Asian Forum for Accelerators and Detectors (AFAD) 2018

Report of Abstracts

January 28-31
Daejeon Convention Center
Daejeon, Korea

Conference Program

January 28			
17:00~ 20:00	Registration and reception (DCC Room 201)		
January 29 (DCC Conference hall, Room 301)			
8:30~9:00	Registration		
9:00~9:10	Welcome remarks		
	Plenary session chair: Youngjoon Kwon, Yonsei Univ.		
09:10~9:40	Plenary talk"Status and prospect of KEK"	Yasuhiro Okada	KEK
9:40~10:10	Plenary talk "Status and Progress with the High Energy Electron Positron Collider (CEPC)"	Xinchou Lou	IHEP
10:10~10:40	Plenary talk "Operational Status of PLS-II and PAL-XFEL"	Dong-Eon Kim	PAL-XFEL
10:40~11:10	**Coffee break**		
11:10~11:40	Plenary talk" Status of RAON construction"	Young-Kwan Kwon	RISP/IBS
11:40~12:10	Plenary talk "KAERI's Developments of various medical/industrial/agricultural/basic scientific electron accelerator"	Yujong Kim	KAERI
12:10~13:30	**Lunch time**		
13:30~18:00	Parallel Sessions for Working Groups (Rooms 101~107)		
18:30~20:30	Forum Dinner (DCC 2F Grand Ballroom)		
January 30 (DCC Conference hall, Room 301 for afternoon sessions)			
9:00 ~ 12:00	Parallel sessions for WG's (Rooms 101~107)		
12:00 ~ 13:00	**Lunch time**		
13:00 ~ 13:15	Summary of WG1	Park, Sungju	PAL/POSTECH
13:15 ~ 13:30	Summary of WG2	Lee, Sehwook	KNU
13:30 ~ 13:45	Summary of WG3	Ob, Byung-Hoon	KAERI
13:45 ~ 14:00	Summary of WG4	Suk, Hyoung	GIST
14:00 ~ 14:15	Summary of WG5	Chung, Moses	UNIST
14:15 ~ 14:30	Summary of WG6	Cho, Kihyeon	KISTI
14:30 ~ 14:45	Summary of WG7	Kwon, Hueok-Jung	KAERI
14:45 ~ 15:15	**Coffee break**		
	Plenary session chair: Eunil Won, Korea Univ.		
15:15 ~ 15:45	Plenary talk "Korean Neutrino Observatory"	Seon-Hee Seo	Seoul Nat'l Univ.
15:45 ~ 16:15	Plenary talk "Computing for High Energy Particle Physics"	Geoff Taylor	CoEPP, Australia
16:15 ~ 16:25	Introduction to sponsoring companies	Jongwon Kim	RISP/IBS
16:25 ~ 16:35	Closing remarks	Director of RISP	RISP/IBS
16:35 ~ 18:30	**Laboratory tour (SRF Test Facility in KAIST Munji Campus)**		
January 31			
9:00 ~ 17:00	**Excursion in Gongju, Buyeo area**		

WG1: Accelerator and its related technologies for photon science. Room 101			
January 29			
Time	Title	Speaker	Affiliation
Session 1 Chair: Dong-Eon Kim (PAL, Korea)			
13:30 - 13:55	Emittance Exchange Program at KEK STF	Masao Kuriki	Hiroshima University, Japan
13:55 - 14:20	Status of Free Electron Lasers in SINAP	Bo Liu/ZHAO, Zhentang	SINAP, China
14:20 - 14:45	Sub-20-femto second timing jitter of PAL-XFEL	Chang-Ki Min	PAL, Korea
14:45 - 15:10	NOVOSIBIRSK FREE ELECTRON LASER FACILITY	Yaroslav Getmanov	Budker INP, Russia
15:10 - 15:40	Coffee break		
Session 2 Chair: Dong-Eon Kim (PAL, Korea)			
15:40 - 16:05	Free Electron Laser based Delhi Light Source Project at IUAC, NewDelhi	Bhuban Kumar Sahu	Inter University Accelerator Centre, India
16:05 - 16:30	Recent Results on X-ray Generation at LUCX	Junji Urakawa	KEK, Japan
16:30 - 16:55	Development of Coherent THz Radiation Source and MIR-FEL in Thailand	Sakhorn Rimjaem	Chiang Mai University, Thailand
16:55 - 17:20	Accelerator R&D activities at PAL	Jang-Hui Han	PAL, Korea
17:20 - 17:45	Study of BINP damping ring performance with the streak camera	Oleg Meshkov	Budker INP, Russia
January 30			
Session 3 Chair: Heung-Sik Kang (PAL, Korea)			
9:00 - 9:25	Harmonic Lasing Self-seeded FEL at PAL-XFEL	In-Hyeok Nam	PAL, Korea
9:25 - 9:50	LUCX pre-bunched e-beam generation and its application to THZ experimental studies	Alexander S. Aryshev	KEK, Japan
9:50 - 10:15	Latest results on the 100-mA CW RF Electron Gun for Novosibirsk ERL FEL	Vladimir Volkov	Budker INP, Russia
10:15 - 10:45	Coffee break		
Session 4 Chair: Heung-Sik Kang (PAL, Korea)			
10:45 - 11:10	Status of the DIRAMS C-band standing-wave accelerator for a radiotherapy machine	Heuijin Lim	DIRAMS, Korea
11:10 - 11:35	The Commissioning and Early User Operation of Dalian VUV Free Electron Laser	Weiqing Zhang	Dalian Institute of Chemical Physics, China
11:35 - 12:00	Structured Light from Helical Undulators	Shunya Matsuba	Hiroshima University, Japan

WG2: Detector technology development. Room 102			
January 29			
Time	Title	Speaker	Affiliation
Session 1 Chair: Sehwook LEE (KNU)			
13:30-13:50	Large GEM foil production using the double mask method	Jason Lee	University of Seoul (UoS)
13:50-14:10	Ceramic GEM	Shoji Uno	KEK
14:10-14:30	GEM-based polarimeter detector development for storage ring proton electric dipole moment measurement	Seongtae Park	CAPP/IBS
14:30-14:50	LAMPS GEM based TPC R&D	Min Sang Ryu	IBS
14:50-15:10			
15:10~15:40	Coffee break		
Session 2 Chair: Jason LEE (UoS)			
15:40-16:00	Liquid argon TPC for neutrino experiment	Ken Sakashita	KEK
16:00-16:20	Liquid scintillator (neutrino)	Kyunggang Joo	Chonnam National University
16:20-16:40	Dual readout calorimeter	Tohru Takeshita	Shinshu University
16:40-17:00	NEOS Detector for Measuring Energy of Reactor Neutrinos	Young Ju Ko	CUP/IBS
17:00-17:20	On the limits of the hadronic energy resolution of calorimeters	Sehwook Lee	Kyungpook National University (KNU)
January 30			
Session 3 Chair: Seongtae PARK (CAPP/IBS)			
9:00-9:20	The design and progress of the Central Detector of JUNO	Yuekun Heng	Chinese Academy of Sciences
9:20-9:40	5μm-Pore Microchannel-Plate and its performance	Shulin Liu	Chinese Academy of Sciences
9:40-10:00	The mass production and batch test of 20 inch MCP-PMT for JUNO	Sen Qian	Chinese Academy of Sciences
10:00-10:20	Coffee break		
10:20-10:40	Research on Liquid Scintillator Cherenkov Detector for Nutrino Physics	Ziyi Guo	Tsinghua Univ
10:40~11:00	PandaX-4T Dark Matter Detector	Jinkai Xia	Shanghai Jiaotong Univ
11:00~11:20	PandsX-III High Pressure Xenon TPC for the Neutrinoless Double Decay Search	Shaobo Wang	Shanghai Jiaotong Univ

WG3: Accelerator technologies for industrial & medical applications. Room 103			
January 29			
Time	Title	Speaker	Affiliation
Session1 Chair: Ken Takayama (KEK)			
13:00-13:30	Present status of Cryomodule and Cryoplant for LIPAc	K. Sakamoto	ITER, Aomori Fusion Energy Center
13:30-14:00	Transmission- and Scanning- Muon Microscopy	Dr. Nagatani	KEK J-PARC
14:00-14:30	Electron linacs for radiotherapy	Chuanxiang Tang/Hao Zha	Tsinghua University/China
14:30-15:00	Development of a superconducting cyclotron based proton herapy sysmte at HUST	Kuanjun Fan/Deming Li	HUST/Sinap, China
15:00-15:30	Carbon Ion Radiotherapy	Guoqing Xiao/Jiawen Xia	IMP, China
15:30~16:00	Coffee break		
Session 2 Chair: Dr. Tang Chuanxiang (Tsinghua University)			
16:00-16:30	Towards a Hadron Driver for the Next Generation of Cancer Therapy	Ken Takayama	KEK, Japan
16:30-17:00	Full-Body PET Camera based on Liq. Xenon TPC technology	Toshiaki Tauchi	KEK, Japan
17:00-17:30	Laser driven proton acceleration enhancement by using nanophotonic butterfly wing targets	Moon, Young Jung	ETRI, Korea
17:30-18:00	Physical design of the proton linac injector for the synchrotron based proton therapy system in China	Shuxin Zheng/Qingzi Xing	Tsinghua University, China
January 30			
Session 3 Chair: B.H. Oh (KAERI)			
9:00-9:30	Dual-energy Electron Accelerator for Container Inspection	B.C. Lee	KAERI/Korea
9:30-10:00	Medical Imaging and Therapy Radioisotope Production Techniques with High Current Cyclotrons	W. Gelbart, K. Butalag, RR Johnson	Advanced System Design Ltd/TeamBest/U. of British Columbia
10:00-10:30	Start of mutation breeding research using ion beam in Korea	Si-Yong Kang	KAERI/Korea
10:30-10:50	Coffee break		
10:50-11:20	Irradiation electron linacs	Huaibi Chen	Tsinghua University/China

WG4: Innovative Accelerator Techniques. Room 104			
January 29			
Time	Title	Speaker	Affiliation
Session 1 Chair: Kazuyoshi Koyama (Univ. Tokyo/KEK)			
13:40-14:05	Development of the laser driven ion injector for the new generation heavy ion cancer therapy	Kiminori Kondo	QST, Japan
14:05-14:30	Compact charged particle accelerators for applications	Seong Hee Park	Korea Univ., Korea
14:30-14:55	Ion acceleration by shock waves and pulse-recyling TNSA	Young-Kuk Kim	UNIST, Korea
14:55~15:30	Coffee break		
Session 2 Chair: Seong Hee Park (Korea Univ.)			
15:30-15:55	Novel laser-plasma electron acceleration experiments at SJTU based on ionization injection and two-color laser pulses	Nasr Hafz	SJTU, China
15:55-16:20	Laser wakefield accelerator for medical application at KERI	Jaehoon Kim	KERI, Korea
16:20-16:45	Laser Plasma Acceleration using the evolution of plasma wave and nanoparticle	Myung-Hoon Cho	IBS/CoRelS, Korea
January 30			
Session 3 Chair: Yen-Chieh Huang (Tsing Hua Univ., Taiwan)			
9:00-9:25	Recent studies on plasma-based acceleration at IHEP	Dazhang LI	IHEP China
9:25-9:50	Researches on laser-driven electron accelerators in Japan	Kazuyoshi Koyama	Univ. Tokyo/KEK, Japan
9:50-10:15	Generation of ion beams with narrow energy spread from a metal-polymer double layer target irradiated by an ultraintense laser pulse	Kitae Lee	KAERI, Korea
10:15~10:40	Coffee break		
Session 4 Chair: Dazhang Li (IHEP)			
10:40-11:05	Opportunities on dielectric laser accelerator on high-brightness radiation	Yen-Chieh Huang	Tsing Hua Univ., Taiwan
11:05-11:30	Laser-plasma-based THz radiation sources and their applications	Hyyong Suk	GIST, Korea
11:30~11:55	Radiation burst from laser-plasma interactions	Min Sup Hur	UNIST, Korea

WG5: Accelerator and its related technologies for hadron (neutron) science. Room 105			
January 29			
Time	Title	Speaker	Affiliation
Session 1 Chair: Moses Chung (UNIST)			
13:30-13:50	Upgrade of Hokkaido University neutron source (HUNS)	Michihiro Furusaka	Hokkaido University
13:50-14:10	Status of the RIKEN Linac upgrade	Narushiko Sakamoto	RIKEN
14:10-14:30	Challenge and status of high intensity heavy ion accelerator facility (HIAF) in China	Jiancheng YANG	IMP
14:30-14:50	Accelerator-driven compact neutron sources in Japan	KatsuyaHirota	Nagoya University
14:50-15:10	Design of 6MeV compact cyclotron for neutron based safety inspection	Jong-Seo Chai	SungKyunKwan University
15:10~15:40	Coffee break		
Session 2 Chair: Narushiko Sakamoto (RIKEN)			
15:40-16:00	Development of CW heavy ion linac at IMP	Xuejun YIN	IMP
16:00-16:20	A Plan for a Pulsed Neutron Source Based on the KOMAC 100-MeV Proton Linac	Hyuk-Joong Kwon	KAERI
16:20-16:40	Development of BNCT at DawonSys	Dong-Soo Kim	DawonSys
16:40-17:00	Current Status of the 28GHz SC-ECR IS for RISP	Yong-Hwan Kim	RISP/IBS
17:00-17:20	Compact neutron source Development with SKKUCY-13 Cyclotron	Mitra Ghergherehchi	SungKyunKwan University
January 30			
Session 3 Chair: Jiancheng Yang (IMP)			
9:00-9:20	Construction and Preliminary Beam Test of RISP 81.25 MHz CW RFQ for Heavy Ions	Bum-Sik Park	RISP/IBS
9:20-9:40	The current status and future plans of Versatile Ion Beam Accelerator Facility	Byung Seob Lee	KBSI
9:40-10:00	BEST 70P Cyclotron beam commissioning at LN Legnaro	Vladimir Ryjkov	Best Cyclotron Inc.
10:00-10:30	Coffee break		
10:30-10:50	Status of an Electron Beam Ion Source for Charge Breeding for RISP	Young-Ho Park	RISP/IBS
10:50-11:10	An X-band Compact Electron Linac Development for a Neutron Radiography	Seung-Wook SHIN	SungKyunKwan University

