Triumph for TRIUMF

As stop-pressed in our October issue, the Canadian federal government has offered 236 million Canadian dollars for the KAON scheme proposed for the TRIUMF Laboratory in Vancouver. This amounts to a third of the project construction costs, matching exactly the funding already offered by the provincial British Columbia government.

The KAON plan is for a high intensity particle beam factory, and would elevate Canada to a position in fundamental physics research in keeping with its place in the seven-nation 'summit' group. So far, Canadian scientists have had to make extensive use of research facilities elsewhere, while the international attraction of the TRIUMF cyclotron, operational since 1974, has waned over the years.

The special federal funding for KAON would be in addition to existing Science and Technology budgets. The federal Canadian and British Columbia governments are actively negotiating on the project, which would also involve additional operating costs for the Laboratory, estimated at about 100 million dollars annually.

The remaining one-third of the construction outlay is expected to come from international partners. An offer worth 75 million dollars from the US was already on paper in 1989.

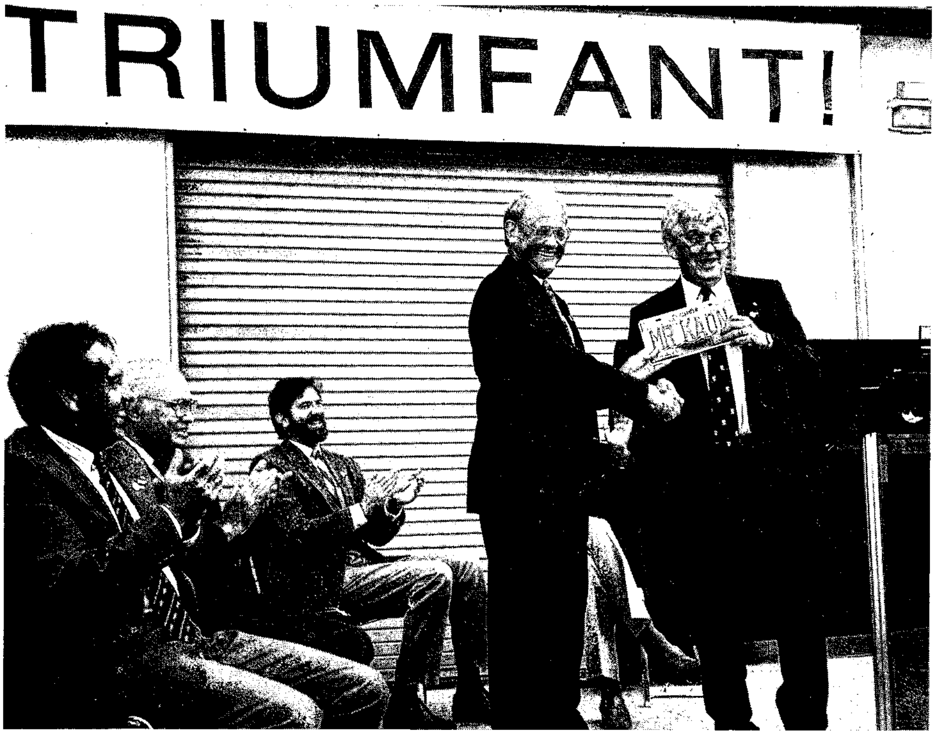
This international support could come in kind as well as cash. Major particle physics projects elsewhere have frequently benefited in this way – CERN and the USSR have a long history of mutual help, while most recently the HERA electron-proton collider now being commissioned at DESY in Hamburg includes major hardware and manpower contributions from abroad. Canada was one of the first nations to offer such support for HERA.

The KAON scheme envisages using the existing TRIUMF 500 MeV cyclotron as injector, with beams subsequently passing through a series of five rings – two fast-cycling synchrotrons interleaved with three d.c. storage rings – to finally deliver the required 100 microamps of 30 GeV primary protons.

Thus the cyclotron would first feed Accumulator and Booster rings sharing a common tunnel, with particles subsequently passing into Collector, Driver and Extender rings in a 1070-metre circumference tunnel.

