Report of "Brainstorming discussion: Interests and priorities for collaboration on accelerator R&D"

Olivier Napoly/Shin Michizono

Three talks+ discussion

-Current and future accelerators at KEK (SuperKEKB, J-PARC and ILC)
-Introduction to the new radioactive beam accelerator (RAON) project in Korea
-Proposal for R&D and value engineering SRF activities for the ILC

-Discussion

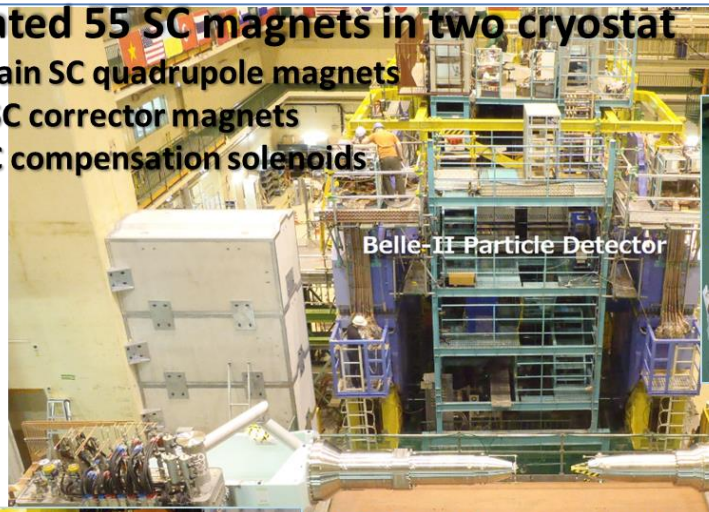
Current and Future Accelerators at KEK

Y. Yamamoto/S. Michizono (KEK)

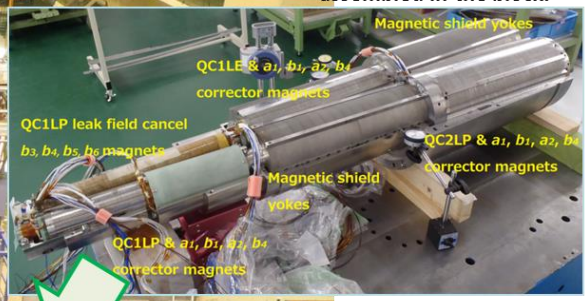
SuperKEKB Final Focus System

Integrated 55 SC magnets in two cryostat

- 8 main SC quadrupole magnets
- 43 SC corrector magnets
- 4 SC compensation solenoids

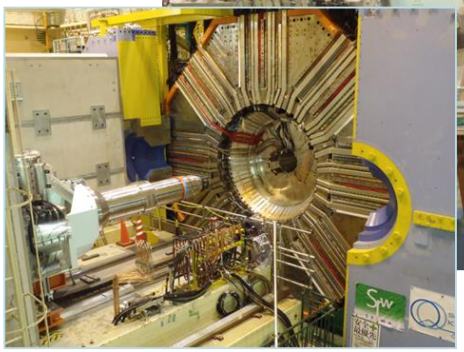


3 main quadrupoles and 16 correctors are assembled in the block.



Corrector magnets: direct winding by BNL

Compensation solenoid(ESL): composed of 12 small solenoids



The beam final focus system was integrated in March 2017, and the Belle-II particle detector has been moved to the SuperKEKB interaction region.

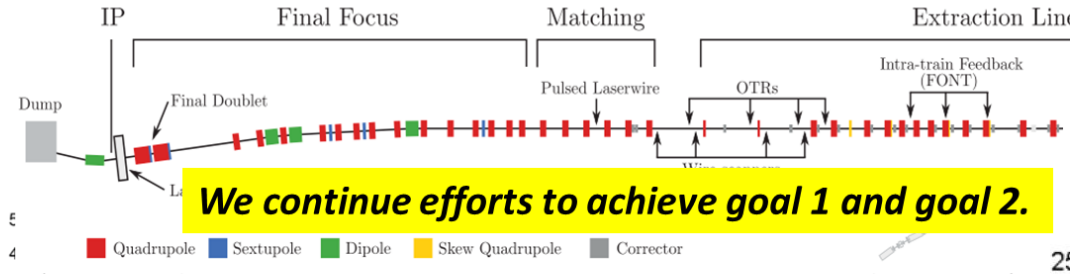
Progress in FF Beam Size and Stability at ATF2

