

## Tactical Planning in the FMCG Industry

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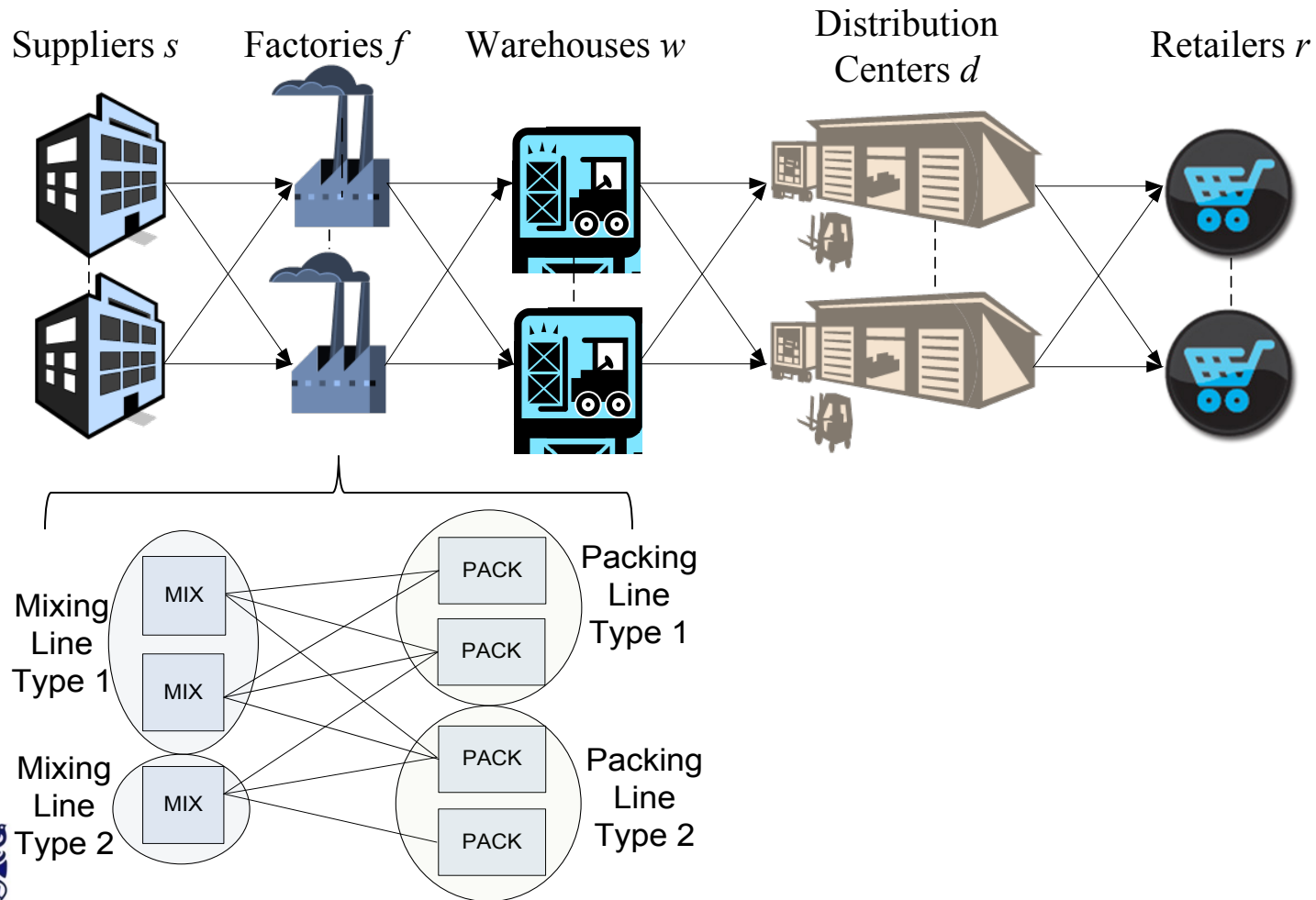
