

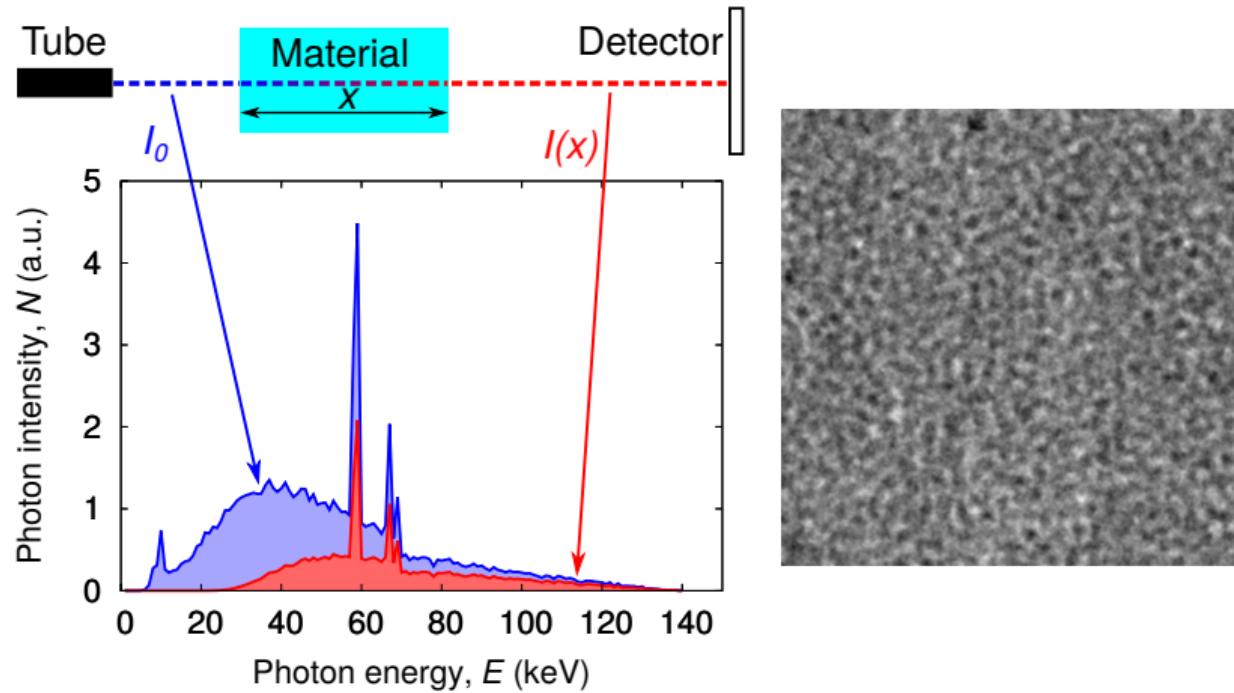


PhD defense **Manuel Baur**

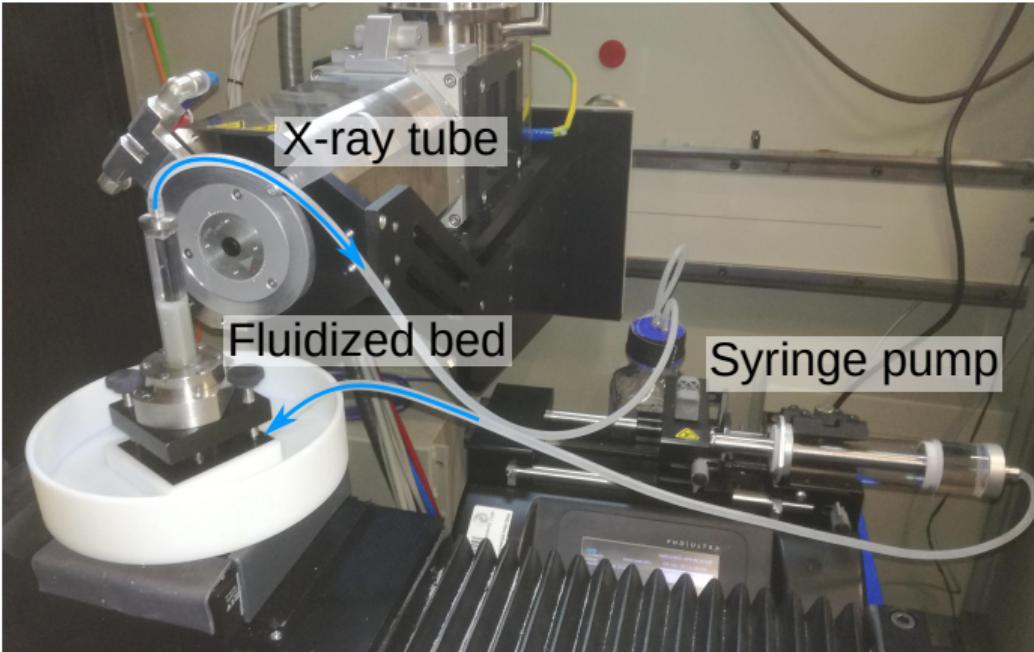
Funded by the German
Federal Ministry for
Economic Affairs and
Energy, grant no. 50WM

