Superconducting collider: A triple start

Magnets determine the practicality of any proposal for a new accelerating device for particle physics. The very name of the Superconducting Super Collider (SSC) — the project to build a machine that will accelerate two beams of protons to energies between 10 trillion and 20 trillion electron-volts (10 to 20 TeV) and collide them with each other — testifies to physicists' belief that its magnets will have to be superconducting. Conventional magnets for something of this sort would put the electric bill entirely out of reach.

Thus it seems appropriate that, at last week's meeting in San Diego of the Applied Superconductivity Conference, Alvin W. Trivelpiece, director of the Office of Energy Research in the Department of Energy (DOE), announced that the SSC now has official status as a research and development project. The department, he says, has released $20 million for the project in fiscal year 1985 (which begins Oct. 1, 1984), and a working committee headed by Maury Tigner of Cornell University has been established.

Physicists had hoped for money for a full three years' R&D, but as one of them said, "This is an election year." Projects of this kind start out officially in an R&D stage during which a design is developed, prototype components fabricated and tested and usually a site selected. Then Congress is asked for an authorization for construction. In the case of the SSC, the DOE had asked that three reference designs be completed before giving the project formal R&D status. At the conference, Peter W. Limon of Fermi National Accelerator Laboratory in Batavia, Ill., described the progress made on these, and physicists from Brookhaven National Laboratory in Upton, N.Y., reported that they had built a magnet that is very close to the reference designs.

Brookhaven National Laboratory

Workers check windings of magnet developed at Brookhaven with SSC needs in mind.

In these machines the actual acceleration is done by radio waves in special wave guides. The machines are circular so that the particles can be passed through the same accelerating sections over and over again, increasing their energy each time. The more energy they have, the stronger the magnets needed to bend their path to the radius of the machine. At the energies of the SSC the magnets are designed for superconducting coils — using materials in which electric currents flow without resistance—to cut the cost of electricity to a practical level. Limon noted, to the satisfaction of his audience, that the project will require 70 million feet of superconducting cable that will use about 11.5 million pounds of niobium-titanium alloy.

The SSC will collide protons against protons. Thus it will need two bores in which the proton beams can circulate until they are ready to collide. This complicates magnet design somewhat, but the crucial point is how strong a field for how large a circle. Design A has the strongest magnets (6.5 teslas) for the smallest circumference, 90 kilometers. B and C use slightly weaker magnets for 110 and 170 km, respectively. Design C, using 4-tesla magnets, comes from Texas, and in formulating it the Texans are explicitly thinking of their own terrain, of which they have plenty.

This Texan attitude annoys proponents of other locations, who have decided—or had it decided for them—not to push particular sites at this time. In fact, a hybrid site plan shown by Limon is divided into sextants, each containing a different type of terrain. By figuring the cost of one-sixth of the machine in each kind of terrain, he says, they can then extrapolate to the cost of the whole thing in various places.

Trivelpiece says that the task for the next couple of years is to reduce the reference designs to one and build and test a few magnets. Meanwhile, the Brookhaven group, whose members include J.G. Cottingham and 18 others, has used material and machinery largely left over from the now canceled Colliding Beam Accelerator project (SN: 7/23/83, p. 53) to fabricate and successfully test two 5-meter-long double-bore magnets "similar to the reference design for the proposed [SSC]." Cooled to 4.5 kelvins they reach a central field strength of 6 teslas, and at 2.6 kelvins the central field strength exceeds 7 teslas. One of the group, Peter Wanderer, told Science News that they started before the SSC reference design came out, and so had to more or less guess. The design is not quite reference design A. It has a smaller bore, which, Wanderer says, is harder to make, but with it many of the components for the reference design magnets can be studied. *— D.E. Thomsen*

New predictor of alcoholism?

The theory that vulnerability to alcoholism is inherited — that people with alcoholism in their immediate biologic family stand a greater chance of becoming alcoholics themselves — has generally been accepted by the scientific community. But how the disease is inherited, and how this susceptibility is manifested, has been the subject of a growing debate. Scientists have unsuccessfully searched for genetic markers — a missing enzyme, for example, or a discrepancy in brain activity. Now a scientist at the University of Pittsburgh School of Medicine is looking for a different sign. A clue to alcoholic vulnerability, says neuropsychologist Ralph Tarter, may lie in behavior.

Tarter has designated six inherited behaviors, or "temperaments": activity level, emotionality, sociability, attention span persistence, reaction to food and soothability. Certain dimensions of these behaviors seen in an individual may suggest a predisposition to alcoholism, he says. He described his theory in detail last week at a National Institute on Alcoholism and Alcohol Abuse seminar.

While several biological traits have been associated with a vulnerability to alcoholism, none has been substantiated or useful as a predictor. What makes his genetic-behavioral model so useful, Tarter says, is that he has been able to link specific temperament traits — high activity level, for example—to a particular biological process. Hyperactivity in children has been associated with low levels of an enzyme, monoamine oxidase, and low brain levels of this enzyme have also been found in alcoholics and their close relatives. This does not mean all hyperactive children become alcoholics, Tarter says. Rather, it may be part of a genetic predisposition, putting them at slightly higher risk. "Behavioral analysis could be very useful," he says, "because these characteristics are overt. You can identify individuals readily and apply intervention."

In the next phase of his research, Tarter will work backwards to try to identify biological markers in young alcoholics who have these behavioral traits, and look at how these traits are predictive of outcome. Says Tarter: "Putting these concepts of vulnerability in some perspective will allow us to really drive our research efforts forward." *—S.I. Benowitz*