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► To cite this version:

Duri Agnès, Bernard Cuq, Frederic Mabilie, Sandra Mandato, Thierry Ruiz. About rheophysics of granular packing columns with an intruder and a PIV. MIT-IATE Meeting, 2015, Montpellier, France. hal-02925107

HAL Id: hal-02925107

<https://hal.inrae.fr/hal-02925107>

Submitted on 28 Aug 2020

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About rheophysics of granular packing columns with an intruder and a PIV

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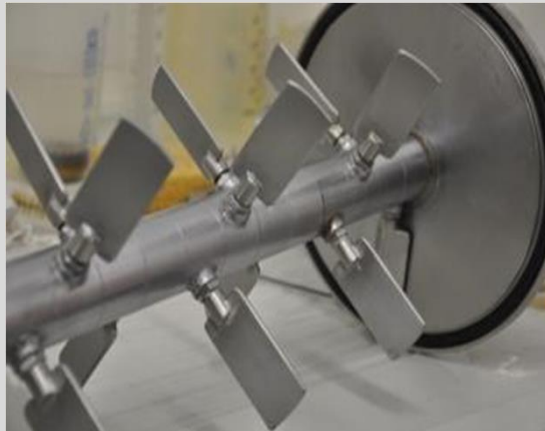
MASSACHUSETTS INSTITUTE OF TECHNOLOGY



Motivation

Experimental analysis of the local force network properties of granular packing columns

From industrial equipments
with a **3D** blade motion...

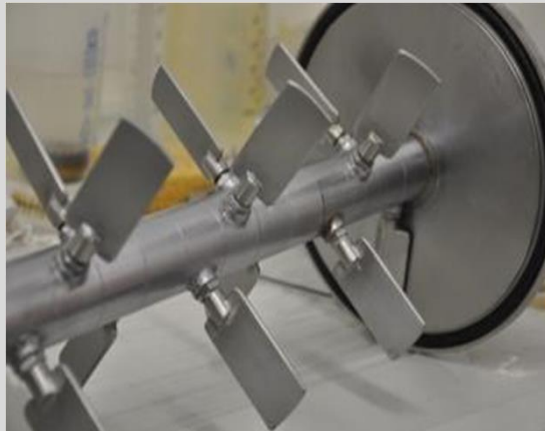


Horizontal mixer

Motivation

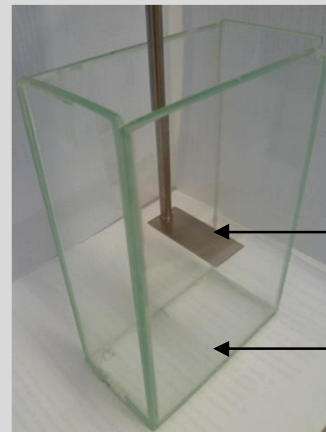
Experimental analysis of the local force network properties of granular packing columns

From industrial equipments with a **3D** blade motion...



Horizontal mixer

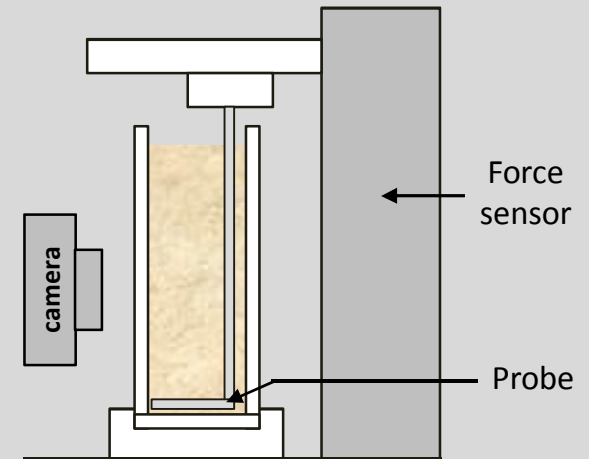
... to an **experimental device** with an **unidirectional** rectangular blade **motion** and a **PIV**



Front view

Small probe

Transparent cell



*Side view
of the texture analyser*

- ✓ **Local force profile in static conditions**
- ✓ **Local force fluctuations and velocity field in dynamic sollicitations**