WG6: Network & Computing. Room 106			
January 29			
Session 1 Chair: Tomoaki Nakamura			
Time	Title	Speaker	Affiliation
13:30-13:50	Networking and Computing Status in IHEP/China	Fazhi QI	IHEP, China
13:50-14:10	Grid Deployment at KEK: Status and Plan	Go Iwai	KEK, Japan
14:10-14:30	KREONET: Research Networking in Korea	Buseung Cho	KISTI, Korea
14:30-14:50	Computing in Korea	Kihyeon Cho	KISTI, Korea
14:50-15:10	Status report from Tokyo Tier2 at ICEPP	Tomoe Kishimoto	ICEPP, Utokyo, Japan
15:10~15:40	Coffee break		
Session 2 Chair: Kihyeon Cho (KISTI)			
15:40-16:00	Research infrastructure development in Academia Sinica (Taiwan)	Eric Yen	ASGC, Taiwan
16:00-16:20	Networking and Computing in Thailand	Burin Asavapibhop	Chulalongkorn University, Thailand
16:20-16:40	Belle II Computing System	Doris Kim	Soongsil U., Korea
16:40-17:00	CMS Tier-2	Dongchul Son	KNU, Korea
17:00-17:20	GSDC@KISTI	Seo-Young Noh	KISTI, Korea
17:20~17:50	Networks for High Energy Physics: LHCOPN and LHCONE	Edoardo Martelli	CERN, Switzland
January 30			
Session 3 Chair: Buseung Cho (KISTI)			
9:00~9:30	Status report in TEIN	ByungKyu Kim	TEIN*CC, Korea
9:30~10:00	NDN for Large-scale Scientific Data and Its Status on HEP	Huhnkuk Lim	KISTI, Korea
10:00~10:30	CoEPP Tier 2 in Melbourne	Sean Crosby and Lucien Boland	U. of Melbourne, Austrailia
10:30~11:00	Coffee break		
	Session 4 Chair: Gang Chen		
11:00~12:00	Discussion		Gang Chen

WG7: Cryogenics, Cryomodule and Superconducting Technology for Accelerator. Room 107			
January 29			
Time	Title	Speaker	Affiliation
Session 1 Chair: Hirotaka Nakai (KEK)			
13:30-13:50	Status of Vertical Test Facility for HWR and QWR at RISP	JuWan Kim	RISP
13:50-14:10	Operation of Cryomodules for Chinese ADS Front-end Demo Linac	Feng Bai	IMP
14:10-14:30	Progress of CEPC cryogenic system	Jianqing Zhang	IHEP
14:30-14:50	A plan of the HWR superconducting linac development at KOMAC	Han-Sung Kim	KOMAC
14:50-15:10	The HWRs for Chinese ADS project	Weiming Yue	IMP
15:10~15:40	Coffee break		
Session 2 Chair: H. J. Kwon (KAERI)			
15:40-16:00	Report on the Asian School on Superconductivity and Cryogenics for Accelerators (ASSCA2017)	Hirotaka Nakai	KEK
16:00-16:20	Cryogenic system of the SuperKEKB IR final focusing SC magnets	Zhanguo Zong	KEK
16:20-16:40	Introduction of PAPS cryogenic system	Shaopeng Li	IHEP
16:40-17:00	Current status of cryomodule development for SCL3 of RAON	Minki Lee	RISP
January 30			
Session 3 Chair: Shaopeng Li (IHEP)			
9:00-9:20	Conceptual design of CEPC superconducting RF system	Jiyuan Zhai	IHEP
9:20-9:40	Progress of Linear IFMIF Prototype Accelerator (LIPAc) in collaboratio with EU	Keishi Sakamoto	QST Rokkasho
9:40-10:00	Current status and challenges of cryogenic systems for RAON accelerator	Tae Kyung Ki	RISP
10:0~10:30	Coffee break		

Abstract Lists

P1

Status and prospect of KEK

Yasuhiro Okada
High Energy Accelerator Research Organization (KEK)

Abstract

KEK is a research institute in Japan carrying out basic science research in a wide range of scientific fields from particle and nuclear physics to materials and life sciences using large accelerator facilities. KEK's research facilities are open to international science communities. Three on-going projects are SuperKEKB/Belle II and Photon Factory at the Tsukuba campus and J-PARC at the Tokai campus, a joint project between KEK and Japan Atomic Energy Agency. KEK is also making efforts to prepare for future projects such as the International Linear Collider. Current status and future prospects of research activities at KEK is described in the talk.

P2

Status and Progress with the High Energy Electron Positron Collider (CEPC)

LOU Xinchou
IHEP, Beijing

Abstract

The Circular Electron-Positron Collider (CEPC) aims at producing a large sample of clean Higgs boson events to allow for precisely measurement of the Higgs couplings to other elementary particles, and through the Higgs boson to explore new physics. The CEPC study group is working on the Conceptual Design Report (CDR) of the accelerator and of the detector, the R&D of the critical technologies, and the investigation of suitable sites in China to place the CEPC collider. This presentation will provide an overview, and the current status and future plan of the CEPC.

P3

Operational Status of PLS-II and PAL-XFEL

LEE Kibong[1], KIM Dong-Eon[2]
PAL/POSTECH[1], PAL[2]

Abstract

At PAL (Pohang Accelerator Laboratory), 3rd generation synchrotron light source PLS-II is in user operation mode since 2011 as a national user facility. Annual user visit reaches about 5000, and more than 1500 experiments are carried out resulting more than 500 SCI papers. And recently 10 GeV S-band linac based 0.1 nm class FEL is successfully commissioned and started user service from 2017. In this report, the current status and future prospects of PLS-II, and PAL-XFEL will be discussed.

P4

Status of RAON construction

KWON Young Kwan
IBS/RISP

Abstract

RAON (Rare isotope Accelerator complex for ON-line experiments) is under active con- struction at Daejeon, Republic of Korea. Based on a 400 kW heavy-ion linear accelerator, RAON will deliver a variety of stable and rare isotope beams with wide range of energy (a few keV/nucleon to a few hundreds MeV/nucleon) and high intensity to experimental areas for researches in fields of basic and applied science. RAON is intended to establish the In-flight Fragment (IF) and Isotope Separation On-Line (ISOL) facilities for production and separation of rare isotope beams. Especially, ISOL and IF facilities can be operated in combination and it is unique feature of RAON, allowing to reach more than 80% of the unexplored region in the chart of nuclide. Recently, test for cryomodule in low energy part of linear accelerator has been performed and demonstration of accelerator including injector system has been accomplished successfully. Now prototyping of major accelerator components is almost completed, and the fabrication of major components has begun. In this talk, the overview of RAON project, its scientific programs, progress on accelerator and experimental systems will be presented.

P5

KAERI's Developments of Various Medical/Industrial/Agricultural/Basic Scientific Electron Accelerators

KIM Yujong
KAERI

Abstract

The particle accelerator is a specially designed system, which can increase the speed of a moving charge particle up to that of light (~ 3.0E+8 m/s) by using the electric field. Since electrons are much lighter than protons or heavy ions, they can be easily accelerated up to the speed of light. As the first working industrial S-band linac in Korea, Korea Atomic Energy Research Institute (KAERI) developed an S-band linear accelerator in 2013, and as the first working medical X-band linac in Korea, KAERI developed a 6 MeV X-band standing wave type linac in 2015. During this talk, speaker will introduce the basic working principle of electron accelerators and their various user applications such as container inspection system, non-destructive test (NDT) with intensive X-rays, soil treatment system with electron beams for continuous-cropping of Panax ginseng, cancer therapy treatment, and so on. Then, he will report recent developments of various low energy S-band and X-band electron accelerators at KAERI.

P6

Korean Neutrino Observatory

SEO Sunny
Seoul National University

Abstract

Korean Neutrino Observatory (KNO) is a future water Cherenkov neutrino observatory which will consist of a 260 kton water tank with 40,000 photo-sensors underground in Korea, as part of the international Hyper-Kamiokande (Hyper-K) program where one of the two identical detectors will be built in Japan. KNO covers various physics topics from astroparticle physics to particle physics using J-PARC neutrino beam. In the Hyper-K program, by locating one of the two detectors in Korea (i.e. KNO) rather than in Japan, the physics sensitivities are further improved thanks to the longer baseline (~1100 km vs. 295 km) and larger overburden (1000 m vs. 650 m) in Korean candidate sites. KNO will operate more than 30 years to study solar, Supernova neutrinos, dark matter search, and neutrino geophysics. Proton decay search is another very interesting topic to be pursued. Together with the Hyper-K detector in Japan, the mystery of the baryon asymmetry of the universe could be revealed using beam neutrinos from J-PARC. In this talk, I will present an overview of the KNO and report its recent progress.

P7

Computing for High Energy Particle Physics

Geoff Taylor
The University of Melbourne

Abstract

This presentation will give an overview of the current capacity and future directions for HEP computing and data storage, based upon experience with the Large Hadron Collider computation grid, WLCG. The authors, members of the Australian Research Council, CoEPP, operate the Australian Tier-2 ATLAS grid site at the University of Melbourne.

WG1-1

Emittance Exchange Program at KEK STF

MASAO Kuriki
Hiroshima University

Abstract

To demonstrate the emittance exchange to optimize the phase-space distribution for a purpose, a collaboration among Hiroshima U, Tohoku U, Waseda U, KEK, Northern Illinois U, and ANL has been started. In KEK-STF, the phase-space rotation technique for the emittance exchange (round to flat transformation) will be demonstrated. In ANL WFA, transverse to longitudinal exchange will be demonstrated. As a future plan, the combination of these two exchange techniques will be demonstrated at KEK STF. Possible application as the photon source will be discussed.

Status of Free Electron Lasers in SINAP

ZHAO Zhentang
Shanghai Institute of Applied Physics

Abstract

Shanghai soft X-ray Free-Electron Laser facility (SXFEL) is under construction at SINAP. SXFEL is being developed in two steps, the test facility SXFEL-TF and the user facility SXFEL-UF. The SXFEL-TF, going to generate 8.8 nm FEL radiation with the two-stage cascaded scheme, is under commissioning, while the SXFEL-UF started to construct in November 2016. SINAP has also participated in the newly approved CW-SRF linac based hard X-ray project – Shanghai Coherent Light Facility (SCLF). Status and future plan of the FEL activities at SINAP is presented here.

WG1-3

Sub-20-femtosecond timing jitter of PAL-XFEL

MIN Chang ki
Pohang Accelerator Laboratory

Abstract

Since 2016, a hard X-ray free electron laser, PAL-XFEL was commissioned and has been operated for user experiments. One of this main application is a time-resolved experiment based on 10 fs level femtosecond pulse duration of XFEL pulses. The obstacle of the experiment is timing jitter between XFEL and experimental optical laser which is usually a few hundred femtosecond in the previous report and limits the time resolution. To reduce this jitter, we developed 10 fs level optical timing synchronization, low phase noise RF system and low noise magnetic power supply. Finally, we were able to obtain sub 20 fs jitter.

WG1-4

NOVOSIBIRSK FREE ELECTRON LASER FACILITY

Yaroslav GETMANOV
Budker Institute of Nuclear Physics (BINP)

Abstract

The Novosibirsk FEL facility has three FELs, installed on the first, second and fourth orbits of the ERL. The first FEL covers the wavelength range of 90 − 240 m at an average radiation power of up to 0.5 kW with a pulse repetition rate of 5.6 or 11.2 MHz and a peak power of up to 1 MW. The second FEL operates in the range of 40 - 80 m at an average radiation power of up to 0.5 kW with a pulse repetition rate of 7.5 MHz and a peak power of about 1 MW. These two FELs are the world's most powerful (in terms of average power) sources of coherent narrow-band (less than 1%) radiation in their wavelength ranges. The third FEL was commissioned in 2015 to cover the wavelength range of 5 − 20 m. The Novosibirsk ERL is the first and the only multiturn ERL in the world. Its peculiar features include the normal-conductive 180 MHz accelerating system, the DC electron gun with the grid thermionic cathode, three operation modes of the magnetic system, and a rather compact (6×40 m^2) design. The facility has been operating for users of terahertz radiation since 2004.

