

KM3780/EP
Addendum No. 1
to
Collaboration Agreement KN3774/EP
for the SHiP Program at CERN

Muon flux measurement at H4

Considering that:

The SHiP Program is governed by Collaboration Agreement KN3774/EP (“the Agreement”), including its Annexes, Addenda and Amendments, which provides the organisational, managerial and financial framework for the execution of the SHiP Program;

Articles 3.1 and 3.3 stipulate that the SHiP Program shall be organised as projects (“the SHiP Projects”) and that each SHiP Project shall be defined in a dedicated Addendum to the Agreement, to be signed by CERN as the Host Laboratory and the SHiP Institutions (as defined in the Agreement) participating in the Project;

On the basis of the proposal for a SHiP Project entitled “Muon flux measurement at H4” (“the Project”) submitted on 12 June 2017 to the SPS and PS Experiments Committee (“SPSC”) (CERN-SPSC-2017-020/SPSC-EOI-016) and a detailed review of the scientific merits, the technological feasibility and estimates of the needed resources, SPSC has recommended the approval of the proposed Project;

The Project includes the design/construction/testing etc. of a replica target and hadron absorber and the measurement of the momentum spectrum of muons entering the SHiP active muon shield.

It is agreed as follows

Article 1: Purpose

1.1 The purpose of this Addendum is to lay down the terms of participation of SHiP Institutions in the Project, which is described in Annex 1. This Addendum is subject to the provisions of the Agreement and signature of this Addendum therefore constitutes approval of the Agreement.

1.2 The Annexes form an integral part of this Addendum.

Article 2: Parties

2.1 The Parties to this Addendum shall be the SHiP Institutions contributing to the Project and CERN as the Host Laboratory. The current list of participating SHiP Institutions is included in Annex 2.

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Article 3: Duration

3.1 This Addendum shall take effect on the date of its signature. It shall remain effective until the termination of the SHiP Program, subject to continued recommendation and approval of the SPSC and the CERN Research Board.

Article 4: The Project

4.1 The work plan consists of a number of sub-units, work packages and/or deliverables as listed in Annex 1.

4.2 The management structure of the Project is described in Annex 3.

4.3 Annex 4 sets out the deliverables, including their value, grouped by Funding Agency.

4.4 A set of Project milestones is included in Annex 5.

Article 5: Financial procedures

5.1 Pursuant to Article 9 of the Agreement, a budget code for the purposes of the SHiP Project is held and administered by CERN. Participating SHiP Institutions may financially contribute to this budget code on a voluntary basis in accordance with the estimated value of deliverables stated in Annex 4.

5.2 The aforementioned budget code is available to cover material, equipment and manpower costs connected to the SHiP Project, on condition that sufficient funds are available on the said budget code.

ANNEXES

Annex 1: Description of the Project

Annex 2: Participating SHiP Institutions

Annex 3: Management structure of the SHiP Program and of the Project

Annex 4: Value of deliverables grouped by Funding Agency

Annex 5: Project milestone

The European Organization for Nuclear Research (CERN)

and

National University of Science and technology MISiS

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

Done in Geneva

29 SEP. 2017

For the European Organization for Nuclear Research (CERN), as the Host Laboratory of the SHiP Program

Eckhard Elsen
Director for Research and
Computing

Eckhard Elsen

Anders Unnervik
Head of Procurement
and Industrial Services

Anders Unnervik

Thierry Lagrange
Head of Industry, procurement
and Knowledge Transfer department

Thierry Lagrange

For the participating SHiP Institution

Institute / Funding Agency

Signatory (Rector)

National Institute of Science and Technology MISiS

Place and Date

Signature (SHiP Team Leader)



The European Organization for Nuclear Research (CERN)

and

The University of Hamburg

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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29 SEP. 2017

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Director for Research and
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Anders Unnervik
Head of Procurement
and Industrial Services

Anders Unnervik
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Thierry Lagrange
Head of Industry, procurement
and Knowledge Transfer department