Illustration

**Blade motion in an
ensiled granular media with a free surface**

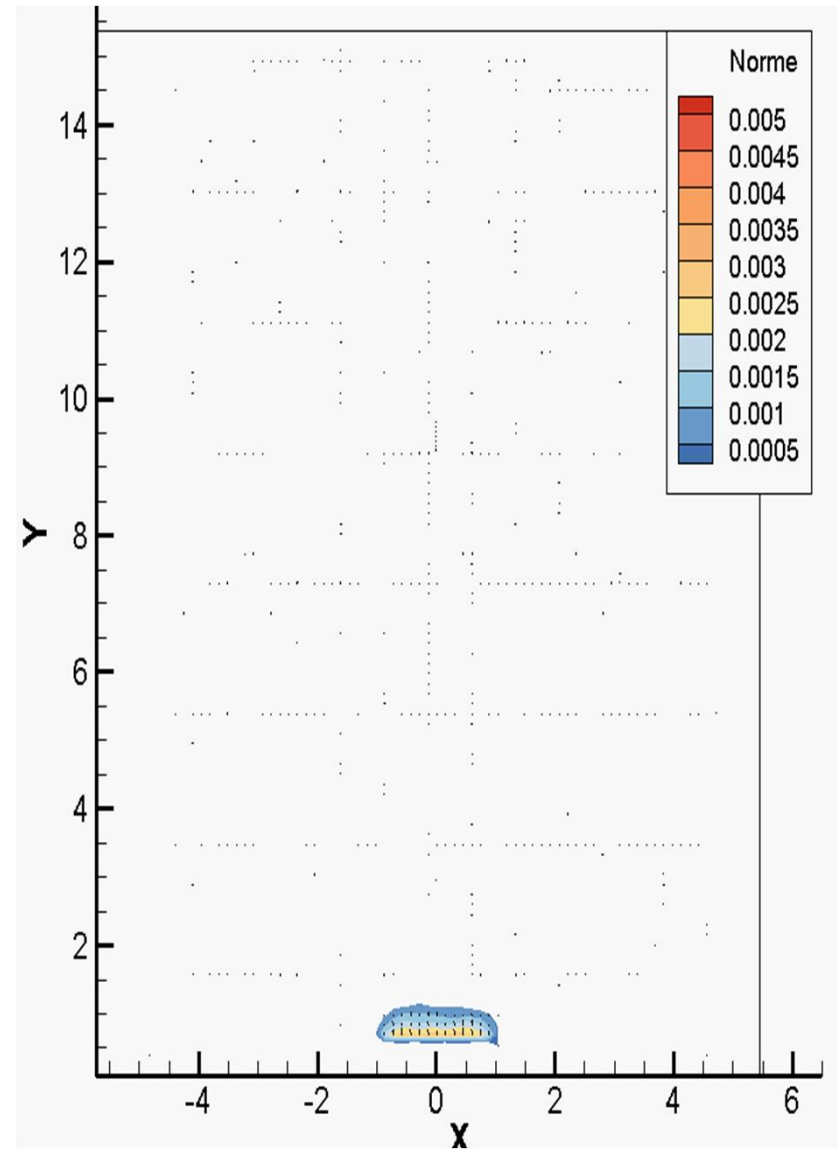


Illustration

**Blade motion in an
ensiled granular media with a free surface**

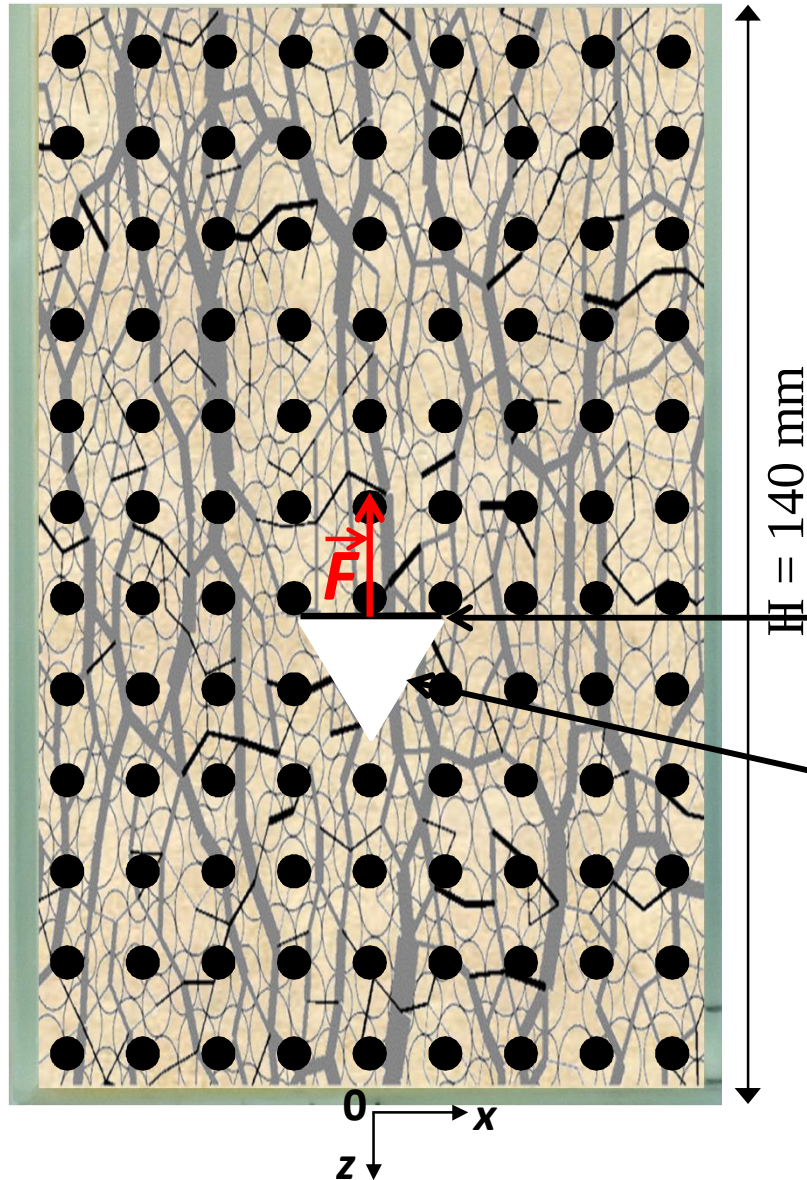


Corresponding PIV analysis

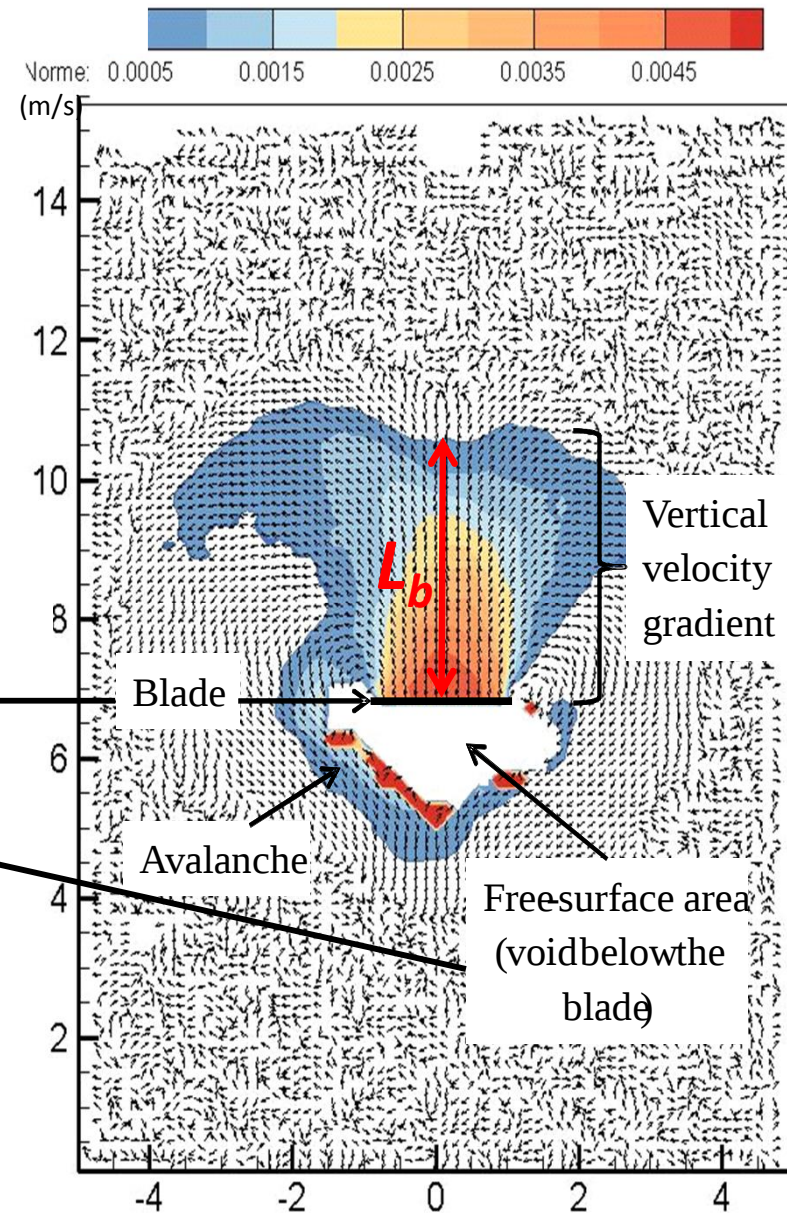


Measurements

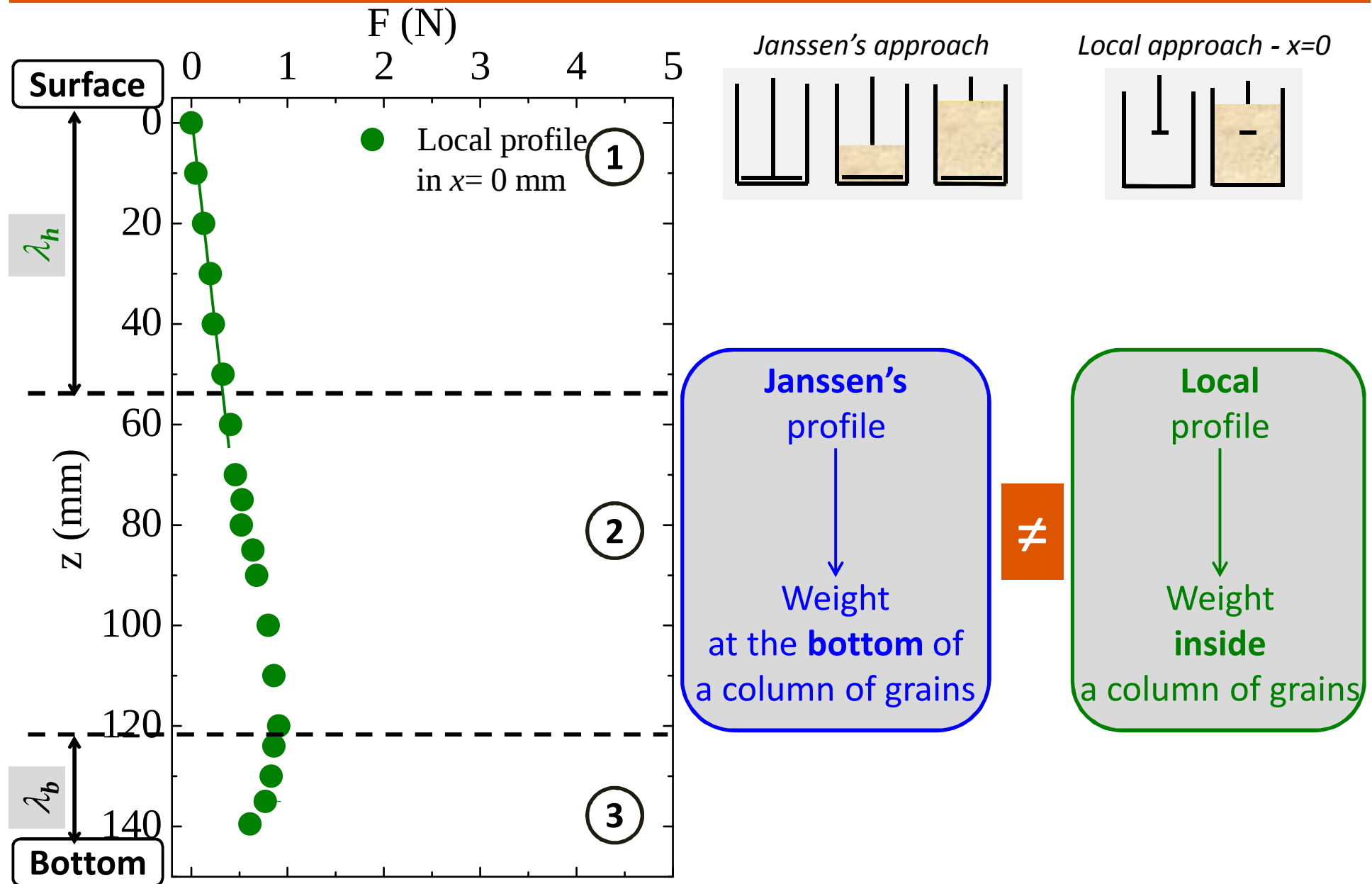
Local vertical force profile
- static and dynamic conditions -



