SURE-based Optimization for Adaptive Sampling and Reconstruction

Supplementary Materials

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PART I
Equal-Time Comparison

Compared Methods:

- **Monte Carlo**
- **Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011]**
- **Random Parameter Filtering [Sen and Darabi, ACMTOG 2012]**
- **SURE-based Optimization (our approach, using cross bilateral filters)**

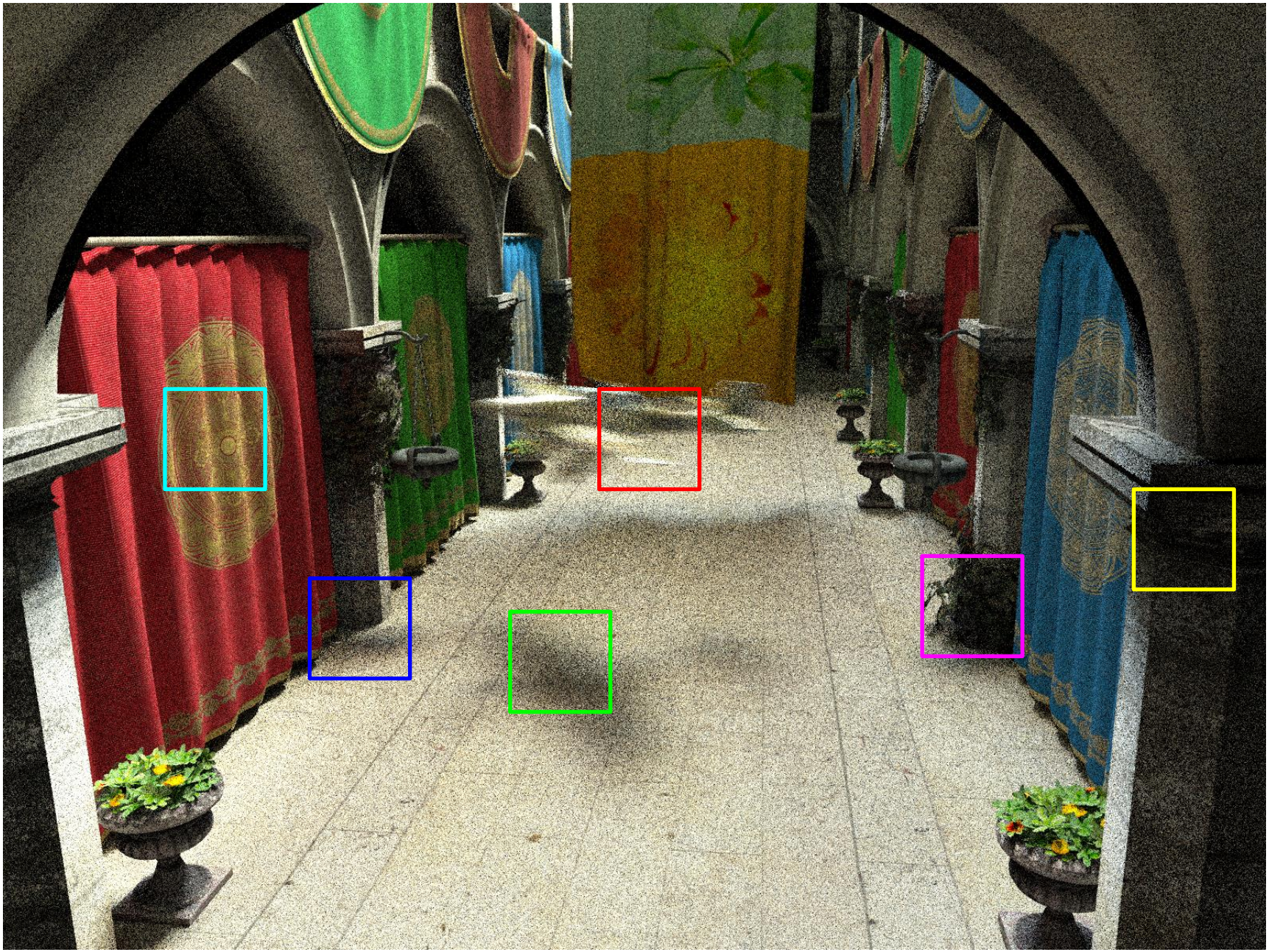
SPONZA

Global Illumination (Path Tracing)
Motion Blur

1600 x 1200

SPONZA

Equal-time Monte Carlo, 68 spp, 890.5 sec.



SPONZA

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 63.84 spp, 906.2 sec.

SPONZA

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 16 spp, 1676.1 sec.

SPONZA

SURE-based Optimization (Our Approach), 63.24 spp, 896.0 sec.

