



# Outcome of Accelerator Theme

KAIST-KAIX Workshop for Future Particle Accelerators  
07/19/2019

Accelerator Session Conveners:

Moses Chung, UNIST

Chong Shik Park, Korea Univ., Sejong



# Workshop Goal



- Physics Studies
  - Understand what has been done (May 2019 Granada Symposium)
  - Identify areas where we can contribute and collaborate
- Enabling technologies (strengthening collaborations)
  - Identify areas where we can contribute and collaborate
  - “Establish” collaborations
- Making Asia’s activities (as a whole) more visible and better understood by the world community



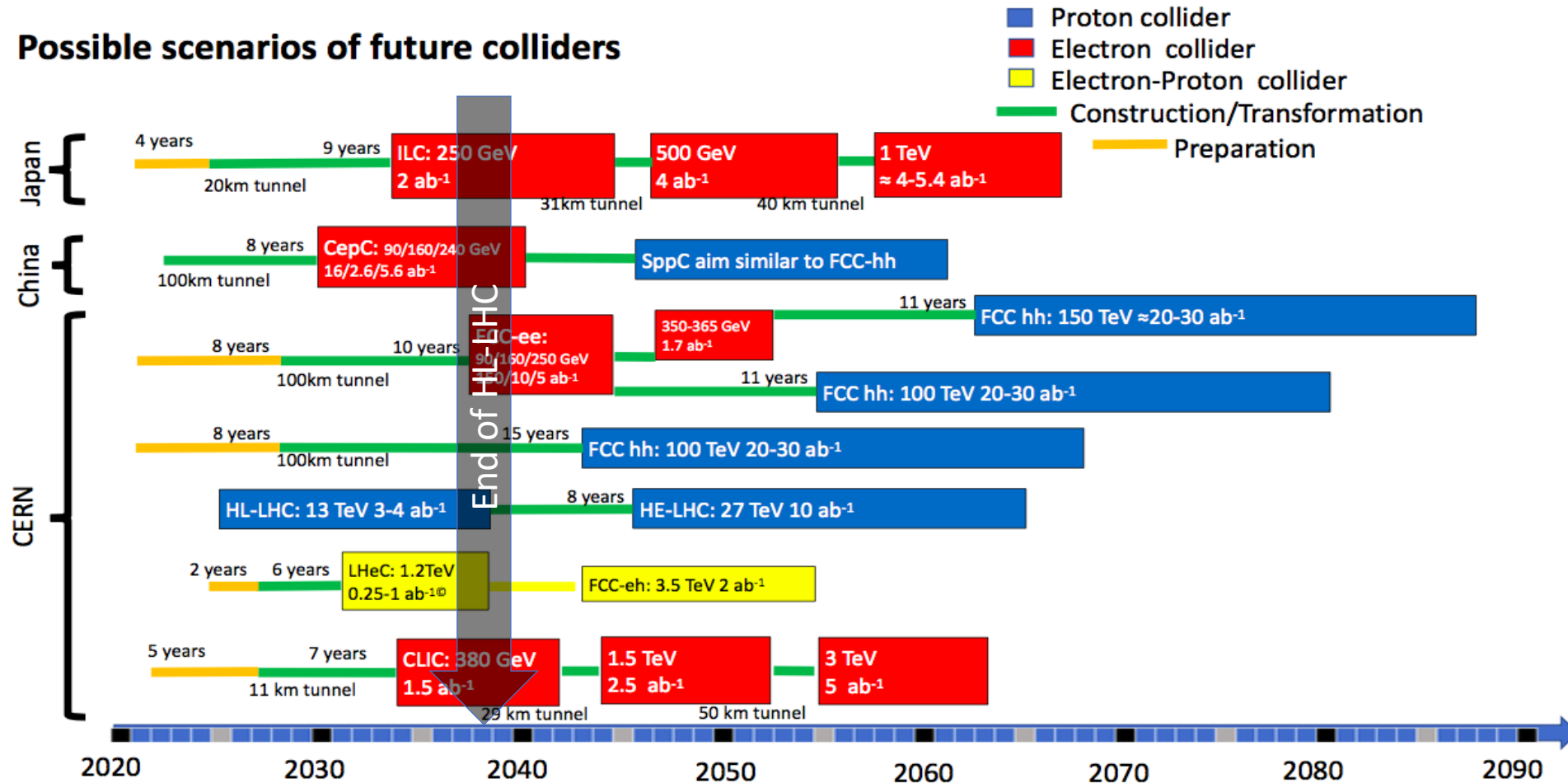
# Plenary Session



## Accelerator-related

- Status of ILC - Hitoshi Hayano
- Status of CepC/SppC - Jie Gao
- Status of FCC-ee, ep, pp - Alain Blondel
  
- Summary of Open Symposium on European Strategy Upgrade: Accelerators - Moses Chung
- Planning for Particle Physics: Perspective from the Americas - Young-Kee Kim
- Planning for Particle Physics: Perspective from Asia - Geoffrey Taylor
- Vision of Future Collider - Yifang Wang

## Possible scenarios of future colliders



# To Make These Projects Realize

- Careful Planning, Cost Sharing, Scheduling, and International Collaborations
- Accelerator Technologies
  - High Power Klystron
  - High Q and High G SRF cavities
  - High Field Magnet: High Temperature Superconducting Magnet
  - Energy Management
  - ...
- Beam Physics
  - Beam-Beam effects: tune shift, beamstrahlung, etc.
  - Dynamic aperture
  - Coherent Beam Instabilities
  - Precise control of beam shape and orbit
  - ...
- Identify issues and need to improve



