How to choose E_{cut}

(1) Temperature change when dN particles are being removed

Let us assume that at a given time, we eliminate all dN particles with energy U larger than $\eta k_B T$
$(\eta \gg 1 \rightarrow dN \ll N)$

Lost energy:

$$dE = dN \left(U + \kappa\, k_B T \right) = dN\, k_B (\eta + \kappa) T$$

$\kappa\, k_B T$ average energy of an evaporated atom in excess of the evaporation threshold U

$\kappa \sim 1$

Let us assume that the rest of the particles rethermalize via collisions

~~Taylor expo~~

$\rightarrow$ New temperature

$$E + dE = (N + dN)\, k_B (T + dT)$$

$$dE = dN\, k_B T (\eta + \kappa)$$
$$E = N k_B T$$

$$E + dE = dN\, k_B T (\eta + \kappa) + N k_B T \overset{!}{=} (N + dN) k_B (T + dT) \approx N k_B T + N k_B dT + k_B T dN$$

combine the two

$$dN\, k_B T (\eta + \kappa) = N k_B dT + k_B T dN$$

$$dN \cancel{k_B} (\eta + \kappa) = N \cancel{k_B} \frac{dT}{T} + \cancel{k_B} dN$$

$$\boxed{\frac{dT}{T} = \frac{dN}{N} (\eta + \kappa - 1)}$$

$\eta + \kappa - 1$ is always larger than zero for e.g. a Maxwell distribution, since $\kappa > 1$

find calculate

$$\frac{\int_{\eta k_B T}^{\infty} E \exp\left[-E/k_B T\right]}{\int_{\eta k_B T}^{\infty} \exp\left[-E/k_B T\right]} \overset{!}{=} \kappa k_B T$$

and you will see that $\kappa > 1$