Analysing and Combining Static Pruning Techniques for Classical Planning Tasks

Master Thesis

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Overview

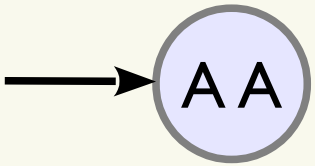
1. Introduction
2. Pruning Techniques
3. Synergies
4. Experiments
5. Conclusion

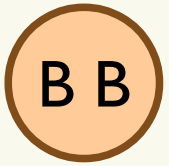
1. Introduction

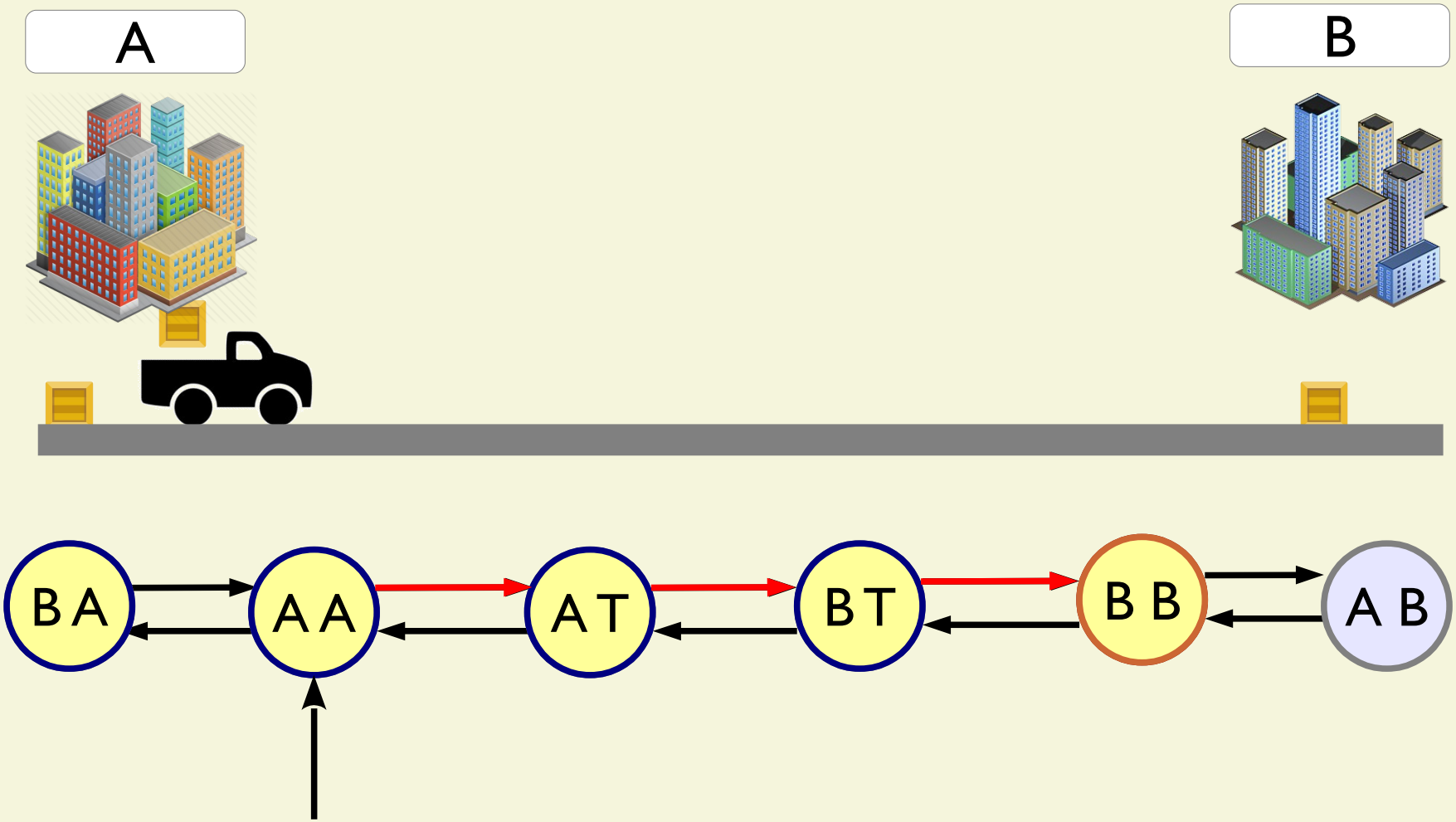
A

B

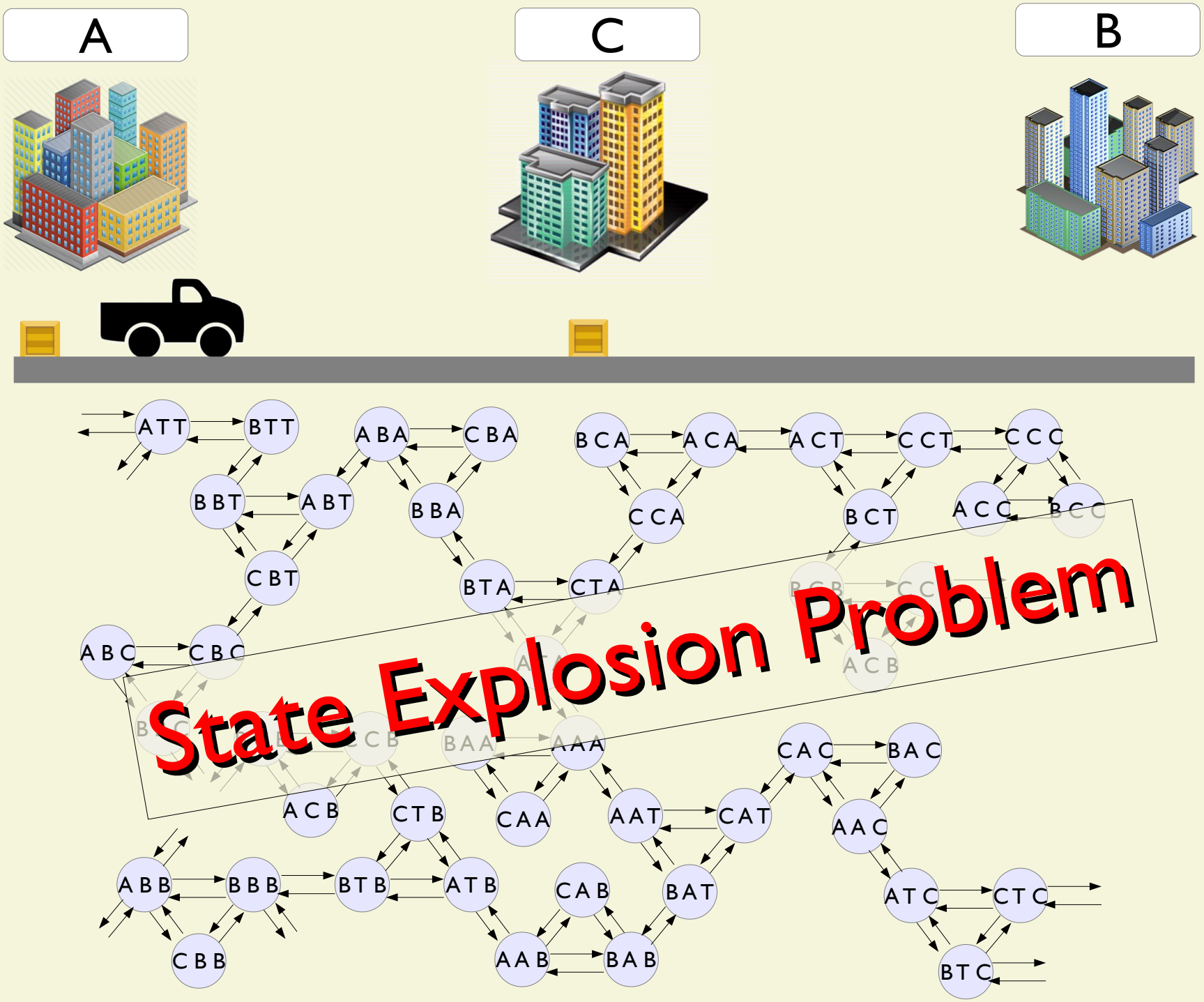
Planning Task

- Variables 
- Operators $drive_{A \to B}$ $drive_{B \to A}$ $load_A$ $unload_A$ $load_B$ $unload_B$
- Initial state 

- Goal state 



Plan: $load_A$ $drive_{A->B}$ $unload_B$


A
