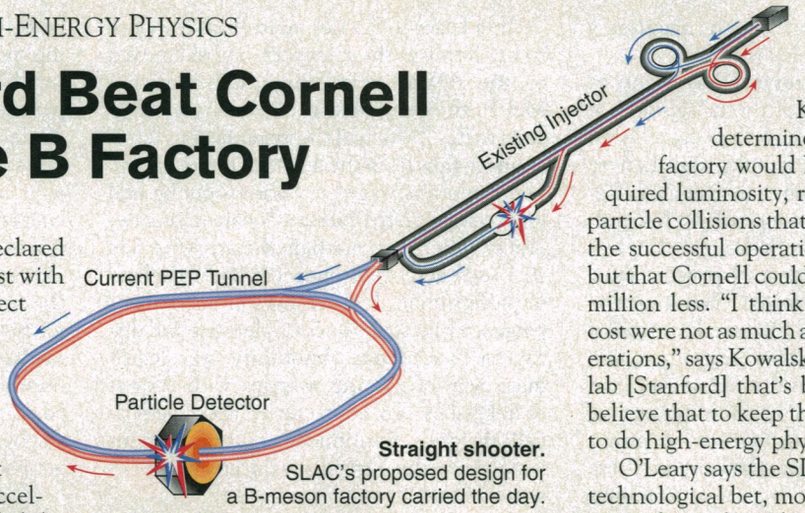
How Stanford Beat Cornell And Won the B Factory



Straight shooter. SLAC's proposed design for a B-meson factory carried the day.

SOURCE: SLAC ILLUSTRATION: C. FABER SMITH

Last week President Clinton declared Stanford the winner in a 4-year contest with Cornell to build a physics megaproject known as a B factory. The competition was hot and heavy: Physicists at both institutions had banked the futures of their labs on this $200 million project to explore fundamental questions about the origins of matter. But the choice of the Stanford Linear Accelerator Laboratory (SLAC) hasn't ended the debate. Instead, Cornell officials and others in the physics community are sputtering about the reasons the Administration gave for rejecting their bid, and others are suggesting that economics and politics played a central role in the decision.

The argument centers in part on the report of an independent scientific review of the two proposals, which concluded this summer that both were technically feasible but Cornell's would cost about half as much as SLAC's. Department of Energy (DOE) Secretary Hazel O'Leary, who made the decision, disputed Cornell's cost advantage and, in a written statement issued with Clinton's announcement, said DOE had more confidence in SLAC's design. O'Leary acknowledged, however, that one additional factor weighing in SLAC's favor is that the B factory is critical to the lab's future—a point made clear in an April 1992 memo from the lab's director, Burton Richter, to his staff, warning that "substantial layoffs" would result from even a 2-year delay in construction. And the economic impact of the choice was underscored by the fact that Clinton announced it during a trip to San Francisco that emphasized his desire to rejuvenate the region's sagging economy.

Given the size of the project, it's no surprise if politics played a role in the outcome. Indeed, political forces have been brought to bear on behalf of both camps during the long history of this project. The idea of this type of accelerator—called a B factory because it is supposed to generate large numbers of particles known as B mesons—arose in the mid-1980s as a way for physicists to solve a scientific puzzle about the balance between matter and antimatter in the universe. In theory, all particles of matter have their nemesis—perfect equals but opposites called antiparticles. When these counterparts chance to meet they annihilate one another. Physicists believe that B particles and anti-B particles will show a sort of skew in their perfect opposition—a fundamental asymmetry known in the jargon as "charge-parity violation"—and it is this property that may have allowed the primordial Big Bang to produce more matter than antimatter.

Scientists at both Cornell and Stanford proposed converting existing accelerators into B factories, and set to work to find the money. Cornell appealed to the National Science Foundation, its present source of funding, and Stanford turned to DOE, which owns SLAC. Although the science was exciting, both agencies decided that there wasn't room in their budgets for a new accelerator, and in January 1992 officials jointly agreed to postpone indefinitely a decision on building a B factory.

Neither lab was willing to let the matter drop, however, and by the fall of 1992 SLAC had persuaded the Bush Administration to put $36 million for construction into DOE's 1994 budget request, which was sent to Congress in January 1993. William Happer, then director of DOE's Office of Energy Research and now a professor of physics at Princeton University, says that the California congressional delegation had lobbied hard for its inclusion. After Bush left office, the delegation took the matter up with the Clinton Administration, and convinced the Office of Management and Budget (OMB) to make a similar request. Buried on page 1223 of the appendix to Clinton's budget, submitted to Congress in April, is a request for $36 million for a B factory at SLAC.

At that point, Cornell's elected representatives got into the act. Finance committee chairman Senator Daniel Moynihan (D–NY)—a key figure in securing passage of Clinton's economic program—persuaded OMB Director Leon Panetta that an impartial review of both proposals was needed. In May, Happer and William Harris, associate NSF director for mathematics and physical sciences, named a 12-member panel headed by MIT physicist Stanley Kowalski, and told it to conduct a 1-month technical review but not to rank either proposal. The panel's report was submitted in August (*Science*, 27 August, p. 1111). Kowalski says his panel determined that either lab's B factory would have achieved the required luminosity, referring to the rate of particle collisions that is the crucial factor in the successful operation of the accelerator, but that Cornell could have done it for $100 million less. "I think technical things and cost were not as much a driver as other considerations," says Kowalski. "They [DOE] have a lab [Stanford] that's been important. They believe that to keep the lab viable they have to do high-energy physics projects," he says.

O'Leary says the SLAC design was a safer technological bet, more likely to achieve its scientific goals under budget and on time. She also noted that Stanford, which will collaborate with Lawrence Livermore and Lawrence Berkeley labs, could draw upon a larger pool of engineers. But O'Leary took issue with the panel's financial conclusions: "[T]he department questions cost estimates in the Cornell proposal…the Cornell budget is considerably understated…the remaining cost difference between these proposals does not become a driving factor for the department's decision."

Cornell's disappointed lab director, Karl Berkelman, says O'Leary's statement "is based on a biased reading" of the Kowalski panel. He points to a statement in the report that, "Although the CESR-B [Cornell's design] represents an innovative approach, it will reach the desired physics goals and is cost-effective, well engineered, and buildable." The report contains similar praise of SLAC's design but refers to it as "conservative" rather than innovative.

Richter says his lab won the competition on its merits. He insists that a careful reading of the 100-page report favors his lab by pointing out a greater number of technical risks associated with Cornell. "I have always been confident that any objective and fair peer-review process would come up with the SLAC/LBL/Livermore project," he says.

Now that they have won the competition for the B factory, Richter and his SLAC colleagues face another formidable challenger in a different race. Across the Pacific, Japan's Ministry of Education has requested money to begin building a similar B factory at Japan's KEK lab. Approval of the U.S. project should spur the Japanese effort, says physicist Aki Maki of the Japan Society for the Promotion of Science. Japan's facility is intended to come on line by 1998, the same year as SLAC's accelerator. "We don't want to be too far behind the U.S. project," Maki says. "If we are not too far behind we will have a chance to find charge-parity violation before the United States."

–Faye Flam