Thickness

Mott Target Ladder Gold Foil Thickness Measurements

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JLab-TN-16-049

Table 1: Summary of gold foil thicknesses measurements for "siblings" of the Mott target foils measured with FESEM technique. Random and systematic sources of uncertainty in these measurements are shown in rows 3-8, and final uncertainty in the thickness measurements is shown in line 9.

	Au_5385_B Ladder pos.15	Au_3057_C Ladder pos.3	Au_5134_B Ladder pos.4	Au_7028_B Ladder pos.2	Au_5275_C Ladder pos.5	Au_5613_D Ladder 8&14	Au_7029_B Ladder pos.1	Au_6809_B Ladder pos.13
Nominal Thickness (nm)	*1000*	*870*	*750*	*625*	*500*	*355*	*225*	*50*
Thickness (all data, nm)	**943.7**	**836.8**	**774.6**	**561.2**	**482.0**	**389.4**	**215.2**	**52.0**
random: nominally identical	29.0	7.1	9.1	8.0	9.7	4.5	1.9	2.3
Systematic								
• FESEM resolution	1.2	1.2	1.2	1.2	1.2	1.2	1.20	1.2
• same image reanalysis	22.6	12.4	13.3	10.2	9.7	9.2	3.80	2.9
• Lebow sibling 5%	47.2	41.8	38.7	28.1	24.1	19.5	10.80	2.6
Systematic total	52.4	43.6	40.9	29.9	26.0	21.6	11.51	4.1
dT (nm)	**59.8**	**44.2**	**41.9**	**31.0**	**27.7**	**22.1**	**11.7**	**4.7**

Good Events

1. For each detector (L/R/U/D) in an individual run…

2. Determine the mean μ_t and sigma σ_t of a Gaussian fit to the timing region around the events from the coil.

3. Apply timing cuts at $\mu_t \pm 2\sigma_t$.

4. For remaining events determine the mean μ_E and sigma σ_E of a Gaussian fit to energy channels [8000:9000].

5. Apply energy cut from $\mu_E - 0.5\sigma_E$ to $\mu_E + 2\sigma_E$.

6. Sum remaining events.

Asymmetries

1. For each run form respective (L/R) and (U/D) super-ratio:

    a. Physics asymmetry
    b. Detector asymmetry
    c. Beam asymmetry

2. We statistically average the asymmetries for a set of runs for a given foil.

3. Note that a different pair of detectors were used for each run:

    a. Run I polarization was horizontal so we use the U/D physics asymmetry
    b. Run II polarization was vertical so we use the L/R physics asymmetry

Rates

1. For each run we first compute an un-normalized rate (Hz) and then correct for:

    a. Electronics dead time, typically 0.1%
    b. DAQ dead time, typically 5-20%

2. For each run we average the un-normalized L/R/U/D and normalize to BCM calibrated average current to form normalized average rate detector rate (Hz/uA).

3. For each run we use the average of the (Run I/II) 1um Au foil runs to correct the corresponding rates of the extrapolation foil measurements:

    a. Run I – correction was 1.0 (no correction)
    b. Run II – correction of 1.0372 +/- 0.0008 applied to foil#15 (1um), foil#2(0.625um) and two of six runs for foil#13(0.050um)

4. We statistically combine the the normalized (Hz/uA) L/R/U/D average corrected rate for a set of runs for a given foil.

5. For each foil we combine three uncertainties to the final rate:
    1. Statistical – per recipe above
    2. Systematic – average of BCM uncertainties (dI/I) of runs per foil, typically 1%
    3. Systematic – drift uncertainty of 1.32% (Run I) and 1.47% (Run II)

Rate Corrections and Drift Uncertainties