OpenMP on BG/Q: Notes

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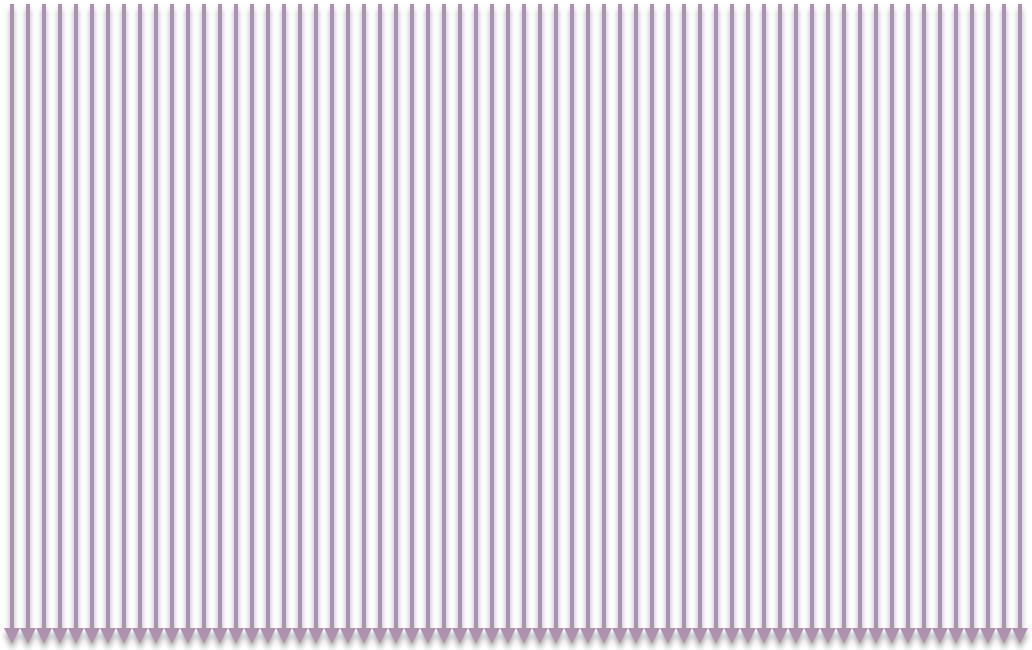


ESP April Workshop – "Code for Q"

4/30/2012

- Implementations
- Environment
- Threads and Cobalt
- OpenMP scaling

Available Implementations

- **IBM XL compilers**
  - OpenMP 3.1
- **GNU compilers**
  - OpenMP 3.0 (gcc 4.4.6)

IBM XL Implementation

- **Use –qsmp compiler flag**
  - -qsmp=omp:noauto
- **New OpenMP features relative to BG/P:**
  - New features in Version 3.1 w.r.t. 2.5
    - Appendix F in http://www.openmp.org/mp-documents/OpenMP3.1.pdf
  - Nested parallelism implemented

GNU Implementation (gomp)

- **Use --openmp compiler flag**
  - mpicc --openmp –o hello hello.c
- **Don’t forget softkey in ~/.soft**

```
@default
+mpiwrapper-gcc
+mpiwrapper-xl
```

Environment

- **OMP_STACKSIZE**
  - Thread stack size (default 4M)
- **OMP_NUM_THREADS**
  - Number of threads per node
- **OMP_NESTED**
  - true/false

Nodes, Ranks, Threads, and Cobalt

- **qsub -n <number of nodes> --mode c*N* --env OMP_NUMTHREADS=*M***
  - *N* is MPI ranks per node
    - Allowed *N* values: {1,2,4,8,16,32,64}
  - *M* is threads per node
    - Allowed *M* values: {1,2,3,…,64}
      - 64 is max hardware threads per node (4 per core)

