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Analysis of Elongated Particle Streaks

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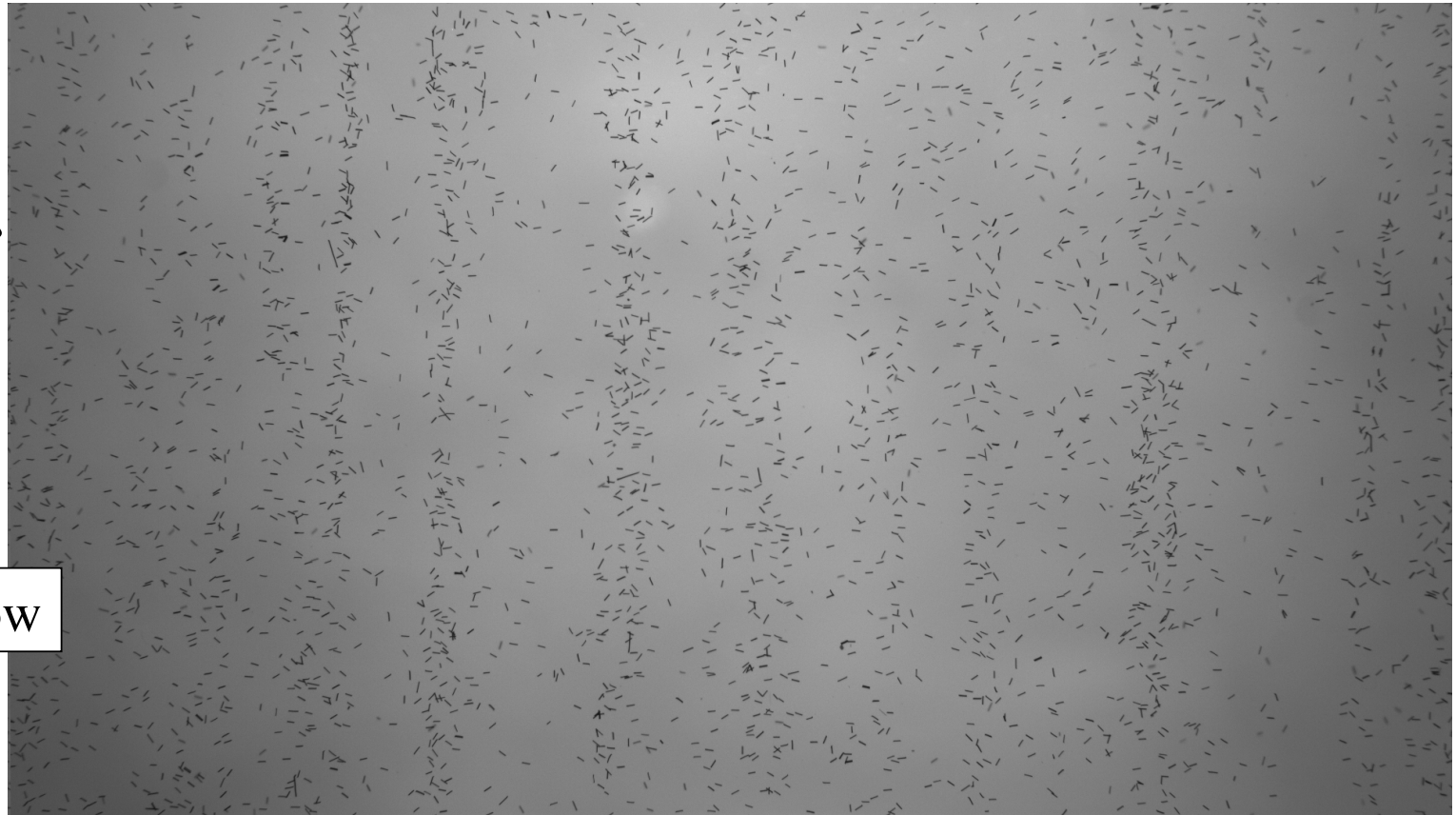
Fibre-Streaks



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Flow



Why?



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- How to quantify particle streaks?
 - Dominant size
 - "Streakiness"
- How to quantify streakiness?
- Streakiness:
 - Relative measure comparing the tendency for fibres to agglomerate in streaks for two cases.
- Difficult: Streaks are anisotropic.

What?

- Analysis method should be independent of:
 - Fibre length
 - Fibre orientation
 - Concentration



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Which image have the strongest streaks?

