

Tiramisu

Objectives

- Improve efficiency of Lattice QCD (LQCD) computations
- Implement LQCD software in modern DSL framework *Tiramisu* and *Halide*
- Enable automatic optimisation and tuning of LQCD codes
- *Extend Tiramisu to accommodate LQCD operations and to generate more efficient CUDA code*

Impact

- Speeds up LQCD calculations by significant factor
- Provides efficient proof-of-concept implementation of conjugate gradient algorithm
- Provide efficient implementation of baryon block construction algorithm
- Open source release of the improved *Tiramisu* and *Halide* DSLs

Accomplishments

Normalized execution times comparing reference code with a Tiramisu implementation (lower is better)

	Reference	Tiramisu
Baryon construction block	90	1
Conjugate gradient	1.2	1

- Extended Tiramisu and Halide to accommodate LQCD data structures and operations
- Extended Tiramisu to support indirect array accesses (array of array accesses)
- Improved the CUDA backend of Tiramisu (automatic host/device data copies, support shared memory, ...).
- Provided proof-of-concept implementation of conjugate gradient that performs 1.2x better than reference implementation (the advantage of Tiramisu in this case is that it provides portability)
- Developed Tiramisu version of baryon block algorithm used for multi-nucleon systems that is 90x faster than reference version