Profile Caching for the Java Virtual Machine

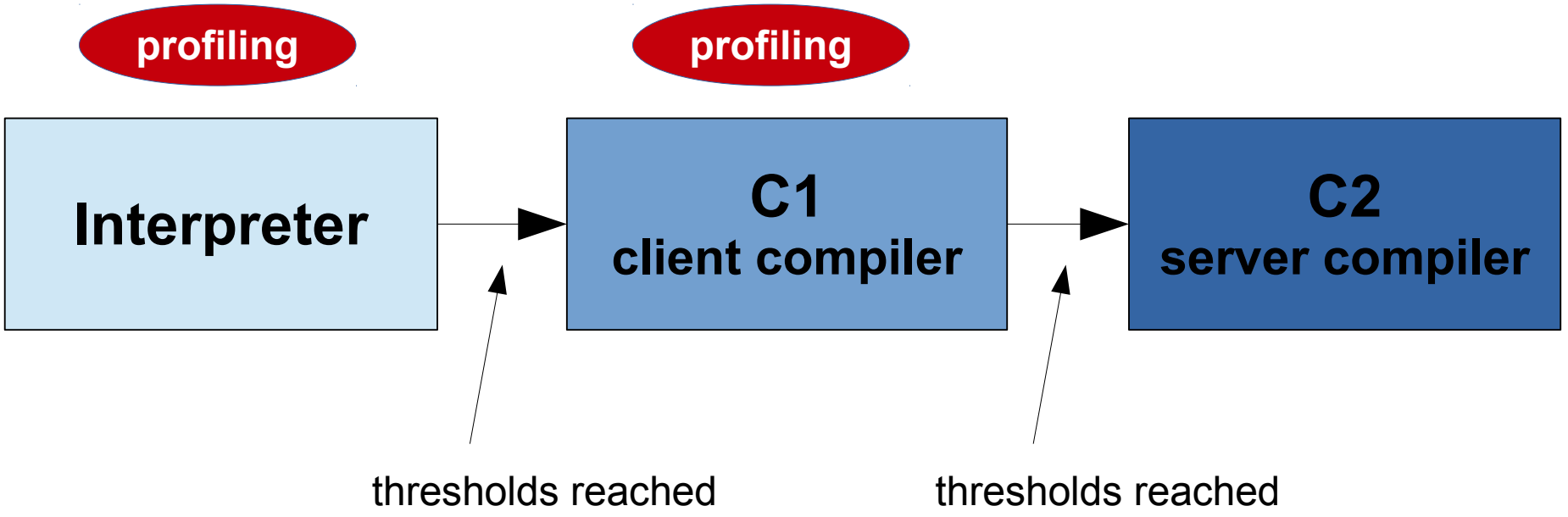
Marcel Mohler, ETH Zurich

Bachelor Thesis

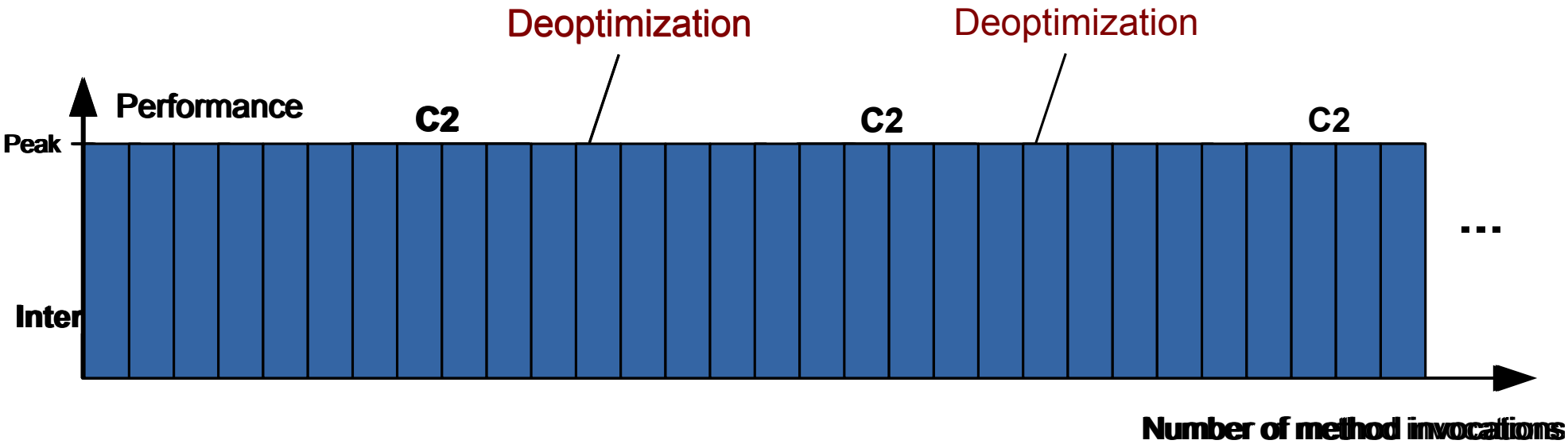
Supervisors: Zoltan Majo, Oracle
Tobias Hartmann, Oracle

Prof. Thomas Gross, Laboratory for Software Technology, ETH

Tiered Compilation in HotSpot JVM



Problem: performance fluctuations



Goal: Decrease performance fluctuations

Observation

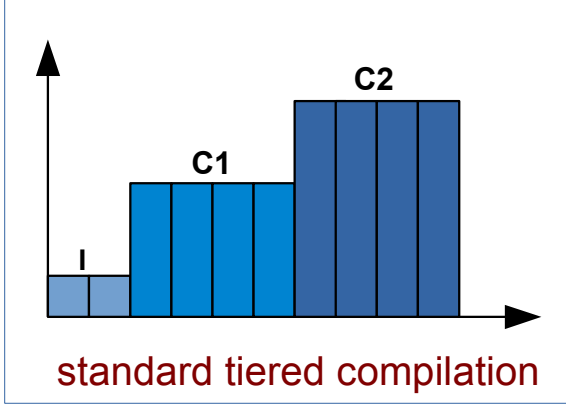
- Profiles need to be gathered each time the JVM starts
- Most frequently used methods often do not change

→ Idea: cache and reuse the profiles!

