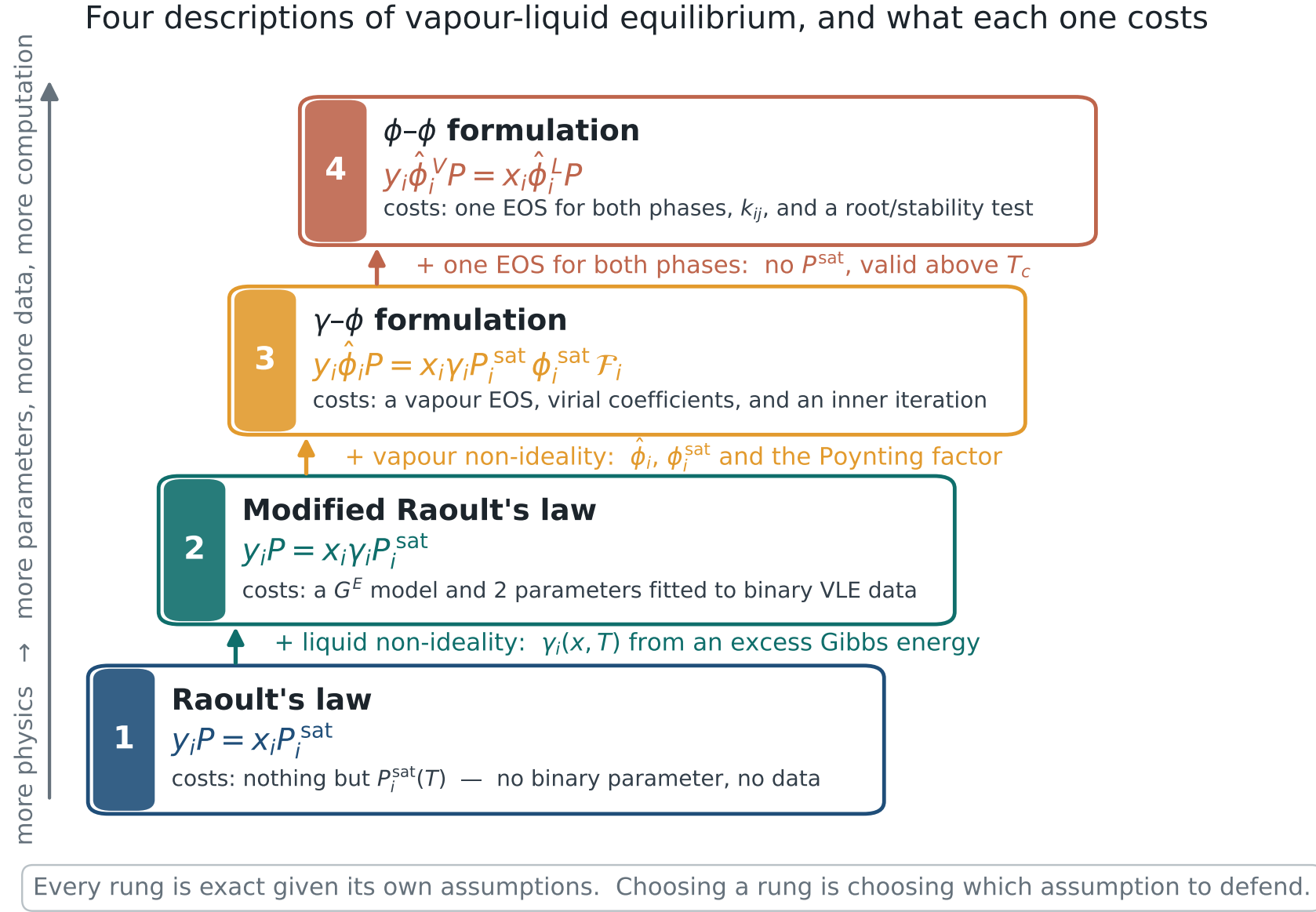
Four descriptions of vapour-liquid equilibrium, and what each one costs
more physics → more parameters, more data, more computation
4
ϕ–ϕ formulation
$y_i\hat{\phi}_i^V P = x_i\hat{\phi}_i^L P$
costs: one EOS for both phases, k_{ij}, and a root/stability test
+ one EOS for both phases: no P^{sat}, valid above T_c
3
γ–ϕ formulation
$y_i\hat{\phi}_i P = x_i\gamma_i P_i^{sat}\phi_i^{sat}\mathcal{F}_i$
costs: a vapour EOS, virial coefficients, and an inner iteration
+ vapour non-ideality: $\hat{\phi}_i$, ϕ_i^{sat} and the Poynting factor
2
Modified Raoult's law
$y_i P = x_i\gamma_i P_i^{sat}$
costs: a G^E model and 2 parameters fitted to binary VLE data
+ liquid non-ideality: $\gamma_i(x,T)$ from an excess Gibbs energy
1
Raoult's law
$y_i P = x_i P_i^{sat}$
costs: nothing but $P_i^{sat}(T)$ — no binary parameter, no data
Every rung is exact given its own assumptions. Choosing a rung is choosing which assumption to defend.