what of electron-proton collisions? TRISTAN Project Director Satoshi Ozaki points out that with HERA now being built at the German DESY Laboratory to supply 820 GeV protons and 30 GeV electrons, KEK prefers to leave this option alone for the moment.

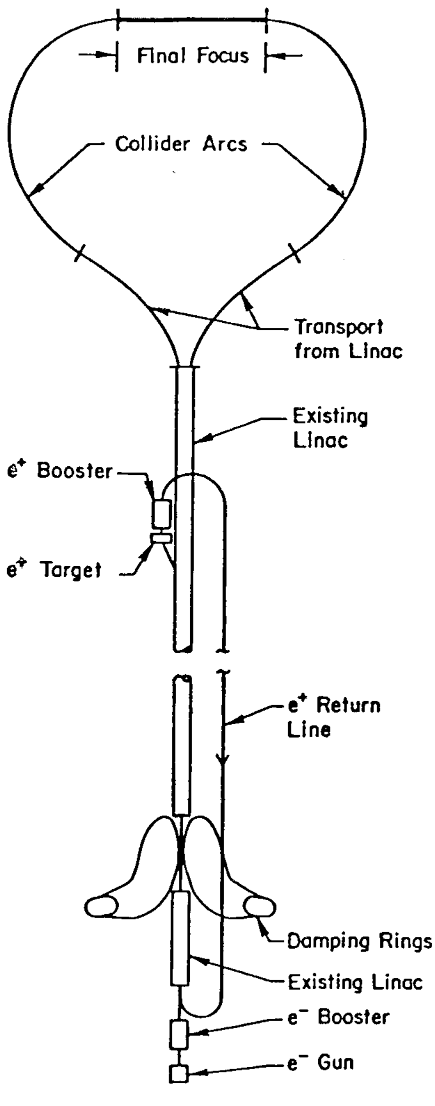
But there is plenty of room at KEK for the options originally foreseen for TRISTAN. The large cross-section Main Ring tunnel is big enough to house a proton ring of several hundred GeV.

By Gordon Fraser

Stanford's Linear Collider

The peak of the construction phase of the Stanford Linear Collider, SLC, to achieve 50 GeV electron-positron collisions has now been passed. The work remains on schedule to attempt colliding beams, initially at comparatively low luminosity, early in 1987.

The tunnels are completed where the magnet arcs, which will guide the electron and positron bunches from the linac into collision, will be installed; construction of the hall for the experiment detectors is well advanced. Most effort during the summer months has been going into the refurbishing of the linac with new beam monitoring instrumentation and controls. Installation of all the more powerful (50 MW) klystrons may not be complete by early '87 but a full complement is not needed to reach 50 GeV. One of these klystron tubes was recently run to 110 MW without failure to test maximum available power. The required operating power of 50 MW therefore looks comfortable but there is not yet enough experience to be able to estimate the average lifetime of these new klystrons. In a SLAC/Japan collaboration, a tube to reach 130 MW has been developed.



Schematic of the Stanford Linear Collider, SLC. The upgraded electron linac of the Stanford Linear Accelerator Centre will produce positron beams which will be brought back for acceleration through the linac. Pulses of electrons and positrons will be moulded to high quality in the damping rings, accelerated along the linac to 50 GeV, sent through opposing arcs and collided. The construction and commissioning schedule aims for colliding beams in February 1987.

By May of next year it is intended to start commissioning the linac systems (electron and positron bunch creation and acceleration). Already electron bunches of the desired intensity (5×10^{10} particles) and high quality have been achieved at the end of the first sector of the linac. The 'South Damping Ring' has stored 4×10^{10} particles in a single bunch but there are some problems with the magnet field quality and it has been decided to rebuild the South Ring. The North Damping Ring is due for completion in January of next year and the reconstructed South Ring should be ready a month later.

The commissioning schedule aims to achieve beams of the required quality at the end of the linac, ready to be fed to the SLC magnet arcs, by October 1986. The subsequent three months to the end of next year would then be available for the tricky manoeuvres attempting to bring the micron size beams into collision. The Mark II detector will be installed at the SLC in January 1987 to begin physics the following month, if all goes well.

The initial luminosity is not expected to exceed 5×10^{28} per cm^2 per s, which is 1 % of the ultimate design aim. Nevertheless, even at this level, Mark II could see some twenty thousand Z^0 events in the five month physics run planned until June '87. By 1989 it is hoped that the design luminosity of 6×10^{30} will be reached but the SLC physics potential could then be swamped by the advent of LEP at CERN. One advantage that the SLC programme could retain is that polarized beams may be available for acceleration by the time LEP comes on – it is hoped to start the development programme to implement polarized beams during the next year.

By 1989 also (if construction funds are assured) the Stanford Linear Detector, now being built by a collaboration of some 120 physicists, could be ready to take over from Mark II with more sophisticated detection techniques. It has been designed for 98 % of the solid angle around the collision region with identical instrumentation in all directions. The SLD will have a CCD charge coupled device (see June 1982 issue, page 179) vertex detector. This is feasible because of the very small beam pipe at the collision point and because of the pulsed nature of SLC operation which will give enough time to clear the CCDs before the next collision pulses arrive. This vertex detector should be capable of 5 micron resolution in three dimensions. Drift chambers form the next layer of the detector and recent tests have achieved a spatial resolution twice as good as anticipated. This has been a satisfying development since the better resolution will compensate for the decision to change from a superconducting to a conventional detector magnet (giving a 0.6 T field in the detector central volume), restoring the detector resolution announced in the design proposal.

The next layer is Cherenkov ring imaging detector (CRID or RICH in CERN parlance), followed by liquid argon calorimeters, the magnet coil and muon detectors. The hope is that the SLD will be ready to have a first spell in the beams early in 1989 for 'shakedown' and will share time on the SLC with the Mark II detector for some six months before taking over completely. For this reason as many services (cryogenics, electronics, etc.) as possible are being built onto the detector itself so that the SLD can roll in and out of the beams with ease.

With the higher energy collider on the horizon there is obvious concern for the future physics programme of the existing 15 GeV PEP electron-positron storage ring. A Workshop was held to define areas of interesting physics with a higher PEP luminosity and as a result the Laboratory has decided to go ahead with an improvement programme for PEP known as 'Mini-Beta'. Just how this would be implemented depends on the experiments which are proposed and for this reason a call for 'letters of intent' was circulated to the physics community in June. It seems likely that the collaboration now working on PEP with the 'Time Projection Chamber' will propose experiments. The TPC took longer than expected to bring into action but it is now working well – in fact so well that other collaborations may not be eager to be in competition on the upgraded PEP.

Beyond this stage there are thoughts about using PEP as a synchrotron radiation source in the venerable tradition established by its predecessor, the SPEAR electron-positron storage ring. An undulator has already been installed in one of the PEP straight sections to extend research with light beams to the sub-angstrom range. Undulators, as opposed to 'wigglers' which the Stanford Synchrotron Radiation Laboratory, SSRL, launched on the world (and of which their latest 54 pole version is so intense that it could be used as a welding torch!), have only a narrow wavelength tuning range. The PEP version has therefore been made as a 'multi-undulator' so that wavelengths can be switched. A second synchrotron light installation on PEP is being planned. It may be that the use of PEP for synchrotron radiation will be extended to some 25 per cent of operating time by 1987.

The SSRL is now studying how effective PEP could be as a synchrotron radiation source when PEP particle physics fades in importance. They are also participating in the various studies going on in several Laboratories in the US to design a 6 GeV dedicated synchrotron radiation source.

By Brian Southworth