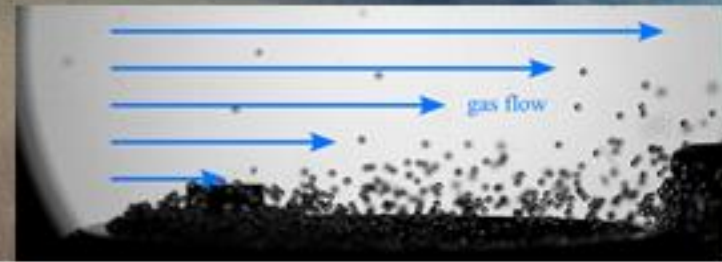




RoadMap Final Workshop



UDE Final Results
Tim Becker



UNIVERSITÄT
DUISBURG
ESSEN

Offen im Denken



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052

19/09/2023





Motivation



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052





Motivation

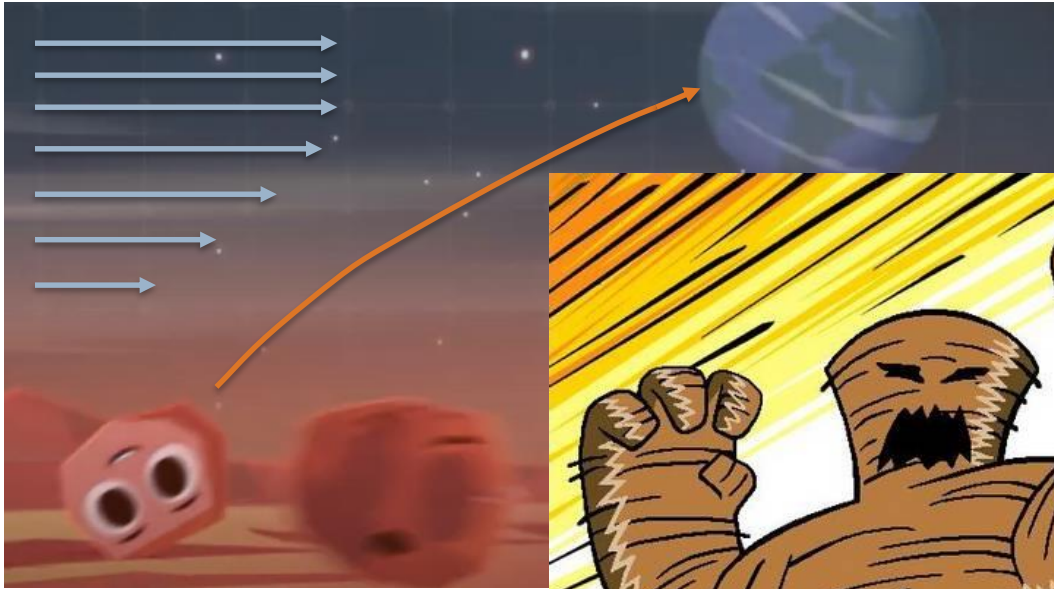


Direct Lifting



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Direct Lifting

Dust Devils



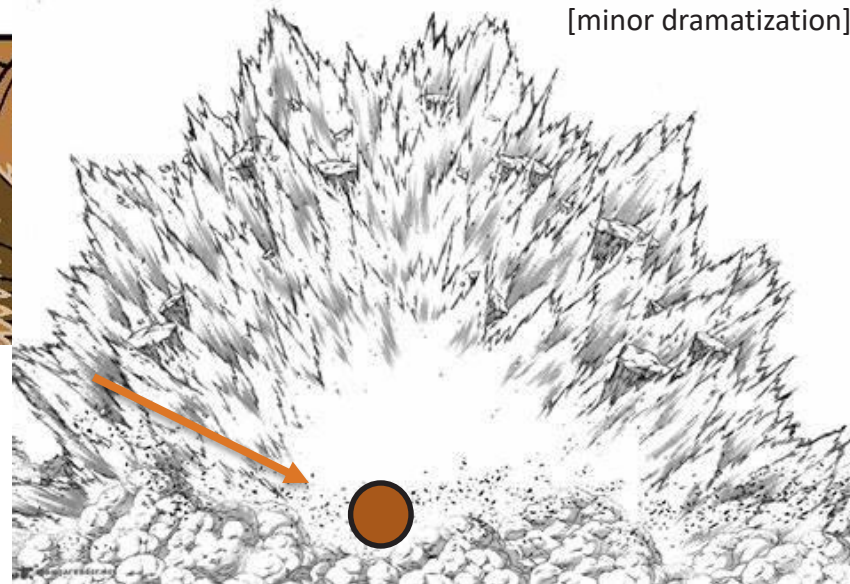


Direct Lifting



Saltation

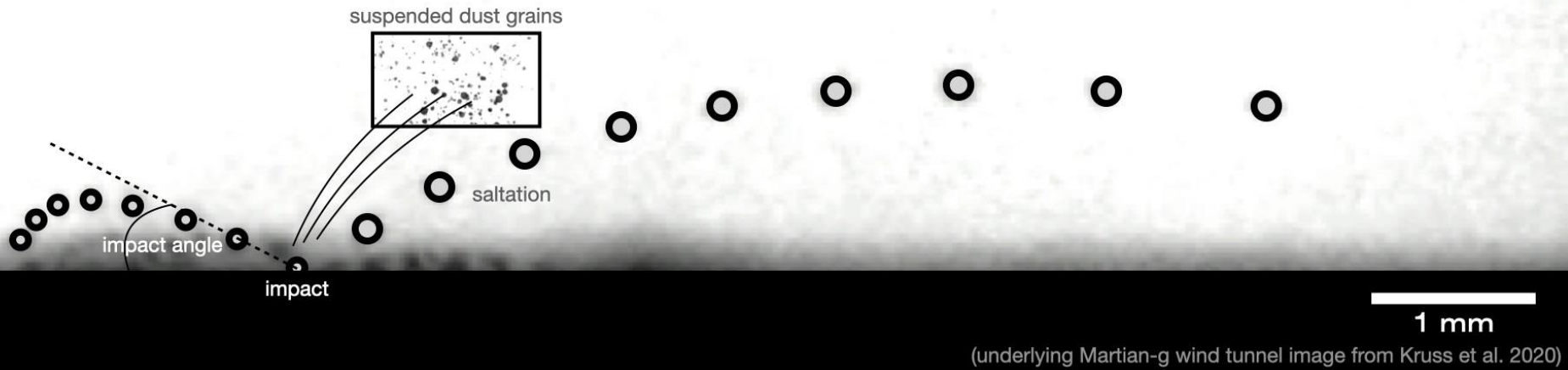
Dust Devils



[minor dramatization]



Motivation



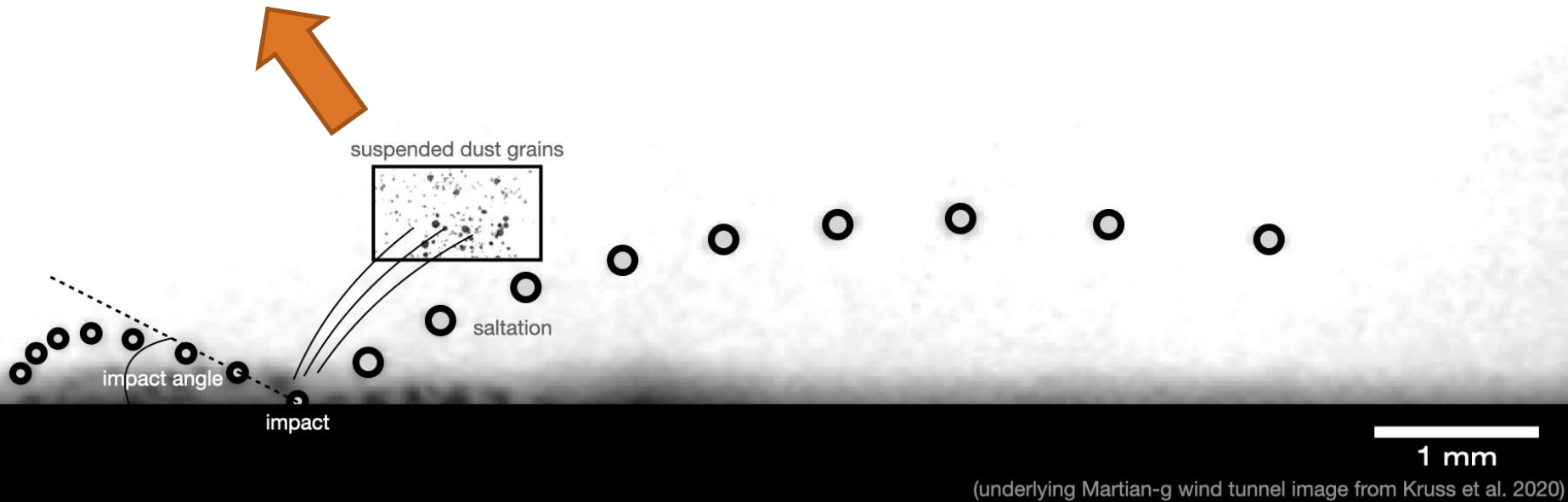
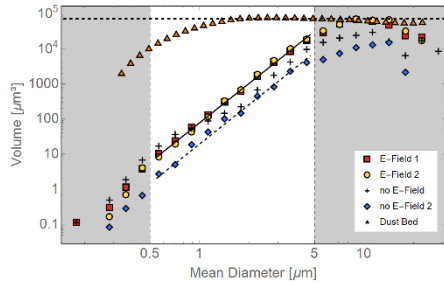
(underlying Martian-g wind tunnel image from Kruss et al. 2020)



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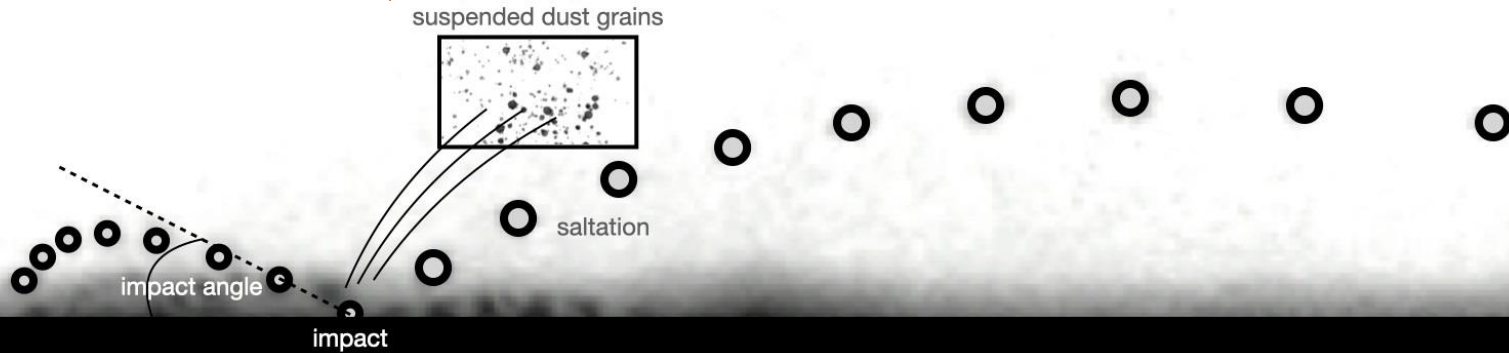
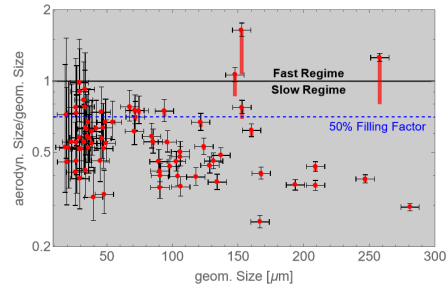
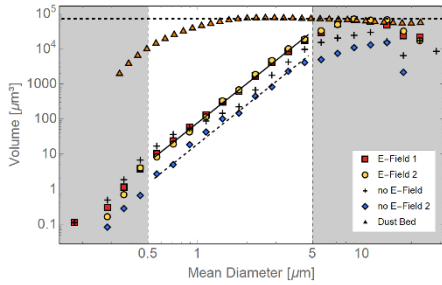
1. Size Distribution



(underlying Martian-g wind tunnel image from Kruss et al. 2020)

2. Aerodynamic Properties

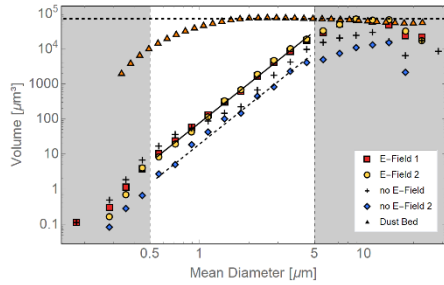
1. Size Distribution



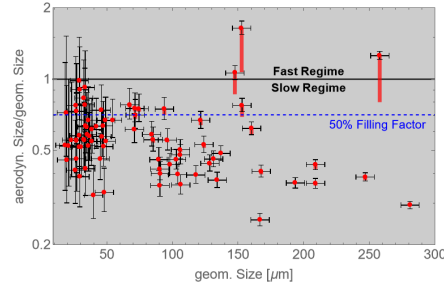
1 mm

(underlying Martian-g wind tunnel image from Kruss et al. 2020)

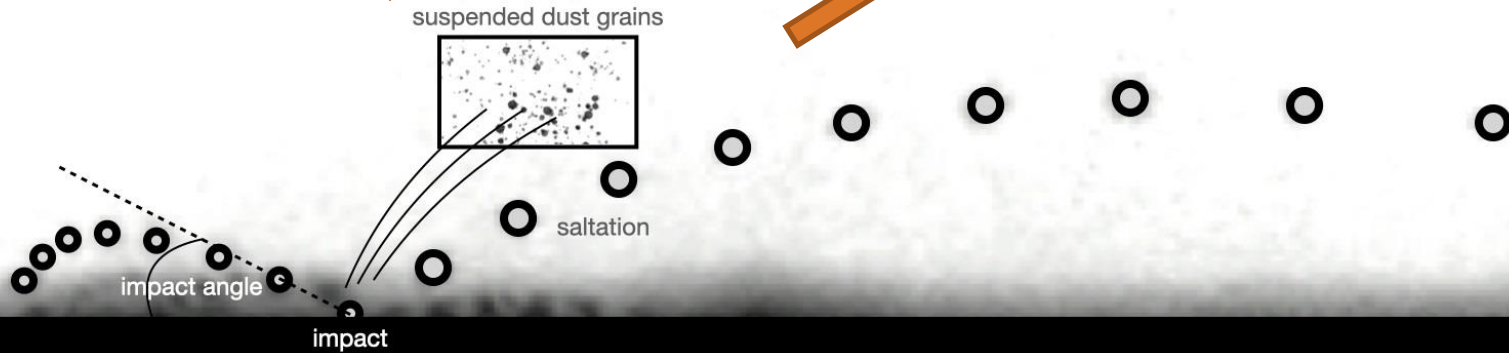
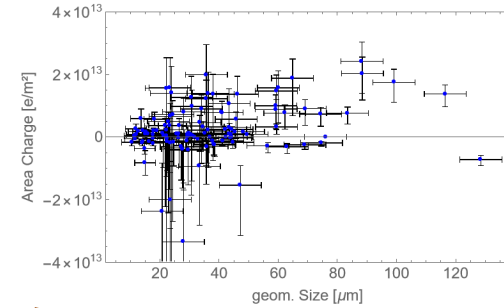
1. Size Distribution



