

# Graphics Processing Units as a Solution for Compute Bound Problems

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The logo for CASPER, featuring the word "CASPER" in a stylized, blue and red font with a white outline, set against a dark blue background with a starburst effect.

# Challenging Problems

Memory Bound

I/O Bound

Compute Bound

# Throughput and Latency

**Throughput:** number of tasks completed per unit time

Ex: KODIAK has a peak performance of  $10.9TF$

**Latency:** time required to complete a single task

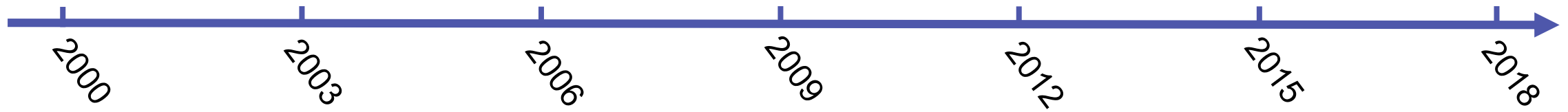
Ex: a cpu takes  $.1ns$  to complete an integer addition

# Serial and Parallel Processing

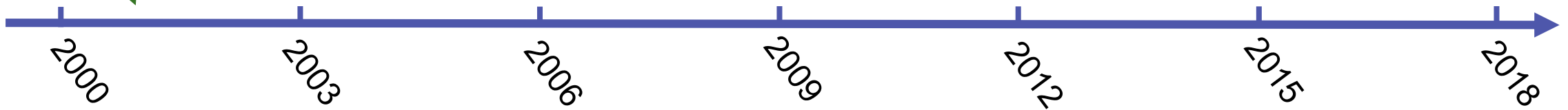
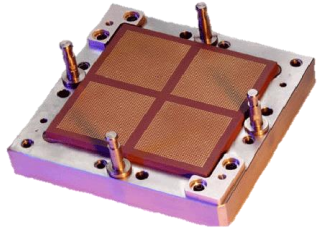
**Serial Processing:** One instruction is completed at time

