Bennett's inequality from Maurer and Pontil: For $Y_1,\dots,Y_m$ IID in $[0,1]$ and $\delta>0$ with variance σ^2, there is probability at least $1-\delta$ that

$$\mathbb{E}(Y)-\frac{1}{m}\sum_{i=1}^m Y_i \leqslant \sqrt{\frac{2\sigma^2\log(1/\delta)}{m}}+\frac{\log(1/\delta)}{3m}.$$

In RQMC we take $m=R$ replicates of n RQMC points. So the width of the one sided interval is at most

$$\frac{\sigma_n}{\sqrt{R}}\sqrt{2\log(1/\delta)}+\frac{\log(1/\delta)}{3R}$$

where σ_n^2 is the RQMC variance using n sample points.

Suppose that $\sigma_n = An^{-\theta}$. For smooth integrands and $d=1$, we have $\theta=3/2$. For RQMC we take $\theta>1/2$. For integrands of bounded variation in the sense of Hardy and Krause, but not smooth, $\theta\approx 1$ is reasonable. Let the budget be $B=nR$. Then the width is asymptotic to

$$\frac{An^{-\theta}}{\sqrt{B/n}}\sqrt{2\log(1/\delta)}+\frac{\log(1/\delta)}{3B/n}=\frac{A}{\sqrt{B}}n^{1/2-\theta}\sqrt{2\log(1/\delta)}+\frac{n\log(1/\delta)}{3B}.$$

For $\theta=1/2$, the best n is $n=1$. We assumed that $\theta>1/2$. Then the derivative with respect to n is

$$(1/2-\theta)\frac{A}{\sqrt{B}}n^{-1/2-\theta}\sqrt{2\log(1/\delta)}+\frac{\log(1/\delta)}{3B}$$

which vanishes at

$$n^{-\theta-1/2}=\frac{\frac{\log(1/\delta)}{3B}}{(\theta-1/2)\frac{A}{\sqrt{B}}\sqrt{2\log(1/\delta)}}$$

that is

$$\begin{aligned}
n &= \left(\frac{(\theta-1/2)\frac{A}{\sqrt{B}}\sqrt{2\log(1/\delta)}}{\frac{\log(1/\delta)}{3B}}\right)^{1/(\theta+1/2)}\\
&= \left(\frac{3(\theta-1/2)A\sqrt{2B}}{\sqrt{\log(1/\delta)}}\right)^{1/(\theta+1/2)}\\
&\propto B^{1/(2\theta+1)}.
\end{aligned}$$

For $\theta=3/2$ we get $n=O(B^{1/4})$ while for $\theta=1$, we get $n=O(B^{1/3})$. Note that with a better rate for σ_n^2 we take smaller n. I think this is because the constant term $\log(1/\delta)/(3R)$ does not respond to n. With small σ_n^2 we can take some larger R.