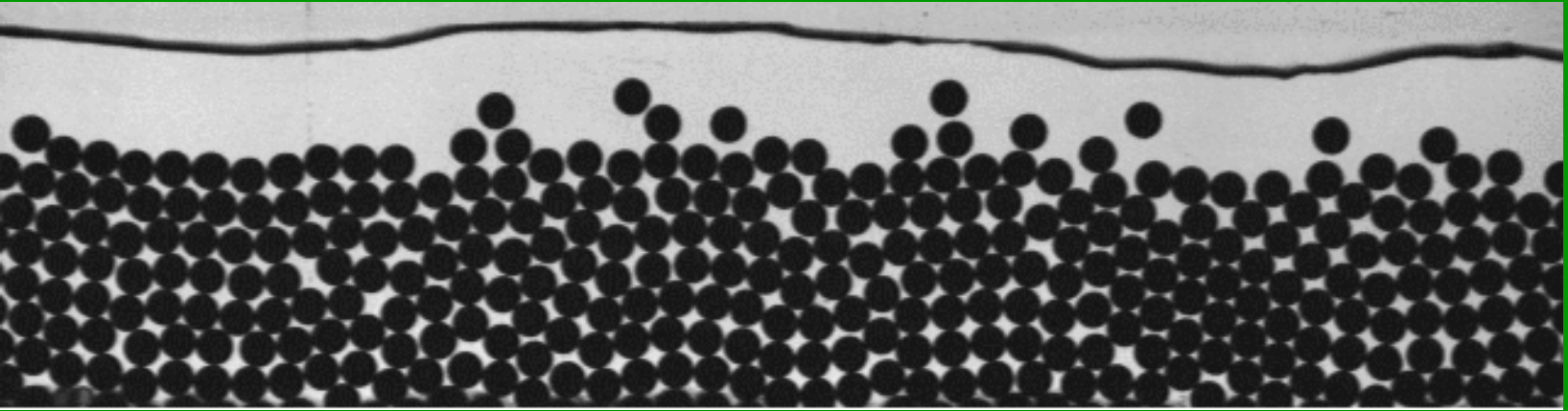


# Structure verticale en transport par charriage

P. Frey

*Cemagref, Grenoble*

# Typical experiment

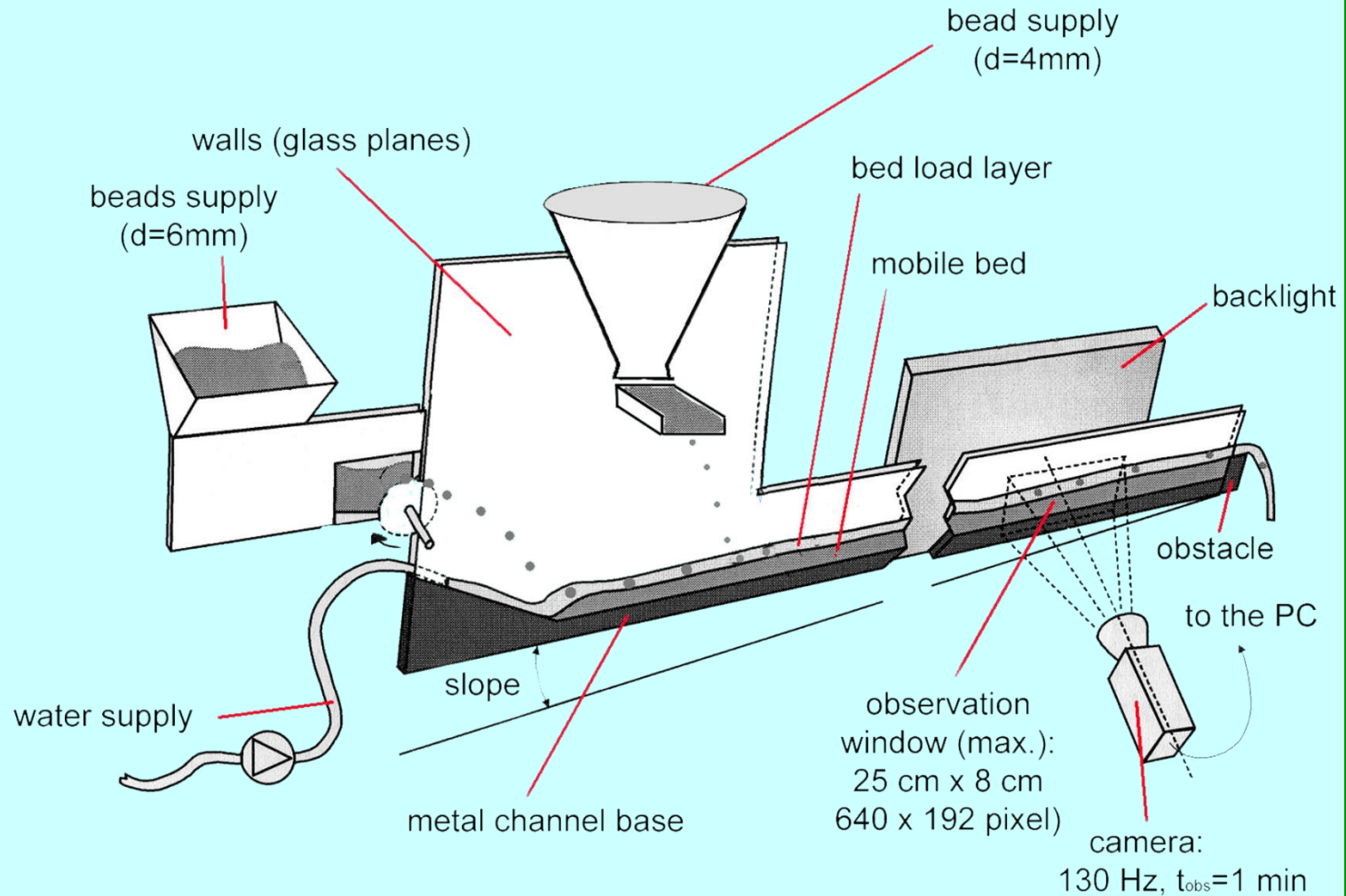


