Appendix A

Outline of the Upgrade Project

The discussion on the SPring-8 upgrade plan was initiated in 2007, and in October, 2008, the SPring-8 upgrade working group (WG) was organized by about 50 staffs. The first result of the discussion done by the working group came out as an internal report in December, 2008, which defined "boundary conditions and expected light source performance of the upgraded SPring-8" from the viewpoint of scientific requirements. The internal report started with setting the time schedule and the target cost range; the upgrade is supposed to be executed in 2019 with one-year dark time, and the budget should be around 40 billion Japanese yen. Another specific 'boundary condition' is that existing buildings with accelerator tunnels as well as experimental hutches should be reused for the cost-effectiveness. Regarding the light source performance, it was claimed that the brilliance should be increased by multiple orders of magnitude by significantly reducing the horizontal emittance, while covering a similar spectral range of X-ray and keeping the stability that the current SPring-8 has.

Upon the requirements, the WG soon started looking through many possibilities, such as the Energy Recovery Linac (ERL) and the minimal upgrade of the existing storage ring. Simultaneously, future scientific cases were extensively discussed, of which result was summarized in the next internal report on "future scientific cases" in March, 2009. The discussion on the expected scientific cases has been continued, and is summarized in the preliminary report as well.

Since the middle of 2009, symposiums and workshops have been held almost annually. The symposiums mainly focus on scientific perspective of future photon sciences that is expected to be explored at the SPring-8 II, or even beyond that. The discussions are not necessarily limited to scientific or industrial areas that are already connected to the photon sciences executed at the SPring-8. Instead, the discussions are open to various possibilities at new scientific frontiers. The workshops, on the other hand, focus on accelerator design for the SPring-8 II. The purpose is to find out an optimum accelerator design that best matches scientific studies and industrial applications discussed at the symposiums and other opportunities.

The first workshop was held in December, 2009. First, the WG showed the ultimate goal of

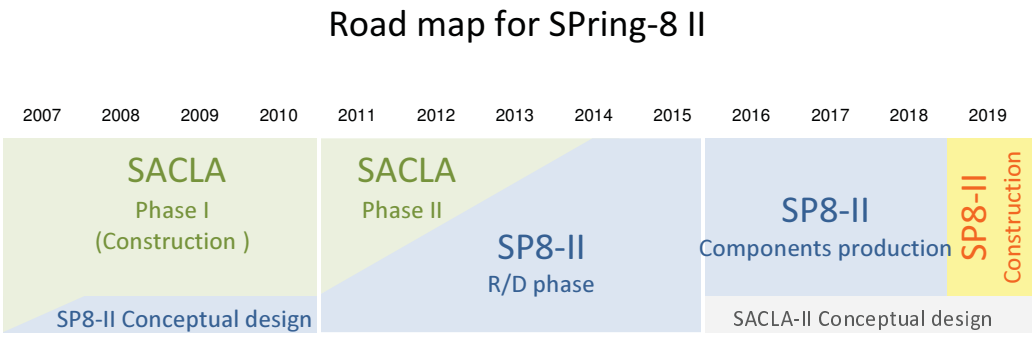

Figure A.1: Planned Schedule for SPring-8 II.

Table A.1: Milestones

Date	Events
Oct. 10, 2008	Kick-off of the SPring-8 Working Group
Dec. 18, 2008	Release of Internal Report on "Boundary Condition and Expected Light Source Performance of the Upgraded SPring-8"
Mar. 24, 2009	Release of Internal Report on Future Scientific Cases
Jun. 19, 2009	1st Symposium on SPring-8 Future Ugprade 2019
Dec. 12, 2009	1st Workshop on SPring-8 II Accelerator Design
Dec. 4, 2010	2nd Symposium on SPring-8 Future Upgrade 2019
Apr. 25, 2011	2nd Workshop on SPring-8 II Accelerator Design

the SPring-8 II plan, and the basic accelerator strategy was introduced. However, the presentation did not go into detail at the stage. Six speakers from KEK and JAEA then talked about accelerator developments and current status at each facility, such as the KEKB, the cERL, and J-PARC.