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CBC
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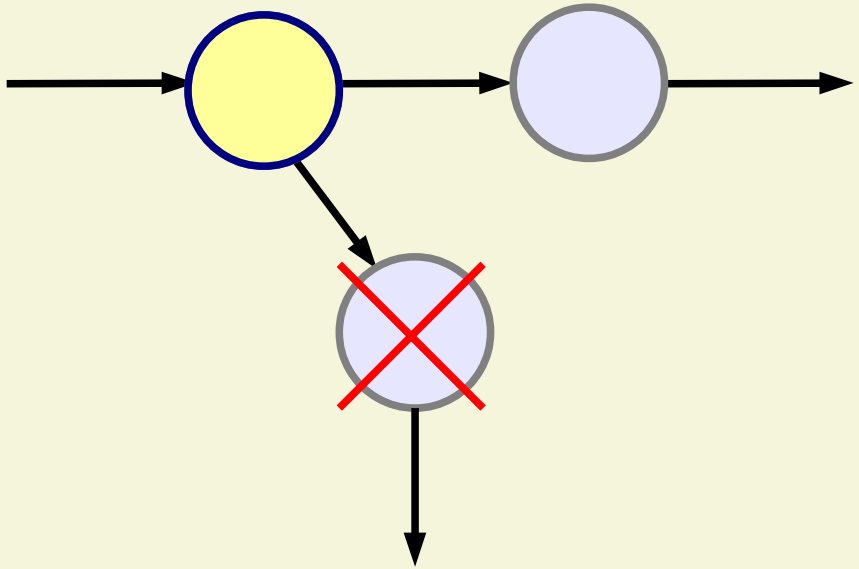
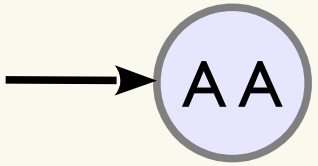
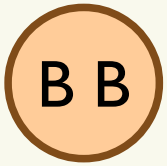
State Explosion Problem

Dynamic Pruning



Static Pruning

- Variables 
- Operators ~~$unload_B$~~ ...
- Initial state 

- Goal state 

2. Pruning Techniques

- Safe Abstraction
- Redundant Operator Reduction
- Dominance Pruning

Safe Abstraction

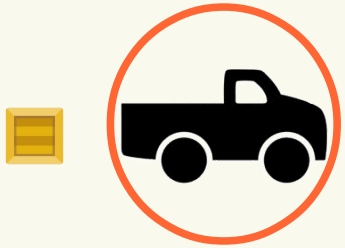
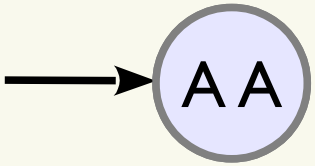
- Original version by Helmert (2006)
- Variant by Haslum (2007)

