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23-28 MAY 2010

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第七回

The First International Particle Accelerator Conference

IPAC'10

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IPAC'10

Special Poster Session for Young Scientists

Sunday, 23 May 2010 from 16:00 to 18:00
(setting up from 15:00)

Kyoto International Conference Centre
Rooms C1 + C2

Classification 1: Circular Colliders

Poster Panel 1
ID: 2514 MOPEC014 ***First Luminosity Scans in the LHC*****, Simon Mathieu White** (CERN, Geneva), Simon Mathieu White, Reyes Alemany Fernandez, Helmut Burkhardt, Mike Lamont (CERN, Geneva) **-** Once circulating beamshave been established in the LHC the first step towards collisions is to remove the physical separation used to avoid collisions during injection and ramp. A residual separation can remain after the collapsing of the separation bumps. The so-called Van Der Meer method allows for a minimization of this unwanted separation by transversally scanning one beam through the other. The beam sizes at the IP can also be determined by this method and used to give an absolute measurement of the luminosity. We report on how this measurement was implemented and performed in the LHC to optimize and calibrate luminosity and provide a detailed analysis of the first results.

Poster Panel 2
ID: 2291 MOPEC005 ***Kick Response Measurements during LHC Injection Tests and Early LHC Beam Commissioning*****, Kajetan Fuchsberger** (CERN, Geneva)**,** Kajetan Fuchsberger, Stephane David Fartoukh, Brennan Goddard, Verena Kain, Malika Meddahi, Frank Schmidt, Jorg Wenninger (CERN, Geneva) **-** The transfer lines from the SPS to the LHC, TI2 and TI8, with a total length of almost 6km are the longest ones in the world. For that reason even small systematic optics errors are not negligible because they add up and result in an injection mismatch in the LHC. Next to other lattice measurement methods Kick-response measurements were the most important sources of information during the early phases of beam commissioning of these transfer lines and the LHC ring. This measurement technique was used to verify orbit-corrector and BPM gains as well as to sort out optics errors. Furthermore fits to off-momentum kick response turned out to be an appropriate method to establish a model for systematic errors of the transfer line magnets. This paper shortly describes the tools and methods developed for the analysis of the taken data and presents the most important results of the analysis.

Poster Panel 3
ID: 1795 TUPEB007 ***Low Emittance Tuning Studies for SuperB*****, Simone Maria Liuzzo** (University of Pisa and INFN, Pisa), Simone Maria Liuzzo (University of Pisa and INFN, Pisa), Maria Enrica Biagini, Pantaleo Raimondi (INFN/LNF, Frascati (Roma)), Martin Donald (SLAC, Menlo Park, California) **-** SuperB is an international project for an asymmetric 2 rings collider at the B mesons cm energy to be built in the Rome area in Italy. The two rings will have very small beam sizes at the Interaction Point and very small emittances, similar to the Linear Collider Damping Rings ones. In particular, the ultra low vertical emittances, 7 pm in the LER and 4 pm in the HER, need a careful study of the misalignment errors effects on the machine performances. Studies on the closed orbit, vertical dispersion and coupling corrections have been carried out in order to specify the maximum allowed errors and to provide a procedure for emittance tuning. A new tool which combines MADX and Matlab routines has been developed, allowing for both corrections and tuning. Results of these studies are presented.

Poster Panel 4
ID: 2293 TUPEB031 ***Muon Collider Scheme based on Frictional Cooling,*** **Daniel Greenwald** (MPI fuer Physics, Muenchen)**,** Daniel Greenwald (MPI fuer Physics, Muenchen) **-** Muon colliders would open new frontiers of investigation in high energy particle physics, allowing precision measurements to be made at the TeV energy frontier. One of the greatest challenges to constructing a muon collider is the cooling of a beam of muons on a timescale comparable to the lifetime of the muon. Frictional cooling holds promise for use in a muon collider scheme. By balancing energy loss to a gas with energy gain from an electric field, a beam of muons is brought to an equilibrium energy in a time on the order of 100s of nanoseconds. A full muon collider front end scheme utilizing frictional cooling to produce high luminosity beams is presented.

Poster Panel 5
ID: 3264 TUPEB036 ***Tune Resonance Phenomena in the SPS and Machine Protection via Fast Position Interlocking*****, Tobias Baer** (CERN, Geneva; DESY, Hamburg; Uni HH, Hamburg)**,** Tobias Baer (CERN, Geneva; DESY, Hamburg; Uni HH, Hamburg), Berta Araujo Meleiro, Thierry Bogey, Jorg Wenninger (CERN, Geneva) **-** The Super Proton Synchrotron (SPS) at CERN with a peak energy of 450GeV is at the top of the LHC preaccelerator-complex. Apart from the LHC, SPS is with Tevatron the accelerator with the largest stored beam energy of up to 2.5MJ. The SPS has a known vulnerability to fast equipment failures that led to an uncontrolled loss of a high intensity beam in 2008, which resulted in major damage of a main dipole. The beam loss was caused by a fast tune decrease towards an integer resonance. Simulations and distinct experimental studies provide clear understanding of the beam dynamics at different SPS tune resonances. Diverging closed orbit oscillations, dispersion explosion and increased beta-beating are the driving effects that lead to a complete beam loss in as little as 4 turns (90μs). Dedicated experiments of fast failures of the main power converters reveal that the current interlock systems with a delay of 7-12ms are much too slow for an adequate machine protection. To counteract the vulnerability of the SPS,

current research focuses on a new fast position interlock system which is planned to become operational in the second quarter of 2010.

Poster Panel 6

ID: 3690 - TUPEB075 ***Analysis of the Beam Loss Monitor during the Crystal Collimation Tests in UA9*****, Daniele Mirarchi** (CERN, Geneva), Daniele Mirarchi (CERN, Geneva) **-** We present a detailed analysis of the beam loss data collected at the SPS during the 2009 machine developments devoted to test crystal collimation. Scintillator counters and Gas electron multiplier detectors were installed in special points to detect the effect of inelastic interaction of protons with the crystals in various orientation with respect to the beam. Clear correlations of the counting rates with the crystal positions and orientation were detected during the data-taking and were crucial to put the crystal in optimal channeling position. For one of the crystal the pattern of losses showed evidence of several planar and axial channeling conditions.

Poster Panel 7

ID: 2286 - TUPEB072 ***Beam-gas Loss Rates in the LHC*****, Yngve Inntjore Levinsen** (CERN, Geneva), Yngve Inntjore Levinsen, Helmut Burkhardt (CERN, Geneva), Robert Appleby (CERN, Geneva; UMAN, Manchester) **-** We report on first observations and detailed simulations of beam gas rates in the LHC. For the simulations, a comprehensive tool has been set up to simulate in a few hours the expected beam gas losses when pressure maps, collimator settings, and/or beam optics changes. The simulation includes both elastic and inelastic scattering, with subsequent multiturn tracking of proton residues. This provides amongst others a more realistic collimator loss distributions from elastic interactions than what was previously available.

Poster Panel 8

ID: 2005 TUPEB061 ***A Novel Extraction Scheme from a Synchrotron Using a Magnetic Shield*****, Alexey Vladimirovich Bondarenko** (BINP SB RAS, Novosibirsk), Alexey Vladimirovich Bondarenko, Sergey Vladimirovich Miginsky, Nikolay Vinokurov (BINP SB RAS, Novosibirsk) - A new beam extraction scheme from a synchrotron is put forward. The main difference from other schemes of extraction is the use of a magnetic shields instead of a septum. Magnetic shields are located in the central dipole magnets of a pulsed chicane. The magnetic shield is a multi-layer copper-iron tube. Numerical simulations and experimental results for the magnetic shield are presented. A good accordance between them has shown. The advantages of the new scheme are easy technical implementation and compactness. The area of application is extraction from a synchrotron. The proposed scheme will be used in a new synchrotron radiation source in Novosibirsk.

Poster Panel 9

ID: 2743 TUPEB034 ***Interaction Region Design for a Ring Ring Version of the LHeC Study*****, Luke Thompson** (Cockcroft Institute, Warrington, Cheshire), Bernhard Johannes Holzer, Simona Bettoni, Oliver Sim Brüning, Stephan Hans Russenschuck (CERN, Geneva), John Dainton, Luke Thompson (Cockcroft Institute, Warrington, Cheshire), Peter Kostka (DESY Zeuthen, Zeuthen), Alexander Kling, Boris Nagorny, Uwe Schneekloth (DESY, Hamburg), Alessandro Polini (INFN-Bologna, Bologna), Max Klein (The University of Liverpool, Liverpool), Robert Appleby (UMAN, Manchester) - The LHeC aims at colliding hadron-lepton beams with center of mass energies in the TeV scale. For this purpose the existing LHC storage ring is extended by a high energy electron accelerator in the energy range of 60 to 140 GeV. The electron beam will be accelerated and stored in a LEP like storage ring in the LHC tunnel. In this paper we present the layout of the interaction region which has to deliver at the same time well matched beam optics and an efficient separation of the electron and proton beams. In general the large momentum difference of the two colliding beams provides a very elegant way to solve this problem: A focusing scheme that leads to the required beam sizes of the electrons and protons is combined with an early but gentle beam separation to avoid parasitic beam encounters and still keep the synchrotron radiation level in the IR within reasonable limits. We present in this paper two versions of this concept: A high luminosity layout where the mini beta magnets are embedded into the detector design as well as an IR design that is optimised for maximum acceptance of the particle detector.

Classification 2: Synchrotron Light Sources and FELs

Poster Panel 10

ID: 2253 WEPEA019 ***Beam Studies for TBONE, Steffen Hillenbrand*** (KIT, Karlsruhe), Steffen Hillenbrand, Miriam Fitterer, Nicole Hiller, Andre Hofmann, Erhard Huttel, Vitali Judin, Marit Klein, Sebastian Marsching, Anke-Susanne Müller, Kiran G. Sonnad (KIT, Karlsruhe), Pedro Tavares (KIT, Karlsruhe; LNLS, Campinas) **-** The Karlsruhe Institute of Technology (KIT) proposes to build a new light source called TBONE (THz Beam Optics for New Experiments), which aims at a spectral range from 0.1 to 150 THz with a peak power of several MW and a pulse length of only 5 fs. In order to achieve this, a beam transport system with minimal losses and a high bunch compression is required. In this paper we present first beam dynamic simulations of the superconducting linac as well as the bunch compressor and give a short status report of the TBONE project.

Poster Panel 11

ID: 2312 - WEPEA021 ***Observation of THz-bursts with a Hot Electron Bolometer at the ANKA Storage Ring*****, Vitali Judin** (KIT, Karlsruhe), Vitali Judin, Steffen Hillenbrand, Nicole Hiller, Andre Hofmann, Erhard Huttel, Marit Klein, Sebastian Marsching, Anke-Susanne Müller, Nigel John Smale, Kiran G. Sonnad (KIT, Karlsruhe), Alexei Semenov (DLR, Berlin), Pedro Tavares (KIT, Karlsruhe; LNLS, Campinas), Heinz-Wilhelm Huebers (Technische Universität Berlin, Berlin) **-** Since a few years CSR-Radiation created in low alpha mode is provided by the ANKA light source of the KIT*. Depending on the bunch current, the radiation is emitted in bursts of high intensity. These bursts display a time evolution which can be observed only on long time scales with respect to the revolution period. The intensity of the emitted radiation during a burst is significantly increased w.r.t. steady state emission. Some users of the THz radiation don't require particularly constant emission characteristics and could profit from the higher intensity. A better understanding of the long term behaviour of those bursts could help to improve the conditions for those users. We have investigated THz radiation in multiturn mode with a hot electron bolometer. Its time response of 165ps allowed us to resolve the signals of individual bunches. Using a 6GHz LeCroy oscilloscope for data acquisition, we were able to save up to 1.6ms long signal sequences at a sampling rate of 20GS/s. This amount of data corresponds to over 4000 bunch revolutions and allows turn-by-turn signal tracking of desired bunches. In single bunch mode we are able to take segmented data to avoid a huge overhead.

Footnotes

* KIT - Karlsruhe Institute for Technology

Funding Agency: This work has been supported by the Initiative and Networking Fund of the Helmholtz Association under contract number VH-NG-320

Poster Panel 12

ID: 2189 WEPEA003 ***Time-resolved Tune Measurements and Stability Analysis of the Australian Synchrotron Booster*****, Tessa Charles** (Monash University, Monash University)**,** Tessa Charles (Monash University, Monash University), Mark James Boland, Rohan Dowd, Martin John Spencer (ASCo, Clayton, Victoria)

Charles, Rohan Dowd **-** The Australian Synchrotron booster synchrotron accelerates electrons from 100 MeV to 3 GeV in 600 ms. The fractional tune components that were measured are presented in two graphical formats showing the time-resolved measurement of the horizontal and vertical tunes. This experiment demonstrated that the current in the booster was extremely sensitive to the ratio of BF to BD combined-function magnets. Large variations of the fractional tunes were found to follow the differences in the gradients of the BD and BF combined-function magnet ramping curves and with this knowledge, alterations were made to the ramping table increasing the efficiency of the booster by on average 40%. Rapid fluctuation of the tunes meant that it could not be distinguished during the first 80ms of the ramp. Multiple side bands to the revolution harmonic were visible during a minimal sweep time of 2.5ms, during this first 80ms.

Poser Panel 13

ID: 2688 WEPEA026 ***On Multipacting-free Waveguide for High Current Light Source*****, Maryam Mostajeran** (IPM, Tehran)**,** Maryam Mostajeran, Mohammad Lamehi Rachti (IPM, Tehran) **-** Multipactor discharge is the most serious problem for operation superconducting cavity at high RF power system. We intend to study a multipacting free waveguide for the high RF power couplers of Cornell SRF module. The secondary electron yield of metallic conductor plays a critical role in the development of multipactor discharge. By reducing the secondary yield below unity, multipactor can be eliminated. One way to overcome this difficulty is roughness method such as sawtooth and rectangular surface. Sometimes it is difficult to apply these grooves due to require size. Here sandblasting method is proposed to reducing the secondary yield. Monte-Carlo method is used to investigate the effect of sandblasting on multipactor. The equation of motion particles between parallel plats is used as the basis for numerical simulations within a wide range of parameters such as the angular distribution and spread of initial velocity of secondary electrons.

Poster Panel 14

ID: 2463 ***WEPEA024 Bunch Lengthening Effects by Utilizing a Third Harmonic Cavity in Conjunction with Crab Cavities in TPS*****, Hossein Ghasem** (IPM, Tehran), Hossein Ghasem (IPM, Tehran), Ahmad Mohammadzadeh (NSTRI, Tehran), Hassan Hassanabadi (Shahrood University of Technology, Shahrood) **-** The effects of utilizing a third harmonic RF cavity in the lengthening mode have been investigated on quality of the electron beam and the emitted photons in the deflecting RF structures for TPS. For the obtained optimum synchronous and relative harmonic phases and harmonic voltage of 0.7 MV, the equilibrium horizontal and vertical emittances blow up as much as 13% and 97%, respectively. In addition, the intensity of the emitted X-ray pulses with 0.54 ps FWHM reduces by 30%.

Poster Panel 15

ID: 2546 TUPE002 ***The Extreme Low Charge Regime Study for European XFEL*****, Vahe Sahakyan** (CANDLE, Yerevan)**,** Vahe Sahakyan, Vitali Khachatryan, Artur Tarloyan, Vasili Mkrtich Tsakanov (CANDLE, Yerevan) **-** The option for extremely low bunch charge regime (< 20 pC) of European XFEL project is studied. The SASE FEL parameters study (saturation length and power) is performed for wide range of the beam normalized emittance, bunch length and energy. The study is based both on the analytical scaling of the SASE FEL performance and numerical simulations.

Poster Panel 16
ID: 2528 TUPE012 ***Stability of Free-Electron Laser Resonators*****, Sushil Arun Samant** (CBS, Mumbai)**,** Sushil Arun Samant (CBS, Mumbai), Srinivas Krishnagopal (BARC, Mumbai) **-** The stability of free-electron laser (FEL) resonators differs from that of resonators of conventional lasers, because of the nature of the FEL interaction. Therefore the stability diagram is modified, and near-concentric configurations are preferred to near-confocal. We study the stability of FEL resonators (especially for g1 =/ g2) using simulations, as well as using a simple thin-lens model, and show that the near-concentric configuration is indeed preferable, while the confocal configuration becomes unstable. Also, since FELs can be widely tuned in wavelength, we investigate the stability of the resonator as a function of the wavelength.

Poster Panel 17
ID: 2318 TUPD075 ***Start-to-end Simulation of a Compact THz Smith-Purcell FEL*****, Christopher Robert Prokop** (Northern Illinois University, DeKalb, Illinois)**,** Christopher Robert Prokop (Northern Illinois University, DeKalb, Illinois), Philippe Regis-Guy Piot (Fermilab, Batavia; Northern Illinois University, DeKalb, Illinois), M.C. Lin, Peter Stoltz (Tech-X, Boulder, Colorado) **-** Terahertz (THz) radiation has generated much recent interest due to its ability to penetrate deep into many organic materials without the damage associated with ionizing radiations. The generation of copious amounts of narrow-band THz radiation using a Smith-Purcell FEL operating as a backward wave oscillator is being pursued by several groups. In this paper we present start-to-end simulations of a Smith-Purcell FEL operating in the superradiant regime. Our concept incorporates a double grating configuration to efficiently bunch the electron beam, followed by a single grating to produce Smith-Purcell radiation. We demonstrate the capabilities and performances of the device, including initial beam properties (emittance and energy spread), with the help of numerical simulations using the conformal finite-difference time-domain electromagnetic solver VORPAL.
Funding Agency: This work was partially supported by the US Department of Education under contract number P116Z050086 with Northern Illinois University.

