A solid chUNK of new physics

Delegates at last year's meeting at Protvino (Moscow region) reviewed the exciting prospects for experiments at the new UNK 3 TeV proton accelerator/collider now under construction.

Opening the International Workshop on the Experimental Programme at the future Serpukhov accelerator and storage complex (UNK), held at Protvino, Moscow Region, USSR, under the sponsorship of the USSR State Committee for Atomic Energy and of the Protvino Institute of High Energy Physics last year, Vice-President of the USSR Academy of Sciences A.A. Logunov reminded the audience that an important decision on the future of high energy physics in the Soviet Union had been made only a few months previously. The UNK project is now considered as one of the major government enterprises for the coming years, and will be strongly supported by the national industry resources (see January/February issue, page 3).

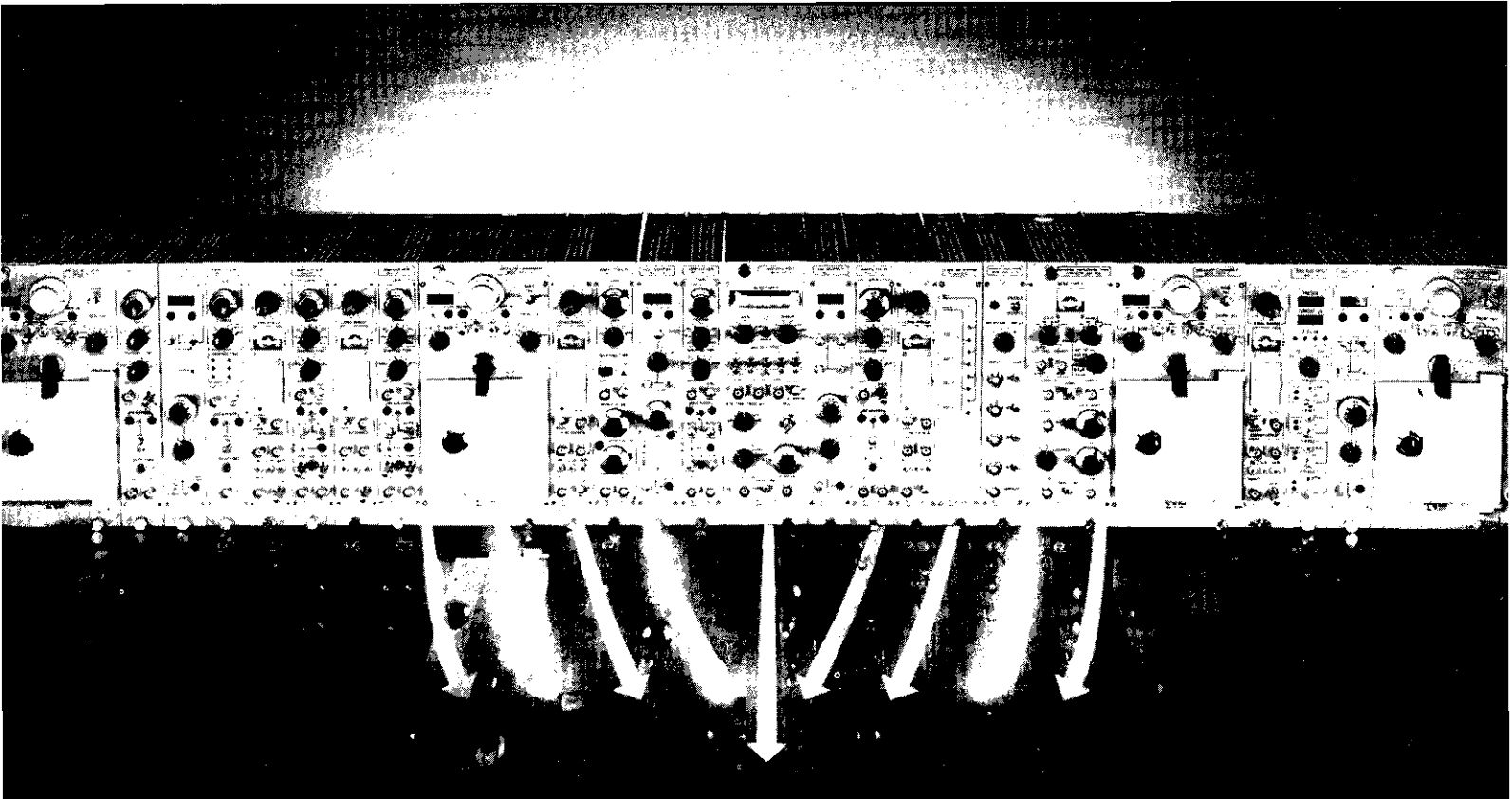
Logunov stressed that following these decisions the physics community should be ready for extracted beams from the superconducting 3 TeV (3000 GeV) machine in 1993, while the addition of a second ring would give 6 TeV total energy proton-proton collisions in 1995.

