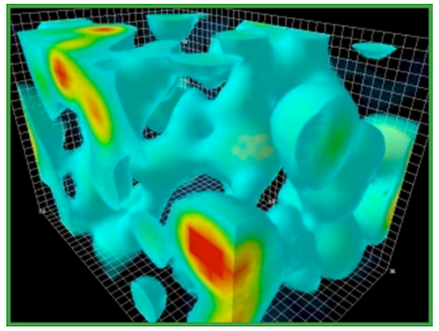
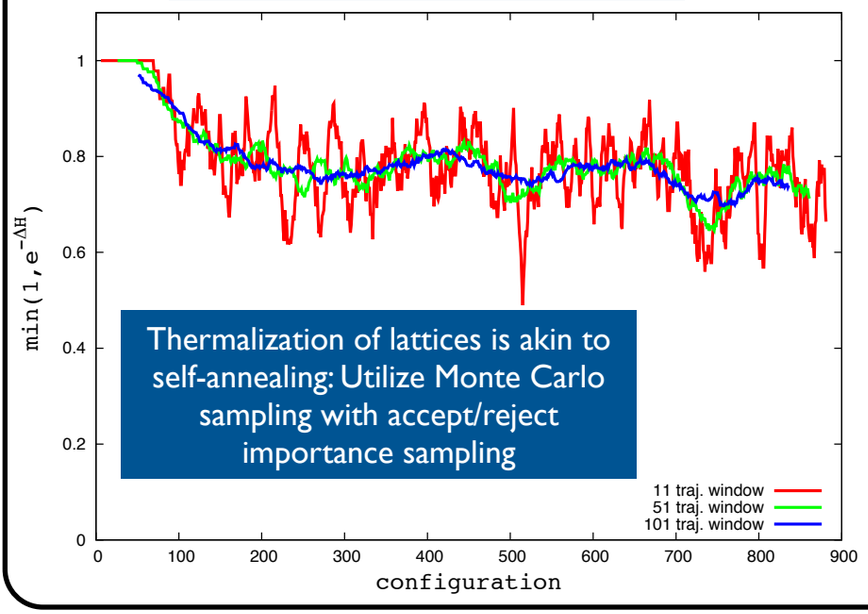
Generating Lattice Gauge Configurations on Sequoia and Vulcan (BG/Q) with further calculations on Edge (GPU)

CalLat Collaboration

Abstract: The BG/Q machines, Sequoia and its successor Vulcan, are producing the next generation of cold QCD, isotropic, clover-improved Wilson lattice gauge configurations at roughly 400 MeV pion-mass, with dimensions of 48^3 spatial x 96 temporal lattice points and 64^3 spatial x 96 temporal lattice points, corresponding to physical spatial size of 6.7 and 9.0 fm (10^{-15} m), respectively. Additionally, the GPU enabled machines are being heavily utilized for matrix-inversions necessary for calculations of physical correlation functions. In this poster we show the current status of these calculations, and describe efforts to improve certain aspects of them.



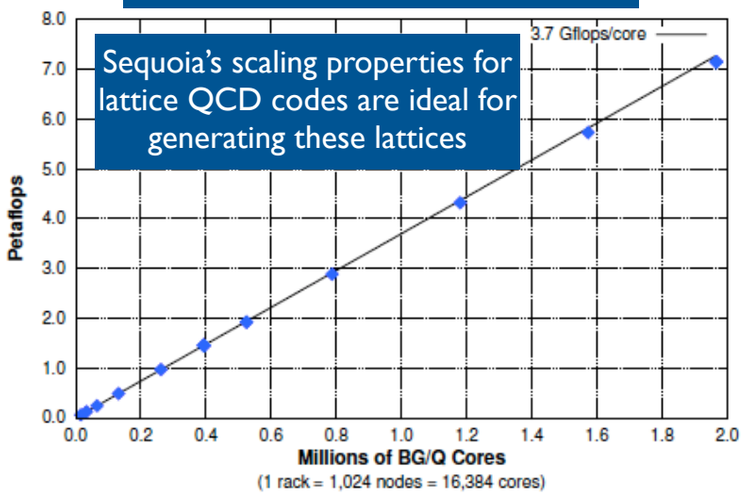
Acceptance Rate



Thermalization of lattices is akin to self-annealing: Utilize Monte Carlo sampling with accept/reject importance sampling