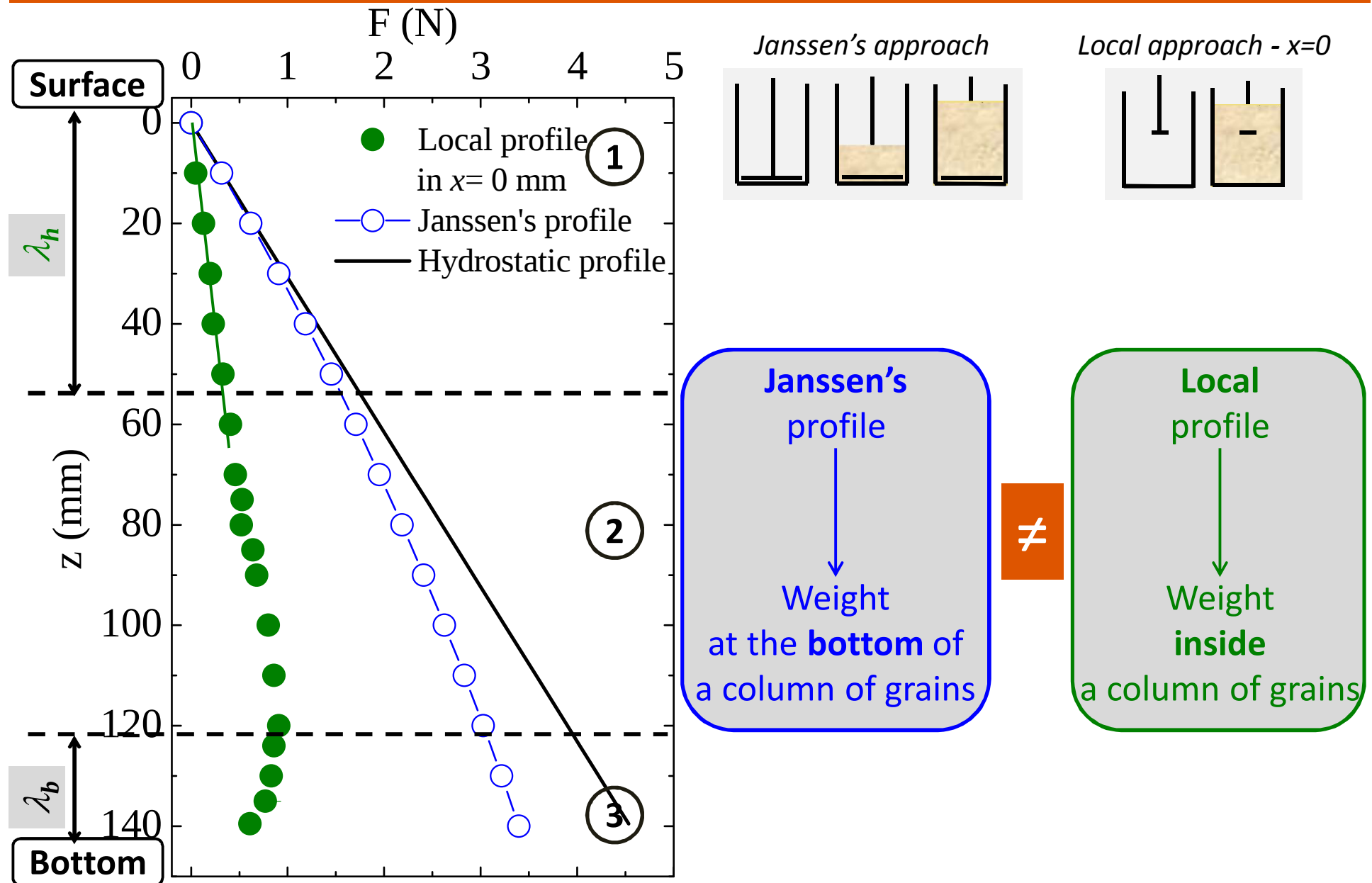
Vertical velocity gradient in dynamic conditions