1653

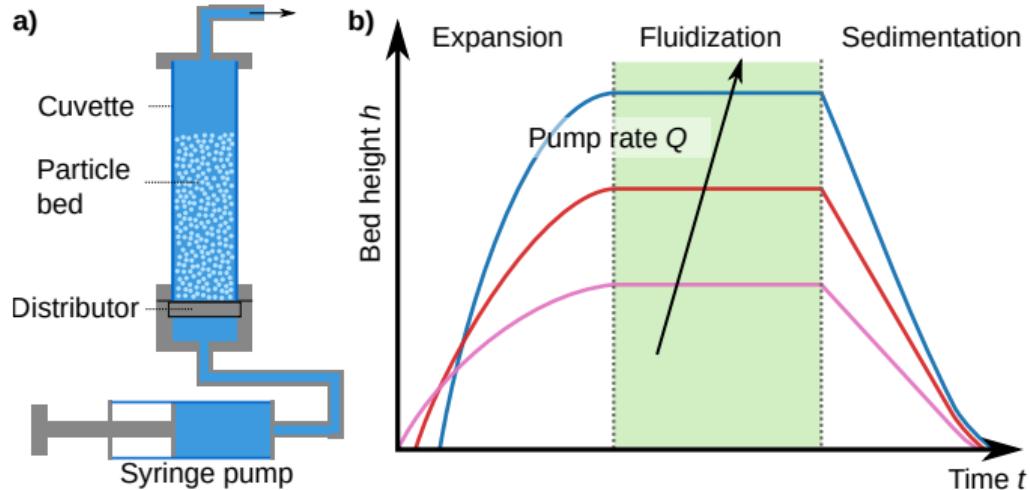
X-ray radiography of granular systems – particle densities and dynamics



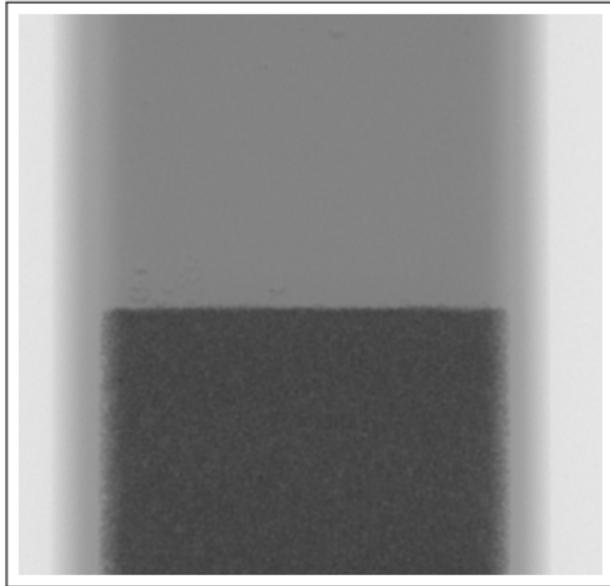
Experimental validation of X-DFA: A suspension of sedimenting particles



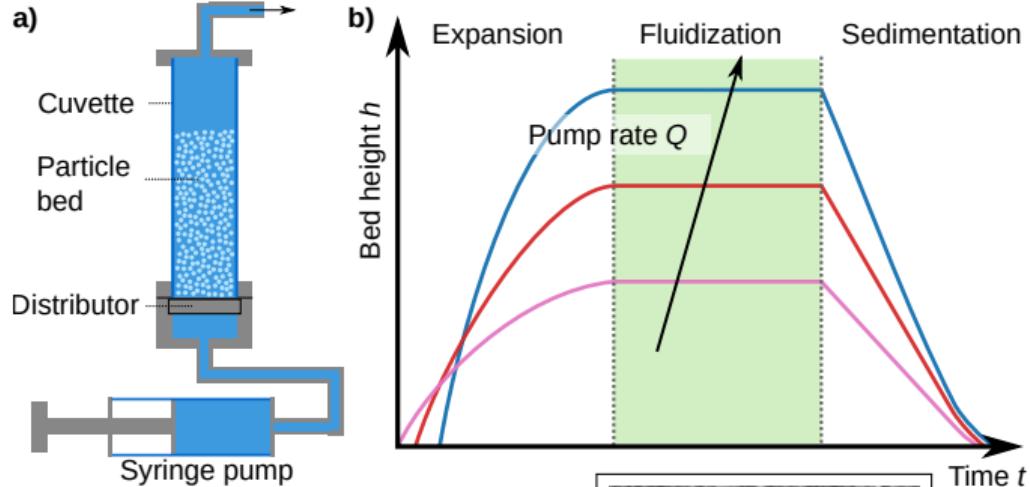
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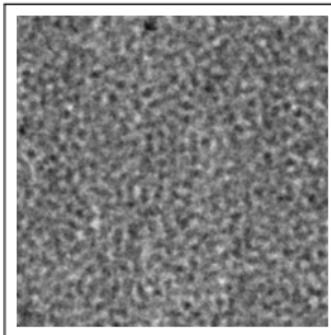
X-ray radiography



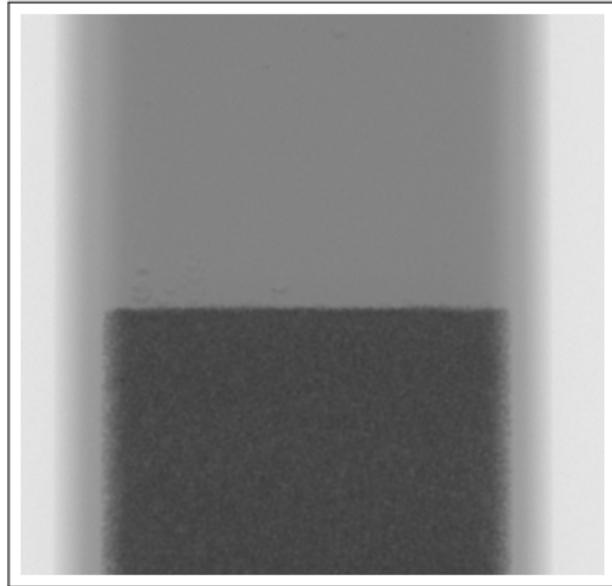
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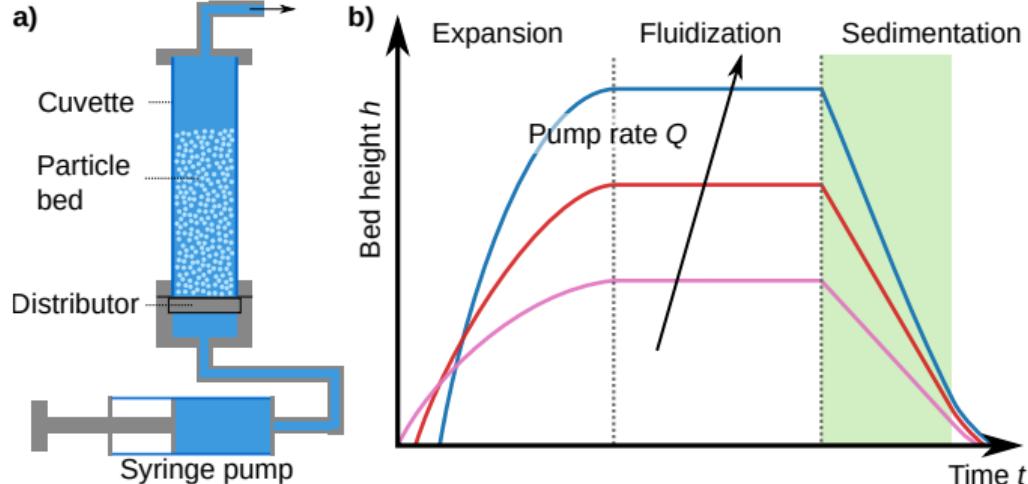
No reliable reference velocity!



