FJPPL Report 2023

Fiscal year April 1st 2023 – March 31th 2024

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	title	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	20 days	2000	IN2P3
Travel	1000	2 travels	2000	IN2P3
Total			4000	

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		35000	JSPS	travel	140
Total			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 2023 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 320kA (instead of 250kA used previously) was performed at the end of 2023. The record beam power of 760kW 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 flux uncertainties. New data (180M triggers compared to 10M used previously) collected during the 2022 NA61/SHINE run will allow to improve this even further. These data are currently being calibrated and analyzed by a joint team of Japanese and French physicists. A significant progress has been achieved during 2023. 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 will be 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 during summer 2023 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 will be deployed and tested. Finally, new important sensitivity studies for the HK long-baseline neutrino program were performed in 2023. The results have been reported at international conferences and are being prepared 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. During 2023 we organized two in-person workshops devoted to the calibration of the upgraded NA61/SHINE spectrometer and analysis of the T2K replica target data. A seminar at LPNHE on the supernovae detection at HK by Koshio-san in December 2023.
Articles, conference talks & posters related to the TYL project	**Development of a Clock Generation and Time Distribution System for Hyper-Kamiokande,** Lucile Mellet, Mathieu Guigue, Boris Popov, Stefano Russo,Vincent Voisin, 2023, *Phys.Sci.Forum* 8 (2023) 1, 72; DOI: **10.3390/psf2023008072** **Updated T2K measurements of muon neutrino and antineutrino disappearance using 3.6x10^{21} protons on target,** T2K Collaboration, K.Abe et al, 2023, *Phys.Rev.D* 108 (2023) 7, 072011; DOI: **10.1103/PhysRevD.108.072011** **Addressing the challenge of neutrino interaction uncertainties in Hyper-Kamiokande ,** C.Dalmazzone (for HK collaboration), talk at the NNN'2023 conference, October 2023

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Jointly Supervised Students	