

ISTITUTO NAZIONALE DI FISICA NUCLEARE

CONSIGLIO DIRETTIVO

DELIBERAZIONE N. 14227

Il Consiglio Direttivo dell'Istituto Nazionale di Fisica Nucleare, riunito a Roma in data 29 novembre 2016, alla presenza di n. 33 suoi componenti su un totale di n. 34;

- premesso che l'Istituto Nazionale di Fisica Nucleare e la Collaborazione ICARUS, sulla base di un lungo programma di R&D, hanno sviluppato la tecnologia denominata "Liquid ARgon Time Projection Chamber" (nel seguito LAr-TPC) per la rivelazione di neutrini;
- vista la deliberazione della Giunta Esecutiva n. 10542 del 10 dicembre 2014 ratificata successivamente dal Consiglio Direttivo con deliberazione n. 13451 del 19 dicembre 2014, con la quale è stato approvato l'Addendum n. 2 to the Memorandum of Understanding for the Collaboration in the Neutrino Program "WA104" – Improving the ICARUS T600 Liquid Argon Time Projection Chamber (LAr-TPC) in order to prepare for its operation at shallow neutrino depths" e sulla base del quale il CERN si è reso disponibile ad ospitare provvisoriamente il rivelatore ICARUS-T600 presso una delle sue sale sperimentali, in attesa di essere trasferito e installato in via definitiva presso il FNAL americano;
- preso atto che il programma di upgrade del rivelatore è terminato e che il rivelatore è pronto per essere inviato e installato al FNAL;
- visto lo schema di "Addendum n. 7 to the Memorandum of Understanding for the Collaboration in the Neutrino Program "WA104-2" – Updated WA104 MoU-Addendum for installation and commissioning of the ICARUS T600 Liquid Argon Time Projection Chamber (LAr-TPC) as far detector in the Short Baseline Neutrino (SBN) facility at FNAL", allegato alla presente deliberazione e di essa parte integrante;
- vista la nota del Presidente di Commissione Scientifica Nazionale II, Prof. M. Pallavicini, del 8 novembre u.s.
- su proposta della Giunta Esecutiva;
- con n. 33 voti favorevoli;

DELIBERA

- 1) E' approvato lo schema di "Addendum n. 7 to the Memorandum of Understanding for the Collaboration in the Neutrino Program "WA104-2" – Updated WA104 MoU-Addendum for installation and commissioning of the ICARUS T600 Liquid Argon Time Projection Chamber (LAr-TPC) as far detector in the Short Baseline Neutrino (SBN) facility at FNAL", allegato alla presente deliberazione e di essa parte integrante.
- 2) Gli oneri finanziari derivanti dall'attuazione del presente Accordo, pari a CHF 3.389.000,00, corrispondenti a circa 3.139.000,00 Euro, per il periodo 2016-2019, trovano copertura sui fondi assegnati alla Commissione Scientifica Nazionale II per l'iniziativa specifica.

Addendum No. 07

to the

Memorandum of Understanding

for Collaboration in the Neutrino Program

WA104-2

Updated WA104 MOU-addendum for the installation and commissioning of the ICARUS T600 Liquid Argon Time Projection Chamber (LAr TPC) as far detector in the Short Baseline Neutrino (SBN) facility at FNAL.

Considering that:

The Italian Istituto Nazionale di Fisica Nucleare (INFN) and the ICARUS Collaboration have developed the technology of the LAr-TPC.

INFN and CERN have signed a common addendum (#2) to the MOU of the CERN Neutrino Platform for the preparation of the existing ICARUS detector at CERN, ready to be shipped for installation as far detector in the SBN Neutrino facility at FNAL.

The next step for the ICARUS detector is the shipment and installation at FNAL. All what is necessary for this activity, including all necessary warm electronics and front-end infrastructure is presented in the new Addendum (#7) to the existing CERN Neutrino Platform MOU.

With the endorsement of the present Addendum (#7), INFN and CERN have accepted the enclosed program and are willing to fund the undertaking hereby described.

It is agreed as follows

Article 1: Purpose

- 1.1 The purpose of this Addendum is to lay down the terms of participation of the contributing Institutes and Funding Agencies for the installation of ICARUS T600 at FNAL.
- 1.3 All the Annexes are an integral part of this Addendum.

Article 2: Parties

- 2.1 The Parties to this MOU shall be all WA104 Institutes that are contributing to the upgrading of ICARUS T600 and of the related R&D, their Funding Agencies (the Neutrino Funding Agencies) and CERN as the Host Laboratory. The current list of involved Institutes and Funding Agencies is given in Annex 3.