Poster Panel 18
ID: 3049 TUPE070 ***Second and Third Harmonic Measurements at the Linac Coherent Light Source*****, Daniel Ratner** (SLAC, Menlo Park, California)**,** Daniel Ratner, Franz-Josef Decker, Yuantao Ding, Paul J. Emma, Josef Frisch, Zhirong Huang, Richard Iverson, Henrik Loos, Marc Messerschmidt, Heinz-Dieter Nuhn, Tonee Smith, James Leslie Turner, James Welch, Juhao Wu (SLAC, Menlo Park, California), Richard M. Bionta (LLNL, Livermore, California) **-** The Linac Coherent Light Source (LCLS) is a Free Electron Laser (FEL) operating with a fundamental wavelength ranging from 1.5-0.15 nm. Characterization of the higher harmonics present in the beam is important to users, for whom harder X-rays can either extend the useful operating wavelength range or represent a background to measurements. We present here measurements of the power in both the second and third harmonics. We also compare these power levels to what is expected from theory and simulations.

Poster Panel 19
ID: 1937 TUPE068 ***Polarization Control for Seeded FELs in a Crossed-Planar Undulator*****, Huiping Geng** (SLAC, Menlo Park, California)**,** Huiping Geng, Yuantao Ding, Zhirong Huang (SLAC, Menlo Park, California), Riccardo Bartolini (Diamond, Oxfordshire), David Dunning, Neil Thompson (STFC/DL/ASTeC, Daresbury, Warrington, Cheshire) **-** The crossed-planar undulator is a promising scheme for full polarization control in an x-ray FEL*. For SASE FELs, it has been shown a maximum degree of circular polarization of about 80% is achievable**. In this paper, we study the effectiveness of a cross undulator for a seeded x-ray FEL. The degree of circular polarization for both the fundamental and the harmonic radiation are considered.
Footnotes
* K.-J. Kim, Nucl. Instrum. Methods A445, 329 (2000).
** Y. Ding, Z. Huang, Phys. Rev. ST-AB 11, 030702 (2008).
Funding Agency: This work was supported by the Department of Energy Contracts No. DE-AC02-76SF00515 and the China Scholarship Council.

Poster Panel 20
ID: 2451 TUPE029 ***Spectral Measurement of VUV CHG at UVSOR-II*****, Takanori Tanikawa** (Sokendai - Okazaki, Okazaki, Aichi)**,** Takanori Tanikawa (Sokendai - Okazaki, Okazaki, Aichi), Masahito Hosaka, Yoshitaka Taira, Naoto Yamamoto (Nagoya University, Nagoya), Masahiro Adachi, Masahiro Katoh, Jun-ichiro Yamazaki, Heishun Zen (UVSOR, Okazaki) **-** Light source technologies based on laser seeding are under development at the UVSOR-II electron storage ring. In the past experiments, we have succeeded in generating coherent DUV (Deep Ultra-Violet) harmonics with various polarizations. A spectrum measurement experiment of CHG (Coherent Harmonic Generation) was carried out by using a spectrometer of from visible to DUV range. In order to diagnose spectra of shorter-wavelength CHG, a spectrometer for VUV (Vacuum Ultra-Violet) has been constructed and the VUV CHG was measured. In addition, we try to use a seeding light source based on not only fundamental of Ti: Sapphire laser and the harmonics generated from non-linear crystals but also HHG (High Harmonic Generation) in a gas for the CHG experiment. Now the HHG system is under development. In this presentation, we introduce the VUV spectral measurement system and the HHG system and also report about comparison between the results of the current CHG experiments and design studies of numerical calculation for them.

Poster Panel 21

ID: 3322 TUPE034 ***Design of FEL by the EEHG Scheme for Tsinghua University*****, Xinlu Xu** (TUB, Beijing)**,** Xinlu Xu, Chuanxiang Tang, Qingzi Xing (TUB, Beijing) **-** Tsinghua University Thomson X-ray source (TTX) has been proposed at Tsinghua University. With the nominal electron beam parameters (beam energy of 50MeV, slice energy spread of 0.5keV, peak current of 600A, rms normalized emittance of 2 mm mrad) of the TTX linac, the design of Free Electron Laser (FEL) by the Echo-Enabled Harmonic Generation (EEHG) scheme is presented. High harmonics of the seeding laser is generated by the EEHG scheme. Parameters of the undulators and seeding lasers are optimized. Simulation results using the GENESIS code are also presented in this paper.

Poster Panel 22

ID: 2078 TUPE057 ***A Tunable Multi-MHz Repetition Rate Soft X-ray FEL*****, Punit R. Gandhi** (UCB, Berkeley, California)**,** Punit R. Gandhi, Xiao-Wei Gu (UCB, Berkeley, California), Kwang-Je Kim, Ryan Roger Lindberg (ANL, Argonne), Gregory Penn, Alexander Zholents (LBNL, Berkeley, California), Jonathan Wurtele (LBNL, Berkeley, California; UCB, Berkeley, California) **-** A major advantage of FEL radiation sources is the ability, in principle, to tune the radiation output frequency by adjusting either the beam energy or the wiggler amplitude. In practice, this may not be readily achievable for systems that require high repetition rate amplifiers. In our scheme, we envision using two oscillators working at two fixed wavelengths and producing tunable radiation using the echo technique* at much shorter wavelengths. This system avoids the need for seeding lasers and will allow producing narrow bandwidth and high brightness x-ray radiation with a multi-MHz repetition rate using low charge electron bunches provided by a DC or cw rf electron gun and superconducting rf linac. This system is first analyzed using a reduced model** for FEL oscillators, in which the transverse profile of the light beam is expanded using the Gauss-Hermite basis and the FEL equations are integrated over the transverse dimensions. The results are compared with simulations from the GENESIS code***. Studies of the FEL performance will be presented, including its tunability and sensitivity to fluctuations in beam energy.

Footnotes

* G. Stupakov, SLAC-Pub 13445 (2008)

** R.R. Lindberg and K.-J. Kim, Phys Rev. ST Accel. Beams 12,070702 (2009)

*** R Reiche, Nucl. Instrum. Methods Phys. Res., Sect. A 429, 243 (1999)

Poster Panel 23

ID: 2597 - TUPD092 ***Coherent Hard X-ray Free-electron Laser based on Echo-enabled Staged Harmonic Generation Scheme*****, Chao Feng** (SINAP, Shanghai)**,** Chao Feng, Zhentang Zhao (SINAP, Shanghai) **-** A novel approach to producing coherent hard x-ray based on the echo-enabled staged harmonic generation (EESHG) scheme is proposed. This scheme is not a simple cascaded EEHG, but consists of an EEHG, a beam shifter and a conventional HGHG like configuration, which also works in the EEHG principle. In the first stage, all over the whole electron beam is energy modulated by a laser beam in the first modulator and then converts into separate energy bands by a very strong dispersion section. In the second modulator, the seed laser is adjusted so that only the tail half part of the e-beam is energy modulated, then this beam is sent through the second dispersion section which converts the energy modulated part into a density modulation. The radiation from the first stage serves as the seed laser of the second stage, the beam shifter is so tuned that the head part of the electron beam can exactly interact with the radiation from the first stage in the modulator of the second stage, so the total harmonic number will be over one thousand. It is shown that fully coherent hard x-ray radiation can be obtained directly from a conventional VUV seed laser.

Poster Panel 24

ID: 3268 TUPE080 ***Study of High Harmonic Generation at Synchrotron SOLEIL using an Echo Scheme*****, Clement Evain** (SOLEIL, Gif-sur-Yvette)**,** Clement Evain, Marie-Emmanuelle Couprie, Jean-Marc Filhol, Marie Labat, Amor Nadji (SOLEIL, Gif-sur-Yvette), Alexander Zholents (LBNL, Berkeley, California) **-** SOLEIL is presently installing a laser bunch slicing set-up to produce ultra-short X-ray pulses. We propose a method to generate coherent synchrotron radiation at high harmonics in a storage ring using an echo scheme. Like in the method proposed recently for free electron lasers, the echo scheme uses two modulators and two dispersive sections. We show that this can be done at the synchrotron SOLEIL by adapting the classical slicing scheme. In the present study at SOLEIL, the two laser/electrons interactions are planned to occur in two out of vacuum wigglers of period 150 mm, and the high harmonic radiation will be emitted in an APPLE-II type undulator with a period of 44mm or 80 mm in the beamline TEMPO or with a period of 52 mm in the beamline DEIMOS.

Poster Panel 25

ID: 2405 TUPEC024 ***Heat Load by the GaAs Cathode in SRF Electron Gun*****, Erdong Wang** (BNL, Upton, Long Island, New York; PKU/IHIP, Beijing)**,** Erdong Wang (BNL, Upton, Long Island, New York; PKU/IHIP, Beijing), Douglas Holmes (AES, Medford, NY), Ilan Ben-Zvi, Andrew Burrill, Jorg Kewisch, Triveni Rao, Qiong Wu (BNL, Upton, Long Island, New York) **-** Superconducting RF (SRF) electron guns deliver higher brightness beams than DC guns because the field gradient at the cathode is higher. SRF guns with metal cathodes have been successfully tested. For the production of polarized electrons a Gallium-Arsenide (GaAs) cathode must be used, and an experiment to test this type of cathode is under way at BNL. Since the cathode will be

normal conducting, the primary concern is cathode-driven heat load. We present measurements of the electric resistance of GaAs at cryogenic temperatures, a prediction of the heat load, and verification by measuring the quality factor of the gun with and without the cathode.

Poser Panel 26
ID: 2712 TUPEC018 ***NEA GaAs Photocathode Preparation and QE Lifetime Study using the ALICE Load-lock System*****, Narong Chanlek** (UMAN, Manchester)**,** Narong Chanlek, Roger Michael Jones (UMAN, Manchester), Joseph Herbert, Lee Jones, Keith Middleman, Boris Leonidovich Militsyn (STFC/DL/ASTeC, Daresbury, Warrington, Cheshire) **-** Gallium Arsenide (GaAs) photocathodes have in recent year been widely used and have become the focus for use in modern accelerators and light sources such as the Accelerators and Lasers in Combined Experiments (ALICE) and the International Linear Collider (ILC). Once activated to a Negative Electron Affinity (NEA) state and illuminated by a laser, these materials can be used as a high-brightness source of both polarised and un-polarised electrons. This work presents an effective preparation procedure including heat cleaning, atomic hydrogen cleaning and the activation process for NEA GaAs photocathode. The stability of quantum efficiency (QE) and lifetime of NEA GaAs photocathode have been studied in the load-lock and photocathode preparation system for the ALICE photo- electron gun which has a base pressure in the order of 10-11 mbar. These studies are also supported with experimental evidence from surface science techniques such as Photoelectron Spectroscopy (XPS) and Low Energy Electron Diffraction (LEED) to demonstrate the processes at the atomic level.

Poster Panel 27
ID: 3007 TUPEC012 ***Experimental Studies of Thermal Emittance of the Mg Cathode at the NSLS SDL*****, Houjun Qian** (BNL, Upton, Long Island, New York; TUB, Beijing)**,** Houjun Qian (BNL, Upton, Long Island, New York; TUB, Beijing), Yoshiteru Hidaka, James Murphy, Boris Podobedov, Sergei Seletskiy, Yuzhen Shen, Xijie Wang, Xi Yang (BNL, Upton, Long Island, New York), Chuanxiang Tang (TUB, Beijing) **-** With a large difference between the work function (3.66 eV) and photon energy (4.66 eV), Magnesium (Mg) cathode is a good candidate for thermal emittance studies. Mg cathode has been in operation at the NSLS Source Development Lab (SDL) since 2006, and we have been routinely operating the Mg cathode with quantum efficiency (QE) better than 10^-4, while the best QE we observed is about 2x10^-3. We have carried out systematic experimental studies of transverse emittance of the Mg cathode in a photocathode RF gun, and the measured projected emittance of the Mg cathode is better than that of Cu cathode reported in the literature. We also observed no thermal emittance change as the QE of the Mg cathode varied from 10^-4 to 10^-3. Our experimental results could not be explained by the 3-step volume photoemission model, and they contradict the popular thermal emittance formula prediction.

Poster Panel 28
ID: 3365 TUPEC011 ***Structure Design and Optimization of a Compact C-band Photocathode RF Gun*****, Xiaohan Liu** (TUB, Beijing)**,** Xiaohan Liu, Chuanxiang Tang (TUB, Beijing) **-** In this paper, we present the preliminary structure design and optimization of a C-band photocathode RF gun for a compact electron diffraction facility. It will work at 5.712GHz. A dual coupler and elliptical iris between half-cell and full-cell are adopt in this gun for lower emittance and larger mode separation. A detailed 3D simulation of the C-band RF gun with coupler is performed. This paper likewise presents the beam dynamics parameters and analysis of this gun.
Funding Agency: Work supported by National Natural Science Foundation of China and National Basic Research Program of China(973 Program).

Poster Panel 29
ID: 1888 TUPEC025 ***Artificial Intelligence Systems for Electron Beam Parameters Optimization at the Australian Synchrotron*****, Evelyne Meier** (ASCo, Clayton, Victoria)**,** Evelyne Meier (ASCo, Clayton, Victoria) **-** We report the use of an artificial intelligent system for the optimization of the Australian Synchrotron Linac electron beam energy spread and transmission. The system is based on state of the art developments in artificial intelligence techniques for video games and is adapted here to beam optimization problems. It consists of a genetically evolved neural network that mimics an operator¿s decisions to perform an optimization task when no prior knowledge other than constraints on the actuators is available. The system¿s decisions are based on the actuators positions relative to their upper and lower limits, the past performance of close points in the search space and the probability of reaching a better performance in a more distant region of the search space. The system¿s optimization ability is demonstrated for problems with known optimum and results obtained from the optimization of the real machine parameters are presented.

Poster Panel 30
ID: 1957 WEPD039 ***First Magnetic Tests of a Superconducting Damping Wiggler for the CLIC Damping Rings*****, Daniel Schoerling** (CERN, Geneva)**,** Daniel Schoerling, Mikko Karppinen, Remo Maccaferri (CERN, Geneva), Robert Rossmanith (FZK, Karlsruhe), Alfons Ams (IMFD, Freiberg), Axel Bernhard, Peter Peiffer (KIT, Karlsruhe) **-** Two damping rings (e+, e-) are foreseen for the CLIC injection chain. In each damping ring 76 two meter long wigglers will be installed. The short period (40-50 mm), combined with a gap larger than 14 mm and a requested field in the mid-plane BPeak > 2 T requires the usage of superconducting technologies to

meet these requirements. To demonstrate the feasibility of this wiggler design a short-model vertical racetrack wiggler (40 mm period; 16 mm gap) was built and successfully tested at CERN. The wiggler carries a current of 730 A and 910 A and reaches a mid-plane peak field of Bpeak = 2 T and Bpeak = 2.5 T at 4.2 K and 1.9 K, respectively. The results show that the wiggler model meets the magnetic requirements of the CLIC damping rings at 1.9 K. The paper will also discuss the improvements we propose to enhance the performance in order to meet the CLIC specifications also at 4.2 K.

Poster Panel 31

ID: 2434 WEPD025 ***Theoretical Examination of Radiation Spectrum from the Quasi-periodic Undulator*****, Sho Hirata** (Hiroshima University, Higashi-Hirosima)**,** Sho Hirata (Hiroshima University, Higashi-Hirosima), Shigemi Sasaki (HSRC, Higashi-Hiroshima) **-** Different form conventional periodic undulators, the quasi-periodic undulator (QPU) can radiate irrational harmonics instead of rational harmonics. It suits with experiments that need highly monochromatic light after passing through the monochromator. For this reason, the QPU is used in many synchrotron radiation facilities all over the world. Recently, new type QPUs that generate radiation spectra different from those by conventional type QPU were proposed*,**. In principle, the shape of radiation spectrum from a new QPU is determined by magnetic field distribution having different quasi periodic pattern. However, calculated spectra using a realistic magnetic field are often different from those of theoretical expectation. In this paper, a detailed comparative study is conducted to examine why there are these differences, how to correct magnetic field to get predicted spectra that fit to the theory. In addition, a possibility of modifying the basis of theory is investigated. These results, new generation method of new quasi-periodicity, and magnetic field distribution to achieve the best performance are presented at the conference.

Footnotes

* S. Sasaki, Proceedings of PAC09, Vancouver, May, 2009.

** S. Sasaki, Proceedings of 6th Annual Meeting of Particle Accelerator Society of Japan (in Japanese).

Postr Panel 32

ID: 2411 WEPD040 ***The Spectrum Property Analysis of Wiggler-like Undulator*****, Sei-Da Chen** (NCTU, Hsinchu)**,** Sei-Da Chen, Tseng-Ming Uen (NCTU, Hsinchu), Ching-Shiang Hwang (NSRRC, Hsinchu) **-** A wiggler with the property of low total radiation power and keeping high photon flux in hard x-ray region, 5-20 keV, which is necessary for the special demand of users, was under investigated for reducing the difficulty of the design of optical components in the beam line and decreasing the load of RF cavity power. Such an insertion devise was called wiggler-like undulator. The spectrum of wiggler-like undulater was investigated with a code, of which the algorithm is based on the compromising between photon flux and radiation power of insertion devices for spectrum optimization. The property of the spectrum of the wiggler-like undulator are discussed herein. Furthermore, the brilliance and the power distribution are somehow also discussed.

Classification 3: Linear Colliders, Lepton Accelerators and New Acceleration Techniques

Poster Panel 33

ID: 3231 WEPE001 ***Optics Studies for the Interaction Region of the International Linear Collider*****, Reine Versteegen** (CEA, Gif-sur-Yvette)**,** Reine Versteegen, Olivier Delferriere, Olivier Napoly, Jacques Payet, Didier Uriot (CEA, Gif-sur-Yvette) **-** The International Linear Collider reference design is based on a collision scheme with a 14 mrad crossing angle. Consequently, the detector solenoid and the machine axis do not coincide. It provokes a position offset of the beam at the Interaction Point in addition to a beam size growth. These effects are modified by the insertion of the anti-DID (Detector Integrated Dipole) aiming at reducing background in the detector. Furthermore a crab cavity is necessary to restore a 'head on' like collision, leading to higher luminosity. This introduces new beam distortions. In this paper, optics studies and simulations of beam transport in the Interaction Region taking these elements into account are presented. Correction schemes of the beam offset and beam size growth are exposed and their associated tolerances are evaluated.