# Toward Higher Energy



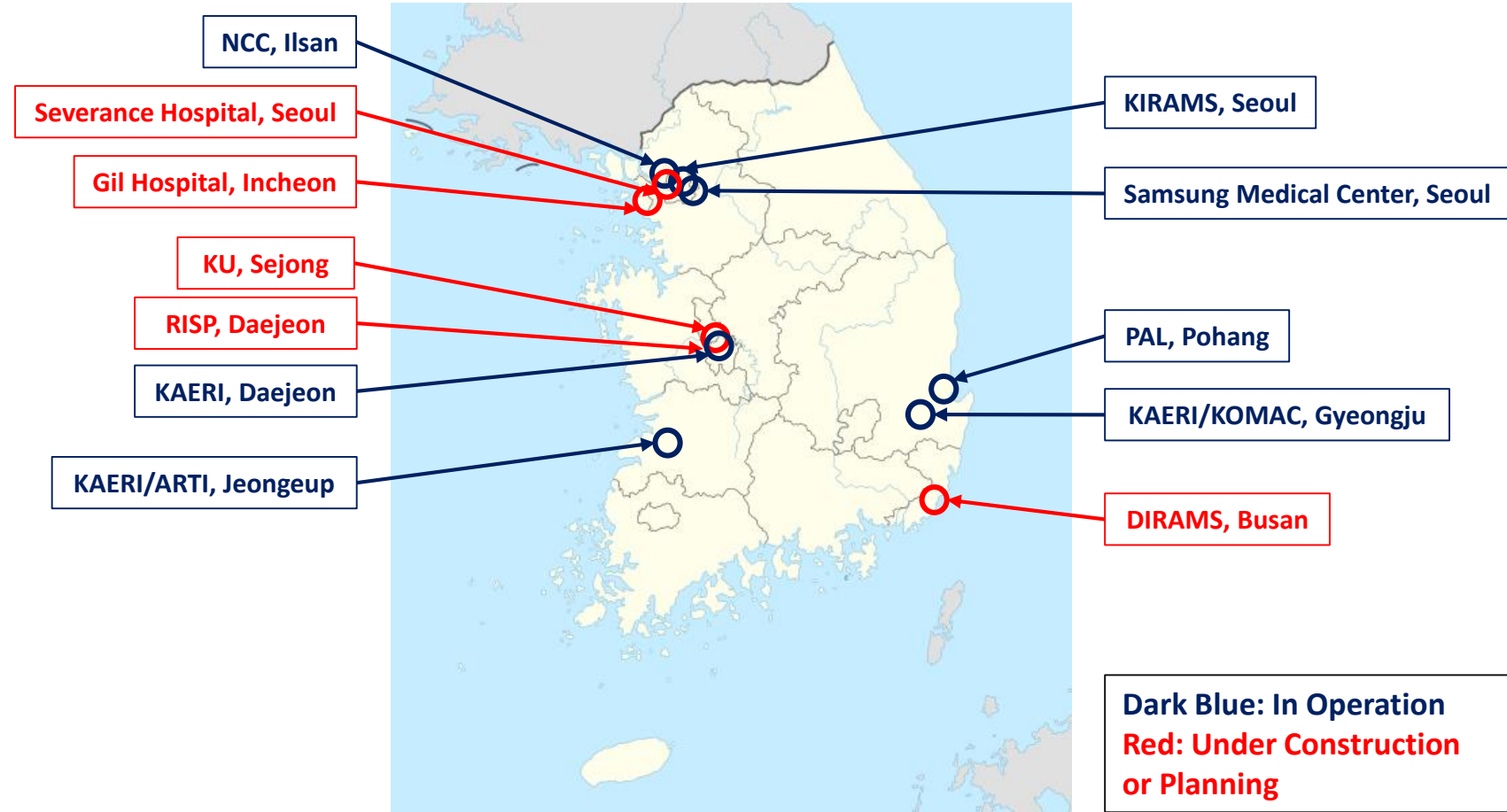
- Muon Collider

- Promise the potential to go to the very high energy
- Not mature for a CDR yet
- Need a careful design study
- Issues: Muon production, capture, and cooling

- Plasma Wakefield Accelerator (PWFA)

- Laser-driven or Beam-driven (electron or proton)
- Issues: high brightness beam, tunability, reproducibility, reliability, and high average power

- There are more than 300 accelerators in Korea
- 43 cyclotrons in medical centers for RI production
- More than 60 linac-based radiosurgery units are working
- ~200 accelerators are used in industry
- Applications:
  - Basic Science (Physics, Chemistry, Biology, etc.)
  - Environment
  - Material Science
  - RI Production
  - Therapy