SPONZA

Reference, 8192 spp

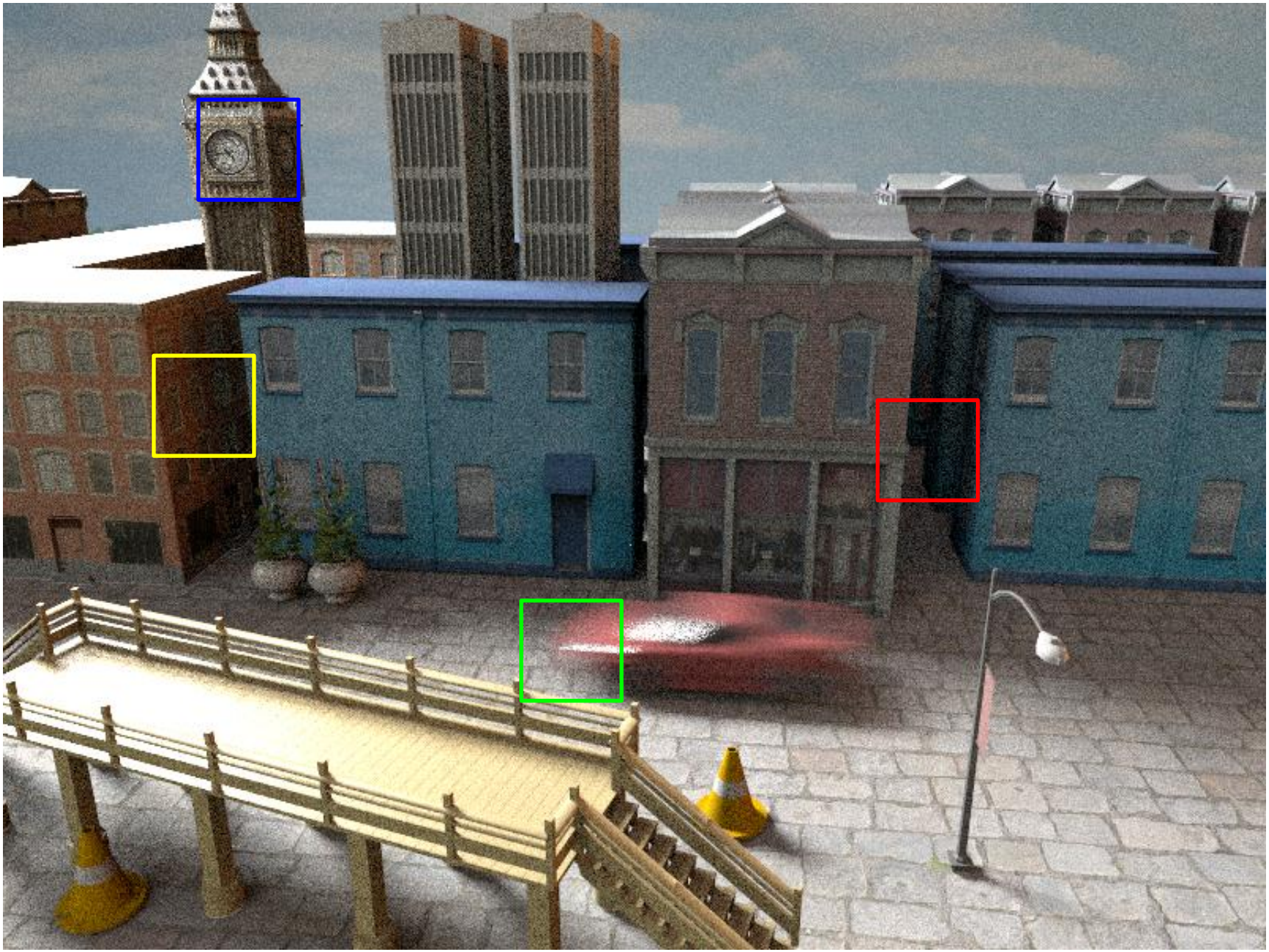
TOWN

Environment Lighting
Area Lighting
Motion Blur

800 x 600

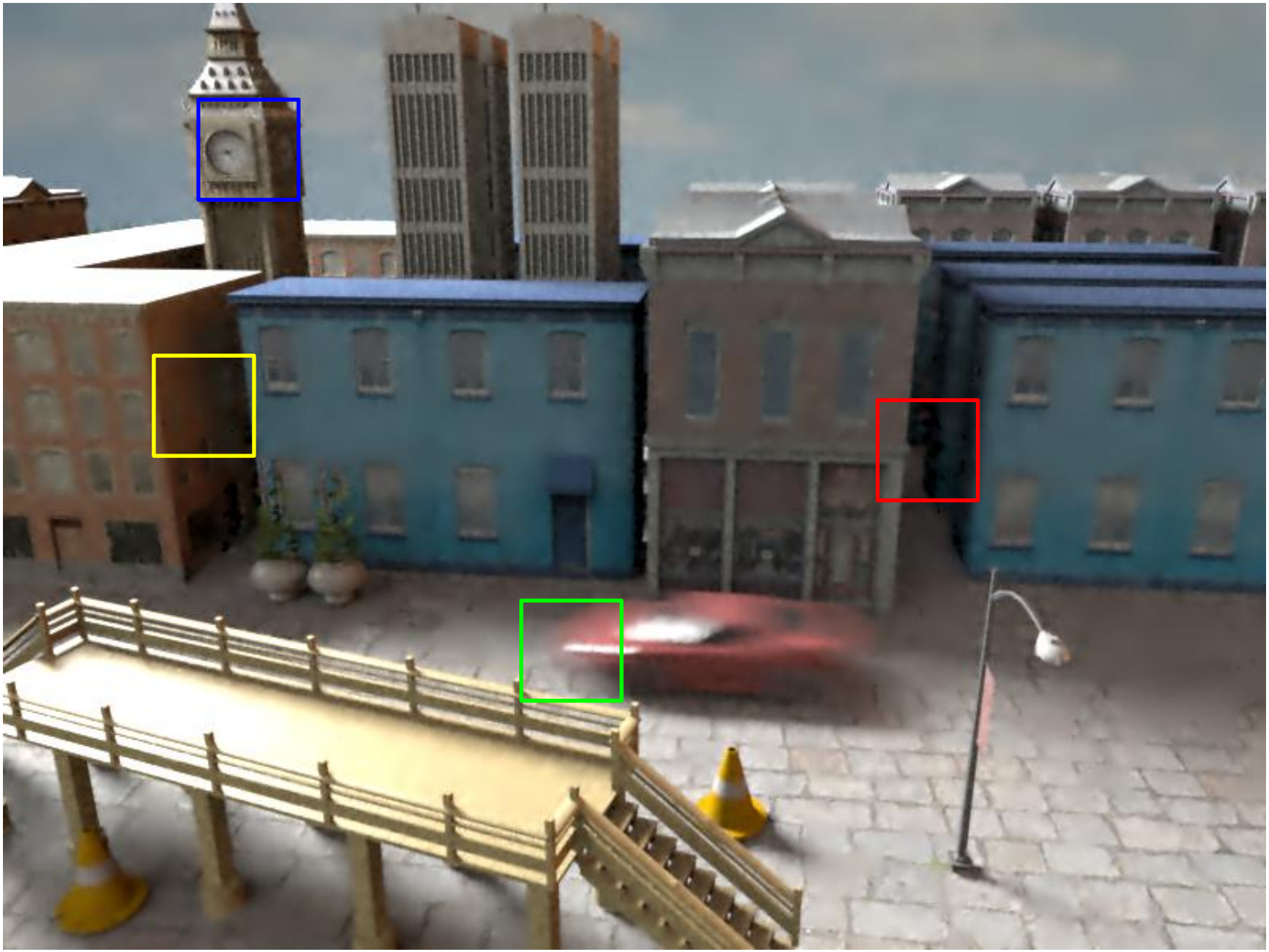
TOWN

Equal-time Monte Carlo, 82 spp, 59.9 sec.



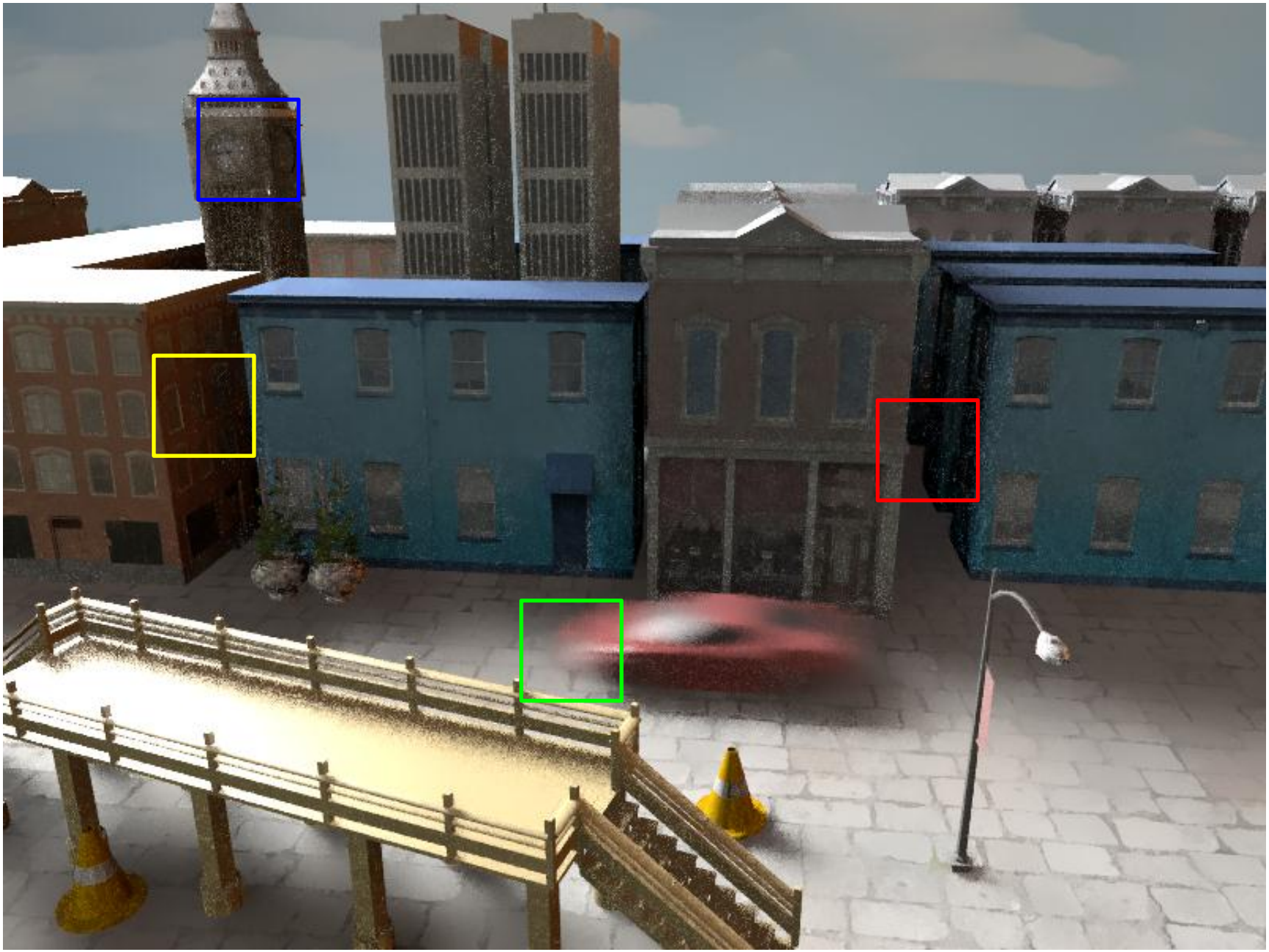
TOWN

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 51.82 spp, 61.8 sec.



