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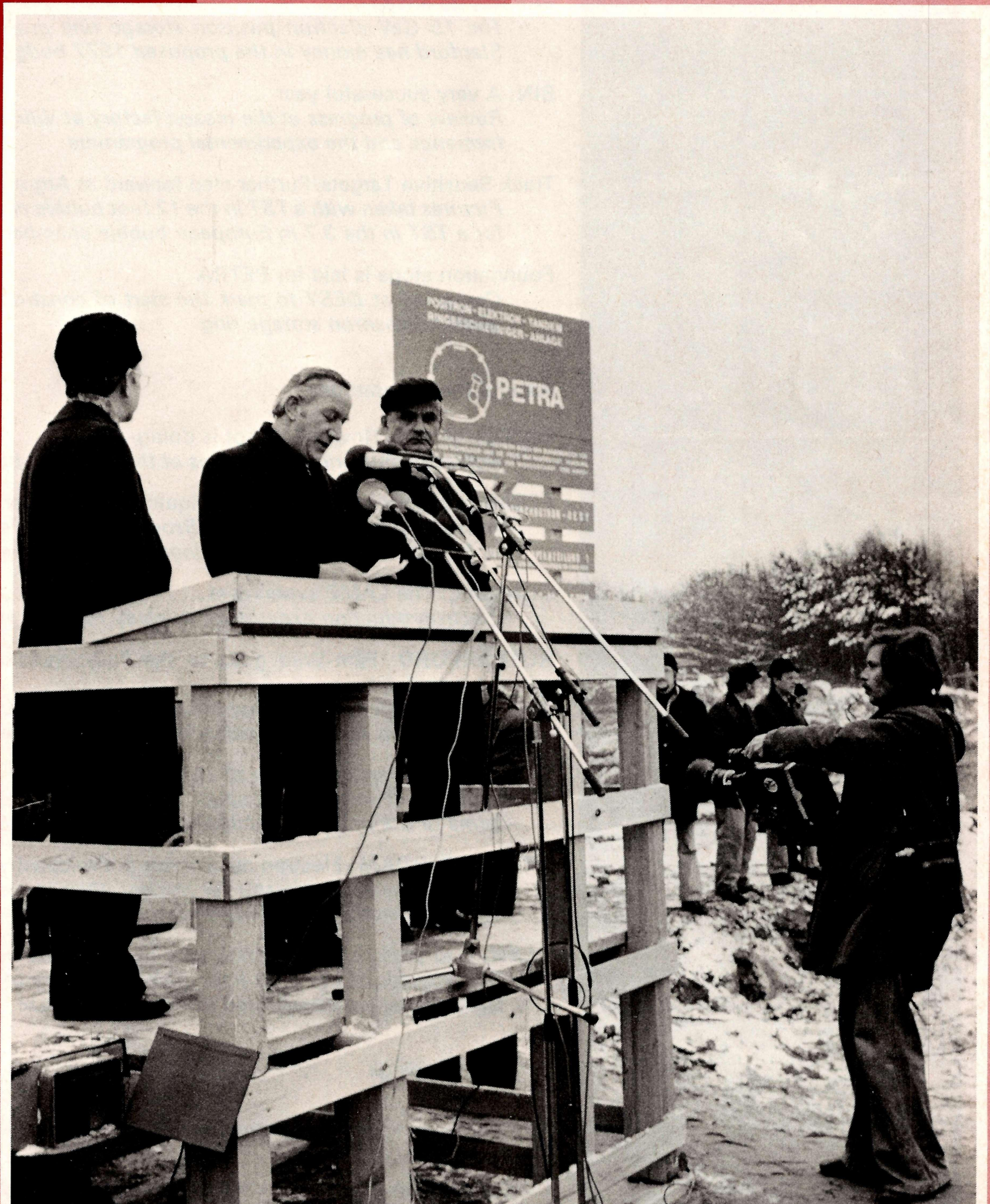

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Contents

Cover photograph: A ceremony was held at the DESY Laboratory on 27 January to lay the foundation stone of the electron-positron storage ring, PETRA. On the platform (right to left) are the Bundesminister für Forschung und Technologie, Hans Matthöfer, the Hamburg Senator für Finanzen, Hans-Joachim Seeler, and the Chairman of the DESY Directorate, Helwig Schopper. The high energy physics community can now rejoice that both PETRA in Europe and PEP in the USA are under way. (Photo DESY)

PEP has go ahead

PEP location sketched in on an aerial view of the Stanford Linear Accelerator Center. The electron linac is on the left (crossed by a Highway). It can feed electrons and positrons into the storage ring to travel in opposite directions. Note the six long straight sections in the ring configuration, five of which will be used for colliding beam experiments.

(Photo SLAC)

On 21 January President Ford delivered his proposed budget for Fiscal Year 1977 to the USA Congress. A cause for pleasure in the high energy physics world is that it contains $25 million for the construction of PEP.

PEP is the joint project of the Lawrence Berkeley Laboratory (LBL) and the Stanford Linear Accelerator Center (SLAC). The initials stand for Positron Electron Project and the aim is to build a 15 GeV storage ring to extend the studies of electron-positron collisions to higher energies. The information emerging from electron-positron interactions at collision energies of a few GeV on the SPEAR storage ring at SLAC and the DORIS storage ring at DESY has opened a new era in physics and PEP is designed to contribute to this new era.

We announced in the January issue that the Senate Appropriations Committee, following an initiative of Congress, had assigned $2.9 million to PEP for the present fiscal year (through to end of September). This passed through all the necessary authorizations in January and, now that money is listed in the President budget for next year, it means that both Legislative and Executive branches of the US government are behind PEP. Though the actual appropriations needed to cover the full construction cost (estimated at $78 million) remain to be made in the coming years, we can consider that the project is under way.

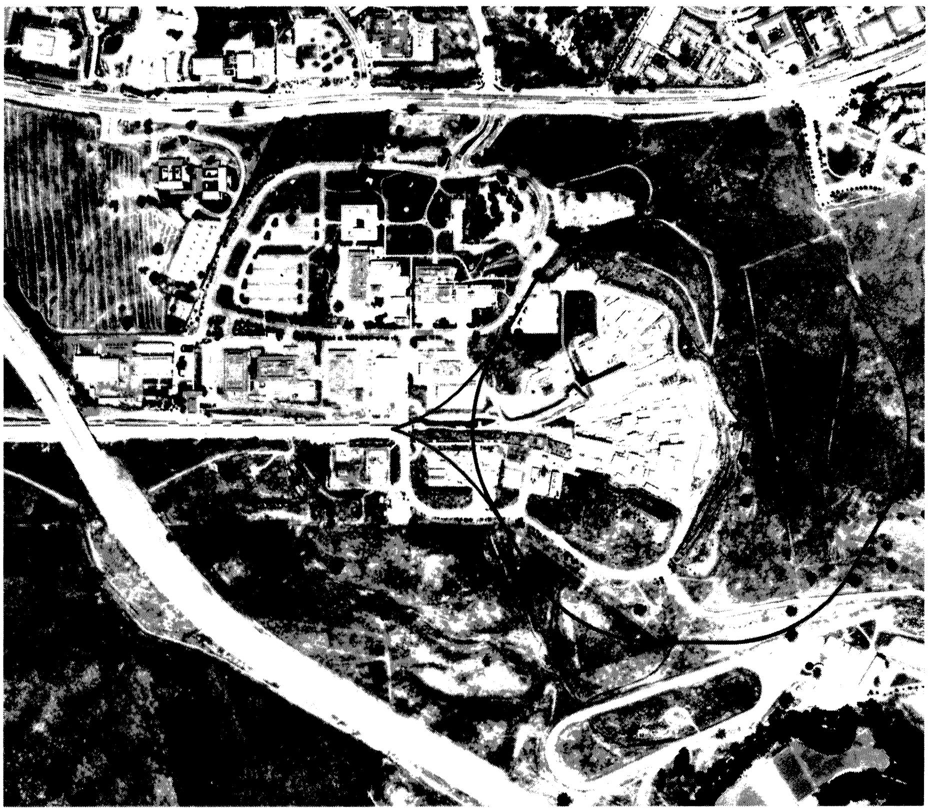
Berkeley and SLAC are therefore hot on the heels of the construction team for PETRA, the 19 GeV electron-positron project at the DESY Laboratory in the Federal Republic of Germany (see page 49). PEP is to be built at Stanford and the completion date with the present construction schedule is 1980.

The proposal for the construction of PEP was published in 1974 (LBL Report No. 2688, SLAC Report No. 171). It is a single ring of diameter about 700 m in which electrons and positrons will circulate in opposite directions. There are six long straight sections at the centre of which the particles can be brought into head-on collision. Five of these interaction regions will be allocated to high energy physics experiments and the other will be reserved for accelerator physics measurements and experiments.

The SLAC linac will be the source of both types of particle and a filling time of about 10 to 15 minutes is possible making the linac available to feed the rest of the experimental programme for most of the time. This filling time is needed for 100 mA per beam. The particles will be concentrated in three bunches, each a few centimetres long, in each ring and the three bunch configuration gives collisions in all six long straight sections with a design luminosity of 10^{32} per cm^2 per s at 15 GeV.

The beams lose energy due to synchrotron radiation at the rate of 26 MeV per turn. This has to be pumped back into the beams to keep them stored in the magnet ring. An r.f. system operating at 358 MHz will be installed capable of an r.f. power of 7.2 MW. The radiation hits the outer wall of the ring vacuum chamber which will be water cooled. The outgassing produced at the chamber walls will be coped with by long sputter ion pumps in the bending magnets so as to sustain a pressure of about 10^{-8} torr. The possibility of using synchrotron radiation for research, as is becoming standard practice at electron storage rings, is being kept in mind in the design.

Possible future developments at PEP include an increase of the beam energies to about 20 GeV. This depends particularly on an increase in installed r.f. power. Longer term, the addition of a high energy proton ring



has always been part of the PEP thinking. With superconducting magnets providing fields of 4.4 T a PEP size ring would give protons of 200 GeV. Colliding these protons with 15 GeV electrons, would take the study of nucleon-electron interactions into a completely new region. The investigation of nucleon structure could be done in a more refined way and the weak interaction will (probably) have grown in strength to be comparable with the electromagnetic interaction. The Berkeley work on superconducting magnets (building a small accelerator known as ESCAR) has this long-term possibility in mind.

The building of PEP will involve many of the human and technical resources at both Laboratories. The 'PEP group' itself is likely to be kept rather small (around 40 people) and will have as its nucleus the group who have been working on design aspects for several years. This group is headed by John Rees from Stanford with Tom Elioff from Berkeley as Deputy.

Division of effort between the two Laboratories is likely to be very flexible as the project progresses with contributions from both to the design of almost all the systems involved. For the moment, effort at Berkeley is taking up most of the running on beam transport, injection, magnet power supplies, alignment and high quality interaction region quadrupoles while SLAC is looking after main ring magnets, r.f. and vacuum system. Other aspects, such as the instrumentation and control and the planning of the experimental facilities, are under attack at both Laboratories.

SIN: A very successful year

The 6th Newsletter of the Schweizerisches Institut für Nuklearforschung (Swiss Institute for Nuclear Research) at Villigen reports a 'very successful year' in 1975. Both accelerator performance and the progress of the experimental programme give cause for such satisfaction.

SIN operates a two cyclotron system to accelerate intense proton beams to 590 MeV. These protons are used primarily to generate high fluxes of mesons and SIN is thus one of the new 'meson factories'. Average and peak proton beam intensities climbed considerably during the year culminating in the acceleration of 62 μA delivered to the external targets on 16 December. Design current is 100 μA. During this peak intensity run the injector cyclotron, which takes the protons to 72 MeV, had an internal current of 95 μA and it was beam losses on its extraction septum (71 % extraction efficiency) that curbed the push to still higher intensity. The ring cyclotron showed no sign of strain with the intense beams and protons were extracted from it with 94 % efficiency. It is the activation produced on the septum in the injector cyclotron which is likely to dictate the limit on the normal operating intensity available in the future.

From the beginning to the end of the year the number of protons extracted from the machine in two month periods increased by a factor of seven (1000 μAh in January-February, 7000 μAh in November-mid-December). The machine reliability was in the meantime moving from around 60 % to around 90 %.

