WORKSHOP
Looking to mass-produce beauty

Physicists' attention is increasingly turning to the possibilities of 'particle factories' to explore the high intensity frontier and complement the traditional push for high energy (July/August, page 26).

A workshop held at the Château de Blois, France, from June 21 – July 1 looked at requirements and physics prospects for factories to manufacture B mesons (containing the fifth 'beauty' quark). Under organizing committee chairmen D. Cline and A. Fridman, the basic goal was to assess the prospects for achieving the necessary high collision rate (luminosity of 10^{34} per sq cm per s) with a B factory to produce more than a thousand million pairs of neutral B mesons per year to search for violation of CP symmetry (combined left/right and particle/antiparticle reversal), seen so far only in the neutral kaon sector, together with other physics aims and related detector constraints.

The machine discussions covered different approaches – linear-linear colliders, linear-circular (symmetric and asymmetric) and fixed target hadron machines. Thinking is turning towards asymmetric colliding beams to produce B pairs for CP violation studies, with the promise of a gain factor of 4.6 over symmetric (equal energy) colliding beams.

The meeting started with a review of B physics, including recent results from Cornell, DESY, UA1 at CERN and CDF at Fermilab. One highlight was a report by the CLEO group at Cornell's CESR electron-positron collider that transitions of beauty (b) to 'up' (u) quarks are beginning to show up (see page 4). Other speakers looked at implications of the production of B meson pairs at both proton-proton and proton-antiproton colliders.

Ideas were aired for prospective B factories at Cornell, Stanford (SLAC), Novosibirsk, Southern California, PSI (Switzerland – July/August, page 27) and Frascati as well as exploiting CERN's new LEP ring.

B physics will also be possible at the new US Superconducting Supercollider (SSC) project, using either a low intensity extracted 20 TeV (20,000 GeV) beam or the proton-proton collisions. In the first case the only real problem is to extract a modest beam, and various ideas, such as a crystal channeling device, were discussed. In the second case the main problem is to live with the extremely large backgrounds in high luminosity proton-proton colliders.

The major objective of the workshop was to assess the prospects for an electron-positron collider reaching a luminosity of 10^{34}, a hundred times higher than the present world record of the CESR machine at Cornell. For circular colliders this means storing a beam of several amps, rather than the conventional hundreds of milliamps. For linear-linear and linear-circular colliders, the problem lies in the positron levels needed.

It was clear that extensive R & D is required before such high luminosity linear colliders can leave the drawing board, however much of this R & D would also be useful for higher energy linear machines. The asymmetric circular colliders fared better but would have to live up to their expected large luminosity increases. Accelerator physicists were optimistic that a solution providing the required luminosity could be found eventually.

Another conclusion was that although the hadron collider option lagged behind that the electron-positron collider solution, it showed great promise, especially using extracted proton beams of several TeV.

From David Cline