DESY Looks to an International Future

HERA is the name of a 650-million-Deutschmark ($265 million) accelerator that European high energy physicists would like to see built at the Deutsches Elektronen-Synchrotron (DESY) laboratory in Hamburg. The huge machine could consist of two storage rings, one for electrons at energies up to 30 billion electron volts (GeV) and one for protons at energies up to 820 GeV, lying one above the other. At four symmetric locations around the 6.5 kilometer circumference of the accelerator, the rings would intersect and the electrons and protons racing inside in opposite directions would collide head on in particle detectors placed at these points. The effective collision (center of mass) energy would be 315 GeV, which is about 40 times greater than that of the largest existing fixed-target electron accelerator, the 3-kilometer-long 33-GeV machine at the Stanford Linear Accelerator Center.

At a DESY workshop this spring, high energy physicists polished up the details of a formal proposal to build HERA. Also in the spring, a federal "big science" committee approved HERA in principle but said construction could wait until 1984. Moreover, the committee asked that ways be found to secure international participation in building HERA because the project is so expensive. Thus, DESY, which started life in 1959 as a strictly German national laboratory, may have to become even more of an international institution than it has been in the last few years if it is to continue to be on the front line of high energy physics.

DESY began two decades ago with a 7-GeV electron synchrotron for the use of German university researchers. In the 1970's, electron-positron colliding-beam storage rings began making important contributions to high energy physics, and DESY was there with DORIS, a 6-GeV center-of-mass-energy machine (now raised to 10 GeV). The last bolt on DORIS was hardly tightened when DESY started drawing up plans for an even larger 38-GeV electron-positron collider called PETRA, which is now running (*Science*, 26 June, p. 1488).

At the time PETRA was being considered for approval, Germany's big science advisory committee was already suggesting the possibility of international financing, although the 98-million-Deutschmark price tag proved to be well within the country's means. To help revive a sluggish construction industry, the Social Democratic government funded the project. Under director Herwig Schopper, who is now director-general of CERN, DESY nonetheless did make a start at becoming internationalized. In response to recommendations of another advisory body, the European Committee for Future Accelerators (ECFA), that PETRA be open to experimenters from all countries, DESY accepted proposals from international consortiums to build the five large detectors that are taking data at PETRA. Although mainly European, the collaborations have participants from China, Japan, Israel, and the United States; one group is headed by Samuel Ting of MIT.

With the German economy performing so poorly these days, DESY is unlikely to see its proposed HERA project sail through the way PETRA did. Moreover, as the laboratory's current director, Volker Soergel, points out, HERA is comparatively a much larger step for DESY than PETRA was. A construction cost of 650 million Deutschmarks spread out over an expected 7-year period means that HERA alone could soak up over half of DESY's present annual budget, which is already under attack by soaring electricity costs and budget cuts. A DESY observer said, "This is the worst possible moment to push HERA."

The European Organization for Nuclear Research (CERN) also poses a problem for the funding of HERA. West Germany is responsible for 25 percent of CERN's budget or about 175 million Deutschmarks. The German Federal Ministry for Research and Technology last year set up an advisory committee to review several big science projects then under consideration in West Germany. The chairman was Klaus Pinkau of the Max Planck Institute for Physics and Astrophysics in Munich. The Pinkau committee completed its report this spring. In the area of high energy physics, the committee said, Germany's first concern is to keep up its participation in CERN, which is currently trying to get approval for a monstrous, 27-kilometer-circumference electron-positron collider called LEP (see accompanying story). ECFA has also several times reiterated that LEP is the number one priority of European high energy physics, although it also "recommends strongly the construction of [HERA] at DESY, and welcomes the possibility of its being used by the European community."

The Pinkau committee itself gave a very strong scientific endorsement to HERA, saying that it would be very desirable to have such a machine and that DESY is the right place to build it. However, the committee found that all the technology to build HERA is not in hand. In particular, to confine 820-GeV protons in orbits "only" 6.5 kilometers in circumference requires very high magnetic fields (4.75 teslas) that can most economically be generated only with superconducting magnets. DESY is planning to use a superconducting magnet design very similar to that recently developed at the Fermi National Accelerator Laboratory. Because it considered the technology of these magnets not yet mature, the Pinkau committee suggested that construction of HERA could well wait until 1984. However, DESY officials remain hopeful that a start on the project could come much sooner, and the government is allowing the laboratory to spend planning money.

Finally, given the commitment to CERN and HERA's high cost, the committee recommended that DESY look for ways to obtain international participation in the HERA project, although the precise nature of the participation was specifically left open. The subject of further internationalizing DESY is a delicate one.

If HERA is built, it would be a unique machine. Nearly every major accelerator center has at one time or another considered an electron-proton collider, but thinking never progressed beyond the conceptual stage. DESY is the first to present a detailed proposal. The center-of-mass energy of electron-proton collisions would be high enough to probe the details of the unified electro-weak gauge theory on which theorists are now pinning so many of their hopes in their quest to understand the world of elementary particles. ECFA asserts that the information from HERA would be complementary to that obtained from LEP and that both machines would be productive.—A.L.R.