Case 1



Case 2



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Direct Correlation

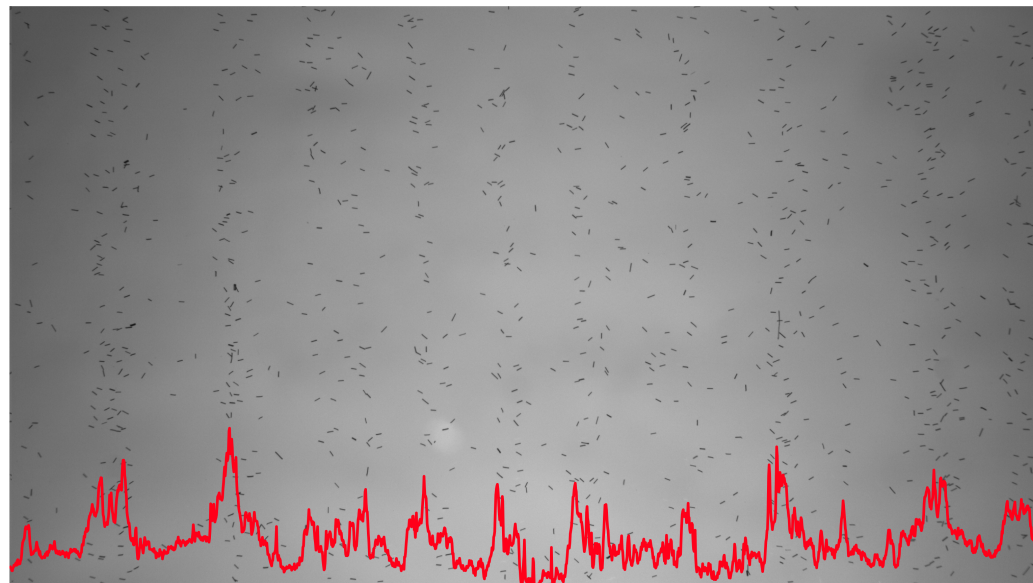
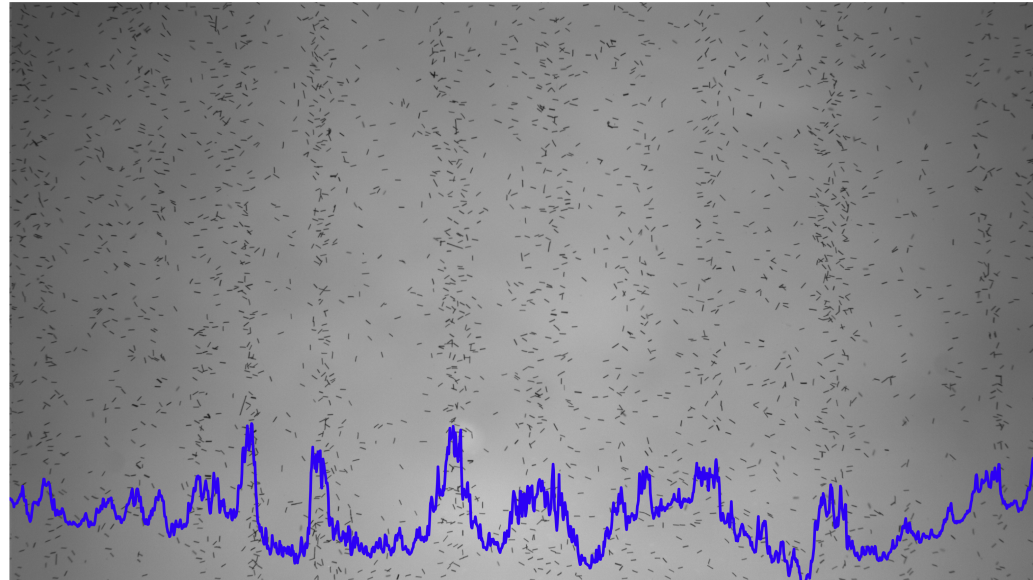
- Using image intensity.
- Streamwise summation.
- Spanwise correlation.



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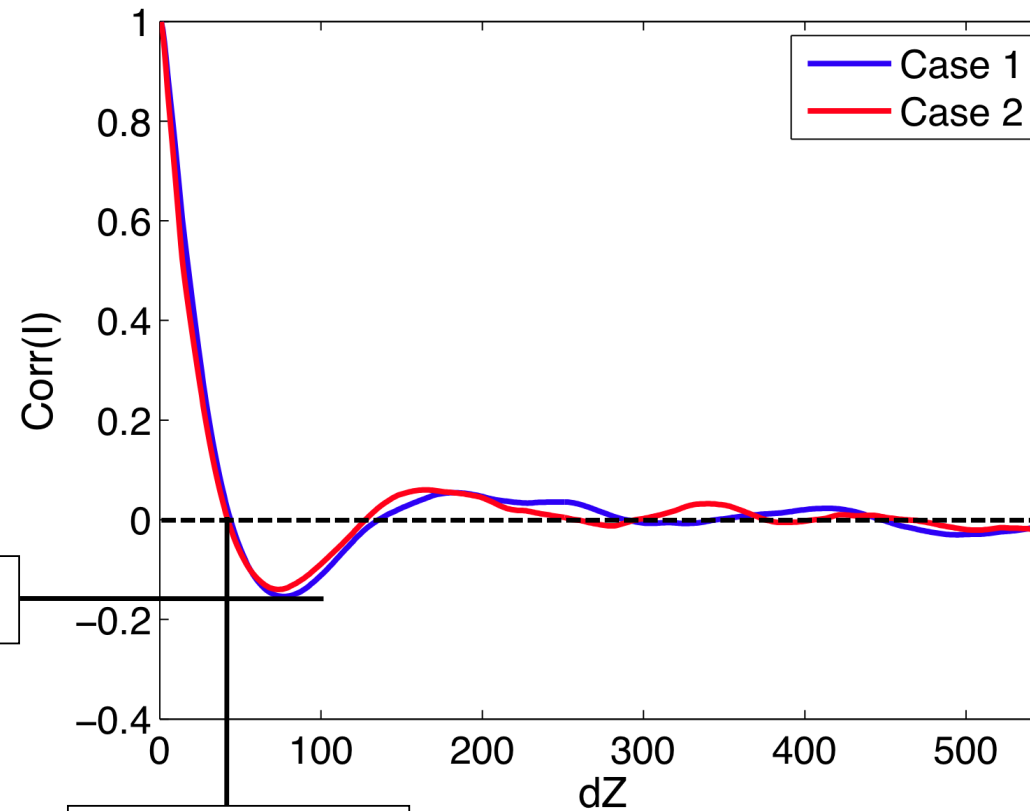
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Direct Correlation



