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# An Overview of the Manufacturing of GenChip® Microarrays

GeneChip® Microarrays Curriculum  
(in support of Activity #3)

# GeneChip® System



**Probe  
Arrays  
(chips)**



**Fluidics  
Station**



**Scanner**



**Software  
Data Analysis**



# GeneChip® Array Manufacturing

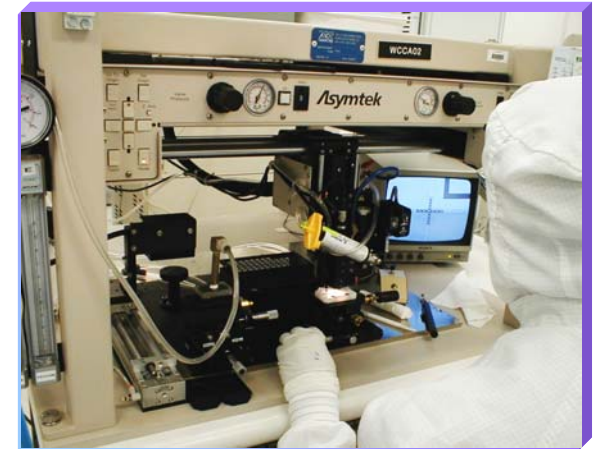


Substrate Preparation



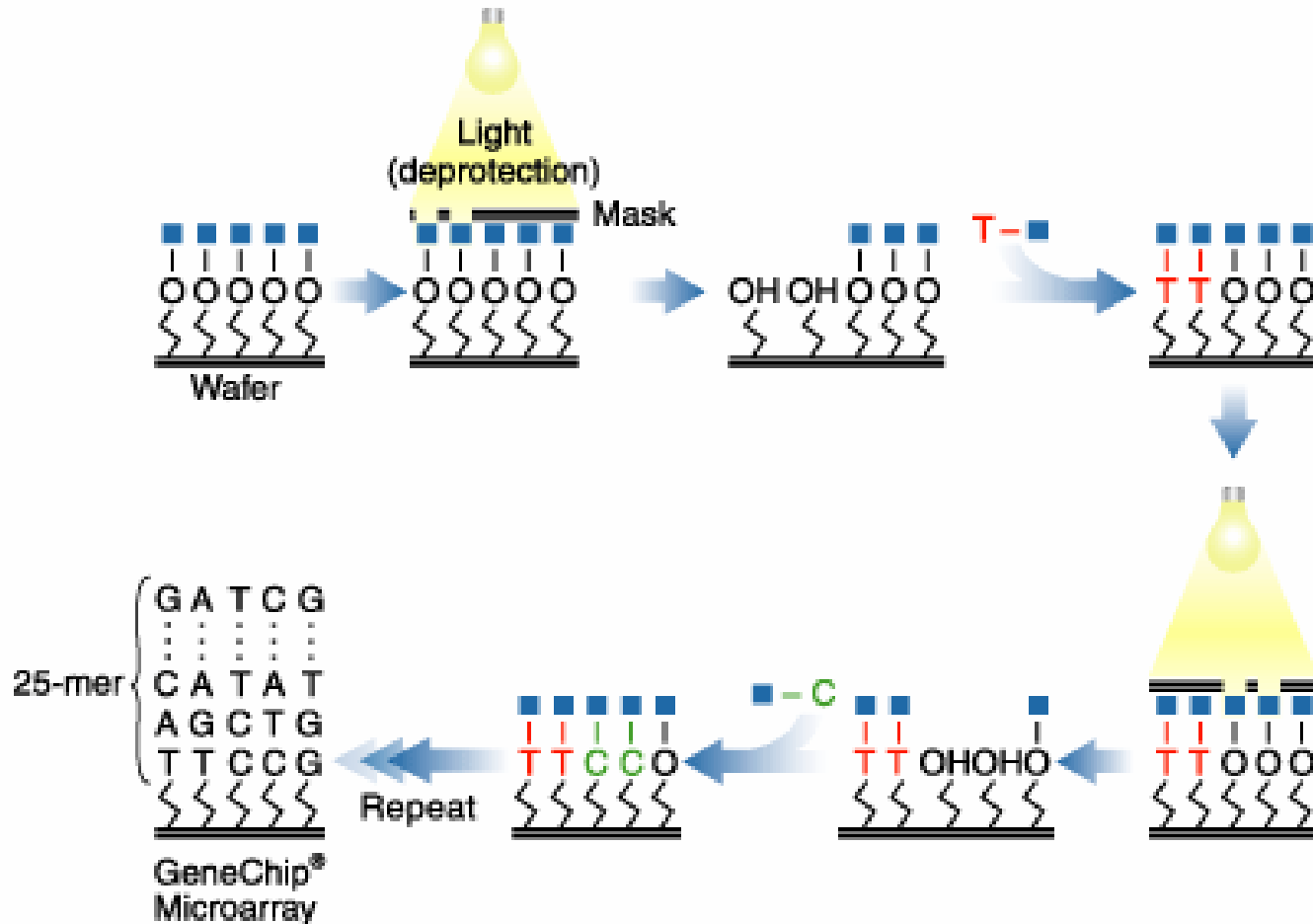
## Synthesis

- Chemistry
- Photolithography

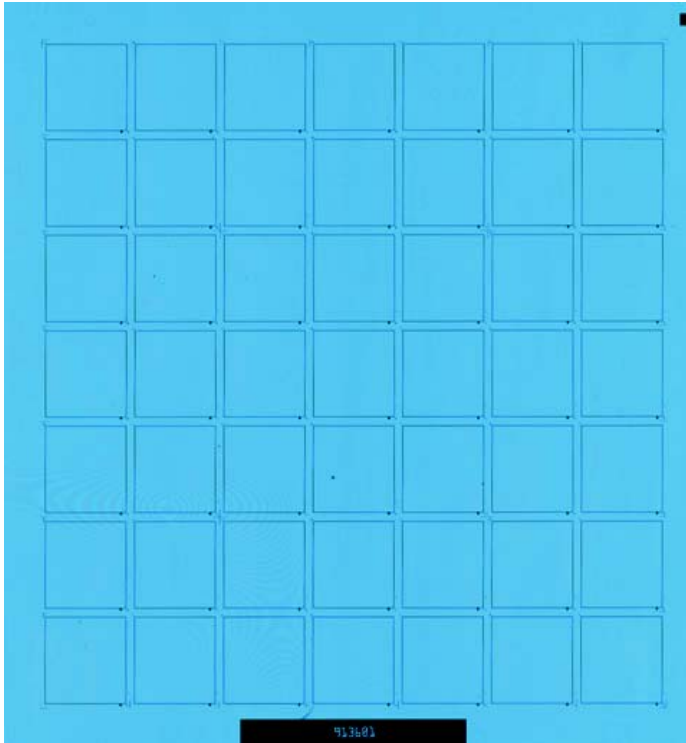


Packaging

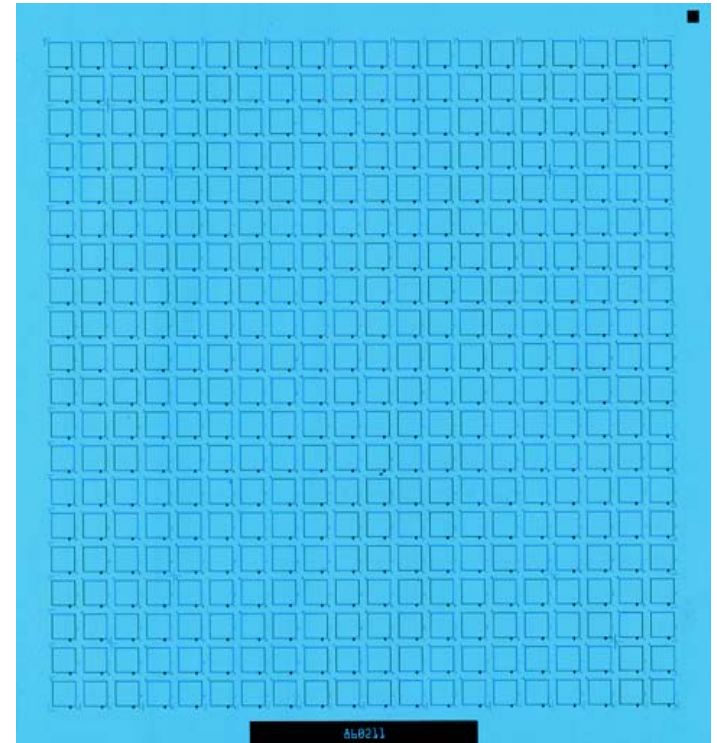
# Synthesis of Ordered Oligonucleotide Arrays



