

THE OPERATION OF ACCELERATORS AS ENTRUSTED BUSINESS AND OUR COMPANY'S FUTURE PLANS CONCERNING THIS TIE-UP

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Abstract

Research Institutes have entrusted the operation of large-scale accelerators to private enterprise in Japan. Research Institutes expect private enterprise to operate and maintain accelerators in a stable condition.

With the use of highly advanced accelerators and the diversification of the research to which they are applied, operators of accelerators have come to be considered as supporters of research and are expected to understand the associated highly advanced technologies.

In this paper, we are going to consider the present operation of accelerators and discuss our company's future plans concerning this business tie-up.

1. INTRODUCTION

Our company started operating accelerators, the 2.5GeV Linac and the 2.5GeV PF Storage Ring, in June 1986. We started this operation with ten operators and since then have developed the Heavy Ion Accelerator, the 8.0GeV Linac, the 8.0GeV PF Storage Ring, the 6.5GeV PF Storage Ring and the Asymmetric Two-ring Collider. The number of operators has now increased to sixty and we have been making a contribution to the progress of accelerator related researches.

For ten years following the start of this tie-up, we have conducted the operation to maintain accelerators in a stable condition with these three aims:

The first aim: Improving fundamental technical skills.
The second aim: Averaging operators' technical skills.
The third aim: Attending to various problems swiftly.

These aims have enabled us to operate highly advanced accelerators, and we have come to train operators to have special technical skills and to be able to support research.

2.COMPATIBILITY OF OPERATOR'S TRAINING WITH STABLE OPERATION

The main aim of this entrusted business is to maintain accelerators in a stable condition. We also try to enable compatibility of operator's training with stable accelerator operation.

2-1 Shifts

Perfectly controlled shifts are indispensable to stable operation. Surplus operators have been placed at each accelerator to back up the shifts.

An operator takes charge of the same accelerator for five or seven consecutive days and the shifts can be switched with a minimum of operators. Thanks to this system, the operation is perfectly under control and any problems will be handled accurately.

Surplus operators are also placed to master their operating skills through on-the-job training based on a training schedule. With using this shift system, we are able to ensure on-going compatibility of operator's training with stable operation.

2-2 Establishment of the Training System

The operation of accelerators includes a variety of tasks; safety control, beam adjustment, observing equipment, drawing operation sheets, handling problems and adjusting the time of incidence ray. Operators need to handle these tasks swiftly and accurately.

At the beginning of this operation, there were only a few operators and only one instructor. Guidance conducted by researchers of each accelerator used to be considered as the only information source and we mastered how to operate accelerators through on-the-job training. Later, we came regard guidance conducted by researchers as the basic training procedure and we have constructed our company's own methods in mastering the operation of accelerators.

(1) Mastering the basic procedure of operating accelerators.

To master the operation of accelerators, operators need to understand the structures of an accelerators' equipment and master how to handle each accelerator. Inexperienced operators have to write a manual of each component through on-the-job training to understand the basic technology. They also have to attend lectures that are conducted external of our company for further understanding.

(2) Establishing the training system for operators.

A rigid training system is indispensable to training excellent operators. We have established each

accelerator's technical standards, essential to operating accelerators. Persons who have mastered these standards are considered to be eligible as trainers and it is only these experienced people who conduct operator training.

(3) Averaging operators' technical skills.

Ten operators take charge of one accelerator based on the accurate shift system. To enable stable operation, these ten operators need to have equivalent technical skills. We have established a training system that enables each operators' technical skills to equalise. On-the-job training of other accelerators and technical meetings are also held to average operator's technical skills and broaden experience.

(4) Training operators to be able to handle problems swiftly.

Operators need to understand a wide variety of technical skills concerning accelerators. We have trained operators by placing them in many fields of advanced technology to master specialised technical skills. These specially trained operators instruct other operators, and all operators can handle any problems swiftly and accurately as a result.

(5) Attending researchers' workshops.

Researchers have been kind enough to promote the training of operators by attendance of researchers' workshops. By attending these workshops, operators can understand the new technologies and reflect on what they learn during daily operation.

We consider these five points, from (1) through to (5), as one cycle which we repeat. Using this cycle, enables the safe operation of accelerators with the forefront of technology.

3.OPERATING ACCELERATORS AS RESEARCH SUPPORTERS

With the appearance of more highly advanced accelerators and a growing diversity of research, operators have come to be considered as not just workers who can handle accelerators, but also as research support staff who can understand the forefront of technology.

We are going to explain our role of support in research and our company's future plans in this area.

3-1 Supporting research

(1) Development of control software.

Operators have been developing control software. They started from development of the simple and easy-handling GUI program and are now developing highly advanced support programs.

(2) Improvement of beam adjustment technology.

With the diversity of experiments, incident ray parameters have been increased and their adjustment has

become complicated. Operators need to be well trained. As for collision type accelerators, the status of beams will always be changed. To enable stable experiments, operators are expected to adjust the beams around the collision point. We try to improve operators' adjustment technical skills and we are also developing the tools that can control beams in a stable manner.

(3) Design and measurement technology.

We are involved with the design and construction of a new beam line for the PF Storage Ring.

(4) Supporting research.

As for supplemental experiments related to the beam line, we support researchers' analysis...

3-2 Future plans

We have performed this business tie-up as described in 3-1. Our company's future plans are as follows:

(1) Training systems engineers who can develop new programs.

A variety of programs are used in operating accelerators. The numbers of systems engineers who can develop control programs are few, while there is great demand for control programs. We need to educate and train more systems engineers who can develop control programs.

(2) Mastering beam inducement theory.

To enable stable operation and to support highly advanced experiments, we need to train engineers who can not only understand operation, (adjustment, basic technology and much operational experience) but to also be able to propose new theory suitable to beam adjustment methods.

(3) Training designers and measurement engineers.

We need to understand the structures and specifications of accelerators to enable general maintenance.

We need to raise special operators who can perform not only maintenance of accelerators but also offer support to researchers.

4.CONCLUSION

We cannot complete operator training over a short period. As for surplus operators, we need to place them in addition to contracted operators. Since we are a private enterprise and we need to generate a profit, sometimes it has been very difficult for us to continue our policy.

But, by entrusting the operation of accelerators, researchers can concentrate only on their research. As we believe our mission is to support progress of research, we will continue to train operators who have highly advanced technical skills.

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