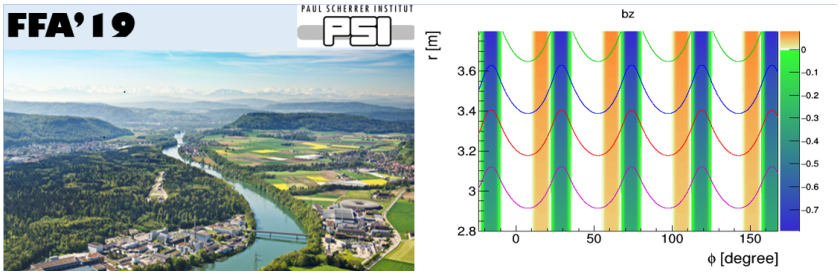

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Precise Modelling and Large Scale Multiobjective Optimisation of Cyclotrons

Thursday 21 November 2019 14:00 (45 minutes)

The usage of numerical models to study the evolution of particle beams is an essential step in the design process of particle accelerators. However, uncertainties of input quantities such as beam energy and magnetic field lead to simulation results that do not fully agree with measurements, hence the final machine will behave differently compared to the simulations. In case of cyclotrons such discrepancies affect the overall turn pattern or alter the number of turns. Inaccuracies at the PSI Ring cyclotron that may harm the isochronicity are compensated by 18 trim coils. These are often absent from simulations or their implementation is simplistic. A realistic trim coil model within the simulation framework OPAL is presented that was used to match the turn pattern of the PSI Ring. Due to the high-dimensional search space consisting of 48 simulation input parameters and 182 objectives (i.e. turns) simulation and measurement cannot be matched in a straightforward manner. Instead, an evolutionary multi-objective optimisation with more than 8000 individuals per generation together with a local search approach was applied that reduced the maximum error to 4.5 mm over all 182 turns.

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