



Applications of PFC^{3D} on longwall top coal caving (LTCC)

Dr. Zhengyang Song

(Zhengyang.Song@student.tu-freiberg.de)

Prof. Dr. Heinz Konietzky

Dr. Martin Herbst

Geotechnical Institute, TU Bergakademie Freiberg, Germany

2020.02.18

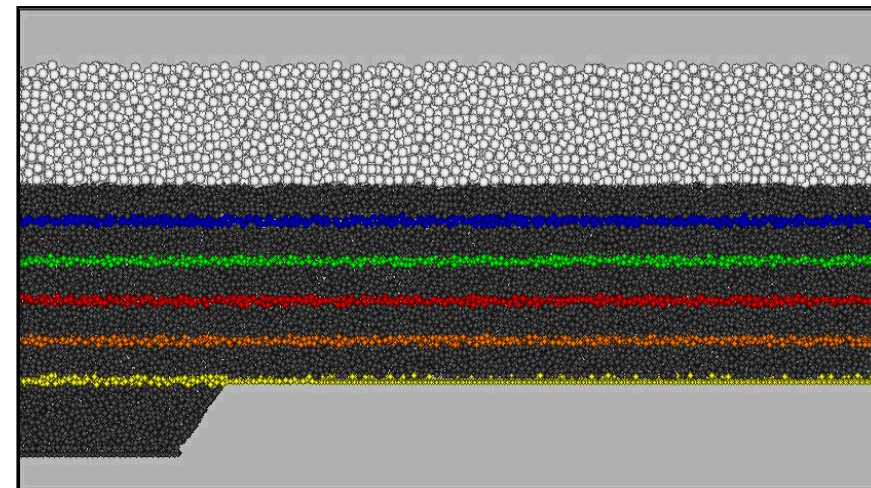
Vienna Austria

Introduction of longwall top coal caving

LTCC procedures



Simple cases based on PFC2D



Bottom coal seam undercut by shearer



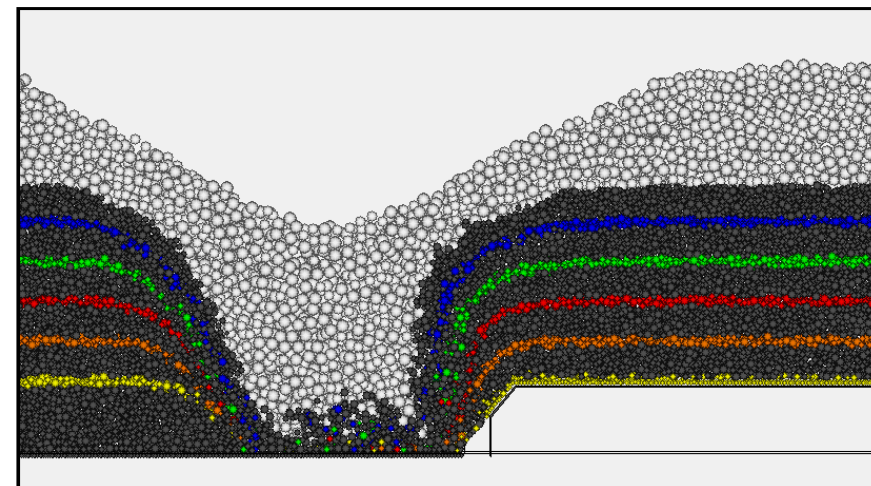
Top coal fractured by abutment and strata pressure

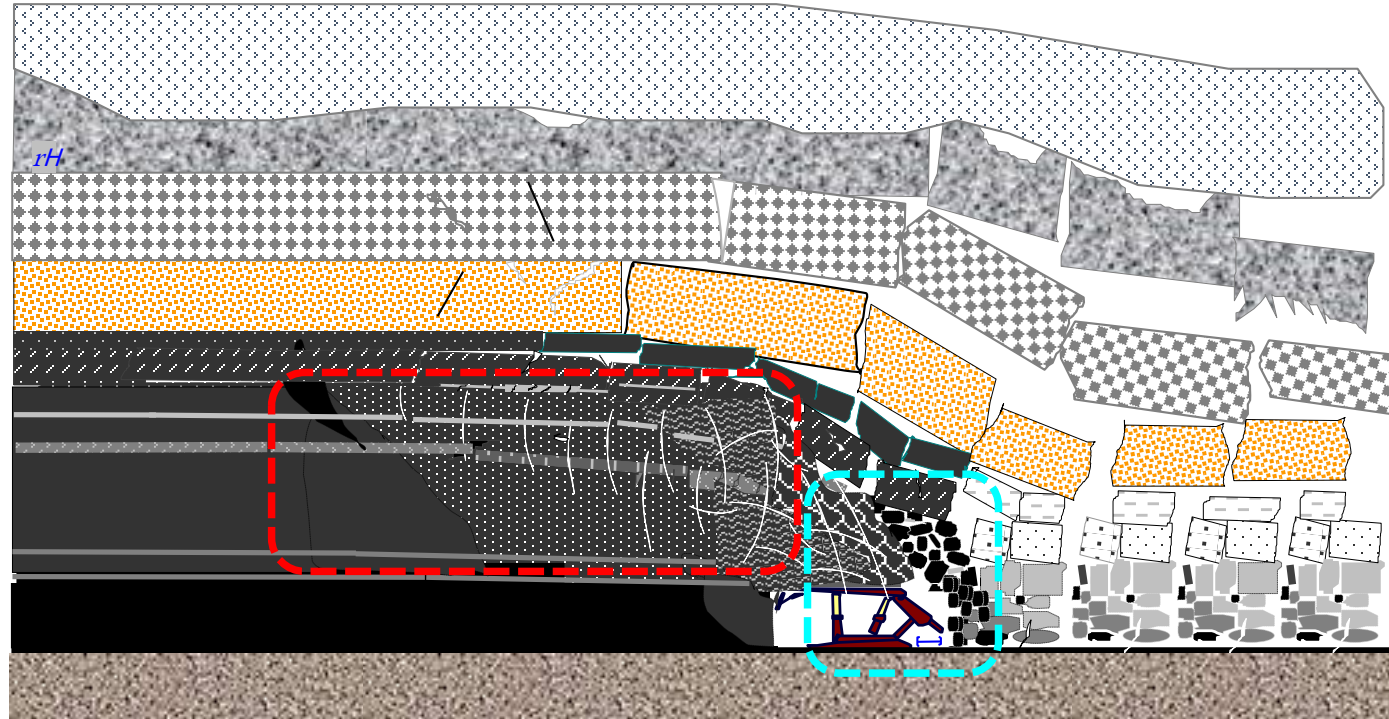


Fractured top coal flow driven by gravity (**Top coal drawing**)



Support advance





1. Fracture of top coal

- ❖ Strength criteria of coal
- ❖ Failure mechanism
- ❖ Deformation and crack coalescence...

2. Drawing mechanism of top coal

- ❖ Gravity flow
- ❖ Top coal recovery ratio
- ❖ Granular mechanics
- ❖ Top coal loss...

Introduction of longwall top coal caving

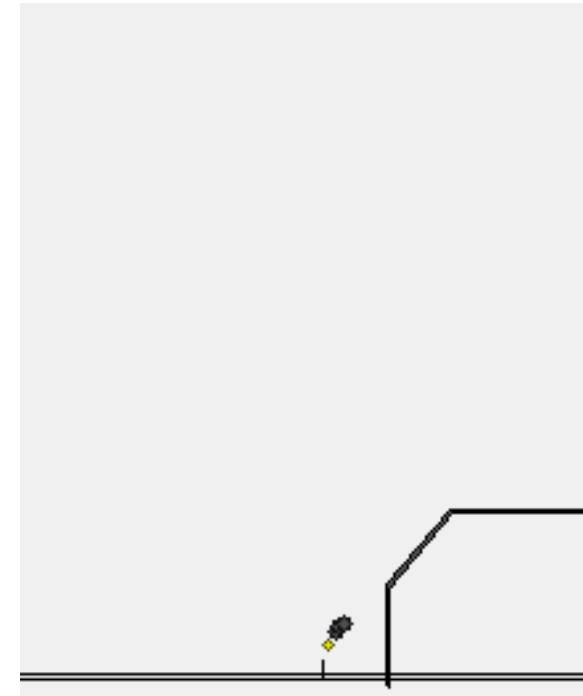
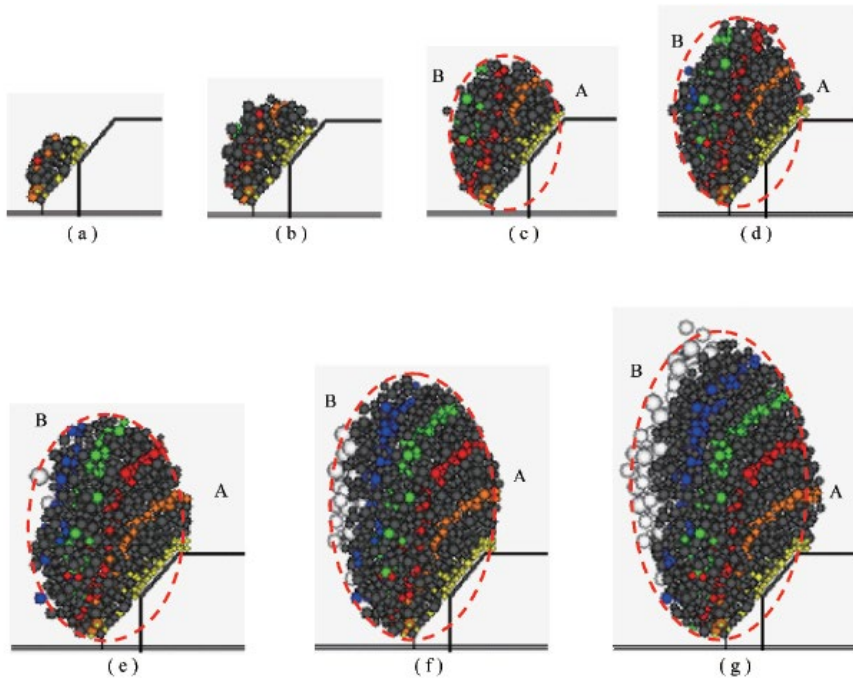
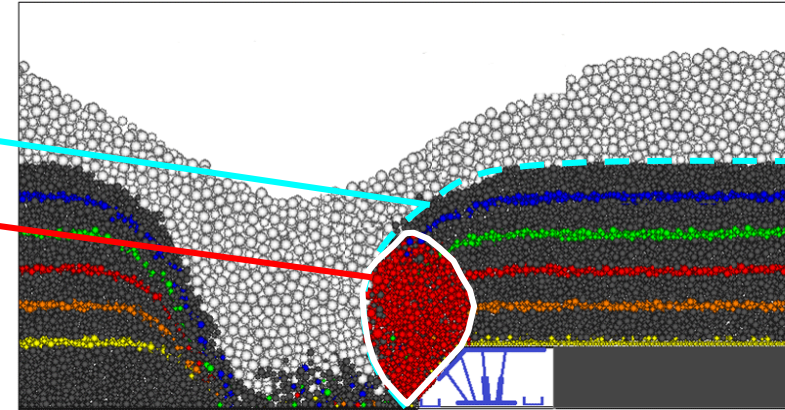
Wang et al. 2015