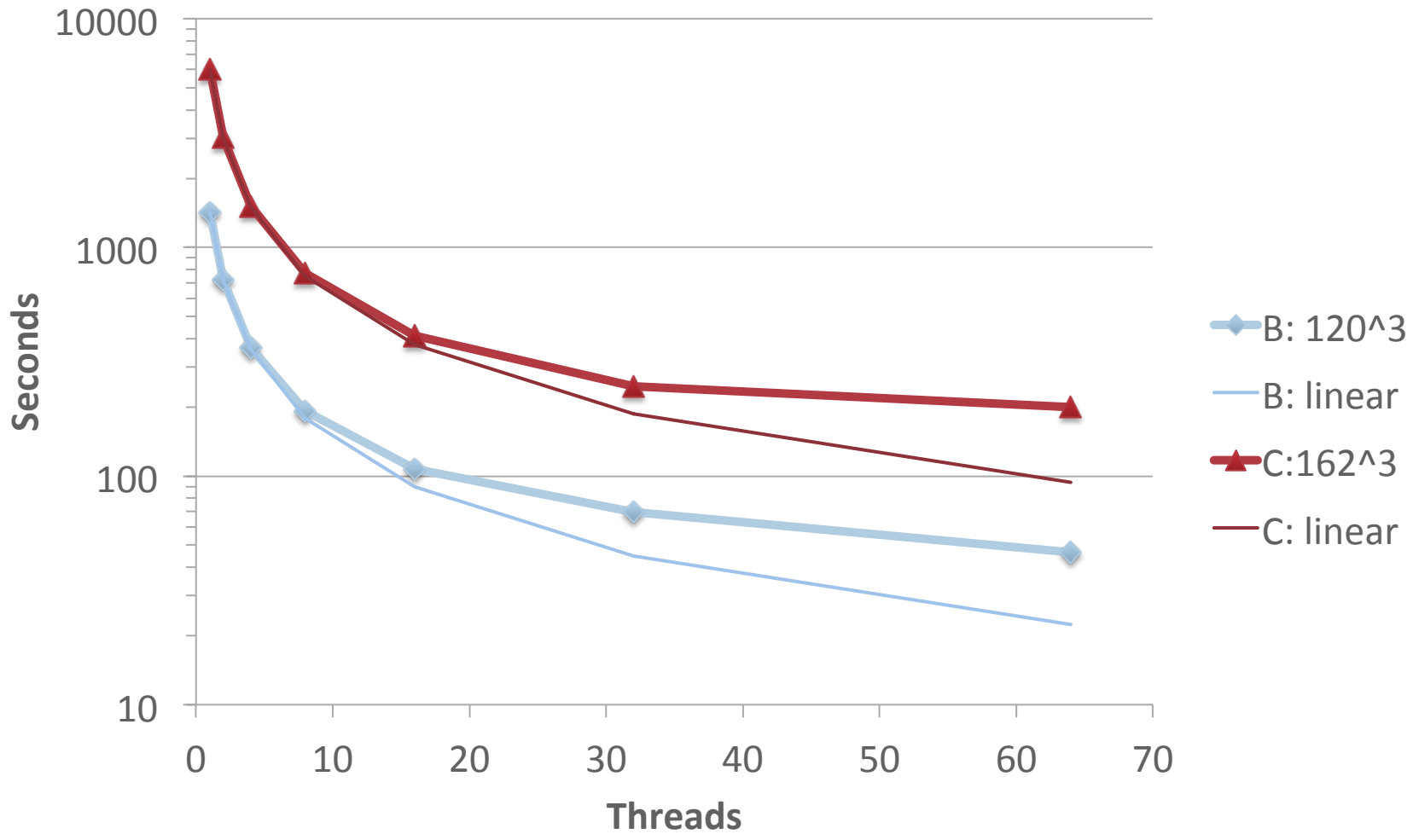
SPEC OMP Benchmarks

- **VEAS**
  - *Vitali Morozov*
  - XL Compilers (beta)
  - Beta system driver
  - Scaling from 8 to 16 threads
    - 310.wupwise_m 1.99x (QCD)
    - 312.swim_m 1.94x (shallow water)
    - 314.mgrid_m 1.96x (multi-grid solver)
    - 316.applu_m 1.34x (parabolic PDE)
    - 320.equake_m 1.36x (finite element simulation of earthquake)
    - 328.fma3d_m 1.77x (atmosphere: T, wind, pollutants)
    - Others: incomplete or runtime problems

