

Radiance Rendering Acceleration

Andrei Kolomenski
MEIT

Andrei.Kolomenski@nasa.gov

James C. Maida
NASA JSC

James.C.Maida@nasa.gov

Benchmark Setup

Hardware:

CPU: Intel Xeon CPU X5670 @ 4Ghz / 49,152 MB RAM

GPU: EVGA GeForce GTX 980 SC / 4 GB VRAM

Software:

Radiance x64 5.0.a.3 <https://github.com/NREL/Radiance/releases>

Accelerad x64 0.3 (5.0.a.3) <http://web.mit.edu/sustainabledesignlab/projects/Accelerad/>



RPICT Rendering Parameters for ISS Interior

Truth: -lr 9 -lw 0.0005 -ps 1 -pt 0.05 -ss 2 -st 0 -as 256 -dr 3 -dp 1024 -ds 0 -dt 0 -dc 1 -ab 11 -ar 256 -aa 0 -ad 2048

Constant: -lr 7 -lw 1.00e-03 -ps 4 -pt 0.05 -dr 1 -dp 512 -dt 0.05 -dc 0.5

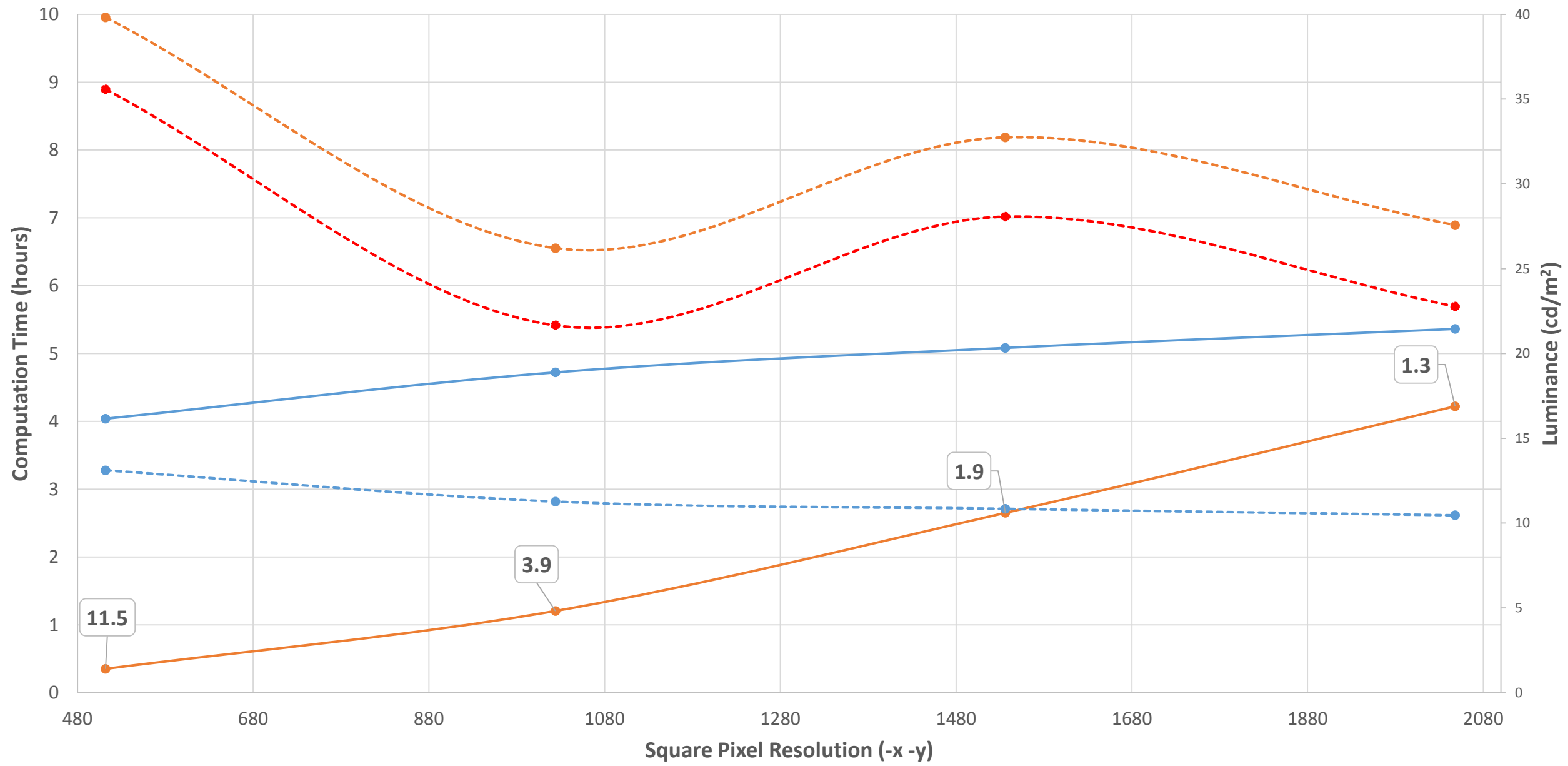
Dynamic (Default): -ab 5 -aa 0.1 -ds 0.1 -st 0.1 -x 1024 -y 1024

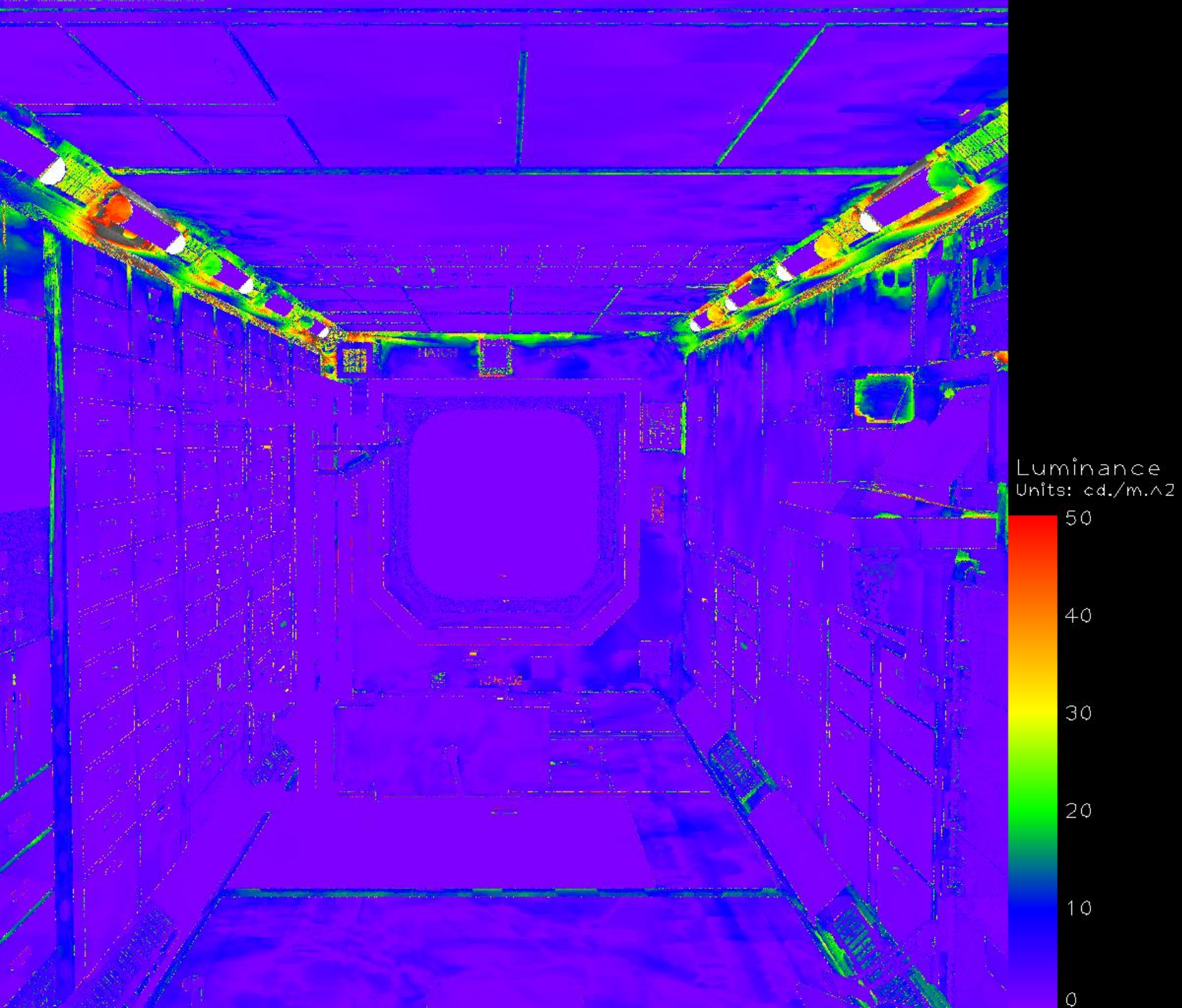
Absolute CPU or GPU Error = abs(CPU or GPU image – Truth image)

