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Ultra-High Sensitivity Techniques for the Determination of 3He/4He Abundances in Helium by Accelerator Mass Spectrometry H. P. MUMM, M. HUBER, NIST - Natl Inst of Stds Tech, W. BAUDER, Pen. State U., N. ABRAMS, Columbia U., C. DEIBEL, Louisiana State U., C. HUFFER, P. HUFFMAN, K. SCHELHAMMER, North Carolina State U., R. JANSSENS, C. JIANG, R SCOTT, R. PARDO, K. REHM, R. VONDRASEK, Argonne Natl Lab, C. SWANK, California Institute of Tech., C. O'SHAUGHNESSY, U. of North Carolina, M. PAUL, Hebrew University of Jerusalem, L. YANG, U. of Illinois at Urbana-Champaign — We report the development of an Accelerator Mass Spectrometry technique to measure the 3He/4He isotopic ratio using a radio frequency (RF) discharge source and the ATLAS facility at Argonne National Laboratory. Control over 3He/4He ratio in helium several orders of magnitude lower than natural abundance is critical for neutron lifetime and source experiments using liquid helium. Due to low ultimate beam currents, the ATLAS accelerator and beam line were tuned using a succession of species of the same M/q. A unique RF source was developed for the experiment due to large natural 3He backgrounds. Analog H_3^+ and DH^+ molecular ions are eliminated by dissociation via a gold stripper foil near the detector. The stripped ions were dispersed in a magnetic spectrograph and 3He^2 + ions counted in the focal plane detector. This technique is sensitive to 3He/4He ratios in the regime of 10^{-12} with backgrounds that appear to be below 10¹14. The techniques used to reduce the backgrounds and remaining outstanding problems will be presented along with results from measurements on high purity 4He samples.

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