

SAMG-Oil

FULL SOLVER FOR IMPLICIT RESERVOIR SIMULATIONS

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All types of reservoir simulators rely on the efficient solution of linear systems. In fully and adaptive implicit simulations, these linear systems involve different, yet coupled types of unknowns with different physical backgrounds.

SAMG-Oil handles the fully coupled system complemented by additional physical information.

Internally, SAMG-Oil selects an appropriate matrix pre-processing, based on the supplied information about the underlying physics. It adjusts the AMG components to the requirements of the individual type of simulation. The multigrid and smoother setup is computed based on the particular matrix coefficients of the given problem. Within the solution process, the convergence quality is monitored. The process is automatically adjusted when necessary.

Thus, the entire linear solution process is encapsulated in SAMG-Oil.

SAMG-Oil can cope with a large variety of types and approaches for simulations. From BlackOil over compositional up to thermal and coupled mechanical applications. The framework behind it facilitates a demand-driven adaptation also to new, not-yet supported simulation approaches.

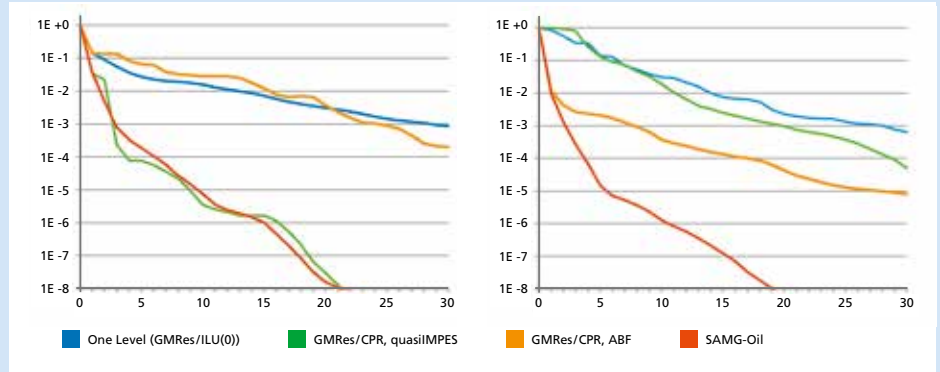
Internally, SAMG-Oil makes use of the well-established SAMG solver with its highly efficient multigrid approach. Any parallel flavor of SAMG is supported by SAMG-Oil as well (MPI, OpenMP, auto-distributed).

Hence, SAMG-Oil is not only a versatile but also an efficient solver.

BlackOil

Representative example cases for a rather well conditioned (left) and a quite ill-conditioned (right) 3D compositional problem.

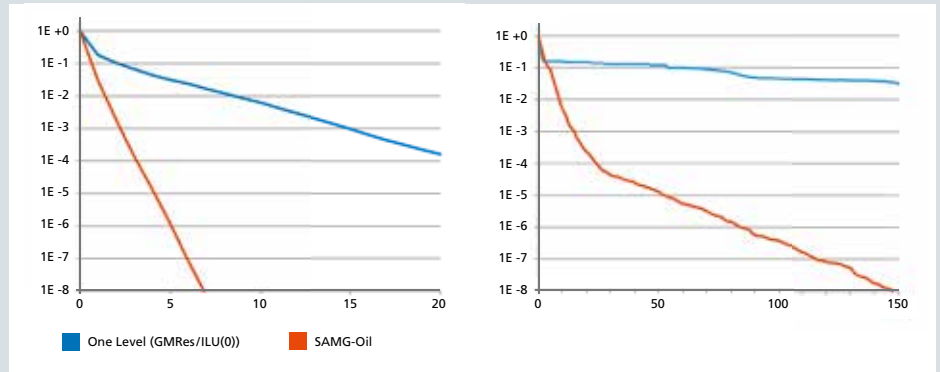
The figures show the accuracy (relative residual) per iteration. Lower is better.



Compositional

Representative example cases for a natural-variable (left) and a volume-balance (right) problem with 4 and 10 components.

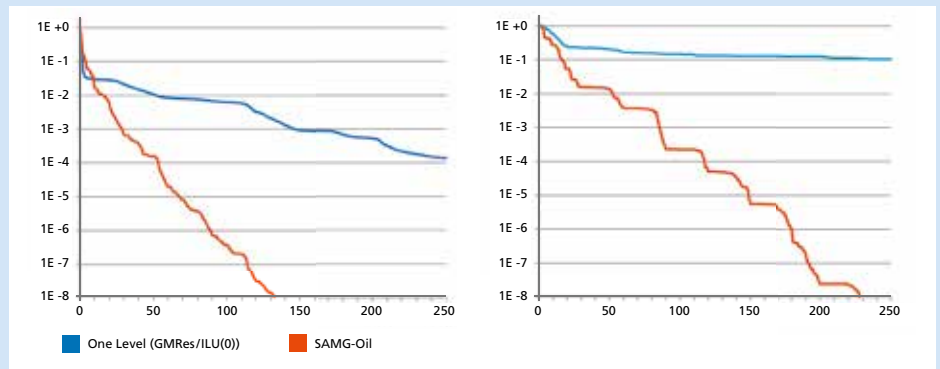
The figures show the accuracy (relative residual) per iteration. Lower is better.



Thermal

Representative example case at two different time steps from a steam injection simulation.

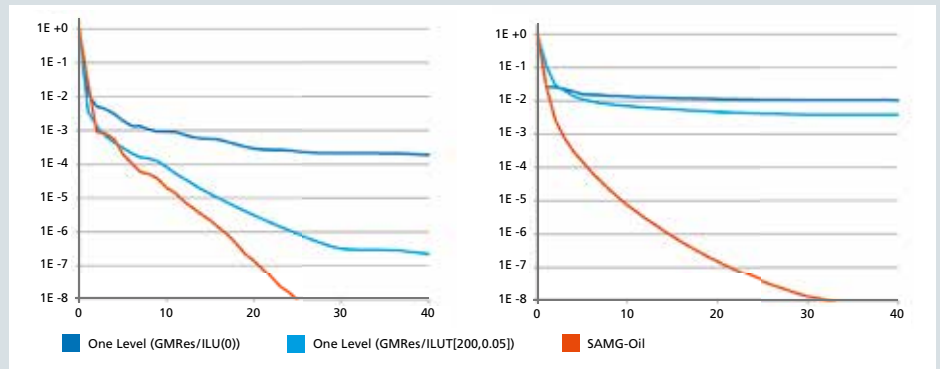
The figures show the accuracy (relative residual) per iteration. Lower is better.



Coupled Mechanics

Representative example case at two different time steps from a consolidation simulation.

The figures show the accuracy (relative residual) per iteration. Lower is better.



Performance

Just as the SAMG solver suite, SAMG-Oil supports MPI and OpenMP parallelism, as well as a combination of both. This holds for all parts of the solution process: From the pre-processing over the multigrid setup to the solution iterations.

The figure shows the cumulated linear solver runtime (in hours) for the linear systems from a full SPE10 simulation.

SAMG-Oil was run with up to 32 MPI processes.