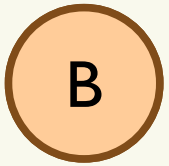
General idea:

1. Abstract *safe* variables
2. Solve abstract task
3. *Refine* plan

Safe Abstraction

Abstract Planning Task

- Variables 
- Operators $drive_{A \to B}$ $drive_{B \to A}$ $load_A$ $unload_A$ $load_B$ $unload_B$
- Initial state 

- Goal state 

Safe Abstraction

Plan: $load_A$ $drive_{A \to B}$ $unload_B$

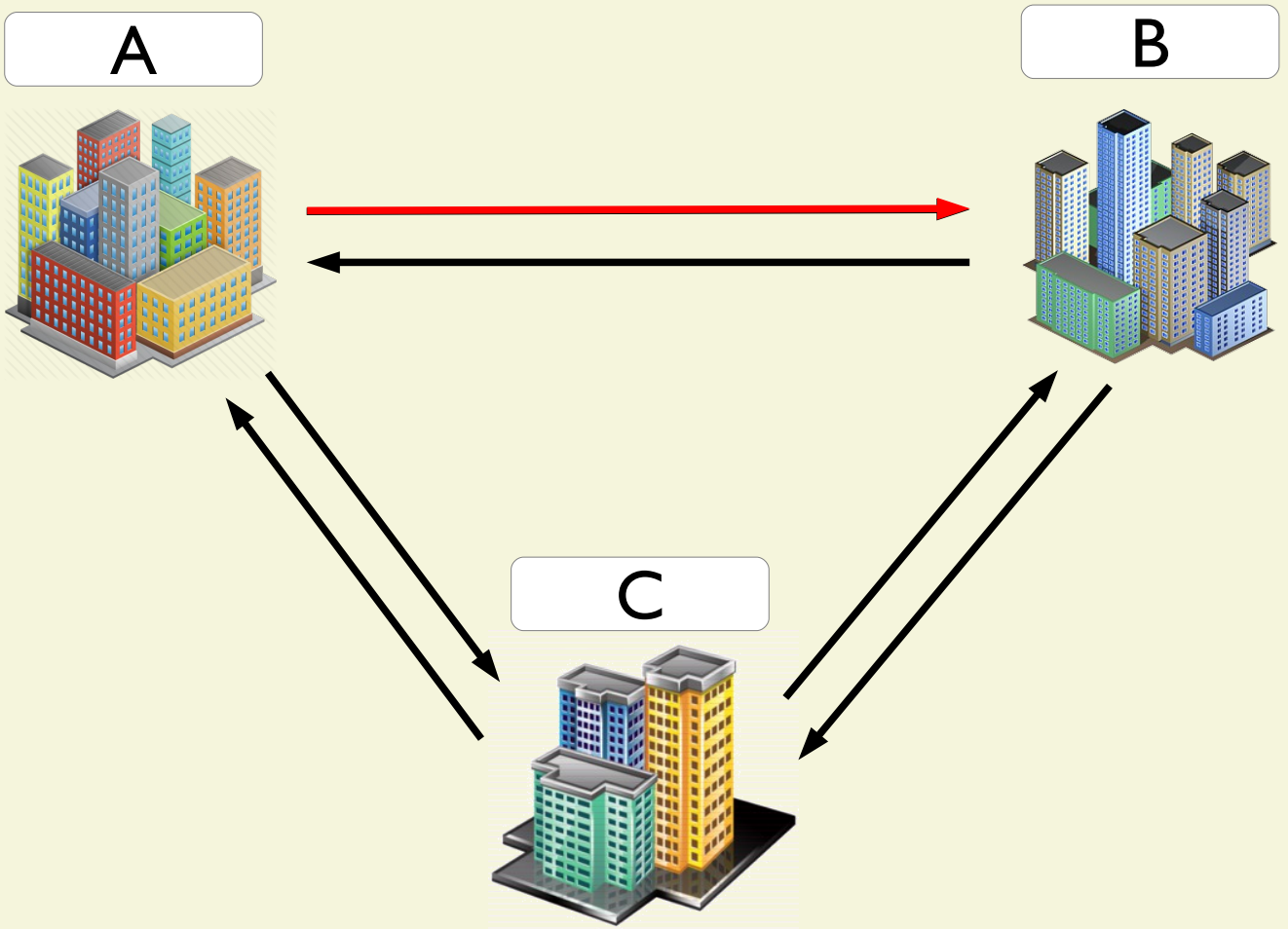
Redundant Operator Reduction

- Researched by Haslum and Jonsson (2000)

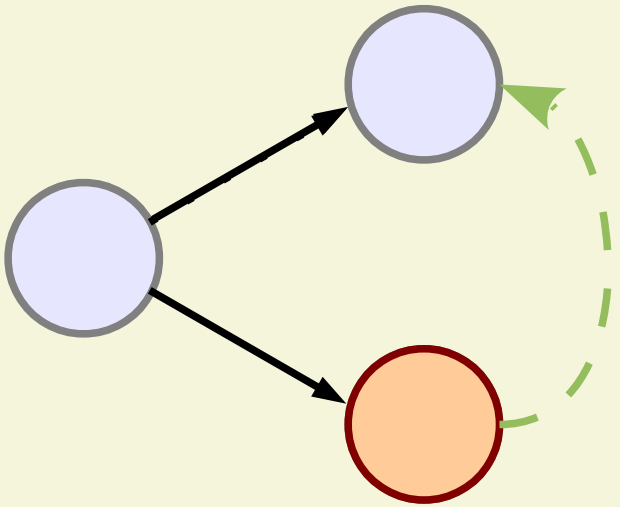
General idea:

- More operators than necessary
- Remove *redundant* operators

Redundant Operator Reduction



Dominance Pruning



- Optimality-preserving

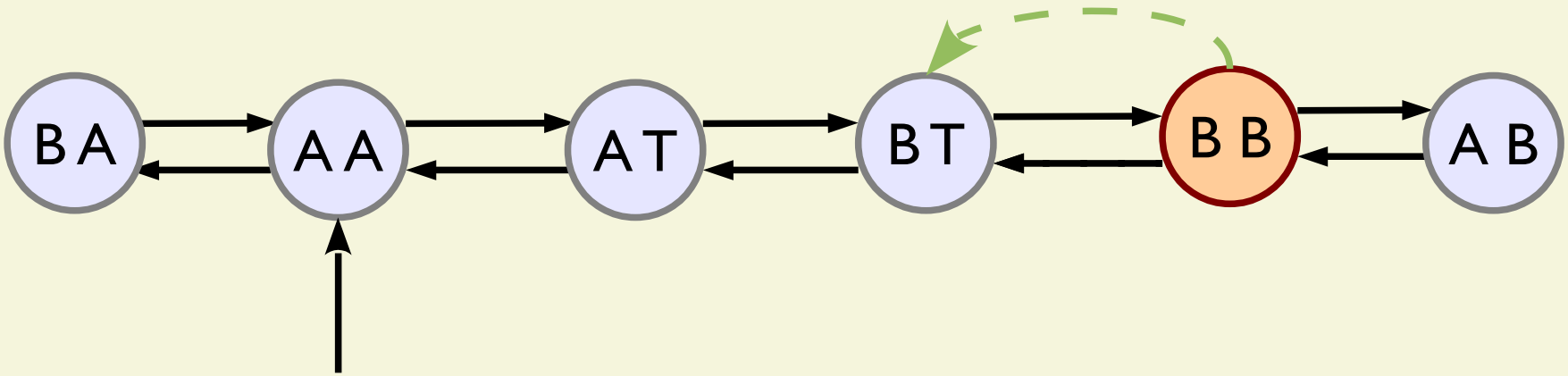
Torralba and Hoffmann (2015)

- Compute state simulation

Kissmann and Torralba (2015)

- Identify *subsumed* transitions
- Remove „bad“ operators

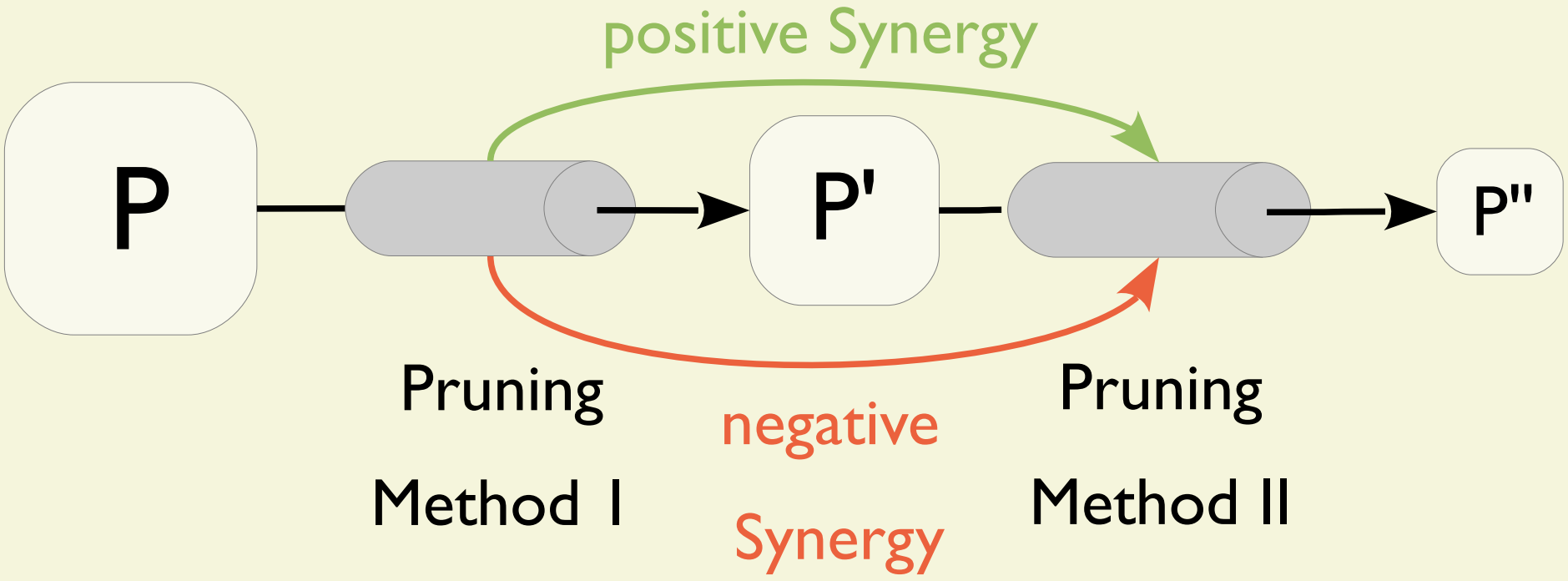
Dominance Pruning



- Operators $drive_{A \to B}$ $drive_{B \to A}$ $load_A$ $unload_A$ ~~$load_B$~~ $unload_B$