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Streakiness

Streak Width

Direct Correlation

- Why is direct summation and correlation from images not good?
- Signal depends on fibre orientation and fibre length.
- Intensity differences in the image causes problems.



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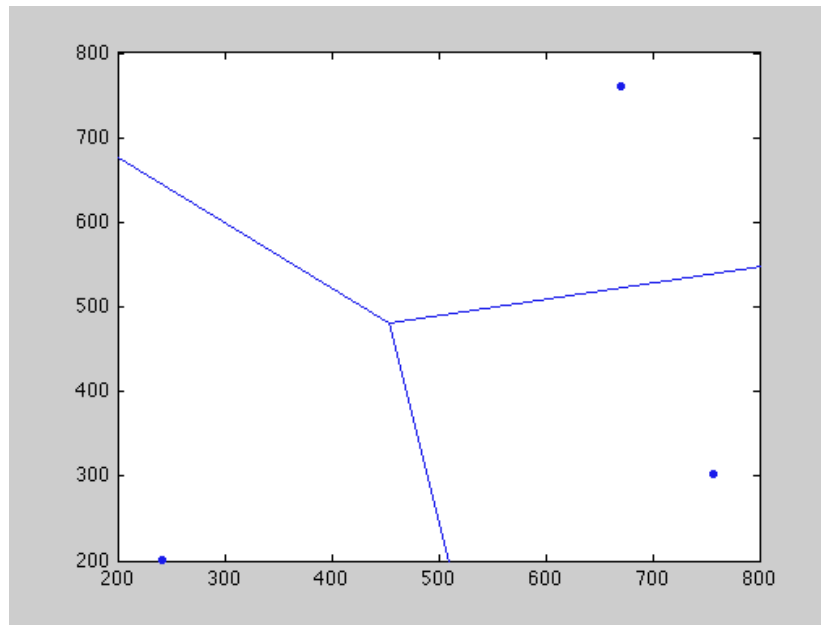
Voronoi Tessellation

- Using fibre position. Acquired by use of steerable filter.
- Removes influence of fibre size and orientation.



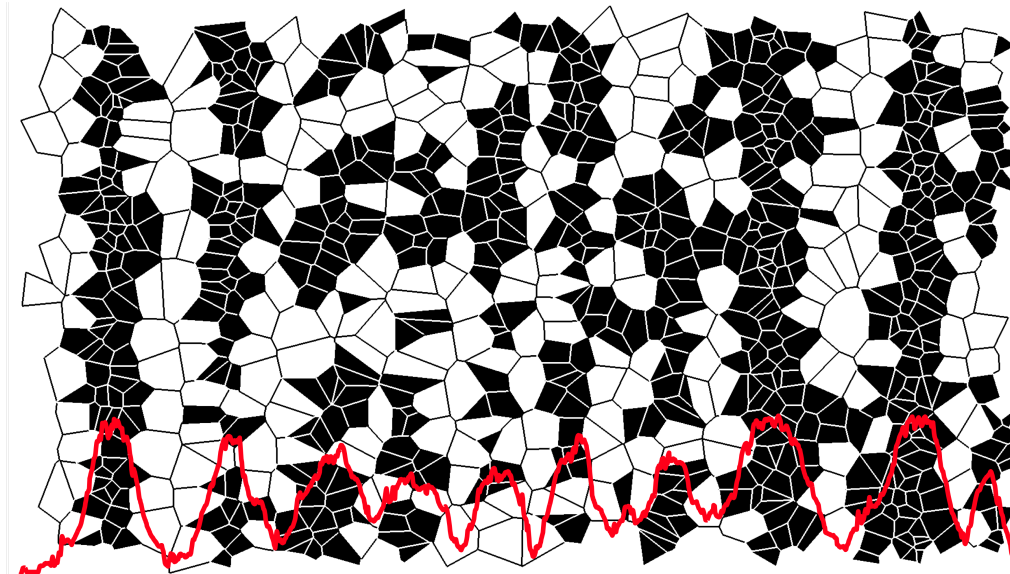
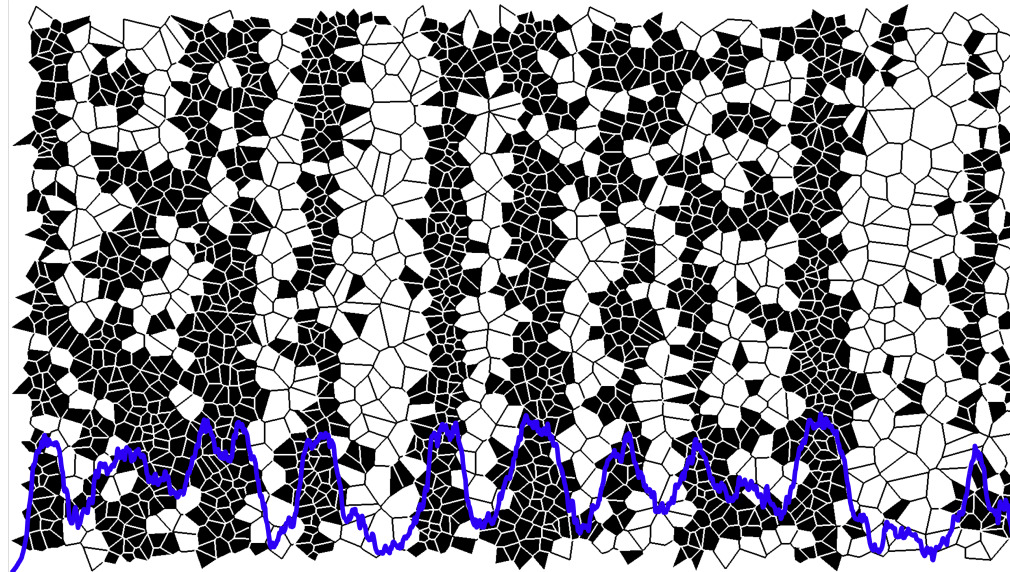
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R. Monchaux et al.
Preferential concentration of heavy
particles: A Voronoi analysis.
Phys. Fluids 22, 103304 (2010);





