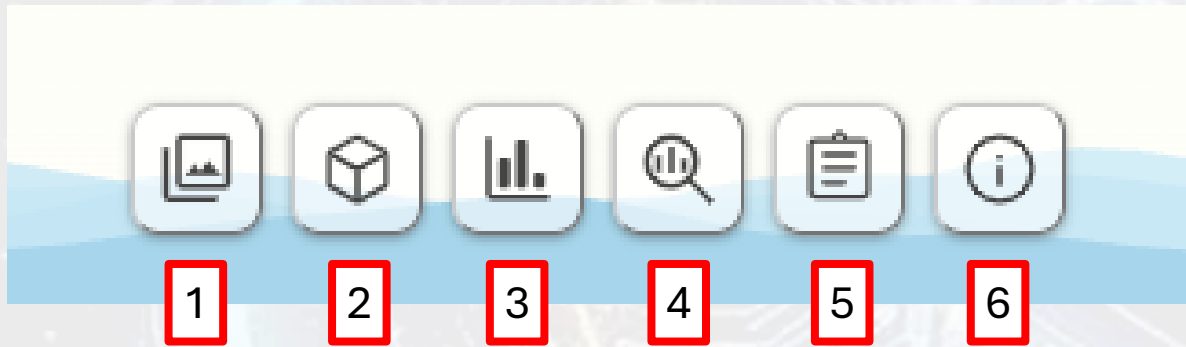




ANNEX B - USER MANUAL

FEMulator Pro

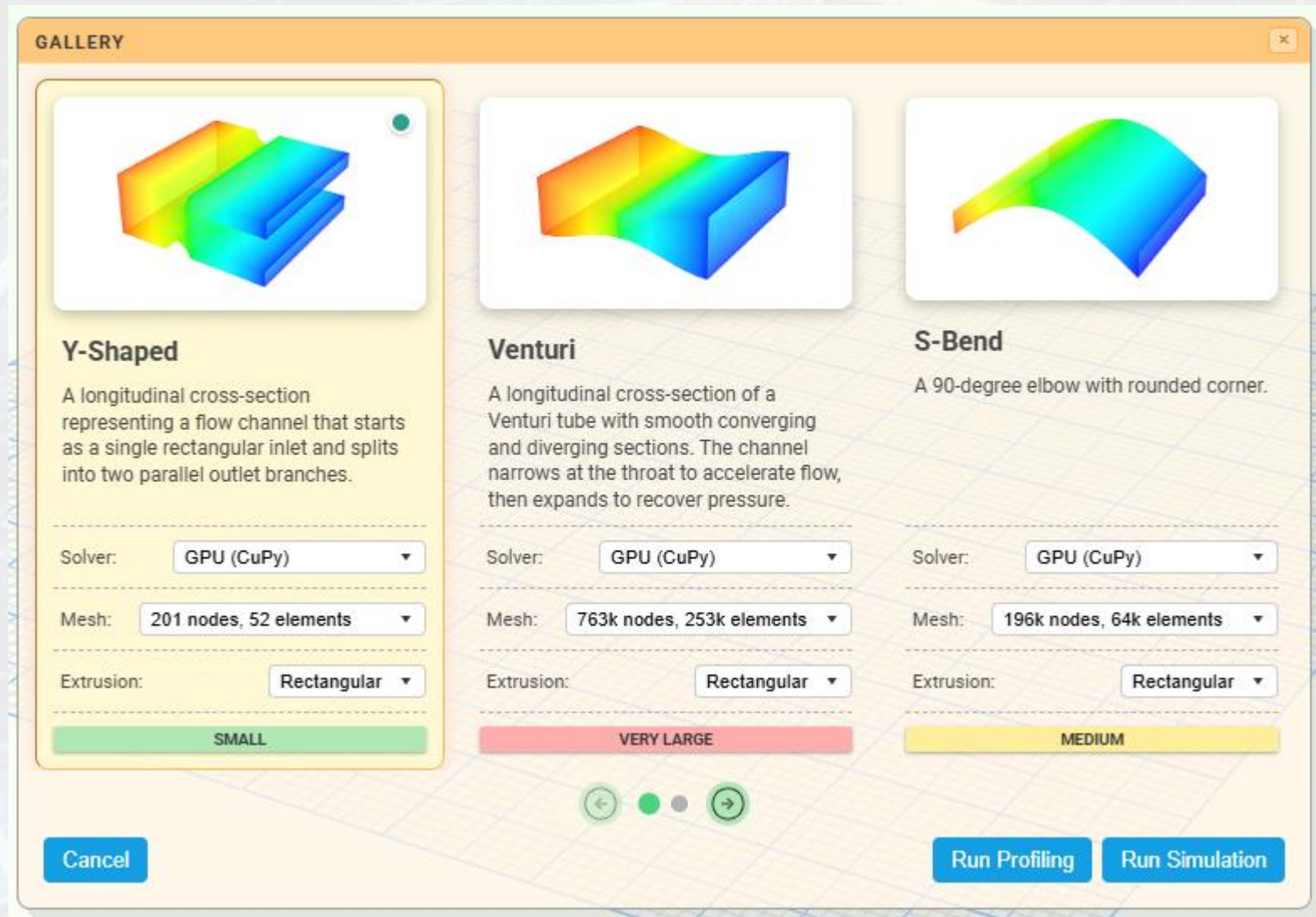
# Control Buttons



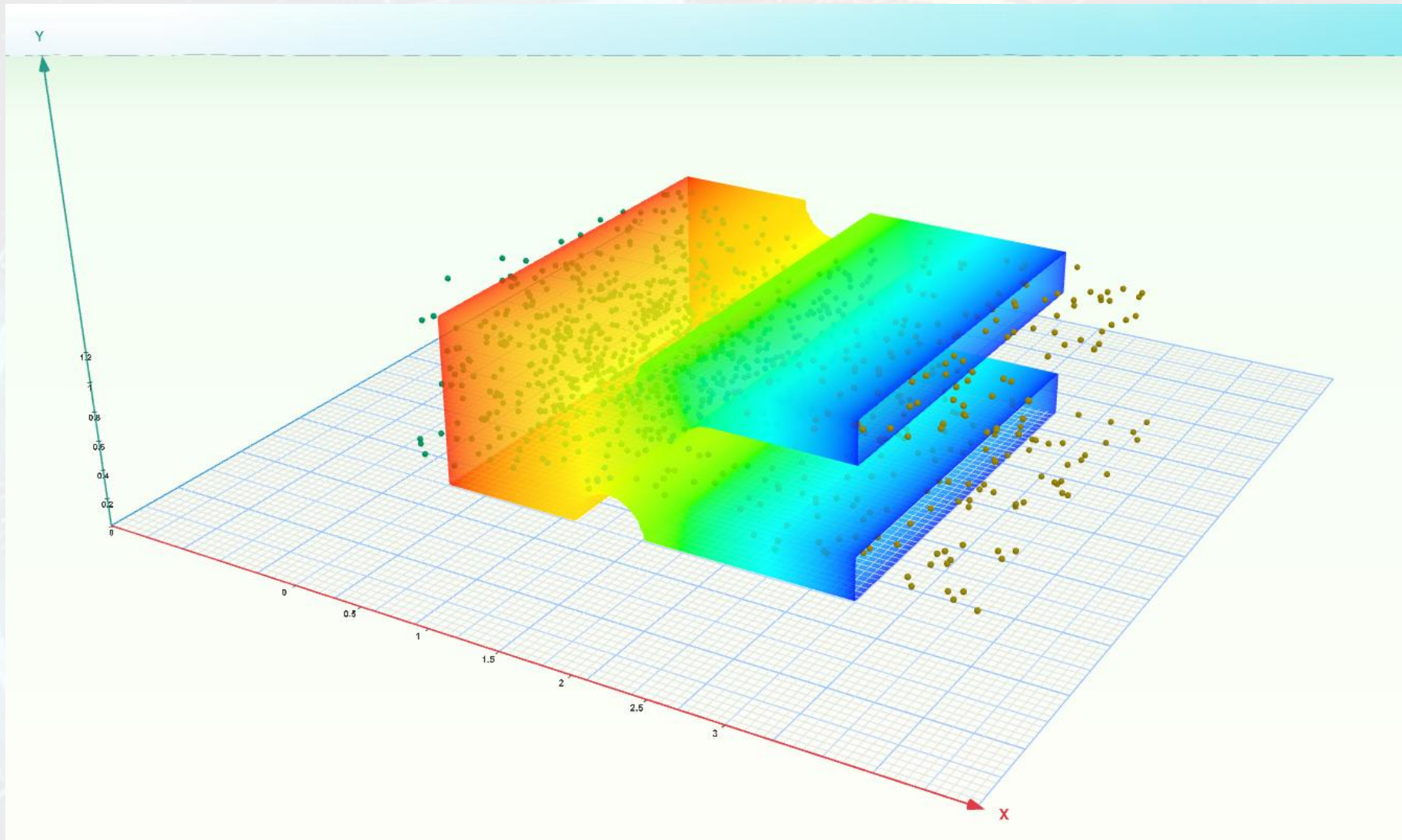
- 1 Mesh Gallery
- 2 Simulation Details, Metrics & Settings
- 3 Benchmark & Simulations History
- 4 Profiling Sessions
- 5 Reporting
- 6 About