Boundary of Top-coal

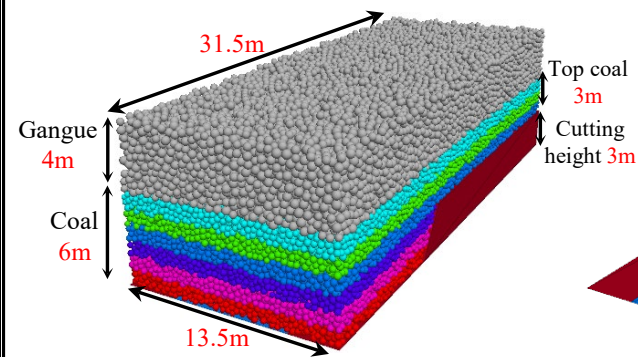
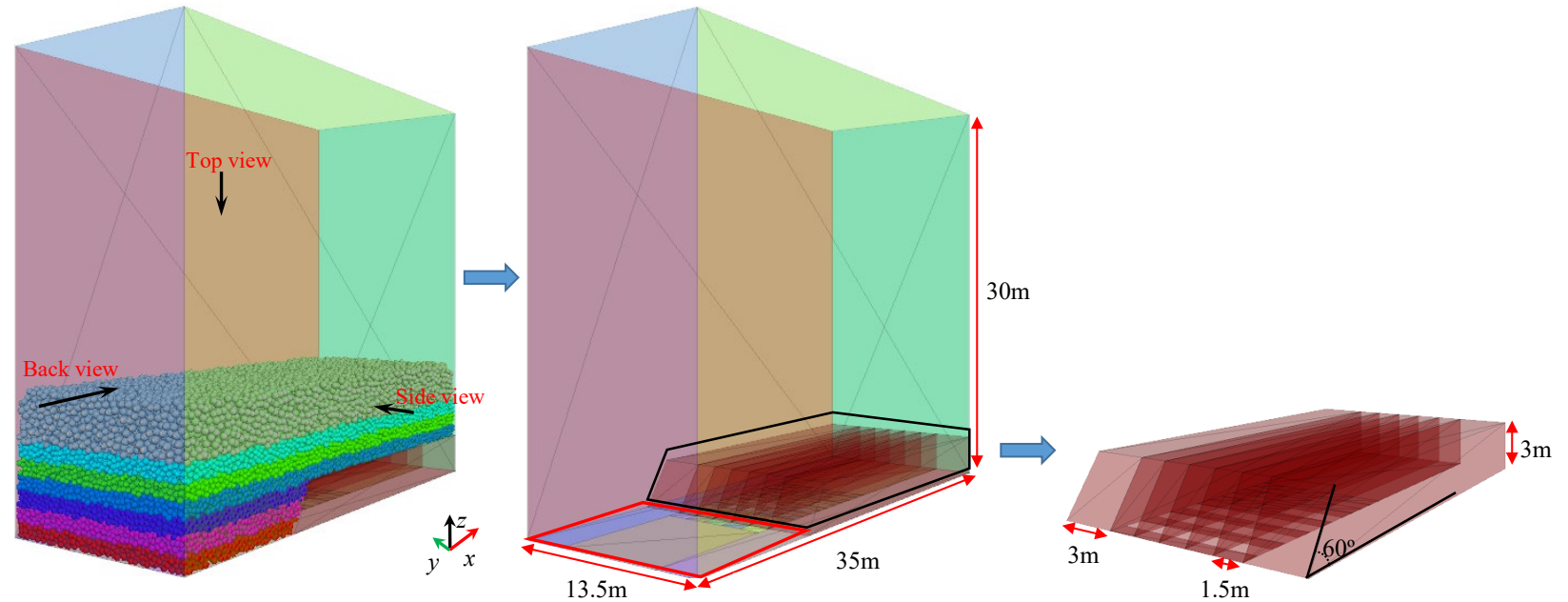
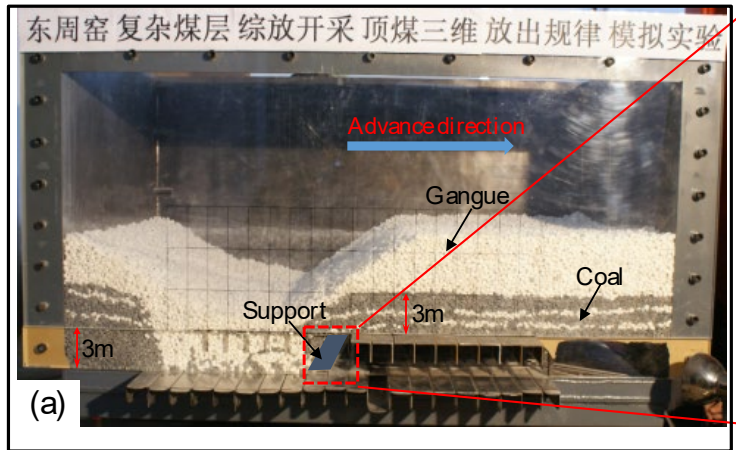
Drawing Body of Top-coal

