Speckle Reduction Performance Estimation

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DYOPTYKA, Ireland.

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Yokohama, Japan.

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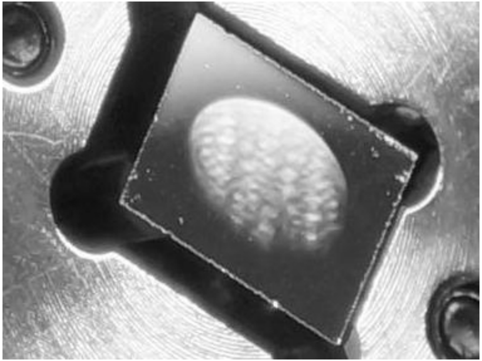
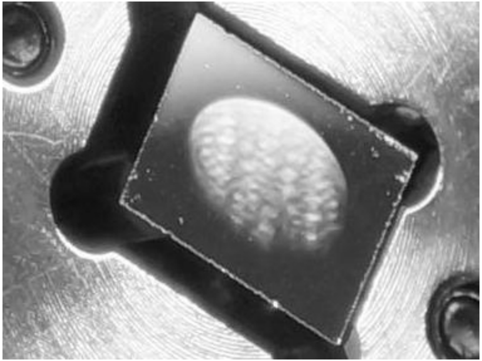
DYOPTYKA technology



Randomly-distributed DM surface deformations.

DYOPTYKA technology



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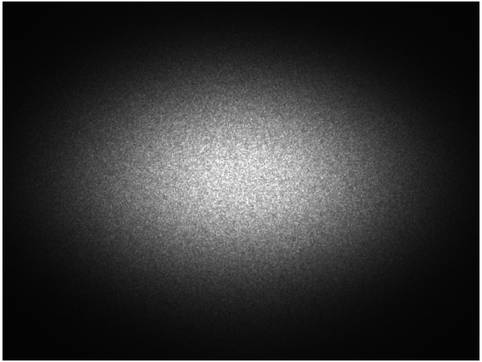

Randomized divergence with small angular extent.

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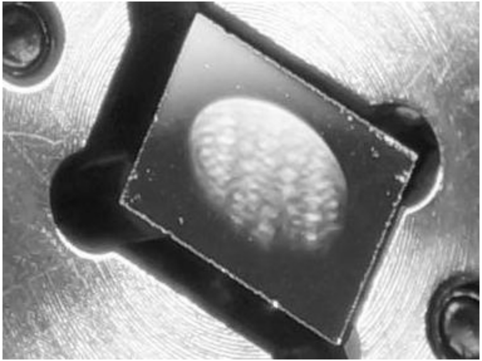

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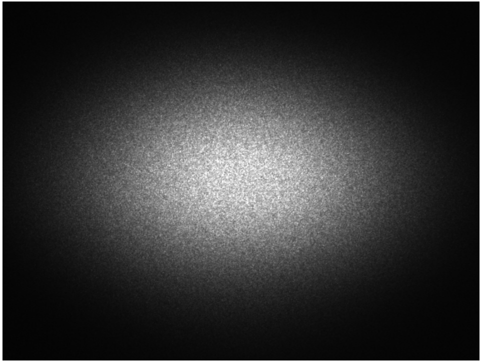
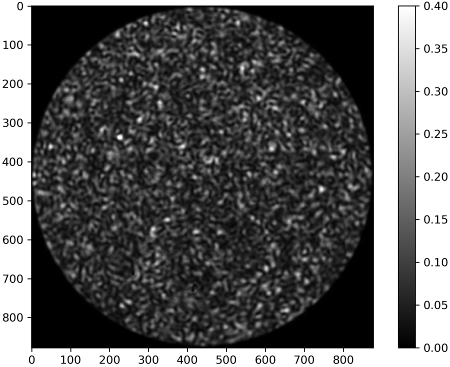


Randomized divergence with small angular extent.

