Contents

Contents

WEIDCC — WG1.1 ERL Sources: Guns (SRF)

THIACC — WG2.3 ERL Instrumentation

THIBCC — WG4.1 SRF: Microphonics Measurement and Control

THICCC — Contributed Oral Presentations

FRIACC — WG5.1 Particle and Nuclear Physics Applications

FRIBCC — Summaries and Closing

Author Index

Program

19-Jun-17 08:55 – 10:10

08:55 – 10:10 MOIACC — WG1.2 ERL Sources: Cathodes A
Session Chair: K. Aulenbacher, HIM (Mainz, Germany)

MOIACC002 Development of SRF Gun Applying New Cathode Idea Using a Transparent Superconducting Layer
T. Konomi (KEK) R. Matsuda (Mitsubishi Heavy Industries Ltd. (MHI)) T. Yanagisawa (MHI-MS)

MOIACC003 Progress of VHF Gun and Electron Source Development at SINAP
J.Z. Gong (SINAP)

19-Jun-17 10:25 – 12:05

10:25 – 12:05 MOIBCC — WG1.2 ERL Sources: Cathodes B
Session Chair: K. Aulenbacher, HIM (Mainz, Germany)

MOIBCC001 High Brightness Electron Source Using Cryo-DC Gun
I.V. Bazarov (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

MOIBCC002 Longitudinal Halo From NEA and PEA Photocathodes
M.A. Dehn (IKP) K. Aulenbacher (HIM)

MOIBCC003 Semiconductor Photocathode Development for the bERLinPro SRF Photoinjector
J. Kuehn (HZB)

MOIBCC004 Multialkali Cathode for High Current Electron Injector: Fabrication, Installation and Testing
T. Rao (BNL)

19-Jun-17 13:40 – 14:55

13:40 – 14:55 MOICCC — WG4.3 SRF: HOM and Power Couplers
Session Chair: I. Ben-Zvi, BNL (Upton, Long Island, New York, USA)

MOICCC001 Power Couplers & HOM Dampers at CERN
E. Montesinos (CERN)

MOICCC002 Coaxial Couplers
Q. Wu (BNL)

MOICCC003 Resonance Control at the Compact ERL in KEK
T. Miura (KEK) N. Liu (Sokendai) M. Sawamura (QST)

19-Jun-17 14:55 – 15:45

14:55 – 15:45 MOPSPP — Poster Session

MOPSPP001 Study of Microbunching Instability in MESA
A. Khan (Institut Theorie Elektromagnetischer Felder, TU Darmstadt) K. Aulenbacher (IKP)

MOPSPP002 Development of an ERL RF Control System
S. Orth (TEMF, TU Darmstadt)

MOPSPP003 RF Performance and Beam Parameter Measurement of the 2nd 3.5 Cell SRF Gun for ELBE
A. Arnold (HZDR) G. Ciovati (JLab)

MOPSPP004 Investigation of K_2CsSb Photocathodes
V. Bechthold (IKP) K. Aulenbacher (HIM)

MOPSPP005 The Small Thermalized Electron Source at Mainz (STEAM)
S. Friederich (IKP)

MOPSPP006 SPOCK - a Triode DC Electron Gun With Variable Extraction Gradient
L.M. Hein (IKP)

MOPSPP007 Beam Dynamics and Collimation Following MAGIX at MESA
B. Ledroit (IKP)

MOPSPP008 Low Energy Beam Transport System for MESA
C. Matejcek (IKP)

MOPSPP009 Beam Break Up Simulations for the MESA Accelerator

C.P. Stoll (IKP)

MOPSPP011 Resonant Coherent Diffraction Radiation System at KEK-cERL
Y. Honda (KEK)

MOPSPP012 Identification of Ion Bombardment Area on the Photocathode After 900 μA CW Beam Operation at cERL
M. Yamamoto (KEK) Y. Kameta (e-JAPAN IT Co. Ltd) T. Kawasaki (Toshiba) N. Nishimori (QST) N. Nishimori (Tohoku University, Research Center for Electron Photon Science)

MOPSPP013 Proposal of Sharing 6-GeV Class CW Superconducting Linac With ILC and High Brilliance X-ray Light Source
M. Shimada (KEK) R. Hajima (QST)

MOPSPP015 Development of a Multialkali Photocathode DC Gun for High Current Operation
N. Nishimori (Tohoku University, Research Center for Electron Photon Science) R. Hajima (QST)

MOPSPP016 Discharge Mechanism of Ultra-High Vacuum Gap Derived From the HV Conditioning Result of the cERL DC-Gun
M. Yamamoto (KEK) N. Nishimori (QST) N. Nishimori (Tohoku University, Research Center for Electron Photon Science)

MOPSPP017 Energy Distribution and Work Function Measurements for Metal Photocathodes With Measured Levels of Surface Roughness
T.S. Beaver (STFC/DL/ASTeC) S. Mistry (STFC/DL)

19-Jun-17 15:45 – 17:50

15:45 – 17:50 MOIDCC — WG3.1 Partially Commissioned Facilities
Session Chair: G.H. Hoffstaetter, Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education (Ithaca, New York, USA)

MOIDCC001 Update on the KEK ERL Test Facility (cERL)
H. Kawata (KEK)

MOIDCC002 Novosibirsk ERL Facility
N.A. Vinokurov (BINP SB RAS) I.V. Davidyuk (NSU) V.L. Dorokhov (BINP) A.G. Tribendis (NSTU)

MOIDCC004 CBETA, a 4-Turn ERL With FFAG Arc
G.H. Hoffstaetter (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

MOIDCC005 Lessons Learned From BNL ERL Test Facility
D. Kayran (BNL)

MOIDCC006 ERL Mode of S-DALINAC: Design and Status
M. Arnold (TU Darmstadt) C. Eschelbach (Frankfurt University of Applied Sciences) T. Kuerzeder (HIM)

20-Jun-17 08:30 – 09:45

08:30 – 09:45 TUIACC — WG5.2 FEL Applications A
Session Chair: P.A. McIntosh, STFC/DL/ASTeC (Daresbury, Warrington, Cheshire, United Kingdom)

TUIACC001 LERF - New Life for the Jefferson Lab FEL
C. Tennant (JLab) R. Alarcon (Arizona State University) J. Balewski (MIT) T. Cao (Hampton University) R. Cervantes (Stony Brook University) K. Dehmelt (SUNY SB) P.E. Evtushenko (HZDR) M. Garcon (CEA/DRF/IRFU) B. Surrow (Temple University)

TUIACC002 Novosibirsk ERL Based FEL as User Facility
V.V. Kubarev (BINP SB RAS)

TUIACC003 Asymmetric, Dual Axis Cavity for Energy Recovery LINAC: Recent Developments and Possible Applications
I.V. Konoplev (JAI) R. Ainsworth (Fermilab) G. Burt (Cockcroft Institute, Lancaster University)

20-Jun-17 10:00 – 11:40

10:00 – 11:40 TUIBCC — WG5.2 FEL Applications B
Session Chair: P.A. McIntosh, STFC/DL/ASTeC (Daresbury, Warrington, Cheshire, United Kingdom)

TUIBCC001 Photon Science Exploitation of ALICE in Biomedical Science

M. Surman (STFC/DL/SRD) T. Craig (The University of Liverpool) A. Cricenti (ISM-CNR) D.J. Dunning (STFC/DL/ASTeC) P. Gardner (MIB) M. Luce (CNR-ISM) R.L. Williams (University of Liverpool)

TUIBCC002 EUV ERLs for Semiconductor Integrated Circuit Lithography
N. Nakamura (KEK)

TUIBCC003 Applications for CBETA at Cornell
G.H. Hoffstaetter (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

TUIBCC004 Applications by Means of the Accelerator Technologies Based on cERL
H. Kawata (KEK)

20-Jun-17 13:15 – 14:55

13:15 – 14:55 TUICCC — WG4.2 SRF: Cavity Performance
Session Chair: I. Ben-Zvi, BNL (Upton, Long Island, New York, USA)

TUICCC001 High-Q R&D at FNAL
M. Checchin (Fermilab)

TUICCC002 Twin-Axis Elliptical Cavity
F. Marhauser (JLab) S.U. De Silva (ODU)

TUICCC003 Cornell ERL CM Performance
F. Furuta (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education) D. Gonnella (SLAC)

TUICCC004 The Potential of Nb/Cu Technology for High Beam Current Applications
S. Aull (CERN)

20-Jun-17 15:45 – 17:50

15:45 – 17:50 TUIDCC — WG2.2 ERL Optics and Lattice Design
Session Chair: D. Schulte, CERN (Geneva, Switzerland)

TUIDCC001 PERLE - Beam Optics Design
S.A. Bogacz (JLab)

TUIDCC002 eRHIC Multi-Pass ERL
V. Ptitsyn (BNL)

TUIDCC003 CBETA Multipass Lattice Design
C.E. Mayes (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

TUIDCC004 CBETA FFAG Beam Optics Design
J.S. Berg (BNL) J.A. Crittenden (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

TUIDCC005 ERL Recirculation Optics for MESA
F. Hug (IKP)

21-Jun-17 08:30 – 10:10

08:30 – 10:10 WEIACC — WG3.2 Planned Test Facilities
Session Chair: G.H. Hoffstaetter, Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education (Ithaca, New York, USA)

WEIACC001 PERLE a Proposed Test ERL at LAL
W. Kaabi (LAL)

WEIACC002 Status of the Berlin Energy Recovery Linac Project bERLinPro
A. Jankowiak (HZB)

WEIACC003 ER@CEBAF, a 7 Gev, 5-Pass, Energy Recovery Experiment
F. Meot (BNL) M.E. Bevins (JLab)

WEIACC004 A Beam Test Facility for High Current Photoinjector and its Key Technologies Development at IHEP
X.P. Li (IHEP) J.Q. Xu (Insititute of High Energy Physics (IHEP))