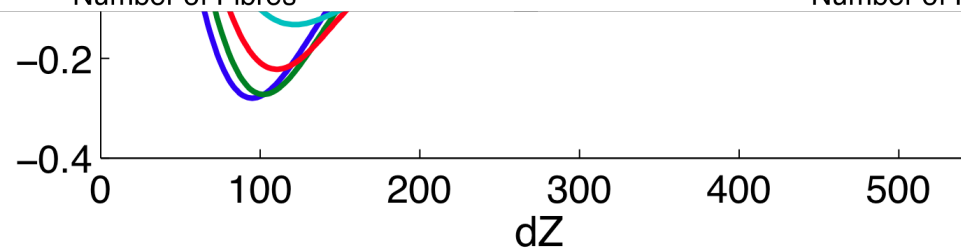
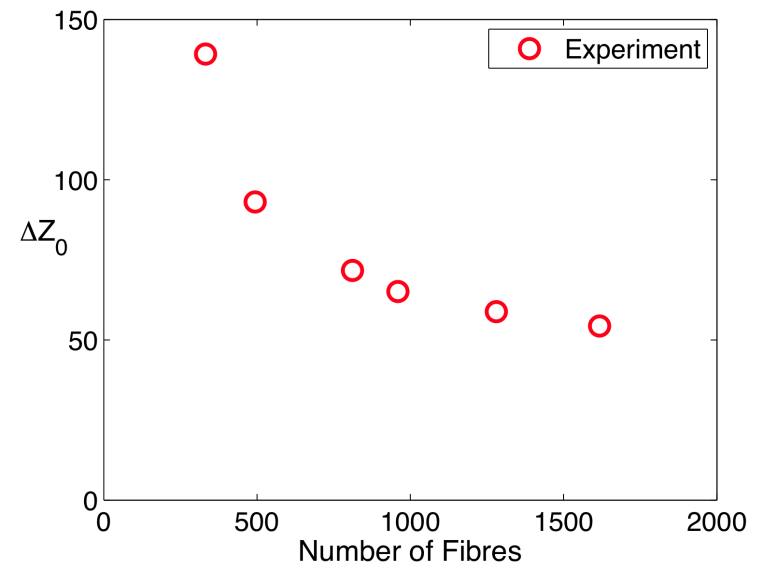
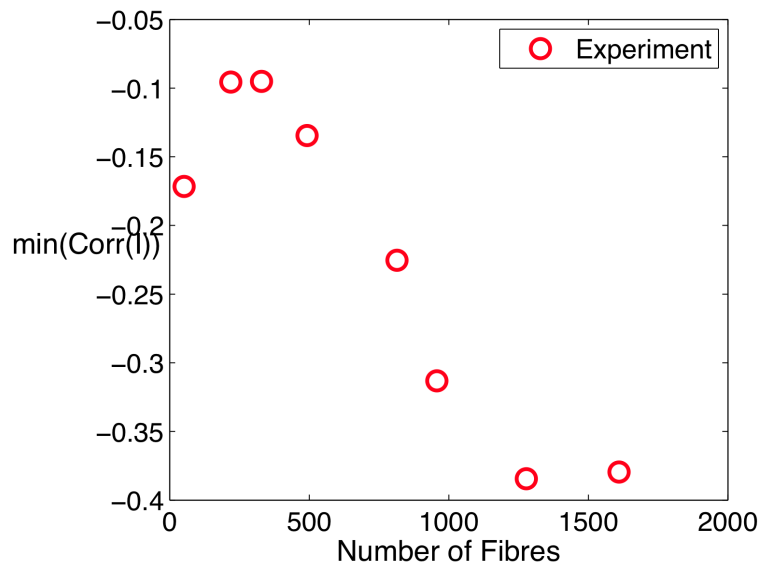
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Voronoi - Correlation