WG1-5

FREE ELECTRON LASER BASED DELHI LIGHT SOURCE PROJECT AT IUAC

SAHU Bhuban Kumar
INTER UNIVERSITY ACCELERATOR CENTRE, India

Abstract

Inter University accelerator Centre (IUAC) is an ion accelerator based research centre in India. In order to serve large inter- disciplinary researchers from various branches of science, a compact Light source based on the principle of Free Electron laser (FEL) is being developed. The facility to be developed in phases, has an electron gun as its main element to produce high brightness and low emittance electron beam with an energy up to 40 MeV which will produce coherent THz and Infrared radiation from undulator magnet and X-ray radiation by inverse Compton scattering. Development and commissioning of the first phase of the project to produce 8 MeV electron beam and coherent THZ radiation using a normal conducting RF photo cathode gun is currently in progress. The 2.6 cell 2860 MHz copper cavity to be used as electron gun is already developed in collaboration with KEK, Japan. The high power RF source consisting of 25 MW Klystron and solid state modulator will be installed in the summer of 2018. The simulation calculation of the beam optics from the photo cathode to the beam dump has been calculated by using the code of ASTRA & GPT. An in-house simulation code has been developed to calculate the THz radiation from the undulator magnet. The electron beam will be produced initially from the copper photocathode and later on from the semiconductor photo cathode by using high power laser system. Currently the laser system is being developed in collaboration with KEK, Japan. The photocathode deposition system is going to be developed and commissioned with the help of BNL, USA. The final testing of the electron beam and THz radiation is expected to be completed by 2019. In subsequent phases, development of a superconducting photo injector has been planned along with the use of 1.3 GHz 9 cell superconducting niobium resonators to increase the energy of the beam to˜ 40 MeV. An overview of the first phase of the project along with future outlook will be presented. REFERENCES [1] S.Ghosh et al. NIMB vol. 402, p. 358-363, 2017. *This project is jointly funded by BRNS and IUAC respectively.

WG1-6

Recent Activities on X-ray Generation at LUCX

URAKAWA Junji
KEK

We are developing photo-cathode RF gun to gen-erate high current electron beam (1000 x 0.6nC) and optical cavity (> 1.2MW) with high energy pulsed laser to make stable collision with the elec-tron beam. I will explain details of recent technol-ogies related the title. Fig.1, Fig.2 and Fig.3 show the schematic view of LUCX, photocathode RF gun system and laser burst amplification system for the optical cavity. We confirmed the 9keV yield of several times 10^8 photons/sec with total bandwidth under the best stable condition.

WG1-7

Development of Coherent THz Radiation Source and MIR-FEL in Thailand

RIMJAEM Sakhorn
Plasma and Beam Physics Research Facility, Department of Physics and Materials Science, Chiang Mai University

Abstract

A project to extend the capability of an electron linear accelerator system to be a source of coherent THz/MIR radiation is in progress at the Plasma and Beam Physics (PBP) Research Facility of Chiang Mai University (CMU) in Thailand. This accelerator system was originally established to generate THz/FIR radiation from femtosecond electron bunces using transition radiation technique. The accelerator system consists of an S-band thermionic RF electron gun, an alpha magnet for electron bunch compression, an S-band traveling-wave linac and several beam diagnostic instruments. This system is able to produce femtosecond electron bunches with adjustable energy between 10 to 20 MeV. To generate higher average power of THz radiation with possible wavelength tunability, a plan to produce coherent THz undulator radiation is ongoing. Furthermore, development of a MIR free-electron laser (FEL) is underway. This facility will be the first light source, which can produce both coherent THz radiation and MIR-FEL in Thailand and South East Asia. The goal of the facility is to produce infrared radiation covering wavelengths from about 10 to 125 micron for spectroscopy and imaging applications.

Accelerator RD activities at PAL

HAN Jang hui
Pohang Accelerator Laboratory

Abstract

After the success of the PLS-II and PAL-XFEL projects, PAL is seeking next challenges. Among them, new PLS-II beamline construction to provide high energy X-ray, ultra-low emittance storage ring, and other compact light sources are under consideration. In this talk, we present recent accelerator R&D activities for future projects at PAL.

Study of BINP damping ring performance with the streak camera

Oleg MESHKOV
Budker Institute of Nuclear Physics (BINP)

Abstract

The paper is dedicated to the study of the trapping and accumulation of a beam into damping ring of Budker Institute of Nuclear Physics. This installation is a part of the injection complex which supplies by the particles to the electron-positron colliders of the BINP. The damping ring (DR) was initially designed and commissioned with 700 MHz RF cavity. The PS-1\S1 streak camera was used for study of the injection of electron beam into accelerator. The obtained data revealed a significant loss of the particles during beam injection from the linear accelerator into the DR due to discrepancy between separatries of the accelerators. In order to increase the efficiency of beam trapping the 700 MHz/ 64-harmonic resonator was recently replaced by the 10.97 MHz/ 1st harmonic resonator and the measurements with the streak camera were repeated. The presented data of both series of the measurements demonstrate the differences of the injection process for old and new RF system of the DR. The longitudinal profile of injected beam and its current dependence was studied. The detailed study of injection of a beam from the damping ring into the VEPP-3 accelerator is presented as well.

WG1-10

Harmonic Lasing Self-seeded FEL at PAL-XFEL

NAM In hyuk
Pohang Accelerator Laboratory

Abstract

Harmonic lasing is a promising way to provide the beams that can be brilliant, stable and narrow-band. We demonstrate the 3rd harmonic lasing operation in the current configuration with gap-tunable planar hybrid type undulator at soft X-ray beam line at PAL-XFEL. In order to suppress the fundamental resonant radiation, we used a set of phase shifters for the optimal condition. This new operation mode can improve the spectral brightness compare to Self-Amplified Spontaneous emission (SASE) mode. In this paper, we report the results of these studies of the harmonic lasing mode for soft X-ray in the wavelength down to 1 nm with the electron beam energy of 3 GeV at PAL-XFEL.

WG1-11

LUCX pre-bunched e-beam generation and its application to THz experimental studies

ARYSHEV Alexander
KEK

Abstract

A compact accelerator facility designed to generate high-brightness, low emittance electron beams is of the great demand throughout a broad scientific community as it can be used to generate intense, tunable THz, VUV, IR and X-ray radiation. The usual associated technical challenge is the generation of extremely short, pre-bunched beams with 100 femtosecond level pulse length without external longitudinal phase space compression [1,2]. The number of micro-bunches accelerated in the same RF bucket is limited by its length and separation. Also, space-charge forces limit the total beam charge and restrict maximum achievable radiation energy for a given acceleration gradient [3]. In this report, the present status of the micro-bunch generation at KEK LUCX, as well as its application for various experimental studies among the AGTaX collaboration [4-6], will be presented. The possible extension of the developed bunching technique to increase coherent radiation power will be shown and a roadmap for future developments will be discussed.

WG1-12

LATEST RESULTS ON THE 100-mA CW RF ELECTRON GUN FOR NOVOSIBIRSK ERL FEL

Vladimir VOLKOV
BINP SB RAS

Abstract

The 100-mA continuous wave (CW) RF electron gun for injecting a high-quality 300 to 400-keV electron beam into the Energy Recovery Linac (ERL) of the Novosibirsk Free Electron Laser (NovoFEL) has been developed, built, and commissioned at BINP SB RAS. The RF gun consists of the normally conducting 90-MHz RF cavity with a grid thermionic cathode unit. The RF gun was tried on the test bench, which includes a diagnostics beam line. The tests produced good results, in strict accordance with our numerical calculations. The test results also demonstrated compliance with the design specifications and reliable and stable long-term operation of the gun. The design features of different components of the RF gun are presented. The preparation and commissioning experience is discussed. The latest beam results are reported.

WG1-13

Status of the DIRAMS C-band standing-wave accelerator for a radiotherapy machine

LIM Heui-jin
Dongnam Institute of Radiological & Medical Sciences

Abstract

We developed and constructed the 6 MeV C-band standing-wave accelerator with a 450 mm accelerating column and a 2.5 MW magnetron, producing the uniformly intense electron beam and X-ray beam. For the medical application, the radiation head was designed and constructed to generate the X-ray beam using the target and shape the beam profile with the collimators. This MV X-ray beam has the exponential relation inside the human body in the depth dose and is used to kill the deep-seated cancer cells. The biological effect of the X-ray beam was verified by the study using human cancer cell lines. The results were compared with the study from the commercial medical linac. The Bremsstrahlung spectrum of X-ray beam was measured using a BGO crystal scintillation detector readout by the photo-multiplier and a FADC data acquisition system. We are developing the radiotherapy machine including a gantry based on the C-band linac and the radiation head. In this paper, we present the status of the DIRAMS C-band linac and discuss the results.

WG1-14

The Commissioning and Early User Operation of Dalian VUV Free Electron Laser

ZHANG Weiqing
Dalian Institute of Chemical Physics

Abstract

A Free Electron Laser with high brightness, ultrafast laser pulses in the vacuum ultraviolet (VUV) wavelength region is an ideal light source for excitation of valence electrons and ionization of molecular systems with very high efficiency. it is quite helpful for studies of important dynamic processes in physical, chemical and biological systems. Dalian Coherent Light Source (DCLS) plans to deliver optical beam from 50-150nm in picoseconds or 100 femtoseconds for such research. High gain harmonic generation is the perfect choice in VUV FEL for narrow bandwidth, stable power and low cost due to fewer undulators. After eight months of installation and machine commissioning, a 300-MeV electron beam was achieved with peak current of more than 300A, and the emittance was less than 1.5 mm.mrad. The FEL power for individual pulse at 133nm approached more than 200uJ with 266nm seed laser on Jan. 2017. The gain curve and spectrum of HGHG & SASE FEL was measured, and tapering undulator helps increase the power by almost 100% when the FEL output saturated. The user experiment has started on Jun. 2017. Early User Operation will be presented in this talk.

WG1-15

Structured Light from Helical Undulators

MATSUBA Shunya
Hiroshima University

Abstract

Higher harmonics of synchrotron radiation from a helical undulator carry orbital angular momentum. To investigate characteristics of such beams, called structured light, experimental measurements were performed at UVSOR-III in collaboration with Nagoya University and Institute for Molecular Science. In this presentation, we introduce characteristics of structured light and outline of experiments.

WG2-1

Large GEM foil production using the double mask method

LEE Jason Sang
University of Seoul

Abstract

We present the current state of the large size GEM foil production in Korea using the double mask method. This talk covers the facilities and the various GEM foil development experiences that have been carried out to date.

WG2-2

Ceramic GEM

UNO Shoji
KEK

Abstract

The GEM detector is useful for various fields, not only high energy physics. But, one uncomfortable feature is to be broken due to a large discharge. One large charge deposit makes a trigger leading the large discharge and carbonization inside the GEM hole. In order to avoid such a bad situation, we are developing new GEM foil without carbon. One good solution is to apply ceramic as an insulator instead of Polyamide and Liquid Crystal Polymer (LCP). New ceramic GEM was manufactured with 100 mm × 100 mm size and 100 [U+F06D]m thickness. The reasonable gas gain and energy resolution were obtained for Ar-CO2 gas mixture using the Fe-55 radioactive source. Also, similar performance was obtained as a neutron detector.

WG2-3

GEM-based polarimeter detector development for storage ring proton electric dipole moment measurement

PARK Seong-Tae
CAPP/IBS

Abstract

Finding nonzero electric dipole moment (EDM) in a fundamental particle would signal strong CP violation and consequently it could explain matter and antimatter asymmetry in our universe. The storage ring EDM collaboration plans to search the EDM in a hadronic or leptonic particle using the storage ring technique with a 10^{-29} e.cm precision level. The EDM is detected by measuring the precession rate in a strong electric field using the polarimeter that measures asymmetrical particle hits on the up/down detectors. In this paper, we discuss experimental results on the GEM detector test, which we develop to use as the prototype polarimeter detectors using Gas Electron Multiplier (GEM) technology. The detectors were equipped with multichannel readout system (CERN SRS), and tested with radiation sources, cosmic rays in the lab. The beam (Deuteron) test results that were carried out with various energies (100~270 MeV) are also discussed. *This work was supported by IBS-R017-D1 of the Republic of Korea.

WG2-4

LAMPS GEM based TPC RD

RYU Min Sang
Institute of Basic Science

Abstract

Large Acceptance Multi-Purpose Spectrometer (LAMPS) is one of nuclear science facilities to study a nuclear Equation of State (EoS) via heavy-ion collisions at Rare isotope Accelerator complex for ON-line experiments (RAON) in Korea. The goal of nuclear physics at RAON is understanding the nuclear structure of nuclei close to drip lines, the astrophysical processes, and the detailed properties of dense nuclear matters. LAMPS is going to investigate nuclear symmetry energy by measuring particle spectrum, yield, ratio and collective flow of pions, protons, intermediate fragments, and neutrons. LAMPS consists of a solenoid spectrometer and a forward neutron wall. In the solenoid spectrometer, a Time Projection Chamber (TPC) with large acceptance ($0^\circ \leq \Phi \leq 360^\circ$ and $24^\circ \leq \theta \leq 127^\circ$) and a time-of-flight (ToF) detector will be placed inside cylindrical solenoid magnet of 0.5 T for identifying particle species and reconstruct the momentum of each charged particles. Eight layers of plastic scintillation detectors will be installed in the forward neutron wall for neutron tracking. TPC is the main tracking detector and consists of a field cage, a gas electron amplifier (GEM), and readout pads for drifting, amplifying, and collecting electrons along with particle track. The prototype of the LAMPS TPC has been made for 1/8 volume of a real LAMPS TPC. In order to understand the performance and characteristics of the TPC prototype, the drift velocity and diffusion has been measured by using a positron beam at the Research Center for ELectron PHoton Science (ELPH) at Tohoku University in Japan and cosmic-ray muons at Institute for Basic Science (IBS).