Recovery Ratio of Top-coal

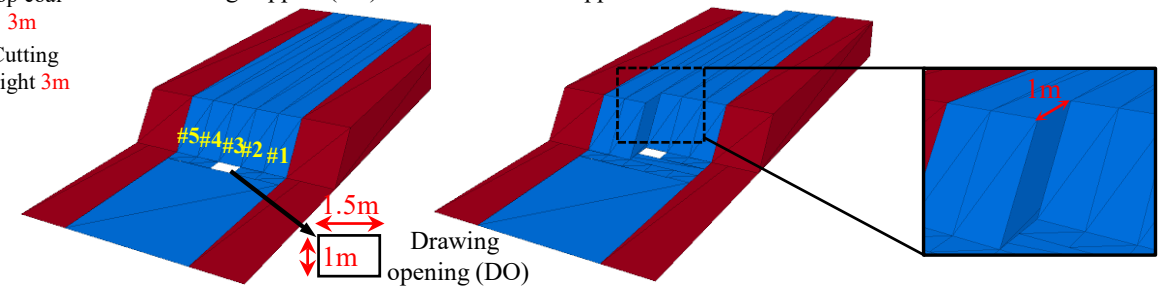
Rock Mixed Ratio of Top-coal



Numerical modelling

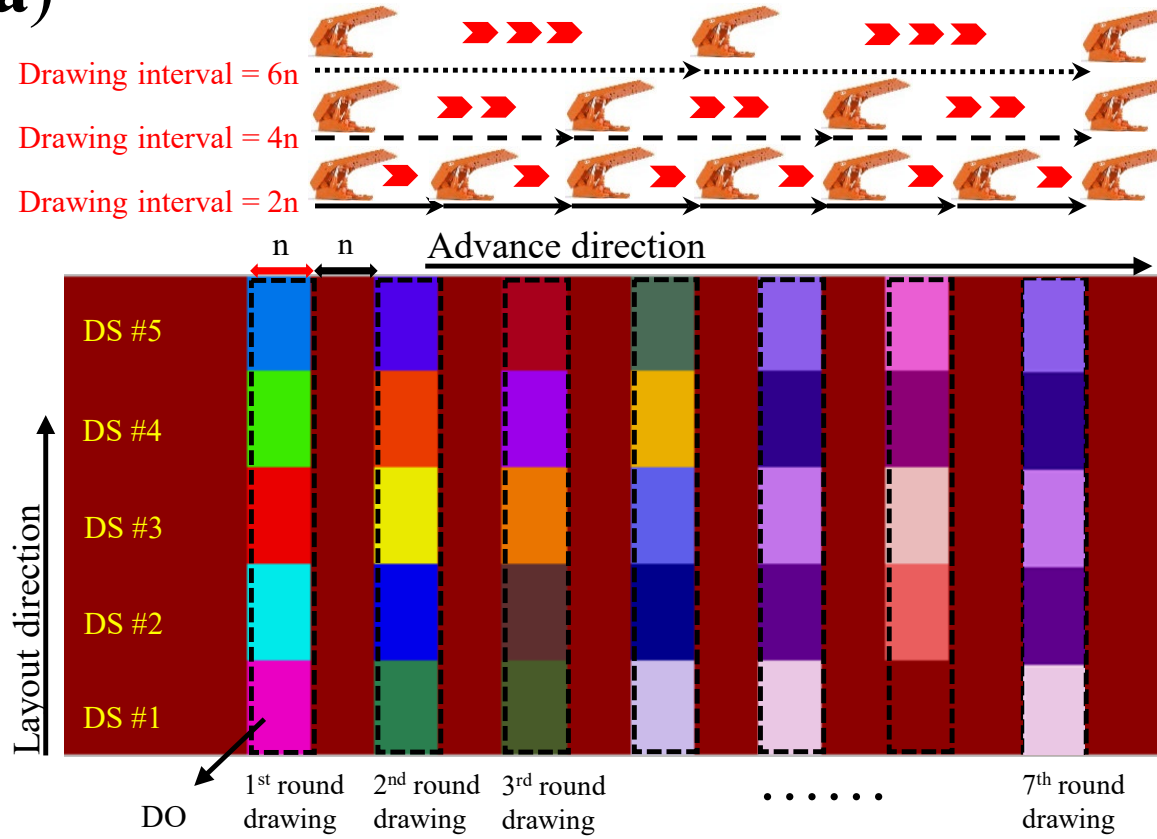


■ Face-end support (FS)
■ Drawing support (DS)

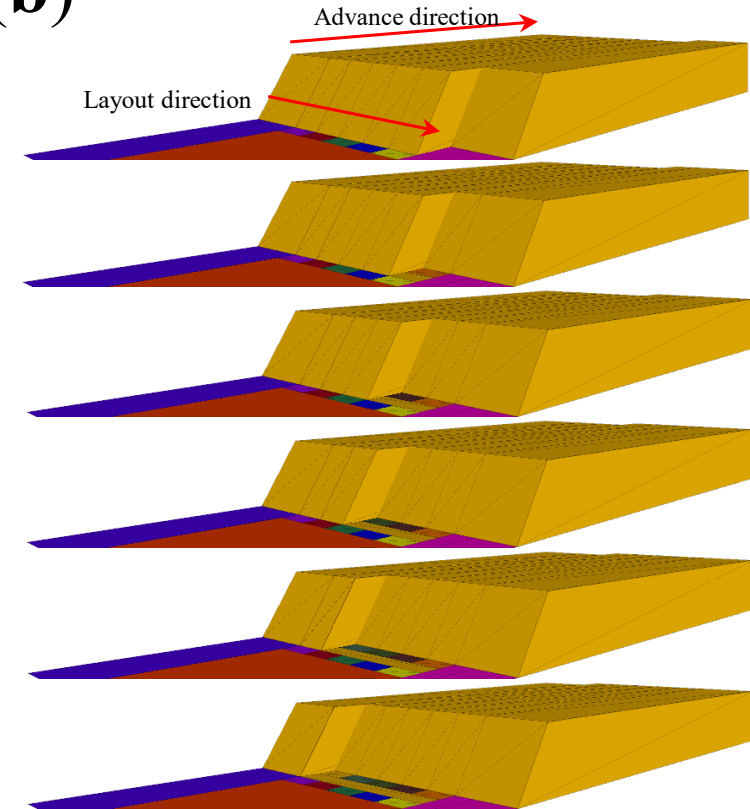


Support system and support advance

(a)



(b)



(c)

