Ising -TeX

Developer
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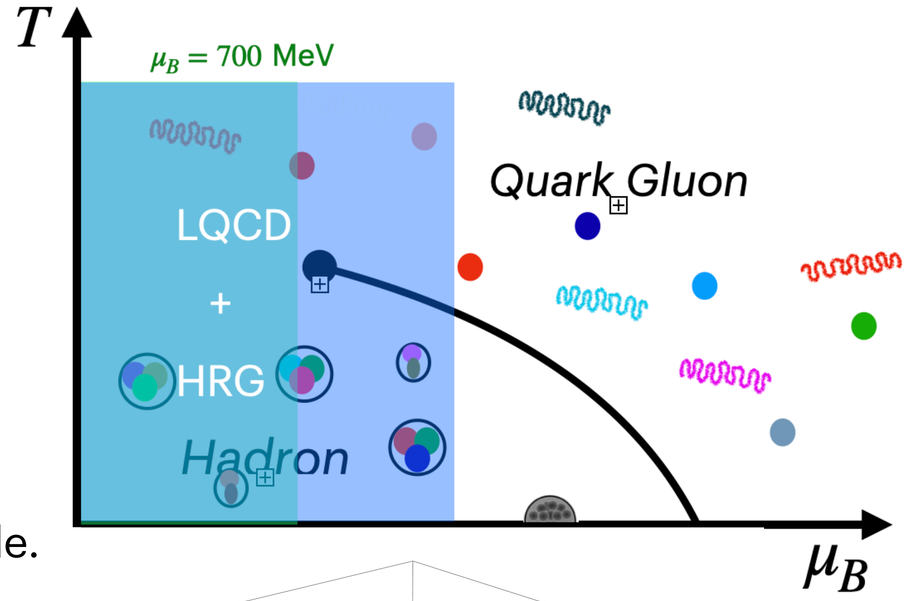
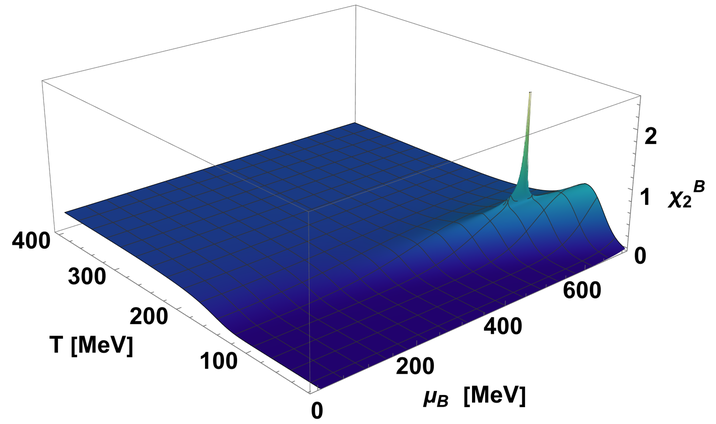
- This module uses current lattice (W B) merged w/ HRG model and T'-expansion scheme to extend the previous (Taylor) coverage from $\mu_B = [0,\ 450\ \text{MeV}]$ to $\mu_B = [0,\ 700\ \text{MeV}]$ & $T = [25,\ 800\ \text{MeV}]$
- Introduces a critical point by Mapping 3D-Ising to QCD
- Mapping has free parameters chosen by the User
  - 6 **Grid Inputs** $T_{min},\ T_{max},\ \delta T,\ \mu_{Bmin},\ \mu_{Bmax},\ \delta\mu_B$
  - 4 **Mapping Inputs** $\mu_{BC},\ w,\ \rho,\ \alpha_{12}$
- **Output** thermodynamics , $n_B(T,\mu_B),\ \chi_2^B(T,\mu_B),\ P(T,\mu_B),\ S(T,\mu_B),$
- $\epsilon(T,\mu_B),\ c_s^2,\ C_v$ with a chosen Grid in T and μ_B.
- The module can easily be reparameterized with new lattice data if available.

