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PARTICLE ACCELERATORS : THE BEGINNING OF A DISCUSSION ?

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Particle accelerators : The beginning of a discussion ?

One important aspect of the development of a modern science is its dependence upon the development of new research tools. In the field of nuclear physics, the technology which is playing the most central role is that of particle accelerators. Since 1932, when Cockroft and Watson built the first accelerator with sufficient energy to produce nuclear reactions, the construction of more and more powerful accelerators has led to a succession of scientific discoveries and technological innovations with applications in a variety of fields ranging from the medical to the military.

It is customary nowadays to view the realm of nuclear physics as being split into three broad areas which are those of nuclear weaponry, civilian applications of nuclear technologies, and fundamental research. Whereas nuclear weapons are of great concern to many people, and many civilian applications such as nuclear energy are on trial, there is little discussion on the potential future impact of the recent advances in the technology of particle accelerators.

Elementary particle physics, at the forefront of fundamental research, is mainly carried out using large high energy accelerators and storage rings, and the international competition for building ever larger machines is increasingly resembling a race. For applications of accelerators requiring lower energies but very high currents, the advances are equally impressive. These developments are leading towards numerous new applications, especially in the fields of nuclear energy and nuclear weaponry. Particle accelerators are becoming usable for efficient breeding of fission and fusion materials, for driving inertial confinement fusion devices, for studying the physics of thermonuclear weapons, etc. The concept of high energy particle beam weapons may become feasible and free-electron lasers using electron accelerator and storage ring technologies may provide a new generation of highly efficient and powerful lasers with many military applications.

The majority of high energy accelerators have usually been built inside or close to national laboratories equipped with reactors and other nuclear facilities. The main exception is the European organization for nuclear research, CERN, in Switzerland, where several large proton accelerators and storage rings are in operation. This laboratory is now planning the construction of the world's largest electron-positron storage ring : LEP, and this project may provide an opportunity to start a debate on the accelerator technology.

The construction of LEP is soon to be decided, and like many other large projects, it has not yet been extensively discussed, neither within the scientific community at large, nor with the general public. People are expressing a growing concern, especially because of its very large size (30 kilometer in circumference) and electrical consumption (250 megawatts at full power). Even though there has been little objection to its scientific interest, physicists have raised questions about the potential competition of various machines planned in other countries, its timeliness, and its impact on the future of CERN and the high energy physics community.

Many such questions have been raised at a recent public meeting organized by an ecological association but which lacked the participation of official CERN representatives. One of the speakers, Robert Jungk, author of a book about the history of CERN, "The Big Machine", expressed his concern with the current evolution of science and the fact that, contrary to what happened in 1953 when CERN was in the planning stage, there was no public discussion on the LEP project. The current and the potential future military applications of particle accelerator technologies were presented by the Director of GIPRI. He suggested that CERN, as a most successful international laboratory devoted to peaceful scientific research, should also study problems involving the responsibility of scientists such as those of nuclear disarmament and possible means for stopping the technological arms race.