Forward Rasterization

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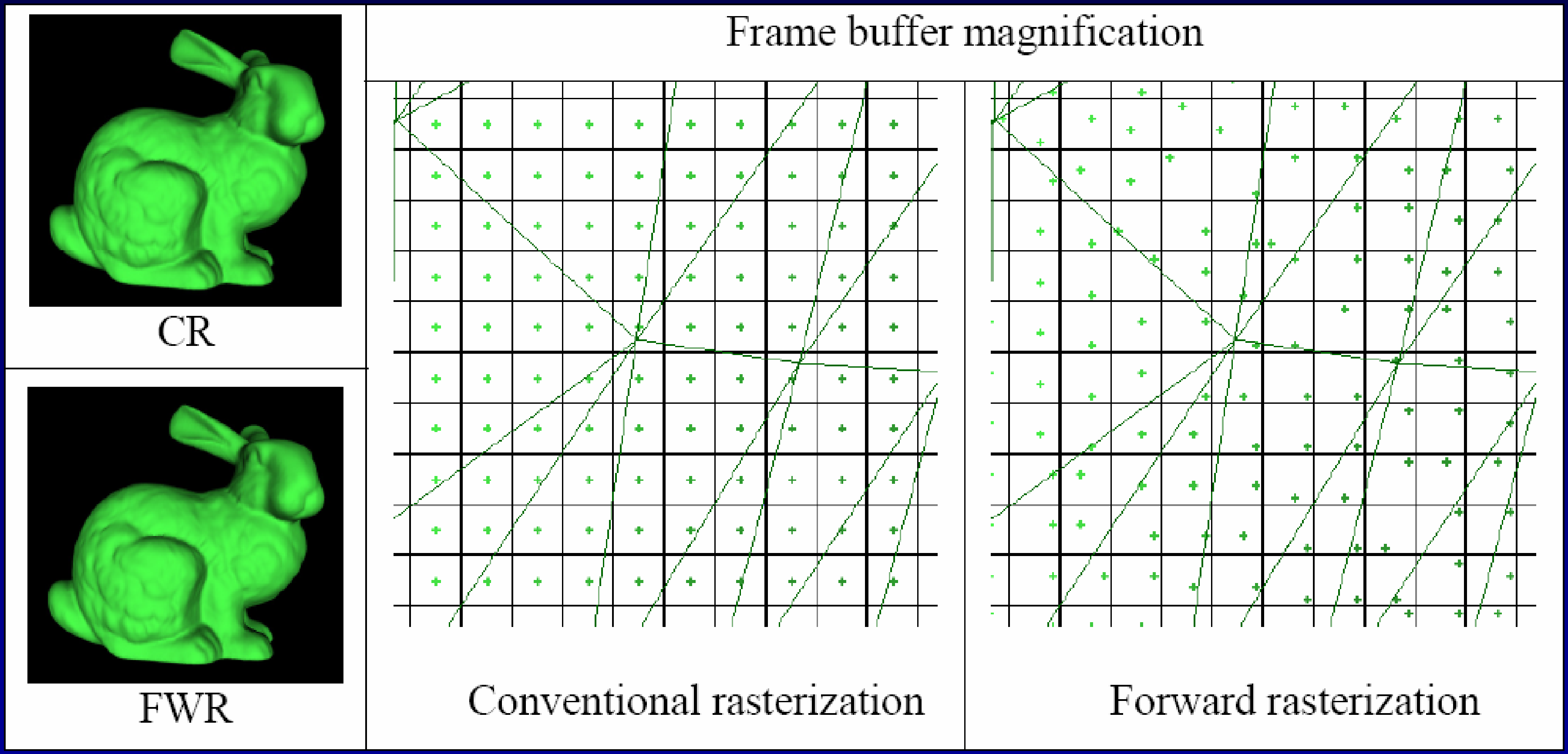
Class of Algorithm

- Samples are generated by interpolation between the vertices of the primitive.
- Sufficient samples are generated to *guarantee* that each pixel covered by the primitive receives at least one sample.
- The position on the desired image plane of each sample is recorded with subpixel accuracy using a pair of offsets.
- After all primitives are rasterized and z-buffered, the final image is reconstructed/resampled using the offsets stored with each sample.

