

# Memorandum of Understanding

## for Maintenance and Operation of the TOTEM Detector

between

The EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH,  
hereinafter referred to as "CERN", Geneva, as the Host Laboratory

on the one hand

and

a Funding Agency/Institution of the TOTEM Collaboration

on the other hand.

### Preamble

- (a) A group of Institutes from CERN Member and non-Member States, and CERN, has agreed to collaborate to form the TOTEM Collaboration. This Collaboration has proposed to CERN an experiment to study particle interactions at the highest possible energies and luminosities to be reached with the Large Hadron Collider (LHC). These Institutes have secured the support of their Funding Agencies to enable them to participate in the TOTEM Collaboration.
- (b) Agreement to establish this Collaboration has been effected through the signature of Memoranda of Understanding (TOTEM RRB-D 2006-002) between each Institute or Funding Agency, as appropriate, in the Collaboration and CERN as the Host Laboratory. These Memoranda of Understanding for construction (Construction MoUs) collectively define the Collaboration and its objectives, and the rights and obligations of the collaborating Institutes in construction matters during the construction period.
- (c) In their Article 6.6, the Construction MoUs specify that the responsibilities for the maintenance and operation (M&O) of the TOTEM detector are to be laid down in a separate Memorandum of Understanding on maintenance and operation procedures (M&O MoU), to be signed by all the Parties. Agreement is effected as for construction, i.e. through Memoranda of Understanding between each Institute or Funding Agency, as appropriate, in the Collaboration and CERN as the Host Laboratory. While the Construction MoUs remain valid, their provisions take precedence over those of the M&O MoUs.

(d) The Resources Review Board (RRB) referred to in Preamble (g) of the Construction MoU is defined therein to have the following roles with respect to M&O :

- reaching agreement on a maintenance and operation procedure and monitoring its functioning
- endorsing the annual maintenance and operation budgets of the detector

The management of the Collaboration reports regularly to the RRB on technical, managerial, financial and administrative matters, and on the composition of the Collaboration.

(e) The M&O MoUs are not legally binding, but the Funding Agencies and Institutes recognise that the success of the experiment depends on all members of the Collaboration adhering to their provisions. Any default will be dealt with in the first instance by the Collaboration and if necessary then by the RRB.

### **Article 1 : Annexes**

- 1.1 All the Annexes are an integral part of this M&O MoU.
- 1.2 Annexes 1, 2, 4.1, 5, 6.1 and 8 shall be identical to Annexes 1, 2, 3, 5, 6 and 8.1 (including any amendments thereto) of the Construction MoU. When the latter ceases to be valid, amendments to these Annexes shall be made in accordance with the provisions of this M&O MoU.

### **Article 2 : Parties to this M&O MoU**

- 2.1 The Parties shall be all the Institutes of the Collaboration as listed in **Annex 1** and their Funding Agencies, and CERN as the Host Laboratory. **Annex 2** lists the Funding Agencies and their duly authorised representatives. The Funding Agency may be an Institute or an established institution acting on behalf of one or more Institutes.
- 2.2 The collaborating Institute(s) and the TOTEM Collaboration will hereinafter be referred to as "Institute(s)" and "Collaboration", respectively.

### **Article 3 : Purpose of this M&O MoU**

- 3.1 This M&O MoU addresses the pre-exploitation and exploitation phases of the TOTEM detector. Its purpose is to define the procedure for determining the maintenance and operation (M&O) costs in these phases along with the mechanisms by which they are reviewed and by which the charges and responsibilities for the execution of this work are distributed amongst the Parties. It sets out

organisational, managerial and financial guidelines to be followed by the Collaboration. Concerning computing, it has been decided to proceed as follows:

- 3.1.1 The software development and maintenance of many products of use to more than one experiment and the provision of offline computing infrastructure are addressed by the Memorandum of Understanding for Collaboration in the Deployment and Exploitation of the LHC Computing Grid<sup>1</sup>.
  - 3.1.2 The development of detector-specific software (such as that for simulation, reconstruction and analysis) and software for physics analysis is considered to be an integral part of the research activities of the scientists in the TOTEM Collaboration and is therefore not subject to any Memorandum of Understanding.
  - 3.1.3 All other aspects of the experiment-specific Core Computing, in particular the contributions from the TOTEM Collaboration to the TOTEM Core Computing development, maintenance and support are addressed in this M&O MoU, in recognition of the operational character of the ongoing development effort required during the life of the Collaboration
- 3.2 Exploitation refers to the time after data-taking for physics has commenced at the LHC. Pre-exploitation refers to the time before this and in particular, for individual sub-detector/system components of the TOTEM detector, to the time after they have been commissioned.
  - 3.3 M&O comprises all of the actions needed to fulfil the TOTEM Collaboration co-ordination function and to operate and keep in good working order the individual components of the TOTEM detector, along with their respective infrastructure and facilities.
  - 3.4 The TOTEM project is executed in the normal framework of the CERN scientific programme, approved by the CERN Council and subject to the bilateral Agreements and Protocols between CERN and non-Member States.
  - 3.5 In case of conflict between relevant Co-operation Agreements or Protocols entered into by CERN and this M&O MoU, the former prevail.

#### **Article 4 : Duration of this M&O MoU and its Extension**

- 4.1 The initial period of validity of this M&O MoU covers the pre-exploitation phase of the TOTEM detector and the expected first four years of physics running, i.e. from 1 November 2007 to 31 December 2011.
- 4.2 The validity of this M&O MoU will be extended automatically at its expiry for successive periods of five years beyond the initial period unless the RRB determines

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<sup>1</sup> CERN-C-RRB-2005-01

otherwise. This provision notwithstanding, this M&O MoU will automatically cease to be valid when the LHC programme is declared closed by the CERN Council.

- 4.3 The provisions of this M&O MoU will apply to elements of the TOTEM detector as they begin to incur M&O costs, as distinct from the costs that belong to the construction phase and are defined in Article 2.2 of the Construction MoU.
- 4.4 Any Funding Agency may withdraw its support from the Collaboration by giving not less than eighteen months notice in writing to the Collaboration and the Director General of CERN. In such an event, reasonable compensation to the Collaboration will be negotiated through CERN and confirmed by the RRB.
- 4.5 Any Institute may withdraw from the Collaboration according to the procedures agreed by the Collaboration, subject to the General Conditions applicable to Experiments Performed at CERN (**Annex 3**), and by giving notice in writing to its Funding Agency.
- 4.6 Any Institute that joins the Collaboration in accordance with the Collaboration rules during the period of validity of this M&O MoU shall accept the agreements in force and will be expected to make an appropriate contribution to the M&O. This will be negotiated by the Collaboration (which reserves the right to request additional contributions from such Institutes) and endorsed by the RRB.

### **Article 5 : The TOTEM Detector and Collaboration**

- 5.1 The detector for the TOTEM experiment has been described in detail in the Technical Proposal submitted to the LHCC in March 1999 and in the subsequent sub-detector/system Technical Design Reports. It consists of a number of sub-detector/system units as listed in **Annex 4.1**. The Core Computing activities are described in **Annex 4.2** and their work breakdown structure is outlined in **Annex 4.3**
- 5.2 The current management structure of the Collaboration is described in **Annex 5**.
- 5.3 The technical participation of the Institutes in detector construction and Core Computing, grouped by Funding Agency, is set out in **Annex 6**.
- 5.4 The Collaboration shall update Annexes 5 and 6 annually to reflect the situation on 1 January of the current year.