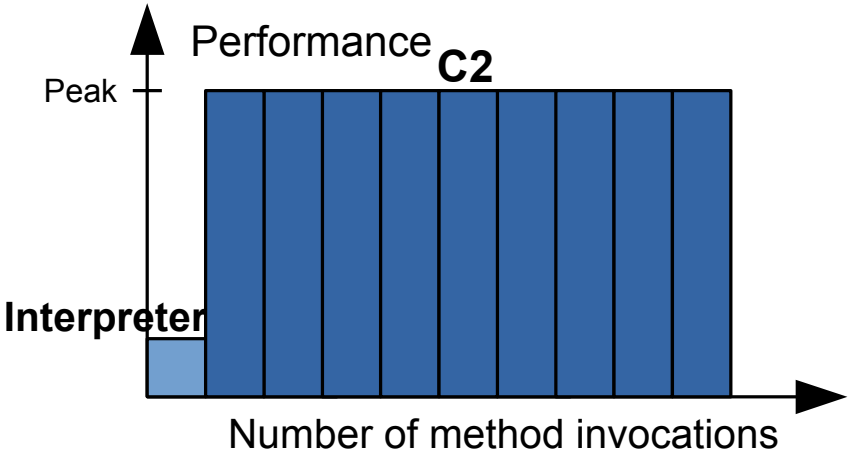
Outline

1. Design
2. Implementation
3. Performance evaluation
4. Conclusion

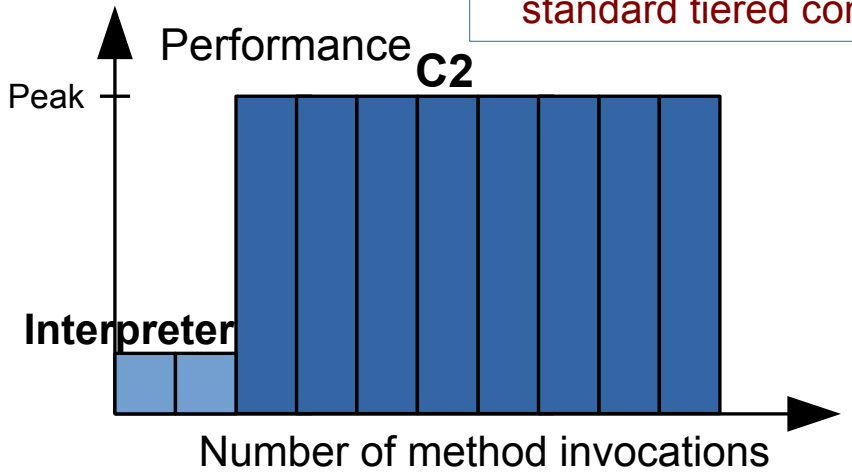
Design: 3 modes



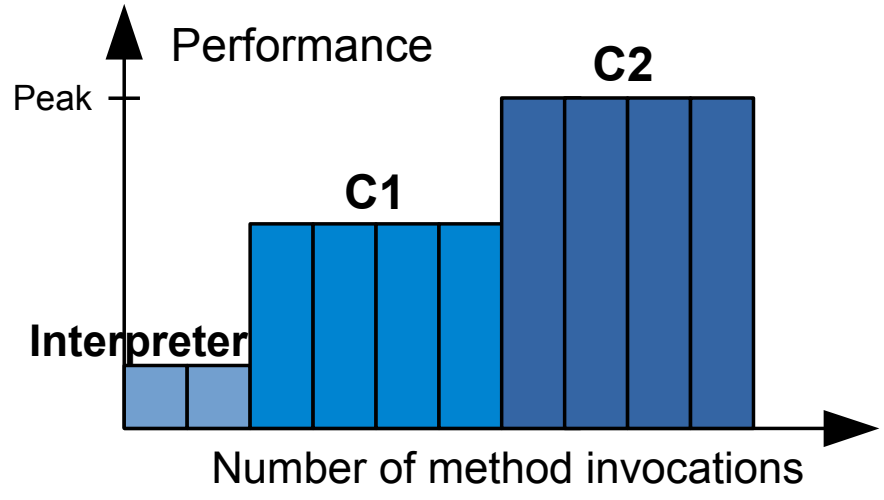
standard tiered compilation



Mode 0

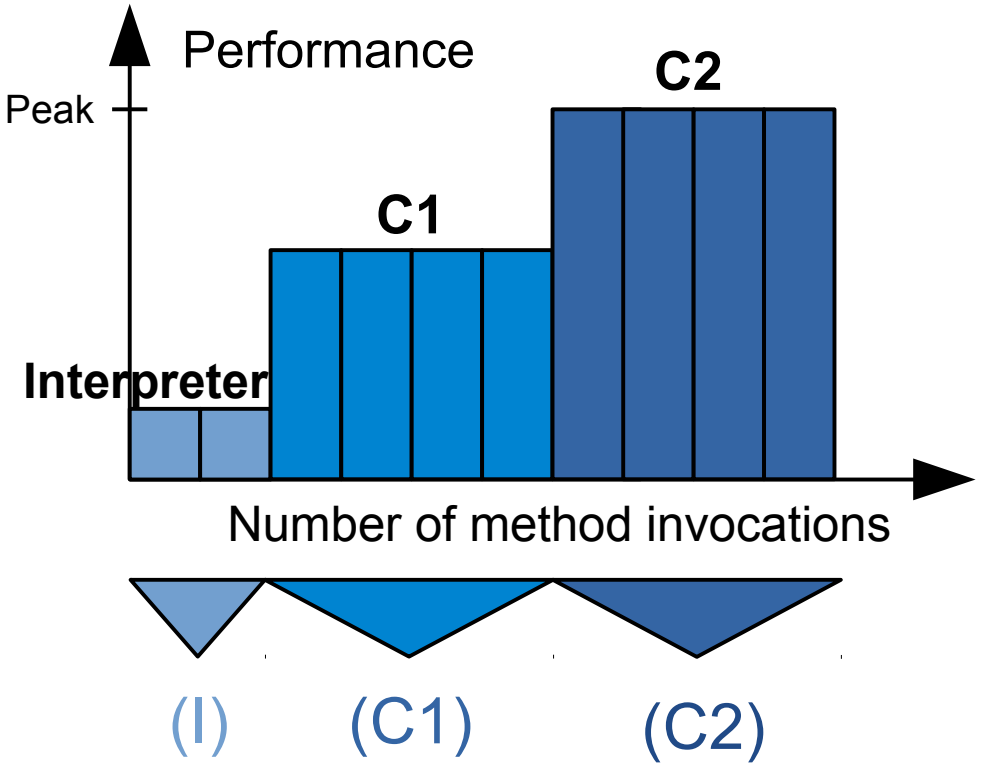


Mode 1



Mode 2

Design: Mode 2



(I) unmodified

(C1) remove profiling code

→ ~30% speedup

