

Wire device for the measurement of the dimensions of the COSY-11 cluster-jet target

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In October 2006 the COSY-11 collaboration performed a direct measurement of the total width of the η' meson ($\Gamma_{\eta'}$). The value of $\Gamma_{\eta'}$ will be derived from the missing mass distribution of the $pp \rightarrow ppX$ reaction and from the shape of the excitation function of the total cross section determined near the kinematical threshold for the $pp \rightarrow pp\eta'$ process. In the experiment a proton beam of COSY and a cluster target were used. The systematical error of the extraction of $\Gamma_{\eta'}$ will depend on the accuracy of the determination the missing mass resolution. This depends predominantly on the momentum spread of the COSY beam (Fig. 1) and on the accuracy of the four-momentum determination of the registered protons. In the case of the experimental technique used by the

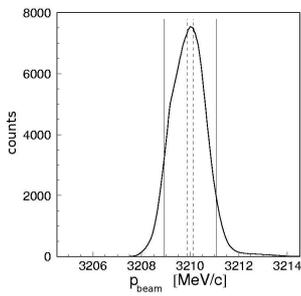


Fig. 1: Beam momentum distribution calculated from the Schotky frequency spectrum measured during the COSY-11 run in 2004. The dashed and solid lines show limits deduced from the target dimensions of 1 mm and 9 mm, respectively. The estimations was based on the know value of dispersion of the COSY beam at the position of the COSY-11 target.

COSY-11 collaboration, both mentioned factors, depend on the dimensions of the target. Therefore it is crucial to monitor precisely the spatial size of the target perpendicular to the COSY beam. To this end we used two independent methods. One of the techniques was based on the determination

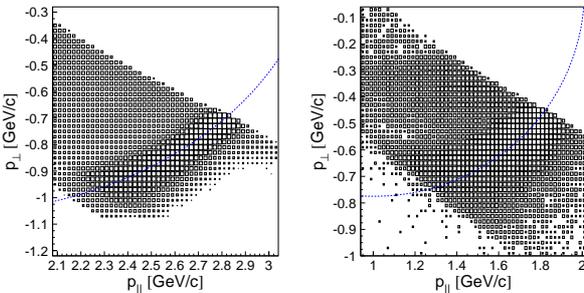


Fig. 2: Distribution of elastically scattered protons. The number of entries per bin is shown in logarithmic scale. (left) This experiment: ≈ 1 mm target width, $p_{beam} = 3211$ MeV/c (right) One of the previous experiments: 9mm target width, $p_{beam} = 2010$ MeV/c [3]

of the momentum distribution of elastically scattered protons (Fig. 2), and the second method relied on the measurement of the pressure of the gas in the last chamber of the cluster-jet dump. The pressure was measured as a function of the position of wires moving with the constant velocity through the cluster beam. These wires were rotated around the axis perpendicular to the beam of hydrogen clusters. In case that one or more wires crossed the cluster beam the clusters hitting a wire were stopped causing a decrease of the vacuum pressure in the last stage of the cluster dump. The wire device (Fig. 3) was located above the reaction point (Fig. 4) making it possible to monitor the target dimensions without disturb-

ing the measurement of the $pp \rightarrow pp\eta'$ reaction. From the knowledge about the dimensions of the wire device it is possible to calculate the target dimensions from the measurement of the pressure change as function of the position of the device. Fig. 5 shows an example of the pressure measurement as function of time using a constant angular velocity of the device. The extraction of target dimensions is in progress. We expect to achieve an accuracy of about 0.2 mm.



Fig. 3: Photograph of the wire device for precision measurement of the cluster target dimensions. The rotation axis of the device is mounted perpendicular to the cluster jet.

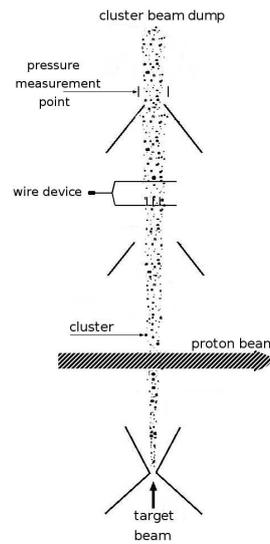


Fig. 4: Schematic view of the target dimensions measurement.

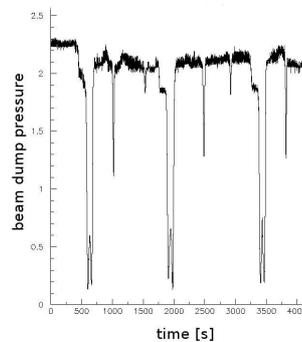


Fig. 5: Experimental data from a target scan using wire device.

References:

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