**Parallel Processing:** Multiple instructions are completed at the same time

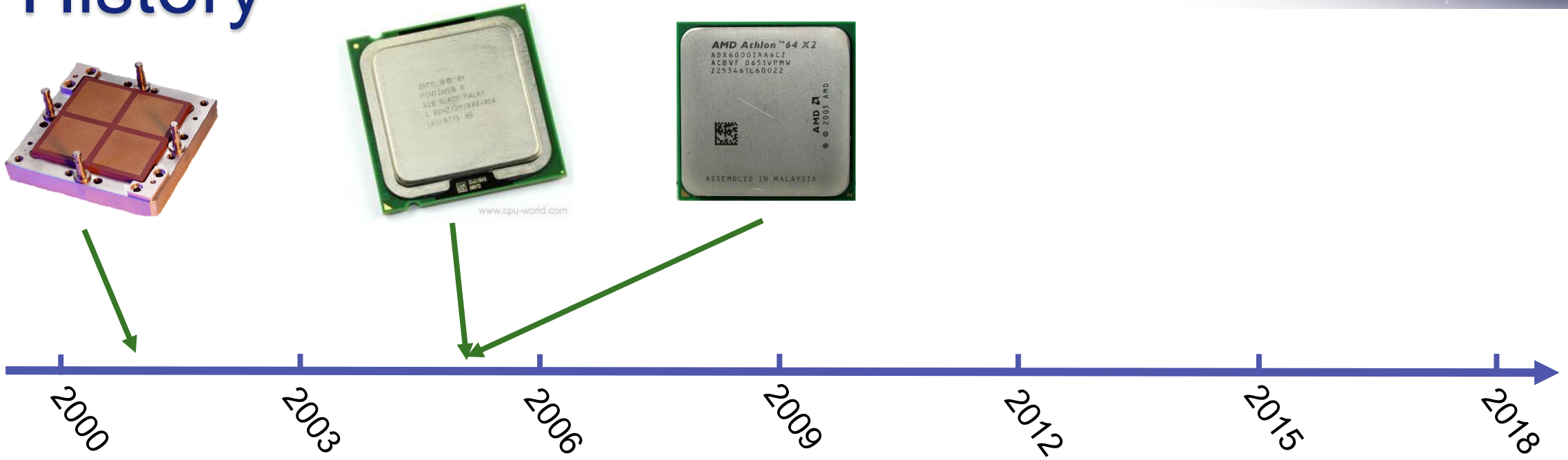