2. Aerodynamic Properties



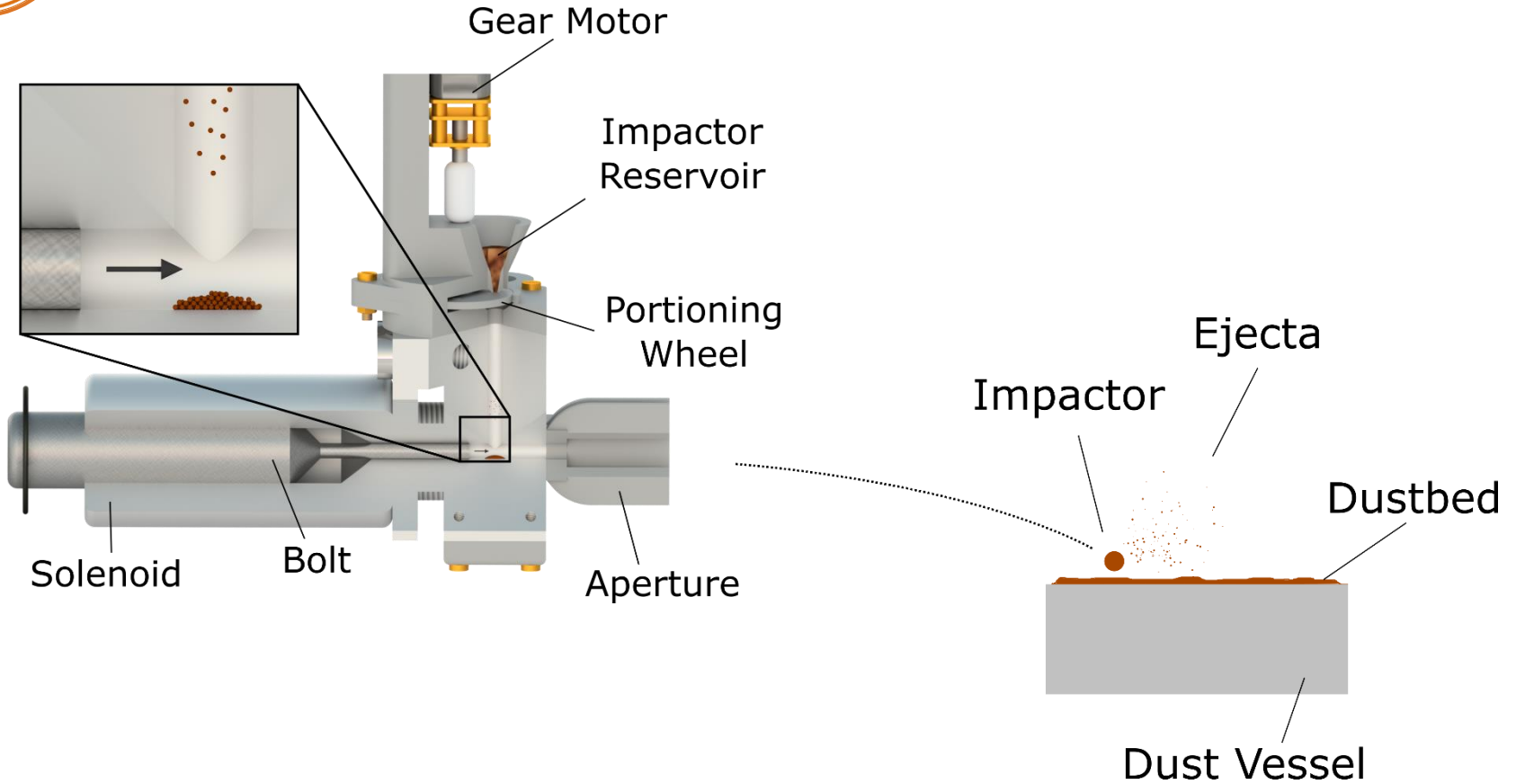
3. Electric Properties



(underlying Martian-g wind tunnel image from Kruss et al. 2020)



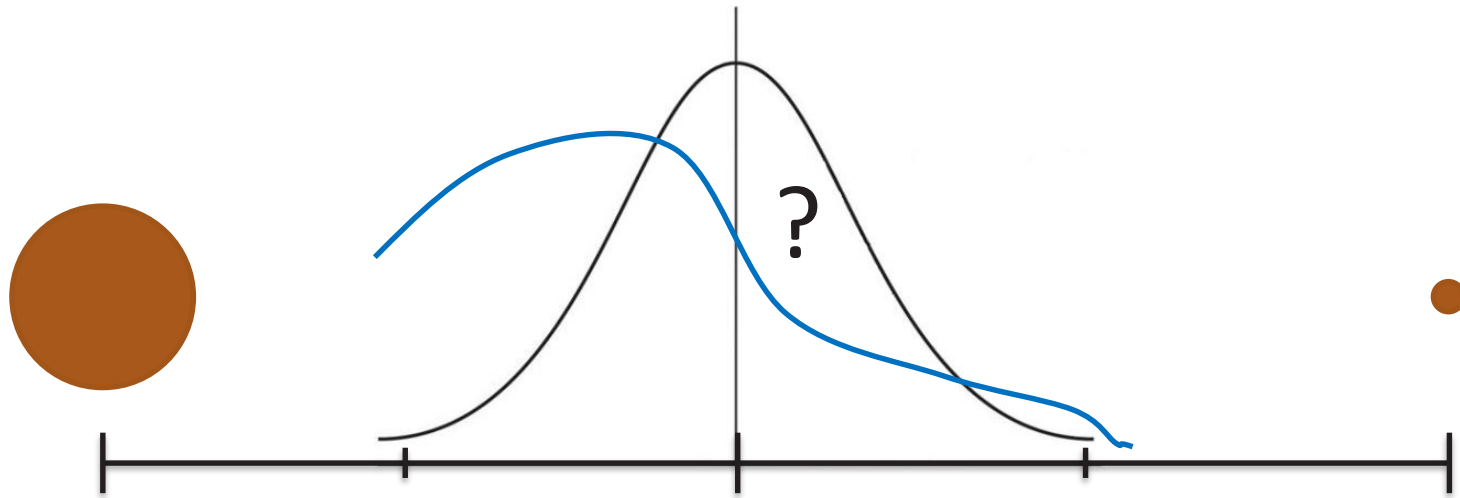
Experiment - Default



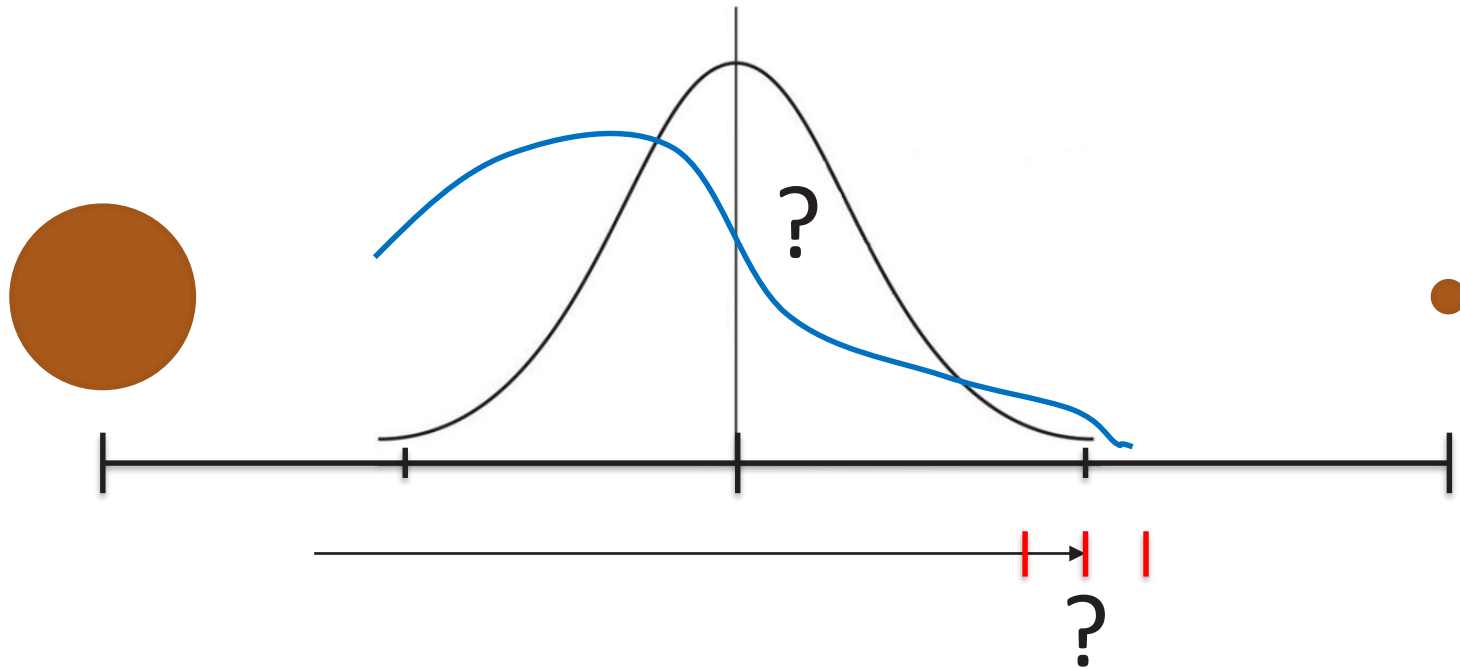
1. Size Distribution



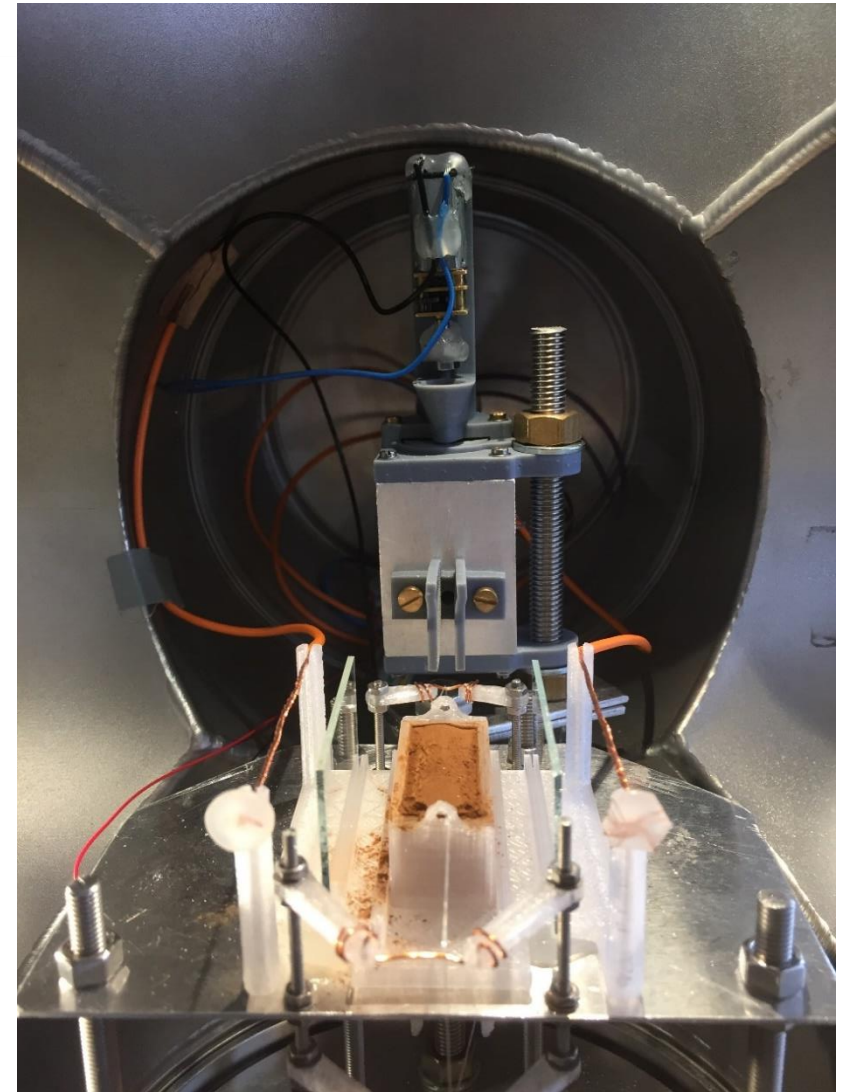
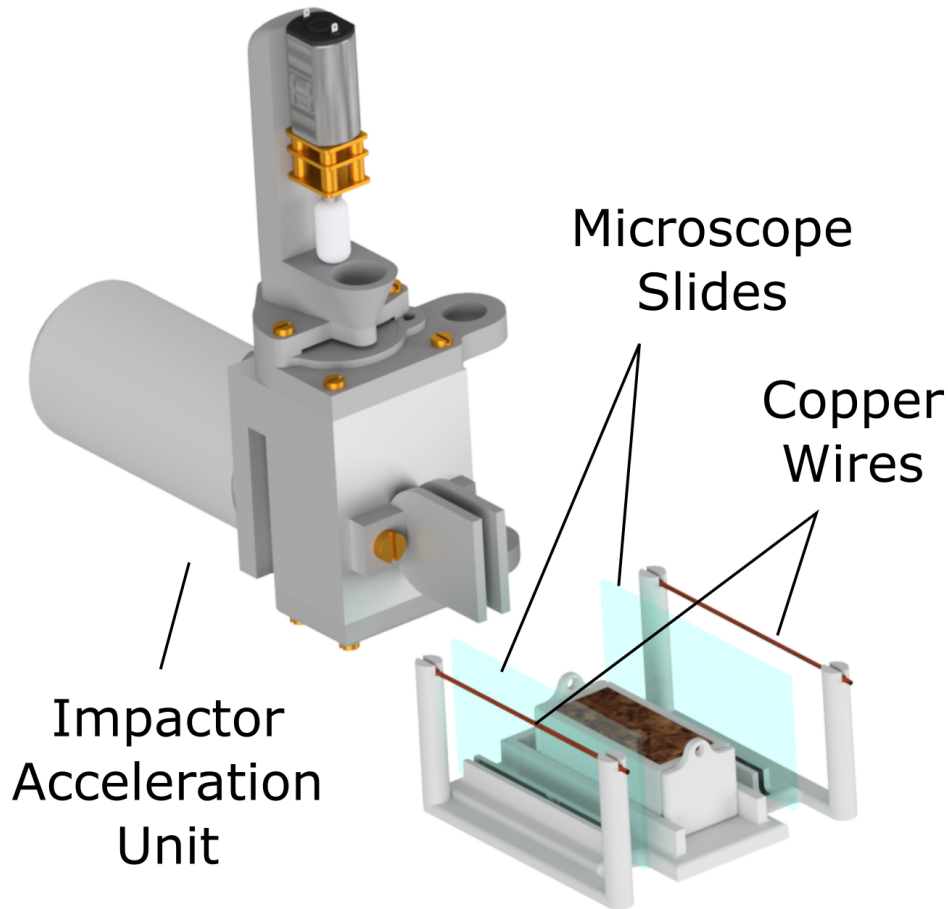
1. Size Distribution