Relative Error = abs(CPU image – GPU image)

Image Resolution VS Computation Time for ISS Interior

—●— CPU Time —●— GPU Time -●- Relative Error -●- CPU Absolute Error -●- GPU Absolute Error





**ALL FALSE COLOR IMAGES
shown are Relative Error Images**

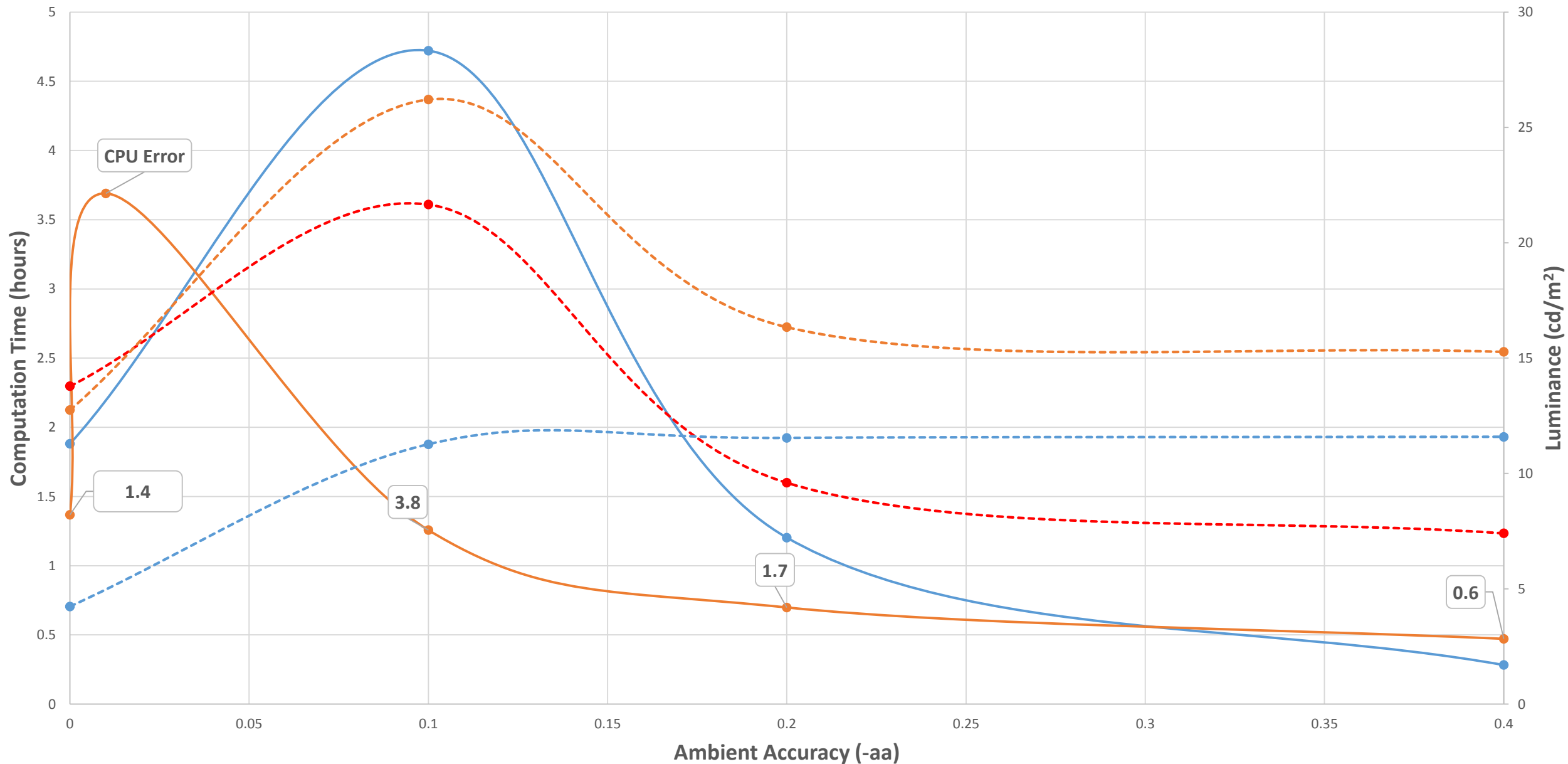
**Dynamic RPICT Parameters:
-ab 5 -aa 0.1 -ds 0.1 -st 0.1 -x 1024 -y
1024**