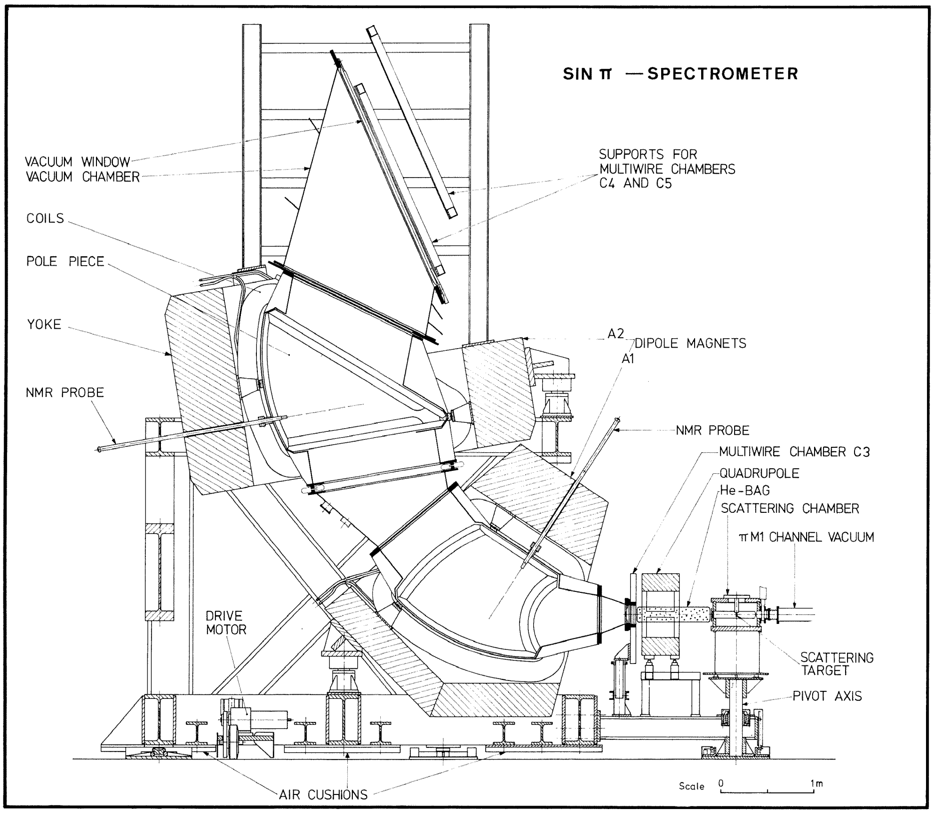
The experimental programme is thriving in these circumstances. There were 1000 hours of beams for low energy experiments at the injector cyclotron and 1750 hours of beam for pion production. Thirty-two experiments have been receiving particles and many results are already being published.

One of the special facilities is a superconducting muon channel (see February issue 1975). This has been providing very pure muon fluxes, such as $3\times10^7\,\mu^-$ at 125 MeV/c, which are close to the expected figures (except at low momenta). They are the highest muon fluxes available at any Laboratory in the world and the superconducting solenoid has resulted in muon densities over a factor of ten higher than with classical magnet systems. The solenoid has been operating with high reliability.

The muon channel has supplied eleven experiments, four with positive muons and seven with negative muons. A muon beam splitter (septum magnet dividing the beam vertically) is being built to provide simultaneous muon beams to areas μE1 and μE2. It is hoped to have the new facility in action about the middle of the year. A short (5 m) superconducting channel is being commissioned to supply muons in the πE2 area.

Among the many muon experiments has been the use of a bent crystal spectrometer for some very precise work on muonic X-rays. Muons falling through energy levels around silicon, magnesium and phosphorous atoms have been investigated. The silicon, data available so far should provide energy level determinations to an accuracy of 20 parts per million providing a refined test of quantum electrodynamics. Other muonic X-ray measurements have looked at metals and alloys measuring a wealth of spectral lines for the first time.

Another experiment aims to improve the measurement of the ratio of the proton and muon magnetic moments (with an accuracy better than 2.6 ppm). This ratio is important for extracting the muon anomalous magnetic moment from the data of the CERN g-2 experiment and for such fundamental



A drawing of the pion spectrometer at the SIN cyclotron in Villigen. It will be used for high precision nuclear physics with pion beams.

figures as the hyperfine structure constant. The technique is to observe the Larmor frequency of stopped muons in a known magnetic field while monitoring the proton-NMR signal at the same time in the same field using a stroboscopic method. The experiment is now confronting the 1 ppm level of accuracy.

Muonic helium and hydrogen at low pressure are being studied as well as the chemical effects of muon capture in solids. Muon spin rotation has been used to look at ferromagnetic materials and interesting effects concerning the local fields seen by the muon in the material have been detected. The same technique has been applied in liquids and signals from muon precession in liquid (water) have been detected for the first time. They have been identified as coming from the muonium atom (electron in orbit around a positive muon) and it is hoped to study muonium in detail.

Pion beams are drawn from two target stations in series (thin target followed by a thick target). The first gives beam into two pion areas, πM1 and πM3, and a polarized proton area, pM1. The second feeds three pion areas, πE1, πE2, and πE3 and a neutron area, nE1, plus the muon channel. Polarized protons were taken to the experimental area in December. The polarized proton source has so far provided a beam of 4 nA at 590 MeV with about 50 % polarization. It is hoped to achieve 100 nA and 80 % polarization.

The polarized protons are being used in a nucleon-nucleon scattering experiment covering the energy range between 200 and 600 MeV. The detection system includes two telescopes of multiwire proportional chambers (total of 7000 wires) and an intricate data collection system. Some tests of the system were made at the CERN synchro-cyclotron and it is now ready to take data at SIN.

The pion beams are used for many nuclear physics experiments and for medical applications. Radiative pion capture, as a way of looking at nuclear structure especially in lighter nuclei, is being measured using a pair spectrometer to look at the emerging high energy photons. Data on oxygen, silicon, sulphur, lithium, carbon, holmium, tantalum and beryllium is collected. A complimentary experiment looks at pion absorption with the emission of neutrons or charged particles and has data on carbon, tantalum and gold.

Two experiments set out to improve the upper limit for the muon-type neutrino mass. One of them looks at the pion decay at rest and measures the muon momentum (which relates the pion, muon and neutrino masses). The team at SIN hope to improve this momentum measurement by a factor of ten. They observe the muon in a 180° single focusing magnetic spectrometer and have already a better value of the momentum (29.787 ± 0.005 MeV/c) than obtained in previous experiments. This yields a value of the squared neutrino mass of (0.23 ± 0.54 MeV^2/c^4).

The second muon-type neutrino mass experiment is tackling the pion mass measurement at the same time since it is largely the uncertainty in the pion mass which sets the upper limit of the neutrino mass. The pion (positive and negative) decay in flight will be studied. The detection system has been installed and tested.

Results have been obtained concerning pion scattering on a polarized proton target and other pion experiments include observation of nuclear rotational spectra in holmium, nuclear fission induced by pions, and total cross-section measurements on hydrogen and deuterium.

Some of the future work in nuclear physics with pions will concentrate on

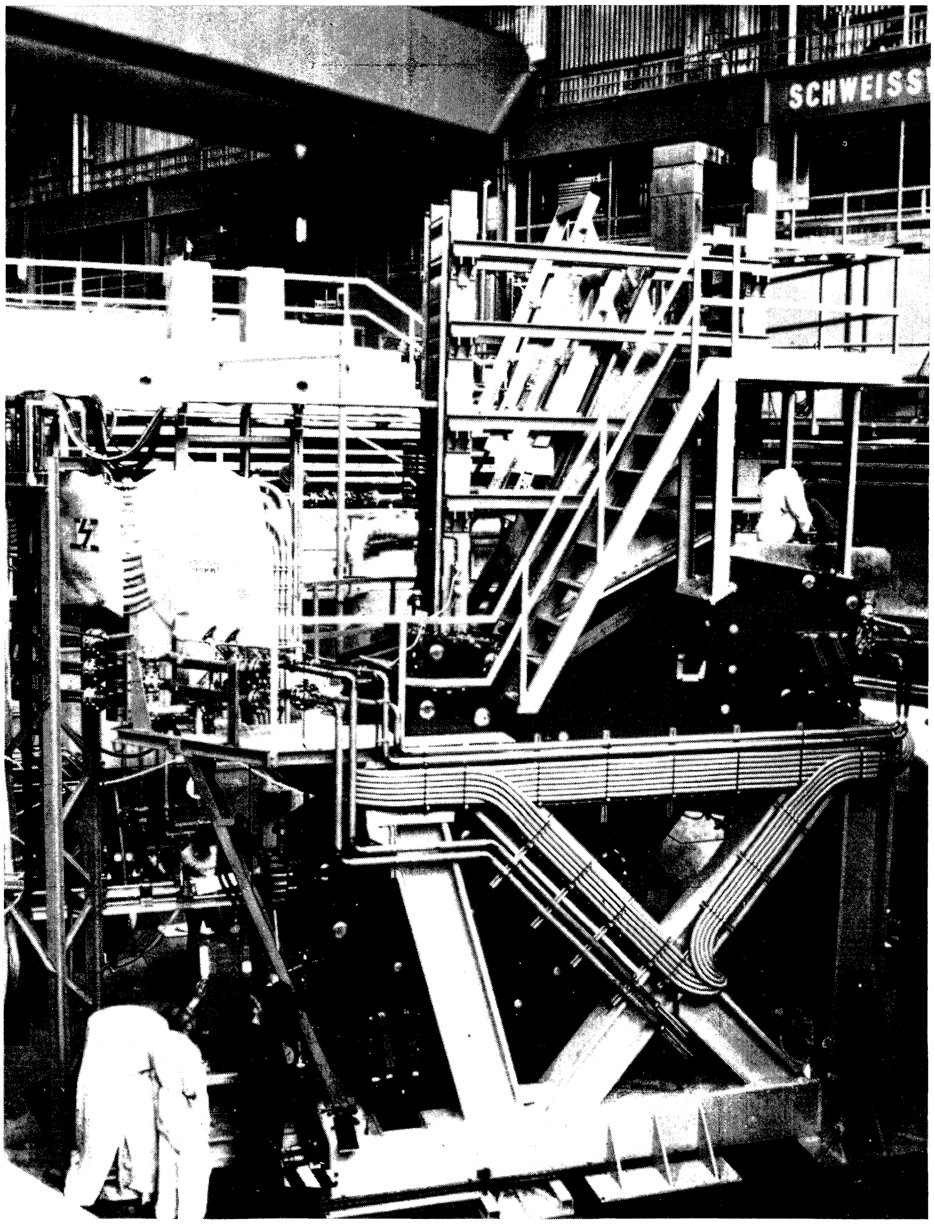
The SIN pion spectrometer shown installed in the experimental area. The spectrometer and its beam line are now being tuned to achieve the desired precision.

(Photos SIN)

the use of a large high precision pion spectrometer. The spectrometer has now been assembled and carefully mapped — all the required tolerances are met. The pion beam line also needs to be of high precision and this was achieved in October after some alignment difficulties were cleared. Tune up of the system is under way and preliminary spectra have been obtained with the resolution getting close to the 10^{-3} level.

Medical investigations with pion beams have included inactivation of cultured mammalian cells, dosimetry measurements using thermoluminescence and conventional techniques and work on the external visualization of the pion stopping region by looking at the emerging gamma rays.

The two target stations where beams are generated have identical plug in units (weighing a ton each including their shielding) at each station, varying only in target thickness. Each carries four targets in the shape of conical wheels rotating at 30 rpm so that the heat generated by the beam is spread over the rim and can be dissipated by thermal radiation. Target materials are beryllium, carbon and molybdenum and, when 100 μA is achieved, the molybdenum target is expected to be heated to a temperature of 1000° C. The two units used throughout 1975 performed without fault.



The SIN machine has been shut down since December while modifications are carried out particularly on the injector cyclotron. The new muon beam line is being completed and the medical pion beam is being improved. It is expected that the experimental programme will be in full swing again in March. We will be able to come back in more detail on some of the topics which have had only brief mention in this short review of last year's work.

Track Sensitive Targets Further step forward at Argonne

The first period of physics operation of a track sensitive target (TST) in the Argonne 12 foot bubble chamber was successfully completed during December 1975. For this run the chamber was filled with a 38 mole percent neon-hydrogen mixture, while the TST contained liquid hydrogen. Cooldown and filling of the chamber and the target were completed on 11 December. Track sensitivity inside as well as outside the target was achieved the same evening and on 13 December physics experiments began.

In total, 63 000 pictures were taken with visible tracks inside the target and the target and chamber were subjected to nearly 200 000 expansions without any mechanical trouble with the TST or its support systems. The installation in the 12 foot chamber is the biggest yet built. This important technique, which extends the potential of research with bubble chambers, thus moves another step forward.

The TST idea originated with Heinrich Leutz at CERN and most of the early work was done at DESY and at the Rutherford Laboratory. The aim is to combine the virtues of hydrogen and of heavy liquid bubble chambers. This means to retain the simplicity of hydrogen (with a single proton at its nucleus) as the target in the bubble chamber while gaining the advantage of a heavy liquid (particularly the ability to 'see' gammas as they materialize into electron-positron pairs).

Chambers filled with hydrogen provide simple target nuclei but lose information since neutral particles easily pass out of the liquid volume before materializing; chambers filled with heavy liquid often materialize neutrals but have complex target nuclei. The TST idea is to introduce a volume of hydrogen as the target in a transparent box within a chamber filled with a hydrogen-neon mixture. By selecting operating conditions appropriately, it is possible to make both volumes sensitive to track formation at the same time and thus to photograph tracks inside and outside the target.

During the December run at Argonne, the programme was arranged to provide a relatively small number of pictures to each of the initially approved experiments for the TST. This gives each of the collaborations some pictures to measure and analyse so as to be able to tackle now any problems which might arise. The exposures included 4 GeV/c antiprotons for a Rutherford/Argonne/Carnegie-Mellon/Melbourne collaboration, 7 GeV/c negative pions for a Notre Dame group, 11 GeV/c protons for an Illinois Institute of Technology/Argonne group and stopping antiprotons for a Tohoku University/Tohoku Gakuin University/Nara Women's University group. Some 1 200 pictures of 900 MeV/c antiprotons had been taken for a Rome/Naples/Padova/Trieste/CERN experiment when an accumulation of dirt and water ice in the TST restricted visibility and the run was stopped.

