Finite temperature twisted mass Wilson fermion ensembles (update since Lattice 2022)

A. Yu. Kotov
for TWEXT collaboration (with M.P. Lombardo, A. Trunin)
Many thanks to: B. Kostrzewa, CINECA

JÜLICH Forschungszentrum

Lattice 2024

Details of the simulations

Details of the simulations

- QCD at finite temperature
- $N_f = 2 + 1 + 1$ twisted mass Wilson fermion (with and without clover term)
- Iwasaki gauge action
- «Fixed scale» approach: $a = \text{const}$, $T \Leftrightarrow N_t$
- $T \in (\sim 120 - 180,\ 600 - 900)\ \text{MeV}$

Details of the simulations

- QCD at finite temperature
- $N_f = 2 + 1 + 1$ twisted mass Wilson fermion (with and without clover term)
- Iwasaki gauge action
- «Fixed scale» approach: $a = \text{const}$, $T \Leftrightarrow N_t$
- $T \in (\sim 120 - 180,\ 600 - 900)\ \text{MeV}$

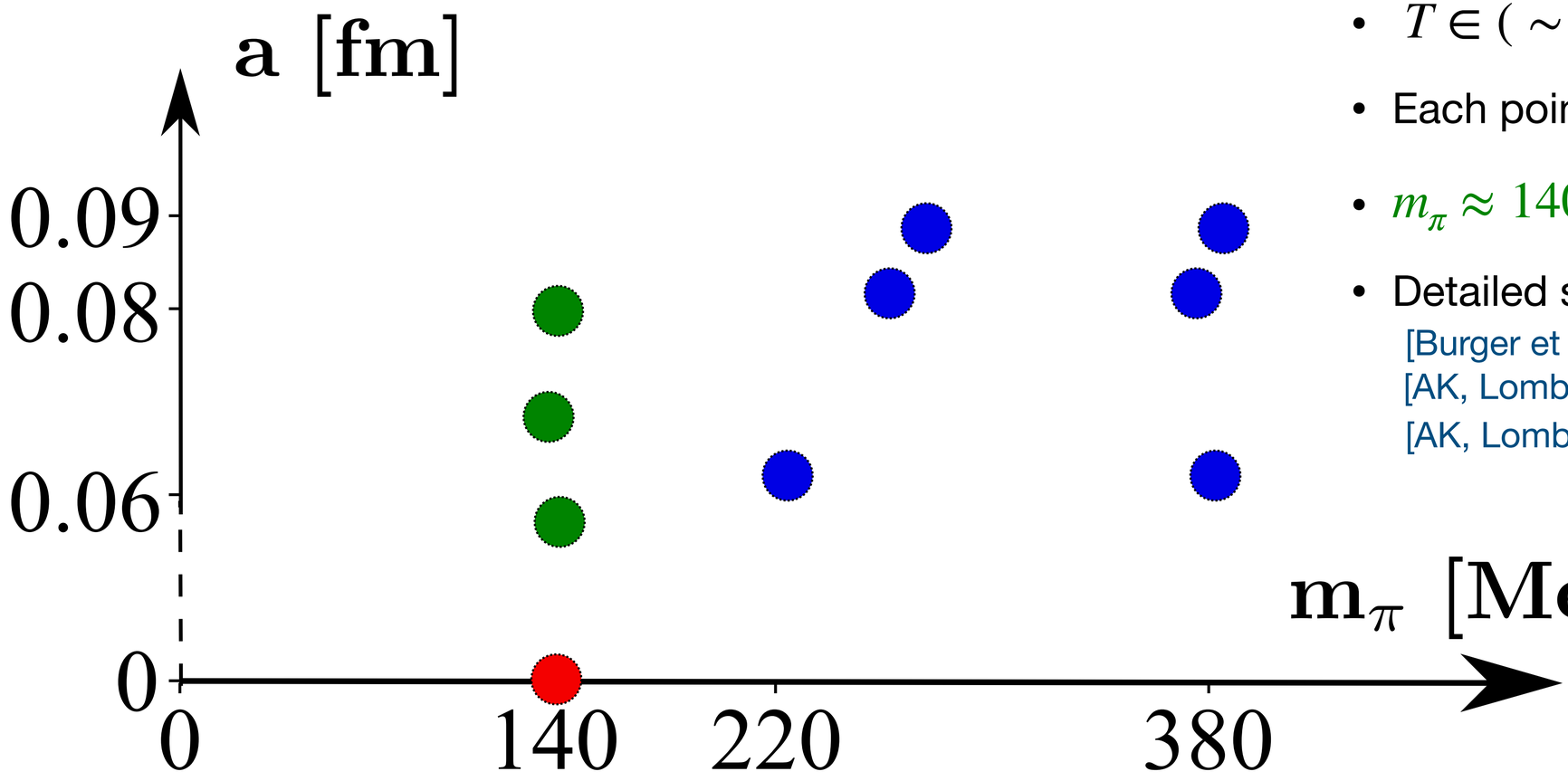
- Standard HMC algorithm
- Configurations separated by several MD traj.
- Multigrid algorithm for Dirac inversions (additional tuning for finite-T configurations)