WG2-5

Liquid argon TPC for neutrino experiment

SAKASHITA Ken
KEK/J-PARC

Abstract

The liquid Argon time projection changer (TPC) allows us to reconstruct tracks with three dimensional views, as a real-time charge imaging detector. Based on this imaging potential, it has a capability of good particle identification and good energy resolution up to several GeV. A large size liquid Ar TPC (>10kton) is a candidate of neutrino far detector in future long-baseline neutrino oscillation experiments as well as SN neutrino observation and a nucleon decay search experiments. We are developing key detector tecnologies toward a realization of the large size liquid Ar TPC. For the large size detector, it is essential to have a long drift length more than 5 m which is also necessary to fully contain all the particle tracks and showers in the detector. On the other hand, the signal could be reduced during the long drift due to impurity of liquid argon. Therefore, high purity liquid argon, high voltage generation (more than 250kV which corresponds to 500V/cm), and charge readout electronics with good signal-to-noize ratio are key R&D items. At KEK, we are studying those key development items using a small setups. In this talk, we will report a present status and future plan of the detector R&D.

WG2-6

Liquid scintillator (neutrino)

JOO Kyung Kwang
Chonnam National University

Abstract

Historically, liquid scintillator (LS) technology has an important role in neutrino community. LS is a mixture of a base solvent plus a scintillating solute. In addition, metals such as Cd, Gd, In, B, Li, Yb, Tn, etc are doped into the LS. Various liquid scintillators are commonly used for detecting neutrinos coming from atmospheric, solar, accelerator beam and reactor experiments. For a successful neutrino experiment, the LS should be chemically stable over the duration of the experiment. Furthermore, certain optical and physical properties as well as safety concerns should be satisfied. In this talk, various LSs used for several neutrino experiments are briefly summarized and reviewed.

WG2-7

Dual readout calorimeter

Tohru Takeshita
Shinshu University

Abstract

The dual read out calorimeter is supposed to give the best energy resolution at high energies because of total absorption without sampling. This is simulated in a large detector which consists of a big PbWO4 block of 2mx2mx2m for pions and electrons. There are two ways of measurements, namely scintillation and Cherenkov lights. They are indeed measured by dE/dx and track length of the charged particles. We found a useful relation between the dE/dx and the track length in the simulation. By suing the relation, we would be able to reach one of the best energy resolution ever. In the talk, the relation and the results would be presented and discussed.

WG2-8

NEOS Detector for Measuring Energy of Reactor Neutrinos

KO Young Ju
CUP/IBS

Abstract

NEOS detector was operated from August 2015 to May 2016 in order to understand the short-distance behavior of reactor neutrino. The detector was located at 24 meters from a reactor core which has 2.8-GW thermal power. The liquid scintillator mixture used for active target has good PSD power. After applying criteria for IBD selection including PSD cut, the number of measured IBD candidates is about 2000 per day and the signal to background ratio is about 22. The detector simulation describes the detector response well after tuning. The energy is calibrated with radioactive source data, which includes non-linearity between charge and energy. The energy resolution is below 5% at 1 MeV for full peak. The IBD energy spectra measured by NEOS detector will be presented.

WG2-9

On the limits of the hadronic energy resolution of calorimeters

LEE, Seh-wook
Kyungpook National University

Abstract

In particle physics experiments, the quality of calorimetric particle detection is typically considerably worse for hadrons than for electromagnetic showers. In this paper, we investigate the root causes of this problem and evaluate two different methods that have been exploited to remedy this situation: compensation and dual readout. It turns out that the latter approach is more promising, as evidenced by experimental results.

WG2-10

The design and progress of the Central Detector of JUNO

HENG Yuekun
IHEP, Beijing

Abstract

Subject[U+FF1A]“The design and progress of the Central Detector of JUNO” By: Yuekun HENG[U+FF0C] Institute of High Energy Physics, Beijing, China, On behalf of JUNO collaboration. Abstract[U+FF1A] The Jiangmen Underground Neutrino Observatory (JUNO) in China is multipurpose neutrino experiments designed to determine neutrino mass hierarchy and precisely measure oscillation parameters by detecting reactor neutrinos from nuclear power plants, observe supernova neutrinos, study the atmospheric, solar neutrinos and geo-neutrinos, and perform exotic searches. The experiment is designed to use the liquid scintillator detector with large scale to have huge target mass and with the critical performance of the precise energy resolution. All the design and research progresses of the central detector of JUNO will be introduced in this talk including detector structure design, high detection efficiency PMT, transparent liquid scintillator, electronics readout, calibration, etc. The central detector is designed to have unprecedented relative energy resolution of 3% at 1 MeV with 20 ktons of liquid scintillator. The liquid scintillator is contained by a acrylic sphere with the diameter of 35.4 m, and the acrylic sphere is supported by stainless steel latticed shell and the shell also holds about 18000 pieces of 20 inch PMTs and 25000 pieces of 3 inch PMTs with high detection efficiency to detect the light from the liquid scintillator. The liquid scintillator is very transparent with the attenuation length of over 20 meters. The central detector is surrounded by pure water as veto Cherenkov detector and its top is covered by tracker detector composed of plastic scintillator with wavelength shift fiber. There are several calibration methods to be used for the central detector. The JUNO international collaboration was formed in 2015 and now over 70 institutions and about 550 collaborators join. The project is going on as the schedule and it will begin to take data in 2020.

WG2-11

5μm pore Microchannel Plate and its performance

LIU Shulin
IHEP, CAS

Abstract

5μm pore Microchannel Plate and its performance Shulin LIU, Baojun YAN, Kaile WEN, Yanjian LIN

(Institute of High Energy Physics, CAS, Beijing, China[U+FF1B] University of Chinese Academy of Sciences[U+FF0C]Beijing, China[U+FF1B] State Key Laboratory of Particle Detection and Electronics, China) Ultra-small pore microchannel plate (MCP) which used in ultra-fast detection and anti- magnetic field has a good application prospect, but because of its ultro-small pore, it is difficult to make good production, and the gain is generally low. We use ALD technology, making nano-meter Al2O3 film in the channel wall of MCP and its input, output surface, the second electron emission coefficient increased, significantly increased the gain, the FWHM of pulse height distribution is improved, which can be widely used in ultra-fast detection and imaging, including MCP-PMT, for the latter, such as the choice of good before and after the close distance, is expected to be applied in strong magnetic field accelerator.***

WG2-12

The mass production and batch test of 20”MCP-PMT for JUNO

SEN Qian
IHEP, CAS

Abstract

The JUNO (Jiangmen Underground Neutrino Observatory) to be built in JiangMen, Guang- dong province in south China is a generic underground national lab for neutrino physics and other research fields. Its neutrino program requires a high performance large detector, which needs approximately 16,000 Photomultiplier Tubes (PMTs), that have large sensitive area, high quantum efficiency, high gain and large peak-to-valley ratio (P/V) for good single photoelectron detection. Researchers at IHEP, Beijing have conceived a new concept of MCP-PMT several years ago. The small MCP (Microchannel Plate) units replace the bulky Dynode chain in the tranditional large PMTs. In addition transmission photocathode on the front hemisphere and reflection photocathode on the rare hemisphere are fabricated in the same glass bulb to form nearly 4π effective photocathode in order to enhance the efficiency of photoelectron conversion. A number of experienced researchers and engineers in research institutes and companies related to PMT fabrication in China jointly worked on the large area MCP-PMT project. After three years R&D, a number of 8 inch prototypes were produced and their performance was carefully tested at IHEP in 2013 by using the MCP-PMT evaluation system built at IHEP. The 20 inch prototypes were followed in 2014, and its’ performance were improving a lot in 2015. Compensating the PMT performances with fiducially volume convert all specifications to cost, radioactivity, dark noise, TTS, the JUNO ordered 15000 pic 20-inch MCP-PMT from the NNVT in Dec.2015. In 2016, the MCP-PMT collaboration group finished to build the mass production line in Nanjing at the end of 2016, and finished the batch test system in the same place within 100 days at the beginning of 2017. From 2017 to 2019, all the 20-inch MCP-PMT will be produced and tested one by one in NNVT for JUNO. This manuscript and presentation will talk about the mass production and batch test result of the first 1K pieces of MCP-PMT prototypes for JUNO.

WG2-13

Research on Liquid Scintillator Cherenkov Detector for Neutrino Physics

GUO Ziyi
Tsinghua University

Abstract

Liquid scintillator Cherenkov detector with slow liquid scintillator (oil-based or water-based) is proposed as the detection material of a few future neutrino experiments. It can be used to distinguish between scintillation and Cherenkov light. Thus neutrino detectors with it will have the direction resolution and particle identification for charged particles, so that a better sensitivity is expected for low energy (MeV-scale) neutrino physics, solar physics, geo-science and supernova relic neutrino search. Linear alkylbenzene (LAB) is the primary component or ingredient of these liquid scintillators. We studied the light yield (including scintillation emission and visible Cherenkov emission), time profile, emission spectrum, attenuation length of different combinations of LAB, 2,5-diphenyloxazole (PPO) and p-bis-(o-methylstyryl)-benzene (bis-MSB). We also measured the attenuation spectrum of some relevant neutrino detector material, like acrylic. Some formulations allow a good separation between Cherenkov and scintillation light, and a reasonable high light yield can also be achieved. The expected improvement on physics with such type of liquid scintillator will also be discussed.

WG2-14

PandaX-4T Dark Matter Detector

XIA Jingkai
Shanghai Jiao Tong University

Abstract

Overwhelming evidence from astronomical and cosmological observations has testified the existence of dark matter (DM). A promising DM candidate is the so-called weakly interacting massive particles (WIMPs), which can be directly detected by searching WIMP-nucleus scattering signals in deep underground experiments. Experiments using the dual-phase xenon time projection chamber (TPC) technique have been constructed to detect WIMP in recent years, pushing the exclusion limits of the WIMP-nucleon elastic scattering cross section to the region predicted by theory models, while none WIMP event has been identified. PandaX-II, whose latest analysis has set a lowest exclusion limit at 8.6×10^(-47) cm^2 at 40 GeV/c^2, is one of the world-leading DM experiments utilizing the xenon TPC. To achieve higher sensitivity, detectors with larger targets and lower background are required. PandaX-4T detector, based on the successful experience of previous PandaX experiments, is under development. In PandaX-4T, a 1.2m scale TPC with 4-ton sensitive xenon region will run in China Jin-Ping Underground Laboratory, to push the DM Spin-Independent sensitivity down to ~10^(-47) cm^2. This talk will introduce the characteristics and developing status of the PandaX-4T detector.

WG2-15

PandaX-III high pressure xenon TPC for neutrinoless double beta decay search

WANG Shaobo
Shanghai Jiao Tong University

Abstract

The PandaX-III experiment uses high pressure Time Projection Chambers (TPCs) to search for neutrinoless double-beta decay of Xe-136 with high energy resolution and sensitivity at the China Jin-Ping underground Laboratory II (CJPL-II). Fine-pitch Microbulk Micromegas will be used for charge amplification and readout in order to reconstruct both the energy and track of the neutrinoless double-beta decay event. In the first phase of the experiment, the detector, which contains 200 kg of 90% Xe-136 enriched gas operated at 10 bar, will be immersed in a large water tank to ensure 5 m of water shielding. For the second phase, a ton-scale experiment with multiple TPCs will be constructed to improve the detection probability and sensitivity. A 20-kg scale prototype TPC with 7 Micromegas modules has been built to optimize the design of Micromegas readout module, study the energy calibration of TPC and develop algorithm of 3D track reconstruction. The preliminary results of the PandaX-III prototype TPC tested with Ar and Xe gas will be also presented in this talk.

WG3-1

Present status of Cryomodule and Cryoplant for LIPAc

SAKAMOTO Keishi
QST, ITER, Aomori Fusion Energy Center

Abstract

The IFMIF (International Fusion Materials Irradiation Facility) project is aiming at the development of neutron source for material tests of a future fusion power plant. The Linear IFMIF Prototype Accelerator (LIPAc) is a prototype of the IFMIF deuteron accelerator projected to demonstrate the validity of acceleration up to 9 MeV with a beam current of 125 mA in continuous wave mode (CW). Here, a superconducting RF Linac (SRF) is adopted to accelerate the 5 MeV Deuteron beam provided by the RFQ up to 9MeV. The SRF is composed of eight 175 MHz half-wavelength niobium cavities in titanium vessels which are arrayed in series in the large vacuum vessel. The RF power is injected into the individual cavity from the eight 100kW tetrode based RF amplifiers. At the upstream side of each cavity, a superconducting solenoid coil is inserted for beam guiding. Liquid He is filled to maintain 4.5 K of the cavities. The SRF components are developed by CEA Saclay in France and under fabrication. To avoid the risk of transportation of the fully assembled SRF, the final assembly process and acceptance test will be carried out in the clean room in QST Rokkasho before being installed to the LIPAc accelerator vault in 2019. The Liquid He is produced by a cryoplant procured by CEA and F4E. The acceptance values of refrigeration and liquefaction capacities measured in the Liquid He Dewar are 103 W and 52 L/h respectively at 4.45 K. The beam acceleration by the SRF will be started at 2020.

WG3-2

Transmission- and Scanning-Muon Microscopy

Yukinori Nagatani
National Institute for Physiological Sciences, Japan.