# The GeneChip® Substrate



**49 Chips per Wafer**



**400 Chips per Wafer**



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# Substrate Cleaning & Coating

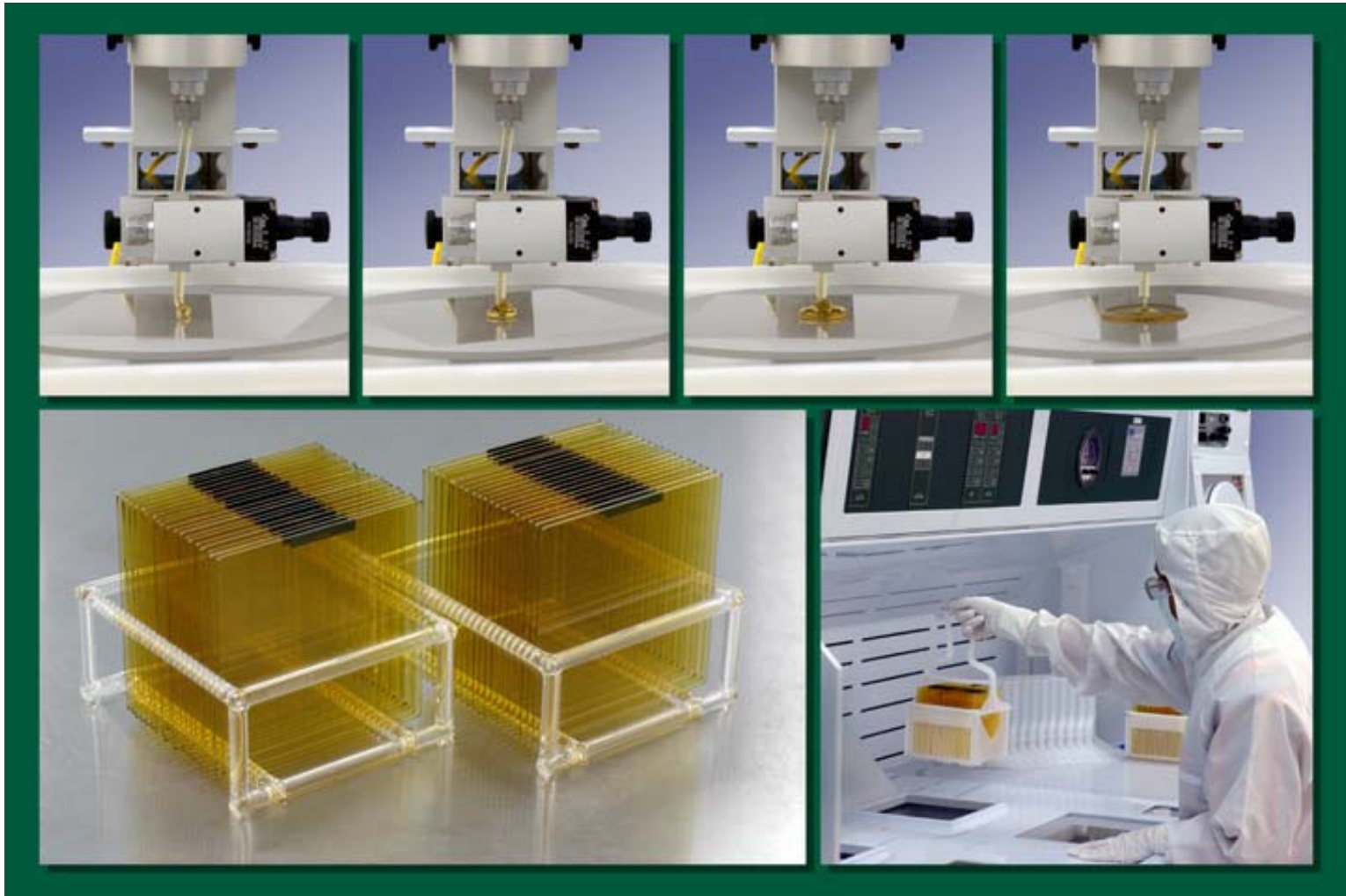






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# Substrate Cleaning & Coating



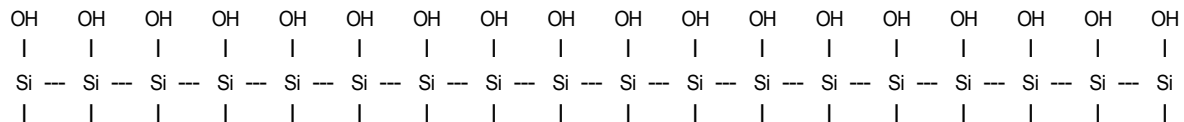






# Substrate Silanation

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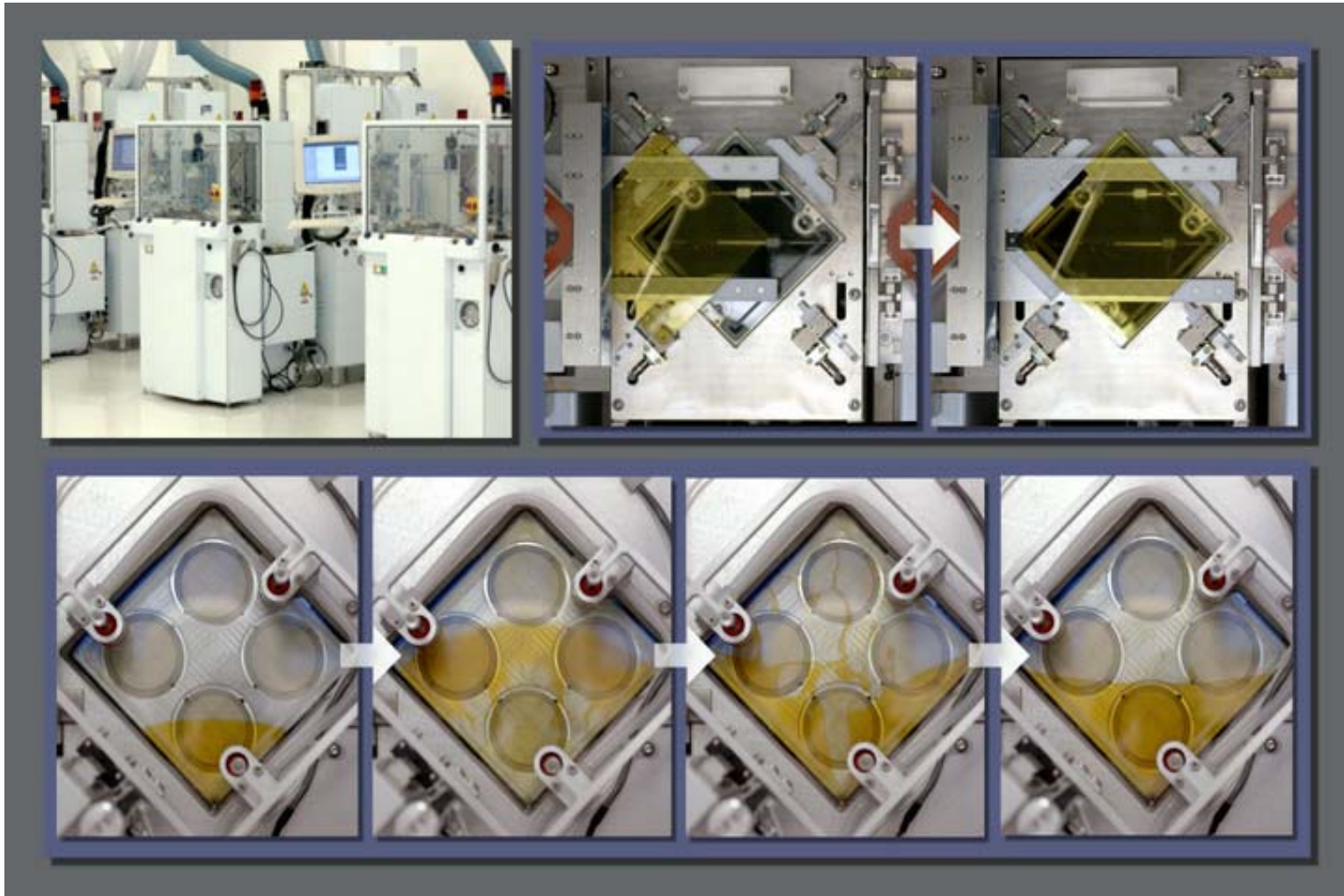
Wafer

