Supporting Text

Estimation of the Bending Energy Penalty. We estimate the bending energy of a single actin filament as $\delta E = \dfrac{1}{2}\dfrac{L\kappa}{r^2} = \dfrac{1}{2}\dfrac{Ll_p k_B T}{r^2}$, where κ is a bending constant, r the radius of curvature, L is the actin filament length, and l_p is the actin filament persistence length, l_p ~ 17 pm. From the length of the filaments (we estimate L ~1 μm measured from the network periphery to the onset of a bundle, see ref. 1) and their curvature (~1 μm^{-1} or less, see ref. 1), we estimate a bending energy penalty of $\delta E \approx 8 k_B T$.

1. Svitkina, T. M., Bulanova, E. A., Chaga, O. Y., Vignjevic, D. M., Kojima, S., Vasiliev, J. M. & Borisy, G. G. (2003) *J. Cell Biol.* **160,** 409-421.