FJPPL (TYL) application 2026:

NU_09 : Characterization of the upgraded J-PARC neutrino beam for T2K-II and HK experiments

Joint France-Japan research team

February 2026

1 Summary of the project activities

The year 2026 will be the crucial year for the NU_09 TYL-FJPPN project.

In 2026 we will pursue our very successful joint France-Japan project with the main goal of improving our knowledge on the upgraded (anti)neutrino beam produced at J-PARC for T2K-II and Hyper-Kamiokande (HK) experiments. After the important J-PARC neutrino beamline upgrade, it now operates regularly achieving the record beam power of 900 kW, thanks to a reduced repetition rate of 1.28 s. Moreover, operation with a horn current set at 320 kA (instead of 250 kA used previously) is now well established. In 2026, we will continue physics data taking for the T2K experiment using upgraded beamline and neutrino detectors.

The measurements of hadron yields from the surface of the T2K target performed with the upgraded NA61/SHINE spectrometer at the CERN SPS are crucial for detailed characterization of the J-PARC neutrino beam and already allowed to achieve unprecedented precision on flux uncertainties, down to 5%. New data (180 M triggers compared to 10 M used previously) collected during the 2022 are being thoroughly calibrated and analyzed by a joint team of Japanese and French physicists. In 2026, after calibration and analysis of collected data, we plan to obtain first results on the production yields of neutral and charged kaons with high momentum, aiming to reduce even further the neutrino flux errors in T2K and HK.

During 2026 we plan to finalize the deployment of the new time synchronization system being developed for the J-PARC neutrino beam by the joint French-Japanese team. Some stability tests will be performed on the J-PARC site. A free-running Rubidium atomic clock accompanied by a set of GNSS antenna and receiver installed at J-PARC will be fully characterized. Additionally, during T2K experiment data taking, we will conduct tests using the new time

synchronization system to evaluate its measurement stability and other functions. A correction method developed to precisely synchronize a time base generated from a free-running atomic clock with the Coordinated Universal Time (UTC) using signals from a GNSS antenna and receiver will be implemented and continuously monitored.

In 2026 we also plan to continue the study of updated Hyper-Kamiokande sensitivity to the neutrino oscillation parameters using combined information from atmospheric neutrinos and the neutrinos produced by the J-PARC accelerator.

The NU-09 is an ongoing project with well defined and ambitious scientific goals. There is a nice working environment within the joint team. It is important to stress that the group meets regularly on the occasions of NA61/SHINE, T2K and HK collaboration meetings. We also organize dedicated Zoom meetings in order to discuss the ongoing activities and to define plans for the future. In-person workshops are also being scheduled, if needed.

New important results are expected in 2026.