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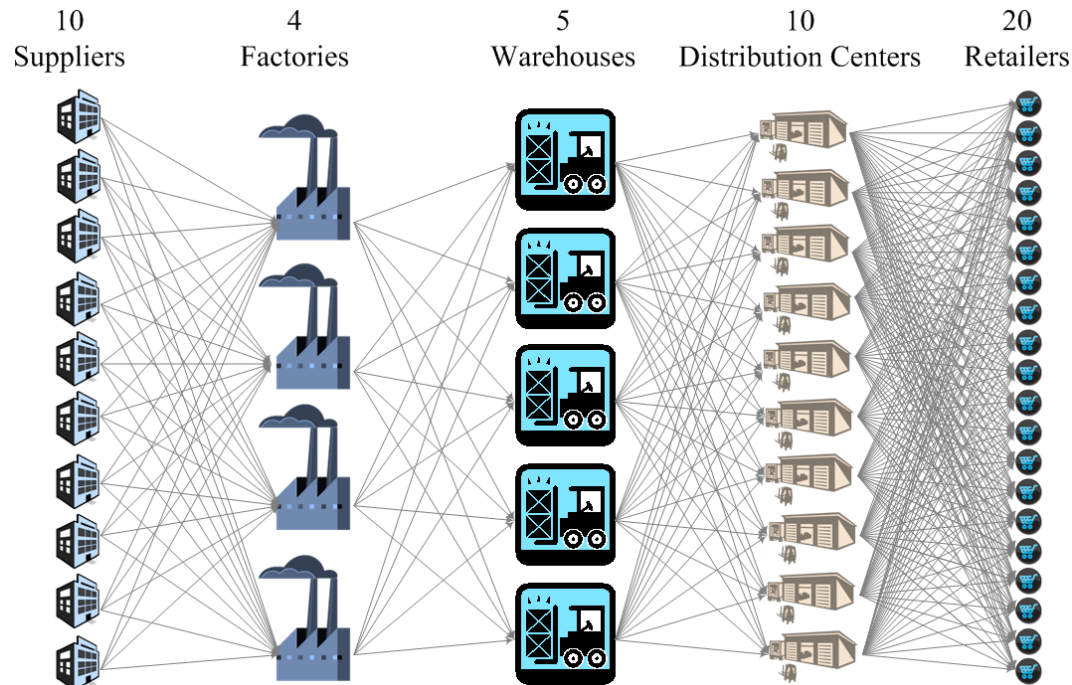
Where innovation starts

