

# Memorandum of Understanding

## for Collaboration in the Construction of the Compressed Baryonic Matter (CBM)

### Experiment at FAIR

between

the Facility for Antiproton and Ion Research in Europe GmbH, hereinafter referred to as  
FAIR GmbH,

and

the full member institutions of the CBM Collaboration  
(hereinafter referred to as *Member Institutions*)

together with the corresponding funding agencies

### Preamble

The *Member Institutions* of the CBM Collaboration and FAIR GmbH agree to collaborate in order to perform a unique experiment and by thus studying the properties of nuclear matter at the highest baryon densities. The CBM Experiment shall be jointly constructed by the *Member Institutions* and established at FAIR.

FAIR GmbH and the GSI Helmholtzzentrum für Schwerionenforschung GmbH jointly represent the *Host Laboratories*, as defined in Annex 9.

This MoU covers the construction period of the CBM Experiment detailed in Article 3 and labelled as *C-MoU* in the following.

The Technical Design Reports (TDRs) document the basis for the construction of the CBM experiment. The TDRs are subject of approval by the FAIR management, following the recommendation of the FAIR Expert Committee Experiments (ECE). Moreover, FAIR monitors the construction costs of the CBM Experiment and its funding together with the funding agencies via the Resources Review Boards (RRBs).

The CBM Technical Coordinator and the CBM Resource Coordinator are besides the CBM Spokesperson the link persons between the CBM Collaboration and FAIR.

A *Pre-Construction* Memorandum of Understanding was signed by the CBM Collaboration in 2012, in order to affirm the intention of the *Member Institutions* to build the CBM Experiment and, in particular, to declare the responsibilities for the construction of the different CBM Sub-Systems. In the *Pre-Construction* MoU, the *Member Institutions* expressed their intention to provide corresponding construction funds or to submit funding applications to their funding agencies.

This C-MoU relates to the *CBM Start Version*, which is to be realized within the FAIR Modularised Start Version (MSV) defined in the FAIR Convention. The *CBM Day-1 Setup* is a largely funded subset of the CBM Start Version (defined in **Annex 10**). The Institutes

confirm their planned contribution to the construction/realization of the CBM experiment either by providing components in-kind or by providing appropriate human resources. In addition, the Institutes and their funding agencies express their intent to contribute to the Common Fund for the construction of the CBM Common Infrastructure according to the scheme laid down in **Annex 8**.

The general obligations of the Host Laboratories and of the *Member Institutions* are defined in the document 'General Conditions Applicable for Experiments Performed at FAIR'.

This document applies fully to the execution of this C-MoU and is attached as **Annex 9**.

**Article 1 Parties to this C-MoU**

- 1.1 Parties to this C-MoU shall be all *Member Institutions* of the CBM Collaboration as defined in **Annex 3** and as listed in **Annex 1**. *Associated Members Institutions* of the CBM Collaboration are not Parties to this C-MoU and therefore not eligible to sign the C-MoU.
- 1.2 In addition, the *Host Laboratories* FAIR GmbH and GSI GmbH will be Parties to this MoU.
- 1.3 The *Funding Agencies* listed in **Annex 2** are also Parties of this C-MoU. A Funding Agency may be a *Member Institution* or an established institution acting on behalf of one or more funding agencies.

**Article 2 Purpose of this C-MoU**

- 2.1 This C-MoU defines the construction phase of the CBM experiment. Its purpose is to define the program of work to be carried out for this phase and the distribution of charges and responsibilities among the Parties for the execution of this work. It further sets out organizational, managerial and financial guidelines to be followed by the Parties.
- 2.2 The construction phase comprises the engineering design, final prototyping, construction, calibration, transportation, assembly, installation and commissioning of the elements which will be part of the CBM Experiment.
- 2.3 In addition, this C-MoU constitutes the intention of the *Member Institutions* to take on responsibilities for the construction of the different sub-systems of the experiments. The corresponding contributions shall be in-kind. The *Member Institutions* expressed their intention to provide corresponding construction funds and/or corresponding human resources or to submit corresponding funding applications to their funding agencies.
- 2.4 The signing funding agencies express the intention to provide corresponding construction funds to the *Member Institutions* of the CBM collaboration as documented as secured amounts in the cost matrix (**Annex 4b**).