(C2) use cached profile

→ better code quality

Implementation

- Based on existing compilation replay functionality
- Configurable by JVM flags
- Select all or an arbitrary set of methods

Evaluation

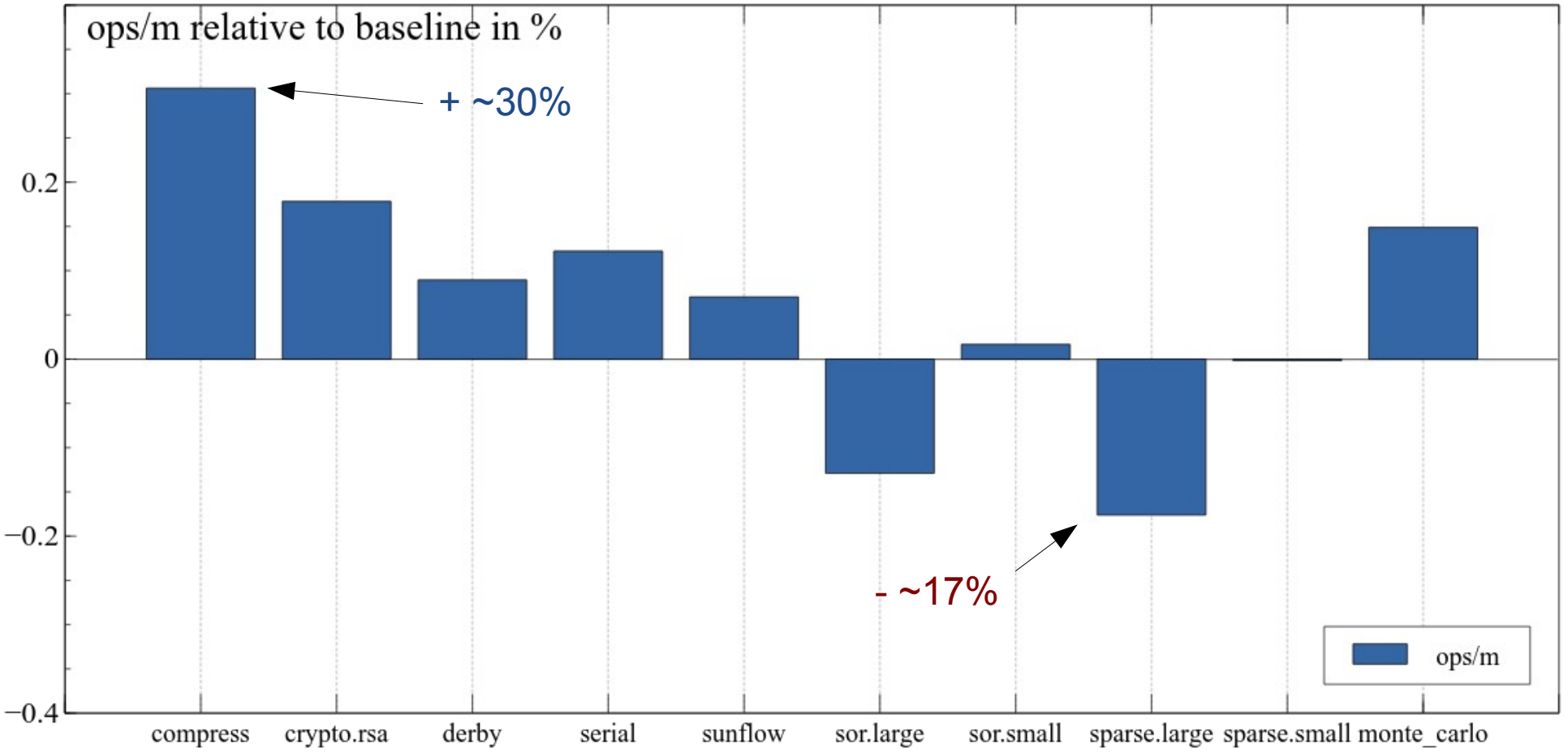
- ETH Data Center Observatory
- Focus on warmup
- 2 benchmark suites
  - SPECjvm 2008

    17/21 individual benchmarks used
  - Google Octane (using Nashorn)

