Measurement of the Cross Section for the Quasi-elastic Photoproduction of $\psi(2S)$ at HERA

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Thesis submitted for the degree of

Doctor of Philosophy

April 1997

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Abstract

The H1 detector first started taking data at the ep collider, HERA, in 1992. Penetrating muons at small angles to the proton beam are identified and measured using the Forward Muon Detector (FMD) at H1. The methods used to calibrate the detector are presented, and the results of monitoring the calibration constants over 1994 and 1995 are shown. The alignment of the FMD is discussed, and the effects of misalignment on the momentum resolution of the detector is shown.

A measurement is presented of the cross section for the quasi-elastic photoproduction of $\psi(2S)$ mesons at H1. The $\psi(2S)$ meson was identified from the decay $\psi(2S) \rightarrow J/\psi\pi^+\pi^-$, and the measurement was made from data taken over 1994 and 1995. For values of the elasticity variable, $z > 0.95$, the cross section was measured to be $18 \pm 3(stat) \pm 3(syst)$ nb, at a centre-of-mass energy of $W_{\gamma p} = 80\,\mathrm{GeV}$. When compared to the equivalent cross section for J/ψ production, this gave a ratio of the cross sections for $\psi(2S)$ and J/ψ of $0.15 \pm 0.03(stat) \pm 0.02(syst)$. The cross section was also measured where the $\psi(2S)$ was identified by the decay channel $\psi(2S) \rightarrow l^+l^-$. Using this sample, the cross section, in the same kinematic region and at the same energy, was found to be $22 \pm 4(stat) \pm 6(stat)$ nb.