1056-62-1851 **Jean Marie Linhart*** (`jmlinhart@gmail.com`), Department of Mathematics, Texas A&M University, Mail Stop 3368, College Station, TX 77843-3368, and **Wolfgang Bangerth** (`bangerth@math.tamu.edu`), Department of Mathematics, Texas A&M University, Mail Stop 3368, College Station, TX 77843-3368. *Statistical Sampling in High Dimensional Inverse Problems.*

Inverse problems arise in fields where abstract model parameters must be inferred from real-world data. In optical tomography we attempt to detect tumors at unknown locations in the human breast based on light measurements on the boundary modeled by a system of PDEs. Determining the material properties of the breast to a resolution of about 1 mm^3 requires ~ 200 grid points using adaptive finite element methods. At each grid point we find optical scattering and absorption coefficients; they are indicators of the presence of tumors. We wish to determine the form of the ~ 200-dimensional posterior distribution; this requires statistical sampling. The objective of our work is to find good sampling methods for use with such high-dimensional problems. We explore the use of the delayed-rejection adaptive-Metropolis (DRAM) method for high-dimensional sampling. This method modifies the Metropolis Hastings algorithm to reduce the rejection rate; it is a non-Markovian sampler that has correct ergodic properties. We will show that this method can be applied to identify the correct posterior distribution for a complex model based on the Poisson equation that can be thought of as a simplified description of optical tomography. (Received September 22, 2009)