    16/17 individual benchmarks used

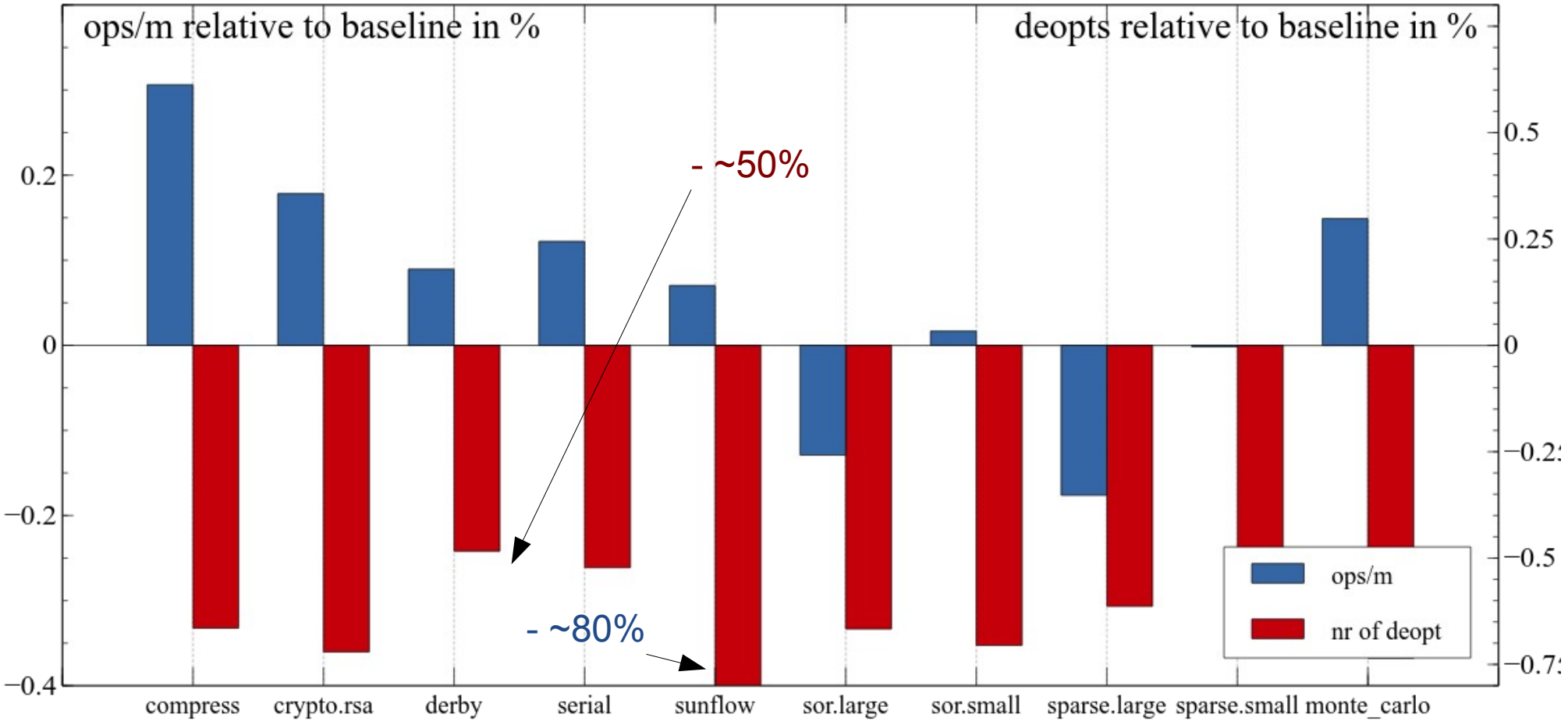
Performance evaluation

- Performance (higher is better)



Performance evaluation

- Deoptimizations (lower is better)

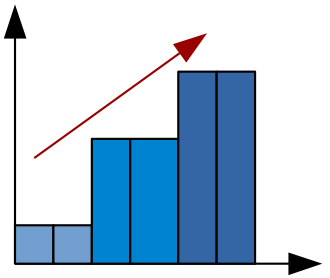


Other benchmark results

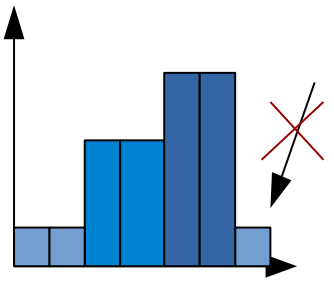
- Benefit mainly from cached C2 compilations. Disabling interpreter profiles rarely affects performance
- Around 70% of the compilations use cached profiles
- No association between performance and load on compile queue

Conclusion

- Cached profiles can improve warmup performance
- System allows fine tuning
- Main benefits:



faster warmup



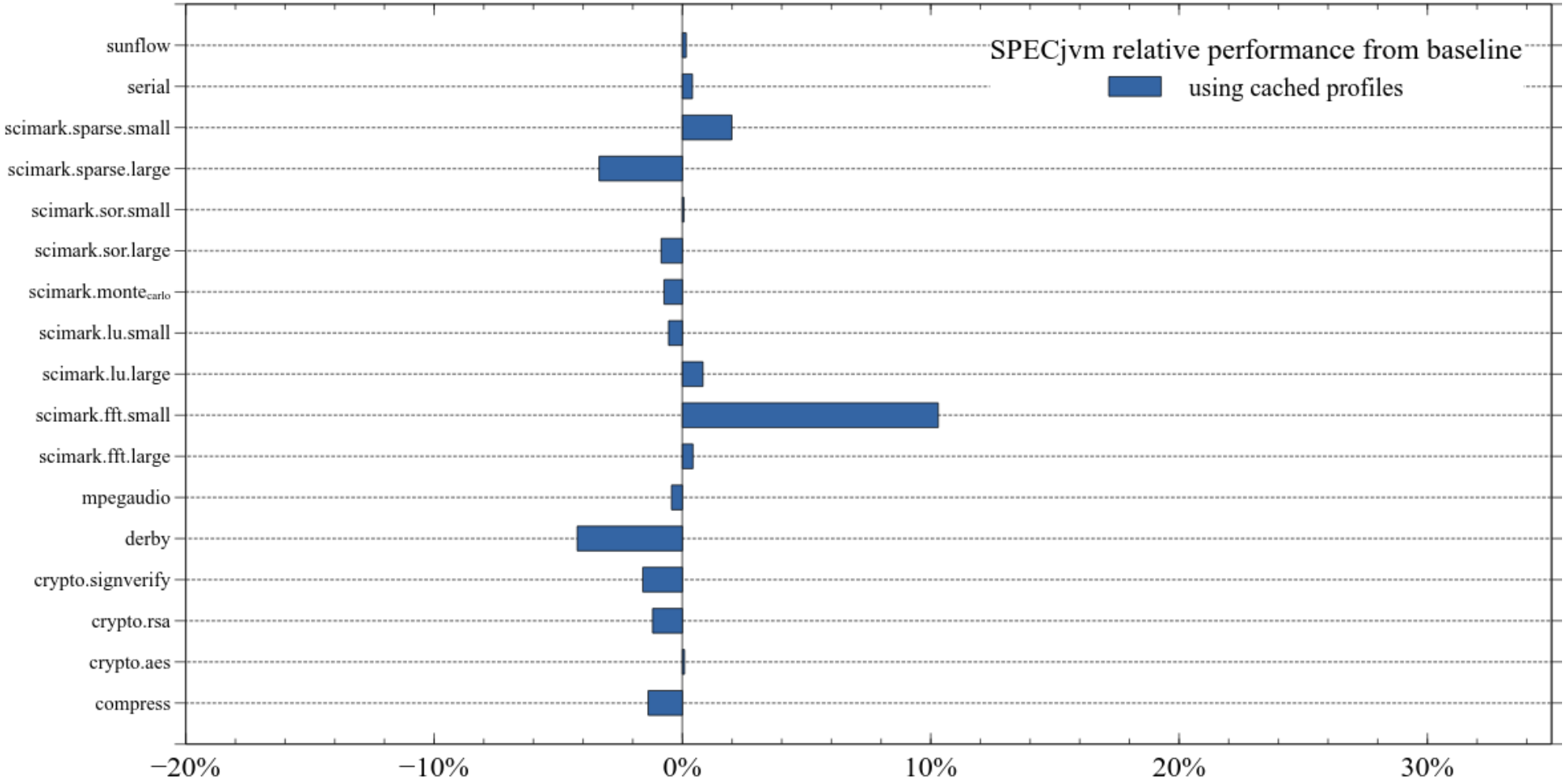
fewer deoptimizations

- Room for future work

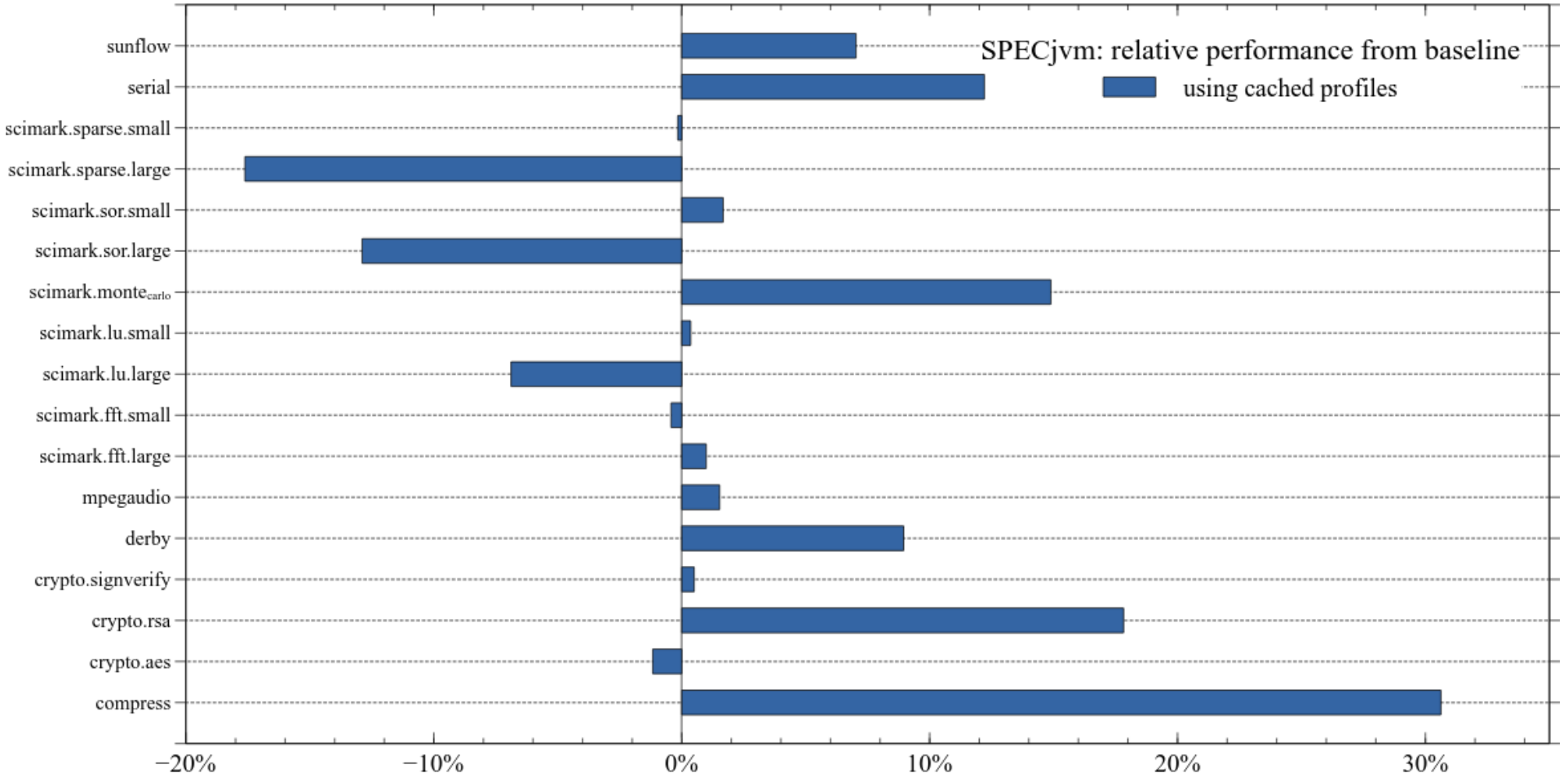
End

Additional graphes follow