# Accelerator Session



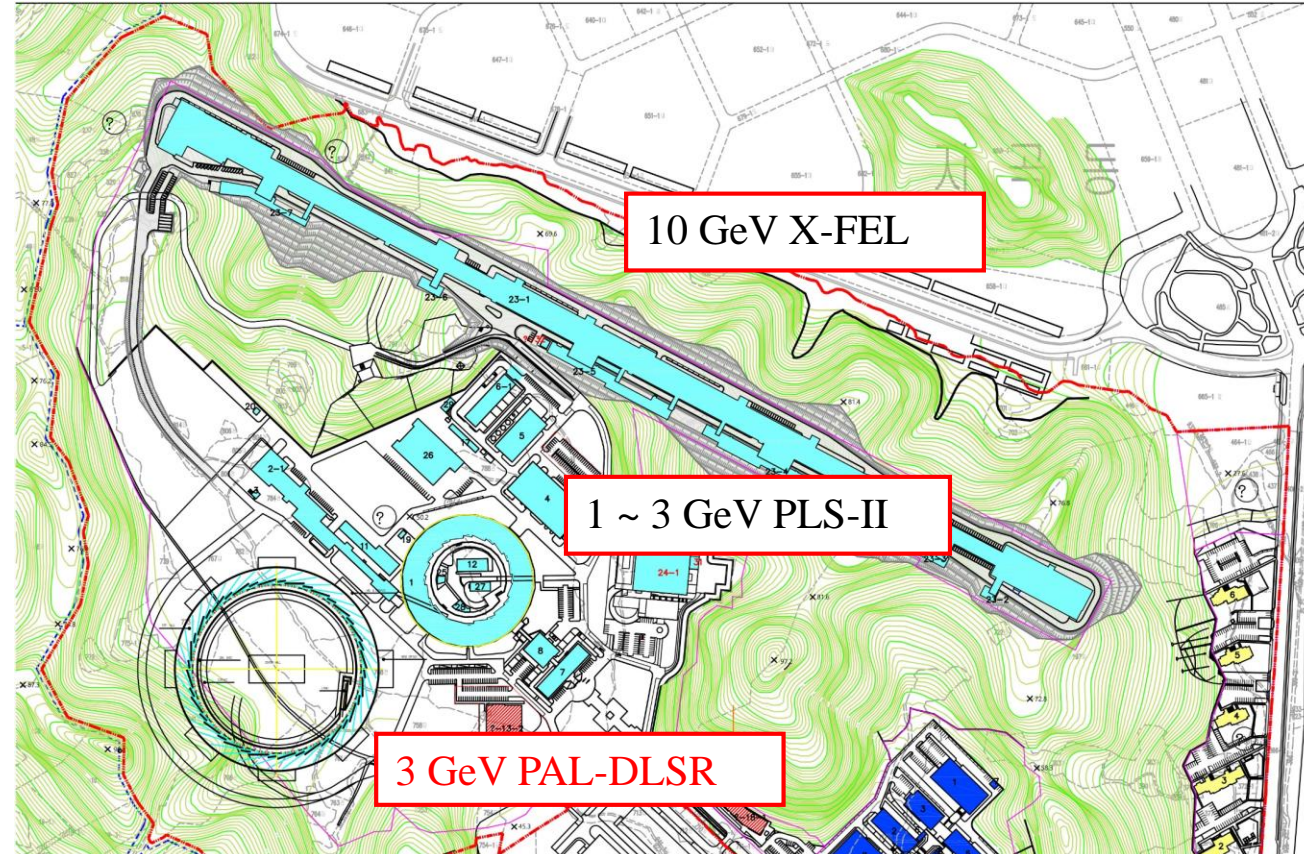
## Current Status of Accelerator Facilities in South Korea

- Status of the electron accelerator programs in Korea
  - Seunghwan Shin, PAL
- Status of the proton accelerator programs in Korea
  - Ky Kim, KAERI/KOMAC
- Overview of the Rare Isotope Science Project (RISP)
  - Myun Kwon, RISP



## Electron Accelerator Facility

- PLS-II
  - has been provided stable photon beam
  - More than 1,600 experiments were conducted annually
- PAL-XFEL
  - A distinguishing performance (world best) was achieved
- Localization and commercialization
  - Most machine components can be delivered in Korea
  - PAL efforts with RISP and KOMAC will generate great synergy for localization and commercialization in Korea
- The 4<sup>th</sup> Generation Storage Ring program makes the future of SR science brighter

