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Scattering in Thin Foils Associated with Passive Proton and Ion Beam Focusing[1] ALBERT YUEN, University of California at Berkeley, STEVEN LUND, JOHN BARNARD, RONALD COHEN, Lawrence Livermore National Laboratory — Recent theory and simulations on passive focusing of intense proton and ion beams propagating through a stack of thin foils demonstrate the validity of the concept under several idealizations [1]. The beam was assumed to penetrate many (hundreds) of metallic foils with negligible beam attenuation or scattering. The foils must also be thick enough for mechanical strength and electron stopping for the scheme to work. Experiments with protons may use Al foils with ∼1 micron thickness. Here, we analyze the impact of finite scattering on the focusing concept. Analytical formulas characterizing the scattering effect are derived. The TRIM code [2], is applied for the case of protons in Al to extract a scaled fit to the analytical formula for the rms scattering angle of particles in the foil that scales as sqrt(t)/E where t is the foil thickness and E is the beam energy. The scattering strength is incorporated in a moment model to calculate the beam emittance growth through a single foil. Results are analyzed to estimate focusing limits due to foil scattering by incorporating the effect in an envelope model in Refs. [1] to characterize deviations of results with and without scattering.

[1] Lund, Cohen and Ni, PRSTAB, in press (2012).
[2] Ziegler and Biersack, NIMB 268, 1818 (2010).

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