Local vertical force profile ($x=0$ mm) in static condition

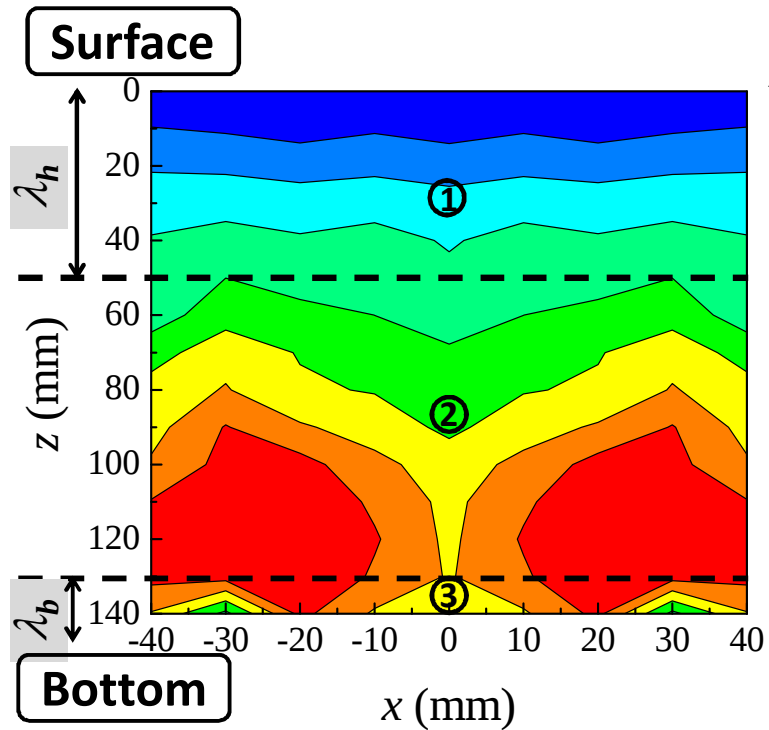


Local vertical force profile ($x=0$ mm) in static condition

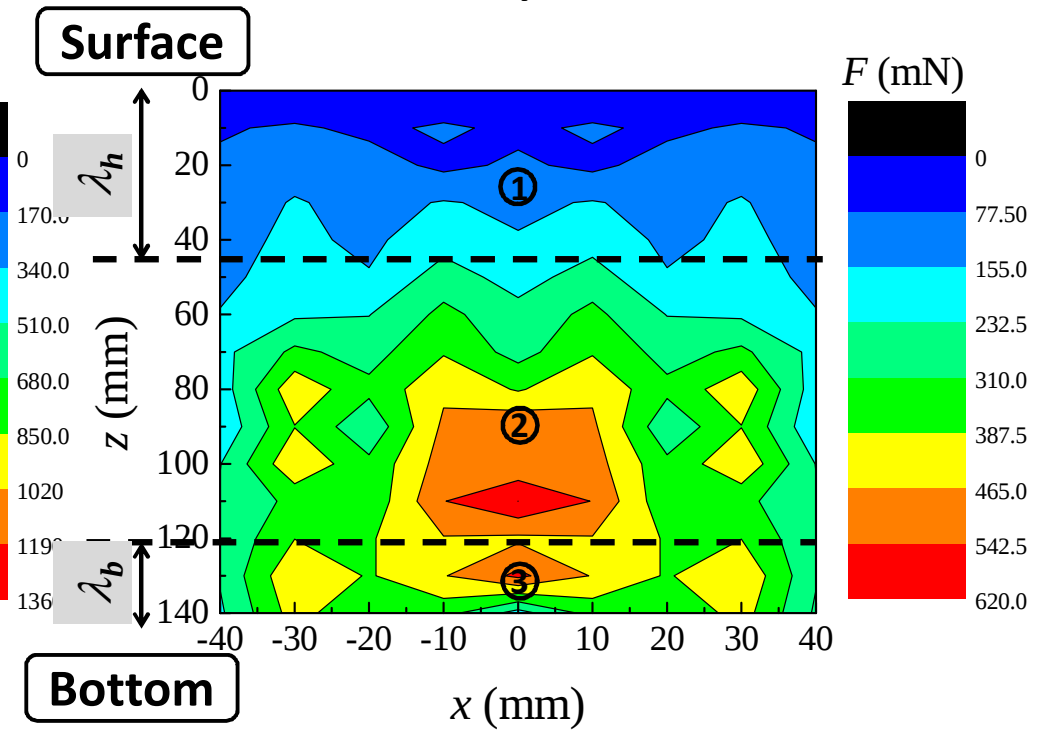


2D iso-force cartography in static conditions

Model system
- *Glass beads* -

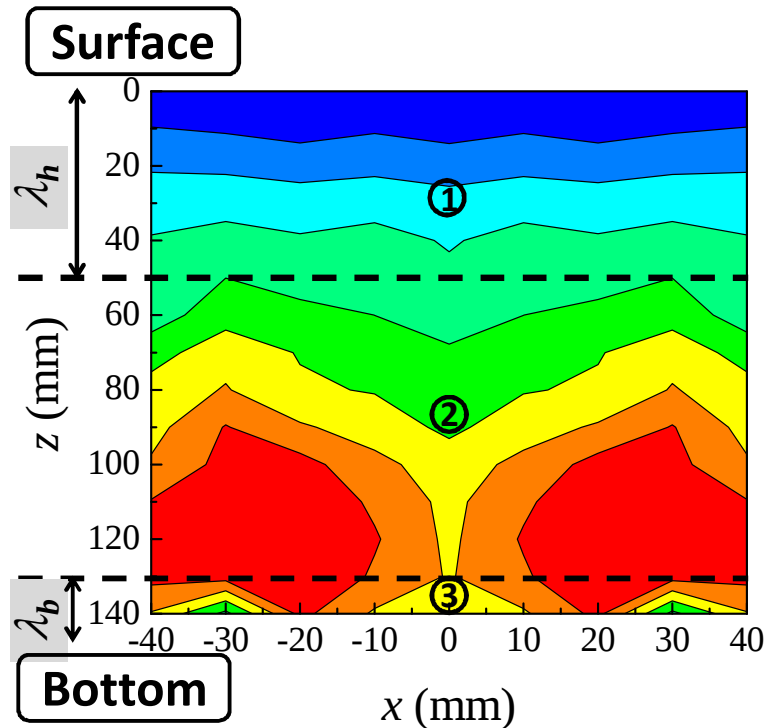


Real system
- *Semolina powder* -

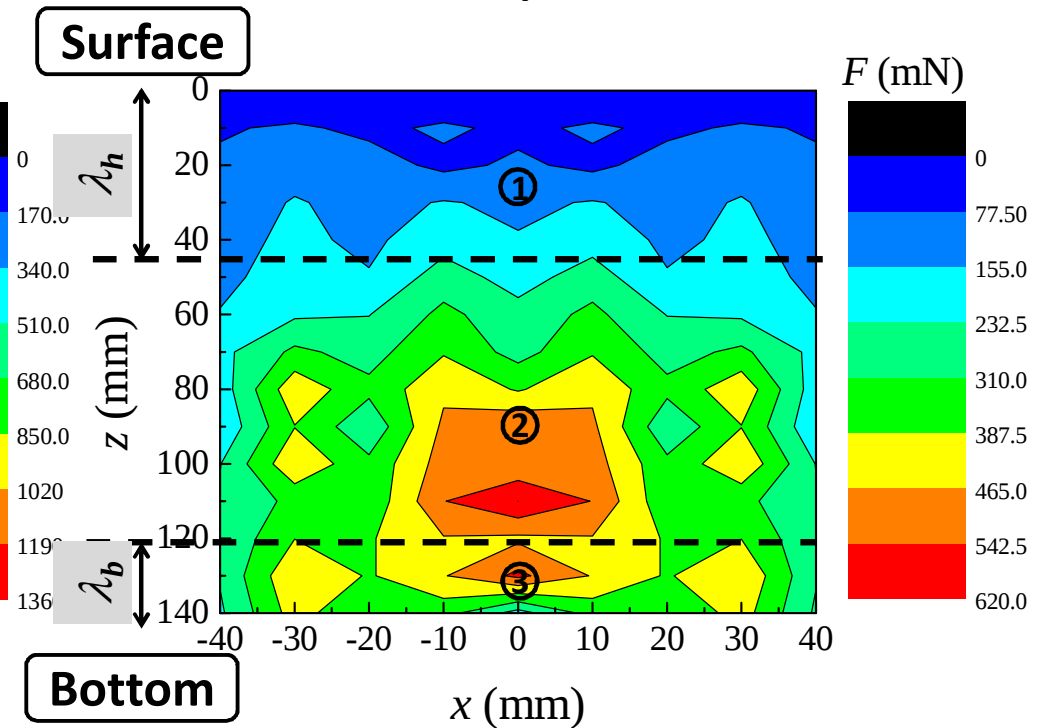