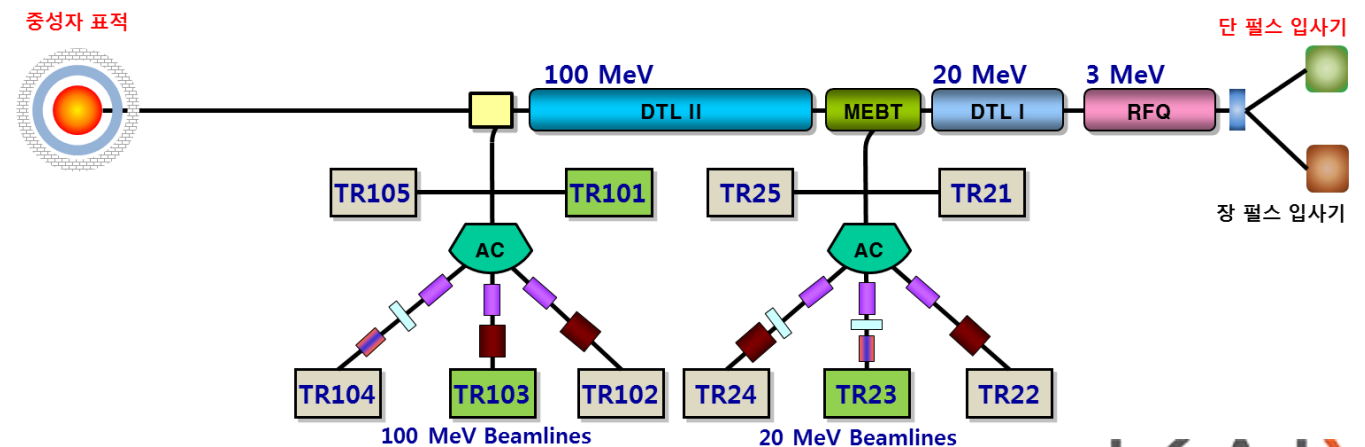


## Proton Accelerator Facility

- 100 MeV proton linac
  - Machine availability : ~95%
  - Steady beam service
  - Multi-purpose beamlines for 20 MeV and 100 MeV
  - RI production beamline : 2016~
  - Low-flux beamline : 2017~
  - Pulsed-neutron beamline & short pulse injector : in development
  - Li-8 beamline: in development
- Plan for Upgrade
  - 1 GeV, 2 MW Proton Linac
  - Short/Long Pulse Neutron Source
  - Muon Source (HEP)
