

RAY TRACING IN CNC



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SIMPLE

BETTER

ANIMATED

AWESOME

A SIMPLE RAY TRACER

A SLIGHTLY BETTER RAY TRACER

AN ANIMATED RAY TRACER

AN AWESOME RAY TRACER

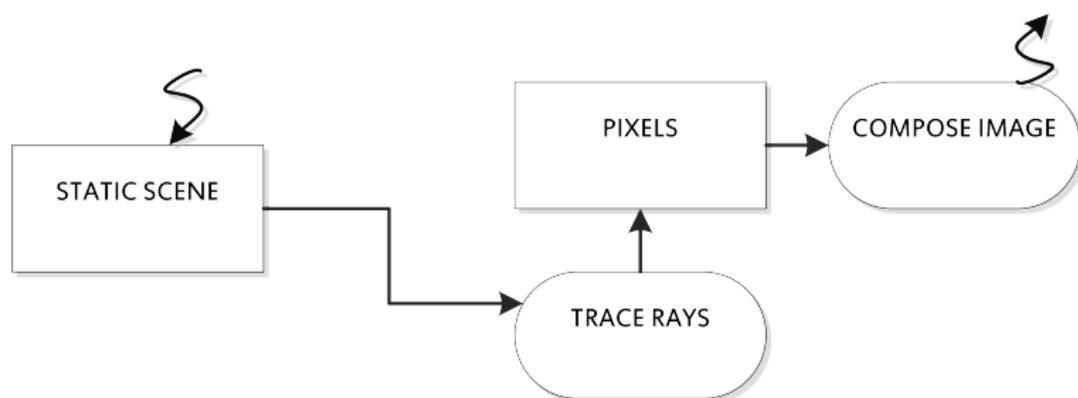
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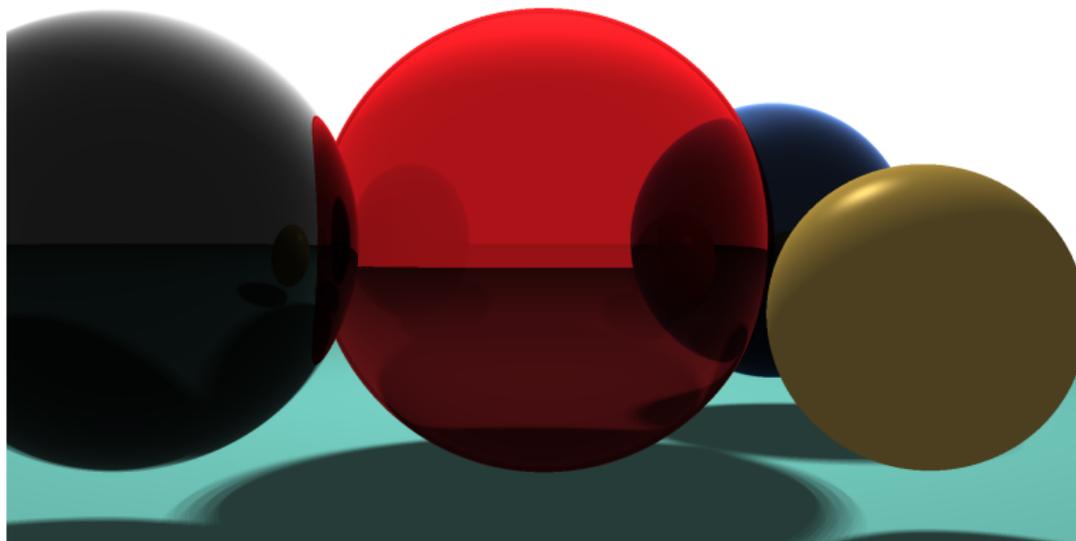
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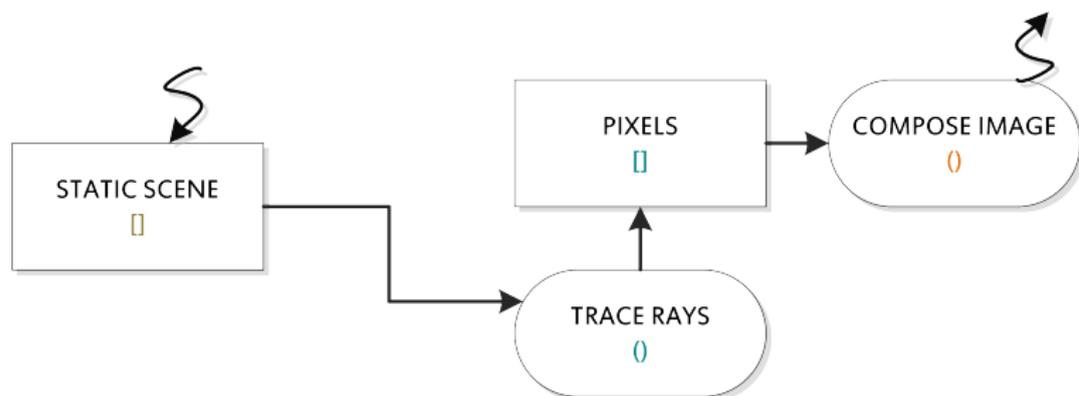
AWESOME