The successful physics run was the latest step in a collaborative development programme between Argonne, CERN and the Rutherford Laboratory. The first test involved operation of the TST in October 1973 with hydrogen both inside and outside the target (see December issue 1973). A second step was operation with a neon-hydrogen mixture without the TST in June 1974.

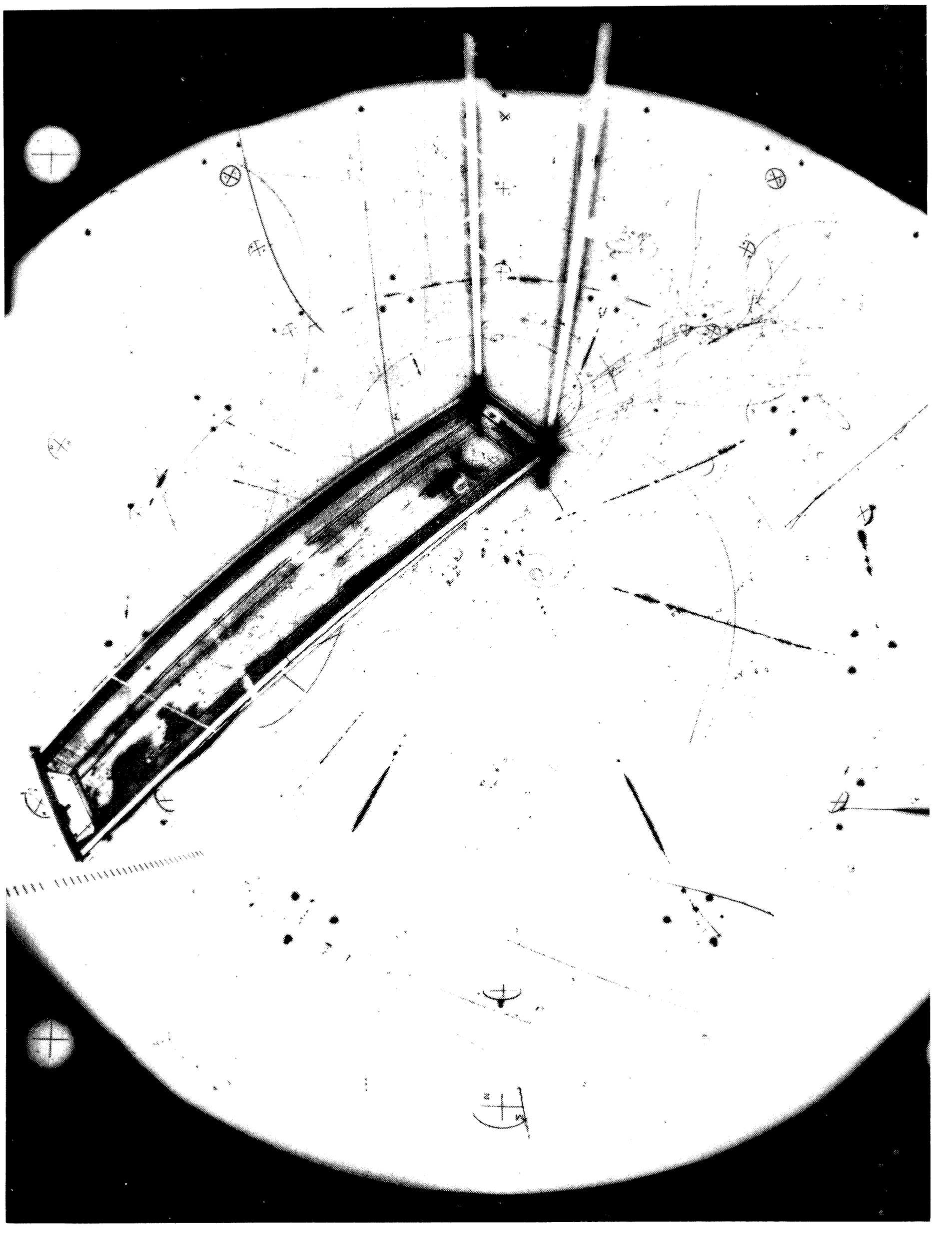
As can be seen in the photograph, the optical properties of the TST used in the December run left something to be desired. The run had originally been scheduled for September 1975 with a plexiglass target box from the earlier tests which had very good optical properties. However, during preparations the TST was ruptured as the result of operator error and the run had to be aborted. A second TST, built at CERN by Leutz, Jean Tischhauser and colleagues, was rushed to Argonne, arriving during November, and was immediately installed in the chamber. This was a box of dimensions 200 cm × 36 cm × 8 cm manufactured out of Lexan, which is a polycarbonate material much stronger than plexiglass though with optical qualities that are not as ideal. This difficulty will be remedied in a third TST (now under preparation) using a new Lexan material known as SL 3000 which has recently been extruded by General Electric. The light transmission through SL 3000 is close to that of plexiglass and should be fully satisfactory.

An interesting aspect of the TST programme at Argonne has been the high degree of international collaboration. In addition to user groups from Japan, Australia, and various European institutions, and the contributions of the CERN TST builders mentioned earlier, valuable consultations and guidance during cooldown were provided by Eddie Fitzharris of the Rutherford Laboratory. His expertise, gained from operating TST's in the 1.5 m British bubble chamber, proved very valuable to the new 12 foot programme at Argonne. Finally, it should be mentioned that a portion of the neon was borrowed from Fermilab under a gas-sharing agreement. Under this same agreement, all of the heavy phase neon used in the Argonne run has now been shipped to Fermilab for use in a heavy-mixture run in their 15 foot bubble chamber (see also page 51).

The Argonne TST and 12 foot bubble chamber now seems to be an operational system. A total of 520 000 further pictures will be required for the presently approved TST experiments and the next physics running period is expected in early fall of 1976, when the new TST will be ready. Also, operation with 70 mole percent neon-hydrogen mixtures will be plan-

Picture taken in the Argonne 12 foot bubble chamber with an 11 GeV/c proton interaction inside a hydrogen filled track sensitive target (TST). Four gamma rays from the event have been converted to visible electron-positron pairs in the 38 mole percent neon-hydrogen mixture outside the target. Because of reduced light transmission through the particular Lexan material of the target, the area of the target was exposed longer than the remainder of the picture in making this photographic print.

Below is a closer view of the target region where three of the electron-positron pairs can be seen. This is the largest TST to have been operated for physics so far. Later this year a better material for the target box will be used and large scale picture taking for several experiments is planned.



ned for several of the experiments that received test pictures with the 38 percent mixture in the December run.

TSTs are also in the limelight elsewhere, particularly at CERN where a very large one is being built for installation in the 3.7 m European bubble chamber BEBC. This will improve the abilities of BEBC for high energy neutrino physics and there is great eagerness to have it in place ready for the first neutrino beams from the 400 GeV synchrotron, the SPS, before the end of this year.

The TST box for BEBC measures 2.4 m × 1.4 m × 0.9 m (to enclose 3 m^3 of hydrogen). It is being built of Lexan SL 3000 and is requiring a number of technical tricks. The material is produced in the USA only in sheets 1/4 inch thick. The main walls of the TST are four times this thickness and the original sheets have to be stuck together by a 'press-polish' technique between chromium plates. Plates of appropriate size have been sent from the Federal Republic of Germany to the USA where the 'press polish' is being supervised by Klaus Jaeger of Argonne who is also looking after the dispatch of the finished Lexan sheets to CERN.

Gluing the Lexan together requires a roughening of the relevant surfaces (using dimethylchloride at —20° C since it has already a fairly high vapour pressure at room temperature), introducing a thin Lexan film between the surfaces and then gluing under a pressure of 30 atmospheres. The BEBC TST box involves 28 such gluings (including those of the specially designed support bars along the edges) and it will require a cool nerve to tackle the last of them because if it goes wrong the box is useless.

All the sheets should be at CERN by the end of February and the aim is to have the TST installed in the chamber ready for a 'technical run' in April. The TST builders are not spending much time asleep. Authorization for the BEBC exercise only came through in October of last year and they were busy through to November building the box for Argonne. As soon as they have finished the one for BEBC they will switch back to the new one for Argonne using SL 3000.

There have been discussions also concerning a TST for the Fermilab 15 foot chamber, pushed particularly by the Brookhaven team who worked on a TST for the Brookhaven 80 inch chamber. Another candidate is the French-built Mirabelle bubble chamber which is in operation at Serpukhov. The Saclay physicists are in contact with the CERN TST builders and Jean Tischhauser has visited Serpukhov.

It is obvious that the track sensitive target technique is firmly embedded in the future of bubble chambers. The construction and installation problems seem to be under control and the measuring and analysis of the bubble chamber photographs have not introduced serious difficulties. We may be at the last generation of big bubble chambers but the generation is proving capable of some useful mutations.

Foundation stone is laid for PETRA

On 27 January, an eminent gathering of politicians and scientists joined the staff of the DESY Laboratory braving the cold of a Hamburg morning to lay the foundation stone for the 19 GeV electron-positron storage ring, PETRA. The 'stone', which is actually a piece of the aluminium vacuum chamber such as will be used in the ring, was laid in the floor of one of the experimental halls where colliding beam physics will be under way by 1980.

Among the speakers at the ceremony were the Bundesminister für Forschung und Technologie, Hans Matthöfer, and the Hamburg Senator für Finanzen, Hans-Joachim Seeler. They both underlined the importance of basic research for the future development of science and technology. The many guests, including the Chairman of the European Committee for Future Accelerators (ECFA), Guy von Dardel, and a Director General of CERN, Leon Van Hove, were welcomed by Herwig Schopper on behalf of the DESY Directorate. He stressed that PETRA will be available to the international community of high energy physicists.

H. Matthöfer, H.J. Seeler and Dieter Biallas, Zweiter Bürgermeister of Hamburg, signed a document which was buried in the foundation stone together with a copy of the PETRA project proposal and other '1976' items. When the ceremony was complete, the bulldozers continued breaking the ground for PETRA.

Two weeks earlier, accelerator experts from CERN, Frascati, Orsay, Rutherford and SLAC went to Hamburg. From 12 to 16 January they participated in a design review meeting on PETRA. The purpose of the meeting was twofold. The PETRA team wanted to present the project at its present stage and to have constructive criticism on the design from

Helwig Schopper, left, Chairman of the DESY Directorate, raises his glass together with Hans Matthöfer, the Bundesminister für Forschung und Technologie, at the ceremony of the laying of the foundation stone for the PETRA 19 GeV electron-positron storage ring at the DESY Laboratory.

1. The 'foundation stone' — a piece of aluminium vacuum vessel such as will be used in PETRA — is positioned in the floor of one of the experimental halls. It contained a signed document by guest celebrities at the ceremony and a copy of the proposal for construction of the storage ring.

2. Many renowned accelerator faces gathered at DESY in January to discuss the PETRA project and to contribute to the detailed design of the storage ring. They were photographed at the DESY Laboratory during the course of the meeting.

(Photos DESY)

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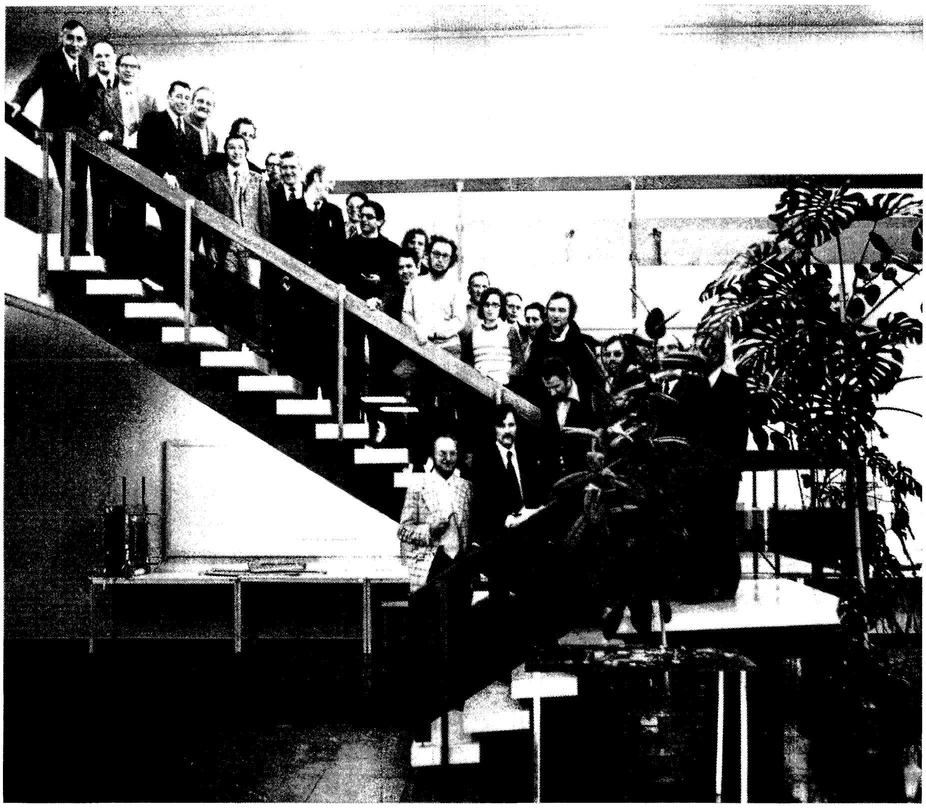


2.

other machine specialists. They also wanted to have experts from other Laboratories interested in the project and to intensify future cooperation on PETRA.