3. Synergies

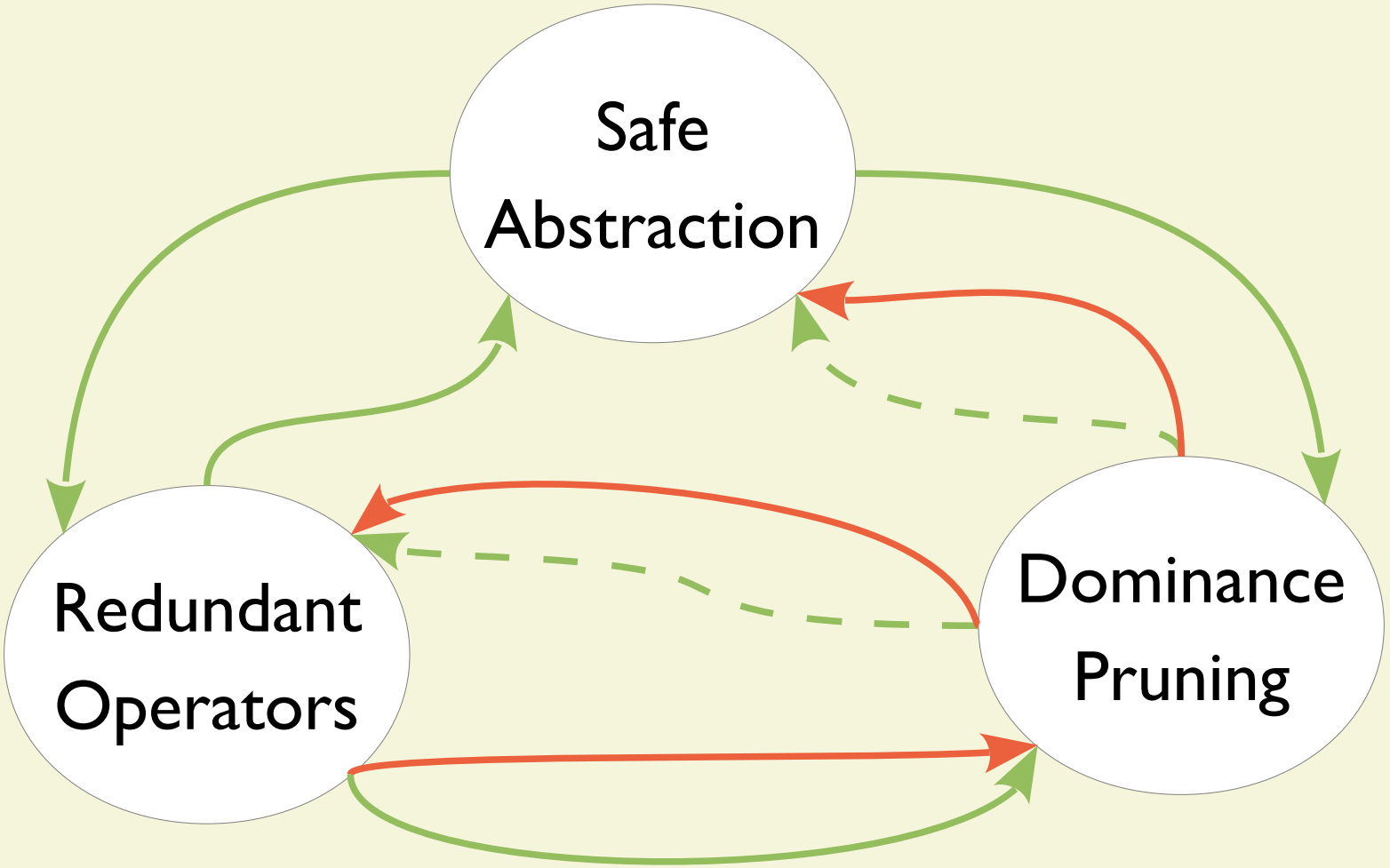
Synergy Effects



Which synergies exist?