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Voronoi

- Large dependence of concentration.
- Streak width changes with concentration.
- Long computational time.
- Choice of threshold is important.

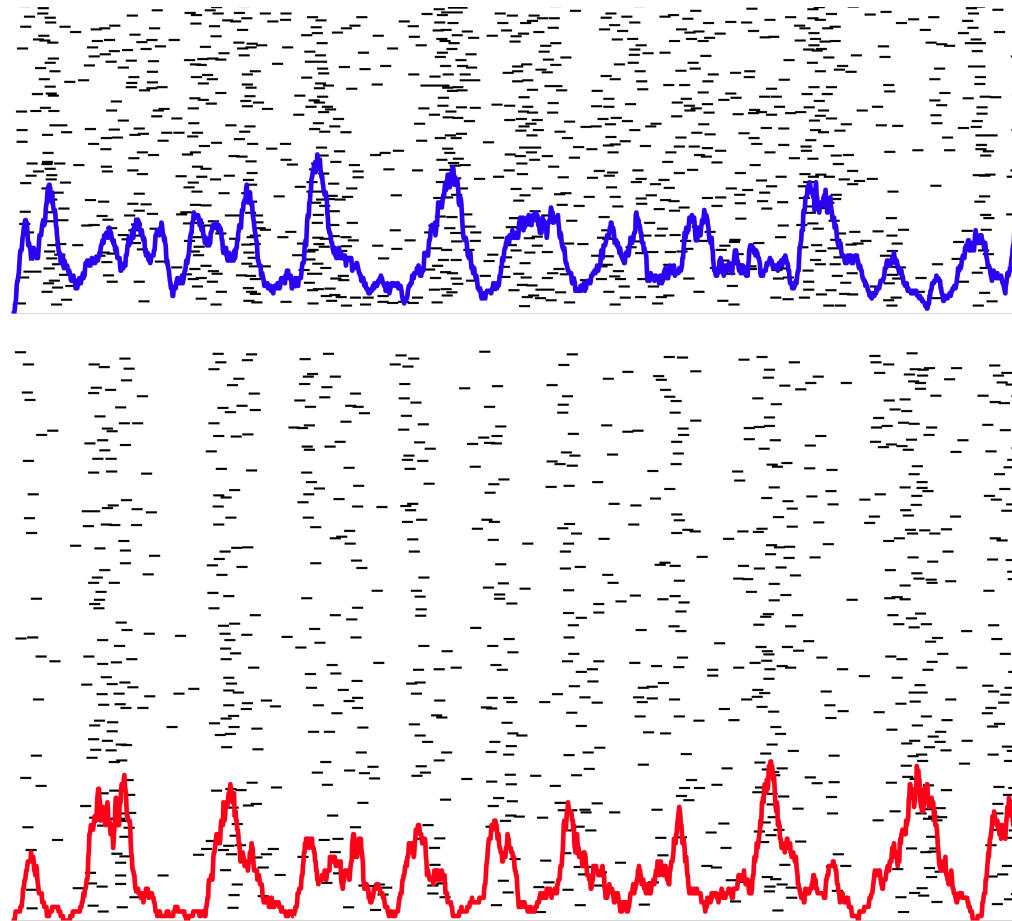