Polyimide Coating

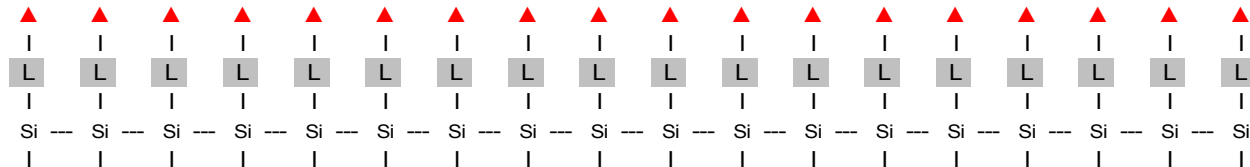
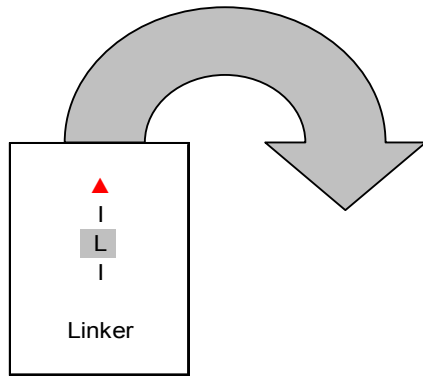


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# Chemical Synthesis Station