# Problem Overview



# Main Challenge

- ❑ Extremely large MILP models
  - Up to thousands of SKUs per product category
  - Realistic case: >100M Variables, >10M Constraints
- ❑ Example case set up: 10-100 SKUs



# SKU Decomposition Algorithm

## □ Single SKU Model

- Limit domain of all variables/constraints to single SKU
- Solve for all SKUs consecutively

## □ Modified Capacity Constraints

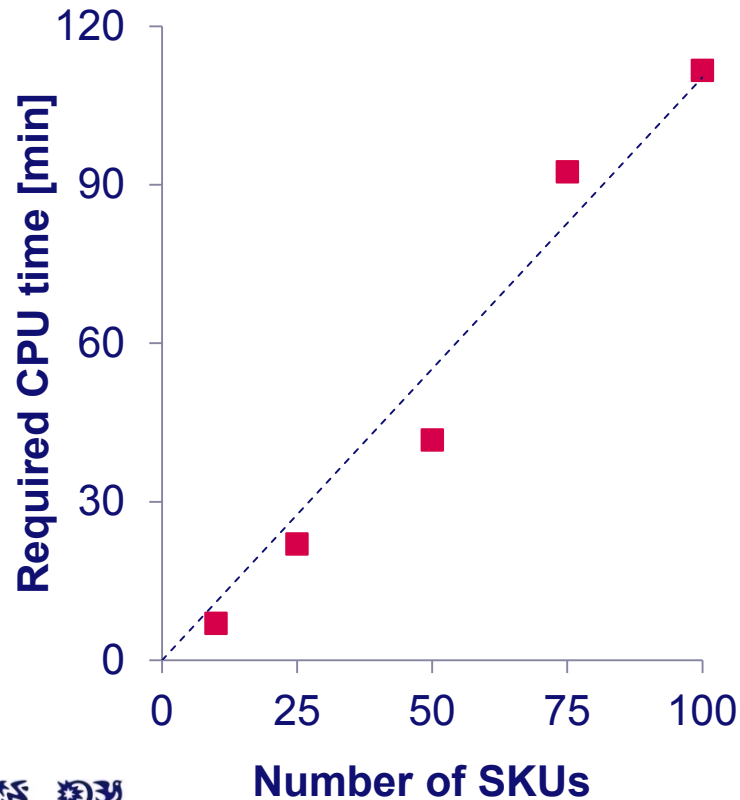
$$WHinv_{i,w,t} + \sum_{i' \neq i} WHinvP_{i',w,t} \leq WHcap_w + \beta_{w,t} \quad \forall i, w, t \quad | i = \text{SKU}$$

Current SKU variable Other SKU Parameters Slack Variable

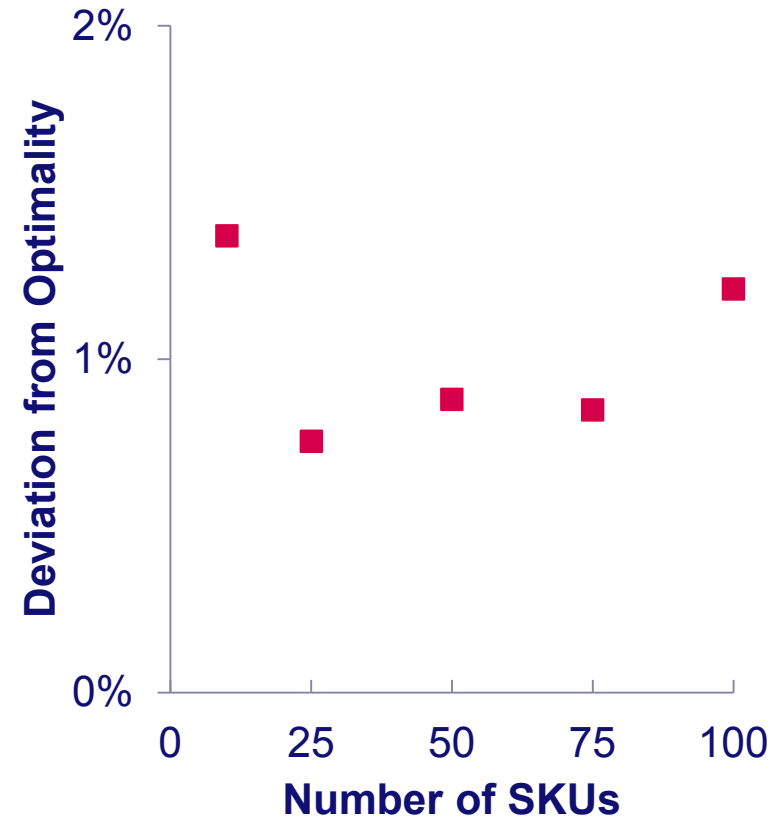
- Slack variable allows initial capacity violation
- Slack variable added to objective with penalty cost
- Obtain feasible solution by slowly increasing pen cost

