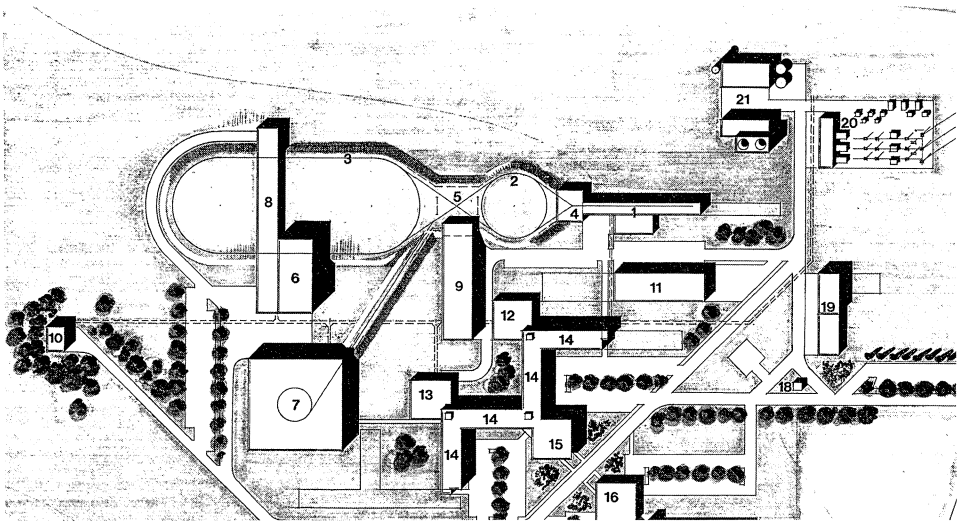
Possible Tau-Charm Factory site layout, from a CERN design in collaboration with LAL-Orsay and Spain. 1 = Linac; 2 = Booster; 3 = Main ring; 4, 5 = Switchyards; 6, 7= Experimental halls; 8 = r.f. + exp. service hall; 9 = Machine access and service hall; 10 = Cryogenics; 11 = Workshops; 12 = Control room; 13 = Computer centre; 14, 15 = Offices and labs.



tual study, along with collaborators from LAL-Orsay and Spain, of a Tau-Charm Factory Laboratory in Spain. This study has been completed and the Spanish authorities have recently proposed considerable funds for the project. Discussions are now underway for CERN to provide the necessary technical expertise and the training of Spanish fellows and technicians.

The machine design envisages a collider and a dedicated synchrotron radiation source, both fed by an intense electron-positron injector operating at up to 2.5 GeV. The collider comprises a pair of 360-m racetrack-shaped rings, spaced vertically by 1.2 m. These are filled with up to 0.6 A positron and electron currents, at energies between 1.5 and 2.5 GeV. The beams are brought together at a single interaction point, with a second interaction region left open as a future option. With high currents and tight focusing at the interaction point, the luminosity is expected to reach 10^{33}, a hundred times that of the best current machine at these energies (BEPC, Beijing).

The Seville meeting also looked at the design of the detector for the Spanish machine. The detector is being developed by an enthusiastic team of physicists and engineers from CERN, France, Germany, Italy, Portugal, Spain, the UK and other European countries, as well as a US team led by Martin Perl of Stanford, who discovered the tau lepton in 1975.

The current ideas for the detector follow the style of CLEO II at Cornell (October 1989, page 14), with a large cesium iodide electromagnetic calorimeter, but optimized for tau-charm physics. In particular it includes a fine-grained outer hadron calorimeter/muon detector to complete the detector coverage and enable the invisible neutrinos produced in tau and charm decays to be 'seen'.

The Tau-Charm Factory is creating a lot of interest in Spain, which has never had a national centre for experimental high energy physics. As well as attracting the international physics community to Spain, the Tau-Charm Factory provides unique opportunities to breed a new generation of Spanish machine physicists and to provide a springboard for industrial spinoffs and future research projects in particle and accelerator physics. With the final decision on the project expected later this year, the first beams should collide early in 1997.