## **Article 6 : Responsibilities of the Institutes for the Maintenance and Operation of the TOTEM Detector, and of CERN as Host Laboratory**

- 6.1 Responsibility for the M&O of the TOTEM detector rests jointly with the Collaboration as a whole and with CERN as Host Laboratory, within the General Conditions applicable to Experiments Performed at CERN. It is a fundamental principle that each Institute within the Collaboration shall participate in both maintenance and operation and contribute a fair and equitable share of common costs.
- 6.2 It is also a fundamental principle that an Institute, which has contributed a component of equipment, will also contribute to the necessary scientific and technical manpower support to operate that component and maintain it in good working order.
- 6.3 Within the fundamental principles set out in Articles 6.1 and 6.2 above, the Collaboration shall, for each M&O cost item, decide whether the cost is to be borne at the common expense of the Collaboration or not. The M&O cost items are thereby divided into two categories :
  - 6.3.1 Common Items, comprising those costs that the Collaboration has agreed to bear at its common expense, and
  - 6.3.2 Sub-detectors/systems that are the responsibility of individual Institutes or groups of Institutes.
- 6.4 **Annex 7** lists the M&O cost items agreed by the Collaboration to be Common Items.
- 6.5 **Annex 8** lists for the second category, by sub-detector/system, the deliverables provided by the Institutes, the CORE value of these deliverables and the sharing amongst Institutes. Also summarised are the CORE values of the deliverables for particular sub-systems/detectors by Funding Agency.
- 6.6 The general obligations of CERN in its role as Host Laboratory and of the Institutes (including CERN in this role) are contained in the General Conditions applicable to Experiments Performed at CERN (**Annex 3**), which in case of contradiction or ambiguity shall prevail over the main body of this M&O MoU.

## **Article 7 : Maintenance and Operation Categories**

- 7.1 The M&O expenses can be divided into the following three categories :
  - 7.1.1 **Category A.** M&O expenses that are shared by the entire Collaboration (cf. Article 6.3.1 above). **Annex 9** lists the headings under which Category A costs are categorised.
  - 7.1.2 **Category B.** M&O expenses that are borne by part of the Collaboration, i.e. by single Institutes or groups of Institutes, and their Funding Agencies (cf.

Article 6.3.2 above). The headings in this category are defined with reference to the distribution of responsibilities amongst the various Institutes for the construction of the TOTEM Detector as given in **Annex 8**. **Annex 10** lists the headings under which Category B costs are categorised.

It is agreed that an Institute having responsibility under a Category B heading will contribute to providing the necessary financial, scientific and technical support, as well as replacement or spare parts, for normal operation of that equipment and for the routine maintenance needed to keep it in good working order. If problems arise that require major modifications, responsibility will lie with the Collaboration as a whole. The Collaboration will propose on a case-by-case basis the events to which this provision will apply. The proposal will be submitted for approval to the next RRB meeting, which will also be asked to approve the provision of the necessary resources.

- 7.1.3 **Category C**. General maintenance and operation expenses that are provided to the Collaboration by CERN, acting in its role as Host Laboratory. Subject to the General Conditions applicable to Experiments Performed at CERN (Annex 3), these are more precisely described in the list given in **Annex 11**.

### **Article 8 : Approval and Oversight**

- 8.1 Oversight of the M&O costs for the TOTEM detector shall lie with the RRB, which will meet normally twice per year, in spring and autumn. The RRB shall have the responsibility for approving the levels and sharing of the Category A costs. It shall also approve the overall level of Category B costs and the sharing of these costs as proposed by the Collaboration.
- 8.2 The RRB shall be assisted in this aspect of its work by a Scrutiny Group that it shall appoint. The role of the Scrutiny Group is to analyse critically the Collaboration's M&O reports and estimates, refine the Category A estimates in consultation with the Collaboration and advise the RRB on the course of action to take.
- 8.3 The Scrutiny group shall operate according to the procedures set out in **Annex 12**.

### **Article 9 : Cost Sharing**

- 9.1 Subject to exceptions that may be agreed on a case-to-case basis by the RRB, the following guidelines are agreed for the sharing of M&O costs :
- 9.2 For Category A, the costs are to be shared amongst the Funding Agencies or Institutes in proportion to the number of their scientific staff holding PhD or equivalent qualifications who are entitled to be named as authors of scientific publications of the Collaboration. To this end, the Collaboration shall maintain a list, by Funding Agency and Institute, of these persons (**Annex 13**). The Collaboration shall update this list annually to reflect the situation on 30 September.

The updated list is to be ready in time for the autumn meeting of the RRB (see Article 10.1 below).

- 9.3 Funding Agencies or their Institutes must pay at least their share of Category A costs, normally in cash. In exceptional circumstances some of the Category A costs could eventually be paid in kind with the agreement of the RRB, subject always to a minimum fixed cash amount per Institute. In such cases the cash value attributed to the in-kind contribution shall also be agreed by the RRB. The Collaboration shall propose annually to the RRB the minimum fixed cash amount to be applied in the following year.
- 9.4 CERN will pay from its operating budget the energy costs falling on Funding Agencies and Institutes in Member States. In recognition of the contributions made to the construction of the LHC machine by some non-Member States, CERN will treat these countries in a manner analogous to Member States and will partially pay the energy costs that fall on their Funding Agencies and Institutes.

The non-Member States for which CERN will partially pay the energy costs are listed in **Annex 14**.

CERN Management shall propose annually in its Medium Term Plan (The Scientific Activities of CERN and Budget Estimates for the Years  $n - n+3$ ) the overall size of these energy payments for the following year, so that they may be incorporated in the M&O budget presented to the RRB for approval in October. The payments are shared amongst the countries concerned according to a formula, the current version of which is explained in **Annex 15**. Any modifications to the arrangements for these payments will also be proposed in the context of the Medium Term Plan.

- 9.5 For Category B, the costs are to be shared by the Funding Agencies and Institutes concerned in a manner that the Collaboration shall propose to the RRB. Institutes may contribute more to category B costs than the amount proposed to the RRB by the collaboration.
- 9.6 For Category C, the costs are paid by CERN from its operating budget.
- 9.7 The boundary between Category A and Category B costs is determined by the Collaboration as explained in Article 6.3 above. Category C costs are determined by the CERN Director General, having regard to the General Conditions applicable to Experiments Performed at CERN and, in particular, the need to provide a safe and secure environment for the operation of the TOTEM detector.

### **Article 10 : Procedure**

- 10.1 Proposals for providing and sharing Category A M&O costs according to the criteria set out in Article 9 above, including the proposal for the minimum fixed cash amount per Institute, will be drawn up annually by the Collaboration and submitted to the RRB at its spring meeting. At the same meeting, the Collaboration will report on Category B costs and on the proposed responsibilities and

commitments for these, while CERN will report on Category C costs. The information for all Categories will comprise the M&O expenses for the previous year and the proposals for the following year, along with estimates for the three subsequent years. The Scrutiny Group will then operate during the summer, with the aim of agreeing the estimates for Category A for the following year, so that they can be endorsed at the autumn meeting of the RRB. It will also make critical comment on the arrangements for Category B costs.

- 10.2 The RRB will approve the M&O budget for the following year at its autumn meeting.
- 10.3 Unless explicitly mentioned, all proposals and estimates are to be expressed in Swiss Francs, using the calculated CERN index for materials cost variations.
- 10.4 For Category A expenses, a common Maintenance and Operation account (M&O Account) will be opened in the name of the Collaboration. All payments made by CERN on behalf of the Collaboration and the related receipts will be shown in that account.
- 10.5 CERN will issue invoices in Swiss Francs to the Funding Agencies of the Collaboration for their M&O contributions. The detailed procedure for the payment of Category A contributions is set out in **Annex 16**.
- 10.6 For Category A, the Resources Co-ordinator (see Annex 5) and other named individuals as necessary will be authorised by the Collaboration to sign commitments and payments relating to the above-mentioned account within the limits of the agreed annual budget for Category A. The authorised signature levels for these persons will be subject to the standard CERN rules for Team Accounts.
- 10.7 The Resources Co-ordinator shall report annually to the autumn meeting of the RRB on the functioning of the M&O arrangements for Categories A and B, and shall point out any cases of default (see Article 12.3 below). At the same meeting CERN Finance Division shall report on the status of the Collaboration accounts for Category A and those parts of Category B for which accounts exist at CERN.
- 10.8 If, for any reason, the RRB should fail to reach agreement on the M&O costs or on their sharing, the arrangements that it last agreed will continue to apply until agreement is reached.

### **Article 11 : Rights and Benefits of Institutes**

- 11.1 The Institutes participating in the Collaboration are entitled to join the pre-exploitation and exploitation phases of the project and to participate in the scientific exploitation of the data acquired. Further details are set out in the document "General Conditions applicable to Experiments Performed at CERN" (Annex 3).



