An Analysis of the Centrally Produced $\pi^+\pi^-$ System at 450 GeV/c

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Synopsis

The WA91 Experiment is designed to study final states formed in the reaction $\mathrm{pp} \longrightarrow \mathrm{p}_f X^0 \mathrm{p}_s$, where the subscripts f and s refer to the fastest and slowest particles in the laboratory frame respectively, and X^0 refers to the central system. Reactions of this type are predicted to be good sources of non-$\mathrm{q}\overline{\mathrm{q}}$ final states, such as glueballs.

This thesis presents results on the $X^0 \longrightarrow \pi^+\pi^-$ channel, taken during the 1992 and 1994 experimental runs. A fit to the $\pi^+\pi^-$ mass spectrum has been performed, and it has been found necessary to include a contribution from a state with a mass of ~ 1500 MeV/c^2 and a width of ~ 200 MeV/c^2. A new parameterization of the $\pi^+\pi^-$ angular distribution has been developed, and the partial waves contributing to the $\pi^+\pi^-$ channel have been extracted. A fit to the S-wave using the same formalism as that used for the mass spectrum also finds it necessary to include a state at around 1500 MeV/c^2.

A novel effect is observed if the data are classified by the azimuthal angle between the outgoing protons. Significantly larger signal-to-background ratios of standard $\mathrm{q}\overline{\mathrm{q}}$ states are observed for events with a "back-to-back" configuration of the outgoing proton p_T's. This effect is not due to the trigger or experimental acceptance, and suggests that the exchange vertices do not factorize.