# 1 – Mesh Gallery



# 1 – Simulation



## 2 – Simulation Details, Metrics & Settings

SIMULATION

DetailsMetricsSettings


Model:Y-Shaped

Mesh:195k nodes, 48k elements

Solver:GPU (CuPy)

Status:Ready

Current Stage:Post-Processing

Convergence Trend (Log Scale):

Residual:**2.325e-9**

Progress:7.4%

Iteration:3700 / 50000

Nodes / Elements:195,853 / 48,607

ETR:0m 16s

Total Time:0m 4s

Clear Scene

Close

SIMULATION

DetailsMetricsSettings

▼ Solver0/4

☐ Convergence Iterations  
Residual vs iteration chart (log scale)

LIVE

☐ Convergence Quality  
Final residual, iterations, convergence status

POST

☐ Timing Breakdown  
Time spent in each solver stage

POST

☐ Speedup Factors  
Performance comparison across solver types

POST

► Model0/2

► System0/2

SIMULATION

DetailsMetricsSettings

VISIBILITY

☒ 3D View

☒ Particles Animation

☒ Particles Color by Speed

☒ Grid Visible

☒ Solid Mesh Visible

☒ Coordinate Axes

APPEARANCE

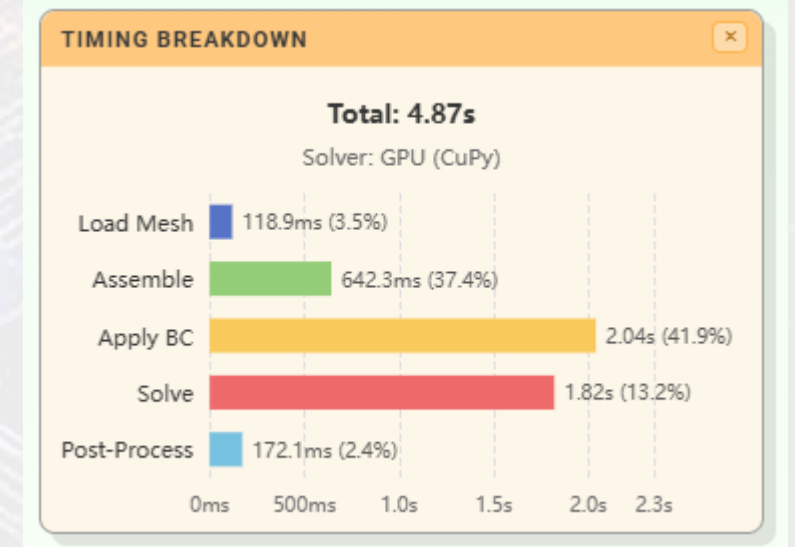
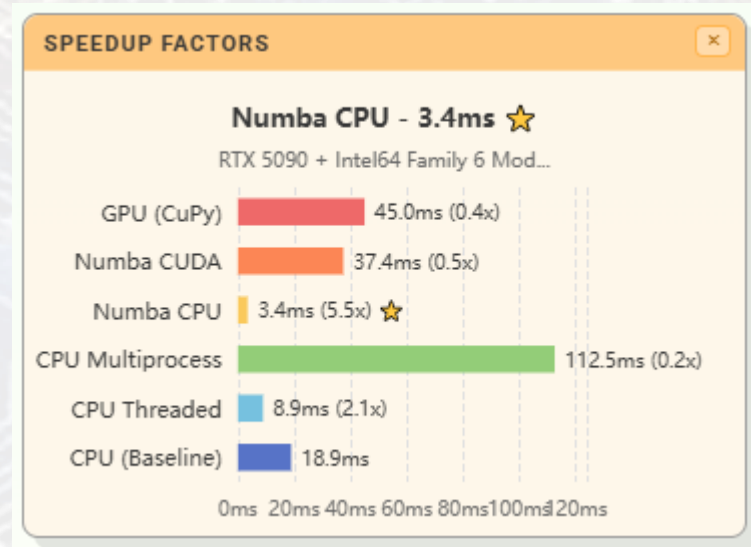
Mesh Opacity100%