Poster Panel 34

ID: 2124 WEPE047 ***Frictional Cooling for a Slow Muon Beam*****, Yu Bao** (IHEP Beijing, Beijing)**,** Yu Bao (IHEP Beijing, Beijing), Daniel Greenwald (MPI fuer Physics, Muenchen), Allen Caldwell, Guoxing Xia (MPI-P, München) **-** Low energy muon beams are useful for a wide range of physics experiments. High quality muon beams are also required for muon colliders and neutrino factories. The frictional cooling method holds promise for delivering slow muon beams with narrow energy spreads. With this technology, we consider the production of a cold muon beam from a surface muon source, such as that at the Paul Scherrer Institute. A cooling scheme based on frictional cooling is outlined. Simulation results show that the efficiency of slow muon production can be raised to 1%, which is significantly higher than current schemes.

Poster Panel 35

ID: 2771 WEPE051 ***Muon Cooling Performance in Various Neutrino Factory Cooling Cell Configurations using G4MICE*****, Androula Alekou** (Imperial College of Science and Technology, London)**,** Androula Alekou

(Imperial College of Science and Technology, London), Jaroslaw Pasternak (Imperial College of Science and Technology, London; STFC/RAL, Chilton, Didcot, Oxon), Chris Rogers (STFC/RAL/ASTeC, Chilton, Didcot, Oxon) - The Neutrino Factory is a planned particle accelerator complex that will produce an intense, focused neutrino beam, using neutrinos from muon decay. Such high neutrino intensities can only be achieved by reducing the muon beam emittance using an ionization cooling system. The G4MICE software is used to study the performance of various cooling cell configurations. A comparison is drawn between the cooling in the FS2 cells, the baseline Neutrino Factory and doublet cells. The beam dynamics in each of cooling channels are presented. The lattices are compared with respect to the equilibrium emittance, muon transmission, acceptance and evolution of emittance along the channel. Conclusions for a possible optimisation of the future muon cooling channel of the Neutrino Factory are presented.

Poster Panel 36

ID: 2953 WEPE054 ***The MICE Muon Beam: Status and Progress*****, Adam James Dobbs** (Imperial College of Science and Technology, London)**,** Adam James Dobbs, Marco Apollonio, Jaroslaw Pasternak (Imperial College of Science and Technology, London), Dean Adams (STFC/RAL/ISIS, Chilton, Didcot, Oxon) - The international Muon Ionisation Cooling Experiment (MICE) is designed to provide a proof of principal of the ionisation cooling technique proposed to reduce the muon beam phase space at a future Neutrino Factory or Muon Collider. The pion production target is a titanium cylinder that is dipped into the proton beam of the Rutherford Appleton Laboratory's ISIS 800 MeV synchrotron. Studies of the particle rate in the MICE muon beam are presented as a function of the beam loss induced in ISIS by the MICE target. The implications of the observed beam loss and particle rate on ISIS operation and MICE data taking is discussed.

Poster Panel 37

ID: 1994 WEPE061 ***Measurements of Muon Beam Properties in MICE*****, Mark Alastair Rayner** (OXFORDphysics, Oxford, Oxon)**,** Mark Alastair Rayner, John Cobb (OXFORDphysics, Oxford, Oxon) - The Muon Ionization Cooling Experiment is one lattice section of a cooling channel suitable for conditioning the muon beam at the front end of a Neutrino Factory or Muon Collider. Scintillating fibre spectrometers and 50 ps resolution timing detectors provide the unprecedented opportunity to measure the initial and final six-dimensional phase space vectors of individual muons. The capability of MICE to study the evolution of muon beams through a solenoidal lattice will be described.

Poster Panel 38

ID: 1808 WEPE048 ***Further Study of Muon Ionization Cooling Process*****, Timofey Vladimirovich Zolkin** (BINP SB RAS, Novosibirsk)**,** Timofey Vladimirovich Zolkin, Alexander Skrinsky (BINP SB RAS, Novosibirsk) - The LyRICS (Lithium Rod Ionization Cooling Simulation) multi-purpose software have been created for muon beams' final cooling scheme (based on consequent lithium rods) research (*),(**). It can simulate 6-dimensional movement of muon beam through the matter including such effects as non-paraxiality, dissipations and stochastic processes like scattering or energy losses fluctuations. Also LyRICS allows to simulate movement in matching sections based on lithium and plasma lenses, including acceleration in RF cavities with taking into account transversal defocusing due to transversal components of RF-fields and estimate it's technical parameters. The special bending sections for non-dissipative phase-space volume redistribution (needed for all 6 dimensions cooling) can be considered in simulation in this concept type and in regime with full simulation. The analysis of possible cooling limit in dependence of technical parameters and type of phase-space volume redistribution is made. The comparison of possible luminosity with other cooling schemes is given. The cooling process optimized and more quality and deep estimation made.

Footnotes

* Skrinsky A.N., in Proc. of 9th ICFA Workshop, Montauk, NY (1995) and NIM, A 391, (1997) pp. 188-195.

** Skrinsky A.N., Zolkin T.V., NIMA50252

Poster Panel 39

ID: 2721 THPD035 ***Matching the Laser Generated p - bunch into a CH-DTL*****, Ali Almomani** (IAP, Frankfurt am Main)**,** Ali Almomani, Martin Droba, Ulrich Ratzinger (IAP, Frankfurt am Main), Ingo Hofmann (GSI, Darmstadt) - The concept of laser acceleration of protons by Target Normal Sheath Acceleration TNSA from thin foils could be used to produce a high intensity proton bunch. This proton bunch could be injected into a linac at energies of ten to several tens MeV. A CH- structure is suggested as the linac structure because of its high gradient. The motivation for such a combination is to deliver single beam bunches with quite small emittance values of extremely high particle number - in the order of 10 billion protons per bunch. Optimum emittance values for linac injection are compared with available, laser generated beam parameters. Options and simulation tools for beam matching by pulsed solenoid and CH- structure using LASIN and LORASR codes are presented.

Poster Panel 40

ID: 3846 THPD036 ***Electron Acceleration by a Whistler Pulse*****, Rohtash Singh** (Indian Institute of Technology Delhi, New Delhi)**,** Rohtash Singh, Ashok Kumar Sharma (Indian Institute of Technology Delhi, New Delhi) - A Gaussian whistler pulse is shown to cause ponderomotive acceleration of electrons in a plasma when the peak whistler amplitude exceeds a threshold value. The threshold amplitude decreases with the ratio of plasma frequency to electron cyclotron frequency $\omega p / \omega c$. However above the threshold amplitude the acceleration

energy decreases with $\omega p / \omega c$. The electrons gain velocities about twice the group velocity of the whistler. For acceleration of electrons one requires a whistler pulse of $\omega > \omega c/2$. It is seen that to enhance the energy gain the value of peak laser amplitude should be above a threshold value.

Poster Panel 41

ID: 1791 THPD040 ***Collimated Electron and Proton Beam from Ultra-intense Laser Interaction with a Rear Hole Target*****, Xiaohu Yang** (National University of Defense Technology, Changsha, Hunan)**,** Xiaohu Yang, Chenglin Tian, Yan Yin, Tongpu Yu (National University of Defense Technology, Changsha, Hunan), Shigeo Kawata (Center for Optical Research and Education, Utsunomiya), Yuqiu Gu (Laser Fusion Research Center, Mianyang), Fuqiu Shao, Han Xu (National University of Defense Technology, Changsha), Yanyun Ma (National University of Defense Technology, Changsha, Hunan; Laser Fusion Research Center, Mianyang; Center for Optical Research and Education, Utsunomiya), Mingyang Yu (Zhejiang University, Hangzhou; Ruhr-Universität Bochum, Bochum) **-** We have proposed a scheme for the generation of collimated proton beams from the interaction of an ultra-intense laser pulse with a rear hole target, which is studied by a 2.5D particle-in-cell (PIC) code PLASIM. When an ultraintense short laser pulse irradiates on such a target, the hot electrons will expand fast into the hole from the inner surfaces of the hole, and strong longitudinal sheath electric field and transverse electric field are produced. However, the plasma in the corners expand slower and be compressed strongly, and then a strong plasma jet is sprayed out from the corner with very high speed, which is just like what happened in armor piercing bullet due to the cumulative energy effect. The two jets extend into the hole and focus along the axis of the hole. At last, a high quality collimated proton beam can be obtained near the end of the hole along the propagation axis. It's found that the beam can propagate over a much longer distance without divergence. The effect of the hole diameter on the collimated proton beam is also investigated. Such target may serve as an important source for collimated proton beam in practical applications.

Poster Panel 42

ID: 2684 THPEC017 ***Measurements of the Correlation Between Plasma Bubble Dynamics and Electron Trapping in a Laser Wakefield Accelerator*****, Michael Helle** (Georgetown University, Washington)**,** Michael Helle (Georgetown University, Washington), Dmitri Kaganovich (Icarus Research, Inc., Bethesda, Maryland), Daniel Gordon, Antonio Ting (NRL, Washington, DC) **-** Generation of conically emitted second harmonic radiation has recently been observed in a laser wakefield accelerator experiment at the U.S. Naval Research Laboratory. This second harmonic is the result of frequency mixing within the sheath surrounding a fully cavitated plasma region, "plasma bubble," created by the ponderomotive force of a laser*. Using this second harmonic signature, we have indirectly studied the dynamics of a plasma bubble. It has been observed that the plasma bubble dynamics are strongly correlated to the generation of electrons. Specifically, the onset of the bubble is connected to the generation of off-axis electrons**, while forward accelerated electrons have been observed when the conical distribution of second harmonic is broken, signifying the disruption of the plasma bubble. Further results on bubble dynamics and its connection to electron beam production will be presented.

Footnotes

* D. F. Gordon et al., Phys. Rev. Lett. 101, 45004 (2008).

** D. Kaganovich et al., Phys. Rev. Lett. 100, 215002 (2008).

Funding Agency: This work is supported by the Office of Naval Research and the Department of Energy.

Poster Panel 43

ID: 3588 THPEC019 ***Implementation of a Polarized Electron Source at the S-DALINAC*****, Christian Eckardt** (TU Darmstadt, Darmstadt)**,** Christian Eckardt, Thore Bahlo, Philip Bangert, Roman Barday, Uwe Bonnes, Marco Brunken, Ralf Eichhorn, Joachim Enders, Markus Platz, Yuliya Poltoratska, Markus Roth, Fabian Schneider, Markus Wagner, Antje Weber, Benjamin Zwicker (TU Darmstadt, Darmstadt), Wolfgang Ackermann, Wolfgang F.O. Müller, Thomas Weiland (TEMF, TU Darmstadt, Darmstadt) **-** At the superconducting 130 MeV Darmstadt electron linac S-DALINAC* a source of polarized electrons** is being installed, extending the experimental capabilities with polarized electron and polarized photon probes for nuclear structure studies. This involves disassembling the existing low energy test stand and rebuilding the beam line in the accelerator hall. The beam itself is produced from a GaAs cathode by irradiation with a pulsed laser. The low-energy electron beam line includes diagnostic elements, a Wien filter for spin manipulation, a 100 keV Mott polarimeter for polarization measurement and a chopper-prebuncher section to modulate the time structure of the beam. At higher energies a 5-10 MeV Mott polarimeter and a 50-130 MeV Moeller polarimeter as well as a Compton transmission polarimeter will be installed to measure the beam polarization after acceleration. The Mott polarimeter is working with backscattered electrons under 165° scattering angle while for the Moeller polarimeter a wide-angle (3°-15°) spectrometer magnet was designed. We report on the performance of the test stand, the ongoing implementation, and the polarimeter research and development.

Footnotes

* A. Richter, Proc. EPAC 96, Sitges, p.110.

** Y. Poltoratska et al., AIP Conference Proc. 1149 (2009), p.983.

Funding Agency: Work supported by DFG through Collective Research Centre 634.

Poser Panel 44
ID: 2164 THPEC026 ***Experimental Results of RF Gun and Generation of Multi Bunch Beam*****, Abhay Deshpande** (Sokendai, Ibaraki)**,** Abhay Deshpande (Sokendai, Ibaraki), Sakae Araki, Masafumi Fukuda, Nobuhiro Terunuma, Junji Urakawa (KEK, Ibaraki), Kazuyuki Sakaue, Masakazu Washio (RISE, Tokyo) **-** At Accelerator Test Facility (ATF) at KEK, we designed and made a new RF Gun with high mode separation of 8.6 MHz and high Q value as compared to earlier guns. This paper presents fabrication details, low power measurements and tuning procedures followed in making the gun cavity. We also discuss in detail, experimentation done using this gun and show the measurement results. Currently we produce 100 bunch per train but we plan to go for 300 or more bunch per train operation. This will make possible to have higher charge available for laser-beam collisions to generate high flux soft X-rays by Inverse Compton Scattering at our setup.

Poster Panel 45
ID: 1801 THPD034 ***Stable Proton Beam Acceleration from a Two-specie Ultrathin Foil Target*****, Tongpu Yu** (HHUD, Dusseldorf), Tongpu Yu, Min Chen, Alexander Pukhov (HHUD, Dusseldorf) - By using multi-dimensional particle-in-cell simulations, we investigate the stability of proton beam acceleration in a two-specie ultra-thin foil. In this two-specie regime, the lighter protons are initially separated from the heavier carbon ions due to their higher charge-to-mass ratio Z/m. The laser pulse is well-defined so that it doesn't penetrate the carbon ion layer. The Rayleigh-Taylor-like (RT) instability seeded at the very early stage then only degrades the acceleration of the carbon ions which act as a "cushion" for the lighter protons. Due to the absence of proton-RT instability, the produced high quality mono-energetic proton beams can be well collimated even after the laser-foil interaction concludes.
This work is supported by GRK 1203 and TR18. We also acknowledge the finical support from DAAD Kongress- und Vortragsreisenprogramm.

Poster Panel 46
ID: 2489 THPEC001 ***Optimization of Nonlinear Wakefield Amplitude in Laser Plasma Interaction*****, Ajay Kumar Upadhyay** (Lucknow University, Lucknow), Ajay Kumar *Upadhyay*, Pallavi Jha (Lucknow University, Lucknow), Srinivas Krishnagopal (BARC, Mumbai), Sushil Arun Samant, Deepangkar Sarkar (CBS, Mumbai) - Nonlinear, high-amplitude plasma waves are excited in the wake of an intense laser pulse propagating in a cold plasma, providing acceleration gradients up to GeV/m. Linear analytic analyses have shown that the wakefield amplitude is optimal for a certain ratio of the pulse length and plasma wavelength*,**. Here we present results of simulation studies to optimize the nonlinear wakefield amplitudes. Variation in the laser pulse length is considered for maximizing amplitudes of wakefields generated by half-sine and Gaussian pulse profiles. Further, the advantages of using a transversely inhomogeneous plasma for the generation of the nonlinear wakefields are studied and compared with the homogeneous case.
* E. Esarey, P. Sprengle, J. Krall and A. Ting, IEEE Trans. Palsma Sci. 24, 252 (1996)
** L. M. Gorbunov and V. I. Kirsanov, Zh. Eksp. Teor. Fiz. 93, 509 (1987), Sov. Phys. JETP, 46, 290 (1988).

Poster Panel 47
ID: 2334 THPD030 ***Characterisation and Optimisation of the ALICE Accelerator as an Injector for the EMMA NS-FFAG*****, James Garland** (UMAN, Manchester), James Garland, Hywel Owen (UMAN, Manchester), Julian William McKenzie, Bruno Muratori (STFC/DL/ASTeC, Daresbury, Warrington, Cheshire) - EMMA is the first proof-of-principle non-scaling FFAG accelerator, and is presently under construction at Daresbury Laboratory in the UK. To probe different parts of the bunch phase space during acceleration from 10 MeV and rapid resonance crossing, electron bunches are needed with sufficiently small emittance and energy spread. The purpose of this paper is to study the emittance and energy spread of the beam in ALICE after the main super-conducting Linac in order to optimise the accelerator as an injector into EMMA.

Classification 4: Hadron Accelerators

Poster Panel 48
ID: 2552 MOPD031 ***Development And Measurements on a Coupled CH Proton Linac for FAIR*****, Robert Brodhage** (IAP, Frankfurt am Main)**,** Robert Brodhage, Holger Podlech, Ulrich Ratzinger (IAP, Frankfurt am Main), Gianluigi Clemente, Lars Groening (GSI, Darmstadt) **-** For the research program with cooled antiprotons at FAIR a dedicated 70 MeV, 70 mA proton injector is required. The main acceleration of this room temperature linac will be provided by six coupled CH-cavities operated at 325 MHz. Each cavity will be powered by a 3 MW klystron. For the second acceleration unit from 11.7 to 24.3 MeV a 1:2 scaled model has been built. Low level RF measurements have been performed to determine the main parameters and to prove the concept of coupled CH-cavities. For this second tank technical and mechanical investigations have been done in 2009 to prepare a complete technical concept for manufacturing. Recently, the construction of the prototype has started. The main components of this second cavity will be ready for measurements in spring 2010. At that time the cavity will be tested with dummy stems (made from aluminum) wich will allow precise frequency and field tuning. This paper reports on the

technical development and achievements during the last year. It will outline the main fabrication steps towards that novel type of proton DTL.

Poster Panel 49

ID: 3401 MOPD060 ***Design Optimisation and Particle Tracking Simulations for PAMELA Injector RFQ*****,** **Matt Easton** (Imperial College of Science and Technology, London)**,** Matt Easton, Morteza Aslaninejad, Simon Jolly, Jürgen Klaus Pozimski (Imperial College of Science and Technology, London), Ken Peach (JAI, Egham, Surrey) **-** The PAMELA (Particle Accelerator for MEdicaL Applications) project aims to design an ns-FFAG accelerator for cancer therapy using protons and carbon ions. For the injection system for carbon ions, an RFQ is one option for the first stage of acceleration. Our integrated RFQ design process* has been developed further using Comsol Multiphysics for electric field modelling. The design parameters for the RFQ are automatically converted to a CAD model using Autodesk Inventor, and the electric field map for this model is simulated in Comsol. Particles can then be tracked through this field map using Pulsar Physics' General Particle Tracer (GPT). Our software uses Visual Basic for Applications and MATLAB to automate this process and allow for optimisation of the RFQ design parameters based on particle dynamical considerations. Possible designs for the PAMELA RFQ, including super-conducting and normal-conducting solutions, will be presented and discussed, together with results of the field map simulations and particle tracking for these designs.