# Single-SKU Algorithm Results

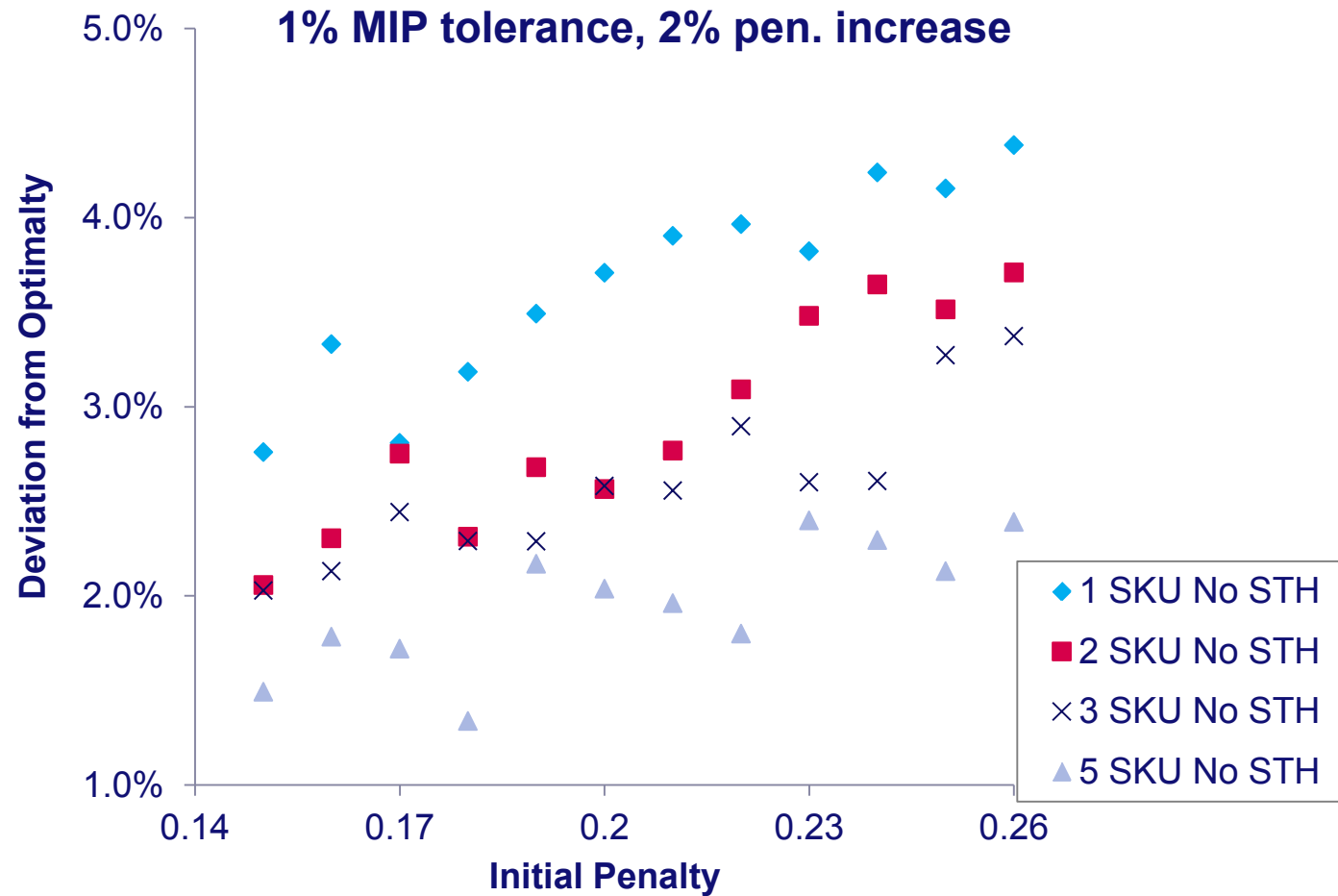
## CPU Time



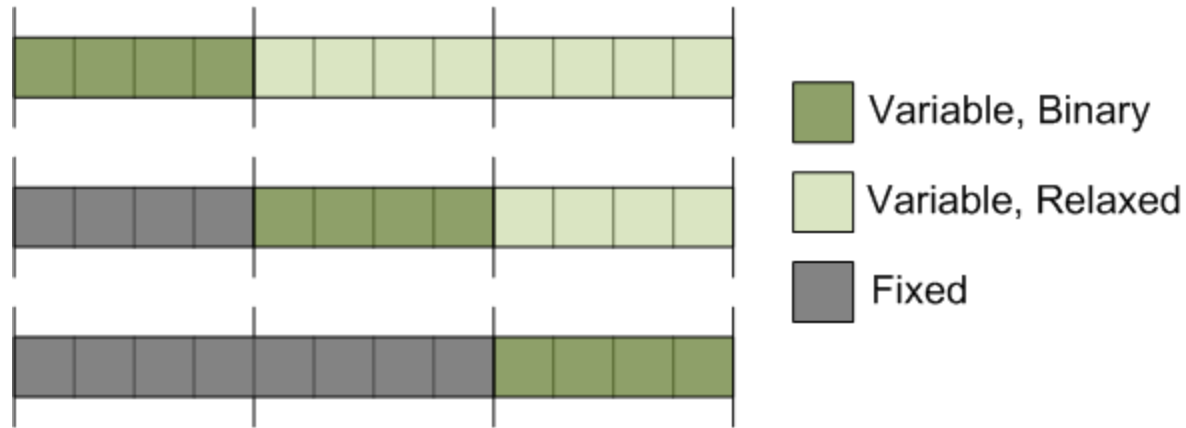
## Cost Increase



# Multi-SKU Algorithm