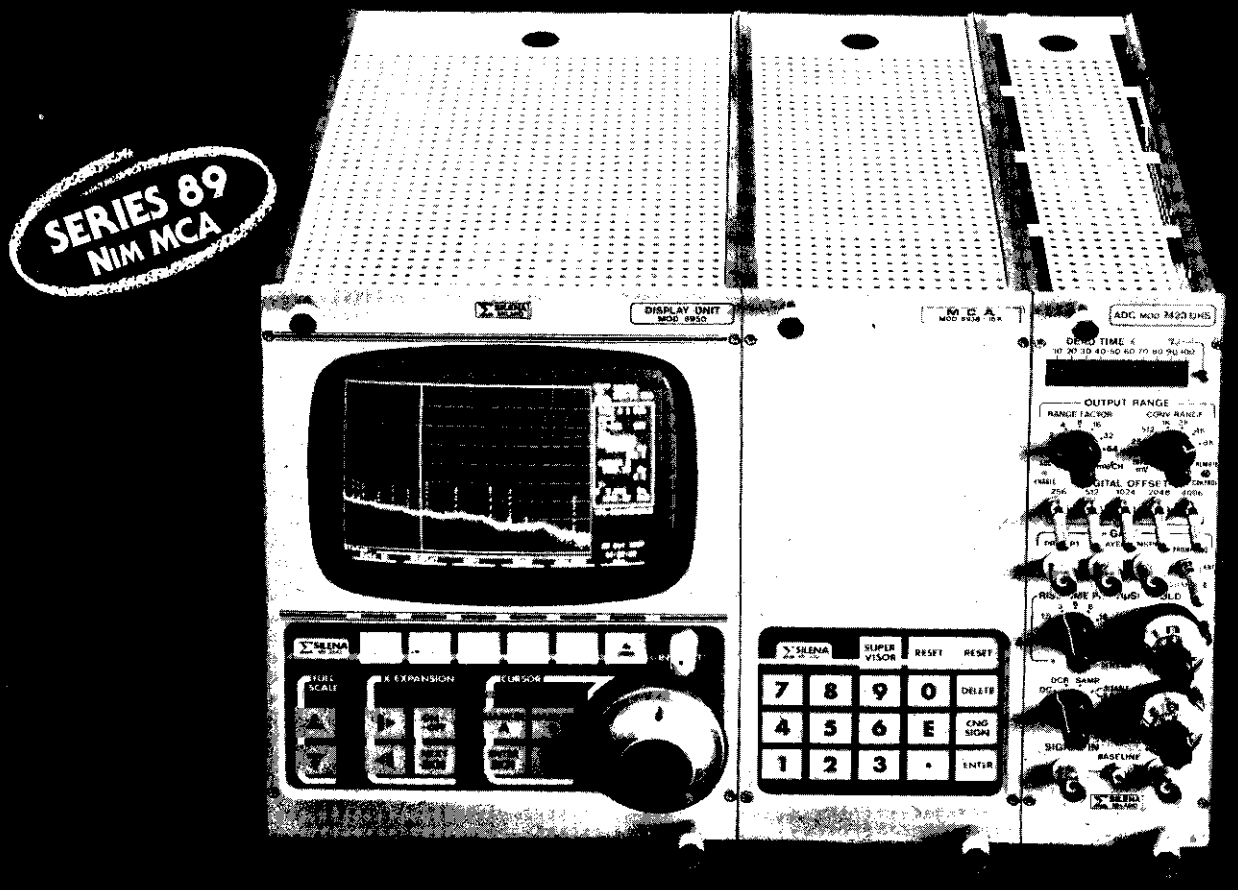
In addition, as soon as the tunnel for the UNK proton machine is ready, the construction team will start tunneling for the electron-positron linear collider on site close to Protvino. This collider will begin operations around 1996 at an energy of 500 GeV per beam, and will later be upgraded to 1 TeV.

