

## Chapter 0 Preface

This Technical Design Report (TDR) is edited in order to describe the full scope of the accelerators for the High-Intensity Proton Accelerator Facility in Japan [1-4], which is now referred to as “J-PARC” project (Japan Proton Accelerator Research Complex). The first purpose of the report is of course to make all the accelerator components consistent with each other. The consistency should be mutually checked by all the subgroups for the accelerator, by carefully reading the parts related to their responsibilities. The second purpose is to present the report to the accelerator technical advisory committee (TAC), which will review the technical aspects of the accelerators. The third purpose is to put the detail of the accelerator design on record. Since the TDR will be on web, being updated during the course of the construction, all the specialists world-wide can make full use of the detail of the design of the accelerator.

The facility comprises a 600-MeV linac, a 3-GeV rapid-cycling synchrotron (RCS), and a 50-GeV synchrotron (MR) as shown in Fig. 0.1. A half of the 400-MeV beams from the linac are injected to the RCS, while the other half are further accelerated up to 600 MeV by the superconducting (SC) linac. The RCS provides a beam power of 1 MW to the pulsed spallation neutron experiment area with a repetition rate of 25 Hz, while the 50-GeV MR provides a beam current of 15  $\mu$ A with a period of 3 s to either the fundamental and nuclear physics experimental area or the neutrino production target. The beams are slowly extracted to the former, while they are fast extracted to the latter.

The 600-MeV beams from the SC linac are transported to the experimental area for the accelerator-driven nuclear waste transmutation system (ADS), where the basic study of the ADS will be conducted. The pulsed spallation neutron experiment area accommodates both the muon-production target and the neutron-production target in a series. The 10 percent of the beam power will be used for the muon production. The fundamental and nuclear physics experimental area is used for the experiments of the hypernuclei, the Kaon rare decay or others. The neutrinos produced here will be sent to the SUPERKAMIONKANDE detector located 300-km far from the accelerator in order to do the long-base line experiment.

The facility will be constructed as a joint project of the Japan Atomic Energy Research Institute (JAERI) and the High Energy Accelerator Research Organisation (KEK). The location of the facility is the JAERI/Tokai site. The project has evolved from the

Neutron Science Project (NSP) [5, 6] of JAERI and the Japan Hadron Facility (JHF) Project [7-10] of KEK. The JHF project itself has evolved from the Japan Hadron Project (JHP) [11].

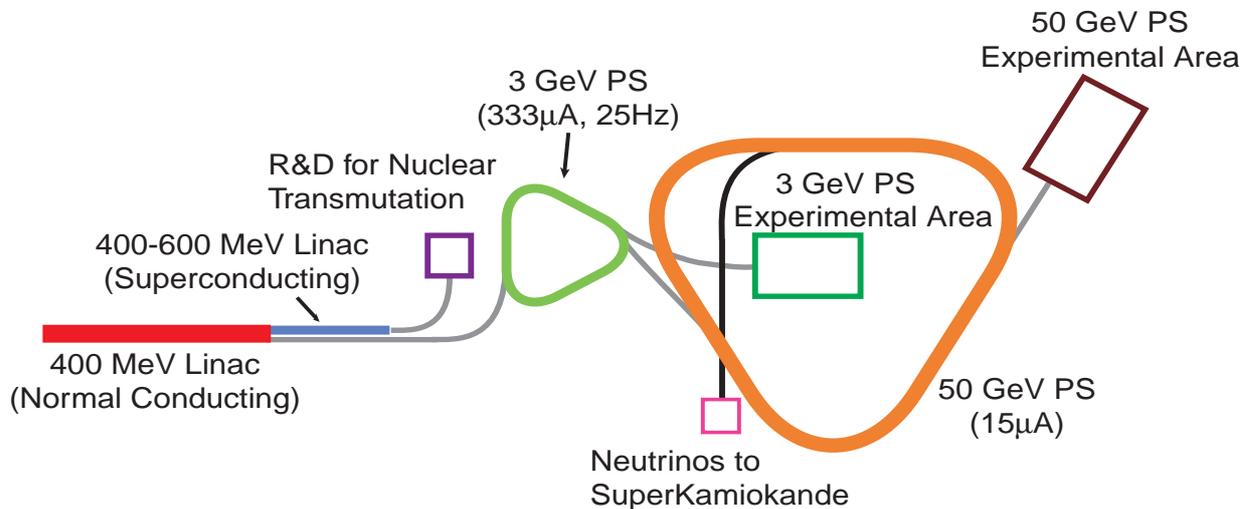


FIG 0.1: Configuration of the accelerator complex

The phase I of the project was approved for the construction starting from April, 2001. The Phase I will be completed by March, 2007. In the Phase I the linac will be constructed only for the RCS injection (400 MeV). Thus, only the preliminary basic experiment is possible for the ADS. The 50-GeV synchrotron will be operated with an energy of 30 GeV or 40 GeV at highest. The neutrino production target area will not be constructed in the Phase I, either. However, the full power system will be constructed for the pulsed spallation neutron source. The effort will be immediately started for the approval of the Phase II in order to start the experiments for the long-base line neutrino experiment and the ADS.