Footnotes

* M J Easton et al., RFQ Design Optimisation for PAMELA Injector, PAC09, Vancouver, Canada, April 2009, FR5REP066.

Poster Panel 50

ID: 2037 MOPD045 ***Design and Simulation of C6+ Hybrid Single Cavity Linac for Cancer Therapy*****,** **Liang Lu** (RLNR, Tokyo)**,** Liang Lu, Toshiyuki Hattori, Noriyosu Hayashizaki (RLNR, Tokyo) **-** A new type Linac, HSC (hybrid single cavity) linac for cancer therapy, which configuration combines RFQ (Radio Frequency Quadrupole) accelerating structure and DT (Drift Tube) accelerating structure is being finished designs and simulations now. This HSC linac design had adopted advanced power-efficiency-conformation, IH (Interdigital H) structure, which acceleration efficiency is extremely high in the low-middle energy region, and had also adopted most advanced computer simulation technology to evaluate cavity electromagnetic distribution. The study purposes of this HSC linac focus to design of injector linac for synchrotron of cancer radiotherapy facilities. Here, this HSC linac has an amazing space effect because of compact size by coupled complex acceleration electrode and integrated the peripheral device which is made operation easy to handle.

Poster Panel 51

ID: 3816 MOPD072 ***Optical Measurement of Transverse Laser Cooling with Synchro-Betatron Coupling*****,** **Masao Nakao** (Kyoto ICR, Uji, Kyoto)**,** Masao Nakao, Tatsuya Hiromasa, Akira Noda, Hikaru Souda, Hiromu Tongu (Kyoto ICR, Uji, Kyoto), Hiromi Okamoto (HU/AdSM, Higashi-Hiroshima), Alexander V. Smirnov (JINR, Dubna, Moscow Region), Kouichi Jimbo (Kyoto IAE, Kyoto), Manfred Grieser (MPI-K, Heidelberg), Toshiyuki Shirai (NIRS, Chiba-shi) **-** Experiments of transverse laser cooling for 24Mg+ beam have been performed at the small ion storage and cooler ring, S-LSR. It is predicted that the longitudinal cooling force is transmitted to the horizontal direction with synchro-betatron coupling at the resonant condition*. The laser system consists of a 532nm pumping laser, a ring dye laser with variable wavelength around 560nm, and a frequency doubler. The horizontal beam size and the longitudinal momentum spread were optically measured by a CCD and a PAT (Post Acceleration Tube) respectively**, ***. The CCD measures the beam size by observing spontaneous emission from the beam and records in sequence of 100ms time windows the development of the beam profile. The time variation of the beam size after beam injection indicates the transverse cooling time. The initial horizontal beam size, which was about 1mm, was decreased by 0.13mm in 1.5s. The longitudinal momentum spread measured by PAT is increased at the resonant condition. This suggests transverse temperature was transferred to longitudinal direction by synchro-betatron coupling. Both measurements denote the horizontal cooling occurred only in the resonant condition ****.

Footnotes

* H. Okamoto, Phys. Rev. {E50}, 4982 (1994)
** M. Tanabe et. al, Appl. Phys. Express 1 (2008) 028001
*** T. Ishikawa Master Thesis, Kyoto Univ.(2008)
**** H. Souda et. al., contribution to IPAC10.

Funding Agency: The present work supported by Advanced Compact Accelerator Development Project of MEXT, the Global COE program "The Next Generation of Physics, Spun from Universality and Emergence"

Poster Panel 52

ID: 2258 MOPEC042 ***Synchrocyclotron Design for a Dual Cyclinac Hadrontherapy Center*****,** **Adriano Garonna** (EPFL, Lausanne; TERA, Novara)**,** Adriano Garonna (EPFL, Lausanne; TERA, Novara), Ugo Amaldi (TERA, Novara) **-** Hadrontherapy, the technique of tumor radiotherapy employing heavy ion beams, is developing rapidly(*). The TERA Foundation proposes an innovative dedicated accelerator, called Cyclinac(**). It is composed of a 230 MeV/u cyclotron providing fast pulsed beams of H2+, for proton therapy with standard techniques, or C6+, injected into a high gradient linac. Its energy can thus be modulated from pulse to pulse (up to 400 MeV/u), for optimal irradiation of solid tumors with the most modern techniques of dose active spreading. A preliminary design of a superconducting synchrocyclotron

for this application is presented. Its advantages are the reduced construction and operating costs (small magnet and low RF power consumption), and the good adaptation of its beam characteristics to therapy (low current and fast repetition rate). The magnet features a central field of 5 T, which has azimuthal symmetry and decreases with the radius, ensuring radial and vertical focusing. The weight is around 300 t. Ions are produced in an EBIS, injected axially and resonantly extracted at 1 m radius. The RF is mechanically modulated by a rotating capacitor, providing the required 400 Hz repetition rate.

Footnotes

* U. Amaldi, G. Kraft, J.Rad.Res., 48 Suppl A (2007) 27

** U. Amaldi, S. Braccini, P. Puggioni, Reviews of Accelerator Science and Technology, Vol.2 (2009)

Poster Panel 53

ID: 2030 MOPEA022 ***PAMELA: Lattice Solution for a Medical C6+ Therapy Facility*****, Suzanne L. Sheehy** (JAI, Oxford)**,** Suzanne L. Sheehy, Ken Peach, Holger Witte, Takeichiro Yokoi (JAI, Oxford), David Kelliher, Shinji Machida (STFC/RAL/ASTeC, Chilton, Didcot, Oxon) **-** PAMELA (Particle Accelerator for MEdicaL Applications) employs novel non-scaling Fixed Field Alternating Gradient (NS-FFAG) technology in the development of a proton and C6+ particle therapy facility. One of the challenges of this design is the acceleration of high energy C6+ in a lattice which enables high flexibility and reliability for treatments, yet remains minimal in size and complexity. Discussed here is the Carbon 6+ lattice solution in terms of both design and performance.

Funding Agency: Supported by EPSRC grant EP/E032869/1

Poster Panel 54

ID: 1840 - MOPEC058 ***StrahlSim, A Computer Code to Simulate the Dynamic Vacuum in Heavy Ion Accelerators*****, Patrick Puppel** (IAP, Frankfurt am Main)**,** Patrick Puppel (IAP, Frankfurt am Main), Peter J. Spiller (GSI, Darmstadt), Lars Bozyk (GSI, Darmstadt; TU Darmstadt, Darmstadt) **-** StrahlSim is a unique code which simulates the dynamic vacuum in heavy ion accelerators. Dynamic vacuum effects are one of the most challenging problems for accelerators using intermediate charge state, high intensity ion beams. Intermediate charge state ions are exposed to a high probability of charge exchange due to interactions with residual gas particles. Ions which underwent a charge change will be deflected differently with respect to the reference ion in dispersive elements and hit the vacuum chamber where an energy-dependent gas desorption takes place. The pressure rise in the accelerator due to this desorption process becomes dependent on the intensity of the ion beam and is referred to as dynamic vacuum. The StrahlSim code is a tool that combines systematic and dynamic beam loss mechanisms, vacuum gas composition and vacuum pumping systems of an accelerator and accounts for the relevant ionization and electron capture cross sections at the actual beam energy. StrahlSim makes it possible to estimate the transmission of heavy ion accelerators, to estimate the pumping power needed to stabilize the dynamic vacuum and to create time dependent longitudinal pressure profiles.

Poster Panel 55

ID: 2272 THPEC039 ***Handling of Beam Impurities in Gamma-spectroscopy Experiments at REX-ISOLDE (CERN)*****, Timo Bloch** (TU Darmstadt, Darmstadt)**,** Timo Bloch, Jörg Leske, Norbert Pietralla (TU Darmstadt, Darmstadt), Jarno van de Walle (CERN, Geneva) **-** The REX-ISOLDE facility at CERN delivers a great variety of radioactive ion beams with energies up to 3.0 MeV/u and therefore allows nuclear structure physics experiments far from stability. A crucial point for the experimentalist is the knowledge of possible unwanted beam contaminations, either from the bunching and charge-breeding procedure (residual gas ions) or directly from the ion-production process (isobaric contaminants). The sources of these contaminations will be discussed, as well as possible ways of elimination during the post-acceleration. Methods to analyse the beam composition in the relevant energy range will be presented with an emphasis on the experimental challenges in Gamma-spectroscopy experiments and data analysis.

Poster Panel 56

ID: 2034 THPEC059 ***Development of Very Small ECR H+ Ion Source*****, Masahiro Ichikawa** (Kyoto ICR, Uji, Kyoto)**,** Masahiro Ichikawa, Hiroshi Fujisawa, Yoshihisa Iwashita, Hiromu Tongu, Shotaro Ushijima, Masako Yamada (Kyoto ICR, Uji, Kyoto) **-** We aim to develop a small and high intensity proton source for a compact accelerator based neutron source. Because this proton source shall be located close to RFQ for simplification, ratio of H+ to molecular ions such as H2+ or H3+ must be large. Therefore, we selected an ECR ion source with permanent magnets as small and high intensity ion source. ECR ion sources can provide high H+ ratio because of their high plasma temperature. Using permanent magnets makes the ion source small and running cost low. Because there is no hot cathode, longer MTBF is expected. Usually, gas is fed into ion sources continuously, even if ion sources run in pulse operation mode. But, continuous gas flow doesn't make vacuum in good level. So, we decided to install pulse gas valve directly to the plasma chamber. Feeding the gas only when the ion source is in operation reduces the gas load to the evacuation system and the vacuum level can be kept high. Up to now, we developed the first and second model of the ion source. And the research is being conducted using the second model. Recent experimental results will be presented.

Poster Panel 57

ID: 1838 THPEB004 ***Slow Extraction from the Superconducting Synchrotron SIS300 at FAIR: Lattice Design Optimization and Simulations of Beam Dynamics*****, Angela Saa Hernandez** (GSI, Darmstadt)**,** Angela Saa Hernandez, Niels Pyka, Peter J. Spiller (GSI,

Darmstadt), Ulrich Ratzinger (IAP, Frankfurt am Main) - With the ability to accelerate heavy ions up to an energy of 32 GeV/u, the SIS300 superconducting (sc) synchrotron is a central part of the new FAIR facility at GSI-Darmstadt. SIS300 will provide beams with a 20-fold increase in energy and, by means of a stretcher mode or a fast ramped mode (1 T/s), 100-10000 times higher average intensity. The beam from SIS300 will be extracted towards the experiments using resonant slow extraction, thus SIS300 becomes the first superconducting synchrotron worldwide with this feature. Coupling and persistent currents are the main practical limitation for operation of sc magnets at high ramping rates and long slow extraction plateaus. The effect of the persistent currents, which are time dependent and depend as well on the magnet's history, is especially critical for slow extraction at low energies. These effects determine the tolerances on magnetic components. In order to address this issue, detailed simulations of beam dynamics at slow extraction have been performed. In particular, the optimization of the lattice and its optical parameters for a low-loss extraction in the presence of steady and time-dependent field components will be presented.

Poster Panel 58
ID: 1958 THPEB007 ***RF-knockout Extraction System for the CNAO Synchrotron*****, Nicola Carmignani** (INFN/LNF, Frascati (Roma))**,** Nicola Carmignani, Caterina Biscari, Mario Serio (INFN/LNF, Frascati (Roma)), Jacques Bosser (CERN, Geneva), Giovanni Balbinot, Erminia Bressi, Michele Caldara, Marco Pullia (CNAO Foundation, Milan), Giuseppe Venchi (University of Pavia, Pavia) - The National Centre for Oncological Hadrontherapy (CNAO) is the first Italian centre for the treatment of patients affected by tumours with proton and carbon ions beams. Its status and commissioning results are presented in this conference in several papers. The synchrotron beam extraction is based on the use of a betatron core. The possibility of using the RF-knockout method as alternative system is being investigated, trying to optimise the performances with the already present hardware and minimum upgrades. A multiparticle tracking program has been written to simulate the beam dynamics during the extraction of the synchrotron, and to optimise the parameters of the radio frequency system. Two types of signals have been studied in order to obtain a constant spill with the minimum ripple: a carrier wave with a frequency and amplitude modulation, and a noise at a given range of frequencies modulated in amplitude. The results of the optimisation and the parameters of the proposed system are presented.

Poster Panel 59
ID: 2237 THPEC080 ***Fabrication of Silicon Crystals for CERN UA9 Experiment*****, Andrea Mazzolari** (INFN-Ferrara, Ferrara)**,** Andrea Mazzolari (INFN-Ferrara, Ferrara) - Channeling in bent crystals is a technique with high potential to steer charged-particle beams for several applications in accelerators physics. Revisited methods of silicon micromachining techniques allowed one to realize a new generation of crystals. Characterizations using x-ray diffraction, atomic force microscopy, high resolution transmission electron microscopy and ion beam analysis techniques, showed high quality of the crystals. A specifically designed holder allowed to mechanically bend a crystal at given curvature and remove unwanted torsion. Characterization of such crystals with 400 GeV at CERN H8 external line highlighted 85% single-pass efficiency. A selected crystal has been installed inside the SPS ring in the environment of the CERN experiment UA9 and successfully employed for collimation of the circulating beam.
Footnotes: On behalf of UA9 collaboration

Poster Panel 60
ID: 3815 MOPD071 ***Horizontal-Vertical Coupling for Three Dimensional Laser Cooling*****, Tatsuya Hiromasa**, Masao Nakao, Akira Noda, Hikaru Souda, Hiromu Tongu (Kyoto ICR, Uji, Kyoto), Kouichi Jimbo (Kyoto IAE, Kyoto), Toshiyuki Shirai (NIRS, Chiba-shi) - In order to achieve three dimensional crystal beam, laser cooling forces are required not only in the longitudinal direction, but also in the transverse directions. With the resonance coupling method*, transverse temperature is transmitted into longitudinal direction, and we have already demonstrated horizontal laser cooling experimentally **. In the present paper, we describe an approach to extend this result to three dimensional cooling. The vertical cooling requires that the horizontal oscillation couples with the vertical oscillation. For achieving horizontal-vertical coupling, a solenoid in electron beam cooling apparatus is utilized with an experiment (Qx=2.07,Qy=1.07). For various solenoidal magnetic fields from 0 to 40Gauss, horizontal and vertical betatron tunes are measured by beam transfer function. For a certain region of the solenoidal magnetic field, these tunes are mixed up each other. By optimization of such a coupling, we aim to proceed to three dimensional laser cooling.
* Okamoto Phys. Rev. E 50, 4982 (1994)
** H. Souda et.al.,contribution to this conference

Poster Panel 61
ID: 2002 THPEB008 ***Insensitive Method to Power Supply Ripple in Resonant Slow Extraction*****, Kota Mizushima (Chiba University, Chiba),** Takuji Furukawa, Koji Noda, Toshiyuki Shirai (NIRS, Chiba-shi) - The betatron tune fluctuation due to the current ripple of power supplies brings the beam spill ripple through the stable area variation in resonant slow extraction. The effect becomes dominant especially in the case of the low beam rate extraction. The RF-knockout slow extraction method is insensitive to the tune ripple compared to the ordinary one because it uses the diffusion with the transverse RF field. However, the ripple effect appears even in the beam spill extracted by it. The amount of the separatrix fluctuation due to the tune ripple depends on the difference between the bare and the resonant tune,

and the sextupole magnetic strength. We measured the correlation between the beam spill and the tune ripple which was the artificially generated with low and high frequency components of 67 Hz and 1167 Hz near those of the real current ripple. We confirmed the reduction of the beam spill ripple by setting the tune away from the resonance while keeping the separatrix area. The comparison between the experimental results, the analytical calculation and the simulation will be reported.

Poster Panel 62
ID: 2683 WEPEA061 ***Comparative Analysis of Compton Scattering Cross Section Derived with Classical Electrodynamics and with use of Quantum Approach*****, Illya Vladimir Drebot** (NSC/KIPT, Kharkov), Illya Vladimir Drebot, Yurij Grigor'ev, Andrey Yurij Zelinsky (NSC/KIPT, Kharkov) - In the paper the expression for cross section of Compton scattering derived with classical electrodynamics approach is presented. The comparative analysis of the Compton cross section value calculated with the presented expression and with expression derived with quantum approach was carried out for the case of head on collision and low photon beam intensity. Results of the analysis show the good agreement of both approaches. It proves legitimacy of classical electromagnetic approach use for analysis of particle beam dynamics and estimation of generated x-ray beam parameters in laser electron storage rings.

Classification 5: Beam Dynamics and Electromagnetic Fields

Poster Panel 63
ID: 3450 THPE035 ***A Non-scaling FFAG Dispersion Suppressor*****, Richard Fenning** (Brunel University, Middlesex)**,** Richard Fenning, Akram Khan (Brunel University, Middlesex), Thomas Robert Edgecock (STFC/RAL, Chilton, Didcot, Oxon), David Kelliher, Shinji Machida (STFC/RAL/ASTeC, Chilton, Didcot, Oxon) **-** Purely scaling FFAG dispersion suppressors can never be perfect for all energies. This paper will show that a significant improvement may be possible if the scaling law is relaxed slightly and the multipole components are independently tuned. This will help towards the design of the gantry and transport line for the PAMELA project.

Poster Panel 64
ID: 2545 THPE024 ***Coupling and Vertical Dispersion Correction in the SPS*****, Glenn Vanbavinckhove** (CERN, Geneva)**,** Glenn Vanbavinckhove, Masamitsu Aiba, Rogelio Tomas (CERN, Geneva), Rama Calaga (BNL, Upton, Long Island, New York) **-** Consolidation of the coupling correction scheme in the LHC is motivated due to a missing skew quadrupole family in Sector 3-4 at the start-up in 2009. Simultaneous coupling and vertical dispersion correction using vertical orbit bumps at the sextupoles, was studied by analyzing turn-by-turn data. This scheme was tested in SPS where the optical structure of arc cells is quite similar to the LHC. In SPS, horizontal and vertical beam positions are measured separately with single plane BPMs, thus a technique to construct "pseudo double plane BPM" is also discussed.