Frame Buffer Magnification



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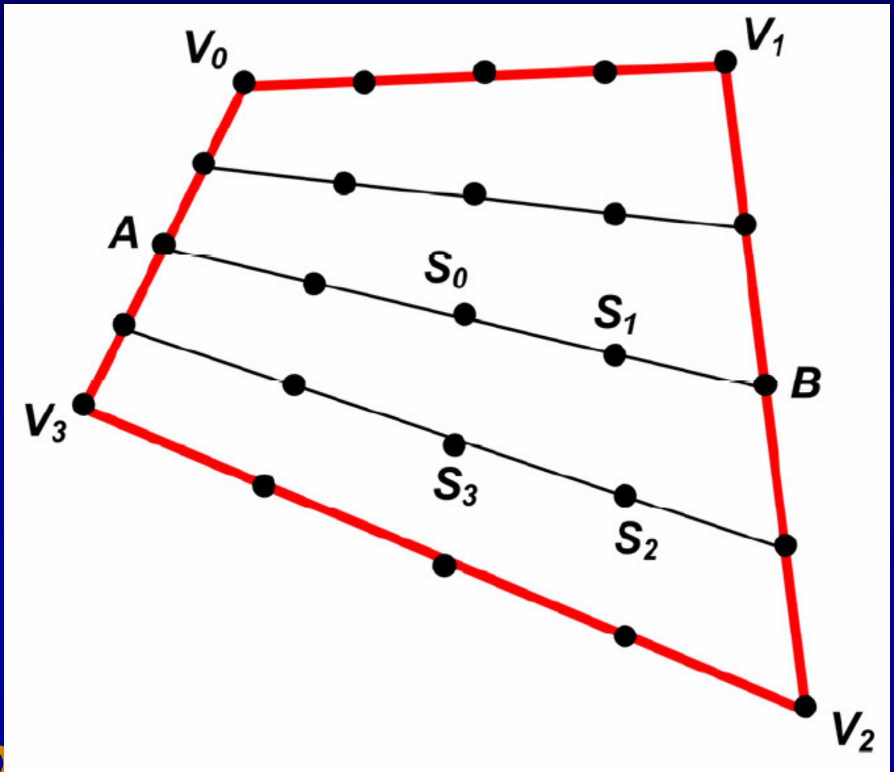
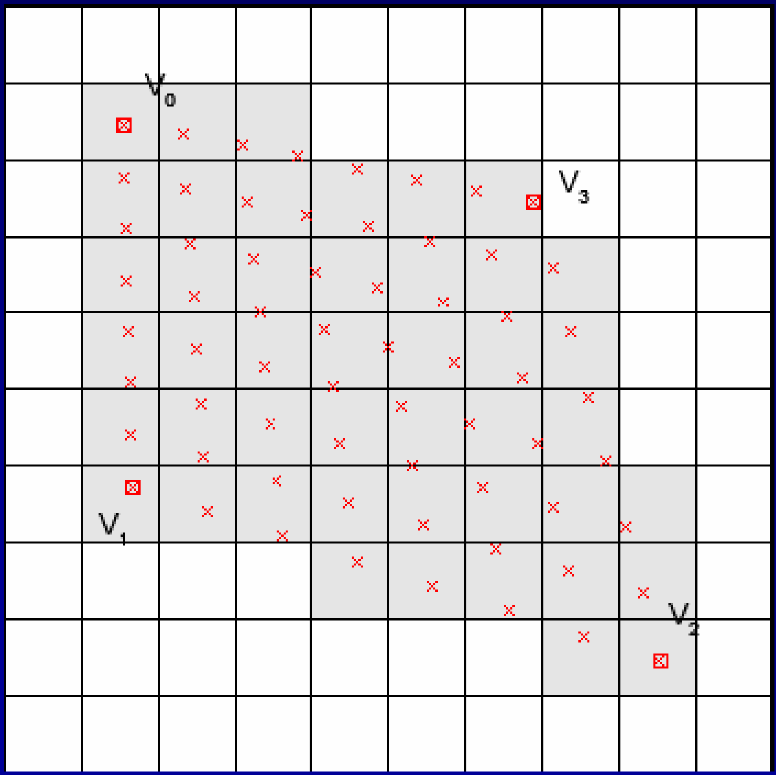
Quadrilateral Rasterization

$$f_0 = \left\lceil \sqrt{2}\max(V_0V_1, V_2V_3) \right\rceil$$
$$f_1 = \left\lceil \sqrt{2}\max(V_0V_3, V_1V_2) \right\rceil$$





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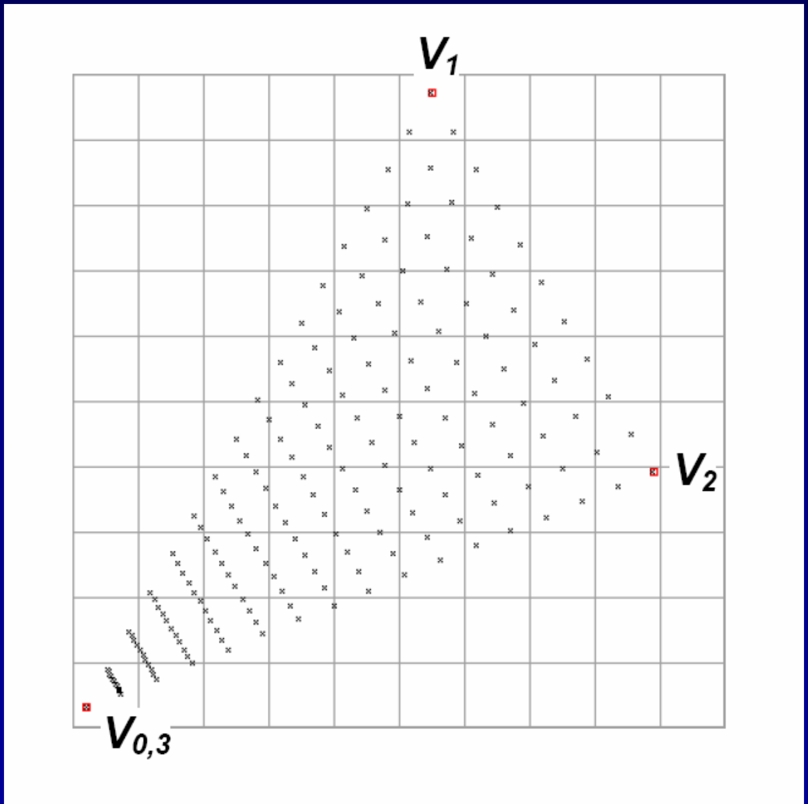
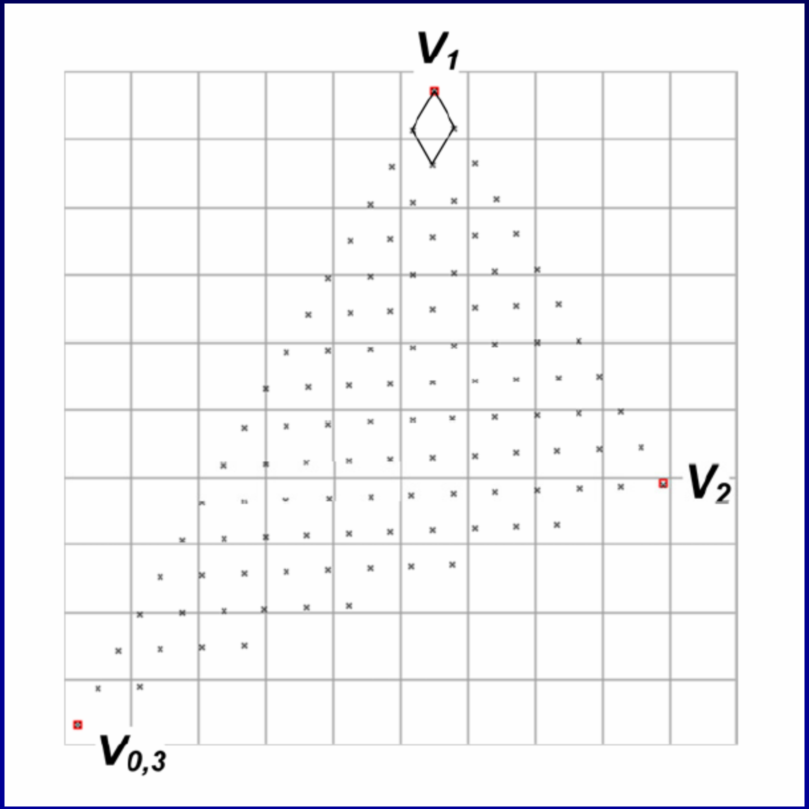
Degenerate Quadrilaterals