During the first two days, the PETRA team, headed by Gus Voss, gave detailed reports on the present status of the project and their problems. It was obvious that a lot of progress has been made since the time that the proposal was put forward. Ewan Paterson from SLAC gave a short review on the status of the USA equivalent — the PEP storage ring. Most of the problems and many of the proposed technical solutions are similar for the two machines.

During the following days there were discussions on those subjects which were felt to be most critical for successful operation. The r.f. system, instabilities and higher order mode losses, r.f., design of the vacuum chamber, satellite resonances, mechanical design of the magnets, sextupole corrections, magnet tolerances, orbit control and beam polarization were some of the topics.

The PETRA team benefited from the thorough discussion on many of these topics. H. Schopper and G.A. Voss expressed their gratitude for the contribution the guests had made to the thinking on PETRA and promised to take into account the suggestions on specific points which had been summarized by Graham Rees from Rutherford. It was generally felt that a continuous collaboration on the project would be very valuable.

Around the Laboratories

BROOKHAVEN
How the 7 foot is doing

Since the 7 foot bubble chamber began running for experiments in November 1973 at the 33 GeV Alternating Gradient Synchrotron, it has taken a total of 750 000 pictures and made about 1.5 million expansions to get them. About 45 % have been taken with the chamber filled with deuterium and the rest with hydrogen. A small number have been test pictures of various kinds but all regular running has been in the wide band neutrino beam, whose energy distribution peaks at about 1.5 GeV. Roughly 20 % of these pictures were taken with the focusing horn polarity reversed so as to produce a beam of antineutrinos.

Analysis of the pictures already taken is under way and they promise to be the source of a good deal of interesting physics. One particular picture which may be a first example of revealed 'charm' has already provided a lot of fun (see April issue 1975, page 108).

The chamber is scheduled to run in late spring or summer in a narrow band neutrino beam peaked at about 8 GeV. The flux in this beam will be down by about two orders of magnitude from the wide band beam and the chamber will therefore be filled with the heaviest possible neon-hydrogen mixture to increase the event rate. In preparation for this run, the chamber was run with about 90 mole % of neon in a test in December. It proved possible to get satisfactory tracks in this mixture and the biggest difficulty seems to be to get the helium contamination down to very low levels so as to avoid collecting a helium bubble in the top of the chamber.

The new narrow band focusing horn together with its special collimators was tested a few months ago with beam on the target and the resulting neutrino flux seems to have the calculated properties. The horn itself has withstood half a million current pulses without failure.

Many of the operating problems with the chamber have been caused by hydrogen leaks from the gas-cooled portion of the magnet leads into the main vacuum. The whole lead system has been completely redesigned to eliminate redundant support paths and a BEBC-type design has been adopted for the gas cooled portion. Fabrication of all the parts is complete and assembly and installation are on schedule for a deuterium run this month.

FERMILAB
First inter-Laboratory liquid neon transfer

On 21 January, the first transfer of liquid neon from Brookhaven to be used in the Fermilab 15 foot bubble chamber was completed. Over the preceding two weeks, two truck loads of liquid neon (11 000 litres in total) had been brought from Long Island New York to Batavia Illinois. The transfer required a heroic effort on the part of Fermilab drivers when they confronted some of the worst winter storms that the Eastern United States has seen this year.

The truck was manned by a team of two drivers followed by an escort car driven by George Mulholland (head of the Fermilab Bubble Chamber Group) and the relief driver. The trips were made at an average speed of 45 mph taking about 26 hours. On the second trip, Jack Riffell, the driver of the truck, lost his escort car in Ohio due to icy road conditions and elected to drive steadily through the remaining several hundred miles. In addition to these monumental efforts, transfer has been helped along by the administrations of the Laboratories involved and the thorough work of Don Bray in the Batavia Area Office of the Energy Research and Development Administration.

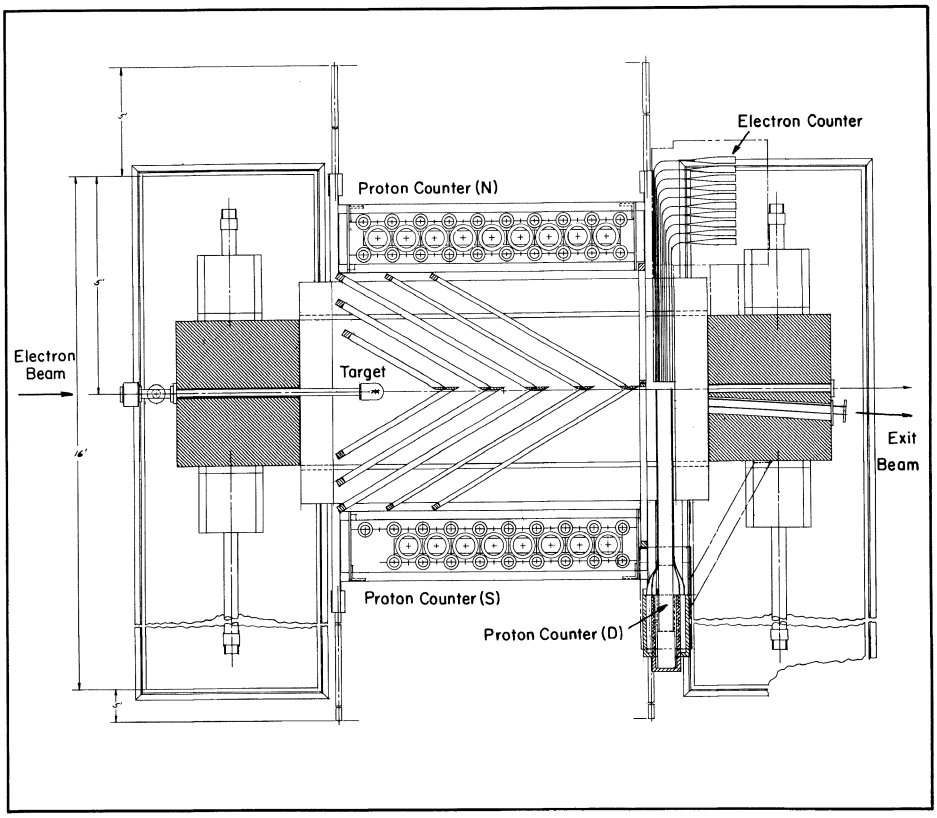
The transfers crown years of discussions between Fermilab, Brookhaven and Argonne. Planning began several years ago when a bubble chamber working group was established by the U.S. Atomic Energy Commission (now ERDA); it included Bob Watt of SLAC, Gale Pewitt of Argonne, Al Prodell of Brookhaven, and Russ Huson of Fermilab. The group worked more than a year and a half mainly on safety matters. One of its important recommendations was that the Laboratories should make arrangements to share their valuable and sparse liquid resources worth several million dollars. Since this 'pool' of liquid constitutes an appreciable fraction of the world's resources, only arrangements of this sort permit the flexible operation of the very large bubble chambers now in existence so that they can change their liquid filling according to the needs of the research programme.

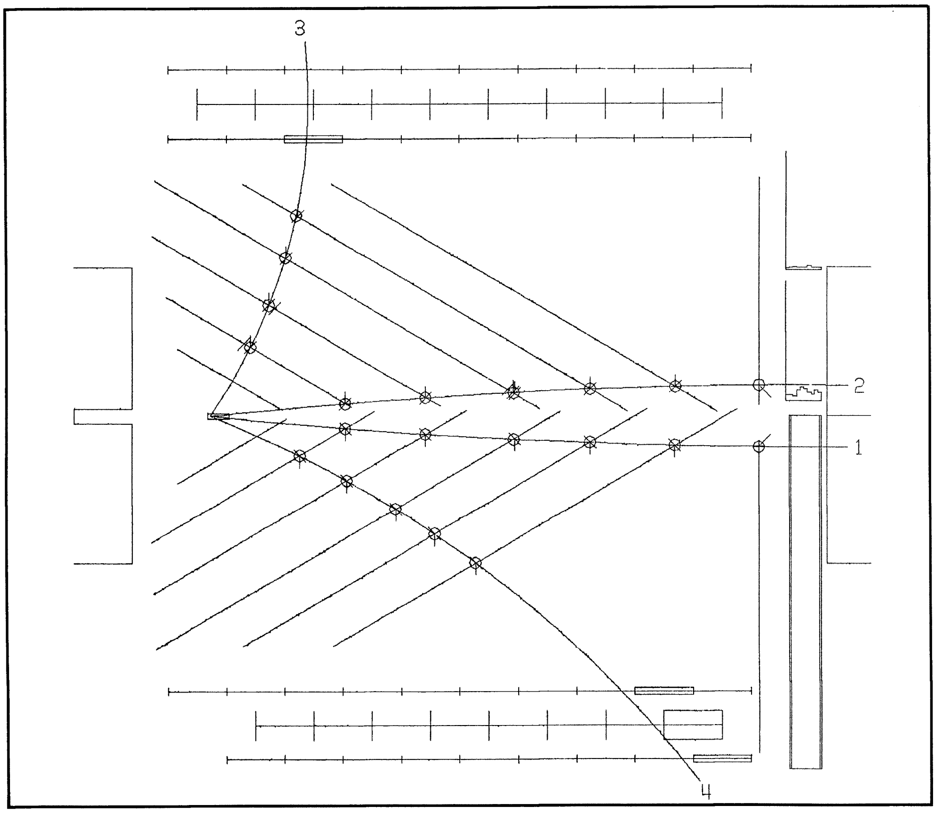
Russ Huson points out that Fermilab does not need to buy any deuterium under the new arrangement. It has, however, developed a neon separator which will not be needed elsewhere — the Laboratories can thus have unique facilities for processing specialized gases. Both neon and deuterium are shared. The new arrangements will require tighter scheduling of the bubble chamber facilities, but the results should be worthwhile.

A special Dewar trailer, modified by the Fermilab Bubble Chamber Group to provide hydrogen cooling, is used to transport the liquid. The neon and deuterium are transported as liquids since a chamber fill can be held in a few truck loads as contrasted to twenty or more as a gas in standard trailers. At the same time, a shipment

The LAME detection system at the Cornell electron synchrotron. A large aperture magnet encloses multiwire proportional chambers to study particles emerging from leptoproduction in a thorough way. The detection system is now clocking up ten thousand events a day.

A typical rho production event as seen by the LAME system and reconstructed by a PDP10 computer. Track 2 is the scattered electron, track 3 is the recoil proton and tracks 1 and 4 are pions coming from rho decay. The effective mass of the pion pair is 750 MeV.





of liquid minimizes the loss of gas by reducing the amount of handling required. The first transfers used a combined Fermilab trailer-Argonne tractor rig and benefited greatly from the cooperation of the Brookhaven Bubble Chamber Group during the filling and road preparation.

The additional neon, plus some from nearby Argonne (see page 47), will be used in the next months for a Columbia/Brookhaven neutrino experiment and a Berkeley/Seattle anti-neutrino experiment in the 15 foot chamber. This experiment is using a richer neon mixture than that used in the recent Wisconsin/CERN/Berkeley/Hawaii run that detected the charmed particle candidates (see January issue). The denser mixture will yield a still higher interaction rate for neutrinos and antineutrinos.

CORNELL
The LAME experiment

Inelastic lepton scattering has been thought for some time to reflect the underlying structure of the nucleon. The data that lead to this belief have been derived almost exclusively from the measurements of inelastic cross sections as a function of the energy which is transferred to the hadron, the energy of the virtual photon, and the square of the momentum transfer. Attempts to learn more by studying the final states (the particles which emerge from an interaction) in leptoproduction have been disappointing. A new experiment at the Cornell electron synchrotron is another escalation in the effort to understand the final particle states in leptoproduction.

The experiment uses a magnet with a useful aperture of $2.4 \times 1.2 \times 0.6$ m^3 and a field of 0.8 T. Multiwire proportional chambers (twenty thousand wires in all) are positioned in the field for the detection of the charged particles and the measurement of their momenta. In addition, there are arrays of scintillation, Cherenkov and multilayer shower counters for particle identification. Both pulse height and time of flight data are recorded on these counters. Data are taken when a large pulse occurs in the electron counter and the events can be reconstructed using a PDP10 computer. The copious electron and photon background is largely removed by making the apparatus insensitive in the median plane.

Data are presently being taken at a rate of about ten thousand reconstructed inelastic electron events per day.

RUTHERFORD Film-Wire goes to the Fair

A new technique developed at the Rutherford Laboratory has been selected by the Department of Trade and Industry of the UK Government as one of their exhibits for the forthcoming Leipzig Spring Fair. Called 'Film-Wire', the technique produces large areas of specially designed high precision conducting material for use in spark chambers. It enables detectors to be made much smaller and lighter than most conventionally built units.