Poster Panel 65
ID: 2516 THPE020 ***Scenarios for the ATF2 Ultra-Low Betas Proposal,*** **Eduardo Marin** (CERN, Geneva)**,** Eduardo Marin, Rogelio Tomas (CERN, Geneva), Philip Bambade (KEK, Ibaraki), Andrei Seryi, Glen White, Mark Woodley (SLAC, Menlo Park, California) **-** The current ATF2 Ultra-Low beta proposal was designed to achieve 20nm vertical IP beam size without considering the multipolar components of the FD magnets. In this paper we describe different scenarios that avoid the detrimental effect of these multipolar errors in the FD. The simplest approach consists in modifying the optics but other solutions are studied as the introduction of new higher order magnets or the replacement of the FD with SC technology. The practical aspects of such an upgrade are the tuning performance and the compatibility with existing devices and instrumentation. These are fully addressed in the paper.

Poster Panel 66
ID: 3634 THPD081 ***Reducing Energy Spread of the Beam by Non-isochronous Recirculation at the S-DALINAC*****, Florian Hug** (TU Darmstadt, Darmstadt)**,** Florian Hug, Asim Araz, Ralf Eichhorn, Norbert Pietralla (TU Darmstadt, Darmstadt) **-** The Superconducting Linear Accelerator S-DALINAC at the University of Darmstadt/ Germany is a recirculating Linac with two recirculations. Currently acceleration in the Linac is done on crest of the acceleration field using the maximum of the field in every turn. The recirculation of the beam is done isochronous without any longitudinal dispersion. In this recirculation scheme the energy spread of the resulting beam is determined by the stability of the used RF system. In this work we will present a new non-isochronous recirculation scheme, which uses longitudinal dispersion in the recirculations and an acceleration on edge of the accelerating field as it is done in microtrons. We will present beam dynamic calculations which show the usability of this system even in a Linac with only two recirculations and first measurements of longitudinal dispersion using RF monitors.
Funding Agency: DFG through SFB 634

Poster Panel 67
ID: 2252 THPE050 ***Real Beam Line Optics from a Synthetic Beam*****, Ryan Michael Bodenstein** (JLAB, Newport News, Virginia)**,** Ryan Michael Bodenstein, Yves Raymond Roblin, Michael George Tiefenback (JLAB, Newport News, Virginia) **-** The Continuous

Electron Beam Accelerator Facility (CEBAF) at Jefferson Lab can be described as a series of concatenated beamlines. Methods used to measure the Twiss parameters in closed orbit machines are not applicable in such open ended systems. We are using properly selected sets of real orbits in the accelerator, as one would for numerical analysis. The evolution of these trajectories along the beamline models the behavior of a synthetic beam which deterministically supplements beam profile-based Twiss parameter measurements and optimizes the efficiency of beamline tuning. Examples will be presented alongside a description of the process.

Funding Agency: Authored by Jefferson Science Associates, LLC under U.S. DOE Contract No. DE-AC05-06OR23177. The U.S. Government retains license to publish or reproduce this manuscript for U.S. Government purposes.

Poster Panel 68

ID: 1878 THPE082 ***Higher Order Mode Analysis of the SPL Cavities*****, Marcel Schuh** (CERN, Geneva; MPI-K, Heidelberg)**,** Marcel Schuh (CERN, Geneva; MPI-K, Heidelberg), Frank Gerigk, Joachim Tuckmantel (CERN, Geneva), Carsten Peter Welsch (Cockcroft Institute, Warrington, Cheshire; The University of Liverpool, Liverpool) **-** Higher Order Modes (HOMs) can severely limit the operation of superconducting cavities in a linac with high beam current, high duty factor and complex pulse structure. The full HOM spectrum has to be analyzed in order to identify potentially dangerous modes already during the design phase and to define their damping requirements. For this purpose a dedicated beam simulation code focused on beam-HOM interaction was developed, taking into account important effects like the HOM frequency spread, beam input jitter, different chopping patterns, as well as klystron and alignment errors. Here this code is used to investigate in detail the HOM properties of the cavities foreseen in the Superconducting Proton Linac (SPL) at CERN and their potential to drive beam instabilities. A special focus is set to HOM excitation by chopped pulses with high repetition rate and on the influence of HOMs on recirculating electron beams in the high-energy part of the SPL. Finally, the HOM characteristics of similar linac designs are presented and compared to the SPL.

Poster Panel 69

ID: 2130 THPE086 ***Non-Linear Parametric Effects and Beam Collapse at Motion of Accelerated Particles in Transversal Focusing Fields*****, Mykhaylo Vysotskyy** (National Taras Shevchenko University of Kyiv, Kiev)**,** Mykhaylo Vysotskyy, Vladimir Vysotskii (National Taras Shevchenko University of Kyiv, Kiev) **-** The new type of oriental motion, so called parametric channeling of accelerated charged particles with internal energy structure in crystals or transversal focusing fields (TFF) is studied*,**. Peculiarities of this motion are connected with parametric coupling of transversal oscillations of fast particle in TFF (e.g. averaged field of crystal plains) and oscillations caused by internal processes in particle. In the work parametric channeling are investigated for small charged mesomolecules, atomic ions and nuclei with internal resonances, relativistic electrons. It was shown that such parametric coupling leads to the possibility of beam cooling and "collapse": critical decrease of transversal oscillations of moving structured ion in TFF due to energy transfer from this ion to its own internal electron (for atomic ion) or its internal low energy nuclear state (for fast nuclei). Also it was shown that parametric beam cooling with the decrease of transversal energy can take place at axial relativistic electron beams channeling. This process is caused by the parametric coupling between quantized channeling states and electron spin states in effective magnetic field in moving system.

Footnotes

* M.V.Vysotskyy V.I.Vysotskii, N.V.Maksuyta. Journal of Surface Investigation, V.2, No 2 (2008) 245.

** V.I.Vysotskii, M.V.Vysotskyy. Journal of Surface Investigation, 2008, V.2, No 2 (2008), 253.

Poster Panel 70

ID: 2326 THPE015 ***Simplified Approach to Evaluation of Beam-beam Tune Spread Compression by Electron Lens*****, Alexander Leonidovich Romanov** (BINP SB RAS, Novosibirsk)**,** Alexander Leonidovich Romanov (BINP SB RAS, Novosibirsk), Vladimir Shiltsev, Alexander Valishev (Fermilab, Batavia) **-** One of the possible ways to increase luminosity of hadron colliders is the compensation of beam-beam tune-spread with an electron lens (EL). At the same time, EL as an additional nonlinear element in the lattice can increase strength of nonlinear resonances so that its overall effect on the beam lifetime will be negative. Time-consuming numerical simulations are often used to study the effects from the EL. In this report we present a simplified model, which uses analytical formulae derived for certain electron beam profiles. Based on these equations the idealized shapes of the compressed tune spread can be rapidly calculated. Obtained footprints were benchmarked against several reference numerical simulations for the Tevatron and RHIC in order to evaluate the selected configurations. One of the tested criteria was "folding" of the compensated footprint, which occurs when particles with different betatron amplitudes have the same tune shift. Also studied were the effects of imperfections, including misalignment of the electron and proton beams, and mismatch of their shapes.

Poster Panel 71

ID: 1818 TUPD004 ***Linear Betatron Coupling Studies in SIS18*****, Wafa Mahmood Daqa** (IAP, Frankfurt am Main)**,** Wafa Mahmood Daqa (IAP, Frankfurt am Main), Ingo Hofmann, Vladimir Kornilov, Jurgen Struckmeier (GSI, Darmstadt) **-** For high current synchrotrons and for the SIS18 operation as booster of the projected SIS100 it is important to improve the multi-turn injection efficiency. This can be achieved by coupling the transverse planes with skew quadrupoles, which can

move the particles away from the septum. Linear betatron coupling by skew quadrupole components in SIS18 including space charge effect was studied in an experiment using different diagnostic methods during the crossing of the difference coupling resonance. The beam loss was measured using a fast current transformer, the transverse emittance exchange was observed using a residual gas monitor and the coupled tunes were obtained from the Schottky noise spectrum. We compared the experimental results with simulation using PARMTRA which is a code developed at GSI.

Poster Panel 72

ID: 1879 TUPD021 ***Method to Extract Transfer Maps in the Presence of Space Charge in Charged Particle Beams*****, Edward William Nissen** (Northern Illinois University, DeKalb, Illinois)**,** Edward William Nissen, Bela Erdelyi (Northern Illinois University, DeKalb, Illinois), Shashikant L. Manikonda (ANL, Argonne) **-** This research involves a method for combining the intricate diagnostic tools for calculating quantities of interest such as tunes, dispersion and resonances from the single particle map of the system, with an accurate approximation of space charge effects on the beam. The space charge calculation involves a novel method of potential integration which allows for rapid Taylor expansion around singularities. This will allow for an accurate computation of space charge induced tune shifts and resonances, as well as allowing for experimental setups to discriminate between space charge caused issues, and lattice caused issues. The code used was COSY Infinity 9.0 which uses Differential Algebras to determine numerical derivatives to arbitrary order, and Normal Form methods to extract information from the map. The effects of space charge are added to the map using Strang splitting. External confounding factors such as the earths magnetic field are also addressed.

Funding Agency: This work is supported by the Department of Energy grant number: DE-FG02-08ER41532

Poster Panel 73

ID: 1782 TUPD002 ***Simulation and Observation of the Space Charge Induced Multi-Stream Instability of Linac Micro Bunches in the SIS18 Synchrotron*****, Sabrina Appel** (TEMF, TU Darmstadt, Darmstadt)**,** Sabrina Appel, Thomas Weiland (TEMF, TU Darmstadt, Darmstadt), Oliver Boine-Frankenheim (GSI, Darmstadt) **-** For the future operation as an injector for the FAIR project the SIS18 synchrotron has to deliver intense and high quality ion bunches with high repetition rate. One requirement is that the initial momentum spread of the injected coasting beam should not exceed the limit set by the SIS18 rf bucket area. Also the Schottky spectrum should be used to routinely measure the momentum spread and revolution frequency directly after injection. During the transverse multi-turn injection the SIS18 is filled with micro bunches from the UNILAC linac at 36 MHz. For low beam intensities the micro bunches debunch within a few turns and form a coasting beam with a Gaussian-like momentum spread distribution. With increasing intensity we observe persistent current fluctuations and an accompanying pseudo-Schottky spectrum. We will explain that the multi-stream instability of the micro bunch filaments is responsible for the turbulent current spectrum that can be observed a few 100 turns after injection. The current spectrum observed in the SIS18 and the results from a longitudinal simulation code will compared to an analytical model of the multi-stream instability induced by the space charge impedance.

Poster Panel 74

ID: 1809 TUPD003 ***Electron Cloud Studies for SIS-18 and for the FAIR Synchrotrons*****, Fedor Borisovich Petrov** (TEMF, TU Darmstadt, Darmstadt)**,** Fedor Borisovich Petrov, Thomas Weiland (TEMF, TU Darmstadt, Darmstadt), Oliver Boine-Frankenheim (GSI, Darmstadt) **-** Electron clouds generated by residual gas ionization pose a potential threat to the stability of the circulating heavy ion beams in the existing SIS-18 synchrotron and in the projected SIS-100. The electrons can potentially accumulate in the space charge potential of the long bunches. As an extreme case we study the accumulation of electrons in a coasting beam under conditions relevant in the SIS-18. Previous studies of electron clouds in coasting beams used Particle-In-Cell (PIC) codes to describe the generation of the cloud and the interaction with the ion beam. PIC beams exhibit much larger fluctuation amplitudes than real beams. The fluctuations heat the electrons. Therefore the obtained neutralization degree is strongly reduced, relative to a real beam. In our simulation model we add a Langevin term to the electron equation of motion in order to account for the heating process. The effect of natural beam fluctuations on the neutralization degree is studied. The modification of the beam response function as well as the stability limits in the presence of the electrons is discussed. Finally we will also address the electron accumulation in long bunches.

Poster Panel 75

ID: 1844 TUPD011 ***Intra-beam Scattering Formulas with Debye Shielding*****, Peicheng Yu** (TUB, Beijing)**,** Peicheng Yu, Jie Wei (TUB, Beijing), Hiromi Okamoto (HU/AdSM, Higashi-Hiroshima), Andrew Sessler (LBNL, Berkeley, California) **-** During the beam crystallization process, the main heating source is Intra-beam scattering (IBS), in which the Coulomb collisions among particles lead to a growth in the 6D phase space volume of the beam. The results of molecular dynamics (MD) simulation have shown an increase of heating rate as the temperature is increased from absolute zero, but then a peak in the heating rate, and subsequent decrease with ever increasing temperature*. This phenomenon has been carefully studied by Y. Yuri, H. Okamoto, and H. Sugimoto**. On the other hand, in the traditional IBS theory valid at high temperatures, heating rate is

monotonically increasing as the temperature becomes lower***. In this paper we attempt to understand the "matching" at low temperatures between the MD results and traditional IBS theory, by including many body effects in the traditional IBS theory. In particular the Debye shielding is included. We shall present how the traditional theory is modified by shielding, and show how this effect improves the "matching" with the results from MD.

Footnotes

* J. Wei, H. Okamoto, and A. Sessler, Phys. Rev. Lett. 80, 2606

** Y.Yuri, H. Okamoto, and H. Sugimoto, J. Phys. Soc. Jpn. 78, 124501

***A. Piwinski, Lect. Notes Phys. 296, 297 (1988)

Funding Agency: Work supported by the U.S. Department of Energy, Office of Basic Energy Sciences, under Contract No. DE-AC02-05CH11231.

Poster Panel 76

ID: 3056 TUPEA015 ***Focusing of an Ultrashort Electron Beam for Head-on Inverse Compton X-ray Experiment*****, Nuan-Ya Huang** (NTHU, Hsinchu)**,** Nuan-Ya Huang, Sidney Yang (NTHU, Hsinchu), Wai Keung Lau (NSRRC, Hsinchu), Hiroyuki Hama (Tohoku University, Sendai) **-** Design of an intense but tightly focused ultrashort electron beam for production of sub-hundred femtosecond X-ray pulses that based on head-on inverse Compton scattering (ICS) has been studied. The three dimensional (3D) space charge dynamics has been tracked and optimized throughout the whole beamline. It is found that electron pulses as short as 51 fsec can be produced by compressing the energy-chirped beam from a 2998 MHz rf gun with alpha magnet and rf linac operating at injection phase near zero crossing. This multi-bunch electron beam has an intensity of 38.7 pC per bunch and is accelerated to 27.6 MeV with an S-band linac structure. The compressed electron beam with normalized emittance ~ 3.2 mm-mrad is focused to 30 μm for scattering with an 800 nm, 3.75 mJ infrared Ti:Sapphire laser in the laser-beam interaction chamber. With this method, total peak flux of back-scattered X-ray photons as high as 7.9 x 10^17 photons/sec is achievable with shortest wavelength of 0.7 Å.

Poster Panel 77

ID: 2615 TUPD054 ***Multi-bunch Effect of Resistive Wall in the CLIC BDS*****, Raphael Mutzner** (EPFL, Lausanne)**,** Raphael Mutzner, Nicolas Mounet (EPFL, Lausanne), Giovanni Rumolo, Rogelio Tomas (CERN, Geneva), Tatiana Pieloni (PSI, Villigen) **-** Wake fields in the CLIC Beam Delivery System (BDS) can cause severe single or multi-bunch effects leading to luminosity loss. The main contributors in the BDS are geometric and resistive wall wake fields of the collimators and resistive wall wakes of the beam pipe. The present work focuses only on the multi-bunch effects from resistive wall. Using particle tracking with wake fields through the BDS, we have established the aperture radius, above which the effect of the wake fields becomes negligible. Our simulations were later extended to include a realistic aperture model along the BDS as well as the collimators. The two cases of 3TeV and 500GeV have been examined in this paper.

Poster Panel 78

ID: 2542 TUPD049 ***Transverse Mode Coupling Instability Measurements at Transition Crossing in the CERN PS*****, Sandra Aumon** (CERN, Geneva; EPFL, Lausanne)**,** Sandra Aumon (CERN, Geneva; EPFL, Lausanne), Pierre Freyermuth, Simone Silvano Gilardoni, Elias Métral, Giovanni Rumolo, Benoit Salvant, Rende Richard Steerenberg (CERN, Geneva) **-** Transition crossing in the CERN PS is critical for the stability of high intensity beams, even with the use of a second order gamma jump scheme. The intense single bunch beam used for the neutron Time-of-Flight facility (n-ToF) needs a controlled longitudinal emittance blowup at flat bottom to prevent a fast single-bunch vertical instability from developing near transition. This instability is believed to be of Transverse Mode Coupling (TMCI) type. A series of measurements taken throughout 2008 and 2009 aim at using this TMCI observed on the ToF beam at transition, as a tool for estimating the transverse global impedance of the PS. For this purpose, we compare the measurement results with the predictions of the HEADTAIL code and find the matching parameters. This procedure also allows a better understanding of the different mechanisms involved and can suggest how to improve the gamma jump scheme for a possible intensity upgrade of the n-ToF beam.

Poster Panel 79

ID: 2559 TUPD053 ***The Six Electromagnetic Field Components at Low Frequency in an Axisymmetric Infinitely Thick Single-Layer Resistive Beam Pipe*****, Nicolas Mounet** (CERN, Geneva; EPFL, Lausanne)**,** Nicolas Mounet (CERN, Geneva; EPFL, Lausanne), Elias Métral (CERN, Geneva) **-** In this study Zotter's formalism is applied to a circular infinitely long beam pipe made of a conductor of infinite thickness where an offset point-charge travels at any given speed. Simple formulae are found for the impedances in the low frequency regime where the usual classic thick wall formula does not apply anymore due to the very large skin depth compared to the pipe radius. In addition, new analytical formulae for the six electromagnetic field components in that regime were obtained, which enables us to give a rather complete physical picture at low frequency.

