Performance Tuning of PIConGPU
Adding Performance Information a.k.a. Instrumentation

main

reg

launch

reg

main

synchronize

Host

GPU

t

GPU Execution Queue

Event

Kernel

Event

Event

47110815 Event

47111234 Event
One GPU

- Try to limit the number of slides you use.
- Keep text to a minimum.
- Instead, speak more to your audience (engage them with anecdotes/enthusiasm/eye contact).
- Try not to read your points verbatim; bullet points should be used for key points only.
- Use images/graphics to help convey your message.
Adding Synchronous MPI Communication
Overlap Computation and Communication

Compute E-Field
Overlap Computation and Communication

Compute E-Field
Communicate E-Field
Overlap Computation and Communication

- Compute E-Field
- Communicate E-Field
- Compute B-Field (Core)
Overlap Computation and Communication

Compute E-Field
Communicate E-Field
Compute B-Field (Core)
Compute B-Field (Border)
Improved Communication
Vector of Structs

<table>
<thead>
<tr>
<th>Mesh memory layout</th>
<th>Particle memory layout</th>
<th>Border crossing</th>
</tr>
</thead>
<tbody>
<tr>
<td>(0,0) (1,0) (2,0) (3,0)</td>
<td>(0,1) (1,1) (2,1) (3,1)</td>
<td>(0,2) (1,2) (2,2) (3,2)</td>
</tr>
</tbody>
</table>

GPU TECHNOLOGY CONFERENCE

CUDA CENTER OF EXCELLENCE
Structs of Vectors

Logical view

Grid

Supercell

Attribute I

Attribute II

Attribute III

Particle

First Tile

Last Tile

Implementation

Tile Management

Attribute I

Attribute II

Attribute III

Attribute Tile Pool
Impact of Improved Data Structures

Dynamic Lists vs. Vectors

- List (S1070)
- List (S2050)
- Vectors (S1070)
- Vectors (S2050)
Overall Impact of Optimized Kernels
Adding Streams
Showing All 512 at Once
So How About Scalability

Weak Scaling

Number of GPUs

Parallel Efficiency

Strong Scaling

Number of GPUs

Parallel Efficiency

M2070 M2090

M2070