Simulated Annealing based Timberwolf Placement

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Physical Design Automation:
Final Project

Agenda

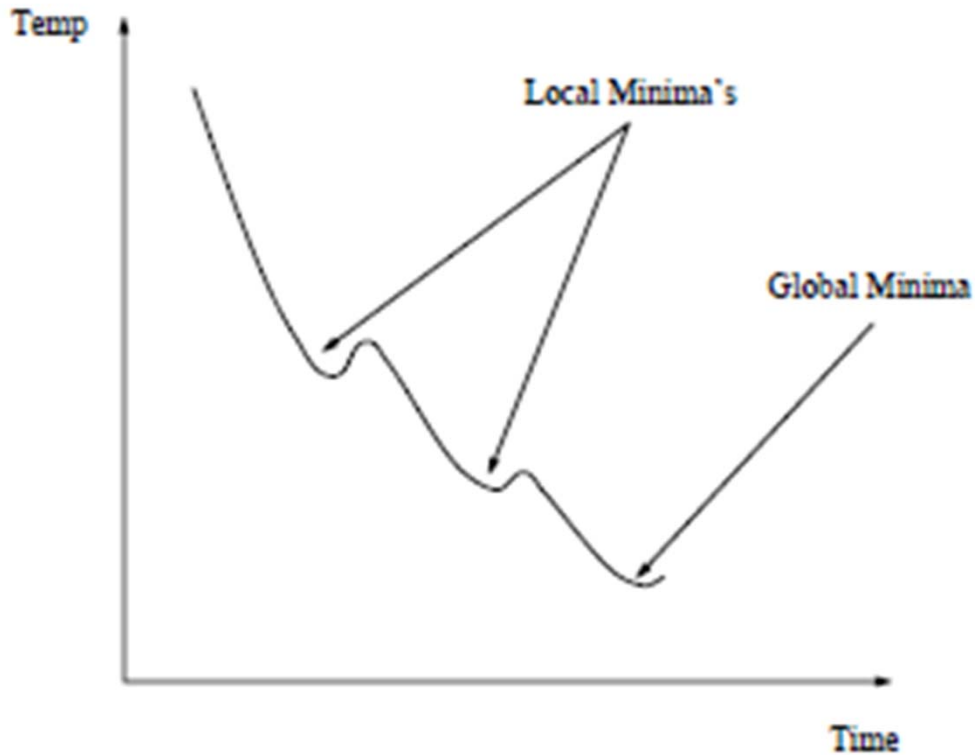
- Algorithm
- Example
- Results
- Questions

Algorithm: Basics

- Row Based TimberWolf Placement
- Goal: To minimize wire length
- Wavelength is estimated by HPBB (Half Perimeter Bounding Box)
- Initial : Find a random solution which is approx 1:1 aspect ratio
- Iteration: Using Simulated annealing

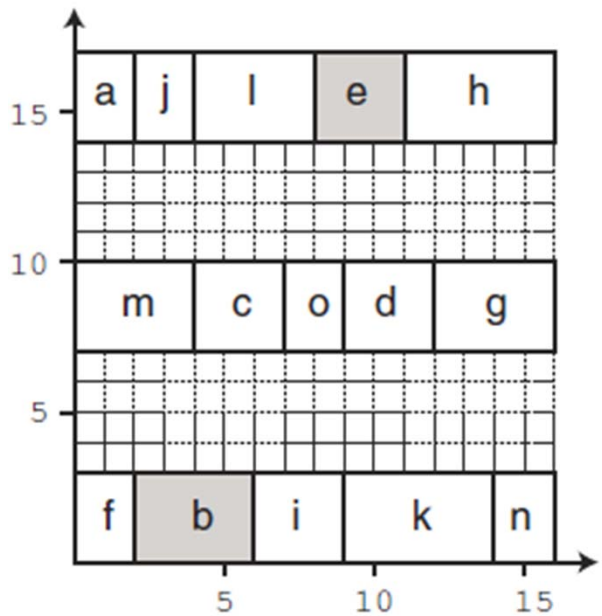
Algorithm: Simulated Annealing(Intro)

