

Abstract Submitted  
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**Using signals at the 2<sup>nd</sup>, 4<sup>th</sup> and combined PEM Harmonics in MSE Polarimeters**<sup>1</sup> S. SCOTT, PPPL, R. MUMGAARD, R. GRANETZ, PSFC/MIT — The use of signal intensities at various harmonic frequencies of paired photo-elastic modulators (PEMs) in polarimeters to measure the polarization angle of linearly polarized light is explored. The Alcator C-Mod Motional Stark Effect diagnostic has been calibrated at the fourth PEM harmonics to an accuracy of about  $0.05^\circ$ , which is within a factor  $\sim 2$  of the calibration accuracy at the traditionally used second harmonic, but requires additional calibration terms. A new mode of operation is derived analytically and verified experimentally; if the PEM retardance is chosen to maximize the combined signal strength at the 2nd and 4th harmonic, and if the polarization angle is deduced from the ratio of the summed signal amplitudes at the second and fourth harmonic, then the magnitude of the  $\cos(4\theta)$  correction term is smaller than operating at the customary PEM retardance and using the second harmonic. In addition, the system is less sensitive to small drifts in the PEM retardance. This new regime of operation provides a 40% improvement in photon statistics without compromising the polarimeter calibration or sensitivity to PEM retardance drift.

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