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Triangle Rasterization

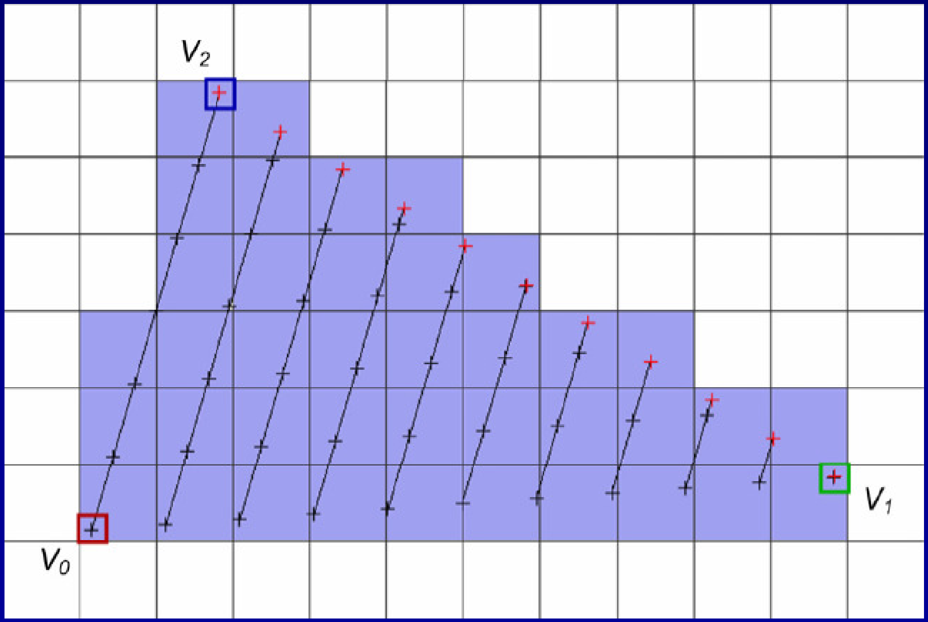
- Test interpolation factors in all 3 sampling directions
- 3rd Edge is a special case

$$f_0 = \left\lceil \sqrt{2} V_0 V_1 \right\rceil$$
$$f_1 = \left\lceil \sqrt{2} V_0 V_2 \right\rceil$$

Interpolation factors for edges in different quadrants

$$f_0 = \lceil \max(abs(u_0 - u_1), abs(v_0 - v_1)) \rceil$$
$$f_1 = \lceil \max(abs(u_0 - u_2), abs(v_0 - v_2)) \rceil$$

Interpolation factors for same quadrant edges



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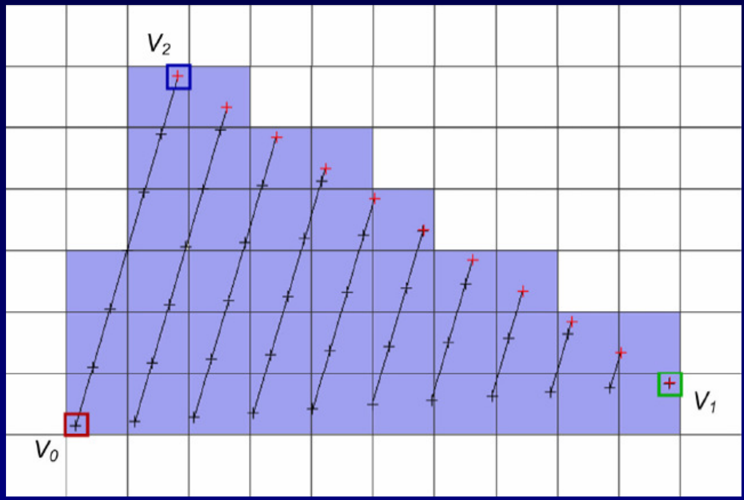
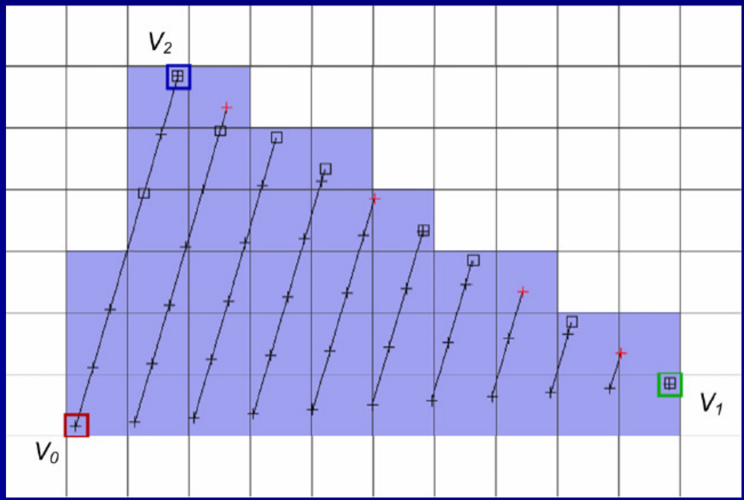
Early Discarding