Average Relative Error = 21.7 cd/m²

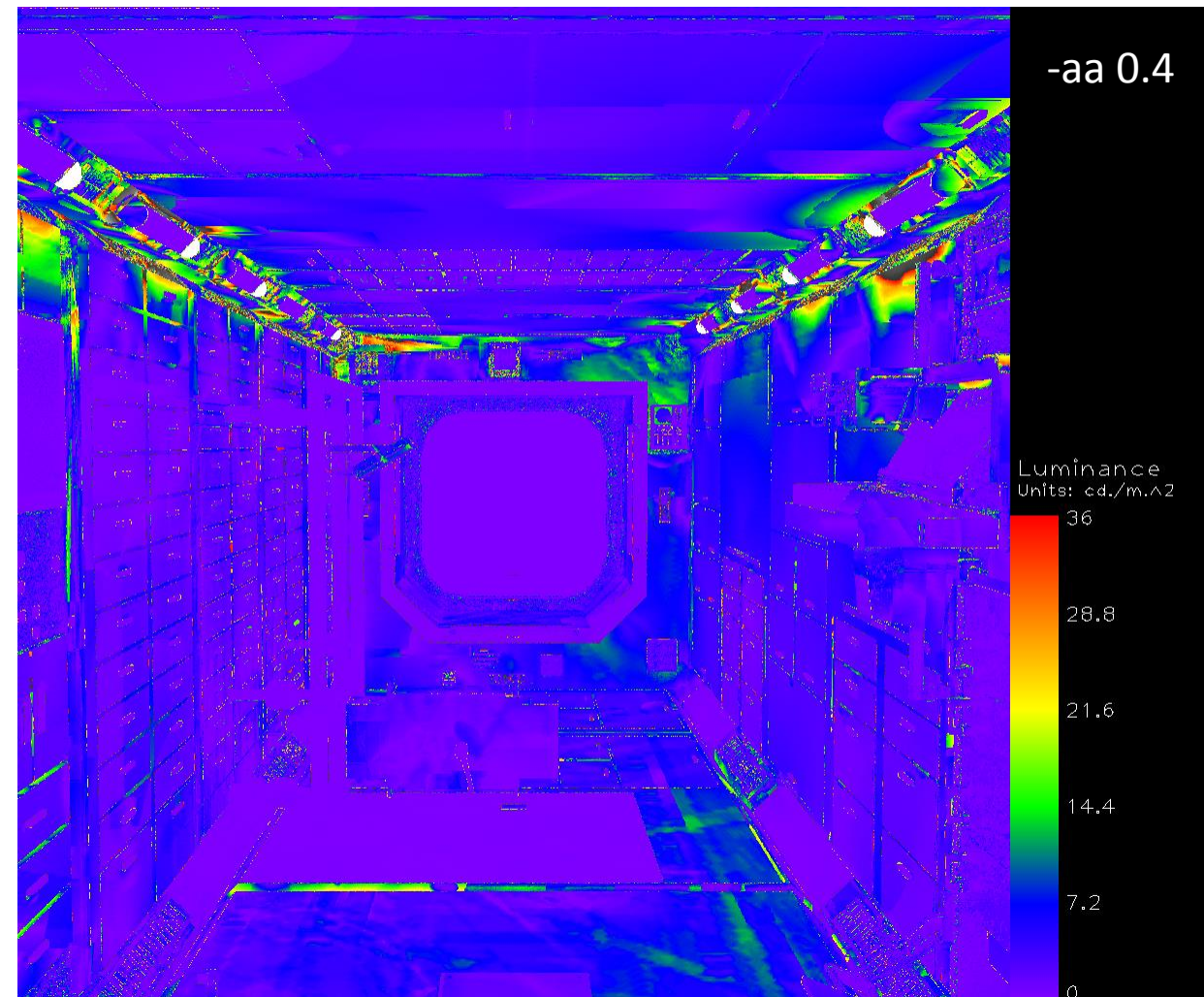
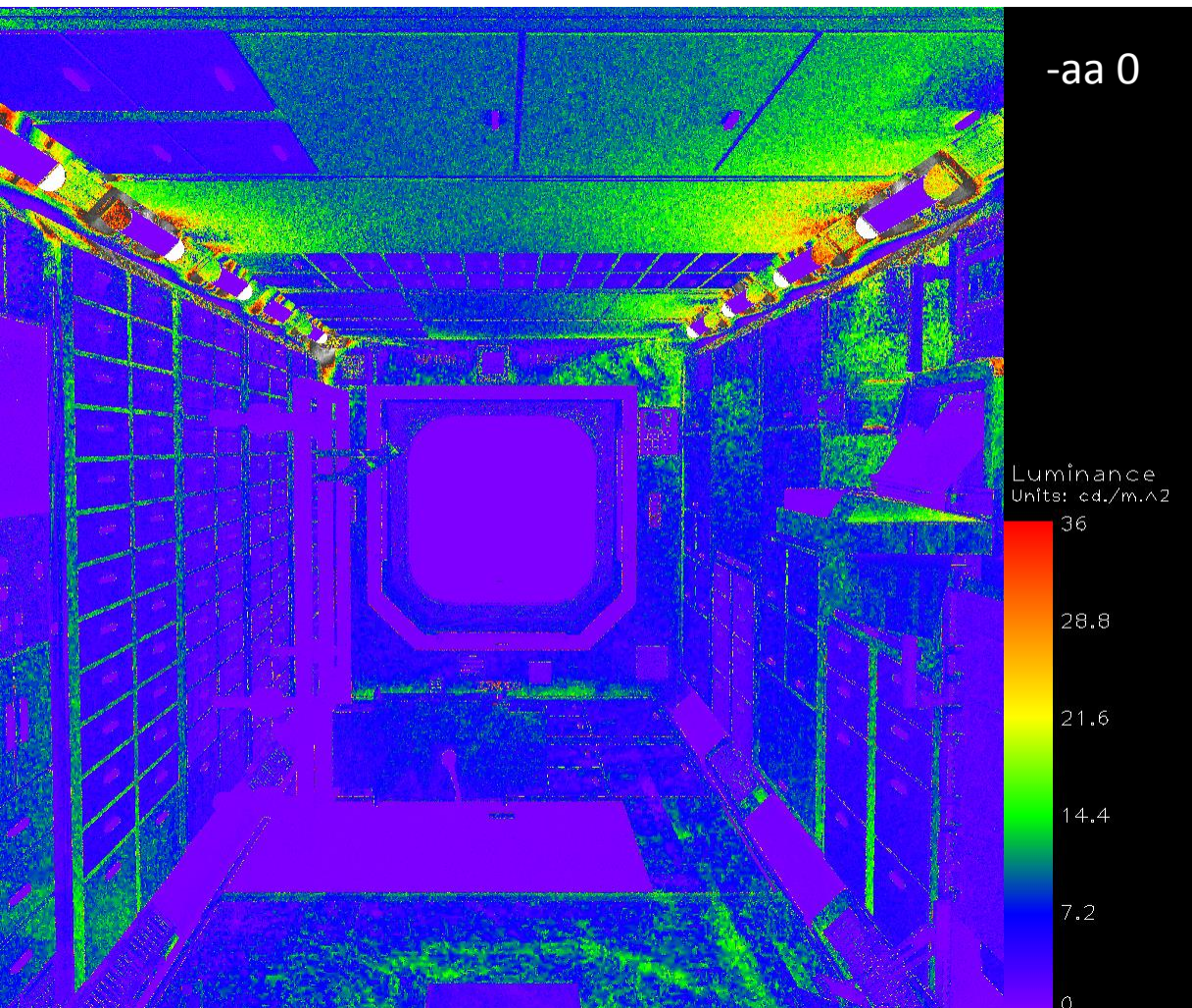
**Error is concentrated around adjacent
surfaces next to light sources.**

Ambient Accuracy VS Computation Time for ISS Interior

—●— CPU Time —●— GPU Time - -●- Relative Error - -●- CPU Absolute Error - -●- GPU Absolute Error