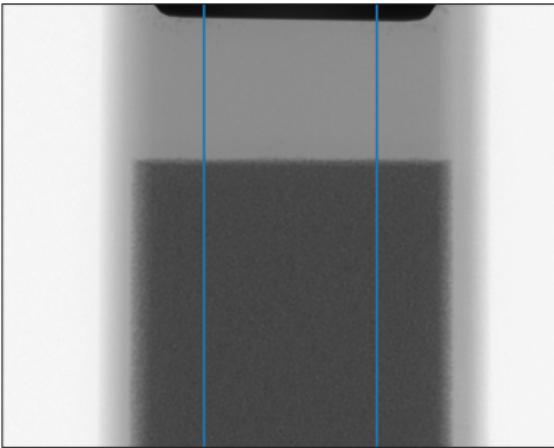
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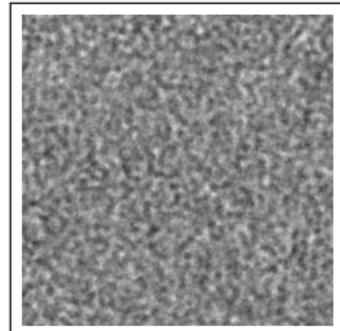
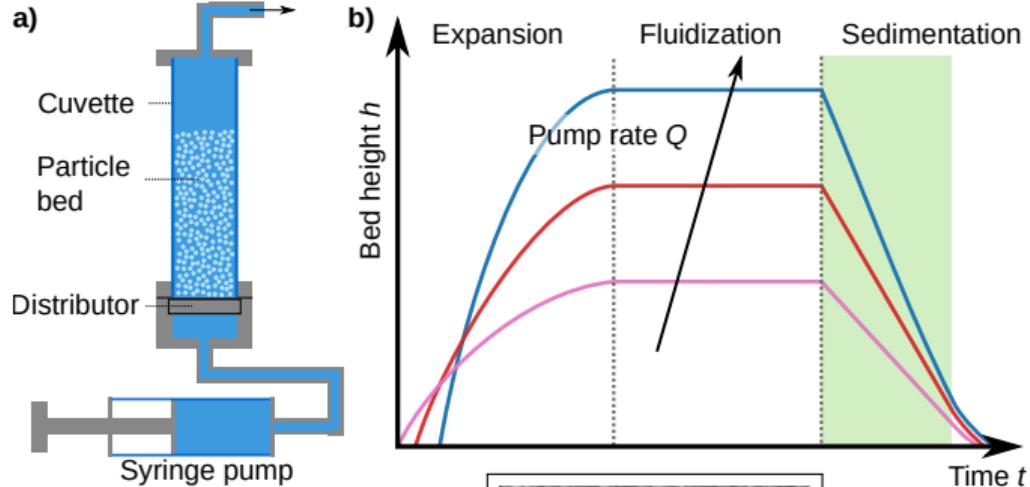
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X-ray radiography

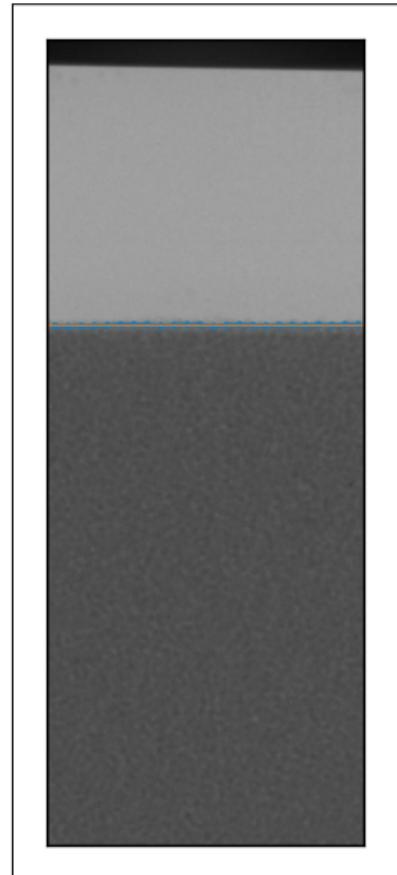


Experimental validation of X-DFA: A suspension of sedimenting particles



Comparison of
 $\langle v \rangle_{\text{dfa}}$ and $\langle v \rangle_{\text{front}}$

X-ray radiography



X-DFA for a suspension of sedimenting particles⁽¹⁾

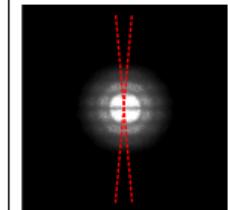


Image structure function:
 $D(\mathbf{q}, \tau) = \langle |\mathcal{F}[\Delta I(\mathbf{r}, t, \tau)]|^2 \rangle_t$

(1) In collaboration with Manuel Escobedo, University of Düsseldorf

X-DFA for a suspension of sedimenting particles⁽¹⁾

Intermediate scattering function⁽²⁾:

$$f(q, \tau) = \cos(q\langle v_s \rangle \tau) \exp\left(-\frac{1}{2}q^2 \delta v^2 \tau^2\right)$$