- ED - Discard samples that land in the same pixel as the previous sample
- EDL – Store previous line of samples





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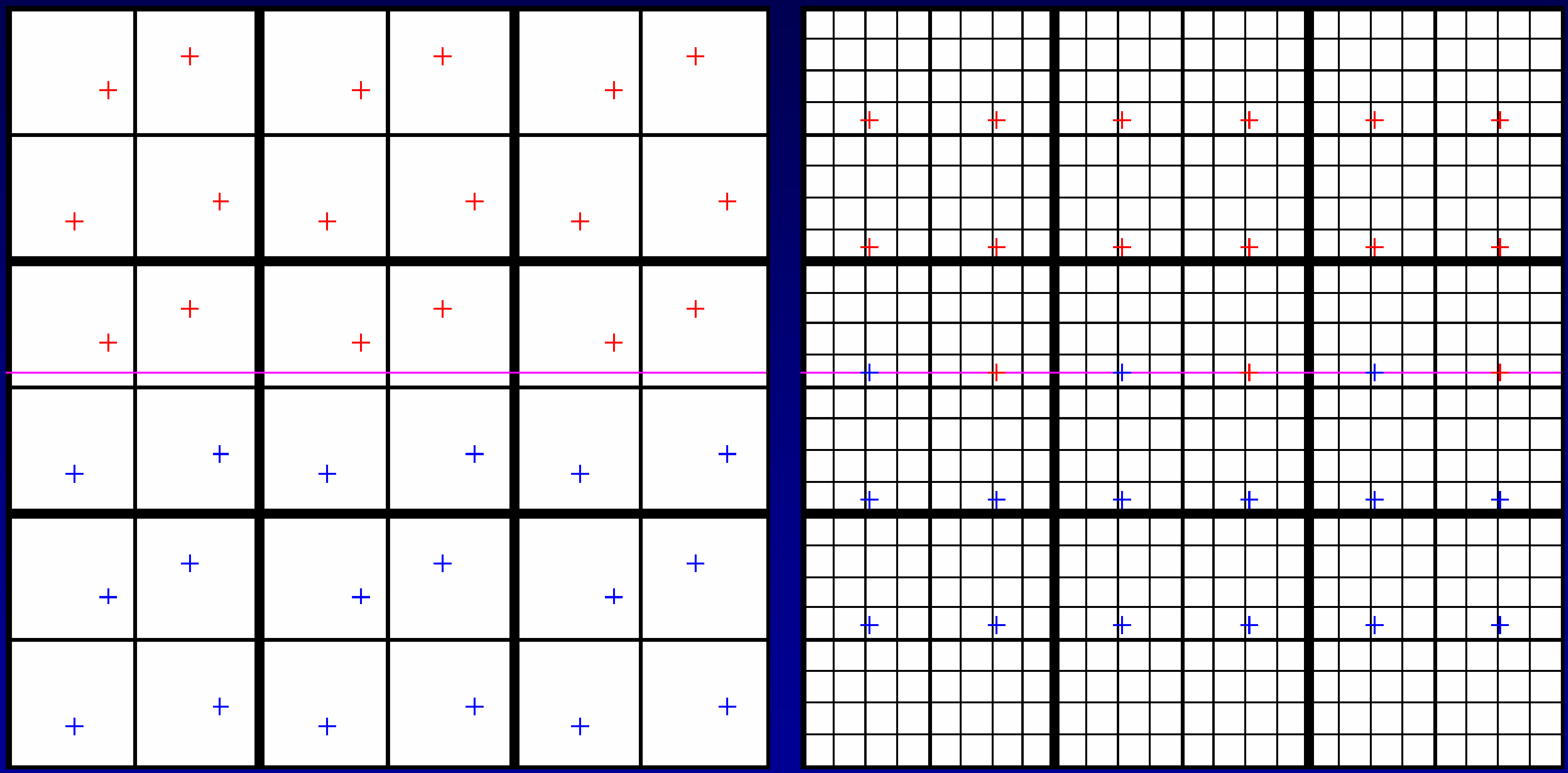
Temporal Aliasing



