FCC Week 2019

Report of Contributions

https://indico.cern.ch/e/727555

Contribution ID: **40** Type: **Presentation**

EuroCirCol WP2+3 FCC-hh design

Monday, June 24, 2019 11:00 AM (30 minutes)

Primary author: DALENA, Barbara (Université Paris-Saclay (FR))

Presenter: DALENA, Barbara (Université Paris-Saclay (FR))

Session Classification: Plenaries

Track Classification: FCC-hh accelerator

Contribution ID: **41** Type: **Presentation**

EuroCirCol WP4 - Vacuum system

Monday, June 24, 2019 11:30 AM (30 minutes)

Primary author: PEREZ, Francis (ALBA-CELLS)

Presenter: PEREZ, Francis (ALBA-CELLS)

Session Classification: Plenaries

Track Classification: FCC-hh accelerator

Contribution ID: **397** Type: **Presentation**

Gaugino Masses at 100 TeV

Thursday, June 27, 2019 2:10 PM (20 minutes)

We discuss prospects of studying supersymmetric model at future pp circular collider (FCC) with its centre-of-mass energy of ~100 TeV. We pay particular attention to the model in which Wino is lighter than other supersymmetric particles and all the gauginos are within the kinematical reach of the FCC, which is the case in a large class of so-called pure gravity mediation model based on anomaly mediated supersymmetry breaking. In such a class of model, charged Wino becomes long-lived with its decay length of ~6 cm, and the charged Wino tracks may be identified in particular by the inner pixel detector; the charged Wino tracks can be used not only for the discrimination of standard model backgrounds but also for the event reconstructions. We show that precise determinations of the Bino, Wino, and gluino masses are possible at the FCC. For such measurements, information about the charged Wino tracks, including the one about the velocity of the charged Wino using the time of the hit at the pixel detector, is crucial. With the measurements of the gaugino masses in the pure gravity mediation model, we have an access to more fundamental parameters like the gravitino mass.

This study has been submitted to JHEP (arXiv:1901.10389).

Primary authors: MOROI, Takeo (The University of Tokyo); ASAI, Shoji (University of Tokyo (JP)); CHIGUSA, So (University of Tokyo); SAWADA, Ryu (University of Tokyo (JP)); TANAKA, Junichi (University of Tokyo (JP)); UNO, Kenta (University of Tokyo (JP)); SAITO, Masahiko (University of Tokyo (JP)); KAJI, Toshiaki (Waseda University (JP)); TERASHI, Koji (University of Tokyo (JP))

Presenter: TERASHI, Koji (University of Tokyo (JP))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **398** Type: **Poster**

JAI Student Project on scSPS

Tuesday, June 25, 2019 4:09 PM (1 minute)

Future Circular Collider for hadrons (FCC-hh) requires a high energy injector. Upgrading the current LHC injector, the Super Proton Synchrotron (SPS), to a superconducting synchrotron (scSPS) could provide adequate extraction energy up to 1.3TeV. Presented here are results of a design study for such an upgrade with a focus on the lattice design, dipole, quadrupole, and sextupole magnets, and RF cavities. In particular, the challenge of the increased energy swing is addressed, from injection to the scSPS at 26GeV to extraction at 1.3TeV. A design for a dispersion suppressor is suggested and the cell dimensions optimised to fit in the existing SPS tunnel. Preliminary designs for the magnets are proposed, including a study of the operating temperature and field quality. A single cell superconducting RF cavity design is presented, with a 200MHz operating frequency, and the large bandwidth requirements are discussed.

Primary authors: ROSS, Aimee Jaye (University of Oxford (GB)); Mr DYKS, Luke (University of Oxford); Mr POSTHUMA DE BOER, David (University of Oxford); Ms ALDEN, Siobhan (Royal Holloway); Mr DALESSANDRO, Gian Luigi (Royal Holloway); Mr HARRYMAN, Daniel (Royal Holloway); Mr BACKHOUSE, Michael (Imperial College London)

Co-authors: VAN RIESEN-HAUPT, Leon (University of Oxford (GB)); TSESMELIS, Emmanuel (CERN)

Presenter: VAN RIESEN-HAUPT, Leon (University of Oxford (GB))

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **399** Type: **Presentation**

Status of the SuShi septum project

Wednesday, June 26, 2019 8:30 AM (20 minutes)

For the extraction of the proton beam from the FCC-hh ring with a compact system, a septum magnet with a magnetic field of at least 3 Tesla is desired. In one of the proposals this device would be realized by the combination of a passive superconducting shield and a dedicated special magnet based on the canted cosine theta concept. After the encouraging tests with different shield prototypes a project has been launched to design and construct a fully fledged small-scale demonstrator prototype. The talk will present the status of the project, including the mechanical design and finite-element simulations.

Primary authors: NOVAK, Martin Istvan; Dr BARNA, Daniel (Wigner Research Centre for Physics); ATANASOV, Miroslav Georgiev (CERN); BORBURGH, Jan (CERN); KIRBY, Glyn (CERN)

Presenter: NOVAK, Martin Istvan

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **400** Type: **Poster**

Industrialization of 16T Nb3Sn magnet production for HE-LHC and FCC

Tuesday, June 25, 2019 4:01 PM (1 minute)

Cost-effective manufacturing of Nb3Sn magnets for HE-LHC and FCC could be achieved through optimization of HL-LHC magnet manufacturing performance using key performance indicators (KPI) such as cost and quality. However, optimization of Nb3Sn magnet manufacturing performance is computationally expensive due to the large number of manufacturing parameters, design variables, and KPI, whose interrelationships need to be modeled and optimized in order to achieve target performance. Thus, probabilistic modeling using Bayesian networks and dimensional analysis conceptual modeling (DACM) framework is proposed to model production cost. Next, a dimension reduction method using graph centrality theory is proposed to enable screening of variables into groups for optimization, based on their level of influence on performance targets.
To achieve KPI-driven performance optimization based on real data from HL-LHC magnet production, a continuous production monitoring platform known as Manufacturing Execution System (MES) is proposed considering the requirements of the production. The MES implementation is assisted by Leanware (Finland) to provide functionalities such as, resource monitoring, magnet component traceability within facility, production scheduling and execution, and support in-process quality control. The MES, Bayesian Networks and dimension reduction based analytics methods enable cost-driven optimization and accurate cost-drivers identification in Nb3Sn magnet production.

Primary author: Mr CHAKRABORTI, Ananda (Tampere University (FI))

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Presenter: Mr CHAKRABORTI, Ananda (Tampere University (FI))

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **401** Type: **Presentation**

Development of a T_c test stand to analyze superconducting thin-film coatings

Tuesday, June 25, 2019 11:06 AM (18 minutes)

The need for particle accelerators and circular colliders capable of reaching energies beyond the state of the art machines, such as the LHC, is resulting in extensive efforts on the development of the required technologies. Among the challenges, the development of new SRF cavities capable of providing higher accelerating fields is critical. To this end, among the several possibilities, current research is exploring A15 compounds as thin film coating materials, in particular Nb3Sn on copper substrate. Presently, the achievement of the literature values for bulk materials of the critical temperature is one of the major challenges. In this work, we present a dedicated test stand that has been commissioned at the Central Cryogenic Laboratory at CERN for contactless, inductive measurements of the critical temperature of superconducting thin film samples deposited on copper. We also present, as proof of principle, the measurement of the critical temperature of a bulk Nb sample performed with the presented test stand.

Primary author: FONNESU, Dorothea (CERN)

Co-authors: BREMER, Johan (CERN); Dr KOETTIG, Torsten (CERN)

Presenter: FONNESU, Dorothea (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **402** Type: **Poster**

Optimal beam dilution pattern of the FCC-hh ring using beating frequencies

Tuesday, June 25, 2019 4:15 PM (1 minute)

In order to avoid the damage of the dump target of the FCC-hh ring, the beam will be swept over its surface in a spiral pattern, using dilution kickers oscillating in the x/y planes with 90 degree phase difference, and an amplitude changing with time. Whereas the natural time-dependence of the amplitude is a convex function (the exponential decay of a damped oscillating circuit $\exp(-t/\tau)$), the optimal shape can be shown to be concave, i.e. have a steeper slope towards small radii, producing a flat energy deposition. This waveform is difficult to realize directly with a dedicated electric circuit. Deviations from the optimal shape lead to areas with an energy deposition density over the damage threshold, or if this is to be respected, to the necessity of the overspecification of the kickers and the absorber in terms of bending power and size, respectively. We propose the realization of the optimal pattern using two beating frequencies. This method has the advantage of using very simple circuitry (independent damped oscillators) which interfere only in their effect on the beam. Besides the demonstration of the concept, a sensitivity analysis to the circuit parameters will be presented.

Primary authors: BARNA, Daniel (Hungarian Academy of Sciences (HU)); Mr FACSKÓ, Benedek (Eötvös Loránd University); LECHNER, Anton (CERN)

Presenter: Mr FACSKÓ, Benedek (Eötvös Loránd University)

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **403** Type: **Poster**

OpenMARS Modelling Approach for Accelerator Availability Studies

Tuesday, June 25, 2019 4:08 PM (1 minute)

FCC availability studies identified a need for combined operations and availability software. This finding led to the development of OpenMARS approach in collaboration with Tampere University and Ramentor Oy. This present how key features of the approach are used in a collider availability model and existing OpenMARS literature.

Primary authors: NIEMI, Arto (CERN); PENTTINEN, Jussi-Pekka (Ramentor Oy)

Presenter: NIEMI, Arto (CERN)

Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **404** Type: **Poster**

Hybrid Positron Source for FCC-ee

Tuesday, June 25, 2019 3:31 PM (1 minute)

We study a hybrid positron source based on the radiation of high energy (GeV) photons by coherent bremsstrahlung in the oriented single crystal, and a subsequent amorphous target for the photons. The primary electron beam could be accelerated to 4.46 GeV energy for the current setup of FCC-ee. It is possible to set photon radiation peak on 3.08 GeV with the proper orientation of the crystal. Second target will be used to convert photons into e+e- pairs. Then positrons with energy around 1.54 GeV will be captured and send to the dumping ring. One of the advantages of the method is the direct high-energy positron beam production. This method is simple since it does not require further acceleration of low energy positrons. Second advantage is the small radiation and pair production angles (~$1/\gamma$) due to the high energy of particles. Another advantage is the possibility of producing longitudinally polarized positrons starting with longitudinally polarized electrons. The dependence of the efficiency of positron production on the target material, thickness, orientation as well as parameters of the positron beam at various energies are presented.

Primary authors: APYAN, Armen (A.I. Alikhanyan National Science Laboratory (ANSL)); ZIMMERMANN, Frank (CERN)

Presenter: APYAN, Armen (A.I. Alikhanyan National Science Laboratory (ANSL))

Session Classification: Poster session

Track Classification: FCC-ee accelerator

Contribution ID: **406** Type: **Presentation**

HOM and heating with smaller central IP beam pipe

Thursday, June 27, 2019 11:24 AM (18 minutes)

We present a modification of the Interaction Region beam pipe for dilution of the beam energy loss. This approach allows decreasing the diameter of the central beryllium pipe to 20 mm, as a request for further improvement of the Interaction Region and giving more freedom for the FCC detector. Additionally we discuss how additional IR elements like BPMs, bellows and flanges may influence on the beam energy loss.

Primary author: NOVOKHATSKI, Alexander (SLAC National Accelerator Laboratory)

Co-authors: SULLIVAN, Michael Kenneth (SLAC National Accelerator Laboratory (US)); BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Presenter: NOVOKHATSKI, Alexander (SLAC National Accelerator Laboratory)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **407** Type: **Poster**

Soldered and diffusion-bonded splices between Nb3Sn Rutherford cables for graded high-field accelerator magnets

Tuesday, June 25, 2019 3:59 PM (1 minute)

The existing designs of the 16 T dipoles of the Future Circular Collider (FCC) consider the use of Nb3Sn grading. Since 2017 a collaboration between CERN and Swiss Plasma Center has been aiming at developing and qualifying intergrade splices. The main goal is obtaining a low electrical resistance (<1 nΩ) at magnetic field higher than 10 T and at a ratio of 1/3 between operational and critical current. Such splices would preferentially be internal splices, i.e. inside the winding pack. One solution is crimped-soldered splice between overlapped cables. Its manufacturing and test in SULTAN is presented in this talk. Preliminary results show also that diffusion-bonded splices are a "clean" potential solution, in the sense that they would avoid the use of fluxing agents. However, their implementation inside a dipole is more complex and must be demonstrated. With this purpose, in this talk, the design of a single pancake racetrack model-coil is discussed. One diffusion-bonded splice is located at each end of the coil, following the curvature in order to reduce the space occupied. The splices form during the coil heat treatment. As diffusion-bonded splices require pressure at high temperature, the clamping fixture that applies the required level of pressure is designed under the constraint of limited space availability for its assembly. We will present progress towards the construction of this model coil, which is expected to be tested by the end of 2019.

Primary author: Mr D'AURIA, Vincenzo (EPFL-SPC)

Co-authors: Dr SARASOLA, Xabier (EPFL-SPC); Dr KUMAR, Mithlesh (EPFL-SPC); BRUZZONE, Pierluigi (EPFL-SPC)

Presenter: Mr D'AURIA, Vincenzo (EPFL-SPC)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **408** Type: **Poster**

The top quark pair cross section at the threshold at FCC-ee

Tuesday, June 25, 2019 3:52 PM (1 minute)

Preliminary studies of top quark pair production in e+e- collision at the production threshold will be presented, where the FCC-ee fast simulation including full particle flow is used.

Primary authors: Mr MANCINI, Mathias (Vrije Universiteit Brussel); Prof. BLEKMAN, Freya (IIHE, Vrije Universiteit Brussel (BE))

Presenter: Mr MANCINI, Mathias (Vrije Universiteit Brussel)

Session Classification: Poster session

Track Classification: Physics

Contribution ID: **409** Type: **Presentation**

Advanced design study of superconducting septum magnet for FCC

Wednesday, June 26, 2019 8:50 AM (20 minutes)

A novel high field septum magnet with truncated cosine theta concept is a key component of FCC. Due to extreme high beam rigidity of FCC, an adequate high field superconducting septum magnet is required to construct the extraction beam line with a reasonable length. By utilizing NbTi technology, a cross section and mechanical design concept for the coil-end of a 4 T septum magnet was presented at FCC Week 2018. It was proved that the concept is very promising. We present our advanced design work such as studies on manufacturing sensitivity to magnetic field quality as well as the 3-dimensional modeling and the magnetic-field evaluation.

Primary author: SUGITA, Kei (GSI)

Co-authors: ATANASOV, Miroslav Georgiev (CERN); BORBURGH, Jan (CERN); FISCHER, Egbert; SPILLER, Peter-Jurgen; SANZ ULL, Alejandro (Eindhoven Technical University (NL))

Presenter: SUGITA, Kei (GSI)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **410** Type: **Presentation**

Transient conjugate heat transfer numerical simulation in superfluid helium

Wednesday, June 26, 2019 11:40 AM (20 minutes)

Computational simulations of superfluid helium are needed in order to improve the design of the cooling system of superconducting magnets in particle accelerators and to achieve a better understanding of the transient phenomena during magnet quenches. A conjugate heat transfer numerical model based on the C++ toolbox OpenFOAM is implemented to three-dimensional case studies involving superfluid helium and heating sources. The governing equations of the solver are modified according to the Kitamura's model, a simplified version of the two-fluid model developed by Khalatnikov which is based on the assumption that the thermo-mechanical effect term and the Gorter-Mellink mutual friction term prevail on the others in the superfluid component momentum equation. Simulations are performed with the thermal conductivity function of superfluid helium both from theory and the formulation used by Sato, who normalized the function according to a different heat exponential coefficient determined from data analysis. An empirical calculation of the Kapitza conductance is adopted in order to simulate the thermal resistance at the interface between helium and solids. Steady-state and transient simulations are compared to experimental data available in the literature.

Primary authors: VITRANO, Andrea; BRUCE, romain (CEA Saclay); Dr BAUDOUY, Bertrand (CEA Paris-Saclay)

Presenter: VITRANO, Andrea

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **411** Type: **Presentation**

Recent progress and trends in development of high-field HTS coated conductors

Thursday, June 27, 2019 2:45 PM (15 minutes)

Progress in development and processing of HTS-coated conductors is presented regarding general trends and particular cases of the double-disordered YBCO conductors. These coated tapes with a length of 400-600 m show already a very high in-field critical current density, up to 1000 A/mm2 at 20 T, B//c, 4.2 K. Potential for further gaining of critical currents and current density is discussed regarding compensation of intrinsic strains and stresses and optimization of deposition temperature kinetic. Efficient methods for characterization of the long tapes are discussed in a view of creation of feasible techniques that on the basis of 77 K measurements allow an evaluation of critical currents and current densities in high and ultra-high fields at helium temperatures. A successful interaction of the development program with the EASITrain EC supported program is demonstrated employing analysis of gained synergistic effects.

Primary authors: USOSKIN, Alexander (BRUKER HTS); Dr BETZ, Ulrich (Bruker HTS GmbH); Mr GNILSEN, Johannes (Bruker HTS GmbH); Dr SCHLENGA, Klaus (Bruker HTS GmbH)

Presenter: USOSKIN, Alexander (BRUKER HTS)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **412** Type: **Poster**

Economic analysis of superconducting magnet production

Tuesday, June 25, 2019 3:38 PM (1 minute)

This study reveals the industrial impact potentials of key processes needed in the construction of an intensity frontier electron-positron collider and identifies new application fields. Suppliers and manufacturing partners of CERN benefit from their know-how being used in other markets in order to improve their internal efficiency and competitivity on the world-market. Higher cost effectiveness and leveraging further markets ultimately translates into lower costs of the superconducting magnets of a future high-energy particle collider.

Method
The study aims to find new application fields for the three most promising technologies and processes (superconducting rutherford cable, thermal treatment and vaccum impregnation with epoxy) by utilizing the TCL method. The most valuable application fields are identified by calculating Benefit Relevance and Strategic Fit.

Results
Among the 38 identified application fields, following three high potential application fields can be highlighted:
• Highly efficient wind turbines
• Efficient recycling of scrap metal
• Management of highly-activated radioactive waste

Primary authors: MEHNER, Barbara; SCHREIBER, Daniel; MAYRHOFER, Ferdinand (WU University); LEDERMÜLLER, Frederik; HARTIG, Heinrich; GUTLEBER, Johannes (CERN); KRETZSCHMAR, Linn; HAUSBERGER, Matthias

Presenter: MAYRHOFER, Ferdinand (WU University)

Session Classification: Poster session

Track Classification: Economics

Contribution ID: **414** Type: **Poster**

Estimation and scaling laws of impedances and beam instabilities from LHC to FCC-hh

Tuesday, June 25, 2019 4:12 PM (1 minute)

Beam instabilities caused by electron clouds and the resistive wall impedance are potential intensity limitations for the FCC-hh. Similar to the LHC, electron cloud build-up results in heat load and possibly beam instabilities. Consequently, the FCC-hh beam screen will be coated partially with a low secondary emission yield (SEY) layer, which will affect also the impedance. The impedances and the electron cloud build-up thresholds are estimated, using the detailed geometry of the FCC-hh beam screen, additional coating, and different SEY models. The simulation results are compared to the LHC. In addition, such resulting effects as instability growth rate, TMCI threshold, and heat load are analyzed. The numerical and analytical results of the heat load due to the electron cloud build-up scaling with beam energy are presented.

Primary author: ASTAPOVYCH, Daria (TU Darmstadt)

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Presenter: ASTAPOVYCH, Daria (TU Darmstadt)

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **415** Type: **Poster**

Dynamic Pressure in the LHC - Influence of Ions Induced by Ionization of Residual Gas by Both the Proton Beam and the Electron Cloud

Tuesday, June 25, 2019 4:10 PM (1 minute)

Ultra-High Vacuum is an essential requirement to reach design performances in high-energy particle colliders. For the future HL-LHC or FCC study, the understanding of the beam interactions with the vacuum chamber is fundamental to provide solutions to mitigate the pressure rises induced by electronic, photonic and ionic molecular desorption. Studies were performed on the ions, produced by molecular ionization generated by the proton beam and the electron cloud, and stimulating molecular desorption by the surface bombardment. In-situ measurements were carried out, on the LHC Vacuum Pilot Sector (VPS)* during the LHC RUN II, to monitor the dynamic pressure, and to collect the electrical signals due to the electron cloud and to the ions interacting with the vacuum chamber walls. In parallel, the ions behaviour in the VPS was simulated to determine the longitudinal and transversal velocity kicks, and the energy spectra. Computation of the dynamic pressure in the VPS was also performed.

Primary author: BILGEN, Suheyla (Centre National de la Recherche Scientifique (FR))

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Presenter: BILGEN, Suheyla (Centre National de la Recherche Scientifique (FR))

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **416** Type: **Poster**

Field test results of self-calibrating cryogenic mass flow meter WEKASENSE

Tuesday, June 25, 2019 3:30 PM (1 minute)

WEKA developed together with Karlsruhe Institute of Technology (KIT) a mass flow meter for cryogenic applications. The sensor is based on a new thermal measurement principle developed and verified by KIT. After successful validation of the self-calibrating capability of the sensor at cryogenic conditions in the TOSKA facility in Karlsruhe, the sensor was installed in several field test applications.
This poster explains the functional principle of the sensor, its main advantages compared to existing solutions and focuses on the experiences and results that were gained from field test installations in different cryogenic facilities.

Primary authors: OKANOVIC, Miralem (WEKA AG); BOERSCH, Michael (WEKA AG); ERNI, Pascal (WEKA AG); CONSOGNO, Guido (WEKA AG); Mr DRACHE, Johannes (WEKA AG); Mr OERTIG, Daniel (WEKA AG); Dr GROHMANN, Steffen (KIT); Mr JANZEN, Andreas (KIT, now General Electric); Mr EBERSOLDT , Andreas (KIT); Mrs BURGER, Birgit (KIT)

Presenter: OKANOVIC, Miralem (WEKA AG)

Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **417** Type: **Presentation**

Geodetic Infrastructure & Alignment –Planning and Studies

Thursday, June 27, 2019 11:35 AM (25 minutes)

In the last year some preliminary work on planning for the FCC has been carried out for both the geodetic infrastructure required and the survey and alignment activities. It is necessary to have the geodetic infrastructure in place before the civil engineering works start, some aspects even before the call for tender, and to start research into more precise techniques and instrumentation for the transfer of position from the surface underground.

Survey and alignment studies to date have primarily been focused on the hadron accelerator, but in the next few years they will turned towards the FCC-ee machine. The misalignment tolerance for this machine can drive both the geodetic infrastructure and the alignment system required. The current concept for the alignment system is that proposed for CLIC. Studies will be undertaken to consider alternative concepts that would still meet the lower precision required for the FCC-ee.

The current results from the planning analysis will be presented, together with details of the proposed studies.

Primary author: JONES, Mark (CERN)

Presenter: JONES, Mark (CERN)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **419** Type: **Presentation**

Two new approaches of estimating the Polarization in High Energy Electron Storage Rings

Wednesday, June 26, 2019 9:42 AM (18 minutes)

I give an overview of our analytical and numerical work on the spin polarization in high-energy electron storage rings including progress since our ICAP18 contributions (see: https://bt.pa.msu.edu/ICAP18) and our IAS contribution (see: http://iasprogram.ust.hk/hep/2019/workshop-accelerator.php). We study the possibility of polarization for FCC-ee and CEPC. Our work is based on the so-called Bloch equation for the polarization density introduced by Derbenev and Kondratenko in 1975. By finding a system of stochastic differential equations underlying the Bloch equation, we are able to approximate the Bloch equation analytically and to solve the latter numerically in an efficient way. We also give an outline of the standard approach, which is based on the Derbenev-Kondratenko formulas. We
stress the differences and similarities between the Bloch-equation approach and the standard approach to estimating the polarization. We are supported by a DOE grant (Award Number: DE-SC0018008), titled: "Re-evaluation of Spin-Orbit Dynamics of Polarized e^+e^- Beams in High Energy Circular Accelerators and Storage Rings: Theory and Computation".

Primary authors: Dr APPELO, Daniel (University of Colorado Boulder); Dr BARBER, Desmond P. (DESY); Prof. ELLISON, James A. (University of New Mexico); Dr HEINEMANN, Klaus (University of New Mexico); Mr BEZNOSOV, Oleksii (University of New Mexico)

Presenter: Dr HEINEMANN, Klaus (University of New Mexico)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **420** Type: **Poster**

Test of HTS Demonstrator Coils at High Field and Variable Temperature in the SULTAN Facility

Tuesday, June 25, 2019 3:58 PM (1 minute)

The testing capabilities of SULTAN have been recently expanded by installing a removable cryostat, which enables the test of accelerator relevant conductors and small insert coils at variable temperature and with a background field of 10.9 T. The cryostat is equipped with High Temperature Superconductor (HTS) current feedthroughs, which can provide 9.5 kA at 50 K to the sample. A series of sub-scale racetrack coils (referred to as FeaTHeR-M0 coils) has been produced at CERN. These coils are wound with REBCO-Roebel cable and aim at testing fabrication techniques, and gaining experience in quench detection and protection. The coils FeaTHeR-M0.4 and M0.5 have been recently tested in SULTAN at high field and temperatures between 4.8 and 50 K. We will report the results of these tests, showing that they were limited by the joint resistance and the apparent resistance across the coil, which increased dramatically after the tests at high field.

This work is partly supported by EuCARD-2, which is co-funded by the partners and the European Commission through the Capacities 7th Framework Programme under the Grant Agreement GA312453.

Primary author: SARASOLA, Xabier (EPFL)

Co-authors: BRUZZONE, Pierluigi (EPFL-SPC); SEDLAK, Kamil (EPFL Lausanne); STEPANOV, Boris (EPFL-SPC); VAN NUGTEREN, Jeroen (CERN); KIRBY, Glyn (CERN); DE RIJK, Gijs (CERN); BOTTURA, Luca (CERN); ROSSI, Lucio (CERN)

Presenter: SARASOLA, Xabier (EPFL)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **421** Type: **Poster**

Cooling of the refrigerant with chilled water before the inlet of the compressor

Tuesday, June 25, 2019 3:39 PM (1 minute)

A general rule is presented, which describes in which cases it is energetically advantageous to cool the inlet stream to a compressor with chilled water. This feature is investigated specifically for the Nelium refrigerator for the cooling of the beam screens of the Future Circular Collider. It turns out that with this modification of the process the required overall power consumption is reduced, the speed requirements on the turbo compressor are reduced, the size of the first cryogenic heat exchanger is reduced and the cooldown capability of the refrigerator is increased. The additional investment costs are moderate, because at each refrigerator location there exists already a chilled water production and distribution system.