## **Article 12 : Administrative and Financial Provisions**

- 12.1 General financial matters and purchasing rules and procedures for the LHC experiments, including the rules that apply for Common Fund operations, are dealt with in accordance with the "Financial Guidelines for the LHC Collaborations" (CERN/FC/3796).
- 12.2 Under the provisions of the CERN basic Convention dated 1st of July 1953 and revised on 17 January 1971, any Institute's staff and property located at CERN shall be subject to the authority of the CERN Director-General and shall comply with the CERN regulations.
- 12.3 Default on provision of the agreed contributions for M&O shall engage the procedure for resolution of disputes described in Article 15.1 below and may result in specific action against the defaulter. Should the outcome of the dispute resolution procedure imply a loss of M&O contributions to the Collaboration, the question of recovery from the loss is for the RRB to address.

## **Article 13 : Intellectual Property Rights**

- 13.1 Rights to contribute pre-existing software: Members of the Collaboration contributing pre-existing software to the Collaboration shall ensure that they have, or that they have procured, the rights to contribute such software for use (which term in this article shall include any modification, enhancement, integration in other software or redistribution) by the Members of the Collaboration in the execution of this M&O MoU.
- 13.2 Rights to contribute created software: Members of the Collaboration having created software in the execution of this M&O MoU shall ensure that they have, or that they have procured, the rights to contribute such software for use by the Members of the Collaboration in the execution of this M&O MoU.
- 13.3 Granting of license: Each Member of the Collaboration contributing pre-existing software to the Collaboration or creating software in the execution of this Addendum ("the software") herewith grants the other Members of the Collaboration the right to use the software for their own scientific purposes, including their participation in the TOTEM Experiment, as well as the right jointly, that is, through the Collaboration, to make the software publicly available, under an open source license in accordance with the terms defined in paragraph 13.4 hereunder.
- 13.4 Such license:
- 13.4.1 shall stipulate that copyright in the software is vested in the contributing Member of the Collaboration and that it may include voluntary contributions;

- 13.4.2 shall permit the installation, use, reproduction, display, modification and redistribution of the software, with or without modification, it being understood that any such redistribution, shall reproduce the above copyright notice and these license conditions, and acknowledge the Collaboration in the user documentation and/or the software;
- 13.4.3 shall stipulate that any licensee publishing or distributing any modifications, enhancements or derivative works of the software without contemporaneously requiring users to enter into a separate written license agreement shall be deemed to have published or distributed such modifications, enhancements or derivative works under the conditions defined in this paragraph;
- 13.4.4 shall stipulate that the Members of the Collaboration provide no warranties or representations and accept no liability of any kind with respect to the software.
- 13.5 Except as provided elsewhere in this article, including in paragraphs 13.1 and 13.2 above, the Members of the Collaboration provide no warranties or representations of any kind with respect to the software to each other. They shall have no liability to each other with respect to the software, it being understood that each Member of the Collaboration shall bear the consequences of its own use of the software.

#### **Article 14 : Amendments**

- 14.1 The Collaboration will make every effort to ensure that the information contained in the Annexes to this M&O MoU is kept up-to-date. To this end it shall review the information at least annually in time for the autumn meeting of the RRB.
- 14.2 This M&O 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 agreement of the RRB.

#### **Article 15 : Disputes**

- 15.1 As indicated in the Preamble (e), the primary mechanism for resolution of any disputes shall be negotiation within the Collaboration in the first instance and then if necessary in the RRB. Should these fail to conclude, the following three mechanisms shall apply, as appropriate. Any dispute between Funding Agencies shall be resolved by negotiation or, failing that, by arbitration through the President of the CERN Council, who will use defined arbitration procedures where they exist and will otherwise adopt one at his or her discretion. Any dispute between a Funding Agency and CERN will be resolved using standard CERN procedures for the resolution of such disputes. Any dispute between Institutes will be resolved according to Collaboration procedures. Decisions taken in application of any of the

dispute resolution procedures referred to in this paragraph shall be binding and final, without right of revision or appeal.

- 15.2 It is understood that any issues that have arisen during the lifetime of the Construction MoU shall be without prejudice to the rights and obligations laid down in this M&O MoU. No party shall be entitled under this M&O MoU to reduce, retain or set-off any obligation due under the Construction MoU.

## The European Organization for Nuclear Research (CERN)

and

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

Done in Geneva

Done in \_\_\_\_\_

on \_\_\_\_\_

on \_\_\_\_\_

For CERN

For

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Jos Engelen  
Chief Scientific Officer

TOTEM

**Annex 1 : Institutes in the TOTEM Collaboration and the names of their Contact Persons.**

Country	Town	Institute	Representative
	Geneva	CERN, European Laboratory for Particle Physics	Ernst Radermacher
Czech Republic	Prague	Institute of Physics, Academy of Sciences of the Czech Republic	Vojtech Kundrat
Estonia	Tallinn	Estonian Academy of Sciences	Endel Lippmaa
Finland	Helsinki	Helsinki Institute of Physics (HIP) and the Department of Physical Sciences, University of Helsinki	Risto Orava
Italy	Bari	INFN Sezione di Bari and Dipartimento Interateneo di Fisica dell'Università e del Politecnico di Bari	Maria Gabriella Catanesi
	Genoa	INFN Sezione di Genova and Università di Genova	Maurizio Lo Vetere
	Pisa/Siena	INFN Sezione di Pisa and Università di Siena	Stefano Lami
Poland (*)	Plock/Warsaw	Warsaw University of Technology, Fac. of Civil Engineering, Mechanics and Petrochemistry, Plock Campus	Janusz Kempa
United Kingdom (*)	Uxbridge	Brunel University, Electronic and Computer Engineering Dept.	Cinzia Da Vià
USA	Cleveland, OH	Case Western Reserve University, Dept. of Physics	Cyrus Taylor
	University Park, PA	Penn State University, Dept. of Physics	Jim Whitmore

**(\*) No longer in the Collaboration**

**Annex 2 : TOTEM Funding Agencies and their Representatives.**

Country	Agency	Place	Represented by
	CERN	Geneva	Jos Engelen
Czech Republic	Academy of Sciences of the Czech Republic, Committee for Collaboration of the Czech Republic with CERN	Prague	Jiri Niederle
	Institute of Physics, Academy of Sciences of the Czech Republic, v.v.i.	Prague	Jan Ridky
Estonia	Estonian Academy of Sciences	Tallinn	Endel Lippmaa
Finland	Helsinki Institute of Physics (HIP)	Helsinki	Dan-Olof Riska
Italy	INFN	Rome	Umberto Dosselli
Poland (*)	Warsaw University of Technology	Plock/Warsaw	Janusz Kempa
United Kingdom (*)	Brunel University	Uxbridge	Stephen Watts
USA	NSF	Washington	Jim Whitmore

**(\*) No longer in the Collaboration**

**Annex 3 : General Conditions applicable to Experiments Performed at CERN.**

**ORGANISATION EUROPEENNE POUR LA RECHERCHE NUCLEAIRE**

**CERN** EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH

# **GENERAL CONDITIONS**

**APPLICABLE TO**

**EXPERIMENTS PERFORMED AT CERN**

14 April 2000

General Conditions applicable to Experiments Performed at CERN

14 April 2000

## ***GENERAL CONDITIONS***

*applicable to*

*Experiments Performed at CERN*

The mission of the European Organization for Nuclear Research (CERN) is to sponsor international scientific research in high-energy physics.

This document sets out the rules and procedures concerning organisational, managerial and financial matters, which apply to all Universities and Research Institutions in connection with their participation in an experiment at CERN.

This document also addresses CERN's role as that of a Host Laboratory, to be distinguished from CERN's scientific responsibility as a member of an experiment Collaboration.

### **1. SCOPE OF APPLICATION**

- 1.1. The General Conditions apply to experiments carried out at CERN by the combined efforts of several Universities and Research Institutions.
- 1.2. These experiments require approval by the CERN Research Board and the Director-General after consideration of written proposals submitted to the appropriate experiments committees, taking into account scientific interest, technical feasibility and the constraints imposed by available resources.
- 1.3. The General Conditions do not apply to "Recognised Experiments", the definition of which was decided by the CERN Research Board (CERN/DG/RB 99-285). The conditions applicable to such experiments are decided by the Research Board on a case-by-case basis and any individual members of these experiments who become registered as CERN users are subject to the rules in operation on the CERN site governing this category of personnel.

