$$I = 2\sigma^{4} = \int_{0}^{\infty} dx \, x^{3} \exp\left(-\frac{1}{2} \frac{x^{2}}{\sigma^{2}}\right) = \int_{0}^{\infty} dx \, f(x) \operatorname{pdf}(x) \approx \frac{1}{N} \sum_{i=1}^{N} f(x_{i})$$
with: $f(x) = \sigma \sqrt{\frac{\pi}{2}} x^{3}$; $\operatorname{pdf}(x) = \begin{cases} \frac{1}{\sigma} \sqrt{\frac{2}{\pi}} \exp\left(-\frac{1}{2} \frac{x^{2}}{\sigma^{2}}\right) & \text{if } x \geq 0 \\ 0 & \text{if } x < 0 \end{cases}$

$$100.3\%$$

$$100.2\%$$

$$100.0\%$$

$$99.9\%$$

$$99.8\%$$

$$99.8\%$$

$$N = \text{number of extracted } x_{i} \text{ for a single Monte-Carlo integral}$$