Primary authors: QUACK, Hans (TU Dresden); HOLDENER, Fridolin (shirokuma GmbH); SAVELYEVA, Sofiya (Technische Universität Dresden); KLOEPPEL, Steffen (TU Dresden); HABERSTROH, Christoph (TU Dresden)

Presenter: HOLDENER, Fridolin (shirokuma GmbH)

Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **422** Type: **Poster**

Niobium Polishing for SRF applications

Tuesday, June 25, 2019 3:36 PM (1 minute)

This work deals with the development and qualification of micro-mechanical polishing (MMP) of niobium complex parts for superconductive radio-frequency (SRF) applications. The aim of the mechanical polishing study was to evaluate the possibility to recover RF surfaces by changing their topographic structure, the smoothening of the surface defects, such as scratches or impacts, and the limitation of the material removal quantity by the electro/chemical etching (BCP, EP). However the softness and the high ductility of niobium make its surface finish very difficult and challenging. The qualification of the MMP process was based on several niobium specimens with initial different surface roughness and various shape complexity (weld bands or interior form). Two types of micro-cutting-tools were used during MMP treatment and the maximal material removal was targeted. The improvement of surface topography in terms of Ra & Rz was measured by optical machine and contact device. The thickness and dimensional measurements were realized to evaluate the material removal and its uniformity. The SEM observation of the MMP polished surfaces was carried out to identify the size of incrusted microtools and therefore the thickness of affected layer to be removed. The chemical and electrical polishing (BCP, EP) was performed and the final SEM observation was done to confirm the contamination removal. The surface roughness measurements was repeated as well to evaluate the gain in term of surface finish when using the MMP technology in SRF parts preparation. The qualification was positive mainly for the combination of MMP & EP where all inclusions of media were removed and the uniform mirror-like surface of Ra about 0.02-0.03 µm was obtained. First trials on the copper and niobium 1.3 GHz cavities were realised.

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Session Classification: Poster session

Track Classification: Superconducting RF & associated technologies

Contribution ID: **423** Type: **Poster**

Update in deposition of Nb thick films on Cu for 6 GHz cavities

Tuesday, June 25, 2019 3:40 PM (1 minute)

One of the well-known difficulties concerning the performances of the Nb coated Cu cavities, is the reproducibility of the results. Two cavities fabricated by the same method and sputtered with the same deposition parameters, may present different performances during the RF characterization. Two main approaches are taken into consideration for this research: substrate and film reproducibility. In order to improve the substrate reproducibility, the standard mechanical grinding of the 6GHz cavities that leads to defects on the inner surface of the cavities that can remain even after chemical treatments, has been replaced for Vibrotumbling technique in order to improve the inner surface of the cavities. For the film reproducibility, a Nb thick film between 40 and 70 microns is deposited to reproduce the bulk niobium superconducting properties. On the other hand, we report the installed experimental setup to study the influence of trapped flux in 6 GHz cavities in: Nb bulk, Nb on Cu thin film and Nb on copper thick film.

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Session Classification: Poster session

Track Classification: Superconducting RF & associated technologies

Contribution ID: **424** Type: **Poster**

HTS coated tapes in local magnetic field with gradients

Tuesday, June 25, 2019 3:41 PM (1 minute)

The behavior of short segments of YBCO coated conductors with double disordered (DD) nano structure were investigated in a 3 T magnetic field which was produced by a self-designed split-electromagnet at 77 K. The tapes investigated with this magnet were exposed to a non-homogeneously distributed field over a length of 10 cm with an imposed constant transport current of 0-10 A. The voltage response of the tape in this setup was measured during 0.3-3 s long magnet pulses. From additional I_c characterization of DD samples at 77 K and 0-6 T field, the field dependence of "core" parameters (n-, alpha-, etc. values) were studied in order to develop a model, which describes the voltage response in pulsed and geometrically limited fields. The voltage signal in the tape, described by the developed "extended alpha approximation" (EAA) takes into account the spatial field dependence of the magnetic field. We have shown that the integral voltage response of the dissipative currents in the field-exposed tapes can be described adequately with the EAA model. It is also shown that the field dependent critical current, defined by a standard 1 μV/cm criterion, can be derived in this experimental setup by using the EAA approach.

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Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **425** Type: **Poster**

Development of Distributed Tin method Nb3Sn wire for FCC

Tuesday, June 25, 2019 4:06 PM (1 minute)

According to the assumed specification of the Nb3Sn for the accelerator magnets of the FCC (Future Circular Collider), it is required to achieve both extremely high Jc, which is unprecedented, and high RRR and low effective filament diameter (deff).
We have developed high performance Nb3Sn wire via DT (Distributed Tin) method, which is a type of internal Sn method with single barrier. So far, Non-Cu JC of 1,100 A/mm2 at 16 T, 4.2 K has been achieved by reducing Sn diffusion length and optimizing Ti content. Effective filament diameter of the samples were about 30 to 60 μm. The values of RRR were about 350, and RRR after 10% rolling assuming deformation of the cabling were 150 to 200, and no decrease in Jc was observed.
From these results, we believe that the DT method has very high potential as a candidate of Nb3Sn wire for FCC. We will continue to improve Jc by further increasing Nb ratio and optimizing for the Sn diffusion distance, ternary additive elements and heat treatment, etc., for targeting the FCC's specification.

Acknowledgments: This work was supported by the CERN and KEK under contract. Appendix 19 to the Agreement on Collaborative Work between CERN and KEK (ICA-JP-0103)

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Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **426** Type: **Poster**

Ternary phase formation in the Nb-Cu-Sn system

Tuesday, June 25, 2019 4:07 PM (1 minute)

The present contribution deals with investigations of heat treated Nb-Cu6Sn5 diffusion couples starting from Nb substrate and deposited Cu-Sn layers serving as models for early stages of intermetallic formation during heat treatment of Nb-Cu-Sn wires upon the production of Nb3Sn multifilamentary wires. In the last years, in contradiction to the long-term belief, also a ternary phase with the composition Nb0.75Cu0.25Sn2 was found and called "nausite". This phase is structurally related to the binary NbSn2 phase and derives from the latter one by partial substitution of Nb by Cu and a change of the stacking sequence in the crystal structure.
In this work, due to the treatments NbSn2 and/or nausite were formed in contact to the Nb substrate. It was demonstrated by energy dispersive X-ray spectroscopy (EDX) that both phases exhibit a ternary homogeneity range. EDX measurements indicate the formation of nausite in the range of 300 to 500℃ with Cu contents reaching from 6 to 13 at.%.
Problems in distinction of NbSn2 and nausite based on EDX in particular occur in case of very thin intermetallic layers. Hence, in addition electron backscatter diffraction (EBSD) was employed for phase differentiation. However, careful analysis of EBSD patterns was necessary to distinguish the two phases because of their structural similarities which lead to similar EBSD patterns. Nevertheless, slight differences between the patterns can be employed if the image quality is sufficient.

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Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **427** Type: **Poster**

Progress with the Deposition of Niobium Nitride Thin Films on Copper

Tuesday, June 25, 2019 3:42 PM (1 minute)

As part of efforts to improve the performance of SRF cavities, to that prescribed by future operating requirements, alternative materials are currently being investigated. NbN provides interest both as a single layer coating and as part of a multi-layer coating for SRF cavities.
In this contribution, an update is provided regarding results from ongoing investigations into DC magnetron sputtered NbN thin films deposited onto copper substrates. The NbN films were prepared in a large scale commercial coating system following a plan created with a "Design of Experiments" program. A high and low value for the substrate temperature, process pressure, bias voltage, cathode power, nitrogen gas percentage, and the working gas type, using either Argon or Krypton, constitute the parameters of this study. The base pressure of the system prior to deposition was 5x10-7 hPa for all coatings.
The resulting films have been characterised using various characterisation methods to determine the effects of the deposition parameters during the film growth process. Adjustment and optimisation of the deposition parameters is ongoing in pursuit of an optimal RF coating. This study forms part of the EASITrain project, which has received funding from the European Union's Horizon 2020 research and innovation programme under grant No 764879.

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Presenter: LEITH, Stewart Bristow

Session Classification: Poster session

Track Classification: Superconducting RF & associated technologies

Contribution ID: **428** Type: **Poster**

Performance Enhancement of Nb3Sn Superconductors by Artificial Pinning Centres

Tuesday, June 25, 2019 3:57 PM (1 minute)

Presently available state-of-the-art Nb3Sn wires have not yet reached the required FCC performance, which heavily depends on the microstructure. New manufacturing techniques aim to push the material further to its limits through grain refinement and pinning enhancement by the introduction of artificial pinning centres (APCs).
In this study, two approaches that recently managed to achieve the FCC target critical current density are presented. One revolves around a novel manufacturing technique based on internal oxidation and formation of ZrO2 nano-precipitates, while the other relies on the introduction of defects by fast neutron irradiation. The influence of the resulting microstructure on the superconducting properties was examined through combined microstructural and magnetic analysis.
By means of scanning and transmission electron microscopy, information about the nature and density of pinning sites, gradients in the elemental composition, grain size distribution and inhomogeneities in the wire geometry was obtained. The superconducting properties including critical current density and critical temperature were determined by scanning Hall probe microscopy and SQUID magnetometry.
A correlation was established between the microstructure and superconducting properties. Similarities and differences between internal oxidized and neutron irradiated wires are discussed, which both show significantly improved properties compared to standard wires.

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Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **429** Type: **Presentation**

Improved concept of the Nelium Turbo-Brayton cycle for the FCC-hh beam screen cooling

Wednesday, June 26, 2019 11:20 AM (20 minutes)

The further development of turbo-compressors has shown that improvements in design are possible by matching the design of the cryogenic cycle to that of the compressor. Different possibilities of the beam screen Nelium Turbo-Brayton cycle arrangement are analysed. The cryogenic cycles with different arrangements of the pre-cooling turbine are studied and compared including the number of necessary turbo-compressor stages. The final concept of the system is described. A reasonable neon-helium mixture composition for efficient process performance and reduced cost will be proposed.

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Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **430** Type: **Poster**

Test rig for the experimental evaluation of turbo-compressor impeller designs for light gases

Tuesday, June 25, 2019 3:37 PM (1 minute)

Currently available turbo-compressors were designed for natural gas. In order to apply them for very light gases, such as neon-helium mixtures for cryogenic Turbo-Brayton cycles, further development is necessary. Therefore, a corresponding study on turbo-compressor technology is performed at the University of Stuttgart. New compressor stages with improved geometry are being designed for a turbo-compressor working with a neon-helium mixture. A dedicated turbo-compressor test rig is going to be built at the University of Stuttgart in cooperation with the Technical University of Dresden to analyse the efficiency of these compressor stages for neon-helium mixtures of varying composition. The design and control of the test rig together with the description of the planned experimental work will be presented on the respective poster.

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Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **431** Type: **Poster**

Photodesorption and Photoelectron Yields from 150-nm Thin NEG Coatings

Tuesday, June 25, 2019 4:03 PM (1 minute)

In the FCC-ee high-luminosity collider and future high-brightness synchrotron radiation (SR) sources, the fundamental properties of Ti-Zr-V non-evaporable getter (NEG) coatings, namely, high effective pumping speeds, low photon-stimulated desorption (PSD) yields, and low total electron yields, are expected to be efficiently exploited. In such accelerators, however, stored beams are more likely to be susceptible to the resistive wall impedance generated by NEG coatings, and a standard NEG-coating thickness of 1 um may exceed the thresholds of the beam instabilities. Since reducing the film thickness limits a maximum number of venting/activation cycles due to its small bulk capacity, the NEG surface after several activation cycles can be saturated with adsorbed oxygen and carbon. Nevertheless, the vacuum systems utilizing such thin NEG coatings have a potential to perform satisfactorily if the initial PSD yields are in the same order as those of 1-um NEG coatings, i.e., 10^-5 molecules/photon; about two orders of magnitude lower than uncoated surfaces. In our experimental study, the PSD yields, as well as the photoelectron (PE) yields, from a 150-nm NEG film coated at CERN in a 1.2-m long vacuum tube are measured on an SR beamline at the KEK Photon Factory, and the aging effects on these properties through 10 venting/activation cycles are investigated. The results indicate that the PSD and PE yields are similar to those of 1-um NEG coatings up to the 10th activation cycle.

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Session Classification: Poster session

Track Classification: FCC-ee accelerator

Contribution ID: **432** Type: **Poster**

A method for coil design of twin-aperture cos-theta superconducting dipoles based on extended sector model

Tuesday, June 25, 2019 3:56 PM (1 minute)

The magnetic design is a basic aspect of the superconducting magnets for particle accelerators. When dealing with single aperture $\cos\theta$-type dipoles, the coil design can be performed with an analytic approach based on a sector dipole approximation followed by a numerical optimization. The great advantage of this approach is a rapid evaluation of the field harmonics which permits an almost exaustive scan on positions and dimensions of the sectors for coil layouts. For some double aperture dipoles, as the 16 T bending dipole of FCC-hh, the magnetic cross-talk between apertures makes this approach unfeasible. We have developed an extension of the sector model, which allows to consider the cross-talk between the two apertures. This method has permitted to find a new possible coil design for the 16 T dipole. This expansion can be generalized to a larger class of magnets.

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Presenter: RICCI, Alessandro Maria (Genova)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **433** Type: **Poster**

Superconducting thin films characterization at HZB with the Quadrupole Resonator

Tuesday, June 25, 2019 3:43 PM (1 minute)

Superconducting thin films have great potential as post-Nb material for use in SRF applications in future accelerators and industry. To test the RF-performance of such films in practice, would require the building and coating of a full RF cavity. Deposition of thin films on such scales in test facilities are challenging, in particular when curved surfaces have to be coated. This greatly complicates their systematic research. In this contribution we report on the method we use to characterize small and flat thin film samples (Deposited onto both Nb and Cu substrates) in an actual cavity named the Quadrupole Resonator (QPR). We also summarize the latest measurement results of NbTiN thin films. The Quadrupole Resonator at HZB is a tool that is able to perform SRF characterizations at frequencies ~415, 847, 1300 MHz with RF fields using an RF-DC power compensation technique.

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Session Classification: Poster session

Track Classification: Superconducting RF & associated technologies

Contribution ID: **434** Type: **Poster**

Update on study for anomalous top FCNC couplings at FCC-eh

Tuesday, June 25, 2019 3:32 PM (1 minute)

The top quark FCNC interactions would be a good test of new physics at present and future colliders. We present an update on study for top-quark-photon and top-quark-Z boson effective FCNC interaction vertices through the production process ep—>eWq+X at future circular collider-electron hadron (FCC-eh). The cross sections for the signal and interfering background have been calculated for different values of coupling parameters lambda_q for tqgamma vertices and kappa_q for tqZ vertices. We find the sensitivities to the branching ratios BR(t->qgamma)=8.5x10^(-7), BR(t->qZ)=6.0x10^(-6) for an integrated luminosity projections of 2 ab^(-1) at FCC-eh.

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Session Classification: Poster session

Track Classification: Physics

Contribution ID: **435** Type: **Presentation**

Outcome of the engineering studies for the FCC-hh cryoplants

Wednesday, June 26, 2019 10:30 AM (30 minutes)

Based on preliminary design works from research institutes, engineering studies were performed by the world-leader industries, Linde and Air Liquide, to assess the conceptual design for the FCC-hh cryoplants with industrial solutions and/or innovative technologies. For such high performance hadron collider, the cryogenic system has to distribute very large cooling capacities all along the 100-km tunnel for the 16T superconducting magnets continuously cooled at 1.9 K and for the beam screens operated between 40 and 60 K. The required total cooling power will be produced in 10 refrigeration plants with a unit equivalent capacity of 100 kW at 4.5 K, up to 4 times larger than the present state-of-the-art. Half of the entropic refrigeration load is due to the synchrotron radiation produced by the high-energy proton beams and deposited on beam screens actively cooled around 50 K. This non-conventional thermal load distribution is an additional challenge for the FCC-hh cryogenic system. Furthermore the cryogenic system has also to cool down the cold mass of the FCC-hh machine in less than 20 days with controlled thermal gradients in the cryo-magnets and beam screens. The presentation presents the main outcome of the engineering studies performed by Linde and Air Liquide to develop reliable and efficient FCC cryogenic systems.

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Presenter: MILLET, Francois

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **436** Type: **Poster**

Iron-based wires and tapes produced with simple and scalable methods

Tuesday, June 25, 2019 3:55 PM (1 minute)

Among the iron-based Superconductors (IBS) the 11 and the 122 family have attracted much attention because they show excellent superconducting properties for high field applications. The 11 family is also very robust against proton induced damage, and this is important in view of applications of superconductors in radiation-harsh environments such as particle accelerators. Moreover, conductors of these two phases produced as Powder In Tube (PIT) wires or Coated Conductors (CC) have reached a transport Jc that exceeds the practical level of 105 A/cm2 at 4.2 K and 10 T but the route to the realization of conductors in a scalable way is still long though.
In this work we explore the possibility to produce 11 coated conductors and 122 ex-situ PIT wires in a simple and scalable way. On one side we are working at the development of prototype IBS CC through the deposition of thin films of the phase Fe(Se,Te) via PLD on different metallic templates with and without buffer layers. In parallel, starting from home-made (Ba,K)Fe2As2 powders produced at SPIN, we produced short samples of ex-situ PIT wires and tapes at ambient pressure.

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Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **437** Type: **Presentation**

Synthesis and study of Tl-1223 Superconducting Thin Films for the CERN Future Circular Collider (FCC-hh) Beam Screen

Wednesday, June 26, 2019 1:50 PM (20 minutes)

The Future Circular Collider (FCC-hh) study is focused on achieving a 100TeV center-of-mass energy through the collision of proton beams steered by superconducting magnets cooled at 1.9 K in a 100 km circular collider. The circulating high-energy proton beams in the accelerator will emit 28W/m/beam of synchrotron radiation and to improve cryogenic efficiency, a beam screen, operating at 50 K is required to absorb the radiations and shield the magnets. At present, a copper coating is used to keep the beam coupling impedance low, but at 50K it might not be sufficient. High-temperature superconductors have a lower surface impedance than copper and a Tl-based superconducting thin film could be befitting this purpose among HTS-systems.
For this work, at CNR SPIN, several techniques are being employed that allow high-quality films to be grown on different substrates. We use electrodeposition, pulse laser deposition, and spin coating methods for the deposition of thin film precursors. Our recent work is directed at trying to improve the Tl-1223 phase in the thin films. For this purpose, various techniques, compositions, and substrates are under study and a variety of substrate have been investigated for the growth of Tl-1223 film, but the study of silver and SrTiO3 is of major interest.
This work is part of the Marie Sklodowska-Curie Training Network EASITrain (European Advanced Superconductivity Innovation and Training), funded by the European Union's H2020 Framework Programme under grant agreement no. 764879. And also We acknowledge funding from CERN for this collaboration activity within the
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Presenter: SABA, Aisha (CNR-SPIN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **438** Type: **Poster**

Triplet Track Trigger for Future Hadron Collider Experiments

Tuesday, June 25, 2019 3:48 PM (1 minute)

For the post High Luminosity LHC era several accelerator projects are under study with the aim to increase the discovery potential for new physics at both the high energy and intensity frontier. The hadron-hadron based Future Circular Collider(FCC-hh) is one such project with the goal to collide proton-proton beams at $\sqrt{s} \sim 100$TeV with a bunch crossing rate of 25ns. Some of the major challenges that the FCC-experiments have to tackle are the very large number of pileup events (~ 1000) and the data processing, namely the reduction of the huge data rate of 1 - 2PBytes/s whilst keeping the signal efficiencies high. The required processing power will be extremely challenging even in 20 years time from now. Therefore, we need smart triggering concepts that not only allow for a significant reduction of pileup and rate but also provide high signal acceptance and purity. One such concept is the triplet track trigger(TTT) based on monolithic pixel sensors.
In the poster, the concept of triplet track trigger using High Voltage Monolithic Active Pixel Sensors(HV-MAPS) is introduced for a generic detector geometry. Based on the tracker layout of the FCC-hh reference detector design, a full Geant4 simulation is done with the TTT placed at a radius of 85cm. Tracking performance studies are presented for a full-scale triplet pixel detector, i.e. three closely spaced pixel layers at sufficiently large radius in a FCC like detector environment. It is demonstrated that the TTT allows for a very simple and fast track reconstruction, providing excellent track reconstruction efficiencies and very high purity at the same time.
It is shown that the TTT can be used to trigger efficiently multi-jet signals using track-jets. A significant pileup, and thus data rate reduction is achieved by reconstructing the z-vertex positions of the jet constituents already at the first trigger level. Results obtained for different triplet layer design parameters are compared.

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Session Classification: Poster session

Track Classification: FCC-hh detector & experiment

Contribution ID: **439** Type: **Poster**

Current Flow Analysis of Tl-1223 Superconductors by Scanning Hall Probe Microscopy and TEM Investigations

Tuesday, June 25, 2019 4:13 PM (1 minute)

The FCC-hh design study included investigations on various high temperature superconducting materials to act as part of the beam screen. A superconducting coating on the beam screen should improve cryogenic efficiency and beam impedance mitigation for a high beam stability margin. The extreme conditions in such a collider make high critical currents at high temperatures necessary. Our study focuses on the still technologically unexploited thallium-based cuprates. For the development of the coating, Tl-1223 pellets are prepared and Tl-1223 thin films are grown on various substrates. We present the microstructural analysis of these Tl-based superconductors performed with Scanning Electron Microscopy and Transmission Electron Microscopy where the chemical composition of the superconducting grains and especially the phase formation is demonstrated. Furthermore, we mapped the magnetic field above the sample surface by means of Scanning Hall Probe Microscopy. By comparing the local magnetization of the superconducting grains with microstructural features we determined the reasons for varying current flow in different parts of the superconductor.

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Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **440** Type: **Presentation**

REBa2Cu3O7 coated conductors as a beam screen coating: Using the classical rigid-fluxon model to link surface resistance to microstructure

Wednesday, June 26, 2019 2:30 PM (20 minutes)

In the foreseen Future Circular Collider-hh operating conditions of 40-60K, 16T and 0-1GHz proton bunch frequency, the intended Cu coating of the beam screen might not guarantee an impedance sufficiently low for a stable beam. This motivates the exploration of high-temperature superconducting coated conductors (CC) as an alternative coating.
In this contribution, we present the surface resistance of different commercially available REBa2Cu3O7 CCs as a function of magnetic field up to 9T at 50K and 8GHz. It is shown that the surface resistance's in-field behavior depends strongly on the microstructure of the corresponding superconducting film. We apply the classical rigid-fluxon model to deduce the surface resistance from electrical transport values and demonstrate a good qualitative description of our measurement data. As a first outlook to the behavior at FCC conditons, the classical rigid-fluxon model allows an extrapolation of the surface resistance and suggests the outperformance of Cu by CCs at 50K, 16T and 1GHz. Finally, we confirm the compatibility of CCs with a-C coatings. It permits to mitigate the secondary electron yield while maintaining a low surface resistance.

Primary author: ROMANOV, Artur (Consejo Superior de Investigaciones Cientificas (CSIC) (ES))

Co-authors: GUTIERREZ, Joffre (ICMAB); KRKOTIC, Patrick (Cells); Prof. O'CALLAGHAN CASTELLA, Juan Manuel; PEREZ, Francis (ALBA Synchrotron - CELLS); PONT, Montse (CELLS-ALBA); ZANIN, Danilo Andrea (CERN); NEUPERT, Holger (CERN); COSTA PINTO, Pedro (CERN); DEMOLON, Pierre (CERN); GRANADEIRO COSTA, Angelo Rafael (Universidade de Lisboa (PT)); CALATRONI, Sergio (CERN); TABORELLI, Mauro (CERN); PUIG, Teresa (ICMAB)

Presenter: ROMANOV, Artur (Consejo Superior de Investigaciones Cientificas (CSIC) (ES))

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **441** Type: **Presentation**

Beam polarization for energy calibration in FCCee

Wednesday, June 26, 2019 9:24 AM (18 minutes)

In this talk an update of beam polarization expectations for energy calibration at FCCee is given.

Primary author: GIANFELICE-WENDT, Eliana (Fermi National Accelerator Lab. (US))

Presenter: GIANFELICE-WENDT, Eliana (Fermi National Accelerator Lab. (US))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **442** Type: **Poster**

FCC-hh Nb3Sn wire development: exploring the microstructure of prototype samples.

Tuesday, June 25, 2019 3:35 PM (1 minute)

A key requirement for the realization of the FCC is the development of high-field superconducting dipole magnets: considering that Nb_3Sn is currently the best candidate material (with the related requirements of non-Cu J_c = 1.5 kA/mm^2 at 16 T and 4.2 K), the microstructural analysis of prototype internal tin Nb_3Sn wires, manufactured by the Bochvar Institute with different designs and heat treatments, will be presented. The chemical composition and microstructure investigation is an important contribution to better understand which directions should be followed in the manufacturing process for producing wires with higher performance. In this study, the homogeneity of elemental concentrations all over the cross section will be discussed and compared for different wires, with a main focus on the Sn distribution. For this purpose, energy dispersive X-ray (EDX) spectroscopy was employed with both scanning electron microscopy (SEM) and transmission electron microscopy (TEM), performing EDX line scans along the radial and tangential directions in wire sub-elements. It will be shown how the elemental distributions are influenced by the wires different characteristics such as sub-element geometries, grain sizes and grain orientations.

This work is part of the Marie Skłodowska-Curie Action EASITrain, funded by the European Union's H2020 Framework Programme under grant agreement no. 764879.

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Presenter: Mrs MOROS, Alice (Technische Universität Wien)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **443** Type: **Poster**

Bi-2212 wire development at CNR-SPIN: GDG process as valid Over Pressure alternative for future high field applications

Tuesday, June 25, 2019 3:54 PM (1 minute)

The Over Pressure (OP) process led to the realization of Bi-2212 wires with Jc performance well beyond the minimum application requirements. While several efforts are under way to demonstrate that it is possible to apply such a process to real coils, researchers at CNR-SPIN are developing a process based on mechanical deformation (the GDG process) to realize denser Bi-2212 wires with superconducting properties satisfying application requirements through an easily industrially scalable process. Initial evidence of the effectiveness of the process has already been reported, but a demonstration on longer wires is needed. Here we present a comparison between the Je results obtained for short and long samples wound on different barrels. We also report a detailed analysis of the evolution of microstructural properties during the partial-melt process to obtain insights to support Jc improvement. Finally, we address the question of whether the OP process is actually needed.

Primary authors: LEVERATTO, Alessandro (CNR-SPIN); CELENTANO, Giuseppe; CHIARELLI, Sandro (ENEA); TRAVERSO, Andrea (University of Genoa); FERDEGHINI, carlo (CNR); PUTTI, Marina (University of Genova); BALLARINO, Amalia (CERN); HOPKINS, Simon (CERN); MALAGOLI, andrea (CNR-SPIN)

Presenter: LEVERATTO, Alessandro (CNR-SPIN)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **444** Type: **Poster**

Comparison of the sensitivities to dimension-eight operators for anomalous neutral triple gauge couplings through pp→□□□ process at HL/HE-LHC and FCC-hh

Tuesday, June 25, 2019 3:50 PM (1 minute)

We study the effects of dimension-eight operators giving rise to anomalous neutral triple gauge boson interactions in Z□□ and Z□Z vertices through the □□□ production at HL/HE-LHC and FCC-hh. The analysis is performed using transverse momentum of photon in the final state including a realistic detector effects for the future hadron colliders. The sensitivity to CP-conserving and CP-violating , and couplings are obtained at 95% C.L. The results are compared to the current experimental limits from ATLAS and CMS results.