Article 3: Duration

- 3.1 The activities foreseen in the Addendum take effect from the date of signature and shall remain valid until 31st December 2018. The Addendum can be extended by mutual agreement in writing.

Article 4: Procurement strategy

- 4.1 Given the short time allowed by the schedule of operations, it is proposed that, in case INFN requests it, some of the procurements related to Annex 2, will be executed by CERN. Case by case INFN will propose to CERN a re-imbursment profile, which will need to be first formally agreed by CERN. The re-imbursment will be done on the CERN team account T299670.

ANNEXES

- Annex 1: List of Institutes participating to WA104
- Annex 2: Value of deliverables, grouped by Funding Agency and/or sub-units (systems) and expenditure profile and manpower resources
- Annex 3: Milestones

The European Organization for Nuclear Research (CERN)

and

The INFN, on behalf of the WA104 Collaboration

endorse the Present Addendum to the Memorandum of Understanding with the indicated installation activities of ICARUS T600.

for CERN

The Director of Research and Computing

Richard Flöser

27.10.2016

for INFN, on behalf of INFN participating Institutes

The President

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Signature

Place and Date

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ANNEX 1:

List Institutes and Representatives of WA104

1. *INFN, LNGS, Assergi (AQ), Italy,
represented by Chiara Vignoli*
2. *INFN, Sezione di Padova, 35131 Padova, Italy,
represented by Alberto Guglielmi*
3. *INFN, Sezione di Pavia, 27100 Pavia, Italy,
represented by Claudio Montanari*
4. *INFN, Sezione di Milano Bicocca, Dipartimento di Fisica G. Occhialini,
20126 Milano, Italy, represented by Maurizio Bonesini*
5. *INFN, Sezione di Milano, 20133 Milano, Italy,
represented by Paola Sala*
6. *INFN, Sezione di Napoli, 80126 Napoli, Italy,
represented by Alfredo Cocco*
7. **Gran Sasso Science Institute (GSSI), L'Aquila, Italy,
represented by Carlo Rubbia**
8. *INFN, Sezione di Catania, Catania, Italy,
represented by Vincenzo Bellini*
9. *CERN, Geneva, Switzerland,
represented by Marzio Nessi*

ANNEX 2: Value of deliverables, grouped by Funding Agency and/or sub-units (systems) and payment profile and manpower resources. For simplicity an exchange rate of Euro=CHF=US\$=1 has been used.

#	Item	cost KCHF	INFN (%)	CERN (%)	start	end	CERN/ INFN costs
<i>T600 transport to FNAL</i>							
1	Two cold vessels with TPC inside	350	0	100	Feb-17	May-17	350
2	Two dewar vessels for Ar and Nitrogen	38	0	100	Aug-16	Oct-16	38
3	Warm vessel + insulation	160	0	100	Nov-16	Feb-17	160
5	All warm electronics and components ordered at CERN	70	0	100	Mar-17	Sep-17	70
6	All installation tools	12	0	100	Nov-16	May-17	12
	<i>total</i>	<i>630</i>	<i>0</i>	<i>630</i>			<i>630</i>
<i>T600 PMT-electronics + DAQ</i>							
7	24 FADC boards x 16 channels, 14 bit each at 500 MHz. 384 channels in total to readout 360 phototubes (One board is spare). Single channel waveform recording. An FPGA is installed on each board for internal trigger, zero skipping and other operations. Discriminated output (LVDS) for external trigger logic. CONET communication for DAQ, identical to the one of the readout boards for the wires	240	100	0	Jan-17	Sep-17	240
8	4 crates are required. They will be recovered from the previous T600 installation. Power supplies have to be upgraded to match the new requirements.	10	100	0	Mar-17	Jul-17	10
9	A3818C boards. CONET communication boards. 6 Boards are needed. They will be procured together with the ones required for the wires readout	12	100	0	Mar-17	Jul-17	12
10	PCI-Express BUS + CPU + Mem. + Eth. Server. 6 rack-mounted computers to be connected to each A3818C (through optical fibre), output on copper or (optional) on fiber. Each CPU (8 cores) handles 4 readout boards (64 channels). 4 cores are dedicated to the DAQ of the 4 boards. 4 cores will be used for additional operations (filtering, logic, data compression).	12	100	0	Mar-17	Jun-17	12
11	Supervisor and event building servers dedicated to the PMTs	3	100	0	Mar-17	Jul-17	3
12	Fibers for communication between V1730B and A3818C boards. Cables for clock distribution. Cables to distribute logical signals and other cables + spares + signal adapters	7	100	0	Mar-17	Jul-17	7
13	8/10 radial to SHV adapters (48 channels each) to adapt the output of the HV supplies (Radial multi pin connector) to the single channel input of each PMT (SHV)	15	100	0	Mar-17	Jul-17	15
14	External cabling for HV and signals	40	100	0	Mar-17	Jul-17	40
15	2 FPGA boards for first level trigger of the PMTs. Handle the discriminated output of the V1730B boards (LVDS)	7	100	0	Mar-17	Jul-17	7
	<i>total</i>	<i>346</i>	<i>346</i>	<i>0</i>			<i>346</i>
<i>T600 readout, warm mechanical components</i>							