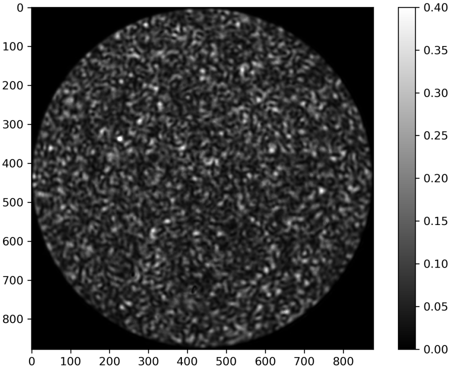
Typical frequency $\geq 1\,\text{MHz}$; *area* $3\,\text{mm}\times 4.5\,\text{mm}$; *reflectance* $\geq 96\%$; *damage* $\geq 1\,\text{W}\,\text{mm}^{-2}$.

Circular core exit face, ⌀200 µm, 0.22 N.A, 20 µs exposure.



DM inactive, $C_S^0 = 59.2\%$.

Circular core exit face, ⌀200 μm, 0.22 N.A, 20 μs exposure.



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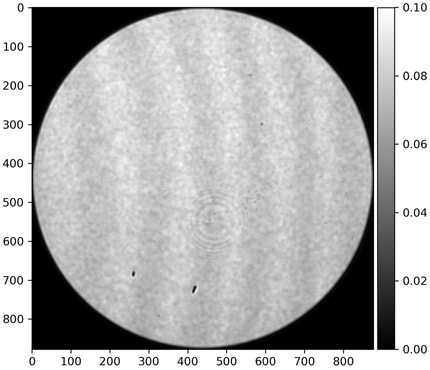
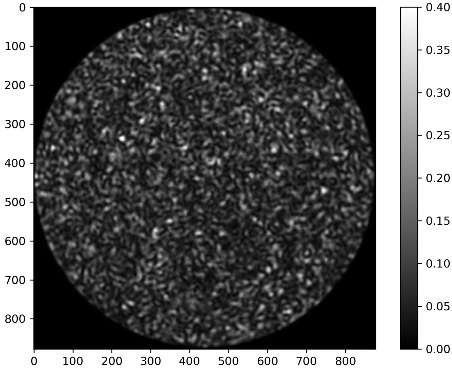


DM active, $C_S^{20} = 5.6\%$.

Circular core exit face, ⌀200 µm, 0.22 N.A, 20 µs exposure.



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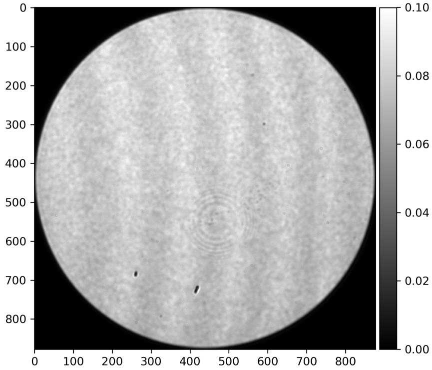
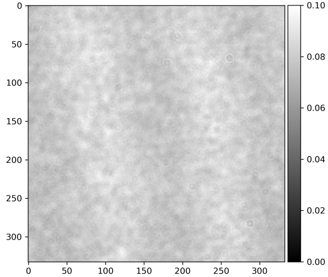


DM active, $C_S^{20} = 5.6\%$.

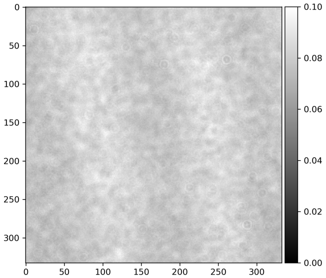
How can C_S measurements from $\geq$ 20 µs exposures be used to estimate C_S for $<$ 20 µs exposures or pulses?

Preprocessing for C_S accuracy



Observed, $C_S^{20} = 5.6\%$.

Preprocessing for C_S accuracy



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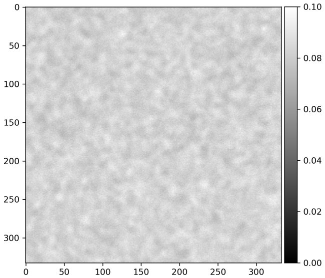
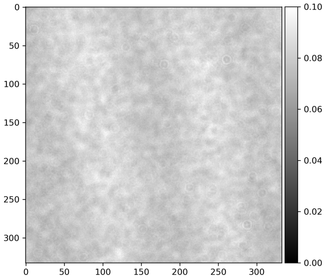


Mean-subtracted, $C_S^{20} = 4.1\%$.