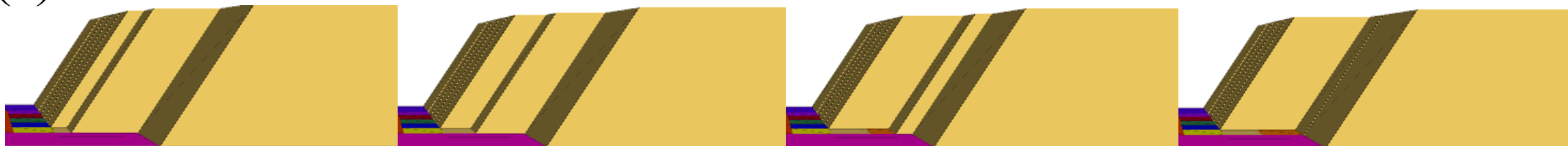
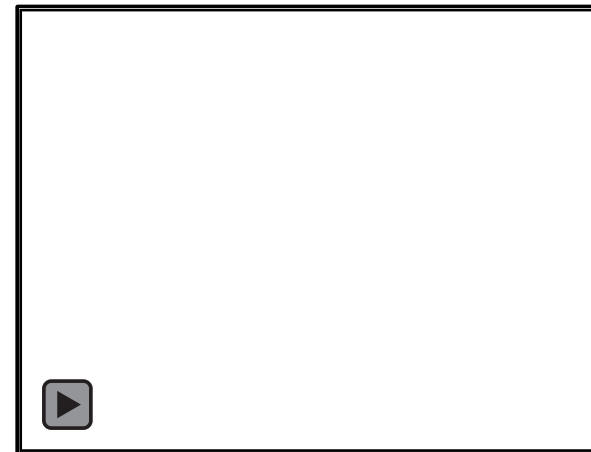
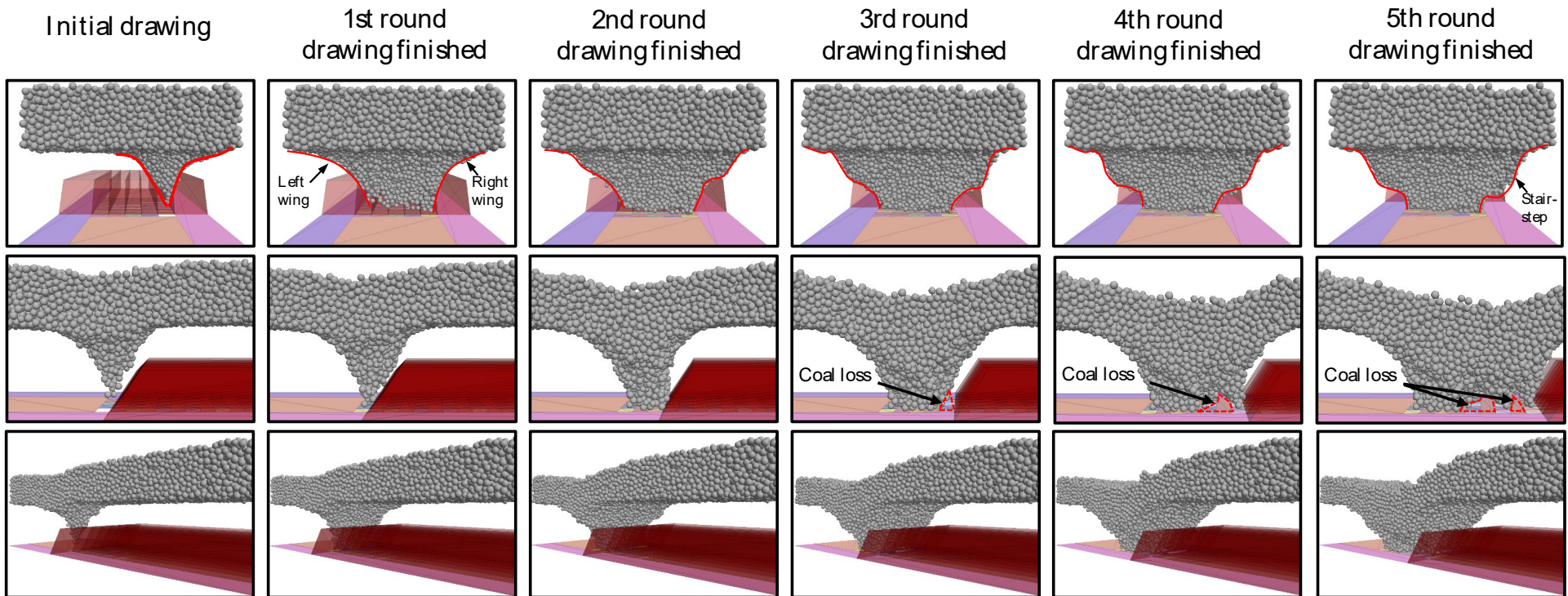
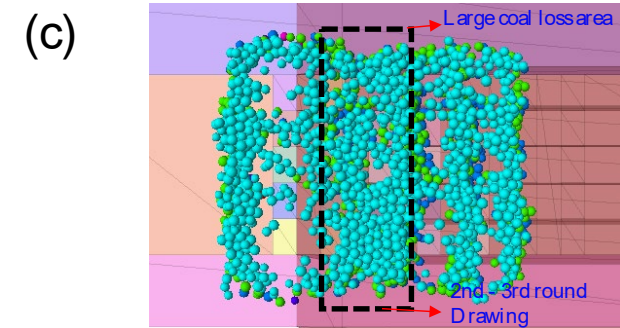
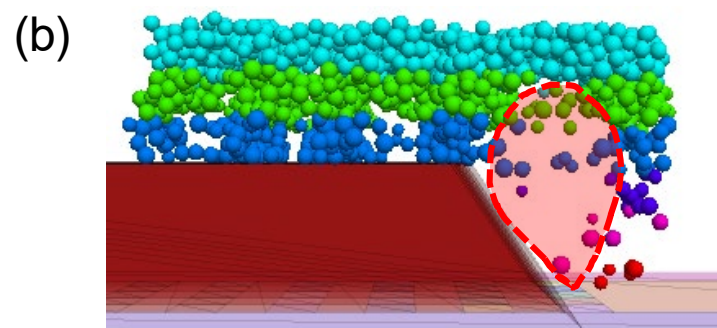
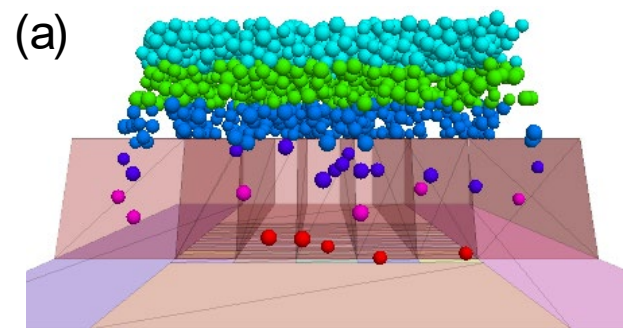
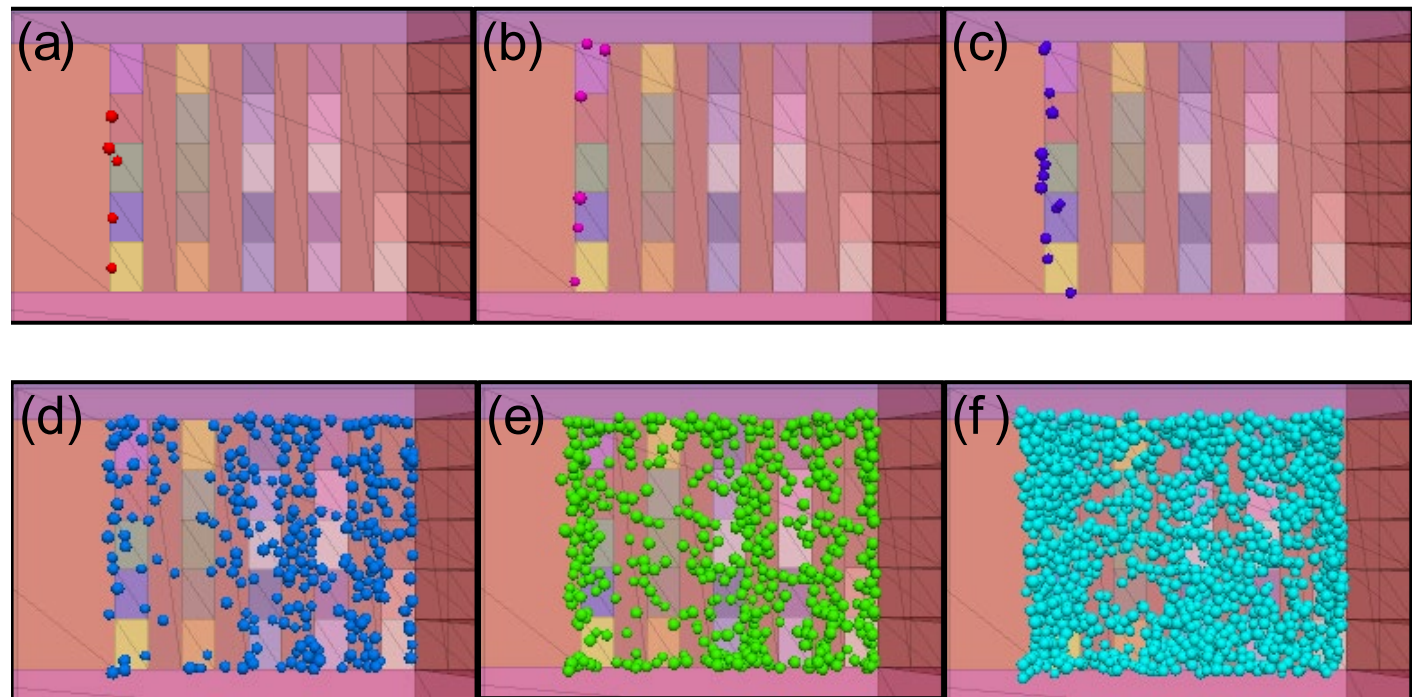
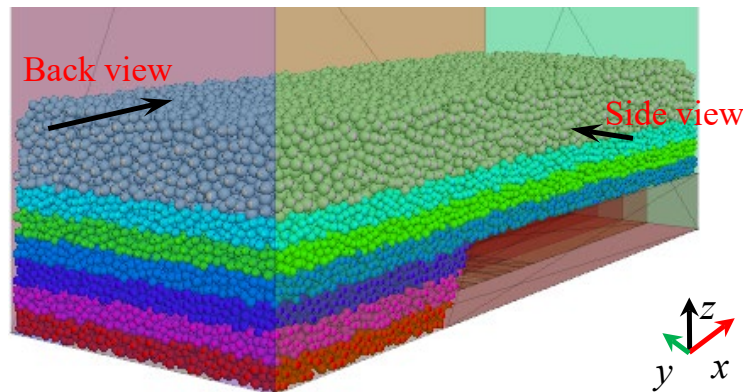


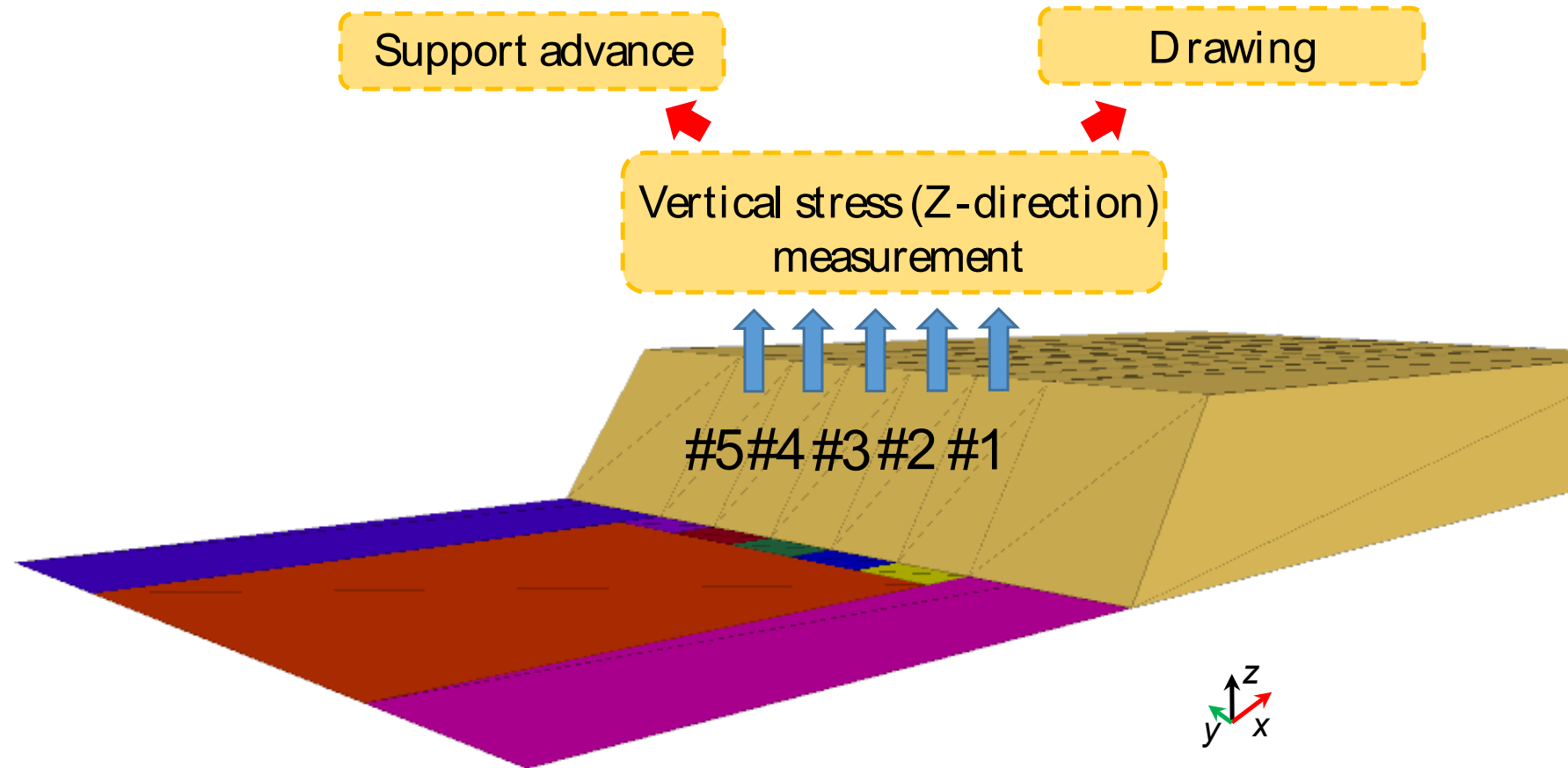
Figure 1 displays a 5x5 grid of 25 sub-images, labeled (a) through (y). Each sub-image shows a 3D scene with a staircase and a colorful sphere. The sphere is positioned at different heights on the staircase in each sub-image. A red box highlights a sequence of sub-images (p) through (u) in the bottom right corner, indicating a specific sequence of interest.