Slope : 10 %,  $D=6$  mm, 20 beads/s

# 2D flume

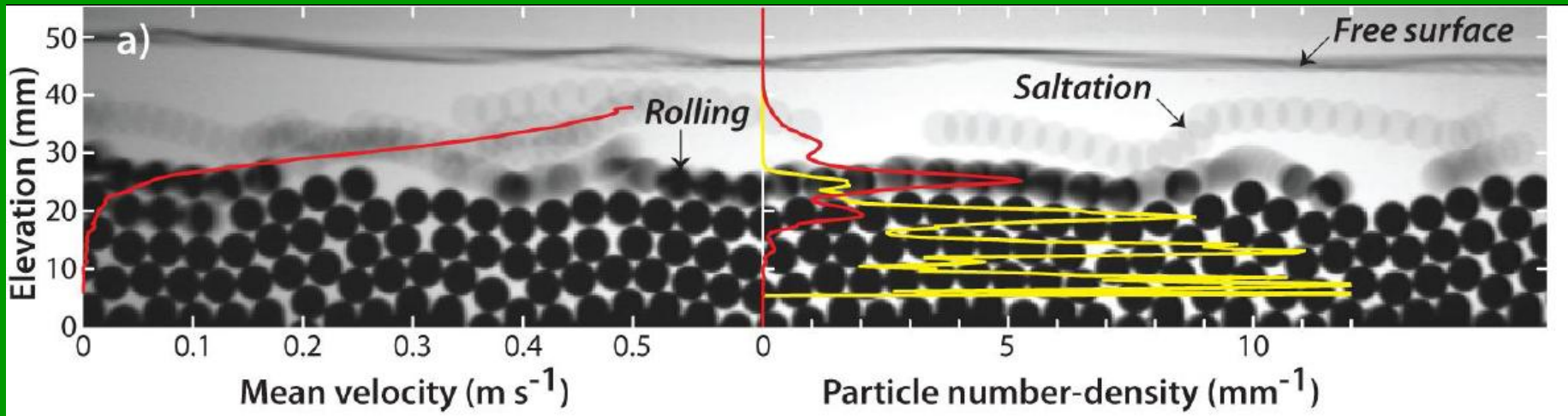


# 2D Flume



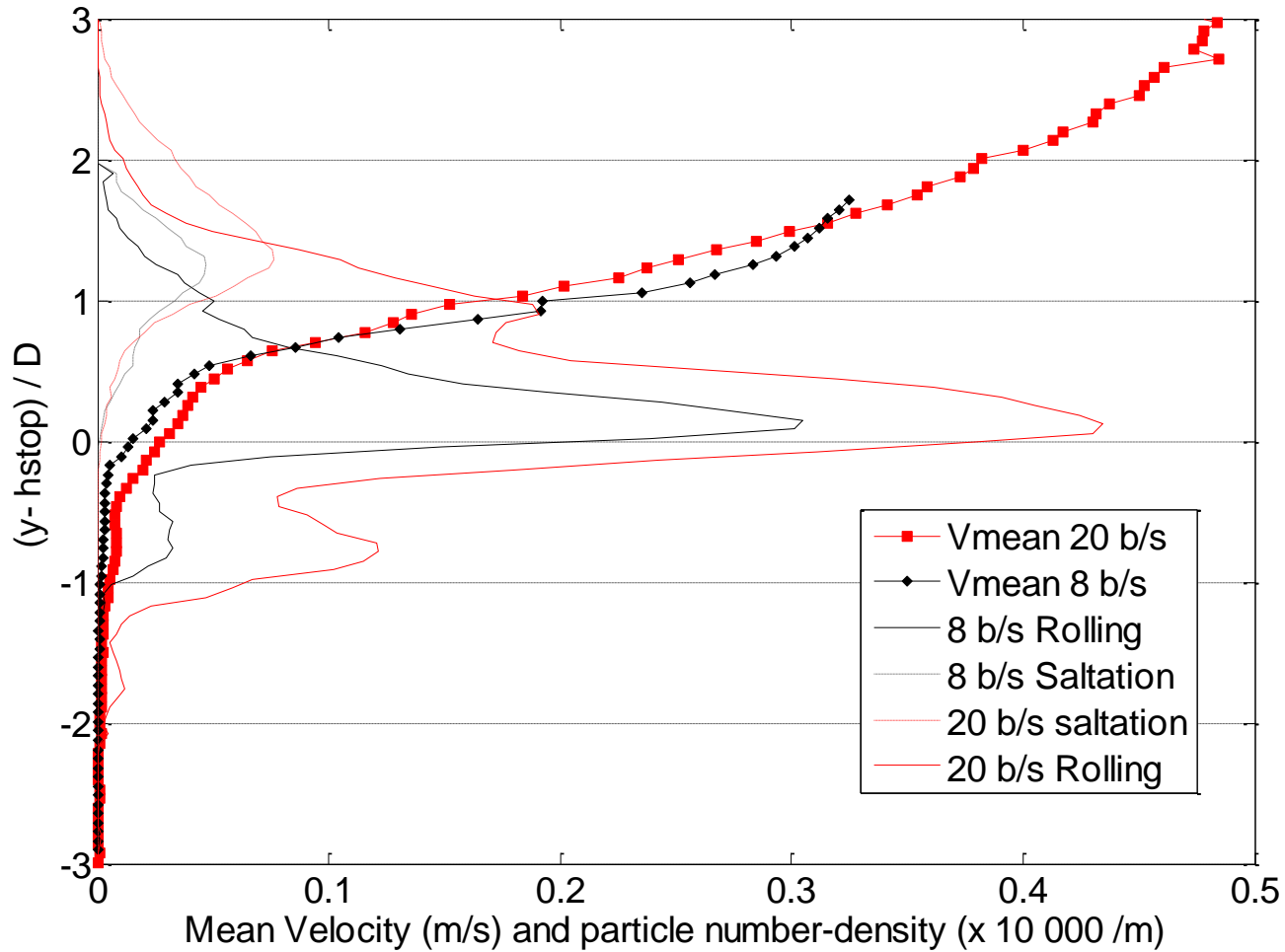
turbulent and supercritical water flow , 2D live-bed bed load transport  
The idea : simplest representation of bed load on steep slopes  
to gain access to variables of each bead

