AGREEMENT

between

THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH (CERN) of Geneva, Switzerland

and

THE UNIVERSITY OF LIVERPOOL acting on behalf of the COCKCROFT INSTITUTE (CI) of Daresbury Science and Innovation Campus, United Kingdom

concerning

THE COLLABORATION BETWEEN THE COCKCROFT INSTITUTE AND CERN IN ACCELERATOR PHYSICS AND TECHNOLOGIES

THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, hereafter referred to as "CERN", an Intergovernmental Organization having its seat in Geneva, Switzerland, represented by its Director-General, Robert Aymar,

on the one hand,

and

THE UNIVERSITY OF LIVERPOOL acting on behalf of THE COCKCROFT INSTITUTE, hereafter referred to as "CI", an unincorporated association of the Universities of Liverpool, Manchester and Lancaster and the Science & Technology Facilities Council which was established as an international centre of accelerator science and technology in the UK and is currently under the leadership of its Inaugural Director, Professor Swapan Chattopadhay,

on the other hand,

(hereafter collectively referred to as "the Parties" and separately as "Party").

CONSIDERING:

- The lasting value of the long-standing scientific collaboration between UK scientific institutes and universities affiliated with CI and CERN;

- That the participation of scientists and technical experts in international, cutting-edge science projects hosted by CERN or CI, through the education of young scientists and technical experts, and through the transfer of technological know-how, would be of mutual benefit;

IT IS AGREED AS FOLLOWS:

ARTICLE 1
Purpose

1.1 The purpose of this Agreement is to establish a long-term operational framework for scientific collaboration in accelerator physics and technologies between the Parties, with such collaboration having as its aim to combine expertise to achieve scientific goals, to develop common specialised knowledge and the effective use of facilities and to increase co-operation and mutual support. The results of the collaboration shall be used for peaceful purposes only.

1.2 With the exception of Articles 5, 6, 7 and 8 of this Agreement, the Parties agree that this Agreement is not legally binding but reflects a spirit of co-operation between them. Each Party may identify collaborative research opportunities of mutual or individual interest, including the exchange of personnel or of designs and data. Where there is agreement to proceed, specific contractual arrangements detailing terms and conditions of the collaboration will be negotiated between the Parties and laid down in Addenda to this Agreement.

ARTICLE 2
Collaboration

2.1 The Parties shall set up dedicated collaborations between CERN and CI to allow for the participation of qualified scientific and technical personnel in:

(a) R&D related to technologies for accelerators,

(b) the training of physicists and engineers in the development and operation of accelerators,

(c) the CERN Accelerator Schools, as the case may be co-sponsored by CI, as well as in other CERN and CI schools, e.g. the CERN Computing School and the School of Physics, and the CI Advanced Accelerator Courses, and

(d) any other project at CERN or at CI related to accelerator physics and technologies that is of mutual interest.

2.2 Details of particular collaboration areas and topics will be outlined in specially agreed upon Addenda to this Agreement. An initial set of collaboration topics, which is not necessarily exhaustive and which will be developed as Addenda and subject to future revisions and further developments, is given in Annexes A through F of this Agreement and consists of:

(i) participation in and assistance with the LHC developments: beam commissioning, R&D on future energy and luminosity upgrades, R&D on LHC Injector Complex (SPL and PS2), and the conceptual development of the LHeC;
(ii) R&D for the Antiproton Decelerator Complex;
(iii) R&D on Multi-TeV electron-positron linear colliders via collaboration in CLIC/CTF3.

In addition, the Parties shall explore the feasibility of collaborating in superconducting linear accelerators using electrons and ions for particle and nuclear physics.

Where CI becomes a member of an experimental collaboration, the provisions of the resulting Memorandum of Understanding shall prevail over the provisions of this Agreement in respect of CI's contribution to such an experiment.

2.3 CERN and CI accept the participation of students, staff and teachers in their respective training programmes, within agreed upon quotas, it being understood that these quotas shall depend on the number of candidates and the capacity to host them. In exceptional cases, and subject to financial support by CI and CERN, the Parties could also accept candidates in programmes for technical or doctoral students.