Thierry Lagrange
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

University of Hamburg

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Place and Date

Signature

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The University of Geneva

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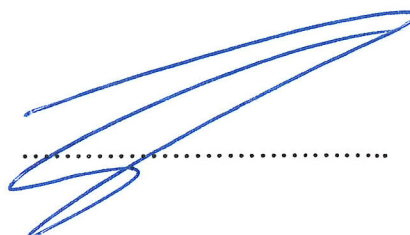
Eckhard Elsen
Director for Research and
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Anders Unnervik
Head of Procurement
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Thierry Lagrange
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

University of Geneva

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Place and Date

Signature

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The European Organization for Nuclear Research (CERN)

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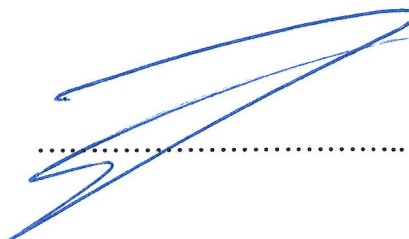
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Thierry Lagrange
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

Istituto Nazionale di Fisica Nucleare (INFN)

Place and Date

Signature

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The European Organization for Nuclear Research (CERN)

and

The University of Korea, KODEL

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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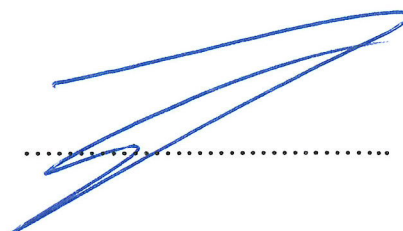
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Thierry Lagrange
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

University of Korea

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Place and Date

Signature

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or

The European Organization for Nuclear Research (CERN)

and

The University of Bonn

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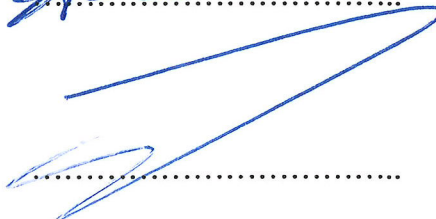
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

University of Bonn

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Place and Date

Signature

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The European Organization for Nuclear Research (CERN)

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The Ecole Polytechnique Fédérale de Lausanne (EPFL)

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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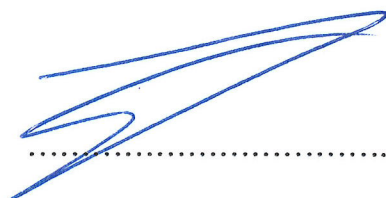
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

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Place and Date

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The European Organization for Nuclear Research (CERN)

and

Imperial College London

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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29 SEP. 2017

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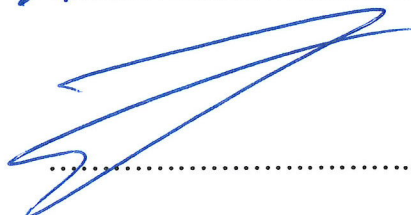
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

Imperial College London

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Place and Date

Signature

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The European Organization for Nuclear Research (CERN)

and

The University of Nagoya

declare that they agree on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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29 SEP. 2017

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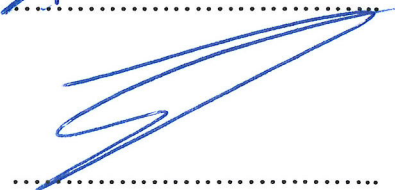
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For the participating SHiP Institution

Institute / Funding Agency

Signatory

University of Nagoya

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Place and Date

Signature

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The European Organization for Nuclear Research (CERN) declares that it agrees on Addendum No 1 to Collaboration Agreement KN3774 for the SHiP Program at CERN concerning the SHiP muon flux measurement at H4.