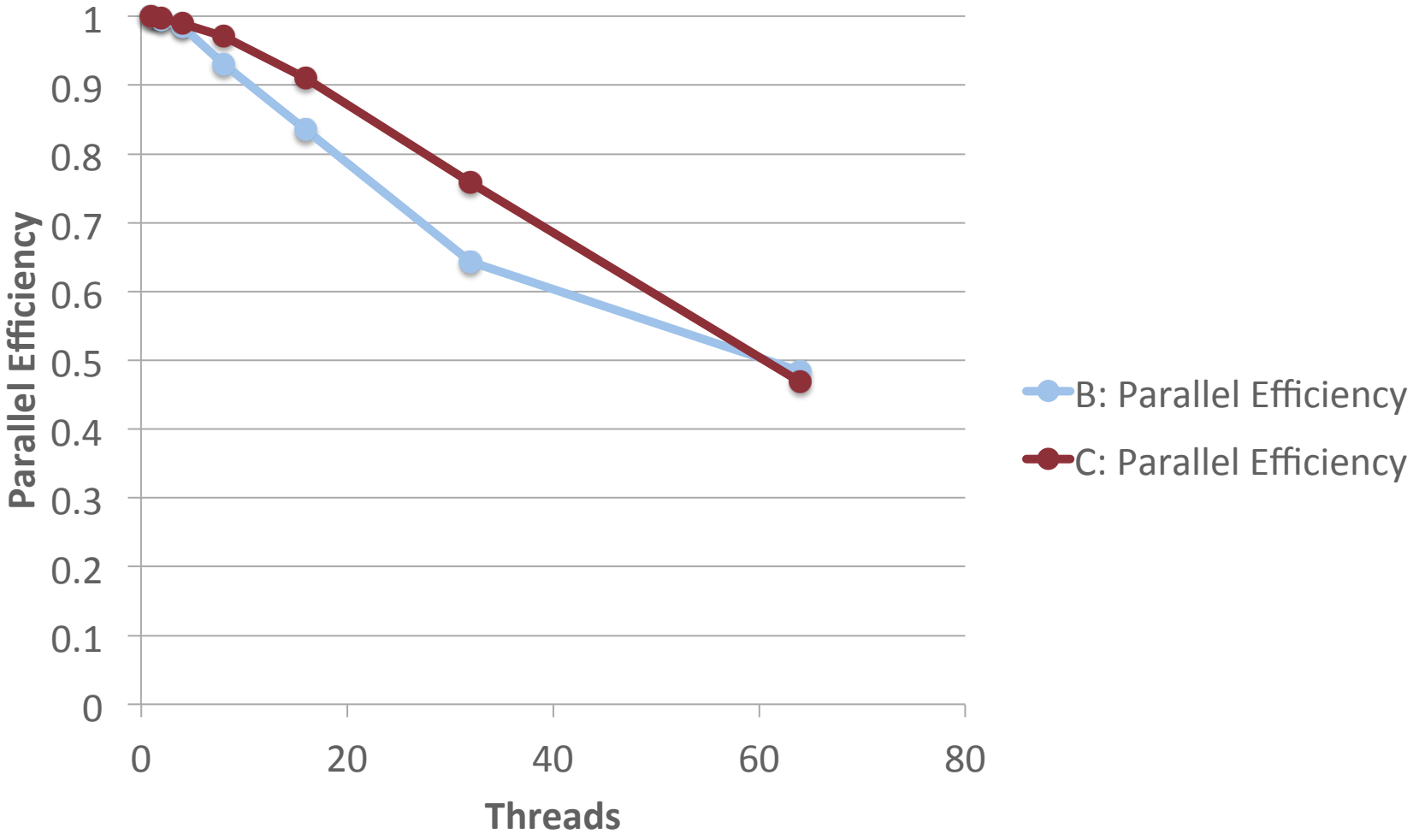
NAS Parallel Benchmarks 3.3

- **OpenMP-only implementation**
  - Non-nested
- **GNU compilers & gomp on VEAS**

