

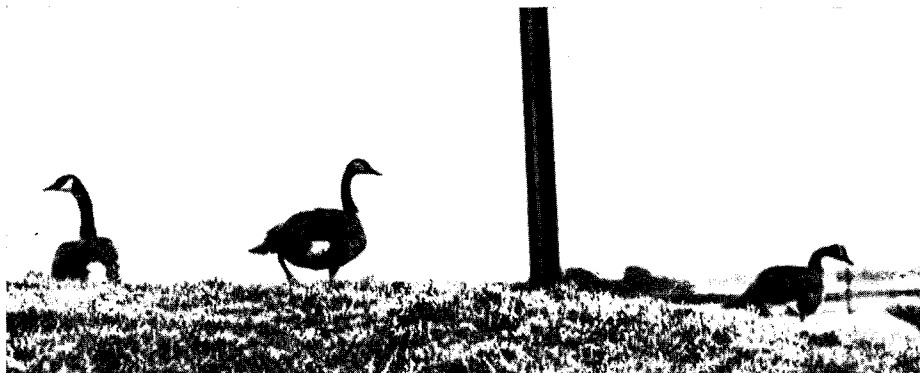
5. Some members of the buffalo herd at Batavia.

6. Comparative newcomers — three Giant Canada geese who are also making their present home at Batavia.

(Photos NAL)



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bison roamed the western plains of America, their number being estimated at around 20 million in 1850. Relentless hunting ate into this number until at one time it had reached a crisis figure of around 550. Preservation efforts have redeemed this situation and the present population is tens of thousands — some of them are alive and well and living at Batavia.

Recently they have had animal competition. At the end of last year, ten Giant Canada geese (note the international collaboration) were brought to make their home at the NAL site. The bird is native to Illinois, where it returns for the breeding season, and it migrates as far North as the Arctic Circle. The geese have a powerful homing instinct and return to the area in which they were hatched to build their own nests. Thus the birds hatched at NAL this spring may well be regular visitors in the winter and spring months to come.

Like the bison, the Giant Canada was in danger of extinction some years ago. An Illinois committee has been set up to supply geese to enthusiasts who agree to protect and nurture the birds. In providing such a home, NAL hopes that flocks of other species of bird might decide that what suits the Giant Canada suits them and might also visit the site during their migratory manoeuvres.

To conclude this article on non-machine aspects of life at Batavia we will mention a topic which should not perhaps figure under a heading 'Lighter side' because its importance in modern American life would be difficult to exaggerate. Another of the policy statements of the Laboratory is 'to seek the achievement of its scientific goals within a framework of equal opportunity and of a deep dedication to the fundamental tenets of human rights and dignity'.

This policy has been pushed hard both in dealings with manufacturers of machine components (opening factories to the negro population) and inside the Laboratory (where special programmes have been implemented to train members of minority groups from the Chicago area for skilled jobs).

In the May issue we may well be back with the accelerator for the last magnet rolled into the main ring on 16 April.

DUBNA Experiments

The size of a pion

At the Serpukhov 76 GeV proton synchrotron, an international group of scientists is studying pion-electron scattering, following a proposal by Dubna physicists. Those taking part include Soviet, Polish and Rumanian physicists from Dubna, physicists from Serpukhov and American physicists from the University of California at Los Angeles.

The aim is to determine the dimensions of the pion. Similar attempts have been made in the past but either the measurements were carried out at an energy level which was too low to produce a significant result, or the analysis of the data was inconclusive.

In the Serpukhov experiment, pions with a momentum of 50 GeV/c scatter on electrons as they traverse a hydrogen target. Due to the high energy of the particles, the momentum transfer can be very high and the experimental result could give a value for the pion radius accurate to within a few per cent. Eighteen magnetostrictive wire chambers are used to record the particle trajectories, hopefully picking out sparks 1 mm apart. The accuracy with which the particle momentum is measured would then be as high as

The detection equipment for studying the regeneration of short-lived neutral kaons from the long-lived variety, set up in the experimental hall of the 76 GeV proton synchrotron at Serpukhov. The decays into pions, occurring in the vacuum tube visible in the background, are recorded by the wire chambers.

0.2 %. The experimental equipment is in operation and the group is collecting data.

A popular model (vector dominance) predicts a pion radius of 0.64×10^{-13} cm. Unfortunately, this model also assumes that the pion radius is equal to the proton radius and yet the experimental value for the latter is 0.81×10^{-13} cm. If the preliminary data which have recently been obtained in colliding-beam experiments at Frascati

are confirmed, then the pion may prove to be a 'point-like' particle measuring much less than 0.64×10^{-13} cm. The experiment at Serpukhov hopes to contribute to resolving these conflicts.

