ICFA-HB2006

39th ICFA Advanced Beam Dynamics Workshop

High Intensity High Brightness Hadron Beams

May 29 - June 2, 2006

EPOCHAL International Congress Center, Tsukuba, Japan

Co-sponsored by KEK and JAEA

Abstract List

ICFA-HB2006 Program Overview

	May 29 (Mon.)	**May 30 (Tue.)**			**May 31 (Wed.)**			**June 1 (Thu.)**			**June 2 (Fri.)**
Room	Hall200	201B	202A	202B	201B	202A	202B	201B	202A	405	Hall200
From 9:00	**Pleanary**	**WG-C+G**	**WG-E**	**WG-A**	**WG-C+G**	**WG-D**	**WG-B**	**WG-C+G**	**WG-F**	**WG-A+B+D**	**Pleanary**
To 12:00	MOAP01	TUAZ01	TUAY01	TUAX01	WEAZ01	WEAY01	WEAX01	THAZ01	THAY01	THAW01	FRAP01
	MOAP02	TUAZ02	TUAY02	TUAX02	WEAZ02	WEAY02	WEAX02	THAZ02	THAY02	THAW02	FRAP02
	MOAP03	TUAZ03	TUAY03	TUAX03	WEAZ03	WEAY03	WEAX03	THAZ03	THAY03	THAW03	FRAP03
	MOAP04	TUAZ04	TUAY04	TUAX04	WEAZ04	WEAY04	WEAX04	THAZ04	THAY04	THAW04	FRAP04
		TUAZ05	TUAY05	TUAX05	WEAZ05	WEAY05	WEAX05	THAZ05	THAY05	THAW05	FRAP05
		TUAZ06	TUAY06	TUAX06	WEAZ06	WEAY06	WEAX06	THAZ06	THAY06	THAW06	FRAP06
					WEAZ07					THAW07	FRAP07
											FRAP08
											FRAP09
	Lunch	Lunch			Lunch			Lunch			Lunch
From 13:30	**Pleanary**	**WG-C+G**	**WG-E**	**WG-A**	**WG-C+G**	**WG-D**	**WG-B**	**WG-C+G**	**WG-F**	**GWG-A+B+D**	
To 15:30	MOBP01	TUBZ01	TUBY02	TUBX01	WEBZ01	WEBY01	WEBX01	THBZ01	THAY07	THBW01	
	MOBP02	TUBZ02	TUBY03	TUBX02	WEBZ02	WEBY03	WEBX02	THBZ02	THBY01		
	MOBP03	TUBZ04	TUBY04	TUBX03	WEBZ03	WEBY04	WEBX03	THBZ03	THBY02		J-PARC tour
				TUBX05		WEBY05	WEBX04	THBZ04			
				TUBX06			WEBX05	THBZ05			
							WEBX06				
	Break	Break			Break			Break			
From 15:50	**Pleanary**	**WG-C+G**	**WG-E**	**WG-A**	**WG-C+G**	**WG-D**	**WG-B**	**WG-C+G**	**WG-F**	**GWG-A+B+D**	
To 17:50	MOCP01	Work	Work	Work	Work	Work	Work	Work	Work	Work	
	MOCP02										
	MOCP03										
	MOCP04										
	Welcome reception				Banquet						

WG-A	Beam Instabilities and their cures	**WG-E**	High intensity linacs / proton drivers
WG-B	Space-charge theory, simulations, and experiments	**WG-F**	FFAG and other advanced techniques
WG-C	Beam diagnostics, collimation, injection/extraction and targetry	**WG-G**	Commissioning strategies and procedures
WG-D	Beam cooling and intra-beam scattering	**GWG-A+B+D**	General parallel session A+B+D - code benchmarking

MOAP01 Approach to a very high intensity beam at J-PARC

Speaker Yoshishige Yamazaki (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)

Authors Yoshishige Yamazaki (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)

Abstract

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOAP02 Recent Beam Commissioning Results from the Spallation Neutron Source

Speaker Stuart Henderson (ORNL, Oak Ridge, Tennessee)

Authors Stuart Henderson (ORNL, Oak Ridge, Tennessee)

Abstract The Spallation Neutron Source accelerator complex consists of a 2.5 MeV H- front-end injector system, a 186 MeV normal-conducting linear accelerator, a 1 GeV superconducting linear accelerator, an accumulator ring and associated beam transport lines. The beam commissioning campaign of the SNS accelerator complex, initiated in 2002, has been performed in seven discrete runs as each successive portion of the accelerator complex has been installed. The final beam commissioning run, in which beam was transported to the liquid mercury target was recently completed. In the course of beam commissioning, most beam performance parameters and beam intensity goals have been achieved at low duty factor. The beam performance and beam dynamics measurements of the linac and ring will be presented.

Funding Agency SNS, managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. DOE, is a partnership of six laboratories: Argonne, Brookhaven, Jefferson, Berkeley, Los Alamos and Oak Ridge.

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOAP03 Comparative Studies of Proton Accelerators for High Power Applications

Speaker Wu-Tsung Weng (BNL, Upton, Long Island, New York)

Authors Wu-Tsung Weng (BNL, Upton, Long Island, New York)

Abstract There are many applications need high power proton accelerators of various kinds. However, each type of proton accelerator can only provide beam with certain characteristics, hence the match of accelerators and their application needs careful evaluation. In this talk, the beam parameters and performance limitations of linac, cyclotron, synchrotron, and FFAG accelerators will be studied and their relative merits for application in muon, neutron, neutrino, and ADS assessed in terms of beam energy, intensity, bunch length, repetition rate, and beam power requirements. A possible match between the applications and the accelerator of choice will be presented in a matrix form. The accelerator physics and technology issues and challenges involved will also be covered.

Funding Agency This work is performed under the auspices of the US Department of Enegry.

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOAP04 Recent progresses on FFAG accelerators

Speaker Yoshiharu Mori (KURRI, Osaka)

Authors Yoshiharu Mori (KURRI, Osaka)

Abstract

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOBP01 ISIS Upgrades — A Status Report

Speaker David Findlay (CCLRC/RAL/ISIS, Chilton, Didcot, Oxon)

Authors David Findlay (CCLRC/RAL/ISIS, Chilton, Didcot, Oxon)

Abstract Since 2002 several accelerator upgrades have been made to the ISIS spallation neutron source at the Rutherford Appleton Laboratory in the UK, and upgrades are currently continuing in the form of the Second Target Station Project. The paper will review the upgrade processes, and will also look forward to possible future schemes at ISIS beyond the Second Target Station.

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOBP02 FAIR at GSI

Speaker Peter J. Spiller (GSI, Darmstadt)

Authors Peter J. Spiller (GSI, Darmstadt)

Abstract A new faciliy for antiproton and ion research (FAIR) is being planned and prepared to be built at GSI, Germany. R&D and prototype design is presently conducted at GSI and several other institutes worldwide, representing the future FAIR member states. Furthermore a major upgrade program for the running GSI accelerators, the heavy ion linac UNILAC and the heavy ion synchrotron SIS18 has been started. In parallel, the plannings for buildings and tunnels and the permit procedure for construction were launched. The new facility will consist of a two stage heavy ion synchrotron SIS100/300 for the generation of intense heavy ion and proton beams. These beams can be delivered wether as short compressed bunches for the production of secondary beams with subsequent processing in storage rings or as slow extracted beams with high duty cycle for fixed target experiments. The quality and intensity of the produced secondary beams (rare isotope and antiproton beams) will be significantly improved in a number of storage rings used for stacking, beam cooling and for internal target experiments.

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOBP03 Upgrade of BNL Accelerator Facility

Speaker Alessandro G. Ruggiero (BNL, Upton, Long Island, New York)

Authors Alessandro G. Ruggiero (BNL, Upton, Long Island, New York)

Abstract A number of upgrades are planned for the Brookhaven accelerator facility that is primarily made of RHIC and its injector, the AGS. The RHIC luminosity and proton polarization are to evolve towards the Enhanced Design parameters by 2008. A new Electron Beam Ion Source is under development, and commissioning is expected in 2009. The aim of the RHIC II upgrade is to increase the heavy ion luminosity by an order of magnitude, through electron cooling in store. With the addition of an electron ring, the high-luminosity electron-ion collider proposal eRHIC can be realized. Studies have also been done for a new injector to the AGS replacing the present Booster for an upgrade of the beam average power to 1 MW at 28 GeV. The new injector to match the AGS repetition rate can be either a 1.5-GeV SCL or a FFAG accelerator. With the upgrade of the injector complex, neutrino superbeams could be produced.

Funding Agency Work performed under the auspices of the US Department of Energy

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOCP01 Beam intensity upgrade at Fermilab

Speaker Alberto Marchionni (Fermilab, Batavia, Illinois)

Authors Alberto Marchionni (Fermilab, Batavia, Illinois)

Abstract

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOCP02 Status and outlook of high intensity accelerator projects in China

Speaker Jie Wei (BNL, Upton, Long Island, New York)

Authors Jie Wei (BNL, Upton, Long Island, New York), Shouxian Fang, Shinian Fu (IHEP Beijing, Beijing)

Abstract High intensity accelerator research is a relatively new subject in China. Recent program includes the accelerator-driven sub-critical power generation and the Beijing Spallation Neutron Source (BSNS) project. The Beijing Spallation Neutron Source (BSNS) is a newly approved project based on a H- linear accelerator and a rapid cycling synchrotron. During the past year, several major revisions were made on the design including the type of the front end, the linac frequency, the transport layout, the ring lattice, and the type of ring components. Possible upgrade paths were also laid out: based on an extension of the warm linac, the ring injection energy and the beam current could be raised doubling the beam power on target to reach 200 kW; an extension with a superconducting RF linac of similar length could raise the beam power near 0.5 MW. Based on these considerations, research and development activities are started. In this paper, we discuss the rationale of design revisions and summarize the recent works.

Funding Agency Work performed under the auspices of the Chinese Academy of Sciences and the U.S. Department of Energy.

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOCP03 Status of the LHC

Speaker Ruediger Schmidt (CERN, Geneva)

Authors Ruediger Schmidt (CERN, Geneva)

Abstract For the LHC to provide particle physics with proton-proton collisions at a centre of mass energy of 14 TeV with a luminosity of 10^34 cm-2s-1, the machine will operate with high-field dipole magnets using NbTi superconductors cooled to below the lambda point of helium. The construction follows a decade of intensive R&D and technical validation of major collider sub-systems. Installation of the accelerator system is in full swing. Commissioning of the injector complex is well advanced, including beam transfer through one of the transfer lines from SPS to LHC. In the LHC machine, commissioning of the cryogenic system and powering system has started. The status of the LHC accelerator and a brief outlook to operation and its consequences for the machine protection systems will be given. The strategy for the machine protection and beam cleaning will have a major impact on commissioning and operation since each of the two LHC proton beam has a stored energy of about 360 MJ. A fraction of less than 10^-3 of the full beam threatens to damage accelerator equipment in case of uncontrolled beam loss, and only 10^-8 protons could already quench a magnet.

Funding Agency

Type of Presentation Invited Oral

Main Classification Plenary (Invited Only)

MOCP04 LHC Upgrade Options and CARE-HHH Activities

Speaker Frank Zimmermann (CERN, Geneva)
Authors Frank Zimmermann (CERN, Geneva)

Abstract The European Accelerator Network on High Energy High Intensity Hadron Beams (CARE HHH) is developing scenarios for luminosity and energy upgrades of the Large Hadron Collider (LHC). The LHC upgrade options under consideration differ in terms of beam parameters, electron-cloud effects, beam-beam compensation, use of crab cavities, and interaction-region layout. Complementary investigations concern injector upgrades, novel magnet technologies, advanced collimation schemes, and ultimate intensity limitations. Flanking these upgrade studies, an accelerator-physics code web repository has been set up, and an extensive simulation-code benchmarking campaign is being prepared.

Funding Agency We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" programme (CARE, contract number RII3-CT-2003-506395)

Type of Presentation Invited Oral
Main Classification Plenary (Invited Only)

TUAX01 Accumulation of High Intensity Beam and First Observations of Instabilities in the SNS Accumulator Ring*

Speaker Viatcheslav V. Danilov (ORNL, Oak Ridge, Tennessee)
Authors Viatcheslav V. Danilov, Alexander V. Aleksandrov, Saeed Assadi, Willem Blokland, Sarah M. Cousineau, Craig Deibele, Stuart Henderson, Jeffrey Alan Holmes, Michael Plum, Andrei P. Shishlo (ORNL, Oak Ridge, Tennessee)

Abstract The Spallation Neutron Source accumulator ring, designed to accumulate up to 1.5e14 protons per pulse, was commissioned in January of 2006. During the run, over 1.e14 protons were accumulated in the ring in the natural chromaticity state without any sign of instabilities. The first beam instabilities were observed for a high intensity coasting beam with zero chromaticity. Preliminary analysis of data indicates instabilities related to extraction kicker impedances, and electron-proton instability. Here we review the background theory and design philosophy of the ring, as it relates to instabilities, and compare the pre-commissioning predictions with the experimental measurements.

