GENERAL COMMENTS ON THE USE OF PROTON STORAGE RINGS

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The CERN-ISR Users' Meeting in June, 1968, produced a number of rough experiment proposals. It is a matter of experience with previous machines that a large fraction of the successful experimental work, at least in the first few years of machine operation,is based on physics ideas advanced years before the start of experimental work. We therefore feel that the justification for the heavy investment of funds and manpower needed for a project of the magnitude of the 2 x 100 GeV proton storage ring at NAL must come from well-defined physics requirements as we see them now.

Simultaneously, it is probably an equally established fact that the design of experimental areas and major experimental equipment should be motivated by the requirements of actual experiment projects. We do not believe that it is wise to devise some super-general, large solid angle and high-resolution detection system and fashion our specifications to the beam intersection regions on such a concept. Such devices are being projected in conjunction with both the Adone e^+e^- storage ring and the CERN-IRS facility, but in the past, such purportedly universal devices have met with modest success and have rather limited the physicists who felt bound by the high investment to use the devices. We should therefore design the experimental area parameters according to the requirements of experiments whose importance is clear today, along lines which

incorporate detection apparatus feasible with present-day techniques.

In addition to the foreseeable there will no doubt be novel developments both in physics concepts and in technology applicable toward detection methods. We do not feel that this fact should lead us to change the above point of view, but rather should caution us to build as much potential flexibility into the entire system as we possibly can.

The classes of physics experiments given some attention at the CERN ISR meeting are

1) pp elastic scattering
2) particle survey
3) isobar production
4) high multiplicity work
5) quark (or new particle) search.

These classes comprise a vast amount of individual reaction studies. In particular, this is an obvious advance, in a quantitative way, into the field of 10,000 GeV target-at-rest physics which has been a very qualitative playground for cosmic-ray physics; the various fireball models, multi-Regge models, etc., of "ultra high"-energy reactions come into the range of well-defined (if laborious) experimentation.

One particular new particle search which was not expressly dealt with at the CERN meeting is the search for the "intermediate boson", the W particle contrived as the mediator of the weak interaction. In an accompanying paper, we look into some aspects of W experiments at the NAL storage-ring facility.

Another field which should not be ignored from the start is the use of the facility for reactions other than the pp-initiated ones.

This is possible in either of two ways:

(1) Acceleration and storage of particles other than protons (most easily feasible with deuterons)

(2) Injection of protons into the storage ring; subsequent production of secondaries at a stationary target, with selected reaction products clashing head-on into the stored proton beam.

It is not likely that either of these possibilities will be realistically pursued in the near future. An accompanying note nevertheless discusses some relevant features for n-p scattering.

The overall impression from discussions this week appears to be that experimentalists would like the following features to be incorporated into the design of machine and experimental areas:

1) Favor a design which uses "low-grade" beam intersection regions (beam pointing outward) for beam injection. This would have the "high-grade" regions available for experimentation. In the present design there are 3 low-grade and 3 high-grade intersection regions. We would have 3 good experimental regions, use 2 low-grade regions for injection, leave one unused.

2) Such a scheme may be modified if it turns out that small-angle pp elastic stationary makes a non-intersecting

interaction region highly desirable (see report by A. Krisch).

3) Provisions should be made for the possible use of C magnets instead of quadrupoles at the end of the drift regions of at least one intersection region. This would make experimentation at small angles much easier.

4) An intersection angle of 50 mrad is probably a good compromise. If we believe that the momentum transfer is the important parameter in high-energy interactions, this will leave the accessible region and attainable resolution roughly the same as at the CERN-ISR (intersecting angle of $\sim 15^{\circ}$).

In addition, we will certainly learn much more from the detailed studies presently conducted at CERN. There is another CERN-ISR users' conference coming up in the near future. We should certainly have our plans open to improvement suggested by CERN experience.