**Article 3 Duration of this MoU and its Extension**

- 3.1 This C-MoU is valid for the construction period of the CBM detector, from 1<sup>st</sup> April 2020 to a date not earlier than 31 December 2025. The actual termination date will be set by the CBM RRB no later than 31 December 2024. The construction phase ends after all construction workpackages are completed and the equipment is installed in the CBM cave.
- 3.2 The responsibilities for the maintenance and operation of the CBM detector is planned to be laid down in a separate *M&O-MoU* on maintenance and operation procedures, which will come into force in the operation phase of the CBM Experiment. The actual start date of the operation phase will be set by the CBM RRB no later than 31 December 2023. The M&O-MoU will be prepared by the

- CBM Collaboration together with FAIR GmbH, in consultation with the CBM RRB and will be signed by all the parties participating in the operation phase of CBM.
- 3.3 Any funding agency may withdraw its support from the Collaboration by giving notice not less than twelve month prior to the date of withdrawal in writing to the CBM RRB, the CBM Collaboration and to the FAIR Scientific Managing Director. In such an event, reasonable compensation to the Collaboration shall be negotiated through FAIR GmbH and confirmed by the CBM RRB.
  - 3.4 Any *Member Institution* may withdraw from the Collaboration according to the CBM Collaboration rules (**Annex 3**) and according to the procedures as set out in the General Conditions (**Annex 9**) and by giving notice in writing to its funding agency.
  - 3.5 Any institute that joins the CBM Collaboration as *Member Institution* in accordance with the Collaboration rules during the term of this MoU shall accept the agreements in force by signing the MoU. The corresponding funding agency shall sign the C-MoU as well.

#### **Article 4 The CBM Experiment and Collaboration**

- 4.1 The CBM Experiment has been described in detail in the Technical Status Report submitted to the FAIR Scientific and Technical Issues Committee (STI) in January 2005 and in the update submitted in January 2006 summarised in the FAIR Baseline Report.
- 4.2 A list of the participating *Member Institutions* and *Associated Member Institutions* in the CBM Collaboration is given in **Annex 1**. The management structure of the CBM Collaboration is described as well in the attached CBM organisation document (**Annex 3**).
- 4.3 The updated information on the concept and technical realization of each sub-system of the CBM experiment is given in the Technical Design Reports (TDRs). The TDRs are submitted to the FAIR scientific management and normally reviewed by the FAIR Expert Committee Experiments (ECE). After approval by the FAIR Scientific Managing Director the involved parties shall finalize negotiations concerning the funding of the respective sub-systems in order to secure the funding. The Status (November 2019) of the CBM TDRs is listed in **Annex 5**.
- 4.4 Any institute that wishes to join the CBM Collaboration as *Member Institution* during the period of validity of this C-MoU will be expected to make an appropriate contribution to the funding of the detector construction including the Common Infrastructure. A contribution through allocation of human resources is also possible. The contribution should fit the needs of the CBM Collaboration for the realization of the CBM Experiment.

Suggested contributions will be negotiated by the CBM Collaboration and endorsed by the CBM RRB. In the event that the detector construction is already fully funded, the new *Member Institution* will have to make a special contribution, e.g. through human-resource allocation to computing subprojects or to the CBM Physics Working Groups.