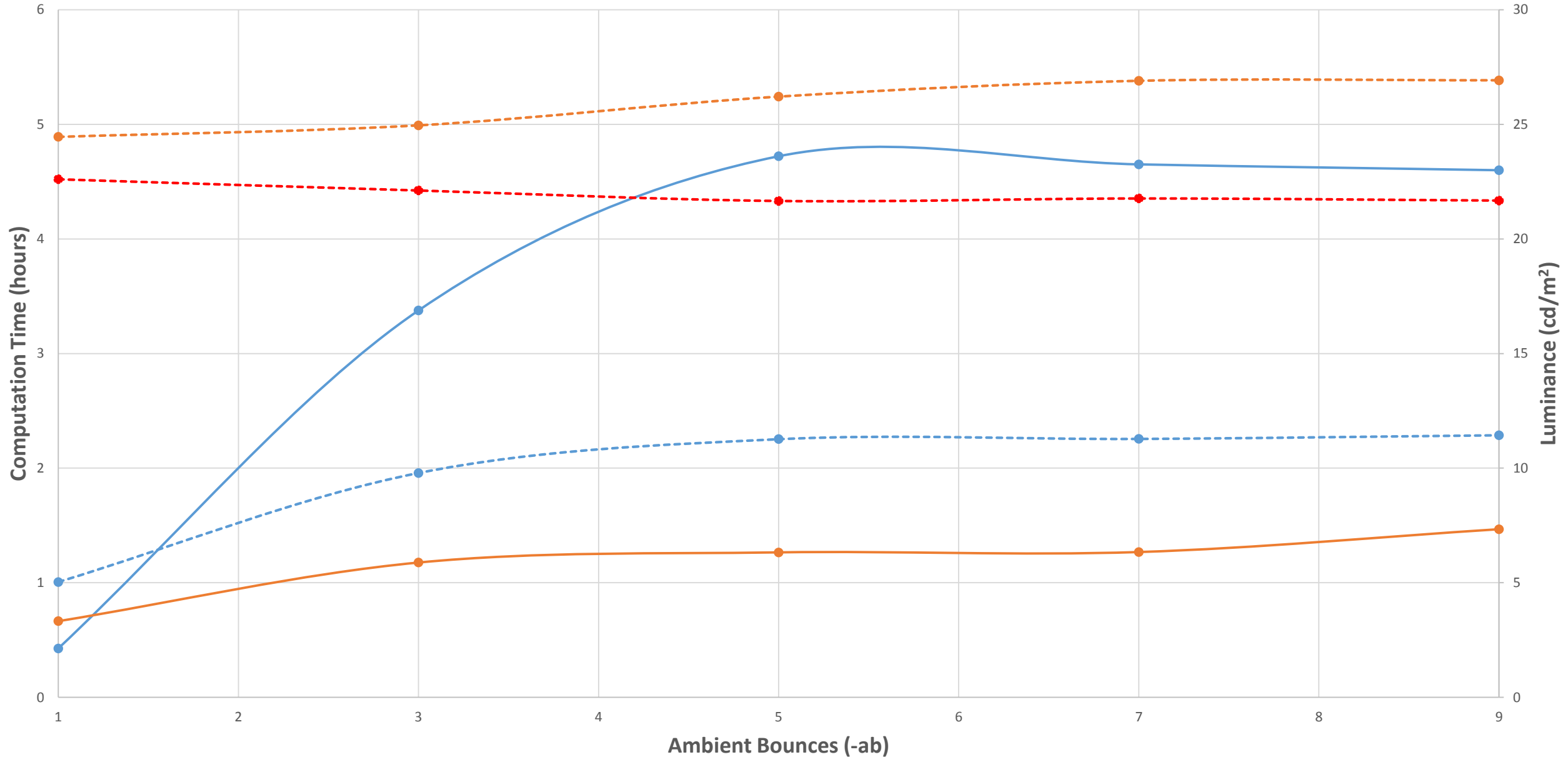
Ambient Accuracy -aa



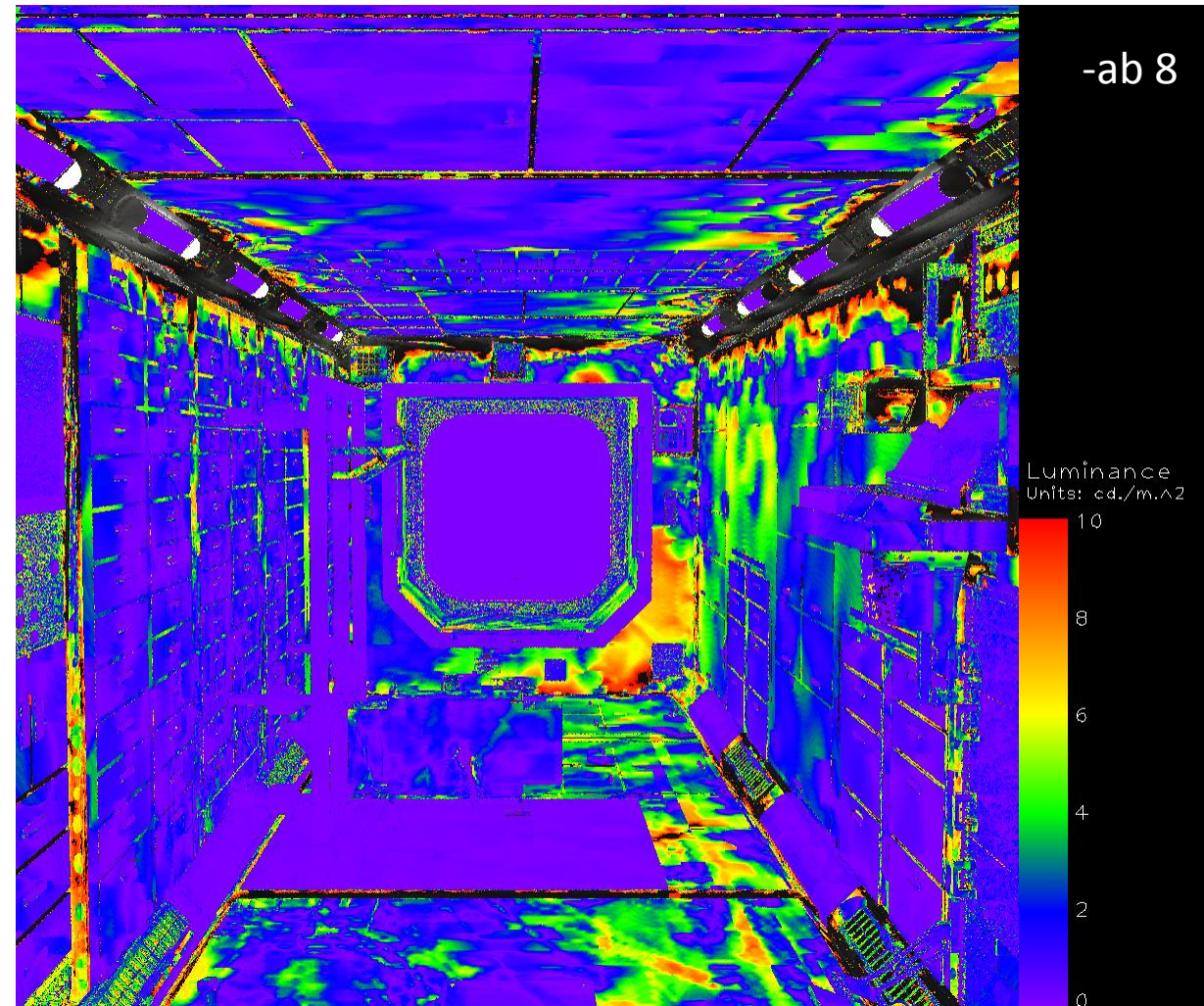
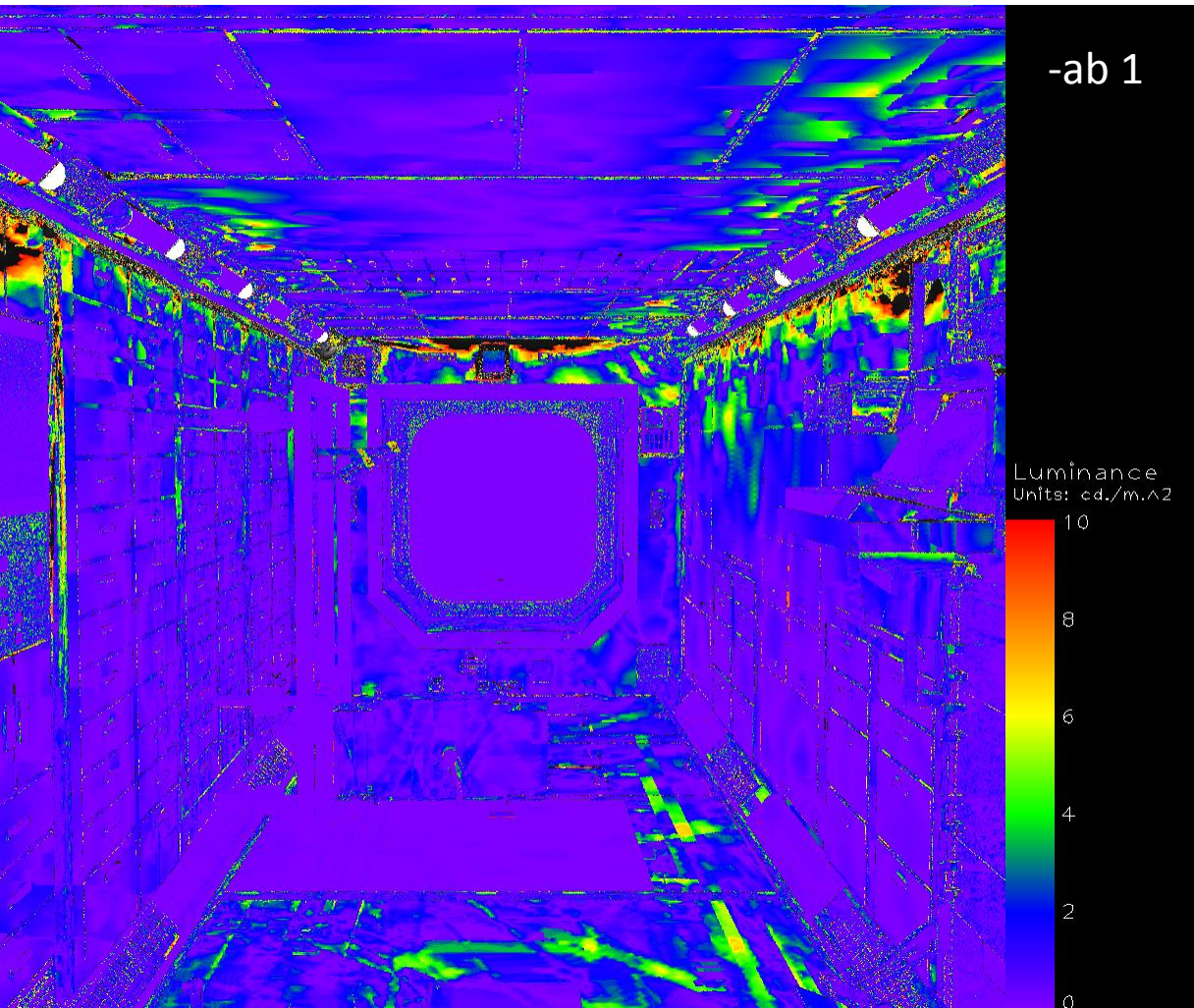
Dynamic RPICT Parameters: -ab 5 -ds 0.1 -st 0.1 -x 1024 -y 1024