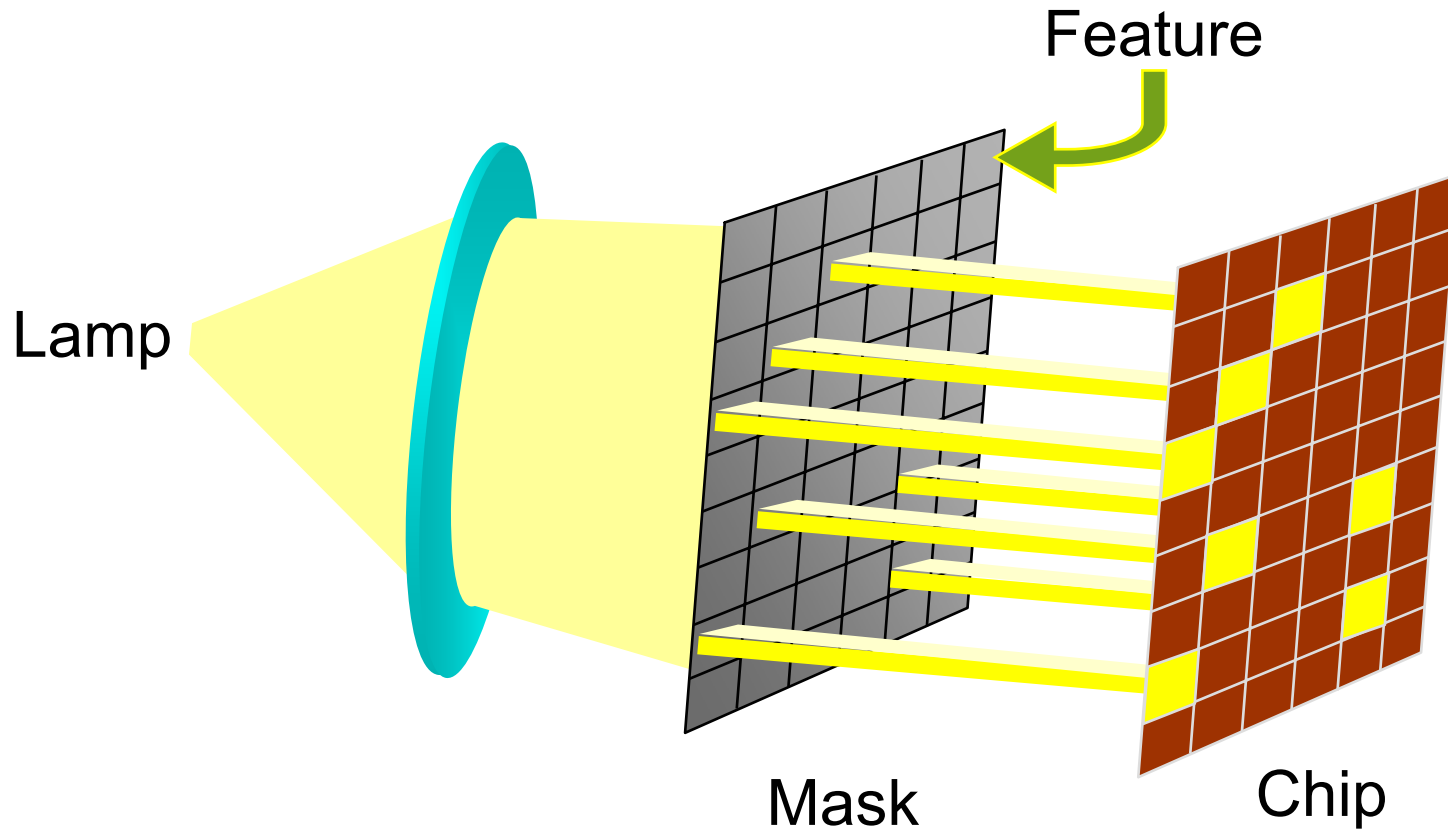
# Linker Addition



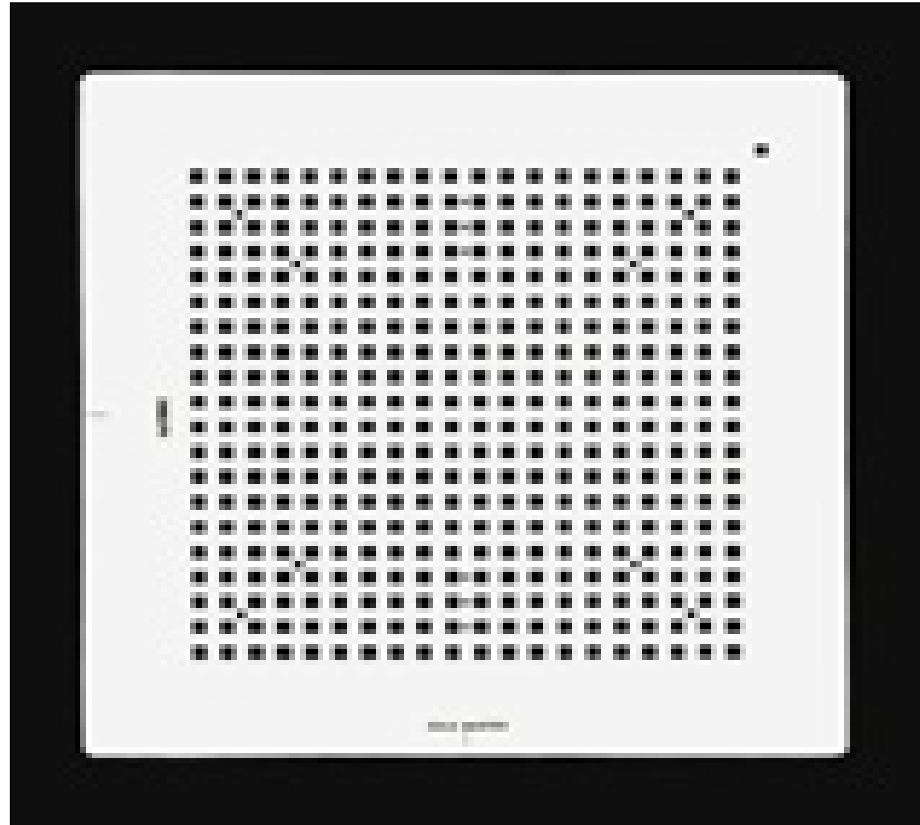
Wafer



# Photolithographic Synthesis

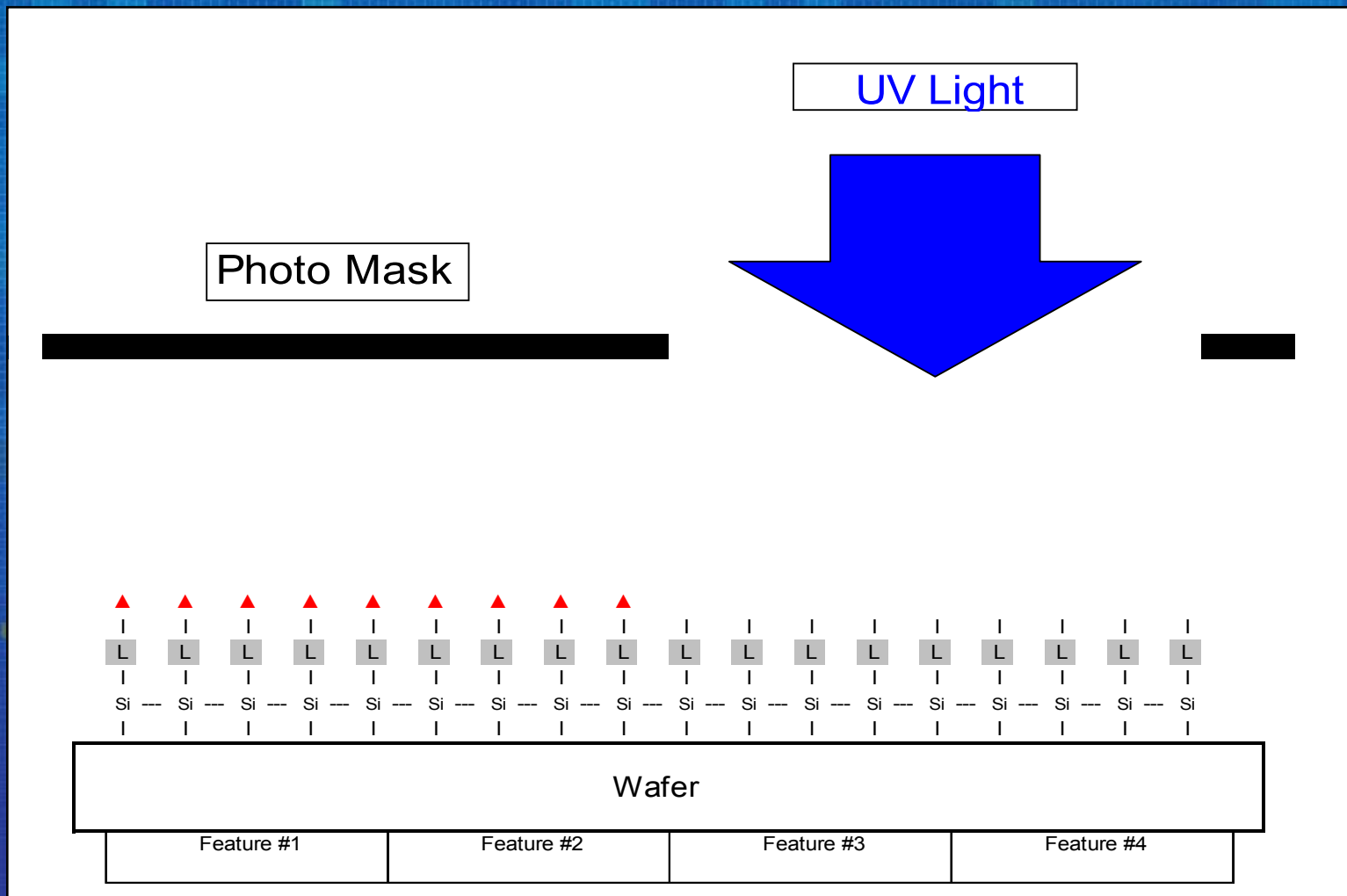


# A Typical Mask



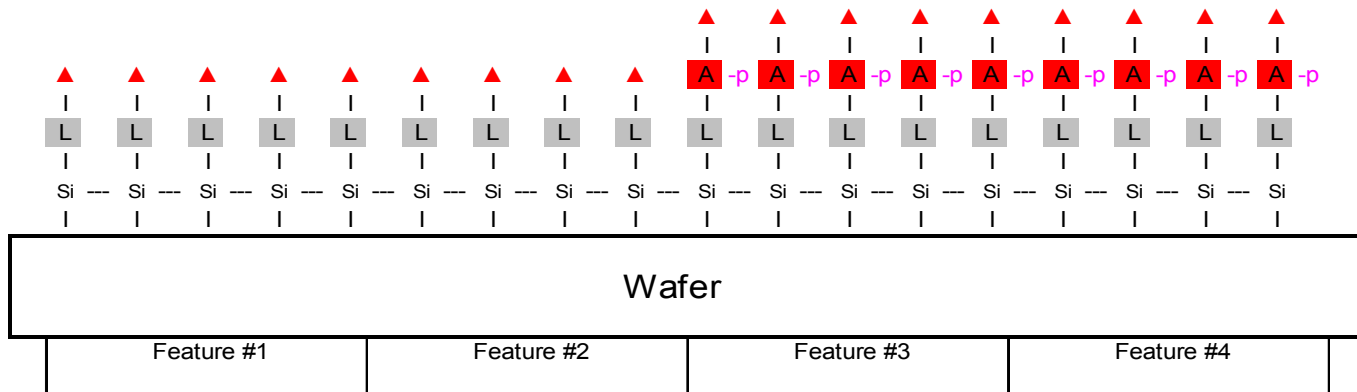
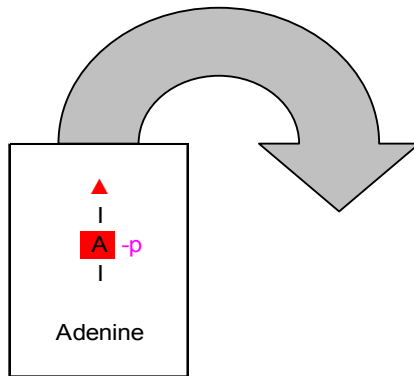
# Spatial Photo-Activation

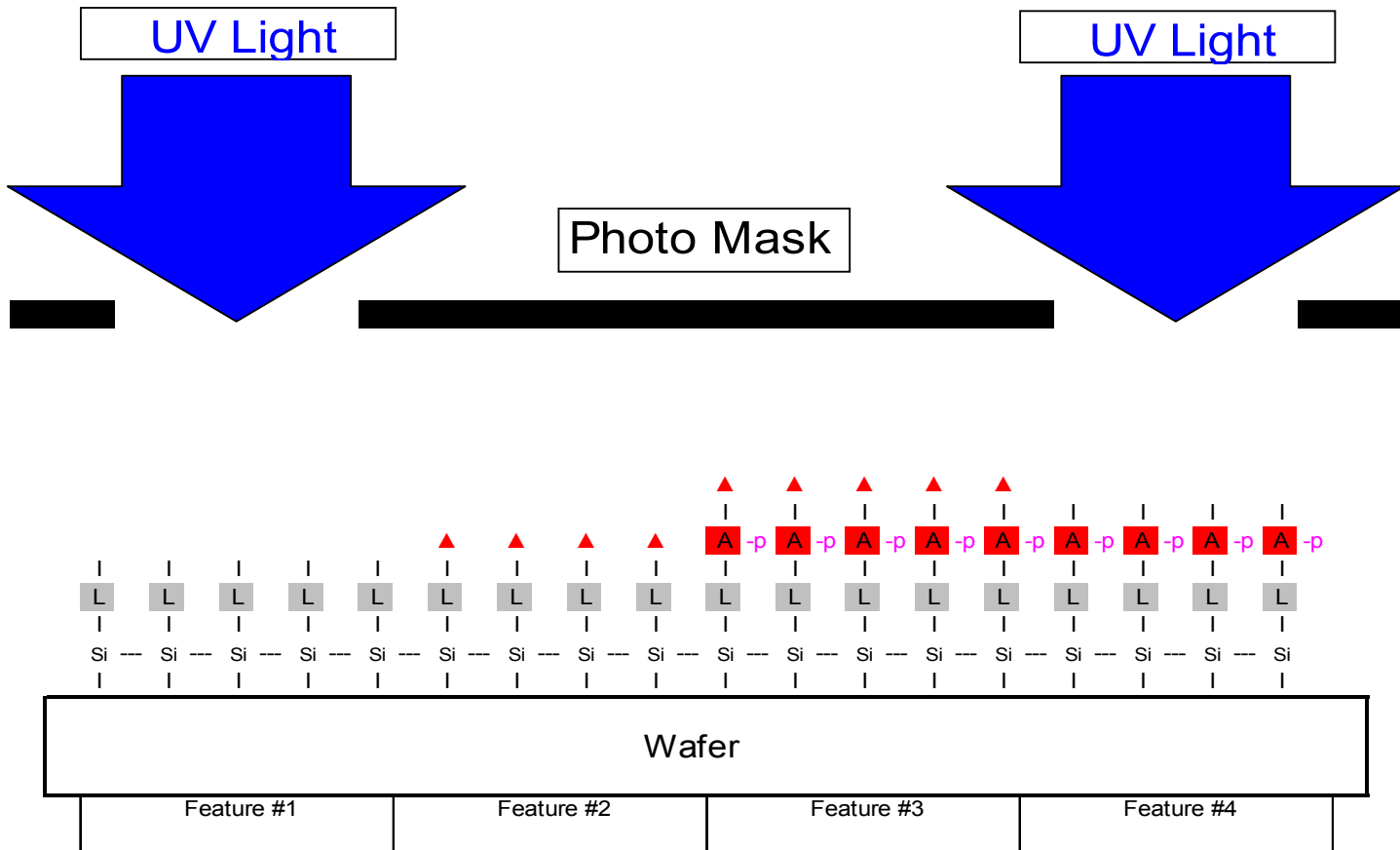
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# Base Addition – Adenine