Boundary of top coal

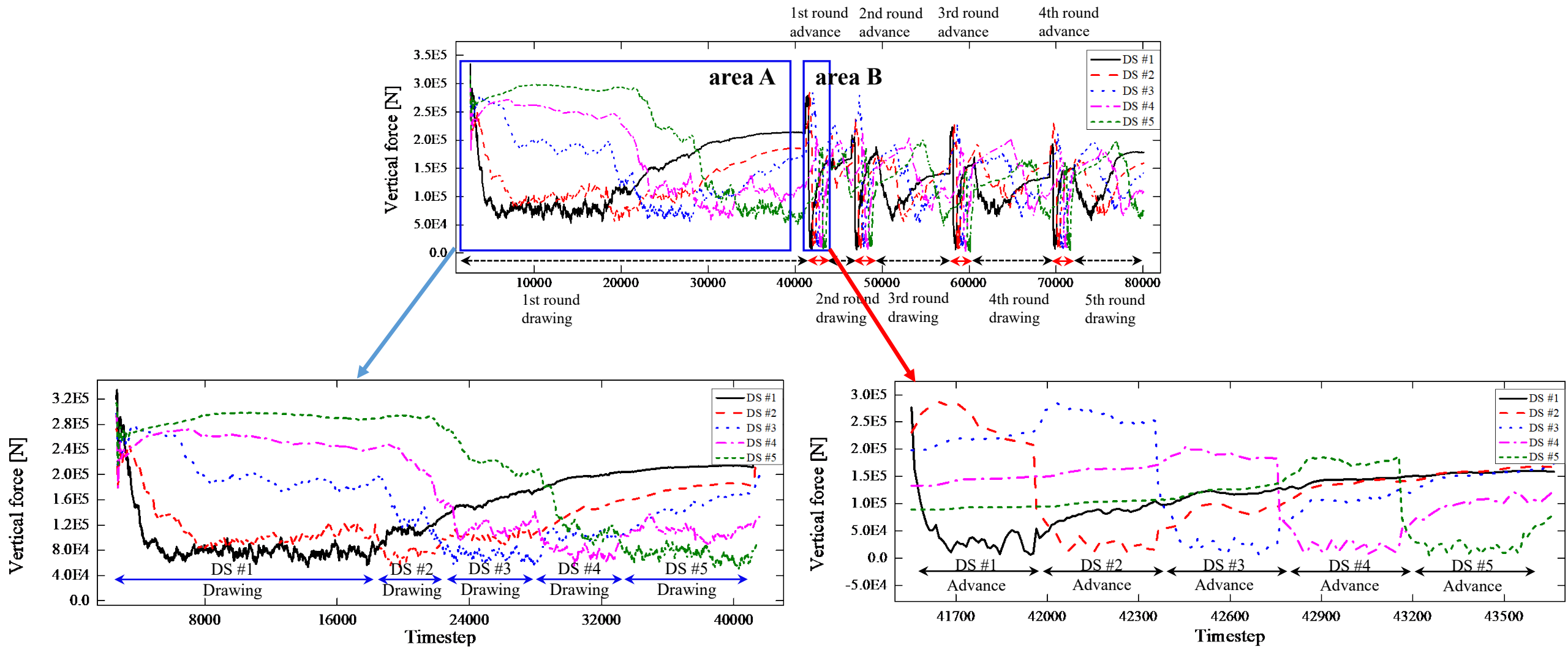


Top coal loss



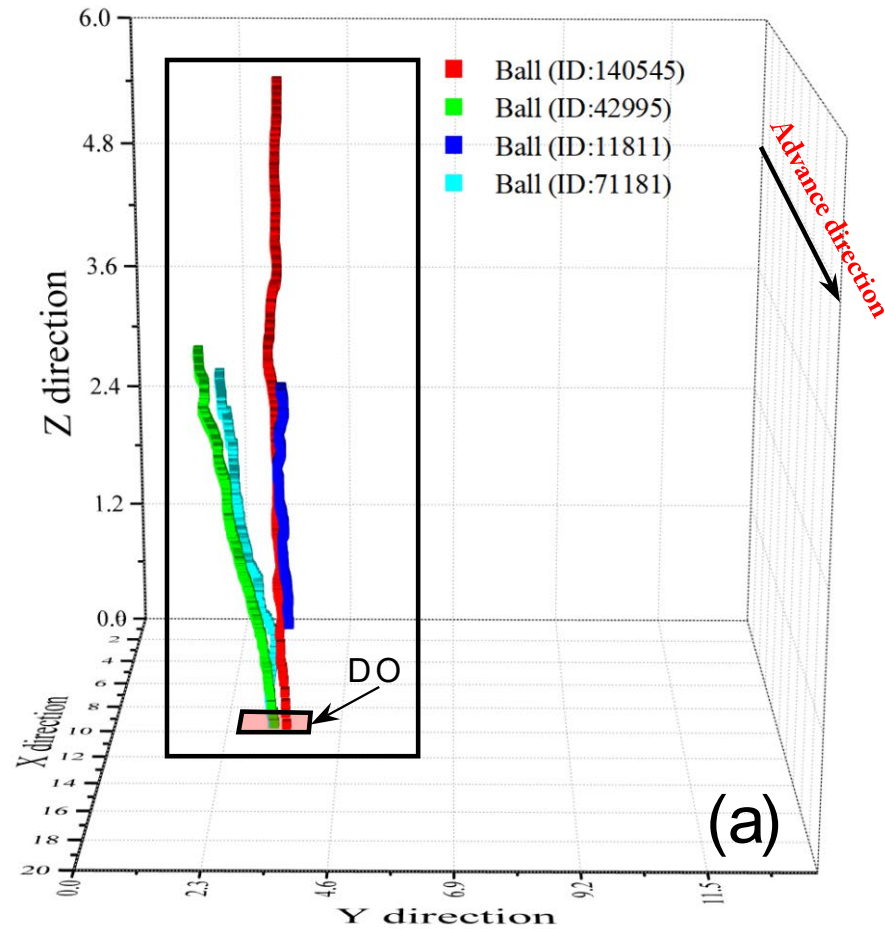


Vertical stress monitoring

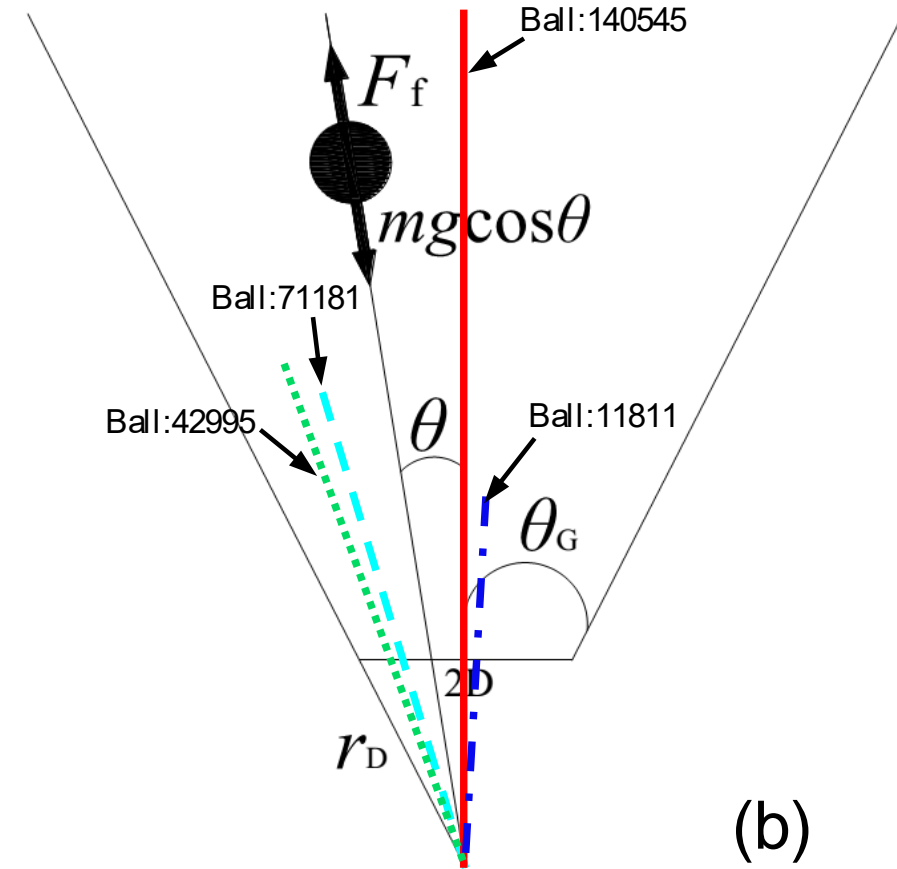


Flowing path

