

state, and apparently too narrow to be a light-quark meson. There was at the time considerable speculation<sup>4</sup> that this was the Higgs debut. The one-doublet Higgs mechanism requires that the Higgs be heavier than 7 GeV, but the two-doublet model merely requires that the quadratic sum of the three neutral Higgs particles exceed this lower limit. A recent calculation<sup>5</sup> by Steven Godfrey, Richard Kokoski and Nathan Isgur at the University of Toronto, however, argues that the  $\xi$  is in fact a high-spin bound state of the strange quark and its antiquark.

"The structure of the Higgs sector is perhaps the greatest mystery of high-energy physics," Lane told the 1982 Snowmass summer study on elementary particles. "We all believe that the Higgs mechanism is responsible for electroweak symmetry breaking, but... we haven't a shred of experimental evidence that this is true, nor

what the Higgs sector consists of and how it works. Settling these issues, we believe, is the most important task of high-energy experiments in this decade."

—BMS

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# R & D funding for the Super Collider

A group of 150 scientists led by Maury Tigner of Cornell submitted a report to DOE in May containing three reference designs for the Superconducting Super Collider. In June the Universities Research Association, which is to administer the R & D phase of the SSC project, designated Tigner as director of the SSC design and R&D program. The Department of Energy, in its FY 1985 budget request, had asked for \$20 million for R&D on the collider. However, it was not until mid-August that it decided to release the \$20 million at the start of FY 1985, on 1 October.

In a memo to DOE Secretary Donald P. Hodel, dated 10 August, Alvin Trivelpiece, head of the DOE Office of Energy Research, described the DOE review of the Reference Designs Study, which had estimated that SSC would cost about \$3 billion in FY 1984 dollars, excluding site costs, detectors, computer capability and start-up operations. An OER review of the study confirmed the cost estimates to within 10%. In addition the DOE Management and Administration Office of Project and Facilities Management reviewed the study and found that the "most studied of the three design options," presumably the 6.5-tesla magnet design, could be built for not more than 25% more construction money. Trivelpiece told us that both DOE reviews essentially support the design study's cost estimates, within experimental error.

Although only FY 1985 money has been committed, DOE is already working on the FY 1986 budget request and will presumably ask for more money for R&D. Trivelpiece said DOE plans to report back to Congress periodically

about progress on the SSC. "It's a big project," he explains, and both DOE and Congress want to keep close tabs on it. High-energy physicists who've been thinking about the SSC design estimate the R&D phase will take about three years and cost about \$200 million.

The SSC is conceived as a proton-proton collider with 20 TeV in each beam and luminosity up to  $10^{33}$   $\text{cm}^{-2}\text{sec}^{-1}$ . The Reference Designs Study (PHYSICS TODAY, June, page 17) considered three magnet types: a 3-tesla superferric magnet (proposed by a Texas consortium), a 5-tesla superconducting magnet (proposed by Fermilab) and a 6.5-tesla superconducting magnet (proposed by Brookhaven and Lawrence Berkeley Lab). During the first year of R&D, DOE expects the group to decide which type of magnet to use and to continue design efforts, improving cost estimates and identifying ways to reduce costs further.

Tigner expects that in the next several months he'll be setting up a central design group to guide the R&D effort and assign various tasks to groups around the country. Trivelpiece has just approved the URA recommendation of Lawrence Berkeley Lab as the site for the central design group.

By the end of the first year, Tigner says, the site criteria would be determined (because once the magnet decision is made, the main-ring diameter is fixed) and he could imagine DOE issuing a "general invitation to whom it may concern" to invite the SSC to be built in a particular region. Such an invitation would include a description of the facility and a long list of questions, such as: What's the depth of the

water table? Who owns the site? A year later, he speculates, a blue-ribbon panel might be formed, such as was done when Fermilab was being established. "This panel might identify six candidate sites, each equally well qualified. You then put them in a black box and out comes the answer."

When the "200-BeV" machine was under consideration in the early 1960's, the old Atomic Energy Commission had allocated a lump sum of money to Lawrence Radiation Lab in Berkeley to do a design study, rather than DOE's present plan of doling the money out a year at a time for the SSC design study. Once Fermilab was chosen as the site and Robert R. Wilson named director, the machine and its magnets were almost completely redesigned, although many of the parameters were retained. When Congress only appropriated \$250 million for the accelerator and the lab, although the Berkeley cost estimate was higher, Wilson and his colleagues delivered it on time, within the budget and capable eventually of reaching 400 GeV (the energy where it routinely operated for many years).

Presumably, such changes in scope are not reasonable for an SSC. Its \$3-billion cost, even allowing for inflation, is roughly three times the cost of establishing Fermilab. So the R&D and design effort for SSC will probably produce a design very close to the one that would eventually get built.

Two years from now, Trivelpiece told us, he hopes the R&D effort will have constructed enough magnets to show they can be produced at an acceptable cost.

Roughly three years hence, there should be enough information to make a clear commitment on whether or not to ask Congress for money to build SSC. Although the Tigner report estimated six years for construction, Trivelpiece remarked that budgetary limitations may prolong the construction time.

Secretary Hodel, in a memo to Trivelpiece dated 16 August, commended the OER and the many scientists and engineers who prepared and reviewed the SSC Reference Designs Study. Hodel continued, "I agree that this project is totally in the spirit of this Administration's commitment to the advancement of science and technology as an essential ingredient in the achievement of national goals. If our ultimate decision is to construct this machine, it will be a symbol of our dedication to scientific excellence."

Hodel urged Trivelpiece to encourage international collaboration for SSC. Trivelpiece heads a working group on international collaboration in high-energy physics through the Economic Summit Process. The Trivelpiece group next meets in France early next year.

—GBL □