Ambient Bounces VS Computation Time for ISS Interior

CPU Time GPU Time Relative Error CPU Absolute Error GPU Absolute Error



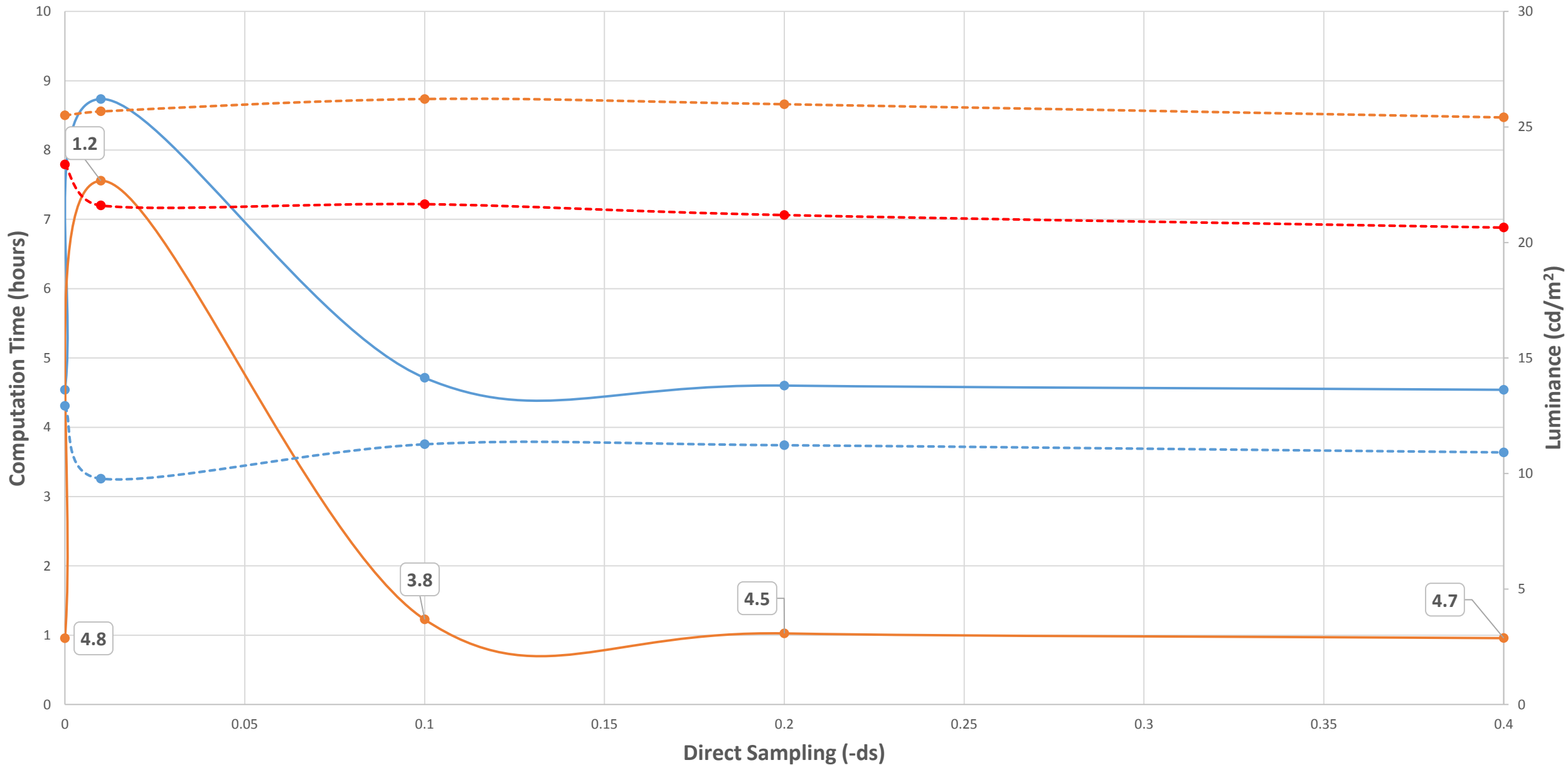
