio of ee decay is very low and a thin target of $\sim 0.5\%$ radiation length must be used to reduce ee pairs from gamma conversion inside the target. Thus, a spectrometer with a large acceptance and high-intensity beam are required to collect a sufficient number of vector mesons. We have developed the spectrometer and have constructed a new beam line for the experiment at J-PARC. As the experiment J-PARC E16, we are allocated 320 hours beam time for a commissioning of the spectrometer and the beam line. The first 160 hours beam time was completed in Jun. 2020 and the left beam time is going to start in Feb. 2021. We discuss the expected physics results and report the current status of the beam line and the experiment.

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