Preprocessing for C_S accuracy



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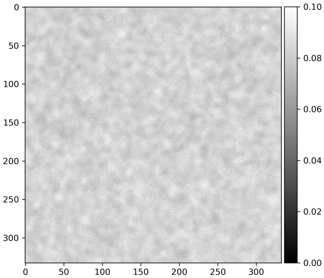

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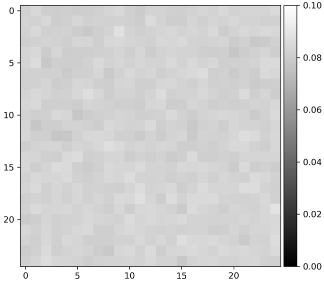
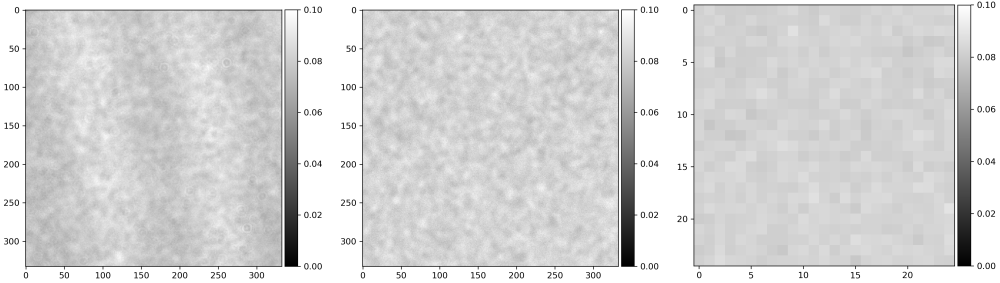


Downsampled $13\times$, $C_S^{20} = 2.1\%$.

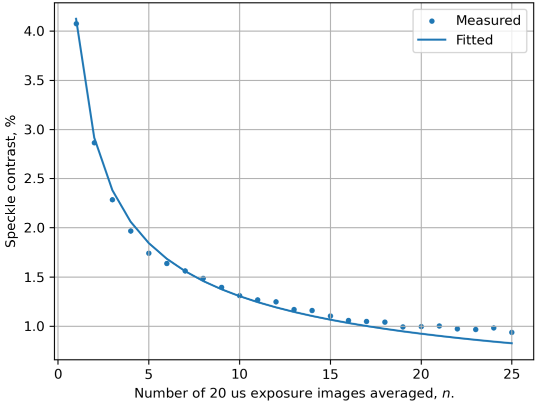
Preprocessing for C_S accuracy



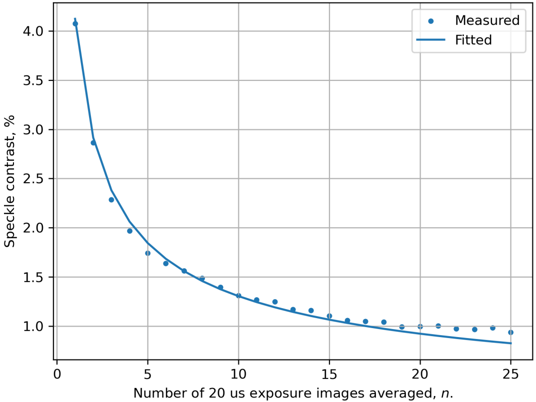
Observed, $C_S^{20} = 5.6\%$. *Mean-subtracted*, $C_S^{20} = 4.1\%$. *Downsampled* $13\times$, $C_S^{20} = 2.1\%$.

Stationary interference fringes removed through a calibration process.