  - Neutrino Source (HEP)

## Ion Beams Facilities

- Gas / Metallic ion beam implanters : normal user service
- 1.7 MV tandem : PIXE, RBS, irradiation, Std. neutron, e-PIXE
- 3.0 MV tandem, 1 MV accelerator, 1 MeV/n RFQ : in development



## Heavy Ion Accelerator Facility

### • Accelerator

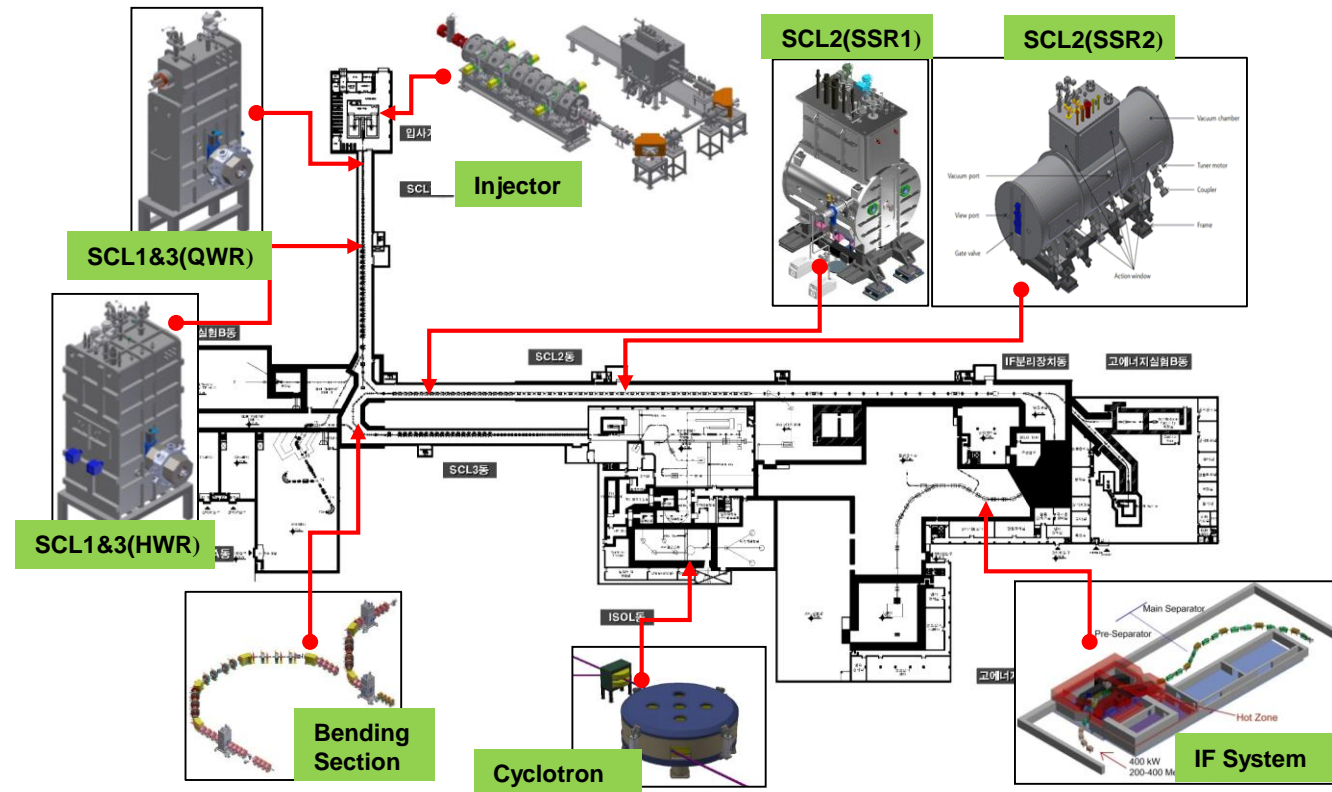
- Mass production for SCL3 is under way
- SCL2 is under pre-production phase
- From April 2019, installation for SCL will start from SCL3

