

Particle Physics Science Opportunities Review – a submission from the LCUK Collaboration

For more than a decade, it has been widely accepted inside the particle physics community that the next major step at the energy frontier after LHC and appropriate upgrades should be a linear electron-positron collider with an energy of at least 500 GeV. The physics case for this is compelling, even before detailed results from LHC, and does not need rehearsing here; it can be found in many places. It has been agreed by all regions, in the form of reports from ACFA, ECFA and HEPAP, accepted by ICFA and widely promulgated to funding authorities worldwide, resulting for example in the formation of FALC- now the “Funding authorities for Large Colliders”. Governments in the form of the OECD Science Ministers meeting in 2004 “acknowledged the importance of ensuring access to large-scale research infrastructure and the importance of the long-term vitality of high-energy physics. They noted the worldwide consensus of the scientific community, which has chosen an electron-positron linear collider as the next accelerator-based facility to complement and expand on the discoveries that are likely to emerge from the Large Hadron Collider currently being built at CERN. They agreed that the planning and implementation of such a large, multi-year project should be carried out on a global basis, and should involve consultations among not just scientists, but also representatives of science funding agencies from interested countries.” There has been no change in the physics landscape since these conclusions were reached. The publication of the ILC Reference Design Report in August 2007, together with a preliminary cost estimate for the ILC, put the design of such a linear collider on a much firmer footing and mapped out the future development until around 2012, when the intention world-wide is to review early results from LHC, the designs for linear colliders as well as progress on neutrino factories and to take some far-reaching decisions on the long-term future of the field.

The above considerations make it clear that linear colliders will play a central role in the future road map of particle physics; UK physicists are in the forefront of this endeavour, in a large number of international leadership roles in both the ILC and in CLIC. The UK is also very prominent in the collaborations who proposed Lol's for the ILC experiments; in particular in the ILD and SiD collaborations and in the technical work developing the necessary techniques in vertex detection and calorimetry. Nevertheless, STFC decided eighteen months ago to “withdraw” – which in practice meant to very severely scale down its activity – from the ILC. While some of the physicists playing leading roles have been able to continue them, the UK's standing has been very severely damaged. This unilateral withdrawal from involvement in the main thrust of the future of particle physics must be reversed if the UK is to remain a leader in the field. It is not necessary to believe that a particular linear collider design, or even a linear collider of any flavour, is still the optimum next step to perceive that the current STFC policy is unwise, unhelpful and unnecessary and should be reversed. This is reinforced by the fact that LC development is at the cutting edge of accelerator technology and offers many opportunities for KE and the involvement of UK industry.

Fortunately the dynamic in particle physics has changed significantly for a number of reasons, not least the advent of a new Director-General of CERN. Collaboration between CLIC and ILC had been growing in advance of the funding problems, dominated by those of the US, in December 2007. This grew subsequently and has been strongly reinforced by the new CERN management. A large number of joint working groups has been set up, which are functioning well, exploiting the obvious synergies between the two projects. In June the ILC GDE Executive Committee and the CLIC Steering Committee met jointly and then subsequently with the CERN DG and Research Director and agreed further steps to integrate their efforts, including the appointment of Jean-Pierre Delahaye, CLIC Project Leader, as a member of the GDE Executive committee and Brian Foster, European Regional Director of the GDE, as a member of the CLIC Steering Committee. The first joint CLIC-ILC workshop will take place in CERN in September 2010. Thus a fully integrated view of the future strategy for linear colliders could emerge from this enhanced cooperation. The role of the UK in CLIC technical issues is also planned to increase, as outlined in the recent SoI sent to STFC on future CLIC involvement. The UK should therefore return to this new integrated linear collider project as a full member and provide sufficient funding to allow the optimal exploitation of the exceptionally prominent role held by UK physicists and accelerator scientists both in the John Adams and Cockcroft Institutes and ASTEC, as well as in the very broad UK community working on the development of the linear collider detectors.

In our view, one of the most important results of the current PPAP review should be to recommend that the UK re-engages with the agreed next major world project, the ILC, thereby restoring its influence in all main areas in the future of particle physics.

Agreed by the LCUK Steering Committee: B. Foster (Oxford) (LCUK Spokesman), G. Blair (RHUL), P. Burrows (Oxford), J. Dainton (Liverpool), C. Damerell (RAL), P. Dauncey (ICSTM), T. Greenshaw (Liverpool), .D. Miller (UCL), M. Thomson (Cambridge), M. Tyndel (RAL), S. Worm (RAL)

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