

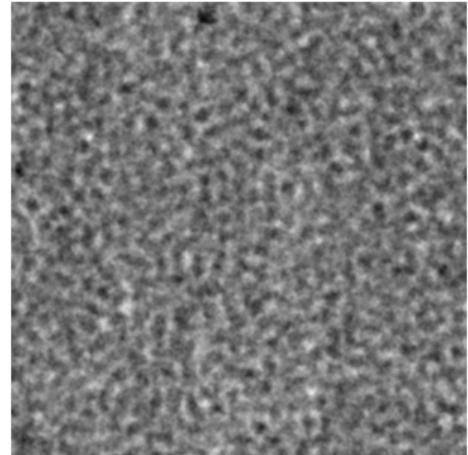
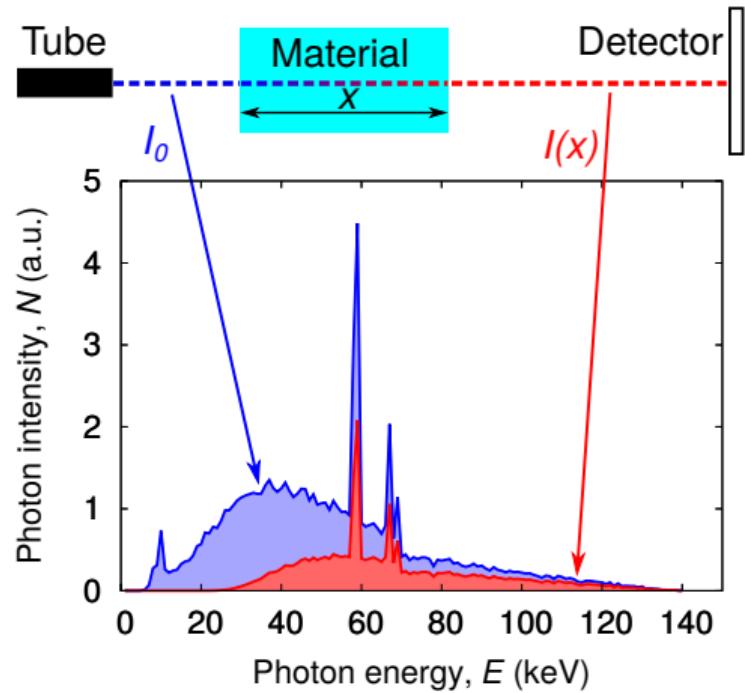


PhD defense  
**Manuel Baur**

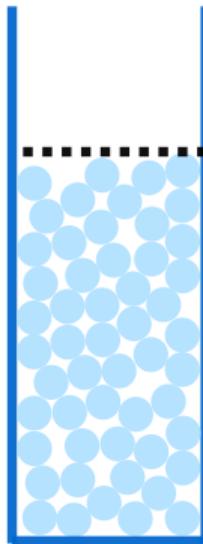
Funded by the German  
Federal Ministry for  
Economic Affairs and  
Energy, grant no. 50WM