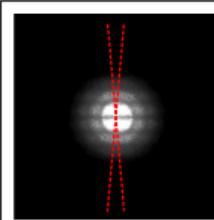
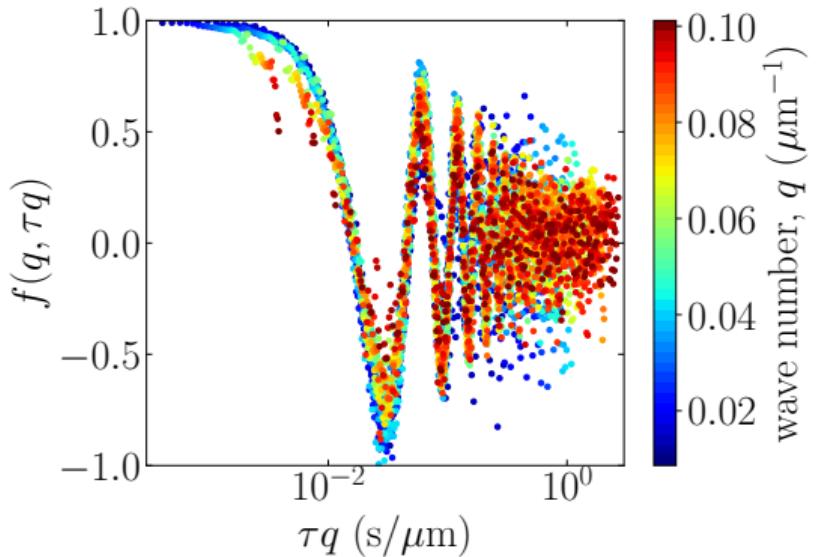


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(2) Kohyama *et al.* (2008)

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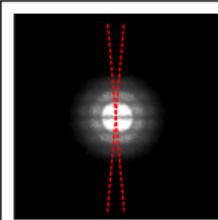
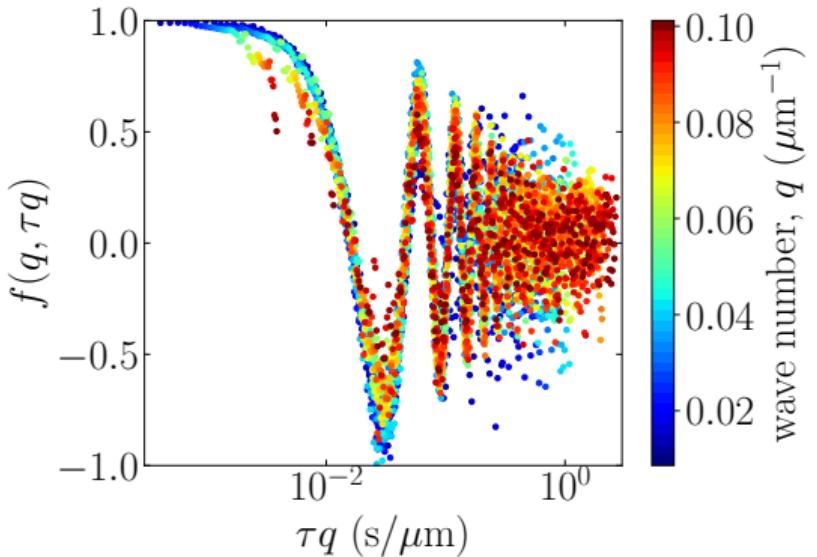


Image structure function:
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$$\langle v_s \rangle = q \tau_\nu \quad \delta v = q \tau_{\delta\nu}$$

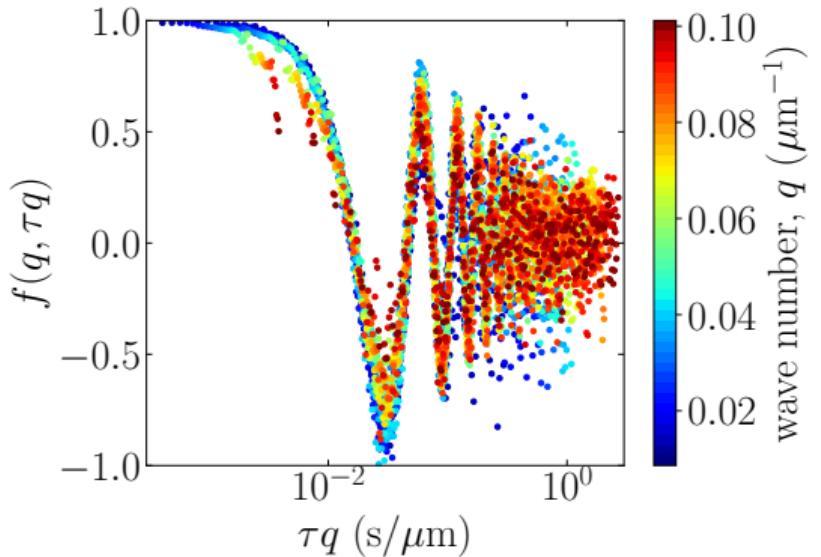
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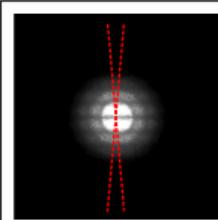
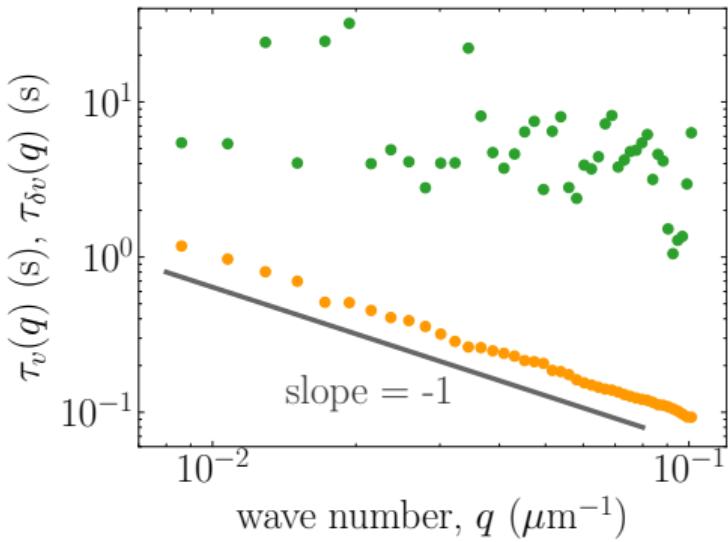


