



# A Recursive Shortcut for CEGAR

## Application to the Modal Logic K Satisfiability Problem

Jean-Marie Lagniez, Daniel Le Berre,  
Tiago de Lima and Valentin Montmirail

CRIL, Université d'Artois and CNRS, France

{lagniez, leberre, delima, montmirail}@cril.fr

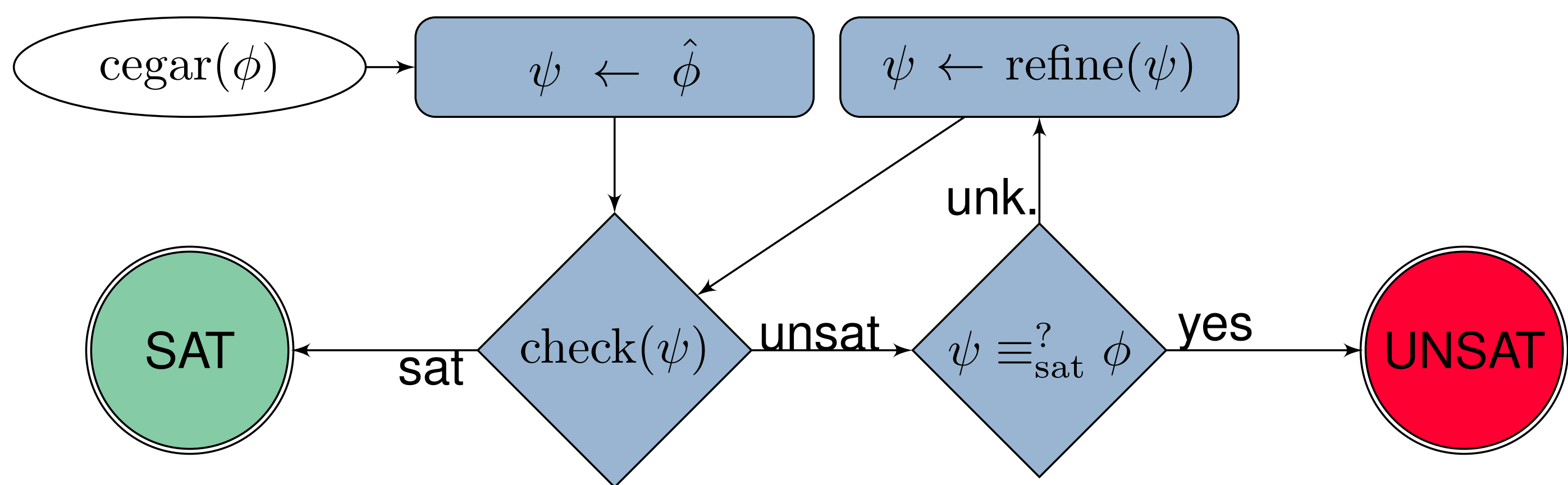


UNIVERSITÉ D'ARTOIS

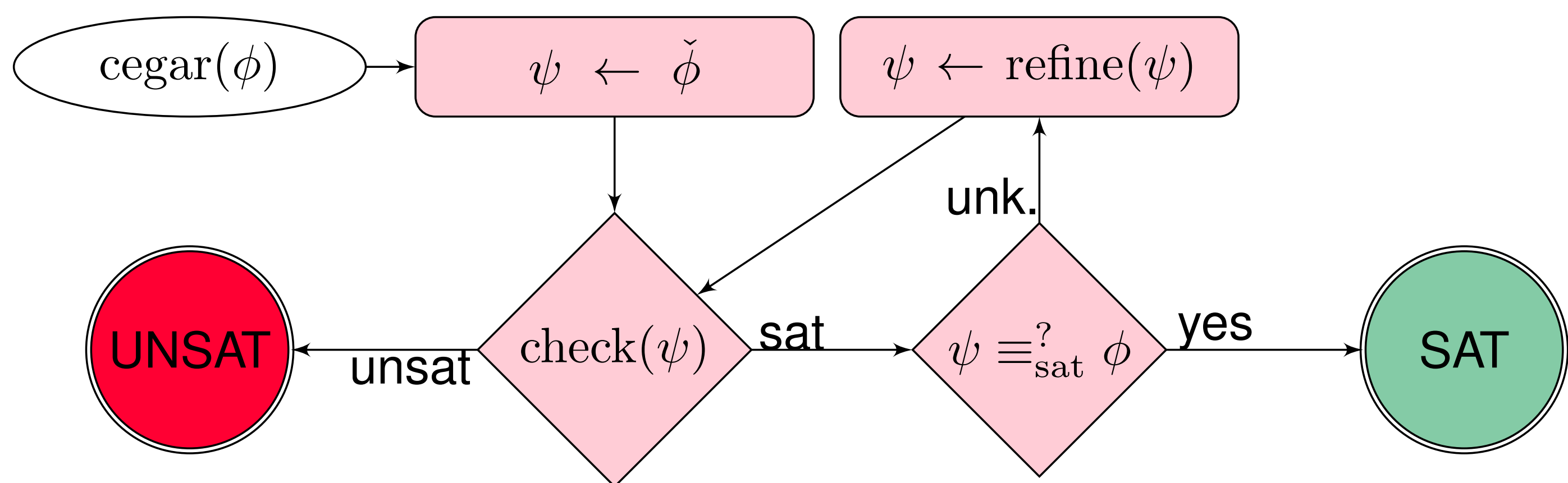
### MOTIVATION AND CONTRIBUTIONS

- Modal Logic K Satisfiability Problem is **PSPACE complete**.
- How to solve a PSPACE problem with a SAT solver? By using the latest features of SAT solver: unsatisfiable cores and incremental SAT.
- Contribution: A CEGAR-like framework called RECAR and an instantiation for modal logic K within the solver MoSaiC

