

and rapid initial loss of protons was observed, indicating that the cause of the loss was strongly dependent on the intensity.

Drawing on ISR experience, it looks as if the presence of electrons from the ionized gas is a likely source of the beam loss. There are no clearing electrodes to pull the electrons out as there are in the ISR and it is known that they can have a stronger effect than the scattering. Another pointer in this direction is that a bunched beam should show less intensity dependence (since the electrons have time to leak away between bunches). This was confirmed and even a 4×10^{12} beam had a lifetime of $2\frac{1}{2}$ hours when bunched.

This first look at the Super Proton Synchrotron as a Super Storage Ring looks good. The performance is already not negligible and at least the dominant causes of the beam losses seem to be understood.

Meanwhile, not to be outdone by the newcomer, CERN's old machines were also showing their paces. During a machine development run on 31 March, Ring II of the ISR topped a 40 A current, for the first time. This followed a period of PS/ISR collaboration which achieved high longitudinal phase space density of the beam.

The ISR uses such runs to find the 'vacuum limit'. The current is increased until beam induced pressure bumps (see November issue 1972, page 361) cause the beam to blow up and be lost. This tells the vacuum people where their weakest points are in the rings. In the run at the end of March the current climbed to 41.1 A before blow up occurred. The beam conditions were not suitable for physics runs but it is, nevertheless, a milestone for the ISR to have doubled the 20A design current.

From 14-21 September the second session of the Workshop on Future ISR Physics will be held at CERN. The first part, with some 40 participants, will be devoted to detailed studies relevant to

the future possibilities at the ISR and the last three days will be discussion meetings for a larger audience. Physicists interested in contributing to the Workshop can communicate their field of interest to B.G. Pope at CERN.

New fire detection technique

Insurance company statistics show that some 30 per cent of all fires are of electrical origin, so that in an environment like a scientific laboratory where a great deal of electrical apparatus is in use, an efficient system of fire detection is necessary.

With electrical installations, the main problem is to detect the potential fire hazard well before insulation begins to deteriorate and the risk increases as short circuits occur. Existing methods of fire detection usually depend on the detection of smoke, flames or high temperatures, but in an electrical installation the insulating material could well have been damaged by the time the fire is detected.

A new method of fire detection has been developed at CERN by A.H. Pietersen after the damaging cable fire at the PS in 1975. It uses an easily detectable gas which is liberated at a low enough temperature to ensure that the insulating material does not have time to ignite. The ideal detection temperature is around 70°C , intermediate between the maximum operating temperature of the cable (50°C) and the temperature at which the insulating material smoulders (90°).

The CERN solution is to use $120\mu\text{m}$ diameter gelatin microcapsules containing liquid freon. When the internal vapour pressure exceeds the critical value as the temperature increases, the microcapsules burst, releasing the easily detectable freon. (The popping sound of the bursting capsules could also be picked up by a cheap microphone.) The microcapsules can

either be scattered on cable arrays directly, or mixed with paint.

FERMILAB Multiparticle spectrometer workshop

A Workshop on the Fermilab Multiparticle Spectrometer Facility (MPS) was held on 4-5 March. This facility, located in the Meson Area, was designed and built by a collaboration of physicists from Cal.Tech / Fermilab / UCLA / Illinois / Indiana. It has been used in an experiment on hadron jets and is now in operation, with a slightly modified configuration, for studies of several exclusive channels.

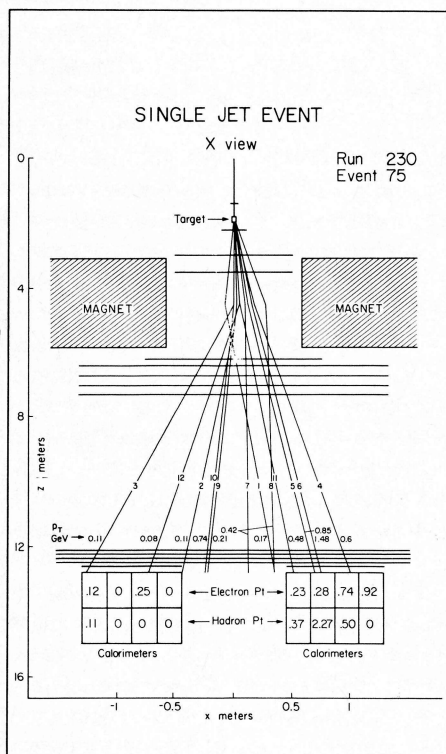
The Workshop convened to examine the physics potential of the MPS based on operating experience, to explore how well second generation experiments can utilize the capabilities of the present facility and to discuss possible improvements.