2.4 Upon mutual agreement, CI and CERN would be willing to offer to each other assistance in the organization of workshops, seminars and schools related to accelerator physics and technologies and for the establishment of the teaching of accelerator physics in the UK and Europe.

2.5 Any such collaboration shall cease through the termination of the activity concerned, or of this Agreement, or by prior written agreement.

ARTICLE 3
Financial, In-kind and Effort Contributions

3.1 Costs relating to collaborative scientific projects under this Agreement shall be apportioned by accord between the Parties, with the Parties exchanging estimates of costs likely to be incurred before such items of expenditures arise, and agreeing on any proposed expenditure.

3.2 The Parties shall make their due contributions as far as these have been formally agreed in the form of Addenda to this Agreement.

3.3 A suggested list of initial collaboration topics and associated effort contributions are outlined in the attached Annexes A through F of this Agreement.

ARTICLE 4
Organization

4.1 The Parties shall each designate a contact person who shall co-ordinate the execution of the scientific collaborations arising from this Agreement.

4.2 The contact persons shall participate in meetings dealing with the implementation of this Agreement, and shall receive all relevant documentation concerning these meetings.

4.3 It is understood that the procurement of materials, equipment and services related to this Agreement shall be in accordance with the relevant financial rules and purchasing procedures of the procuring Party and its partnering institutions.

ARTICLE 5
Personnel

5.1 The Parties shall ensure the selection of personnel with the necessary skills and competence to take part in the activities referred to in Articles 2.1 and 2.2 of this Agreement.

5.2 Each Party shall pay for the travel of its own personnel to the other Party, unless otherwise agreed upon.

5.3 Except when they are simple visitors, CI personnel shall be given for the duration of their presence at CERN the status of associated members of the personnel, as that term is used in the CERN Staff Rules and Regulations, copies of which shall be provided to CI and its personnel. They shall be registered in and assigned to the relevant CERN Department. Similar affiliated status shall be created and reciprocated by CI.

5.4 CI personnel and the personnel of CERN shall remain employees of their home institutions, which, as employers, shall each bear exclusive responsibility for the remuneration and for the procurement of social security of its personnel, including health and accident insurance and third party liability insurance at levels prevailing in their respective Host State(s), as well as insurance against the financial consequences of death and disability. Each Party shall hold the other Party free and harmless from any liability in this respect.

5.5 Without prejudice to the operation of the Protocol on the Privileges and Immunities of CERN, in force in the UK, each Party shall take the necessary steps to ensure a level of protection for the personnel of the other Party, when on the premises of the host establishment, equivalent to that granted to the personnel of the host establishment.

ARTICLE 6
Safety

6.1 The personnel of each Party shall comply with the rules for conduct and safety in force at the host establishment.

6.2 Any item or equipment constructed and used by personnel from either Party shall conform to the rules for industrial safety in force at the host establishment where it will be installed and operated.

ARTICLE 7
Intellectual Property

7.1 Ownership of the intellectual property rights resulting from the execution of this Agreement shall be vested in whichever Party generated them and that Party grants to the other a free, irrevocable and perpetual license to use such rights for scientific and academic purposes. The Parties express their willingness to grant to each other a license to use their intellectual property rights for commercial purposes on fair and reasonable terms. Intellectual property rights which are developed jointly by the Parties shall be owned jointly provided that neither Party shall commercially exploit such jointly-owned rights without a non-exclusive license from the other on fair and reasonable terms.

7.2 Each Party shall hold the other Party free and harmless from, and indemnify it for, any loss or damage resulting from its use (including any (sub) licensing) of intellectual property rights resulting from the execution of this Agreement.