Ambient Bounces -ab



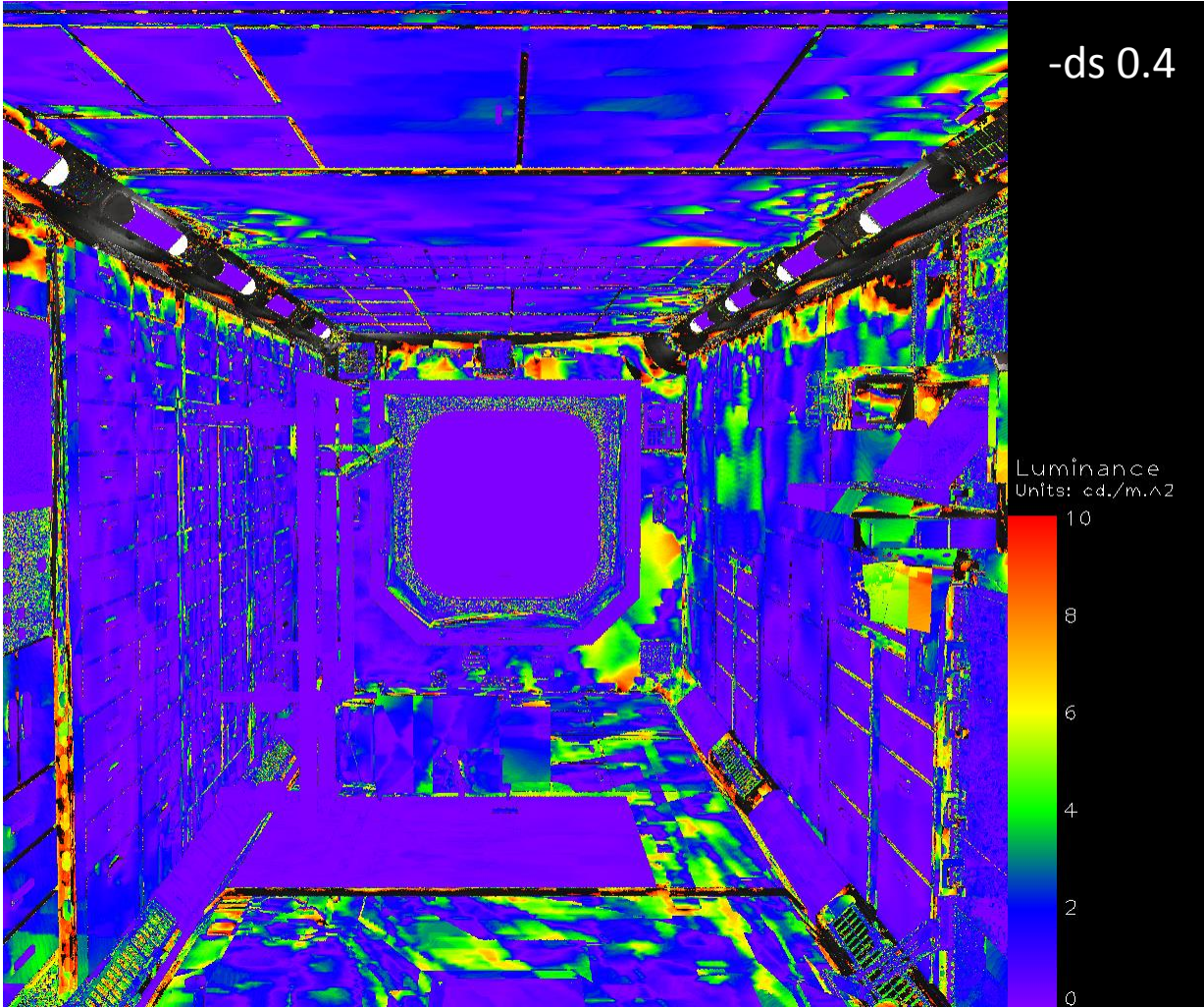
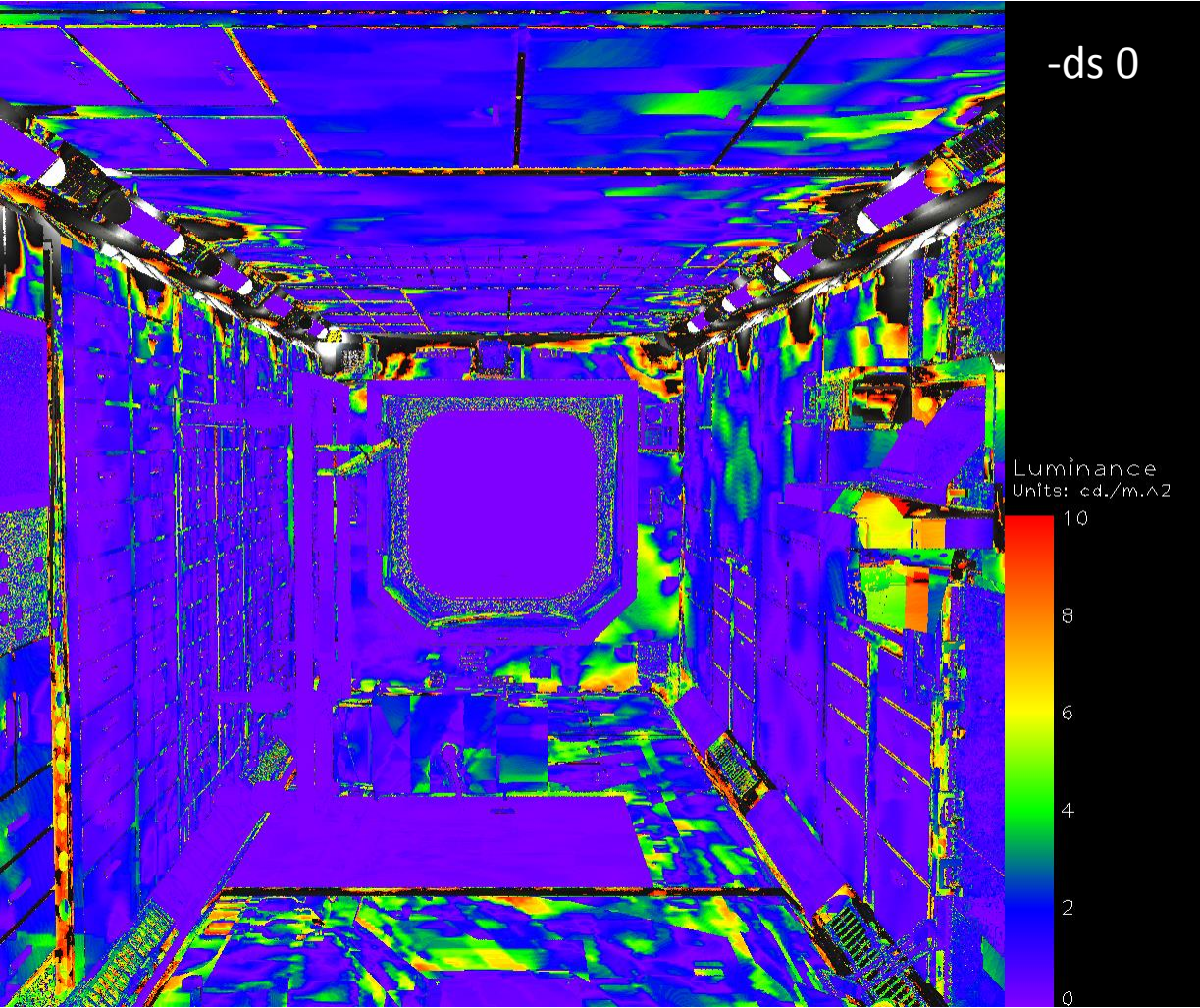
Dynamic RPICT Parameters: -aa 0.1 -ds 0.1 -st 0.1 -x 1024 -y 1024