Regeneration of neutral kaons

A group of physicists from Dubna are performing an experiment at Serpukhov to study the regeneration of

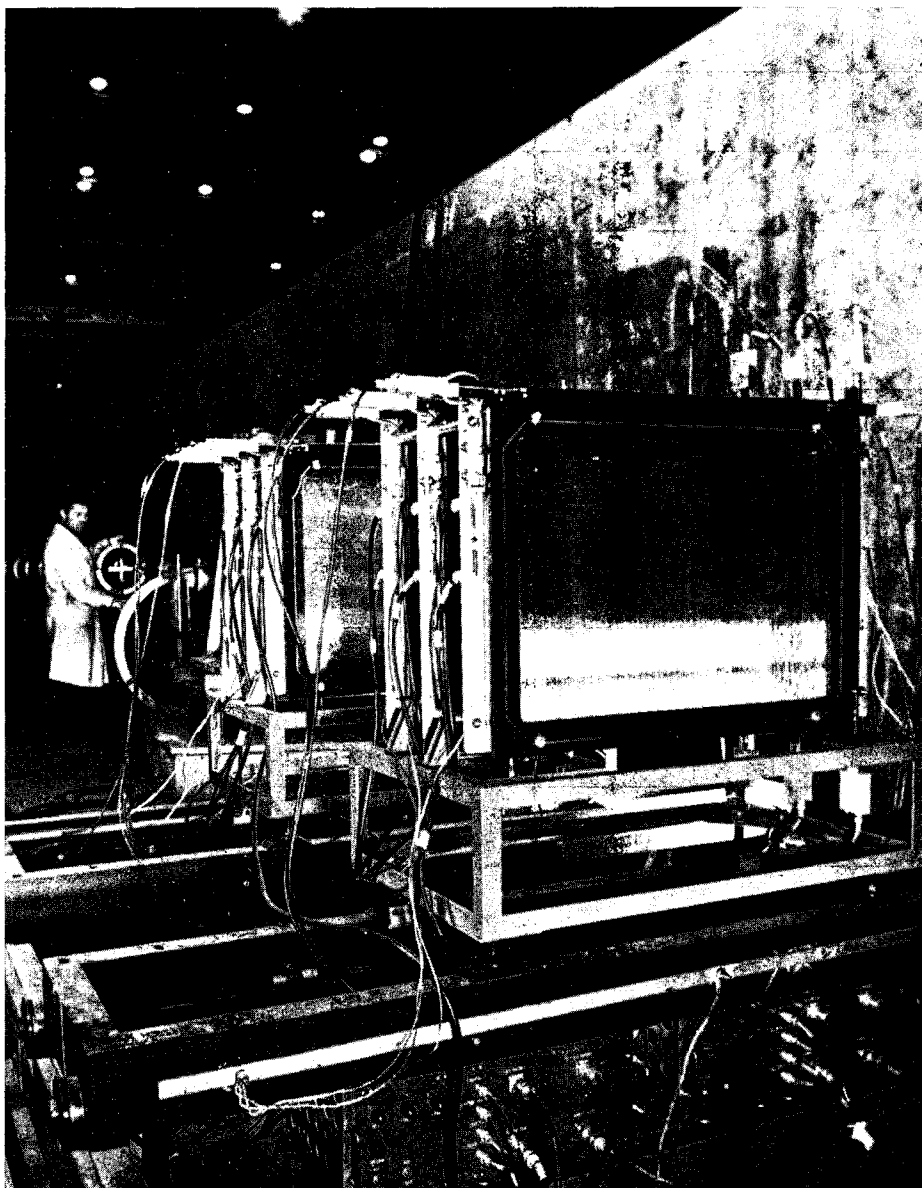
short-lived from long-lived neutral kaons on hydrogen over the energy range 10 to 40 GeV. A study of the regeneration at high energies provides a convenient way to investigate the behaviour of the amplitude difference of the $K^0 p$ and $\bar{K}^0 p$ interaction and to check the Pomeranchuk theorem. By studying the interference pattern which occurs behind the hydrogen regenerator and which is conditioned by the interference from the transmission and CP violation amplitudes, it is possible to investigate not only the energy dependence of the modulus of the amplitude difference but also the phase of the amplitude.

The experiment is being performed on a neutral beam coming off at 1° . The particle detectors record the two pion decays of the kaons occurring after the neutral kaons are passed through a 3 m hydrogen target. The detectors consist of a magnetic spectrometer, having 18 two-coordinate spark chambers with magnetostrictive read-out and an on-line computer, and 2 electron and 2 muon detectors for the identification of K_{e3} and $K_{\mu 3}$ decays. The experimental data are recorded on magnetic tape and undergo final processing at Dubna.

The equipment came into operation in July 1970, just before the Kiev Conference, and approximately 1000 kaon decays into two pions were recorded, giving a very preliminary set of results which caused quite a stir at the Conference since they were so different from what is expected. Another series of measurements was carried out in December and the group are now attempting to increase the statistics. At the same time, the analysis of the data obtained in the summer is being completed.

Negative pion-proton interactions

The total cross-sections of negative pion-proton interactions are being



measured at the Dubna 10 GeV synchrophasotron in the 4 to 6 GeV energy range with a systematic error not exceeding 25 microbarn.