Primary author: Prof. DENIZLI, Haluk (Bolu Abant Izzet Baysal University)

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Presenter: Prof. DENIZLI, Haluk (Bolu Abant Izzet Baysal University)

Session Classification: Poster session

Track Classification: FCC-hh detector & experiment

Contribution ID: **445** Type: **Poster**

FCC-hh Nb3Sn wire development: superconducting and magnetic properties of prototype samples

Tuesday, June 25, 2019 3:34 PM (1 minute)

Nb3Sn is the principally envisaged superconductor for the Future Circular Collider (FCC-hh) dipole magnets, in principle able to reach the required specifications (non-Cu Jc=1.5 kA/mm2 at 16T and 4.2K). We present the superconducting and magnetic characterization of prototype internal tin Nb3Sn wires, manufactured at the Bochvar Institute (RU) with different designs and heat treatments. In particular, the possible inhomogeneities related to the manufacturing process were investigated by means of magnetization methods: AC susceptibility was used to assess the critical temperatures of the samples, evaluating as well the longitudinal inhomogenities. The local properties were investigated using scanning Hall probe microscopy (SHPM): field maps of the Meissner-state revealed the effective geometry of the prototype design (sub-elements structure, barriers, width of resistive separators) whereas the scans of the remnant field enabled us to calculate the local critical currents. For these purposes, all the samples were carefully prepared reaching slice thicknesses of about 10 um. These results will be related to the microstructural analysis performed at USTEM (TU Wien).

Primary authors: MOROS, Alice (Technische Universität Wien); ALEKSEEV, Maxim (Bochvar Institute of Inorganic Materials); TSAPLEVA, Anastasia (Bochvar Institute of Inorganic Materials); LUKYANOV, Pavel (Bochvar Institute of Inorganic Materials); ABDYUKHANOV, ILDAR (VNIINM (Bochvar Institute)); PANTSYRNY, Victor (Bochvqr Institute); BORDINI, Bernardo (CERN); HOPKINS, Simon (CERN); BALLARINO, Amalia (CERN); BERNARDI, Johannes; EISTERER, Michael (Vienna University of Technology (AT))

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **446** Type: **Poster**

HTS REBaCuO coated conductors for the FCC-hh beam screen: Performance under photon irradiation at the ALBA Synchrotron Light Source

Tuesday, June 25, 2019 4:11 PM (1 minute)

High-Temperature Superconductor (HTS) REBaCuO coated conductors (REBCO-CC) are being considered as possible coating materials for the beam screen of the FCC vacuum chamber replacing Cu which might not present sufficiently low beam impedance. Understanding the behaviour of the tapes under the influence of RF fields, magnetic fields and synchrotron radiation is fundamental to achieve a sound decision.
Samples from different manufacturers have been studied at the ALBA Synchrotron Light Source which produces a photon flux spectrum comparable to that expected at the FCC-hh with protons at 100 TeV and a beam current of the order of 0.5 A.
A cryo-finger which works from 20K to room temperature has been installed in the ALBA SR along the hard X-ray pinhole. The setup allows the measurements of the resistance as a function of temperature while the samples are irradiated with high energy photons. The first results obtained on the tapes, as a function of the dose received, will be presented, as well as the plans for the future to expand the measuring capabilities to include surface impedance determination.

Primary author: KRKOTIĆ, Patrick (ALBA)

Co-authors: PONT, Montse (CELLS-ALBA); PEREZ, Francis (ALBA Synchrotron - CELLS); O'CALLAGHAN, Joan (UPC); ROMANOV, Artur (ICMAB (ES)); GUTIERREZ, Joffre (ICMAB); PUIG, Teresa (CSIC)

Presenter: KRKOTIĆ, Patrick (ALBA)

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **448** Type: **Poster**

Coating the FCC-hh beam screen chamber with REBa2Cu3O7-x coated conductors

Tuesday, June 25, 2019 4:14 PM (1 minute)

The beam screen chamber of the Future Circular Collider-hh will be operating at conditions of 40-60K, 16T and 0-1GHz proton bunch frequency. Under these conditions, Cu coating technology might not guarantee an impedance sufficiently low for a stable beam. Recently, we have shown that the surface resistance of REBa2Cu3O7-x Coated Conductors (CCs) out performs that of copper at 8 GHz, 50 K and up to 9 T. Moreover, according to the rigid fluxon model, this trend will be more accentuated at 1 GHz. For this reason, CCs are a solid candidate to replace copper as the beam screen coating of the Future Circular Collider-hh.
The challenge now remains on how to attach a coated conductor on the FCC beam screen chamber steel. In this contribution we present a scalable technology that allows us to attach the CC to the FCC beam screen chamber stain less steel using low temperature welding. We present the first results of the surface resistance, superconducting and mechanical properties (bending radius and tensile stress tests) and vacuum tests of a CC / stainless steel stack, showing that the stack still presents a lower surface resistance than Cu at 8 GHz, 50 K and up to 9 T.

Primary authors: Dr GUTIERREZ ROYO, Joffre (ICMAB - CSIC); GRANADOS, Xavier (ICMB); ROMANOV, Artur (ICMAB (ES)); KRKOTIĆ, Patrick (ALBA); O'CALLAGHAN, Joan (UPC); GONZALEZ, Pedro (Institut de Fisica d'Altes Energies); KOROLKOV, Ilya (The Barcelona Institute of Science and Technology (BIST) (ES)); PEREZ, Francis (ALBA Synchrotron - CELLS); PONT, Montse (CELLS-ALBA); CALATRONI, Sergio (CERN); PUIG, Teresa (ICMAB)

Presenter: Dr GUTIERREZ ROYO, Joffre (ICMAB - CSIC)

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **449** Type: **Poster**

Optimisation of a multi-stage turbocompressor architecture operating with a neon- helium gas mixture

Tuesday, June 25, 2019 3:44 PM (1 minute)

Within the framework of the Future Circular Collider (FCC) currently being investigated at CERN, the entire cryogenic cycle required to maintain a temperature level of the superconducting magnets near absolute zero had to be revised with respect to the existing Large Hadron Collider (LHC). In particular, a novel as well as sustainable architecture of the pre-cooling cycle had to be developed. This led to a closed-loop cryogenic cycle operating with a mixture of helium and neon, also called nelium.

Whereas screw compressors remain a viable option in a standard helium cryogenic cycle, by ballasting the operating fluid with a heavy gas such as neon, the usage of a multi-stage turbocompressor becomes realistic. Moreover, this new approach justified the collaborative research to work on the turbocompressor side between CERN, MAN Energy Solutions and ITSM at University of Stuttgart. The main goal of this research group is to provide an efficient and economically viable solution for the multi-stage turbocompressor. This poster aims at exploring the different architecture alternatives and highlight the limitations.

The poster will include a description of a 1D performance prediction tool used to predict turbocompressor performance at design point as well as at off-design operation. The influence of using a same impeller for various concentrations of helium and neon on its performance is also presented.

A model predicting the performance of multi-stage turbocompressor from its architecture is then described. Based on the constraints coming from the design of an existing high speed multi-stage turbocompressor as well as the heat load requirements imposed by the particle accelerator during operation, boundary conditions can be set for the machine. The overall machine performance can then be obtained by a stacking method knowing the performance of each individual stage.

Then, the theory behind a Breeder Genetic Algorithm (BGA) is introduced. The latter has been used first to generate an impeller data base optimised for certain boundary conditions as well as to determine the best theoretical multi-stage machine architecture.

The final multi-stage architectures for each gas mixture are then compared and conclusion can be drawn on the most desirable gas mixture with respect to the machine architecture, performance and size.

Primary author: PODEUR, Maxime Pierre

Co-author: VOGT, Damian Maria Anton

Presenter: PODEUR, Maxime Pierre

Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **450** Type: **Presentation**

RF Characterisation of HTS-CC Tapes as Alternative Coating for the FCC-hh Beam Screen

Wednesday, June 26, 2019 2:10 PM (20 minutes)

We are investigating high-temperature superconducting coated conductors (HTS-CCs) as an optional coating material for the beam screen of the FCC-hh, in order to reduce the beam coupling impedance. We focus on the use of shielded Hakki-Coleman resonators to validate the rf performance stemming several key test requirements: design, temperature, magnetic field and power. In our past work, we have proved that in temperature and dc magnetic field conditions close to those in the FCC, HTS surface resistance is significantly lower than that of copper. In this work, we analyse the rf magnetic field amplitude at the HTS surface within the resonator and find that it is comparable to FCC-hh requirements. Furthermore, we have extended our experimental set-up to measure surface reactance. These data can be used to extract HTS penetration depths and depinning frequencies.

Primary authors: O'CALLAGHAN CASTELLA, Juan Manuel; PONT, Montse (CELLS-ALBA); KRKOTIC, Patrick (Cells)

Co-authors: ROMANOV, Artur (ICMAB (ES)); PEREZ, Francis (ALBA Synchrotron - CELLS); GUTIERREZ ROYO, Joffre (ICMAB - CSIC); PUIG, Teresa (ICMAB)

Presenter: KRKOTIC, Patrick (Cells)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **451** Type: **Poster**

Study on aNTGCs from D8 operators for ZZ production at FCC-hh

Tuesday, June 25, 2019 3:49 PM (1 minute)

We investigate the effects of dimension-eight operators of the anomalous neutral triple gauge boson interactions in ZZ production at 100 TeV centre of mass energy of circular hadron collider, namely FCC-hh. The analysis is performed on four-lepton final state including the realistic detector effects. The sensitivities to the CP-conserving C_{\tilde{B}W} and CP-violating C_{BW},C_{BB} ,C_{WW} couplings are obtained at 95% C.L through the analysis of invariant mass distribution of 4l system and the results are compared with the latest experimental limits from the LHC.

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Presenters: Prof. TURK CAKIR , İlkay (Giresun University); Prof. CAKIR , Orhan (Ankara University)

Session Classification: Poster session

Track Classification: FCC-hh detector & experiment

Contribution ID: **452** Type: **Poster**

Progress on Boron synthesis technique through precursor modification for introduction of artificial pinning centers in MgB2 wires

Tuesday, June 25, 2019 3:33 PM (1 minute)

The aim to improve critical properties of MgB2 is crucial for its future application. Introduction of artificial pinning center (APC) in MgB2 will be a key factor for enhancement of critical current density. Here we report the progress on synthesis of boron precursor prepared following a patented process developed at SPIN-CNR laboratories. Basic idea is manipulate B precursor B2O3 in liquid phase (water solution) where it is possible to introduce homogeneous dopants by dispersion. Solution is sprayed in liquid nitrogen and freeze-dried to remove water and keep homogeneous dopant distribution.
Dopants must be soluble in water and resist to hydrolysis up to about 80-100 ℃, with a large pool of possible candidates. We report a systematic study on the effect of poly-saccharide at different concentrations on MgB2 and interaction of C-rich aggregates with surrounding lattice. BN, CaF2, ZrO2 and TiO2 were used as dopants by preparing a stable suspension of these ceramic materials and their effects on critical properties and morphology are reported. Chlorides of transition metals (Zr, Ti, Y) were investigated for the possibility to introduce nanometrical binary borides coherently with MgB2 lattice, useful as effective pinning centres.

Primary authors: BOVONE, Gianmarco (CNR - SPIN); CAPRA, Marco (University of Genova); Mr FEDERICO, Loria (CNR - SPIN); Ms BERNINI, Cristina (CNR - SPIN); PUTTI, Marina (University of Genova); FERDEGHINI, Carlo (CNR - SPIN); HOPKINS, Simon (CERN); BALLARINO, Amalia (CERN); TROPEANO, Matteo; VIGNOLO, M. (CNR - SPIN)

Presenter: BOVONE, Gianmarco (CNR - SPIN)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **453** Type: **Poster**

Fluid mixtures properties modeling

Tuesday, June 25, 2019 3:45 PM (1 minute)

Based upon the conceptual design reports for the FCC cryogenic system, the need for more accurate thermodynamic property models of mixtures was identified. Both academic institutes and world-wide industries have identified the lack of reliable equation of states for mixtures used at very low temperatures. Detailed cryogenic architecture modeling and design cannot be assessed without valid fluid properties. Therefore, the latter is the focus of this work. Initially driven by the FCC study, the modeling was extended to other fluids beneficial for scientific and industrial application beyond the FCC needs. The properties are modeled for the mixtures of some noble gases with the use of multi-fluid Helmholtz-energy-explicit models: helium/neon, neon/argon, and helium/argon. The on-going studies are performed at CEA-Grenoble, France and at the National Institute of Standards and Technology, U.S.

Primary authors: TKACZUK, Jakub (CEA Grenoble); LEMMON, Eric (National Institute of Standards and Technology); BELL, Ian (National Institute of Standards and Technology); MILLET, Francois (CEA Grenoble); LUCHIER, Nicolas (CEA Grenoble)

Presenter: TKACZUK, Jakub (CEA Grenoble)

Session Classification: Poster session

Track Classification: Technical infrastructure & operation

Contribution ID: **454** Type: **Poster**

Single vector-like B-quark search in the B to tW decay channel at FCC-hh

Tuesday, June 25, 2019 3:51 PM (1 minute)

We study single production of heavy vector-like bottom (VLB) quark partner and its decay to a top quark and W boson at the future circular hadron collider (FCC-hh) with high center of mass energy of 100 TeV. The results show that the mixing between the vector-like quark and third generation quarks can largely enhance the production cross section. We analyze the final state kinematical distributions for all hadronic mode. Studying the observability of single VLB quark through the process pp->Bbq+X, we set attainable mass limits depending on different coupling strength relevant to the single production at FCC-hh.

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Co-authors: Mr CANBAY, Ali Can (Ankara University); Dr KUDAY, Sinan (Istanbul Aydin University)

Presenters: Prof. TURK CAKIR, Ilkay (Giresun University); Prof. SARPUN, Ismail Hakki (Akdeniz University)

Session Classification: Poster session

Track Classification: Physics

Contribution ID: **455** Type: **Poster**

Status and development of superconductive MgB2 wires and tapes

Tuesday, June 25, 2019 3:46 PM (1 minute)

The Magnesium Diboride is a superconducting compound discovered in 2001 with a relatively high-critical temperature. The absence of weak-link and the simple crystalline structure allows producing low-cost wires through the powder in tube (PIT) technique, allowing the industrial application.
In the past ten years, the MgB2 wire technology has made a significant progress, thanks to the continuing development and improvement supported mostly at industrial level. MgB2 is now a good candidate to replace NbTi in cryogenic-free MRI magnets, but also in rotating electrical machines, wave-energy converters and in high current cables for powering devices or in transmission and distribution electrical power lines.
The effort made by Columbus MgB2 wire unit (ASG Superconductors Spa) develop a technology which allows to produces MgB2 multi-filamentary wires with unit length exceeding 2-4 Km in a single piece.
Now the development efforts are oriented to improve the critical current in-high-field performances, this challenge is part also of EASITRAIN project.
Here we present the status and the plans for future development.

EASITrain – European Advanced Superconductivity Innovation and Training. This Marie Sklodowska-Curie Action (MSCA) Innovative Training Networks (ITN) has received funding from the European Union's H2020 Framework Programme under Grant Agreement no. 764879

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Presenters: Dr DONATO, Mattia (ASG Superconductors SpA); Dr TROPEANO, Matteo

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **456** Type: **Poster**

Mechanical characterization of large grain niobium sheets for high-velocity forming of SRF cavities

Tuesday, June 25, 2019 3:47 PM (1 minute)

The reduced price of large grain niobium sheets, compared with the standard small grain sheets, can play a significant role in cost reduction for the fabrication of superconducting radio frequency (SRF) cavities in large particle accelerators projects. However, the anisotropic properties of the blank hinder its formability with conventional forming techniques, e.g. deep-drawing and spinning. Fast forming technologies such as electro-hydraulic forming and explosive forming might be a good solution to form such highly anisotropic sheets. For this reason, the investigation of large grain niobium properties at high strain rates was performed. Specimens in different crystallographic orientations were cut from a blank for mechanical characterization in tension and compression. Experiments in both stress states for strain rates ranging from 10⁻⁴ to 10³ s⁻¹ were performed to evaluate the strain rate sensitivity and anisotropy of niobium single crystals used in SRF applications. The effect of strain localization and adiabatic heating for the different orientations and strain rates is discussed.

Primary author: Mr CROTEAU, Jean-Francois (I-Cube Research)

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Presenter: Mr CROTEAU, Jean-Francois (I-Cube Research)

Session Classification: Poster session

Track Classification: Superconducting RF & associated technologies

Contribution ID: **457** Type: **Presentation**

Recent Results on NEG Coating Characterisation

Wednesday, June 26, 2019 10:50 AM (20 minutes)

The non-evaporable getter (NEG) coating is an important component of vacuum systems in many current particle accelerators due to its high evenly distributed pumping speed and low thermal outgassing and electron, photon and ion stimulated desorption yields. Coatings made of compound materials, e.g. TiZrV or TiZrHfV, have been found to have the highest sticking probabilities and lowest desorption yields. However, multi-metal targets are difficult and expensive to manufacture. Moreover, having a single-metal target would allow for deposition of a more uniform coating on vacuum chambers of various shapes and sizes. In this work, an analysis of two NEG-coated tubular samples with dense and columnar single-metal zirconium film structure will be demonstrated. Obtained sticking probabilities, pumping capacities and electron stimulated desorption (ESD) yields show that Zr coating is a good candidate material to replace TiZrV thin films in accelerator vacuum chambers. The columnar coating is fully activated at 160℃ and has sticking probability close to 0.2, which is comparable to that of the ternary NEG coating activated at the same temperature, while ESD yields are also similar to the ones measured from TiZrV samples. Another important aspect to be considered before installing NEG-coated parts in future accelerators like FCC is a low temperature of the beam screen. There is a lack of knowledge about the behaviour of the NEG coating at cryogenic temperatures, and this study will provide data on how sticking probability and ESD yields depend on the temperature of the NEG film. The experimental setup and procedure will be explained, along with preliminary results obtained by testing two columnar TiZrV samples.

Primary author: SIRVINSKAITE, Ruta (University of Loughborough)

Co-authors: MALYSHEV, Oleg (STFC Daresbury Laboratory); Dr VALIZADEH, Reza (STFC Daresbury Laboratory); HANNAH, Adrian (Science Technology Facilities Council); CROPPER, Michael D.

Presenter: SIRVINSKAITE, Ruta (University of Loughborough)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **458** Type: **Poster**

Mechanical validation of the support structure of the eRMC and RMM, the 16-T R&D magnets for the FCC

Tuesday, June 25, 2019 3:53 PM (1 minute)

High field superconducting magnets are of the essence to further increase the energy of particle colliders beyond their current state-of-the-art. A magnet technology development program is being carried out at CERN to explore the Nb3Sn performance limits at dipole field levels of 16—18 T. Both the enhanced Racetrack Model Coil (eRMC) and the Racetrack Model Magnet (RMM) aim to develop these fields, respectively, in the magnet horizontal mid-plane, and in a closed 50-mm bore. These magnets, mechanically preloaded using the method of bladders and keys, will feature the same support structure featuring an aluminum alloy shrinking shell.

To verify the assembly and loading process, the structure was mounted using aluminum blocks in lieu of actual Nb3Sn coils. The mechanical assembly was instrumented with strain gauges on the external shell, tie-rods and dummy coils. Two thermal cycles to 80K were performed with different preload levels. This paper compares the tests results to the finite-element (FE) mechanical model for validation. The results imply that the low-yield aluminum alloy has plastified during the first thermal cycle. Both the strain measurements and the final deformed coil shape match, within reasonably margins, the FE predictions.

Primary author: GARCIA PEREZ, Manuel Francisco (CERN)

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Presenter: GARCIA PEREZ, Manuel Francisco (CERN)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **459** Type: **Poster**

Influence of longitudinal impedance on beam-beam interaction

Tuesday, June 25, 2019 4:05 PM (1 minute)

In conventional e+e- storage ring colliders, we only use lengthend bunch length in beam-beam simulation instead of considering impedance directly. It is no problem since the longitudinal dynamics is not sensitive to beam-beam interaction. But it is different since the bunch will also be lengthend during beam-beam interaction by beamstrahlung effect. It is very natural and more self-consistent to consider the longitudinal impedance in the beam-beam simulation. The simulation shows that the working point region of stable collision is slightly shifted by the longitudinal impedance. It is found that the vertical coherent oscillation may decreases the beam-beam limit with impedance at some working point.

Primary author: ZHANG, Yuan

Presenter: ZHANG, Yuan

Session Classification: Poster session

Track Classification: FCC-ee accelerator

Contribution ID: **460** Type: **Presentation**

Positron source for FCC-ee

Wednesday, June 26, 2019 2:24 PM (18 minutes)

Positron sources are critical components of the future linear (circular) collider projects. Due to the large 6D production emittance and important thermal load in the production target, the positron injector, in particular the positron source, is one of the key elements of the FCC-ee, requiring special attention. To ensure high reliability of the positron source, conventional and hybrid targets are currently under study. The final choice of the positron target will be made based on the estimated performances. In this framework, we present a preliminary design of the FCC-ee positron source, with detailed simulation studies of positron production, capture and primary acceleration.

Primary authors: CHAIKOVSKA, Iryna (LAL); ZIMMERMANN, Frank (CERN); CHEHAB, Robert (INSTITUT DE PHYSIQUE NUCLEAIRE DE LYON-IN2P3/CNRS (France)); FAUS-GOLFE, Angeles (Laboartoire de l'Accelerateur Lineaire); APYAN, Armen; MARTYSHKIN, Pavel (Budker Institute of Nuclear Physics (RU)); OGUR, Salim (CERN); RINOLFI, Louis (CERN / JUAS); SIEVERS, Peter; OIDE, Katsunobu (High Energy Accelerator Research Organization (JP)); PAPAPHILIPPOU, Yannis (CERN); ENOMOTO, yoshinori (KEK); FURUKAWA, Kazuro (KEK); SUWADA, Tsuyoshi (KEK); KAMITANI, T. (KEK, Ibaraki (JP)); MIYAHARA, F. (KEK, Ibaraki (JP)); SATOH, M. (KEK, Ibaraki (JP)); SEIMIYA, Y. (KEK, Ibaraki (JP)); SUWADA, T. (KEK, Ibaraki (JP))

Presenter: CHAIKOVSKA, Iryna (LAL)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **461** Type: **Presentation**

A self-consistent analysis method in X-ray interferometer in the FCC and proposal for testing in the X-ray monitor line in the SuperKEKB

Wednesday, June 26, 2019 11:06 AM (18 minutes)

An X-ray interferometer was proposed for the apparent extremely small beam size measurement in the FCC-ee. The wavelength information is necessary to determine the beam size via interferometry. Certain monochrometer such as band-pass filter is used for identify the wavelength in ordinal interferometer using the visible SR. the K-edge filter is proposed as getting quasi monochromatic X-ray for the X-ray interferometer, but due to wide band width, the effective wavelength is not clear. Since this reason, we propose a method for determine the wavelength by interferometer itself. Since one of the function of interferometer is absolute measurement of wavelength. we can determine the wavelength of input X-ray from pitch of interference fringe. By applying this method, we can determine beam size from the data of interferometer self consistently.
We propose a test of X-ray interferometer with this method at X-ray montor line in the SuperKEKB. The X-ray monitor line is used for beam size measurement mainly with coded aperture, and it has a long range X-ray beam line which is suitable for testing the X-ray interferometer.

Primary authors: MITSUHASHI, Toshiyuki (KEK); MITSUKA, Gaku (KEK); FLANAGAN, J. (KEK); ZIMMERMANN, Frank (CERN); OIDE, Katsunobu (High Energy Accelerator Research Organization (JP))

Presenter: MITSUHASHI, Toshiyuki (KEK)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **462** Type: **Presentation**

Development of a Cryogenic System for the FCC-hh Inner Triplets Cold Mass Cooling

Wednesday, June 26, 2019 11:00 AM (20 minutes)

The final beam-focussing quadrupoles, the so-called inner triplets, are located immediately before the interaction points and receive high specific heat loads with an unequal spatial distribution. Despite the installation of a tungsten shield which absorbs the major part of the emitted photons at an intermediate temperature level of about 50 K, the remaining radiative power falling on the cold mass exceeds the specific heat load of the beam-bending sections by a factor of up to 102 and has to be extracted at superfluid helium temperature level (1.9 K). Given the peculiar heat load distribution, the application of well-established cooling concepts is incompatible for the FCC-hh inner triplets with its magnetic lattice structure and the cold mass design.

In this talk a rough overview of the current inner triplets design and the cryogenic requirements is given, followed by the explanation of the difficulties and disadvantages for common cryogenic systems operating at 1.9 K due to the high and non-uniform heat load. In the end, developments of the inner triplet design and the cryogenic system are discussed to assure reliable cooling and operation.

Primary authors: DELIKARIS, Dimitri (CERN); TAVIAN, Laurent Jean (CERN); KOTNIG, Claudio

Presenter: KOTNIG, Claudio

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **463** Type: **Presentation**

Evolution of the canted costheta (CCT) design

Wednesday, June 26, 2019 1:50 PM (20 minutes)

We present the CCT design for an FCC-hh or HE-LHC 16-T main dipole magnet and its evolution from initial designs from Lawrence Berkeley National Laboratory to the conceptual design reports. We also discuss main advantages and disadvantages of this design, together with technical challenges and potential solutions as encountered in the model-magnet design and construction at Paul Scherrer Institute.

Primary author: AUCHMANN, Bernhard (CERN)

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Presenter: AUCHMANN, Bernhard (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **464** Type: **Presentation**

SuperKEKB status and experience with collisions at large Piwinski angle

Wednesday, June 26, 2019 11:42 AM (18 minutes)

SuperKEKB is an asymmetric circular e+e- collider operated with low emittance 3nm(x) and 10pm (y) and extremely low beta*30mm(x) and 0.3mm(y). Beam-beam collision is executed 15 mrad in half angle and Piwinski angle is 26. In commssioning at 2019 summer, SuperKEKB is operated with the design emittance (~1% coupling) and bx=100-200mm by=3mm. Piwinski angle is 10. Luminosity performance is insufficient, the beam-beam parameter calculated by luminosity is ~0.02. We struggle against optics aberration at IP to improve luminosity performance. Optics aberration is more serious for squeezing beta*

Coherent beam-beam head-tail (BBHT) instability is another topic. Crossing angle induces synchro-beta instability coupled to two beams. The instability should be serious in FCCee.

Primary author: OHMI, kazuhito (KEK)

Presenter: OHMI, kazuhito (KEK)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **465** Type: **Poster**

Strong-strong beam-beam simulation for multi-IP and multi-beam in circular colliders

Tuesday, June 25, 2019 4:02 PM (1 minute)

Beam-beam simulation code BBSS is extended to multi-IP and multi-beam collision. Increasing IP, synchrotron tune is kept due to limitation of RF voltage, synchrotron phase advance between IP is smaller. Condition of beam-beam head-tail (BBHT) instability is changed for increasing IP. We discuss simulation results for CEPC and FCCee.

