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INITIAL PROGRAM CAPACITY AT NAL

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July 25, 1968

This note will attempt to estimate the number of secondary beams initially needed at the accelerator. It is recognized that these beams may not all be available at turn-on, but the facilities for these beams should be part of the initial construction package. The point of view of this analysis will be to estimate the needs as an "experiment processing" problem. That is, to size the experimental facilities at NAL to the number of groups that need to be served over and above these that will be accommodated at other accelerators. No identification of specific beams will be made except that the gross number of secondary beams will be specified.

It is expected that most counter and bubble-chamber groups will intend to use the new accelerator. However, they cannot all be accommodated and consequently will continue to use other accelerators where they can get running time. As the experimental facilities expand at NAL, more groups will be able to use the accelerator. However, in spite of the development of more beams, it is unlikely that the backlog of proposed experiments will be appreciably reduced compared to present-day experience.

The point of departure for this estimate of secondary beams needed is an analysis of the present number of research groups, their composition and an extrapolation into the future. It is not possible to define accurately what constitites a group, but names of senior researchers occur to one after thinking about each university or institution. These researchers usually lead an experimental team although they often join other colleagues for certain experiments. Furthermore, some of the bubble-chamber groups are quite large and are usually composed of subgroups. In counting them, the larger groups are counted as several equivalent groups.

The result of this subjective analysis indicates that there are now 81 counter groups of which 45 were existing five years ago. Similarly, for the bubble-chamber groups 62 exist now and 34 existed five years ago. This gives a grand total of ~ 140 effective groups at the present time. An independent count of the number of experimental physicists in the country at the present time gives about 800 individuals. This indicates an average of six persons per group. One can see that the number of counters and bubble-chamber groups grew by 15% per year. It is hard to believe that high-energy physics research will enjoy the same amount of financial support it has had in the past, and a increase of 10% per year is assumed for the projected growth. This implies that there will be nearly 210 groups in five years. Furthermore, it is assumed that the present ratio of counter groups to bubble-chamber groups will be

maintained. It is realized that this ratio may change in the future, but the total number of groups will still remain to be accommodated by secondary beams regardless of detectors used. Consequently, there will then be ~ 120 counter groups and 90 bubble-chamber groups in 1973-1974.

The nature of data collection is quite different between counter groups and bubble-chamber groups. Experience has shown that a well-paced counter research program includes spending about 1/3 of the time operating at the accelerator, either setting up, testing, or data taking. Bubble-chamber researchers, however, use existing beams and detectors which involves only data taking. The actual film accumulation takes about 1/3 of the time needed by counter groups. That is, a typical bubble-chamber research group spends about 1/9 of its time running at an accelerator.

The viable existence of 120 counter groups in the future requires that 40 of them be able to occupy spaces at the end of beams at U. S. accelerators at any one time. Similarly, there is a need for 10 operating bubble-chamber beams and chambers in the country.

A subjective and personal count of the equivalent number of beams for counter experiments that are likely to exist at accelerators, other than NAL, in 1973, produced an estimate of 27 beams. Similarly, there will probably be eight bubble-chamber beams at accelerators other than NAL. Subtracting these number of beams from the overall number needed to satisfy the national demand for experimental facilities, yields an

estimate of the number of experimental beams needed at NAL. The residual number of beams that should be provided at NAL as part of the initial construction package are 13 counter beams and two bubble-chamber beams.

In conclusion, it is emphasized that this number of beams represents a lower limit to the experimental facilities needed for the initial research program at the accelerator. As time goes on, the number of beams and the addition of branches in existing beams will have to grow to accommodate the expanding needs for research outlets.