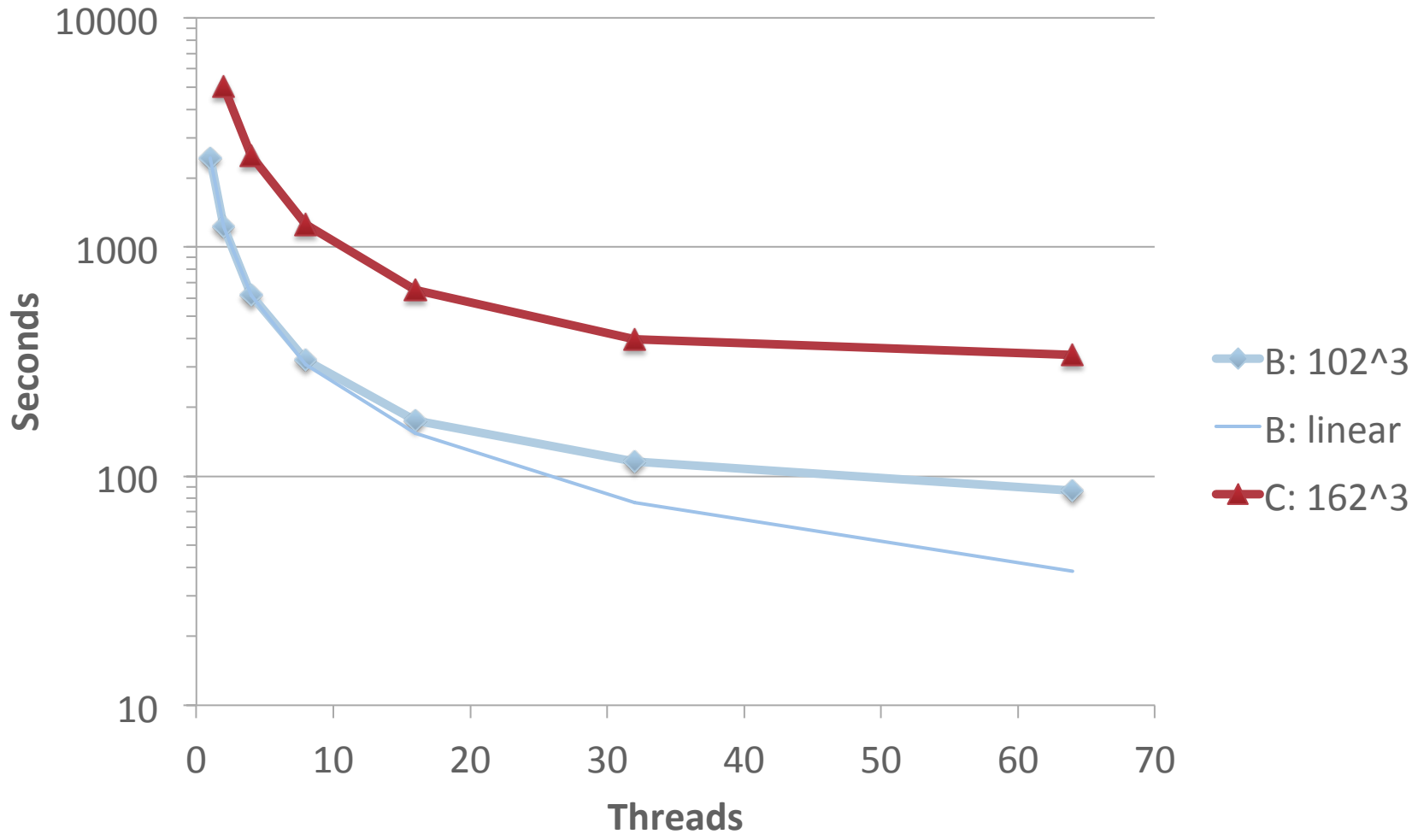
NAS LU Benchmark



