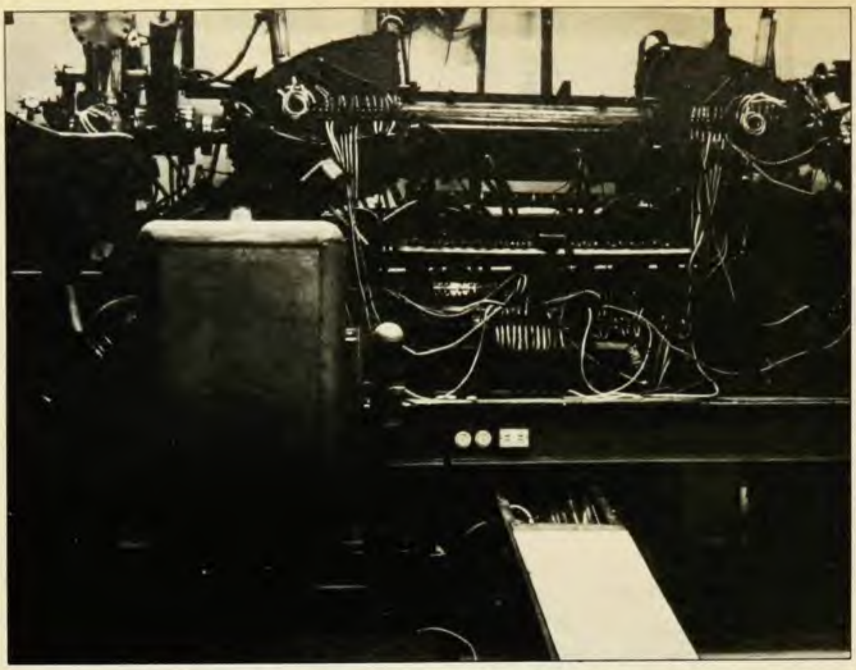

Electron-cooling device at the Nuclear Physics Institute in Novosibirsk. The electron gun is at lower left, and the collector at right. The cooling region is in the center. The proton-beam pipe is visible, entering at upper left. The proton-beam amplitude is reduced from 1 cm to 0.5 mm.

colliding-beam device, one would have a unique glimpse of what the future holds for elementary particles. Its proponents argue that the scheme could be operating in a matter of a few years and at a cost in the $10-million ballpark. A comparable energy range will not otherwise be available until Isabelle started operating, at least eight years hence, at a cost of about $200 million. If the p-$\bar{p}$ scheme works, one could start looking for the intermediate vector boson (predicted to be 64–79-GeV/c^2) or for the Higgs boson.

Fermilab is building a 140-meter-circumference race track with dipoles, quadrupoles and cooling features that is designed to study cooling and accumulation of 200-MeV protons. Fermilab expects to have an electron gun with higher current density than has been available at Novosibirsk. Electron energy will be 110 keV. Fermilab has requested partial support for the cooling experiments from NSF. In any case the lab expects to be able to start experiments this fall.

A year later, according to Mills, Fermilab will make a decision on whether to proceed with some scheme to produce p-$\bar{p}$ collisions either in the main ring or the Energy Doubler, which is now under development. The Doubler will share the same tunnel as the main ring and by means of superconducting magnets would produce 1000-GeV protons instead of 500 GeV. If the main-ring cycle were used, Rubbia believes it would be good to operate with each beam at 270 GeV. This is equivalent, Rubbia notes, to a 1-erg cosmic-ray particle, comparable to the jump of a flea. If the Doubler were used for p-$\bar{p}$ collisions, an energy of 2 TeV would be available. To produce that energy by bombarding a fixed target would require an accelerator energy of 2 million GeV.

Mills says that if all goes well, one could achieve a luminosity of at least 10^{29} $cm^{-2}sec^{-1}$ in the main ring, and 10^{30} in the Doubler. By spending additional money, these luminosities could be raised. Using either the main ring or the Doubler, the cost of making a proton-antiproton colliding-beam device is estimated at $5–10 million.

CERN has set up a study group for a proton–antiproton project, headed by Simon Van der Meer. At the same time both electron cooling and stochastic cooling will be studied experimentally. Van der Meer had proposed stochastic cooling in 1975. In this scheme the beam is given a nudge by electric fields to cause the "center of gravity" of the beam to move in a desired orbit. By a statistical process, the beam is cooled in a progressive fashion.

The experimenters will use the (g-2) ring, which was formerly used as a storage ring for 3-GeV muons. Experiments are scheduled to be done over the next year with the expectation of a decision to go ahead with a full-scale proton-antiproton scheme to be made by the end of 1977.

The first CERN project will take protons from the Proton Synchrotron in the range 50 MeV–3 GeV, the low energy being for electron cooling, the high for stochastic cooling. There are four straight sections, each 5 meters long. In one straight section is a 30-ampere electron gun which will produce 100-kV electrons. These will be used in the electron cooling on protons in the range 50–200 MeV. The Novosibirsk studies were done in a 1-cm^2 beam, whereas the (g-2) ring has a 50-cm^2 beam.

Because CERN does not have an Energy Doubler in the works, Rubbia notes, CERN has a special incentive to take advantage of the cooling schemes. Each of the 20 bunches in the Proton Synchrotron carries 10^{11} protons. With just one bunch, Rubbia believes a luminosity of 0.5×10^{30} cm^{-2} sec^{-1} is possible, and if more bunches are used, of course, the luminosity goes up. —GBL

Scyllac expires: And now there are two

Last year ERDA gave Los Alamos Scientific Laboratory a deadline of September 1977 to demonstrate stabilization of plasma in Scyllac, a circular theta-pinch device that had been one of the three major components of the magnetic-fusion program (PHYSICS TODAY, July 1976, page 17). Now ERDA and Los Alamos have decided to terminate operation of Scyllac between 1 July and 30 September.

Edwin Kintner, Director of Magnetic Fusion Energy at ERDA, told us that in the future, tokamaks will continue as the main-line component and magnetic mirrors as the back-up. Los Alamos will pursue a broader physics effort supporting the rest of the fusion program. In this regard, ERDA decided that Los Alamos will build a small Reversed Field Pinch Experiment, ZT-40, and that the lab will submit a proposal for a 15–25-meter linear theta-pinch device to use the existing Scyllac capacitor bank. Los Alamos proposals for other experiments (imploding liners and high-beta tokamak) will be revised, and Los Alamos will continue to work on other, smaller experiments. —GBL

in brief

Sandia Laboratories has begun testing Proto II, an electron-beam accelerator to be used in fusion experiments. It will ultimately produce about 100 kJ in a double diode at a voltage of 1.5 MV and a peak current of 6 megamps. Pulse length will be 24 nanosec.

ERDA has selected a site near Barstow, Calif. in the Mojave Desert for its first solar-electric pilot plant. The 10-MW plant will utilize the central-receiver concept and will be completed in 1980–81. The $23.3-million cost is shared by ERDA and a team of utility companies headed by Southern California Edison. □