INTERNATIONAL COOPERATION

Finding a New Home for BESSY in the Middle East

Germany wants to make a donation of a used synchrotron. But how will this scientific foster child fit into the Middle East's dysfunctional family?

PARIS—Germans are well known for their environmentally responsible attitude toward reusing and recycling, and now they are extending that attitude to large research facilities. Faced with the need to decommission BESSY 1, a successful synchrotron x-ray source in Berlin, German physicists and their colleagues around the world decided it would be a shame to just sell it off as scrap. Instead, why not give it to some part of the world that would like such a machine but couldn't afford to build one? Somewhere like the Middle East.

Moving on. BESSY's current home in Berlin, due to close at the end of this year.

This somewhat quixotic idea is now on a fast track to reality. At a meeting held here last week under the auspices of UNESCO, the United Nations Educational, Scientific and Cultural Organization, representatives of five governments from the Middle East region—including Palestine—expressed official interest in hosting an upgraded BESSY 1a. These countries and others, together with well-wishing members of the synchrotron community around the world, will now look at ways to set up and fund an international center to house the machine—a center open to Arab and Israeli, Turk and Cypriot alike. As Federico Mayor, the director-general of UNESCO, put it when opening the meeting: "Such a center would encourage regional and international cooperation in science [and offer] an impressive practical illustration of 'science for peace.'"

When you whirl electrons around in circles vigorously enough, they give off energy in the form of peculiarly pure x-rays. This is something of an irritation for particle physicists, but a boon for their solid-state colleagues, as well as for structural biologists, surface scientists, environmental chemists, and a growing number of other specialists in all sorts of fields. When the usefulness of these very bright x-rays became clear in the 1970s, governments started to purpose-build storage rings to produce x-rays—dedicated synchrotron light sources.

The more light sources that have been built, the more uses researchers have found for their light, and so yet more light sources have been commissioned. According to Herman Winick of the Stanford Synchrotron Radiation Laboratory, the person who first suggested giving BESSY 1 to the Middle East, about 45 synchrotron sources are in use around the world, with 11 more under construction and 16 more being designed. Unlike most big-science installations, these are inherently multidisciplinary, which is one of the things that makes them so attractive.

The field's fast and continuing growth means that new machines are coming online before older ones have outlived their usefulness. Hence, a few older machines have found a new life in retirement. A Japanese synchrotron built for a fixed-term industrial research program has recently been shipped to Thailand. And a Dutch accelerator and storage ring used for nuclear physics is being moved to Dubna, outside Moscow, to add to Russia's synchrotron capability. BESSY 1, which is being replaced by a bigger machine, BESSY 2, still has plenty of life left in it.

Synchrotron researchers say that although these machines may be secondhand, they need not be second rate. According to Gustaf-Adolf Voss of DESY, Germany's national accelerator center in Hamburg, the upgraded BESSY 1a that would be sent to the Middle East would be a "world-class machine." It would have a new control system and vacuum system and room for more "insertion devices"—arrays of magnets that kink the beam in order to produce x-rays of particular brilliance. Although in early discussions of the project some scientists from the Middle East were a little leery about a cast-off machine, the proposed upgrades appear to have convinced everyone that the region could do very nicely with BESSY 1a. If, that is, the interested parties can find a place to put it, money to pay for it, and scientists to use it.

For any big science project, site selection is all-important and usually deeply contentious. Big machines are prizes that bring opportunities, prestige, and money—a lot of the spending in such projects is local. Such factors no doubt motivated the five territories whose representatives in Paris expressed an interest in providing BESSY's new home—Iran, Egypt, Palestine, Turkey, and Cyprus. The Palestinian delegation was particularly strident—"This is the least the world community can do [for us]," said Hanna Hallak of Bethlehem University in the West Bank. After Hamid Mohamed Roushdy El-Kady of Egypt's National Centre for Radiation Research had gone through his country's many successes in the running of physical science institutes, Said Assaf of the Arafat National Science Centre for Applied Research came back with a grin: "You have many institutes—you need one more?"

By the middle of July, Voss and his colleagues on a committee looking at the technical aspects of the BESSY 1a program will have drafted requirements for the site, such as the nature of the bedrock, local sources of vibration, and stable electrical power. (The synchrotron will need perhaps 3 megawatts.) Interested nations will have until the end of November to put together a bid, and the decision might then be made by the end of the year. If this seems terribly fast, that's because it is. The German government wants the synchrotron gone within a year of its closing down late in 1999, not least because the Max Planck Society wants to move a new center for the history of science into the vacated building.

Whatever final requirements the site

CREDITS: BESSY

has to meet, one of them is clearly not negotiable: It must be accessible to all nations of the region, including Israel. Israel made it clear at the Paris meeting that it is not offering to host the facility—there would undoubtedly be resentment if it did—but it is vital to the project's success for two reasons. One is that without Israel's involvement it would hardly look like science for peace. The other is that in one small country the Israelis have more expertise in synchrotrons and their use than the rest of the region put together. There are more than 20 Israeli teams working on synchrotrons around the world, and the country is an associate member of the European Synchrotron Radiation Facility, whose machine in Grenoble is one of the world's biggest and best. Israel thus has many academics interested in using such a facility, and it also has industries that might conceivably wish to participate.

