

HERAlding HERA

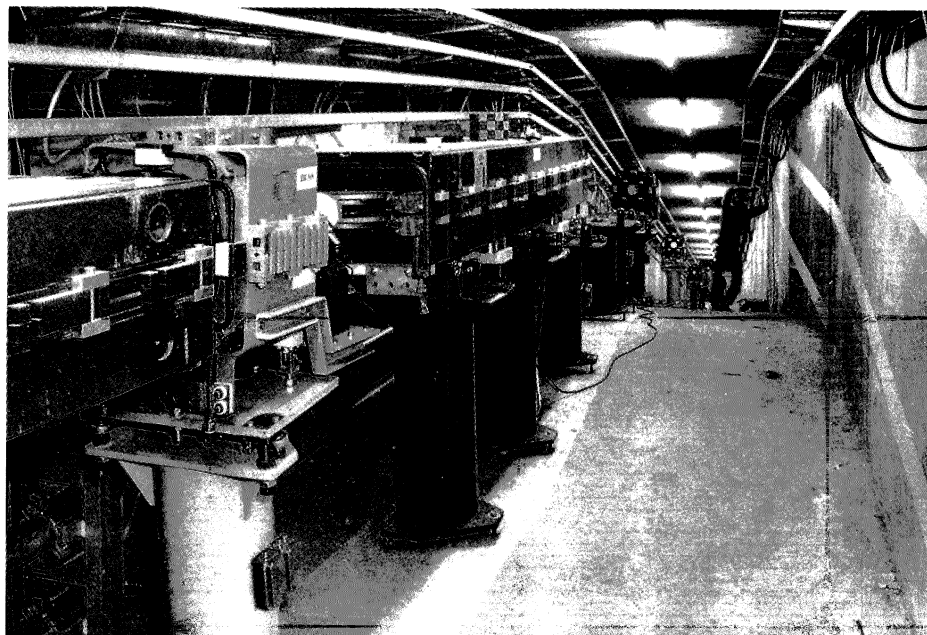
On Wednesday 19 August, the machine cutting the tunnel for the HERA electron-proton collider at the German DESY Laboratory in Hamburg arrived back at the South Hall, where it set out on its 6.3 kilometre circuit 27 months ago.

Behind the tunnelling machine, concrete finishing is going up fast, while further back installation is well underway, with large numbers of magnets already in place for the 30 GeV electron ring. Both the proton and electron injection lines from the neighbouring PETRA ring into HERA have been tested (the proton line with positrons pending the arrival of protons).

Having worked exclusively with electron beams throughout its 28-year history, the DESY Laboratory is having to add a proton plant. The radiofrequency quadrupoles (built by Frankfurt) to give the protons their first impulse have performed well (see June issue, page 1), but the new proton linac has been delayed. Beamline equipment to take protons from the linac to the synchrotron, supplied by Canada, has arrived.

For the protons, the original DESY electron synchrotron has been rebuilt as DESY III, with 32 additional quadrupoles giving the old combined function (bending and focusing) machine more the appearance of a latter-day separated function accelerator.

DESY III surrounds the new DESY II electron machine, impressively commissioned after only one month of running in. The original intention was to lower DESY III to enable the electron beams from DESY II to get out. However the old machine was built so solidly that it proved easier and cheaper to install the two machines in the same horizontal plane, with electron beams traversing the pro-



The tunnel leading from the PETRA ring down to the HERA Main Ring at DESY.

ton machine, and with the two vacuum systems delicately interlocked!

Conversion work is also needed to adapt the PETRA ring to handle 40 GeV proton beams, in particular for the protons to bypass the high-impedance radiofrequency accelerating cavities for electron beams. Work should start soon. The two new PETRA accelerating cavities for protons are nearing completion in Canada.

All orders for the superconducting magnets for HERA's proton ring have been placed with European industry. While reliable large-scale production of these vital units has yet to be demonstrated, hopes are high after successful tests of prototype 9-metre dipoles from DESY and BBC in Germany, quadrupoles (developed at Saclay) and correction coils from the Netherlands, hinting that protons could eventually be taken above the 820 GeV HERA design level.