### • By the end of 2021

- Stable / RI beams will be delivered to low-E experimental hall
- Beam commissioning starts for SCL2

### • Post RISP (after 2021)

- Beam acceleration for ISOL  $\rightarrow$  SCL3  $\rightarrow$  SCL2  $\rightarrow$  IF (ISOL+IF)
- Beam commissioning and experiments for IF, LAMPS, Neutron, bio-medical and muSR
- Ramping-up to get the 400kW beams (more 5 yrs)
- Energy upgrade to 400MeV/u (require budget)





# Goal1: Identify Areas Where Korean Accelerator Community Could Contribute and Collaborate



- Accelerator Technologies
  - Mature level to design and fabricate SRF cavities (RISP, PAL, and KU)
  - HTS magnet R&D's are on-going (PAL, SNU, and KERI)
  - More than 10 accelerator-related companies
    - NC and SC Cavities, Power Coupler, Klystron, Magnet, BPM, etc.
  - (Strong LWFA and PWFA research activities (GIST, KERI, KU, and UNIST))
  - Need to establish active international collaborations (e.g., TTC)
- Beam Physics
  - Individual participations in international accelerator collaborations (ILC, AWAKE, FAST/IOTA, etc.)
  - Need more research efforts in accelerator theory and simulation (HPC)
  - Accelerator/Beam Test Facility
- Training MORE young accelerator scientists and engineers
  - Accelerator graduate programs in 6 universities
  - Accelerator School: KUPASS2019 and ASSCA2019



