Globalization of HEP

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1 Overview

All current HEP facilities have risen with a single nation or region building and financing the project. With the demise of the SSC in 1993, the ability of the US HEP community to generate the consensus and support needed to build a machine on the energy frontier was brought into serious question. Among the major detriments [1] of that project was the lack of any serious international cooperation in its construction and projected operating costs.

As young physicists, whose careers and research aspirations are most tightly coupled to the development of the next energy frontier facility, this is an especially important time to study the potential of globalization in HEP. One of our goals should be to examine political and scientific structures that can enable planning and funding of large experiments. At the same time, we might be able to maintain the importance of existing national laboratories, and preserve or possibly improve the ability to work despite large distances from an experiment. This note reviews the current situation within HEP, in terms of international groups and infrastructure, and will discuss some recent ideas on how current structures might scale up to the global level.

2 International Cooperation in HEP

Several proposals for new facilities in HEP require budgets that are probably beyond the means of any single country. Although international collaboration has occurred for years, forming an international consensus in HEP seems far more difficult. From time to time, an ad hoc committee studies the most pressing issues of HEP, but these groups form, report, and disband. Long term planning is very difficult with only these groups, and there is no guarantee that the findings will be widely accepted. It may be that a degree of consensus can be reached at Snowmass, but a permanent international steering group have farther reaching influence.

The members serving on this committee would have to be carefully selected. A project cannot live without the approval of funding agencies. The success of an international project could be very sensitive to the differences between funding systems in various countries. Government representatives are present in some of the committees studying possible future facilities; their input and agreement would be valuable to a permanent international planning committee. In the next 20 years, the differences in the subcultures experienced by theorists, particle physicists, and accelerator physicists are likely to grow. It then becomes important to include physicists from different subfields in steering committees.

There are several advantages to an international steering group with government funding agency members. It could serve a purely advisory role, but it could eventually become a kind of international funding agency. Even in the advisory capacity, national funding agencies should be more likely to respond once international consensus is reached, and larger projects become easier to fund with cooperating nations. There are also some disadvantages.. One might lose a sense of national pride in projects when they are international, and there is a loss of control by any single country. There is also a risk that the total HEP budget for any given country will decrease because other nations are contributing to the same project.

3 The International Laboratory

The funding and management structure of an international laboratory can take several forms; ICFA [2] lists several possibilities, among them:

- National facilities, operated by host country (including operational costs). Planning, project definition done in international collaboration.
- Larger facilities, operated by host country (including operational costs). Constructed by several countries, payment in funds or components of subsystems. Planning and definition internationally, as in the case before (the "HERA model").
- Very large shared projects: several countries share total construction and operation costs. All countries share the responsibility and costs for operation. Staff for operation comes from all participating countries.

- Very large, self-organized projects: here the countries do not directly manage the lab, they contribute to an international organization and then it autonomously runs the projects (the “CERN model”).

For an even larger project, distance can provide a barrier to effective contributions. Traditionally, the laboratory is the primary location for analysis and a natural location for accelerator control, but for truly international responsibility there can be a large cost associated with this. This cost is not only monetary but also reflects the difficulty in recruiting and retaining talent when extended overseas travel is required. Recently, large experiments have tried to distribute analysis responsibilities, with some success. Although remote data processing farms have been very successful, remote data acquisition is just being attempted.

3.1 Regional Centers

A possible solution to these problems is to establish several regional centers for high energy physics. Although current technology has not achieved it yet, at the core of these centers lies a fast network connection that allows reliable remote control of several experiments and accelerators. This way, actual control could be passed from one center to another and back to the local control room without disruption. For offline work, the center would ideally have local data storage and processing farms also.

Visiting scientists and students from surrounding universities would make use of the facility; the more regional centers there are, the lower the travel costs. To take advantage of existing personnel and equipment, a regional center could be located at some or all existing national laboratories. Smaller, more specialized centers could be located anywhere, built by consortia of universities. To make a suitable working environment, a center would need excellent computing facilities, access to data, and might need video conferencing that is a generation beyond what we see today. Students at the lab still tend to finish their theses sooner than the students working remotely from their universities; younger physicists might benefit from something in between.

Regional centers, once technologically feasible, could have many benefits. Ideally, they would ensure that some degree of control and responsibility are possible in countries other than the lab host. This issue of periodic control might particularly appeal to national funding agencies. It might be natural for the directors of the regional centers to serve as the physicist members of the international steering council as mentioned in section 2. Regional centers prevent the lab infrastructure from being overwhelmed with visiting scientists, and make it easier to attract students because they won't have to move overseas. In essence, the centers are an attempt to ensure an HEP community can survive in the regions that do not actually host the next large facility. The drawbacks are the presumed expense and the speculative timeframe for viability.

4 Summary

At Snowmass 2001, physicists can discuss how necessary globalization is, and to what degree. This article has identified three aspects of HEP that could in principle be handled at an international level:

- steering of long-term decisions
- funding and construction of large projects
- operation of large projects

Although each of these aspects has an existing international example, these elements might need to be combined or greatly extended in the future. Each of us will have to weigh the associated costs against the benefits.

References

[1] Session J1 of the April 2001 Meeting of the American Physical Society, http://www.aps.org/meet/APR01/baps/abs/S1210001.html

For a review of the session, consult Jordan Raddick, "Session Analyzes Big Science Projects", APS News Online, June, 2001, http://www.aps.org/apsnews/0601/060105.html.

[2] The International Committee for Future Accelerators is a subgroup within the International Council of Scientific Unions. ICFA meets twice a year and makes recommendations that are considered by various national laboratories and national funding agencies. Over

the last few years it has formed a Task Force to study the concept of a Global Accelerator Network; the full report is due in 2001. http://www.fnal.gov/directorate/icfa/icfa_home.html

For yet more information, consult http://ypp.hep.net/ypp_reference.html