**Goals for the Mott Paper**

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I am writing to try to help clear up some possible confusion about the goals for the Mott paper. Ultimately, we measure an asymmetry Ao corresponding to elastic scattering at zero foil thickness. Associated with this asymmetry is a systematic and statistical uncertainty δAo. This uncertainty takes into account foil-thickness (or scattered intensity) extrapolation fitting error, systematic effects corresponding to scintillator count discrimination, beam intensity, beam position, etc. Along with counting statistics, all of these uncertainties combine to give us the “precision of the measurement of Ao”, δAo/Ao .

When Ao is divided by the theoretically-determined Sherman function, S, we get the electron polarization Pe. The value of S is determined for single elastic scattering from a gold atom. We have effectively met these conditions by our foil-thickness (or scattered intensity) extrapolation and scintillator energy cuts. There are three uncertainties in S, δSa, δSb,andδSc, due, respectively, to (a) the physics approximations used in its calculation, (b) computational numerical error, and (c), in implicit error due to the *experimental* uncertainty in the incident electron energy.

While we can always give a best estimate of Pe (on that day, for that photocathode!), there are two ways we can quote uncertainties in our specification of Pe in a paper. Thus we consider two possible scientific goals for puplication:

1) To specify Pe to a given *precision*. This involves a determination of δAo and δSc only. To write a paper that does this, we need to carefully determine the uncertainty in our beam energy, and should probably make a few exploratory runs between 4 and 6 MeV to see if there are any (unexpected) systematic effects that crop up as the energy is varied. Joe’s plan does this. Of course, if we believe the theorist’s estimates δSa and δSb , we can live dangerously and quote Pe to a given accuracy too!

2) To specify Pe to a given *accuracy*. This is a much more ambitious goal. It would require us to essentially repeat the production runs we have done at 5 MeV at (at least) 3 and 7 MeV as well. Then we repeat everything with carbon and copper targets! This gives us several independent ratios we can use to evaluate the theorist’s claims of accuracy. We thus develop an experimental estimate of δSa and δSb , and can quote it. While this is a desirable goal, it is not something I anticipate us being able to do in the next year or so.

Joe’s plan for October essentially takes care of goal 1. There is, however, a more compelling reason to run in October. If history at 120 keV is any guide, I expect that our biggest contributor to δAo will be extrapolation (either thickness or count rate – we have to check both) uncertainty. We have done this once, in January. We need to check to see how *reproducible* our fits are, not to mention other possible systematic effects. Careful work demands this.