Falling Sand

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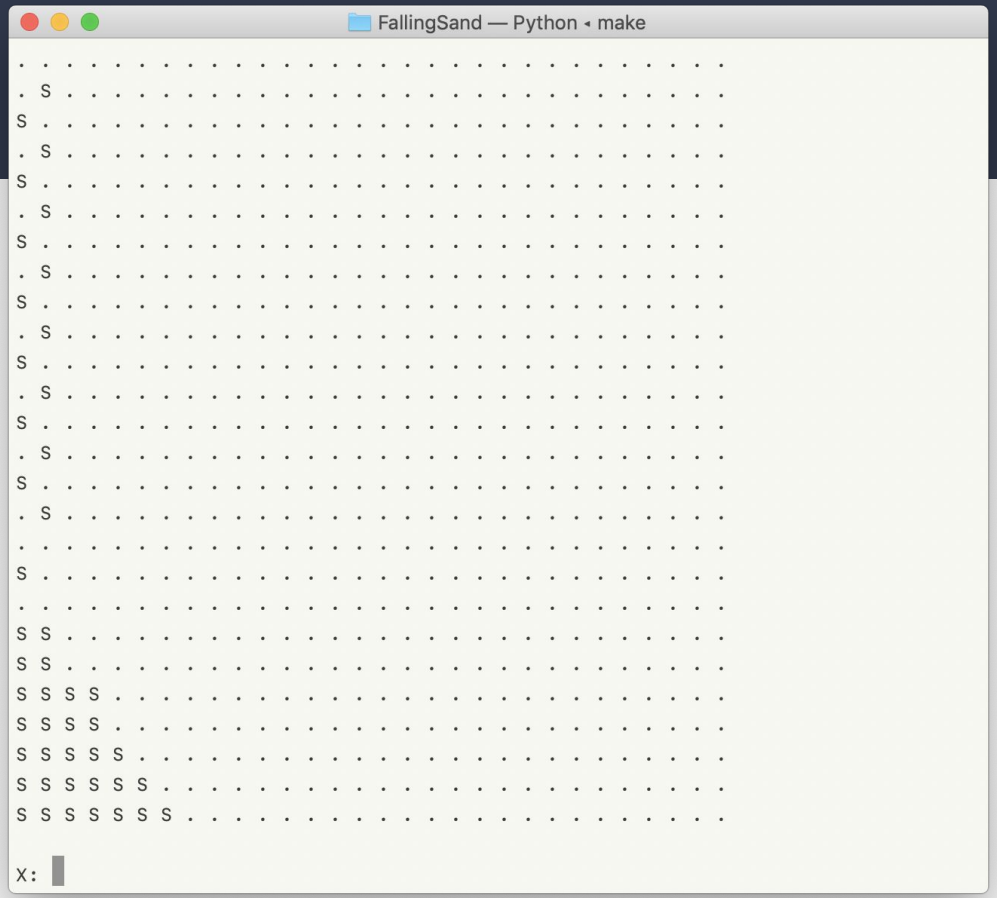