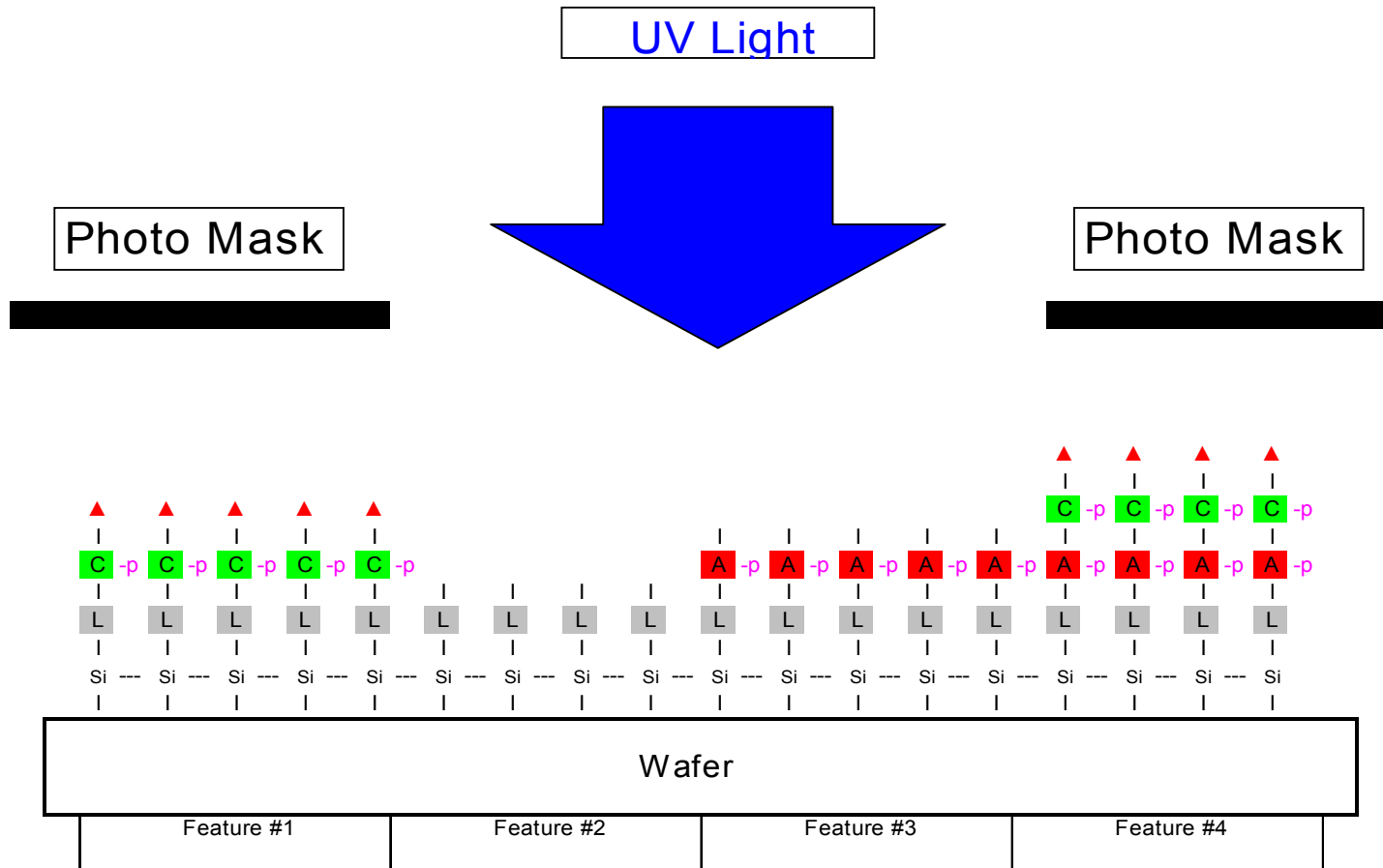




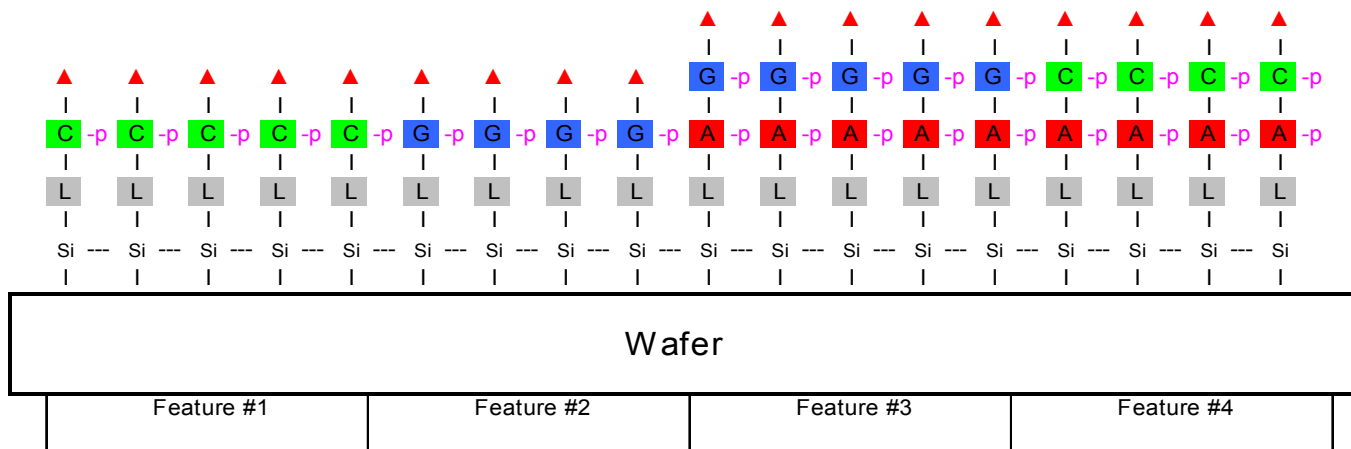
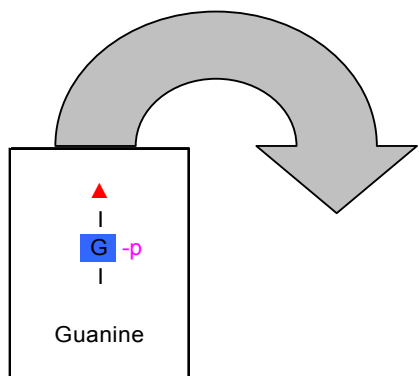