21-Jun-17 10:25 – 12:05

10:25 – 12:05 WEIBCC — WG2.1 ERL Beam Dynamcs

	Session Chair: S.A. Bogacz, JLab (Newport News, Virginia, USA)
WEIBCC001	Beam Dynamics Issues for Multi-Pass ERLs G.H. Hoffstaetter (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)
WEIBCC002	LHeC ERL - Beam Dynamics Challenges D. Pellegrini (CERN)
WEIBCC003	Beam Dynamics and Optics Challenges of bERLinPro M. Abo-Bakr (HZB)
WEIBCC004	Studies of CSR and Microbunching at the Jefferson Laboratory ERLs C. Tennant (JLab) C.-Y. Tsai (SLAC)

21-Jun-17 13:40 – 15:20

13:40 – 15:20	WEICCC — WG1.1 ERL Sources: Guns (DC) Session Chair: E. Wang, BNL (Upton, Long Island, New York, USA)
WEICCC001	Commission Results of the Compact ERL High Voltage DC Gun N. Nishimori (Tohoku University, Research Center for Electron Photon Science) R. Hajima (QST) Y. Honda (KEK) M. Kuriki (HU/AdSM)
WEICCC002	The ALICE ERL - DC Photocathode Gun Commissioning L.B. Jones (STFC/DL/ASTeC)
WEICCC003	Injector Challenges for CBETA Demonstration Experiment K.W. Smolenski (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)
WEICCC004	First Results of Commissioning DC Photo-Gun for RHIC Low Energy Electron Cooler (LEReC) D. Kayran (BNL)

21-Jun-17 16:10 – 17:50

16:10 – 17:50	WEIDCC — WG1.1 ERL Sources: Guns (SRF) Session Chair: E. Wang, BNL (Upton, Long Island, New York, USA)
WEIDCC001	The Development of the DC-SRF Photoinjector at Peking University H.M. Xie (PKU)
WEIDCC002	High Charge High Current Beam From BNL 113 MHz SRF Gun I. Pinayev (BNL) K. Mihara (Stony Brook University) I. Petrushina (SUNY SB) K. Shih (SBU)
WEIDCC003	Metal and Semiconductor Photocathodes in the HZDR SRF Gun J. Teichert (HZDR)
WEIDCC004	The bERLinPro SRF Photoinjector System - From Design to First RF Commissioning Results A. Neumann (HZB)

22-Jun-17 08:30 – 09:45

08:30 – 09:45	THIACC — WG2.3 ERL Instrumentation Session Chair: G.H. Hoffstaetter, Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education (Ithaca, New York, USA)
THIACC001	Higher Bunch Charge Operation in Compact ERL at KEK T. Miyajima (KEK)
THIACC002	Dark Current and Halo Tracking in ERLs M. McAteer (HZB)
THIACC003	Low Emittance Optimization and Operation P.H. Williams (STFC/DL/ASTeC)

22-Jun-17 10:00 – 11:40

10:00 – 11:40	THIBCC — WG4.1 SRF: Microphonics Measurement and Control Session Chair: F. Gerigk, CERN (Geneva, Switzerland)
THIBCC001	Resonance Control of the PIP-II SC Cavities W. Schappert (Fermilab)
THIBCC002	Microphonics Analysis of ERL Cryomodule

MOIACC — WG1.2 ERL Sources: Cathodes A

MOIACC002

Development of SRF Gun Applying New Cathode Idea Using a Transparent Superconducting Layer

T. Konomi, Y. Honda, E. Kako, Y. Kobayashi, S. Michizono, T. Miyajima, K. Umemori, S. Yamaguchi, M. Yamamoto (KEK) R. Matsuda (Mitsubishi Heavy Industries Ltd. (MHI)) T. Yanagisawa (MHI-MS)

KEK has been developing a superconducting RF gun for CW ERL since 2013. The SRF gun is a combination of a 1.3 GHz, 1.5-cell superconducting RF cavity and a backside excitation type photocathode. The photocathode consists of transparent substrate MgAl2O4, transparent superconductor LiTi2O4 and bi-alkali photocathode K2CsSb. The reason for using transparent superconductor is to reflect RF by using the feature of penetration depth of superconductor, which is defined from London equation. It protects optical components from RF damage. The critical DC magnetic field of the cathode, quantum efficiency and initial emittance were measured. These show the cathode can be used for the SRF gun. The gun cavity was designed to satisfy the photocathode operation. Eight vertical tests of the gun cavity have been performed. The surface peak electric field reaches to 75 MV/m with the dummy cathode rod which was made of bulk niobium.

MOIACC003

Progress of VHF Gun and Electron Source Development at SINAP

J.Z. Gong, Q. Gu, X.D. Li (SINAP)

The R&D work on the VHF gun and high brightness electron source for energy recovery linac (ERL) has been carried out in Shanghai Institute of Applied Physics (SINAP). A 250 MHz RF gun has been designed. The results of cold test and high power test have been presented. In addition, some research and work on high brightness electron sources also have been carried out.

MOIBCC — WG1.2 ERL Sources: Cathodes B

MOIBCC001

High Brightness Electron Source Using Cryo-DC Gun

I.V. Bazarov (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

Abstract not submitted at print time.

MOIBCC002

Longitudinal Halo From NEA and PEA Photocathodes

M.A. Dehn, K. Aulenbacher, V. Bechthold, F. Fichtner (IKP) K. Aulenbacher (HIM)

For high average electron beam currents the length of the electron bunches must match the acceptance of the accelerator. At Johannes Gutenberg-Universität we are able to measure the longitudinal pulse responses of different photocathodes: negative electron affinity (NEA) types and positive electron affinity (PEA) types. With NEA (Cs:GaAs), the pulse response depends on the wavelength of photoexcitation and show at 800nm a long and relatively intense tail whereas at 400nm a similar shape but with orders of magnitude lower intensity is observed. In comparison to this distribution, PEA pulse responses (K2CsSb) show a similar shape as well but another order of magnitude less intensity than NEA in the blue excitation.
Funding: BMBF-HOPE II

MOIBCC003

Semiconductor Photocathode Development for the bERLinPro SRF Photoinjector

J. Kuehn (HZB)

At HZB an ERL type accelerator, called bERLinPro, is being built. Cs-K-Sb photocathodes have been identified as electron source for low emittance and high current operation (100 mA). At the moment, the SRF-photoinjector for bERLinPro with an extensive diagnostics beam line is in the commissioning phase, which will also serve as a testbed to assess the performance of in-house produced Cs-K-Sb photocathodes. The deposition of Sb, K and Cs in order to prepare Cs-K-Sb photocathodes is demanding and requests an ultra-high vacuum. Even marginal changes to the process may influence the spectral quantum efficiency, the emittance and the lifetime of the photocathode, and hence change the characteristics of the electron bunch in the SRF-photoinjector. In my talk I will present the latest results of our photocathode research and I will give an update on the status of the SRF-photoinjector and bERLinPro.

MOIBCC004

Multialkali Cathode for High Current Electron Injector: Fabrication, Installation and Testing

T. Rao (BNL)

The ability to produce high average current reliably and reproducibly over a long period of time with good quantum efficiency at visible wavelength is important for all ERL applications. There has been considerable interest in developing suitable cathodes for 24/7 operation under such stringent conditions. Recently, at BNL, we have fabricated cathodes with QE in the range of 10% for Cs-K-Sb cathodes and 5% for Na-K-Sb cathodes when irradiated with 532 nm laser and a single pulse charge up to 5 nC in the SRF gun has been produced. In this presentation, we discuss the fabrication of Cs-K-Sb and Na-K-Sb cathodes using both dispensers and effusion cells as sources of alkali metal, characterization of these cathodes, transporting them from the fabrication location to the RHIC tunnel under UHV conditions and installation in the electron guns in the tunnel.
Funding: U.S. Department of Energy under Contract No. DE-AC02-98CH10886

MOICCC — WG4.3 SRF: HOM and Power Couplers

Power Couplers & HOM Dampers at CERN

Abstract not submitted at print time.

E. Montesinos (CERN)

Coaxial Couplers

Q. Wu (BNL)

The method of couple power into and out of an RF resonator tends to be based on either waveguide or coaxial couplers. Coaxial couplers are widely used due to multiple merits, such as compactness, easy fabrication, less heat leak, easy to compress multipacting, etc.. However, the coaxial couplers also encounter cooling and power handling problems at high power transmission scenarios. We will discuss the characteristics of the coaxial coupler designs and their application in various projects.

Funding: Work supported by by Brookhaven Science Associates, LLC under Contract No. DE-AC02-98CH10886 with the U.S. Department of Energy

Resonance Control at the Compact ERL in KEK

T. Miura, D.A. Arakawa, M. Egi, K. Enami, T. Furuya, E. Kako, H. Katagiri, T. Konomi, T. Matsumoto, S. Michizono, F. Qiu, H. Sakai, K. Umemori (KEK) N. Liu (Sokendai) M. Sawamura (QST)

The compact energy recovery linac (cERL) in KEK is a test facility for the future 3-GeV ERL light source. The 1.3 GHz superconducting cavities are used in the injector linac cryomodule and the main linac cryomodule. The slide-jack tuner with stepper motor is used for coarse tuning of the resonant frequency, and piezo tuner is used for fine tuning. The digital tuner feedback system based on micro-TCA standard has been employed. The frequency band of the tuner feedback has been set lower than the mechanical resonance frequency. The rf field fluctuation caused by the Michrophonics is compensated by the rf feedback. In the injector linac, one rf source drives two cavities with vector-sum control. The vector-sum calibration error affected the beam energy jitter, but that has been improved after adopting the high gain parameter in resonant frequency feedback in order to keep the field balance of the cavities.