2D iso-force cartography in static conditions

Model system
- *Glass beads* -

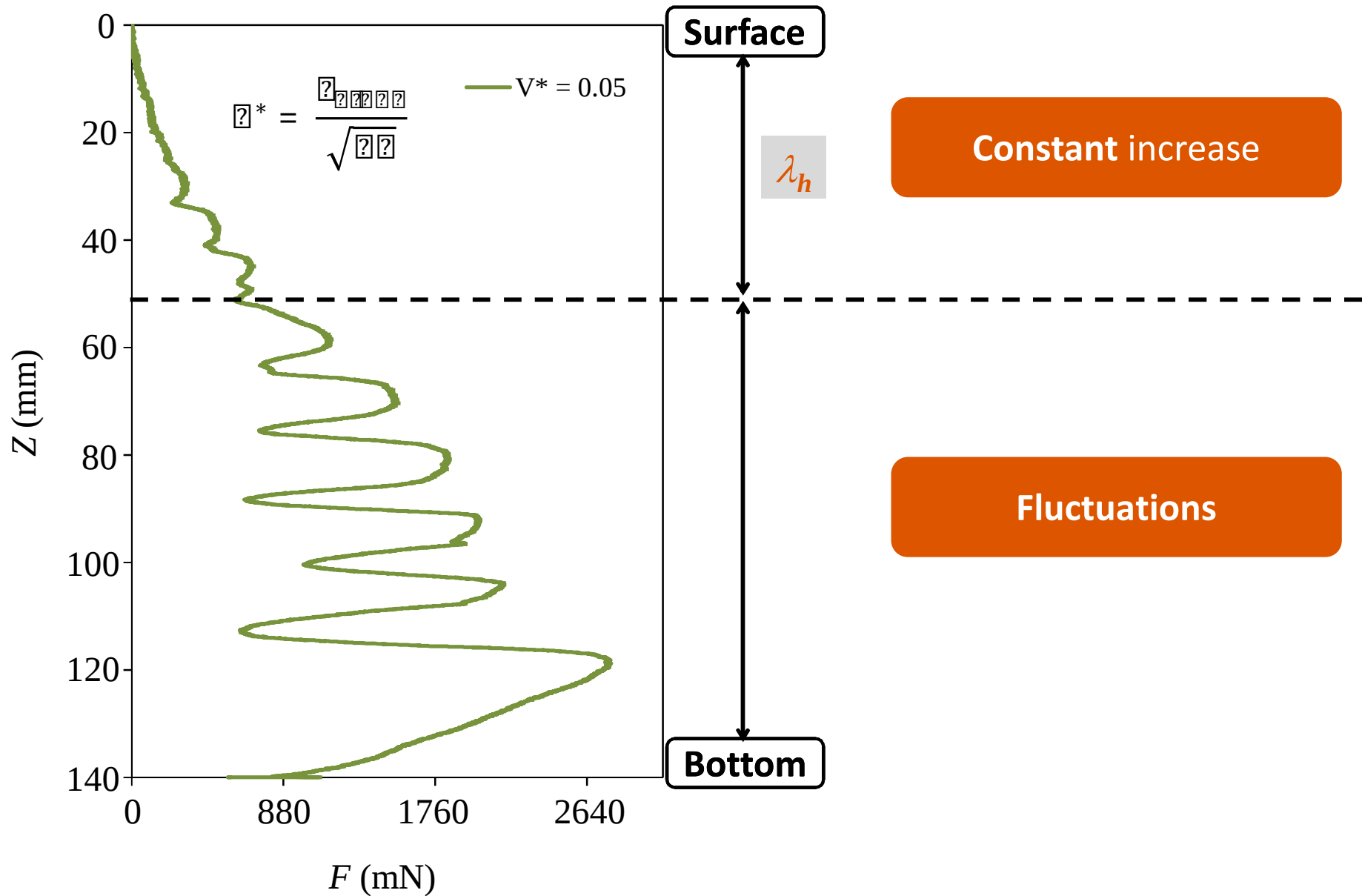


Real system
- *Semolina powder* -

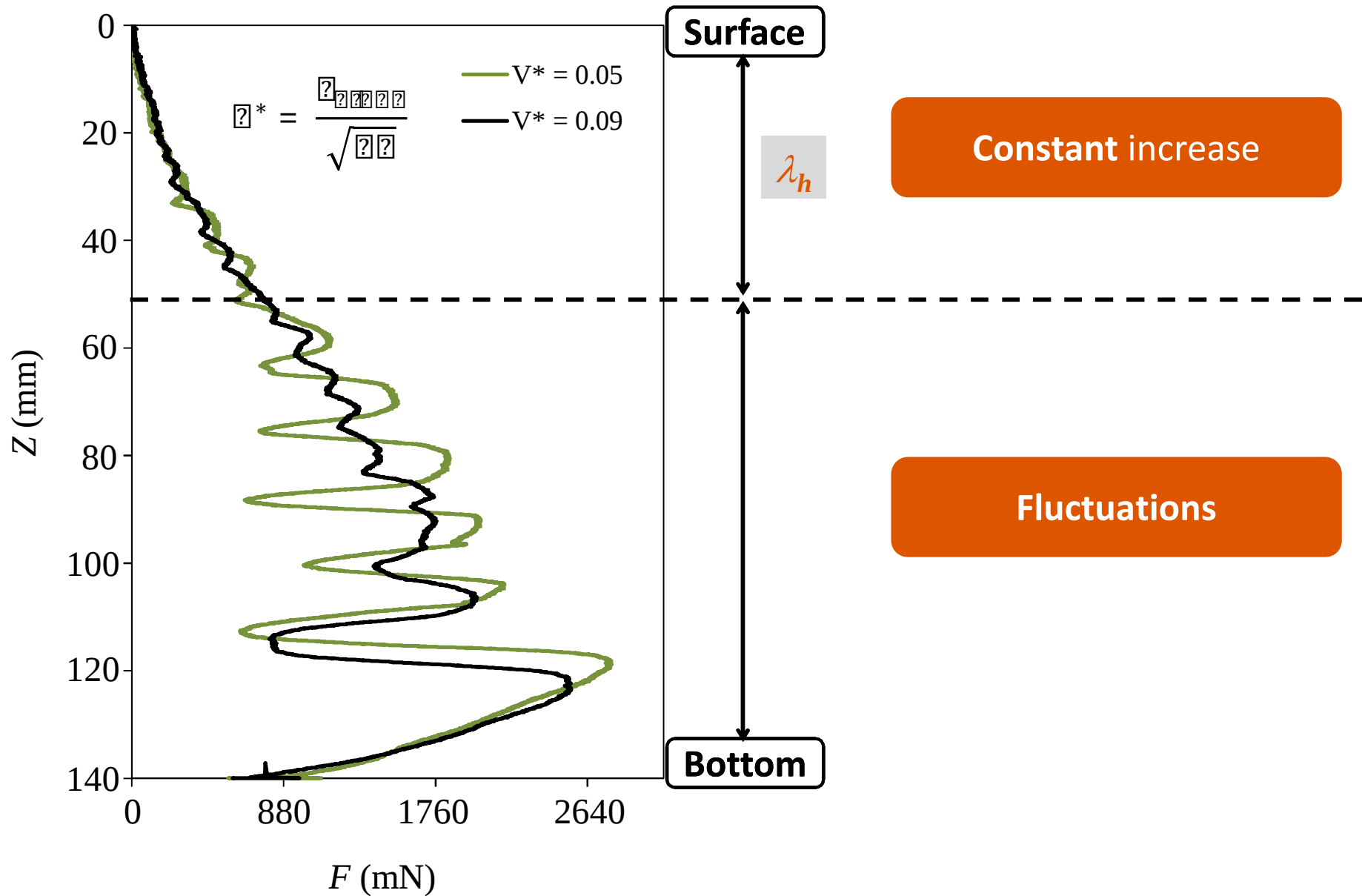


The 2D local force shape seems correlated with the bed implementation

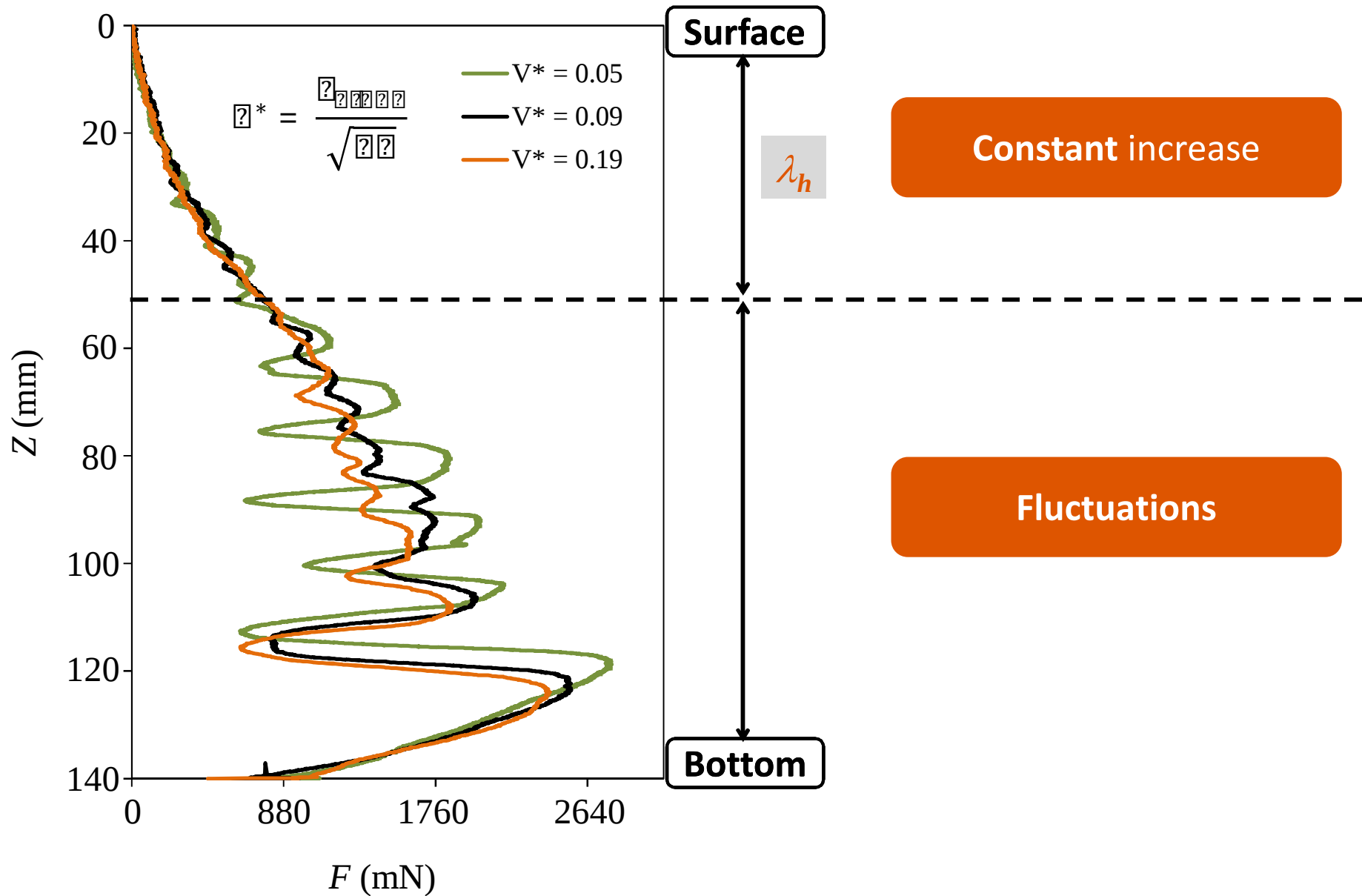
Local vertical force profile ($x=0$ mm) in dynamic conditions