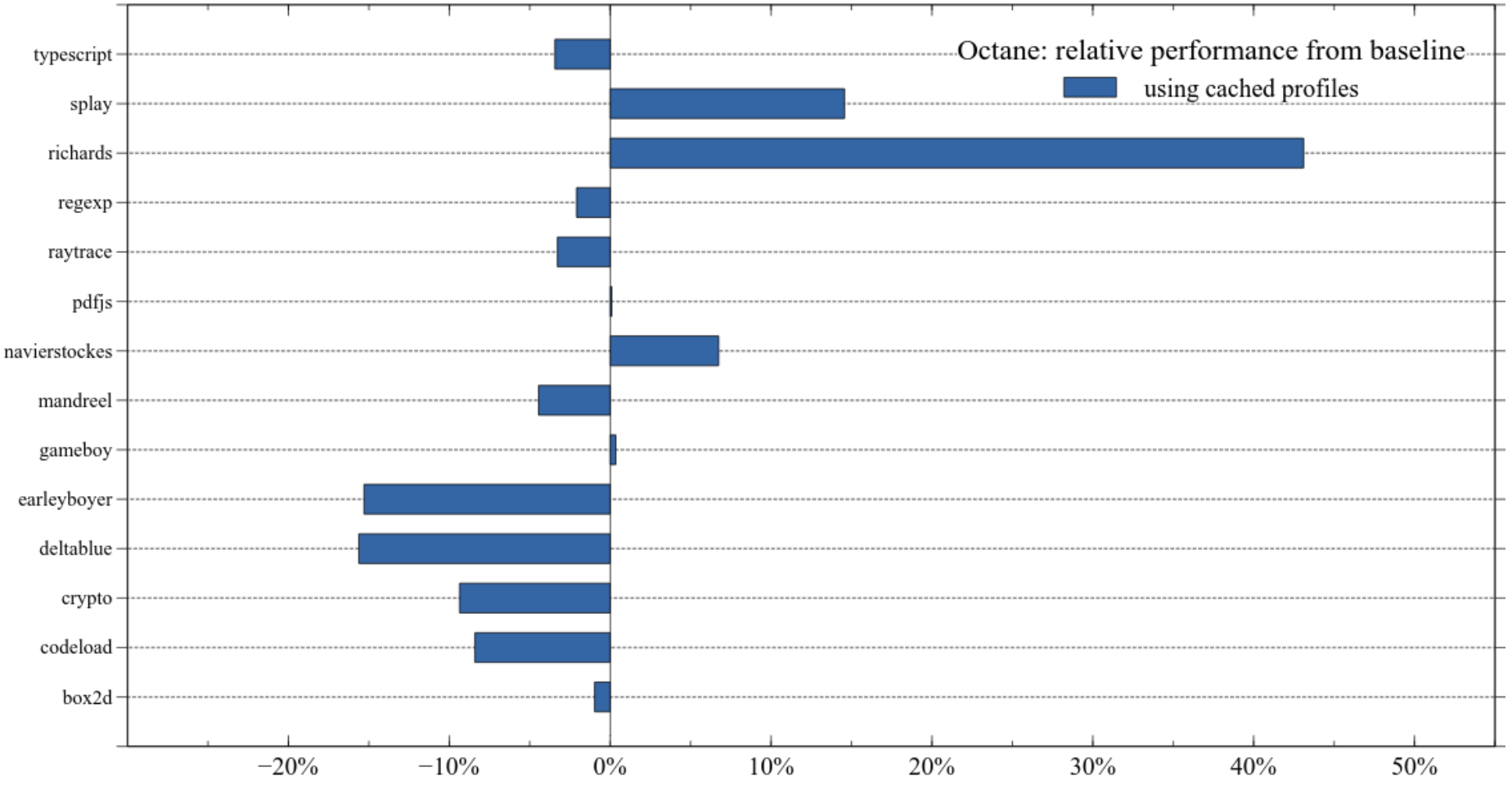
SPECjvm: relative performance full runs (2+4 minutes)



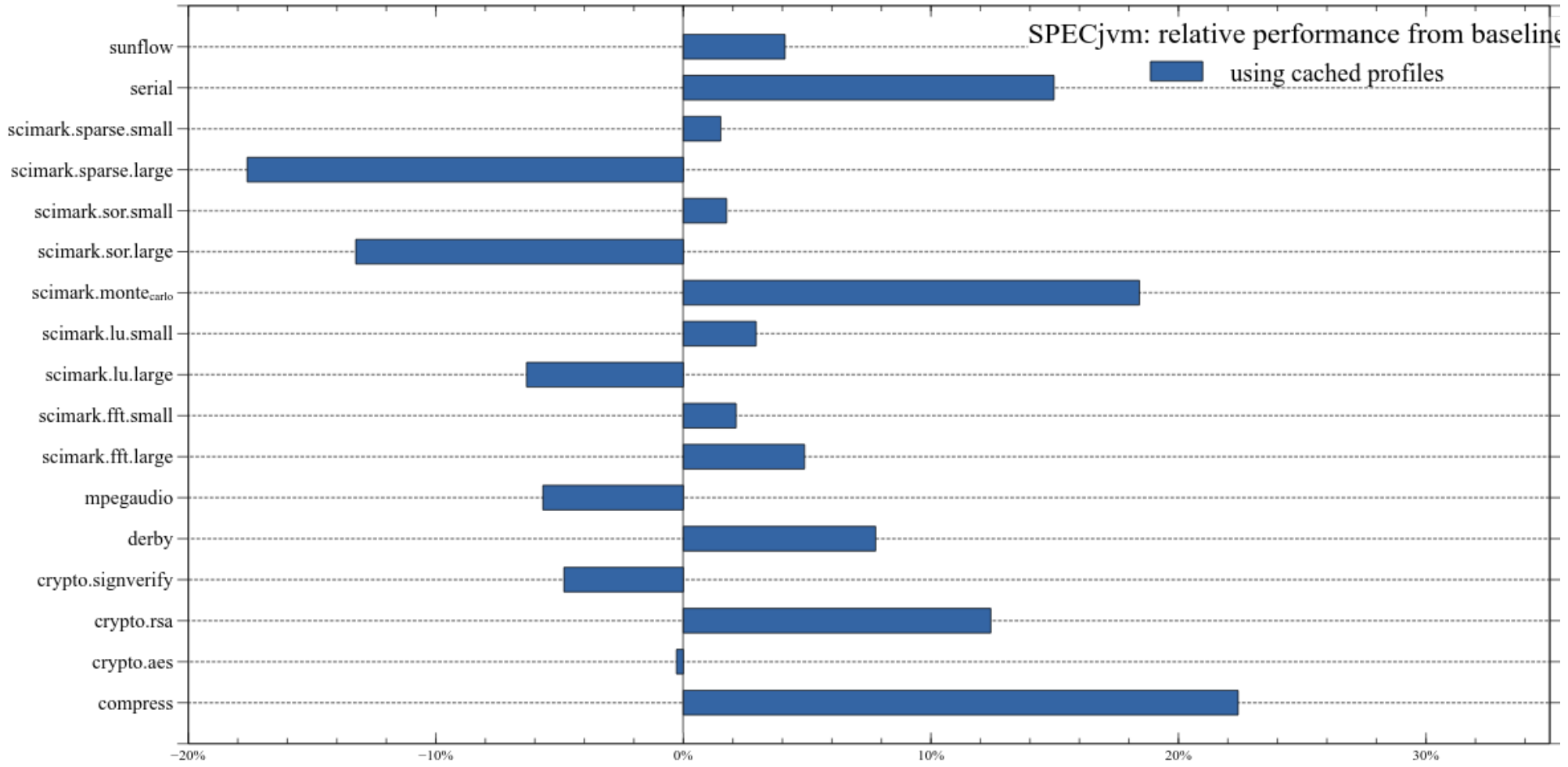
SPECjvm: relative performance warmup: all benchmarks



