Spectroscopic study of hyperon resonances below $\bar{K}N$ threshold via the (K^-, n) reaction on Deuteron

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$\Lambda(1405)$ has been discussed on its structure for a long time. From theoretical calculations with different potential model, one-pole or two-pole structure of $\Lambda(1405)$ is predicted [1, 2]. In the recent experiments, the peak position and line shape of $\Lambda(1405)$ is reported with enough statistics [3, 4]. Some results are different from theoretical predictions or experimental measurements on different reaction. Moreover, these results have shown $\Lambda(1405)$ is affected by dynamics of reaction. Therefore, it is important to investigate the resonance state directly connected from $\bar{K}N$ interaction.

We plan to study of $\Lambda(1405)$ via the $d(K^-, n)$ reaction on the deuteron target at the K1.8BR beam line of the J-PARC hadron facility (J-PARC E31 [5]). The reaction is expected to enhance a virtual $\bar{K}N$ scattering process, where a K^- beam which has momentum of $1\ \mathrm{GeV}/c$ kicks a neutron out of the deuteron in a forward angle and slowing down to form a $\Lambda(1405)$. Therefore, $\Lambda(1405)$ can be produced dynamically from meson-baryon resonant state. Since the presented reaction depend on potential of meson-baryon interaction, the interaction of $\bar{K}N$ can be identified. The produced hyperon state will be reconstructed by means of missing mass method. In the $d(K^-, n)$ reaction, both of $I = 0$ and 1 states are produced. In order to decompose the isospin state, we will measure all $\pi\Sigma$ final states.

In this experiment, a cylindrical detector system and a forward Time of Flight (TOF) counter for measuring scattered particles are used. Those detectors are same setup of the E15 experiment. In addition, since $\Lambda(1405)$ is recoiled at a backward angle in the present reaction, backward decay particle counters are installed at the upstream of the target. These detectors had been worked with great performance in the previous beam time of E15 experiment. We have almost finished preparing the experimental setup.

In this contribution, an overview of the E31 experiment will be presented.

References

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