A SIMPLE RAY TRACER

- ▶ 1080x1920
- ▶ 2073600 pixels
- ▶ 2073600 \times 4 \times 4 initial rays
- ▶ **23.9314** seconds to compute
- ▶ **1** instance of the trace rays step

A SIMPLE RAY TRACER



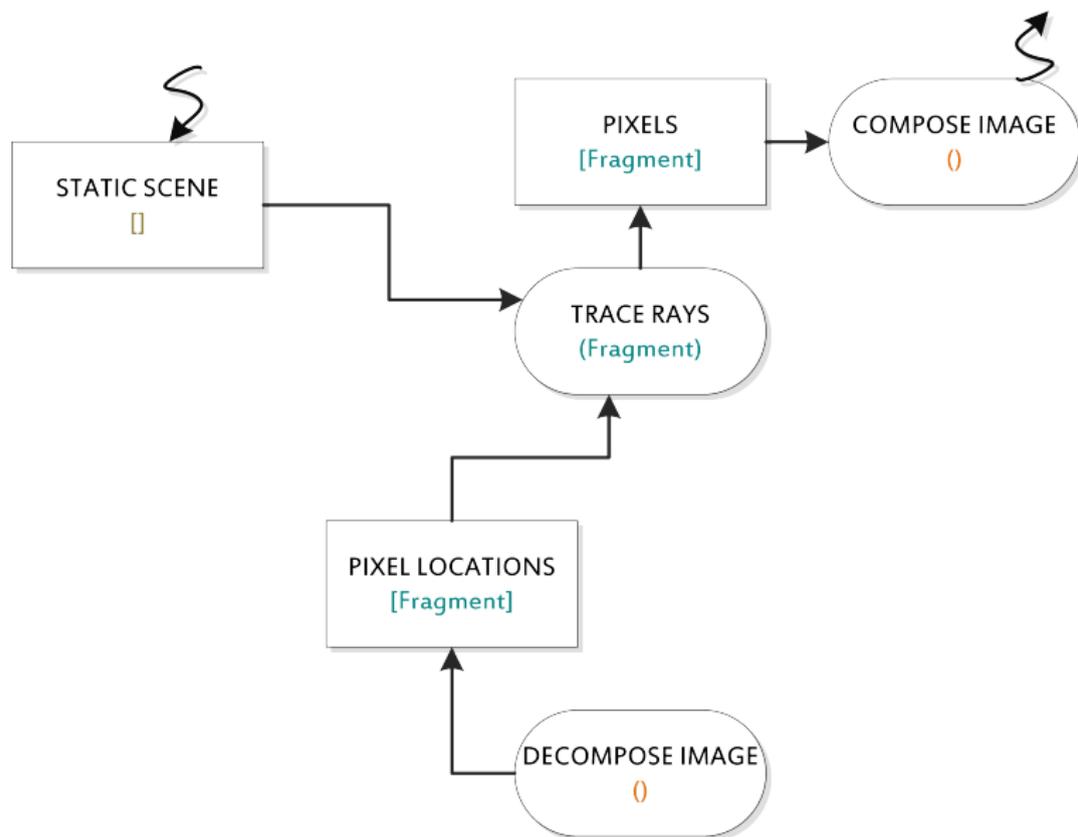
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A SLIGHTLY BETTER RAY TRACER