To supply the proton ring and magnet testbed with liquid helium meant building the largest refriger-

ation plant in Europe. Sulzer has been awarded a supplementary contract to oversee the running of this complicated technology.

HERA's electrons require 30 GeV of energy. Most of this will be supplied by copper radiofrequency units taken from the PETRA ring. The hope is that the additional energy will be supplied by the twin four-cell 500 MHz superconducting niobium units developed in intense R and D during the past few years and which have proved so successful in bench tests.

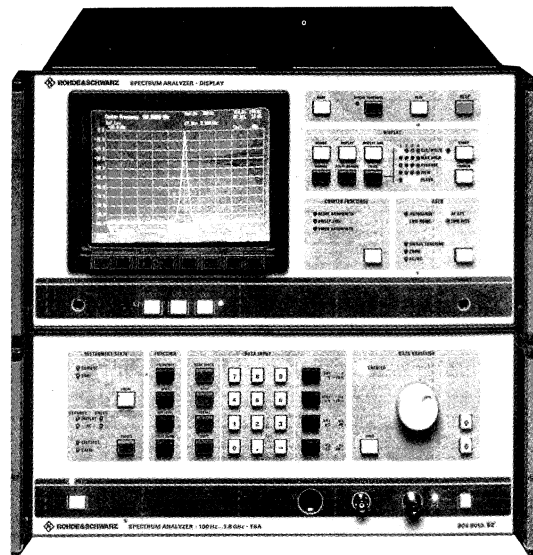
Initial beam tests of the superconducting cavities in PETRA encountered unforeseen problems but this should be mastered for further beam tests later this year.

In the meantime installation has begun of the klystron equipment taken over from PETRA to drive the copper radiofrequency accelerating units for the electron beams. HERA will handle polarized (spin-oriented) electrons and making their appearance are the first rotator magnets to change the

Analyseur de spectre FSA

de  **ROHDE & SCHWARZ**

- de faible niveau de bruit propre typique < -150 dBm
- gamme sans intermodulation ≥ 100 dB
- faible bruit de phase < -114 dBc (Hz) pour un écart de porteuse de 1 kHz
- gamme de fréquence de 100 Hz à 1,8 (2,0) GHz
- excursion de fréquence réglable en continu de 100 Hz à 1,8 (2,0) GHz
- résolution réglable de 6 Hz à 3 MHz
- bande passante $< 0,6$ dB
- erreur d'amplitude < 1 dB
- moniteur couleur



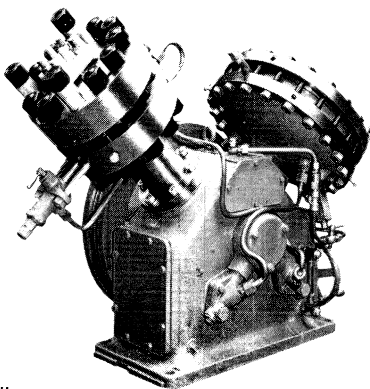
Représentation
générale et service
pour la Suisse



ROSCHI
TELECOMMUNICATION SA

CH-3063 Ittigen, Case postale
Téléphone 031 58 90 11
Télex 911759

Burton Corblin Membrankompressoren sind problemlos



Das hermetische System verdichtet ölfrei alle Gase bis 2500 bar und hält die Gase und Umwelt rein.

Lieferbar in vielen Bauarten und Leistungsstufen, vom Laborgerät bis zum 100 kW-Kompressor – auch als Trockenläufer mit Membran-Endstufe und als Komplettseinheit. Sie entsprechen allen Abnahmevorschriften.

HERBERT OTT AG

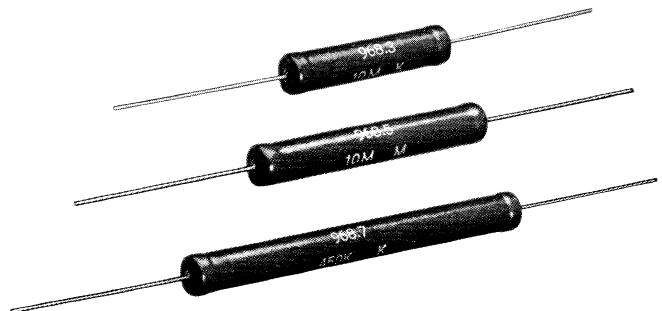
Missionsstrasse 22, Postfach, CH-4003 Basel
Telefon 061 / 25 98 00, Telex 964 562 (hoc)