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Fixed Width



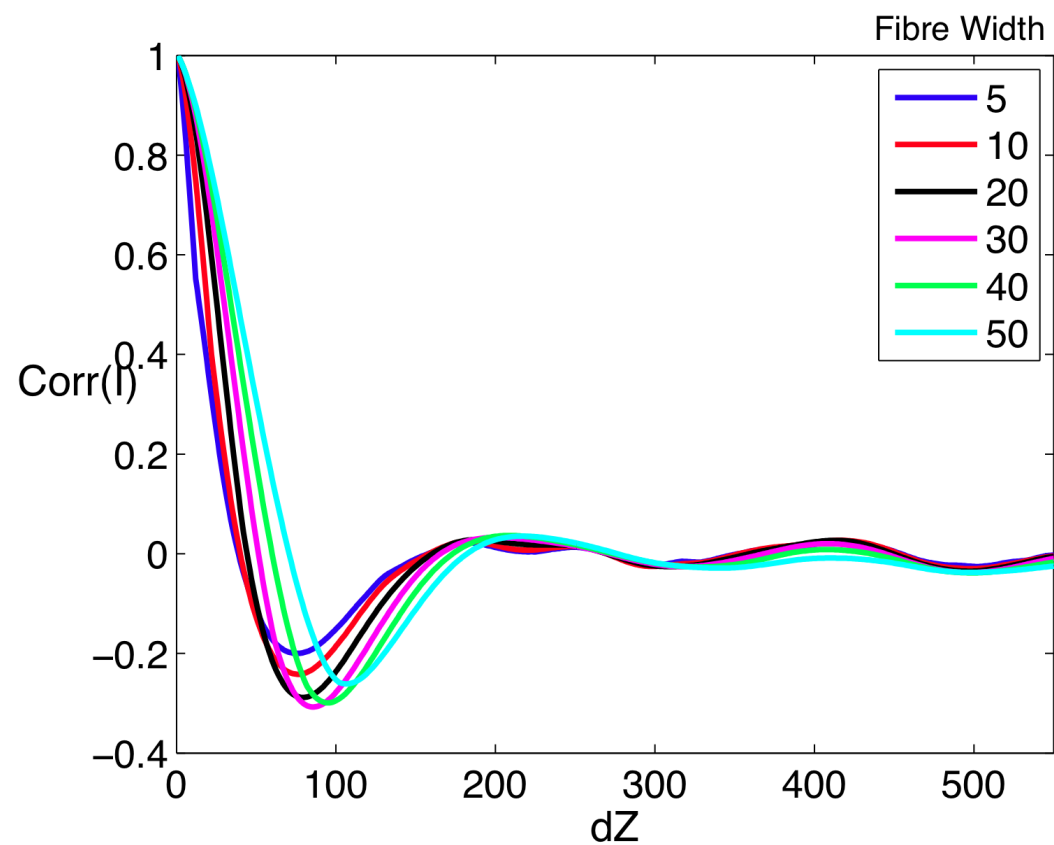
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Varied Fibre Width



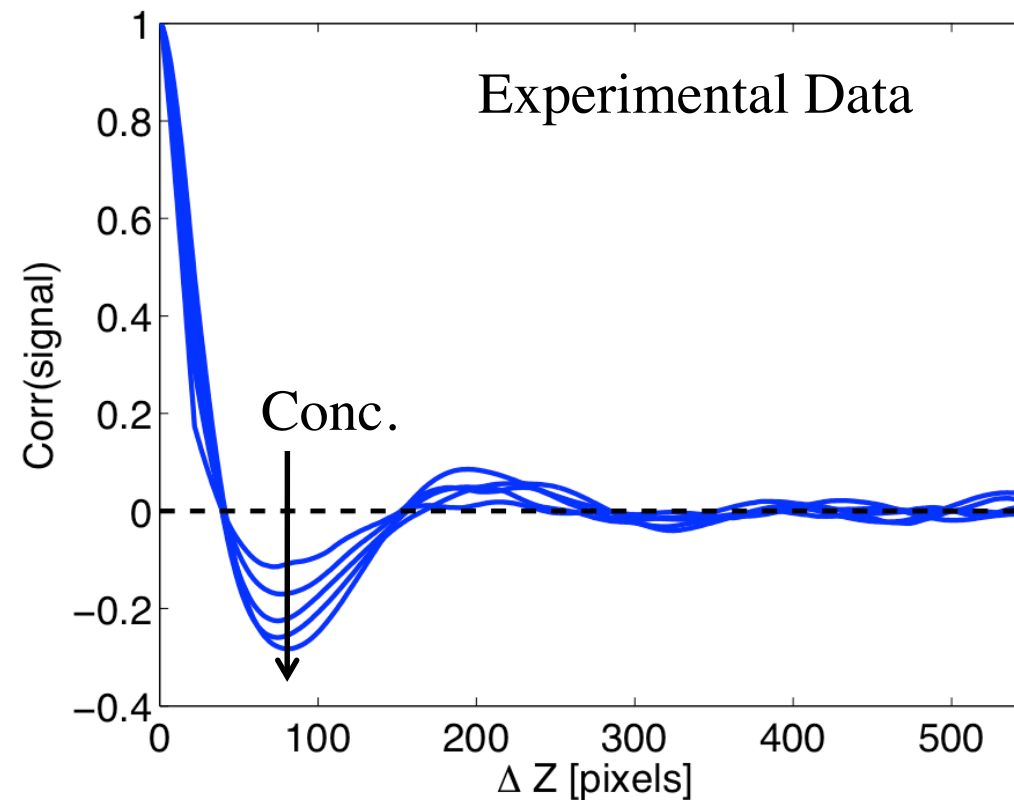
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Fixed Width - Concentration



