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muCool: A novel high-brightness low-energy muon beam

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The next generation experiments with muons and muonium atoms require high-intensity muon beams with low energy, small transverse size and small divergence. At the Paul Scherrer Institute, we are developing a novel device that reduces the phase space of a standard μ^+ beam by a factor of 10^{10} with 10^{-3} efficiency. The phase space compression is achieved by stopping μ^+ in cryogenic helium gas and applying strong electric and magnetic fields and gas density gradients. This device consists of several consecutive stages, which have been tested separately. The measurements show that we can achieve efficient muon beam compression, as predicted by the simulations. As a next step, we will combine the various stages and extract the compressed muon beam from the gas into vacuum.

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