Traditional methods for constructing spark chambers usually require many individually tensioned wires to be used. Maintaining all these wires in position requires large and bulky frames. In the Film-Wire method, fine wires are bonded close together on large polyester sheets providing large areas of conducting material in which the positions of the wires are known with great precision. The material is very easy to handle, can be stored and incorporated, when required, into experimental equipment with a minimum of additional installation.

Because the wires are continuous, sheets of Film-Wire can be cut and stuck together to form a braid-like cable to connect with external electronics, so minimising the need for complex and unreliable soldering. It can be made with the top surface conducting and also with polyester insulation on both sides. In both cases the insulation is very easy to remove when required.

Spark chambers made with Film-Wire are now being used in kaon-nucleon polarisation experiments on the 7 GeV proton synchrotron Nimrod and would also be used in the project for a Rapid Cycling Vertex Detector to study hyperon resonances. In the RCVD project, four low mass cylindrical spark chambers using Film-Wire would form the main triggering components. They are made by laminating melinex, expanded polystyrene and Film-Wire into shells which are accurately spaced apart by insulated rings to form the active gas filled gap.

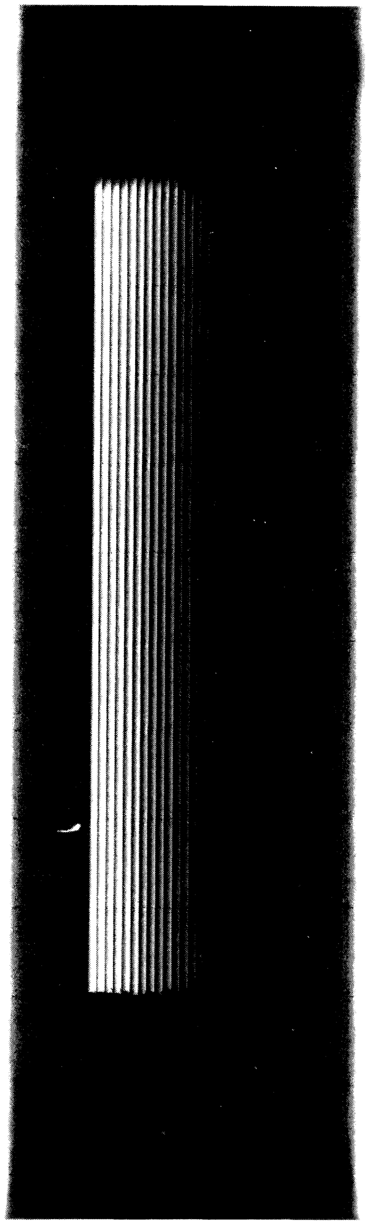
Although the use of the new technique is at present confined to the manufacture of spark chambers, important potential extensions are seen in the aerospace and communications industries.

Stretching things a bit for neutrons

Another technique first developed at Rutherford for high energy physics research is now being applied with great success by the Laboratory's Neutron Beam Research Unit. It was first used for stretching thin aluminized Melinex films to make lightweight mirrors and spark chamber electrodes and has been adapted for three different devices used in neutron scattering experiments.

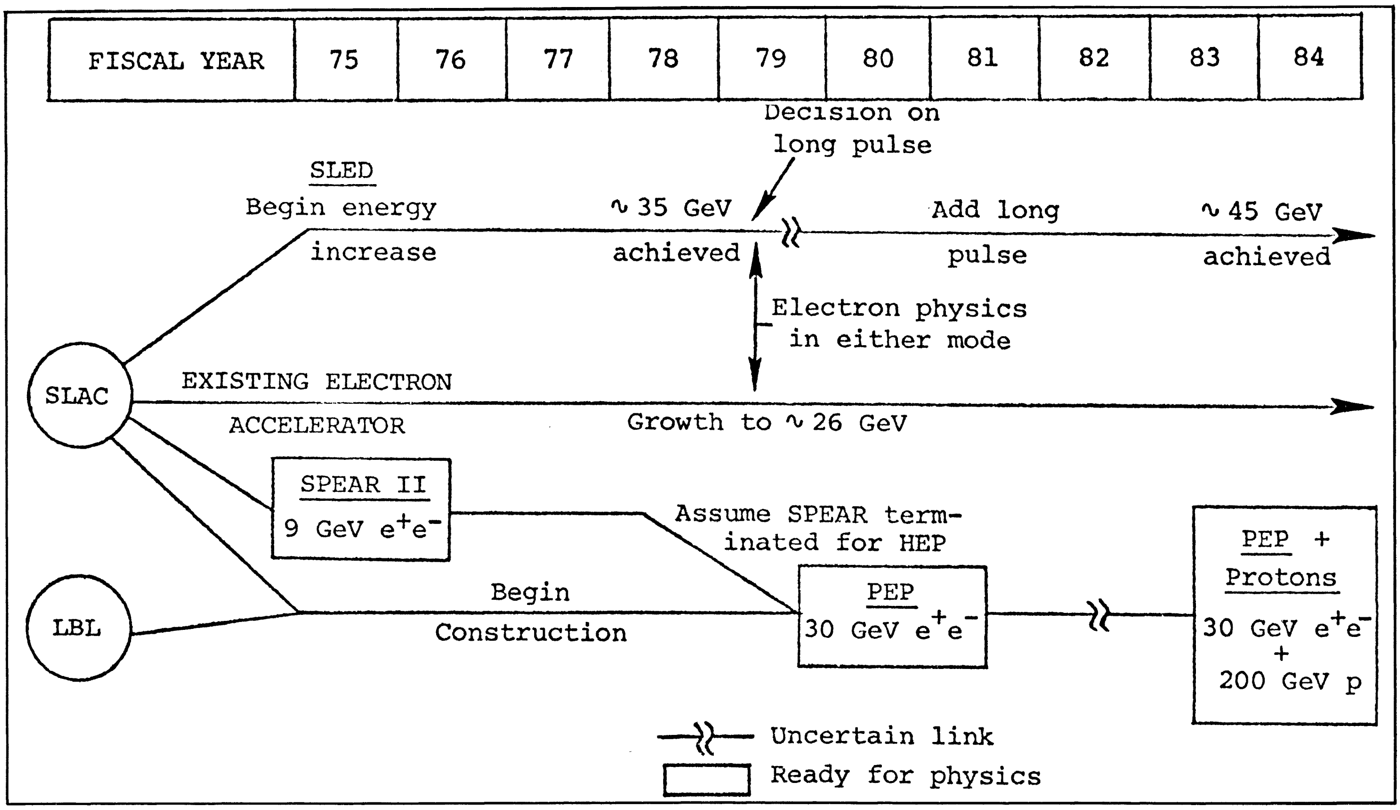
Beams of low energy neutrons

An example of the excellent collimation of thermal neutron beams which can be achieved using the stretched film technique developed initially for high energy physics purposes at the Rutherford Laboratory. The extreme left-hand slot of the collimator was lined up with the centre of a 2.5 cm diameter neutron beam at a distance of 4 m. Blades in direct line with the neutron beam on the left-hand side of the collimator are seen in sharp focus but, with the increasing angular divergence of the beam, as successive blades become further off-centre, increasing absorption is seen until no neutrons at all are transmitted through the right hand side.
(Photo Rutherford)



(energies measured in milli electron volts, meV, rather than the more familiar MeV) are widely used in the study of the structure of condensed matter, in chemistry and, increasingly, in biology. The Neutron Beam Research Unit was set up to support UK scientists using slow neutron scattering as a research tool. For the most part these neutrons are provided by the nuclear reactors at the UK Atomic Energy Research Establishment at

The immediate and longer term plans for the development of the research facilities of the Stanford Linear Accelerator Center.



Harwell, next door to the Rutherford Laboratory, at other UK research reactors and at the Institut Laue-Langevin at Grenoble, France, where there is a high flux research reactor.

In one application of HEP techniques to neutron beam apparatus, collimators have been constructed which restrict the divergence of a beam to a fraction of a degree. The idea is to construct a device containing equidistant, parallel plates to absorb neutrons which diverge from the required direction. For good collimation either very long plates must be used or the gaps between them must be made very small and for optimum performance the plates must also be thin and straight. To satisfy all these requirements is difficult using conventional methods but excellent results have been obtained using stretched film coated with neutron-absorbing material and glued to thin picture-frame metal formers.

These devices are some 10 % more efficient than the best methods reported so far and are certainly much better than most collimators presently in use. At the same time they are economical and straightforward to manufacture (when you know how). So far, eighteen such collimators have been supplied to the Institut Laue-Langevin, and more are on order for the Atomic Energy Research Establishment at Harwell. Others are being designed for use at Risö (Denmark) and Uppsala (Sweden).

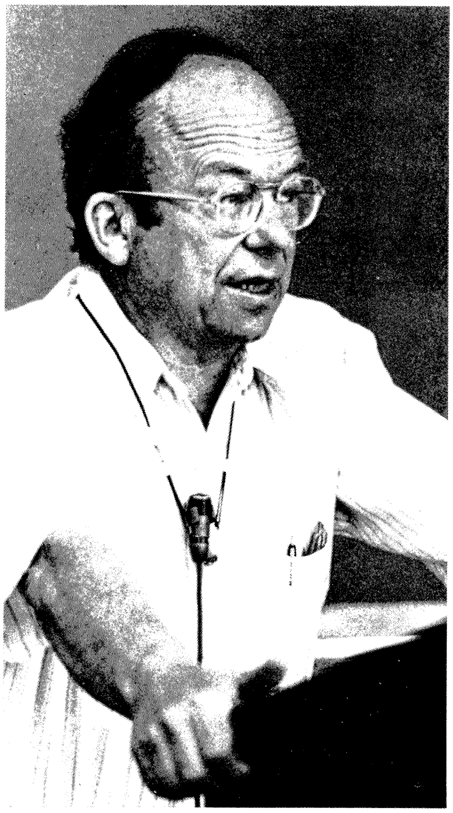
Another application is in devices for deflecting beams of long wavelength neutrons through angles of a few degrees which is useful since it results in a beam line which does not look directly at the reactor moderator and therefore transmits much lower levels of background radiation.

By a process analogous to the total internal reflection of light, neutrons hitting reflecting surfaces at low glancing angles can be totally reflected and, if two such surfaces are made to face each other, the neutrons bounce backwards and forwards between them travelling long distances. If the two surfaces lie on a curve, the neutrons can even be made to go round corners! Persuading neutral neutrons, which cannot be steered by electric or magnetic fields, to go round the bend is quite an achievement.

Because of the small glancing angles required, conventional neutron guide tubes have to be very large — to deflect a neutron through 5° can require a guide tube 26 m long, which is difficult to make. Using the thin film approach, a 5° neutron bender has been made which is only 16 cm long. As well as being much smaller and easier to manufacture, these film based benders are more efficient, since the films block off only a small amount of the incident beam.

Polarisation analysis — the inter-

Professor Panofsky delivering his 'State of SLAC' message at the end of January.



action of polarised neutron beams with magnetic moments of target atoms — has enabled new information on magnetic materials to be obtained. This work requires special equipment to handle polarised neutron beams and here too the thin film techniques initially developed for HEP applications are proving useful.

One method of polarising a neutron beam is to reflect it from a mirror coated with a film of magnetic material so that neutrons of one spin direction tend to be reflected while those of the other are transmitted. A very efficient and compact polariser can be made from a stack of thin plastic films, each coated with a thin layer of iron-cobalt alloy.

Such polarising equipment would be useful in studies of the magnetic defects of materials and could, for example, enable magnetic scattering to be separated from nuclear scattering in experiments on magnetic alloys containing dilute paramagnetic impurities.

STANFORD Director's 'State of SLAC' report

The juicy news from Professor Panofsky's report 'The State of SLAC' given to the SLAC staff at the end of January concerned the money for PEP which we covered in our opening article. This piece picks a few other items of interest taken mainly from Pief's talk.

The President's budget for Fiscal Year 1977 has increased in all categories of expenditure at SLAC compared to the 1976 figures. Leaving aside PEP, operating funds climb from $27.4 million to $29.4 million, capital equipment funds from $2.5 million to $3.1 million, accelerator improvement funds from $0.7 million to $1 million and general plant project funds from $0.82 million to $0.9 million. It keeps Stanford just ahead of inflation which is very important because salary and salary related costs account for over 70 % of the total operating costs not leaving much flexibility for the research programme if the budget is hit.

The accelerator improvement funds will be used mainly for the SLED project which will increase the peak energy of the electron linear accelerator (see January issue, page 11). Design and engineering work for SLED is essentially complete and components are beginning to be installed at the machine. The climb to around 35 GeV will be achieved progressively over the next few years aiming for completion in FY 1978.