Funding Agency *Research sponsored by UT-Batelle, LLC, under contract no. DE-AC05-00OR22725 for the U.S. Department of Energy

Type of Presentation Invited Oral
Main Classification A. Beam Instabilities and their cures

TUAX02 Coherent Instabilities at the Fermilab Booster

Speaker Valeri Lebedev (Fermilab, Batavia, Illinois)
Authors Valeri Lebedev, William Pellico, Xi Yang (Fermilab, Batavia, Illinois)

Abstract Fermilab booster is a fast cycling synchrotron operating on 15 Hz. To exclude problem of eddy currents excited in the vacuum chamber by fast changing magnetic field Booster does not have a conventional vacuum chamber. Instead, the vacuum chamber is formed by poles of the laminated combined function magnets. The exposed magnet laminations result in large transverse and longitudinal impedances affecting both the transverse and longitudinal stability of the beam. Presently, the transverse instability is suppressed by large chromaticity negatively affecting the dynamic aperture and the beam lifetime. Earlier attempts to stabilize the instability by transverse feedback system were unsuccessful. Recently we performed experimental studies to find out the reason. We observed that at reduced chromaticity at injection the

most unstable mode is the multibunch high order head-tail mode with growth time of about 12 turns. It develops at synchro-betatron tune with very small fractional part where the transverse impedance is at a maximum. Analytical calculations and numerical simulations verify the observations and allowed us to compute the value of transverse impedance. Another persistent probl

Footnotes Work supported by the Universities Research Assos., Inc., under contract DE-AC02-76CH03000 with the U.S. Dept. of Energy.

Funding Agency

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

TUAX03 Beam loss, emittance growth and halo formation due to the pinched electron cloud

Speaker Elena Benedetto (CERN, Geneva)

Authors Elena Benedetto, Frank Zimmermann (CERN, Geneva), Giuliano Franchetti (GSI, Darmstadt), Kazuhito Ohmi (KEK, Ibaraki)

Abstract Electron cloud can cause beam losses and emittance growth in proton or positron storage rings. If the electron density exceeds a certain threshold value, a strong head-tail instability manifests itself, characterized by a rapid beam-size blow-up with a rise time comparable to the synchrotron period. However, even for densities below the coherent-instability threshold, the electron-cloud can give rise to a significant emittance growth. We identified the mechanism for this incoherent growth as one caused by the combined effect of the beam particles synchrotron motion and the longitudinal variation of the tune shift, which is proportional to the pinched electron-cloud distribution along the bunch. This can give rise to the periodic crossing of a resonance, in analogy to halo formation in space-charge dominated beams, or eventually, if the tune shift is sufficiently large, to the crossing of bunch regions where the single-particle motion is linearly unstable.

Funding Agency

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

TUAX04 Test of a prototype active damping system for the e-p instability at the LANL PSR

Speaker Robert James Macek (LANL, Los Alamos, New Mexico)

Authors Robert James Macek, Rodney C. McCrady, Sara Walbridge, Thomas Zaugg (LANL, Los Alamos, New Mexico), John Byrd (LBNL, Berkeley, California), Saeed Assadi, Craig Deibele, Stuart Henderson, Michael Plum (ORNL, Oak Ridge, Tennessee), Mauro Torino Francesco Pivi (SLAC, Menlo Park, California)

Abstract Our collaboration from LANL, SNS, LBNL and SLAC has developed and successfully tested a prototype of an analog, transverse (vertical) feedback system for active damping of the two-stream (e-p) instability at the Los Alamos Proton Storage Ring (PSR). This system was able to improve the instability threshold (as measured by the RF buncher voltage) by ~30%. Beam leakage into the gap at lower RF buncher voltage and resulting higher growth rates from more trapped electrons is the likely cause of this limitation. We will describe the system configuration and results of several experimental tests of system performance. We will also discuss our studies and analysis of the factors limiting system performance.

Funding Agency Work performed under the auspices of the U.S. Department of Energy.

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

TUAX05 Studies of e-cloud build up for the FNAL main injector and for the LHC

Speaker Miguel Furman (LBNL, Berkeley, California)
Authors Miguel Furman (LBNL, Berkeley, California)

Abstract We present a summary of recent simulation studies of the electron-cloud (EC) build-up for the FNAL Main Injector and for the LHC. In the first case we pay particular attention to the dependence on bunch intensity (Nb) at injection energy, and we focus on the dipole magnets and field-free regions. The saturated value of the average EC density shows a clear threshold in Nb beyond which the beam will be approximately neutralized on average. For the case of the LHC we limit our discussion to arc dipoles at collision energy, and bunch spacings tb=25 ns or tb=75 ns. The main variables exercised in this study are Nb and the peak value of the secondary emission yield (dmax). For tb=25 ns we conclude that the EC power deposition is comfortably below the available cooling capacity of the cryogenic system if dmax is below ~1.2 at nominal Nb. For tb=75 ns, the EC power deposition is insignificant. As a byproduct of this exercise, we reach a detailed understanding of the significant role played by the backscattered secondary electrons.

Funding Agency Work supported by the US Department of Energy under contract DE-AC02-05CH11231 and by the US-LHC Accelerator Research Project (US-LARP).

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

TUAX06 Electron-clouds and single bunch instabilities at RHIC

Speaker Jie Wei (BNL, Upton, Long Island, New York)
Authors Jie Wei, Michael Blaskiewicz, Wolfram Fischer, Hsiao-Chaun Hseuh, Thomas Roser, S.Y. Zhang (BNL, Upton, Long Island, New York), Ubaldo Iriso (CELLS, Bellaterra (Cerdanyola del Vallès)), Lanfa Wang (SLAC, Menlo Park, California)

Abstract Electron cloud is one of the leading mechanisms that limit the performance of high intensity circular accelerators and colliders. Electron cloud in RHIC is in an intermediate regime sharing features of both the long-bunch (PSR) and short-bunch (photon factories) machines. Vacuum-pressure rises, transverse tune shifts, and electron flux are observed at injection, upon transition crossing, and at top energy. Transverse emittance growth, fast instabilities, and beam loss also occur upon transition crossing. Mitigation measures are implemented both to reduce the production of electron cloud and to control the beam stability. This paper summarizes the observation and initial analysis of the electron-cloud effects at RHIC.

Funding Agency Work performed under the auspices of the U.S. Department of Energy.

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

TUAY01 Overview of proton driver studies for neutrino and muon factories

Speaker Weiren Chou (Fermilab, Batavia, Illinois)
Authors Weiren Chou (Fermilab, Batavia, Illinois)

Abstract There are a number of proton driver studies around the world: SPL at CERN, an 8 GeV SCRF linac at Fermilab, AGS upgrade at BNL, Proton Driver for the International Scoping Study on Neutrino Factories and Superbeams, FFAG based proton driver in Japan, etc. This talk will give an overview of them and compare their similarities and differences. Common R&D projects and possible inter-laboratory collaborations will be discussed.

Funding Agency Work supported by Universities Research Association, Inc. under contract No. DE-AC02-76CH03000 with the U.S. Dept. of Energy.

Type of Presentation Invited Oral

Main Classification E. High intensity linacs / Proton drivers

TUAY02 End-to-end beam dynamics for CERN Linac4

Speaker Alessandra Maria Lombardi (CERN, Geneva)

Authors Alessandra Maria Lombardi (CERN, Geneva)

Abstract LINAC 4 is a normal conducting H- linac which aims to intensify the proton flux available for the CERN accelerator complex. This injector is designed to accelerate a 65 mA beam of H- ions up to 160 MeV for injection into the CERN Proton Synchrotron Booster. The acceleration is done in three stages : up to 3 MeV with a Radio Frequency Quadrupole (the IPHI RFQ) operating at at 352 MHz, then continued to 90 MeV with drift-tube structures at 352 MHz (conventional Alvarez and Cell Coupled Drift Tube Linac) and, finally, with a Side Coupled Linac at 700MHz. The accelerator is completed by a chopper line at 3 MeV and a transport and matching line to the PS booster. After the overall layout was determined based on general consideration of beam dynamics and RF, a global optimisation based on end-to-end simulation has refined some design choices. The results and lessons learned from the end-to-end simulations are reported in this paper.

Funding Agency

Type of Presentation Invited Oral

Main Classification E. High intensity linacs / Proton drivers

TUAY03 Design of the Driver Linac for the Rare Isotope Accelerator

Speaker Peter Ostroumov (ANL, Argonne, Illinois)

Authors Peter Ostroumov, Jerry Nolen, Kenneth Shepard (ANL, Argonne, Illinois)

Abstract The proposed design of the Rare Isotope Accelerator (RIA) driver linac is based on cw fully superconducting 1.4 GV linac capable to accelerate uranium ions up to 400 MeV/u and protons to 1 GeV with 400 kW beam power. Extensive research and development effort has resolved many technical issues related to the construction of the driver linac and other systems of the RIA facility. Particularly, newly developed high-performance SC cavities will provide the required voltage for the driver linac using 300 cavities designed for six different geometrical betas. We are currently looking at alternatives for staging the facility to reduce the initial cost by about a factor of two. A possibility for the first stage includes ~850 MV driver linac to deliver uranium beams at 200 MeV/u and protons at 550 MeV. Thanks to successful tests of the front end systems, 400 kW beams can be obtained with increased intensities of heavy-ion beams from the ECR and higher rf power in the linac even at the first stage of the facility.

Funding Agency Work supported by the U. S. Department of Energy under contract W-31-109-ENG-38.

Type of Presentation Invited Oral

Main Classification E. High intensity linacs / Proton drivers

TUAY04 Beam Dynamics Design of the PEFP 100 MeV Linac

Speaker Ji-Ho Jang (KAERI, Daejon)

Authors Ji-Ho Jang, Yong-Sub Cho, Ky Kim, Yong-Hwan Kim, Hyeok-Jung Kwon (KAERI, Daejon)

Abstract The Proton Engineering Frontier Project (PEFP) is constructing a 100 MeV proton linac in order to provide 20 MeV and 100 MeV proton beams. The linac consists of a 50 keV proton injector including an ion source and a low energy beam transport (LEBT), a 3 MeV radio-frequency quadrupole (RFQ), a 20 MeV drift tube linac (DTL), a medium energy beam transport (MEBT), and the higher energy part (20 MeV ~ 100 MeV) of the 100 MeV DTL. The MEBT is located after the 20 MeV DTL to extract 20 MeV proton beams. The

20 MeV part of the linac was completed and is now under beam test. The higher energy part of the PEFP linac was designed to operate with 8% beam duty. This brief report discusses the design of the PEFP 100MeV linac as well as the MEBT.

Funding Agency This work was supported by the 21C Frontier R&D program in Mnistry of Science and Technology of the Korean Government.

Type of Presentation Invited Oral

Main Classification E. High intensity linacs / Proton drivers

TUAY05 Application of the extreme value theory to estimate beam loss in an ion linac, using large scale Monte Carlo simulations

Speaker Romuald Duperrier (CEA, Gif-sur-Yvette)

Authors Romuald Duperrier, Didier Uriot (CEA, Gif-sur-Yvette)

Abstract The influence of random perturbations of high intensity accelerator elements on the beam losses is considered. This paper presents the error sensitivity study which has been performed for the SPIRAL2 linac in order to define the tolerances for the construction. The proposed driver aims to accelerate a 5 mA deuteron beam up to 20 A.MeV and a 1 mA ion beam for q/A = 1/3 up to 14.5 A.MeV. It consists in an injector (two ECRs sources + LEBTs with the possibility to inject from several sources + Radio Frequency Quadrupole) followed by a superconducting section based on an array of independently phased cavities where the transverse focalization is performed with warm quadrupoles. The correction scheme and the expected losses are described. The Extreme Value Theory is used to estimate the expected beam losses. The described method couples large scale computations to obtain probability distribution functions. The bootstrap technique is used to provide confidence intervals associated to the beam loss predictions. With such a method, it is possible to measure the risk to loose a few watts in this high power linac (up to 200 kW).

Funding Agency

Type of Presentation Invited Oral

Main Classification E. High intensity linacs / Proton drivers

TUAY06 Stability Issues in Superconducting Radio-Frequency Linear Accelerators

Speaker Mark Stuart Champion (ORNL, Oak Ridge, Tennessee)

Authors Mark Stuart Champion (ORNL, Oak Ridge, Tennessee)

Abstract Field stability in superconducting radio-frequency (RF) cavities is critical to the performance of linear accelerators. The Spallation Neutron Source (SNS) Linac requires field stability within 1% and 1 deg of amplitude and phase, respectively, whereas the proposed International Linear Collider requires field stability one to two orders of magnitude more stringent. Field stability is affected by many factors including beam loading, Lorentz-force detuning, cryogenic system pressure and temperature stability, high-voltage system stability, thermal drift in electronics and transmission lines, timing and reference system stability, vibration-induced microphonics detuning, component aging, and the stability and robustness of the low-level RF (LLRF) control system itself. The LLRF control system must compensate for all of the sources of instability through a combination of feedback and feedforward techniques. In this paper the author will discuss stability issues drawing on examples from the recently-commissioned SNS Linac. Performance measurements, some completed and some planned, will be presented along with discussion of the techniques employed to provide the required field stability.

Funding Agency SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy.

Type of Presentation Invited Oral
Main Classification E. High intensity linacs / Proton drivers

TUAZ01 Overview of recent halo diagnosis and non-destructive beam profile monitoring

Speaker Kay Wittenburg (DESY, Hamburg)
Authors Kay Wittenburg (DESY, Hamburg)

Abstract Beam profile (emittance) and beam halo are characteristic properties of high-intensity and high energy beams that might limit the performance of the adjacent accelerator. Therefore a reliable measurement and determination of these parameters is most helpful for understanding, tuning and improvement of the whole accelerator chain to achieve the best (at least the design-) performance. This talk will give an overview over recent instruments used for non-destructive beam profile and halo monitoring and will discuss their limits, experiences and latest improvements.

