Accelerator Science and Technology

Tuesday, 19.08.2025, Room Erika Weinzierl Saal

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<tr><th>Time</th><th>ID</th><th>ACCELERATOR SCIENCE AND TECHNOLOGY
Chair: Mike Seidel, PSI Villigen</th></tr>
<tr><td>16:00</td><td>481</td><td>Superconducting-Magnet R&D for the Future Circular Collider at the PSI MagDev Laboratory

Bernhard Auchmann [1], Douglas Martins Araujo [1], André Brem [1], Jaap Kosse [1], Dmitry Sotnikov [1], Thomas Michlmayr [1], Henrique Garcia Rodrigues [1], Kirtana Puthran [1], Ines Santos Perdigao Peixoto [1], Jürgen Schmidt [1], Joep Van den Eijnden [1], Matteo Crescenti [1], Anna Stampfli [1], Christian Lindner [1], Collin Müller [1], Stéphane Sanfilippo [1], Ariel Haziot [1], Amalia Ballarino
[1] PSI, Villigen, Switzerland, [2] CERN, Geneva, Switzerland

The MagDev Laboratory at PSI was created through the CHART program (Swiss Accelerator Research and Technology) to carry out innovative R&D in superconducting magnets for the Future Circular Collider. In this contribution, we give an overview of ongoing activities at the MagDev laboratory, from Nb_3Sn high-field dipoles to REBCO technology for bending magnets, to REBCO no-insulation solenoids. We conclude with a series of synergistic activities with other fields that generate societal impact of HEP-related R&D.</td></tr>
<tr><td>16:15</td><td>482</td><td>Towards multi-scale modelling of Nb_3Sn cable for accelerator magnets

Joep Van den Eijnden [1], Douglas Araujo [2], Bernhard Auchmann [2], Xiang Kong [1], Theo Tervoort [1], Jasmin Smajic [1], Jürg Leuthold [1]
[1] ETH Zürich, Switzerland, [2] Paul Scherrer Institute, Villigen, Switzerland

Under the Swiss Accelerator Research and Technology (CHART) initiative, we are developing simulation tools to advance superconducting magnet technology in support of the Future Circular Collider. To achieve dipole magnetic fields exceeding 14 T, it is critical to understand and predict how mechanical stress affects the performance of Nb_3Sn magnets. The Lorentz forces acting on these meter-long magnets influence the superconducting behavior of micrometer-scale filaments. To address this, we develop a multiscale approach, utilizing measured material properties, that downscales to a submodel resolving individual strands and capturing cabling-induced deformation. This enables links to performance reduction observed in experiments at PSI. Once validated, we aim to integrate the work into the PyMBSE framework and extend this approach to high-temperature superconductor cables.</td></tr>
<tr><td>16:30</td><td>483</td><td>Quench Protection based on Smart Insulation for the Final Cooling Solenoid of the Muon Collider

Matteo Crescenti [1,2], Bernhard Auchmann [1], André Brem [1], Michal Duda [1], Jaap Kosse [1], Jürgen Schmidt [1], Carmine Senatore [2]
[1] PSI, Center for Accelerator Science and Engineering (CAS), Villigen PSI, Switzerland,
[2] University of Geneva, Department of Quantum Matter Physics, Geneva, Switzerland