Goal 1: Establish the ILC final focus method with same optics and comparable beamline tolerances

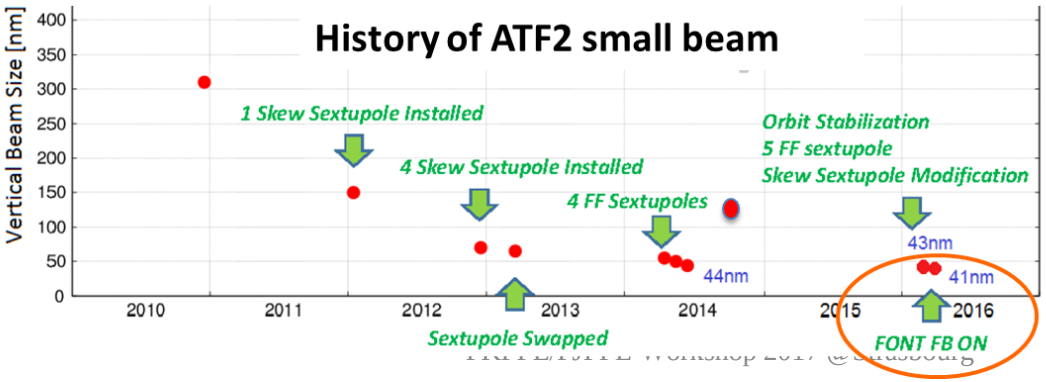
- ATF2 Goal : **37** nm → ILC **6** nm
  - Achieved **41 nm** (2016)

Goal 2: Develop a few nm position stabilization for the ILC collision

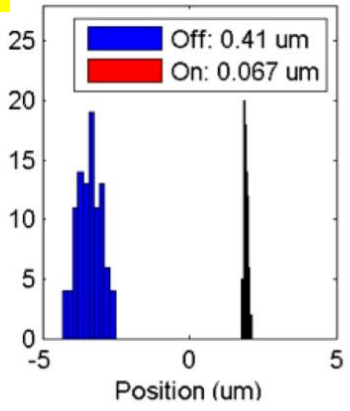
- **FB latency 133 nsec achieved** (target: < 300 nsec)
- **positon jitter at IP: 410 → 67 nm (2015)** (limited by the BPM resolution)



We continue efforts to achieve goal 1 and goal 2.



Nano-meter stabilization at IP



Recent SRF Activities for ILC in KEK

- N_2-infusion
  - First vertical test last month → Not good result (under consideration)
  - Vacuum furnace in J-PARC (next page)
- Lower cost Nb material
  - Nb sheet from CBMM is used in CFF
- Power Coupler R&D
  - To be presented in tomorrow's session
- EP treatment study
  - Vertical EP/HF-free EP…
- STF-2 cryomodule operation in 3rd cooldown test
  - To be presented in IPAC2017
- New SRF Facility (COI)
  - Under construction, but cryogenic system is under progress

Brainstorming discussion: Interests and priorities for collaboration on accelerator R&D

2017 Joint Workshop of the France-Korea (FKPPL) and France-Japan (TYL/FJPPL) Particle Physics Laboratories
IPHC, Strasbourg, France, May 10-12, 2017

Introduction to the RAON project in Korea

Byungsik Hong
(Korea University)