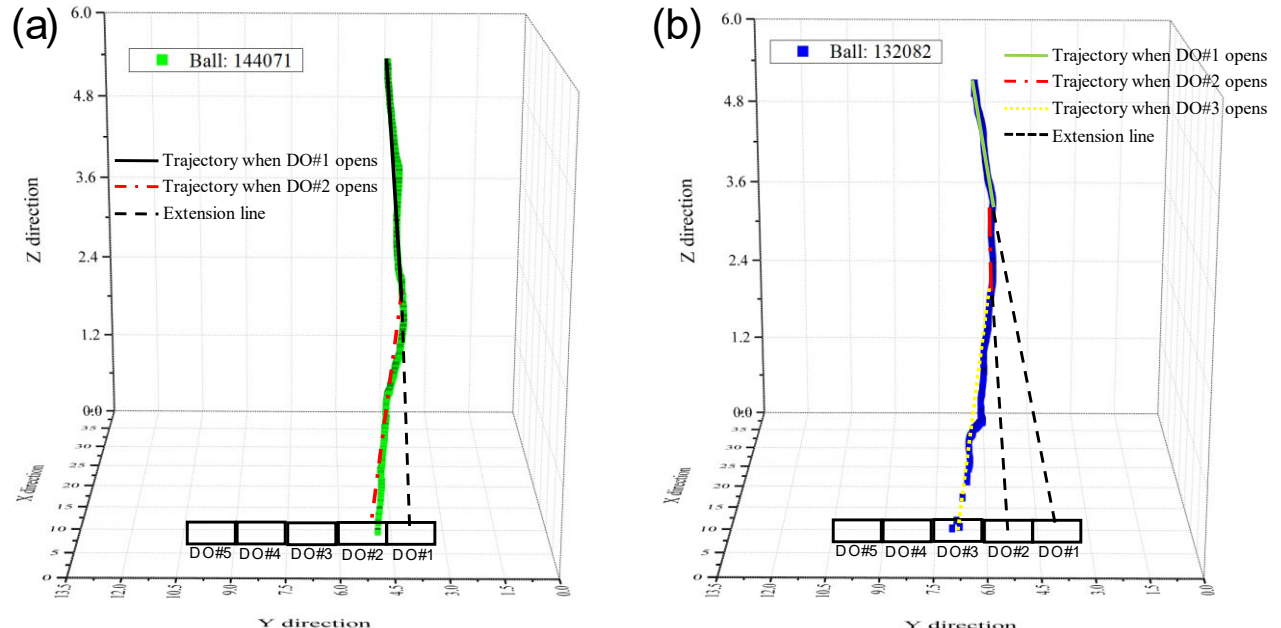
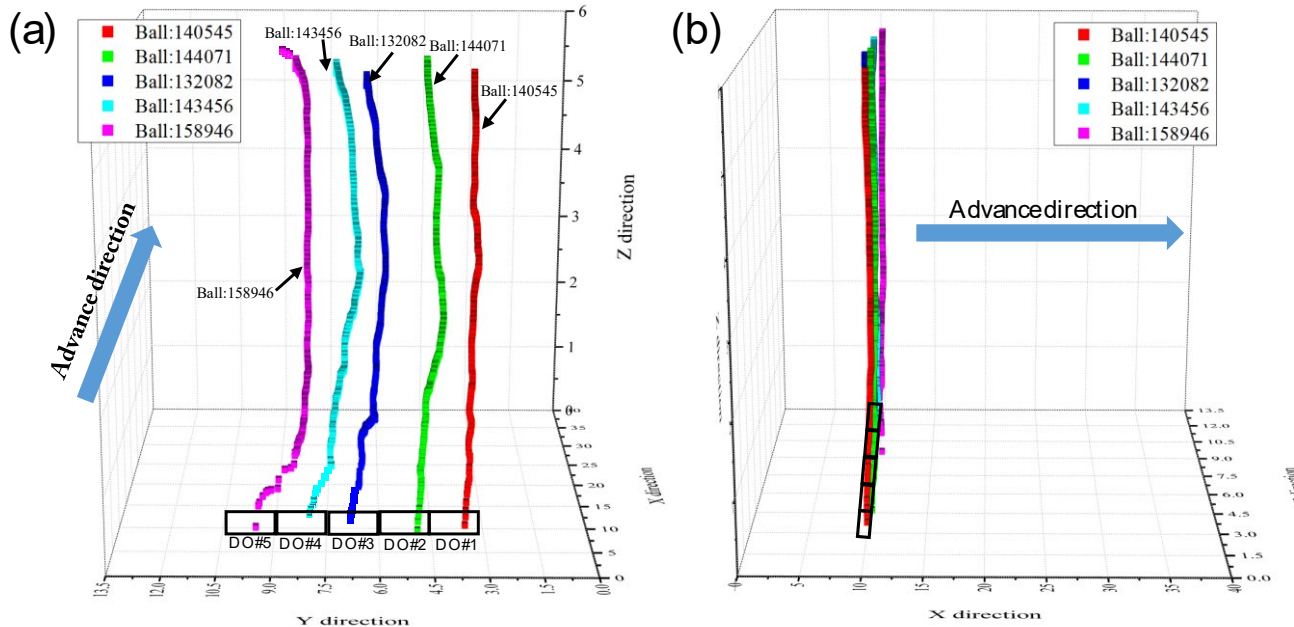
Recorded flowing path



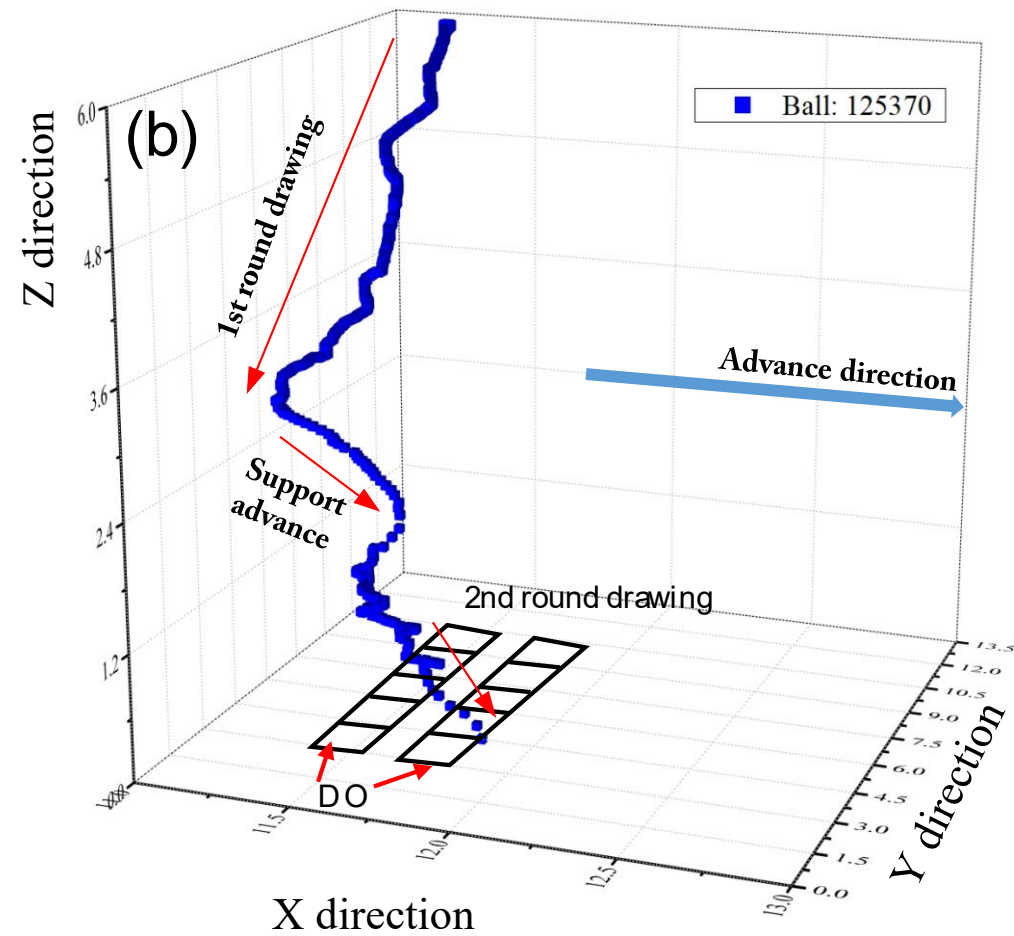
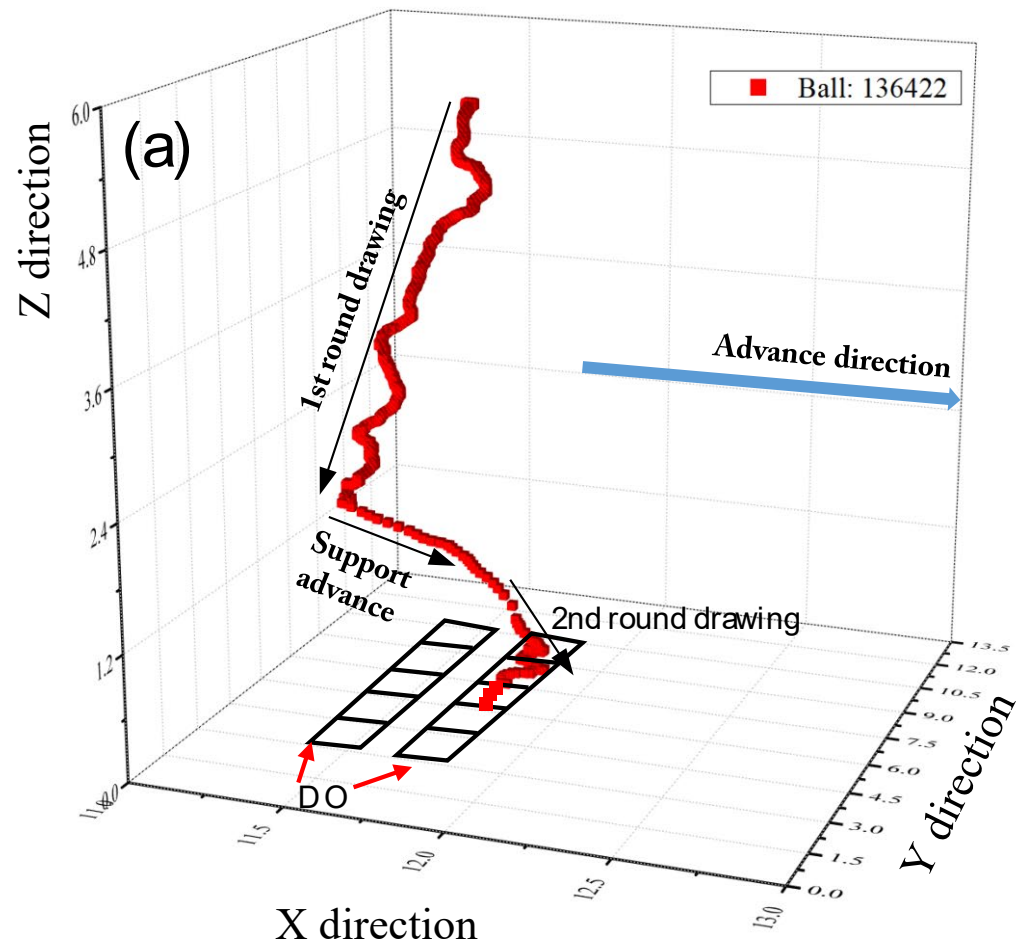
Bergmark-Roos Model