[Alexandrou et al., 2016]

- Public ETMC code, run on CPUs & GPUs

[https://github.com/etmc/tmLQCD]

Ensemble summary



- Blue: Wilson twisted mass, $1k - 10k$ configs per T
- Green: Wilson-clover twisted mass, $O(500)$ configs per T
- Red: physical point
- Each point: $O(10 - 20)$ values of T
- $T \in (\sim 120 - 180,\ 600 - 900)$ MeV
- Each point: one or two spatial volumes
- $m_\pi \approx 140$ MeV: $L \approx 5.0 - 5.5$ fm
- Detailed summary:
  [Burger et al., 2018]
  [AK, Lombardo, Trunin, 2021]
  [AK, Lombardo, Trunin, in preparation, 2024]

Data management

- Total space ≈ 78 TB
- Stored at CINECA
- Two (or three) different copies (SCRATCH/DRES, another machine)

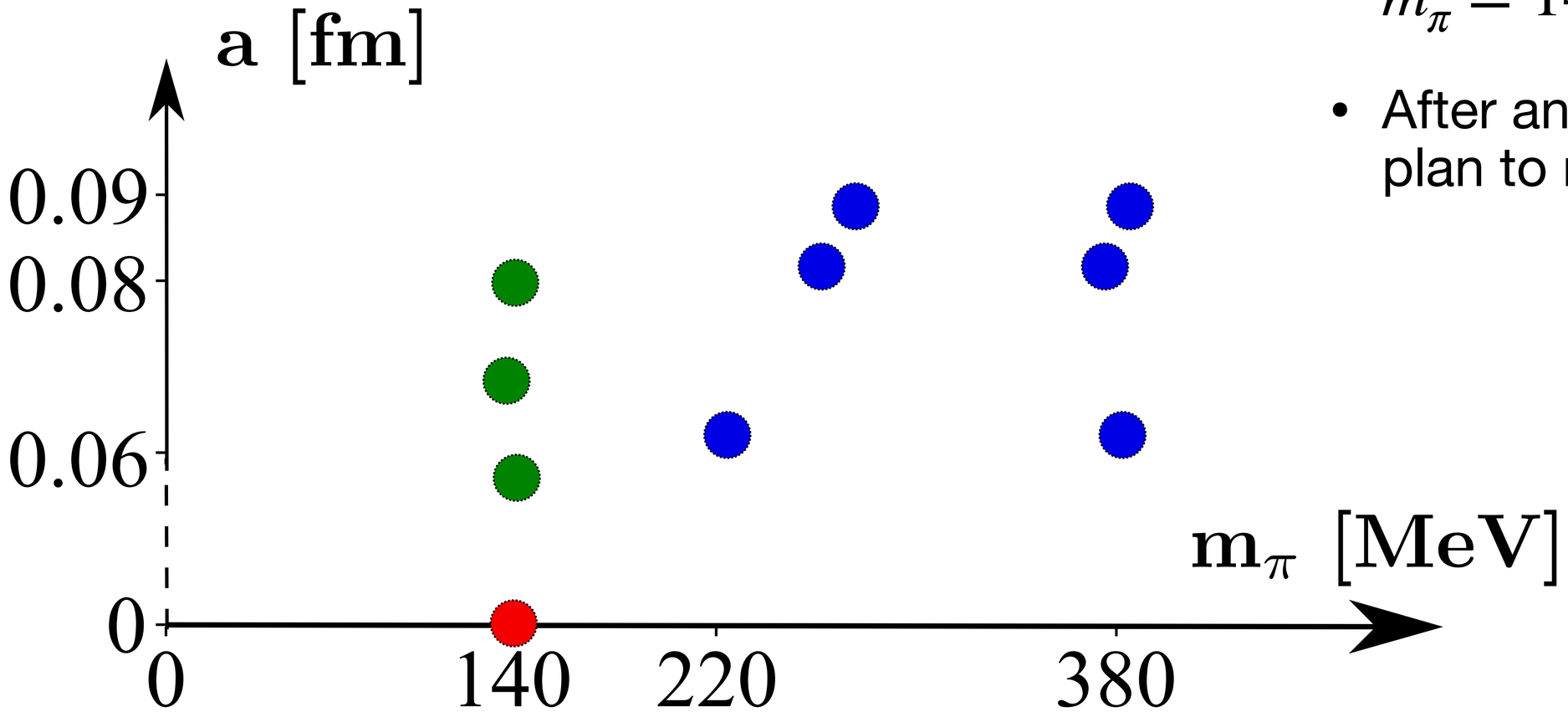
Data management

- Total space ≈ 78 TB
- Stored at CINECA
- Two (or three) different copies (SCRATCH/DRES, another machine)

Data availability

- Not available to everyone: ongoing analysis
- Available at request/open for collaborations
- Future plans: after analysis we plan to make public (dates not known now)

Future plans



- Accumulate more data for $m_\pi = 140$ MeV
- After analysis: plan to make public

Finite temperature
twisted mass Wilson fermion ensembles
«fixed scale» approach, $O(10-20)$ values of T
$T \in (\sim 120-180,\ 600-900)$ MeV