1653

# X-ray radiography of granular systems – particle densities and dynamics

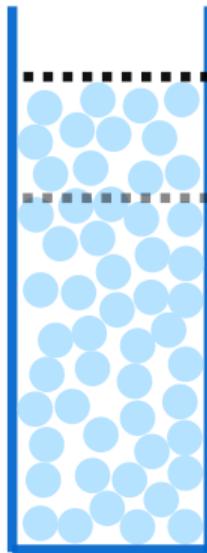


# X-ray radiography of granular systems – particle densities and dynamics



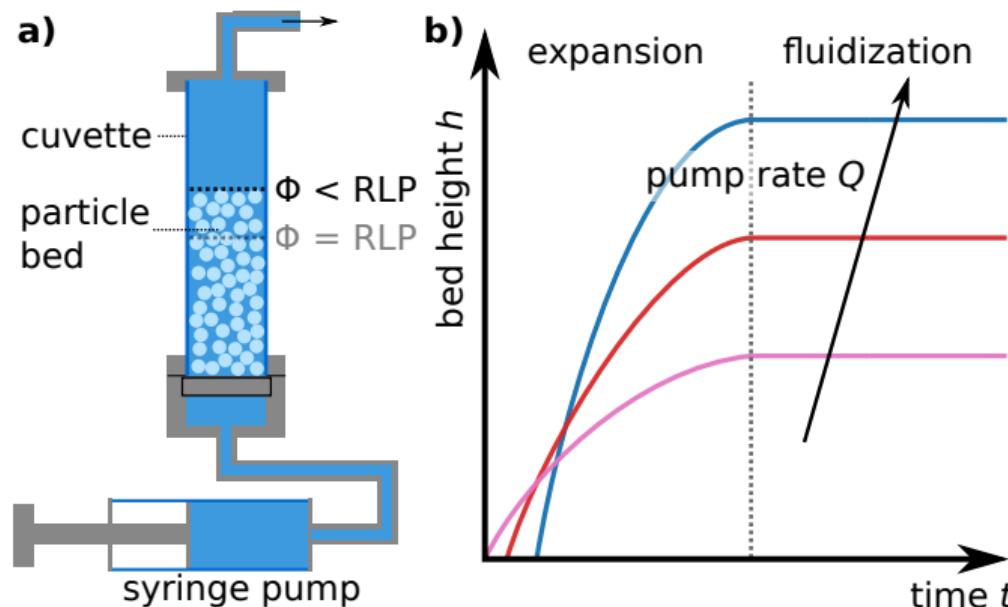
$$\Phi = \text{RLP}$$

# X-ray radiography of granular systems – particle densities and dynamics



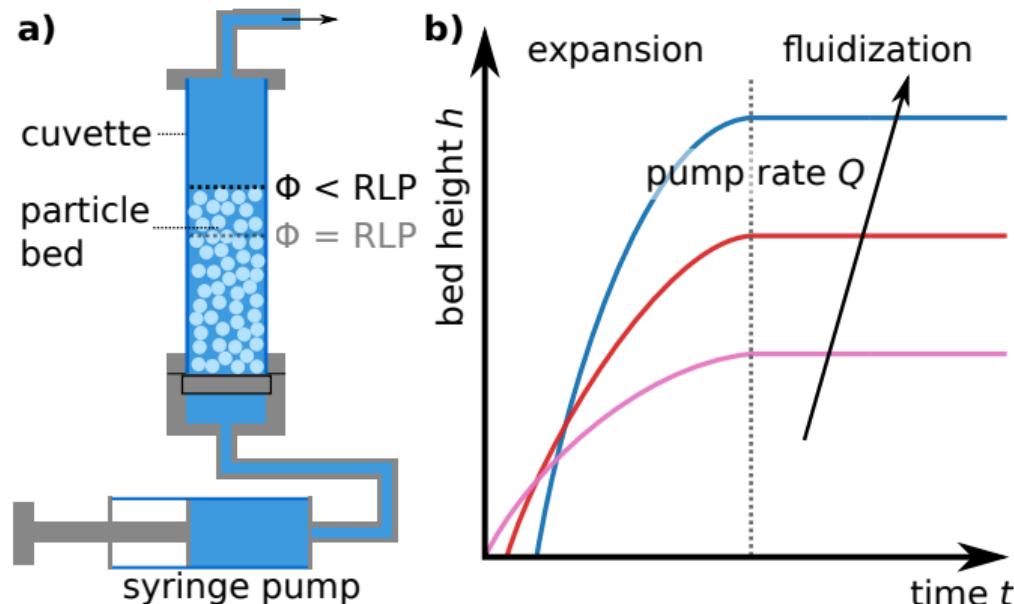
# X-ray radiography of granular systems – particle densities and dynamics