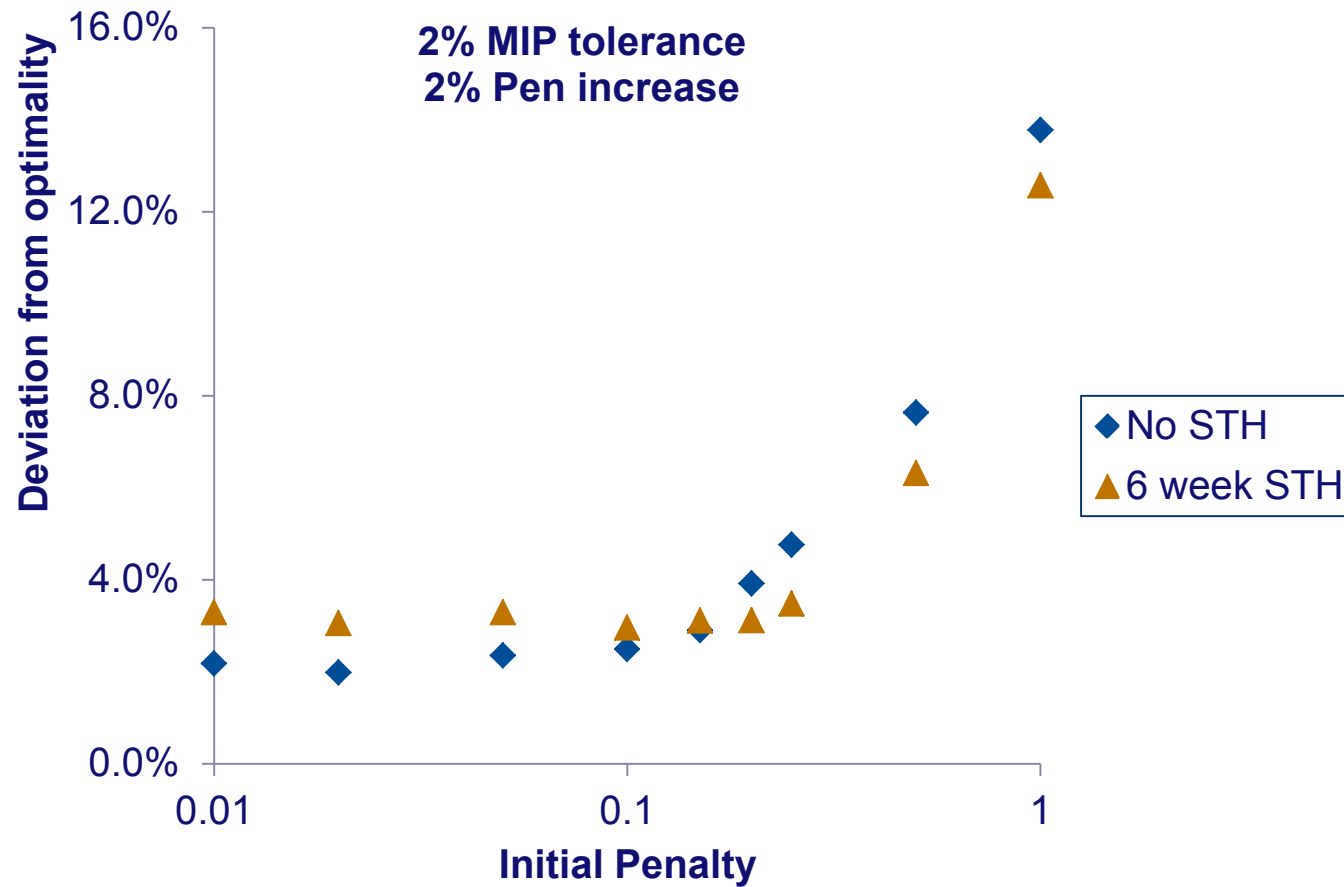


# Shrinking Time Horizon



- Fewer binary variables
- Plan for the first part of the horizon still feasible
- Reduced capacity in relaxed periods

