Globalization of HEP

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1 Overview

This group is exploring the necessary steps to globablizing efforts in HEP. We want to find successful political and scientific structures for international organization that enables planning and funding of large experiments in international collaboration, that maintain the importance of existing national laboratories and preserve or even improve the ability to work despite large distances from an experiment.

High-Energy Physics (HEP) is at a crucial point in its development: in order to further push the limits of our understanding of particle physics, new experiments and accelerators have to be built and their financial and structural support cannot be achieved by any one country or even region. For such a project to be successful, truly international cooperation has to occur. What is even more daunting is that international cooperation and organization will be necessary for more than just one specific project in the future, each new Energy Frontier project will have such requirements. We review here the current situation in terms of international groups and organization dealing with the international HEP situation and discuss the possible short comings of the current situation.

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 occured 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 international consensus can be reached at Snowmass, but maybe a permanent international steering group needs to be formed.

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 internation steering group with government funding agency members. It could be a kind of international funding agency, with more than just an advisory role. National funding agencies are more likely to respond once consensus is reached, and larger projects become possible more frequently. There are also some disadvanges. 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 managment structure of an international laboratory can take several forms; ICFA (see references) listed the following possibilities:

- 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 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 (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 travel cost associated with this. Recently, large experiments have tried to distribute analysis responsibilites, with some success. Although remote data processing farms have been very successful, students at the lab still tend to finish their theses sooner than the students working remotely.

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.

It isn't clear if the costs of constucting and operating these regional centers really outweighs the saved travel costs, but they would ensure that some degree of control and responsibility are possible in countries other than the lab host. They also prevent the lab infrastucture from being overwhelmed with visiting scientists. Finally, they could be placed frequently enough to make travel from universities to the center brief for a large number of physicists, and prevent too frequent international travel.

4 Summary

At Snowmass 2001, physicists can discuss how necessary globalization is, and to what degreee. 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.

5 For Further Reading

ICFA 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