

Take Away Message



Industry Feedback

High-Performance Computing is the path forward for incorporating new fuels and advanced engine concepts faster to the market in a cost-effective manner

VERIFI Approach

Towards predictive engine simulations => advanced sub-models, grid convergence, LES turbulence modeling, full geometry and multi-cylinder engine simulations

- **Large scale simulations together with extensive parametric sweeps cannot be run on standard clusters (~ 5000 processors)**
 - Today's simulations were run on more than 8K+ processors
- **Codes need to be optimized for performance “at scale” on supercomputers such as MIRA (768K processors)**



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VERIFI program at Argonne in collaboration with ALCF

Optimized CONVERGE code to run on MIRA:

- Speed-up restart (>20x)
- Write restart file (500x)
- Speed-up output and post file writes (1000x)
- Load balancing of cells with METIS (resolved memory constraints)
- Load balancing the chemical kinetic calculations (>3x)
- OpenMP (1.05x)

Engine problem is perhaps the toughest HPC problem

- Highly turbulent
- Detailed chemistry with multi-components
- Moving boundaries
- Adaptive mesh
- Multi-phase flow
- All modes of heat transfer



**VERIFI focusses on your
specific problem of interest
with your code of expertise**



Thank You

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