

Memorandum of Understanding for the Future Circular Collider (FCC) Study hosted by CERN

THE INSTITUTES, LABORATORIES, UNIVERSITIES AND THEIR FUNDING AGENCIES AND OTHER SIGNATORIES OF THIS MEMORANDUM OF UNDERSTANDING AND CERN AS THE HOST LABORATORY (“the Participants”)

Whereas

At a dedicated session of the CERN Council held on 30 May 2013, the Council adopted the Update of the European Strategy for Particle Physics which included *inter alia* the following statement:

“...Europe needs to be in a position to propose an ambitious post-LHC accelerator project at CERN by the time of the next Strategy update, when physics results from the LHC running at 14TeV will be available. CERN should undertake design studies for accelerator projects in a global context, with emphasis on proton-proton and electron-positron high-energy frontier machines. These design studies should be coupled to a vigorous accelerator R&D programme, including high-field magnets and high-gradient accelerating structures, in collaboration with national institutes, laboratories and universities worldwide.”

The conceptual design study (the “FCC Study”) must be available in time for the next update of the European Strategy for Particle Physics foreseen to take place in 2018,

It is hereby understood as follows:

1. Purpose of this Memorandum

- 1.1. This Memorandum establishes a common understanding among the Participants of the collaborative effort required for the execution of the FCC Study. The FCC Study and its results shall be used for peaceful purposes only.
- 1.2. By signing this Memorandum, the signatory becomes a Participant in the FCC Study, together with the other institutes, laboratories, universities and their funding agencies who are, or who subsequently become, Participants in the FCC Study.
- 1.3. It is expressly acknowledged that, except for Articles 4.2, 4.3, 7, 9 and this Article, this Memorandum is not legally binding and each Participant’s involvement in the FCC Study is on a “best-efforts” basis. This Memorandum does not imply any commitment of resources. Each Participant’s involvement in the FCC 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 understood that the main emphasis of the FCC Study shall be the long-term goal of a hadron collider (FCC-hh) with a centre-of-mass energy of the order of 100 TeV in a new tunnel of 80-100km circumference for the purposes of studying physics at the highest energies. The hadron collider and its detectors shall determine the basic requirements for the tunnel, surface and technical infrastructures. The corresponding hadron injector chain shall be included in the study, taking into account the existing CERN accelerator infrastructure and long-term accelerator operation plans. The performance and cost of the hadron collider shall be compared to a high-energy LHC, based on the same high-field magnet technology and housed in the LHC tunnel.
- 2.2. The FCC Study shall also include a lepton collider (FCC-ee) and its detectors, as a potential intermediate step towards the realisation of the hadron facility. The design of the lepton collider complex shall be based on the hadron collider infrastructure and any substantial incompatibilities with respect to the hadron collider infrastructure requirements shall be analysed and quantified. Potential synergies with linear collider detector designs should be considered.
- 2.3. Options for hadron-electron scenarios and their impact on the infrastructure shall be examined at a conceptual level.
- 2.4. The study shall include cost and energy optimisation, industrialisation aspects, and provide implementation scenarios, including schedule and cost profiles.

3. Organization

- 3.1. CERN shall act as the host organization for the FCC Study. The FCC Study shall be executed through the following entities, each of which shall decide on its own decision-making procedures:
 - (i) An International Steering Committee (“the Steering Committee”) whose mandate is to refine the goals of the FCC Study, approve the work programme and review progress, and provide feedback to the Study Leader if requested by the latter.
 - (ii) An International Collaboration Board whose mandate is to review the resources, including the channelling of the external contributions and which will report to the Steering Committee.
 - (iii) An International Advisory Committee whose mandate is to review the scientific and technical progress of the study and to submit recommendations to the Steering Committee.

(iv) A FCC Study Leader (“the Study Leader”) assisted by a deputy (“the Deputy Study Leader”), whose mandate is the overall coordination and organisation of the FCC Study reporting to the Steering Committee, acting under the authority of the CERN Director-General.

(v) A FCC Study coordination group (“the Study Coordination Group”) comprised of experts drawn from Participants in the FCC Study.

3.2. The Study Leader will be supported by an office at CERN (“the Study Support Office”) which shall provide the Study Leader with administrative and organisational support (in particular scheduling, resource planning and project coordination matters).

4. Mandate of the Study Leader

4.1. The Study Leader shall:

- nominate, convene and guide the Study Coordination Group;
- establish collaborations with the Participants and any other involved entities;
- ensure coherent communications;
- coordinate all resources associated with the FCC Study;
- organise workshops, conferences and meetings relevant for the FCC Study;
- integrate all existing activities concerning future circular colliders at CERN into the FCC 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 matters concerning 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 provide health insurance cover for such personnel at levels that are adequate in CERN’s host states, Switzerland and France.

5. Mandate of the Study Coordination Group

The Study Coordination Group shall, under the guidance of the Study Leader and through the contributions of the Participants and any other involved entities:

- organise and carry out a conceptual design study at international level for high-energy frontier circular collider(s) at CERN for the post-LHC era;

- elaborate the specific physics cases and formulate the key parameters for the different collider options and experiments;
- provide machine and infrastructure conceptual designs and detector concepts;
- identify, launch and co-ordinate related R&D programmes in particular in the areas of high-field magnets and superconducting RF and other key technologies;
- identify synergies with other high-energy frontier collider studies worldwide;
- provide cost estimates and propose implementation scenarios for the technical design, realisation and operation phase.

6. Contributions by the Participants

- 6.1.** Each Participant's contribution to the FCC 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.
- 6.2.** 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.
- 6.3.** Except as agreed otherwise, each Participant shall bear the cost of its contribution to the FCC 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.

7. Intellectual Property

- 7.1.** 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.
- 7.2.** Each Participant that provides intellectual property under this Memorandum is understood to be giving no 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.

8. Publications

- 8.1. The Participants shall strive to jointly publish the results of their collaboration as Open Access publications.
- 8.2. 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.

9. Liability

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

10. Duration

- 10.1. In recognition of the fact that this Memorandum does not imply any commitment of resources, a Participant may withdraw from this Memorandum by giving reasonable written notice to CERN as the host organization.
- 10.2. 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 MTA Wigner Research
Centre for Physics (Wigner RCP)**

Michael Benedikt
FCC Study Leader

Péter Lévai
Director General

Date: _____

Date: _____

MoU Future Circular Collider

