

6th Blue Gene Extreme Scaling Workshop



As an optional appendix to this year's JUQUEEN Blue Gene/Q Porting and Tuning Workshop at Jülich Supercomputing Centre (JSC), two additional days (5-6 February) were offered for select code-teams to (im)prove their applications' scalability to the entire 458,752 cores. This continued the tradition of the initial initial 2006 workshop using the JUBL Blue Gene/L, 2008 workshop using the JUGENE Blue Gene/P and three subsequent workshops dedicated to extreme scaling which attracted participants from around the world. [1,2,3,4]

Seven international application code-teams took up this offer: **CoreNeuron** brain activity simulator (EPFL Blue Brain Project), **FE2TI** scale-bridging incorporating micro-mechanics in macroscopic simulations of multi-phase steels (University of Cologne and TU Freiberg), **FEMPAR** finite-element code for multi-physics problems (from UPC-CIMNE), **ICON** icosahedral non-hydrostatic atmospheric model (DKRZ), **MPAS-A** multi-scale non-hydrostatic atmospheric model for global, convection-resolving climate simulations (KIT and NCAR), **psOpen** direct numerical simulation of fine-scale turbulence (RWTH-ITV and JARA), and **SHOCK** structured high-order finite-difference kernel for compressible flows (RWTH-SWL).

JSC Simulation Laboratories for Climate Science, Fluids & Solids Engineering and Neuroscience assisted the code-teams, along with JSC Cross-sectional Teams, JUQUEEN and IBM technical support.

12 million core-hours were used, covering a 30 hour period with the full 28 racks reserved, and all seven codes managed their first successful execution using all 28 racks within the first 24 hours of access. Figs. 1 & 2 show that the codes demonstrated excellent strong and/or weak scalability, six using 1.8 million MPI processes or OpenMP threads, which improved the existing High-Q Club entry for FEMPAR and qualified five new members for the High-Q Club. MPAS-A unfortunately was not accepted as its scaling was limited to only 24 racks (393,216 cores) with its 1.2 TB 3-km dataset of 65 million grid points.

Detailed workshop reports provided by each code-team, and additional comparative analysis to the other 16 High-Q Club member codes, are available in a technical report and expected to be published in the proceedings of a ParCo conference minisymposium later this year. The workshop surpassed our expectations and completely achieved its goal, with all participants finding it to have been extremely useful as on-hand support made it possible to quickly overcome issues. To follow-up a workshop is being organised at this year's ISC-HPC conference to compare JSC application extreme-scaling experience with that of leading supercomputing centres. [5]