# Goal2: “Establish” Collaborations



A Group Photo of Accelerator Scientists from the US, China, and Korea





# Accelerator School I



## Korea University Particle Accelerator Summer School 2019

### 2019년도 과학벨트 기능지구 지원사업 산학연계 전문인력 양성 가속기 여름 학교

**주관** 고려대학교 세종캠퍼스 가속기 연구 센터, 가속기 과학과

**목적** 국내외 가속기 분야의 우수 인재 유치 지원책의 일환으로, 가속기 기술 분야에 대한 기초적인 강의와 그에 따른 체험 실습을 통해 미래를 선도할 인재 발굴 및 교육 기반 조성

**장소** 고려대학교 세종캠퍼스, 가속기 ICT 융합관 323호

**일시** 2019년 8월 19일(월) ~ 8월 23일(금) (4박 5일)

**참여대상 및 인원** 국내 이공계열 학부생 및 대학원생

**참여비용** 무료 (1인실 혹은 2인실의 기숙사, 점심 및 저녁식사 제공)

**문의** 박종식 교수 kupyh@webmail.korea.ac.kr  
가속기 ICT 융합관 2층 가속기과학과 사무실 (044-860-1309)

**신청** <https://indico.korea.ac.kr/event/14>



#### 세부 프로그램 일정표

	8/19(월)	8/20(화)	8/21(수)	8/22(목)	8/23(금)
09:30~10:00	등록 및 개회식				
10:00~12:00	가속기 기초 및 응용	RF 시스템	RF 가속관	빔 진단 기초	이론편
12:00~13:30	점심	점심	점심	점심	점심
13:30~15:45	빔물리 입문1	전산 실습1	커뮤니 계획1	빔 진단 장비 실습1	빔 설계1
15:45~16:15	휴식	휴식	휴식	휴식	휴식
16:15~17:15	산업체 소개1	산업체 소개2			
17:15~18:15	빔물리 입문2	전산 실습2	커뮤니 계획2	빔 진단 장비 실습2	빔 설계2
18:15~19:00					
19:00~20:30	저녁	저녁	연회	저녁	폐회식 및 퇴소
20:30~22:00	과제	과제		과제	



- At Korea University, Sejong Campus
- 2019/08/19 ~ 2019/08/23
- For undergraduate and graduate students
- <https://indico.korea.ac.kr/e/kuass2019>



# Accelerator School II



## Asian School on Superconductivity and Cryogenics for Accelerators 2019

### The 4th Asian School on Superconductivity and Cryogenics for Accelerators (ASSCA2019)

16-24 February 2020  
Asia/Seoul timezone

- Overview
- Committee
- Program
- Lecturers
- Timetable
- Hands-On Training
- Registration
- Participant List
- Venue
- Accommodation
- Travel Information
- Visa Information
- Previous Schools
- Contact

**Starts** 16 Feb 2020, 07:00  
**Ends** 24 Feb 2020, 18:00  
Asia/Seoul

**Location:** Korea University, Sejong Campus  
2511 Sejong-ro, Sejong-si, Republic of Korea

**Organizer:** Eun-San Kim

[ASSCA2019 Program at a glance](#)

**School Description...**

Time	Day 1 Sun 02/16/2020	Day 2 Mon 02/17/2020	Day 3 Tue 02/18/2020	Day 4 Wed 02/19/2020	Day 5 Thr 02/20/2020	Day 6 Fri 02/21/2020	Day 7 Sat 02/22/2020	Day 8 Sun 02/23/2020	Day 9 Mon 02/24/2020	
07:30 - 08:30 (60 min)	Breakfast									
08:30 - 08:40 (10 min)	Welcome	Information and Announcement								
08:40 - 10:10 (90 min)	Introductory Course (Acc. Basic)	SC Magnet	SC Magnet	SRF Cavity	Special Lecture (SRF Cavity)	Cryogenics	ceremony			
10:10 - 10:30 (20 min)	Break									
10:30 - 12:00 (90 min)	Arrival	Introductory Course (SC Magnet & SRF Cavity)	SC Magnet	Special Lecture (SC Magnet)	SRF Cavity	Cryogenics	Cryogenics		Departure	
12:00 - 13:10 (70 min)	Lunch									
13:10 - 14:40 (90 min)	Introductory Course (Cryogenics)	SC Magnet	SRF Cavity	SRF Cavity	Cryogenics	Special Lecture (Cryogenics)	Excursion and/or Field Trip			
14:40 - 15:00 (20 min)	Break									
15:00 - 18:00 (180 min)	Hands-on Training	Hands-on Training	Hands-on Training	Hands-on Training	Hands-on Training	Hands-on Training				

- At Korea University, Sejong Campus
- 2020/02/16 ~ 2020/02/24
- For graduate students and postdocs
- <https://indico.korea.ac.kr/e/ASSCA2019>



Thank you for your attention!