The project entitled " Time lapse study and numerical modeling of granular symmetric and asymmetric flows in silos using X-ray tomography" aimed at comparing experimental and numerical results from Discrete Element Method (DEM) of local porosity and velocity fields during gravitational flow of granular material of different morphologies in silos during concentric and eccentric discharging. To the researchers' point of view, this important topic still needs knowledge to be acquired, especially in the 3-dimensional case. Recent works from the researchers have shown that time lapse X-ray tomography experiments of silo discharging provide valuable 2D and 3D information, thanks to the contrast generated by concentration changes. However, accurate knowledge of the initial packing of the granular material prior to discharging is essential to understand local concentration changes, but also how particle will move during gravitational flow. This also applied for modeling since the comparison with experimental data assumes that initial conditions are accurately transposed into the model.

To characterize the granular movement during silo discharging, the chosen granular materials, i.e. glass spheres and glass grits, will be mixed with tracer particles of similar morphological/mechanical properties but with larger density, so as to ambiguously distinguished and segment them after X-ray tomography scanning. The 3D images that will be acquired for different flow scenarios combining flow type (funnel/mass), discharge mode (concentric/eccentric), wall roughness (smooth/very rough), initial granular packing (loose/dense) and particle type (spheroid/angular shape) will be further processed and analyzed. This will enable the characterization of the evolution of porosity field of the granular material as well as translational/rotational motion of tracer particles over discharging time. Moreover, the initial packing arrangement of granular solids will be extracted from tomography images and inserted in the DEM computational domain, so as to have a model as close as possible to real experimental conditions.

This work has been motivated by a statement formulated by Brown and Nielsen in 1998, who wondered "Can we improve experimental techniques to give more reliable and complete observations, especially concerning the interior of the bulk of granular solid?" It is our believe that the use of X-ray tomography can significantly fill this gap and allow, in the case of confined flow process, to accurately measure experimentally bulk characteristics and see the comparison with numerical simulation from another perspective.