C_S of multiple 20 µs exposure image averages

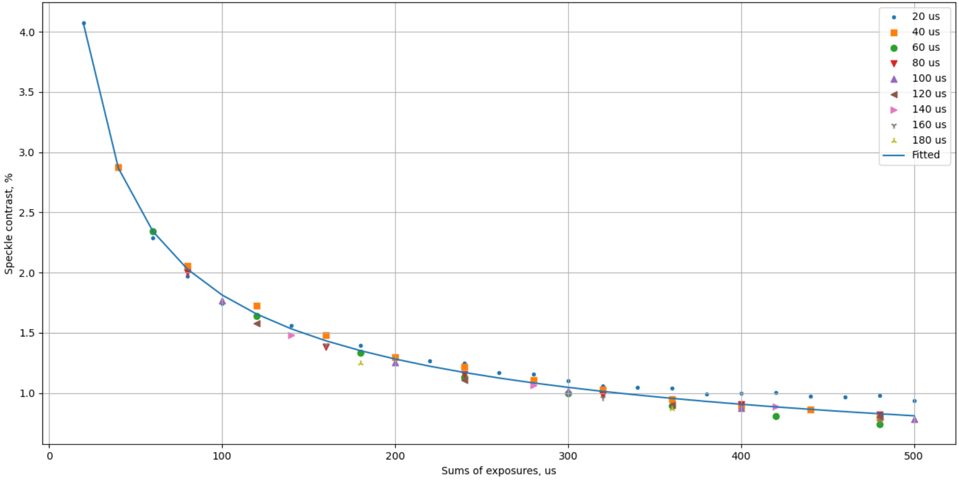


C_S of multiple 20 µs exposure image averages

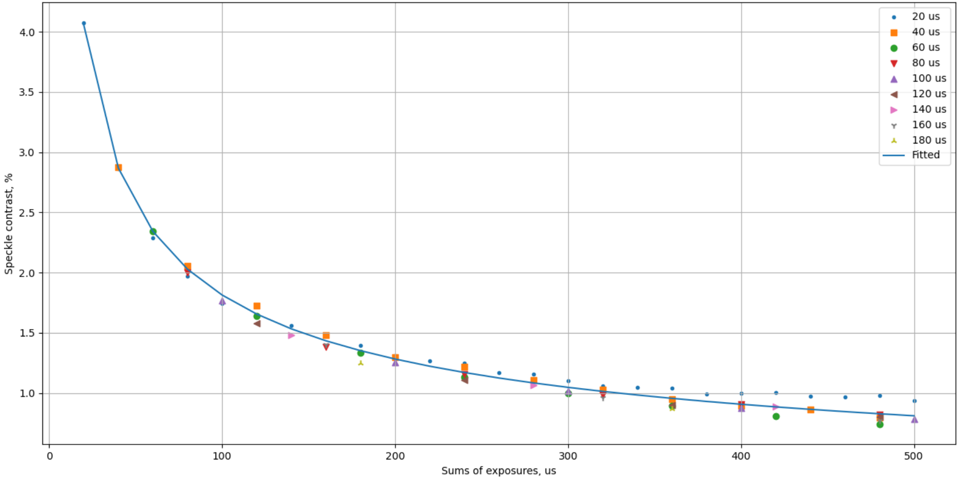


$$C_S^{20n} \approx C_S^{20} / \sqrt{n}.$$

C_S of different exposure image averages

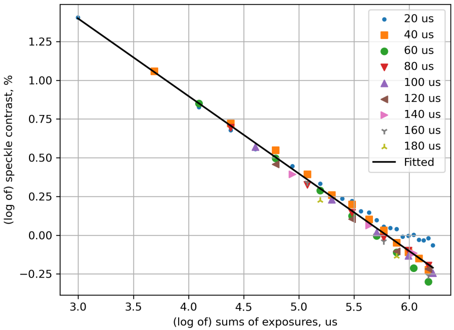


C_S of different exposure image averages



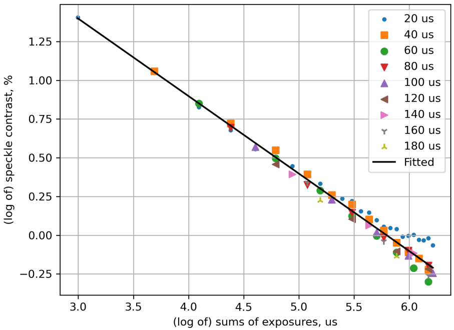
C_S consistent for multiple shorter exposures and fewer longer exposures.

