A. Chudakov, BUST is a four-storey underground building with floors and walls (eight planes in total) covered with 3150 scintillation detectors - about 300 tons of liquid scintillator. Using time-of-flight measurements in this multi-purpose instrument, upward neutrino-induced muons are separated from the usual (and 10^7 times more intense) flux of atmospheric muons.

Among the most important BUST results so far is an upper limit for the superheavy magnetic monopole flux. A new possibility for the veteran underground cosmic ray muon detector is the analysis of muon bundles whose multiplicities reflect the nuclear composition of the primary cosmic rays.

In the energy range from hundreds of MeV to tens of GeV per nucleon, the nuclear and even isotopic composition of cosmic ray primaries is directly measured by space- and balloon-borne detectors. The range 10^{14}-10^{16} eV studied by BUST is particularly important because it is the region of the well-known 'knee' - where the cosmic ray energy dependence changes sharply (see page 17). The analysis so far suggests unchanged primary composition compared with lower energies, with a variety of nuclei - 40% primary protons, 20% helium and 10% iron nuclei at a given energy per nucleus (for a given energy per nucleon these contributions are 94, 5 and $3x10^{-4}$% respectively).

For all theories of the origin, acceleration and propagation of cosmic rays, their composition with energy is of fundamental importance. However the measured value is an effective atomic number of nuclei in a wide energy range. The constant composition hypothesis is based on the suggestion that different groups of nuclei have similar energy spectra. There are serious doubts about the validity of this hypothesis, especially in the 'knee' region. If so, the muon bundles should be more detailed and an estimation of the energy of each event highly desirable. The Andyrchi array will do this by measuring the size of each extensive air shower accompanying the muon bundle seen by BUST.

This idea is not new. The Italian Gran Sasso underground Laboratory has the MACRO large underground muon detector and the EAS-TOP extensive air show array above it. MACRO is four times deeper and is sensitive to much higher primary cosmic ray energies. Thus the Gran Sasso and Baksan data will complement each other.

The third large Baksan facility is 'Kovyor' (Carpet), one kilometre away, but which eventually will be incorporated with the other detectors. With its large sensitive area (200 sq m), it will soon be upgraded with a 700 sq m muon detector. Then it will be able to measure the muon content of extensive air showers at large distances, with the core region being monitored by the Andyrchi-BUST tandem scheme.

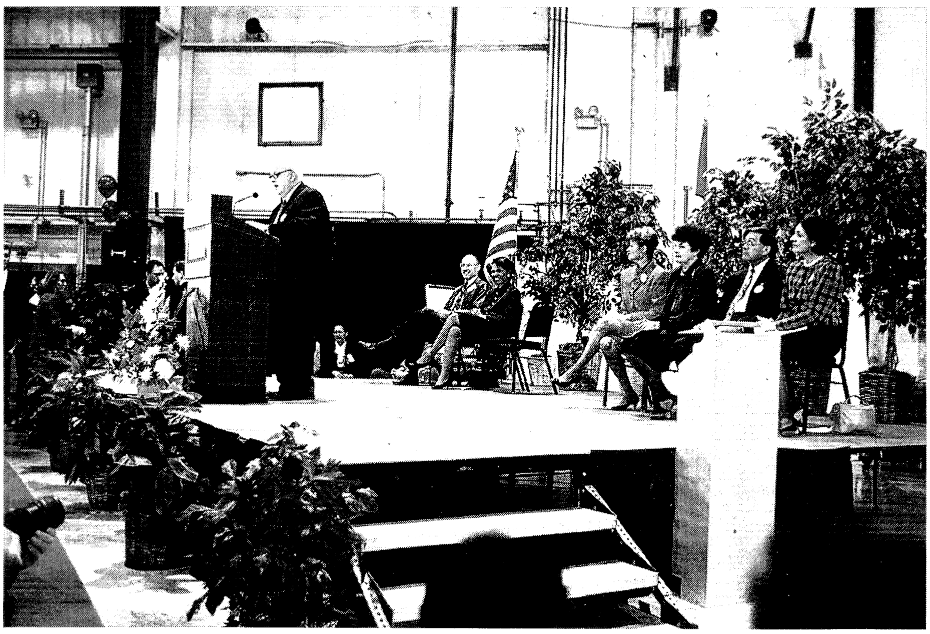
STANFORD (SLAC) B factory construction begins

At a ceremony marking the start of construction, members of the US Congress and Secretary of Energy Hazel O'Leary hailed the new Asymmetric B Factory as the key to continued vitality of the Stanford Linear Accelerator Center (SLAC).