Abstract

We are constructing a Transmission Muon Microscopy (TmuM) in the JPRAC site. The TmuM employs positive muon-beam instead of electron-beam in the transmission electron microscopy (TEM). The deeper transmission-power of accelerated muon-beam is applied to microscopy, which can visualize the 3D-structures or functions of thick (>10um) objects which cannot be observed by TEMs. I will talk about how to realize the fine-emittance point-source of positive muon, and why cyclotron is used to accelerate muon-beam with keeping its low energy-dispersion, which are required for high-resolution and deeper-transparency of the TmuM. I also report the Scanning Muon Microscopy (SmuM), which is similar to Scanning Electron Microscopy(SEM). The positive muon SmuM can visualize the 3D magnetic structure
of the surface. The negative muon SmuM can analyze 3D elemental distribution, where cooling techniques of negative muon-beam is used.

WG3-3

Electron linear accelerator for radiotherapy

Chuanxiang Tang, Hao Zha
Department of Engineering Physics, Tsinghua University, Beijing, China.

Abstract

This talk presents recent developments of medical use electron linear accelerators (LINACs), which are the commonly used sources for radiotherapy. Over a century, many technologies had been developed for radiation therapy to seek the higher local control rate the and the lower side effect. Recent research activities on radiotherapy technologies were focused on two approaches: the imaged-guide radiotherapy (IGRT) and the stereotactic body radiotherapy (SBRT). Electron LINACs with higher dose rate or higher mobility and dual-energy LINACs are now investigated to meet the demands of hese approaches in Tsinghua university. The status of the research projects will be introduced.

WG3-4

Development of a superconducting cyclotron based proton therapy system at HUST

Kuanjun Fan,
Institute of Applied Electromagnetic Engineering, Huazhong University of Science and Technology (HUST)

Abstract

The study of proton therapy equipment has earned more and more attention in recent years in China. A national key project of proton therapy based on a superconducting cyclotron has been approved by the Chinese government with the aim of developing domestic proton therapy system. It is a joint project developed by Huazhong University of Science and Technology (HUST) and the China Institute of Atomic Energy (CIAE). The project adopts a 250 MeV isochronous superconducting cyclotron to provide the proton beam for Two treatment rooms with 360 degree rotating gantry and one fixed treatment room. This presentation will report the progress of the development of the project.

Carbon Ion Therapy

Guoqing Xiao and Jiawen Xia
Institute of Modern Physics, CAS

Abstract

N/A

WG3-6

Towards a Hadron Driver for the Next Generation of Cancer Therapy

TAKAYAMA Ken
KEK

Abstract

Recently a novel but promissive hadron accelerator system has been proposed with devel- opment of key technology at KEK uder the international collaboration with South Asian countries. It is expected to take an important role to realize the next generation of hadron cancer therapy, where never emploies an injector such as RFQ or kinac and an expensive gantry. In the conference, an outline of the hadron therapy system will be introduced. The presentation will be followed by the next talk.

WG3-7

Full-Body PET based on Liquid Xe TPC

TAUCHI Toshiaki
KEK

Abstract

A next generation PET (Positron Emission Tomography) based on a liquid xenon detector has recently been developed to obtain the more efficient imaging with the minimum parallax as well as a possible large reduction of the dose injected to patients. The essential techniques are originated from detectors at the high energy experiments in the world. In this talk, I will briefly explain the principle of these detectors and the application to the PET. This novel PET has an additional capability of the Compton telescope because the accurate measurements of 3D positions and the deposit energies in the non-segmented scintillation medium of liquid xenon. This leads to a new innovative imaging modality so called “3 γ imaging PET”. Present R&D status of these prototypes are also presented. Finally I will mention a prospect for the real-time imaging at future hadron theraphy.

WG3-8

Laser-driven proton acceleration enhancement by using nanophotonic butterfly wing targets

Jinsun Kim[1], Moon Youn Jung[1], Sanggwun Lee[1], Ilwoo Choi[2], Sungwoo Kang[2]
Electronics and Telecommunications Research Institute (ETRI)[1]
Gwangju Institute of Science and Technology (GIST)[2]

Abstract

In the field of laser-driven particle acceleration, increasing the maximum proton energy is one of the main research topics. Especially improving proton energy by target technology without changing laser parameters is important for future applications since adjusting the laser parameters is relatively expensive and labor-intensive. We investigated the effect of increasing maximum proton energy by using unconventional targets which are butterfly wing coating on the thin metal foils. We observed a significant increase of the maximum proton energy in the laser ion acceleration experiments.

WG3-9

Physical design of the proton linac injector for the synchrotron based proton therapy system in China

XING Qingzi
Tsinghua University, Beijing

Abstract

The physical design of the 7 MeV proton linac injector for one synchrotron based proton therapy system is described. The construction of the proton therapy facility has been approved by the Chinese government under the support of the National Key Research and Development Program. The proton linac injector consists of one Electron Cyclotron Resonance (ECR) proton source, one Low Energy Beam Transport (LEBT) section, one Radio Frequency Quadrupole (RFQ) accelerator, and one Alvarez-type Drift Tube Linac (DTL). The peak current of the proton beam at the exit of the DTL accelerator is required to be larger than 12 mA, with the normalized emittance of less than 1.0π mm•mrad (90% particles), repetition rate of 0.5~10 Hz, and beam pulse width of 40~100 s. The current of the beam component which momentum spread is within ±0.3% is desired to be larger than 8 mA. The design optimization of the linac injector is carried out in the principle of adopting domestic mature technologies and cost control.

WG3-10

Dual-energy Electron Accelerator for Container Inspection

Byung-Cheol Lee[1], H.D. Park[2], K. B. Song[2], B. N. Lee[3], D.H. Lee[4], S. R. Cho[4]
[1]AccuScan, [2]RTX, [3]KAERI, [4]KAIST

Abstract

A 9/6 MeV dual-energy S-band electron linear accelerator has been developed for materials discrimination in container inspection systems, Dual-energy acceleration of electron beam is realized by the combination of high/low-voltage e-gun voltage and high/low RF power. The linac generates 30 Gy/min@1m of X-ray at 9 MeV of electron energy, and 10 Gy/min@1m of X-ray at 6 MeV of electron energy. An S-band magnetron driven by a dual-voltage solid-state modulator generates dual-power 3 GHz RF power. New materials discrimination algorithm has been developed, which is based on dual-energy X-ray tomographic image of rotating phantoms.

WG3-11

Medical Imaging and Therapy Radioisotope Production Techniques with High Current Cyclotrons

JOHNSON Richard
Universiy of British Columbia

Abstract

Nuclear Medicine has moved to effective therapy protocols and with the combination of diag- nostics and therapy (Theranostics) disease treatment can be monitored. New radioisotopes with halflives that match the biological circulation lifetimes of theranostic drugs may be produced from targetry installed on cyclotrons with beam currents that are now accessible in modern installations. The use of 70 MeV beams to produce Lu177 and Ac225(a significant alpha emitting therapy isotope) is presented and compared with lower energy reaction processes. Germanium 68 production is described. The target assemblies are described. Neutron production targets that allow either neutron beam therapy or allow neutron induced radioisotope production are presented together with a scope of technical details that allow a laboratory to produce significant quantities of these isotopes.

WG3-12

Start of mutation breeding research using ion beam in Korea

KANG Si-yong
Korea Atomic Energy Research Institute

Abstract

Radiation irradiation has been generated many new useful varieties and genetic resources since discovery of X-ray can occur mutation in plant in 1928. Since early 1990s, many breeding programs have been done in Japan using big heavy ion beam accelerators of four institutes. Ion beam with high liner energy transfer (LET) show high relative biological effectiveness (RBE) and it gives more effective for a broad variation of plant mutation induction than low LET radiations, i.e., X-rays, gamma rays and electrons. It has been suggested that ion beams induce higher single and double strand DNA breaks as well as large DNA deletion than low LET radiations. Some research groups in Korea have been done mutation induction and biological effect tests using proton beam of MC-50 cyclotron (45 MeV) at the Korea Institute of Radiological and Medical Science, but the effect of mutation is not clearly higher than gamma rays. The KOMAC (Korea Multi-Purpose Accelerator Complex) under the KAERI was constructed in Gyeongju and then has been provide 100 MeV proton beam irradiation service since July 2013. We investigated the radiation damages in the Cymbidium plants caused by two types of proton beam (45 MeV and 100 MeV) that has been hardly researched in the world. From the research result, proton beam especially with 100 MeV caused extremely oxidative stress in Cymbidium compared with gamma ray and it is also expected to be a useful tool for mutation induction in plants. In 2017, our research group started wide researches for setting the irradiation condition of 100 MeV proton beam of the KOMAC for mutation breeding to 15 main crop plants. The LAON heavy ion beam accelerator (200 MeV) has been constructed at the Institute of Basic Science in Korea. In near future, many applications in the plant mutation breeding will be done using the proton and heavy ion beam with high LET. In this presentation, I would like to summarize the basic characteristics, some successful research achievements and current status of research in Korea of the plant mutation breeding using ion beam.

WG3-13

Irradiation electron linacs

Huaibi CHEN
Department of Engineering Physics, Tsinghua University

Abstract

Irradiation electron linacs have been widely used in the industry including the purposes of material processing, sterilization and Custom quarantine. Backward-travelling-wave (BTW) linacs have been developed in Tsinghua University and Nuctech and deployed in several major industrial areas in China. This presentation introduces the electron linacs developed for irradiation purpose in Tsinghua University with a brief summary of the development of irradiation accelerators in China.

WG4-1

Development of the laser driven injector for a new generation heavy ion cancer therapy

KONDO Kiminori
National Institutes for Quantum and Radiological Science and Technology

Abstract

In National Institutes for Quantum and Radiological Science and Technology (QST), the project for developing a new generation heavy ion cancer therapy machine, which is called “Quantum Scalpel”, has been started. Quantum Scalpel is a very compact and cheap heavy ion cancer therapy machine based on not only the superconducting magnet technology, but also the laser driven ion acceleration technology. The recent Peta-Watt-class power laser technology will make it possible to produce enough number of carbon ions for the compact ion injector to the main synchrotron accelerator in Quantum Scalpel.

WG4-2

Compact Charged Particle Accelerators for Applications

PARK Seong Hee
Korea University

Abstract

As developed the acceleration technologies in laser-induced plasma acceleration, the demand of more compact systems has been increased for applications. KAERI has been developed new skills in laser accelerations: metalic targets for high vacuum in laser electron acceleration and ion layer embedded foils for high efficiency in laser proton acceleration. I will present the status and plans of R&Ds on compact charged particle accelerators for appplications, such as, light sources and/or cancer therapy.

WG4-3

Ion acceleration by shock waves and pulse-recycling TNSA

KIM Young-kuk
Ulsan National Institute of Science and Technology

Abstract

Ion acceleration from an intense laser-target interaction is attracting much attention due to its diverse applications. Various laser-driven ion acceleration scenarios have been suggested to enhance ion beam qualities. Target-normal-sheath-acceleration (TNSA) is the most actively studied scenario because of easy condition for experiment. We have suggested recycling of the reflected laser pulse by inserting auxiliary target for enhance efficiency in TNSA. 2D particle-in-cell (PIC) simulation shows higher beam energy and control of beam flight direction. Another regime, laser-driven shock ion acceleration, has been suggested to overcome the limitation of TNSA. We suggest shock generation by a circularly polarized laser pulse (CP) via relativistic transparency. Multi-dimensional PIC simulations shows a CP-driven shock efficiently accelerates ion beam than a shock driven by a linearly polarized laser pulse. This is due to the fact that the shock can be generated at lower density plasmas when CP compresses them. It will be realized as grown of experiment technique such as high density cryogenic micro-jet.

WG4-4

Novel laser-plasma electron acceleration experiments at SJTU based on ionization injection and two-color laser pulses

HAFZ Nasr
Shanghai Jiao Tong University

Abstract

Laser-plasma particle acceleration is a non-traditional acceleration technique that could lead to a significant downsizing of future high-energy accelerators [1-2]. Recently we conducted laser-plasma electron acceleration experiments in Shanghai, China. Experiments were based upon a newly-installed 200 TW 30 fs Ti:sapphire laser. We performed two types of laser wakefield acceleration (LWFA) experiments; the first was based on the self-injection of electrons in 4 mm long pure He plasma interacted with 30 TW laser pulses (a0˜1.2). We observed˜120 MeV electron beams with˜ 40 % energy-spread [3]. In order to improve the electron beams we conducted a second type of experiments where we employed the ionization-injection mechanism, by which we observed a significant enhancement of the beam energy up to 400 MeV and a reduction of the energy-spread to 4% [4]. In a follow up experiment on ionization injection, and in order to boost the electron energy and quality, we employed˜ 120 TW laser pulses and 1 cm-scale plasma. Here we observed narrow energy-spread beams (7 %) with 1.2 giga-electron volts peak energy; see Fig. 1 [5]. The experimental results and the involved physics were verified by 3D-PIC simulations. Additionally, we have measured the emission of synchrotron x-rays from the accelerated relativistic electrons; few mrad, hard x-ray beams with energy up to 100 keV were observed [6]. Finally by the electrodynamics process of bremsstrahlung we have observed electron-position pairs with energies of 75 MeV and 10 MeV gamma ray beams [7]. In my talk, these results will be presented in great details.

WG4-5

Laser wakefield accelerator for medical application at KERI

KIM Jae-hoon
Korea Electrotechnology Research Institute

Abstract

As an alternative to cancer therapy using conventional RF based linear accelerators, a laser wakefield acceleration was studied at KERI by using 20 TW laser system. The electron energy from the conventional linear accelerator is limited to about 20 MeV of energy due to the size of the device. However, high-energy electron beams with energies of 50 MeV or higher penetrate deeply into the human body and are less exposed to surrounding normal cells. Thus, these small, high energy electron beam accelerators can be an alternative to small, low cost new cancer therapies. In this study, the characteristics of the electron beam generated from the laser wakefield acceleration with a mixed helium and nitrogen gas. The results will be used for the feasibility study of the beam for the medical application.