MOPSPP — Poster Session

MOPSPP001

Study of Microbunching Instability in MESA

A. Khan, O. Boine-Frankenheim (Institut Theorie Elektromagnetischer Felder, TU Darmstadt) K. Aulenbacher (IKP)

The Institute for Nuclear Physics (KPH) at Mainz is building a multi-turn energy recovery linear accelerator, the Mainz Energy-recovering Superconducting Accelerator (MESA), to deliver a CW beam at 10^5 MeV with short pulses, high current and small emittance for physics experiments with an internal target. Space charge effects potentially cause beam quality degradation for medium energy beams in smaller machines like MESA. As beam quality preservation is a major concern in an ERL during recirculation. We present a study on Microbunching Instability (MBI) caused by Longitudinal Space Charge (LSC) in MESA. Our results demonstrate the impact of the MESA arc lattice design on the development of Microbunching Instability.
Funding: Supported by the DFG through GRK 2128

MOPSPP002

Development of an ERL RF Control System

S. Orth, D. Domont-Yankulova, H. Klingbeil (TEMF, TU Darmstadt)

The Mainz Energy-recovering Superconducting Accelerator (MESA), currently under construction at Johannes Gutenberg-Universität Mainz, requires a newly designed digital low-level radio frequency (LLRF) system. Challenging requirements have to be fulfilled to ensure high beam quality and beam parameter stability. First, the layout with two recirculations and the requirements will be shown from an LLRF point of view. Afterwards, different options for the control system are presented. This includes the generator-driven system, the self-excited loop and classical PID controller as well as more sophisticated solutions.
Funding: Work supported by Deutsche Forschungsgemeinschaft (DFG): GRK 2128 "AccelencE"

MOPSPP003

RF Performance and Beam Parameter Measurement of the 2nd 3.5 Cell SRF Gun for ELBE

A. Arnold, M. Freitag, P.N. Lu, P. Murcek, H. Vennekate, R. Xiang (HZDR) G. Ciovati, P. Kneisel, L. Turlington (JLab)

In May 2014 the 1st superconducting photo injector (SRF gun) at HZDR was replaced by a new gun, featuring a new resonator and cryostat. The intention for this upgrade was to reach higher beam energy, higher bunch charge and lower emittance at the same time in order to serve user experiments at the superconducting CW accelerator ELBE. In our contribution we will report on the commissioning of the SRF gun by presenting a full set of RF performance results as well as detailed beam parameter measurements up to a bunch charge of 300 pC. Additionally, we will present the results of the first two user experiments (neutron and THz generation) that demonstrated the reliability of this gun concept.

MOPSPP004

Investigation of K_2CsSb Photocathodes

V. Bechthold, K. Aulenbacher, M.A. Dehn, S. Friederich (IKP) K. Aulenbacher (HIM)

The interest in multi alkali antimonide photocathodes, e.g. K_2CsSb, for future ERL projects like BERlinPRO (Berlin Energy Recovery Linac Prototype) and MESA (Mainz Energy-Recovering Superconducting Accelerator) has grown in recent years. In particular for the case of RF-sources the investigation of the time response is of great importance. In Mainz we are able to synthesize these kinds of photocathodes and investigate their pulse response at 1 picosecond level using a radio frequency streak method. We present on the one hand the cathode plant which is used for synthesizing the multi alkali antimonide photocathodes and on the other hand first measurements showing pulse responses of K_2CsSb at 400 nm laser wavelength. Furthermore, an analyzing chamber has been installed, which allows investigation of lifetime under laser heating and in-situ measurements of the work function using a UHV Kelvin Probe.
Funding: BMBF-HOPE II

The Small Thermalized Electron Source at Mainz (STEAM)

MOPSPP005

S. Friederich, K. Aulenbacher (IKP)

The Small Thermalized Electron Source at Mainz (STEAM) is a photoelectron source which will be operated using NEA GaAs excited near its band gap with an infrared laser wavelength to reach smallest emittances. CST simulations indicate that emittance growth due to vacuum space charge effects can be controlled up to bunch charges of several tens of pC. The goal of the project is to demonstrate that the intrinsical high brightness can still be achieved at such charges. The current status will be presented.

Funding: Work supported by BMBF-HOPE II and DFG through RTG 2128.

SPOCK - a Triode DC Electron Gun With Variable Extraction Gradient

MOPSPP006

L.M. Hein, K. Aulenbacher, V. Bechthold, M.A. Dehn, S. Friederich, C. Matejcek (IKP)

The electron source concept SPOCK (Short Pulse Source at KPH) is a 100kV DC source design with variable extraction gradient. Due to its triode inspired design the extraction gradient can be reduced for e.g. investigations of cathode physics, but also enhanced to mitigate space charge effects. In the framework of the MESA-Project (Mainz Energy-Recovering Superconducting Accelerator) its design has been further optimized to cope with space charge dominated electron beams. Although it injects its electron beams directly into the LEBT matching section, which excludes any adjustments of the electron spin, the source SPOCK will allow higher bunch charges than the MESA standard source.

Funding: German Federal Ministry of Education and Research (BMBF project HOPE-II FKZ 05K16UMA) and the Cluster of Excellence "PRISMA

Beam Dynamics and Collimation Following MAGIX at MESA

MOPSPP007

B. Ledroit, K. Aulenbacher (IKP)

The Mainz Energy-recovering Superconducting Accelerator (MESA) will be an electron accelerator allowing operation in energy-recovery linac (ERL) mode. After the beam hits the target at the MESA Internal Gas Target Experiment (MAGIX), the beam is phase shifted and recirculated back into the linac sections. These will transfer the kinetic beam energy back to the RF-field by deceleration of the beam and allow for high beam power with low RF-power input. Since most of the beam does not interact with the target, the beam will mostly just pass the target untouched. However, a fraction of the scattered electrons may be in the range outside the accelerator and detector acceptances and therefore cause malicious beam dynamical behavior in the linac sections or even damage to the machine. The goal of this work is to determine the beam behavior upon target passage by simulation and experiment and to protect the machine with a suitable collimation system. The present status of the investigations is presented.

Funding: Supported by the DFG through GRK 2128

Low Energy Beam Transport System for MESA

MOPSPP008

C. Matejcek, K. Aulenbacher, S. Friederich, L.M. Hein (IKP)

An important part of the new accelerator MESA (Mainz Energy recovering Superconducting Accelerator) is the low energy beam transport system connecting the 100 keV electron source with the injector accelerator. Here the spin manipulation and the bunch preparation for the injector accelerator take place. Due to the low energy, space charge will be an challenging issue in this part. Therefore, start-to-end simulations were done with a combination of the two particle dynamics codes PARMELA* and CST**. At the moment, a test setup is being built up to check the functionality of devices and compare the beam parameters with the simulation. Here the focus lies on the bunch preparation system because at this part we expect high impact of the space charge by reason of the necessary bunch compression. The advance of the test setup, the simulations and measurements done so far will be shown.

* Phase and Radial Motion in Ion Linear Accelerators ** Computer Simulation Technology

MOPSPP009

Beam Break Up Simulations for the MESA Accelerator

C.P. Stoll, F. Hug, D. Simon (IKP)

MESA is a recirculating superconducting accelerator under construction at Johannes Gutenberg-Universität Mainz. It will be operated in two different modes: the first is the external beam (EB) mode, where the beam is dumped after being used at the experiment. The required beam current in EB mode is 150 μA with polarized electrons at 155 MeV. In the second operation mode MESA will be run as an energy recovery linac (ERL) with an unpolarized beam of 1 mA at 10^5 MeV. In a later construction stage of MESA the achievable beam current in ERL-mode shall be upgraded to 10 mA. To understand the behavior of the superconducting cavities under recirculating operation with high beam currents simulations of beam breakup have to be performed. Current results for transverse beam break up calculations and simulations with Beam Instability (bi) code are presented.

Funding: Supported by DFG through GRK 2128

MOPSPP011

Resonant Coherent Diffraction Radiation System at KEK-cERL

Y. Honda, A. Aryshev, T. Miyajima, T. Obina, R. Ryukou, M. Shimada, R. Takai, N. Yamamoto (KEK)

Coherent radiation from a short bunched electron beam has been expected to be a high power source in THz regime. Especially the feature of the modern energy recovery linac is suitable for a high averaged power source. We propose to test an advanced scheme of resonantly exciting coherent diffraction radiation in an optical cavity. By stimulating the radiation in a multi-bunch beam, highly enhanced radiation power can be extracted. This system can excite all the cavity longitudinal modes at the same time, it can be a broadband source. We are preparing an experimental setup to test the resonant radiation in the cERL at KEK.

MOPSPP012

Identification of Ion Bombardment Area on the Photocathode After 900 μA CW Beam Operation at cERL

M. Yamamoto, Y. Honda, X.J. Jin, T. Miyajima, T. Obina (KEK) Y. Kameta (e-JAPAN IT Co. Ltd) T. Kawasaki (Toshiba) N. Nishimori (QST) N. Nishimori (Tohoku University, Research Center for Electron Photon Science)

Compact-ERL (cERL) which is under development as an ERL demonstration machine at KEK succeeded in stable supply of CW beam exceeding 900 uA from a GaAs photocathode mounted on a DC-gun in March 2016. In the case of high current beam operation, the ions generated by collision of the beam and the residual molecules on the beam axis is increase and its flow back to the electron gun. As a result, the quantum efficiency (QE) of the photocathode decreases due to ion bombardment is the main factor of determining the cathode lifetime. After the CW operation of the accumulated extracted charge of ~10 Coulomb, steady decrease in QE due to ion bombardment has not yet been clearly confirmed. In order to analyze the area damaged by ion bombard, 2D QE distribution (QE map) measurement system was newly installed in the cathode preparation system. From QE map analysis before and after the CW operation, we confirmed two types of QE decrease. The area about 2 mm diameter near the center of the photocathode that the QE recovery is insufficient by the reactivation process is presumed the damage by ion bombardment.

MOPSPP013

Proposal of Sharing 6-GeV Class CW Superconducting Linac With ILC and High Brilliance X-ray Light Source

M. Shimada, M. Yamamoto, K. Yokoya (KEK) R. Hajima (QST)

We propose sharing of the 6-GeV class CW superconducting linac with ILC and X-ray light source. ILC utilizes it for the positron source and the two boosters for the 5-GeV damping ring. The conventional positron source, which is based on a collision of the multi-GeV electron with the target, was chosen to lengthen the macro-pulse duration for avoiding the heat loading. In this proposal, the CW linac realizes the long macro-pulse duration beam operation of the positron beam as well as the electron for collision with the target. Simultaneously, the CW linac can used as the 5-GeV booster

of the polarized electron beam at the same bunch pattern. Because of the low average current of beams of ILC, the CW linac have enough ability to accelerate/decelerate the high quality electron beam for the high brilliant X-ray light source such as 6-GeV class ERL light source and XFELO. Each electron beam has different injection energy, injects at the different merger and accelerates at the different RF phase. Therefore, the electron energies are different at the end of the CW linac and it makes the simultaneous operation possible.