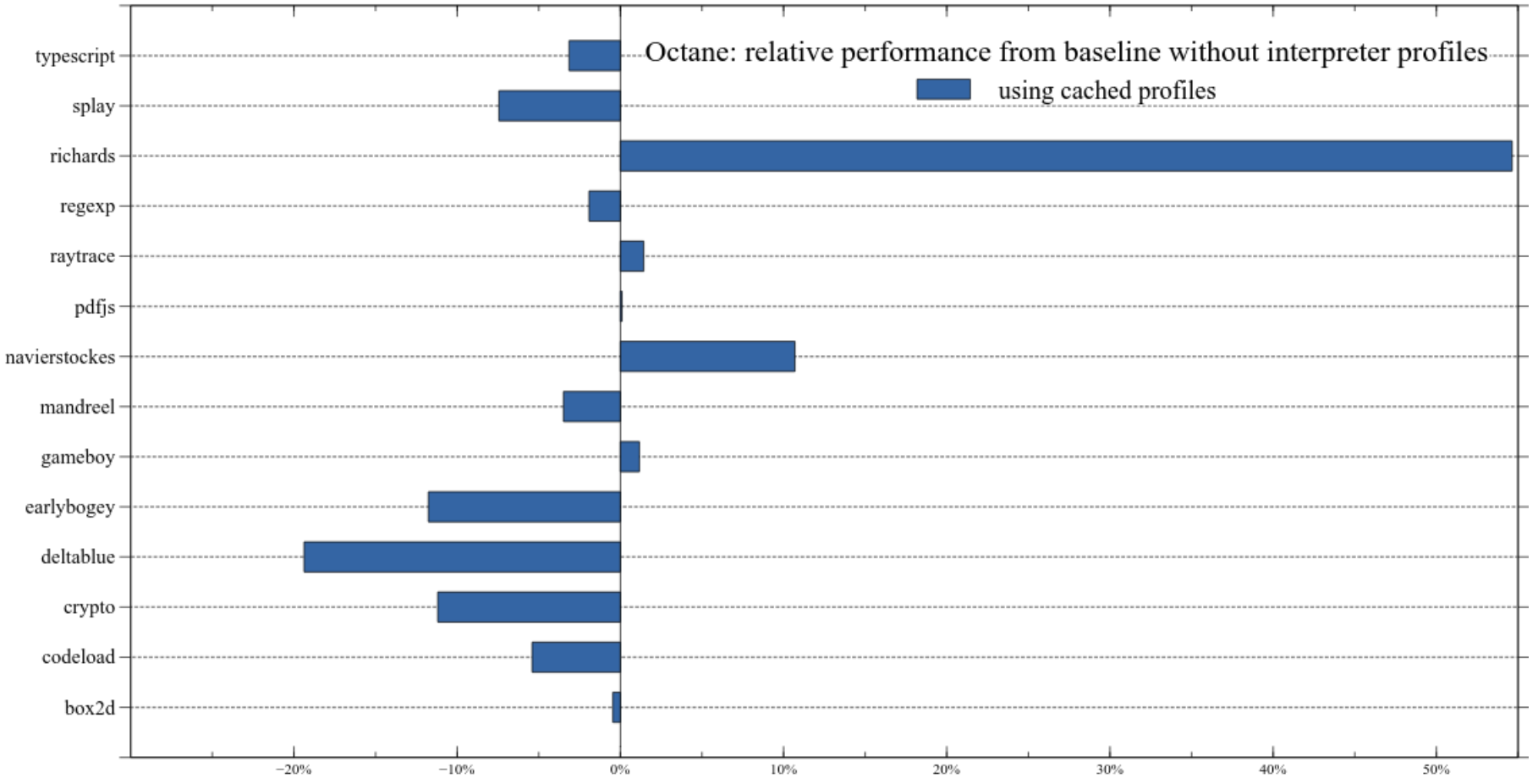
Octane: relative performance all benchmarks