### **2. PARTIES AND THEIR REPRESENTATION**

#### 2.1. The Parties concerned include:

- CERN as Host Laboratory, hereinafter referred to as "***CERN as Host***" (or simply "CERN") - in this connection, the "***CERN site***" refers to all parts of CERN's fenced-in territory and all of its underground works,
- the Institutions responsible for the research teams taking part in the experiments and forming ***the Collaborating Institutions***, hereinafter collectively referred to as the ***Collaboration***. CERN may be a Collaborating Institution as well as Host Laboratory.

#### 2.2. Each Party shall have a Representative:

- CERN as Host shall be represented by a ***Director of Research***, acting on behalf of the Director-General.



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- The Collaboration shall be represented by a duly appointed *Spokesperson*, who represents the Collaboration to the outside and who co-ordinates its work. Where the Spokesperson is not stationed permanently at CERN, the Collaboration shall appoint in addition a *Contactperson* at CERN.
- In its relations with CERN, each Collaborating Institution taking part in the experiment shall be represented by a **team member** appointed by the relevant Institution and/or a **member** of the relevant **Funding Agency**.

2.3. All Parties shall assume responsibility for ensuring that all members of their teams comply with these General Conditions.

### 3. BASIC DOCUMENTS GOVERNING THE COLLABORATION

3.1. The following documents shall constitute the formal basis for experiments performed at CERN:

- 3.1.1. the *EXPERIMENTAL PROPOSAL*, after its approval by the CERN Research Board;
- 3.1.2. *TECHNICAL DESIGN REPORTS*, where appropriate;
- 3.1.3. a *MEMORANDUM OF UNDERSTANDING*, which sets out the detailed arrangements and provisions specific to the experiment and which must be agreed and signed by CERN as Host and by the Collaborating Institutions and/or Funding Agencies; special agreements or protocols of relevance may be appended to the Memorandum of Understanding;
- 3.1.4. the present *GENERAL CONDITIONS*, which the Parties accept by signing the Memorandum of Understanding, except as otherwise specified therein.

#### Contents of the Memorandum of Understanding

3.2. As a guide, the essential parts of the Memorandum of Understanding are the following:

- a) a list of the Collaborating Institutions and/or the Funding Agencies, responsible for the teams in the Collaboration;
- b) details of the persons with specific responsibilities in the experiment;
- c)
  - the definition of the obligations of the Parties with respect to the construction of the detector and the auxiliary equipment;
  - a breakdown of the funding requirements for the main items of the detector and of the auxiliary equipment, together with the contributions of the Parties;
  - a timetable for the construction and installation of the equipment to be provided for the experiment;
- d) the obligations of the Parties concerning the installation, operation and maintenance of the detector and auxiliary equipment, unless they are specified in a separate Maintenance and Operation agreement;
- e) a mechanism for the resolution of disputes amongst the Parties;

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- f) an explicit reference to the General Conditions (in particular 6.7, 6.8 and 6.13), which the Parties accept unless otherwise specified in the Memorandum of Understanding; moreover, references should be made to the specific agreements and protocols relevant to the experiment.

#### **4. ORGANISATION OF THE COLLABORATION**

##### **Internal autonomy and co-ordination with CERN**

- 4.1. In its internal relations, the Collaboration is free to take such organisational decisions as deemed necessary. However, in preparing and performing the experiment, the Collaboration shall take into account the rules in force on the CERN site. In particular, financial arrangements between CERN and the Collaboration shall be subject to the Financial and Administrative Provisions for Visiting Teams currently in force.

##### **Co-ordination in matters of safety**

- 4.2. The Leader of the CERN Division with responsibility for the physics programme to which the experiment belongs shall appoint a Group Leader in Matters of Safety (GLIMOS) on the proposal of the Spokesperson of the Collaboration. The rights and obligations of the GLIMOS are defined in the document "Safety Policy at CERN SAPOCO/42".

##### **Finance Review Committee/Resources Review Board**

###### **Initial Decision**

- 4.3. For experiments involving large capital investments, a Finance Review Committee (FRC) or a Resources Review Board (RRB) may be set up in agreement with all the Parties concerned.

###### **Membership**

- 4.4. The FRC/RRB will consist of one representative of each Funding Agency or Collaborating Institution, and the Managements of CERN and the Collaboration. It will be chaired by the appropriate Director of Research.

###### **Terms of reference**

- 4.5. The role of the FRC/RRB includes:
- reaching agreement on the Memorandum of Understanding;
  - monitoring the Common Projects and the use of the Common Funds;
  - monitoring the general financial and manpower support;
  - approving a maintenance and operation procedure and monitoring its functioning;
  - approving the annual construction and maintenance & operation budgets.
- 4.6. The Collaboration Management reports to the FRC/RRB on technical, managerial, financial and administrative matters, and on the composition of the Collaboration.

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## 5. CERN'S OBLIGATIONS AS HOST LABORATORY

- 5.1. CERN is the Host Laboratory for the Collaboration. The provisions of this Section concern its obligations as Host.

### PRINCIPLES

#### Installation

- 5.2. CERN will agree to the installation of the detector, its auxiliary equipment and counting rooms in the appropriate experimental area, provided that they satisfy CERN safety standards.

#### Duration

- 5.3. CERN will agree to keep the detector on-site during the data taking for the experimental programme approved by its Research Board.

#### Network Connections

- 5.4. CERN agrees that computers and peripherals belonging to the Collaboration, which are needed for the operation of the detector and its auxiliary equipment, may be connected to the CERN Computer network, provided they conform to its compatibility standards.

#### Insurance<sup>2</sup>

##### - *Property*

- 5.5. The items belonging to the Collaboration and the Collaborating Institutions, once they have been officially accepted on the CERN site, shall be insured at CERN's expense and under the conditions and within the limits set out in the relevant insurance policy against the risks of fire, explosion, natural disaster and water damage.

##### - *Third Party Liability*

- 5.6. Any third party liability of the Collaboration, the Collaborating Institutions and their personnel arising from the experiment shall be insured at CERN's expense under the conditions and within the limits set out in the relevant insurance policy.

##### - *Limitation of coverage*

- 5.7. However, CERN's insurance coverage is effective only above specified amounts of excess. Any amount not covered by CERN's insurance policies shall be for the account of the Collaboration. CERN shall not be liable for any loss or damage arising from or in connection with the experiment.

#### Social insurance

- 5.8. Independently of the foregoing provisions, social insurance cover for the experimental teams shall remain the responsibility of the employer institutions concerned.

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<sup>2</sup> CERN's insurance policies are currently under review and it is intended that new insurance policies will come into effect on 1 January 2003. CERN does not warrant that the new insurance policies will continue to cover the risks set out in clauses 5.5 and 5.6 and accepts no liability in this connection.

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## SERVICES

### User Support and Users Office

- 5.9. CERN will provide access to its services, as described in the document "CERN User's Guide". The Users Office will provide assistance, if required, on questions concerning access to the services provided by CERN.

### Standard Services

- 5.10. CERN will generally provide, for the duration of the experiment, free of charge and within the limits and general constraints imposed by the available resources and schedules of accelerators, the standard services and facilities listed below:

#### *Particle beams and equipment*

- a) particle beams and related shielding, monitoring equipment and standard communication with the accelerator control rooms;
- b) beam time allocation and scheduling, following the recommendations of the relevant Experiment Committee;
- c) test beam time for testing prototypes and calibrating final detector elements, subject to the normal scheduling and allocation procedures;

#### *Space*

- d) floor space in the experimental area(s) for the experimental detector and its auxiliary equipment;
- e) laboratory and hall space for construction, testing and assembly of equipment;
- f) temporary, short-term storage place for spare parts, handling and assembly tools, detector and auxiliary equipment that is awaiting installation or removal. CERN reserves the right to charge longer term storage of the above items to the Collaborating Institutions;
- g) office space, equipped with standard furniture and infrastructure facilities including network connections, telephones and electricity;

#### *Supplies and installations at the experiment*

- h) assistance with the installation and removal of the detector and its auxiliary equipment, such as the provision of crane and rigging services, geometrical survey and alignment, transport of equipment on and between the parts of the CERN site, as well as inside the experimental areas;
- i) mechanical infrastructure, local infrastructure for the supply of mains electricity, raw cooling water, compressed air and standard connections to the CERN communication network;

#### *Computing*

- j) central computing resources for the Collaboration for the duration of the experiment in amounts to be decided by the normal CERN allocation procedures;

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*Transport of persons*

- k) basic transportation for personnel between the main parts of the CERN site;

*Safety services*

- l) access to its safety services for advice, inspection and control, and first aid or other emergency help;

*Administrative services*

- m) access to its administrative services to help the Collaboration in financial matters, in accordance with the CERN Financial Rules and in particular with those applying to Visiting Teams.