In December, 2010, and April, 2011, the second symposium and workshop were held. Through the second series of the meetings, the scientific perspective of future photon sciences at the SPring-8 and the resulting requirements to the light source performance had been made clearer, and the further developed accelerator design, not only in lattice but also in hardwares, was presented and was intensively discussed. Although there are still critical issues remained for securing the new accelerator design, the basic strategy was briefly fixed. The accelerator design described in this report is based on the result of the 2nd workshop.

In addition to the two series of symposiums and workshops, the WG members have presented the upgrade plan at public conferences, workshops, and meetings. The presentations are listed in the following.

Presentation Lists

1st Symposium on SPring-8 Future Upgrade 2019 (Tokyo, Jun. 19, 2009)

M. Yabashi, “Overview of the SPring-8 upgrade”
M. Suzuki, “Perspective on future photon sciences with the upgraded SPring-8”
K. Soutome, “Accelerator design approach toward the SPring-8 upgrade”
H. Yamazaki, “Strategy of beamline developments for the future plan”
K. Maejima, “X-ray bioimaging: possibilities and future”
S. Matsui, “Cutting-edge nano-technology and photon science”
Y. Tokoro, “Photo-induced phase transition dynamics”
S. Fujioka, “Future perspective of high-energy density science”
(All in Japanese.)

1st Workshop on SPring-8 II Accelerator Design (SPring-8, Dec. 22, 2009)

M. Yabashi, “Introduction of SPring-8 upgrade plan”
T. Watanabe, “Future strategy of accelerator development for the upgrade”
M. Yoshida, “Improvement of beam quality of Linac and its application”
H. Sakai, “Development status of ERL linac and super-conducting cavities”
Y. Ohnishi, “Current status of KEKB and the upgrade plan”
M. Kinsho, “Current status of J-Parc accelerators and the power upgrade plan”
K. Oide, “Suggestions to the SPring-8 upgrade plan - round beam, second-floor ring etc -”
(All in Japanese.)

2nd Symposium on SPring-8 Future Upgrade 2019 (Tokyo, Dec. 4, 2010)

M. Yabashi, “Current status of SPring-8 upgrade plan”
M. Suzuki, “Future photon sciences enabled by the SPring-8 II”
T. Watanabe, “Next generation light source development for future sciences”
R. Kainuma, “Discovery of magnetic shape memory alloy and its exotic behavior”
S. Kobata, “Light-driven controllable molecules and crystals”
T. Fukada, “Elucidation of functions of bio-essential elements and its future clinical applications”
(All in Japanese.)

2nd Workshop on SPring-8 II Accelerator Design (SPring-8, Apr. 25–26, 2011)

T. Watanabe, “Overview of SPring-8 upgrade plan”
K. Soutome, “New lattice design of ultimate storage ring”

K. Fukami, “New designs and developments of magnet and vacuum systems”
T. Fujita, “Challenges of monitor systems for SPring-8 II”
T. Nakamura, “Proposal of new injection systems”
H. Ego, “Development of fundamental and higher harmonic RF systems”
M. Masaki, “Study on short X-ray pulse generation from storage ring”
Y. Shimosaki, “Numerical result of detuned lattice” etc.
(All in Japanese.)