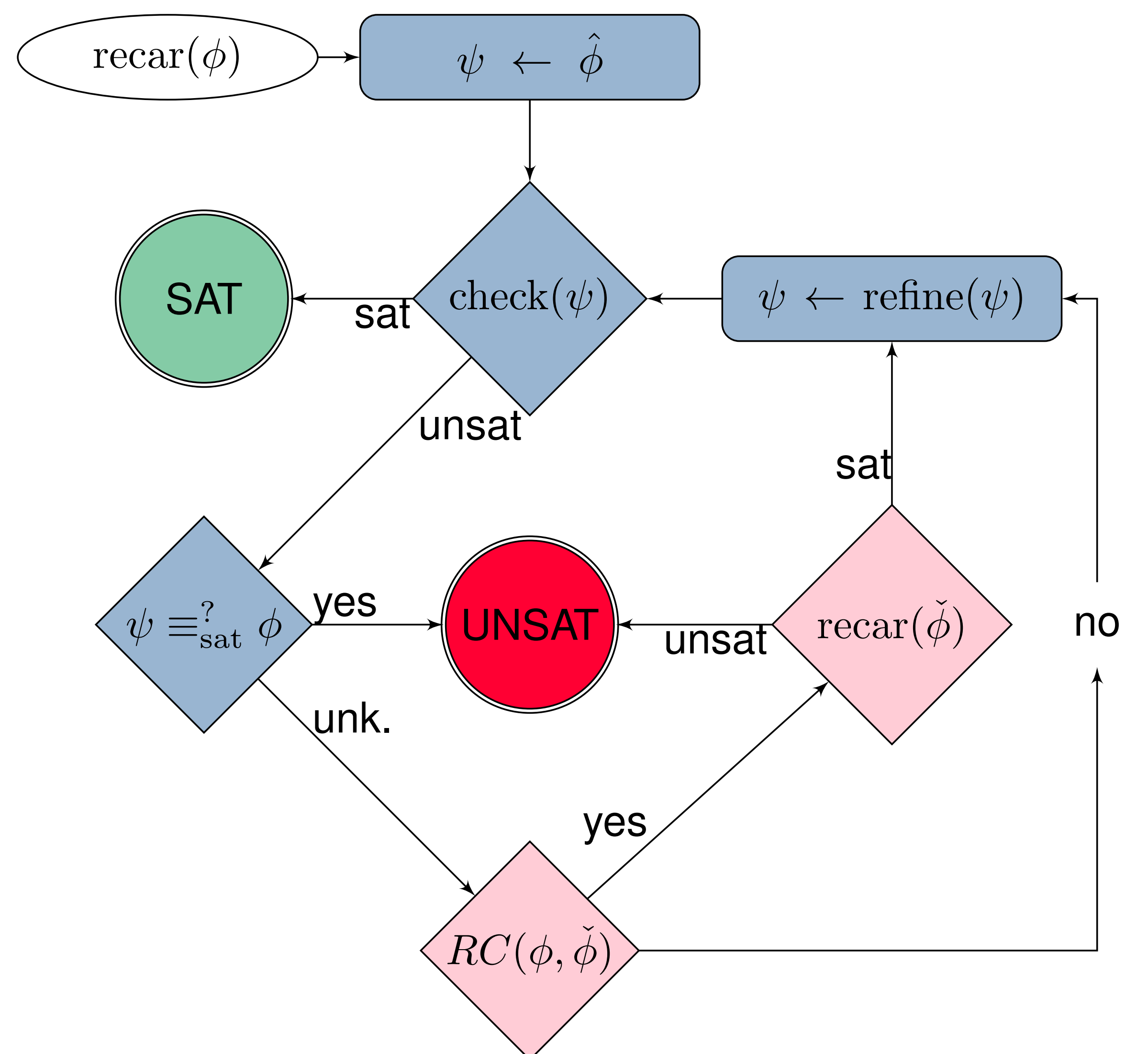
### CEGAR WITH OVER-APPROXIMATIONS



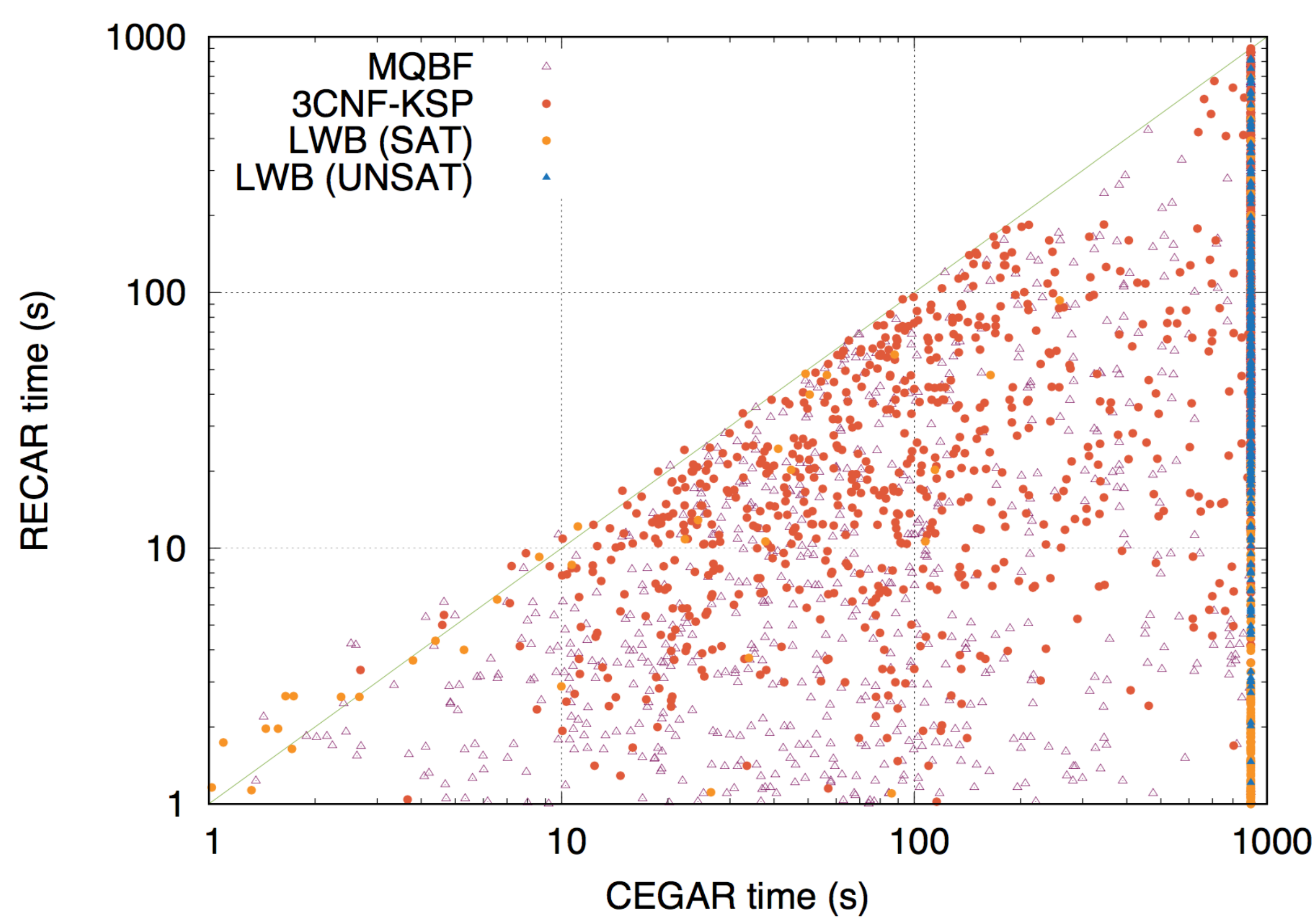
### CEGAR WITH UNDER-APPROXIMATIONS



### RECAR: RECURSIVE EXPLORE AND CHECK ABSTRACTION REFINEMENT

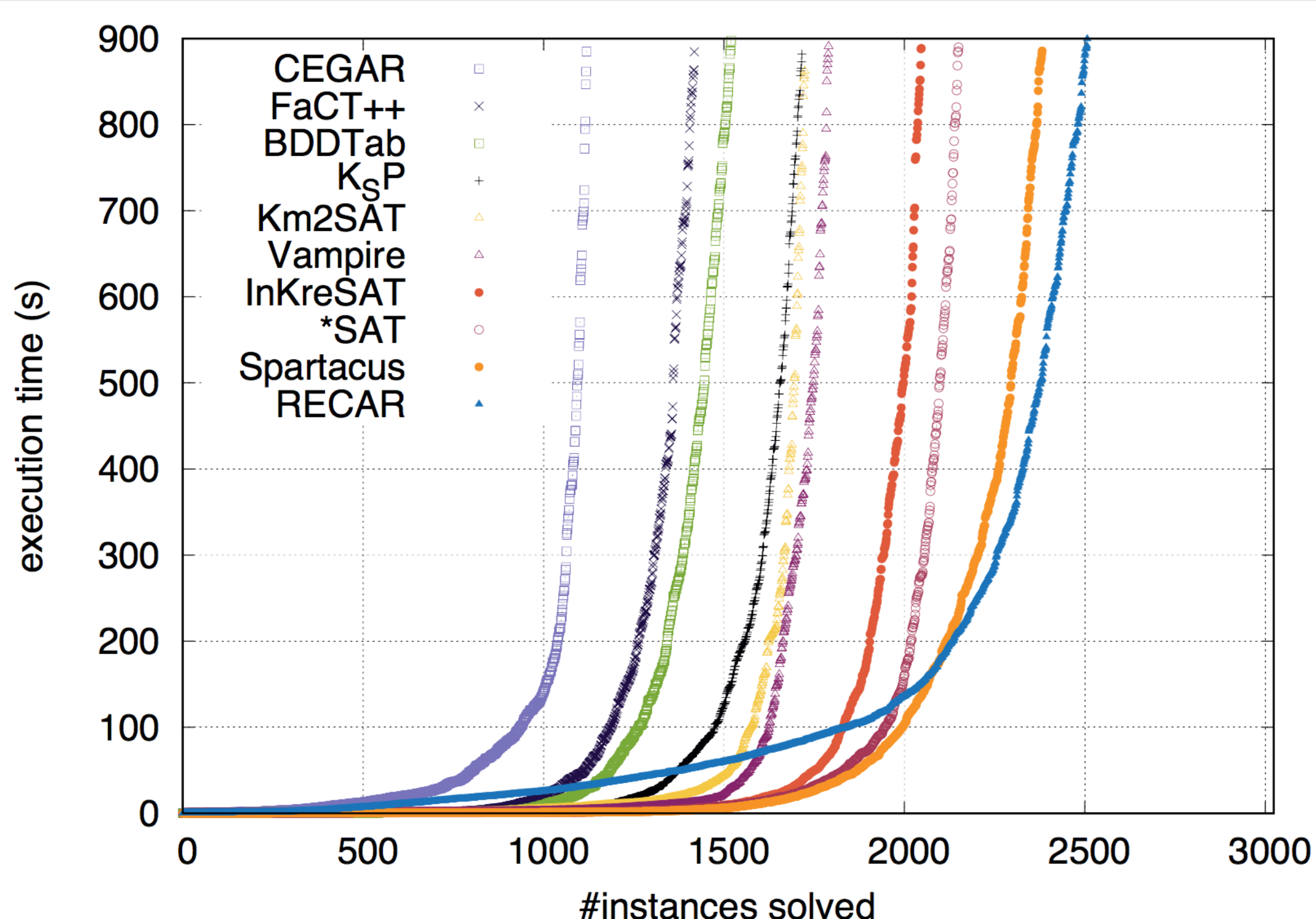


