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Two Distinct Monte Carlo Simulations for a Photomultiplier's One-Photoelectron Response ALEJANDRO DE LA PUENTE, DR. JOERG REINHOLD TEAM — The research focused on the need to obtain an accurate model of a one-photo electron distribution response, which is caused by the dynodic avalanche within a photomultiplier tube (PMT). The Monte Carlo simulations will allow for future direct comparison with the experimental PMT's output and aid in the determination of intrinsic constants that governs the PMT's internal structure and electron gain. The PMT's simulated were model ADIT B29B02H. The simulations were implemented using two distinct Monte Carlos, written mainly in the C++ and C programming languages. The first Monte Carlo was described by an iterative process based solely on the assumption that each photoelectron released from any given dynode by electrons from the previous dynode were correctly described by a Poisson distribution [1]. The only problem found with this implementation was the long computer time needed to run the program. The second Monte Carlo was based on the an statistical theorem, The Central Limit Theorem (CLT), which states that given a random variable of any distribution that has a finite mean (expectation value) and variance; the sample mean of $n$observations will approach the mean of the distribution as n goes to infinity [2]. For both simulations, a one-photoelectron gain was fixed at 1.0x10^6. Both methods were simulated and a histogram was created and fitted with a Gaussian distribution. From the data and fits, it was concluded that both simulations did not exactly follow Gaussian statistics; reproduced with a high degree of precision the fixed one-photoelectron gain; and that the CLT method could be used over the Iterative Method.

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