Funding Agency
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUAZ02 High-Intensity Beam Collimation and Targetry

Speaker Nikolai V. Mokhov (Fermilab, Batavia, Illinois)
Authors Nikolai V. Mokhov (Fermilab, Batavia, Illinois)

Abstract Principles, design criteria and realization are described for reliable collimation systems for the high-power accelerators (Fermilab Booster and Main Injector, SNS, J-PARC), hadron colliders (Tevatron and LHC) and e+e- linear colliders (ILC). Factors affecting the expected and achieved collimation performances are analyzed. Functionality of collimators as the key elements of the machine protection system are considered using as an example a recent beam accident case in the Tevatron. A substantial progress on the crystal collimation front is described. The key issues are considered in design of high-power target systems and achieving their best performance. Simulation code requirements and recent benchmarking results are presented. A status of conventional neutrino targets and neutrino factory target concepts is described along with performed and planned beam tests. Overview of the target and collimator material beam tests concludes this report.

Funding Agency Work supported by the Universities Research Association, Inc., under contract DE-AC02-76CH03000 with the U.S. Department of Energy.
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUAZ03 The LHC beam collimation

Speaker Stefano Redaelli (CERN, Geneva)
Authors Stefano Redaelli (CERN, Geneva)

Abstract The Large Hadron Collider (LHC), presently under construction at the European Organization for Nuclear Research (CERN), will accelerate and collide 7 TeV proton beams with an unprecedented stored beam energy of 360 MJ. Handling this large stored energies in a superconducting machine requires a powerful collimation system which should provide a cleaning performance 100 to 1000 times better than what has been achieved in other operating storage rings. The LHC collimation system has also an important role in machine protection in case of system failures. Approximately 90 collimators with be available at the LHC from startup in order to fulfill these requirements. In this paper, the final LHC collimation system is presented. The designs of the various collimators is reviewed and the predicted performance of the overall system is discussed.

Funding Agency

Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUAZ04 Safe disposal of the LHC beams by extraction onto the beam dumping blocks

Speaker Brennan Goddard (CERN, Geneva)
Authors Brennan Goddard (CERN, Geneva)

Abstract The function of the LHC beam dumping system is to fast-extract the beam in a low-loss way from each ring of the collider and to transport it to an external absorber, positioned sufficiently far away to allow for appropriate beam dilution in order not to overheat the absorber material. Fast extraction will require a particle-free gap in the circulating beam, during which the field of the extraction kicker magnets can rise to its nominal value. Given the destructive power of the LHC beam, the dumping system must meet extremely high reliability criteria, which condition the overall and detailed design.

Funding Agency
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUAZ05 Comparison of Graphite and Diamond Structured Carbon Stripper Foils under Operational Conditions at the Los Alamos PSR

Speaker Thomas Spickermann (LANL, Los Alamos, New Mexico)
Authors Thomas Spickermann, Michael J. Borden, Robert James Macek (LANL, Los Alamos, New Mexico), Isao Sugai (KEK, Ibaraki), Robert Shaw (ORNL, Oak Ridge, Tennessee), Charles Feigerle (University of Tennessee, Knoxville, Tennessee)

Abstract In the Los Alamos Proton Storage Ring H--Ions merge with circulating protons in a bending magnet and are stripped of their two electrons in a carbon stripper foil. The circulating protons continue to interact with the foil. Despite efforts to minimize the number of these foil hits, like "painting" of the vertical phase space, they can not totally be eliminated. As a result foil heating and radiation damage limit the lifetime of these foils. In recent years LANL has collaborated with KEK to improve the graphite foils in use at PSR and these foils now last typically for two months. Recently an alternative in the form of diamond structured carbon foils has been proposed for use at SNS. Depending on the grain size these are referred to as microcrystalline or nanocrystalline foils. Both types have been tested in PSR, with quite different results. While the microcrystalline foil failed catastrophically before production beam currents were reached the nanocrystalline foil was successfully used in normal operation for several weeks. Advantages of the diamond foil concept as well as some noteworthy differences that we observed with respect to the LANL graphite foils will be discussed here.

Funding Agency Work conducted at the Los Alamos Laboratory, which is operated by the University of California for the United States Department of Energy under contract W-7405-ENG-36.
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUAZ06 Realization of High-Durability, Boron Mixed Carbon Stripper Foils for High Power Accelerator

Speaker Isao Sugai (KEK, Ibaraki)
Authors Isao Sugai, Yoshio Arakida, Zenei Igarashi, Kiyoshi Ikegami, Yoshiro Irie, Akira Takagi, Yasuhiro Takeda (KEK, Ibaraki), Hirokane Kawakami, Michihiro Oyaizu (New Affiliation Request Pending,)

Abstract We have successfully made long-lived and hybrid , thick, boron mixed carbon

stripper foils for high energy and high intensity accelerators. The foils were made by the controlled DC arc-discharge method, and the thickness is wide range from 50 to 600 ug/cm2. The lifetime of the foils was tested with use of 3.2 MeV Ne+DC beams of 2.5 uA, in which a significant of energy was deposited in the foils and thus we could simulate the condition by high power accelerator. The lifetime in maximum was shown to be extremely long, 102 and 410 times longer those of diamond and commercially available best carbon foils, respectively.

Funding Agency

Type of Presentation Contributed Oral

Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUBX01 Impedance and radiation generated by a ceramic chamber with RF shields and TiN coating

Speaker Yong Ho Chin (KEK, Ibaraki)

Authors Yong Ho Chin, Seishu Lee, Koji Takata, Takeshi Toyama (KEK, Ibaraki), Yoshihiro Shobuda (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Hiroshi Tsutsui (SHI, Tokyo)

Abstract In the RCS (Rapid Cycle Synchrotron) ring of J-PARC, we use ceramic chambers with the interior TiN coating and exterior Cu RF shields in the magnet sections. A new theory has been developed for calculation of impedance in this unusual configuration. When it was applied to a prototype RCS ceramic chamber, the calculation results got good agreement with the measurement results. We also considered the dipole radiation from gaps between Cu shields of the ceramic chamber in the bending magnets. The effects turn out to be rather small thanks to the special configuration of the ceramic chambers. We measured the radiation from a ceramic break with and without RF shields and capacitors in the KEK, PS and found that the RF shields with capacitors considerably suppress the radiation from the ceramic break. We summarize all these studies in this paper.

Funding Agency

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

TUBX02 Collective Transverse Instabilities in the GSI Synchrotrons

Speaker Vladimir Kornilov (GSI, Darmstadt)

Authors Vladimir Kornilov, Oliver Boine-Frankenheim, Ingo Hofmann (GSI, Darmstadt)

Abstract One of the primary challenges for the design of the FAIR synchrotrons at GSI Darmstadt is the high current operation close to the stability limits, with small tolerable beam losses. Collective instabilities are a potential limiting factor for the performance of the rings. We discuss results of experimental and numerical investigations of transverse collective beam behavior in the SIS 18 synchrotron. Also damping mechanisms in the presence of space charge, including the linear Landau damping and decoherence due to nonlinearities are discussed. These are the essential factors to define impedances budgets for the GSI synchrotrons. As a computational tool accounting the beam nonlinear dynamics with impedances and self-consistent space charge, the particle tracking code PATRIC is used.

Funding Agency

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

TUBX03 Coupling impedance of the J-PARC kicker magnets

Speaker Takeshi Toyama (KEK, Ibaraki)

Authors Takeshi Toyama, Yoshinori Hashimoto, Eiji Nakamura, Yoshihisa Shirakabe (KEK, Ibaraki), Junichiro Kamiya, Yoshihiro Shobuda (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)

Abstract The single- and twin-wire measurements both for the longitudinal (ZL) and transverse impedances (ZT) will be discussed for the J-PARC kicker magnets: a lumped circuit kicker and several types of traveling wave kickers. The question if a position shifted single-wire can measure ZT is discussed. The measurement results are compared with the equivalent circuit analysis. The relation between the imaginary part of the impedance and causality will also be discussed.

Funding Agency

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

TUBX05 Cures for beam instabilities in the CERN SPS and their limitations

Speaker Elena Shaposhnikova (CERN, Geneva)

Authors Elena Shaposhnikova (CERN, Geneva)

Abstract The LHC beam in the SPS is unstable with a threshold almost an order of magnitude below the nominal intensity. The cures used to stabilise this beam against coupled bunch instabilities apart from beam feedback, feed-forward and longitudinal damping, include a fourth harmonic RF system and controlled emittance blow-up. The limitations of the two last methods were studied experimentally and are analysed here from the point of view of beam quality requirements at extraction and future intensity increases up to ultimate value.

Funding Agency

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

TUBX06 Betatron Tune Shift due to Nonlinear Resistive-Wall Wake Field

Speaker Frank Zimmermann (CERN, Geneva)

Authors Frank Zimmermann (CERN, Geneva)

Abstract I present formulae for the coherent and incoherent tune shifts of a single bunch traveling between two parallel resistive plates. It is shown that for the parameters of an LHC prototype collimator in the SPS, both the nonlinear wake-field components, calculated by Piwinski, and the correct time dependence, e.g., as derived by Burov and Lebedev, must be taken into account.

Funding Agency We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 “Structuring the European Research Area” programme (CARE, contract number RII3-CT-2003-506395)

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

TUBY02 Physics Design of a Multi-GeV Superconducting H-minus Linac

Speaker Peter Ostroumov (ANL, Argonne, Illinois)

Authors Peter Ostroumov (ANL, Argonne, Illinois), Giorgio Apollinari, G. William Foster, Robert C. Webber (Fermilab, Batavia, Illinois)

Abstract We discuss design of a pulsed linac based on 430 independently phased superconducting resonators for acceleration of 40 mA peak current H-minus beam up to 8-GeV. Most of the voltage gain (from ~410 MeV to 8 GeV) is provided by ILC cavities and squeezed ILC-style cavities operating at 1300 MHz. Significant cost savings are expected from the use of an rf power fan out from high-power klystrons to multiple cavities. The front end of the linac operating at 325 MHz will be based on multiple-spoke cavities. A room

temperature section comprised of a conventional RFQ and 16 short normal conducting H-type resonators is proposed for the initial acceleration of an H-minus or proton beam up to 10 MeV. We have developed an accelerator lattice which satisfies the beam physics and engineering specifications.

Funding Agency This work was supported by the U.S. Department of Energy under Contracts No. W-31-109-ENG-38 and DE-AC02-76CH03000.

Type of Presentation Contributed Oral

Main Classification E. High intensity linacs / Proton drivers

TUBY03 Error study of LINAC 4

Speaker Maud Baylac (LPSC, Grenoble)

Authors Maud Baylac, Jean-Marie De Conto, Emmanuel Froidefond (LPSC, Grenoble), Edgar Zhora Sargsyan (CERN, Geneva)

Abstract LINAC 4 is a normal conducting H- linac which aims to intensify the proton flux available for the CERN accelerator complex. This injector is designed to accelerate a 65 mA beam up to 180 MeV. The linac consists of 4 different types of accelerating structures: the 352 MHz IPHI-RFQ, a 352 MHz 3-tank Drift Tube Linac, a 352 MHz Coupled Cavity Drift Tube Linac, and a 704.4 MHz Side Coupled Linac to boost the beam up to the final energy. As LINAC 4 is also designed as a pre-injector for a high power superconducting linac (3.5 GeV, 4 MW) the requirements on acceptable beam emittance growth, halo formation and particle loss are extremely tight. In order to determine the tolerances on the linac components, we examined the sensitivity of the structure to errors on the accelerating field and on the focusing quadrupoles. Simulations were performed between 3 and 180 MeV with the transport code TRACEWIN to evaluate the emittance growth, energy and phase jitter, halo formation of the transported beam and the amount of lost particles. We will present results on individual sensitivities to a single error, as well as the global impact of simultaneous errors on the beam quality. We will mention a f

Funding Agency

Type of Presentation Contributed Oral

Main Classification E. High intensity linacs / Proton drivers

TUBY04 Operational flexibility of the SPL as proton driver for neutrino applications

Speaker Frank Gerigk (CERN, Geneva)

Authors Frank Gerigk, Roland Garoby (CERN, Geneva)

Abstract Due to their limitation in energy proton linacs can only produce a certain time structure of the beam which is constrained by the RF system and the capabilities of the particle source. In order to achieve short bursts of protons in the microsecond range with bunch lengths in the order of nanoseconds the linac must be complemented by an accumulator and compressor ring. Using multiple fillings of the rings within single linac pulses opens the possibility for a flexible adaption of the linac time structure to the needs of a neutrino facility. This paper illustrates the possible modes of operation of the SPL (CERN) in combination with accumulator and compressor rings and outlines the consequences for the design and power consumption of a subsequent neutrino facility.

Funding Agency

Type of Presentation Contributed Oral

Main Classification E. High intensity linacs / Proton drivers

TUBZ01 The Beam Diagnostics System for J-PARC Synchrotrons

Speaker Naoki Hayashi (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)

Authors Naoki Hayashi, Seiji Hiroki, Kenichirou Satou, Ryoji Toyokawa (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken), Dai Arakawa, Yoshinori

Hashimoto, Seishu Lee, Takako Miura, Takeshi Toyama (KEK, Ibaraki)

Abstract The beam diagnostics system for J-PARC synchrotrons (RCS and MR) will be presented. The design of the system will be described for high current machines. Some test results will be reported.

