

MIT Media Lab, Cambridge, MA

Research Scientist

September 2014 - February 2016

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Reading a book without opening it

Challenges

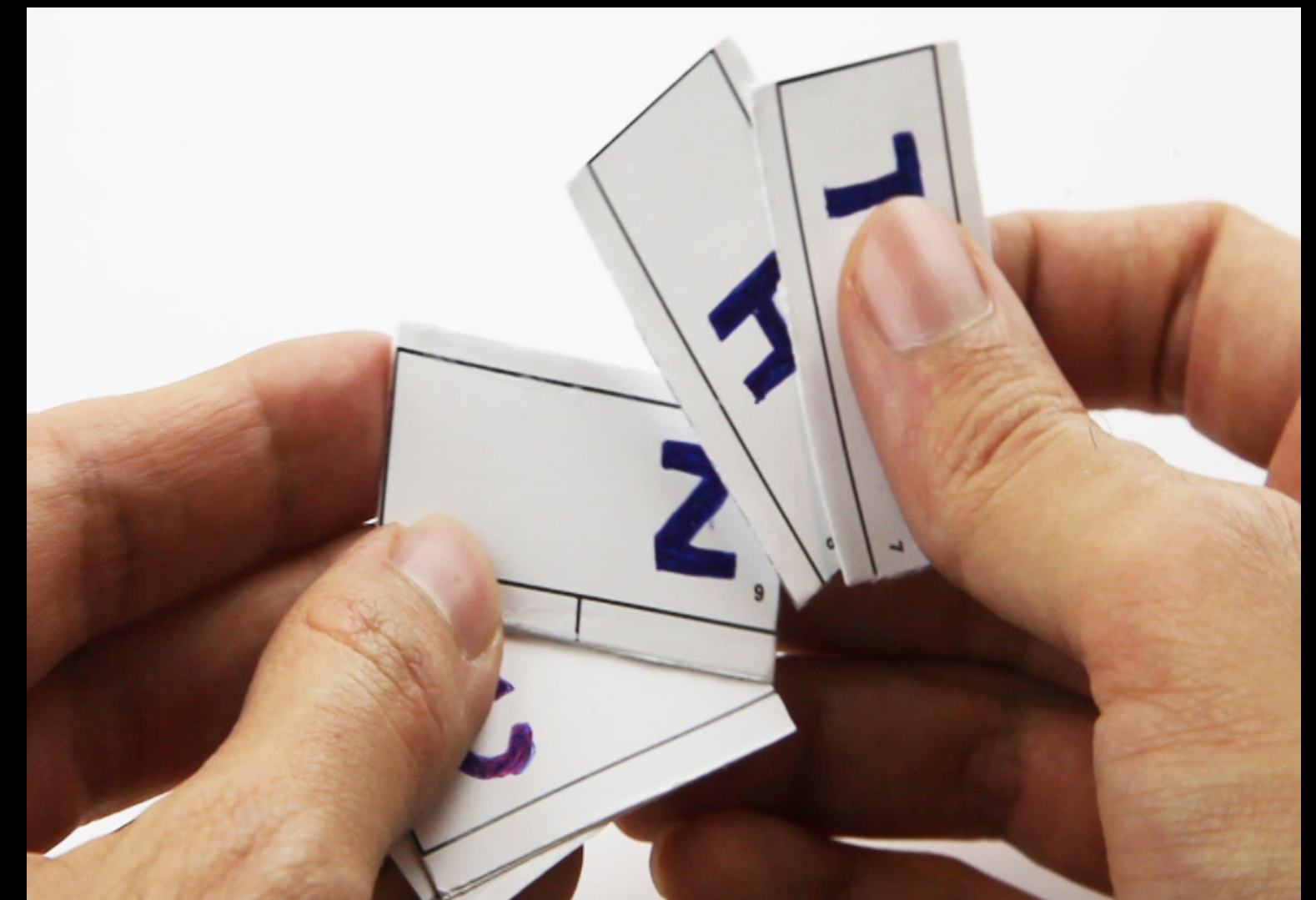
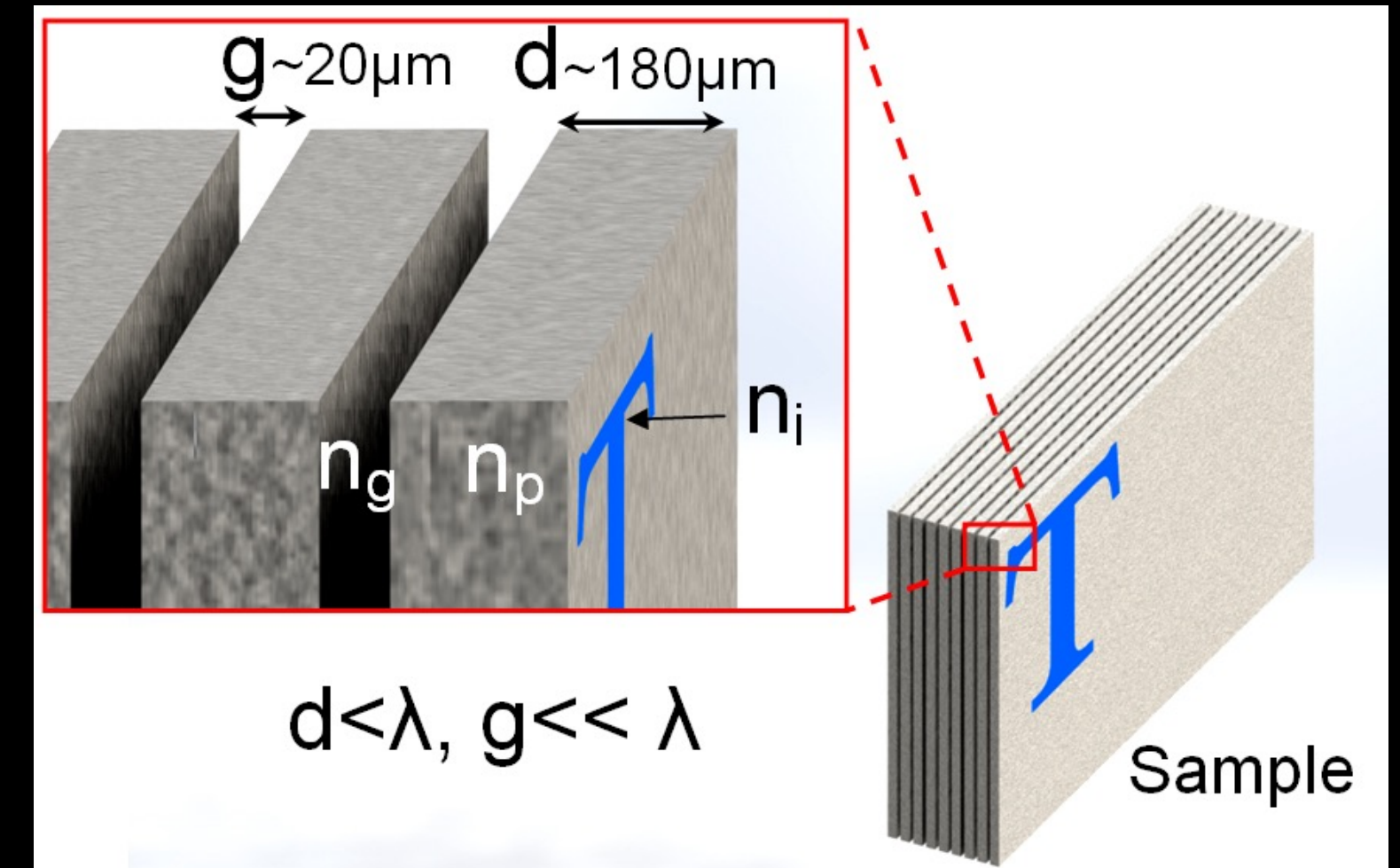
High losses