16	PMT HV and signal flanges. 36 DN100CF flanges with 10 signal feedthroughs for the PMTs + 4 SHV feedthroughs for the wires biasing. 36 DN100CF flanges with 10 SHV feedthroughs for the PMTs + 4 SHV feedthroughs for the wires biasing. 8 DN100CF Flanges with 4 SHV feedthroughs for the wires biasing + 2 multi pin feedthroughs for readout the LAr levels and temperature probes.	200	100	0	Oct-16	Apr-17	200
17	96 + 4 spares custom design DN200CF Feedthrough flanges for the wires readout	200	100	0	Oct-16	Apr-17	200
18	96 + 4 spares mini crates to host the wires readout electronics	220	100	0	Oct-16	Jul-17	220
19	Missing by-metal tubes	30	0	100	Apr-16	Jul-16	30
	<i>total</i>	<i>650</i>	<i>620</i>	<i>30</i>			<i>30 / 620</i>
<i>T600 DAQ + trigger items</i>							
20	24 hosts (server ps 1U rack), 1 CPU (8 cores) handles 2 CAEN CONET boards , 48 CAEN CONET communication A3818. 210 fibers, 1100 transceivers, links, , optical fibre couples, 40 m length, to connect the mini crates to the A3818 boards . Timing board (NI PXI-6683 or similar compatible with White Rabbit System) .	235	100	0	Mar-17	Jun-17	235
	<i>total</i>	<i>235</i>	<i>235</i>	<i>0</i>			<i>235</i>
<i>T600 laser calibration system</i>							
21	10 optical fibre splitters to distribute the calibration signal on 10 PMTs (36 splitters + 4 spares). To be installed inside the detector on the top flanges	40	100	0	Mar-17	Jul-17	40
22	400 FC to FC connectors for the internal optical fibers. 40 optical feedthroughs on DN40CF flanges + CF to CF adapters	33	100	0	Mar-17	Jul-17	33
23	Laser with control electronics (timing and pulse-height). Mechanical components for support and alignment .	18	100	0	Mar-17	Jul-17	18
24	Laser triggering electronics + laser power meter	5	100	0	Mar-17	Jul-17	5
25	1 to 42 commercial optical switch to distribute the calibration signal from the laser to the feedthrough flanges.	15	100	0	Mar-17	Jul-17	15
26	36 fibers + 4 spares to transport the calibration signal from the optical switch to the feedthrough flanges. Length = 20 m.	12	100	0	Mar-17	Jul-17	12
	<i>total</i>	<i>123</i>	<i>123</i>	<i>0</i>			<i>123</i>
<i>T600 warm electronics and cold components</i>							
27	874 Digital Boards (64 channels each)	1750	100	0	Mar-17	Sep-17	1750
28	6.050 Pre-amplifier (8 channels each)	177	100	0	Mar-17	Sep-17	177
29	Linear Power Supplies for Mini-Crates	120	100	0	Mar-17	Sep-17	120
30	Communication card	18	100	0	Mar-17	Sep-17	18
31	Decoupling boards (components and industrial assembly)	150	0	100	Mar-16	Oct-16	150
	<i>total</i>	<i>2215</i>	<i>2065</i>	<i>150</i>			<i>150/2065</i>

<i>T600 installation at FNAL</i>							
32	Cryogenics installation at FNAL	300	0	100	Jul-17	Dec-17	300
33	Specific assembly tools	115	0	100	Oct-16	Jun-17	115
34	CERN assembly technical manpower at FNAL:4 FTEs, incl. travel costs	0	0	100	Dec-16	Dec-17	0
35	INFN assembly technical manpower at FNAL: 4.5 FTEs, incl travel costs	0	100	0	Dec-16	Dec-17	0
	<i>total</i>	<i>415</i>	<i>0</i>	<i>415</i>			<i>415 / 0</i>
	Gran Total T600 (KCHF)	INFN Contrib.		CERN Contrib.			
	4614	3389		1225			

ANNEX 3: Project Milestones

1. T600 Cold vessels transport to FNAL: April 2017
2. Start warm structure installation at FNAL: January 2017
3. T600 Cold vessels installation at FNAL: June 2017
4. ICARUS installed and connected : December 2017
5. ICARUS ready for cool down : January 2018