

Plan for a Multi-Foil Solid Target
Hall D SRC/CT Experiment
E12-19-003

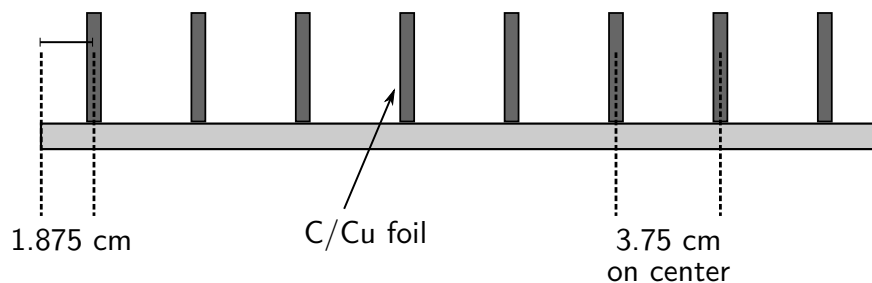
We propose to use a multi-foil target ladder for our solid target running, in order to reduce the magnitude of acceptance corrections when taking ratios between solid and liquid targets. We plan to use two 8-foil ladders, with the foils distributed over the 30 cm distance occupied by the liquid target cell. We will have separate carbon and copper ladders.

The thickness of the original carbon target (1.9 cm) was set by the expected electromagnetic backgrounds. With this in mind, we have chosen a total copper thickness to maintain the total electron density. The relevant parameters are in the table below.

Material	e ⁻ Density [cm ⁻³]	Density [g/cm ³]	Total Thickness [cm]	Per foil [cm]
Carbon	6.65 E23	2.21	1.90	0.238
Copper	2.46 E24	8.96	0.514	0.064

The original target's electron density budget is 1.9 cm x 6.65 E23 e⁻/cm³ = 1.26 E24 e⁻/cm². The equivalent thickness for copper is 1.26 E24 e⁻/cm² / 2.46 E24 cm⁻³ = 0.514 cm.

We intend to divide these total thicknesses over 8 foils spaced by 3.75 cm on center. An illustration of the intended multi-foil target is shown below.



To estimate the new count rates, we have scaled our estimates from the proposal according to:

$$R_{Cu} = R_C \cdot \frac{\rho_{Cu}}{\rho_C} \cdot \frac{x_{Cu}}{x_C} \cdot \frac{T_{Cu}}{T_C}$$

where R is the count rate, ρ is the density (in g/cm³), x is the target thickness, and T is the nuclear transparency. We assume $T_{Cu} = 0.26$ and $T_C = 0.44$. In this experiment, there is an important distinction between “Short-Range Correlations” (SRC) kinematics and “Mean-Field” (MF) kinematics. The table below lists anticipated count rates for the $n(\gamma, \pi^- p)$ reaction, which is one of the lowest cross sections among the reactions of interest.

Kinematics	R_C [events/day]	R_{Cu} [events/day]
MF	740	480
SRC	230	150