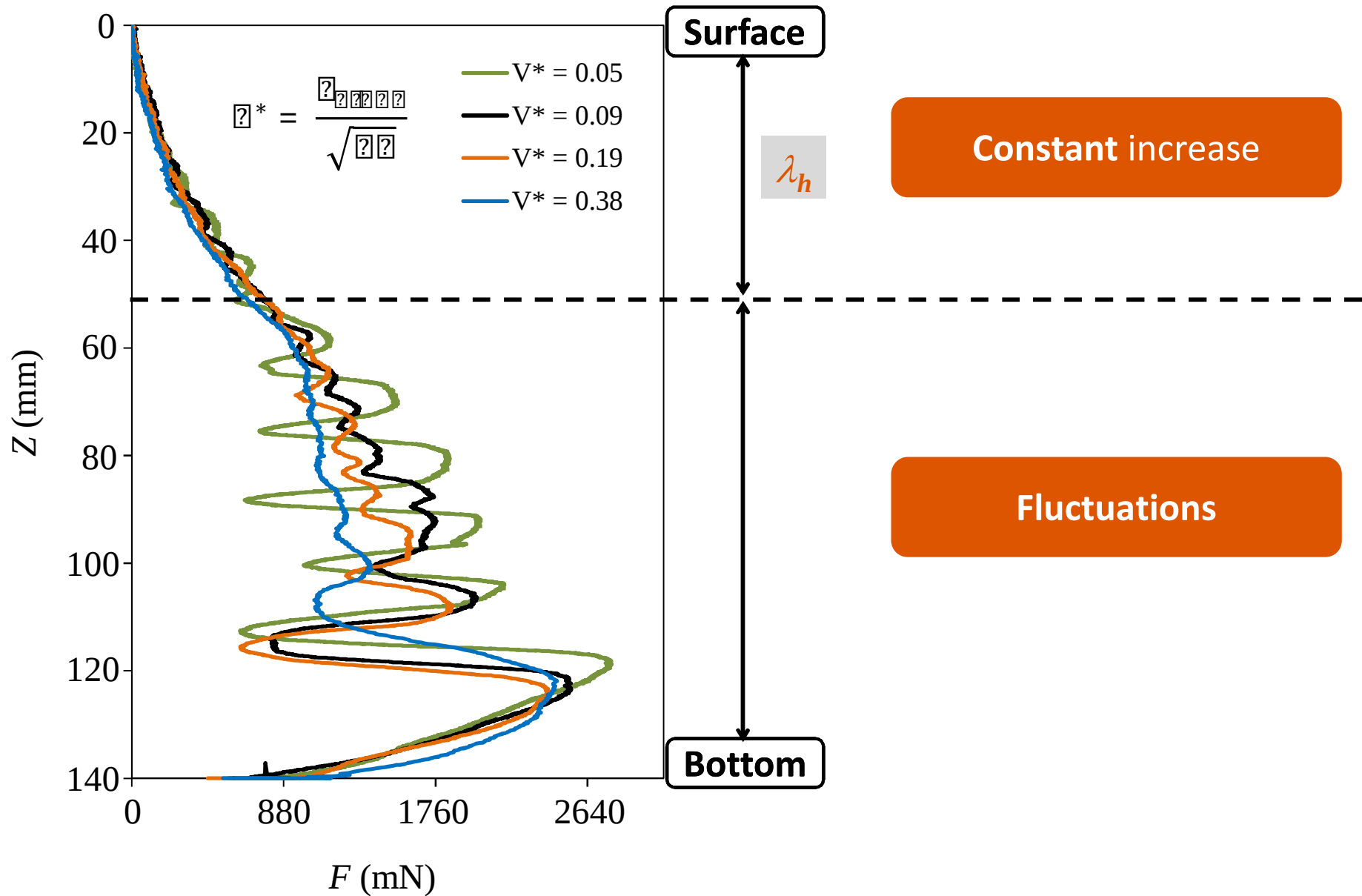
Local vertical force profile ($x=0$ mm) in dynamic conditions



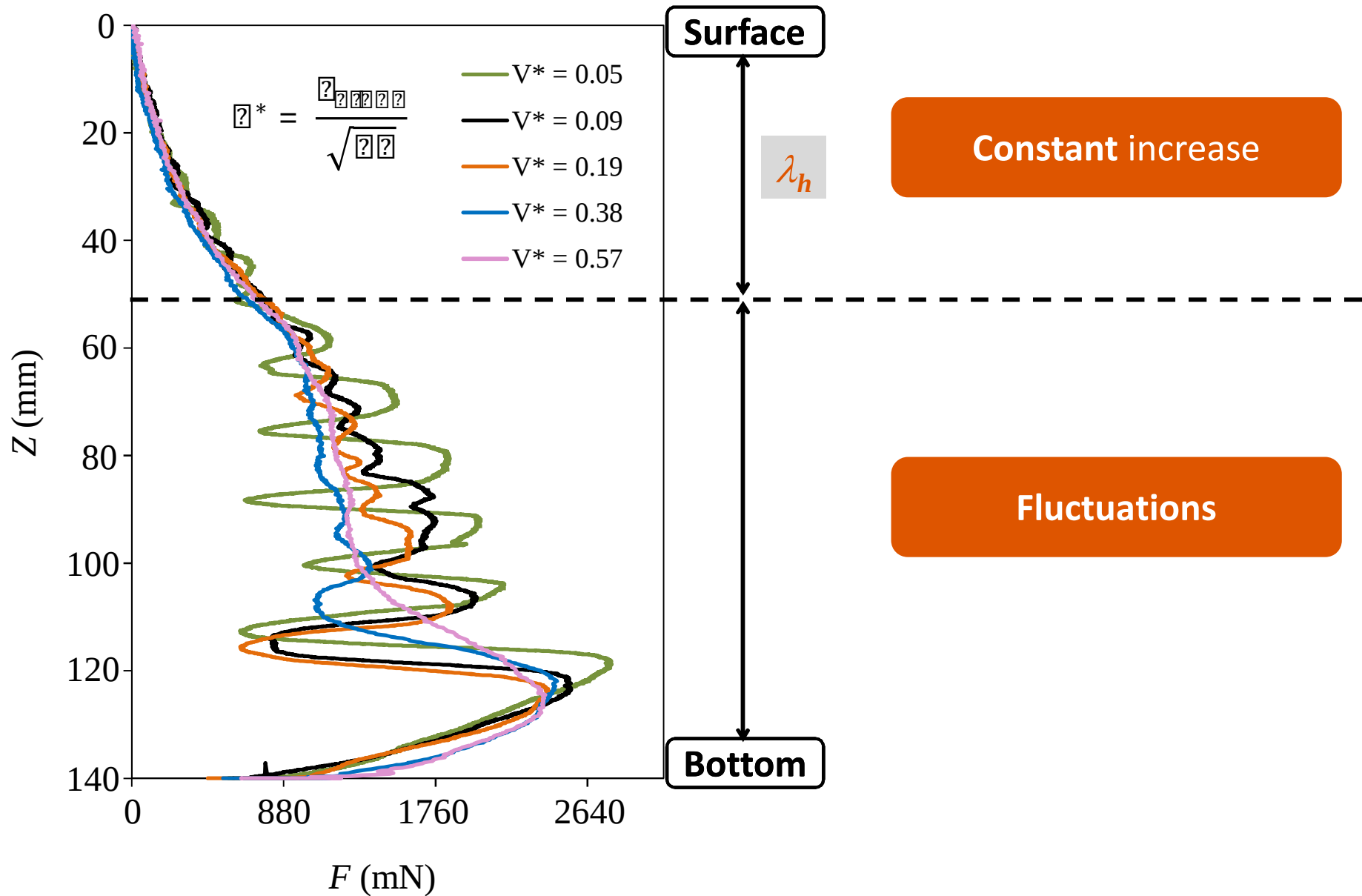
Local vertical force profile ($x=0$ mm) in dynamic conditions



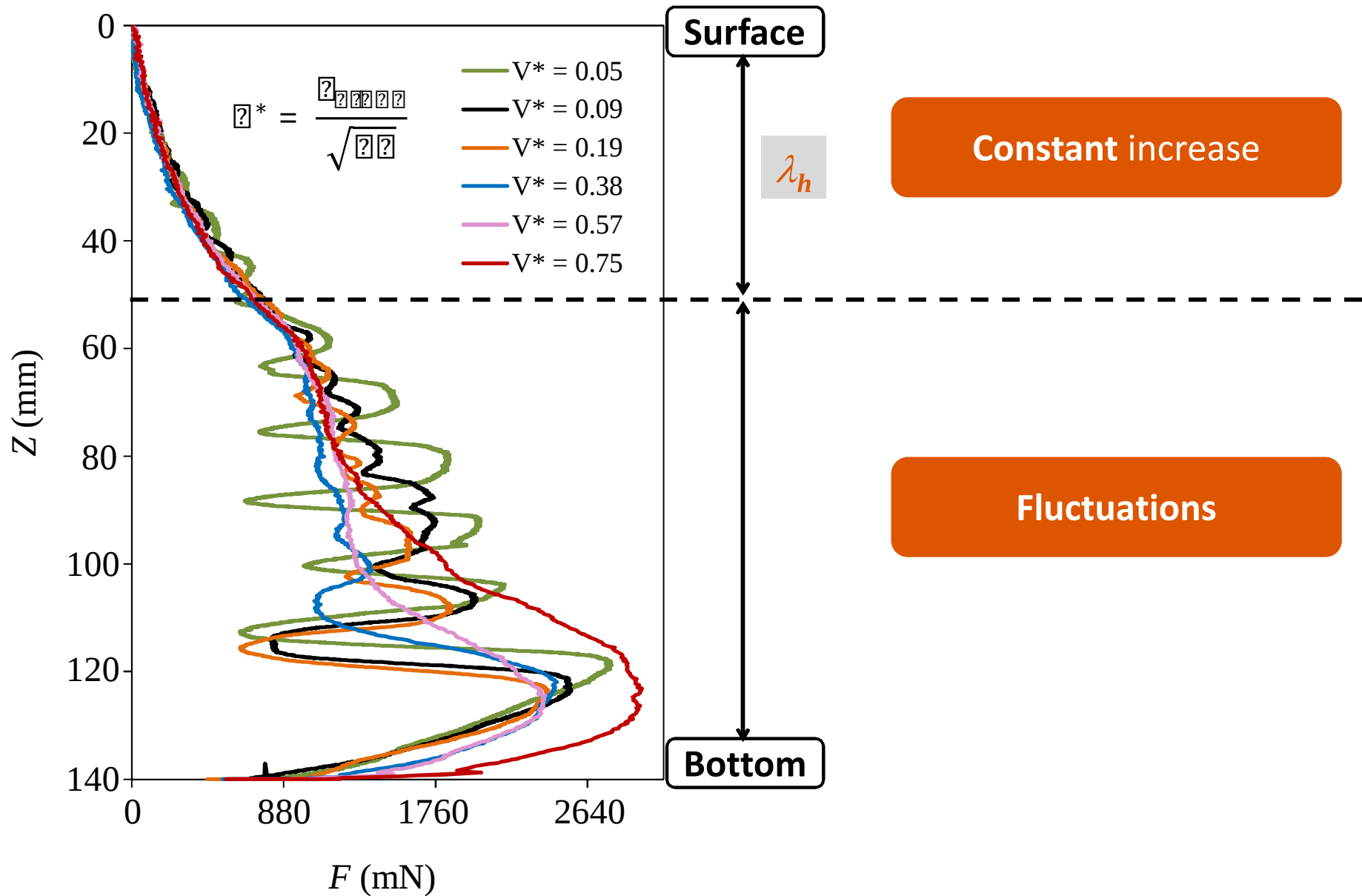
Local vertical force profile ($x=0$ mm) in dynamic conditions