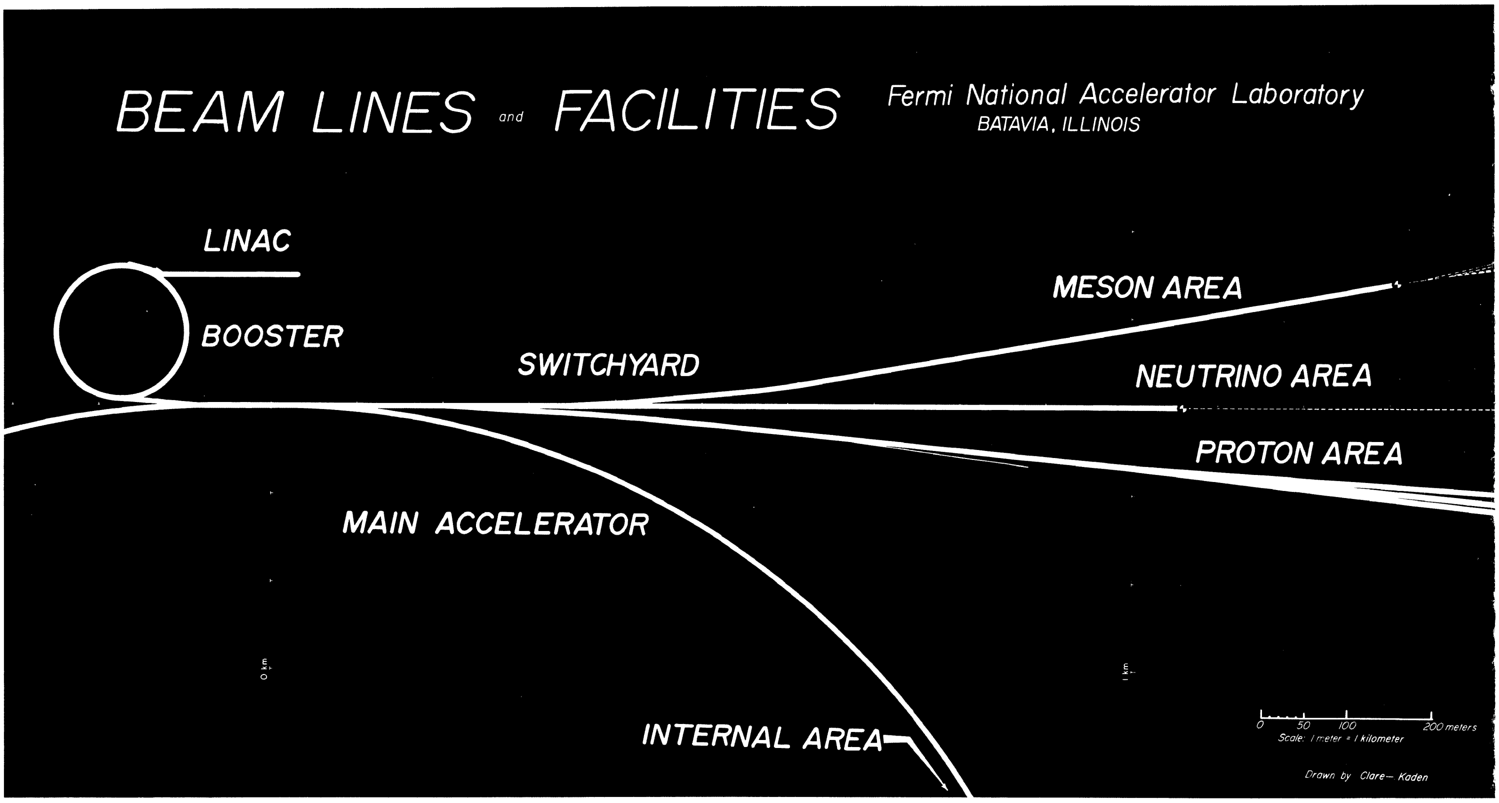
The plans for major new experimental devices centre on two detection systems for the study of electron-positron collisions at the SPEAR storage ring. One of them is 'Mark II' of the large magnetic detector which spotted the 3.1 GeV particle. It is being designed in such a way that it could be moved to PEP at a later date. Coil winding for the magnet, which has a design field of 0.5 T, has just started. It will enclose drift chambers and possibly multiwire proportional chambers (depending upon whether the drift chambers alone are thought capable of handling neutral kaons). There will be trigger counters, shower counters (of the liquid argon/lead strip type) and muon identifiers outside the magnet. The aim is to begin installation of Mark II in June 1977.

The other detector is a device which would try to see the emerging neutral particles with high efficiency. It is still in the early planning stage but it has already become known as the 'crystal ball' since it is likely to consist of a spherical array of sodium iodide crystals and associated counters which would surround one of the two SPEAR interaction regions. We will have more on these detectors as their design develops.

SLAC's computational facilities have been considerably enlarged during the past year with the acquisition of two IBM 370/168 computers. These are coupled to the older 360/91 forming a very powerful 'triplex' system which now gives a growing fraction of its time to on-line analysis of experimental data. The experimenter is thus able to see some of his collected events analysed almost instantly. The computers are housed in a new building which we showed in a photograph in the October issue of last year.

IKO AMSTERDAM Electron accelerator under construction

The Institute for Nuclear Physics Research (Instituut voor Kernphysisch



A neat presentation of the beam lines and major experimental installations at the Fermilab 400 GeV proton synchrotron. Protons can be fed to all three experimental areas simultaneously and with accelerated beam intensities of 2 × 10^{13} protons per pulse, there are plenty to go around.

Onderzoek, IKO) is building a 500 MeV electron linear accelerator. It is located in a Scientific Centre, alongside the existing IKO premises in Amsterdam, where the National Institute for Nuclear and High Energy Physics is also based.

This new accelerator (which has been christened MEA for Medium Energy Accelerator) was authorised at the end of 1972 to succeed a synchro-cyclotron and a lower energy electron linac as IKO's main research tool. The linac is designed for a 2.5 % duty cycle at full energy, rising to 10 % at 250 MeV. The maximum beam power is 250 kW and the energy spread for 50 % of the beam current is 0.3 %. Beam diameter for 90 % of the beam current is expected to be 5 mm with a divergence of 10^{-4} rad.

The accelerator is housed underground in a building (which has been constructed) 200 m long. The linac itself is 165 m long preceded by a pre-injector. It has twelve sections, each 14.6 m and fed by its own klystron (100 kW average, 1 to 4 MW peak), separated by 1.6 m sections for vacuum valves and beam diagnostic equipment.

About 1/3 of the way along its length an electron beam can be brought out to a low energy station. Beams will be used there mainly to produce radioisotopes (now produced at the synchro-cyclotron) and for low energy electron scattering experiments. At the high energy end of the machine there will be three experimental areas for chemistry, electron scattering and pion/muon experiments. These halls are at present under construction.

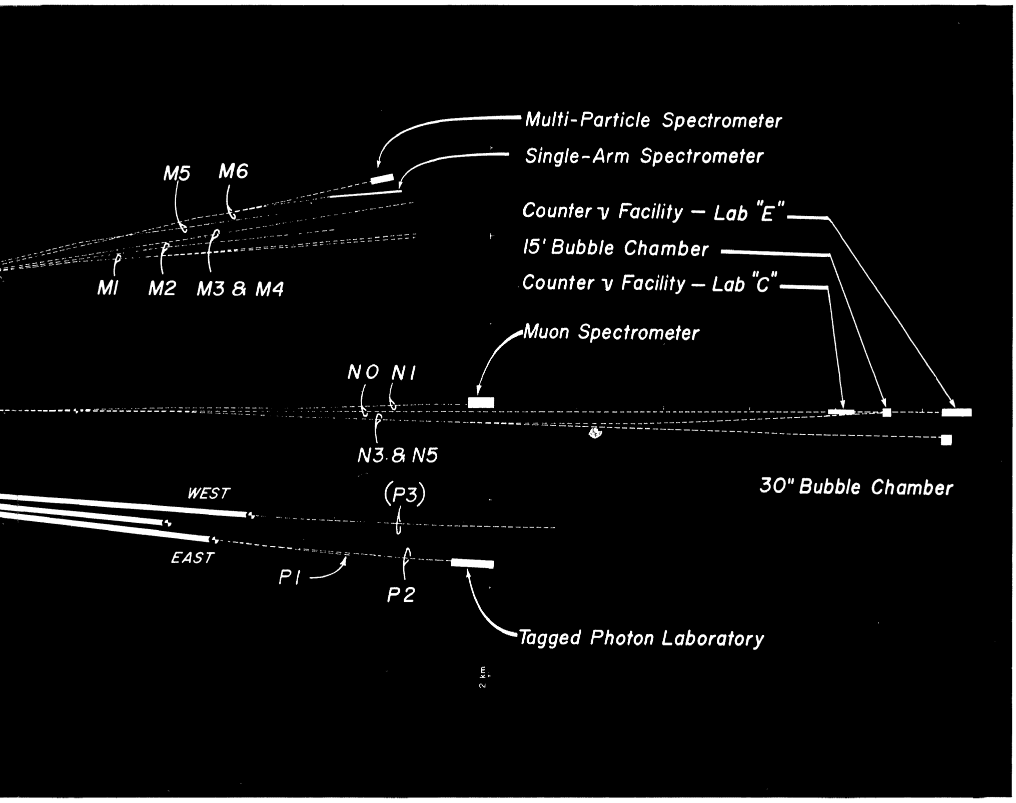
IKO aims to promote fundamental and applied scientific research in nuclear physics and associated fields in the Netherlands. The electron accelerator will make an important contribution to fulfilling these aims.

CERN
First protons at new linac

The new linac, which is scheduled to take over from the existing linac at the CERN proton synchrotron in 1978, is taking shape. Its building is complete and the Faraday cage and pre-injector are installed. The linac is intended to supply high intensity beams of good quality at twice the present repetition rate. Such beams will be needed to supply the PS/ISR/SPS in the coming years.

Tests with the pre-injector began before Christmas and the voltage was taken to 820 kV. It is probable that 850 kV can be reached. Proton pulses 200 μs long were obtained and emittance measurements (determining the beam quality) will begin at the end of February.

There are several important differ-



ences between the new pre-injector and its predecessor. The emerging beam energy has been increased to 750 kV, using a cascade Cockcroft-Walton, which will reduce space charge effects and improve beam bunching. The length of the accelerating column has been increased in consequence. The power necessary for the ion source is transmitted via a sequence of three insulating transformers replacing the traditional generator on the platform driven by a motor below. The control system (as for all the new linac) uses CAMAC units. The control signals are communicated to the components on the high voltage platform by an optical link operating at 2 MHz. Recent improvements with duoplasmatron ion sources have reduced the flow of hydrogen by a factor of ten and made it possible to use thermomolecular vacuum pumps rather than mercury pumps.

The next stages of construction of the linac involve the installation of the transport and matching system for the 750 keV beam and of the first linac tank. The next milestone should be the achievement of 10 MeV protons through the tank at the end of the summer.

Ions in the CERN machines?

During the two days before Christmas, when the CERN machines were officially shut down, the pre-accelerator and Linac operation crews who got the first test of their new pre-accelerator off the ground (see above) were also busy on their old machine. In a very short test they repeated the performance which was achieved already 11 years ago by producing deuterons and accelerating them to PS injection energy, where a current of 8 mA was achieved. As this test proceeded very smoothly, it was decided to exchange the deuterium bottle at the source for a helium bottle and, within a few hours, 0.8 mA of He^{++} at PS injection energy were produced. With such currents it is estimated that it will be possible to obtain, respectively, a few 10^{11} and around 10^{10} particles per pulse out of the PS.

Acceleration of ions in the CERN machines is only possible if the ions are fully stripped (all their electrons torn off). This is because the linac has to have charge to mass ratios near 0.5 (e.g. the deuteron has one positive charge and two nucleon mass) in order to accelerate the ions. Also the vacuum conditions (around 10^{-7} torr) in the PS and SPS would cause the charge to mass ratio of too high a proportion of the ions to change during the acceleration time, thus changing the acceleration conditions and causing the ions to be lost.

The realisable beam intensities are the most difficult quantities to estimate at the moment. A lot depends on developments in the art of ion sources to give fully stripped ions (E. Donets at Dubna has suggested a promising approach using electron beams to remove the atomic electrons). If work on such sources went well, the CERN machines might be used for ions as high up the periodic table as neon or even argon.

