CERN: A European laboratory for a global project

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Abstract. In the most important shift of paradigm of its membership rules in 60 years, CERN in 2010 introduced a policy of “Geographical Enlargement” which for the first time opened the door for membership of non-European States in the Organization. This short article reviews briefly the history of CERN’s membership rules, discusses the rationale behind the new policy, its relationship with the emerging global roadmap of particle physics, and gives a short overview of the status of the enlargement process.

In 2014, CERN celebrates it 60th anniversary. On July 1, 2014, the cycle of events commemorating the birthday of this unique scientific, political and human endeavour was opened in Paris, commemorating the anniversary of the CERN Convention, which was signed at the UNESCO Headquarters by representatives of the twelve founding Members in 1953. These twelve signatures are worth commemorating indeed. For more than half a century, the Convention has stood the test of time as a masterpiece of simple and minimalistic legal language that focuses wisely on the essential cornerstones of CERNs institutional basis and governance. At the same time, it provides for the leeway that is necessary to adapt the Organization to a changing political environment, and to new scientific and technological challenges. The Convention is a testimony to the wisdom and foresight of CERN’s founding fathers, on par with their vision of rebuilding peace in Europe by establishing a unique focal point that would foster scientific collaboration on an unprecedented scale, between nations that that had fought war against each other only a few years earlier. On the basis of this Convention, CERN has served as a model for other, successful European science organizations, and most recently for the SESAME synchrotron light source in the Middle East.

Some of the most intriguing aspects of the CERN Convention are in the provisions for Membership in the Organization. Whereas it stipulates that “the Organization shall provide for collaboration among European States in nuclear research of a pure scientific and fundamental character ...”, nowhere does it state explicitly that Membership in CERN is restricted to European States. This ambiguity is by no means fortuitous. It reflects the fact that already in the early 1950s, a possible enlargement of Membership beyond Europe was a hotly debated issue on which the provisional Council could not reach agreement. It agreed, however, on a carefully crafted compromise that left a door open to shaping the membership policy of CERN at a later stage, and to adapt it to an evolving scientific and political landscape. Indeed CERN continued to grow and counted 20 European Member States at the end of the 20th century, thanks largely due to the accession of countries from Central and Eastern Europe following the fall of the Berlin Wall.

The Council debated a widening of Membership beyond Europe on several occasions in the past, but repeatedly confirmed a restrictive interpretation of the Convention, whereby Membership remained reserved for European countries. Only in 2010, it approved the most
Figure 1. The 21 Member States of CERN after the accession of Israel in 2014. Romania and Serbia are expected to become Member States in 2015 and 2017, respectively. Turkey joined as an Associate Member State in 2015.

radical shift of paradigm of CERN’s membership policy to date, embedded in a policy of “Geographical Enlargement” and opening Membership to non-European States irrespective of their geographical location [1]. At the same time, the Council introduced the new instrument of Associate Membership in order to facilitate the accession of new Members, including emerging countries outside Europe, which may not command sufficient resources to sustain full Membership in the foreseeable future. Under this new policy, Israel joined CERN as 21st, and first non-European Member State, in 2014 (Fig. 1). In parallel, a new policy of “Scientific Enlargement” allows, for the first time, the Laboratory to participate in global accelerator projects outside Europe.

CERN’s new Membership rules are not a political end in itself but follow a twofold science policy rationale: they underpin the unprecedented migration of the global particle physics community to Europe, reflecting the scientific attractiveness and success of the LHC; and they serve to prepare CERN for its long-term future. They mirror the globalization of particle physics, which in turn has become a prominent paradigm for the globalization of science at large.

For more than fifty years, CERN has supported free movement of scientists across countries,
regions and continents with a policy of open doors, providing free access to its scientific facilities without discrimination between Member States and non-Member States. This policy had been formalized in 1980 in ICFA guidelines for free, mutual and balanced access of physicists from different regions to regional laboratories in other parts of the world [2]. It was shaped at a time when Europe, North America and Japan owned all major facilities for accelerator-based particle physics, when the global HEP community was strongly dominated by scientists from the same three regions, and when exchange between the same regions was healthy and balanced indeed.