HIGH-VOLTAGE RESISTORS

high reliability, Metallux Patent

Ohm Range	5 K Ω $\pm$ 35 G Ω
Operating Voltages	5 kV $\pm$ 75 kV
Rated power at 40°C	3 W $\pm$ 105 W
Temperature coefficients	10 $\pm$ 250 ppm/°C
Voltage coefficients	1 ppm/V $\pm$ 10 ppm/V
Stability	$\Delta R/R < 0,5\%$, 1000 h, 40°C

Please ask for new techn. documentation!



METALLUX
ELECTRONIC



Metallux AG
CH-6850 Mendrisio
Via A. Maspoli 10
Tel. 091/46 49 35-6
Telefax 091/46 52 10
Telex 842 257

Metallux GmbH
D-7305 Altbach
Stauferstrasse 3
Postfach 31
Tel. 07153/2 87 11

CBdK

Right, the new DESY II synchrotron, and left, the original DESY synchrotron, rebuilt to supply protons for the HERA electron-protons collider being built at the DESY Laboratory in Hamburg. The DESY II electron beam exits through the proton machine.

polarization direction of the electrons before and after each collision point.

Experiments

To exploit HERA's unique colliding electron and proton beams, (the plan is also to run with positrons and protons), the two big detectors – ZEUS and H1 – are pushing ahead at top speed to be ready for the first collisions in 1990. With almost 1000 GeV of proton energy slamming into a 30 GeV electron, the detectors are highly asymmetrical. This, together with the bunching of HERA's beams, posed special problems for the detector designers. Precise analysis of the produced hadrons (strongly interacting particles) will be needed, especially for the interesting interactions producing neutrinos. These will fly out undetected other than through detailed measurement of energy balance.

ZEUS uses a 'compensated' calorimeter design with interleaved sheets of depleted uranium and scintillator to give accurate energy measurement of electrons and hadrons, while H1 prefers liquid argon as the sensitive medium with iron plates as absorber. Some detailed work has gone into the development of optimal calorimeter configurations.

In addition to these two new HERA experiments, the ARGUS detector will continue to study electron-positron collisions in DESY's DORIS II ring, although DORIS operations are temporarily halted during the machine rebuilding.

ARGUS hit the headlines earlier



this year with the observation of the 'mixing' of electrically-neutral B mesons (see June issue, page 16). At the Symposium on Lepton-Photon Interactions at High Energies in Hamburg in July, the ARGUS collaboration reported evidence for the expectedly very rare decays of B mesons without the production of particles carrying the charm quantum number (see page 4).