1. Size Distribution



Experiment: Size Distribution





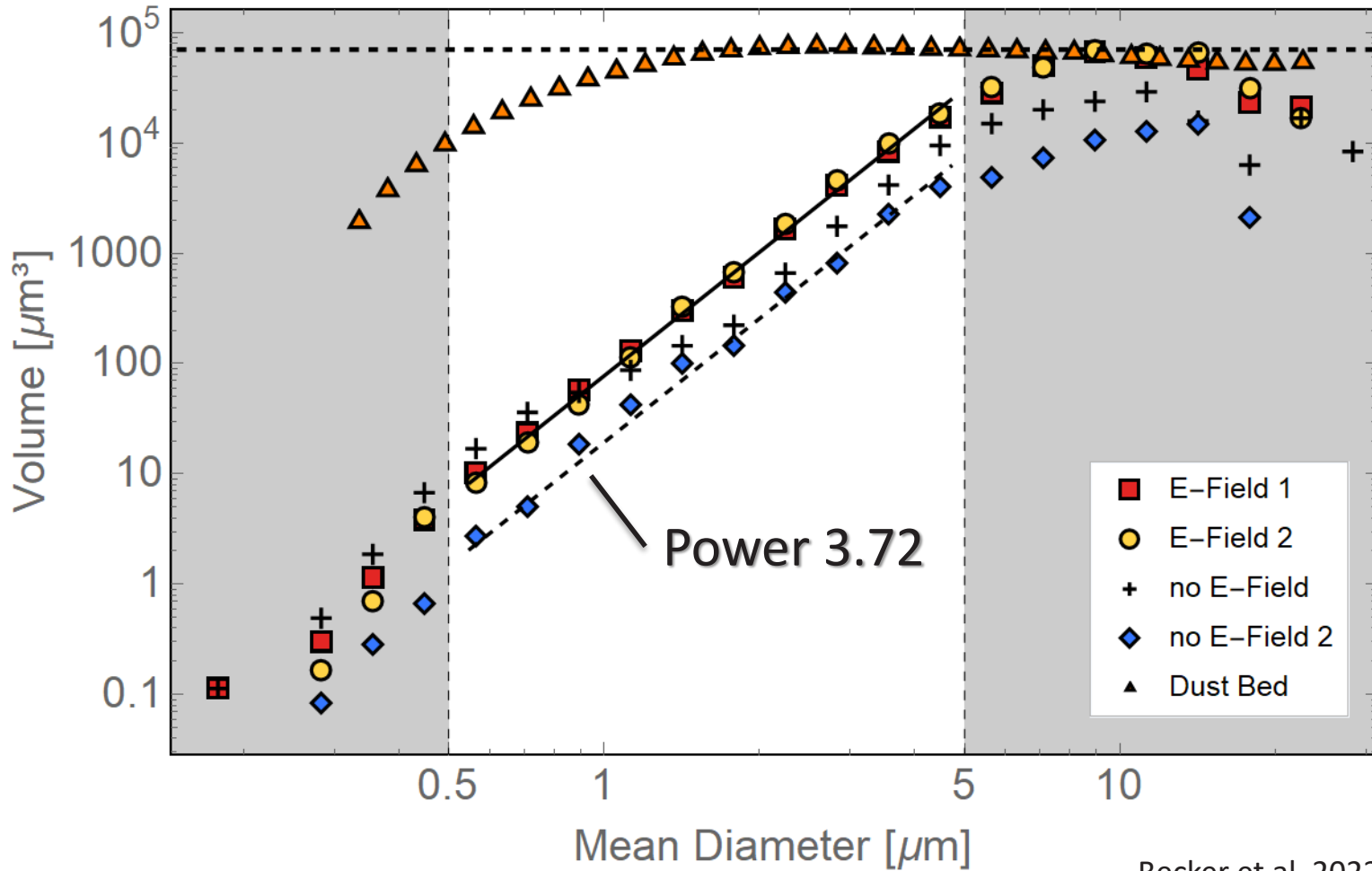
Result: Size Distribution



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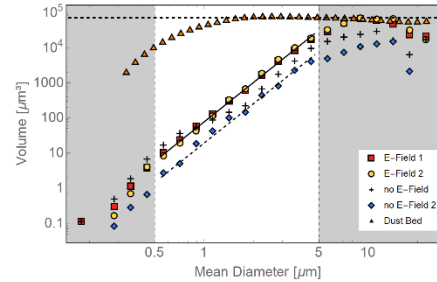
Result: Size Distribution



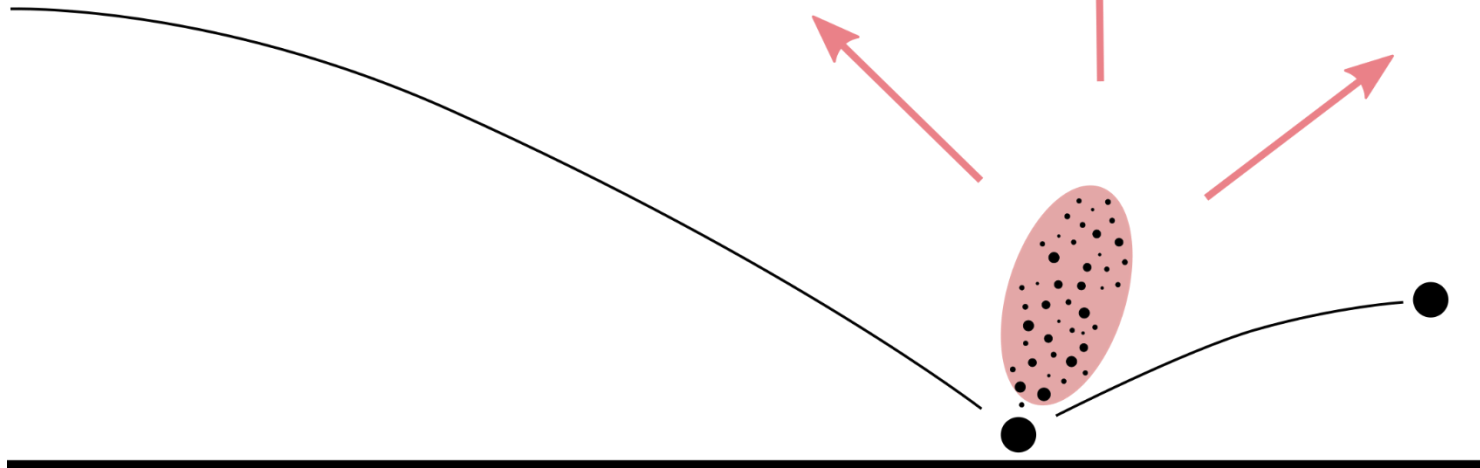
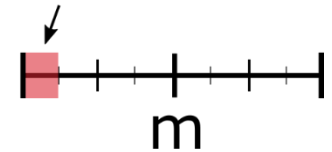
Becker et al. 2022

Result: Size Distribution

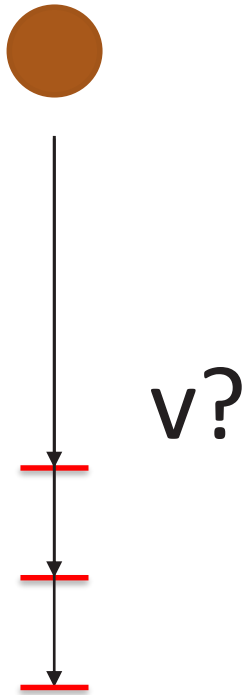
**~0.02% of impactor
Mass for <math><3\mu\text{m}</math> particles**



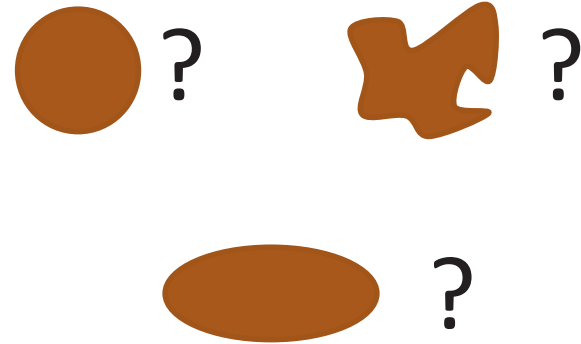
Yes!



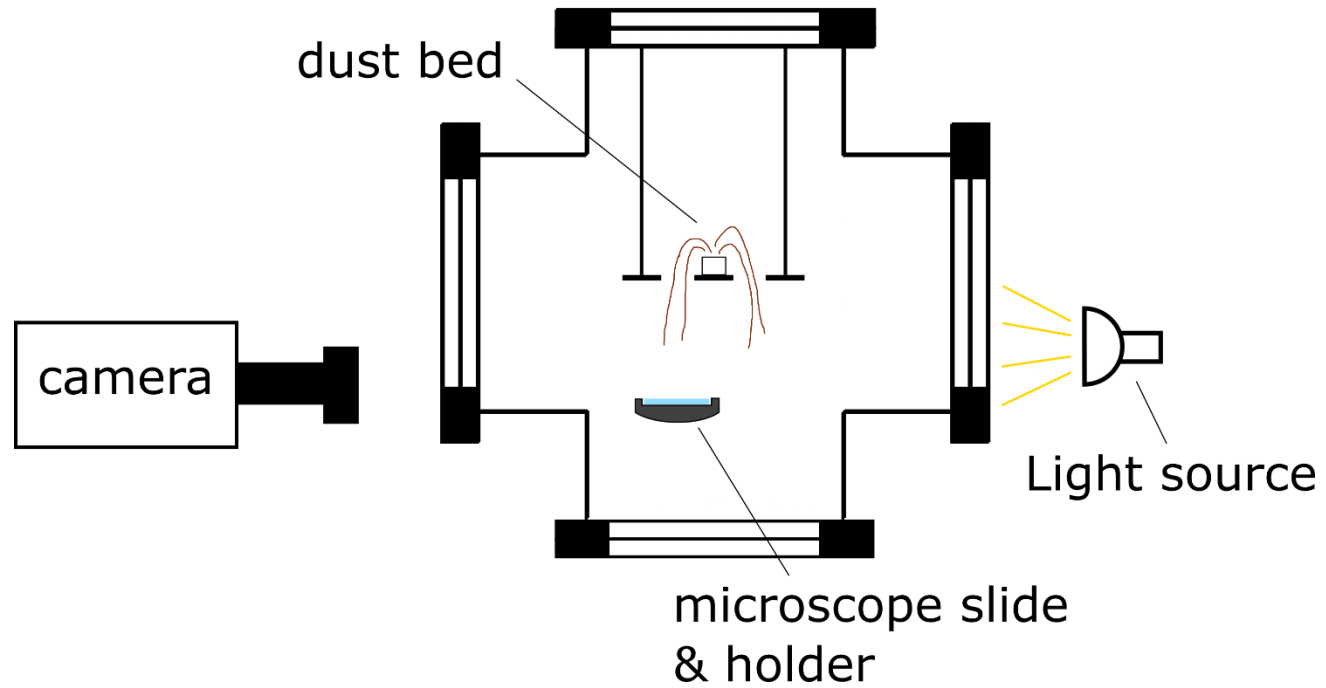
2. Aerodynamic Properties



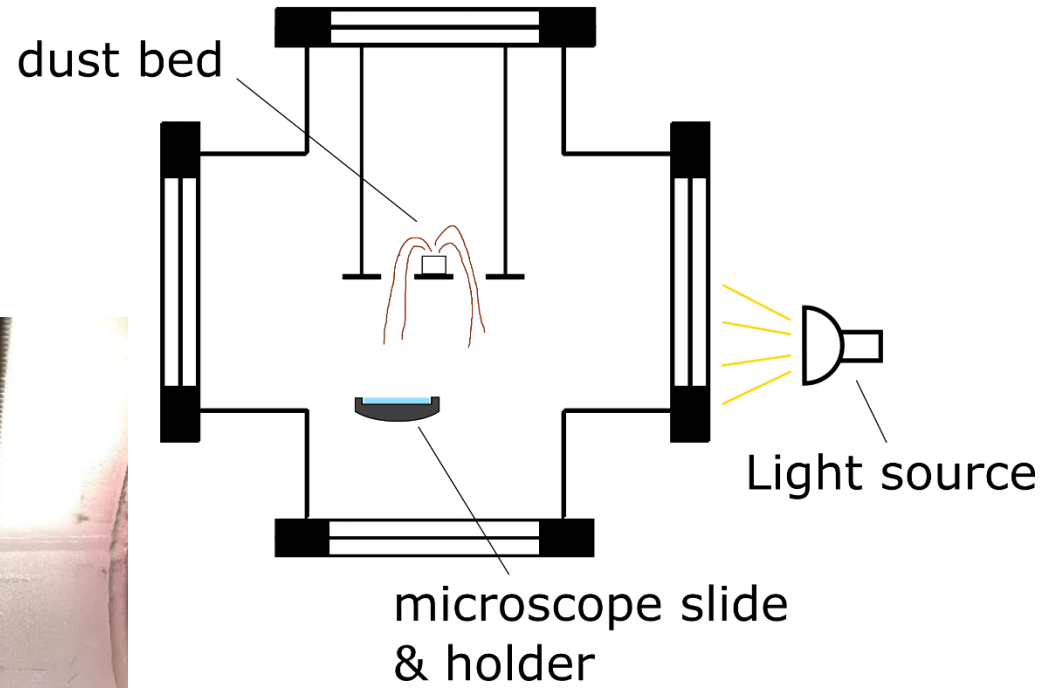
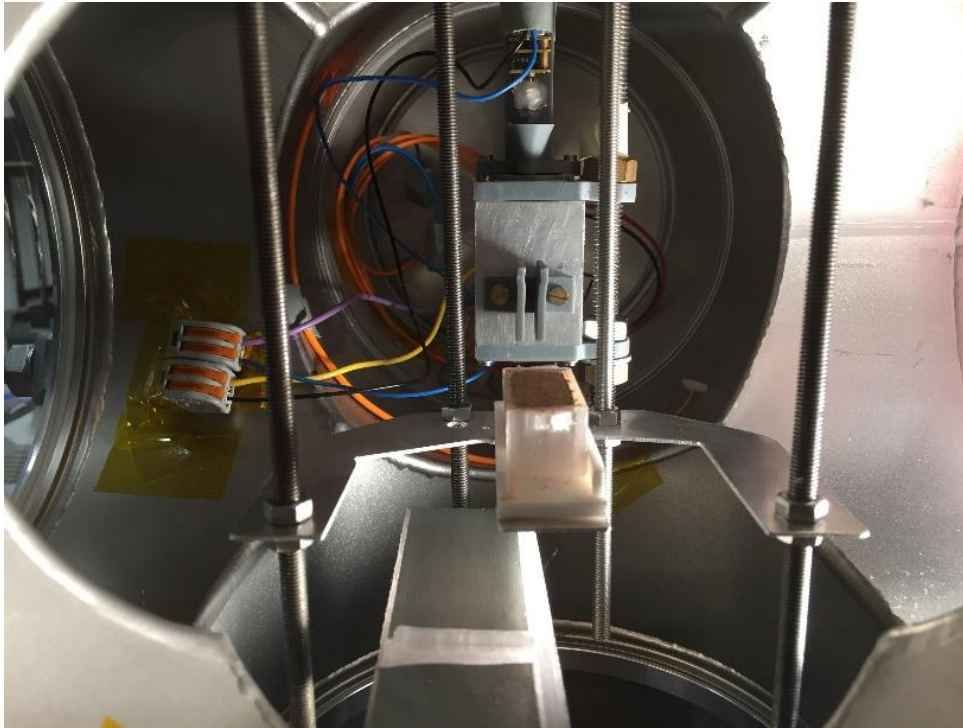
2. Aerodynamic Properties



