MILC Gauge Ensembles

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for the MILC Collaboration

Background

- MILC has been sharing configurations for over two decades
  - Initial users of Gauge Connection at NERSC
- Extensive set of ensembles with the asqtad action, now primarily at FNAL
- Still generating ensembles with HISQ action
  - 0.15, 0.12, 0.09, 0.06, 0.042, 0.03 fm
  - for the finest lattice spacing no physical mass ensemble yet (waiting for exascale computers)

Information on Web

- MILC has a github page with documents related to sharing policy
  - sharing policy
  - list of available ensembles
  - how to acknowledge use of ensembles
- Twenty five HISQ ensembles listed later are freely available.
  - Many on disk at FNAL, easily accessible to USQCD members
  - Gauge Connection at NERSC is moribund
  - Contact us if you need help

asqtad ensembles

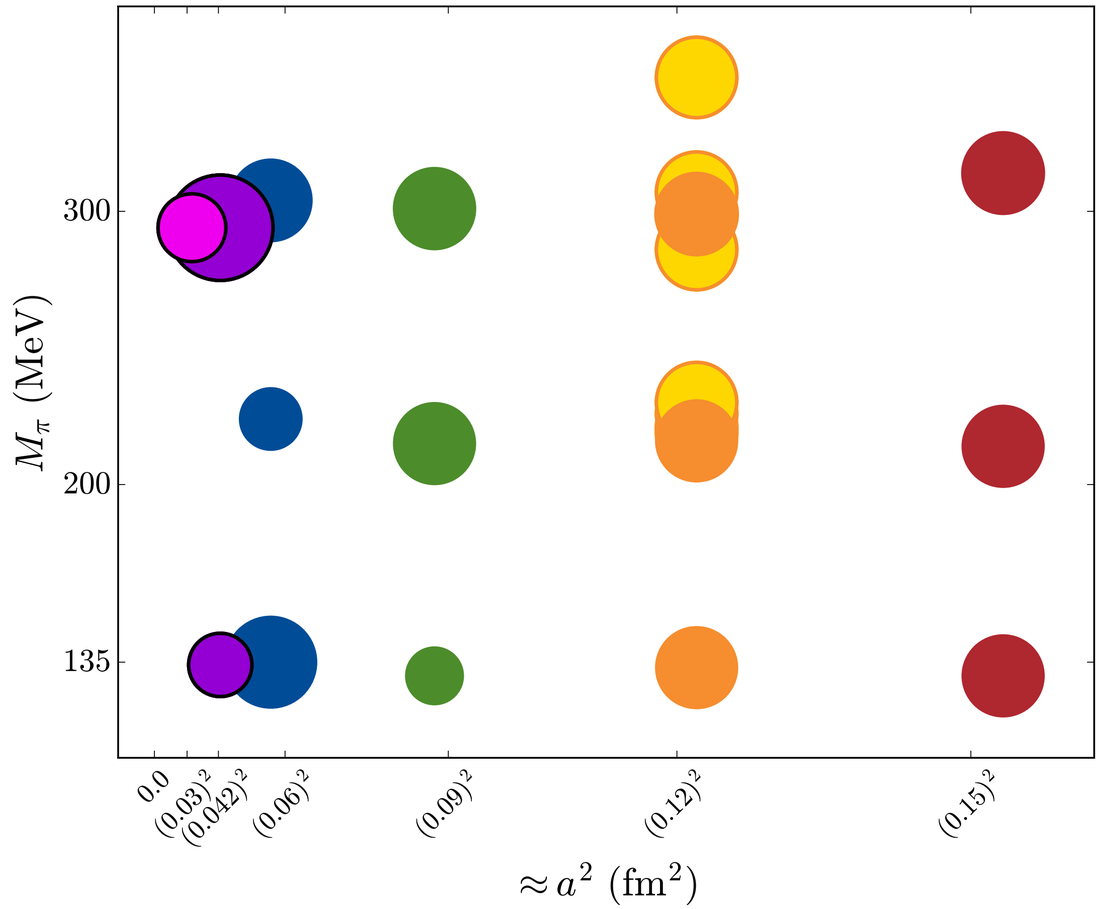
- asqtad ensembles have dynamical up, down, and strange quarks
  - no longer used very much
    - only one copy on tape at FNAL
    - second copy did not get copied to new tape system Ranch at TACC
- Rev. Mod. Phys. **82**, 1349 (2010)

HISQ Ensembles

- Dynamical up, down, strange, and charm quarks
- HISQ action developed by HPQCD
- Lattice generation began over a decade ago.
  - At 0.12 fm, have some ensembles that differ only in volume, generally not at physical light quark
  - Have ensembles with strange quark lighter than in Nature to test chiral perturbation theory and determine low energy constants

a=0.15 fm	l1648f211b580m013m065m838
	l2448f211b580m0064m0640m828
	l3248f211b580m00235m0647m831
	l3248f211b580m002426m06730m8447
	l3248f1111b580m001524m003328m06730m8447
a=0.12 fm	l2464f211b600m0102m0509m635
	l2464f211b600m0102m03054m635
	l2464f211b600m00507m0507m628
	l3264f211b600m00507m0507m628
	l4064f211b600m00507m0507m628
	l2464f31b600m01275m640
	l3264f211b600m00507m0304m628
	l3264f211b600m00507m022815m628
	l3264f211b600m00507m012675m628
	l3264f31b600m00507m628
	l3264f211b600m0088725m022815m628
	l4864f211b600m00184m0507m628
	l4864f211b600m001907m05252m6382
	l3264f1111b600m00507m012675m022815m628
a=0.09 fm	l3296f211b630m0074m037m440
	l4896f211b630m00363m0363m430
a=0.06 fm	l48144f211b672m0048m024m286
	l64144f211b672m0024m024m286
	l96192f211b672m0008m022m260
a=0.042 fm	l64192f211b700m00316m0158m188

Ensembles have $\geq$ 1000 configurations



Overview of MILC HISQ ensembles

This plot is out of date but still of some use. Includes some nonpublic ensembles, does not always reflect current statistics.

DOIs

- Jim SImone has been active in getting DOIs for MILC ensembles:
  - Here is an article about his efforts
- There are DOIs for a number of the asqtad ensembles.
- Here is an example of how to cite an ensemble:
  - Lattice QCD gauge ensemble: USQCD/MIC/asqtad/ 2064f21b676m007m050b-MILC Collaboration (Aubin, Christopher Alan et al.)
  - see Ref. 29 in inspirehep record for: e-Print: 1507.01618 [hep-ph]

Provenance

- Most log files from generation are available
  - info files contain time of generation, plaquette, and checksum
  - not all log files contain machine name, but usually can tell from other details
- In addition to log files there are many physical measurements
  - We have been redoing gauge flow measurements quite systematically
    - CalLat has done their own study on a number of our ensembles

In conformity with USQCD policy, we reserve the right to use the configurations we have generated for the following projects before releasing them for competing projects. Our reserved topics, broadly specified, include hadronic vacuum polarization contribution to the anomalous magnetic moment of the muon, leptonic and semileptonic decays of hadrons containing up, down, strange, charm, and bottom quarks, and QED contributions to the topics listed above.

The Fermilab Lattice and MILC Collaborations would welcome the opportunity to collaborate with others on topics of mutual interest. Thus, we would be happy to receive inquiries about potential collaborations on topics listed above or about topics proposed by others that are sufficiently different from our own work that they would not be considered as competing with our plans.

FNAL/MILC Data Management Plan (August 31, 2021)