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Simulation of a first case study for magnetic field imaging with the Magic- μ technique

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We present a feasibility study for a new muography technique, MAGnetic field Imaging by Cosmic-ray MUons (Magic- μ), whose general principles are introduced in another presentation. This new application exploits the charge of cosmic-ray muons, which causes them to shift their trajectory in response to magnetic flux density. As a first case study, we simulated the measurement of the field generated by a permanent magnet. In the first step, the magnetic field was calculated using the three-dimensional finite-element solution package AMaze. Then, the magnetic field flux density data were converted into a readable format for the PHITS Monte Carlo simulation code and muography images were obtained for two states of the magnetic field region ON and OFF. Positive and negative muons were generated using the PARMA model implemented in PHITS. The resulting image of the magnetic field ON is significantly blurred compared to the image of the magnetic field OFF. This blurred image can also be used for the analysis of the magnetic field. The simulation results are promising for the newly proposed application of cosmic-ray muons, the imaging of the magnetic field.

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