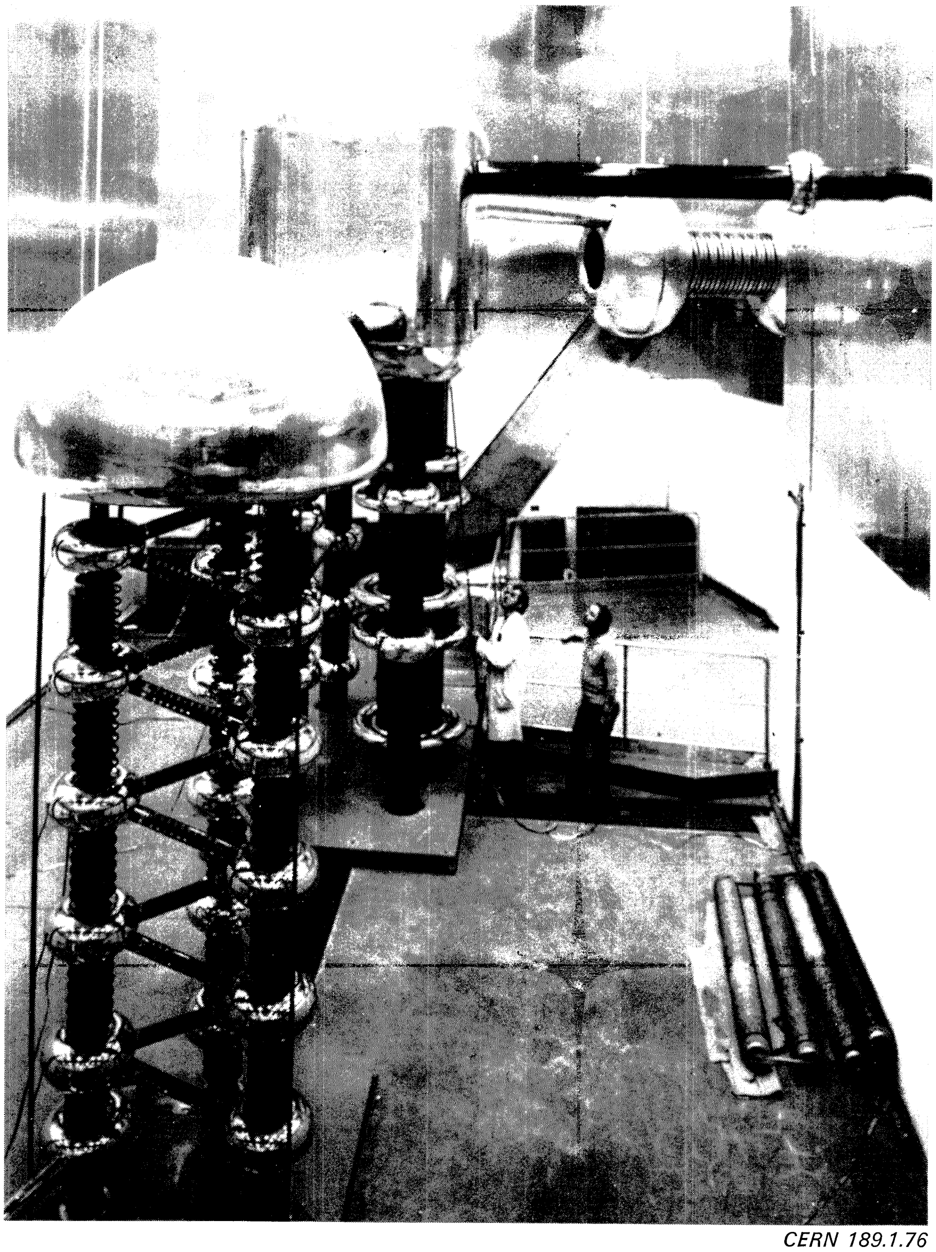
The existing 50 MeV linac and the new linac, which is being constructed, can both accelerate ions. The velocities during acceleration are about half those of protons (because of the charge to mass ratio) and the ions are thus accelerated between the drift tube gaps on every other r.f. cycle.

The PS is able to trap the slower moving ions without doubling the r.f. frequency by trapping ions initially in 40 bunches instead of the usual 20. Their energy can then be taken higher and they can be debunched and trapped again in 20 bunches. This trick has been successfully simulated with protons. The ISR could store ions above its transition energy (8.5 GeV per nucleon) and up to 15.5 GeV per nucleon.

The SPS, after some doctoring of the r.f. system, could take ions from the PS at the normal injection field levels or the PS could run to higher energies to feed in at higher field levels. The ion output from the SPS, 200 GeV per nucleon, would correspond to those rare events seen in cosmic ray physics due to very high energy nuclei.

The necessary additional investment to open up these possibilities is comparatively small but, in times of budget stringency, the physics interest needs to be clearly demonstrated before any investment is made. Some physicists suggest that new phenomena might occur in high energy collisions of nuclei but it will be equally important to learn how to extract information from these complicated events where many more secondaries are to be expected than from proton interactions.

The pre-injector of the new linac at the CERN proton synchrotron. In the foreground is the Cockcroft-Walton generator and behind is the platform where the electronic units for the ion source are installed. On the right is the accelerating column where the ion source itself is enclosed.



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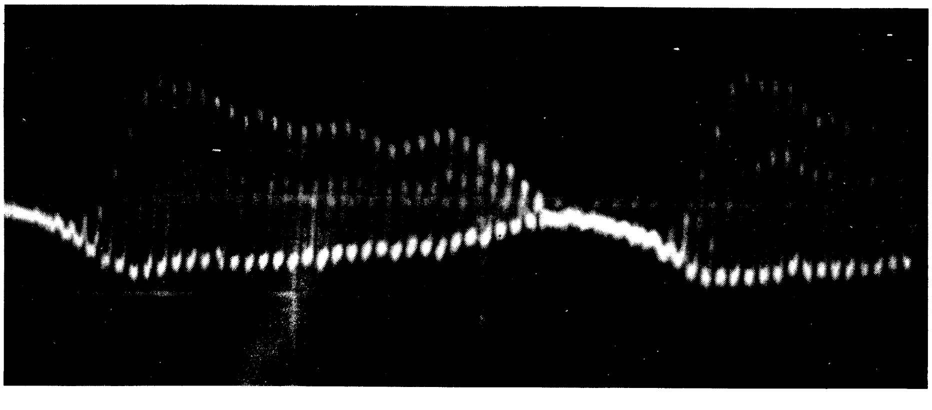
To illustrate our piece on ions in the CERN machines we have penetrated the archives to find a polaroid taken during the first deuteron runs at the PS in March 1964. The trace records the deuterons orbiting the ring (40 bunches) one millisecond after they were injected at 25 MeV. The horizontal scale is 2 μs per division.



People and things

Death of Werner Heisenberg

Professor Werner Heisenberg died on 1 February. He was one of the great figures in the physics of this Century and amongst the most active and influential scientists who worked for the creation of CERN in the early 1950s.

Heisenberg was born in 1901 and thus participated in his 20s in the glorious days of the evolution of quantum theory. It is from this epoch that his name achieved immortality linked to the 'Uncertainty Principle' that he formulated in 1926. This was a great insight into the consequences of the quantum interpretation of Nature. It demonstrated that 'exact' observation (as it had previously been interpreted) of Nature's behaviour is not possible beyond a certain precision. This insight remains a cornerstone of modern physics and has had wide influence also on human philosophy in general. It brought Heisenberg the Nobel Prize for Physics in 1932 at which time he was the youngest ever recipient.

Heisenberg's involvement in the affairs of CERN began as delegate of the Federal Republic of Germany at the formative meeting in 1951 where he promoted the attitude that CERN should go for accelerator performance beyond what had been previously achieved in the USA. In 1952 he signed the Agreement establishing CERN in the name of the German government.

He continued to give his time and abilities to CERN both 'politically' as delegate to the CERN Council (through to 1963) and 'scientifically' as a member of the Scientific Policy Committee (through to 1961). Beyond that, as a father-figure in German science circles, he has greatly influenced the policy decisions of his country with regard to CERN. For a time he opposed the building of ever larger accelerators but he came down on the side of the CERN 300 GeV project at the crucial time of decision in 1970-71. His last official appearance at CERN was in October 1971 when he inaugurated the Intersecting Storage Rings.

Werner Heisenberg was a man of great stature who within his lifetime did much to shape physics and the scientific environment in which physics is carried out.

Luminous ISR

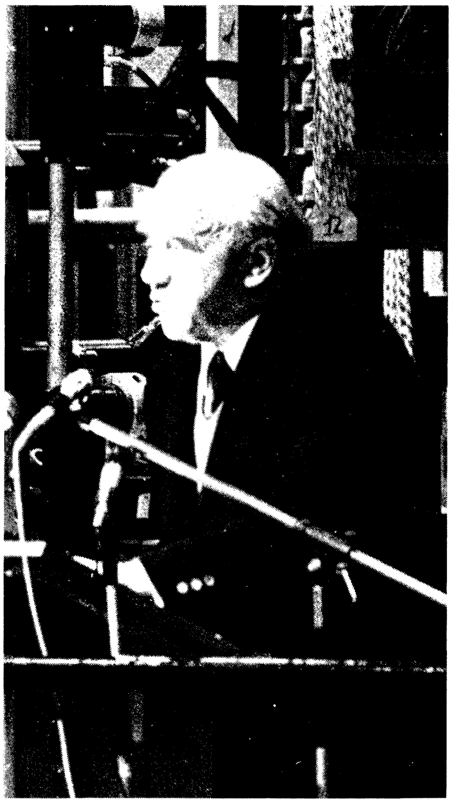
The sums on the performance of the CERN Intersecting Storage Rings during 1975 give an integrated luminosity over the year of 5.3×10^{37} per cm^2. This is more than double the achievement of the previous year (1.9×10^{37}). 70 % of the physics time was absorbed by operation at beam energies of 26 GeV in each ring at which energy the peak luminosity was 2.1×10^{31} cm^2 per s (five times the design figure). In a low beta insertion at intersection I-7, the luminosity has climbed up to 4×10^{31}. Typical currents in each ring were around 25 A. The beams have been so well under control that (with average vacuum in the 7×10^{-12} torr region) protons are lost more from the desired collisions in the intersection regions than from other causes and the experiments are carried out in very low background conditions. The ISR is sustaining its reputation as the most perfect machine ever built.

SLAC Committees

The interests of the User community at the Stanford Linear Accelerator Center are represented by a Scientific Policy Committee, which meets several times a year to review such things as SLAC's programme and policies and its relationship with Users, etc. The present membership is A. Pais — Chairman (Rockefeller), J. Cronin (Chicago), P. Piroue (Princeton), E. Henley (Univ. of Washington), N. Samios (Brookhaven), E. Lohrmann (DESY), B. Barish (Cal. Tech.), B. McDaniel (Cornell), D. Cline (Wisconsin), J. Sanford (Fermilab), M. Goldberger (Princeton), A. Silverman (Cornell), B. Lee (Fermilab), and M. Stevenson (Berkeley).

The SLAC Program Advisory Committee has the following membership — J. Ballam (SLAC), C. Baltay (Columbia University), R. Blankenbecler (SLAC), H.C. De Staebler (SLAC), G.S. Masek (San Diego), D. Meyer (Univ. of Michigan), D. Nygren (Berkeley), C. Quigg (Fermilab), M. Schwartz (Stanford University) and K.G. Wilson (Cornell).

Werner Heisenberg at the Inauguration of the CERN Intersecting Storage Rings in October 1971.



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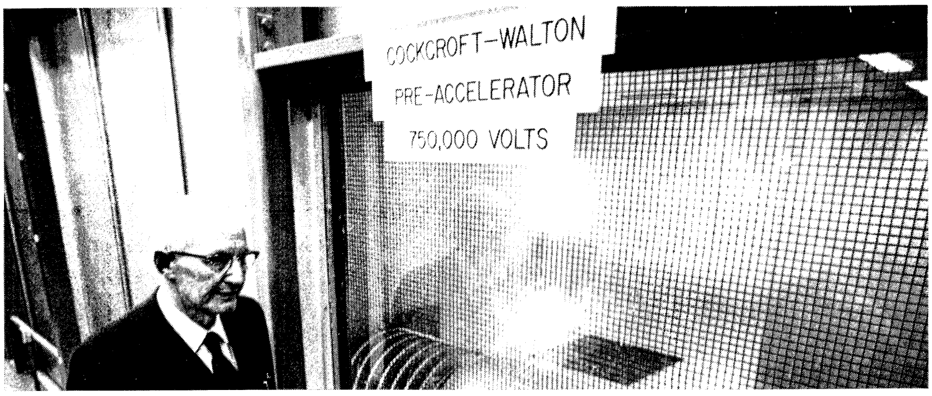


Ernest Walton, visiting the Fermilab, looks at today's model of the type of accelerator which he pioneered in the 1930s with John Cockcroft.

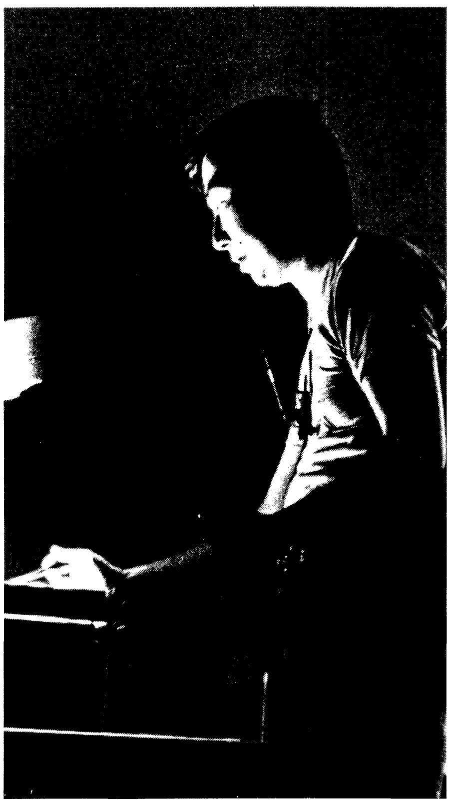
(Photo Fermilab)

Lawrence Award

The Ernest Orlando Lawrence Memorial Award for 1976 has been given to Burt Richter and Sam Ting, leaders of the teams who unearthed the 3.1 GeV particle at Stanford and at Brookhaven. Their citations read:
Professor Burton Richter: 'For important contributions to the measurement of photo-induced high energy reactions, for leadership in the realization of electron-positron storage rings, culminating in the discovery of new particles of matter.'
Professor S.C.C. Ting: 'For powerful new experimental techniques that have extended the range of validity of quantum electrodynamics, determined the properties of vector mesons and culminated in the discovery of new particles of matter.'

