

8.46 The Erlangen Double Scattering Arrangement for Polarization Measurements

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In this contribution we report on a double scattering arrangement which consists of a sliding seal chamber, a magnetic QDQ spectrometer and a high pressure ^4He polarimeter. An outline of this device is shown in fig.1.

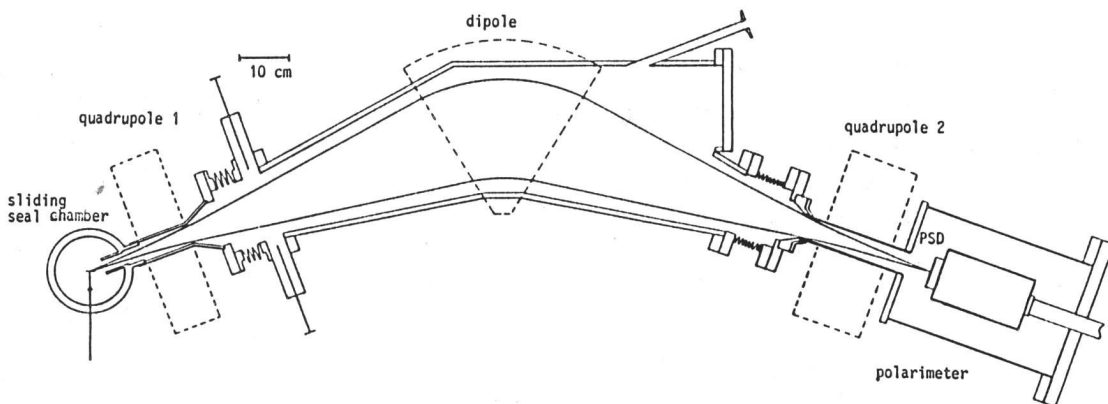


Fig.1 Top view of the double scattering arrangement.

The first scattering takes place in the sliding seal chamber ¹⁾ which contains a target ladder, a Faraday-cup and some detectors. These can be arranged in a left-right position at backward angles and may be used to determine the polarization of the incoming beam. The metal belt is teflon coated for a better sealing and the opening of the chamber allows a positioning of the spectrometer in the angular range $-10^\circ \leq \theta \leq 120^\circ$ where positive angles correspond to scattering to the right. Since the accepted solid angle should be as high as possible the dimensions of the chamber were minimized resulting in an inner diameter of only 14 cm.

The spectrometer has a deflection angle of 40° and is designed for proton energies up to 19 MeV. Both magnetic quadrupoles give rise to a defocusing effect in the scattering plane and to a focusing effect in a perpendicular plane. The image qualities of the whole system were optimized experimentally by a proper modification of the dipole fringe field via an adjustment of magnetic field clamps with small iron plates. So in an iterative way different particle beams, defined by a slit after the first quadrupole, can be focused to the same place at a position sensitive detector placed in front of the polarimeter. The spectrometer is double focusing with a maximum accepted solid angle of 20.3 msr corresponding to $\Delta\theta = +3.3^\circ$ and $\Delta\phi = +6.4^\circ$ where θ is in the scattering plane and ϕ perpendicular to it. The energy resolution is at least $E/\Delta E = 315$, it can be improved if the accepted solid angle is reduced by collimators at the entrance of the first quadrupole.

The ^4He polarimeter is a tube containing left-right and top-bottom detectors with angle defining lamellas in front. The particles enter the high pressure ^4He (up to 50 bar) through a ΔE scintillator and a metal foil and then they are stopped in stripe detectors at the end of the tube. A removable position sensitive detector at the entrance of the polarimeter can be used to check the position and diameter of the beam after the spectrometer. The parallelity of the beam within the polarimeter can be investigated by a measurement of the beam diameter at different places along the symmetry axis. The polarimeter as a whole can be turned by 180° around its axis which

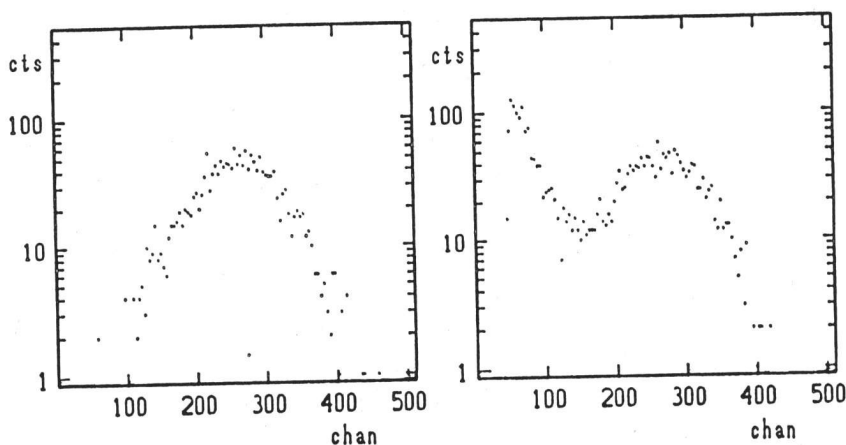


Fig.2 Polarimeter spectra with and without coincidence to the entrance ΔE detector.

enables an elimination of instrumental asymmetries. By a coincidence measurement of the polarimeter detectors with the ΔE scintillation detector very clean spectra have been obtained (see fig.2). The effective analyzing power of the polarimeter for protons depends weakly on the energy and the ^4He pressure and varies between 0.6 and 0.8, which was measured with polarized and unpolarized protons at energies between 8 and 12 MeV.

With this device several depolarization measurements have been performed for the proton-proton scattering ²⁾ and for the elastic proton scattering on ^{27}Al and ^{89}Y ³⁾.

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