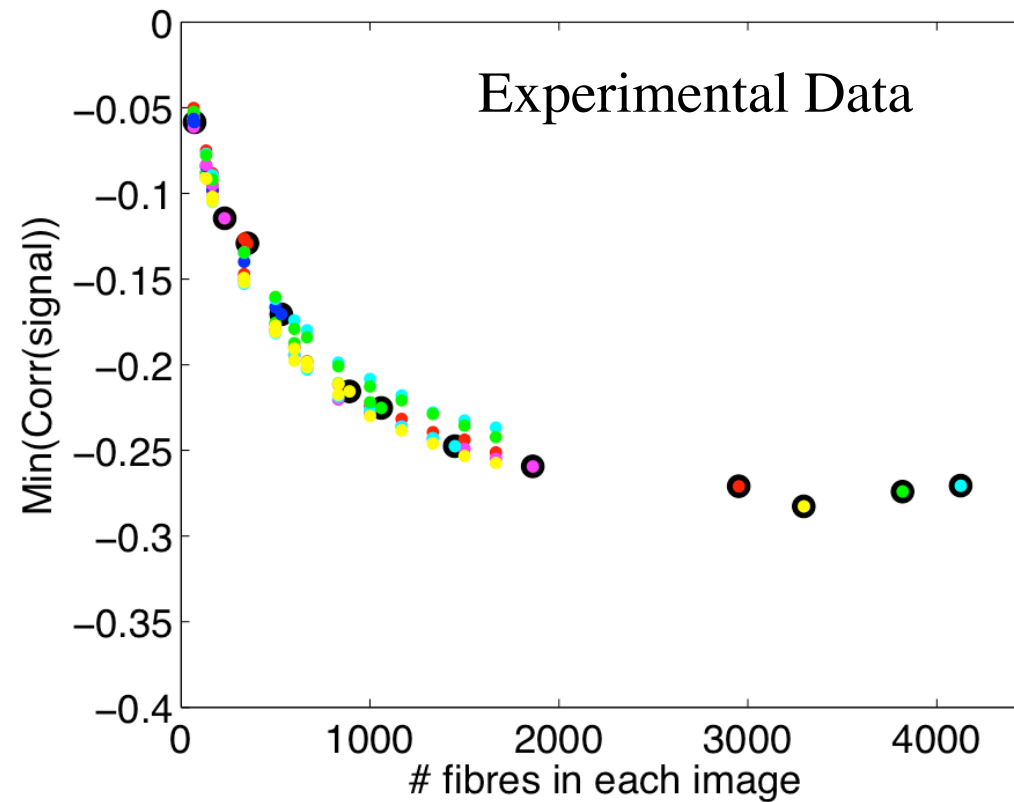
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Fixed Width - Concentration



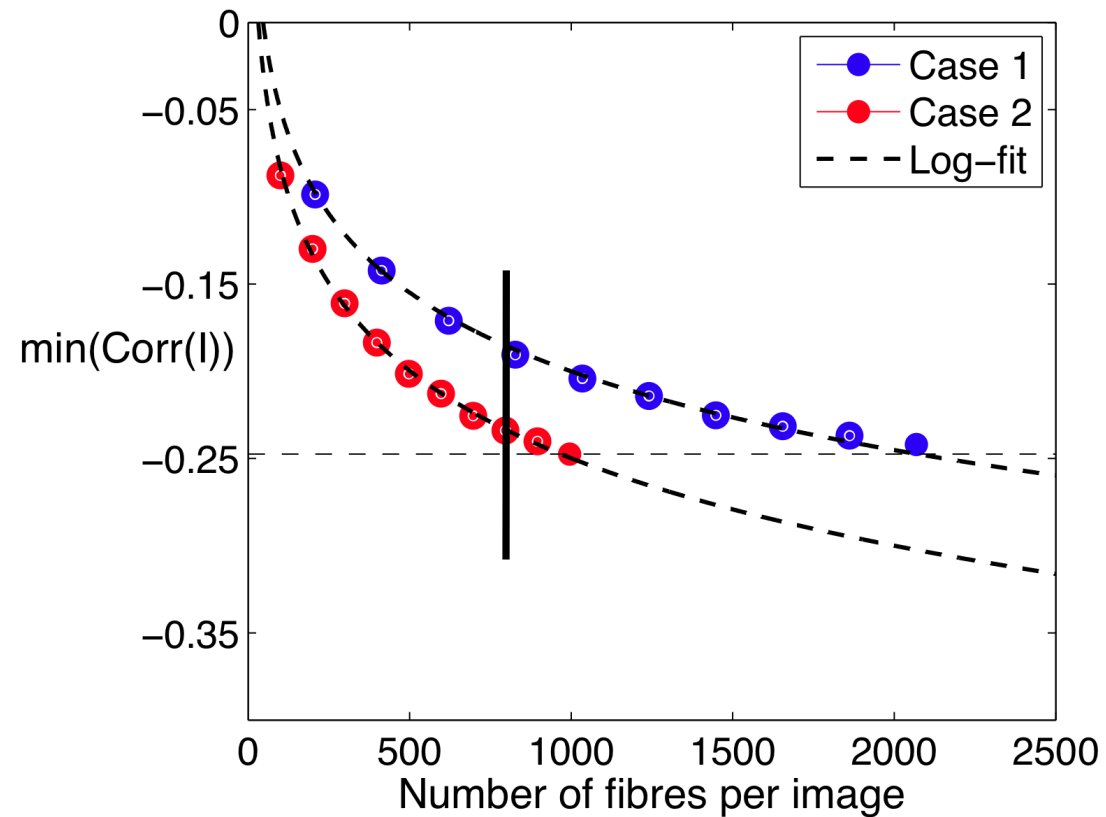
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Adapted Correlation