### EXPERIMENTAL RESULTS: RECAR AGAINST CEGAR



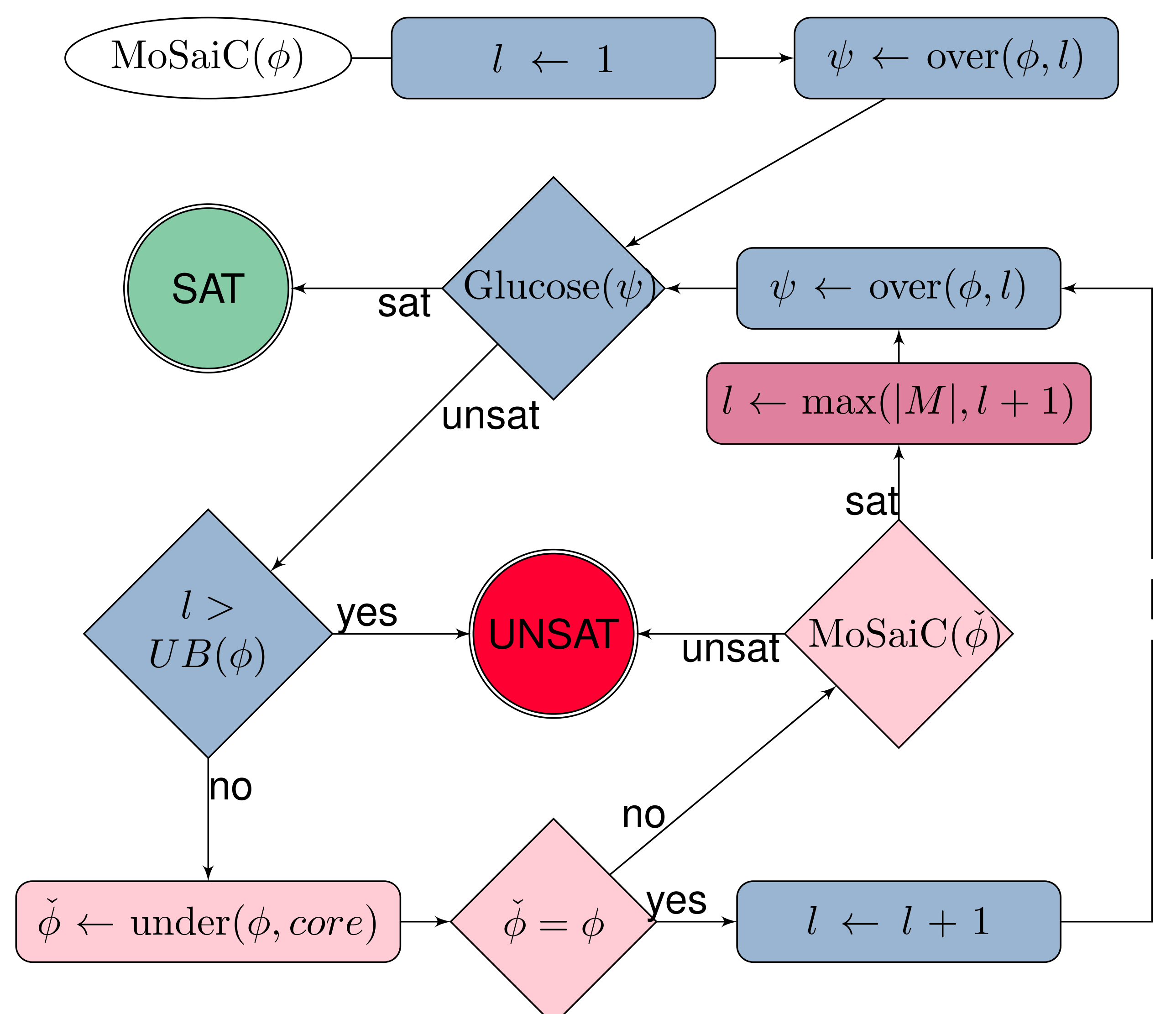
The RECAR-loop increases strongly the results on UNSAT benchmarks.

### EXPERIMENTAL RESULTS: MoSaiC AGAINST SOTA SOLVERS



MoSaiC outperforms the other solvers on the benchmarks considered.

### MoSaiC: MODAL LOGIC K SOLVER USING RECAR



### EXPERIMENTAL SETTINGS

2 configurations of MoSaiC: CEGAR vs RECAR

Many state-of-the-art solvers for modal logic K satisfiability problem

CentOS 6.0, bi-proc. XEON, 4 cores, 3.3 GHz, 32GB, 900 seconds.

### CONCLUSION AND FUTURE WORK

\* RECAR is an efficient merge between CEGAR-over and CEGAR-under

- RECAR for other PSPACE problems

- Improve MoSaiC for others modal logics

