# US physicists back linear collider proposal . . .

**Washington**. Ten months after the crushing blow delivered by the Congress's cancellation of the Superconducting Super Collider (SSC), US particle physics is getting off its knees. Its new plan is an old plan: for another massive collider, not so large as the SSC but not far off; not round, but straight; and not for protons, but for electrons.

Physicists are acutely aware of the public derision that may greet proposals for a new linear collider. Thus, when Sidney Drell, of the Stanford Linear Accelerator Center (SLAC), delivered his landmark report on the future of US high-energy physics in May (see *Nature* **369**, 266; 1994), he emphasized immediate issues, and played down the section on future accelerator needs.

Furthermore, eyebrows were raised when Burt Richter, the director of SLAC, used a recent visit of the Emperor of Japan to advertise his proposal for a Next Linear Collider (NLC). Yet hope persists that, provided the painful lessons of the SSC debacle are properly learned, plans for such a linear collider can come to fruition.

The appropriate research, for example, needs to be completed beforehand, to enable project costs to be reliably fixed. The new machine also needs to be truly international from its inception. "This time, we're starting at the beginning," says SLAC's David Burke, who chairs a 23-strong international collaborative council set up last October to steer the project. "The SSC had severe problems trying to do it at the end."

The council includes representatives from eight establishments in the United States, ten in Western Europe, two in Russia and three in Asia. It will conduct formal reviews of the state of the embryonic project, the first being due for completion early next year. "The idea is to get everyone working on a common set of physics parameters for the machine," says Richter.

The machine would consist of two linear accelerators, one to drive electrons, the other positrons in the opposite direction. Physicists want collisions with an energy of $10^{12}$ TeV, which means 500 GeV in each direction. One way of achieving this would be to start by building two 250 GeV machines, and upgrade them later. In the case of SLAC's NLC design, the 250 GeV accelerators would each be 7.5 km long, with the potential of being upgraded either by doubling the length, or by doubling the acceleration rate.

**SLAC: looking to the future.**

One approach to the linear collider favoured both by SLAC and by the Japanese national laboratory of high-energy physics, KEK (see box) would be a ramped-up version of SLAC's existing 50 GeV linear collider. But that technology is inefficient and the particle beams would have to be very finely focused.

Another approach being explored by the international Tesla collaboration, led by the German Deutsches Elektronen-Synchrotron (DESY) laboratory in Hamburg, is to use super-cooled, superconducting cavities to contain the beam. These are far more energy-efficient, thus removing the need to focus the beam so tightly. But they would be expensive, and require an even longer accelerator to provide the necessary energy level.

Richter hopes design variants will all coalesce into a single internationally agreed design by 1997, with construction beginning in 1999. As he made clear during a visit to SLAC on 23 June by Emperor Akihito and Empress Michiko, Richter sees the construction of NLC primarily as a Pacific Rim project. "Europe is going to be tied up with the LHC through 2003 or 2005," says Richter. "If we want to start before then, the major players are going to have to be non-European." But Japan has its own plans for a collider, and is unlikely to support one built on US soil. The US Congress is also likely to be baffled by calls for a big straight collider in place of the circular one it has only recently abandoned.

But from the particle physicists' point of view, electron colliders and proton rings complement each other. For example, a proton ring at Fermilab recently came close to finding the mass of the top quark; armed with this information, an electron collider will be more effective in producing large numbers of top quarks for further study.

Research work is proceeding on the linear accelerator design and the US Department of Energy, as well as other funding sources around the world, appears happy to pay for the early research.

Funding the project itself will be more problematic. Richter says it is too early to estimate the total cost. But the engineering task is around one-third that of the SSC, which was due to cost around $11 billion at the time of its death. **Colin Macilwain**

## . . . but Japan wants to take the lead

**Tokyo**. Japan's high-energy physicists, who are developing their own plans for a giant linear collider, say that it is highly unlikely that their government would contribute to a collider built in the United States.

The Japan Linear Collider (JLC) would consist of two linacs with a combined total length of 25 kilometres. In the first phase, the energy would be set at 150 GeV per linac, and this would be upgraded to 250 GeV each within a few years (see *Nature* **358**, 266; 1992).

The project has not yet received official backing from the Japanese government. But considerable progress has been made on research and development for the collider using general research funds. Next year, for example, the National Laboratory for High Energy Physics (KEK) in Tsukuba will open a facility for testing components for the collider.

KEK is collaborating with the Stanford Linear Accelerator Center (SLAC) in the United States in this initial phase, and researchers from the two institutions recently succeeded in producing a 74 nanometre beam spot at SLAC. A critical requirement for the JLC design is a beam at the collision point which is only a few nanometres in height and a few hundred nanometres in width.

But Japanese high-energy physicists are determined to take the leading role in building the world's next linear collider. Given their bitter experiences over the Superconducting Super Collider (SSC) where pressure was repeatedly put on Japan to support SSC construction costs until the project was finally killed by the US Congress, they have no intention of taking a supporting role in a US project.

"We do not want to repeat the mistakes of the SSC," says Hirotaka Sugawara, director general of KEK. The JLC was adopted as a future domestic project by Japan's high-energy physics community in 1986, and scientists are keen on international participation. "But we can't expect large contributions [from overseas]", says Sugawara. "We don't have politicians like [George] Bush to push for us" — a reference to the former president's role in promoting the SSC. **David Swinbanks**