# History



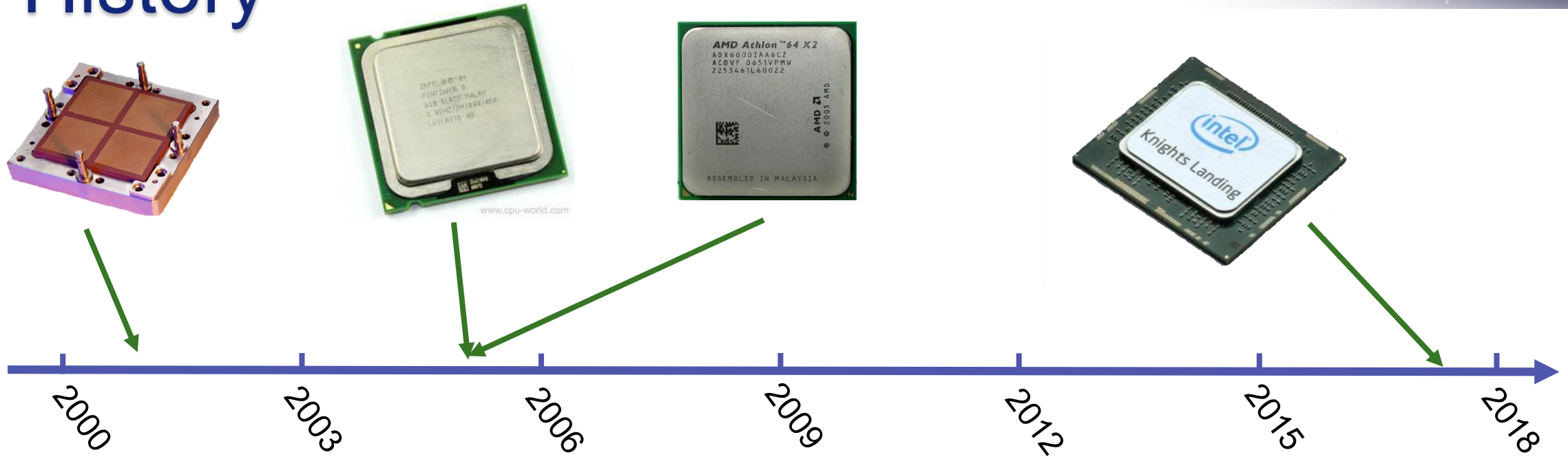
# History



# History

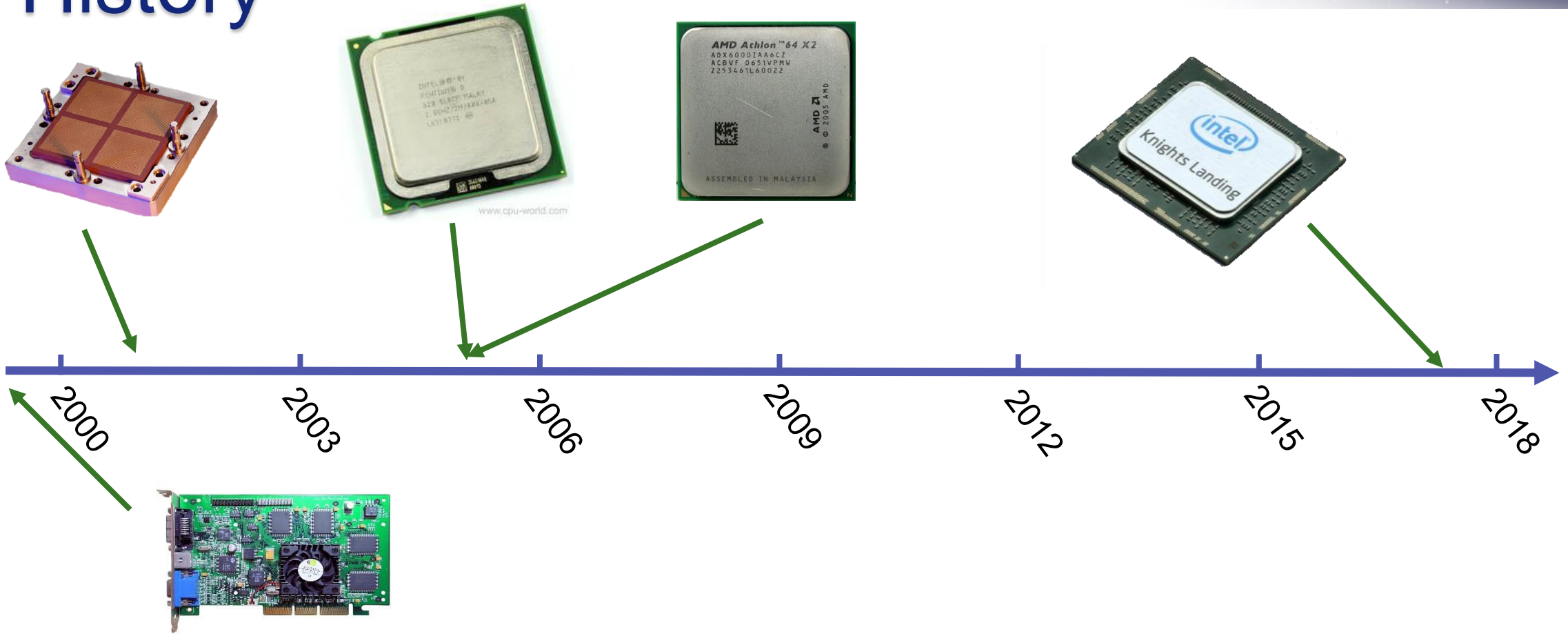


# History

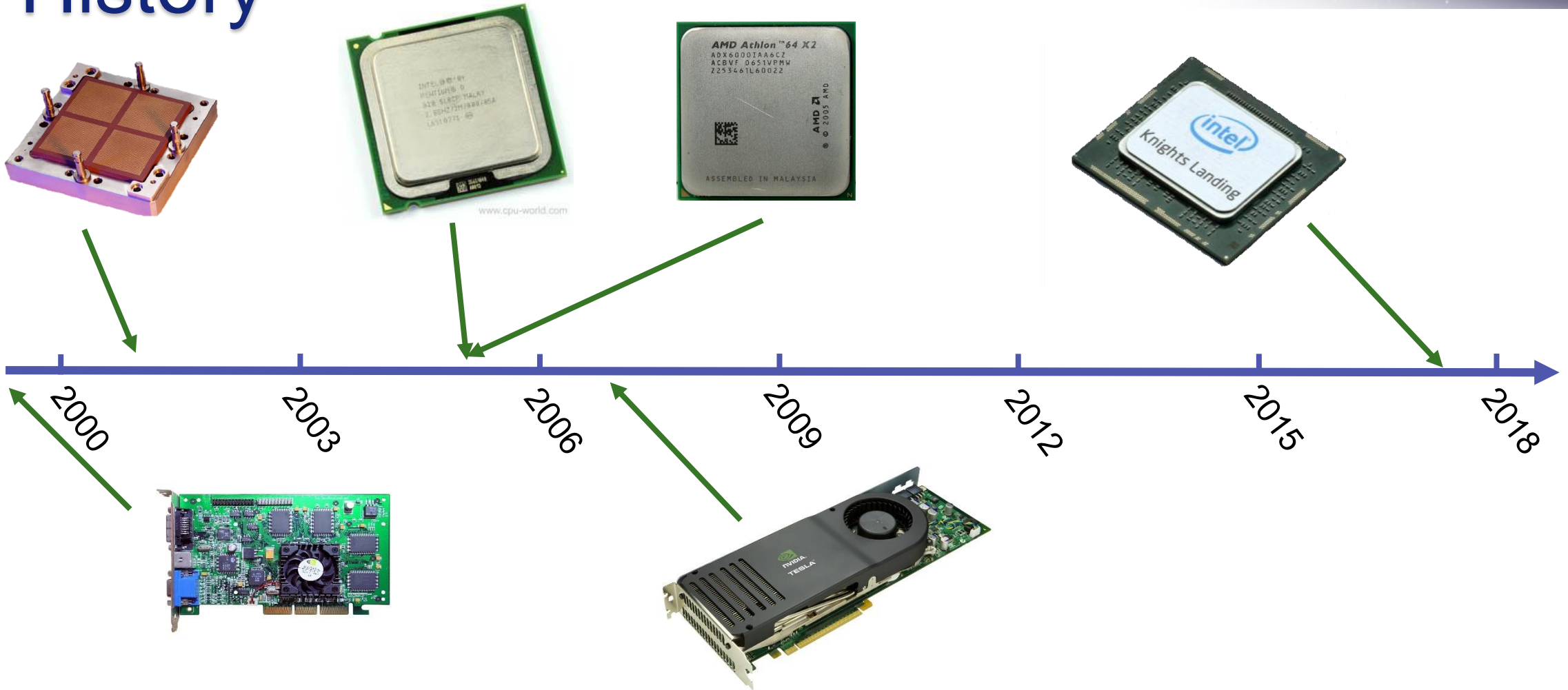