ARTICLE 8
Confidentiality

Each Party shall keep confidential and only use for the purpose for which it was disclosed all information that has been marked by the disclosing Party as confidential or which must reasonably be understood as confidential. These obligations do not apply where the information:

a) is known to the Party making the disclosure before its receipt and not subject to any obligation of confidentiality to another party; or

b) is or becomes publicly known without any breach of this Agreement or any other undertaking to keep it confidential; or

c) has been obtained by the Party making the disclosure from a third party in circumstances where the Party making the disclosure has no reason to believe that there has been a breach of an obligation of confidentiality; or

d) has been independently developed by the Party making the disclosure; or

e) is disclosed pursuant to the requirement of any law or regulation or the order of any Court of competent jurisdiction, and the Party required to make that disclosure has informed the other Party whose information it is, within a reasonable time after being required to make the disclosure, of the requirement to make the disclosure and the information required to be disclosed; or

f) is approved for release in writing by an authorised representative of the Party whose information it is.

ARTICLE 9
Duration

This Agreement shall take effect on the date of signing and shall remain valid for a period of five years. It is also understood that Articles 5, 7 and 8 of this Agreement shall survive its termination, howsoever caused.

ARTICLE 10
Dispute Resolution

Should questions arise about interpretation of the provisions of this Agreement, or disputes arise in relation to this Agreement or any Addenda, the Parties shall promptly consult with each other and actively work together to achieve a mutually acceptable solution.

Executed in two copies in the English language.

For the European Organization for Nuclear Research

.....

Robert Aymar
Director-General

Date: 29 August 2008

For the University of Liverpool on behalf of the Cockcroft Institute

.....

James Fox
Contract Manager
University of Liverpoool

Date: 25 September 2008

Acknowledged by

.....

Swapan Chattopadhyay
Director of the Cockcroft Institute
and
Sir John Cockcroft Chair of Physics
University of Liverpool, Manchester
and Lancaster

Date: 29 August 2008

ANNEX A

PARTICIPATION IN AND ASSISTANCE WITH LHC BEAM COMMISSIONING

During the period 2008-2010, CI will contribute one faculty, one Post Doctoral Research Assistant (PDRA) and possibly two post-graduate students, integrating with the LHC Beam Commissioning teams to bring about the initial operation of the LHC with proton beams and slowly raise its operating running luminosity.

Effort: 3-FTE / year

Primary CERN contact: Paul Collier

Other CERN Investigator: Roger Bailey

Primary CI contact: Rob Appleby

Other CI Investigators: Frederico Roncaorolo and CI Post-graduate students (to be determined)

ANNEX B

R&D ON LHC LUMINOSITY UPGRADES, INCLUDING SLHC

There is a maturing plan at CERN to improve the collision optics for proton-proton collisions to raise the instantaneous luminosity to twice its initial design luminosity, to a value of 2×10^{34} $cm^{-2}s^{-1}$, in the immediate luminosity upgrade of the LHC beyond its design value. Eventually, with the addition of crossing angle optics, increased beam currents, implementation of 'Crab Cavities,' etc., the upgraded luminosity is expected to reach 10^{35} cm^{-2} s^{-1} after 2017, resulting in a successful SLHC.

CI will contribute effort in developing the necessary optics and RF cavity, Crab Cavity and beam-current dependent controls to advance the upgrade goals.

Effort: To be developed

Primary CERN contact: Oliver Bruning

Other CERN Investigator: Frank Zimmerman

Primary CI contact: Graeme Burt

Other CI Investigator: Peter McIntosh

ANNEX C

R&D ON LHC INJECTOR COMPLEX: SPL AND PS2

During the period 2008-2011, the upgrade of the LHC has to be prepared. An important part of this work concerns the replacement of the low energy injectors (PSB and PS) by new accelerators matched to the needs of the LHC and capable to push its performance to its maximum. The new complex will be based on a 4-5 GeV superconducting H- LINAC (the SPL) followed by a 50 GeV synchrotron (PS2).