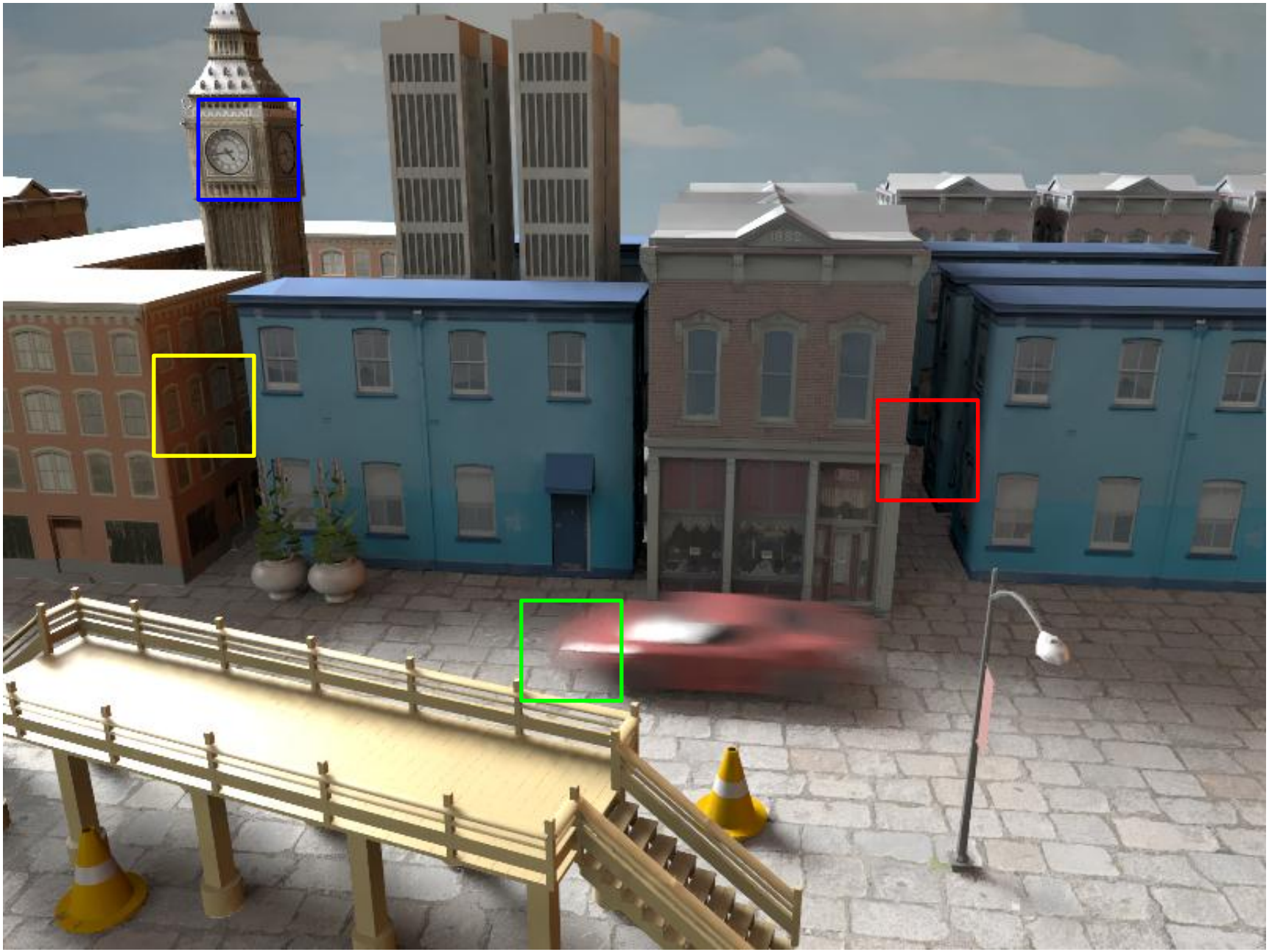
TOWN

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 272.4 sec.



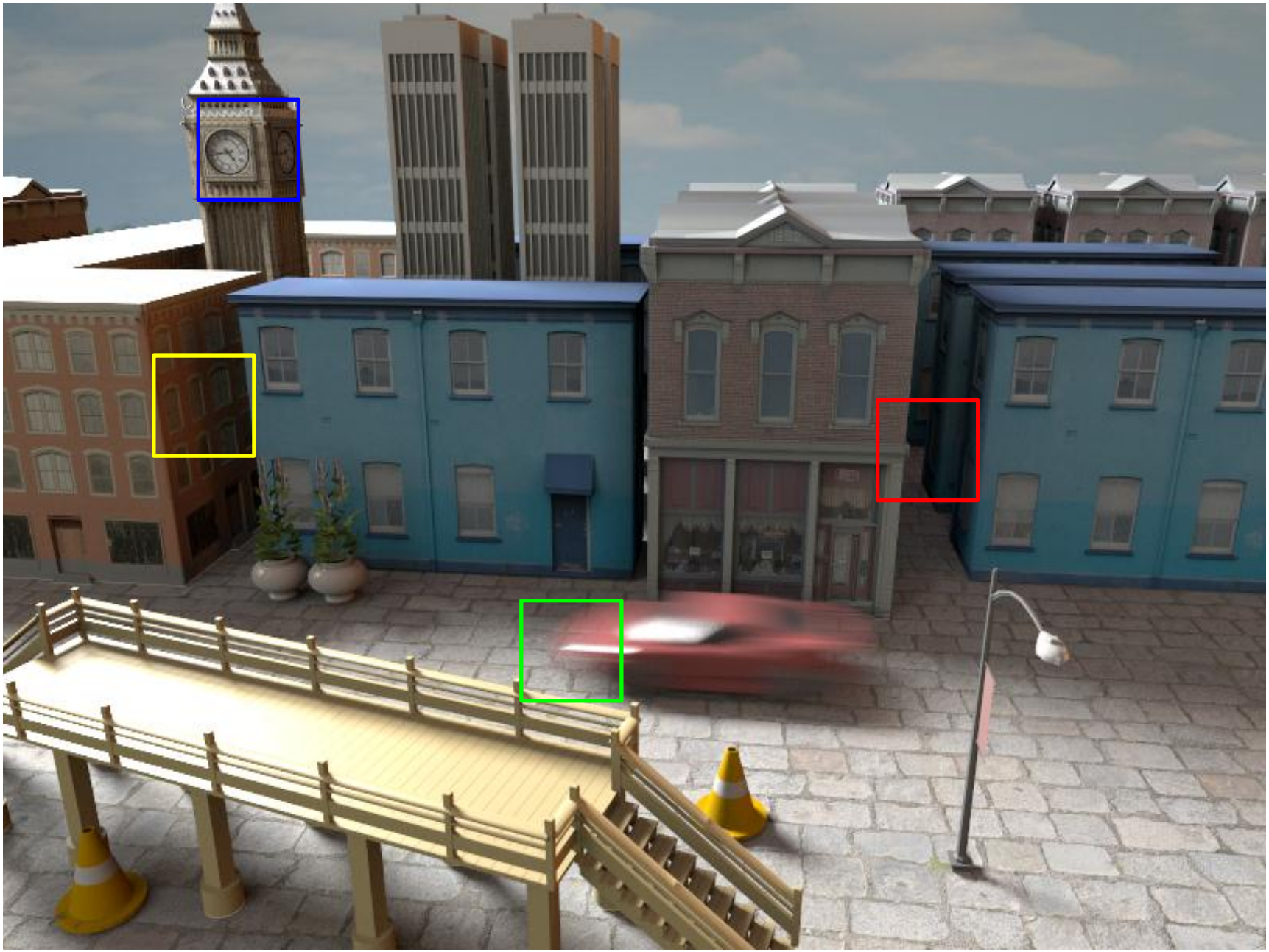
TOWN

SURE-based Optimization (Our Approach), 39.79 spp, 59.6 sec.



