FJPPL Report 2024

Fiscal year April 1st 2024 – March 31th 2025

Please replace the red examples by the appropriate data in black

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

Project Leader	French Group			Japanese Group			
	name	email	lab	name	email	title	lab
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Spending on French Funds

Description	€/unit	Nb of units	Total (€)	Provided by:[1]
Visit to Japan	100/day	10 days	1000	IN2P3
Travel	1000	1 travel	1000	IN2P3
Total			2000	

Spending on KEK Fund

Description	k¥/Unit	Nb of units	Total (k¥)	Provided by:[1]
Visit to France	20/day	10 days	200	KEK
Travel	150	1 travel	150	KEK
Total			350	

Additional spending on French funds			Additional spending on Japan funds		
Provided by:[2]	Type	€	Provided by:[3]	Type	k¥
IN2P3 AP		31000	JSPS	travel	
Total		31000	Total		

[1] IN2P3, Irfu or KEK. [2] French Embassy, other CNRS or CEA programs, PICS, European grants…. [3] JSPS, RIKEN, Universities …

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Summary of 2024 Activities	The main goal of this joint France-Japan project is to improve our knowledge on the upgraded (anti)neutrino beam produced at J-PARC for T2K-II and HyperKamiokande (HK) experiments. The important upgrade of the J-PARC neutrino beamline was finalized in 2023. Operation with a horn current set at 320 kA (instead of 250 kA used previously) has started since the end of 2023 and successfully continues till now. The record beam power of 800 kW has been reached. Dedicated hadron production data collected with a replica of the T2K target using a significantly upgraded NA61/SHINE spectrometer at the CERN SPS are being used to improve our knowledge about the obtained (anti)neutrino flux. The measurements of hadron yields from the surface of the T2K target are crucial for detailed characterization of the J-PARC neutrino beam and already allowed to achieve unprecedented precision on T2K/HK flux uncertainties. New data (180 M triggers compared to 10 M used previously) collected during the 2022 NA61/SHINE run will allow to improve this even further. These data are currently being thoroughly calibrated and analyzed by a joint team of Japanese and French physicists. A significant progress has been achieved during 2024. Another important task for the long-baseline neutrino experiment is the synchronization of the accelerator spill from J-PARC with neutrino interactions observed in the near (ND280) and far (SK or HK) detector. In the framework of this project a new time synchronization system is being developed and being installed at J-PARC by the joint French-Japanese team. An intensive R&D has already been performed at LPNHE and important tests of the selected equipment (GNSS antenna and receiver) were performed in both 2023 and beginning of 2025 at both J-PARC and HK sites. A required scheme of the timing system with a free-running Rubidium atomic clock accompanied by a set of GNSS antenna and receivers is being deployed and tested. A dedicated correction algorithm has been successfully developed and tested in order to align the local reference time with the UTC. This is crucial for future multi-messenger astrophysics with the HK detector. Finally, new important sensitivity studies for neutrino oscillation parameters with the HK long-baseline neutrino program were finalized in 2024. These results have been reported at international conferences and are being submitted for publication.
Workshop / satellite session at annual workshop	The group meets regularly on the occasion 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. At the beginning of 2025 a workshop devoted to the calibration of the upgraded NA61/SHINE spectrometer and analysis of the T2K replica target data was organized in Japan. A talk on the NA61/SHINE experiment (Claire Dalmazzone) and two posters on charged (Shiraishi-san) and neutral (Nishimori-san) kaon production from the T2K replica target have been presented at the J-PARC symposium in October 2024.

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Articles, conference talks & posters related to the TYL project	**Precise synchronization of a free-running Rubidium atomic clock with GPS Time for applications in experimental particle physics,** Claire Dalmazzone, Lucile Mellet, Mathieu Guigue, Boris Popov, Stefano Russo,Vincent Voisin, 2024, e-Print: **2407.20825 [physics.ins-det]** **First Joint Oscillation Analysis of Super-Kamiokande Atmospheric and T2K Accelerator Neutrino Data,** T2K and SK Collaborations, K.Abe et al, 2023, *Phys.Rev.Lett.* 134 (2025) 1, 011801; DOI: **10.1103/PhysRevLett.134.011801** **KS0 meson production in inelastic p+p interactions at 31, 40 and 80 GeV/c beam momentum measured by NA61/SHINE at the CERN SPS,** NA61/SHINE Collaboration, N.Abgrall et al, 2024, *Eur.Phys.J. C* 84 (2024) 8, 820; DOI:10.1140/epjc/s10052-024-13056-2 **NA61/SHINE experiment at the CERN SPS,** C.Dalmazzone (for NA61/SHINE collaboration), talk at the J-PARC symposium, October 2024
Jointly Supervised Students	