Ions in the fire

In the euphoria following the smooth addition of high energy ion beams to the physics armoury at CERN, the pioneering work in other Laboratories or the plans elsewhere to carry the ion energies still higher should not be overlooked.

Berkeley has held pride of place for some years with the Bevalac providing ions across the periodic table at energies from 20 MeV to 2 GeV per nucleon. Many of the beams have the highest available intensities, supporting a broad nuclear physics programme plus a biomedical programme. The latest proposal dates from 1986 and involves replacing the venerable Bevatron with a modern synchrotron to step up beam intensities by a factor of a hundred.

Alert readers spotted the inadvertent error in our September 1986 issue alleging that the SPS wrested the oxygen ion energy record from the Bevalac. The Berkeley machine can reach 32 GeV for oxygen but this is surpassed by the Synchrophasotron at Dubna (USSR) which takes the ions to 67 GeV. This work at Dubna began in 1971 and they can achieve 4.2 GeV per nucleon with fully stripped ions up to silicon. They have been working on the design of a superconducting synchrotron, called the Nuclotron, to accelerate the full range of elements up to 6 GeV per nucleon. Another machine that was revivified by conversion to ions, like the Synchrophasotron, is Saturne at Saclay.

A Laboratory with long experience with ions is GSI Darmstadt where the Unilac linear accelerator has been providing beams since 1976. They are now constructing a synchrotron and small storage ring to be fed from Unilac. They plan to have a wide range of ion beams with energies up to 2 GeV per nucleon.

In Japan interest in ions has been alive since the mid-70s. A Test Accumulation Ring, TARN, at INS Tokyo is being upgraded as TARN II to provide 0.5 GeV per nucleon for the lighter ions. Dreams of GeV beams with ions up to uranium led to a design report for a 'Numatron' ten years ago, but it has not had financial support.

Another possibility is provided by the 12 GeV Proton Synchrotron at the nearby KEK Laboratory.

Another project awaiting dollars is one which could take over the torch from CERN — the RHIC, Relativistic Heavy Ion Collider, at Brookhaven. This would use the Isabelle ring tunnel to set up colliding ion beams at up to 100 GeV per nucleon. Preparations are well underway and ions went through Brookhaven's Alternating Gradient Synchrotron for the first time in 1986.

It has long been realized that important information could come from measuring the influence of the proton polarization on that of the hyperon. Does the hyperon spin remember the proton spin direction? The simple quark picture implies that lambda particles should have no memory of the proton spin direction but that sigma particles should have their spin pointing in the same direction as the proton almost all the time.

The advent of the polarized proton beam at the Brookhaven Alternating Gradient Synchrotron allowed this measurement to be made. A team of physicists from Rice / Brookhaven / Johns Hopkins / Houston / Southeastern Massachusetts performed the first part of the experiment by measuring the lambda polarization using 13 and 18 GeV polarized proton beams. They report that, as predicted, the lambda polarization is uninfluenced by that of the proton. In addition the left-right asymmetry in lambda production arising from the proton spin direction is very small, in agreement with the prediction of the model. This group is planning to extend the measurements to the neutral sigma particle.

PARTICLE BEAMS Frontier course

Driven by the quest for higher energies and optimal physics conditions, the behaviour of particle beams in accelerators and storage rings is the subject of increasing attention. Thus the second course organized jointly by the US and CERN Accelerator Schools looked towards the frontiers of particle beam knowledge. The programme,

At the US/CERN Joint Topical Course on the Frontiers of Particle Beams, held on South Padre Island, Texas, from 23-29 October, the US Particle Accelerator School's 1986 Prize for Achievement in Accelerator Physics and Technology was awarded to Tom Weiland of DESY, Helmut Piel of Wuppertal and Maury Tigner, Director of the Central Design Group of the proposed US Superconducting Supercollider. With the awards are (left to right) Piel, ceremony chairman and CEBAF project director Herman Grunder, Jorg Rossbach of DESY (receiving the award on behalf of Weiland), and Tigner.

(Photo S. Turner)

The US Particle Accelerator School's 1986 Prize for Achievement in Accelerator Physics and Technology was awarded to Tom Weiland, Helmut Piel and Maury Tigner (see October 1986 issue, page 39) after the School banquet.

The next major event for the CERN Accelerator School (CAS) is a Workshop on New Developments in Particle Acceleration Techniques to be held in Orsay, France, from 29 June-4 July. It will review current theoretical and experimental developments in the techniques for accelerating charged particles, including specific objectives related to higher energy machines for the future. After introductory talks, the programme will be split between plenary sessions and working/discussion groups. Further information from Mrs. N. Mathieu, LAL, Bat. 200, 91405 Orsay Cedex, France.

CAS will be having its Advanced Accelerator Physics Course in Berlin (West), in collaboration with the BESSY synchrotron radiation centre, from 14-25 September.

held at South Padre Island, Texas, from 23-29 October attracted 125 participants including some 35 from Europe. (The first joint course, held in Sardinia early in 1985, dealt with nonlinear dynamics.)

The first half of the course covered mainly mathematical topics - single and multiparticle dynamics, multiparticle correlations and beam noise, intra-beam scattering, coherent instabilities, and electromagnetic fields with emphasis on wake field calculations and space-charge dominated beams. Synchrotron radiation and coherent radiation in the free electron laser were described from a less mathematical viewpoint.

The second half of the course reflected the wide interest in linear colliders. The programme was supplemented by a series of topical seminars including the recent idea of 'crystal beams', where the transverse beam temperature becomes so low that in principle the beam particles should take up positions in a lattice.

CHALK RIVER Superconducting tandem

The Tandem Accelerator Superconducting Cyclotron (TASCC) at the Chalk River Nuclear Laboratories of Atomic Energy of Canada Limited, officially opened in October, provides world-class research facilities for intermediate energy heavy ion physics.

The Chalk River tandem which came into operation in 1967 was upgraded from 10 MV terminal voltage to 13 MV in 1972. At the same time, plans were made to use it as an injector for a booster accelerator to produce beams of up to 50 MeV/nucleon for light, fully stripped ions and up to 10 MeV/nucleon for uranium.The chosen accelerator was a superconducting cyclotron conceived at Chalk River by Bruce Bigham and Harvey Schneider: a four-sector isochronous machine with a maximum midplane field of 5 T.

For budgetary reasons the project was divided into two parts: the first covered building additions, modifications to the tandem (including reversing the beam direction, construction of the cyclotron and beamlines from the tandem). Interim target locations just beyond the cyclotron are available with beams from TASCC or from the tandem alone. The second phase covers construction of beamlines