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Off-Axis Calibration of KamLAND and Modeling of the "FourPi" Calibration System[1] GILLY ELOR, Lawrence Berkeley National Laboratory, UC Berkeley Physics Department — KamLAND is 1000-ton liquid scintillator detector which uses the prompt and delayed signals from inverse beta decay to detect electron anti-neutrinos produced in nuclear reactors. KamLAND has made the first observation of the disappearance of reactor electron anti-neutrinos. The largest contribution to the systematic uncertainty in KamLAND is the fiducial volume uncertainty (4.7 % out of a total 6.5 %). Until now the detector has been calibrated using gamma-ray sources of known energy deployed along the detector's vertical axis. A new 4π calibration system allows for off-axis source deployment throughout the entire fiducial volume. The 4π system is expected to reduce the fiducial volume uncertainty from 4.7 % to $\sim$ 1-2 %, and improve KamLAND's sensitivity in the determination of the mass-difference parameter Δm^2_{12}. The 4π system is currently in the initial stages of off-axis deployment. An off-line calculation is used to predict the location of the gamma-ray sources within the detector. The calculation takes into account the systems geometry, buoyancy effects in the liquid scintillator, and gravitational deflection of the 4π pole from its neutral axis (deflection correction incorporates both a theoretical model, and survey data). Comparison of the predicted source location with the vertex reconstructed using the KamLAND analysis software, allows for an investigation of the biases in the reconstruction procedure.

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