**Special Services**

- 5.11. A variety of services other than those specified above may be provided to the Collaborating Institutions on request, subject to the availability of resources. Such services will be charged to the Collaborating Institutions according to the rules currently in force at CERN.

**Special Equipment**

- 5.12. Any additional infrastructure equipment to be provided by CERN shall be explicitly mentioned in the Memorandum of Understanding. The respective obligations of CERN and of the Collaborating Institutions with regard to the construction, operation and maintenance of this equipment shall also be specified therein or in the Maintenance and Operation agreement, where this is a separate document.

**6. OBLIGATIONS OF THE COLLABORATING INSTITUTIONS**

**Basic Obligations**

- 6.1. The team members and property of Collaborating Institutions shall, while located on the CERN site, be subject to the authority of the Director-General of CERN and shall comply with the regulations in force on the Organization's site. Each Collaborating Institution shall nominate a Team Leader who is responsible, among other things, for ensuring that all members of the team (paid academic, research, technical and administrative staff and registered students) are aware of the regulations and obligations, and of the need to comply with them at all times while on the CERN site.

**Medical surveillance and certificates**

- 6.2. Each Collaborating Institution sending team members to CERN shall remain responsible as employer for the medical surveillance of its team members and, in the case of team members who are to work in conditions deemed to constitute special risks (e.g. radiation controlled areas), shall supply a certificate of medical fitness on first arrival at CERN.

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### **Safety briefings and inspections**

- 6.3. Collaborating Institutions shall participate in safety meetings and studies of their experiment, and shall accept the right of the CERN safety personnel to carry out safety inspections as well as other safety measures set out in the document "Safety Policy at CERN - SAPOCO/42".

### **Supply of equipment**

- 6.4. The Collaborating Institutions shall make available on the CERN site, according to an agreed timetable and in working order, the equipment that they have undertaken to supply and to commission. The Spokesperson shall inform the appropriate Director of Research of any significant failure to meet the agreed schedule. For experiments with FRCs or RRBs, these bodies will monitor such matters.

### **Ownership status**

- 6.5. The delivery of items to the CERN site, or the handling of such items there, will not affect the property rights relevant to those items, unless otherwise formally agreed with the owner. On the other hand, the ownership of equipment no longer required by the Collaboration can, subject to formal mutual agreement, be transferred to CERN, where this is in the mutual interest of CERN and the Collaboration concerned.

### **Ownership inventory**

- 6.6. As a condition of coverage by CERN's Insurance, each Collaborating Institution must provide CERN with a list of the property it installs on the CERN site. All equipment delivered to the CERN sites must be properly documented to indicate its ownership status, handling requirements and any potential hazards that it may pose. It shall keep the list up to date and, where necessary, inform CERN of any modifications to it.

### **Transport of equipment**

- 6.7. Each Collaborating Institution supplying equipment shall be responsible for its delivery to and removal from the CERN site.

### **Installation and dismantling of equipment**

- 6.8. The Collaboration is collectively responsible for the installation and dismantling of the equipment supplied by the Collaborating Institutions, in common or individually.

### **Operation and maintenance costs of equipment**

- 6.9. The Collaborating Institutions shall be collectively responsible for the operation and maintenance of the equipment supplied by them, and for providing the resources necessary to carry out the experimental programme. The resources needed to operate and maintain the infrastructure and other equipment supplied by CERN as Host shall be provided by CERN.

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### **Assignment of equipment**

- 6.10. Any Party providing equipment undertakes to continue to make it available to the Collaboration at CERN until the experiment is officially declared to have been completed (see 8.2 below).

### **Early removal of equipment**

- 6.11. If equipment provided by a Collaborating Institution is, in the opinion of the Collaboration, no longer required, the Parties may agree to and request its removal from the CERN site under the responsibility of the Institution concerned.

### **Release of space**

- 6.12. Space allocated for construction and assembly should be released when these activities have been terminated. CERN reserves the right to change the space allocation during the lifetime of the experiment. As soon as the experiment is declared to have been completed (see 8.2 below), all space used by the Collaboration, including office and laboratory space, and the space used for testing and running the experiment, will be made available to CERN for reallocation.

### **Removal of equipment**

- 6.13. Equipment associated with an experiment shall be removed from the CERN site within six months following a request from the CERN Division Leader concerned.

## **7. INTELLECTUAL PROPERTY**

### **Free use of knowledge and data**

- 7.1. CERN is bound by its Convention to publish or otherwise make generally available the results of its experimental and theoretical work. In addition, subject to clause 7.2 hereunder, each Collaborating Institution and CERN as the Host Laboratory is entitled to use for its own purposes any data and knowledge arising from the preparation or execution of the experiment.

### **Matters for prior agreement**

- 7.2. Title to any patentable invention or any know-how arising from the preparation or execution of the experiment is vested in the Collaborating Institution(s) which is/are its author(s), who shall decide on the taking of measures, at its/their own expense, to protect such invention or know-how and who shall grant each Collaborating Institution and CERN a free, perpetual and irrevocable license to use such invention or know-how for its own purposes. Such license does not include the right to sub-license.

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## 8. FINAL PROVISIONS

### Modifications and formal amendments

- 8.1. The Collaboration shall reach agreement on any modification or addition to the experiment that affects the terms of the Memorandum of Understanding and shall inform CERN of such changes. Where the changes constitute a substantial change to the experiment, they will be submitted to the appropriate committee for approval and acceptance by CERN. In cases where the Collaboration has an FRC/RRB, the latter bodies must also approve any such changes. Major modifications shall be approved as formal amendments to the Memorandum of Understanding and signed by the representatives of all the Parties.

### Duration of applicability of the Memorandum of Understanding

- 8.2. Unless the duration of applicability is specified in the Memorandum of Understanding, the terms and conditions of the Memorandum of Understanding will apply until the appropriate CERN Research Director, in agreement with the Spokesperson, declares the experiment to have been completed, dismantled and the arrangements for its disposal agreed.

### Observance of the Memorandum of Understanding

- 8.3. The Memorandum of Understanding formalises the agreement reached between all the Parties on the experiment, who will do their best to adhere to its provisions. Any default under its provisions will be dealt with by the Collaboration, in consultation with the CERN Management.

### Relevant documents

- 8.4. The following documents are fully applicable in the execution of the Memorandum of Understanding:
- the CERN Users' Guide,
  - the Safety Guide for CERN experiments,
  - the Safety Policy at CERN - SAPOCO/42,
  - Financial Guidelines for the LHC Collaborations (CERN/FC/3796) - for the LHC experiments only,
  - Financial and Administrative Provisions for Visiting Teams.

### ACCU

- 8.5. The Advisory Committee of CERN Users (ACCU) promotes links between CERN Management and the User Community and advises CERN Users on the working conditions and the arrangements for technical support.



**Annex 4 : Main Headings of TOTEM Experiment Activities.****Annex 4.1 : Sub-detector Structure of the TOTEM Experiment.**

<b>ROMAN POTS</b>
1. Roman Pot mechanics
2. Movement
3. Beam position monitor
4. Detector mechanics
5. Silicon sensors
6. Cooling
7. Electronics
8. Power supplies and cables
9. Miscellaneous
<b>T1-CSC</b>
1. 70 CSC Detectors
2. Electronics
3. Power supplies and cables
4. Supports and services
<b>T2-GEM</b>
1. 50 GEM Detectors
2. Electronics
3. Power supplies and cables
4. Supports and services
<b>TEST SETUP</b>
1. Cables, power supplies and infrastructure
2. Electronics DAQ and computing
3. Pool rental & Consumables
<b>DAQ EVENT BUILDER</b>
1. Readout column
2. Link into CMS DAQ*
3. Online PC & storage
<b>DETECTOR CONTROLS</b>

### **Annex 4.2 : TOTEM Core Computing.**

The TOTEM Core computing comprises the following activities:

- a) The Core part of the *“Software”* activity including items such as: application framework, basic software toolkits, persistency, etc.
- b) The *“Computing”* activity comprising the distributed TOTEM computing systems at CERN and offsite including, for example:
  - infrastructure for software development, installation and distributed deployment;
  - database, information and documentation services/systems;
  - liaison with regional centres to define, establish and monitor the TOTEM computing environment;
  - ensuring the safe storage and distribution of TOTEM data;
  - liaison with LCG / Grid projects to specify requirements and test and integrate products;
  - infrastructure and production operation of large-scale Monte-Carlo simulation, reconstruction, and analysis activities; and
  - building, deploying and operating systems for general and user-specific data productions.