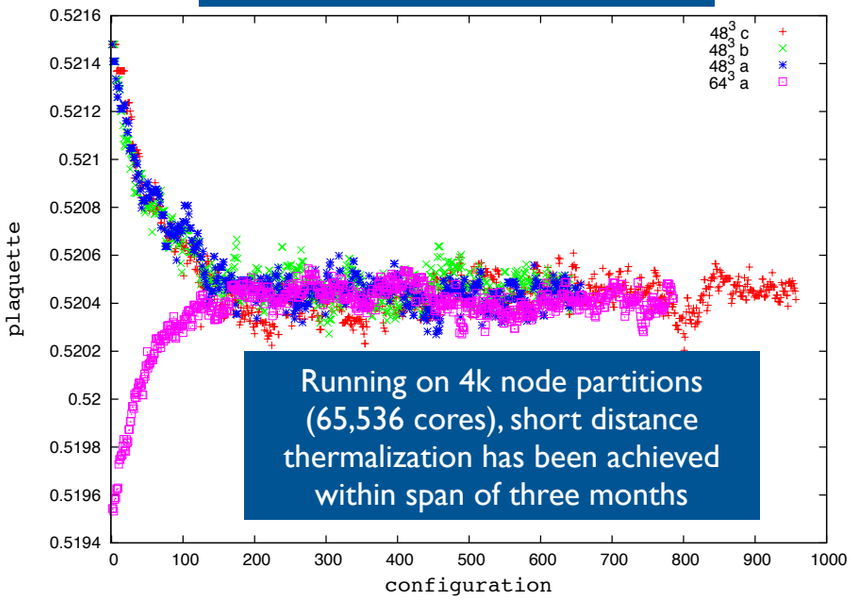
BG/Q

Weak Scaling on BG/Q



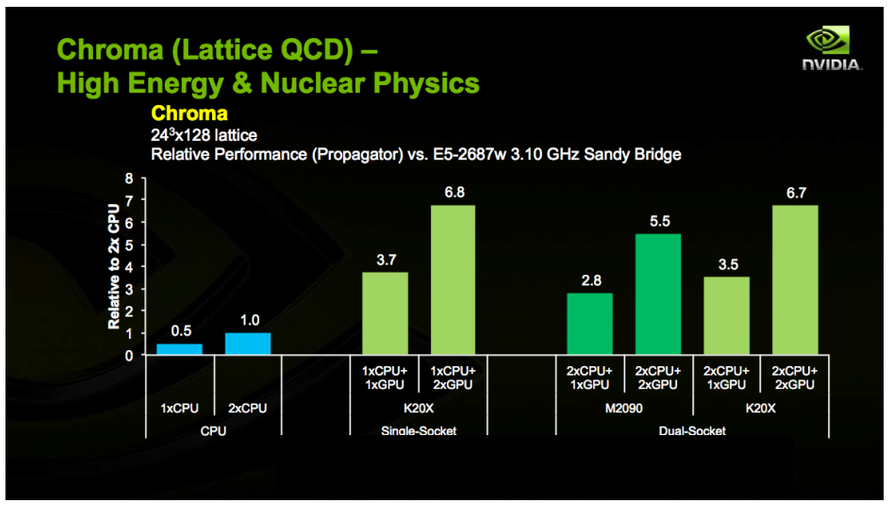
Sequoia's scaling properties for lattice QCD codes are ideal for generating these lattices

Plaquette Thermalization

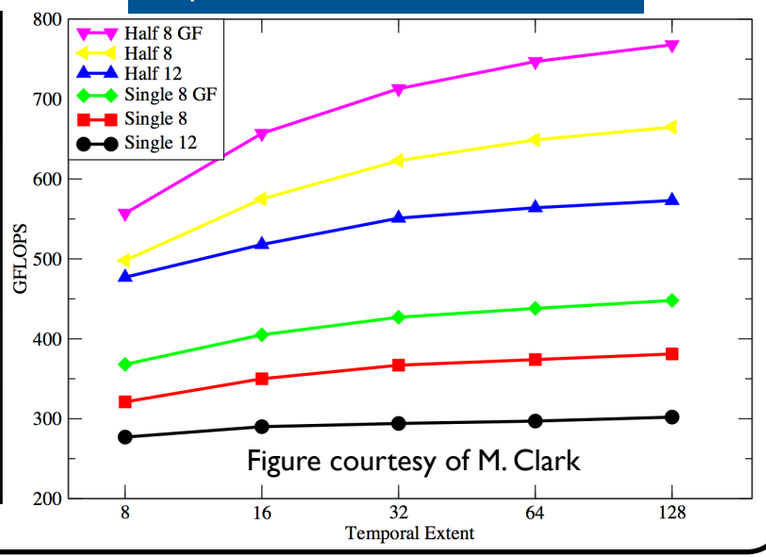


Running on 4k node partitions (65,536 cores), short distance thermalization has been achieved within span of three months

GPU



Kepler Wilson-Dslash Performance



Next steps:
Calculation of the physical correlation functions require complex tensor contractions, which naively scale factorially with the number of "quark" lines. We are investigating whether the multi-threaded environments on both gpu and BG/Q architectures can be utilized to speed up these contractions.