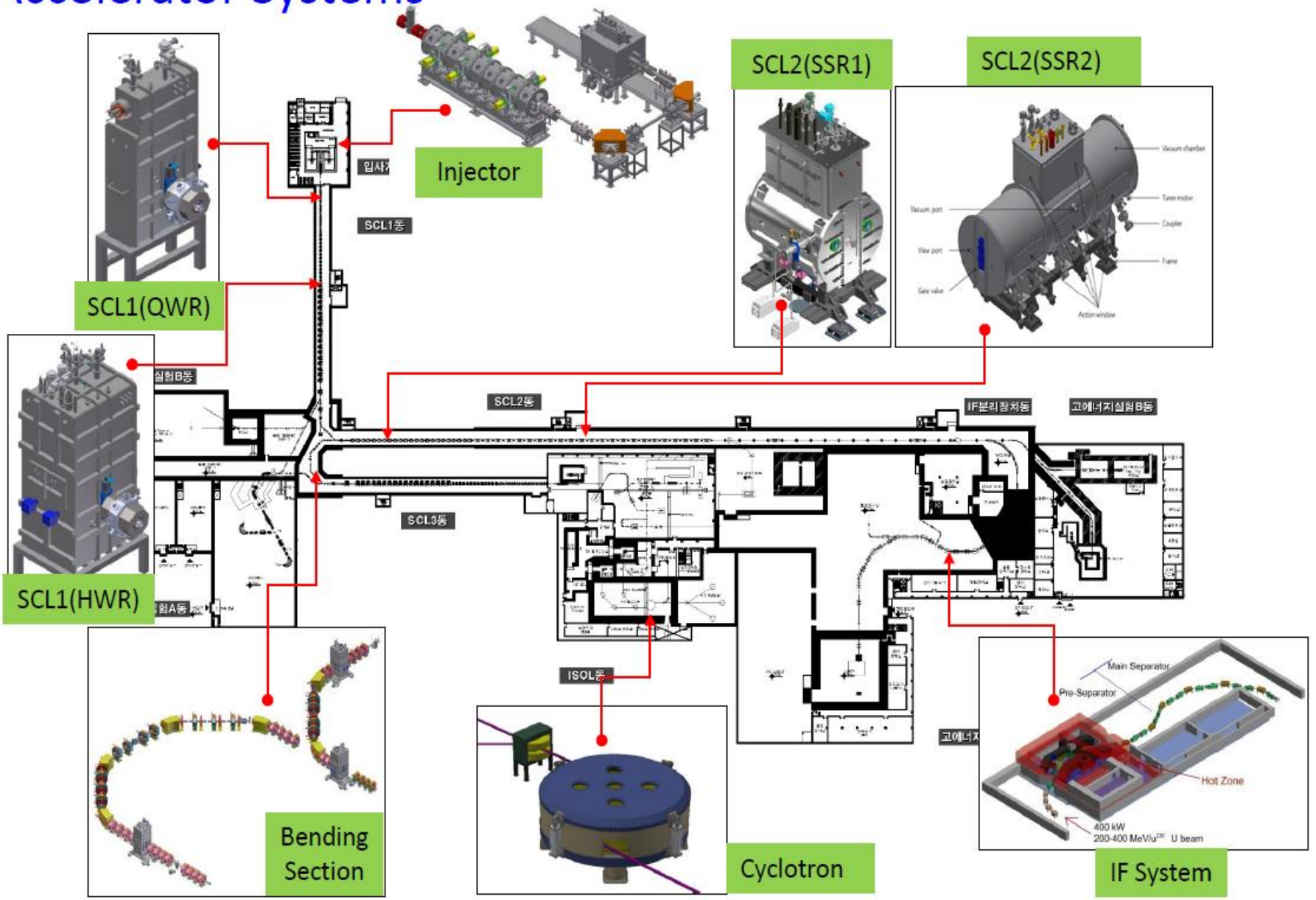
Rare Isotope Science Project (RISP)

- Goal: To build the heavy ion accelerator complex **RAON** for rare isotope science research
- Budget: Total ~U$ 1.43 B
  - Facilities: ~U$ 460 M
  - Buildings and utilities: ~U$ 970 M
- Period: December 2011 – December 2021
- Brief history
  - 2009.01: International Science Business Belt Plan
  - 2011.02: Conceptual Design Report
  - 2011.12: RISP launched
  - 2012.06: Baseline Design Summary & Technical Design Report
  - 2014.12: Civil engineering & construction project of RISP launched
  - 2015.05: 2nd amendment of the basis plan