Both the Core Software and Computing activities require Computing Professionals skilled in areas such as OO analysis and design, C++ and other languages, databases and data management systems, computing systems, software process, quality control, and so on. In general, such people have formal computing education and experience although some may be physicists who have changed career path by learning the requisite skills.

Computing for TOTEM also comprises the *“Analysis”* and *“Detector”* activities as well as those aspects of the *“Software”* activity such as physics and detector simulation, reconstruction, calibration and physics analysis; the Higher Level Triggers and the associated algorithms; and the assurance of the quality and integrity of TOTEM data. These tasks are predominantly carried out by physicists and are an intrinsic part of the physics research programs of TOTEM Institutes. They are not subject to any Memorandum of Understanding. For completeness their Work Breakdown Structure is shown in **Annex 4.4**.

### Annex 4.3 TOTEM outline Work Breakdown structure (WBS) for the Core Software & Computing Activities.

WBS Tasks	
Project	Task
<b>1. Software</b>	1.1 Software process (lifecycle, specs, design, construction, testing, deployment, documentation, operation, maintenance & support, configuration management)
	1.2 Software project coordination
	1.3 Development environment (source, numerics, libs, debug management)
	1.4 Quality assurance, testing, validation and verification procedures
	1.5 Build & release workspace and management
	1.6 Application Framework: maintenance, integration with CMS
	1.7 Interface with the machine (proton transport)
	1.8 Databases
	1.9 Physics software toolkits and Analysis Tools (use, interface, integration)
<b>2. Computing</b>	2.1 Computing coordination
	2.2 Central Computing Environment and Distributed Computing management, TOTEM software installation and replication
	2.3 Production: coordination, tools
	2.4 Data Management (raw, DST, miniDST)
	2.5 Infrastructure, web, desktops, users, administration, support

**Annex 4.4 TOTEM outline Work Breakdown Structure (WBS) of the Analysis, Physics "Software", and Detector Activities.**

<b>WBS Tasks</b>	
<b>Project</b>	<b>Task</b>
<b>1. Analysis</b>	1.1 Data reduction (HLT, I/O) 1.2 Reconstruction 1.3 Full Simulation 1.4 Analysis of the physics observables
<b>2. Detector act.</b>	2.1 Calibration and alignment 2.2 Performances and response 2.3 Resolution of the physics observables

## Annex 5 : The Organizational Structure of the TOTEM Collaboration.

### Annex 5.1 The Management Structure of the TOTEM Collaboration

1. Concerning all scientific and technical matters, in particular the definition, construction and operation of the detector, the Collaboration is governed by the **TOTEM Collaboration Board (CB)**. This board is composed of one representative from each collaborating institution, with voting rights; and the Spokesperson, the Deputy-Spokesperson and the Technical Coordinator as ex-officio members, without voting rights. The CB elects the **Chairperson of the CB** from among the Members of the Collaboration. On request of the Chairperson, other coordinators can be invited to attend (without voting rights).
2. All scientific and technical issues are discussed in the **Plenary Meeting** before any major decisions are taken by the CB.
3. Concerning all resource and legal matters, the Collaboration is monitored by the **TOTEM Resource Review Board (RRB)**. This board is composed of representatives of each Funding Agency, with voting rights, and ex-officio members of the TOTEM Management and CERN Management, without voting rights. The RRB is chaired by CERN's Chief Scientific Officer.
4. The Project Leaders of the sub-detectors listed in **Annex 4** and the Coordinators listed in **Annex 5.2** are ratified by the Collaboration Board on proposal by the Spokesperson.
5. The **Spokesperson** represents the Collaboration to the outside and leads the Collaboration in all day-to-day matters. He/she is appointed by the CB following the rules in the TOTEM Collaboration Governance document.
6. The **Resource Coordinator** oversees the resource planning of the TOTEM project and will typically deal with budget planning, manpower planning, Memoranda of Understanding and the Common Fund. He/she is appointed by the CB in consultation with the CERN Management.
7. The **Technical Coordinator** has the responsibility to oversee all technical aspects of the detector construction. In particular, he/she ensures the integration of all sub-detectors into the complete detector and directly monitors the Common Projects. He/she is appointed by the CB in consultation with the CERN Management.
8. The Group Leader in Matters of Safety (**GLIMOS**) is responsible to the CERN Management for all matters of safety concerning TOTEM personnel, work and equipment on the CERN premises. He/she is appointed by the CERN Management in consultation with the TOTEM Management.

The list of persons presently holding management and other senior positions is presented in **Annex 5.2**.

### Annex 5.2 Persons currently holding Management and other senior positions within the TOTEM Collaboration

Spokesperson	Karsten Eggert
Deputy	Maurizio Lo Vetere
Collaboration Board Chairperson	Angelo Scribano

Resource Coordinator	Simone Giani
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Technical Coordinator	Ernst Radermacher
Deputy & Integration Coordinator	Marco Oriunno

Physics Coordinator	Risto Orava
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Electronics Coordinator	Walter Snoeys
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DAQ Coordinator	Emilio Radicioni
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Software Coordinator	Valentina Avati
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<b>Project Leaders</b>	
Roman Pot Project	Ernst Radermacher & Gennaro Ruggiero
T1 Project	Saverio Minutoli & Enrico Robutti
T2 Project	Kari Kurvinen & Leszek Ropelewski
Level 1 Trigger	Nicola Turini
Test Beam	Mario Deile

## Annex 6 : Overview of the Technical Participation of Institutes in TOTEM.

## Annex 6.1 Detector Construction

Sub-DETECTOR	responsibilities										
	Brunel (*)	CERN	Helsinki	INFN (Bari)	INFN (Genoa)	INFN (Pisa)	Warsaw (*)	EAS (Tallinn)	Prague	USA (Penn St.)	USA (CWRU)
<b>Roman Pots</b>											
Mechanics		x							x		
Si-Detectors		x									
FE electronics for Si-Det.		x			x		x	x		x	
Support and installation		x							x		
Proton Trigger		x		x		x		x		x	x
<b>T1 Detector</b>											
CSC Detectors					x						
CSC FE electronics		x			x						
Support and installation		x			x						
Inelastic Trigger				x	x	x					
<b>T2 Detector</b>											
GEM Detectors		x	x								
GEM FE electronics		x	x	x		x				x	x
Support and installation		x	x								
Inelastic Trigger		x		x		x					
<b>DAQ electronics</b>		x		x							
<b>Test Setup</b>	x	x	x	x	x	x	x	x	x	x	x
<b>Large Size GEM Prototypes</b>		x		x	x	x				x	x

(\*) No longer in the Collaboration.

