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Hadron Production measurements at the NA61/SHINE experiment for the T2K Neutrino Flux Prediction

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The largest source of uncertainty on the initial neutrino flux in modern accelerator neutrino experiments is the poor knowledge on the production of hadrons that decay into neutrinos. T2K is a long baseline neutrino experiment that aims to precisely measure the parameters of the PMNS matrix via the $\nu_\mu \rightarrow \nu_e$ appearance and ν_μ disappearance as well as to look for the first indication of CP violation in the lepton sector. The required total systematic uncertainty on the neutrino flux as low as 5% can hopefully be achieved with high precision hadron production measurements, performed by the dedicated auxiliary NA61/SHINE experiment at the CERN SPS. Production of hadrons in 31 GeV/c proton interactions on Carbon is measured with a thin target (4% of the nuclear interaction length) to study the primary interactions and with a T2K replica target (1.9 interaction length) to investigate re-interactions in the long target.
The low statistic pilot data-set taken in 2007 was used to measure hadron multiplicities with the thin target and to demonstrate the capabilities of the spectrometer with the T2K replica target. High statistics 2009 and 2010 runs have been used to perform precise measurements. The latest 2009 results on charged pion, kaon and proton spectra are presented and experimental data are compared to model predictions.
The re-weighting procedure used to tune the T2K neutrino flux is presented as well. This method will be very important also for the future neutrino long-baseline experiments for which a precision of about 2% on the flux knowledge is required for the discovery of CP violation in the lepton sector.

WG3: Accelerator Physics (Yes/No)

No

WG2: Neutrino Scattering Physics (Yes/No)

Yes

WG4: Muon Physics (Yes/No)

No

WG1: Neutrino Oscillation Physics (Yes/No)

Yes

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