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29 SEP. 2017

For the European Organization for Nuclear Research (CERN), as the Host Laboratory of the SHiP Program

Eckhard Elsen
Director for Research and
Computing



For the European Organization for Nuclear Research (CERN), as a participating SHiP Institution

Signatory

Place and Date

Signature

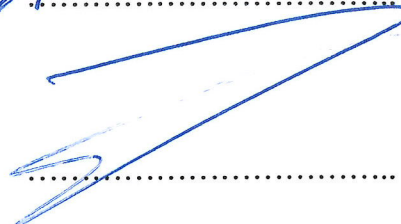
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Anders Unnervik
Head of Procurement
and Industrial Services



Thierry Lagrange
Head of Industry, procurement
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ANNEXES TO ADDENDUM No. 1

ANNEX 1: Description of the Project

The objective of the muon flux measurement at H4 is to determine the momentum spectrum of muons after the SHiP target and hadron absorber to make a more realistic design of the muon shield. The setup will also be used to do an optimization run of the charm cross-section measurement.

The muon flux measurement is organized in three work packages described in summary below.

Work package 1: Construction of a replica of the SHiP target. The specifications of the replica target are given in <https://edms.cern.ch/document/1823120/1>.

Work package 2: Construction of the muon flux measurement detector, comprising scintillators for triggering, drift tubes for tracking and RPCs for muon identification.

Work package 3: Construction of the detector for the charm cross section optimization run, consisting of additional silicon and scintillating fibre detectors for tracking and emulsion films for vertexing.

ANNEX 2: Participating SHiP Institutions

1. National University of Science and Technology MISiS, represented by: Y. Krasilnikova
2. CERN, represented by H. Dijkstra
3. University of Hamburg, Germany (BMBF, DFG), represented by D. Bick
4. University of Bonn, Germany (BMBF, DFG), represented by M. Cristinziani
5. INFN represented by W. Bonivento. Participating groups: Università Federico II and INFN of Naples, and University and INFN of Bari, Italy
6. KODEL, University and of Korea, Korea, represented by S. K. Park
7. Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland (Swiss National Science Foundation), represented by A. Bay
8. University of Geneva, Switzerland, represented by P. Mermod
9. Imperial College, London, United Kingdom, represented by M. Patel
10. University of Nagoya, Nagoya, Japan, represented by M. Komatsu

ANNEX 3: Management structure of the SHiP Program and of the Project

Spokesperson: **A. Golutvin**

Technical Coordinator: **R. Jacobsson**

Chairperson of the SHiP Board: **E. van Herwijnen**

Project leader for the muon flux measurement: **E. van Herwijnen**

Project leader for the charm cross-section measurement: **G. De Lellis**

ANNEX 4: Value of deliverables grouped by Funding Agency

The following table summarizes the deliverables for the construction of the SHiP replica target.

	COST [kCHF]	CERN	MISiS	INFN	Nagoya
Container box	10	10			
W, Mo, Ta	50		50		
Emulsion	30				30
Movable table prototype	5			5	
Mechanics	10		10		
Total [kCHF]	105	10	60	5	30

Table 1: Work package 1, construction of the SHiP replica target

The following table summarizes the deliverables for the construction of the muon flux detector.

	COST [kCHF]	CERN	IC	Hamburg	INFN	Geneva	KODEL
Beam definition scintillator	5					5	
Drifttube tracking stations+DAQ	50			50			
RPC gaps/strips	20						20
RPC Bakelite, electronics & mechanics	30				30		
Sw integration, analysis	44	24	10		10		
Total [kCHF]	149	24	10	50	40	5	20

Table 2: Work package 2, construction of the SHiP muon flux detector

The following table summarizes the deliverables for the construction of the charm cross-section detector.

	COST [kCHF]	MISiS	Bonn	EPFL	INFN
Silicon trackers	20		20		
SciFi trackers	50			50	
Magnet for target	10	10			
Sw integration, analysis	20				20
Total [kCHF]	100	10	20	50	20

Table 3: Work package 3, construction of the SHiP charm cross section detector

ANNEX 5: Project milestones

1. Construction of the target replica and its container box: December 2017
2. Delivery of passive material for the charm cross section target: December 2017
3. Assembly of the drifttubes: January 2018
4. Assembly of the RPCs: February/March 2018
5. Assembly of the trigger including the beam definition scintillator: January/February 2018
6. Assembly of the silicon detectors: February/March 2018
7. Assembly of the Scintillating Fibre Detectors: February/March 2018
8. Commissioning of the detector with cosmics: February/March 2018
9. Data taking: March/April 2018

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