Particle Count1,000

Speed Scale0.3x



## 2 – Simulation Metrics - Examples



# 3 – Benchmark & Simulations History

BENCHMARK

SOLVERS

All Solvers

MESHES

All Meshes

SERVICES

All Servers

TESTING

All

REPORTS

Mesh Performance

View

	Model	Solver	Nodes	Elements	Total Time	Assembly	Solve	Iterations	Peak RAM	Peak VRAM	Status	Date
<input type="checkbox"/>	FEMULATOR	i9-13900K	94.3 GB RAM	RTX 4090	24 GB VRAM							1 record
▶	DESKTOP-B968RT3 (Automated)	AMD64 Family 25 Mode...	- RAM	RTX 5060 Ti	15.9 GB VRAM							432 records
▶	RICKYROG700 (Automated)	Intel64 Family 6 Mod...	- RAM	RTX 5090	31.8 GB VRAM							432 records
▶	KRATOS (Automated)	Intel64 Family 6 Mod...	- RAM	RTX 4070	12 GB VRAM							432 records
▶	MERCURY (Automated)	i9-13900K	94.3 GB RAM	RTX 4090	24 GB VRAM							432 records

Delete Selected

Refresh

Copy

Export

Close

# 3 – Benchmark & Simulations History - Reports

REPORTS

Stage Breakdown

View

Mesh Performance

Testing Environment

Timing Totals

Stage Breakdown

Scaling Analysis

Convergence Verification

Efficiency Metrics

Testing Reproducibility

Critical Analysis

Conclusions

TIMING TOTALS

Total Workflow Time

Values are mean ± std across 5 servers.

Backward-Facing Step (XS) - 287 nodes

Implementation	Total Time	Speedup	N
CPU Baseline	33ms ± 6ms	1.0x	12
CPU Threaded	19ms ± 5ms	1.7x	12
CPU Multiprocess	2.12s ± 1.30s	0.0x	12
Numba CPU	<0.01s ± 1ms	6.6x	12
Numba CUDA	47ms ± 8ms	0.7x	12
CuPy GPU	57ms ± 8ms	0.6x	12

Time (seconds)

Total Time Comparison - Backward-Facing Step (XS)

Implementation	Total Time (s)
CPU Baseline	0.033
CPU Threaded	0.019
CPU Multiprocess	2.12
Numba CPU	<0.01
Numba CUDA	0.047
CuPy GPU	0.057

Backward-Facing Step (M) - 195,362 nodes

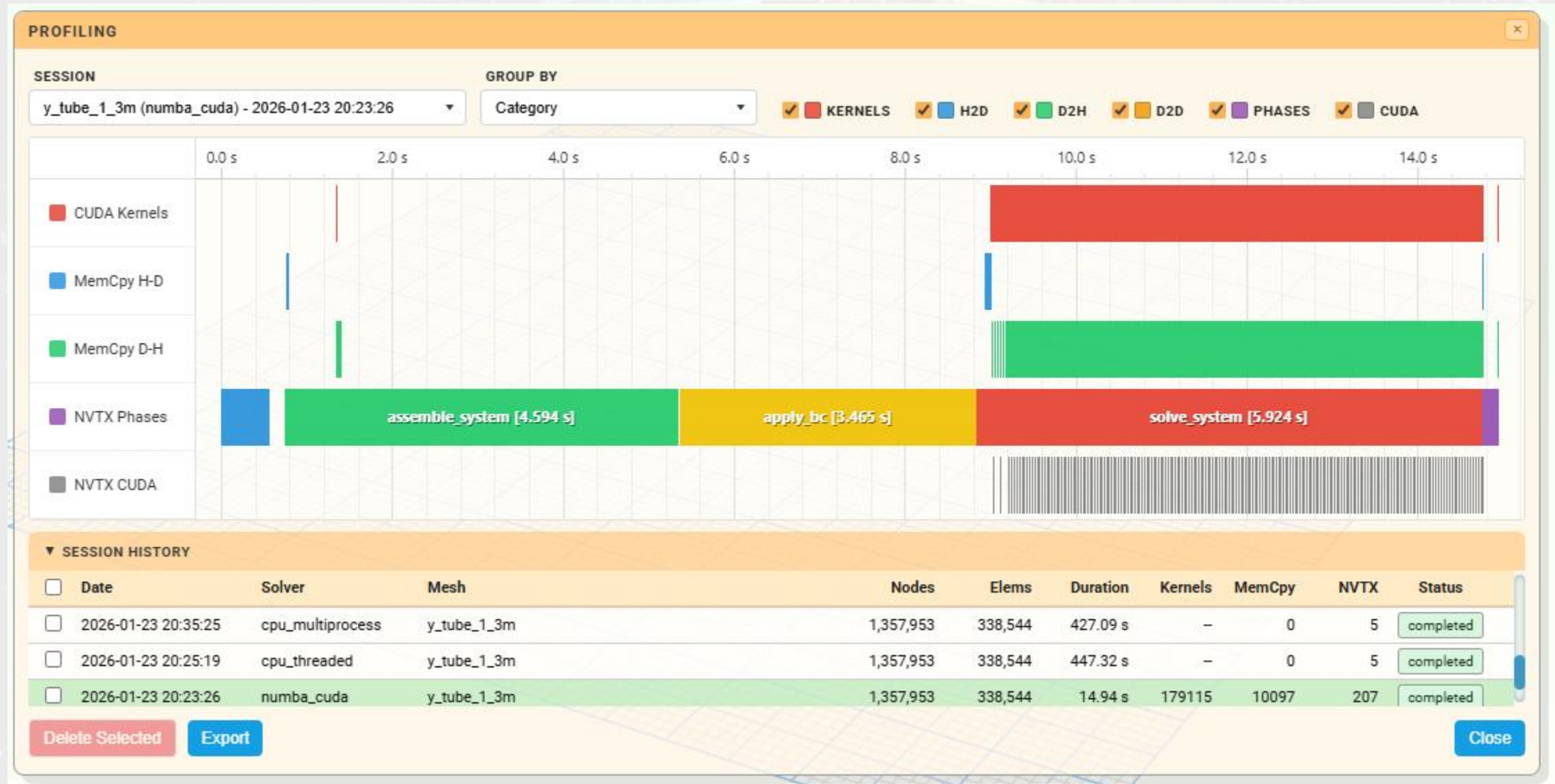
Implementation	Total Time	Speedup	N
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Copy