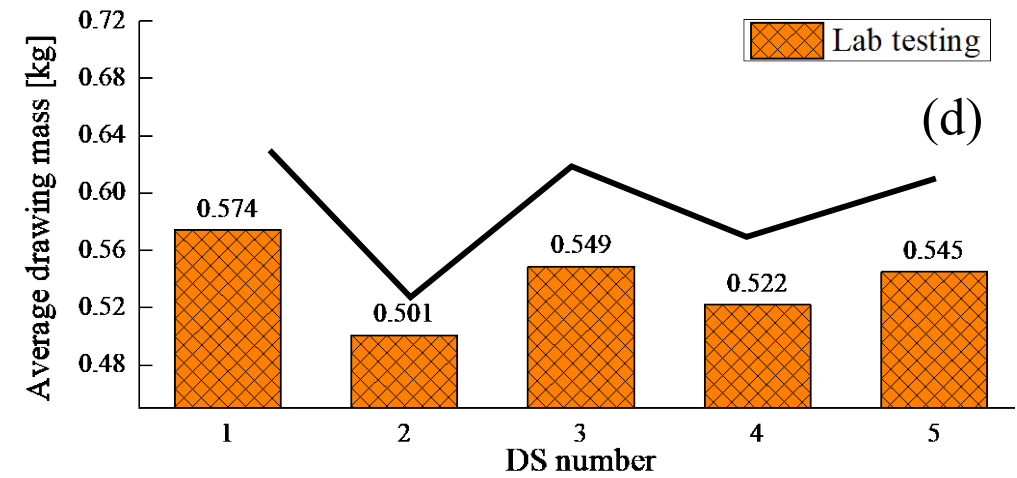
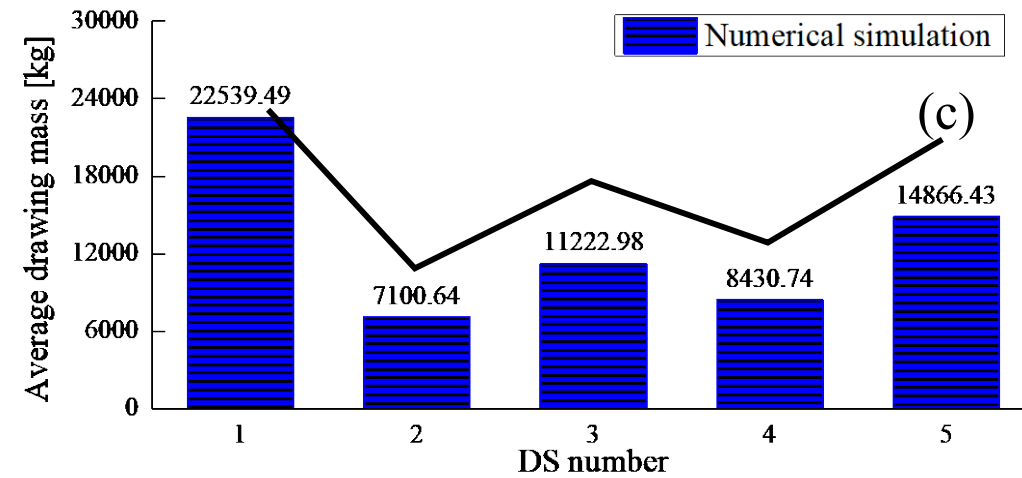
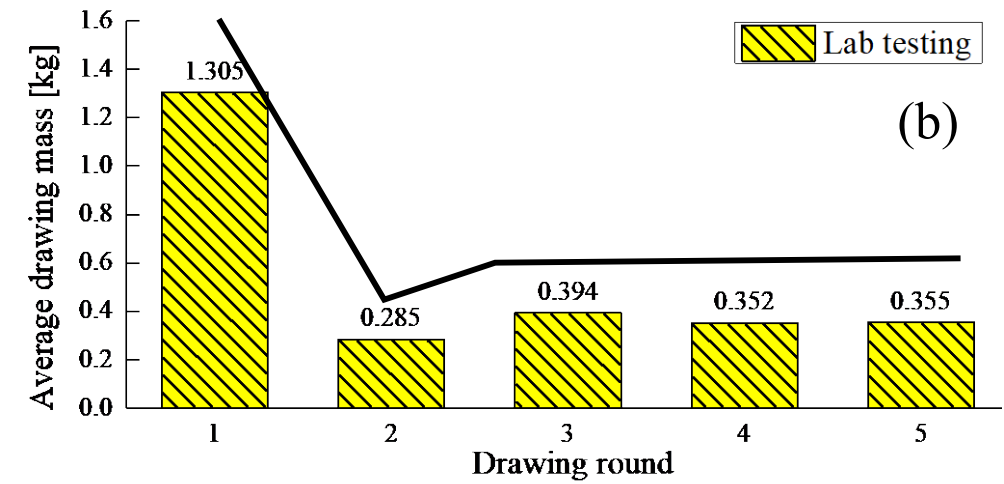
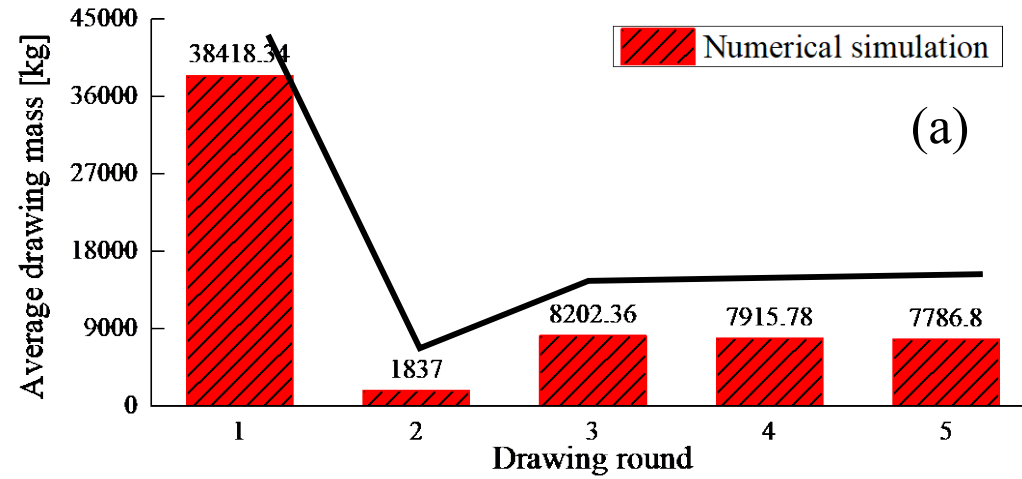
Flowing path