Poster Panel 80

ID: 2652 TUPD048 ***Amorphous Carbon Coatings for the Mitigation of Electron Cloud in the CERN SPS*****, Christina Yin Vallgren** (CERN, Geneva)**,** Christina Yin Vallgren, Gianluigi Arduini, Jeremie Bauche, Sergio Calatroni, Paolo Chiggiato, Karel Cornelis, Pedro Costa Pinto, Elias Métral, Giovanni Rumolo, Elena Shaposhnikova, Mauro Taborelli, Giovanna Vandoni

(CERN, Geneva) - Amorphous carbon coatings with low secondary electron yield have been applied to the liners in the electron cloud monitors and to vacuum chambers of three dipole magnets in the SPS. The electron cloud is completely suppressed for LHC type beams in these monitors even after 3 months air venting and no performance deterioration is observed after more than one year of SPS operation. Upon variation of the magnetic field in the monitors the electron cloud current maintains its intensity down to weak fields of some 40 Gauss, where fast conditioning is observed. This is in agreement with dark traces observed on the RF shields between dipoles. The dynamic pressure rise has been used to monitor the behavior of the magnets. It is found to be about the same for coated and uncoated magnets, apart from a weak improvement in the carbon coated ones under conditions of intense electron cloud. Inspection of the coated magnet is foreseen in order to detect potential differences with respect to the coated monitors. Measurements of the stray fields outside the dipoles show that they are sufficiently strong to induce electron cloud in these regions.

Poster Panel 81

ID: 2523 TUPD047 ***Head Tail Instability Observations and Studies at the Proton Synchrotron Booster*****, Diego Quatraro** (CERN, Geneva)**,** Diego Quatraro, Alan Findlay, Bettina Mikulec, Giovanni Rumolo (CERN, Geneva) - Since many years the Proton Synchrotron Booster (PSB) high intensity beams have shown head-tail instabilities in all of the four rings at around 100 ms after the injection. In this paper we present the latest observations together with the evaluation of the instability rise time and its dependence on the bunch intensity. The acquired head-tail modes and the growth rates are compared with HEADTAIL numerical simulations, which together with the Sacherer theory points at the resistive wall impedance as a possible source of the instability.

Poster Panel 82

ID: 2268 TUPD073 ***Effect of Bunch Shape on Electron-Proton Instability*****, Zhengzheng Liu** (IUCF, Bloomington, Indiana)**,** Zhengzheng Liu, Shyh-Yuan Lee (IUCF, Bloomington, Indiana), Sarah M. Cousineau, Viatcheslav V. Danilov, John Galambos, Jeffrey Alan Holmes, Michael Plum, Andrei P. Shishlo (ORNL, Oak Ridge, Tennessee) - The instability caused by the electron cloud effect (ECE) may set an upper limit to beam intensity in proton storage rings. This instability is potentially a major obstacle to the full intensity operation, at 1.5e14 protons per pulse, of the Spallation Neutron Source (SNS). High intensity experiments have been done with different sets of parameters that affect the electron-proton (e-p) instability, of which bunch intensity and bunch shape are considered as two main factors. In the experiment, the phase and amplitude of the second harmonic RF cavity are used to modify the bunch shape. Simulation with the beam dynamics code ORBIT has been carried out to compare with experimental results and to understand the impact of bunch shape on electron cloud build-up and beam stability. We have also attempted to benchmark the e-p model to predict the frequency spectrum and the RF buncher voltage threshold values against experimental results. Details and discussion will be reported in this conference.

Footnotes

* M.T.F. Pivi and M.A. Furman, PRSTAB 6, 034201 (2003)

** V. Danilov et. al, 39th ICFA Advanced Beam Dynamics Workshop, 2006

*** B. Macek et. al, PAC 2003

Poster Panel 83

ID: 1683 TUPEC053 ***Hellweg 2D Code for Electron Dynamics Simulations*****, Sergey Kutsaev** (MEPhI, Moscow)**,** Sergey Kutsaev (MEPhI, Moscow) - This paper introduces "Hellweg 2D" code, a special tool for electron dynamics simulation in waveguide accelerating structure. The underlying theory of this software is based on the numerical solutions of differential equations of particle motion. The effects considered in this code include beam loading, space charge forces, external focusing magnetic field. "Hellweg 2D" is capable to deal with multisectional accelerators. Along with a manual input of electrodynamical parameters of the cells, for disk-loaded structures they can be calculated automatically with a help of experimental data tables. In order to obtain the maximum capture in the buncher section, the optimizer of phase velocity and electric field strength functions is provided. The results of beam dynamics simulation of a hybrid accelerator with a standing wave buncher and traveling wave regular section are presented. In this accelerator both electrically and magnetically coupled structures are considered.

Poster Panel 84

ID: 2172 TUPEC050 ***Analysis of the Measurement of Electron Cloud Density under Various Beam-optics Elements in KEKB LER***, Puneet Jain (Sokendai, Ibaraki)**,** Puneet Jain (Sokendai, Ibaraki), Hitoshi Fukuma, Ken-ichi Kanazawa, Yusuke Suetsugu (KEK, Ibaraki) - Electron Cloud (ECLOUD) deteriorates the performance of proton and positron storage rings. Therefore it is desirable to understand the ECLOUD buildup in a given machine. The data taken by Retarded Field Analyzer (RFA) with a multi channel plate showed that the signal had the peaks coinciding with the positron bunch pattern if a high voltage of -2kV is applied to the retarded grid*. This suggests that the cloud electrons get maximum kick near the positron bunch. A computer program has been developed to study the near bunch ECLOUD density at KEKB LER (Low Energy Ring). In simulations, secondary electron emission is modeled according to the Furman and Pivi's model**. In this paper we compare the simulation results of the ECLOUD buildup with the experiments performed in KEK under different beam-optics elements.

Footnotes

* K. Kanazawa et al., PAC05, 1054.

** M. Furman and M. Pivi, PRST-AB, 5, 124404 (2002).

Poster Panel 85
ID: 3357 TUPEC057 ***Advances With Merlin - A Beam Tracking Code*****, James Molson** (Cockcroft Institute, Warrington, Cheshire; UMAN, Manchester) - MERLIN is a highly abstracted particle tracking code written in C++ that provides many unique features, and is simple to extend and modify. We have investigated the addition of high order wakefields to this tracking code and their effects on bunches, particularly with regard to collimation systems for both hadron and lepton accelerators. Updates have also been made to increase the code base compatibility with current compilers, and speed enhancements have been made to the code via the addition of multi-threading to allow cluster operation on the grid. In addition, this allows for simulations with large numbers of particles to take place. Instructions for downloading the new code base are given.

Poster Panel 86
ID: 3055 TUPEC065 ***A Second-order Electromagnetic Algorithm for Curved Dielectric Boundaries on the Yee Mesh*****, Carl Bauer** (CIPS, Boulder, Colorado), Carl Bauer, Gregory Werner (CIPS, Boulder, Colorado), John R. Cary (CIPS, Boulder, Colorado; Tech-X, Boulder, Colorado) - Dielectric materials may be used in future particle accelerator cavities since they are more resistant to electrical breakdown than metals, especially at higher frequencies. The accurate simulation of dielectric boundaries for complex 3D geometries poses a significant challenge. We have developed an electromagnetic algorithm that simulates curved 3D dielectric interfaces between materials with anisotropic dielectric constants. The algorithm is based on the Yee mesh and has second-order error in resonant frequencies. We have also successfully combined our new dielectric algorithm with a second-order algorithm for curved metallic boundaries. This allowed second-order convergence to be shown by comparison with an analytically solvable problem. Results will be shown for simulations of a dielectric sphere with isotropic dielectric constant inside a spherical metallic cavity and a photonic crystal of ellipsoids that had an anisotropic dielectric constant.

Poster Panel 87
ID: 2386 THPE001 ***Low Emittance Lattice Optimization Using Multiobjective Genetic Algorithm*****, Weiwei Gao** (USTC/NSRL, Hefei, Anhui), Weiwei Gao, Wei-min Li, Lin Wang (USTC/NSRL, Hefei, Anhui) - Low emittance is a desirable performance for high brightness synchrotron light source and damping ring. The work presented in this paper demonstrates that the lattice of a given electron storage ring, which has fixed circumference and magnet layout, can be optimized to obtain low emittance by using MOGA (Multi-objective Genetic Algorithm). Both dispersion-free and non-dispersion-free lattices of HLS (Hefei Light Source) upgrade project are computed as an illustration. Simulation result shows that this method is fast and straightforward.

Classification 6: Beam Instrumentation and Feedback

Poster Panel 88
ID: 2162 MOPD079 ***A Novel Synchrotron Radiation Interferometer for the Australian Synchrotron*****, Kent Peter Wootton** (Monash University, Monash University), Kent Peter Wootton (Monash University, Monash University), Mark James Boland (ASCo, Clayton, Victoria) **-** A new arrangement for the synchrotron radiation interferometer was proposed - as far as is known, it is unique in the world. The Young's-type interferometer is composed of two independent and optically identical paths, each with a single slit on a motorised translating stage. These two single slit patterns are interfered to produce a double slit diffraction pattern. This arrangement permits rapid scanning of the profile of fringe visibility as a function of slit separation. The interferometer was used on two beamlines at the Australian Synchrotron, the optical diagnostic and infrared beamlines. The interferometer was used to measure the coherence of the photon beam created by the electron beam source, for normal and low emittance couplings. A large change in fringe visibility was observed, proving the experimental arrangement. The interferometer was validated in the measurement of the width of a hard-edged single slit, akin to Thompson and Wolf's diffractometer. Optical simulations and measurements inform proposed modifications to the optical diagnostic beamline, so as to implement the interferometer as a regular diagnostic tool.
Funding Agency: This research was undertaken on the optical diagnostic, and infrared microspectroscopy beamlines at the Australian Synchrotron, Victoria, Australia.

Poster Panel 89
ID: 2428 MOPE055 ***Design for a Longitudinal Density Monitor for the LHC*****, Adam Jeff** (CERN, Geneva)**,** Adam Jeff, Enrico Bravin, Aurélie Goldblatt, Thibaut Lefevre (CERN, Geneva), Carsten Peter Welsch (The University of Liverpool, Liverpool) **-** Synchrotron radiation is currently used on LHC for beam imaging and for monitoring the proton population in the 3 microsecond abort gap. In addition to these existing detectors, a study has been initiated to provide longitudinal density profiles of the LHC beams with a high dynamic range and a 50ps time resolution. This would allow for the precise measurement both of the bunch shape and the number of particles in the bunch tail or drifting into ghost bunches. A solution is proposed based on counting synchrotron

light photons with two fast avalanche photo diodes (APD) operated in Geiger mode. One is free running but heavily attenuated and can be used to measure the core of the bunch. The other is much more sensitive, for the measurement of the bunch tails, but must be gated off during the passage of the core of the bunch to prevent the detector from saturating. An algorithm is then applied to combine the two measurements and correct for the detector dead time, after pulsing and pile up effects. Initial results from laboratory testing of this system are described in this paper.
Funding Agency: This work has been funded by the DITANET Marie Curie network.

Poster Panel 90
ID: 2040 MOPE054 ***Design of a 1.42 GHz Spin-Flip Cavity for Antihydrogen Atoms*****, Silke Federmann (CERN, Geneva),** Silke Federmann, Fritz Caspers, Edgar Mahner (CERN, Geneva), Bertalan Juhasz, Eberhard Widmann (SMI, Vienna) **-** The hyperfine transition frequency of hydrogen is known to a very high precision and therefore the measurement of this transition frequency in antihydrogen is offering one of the most accurate tests of CPT symmetry. The ASACUSA collaboration will run an experiment designed to produce ground state antihydrogen atoms in a CUSP trap. These antihydrogen atoms will pass with a low rate in the order of 1 per second through a spin-flip cavity where they get excited depending on their polarization by a 1.42 GHz magnetic field. Due to the small amount of antihydrogen atoms that will be available the requirement of good field homogeneity is imposed in order to obtain an interaction with as many antihydrogen atoms as possible. This leads to a requirement of an RF field deviation of less than ± 10 % transverse to the beam direction over a beam aperture with 100 mm diameter. All design aspects of this new spin-flip cavity, including the required field homogeneity and vacuum aspects, are discussed.

Poster Panel 91
ID: 2262 MOPD086 ***Beam Position Monitoring based on Higher Beam Harmonics for Application in Compact Medical and Industrial S-Band Linear Electron Accelerators*****, Marcel Ruf** (U. Erlangen-Nurnberg LHFT, Erlangen)**,** Marcel Ruf, Lorenz-Peter Schmidt (U. Erlangen-Nurnberg LHFT, Erlangen), Stefan Setzer (Siemens Med, Erlangen) **-** The usability of conventional BPM topologies in compact linear accelerators used for medical and industrial applications is very limited due to tight space restrictions in such systems. To overcome these limitations, a different approach tailored to S-Band system requirements is introduced and the setup and results for a demonstrator will be presented in this paper. The demonstrator uses capacitive pickups of the button type for displacement sensing; signal processing is based on commercially available hard- and software. Furthermore, a new beam induced signal processing architecture based on the evaluation of higher beam harmonics is presented and its capabilities for usage in compact linac machines are investigated. The test system allows for control of the beam position in the range of milliseconds with the help of feedback steering coils attached to standing-wave linac structures which are typically used in compact machines.
Funding Agency: Work supported by Bayerische Forschungsstiftung in the project "MEDieMAS - Effiziente Bestrahlungsgeraete fuer Krebstherapie (Efficient radiation systems for cancer therapy)", file number AZ-735-07

Poster Panel 92
ID: 3353 MOPD082 ***GEM-TPC Trackers for the Super-FRS at FAIR*****, Matti Kalliokoski (HIP, University of Helsinki),** Matti Kalliokoski, Francisco Garcia, Antti Numminen, Eija M. Tuominen (HIP, University of Helsinki), Rudolf Janik, Miroslav Pikna, Branislav Sitar, Peter Strmen, Imrich Szarka (Comenius University in Bratislava, Bratislava), Rauno Lauhakangas (Helsinki University, University of Helsinki) **-** The Super-FRS is a superconducting fragment separator that will be built as part of the FAIR facility. For the slow-extraction part of the beam diagnostics system a total of 32 detectors are needed for beam monitoring and for tracking and characterization of the produced ions. Since GEM-TPC detectors can perform over wide dynamic range without disturbing the beam, they are suitable for this kind of in-beam detection. We have studied the performance of a prototype GEM-TPC. The current status of the prototype detector and the measurement results are shown.

Poster Panel 93
ID: 1911 MOPE069 ***A 2-D Laser-wire Scanner at PETRA-III*****, Thomas Aumeyr** (JAI, Egham, Surrey)**,** Thomas Aumeyr, Grahame A. Blair, Stewart Takashi Boogert, Gary Boorman, Alessio Bosco (JAI, Egham, Surrey), Klaus Balewski, Eckhard Elsen, Vahagn Gharibyan, Gero Kube, Siegfried Schreiber, Kay Wittenburg (DESY, Hamburg) **-** The PETRA-III Laser-wire, a Compton scattering beam size measurement system at DESY, Hamburg uses an automated mirror to scan a Q-switched laser across the electron beam and is developed from the system previously operated at PETRA-II. This paper reports on recent upgrades of the optics, vacuum vessel and data acquisition. First emittance measurements and related systematic studies are presented.

Poster Panel 94
ID: 2274 MOPE071 ***Coherent Diffraction Radiation Longitudinal Beam Profile Monitor for CTF3*****, Maximilian Micheler** (JAI, Egham, Surrey)**,** Maximilian Micheler, Robert Ainsworth, Grahame A. Blair, Gary Boorman, Pavel Karataev, Konstantin Lekomtsev (JAI, Egham, Surrey), Roberto Corsini, Thibaut Lefevre (CERN, Geneva) **-** A setup for the investigation of Coherent Diffraction Radiation (CDR) from a conducting screen as a tool for non-invasive longitudinal electron beam profile diagnostics has been designed and installed

in the Combiner Ring Measurement (CRM) line of the CLIC Test Facility (CTF3, CERN). This setup also allows the measurements of Coherent Synchrotron Radiation (CSR) from the last bending magnet. In this report the status of the monitor development and results on the interferometric measurements of CDR and CSR spectra are presented. The CDR and CSR signal dependence on the klystron phase is reported. Additionally, an off-centre adapter flange has been installed to block the background in the CRM line and studies presenting the effect of this flange are displayed. The future plans for the system improvements are also discussed.

Poster Panel 95

ID: 3417 MOPE033 ***A New Beam Profile Diagnostic System based on the Industrial Ethernet*****, Yichao Xu** (SINAP, Shanghai)**,** Yichao Xu, Yongzhong Chen, Kecheng Chu, Lifeng Han, Yongbin Leng, Guobi Zhao (SINAP, Shanghai) **-** A new beam profile diagnostic system based on industrial Ethernet has been installed in Shanghai Deep Ultraviolet Free Electron Laser (SDUV-FEL) facility recently. By choosing GigE Vision cameras, the system provides better image quality over a long distance than before. Beam images are captured from the beam profile monitors which are controlled by air cylinders or step motors. In order to fit for the system expansibility and curtail the cables, all devices are operated through the Ethernet and distributed along the FEL facility. The approach to the design of the hardware and software will be described in this paper. Applications and experiment results will be shown in this paper as well.

Poster Panel 96

ID: 1754 MOPE073 ***Optimization Studies of Planar Supersonic Gas-jets for Beam Profile Monitor Applications*****, Massimiliano Putignano** (The University of Liverpool, Liverpool; MPI-K, Heidelberg)**,** Massimiliano Putignano (The University of Liverpool, Liverpool; MPI-K, Heidelberg), Kai-Uwe Kuehnel (MPI-K, Heidelberg), Carsten Peter Welsch (The University of Liverpool, Liverpool; Cockcroft Institute, Warrington, Cheshire; MPI-K, Heidelberg) **-** Supersonic gas-jets have attracted much interest as experimental targets in several fields of science since they combine low internal temperatures with high directionality. Axisymmetric jets have found widespread application, triggering a wealth of studies on their properties, while only a limited number of detailed studies have been done on planar jets. In this paper, the design of a beam profile monitor based on a planar supersonic gas-jet for use in the Ultra-low energy Storage Ring (USR) at the Facility for Antiproton and Ion Research (FAIR) in Germany is described. Optimization of the monitor requires investigation into different characteristic jet parameters. For that purpose extensive simulation work with the Gas Dynamics Tool (GDT) was done. The results of these studies are presented together with a description of a novel nozzle-skimmer configuration and an experimental test stand to benchmark the numerical results.