In order to efficiently construct the facility by the joint effort of the two institutes, the detailed agreement was signed between them. Under this agreement the Project Team was formed. Approximately 300 staffs were assigned from the staff members of the two institutes to work as the Project Team members under the single Project Director (approximately half of the KEK staffs have other duties in the KEK campus, Tsukuba). The Project Director placed the team members into the eight groups, including the accelerator group. The Project Team will do all the works for the construction of the facility and the research and development necessary for the project.

Since the number of accelerator staffs (109 including 5 postdoctoral fellows, and 29 staffs with other duties) are very limited, the accelerator team was organised for the highest efficiency as the following mesh structure. One grouping system is based upon the speciality: RF, vacuum, magnet, and so on. For example, the RF group is responsible for both the RF system of the RCS and that of the MR. The vacuum group is responsible for all the vacuum system of the linac, the RCS and the MR. On the other hand, some works should be done within a framework of each machine. Thus, the staffs are also belonging to three accelerator groups.

The construction of the low-energy front 60-MeV linac [4] was already started in KEK by the JFY (Japanese Fiscal Year starting from April) 1998 supplementary budget for the JHF. From 2000 on, JAERI has been supporting the construction by both its budget and manpower. Then, some of the remaining components for the linac were funded by the JFY2000 supplementary budget to JAERI. The contracts for half of the remaining components of the 200-MeV linac was completed by the end of JFY2001 as four-year contracts. The contracts for the major components for the MR have been done by the end of JFY2001, including the bending magnets, the quadrupole magnets, the power supplies for these magnets, some of the RF systems, and so forth.

The first version of the TDR was completed and presented to the A-TAC on May 21<sup>st</sup>, 2002, being on web later. Since the designs for the ordered components have been fixed by that time, the detailed description for them are presented in the first version. On the other hand, major components for the RCS has not yet been contracted at that time. Furthermore, the basic design for the RCS, including the lattice design, has been drastically changed in 2001. For these reasons, the designs for some components for the RCS were in progress, being conceptually described in the first version. This is also true for the remaining components for the linac and MR.

After the first version of the TDR was on web, the hard copies of the TDR have been requested from all over the world. The hard copies are sometimes useful for quickly surveying the report throughout. For these reasons and others, the Project Team decided to publish the TDR in both KEK Report and JAERI Technical Report. At first, it was planned to publish the first version as it is, in order to minimize the effort of the staffs, who are extremely busy in construction of the accelerators. However, many significant changes and improvements have been done after the first version was published, including the RCS lattice design and the injection design. So, this TDR is the second version, which is updated

in January, 2003. The TDR will be updated even after this version published, to be completed by the completion of the construction itself.

## References

- [1] "The Joint Project for High-Intensity Proton Accelerators", KEK Report 99-4, JHF-99-3 and JAERI-Tech 99-056 (1999).
- [2] Y. Yamazaki et al., "Accelerator Complex for the Joint Project of KEK/JHF and JAERI/NSP", Proc. 1999 Part. Accel. Conf., THDL1 (1999).
- [3] Y. Yamazaki et al., "High Intensity Proton Accelerators for the JAERI/KEK Joint Project", Proc. 2000 European Accel. Conf., THOAF201(2000).
- [4] Y. Yamazaki et al., "The Construction of the Low-Energy Front 60-MeV Linac for the JAERI/KEK Joint Project", Proc. 2000 Linac Conf., TUD07 (2000).
- [5] M. Mizumoto et al., Proc. 1st Asian Part. Accel. Conf., 5A001-309 (1998).
- [6] M. Mizumoto et al., "A High Intensity Proton Linac Development for the JAERI Neutron Science Project", Proc. 1998 Linac Conf., TU1004 (1998).
- [7] JHF Project Office, "Proposal for Japan Hadron Facility", KEK Report 97-3 (JHF-97-1).
- [8] JHF Project Office, "JHF Accelerator Design Study Report", KEK Report 97-16 (JHF-97-10).
- [9] Y. Mori, Proc. 1997 Part. Accel. Conf., 920 (1997).
- [10] Y. Yamazaki, Proc. 1st Asian Part. Accel. Conf., (1998).
- [11] Y. Yamazaki and M. Kihara, "Development of the High-Intensity Proton Linac for the Japanese Hadron Project", Proc. 1990 Linac Conf., 543 (1990).