Occlusion

Sub-wavelength features

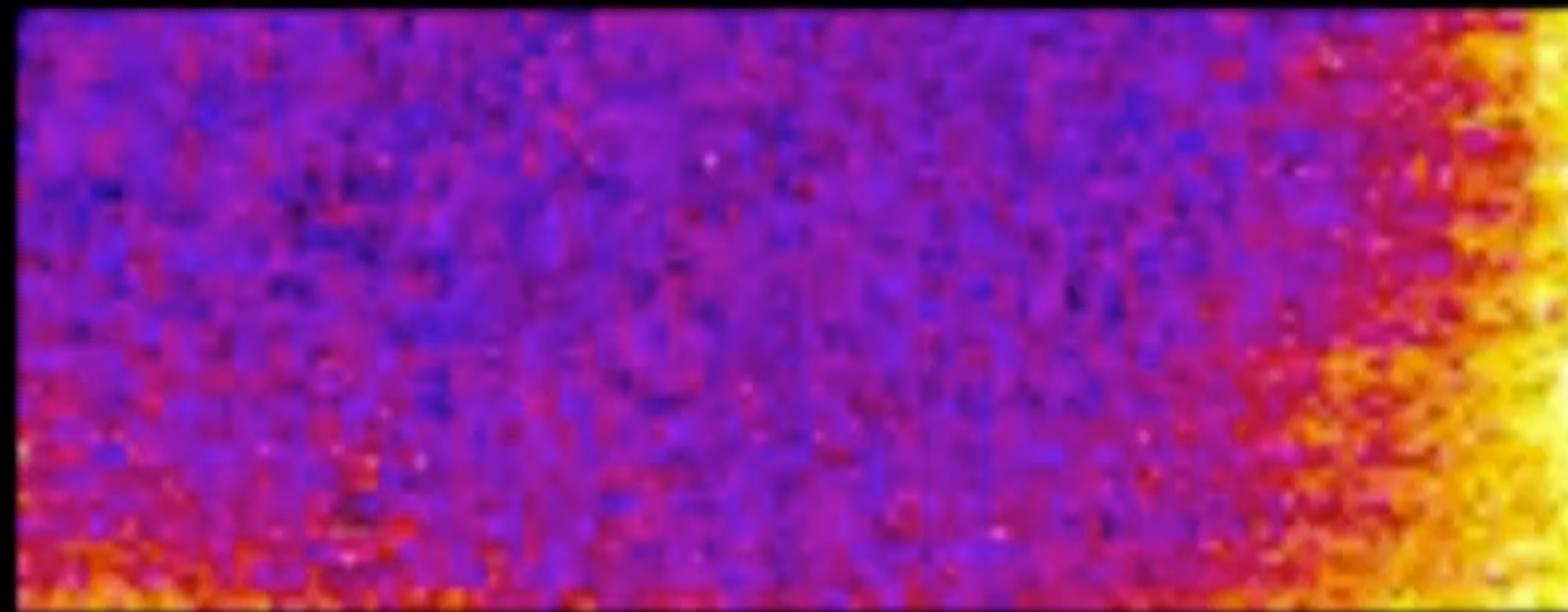
Low contrast

[TEDx talk](#): Unlimited vision

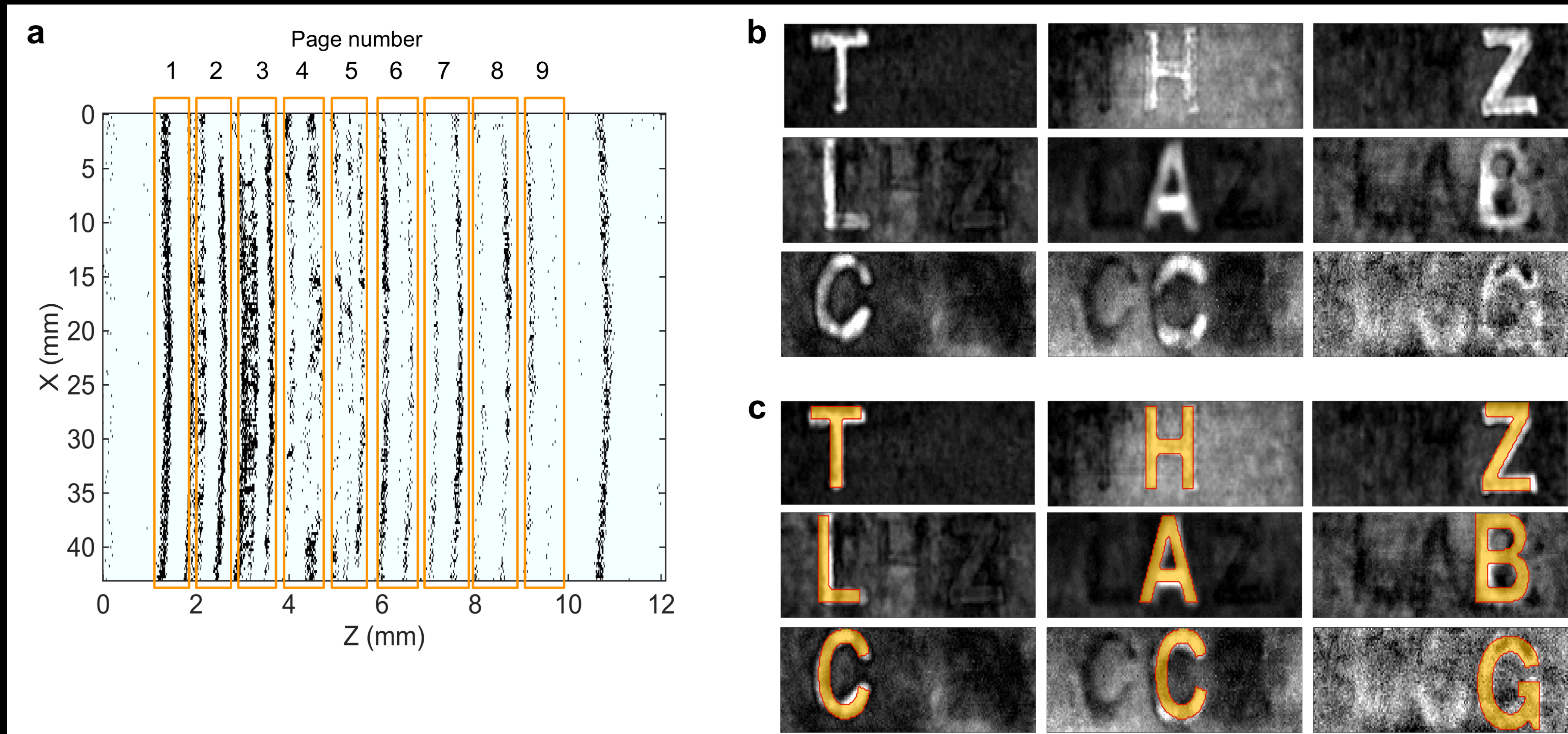


Redo-Sanchez, A., Heshmat, B., Aghasi, A., Naqvi, S., Zhang, M., Romberg, J., & Raskar, R. (2016). Terahertz time-gated spectral imaging for content extraction through layered structures. *Nature Communications*, 7, 12665. doi:10.1038/ncomms12665

