

A 1 Total Cross Sections of π^\pm , K^\pm , P and \bar{P} on Protons and Deuterons

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We report here an extension of our earlier experiment on the measurement of hadron total cross sections up to 370 GeV/c. The higher momenta were achieved by the upgrading of the M1 beam in the Meson Laboratory at Fermilab^{4,5} where the experiment was carried out, and the availability of 400 GeV/c protons on the Meson Laboratory target.

Data analysis was carried out similarly to that described previously. As before, the extrapolation procedure was verified using proportional wire chambers for 280 GeV/c anti-protons. The proportional wire chamber data showed that down to at least $-t \approx .006$ (GeV/c)², there was no rapid change in partial cross section slope.

Several earlier cross sections measurements were repeated here, and agreement with the new data was always very good.

Based on the reproducibility of the data and upon the uncertainty in extrapolation procedure, we estimate the momentum dependent systematic uncertainty in p and \bar{p} cross sections to be $\pm 0.1\%$ in addition to the statistical error. For pions and kaons, the estimated systematic uncertainty was increased to between $\pm 0.15\%$ and $\pm 0.3\%$ as a result of uncertainties in the muon contamination. A momentum independent systematic scale error in the absolute magnitude of the cross sections is introduced by uncertainties in the form of extrapolation and in the hydrogen and deuterium densities and contaminations. It is estimated to be $\pm 0.4\%$ for protons and $\pm 0.5\%$ for deuterons.

Results of this experiment are displayed in Figs. 1a and 1b, together with previous data.

The new data above 200 GeV/c for all cross sections extrapolates well from earlier measurements, and continues the trends observed there. In particular, the $\bar{p}p$ cross section appears momentum independent above ~ 120 GeV/c; this is consistent with the behavior of

all other cross sections where the cross sections, after falling with increasing momentum,

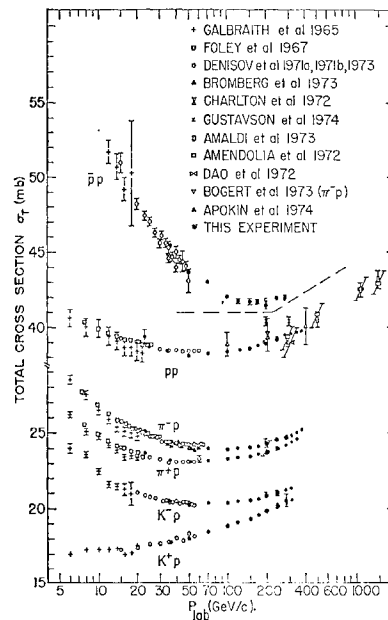


Fig. 1a. Total cross sections on protons.

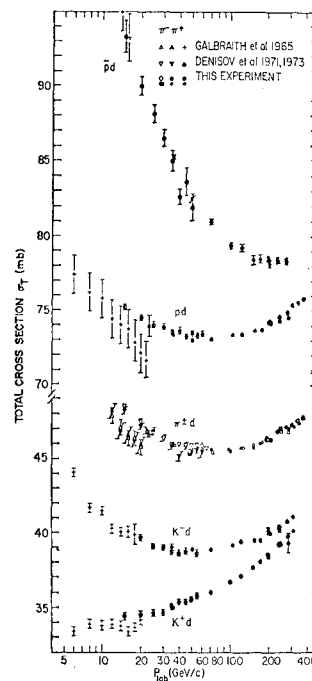


Fig. 1b. Total cross sections on deuterons. Only momentum dependent errors are shown.