# Vertical profiles

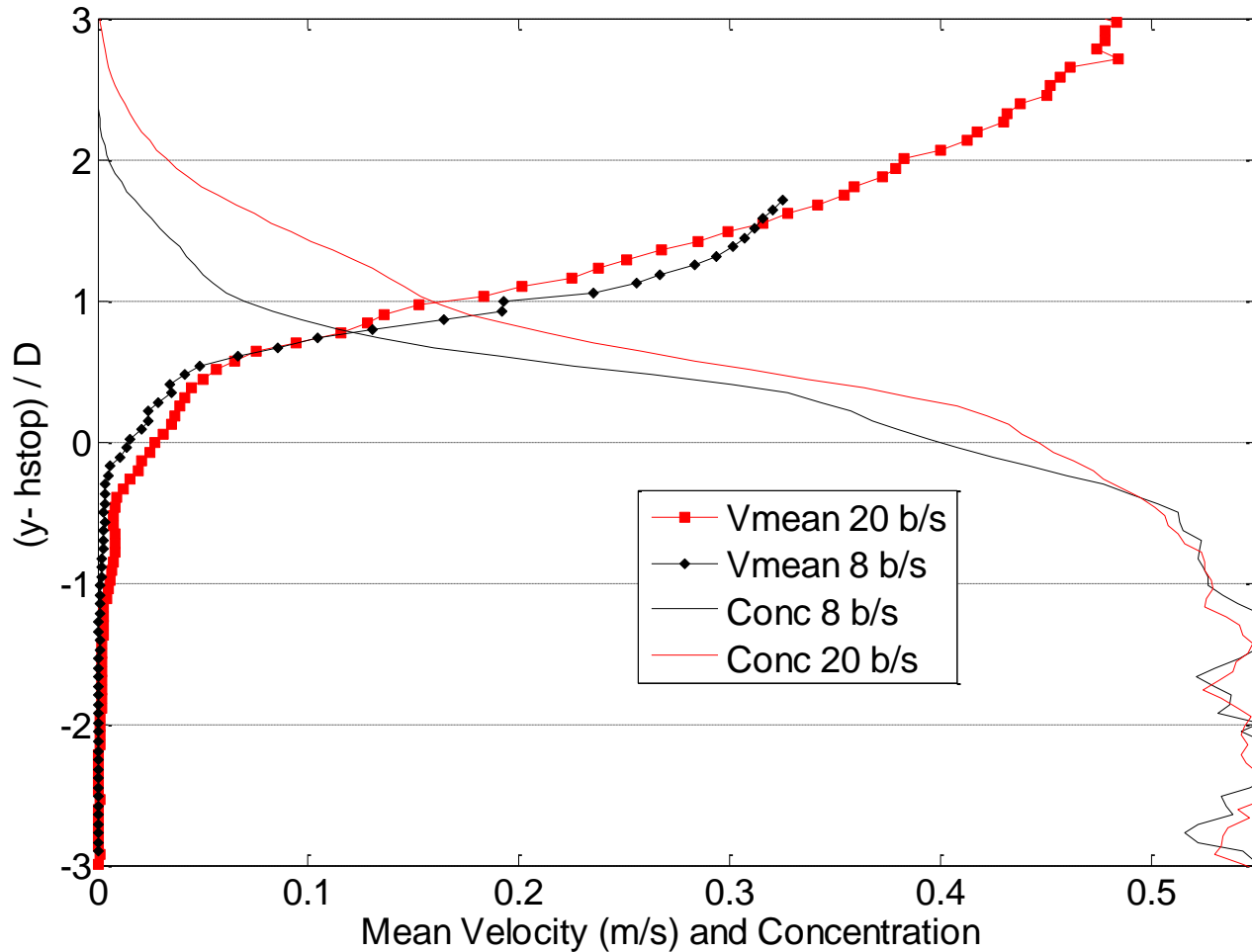


Experiments by Böhm, 2006

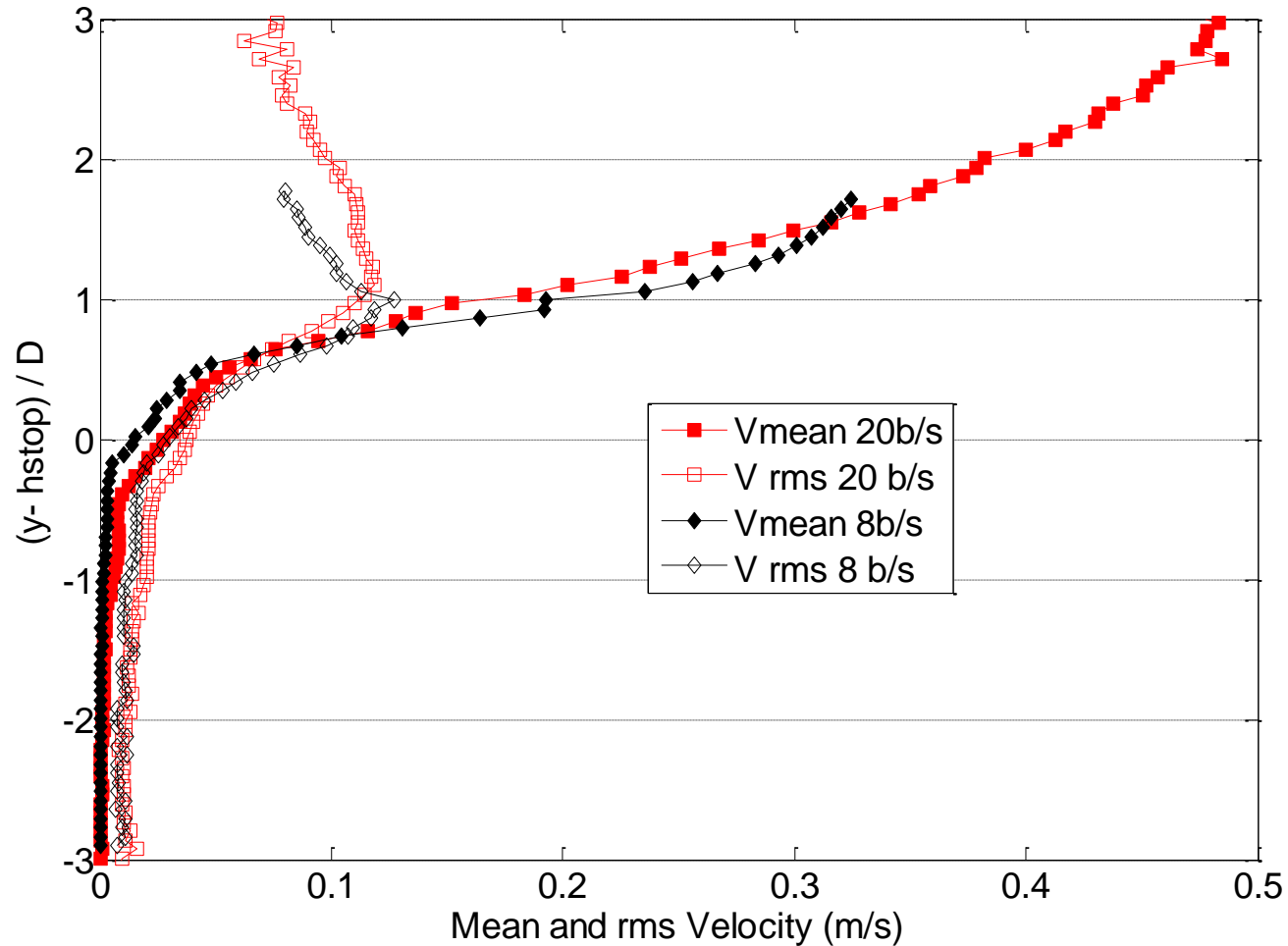
# Rolling and saltating