TOWN

Reference, 4096 spp



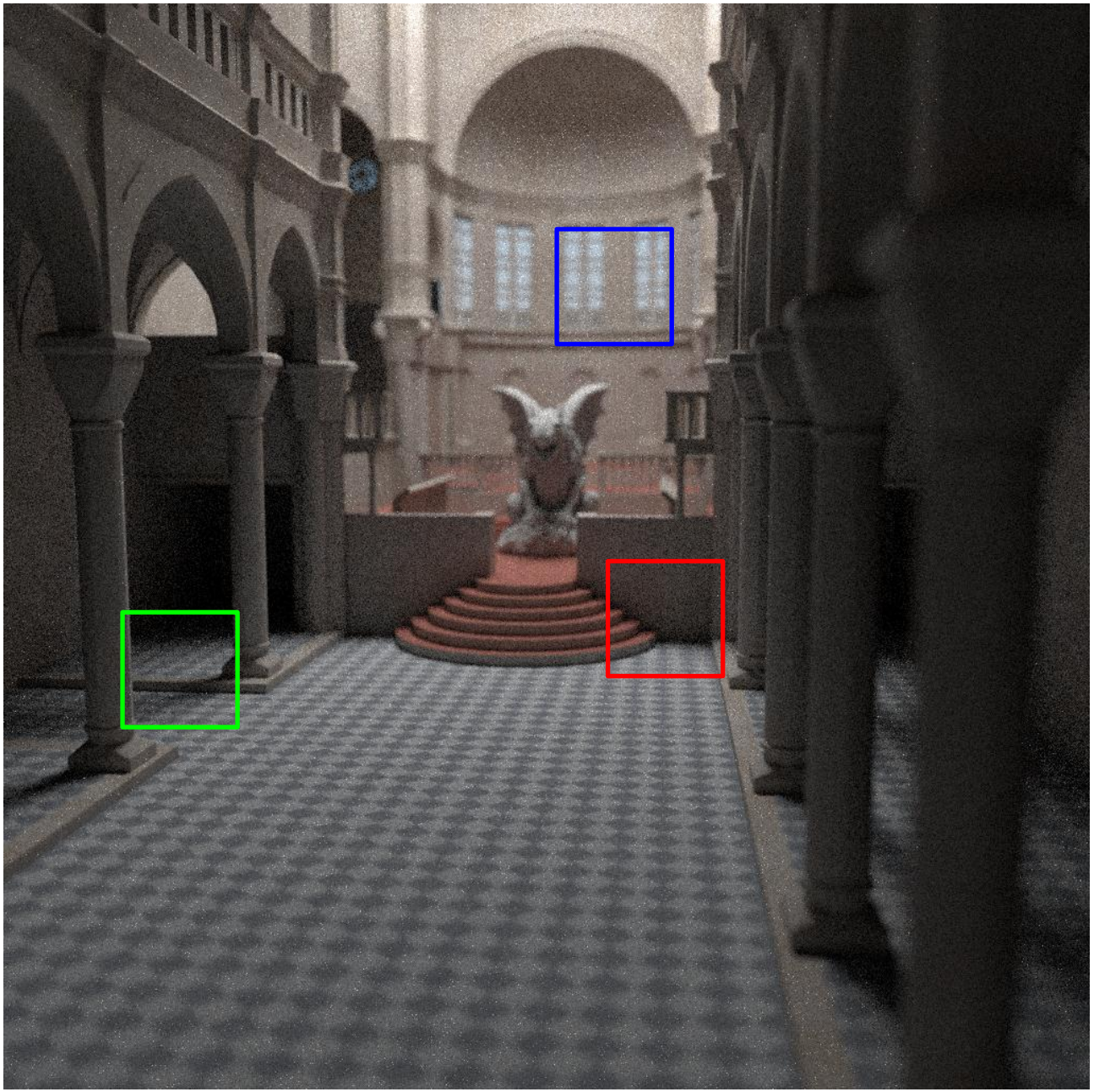
SIBENIK

Global Illumination (One-Bounce Path Tracing)
Depth of Field

1024 x 1024

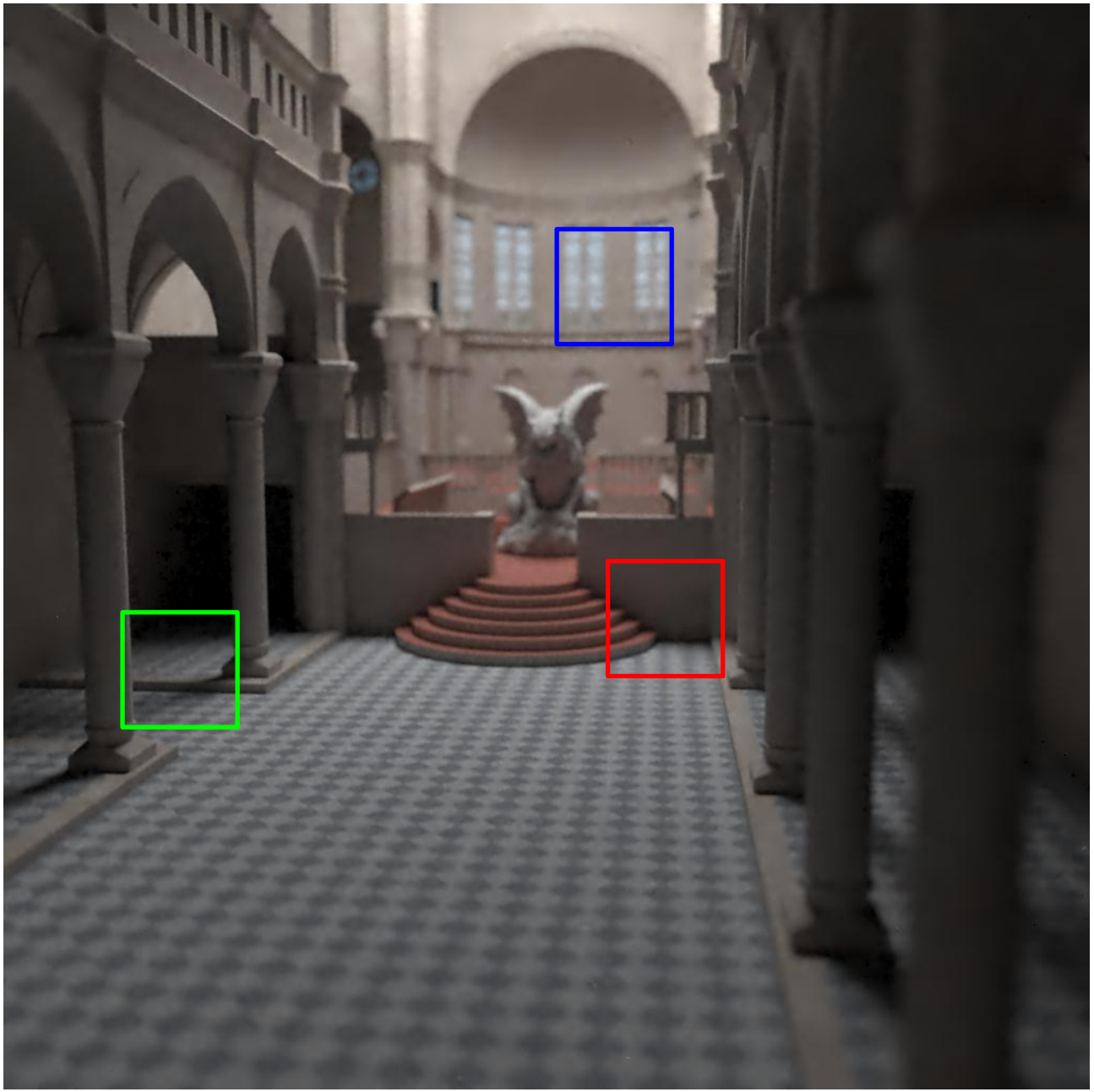
SIBENIK

Equal-time Monte Carlo, 44 spp, 140.0 sec.