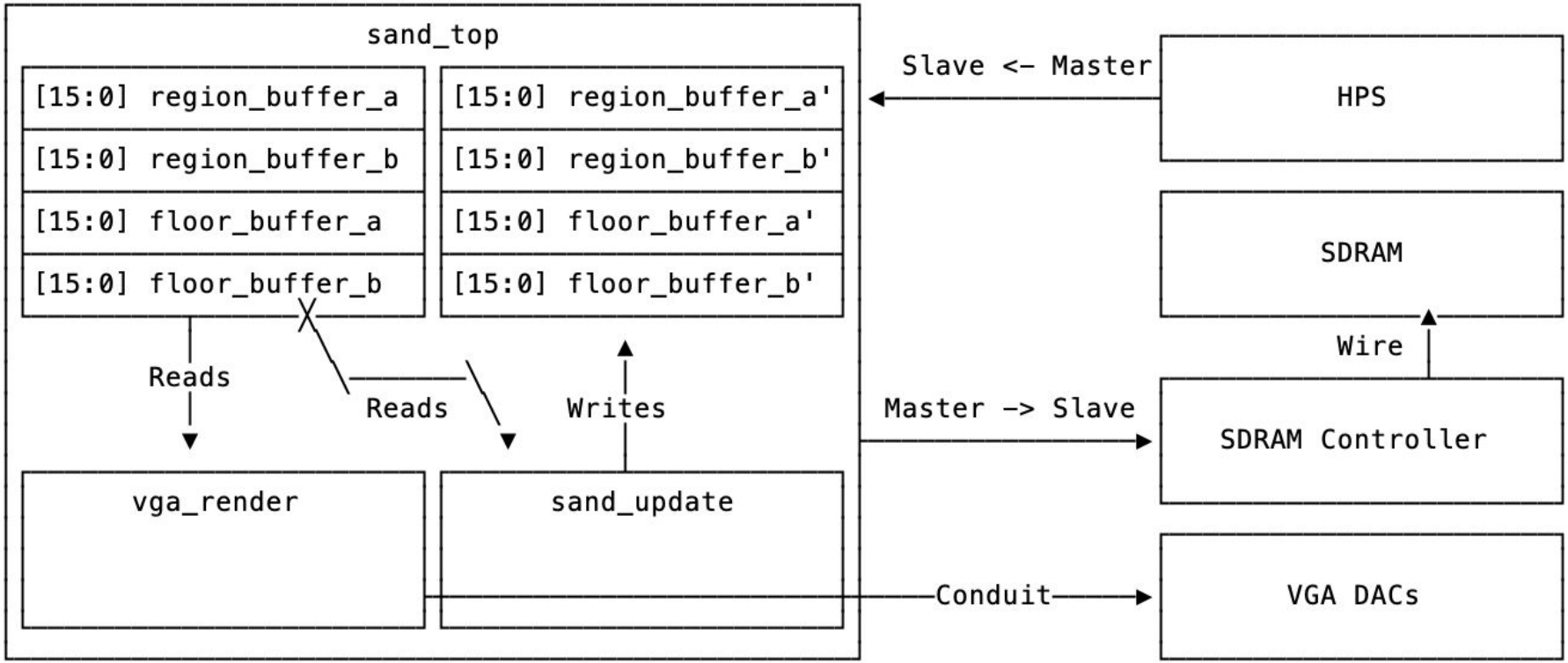
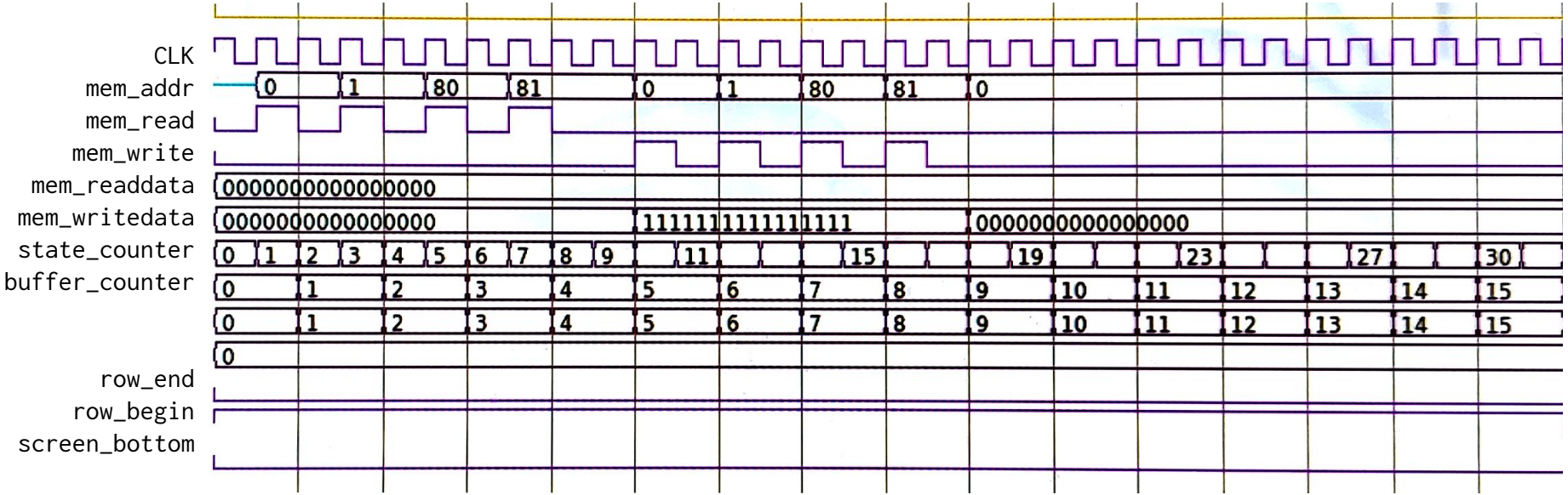
Prototype