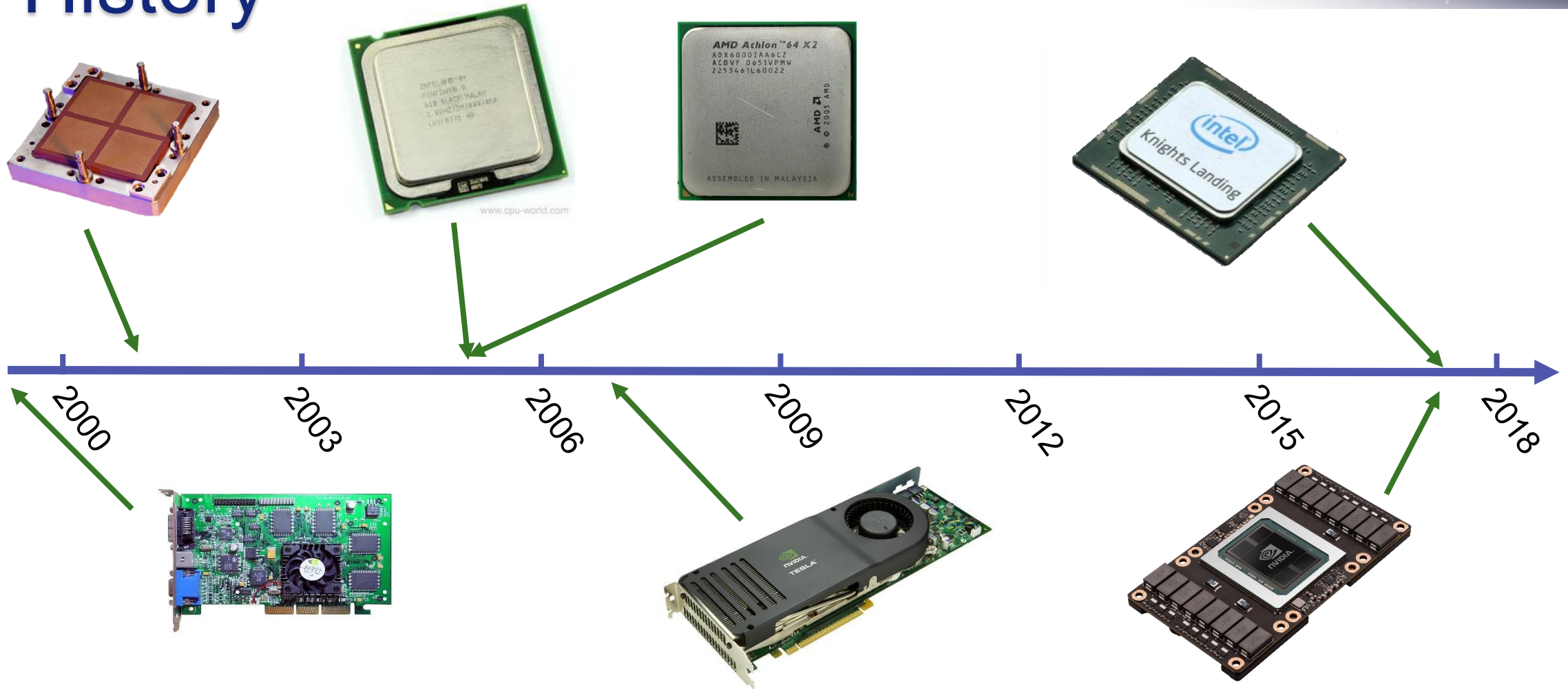
# History



# History



# History



# GPU VS CPU

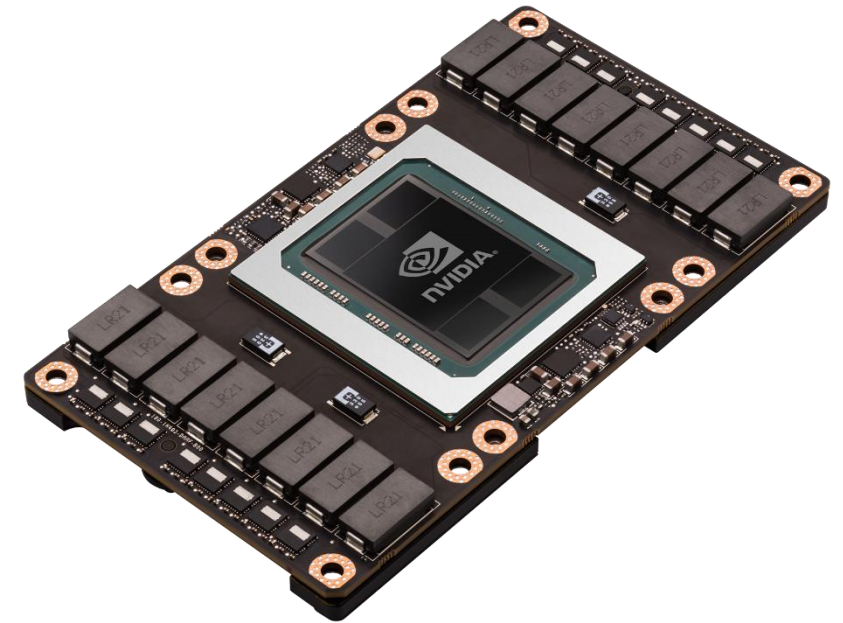