Funding Agency

Type of Presentation Contributed Oral

Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUBZ02 OTR Detectors for Intense Proton and Antiproton Beams at FNAL

Speaker Victor Scarpine (Fermilab, Batavia, Illinois)

Authors Victor Scarpine, Gianni Tassotto (Fermilab, Batavia, Illinois), Alex Lumpkin (ANL, Argonne, Illinois)

Abstract Fermi National Acceleratory Laboratory (FNAL) is developing Optical Transition Radiation (OTR) detectors for proton and antiproton beam profile monitors. These OTR detectors are part of the collider Run II upgrade program and the NuMI primary proton beamline. The OTR detectors utilize radiation-hardened CID cameras and variable optics to measure 120 GeV protons and 150 GeV antiprotons over a wide range of beam intensities in both beam directions. This talk will discuss the resolution and 2-D imaging advantages of these detectors over standard wire detectors. Also presented are recent results from our production OTR detectors and measurements from our prototype OTR detector that was used to measure beams of up to 5e12 120 GeV protons at 0.5 Hz. Different type of transition foils are discussed for operation over intensity range of ~5e9 to over 1E13 particles per pulse.

Funding Agency Work supported by the U.S. Department of Energy under contract No. DE-AC02-76CH03000 and U.S. Department of Energy, Office of Basic Energy Sciences, under Contract No. W-31-109-ENG-38.

Type of Presentation Contributed Oral

Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

TUBZ04 Experimental Studies of Targets and Collimators for High Intensity Beams

Speaker Nikolaos Simos (BNL, Upton, Long Island, New York)

Authors Nikolaos Simos (BNL, Upton, Long Island, New York)

Abstract Intense muon or neutrino beams require high-performance targets intercepting multi MW proton beams. To achieve it one must push the envelope of the current knowledge regarding material behavior and endurance for both short and long exposure. It is also true for collimator structures intercepting the halo of the intense beam under normal or the entire beam during off-normal conditions. The limitations of most materials in playing such pivotal roles have led to an extensive search and experimentation with new alloys and composites that, at first glance, appear to possess the right combination of properties satisfying target and /or collimation requirements. In this study, a number of new and "smart" materials are experimentally evaluated for resilience to radiation damage and potential use in target and collimation schemes. These include targets for the muon collider and the neutrino superbeam as well as LHC collimation. Results of the on-going experimental effort under way at BNL and involving heavy irradiation of candidate materials using 200 MeV proton beams and post-irradiation analysis for irradiation damage assessment will be presented.

Funding Agency

Type of Presentation Contributed Oral

Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEAX01 Resonance trapping due to space charge and synchrotron motion, in theory, simulations, and experiments

Speaker Giuliano Franchetti (GSI, Darmstadt)
Authors Giuliano Franchetti (GSI, Darmstadt)
Abstract With the development of high intensity accelerator, the role of space charge effect in a nonlinear lattice gained special attention, as in the FAIR project at GSI, where long term storage of high intensity beams is required. The simultaneous presence of space charge and a nonlinear lattice creates an unprecedented challenge for ring designers as well as a new area of studies in beam physics. We present our understanding of the effect of space charge and chromaticity on the nonlinear beam dynamics of a bunched beam.
Funding Agency
Type of Presentation Invited Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEAX02 Space charge simulation of J-PARC main ring
Speaker Alexander Yu. Molodozhentsev (KEK, Ibaraki)
Authors Alexander Yu. Molodozhentsev, Masahito Tomizawa (KEK, Ibaraki)
Abstract The space charge effect in combination with the intrinsic field nonlinearity like the sextupole nonlinearity, used for the chromaticity correction, could lead to significant particle losses in a high beam intensity proton machine. For J-PARC Main Ring (MR) the total particle losses at the ring's collimator should be less than 1% from the expected maximum beam power of 45kW at the injection energy of 3GeV. To keep the particle losses during the injection process within the required limit it is necessary to optimize the beam parameters from the injector (J-PARC RCS), the collimator aperture of the beam-line from RCS to MR and the collimator aperture of MR. Influence of the structure and non-structure high-order resonances for different working points is discussed. The budget of the beam losses for different MR commissioning scenario is presented.
Funding Agency
Type of Presentation Invited Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEAX03 Space charge neutralization and its dynamic effects
Speaker Romuald Duperrier (CEA, Gif-sur-Yvette)
Authors Romuald Duperrier, Didier Uriot (CEA, Gif-sur-Yvette), Nicolas Pichoff (CEA, Bruyères-le-Châtel), Ahmed BenIsmail (LLR, Palaiseau)
Abstract High-power accelerators are being studied for several projects including accelerator driven neutron or neutrino sources. The low energy part of these facilities has to be carefully optimized to match the beam requirements of the higher energy parts. In this low energy part, the space charge self force, induced by a high intensity beam, has to be carefully controlled. This nonlinear force can generate a large and irreversible emittance growth of the beam. To reduce the space charge (SC), neutralization of the beam charge can be done by capturing some particles of the ionised residual gas in the vacuum chamber. This space charge compensation (SCC) regime complicates the beam dynamics study. This contribution aims to modelize the beam behavior in such a regime and to give order of magnitude to the linac designer for the neutralization rise time and the induced emittance growth.
Funding Agency
Type of Presentation Invited Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEAX04 High Intensity Cyclotron Simulations: Towards Quantitative Predictions
Speaker Andreas Adelmann (PSI, Villigen)
Authors Andreas Adelmann, Stefan Rudolf Alfred Adam, Rudolf Dölling, Martin

Humbel (PSI, Villigen)

Abstract PSI operates the most powerful cyclotron worldwide to the benefit of a multi-user, cross-disciplinary research facility. The accelerator complex consists of a Cockcroft-Walton pre-injector, a 72-MeV separated sector injector cyclotron and a 590-MeV separated sector Ring Cyclotron. A beam current of 1.9 mA is routinely extracted from the Ring Cyclotron overall absolute losses are below 1E-3. The facility has a considerable potential for further improvements, an ongoing upgrade project aims at a beam current of 3 mA. The purpose of our multi-scale three-dimensional parallel code and methods development is to make the step from qualitative to quantitative predictions. Their simulation requires the accurate three-dimensional modeling of large and complicated accelerator structures including space charge, beam lines, collimation, and in the future secondary effects. We will show methods, both numerically and computational, that we use presently and give an overview on future directions. Measurements from the cyclotrons and beamlines will be compared with simulations carried out in the frame of the high intensity upgrade program.

Funding Agency

Type of Presentation Invited Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEAX05 Space-Charge Beam Physics Research at the University of Maryland Electron Ring (UMER)*

Speaker Santiago Bernal (IREAP, College Park, Maryland)

Authors Santiago Bernal, Brian Louis Beaudoin, Donald Feldman, Renee Feldman, Ralph Fiorito, Terry Godlove, Irving Haber, Rami Alfred Kishek, Christos Papadopoulos, Bryan Quinn, Diktys Stratakis, Kai Tian, C. Tobin, Mark Walter (IREAP, College Park, Maryland), David Sutter (HENP, SW Washington), Martin Reiser (IREAP, College Park, Maryland; University Maryland, College Park, Maryland), Patrick G. O'Shea (University Maryland, College Park, Maryland; IREAP, College Park, Maryland)

Abstract The University of Maryland electron ring (UMER) is a low-energy, high current recirculator for beam physics research with relevance to any applications that rely on intense beams of high quality. We review the space-charge physics issues, experimental and computational investigations, which are currently being conducted at the UMER facility. The physics issues cover a broad range, but we focus on transverse beam dynamics: halo formation, strongly asymmetric beams, Montague resonances, equipartitioning, etc. Furthermore, we report on recent developments in experiments, simulations, and improved diagnostics for space-charge dominated beams.

Funding Agency This work is funded by US Dept. of Energy grant numbers DE-FG02-94ER40855 and DE-FG02-92ER54178, and the office of Naval Research grant N00014-02-1-0914.

Type of Presentation Invited Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEAX06 Measurements and Synergia simulations of emittance dilution at the Fermilab Booster.

Speaker Panagiotis Spentzouris (Fermilab, Batavia, Illinois)

Authors Panagiotis Spentzouris (Fermilab, Batavia, Illinois)

Abstract We present a study of the beam evolution in the Fermilab Booster operating both under nominal conditions and in the vicinity of the sum resonance for different beam currents. We simultaneously recorded the horizontal and vertical beam profiles using the Ion Profile Monitor and beam current. Our analysis extracted 2-D emittances and beam shape information from the IPM

data. We compare the results with Synergia simulations including 3-D space charge and higher-order optics to analyze and interpret the experimental results.

Funding Agency

Type of Presentation Invited Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEAY01 New advances in beam cooling

Speaker Igor Meshkov (JINR, Dubna, Moscow Region)

Authors Igor Meshkov (JINR, Dubna, Moscow Region)

Abstract New developments in beam cooling since ICFA' 2004 seminar are presented with concentration on trends in electron cooling, stochastic cooling, muon cooling and beam crystallization - the trends, which, as one can expect, will mark the future in the cooling methods applications.

Footnotes Keywords: particle storage rings, cooling methods, electron beam, Schottky noise.
PACS: 29.20.C, 29.20.Dh; 29.27.Bd

Funding Agency

Type of Presentation Invited Oral

Main Classification D. Beam cooling and intra-beam scattering

WEAY02 Electron cooling of 8 GeV antiprotons at Fermilab's Recycler: Results and operational implications

Speaker Lionel Prost (Fermilab, Batavia, Illinois)

Authors Lionel Prost, Daniel Robert Broemmelsiek, Alexey Burov, Kermit Carlson, Consolato Gattuso, Martin Hu, Thomas K. Kroc, Jerry Leibfritz, Sergei Nagaitsev, Stanley M. Pruss, Greg Warren Saewert, Charles Schmidt, Alexander V. Shemyakin, Mary Sutherland, Vitali Tupikov, Arden Warner (Fermilab, Batavia, Illinois)

Abstract Electron cooling of 8 GeV antiprotons at Fermilab's Recycler storage ring is now routinely used in the collider operation. It requires a 0.1-0.5 A, 4.3 MeV DC electron beam that reduces the longitudinal phase-space of the circulating antiproton beam. This paper first describes the characteristics of the electron beam that was achieved to successfully cool antiprotons as well as its necessary stability. Then, results from various cooling force measurements along with comparison to a simple non-magnetized model will be presented. Finally, operational aspects of the implementation of electron cooling at the Recycler will be discussed, such as regulation of the cooling rate and the influence of the electron beam on the antiprotons lifetime.

Funding Agency Operated by Universities Research Association Inc. under Contract No. DE-AC02-76CH03000 with the United States Department of Energy

Type of Presentation Invited Oral

Main Classification D. Beam cooling and intra-beam scattering

WEAY03 Experimental studies of stability issues at HIMAC cooler

Speaker Koji Noda (NIRS, Chiba-shi)

Authors Koji Noda, Takashi Fujisawa, T. Honma (NIRS, Chiba-shi), Shinji Shibuya (AEC, Chiba), Evgeny Syresin (JINR, Dubna, Moscow Region), Masamitsu Aiba, Yoshinori Hashimoto (KEK, Ibaraki), Tomonori Uesugi (KURRI, Osaka)

Abstract We have investigated coherent transverse instability when high-density circulating-ion beam was obtained with cool-stacking injection in the HIMAC synchrotron. By using a cooled beam and the Oxygen gas-sheet beam profile monitor, further, we have observed a particle trapping in resonance crossing. We will report these experimental studies at the HIMAC synchrotron.

Funding Agency
Type of Presentation Invited Oral
Main Classification D. Beam cooling and intra-beam scattering

WEAY04 Magnetized cooling: theory and experimental benchmarking
Speaker Alexei V. Fedotov (BNL, Upton, Long Island, New York)
Authors Alexei V. Fedotov (BNL, Upton, Long Island, New York)
Abstract A comprehensive examination of theoretical models for the friction force, which ions experience by passing through an electron beam, was performed. Here, we present quantitative comparison both for the friction force expressions and description of the cooling process as a whole. Quantitative comparison with experimental data is also presented.
Funding Agency U.S. Department of Energy
Type of Presentation Invited Oral
Main Classification D. Beam cooling and intra-beam scattering

WEAY05 New experimental results on electron cooling at COSY-Juelich
Speaker Jürgen Dietrich (FZJ, Jülich)
Authors Jürgen Dietrich (FZJ, Jülich)
Abstract Recent electron cooling results of a proton beam at COSY — Juelich are summarized. The influence of residual gas ions trapped in the electron beam on the cooled beam stability as well as methods to suppress the instabilities are described. Results on the numerical simulation for the formation of a crystalline proton beam in COSY using the BETACOOL code and results of experimental investigations of the cooling process at extremely low proton beam intensity are reported. Future plans are briefly addressed.
Funding Agency
Type of Presentation Invited Oral
Main Classification D. Beam cooling and intra-beam scattering

WEAY06 Experimental Strategy for Realization of 3-D Beam Ordering with Use of Tapered Cooling at S-LSR
Speaker Akira Noda (Kyoto ICR, Uji, Kyoto)
Authors Akira Noda, Masahiro Ikegami, Toshiyuki Shirai, Hikaru Souda, Mikio Tanabe (Kyoto ICR, Uji, Kyoto), Hiromi Okamoto (HU/AdSM, Higashi-Hiroshima), Koji Noda (NIRS, Chiba-shi)
Abstract At ICR, Kyoto University, an ion storage/cooler ring, S-LSR has been operated since the October, 2005. S-LSR has capability of dispersion free mode* throughout the whole circumference in order to avoid the shear heating** due to momentum dispersion of ion beam orbits. With such a mode, we need a special devise to develop necessary coupling between the longitudinal and transverse degrees of freedom for 3-dimensional laser cooling.*** A Wien Filter, in which the magnetic and electric fields overlap with strengths compensating each other for ions with a certain velocity, is to be utilized in the straight section where the usual laser cooling is applied. Due to the potential difference caused by the electric field in the Wien Filter, the difference in horizontal position of the circulating ion creates the difference of the equillibrium energy after laser cooling, which realizes "Tapered Cooling"****. In the present paper, a possible strategy of experimental approach at S-LSR toward 3-dimensional crystalline ion beams with use of the Wien Filter is to be presented.
Footnotes * M. Ikegami et al., PR-STAB,7, 120101(2004).
** A. Rahman and J.P. Schiffer, PRL, 57, 1133(1986).
*** H. Okamoto et al., PRL 72, 3977-3980 (1994).
**** J. Wei et al., PRL 80, 2606-2609 (1998).