- Help to get out of local minima to hopefully find global minima.
- Cost: e^(-change(wirelength)/temp)
- Tuning Parameters:
  - Initial Temp
  - Alpha (decay factor)
  - Freeze condition
  - # of swap @ each temp



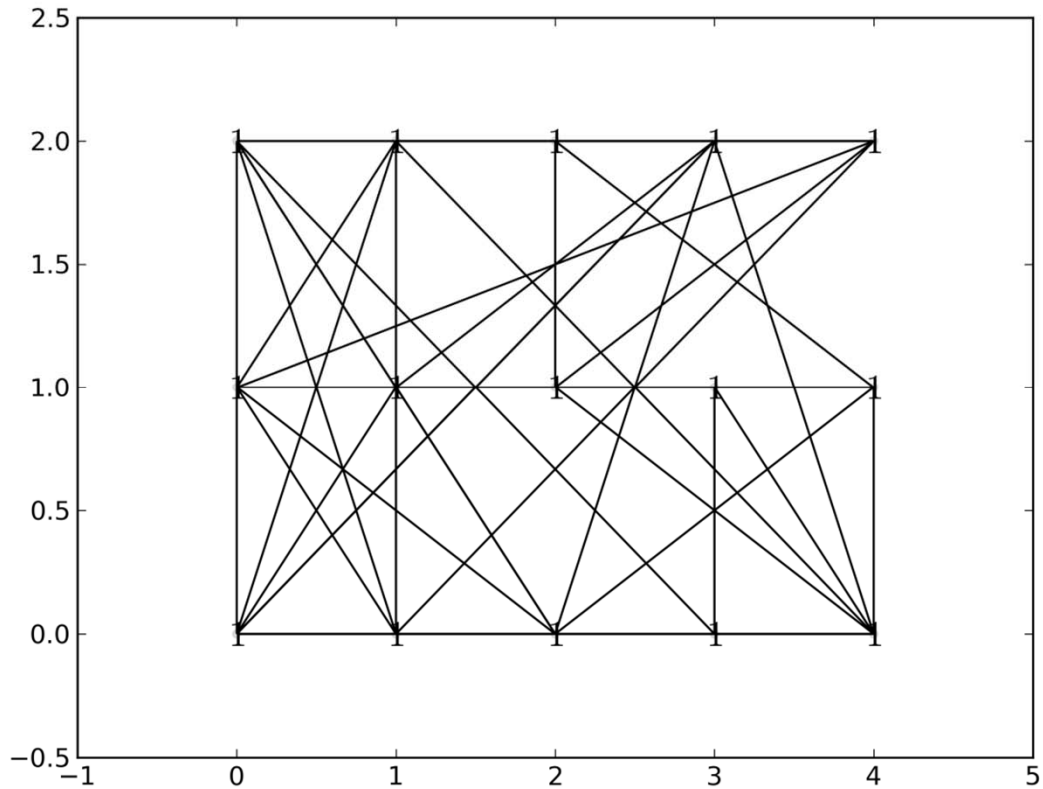
Algorithm: Basics

- Row Swapping : swap(b,e) => calculate new wire length
- Imp: All cells are of same dimension