Export



# 4 – Profiling Sessions



# 5 – Reporting

REPORTING

▼ Tutorial #3 - Final Report

High-Performance GPU-Accelerated Finite Eleme...

> 1. Introduction - Finite Element Method

> 2. Software Architecture

> 3. Implementations

> 4. Performance Evaluation

> 5. Progressive Profiling Optimization

> 7. Conclusions

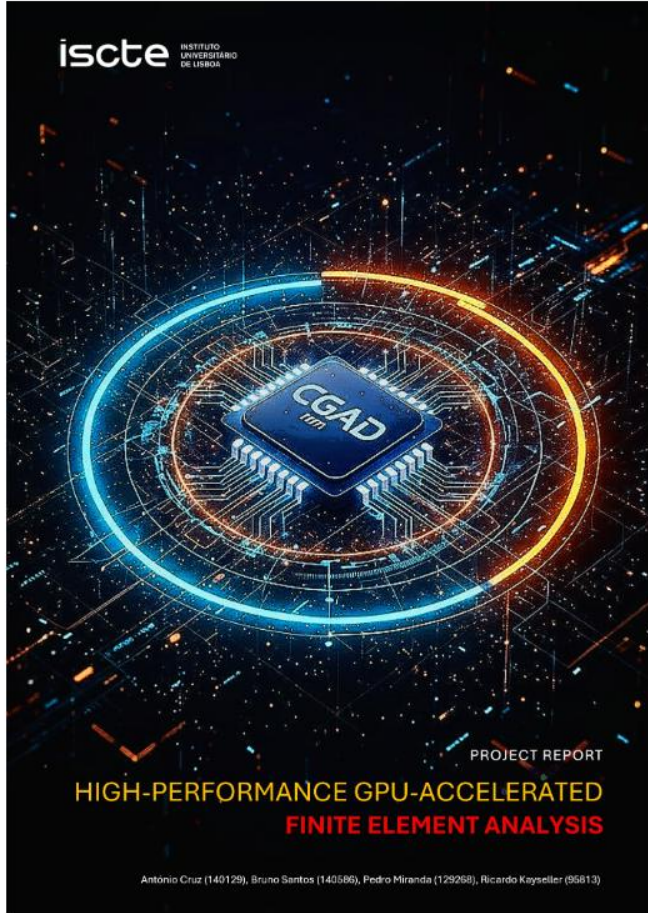
> 8. Annexes

> Annex A - Solver Implementations Detailed Report

> Annex B - FEMulator Pro Installation

> Annex C - Project Proposal (Tutorial #1)


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PROJECT REPORT

HIGH-PERFORMANCE GPU-ACCELERATED  
FINITE ELEMENT ANALYSIS

Antonio Cruz (140129), Bruno Santos (140586), Pedro Miranda (129268), Ricardo Kayseller (95813)



Edit

# 6 - About