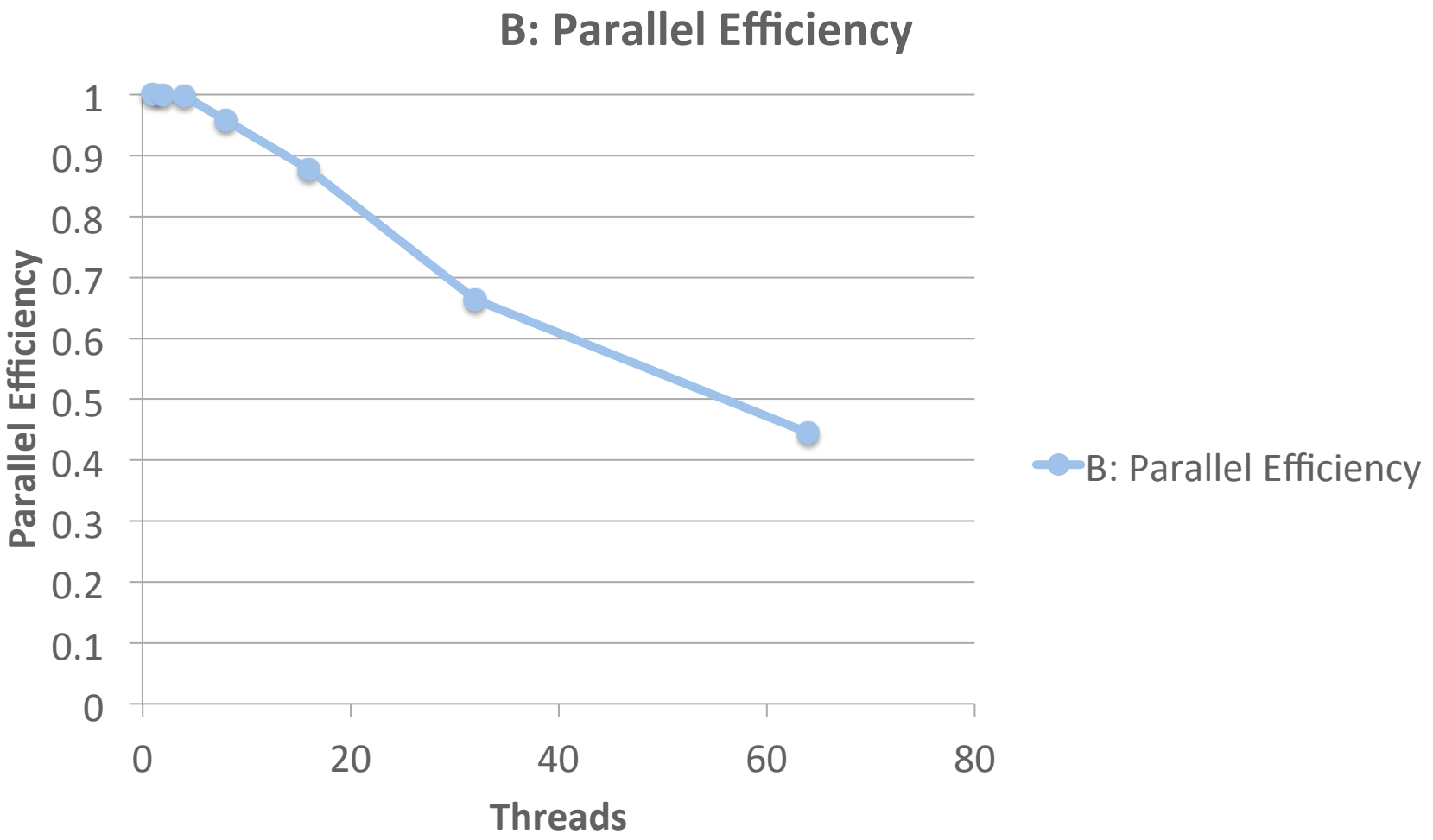
NAS LU Benchmark