Example

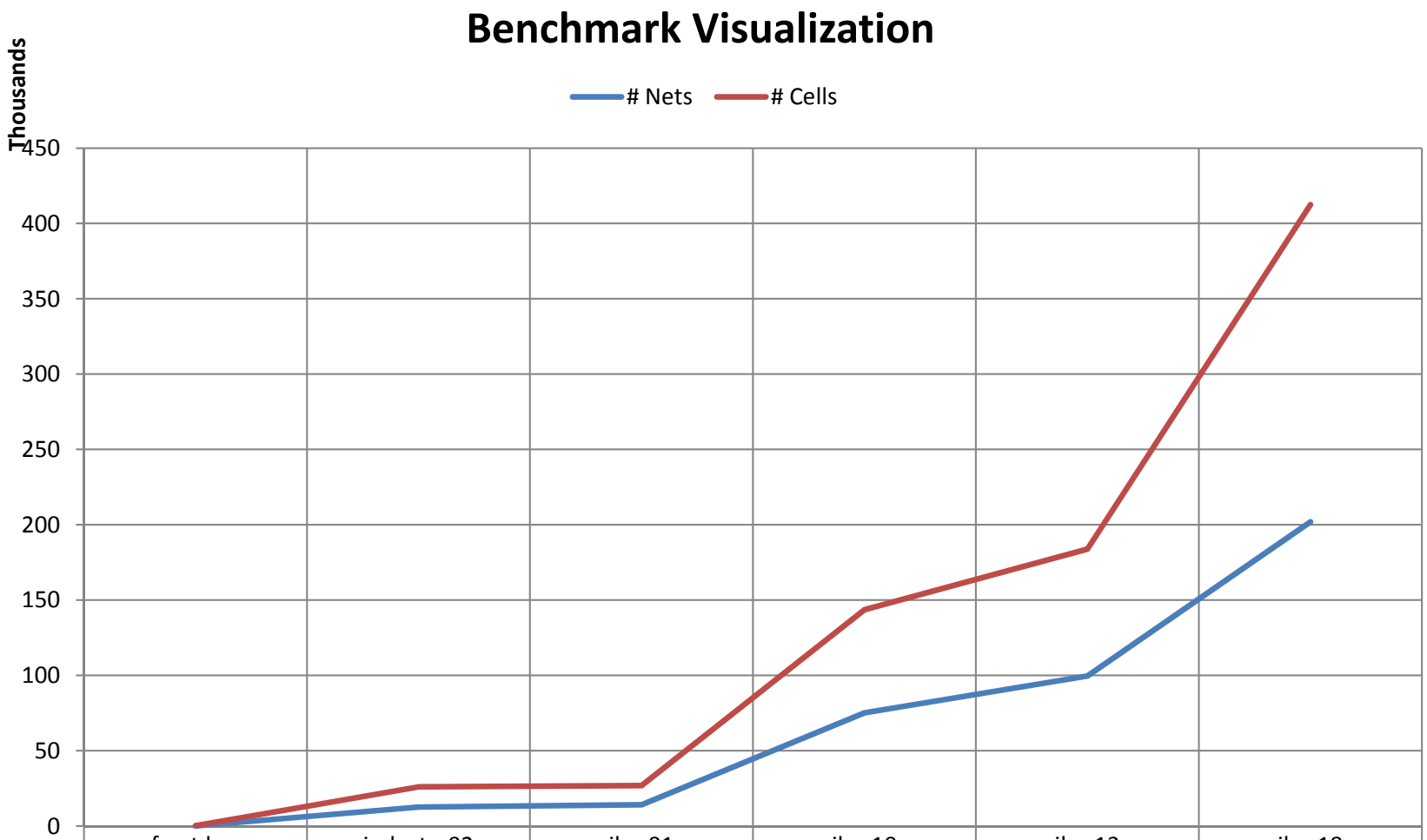
- Number of Nodes:15
- Split into 3 rows
- Wirelength = 39
- Starting annealing