Development of a Multialkali Photocathode DC Gun for High Current Operation

MOPSPP015

N. Nishimori (Tohoku University, Research Center for Electron Photon Science) R. Hajima, R. Nagai, M. Sawamura (QST)

We have developed a DC gun test stand at National Institutes for Quantum Radiological Science and Technology (QST) for high current electron beam generation. The gun test stand consists of an alkali antimonide photocathode preparation chamber, a DC gun with a 250kV-50mA Cockcroft Walton high voltage power supply, and beam line with a water cooled beam dump to accommodate 1.5 kW beam power. We successfully fabricated a Cs_3Sb photocathode with quantum efficiency of 5.8 % at 532 nm wavelength and generated 150 keV beam with current up to 4.3 mA with 500 mW laser at 532 nm wavelength. Unfortunately, we encountered a vacuum incident during beam transport of high current beam and the development has been halted. We will fix the vacuum problem and restart the gun development as soon as possible.
Funding: This work is partially supported by a JSPS Grant-in-Aid for Scientific Research in Japan (15K13412).

Discharge Mechanism of Ultra-High Vacuum Gap Derived From the HV Conditioning Result of the cERL DC-Gun

MOPSPP016

M. Yamamoto (KEK) , N. Nishimori (QST) , N. Nishimori (Tohoku University, Research Center for Electron Photon Science)

Development of a high brightness electron beam source is indispensable for realizing high repetition X-FEL and CW EUV-FEL as a next generation light source. The high voltage (HV) DC-gun that realized acceleration voltage of > 500 kV and electric field of > 5 MV/m is one of the candidates. In order to stably DC-gun operation, the HV conditioning process is an essential step as preparation of DC-gun operation. The HV conditioning was carried out on compact-ERL (cERL) electron gun and clarified the following four points. i) The voltage at which discharge stops (discharge stop voltage) exists, ii) The discharge stop voltage increases almost continuously with the number of discharges, iii) The gas released at the occurrence of discharge is almost proportional to the difference between the discharge start voltage and the discharge stop voltage, iv) The hold-off time of the voltage is very long under the discharge stop voltage. We focused on the electron stimulated desorption (ESD) phenomenon occurring at the anode can explain these phenomena in a consistent and considered the mechanism of discharge generation in DC field and HV conditioning progression in ultrahigh vacuum (UHV).
Funding: JSPS Grant-in-Aid for Scientific Research in Japan (15H0359,16K05385)

Energy Distribution and Work Function Measurements for Metal Photocathodes With Measured Levels of Surface Roughness

MOPSPP017

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The minimum achievable emittance in an electron accelerator depends strongly on the intrinsic emittance of the photocathode electron source which is measureable as the mean longitudinal and transverse energy spreads in the photoemitted electrons. Reducing emittance in an accelerator driving a Free Electron Laser (FEL) delivers significant reduction in the saturation length for an X-ray FEL, reducing machine cost and increasing X-ray beam brightness. There are many parameters which affect the intrinsic emittance of a photocathode. Surface roughness is a significant factor*, and consequently the development of techniques to manufacture low roughness photocathodes with optimum emission properties is a priority for the electron source community. In this work, we present transverse energy distribution and work function measurements made using our TESS facility** for electrons emitted from copper and molybdenum photocathodes with differing levels of measured surface roughness.
* Proc. FEL '06, THPPH013, 583586 ** Proc. FEL '13, TUPPS033, 290293

Funding: The work is part of EuCARD2, partly funded by the European Commission, GA 312453. Funded by the Science and Technology Facilities Council.

MOIDCC — WG3.1 Partially Commissioned Facilities

Update on the KEK ERL Test Facility (cERL)

MOIDCC001

H. Kawata (KEK)

The test facility of Compact ERL (cERL) was constructed to develop critical accelerator components for future light sources. The target of cERL is to realize the ERL operation under the conditions of low emittance (lower than 1 mm mrad) with high current (averaged current of 10 mA). Our group presented the construction and initial commissioning result at the previous ERL15 workshop. After that, we have made an effort to update the performance, so that we have succeeded the ERL operation under the conditions of beam current of 1mA with lower emittance of 1mm mrad. At the bunch charges of 0.5 pC and 7.7 pC, the beam emittance was demonstrated at the March of 2016 as 0.3 mm mrad and 1-1.8 mm mrad, respectively. We also achieved the stable beam operation at the conditions of 1mA with 162.5 MHz with a small beam loss, so that it is expected to be possible to operate 10 mA at cERL with a present radiation shielding geometry. Furthermore, recently, we have made an effort to realize the beam development under high bunch charge (40 pC/bunch) operation. I will present these updated developments from the previous ERL15 workshop.

Novosibirsk ERL Facility

MOIDCC002

N.A. Vinokurov, V.M. Borin, I.V. Davidyuk, O.I. Deichuli, E.N. Dementyev, B.A. Dovzhenko, Ya.V. Getmanov, Ya.I. Gorbachev, B.A. Knyazev, E.I. Kolobanov, A.A. Kondakov, V.R. Kozak, E.V. Kozyrev, S.A. Krutikhin, V.V. Kubarev, G.N. Kulipanov, E.A. Kuper, I.V. Kuptsov, G.Y. Kurkin, L.E. Medvedev, O.I. Meshkov, S.V. Motygin, A.A. Murasev, V.N. Osipov, V.K. Ovchar, V.M. Petrov, A.M. Pilan, V.M. Popik, V.V. Repkov, T.V. Salikova, M.A. Scheglov, I.K. Sedlyarov, S.S. Serednyakov, O.A. Shevchenko, A.N. Skrinsky, S.V. Tararyshkin, V.G. Tcheskidov, A.G. Tribendis, P. Vobly, V. Volkov (BINP SB RAS) I.V. Davidyuk, Ya.V. Getmanov, B.A. Knyazev, E.V. Kozyrev, S.S. Serednyakov, **N.A. Vinokurov** (NSU) V.L. Dorokhov (BINP) A.G. Tribendis (NSTU)

The first project of the four turn ERL for Novosibirsk FELs (NovoFEL) was proposed at FEL'90 Conference. Later the project was modified, but the base lines kept: a four turn normal conductance linac with energy recovery, low RF cavities (180 MHz), grid controlled DC gun (Q~1 nC, tau=1 nsec, f rep = 10 kHz-50 MHz). The ERL can operate in the three modes, providing an electron beam for the three different FELs (from 300 μm up to 5 μm). Construction and commissioning four track ERL was divided on three stage: the first stage NovoFEL working in spectral range (90-240) μm, based on one track energy recovery linac (ERL) with energy 12 MeV and current 30 mA, was commissioned in 2003. The second stage of NovoFEL working in spectral range (35-80) μm, based on two track energy recovery linac with energy 22 MeV and current 7 mA, was commissioned in 2009. The third stage of NovoFEL working in spectral range (8-15) μm, based on four track energy recovery linac with energy 42 MeV and current 5 mA was commissioned in 2015.

CBETA, a 4-Turn ERL With FFAG Arc

MOIDCC004

G.H. Hoffstaetter (Cornell University, CLASSE)

Cornell University has been pioneering Energy Recovery Linacs (ERLs) technology that is essential for any high brightness electron ERL. This includes a DC electron source and an SRF injector Linac with world-record current and normalized brightness in a bunch train, a high-current linac cryomodule, and a high-power beam stop, and several diagnostics tools for high-current and high-brightness beams. All these are now being used to construct a novel one-cryomodule ERL in Cornell's Wilson Lab. BNL has designed a multi-turn ERL for eRHIC, where beam is transported more than 20 times around the 4km long RHIC tunnel. The number of transport lines is minimized by using two arcs with strongly-focusing permanent magnets that can control many beams of different energies. A collaboration between BNL and Cornell has been formed to investigate this multi-turn eRHIC ERL design by building a 4-turn, one-cryomodule ERL at Cornell. It also has a return loop built with strongly focusing permanent magnets and is meant to accelerate 40 mA beam to 150 MeV. This high-brightness beam will have applications beyond accelerator research, in industry, in nuclear physics, and in X-ray science.

MOIDCC005

Lessons Learned From BNL ERL Test Facility

D. Kayran (BNL)

First photocurrent from ERL SRF gun at BNL has been delivered in November 2014. In June 2015 a high charge 0.5nC and 20 uA average current were demonstrated. In July 2015 the gun to dump beam test started. The beam was successfully transported from the SRF gun through the injection system, then through the linac to the beam dump. All ERL loop components have been installed. In October 2015, the SRF gun cavity has been found contaminated during severe cathode stalk RF conditioning. This cavity has been sent for repair and modification for later use in the low-energy RHIC electron cooler (LEReC). LEReC scheduled to start commissioning in early of 2018 [1]. We present our results of BNL ERL beam commissioning, the measured beam properties, the operational status, and future prospects.

[1] D. Kayran et all.,. First Results of Commissioning DC Photogun for RHIC Low Energy Electron Cooler (LEReC). In this procedures.

Funding: Work supported by Brookhaven Science Associates, LLC under Contract No. DE-AC02-98CH10886 with the U.S. Department of Energy.

MOIDCC006

ERL Mode of S-DALINAC: Design and Status

M. Arnold, C. Burandt, J. Pforr, N. Pietralla (TU Darmstadt) C. Eschelbach, M. Lösler (Frankfurt University of Applied Sciences) T. Kuerzeder (HIM)

Recently, the S-DALINAC was extended by an additional recirculation beam line to a thrice-recirculating linear accelerator. This upgrade enables an increase of the maximum achievable energy close to its design value of 130 MeV as well as an operation as an ERL. The new beam line features a path-length adjustment system which is capable of changing the phase of the beam by a full RF phase and, thus, allowing to shift the timing of the electron bunches to the decelerating phase. The project comprises different aspects concerning the design (magnets, beam dynamics, lattice, etc.) and the construction work including the alignment done at the accelerator. This contribution presents a rough overview on the design, installation and status.

