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Measuring the muon (anti-)neutrino induced charged-current coherent pion production cross sections on carbon using the off-axis T2K near detector

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A neutrino (or an anti-neutrino) can interact with an entire nucleus coherently (this means that the target nucleus has to stay intact after the interaction) and produce a pion - we call such an interaction coherent pion production. The interaction can either be mediated by a Z boson (neutral current) or a W boson (charged current). This process is not well understood theoretically. Additionally, the neutral current channel can be a background source to the electron neutrino appearance measurements. The Tokai-to-Kamioka (T2K) experiment has previously published the first sub-GeV charged current coherent pion production (CC-COH) measurement using a 0.6 GeV muon neutrino beam. Since then, T2K has collected roughly twice the muon neutrino data and an equivalent amount of muon anti-neutrino data. The detector reconstruction and the modelling of neutrino interactions have also been greatly improved. An improved muon neutrino induced CC-COH measurement (compared to the previously published T2K result) and the first sub-GeV muon anti-neutrino induced CC-COH measurement are in progress. This talk will describe the challenges associated with measuring the muon neutrino and anti-neutrino induced CC-COH cross-sections and how T2K addresses these issues.

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