Show Annealing Figures

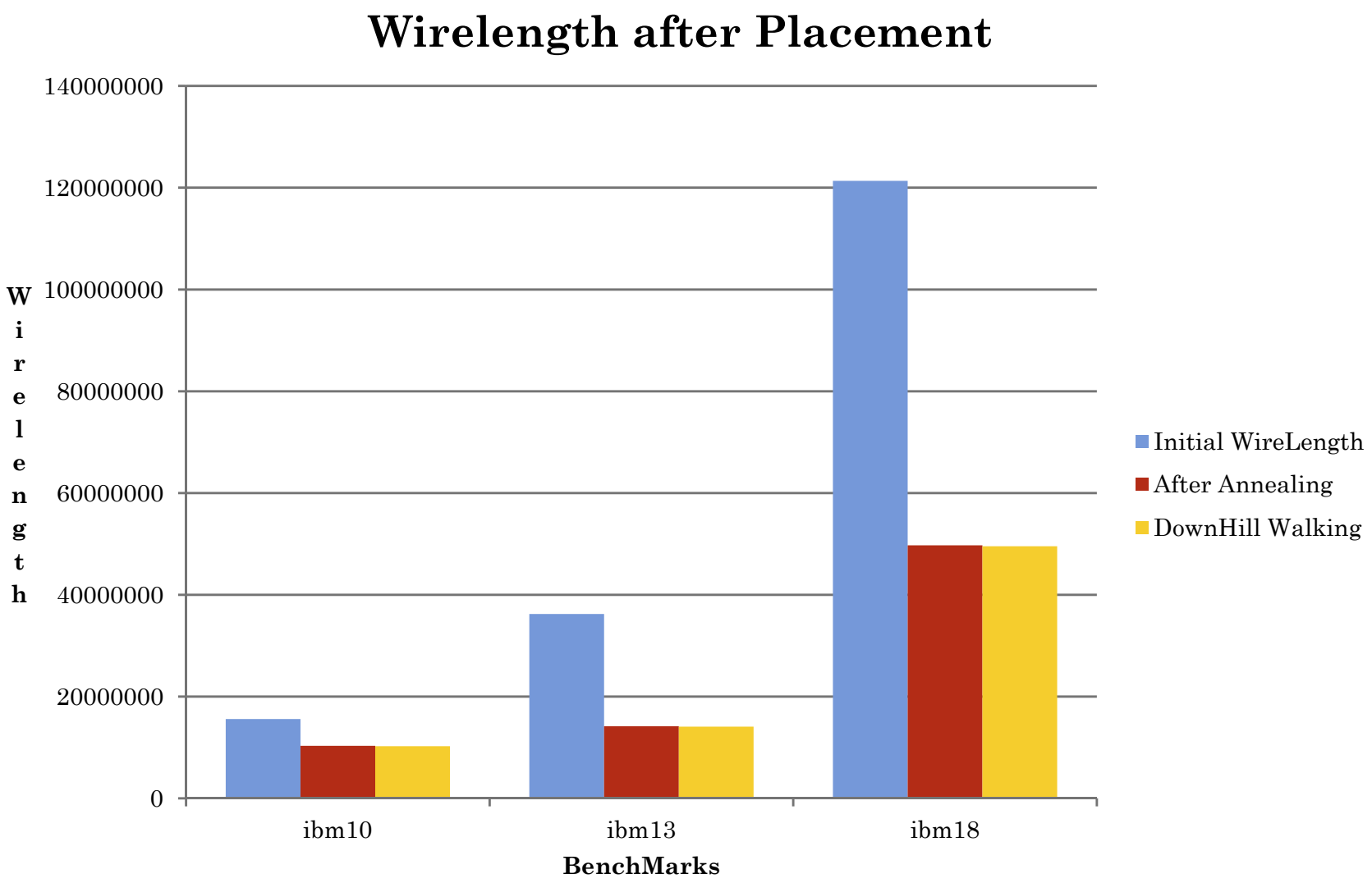
- Apologize for not having the labels

Results

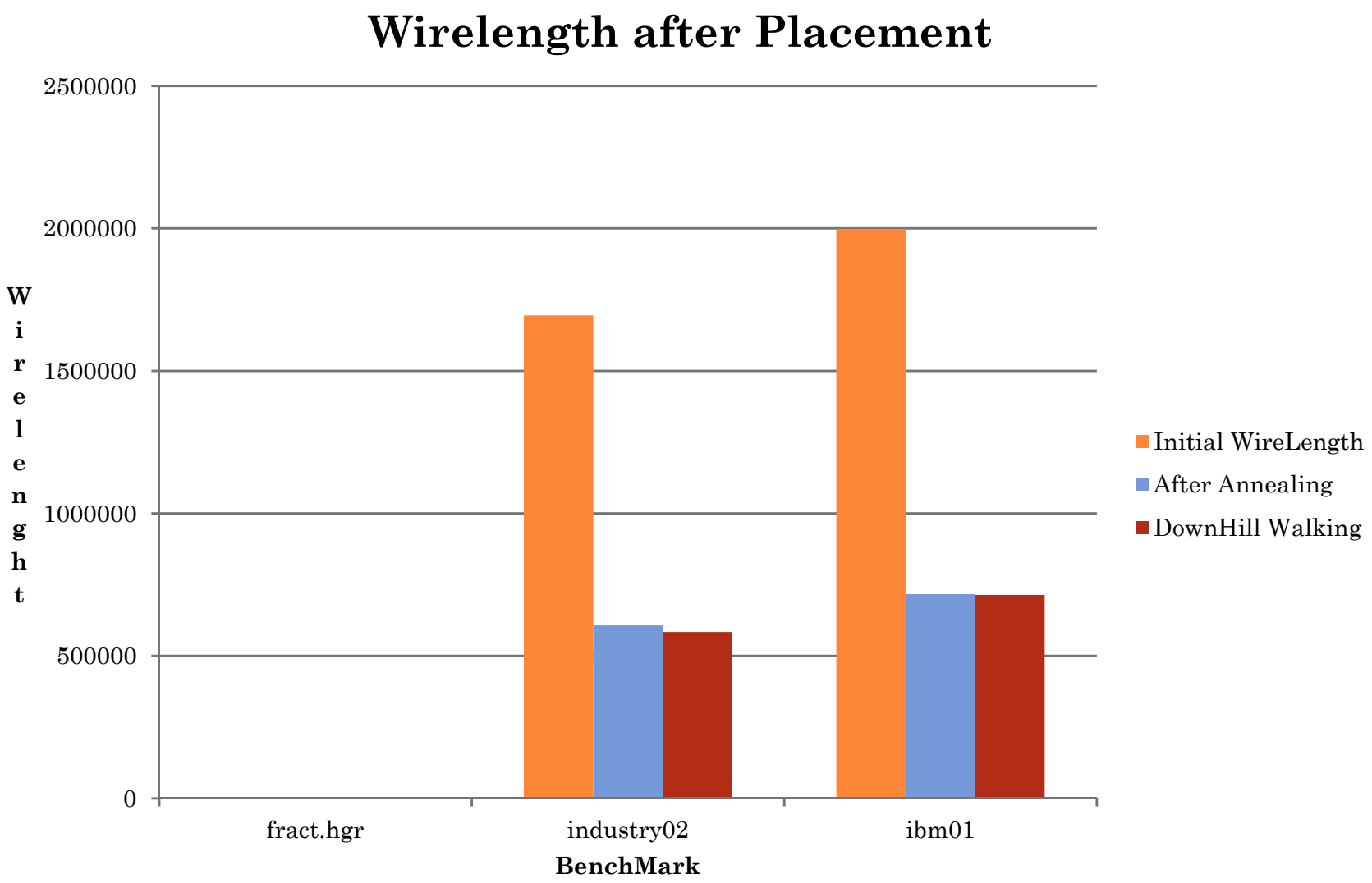


	fract.hgr	industry02	ibm01	ibm10	ibm13	ibm18
# Cells	149	13419	12752	68429	84199	210613
# Nets	147	12637	14111	75196	99666	201920

