

It will then lock onto the star and the computer will do the calculations to take account of the earth's rotation and make the adjustments to keep the star in view (and of course keep the dome, shutters, mirror and siderostat also in phase). Further complications that the computer can take care of are corrections for the bending of the mechanical parts of the telescope according to the particular orientation and corrections for the thickness of the air layer (giving atmospheric refraction) traversed by the incoming light.

During the observation period the astronomer will communicate with the telescope via the computer's cathode ray display and keyboard. Data will be collected and stored by the computer but will normally be transferred, for example to magnetic tape, to be taken away to a larger computer for analysis. However some data reduction will be possible to give samples of the quality of the information being collected.

Testing of the computer control scheme, with mock-ups of motor drive systems etc., is already underway and the computer programs are being developed.

The present schedule calls for assembly of the telescope in Europe early in 1975 and, if all goes well, the telescope should move to Chile at the end of the same year and come in to use in 1976 on La Silla mountain.

Booster commissioning

Running in of the PS Booster started on 1 May. The Booster is one of the major items of the improvement programme at the 28 GeV proton synchrotron. It will take the linac beam at an energy of 50 MeV and, in four superposed rings, accelerate the protons to 800 MeV before feeding them to the synchrotron. By injection at this higher energy the space charge limit in the PS will be raised and it should then be possible to achieve beam intensities in the 10^{13} protons per pulse region.

At the time of writing, there have been five experimental runs with the Booster. At the time of the first run it was a comparatively 'unaligned' machine — alignment of the quadrupoles was going on progressively in parallel with the first tests. On 3 May, the beam was taken $2\frac{1}{2}$ times around Ring 3 (Ring 3 is in the same vertical plane as the linac beam and hence injection was simplified, being two-dimensional rather than three-dimensional as will be required for the other Rings). At that time about half the quadrupoles were aligned.

Two days later a circulating beam was achieved and the signal induced by the beam can be seen in the photograph. On 16 May, with the machine fully aligned, the beam circulated for 7 ms (4200 turns). The beam was lost only when steered out to the vacuum chamber wall under the influence of the rising magnetic field (no r.f. acceleration being applied).

In the next issue we hope to report further progress on the running in of the injection beam-line and the PS Booster.

Spring Study

During the last two weeks of April a concerted attack on the theoretical aspects of the SPS design was held at CERN. It brought together about

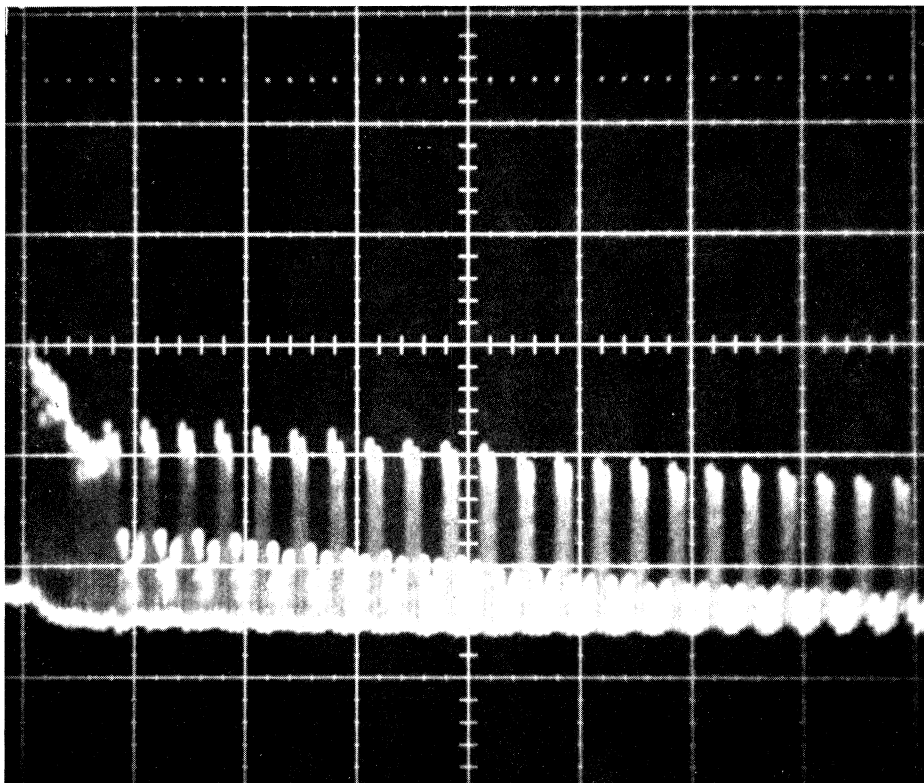
twenty machine theorists from other Laboratories and, when a similar number of participants from CERN itself is added, it must have been one of the largest gatherings of its type ever to be held.