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Type of Presentation Invited Oral
Main Classification D. Beam cooling and intra-beam scattering

WEAZ01 Overview of beam loss mechanisms in injection and extraction
Speaker Masahito Tomizawa (KEK, Ibaraki)
Authors Masahito Tomizawa (KEK, Ibaraki)
Abstract
Funding Agency
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEAZ02 Beam Loss at the Fermilab Booster and Main Injector: Recent Experience and the Road to MW Class Beams
Speaker Robert Miles Zwaska (Fermilab, Batavia, Illinois)
Authors Robert Miles Zwaska, Bruce Brown, Ioanis Kourbanis, Alberto Marchionni, Eric Prebys (Fermilab, Batavia, Illinois)
Abstract The Fermilab Booster and Main Injector synchrotrons produce high-rate proton beams for neutrino and antiproton production. Operation of these machines at high beam power has required novel approaches to managing beam loss during acceleration and at extraction. Routinely, the beam loss in the Booster limits it throughput, instead of any physical limitation. With pending intensity upgrades the same may also become true of the Main Injector. Future advances in beam power require a fully complementary reduction of oncontrolled losses.
Funding Agency
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEAZ03 DESIGN AND TESTS OF A LOW-LOSS MULTI-TURN EJECTION FOR THE CERN PS
Speaker Massimo Giovannozzi (CERN, Geneva)
Authors Massimo Giovannozzi (CERN, Geneva)
Abstract Following the positive results of the three-year measurement campaign at the CERN Proton Synchrotron, the study of a possible implementation of the proposed multi-turn extraction based on beam splitting with stable islands in the transverse phase space was undertaken. A substantial reduction of beam losses, with respect to the present extraction scheme, should be achieved with the proposed technique when delivering the high-intensity proton beams required for the planned CERN Neutrino to Gran Sasso Project. Major modifications to the ring layout are foreseen, such as a new design of the extraction bumps including also the installation of three additional kickers to create a closed-bump over the five turns used to extract the split beam. The ring aperture was reviewed and improvements are proposed to reduce possible beam losses between beam splitting and extraction. The goal consists of implementing the proposed changes by beginning of 2008 and to commission the novel extraction during the 2008 PS physics run.
Funding Agency
Type of Presentation Invited Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEAZ04 Beam-Induced Damage to the Tevatron Components and What Has Been Done About It

Speaker Nikolai V. Mokhov (Fermilab, Batavia, Illinois)
Authors Nikolai V. Mokhov (Fermilab, Batavia, Illinois)
Abstract The Tevatron collimators and magnets were damaged and two thirds of the superconducting ring were quenched on December 5, 2003, induced by a failure in the CDF Roman Pot detector positioning at the end of a 2-TeV proton-antiproton colliding beam store. Analysis of a failure in the abort kicker AC distribution, and detailed modeling of a misbehaved beam dynamics, induced energy deposition and ablation process in the collimator material, have provided a good understanding of the event. The improvements to the detectors, Tevatron quench protection and beam loss monitor systems to avoid such an accident in the future are described.
Funding Agency Work supported by the Universities Research Association, Inc., under contract DE-AC02-76CH03000 with the U.~S.~Department of Energy.
Type of Presentation Contributed Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEAZ05 Very Fast Beam Losses at HERA, and what has been done about it
Speaker Kay Wittenburg (DESY, Hamburg)
Authors Kay Wittenburg, Matthias Werner (DESY, Hamburg)
Abstract During the Luminosity upgrade of HERA in 2000/2001 more than 50 new magnets were installed close to the interaction region to provide a stronger focussing of the two beams. Some of these magnets are located at very large values of the betatron function and therefore act with a large gain on the beam. Sudden changes in the power supply currents had led to very fast beam losses, creating quenches and increased radiation levels. This talk will discuss the improvements made to the HERA machine protection system to make sure that the beam is dumped in time in case of these events.
Funding Agency
Type of Presentation Contributed Oral
Main Classification G. Commissioning strategies and procedures

WEAZ06 Transfer line damage during high intensity proton beam extraction from the SPS in 2004
Speaker Brennan Goddard (CERN, Geneva)
Authors Brennan Goddard, Verena Kain, Volker Mertens, Jan Uythoven, Jorg Wenninger (CERN, Geneva)
Abstract During extraction of a high intensity beam from the SPS in 2004 an incident occurred in which the vacuum chamber of a transfer line quadrupole magnet was badly damaged. The beam was a 450 GeV full LHC injection batch of 3.4e13 p+ in 288 bunches, and was extracted with the wrong trajectory. The incident causes have been identified, with details reconstructed from the logged data and the damage to the vacuum chamber. The remedial measures which were taken are explained, and further recommendations made concerning the interlocking system performance and tests, as well as the operational procedures which must be adopted when commissioning with high intensities. The specific issues of how the incident happened, why the existing protection system was not sufficient and what can/has been done about it are addressed.
Funding Agency
Type of Presentation Contributed Oral
Main Classification G. Commissioning strategies and procedures

WEAZ07 Shock wave propagation near 7 TeV proton beam in LHC collimator materials
Speaker Alexander Ryazanov (RRC, Moscow)
Authors Alexander Ryazanov, Alexei Klaptzov, Sergey Pavlov (RRC, Moscow),

Ralph Assmann, Ruediger Schmidt (CERN, Geneva)

Abstract A study is presented to estimate the influence of the impact of a 7 TeV proton beam on the physical-mechanical material properties, such as C for collimators, and Cu elsewhere. The high energy stored in each bunch can produce a shock wave near the impacting proton beam in these materials. The theoretical model for the investigations of shock wave propagation in the collimator materials takes into account ionization, electronic excitation, and energy transfer from excited electronic subsystem in the materials to the ionic subsystem. The change of other physical properties of the material is also considered. The deposited energy is calculated with FLUKA [1]. The numerical results of the microstructure change in the material are presented for different numbers of bunches. The method allows investigating changes of density and internal pressure, the distributions of atomic and sound velocities, and the temperature profiles in electronic and ionic subsystems of materials near the front of shock wave. These results are very relevant for the understanding the behavior of collimator materials used in LHC under 7 TeV proton beam.

Footnotes [1] A.Fasso et al. The physics models of FLUKA: status and recent development, CHEP 2003, LA Jolla, California, 2003

Funding Agency

Type of Presentation Contributed Oral

Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEBX01 Recent Development of the IMPACT Parallel Beam Dynamics Code Suite

Speaker Ji Qiang (LBNL, Berkeley, California)

Authors Ji Qiang (LBNL, Berkeley, California)

Abstract In this paper, we report on recent development of new capabilities to the IMPACT parallel beam dynamics code suite. These new capabilities include modeling multiple charge state beam, modeling ion beam formation and transport in LEBT, horizontal/vertical bend, higher order multipoles, rf traveling wave structure and wake fields. We will present physical models and computational methods for these new capabilities. Some application examples will also be presented in this paper.

Funding Agency

Type of Presentation Contributed Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEBX02 Observation of Emittance Growth at the injection in the KEK PS Main Ring

Speaker Susumu Igarashi (KEK, Ibaraki)

Authors Susumu Igarashi, Takako Miura, Eiji Nakamura, Yoshito Shimosaki, Masashi Shirakata, Ken Takayama, Takeshi Toyama (KEK, Ibaraki)

Abstract We have been studying the emittance growth and beam loss mechanism during the injection period of the 12 GeV main ring of the KEK proton synchrotron to achieve higher intensity. The typical beam loss is about 30 % during the injection period of 500 milliseconds for the high intensity operation. Measurement of the transverse beam profiles using flying wires has revealed a characteristic temporal change of the beam profile within a few milliseconds after the injection. Horizontal emittance growth was observed when the horizontal tune was close to the integer. The effect was more enhanced for higher beam intensity and could not be explained with the injection mismatch. A resonance created by the space charge field was the cause of the emittance growth. A multiparticle tracking simulation program, ACCSIM, taking account of space charge effects has successfully reproduced the beam profiles.

Funding Agency

Type of Presentation Contributed Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEBX03 Modeling of Non-linear Effects in RF Cavities

Speaker Dan Tyler Abell (Tech-X, Boulder, Colorado)
Authors Dan Tyler Abell, George I. Bell, David L. Bruhwiler (Tech-X, Boulder, Colorado), Ilan Ben-Zvi, Jorg Kewisch (BNL, Upton, Long Island, New York), Robert D. Ryne (LBNL, Berkeley, California)

Abstract Emerging accelerator applications require electron beam radii comparable to RF cavity apertures, placing more stringent demands on the modeling of particle motion in RF cavities using map-based techniques. High-gradient cavities and cavities with significant axial asymmetries also demand improvements in modeling capabilities. A new method has been developed for computing high-order nonlinear maps for arbitrary RF cavities*. It has been implemented through fifth order in MaryLie/IMPACT, so simulations can include the effects of space-charge. We describe this new approach and present comparisons with more traditional approaches.

Footnotes * D.T. Abell, submitted to PRST-AB.

Funding Agency This work is supported by the U.S. DoE Office of Science, Office of Nuclear Physics under grant DE-FG02-03ER83796.

Type of Presentation Contributed Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEBX04 Measurement strategy for the CERN Linac4 Chopper-line

Speaker Jean-Baptiste Lallement (CERN, Geneva)
Authors Jean-Baptiste Lallement, Klaus Hanke, Masaki Hori, Alessandra Maria Lombardi, Edgar Zhora Sargsyan (CERN, Geneva)

Abstract Linac4 is a new accelerator under study at CERN. It is designed to accelerate H- ions to 160 MeV of energy, for injection into the existing Proton Synchrotron Booster. The low energy section, comprising an H- ion source, a 352 MHz Radio Frequency Quadrupole and a 3 MeV chopper line will be assembled at CERN in the next years. Linac 4 is also designed as an injector for the SPL, a high power proton driver delivering 5MW at 3.5 GeV. In this case the beam losses must be limited to 1 W/m and therefore the formation of transverse and longitudinal halo at low energy becomes a critical issue which has to be measured and controlled. The chopper-line is composed of 11 quadrupoles, 3 bunchers and the chopper itself. Its beam dynamics will be characterized with specific detectors and diagnostic lines. In particular the transverse and longitudinal halo will be measured by a Beam Shape and Halo Monitor (BSHM) with a sensitivity of 10.000 particles per bunch and a time resolution of 2ns. In this paper we present the simulation work in preparation for the measurement campaign scheduled in 2008.

Funding Agency

Type of Presentation Contributed Oral
Main Classification B. Space-charge theory, simulations, and experiments

WEBX05 Scaling laws for space charge resonances

Speaker Ingo Hofmann (GSI, Darmstadt)
Authors Ingo Hofmann, Giuliano Franchetti (GSI, Darmstadt), Shyh-Yuan Lee (IUCF, Bloomington, Indiana)

Abstract Space charge can be the driving term of nonlinear resonances, like the resonant emittance exchange 2Qx-2Qy=0 ("Montague resonance", in linacs and high-intensity rings), or the fourth-order structure resonance 4Qx=n (high-intensity rings, FFAG's). In this study we present scaling laws to describe the dependence of the expected emittance growth effect on the initial

emittances, the tune shift and/or the crossing rate through the resonance.

Funding Agency

Type of Presentation Contributed Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEBX06 Analysis of emittance growth in the Fermilab Booster

Speaker King Yuen Ng (Fermilab, Batavia, Illinois)

Authors King Yuen Ng (Fermilab, Batavia, Illinois)

Abstract Multi-particle similations are performed to study emittance growth in the Fermilab Booster. Analysis shows that the sourcce of the vertical emittance growth comes mostly from random errors in skew quadrupoles as well as the transverse space-charge force. Random errors in the dipole fields and the Montague resonance do contribute but to a much lesser extent. The effect of random errors in the quadrupoles is small because the betatron envelope tunes are resonably far away from the half-integer stopband.The coupling impedances of the Fermilab Booster, consisting mostly of unshielded laminated magnets and connecting beam pipes, are computed. The results are applied to study various single-bunch and multi-bunch collective instabilities.

