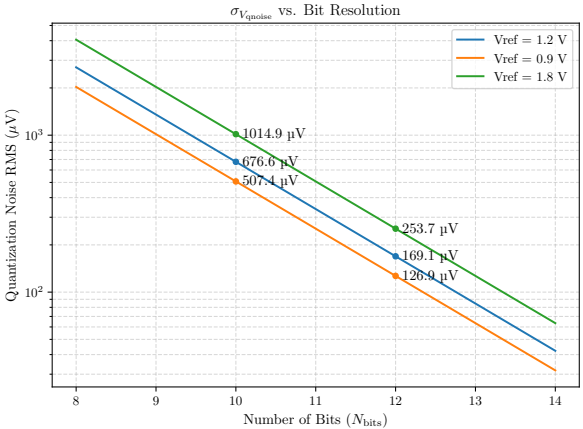
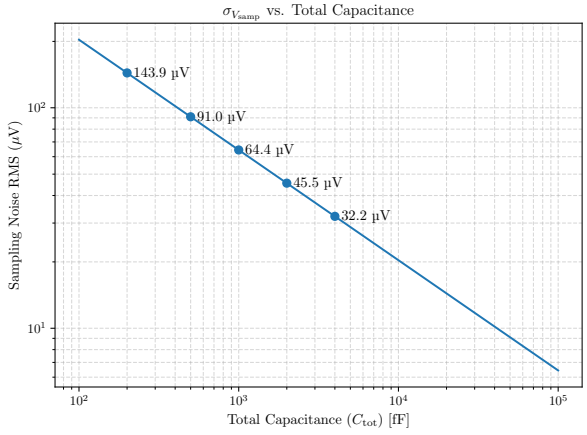
Quantization Noise in ADCs

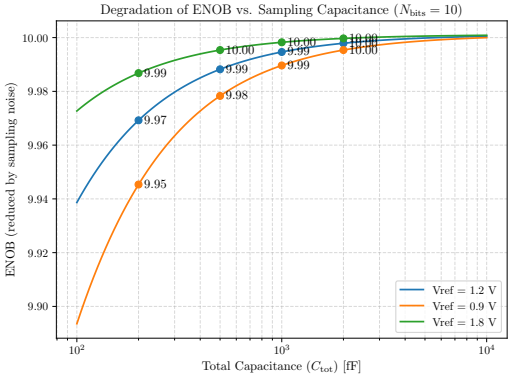


$$\sigma_{V_{\text{qnoise}}} = \frac{2V_{\text{ref}}}{2^N\sqrt{12}}$$

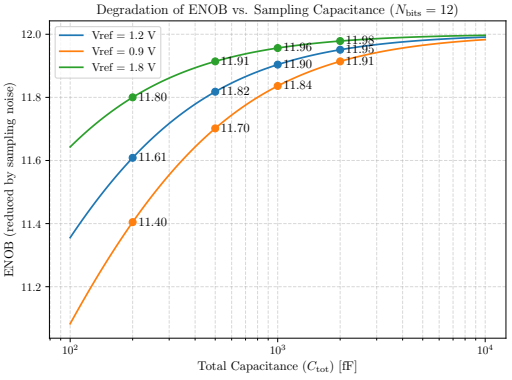
Sampling Noise in SAR ADCs



ENOB vs C_{tot}: Sampling Noise



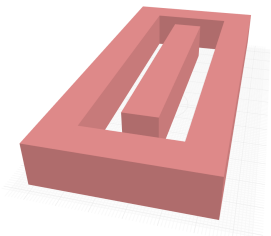
10-bit

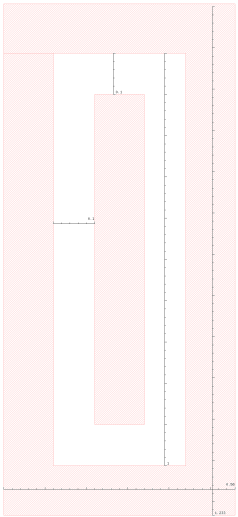


12-bit

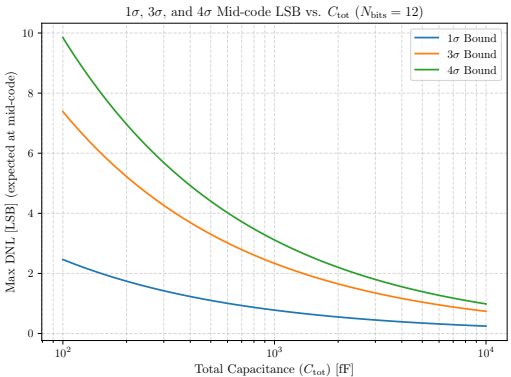
Unit Fringe Capacitor

1 layer: 0.31 $\mathrm{fF}/\mu\mathrm{m}^2$
2 layers: 0.62 $\mathrm{fF}/\mu\mathrm{m}^2$
3 layers: 0.93 $\mathrm{fF}/\mu\mathrm{m}^2$
Matching coefficient:
$\sigma(\Delta C/C) = 0.85\% \times \sqrt{C\ [\mathrm{fF}]}$

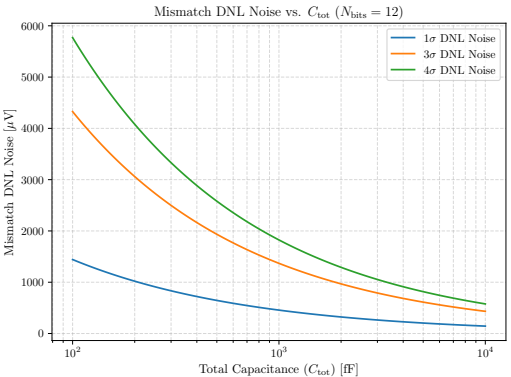




Expected Mismatch and DNL Noise

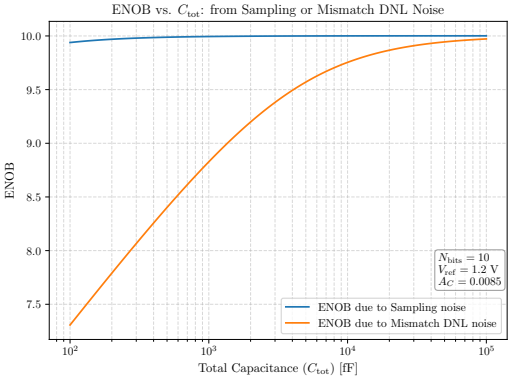


Expected Mismatch (12-bit)

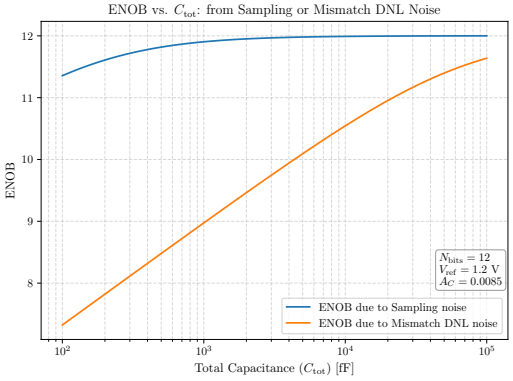


DNL Noise from Mismatch (12-bit)

ENOB vs C_{tot}: Sampling Noise or Mismatch DNL Noise



10-bit Comparison



12-bit Comparison

Note: Assuming a worst case 3σ variation, corresponding to roughly 1 in 300 ADCs

CDAC Array Overview

Total Area $= 1940\ \mu\mathrm{m}^2$

$C_{\mathrm{tot}} = 1.4\ \mathrm{pF}$