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Identifying Charged Current Single Pion Production Neutrino Events at Super Kamiokande

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Super Kamiokande is a large water Cherenkov detector that is used to detect neutrino interactions and measure neutrino oscillation parameters. In Super Kamiokande charged particles are identified by classifying the rings of Cherenkov light, traditionally as either electron-like with a fuzzy ring edge, or as muon-like with a sharp ring edge. A maximum likelihood reconstruction algorithm now makes it possible to identify other particles such as pions. Although the Cherenkov rings produced by muons and charged pions are very similar, charged pions, unlike muons, undergo hadronic interactions in the water which affect the amount and properties of the Cherenkov light they produce. These hadronic interactions make it possible to distinguish charged pions from muons, and by extension to identify charged current single π^+ production neutrino interactions ($\nu_\mu + p/n \rightarrow \mu^- + \pi^+ + p/n$) at Super Kamiokande. Charged current single π^+ production neutrino events have never been explicitly identified at Super Kamiokande before, and including them in analyses will require evaluation of the systematic errors associated with charged pion hadronic interactions and Cherenkov light production in water.

Author: BERKMAN, Sophie (University of British Columbia)

Presenter: BERKMAN, Sophie (University of British Columbia)

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