SOUTH AMERICA Looking for partners

A Regional Meeting on Fundamental Physics organized at the CIF International Physics Centre in Bogota, Colombia, in April, looked at future international collaboration possibilities for physicists from the South American Andean region in general, and from Colombia in particular.

There is a strong tradition of Latin American collaboration at Fermilab, and all the signs are that this will continue to flourish. In addition, a new collaboration agreement drawn up between CIF and the Canadian TRIUMF Laboratory in Vancouver opens up new horizons.

Cayetano Lopez of Madrid, a former Vice President of CERN Council, looked at possibilities in Europe. Spain, now playing an influential role in CERN and with plans to create a home-based accelerator centre, could provide a natural cultural bridge.

A collaboration agreement has been signed between CERN and Brazil (April 1990, page 26), and accords will soon be signed with Argentina and Chile. At the Bogota meeting Georges Charpak of CERN pointed out the usefulness of such agreements, in particular for Colombia, where CIF, founded in 1985, provides a natural base.

Apart from accelerator-based physics, countries with high mountains near the Equator provide natural advantages for observational physics.

Concluding the meeting, Galileo Violini of CIF looked forward to increased opportunities across a broad front. A special steering committee has been set up with representation from Italy, the US (Leon Lederman of Chicago) and Canada (Erich Vogt of TRIUMF) as well as South American Countries.

BROOKHAVEN
Rare kaon decays, phase II

Hints on forthcoming particle physics attractions often come from experiments at energies well below the threshold for production of the new particles themselves. For example hadron substructure was presaged by the observation of the very anomalous magnetic moment of the proton, and the fourth quark, charm, by the unexplained suppression of certain kaon decays.

Brookhaven's rare kaon decay programme, which began in the mid-1980s, continues to probe the high energy frontier in this tradition. All four Alternating Gradient Synchrotron (AGS) experiments (E777, E787, E791, and E845) have now established new sensitivity records for suppressed reactions like the decay of the long-lived neutral kaon into two charged muons. These high statistics samples of suppressed decay modes allow the parameters of the Standard Model to be fine tuned.

However the main goal is to search for decay modes which are at least extremely suppressed, if not forbidden, in the Standard Model.

E777 and E791 search for violations of the hitherto sacrosanct conservation of lepton number – reactions such as a charged kaon decaying into a pion, a muon and an electron, or a neutral kaon giving a muon and an electron. The branching ratio limit obtained by E777 was 2.1 x 10^{-10}, while a limit of 6.1 x 10^{-11} was reported by E791 on the muon-electron mode which is expected to improve slightly when the 1990 data sample is analysed.

GHz rates of beam particles with MHz kaon rates are now possible because of the high proton current from the AGS and the sophisticated data acquisition systems of these experiments. Typically the level 1 trigger rate exceeds 10KHz with about a hundred events per second finally written to tape.

E787 searches for the decay of a charged kaon into a charged pion and accompanying neutrinos, a second order weak process predicted by the Standard Model to occur at a level of a few times 10^{-10}. A result significantly above or below this level would indicate new physics, while a measurement consistent with the Standard Model would determine the poorly-known mixing between top and down quarks.

The decay of a neutral kaon into a neutral pion and an electron-positron pair is suppressed in the Standard Model. E845 found no evidence for this decay mode (less than 5.5 x 10^{-9}) but found an unanticipated background due to decays into an electron-positron pair and a photon. Unfortunately this background kinematically overlaps the decay mode of interest and will be a major irritation to other experiments pushing the sensitivity for this decay mode toward the Standard Model value.

Brookhaven's rare kaon decay programme might now be said to have completed Phase I and to be preparing for Phase II, incorporating detector and secondary beamline upgrades to exploit higher beam intensities from the AGS Complex after commissioning the new Booster and improving the radiofrequency system.

The successor to E777 is E865. This experiment will utilize a more intense kaon beam, larger apparatus, and improved hardware made

Status of Brookhaven search for 'rare' (suppressed or classically forbidden) kaon decays. The black line shows the limits listed in the 1986 'Review of particle Properties' (left extremity of black line), current (right extremity) and anticipated progress (dotted line). Standard Model (SM) predictions are indicated.