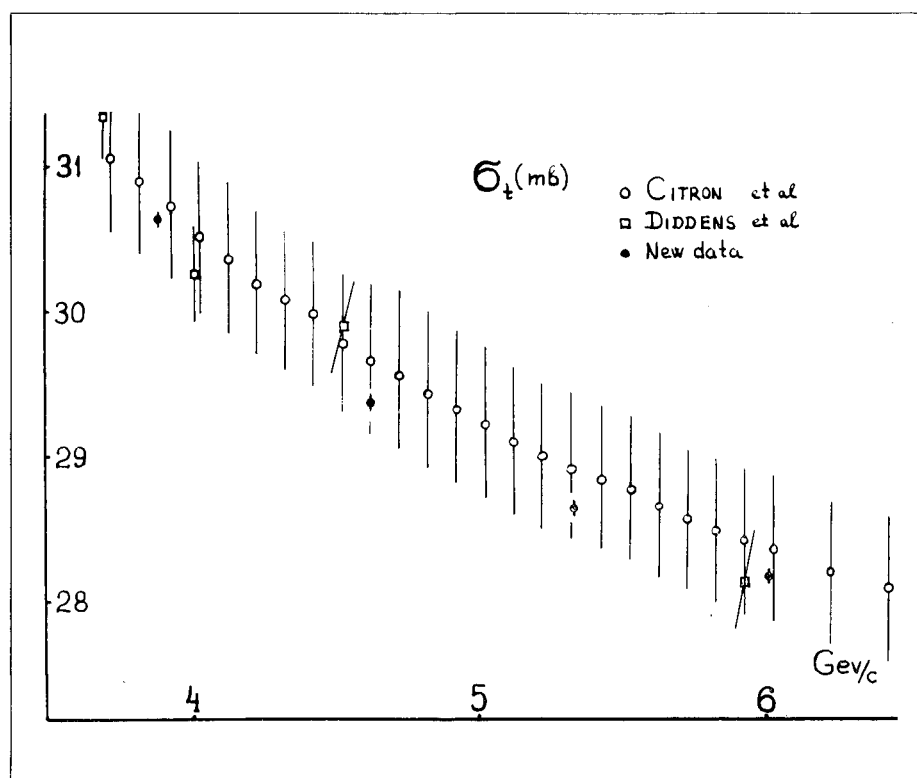
The work is based on a new method for measuring the scattering angle of particles from their Vavilov-Cherenkov radiation. The primary pion beam was determined by a self-collimating Cherenkov counter and the particles which traverse the scattering material without undergoing an interaction, or which are scattered at small angles, were measured by a Cherenkov hodoscope. The ring-shaped image of Vavilov-Cherenkov radiation was fixed in the hodoscope's focal plane by a system of diaphragms and mirrors. The maximum displacement was selected by a specially designed electronic instrument. The Cherenkov hodoscope ensured an angular resolution of 2.5 mrad and a resolution time of 100 MHz. A specially designed liquid hydrogen target having flat windows and with the hydrogen density stabilized to 0.04 %, was used as the scatterer.

The results of the measurements are shown in the graph and are compared with other data. The errors include systematic errors.

Element 105

This information concerning element 105 was written by V.A. Biryukov: In February 1970, G.N. Flerov's group announced that element 105 had been discovered at Dubna ('Spontaneous fission of the isotopes of elements 103 and 105', JINR P7-4932, 1970).

The work was carried out on the 310 cm cyclotron using an intense beam of neon ions (^{22}Ne) and a target of Americium (^{243}Am) to yield the heavy element 105. A study was made of the spontaneous fission of the new element. The angular distribution of the recoil atoms was studied to confirm the synthesis of an element with



$z = 105$. (This method had already been successfully used to confirm that a spontaneously fissionable isotope with half-life of 0.1 s belongs to kurchatovium, element 104, synthesized at Dubna in 1964.)

In later experiments, use was made of the formation mechanisms of the new spontaneously fissionable isotope with half-life 1.8 ± 0.6 s and it was shown that the atomic number of this isotope was 105.

Following the experiments to investigate spontaneous fission, the behaviour of the chlorides of element 105 was studied using gas chromatography. It was established that this element corresponds in terms of its physico-chemical properties to ekatantal (i.e. an element coming below tantalum in the periodic table and displaying similar chemical properties).

By knowing the life-time of the new element's isotope, it was possible to

make a very rapid study of the alpha-decay branch. It was shown that an isotope with a half-life of approximately 1.5 s emits alpha particles with an energy ranging from 8.9 to 9.2 MeV. The cross-section for the formation of the alpha-radioactive isotope of element 105 is approximately $2 \times 10^{-33} \text{ cm}^2$.

In April 1970, it was announced that element 105, with a half-life of 1.5 s, had been synthesized at Berkeley. The results obtained by the American physicists confirmed both the synthesis and properties of the new element. Flerov's group propose that element 105 be named after Niels Bohr.

TRIUMF Project progress

The 500 MeV cyclotron project, TRIUMF, being built at the University of British Columbia, Vancouver, Canada, has now reached the stage