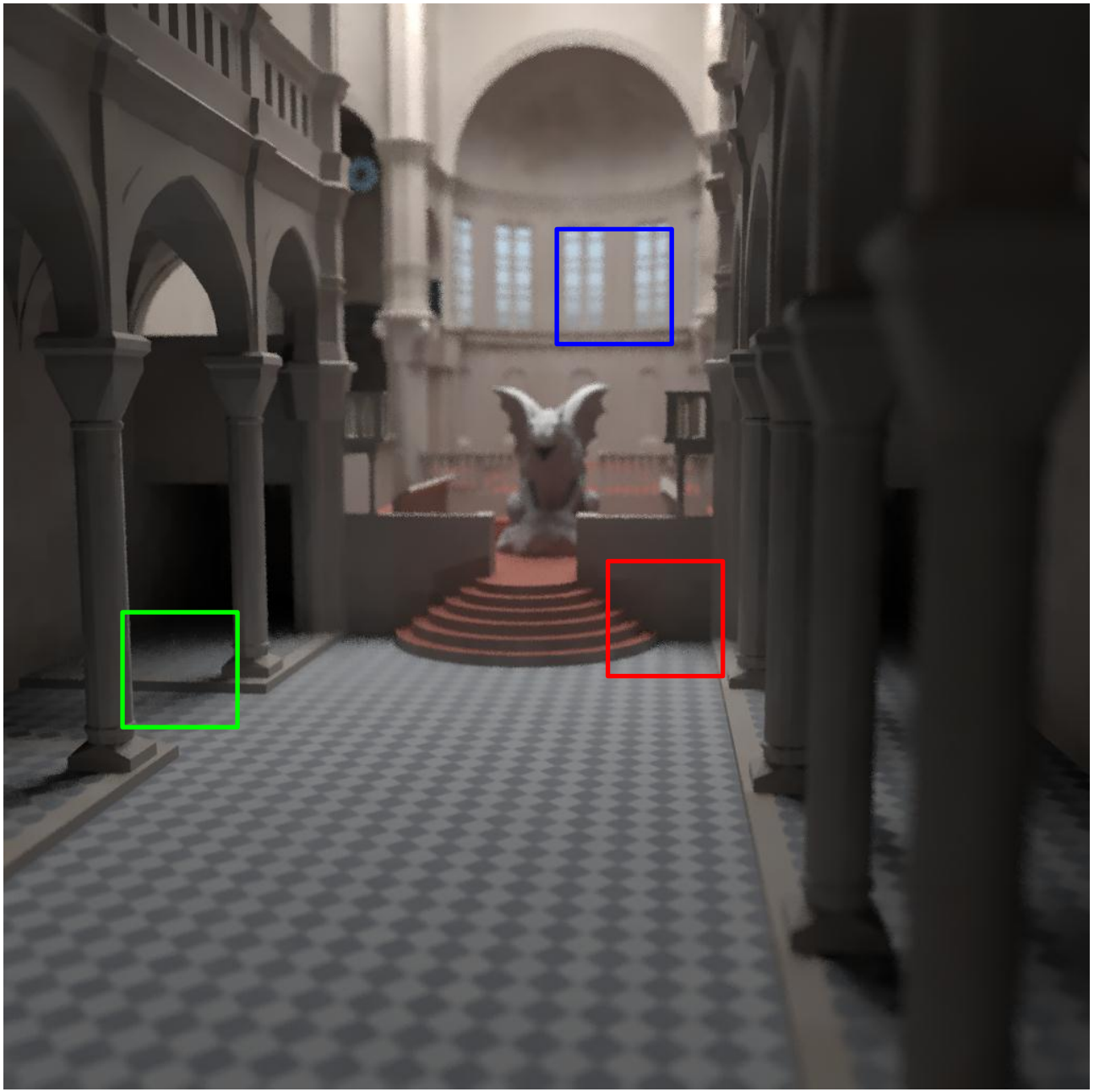
SIBENIK

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 39.86 spp, 135.0 sec.



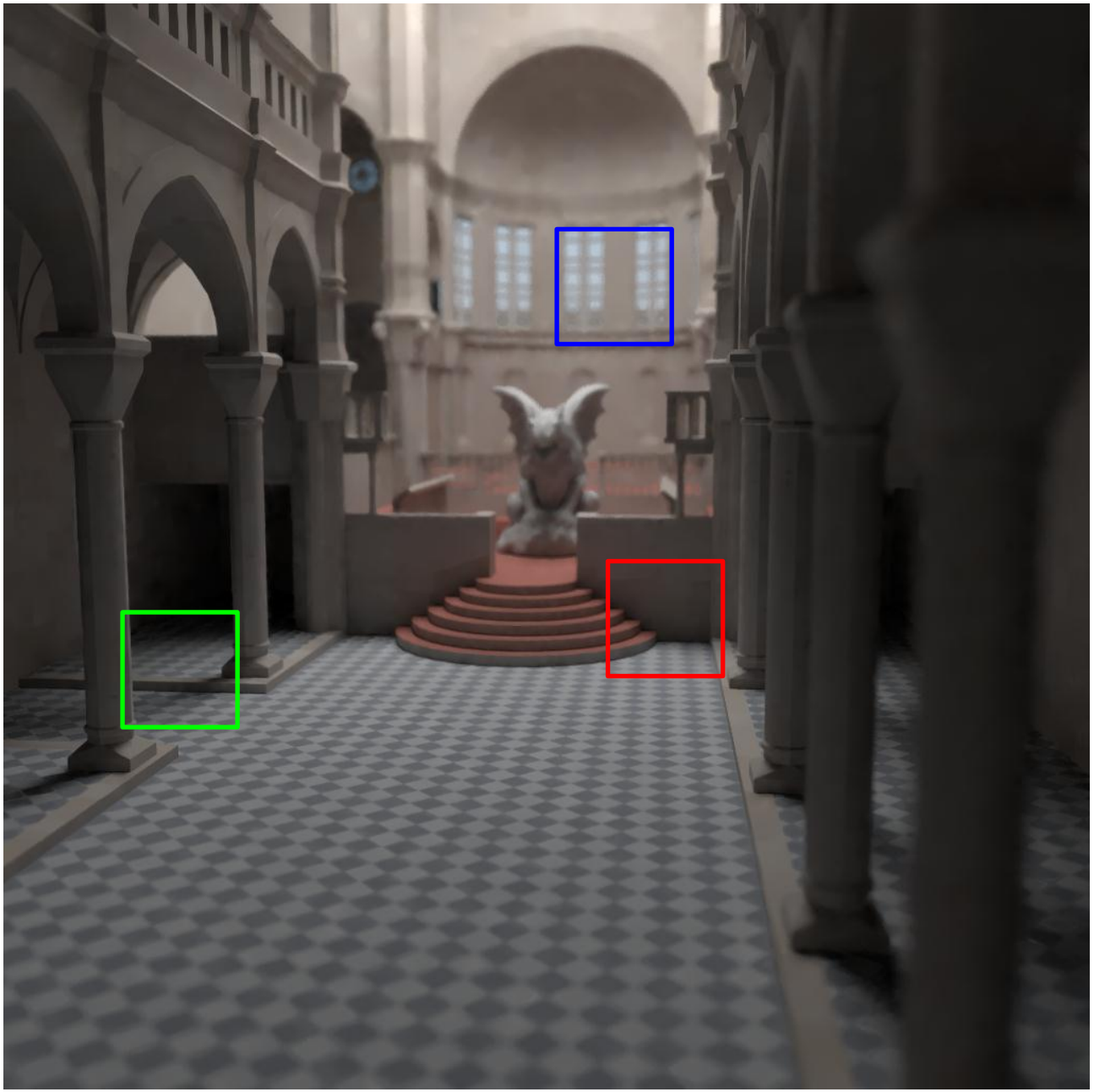
SIBENIK

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 363.0 sec.



