GORDIAN ALGORITHM

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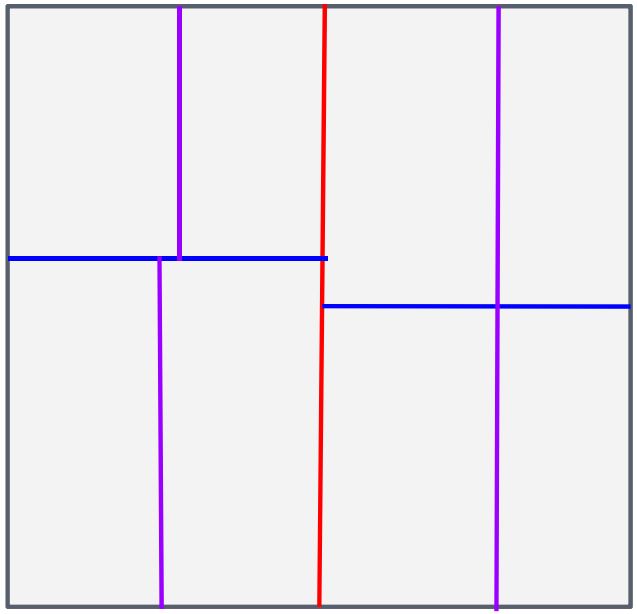
GORDIAN ALGORITHM IMPLEMENTATION

- Languages Used: C++, MATLAB, python
- Qp solver : QuadProg (MATLAB)
  ~~QuadProg (C++ library)~~
- GUI: python
- Partitioning Method
  - Recursive Bipartitioning
  - Slice (Extension)
- Global Optimizer
  - Original Gordian
  - GordianL (Extension to be finished)
- Area Minimization

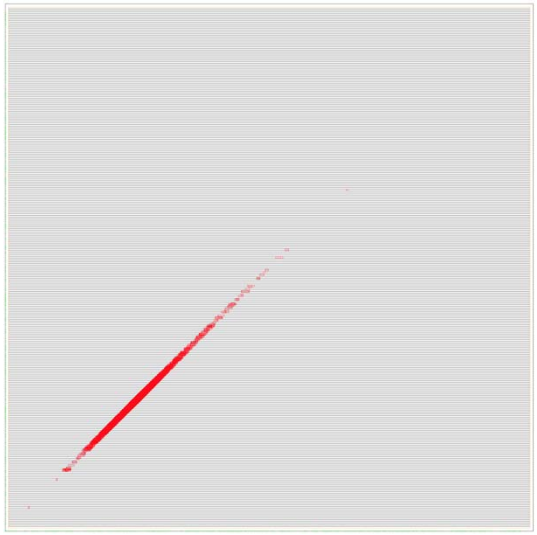
Partition Method: Recursive Bipartitioning



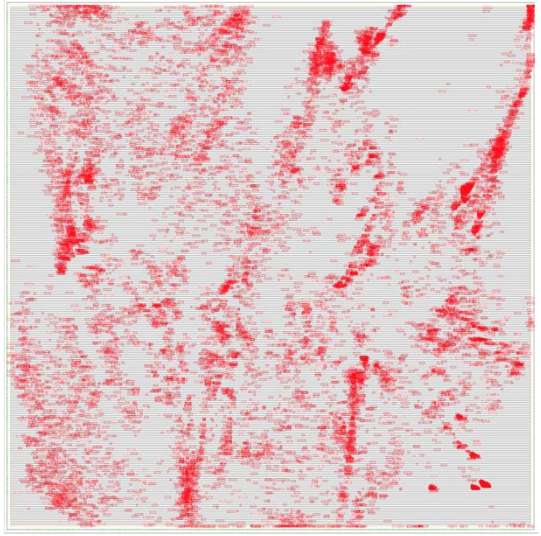
- Odd levels: vertical cut
- Even levels: horizontal cut
- At each level L, there are 2^L partitions
- Each partition has at most 2 cells
- Maximum level = $\log_2(N)$