# Results: STH





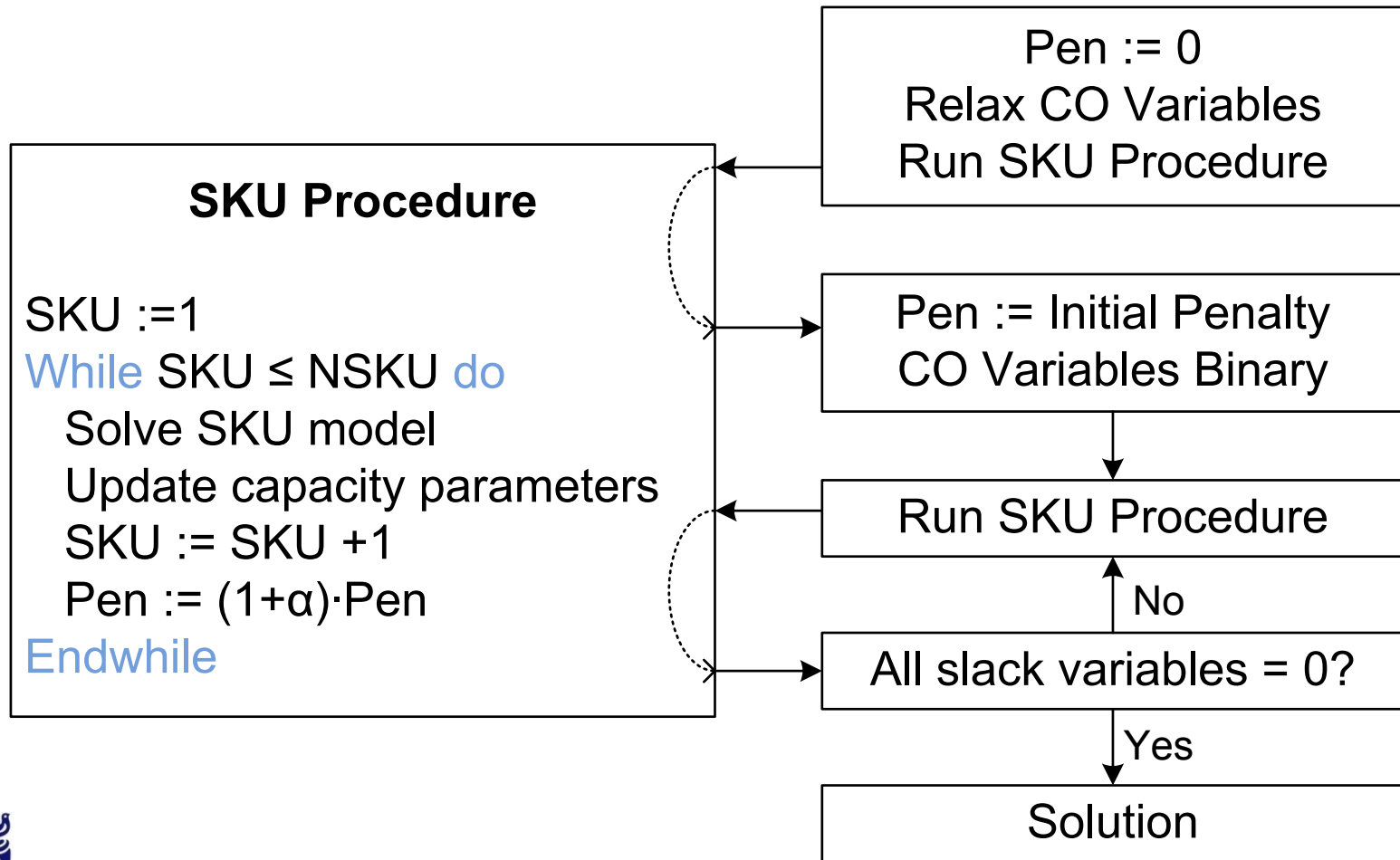
# Conclusions

- ❑ **Multi-SKU algorithm can improve the solution**
  - **Submodels should be solved relatively quickly**
  
- ❑ **STH can reduce required computational time**
  - **Solution may become worse**
  