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A SLIGHTLY BETTER RAY TRACER

- ▶ 1080x1920
- ▶ 2073600 pixels
- ▶ 2073600 \times 4 \times 4 initial rays split amongst 8 fragments (259200 pixels each)

| | | | |
|---------|---------|---------|---------|
| 1 | 2 | 3 | 4 |
| 2.86122 | 5.78101 | 3.40776 | 5.82813 |
| 5 | 6 | 7 | 8 |
| 7.89721 | 7.67004 | 8.41823 | 5.80659 |

- ▶ **6.19** average seconds to compute
- ▶ **8** instances of the trace rays step

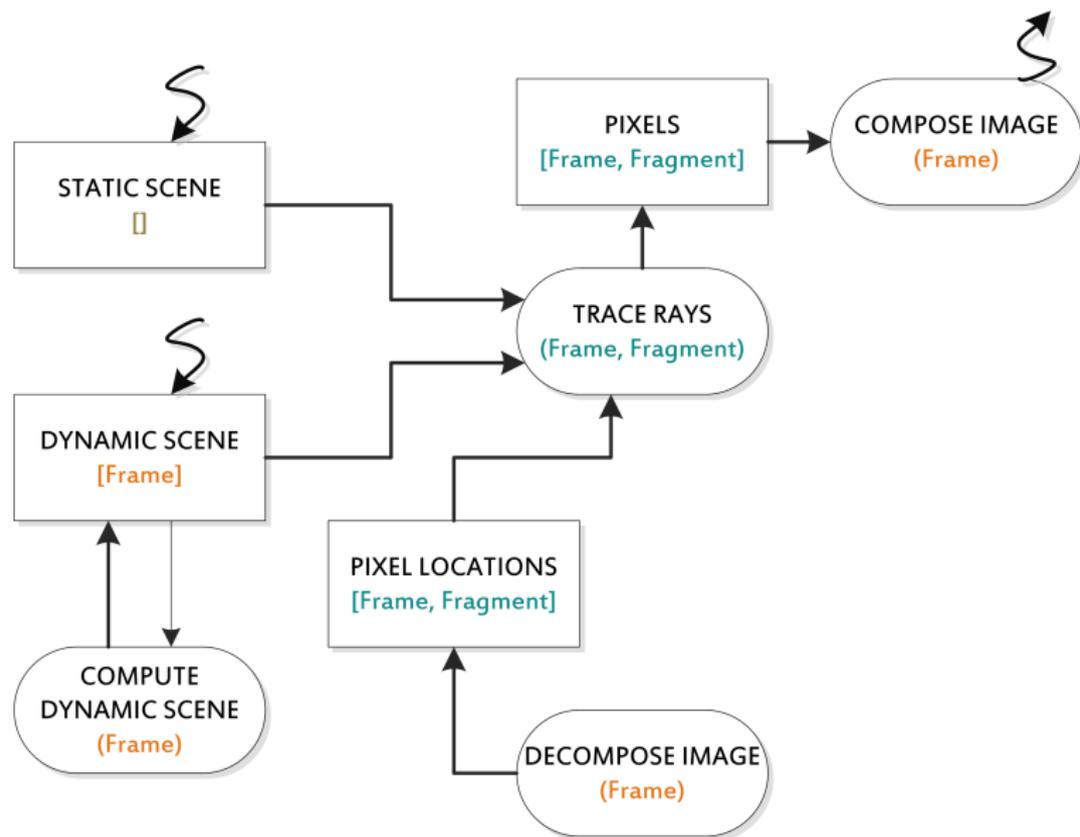
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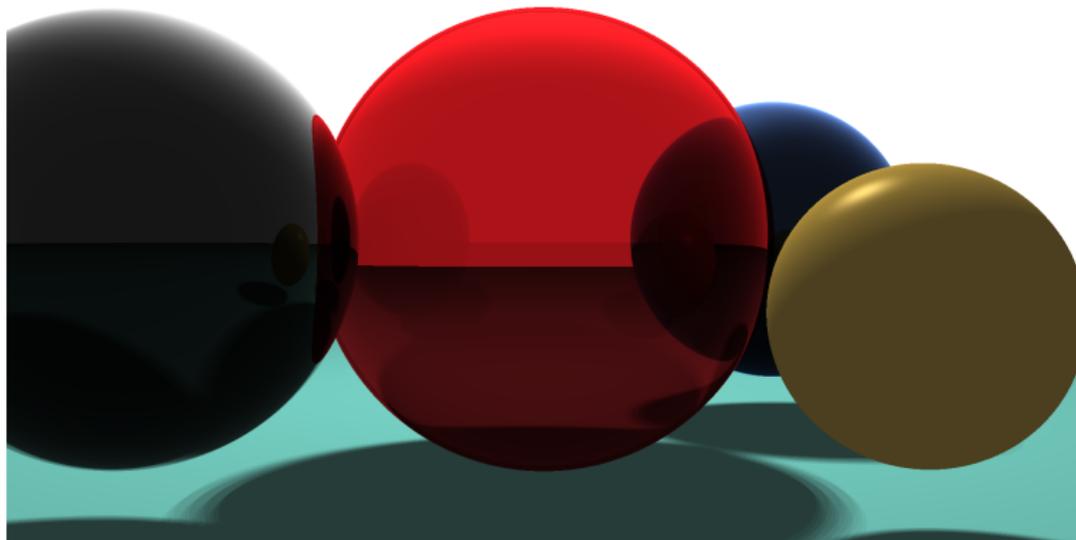
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AN ANIMATED RAY TRACER

