* see also page 26

In the meantime the LEP experiments have their work cut out to sharpen the picture at currently available or accessible energies and provide a more confident basis for extrapolations to simulate the evolution of physics after the Big Bang.

DESY
40 GeV protons in PETRA*

In February protons were accelerated for the first time in the PETRA ring at Hamburg's DESY Laboratory to the 40 GeV needed for injection into the new HERA electron-proton collider.

The next step is to increase the intensity and quality of these PETRA proton beams prior to injection into HERA's 6.4 kilometre ring of superconducting magnets.

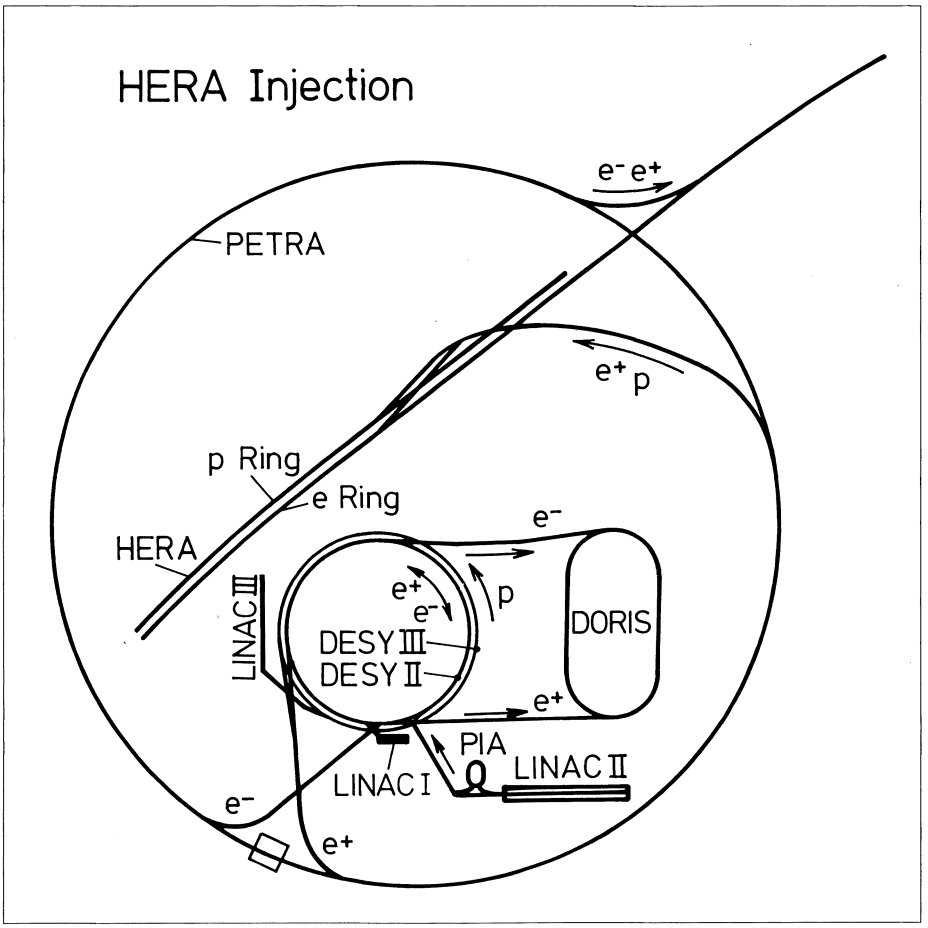
The PETRA ring, built as an electron-positron collider, came into operation in 1978. The physics programme terminated in 1986 to prepare the ring for its new career as HERA's injector of both electrons and protons.

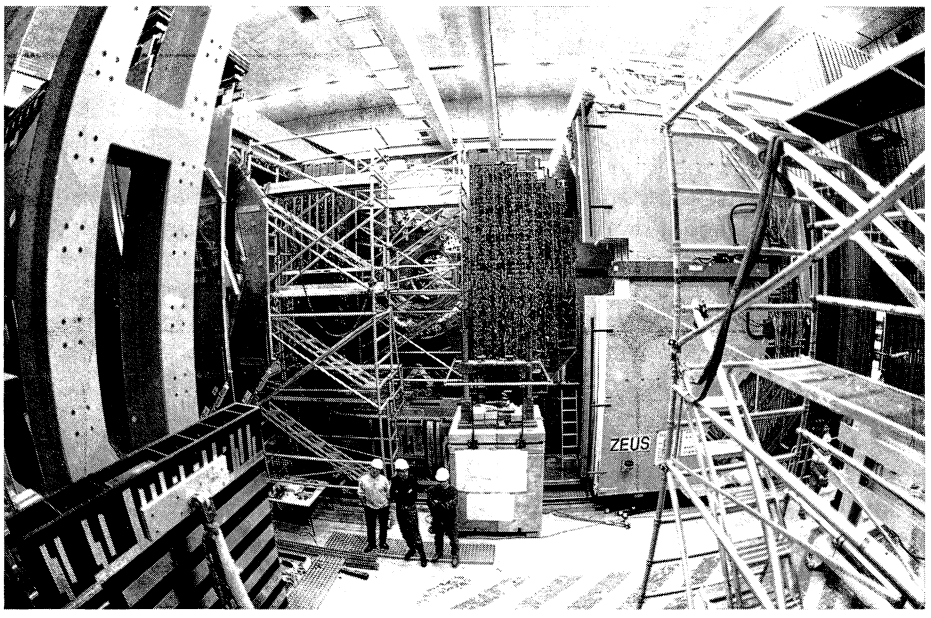
The complete 'DESY chain' of electron machines was tested in 1989, with electrons being taken to 14 GeV in PETRA and above 27 GeV in the HERA electron ring.

