SCALING OF AGS OPERATING EXPERIENCE TO NEUTRINO EXPERIMENTS AT NAL

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ABSTRACT

AGS operating experience of the past several years projected to the time after the conversion indicates the 7-foot bubble chamber will have available $\sim 1 \times 10^{13}$ ppp for continuous operation. A parallel argument points to the possibility of continuous operation of the NAL 25-foot bubble chamber for neutrino physics when the accelerator reaches full intensity. This would seem to be a relevant factor in considering utilization of the 25-foot chamber for strong-interaction physics.

A program of strong-interaction physics in the 25-foot bubble chamber is tied to the availability of the chamber in view of the neutrino program for the chamber. Operation of neutrino experiments in the past has absorbed the entire intensity of the AGS because of the low event rates involved. If this condition prevailed at NAL, the rest of the experimental program would have to be turned off during the neutrino running time, providing a pressure to limit the duration and number of such experiments. The 25-foot chamber would then be available for substantial blocks of time for strong-interaction physics. Such items as visible-track targets in the chamber, hydrogen-neon mixtures, etc. could be planned relatively independently of the neutrino program.

The present canonical number for neutrino interactions in the 25-foot chamber is one event/pulse for 2×10^{13} interacting protons. From the not inconsiderable background problems and the problems of targeting, such intensities to operate at less than this would not be economically reasonable in view of film costs, etc. Even at 4×10^{13} ppp the chamber is not saturated with events, again from background.

The design intensity of the accelerator is 5×10^{13} with $> 99\%$ extraction efficiency. With such intensities available, even if the bubble chamber takes most of the protons, e.g., 4×10^{13} ppp as above, there is still the order of 10^{13} ppp available for use on target stations T_2 (and T_3 later on). If we may extrapolate from AGS experience, this will be adequate, certainly for testing counter setups and, with some exceptions, also for running the counter program.

The AGS has had the capability of accelerating $> 2 \times 10^{12}$ ppp for several years. In CY 1969 to date the average performances has been 1.7×10^{12} ppp, up from 1.5×10^{12} ppp in CY 1968. The intensity has been deliberately held down to hold radiation damage in the G-10 area to a tolerable limit. In addition, background problems in some experiments required that the intensity be throttled back even below the radiation damage limits. It was only in the last week of running before the present shutdown, when a capability was achieved of simultaneously targeting with a slow spill on the internal and external target stations, that the full capability of 2.4×10^{12} ppp could be used. Approximately 1.2×10^{12} ppp, the nominal limit set by radiation damage, was targeted on the internal target and $\sim 0.9 \times 10^{12}$ on the external target station. The remaining $\sim 3 \times 10^{11}$ was used up by the bubble chambers and by proton loss in the machine. Under these conditions, the data rate capabilities of most experiments on the floor were saturated.

If these numbers are at all indicative, it seems that with an accelerated intensity of 5×10^{13} ppp it would be possible, barring an exotic experiment requiring an extraordinary fraction of the beam at T_2 or T_3, to operate the 25-foot chamber continuously for neutrino physics without seriously perturbing the experimental programs at E_2 and/or E_3.

Under these circumstances, the strong-interaction physics program in the 25-foot chamber must be interleaved fairly tightly with the neutrino program. This would seem to indicate that such things as visible track targets, liquids, and liquid mixtures will have to be worked out to be compatible with both ν and S. I. P. requirements.