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Reference

NEW INVESTIGATIONS OF THE POLARIZED NEUTRON BEAM IN NA2

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The NA2 area at PSI is a multi-purpose facility for unpolarized as well as polarized nucleon beams of high intensity[1]. Our collaboration performed an experimental programme to measure spin dependent elastic np scattering. The measurements were finished in 1995, and first results were presented on different occasions[2, 3]. Here we report on a measurement of the neutron beam energy spectrum and polarization, which is a prerequisite for the analysis of the spin observables. The set-up consisted of an LH2 target and a magnetic spectrometer, enabling the measurement of the recoil protons. More details on the set-up can be found in[1]. Neutrons are produced on a 12 cm long 12C target at 0° by 590 MeV protons. The neutron energy spectrum, shown in Figure 1, was obtained by a time-of-flight measurement, using the radio frequency signal of the accelerator. The quasi-elastic peak at 530 MeV is produced in the process 12C(p, n)12N, where the recoil nucleus can also be left in an excited 12N* state. The measured data are well reproduced by a calculation based on the 12N excitation curve at 0°, as measured by [4] with 295 MeV protons (see curve in Figure 1). The energy loss of the incident protons in the target as well as the resolution of the energy measurement were taken into account. The broad continuum at energies below 400 MeV is due to more complicated processes, including pion production. The polarization of the neutron beam was determined via the analyzing power of np elastic scattering[5]. The beam polarization was flipped every second and the asymmetry of the recoil protons was measured at an angle of θlab = 30°, where the analyzing power is large. The resulting neutron beam polarization is shown in Figure 2. It agrees with the older measurement[1], where a different set-up was used. The monotonous decrease below 450 MeV, for neutrons originating from complex inelastic processes, follows surprisingly well the energy dependence of the polarization of free pn charge exchange. According to previous measurements[4, 6], at the quasi-elastic peak (530 MeV) a larger negative polarization would be expected for a 12N gs final state. The structure at 500 MeV is not yet understood. It could be due to the influence of excited 12N states, leading to a lower neutron polarization.

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References