Funding Agency

Type of Presentation Contributed Oral

Main Classification B. Space-charge theory, simulations, and experiments

WEBY01 Commisioning of Electron Beam Cooling at S-LSR

Speaker Toshiyuki Shirai (Kyoto ICR, Uji, Kyoto)

Authors Toshiyuki Shirai, Shinji Fujimoto, Masahiro Ikegami, Akira Noda, Hikaru Souda, Mikio Tanabe, Hiromu Tongu (Kyoto ICR, Uji, Kyoto), Tetsuya Fujimoto, Souma Iwata, Shinji Shibuya (AEC, Chiba), Igor Meshkov, Igor Alekseevich Seleznev, Alexander V. Smirnov, Evgeny Syresin (JINR, Dubna, Moscow Region), Hicham Fadil, Manfred Grieser (MPI-K, Heidelberg), Koji Noda (NIRS, Chiba-shi)

Abstract S-LSR is a new compact ion cooler ring at Kyoto University. The circumference is 22.557 m. The commissioning of the electron cooling was started using the 7 MeV proton beam from November, 2005. The total length of the electron cooler is 1.63 m. In order to maximize the effective cooling length in the limited space, the magnetic field of the solenoid and the troid coils was calculated precisely by the 3D code. The electrostatic deflector for the electron and the steering magnet for the ion are placed in the troid. The performances of these devices are evaluated by the cooling measurements. Experiments using the electron cooling are also stared. One is an induction sweep cooling of the proton beam. It is an cooling with the assist of the induction acceleration and possible to reduce the cooling time of the hot ion beams like secondary particles. We also observe the behavior of the cooled ion beam in the small ion number case and the large ion number case. We discuss about the possibility of the phase transition of the proton in the former case and discuss about the coherent instability conditions in the latter case.

Funding Agency The present work is financially supported by Advanced Compact Accelerator Development from MEXT of Japanese Government and the 21 COE of Kyoto University.

Type of Presentation Contributed Oral

Main Classification D. Beam cooling and intra-beam scattering

WEBY03 Experimental studies of IBS in RHIC and comparison with theory

Speaker Alexei V. Fedotov (BNL, Upton, Long Island, New York)

Authors Alexei V. Fedotov, Wolfram Fischer, Steven Tepikian, Jie Wei (BNL, Upton, Long Island, New York)

Abstract A high-energy electron cooling system is presently being developed to overcome emittance growth due to Intra-beam Scattering (IBS) for heavy ion operation in RHIC. A critical item for choosing appropriate parameters of the cooler is an accurate description of the IBS. The analytic models were verified vs dedicated IBS measurements. Analysis of the 2004 data with the Au ions showed very good agreement for the longitudinal growth rates but significant disagreement with exact IBS models for the transverse growth rates. Experimental measurements were improved for the 2005 run with the Cu ions. Here, we present comparison of the 2005 data with theoretical models.
Funding Agency U.S. Department of Energy
Type of Presentation Contributed Oral
Main Classification D. Beam cooling and intra-beam scattering

WEBY04 Refined Models of Intrabeam Scattering

Speaker Frank Zimmermann (CERN, Geneva)
Authors Frank Zimmermann, Francesco Ruggiero (CERN, Geneva)
Abstract We discuss two extensions of intrabeam-scattering theory. First, starting from the Bjorken-Mtingwa recipe, general formulae are derived for the three electro-magnetic intrabeam scattering growth rates, including non-ultrarelativistic terms and vertical dispersion, but maintaining a Gaussian beam approximation. A few applications demonstrate the importance of the vertical dispersion. Second, aside from electromagnetic interactions, hadrons may also undergo nuclear scattering off each other. We estimate the magnitude of this process, and argue that the loss rate due to "nuclear intrabeam scattering" could become significant in high-energy proton or ion storage rings, such as the LHC.
Funding Agency We acknowledge the support of the European Community-Research Infrastructure Activity under the FP6 "Structuring the European Research Area" programme (CARE, contract number RII3-CT-2003-506395)
Type of Presentation Contributed Oral
Main Classification D. Beam cooling and intra-beam scattering

WEBY05 Simulating dynamical friction in wiggler-based high-energy electron coolers, including finite-time effects

Speaker Dan Tyler Abell (Tech-X, Boulder, Colorado)
Authors George I. Bell, Dan Tyler Abell, David L. Bruhwiler, Richard Busby, Peter Messmer (Tech-X, Boulder, Colorado), Ilan Ben-Zvi, Alexei V. Fedotov, Vladimir N. Litvinenko (BNL, Upton, Long Island, New York), Anatoly Olegovich Sidorin (JINR, Dubna, Moscow Region)
Abstract The proposed RHIC-II luminosity upgrade includes a novel electron cooling section, using ~55 MeV electrons to cool fully-ionized gold. We present simulations of the dynamical friction force exerted on the Au ions. Rather than a strong solenoid, a long helical wiggler magnet is used to provide focusing and suppress recombination. In the rest frame of the relativistic electron and ion beams, with non-relativistic motion and electrostatic fields, the Lorentz transformed wiggler field yields strong, rapidly-varying electric fields. The VORPAL simulation framework applies a semi-analytic binary collision algorithm, in which ion-electron collisions are modeled pairwise. This model is combined with standard particle-in-cell (PIC) techniques, through an operator-splitting approach, to include the effects of external fields. Charge shielding due to electron-electron interactions is also included via PIC. Simulated friction results are compared with BETACOOL, which integrates the standard unmagnetized formulas. With finite interaction times and electron wiggle motion correctly included, we find good agreement with VORPAL.

Funding Agency This work was supported by the U.S. DOE Office of Science, Office of Nuclear Physics under grant DE-FG02-04ER84094.
Type of Presentation Contributed Oral
Main Classification D. Beam cooling and intra-beam scattering

WEBZ01 Correction of unevenness in Recycler beam profile

Speaker King Yuen Ng (Fermilab, Batavia, Illinois)
Authors King Yuen Ng, James L. Crisp, Martin Hu (Fermilab, Batavia, Illinois)
Abstract When a beam is confined between two rf barriers in the Fermilab Recycler Ring, it is observed that the longitudinal beam profile between the barriers is in general very uneven (typically about 20% for a beam of intensity 5E11). This leads to the consequence that the momentum-mined antiproton bunches may have an intolerable variation in bunch intensity. It is shown that the observed unevenness in beam profile is the result of a tiny amount (around 2%) of rf potential imperfection and a tiny amount (around 0.5%) of rf beam loading. The beam profile can be made even by feeding back the unevenness of the effective rf potential to the low-level rf.
Funding Agency
Type of Presentation Contributed Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEBZ02 BEAM TRACKING FOR J-PARC 3 GEV RCS INJECTION

Speaker Masashi Shirakata (KEK, Ibaraki)
Authors Masashi Shirakata, Hiroshi Fujimori (KEK, Ibaraki), Yoshiro Irie, Tomohiro Takayanagi (JAEA/J-PARC, Tokai-Mura, Naka-Gun, Ibaraki-Ken)
Abstract In the J-PARC 3 GeV RCS injection system, the orbit-bump magnets of large-bore are located close with each other, and the incoming beam passes through the non-linear field region of the ring quadrupole magnet. Beam behavior under these conditions is analysed by means of the Runge-Kutta method in the three dimensional magnetic field distribution. The charge exchange foil is inserted between the bump magnets. Orbit of the stripped electrons from the foil is also investigated.
Funding Agency
Type of Presentation Contributed Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

WEBZ03 A New High Rate Charged Particles Detector

Speaker Philippe Legou (CEA, Gif-sur-Yvette)
Authors Philippe Legou (CEA, Gif-sur-Yvette)
Abstract Sextant is a new Beam Spectrometer.This detector is based on a Time Projection Chamber(TPC)principle, using a gaseous detector called Micromegas. Thus, we have a better efficiency, with the minimum amount of material in the way of the beam. Moreover, using the TPC technique, the Mesh of the detector is positioned outside the high intensity region covered by the beam. Peformances of this detecor are very good in a high intensity hadron beams (spatial resolution : 70μm and time resolution 600ps). The integration of the front end on the PCB led to a very low noise for the entire detector.Main characteristics of the preamplifier are 1ns of rise time and a very low noise, lower than 600 μV rms. Sextant is an evolution of KABES, a beam spectrometer on NA 48II at CERN. This concept have shown very good performances and robustness.
Funding Agency
Type of Presentation Contributed Oral
Main Classification C. Beam diagnostics, collimation, injection / extraction, and targetry

THAW01 New simulation capabilities of electron clouds in ion beams with large tune depression

Speaker Jean-Luc Vay (LBNL, Berkeley, California)
Authors Jean-Luc Vay, Miguel Furman, Peter Seidl (LBNL, Berkeley, California), Ronald Cohen, Alex Friedman, David Grote, Michel Kireeff Covo, Arthur Molvik (LLNL, Livermore, California), Peter Stoltz, Seth Andrew Veitzer (Tech-X, Boulder, Colorado), John Verboncoeur (UCB, Berkeley, California)

Abstract We have developed a new, comprehensive set of simulation tools aimed at modeling the interaction of intense ion beams and electron clouds (e-clouds). The set contains the 3-D accelerator PIC code WARP and the 2-D "slice" e-cloud code POSINST [M. Furman, this workshop], as well as a merger of the two, augmented by new modules for impact ionization and neutral gas generation. The new capability runs on workstations or parallel supercomputers and contains advanced features such as mesh refinement, disparate adaptive time stepping, and a new "drift-Lorentz" particle mover for tracking charged particles in magnetic fields using large time steps. It is being applied to the modeling of ion beams (1 MeV, 180 mA, K+) for heavy ion inertial fusion and warm dense matter studies, as they interact with electron clouds in the High-Current Experiment (HCX) [experimental results discussed by A. Molvik, this workshop]. We will describe the capabilities and simulation results with detailed comparisons against the HCX experiment, as well as their application (in a different regime) to the modeling of e-clouds in the Large Hadron Collider (LHC).

Funding Agency This work performed under the auspices of the U.S. DOE by Univ. of California, Lawrence Livermore and Lawrence Berkeley National Laboratories under contracts No. W-7405-Eng-48 and DE-AC02-05CH11231.

Type of Presentation Invited Oral
Main Classification A. Beam Instabilities and their cures

THAW02 New experimental measurements of electron clouds in ion beams with large tune depression*

Speaker Arthur Molvik (LLNL, Livermore, California)
Authors Arthur Molvik, Ronald Cohen, Alex Friedman, Michel Kireeff Covo (LLNL, Livermore, California), Frank Bieniosek, Peter Seidl, Jean-Luc Vay (LBNL, Berkeley, California)

Abstract We study electron clouds in high perveance beams (K = 8E-4) with a large tune depression of 0.2 (defined as the ratio of a single particle oscillation response to the applied focusing fields, with and without space charge). These 1 MeV, 180 mA, K+ beams have a beam potential of +2 kV when electron clouds are minimized. Simulation results are discussed in a companion paper [J-L. Vay, this Conference]. We have developed the first diagnostics that quantitatively measure the accumulation of electrons in a beam [M. Kireeff Covo, et al., to be submitted to Phys. Rev. Lett.]. This, together with measurements of electron sources, will enable the electron particle balance to be measured, and electron-trapping efficiencies determined. We measure and simulate ~10 MHz electron oscillations in the last quadrupole magnet when we flood the beam with electrons from an end wall. Experiments where the heavy-ion beam is transported with solenoid magnetic fields, rather than with quadrupole magnetic or electrostatic fields, are being initiated. We will discuss the initial results using electrode sets (in the middle and at the ends of magnets) to either expel or to trap electrons within the magnets.

Funding Agency *This work performed under the auspices of the U.S. DOE by Univ. of California, Lawrence Livermore and Lawrence Berkeley National Laboratories under contracts No. W-7405-Eng-48 and DE-AC02-

05CH11231.

Type of Presentation Invited Oral

Main Classification A. Beam Instabilities and their cures

THAW03 RF Barrier Cavity Option for the SNS Ring Beam Power Upgrade

Speaker Jeffrey Alan Holmes (ORNL, Oak Ridge, Tennessee)

Authors Jeffrey Alan Holmes, Sarah M. Cousineau, Viatcheslav V. Danilov, Andrei P. Shishlo (ORNL, Oak Ridge, Tennessee)

Abstract RF barrier cavities present an attractive option for facilitating the path to higher beam intensity in the SNS power upgrade. Barrier cavities lead to flat longitudinal current densities, thus minimizing bunch factor effects. In addition to allowing more beam to be injected in this fashion, flat current profiles may lead to increased e-p instability thresholds due to reduced multipacting during the trailing stage of the bunch. Finally, it is possible to inject self-consistent beam distributions into barrier buckets, thus providing the additional advantages of uniform transverse beam density (good for meeting target constraints) and little or no halo (good for low losses). Simulations addressing all these issues will be presented and discussed.

Funding Agency SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy. SNS is a partnership of six national laboratories: Argonne, Brookhaven, Jefferson, Lawrence Berkeley, Los Alamos and Oak Ridge.

Type of Presentation Invited Oral

Main Classification B. Space-charge theory, simulations, and experiments

THAW04 Experimental Characterization of the "1st Pulse" e-p Instability at the LANL PSR

Speaker Robert James Macek (LANL, Los Alamos, New Mexico)

Authors Robert James Macek, Thomas Spickermann (LANL, Los Alamos, New Mexico)

Abstract A puzzling aspect of the e-p instability at PSR is the so called "1st Pulse" instability phenomenon. It shows up on the first beam pulse after a period (10 to 30 minutes or more) of beam off time. This pulse has a significantly lower threshold than subsequent beam pulses that follow with the standard time separation. While the standard PSR operation for Lujan Center operation is unaffected by this phenomenon, it does interfere with some high intensity, single pulse experiments using PSR beam. We will summarize the present experimental data characterizing this phenomenon as compared with the typical e-p instability observed at higher repetition rates at PSR and discuss some possible explanations.