Primary author: OHMI, kazuhito (KEK)

Presenter: OHMI, kazuhito (KEK)

Session Classification: Poster session

Track Classification: FCC-ee accelerator

Contribution ID: **466** Type: **Presentation**

Luminosity with e+e- -> gamma gamma: theory perspective

Tuesday, June 25, 2019 5:30 PM (30 minutes)

The unprecendented precision goal of the future FCC-ee machine in key measurements in the Standard Model and beyond will require that the accelerator luminosity is know with extremely high accuracy, at the 10^{-4} level and even better. In this context, QED processes (and their accurate theoretical prediction) play the role of precise luminosity monitoring processes: together with the standard Bhabha scattering, used in the past at LEP and flavour factories, it is interesting and worthwhile to consider also the $e^+e^- \to \gamma\gamma$ process, which, despite a lower statistics than Bhabha, can be predicted with very high accuracy. In this presentation, the current status of $e^+e^- \to \gamma\gamma$ calculations and Monte Carlo tools will be reviewed and the perspective for future theory improvements will be traced and discussed in detail.

Primary authors: CARLONI CALAME, Carlo Michel (INFN, Pavia (IT)); CHIESA, Mauro (University of Würzburg); MONTAGNA, Guido (University of Pavia e INFN, Pavia (IT)); NICROSINI, Oreste (INFN, Sezione di Pavia); PICCININI, Fulvio (Universita and INFN (IT))

Presenter: CARLONI CALAME, Carlo Michel (INFN, Pavia (IT))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **467** Type: **Presentation**

Casual thresholds and infrared singularities in the forest

Tuesday, June 25, 2019 5:00 PM (30 minutes)

We present the first comprehensive analysis of the unitarity thresholds and anomalous thresholds of scattering amplitudes at two loops and beyond based on the loop-tree duality, and show how non-causal unphysical thresholds are locally cancelled in an efficient way when the forest of all the dual on-shell cuts is considered as one. We also prove that soft and collinear singularities at two loops and beyond are restricted to a compact region of the loop three-momenta, which is a necessary condition for implementing a local cancellation of loop infrared singularities with the ones appearing in real emission; without relying on a subtraction formalism.

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Presenter: RODRIGO, German (IFIC UV-CSIC)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **468** Type: **Presentation**

Messages from EW tests after the Higgs discovery

Tuesday, June 25, 2019 4:30 PM (30 minutes)

The global fit of the Standard Model predictions to electroweak precision data, which has been routinely performed in the past decades by several groups, led to the prediction of the top quark and the Higgs boson masses before their respective discoveries. With the measurement of the Higgs boson mass at the Large Hadron Collider (LHC) in 2012 by the ATLAS and CMS collaborations, the last free parameter of the Standard Model of particle physics has been fixed, and the global electroweak fit can be used to test the full internal consistency of the electroweak sector of the Standard Model and constrain models beyond. In this article, we review the current state-of-the-art theoretical calculations, as well as the precision measurements performed at the LHC, and interpret them within the context of the global electroweak fit. Special focus is drawn in the impact of the Higgs boson mass on the fit. We will also discuss, which observables should be measured with higher precision in the coming years, as well as the impact of more precise measurements on the EW Fit.

Primary authors: SCHOTT, Matthias (CERN / University of Mainz); ERLER, Jens (IF-UNAM)

Presenter: SCHOTT, Matthias (CERN / University of Mainz)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **469** Type: **Presentation**

New physics in double Higgs production

Thursday, June 27, 2019 11:10 AM (20 minutes)

Double Higgs production is suppressed in the SM and therefore it is a clean probe of new physics. In particular,
I will discuss on the effects the dimension-six operators of the SMEFT and how they will be tested by double Higgs production at future e+e− colliders.

Primary author: DEGRANDE, Celine Catherine A

Presenter: DEGRANDE, Celine Catherine A

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **470** Type: **Presentation**

Requirements for longitudinal HOM damping in FCC-hh

Tuesday, June 25, 2019 8:48 AM (18 minutes)

Longitudinal coupled-bunch instability (CBI) can be driven by not sufficiently damped high-order modes of rf cavities or/and other machine elements. To prevent them in hadron machines, where synchrotron radiation is weak, one has to rely on Landau damping. Unlike the case of accelerators with relatively low number of bunches, in which the instability thresholds can be obtained from macro-particle simulations, only semi-analytical methods can be applied for the Future Circular hadron-hadron Collider (FCC-hh) with up to 10400 circulating bunches per beam. In this work, calculation of the longitudinal CBI threshold for particle distributions of binomial family during the acceleration cycle of the FCC-hh is presented. It is compared with HOMs of different crab cavity designs proposed to be used in the FCC-hh and in the High-Luminosity Large Hadron Collider (HL-LHC). As the result, we define the requirements for the HOM damping, so that the longitudinal CBI can be suppressed.

Primary author: KARPOV, Ivan (CERN)

Co-author: SHAPOSHNIKOVA, Elena (CERN)

Presenter: KARPOV, Ivan (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **471** Type: **Presentation**

Superconducting Detector Magnets for Particle Physics Experiments at the Future Circular Collider

Wednesday, June 26, 2019 8:30 AM (30 minutes)

New general-purpose particle detectors are foreseen to probe electron-positron (ee), electron-hadron (eh) and hadron-hadron collisions (hh). A conceptual design report is due in 2019 for all FCC collider and detector options. Baseline designs for the various Detector magnets were developed.
For FCC-ee two detector magnet variants were defined, a 7.6 m bore and 7.9 m long classical 2 T solenoid of about 600 MJ surrounding the calorimeter, and a very challenging 4 m bore, 6 m long, ultra-thin and radiation transparent 2 T solenoid with 170 MJ stored energy surrounding the tracker only.
For FCC-eh the detector solenoid is combined with a dipole magnet required for guiding the electron beam in and out the collision point. This detector requires a 3.5 T solenoid, 2.6 m free bore and 9.2 m length with some 230 MJ stored energy.
Most demanding, however, is FCC-hh's detector with a 14 GJ stored energy magnet system comprising three series connected solenoids, requiring 4 T in the main Solenoid with 10 m free bore and length of 20 m, in line with two 3.2 T forward solenoids with 5.1 m free bore and 4 m length.
We see a challenging landscape of detector magnets that need to be further engineered in the years to come. The superconductor technology though is essentially the same in all solenoids, to use Ni doped and structurally reinforced pure Al stabilized NbTi/Cu strands based Rutherford cables, conduction cooled in solenoid windings almost entirely comprising high yield strength Al alloy. The design of the various baseline magnets is presented as well as their engineering challenges.

Primary authors: TEN KATE, Herman (CERN); Dr BERRIAUD, Christophe (Université Paris-Saclay (FR)); CURE, Benoit (CERN); DUDAREV, Alexey (CERN); GADDI, Andrea (CERN); GERWIG, Hubert (CERN); ILARDI, Veronica (Twente Technical University (NL)); KLYUKHIN, Slava (M.V. Lomonosov Moscow State University (RU)); KULENKAMPFF, Tobias (CERN); MENTINK, Matthias (CERN); PAIS DA SILVA, Helder Filipe (LIP Laboratorio de Instrumentacao e Fisica Experimental de Part); WAGNER, Udo (CERN)

Presenter: TEN KATE, Herman (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Common detector technologies and offline software

Contribution ID: **472** Type: **Presentation**

Complementarities between Higgs and electroweak measurements at future lepton colliders

Thursday, June 27, 2019 10:50 AM (20 minutes)

With Higgs measurement prospects reaching the permil level at future lepton colliders, their interplay with the electroweak sector of the standard-model effective field theory is expected to become relevant. We perform the first rather complete effective-field-theory analysis covering jointly the Higgs and electroweak sectors. It allows us to investigate the impact of electroweak parameter uncertainties in Higgs coupling determination; to examine what electroweak measurements are needed to achieve the full potential of the precision Higgs physics program; and conversely to discuss the possible improvement on electroweak parameters otherwise brought by Higgs measurements.

Primary author: DURIEUX, Gauthier (Technion- Israel Institute of Technology (IL))

Co-authors: DE BLAS, Jorge (INFN-Padova); GROJEAN, Christophe (DESY (Hamburg) and Humboldt University (Berlin)); GU, Jiayin (JGU Mainz); Dr PAUL, Ayan (INFN, Sezione di Roma)

Presenter: DURIEUX, Gauthier (Technion- Israel Institute of Technology (IL))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **473** Type: **Presentation**

Assembly and First Test of the US-MDP Nb3Sn Dipole Demonstrator

Thursday, June 27, 2019 3:48 PM (18 minutes)

U.S. Magnet Development Program (US-MDP) has developed a Nb3Sn dipole demonstrator for a post-LHC pp Collider. The magnet has 60-mm aperture, 4-layer shell-type graded coils, and cold iron yoke. The cable in the two inner layers has 28 strands 1.0 mm in diameter and the cable in the two outer layers has 40 strands 0.7 mm in diameter. Both cables are using RRP Nb3Sn wires produced by Bruker-OST. A mechanical structure is based on aluminum I-clamps and a thick stainless steel skin. The maximum field for this design is limited by 15 T due to mechanical considerations. The first magnet assembly was done with lower coil pre-load to minimize the risk of coil damage during assembly. This presentation describes the details of the magnet design and the assembly procedure. First results of magnet cold tests are presented and discussed.

Primary author: ZLOBIN, Alexander (Fermilab)

Presenter: ZLOBIN, Alexander (Fermilab)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **474** Type: **Presentation**

Mixed QED-EW corrections for Higgs production

We propose an alternative approach based on series representation to directly reduce multi-loop multi-scale scattering amplitude into set of freely chosen master integrals. And this approach avoid complicated calculations of inverse matrix and dimension shift for tensor reduction calculation. During this procedure we further utilize the Feynman parametrization to calculate the coefficients of series representation and obtain the form factors. Conventional methodologies are used only for scalar vacuum bubble integrals to finalize the result in series representation form. Finally, we elaborate our approach by presenting the reduction of a typical two-loop amplitude for W boson production.

Primary author: Prof. LI, Zhao (IHEP-CAS)

Presenter: Prof. LI, Zhao (IHEP-CAS)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **475** Type: **Presentation**

Low emittance tuning of FCC-ee

Wednesday, June 26, 2019 9:06 AM (18 minutes)

The FCC-ee project studies the design of a future 100 km e+/e circular collider for precision studies and rare decay observations in the range of 90 to 350 GeV centre of mass energy with luminosities in the order of 10^{35} cm^{-2} s^{-1}. In order to reach these luminosity requirements, strong focusing is needed in the interaction regions. Large maximum beta values (of 7736 m for the Z energy) and the small beta star values, make the FCC-ee lattices particularly susceptible to misalignments and field errors. FCC-ee therefore presents an appreciable challenge for emittance tuning. In this talk, we describe a comprehensive correction strategy used for the low emittance tuning. The strategy includes programs that have been developed to optimise the lattice based on Dispersion Free Steering (DFS), linear coupling compensation based on Resonant Driving Terms (RDT) and beta beat correction utilising response matrices. One hundred misalignment and field error random seeds were introduced in MAD-X simulations and the final corrected lattices are presented.

Primary author: CHARLES, Tessa (University of Melbourne (AU))

Co-authors: ZIMMERMANN, Frank (CERN); OIDE, Katsunobu (High Energy Accelerator Research Organization (JP)); HOLZER, Bernhard (CERN)

Presenter: CHARLES, Tessa (University of Melbourne (AU))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **476** Type: **Presentation**

Safety topics requiring further investigation

Thursday, June 27, 2019 10:30 AM (22 minutes)

One of the aims of the FCC CDR was to demonstrate that a high-energy accelerator in a 100 km tunnel could be built and operated safely without putting human life at danger. The safety-performance based design method (chosen for the CDR) showed that life safety for potential fire and oxygen deficiency scenarios was assured for a tunnel separated into 440 m long compartments with fire resistant walls and smoke/helium extraction systems.
Future studies must extend this analysis to areas other than the FCC main tunnel and address wider safety objectives, which include environmental protection, protection of CERN's property (equipment and infrastructures) and the continuity of operation of the accelerator and experimental facilities. To address cryogenic hazard, improved models must be developed to describe the development of a helium release in more detail.
Future radiation protection studies shall include the evaluation of activation levels at the FCC ee machine, mitigation methods in the FCC-hh experiments and validate the fluids management and surface site organisation as the project develops, to demonstrate compliance with radiation protection requirements.

Primary author: OTTO, Thomas (CERN)

Co-authors: RIOS RUBIRAS, Oriol (CERN); WIDORSKI, Markus (CERN); HENRIQUES, Andre (CERN)

Presenter: OTTO, Thomas (CERN)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **477** Type: **Presentation**

RF performances of superconducting coatings on copper for the FCC study

Tuesday, June 25, 2019 10:48 AM (18 minutes)

The conceptual design report for the future circular collider (FCC) study indicated niobium on copper (Nb/Cu) as the technology of choice for the realization of superconducting radio frequency (SRF) accelerating cavities for the 400 MHz RF systems. This technology is well established at CERN and provides a significant reduction of the costs involved as compared to bulk Nb. Nevertheless, a well-focused R&D is still required to further improve the overall RF performances of the Nb coatings. In particular, the aim is to mitigate the so-called "Q-slope" issue and thus reduce the RF losses at a relatively high accelerating gradient. Moreover, such an R&D effort could possibly lead to the demonstration of the advantage of the Nb/Cu technology over bulk Nb even at the operation frequency of 800 MHz.
Energetic condensation techniques, like the high power impulse magnetron sputtering (HiPIMS) and the electron cyclotron resonance (ECR), provide niobium films with improved microstructure and enhanced RF performances. Our results, in fact, show the feasibility of coatings characterized by a surface resistance Rs 2-3 times lower than the values obtained in the state-of-the-art Nb/Cu LHC cavities.
A significant boost towards a further reduction of the cryogenic power consumption associated to Rs could come from the use of alternative superconductors beyond Nb characterized by larger critical temperature and field. In this respect, materials of the A15 family, such as the Nb3Sn alloy, are among the most promising. The coating of high quality Nb3Sn on copper has been optimized at CERN and the first RF characterizations are very promising.
In this talk, we shall present the main results of the RF performances of both Nb and Nb3Sn films coated on copper substrates. The investigation was carried out employing the CERN quadrupole resonator (QPR). The QPR is a very versatile tool and it allows for the measurement of the Rs of flat samples at different temperatures, frequencies and RF field values. The results will be compared with those of a bulk Nb sample, measured with the same technique.

Primary author: Dr ARZEO, Marco (CERN)

Co-authors: Dr ROSAZ, Guillaume Jonathan (CERN); Dr FERNANDEZ-PEÑA, Stephanie (CERN); Dr ILYINA BRUNNER, Katsiaryna; Dr VALENTE, Anne-Marie (Jefferson lab); Mr VENTURINI-DELSOLARO, Walter (CERN); Prof. SENATORE, Carmine (Geneva university); Dr BONURA, Marco (Geneva university)

Presenter: Dr ARZEO, Marco (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **478** Type: **Presentation**

Thermo-mechanical studies of collimator robustness

Tuesday, June 25, 2019 11:40 AM (15 minutes)

Thermo-structural studies of the most loaded primary (TCP) and secondary (TCS) collimators of the FCC were performed for both 1 h Beam Lifetime (BLT) and 0.2 h BLT operating conditions. The simulated collimator has a similar design to primary and secondary collimators used in LHC, though a thicker absorber block in Carbon-Fiber-Carbon (CFC) is adopted. For the early conceptual design, a perfectly bonded assembly was assumed in calculations, to increase the stiffness of the structure. The results highlight a considerably high temperature on the absorber block, especially for the TCP in 0.2h BLT (660 ℃), but still without failure. In terms of jaw deflection, the highest value is reached for the most loaded secondary collimator and is around 370 μm away from the beam. However, the onset of plasticity appears on the cooling pipes, an issue that could be cured with alternative materials or geometry.

Primary author: GOBBI, Giorgia (CERN)

Co-authors: PASQUALI, Michele (CERN); CARRA, Federico (CERN); BERTARELLI, Alessandro (CERN); VARASTEH, Mohammad (CERN); BRUCE, Roderik (CERN); REDAELLI, Stefano (CERN)

Presenter: GOBBI, Giorgia (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **479** Type: **Presentation**

Recent progress on APC in multi-filamentary Nb3Sn wires'

Thursday, June 27, 2019 10:30 AM (20 minutes)

Internal oxidation technique could generate nano oxide particles in Nb3Sn strands, which could significantly refine the Nb3Sn grain size and boost the high-field critical current density. Our recent APC (Artificial Pinning Center) Nb3Sn wires with Ta and Zr doping demonstrated substantial grain refinement and significantly increased Jc,nonCu, while retaining the high Bc2 values of the best ternary Nb3Sn conductors. The non-Cu Jcs of these APC conductors has reached nearly 1500 A/mm2 at 16 T/4.2 K, which achieve the current CERN FCC target. Their layer Jc reaches 4700 A/mm2 at 16 T/4.2 K - more than double the present best ternary Nb3Sn conductors. Their Bc2 was about 28 T, about 1-2 T higher than present state-of-the-art conductors. Microscopy analysis shows that this APC wires still have overly high residual Nb fractions due to the low Sn/Nb ratio, indicating that there is still great potential for further Jc,non-Cu improvement. This strand has been made to 61-filament restack strands getting filament size of 45 micros at the 0.5 mm strand.

Primary authors: Dr PENG, Xuan (Hyper Tech Research Inc.); XU, Xingchen (Fermi National Accelerator Lab); ROCHESTER, JACOB (The Ohio State University); SUMPTION, Mike (The Ohio State University); RINDFLEISCH, Matt (Hyper Tech Research); TOMSIC, Michael (Hyper Tech Research Inc.)

Presenter: Dr PENG, Xuan (Hyper Tech Research Inc.)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **480** Type: **Presentation**

HOM damping design studies for FCC-ee cavities

Tuesday, June 25, 2019 8:30 AM (18 minutes)

The present baseline of FCC-ee considers 400 MHz single-cell cavities for the Z-pole machine, 400 MHz four-cell cavities for the W and H modes of operation, complemented by 800 MHz five-cell cavities for the tt operation. In this presentation different higher order mode (HOM) damping schemes are compared for the four operating scenarios of FCC-ee. The longitudinal and transverse impedance of the HOM-damped cavities are compared with an impedance limit set by synchrotron radiation. Studying one cavity is usually not sufficient to fully characterize the behavior of cavities in a module. In a module composed of several cavities, some modes could arise which are not present in a single cavity. Furthermore, there is a difference between the amount of power absorbed by the HOM couplers in a single cavity and cavities in a module due to the effect of end beam pipes. Therefore, the HOM power for a single-cavity and four-cavity module with different HOM damping schemes is calculated as well and the power handling capabilities required for the respective schemes is determined.

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Co-authors: VAN RIENEN, Ursula Helga; CALAGA, Rama (CERN)

Presenter: GORGI ZADEH, Shahnam (Rostock University)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **481** Type: **Presentation**

The SACLA C-band linac

Tuesday, June 25, 2019 5:24 PM (18 minutes)

The Japanese XFEL (X-ray Free Electron Laser), SACLA adopts C-band normal conducting RF acceleration system as a main accelerator. The C-band system has constantly provided an acceleration gradient of about 40 MV/m since 2011 and it has accelerated electron beams up to 8.5 GeV at the maximum keeping sufficiently high stability of RF amplitude and phase required for high performance XFELs. Sixty-four accelerator units were in total installed, each of which consists of two 1.8 m-long accelerator structures, a cavity-type rf pulse compressor, a 50 MW pulsed klystron, a modulator and a PFN charger. This talk will be presenting the outline of our C-band acceleration system, achieved operational performance including fault statistics.

Primary authors: INAGAKI, Takahiro (RIKEN SPring-8 center); Dr ASAKA, Takao (JASRI / RIKEN); Dr KONDO, Chikara (JASRI / RIKEN); MAESAKA, Hirokazu (RIKEN SPring-8 Center); Dr OHSHIMA, Takashi (JASRI / RIKEN); Mr SAKURAI, Tatsuyuki (JASRI); Dr TANAKA, Hitoshi (RIKEN SPring-8 center)

Presenter: INAGAKI, Takahiro (RIKEN SPring-8 center)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **482** Type: **Presentation**

PAL-XFEL S-band Linac

Tuesday, June 25, 2019 5:06 PM (18 minutes)

PAL-XFEL is Korea's first, and the world's third, hard X-ray free-electron laser facility. PAL-XFEL is based on a 10-GeV S-band normal conducting linac consisting of 170 units of the 3-m long S-band accelerating structure, 46 units of the 80 MW S-band klystron, 41 units of S-band energy doubler, one X-band klystron, and three magnetic bunch compressor chicanes. A photo-cathode RF gun is used as a high brightness electron beam source. The e-beam is accelerated and compressed to a 3-kA or higher current beam with the bunch charge of 200 pC and at 60 Hz. A state-of the art design of klystron modulator and a reference timing system enables a very stable electron beam with an energy jitter of below 0.015% and an arrival time jitter of better than 15 fs.

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Presenter: Dr KANG, Heung-Sik (Pohang Accelerator Laboratory)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **483** Type: **Presentation**

Recent progress on iron-based superconductors: potentials for high-field applications

Thursday, June 27, 2019 3:00 PM (15 minutes)

Iron-based superconductors (IBS) since their discovery appeared very promising for applications at 4.2K and high fields. Two technologies are advancing towards realistic applications, namely Powder-In-Tube (PIT) and Coated Conductors (CCs). PIT tapes of the 122 family attained critical current densities Jc of 105A/cm2 at 15T with hot pressing, while CCs on commercially available IBAD and RABiTS templates showed Jc up to 105A/cm2 at 30T for both 122 and 11 families. Current efforts are focused on the development of scalable techniques for PIT conductors and the identification of simpler substrate architectures for CC. On the other hand, IBS continue to attract research interest because of their rich structural variety. In particular, the recently discovered CaAFe4As4 phase (1144) could be a promising candidate for superconducting wires and tapes.
In this talk, the state of the art of IBS will be reviewed.

Primary author: PUTTI, Marina (University of Genova)

Co-authors: PROVINO, A. (CNR-SPIN, Genova, Italy); BALLARINO, Amalia (CERN); Ms BERNINI, Cristina (CNR Spin Genova); BELLINGERI, Emilio (CNR-SPIN); SYLVA, Giulia (Università degli Studi di Genova and CNR Spin Genova); MANFRINETTI, P. (University of Genova, Italy); HOPKINS, Simon (CERN); BRACCINI, V. (CNR-SPIN, Genova, Italy); MALAGOLI, andrea (CNR-SPIN); FERDEGHINI, carlo (CNR)

Presenter: PUTTI, Marina (University of Genova)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **484** Type: **Presentation**

Fluka simulation for the HE-LHC machine (IR7)

Tuesday, June 25, 2019 2:15 PM (20 minutes)

The High Energy LHC (HE-LHC) machine with center-of-mass energy of 27 TeV (≈2×LHC) and stored beam energy of 1.3 GJ (≈3.7×LHC) is meant to use the FCC-hh magnet technology in the present tunnel. Particle-tracking calculation followed by shower calculation allows quantifying the power deposition along the beam line. The HE-LHC's betatron cleaning insertion features a similar design as the LHC machine and aims to sustain, for at least 10 seconds, the impact of about 1.9 MW, corresponding to a beam lifetime of 12 minutes. In order to assess the loss effect on the dispersion suppressor cold magnets, a three-step simulation approach was applied, investigating the role of two local collimators (TCLDs). Moreover, in this study, the implications of the dogleg removal from the long straight section were studied.

Primary author: VARASTEH, Mohammad (CERN)

Co-authors: BRUCE, Roderik (CERN); CERUTTI, Francesco (CERN); CROUCH, Matthew Paul (CERN); MEREGHETTI, Alessio (CERN); ZIMMERMANN, Frank (CERN)

Presenter: VARASTEH, Mohammad (CERN)

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **485** Type: **Presentation**

The CEA dipole model for the FCC

Thursday, June 27, 2019 4:24 PM (18 minutes)

F2D2, the FCC Flared-ends Dipole Demonstrator, is a 15 T single-aperture short model being developed within a collaboration between CEA Paris-Saclay and CERN. The magnet will be fabricated at CEA and then tested at CERN. The design phase is ongoing at CEA and we will report on its status. The 2D magnetic and mechanical designs have been optimized and allowed defining the operating points and the required structural components. F2D2 will be the first Nb3Sn block-coil magnet using two cable grades. The cables will be spliced outside of the magnet, which represents one of the most complex design feature, and requires a special focus on the magnet ends. To do so, the design of the magnet has been performed using a CAD (Computer Aided Design) and both magnetic and mechanical 3D FEM (Finite-Elements Models). The CAD defines precisely the complex coil-ends shape that allows positioning the layer jumps and routing the cable exits. The FEM are used to optimize the longitudinal pre-load system in order to contain the large Lorentz forces during operation. The magnet is pre-loaded transversally with bladders and keys and with an external Al shell; and longitudinally with Al tie-rods and end-plates. The pre-load levels are computed to operate the magnet under sufficient compression, while minimizing the stress in the coil and avoid degradation.

Primary authors: ROCHEPAULT, Etienne (Université Paris-Saclay (FR)); FELICE, Helene (Université Paris-Saclay (FR)); CALVELLI, Valerio (INFN e Universita Genova (IT)); DURANTE, Maria; Mr MALLON, Philip Jonathan (CEA Paris-Saclay); MANIL, Pierre (Université Paris-Saclay (FR)); Mr MILLOT, Jean-François (CEA Paris-Saclay); Mr MINIER, Gilles (CEA Paris-Saclay); IZQUIERDO BERMUDEZ, Susana (CERN)

Presenter: ROCHEPAULT, Etienne (Université Paris-Saclay (FR))

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **486** Type: **Presentation**

Challenges for tau polarisation measurement

Tuesday, June 25, 2019 10:50 AM (20 minutes)

The unequal coupling of the Z boson to left-handed and right-handed electrons and taus produces the tau polarisation asymmetries, Ptau and ApolFB, that are related to the ratios of the effective vector to axial-vector couplings. In the context of the Standard Model, these couplings can in turn be interpreted as a measurement of the effective electroweak mixing angle. The parity violating effects of the neutral weak current as seen in the process e+e- to Z to tau+ tau- were probed with great precision at the four LEP experiments ALEPH, DELPHI, L3, and OPAL. This presentation will review these measurements and try to provide a perspective on the potential and challenges for improving their evaluation at the FCC-ee.

Primary author: VINCTER, Manuella (Carleton University (CA))

Presenter: VINCTER, Manuella (Carleton University (CA))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **487** Type: **Presentation**

Impedance budget and stability

Tuesday, June 25, 2019 9:42 AM (18 minutes)

FCC-hh impedance-driven beam instabilities and the corresponding mitigation techniques will be outlined. Recent post-CDR updates on impedances will be summarized.

Primary author: ARSENYEV, Sergey (CERN)

Presenter: ARSENYEV, Sergey (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **488** Type: **Presentation**

FCC-hh: Longitudinal beam dynamics and RF requirements

Tuesday, June 25, 2019 10:30 AM (15 minutes)

In addition to physics requirements and the injector chain capability, the choice of the rf and longitudinal beam parameters in the FCC-hh is defined by transverse and longitudinal single-bunch stability. Namely, the Transverse Mode Coupling Instability (TMCI) should be prevented for the calculated transverse impedance model, and Landau Damping in the longitudinal plane should be provided for the assumed longitudinal inductive impedance,based on the LHC experience. This work presents an update on the beam and rf parameters, which satisfy these criteria with sufficient margin during injection, acceleration, and physics. The rf power required for the transient beam loading compensation during cycle is also discussed.

