Poster session 4 – Friday 8 July

P4.004 **Atmospheric neutrinos in JUNO**

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The Jiangmen Underground Neutrino Observatory (JUNO), a 20 kton multi-purpose underground liquid scintillator (LS) detector, are constructing in China to primarily determine the neutrino mass hierarchy (MH) by detecting reactor antineutrinos. The JUNO central detector as a LS calorimeter has excellent energy resolution and a very low energy threshold. It is found that the LS detector has the capability to reconstruct the track direction of the energetic charged particle by use of the timing pattern of the first-hit on the photomultiplier tubes since the energetic particle travels faster than light in the LS. Characteristic signals from Michel electrons, neutron captures and unstable daughter nuclei are helpful for the particle recognition. Based on the above capabilities, JUNO is a promising detector for atmospheric neutrino oscillation measurements. Here we focus on the JUNO sensitivities to neutrino MH, the octant of atmospheric mixing angle θ_{23} and the CP phase δ. In terms of the current reconstruction potential of the JUNO detector, we conservatively use the atmospheric $\upsilon\mu$ and $\upsilon\mu$ charged current (CC) events with the muon track length $L_\mu > 5$ m for our physical analysis. These events have been classified as the full contained (FC) υ_μ-like, FC $\bar{\upsilon}_\mu$-like, partially contained (PC) υ_μ-like and PC $\bar{\upsilon}_\mu$ -like samples based on the $\mu \pm$ track and the statistical charge separation. Our numerical results have shown that the JUNO's MH sensitivity can reach 0.9 σ for a 200 kton-years exposure and $\sin^2 \theta_{23} = 0.5$, which is complementary to the JUNO reactor antineutrino results. The wrong θ_{23} octant could be ruled out at 1.8 σ (0.9 σ) for the true normal (inverted) hierarchy and $\theta_{23} = 35°$. The JUNO sensitivity to CP violation is very small since we only consider the high energy υ_μ and $\bar{\upsilon}_\mu$. In contrast to the conservative case, we have given an optimistic estimation for the MH where we include the $\upsilon\mu_e/\bar{\upsilon}_e$ CC events and extend the selection condition $L_\mu > 5$ m to $L_\mu > 3$ m for the $\upsilon_\mu/\bar{\upsilon}_\mu$ CC events. It is found that the combined sensitivities can reach 1.8 σ and 2.6 σ for 10 and 20 years of data taking, respectively.