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Electromagnetic analysis of a superconducting bus-bar for SIS100 particle accelerator at FAIR

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Sections of the superconducting magnets of SIS100 particle accelerator (under construction at GSI, Darmstadt) are going to be connected with by-pass lines used to transfer electric current and liquid helium. Each by-pass line will contain four pairs of Nuclotron-type superconducting cables (bus-bars) used to supply the different types of magnets with electric current. Since the accelerator is going to be powered with fast-ramping currents, some interactions between the bus-bars are expected. In this work the electromagnetic behaviour of the line is considered. The distribution of the magnetic field around a superconducting cable is analysed and used to find some electrical properties of the line - its electric capacity, self-inductance and mutual inductances between the bus-bars. Inductances are then applied in the calculation of cross-talk currents. Knowledge of these currents is crucial for the operation of the accelerator. The disturbance in the amount of supplied current can lead to the deformation of the magnetic field generated by the superconducting and in turn the decrease of luminosity or even the loss of particle beam.

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