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The spectrometer and target systems for hypernuclear physics at MAMI

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At the Mainz Microtron MAMI, the technique of high-resolution spectroscopy of decay-pions in strangeness electroproduction has been established to extract Λ ground state binding energies of light hyperfragments. In a first series of measurements, a ^{9}Be target was used to determine the $^{4}_{\Lambda}$H binding energy with unprecedented precision in a momentum setting near 133 MeV/c. The current measurement employs a novel lithium target of 50 mm length and only 0.75 mm thickness to precisely determine the hypertriton binding energy in a 114 MeV/c setting.

The complex setup in the spectrometer hall comprises a pre-target beam-line chicane, a high-luminosity lithium target, two high-resolution pion spectrometers, one zero-degree forward spectrometer for strangeness tagging, one photon beam-line and one electron exit beam-line. The focusing magnetic spectrometers provide a high momentum resolution at the 10^{-4} level over the momentum range of hypernuclear decay-pions, a large acceptance in both angle and momentum, good position and angular resolution in the scattering plane, an extended target acceptance, and a large angular range to optimally accommodate for different beam-target angles. A thermal imaging system controls the target alignment with respect to the beam. A recalibration of the pion spectrometers will be possible due to the precise beam energy determination with the undulator light interference method.

The experiment aims for a statistical and systematic error of about 20 keV and will run during the summer of 2022.

Collaboration

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