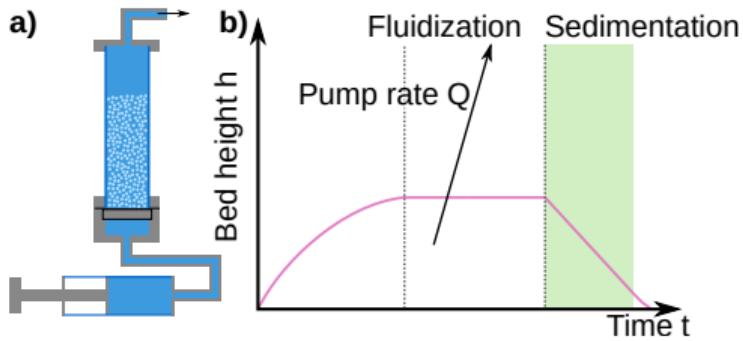
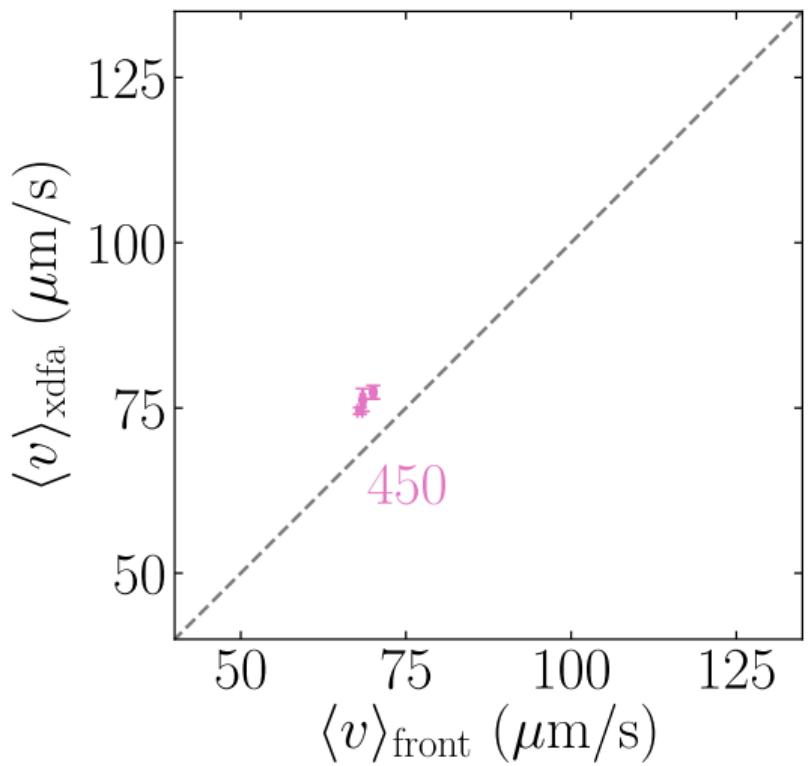
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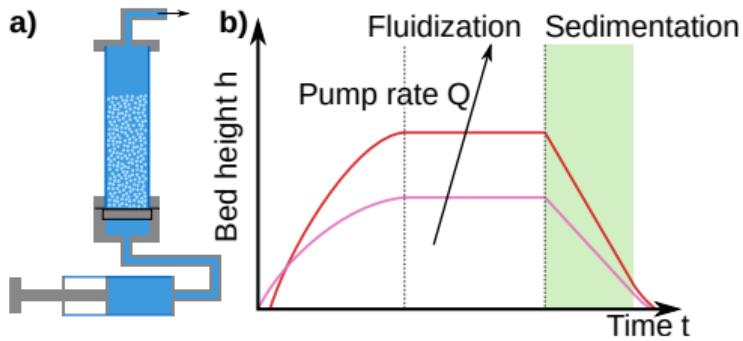
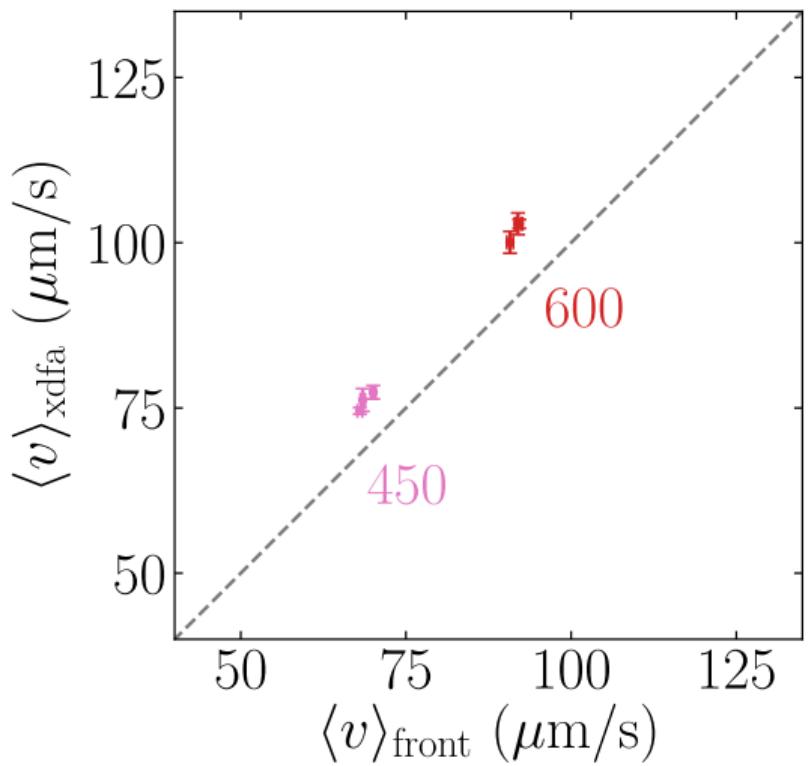