# Spatial Photo-Activation

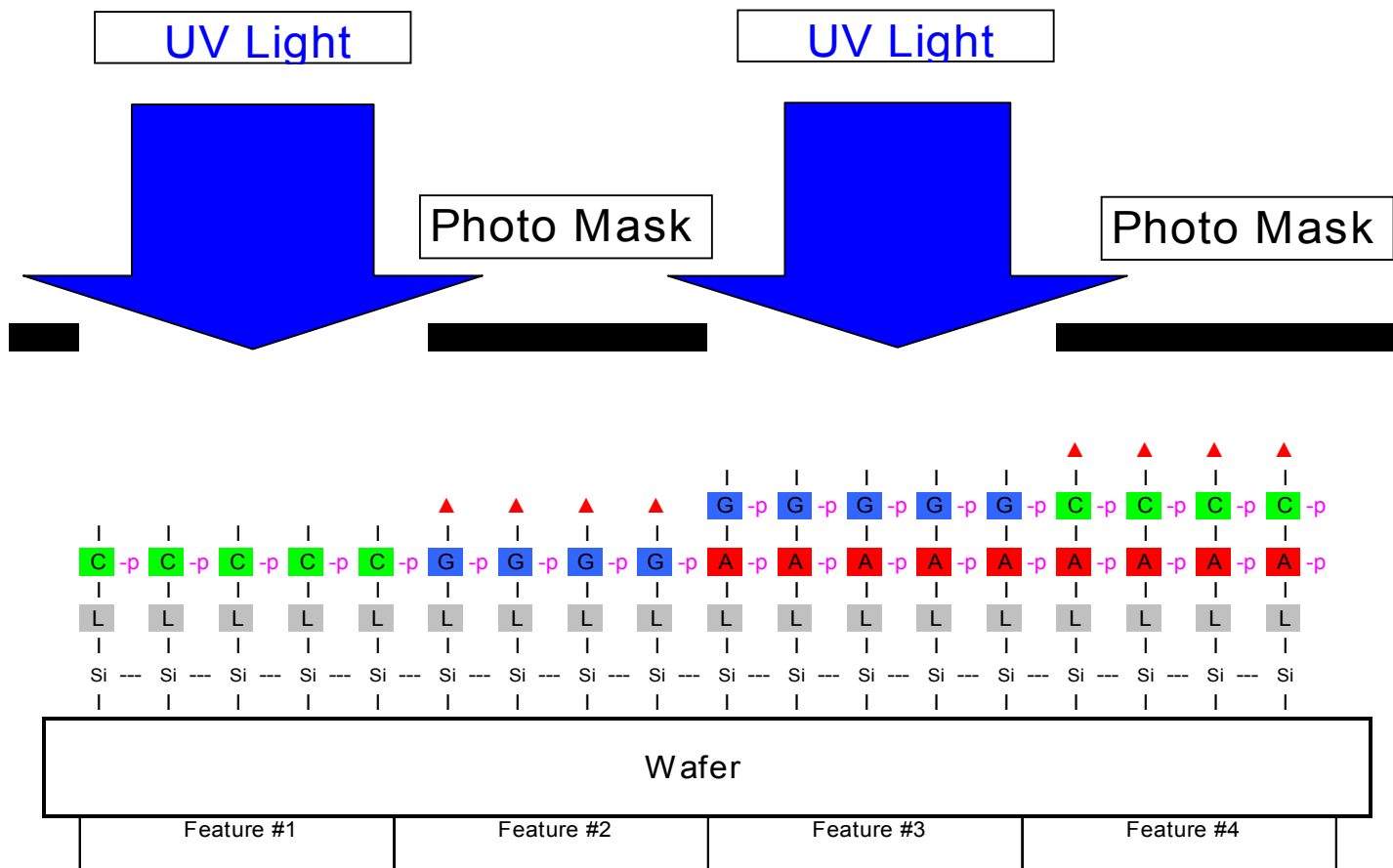


# Base Addition – Guanine



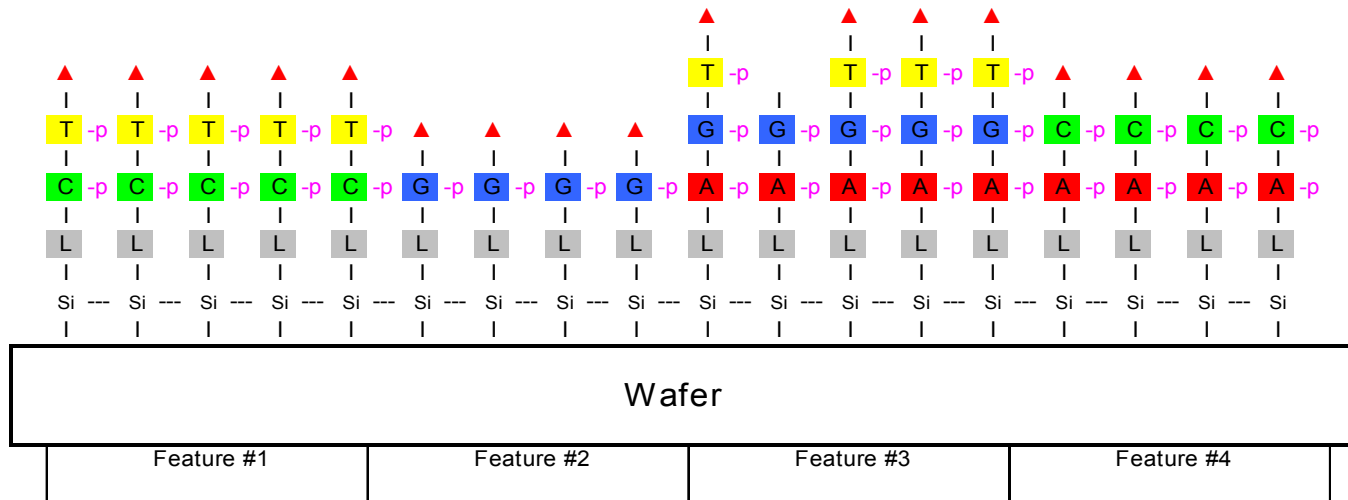
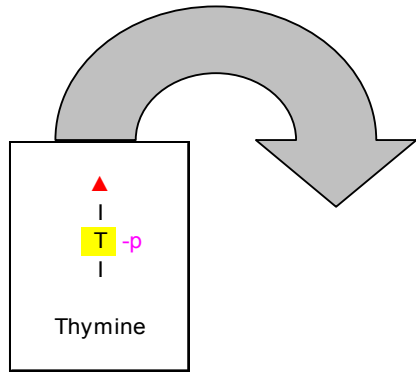
# Spatial Photo-Activation

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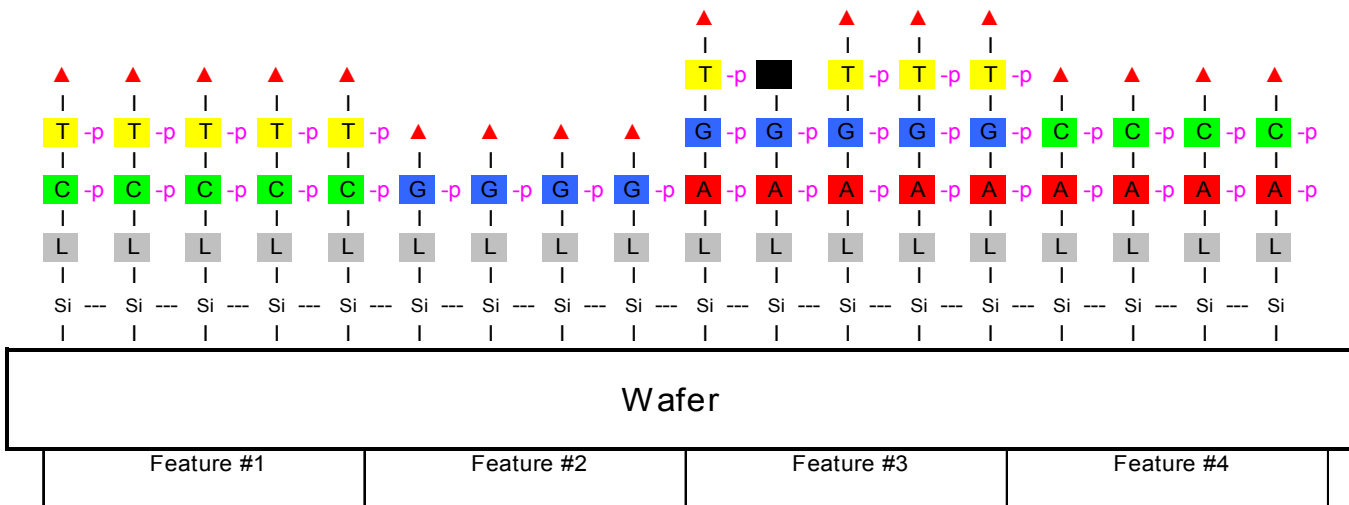
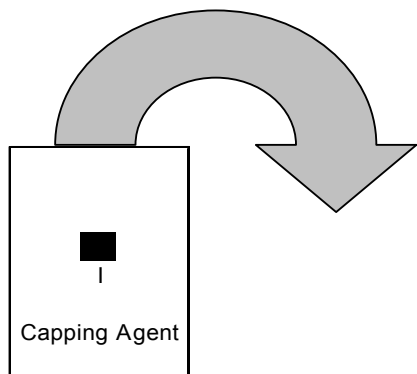




