

# ESTIMATION OF ACCELERATOR NEUTRINO FLUX

PARAS KOUNDAL (MS14083)

## Abstract

Neutrino Physics over decades has proved crucial in improving our understanding of the Standard Model of Particle Physics and has moreover opened ways to probe Beyond Standard Model Physics too. The discovery of the process of conversion of neutrino from one flavor to other during propagation, called as Neutrino Oscillation has demonstrated that neutrinos have a non-zero mass. It has also made us possible to ask if neutrinos may hold the key to many other great questions of physics such as why is the Universe dominated by matter (over anti-matter). Neutrino data collection from various sources has already provided us with some insights into these mechanisms. However, all these suffer from a significant drawback of no control over the source. This limits the number as well as the sensitivity of the parameters we want to measure. Accelerator facilities come to rescue here. Due to greater control over the source, we can produce neutrinos of all flavors as well as control other parameters like intensity, propagation direction, etc. It is also essential to understand the flux because of its direct dependence in every neutrino-nucleus cross-section measurement, estimation of oscillation parameters etc.. This thesis details the neutrino flux estimation at any detector location on earth considering three accelerator neutrino sources, namely: CERN, Fermilab, and J-PARC. This provides the benefit of accessing three different baselines for a single detector experiment. Presence of three different baselines not only offer a way to cross-check results but also provide an opportunity to access different sensitivity regions to probe different parameters. This thesis focusses on flux estimation at two detector locations, namely: Indian Neutrino Observatory and EHEP (Experimental High Energy Physics) Lab, IISER Mohali, India.