- ❑ **Under time restrictions, 'worse' settings may lead to better results**

# Questions

## Questions?

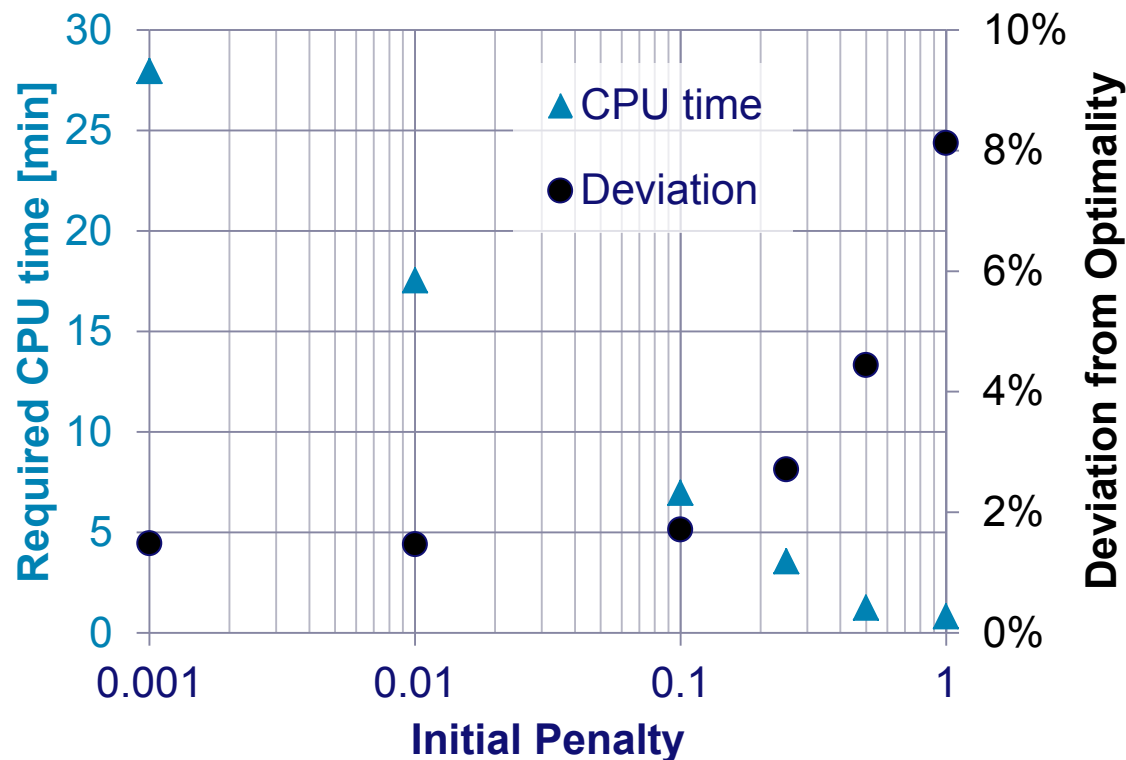
# SKU Decomposition Algorithm



# Results: Algorithm Penalty values

□ 10 SKU