Extrapolation of C_S best fit for shorter exposures



Previous plot with log-log *scales.*

Extrapolation of C_S best fit for shorter exposures



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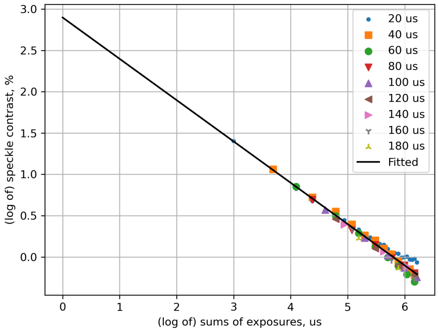
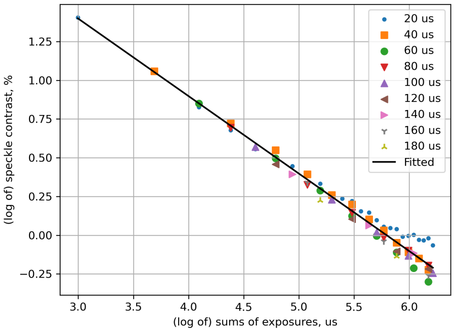
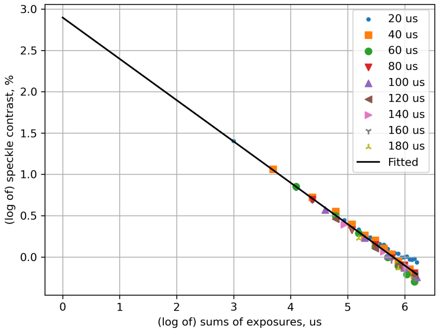


Extrapolation of C_S to 1 μs *exposure period.*

Extrapolation of C_S best fit for shorter exposures



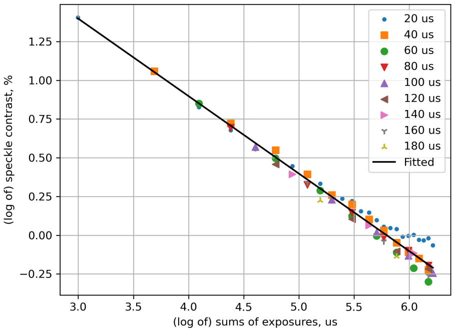
Previous plot with log-log *scales.*



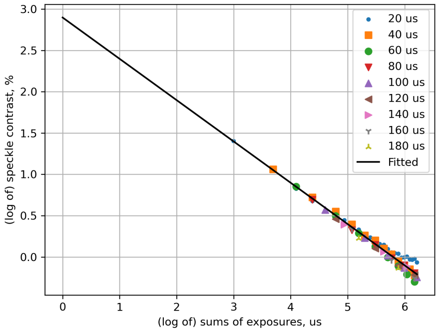
Extrapolation of C_S to 1 μs *exposure period.*

Extrapolated $C_S^1 \approx 18\%$ for 1 μs *exposure.*

Extrapolation of C_S best fit for shorter exposures



Previous plot with log-log *scales.*



Extrapolation of C_S to 1 μs *exposure period.*

Extrapolated $C_S^1 \approx 18\%$ *for* 1 μs *exposure.*

Since $C_S^1 \approx C_S^0/\sqrt{n}; \implies 18\% \approx 59\%/\sqrt{n}; \implies n \approx 11$ *within* 1 μs.

Conclusions

- Short exposure period estimates confirmed with customer observations.
- Observations close to short period of interest improve estimation.
- Customer observations essential for good estimation!

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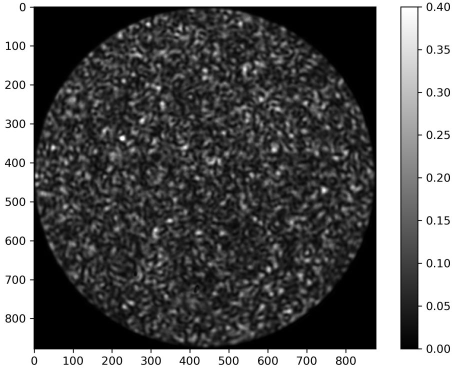
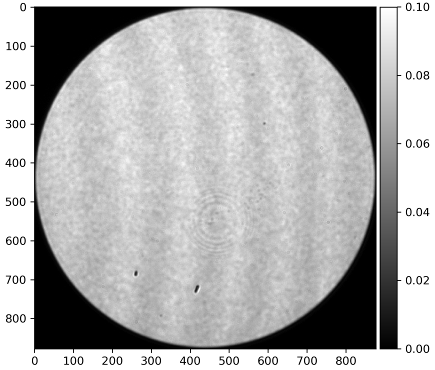
Thank You!





Please contact me to discuss:

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