A little more concerning 2×10^{13}

Just before the presses rolled for the January issue, we were able to squeeze in the news that Fermilab had topped 2×10^{13} protons per pulse at 400 GeV on 20 January. The peak figure was in fact 2.016×10^{13}. The advance on the previous record of 1.9×10^{13} came from pouring more into the 8 GeV Booster from the 200 MeV linac — 150 mA in two turns rather than lower currents over four turns. It is hoped to tread this particular path further. The linac is now aiming for a current of 240 mA, the linac-Booster transfer line is being improved and a 'super-damper', providing fast feedback on the beam, is being installed in the Booster. With these modifications, it is hoped to reach 3×10^{13} in the summer. Later in the year a new pre-injector will make negative ions available and possibly feed still more into the Booster to take intensities higher.



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1. Burt Richter in his office at SLAC.

2. Sam Ting lecturing at Brookhaven.

First doubler production magnet

Winding of the coil for the first 'production magnet' of the Fermilab Energy Doubler/Saver began towards the end of January. The Doubler is intended to increase the peak energy at Fermilab to 1000 GeV using about 1000 superconducting magnets. Construction of the first production magnet, 6 m long, follows the experience with a series of prototypes. It is hoped by June to have developed the construction techniques so as to achieve a production schedule of one magnet per week.

Summer School

The IPP International Summer School will be held at Montreal, Quebec, Canada from 21 to 26 June 1976 under the title 'Experimental Status and Theoretical Approaches in Phy-

Ted Shaw former Head of the CERN Public Information Office.

sics at the High Energy Accelerators'. Further information can be obtained from Prof. R. Henzi, Organizing Committee IPPSS, Department of Physics, McGill University, PO Box 6670 Station A, Montreal, Quebec, Canada H3C 3GI.

6600 moves out

The CDC 6600, which was for many years CERN's main central computer, left to continue its service in Brussels at the end of last year. It had been at CERN for ten years and for most of them had borne the brunt of the Laboratory's computing load (often staggering under it) prior to the arrival of its successor, the 7600. Dereck Ball, who did much to keep it upright when it was staggering, wrote a not unsympathetic obituary in the January issue of the CERN Computer Newsletter, stating 'With all of its associated difficulties the 6600 has performed valient work... Looking at the computing scene, large-scale scientific computing would not be where it is today without the 6600...'

President of INFN appointed

Professor Alberto Gigli Berzolari has been appointed by the Italian Minister for Public Education as President of the Istituto Nazionale Fisica Nucleare (INFN) for a period of three years beginning 1 January 1976 following the recommendation made on 3 October 1975 by the INFN Board of Directors. A. Gigli Berzolari is Professor of General Physics at the University of Pavia where he has been Dean of the Faculty of Sciences since 1969. He has been involved in the INFN direction since 1968 serving first as member of the Executive Committee and, since 1972, as Vice-President. From 1963 he has been Vice-Director of the journal Il Nuovo Cimento. The former President of INFN, Professor Claudio Villi, has been appointed Vice-President of INFN for three years.

Departure of Ted Shaw

At the end of January Edwin Shaw, who was Head of the Public Information Office for nine years, left CERN. During his term of office he developed CERN's relations with the 'outside world' to a remarkable extent. Contacts with the media benefited greatly from the fact that he had previously spent many years on the other side of the fence and knew thoroughly the requirements of journalists, television teams, etc... CERN became one of the rare Organizations that journalists were ready to enter by the front door because they knew that they would be treated honestly and professionally by someone who understood the job they were doing.

In Geneva itself, home of a host of international Organizations, the reputation of the CERN Public Information Office was second to none. It was also significant that the fledgling European scientific Organizations — European Southern Observatory, European Molecular Biology Organization and European Physical Society — all asked Ted Shaw to help with their public relations.

It is with particular warmth that we record his contribution to the development of the COURIER. He brought with him broad experience as Editor and Managing Director of many scientific and technical journals and helped create an environment of freedom and responsibility which has been invaluable in editing the COURIER. His understanding, sound practical advice and unfailing encouragement have been a steady source

of inspiration during the evolution from an internal 'house organ' to a journal of international standing. It is with a personal note of appreciation that the Editor wishes to mark the years that he has worked with Ted Shaw.

With the departure of Edwin Shaw the CERN Public Information Office has been disbanded and its functions absorbed in other services. Production of the COURIER now takes place in the Publications Section of the Scientific Information Service.


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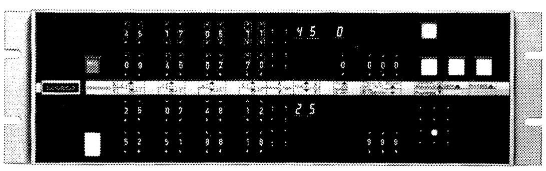


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Where experiments require a large number of plastic scintillator sheets, costs can be considerably reduced and yet a good overall performance maintained by the use of the new low-cost NE 114 plastic scintillator.

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The long term stability of NE 114 under reasonable laboratory working conditions is guaranteed for a minimum of 5 years and it is supplied rough cut or machined with polished edges. Sheets up to 4 metres long are now being produced in the Nuclear Enterprises Edinburgh Laboratories where production capacity for plastic scintillators has been tripled in the past year.

Details of cost and delivery for NE 114 and the world's most extensive range of scintillation detectors are available on request.

Illustrated below: Some of the new vats for the processing of NE 114 plastic scintillator at the Edinburgh Laboratories of Nuclear Enterprises.

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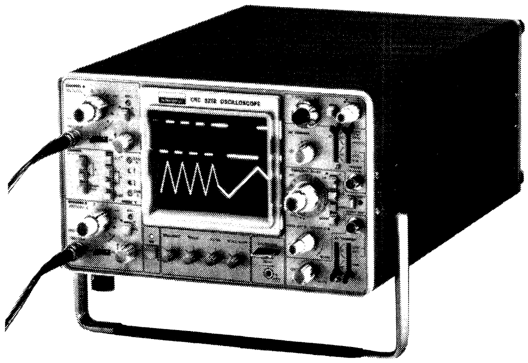
Un nouvel oscilloscope brillant

Le nouvel oscilloscope modèle 5212 est un appareil compact très facile d'emploi aux performances brillantes.
Il offre deux voies de 85 MHz (temps de montée 4 ns) et deux bases de temps.
Composé seulement de trois circuits imprimés, il fait appel à l'emploi généralisé de circuits intégrés qui lui confèrent ainsi une fiabilité maximum.



Oscilloscope portable 85 MHz double trace

Parmi les nombreuses particularités de cet oscilloscope citons:

- Ses deux possibilités d'amplification verticale, 85 MHz–5 mV/div sur chacune des deux voies ou par simple commutation 1 mV/div–20 MHz sur l'une des voies
- L'indication lumineuse de direction de sortie du spot hors de l'écran
- Sa double base de temps mixée 10 ns/div avec hold-off réglable
- La visualisation par bouton poussoir du signal de synchronisation
- Son faible poids (9 kg seulement) et son prix extrêmement avantageux en regard de ses hautes performances.

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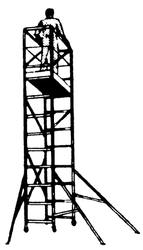
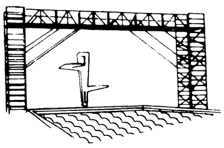
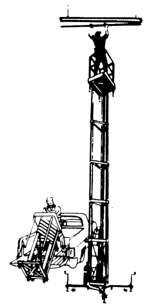

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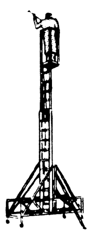
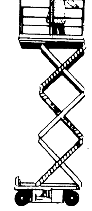

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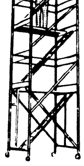
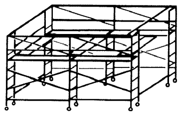
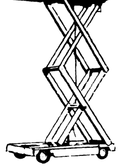

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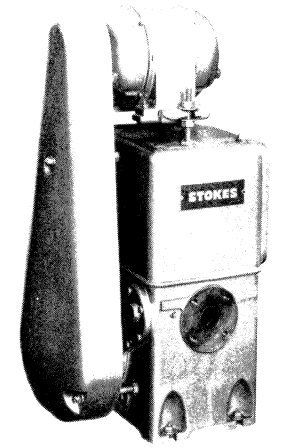

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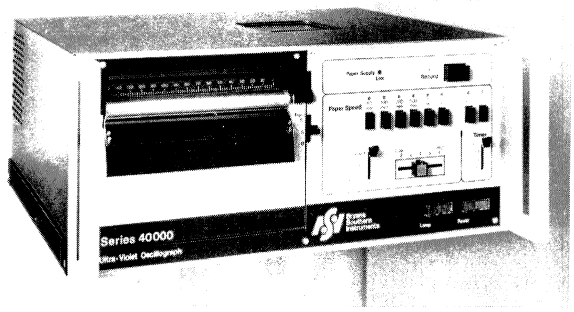

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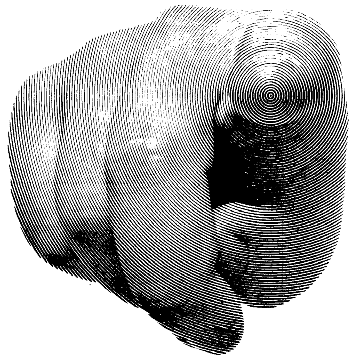

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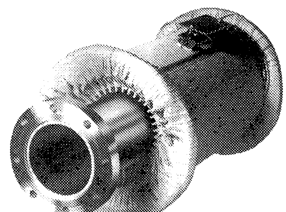

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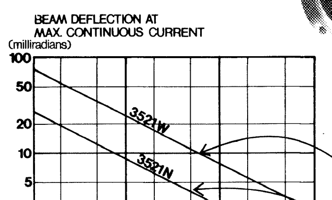

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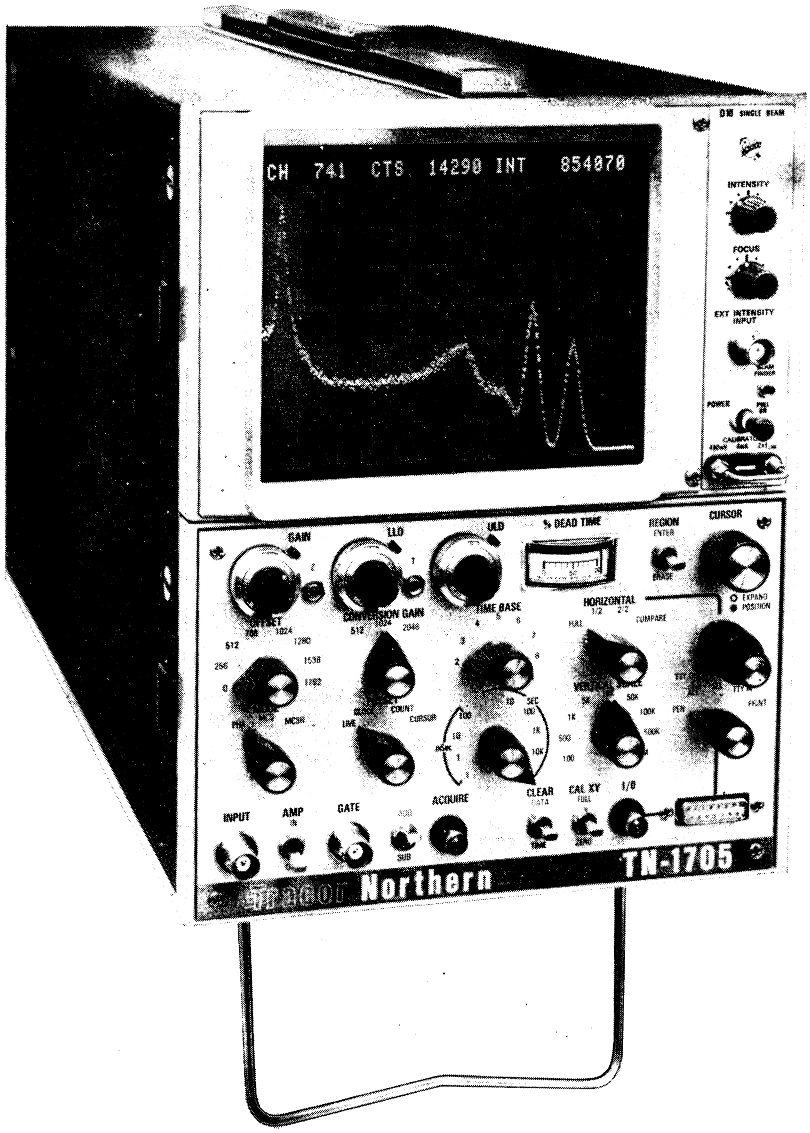

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