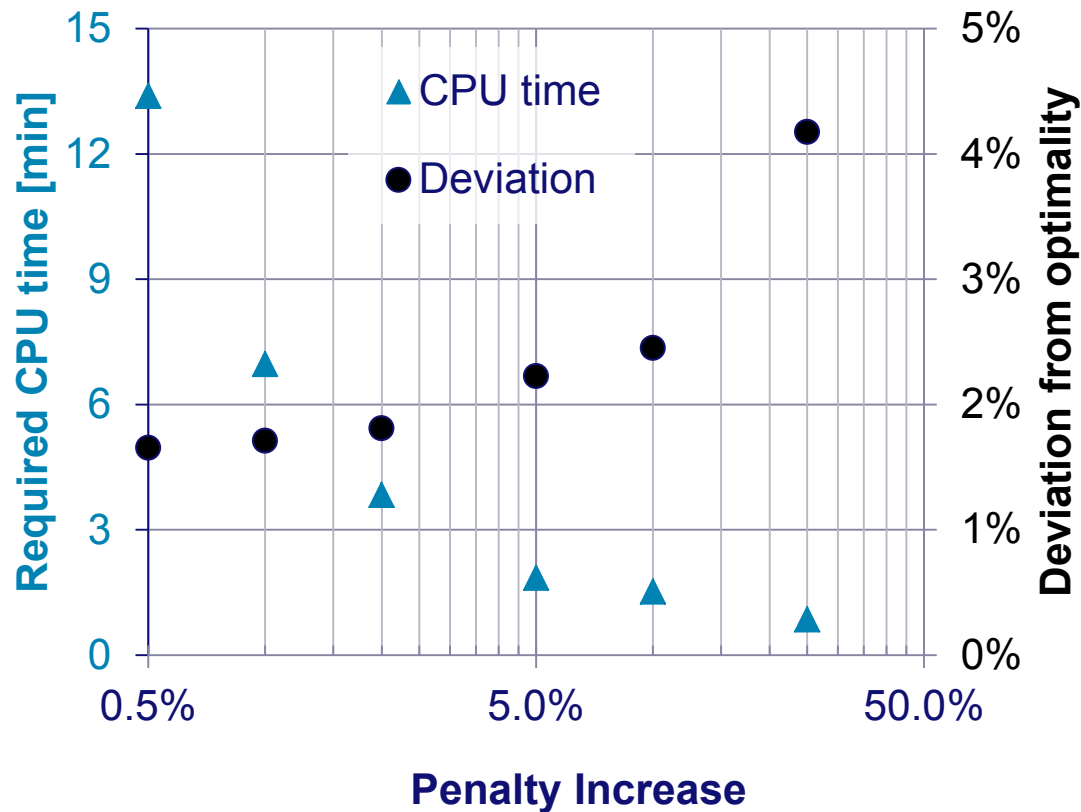
□ Penalty increase 1% per SKU,  $\pm 10\%$  per iteration



# Results: Algorithm Penalty values

□ 10 SKU

□ Initial Penalty 0.1



# Scheduling

