las Allen is building a Bristol-type antenna.

In Italy, at ESRIN in Frascati, K. Maischberger, Bruno Bertotti and G. Fiocco are now operating a Weber-type detector at 1661 Hz; Weber hopes to join in a coincidence experiment with them. At the University of Rome Edoardo Amaldi, Guido Pizzella and Giorgio Careri are planning a third cylinder like the ones to be at LSU and Stanford, thus allowing the possibility of measuring the speed of the waves picked up at all three locations.

In Germany, Hans Billing (Max Planck Institute in Munich) is constructing a duplicate of Weber's experiment. He is planning to do a coincidence experiment with Frascati and Weber. —GBL

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First experiments set for CEA colliding beams

The Cambridge Electron Accelerator, which has been developed into an electron-positron colliding-beam device, is now producing electron and positron beams at 2 GeV and with peak currents of about 15 mA and is preparing for its first high-energy experiments. To produce a collision between a positron beam and a stationary electron with the same center-of-mass energy, one would need a positron beam energy of 16 000 GeV.

The development of the device has been the primary activity of the laboratory since July 1970. The electron-positron collisions will be used to investigate electromagnetic processes and the production of strongly interacting particles by one- and two-photon processes.

CEA is now the highest energy electron-positron colliding-beam device in the world. In later experiments, each beam will have its energy increased from 2 to 3.5 GeV. The next highest energy operating device of a similar nature is located at Frascati, Italy, where beams of 1.3 GeV are available. Three other storage rings currently under construction in the same energy range as the CEA are SPEAR at SLAC with 2.5 GeV in each beam, DESY (Deutsches Elektronen Synchrotron) in Hamburg with 3.5 GeV in each beam and Novosibirsk in the Soviet Union with about 3 GeV in each beam.

The most important of the recent modifications to the accelerator, which began operations in 1962, is a 150-foot long stretch of vacuum chamber into which the two counter-rotating beams are switched for storage and collision. The chamber, known as the bypass section, contains a special arrangement of focusing quadrupole magnets, called a low-beta insert, which focuses the beams to a cross-sectional diameter of about 0.004 inches, one-tenth of the beam diameter in the ring. Without these special focusing sections, head-on electron-positron collisions would be so rare an experimenter might have to wait several weeks for one. The sections were first proposed by K. W. Robinson and G.-A. Voss of the CEA.

An extremely high particle density is necessary for a useful number of collisions. To provide this, beams are built up by injecting a succession of pulses of electrons and positrons at lower energy from a linear accelerator and then storing the beams after they have reached full energy for an hour or so while they collide. CEA researchers had to produce a vacuum of about 10^{-12} atmospheres to permit such long storage times.

New magnets also had to be developed for a damping system to control radiation anti-damping and others to keep beam instability from growing out of control during the storage period.

Like previous colliding-beam systems, the CEA development has been plagued by the effects of beam instabilities and beam-beam interactions. At this time the positron beam that can be annihilated routinely is limited to a peak value of about 15 mA by coherent synchrotron oscillations, and the electron beam that can be safely injected in the presence of positrons is limited to about the same value by beam-beam interaction. Several ways of increasing both limits are being developed.

The electron-positron collisions that will be produced by the machine will provide a way to test the fundamental laws of quantum electrodynamics, and since all energetically permitted particle-antiparticle pairs that are coupled to the electromagnetic field will be produced, there is a chance to observe new particles with the machine.

In the one-photon process, which will be studied at the CEA, a colliding electron-positron pair results in the annihilation of both to one virtual photon, which then produces a particle-antiparticle pair.

CEA 2-GeV colliding-beam device is now *producing peak currents of about 15 mA.* Bypass is in front and synchrotron in rear. Technician stands at the interaction region, which is now surrounded by detection apparatus.

The field of "two-photon physics," in which two virtual photons collide and produce a variety of reactions, will also be studied with the CEA. In this type of collision, the electron and positron each emit virtual photons, which then collide and produce particle-antiparticle pairs while the original electron and positron keep traveling with reduced energy.

The first experiment on the CEA, which will be carried out by a joint CEA-Harvard group, concentrates on the study of electromagnetic one- and two-photon processes and on the measurement of the cross sections for hadron production. A second experiment being prepared by a group of physicists from CEA, MIT, Southeastern Massachusetts University and Northeastern University will use a magnetic field around the interaction region for a detailed analysis of the collision products.

Van de Graaff voltage raised to 14.4 MV

Many nuclear physicists working with big tandem Van de Graaffs would like to raise the energy of their accelerators by buying new acceleration tubes from High Voltage Engineering Corp. In tests with its own MP-0 (Emperor) tandem Van de Graaff, High Voltage reported that voltages as high as 14.4 MV were achieved, which the company says is the highest dc voltage ever applied to an acceleration tube. In the past, tandems only ran at 10–11 MV on terminal; beyond this value the tubes would fail. With the new tubes, a conventional tandem would be able to run at 28–30 MeV. □