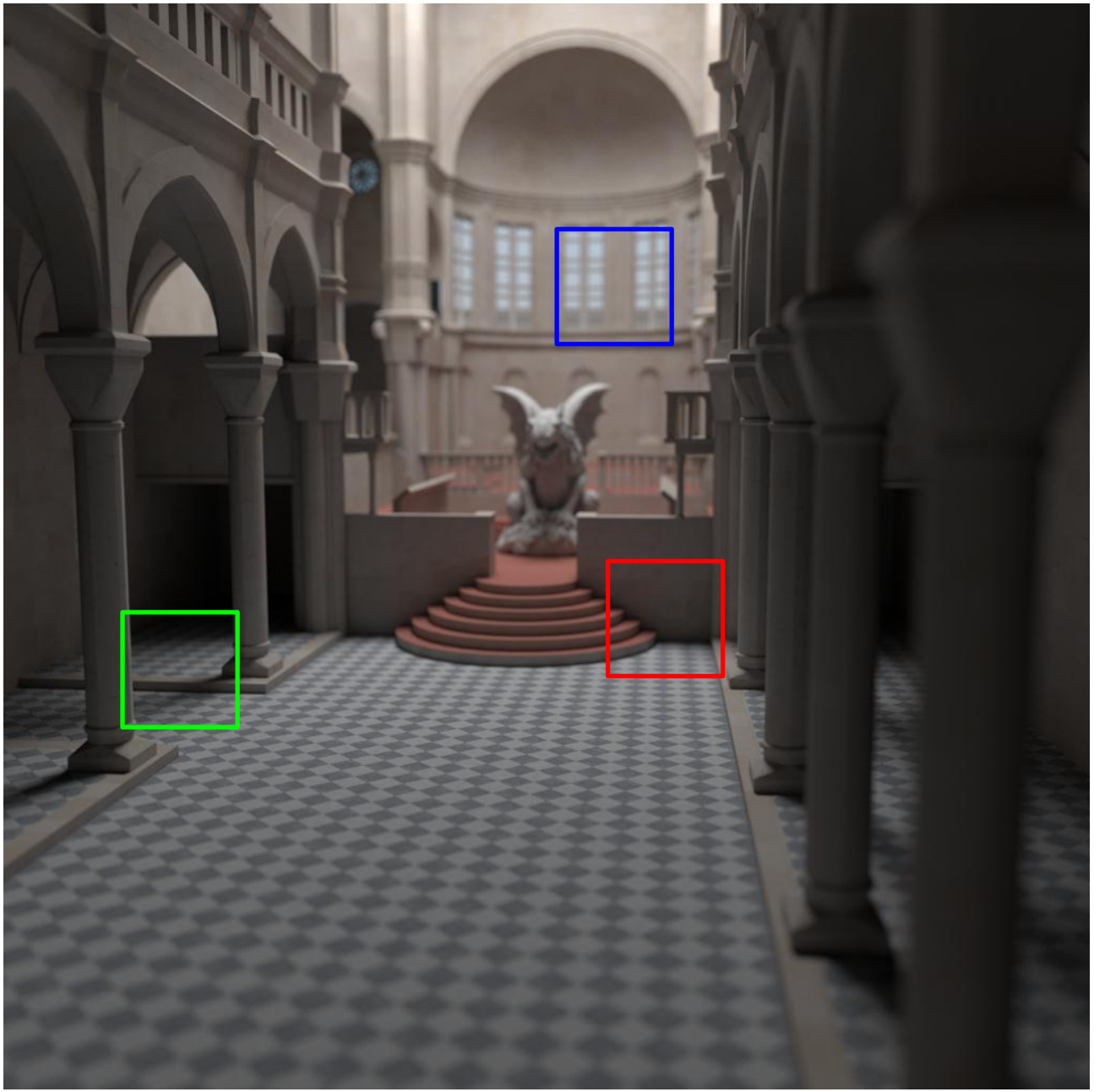
SIBENIK

SURE-based Optimization (Our Approach), 26.69 spp, 140 sec.



SIBENIK

Reference, 4096 spp



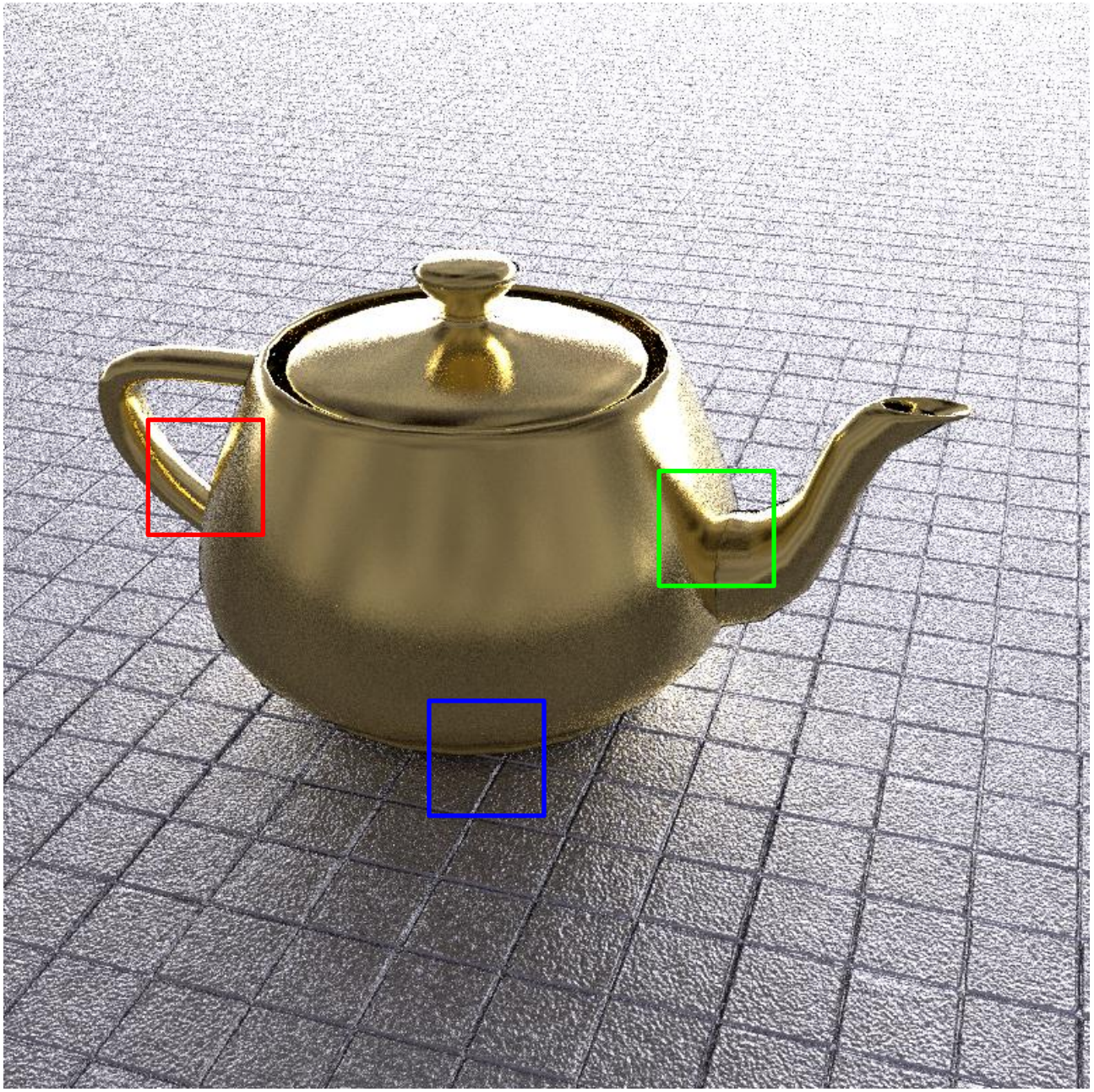
TEAPOT

Environment Lighting
Glossy Reflection

800 x 800

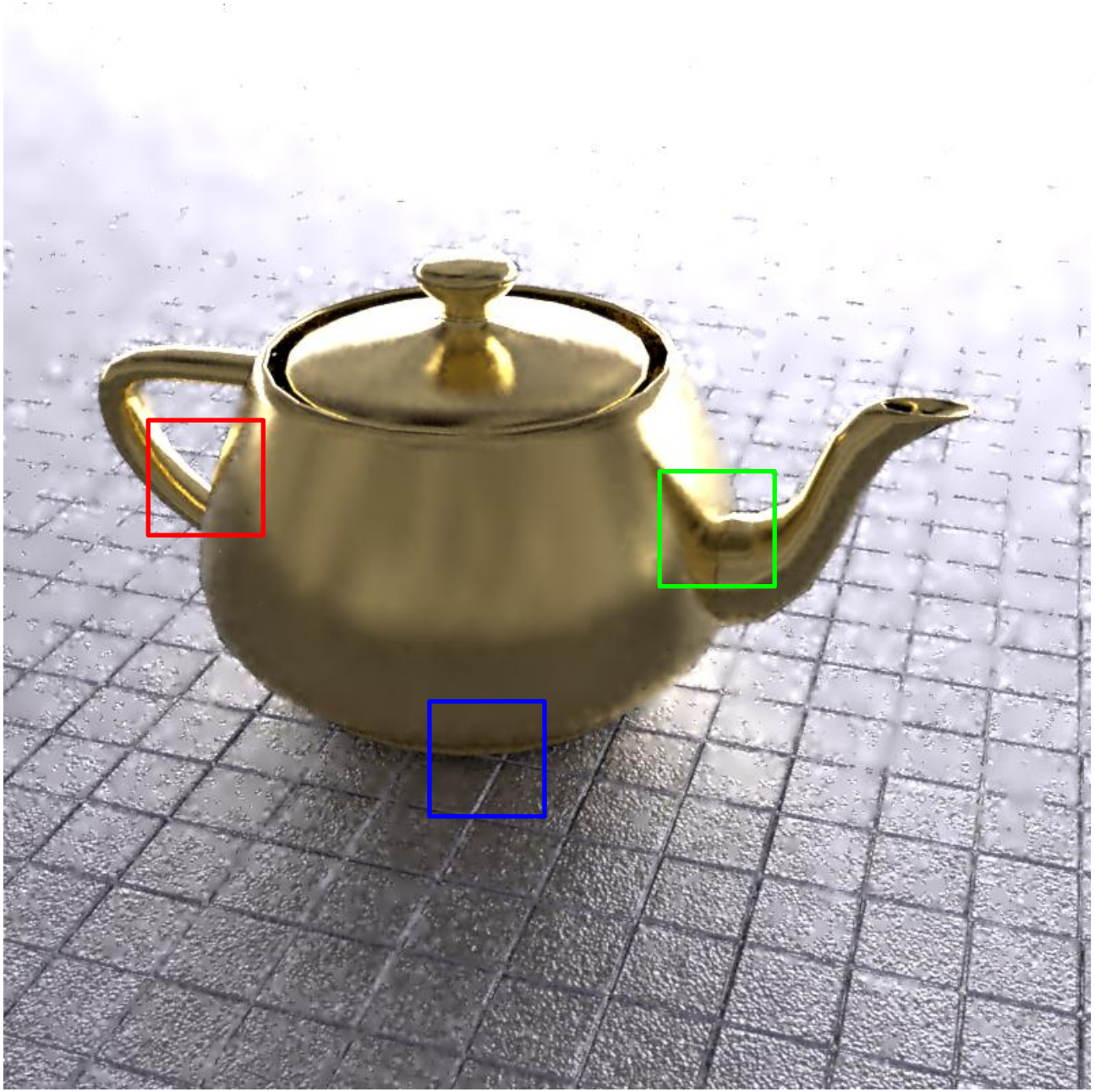
TEAPOT

Equal-time Monte Carlo, 35 spp, 42.0 sec.