The spectrometer is built around a superconducting magnet with a 0.6m high aperture and a maximum p_t kick of $750\text{MeV}/c$. Charged particles emerging from a hydrogen target upstream of the magnet at angles out to about 150mrad are analysed by the magnet and track chambers. In the hadron jet configuration, the MPS is triggered by two large downstream calorimeters. Each module has a lead scintillator front section (for electromagnetic showers) and an iron scintillator back section (for hadron cascades). These calorimeters can trigger the apparatus on a jet, defined experimentally as a cluster of high p_t particles. Track chambers interspersed through the apparatus give charged particle trajectories while several large multicell atmospheric Cherenkov counters are used for mass identification of emerging particles.

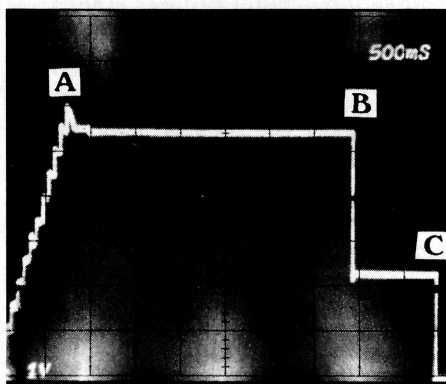
There is also a cylindrical proportional wire chamber and a 24 segment

1. A single jet event recorded in the Fermilab multiparticle spectrometer (MPS). A Workshop was held in March to discuss the future use of this facility.

2. Beam intensity trace at the Fermilab synchrotron during double pulse extraction for neutrino experiments in the 15 foot bubble chamber. The 'staircase' pattern at A shows the increasing intensity during the injection of twelve pulses from the 8 GeV Booster. The intensity stays constant during acceleration and at B the first extraction takes place (7/12 of the beam) and at C, one second later, the remaining beam is extracted.



1.



2.

barrel shower counter surrounding the hydrogen target. Chambers line the magnet to select highly asymmetric double pion scatters. Test runs on the latest experiment were in progress at the time of the Workshop and the new configuration appears to be working well.

The physics results from the MPS were reported at the Workshop. The experimenters showed evidence for a coplanar double jet structure and

stated that the distribution in z (the fraction of jet momentum carried by individual charged particles) shows a striking similarity to that observed in lepton induced processes. The opposite side z distribution shows that the single particle (one high p_t particle trigger) and jet triggers balance transverse momentum in similar ways. This is expected in the quark picture but seems difficult to understand in the constituent interchange model. The experimenters report that the jet and single particle cross sections have a similar shape from 3 to 5 GeV/c but the jet cross section is over two orders of magnitude larger.

The particles in the jet naturally divide into three categories: (1) charged particles, comprising 57% of the jet momentum with a typical multiplicity of three into the calorimeter and a total observed event multiplicity of nine or above, (2) photons from neutral pion or other decays, comprising 30% of the jet momentum and (3) neutral hadrons. The possibility that the jet cross section is several orders of magnitude higher than the single particle cross section had been predicted in models which postulate that hadrons with large p_t come from the fragmentation of quarks in a hard collision between constituent quarks in the initial hadrons. No clear resonance signals are seen in the jet data.

Ideas for future experiments and improvements for the MPS are plentiful. Some of the topics discussed were charm searches, a study of multiparticle peripheral hadron reactions yielding forward neutral mesons, the use of nuclear targets, double V^0 physics (double kaons and double lambdas to high effective mass), and further study of hadron jets up to 400 GeV. Possible improvements for the MPS include replacing existing spark chambers with proportional wire chambers to increase the rate capability, larger aperture calorimeters and doubling the energy of the beam.

The meeting concluded with two rousing theoretical talks by Ed Berger (Argonne) and Steve Ellis (Washington) who challenged the Workshop participants with the many exciting physics possibilities they could envisage for the MPS or similar multiparticle detectors.

Double pulse test completed

A new mode of extracting beam from the Fermilab accelerator was tested on 4 March. It aimed to demonstrate the possibility of taking two neutrino experiment pictures in the 15 foot bubble chamber during each accelerator cycle with the chamber filled with a heavy neon-hydrogen mixture. This would substantially increase the number of neutrino events recorded without burning up the target (as can happen if all the beam is extracted at one time). It is, therefore, of great interest to the Laboratory's programme scheduling as well as to experimenters using the chamber.

The new approach has been under discussion for some time. The 15 foot was double pulsed successfully with a hydrogen fill about a year ago. Tests of other component systems had been made over the preceding weeks. The focusing horn on the Neutrino Line was tested in the two pulse mode. The 15 foot was again checked for the capability of getting clear pictures on two expansions less than one second apart. The Switchyard Group developed hardware for removing the beam from one half of the Main Ring's four-mile circumference with one pulse of the fast extraction magnet and the other half with a second pulse at the end of the cycle.

All the systems were put together for a six-hour operating period on 4 March. Two thousand pictures were taken and the results were satisfactory.