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Dr Nigel Lockyer
Director, Fermi National Accelerator

cc: Dr Joseph Lykken, Dr Stephen Geer; Prof Kevin McFarland, Dr Deborah Harris

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Dear Nigel:

We are writing in support of MINERvA's antineutrino data runs and the CAPTAIN-MINERvA project.

T2K has made use of Fermilab neutrino cross-section data in every oscillation analysis from its beginning. Initially it was MiniBooNE and SciBooNE data sets, but, as they have become available, multiple MINERvA results are now incorporated into T2K's external data fits. T2K has its own near detectors, both on and off-axis. Even with these, the external cross-section data play a critical role in selecting neutrino-scattering models for the oscillation analysis and in tuning/restricting parameters within those models.

The fact that these measurements are made in neutrinos and antineutrinos, at energies and on nuclei beyond those used by T2K in its oscillation analysis sample, is actually a strength of the datasets, in that it helps to test models in ways that T2K cannot do by itself. This stems from the fact that each neutrino beam is inherently wide-band in energy with respect to the nuclear effects that drive the systematic uncertainties of neutrino oscillation analyses. Accordingly, T2K expects to benefit from more antineutrino results from MINERvA.

Similarly, CAPTAIN-MINERvA data, because it offers a unique opportunity to compare measurements in two capable detectors with nuclei of significantly different size and density, should be beneficial to the T2K program of using MINERvA data to constrain nuclear models.

Having the legacy datasets from MiniBooNE and SciBooNE is valuable, but there is additional value from a contemporary experiment. There is active feedback between MINERvA and T2K that has resulted in new analyses being completed on MINERvA which then are applied to the T2K oscillation analysis. The coherent pion and low recoil ("2p2h") analysis are good examples of this.

The information provided by MINERvA has been important in not only formulating the systematic uncertainties for the oscillation results, but has also actively helped T2K reduce them to levels below what was foreseen in the original proposal. New data sets with antineutrinos and argon nuclear targets will certainly continue, and enhance, these benefits.

Best regards,
T. Nakaya and M. Wascko
T2K Spokespersons