WG4-6

Laser Plasma Acceleration using the evolution of plasma wave and nanoparticle

CHO Myung Hoon
Institute of Basic Science

Abstract

Laser wakefield acceleration is one of compact electron acceleration schemes due to its high accelerating field 1 GeV/cm. Despite of the great progress of several GeV electron beams with high power lasers, the electron injection into the wakefield is still a critical issue for a very low density plasma 10^17 electrons/cc. Electron injection depends on structure of wakefied which be considered as stationary or nonstationary. In this talk the modified electron acceleration is presented in nonstationary wakefield and a novel method to control the injection using nanoparticles is proposed in case of stationary wakefield. In case of nonstationary wakefield, we modified electron acceleration model from previous stationary wakefield model. The modified model suggested a possible phase locking scenario to enhance electron energy. To investigate the nanoparticle-assistant electron injection, we analyzed electron Hamiltonian description and suggested controlled electron beam characteristics such as beam charge and energy spread. Our studies are investigated by showing analytical models and multi-dimensional particle-in-cell simulations using JoPIC (Cartesian code) and JoPIC-CYL (cylindrical code) to present proof-of-principles.

Recent studies on plasma-based acceleration at IHEP

LI Dazhang
IHEP, CAS

Abstract

Laser-driven and electron beam-driven plasma-based acceleration studies started since 1979 and 1985, respectively. Due to its ultra-high accelerating gradient, plasma-based acceleration got widely attention in conventional accelerator community. IHEP started laser plasma acceleration studies since 2005. In the last 10 years, we got a series of results under the collaboration with other experienced group, such as IOP, Tsinghua University, etc. Last year, we produced and optimized electron bunches based on 20TW laser facilities at IOP. The stability and quality of this electron sources are quite good compared with other laser-plasma generated sources. By using such high-quality electrons, we obtained a hard X-ray source through Thomson scattering process. The produced continuous spectrum of X-rays has the yield of 4.5×10^7, which also extends up to hundreds of keV. And the photon number exceeding 200 keV is about 1.2×10^7, which is in agreement with our calculation. In addition, we also did experiment on 100J/1ps laser facility at CAEP, China. In the experiment, we obtain sub-100nC electron for one single shot with the high energy tail around 100MeV. Meanwhile, we also got high flux X-ray radiation. The source size was no larger than 50um. Some other experiment results on 200TW laser facility at SJTU will also be presented in my report.

Researches on laser-driven electron accelerators in Japan

KOYAMA Kazuyoshi
KEK

Abstract

Researches of the laser wakefield acceleration (LWFA) and the dielectric laser acceleration (DLA) are conducted at several ibstitutes and universities in Japan. Objectives of the LWFA research are developping compact accelerators for practical use such as an XFEL, an all optical laser-Compton gamma-ray source, etc. A new research program on LWFA will start at RIKEN-HARIMA. The laser system has been installed to perfom the experiment on LWFA-based XFEL. The objective of DLA research is to develop a table-top micro-beam souce for the radio biology. The whole system, including the laser, must be compact enough. The University of Tokyo and KEK are designing variouse types of DLA structure. The simplist structure, binary blazed gratings made of silica, has been fabricated to do the preliminary experiment.

WG4-9

Generation of ion beams with narrow energy spread from a metal-polymer double layer target irradiated by an ultraintense laser pulse

LEE Ki-tae
Korea Atomic Energy Research Institute

Abstract

Generation of intense ion beams with a narrow energy spectrum is important for their potential applications in the laser acceleration technology. However, despite much effort, no significant improvement has been obtained. Kim et al.[K. N. Kim et al., Phys. Plasmas 23, 033119 (2016)] recently proposed a layered-target named Ion-Layer-Embedded Foil (ILEF), which consists of an ion-layer embedded between two metal foils. A two- dimensional particle-in-cell (PIC) simulation shows that proton energy spectra with an energy peak can be obtained. Such a proposal shows that the ion energy spectrum can be improved with an appropriate target structure, or layered structure. Intense ion beams from double-layer targets have been obtained, which was irradiated by a high-contrast 100 TW Ti:Sapphire laser pulse with a laser intensity of 1020 W/cm2. When the laser pulse was focused on a 2- m thick copper foil, a typical thermal-like spectrum was obtained. However, when it was focused on the copper side of a PMMA-coated-copper foil, the intensity in the high- energy part was increased significantly. Ion beams with a peaked spectrum were also observed. A two-dimensional PIC simulation with EPOCH code shows similar energy spectra.

WG4-10

Opportunities of dielectric laser accelerator on high-brightness radiation

HUANG Yenchieh
National Tsinghua University, Taiwan

Abstract

A dielectric laser accelerator (DLA), operating at the optical frequencies with a pulse rate close to 1 GHz, is expected to generate high-energy nano-electron bunches with a moderate average current. The nano-electron bunch permits highly efficient electron superadiance in the EUV and x-ray spectrum. In this talk, I will compare the peak and average brilliance of envisioned DLA-driven radiation sources against the 3rd- and 4th-generation light sources. Since a DLA operates with a much less average beam power, superior performance of a DLA-driven radiation source stands out when the brilliance under comparison is normalized to beam power.

WG4-11

Laser-plasma-based THz radiation sources and their applications

SUK Hyyong
GIST

Intense laser pulses can have strong interactions with plasma and many interesting phenomena can happen in the process. One of them is the generation of strong THz waves, which is very important for many applications. It is well-known that generation of strong THz radiations is not easy by other methods, but strong laser-plasma interactions can produce intense THz waves. In our laboratory, we use a Ti:sapphire laser system and plasma for this research. So far we have investigated diverse ways for production of strong THz waves and our efforts were very successful. We produced a wide range of spectrum from sub-THz to 50 THz and used the THz waves for some applications. In this talk, some details of our research activities on laser-plasma-based THz source will be introduced.

WG4-12

Radiation Burst from Laser-Plasma Interactions

HUR Min Sup
UNIST

Abstract

Radiation emission from plasma oscillation is an interesting but controversial subjects. In the astrophysics, motivated by observation of solar radio burst type II or III, the mechanisms of conversion from Langmuir wave to the electromagnetic emission have been discussed for decades. In the laboratory plasma, the plasma oscillation can be a promising source of sub-millimeter waves, the so called terahertz. In this presentation, some controversial points in the plasma emission are introduced, and a new idea of generating a strong terahertz burst using laser-plasma interaction is discussed.

WG5-1

Upgrade of Hokkaido University neutron source (HUNS)

FURUSAKA Michihiro
School of Engineering, Hokkaido University

Abstract

The electron linac driven neutron source at Hokkaido University (HUNS) had been running for more than 40 years since 1974. In late Octo-ber this year, we shutdown the accelerator and already removed the old accelerator. Our new linac is being installed at the same place where the old linac was sitting. The accelerator used to deliver about 1.2 kW of beam power at 35 MeV and 50 Hz. Its main use was targeted for very cold neutron source development at first, but it turned out to be very useful neutron source development machine and produced many good results related to modera-tor development. One of such results is the cou-pled (para-)hydrogen moderator with a premod-erator concept, now being used or planned to be used at very large spallation neutron facilities, like J-PARC, SNS and ESS. HUNS has also been used routinely now for real researches, such as, small-angle neutron scattering experiment for nanoscopic structure characterization or Bragg-edge transmission ex-periments characterizing Battery materials. Specifications for the new linac are, 40 MeV, 3 kW at 100 Hz. Instead of using three accelerator tubes of 2 m each, it will have only two tubes with 3 m each, driven by two-7.5 MW klystrons. The new injector consists of an electron gun fol-lowed by pre-buncher and buncher sections and a few accelerating cavities. We aim to finish in-stallation and resume operation in May 2018.

Status of the RIKEN Linac upgrade

SAKAMOTO Naruhiko
RIKEN Nishina Center

Abstract

An upgrade project of the RIKEN Heavy-Ion Linac, RILAC, is under going, which aims at the further investigation of the super-heavy elements and production of radioactive isotopes for medical applications. In this project, a new superconducting ECR ion source and superconducting RF (SRF) booster linac are being developed and constructed. The SRF linac consists of 10 quarter-wavelength resonator operated at 73 MHz, that are contained in three cryomodules. The construction status, including the first vertical test results, will be given in this paper.

WG5-3

Status and challenges of high intensity heavy ion accelerator facility (HIAF) in China

YANG Jiancheng
Institute of Modern Physics, CAS

Abstract

HIAF (High Intensity heavy ion Accelerator Facility) is a proposed new accelerator facility in China. The facility is being designed to provide intense primary and radioactive beams for a wide range of research fields. The HIAF facility plan was approved by central government of China in December 2012. The final approval of central government was in December 2015. The machine studies are now mainly focused on design optimization and key technical R&D. Projected funding for HIAF is estimated to be up to $500 million and the approximately 7-year period is expected to design and construct the facility. The unique features of the first phase of HIAF are high current pulsed beams from iLinac and high intensity heavy ion beams with ultra-short bunch length from BRing. The cooled rare isotope beams also will be prepared through projectile-fragmentation (PF) method and advanced beam cooling technology. To reach the main goals of the HIAF facility, there are still several technical challenges such as operation with high intensity beams, control of the dynamic vacuum pressure, beam compression for very short pulse beam and the design of Nuclotron- type superconducting magnets. For most of those challenges solutions have been found and prototypes are being built through close international collaborations. The general description, accelerator challenges and present status are given in the presentation.

WG5-4

Accelerator-driven compact neutron sources in Japan

HIROTA Katsyua
Nagoya University

Abstract

Recent advances in accelerator technology and neutronic design have made possible the construction of small-scale accelerator-driven neutron facilities that will be able to play a sig-nificant role in future advancements in neutron technology and science. This opens up new op-portunities to enter the field of neutron physics with modest investments and without the prolif-eration and safety concerns associated. Such facilities can be used in fields as diverse as ma-terials science, nuclear physics, medical physics, engineering, and cultural heritage. A few small-scale neutron sources have been constructed, some others are under construction or under discussion in Japan. These sources are designed relatively specialized for specific ap-plications. The combination of large-scale neu-tron sources and (small-scale) application-oriented specialized sources is becoming more important. And, of course, the combination of new neutron detector and the other neutron op-tics is also important. In this presentation, we discuss the present status of our trial of compact accelerator-driven neutron sources in Japan and related detector development.

WG5-5

Development of High-flux Neutron Production Technologies and their Applications using Compact Accelerators

CHAI Jong Seo
Sungkyunkwan University

Abstract

It is necessary to develop a high-flux neutron production system based on a compact accelerator in order to carry out basic researches such as neutron measuring method with a wide energy range and to open application fields such as neutron imaging and scattering experiments. For this purpose, we will develop target, moderator, reflector, etc., which are key elements of neutron generation, and acquire relevant technology by performing calculation of shielding to secure radiation safety. The development of TRMS for high-flux neutron production and the construction and utilization of neutron energy and flux detection system will be conducted. Technological development using neutron imaging and scattering device will be proceeded by using the constructed neutron related facilities.

WG5-6

Development of CW heavy ion linac at IMP

YIN Xuejun
Institute of Modern Physics, Chinese Academy of Sciences

Abstract

As the main part of the upgrade project of HIRFL, a new heavy-ion linac which will operate at CW mode was designed and constructed as the injector for the separated-sector cyclotron (SSC). This linac mainly consists of a superconducting high-charge-state electron cyclotron resonance (ECR) ion source, a CW RFQ and four CW IH-DTL cavities. Both of the CW 4-rod RFQ and IH-DTL operating at 53.667MHz have been developed. In the linac commissioning, various type ions were successfully injected and accelerated to 293.0keV/u with high beam current. In this paper, the recent R&D progress of the SSC-Linac including the development of key components and the beam commissioning results are presented.

WG5-7

A Plan for the Pulsed Neutron Source based on the KOMAC 100-MeV Linac*

KWON Hyeok Jung
KOMAC, KAERI

Abstract

Pulsed neutron source has various application fields such as bio-medical application, material science and environmental research and applications. At KOMAC (Korea Multi-purpose Accelerator Complex), a 100-MeV proton linac has been operated since 2013 and provided the accelerated proton beam to various users. To support research and development efforts with pulsed neutron, we are developing a secondary particle utilization facility based on existing 100-MeV linac at KOMAC. For pulsed neutron source facility, we performed basic study including target system and moderation system design as well as neutron measurement system. In addition, beam energy upgrade up to 160 MeV by using SRF technique is considered for higher neutron yield. Details on the pulsed neutron source development plan and results of preliminary design study will be given in this presentation.

WG5-8

Development of the accelerator based Boron Neutron Capture Therapy system for cancer treatment within 1 hour therapeutic time

Dong-Soo Kim, B. H Choi and S. S. Park
DAWONSYS, Korea

Abstract

An accelerator based BNCT (A-BNCT) system is under development with a goal to use practical cancer treatments within about 1 hour therapeutic time at a hospital in Korea. To meet the goal we have designed and developed a high power accelerator system and its target assembly to produce a high epithermal neutron flux of 2x109 n/cm2.S. It consists of 10MeV proton linear accelerator and 80 kW beryllium (Be) target and moderator system in consideration to reduce residual gamma radiations and fast neutrons. This paper is focused on some details of design, engineering and construction of a practical epithermal neutron source for hospital based uses.