# Base Addition – Thymine



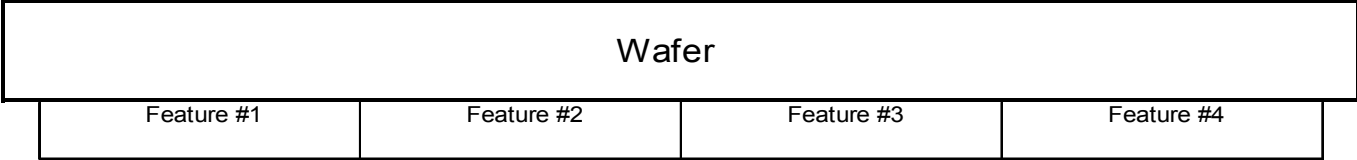
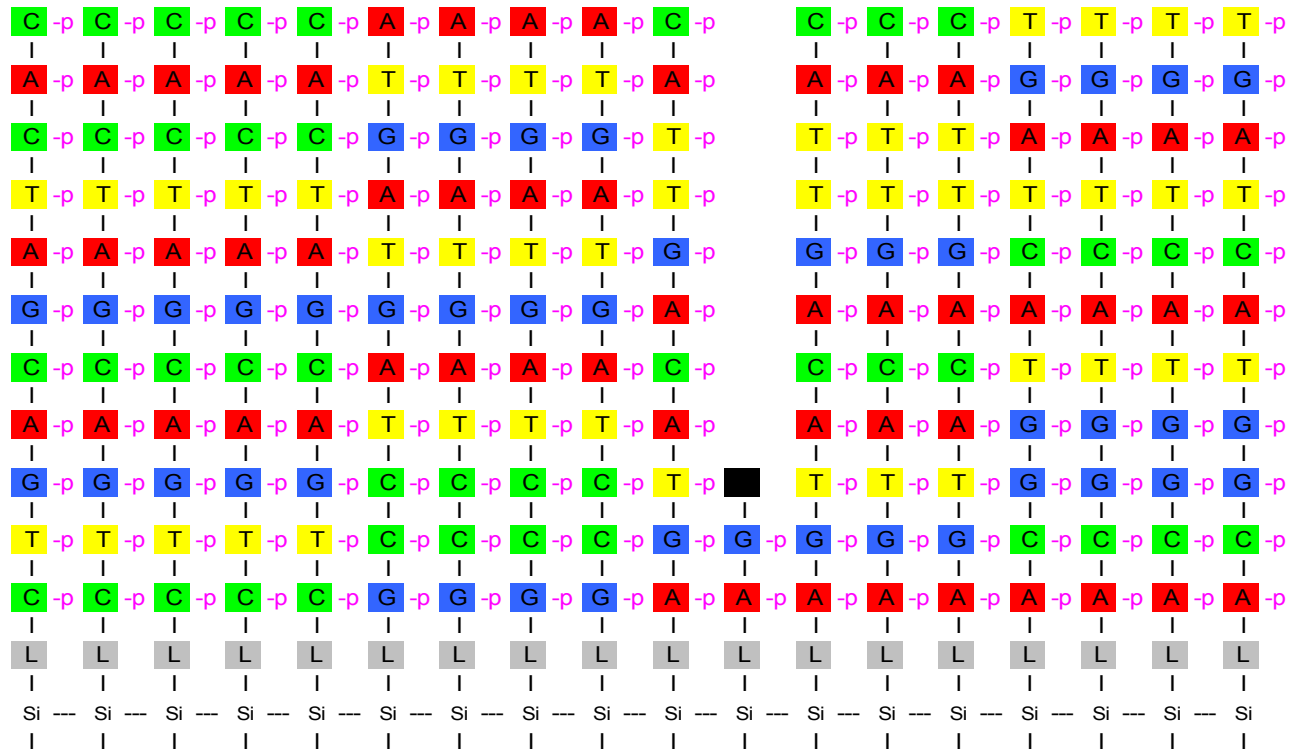
# Capping of Incomplete Additions





