Soil granular dynamics on-a-chip: fluidization inception under scrutiny - Supplementary Material

M. Houssais*
Levich Institute, City College of CUNY, 140th Street and Convent Avenue, New York, NY 10031, USA.

C. Maldarelli and J. Morris
Levich Institute and Chemical Engineering Department, City College of CUNY, 140th Street and Convent Avenue, New York, NY 10031, USA.

Supplementary material.

I. DETAILS ON APPARATUS FABRICATION

Figure 1a is a photo presenting the whole apparatus.

Tubing of the channel had to be made under two extra specific constrains: 1) the channel is set vertically and under a significant hydrostatic pressure for a long time (hours to day) while performing experiments and 2) frictional particles had to be introduced in – and remove from – the channel. To prevent any development of leaks at the channel bottom tube hole, it is punched with a significant angle with the vertical, then, the tube external surface is glued to the channel while introduced, and the tube-channel junction is then covered with extra PDMS (see figure 1b).

II. VOIDS SPATIAL DISTRIBUTION

Figure 2 presents a typical example of spatial repartition of voids size measurements, normalized by the average particle section $\pi(d/2)^2$. One can notice that the two major peaks at about 0.12 and about 0.35 are present everywhere spatially. One can also notice that voids sizes present a visible growth near the lateral sides of the pictures (for $20 < x/d < 40$ and $140 < x/d < 40 < 160$. This is systematic and due to the images focus point diverging from the particle centers on the sides, and the light source angle. For this reason, all data averaging were made for $40 < x/d < 140$.

* housais.morgane@gmail.com.

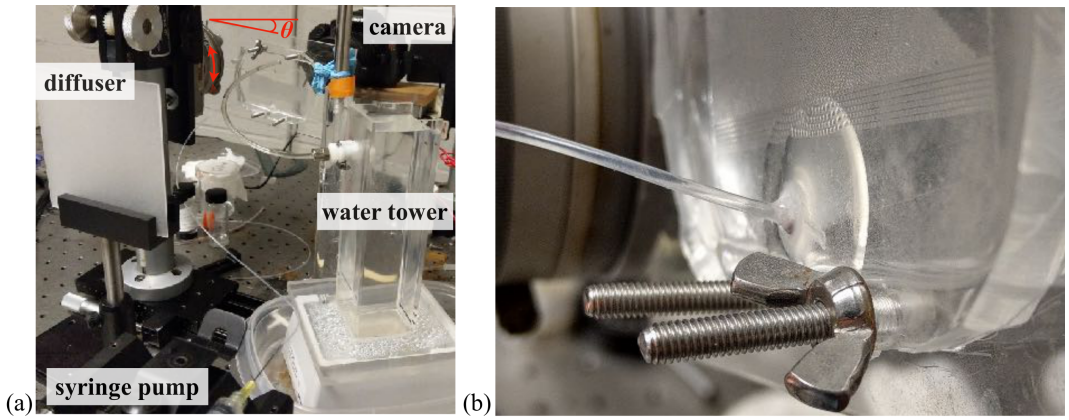

FIG. 1. (a) Photo of the full setup (light source excluded), with an apparent positive channel angle θ. (b) Close up photo of the inlet at the bottom of the experiment, where the tubbing was set with an downward angle and was covered of extra PDMS to prevent any leakage.

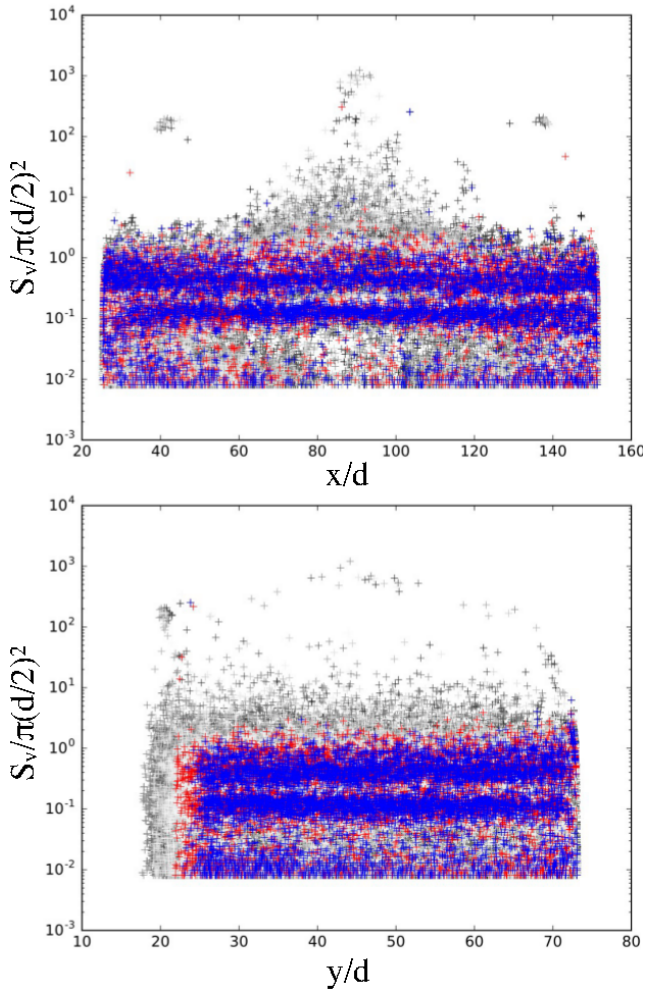

FIG. 2. Typical example of spatial repartition of the voids size measurements, as a function of the horizontal coordinate x (top), and as a function of depth y (bottom), for the condition of $Q_f = 305\mu$L/min. Blue crosses represent the measurement at $t = t_0$, and red crosses at $t = t_{end}$. Gray crosses represent intermediate stages, with lighter gray levels representing later stages in time.