## CPU

- Linear Code
- Conditionals

## Applications

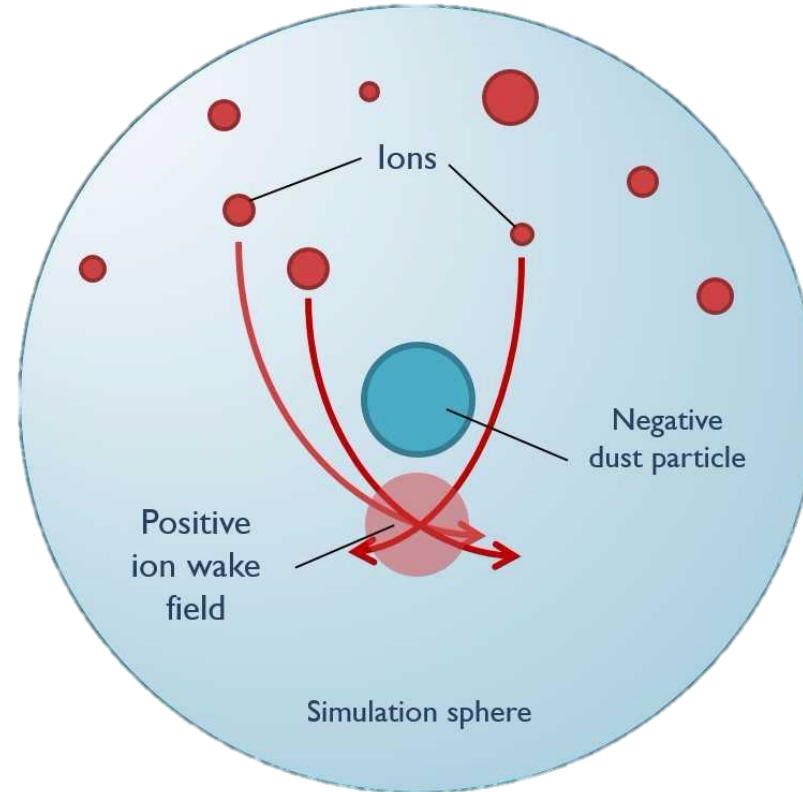
- Asynchronous
- Little I/O



