This “Report of the Review Committee” has been excerpted and translated from the original document (高エネルギー物理学研究所物理研究成果発表会報告書, 1981) written in Japanese. If there is any question in the content of this translation, the original Japanese document should be consulted.

Report of the Review Committee

In 1971, National Laboratory for High Energy Physics (KEK) was established, and the construction of 8 (12) GeV Proton Synchrotron (PS) started. After 10 years, the TRISTAN project has been launched as the next Japanese high-energy physics project. The purpose of this report is to examine and evaluate the accomplishments of KEK generally, and extract lessons from them at this point. This review is naturally partial fulfillment of obligations to tax payers who supported an investment to such a big science, and at the same time we believe that it is useful for the future of high-energy physics community and KEK.

In order to evaluate the achievements at KEK, a number of measures may be considered, but it would be natural to focus on physics results obtained from research activities because the primary purpose of the laboratory is to contribute to the progress in physics. Based on this point of view, we have examined the report from each experiment conducted at the KEK-PS. However, what make experimental investigation possible is not only the synchrotron itself, but also associated equipments and detectors. They strongly constrain the success of experiments. As a matter of fact, the first six years were spent for the construction and commissioning of the accelerator complex. It was only in 1977 that experiments started and in 1979 that the goal of a beam energy of 12 GeV and an intensity of 2 x 10^12 protons per pulse was achieved. Full-scale activities of the experiments started at this point. Therefore, we will review physics achievements in the past four years.

To be objective, the significance of the 8 (12) GeV PS should be evaluated differently from the international point of view and from the domestic point of view. From the former point of view, the KEK-PS was launched when a few hundred GeV proton accelerators were in operation in US or under construction in Europe, and 6 – 12 GeV machines, Nimrod, PAA, and ZGS, were shut down. Therefore, it was not possible at all to make the forefront research in particle physics with the KEK-PS. However, it is fair to say that its significance is completely different from the domestic point of view. Before the last world war, the Japanese nuclear and particle physics community had been playing an international role both experimentally and theoretically thanks to pioneers; Nishina, Yukawa, Tomonaga, and Sakata, for example. After the war, however, Japanese contribution to the development of nuclear and particle physics fell considerably behind the world, at least in the experimental aspect. As the first step to catch up the world level, the KEK-PS has great significance. The primary purpose of the KEK-PS has been to obtain experiences for constructing and utilizing experimental apparatus, to educate and foster young researchers, and to give confidence to the Japanese high-energy physics community. Nevertheless it has also been requested to achieve significant physics results. How to cope with these qualitatively different requirements has been the main problem of the KEK-PS. The adopted strategy was to provide high-quality data in relatively low-energy regions. Along these lines, there were also plans to obtain the new information using, for example, polarized targets and polarized beams.

Up to the present, twenty experiments completed data-taking, but most of them are still in the stage of analysis. (In addition, seven experiments are running and other seven experiments are in preparation.)

Taking into account the fact that the KEK-PS was planned with various constraints mentioned above, we evaluate its achievements as summarized below.

1. In the context of the domestic point of view, the purposes of gaining experiences for the construction of experimental apparatus, training experimental researchers, and giving confidence to the community have been fully achieved. This fact also bears considerable significance if the KEK-PS is viewed as a sort of preparatory stage for the next Japanese high-energy physics project, TRISTAN.

2. The performance of the KEK-PS such as the beam energy, intensity, and quality largely reached the design level. Although the basic design is relatively conservative, ingenious ideas are found in a number of places. We evaluate that this accelerator ranks high in this energy region. However, when the physics run started the beam quality did not improve rapidly. This was a major limitation for the experimental program and caused the quality of the physics outputs lower than expected. We feel it regrettable though to some extent unavoidable. (It seems that the Kyoto and Nagoya groups that carried out the first-round experiments were able to collect only two thirds of the data they planned to take in their approved proposals.)

3. The physics outputs obtained so far are not impressive, but in a sense this is an expected result. We feel it is appropriate to give an intermediate rating. First of all, there have been no remarkable discoveries. However, it is unavoidable consequence of

the accelerator energy. Second, it should be pointed out that the quality of the data obtained is less than expected. We recognize that one of the reasons for this unsatisfactory result is the fact that the intensity of the beam reached the design value only after 1979. Nevertheless, there are a few noteworthy experiments which obtained interesting results in nuclear or intermediate energy physics. This suggests one of the directions for the future activities at the 12 GeV KEK-PS, and it is desirable to encourage these kinds of researches.

4. There are a number of lessons to be seriously considered in the coordination of the experimental program and other related points. At any accelerator facilities, selection of the experiments and allocation of the beam time to the approved experiments are both very important problems to be considered based on the scientific merits. At KEK, however, there is a special factor to be considered in addition, that is, KEK is a Japanese inter-university facility. Because the KEK-PS is the only high-energy accelerator in Japan, there is a policy that every university group should have equal opportunities to get beam time. Some compromise was needed between the scientific merit and the above-mentioned policy, which resulted in unsatisfactory coordination of the experimental program from the both points of view. For example, even at the present not all the experimental teams from universities and the KEK laboratory have gained beam time. On the other hand, we feel that some finished experiments deserved to be given more beam time to obtain more complete data set. We also feel that more efforts had to be paid to pursue new ideas. This is a rather delicate problem left to be solved in future.

5. In relation to the above-mentioned problem, we feel embarrassment in the grouping of the experimental teams. Particularly we feel so in that of the KEK in-house teams, because an in-house team was created for each experiment and disbanded when the data-taking was over. It may be understandable from the viewpoint that the KEK staff should concentrate on the duty of user support. However, we feel that it is a serious loss of opportunities to build up and develop experimental apparatus and accumulate experiences to use them. We recommend that KEK should form good in-house teams which are as strong as experimental teams from universities.

Another potentially serious problem we find is that although high energy physicists and physicists from other areas have been working at the same site using the same accelerator, they have exchanged less intellectual communications compared to those scientists working at the KEK Photon Factory.

At KEK-PS, there are running experiments in which foreign scientists participate. Internationalization of KEK will be inevitable, including foreign users not only from US and Europe but also from neighboring countries. We recommend that KEK should establish the policies to positively accommodate future internationalization.

6. This Review bears particular significance as it is held when physics achievements from the KEK-PS have been reasonably accumulated and the next Japanese high-energy physics project, TRISTAN, has been launched. We recommend that this kind of review should be made periodically at an appropriate interval.

In this report we have made rather critical comments. However, the most significant effect that the KEK-PS experiments brought about is the fact that although there have been no remarkable results, steady and modest physics outputs in the last four years gave confidence to Japanese high-energy experimentalists in the international community. Based on this, Japan-US and other international collaborations have been launched, and the next Japanese high-energy physics project has been promoted with confidence. We think that this is the most significant achievement of KEK. In conclusion, we hope that these confidences will lead to fruitful physics outputs in near future.

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