Being built in collaboration with the Lawrence Berkeley Laboratory and the Lawrence Livermore National Laboratory, the B factory is a $177 million upgrade of the existing PEP electron-positron collider.

Scheduled for completion in 1998, the B factory will generate many millions of B mesons, allowing,

Below, Stanford Linear Accelerator Centre Director Burton Richter opens the inaugural ceremony for the SLAC/Lawrence Berkeley Laboratory/Lawrence Livermore Laboratory B factory, now under construction on the SLAC site. Seated behind him are (left to right) Project Director Jonathan Dorfan, Stanford Provost Condoleezza Rice, Secretary of Energy Hazel O'Leary, Senator Dianne Feinstein, and Representatives Norman Mineta and Anna Eshoo. (Photo Joe Faust)



B Factory Director Jonathan Dorfan briefs US Energy Secretary Hazel O'Leary on some details of the project. (Photo Stanford Daily)

among other physics, an intensive search for the phenomenon of CP violation in the decays of these particles.

The novel feature of this collider is the fact that electron and positron beams will circulate at different energies - 9.0 GeV for the electrons and 3.1 GeV for the positrons. For this, a second, positron ring is being added to the existing PEP storage ring, which will be refurbished to handle the much higher beam currents that will be used in the B factory, typically 1-2 amperes. The design luminosity of this collider is $3 \times 10^{33}\ cm^{-2}s^{-1}$.

The combination of higher luminosity and the asymmetric nature of the electron-positron collisions will permit a much more detailed study of CP violation than is possible at any existing collider.

The B Factory project emerged relatively unscathed from last summer's US legislative hiatus which voted down the SSC Superconducting Collider (December 1993, page 2). The B Factory project is now underway, with the first $14 million being spent.

A collaboration of over 300 physicists from a dozen countries is now developing a detailed conceptual design of a new B factory detector, estimated to cost about $60 million. Further details of both the collider and detector in forthcoming issues.

ORSAY Helium polarized electrons

At the beginning of the 1980s a group of atomic physicists from Rice University built a device producing polarized electrons for atomic physics. For preliminary studies for a possible European accelerator, Orsay's Institute for Nuclear Physics (INP) decided at the end of 1989 to take advantage of this work.

This new source is now operational. Very pure gaseous helium passes through a microwave cavity which excites and partially ionizes it. A very efficient Roots blower pumps this gas at high speed (some 100 m/sec). After the electrons and ions have been trapped on the walls, all that are left are metastable helium atoms (2^3S_1 state) mixed with helium atoms in the ground state. It is then possible, by optical pumping by circularly and linearly polarized light, to populate these metastable atoms in a spin state +1(↑↑) or -1(↓↓) passing through an intermediate level (2^3P_0). This light comes from a laser with a wavelength of 1.08 mm and a power of 5W built at INP.

In the subsequent stage a Penning reaction on the metastables releases polarized electrons:

$$He(2^3S_1)\uparrow\uparrow + CO_2 \rightarrow He\,(1S_0)\uparrow\downarrow + CO^+_2\uparrow + e^-\uparrow$$

This reaction, which conserves angular momentum, uses gaseous CO_2 because of its high chemical ionization rate.

As soon as they are emitted, the electrons are collected and formed into a beam by an electrostatic optical system and their polarization measured using a Mott polarimeter.

The Rice group had taken the transition through the 2^3P_1 level , very close to the 2^3P_2 level, which can be attained owing to the Doppler width and its depolarizing effect. Orsay's choice of the 2^3P_0 level , far from the 2^3P_2 level, makes it possible to employ a cheap and easy-to-use multimode laser.

INP has also built a small single-mode laser to measure the number of magnetic substates and hence the polarization of the metastable atoms. The polarization rate of the metastables is better than 90% and that of the electrons is about 85% for cur-