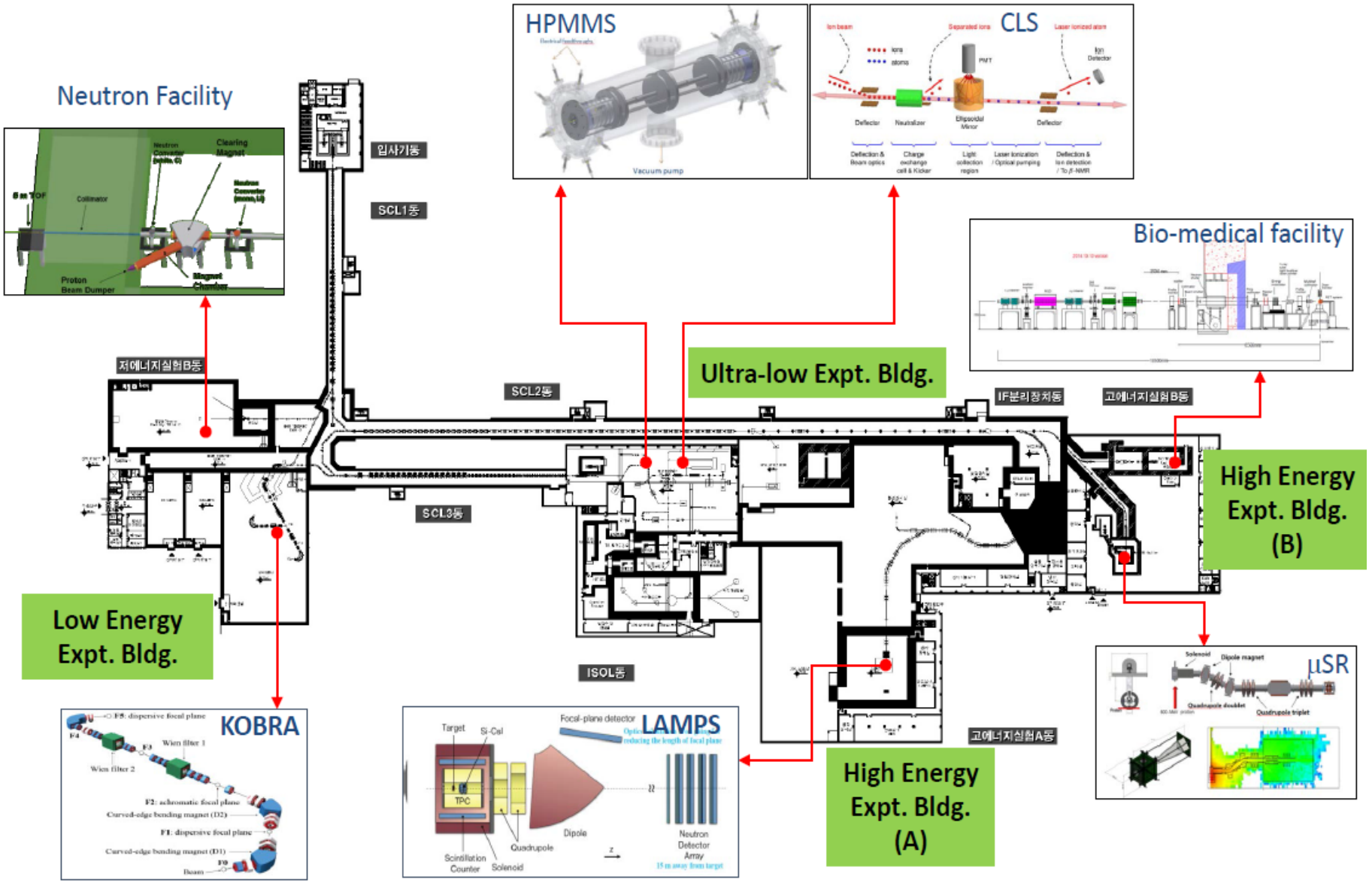
Site Plan


Bird's eye view
952,066m²
Supply/Test/Office Bldg
Exp. Halls
IF Target
ISOL
Preserved Forest Area
Driver
SC Linac
Post
Accelerator
Injector
Control
Center
Exp. Halls
SRF Facility
Basic design was finished in December 2015.
A construction company was selected in September 2016.