# Velocity and concentration

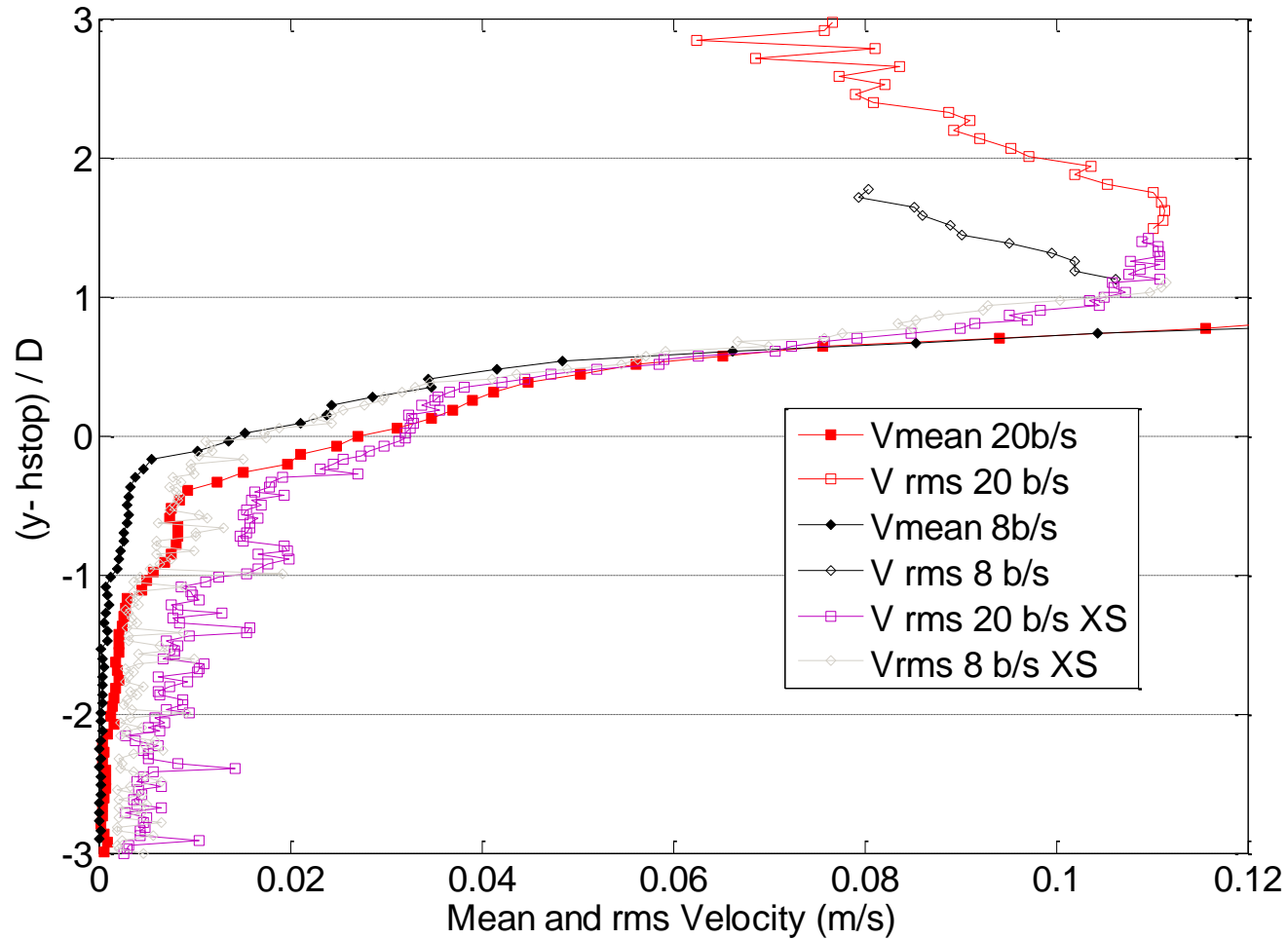


# Mean and rms velocity





# Mean and rms velocity (detail)



# Questionnement

- Similitudes et différences avec granulaire « sec » ?
- Vers une « rhéologie » du charriage ?
- Ségrégation/ tri granulométrique
- De la bille au terrain ?

