capture section in the injector and ten 1 m 20-cell cavities behind it – are made of niobium metal and are of a now standard design.

However in contrast to the cavities now being used or introduced in high energy electron machines throughout the world, the S-DALINAC cavities are operated at a higher frequency (2997 MHz) and a lower temperature (2K, using supercooled liquid helium). The high frequency and thus small cavities result in a very economic cryostat and a slim accelerator.

The S-DALINAC delivers a continuous (c.w.) beam current and, with the continuous variation of input power in the injector and the recirculating linac, a wide range of beam energies (2-130 MeV), while beam currents and their time structure can be varied to suit different needs.

For nuclear physics experiments beam currents of 20 microamps with a bunch spacing of 334 ps are available, while average beam currents of 60 microamps are used to drive the infrared FEL (tunable between wavelengths of 2.5 and 5 microns). In the latter case the electron bunches are 100 ns apart, corresponding to a 10 MHz repetition rate. Peak current in the bunch is then as high as 2.7 A.

Increased reliability and stability have resulted from recent developments including the use of new high purity 20-cell niobium cavities manufactured at Dornier, Friedrichshafen, and tuned for high field flatness at Darmstadt. These cavities are operated with accelerating fields well in excess of 5 MV/m.

Furthermore, a microprocessor-controlled radiofrequency system to operate these cavities has been constructed. Tuners with magnetostrictive elements integrated into the r.f control have been developed and are now used routinely with all cavities .

The accelerator has so far been operated for 2600 hours with low energy beams for nuclear physics and channeling radiation experiments. These studies are continuing with higher energies, while the FEL facility, whose undulator is now in place, is also being put through its paces.

The main accelerator development programme will concentrate on bringing the machine up to higher energies, in gaining long-term operational experience and in testing new superconducting cavity types for very high energy superconducting accelerators in the context of the TESLA (TeV Energy Superconducting Linear Accelerator) collaboration (April, page 16).

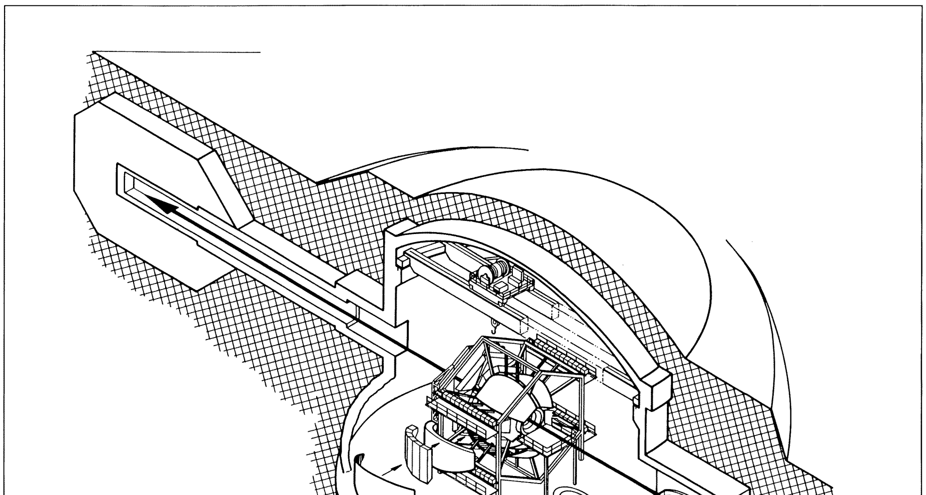
A 9-cell 5 GHz cavity fabricated at Cornell and finished at Wuppertal will soon be installed and tested with electron beams. Since the Darmstadt accelerator can provide true c.w. beams with narrow and large bunch spacing both with and without a superimposed macrostructure, a 'collider-like time structure' of the beam is possible.

CEBAF
First experimental equipment

The Continuous Electron Beam Accelerator Facility (CEBAF) under construction in Newport News, Virginia, has ordered its first major piece of experimental equipment: the superconducting toroidal magnet for the CEBAF Large-Acceptance Spectrometer, CLAS.