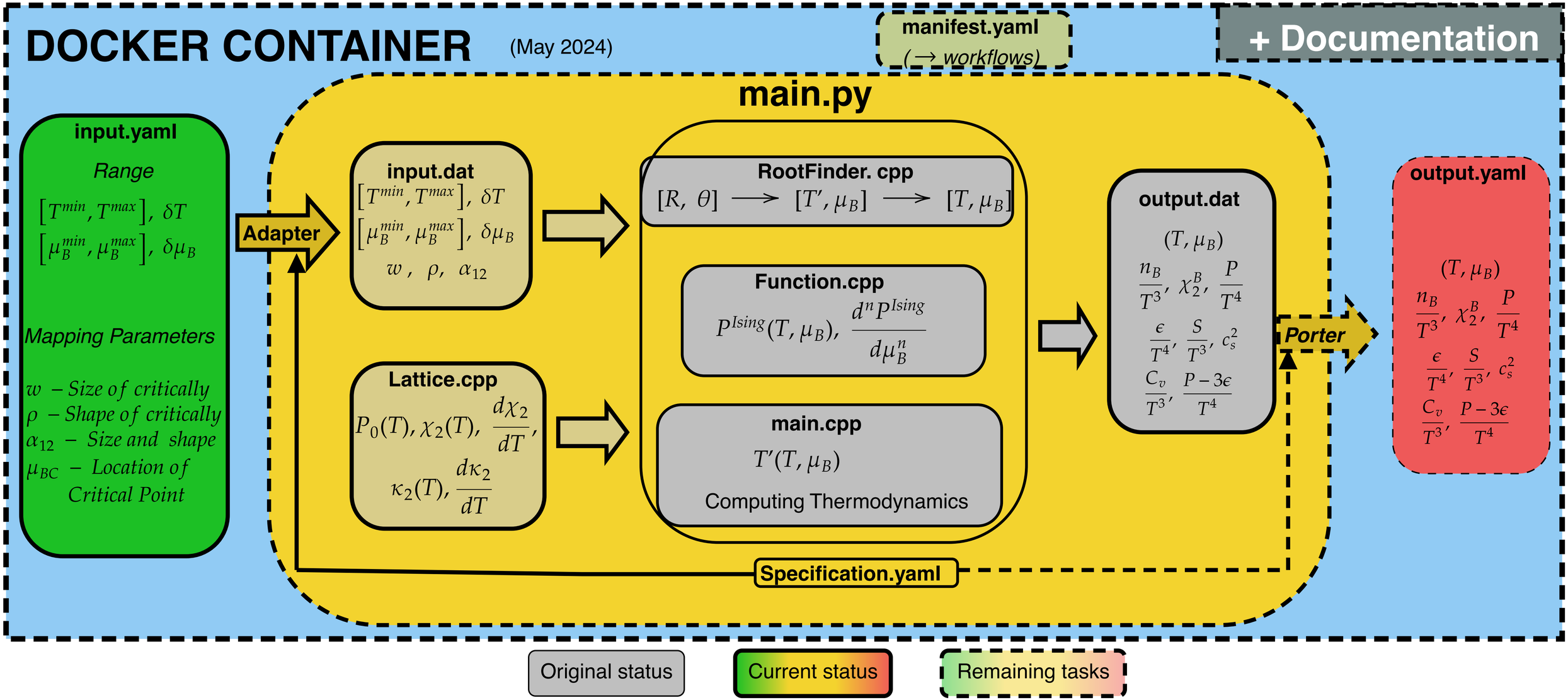


Challenges

- Numerical noise this limit computation high order derivatives
- Adaptive grind (more points around the critical region).
- Parameter Scan for stable EoS for each possible input choice.



Flow Chart


DOCKER CONTAINER
(May 2024)
manifest.yaml
(→ workflows)
+ Documentation
main.py
input.yaml
Range
$[T^{min}, T^{max}]$, δT
$[\mu_B^{min}, \mu_B^{max}]$, $\delta\mu_B$
Mapping Parameters
w – Size of critically
ρ – Shape of critically
α_{12} – Size and shape
μ_{BC} – Location of Critical Point
Adapter
input.dat
$[T^{min}, T^{max}]$, δT
$[\mu_B^{min}, \mu_B^{max}]$, $\delta\mu_B$
w, ρ, α_{12}
Lattice.cpp
$P_0(T), \chi_2(T), \frac{d\chi_2}{dT}, \kappa_2(T), \frac{d\kappa_2}{dT}$
RootFinder. cpp
$[R, \theta] \longrightarrow [T', \mu_B] \longrightarrow [T, \mu_B]$
Function.cpp
$P^{Ising}(T, \mu_B), \frac{d^n P^{Ising}}{d\mu_B^n}$
main.cpp
$T'(T, \mu_B)$
Computing Thermodynamics
output.dat
(T, μ_B)
$\frac{n_B}{T^3}, \chi_2^B, \frac{P}{T^4}$
$\frac{\epsilon}{T^4}, \frac{S}{T^3}, c_s^2$
$\frac{C_v}{T^3}, \frac{P-3\epsilon}{T^4}$
Porter
output.yaml
(T, μ_B)
$\frac{n_B}{T^3}, \chi_2^B, \frac{P}{T^4}$
$\frac{\epsilon}{T^4}, \frac{S}{T^3}, c_s^2$
$\frac{C_v}{T^3}, \frac{P-3\epsilon}{T^4}$
Specification.yaml
Original status
Current status
Remaining tasks