Funding Agency Work performed under the auspices of the U. S. Department of Energy under contract W-7405-ENG-36.

Type of Presentation Contributed Oral

Main Classification A. Beam Instabilities and their cures

THAW05 Electron Cloud Investigations in the Fermilab Main Injector

Speaker Robert Miles Zwaska (Fermilab, Batavia, Illinois)

Authors Robert Miles Zwaska, Weiren Chou, Ioanis Kourbanis, Alberto Marchionni, Vladimir Shiltsev, Xiaolong Zhang (Fermilab, Batavia, Illinois)

Abstract The Fermilab Main Injector currently accelerates 300 kW of 120 GeV protons for antiproton and neutrino production. We report on searches for the formation of an electron cloud within the Main Injector, and possible associated proton beam instabilities. Current capabilities and instrumentation upgrades will be discussed. These studies are performed with the anticipation that future plans could lead to a fourfold increase of the proton charge in the Main Injector.

Funding Agency
Type of Presentation Contributed Oral
Main Classification A. Beam Instabilities and their cures

THAW06 Electron cloud effect in J-PARC
Speaker Kazuhito Ohmi (KEK, Ibaraki)
Authors Kazuhito Ohmi (KEK, Ibaraki)
Abstract We discuss electron cloud instability in J-PARC proton rings. Instabilities in both of bunched and coasting beam are treated.
Funding Agency
Type of Presentation Contributed Oral
Main Classification A. Beam Instabilities and their cures

THAW07 Transverse electron-antiproton instability in the Recycler Ring
Speaker Alexey Burov (Fermilab, Batavia, Illinois)
Authors Alexey Burov (Fermilab, Batavia, Illinois)
Abstract Lifetime degradation of electron-cooled ions was observed at several electron coolers. In the Recycler, both the lifetime drop and emittance growth of the e-cooled pbars are seen. A possible reason for that can be a coherent interaction between the electron and antiproton beams. A theoretical model of this instability is presented, and a practical recommendation for its suppression is explained and discussed.
Funding Agency
Type of Presentation Contributed Oral
Main Classification D. Beam cooling and intra-beam scattering

THAY01 Progress in induction synchrotrons
Speaker Ken Takayama (KEK, Ibaraki)
Authors Ken Takayama (KEK, Ibaraki)
Abstract
Funding Agency
Type of Presentation Invited Oral
Main Classification F. FFAG and other advanced acclerators and technologies

THAY02 Progress in slip stacking and barrier-RF
Speaker Kiyomi Seiya (Fermilab, Sequim, Washington)
Authors Kiyomi Seiya (Fermilab, Sequim, Washington)
Abstract Slip stacking for pbar production has been operational since December 2004 and increased the beam intensity on pbar target more than 60%. We plan to use slip stacking for NuMI neutrino experiment for effectively increasing intensity to NuMI target by about a factor two in a 2.2 sec MI cycle. In parallel with slip stacking, we plan to study fast momentum stacking using barrier buckets. One barrier rf system has been installed and tested, and second system is being installed during the current shutdown.
Funding Agency Universities Research Assoc., Inc., under contract DE-AC02-76CH03000 with the U.S. Dept. of Energy
Type of Presentation Invited Oral
Main Classification F. FFAG and other advanced acclerators and technologies

THAY03 Challenges for hadron (and leptons) nonscaling FFAGs
Speaker Alessandro G. Ruggiero (BNL, Upton, Long Island, New York)
Authors Alessandro G. Ruggiero (BNL, Upton, Long Island, New York)
Abstract The concept of Fixed-Field Alternating-Gradient (FFAG) accelerators was introduced about a half century ago. Few prototypes were built soon after and successfully placed in operation. Nevertheless, because of the perceived

complexity of the early model magnets and design, the concept was soon abandoned in favor of cyclotrons, synchrotrons and linacs. It was subsequently occasionally revived for possible application as spallation neutron sources; but it was only recently that, because of the need of fast acceleration of muons, that FFAGs were re-considered and studied with more attention. Two prototypes were eventually built and operated at KEK for the acceleration of Protons. The interest indeed soon switched more steadily toward acceleration of protons (and electrons) as application for high-power proton drivers and medical accelerators. The paper describes the design procedure of a proton FFAG accelerator that employs a Non-Scaling lattice and exposes the main inherent issues, namely: the crossing of multiple resonances, space-charge at injection, and the fast acceleration rate that may impose limitations on the RF cavity hardware.

Funding Agency Work performed under the auspices of the US Department of Energy
Type of Presentation Invited Oral
Main Classification F. FFAG and other advanced acclerators and technologies

THAY04 Review of high-brightness proton and ion acceleration using pulsed lasers

Speaker Julien Fuchs (University of Nevada, Reno, Reno, Nevada)
Authors Julien Fuchs (University of Nevada, Reno, Reno, Nevada)

Abstract In the last few years, intense research has been conducted on laser-accelerated ion sources and their applications. These sources have exceptional properties, i.e. high brightness and high spectral cut-off, high directionality and laminarity, short burst duration. We have shown that for proton energies >10 MeV, the transverse and longitudinal emittance are respectively <0.004 mm-mrad and <10^-4 eV-s, i.e. at least 100-fold and may be as much as 10^4-fold better than conventional accelerators beams. Thanks to these properties, these sources allow for example point-projection radiography with unprecedented resolution. They also open new opportunities for ion beam generation and control, and could stimulate development of compact ion accelerators for many applications. We have shown [*] that there is an optimum in the laser pulse duration of ~200 fs-1 ps, with a needed laser energy level of 30 to 100 J, in order to achieve e.g. 200 MeV energy protons. Also, as, for such applications beam control is an essential requirement, we have developed [**] an ultra-fast laser-triggered micro-lens that allows tuneable control of the beam divergence as well as energy selection.

Footnotes [*] J. Fuchs et al., Nature Physics 2, 48 (2006).
[**] T.Toncian, M.Borghesi, J.Fuchs et al, www.sciencexpress.org / 16 February 2006 / 10.1126/science.1124412.

Funding Agency
Type of Presentation Invited Oral
Main Classification F. FFAG and other advanced acclerators and technologies

THAY05 Progress in Accelerator R&D for High Energy Density Physics and Warm Dense Matter Applications

Speaker Hong Qin (PPPL, Princeton, New Jersey)
Authors Hong Qin (PPPL, Princeton, New Jersey)

Abstract The research objectives of the U.S. Heavy Ion Fusion Science Virtual National Laboratory include: achieving warm dense matter conditions on near-term experiments and addressing the top-level scientific question: "How can heavy ion beams be compressed to the high intensities required for creating high energy density matter and fusion ignition conditions?" The accelerator R&D effort is focused on the Neutralized Drift Compression Experiment (NDCX), studies of electron cloud, and advanced theory and simulation. NDCX has achieved a longitudinal compression factor of 60 in a

background plasma. Simulations using the LSP code agreed well the experiments. A kinetic model showed that the Vlasov equation possesses a class of exact solutions describing both transverse and longitudinal compression. Extensive measurements of electron cloud were carried out on a high brightness beam. An algorithm for large time-step advancement of electron orbits and a suite of models for electrons, gas, and wall interactions were implemented in the WARP 3D code. Electron-ion two-stream instabilities and the temperature-anisotropy instability have been simulated using a low-noise delta-f method by the BEST code.

Footnotes For the U.S. Heavy Ion Fusion Science Virtual National Laboratory

Funding Agency Research supported by the U. S. Department of Energy.

Type of Presentation Invited Oral

Main Classification F. FFAG and other advanced acclerators and technologies

THAY06 Fast-Pulsed Superconducting Magnets

Speaker Carsten Muehle (GSI, Darmstadt)

Authors Carsten Muehle (GSI, Darmstadt)

Abstract Up to now only one synchrotron (Nuclotron at JINR, Dubna) has been equipped with fast-pulsed superconducting magnets. The demand for high beam intensities leads to the requirement of fast-pulsed, periodically cycling magnets for synchrotrons and fast-pulsed magnets for storage rings. An example is FAIR (Facility for Antiproton and Ion Research) at GSI, which will consist of two synchrotrons in one tunnel and several storage rings. The fast field ramp rate and repetition frequency introduce many magnet design problems and constraints in the operation of the accelerator. Persistent currents in the superconductor and eddy currents in wire, cable, iron and vacuum chamber reduce the field quality and generate cryogenic losses. A magnet lifetime of 20 years is anticipated, resulting in up to 108 magnet cycles. Therefore special attention has to be paid to magnet material fatigue problems. R&D work is being done in collaboration with many institutions, to reach the requirements mentioned above. Model dipoles were built and tested. The results of the R&D are reported. The advantages of the use of low field, fast pulsed superconducting, compared to resistive, magnets will be discussed.

Funding Agency

Type of Presentation Invited Oral

Main Classification F. FFAG and other advanced acclerators and technologies

THAY07 SC Spoke Cavity

Speaker Michael Kelly (ANL, Argonne, Illinois)

Authors Michael Kelly (ANL, Argonne, Illinois)

Abstract Superconducting (SC) TEM-class spoke cavities have been an area of active research during the past decade with application to cw and pulsed ion linacs required for proposed facilities world-wide. Single- and multi-spoke geometries have been developed for use with ions over the full mass range and with velocities $0.2 < v/c < 0.8$. Spoke cavities for this range, generally designed for 4 K operation, have several advantages over 2 K elliptical-cell cavities stemming mostly from the lower operating frequency. However, recent spoke-cavity results in 2 K operation, based on new and evolving cavity processing techniques such as clean assembly and hydrogen degassing, show very low rf losses even for high surface fields (EPEAK ~30 MV/m) required in operations. 2K results indicate even higher voltage gains per cavity with reduced heat loads are possible. Other implications of 2 Kelvin spoke cavity operation for ion linacs are discussed.

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Type of Presentation Invited Oral
Main Classification F. FFAG and other advanced acclerators and technologies

THAZ01 Experience with high-power operation of the PSI proton accelerator facility
Speaker Pierre A. Schmelzbach (PSI, Villigen)
Authors Pierre A. Schmelzbach (PSI, Villigen)
Abstract The PSI proton accelerator delivers a maximun current of 2 mA (routinely 1.9 mA) at 590 MeV. Ongoing developments aim at an upgrade of the beam current to 3 mA. This will result in an increase of the beam power from 1.2 to 1.8 MW on the pion/muon production targets and from 0.8 to 1.2 MW on the neutron spallation source SINQ. Our approach to the safe operation of a facility a these power levels will be presented. This includes considerations on the design of the cyclotrons, the beam lines and the tools to handle highly radioactive components. The protection of the facility via device controls, beam diagnostics and loss monitoring will be discussed. The specific requirements for operation with a sensitive liquid metal target like MEGAPIE will also be addressed.
Funding Agency
Type of Presentation Invited Oral
Main Classification G. Commissioning strategies and procedures

THAZ02 SNS Commissioning Strategies and Tuneup Algorithms
Speaker John Galambos (ORNL, Oak Ridge, Tennessee)
Authors John Galambos (ORNL, Oak Ridge, Tennessee)
Abstract The Spallation Neutron Source (SNS) has been recently commissioned. The strategies for the initial beam commissioning of the superconducting linac (SCL) and storage ring will be discussed. The SCL commissioning had to accommodate an unanticipated wide range of cavity performance, compared to design expectations. Methods for setting cavity phases and determination of amplitudes will be discussed. The ring commissioning involved the usual establishment of a circulating beam, and then measurement and correction the tune and beta functions, all with a low intensity beam. Then the gradual increase of beam intensity and commissioning of RF and phase space painting were investigated. The methods to accomplish these tasks will be discussed. In general, the first order beam behavior is well understood. Key factors in the successful commissioning are: flexibility in accommodating beam conditions that are different from the design, good communication between the different groups, and attention to detail. Examples for these factors will be emphasized.
Funding Agency SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy. SNS is a partnership of six national laboratories: Argonne, Brookhaven, Jefferson, Lawrence Berkeley, Los Alamos, and Oak Ridge
Type of Presentation Invited Oral
Main Classification G. Commissioning strategies and procedures

THAZ03 Safe LHC Beam Commissioning
Speaker Jan Uythoven (CERN, Geneva)
Authors Jan Uythoven, Ruediger Schmidt (CERN, Geneva)
Abstract Due to the large amount of energy stored in magnets and beams, safe operation of the LHC is essential. The commissioning of the LHC machine protection system will be an integral part of the general LHC commissioning program. A brief overview of the LHC Machine Protection System will be given, identifying the main components: the Beam Interlock System, the Beam Dumping System, the Collimation System, the Beam Loss Monitoring system and the Quench Protection System. An outline is given of the

commissioning strategy of these systems during the different commissioning phases of the LHC: without beam, injection and the different phases with stored beam depending on beam intensity and beam energy.