- ▶ 1080x1920 x 10 frames
- ▶ 2073600 pixels per frame
- ▶ 2073600 x 4 x 4 initial rays per frame split amongst 8 fragments (259200 pixels each)
- ▶ **6.19** average seconds to compute
- ▶ **80** instances of the trace rays step

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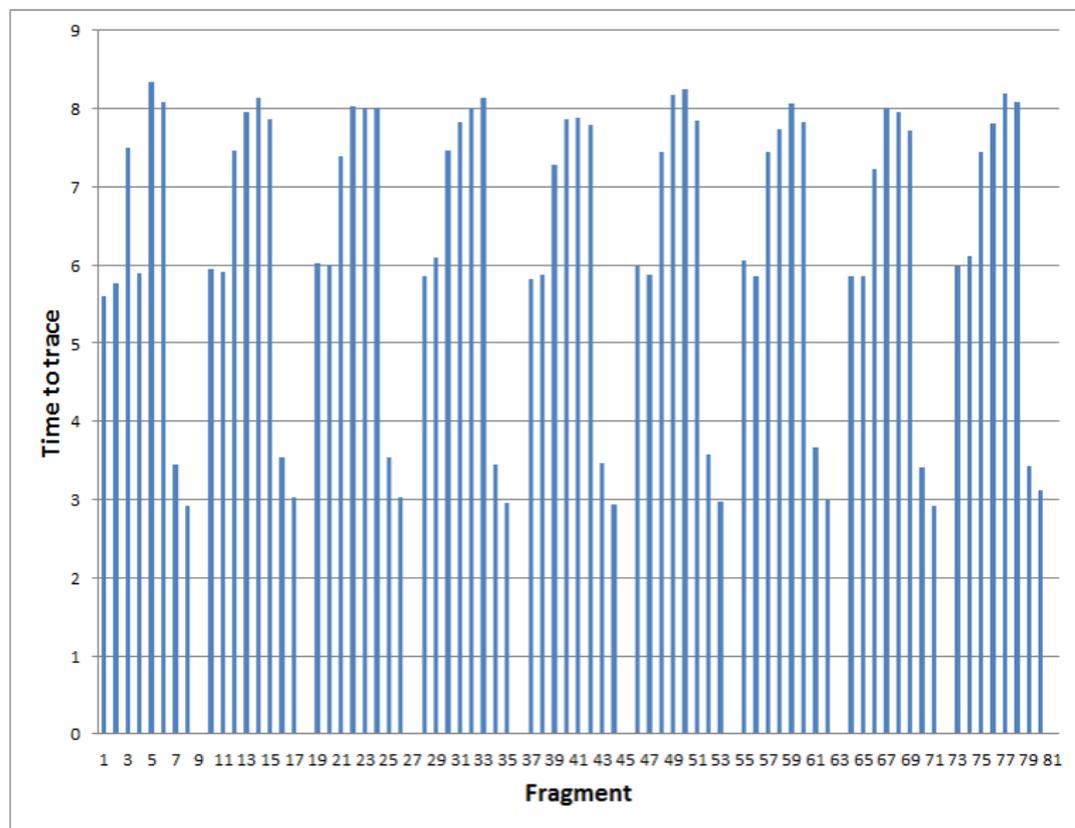
COMPUTATION TIME PER FRAGMENT