The Study followed an initiative of the Advisory Machine Committee and is one of the ways in which the accelerator expertise in the other European Laboratories is being brought into the SPS project. There were people from Frascati, Orsay, Rutherford, DESY, Daresbury, Saclay and Karlsruhe, plus one participant from Brookhaven.

The exercise started in March when a series of talks by Laboratory II Group Leaders presented the machine design. With this basic information the theoreticians were able to get their teeth into refined aspects of anticipated machine behaviour. For example, they were able to tackle such topics as high intensity effects which there had not been time to go into in great detail in the course of the preparation of the design report (CERN 1050). As a result, though there were no recommendations to change any important features of the design, the machine is much better understood and some potential difficulties, which might arise when every possible bit of intensity is squeezed from the machine, have been identified and now can be steered around.

Topics included a study of the 'stop-bands' where more detailed figures were fed into such things as the resonance widths and the growth rates for instabilities. The possibilities of selecting a different working point were examined but none seemed clearly preferable to the 27.75 value previously selected. A look at instabilities and the correcting elements which would be needed to cure them did bring some minor changes. The number of correction sextupoles can be reduced but their places will need to

On the evening of 5 May a beam transformer in Ring 3 of the PS Booster recorded this signal indicating that a circulating beam had been achieved for the first time. To make monitoring of the beam easier it was chopped into five bunches at the linac input. From the third turn on, three of the bunches appear at much reduced intensity. When this was analysed later, it seemed probably due to a timing error on the fast injection kicker magnet.



be taken by octupoles required to cope with the 'resistive wall instability'. (The effect of the octupoles on ejection conditions has not yet been worked out.) Disturbance of the beam at transition seems to be no problem. Instabilities due to the presence of electrons from the ionization of the residual gas could be troublesome but the introduction of a gap in the accelerated beam would cure it. Beam-component interactions which could perturb the beam do not seem to be a worry with the possible exception of interactions with the r.f. cavity structure.

A look was also taken at possible future storage ring schemes, the aim being simply to keep options open — to avoid doing anything unnecessarily which would make the SPS accelerated beams less suitable for storage rings should this seem an appropriate development many years from now. Among the schemes examined were a superconducting conversion of the ISR

for higher energies (where the SPS characteristics look good), a by-pass scheme (where potential luminosities and costs do not look encouraging) and electron-proton schemes (where physics interest is currently high).

Another study is planned for the autumn when the work will concentrate on beam diagnostic equipment for the SPS.

Leptonic decays of hyperons

An experiment to study the leptonic decays of negative hyperons is under way in the East Hall of the 28 GeV proton synchrotron. This is another example of an experiment which was impossible prior to the recent setting up of hyperon beams at Brookhaven and at CERN.

The experiment is being carried out by a collaboration of scientists from CERN, Ecole Polytechnique and Orsay.

The same team is now publishing the results of the previous experiment on the hyperon beam in which they looked at the sigma minus-proton total cross-section where the quark model predicts a relationship between this cross-section and other known cross-sections (the beam-line and the experiment were described in vol. 11, page 191). Expressing their result briefly — the quark model has stood up to the test.

The new experiment adds two streamer chambers to the collection of detectors and the sequence of equipment now reads as follows: the high energy slow ejected beam from the PS hits a target to produce the hyperons (higher energy increasing their life-time) which are filtered out through a focusing and analysing system crowded together in only 3.7 m of beam-line to preserve as many of the short-lived hyperons as possible. The beam-line consists of two bending magnets and two short superconducting quadrupoles. A DISC (differential Cherenkov counter) at the output of the beam-line selects between the different particles. A useful flux of about 100 negative sigma hyperons is obtained from a beam of 2×10^{11} protons on the target. Multiwire proportional chambers on either side of the DISC give the direction of an incoming hyperon to a precision of ± 0.5 mrad.

A small sweeping magnet gets rid of low energy electrons just before the particles enter the first streamer chamber. This chamber is 3 m long, built by Orsay and Ecole Polytechnique, and is performing well. The leptonic decays of interest (such as negative sigma hyperon decaying into neutron, electron and antineutrino or into lambda, electron and antineutrino) take place in the streamer chamber and the charged particle tracks can be photographed. A threshold Cherenkov counter follows to identify the electrons (pions, which occur much more