Funding Agency
Type of Presentation Invited Oral
Main Classification G. Commissioning strategies and procedures

THAZ04 Commissioning and Operational Scenarios of the LHC Beam Loss Monitor System

Speaker Eva Barbara Holzer (CERN, Geneva)
Authors Eva Barbara Holzer (CERN, Geneva)

Abstract One of the most critical elements for the protection of CERN's Large Hadron Collider (LHC) is its beam loss monitoring (BLM) system. It aims to prevent the super conducting magnets from quenching and to protect the machine components from damages, as a result of critical beam losses. The contribution will discuss the commissioning procedures of the BLM system and the envisaged operational scenarios. About 4000 monitors will be installed around the ring. The specification for the BLM system includes a factor of 2 absolute precisions on the prediction of the quench levels, a wide range of integration times (100 us to 100 s) and a fast (one turn) trigger generation. When the loss rate exceeds a pre-defined threshold value, a beam abort is requested. Magnet quench and damage levels vary as a function of beam energy and loss duration. Consequently, the beam abort threshold values vary accordingly. By measuring the loss pattern, the BLM system helps to identify the loss mechanism. Furthermore, it will be an important tool for commissioning, machine setup and studies. Special monitors will be used for the setup and control of the collimators.

Funding Agency
Type of Presentation Invited Oral
Main Classification G. Commissioning strategies and procedures

THAZ05 Beam Loss Management and Machine Protection in Beam Commissioning

Speaker John Galambos (ORNL, Oak Ridge, Tennessee)
Authors Coles Sibley III (ORNL, Oak Ridge, Tennessee)

Abstract Machine Protection Systems during commissioning have to be very reliable and flexible. The consequence of not disabling the beam could be catastrophic in terms of the superconducting cavities or High Power mercury targets. On the other hand, as the machine is commissioned the beam parameters are being measured which in turn causes beam loss so losses are unavoidable. One commissioning activity involves fault studies where worst case beam loss scenarios are investigated and radiation in occupied area's is measured and verified to be with the safety limits when extracted to full power. The beam loss monitor system also gets calibrated during these studies. These activities require flexibility in the system to be able to bypass MPS inputs while maintaining strict configuration control over the MPS hardware and software systems.

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Type of Presentation Invited Oral
Main Classification G. Commissioning strategies and procedures

THAZ06 Commissioning scenarios for the J-PARC accelerator complex

Speaker Tadashi Koseki (KEK, Ibaraki)
Authors Tadashi Koseki (KEK, Ibaraki)

Abstract The J-PARC accelerator complex consists of a 400-MeV linac, a 3.0-GeV rapid-cycling synchrotron (RCS), a 50-GeV main ring (MR) and associated beam transport lines to experimental facilities, which use the 3- and 50-GeV proton beams. It is now under construction in the Tokai campus of JAEA as a joint project between JAEA and KEK. The beam commissioning of each accelerator is scheduled to start for linac in December 2006, RCS in September 2007 and MR in May 2008. The commissioning strategy for the accelerator complex will be presented.

Funding Agency

Type of Presentation Invited Oral

Main Classification G. Commissioning strategies and procedures

THBW01 Code benchmarking on induce space charge particle trapping

Speaker Giuliano Franchetti (GSI, Darmstadt)

Authors Giuliano Franchetti, Ingo Hofmann (GSI, Darmstadt), Shinji Machida (CCLRC/RAL/ASTeC, Chilton, Didcot, Oxon)

Abstract Trapping of particles in a high intensity bunch has been studied by using the MICROMAP. The numerical studies were used to interpret the CERN-PS experiments and explore the underlying beam loss/emittance growth mechanisms. We present in this contributed talk the first attempt of code benchmarking in modeling the long term storage of a high intensity bunch. The code benchmarking is initiated between MICROMAP and SIMPSONS.

Funding Agency

Type of Presentation Contributed Oral

Main Classification B. Space-charge theory, simulations, and experiments

THBY01 Acceleration of Intense Beams of Highly-Charged Ions using Direct Plasma Injection Scheme

Speaker Sergei Kondrashev (ITEP, Moscow)

Authors Sergei Kondrashev (ITEP, Moscow), Hirotsugu Kashiwagi (JAEA/ARTC, Gunma-ken), Takeshi Kanesue (Kyushu University, Fukuoka), Robert Jameson, Masahiro Okamura (RIKEN, Saitama), Kazuhiko Sakakibara (RLNR, Tokyo), Jun Tamura (TIT, Yokohama)

Abstract Laser Ion Source (LIS) is the most intense source of highly-charged ions capable to provide beams with current 10 ÷ 100 mA and pulse durations 1 ÷ 10 μs. Such parameters well meet requirements of single turn injection into synchrotron rings and FFAG. Few years ago Direct Plasma Injection Scheme (DPIS) was proposed to extract and accelerate intense ion beams from laser induced plasma. By this approach extraction of ions happens almost inside first acceleration cell of RFQ, eliminating severe space charge problems in LEBT and LEBT itself. About 35 mA of 12C4+ ions and 17 mA of 12C6+ ions were accelerated by RFQ up to 100 keV/u using DPIS. Amplitude of total current of carbon ions is equal to 60 mA. The latest results on 27Al and 56Fe ions acceleration using DPIS are presented. The results obtained show that DPIS is, probably, the best choice as a high current injector of highly-charged ions for FFAG.

Funding Agency

Type of Presentation Contributed Oral

Main Classification F. FFAG and other advanced acclerators and technologies

THBY02 Present status of POP experiment of lasaer stripping at BNL

Speaker Isao Yamane (KEK, Ibaraki)

Authors Isao Yamane (KEK, Ibaraki)

Abstract The present status of the POP experiment of laser stripping via a broad Stark state using BNL 200 MeV H- beam is presented. First, we will briefly review

the original motivation of experiment and the plan of experimental procedure. Then, we will show the experimental setup that has been completed in the BNL REF tunnel and talk about the first beam time we had in the last June. Finally, our plan of improvement for experimental setup and next beam time will be shown.

Funding Agency
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Main Classification F. FFAG and other advanced acclerators and technologies

THBZ01 Commissioning of the LHC collimation system

Speaker Stefano Redaelli (CERN, Geneva)
Authors Stefano Redaelli, Ralph Assmann, Chiara Bracco, Michel Jonker, Guillaume Robert-Demolaize, Thomas Weiler (CERN, Geneva)

Abstract The collimation system of the Large Hadron Collider (LHC) will rely on 90 collmators for beam cleaning and machine protection. The full system includes betatron and momentum cleaning collimators, beam absorbers, local protection elements, injection protection devices and transfer line collimators. These collimators must all be coherently adjusted with tight tolerances to small gaps around the beam, at distances from the beam centre that range from 4.5 to 10 betatron beam sigmas. In particular, the relative rectraction of elements placed in different locations along the 27~km LHC ring must be respected to ensure the required overall cleaning and protection performance. In this paper, the proposed scenarios for commissioning and operating this complex system are discussed. The achievements at SPS with a collimator prototype are also outlined.

Funding Agency
Type of Presentation Contributed Oral
Main Classification G. Commissioning strategies and procedures

THBZ02 Commissioning strategies for J-PARC linac and L3BT

Speaker Masanori Ikegami (KEK, Ibaraki)
Authors Masanori Ikegami, Seishu Lee (KEK, Ibaraki), Yasuhiro Kondo, Tomohiro Ohkawa (JAEA, Ibaraki-ken), Akira Ueno (JAEA/LINAC, Ibaraki-ken)

Abstract We plan to start the beam commissioning of J-PARC linac with reduced energy of 181 MeV in the end of this year. Detailed commissioning strategies for the linac and the succeeding beam transport line, to which we refer as L3BT or Linac-to-3-GeV-synchrotron Beam Transport, will be presented in this talk. The emphasis will be put on the commissioning procedures for two debuncher cavities and a transverse collimator system located in L3BT, because they are key elements in determining the final beam quality at the injection point to the succeeding 3-GeV synchrotron. The unique design and features of the collimator system are also presented.

Funding Agency
Type of Presentation Contributed Oral
Main Classification G. Commissioning strategies and procedures

THBZ03 Commissioning of the Fermilab NuMI Neutrino Beam

Speaker Robert Miles Zwaska (Fermilab, Batavia, Illinois)
Authors Robert Miles Zwaska (Fermilab, Batavia, Illinois)

Abstract NuMI (Neutrinos at the Main Injector) is an intense muon-neutrino beam used for long-baseline accelerator neutrino experiments. The neutrinos are produced from the interactions of a high-power, high-energy proton beam in a solid target. NuMI was commisioned in the winter of 2004-2005 and subsequently began regular operation. This talk will discuss: commissioning of the primary, secondary, and tertiary beams; beam-based alignment of the

beam components; and incremental tuning of the accelerator and beamline for high-power running (current max of ~ 250 kW).

Footnotes Present on behalf of the MINOS collaboration.

Funding Agency

Type of Presentation Contributed Oral

Main Classification G. Commissioning strategies and procedures

THBZ04 Installation and first beam of SPES source at INFN-LNL

Speaker Enrico Fagotti (INFN/LNL, Legnaro, Padova)

Authors Enrico Fagotti, Lucia Boscagli, Michele Comunian, Alessio Galatà, Michele Lollo, Selvino Marigo, Antonio Palmieri, Andrea Pisent (INFN/LNL, Legnaro, Padova), Luigi Celona, Giovanni Ciavola, Santo Gammino (INFN/LNS, Catania)

Abstract Since the fall of 2000 proton beams are available from the source TRIPS, a high intensity microwave discharge ion source, the goal of which is the injection of a proton current of 40 mA in the following RFQ, with a rms normalized emittance lower than 0.2π mm-mrad for an operating voltage of 80 kV. TRIPS has recently moved to LNL and it is now under commissioning for a further optimization necessary to achieve SPES requirements. Details of the platform installation and preliminary characterization of extracted beam are presented.

Funding Agency

Type of Presentation Contributed Oral

Main Classification G. Commissioning strategies and procedures

THBZ05 The SNS linac commissioning – comparison of measurement and model*

Speaker Dong-o Jeon (ORNL, Oak Ridge, Tennessee)

Authors Dong-o Jeon (ORNL, Oak Ridge, Tennessee)

Abstract The Spallation Neutron Source linac commissioning was an excellent opportunity to benchmark the model with the measurement data for a high intensity linac. A new halo formation mechanism due to large beam eccentricity predicted by simulation was confirmed through a series of emittance measurement. Also the phase scan technique and the acceptance scan technique were benchmarked. Commissioning both demonstrated the validity of the model and revealed the shortfall of the model.

Funding Agency * SNS is managed by UT-Battelle, LLC, under contract DE-AC05-00OR22725 for the U.S. Department of Energy.

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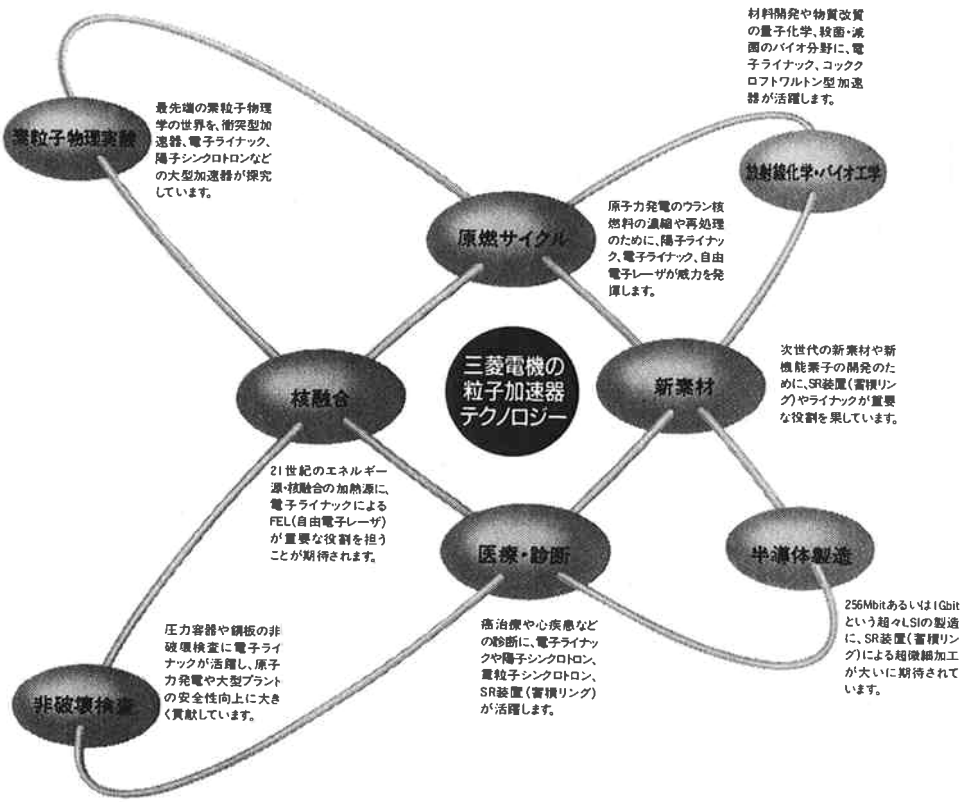

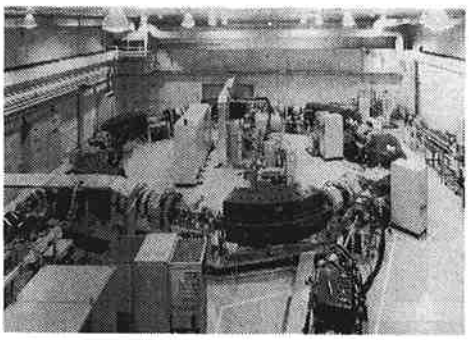

物質・生命・材料・医療の分野を革新する、高エネルギー科学の世界へ

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