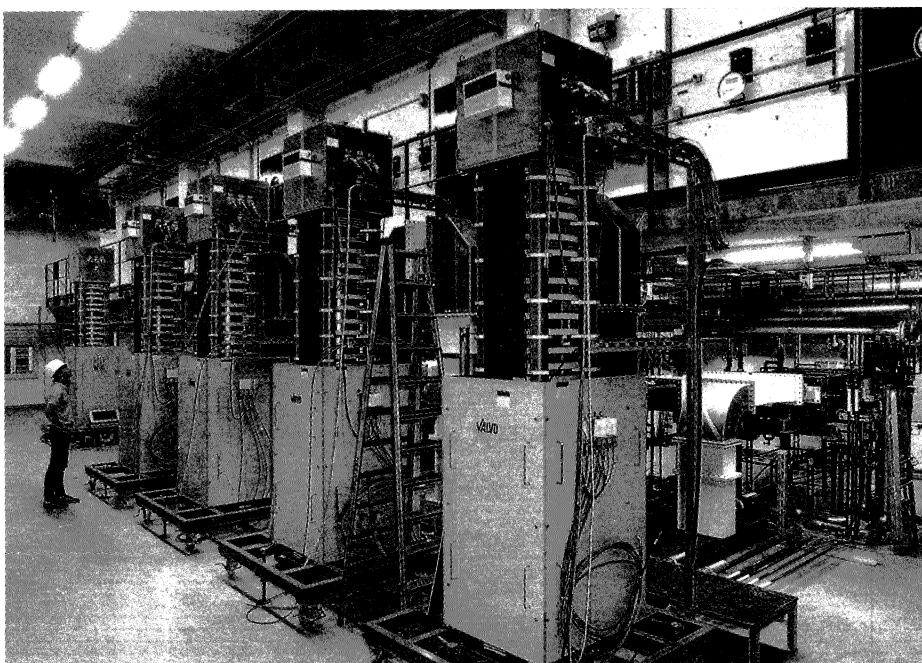
More light

Electron machines produce intense beams of synchrotron radiation. This loss of electromagnetic energy is a curse for high energy electron beams but a blessing for scientists looking for a probe of

matter structure.

At DESY, the DORIS ring runs for 30 per cent of its time with electron beams for the HASYLAB synchrotron radiation centre, while additional beam time comes from 'parasitic' running during high energy physics studies with colliding electron and positron beams, providing particularly interesting beam conditions.

Each year, HASYLAB caters for some 500 scientists from 100 institutes. For the future, more synchrotron radiation might be available if a decision goes through to build a new bypass around the second DORIS collision region (previously used by the Crystal Ball experiment). This will contain six 'undulators', increasing both the quantity and quality of the available



Klystrons installed for HERA.

PROMISES KEPT

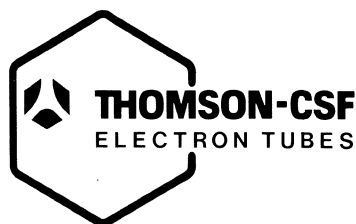
By delivering the total number of very high power klystrons ordered by CERN, Thomson-CSF confirms once again its position as a world leader in the development and production of professional electron tubes.

In order to satisfy the ever-escalating demands for RF power emanating from the high energy physics community and our industrial partners, the Electron Tube Division devotes a major part of its turnover (36 %) to investment and R & D.

This is why we have been chosen to develop and furnish klystrons for the world's major projects :

- 1 MW CW at 352 MHz for LEP ring
- 35 MW peak at 3 GHz for LEP injector
- 500 kW CW at 3.7 GHz for JET and TORE SUPRA

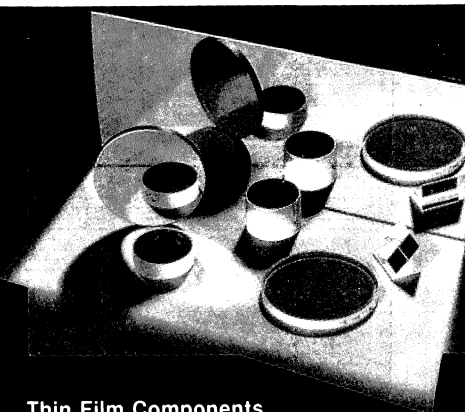
... as well as multi-megawatt klystrons delivering long RF pulses for several major free electron lasers.



THOMSON-CSF - DIVISION TUBES ELECTRONIQUES

38, RUE VAUTHIER / BP 305
F - 92102 BOULOGNE-BILLANCOURT CEDEX / FRANCE
TEL (33 1) 46 04 81 75
TELEX : THOMTUB 200 772 F TELEFAX : (33 1) 46 04 52 09

SWISS



QUALITY

**Thin Film Components
for demanding application
in Laser-Optics.**

- REMAX - Mirrors for High Power Lasers
- REPOL - Thin Film Polarizers for Lasers
- REPART - Beam Splitters
- REPASS - Long- and Shortpass Edge Filters
- REMIN - Antireflection Coatings
- OPTISA - Manufactures following
Your Requirements

OPTISA Ltd
Gewerbehofstrasse 11
CH-2503 Biel, Switzerland

Tel. 032/23 86 23
Telex 931 223 opti ch

OPTISA

41. rue de Villiers, 92200 Neuilly-sur-Seine, Tél. (1) 47.58.11.62

AUBERT & DUVAL
aciérie des ancizes



**aciers spéciaux
et
super alliages
pour techniques avancées**

A view of the experimental floor at the HASYLAB synchrotron radiation laboratory at DESY.