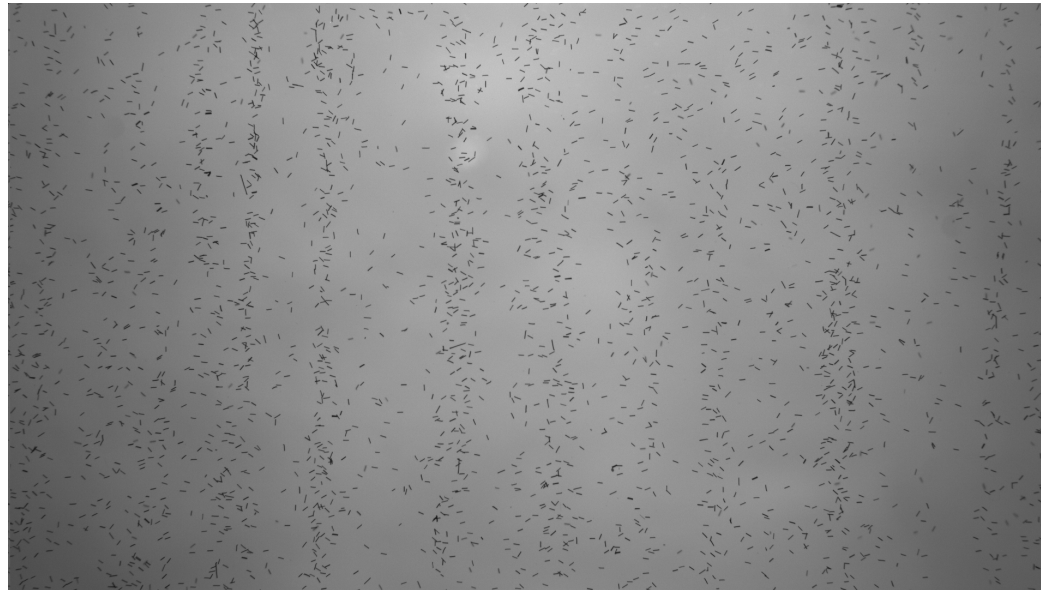


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Case 1

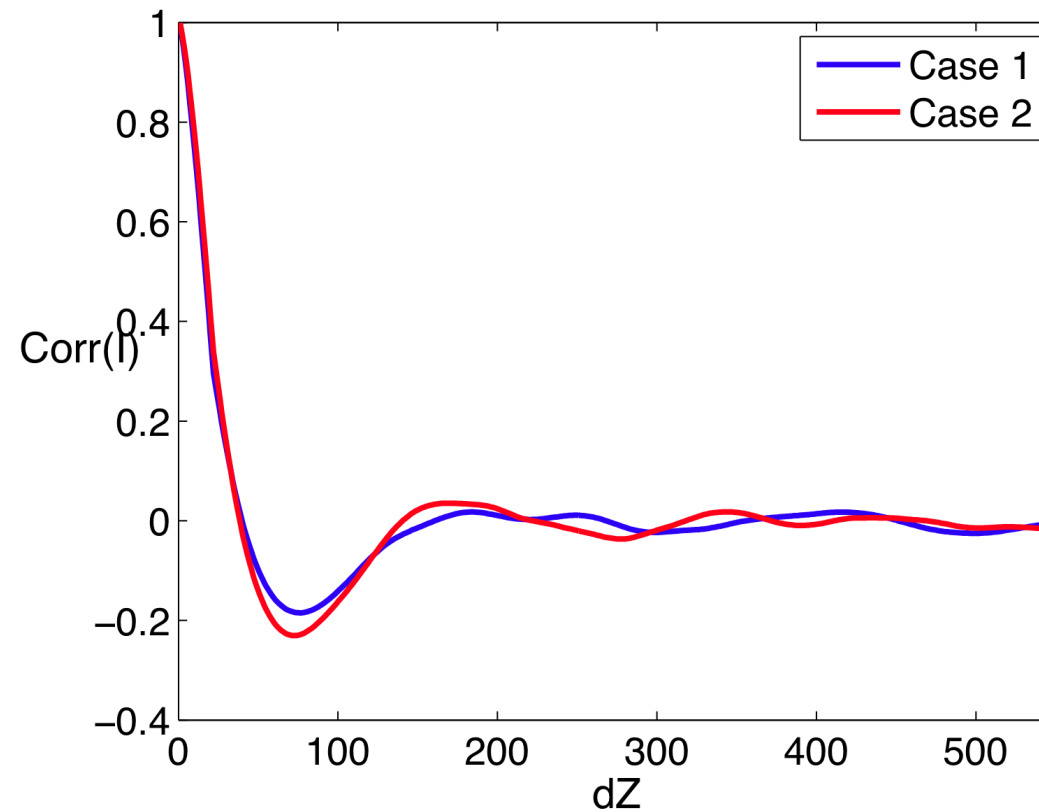


Case 2

Adapted Correlation



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Conclusions

- Proposed a consistent way to measure relative streakiness.
- Minimum correlations at equal concentration with fixed width.



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Thank you



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