Experiment: Aerodynamic Properties

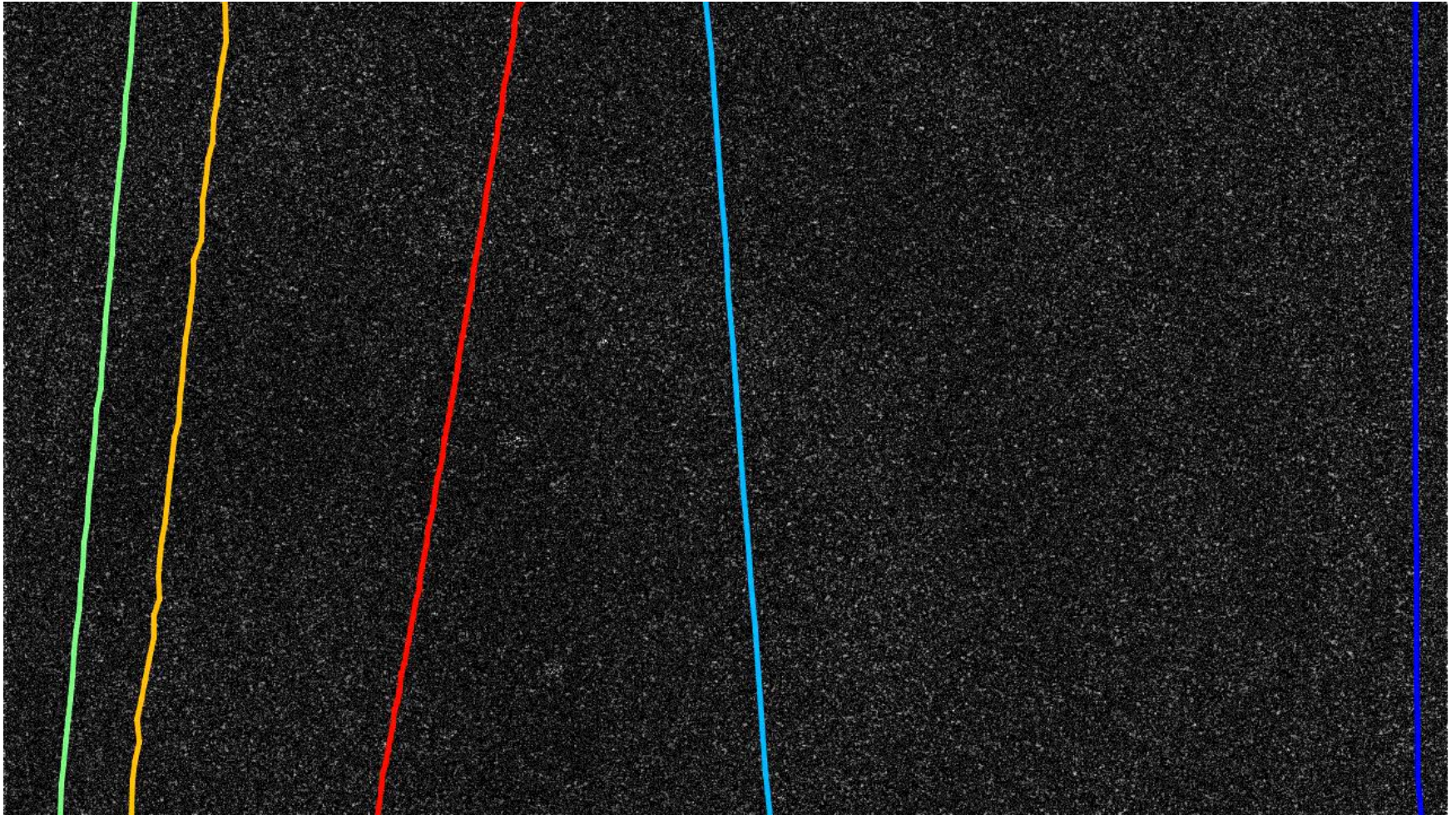


Experiment: Aerodynamic Properties





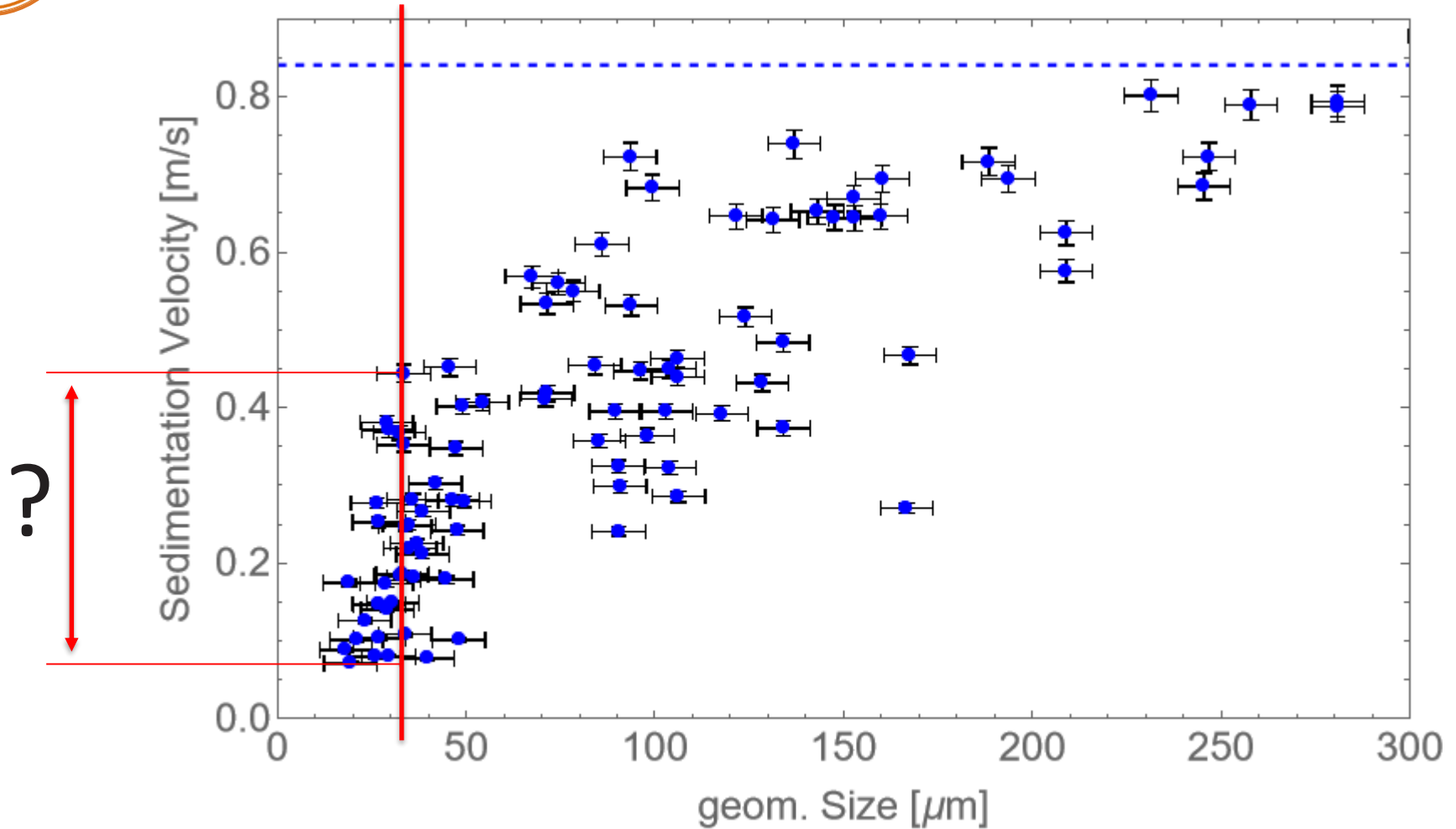
Result: Aerodynamic Properties



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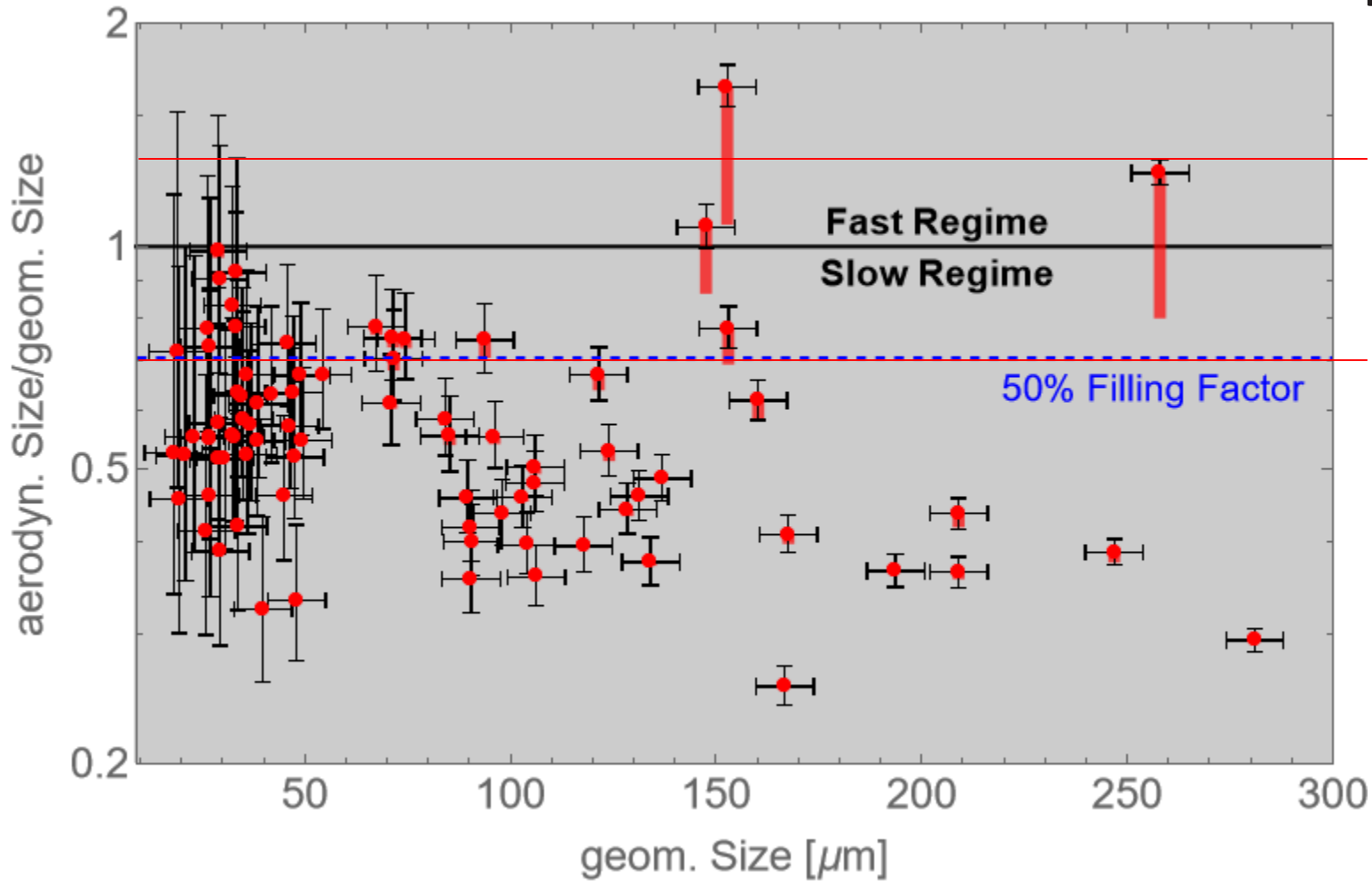


Result: Aerodynamic Properties

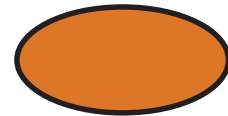
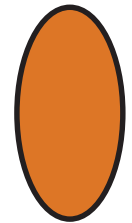