Jittered supersampling

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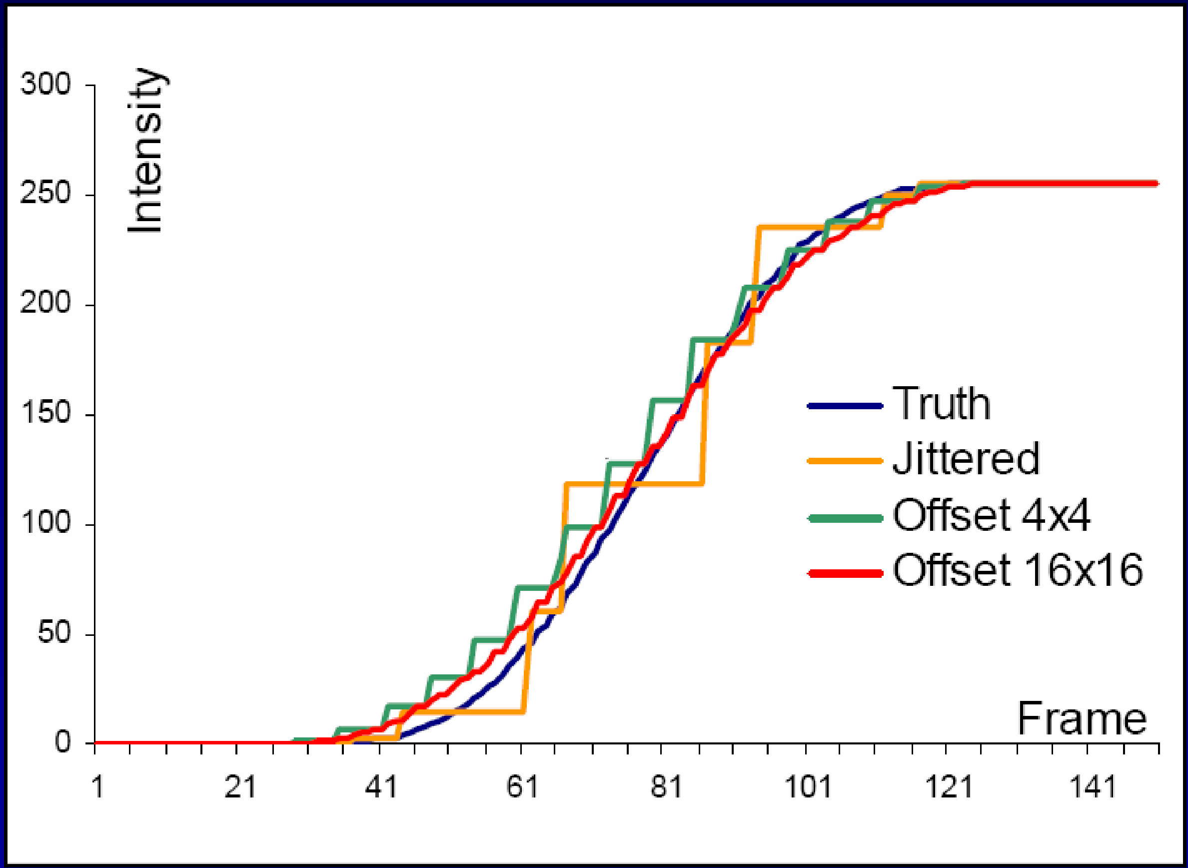
Temporal Aliasing



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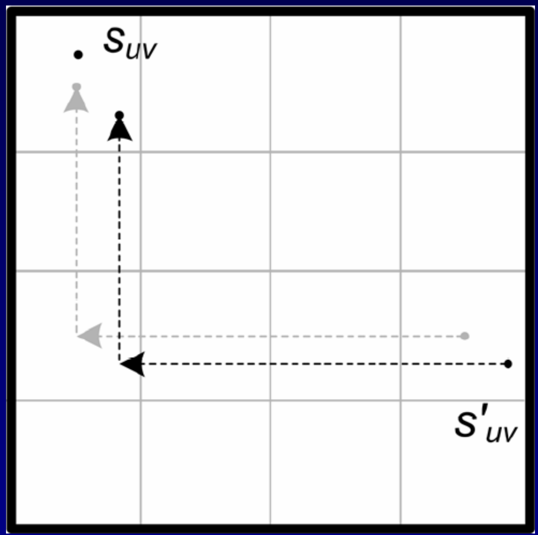
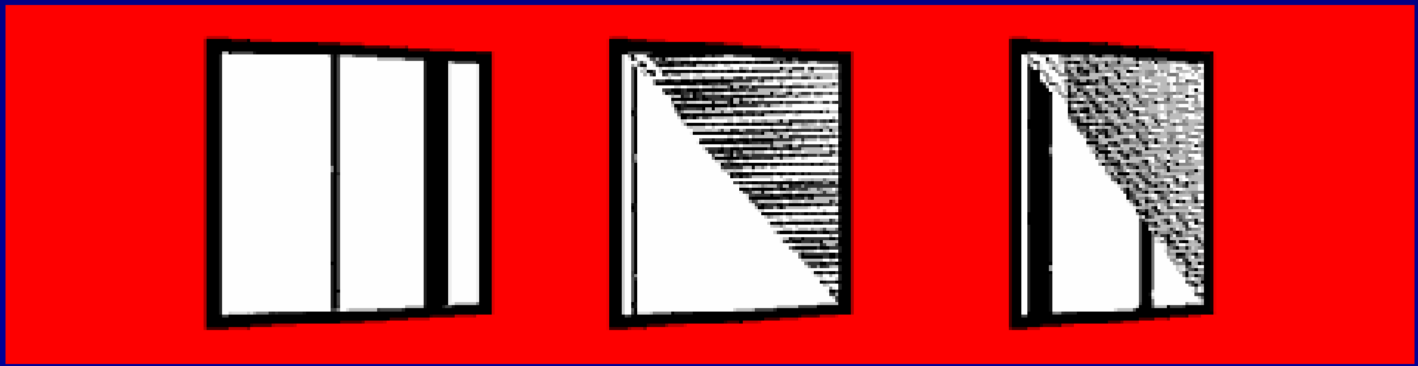
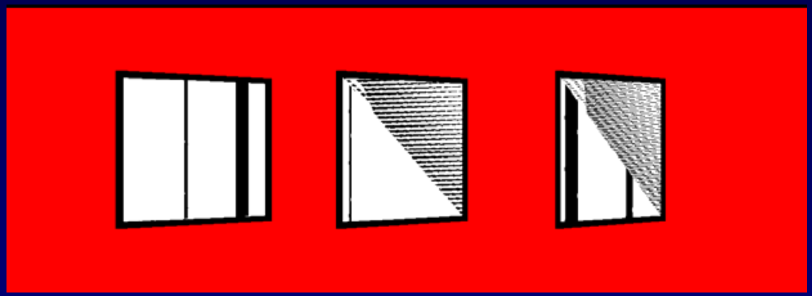
Depth Buffer Correction