In the framework of the Horizon Europe Mucol, we investigate the use of materials with strong thermo-resistive behavior as “smart insulation” to improve quench protection in high-field magnets based on high-temperature superconductors (HTS). A finite element model was developed to analyze the thermal-electromagnetic behavior of a 40 T solenoid under design for final muon beam cooling in a 10 TeV Muon Collider concept. Several "smart" materials triggered by temperature or voltage were screened, and a method was developed to fine-tune turn-to-turn contact resistance in the winding. The approach aims to enhance the electro-thermal stability by locally decreasing the turn-to-turn resistance during a quench, avoiding damage while preserving the benefits of insulated magnets.</td></tr>
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16:45	484	**Update on Beam Halo Removal Studies for HL-LHC** *Milica Rakic [1], Pascal Hermes [2], Stefano Redaelli [2]* *[1] EPFL, Lausanne, Switzerland, [2] CERN, Meyrin, Switzerland* Measurements throughout LHC operation have shown that the transverse beam halo can contain a non-negligible fraction of the total stored beam energy. With the increased stored energy in the High-Luminosity LHC (HL-LHC), risks associated with the beam halo become more significant. Accurate halo modelling is therefore essential for simulating beam losses during HL-LHC failure scenarios involving sudden orbit shifts. Based on Run3 data, the HL-LHC halo model has been revised and replaced by two new q-Gaussian models: one optimized for best agreement with measured data, and a more conservative variant slightly overestimating the halo population. This contribution presents the updated halo models and evaluates the halo depletion efficiency of Hollow Electron Lenses for HL-LHC, comparing performance with the previous model.
17:00	485	**Accelerating Mixed Ion Beams for Treatment Monitoring Research** *Matthias Kausel [1,2], Claus Schmitzer [1], Elisabeth Renner [2], Albert Hirtl [2], Thomas Bergauer [3], Felix Ulrich-Pur [3,4], Andreas Gsponer [3], Hermann Fuchs [5]* *[1] EBG MedAustron GmbH, Wiener Neustadt, Austria, [2] TU Wien, Austria,* *[3] Austrian Academy of Sciences, Vienna, Austria,* *[4] GSI Helmholtz Institute for Heavy Ion Research, Darmstadt, Germany,* *[5] Medical University of Vienna, Austria* Irradiation with mixed helium and carbon ion beams is emerging as a promising approach to treatment monitoring in ion beam therapy. In this scenario, the carbon ions are used to irradiate the tumor, whereas the specific energy loss of the helium ions downstream of the patient serves as range probe. This talk presents the ongoing research on generating and accelerating such a mixed beam at the MedAustron accelerator facility in Wiener Neustadt, focusing on the developments that allowed for the delivery of a mixed $^{4}He^{2+}$ and $^{12}C^{6+}$ beam for the first time using a sequential injection scheme into the MedAustron synchrotron.
	~~486~~	*cancelled*
17:15	487	**The Upgrade of the Swiss Light Source and Characterization of its Beam Optics** *Jesus Avila Pulido, Jonas Kallestrup, Paul Scherrer Institute PSI, Villigen, Switzerland* The Swiss Light Source upgrade, SLS2.0, is currently undergoing commissioning. This next-generation storage ring features an ultra-low emittance lattice based on a seven-bend achromat design and operates at an electron beam energy of 2.7 GeV. Each unit cell incorporates a combination of longitudinal gradient bends and reverse bend magnets to achieve the desired optical performance. Following an introduction to the Swiss Light Source and its upgrade, the key characteristics of the SLS2.0 storage ring will be presented, alongside measurements of several quantities and their comparison with simulation results. Emphasis will be placed on the measurement of the beta functions since the knowledge and control of the linear optics is essential for the optimal machine performance.
17:30	488	**Implementation of the Synchrotron Radiation Integrals in Xsuite** *Simon Buijsman, CERN, Switzerland* High-precision simulation of beam dynamics in storage rings is essential for accelerator design. Xsuite, a Python-based package, is primarily tailored to hadron rings, and work is being performed to extend its applicability to electron rings, where synchrotron radiation (SR) plays a dominant role. While Xsuite includes sophisticated SR models, their results are difficult to trace to individual beam line elements. Radiation integral calculations based on orbit curvature have been implemented, enabling support for non-planar bends and improved interpretability. Benchmarking against Chao's formalism across various accelerator configurations shows agreement within 10^{-3} for equilibrium emittances and 10^{-4} for exponential damping times. This new functionality allows for attributing SR effects to specific elements, aiding optics design in Xsuite.

17:45	**489**	**Energy-efficient ERL-based accelerators from a beam dynamics perspective** *Lode Vanhecke [1], Mike Seidel [2], Tatiana Pieloni [1]* *[1] École Polytechnique Fédérale de Lausanne, Switzerland,* *[2] Paul Scherrer Institute, Villigen, Switzerland* Sustainability requirements are becoming an increasingly important aspect of accelerator physics. Providing an energy-efficient and sustainable solution, Energy Recovery Linac (ERL) concepts enable the generation of high-intensity beams while keeping electrical power consumption comparatively low. ERL accelerators meet these demands with the use of superconducting radio-frequency (SRF) technology. The Innovate for Sustainable Accelerating Systems (iSAS) initiative aims to integrate various energy-saving advancements into a next-generation, energy-efficient cryomodule design. This work analyses the iSAS SRF cavity design from a beam dynamics perspective, identifying coherent beam instabilities and providing feedback on higher-order mode resonances for further optimisation. The integration of this cryomodule into ERL-based systems is investigated. These results aim to contribute to the implementation of high-performance, environmentally responsible accelerating systems.
18:00		***END***
		Transfer to ÖAW *Doktor-Ignaz-Seipel-Platz 2, 1010 Wien*
19:00		***Public Lecture***