WG5-9

Current status of the 28GHz ECR ion source for RISP

KIM Yong-hwan
RISP/IBS

Abstract

For the RISP(Radio Isotope Science Project) in Korea, A fully superconducting ECRIS, of which plasma chamber volume of 10 liter is adapted, uses a 28GHz MW power as a main power source and an 18GHz MW power as a secondary power source. We characterized our ion source at a relatively low magnetic field just with an 18 GHz MW power. A reference O7+ beam was monitored with the experimental parameters such as MW power, vacuum pressure, and magnetic field profile.

WG5-10

Compact neutron source Development with SKKUCY-13 Cyclotron

Mitra Ghergherehchi[1], Jong seo Chai[1], Huisu Kim[2]
College of Information & Communication Engineering, School of Electronics and Electrical Engineering, Sungkyunkwan University[1]
Department of Energy Science, Sungkyunkwan University[2]

Abstract

The neutron is a useful inquiry for non-destructive testing, material classification and biological material probing. We have done a simulation of a neutron beam-shaping assembly by using MCNPX Code. Our neutron source consist of a proton cyclotron named SKKUCY-13, which was installed at Sungkyunkwan University. Designing a compact, optimized, and geometrically simple beam shaping assembly for a neutron source based on a proton cyclotron for BNCT was considered in simulation study. In this cyclotron H- ions are accelerated and extracted 13MeV proton beams of 250 μA on a 9Be target. In our simulation the fast neutron flux still is high so by filtration method it can be reduce.

WG5-11

Construction and Preliminary Beam Test of RISP 81.25MHz CW RFQ for Heavy Ions

PARK Bum-sik
RIPS/IBS

Abstract

A CW 81.25MHz radio frequency quadrupole (RFQ) was developed to accelerate from proton to uranium ions at Rare Isotope Science Project (RISP). Generally, a heavy ion accelerator capable of the continuous wave (CW) operation is preferable in considering the amount of highly charged ions extracted from the electron cyclotron resonance (ECR) ion source. The RISP RFQ is designed as a four-vane type for CW operation and high RF power operation. Moreover it has been designed to have a ramped inter-vane voltage profile to reduce the length of cavity and to operate efficiently. The cavity with a total length of 5m and a diameter of 1m is composed with the oxygen free electric (OFE) copper. It is consisting of 9 modules which were produced through three steps of brazing processes. Each module was precisely assembled using a laser tracker and tuned to have designed RF characteristics. The RFQ was installed in the test facility and a preliminary beam test was performed. The 10keV/u O+6 beam extracted from the ECR ion source was successfully accelerated in pulse mode to the designed value of 500keV/u. The performance of RISP RFQ was confirmed including the design, fabrication and tuning processes by the preliminary test results.

WG5-12

The Current Status and Future Plans of Versatile Ion Beam Accelerator Facility

LEE Byoung Seob
Korea Basic Science Institute

Abstract

The Versatile Ion Beam Accelerator Facility (VIBA) has been developed to service high current heavy ion beams at KBSI (Korea Basic Science Institute). VIBA system which includes 28 GHz superconducting ECR ion source, low energy beam transport system, and RFQ (Radio Frequency Quadrupole) accelerator, and so on supports nuclear physics and material research. After overhaul for improve performance, we generated new beam extraction results and confirmed possibility of ion implantation service. From their results, we changed service plan of our facility and started new project for operation of VIBA system. Also, The new building for VIBA system will be construct until August, 2018. In this presentation, we report the current status of VIBA system and explain future plans include re-installation at new sites.

WG5-13

BEST 70p cyclotron beam commissioning at LN Legnaro

RYJKOV Vladimir[1], DU David[1], JOHNSON Richard[2], SABAIDUC Vasile[1]
Best Cyclotron Systems Inc[1], Univ British Columbia[2]

Abstract

Best Cyclotron Systems Inc (BCSI) manufactured and installed 70 MeV compact cyclotron at INFN LN Legnaro. Results from the recent tests are presented. The system operated in single side proton beam extraction mode with currents up to 500μA. At present the operational limitations are the INFN supplied beam dump capability and the radiological protection oversight. The cyclotron demonstrated very stable beam delivery, the beam on target drift over multiple hours of operation was <1% without any operator adjustments. Vacuum level in the main tank was stable during operation, in the 5×10^{-8} Torr range. Similar system is being manufactured for delivery and installation at IBS RAON facility.

WG5-14

Status of an Electron Beam Ion Source for Charge Breeding for RISP

PARK Young-ho
Institute for Basic Science

Abstract

We are developing an electron beam ion source (EBIS) charge breeder which boosts the kinetic energy of the ion beam to accommodate the beam energy requirements of the RFQ accelerator downstream. In this presentation, we describe the design of our EBIS system and the current status of development which includes the test results of superconductor magnet, the preparation of the vacuum system, the performance of the electron gun, and the electron beam transmission experiment etc.

WG5-15

An X-band Compact Electron Linac Development For A Neutron Radiography

SHIN Seung-wook
Sungkyunkwan University

Abstract

A portable and low energy neutron generating electron accelerator is a very attractive device in the field of neutron radiography. We present the 15 MeV electron linac using X-band klystron for a portable Non-destructive test(NDT) device. This electron accelerator was designed using the ASTRA code for beam dynamics. For more efficient electron accelerator design, genetic algorithm was adopted for the optimization process.

The Networking and Computing Status in IHEP/China

QI Fazhi
IHEP, CAS

Abstract

The Institute of High Energy Physics (IHEP), a Chinese Academy of Sciences research institute, is China's biggest laboratory for the study of particle physics. The big science facilities in IHEP,for example the BEPCII/BESIII, DayaBay , CSNS ,LHAASO and JUNO experiments, are producing mass data to analysis for the physics research. This presentation will introduce the current status of the networking and computing facilities in IHEP, and also the future plan will be mentioned.

Grid Deployment at KEK: Status and Plan

IWAI Go
KEK

Abstract

The KEK Central Computer System (KEKCC) caters for the research demands of particle physics, nuclear physics, the photon factory, neutron science, accelerator development, theory computation, etc. The EMI Grid middleware is deployed in the KEKCC for analysing and sharing experimental data over the distributed systems. The system is operated under the WLCG project. The researchers working on the Belle II, T2K, ILC and Kagra experiments perform their data analysis using the Grid infrastructure to manage large amounts of experimental data. We would like to share our experiences and challenges related to the operation and experiment- specific applications, as well as the requirements for storage and computing resources of the KEKCC in particular on the Grid computing system.

WG6-3

KREONET: Research Networking in Korea

CHO Buseung
KISTI

Abstract

KREONET has provided high performance networking service to advanced R&D communities including High Energy Physics, specially for the distribution of large data from CERN LHC, Belle experiment, and so on. KREONET's domestic and international infrastructure has been upgraded to support end-to-end 100Gbps transmission last year. In this talk, optical infrastucture, KREONET Softwarization Project, KREONET's user supporting activities including DTN, PerfSONAR, Science DMZ would be introduced. Also LHCOPN and LHCONE activities of KREONET will be presented.

WG6-4

Computing in Korea

CHO Kihyeon
KISTI

Abstract

The Standard Model in particle physics is well defined. However, new physics beyond the standard model, requires thousand to million times of simulation events compared to those of the Standard Model. Thus, the development of software is required. In addition, computing is evolving, which requires the development of the simulation tool kit to meet the evolving computing architecture. The current status and future plan of this effort in Korea is discussed.

WG6-5

Status report from Tokyo Tier2 at ICEPP

KISHIMOTO Tomoe
University of Tokyo

Abstract

The Tokyo Tier2 center, which is located in the International Center for Elementary Particle Physics (ICEPP) at the University of Tokyo, is providing computer resources for the ATLAS experiment in the Worldwide LHC Computing Grid (WLCG). The official site operation in the WLCG was launched in 2007 after several years of development. We replaced almost all hardware devices in every three years in order to satisfy the requirement of the ATLAS experiment. The latest hardware upgrade was done in January 2016, and the new system (so-called 4th system) is stably running. In the 4th system, 6144 CPU cores (256 worker nodes) and 7392 TB disk storages are reserved for the ATLAS experiment. For the Grid middle wares, the ARC-CE is deployed as the computing element in front of the HTCondor batch job scheduler. The disk storage consists of 48 sets of a disk array and a file server, which is managed by the Disk Pool Manager (DPM). In this presentation, the status of the Tokyo Tier2 center and recent activities such as an implementation of redundancy in the database of the DPM and the migration to IPv6 will be reported.

WG6-6

Research Infrastructure Development in Academia Sinica (Taiwan)

YEN Eric
Academia Sinica Grid Computing Centre

Abstract

(WG6-6) Academia Sinica Grid Computing Centre is now aiming at supporting big data analysis of multiple disciplinary basic research experiments such as LHC, AMS, gravitational wave, TEXONO, life science, environmental changes, earth science and disaster mitigation, etc. The goal is to enable researchers from all disciplines to have easy and open access to the advanced services, data, and knowledge they need to collaborate and to achieve excellence in science and innovation. The research infrastructure, based on distributed cloud infrastructure, is built to make efficient use of resources and services in partner institutes. In addition to scalability and system efficiency, the thematic scientific gateways (or web portals) were established for optimized application workflows. Shared and common resources and services will keep growing in the research infrastructure by more and more applications and users. In this presentation, the experiences and case studies of ASGC will be shared.

Network and Computing in Thailand

Burin Asavapibhop
Chulalongkorn University, Thailand

Abstract

H.R.H. Princess Maha Chakri Sirindhorn's initiation of the collaboration between Thai research scientists and the European Organization for Nuclear Research (CERN) on high energy physics has led to the foundation of the National e-Science Infrastructure Consortium in 2011. The consortium aims to develop computational instrument, data storage and fundamental datasets as a sustainable infrastructure to support various research areas in Thailand such as computational science and engineering, water resource, energy and environment management, climate change, and high energy particle physics. In 2013, the consortium joined the Worldwide LHC Computing Grid (WLCG), and has operated two tier-2 sites including T2-TH-CUNSTDA and T2-TH-SUT until the present.

WG6-8

The Belle II Computing System

KIM Doris
Soongsil University

Abstract

The Belle II experiment is the upgraded version of the Belle experiment, and is a next generation B factory with excellent new physics opportunities. One consequence of the upgrade is that the experiment has to manage a 50 times larger data set than the previous one, which will be generated by the SuperKEKB collider. At the end of 2018, the SuperKEKB will start creating the data set by colliding high luminosity electron and positron beams, and the run will continue for several years. The Belle II collaboration has been constructing a worldwide grid computing system to analyze and store the anticipated amount of the data set. In this talk, the structure of the Belle II computing system will be summarized and the strategies to handle this ambitious physics plan will be discussed.

CMS Tier-2

Dongchul Son
Kyungpook National University

Abstract

N/A

WG6-10

Introduction to GSDC – data center for data intensive research

NOH Seo young
Korea Institute of Science and Technology Information

Abstract

Data-centric research is emerging and a new research paradigm is shifting to data-intensive scientific discovery. In such a circumstance, it is believed that data infrastructure is getting more important and plays a critical role in data intensive research. Global Science experi- mental Data hub Center at KISTI has been providing its unique ICT-infrastructure service for domestic and global research communities tightly collaborating with advanced global research laboratories including CERN, Fermilab and KEK. In this talk, data infrastructure and services that GSDC is providing will be covered and the future direction of the data center will be introduced.

WG6-11

Networks for High Energy Physics: LHCOPN and LHCONE

Edoardo Martelli
CERN, Switzland

Abstract

The LHC experiments have been producing an unprecedented amount of data that could hardly be analyzed by CERN alone. Many institutes around the world help CERN in this endeavor by taking portions of the data and decoding them in their datacentres. LHCOPN and LHCONE are the worldwide networks that have been developed to efficiently and securely distribute LHC data to all the interested partners. The talk will explain the origin of these networks, their architecture, how they have been evolving over time and what are the challenges that will be tackled in the coming years.

WG6-12

Status Report on TEIN

KIM, Byung Kyu
TEIN-star Cooperation Center (TEIN*CC)

Abstract

Since the TEIN (Trans-Eurasia Information Network) Initiative has been launched at the 3rd Asia-Europe Meeting Summit (ASEM-3), TEIN projects has been evolved into several phases such as TEIN-2, TEIN-3, and TEIN-4 under the official endorsements by successive ASEM Summits and strong supports from the participating partners' Governments. TEIN has contributed to the UN Sustainable Develop Goals (SDGs) as well as the Millennium Development Goals (MDGs) since year 2000. The Asi@Connect (successor to TEIN) project is to provide and further develop a dedicated regional high capacity, high quality Internet connectivity network for research and higher education, also leveraging the e-infrastructure developed for public service projects, such as e-science (including High Energy Physics), food security, health, earth and ocean observation related to natural disasters, e-government, education and training, and cultural heritage, with an emphasis on applications of broad societal benefit. Governments in Asia have long recognized the importance of IT and research to the future of the region. They initiated numbers of major initiatives, both nationally and regionally, to build the infrastructure required to allow researchers and educators to work in a collaborative global environment. A critical infrastructure component is the network connectivity to the global research and education (R&E) community. In this presentation, it has been introduced how TEIN has linked in the High Energy Physics communities and activities, and to seek a future cooperative solution with the R&E communities in Asia.