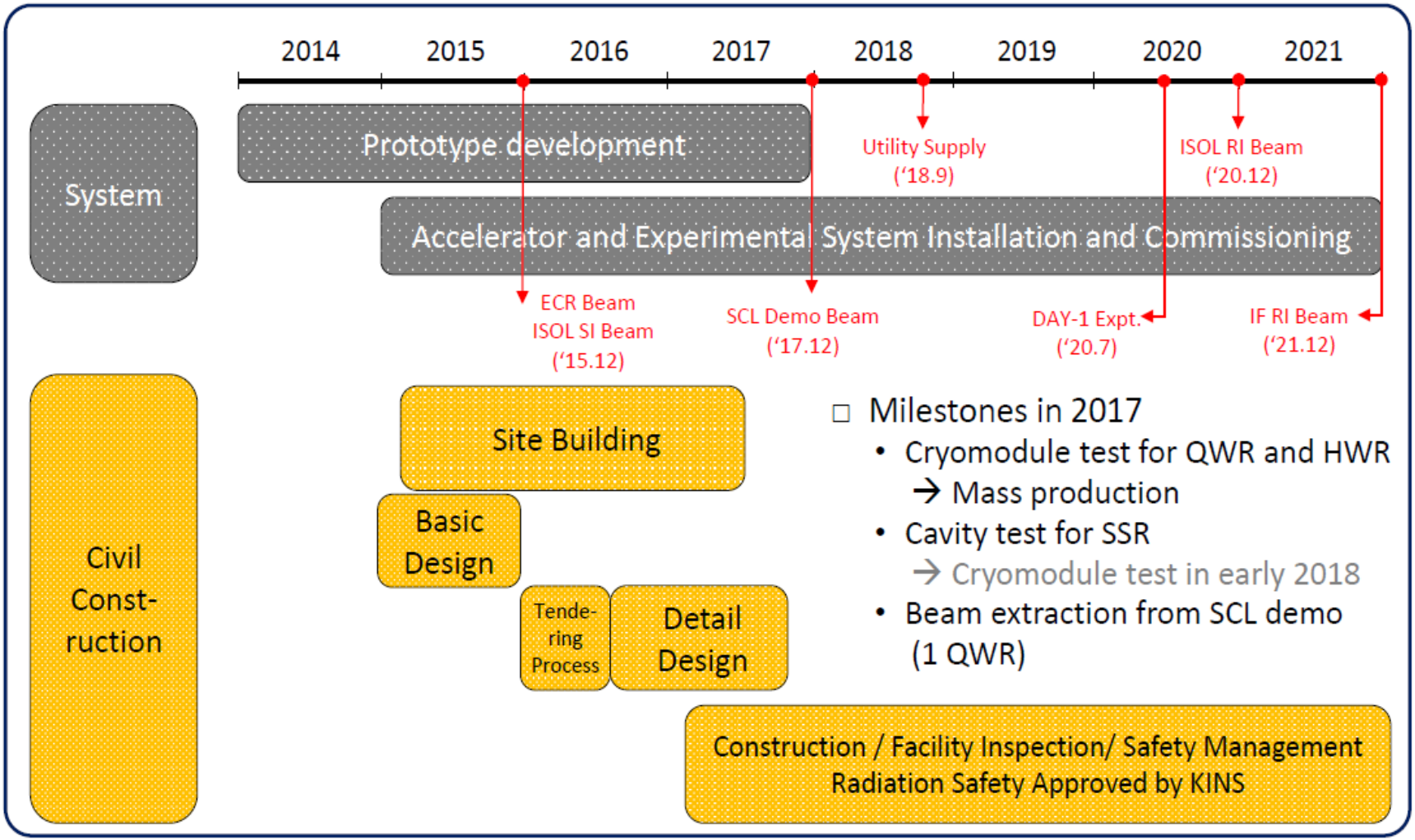
Accelerator Systems



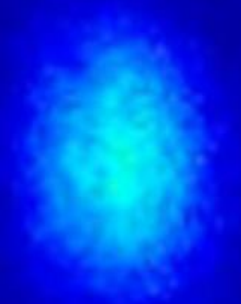
Experimental Systems



Major Milestones



Proposal for R&D and value engineering SRF activities for the ILC



First lasing at EU-XFEL

Olivier Napoly (CEA)