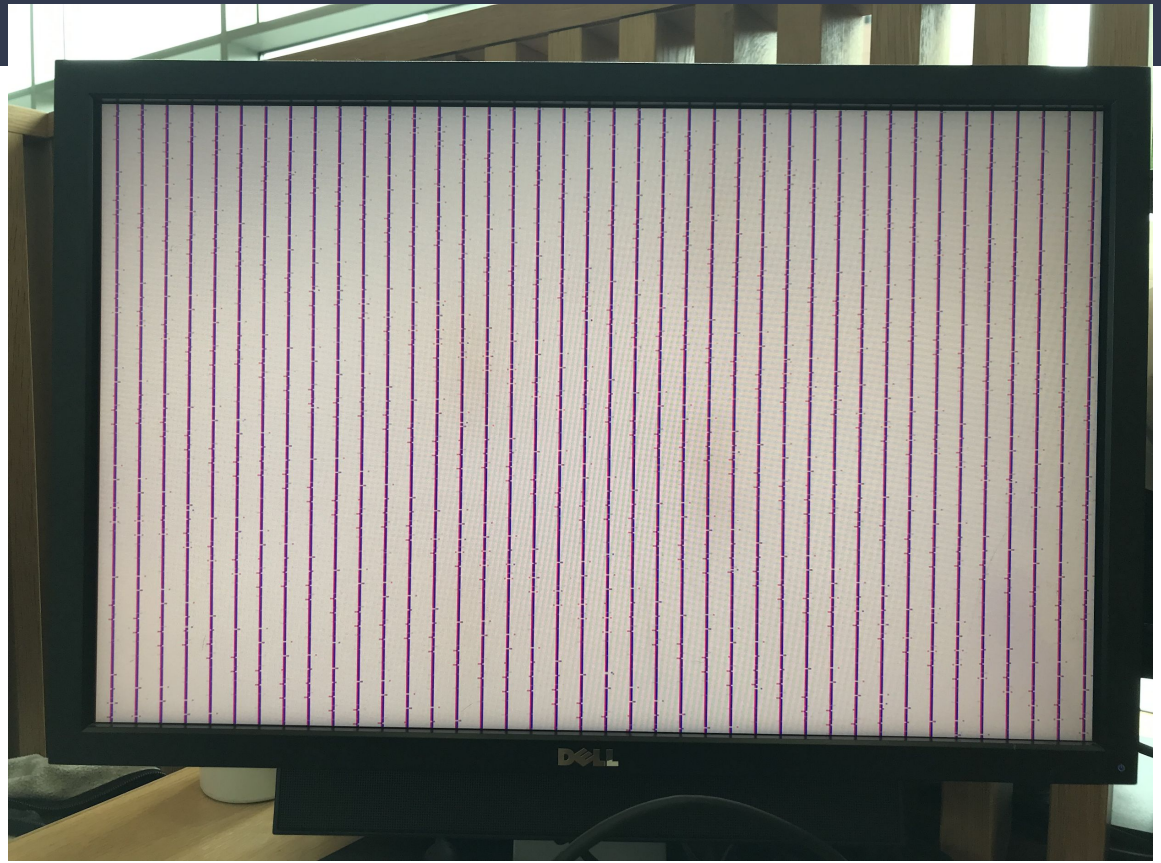
Top Level


sand_top
[15:0] region_buffer_a
[15:0] region_buffer_b
[15:0] floor_buffer_a
[15:0] floor_buffer_b
[15:0] region_buffer_a'
[15:0] region_buffer_b'
[15:0] floor_buffer_a'
[15:0] floor_buffer_b'
Reads
Reads
Writes
vga_render
sand_update
Slave <- Master
HPS
SDRAM
Wire
Master -> Slave
SDRAM Controller
Conduit
VGA DACs

Timing

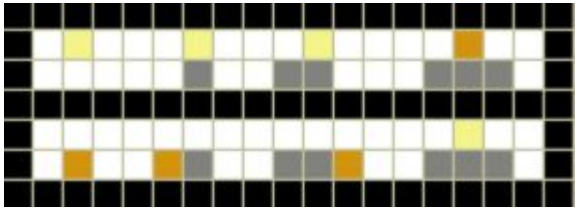

CLK
mem_addr
mem_read
mem_write
mem_readdata
mem_writedata
state_counter
buffer_counter
row_end
row_begin
screen_bottom
0
1
80
81
0
1
80
81
0
0000000000000000
0000000000000000
1111111111111111
0000000000000000
0 1 2 3 4 5 6 7 8 9 11 15 19 23 27 30
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
0