# Ion Wake

## N-Body

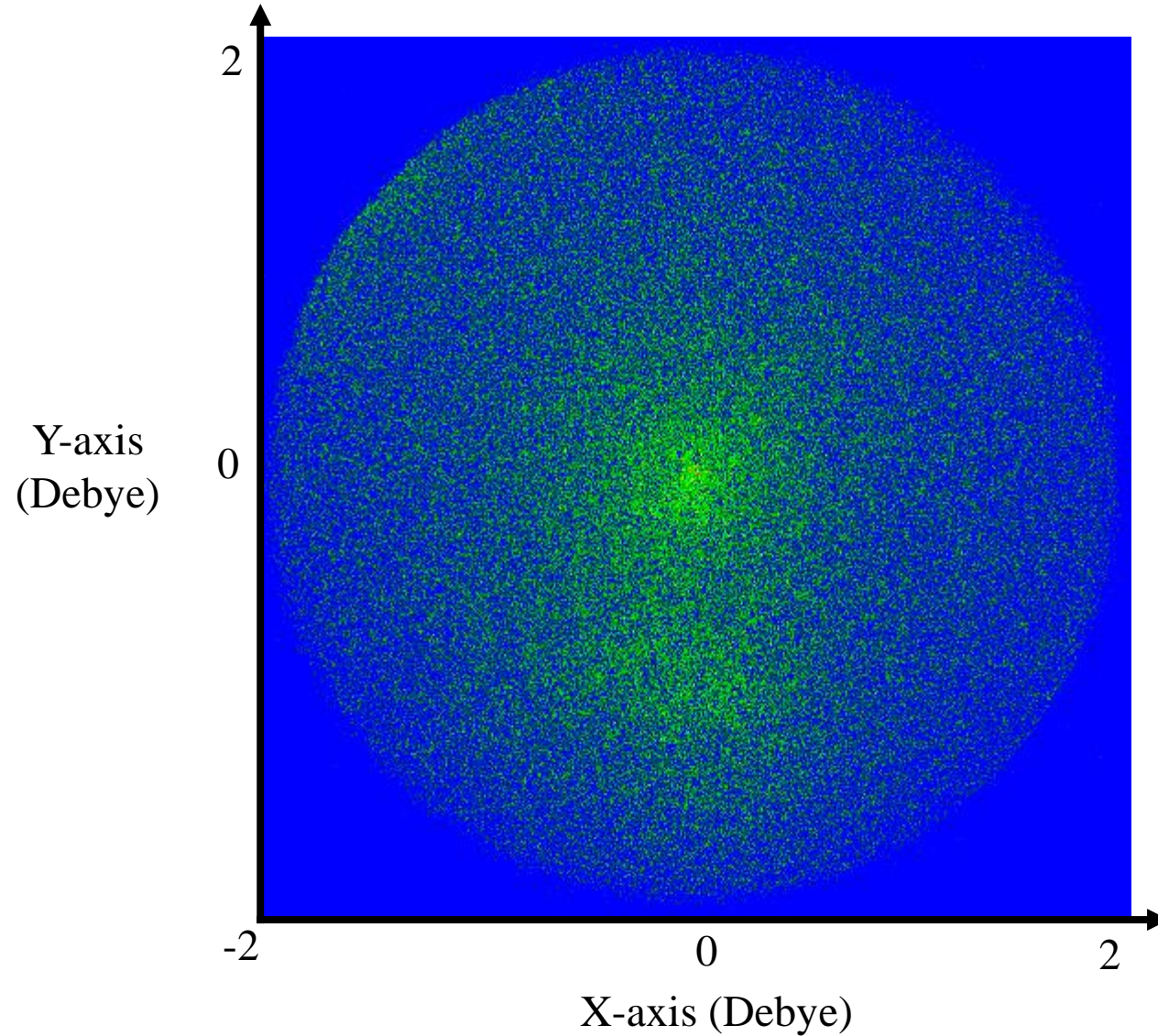
- Large Matrices
- Not Memory Intensive
- Few Conditionals
- Compute Bound