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AN ANIMATED RAY TRACER

- ▶ Producing high definition images at around 6 seconds per frame, not bad!
- ▶ A standard deviation of 1.9 hurts the actual time per frame, 8.12
- ▶ But... what if we dynamically assign the pixels based on the previous computation time?

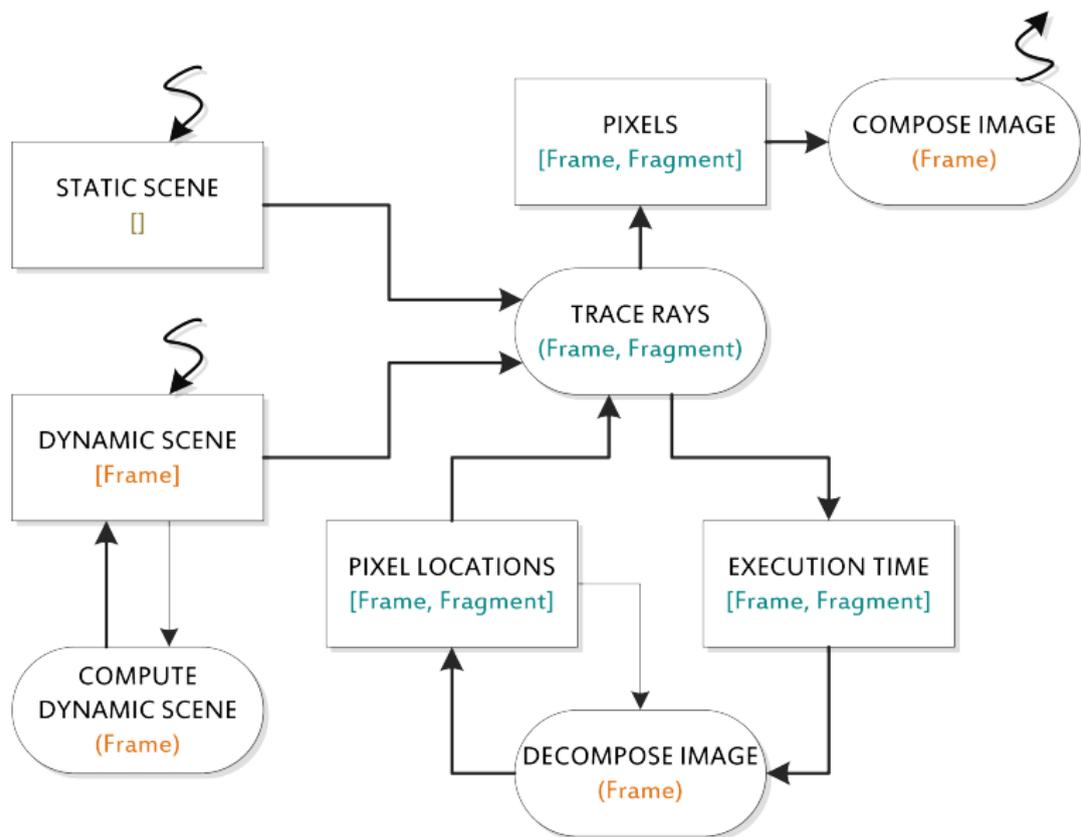
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AN AWESOME RAY TRACE