This scheme would boost available particle intensities by a factor of about a hundred, and the result-

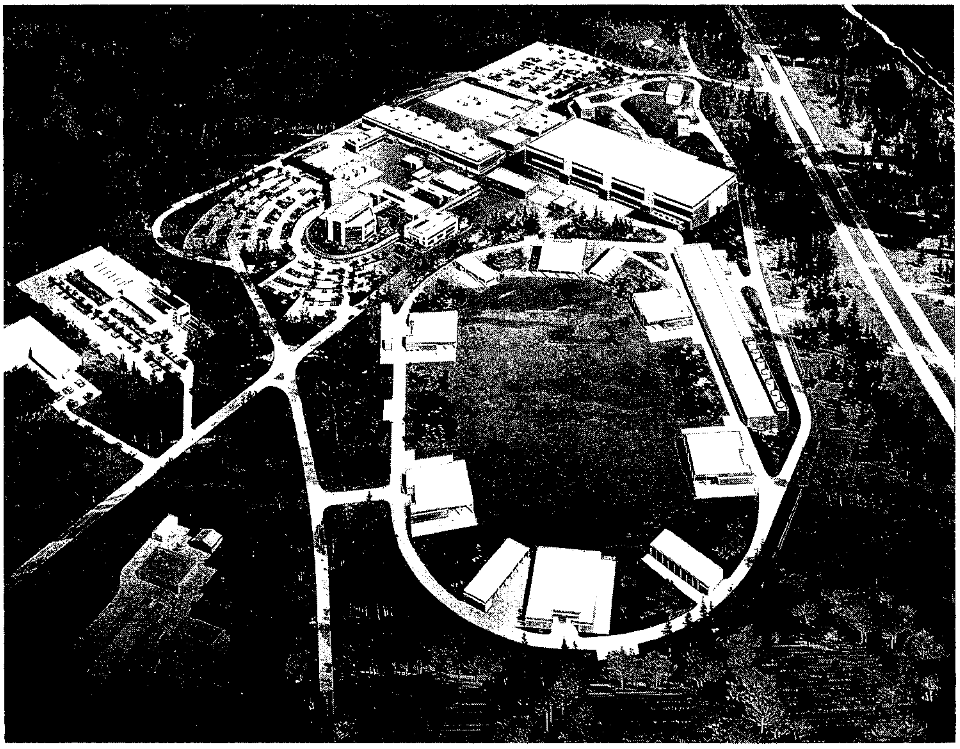
Erich Vogt, Director of the Canadian TRIUMF Laboratory in Vancouver, has been an indefatigable driving force behind the KAON project.



British Columbia Education Minister Stan Hagen, a long-time backer of the KAON project, receives his 'MR. KAON' licence plate from TRIUMF Director Eric Vogt.

ing physics opportunities, covering a broad front, have been examined at an international series of workshops.

Kaons are not the only particles on the KAON menu – the name being an acronym for Kaons, Antiprotons, Other hadrons, and Neutrinos.



Proposed layout of the KAON particle factory at the Canadian TRIUMF Laboratory in Vancouver. The Canadian government has offered a third of the construction money, the regional British Columbia administration another third.

Needles in high-speed haystacks

The new generation of big proton-proton colliders now being planned in Europe and the US aims to open up the collision physics of the constituent quarks and gluons hidden deep inside the proton. Locked inside nuclear particles, quarks and gluons cannot be liberated as free particles, at least under current laboratory conditions. To study them needs microscopes the size of the LHC collider foreseen for CERN's 27-kilometre LEP tunnel and the 87-kilometre Superconducting Supercollider (SSC) planned in the US. But the researchers using these gigantic new microscopes have to have good eyesight – they need the right detectors.

Seeing things this small needs collision energies of some 1 TeV (1000 GeV) per constituent quark/gluon, or at least 15 TeV viewed at the proton-proton level. Most of the time, the collisions would be 'soft', involving big pieces of proton, rather than quarks and gluons. To see enough 'hard' collisions, when the innermost proton constituents clash against each other, physicists need very high proton-proton collision rates.

These rates are measured by luminosity. (The luminosity of a two-beam collider is the number of particles per second in one beam multiplied by the number of collisions per unit area of the other beam.) For LHC, luminosities of up to a few times 10^{34} are needed.

Quite apart from the challenge of delivering this number of high energy protons, having such intense beams continually smashing through physics apparatus makes problems for detector designers.

As well as quickly wearing out detector components, these conditions imply new dimensions of data handling. Proton bunches would sweep past each other some 60 million times per second, each time producing about 20 interactions of one kind or another. Only one in a billion of these interactions would be of the hard kind which interests the physicists, and the instrumentation and data systems would have to filter out interesting physics fast enough to avoid being swamped by the subsequent tide of raw data.

It is as though a passenger in a train, watching haystacks flash