Direct Sampling VS Computation Time for ISS Interior

—●— CPU Time —●— GPU Time -.-●- Relative Error -.-●- CPU Absolute Error -.-●- GPU Absolute Error



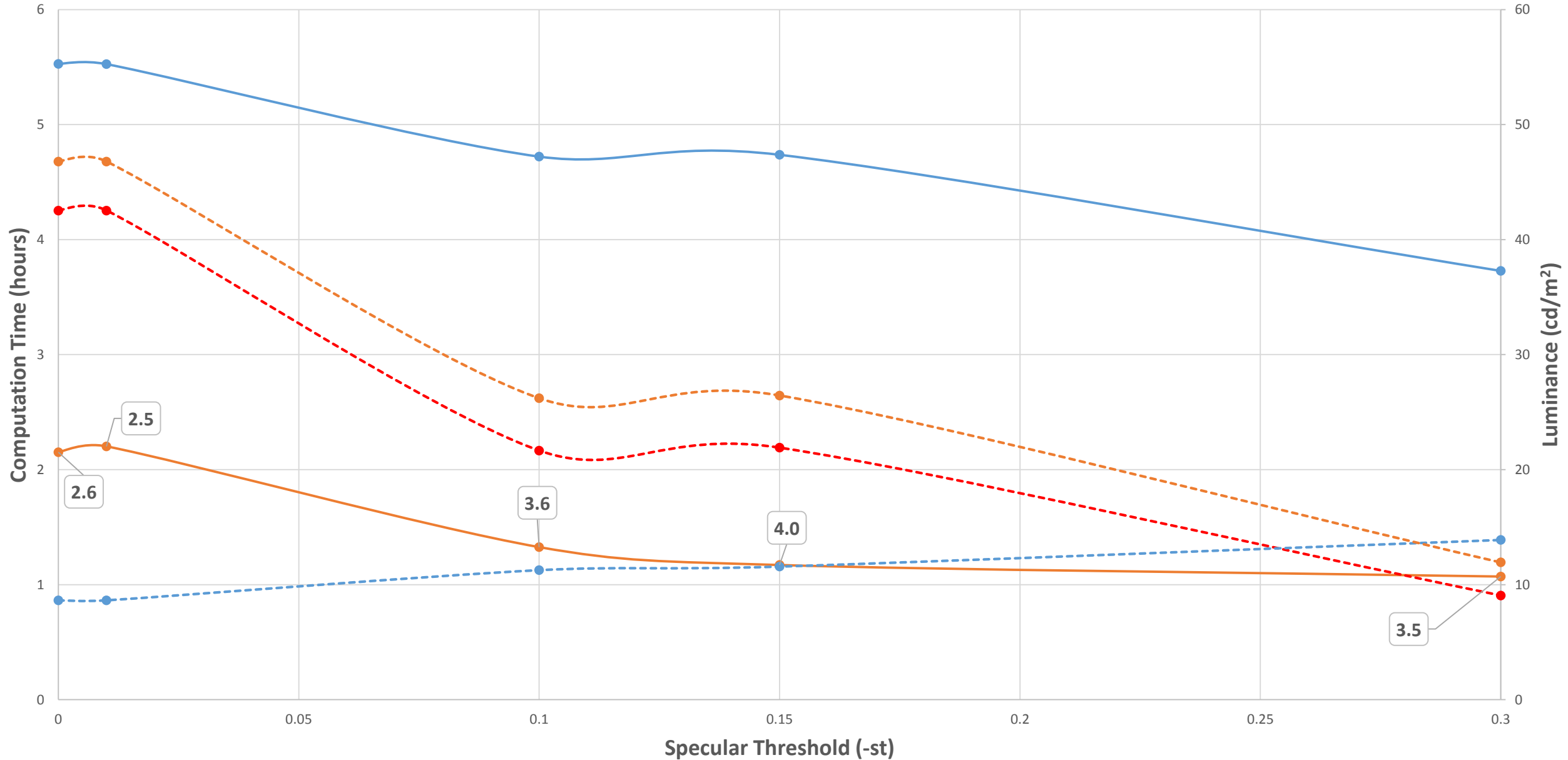
Direct Sampling -ds



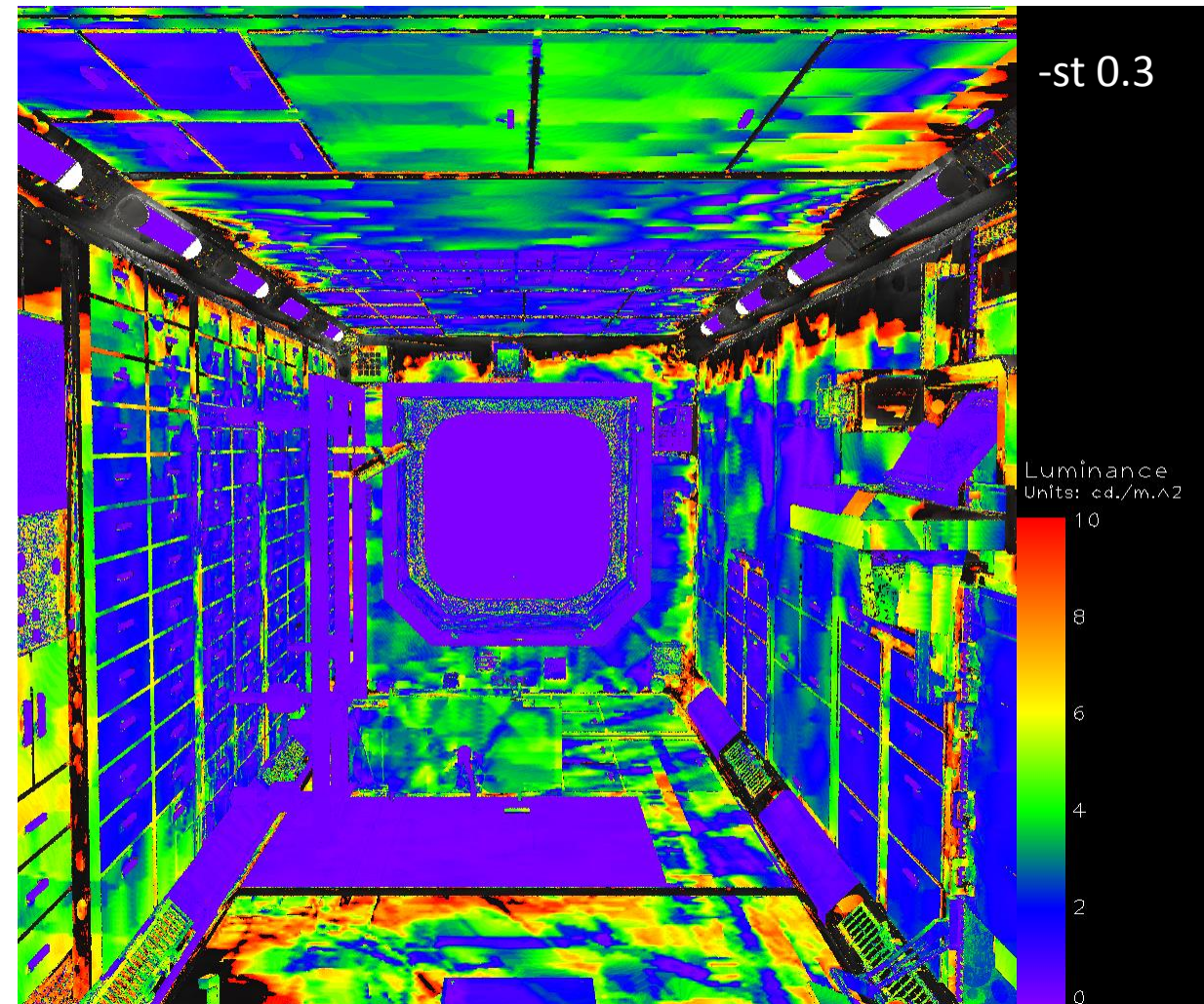
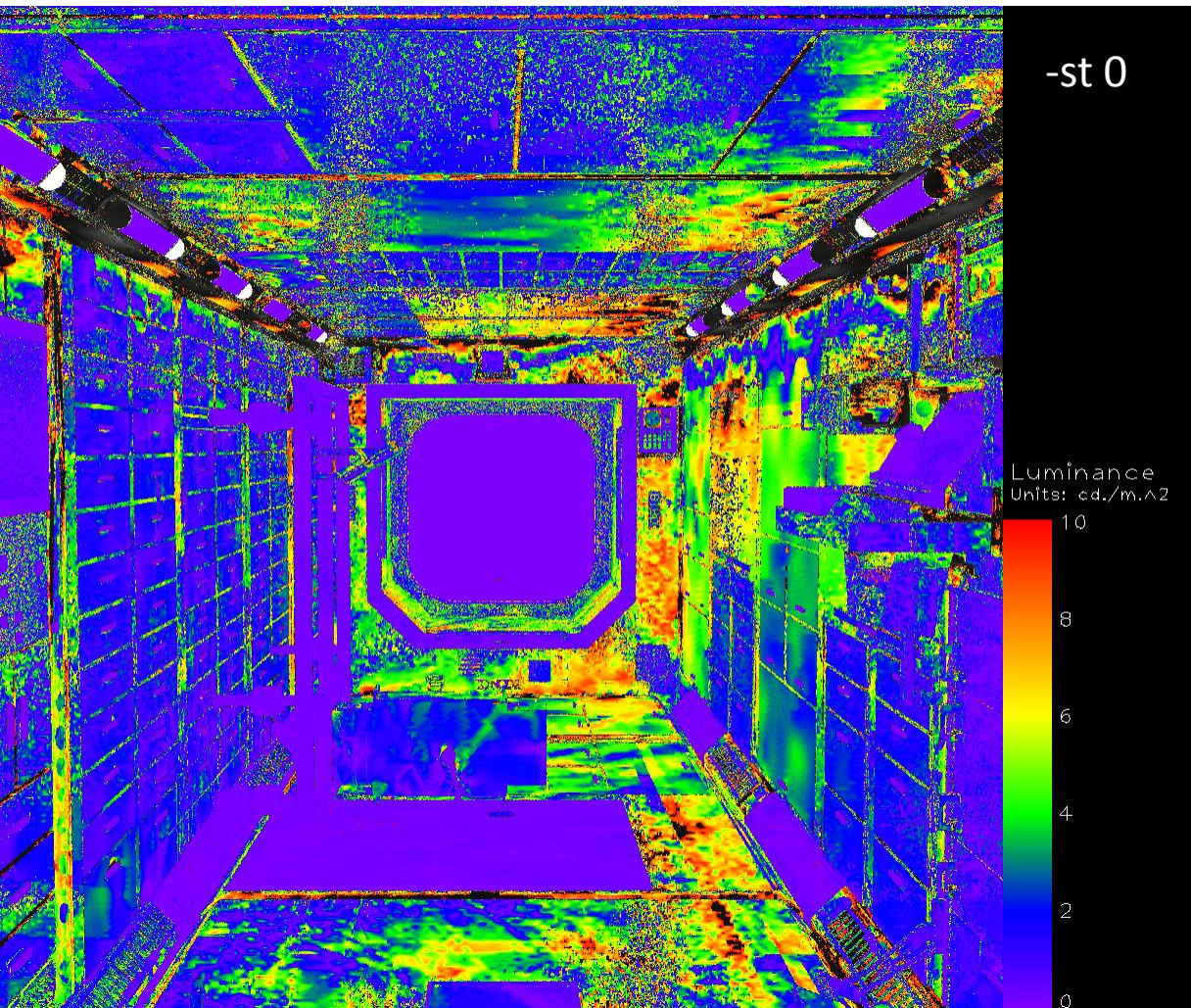
Dynamic RPICT Parameters: -ab 5 -aa 0.1 -st 0.1 -x 1024 -y 1024

Specular Threshold VS Computation Time for ISS Interior

CPU GPU Relative Error Absolute CPU Error Absolute GPU Error



Specular Threshold -st



Dynamic RPICT Parameters: -ab 5 -aa 0.1 -ds 0.1 -x 1024 -y 1024