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COMPUTATION TIME PER FRAGMENT

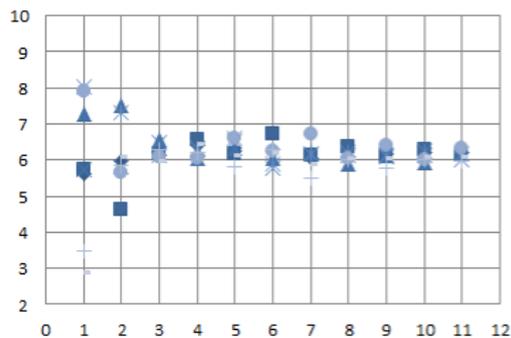
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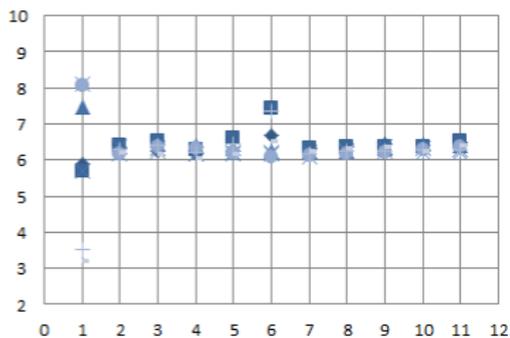
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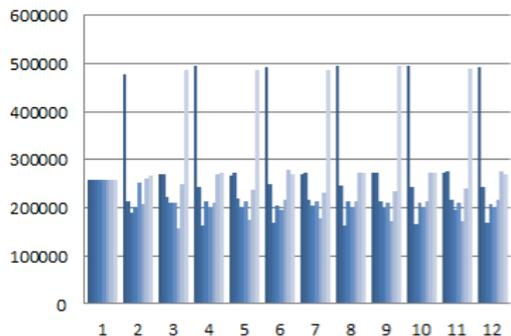
Execution Time per Frame (Sequential Picking)



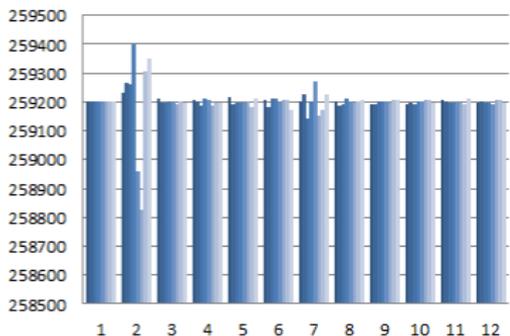
Execution Time per Frame (Random Picking)



Pixels per Frame per Bin (Sequential Picking)



Pixels per Frame per Bin (Random Picking)



AN AWESOME RAY TRACER

- ▶ Tested using two different algorithms, sequential and random picking
- ▶ Statistics were taken after the first iteration

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| case | average | worst | best | sdd |
|--------------------|-------------|-------------|-------------|-------------|
| no fragments | 6.16 | | | |
| constant size | 6.19 | 8.35 | 2.91 | 1.90 |
| sequential picking | 6.17 | 7.51 | 4.62 | 0.35 |
| random picking | 6.32 | 7.44 | 6.05 | 0.21 |