The meeting was designed to update the international physics community on the UNK project and evaluate critically the main aspects of the research programme now being planned for the first years of operation. It was structured in three sessions, with theoretical, experimental and instrumentational aspects of the UNK research programme covered.

Machine structure and parameters as well as the status of the construction were covered by K.P. Myznikov.

Theoretical problems related to future experiments at UNK were discussed in several talks by members of the theory working group from the Protvino Institute of High Energy Physics. These included soft and semihard hadronic collisions (V.A. Petrov), composite structure of leptons and quarks (Yu. F. Pirogov), supersymmetry and superstring manifestations (A.G. Liparteliani), heavy quarks (S.R. Slabospitsky) and polarization phenomena (S.M. Troshin). Perspectives for TeV neutrino beams were reviewed by V.A. Tsarev (Lebedev Physical Institute). Almost all speakers were optimistic about UNK's potential for revealing new phenomena, even when competing





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with other hadron colliders.

R.D. Peccei and A. Ali from DESY looked for the challenges of fixed target physics at UNK. In their opinion, enthusiastically accepted, UNK may operate as a hadronic B-factory (for particles containing the sixth 'beauty' quark), opening the door to rare phenomena, in particular the CP violation in the B-sector (so far the study of CP violation has been limited to neutral kaons). G. Preparata (Bari) spoke on spin physics at high energies.

A number of experimental proposals were presented, and the discussion centred around the priority experiments expected to be ready when the new accelerator starts running. A jet-target technique is proposed for polarization experiments in the internal beam (presented by V.L. Solovjanov, IHEP). The intention is to use both the warm iron 400 GeV booster and the 3 TeV superconducting accelerator.

An extension of the current IHEP research programme in the study of gluon-gluon interactions was presented by Yu. D. Prokoshkin (IHEP). The proposed setup continues along the lines of the successful GAMS programme at IHEP and CERN which has recently discovered the G(1590) and X(1800) 'glueball' candidates. Discovery of the glueballs (particles composed of gluons rather than quarks) and the measurement of their spectrum are generally considered a key step in understanding how to apply quark-gluon field theory (QCD) at large distances.

The design for a new high-resolution wide-aperture multiparticle spectrometer for heavy quark studies was presented by A.M. Zaitzev (IHEP). This physics concentrates on B-particles, including the mixing of neutral B mesons and CP-violation studies. Ultimately, the experiment will run with beams of about 10^7-10^8 particles per second, using a sophisticated trigger.

A second proposal along these lines but with a special emphasis on the hyperon beam was presented by A.A. Vorobjev from Leningrad (Institute for Nuclear Physics).

The neutrino programme was the last in the list of fixed target experiments but took longest to discuss. An approach to use neutrino experiments as a tool to look for deviations from the currently accepted standard model was presented by V.V. Ammosov (IHEP) and S.A. Bunjatov (JINR, Dubna), and updated in comments by R. Leiste (Zeuthen, GDR), V. Khovansky (ITEP, Moscow) and I.A. Savin (JINR, Dubna), who concentrated on a search for new phenomena in the tau lepton sector.

A separate session was given over to experiments at the future UNK proton-proton collider at 3 TeV per beam and luminosity 4×10^{32}. S.P. Denisov (IHEP) and V.N. Roynishvily (Tbilisi)) had two complementary proposals aimed at different domains of collider physics. The first is a full solid angle calorimetric detector with precision tracking inside a superconducting solenoid to look for new behaviour in violent collisions, while the second, still exploratory, envisages a large streamer chamber surrounded by photon calorimeters.

The Workshop was complemented with detailed and very interesting review talks by L. Montanet, CERN (fixed target programme at CERN), R. Ruckl, DESY (physics at electron-proton colliders), R. Dixon, E. Knapp and T. Toohig (present and future particle physics in the United States).

The UNK meeting highlighted the high hopes that a new physics domain will be opened in 1993 with the start of the 3 TeV fixed target programme at UNK, while the subsequent provision of 6 GeV collision energies would be a unique research attraction.

From E. Kištenev