Result: Aerodynamic Properties



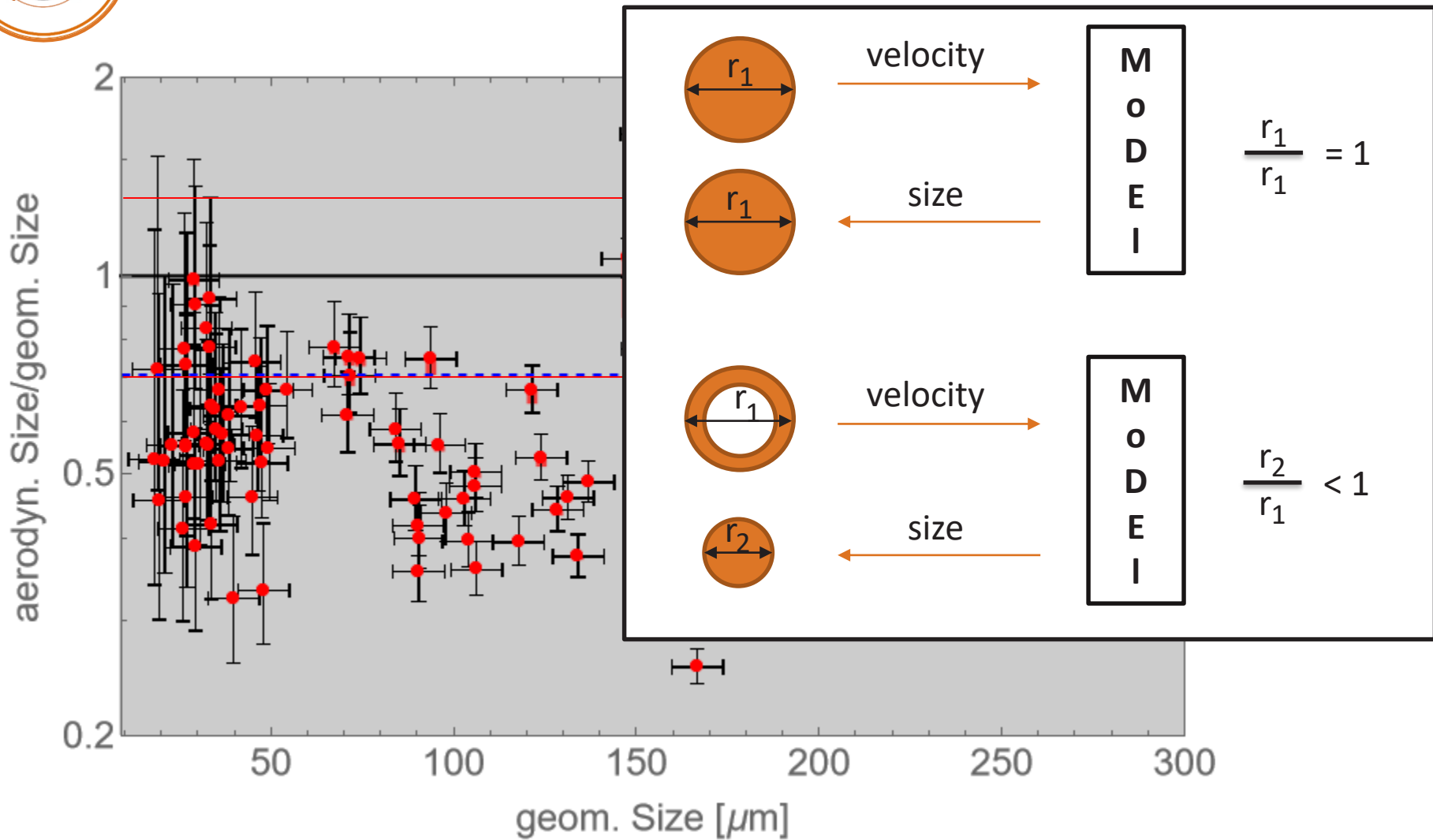
Reference:



For 2:1

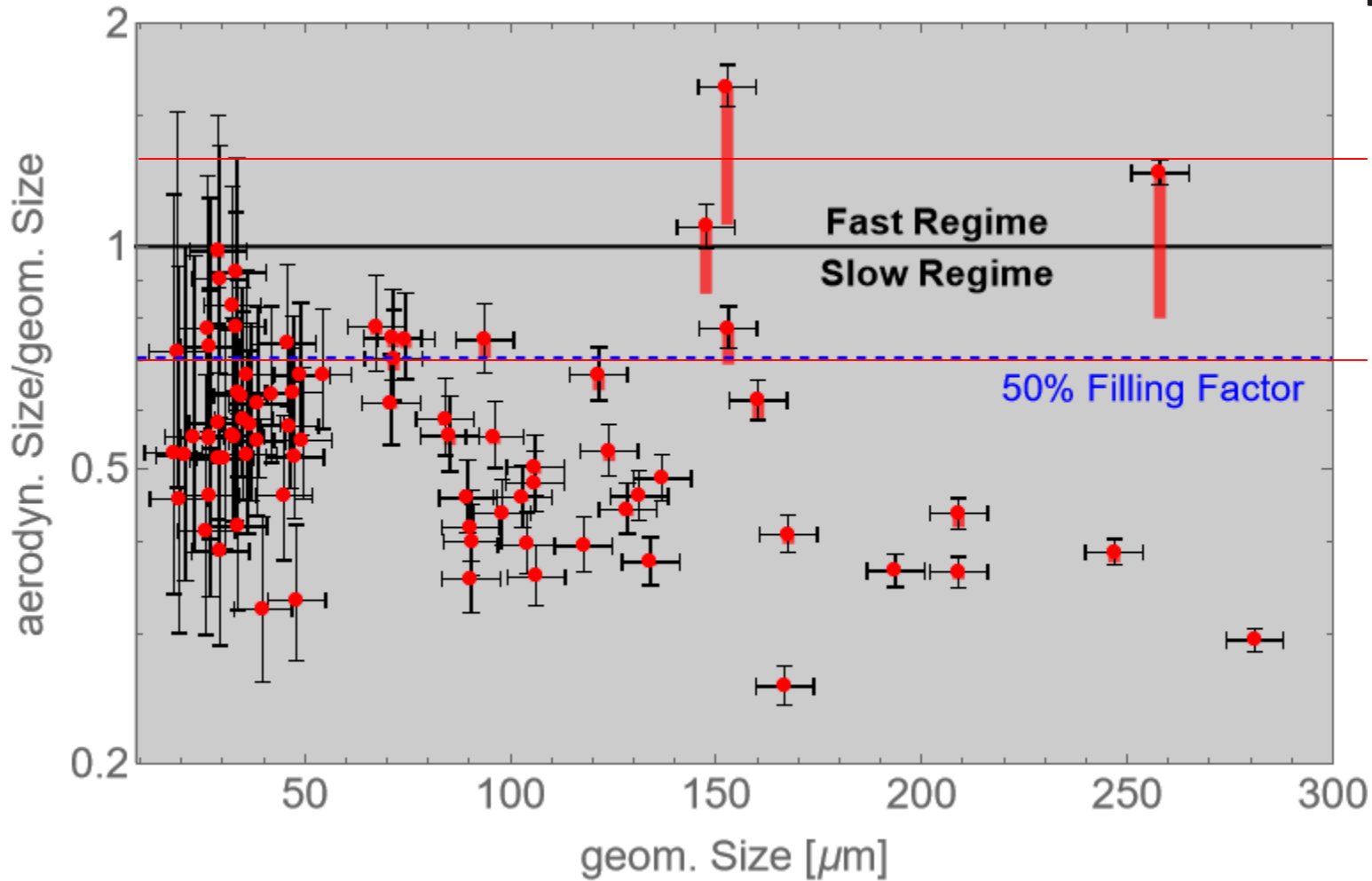


Result: Aerodynamic Properties

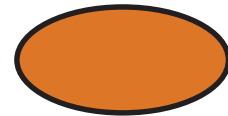
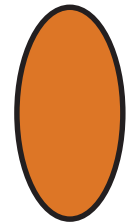




Result: Aerodynamic Properties



Reference:



For 2:1





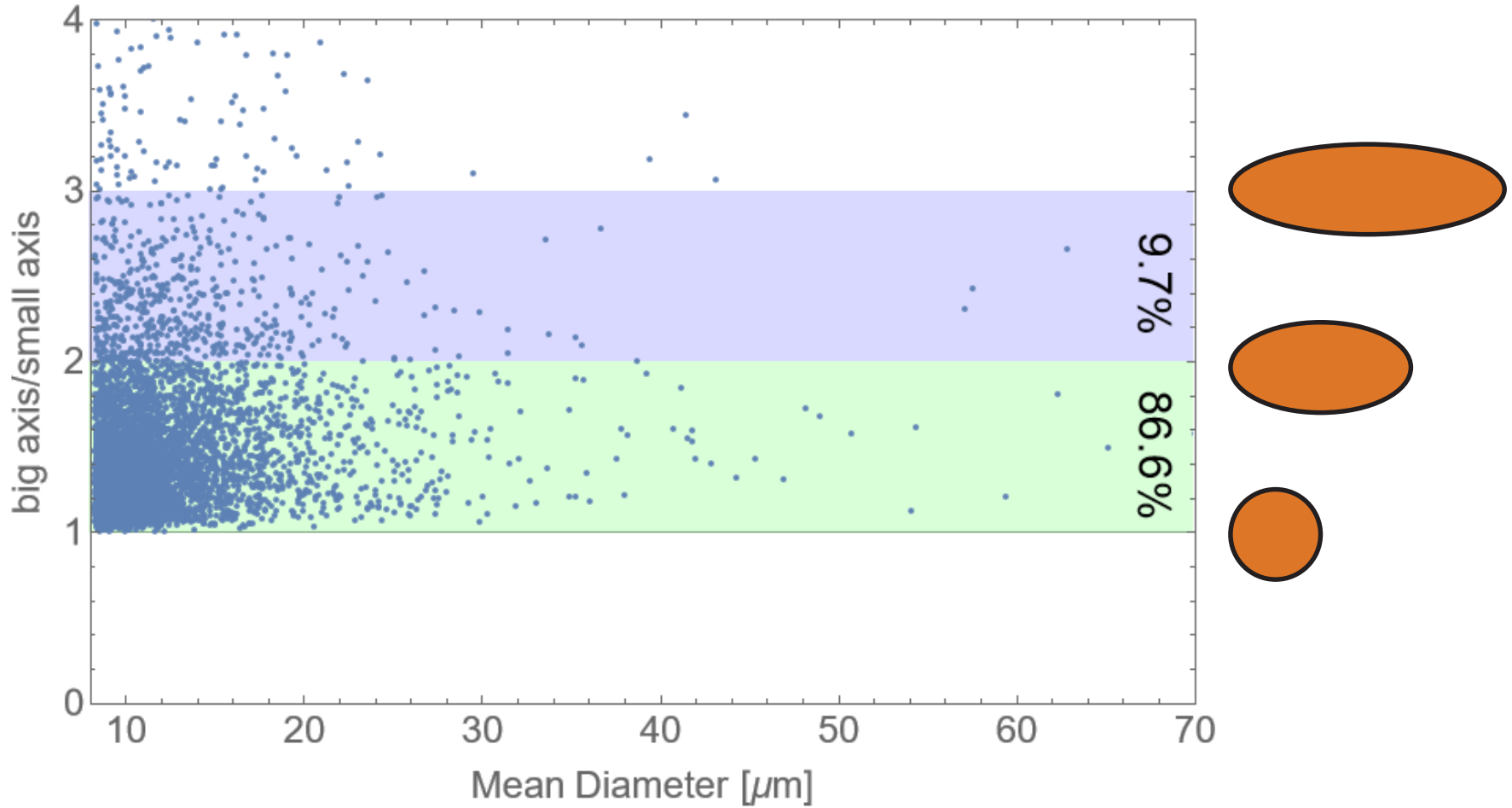
Result: Aerodynamic Properties



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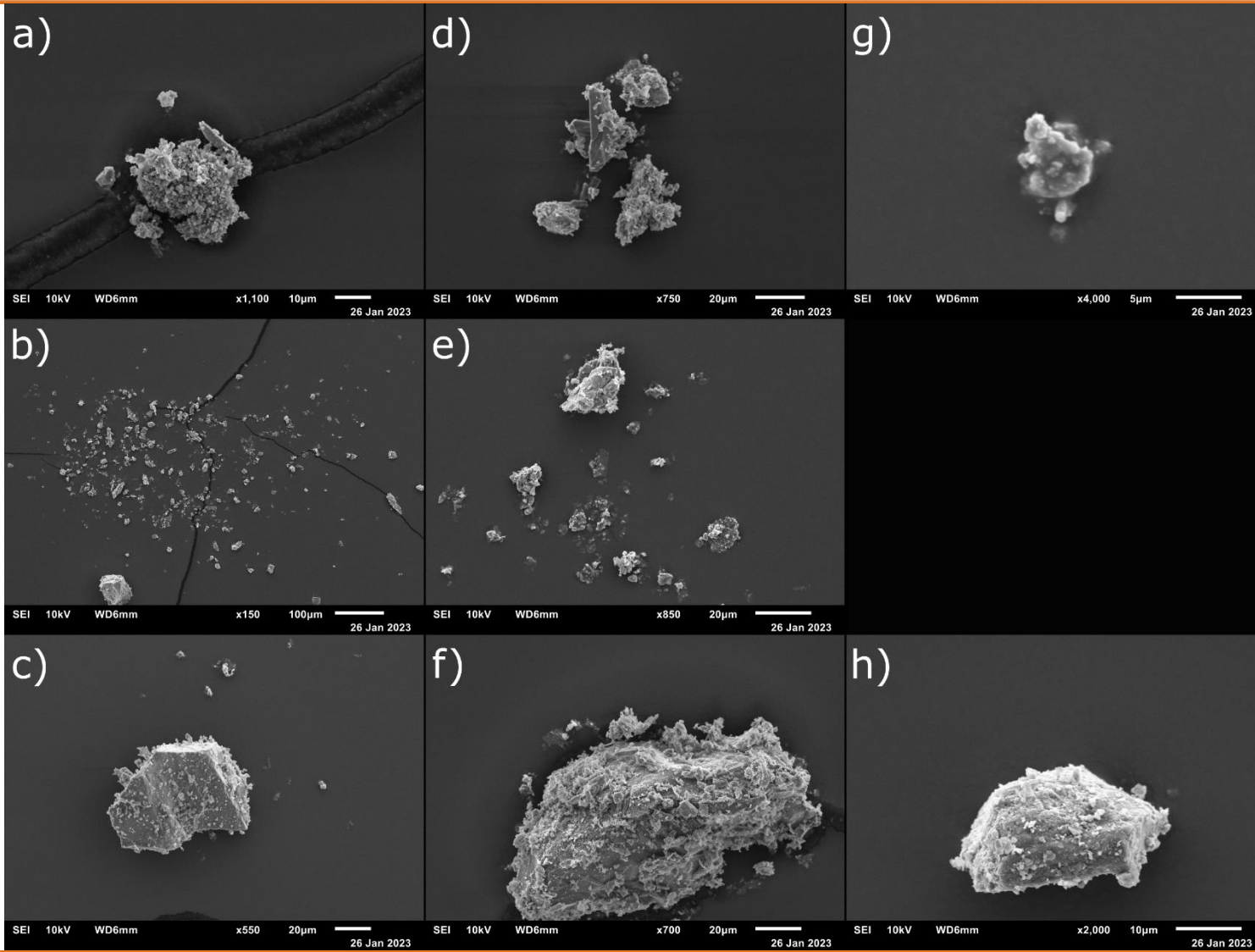
Result: Aerodynamic Properties





Result: Aerodynamic Properties

SEM Footage:



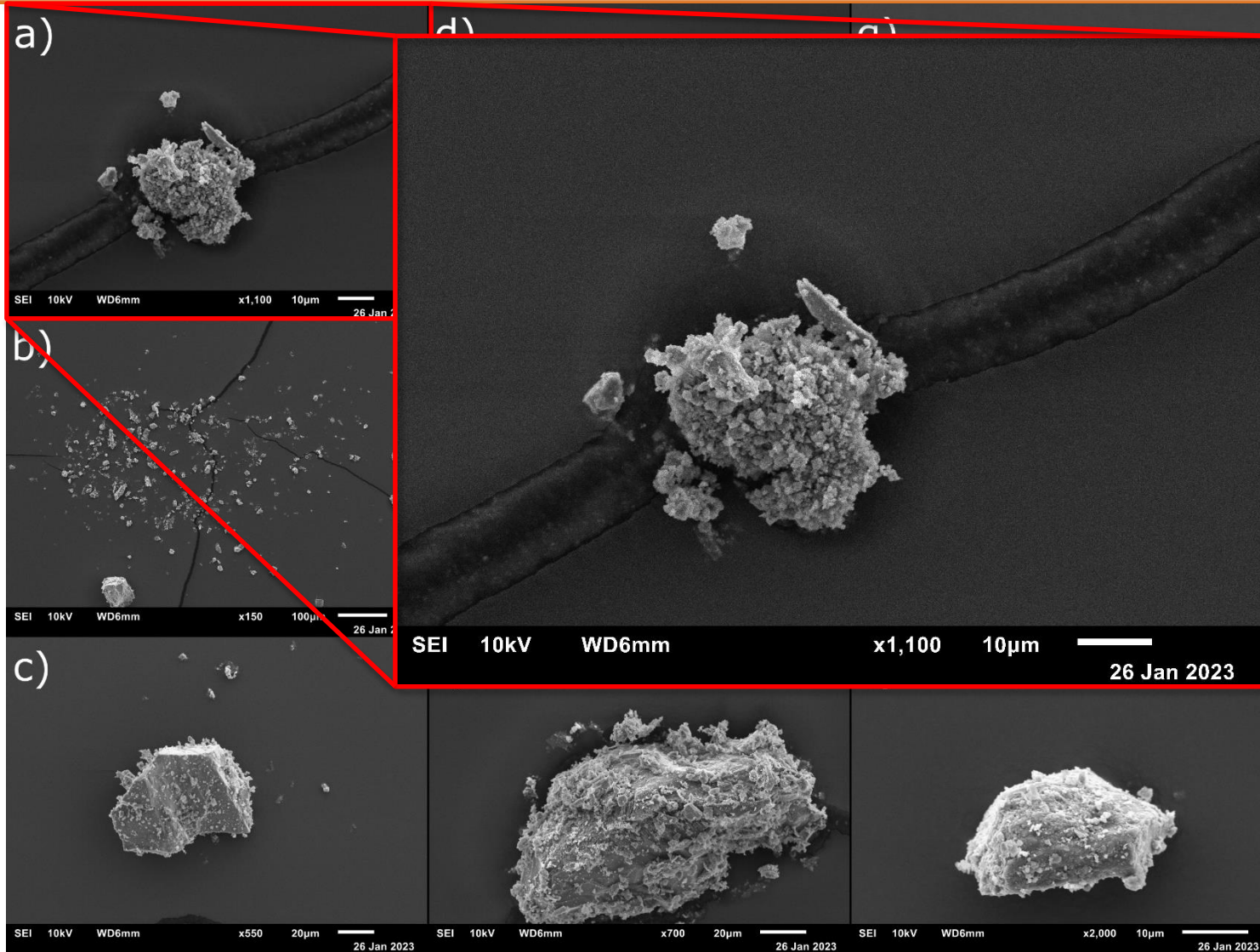
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Result: Aerodynamic Properties

SEM Footage:



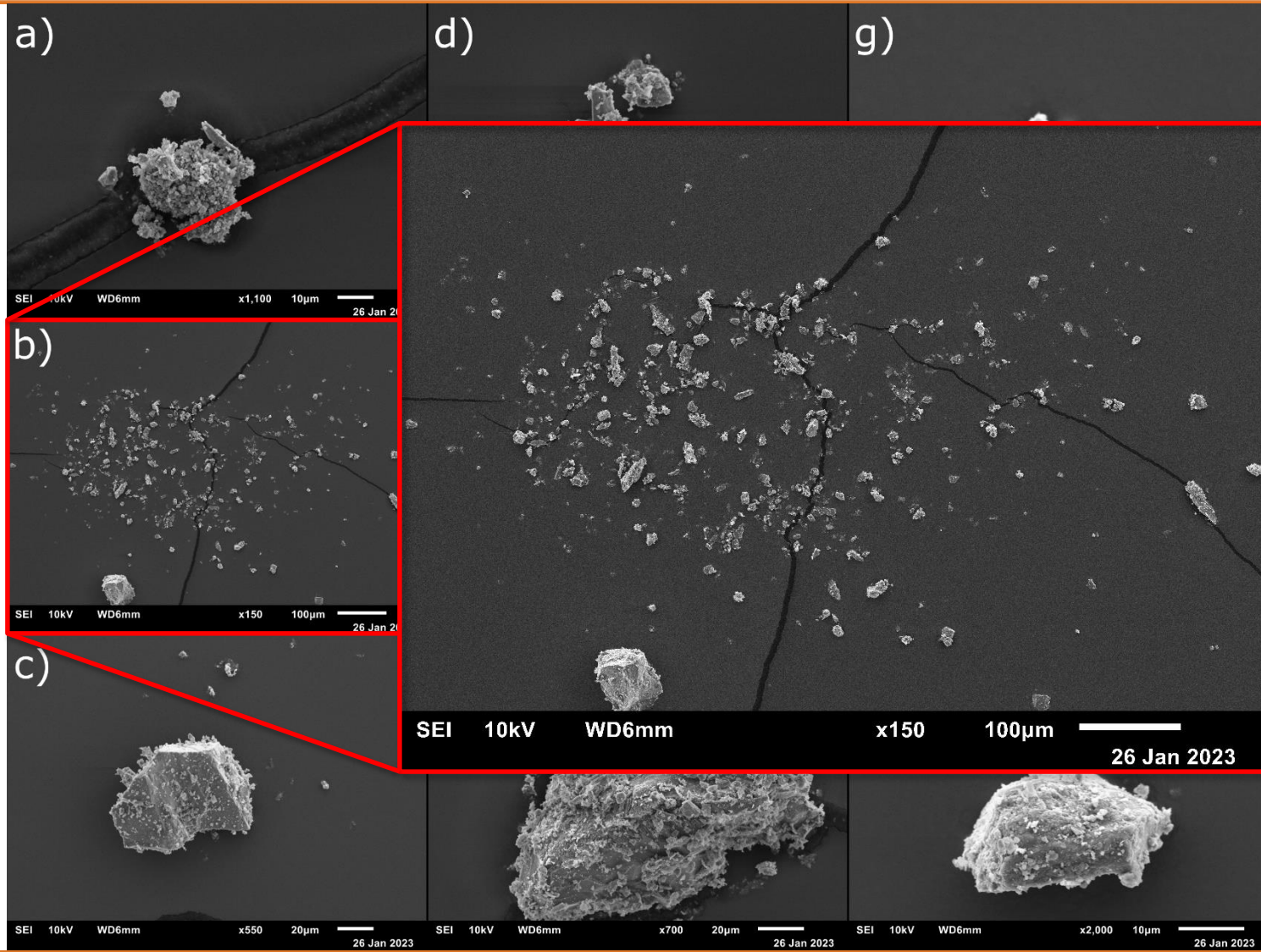
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052





Result: Aerodynamic Properties

SEM Footage:



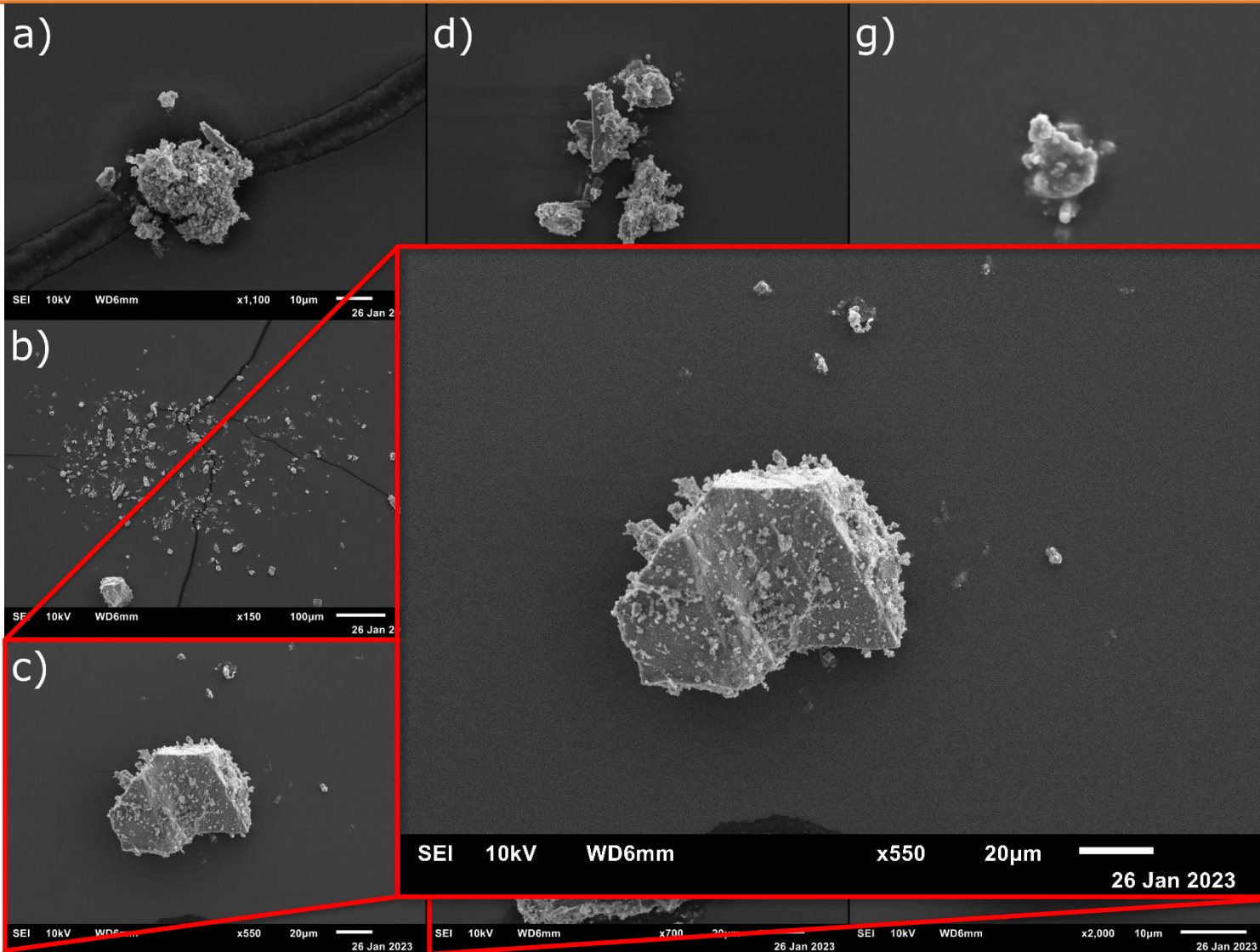
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052





Result: Aerodynamic Properties

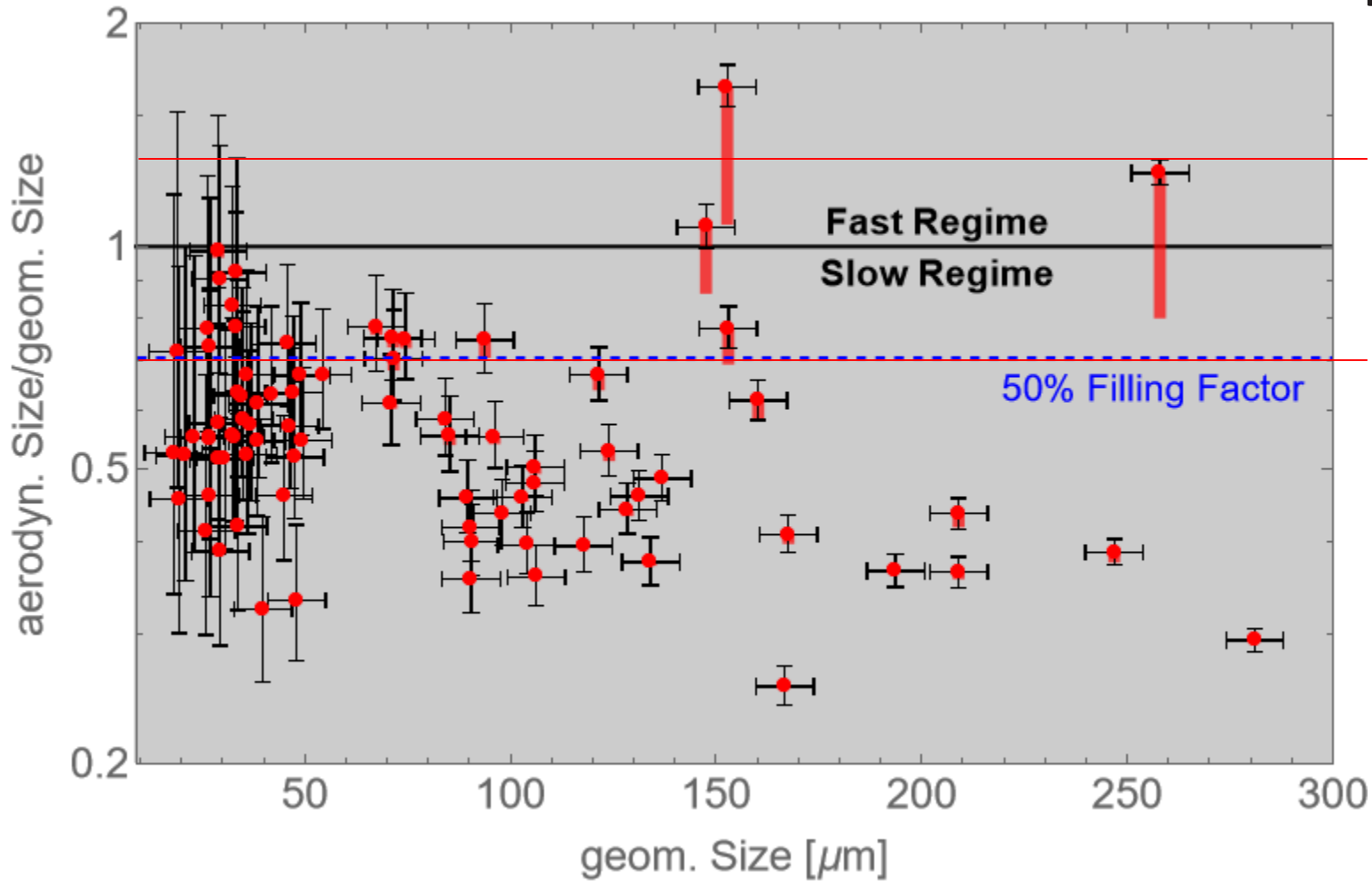
SEM Footage:



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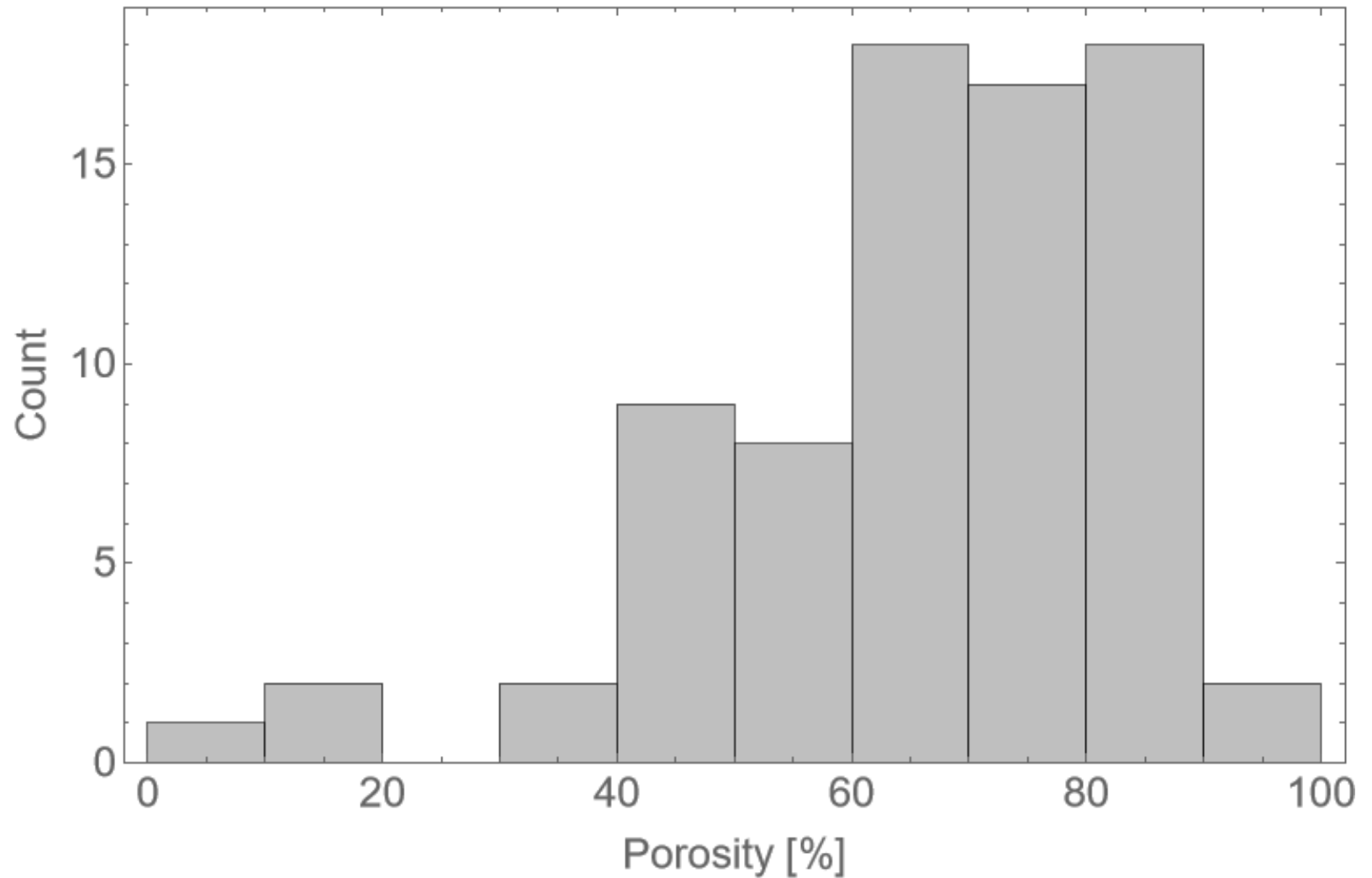


Result: Aerodynamic Properties





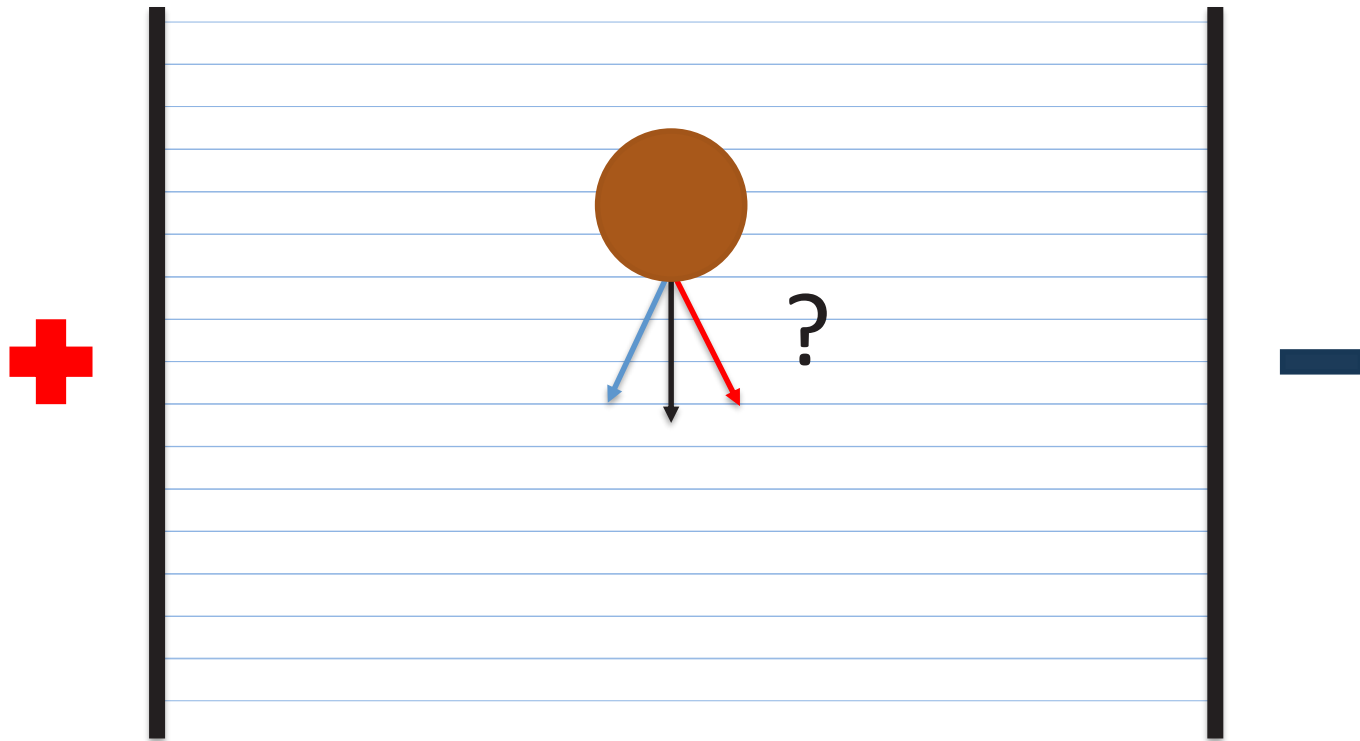
Result: Aerodynamic Properties



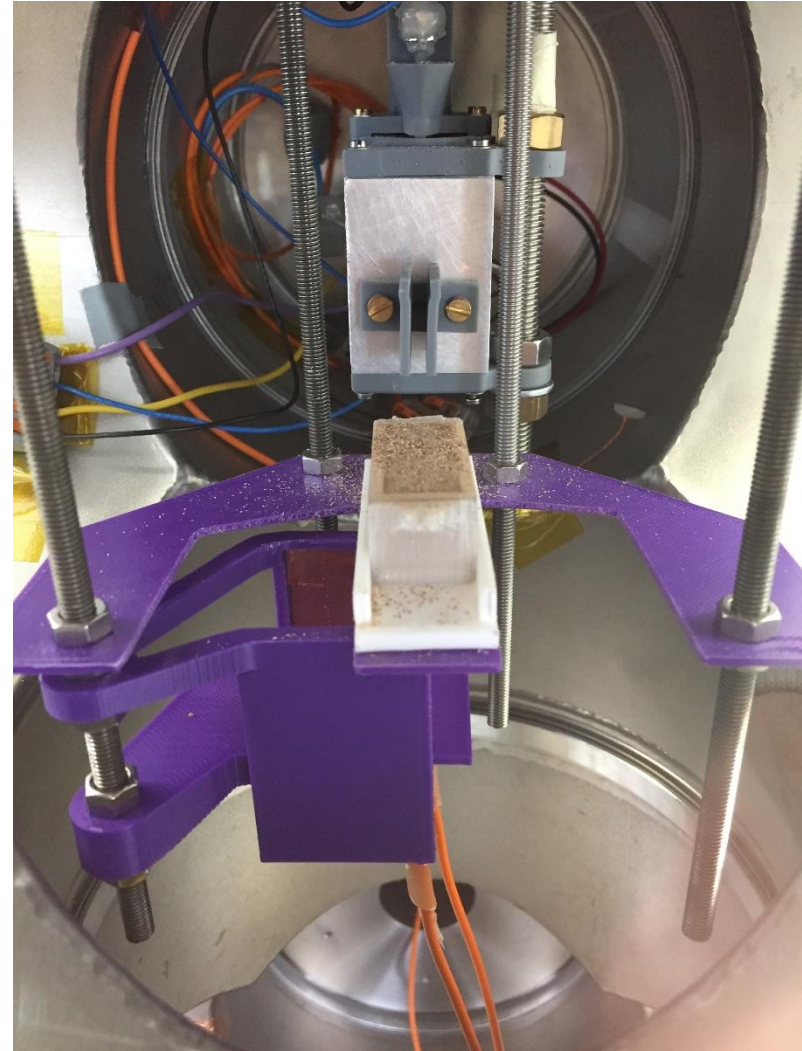
This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101004052



3. Electric Properties



Experiment: Electric Properties





Experiment: Electric Properties

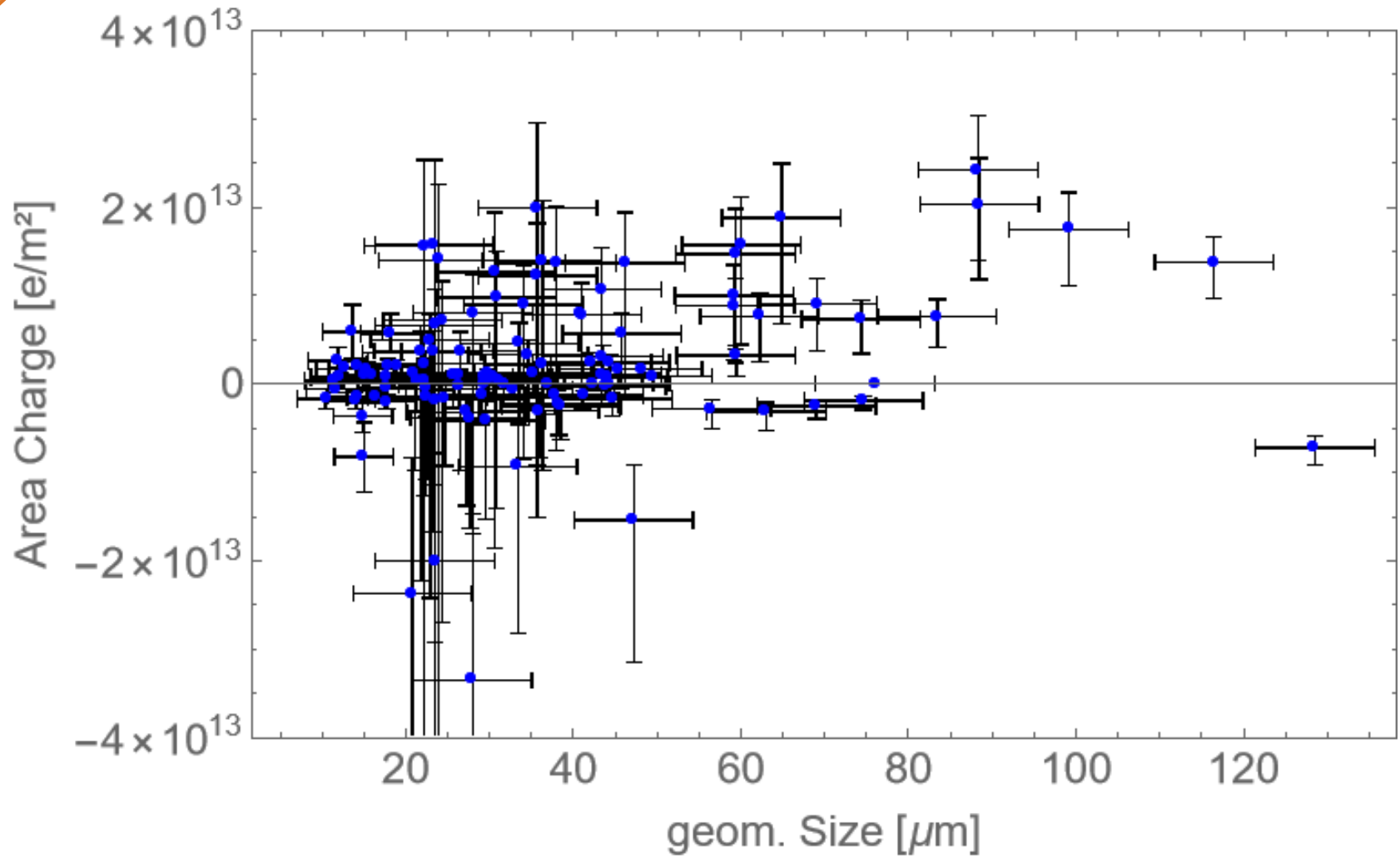


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Result: Electric Properties (prelim.)