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Results



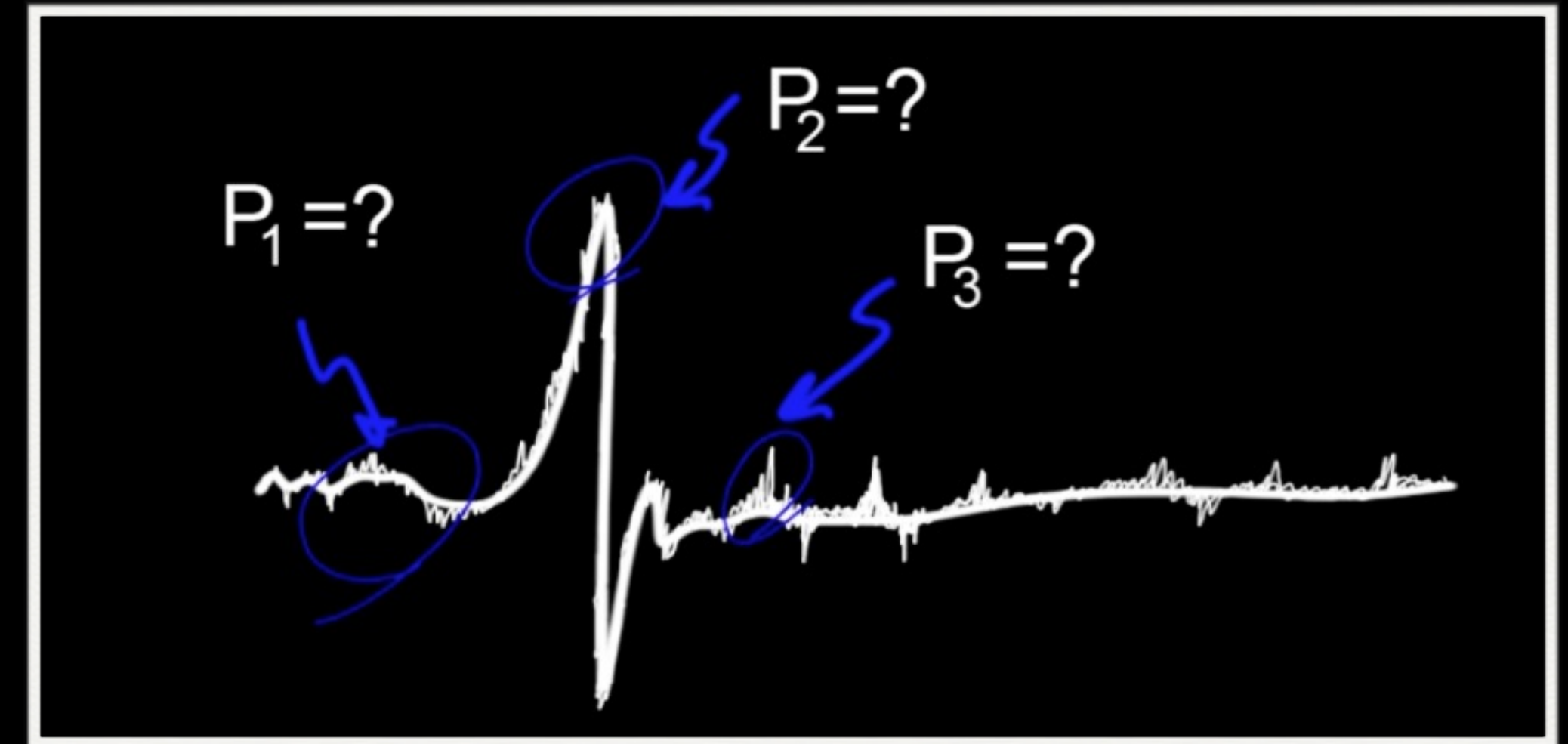
Probabilistic Pulse Extraction (PPEX)

What is the probability of a point of being an extremal value?