### Annex 6.2 Core Computing and Software

The following institutes are participating in Computing and/or Software (Core Software only, not including physics/detector aspects)

	<b>responsibilities</b>										
	Brunel (*)	CERN	Helsinki	INFN (Bari)	INFN (Genoa)	INFN (Pisa)	Warsaw (*)	EAS (Tallinn)	Prague	USA (Penn St.)	USA (CWRU)
<b>Core Computing &amp; SW</b>		x	x	x	x	x	x	x	x	x	x

(\*) No longer in the Collaboration



**Annex 7 : Common Items - M&O Costs that the Collaboration has agreed are to bear at its common expense.**

Ref	System	Sub-system	Item
<b>1.</b>	<b>Any subdetector</b>	<i>Any</i>	
1.1			<i>Commercial spare parts of any kind</i>
1.2			<i>Gas systems</i>
1.3			<i>Gas consumption</i>
1.4			<i>Cooling systems</i>
1.5			<i>Cooling fluids (above -50°C)</i>
1.6			<i>Moving/hydraulic systems</i>
1.7			<i>Detector Control system</i>
1.8			<i>Detector Safety systems</i>
1.9			<i>Shutdown activities</i>
1.10			<i>General Technical support</i>
1.11			<i>UPS maintenance</i>
1.12			<i>Electronics pool rental</i>
1.13			<i>Beam pipe &amp; vacuum</i>
1.14			<i>Counting &amp; control rooms</i>
<b>2.</b>	<b>Software</b>		
<b>2.1</b>		<i>Core Software</i>	
2.1.1			<i>Software process management, from specs/design to operation, and configuration management</i>
2.1.2			<i>Project management</i>
2.1.3			<i>Development environment (code, numerics, libs, debug)</i>
2.1.4			<i>Software testing, Quality Assurance, validation, verification</i>
2.1.5			<i>Build and release procedures (incremental reference tagging, workspace management)</i>
2.1.6			<i>Application framework, CMS interface</i>
2.1.7			<i>Proton transport, machine interface</i>
2.1.8			<i>Persistency and databases</i>
2.1.9			<i>Integration of physics toolkits and analysis tools</i>
<b>2.2*</b>	<i>*shown for completeness</i>	<i>Analysis and Detector</i>	
2.2.1			<i>Data reduction</i>
			<i>High Level Trigger / Data Quality: Input/Output</i>
			<i>Data Handling, Control and Monitoring, Quality assurance/control</i>
2.2.2			<i>Reconstruction</i>
2.2.3			<i>Full simulation</i>
2.2.4			<i>Analysis of physics observables</i>
2.2.5			<i>Detector calibration and alignment</i>
2.2.6			<i>Detector performances and response</i>
2.2.7			<i>Detector resolution of physics observables</i>
2.2.8			

ctd...

## Annex 7 ctd.

Ref	System	Sub-system	Item
<b>3.</b>	<b>Computing</b>		
<b>3.1</b>		<b>Computing coordination</b>	
3.1.1			Management and traceability tools
<b>3.2</b>		<b>Infrastructure &amp; Services</b>	
3.2.1			Central&Distributed Computing Environment
3.2.2			Standard Operating System/Grid Environment
3.2.3			Dedicated developer platforms and general desktop support and operations
3.2.4			Database administration
3.2.5			Platform and compiler validation and support
3.2.6			www server, Collaboration DB, document storage
3.2.7			Support of videoconferencing, email lists, news, calendar, agendas
3.2.8			User support
3.2.9			Help-desk system and staff
3.2.10			User and resource administration at CERN and TOTEM Grid virtual organisation
3.2.11			Computing and software documentation and training
3.2.12			Software repository access rights and mirroring
3.2.13			Code-dependency checking,, bug-tracking, performance profilers
<b>3.3</b>		<b>Production</b>	
3.3.1			Common support for production operations
3.3.2			Software packaging and distributed installation & replication of TOTEM environment
3.3.3			Productions management
3.3.4			Technical support for Production tools
<b>3.4</b>		<b>Data Management</b>	
3.4.1			Data reduction process and organization of raw,dst,mini-dst data on servers
3.4.2			Database of settings data
3.4.3			Dataset request, resource management, access optimization of backed-up or mass-storage data
3.4.4			Dataset validation, error correction and publishing
<b>4.</b>	<b>Exp. Infrastructure</b>		
<b>4.1</b>	<b>To be moved after Any subdetector</b>	<b>Access and Survey</b>	
4.1.1			Gangways, Stairs
4.1.2			Structures on Yoke
4.1.3			Personnel Access Equipment
4.1.4			General Survey
<b>4.2</b>		<b>General Installation</b>	
4.2.1			Counting Room Structures
4.2.2			Racks with Cooling
4.2.3			Electrical Distribution from Outlets
4.2.4			Gas Systems and Primary Distrib. Racks
4.2.5			Beam Pipe
4.2.6			Cable Trays to Counting Rooms
4.2.7			Control Room and Cabling to Surface
4.2.8			General Piping
<b>4.3</b>		<b>Cooling and Ventilation</b>	
4.3.1			Detector Cooling Plant
4.3.2			Detector Specific Ventilation
4.3.3			Detector Primary Cooling System
<b>4.4</b>		<b>Safety</b>	
4.4.1			Safety Installations
4.4.2			Safety Equipment Control
4.4.3			Hard-wired Safety System
4.4.4			Insertion System

**Annex 8 : Summary Table of the Contributions to TOTEM (kCHF) by Funding Agency and Sub-detector, including Common Projects**

		CERN	INFN	Finland	Brunel	Estonia	Prague	Warsaw	NSF	C. Projects
<b>ROMAN POTS</b>		<b>2476</b>								
1. Roman Pot mechanics	651	456					195			
2. Movement	204	204								
3. Beam position monitor	171	169					2			
4. Detector mechanics	133	133								
5. Silicon sensors	228	110			55				63	
6. Cooling	209	209								
7. Electronics	554	175				40			324	15
8. Power supplies and cables	287	160						127		
9. Miscellaneous	40	40								
<b>T1-CSC</b>		<b>1820</b>								
1. 70 CSC Detectors	627		627							
2. Electronics	666	73	509						70	15
3. Power supplies and cables	159	119	40							0
4. Supports and services	369	249	50							70
<b>T2-GEM</b>		<b>1303</b>								
1. 50 GEM Detectors	434			434						
2. Electronics	533		518						0	15
3. Power supplies and cables	138		138							
4. Supports and services	199			90						109
<b>TEST SETUP</b>		<b>150</b>								
1. Cables, power supplies and infrastructure	40									40
2. Electronics DAQ and computing	70									70
3. Pool rental & Consumables	40									40
<b>DAQ EVENT BUILDER</b>		<b>720</b>								
1. Readout column	170	0	170			0			0	
2. Link into CMS DAQ*	500	500	0						0	
3. Online PC & storage	50		33						0	17
<b>TOTAL TOTEM</b>		<b>6470</b>								
		2095	2085	524	55	40	197	127	457	390
		500*								

5.2 will be staged



**Annex 9 : Category A Headings for TOTEM M&O Costs Categorisation****Detector related costs**

- Gas systems
- Gas consumption
- Cooling systems
- Cooling fluids (above -50°C)
- Moving/hydraulic systems
- Detector safety systems
- Shutdown activities
- General Technical support
- UPS maintenance
- Electronics pool rentals
- Beam pipe & vacuum
- Counting & control rooms
- Power supplies
- Cables and miscellaneous

**Manpower @ CERN**

- Hired as external computer scientists consultants (CHF)
- Project Associates
- Unpaid Associates from Collaborating Institutes (FTE)

**Secretariat**

- Secretarial assistance
- Economat
- Fax, photocopiers, printers
- Printing and publication

**Communications**

- GSM phones/on-call service
- Automatic call-back

**On-line computing (no recording media)**

- System management
- Data storage, (temporary on disk)
- Detector controls
- Computers/processors/LANs
- Software licenses
- Common desktop infrastructure

**Core Computing & Software**

- Software process and project management
- Development environment
- Quality assurance and testing procedures
- Build workspace and Release management
- Application framework documentation and maintenance

- Interface with the machine, proton transport
- Database applications
- Integration of physics toolkits and analysis tools
- Distributed&central computing coordination
- TOTEM environment installation and replication
- Production management and tools
- Data management and servers
- Infrastructure and services
- User support
- Common support for production operations

**Test beams, calibration facilities**

- General operation
- Common electronics
- Electronics pool rentals
- Gas systems
- Gas consumption

**Laboratory operations**

- Assembly areas, clean rooms
- Workshops
- Laboratory instruments

**General services**

- Cooling & ventilation
- Power
- Power distribution system
- Heavy transport
- Cranes
- Cars
- Cleaning
- Survey
- Storage space
- Common desktop infrastructure
- Academic subsistence
- Outreach

**Annex 10 : Category B Headings for TOTEM M&O Costs Categorisation.**

**Detector maintenance and repairs.** The sharing is based on the proportions of the original investment as shown in Annex 8

Sub-DETECTOR	Responsibilities					
	CERN	INFN	Helsinki	Estonia	Prague	NSF
<b>Roman Pots</b>						
Mechanics + Installation	85%				15%	
Si Detectors	73%					27%
Electronics	50%			5%		45%
<b>T1 Detector</b>						
CSC Detectors		100%				
Electronics		90%				10%
Supports + Services	90%	10%				
<b>T2 Detector</b>						
GEM Detectors			100%			
Electronics		100%				
Supports + Services	50%		50%			
<b>DAQ</b>						
Read-out Column		100%				
<b>Detector Controls</b>	25%	25%	25%			25%