Funding Agency: Work supported by the EU under contract PITN-GA-2008-215080; Helmholtz Association of National Research Centers (HGF) under contract number VH-NG-328; GSI Helmholtz Centre for Heavy Ion Research GmbH.

Poster Panel 97

ID: 3210 MOPE027 ***Simulations for the Measurements of Longitudinal Bunch Profile using Coherent Smith-Purcell Radiation*****, Dai Wu** (TUB, Beijing)**,** Dai Wu, Wenxin Liu, Chuanxiang Tang (TUB, Beijing) **-** The coherent Smith-Purcell radiation (CSPR) has been demonstrated as an efficient technique for measuring the longitudinal profile of beam bunches. To measure the ultrashort beam bunches, the simulations for the measurements using CSPR are anlyzed with tools of three dimensional particle-in-cell simulations and Kramer-Kronig reconstruction. Different parameters such as rms length of beam bunch and profiles of grating are studied. Furthermore, the measurement device based on a Martin-Puplett Interferometer is introduced, in which noises and attenuation can be reduced.

Funding Agency: Supported by NSFC with grants (10735050, 10875070, 10905032), China Postdoctoral Foundations with grant (20080440031) and China Postdoctoral Science Special Foundation with grant (200902088).

Poster Panel 98

ID: 1874 WEPEB008 ***PLC Control System of the Deuteron Injector*****, Quanfeng Zhou** (PKU/IHIP, Beijing)**,** Quanfeng Zhou, Jia-er Chen, Zhiyu Guo, Yuanrong Lu, Shi Xiang Peng, Jie Zhao (PKU/IHIP, Beijing) **-** A compact remote PLC control system with S7-300 is being designed for PKUNIFTY (Peking University Neutron Imaging FaciliTY). At present stage, the front part for the deuteron injector¬, consisting of the electron cyclotron resonance (ECR) D+ ion source and the low energy beam transport (LEBT) system, is finished. The Human Machine Interface (HMI) is developed by the Siemens WinCC software to monitor and control the system, with the SQL2000 database to acquire and archive data. A Software-Redundant framework including two 315-2DPs enhances the system's safety for fear of CPU failure, and some other unstable environment factors are taken into account. Experiments proved its stability.

Funding Agency The National Science Foundation of China No.10675015 and No.10735020.

Poster Panel 99

ID: 2289 WEPEB040 ***Adaptive Scheme for the CLIC Orbit Feedback*****, Juergen Pfingstner** (CERN, Geneva)**,** Juergen Pfingstner, Hermann Schmickler, Daniel Schulte (CERN, Geneva), Michael Hofbaur (UMIT, Hall in Tirol) **-** The main challenge of the CLIC main linac optics is the preservation of the ultra-low beam emittance, despite the very strong wakefield and dispersive effects. Dynamic effects, which would lead to a rapid emittance increase,

have to be counteracted by using feedback (FB) systems. These FBs have to optimally attenuate ground motion (disturbances), in spite of drift of accelerator parameters (imperfect system knowledge). This paper presents a new FB strategy for the main linac of CLIC. It addresses the mentioned issues separately, with the help of an adaptive control scheme. The first part of this system is a system identification unit. It delivers an estimate of the time varying system behavior. The second part is a control algorithm, which uses the most recent system estimate of the identification unit. It uses H2 control theory to deliver an optimal prediction of the ground motion. This approach takes into account the frequency and space domain properties of the ground motion, as well as their impact on the emittance growth.

Poster Panel 100
ID: 1971 WEPEB079 ***Final Design and Features of the B-train System of CNAO*****, Giovanni Franzini** (INFN/LNF, Frascati (Roma))**,** Giovanni Franzini, Oscar Coiro, Donato Pellegrini, Mario Serio, Angelo Stella (INFN/LNF, Frascati (Roma)), Marco Pezzetta, Marco Pullia (CNAO Foundation, Milan) **-** CNAO, the Italian Centre of Oncological Hadrontherapy located in Pavia, is under commissioning and will be soon fully operational. It is based on a synchrotron that can accelerate carbon ions up to 400 MeV/u and protons up to 250 MeV for the treatment of patients. In this paper we present the subsystem, called B-Train, which has the purpose of measuring the magnetic field in a dedicated dipole connected in series with the sixteen dipoles of the synchrotron and to provide instantaneous values of the synchrotron field to the dipole power supply, to the RF, diagnostics and dump bumpers control systems, via optical lines, using a custom communication protocol. In order to measure the magnetic field with the specified precision (0.1G over 1.5T @ 3 T/s), a different approach has been taken with respect to previous versions of the system. The field is obtained by digitizing the voltage induced on a pick-up coil inserted in the gap of the dedicated dipole through a 18 bit, 1.25 Msamples/s ADC and integrating it by numerical methods. This paper describes the final design and features of the B-Train system, as well as the results obtained on the magnetic field readings precision.

Poster Panel 101
ID: 2114 MOPE050 ***Multi Optical Transition Radiation System for ATF2*****, Javier Alabau-Gonzalvo** (IFIC, Valencia), Javier *Alabau-Gonzalvo*, Cesar Blanch Gutierrez, Jose Vicente Civera, Angeles Faus-Golfe, Juan Jose Garcia-Garrigos (IFIC, Valencia), Juan Cruz, Douglas McCormick, Glen White (SLAC, Menlo Park, California) - In this paper we describe the design, installation and first calibration tests of a Multi Optical Transition Radiation (OTR) monitor system in the beam diagnostic section of the Extraction (EXT) line of ATF2, close to the multi wire scanner system. This system will be a valuable tool for measuring beam sizes and emittances from the ATF Damping Ring (DR). With an optical resolution of about 2 um an original OTR design demonstrated the ability to measure a 5.5um beam size in one beam pulse and to take many fast measurements. This gives the OTR the ability to measure the beam emittance with high statistics, giving a low error and a good understanding of emittance jitter. Furthermore the near by wire scanners will be a definitive test of the OTR as a beam emittance diagnostic device. The muti-OTR system design proposed here is based on the existing OTR1X, located after the septums at the entrance of the EXT line.

Classification 7: Accelerator Technology

Poster Panel 102
ID: 2412 THPEA030 ***Design and Analysis of RF Cavities for the Cyclotron CYCHU-10*****, Tongning Hu** (HUST, Wuhan)**,** Tongning Hu, Xiao Hu, Dong Li, Ping Tan, Jun Yang, Tiaoqin Yu (HUST, Wuhan) **-** The design study of a 10Mev compact cyclotron CYCHU-10 has been developed at Huazhong University of Science and Technology (HUST). We developed the basic shapes and dimensions and carried out the simulations for the CYCHU-10 cavities with 3D numerical calculation softwares in this paper. The distributions of electromagnetic field, temperature and displacements in cavities are illustrated as well, by means of the electromagnetic, thermal and structural analysis. In addition, This paper gives the frequency shift results after remodeling the cavities which deformed due to high frequency power dissipation under practical operation condition. This work helps to evaluate the performances of capacitive frequency trimmer design.

Poster Panel 103
ID: 1972 THPEA035 ***Multi-cell RF Deflecting System for Formation of Hollow High Energy Heavy Ion Beam*****, Alexey Sitnikov** (ITEP, Moscow)**,** Alexey Sitnikov, Nikolay Nikolaevich Alexeev, Alexander Golubev, Victor Koshelev, Timur Kulevoy, Sergey Minaev, Boris Sharkov (ITEP, Moscow), Dieter H.H. Hoffmann, Naeem A. Tahir, Dmitry Varentsov (GSI, Darmstadt) **-** Terra Watt Accumulator project (ITEP-TWAC) is aiming the accumulation of an ion beam accelerated up to 0.7 GeV/u in a storage ring providing intensity of heavy ions up to 10 power 12 particles per pulse for experiments on heavy ion beam-plasma interaction. For advanced experiments on high energy density physics the hollow cylindrical target is needed. A new method for RF rotation of the ion beam is applied for reliable formation of the hollow cylindrical beam. A principle of fast beam rotation by using a system of the multi-cell RF deflectors is considered in this paper. A four-cell H-mode deflecting

cavity operating at the frequency of 298 MHz has been developed; similar 1.5 m long cavities being applied for both x- and y- directions. The shape of the deflecting electrodes has been optimized in order to provide the uniform deflection over the whole aperture taking into account both electric and magnetic components of the RF field. A deflecting system and a focusing quadrupole triplet applied to the beam with the energy of 450 MeV/u and normalized transverse emittance of 10*pi mrad*mm may form the quasi-hollow configuration with the inner radius up to 1.5 mm and thickness of 1 mm.
Funding Agency: State contracts Rosatom N.4e.45.03.09.1086

Poster Panel 104
ID: 1952 THPEA040 ***Characteristics of the Parallel Coupled Accelerating Structure*****, Alexey Levichev** (BINP SB RAS, Novosibirsk)**,** Alexey Levichev, Viatcheslav Pavlov (BINP SB RAS, Novosibirsk), Vladimir Ivannikov, Igor Shebolaev (ICKC SB RAS, Novosibirsk), Yura Chernousov (ICKC, Novosibirsk) **-** The prototype of parallel coupled accelerating structure is developed. It consists of five accelerating cavities, common excitation cavity and RF power waveguide feeder. The excitation cavity is a segment of rectangular waveguide loaded by resonance copper pins. The excitation cavity operate mode is TE105. Connection between excitation cavity and accelerating cavities is performed by magnetic field. The theoretical model of the parallel coupled accelerating structure is developed. According to model the tuning and matching of the structure are performed. The electrodynamics characteristics are measured. In storage energy regime the accelerated electron beam is obtained.

Poster Panel 105
ID: 3005 THPEA027 ***Study on Frequency Change by 3D Reconstruction of Deformed Cavities of LINAC Collinear Load*****, Zhao Shu** (USTC/PMPI, Hefei, Anhui)**,** Zhao Shu, Lianguan Shen, Yuan Sun, Xiucui Wang (USTC/PMPI, Hefei, Anhui), Yuanji Pei (USTC/NSRL, Hefei, Anhui) **-** Thermal deformation of accelerating cavities affects their resonant frequency deeply. While conventional evaluation methodology is usually linear and rough, a new approach of 3D reconstruction was utilized to reconstruct the deformed solid geometry model. Nodal temperature and displacement distribution which is non-uniform were obtained in CAE software I-DEAS. First renewed the FE model by adding the nodal displacements to the coordinates of the corresponding nodes. Then extract and sort the boundary nodal data of the cavities according to which the section curves of the inner surfaces are obtained. Finally the deformed solid model enclosed by the inner surfaces was got and directly saved as IGES files which can be imported into CST Microwave Studio for electro-magnetic analysis. The data processing and reconstruction operation is done in self-developed JAVA programs by which the accurate influence of deformation of different shapes on frequency change can be acquired. This method is now applied on a 10kW collinear load of a LINAC on which a symmetrical double helix water jacket is adopted in cooling system. The error of reconstruction is controlled within one micrometers.
Footnotes
* Tian Z. etc., "Finite Element Analysis of RF Cavity", Parietti L. etc., "Thermal/Structural Analysis and Frequency Shift", Anthony, etc. "A NURBS-based Technique for Subject-specific Construction".
Funding Agency: Supported by National Natural Science Foundation of China.

Poster Panel 106
ID: 3704 WEPEC012 ***Study of Multipacting in a Coaxial Coupler*****, Asavari Santosh Dhavale** (BARC, Mumbai)**,** Asavari Santosh Dhavale (BARC, Mumbai), Kailash Chander Mittal (BARC-EBC, Mumbai) **-** The performance of superconducting cavity, couplers and ceramic windows is greatly affected due to multipacting. The present paper describes the multipacting simulations carried out on the co-axial coupler. The equation of motion of electron in RF field is calculated numerically. The enhanced counter function (ECF) is calculated to find out whether a particular electron will give rise to the multipacting.The simulation was carried out for a co-axial coupler having the inner conductor diameter of 34.78 mm and outer conductor diameter of 80 mm at a RF frequency of 350MHz, 700MHz and 1050MHz.

Poster Panel 107
ID: 3709 WEPEC049 ***Novel Geometry for the LHC Crab Cavity*****, Benjamin Hall** (Cockcroft Institute, Lancaster), Benjamin Hall, Graeme Burt, Christopher Lingwood (Cockcroft Institute, Lancaster), Haipeng Wang (JLAB, Newport News, Virginia) - The planned luminosity upgrade to LHC is likely to necessitate a large crossing angle and a local crab crossing scheme. For this scheme crab cavities align bunches prior to collision. The scheme requires at least four such cavities, a pair on each beam line either side of the interaction point (IP). Upstream cavities initiate rotation and downstream cavities cancel rotation. Cancellation is usually done at a location where the optics has re-aligned the bunch. The beam line separation near the IP necessitates a more compact design than is possible with elliptical cavities such as those used at KEK. The reduction in size must be achieved without an increase in the operational frequency to maintain compatibility with the long bunch length of the LHC. This paper proposes a suitable superconducting variant of a four rod coaxial deflecting cavity (to be phased as a crab cavity), and presents analytical models and simulations of suitable designs.

Poster Panel 108
ID: 2256 WEPEC005 ***Optical Inspection of SRF Cavities at DESY*****, Sebastian Aderhold** (DESY, Hamburg)**,** Aderhold (DESY, Hamburg) **-** The prototype of a camera system developed at KEK/Kyoto University

for the optical inspection of the inner surface of cavities is in operation at DESY since September 2008. More than 20 prototype nine-cell cavities for the European XFEL have been inspected. The unique illumination system combined with the optical sensors allows for the in-situ search of surface defects in high resolution. Such defects may limit the gradient when causing a breakdown of the superconducting state (quench). The comparison of features detected in the optical inspection and hotspots from the temperature mapping during RF-measurements give evidence for correlations. Consecutive inspections of cavities in different stages of the surface preparation process monitor the evolution of surface defects. There are examples for defects traced from the untreated surface condition to the RF-test with temperature map, which identify the defect as the quench location.

Poster Panel 109

ID: 2331 WEPEC051 ***3D Simulation of the Effects of Surface Defects on Field Emitted Electrons*****, Arash Zarrebini** (Imperial College of Science and Technology, London)**,** Arash Zarrebini, Kenneth Long, Mihailo Ristic (Imperial College of Science and Technology, London), Rebecca Seviour (Cockcroft Institute, Lancaster) **-** The ever-growing demand for higher beam energies has dramatically increased the risk of RF breakdown, limiting the maximum achievable accelerating gradient. Field emission is the most frequently encountered RF breakdown where it occurs at regions of locally enhanced electric field. Electrons accelerated across the cavity as they tunnel through the surface in the presence of microscopic defects. Upon Impact, most of the kinetic energy is converted into heat and stress. This can inflict irreversible damage to the surface, creating additional field emission sites. This work aims to investigate, through simulation, the physics involved during both emission and impact of electrons. A newly developed 3D field model of an 805 MHz cavity is generated by COMSOL Multiphysics. Electron tracking is performed using a Matlab based code, calculating the relevant parameters needed by employing fourth Order Runge Kutta integration. By studying such behaviours in 3D, it is possible to identify how the cavity surface can alter the local RF field and lead to breakdown and subsequent damages. The ultimate aim is to introduce new surface standards to ensure better cavity performance.

Poster Panel 110

ID: 1849 WEPEC043 ***Design, Fabrication and Testing of a Single Spoke Cavity at Peking University*****, Zhongyuan Yao** (PKU/IHIP, Beijing)**,** Zhongyuan Yao, Xiangyang Lu, Kui Zhao (PKU/IHIP, Beijing) **-** The design of a 450MHz β=0.2 superconducting single spoke cavity has been finished at Peking University. For most current test results, the performance limitation in a spoke cavity is the thermal-magnetic quench with little or no field emission, the major goal of geometry optimization is minimizing Bpk. In this poster, the optimization of the spoke cavity is described in detail. The RF simulation gives the optimum RF parameters Epk/Eacc=2.65 and Bpk/Eacc=5.22mT/(MV/m). Low Bpk/Eacc will provide a high gradient cavity. The mechanical properties of the cavity are also studied by simulation. Stiff ribs are used to offer a credible mechanical stability. The impacts of mechanical errors on cavity RF performance are analyzed. Conclusion shows that single spoke cavity is robust with respect to mechanical errors, and gives directions on cavity fabrication. Fabrication art has been fixed. Considering reducing welding connections at peak magnetic field area, the art has been improved, and the cross-sections of spoke bar and cavity barrel are formed by deep drawing without welding. The processing is under going now. The post-processing and vertical test will be done at early of 2010.

Poster Panel 111

ID: 1780 WEPEC041 ***Manufacturing of the First Main Accelerator with TESLA-like 9-cell SRF Cavities at Peking University*****, Feisi He** (PKU/IHIP, Beijing)**,** Feisi He (PKU/IHIP, Beijing) **-** The main accelerator for the PKU-FEL project, which is under construction, has been manufactured, while the beam commissioning will be done after the power source and the LHe system are ready. In this poster, some technical issues in the manufacturing progress are reported, including: the TIG welding of the LHe vessel made of Ti and the superconducting cavity made of Nb in a glove box filled with argon; the demagnetization of the vacuum vessel made of Fe, to decrease the residual magnetic field in the cavity region, which is caused by the magnetization of the vessel during machining and geomagnetism, under 20 mGs; the manufacturing and low power testing of the main power coupler.

Funding Agency: Supported by National Basic Research Program(No. 2002CB713600) and NSFC(No. 10775010)

Poster Panel 112

ID: 2121 WEPEC042 ***Tuning for the First 9-cell TESLA Cavity of PKU*****, Liu Yang** (Peking University, Beijing)**,** Liu Yang (Peking University, Beijing) **-** A method based on circuit model is used to tune the first home-made 9-cell TESLA type superconducting niobium cavity at Peking University. After tuning, a flat field profile with a final π-mode frequency within 3 kHz of target frequency is achieved. The field flatness is measured by bead-pull method, and the relative electric field is calculated from the frequency shift perturbed by the bead stepping along the axis of the cavity.