Zeus

Installation work is in full swing for the two big detectors – H1 (April, page 10) and Zeus for the HERA electron-proton collider soon to be

The 'DESY chain' of injectors preparing electron and proton beams for the HERA electron-proton collider soon to begin operations at the DESY Laboratory in Hamburg.





Now taking shape in the South Hall of the HERA electron-proton collider at DESY, Hamburg, is the Zeus detector.

(Photo Nick Wall)

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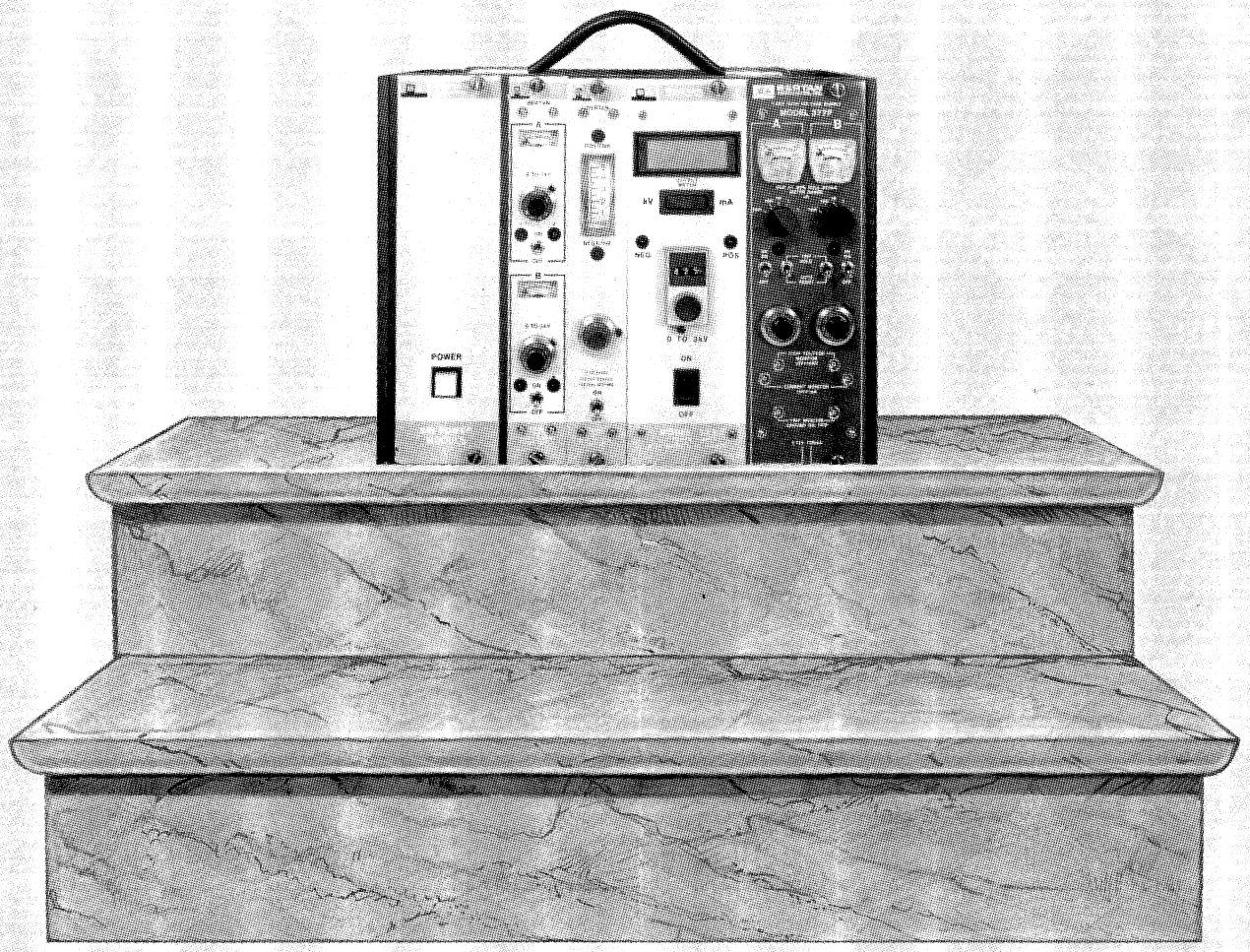

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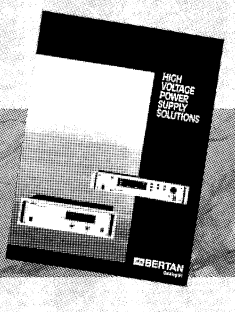


commissioned at the Hamburg DESY Laboratory.