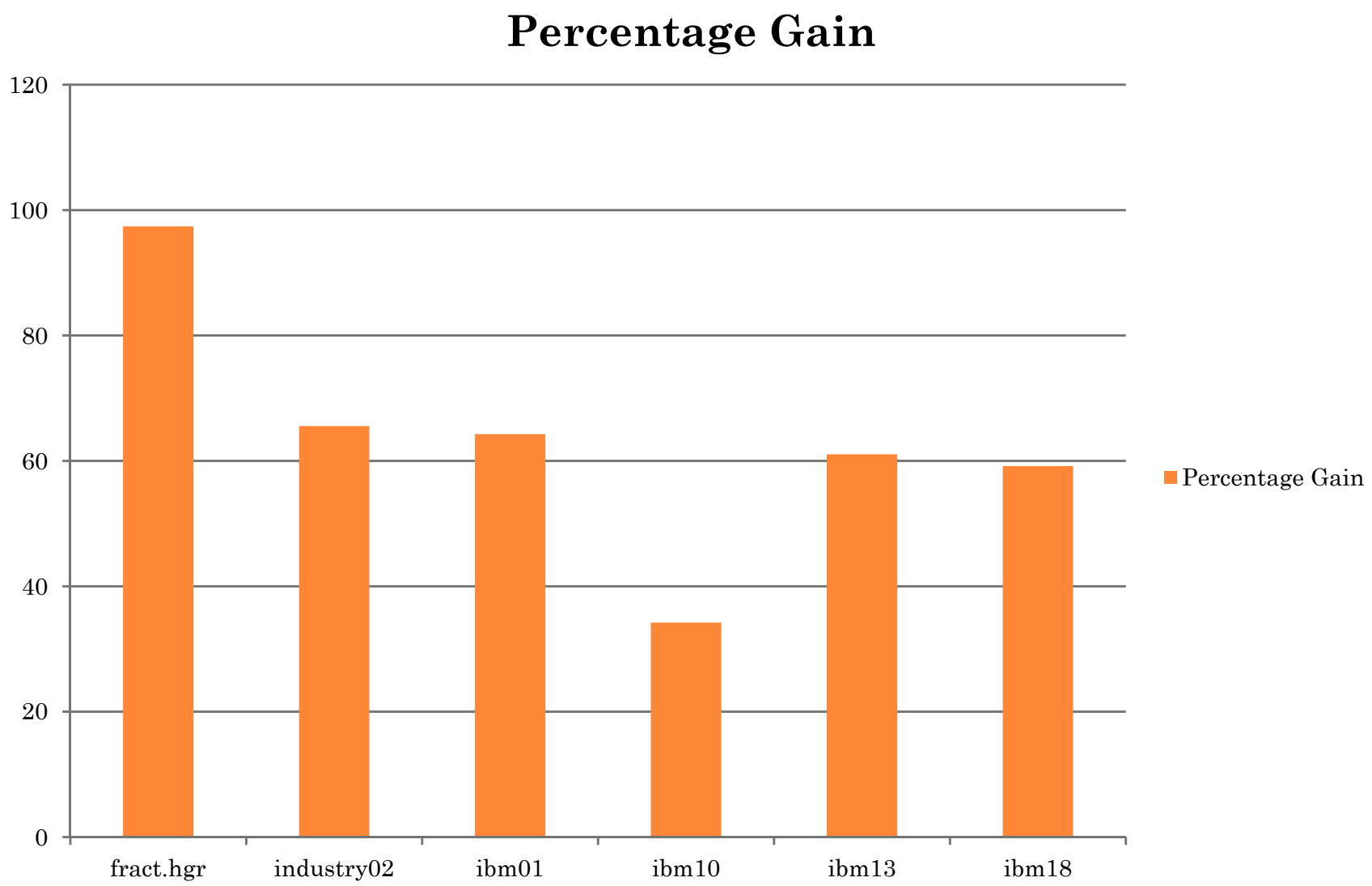
Results


Wirelength after Placement
140000000
120000000
100000000
80000000
60000000
40000000
20000000
0
Wirelength
ibm10
ibm13
ibm18
BenchMarks
Initial WireLength
After Annealing
DownHill Walking