2nd Workshop on Nonlinear Beam Dynamics in Storage Rings (Oxford, Nov. 2–4, 2009)

Y. Shimosaki, “Nonlinear resonance analysis for correction of off momentum dynamic aperture”.

Workshop on Low Emittance Ring (CERN, Jan. 12-15, 2010)

T. Watanabe, “SPring-8 upgrade plan and short bunch options”
K. Soutome, “Feasibility study of very low emittance rings at SPring-8”

ICFA Advanced Beam Dynamic Workshop on Future Light Sources (SLAC, Mar. 1–5, 2010)

T. Watanabe, “SPring-8 upgrade plan”

International Particle Acceleartor Conference 2010 (Kyoto, May 23–28, 2010)

K. Soutome, “Design study of a very low-emittane storage ring for the future upgrade plan of SPring-8”

7th Annual Meeting of Particle Accelerator Society of Japan (Himeji, Aug. 4–6, 2010)

K. Fukami, “Beam transport from XFEL-linac to storage-ring in SPring-8”
Y. Shimosaki, “Correction of off-momentum dynamic aperture” (All in Japanese.)

Joint Meeting of High-Pressure Materials Science Group and Planetary Science Group (SPring-8, Jan. 5–6, 2011)

M. Suzuki, “Introduction of SPring-8 upgrade plan” (in Japanese).

24th Annual Meeting and General Assembly of the Japanese Society for Synchrotron Radiation Research (Tsukuba, Jan. 7–10, 2011)

Y. Shimosaki, "Design study of very low-emittance lattice for SPring-8 II storage ring" M. Masaki, "SPring-8 upgrade plan: Study on short X-ray pulse generation" (All in Japanese.)

Meeting of Industrial Users Society of SPring-8 (Kobe, Jun. 9, 2011)

M. Suzuki, "Overview of SPring-8 upgrade plan" (in Japanese).

The 14th Annual Meeting of Japanese XAFS Society (UVSOR, Sep. 9, 2011)

Y. Tamenori, "Introduction of SPring-8 upgrade plan" (in Japanese).

ICFA Beam Dynamics Mini Workshop on Low Emittance Rings 2011 (Crete, Greece, Oct. 3–5, 2011)

K. Soutome, "SPring-8-upgrade: Lattice design of a very low emittance storage ring"
K. Fukami, "SPring-8 upgrade: Strong magnets for ultimate storage ring"

8th Annual Meeting of Particle Accelerator Society of Japan (Tsukuba, Aug. 1–3, 2011)

Y. Shimosaki, "Dynamic aperture correction for very low-emittance storage ring of SPring-8 II"
C. Mitsuda, "Construction of beam transport magnets from SACLA linac to SPring-8 storage ring"
M. Masaki, "Simulation study of short bunch generation using mm-wave inverse FEL at the SPring-8 storage ring"
(All in Japanese.)

SPring-8 Conference 2011 (Tokyo, Nov. 1–2, 2011)

M. Suzuki, "Contribution to cost-effective society through ultimate storage Ring (1)"
T. Watanabe, "Contribution to cost-effective society through ultimate Storage ring (2)"
(All in Japanese).

Meeting of SUNBEAM Consortium (SPring-8, Nov. 7, 2011)

M. Suzuki, "Introduction of SPring-8 upgrade plan" (in Japanese).

The 2nd Meeting on High-Pressure Applications of Future Light Source (Okinawa, Nov. 8, 2011)

N. Hirao, “SPring-8 upgrade plan” (in Japanese).

International Particle Accelerator Conference 2011 (San Sebastian, Spain, Nov. 11, 2011)

T. Watanabe, “Current status of SPring-8 upgrade plan”
Y. Shimosaki, “Lattice design of a very low-emittance storage ring for SPring-8 II”
M. Masaki, “A proposal of short X-ray pulse generation from compressed bunches by mm-wave iFEL in the SPring-8”
C. Mitsuda, “The construction status of beam transport line from XFEL-linac to SPring-8 storage ring”
K. Tsumaki, “Design of a beam transport line from the SACLA linac to the SPring-8 storage ring”
T. Watanabe, “Measurement of longitudinal dynamics of injected beam in a storage ring”

Note: In above, only speakers are shown without co-authors or the on-behalf-of descriptions, and some of Japanese titles were translated into English not by the speakers, but by the editors of the preliminary report.