## Simulation

- Ion-Ion Forces
- Ion-Dust Forces
- Multiple Dust Particles
- Basic Output

# Ion Position Map

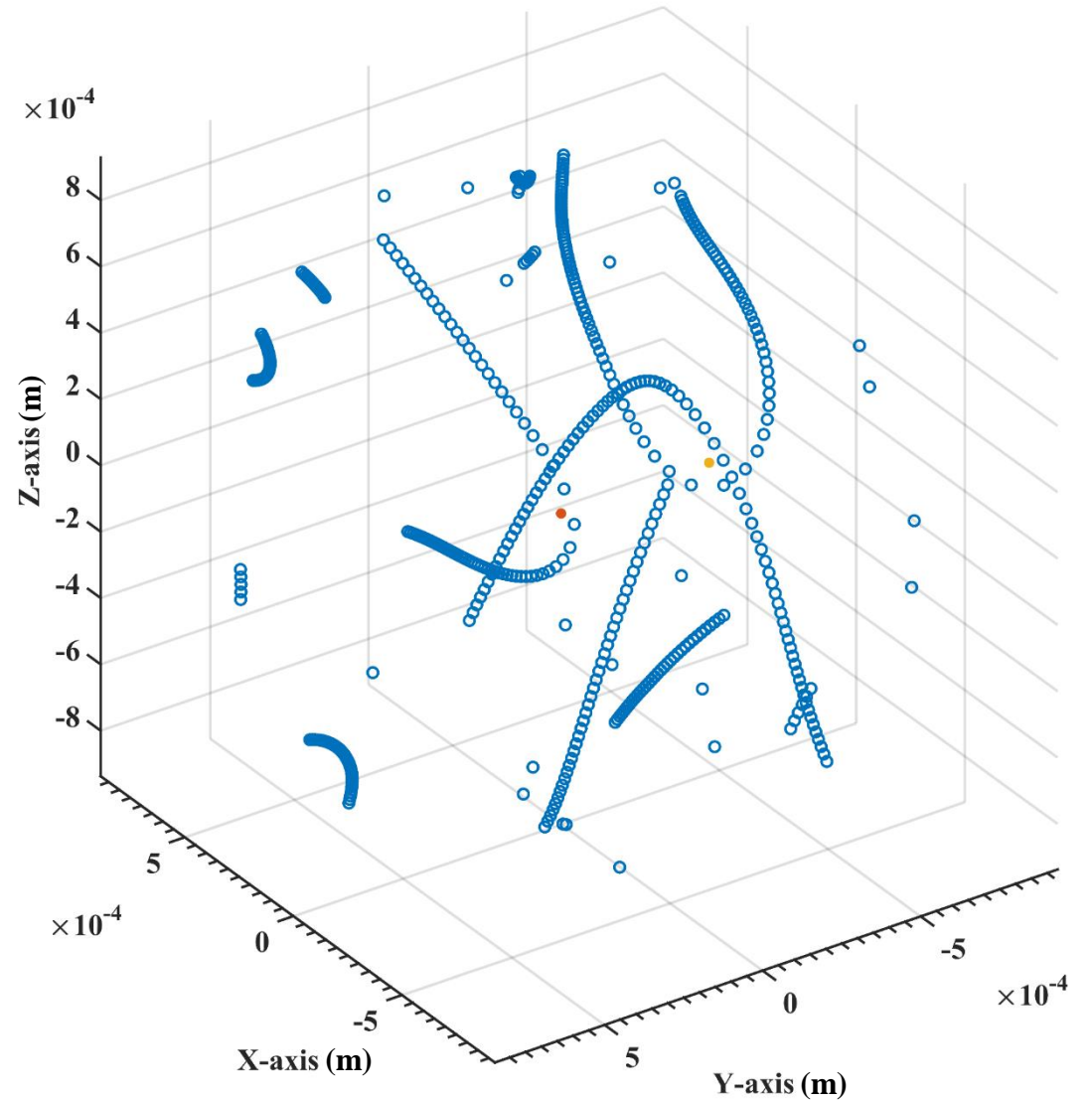
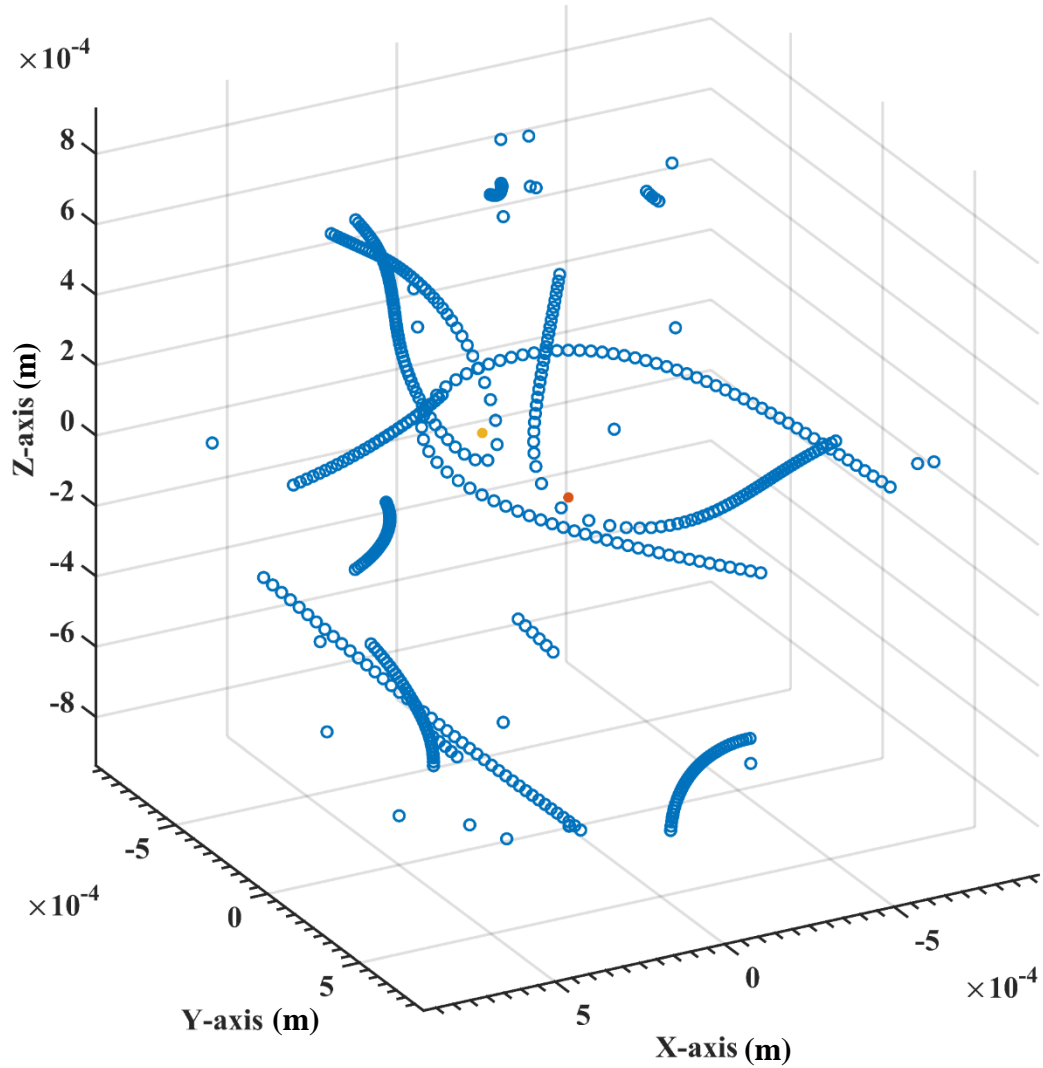


Ion Flow  
Direction



Dust Particle Positions:  
(0, 0, 0) and (0, -1, 0)

# Ion Trace



# Acknowledgments

Lorin Matthews  
Truell Hyde  
Beau Brooks  
Naoki Ellis



**B-TRUE**



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