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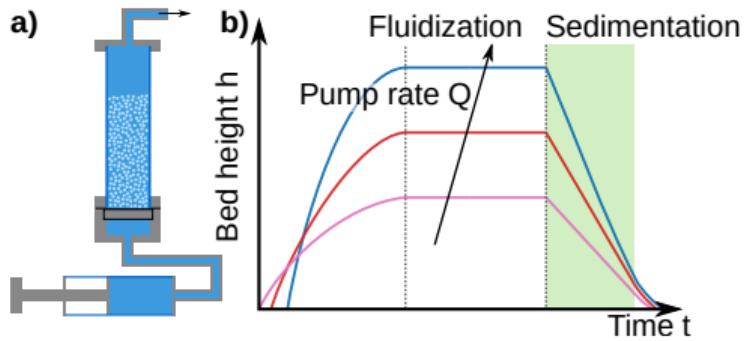
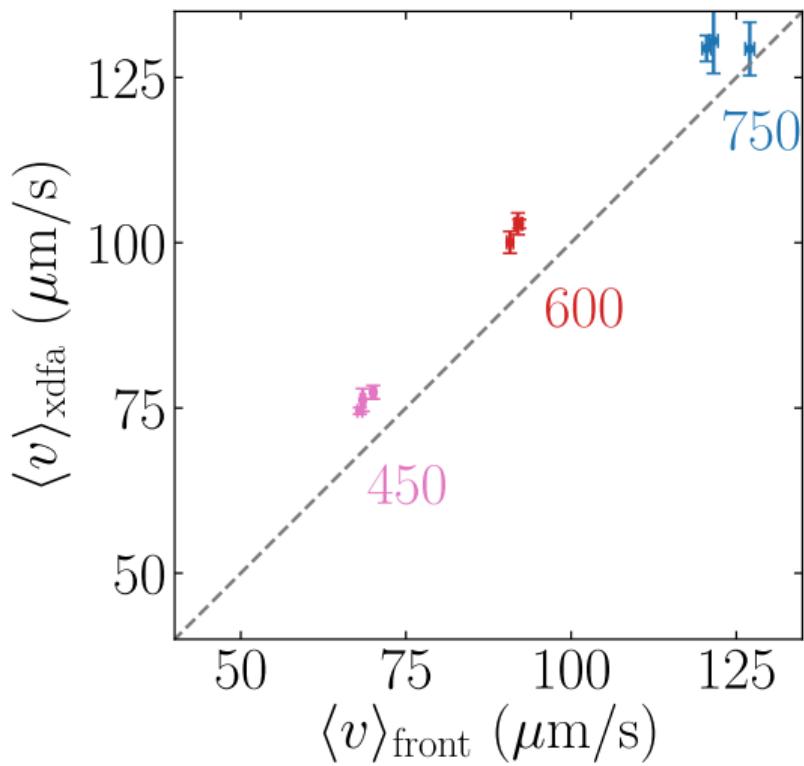
Front tracking vs. X-DFA