Funding: *Work supported by DFG through RTG 2128, INST163/383-1/FUGG and INST163/384-1/FUGG

TUIACC — WG5.2 FEL Applications A

LERF - New Life for the Jefferson Lab FEL

TUIACC001

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In 2012 Jefferson Laboratory's energy recovery linac (ERL) driven Free Electron Laser successful completed a transmission test in which high current CW beam (4.3 mA at 100 MeV) was transported through a 2 mm aperture for 7 hours with beam losses as low as 3 ppm. The purpose of the run was to mimic an internal gas target for DarkLight* - an experiment designed to search for a dark matter particle. The ERL was not run again until late 2015 for a brief re-commissioning in preparation for the next phase of DarkLight. In the intervening years, the FEL was rebranded as the Low Energy Recirculator Facility (LERF), while organizationally the FEL division was absorbed into the Accelerator division. In 2016 several weeks of operation were allocated to configure the machine for Darklight with the purpose of exercising - for the first time - an internal gas target in an ERL. Despite a number of challenges, including the inability to energy recover, beam was delivered to a target of thickness 10^{18} cm^{-2} which represents a 3 order of magnitude increase in thickness from previous internal target experiments. Details of the machine configuration and operational experience will be discussed.

* J. Balewski et al., A Proposal for the DarkLight Experiment at the Jefferson Laboratory Free Electron Laser, May 2012.

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Novosibirsk ERL Based FEL as User Facility

TUIACC002

V.V. Kubarev (BINP SB RAS)

The Novosibirsk free electron laser (NovoFEL) is the first multi-turn energy-recovery linear accelerator with three separate laser systems (the terahertz, far-infrared and mid-infrared ones). Radiation of the FELs is transported now from accelerating hall to thirteen user and diagnostics stations by one optical channel filled dry air-nitrogen mixture. In this paper, we describe main radiation parameters of the NovoFEL, workstations of the facility and survey selected recent experiments using substantially intense monochromatic terahertz laser radiation, which can be tuned from 90 μm to 240 μm.

Asymmetric, Dual Axis Cavity for Energy Recovery LINAC: Recent Developments and Possible Applications

TUIACC003

I.V. Konoplev, A.J. Lancaster, K. Metodiev, A. Seryi (JAI) R. Ainsworth (Fermilab) G. Burt (Cockcroft Institute, Lancaster University)

High luminosity THz and X-ray radiation are vital for many branches of science and industry (for example biochemistry and material science) and to achieve it a high electron bunch current is needed. Another requirement to such radiators is high wall plug efficiency. The efficiency is usually very low and the electron beam energy recovery is the most attractive way to improve it. This is normally done using SCRF ERL systems but the bunch current limitations for these systems are more dramatic when compared with a conventional LINACs. Increase of the bunch current in conventional ERLs above some threshold value (normally around 100 mA) leads to beam instabilities development and beam transportation termination. This naturally limits the instruments' luminosity. Here we suggest and discuss the novel concept and specific designs which can enable a SCRF ERL system capable of generating picosecond electron bunches with up to 1A current. The aim of the project is to demonstrate the operation of dual axis asymmetric ERL and its application in research and industry. A preliminary market research of such devices has been recently conducted and results will be also presented.

TUIBCC — WG5.2 FEL Applications B

Photon Science Exploitation of ALICE in Biomedical Science

TUIBCC001

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The UK has maintained an ambition to build a national FEL facility and this has been reinforced in a recent strategic review*. The Daresbury Laboratory is engaged in research and development programmes to ensure delivery of a high performance UK XFEL and is operating a number of research accelerators to support all aspects of FEL technology. ALICE is an ERL built to develop skills and experience in superconducting RF. It provides mid infrared and THz light from a cavity FEL and a CSR source respectively. From the very start of the ALICE programme a photon science exploitation activity was pursued. In the last few years all funding for ALICE was for biomedical exploitation by a consortium led by the University of Liverpool, which includes clinicians as well as scientists. In this paper we review the work, including investigating the effect of THz radiation on living cells and sub-diffraction chemical imaging of normal and cancerous human tissue by IR microscopy. The stringent demands of these experiments required substantial improvement on the performance of ALICE. Limitations of the current configuration are discussed and schemes for extending its capability are presented.

* www.stfc.ac.uk/files/fel-report-2016/

Funding: UK Research Counils EPSRC and STFC

EUV ERLs for Semiconductor Integrated Circuit Lithography

TUIBCC002

N. Nakamura (KEK)

Although the technologies on EUV Lithography are progressing based on laser-produced plasma (LPP) source, which is expected to produce the EUV power of 250 W or more, it is important to develop a new-type EUV source to meet future demand for higher power than 1 kW. Energy recovery linac(ERL) based free electron lasers(FEL) are possible candidates of a high-power EUV source that can distribute 1 kW class power to multiple scanners simultaneously. In order to demonstrate the feasibility of EUV ERLs for lithography, an EUV source based on an 800 MeV ERL operating at the wavelength of 13.5 nm has been designed using available technologies without too much development and resources of the KEK cERL. In addition, the EUV-FEL Light Source Study Group for Industrialization has been established in Japan to realize industrialization of such an ERL-EUV source and the related items. We will present recent progress of the EUV-ERL design work and some activities and considerations for the industrialization.

Applications for CBETA at Cornell

TUIBCC003

G.H. Hoffstaetter (Cornell University, CLASSE)

At Cornell, a 4-turn ERL with FFAG return loop is being constructed by a collaboration of Cornell and BNL. It is designed to produce a high-current (up to 40mA) CW beam of moderate energy (150MEV). For after successful commissioning, several applications of CBETA have been envisioned and are being analyzed, these include (a) a dark-photon search, (b) a Compton-Backscattering hard-x-ray source, (c) a Terahertz FEL, (d) a facility or ERL accelerator physics studies, and (e) a test facility with CW beam to test, for example, SRF cryomodules for eRHIC or for industrial isotope production

Applications by Means of the Accelerator Technologies Based on cERL

TUIBCC004

H. Kawata (KEK)

The cERL has been constructed for the test facility so as to demonstrate the ERL operation as the view point of the accelerator technologies. Therefore, the application programs by using cERL are not the main purpose. However, we have demonstrated several test productions such as laser Compton scattering X-ray production and THz radiation. Furthermore, we have

tried to draw several industrial applications such as EUV-FEL light source, security systems for nuclear material based on gamma-ray production by means of laser Compton scattering, high resolution medical x-ray imaging systems, and so on. I will present these activities at the workshop.

TUICCC — WG4.2 SRF: Cavity Performance

High-Q R&D at FNAL

TUICCC001

M. Checchin (Fermilab)

Modern projects of accelerators for High Energy Physics and FEL accelerators (PIP II, LCLS II, etc.) demand operation of the SRF cavities in CW regime. In this situation, low cryogenic losses are essential. Decrease of the losses or, thus, increase of the cavity unloaded quality factor Q0 allows great savings in capital and operational cost. The new N-doping technique for the SRF cavity processing in order to achieve high Q0 is described, which is now a ready-to-use technology for SRF accelerators. The current implementation of this technique for the LCLS-II cavity production, allow us to present how ultra-high Q-factors can be maintained from the vertical to the horizontal test. In particular, efficient cooling and optimization of shielding design will be discussed to address potential Q degradation from the remnant magnetic fields in the cryomodule. The talk will go through the physics and fundamental studies performed at FNAL that allowed us a) to define the best nitrogen doping treatment which minimizes the Q sensitivity to trapped magnetic field, b) to maximize magnetic flux expulsion based on cavity treatment.

Twin-Axis Elliptical Cavity

TUICCC002

F. Marhauser, A. Hutton (JLab) S.U. De Silva, J.R. Delayen, H. Park, L. Sweat (ODU)

Energy Recovery Linacs (ERLs) use superconducting RF cavities to accelerate the primary electron beam while the spent electron beam is decelerated in the same cavities to recover the energy. Using separate beam pipes for the accelerated and decelerated beams allows for independent focusing and better merging of the beam from the injector into the ERL. In the frame of a DoE accelerator stewardship program we have designed and built a prototype 1.5 GHz twin-axis single-cell cavity as a proof of principle. Experiences on fabrication techniques and lessons learned will be reported prior to the vertical RF testing.
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Cornell ERL CM Performance

TUICCC003

F. Furuta, J. Dobbins, R.G. Eichhorn, M. Ge, G.H. Hoffstaetter, M. Liepe, T.I. O'Connell, P. Quigley, D.M. Sabol, J. Sears, E.N. Smith, V. Veshcherevich (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education) D. Gonnella (SLAC)

The main linac prototype cryomodule (MLC) is a key component for the Cornell-BNL ERL Test Accelerator (CBETA) project, which is a 4-turn FFAG ERL under construction at Cornell University. This novel cryomodule is the first SRF module ever to be fully optimized simultaneously for high efficient SRF cavity operation and for supporting very high CW beam currents. After the success of the initial MLC testing, the MLC had been moved into the final location for the first MLC beam test. Cornell ERL high voltage DC gun and Injector Cryomodule were connected to MLC via the entry beam line; the beam stop assembly was also installed as the exit line. In this paper, we summarize the performance of this novel ERL cryomodule including the results of the first beam test and the additional tests focused on RF field stability and cavity microphonics.

The Potential of Nb/Cu Technology for High Beam Current Applications

TUICCC004

S. Aull (CERN)

Particle accelerators with high beam current require not only robust fundamental power couplers that can deliver high power to the accelerating cavities but also thorough handling of losses due to higher order modes induced by the particle beam. Both favour low frequency superconducting RF cavities with big apertures. We present the advantages and limitations of niobium coated copper cavities in comparison to the well-established bulk niobium technology and its potential for high beam current applications such as energy recovery linacs.

