Quinn, Hong, and Luding Reply: Canul-Chay *et al.* [1] have conducted the segregation experiment of binary granular mixtures in a bed and subjected the bed to vibration. They report that the reverse Brazil nut problem was never observed in their experiments, and thus conclude that such an effect does not exist. However, we have clearly demonstrated in [2] via molecular dynamics simulations that the reverse Brazil nut problem exists, as well as determined the phase boundary with a scaling theory for the crossover from the Brazil nut to the reverse Brazil nut problem. Instead of disputing Canul-Chay *et al.*'s experimental results [1], in this Reply we want to draw the reader's attention to the (1) experimental setup and (2) an interpretation of the experimental results.

(i) The system considered in [1] is definitely not the same as ours, because the vibrating bed exhibits a temperature gradient along the vertical axis. In our system, the mixture is in contact with a thermal reservoir at a global temperature of T (the system is then held at the value of this global temperature). Each particle was kicked by random noise such that the average kinetic energy $m\langle v^2 \rangle/2 = T$.

(ii) In order to observe the reverse Brazil nut problem, it is essential that the bed be subjected to a global temperature. There may be a way to define a global thermodynamic temperature for the weakly excited case [3–6]. One can determine the effective thermodynamic temperature in a vibrating bed as follows. The density profile of a weakly excited monodisperse granular system [3] can be fit either with the Fermi function [3,4] or with the Enskog profile plus a rectangle used to include the solid-like region of the system [5,6]. (See Fig. 4 in Ref. [6] for an illustration of this). One has to convert the global Fermi temperature of the vibrating bed to the effective thermodynamic temperature of the system. This was done in Ref. [6] by fitting the density profiles with both the Fermi and Enskog profiles. Then we were able to relate the global thermodynamic temperature obtained with the Enskog profile directly to the configurational temperature obtained with the Fermi profile. By doing this, we were able to relate the effective thermodynamic temperature of the vibrating wall system directly to the vibrational control parameter Γ. This procedure can be used to find the condensation temperature of two different species of particles and relate it to a vibrational strength Γ. Hence, the condensation temperatures, say $T(A)$ and $T(B)$ for two species A and B, are determined.

(iii) Once the condensation temperatures $T(A)$ and $T(B)$ for the two species and the global thermal temperature of the bed are determined, we can quench the system to a temperature T that is between $T(A)$ and $T(B)$. In this case, the system might exhibit the crossover from the Brazil nut to the reverse Brazil nut problem as predicted in [2]. If one still does not observe the reverse Brazil nut problem, then one can only conclude that the vibrating bed may be different from our molecular dynamics setup, where the bed is subjected to a global temperature. One will then have to think through how to achieve the reverse Brazil nut problem for the vibrating bed.

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[1] G. A. Canul-Chay *et al.*, preceding Comment, Phys. Rev. Lett. **89**, 189601 (2002).
[2] D. C. Hong, P. V. Quinn, and S. Luding, Phys. Rev. Lett. **86**, 3423 (2001).
[3] H. Hayakawa and D. C. Hong, Phys. Rev. Lett. **78**, 2764 (1997).
[4] E. Clement and J. Rajchenbach, Europhys. Lett. **16**, 1333 (1991).
[5] D. C. Hong, Physica (Amsterdam) **271A**, 192 (1999); S. Luding, Phys. Rev. E **63**, 042201 (2001).
[6] P. V. Quinn and D. C. Hong, Phys. Rev. E **62**, 8295 (2000).