Primary authors: Dr SHAPOSHNIKOVA, Elena (CERN); Dr KARPOV, Ivan (CERN)

Presenter: Dr KARPOV, Ivan (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh detector & experiment

Contribution ID: **489** Type: **Presentation**

Longitudinal parameters

Tuesday, June 25, 2019 1:40 PM (15 minutes)

Longitudinal parameters of the HE-LHC at injection energy, during ramp and physics are determined taking into account longitudinal single-bunch stability and LHC experience

Primary author: Dr SHAPOSHNIKOVA, Elena (CERN)

Presenter: Dr SHAPOSHNIKOVA, Elena (CERN)

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **490** Type: **Presentation**

Common Turnkey Software Stack

Wednesday, June 26, 2019 1:45 PM (25 minutes)

Future HEP experiments require detailed simulation and advanced reconstruction algorithms to explore the physics reach of their proposed machines and to design, optimise, and study the detector geometry and performance. To synergise the development software efforts, the CERN EP R&D road map proposes the creation of a "Turnkey Software Stack", which is foreseen to provide all the necessary ingredients, from simulation to analysis, for future experiments, including FCC. The software stack will facilitate writing specific software for experiments ensuring coherency and maximising re-use of established packages to benefit from existing solutions and community developments, for example, ROOT, Geant4, DD4hep, Gaudi and PODIO.

The current status and plans of the turnkey software stack will be presented and details of the plans for future developments to generalise the applicability to FCC-ee and beyond.

Primary author: STEWART, Graeme A (CERN)

Presenter: STEWART, Graeme A (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Common detector technologies and offline software

Contribution ID: **491** Type: **Presentation**

QCD uncertainties in the weak mixing angle extraction from e+e−>Z(b bbar) asymmetries

Thursday, June 27, 2019 8:30 AM (20 minutes)

The forward-backward asymmetry of b-quarks measured at LEP in e+e− collisions around the Z pole, $A_{FB}^{0,b}|^{exp}$=0.0992±0.0016, remains today the electroweak precision observable with the largest disagreement (2.8σ) with the Standard Model theoretical prediction, $A_{FB}^{0,b}|^{th}$=0.1037±0.0008, and thereby also the weak mixing angle $\sin^2\theta_W$ derived from it. The dominant systematic uncertainties are due to QCD effects — b,c-quark showering and fragmentation, and B,D meson decay models — that have not been revisited in the last 20 years. We reassess the QCD uncertainties of the eight LEP original $A_{FB}^{0,b}$ measurements, using modern parton shower simulations based on PYTHIA-8 and PYTHIA-8 plus VINCIA with different tunes of soft and collinear radiation as well as of hadronization. Our analysis indicates QCD uncertainties that are overall smaller but still consistent with the original ones. Using the reassessed QCD systematic uncertainties, we present updates of the $A_{FB}^{0,b}$ and $\sin^2\theta_W$ values derived from the LEP data, and future estimates for FCC-ee.

Primary author: D'ENTERRIA, David (CERN)

Presenter: D'ENTERRIA, David (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **492** Type: **Presentation**

Industrialization of 16T Nb3Sn magnet production for HE-LHC and FCC

Thursday, June 27, 2019 9:30 AM (20 minutes)

Cost-effective manufacturing of Nb3Sn magnets for HE-LHC and FCC could be achieved through optimization of HL-LHC magnet manufacturing performance using key performance indicators (KPI) such as cost and quality. However, optimization of Nb3Sn magnet manufacturing performance is computationally expensive due to the large number of manufacturing parameters, design variables, and KPI, whose interrelationships need to be modeled and optimized in order to achieve target performance. Thus, probabilistic modeling using Bayesian networks and dimensional analysis conceptual modeling (DACM) framework is proposed to model production cost. Next, a dimension reduction method using graph centrality theory is proposed to enable screening of variables into groups for optimization, based on their level of influence on performance targets.
To achieve KPI-driven performance optimization based on real data from HL-LHC magnet production, a continuous production monitoring platform known as Manufacturing Execution System (MES) is proposed considering the requirements of the production. The MES implementation is assisted by Leanware (Finland) to provide functionalities such as, resource monitoring, magnet component traceability within facility, production scheduling and execution, and support in-process quality control. The MES, Bayesian Networks and dimension reduction based analytics methods enable accurate cost-drivers identification and cost-driven optimization in Nb3Sn magnet production.

Primary author: Mr CHAKRABORTI, Ananda (Tampere University (FI))

Co-authors: Mr PANICKER, Suraj (Tampere University (FI)); Mr SAARELAINEN, Pekka (Leanware Oy (FI)); Dr SCHOERLING, Daniel (CERN); Prof. COATANÉA, Eric (Tampere University (FI)); Prof. KOSKINEN, Kari (Tampere University (FI))

Presenter: Mr CHAKRABORTI, Ananda (Tampere University (FI))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **494** Type: **Presentation**

Recent progress on the development of high performance Bi-2212 wires and coils

Thursday, June 27, 2019 3:15 PM (15 minutes)

Bi-2212 round wire made by powder-in-tube technique has emerged as a very promising conductor for high field NMR and accelerator magnets because it is can be made in multiple multifilament architectures and in the twisted state that benefits low hysteretic losses, isotropic properties, and high magnetic field quality. Bi-2212 powder is now available from two US companies, MetaMateria and nGimat. Bruker-OST is routinely producing Bi-2212 wires in multiple architectures and kilometer pieces. We are investigating Bi-2212 powders made by MetaMateria and nGimat, and are doing overpressure heat treatments (OP-HT) on wires made from these powders by Bruker-OST. We have studied the effects of twisting, Rutherford cabling, and heat treatment condition on the superconducting properties and microstructure of the recent wires. Critical current density of Bi-2212 wire has been improved significantly. Short samples of wire made with nGimat powder have JC(4.2K,15T) = 6860 A/mm2 (4.2 K, 5 T) and JE(4.2K, 15T) = 1360 A/mm2 with overpressure processing. These wires are now going into significant coils and much of the focus is now shifting to ensuring that such good properties can be maintained in useful coil forms. Recent progress will be described.

Primary authors: LARBALESTIER, David (National High Magnetic Field Laboratory); HELLSTROM, Eric (Florida); Prof. KAMETANI, Fumitake (NHMFL); JIANG, Jianyi (Florida State University)

Presenter: LARBALESTIER, David (National High Magnetic Field Laboratory)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **495** Type: **Presentation**

SwissFEL C-band Linac and S-band Linac for FERMI

Tuesday, June 25, 2019 5:42 PM (18 minutes)

The SwissFEL 6 GeV electron Linac utilizes 104 C-band copper accelerating-structures of 2m length each. For series production of these structures PSI has developed together with industry a new production process. The key features of this process are on-tune ultra-precision machining and vacuum brazing of the full stack of cups together with the couplers in a single brazing step. This process proofed to be very reliable and robust, not a single structure was lost in the production process, during high power conditioning and in operation. The field flatness, structure straightness and high field properties are consistently very good. Because of the on-tune machining neither a tuning procedure nor design provisions for such a procedure are required.
Since the completion of the C-band series in 2016 the same process has also been applied to X-band prototypes for CLIC and, in a collaboration with CERN and DESY, for X-band deflectors used for femtosecond scale beam diagnostic. For the C-band structures acceleration of up to 50MV/m was demonstrated, the X-band structures reach acceleration fields in excess of 100MV/m in the CLIC RF testing facility at CERN. Currently a collaboration of PSI with FERMI at ELETTRA aims at qualifying the same process for 3m long S-band structures with an operational acceleration field in excess of 30MV/m. A short test structure was already successfully tested at FERMI up to 35 MV/m with extremely low breakdown rate.
The talk gives an overview of the technology and discusses a possible use in the FCC-ee injector.

Primary author: BRAUN, Hans-H.

Presenter: BRAUN, Hans-H.

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **496** Type: **Presentation**

Study on the beam induced vacuum effects in the FCC-hh beam vacuum chamber

Wednesday, June 26, 2019 8:30 AM (20 minutes)

The vacuum chamber of the FCC-hh will have to cope with unprecedented levels of synchrotron radiation power for proton colliders, dealing simultaneously with a tighter magnet aperture. Since the high radiation power and photon flux will release larger amounts of gas into the system, to keep a good vacuum level in the FCC-hh becomes considerably more challenging than in the LHC. This contribution presents the study carried out on the FCC-hh beam induced vacuum effects, the different phenomena which, owing to the presence of the beam, have an impact on the residual gas density. It is concluded that thanks to the proposed mitigation measures, the vacuum level in the FCC-hh should be adequate, allowing to reach the molecular density requirement of better than $\leq 1 \times 10^{15}$ $H_{2\,eq}/m^3$ with baseline beam parameters within the first months of conditioning.

Primary author: BELLAFONT, Ignasi

Co-authors: METHER, Lotta (EPFL - Ecole Polytechnique Federale Lausanne (CH)); KERSEVAN, Roberto (CERN)

Presenter: BELLAFONT, Ignasi

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **497** Type: **Presentation**

SLAC/SLC 2-mile S-Band Linac

Tuesday, June 25, 2019 4:30 PM (18 minutes)

The technical history of the SLAC/SLC 2-mile Linear Collider will be discussed including the concept, construction, accelerator physics advances, and the collider operation on the Z resonance.

Primary author: Dr SEEMAN, John (SLAC)

Presenter: Dr SEEMAN, John (SLAC)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **498** Type: **Presentation**

Multiple-Readout Compensated Calorimetry R&D

Wednesday, June 26, 2019 11:59 AM (1 minute)

Dual Readout Calorimetry measures scintillation light and Cerenkov light on the same hadron shower to correct the jet energy to compensate hadron and jet energy measurements,We present dual readout calorimetry with scintillator and Cerenkov tile readout and beyond to multiple tile readout, with superior energy resolution, radiation resistant ionization sensors in the form of tiles (inorganic scintillators, Si, LArgon). Monte Carlo (MC) studies were used to design a prototype tile dual calorimeters using Fe or Cu absorbers, Cerenkov and plastic scintillator tiles, including an integral Cerenkov-compensated e-m front end using Pb tiles. The MC studies are extended to other tile type appropriate for dual readout and extend to multiple readout with 3 or more types of tile radiation sensors – sensors with different responses and/or higher contrast to component signals to e-m or hadron showers, neutrons and ions. Sensors include tiles with low refractive indices (aerogel, others), transition radiation "tiles", secondary emission tiles sensitive to ions and low energy protons, hydrogenous vs non-hydrogenous ionization-sensing tiles, and neutron sensing tiles. Multiple readout improves dual readout by extending to triple or more readout. Of special interest is application of tile dual or multiple tile readout to high granularity particle/energy flow calorimeters, not possible with parallel fibers.

Primary authors: ONEL, Yasar (University of Iowa (US)); WINN, David (Fairfield University (US))

Presenter: ONEL, Yasar (University of Iowa (US))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **499** Type: **Poster**

High Precision Timing and High Rate Detectors in Energy Frontiers

Tuesday, June 25, 2019 4:19 PM (1 minute)

High precision timing is becoming an important issue in particle physics especially in Energy Frontiers. Signals with FW10%-10% Max < 25ns and segmentation to handle >200 pileup(PU) are advantageous in many future Colliders and upgrades The high track density and pile-up in high luminosity particle colliders are challenges for event reconstruction and analysis. MIP (minimum ionizing particle) pileup is a few percent in ~1x1 cm2, 1200 cm radially along h=0.The case for adding a timing 4th dimension to calorimetry and tracking is becoming compelling. Timing detectors must withstand 50 MRad and neutrons >3x1015n/cm2. Timing has been shown by CMS and ATLAS to improve ETmiss resolution, and tag secondary vertices to ±few mm. Precise timing of calorimeter deposits and vertexes enable rejection of spurious data inconsistent with the primary vertex time. We discuss detectors for MIPs capable of timing precision to ±10's ps, and rate capabilities exceeding 100's of MHz.Issues for defining a Figure of Merit for timing scales as tdecay/√Nelectrons. The rate capability scales inversely as tdecay. For optical transducers (SiPM, PMT, MCP-PMT), the timing precision is dominated by Trise and inversely by S/N. Noise in the experiments from low energy photons/x-rays scales inversely with Xo. SiPM and MCP-based detectors have risetimes shrinking to ~100-20ps. Optical signals include scintillators with decay constants less than 2ns,Cherenkov radiators, and secondary emission detectors. Scintillators with high FOM include ZnO:Ga(GZO) (0.7ns decay), CdS:In (0.2ns decay) and organic solid and liquid (with rad resistance) scintillators with decays less than 1ns. We discuss scintillators, Cherenkov radiators(aerogels, quartz, Teflon AF, water, oils) and direct secondary emission MIP detectors as precision timing and high rate detectors.

Primary authors: ONEL, Yasar (University of Iowa (US)); WINN, David (Fairfield University (US))

Presenter: ONEL, Yasar (University of Iowa (US))

Session Classification: Poster session

Track Classification: FCC-ee detector & experiment

Contribution ID: **500** Type: **Presentation**

Challenges for EW b physics measurements

Tuesday, June 25, 2019 11:10 AM (20 minutes)

Measurements of the partial widths to b-quarks normalised to the total hadronic width (Rb) and the forward-backward b asymmetry probe the fundamental charge and weak isospin structure of the Standard Model couplings for b-quarks, which are in turn sensitive to new physics. I will discuss the current status of the LEP+SLD measurements and methods, discussing the achievable precision at the FCC-ee. Particular emphasis will be given to the systematic uncertainties, which will limit the experimental precision, and discuss possible implications on the detectors.

Primary author: PALLA, Fabrizio (INFN Sezione di Pisa, Universita' e Scuola Normale Superiore, P)

Presenter: PALLA, Fabrizio (INFN Sezione di Pisa, Universita' e Scuola Normale Superiore, P)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **501** Type: **Presentation**

Field Quality at injection for FCC-hh

Tuesday, June 25, 2019 9:06 AM (18 minutes)

The Nb_3Sn dipole design for the hadron machine option of the Future Circular Colliders enters in an intense and long R&D phase. As a result, more realistic dipole field quality evaluations are available for beam dynamics studies. The impact of the dipole field quality on the optics design and on the beam lifetime at injection are presented and the non-linear correction schemes defined. The effects of the Landau Damping octupoles and the RF bucket size at injection are also discussed. Main highlights of this topic, inside the EuroCirCol study, and perspectives are summarized.

Primary author: DALENA, Barbara (Université Paris-Saclay (FR))

Co-authors: CHANCE, Antoine (CEA Irfu); BOUTIN, David (CEA); SCHULTE, Daniel (CERN)

Presenter: DALENA, Barbara (Université Paris-Saclay (FR))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **502** Type: **Presentation**

Photodesorption Studies on FCC-hh Beam Screen Prototypes at KARA

Wednesday, June 26, 2019 11:10 AM (20 minutes)

In the framework of the EuroCirCol collaboration (work package 4 "Cryogenic Beam Vacuum System"), three FCC-hh beam screen (BS) prototypes have been tested at the Beam Screen TEstbench Experiment (BESTEX) installed at the 2.5 GeV electron storage ring KARA (KArlsruhe Research Accelerator) light source at the Karlsruhe Institute for Technology (KIT). Each of the three BS prototypes, 2 m in length, implement a different design feature: 1) baseline design (BD), with electrodeposited copper and no electron-cloud (EC) mitigation features; 2) BD with set of distributed cold-sprayed anti-EC clearing electrodes; 3) BD with laser-ablated anti-EC surface texturing. The results of the measurements hereby presented provide relevant data related to photon stimulated desorption, photon reflectivity, photon induced heat loads and photo-electron generation during irradiation of these three BS prototypes with a FCC-hh type SR beam.

Primary author: GONZALEZ GOMEZ, Luis Antonio (INFN e Laboratori Nazionali di Frascati (IT))

Co-authors: Dr BAGLIN, Vincent (CERN); BELLAFONT, Ignasi; CASALBUONI, Sara (IBPT-KIT); CHIGGIATO, Paolo (CERN); GARION, Cedric (CERN); HUTTEL, Erhard; KERSEVAN, Roberto (CERN); PEREZ, Francis (CELLS)

Presenter: GONZALEZ GOMEZ, Luis Antonio (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **503** Type: **Presentation**

Development of Nb3Sn for FCC at BRUKER

Thursday, June 27, 2019 1:45 PM (15 minutes)

CERN and BRUKER have been longstanding, historic partners in the development, manufacture and support of today's materials for accelerator magnets. With the Future Circular Collider on the horizon, both companies decided to build on their partnership and extend their collaboration in order to ready today's state of the art A-15 Materials for the requirements of future accelerator magnets. As of 2018, CERN and BRUKER are collaborating on three major topics:

First – The development, reproducible characterization and evaluation of the effect of internal oxidation and other APC approaches on several variations of BRUKER's PIT and RRP® designs.

Second – The refinement of manufacturing strategies and heat treatments to maintain a high Jc and RRR at very small filament diameters.

Third – The development of a more resource-efficient, cost-saving and less energy-intensive manufacturing route for the large scale fabrication of high-Jc Nb3Sn conductors.

In this talk, BRUKER presents the extent of their joint project and discusses first results, methods, challenges and perspectives of the internal oxidation in PIT conductors with the goal to establish a common base for the characterization of such wires and to understand the working principles of this promising technique.

Primary author: BUEHLER, Carl (Bruker EST)

Co-authors: Mr WANIOR, Matheus (Bruker EAS); SAILER, Bernd (Bruker EAS GmbH); THOENER, Manfred (Bruker EAS); Dr SCHLENGA, Klaus (Bruker HTS GmbH); Dr KAUFMANN-WEISS, Sandra (KIT); HOLZAPFEL, Bernhard; Prof. HEILMAIER, Martin (KIT)

Presenter: BUEHLER, Carl (Bruker EST)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **504** Type: **Presentation**

Welcome

Monday, June 24, 2019 8:30 AM (5 minutes)

Primary author: D'HONDT, Jorgen (Vrije Universiteit Brussel (BE))

Presenter: D'HONDT, Jorgen (Vrije Universiteit Brussel (BE))

Session Classification: Plenaries

Track Classification: Others

Contribution ID: **505** Type: **Presentation**

Welcome speech

Monday, June 24, 2019 8:35 AM (10 minutes)

Primary author: Dr BURTSCHER, Wolfgang (EC's Directorate-General for Research and Innovation (RTD))

Presenter: Dr BURTSCHER, Wolfgang (EC's Directorate-General for Research and Innovation (RTD))

Session Classification: Plenaries

Track Classification: Others

Contribution ID: **506** Type: **Presentation**

Welcome speech

Monday, June 24, 2019 8:45 AM (10 minutes)

Primary author: GIANOTTI, Fabiola (CERN)

Presenter: GIANOTTI, Fabiola (CERN)

Session Classification: Plenaries

Track Classification: Others

Contribution ID: **507** Type: **not specified**

Keynote talk

Monday, June 24, 2019 9:00 AM (30 minutes)

Primary author: Mr VAN ROMPUY, Herman (President Emeritus of the European Council, Former Prime Minister of Belgium)

Presenter: Mr VAN ROMPUY, Herman (President Emeritus of the European Council, Former Prime Minister of Belgium)

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **508** Type: **Presentation**

FCC and the Future of Fundamental Physics

Monday, June 24, 2019 9:30 AM (30 minutes)

Primary author: Prof. ARKANI-HAMED, Nima (School of Natural Sciences, Institute of Advanced Studies, University of Princeton)

Presenter: Prof. ARKANI-HAMED, Nima (School of Natural Sciences, Institute of Advanced Studies, University of Princeton)

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **509** Type: **Presentation**

Overview of the Future Circular Collider study

Monday, June 24, 2019 10:00 AM (30 minutes)

Primary author: BENEDIKT, Michael (CERN)

Presenter: BENEDIKT, Michael (CERN)

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **510** Type: **Presentation**

FCC-ee design overview

Monday, June 24, 2019 2:00 PM (30 minutes)

Primary author: ZIMMERMANN, Frank (CERN)

Presenter: ZIMMERMANN, Frank (CERN)

Session Classification: Plenaries

Track Classification: FCC-ee accelerator

Contribution ID: **511** Type: **Presentation**

SRF and powersources R&D overview

Monday, June 24, 2019 2:30 PM (30 minutes)

Primary author: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

Presenter: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

Session Classification: Plenaries

Track Classification: Superconducting RF & associated technologies

Contribution ID: **512** Type: **Presentation**

FCC infrastructures and operation overview

Monday, June 24, 2019 3:00 PM (30 minutes)

Primary author: MERTENS, Volker (CERN)

Presenter: MERTENS, Volker (CERN)

Session Classification: Plenaries

Track Classification: Technical infrastructure & operation

Contribution ID: **513** Type: **Presentation**

Horizon Europe and Europe's Strategy on R&I

Monday, June 24, 2019 4:00 PM (30 minutes)

Primary author: SEQUEIRA, Keith (European Commission)

Presenter: SEQUEIRA, Keith (European Commission)

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **514** Type: **Presentation**

Fundamental research as driver for Innovation

Monday, June 24, 2019 4:30 PM (30 minutes)

Primary author: Mr OLIVEIRA, Carlos (Member of EC's High LEvel Group of Innovators)

Presenter: Mr OLIVEIRA, Carlos (Member of EC's High LEvel Group of Innovators)

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **515** Type: **Presentation**

Update on the European Strategy for Particle Physics

Monday, June 24, 2019 5:00 PM (30 minutes)

Primary author: D'HONDT, Jorgen (Vrije Universiteit Brussel (BE))

Presenter: D'HONDT, Jorgen (Vrije Universiteit Brussel (BE))

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **516** Type: **Presentation**

Synchrotron radiation backgrounds in the experimental insertion region of the FCC-hh

Tuesday, June 25, 2019 4:30 PM (15 minutes)

Synchrotron radiation emitted by the 50 TeV protons of the FCC-hh in the last bending and quadrupole magnets upstream the interaction region has been simulated and characterized in terms of emitted power, flux, photons spectrum and fans. The study is focused on the evaluation of the fraction of photons that reaches the experimental region and may hit the detector.

This work was supported by the HORIZON 2020 project EuroCirCol, grant agreement 654305.

Primary author: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Presenter: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **517** Type: **Presentation**

Possible Designs of HOM Couplers for Superconducting 400 MHz RF Cavities

Tuesday, June 25, 2019 9:06 AM (18 minutes)

The Future Circular Collider (FCC) is one possible future successor of the Large Hadron Collider (LHC) at CERN. The proton-proton collider center-of-mass collision energy is set to 100 TeV with a beam current of 0.5 A. To achieve this energy a stable acceleration is critical and therefore higher order modes (HOM) need to be damped. HOM dampers, further characterized as couplers, need to fulfill several criteria to be efficient. As a first property the couplers should assure a longitudinal impedance of higher order modes of below 10 kΩ. Furthermore, the loaded Q-factor should be below 1000 and the corresponding R/Q value should be in the range of 10 Ω or lower. Besides the Hook-type and Probe-type HOM coupler two additional designs were simulated. The recent results of the different couplers attached to a superconducting 400 MHz RF cavity will be presented.

Primary author: PETRY, Nils

Co-author: Mr PODLECH, Holger (Goethe University Frankfurt)

Presenter: PETRY, Nils

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **518** Type: **Presentation**

EuroCirCol WP5 16 T magnet R&D overview

Monday, June 24, 2019 12:00 PM (30 minutes)

The talk summarizes the activity performed within EuroCirCol on the 16 T magnets, and will be composed of two parts. The first part, presented by Davide Tommasini, will provide a general overview of the 16 T magnets programs and recall the related achievements of the EuroCirCol initiative, including new initiatives coming as a direct consequence of the program. The second part, presented by Bernardo Bordini, will summarize the evolution and results of the EuroCirCol conductor program.

Primary authors: TOMMASINI, Davide (CERN); BORDINI, Bernardo (CERN)

Presenters: TOMMASINI, Davide (CERN); BORDINI, Bernardo (CERN)

Session Classification: Plenaries

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **519** Type: **Presentation**

Update on R2E and heat load simulations

Thursday, June 27, 2019 11:14 AM (21 minutes)

At energies up to 50 TeV, understanding the impact of beam interactions with the residual gas along the vacuum chamber is essential during the design of the FCC-hh. Despite the ultra high vacuum (UHV) environment, secondary showers generated by such interactions produce a range of detrimental effects and place constraints on the maximum possible gas density.

A 214 m long FCC arc cell has been created in the Monte Carlo physics package FLUKA, based on the latest lattice configuration, beam screen and element designs. In this contribution simulations of beam-gas interactions, taking into account the most recent gas density distribution estimations, are presented. Building upon previous studies, an updated assessment of relevant quantities for the design of the lattice is provided, including dose, peak power density and total load on magnets. Additionally, in the scope of the R2E project, radiation levels in critical areas for the electronics have been ascertained and are discussed.

Primary author: HUNT, James (CERN)

Co-authors: INFANTINO, Angelo (CERN - EN/STI-FDA); CERUTTI, Francesco (CERN)

Presenter: HUNT, James (CERN)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **520** Type: **Presentation**

FCC-ee beam vacuum challenges, concepts and future R&D plans

Wednesday, June 26, 2019 1:30 PM (20 minutes)

The FCC-ee vacuum system design presents several challenges, stemming from various technical specifications, namely its sheer unprecedented size, a twin-ring design (contrary to LEP's single-ring), and the fact that it needs to accommodate both a low-energy/high-current and high-energy/low-current machines. Another important challenge is the need to condition the various machines in as short time as possible, especially the low-energy Z-pole version, in order to allow the experimenters to integrate as much luminosity as possible prior to moving on to the next beam energy. A final challenge is identified in the design of the MDI area, which needs to avoid as much as possible any synchrotron radiation (SR) photons hitting the vertex area, and manage the extremely high energy SR photons generated along the final focus doublets. The conceptual design of the arc sections will be given, alongside with a preview of the needed R&D studies and prototyping.

Primary authors: Mr KERSEVAN, Roberto (CERN); Dr GARION, Cedric (CERN)

Presenter: Mr KERSEVAN, Roberto (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **521** Type: **Presentation**

FCC Host States implementation. Institutional and administrative framework

Thursday, June 27, 2019 8:55 AM (20 minutes)

This session will present the main institutional and administrative challenges for the FCC implementation, in particular the compliance with the two Host States' specific legal requirements in a unique environment.

Primary author: MARTIN, Olivier (Ministere des affaires etrangeres et europeennes (FR))

Presenter: MARTIN, Olivier (Ministere des affaires etrangeres et europeennes (FR))

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **522** Type: **Presentation**

Study of HE-LHC ventilation strategy in case of fire

Thursday, June 27, 2019 10:52 AM (22 minutes)

The current CDR sets a ventilation strategy developed together with EN/CV. CFD simulations of the inflow and outflow requirements of such a new system are necessary to properly size it and ensure performance with all different credible and degraded scenarios (e.g. fire). Additionally, a detailed study on the mechanical smoke dampers and required fire resistance of the ducts will help on optimizing the cost/efficient solution. This talks will present and in-depth CFD analysis of full LHC sector considering different fire scenarios and degraded modes. The simulations will also be used to establish the system requirements in terms of fire resistance.