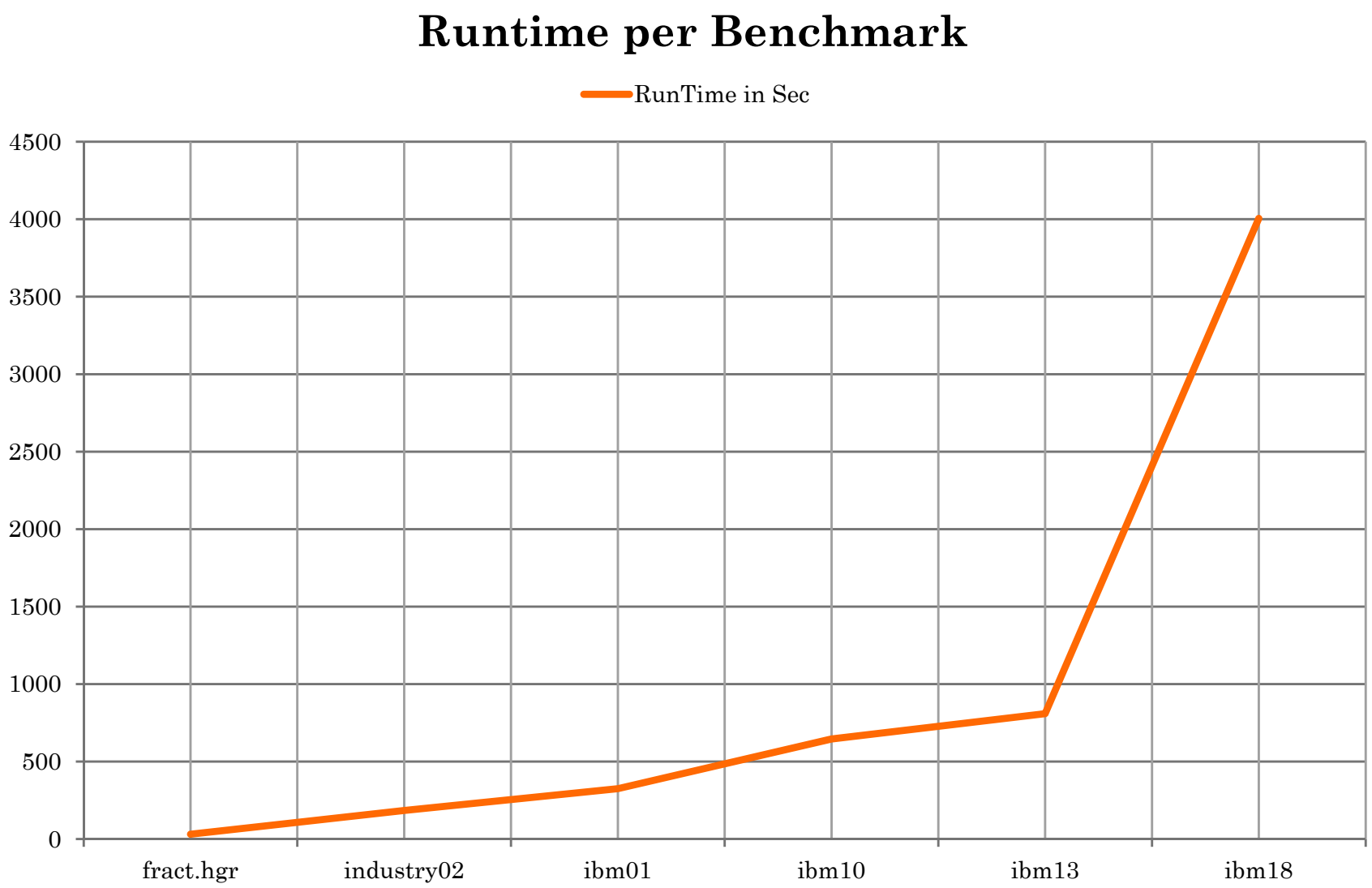
Results


Wirelength after Placement
2500000
2000000
1500000
1000000
500000
0
Wirelenght
fract.hgr
industry02
ibm01
BenchMark
Initial WireLength
After Annealing
DownHill Walking

Results


Percentage Gain
120
100
80
60
40
20
0
fract.hgr
industry02
ibm01
ibm10
ibm13
ibm18
Percentage Gain

Results


Runtime per Benchmark
RunTime in Sec
4500
4000
3500
3000
2500
2000
1500
1000
500
0
fract.hgr
industry02
ibm01
ibm10
ibm13
ibm18

Enhancement

- Enhance to handle Overlap-Free Placement
- Performing Clustering before placement
- Use advanced tuning techniques to annealing

Question ??

Thank You!