ICHEP 2016 Chicago

38th INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS

AUGUST 3 - 10, 2016
CHICAGO

Contribution ID: **1459** Type: **Poster**

IBD BACKGROUND REJECTION AND TAGGING AT THE DOUBLE CHOOZ EXPERIMENT

Saturday, 6 August 2016 18:00 (2 hours)

Double Chooz (DC) is a reactor anti-nue disappearance experiment located in France near the power plant of Chooz. The main goal of the experiment is the measurement of the θ13 mixing angle and, already in 2011, it provided the first positive indication for a non-zero value of such an oscillation parameter, using a single detector. The exploitation of the second detector (near detector), taking data since December 2014, provided the partial cancellation of some systematic errors. This posters shows the first results for both detectors, including both phases: single detector (2011-2014) and double detector (from 2015). Major improvements have followed through the different released analyses, especially on the the reduction and active rejection of both radiogenic and cosmogenic backgrounds. Currently, despite its lowest overburden (100 m.w.e. for the near detector), DC has among the best correlated and uncorrelated (accidental) background systematics errors in the θ13 reactor field. In fact, DC is able to active reject all type of backgrounds using several unprecedented multi-detector correlation strategies. So, multi-Compton radioactive, stopping-muon, fast-neutron and event the generation of spallation isotopes such as Li(9), H(8) and B(12) can be tagged, for energy spectra characterisation and eventual rejection. In addition, the FADC based electronics provide the recording the waveform of each PMT, which is exploited for additional background rejection based on pulse shape analyses in time and frequency domain (i.e. Fourier transformed). All the strategies here described are validated by invaluable reactor-OFF data, only available to DC (1 week). Last, upon the measurement of θ13, DC articulates further constraining of background exploiting its excellent response control, reducing the main background errors by up to 2x. In this poster, we illustrate the full background tagging and rejection framework (i.e. ~10 different analyses), including the articulation of background higher precision improvement during neutrino oscillation fit. The hereby presented techniques are expected to be of large value for the development of similar techniques by similar detectors.

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Session Classification: Poster Session

Track Classification: Neutrino Physics