Method 1: Recursive Bipartitioning

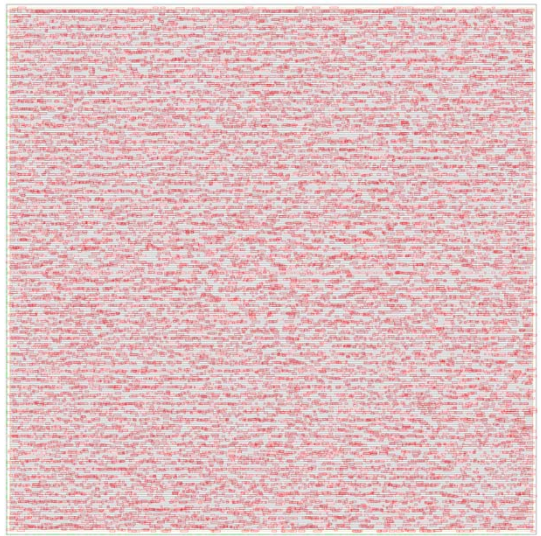
industry 3 (438 IO cells, 14968 placeable cells)



Level 0
Unconstrained
~ 69 secs (CPU time ~27s)



Level 4
16 partitions
~ 4 mins (CPU time ~67s)

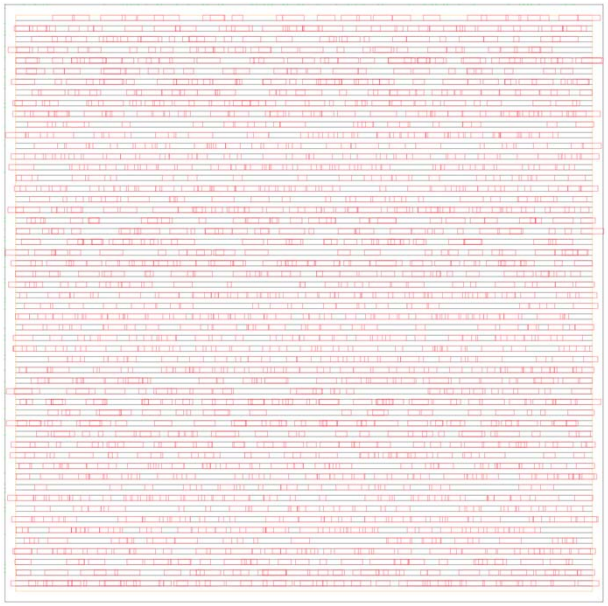


Level 13
8192 partitions
~ 13 mins (CPU time ~ 171s)