Primary author: RIOS RUBIRAS, Oriol (CERN)

Presenter: RIOS RUBIRAS, Oriol (CERN)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **523** Type: **Presentation**

QED at the Z pole: Challenges

Tuesday, June 25, 2019 1:30 PM (30 minutes)

The expected experimental precision of the rates and asymmetries in the Future Circular Collider with electron positron beams (FCC-ee) in the centre of the mass energy range 88-365GeV considered for construction in CERN, will be better by a factor 5-200. This will be thanks to very high luminosity, factor up to 105 higher than in the past LEP experiments. This poses the extraordinary challenge of improving the precision of the Standard Model predictions by a comparable factor. In particular the perturbative calculations of the trivial QED effects, which have to be removed from the experimental data, are considered to be a major challenge for almost all quantities to be measured at FCC-ee. The task of this paper is to summarize on the "state of the art" in this class of the calculations left from the LEP era and to examine what is to be done to match the precision of the FCC-ee experiments – what kind of technical advancements are necessary. The above analysis will be done for most important observables of the FCC-ee like the total cross sections near Z and WW threshold, charge asymmetries, the invisible width of Z boson, the spin asymmetry from τ lepton decay and the luminosity measurement.

Primary author: Prof. JADACH, Stanisław (IFJ PAN)

Presenter: Prof. JADACH, Stanisław (IFJ PAN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **524** Type: **Presentation**

Collective effects with ttbar configuration

Wednesday, June 26, 2019 10:30 AM (18 minutes)

In this talk the collective effects for the FCC-ee with ttbar configuration will be presented. The resistive wall and RF cavity systems at 400 MHz and 800 MHz are taken into account for the short range wakefield in the longitudinal and transverse planes. The thresholds of the transverse mode coupling and microwave instabilities are evaluated and compared with the Z-pole configuration.

Primary author: MIGLIORATI, Mauro (University of Rome ”LA SAPIENZA”)

Presenter: MIGLIORATI, Mauro (University of Rome ”LA SAPIENZA”)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **525** Type: **Presentation**

Collective effects in the booster synchrotron

Wednesday, June 26, 2019 2:06 PM (18 minutes)

In this talk a preliminary overview of the collective effects for the FCC-ee booster will be presented. In particular we will give a first evaluation of the microwave instability threshold and discuss possible actions to eventually increase such a threshold. Finally, a plan for the future work on collective effects of this machine will be discussed.

Primary author: MIGLIORATI, Mauro (University of Rome ”LA SAPIENZA”)

Presenter: MIGLIORATI, Mauro (University of Rome ”LA SAPIENZA”)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **526** Type: **Presentation**

Civil engineering summary: cost drivers, risk factors, schedule for preparatory phase

Thursday, June 27, 2019 9:15 AM (20 minutes)

This presentation summarizes the civil infrastructure required to accommodate the hadron and lepton machines proposed for the Future Circular Collider. With the aid of a bespoke web-based tool, the position of the FCC tunnel has been optimised by integrating aspects such as geology, surface constraints and particular functional requirements of the tunnel system. This presentation will describe the developments of the baseline design and tunnel layout following the review of the surface sites and assessment of geological conditions. The civil engineering infrastructure will be built in a variety of ground conditions from limestone and molasses to water bearing moraines. A preliminary risk assessment has been carried out for the planned underground works, describing the main risk factors and proposed mitigation measures. The schedule for the preparatory phase will be shown along with the required types of site investigations. Detailed cost and schedule studies were conducted by the civil engineering expert company ILF. In addition to the bottom up approach to cost estimating, a 'scatter' graph showing comparable tunnelling projects and associated costs will be presented.

Primary authors: OSBORNE, John Andrew (CERN); TUDORA, Alexandra

Presenter: TUDORA, Alexandra

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **527** Type: **Presentation**

FCC-hh single beam intensity limitations and cures

Tuesday, June 25, 2019 9:24 AM (18 minutes)

Landau damping provided by dedicated octupole magnets should be employed in the FCC-hh as a cure against transverse coherent instabilities, in addition to a transverse feedback system. In the LHC, the Landau octupoles are routinely combined with finite chromaticity and the transverse feedback system in order to ensure the bunch stability through the cycle. We estimate the required Landau damping for coherent transverse instabilities driven by the beam screen impedance. Stability estimates from two-dimensional dispersion relations with octupoles and other Landau damping mechanisms are compared to particle tracking studies.For the FCC-hh design beam parameters the electron cloud buildup should be suppressed by the foreseen a-C screen coating. We estimate the residual electron cloud density and the scaling of the electron cloud induced heat load and tune shifts with energy and screen diameter.

Primary author: BOINE-FRANKENHEIM, Oliver (TU Darmstadt)

Co-authors: ARSENYEV, Sergey (CERN); ASTAPOVYCH, Daria (TU Darmstadt); KORNILOV, Vladimir (GSI Helmholtzzentrum Darmstadt, Germany); METHER, Lotta (EPFL - Ecole Polytechnique Federale Lausanne (CH)); SCHULTE, Daniel (CERN)

Presenter: BOINE-FRANKENHEIM, Oliver (TU Darmstadt)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **528** Type: **Presentation**

Low luminosity interaction regions

Tuesday, June 25, 2019 4:45 PM (15 minutes)

The baseline design for the FCC-hh foresees next to the two high luminosity experiments also two lower luminosity experimental insertions. Similar as in the LHC, in these insertions also the beams from the injector will be injected upstream of the experiment. We present here the status of design for these insertions together with the challenges arising from the combination of these two systems. In addition, an outlook of what could be expected in terms of both the instantaneous and integrated luminosity is presented.

Primary author: HOFER, Michael (Vienna University of Technology (AT))

Co-authors: SCHULTE, Daniel (CERN); RENNER, Elisabeth (Vienna University of Technology (AT)); BURKART, Florian; CERUTTI, Francesco (CERN); BESANA, Maria Ilaria (CERN); TOMAS GARCIA, Rogelio (CERN); MARTIN, Roman (CERN); BARTMANN, Wolfgang (CERN)

Presenter: HOFER, Michael (Vienna University of Technology (AT))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **529** Type: **Presentation**

HE-LHC nonlinear correctors & dynamic aperture

Thursday, June 27, 2019 1:50 PM (20 minutes)

In the framework of the Future Circular Collider study, the option for an energy upgrade of the LHC is explored, the so called High Energy LHC (HE-LHC). To achieve the targeted 27 TeV, it relies on the use of 16 T dipoles, based on Nb_3Sn and which are currently under development for the FCC-hh. At injection energy, the field quality of these dipoles is of major concern due to its large impact on the dynamic aperture. Here we present the results of the dynamic aperture calculations using the latest field quality estimates for different injection energies together with the employed nonlinear corrections schemes.

Primary author: HOFER, Michael (Vienna University of Technology (AT))

Co-authors: ZIMMERMANN, Frank (CERN); KEINTZEL, Jacqueline (Vienna University of Technology (AT)); VAN RIESEN-HAUPT, Leon; GIOVANNOZZI, Massimo (CERN); TOMAS GARCIA, Rogelio (CERN); IZQUIERDO BERMUDEZ, Susana (CERN); NOSOCHKOV, Yuri (SLAC National Accelerator Laboratory (US))

Presenter: HOFER, Michael (Vienna University of Technology (AT))

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **530** Type: **Presentation**

A first overview of the legal and technical framework for the reuse of FCC's proposed excavated spoil material

Thursday, June 27, 2019 9:50 AM (10 minutes)

This presentation follows the talk "Excavation material use strategy'" and will give an overview of the current technical and legal situation for the reuse of FCC's proposed excavated spoil material. First results based on mineralogical, geotechnical and petrophysical analyses will be presented that are directed by the legal framework of national (France and Switzerland) as well as European Union (France) legislation therein. Special attention will be paid to advanced scientific opportunities that open up within the scope of such a multi-scale study considering the voluptuous amount of spoil. The presentation will also include an overview of all the influencing parameters of reusing tunnel spoil and how to overcome impediments to use the excavated material in the sense of a circular economy.

Primary author: HAAS, Maximilian (Leoben University (AT))

Presenter: HAAS, Maximilian (Leoben University (AT))

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **531** Type: **Presentation**

Activities with Host States

Thursday, June 27, 2019 8:30 AM (25 minutes)

Primary author: GUTLEBER, Johannes (CERN)

Presenter: GUTLEBER, Johannes (CERN)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **532** Type: **Presentation**

Excavation material use strategy

Thursday, June 27, 2019 9:35 AM (15 minutes)

This talk precedes to the presentation "A first overview of the legal and technical framework for the reuse of FCC's proposed excavated spoil material" and focuses on advanced online technologies for analysing the excavated materials. In that regard, Industry 4.0 gains great attention and a high priority status. It will give an outlook for proposed important information regarding requirements for raw materials used in industrial processes, which are grain size distribution, mineralogical composition, geochemistry and water content. Research on face monitoring as well as disc-cutter load measurement systems support objective results from geological-geotechnical data taken at the tunnel's face area.

Primary author: Prof. GALLER, Robert (Montanuniversität, Chair of Subsurface Engineering, Leoben, Austria)

Co-author: HAAS, Maximilian (Leoben University (AT))

Presenter: Prof. GALLER, Robert (Montanuniversität, Chair of Subsurface Engineering, Leoben, Austria)

Session Classification: Infrastructure and operation

Track Classification: Technical infrastructure & operation

Contribution ID: **533** Type: **Presentation**

High Jc Nb3Sn conductor via Hf addition: a route for achieving the FCC conductor targets

Thursday, June 27, 2019 10:50 AM (20 minutes)

Primary author: BALACHANDRAN, Shreyas (NATIONAL HIGH MAGNETIC FIELD LAB)

Presenter: BALACHANDRAN, Shreyas (NATIONAL HIGH MAGNETIC FIELD LAB)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **536** Type: **Presentation**

Electro-mecahnical properties of Nb3Sn conductors for appplication to high-field magnets

Thursday, June 27, 2019 2:00 PM (15 minutes)

Primary author: BORDINI, Bernardo (CERN)

Presenter: BORDINI, Bernardo (CERN)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **538** Type: **Presentation**

Recent progress on HTS conductor for high-field magnets: critical surface studies

Thursday, June 27, 2019 2:30 PM (15 minutes)

Primary author: SENATORE, Carmine (University of Geneva)

Presenter: SENATORE, Carmine (University of Geneva)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **539** Type: **Presentation**

Lattice integration

Tuesday, June 25, 2019 8:30 AM (18 minutes)

Primary author: Dr CHANCE, Antoine (CEA Irfu)

Presenter: Dr CHANCE, Antoine (CEA Irfu)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **540** Type: **Presentation**

Correction schemes

Tuesday, June 25, 2019 8:48 AM (18 minutes)

Primary author: BOUTIN, David (CEA)

Presenter: BOUTIN, David (CEA)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **541** Type: **Presentation**

Electron cloud

Tuesday, June 25, 2019 10:45 AM (15 minutes)

Primary author: METHER, Lotta (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Presenter: METHER, Lotta (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **542** Type: **Presentation**

Collimation inefficiency

Tuesday, June 25, 2019 11:15 AM (15 minutes)

Primary author: MOLSON, James (CERN)

Presenter: MOLSON, James (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **543** Type: **Presentation**

Ion option for FCC-hh

Tuesday, June 25, 2019 5:30 PM (15 minutes)

Primary author: SCHAUMANN, Michaela (CERN)

Presenter: SCHAUMANN, Michaela (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **544** Type: **Presentation**

Optics

Tuesday, June 25, 2019 1:30 PM (18 minutes)

Primary author: MARTIN, Roman (CERN)

Presenter: MARTIN, Roman (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **545** Type: **Presentation**

Alternative optics

Tuesday, June 25, 2019 1:48 PM (18 minutes)

Primary author: VAN RIESEN-HAUPT, Leon

Presenter: VAN RIESEN-HAUPT, Leon

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **546** Type: **not specified**

Beam-Beam effects

Tuesday, June 25, 2019 2:06 PM (18 minutes)

Primary authors: TAMBASCO, Claudia (EPFL - Ecole Polytechnique Federale Lausanne (CH)); PIELONI, Tatiana (EPF Lausanne)

Presenter: PIELONI, Tatiana (EPF Lausanne)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **547** Type: **Presentation**

Dynamic aperture Studies

Tuesday, June 25, 2019 2:24 PM (18 minutes)

Primary author: CRUZ ALANIZ, Emilia (University of Oxford JAI)

Presenter: CRUZ ALANIZ, Emilia (University of Oxford JAI)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **549** Type: **Presentation**

Injector Design

Tuesday, June 25, 2019 5:00 PM (15 minutes)

A High Energy Booster (HEB) is needed as an injector for the FCC-hh. This talk outlines the options available based on studies carried out over the last few years. The principal features of each option are shown and a strategy on how to proceed to reach a HEB TDR in 5 years is proposed.

Primary authors: BORBURGH, Jan (CERN); BARTMANN, Wolfgang (CERN)

Presenter: BORBURGH, Jan (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **550** Type: **Presentation**

Injection and extraction insertions

Tuesday, June 25, 2019 5:15 PM (15 minutes)

Primary authors: CHMIELINSKA, Agnieszka (EPFL - Ecole Polytechnique Federale Lausanne (CH)); BARTMANN, Wolfgang (CERN)

Presenter: CHMIELINSKA, Agnieszka (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **553** Type: **Presentation**

Photo desorption studies at the WINDY set-up at LNF

Wednesday, June 26, 2019 9:30 AM (20 minutes)

Primary author: ANGELUCCI, Marco

Presenter: ANGELUCCI, Marco

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **554** Type: **Presentation**

Update of the design and thermal mechanical study of the FCC-hh beam screen

Wednesday, June 26, 2019 11:30 AM (20 minutes)

Primary author: MORRONE, Marco (CERN)

Presenter: MORRONE, Marco (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **555** Type: **Presentation**

Evolution of the block-coils design

Wednesday, June 26, 2019 1:30 PM (20 minutes)

Primary author: Dr ROCHEPAULT, Etienne (Université Paris-Saclay (FR))

Presenter: Dr ROCHEPAULT, Etienne (Université Paris-Saclay (FR))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **556** Type: **Presentation**

Evolution of the common-coils design

Wednesday, June 26, 2019 2:10 PM (20 minutes)

Primary author: TORAL, Fernando (Centro de Investigaciones Energéti cas Medioambientales y Tecno)

Presenter: TORAL, Fernando (Centro de Investigaciones Energéti cas Medioambientales y Tecno)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **557** Type: **Presentation**

Evolution of the costheta design

Wednesday, June 26, 2019 2:30 PM (20 minutes)

Primary author: FARINON, Stefania (INFN e Universita Genova (IT))

Presenter: FARINON, Stefania (INFN e Universita Genova (IT))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **558** Type: **Presentation**

Cost model

Thursday, June 27, 2019 8:30 AM (20 minutes)

Primary author: SCHOERLING, Daniel (CERN)

Presenter: SCHOERLING, Daniel (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **560** Type: **not specified**

SuperKEKB S-band/C-band linac

Tuesday, June 25, 2019 4:48 PM (18 minutes)

Primary author: FURUKAWA, Kazuro (KEK)

Presenter: FURUKAWA, Kazuro (KEK)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **561** Type: **not specified**

Issues for the next step

Wednesday, June 26, 2019 8:30 AM (18 minutes)

Primary author: OIDE, Katsunobu (High Energy Accelerator Research Organization (JP))

Presenter: OIDE, Katsunobu (High Energy Accelerator Research Organization (JP))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **562** Type: **Presentation**

Beam-beam effects for 4 IP

Wednesday, June 26, 2019 8:48 AM (18 minutes)

Primary author: SHATILOV, Dmitry (Budker Institute of Nuclear Physics (RU))

Presenter: SHATILOV, Dmitry (Budker Institute of Nuclear Physics (RU))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **563** Type: **Presentation**

Feedback scenarios

Wednesday, June 26, 2019 10:48 AM (18 minutes)

Primary author: TEYTELMAN, Dmitry (Dimtel, Inc.)

Presenter: TEYTELMAN, Dmitry (Dimtel, Inc.)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **564** Type: **Presentation**

FCC-ee machine availability

Wednesday, June 26, 2019 11:24 AM (18 minutes)

Future Circular Electron Positron Collider FCC-ee will be the largest collider ever built. Although the operational availability of such machines has been high, the increased complexity of the new infrastructure can become a challenge. At the early stage of research, the main activity should be identifying the potential leading causes for downtime. This analysis can be done by studying availability data from existing machines and estimating how complex the systems in FCC-ee are when compared to existing ones. This talk present already identified critical systems for FCC-ee and recommendation for on-going studies.

Primary author: NIEMI, Arto (CERN)

Presenter: NIEMI, Arto (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **565** Type: **Presentation**

Baseline scheme

Wednesday, June 26, 2019 1:30 PM (18 minutes)

Primary author: OIDE, Katsunobu (High Energy Accelerator Research Organization (JP))

Presenter: OIDE, Katsunobu (High Energy Accelerator Research Organization (JP))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **566** Type: **Presentation**

Alternatives

Wednesday, June 26, 2019 1:48 PM (18 minutes)

Primary author: SCHULTE, Daniel (CERN)

Presenter: SCHULTE, Daniel (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **567** Type: **Presentation**

Damping of injection oscillations and transverse stability in the PBR

Wednesday, June 26, 2019 2:42 PM (18 minutes)

Primary author: ZIMMERMANN, Frank (CERN)

Presenter: ZIMMERMANN, Frank (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **568** Type: **Presentation**

Overview of MDI issues toward the TDR

Thursday, June 27, 2019 8:30 AM (18 minutes)

Primary author: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Presenter: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **569** Type: **Presentation**

Mechanical design of the interaction region

Thursday, June 27, 2019 8:48 AM (18 minutes)

Primary author: LEVICHEV, Evgeny (Budker Institute of Nuclear Physics (RU))

Presenter: LEVICHEV, Evgeny (Budker Institute of Nuclear Physics (RU))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **570** Type: **Presentation**

Final-focus quadrupoles and solenoids

Thursday, June 27, 2019 9:06 AM (18 minutes)

Primary author: KORATZINOS, Michail (Massachusetts Inst. of Technology (US))

Presenter: KORATZINOS, Michail (Massachusetts Inst. of Technology (US))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **571** Type: **Presentation**

Improvement of detector performance with smaller central IP beam pipe

Thursday, June 27, 2019 11:06 AM (18 minutes)

Primary author: LEOGRANDE, Emilia (CERN)

Presenter: LEOGRANDE, Emilia (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **572** Type: **Presentation**

Beam losses at IR

Thursday, June 27, 2019 10:48 AM (18 minutes)

Primary author: BURKHARDT, Helmut (CERN)

Presenter: BURKHARDT, Helmut (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **573** Type: **Presentation**

Impact of beam-beam effects on luminosity measurement

Thursday, June 27, 2019 9:42 AM (18 minutes)

Primary author: PEREZ, Emmanuel Francois (CERN)

Presenter: PEREZ, Emmanuel Francois (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **574** Type: **Presentation**

Synchrotron radiation background studies

Thursday, June 27, 2019 10:30 AM (18 minutes)

Primary author: LUCKHOF, Marian (Hamburg University (DE))

Presenter: LUCKHOF, Marian (Hamburg University (DE))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **575** Type: **Presentation**

Parameter update

Tuesday, June 25, 2019 1:30 PM (10 minutes)

Primary author: ZIMMERMANN, Frank (CERN)

Presenter: ZIMMERMANN, Frank (CERN)

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **576** Type: **not specified**

Impedance Model and Beam Stability

Tuesday, June 25, 2019 1:55 PM (20 minutes)

Primary author: AMORIM, David (CERN / Universite Grenoble-Alpes (FR))

Presenter: AMORIM, David (CERN / Universite Grenoble-Alpes (FR))

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **577** Type: **Presentation**

HE-LHC IR Optics

Thursday, June 27, 2019 2:10 PM (20 minutes)

Primary author: VAN RIESEN-HAUPT, Leon

Presenter: VAN RIESEN-HAUPT, Leon

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **578** Type: **Presentation**

HE-LHC collimation system

Thursday, June 27, 2019 2:30 PM (20 minutes)

Primary author: CROUCH, Matthew Paul (CERN)

Presenter: CROUCH, Matthew Paul (CERN)

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **579** Type: **Presentation**

The INFN dipole model for the FCC

Thursday, June 27, 2019 4:06 PM (18 minutes)

Primary author: VALENTE, Riccardo Umberto (LASA-INFN (Milano, Italy))

Presenter: VALENTE, Riccardo Umberto (LASA-INFN (Milano, Italy))

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **580** Type: **Presentation**

R&D of seamless elliptical cavities

Tuesday, June 25, 2019 9:24 AM (18 minutes)

Primary author: PIRA, Cristian (LNL-INFN)

Presenter: PIRA, Cristian (LNL-INFN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **581** Type: **Presentation**

NB film engineering with energetic condensation for tailored RF behavior

Tuesday, June 25, 2019 10:30 AM (18 minutes)

Primary author: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

Presenter: VALENTE-FELICIANO, Anne-Marie (Jefferson Lab)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **582** Type: **Presentation**

Active shielding for Cryomodules

Tuesday, June 25, 2019 1:30 PM (22 minutes)

Primary author: IVANOV, Anton Evgeniev (CERN)

Presenter: IVANOV, Anton Evgeniev (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **584** Type: **Presentation**

High efficiency klystrons development at CERN

Tuesday, June 25, 2019 2:14 PM (22 minutes)

Primary author: CAI, Jinchi (CERN)

Presenter: CAI, Jinchi (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **585** Type: **Presentation**

Towards a high efficiency klystron for LHC

Tuesday, June 25, 2019 2:36 PM (22 minutes)

Primary author: BEUNAS, Armel (THALES)

Presenter: BEUNAS, Armel (THALES)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **586** Type: **Presentation**

FCC-hh kicker systems: status and R&D plans (injection, extraction, dilution)

Wednesday, June 26, 2019 9:10 AM (20 minutes)

Primary author: KRAMER, Thomas (CERN)

Presenter: KRAMER, Thomas (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **587** Type: **Presentation**

FCC-ee beam dump system concept and technological challenges

Thursday, June 27, 2019 1:50 PM (20 minutes)

Primary authors: APYAN, Armen; BARTMANN, Wolfgang (CERN)

Presenter: APYAN, Armen

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **588** Type: **Presentation**

HE-LHC dump system: status and R&D plans (kickers, septa, protection devices, block)

Thursday, June 27, 2019 1:30 PM (20 minutes)

Primary authors: KRAMER, Thomas (CERN); BARTMANN, Wolfgang (CERN)

Presenter: KRAMER, Thomas (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **589** Type: **Presentation**

Status of FCC main magnet circuit layouts, powering and protection

Thursday, June 27, 2019 4:10 PM (20 minutes)

Primary author: VERWEIJ, Arjan (CERN)

Presenter: VERWEIJ, Arjan (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **590** Type: **Presentation**

Status of studies on beam impact & machine protection challenges

Thursday, June 27, 2019 2:10 PM (20 minutes)

Primary author: WIESNER, Christoph (CERN)

Presenter: WIESNER, Christoph (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **591** Type: **Presentation**

Simulation tools for beam dump blocks and intercepting protection devices

Thursday, June 27, 2019 2:30 PM (20 minutes)

Primary author: GILARDONI, Simone (CERN)

Presenter: GILARDONI, Simone (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **592** Type: **Presentation**

Status of concepts and main technologies for the FCC-hh beam instrumentation systems

Thursday, June 27, 2019 3:30 PM (20 minutes)

Primary author: DODINGTON, Tom (CERN)

Presenter: DODINGTON, Tom (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **593** Type: **Presentation**

Challenges, concepts and R&D plans for the FCC-ee beam instrumentation systems

Thursday, June 27, 2019 3:50 PM (20 minutes)

Primary author: LEFEVRE, Thibaut (CERN)

Presenter: LEFEVRE, Thibaut (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **594** Type: **Presentation**

Status of radiation environment assessment in the FCC-hh and FCC-ee machines

Thursday, June 27, 2019 4:30 PM (20 minutes)

Primary author: CERUTTI, Francesco (CERN)

Presenter: CERUTTI, Francesco (CERN)

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **595** Type: **Presentation**

Impact of beam-beam effect on beam energy and crossing angle at IP

Tuesday, June 25, 2019 8:50 AM (20 minutes)

Primary author: SHATILOV, Dmitry (Budker Institute of Nuclear Physics (RU))

Presenter: SHATILOV, Dmitry (Budker Institute of Nuclear Physics (RU))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **597** Type: **Presentation**

Overview and status of CM energy uncertainties

Tuesday, June 25, 2019 9:30 AM (30 minutes)

Primary author: KORATZINOS, m (Massachusetts Inst. of Technology (US))

Presenter: KORATZINOS, m (Massachusetts Inst. of Technology (US))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **599** Type: **Presentation**

The e+e- -> WW process: QED exponentiation

Tuesday, June 25, 2019 2:00 PM (30 minutes)

Primary author: SKRZYPEK, Maciej (Polish Academy of Sciences (PL))

Presenter: SKRZYPEK, Maciej (Polish Academy of Sciences (PL))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **600** Type: **Presentation**

Initial state radiation for Higgs production

Tuesday, June 25, 2019 2:30 PM (30 minutes)

Primary author: GRECO, Mario

Presenter: GRECO, Mario

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **601** Type: **Presentation**

Discussion

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **602** Type: **Presentation**

HE-LHC Lattice Design and Optics Integration

Thursday, June 27, 2019 1:30 PM (20 minutes)

The High Energy Large Hadron Collider (HE-LHC), a possible successor of the High Luminosity LHC (HL-LHC) aims at reaching a centre-of-mass energy of about 27 TeV using basically the same 16 T dipoles as for the hadron-hadron Future Circular Collider FCC-hh.
Before concluding on two possible baseline desings, namely an 18×90 (18 LHC-like arc FODO cells with 90° phase advance in both transverse planes) and a 23×90 lattice, various arc FODO cell and dispersion suppressor (DS) options have been generated, using ALGEA (Automatic Lattice GEneration Application), and tested. Minimizing the geometry offset results in updated arc and DS designs, and leads to sufficient optics integration of interaction regions, specially designed for the HE-LHC. Merits of each design are highlighted and possible solutions to overcome beam stay clear minima are presented.

Primary author: KEINTZEL, Jacqueline (Vienna University of Technology (AT))

Co-authors: HOFER, Michael (Vienna University of Technology (AT)); TOMAS GARCIA, Rogelio (CERN); ZIMMERMANN, Frank (CERN); RISSELADA, Thys; VAN RIESEN-HAUPT, Leon

Presenter: KEINTZEL, Jacqueline (Vienna University of Technology (AT))

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **603** Type: **Presentation**

Main quadrupoles for the FCC

Thursday, June 27, 2019 9:10 AM (20 minutes)

A 2D collar-based mechanical analysis and a 3D electromagnetic investigation of the 360 T/m FCC main quadrupoles are presented. The magnet coils rely on a conventional cos(2θ) layout. One of the challenges is the windability around the 50 mm aperture of the 16 mm wide Rutherford cable made of 0.85 mm strand. This is going to be investigated in the near future.

