

**Addendum to EOI-015: requests to CERN from EOI-015 project****“Near detectors based on gas TPCs for neutrino long baseline experiments”****1. Status of the project**

The T2K collaboration discussed the ND280 upgrade project in its collaboration meeting in the second week of February and formally decided to launch it in its Collaboration General Assembly: *“On February 11, 2017, the T2K Collaboration launched its Near Detector Upgrade project. The upgrade is targeted at reducing systematic errors in T2K’s search for CP violation in the neutrino sector. The current conceptual design will be developed into a technical design, leading to a full proposal, by the end of 2017. The collaboration aims to install the upgraded near detector around 2020, to fully benefit from the foreseen increase of the J-PARC MR beam power.”* The project leader is Marco Zito (CEA-IRFU, Saclay), the deputy is Masashi Yokoyama (University of Tokyo, Japan) and the project contact-person with CERN is Alain Blondel (DPNC, University of Geneva).

The 2nd Workshop on Neutrino Near Detectors based on gas TPCs <https://indico.cern.ch/event/613107/> was held at CERN 20-21 March 2017. At this occasion more concrete proposals for the project were presented in particular by CERN members (see below). A special PI meeting (group leaders of all institutions) was held at the occasion of the workshop, during which were reviewed 1) a table of work-packages and work-package conveners; 2) the status of available, requested or pencilled resources by the various members of the collaboration; and 3) the general schedule.

**The list of work-packages**, involved institutes and contact persons is as follows.

	WP name	Institutes	Conveners
WP1	Mechanical design and integration	<b>CERN</b> , UNIGE, Krakow, Liverpool	D. Sgalaberna, M. Batkiewicz
WP2	TPC field cage and gas vessel	INFN	E. Radicioni, G. Collazuol
WP3	TPC Readout system	<b>CERN</b> , CEA	<b>TBD</b> , A. Delbart
WP4	TPC electronics and DAQ	CEA, Warsaw, LPNHE-Paris	D. Calvet, A. Rychter
WP5	Scintillator-based trackers	Japan groups, LLR-Palaisseau,	M. Yokoyama
WP6	TOF system	INR, UNIGE, Sofia, Uppsala	Y. Kudenko
WP7	Gas system and calibration	<b>CERN</b> , Aachen, Barcelona, Winnipeg	<b>TBD</b> , B. Jamieson
WP8	Test beam measurements	<b>CERN</b> , IFAE	S. Bordoni, F. Sanchez
WP9	High Pressure TPC	UK groups	A. Kaboth, M. Wascko
WP10	Simulation and optimization studies	All	D. Sgalaberna
WP11	Physics studies	All	S. Bolognesi, C. Giganti
WP12	DAQ	Oxford	G. Barr
WP13	Software	ICLondon	Y. Uchida

**Resources** are secured for R&D in CEA, Japan, Spain, Switzerland, Russia, UK. The Japanese groups already have funding for the ND280 detector upgrade. Funding requests for construction have been submitted or are pencilled to be submitted in France, Italy, Poland, Switzerland, Russia. The collaboration plans to submit an ITN request to EU. The study towards the proposal in 2017 will lead to a definition of the responsibilities of the various parties.

## **Timescales**

In a first step (2017) the aims are: 1) finalize the T2K ND280 upgrade configuration and its cost estimate, to be agreed by the collaboration in the October 2017 collaboration meeting; 2) prepare a full proposal to the CERN SPSC (and the JPARC PAC), for the development and construction of state-of-the-art components for near detectors based on gas TPCs both for the T2K off axis ND280 upgrade (T2K-II) and for high pressure TPC prototypes for future neutrino experiments. This proposal will serve as basis for funding requests. A technical reference document will be prepared in the following 6 months to prepare construction. Test beam of TPC prototypes could take place in summer 2018. Construction is expected to take place in 2018-2020, followed by installation in T2K for data taking in 2021.

## **2. CERN contributions**

The work will be executed in collaboration with the other participants to the project. The following concerns only the first phase (preparation of proposal).

### Work packages led by CERN:

-- **WP3** Study and cost estimate of the TPC readout system including the MPGC (Micromegas or GEM) devices, and the associated mechanics (in collaboration with IRFU/Saclay). See the presentation “Resistive Bulk MicroMegas at CERN , screen printing vs. diamond-like carbon” by Rui de Oliveira (CERN EP-DT) at the 2d TPC workshop <https://indico.cern.ch/event/613107/>

-- **WP7** Study and cost estimate of the gas system with the required calibration capabilities (in collaboration with Aachen, Barcelona, Winnipeg). See the presentation “Gas systems for particle physics experiments” by Roberto Guida (CERN EP-DT) at the 2d TPC workshop <https://indico.cern.ch/event/613107/>

-- **WP8** Study of possible test beam measurements both for detector testing and physics related quantities (in collaboration with IFAE Barcelona). See the session on test beam measurements organized by Stefania Bordoni (CERN EP-NU) at the 2d TPC workshop <https://indico.cern.ch/event/613107/> The specific requirements for test beam at CERN will be determined in the course of the project. If possible and for the major ones they will be spelled out in the proposal.

### Inside the work package **WP1** on mechanical design and integration:

-- engineering (one engineer) to assist in the study and design of the mechanical integration of TPCs with the other detector elements. In the case of T2K these are: water or scintillator targets, time-of-flight, calorimeters inside the T2K ND280 basket, using a structure that is as light and transparent as possible. In the case of High Pressure TPC: issues related with the high pressure vessel, feed-throughs, etc. In the case of test beam projects, integration of the test beam set-up, possible magnet integration. Evaluation of the space and time required at CERN for the integration tasks and general project management. (In collaboration with UniGE, Cracow, Liverpool and others) This will require a new person in the framework of the neutrino platform.

Inside the work packages **WP10** and **WP 11** on physics and simulation study

-- Participation in the working groups on simulation and optimization studies and physics studies;  
Engagement and collaboration (organisation of workshops; interaction with, and involving, theorists)  
to develop phenomenological studies to improve the current understanding and modelling of  
neutrino interactions which impact will be of clear benefit for the world-wide neutrino community.  
Albert de Roeck, S. Bordini et al. (EP-nu group)