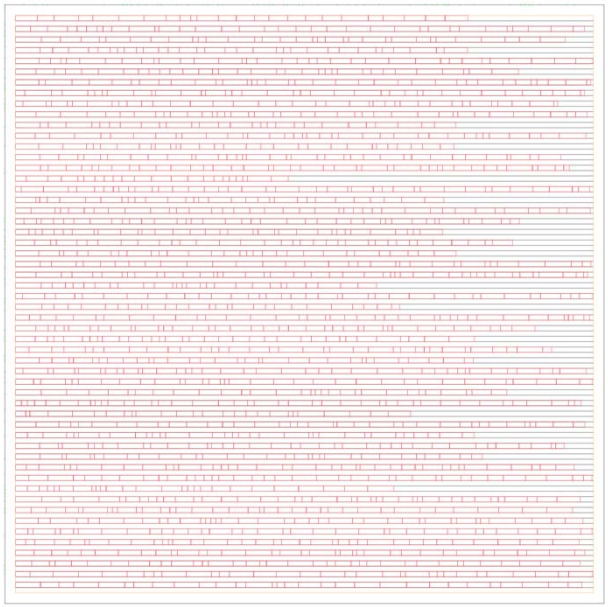
Method 1: Recursive Bipartitioning

p2 (102 IO cells, 1850 placeable cells) Level = 10

Level 10 Gordian Placement



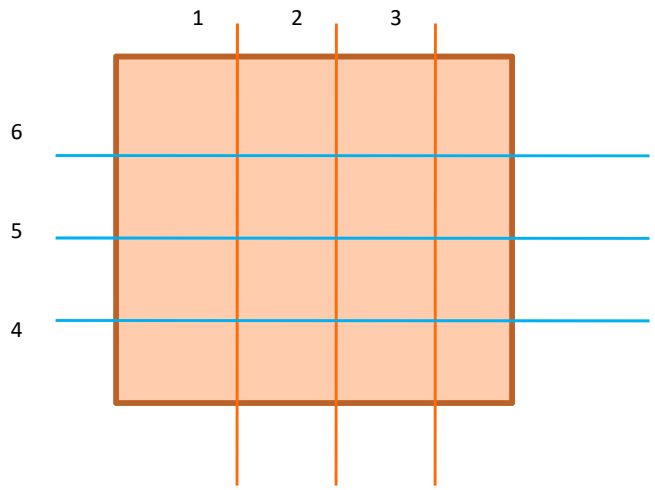
Standard Cell Placement



Overlap Removal

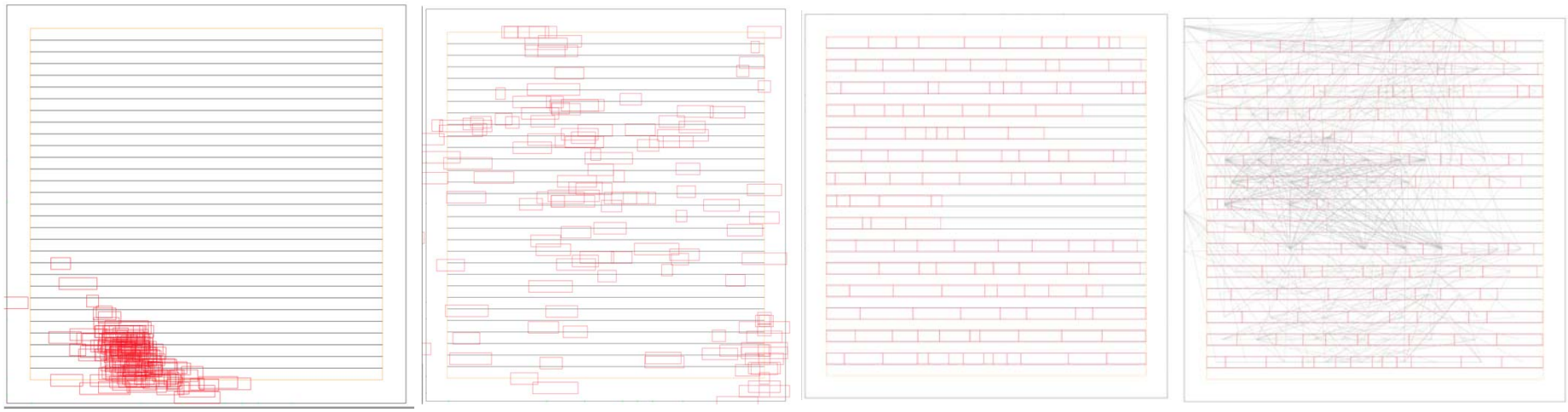
Partition Method: Slice

- n cuts in total
- n/2 vertical cuts
- n/2 horizontal cuts
- Vertical cuts first from left to right
- Horizontal cut from bottom to top



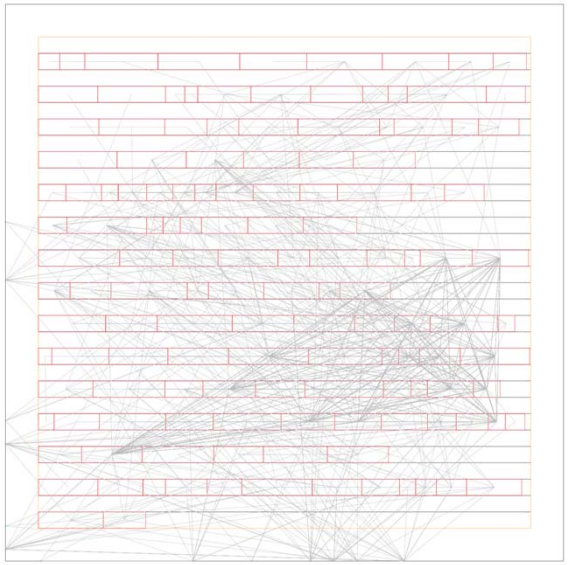
Method : Slice

Fract (13 IO cells, 136 Cells)