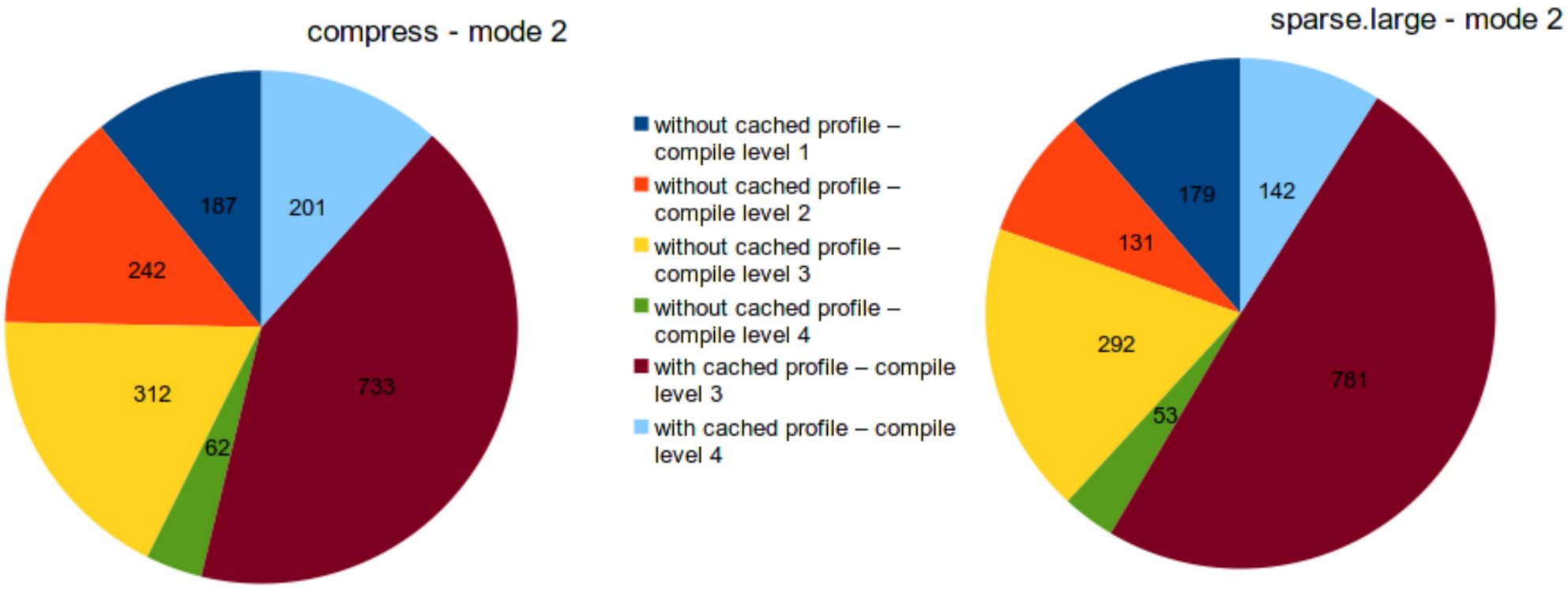
SPECjvm: relative performance without interpreter profiles



Octane: relative performance without interpreter profiles

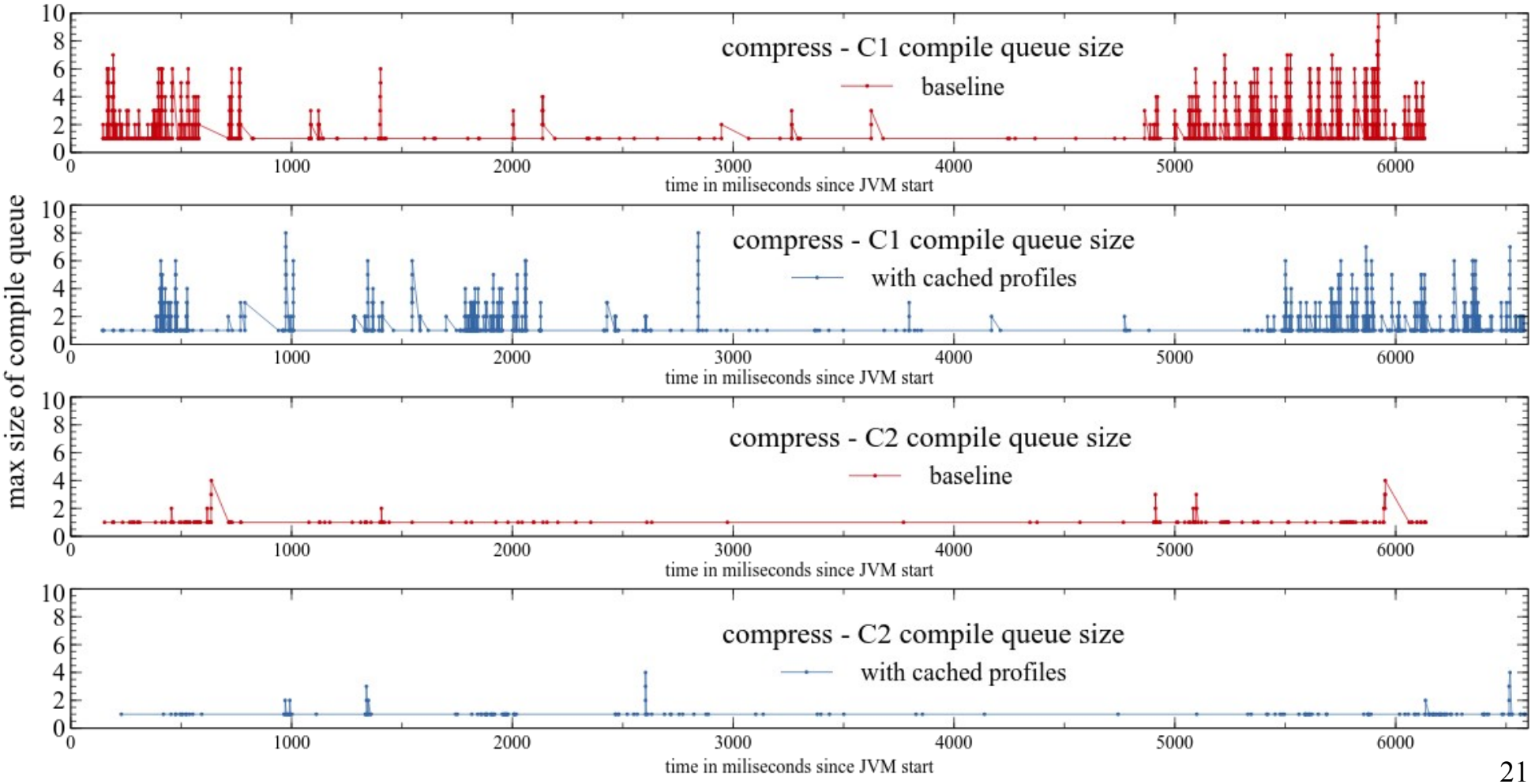


Type of compilations



Compile queue

- compress



Compile queue

- scimark.sparse.large