TUIDCC — WG2.2 ERL Optics and Lattice Design

TUIDCC001

PERLE - Beam Optics Design

S.A. Bogacz (JLab)

PERLE (Powerful ERL for Experiments) is a novel ERL test facility, initially proposed to validate design choices for a 60 GeV ERL needed for a future extension of the LHC towards a hadron-electron collider, the LHeC. Its main goal is to test the limits of a high current, CW, multi-pass operation with superconducting cavities at 802 MHz (and perhaps exploring other frequencies of interest). PERLE optics features Flexible Momentum Compaction (FMC) lattice architecture for six vertically stacked return arcs and a high current, 5 MeV photo-injector. With only one pair of 4-cavity cryomodules, 400 MeV beam energy can be reached in three re-circulation passes, with beam currents in excess of 15 mA. This unique quality beam is intended to perform a number of experiments in different fields reaching from uncharted tests of accelerator components via elastic ep scattering to laser-Compton backscattering for photon physics. Following the experiment, the CW beam is decelerated in three consecutive passes back to the injection energy, transferring virtually stored energy back to the RF.

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TUIDCC002

eRHIC Multi-Pass ERL

V. Ptitsyn (BNL)

The talk concentrates on accelerator physics and accelerator technology issues related with the multi-pass ERL of ERL-Ring design option of future high luminosity electron-hadron collider eRHIC. Possible solutions for recirculating passes are described which include individual loops as well as FFAG-type re-circulations. Major beam dynamics effects dominating the ERL performance are described, which include electron beam disruption, multi-pass beam-break-up, preservation of transverse emittance and energy spread during acceleration and deceleration process. The recent design modifications of ERL-Ring eRHIC aim to balance technological risks and the project cost.

TUIDCC003

CBETA Multipass Lattice Design

C.E. Mayes (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

Cornell University and Brookhaven National Laboratory are currently designing the Cornell-BNL ERL-FFAG Test Accelerator (CBETA), to be built at Cornell that utilizes the existing energy recovery linac (ERL) injector and main linac cryomodule (MLC). The bulk of the recirculation arcs will consist of fixed-field alternating-gradient (FFAG) magnets made from permanent magnet material. Four acceleration passes through the MLC will bring the beam to 150 MeV. We will review the overall lattice design for this machine.

TUIDCC004

CBETA FFAG Beam Optics Design

J.S. Berg, S.J. Brooks, F. Meot, D. Trbojevic, N. Tsoupas (BNL) J.A. Crittenden, Y. Li, C.E. Mayes (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

CBETA is an Energy Recovery Linac (ERL) accelerating an electron beam to 150 MeV in four linac passes. Instead of having four separate return loops to the linac, it instead has a single fixed field alternating gradient (FFAG) beamline with nearly a factor of 4 energy acceptance. While ideally the FFAG would be circular with identical cells all around, space and cost considerations dictate that small radius of curvature FFAGs should be used near the linac, connected by a straight beamline. To ensure good orbit matching over the entire energy range, adiabatic transitions are inserted between the arcs and the straight. After briefly introducing basic principles of FFAG optics, we describe how we choose the parameters of the arc cell, the basic building block of the lattice. We then describe how the straight cell is chosen to work well with the arc. Finally we describe the design process for the transition that ensures orbits over the entire energy range end up very close to the axis of the straight. We discuss how the realization of this lattice design with physical magnets impacts the design process.

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ERL Recirculation Optics for MESA

F. Hug (IKP)

MESA is a recirculating superconducting accelerator under construction at Johannes Gutenberg-Universität Mainz. It will be used for high precision particle physics experiments in two different operation modes: external beam (EB) mode and energy recovery (ERL) mode. The operating beam current and energy in EB mode is 0.15 mA with polarized electrons at 155 MeV. In ERL mode a beam of 1 mA at 10^5 MeV will be available. In a later construction stage of MESA the beam current in ERL-mode shall be upgraded to 10 mA. The recirculating main linac follows the concept of a double sided accelerator design with vertical stacking of return arcs. Acceleration is done by in total four TESLA/XFEL 9-cell SRF-cavities mounted in two modified ELBE cryomodules. Within this contribution the recirculation optics for MESA will be presented focussing on achieving best energy spread at the experimental setups in recirculation ERL and non-ERL operation.

Funding: Work supported by DFG through the PRISMA cluster of excellence EXC 10^{98}/2014 and RTG 2128 and by the European Union's Horizon 2020 Research and Innovation programme under Grant Agreement No 730871.

WEIACC — WG3.2 Planned Test Facilities

WEIACC001

PERLE a Proposed Test ERL at LAL

W. Kaabi (LAL)

Abstract not submitted at print time.

WEIACC002

Status of the Berlin Energy Recovery Linac Project bERLinPro

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The Helmholtz-Zentrum Berlin is constructing the Energy Recovery Linac Prototype bERLinPro, a demonstration facility for the science and technology of ERLs for future light source applications. BERLinPro is designed to acceleration a high current (100 mA, 50 MeV), high brilliance (norm. emittance below 1 mm mrad), short pulse (below 2 ps) cw electron beam. Here the project status will be reported. This includes the completion of the building and the installation of the first accelerator components, as well as the assembly of the srf gun and GunLab beam diagnostics, which are now under commissioning.
Funding: Work supported by the German Bundesministerium für Bildung und Forschung, Land Berlin and grants of the Helmholtz Association.

WEIACC003

ER@CEBAF, a 7 Gev, 5-Pass, Energy Recovery Experiment

F. Meot, I. Ben-Zvi, Y. Hao, C. Liu, M.G. Minty, V. Ptitsyn, G. Robert-Demolaize, T. Roser, P. Thieberger, N. Tsoupas, C. Xu, W. Xu (BNL) M.E. Bevins, S.A. Bogacz, D. Douglas, C.J. Dubbe, T.J. Michalski, Y. Roblin, T. Satogata, M. Spata, C. Tennant, M.G. Tiefenback (JLab)

A multiple-pass, high energy Energy Recovery Linac experiment at the JLab CEBAF will be instrumental in providing necessary information and technology testing for a number of possible future applications and facilities such as Linac-Ring based colliders, which have been designed at BNL (eRHIC) and CERN (LHeC), and also drivers for high-energy FELs and 4th GLS. The project has been submitted to, and has received approval from, JLab Program Advisory Committee (PAC 44) in July 2016. Since it was launched 2+ years ago, it has progressed in defining the experimental goals, including for instance multiple-beam instrumentation, ER efficiency, BBU, and the necessary modifications to CEBAF lattice, including for instance a 4-dipole phase chicane in recirculation Arc A, a dump line, and new linac optics. End-to-end simulations have been undertaken and software tools are under development. A next major objective in demonstrating readiness is a technical review as mandated by PAC 44. This paper gives a status of the project and its context, and presents plans for the near future.
Funding: Work supported by Brookhaven Science Associates, LLC under Contract DE-AC02-98CH10886 with the U.S. DOE, Jefferson Science Associates, LLC under Contract DE-AC05-06OR23177 with the U.S. DOE.

WEIACC004

A Beam Test Facility for High Current Photoinjector and its Key Technologies Development at IHEP

X.P. Li, Y.L. Chi, S. Pei, J.Q. Wang, J.Y. Zhai (IHEP) J.Q. Xu (Insititute of High Energy Physics (IHEP))

A beam test facility for high current photoinjector has been supported for future advanced light source at the Platform of Advanced Photon Source Technology R&D (PAPS) which is going to be completed before July of 2020. This test facility is based on a photocathode DC-Gun followed by two 2-cell 650MHz superconducting RF cavities. The detailed design of the photoinjector and its related key technologies R&D progress such as DC-Gun and superconducting cavities are presented.

WEIBCC — WG2.1 ERL Beam Dynamcs

Beam Dynamics Issues for Multi-Pass ERLs

WEIBCC001

G.H. Hoffstaetter (Cornell University, CLASSE)

Several labs have proposed multi-turn ERLs as electron-drivers for major experiments. The beam dynamics of the 4-turn ERL CBETA will be studied in detail to understand the beam-dynamic issues for these electron drivers. These issues include: (a) current limits by the recirculative beam-breakup instability(BBU) and its control by HOM damping, optics adjustments, and optical coupling, (b) ions attracted to the electron beam and their control by clearing electrodes, current modulations, and beam shaking, (c) loss mechanism including Touschek scattering, gas scattering, field emission, ghost pules, and spurious emotions from the cathode, (d) high-chromaticity operation, orbit and optics controls of superimposed beams, coherent synchrotron radiation, micro-bunching, and longitudinal space charge, and (e) low energies space charge and emittance control

LHeC ERL - Beam Dynamics Challenges

WEIBCC002

D. Pellegrini (CERN)

The LHeC is envisioned as a natural upgrade of the LHC that aims at delivering an electron beam for collisions with the existing hadronic beams. The current baseline design for the electron facility consists of a multipass superconducting energy-recovery linac (ERL) operating in a continuous wave mode and delivering a beam current up to 25 mA at the energy of 60 GeV. This contribution aims at briefly reviewing the beam dynamics aspects motivating the existing design choices. Emphasis will be put in the open issues with their potential synergies with other projects.

Beam Dynamics and Optics Challenges of bERLinPro

WEIBCC003

M. Abo-Bakr (HZB)

The Helmholtz-Zentrum Berlin is constructing the Energy Recovery Linac Prototype bERLinPro, a demonstration facility for the science and technology of ERLs for future light source applications. bERLinPro is designed to accelerate a high current (100 mA, 50 MeV), high brilliance (norm. emittance below 1 mm mrad) cw electron beam. Various aspects and challenges of beam dynamics and optics in an ERL will be introduced and their relevance and influence on the beam optics layout of bERLinPro discussed. Beside storage ring known requirements emphasis is put to ERL specific problems. Especially collective effects due to space charge and high current are considered.