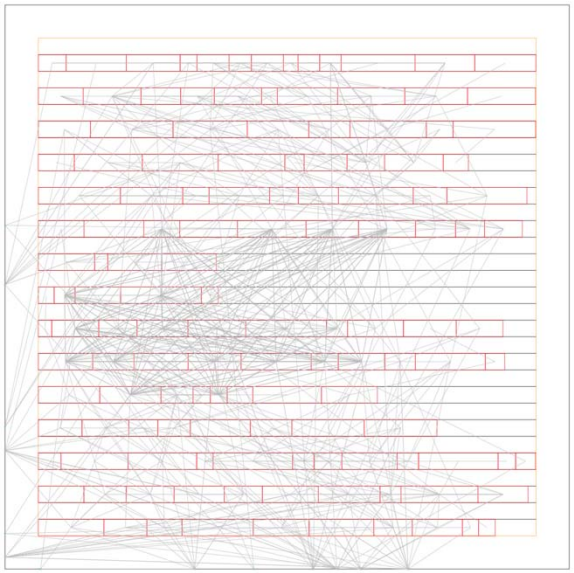


Level 0 | Level 4 | Overlap removal | Wire connection

Placement result (fract)

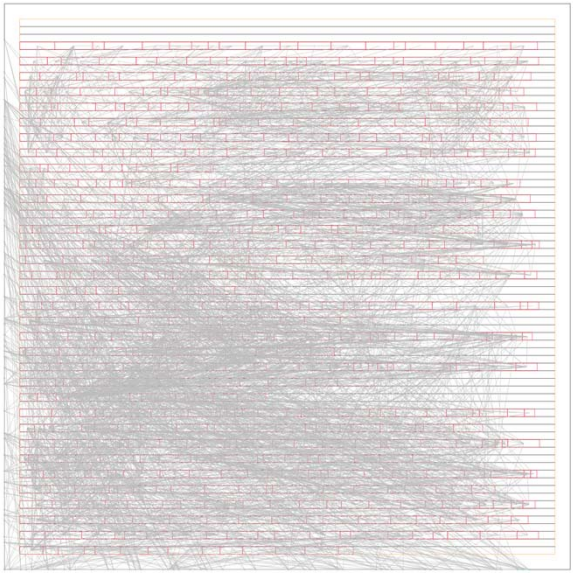


recursive bipartitioning
WL^2: 211,812 um^2 ~ **6% longer**
WL: 11,830 um ~ **3% longer**

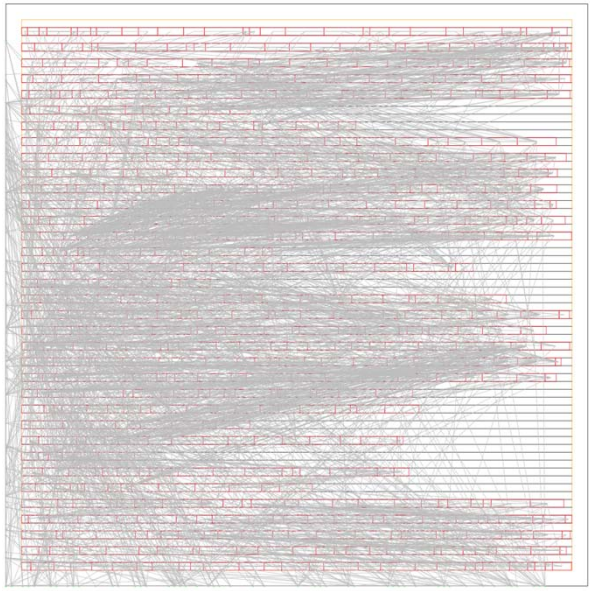


slice
WL^2: 199,922 um^2
WL: 11,491 um

Placement result (p1)



recursive bipartitioning
WL^2: 4,678,866 um^2
WL: 131,018 um



slice
WL^2: 7,284,720 um^2 ~ **56% longer**
WL: 166,716um ~ **27% longer**

Best possible result

Circuit	# non-IO Cells	Run time	Wirelength^2 (um^2)	Wirelength (um)	Area (um^2)	Optimal Level
fract	136	~ 10 secs	199,922	11,491	882	6
p1	735	~ 10 secs	4,678,866	131,018	4,532	8
structP	1,850	~ 12 secs	16,892,461	290,515	11,431	5
p2	2,826	~ 30 secs	81,578,695	1,328,537	17,466	10
biomedP	6,228	~ 4 mins	7,766,064,773	85,929,200	38,420	10
industry2	12,237	~10 mins	6,292,839,028	63,653,951	75,738	12
industry3	14,968	~9 mins	921,535,358	10,433,707	92,967	10

To be finished

GordianL implementation