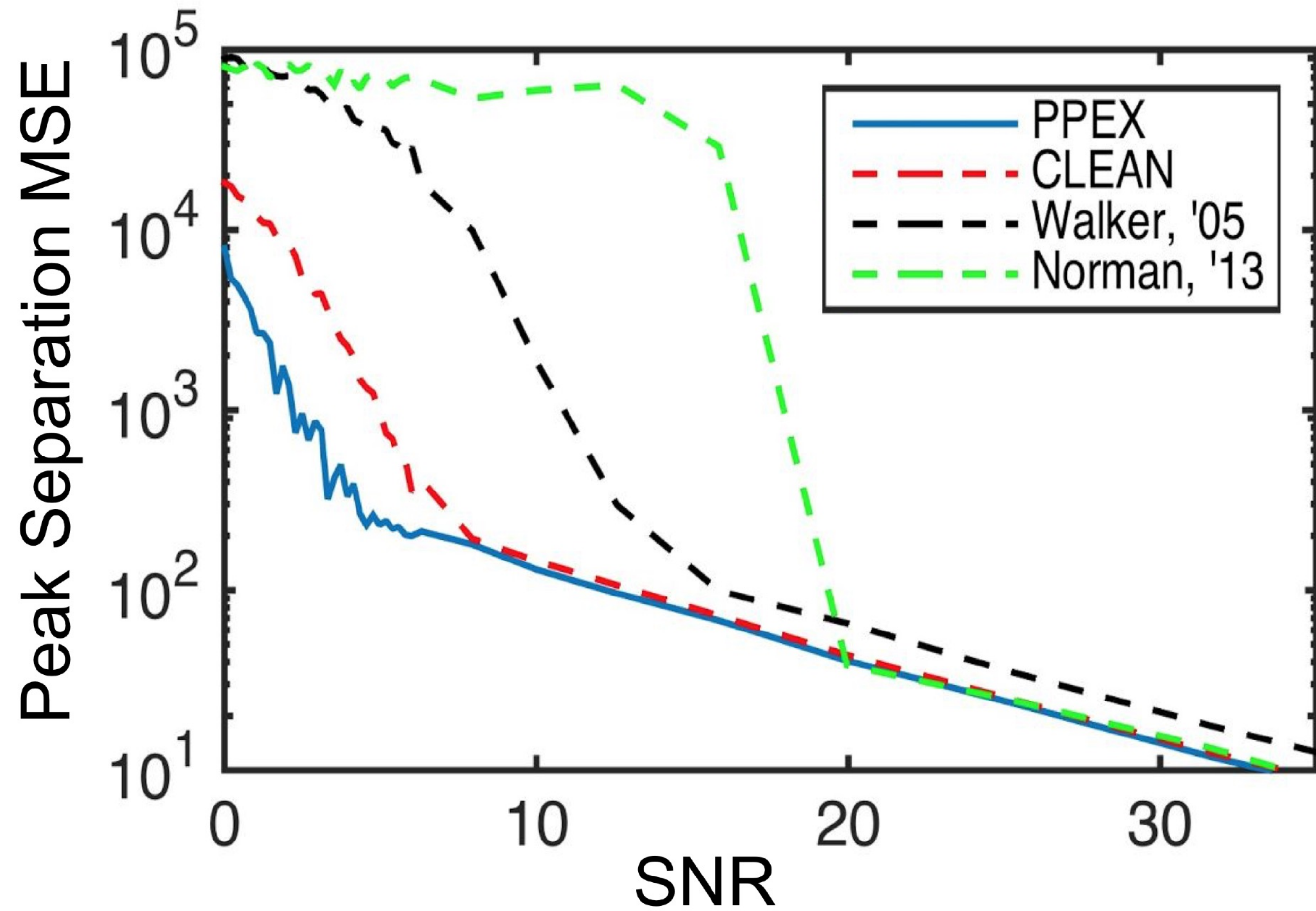
Use condition of extremal value

Consider waveform contains mostly noise

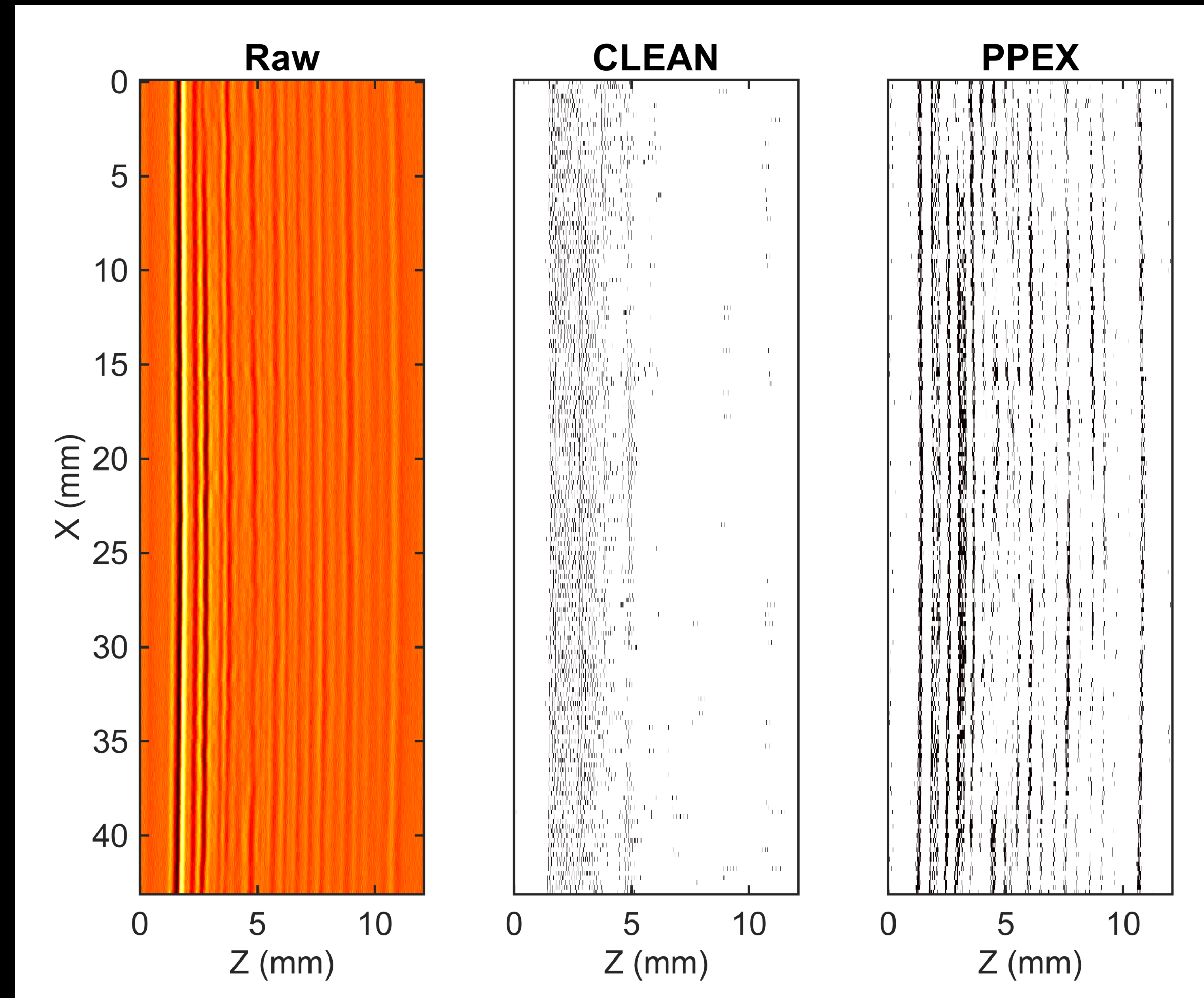
Noise is normally distributed



PPEX performance



PPEX vs CLEAN



PPEX: Procedure

Transform waveform to normalized “phase-space”

Define an “energy” to separate signal from noise

Statistical confidence level as threshold

$$\begin{aligned}(Y, t) &\rightarrow \left(Y, \frac{dY}{dt}\right) = (Y, \dot{Y}) \\ u &= (Y - \bar{Y})/\sigma_Y \\ v &= \dot{Y}/\sigma_{\dot{Y}} \\ \epsilon &= \sqrt{u^2 + v^2} \\ P(y) |_{(u,v)} &= \frac{4}{\sqrt{\pi}} \int_0^{|y|} e^{-x^2} dx - 1/2 \\ P(u, v) &= P(u) \cdot (1 - P(v))\end{aligned}$$

