OFF THE BEAT

eV; meV; GeV; TeV

Teravolt. To a particle physicist that's a lovely word. The energy of the accelerators that particle physicists use in their experiments is measured in multiples of volts, of which teravolt is one. (Before some nit begins to pick, let us concede that the more proper term is electron-volt, but since the electric charge of the particles to be accelerated is always the same, the two terms can be used interchangeably.)

One teravolt. That is the next plateau, as they used to say on the quiz show that gave Dr. Brothers her first continent-wide audience, the next plateau that physicists expect proton accelerators to reach. They now have protons at half a teravolt from the synchrotron at the Fermi National Accelerator Laboratory in Illinois, and they will be shortly working with protons at four tenths of a teravolt from the new Super Proton Synchrotron at the CERN laboratory in Geneva. Meanwhile the Fermilab people are busily working on an energy doubling system that is planned to yield a teravolt.

With that plateau more or less assured, physicists are beginning to consider the next level. It is widely supposed that that is likely to be 10 teravolts. To avoid the confusion between American and British usage in the nomenclature of large numbers we will spell it out in ciphers: 10,000,000,000,000 volts. That's a lot of zap. It was not much more than 20 years ago that a thousandth of a teravolt was considered really high energy.

Ten teravolts becomes much more than a $64,000 or even $64 million question. So far the only single government in the world that has both the finances and the willingness to go for one teravolt as a strictly national project is the United States. (There are plans afoot in the Soviet Union.) Everyone who talks about 10 teravolts assumes that such an accelerator would be an international project of worldwide scope. In May of this year a meeting of accelerator people in Moscow considered such a thing and agreed that it would have to be worldwide, but they more or less shelved the 10-teravolt idea in favor of considering possible intermediate steps that could still be done on a national or regional basis.

Most recently, however, the director of Britain's Rutherford Laboratory, Godfrey Stafford, has begun agitating for the 10-teravolt option. For the subject of a government that recently slapped down the Rutherford Laboratory's much more modest proposal for a pair of electron-positron storage rings of only 10,000,000,000 volts and at one time almost sabotaged CERN's Super Proton Synchrotron, that takes perhaps more than an accelerator builder's traditional bubbling optimism. Anyhow, Stafford told the British Association for the Advancement of Science some of the things that such an accelerator might do. It could, for example, find out just how many quarks there really are. It might also finally materialize the long elusive intermediate vector boson, a particle whose existence is crucial to current theories, but is apparently too heavy for current accelerators to make. In short, 10 teravolts would give physicists a probe into the most intimate details of the structure of matter, and who knows what might come from that? Before you laugh, gentle reader, remember that in the 1930s there were many scientists who said, yes, the binding energy of atomic nuclei adds up to a fantastic number if you take all the atoms in a handful of uranium, but, really, there's not any foreseeable way to make it do anything practical.

One way or the other, if the 10-teravolt machine should come to pass, it would certainly be a surety for world peace. In fact it could be a physical as well as a financial surety if it were built across the bloc border, piercing what used to be called the iron curtain, so to speak.

We already have the precedent of a border-crossing accelerator. The Super Proton Synchrotron goes from Switzerland to France and back again. Apparently when it was being planned, no one gave a moment's thought to the possibility of hostilities between Switzerland and France. (The thought of hostilities against Switzerland is likely to cause cold chills in any chancellery in the world. Suppose the Swiss retaliated by telling the names behind all those numbered bank accounts?)

Even the idea of breaking through the iron curtain with an accelerator is not new. We can remember many years ago when the Berlin Wall was new and irritating, hearing John P. Blewett suggest building such a thing around Greater Berlin, east and west together. (If done in the round, such a machine would have a diameter between 5 and 15 kilometers, so it was an eminently practical suggestion.)

Nowadays, of course, the Berlin Wall has subsided into Robert Frost's category of good fences making good neighbors, so we are tempted to offer a couple of alternatives of our own.

How about a proton linear accelerator to end all linear accelerators? It might be built between Vienna and Bratislava. It would have to be covered by a berm of earth, and that would make a fine foundation for a high-speed tram line between the two cities. After all, before the fall of the House of Hapsburg, Bratislava was nearly a suburb of Vienna. People used to run over to Vienna for an evening of opera and schlagobers. Maybe they might still like to.

Another possibility is installing the linear accelerator in the middle of a causeway across the Bering Strait. This could carry rails and highways on its top too, making possible a New York-Moscow-Paris luxury express. It would also be more likely to interest the Chinese than anything built in Europe. Suppose the causeway cut the flow of Arctic water into the Pacific. Think what that would do for the climate.

There are, of course, other possibilities. Still, the prospect of worldwide collaboration on any sort of project is such a pleasant change from recent decades that it seems a shame to let it pass.

—Dietrick E. Thomsen

Third Party's Plans

In recent years while particle physicists in the United States and Western Europe have been building new higher-energy accelerators and dreaming and planning out loud about even further steps, little has been heard from the Soviet Union. Yet, until a few years ago the Soviet proton synchrotron at the Institute for Higher Energy Physics at Serpukhov with its 76-billion-electron-volt (76-GeV) energy was the world's most energetic accelerator, and Soviet physicists were among the first in the world to put out design projections that pushed toward the 1,000 GeV or one tera-electron-volt (TeV) range.

Now, according to a report in the September CERN Courier, Soviet physicists have made public plans for a complex of new facilities at Serpukhov, which would include no less than two machines with maximum energy of 2 TeV. The first stage of this progress would be a 2-TeV proton synchrotron and a 20-GeV electron synchrotron (that's at the top of the current range for electron accelerators too). Provision would be made for colliding the proton and electron beams with each other.

This first 2-TeV machine would be built with superconducting magnets (made of niobium-tin alloy). The existing 76-GeV synchrotron would be used to inject protons into it. The 2-TeV accelerating ring would be housed in a tunnel 18 kilometers in circumference.

The second 2-TeV installation would start with acceleration in a smaller 400-GeV synchrotron (rather similar to those now operating at the Fermi National Accelerator Laboratory in Illinois and the CERN laboratory at Geneva) and then go to a second ring with superconducting magnets to reach 2 TeV. The first 2-TeV machine would be able to store proton beams of up to 800-GeV energy, and these could be collided with the 2-TeV beam of the second machine.

—D.E.T.