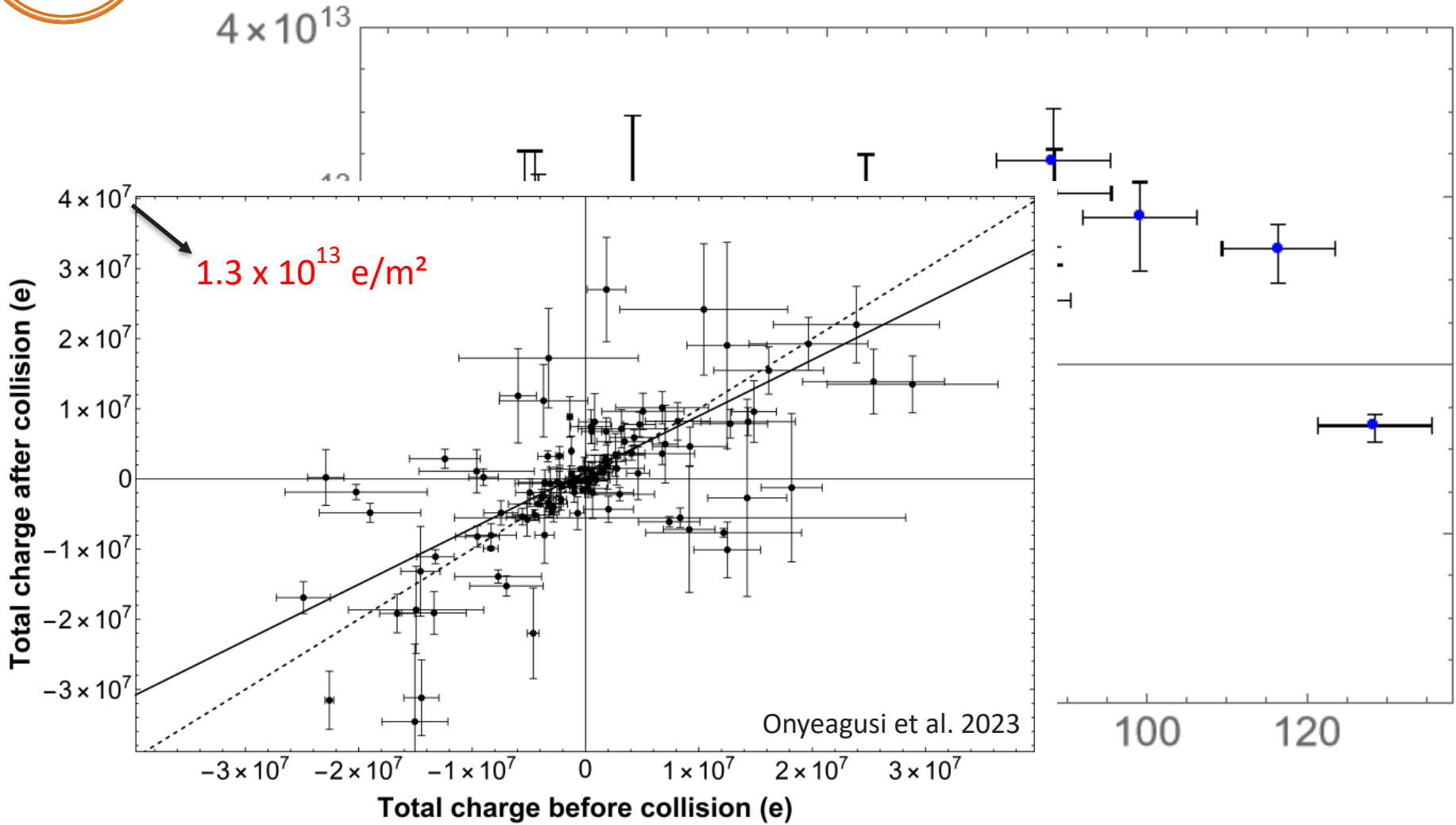


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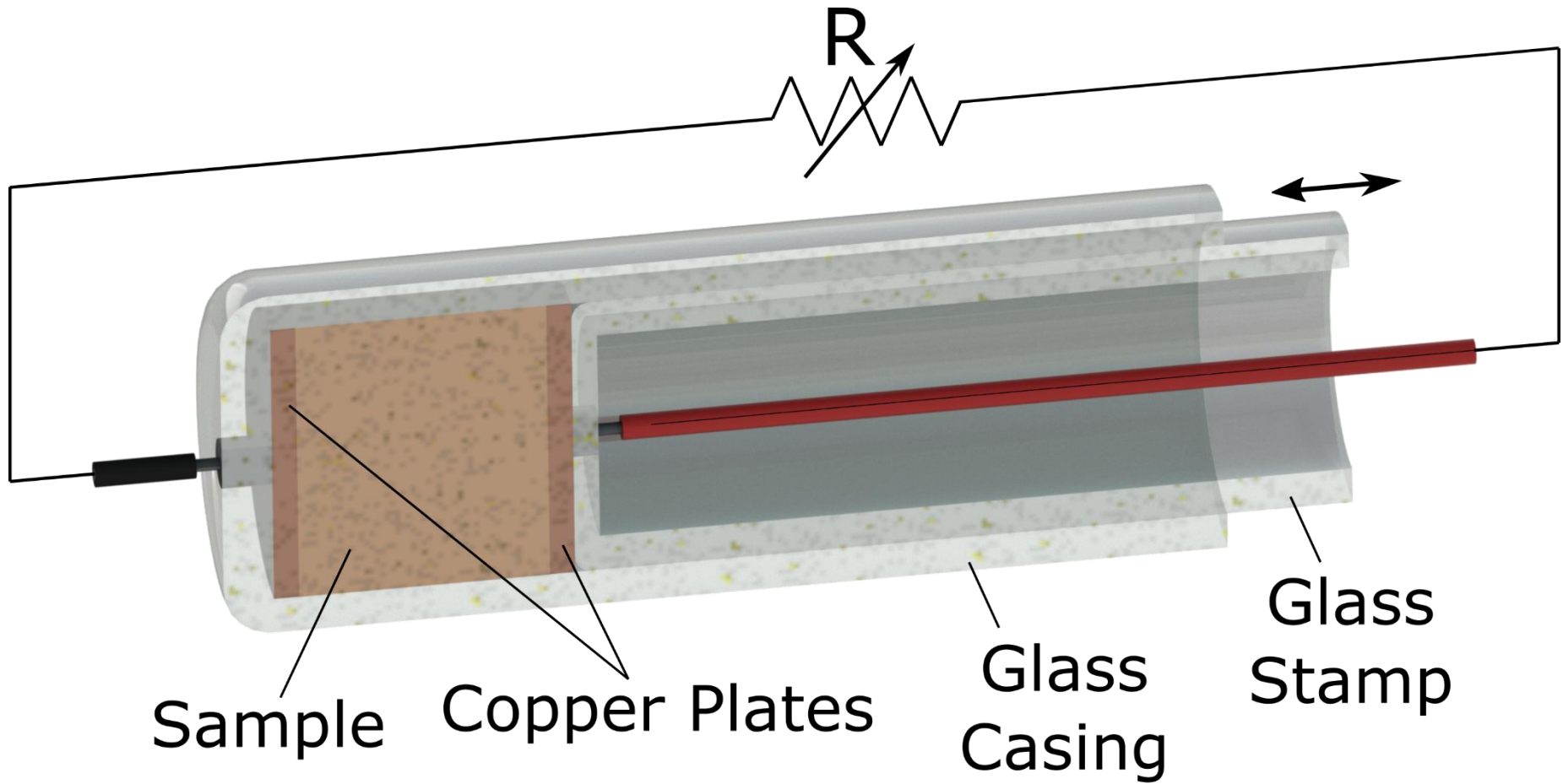
Result: Electric Properties (prelim.)



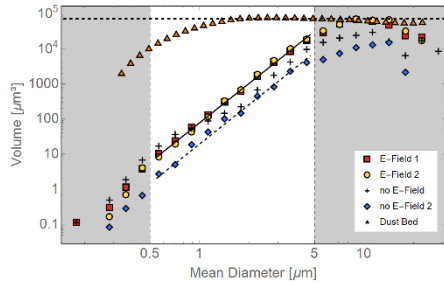
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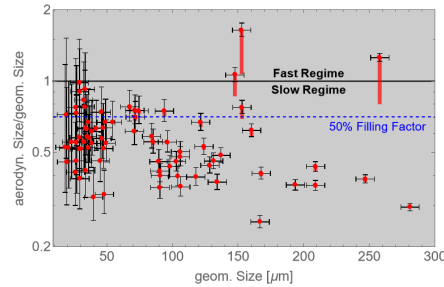
Result: Electric Properties (prelim.)



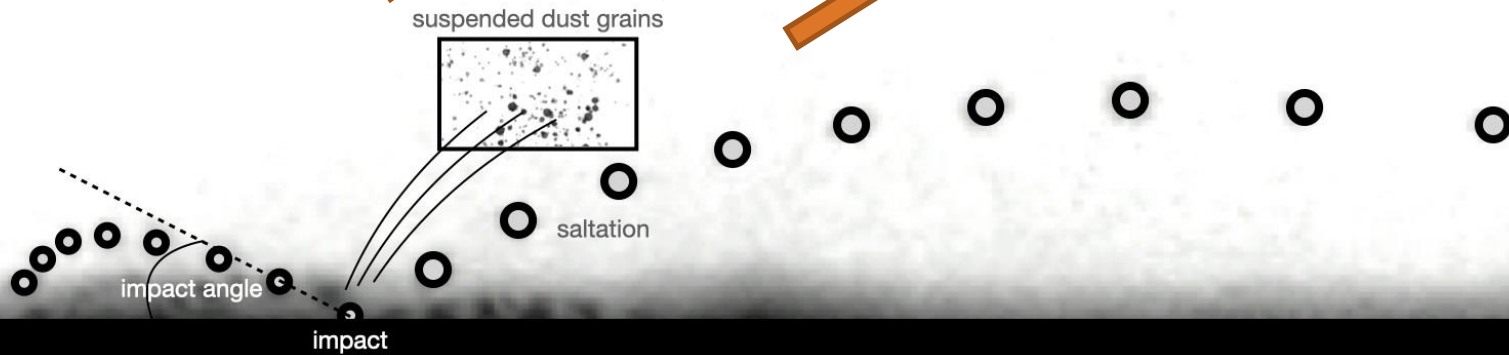
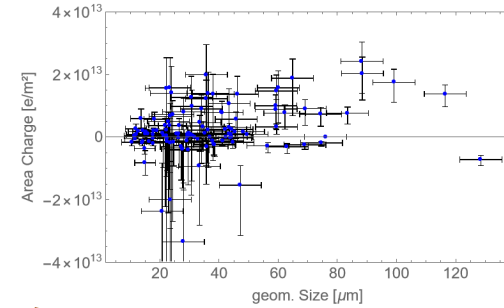
1. Size Distribution



2. Aerodynamic Properties



3. Electric Properties



(underlying Martian-g wind tunnel image from Kruss et al. 2020)



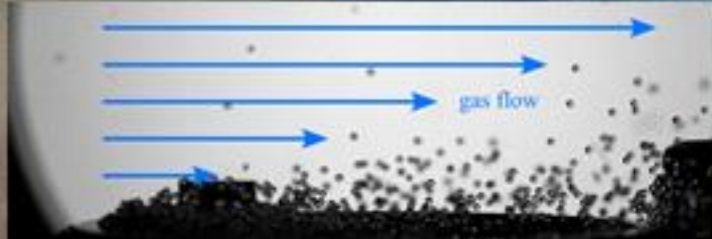
Acknowledgments

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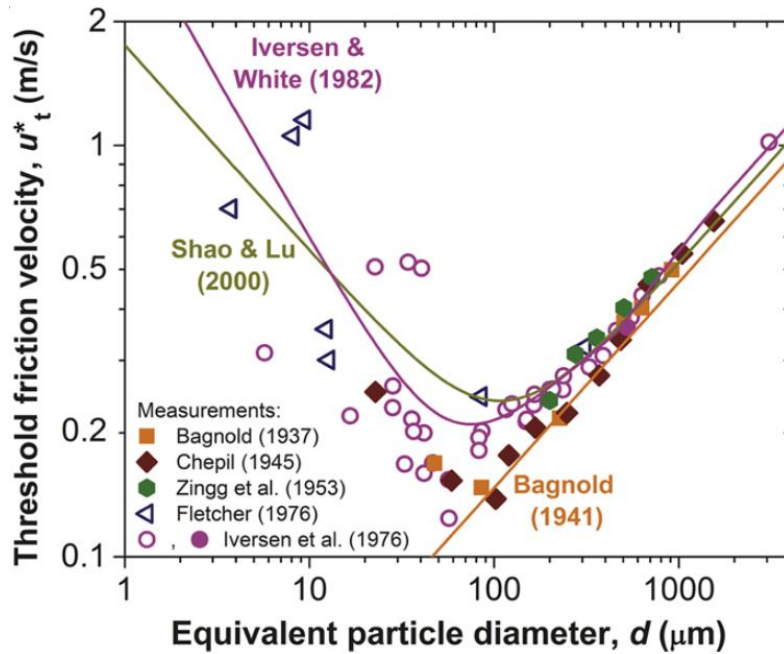
THANK YOU!
BEDANK!

Bye Bye Inglorious Dustards!

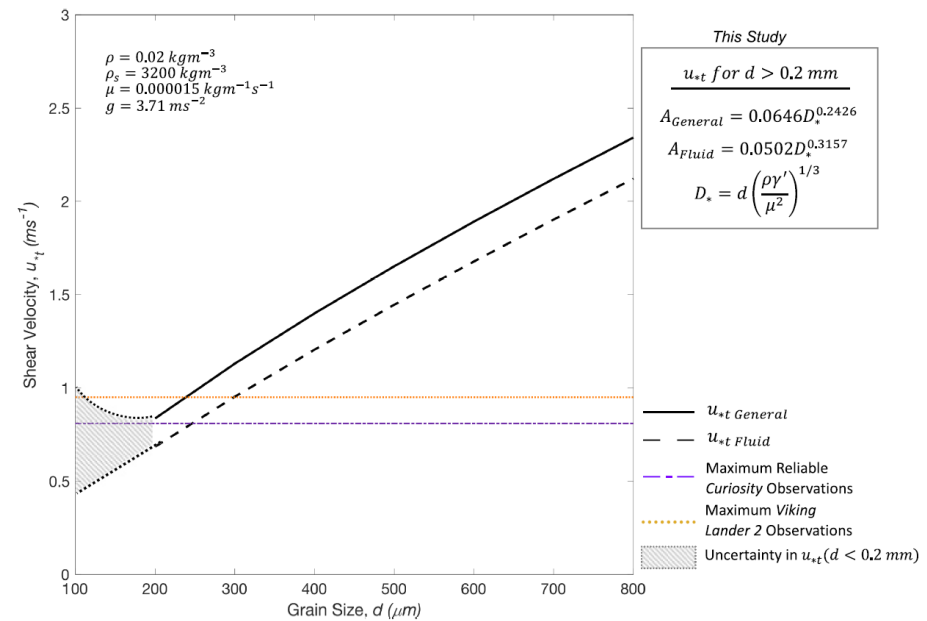


BONUS

Neakrase et al. 2016



Swann et al. 2020





Bonus: Math

Ejection Probability:

power law is direct probability density of how much dust of a certain size is lifted

$$\rho = \frac{dV_{true}/d\log s}{dV_{init}/d\log s} \sim s^b$$

Ejected Mass:

$$R = \frac{V_{true}}{V_{impactor}} = c \cdot \left(\frac{s_{cut}}{1\mu m} \right)^b$$

$$c = a / (b \cdot N \cdot f_{capt} \cdot V_{imp})$$



About 0.02% of impactor mass is emitted for <3μm dust per impact (using our parameters)

- a = scaling factor
- b = power (3.72)
- N = Number of impactors
- f_{capt} = correction factor
- V_{imp} = Volume impactor
- s_{cut} = cutoff diameter