- 2 surfaces close together
- Move depth sample to new location

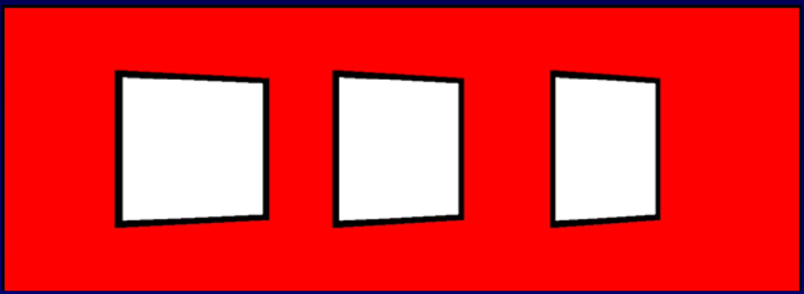




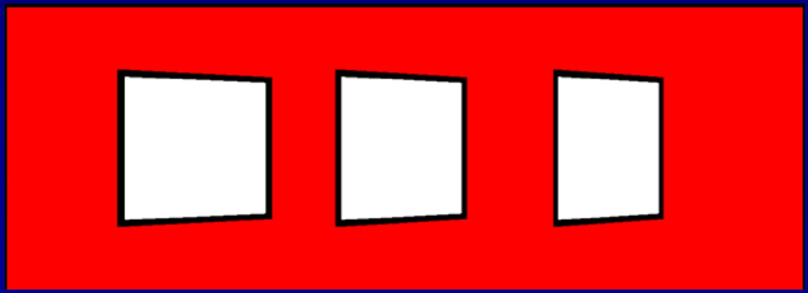
Depth Buffer Correction



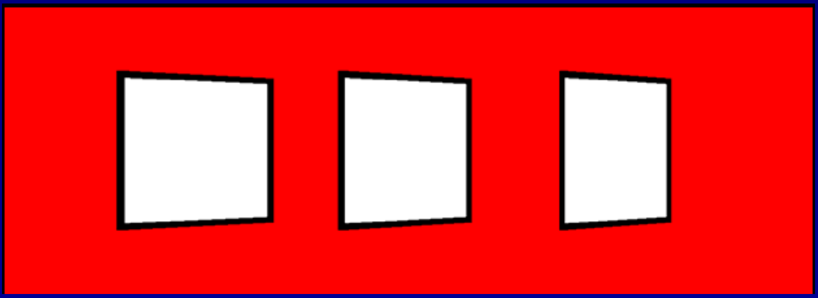
z = 1m, a = 30^{o}, r = 0.125mm, no corr.



z = 1m, a = 30^{o}, r = 0.125mm, x4 corr.



z = 1m, a = 30^{o}, r = 0.5mm, no corr.



z = 1m, a = 30^{o}, r = 0.03mm, x16 corr.

Results – Quad Rasterization

Conventional Rasterization

Forward Rasterization

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Results – Quad Rasterization

	Quad size (pix)	Inner loop FWR/CR (%)	Overdraw	Overdraw ED
Min	1.35	47	2.44	1.76
Max	4.12	88	2.97	2.11
Average	1.83	65	2.64	1.90
Median	1.72	66	2.60	1.87
Median Overdraw	2.24	53	2.60	1.87

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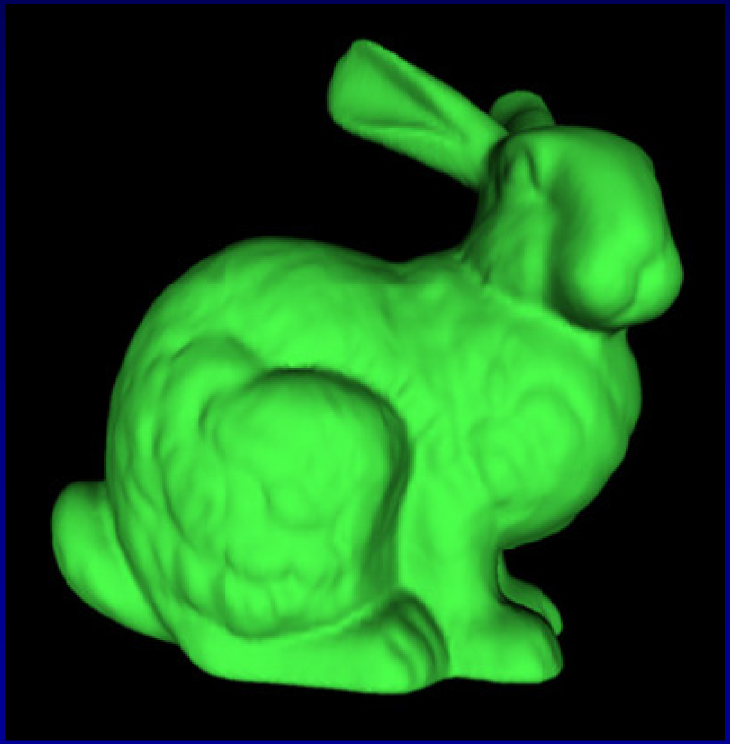
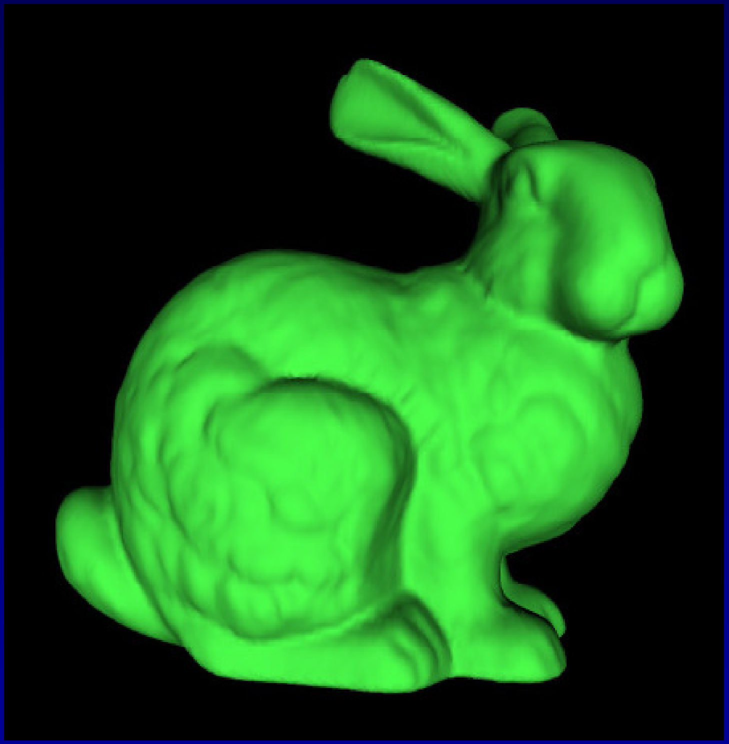
Results - Bunny (69Ktris)