→ Proven theorems

Synergy Effects



4. Experiments

- Implementation in Fast Downward
- IPC Benchmarks

Roadmap Experiments

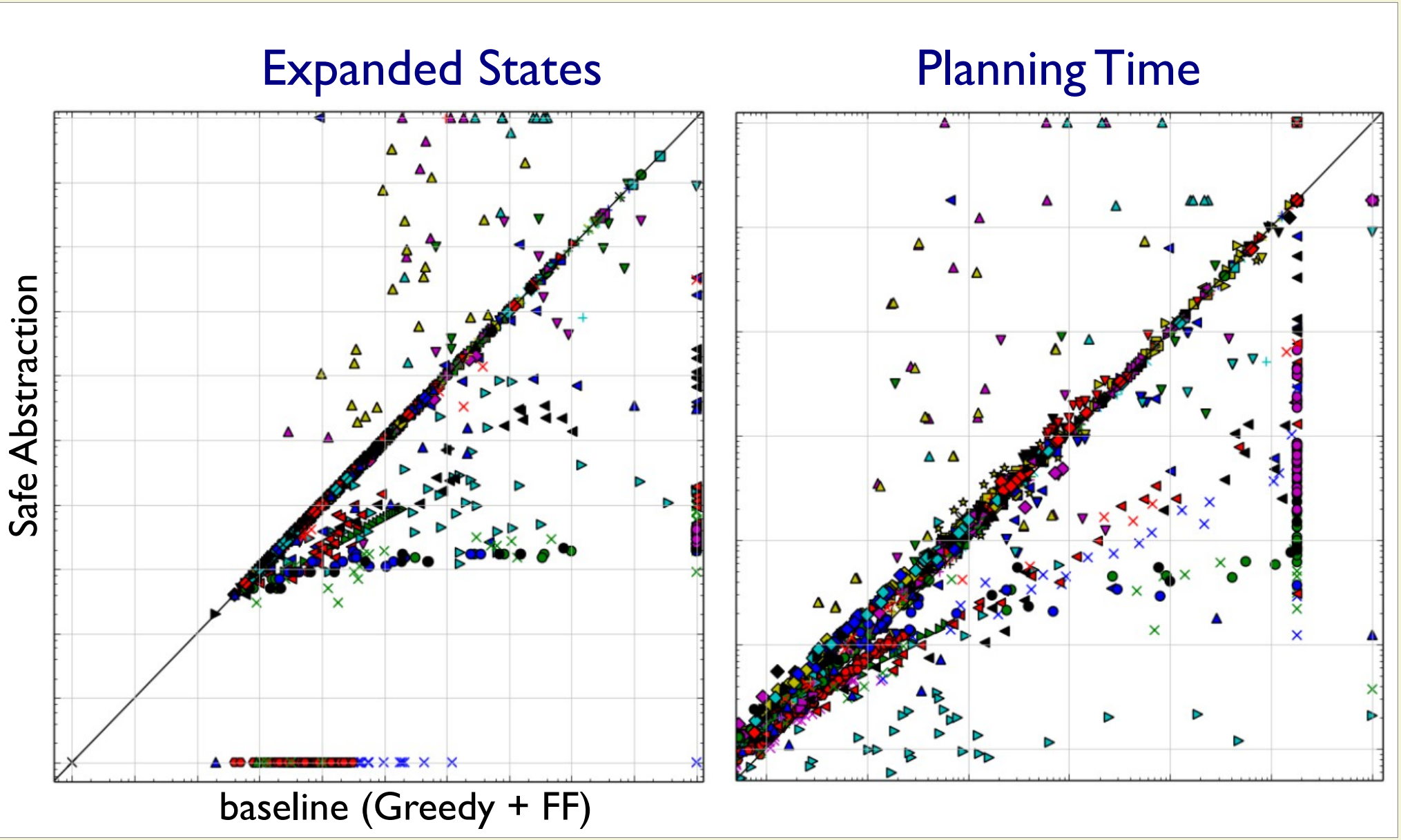
1. Techniques separately

- Configurations
- Best performance

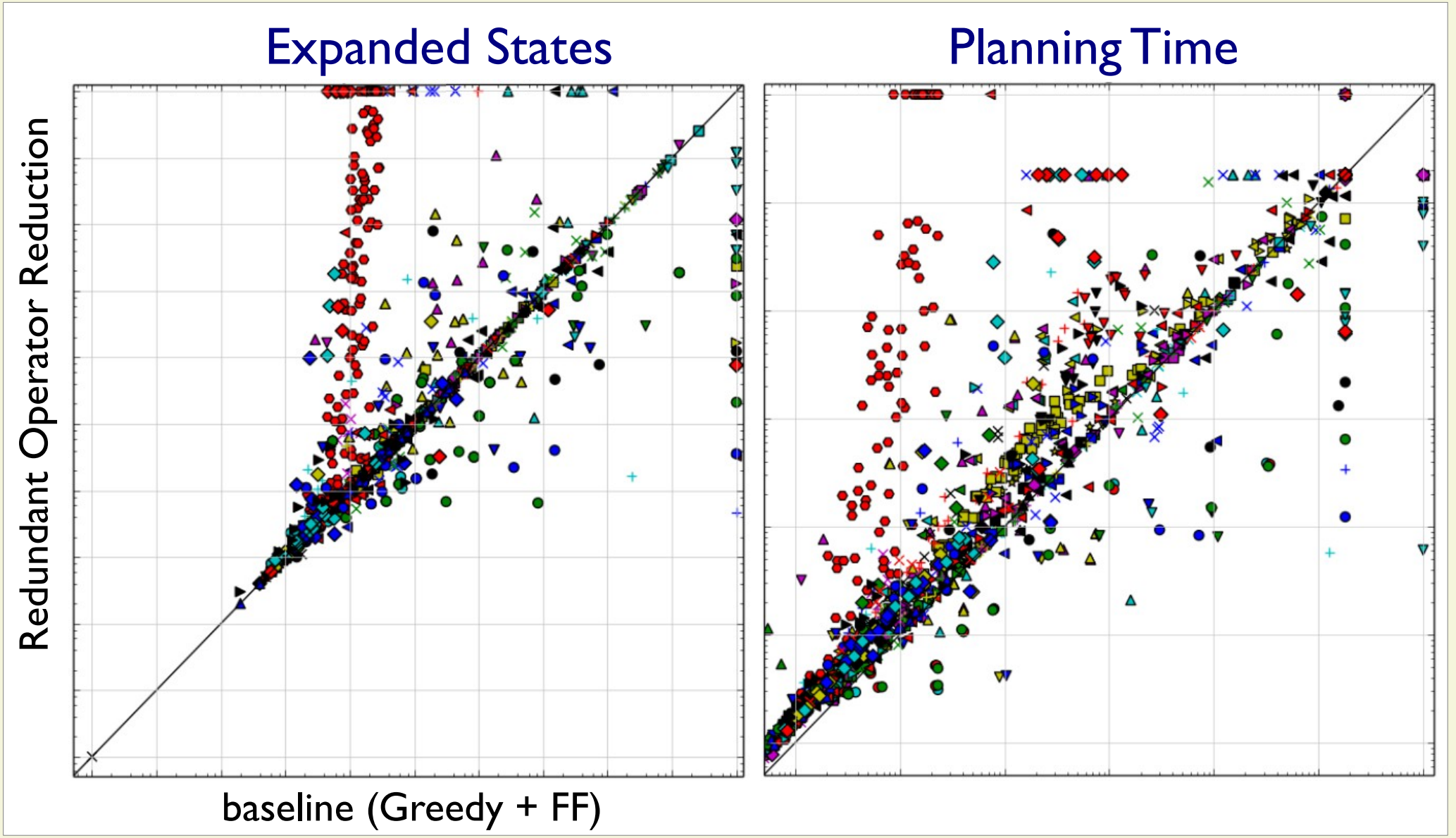