CEA Activities on SCRF

After the completion of the 103 E-XFEL modules assembly in July 2016, CEA is mostly involved in the construction of SRF linacs:

- IFMIF/LiPAC : one 8-HWR-cavity cryomodule (176 MHz)
- ESS : 30 medium and high beta cryomodules (704 MHz)
- SARAF : four 7-HWR-cavity cryomodules (176 MHz)

CEA is therefore naturally inclined to improve module assembly process w.r.t. quality, productivity and cost.

R&D programs need a new boost !

Robotization

From E-XFEL experience, the cost of module assembly for ILC 500 GeV is in the ballpark of 200 M€, almost entirely in labour cost.

→ **Automation and Robotization**

- Once the vacuum groups are connected to the cavities, vacuum operations (pumping, venting, flushing, leak checking) should be **fully automated,** to include slow pumping and venting, and valve opening.
- **Robotization** could be implemented e.g.
  - Ionized N2 cleaning
  - Cold coupler assembly
  - String assembly
  - Warm coupler assembly

Robotization

Robotization will be beneficial with respect to :

- Reducing labour cost
- Reducing the assembly mistakes and non-conformities
- Uniformization of assembly procedures across the 3 or 4 regional assembly plants
- Introducing some ‘plug-compatibility’ in the module design

RF Coupler: R&D and Value Engineering

This activity could be led by CNRS-Orsay.

It would be focused on value engineering of the RF coupler production, including potential re-design or re-evaluation of specifications.

New industrialisation studies could be undertaken encompassing fabrication, clean room preparation, RF conditioning and assembly in order to minimize the overall cost and risk of this highly complex component.

This effort would be directed towards making the coupler production and assembly more efficient, streamlined and cost-effective.

RF Coupler: R&D and Value Engineering

Possible themes of work:

- In-depth investigation on the lightening observed during the RF conditioning in some XFEL couplers: Origin, impact on coupler and how to supress it.
- Test on a “new” multipactor suppressor thin layer on ceramic: Cr2O3.
- Impact of different finishing processes (Brushing, glass bead blasting, burnishing…) on copper plated surface roughness, RRR and SEY.
- Coupler cleaning-rinsing-drying procedure automatization: to avoid operator dependence, guarantee the process repeatability and save time and money.
- Mechanical design, thermal and RF studies of coupler operating in CW mode.

Summary and Discussion/Comments

- ***Japan/Korea's on-going/future accelerator projects were presented.***
  - J-PARC, SuperKEKB, Linear collider, RISP …
  - These are the seeds of the collaboration.
  - Current FKPPL and TYL/FJPPL activities are active at some specific region but do not cover all the projects.
  - It looks there is enough room for starting the collaboration at France/Japan, France/Korea.
- ***France's promising future collaboration proposal was presented.***
  - These are based on the huge expertise based on the mass-production/industriarization developed by European projects.
  - These proposals are applicable to the various on-going/future superconducting accelerator projects at Japan/Korea.
- ***Other Comments***
  - Some accelerator component R&D could be revived.
  - For example, "positron source" was the active theme before. It ceases due to the limitation of the funding of each lab. But it would be an essential for the future accelerator R&D.
  - FJPPL/FKPPL might help such researchers survive for the future in-need.
  - The current collaborative activities of the CNRS/IN2P3 will continue in future years, and some of them may even be enhanced:
    1) SuperKEKB MDI / interaction point physics
    2) ILC BDS and MDI, including parameter optimization