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Filtration of Rod-like Granular Materials and the Buffon-Laplace Needle Problem[1] SCOTT FRANKLIN, ZACK DELL, MADDIE PELZ, Rochester Institute of Technology — We investigate the efficacy of filtering rod-like granular materials from solution by a square-grid mesh. Because rods of large aspect ratio are much longer than they are wide, the probability of getting caught by a sieve depend sensitively on the particle orientation. We have measured the probability for a needle to be filtered as a function of mesh size, particle length, and aspect ratio. Results are compared with a theoretical calculation based on the Buffon-Laplace Needle problem. In 1770, Buffon solved for the probability that a needle dropped on a surface covered by parallel lines will intersect a line., Laplace correctly generalized this to a grid in 1812, hence the name "Buffon-Laplace Needle Problem" (BLNP). We have extended the BLNP to account for sphero-cylinders of finite width, and thus well-defined aspect ratio and to include an isotropic angular distribution in the zenith angle ϕ. The solution is the probability that a sphero-cylinder in three dimensions will make contact with a 2D sieve-like mesh, which we then compare with our experimental data.

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