**Manpower @ CERN**

Hired as Industrial Support (CHF)

Technicians from Collaborating Institutes (FTE)

**Annex 11 : Headings that give rise to Category C M&O costs.**

General services

Safety & radioprotection

INB compliance

Radioactive waste disposal

Access system

Elevators

Gerant de site

Flood control

Insurance (CERN standard)

Cleaning

Office space



**Annex 12 : Rules of Procedure for the M&O Scrutiny Group**

- 12.1 The RRBs of the LHC experiments, acting together, shall appoint a Scrutiny Group to assist them in exercising their duties with respect to the oversight of M&O costs and the approval of M&O spending for the coming year. The Scrutiny Group has a technical role and shall be composed of six persons chosen appropriately by the RRBs acting jointly and four persons chosen by CERN. The Scrutiny Group shall perform its duties for all of the LHC Collaborations. The members chosen by the RRBs shall normally include at least one person from each of a large Member State, a small Member State, a large non-Member State and a small non-Member State.
- 12.2 In order to promote continuity in its deliberations, appointments to the Scrutiny Group shall normally be for two years, with the possibility of re-appointment. Half of the members chosen by the RRBs and half of those chosen by CERN will be replaced each year. In order to establish this rolling replacement, half of the initial members of the Scrutiny Group will serve for three years.
- 12.3 The names of new Scrutiny Group members for the current and following year will normally be settled at the spring meeting of the RRBs. For the members to be chosen by the RRBs, the RRB Chairperson will receive nominations. CERN will inform the RRBs of its choice of members. The RRBs will then appoint the Scrutiny Group members by consensus in plenary session.
- 12.4 The Scrutiny Group shall select its Chairperson from amongst the members chosen by the RRBs.
- 12.5 At his or her discretion, the Chairperson of the Scrutiny Group will accept that, in exceptional circumstances, a member is replaced at an individual meeting by a named proxy.
- 12.6 The Scrutiny Group will receive for scrutiny, normally at the spring meetings of the RRBs, the Collaborations' proposals concerning the level, provision and sharing of Category A M&O costs for the following year, along with their reported Category B costs and the proposed responsibilities and commitments for these. It will then carry out its scrutiny activities and will submit its reports for each experiment to the autumn meetings of the RRBs.

**Annex 13 : Participants in the TOTEM Collaboration.**

Scientific staff in the TOTEM Collaboration holding PhD or equivalent qualifications who are entitled to be named as authors of scientific publications of the Collaboration.

**CERN**

CERN, European Laboratory for Particle Physics:

G. Antchev, P. Aspell, V. Avati<sup>1</sup>, M. Deile, E. Dimovasili<sup>2</sup>, K. Eggert, S. Giani, F. Haug, P. Jarron, J. Kaspar<sup>3</sup>, F. Lucas Rodriguez, D. Macina, H. Niewiadomski, M. Oriunno, P. Palazzi, E. Radermacher, L. Ropelewski, G. Ruggiero, W. Snoeys, J. Wu

**Czech Republic**

**Prague**, Institute of Physics of the ASCR, v.v.i.:

V. Kundrať, M. Lokajicek

**Estonia**

**Tallinn**, Estonian Academy of Sciences

E. Lippmaa, A. Rummel, A. Trummal

**Finland**

**Helsinki**, Helsinki Institute of Physics (HIP) and Department of Physical Sciences, University of Helsinki:

F. Garcia, K. Kurvinen, R. Lauhakangas, R. Orava, K. Österberg, H. Saarikko, N. van Remortel

**Italy**

**Bari**, INFN Sezione di Bari and Dipartimento Interateneo di Fisica dell'Università e del Politecnico di Bari:

V. Berardi, F. Cafagna, M. Calicchio, M.G. Catanesi, E. Radicioni

**Genoa**, INFN Sezione di Genova and Università di Genova:

M. Bozzo, A. Buzzo, F. Ferro, M. Lo Vetere, M. Macri, S. Minutoli, P. Musico, E. Robutti, A. Santroni, G. Sette

**Pisa/Siena**, INFN Sezione di Pisa and Università di Siena:

U. Bottigli, P.L. Catastini, M.A. Ciocci, S. Lami, G. Latino, M. Meucci, E. Oliveri, R. Paoletti, G. Sanguinetti, A. Scribano, F. Spinella, P. Squillacioti, N. Turini

**USA**

**Cleveland, OH**, Case Western Reserve University, Dept. of Physics:

C. Taylor

**University Park, PA**, Penn State University, Dept. of Physics:

J. Whitmore

<sup>1</sup>also at Case Western Reserve University, Dept. of Physics, Cleveland, OH

<sup>2</sup>also at Penn State University, Dept. of Physics, University Park, PA

<sup>3</sup>also at Institute of Physics of the ASCR, v.v.i., Czech Republic, Prague

**Annex 14 : Non-Member States for which CERN will partially pay the energy costs**

14.1 CERN will partially pay the energy costs for the following CERN Non-Member States by virtue of their contributions to the construction of the LHC machine.

1. Canada
2. India
3. Japan
4. Russian Federation
5. United States of America

14.2 Under a co-operation agreement Israel contributes to CERN 20% of the amount that would normally be expected of it as a Member State. The further provisions of this co-operation agreement on the use of these funds lead to the conclusion that CERN should pay 16% of the energy costs for this country.

### Annex 15 : Formula used for determining the sharing of the CERN payment of energy costs amongst the eligible non-Member States.

$M_i$  = contribution to the LHC machine of country  $i$

$M_{MS}$  = contribution to the LHC machine of CERN Member States taken together

$M_{NMS}$  = contribution to the LHC machine of the non-Member States listed in Annex 14.1 taken together

$G_i$  = GDP of country  $i$  (see explanatory note below)

$A_i$  = category A costs for country  $i$

$E_{MS}$  = energy costs of the Member States together

$E_{NMS}$  = energy costs of the non-Member States listed in Annex 14.1 taken together

$E_i$  = Energy costs attributable to country  $i$

The CERN share  $E_{NMS(CERN)}$  of  $E_{NMS}$  is determined by the LHC machine contribution of these countries relative to the contribution of the CERN Member States, i.e.

$$E_{NMS(CERN)} = E_{NMS} \cdot M_{NMS} / M_{MS}$$

Beyond this, the algorithm used for sharing amongst the eligible non-Member States is:

$$E_i = k \cdot (M_i / G_i) \cdot A_i \quad \text{where } k = \frac{E_{NMS(CERN)}}{\sum_{NMS} ((M_i / G_i) \cdot A_i)}$$

### Explanatory note on the calculation of GDPs

The Gross Domestic Products to be taken into account in preparation for the decision in the autumn of year  $n$  on the payment of energy costs by CERN in year  $n+1$  to contributing non-Member States are those for the years of LHC construction (1996-2006). Thus initially the averaged Gross Domestic Product in Swiss francs for each contributing non-Member State is calculated as described in the following two paragraphs.

1. The Gross Domestic Product (GDP) in US Dollars of each contributing non-Member State for the years 1996 to  $m$ , the last year available ( $m \leq n-1$ ), is obtained from the document "International Financial Statistics" published by the International Monetary Fund (IMF), Washington DC.
2. An average of the resulting data for each contributing non-Member State is calculated by the application of the following formula :

$$(GDP_{1996} + GDP_{1997} + \dots + GDP_m) / (m-1996+1)$$

When  $m$  reaches 2006, the averaged GDP for the country in question will cover the whole period of LHC construction and will then be used unchanged in subsequent years.

**Annex 16 : Procedure for the payment of Category A contributions**

For Category A expenses, CERN will issue, each calendar year, on the basis of the agreed costs and sharing, invoices in Swiss francs to the Funding Agencies of the various Institutes for payment during that year; any necessary adjustments will be made and taken into account in the following year. Payment of 50% of the amount invoiced will be due not later than 10 February and the remaining 50% not later than 10 June. Advance payments are encouraged. The RRB will be informed at its autumn meeting each year of the interest gained or lost by the Collaboration.