Fluidized bed



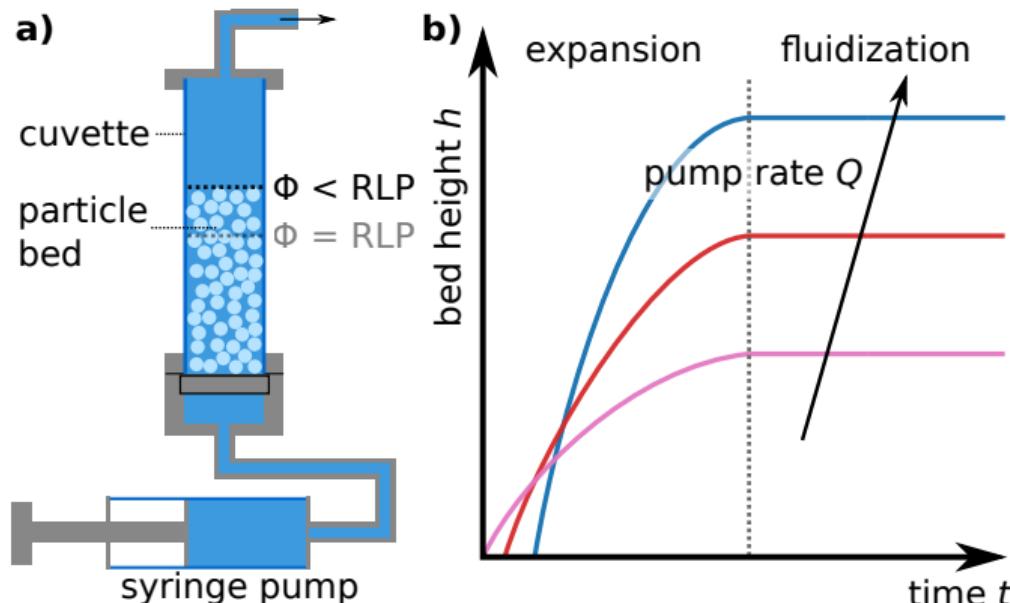
# X-ray radiography of granular systems – particle densities and dynamics

Fluidized bed



# X-ray radiography of granular systems – particle densities and dynamics

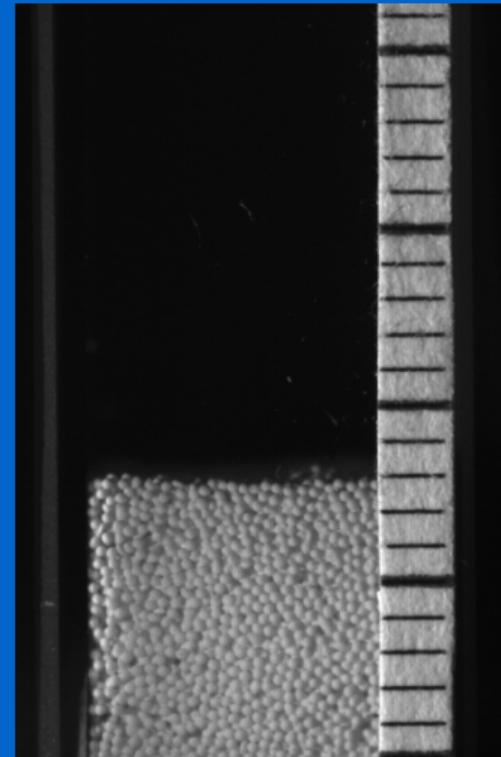
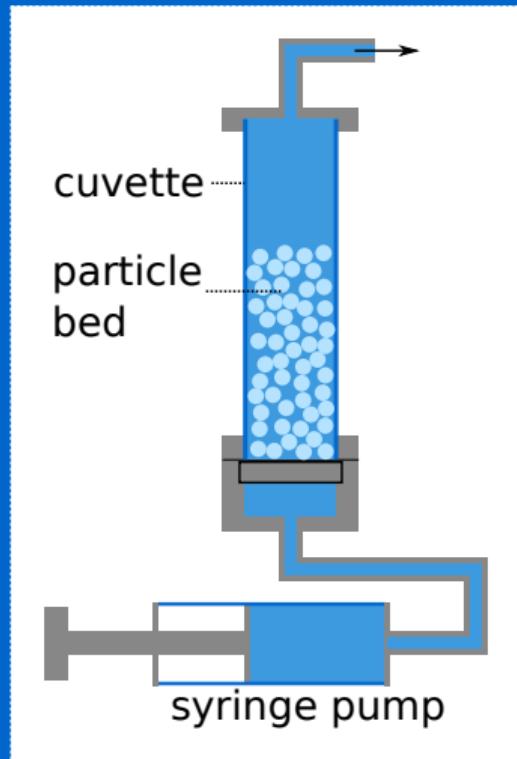
Fluidized bed