Being able to attract such fee-paying users will undoubtedly decide the project's success. Many in Paris felt that the German estimates of $10 million for the upgrade, $10 million for infrastructure at the new site, and about $4 million for running costs was at best optimistic. Various possible donors were discussed, including the European Union's Mediterranean development budget and U.S. aid toward the Middle East peace process, which runs to billions of dollars. Closer to home, there are the oil-rich Arab states. None of these were represented in Paris, but if they could be persuaded to join the project, they could be a valuable source of cash.

But as James Vary of the International Institute for Theoretical and Applied Physics at Iowa State University in Ames points out, the big sum up front is not the most serious worry. "After the money for science for peace, you still need money for science." And the Middle East is not renowned for its generous research budgets. Khaled Elshuraydeh of Jordan's Higher Council for Science and Technology estimates that Arab governments spend on average 0.2% of their mostly rather modest national incomes on R&D. A state-of-the-art synchrotron, together with the beamlines needed to channel its x-rays and the experimental setups required to use them, would be a very big fish in a small pool—possibly, given what else might be done with the money, an inappropriately big fish.

The researchers' solution to this would be to increase the size of the pool. As Miguel Virasoro, director of the Abdus Salam International Centre for Theoretical Physics in Trieste, Italy, points out, there is no conservation law keeping Middle Eastern research budgets at their current low level. The need to make accommodations for the synchrotron could be a way of focusing attention on research. "This means that governments [have to] raise it to a higher level on their agenda," agrees Vary. But for that to work, there have to be researchers and they need to be nurtured and trained now, even if the synchrotron will not start work for several years. The Abdus Salam center already runs courses in synchrotron radiation applications, which have been put to good use by the Thais in setting up their center based around the Japanese synchrotron and also by the Brazilians, who built their own light source from scratch. According to Stanford's Winick, the U.S. Department of Energy might be willing to provide training at its facilities, although it would not cover all the costs.

By the end of the Paris meeting, the disparate group of participants had organized themselves into an interim council for the project with various committees looking at different aspects, such as training and funding. Arabs and Israelis nominated each other to the committees with a clear concern both to get the right people and the right balance. In this genuinely good-natured and open tone, the Paris meeting proved that the builders and users of synchrotrons are a community in more than name. "It's amazing how open people are here," said a watching particle physicist. "If only we could transmit this spirit to the people back home," said Voss. Even if it can't be transmitted directly, they'll do their best to put it into a storage ring. **–OLIVER MORTON**

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PHYSICS

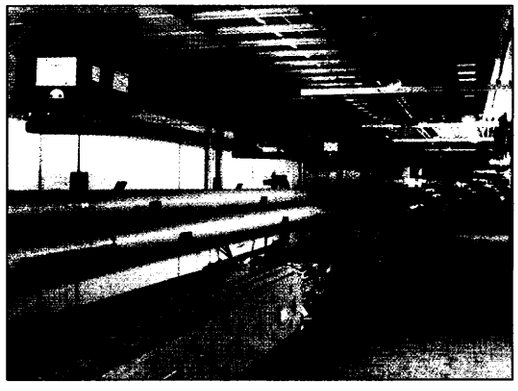
Will the Higgs Particle Make An Early Entrance?

A raison d'être for the potent accelerator now being built at CERN in Europe, this long-sought particle may be within reach of an existing U.S. machine

BATAVIA, ILLINOIS—When physicists at the Fermi National Accelerator Laboratory discovered the top quark 4 years ago, the choice of music to play over the lab's public address system was obvious: Cole Porter's "You're the Top." Now they—and their colleagues from another major particle physics laboratory, CERN, in Geneva, Switzerland—are speculating that a new theme could soon be in order: "You Turned the Tables on Me."

The music would celebrate the Higgs boson, an eagerly sought particle believed to account for the origin of all mass, including that of the top quark. Most estimates had placed the mass of the Higgs itself too high for Fermilab's Tevatron accelerator to create it—leaving the search for the Higgs to CERN and its Large Hadron Collider (LHC), a far more powerful accelerator that won't be completed until at least 2005. But now it looks as if Fermilab might just be able to steal a march on CERN.

As the Tevatron and other accelerators have measured particle masses more precisely and theorists have refined their calculations, the best estimates for the Higgs mass have narrowed. Those calculations, the subject of intense discussion last week at a conference* here at Fermilab, near Chicago, "tell us the Higgs has to be rather light," says Marcela Carena, a CERN theorist on leave at Fermilab. "This is where the Tevatron becomes interesting," she adds. The calculations imply that the Tevatron, newly upgraded at a cost of $260 million, just might spot the Higgs before the LHC does. But the Fermilab-first scenario could depend on whether the upgraded Tevatron is allowed to run for longer than the 2 years now planned—and on whether the Higgs's low mass has opened the way to a surprise winner, CERN's current accelerator (see sidebar).



Particle factory. Fermilab's Tevatron accelerator may have a shot at the Higgs.

The Higgs is crucial for modern particle theory, which is based on an interplay of symmetries but must also explain why particles in nature have wildly different masses. A "Higgs field," which is envisioned as permeating all of space like a sort of unchang-

* 7th International Conference on Supersymmetries in Physics (SUSY99).