Funding: Work supported by the German Bundesministerium für Bildung und Forschung, Land Berlin and grants of Helmholtz Association

Studies of CSR and Microbunching at the Jefferson Laboratory ERLs

WEIBCC004

C. Tennant, S.V. Benson, D. Douglas, R. Li (JLab) C.-Y. Tsai (SLAC)

One attractive feature of energy recovery linacs (ERLs) is they are source limited. However as beam brightness increases so too do the effects of coherent synchrotron radiation (CSR) and the microbunching instability. The Low Energy Recirculator Facility at Jefferson Laboratory provides a test bed to characterize aspects of CSR's effect on the beam by measuring the energy extraction via CSR as a function of bunch compression. Data was recorded with acceleration occuring on the rising part of the RF waveform while the full compression point was moved along the backleg of the machine and the response of the beam measured. Acceleration was moved to the falling part of the RF waveform and the experiment repeated. Initial start-to-end simulations using a 1D CSR model show good agreement with measurements. The experiment motivated the design of a modified Continuous Electron Beam Accelerator Facility style arc with control of CSR and the microbunching gain. Insights gained from that study informed designs for recirculation arcs in an ERL-driven electron cooler for Jefferson Laboratory's Electron Ion Collider. Progress on the design and outstanding challenges of the cooler are discussed.

Funding: Authored by Jefferson Science Associates, LLC under U.S. DOE Contract No. DE-AC05-06OR23177.

WEICCC — WG1.1 ERL Sources: Guns (DC)

WEICCC001

Commission Results of the Compact ERL High Voltage DC Gun

N. Nishimori (Tohoku University, Research Center for Electron Photon Science) R. Hajima, R. Nagai (QST) Y. Honda, X.J. Jin, T. Miyajima, T. Obina, T. Uchiyama, M. Yamamoto (KEK) M. Kuriki (HU/AdSM)

Beam commissioning of the compact ERL (cERL) has been performed for the next generation ERL light sources such as a laser Compton gamma-ray source and a high power FEL for EUV lithography. The operational high voltage of the cERL DC gun has been limited to 390 kV due to failure of the ten segmented insulators. In November 2015, we installed an additional two segmented insulators on the top of the existing ten segmented insulators. In December 2015, we successfully performed high voltage conditioning up to 500 kV. We also found high voltage threshold for stable operation in a dc electron gun [1]. The cERL operational voltage has been 450 kV in maximum since then. We will present details of the high voltage upgrade and operational status at 450 kV of the cERL gun.

[1] Masahiro Yamamoto and Nobuyuki Nishimori, APL 109, 014103 (2016).

Funding: This work is partially supported by JSPS Grant-in-Aids for Scientific Research in Japan (15H03594, 16K05385).

WEICCC002

The ALICE ERL - DC Photocathode Gun Commissioning

L.B. Jones (STFC/DL/ASTeC)

The ALICE (Accelerators and Lasers In Combined Experiments) accelerator was the first ERL to be operated in Europe. ALICE was used to drive the UK's first Free-Electron Laser, generating infra-red light in the 4 - 20 micron range which was used in the development of pioneering cancer diagnostics. This talk will present an overview of the ALICE DC GaAs photocathode gun, and review the measured performance of the gun when it was operated in to a dedicated diagnostics beamline.

WEICCC003

Injector Challenges for CBETA Demonstration Experiment

K.W. Smolenski (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

CBETA, currently under construction, is a 4-pass, 40mA 150MeV ERL based on the proven Cornell ERL injector chain mated with an FFAG loop. The Cornell ERL injector program, originally intended for a large scale X-Ray light source, has been under development and operated for over 10 years. The status of the Cornell ERL injector is reviewed and its parameters compared with the challenges presented by the requirements for CBETA operation. The injector consists of a high voltage DC photocathode gun, a normal conducting buncher cavity, the superconducting injector cryomodule, followed by a splitter magnet that can transport the beam into either a diagnostics beamline or merge the beam into the CBETA ERL loop. The current status of the Cornell DC gun development program and its history will be reviewed. The performance of the injector cryomodule, capable of accelerating beams to 15MeV, will be discussed with a focus on the lessons learned from its operation. Finally the diagnostics beamline and the merger will be detailed along with the latest results from our low emittance beam studies.

Funding: This work was performed with the support of NYSERDA (New York State Energy Research and Development Agency) and of the National Science Foundation (Award No. NSF-DMR 0807731).

First Results of Commissioning DC Photo-Gun for RHIC Low Energy Electron Cooler (LEReC)

D. Kayran, Z. Altinbas, D. Bruno, M.R. Costanzo, A.V. Fedotov, D.M. Gassner, X. Gu, L.R. Hammons, P. Inacker, J.P. Jamilkowski, J. Kewisch, C.J. Liaw, C. Liu, K. Mernick, T.A. Miller, M.G. Minty, V. Ptitsyn, T. Rao, J. Sandberg, S. Seletskiy, P. Thieberger, J.E. Tuozzolo, E. Wang, Z. Zhao (BNL)

Non-magnetized bunched electron cooling of ion beams during low energy RHIC operation requires electron beam energy in the range of 1.6-2.6 MeV, with an average current up to 45 mA, very small energy spread, and low emittance. A 400 kV DC gun equipped with a photocathode and laser system will provide a source of high-quality electron beams. During DC gun test critical elements of LEReC such as laser beam system, cathode exchange system, cathode QE lifetime, DC gun stability, beam instrumentation, the high-power beam dump system, machine protection system and controls has been tested under near- operational conditions [1]. We present the status, experimental results and experience learned during the LEReC DC gun beam testing.

[1] D. Kayran et al., DC Photogun Gun Test for RHIC Low Energy Electron Cooler (LEReC), NAPAC2016 proceedings, WEPOB54.

Funding: Work supported by Brookhaven Science Associates, LLC under Contract No. DE-AC02-98CH10886 with the U.S. Department of Energy

WEIDCC — WG1.1 ERL Sources: Guns (SRF)

WEIDCC001

The Development of the DC-SRF Photoinjector at Peking University

H.M. Xie, W. Cheng, L.W. Feng, J.K. Hao, S. Huang, L. Lin, K.X. Liu, W. Qin, S.W. Quan, F. Wang, F. Zhu (PKU)

Stable operation of the DC-SRF photoinjector has been realized and the electron beam has been delivered to a 2 × 9-cell SRF linac for further acceleration and terahertz superradiant undulator radiation experiments. In this talk we will present our latest experiment progress and recent work for decreasing the immitance of the DC-SRF photoinjector. The purpose is to build an upgraded DC-SRF photoinjector capable of driving CW X-ray free-electron lasers.

WEIDCC002

High Charge High Current Beam From BNL 113 MHz SRF Gun

I. Pinayev, Z. Altinbas, S.A. Belomestnykh, I. Ben-Zvi, K.A. Brown, J.C.B. Brutus, A.J. Curcio, L. DeSanto, A. Di Lieto, C. Folz, D.M. Gassner, M. Harvey, T. Hayes, R.L. Hulsart, P. Inacker, J.P. Jamilkowski, Y.C. Jing, D. Kayran, R. Kellermann, R.F. Lambiase, D. Lehn, V. Litvinenko, C. Liu, G.J. Mahler, M. Mapes, K. Mernick, R.J. Michnoff, T.A. Miller, M.G. Minty, G. Narayan, P. Orfin, M.C. Paniccia, D. Phillips, T. Rao, T. Roser, S.K. Seberg, B. Sheehy, J. Skaritka, L. Smart, K.S. Smith, V. Soria, Z. Sorrell, R. Than, C. Theisen, P. Thieberger, J.E. Tuozzolo, J. Walsh, E. Wang, G. Wang, D. Weiss, B. P. Xiao, T. Xin, W. Xu, A. Zaltsman, Z. Zhao (BNL) K. Mihara (Stony Brook University) I. Petrushina (SUNY SB) K. Shih (SBU)

We are commissioning the accelerator for the Coherent Electron Cooling Proof-of-principle (CeC PoP) Experiment. The 113 MHz superconducting RF gun with Cs2KSb photocathode serves as a source of the electrons. The gun is designed to operate up to 5 nC beam with repetition rate of 78 kHz. In the paper we present status of the gun as well as achieved beam parameters. The photocathode performance (quantum efficieny, lifetime) is also discussed.

Funding: Work supported by Brookhaven Science Associates, LLC under Contract No. DE-AC02-98CH10886 with the U.S. Department of Energy.

WEIDCC003

Metal and Semiconductor Photocathodes in the HZDR SRF Gun

J. Teichert, A. Arnold, P.N. Lu, P. Murcek, H. Vennekate, R. Xiang (HZDR)

The superconducting RF photoelectron gun at the ELBE accelerator facility is a high-repetition rate electron injector for CW operation and can provide high average current and high brightness electron beams. During commissioning and operating time different types of photocathodes, metallic (Cu, Mg) and semiconductors (Cs2Te), have been used. We present the preparation processes, properties as well as performance and operational experience of the cathodes in the SRF gun. Furthermore, specific issues like cathode cooling, multipacting, and dark current will be discussed.

WEIDCC004

The bERLinPro SRF Photoinjector System - From Design to First RF Commissioning Results

A. Neumann (HZB)

Helmholtz-Zentrum Berlin (HZB) is currently constructing an high average current superconducting (SC) ERL as a prototype to demonstrate low normalized beam emittance of 1 mm·mrad at 100mA and short pulses of about 2 ps. To reach the required beam properties, an SRF based photo-injector system was developed and recently underwent RF commissioning. The medium power prototype- a first stage towards the final high power 100 mA design- presented here features a 1.4 x lambda/2 cell SRF cavity with a normal-conducting, high quantum efficiency Cs2KSb cathode, implementing a modified HZDR-style cathode insert. This injector potentially allows for 6 mA beam current and up to 3.5 MeV kinetic energy, limited by the modified twin TTF-III fundamental power couplers. In this contribution an overview of the design approach, cavity production and module assembly up to the first RF commissioning results of the photo-injector module will be presented.

Funding: Work supported by German Bundesministerium für Bildung und Forschung, Land Berlin, and grants of Helmholtz Association

THIACC — WG2.3 ERL Instrumentation

Higher Bunch Charge Operation in Compact ERL at KEK

Abstract not submitted at print time.