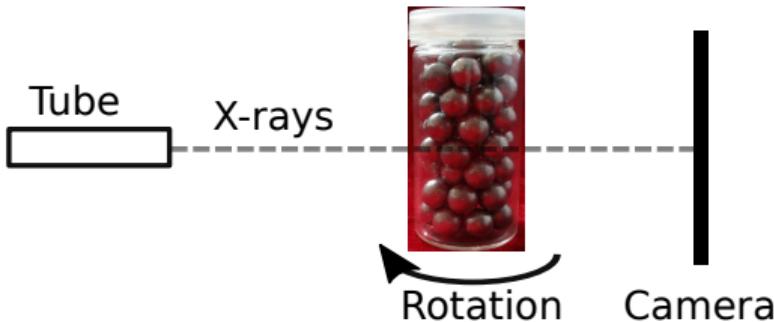
Fluidized bed reactor

**"Lack of understanding:**  
It is very difficult to predict and calculate the **complex mass** [...] **flows** within the bed."

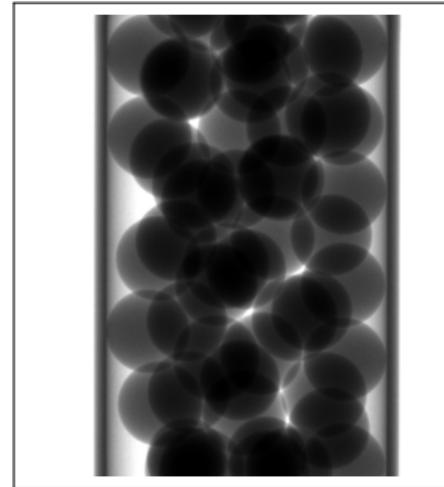
# Particulate flows are **opaque**



# X-ray radiography

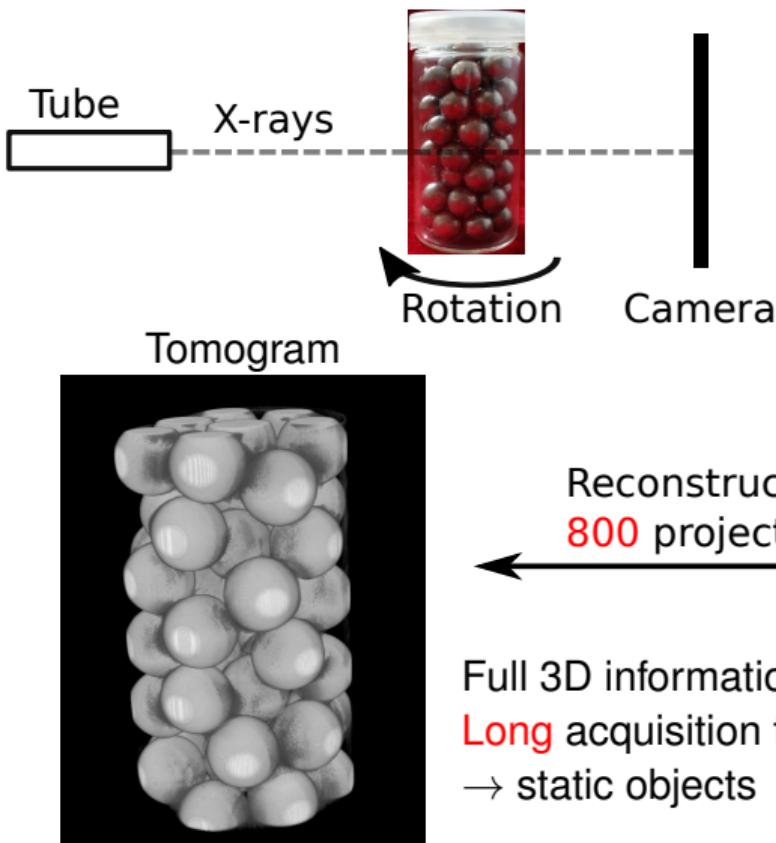


Radiogram



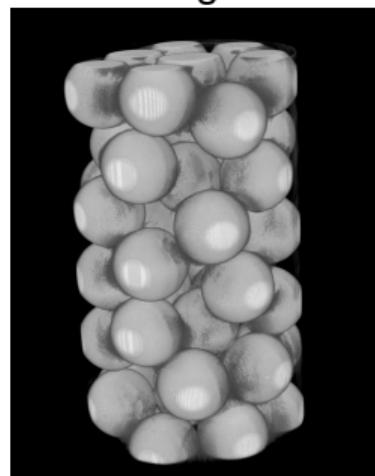
2D projections of 3D object  
Short acquisition time