Primary authors: LORIN, Clement (Université Paris-Saclay (FR)); Mr GENOT, Clement (CEA-ENSEM); Mr MINIER, Gilles (CEA Paris-Saclay)

Presenter: LORIN, Clement (Université Paris-Saclay (FR))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **604** Type: **Presentation**

Liquid Argon Calorimetry for FCC-ee

Wednesday, June 26, 2019 9:20 AM (20 minutes)

Calorimetry using liquid Argon (LAr) as active material has been successfully used in many high energy physics experiments. It has been intensively studied as a promising candidate for the electromagnetic calorimetry for FCC-hh where - due to the extreme radiation environment - this technique was chosen for the reference detector. In this presentation the prospects of LAr calorimetry for an FCC-ee experiment will be discussed and a possible implementation will be shown.

Primary author: ALEKSA, Martin (CERN)

Presenter: ALEKSA, Martin (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **605** Type: **Poster**

Collective effect estimates for the FCC-ee pre-booster ring

Tuesday, June 25, 2019 4:17 PM (1 minute)

The FCC-e+e– injector complex needs to produce and to transport a high intensity e+e– beam at a fast repetition rate for topping up the collider at its collision energy. Two different options are under consideration as pre-accelerator before the bunches are transferred to the high-energy booster: using the existing SPS and designing a completely new ring. The purpose of this paper is to present updated studies of the pre-booster ring design and parameter choice, focusing in particular on first estimates with respect to collective effects.

Primary author: ETISKEN, Ozgur (Ankara University (TR))

Co-authors: PAPAPHILIPPOU, Yannis (CERN); ANTONIOU, Fanouria (CERN); Prof. CIFTCI, abbas kenen (Izmir University of Economics)

Presenter: ETISKEN, Ozgur (Ankara University (TR))

Session Classification: Poster session

Track Classification: FCC-ee accelerator

Contribution ID: **606** Type: **Presentation**

Energy deposition in the FCC-hh EIR

Tuesday, June 25, 2019 2:42 PM (18 minutes)

The FCC-hh interaction region is heavily impacted by the collision debris, generated at the interaction point. In order to assess its effects on the triplet as well as on the matching section magnets, FLUKA simulations were performed assuming the ultimate integrated and instantaneous luminosity. In this presentation, the obtained results will be discussed for both the vertical and the horizontal crossing schemes.
In order to avoid long term fatal damage to the superconducting materials and insulators as well as magnet quenching, different mitigation strategies were explored. Equally the effects of protection devices like collimators and masks, the regular change of the crossing scheme and the optimisation of the magnets design were studied. Additionally, the effectiveness of these countermeasures will be discussed in this talk.

Primary authors: HUMANN, Barbara (Vienna University of Technology (AT)); BESANA, Maria Ilaria (CERN)

Presenter: HUMANN, Barbara (Vienna University of Technology (AT))

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **607** Type: **Presentation**

Analysis of FCC Nb3Sn Conductor at CERN

Thursday, June 27, 2019 11:10 AM (15 minutes)

In order to develop superconducting wires meeting the requirements for the 16 T dipole magnets proposed for FCC-hh, CERN is coordinating a conductor development programme, now involving 6 manufacturers and 6 academic partners.
A key goal of the programme is to develop Nb_3Sn wires with a non-copper critical current density (J_c) of 1500 A mm^{-2} at 16 T and 4.2 K, and to demonstrate their suitability for long-length manufacturing and cabling.
In this presentation, the progress with this development will be reported, with a particular focus on superconducting characterisation and quantitative microscopy performed at CERN of recently developed Nb_3Sn wires with novel layouts. Initial evidence of the suitability of these designs for the production of Rutherford cables will be presented based on rolling studies and cabling trials.
Finally, at a stage of the programme at which the interim target of a J_c comparable with the HL-LHC wire specification has been achieved, the next steps for the development will be briefly summarised.

Primary author: Dr HOPKINS, Simon (CERN)

Co-authors: Dr BASKYS, Algirdas (CERN); BORDINI, Bernardo (CERN); Dr BALLARINO, Amalia (CERN)

Presenter: Dr HOPKINS, Simon (CERN)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **608** Type: **Presentation**

Development of Nb3Sn for FCC In Russia

Thursday, June 27, 2019 11:25 AM (15 minutes)

Primary author: PANTSYRNY, Victor (Bochvqr Institute)

Presenter: PANTSYRNY, Victor (Bochvqr Institute)

Session Classification: Magnets

Contribution ID: **609** Type: **Presentation**

Material properties of relevance to cryogenic vacuum systems

Wednesday, June 26, 2019 8:50 AM (20 minutes)

The properties of vacuum components working at cryogenic temperature represent a crucial aspect to assure accelerator's best performances. Recently, pulsed laser processing of Cu samples (LASE-Cu) has been demonstrated to produce rough surfaces, whose structuring at the nanoscale ensures an impressive reduction of the secondary electron yield and, then, of electron cloud phenomena. This feature has such undoubted appealing that LASE samples have been proposed to be integrated in the cryogenic beam screen of FCC-hh. However, the effective application of LASE surfaces requires a rigorous evaluation of their vacuum behavior at cryogenic temperatures.
To this aim, the behavior of a LASE-Cu substrate has been studied by thermal programmed desorption and compared to flat Cu. Ar, CO, CH_4 and H_2 have been cryosorbed at 15 K on both surfaces and their desorption has been followed between 20 and 70 K. Our results highlight that the sponge-like structural features determines for the LASE sample non-negligible effects due to the gas-substrate interaction. This results in a much vaster and higher desorption temperature range with respect to what is observed from the flat substrates.
On these bases, although the electron cloud mitigation efficiency has been settled, before definitely including porous surfaces in any cryogenic machine design, all the consequences of having a rough rather than a flat wall should be carefully evaluated. Photo and electron induced desorption yield should also be carefully studied to validate any new material to be used in FCC-hh.

Primary author: SPALLINO, Luisa (INFN - National Institute for Nuclear Physics)

Presenter: SPALLINO, Luisa (INFN - National Institute for Nuclear Physics)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **610** Type: **Presentation**

Software development and deployement

Wednesday, June 26, 2019 2:10 PM (25 minutes)

Software plays a major role in all phases of High-Energy Physics research, from the processing of the first particle collisions to the final end-user analyses. Therefore, the quality of all software products involved must be ensured in order to achieve successful results now and in the future. Quality of software is heavily correlated to multiple stages of the software development process as well as its deployment. These processes need to be built based on best practices previously agreed upon with the collaboration.

This talk highlights the pillars in which the FCC Software developments should rely on in accordance with our years of experience in the current LHC experiments. The main goal is to establish a set of common practices and conventions to develop a robust but flexible software system for the FCC detector studies. The design of such software system should allow physicists to use and develop the software for a variety of use cases such as using an existing release to do some simulation or analysis, testing and validation of new algorithms or development of final analyses. At the same time, the architecture ought to be easy to maintain and evolve over the years.

Primary author: CERVANTES VILLANUEVA, Javier (CERN)

Presenter: CERVANTES VILLANUEVA, Javier (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Common detector technologies and offline software

Contribution ID: **611** Type: **Presentation**

Characterization of FCC conductors at TU Vienna

Thursday, June 27, 2019 2:15 PM (15 minutes)

The Vienna University of Technology (TU Wien) is supporting the FCC wire development program by advanced characterization techniques of the superconducting properties of prototype wires and microstructural analysis. The aim of the work is to deepen the understanding of the relationship between the local superconducting properties, the underlying microstructure, and the resulting macroscopic behavior. The microstructural investigations have been done by means of scanning and transmission electron microscopy (SEM, TEM), the local superconducting properties have been assessed by scanning Hall probe microscopy (SHPM). Recent exemplary results on compositional gradients, grain size distribution and the influence of artificial pinning centers (APC) will be presented.

Primary authors: EISTERER, Michael (Vienna University of Technology (AT)); Dr BAUMGARTNER, Thomas (Atominstitut, TU Wien); Mr ORTINO, Mattia (TU Wien (Vienna)); BERNARDI, Johannes; PFEIFFER, Stephan (Vienna University of Technology); MOROS, Alice (Technische Universität Wien); STÖGER-POLLACH, Michael (TU Wien); SUMPTION, Mike (The Ohio State University); XU, Xingchen (Fermi National Accelerator Lab); PENG, Xuan (Hyper Tech Research Inc.); ALEKSEEV, Maxim (Bochvar Institute of Inorganic Materials); TSAPLEVA, Anastasia (Bochvar Institute of Inorganic Materials); LUKYANOV, Pavel (Bochvar Institute of Inorganic Materials); ABDYUKHANOV, ILDAR (VNIINM (Bochvar Institute)); PANTSYRNY, Victor (Bochvqr Institute); BORDINI, Bernardo (CERN); HOPKINS, Simon (CERN); BALLARINO, Amalia (CERN)

Presenter: EISTERER, Michael (Vienna University of Technology (AT))

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **612** Type: **Presentation**

Status of FCC-hh collimation studies

Tuesday, June 25, 2019 11:00 AM (15 minutes)

An overview is given of the design principles and layout of the FCC-hh collimation system, and recent modifications are highlighted. Furthermore, a brief overview of the simulated performance of the system is shown, comparing with design scenarios for beam losses. This topic will be expanded in more detail in the following talks.

Primary authors: BRUCE, Roderik (CERN); CARRA, Federico (CERN); MOLSON, James (CERN); GOBBI, Giorgia (CERN); PASQUALI, Michele (CERN); REDAELLI, Stefano (CERN); CERUTTI, Francesco (CERN); ABRAMOV, Andrey (University of London (GB)); BERTARELLI, Alessandro (CERN); Mr KRAINER, Alexander (CERN); BESANA, Maria Ilaria (CERN); FAUS-GOLFE, Angeles (Laboartoire de l'Accelerateur Lineaire); FIASCARIS, Maria (CERN); LECHNER, Anton (CERN); MEREGHETTI, Alessio (CERN); MIRARCHI, Daniele (CERN); SCHULTE, Daniel (CERN); SERLUCA, Maurizio (Centre National de la Recherche Scientifique (FR)); VARASTEH, Mohammad (CERN); SKORDIS, Eleftherios (CERN)

Presenter: BRUCE, Roderik (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **613** Type: **Presentation**

New Spiral Beam Screen Design for the FCC-hh Injection Kicker Magnets

Wednesday, June 26, 2019 9:30 AM (20 minutes)

The injection kicker system for the Future Circular Collider (FCC-hh) must satisfy demanding requirements. To achieve low pulse ripple and fast field rise and fall times, the injection system will use ferrite loaded transmission line type magnets. The beam coupling impedance of the kicker magnets is crucial, as this can be a dominant contribution to beam instabilities. In addition, interaction of the high intensity beam with the real part of the longitudinal beam coupling impedance can result in high power deposition in the ferrite yoke. This gives a significant risk that the ferrite yoke will exceed its Curie temperature: hence, a suitable beam screen will be a critical feature. In this paper, we present a novel concept - a spiral beam screen. The fundamental advantage of the new design is a significant reduction of the maximum voltage induced on the screen conductors, thus decreased probability of electrical breakdown. In addition, the longitudinal beam coupling impedance is optimized to minimize power deposition in the magnet. This paper introduces the conventional and spiral beam designs and discusses the advantages of the spiral design.

Primary author: CHMIELINSKA, Agnieszka (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Presenter: CHMIELINSKA, Agnieszka (EPFL - Ecole Polytechnique Federale Lausanne (CH))

Session Classification: Special Technologies

Track Classification: FCC accelerator technologies

Contribution ID: **614** Type: **Poster**

FCC-hh jet substructure studies

Wednesday, June 26, 2019 9:00 AM (20 minutes)

Primary author: NEUBUSER, Coralie (CERN)

Presenter: NEUBUSER, Coralie (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-hh detector & experiment

Contribution ID: **615** Type: **Presentation**

FCC-hh detector overview

Wednesday, June 26, 2019 10:30 AM (20 minutes)

Primary author: RIEGLER, Werner (CERN)

Presenter: RIEGLER, Werner (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-hh detector & experiment

Contribution ID: **616** Type: **Presentation**

Progress on IDEA

Wednesday, June 26, 2019 10:50 AM (20 minutes)

Primary author: PEZZOTTI, Lorenzo (Universita and INFN (IT))

Presenter: PEZZOTTI, Lorenzo (Universita and INFN (IT))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **617** Type: **Presentation**

Progress on CLD

Wednesday, June 26, 2019 11:10 AM (20 minutes)

Primary author: VIAZLO, Oleksandr (CERN)

Presenter: VIAZLO, Oleksandr (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **618** Type: **Presentation**

AIDA ++

Wednesday, June 26, 2019 11:30 AM (29 minutes)

Primary author: GIACOMELLI, Paolo (INFN Sezione di Bologna)

Presenter: GIACOMELLI, Paolo (INFN Sezione di Bologna)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **619** Type: **Presentation**

General status and plans

Wednesday, June 26, 2019 1:30 PM (15 minutes)

Primary author: HELSENS, Clement (CERN)

Presenter: HELSENS, Clement (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **620** Type: **Presentation**

Combined reconstruction with tracker and calorimeter

Wednesday, June 26, 2019 2:35 PM (25 minutes)

Primary author: VOLKL, Valentin (University of Innsbruck (AT))

Presenter: VOLKL, Valentin (University of Innsbruck (AT))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **621** Type: **Presentation**

Differential top distributions at production threshold

Primary author: RAUH, Thomas

Presenter: RAUH, Thomas

Session Classification: FCC physics, experiments & detectors

Contribution ID: **622** Type: **Presentation**

Prospects for Higgs self-couplings

Thursday, June 27, 2019 11:30 AM (20 minutes)

Primary author: ORTONA, Giacomo (Centre National de la Recherche Scientifique (FR))

Presenter: ORTONA, Giacomo (Centre National de la Recherche Scientifique (FR))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **623** Type: **Poster**

Studies of Internal Oxidation in ternary Nb3Sn at UNIGE

Tuesday, June 25, 2019 4:18 PM (1 minute)

Primary author: SENATORE, Carmine (University of Geneva)

Presenter: SENATORE, Carmine (University of Geneva)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **624** Type: **Presentation**

Welcome

Tuesday, June 25, 2019 8:30 AM (5 minutes)

Primary author: GUTLEBER, Johannes (CERN)

Presenter: GUTLEBER, Johannes (CERN)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **625** Type: **Presentation**

Introduction

Tuesday, June 25, 2019 8:35 AM (10 minutes)

Primary author: LAGRANGE, Thierry (CERN)

Presenter: LAGRANGE, Thierry (CERN)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **626** Type: **Presentation**

The Challenges for Europe's R&I

Tuesday, June 25, 2019 8:45 AM (15 minutes)

Primary author: Mr BONI, Michal (European Parliament)

Presenter: Mr BONI, Michal (European Parliament)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **627** Type: **Presentation**

Towards sustainable RI

Tuesday, June 25, 2019 9:40 AM (15 minutes)

Presenter: RIBEIRO, Margarida (EC-DG-RI)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **628** Type: **Presentation**

The SKA approach to sustainable research

Tuesday, June 25, 2019 9:00 AM (20 minutes)

Primary author: Mr BERRY, Simon (SKA Organisation)

Presenter: Mr BERRY, Simon (SKA Organisation)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **629** Type: **Presentation**

Designing a socio-economic impact framework for research infrastructures: lessons from the RI-PATHS project

Tuesday, June 25, 2019 10:30 AM (30 minutes)

Primary author: REID, Alasdair (European Future Innovation System (EFIS) Centre)

Presenter: REID, Alasdair (European Future Innovation System (EFIS) Centre)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **630** Type: **Presentation**

Socio-economic impact assessments of ESA programmes

Tuesday, June 25, 2019 11:00 AM (30 minutes)

Primary author: Ms MATHIEU, Charlotte (European Space Agency)

Presenter: Ms MATHIEU, Charlotte (European Space Agency)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **631** Type: **Presentation**

Social Cost Benefit Analysis (CBA) of research infrastructures in physics

Tuesday, June 25, 2019 11:30 AM (30 minutes)

Primary author: FLORIO, Massimo (Università degli Studi e INFN Milano (IT))

Presenter: FLORIO, Massimo (Università degli Studi e INFN Milano (IT))

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **632** Type: **Presentation**

Findings from the LHC/HL-LHC programme

Tuesday, June 25, 2019 1:30 PM (20 minutes)

Primary author: BASTIANIN, Andrea (Università degli Studi e INFN Milano (IT))

Presenter: BASTIANIN, Andrea (Università degli Studi e INFN Milano (IT))

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **633** Type: **Presentation**

Designing a RI with impact in mind

Tuesday, June 25, 2019 1:50 PM (20 minutes)

Primary author: VIGNETTI, Silvia (CSIL)

Presenter: VIGNETTI, Silvia (CSIL)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **634** Type: **Presentation**

Leveraging the economic potential of accelerator technologies: the case of superconductivity

Tuesday, June 25, 2019 2:10 PM (10 minutes)

Primary author: KRETZSCHMAR, Linn (WU Vienna University of Economics and Business)

Presenter: KRETZSCHMAR, Linn

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **635** Type: **Presentation**

Rethinking the public value of science

Tuesday, June 25, 2019 2:20 PM (20 minutes)

Primary author: Prof. LOUREIRO, Maria (University Santiago de Compostela)

Presenter: Prof. LOUREIRO, Maria (University Santiago de Compostela)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **636** Type: **Presentation**

The drivers of innovative collaborations and the role of public policies

Tuesday, June 25, 2019 2:40 PM (20 minutes)

Primary author: Prof. CRESCENZI, Riccardo (London School of Economics)

Presenter: Prof. CRESCENZI, Riccardo (London School of Economics)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **637** Type: **Presentation**

R and PY from candidate materials for the FCC-hh Vacuum system.

Wednesday, June 26, 2019 9:10 AM (20 minutes)

In recent and future high performance energy colliders, the knowledge of many physical properties of the materials walls to be used is an essential prerequisite. Among others, it is necessary to study materials behaviour after exposure to the synchrotron radiation (SR) produced by the circulating particles. Such SR interacts with the machine vacuum walls and may produce photoelectrons, induce heat load, vacuum and beam instability. Actually, photon Reflectivity (R), Photo Yield (PY i.e. the number of photoelectrons produced per incident photon) and their geometrical distribution, are essential ingredients to simulation codes. Moreover, such parameters must be studied not only on realistic "technical materials", but also in conditions as close as possible to the operative ones. This implying a significant effort to study such properties at the very grazing angle of incidence (as low as 0.08°) at which such interaction occurs in real machines.
Here we present some results of an experimental campaign, carried out at the Optics Beamline of BESSY-II combined to the available versatile Reflectometer end station. This experimental set up, designed to investigate by "at wavelength" metrology quasi-perfect optical elements, is an ideal tool to perform Photon Reflectivity and Photo Yield studies of technical materials of interest for some present and future accelerators at very grazing incidence angles and in the 35 – 1850 eV energy range. This photon energy range is only partially covering the one emitted by FCC-hh, whose SR spectrum has a critical energy of ~4.5 keV. Nevertheless, since most of the expected phenomena related to SR are generally induced by low up to soft X-ray photons, this study cover a valuable part of it. As will be discussed in the following, surface coatings, roughness, nano-, micro- or macro- modification of a Cu surface are shown to significantly influence the parameters under study.

Primary authors: CIMINO, Roberto (LNF-INFN); LA FRANCESCA, Eliana (LNF-INFN Frascati (Rome) , Italy); ANGELUCCI, Marco; LIEDL, Andrea (Istituto Nazionale Fisica Nucleare Frascati (IT)); GONZALEZ GOMEZ, Luis Antonio (INFN e Laboratori Nazionali di Frascati (IT)); BELLAFONT, Ignasi; SIEWERT, Frank (Helmholtz Zentrum Berlin (DE)); SERTSU, Mewael (Helmholtz Zentrum Berlin (DE)); SOKOLOV, Andrey (Helmholtz Zentrum Berlin (DE)); SCHÄFERS, Franz (Helmholtz Zentrum Berlin (DE))

Presenter: CIMINO, Roberto (LNF-INFN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **638** Type: **Presentation**

FCC-hh machine design summary

Friday, June 28, 2019 8:30 AM (20 minutes)

Primary author: Dr CHANCE, Antoine (CEA Irfu)

Presenter: Dr CHANCE, Antoine (CEA Irfu)

Session Classification: Summaries

Track Classification: FCC-hh accelerator

Contribution ID: **639** Type: **Presentation**

FCC-ee machine design summary

Friday, June 28, 2019 8:50 AM (20 minutes)

Primary author: CHARLES, Tessa (University of Melbourne (AU))

Presenter: CHARLES, Tessa (University of Melbourne (AU))

Session Classification: Summaries

Track Classification: FCC-ee accelerator

Contribution ID: **640** Type: **Presentation**

Infrastructure & operation summary

Friday, June 28, 2019 9:10 AM (20 minutes)

Primary author: GUTLEBER, Johannes (CERN)

Presenter: GUTLEBER, Johannes (CERN)

Session Classification: Summaries

Track Classification: Technical infrastructure & operation

Contribution ID: **641** Type: **Presentation**

Technologies sumamry

Friday, June 28, 2019 9:30 AM (20 minutes)

Primary author: SIEMKO, Andrzej (CERN)

Presenter: SIEMKO, Andrzej (CERN)

Session Classification: Summaries

Track Classification: FCC accelerator technologies

Contribution ID: **642** Type: **Presentation**

Magnets summary

Friday, June 28, 2019 9:50 AM (20 minutes)

Primary author: SCHOERLING, Daniel (CERN)

Presenter: SCHOERLING, Daniel (CERN)

Session Classification: Summaries

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **643** Type: **Presentation**

RF summary

Friday, June 28, 2019 10:10 AM (20 minutes)

Primary author: Mr PEAUGER, Franck (CERN)

Presenter: Mr PEAUGER, Franck (CERN)

Session Classification: Summaries

Track Classification: Superconducting RF & associated technologies

Contribution ID: **644** Type: **Presentation**

FCC-eh summary

Friday, June 28, 2019 11:00 AM (15 minutes)

Primary author: KLEIN, Max (University of Liverpool (GB))

Presenters: KLEIN, Max (University of Liverpool (GB)); BRUNING, Oliver (CERN)

Session Classification: Summaries

Track Classification: FCC-eh

Contribution ID: **645** Type: **Presentation**

Heavy Ions summary

Friday, June 28, 2019 11:15 AM (15 minutes)

Primary author: D'ENTERRIA, David (CERN)

Presenter: D'ENTERRIA, David (CERN)

Session Classification: Summaries

Track Classification: Physics

Contribution ID: **646** Type: **Presentation**

FCC-ee summary

Friday, June 28, 2019 12:00 PM (30 minutes)

Primary author: JANOT, Patrick (CERN)

Presenter: JANOT, Patrick (CERN)

Session Classification: Summaries

Track Classification: FCC-ee detector & experiment

Contribution ID: **647** Type: **Presentation**

FCC-hh summary

Friday, June 28, 2019 11:30 AM (30 minutes)

Primary author: HELSENS, Clement (CERN)

Presenter: HELSENS, Clement (CERN)

Session Classification: Summaries

Track Classification: FCC-hh detector & experiment

Contribution ID: **648** Type: **Presentation**

Closing remarks

Friday, June 28, 2019 12:30 PM (10 minutes)

Primary author: BENEDIKT, Michael (CERN)

Presenter: BENEDIKT, Michael (CERN)

Session Classification: Summaries

Track Classification: Others

Contribution ID: **649** Type: **Presentation**

Magnets quench protection

Thursday, June 27, 2019 8:50 AM (20 minutes)

Three different 16 T dipole magnet options for the Future Circular Collider have been designed within the H2020 EuroCirCol collaboration. Namely, a cosθ-type, a block-type, and a common-coil type magnets have been considered. All magnets were designed using the same design criteria related to magnetic field, cable parameter space, mechanical constraints, and quench protection. The quench protection analysis was centralized and done for all options using the same tools and methods. We present here the main steps considered in the magnet quench protection analysis, starting from the requirements defined in the early design phase, the developed tools, performed analysis, and arriving to the final protection schemes.
The designed final protection schemes are based either on traditional quench heaters or on the novel CLIQ-method (Coupling Loss Induced Quench). It will be shown that CLIQ is more efficient in reducing peak temperatures than heaters, and it has been chosen as the baseline protection option. With protection heaters the peak temperatures are higher (approaching the set limit of 350 K when assuming 20 ms detection time and adiabatic hotspot temperature calculation) and it is hard to obtain the required redundancy and safety margin. The future development of heaters is however considered a back-up option.

Primary authors: Dr SALMI, Tiina (Tampere University, Finland); Dr PRIOLI, Marco (INFN, Milan, Italy)

Presenter: Dr SALMI, Tiina (Tampere University, Finland)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **650** Type: **Presentation**

ERL: Overview and Cost

Thursday, June 27, 2019 3:50 PM (20 minutes)

Primary author: BRUNING, Oliver (CERN)

Presenter: BRUNING, Oliver (CERN)

Session Classification: FCC-eh

Track Classification: FCC-eh

Contribution ID: **651** Type: **Presentation**

Introduction and Overview

Thursday, June 27, 2019 3:30 PM (20 minutes)

Primary author: KLEIN, Max (University of Liverpool (GB))

Presenter: KLEIN, Max (University of Liverpool (GB))

Session Classification: FCC-eh

Track Classification: FCC-eh

Contribution ID: **652** Type: **Presentation**

PERLE Status and Plans

Thursday, June 27, 2019 4:10 PM (20 minutes)

Primary author: KAABI, Walid (CNRS-IN2P3)

Presenter: KAABI, Walid (CNRS-IN2P3)

Session Classification: FCC-eh

Track Classification: FCC-eh

Contribution ID: **653** Type: **Presentation**

Progress on the eh Interaction Region

Thursday, June 27, 2019 4:30 PM (15 minutes)

Primary author: ANDRE, Kevin Daniel Joel (University of Liverpool (GB))

Presenter: ANDRE, Kevin Daniel Joel (University of Liverpool (GB))

Session Classification: FCC-eh

Track Classification: FCC-eh

Contribution ID: **654** Type: **Presentation**

The Interation Region Design (protons)

Thursday, June 27, 2019 4:45 PM (15 minutes)

Primary author: CRUZ ALANIZ, Emilia (University of Oxford JAI)

Presenter: CRUZ ALANIZ, Emilia (University of Oxford JAI)

Session Classification: FCC-eh

Track Classification: FCC-eh

Contribution ID: **656** Type: **Presentation**

Development of Nb3Sn for FCC in Japan

Thursday, June 27, 2019 1:30 PM (15 minutes)

CERN, KEK and Tohoku & Tokai university have jointly launched a R&D program.The scope of the program is to develop, produce in representative lengths and characterize Nb3Sn wire with enhanced characteristics. The final goal is to achieve in representative unit lengths of material the development targets defined, on the basis of magnets performance, for the FCC Nb3Sn conductor. Two Japanese companies have joined this program and started the conductor R&D. Several R&D wires have been produced and non-copper Jc exceeding 1100 A/mm^2 has been achieve in one of the R&D wires. In the presentation, the status of the R&D and the future plan will be presented.

