Physics monitor

Collision course. Delegates at the second workshop on the Physics Potential and Development of Muon Colliders, held in Sausalito, California, in November.

Muon colliders

The increasing interest in the possibility of positive-negative muon colliders (October 1994, page 24) was reflected in the second workshop on the Physics Potential and Development of Muon Colliders, held in Sausalito, California, from 16-19 November, with some 60 attendees.

It began with an overview of the particle physics goals, detector constraints, the muon collider and mu cooling, and source issues.
The major issue confronting muon development is the possible luminosity achievable. Two collider energies were considered: 200 + 200 GeV and 2 + 2 TeV. The major particle physics goals are the detection of the higgs boson(s) for the lower energy collider, together with WW scattering and supersymmetric particle discovery.

At the first such workshop, held in Napa, California, in 1992, it was estimated that a luminosity of some 10^{30} and 3 x 10^{32} cm^{-2} s^{-1} for the low and high energy collider might be achieved (papers from this meeting were published in the October issue of NIM). This was considered a somewhat conservative estimate at the time.

At the Sausalito workshop the goal was to see if a luminosity of 10^{32} to 10^{34} for the two colliders might be achievable and usable by a detector. There were five working groups - physics, 200 + 200 GeV collider, 2 + 2 TeV collider, detector design and backgrounds, and muon cooling and production methods. Considerable progress was made in all these areas at the workshop.

The muon collider has a powerful physics reach, especially if muon polarization can be maintained. One interesting possibility is the direct observation of the supersymmetric higgs. The detector backgrounds will be considerable due to high energy muon decays upstream, however the working group concluded that these backgrounds might be manageable.

One key to achieving a high luminosity collider is the collection of a maximum of muons from pion decays. This is far from trivial and leads to conclusions from groups 2 and 3 that the present uncertainty in luminosity is of order $10^{2\pm1}$ (these orders of magnitude unfortunately span the range from being uninteresting to being very interesting!). Hopefully this uncertainty can be reduced before the next meeting.

Perhaps the most interesting aspect of a muon collider is the need to cool the positive and negative muon beams over a very large dynamic range.

Three experimental programmes were discussed and are being initiated to study muon cooling: at Brookhaven, Fermilab, and a UCLA group is proposing to study cooling and acceleration in crystals at TRIUMF.

One major conclusion of the meeting is that muon colliders are complementary to both proton-proton (LHC) and electron-positron (NLC) colliders, especially for the higgs Sector and for the study of supersymmetric particles.

The third meeting in this series will be held in San Francisco, California, in December. Another workshop, addressing machine issues, will be held on Long Island in October. Proceedings of the Sausalito workshop will be published by the American Institute of Physics.

From David Cline UCLA

Cosmic rays of the highest energies

With the objective of designing a new detector to probe the behaviour of the highest energy cosmic rays, a Giant Airshower