A Branching Ratio Measurement of the Charmless Hadronic Decay $B^+ \to \rho^0\pi^+, \rho^0 \to \pi^+\pi^-$ Using the BaBar Detector

Richard Penny

Experimental Particle Physics Group

School of Physics & Astronomy

University of Birmingham UK

June 2004

A thesis submitted to the University of Birmingham

for the degree of Doctor of Philosophy

Abstract

An analysis of the B^+ decay mode to $\rho^0\pi^+$ with subsequent decay $\rho^0 \to \pi^+\pi^-$ has been undertaken. Data consists of 88.9×10^6 B^+B^- pairs produced in the BaBar detector by the PEP-II collider at Stanford Linear Accelerator Center during the period 1999-2002. A full selection process for these events from all data allows measurement of the branching fraction

$$Br[B^+ \to \rho^0\pi^+, \rho^0 \to \pi^+\pi^-] < (10.22 \pm 2.00 \pm 4.22) \times 10^{-6}$$

including charge conjugate states. This corresponds to 179 observed events, however the 90% confidence level upper limit for the $B \to \pi^+\pi^-\pi^+$ decay mode is equivalent to 30 of these events.

A search for direct CP violation via a charge asymmetry measurement A through the $B^+ \to \rho^0\pi^+, \rho^0 \to \pi^+\pi^-$ and $B^- \to \rho^0\pi^-, \rho^0 \to \pi^+\pi^-$ channels is also presented, although asymmetry measurement results are inconclusive owing to lack of statistics.