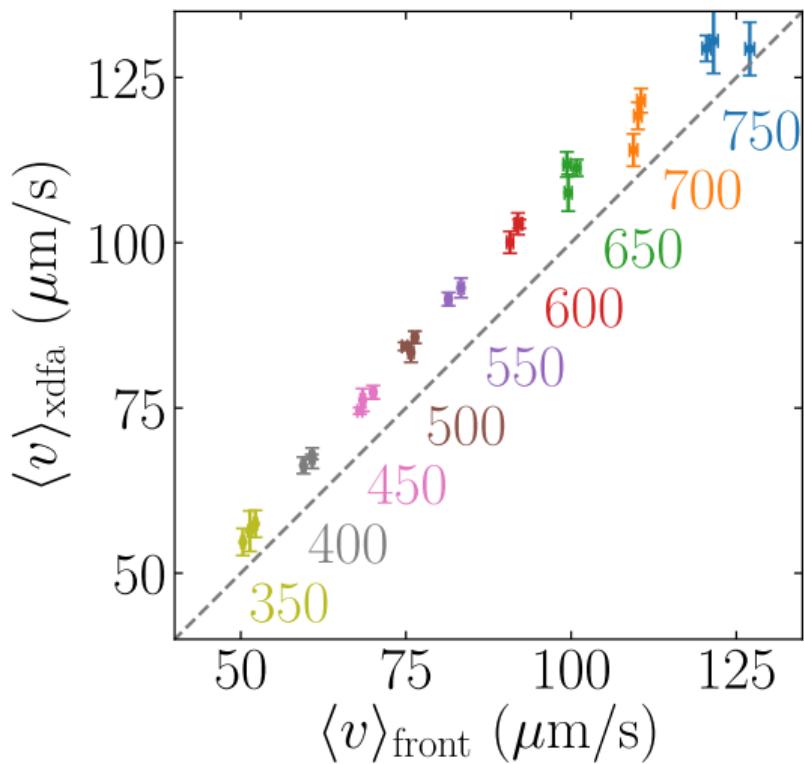
Front tracking vs. X-DFA



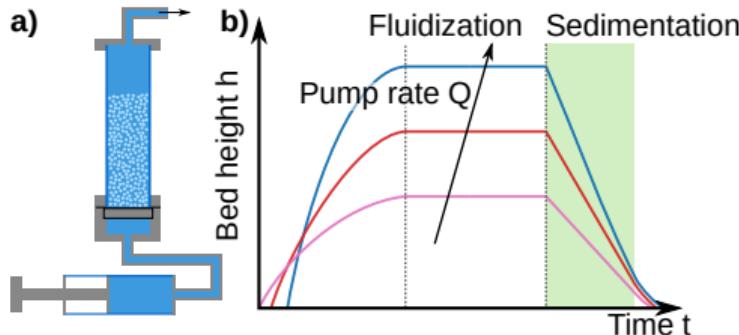
Front tracking vs. X-DFA



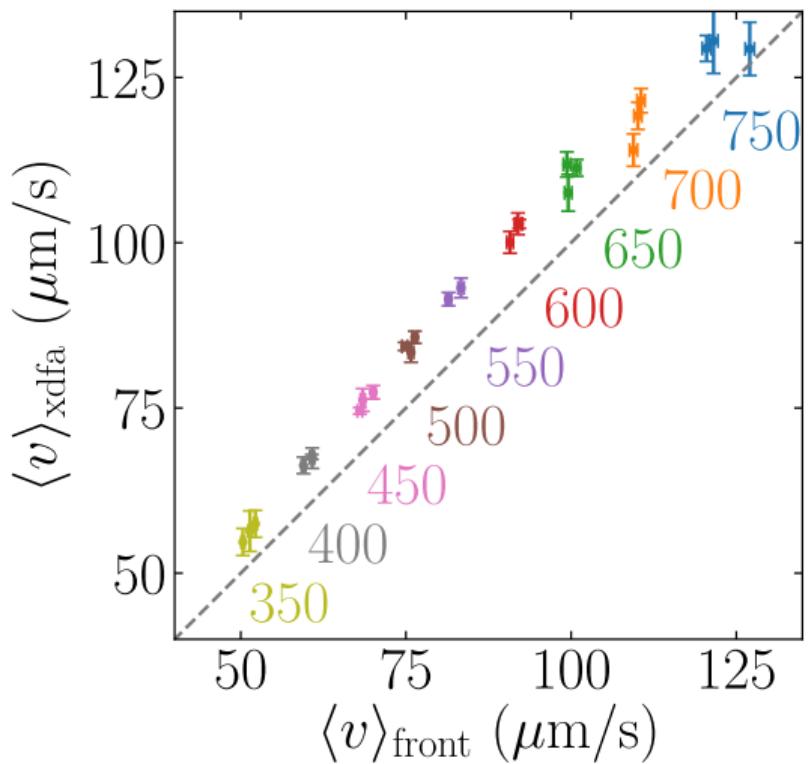
Front tracking vs. X-DFA



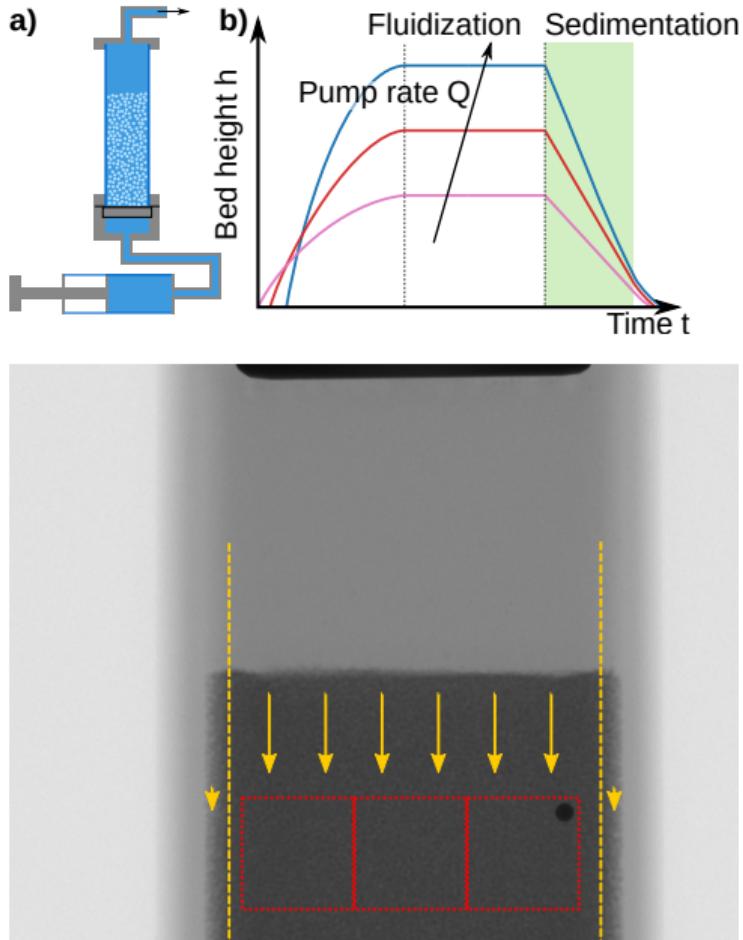
$\langle v \rangle_{\text{xdfa}} > \langle v \rangle_{\text{front}}$ by 9.4%



Front tracking vs. X-DFA

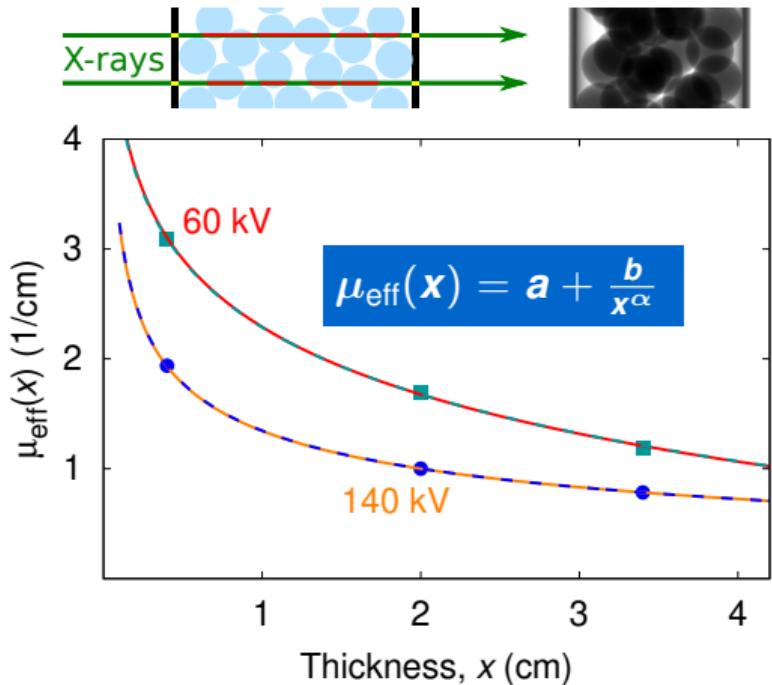


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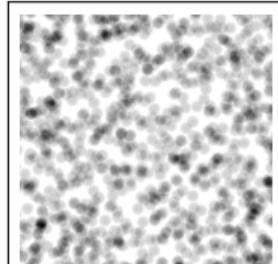
Conclusion