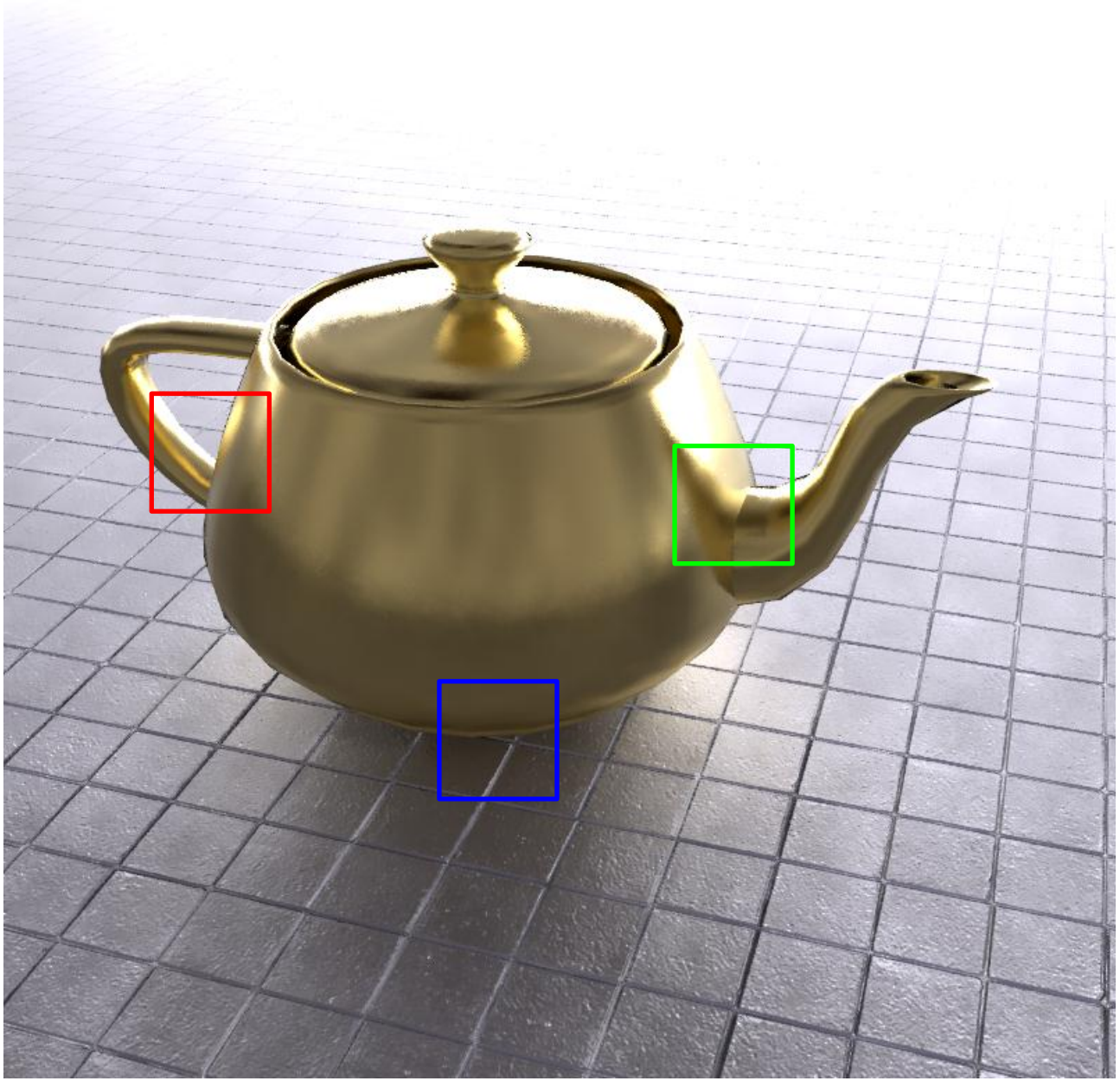
TEAPOT

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 23.96 spp, 44.3 sec.



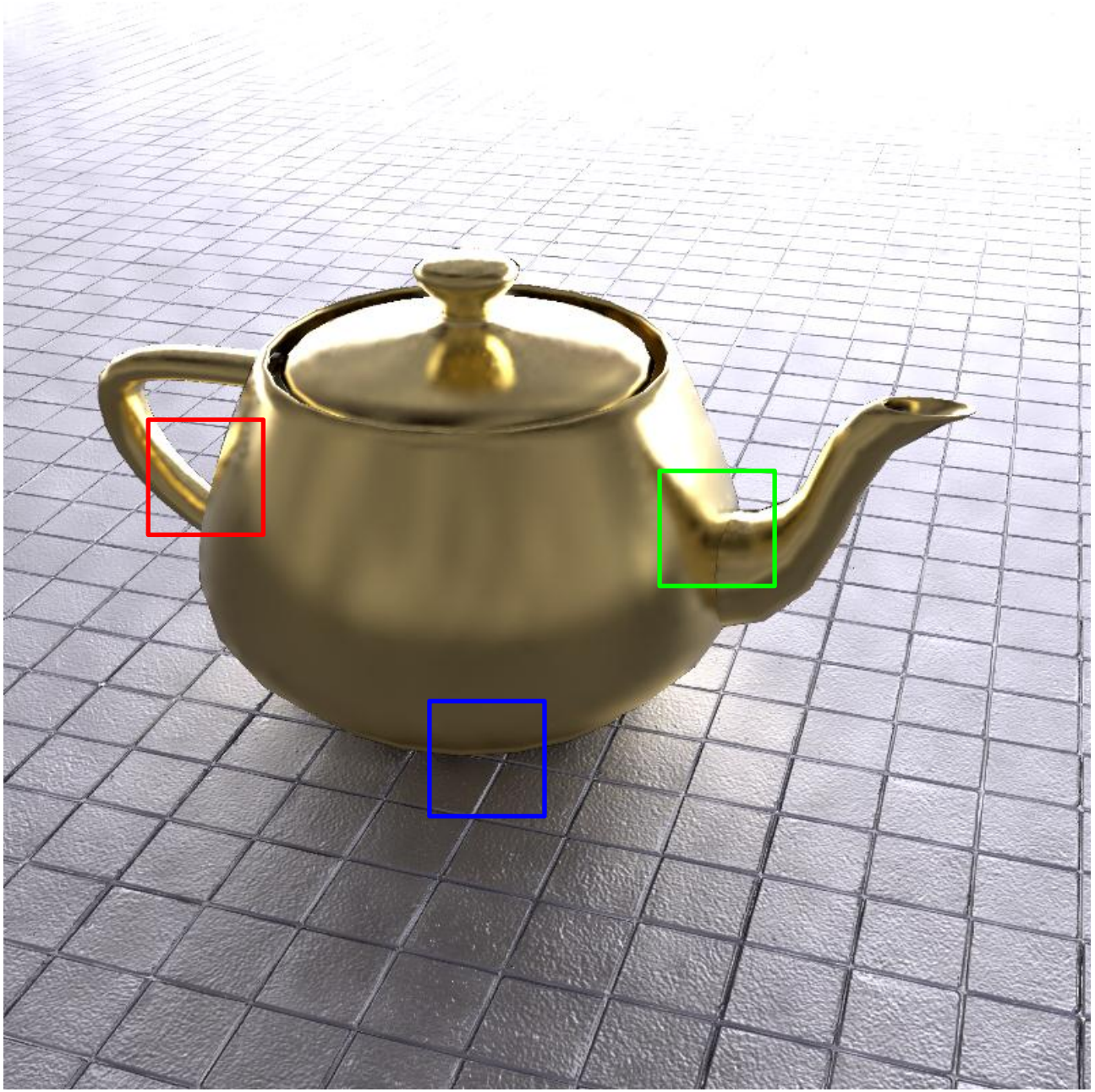
TEAPOT

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 374.4 sec.



