

Memorandum on Cooperation for the Muon Collider (MC) Study

THE INSTITUTES, LABORATORIES, UNIVERSITIES AND FUNDING AGENCIES AND OTHER SIGNATORIES OF THIS MEMORANDUM ON COOPERATION AND CERN AS THE HOST ORGANIZATION (“the Participants”)

Whereas

At a dedicated session of the CERN Council held on 19 June 2020, the Council updated the European Strategy for Particle Physics which included *inter alia* the following statement:

“...Innovative accelerator technology underpins the physics reach of high-energy and high-intensity colliders. It is also a powerful driver for many accelerator-based fields of science and industry. The technologies under consideration include high-field magnets, high-temperature superconductors, plasma wakefield acceleration and other high-gradient accelerating structures, bright muon beams, energy recovery linacs. The European particle physics community must intensify accelerator R&D and sustain it with adequate resources. A roadmap should prioritise the technology, taking into account synergies with international partners and other communities such as photon and neutron sources, fusion energy and industry. Deliverables for this decade should be defined in a timely fashion and coordinated among CERN and national laboratories and institutes.”

The underlying Deliberation Document of the 2020 Update of the European Strategy for Particle Physics stipulates that, in addition to high field magnets, the accelerator R&D roadmap should contain:

“...an international design study for a muon collider, as it represents a unique opportunity to achieve a multi-TeV energy domain beyond the reach of e^+e^- colliders, and potentially within a more compact circular tunnel than for a hadron collider. The biggest challenge remains to produce an intense beam of cooled muons, but novel ideas are being explored”;

A conceptual design study for a muon collider (the “MC Study”) shall be available in time for the next Update of the European Strategy for Particle Physics;

CERN has offered to act as the initial host of the MC Study, it being understood that hosting responsibilities may transfer to another institute in the course of the study,

It is hereby acknowledged:

1. Purpose of this Memorandum

- 1.1. This Memorandum establishes a common basis among the Participants for the collaborative effort required for the execution of the MC Study. The MC Study and its results shall be used for peaceful purposes only.
- 1.2. By signing this Memorandum, the signatory becomes a Participant in the MC Study, together with the other institutes, laboratories, universities and their funding agencies who are, or who subsequently decide to become, Participants in the MC Study.
- 1.3. It is expressly acknowledged that, except for Articles 4.2, 4.3, 6, 8 and this Article, this Memorandum is not legally binding and each Participant's involvement in the MC Study is on a "best-efforts" basis. This Memorandum does not imply any commitment of resources. Each Participant's involvement in the MC Study is governed, as the case may be, by its internal policies and regulations and the laws to which it is subject.

2. Scope

- 2.1. At the date of conclusion of this Memorandum it is envisaged that the main emphasis of the MC Study shall be to establish whether the investment into a full Conceptual Design Report ("CDR") and demonstrator for a muon collider is scientifically justified. The MC Study shall provide a baseline concept for a muon collider, well-supported performance expectations and assess the associated key risks as well as the cost and electricity consumption drivers. It shall also identify an R&D path to demonstrate the feasibility of the collider and support its performance claims.

In particular, the MC Study shall focus on the high-energy frontier and consider options with a centre-of-mass energy of 3 TeV and of 10 TeV or more.

Potential synergies with other projects shall be explored and used where beneficial to the MC Study.

3. Organization

- 3.1. CERN shall act as the initial host organization for the MC Study, until such time as a change to the hosting of the MC Study shall be agreed by the International Collaboration Board ("ICB") following a proposal by CERN, whereupon this Memorandum shall be amended accordingly.
- 3.2. The MC Study shall be executed through the following entities, each of which shall decide on its own decision-making procedures:

- (i) An International Collaboration Board (ICB) whose mandate is to oversee the MC Study and channel contributions from the Participants. Each Participant shall have one representative in the International Collaboration Board. The ICB shall elect its Chair and can invite representatives of institutes that have not signed this Memorandum to participate in the discussions, without the right to vote.
- (ii) An International Advisory Committee whose mandate is to review the scientific and technical progress of the Study typically on an annual basis and to submit recommendations to the ICB.
- (iii) The MC Study Leader's (the "Study Leader") mandate is the overall coordination and organisation of the MC Study. He or she will be appointed by the ICB and guided by its decisions, and will act under the authority of the head of the host organization.
- (iv) The term of office of the Study Leader shall be three years, renewable.

3.3. The host organization shall provide administrative support to the Study Leader.

4. Mandate of the Study Leader

4.1. The Study Leader shall:

- organise and guide the study;
- establish collaborations with the Participants and any other involved entities;
- ensure coherent communications;
- coordinate all resources associated with the MC Study;
- organise workshops, conferences and meetings relevant for the MC Study.

4.2. It is understood that the activities of the Study Leader do not diminish the Participants' responsibility for the delivery of their contributions, nor responsibility for their personnel, including but not limited to the provision of social insurance.

4.3. Insofar as required, where a Participant's personnel spend time at CERN, they may be granted the status of associate member of CERN's personnel. The Participant agrees to, in particular, ensure that health insurance cover for such personnel at levels that are adequate in CERN's host states, Switzerland and France, is in place for the duration of their association with CERN.

5. Contributions by the Participants

- 5.1. Each Participant's contribution to the MC Study shall be laid down in Addenda to this Memorandum, which shall be signed by the Study Leader (or his designated representative) and a representative of the Participant.
- 5.2. The Participants may, as between themselves, and with any other entity, enter into arrangements or agreements as may be necessary for the delivery of their contributions, provided always that their terms shall be consistent with the provisions of this Memorandum.
- 5.3. Except as agreed otherwise, each Participant shall bear the cost of its contribution to the MC Study. A Participant may contribute in terms of funds, expertise, equipment, materials, knowledge and other resources to the realization of any other Participant's contribution.

6. Intellectual Property

- 6.1. Title in intellectual property that is developed by a Participant in the execution of this Memorandum shall be vested in that Participant (or if developed collectively by two or more Participants, vested in those Participants), who shall grant the other Participants a free, non-exclusive licence for the use of such intellectual property in the execution of their scientific programmes, including their participation in the MC Study.
- 6.2. Each Participant that provides intellectual property under this Memorandum to another Participant does not provide any warranty in respect of such intellectual property and any Participant using such intellectual property shall be exclusively liable for any cost and expense resulting from such use.

7. Publications

- 7.1. The Participants shall jointly publish the results of their collaboration as Open Access publications.
- 7.2. Publications shall acknowledge the collaboration between the Participants, including, wherever appropriate, the experts having taken part in the development of the results covered by the publication.

8. Liability

Except as expressly provided in this Memorandum, the Participants shall have no liability in connection with their participation in the MC Study.

9. Duration

- 9.1. In recognition of the fact that this Memorandum does not imply any commitment of resources, a Participant may withdraw from this Memorandum by giving a minimum of three months written notice to CERN as the host organization.
- 9.2. This Memorandum shall remain in force for as long as required to give effect to its provisions.

Signed by the authorized representatives of:

**For the European Organization for
Nuclear Research (CERN) as the
Host Organization**

**For the “{Name of Participant
Institute}” ({Short name})**

Mike Lamont
Director for Accelerators &
Technology

{First Name, Last Name}
{Function}

Date:

Date:
