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Design and Calibration of a High-Precision Density Gauge for Firn and Ice Cores[1] DANIEL BRETON[2], GORDON HAMILTON[3], University of Maine — The Maine Automated Density Gauge Experiment (MADGE) is a field deployable gamma-ray density gauging instrument designed to provide high resolution (3.3 mm) and high precision (± 0.004 g cm^{-3}) density profiles of polar firn and ice cores at a typical throughput of 1.5 m h^{-1}. The resulting density profiles are important in ice sheet mass balance and paleoclimate studies, as well as the modeling electromagnetic wave propagation in firn and ice for remote sensing and ground penetrating radar applications. This study describes the design (optimal gamma-ray energy selection, measurement uncertainty analysis, dead-time corrections) and calibration (mass-attenuation coefficient and absolute density calibrations) of the instrument, and discusses the results of additional experiments to verify the calculated measurement uncertainty. Data collected from firn cores drilled on the recent 2006-2007 U.S. Internation Trans-Antarctic Scientific Expedition are also shown and discussed.

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