# X-ray radiography



Radiogram

2D projections of 3D object  
Short acquisition time

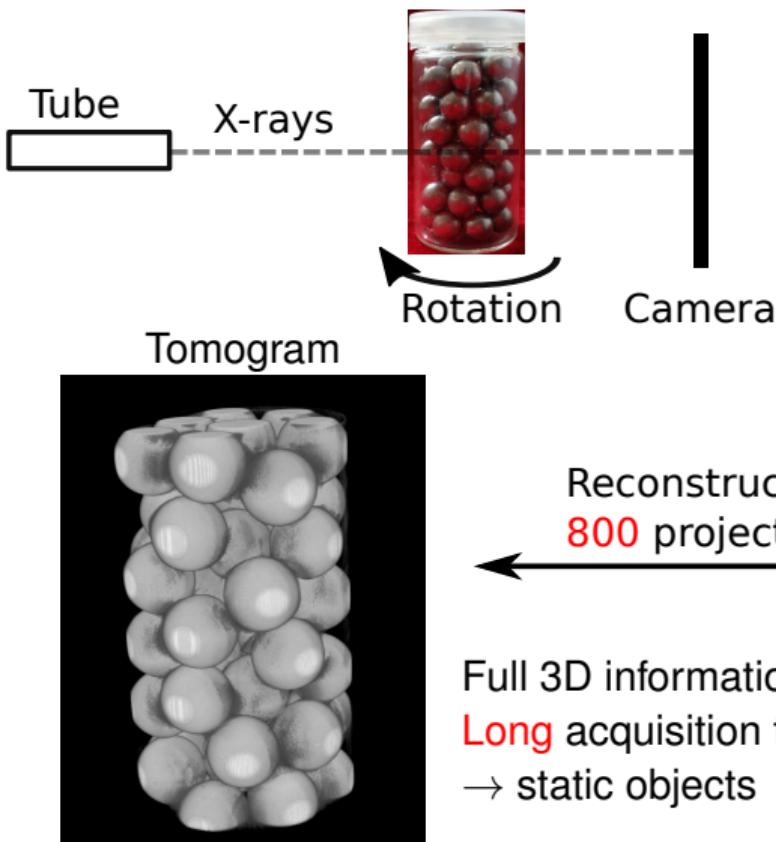


Tomogram

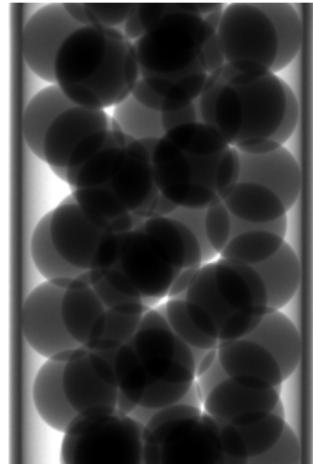
Reconstruction from  
800 projections

Full 3D information  
Long acquisition time  
→ static objects

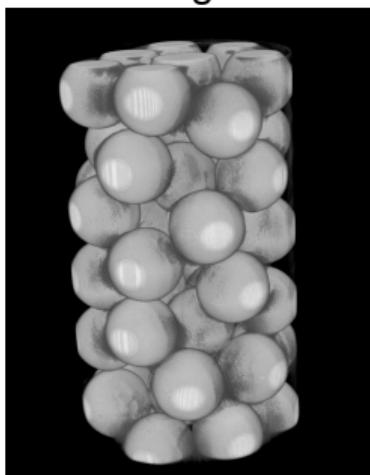
# X-ray radiography



Radiogram



2D projections of 3D object  
Short acquisition time



Tomogram

Full 3D information  
Long acquisition time  
→ static objects

Dynamic system