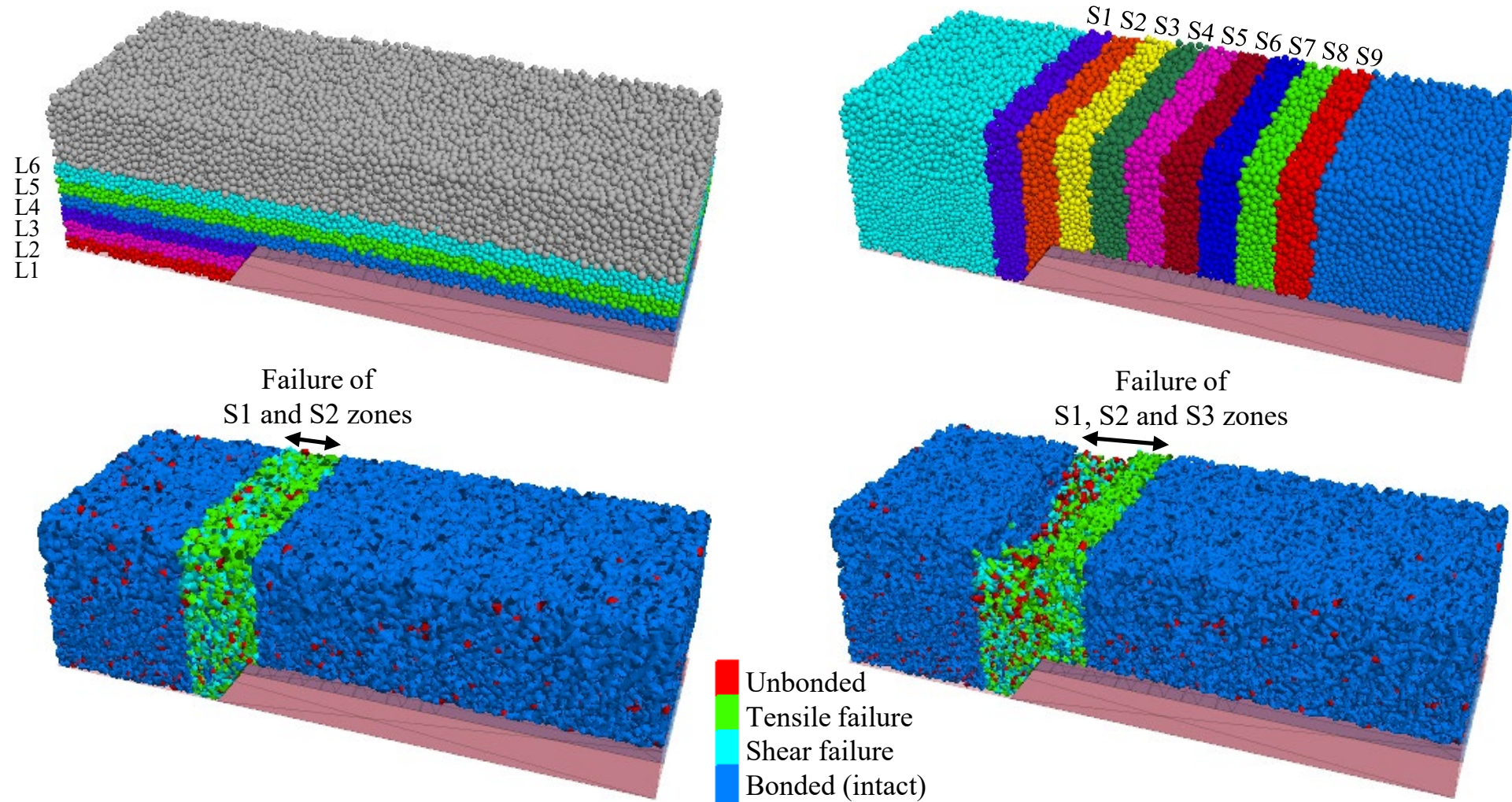
Flowing path



Calibration with Lab testing

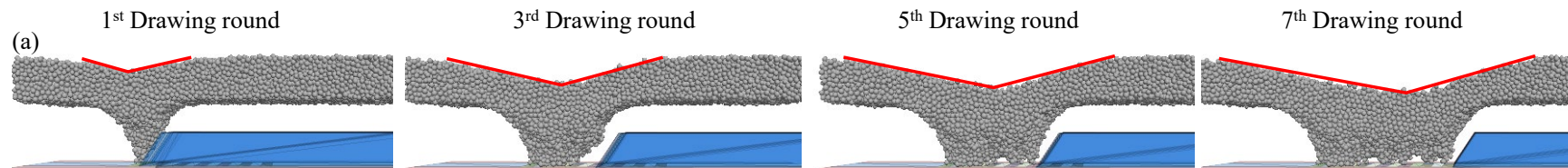


Sectional failure modelling

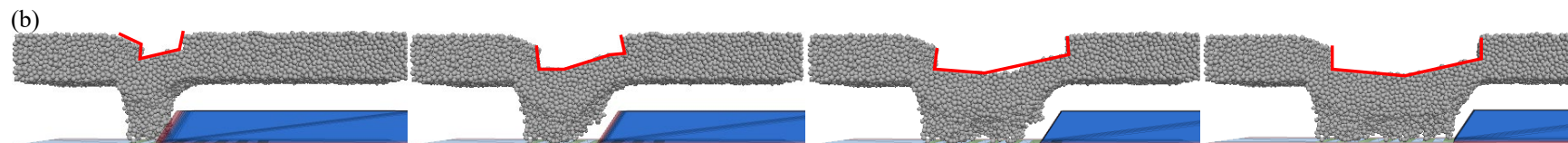


Sectional failure modelling

Completely loose

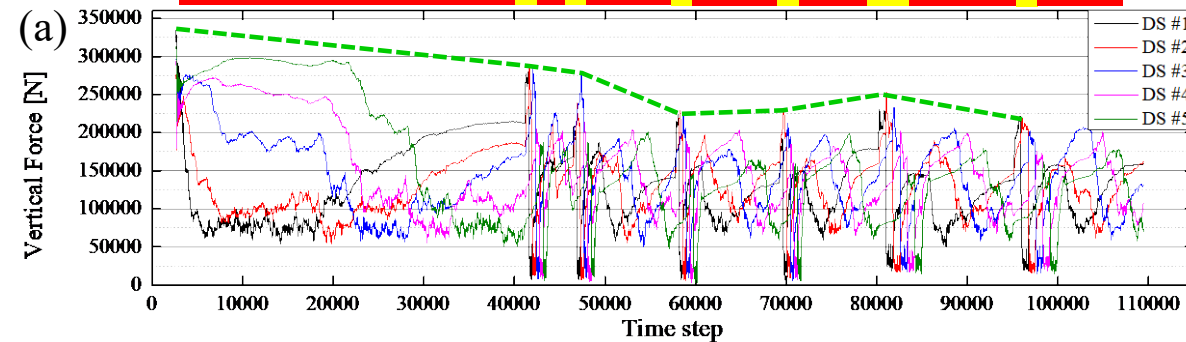


Sectional failure

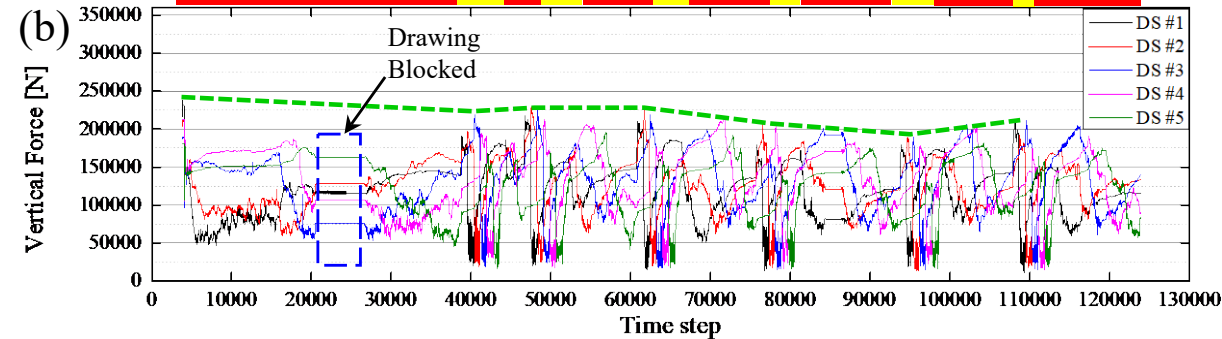


■ Drawing Procedure ■ Support advance

Completely loose



Sectional failure



The background of the slide is a textured, light brown surface. In the bottom-left corner, there is an ornate, golden-brown floral and scrollwork decoration. The text "Thank you for your attention!" is centered in a black, elegant script font.

*Thank you for your
attention!*