The design of these accelerators has to take place during the period 2008-2011. The SPL is planned to be built in two stages. In the first one ("Low Power SPL" or LPSPL), its characteristics will simply fit the needs of the LHC: it will deliver a 20 mA beam pulse at 4 GeV with a repetition rate of 2 Hz. In the second one (SPL), it will be able to deliver the high beam power that is contemplated for the needs of new physics facilities for neutrinos or radio-active ion beams. It will then deliver a 40 mA beam pulse at 5 GeV with a repetition rate of 50 Hz.

CI is willing to contribute to essential developments by supporting the following tasks:

- Design and construction of a prototype of the RF power distribution to feed up to 8 superconducting cavities from a single high power (4 MW) klystron operating at 704 MHz. The power delivered to each cavity has to be adjustable to let it operate at its maximum operational gradient.
- Design and construction of a prototype of a high power amplitude & phase modulator for the precise control of the field in each accelerating cavity. Operating at 1 MW peak power and 6 % duty cycle, the device must be as compact as possible to minimize the volume in the accelerator tunnel.
- Beam dynamics studies and design of the collimation system in the SPL and in the transfer line from SPL to PS2.
- Design of magnets for the PS2 proton synchrotron.

Effort and Scope: ~ 2 FTEs/year

Primary CERN contacts: Michael Benedikt (PS2) and Roland Garoby (SPL)

Primary CI contacts: Neil Marks (PS2) and Richard Carter/Peter McIntosh (SPL)

ANNEX D

PHYSICS DESIGN OF THE LHeC: BOTH RING-RING AND LINAC-RING

During the period 2008-2010, CI will contribute one senior accelerator physicist, one other staff or PDRA and mentoring efforts of three senior scientists in developing the Physics Feasibility Design of a potential 100 GeV electron/positron X 7 TeV proton Large Hadron electron Collider (LHeC), ready for further development of a technical engineering design.

Effort: 2-FTEs/year

Primary CERN contacts: Oliver Bruning and Frank Zimmerman

Other CERN Investigator: Steve Myers

Primary CI contact: Swapan Chattopadhyay

Other CI Investigators: John Dainton and Max Klein (Universities of Liverpool)

ANNEX E

R&D FOR ANTI-PROTON DECELERATOR COMPLEX: DESIGN, DEVELOPMENT AND CONSTRUCTION OF ELENA

CI scientists have been approached by several users in the experiments at the CERN Anti-proton Decelerator (AD) complex about a careful evaluation of the CERN design and cost estimate of the proposed ELENA ring at the AD complex and its eventual design and construction. This machine can also be thought of as a prototype of the USR facility at FAIR in the future.

Effort: To be determined after careful evaluation of CERN's first estimate

Primary CERN contact: Tommy Eriksson

Other CERN Investigator: Dieter Mohl

Primary CI contact: Carsten Welsch

Interests from other CI Affiliates and Partners:
Paul Nolan, University of Liverpool
Gerald Gabrielse, Harvard University and CI
Jonathan Wurtele, Univ. of California at Berkeley
Walter Oolert, CERN

ANNEX F

R&D ON MULTI-TEV ELECTRON-POSITRON LINEAR COLLIDERS VIA COLLABORATION IN CLIC AND CTF3

Scientists from CI will focus on five possible areas of collaboration in developing the future multi-TeV Electron-Positron Linear Colliders in partnership with the CERN-CLIC group:

- participation to CTF3 commissioning with beam,
- high-gradient RF structures,
- transversely-deflecting cavities,
- damping rings,
- positron sources,
- Beam diagnostics and Coherent Synchrotron Radiation (CSR).

Effort: Multi-FTE equivalent/year

Primary CERN contacts: Jean-Pierre Delahaye and Guenther Geschonke
Primary CI contacts: Andy Wolski and Jim Clarke

Other CI Investigators:
Roger Jones (High Gradient Structures including Transversely Deflecting cavities)
Graeme Burt, Amos Dexter (Crab Cavities, Power Sources)
Peter McIntosh (General RF and Cavities)
Carsten Welsch (Diagnostics/Instruentation)
Andy Wolski (Damping Rings)
Jim Clarke (Positron Sources)
Ian Bailey (CTF3 Commissioning with Beam and Positron Sources)