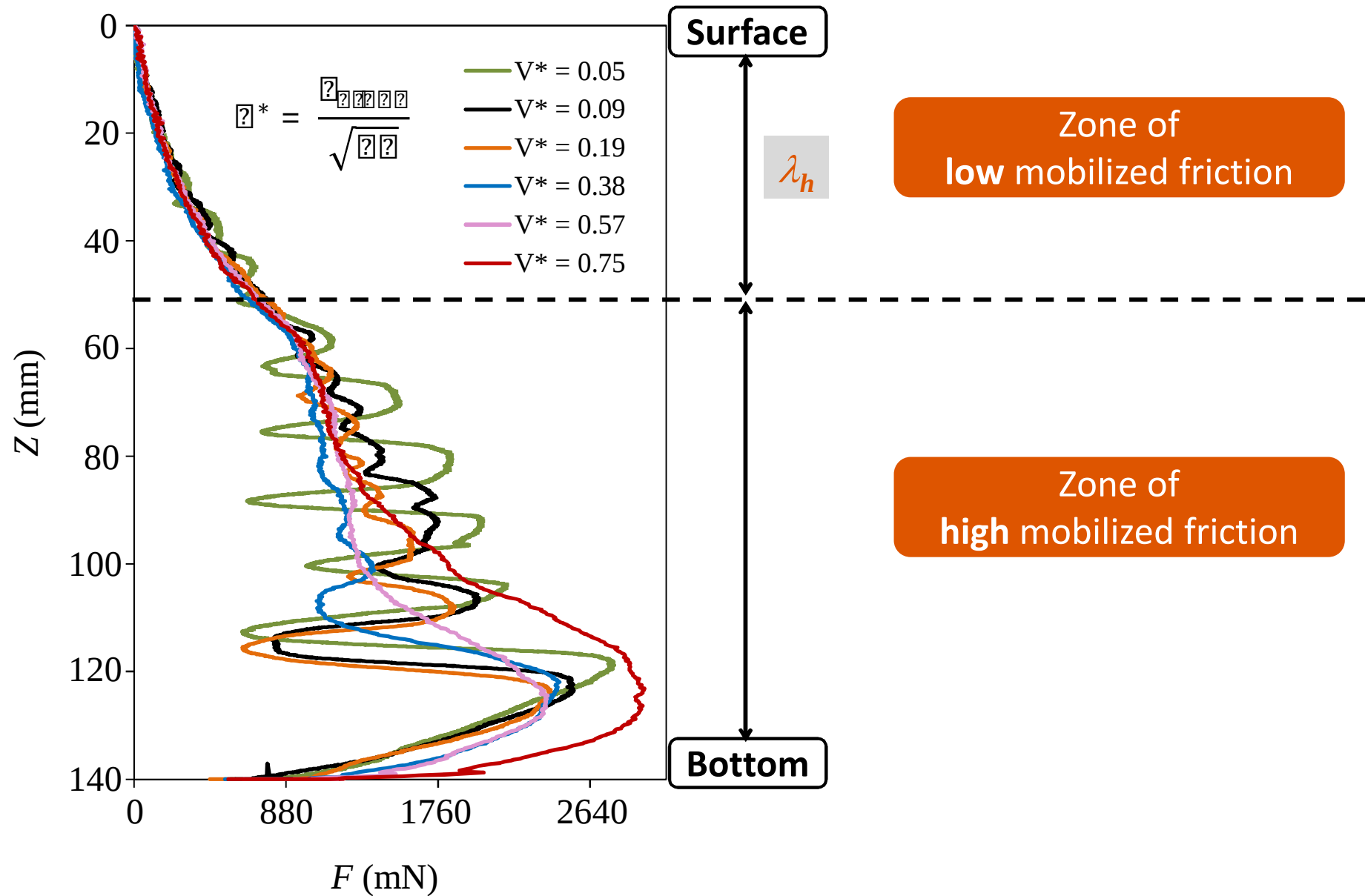
Local vertical force profile ($x=0$ mm) in dynamic conditions



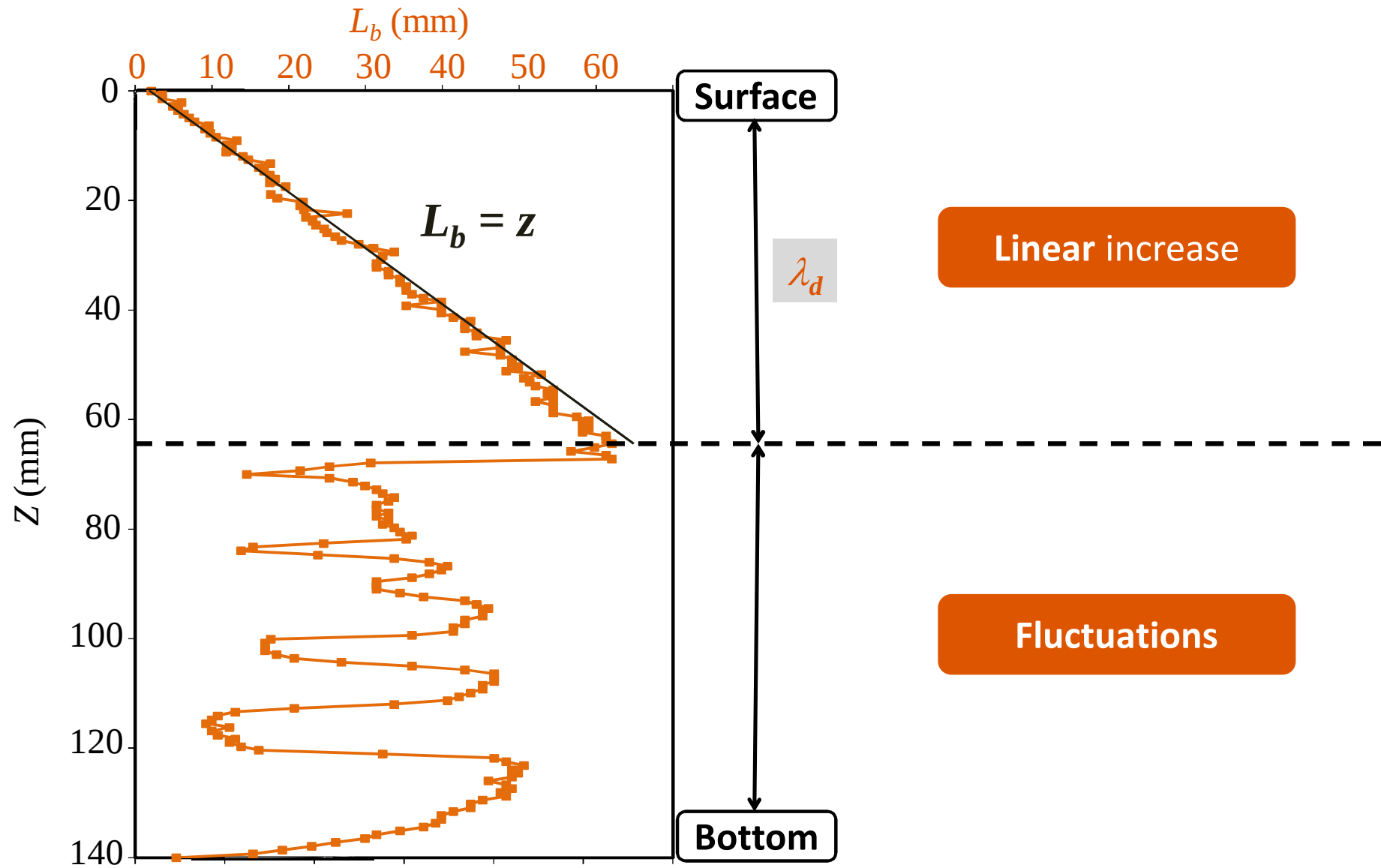
Local vertical force profile ($x=0$ mm) in dynamic conditions