2. Combinations and Synergies

- Synergies separately
- Synergies compared

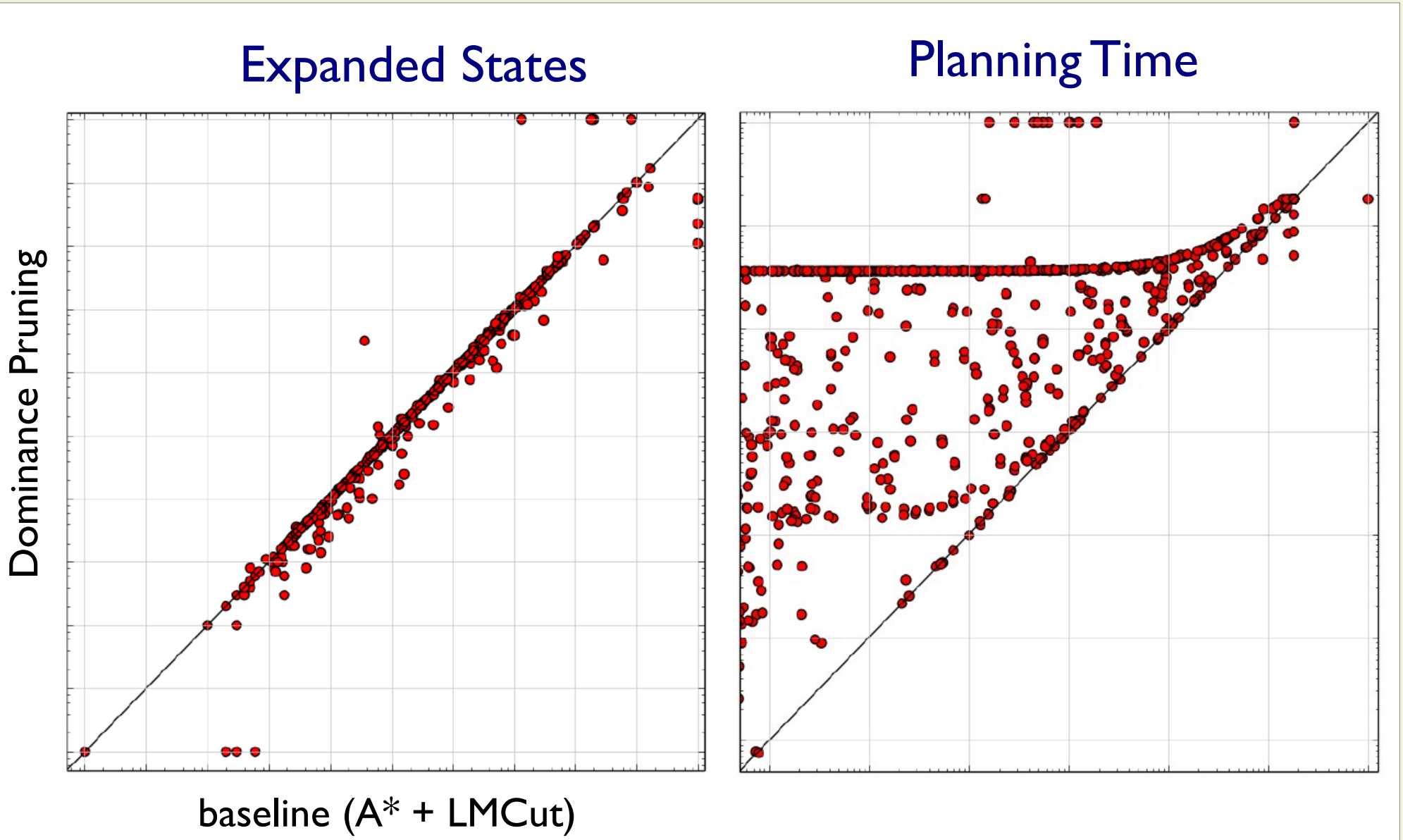
Safe Abstraction



Redundant Operator Reduction

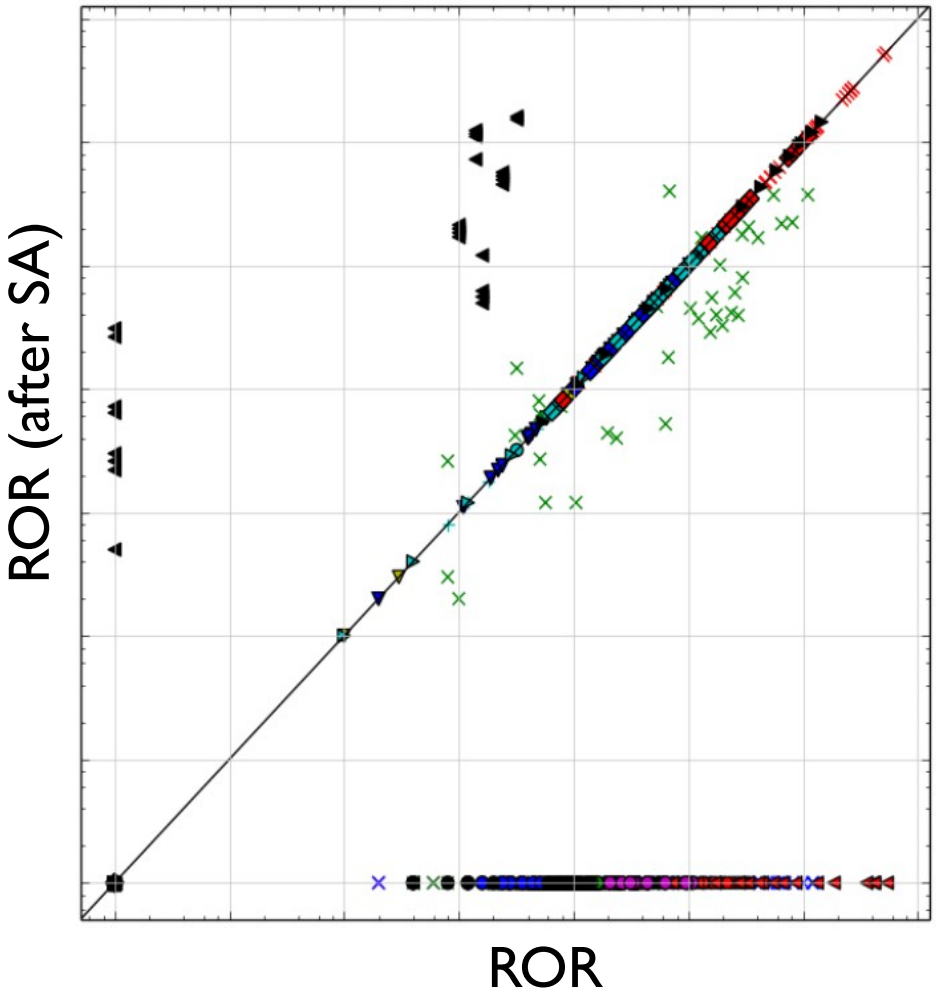


Dominance Pruning

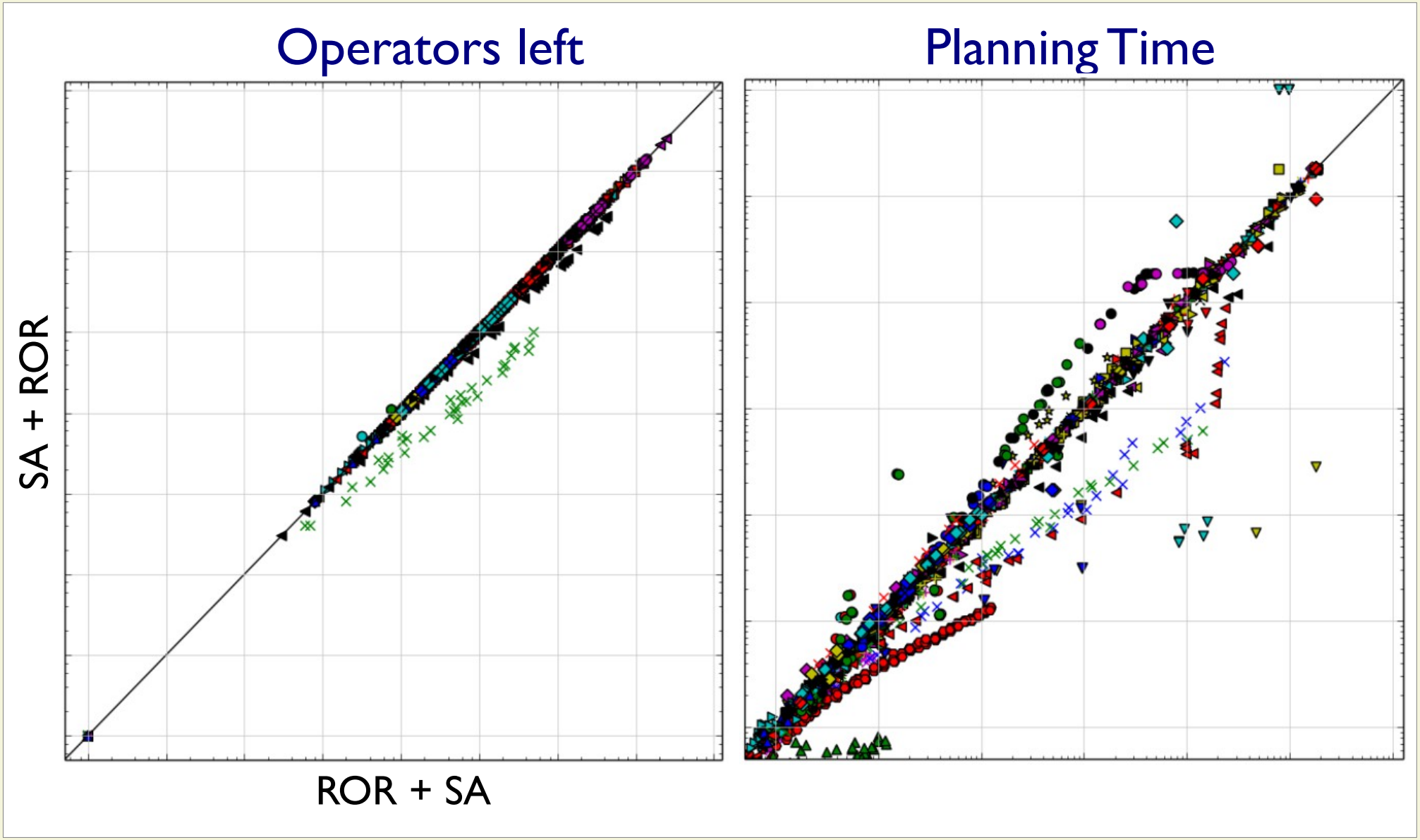


Synergies separately

Pruned Operators



Synergies compared



5. Conclusion

- Static Pruning can improve coverage
- Synergies exist & occur on IPC domains

Further research:

- less strict Safe Abstraction
- more fine-grained ROR
- satisficing Dominance Pruning

Thank you!