Correction of X-ray beam hardening

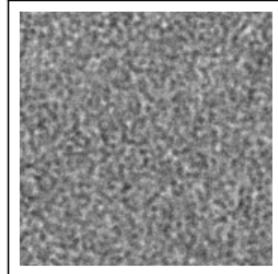


X-ray Digital Fourier Analysis

Synthetic radiograms

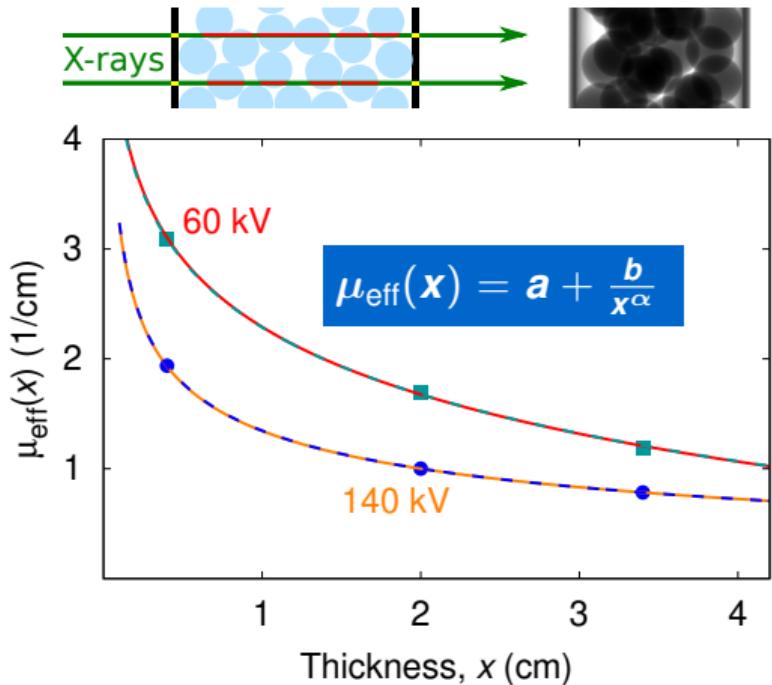


Experimental validation



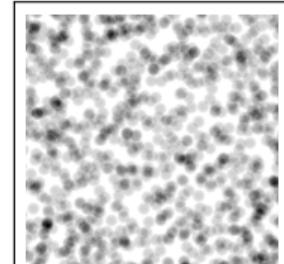
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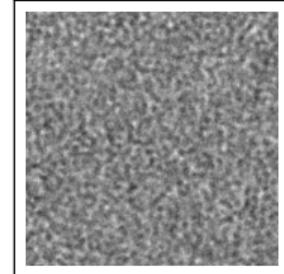


X-ray Digital Fourier Analysis

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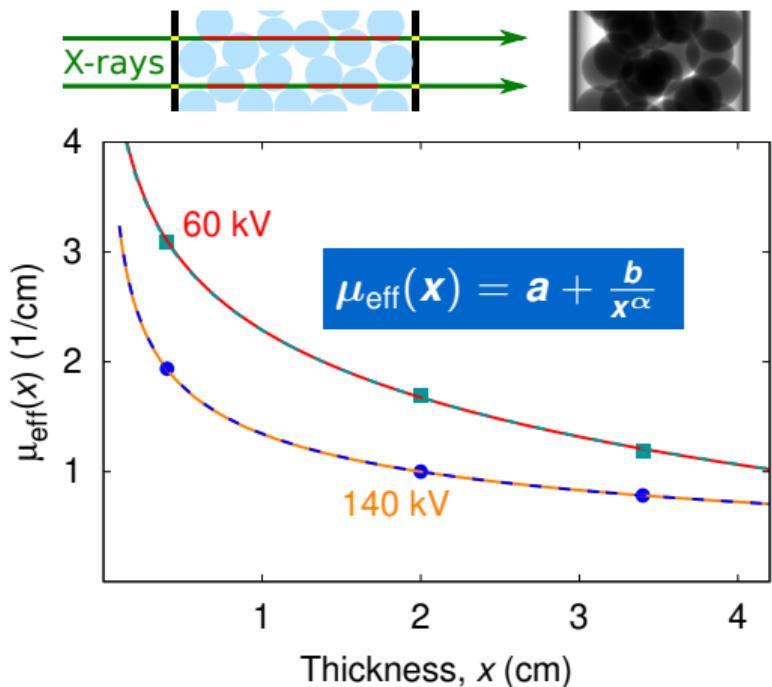


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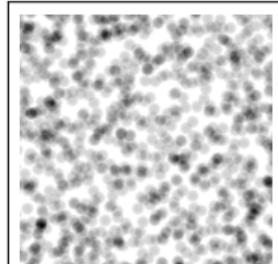
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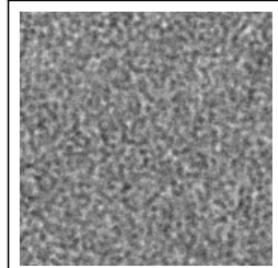


X-ray Digital Fourier Analysis

Synthetic radiograms



Experimental validation



Temporal resolution of X-ray radiography

Thank you for your attention!