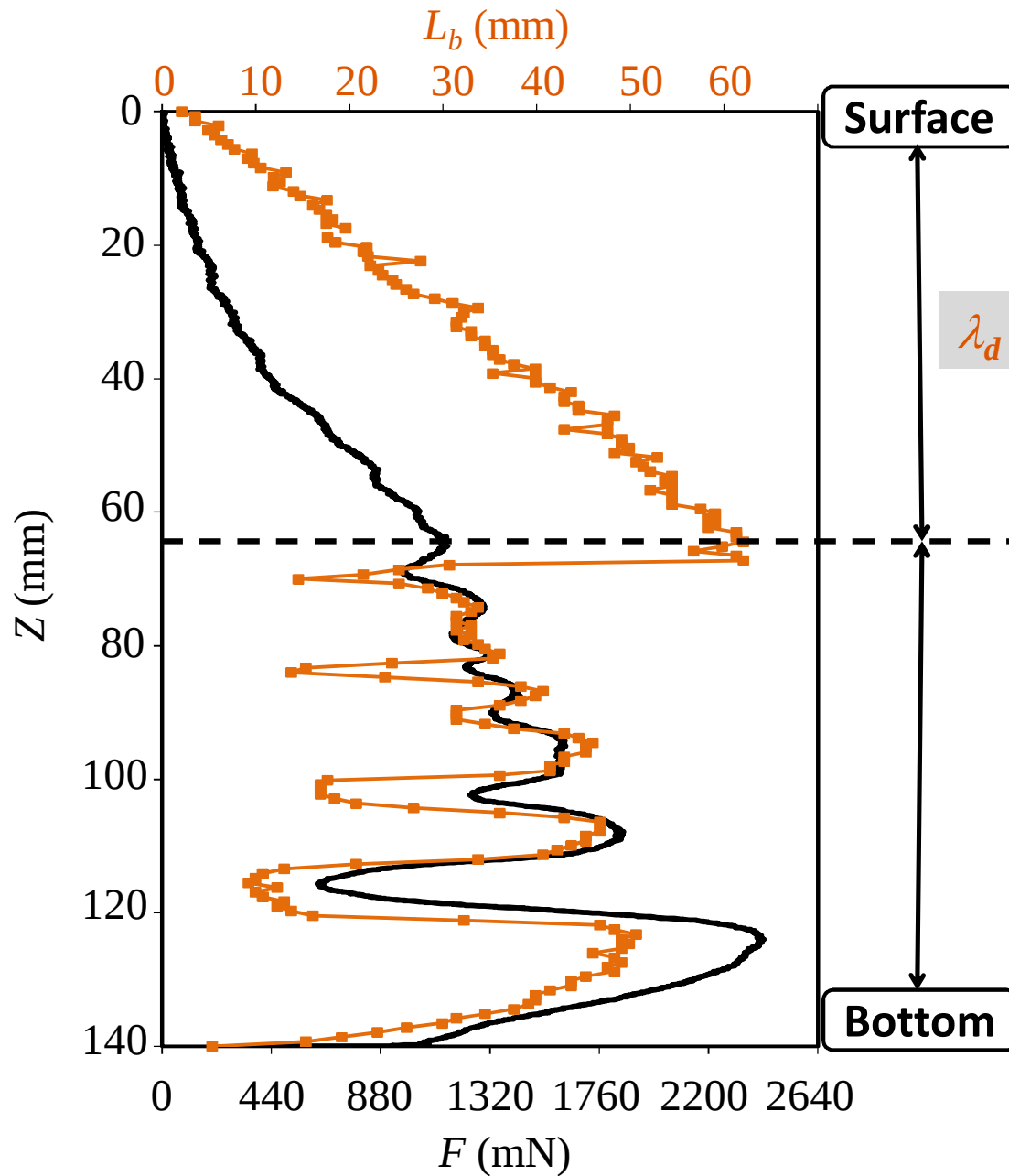
Local vertical force profile ($x=0$ mm) in dynamic conditions



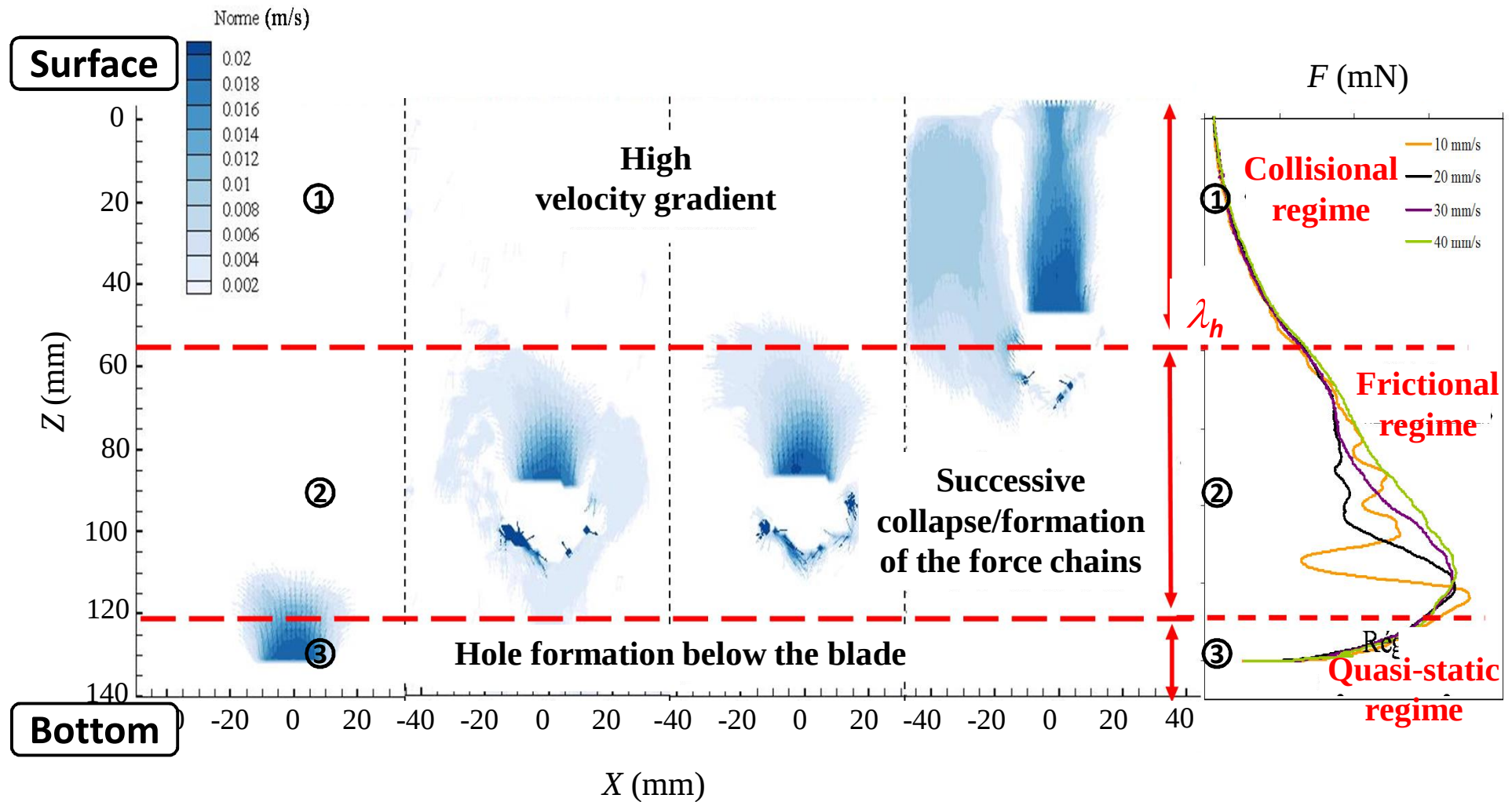
Height of the vertical velocity gradient



Height of the vertical velocity gradient/Local vertical force



Height of the vertical velocity gradient/Local vertical force



Conclusion

Flow regime experimental characterization of an **ensiled granular media** with a **free surface** and submitted to an **intruder**

Perspective

Deeper analysis of **PIV** data
to better **quantify** the **mobility** of granular matter