## Article 5 Program of Work for the Construction Phase of the CBM Experiment and Sharing of Responsibilities for its Execution

- 5.1 The total construction work for the CBM Experiment is divided into:
- 5.1.1 Sub-system construction, which will be the responsibility of individual *Member Institutions*, or groups of *Member Institutions*, and
  - 5.1.2 Common Infrastructure (as defined in Annex 8) comprising those elements of the experiment construction which the Collaboration has agreed are to be provided by a Construction Common Fund; according to provisions of Article 6.
- 5.2 The technical participation of the *Member Institutions* in subsystem construction is defined in **Annex 4a**. Moreover, this Annex specifies the deliverables, which belong to each workpackage (PSP code) according to the CBM Component Data Base. These deliverables are to be provided by the corresponding *Member Institution*.
- 5.3 The monitoring of the construction progress of the in-kind contributions is performed by the FAIR Project Leader. This monitoring comprises also the Risk Assessment and the Quality Assurance (QA). The final acceptance of an in-kind contribution is determined according to the procedures established at FAIR.
- 5.4 **Annex 4b** includes summary tables of the values of commitments by Country and Funding Agency to the CBM Subsystems. In addition, the detailed Cost and Funding Matrix is included for all CBM subsystems as presented to and endorsed by the CBM RRB.
- 5.5 The following definition regarding the in-kind contributions (not applicable to cash contributions) of the *Member Institutions* of the CBM collaboration to the CBM Experiment were made by the FAIR Cost Review Committee for Experiments (CORE-E) and is valid for this C-MoU:
- The human and financial resources needed for the construction of the CBM experiment are grouped into three headings:
- 5.5.1 R&D work on the various detector elements;
  - 5.5.2 costs for infrastructure in the *Member Institutions*, and costs for personnel, travel, etc. of the *Member Institutions* as arising from their participation in the CBM Collaboration;
  - 5.4.3 engineering design, final prototyping, construction, calibration, transportation, assembly, installation and commissioning costs for the complete detector.
- The resources needed for work under the headings 5.4.1 and 5.4.2 are the responsibility of the *Member Institutions* supported by their respective Funding Agencies. These resources are neither accounted for in detector construction costs, nor monitored centrally by the Collaboration.
- 5.6 The Institutes, supported by their Funding Agencies, will make their best efforts to design, produce final prototypes, construct, calibrate, transport, assemble, install and commission all the deliverables listed in Annex 4a within the limits of their funding. In the event of cost overruns, these will first be brought, by the Member

Institution(s) concerned, to the attention of the CBM Collaboration and then to the CBM RRB if solutions have not been found. The Collaboration will propose ways of accommodating such overruns including de-scoping or staging if other ways cannot be found, and seek the endorsement of the CBM RRB.

- 5.7 **Annex 7** gives an overview of the foreseen construction schedule.
- 5.8 Substantial human-resource allocations to computing subprojects or to CBM Physics Working Groups are also recognized as eligible contributions to qualify for signing this C-MoU. A breakdown indicating the present substantial human-resource allocations of the institutes to the subsystem construction, to computing subprojects, to the Physics Working Groups and to Preparation and Coordination tasks is given in **Annex 6**. There is no obligation for the funding agencies by signing this C-MoU to provide funding for the human-resource pledges of the Member Institutions.

## **Article 6 Common Infrastructure and Construction Common Fund**

- 6.1 The items belonging to the Common Infrastructure of CBM are defined in **Annex 8**, and shall be funded through the implementation of a Construction Common Fund as described in **Annex 8**.
- 6.2 The purchasing process of the Common Infrastructure will be organized by the FAIR GmbH under the condition of support through cash supplements by all CBM Member Institutions into a dedicated Construction Common Fund. In-kind contributions are also possible. The Construction Common Fund will be managed and operated by the CBM Resource Coordinator in consultation with the CBM Management and the FAIR Management. All Construction Common Fund operations will be annually evaluated the Experiment Cost Scrutiny Group (ECSCG) and monitored by the RRB.
- 6.3 The detailed procedure for collecting the cash supplements and the planned spending profile is given in Annex 8. The cash contributions depend on the number of PhD holders per member institute. The due amounts of the member institutes to the Common Fund were calculated, according to the number of PhD holders per member institute, which are presently\* listed in the CBM Collaboration database \*(status memberships and number of PhD holders of November 2019 is used for this calculation). The member institutes can also fulfil their obligations regarding the Common Fund by paying equal annual amounts in the years 2020 to 2024, or by an early down payment of the full amount per PhD holder.
- 6.4 Institutes, which join the CBM collaboration as Member Institutions during the construction period, have to pay the same amount to the Common Fund according to the number of PhD holders working for CBM, as if they were Member Institutions during the whole construction period.
- 6.5 The CBM Common Infrastructure items are purchased and owned by FAIR GmbH. The member institutes of the CBM Collaboration support the financing by paying cash supplements into the Common Fund as described above.
- 6.6 If a Member Institution is able and willing to procure one or several items of the Common Infrastructure, which correspond exactly to the technical specifications of Common Infrastructure items as listed in the Common Infrastructure cost