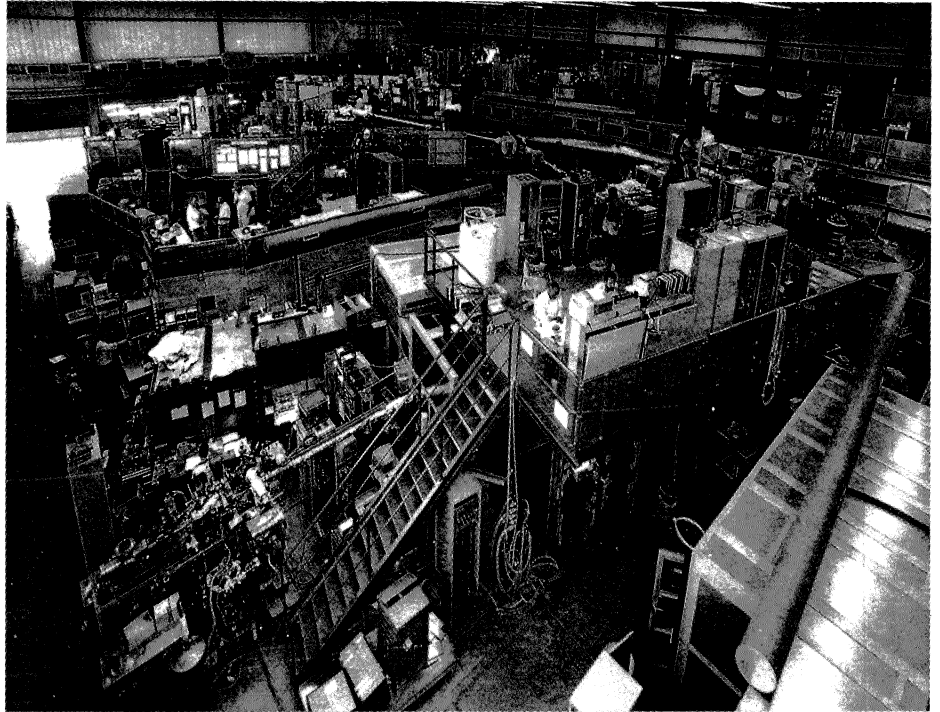
(Photos DESY)

beams. Three wiggler magnets are already installed at DORIS and a new hall for high energy X-rays has been opened.

Although DESY manpower is almost completely taken up by the ambitious HERA project, farsighted efforts continue towards the development of new accelerating techniques for the full-scale machines of tomorrow. The DESY wakefield scheme has provided promising initial results (see page 7). A realistic proposal could emerge if these results can be scaled up appropriately.

With no immediate parallel anywhere, DESY's main HERA effort can look forward to many years of profitable exploitation in the 1990s to build up a comprehensive picture of the interactions of quarks with electrons and with positrons under all electron/positron spin possibilities.

As well as providing unique physics conditions, HERA has also blazed a new trail in international collaboration. Italy, France, the



Netherlands and Canada are supplying components, while the US and Israel are contributing to the technological developments, and Poland and China, together with the UK, are supplying valuable

manpower. With international involvement in big new projects being increasingly stressed, this HERA experience is especially useful.

By Gordon Fraser

Brookhaven — going for gold

In September, the Brookhaven National Laboratory is celebrating its fortieth anniversary. It moves into middle age serving a larger user community than ever before and with research programmes and facility developments which should guarantee several more decades of front-line work.

Though the emphasis for the future has moved off particle physics, there are still some 350 physicists involved in particle physics experiments at the AGS Alternating

Gradient Synchrotron, including some unique topics. The search for unusual kaon decays is a prime example and four detection systems are pushing the limits further out. During the past year, two of them (kaon to pion, muon, electron and kaon to muon, electron) passed previous best limits, reaching 10^{-9} and over the next year should be entering the interesting physics range of 10^{-10} or better.

The tantalizing situation with the results from two experiments

searching for neutrino oscillations remains unresolved. Both see an excess of electrons, implying that the muon-neutrino is converting to electron-neutrino, but further analysis of other possible sources may whittle away the electron counts. To settle the question definitively, a two-detector experiment may well be needed so that any variation of electron counts with distance from the neutrino source could be studied.

Experiments using polarized (spin