T. Miyajima (KEK)

Dark Current and Halo Tracking in ERLs

M. McAteer (HZB)

Particles that are far from the core of a bunch are often lost in an uncontrolled way within an accelerator, and in high-current machines beam loss can quickly damage accelerator components or cause significant residual activation. We give a brief overview of the common sources of unwanted beam, including halo generated by nonlinear dynamics, dark current from field emission in the cavities, out-of-time scattered laser light on the cathode, and incompletely blocked laser pulses. The results of tracking simulations to model these effects in bERLinPro are discussed.
Funding: Work supported by the German Bundesministerium für Bildung und Forschung, Land Berlin and grants of Helmholtz Association

Low Emittance Optimization and Operation

Abstract not submitted at print time.

P.H. Williams (STFC/DL/ASTeC)

THIBCC — WG4.1 SRF: Microphonics Measurement and Control

THIBCC001

Resonance Control of the PIP-II SC Cavities

W. Schappert (Fermilab)

Abstract not submitted at print time.

THIBCC002

Microphonics Analysis of ERL Cryomodule

F. Furuta, N. Banerjee, J. Dobbins, R.G. Eichhorn, M. Ge, G.H. Hoffstaetter, M. Liepe, P. Quigley, J. Sears, V. Veshcherevich (Cornell University (CLASSE), Cornell Laboratory for Accelerator-Based Sciences and Education)

The main linac prototype cryomodule (MLC) is a key component for the Cornell-BNL ERL Test Accelerator (CBETA) project, which is a 4-turn FFAG ERL under construction at Cornell University. After the success of the initial MLC test, the MLC has been moved into the final location for the initial beam test into the MLC. The levels of microphonic in the MLC cavities without fast tuner compensation were measured at the initial and the final location, confirming that these should not limit the CBETA requirement of a nominal energy gain of 36 MeV per pass. Nevertheless, a further reduction of microphonics is desirable for improved energy stability and reduced RF power demand. The cryogenic gas line to the MLC was optimized to reduce vibrations. A piezoelectric-driven fast tuner is installed on each MLC cavity, and its usefulness in compensating cavity microphonics was studied. Here we report details from these tests and summarize results.

THIBCC005

Development of an ERL RF Control System

S. Orth, D. Domont-Yankulova, H. Klingbeil (TEMF, TU Darmstadt)

The Mainz Energy-recovering Superconducting Accelerator (MESA), currently under construction at Johannes Gutenberg-Universität Mainz, requires a newly designed digital low-level radio frequency (LLRF) system. Challenging requirements have to be fulfilled to ensure high beam quality and beam parameter stability. First, the layout with two recirculations and the requirements will be shown from an LLRF point of view. Afterwards, different options for the control system are presented. This includes the generator-driven system, the self-excited loop and classical PID controller as well as more sophisticated solutions.

Funding: Work supported by Deutsche Forschungsgemeinschaft (DFG): GRK 2128 "AccelencE"

THICCC — Contributed Oral Presentations

Beam Halo Study at the KEK Compact ERL

THICCC001

O. Tanaka, T. Miyajima, N. Nakamura, M. Shimada (KEK) T. Hotei (Sokendai) K. Osaki (Toshiba)

The beam halo control is of a great importance to attain high intensity beams. Thus, its detailed treatment is indispensable for the stable and safe operation. A systematic beam halo study was established at the KEK Compact ERL (cERL) since machine commissioning in spring 2015 in order to understand the beam halo formation and to have the stable and safe operation. The results of halo simulations have given a reasonable explanation of the low bunch charge (0.2-0.3 pC) beam profiles evaluated during the measurement. Thus, vertical beam halos observed at cERL are supposed to be due to the longitudinal bunch tails transferred into the transverse plane. Tails are mainly produced by the cathode response on the laser excitation. Further, when a beam passing the rf cavity off-center it experiences rf field kicks. The beam tilt could be a complex effect of the steering coils and cavities misalignments. During spring 2017 commissioning the bunch charge was increased up to 40 pC. In present study we are challenging to describe how the space charge effect acts on the beam halo profiles, and how the halo formation mechanisms change in this connection.

Funding: Work supported by the Grant-in-Aid for Creative Scientific Research of JSPS (KAKENHI 15K04747).

Study of Microbunching Instability in MESA

THICCC002

A. Khan, O. Boine-Frankenheim (Institut Theorie Elektromagnetischer Felder, TU Darmstadt) K. Aulenbacher (IKP)

The Institute for Nuclear Physics (KPH) at Mainz is building a multi-turn energy recovery linear accelerator, the Mainz Energy-recovering Superconducting Accelerator (MESA), to deliver a CW beam at 10^5 MeV with short pulses, high current and small emittance for physics experiments with an internal target. Space charge effects potentially cause beam quality degradation for medium energy beams in smaller machines like MESA. As beam quality preservation is a major concern in an ERL during recirculation. We present a study on Microbunching Instability (MBI) caused by Longitudinal Space Charge (LSC) in MESA. Our results demonstrate the impact of the MESA arc lattice design on the development of Microbunching Instability.

Funding: Supported by the DFG through GRK 2128

Development of a Multialkali Photocathode DC Gun for High Current Operation

THICCC003

N. Nishimori (Tohoku University, Research Center for Electron Photon Science) R. Hajima, R. Nagai, M. Sawamura (QST)

We have developed a DC gun test stand at National Institutes for Quantum Radiological Science and Technology (QST) for high current electron beam generation. The gun test stand consists of an alkali antimonide photocathode preparation chamber, a DC gun with a 250kV-50mA Cockcroft Walton high voltage power supply, and beam line with a water cooled beam dump to accommodate 1.5 kW beam power. We successfully fabricated a Cs_3Sb photocathode with quantum efficiency of 5.8 % at 532 nm wavelength and generated 150 keV beam with current up to 4.3 mA with 500 mW laser at 532 nm wavelength. Unfortunately, we encountered a vacuum incident during beam transport of high current beam and the development has been halted. We will fix the vacuum problem and restart the gun development as soon as possible.

Funding: This work is partially supported by a JSPS Grant-in-Aid for Scientific Research in Japan (15K13412).

ERL Upgrade Plans for the ARIEL E-Linac

R.E. Laxdal (TRIUMF, Canada's National Laboratory for Particle and Nuclear Physics)

TRIUMF is engaged in a major project, ARIEL, with the aim to triple the radioactive ion beam output available to ISAC experiments. A central piece of the ARIEL project is a new superconducting 1.3GHz electron linac with final design parameters of 50MeV and 10mA cw. Presently two cryomodules housing three elliptical cavities and capable of 30-35MeV have been installed and are being commissioned. Space has been saved in the electron linac hall to allow a future recirculating ring to operate in energy boost mode or as an energy recovery linac. Initial design considerations for the ERL are being discussed to converge towards a proposal to be submitted as part of the next TRIUMF five year plan, 2020-2025.

FRIACC — WG5.1 Particle and Nuclear Physics Applications

Generation of High-flux High-energy Ultra-short Vortex Photon Beams From JLab ERL Facility

FRIACC001

Abstract not submitted at print time.

S. Zhang (JLab)

Nuclear Physics Experiments at Mesa

FRIACC002

K. Aulenbacher (IKP)

The MESA-ERL will create unique possibilities for scattering experiments with windowless targets. This research program will take place at a didicated set up for which a two arm spectrometer with specifically adapted detector technolgy is bein build. The suite of experiemtns includes a wide range of physics topics, e.g. search of exotic particles or accurate determination of nuclear form factors.

Funding: Work supported by the DFG through excellence cluster PRISMA

ERL Developments for eRHIC

FRIACC003

Abstract not submitted at print time.

V. Litvinenko (BNL)

FRIBCC — Summaries and Closing

FRIBCC001

ERL17 Workshop, WG1 Summary: Injectors

E. Wang (BNL) K. Aulenbacher (HIM)

The 59th ICFA Advance Beam Dynamics Workshop on Energy Recovery Linacs, hosted by the CERN was held on CERN campus. The working group (WG) 1 ERL injectors focused on high-brightness, high-power CW electron gun and high QE long lifetime semiconductor photocathode. The working group 1 was separated into two sessions: One is electron gun session, which has eight invited talks; another is photocathode session, which has six invited talks and one contributed talk. This report summarizes the state of the art of electron guns and photocathodes discussed in the ERL workshop WG1.

FRIBCC002

ERL17 Workshop, WG2 Summary: Optics, Beam Dynamics and Instrumentation

S.A. Bogacz (JLab) D. Schulte (CERN)

During the workshop a number of interesting projects were discussed: ERL at KEK, ALICE, PERLE, LHeC, eRHIC, CBETA, ERL for MESA and bERLinPro; a nice mixture of future, existing and past facilities. A rather vigorous development of new ERLs is aggressively pushing the limits: maximizing number of passes, maximizing virtual beam power, opening longitudinal acceptance, mitigation of limiting factors: BBU, CSR/microbunching, diagnostics and Instrumentation for multiple beams, multiparticle tracking studies of dark current and halo formation. A bright future can be expected for the field.

FRIBCC003

ERL17 Workshop, WG3 Summary: Test Facilities Around the World

A. Stocchi (LAL) , G.H. Hoffstaetter (Cornell University, CLASSE)

This contribution has not been submitted.

FRIBCC004

ERL17 Workshop, WG4 Summary: Superconducting RF

F. Gerigk (CERN) , I. Ben-Zvi (BNL)

Working Group 4 consisted of 10 talks, which were split into three sessions around four main themes. These themes will be listed and summarized in the following along with a summary of the discussion session.

FRIBCC005

ERL17 Workshop, WG5 Summary: Applications

P.A. McIntosh (STFC/DL/ASTeC) I.V. Konoplev (JAI)

For the ERL17 Applications Working Group (WG5), a focus was identified for Photon science and Particle and Nuclear Physics application areas. For the Photon applications; THz, FEL and Compton drivers were most relevant and for the Particle and Nuclear Physics field, Compton, Polarised and Cooled beams were most prominent. The following then highlights the key performance needs, challenges and anticipated future demands for each of these application areas as reviewed and discussed at the workshop.

Author Index

A

B

C

D

E

Author Index

Author Index

O

P

Q

R

S

T

Italic papercodes indicate primary author