Conventional Rasterization



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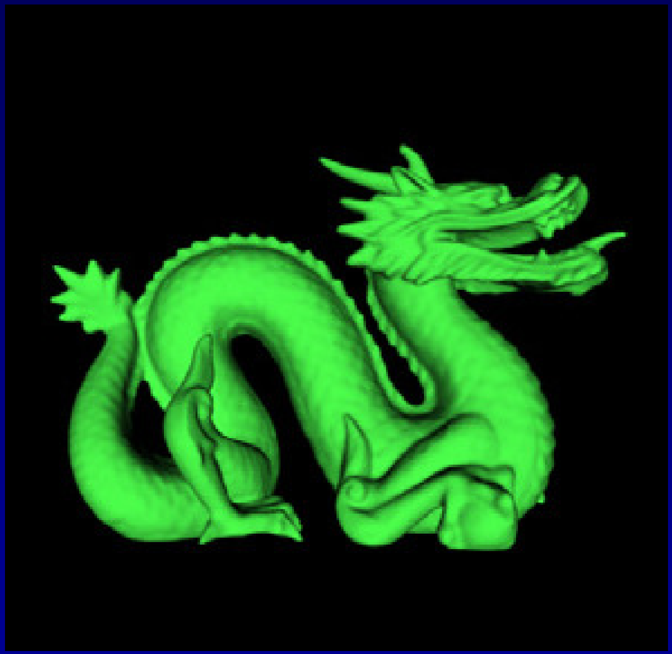
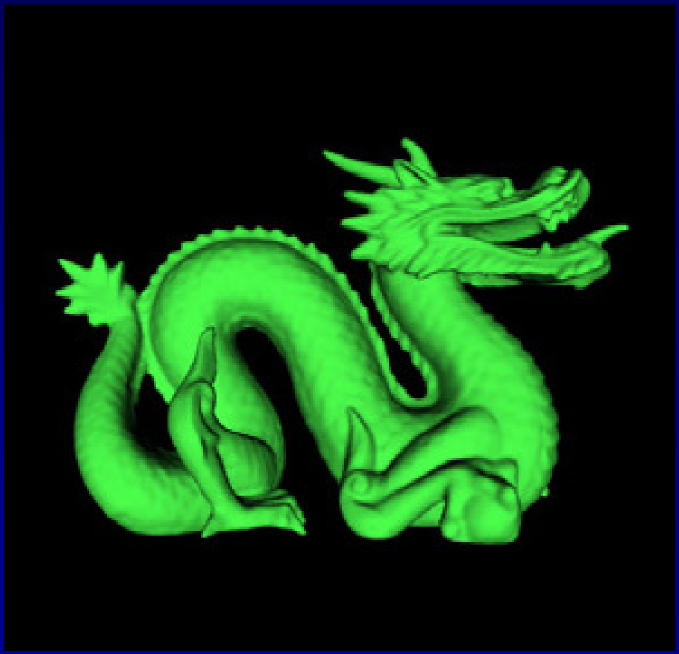
Results – Dragon (201Ktris)

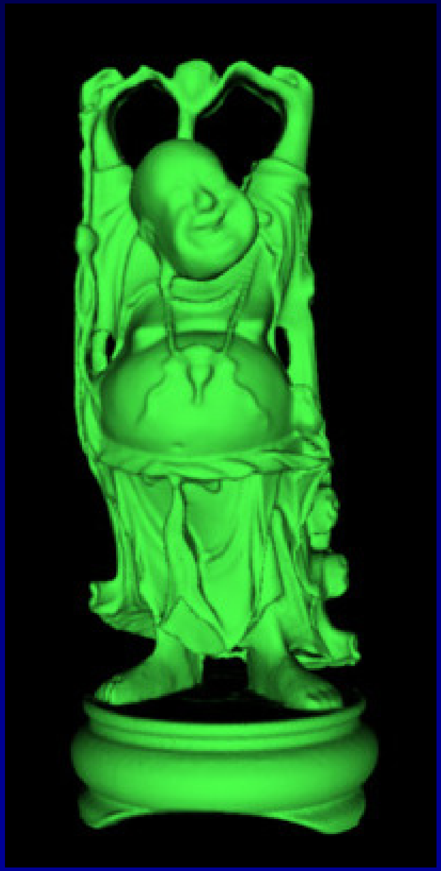


Conventional Rasterization

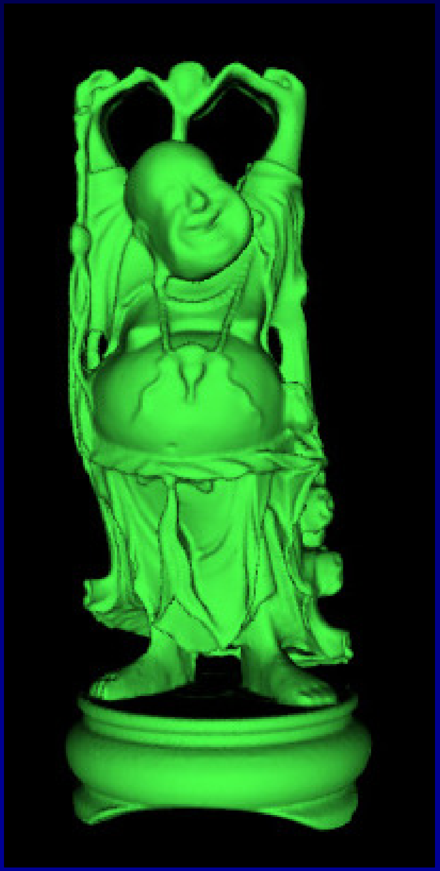


Forward Rasterization

Results – Buddha (292Ktris)