# Dry velocity profiles

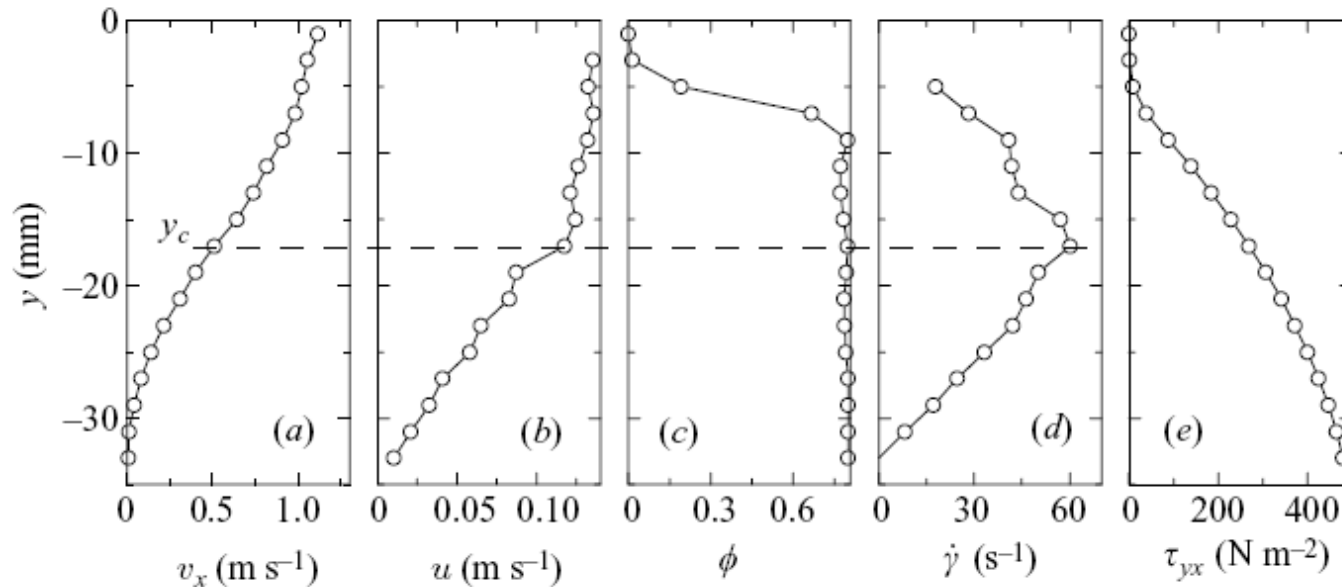
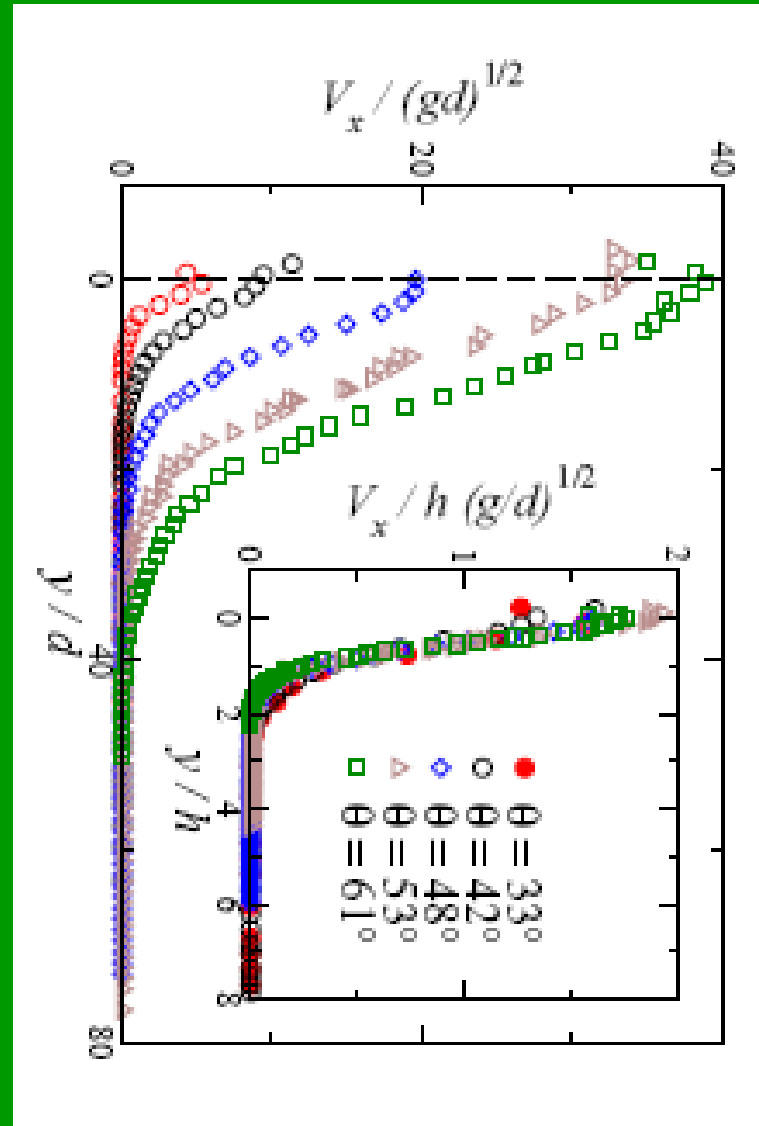


FIGURE 21. Profiles of the mean velocity  $v_x$ , the r.m.s. velocity  $u$ , the area fraction ( $\phi$ ), the shear rate  $\dot{\gamma}$  and the shear stress  $\tau_{yx}$  in the flowing layer for 2 mm SS balls rotated at 6 r.p.m. The dashed line denotes the transition depth  $y_c$ .

Similaire (mais vitesse rms/mean plus faible)