breakdown, these contributions are accounted with the listed amounts instead of cash contributions to the CBM Common Fund. However, they cannot be accounted as an In-Kind contribution of a shareholder to FAIR GmbH.

## **Article 7 Obligations of the Host Laboratories, and of the Institutes**

- 7.1 The obligations of FAIR GmbH and GSI GmbH as Host Laboratories and of the *Member Institutions* are contained in the document 'General Conditions Applicable for Experiments Performed at FAIR'. This document is regarded as an integral part of this MoU and is attached as **Annex 9**.
- 7.2 All equipment brought to the FAIR/GSI site must comply with FAIR's safety regulations, which are determined by German law and regulations.
- 7.3 If relevant, the design, test criteria and testing of equipment should be discussed well in advance with FAIR's safety officials. All equipment brought to the FAIR/GSI site must be accessible for inspection with regard to matters of safety. All Parties assure that contributions (e.g. technology, knowledge, goods, services, or money) provided within the framework of this C-MoU are exclusively used (or transferred) for non-military purposes.
- 7.4 It is a fundamental principle that an *Member Institution* having contributed a component of equipment, shall also contribute to the necessary scientific and technical manpower support to operate that component, maintain it in good working order and dismantle it when individual experiments are completed.
- 7.5 If a *Member Institution* withdraws from the membership in the CBM Collaboration during the construction phase, the CBM Management Board shall make a recommendation to the CBM Collaboration Board how to cope with the unfinished obligations, which were taken over by this institute. A solution for these obligations should be found and agreed on between the *Member Institutions*, the corresponding funding agencies and the CBM Collaboration. Already delivered hardware and software remains part of the CBM Experiment and cannot be removed without the consent of the CBM Collaboration and the Host Laboratories.

## **Article 8 Relationship CBM Collaboration – FAIR**

The CBM Collaboration is represented by its management in the communication with FAIR. The CBM Technical Coordinator (TC) and the CBM Resource Coordinator (RC) are besides the CBM Spokesperson the link persons between the CBM Collaboration and the FAIR management.

The Spokesperson, the TC and the RC are elected by the CBM Collaboration according to the organizational procedures defined in **Annex 3**. The TC and the RC are normally either seconded to or directly employed by FAIR GmbH. The TC and the RC report to the CBM Collaboration Board and to the CBM Management Board.

**Article 9 Rights and Benefits of the Institutes**

The Member Institutions of the Collaboration are entitled to join the operational phase of the project and to participate in the scientific exploitation of the data acquired. Further details are set out in the current document “General Conditions Applicable to Experiments Performed at FAIR” (**Annex 9**).

**Article 10 Administrative and Financial Provisions**

General financial matters and purchasing rules and procedures for the FAIR experiments, including the rules which apply for Common Fund operations, are dealt with in accordance established procedures at FAIR GmbH.

The budget for the Common Fund listed in **Annex 8** shall be endorsed annually in advance by the CBM Collaboration Board, annually evaluated by the Experiment Cost Scrutiny Group (ECSG) and monitored and endorsed by the CBM RRB. The cost shall be shared according to the rules defined in **Annex 8**. The closing of the books for the expenditures by the Common Fund of the previous year is also subject of endorsement by the CBM RRB.