Conventional Rasterization



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Results – Armadillo (346Ktris)

Conventional Rasterization

Forward Rasterization

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Sample Comparison

	Tri. Size (pix)	Inner loop FWR/CR (%)	ED (%)	Overdraw inside tris.	Overdraw overall
Bunny	3.0	75	51	1.27	1.57
	6.0	64	31	1.26	1.32
Dragon	2.0	90	55	1.34	2.01
	3.5	72	39	1.35	1.44
Buddha	1.2	119	68	1.32	2.92
	2.2	89	52	1.36	1.88
Armad.	1.2	112	75	1.22	2.8
	2.0	86	62	1.24	1.86

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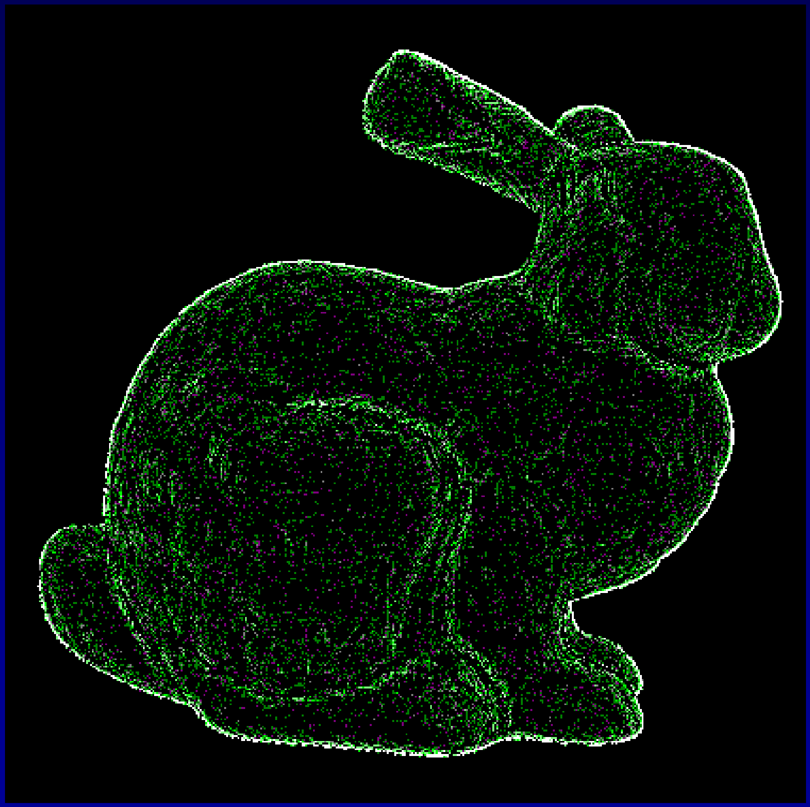
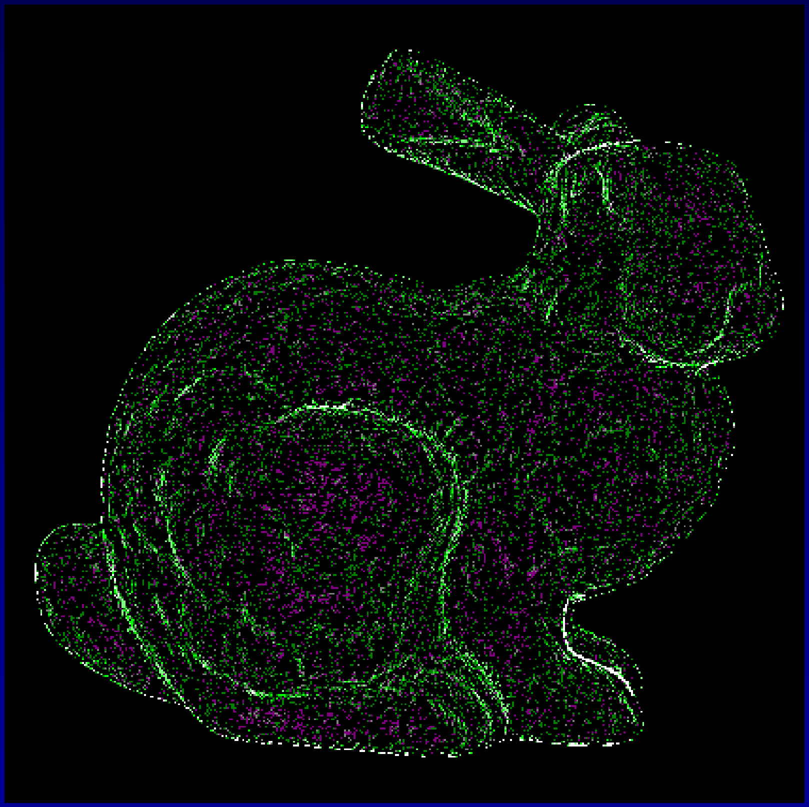
Per Pixel Difference



$(I_{FWR} - I_{CR}) * 127$



$(I_{CR} - I_{FWR}) * 127$

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Questions?

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