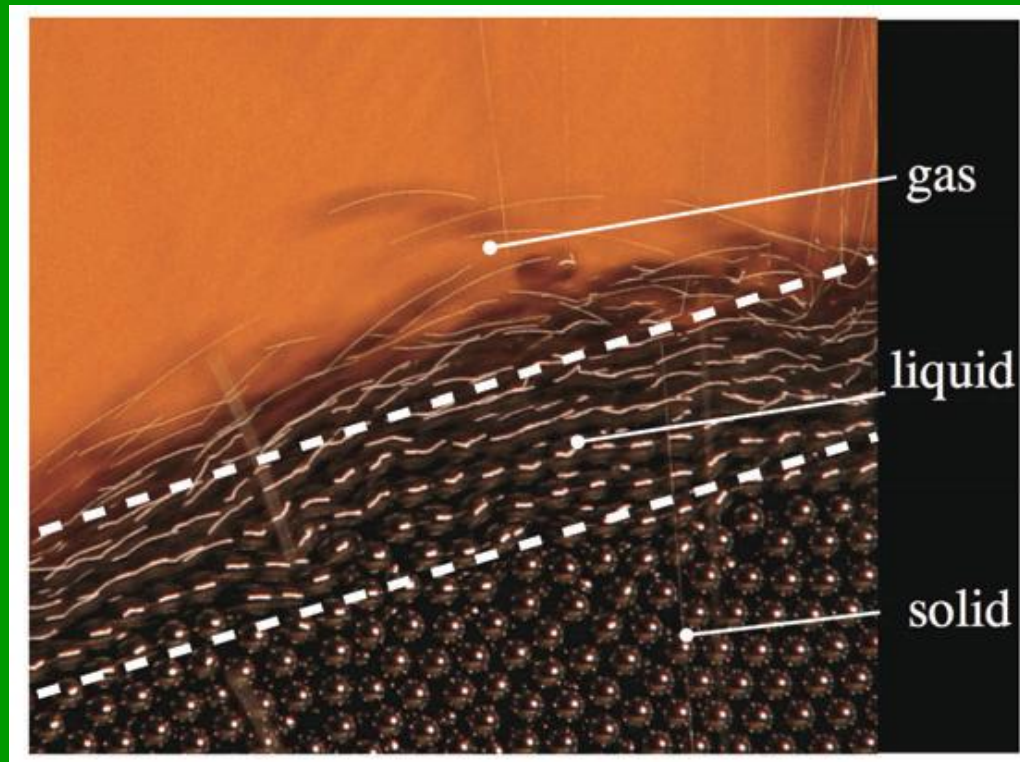
Orpe and Khakhar, JFM 2007

# Dry velocity profiles



Metayer et al. P&G 2009

# Dry granular flow : Solid, liquid, gas ?

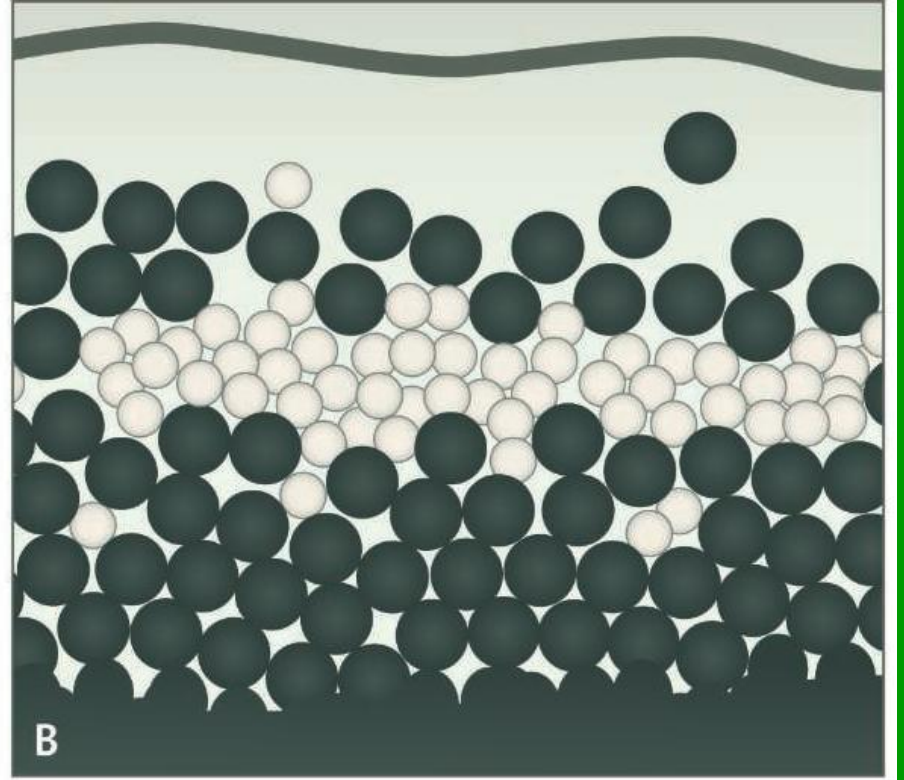


*In (Forterre and Pouliquen ARFM 2008)*

# Ségrégation



Vedder River, BC, Canada



Garage lab

Merci de votre attention