Since 1990, however, the landscape has changed dramatically: starting with the demise of the SSC, the shut-down of major accelerators around the globe – or their conversion into applied science facilities – has severely broken the symmetry of scientific exchange. Since 2004, the community of CERN’s visiting scientists (“Users”) has grown from just above 6000 to more than 11000 physicists and engineers from all continents. Today, these scientists come to CERN from about 650 different institutes in more than 70 countries (Fig. 2) and represent around 100 different nationalities. This growth has been driven by non-Member States (NMS) more than by the Member States: scientists from NMS institutes now account for almost 40% of CERN’s Users, and their participation is expected to increase further. Whereas the numbers are dominated by North America, in recent years the most important growth rates are observed for Asia and Latin America, where new players emerge on the field of international science (Fig. 3). These data convincingly illustrate particle physics’ strong tradition of defying political, geographical and cultural boundaries.

From a European perspective, the unprecedented non-Member State participation in the LHC has brought about substantial scientific, technical and political benefits. It has contributed to
establishing CERN as the world’s leading center at the high energy frontier in the awareness of governments and funding agencies, and of the general public. The LHC has convincingly demonstrated the potential of global partnership in basic science, and is widely perceived as a paradigm of successful world-wide co-operation on megascience projects. To take this co-operation to the next higher level, and to fully exploit its potential to the benefit of all stakeholders, CERN’s enlargement policy offers a new institutional framework for a sustained global partnership in particle physics research.

More important, the Geographical Enlargement policy is a first step in preparing CERN’s membership and governance for the post-LHC future. Whereas the LHC experiments today are truly global operations, the LHC machine was built as a predominantly European project, with a contribution from outside Europe that was technically and politically significant but represented only about 10% of the construction cost, and was mostly provided in-kind. This model cannot be expected to work for a large, next-generation facility in Europe. With the CLIC and FCC studies, CERN is exploring two different, challenging avenues to prepare its future, and the future of our field, after the LHC. No cost estimate exists yet for either option, but it seems inconceivable that any of them can be approved and build within the same membership, governance and funding structures that worked more than twenty years ago – successfully, but under great labour pains – for the LHC.

In one of the most significant developments in recent years, the three most important regional particle physics roadmaps – i.e. the proposal of the Japanese community to host the ILC; the 2013 Update of the European Strategy for Particle Physics [3]; and the US P5 report of 2014 [4] – have been developed in a complementary approach and with a strong focus on inter-regional
collaboration, such that together they form an important milestone on the way to a *global* roadmap. CERN’s enlargement policy is designed to fit seamlessly into this emerging global strategy for accelerator-based particle physics. It opens Membership in the Organization to all States irrespective of their geographical location, and introduces the new scheme of Associate Membership with reduced obligations and benefits. The important instrument of International Co-operation Agreements is maintained for partners who are not willing or able to shoulder the obligations of CERN membership in the near future; almost 50 such Agreements are in place today and provide the formal framework for most of the co-operation with non-European countries.

In a reciprocal move, for the first time CERN is formally allowed to participate in *global* HEP projects outside Europe; this policy, which was confirmed by the 2013 European Strategy Update, will initially enable CERN to serve as a gateway for European participation in the LBNF facility at Fermilab, and later in the ILC.

With ten applications for Membership or Associate Membership received in recent years from countries of different size, and from in- and outside Europe (Brazil, Croatia, Cyprus, Israel, Pakistan, Russia, Serbia, Slovenia, Turkey, Ukraine), the enlargement process has made a promising start; some of the accession procedures have been completed (Israel, Turkey) or are expected to conclude in the near future. Other countries which are perceived as natural candidates, while they acknowledge the promise and potential of a continued scientific and technological partnership, have so far remained absent, or are hesitant on political or financial grounds. More work, stamina, and patience will be needed to enlarge the Membership of CERN to a size that is commensurate with its future ambitions in quantity and quality. Not all States that are obvious candidates for a closer scientific and technical partnership may share today the values of a governance that is excellence-driven and consensus-oriented, and which has prevailed most of the time in CERN’s 60-years history. In the long term, broadening the institutional base without sacrificing the traditional values of European co-operation that have been a key ingredient in CERN’s past successes is likely to emerge as the true challenge of the enlargement process.

The partnership between CERN, its Member States and non-Member States in building the LHC and harvesting its scientific potential has developed into a solid backbone of successful co-operation of unprecedented, global dimensions. CERN wants this partnership to continue, to grow and to flourish on the basis of an enhanced institutional participation of both European and non-European countries. The policy of Geographical Enhancement is well matched to the unfolding, global roadmap of particle physics.

1. References

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