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# Completed Array

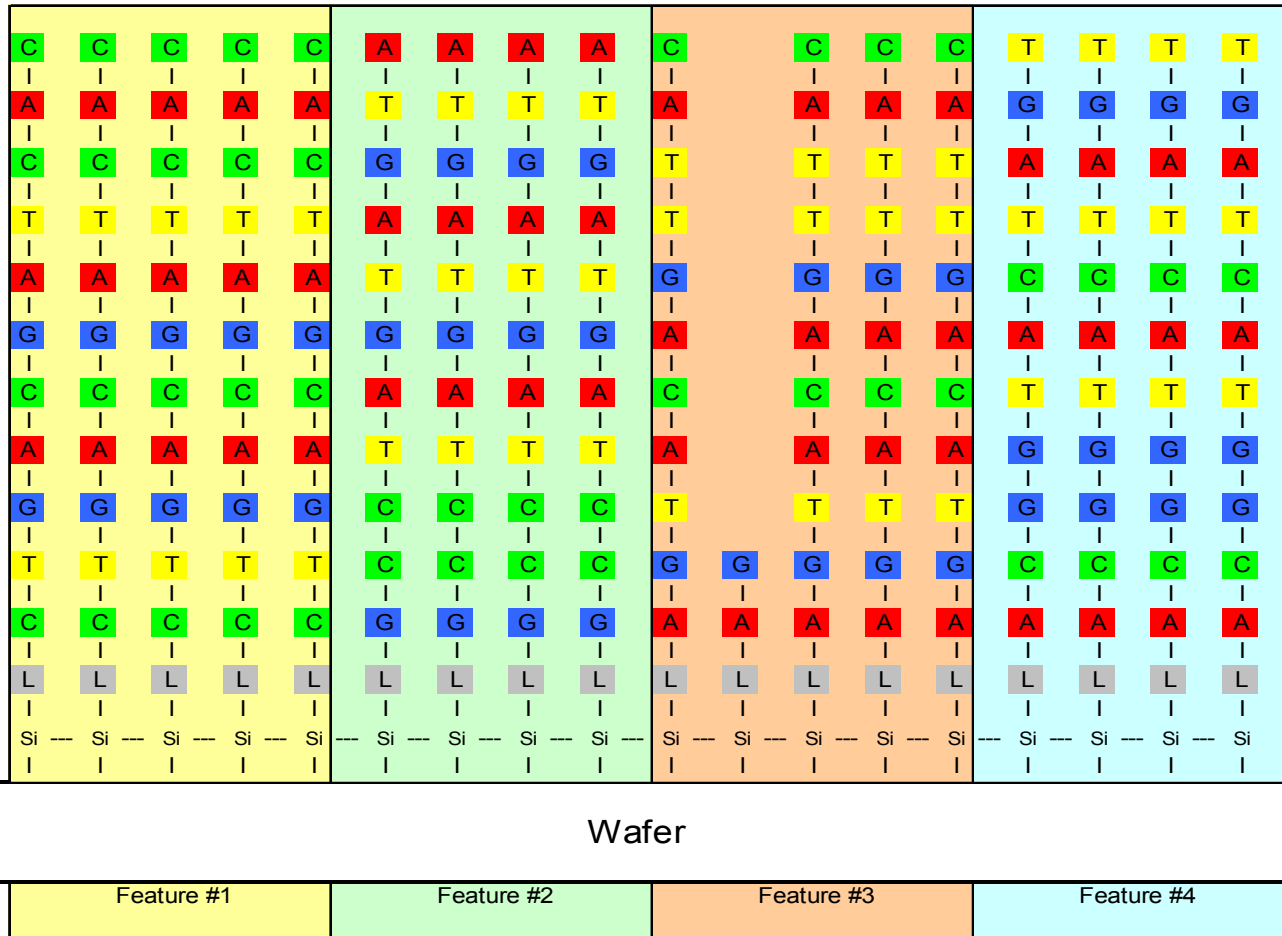




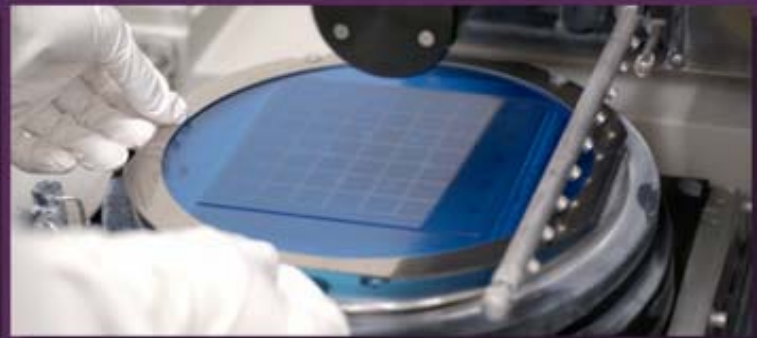
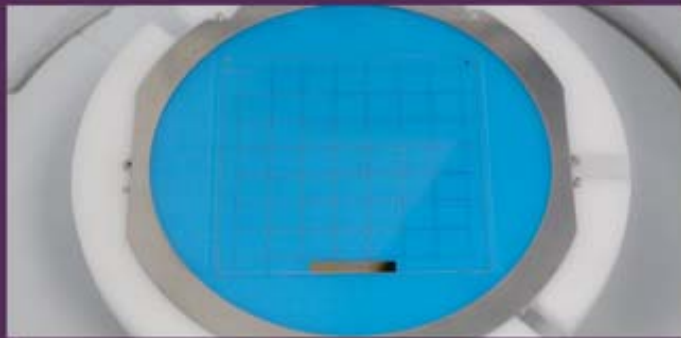
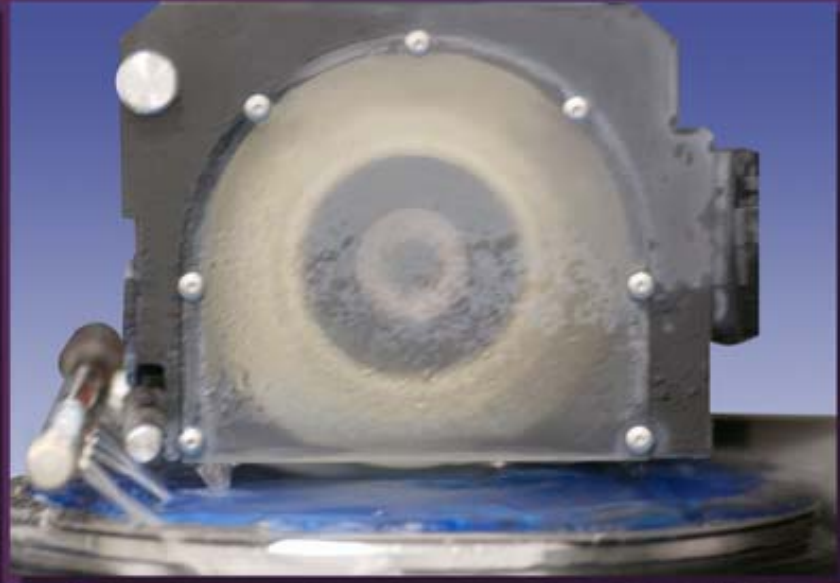


# Completed Synthesis Product

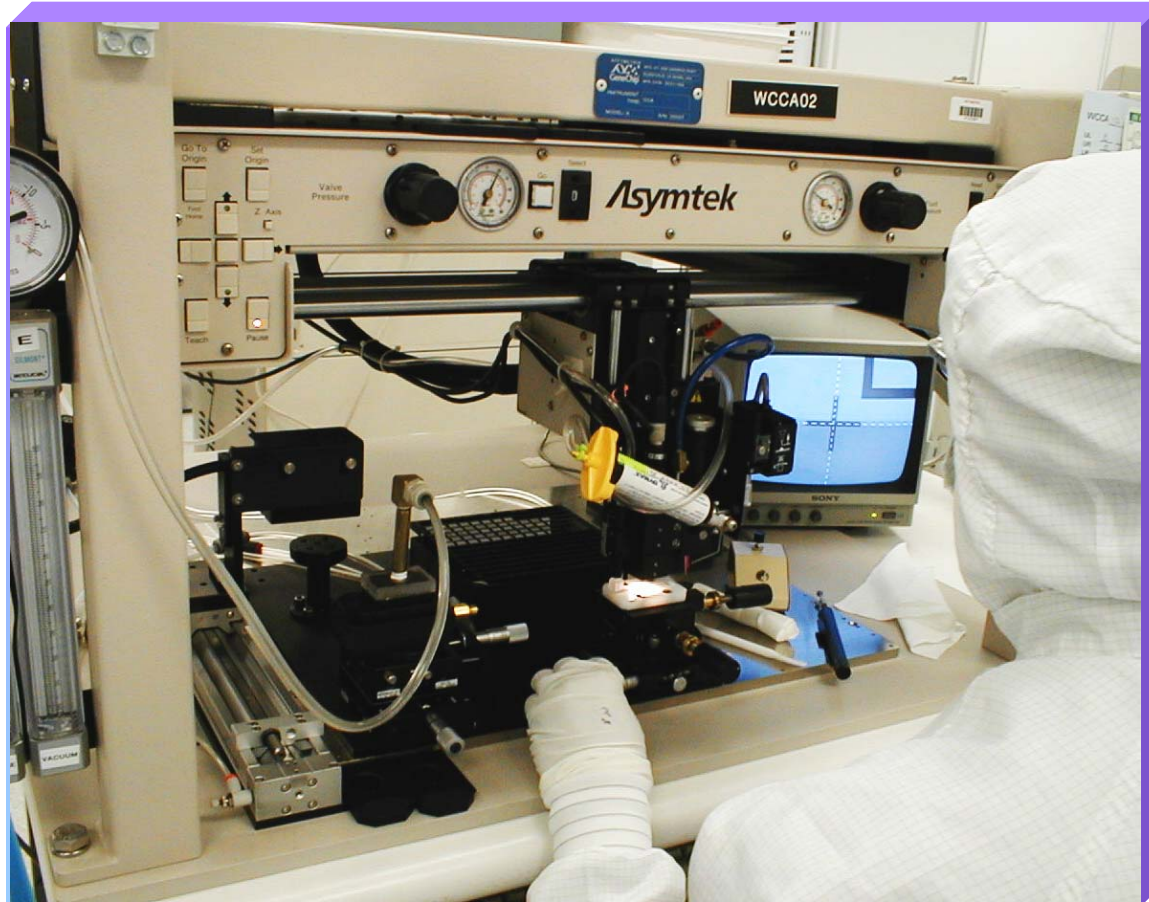
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# Wafer Dicing



# Chip Packaging







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# Pick and Place Station





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# Cartridge Assembly Station



# A Scalable Manufacturing Process

Feature Size	Features*	Resequencing <sup>1</sup>	Expression <sup>2</sup> Monitoring	Genotyping <sup>3</sup>
100µm	16,000	2kb	400 - 2,000	800 markers
50µm	64,000	8kb	1,600 - 8,000	3,200 markers
20µm	400,000	50kb	10,000 - 50,000	20,000 markers
10µm	1.6 million	200kb	40,000 - 200,000	80,000 markers

\* (1.28cm)<sup>2</sup> chip

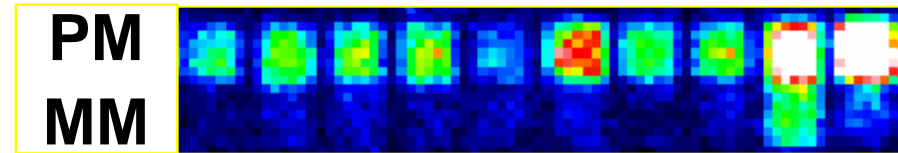
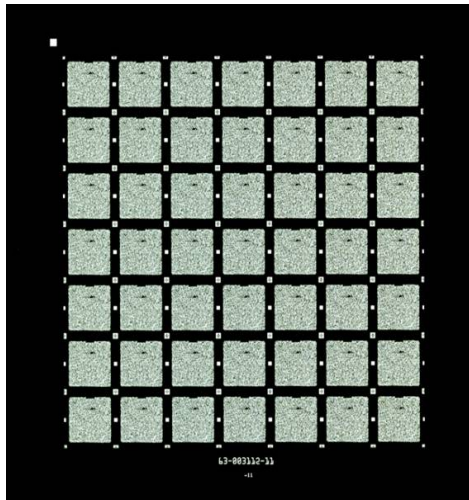
<sup>1</sup> 8 probes/base

<sup>2</sup> 8 - 40 probes/gene

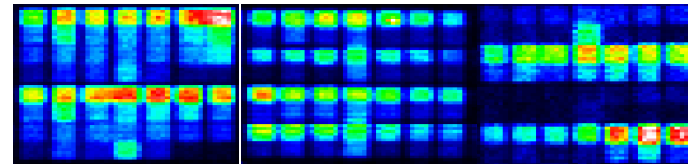
<sup>3</sup> 20 probes/marker



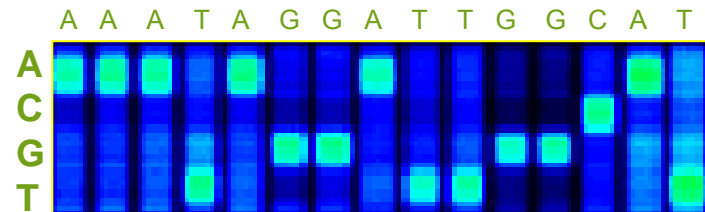
# Mask Designs Represent Array Content



Expression analysis



Genotyping analysis



DNA sequence analysis