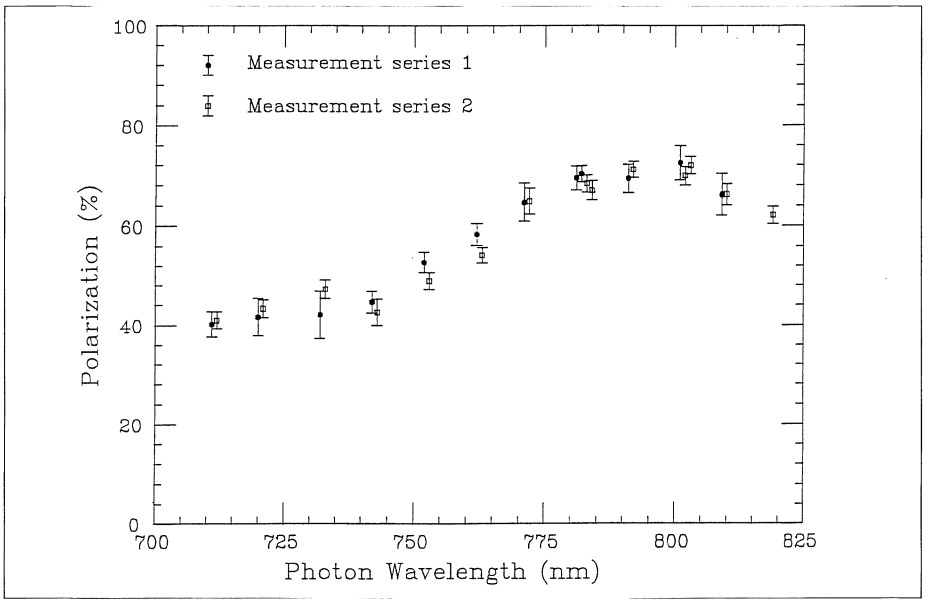
Zeus' iron magnet yoke and the superconducting solenoid and compensator have been in place for some time and successfully tested. Uranium-scintillator calorimeter elements began to go in last November, initially for the forward (proton direction) and rear modules, and installation of the central barrel is now underway. All proportional-tube chambers for the backing calorimeter in the iron yoke are in place.

The toroids of the forward muon detector have been mounted and operated. All drift chamber planes have been installed as well as two of the four limited-streamer tube planes for the trigger. The inner chambers of the muon barrel are in place and mounting of the outer layer has begun.

The inner tracking system – vertex detector, central drift chamber and planar drift chambers alternating with transition radiation elements in the forward direction, together with its special section of beam pipe – is taking shape.

After initial installation to ensure its compatibility with HERA machine components, the luminosity monitor has been removed awaiting the availability of well-controlled beams.

Work at the Japanese KEK Laboratory has shown how to obtain highly polarized electron beams from a laser-irradiated treated semiconductor photocathode. Shown here is the variation in polarization with laser wavelength.



KEK
Producing highly polarized electrons (1)

With the Japan Linear Collider (JLC) electron-positron project having highest priority in Japanese high energy physics planning, many associated research and development tasks are underway at the Japanese KEK Laboratory. Despite a relatively recent appearance on the scene, work on a polarized (spin oriented) electron source has nevertheless made significant progress.

After a brief but intensive spell of work to find the optimal superlattice photocathode structure, an impressive polarization level, 71 per cent, has been achieved for a solid-state photocathode at room temperature by a team of researchers from KEK, Nagoya and NEC Corp (see also page 6).

This should go on to pay dividends in a future research programme. In the electroweak picture of electromagnetism and the weak nuclear force, 'handedness' plays a vital role. Particularly when the weak force is in action, Nature cares about the direction in which things happen, and a reaction open to left-handed electrons can be totally blocked for their right-handed counterparts.

With particles spinning in their direction of motion (clockwise) being right-handed, and those spinning against the direction of motion being left-handed, polarized particles provide a powerful probe of these effects.

Thus polarized beams are a major goal in electron-positron colliders. In conventional storage rings, orbiting particles become transversely polarized due to radiation emission – for example, polarizations of about 40 per cent were observed at 29 GeV at KEK's TRISTAN ring (December 1990, page 11) and 10 per cent at 50 GeV at CERN's LEP (November 1990, page 3). But this effect depends strongly on machine parameters and is difficult to control.

In contrast, in a linear collider such as JLC, once polarized electrons are injected, the spin could be maintained through to an interaction point, provided depolarizing effects are avoided. Thus a key requirement is a highly polarized electron source.

The conventional source is bulk gallium arsenide with a negative electron affinity surface, illuminated by circularly polarized monochromatic photons from a laser. But the polarization obtainable this way