WG6-13

NDN for Large-scale Scientific Data and Its Status on HEP

Huhnkuk LIM
KISTI, Korea

Abstract

Named Data Networking (NDN) is one instance of Information Centric Networking (ICN), which is a clean-slate approach that promises to reduce inefficiencies in the current Internet. NDN provides intelligent data retrieval using the principles of name-based symmetrical forwarding of Interest/Data packets and in-network caching. The continually increasing demand for rapid dissemination of large-scale scientific data is driving the use of NDN in big science experiment. In this talk we address recent R&D status on NDN construction for HEP, as well as our intercontinental NDN testbed to offer complete insight into NDN construction for one large scale scientific data.

WG6-14

CoEPP Tier 2 in Melbourne

CROSBY Sean, BOLAND Lucien
The University of Melbourne

Abstract

The Centre of Excellence for Particle Physics at the Terascale (CoEPP) is the premier high energy physics group in Australia. We purchase and operate our own computing cluster for use by ATLAS as a Tier 2, Belle 2 as a Tier 2, and our local researchers. We will outline what resources we have, what the needs of our researchers are, and where we see the computing infrastructure for our researchers in the future.

Status of the Vertical Test for HWR and QWR at RISP

KIM Ju wan
IBS

Abstract

Several vertical Tests for the prototype cavities were carried out at RISP last year. Vertical Test system is being updated for the mass production scheduled in late 2018. Vertical Test for approval of Vertical Test RF system was performed in early 2017. and then HWR prototype bare cavity from VITZRO and QWR prototype bare cavity from RI were tested respectedly. We have tested 2 cavities simultaneously on Bare and Jacket Cavities. To shorten the RF conditioning time, We used Signal Analyser and Power meter only to do RF conditioning in addition to VCO-PLL system. To protect the cavity from the magentic field in the test pit of ambient high magnetic field , we added the inner magntic shield made of cryphy in addition to the outer magnetic shield of Mumetal. For the high magnetic field was over 1000mG in the test pit, which is two or more times higher in the surface of the earth. New cryostat of 1200mm inner diameter for jacket cavity is to be fabricated.

Operation of Cryomodules for Chinese ADS Front-end Demo Linac

BAI Feng
Institute of Modern Physics, Chinese Academy of Sciences

Abstract

Two types of cryomodules have been designed for China Accelerator Driven Sub-critical System Injector [U+2161](CADS) at the Institute of Modern Physics (IMP) of the Chinese Academy of Science (CAS). And two HWR010 cavity cryomodules are located in front of ADS linac which contains six β=0.1 HWR010 cavities and six 5.5T solenoids operating at 4.2K&1.05Bar, while taper cavity cryomodule is the third cryomodule of ADS Linac and contains five β=0.15 taper cavities and five 5.5T solenoids which has been accelerated proton beam to 18MeV. This paper will report the operation and performance of these cryomodules for Chinese ADS Front-end Demo Linac.

WG7-3

Progress of CEPC cryogenic system

ZHANG Jianqin
IHEP, CAS

Abstract

The CEPC has two rings, the booster ring and the collider ring. There are 432 super- conducting cavities in total. In the booster ring, there are 96 ILC type 1.3 GHz 9-cell superconducting cavities; eight of them will be packaged in one 12-m-long module. There are 12 such modules. In the collider ring, there are 336 650 MHz 2-cell cavities; six of them will be packaged in one 11-m-long module. There are 56 of them. All the cavities will be cooled in a liquid-helium bath at a temperature of 2K to achieve a good cavity quality factor. The cooling benefits from helium II thermo-physical properties of large effective thermal conductivity and heat capacity as well as low viscosity and is a technically safe and economically reasonable choice. The 2K cryostat will be protected against heat radiation by means of two thermal shields cooling with 5-8K helium as well as 40-80K helium from a refrigerator. There are 4 cryo-stations along the 100km circular collider with the physical design of double ring. Generally, each cryo-station is supplied from a common cryogenic plant, with one refrigerator and one distribution box. The cooling capacity of each refrigerator is 18kW @ 4.5K. Now CEPC is on the stage of Conceptional Design Report(CDR).

A Plan of the HWR Superconducting Linac Development at KOMAC*

KIM Han Sung
KOMAC, KAERI

Abstract

A 100-MeV proton linac has been operated since 2013 at KOMAC (Korea Multi-purpose Accelerator Complex) and provides the accelerated proton beam to various users from the research institutes, universities, and industries. To expand the utilization fields of the accelerator, we are developing a secondary particle utilization facility based on existing 100 MeV linac at KOMAC. Secondary particles of primary interest include a pulsed neutron for various applications and Li-8 beam for beta-NMR. To increase the proton beam energy from 100 MeV to 160 MeV for higher yield of secondary particle generation, we performed a design study on the half-wave resonator (HWR) with baseline parameters such that 350-MHz operating frequency, 2 K operation temperature, and the peak electric and magnetic field less than 35 MV/m and 70 mT, respectively. The prototyping of the HWR is in progress and the vertical test stand for HWR is under preparation. Details on the HWR design and analysis results along with the prototyping effort will be given in this presentation. *This work has been supported through KOMAC (Korea Multi-purpose Accelerator Complex) operation fund of KAERI by MSIT (Ministry of Science and ICT)

The HWRs for Chinese ADS project

YUE Weiming
Institute of Modern Physics, Chinese Academy of Sciences

Abstract

Two ypes of superconducting half-wave resonator with optimize beta of 0.10 and 0.15 have been developed for Injector II of China Accelerator Driven Sub-critical System (CADS) Project at Institute of Modern Physics (IMP). Proton beam has been accelerated from 2.1MeV to 18MeV by three cryomodules, which are composed of 12 superconducting HWR010s and 5 HWR015. In this paper, we present the electromagnetic design, Mechanical analysis, fabrication arts and test results of HWR010 and HWR015.

Report on the Asian School on Superconductivity and Cryogenics for Accelerators (ASSCA2017)

NAKAI Hirotaka
KEK

Abstract

The Asian School on Superconductivity and Cryogenics for Accelerators (ASSCA) was held at the High Energy Accelerator Research Organization (KEK), Tsukuba, Japan from December 10 to December 17, 2017. This school was aimed at providing not only lectures but also hands-on training on superconductivity and cryogenics for accelerators for young researchers and students in Asian countries. Registration fee was not required for easier attendance of young people, and accommodation and ordinary meals were served free of charge. Instead we asked applicants to submit their CVs and recommendations to select highly motivated attendees. The final number of attendees and lecturers was 57 from 9 countries of Asia, Oceania and Europe including Japan. This school was financially supported by KEK, Foundation for High Energy Accelerator Science (FAS), SAKURA Exchange Program in Science of Japan Science and Technology Agency (JST) and 10 companies in Japan and China. Their contributions are greatly appreciated for organizing this school.

WG7-7

Cryogenic system of the SuperKEKB IR final focusing SC magnets

ZONG Zhanguo
High Energy Accelerator Research Organization (KEK)

The SuperKEKB is seeking 40 times greater luminosity than the world's highest record at its predecessor, KEKB, and this improvement allows us to discover new particle physics beyond the Standard Model on the luminosity frontier. Now it's under construction by upgrading the KEKB accelerator and the Belle detector. After 5.5 years construction, the SuperKEKB accelerator achieved "first turns" (first circulation of electron and positron beams) in February 2016 and the Phase I commissioning was carried out to perform machine tuning and vacuum scrubing during February to June in 2016, without the final focusing magnet system (QCS) and the BELLE II detector. In early 2018, first collisions are expected in the Phase II commissioning and the machine will be tuned for beam collisions with the QCS system and Belle II detector. The final focusing magnet system consists of 8 main quadrupole superconducting (SC) magnets, 43 SC correction coils, and 4 compensation SC solenoids and forms the doublets for each beam. The SC magnets are assembled into two cryostats, loacated at the left and right sides of the accelerator interation point, respectively. The two cryostats are cooled with sub-cooled liquid helium (LHe) at 0.16 MPa and 4.5 K by two independent refrigerators of about 250 W cooling capacity. In February 2017, the two QCS cryostats had been installed into the beam lines of the SuperKEKB interaction region and had been inserted into the Belle II detector in April. After the connections with cryogenic systems, all SC magnets were cooled down to 4.5 K and were excited with their own design currents. From May to August 2017, magnetic field measurements were performed for the Phase II commissioning of the SuperKEKB accelerator. In this presentation, the designs and features of cryogenic system of the SuperKEKB IR final focusing SC magnets will be introduced. The construction progress and commissioning operation of cryogenic system in 2017 will be reported. The QCS preparation work for the accelerator Phase II commissioning will be presented.

Introduction of PAPS cryogenic system

LI Shaopeng
Institute of High Energy Physics (IHEP), CAS, China

Abstract

The cryogenic system of Platform of Advanced Photon Source Technology R&D (PAPS) will construct a 2.5KW@4.5K or 300W@2K superfluid helium cryogenic system with three vertical test stand, two horizontal test station and a beam test stand of superconducting cavities. At the same time, the impure helium recovery and purification system with the capacity of 210m3/h helium recovery and 100m3/h helium purification will be constructed. The PAPS cryogenic system will support the development and performance test of various type of superconducting cavity. This presentation will introduce the design and progress of PAPS cryogenic system at present.

WG7-9

Current status of cryomodule development for SCL3 of RAON

MINKI Lee
RISP

Abstract

The RAON(Rare isotope Accelerator complex for ON-line experiments) consists of theree accelerator lines(SCL1, SCL2 and SCL3). SCL1 and SCL3 consist of QWR(Quater Wave Resonator, 81.25MHz) section and HWR(Half Wave Resonator, 162.5MHz) section. SCL2 is composed of SSR1 section and SSR2(Singl Spoke Resonator, 325MHz) section. The QWR cryomoudle corresponding to SCL1 and SCL3 has a single cavity and operating in the 4.2K. The HWR section consists of two modules(HWR A and HWR B). The first HWR A has two cavities, and the second HWR B consists of four cavities, both of which operate in the 2.1K. We designed three kinds of modules and tested the performance of two modules. The static thermal performance of the QWR module is 7W and the static thermal performance of the HWR A is 4.3W.

WG7-10

Conceptual design of CEPC superconducting RF system

ZHAI Jiyuan
IHEP

Abstract

CEPC is a 100 km circular electron positron collider operating at 90-240 GeV center-of-mass energy of Z, W and Higgs bosons. CEPC and its successor SPPC, a 100 TeV center-of-mass super proton-proton collider, will ensure the elementary particle physics a vibrant field for decades to come. The conceptual design report (CDR) of CEPC will be published in 2018 as an important step to move the project forward. In this presentation, CEPC superconducting RF system design and challenges will be introduced, including the system layout and parameter choices, configuration at different operation energies, cavity and cryomodule design, key technology R&D and SRF infrastructure plan and progress.

WG7-11

Progress of Linear IFMIF Prototype Accelerator (LIPAc) in collaboration with EU

SAKAMOTO Keishi
QST, Rokkasho, Japan

Abstract

The IFMIF (International Fusion Materials Irradiation Facility) project is aiming at the development of neutron source for material tests of a future fusion power plant. The Linear IFMIF Prototype Accelerator (LIPAc) is a prototype of the IFMIF deuteron accelerator projected to demonstrate the validity of acceleration up to 9 MeV with a beam current of 125 mA in continuous wave mode (CW). Most of components and subsystems necessary are delivered as in-kind contributions of several European institutes, namely CEA (France), CIEMAT (Spain), INFN (Italy), and SCK-CEN (Belgium) under the responsibility of Fusion for Energy (F4E), and QST has been in charge of the installation of the delivered equipment. The commissioning of the accelerator is carried out by the International LIPAc Integration Unit consisted by EU and Japan team. In 2017, major components of the accelerator for the 5MeV D+ beam commissioning, i.e. RFQ (4-vane Radio Frequency Quadrupole linac), MEBT (middle energy beam transport), DP (diagnostics plate) and a low power beam dump (LPBD), have been installed in line and evacuated. On the injector experiment, the emittance of˜0.15[U+F070]mm･mrad has been demonstrated at the D-beam extraction current of 175 mA. Eight sets of RF modules (175MHz, 200kW for each) were connected to the RFQ with 8 coaxial waveguides, and RF conditioning has been started. With a simultaneous power injection from 8 RF modules into the RFQ, a required RF filed for the 5MeV D+ beam acceleration was obtained at short pulse. The pulse extension is underway toward the CW operation. The first H+ beam acceleration will be implemented in February 2018. After the H+ beam commissioning, D+ beam acceleration will be implemented aiming at 5 MeV 125mA, 0.1% duty. In parallel, the preparation of SRF (superconducting Radio-Frequency linac), which accelerates the D+ beam up to 9 MeV, has proceeded.

WG7-12

Current status and challenges of cryogenic systems for RAON accelerator

KI Tae kyung
Institute for Basic Science

Abstract

In this paper, a cryogenic system, cryoplants, a helium distribution system, a recovery system, and a safety system of the RAON accelerator is introduced. A strategy using three cryoplants (SCL1, SCL2, and SCL3 cryoplants) and a distribution box is adopted as considering costs and periods of beam operations. Technical specifications of the cryoplants and other systems such as mass flow rates, temperature and pressure conditions, stability of pressure, exergy efficiency, and others are discussed. To achieve challenges made from requirements of cryomodules and superconducting magnets, solutions and what we are doing are presented. This paper will be helpful to understand technically a state-of-the-art cryogenic system for a big superconducting system and to check what kinds of things should be considered.