- Clarifying comment on MC integration uncertainty:

- Saw yesterday that MC integration formula in any number of dimensions is

$$\boxed{I \approx \frac{V}{N}\sum_{i=1}^{N} f_i \pm \frac{V\sigma_f}{\sqrt{N}}}$$

  - f_i are the $f(\bar{x}_i)$ at sampled $\bar{x}_i$ input points
  - V is the volume of the d dimensional integration region (e.g. a box in $\bar{x}$ space, $V = L^d$)
  - σ_f is the (sample) standard deviation of the f_i samples $\sigma_f = \sqrt{\frac{1}{N-1}\sum(f_i - \bar{\mu}_f)^2}$
  - N is number of $\bar{x}_i$ samples

- Said: MC error scales as $O(\frac{1}{\sqrt{N}})$, <u>indep. of dimensionality</u>.

  → But what about V in $\frac{V\sigma_f}{\sqrt{N}}$? $V = L^d$ certainly scales with dim...

  → Yes, but doesn't affect how the error scales with the <u>number of additional samples</u>.

  → V only sets overall scale: $I \approx V\left[\frac{1}{N}\sum f_i \pm \frac{\sigma_f}{\sqrt{N}}\right]$

  → Errors are larger in high dim, but doubling N always gives a factor $\frac{1}{\sqrt{2}}$ reduction in error!