Poster Panel 113

ID: 3483 WEPEC034 ***Various Rinsing Effects to Mitigate Contaminants Brought by BCP on Niobium SRF Cavity Surface*****, Puneet Veer Tyagi** (Sokendai, Ibaraki)**,** Puneet Veer Tyagi (Sokendai, Ibaraki), Hitoshi Hayano, Shigeki Kato, Michiru Nishiwaki, Takayuki Saeki, Motoaki Sawabe (KEK, Ibaraki) **-** Buffered chemical polishing (BCP) has been widely used as a final

recipe of the surface treatment for niobium cavities and there is still much room to improve this technology since it is environment friendly, cheaper and simpler than electro-polishing. To examine BCPed surface in detail, we carried out BCP experiment followed by various rinsing methods on a series of niobium samples at KEK. As a result of the BCP process some contaminants like fluorine, carbon, etc. have been detected at the surfaces which may be the prominent cause of limiting the performance of SRF cavities. To remove these contaminants, various rinsing processes such as ultra pure water rinse, ultrasonic pure water rinse, alcoholic rinse, detergent rinse, high pressure water rinse (HPR) had been tested after the BCP. The preliminary results show that, only HPR had potential to mitigate these contaminants. In this article, we describe the surface analysis results using X-ray photo electron spectroscopy etc and a comparative study of niobium BCPed samples followed by above mentioned rinsing processes.

Poster Panel 114

ID: 2327 THPD088 ***Study of Coupler's Effects in ILC Like Lattice*****, Arun Saini** (University of Delhi, Delhi)**,** Arun Saini (University of Delhi, Delhi), Andrea Latina, Andrei Lunin, Kirti Ranjan, Nikolay Solyak, Vyacheslav P. Yakovlev (Fermilab, Batavia) **-** It is well known that insertion of a coupler into a RF cavity breaks the rotational symmetry of the cavity, resulting in an asymmetric field. This asymmetric field results in a transverse RF Kick. This RF kick transversely offsets the bunch from the nominal axis & it depends on the longitudinal position of the particle in the bunch. Also, insertion of coupler generates short range transverse wake field which is independent from the transverse offset of the particle. These effects cause emittance dilution and it is thus important to study their behavior & possible correction mechanisms. These coupler effects, i.e. coupler's RF kick & coupler's wake field are implemented in a beam dynamics program, Lucretia. Simulations are performed for main linac & bunch compressor of International Linear Collider (ILC) like lattices. Results are compared with Placet results & a good agreement has been achieved.

Poster Panel 115

ID: 1693 THPEA072 ***Model of HeI/HeII Phase Transition for the Superconducting Line Powering LHC Correctors*****, Monika Sitko** (CUT, Krakow)**,** Monika Sitko, Blazej Skoczen (CUT, Krakow) **-** The array of corrector magnets in the LHC is powered by means of a superconducting line attached to the main magnets. The subcooling time of the line has to be minimized in order not to delay the operation of the collider. The corresponding cable-in-conduit problem is formulated in the framework of two-fluid model and the Gorter-Mellink law of heat transport in superfluid helium. A model of lambda front propagation along the narrow channel containing superconductors and liquid helium is presented. The one-dimensional model* adopts plane wave equations to describe lambda front propagation. This approach to normal-to-superfluid phase transition in liquid helium allows to calculate the time of subcooling and the temperature profile on either side of the travelling front in long channels containing superconducting bus-bars. The model has been verified by comparing the analytical solutions with the experimental results obtained in the LHC String 2 experiment. The process of the LHC Dispersion Suppressors subcooling has been optimized by using the presented model. Based on the results, a novel concept of copper heat exchanger for LHC DS operating in superfluid helium is introduced.

Footnotes

* M. Sitko, B. Skoczeń, Modelling HeI-HeII phase transformation in long channels containing superconductors, Int. Journal of Heat and Mass Transfer, Vol. 52, Issues 1-2,pp. 9-16, 2009.

Poster Panel 116

ID: 2521 TUPEA026 ***High Reliability Design using Programmable Logic Devices applied to the Machine Interlock Systems of the LHC and SPS at CERN*****, Maciej Kwiatkowski** (CERN, Geneva)**,** Maciej Kwiatkowski, Alejandro Castaneda, Bruno Puccio, Iván Romera, Benjamin Todd (CERN, Geneva) **-** Machine Interlock systems for the CERN SPS and LHCmake extensive use of Programmable Logic Devices (PLD) to implement their safety critical functions. The dependability (reliability, safety, availability and maintainability) of these functions is difficult to determine: the use of Hardware Description Language (HDL) in the design phase requires careful consideration to ensure system behaviour. Simulation of function is a key consideration; behavioral simulation does not always give results which match real hardware, and although Gate-level simulations match hardware they are time consuming, making them somewhat impractical. In both cases, code coverage is a basic requirement. Hardware testing is also required to validate the implementation, proving that final hardware conforms to specification. This paper describes how the receiver module of the Safe Machine Parameter (SMP) system is being engineered, highlighting the techniques and processes which are currently being developed by CERN in order to maximize the safety of systems relying on PLD. The ultimate goal is to produce a set of guidelines which can be used to develop any dependable hardware which uses PLDs.

Poster Panel 117

ID: 2118 TUPEA032 ***A New Timing System: the Real-time Synchronized Data Bus*****, Ming Liu** (SINAP, Shanghai)**,** Ming Liu, Dekang Liu, Chongxian Yin, Liying Zhao (SINAP, Shanghai) **-** Currently, the real-time data transfer system is widely implemented in the accelerator control system. If timing system and real-time data transfer system could be combined into one uniform system, it would be convenient to build distributed feedback system, fast interlock system and so on. So, a new timing system, the real-time synchronized data bus is

developed to realize this idea. The architecture of the system and the hardware prototype design are introduced in the paper. The data exchange mechanism and system specification, including timing trigger synchronization accuracy, timing jitter relative to RF clock, data transfer rate and latency are described in detail. Redundant topology structure and fiber length compensation are specially considered. In the end, the results of testing in lab are presented.

Poster Panel 118

ID: 1846 TUPEA062 ***LLRF and RF System Models for the LHC with Application to Longitudinal Dynamics Effects*****, Themis Mastorides** (SLAC, Menlo Park, California)**,** Themis Mastorides, John Fox, Claudio Hector Rivetta, Daniel Van Winkle (SLAC, Menlo Park, California), Philippe Baudrenghien (CERN, Geneva) **-** Radio Frequency (RF) accelerating system noise and non-idealities can have detrimental impact on the LHC performance through longitudinal motion and longitudinal emittance growth. For example, disturbances on the accelerating voltage from system noise and harmonic/sub-harmonic spectral lines of the klystron power supply ripple can contribute to beam motion and diffusion. The LHC RF station-beam interaction is simulated via engineering-level models of the LLRF and RF systems to study the dynamics of the station and the beam. We model the RF station at high current and with future upgraded operating conditions of the LHC, study optimal configuration techniques, and estimate operational limits of the Beam-LLRF system. Non-idealities and noise of the implementation are modeled to study bunch centroid stability, position, and longitudinal motion. The Fokker-Planck diffusion coefficients that describe the bunch shape and diffusion are estimated as a function of the RF and Low Level RF configurations, and the system's technical characteristics. The effect of the operating configurations on the 50 Hz power supply ripple line and the related particle losses during the ramp are estimated.

Funding Agency: This work supported by the DOE through the US LHC Accelerator Research Program (LARP) and under contract #DE-AC02-76SF00515.

Poster Panel 119

ID: 3685 TUPEA053 ***Piezo Control for Lorenz Force Detuned SC Cavities of DESY FLASH*****, Konrad Przygoda** (TUL-DMCS, Lodz)**,** Konrad Przygoda, Andrzej Napieralski, Tomasz Pozniak (TUL-DMCS, Lodz), Mariusz Krzysztof Grecki (DESY, Hamburg) **-** DESY FLASH accelerator is composed of 6 accelerating modules. The single accelerating module contains 8 superconducting resonant cavities. Since FLASH operation is dedicated for various energy physics experiments such as high current beam acceleration or SASE tuning, the sc cavities are Lorentz force detuned when operated with high gradient accelerating fields*. The ACC 3, 5 and 6 cryomodules are equipped with piezo tuners allow compensating of dynamic detuning during the RF pulse. In order to assure the simultaneous control of all available piezo tuners a distributed, multichannel digital and analogue piezo control system was applied. The paper describes the main parts of the system as well as its efficiency measurements obtained during high current beam acceleration (9 mA tests) performed in DESY. The piezo tuners were operable for 23 cavities for several hours. Moreover, the first piezo sensor measurements using double stack piezos installed in ACC 6 cryomodule are briefly demonstrated.

Footnotes

* M. Grecki, A. Andryszczak, T. Poźniak, K. Przygoda, S. Sękalski, "Compensation of Lorentz Force Detuning For SC Linacs (With Piezo Tuners)", Proceedings of EPAC 2008, pp. 862-864.

Funding Agency: The research leading to these results has received funding from the European Commission under the EuCARD FP7 Research Infrastructures grant agreement no. 227579

Poster Panel 120

ID: 2600 TUPEA074 ***Kanthal Alloy based S-Band Collinear Load R&D for Linear Accelerators*****, Yuan Sun** (USTC/PMPI, Hefei, Anhui)**,** Yuan Sun, Lianguan Shen, Zhao Shu, Xiucui Wang (USTC/PMPI, Hefei, Anhui), Yuanji Pei (USTC/NSRL, Hefei, Anhui) **-** Collinear load is a substitute for waveguide load to miniaturize irradiation accelerators and make the system compact. A key technology is to design coaxial cavities coated with certain attenuating material inside which will terminate the residual power, meanwhile the operating frequency of 2856MHz retains. For lossy metals such as Kanthal (25%Cr-5%Al-Fe) alloy, a simulation design method is created based on a conventional cavity test structure. Simulations of the load cavities reveal that the resonance frequency falls linearly as circumferential coating increases, while it appears parabolic as longitudinal coating increases on the disks, with a minimum presenting at about 29mm away from the axis. Adjusting original cavity dimensions will compensate the deviation. Attenuation constants of the cavities rise linearly as the coating increases; however the coating on the disks affects more. Six load cavities of $2\pi/3$ mod are designed with uniform absorption of the remnant power. The total one-way attenuation achieves -18.83dB. The cavities have been developed, with Kanthal alloy thermal-sprayed inside and the resonance frequencies and Q factors are compared with theoretical values.

Funding Agency: This work is supported by the NSFC (No. 10775128) and Innovation Funding for Graduates of USTC.

Poster Panel 121

ID: 2159 TUPEA078 ***Electron Injection into a Cyclic Accelerator using Laser Wakefield Acceleration*****, Yaroslav V. Getmanov** (BINP SB RAS, Novosibirsk), Yaroslav V. Getmanov, Oleg A. Shevchenko (BINP SB RAS, Novosibirsk), Nikolay Vinokurov (BINP SB RAS, Novosibirsk; NSU, Novosibirsk) - We consider a technique for electron injection into a cyclic accelerator

using the laser wakefield acceleration (LWFA) technique. Accelerators with this type of injector can be used for different purposes due to lower size, cost and low radiation hazard. To use the LWFA technique it is necessary to create a small gas cloud inside the accelerator vacuum chamber. But it leads to the increase of particle losses due to scattering on residual gas atoms. Therefore we propose to use magnesium as evaporated gas because of its high absorbability ¿ its atoms stick to walls at the first contact. We presented estimations of the LWFA-based injection system parameters, including maximum stored current. The proposed technique looks very prospective for compact accelerators and storage rings.

Panel 122

ID: 2672 WEPEC047 ***New Methods for Thin Film Deposition an First Investigations of the use of High Temperature Superconductors for Thin Film Cavities*****, Anna Gustafsson** (CERN, Geneva), Anna Gustafsson, Sergio Calatroni, Wilhelmus Vollenberg (CERN, Geneva), Rebecca Seviour (Cockcroft Institute, Lancaster) - Niobium thin film cavities have shown good and reliable performance for LEP and LHC, although there are limitations to overcome if this technique should be used for new accelerators such as the ILC. New coating techniques like High Power Impulse Magnetron Sputtering (HiPIMS) has shown very promising results and we will report on its possible improvements for Nb thin film cavity performance. Current materials used in accelerator SRF technologies operate at temperatures below 4 K, which require complex cryogenic systems. Researchers have investigated the use of High Temperature Superconductors (HTS) to form RF cavities, with limited success*. We propose a new approach to achieve a high-temperature SRF cavity based on the superconducting 'proximity effect'**. The superconducting proximity effect is the effect through which a superconducting material in close proximity to a non-superconducting material induces a superconducting condensate in the latter. Using this effect we hope to overcome the problems that have prevented the use of HTS for accelerating structures so far. We will report the preliminary studies of magnetron sputtered thin films of Cu on Nb.

* E. J. Minehara et al, Superconductivity 3, p277 (1990)
** R. Seviour et al, Superlattices and Microstructures, 25, p647 (1999)

The research leading to these results has received funding from the European Commission under the FP7 Research Infrastructures project EuCARD, grant agreement no. 227579.

Poster Panel 123

ID: 2083 WEPEC084 ***Higher Order Mode Properties of Superconducting Parallel-Bar Cavities*****, Subashini Uddika De Silva** (ODU, Norfolk, Virginia; JLAB, Newport News, Virginia), Subashini Uddika De Silva, Jean Roger Delayen (ODU, Norfolk, Virginia; JLAB, Newport News, Virginia) Registered - The superconducting parallel-bar cavity* has properties that makes it attractive as a deflecting or crabbing rf structure. For example it is under consideration as an rf separator for the Jefferson Lab 12 GeV upgrade and as a crabbing structure for a possible LHC luminosity upgrade. Initial cavity shape optimization has been performed to obtain a high transverse deflecting voltage with low surface fields. We present here a study of the Higher Order Mode (HOM) properties of this structure. Frequencies, R/Q and field profiles of HOMs have been evaluated and are reported.

* J.R. Delayen and H. Wang, Phys. Rev. ST Accel. Beams 12, 062002 (2009).

Classification 8: Applications of Accelerators, Technology Transfer and Industrial Relations

Poster Panel 124

ID: 2115 MOPEB067 ***The Novel Method of Focusing-SANS with Rotating Magnetic Sextupole Lens and Very Cold Neutrons*****, Masako Yamada** (Kyoto ICR, Uji, Kyoto)**,** Masako Yamada, Masahiro Ichikawa, Yoshihisa Iwashita, Toshiji Kanaya, Hiromu Tongu (Kyoto ICR, Uji, Kyoto), John Marland Carpenter, Lal Jyotsana (ANL, Argonne), Shane J. Kennedy (ANSTO, Menai), Ken Andersen, Peter Geltenbort, Bruno Guerard, Giuliana Manzin (ILL, Grenoble), Kenji Mishima, Hirohiko M. Shimizu (KEK, Ibaraki), Norifumi L. Yamada (KEK, Tsukuba), Masahiro Hino, Masaaki Kitaguchi (KURRI, Osaka), Markus Bleuel (RID, Delft), Katsuya Hirota (RIKEN, Wako, Saitama) **-** We have developed a motorized magnetic lens for focusing of pulsed white neutron beams. The lens is composed of two concentric permanent magnet arrays, in sextupole geometry, with bore of 15 mm and magnet length of 66 mm. The inner magnet array is stationary, while the outer array is rotated (the frequency of the modulation of magnetic field inside the bore $\nu \leq 25$Hz), providing a sextupole magnetic field gradient range of $1.5\text{x}10^{4}\text{T/m}^{2} \leq g' \leq 5.9\text{x}10^{4}\text{T/m}^{2}$. By synchronization of a pulsed neutron beam with the sinusoidal modulation of the magnetic field in the lens, the beam is focused, without significant chromatic aberration, over a wide neutron wavelength band. We have constructed a focusing-SANS (Small Angle Neutron Scattering) test bed on the PF2-VCN (Very Cold Neutron) beam line at the Institut Laue-Langevin in Grenoble. The beam image size matched the source size ($\approx$ 3mm) over of wavelength range of $30\text{Å} \leq \lambda \leq 48\text{Å}$ with focal length of ~ 2.3 m. Further, we have demonstrated the performance of this device for high resolution time-of-flight (tof) SANS for a selection of polymeric &

biological samples, in a compact geometry of just 5 m.

Poster Panel 125
ID: 2016 MOPEA001 ***Production and Characterisation of Inverse Compton Scattering X-rays with a 17 MeV Electron Beam*****, Anne-Sophie Chauchat** (THALES, Colombes)**,** Anne-Sophie Chauchat, Jean-Pierre Brasile (THALES, Colombes), Alain Binet, Vincent Le Flanchec, Jean-Paul Nègre (CEA, Arpajon), Jean-Michel Ortega (CLIO/ELISE/LCP, Orsay) **-** Inverse Compton scattering is a well-known process to produce X-rays. Thanks to recent progress in accelerators and laser field, such sources have been developed worldwide. The ELSA facility (CEA DAM DIF, Arpajon, France), a linear electron accelerator, has just made its own source. The 17 MeV electron beam interacts with a 532 nm laser to provide a pulsed 10 keV X-ray source. Careful spatial and temporal overlappings of the bunches were required to observe the X-ray profile on radio-luminescent imaging plates. The aim of this source is to validate some technical process and simulation codes to design a compact X-ray source for industrial and medical applications. Instrumentation developments and experimental results are presented.

Poster Panel 126
ID: 3105 MOPEA067 ***PIC Simulation of the Coaxial Magnetron for Low Energy X-band Linear Accelerators*****, Jiaqi Qiu** (TUB, Beijing)**,** Jiaqi Qiu, Huaibi Chen, Chuanxiang Tang (TUB, Beijing) **-** For the miniaturization of low energy linear accelerators, X-band pulsed magnetron with stable performance of 1.5 MW peak power is needed to be developed. This paper presents the 3D particle-in-cell (PIC) of an X-band coaxial magnetron. A time evolved electron flow exhibits N/2 spokes in the simulations, which confirms the generation of pi-mode. Computer modeling indicates the mode competition in the startup process according to the spectra. By changing the DC voltage, we got the voltage-current characteristics of this magnetron, and comparison with the experiment was also been presented.