**Article 11 Amendments**

This C-MoU may be amended at any time with the agreement of its signatories or of their appointed successors. Any such amendments will be subject to the prior endorsement of the CBM RRB.

**Article 12 Disputes**

The primary mechanism for resolving disputes between Institutes shall be negotiation within the CBM Collaboration Board according to the Collaboration rules.

Any dispute between Funding Agencies (as listed in Annex 2) shall be resolved by negotiation or, failing that, by arbitration through the Chair of the FAIR Council, who may, at his or her discretion, adopt any form of arbitration process.

Any dispute between a Funding Agency and FAIR GmbH will be addressed on the FAIR council level.

**Article 13 Annexes**

All the Annexes are an integral part of this MoU. They are understood to be the planning basis for the construction of the CBM experiment.

**Article 14 Final Provisions**

Article 7.1 and 7.2 on the “Obligations of the Host Laboratories, and of the Institutes” are legally binding.

All other regulations in this MoU are not legally binding, but the collaborating institutes and funding agencies recognize that the success of the CBM Collaboration depends on all its members adhering to its provisions.

**ANNEXES**

All the annexes are an integral part of this MoU. They are understood to be the planning basis for the construction and commissioning of the CBM experiment. Updates will be possible and must be agreed upon by the respective parties by means of amendments to the appropriate annex or annexes.

- Annex 1: List of *Member Institutions* and *Associate Member Institutions* of the CBM Collaboration
- Annex 2: List of Funding Agencies
- Annex 3: Organisation rules of the CBM Collaboration and management structure of the CBM Collaboration
- Annex 4a: Responsibilities of the *Member Institutions* for the work packages on detector/subsystems construction
- Annex 4b: Summary tables on construction cost and funding
- Annex 5: Status of Technical Design Reports
- Annex 6: List of substantial human-resource allocations of Member Institutions to the subsystem construction, to computing subprojects, to the Physics Working Groups and to preparation and coordination tasks
- Annex 7: Construction schedule
- Annex 8: Procedures for the Construction Common Fund for the Common Infrastructure
- Annex 9: General Conditions Applicable to Experiments at FAIR
- Annex 10: The CBM Start Version and the Day-1 Setup

**The Facility for Antiproton and Ion Research in Europe GmbH (Darmstadt, Germany),  
GSI Helmholtzzentrum für Schwerionenforschung GmbH (Darmstadt, Germany)  
and  
Nuclear Physics Institute of the Czech Academy of Science,  
Czech Republic**

declare that they agree on the present Memorandum of Understanding for the CBM Experiment.

Done in Darmstadt

4.8.2020

Done in Rez

18.11.2020

For FAIR GmbH

[Signature]

For

**Nuclear Physics Institute of the Czech Academy of Science**

[Signature]

For GSI GmbH

[Signature]

[Signature]

**The Facility for Antiproton and Ion Research in Europe GmbH (Darmstadt, Germany),  
GSI Helmholtzzentrum für Schwerionenforschung GmbH (Darmstadt, Germany)  
and  
Czech Technical University (CTU), Czech Republic**

declare that they agree on the present Memorandum of Understanding for the CBM Experiment.

Done in Darmstadt

4.8.2020

Done in Prague

23.11.2020

For FAIR GmbH

For  
Czech Technical University (CTU)

For GSI GmbH

[Signature]

[Signature]

[Signature]

**The Facility for Antiproton and Ion Research in Europe GmbH (Darmstadt, Germany),  
GSI Helmholtzzentrum für Schwerionenforschung GmbH (Darmstadt, Germany)**  
and

**Ministry of Education, Youth and Sports (MSMT), Czech Republic**

declare that they agree on the present Memorandum of Understanding for the CBM Experiment.

Done in Darmstadt

Done in Prague

4.8.2020

30-10-2020

**For FAIR GmbH**

**For  
Ministry of Education, Youth and  
Sports (MSMT)**

[Signature]

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**For GSI GmbH**

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