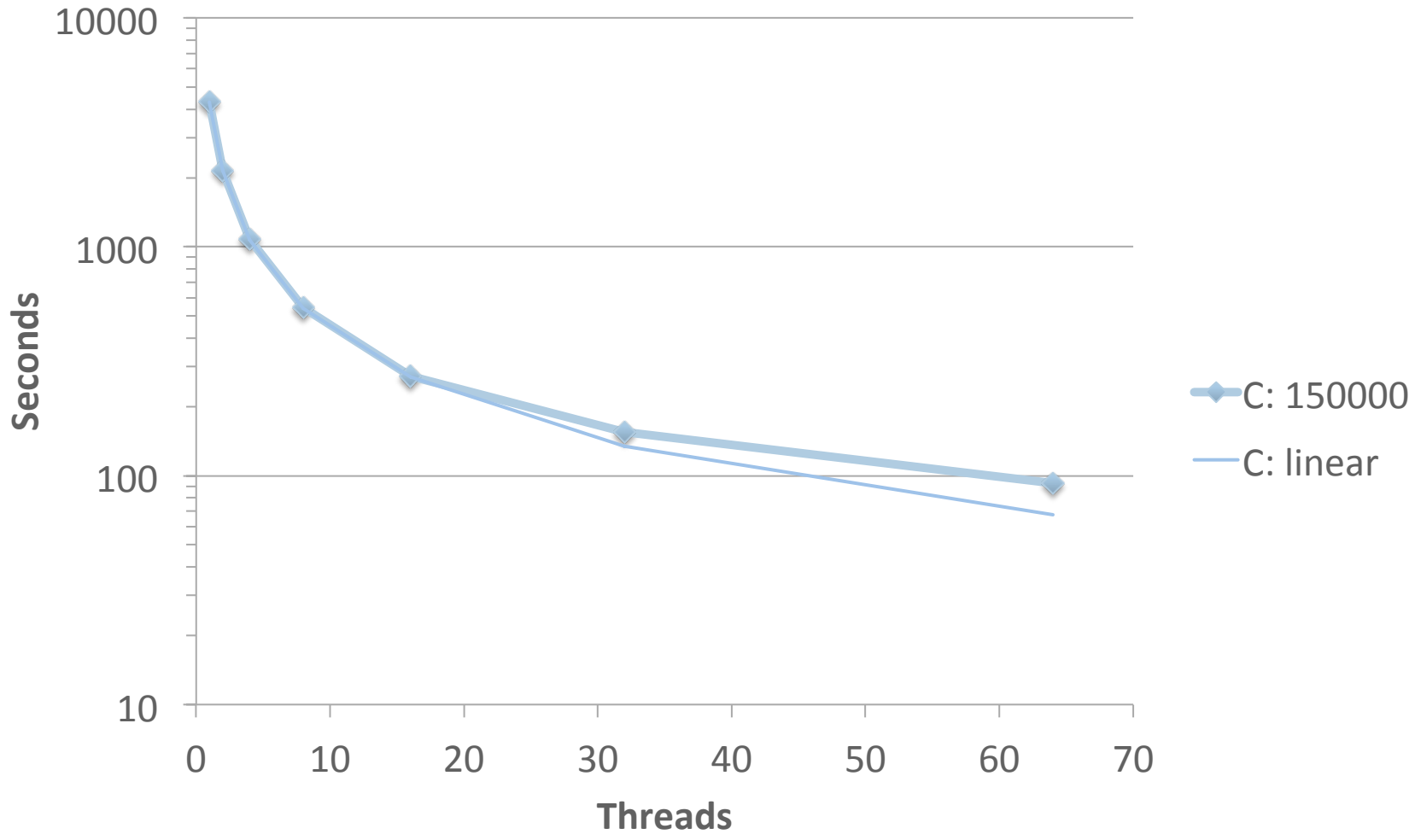
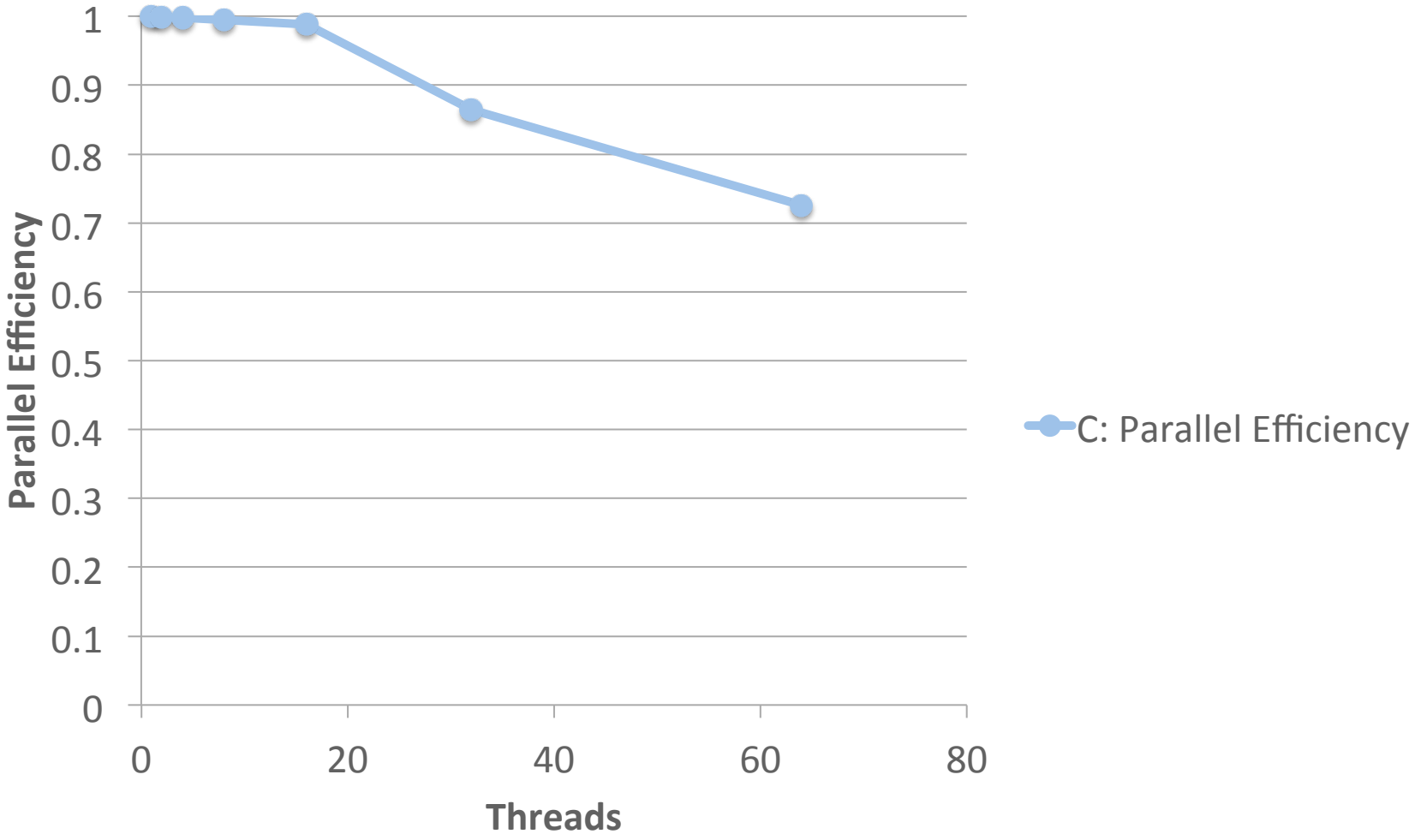
NAS BT Benchmark



NAS BT Benchmark



NAS CG Benchmark



NAG CG Benchmark