

years to come. With the advent of the SPS, Daresbury is proposing collaboration in research with muon beams in the North Area and experiments involving a tagged photon beam to Omega in the West Hall.

Financial restrictions mean that the resources to support the growing programme at CERN have to be found at the expense of the existing programme at NINA. Most of the money for major new equipment will be required for the programme at the SPS.

The NINA operating hours are being cut from 6000 to 5000 per year and the idea of having higher energy injection has been dropped. However, 'programmed quadrupoles', which will enable the operators to play tunes at high energies and thus avoid vertical beam blow-up on crossing resonances (leading to lower ejection efficiency), will be installed next year. There are four pairs of quadrupoles giving control of both horizontal and vertical working points with power supplies which can be fully programmed through computers.

The addition of a sextupole and septum following the installation of these quadrupoles will make 'separated function ejection' possible. This will replace the regenerator ejection system which, because of the regenerator strip fields, causes orbit distortions making simultaneous ejection difficult. Thus NINA will still manage a minor face-lift in her final years of independent operation for high energy physics.

PEP Summer Study

A Summer Study on the problems involved in proton-electron-positron colliding beam systems was held in the San Francisco area from 6 to 31 August. It was organized by the Lawrence Berkeley Laboratory and the Stanford Linear Accelerator Centre

and pulled in participants from CERN, DESY, Frascati, Orsay and Rutherford, as well as from the U.S. high energy physics Laboratories.

Systems currently under study for e^+e^-p include PEP, which is being investigated jointly by LBL and SLAC; EPIC, which is being investigated by Rutherford and Daresbury; ISABELLE which is under study at Brookhaven and the DESY programme for DORIS. Results from existing storage rings (ISR, SPEAR, ACO, ADONE, etc.) were reviewed and a number of experiments with them were suggested to help clarify the present understanding of the machine physics involved.

Lattice design problems received considerable attention. These included synchronization of bunched electron and proton beams over a range of operating energies with maximum luminosity. There was considerable discussion on methods of achieving head-on collisions and collisions at a small crossing angle with their respective merits and demerits including the effects of unbunched and tightly bunched beams. Other questions concerned injection, acceleration, resonances, cell structure and coupling effects.

Among the single beam phenomena which were studied were bunch lengthening and multi-bunch longitudinal instabilities. Discussions on transverse and longitudinal beam-beam limits led to lively controversies on the roles of simple isolated resonances, many resonances, stochasticity, and Arnold diffusion. In connection with longitudinal motion, the benefits from exciting higher order modes in r.f. cavities were considered and schemes were devised in which cavities driven by the beams might be used to achieve very short proton bunch lengths. Some aspects of superconducting systems for protons were also considered. Work from the study

will be reported in internal LBL-SLAC PEP notes and subsequently will be compiled into a report.

Photon-photon Colloquium

An International Colloquium on Photon-Photon Collisions in Electron-Positron Storage Rings was held at the Collège de France (Paris) on 3-4 September. It was attended by about a hundred physicists (theorists and experimentalists). The subject concerns those processes where the electron and the positron in the storage ring beams, instead of annihilating each other, act as generators of quasi-real photons. It is as if two photon beams (with large momentum spread) are colliding with each other.

The first pioneering studies on this subject date back to 1960 (F. Low, M. Calogero and C. Zemach) but had been forgotten to some extent for a number of years. It is back in vogue since 1969 particularly due to the work of three independent groups of theorists at the Collège de France, Novosibirsk and SLAC-Cornell. A large number of theoretical papers have been published in the last four years and the first experiments have been performed on VEPP-2 (Novosibirsk) and ADONE (Frascati). Their results are very encouraging although they are limited for the moment to the study of pure quantum electrodynamics. Other photon-photon collision experiments are being prepared for the high energy, high luminosity storage rings which have been recently brought into operation or are under construction — SPEAR at Stanford, DORIS at DESY, DCI at Orsay and VEPP-4 at Novosibirsk.

The programme of the Colloquium was divided in an experimental and a theoretical part. In the experimental part, reports on past and future experi-