This large instrument will detect multiparticle final states in nuclear physics experiments in one of CEBAF's three experimental halls. Six

First experimental equipment to be ordered for the CEBAF electron accelerator under construction at Newport News, Virginia, is the Large-Acceptance Spectrometer.



superconducting coils arranged symmetrically around the beam beamline will generate CLAS' magnetic field.

The $6.54 million contract went to Oxford Instruments of the UK. Eight experiments for CLAS have been approved, with another six conditionally approved.

Equipment procurement is also advancing for the other two CEBAF halls, one to have a pair of high resolution spectrometers, the other a high momentum spectrometer with complementary instrumentation. The halls themselves are half finished.

BROOKHAVEN RHIC intent

With construction of the Relativistic Heavy Ion Collider (RHIC) imminent and its physics programme expected to start in 1997, a call for Letters of Intent for experiments was issued last year.

Nine letters were submitted by collaborations from over fifty universities and research centres, represented by over 300 researchers from the US and abroad. The proposed detectors varied in their scope and physics focus, but all were designed with high segmentation to cope with the 10,000 or so secondary particles expected from each collision of gold nuclei at 100 GeV per nucleon per beam.

Such segmentation, and bunch crossings every 114 nanoseconds, put high demands on the density and speed of the readout electronics. The detectors also aim to utilize RHIC's flexibility to accelerate ions ranging from the light (protons) at 250 GeV to the heavy (gold) at 100 GeV per nucleon, and colliding different beams at several energies.

These detectors will provide the first look at the new domain of extreme nuclear densities that is RHIC's hallmark. Each is designed to focus on multiple indicators of the formation of the long-awaited quark-gluon plasma (QGP) and the liberation of quarks from their confinement inside hadrons. These heavy ion collisions are expected to approximate to the conditions of the microsecond following the Big Bang, thus providing a new link between particle physics and cosmology.

The Letters can be grouped in three broad categories – electron and photon detectors augmented with tracking for hadron identification, tracking detectors that stress particle production spectra, and one muon detector.

Three letters belong to the first category. TALES, proposed by a Japanese-led collaboration, plans a two-arm photon and hadron spectrometer with two conventional dipoles for momentum analysis, time projection chambers for tracking, electromagnetic calorimetry for photon and electron detection, and ring-imaging Cherenkov counters augmented by time-of flight counters for particle identification. The detector aims to pick up electron pairs, a good probe of the quark-gluon plasma since they are not prone to final state strong interactions.

The OASIS letter, submitted by a collaboration led by Columbia and Brookhaven, proposes a very large axial field spectrometer, possibly utilizing recycled magnet iron from the Gatchina cyclotron in Leningrad. The ambitious programme attempts to identify several quark-gluon plasma signatures simultaneously: a high resolution liquid argon calorimeter of novel design for electron and photon detection; transition radiation trackers, time-of-flight scintillators and Cherenkov counters for hadron identification and studies of jet production; and finally silicon strip as well as silicon drift detectors for vertexing and global event characterization. The detector is tailored to measure low mass electron pairs and high transverse momentum direct photons as well as jets.

The third letter in this category comes from a Stony Brook-led collaboration that uses a six-coil superconducting air toroid configuration with cesium iodide and lead-glass calorimetry of varying levels of energy and spatial resolution for electron and photon measurements augmented by transition radiation tracking detectors for electron and hadronic tracking, and silicon strip detectors for vertexing and multiplicity detectors. The emphasis again is on jet physics, direct photons and electron pairs at high transverse momenta.

The next group of letters emphasize hadron tracking and particle production spectra in both transverse momentum and angular distribution. A forward, variable angle spectrometer is proposed by a Brookhaven group, with septum dipoles, a time projection chamber for tracking, and Cherenkov counters to measure particle yields. The projected coverage extends from the very forward baryon-rich region well into the baryon-free region expected from quark-gluon plasma formation. The sought-for signatures are particle/antiparticle ratios as well as the relative yields of various quark flavours, such as kaon to pion ratios.

A complementary experiment, MARS, led by a group from MIT,