contact: Brian Wylie,
b.wylie@fz-juelich.de

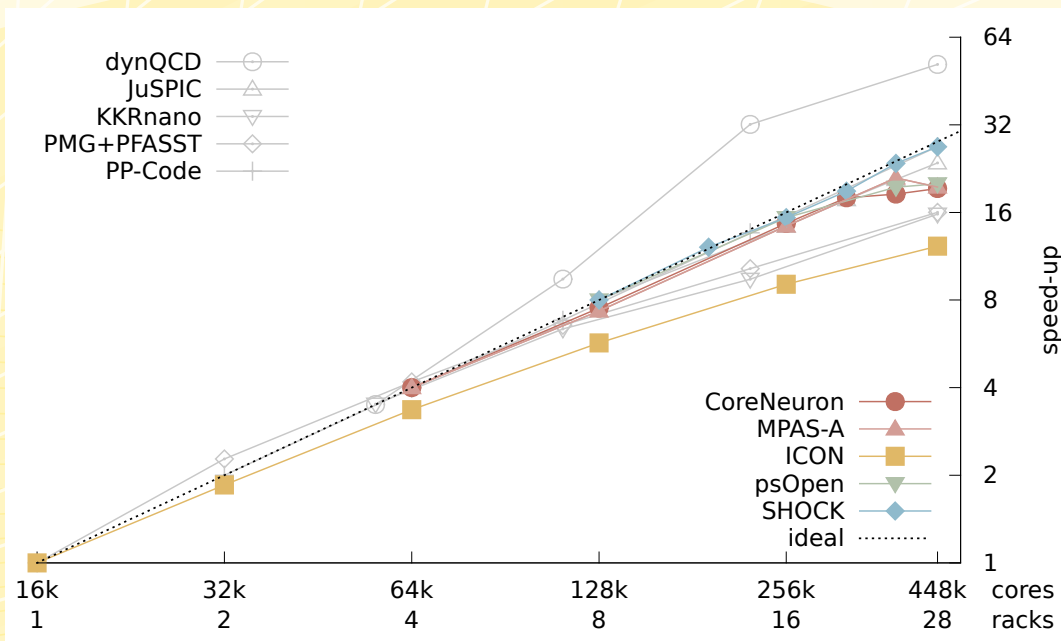


Figure 1: Strong scaling of workshop application codes compared to existing High-Q Club members.

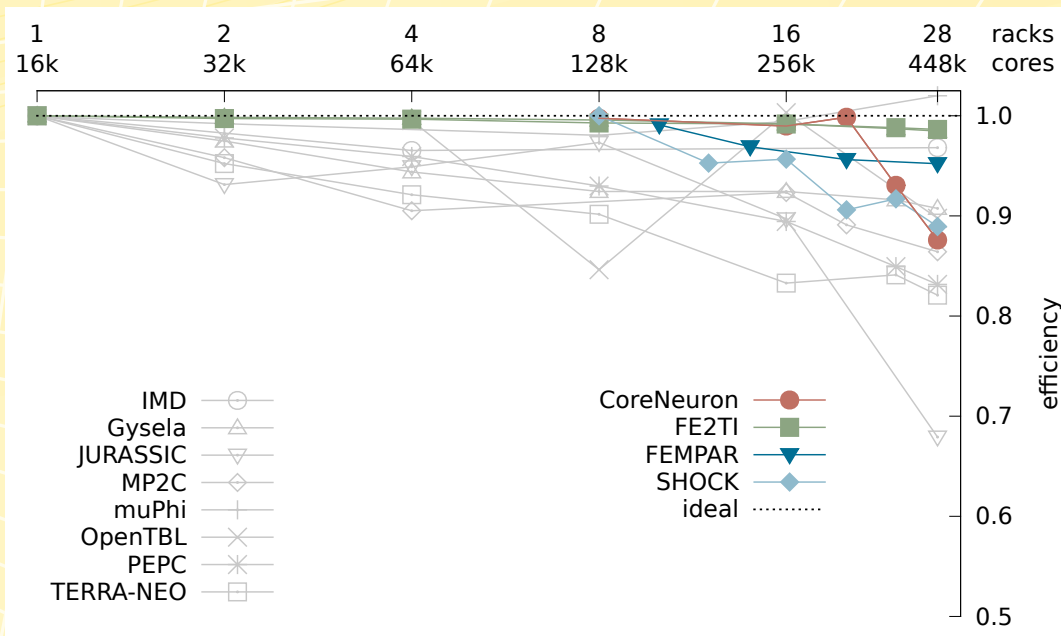


Figure 2: Weak scaling of workshop application codes compared to existing High-Q Club members.

References

- [1] **Mohr, B., Frings, W.**
Jülich Blue Gene/P Porting, Tuning & Scaling Workshop 2008, inside 6(2), 2008
- [2] **Mohr, B., Frings, W. (Eds.)**
Jülich Blue Gene/P Extreme Scaling Workshops 2009,2010,2011, Tech. Reports FZJ-JSC-IB-2010-02, FZJ-JSC-IB-2010-03 & FZJ-JSC-IB-2011-02.
- [3] The High-Q Club
<http://www.fz-juelich.de/ias/jsc/high-q-club>
- [4] **Brömmel, D., Frings, W., Wylie, B. J. N.**
2015 JUQUEEN Blue Gene/Q Extreme Scaling Workshop, Tech. Report FZJ-JSC-IB-2015-01 <http://juser.fz-juelich.de/record/188191>
- [5] ISC-HPC Workshop on Application Extreme-scaling Experience of Leading Supercomputing Centres (Frankfurt, 16 July 2015)
<http://www.fz-juelich.de/ias/jsc/aXXLs/>

- Dirk Brömmel
- Wolfgang Frings
- Brian Wylie

Jülich
Supercomputing
Centre (JSC),
Germany