Primary authors: OGITSU, Toru; SUGANO, Michinaka; NAKAMOTO, Tatsushi; SUZUKI, Kento; AWAJI, Satoshi (Tohoku University); Dr OGURO, Hidetoshi (Tokai university); BALLARINO, Amalia (CERN); HOPKINS, Simon (CERN); DEVRED, Arnaud (CERN); LARBALESTIER, David (National High Magnetic Field Laboratory); KAWASHIMA, Shinya (KOBE STEEL, LTD.); Mr KAWARADA, Takao (KOBE STEEL, LTD.); Mr MURAKAMI, Yukinobu (Japan Superconductor Technology, Inc,); Dr SAITO, Kazuyoshi (Japan Superconductor Technology, Inc,); ASAMI, DAISUKE (FURUKAWA ELECTRIC CO., LTD.); II, Hideki (Furukawa Electric); SAKAMOTO, Hisaki (Furukawa Electric Co., Ltd); KATO, Tomoya (Furukawa Electric)

Presenter: OGITSU, Toru

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **657** Type: **Presentation**

Beam-beam blow-up issues

Thursday, June 27, 2019 9:24 AM (18 minutes)

Primary author: EL KHECHEN, Dima (CERN)

Presenter: EL KHECHEN, Dima (CERN)

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **658** Type: **Presentation**

Synchrotron radiation with smaller central IP beam

Thursday, June 27, 2019 11:42 AM (18 minutes)

Primary authors: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT)); SULLIVAN, Michael (Unknown)

Presenter: BOSCOLO, Manuela (INFN e Laboratori Nazionali di Frascati (IT))

Session Classification: FCC-ee accelerator

Track Classification: FCC-ee accelerator

Contribution ID: **659** Type: **Presentation**

Electrodeposition of copper for seamless cavity

Tuesday, June 25, 2019 9:42 AM (18 minutes)

Primary author: ROSAZ, Guillaume Jonathan (CERN)

Presenter: ROSAZ, Guillaume Jonathan (CERN)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **660** Type: **Presentation**

Cross section and differential distributions for top quarks near the production threshold

Thursday, June 27, 2019 9:30 AM (20 minutes)

A top threshold scan at the FCC-ee could provide a measurement of the top-quark mass in a well-defined scheme with unrivaled precision as well as a determination of the top-quark width and Yukawa coupling. The threshold region is subject to two interesting effects, the strong color-Coulomb attraction between the top quarks which drives the formation of toponium resonances and the fast top-quark decays which impedes this formation, and both need to be incorporated in a sophisticated effective theory framework to obtain reliable results. I review the current status of theoretical predictions for the inclusive $W^+W^-b\bar{b}$ cross section and differential distributions and present sensitivity estimates for the mass and other parameters.

Primary author: RAUH, Thomas

Presenter: RAUH, Thomas

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **661** Type: **Presentation**

The US-MDP program

Thursday, June 27, 2019 3:30 PM (18 minutes)

Primary author: PRESTEMON, Soren (LBNL)

Presenter: PRESTEMON, Soren (LBNL)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **663** Type: **Presentation**

Heavy resonances

Thursday, June 27, 2019 1:50 PM (20 minutes)

Primary author: HELSENS, Clement (CERN)

Presenter: HELSENS, Clement (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **664** Type: **Presentation**

First performance results for Liquid Argon Calorimetry for FCC-ee

Wednesday, June 26, 2019 9:40 AM (20 minutes)

Primary author: VOLKL, Valentin (University of Innsbruck (AT))

Presenter: VOLKL, Valentin (University of Innsbruck (AT))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **666** Type: **Presentation**

Beam loss studies with BDSIM

Tuesday, June 25, 2019 2:35 PM (20 minutes)

Primary author: PIKHARTOVA, Helena (University of London (GB))

Presenter: PIKHARTOVA, Helena (University of London (GB))

Session Classification: HE LHC

Track Classification: High Energy LHC

Contribution ID: **667** Type: **Presentation**

The MYRRHA project

Wednesday, June 26, 2019 3:30 PM (40 minutes)

Primary author: Dr VANDEPLASSCHE, Dirk

Presenter: Dr VANDEPLASSCHE, Dirk

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **668** Type: **Presentation**

Much smaller accelerators at IBA : selected news about their applications

Wednesday, June 26, 2019 4:10 PM (40 minutes)

Primary author: Dr FORTON, Eric

Presenter: Dr FORTON, Eric

Session Classification: Plenaries

Track Classification: Keynote

Contribution ID: **669** Type: **Presentation**

Prospects for new studies in the flavour sector

Thursday, June 27, 2019 8:50 AM (20 minutes)

Primary author: MONTEIL, Stephane (Université Clermont Auvergne (FR))

Presenter: MONTEIL, Stephane (Université Clermont Auvergne (FR))

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **670** Type: **Presentation**

Test results and Operational experience of the High Power IOT development for ESS

Tuesday, June 25, 2019 1:52 PM (22 minutes)

The European Spallation Source, currently under construction in Lund, Sweden launched a project to procure and test two MB-IOTs as technology demonstrators. The MB-IOTs were designed for pulsed operation at 1.2 MW, 704 MHz, 3.5 ms pulse width with a repetition rate of 14 Hz. This talk will summarise the outline design and specification of the two MB-IOTs delivered and will describe the test results and operational experience during the testing.

Primary author: JENSEN, Morten (European Spallation Source)

Presenter: JENSEN, Morten (European Spallation Source)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **671** Type: **Presentation**

Polarization prediction for Z and W operation

Tuesday, June 25, 2019 8:30 AM (20 minutes)

Primary author: GIANFELICE-WENDT, Eliana (Fermi National Accelerator Lab. (US))

Presenter: GIANFELICE-WENDT, Eliana (Fermi National Accelerator Lab. (US))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **672** Type: **Presentation**

BSM theory prospects in flavour sector

Thursday, June 27, 2019 9:10 AM (20 minutes)

Primary author: BISHARA, Fady Adibsamy (DESY)

Presenter: BISHARA, Fady Adibsamy (DESY)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **673** Type: **Presentation**

ALPs at future colliders

Thursday, June 27, 2019 1:30 PM (20 minutes)

Primary author: MCCULLOUGH, Matthew Philip (CERN)

Presenter: MCCULLOUGH, Matthew Philip (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: Physics

Contribution ID: **674** Type: **Presentation**

Characterization of a nobium thin film deposited on 6 Ghz SRF cavities

Tuesday, June 25, 2019 11:24 AM (18 minutes)

Niobium thin film deposited on copper cavity has the potential to replace bulk niobium superconducting cavity in particle accelerators. Bulk niobium has a typical heat conductance of about 75 W/m.K at best, while for copper is as high as 300-2000 W/m.K and the cost of copper is a fraction of that of niobium. INFN Legnaro has been producing special seamless 6 GHz copper cavity from a single 2mm sheet of Cu. The cavity goes through normal BCP treatment prior to deposition. RF tested at 1.8 K of the deposited cavity is carried out at INFN. Finally the cavities are cut and the film at the iris and the cell are characterised using scanning and transmission electron microscopy (SEM & TEM), Electron backscattered diffraction, X-ray tomography, X-ray diffraction and DC SQUID magnetometry.
It is shown that the growth of the columnar Nb grains is influenced by the positioning of the Nb source. The grains located close to the curve midpoint (cell position) tend to orient perpendicular to the substrate/Nb interface, whereas grains at either end of curve (iris position) tilt toward the source. Furthermore, the initial fine grain Nb formation in the early stages of deposition gives way to the formation of columnar grains and the niobium texture plots indicate a preferred 011 crystal orientation parallel to the columnar grain growth direction.

Primary authors: VALIZADEH, Reza (STFC Daresbury Laboratory); PIRA, Cristian (LNL-INFN); GARCIA, Vanessa (INFN-LNL); Dr STENNING, Gavin (STFC); Dr DAWSON, Karl (Liverpool University)

Presenter: VALIZADEH, Reza (STFC Daresbury Laboratory)

Session Classification: SRF

Track Classification: Superconducting RF & associated technologies

Contribution ID: **675** Type: **Presentation**

Evaluation of LASER ablated surface engineering of copper and stainless steel for particle accelerators

Wednesday, June 26, 2019 10:30 AM (20 minutes)

The reduction of secondary electron yield (SEY) is a very effective way of mitigation of electron cloud (e-cloud) and beam induced electron multipacting in accelerator beam chambers and RF wave guides. During the past five years it has been shown that Laser Ablation Surface Engineering (LASE) is very effective method to reduce SEY well below one. Furthermore, it was shown that the reduction of the SEY is due to creation of hierarchy of structures generated during the laser ablation, these structures are very effective to trap the emitted secondary electron within the surface by multiple scattering and most efficient for the low energy electron. To enable an application of LASE for accelerator beam chamber a number of questions has been addressed in ASTeC.

The LASE beam chamber must be vacuum compatible. The difference in thermal outgassing between the LASE treated and non-treated samples is below the sensitivity limit. The electron stimulated desorption (ESD) study has been conducted to compare the LASE treated and non-treated stainless steel and copper samples. Particulate generation can be controlled. The LASE surface does not require any cleaning after the laser processing; however, if it has been contaminated, it can be cleaned with vacuum cleaning solvent and in ultrasonic bath, but it may lead to some increase in SEY.

The presence of LASE structures at the surface may increase the surface resistance, which can lead to increased beam impedance and energy spread as well as to an increase in the heat load budget at cryogenic beam chamber. Hence, it is essential to accurately determine the surface resistance after laser surface treatment. High conducting oxygen free (HCOF) copper and stainless steel samples were irradiated with infrared laser at different repetition rates and power to produce different surface structure. This has produced different surface structure with various SEY. The surface resistance of these surfaces is measured using cylindrical symmetric resonator, which can generate surface currents in the samples whose surface resistance can be determined from the resonator's quality factor.

A correlation between laser parameter, induced surface structure, ESD, SEY and surface resistance will be reported.

Primary authors: VALIZADEH, Reza (STFC Daresbury Laboratory); Mr HANNAH, Adrian (STFC); Ms MUCH, Jennifer (STFC); Dr WHITEHEAD, David (Manchester University); KRKOTIĆ, Patrick (ALBA); MALYSHEV, Oleg (STFC Daresbury Laboratory); O'CALLAGHAN CASTELLA, Juan Manuel; PONT, Montse (CELLS-ALBA)

Presenter: VALIZADEH, Reza (STFC Daresbury Laboratory)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **676** Type: **Presentation**

Design Status of a Fast Cycled Low Loss 6 T Model Dipole Cooling at 1.9 K

Thursday, June 27, 2019 4:42 PM (18 minutes)

The concept of new fast cycled low loss 6 T model dipole cooling at 1.9 K is proposed. The magnet is considered in the context of the FCC-hh high energy injector based on the modernized CERN SPS synchrotron. The new machine would operate in a cycled mode also to feed experimental areas, much like the SPS nowadays. Due to this specific cycled operation, innovative design and development approaches is required to cope with the AC losses in the superconducting cables and iron yoke. The research joins experience accumulated at CERN and JINR respectively in the design and operation of large systems operated at 1.9 K and, in fast ramped and cycled magnets. The specified parameters are the following: magnet aperture -80 mm; aperture field – 6 T; field ramp 0.2-0.5 T/s; coil conductor – NbTi; magnetic field homogeneity between 0.12 and 6 T of the order of 5·10e-4. The minimization of the cycling losses is particular important. Total thermal losses should be limited to tentatively < 2 W/m at 4.2 K. The magnet design, and the results of preliminary tests on a candidate NbTi-wire for building a model magnet are presented, expected level of the power losses are discussed.

Primary authors: KOVALENKO, Alexander (Joint Inst. for Nuclear Research (RU)); GROMOV, Vladimir (Nikhef National institute for subatomic physics (NL)); KOLOMIETS, Andrey (JINR); KOZUB, Sergey (Institute for High Energy Physics); PEREPELKIN, Evgeny; TKACHENKO, Leonid (Institute for High Energy Physics); BORDINI, Bernardo (CERN); TOMMASINI, Davide (CERN)

Presenter: KOVALENKO, Alexander (Joint Inst. for Nuclear Research (RU))

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **677** Type: **Presentation**

Update on W mass measurement studies

Tuesday, June 25, 2019 10:30 AM (20 minutes)

Improving the accuracy of the W mass measurement at or beyond the theoretical prediction would be a crucial test of the overall consistency of the SM and any deviation might reveal the emergence of new physics. With more than 2x10^8 W pairs produced at the W threshold energy and above, the FCCee collider will be a W factory and will allow for W mass measurement with unparalleled precision.
With enough statistics in lepton collisions, the W mass can be directly measured at and above threshold from the kinematic reconstruction of the W-pair decay products. In addition, e+e- collisions offer the possibility to derive the W mass from the WW cross-section measured at the pair-production threshold. The update of the measurement of the W mass and width, with both methods, is presented. The other opportunities linked to the W decay physics at FCCee are also discussed.

Primary author: BÉGUIN, Marina (Université Paris-Saclay (FR))

Presenter: BÉGUIN, Marina (Université Paris-Saclay (FR))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **678** Type: **Presentation**

Measurement of the beam-beam effects on the crossing angle and CM energy at IP

Tuesday, June 25, 2019 9:10 AM (20 minutes)

The beam-beam "pinch" effect at the interaction point causes the FCC-ee beam energies to increase by a small amount (60 keV at the Z pole) at the interaction point with respect to the values measured by resonant depolarization. This increase is accompanied by an increase of the crossing angle at the IP by 0.177 mrad. The centre-of-mass energy calculated with the beam energies measured by resonant depolarization and by the crossing angle measured at the IP would be biassed by -120 keV with respect to the actual centre-of-mass energy. This bias is of the same order as the precision of the beam energy measurement. A method to measure the crossing angle increase in situ, and therefore to correct for this bias, is presented.

Primary author: JANOT, Patrick (CERN)

Presenter: JANOT, Patrick (CERN)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **679** Type: **Presentation**

Development of Nb3Sn for FCC in Korea

Thursday, June 27, 2019 11:40 AM (15 minutes)

KAT have manufactured various kinds of wires to achieve an FCC requirement during last two years. As a result, it succeeded in developing a wire having a critical current density of 1,070 A/mm2@16T and an effective diameter of 69 micrometers with short piece length. Recently, our research has been successfully conducted to secure a piece length of 100 m or more. Totally 6 km of strand has been produced to deliver CERN in this year. In order to improve the critical current density and the effective diameter, further optimization of the final heat treatment and homogeneous distribution of Sn and Ti will be attempted in the future research.

Primary author: KIM, Jiman (Kiswire Advanced Technology)

Co-author: Mr SHIN, Iksang (Kiswire Advanced Technology)

Presenter: KIM, Jiman (Kiswire Advanced Technology)

Session Classification: Magnets

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **680** Type: **Presentation**

New Physics in Diboson Channels at High Invariant Mass

Thursday, June 27, 2019 10:30 AM (20 minutes)

Thus far, the LHC has not discovered any new resonances with the notable exception of the SM-like Higgs boson. Nevertheless, if New Physics states (i.e., new states beyond the SM) exist but are out of reach for the LHC or even a future collider with a higher center-of-mass (CoM) energy, these resonances can manifest themselves in the growth with partonic CoM energy of certain amplitudes below their mass scale. In this talk, I will review a particularly promising set of channels – the diboson channels – where such effects can be used to place bounds on (or, optimistically, observe deviations in) the operators that are generated from integrating out new resonances. In particular, I will discuss the interplay between the WZ, Zh, and Wh channels in order to break flat directions in the Likelihood function.

Primary author: BISHARA, Fady Adibsamy (DESY)

Presenter: BISHARA, Fady Adibsamy (DESY)

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-hh detector & experiment

Contribution ID: **681** Type: **Presentation**

Cold losses and deposited power density

Tuesday, June 25, 2019 11:30 AM (10 minutes)

Primary author: VARASTEH, Mohammad (CERN)

Presenter: VARASTEH, Mohammad (CERN)

Session Classification: FCC-hh accelerator (EuroCirCol)

Track Classification: FCC-hh accelerator

Contribution ID: **682** Type: **Presentation**

FCC-hh heavy-ion collimation

Tuesday, June 25, 2019 5:45 PM (10 minutes)

Primary author: ABRAMOV, Andrey (University of London (GB))

Presenter: ABRAMOV, Andrey (University of London (GB))

Session Classification: FCC-hh accelerator (EuroCirCol)

Contribution ID: **683** Type: **Poster**

Tile Multiple readout and beyond

Tuesday, June 25, 2019 4:20 PM (1 minute)

Dual Readout Calorimetry measures scintillation light and Cherenkov light on the same hadron shower to correct the jet energy in order to compensate hadron and jet energy measurements. Dual Readout with parallel plastic scintillator and quartz fibers shows promise, but limitations exist including but not limited to radiation damage of the plastic scintillators and high costs. We present dual readout calorimetry with scintillator and Cherenkov tile readout and beyond to multiple tile readout, with superior energy resolution, and radiation resistant ionization sensors in the form of tiles (inorganic scintillators, Si, LArgon).

Primary author: ONEL, Yasar (University of Iowa (US))

Presenter: ONEL, Yasar (University of Iowa (US))

Session Classification: Poster session

Track Classification: FCC-ee detector & experiment

Contribution ID: **684** Type: **Presentation**

FCC-ee ERL option for low power and/or high energy

Tuesday, June 25, 2019 11:42 AM (18 minutes)

Primary authors: CHAMIZO LLATAS, Maria (Brookhaven National Laboratory (US)); CHAMIZO LLATAS, Maria (Brookhaven National Laboratory (US))

Presenters: CHAMIZO LLATAS, Maria (Brookhaven National Laboratory (US)); CHAMIZO LLATAS, Maria (Brookhaven National Laboratory (US))

Session Classification: SRF

Contribution ID: **685** Type: **Presentation**

Determination of Luminosity

Tuesday, June 25, 2019 11:30 AM (20 minutes)

For the FCC-ee physics programme, a precise measurement of the luminosity is essential. The high statistics scan of the Z line shape dictates the ambitions goals of 10^-4 precision on the absolute luminosity measurement and 10^-5 on the relative luminosity measurement between energy scan points. The reference process for the measurement is small angle Bhabha scattering observed by a set of two calorimeters centered around the two outgoing beam lines. The relevant forward region is a very crowded one, and the very compact silicon-tungsten-sandwich luminometers have their faces positioned only about 1 m from the IP. The Bhabha scattering cross section has a very strong angular dependence, and the geometrical precision of the luminomitors shall allow the radial coordinate of showers to be determined to about 1 micron precison. Machine related background processes have been investigated and found to be small. An important effect, which is under study, is the focussing of the final state Bhabha electrons by the strong EM field of the opposing beam resulting in a systematic shift of the scattering angle. It has been found that this effect is correlated with a similar beam-beam effect which causes the beam crossing angle to increase by ~0.3 percent. Hence, a precise study of the beam crossing angle via the copiously produced dimoun events will give valuable information on the detailed beam-beam interaction.

Primary author: DAM, Mogens (University of Copenhagen (DK))

Presenter: DAM, Mogens (University of Copenhagen (DK))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **686** Type: **Poster**

Considerations for large scale production of the FCC-hh beam screens

Tuesday, June 25, 2019 4:21 PM (1 minute)

Primary author: GARION, Cedric (CERN)

Presenter: GARION, Cedric (CERN)

Session Classification: Poster session

Track Classification: FCC-hh accelerator

Contribution ID: **687** Type: **Presentation**

The ESS approach to sustainable research

Tuesday, June 25, 2019 9:20 AM (20 minutes)

Presenter: WOMERSLEY, John (European Spallation Source)

Session Classification: Economics of Science Workshop

Track Classification: Economics

Contribution ID: **692** Type: **Poster**

Effects of Emittance Constraints on Monochromatization at Future Circular Colliders

Direct s¬channel Higgs production in e+e− collisions is of interest if the collision energy spread can be comparable to the natural width of the standard model Higgs boson. At the Future Circular e+ e¬ Collider (FCC¬ee), a monochromatization scheme could be employed in order to reduce the collision energy spread to the target value. This may be achieved by introducing a non¬zero horizontal dispersion of opposite sign for the two colliding beams at the interaction point. In this case, the beamstrahlung increases the horizontal emittance in addition to energy spread and bunch length. The vertical emittance could either be tuned to a certain minimum value, possibly limited by the diagnostics resolution, or it could scale linearly with the horizontal emittance. For the FCC¬ee at 62.5 GeV beam energy, we optimize the IP optics and beam parameters, considering these two different assumptions for the vertical emittance. We derive the maximum achievable luminosity as a function of collision energy spread for either case.

Primary author: VALDIVIA GARCIA, Marco Alan (Universidad de Guanajuato (MX))

Presenter: VALDIVIA GARCIA, Marco Alan (Universidad de Guanajuato (MX))

Session Classification: FCC physics, experiments & detectors

Track Classification: FCC-ee detector & experiment

Contribution ID: **693** Type: **Poster**

Tough Epoxy Systems for the Impregnation of (Future) High Field Superconducting Magnets

The following work addresses improvements of the resin impregnation systems with the goal to overcome field limiting effects occurring during training like micro-cracks, plastic events, or delamination. A current cooperation between ETH Zürich, Paul Scherrer Institute and CERN, embedded in the CHART (Swiss Accelerator Research and Technology) initiative, aims at the development of tough epoxy systems suited for the impregnation of future high field superconducting magnets. In the first project period a baseline is established by the characterization of three technically relevant systems (CTD-101K, Mix61, MY750/HY5922) that are compared with
regards to their mechanical and processing properties at room temperature which will be transferred to liquid nitrogen/helium temperatures in the upcoming project period.

Primary author: GOLD, Barbara

Presenter: BREM, André (Eidgenössische Technische Hochschule Zürich)

Session Classification: Poster session

Track Classification: Superconducting magnets & associated technologies

Contribution ID: **694** Type: **Presentation**

Superconducting characterization of prototype LTS samples

Thursday, June 27, 2019 3:30 PM (18 minutes)

Primary author: ORTINO, Mattia (TU Wien (Vienna))

Presenter: ORTINO, Mattia (TU Wien (Vienna))

Session Classification: EASITrain

Contribution ID: **695** Type: **Presentation**

Microstructural characterisation of superconducting materials

Thursday, June 27, 2019 3:48 PM (18 minutes)

This presentation shows the current status of the microstructural analyses concerning several superconducting materials, envisioned for diverse components of the Future Circular Collider: Nb3Sn, YBCO, MgB2 (Magnets), Tl-1223 (Beam screen) and NbN (RF Cavities). All the samples have to be properly prepared in order to be consequently well characterized by employing different electron microscopy techniques with both Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The microstructural investigation represents a fundamental tool for understanding how the material superconducting properties can be enhanced.

Primary author: MOROS, Alice (Technische Universität Wien)

Presenter: MOROS, Alice (Technische Universität Wien)

Session Classification: EASITrain

Contribution ID: **696** Type: **not specified**

Assessment of high-performance superconducting wires at low temperatures

Thursday, June 27, 2019 4:06 PM (18 minutes)

In earlier study a 3 T pulsed electromagnet was the key tool in our experiments. Short pieces (of 20 cm length) of long tapes have been introduced in the magnet channel of the magnet and loaded with up to 10 A transport current. The voltage signal during the magnetic field pulse has been recorded and interpreted in terms of an "extended alpha approximation" approach. To develop this model, the commonly used n- and alpha-approximation, usually taken for critical current approximations at high fields, has been "extended" towards fields in the range of 0-6 T by determining n- and alpha-values of a number of samples at TU-Wien at 77 K and 0-6 T (B//c). Occurring gradients in the pulsed
field have been taken into account by integrating the voltage signal along the sample length x by using a function B(x) for the magnetic field.
Furthermore, the field distribution of a 2.54 T permanent magnet has been measured and sufficient stability of the magnetic field has been observed in the course of multiple temperature cycling performed between room temperature and the temperature of liquid nitrogen. The results of studies of both sources of magnetic field are used in the development of a tape characterization tool in which field gradients may appear.

Primary author: GNILSEN, Johannes

Presenter: GNILSEN, Johannes

Session Classification: EASITrain

Contribution ID: **697** Type: **Presentation**

Fluid properties modeling

Thursday, June 27, 2019 4:24 PM (18 minutes)

Based upon the conceptual design reports for the FCC cryogenic system, the need for more accurate thermodynamic property models of mixtures was identified. Both academic institutes and world-wide industries have identified the lack of reliable equation of state for mixtures used at very low temperatures. Detailed cryogenic architecture modeling and design cannot be assessed without valid fluid properties. Therefore, the latter is the focus of this work. Initially driven by the FCC study, the modeling was extended to other fluids beneficial for scientific and industrial application beyond the FCC needs. The properties are modeled for the mixtures of some noble gases with the use of multi-fluid Helmholtz-energy-explicit models: helium-neon, neon-argon, and helium-argon. The on-going studies are performed at CEA-Grenoble, France and at the National Institute of Standards and Technology, U.S.

Primary author: TKACZUK, Jakub

Presenter: TKACZUK, Jakub

Session Classification: EASITrain

Contribution ID: **698** Type: **Presentation**

Production of high temperature superconducting Thallium-based thin-film coatings

Thursday, June 27, 2019 4:42 PM (18 minutes)

The study of high-energy Future Circular Collider (FCC-hh) study includes investigation on thallium based high temperature superconducting materials to act as part of the beam screen for the circulating high energy proton beams stability. At present, the copper coating is used to keep the beam coupling impedance low, but at 50K it might not be sufficiently low. For beam stability, high-temperature superconductors have lower surface impedance than copper and Tl based superconducting thin film could be befitting this purpose among HTS-systems.
For this work, at CNR SPIN, several techniques are being employed that allow high-quality films to be grown on different substrates. We synthesis TBCCO superconducting thin films and pellets. For the deposition of the films electrodeposition, pulse laser deposition, and spin coating techniques are being used. Our recent work is directed at trying to improve the Tl-1223 phase in the thin films. And for this purpose, various techniques, compositions, and substrates are under study and a variety of substrate have been investigated for the growth of Tl-1223 film.

Primary author: SABA, Aisha (CNR-SPIN)

Presenter: SABA, Aisha (CNR-SPIN)

Session Classification: EASITrain

Contribution ID: **699** Type: **Presentation**

Development and efficiency assessment of a reference Nelium refrigeration cycles

Thursday, June 27, 2019 5:00 PM (18 minutes)

Development of a Nelium Turbo-Brayton cryogenic refrigerator for the FCC-hh -
EASITrain project status overview
S. Savelyeva, S. Klöppel, Ch. Haberstroh, H. Quack
Technische Universität Dresden - Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology
The scope of the EASITrain project includes the development of the cryogenic system for the 40-60 K beam screen cooling as a part of the FCC-hh design. The study includes such topics as comparison of cryogenic cycle arrangements, matching of turbo-compressor and cycle designs, Nelium composition improvement, assessment of component efficiencies and operational mode performance. The current state of the project and main results of ESR11 will be presented.

Primary author: SAVELYEVA, Sofiya (Technische Universität Dresden)

Presenter: SAVELYEVA, Sofiya (Technische Universität Dresden)

Session Classification: EASITrain