VGA

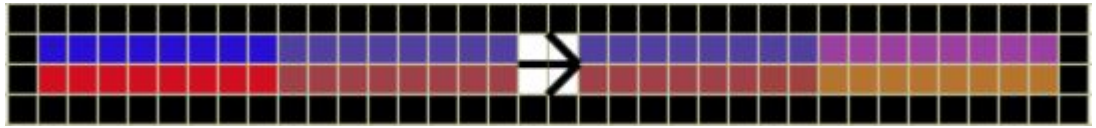


Physics

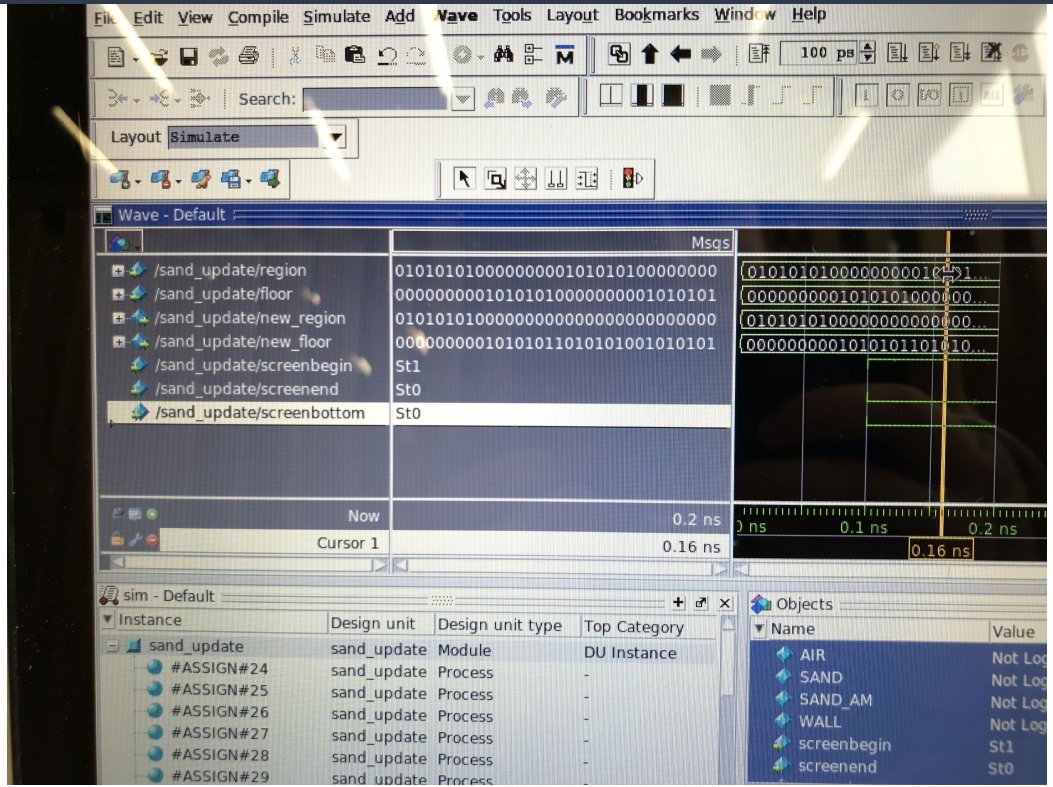
Particle transforms were based on surrounding particles.
We used 4 particle types:
Air, Sand, Sand_AM, and Wall



To ensure there was no “columning error”, trapping sand within an 8 pixel wide partition, each tested value was 4 SDRAM words from memory - two from the current row, and 2 beneath it. The second column of chunks becomes the first column of chunks in the next iteration.



Physics


File Edit View Compile Simulate Add Wave Tools Layout Bookmarks Window Help
100 ps
Search:
Layout Simulate
Wave - Default
Msgs
/sand_update/region
/sand_update/floor
/sand_update/new_region
/sand_update/new_floor
/sand_update/screenbegin
/sand_update/screenend
/sand_update/screenbottom
St1
St0
St0
Now
0.2 ns
Cursor 1
0.16 ns
0.1 ns
0.2 ns
0.16 ns
sim - Default
Instance
Design unit
Design unit type
Top Category
sand_update
sand_update
Module
DU Instance
#ASSIGN#24
#ASSIGN#25
#ASSIGN#26
#ASSIGN#27
#ASSIGN#28
#ASSIGN#29
Process
Objects
Name
Value
AIR
SAND
SAND_AM
WALL
screenbegin
screenend
St1
St0

Challenges

SDRAM access - the SDRAM controller escaped us. We tested it by using read/write verification signals represented by blue and red particles in our chunk. Red and Blue stripes appeared at 8 pixel intervals, verifying our VGA driver but revealing that SDRAM continued to not actually store values.