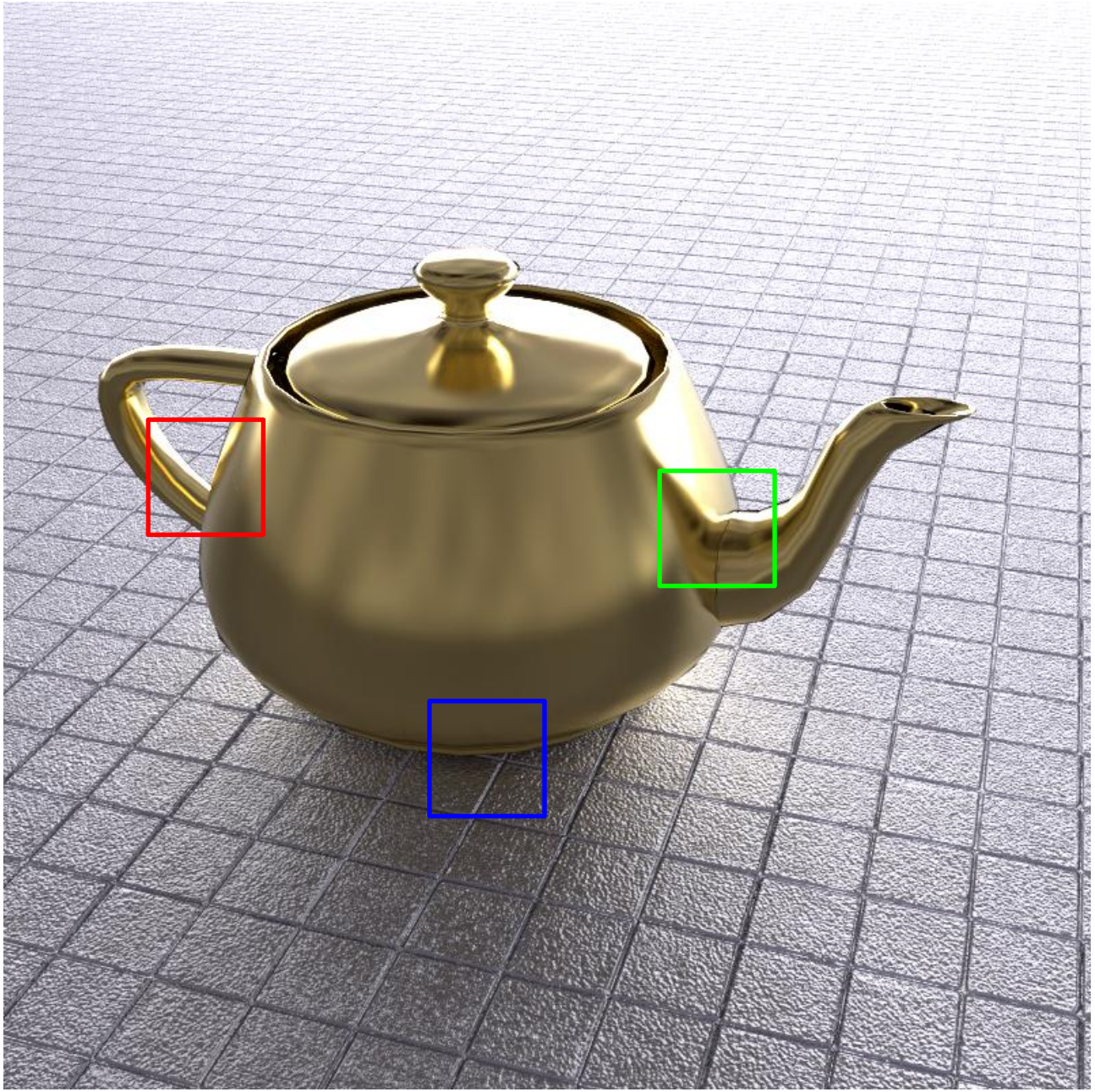
TEAPOT

SURE-based Optimization (Our Approach), 8 spp, 40.4 sec.



TEAPOT

Reference, 4096 spp



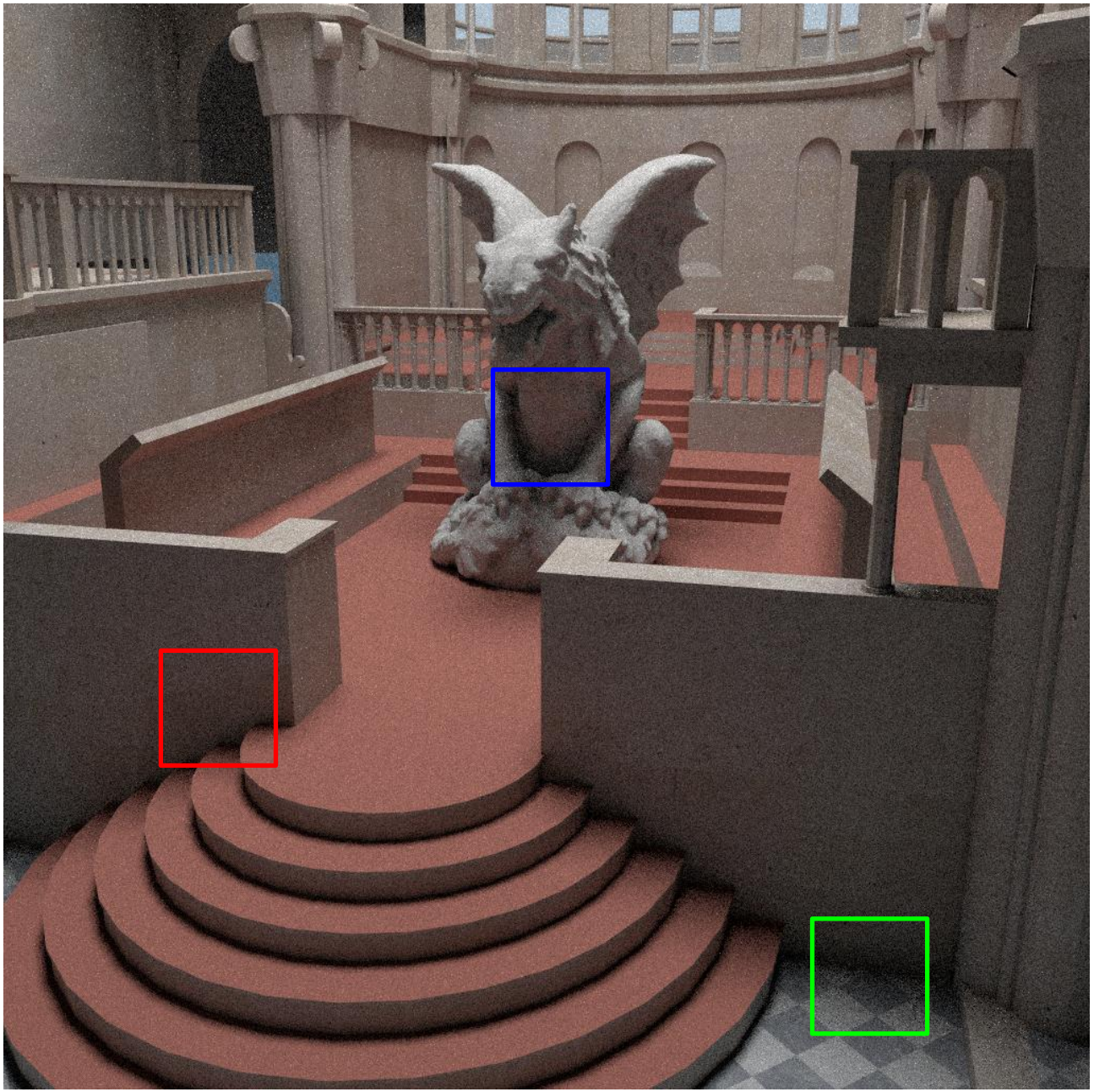
GARGOYLE

Global Illumination (One-Bounce Path Tracing)

1024 x 1024

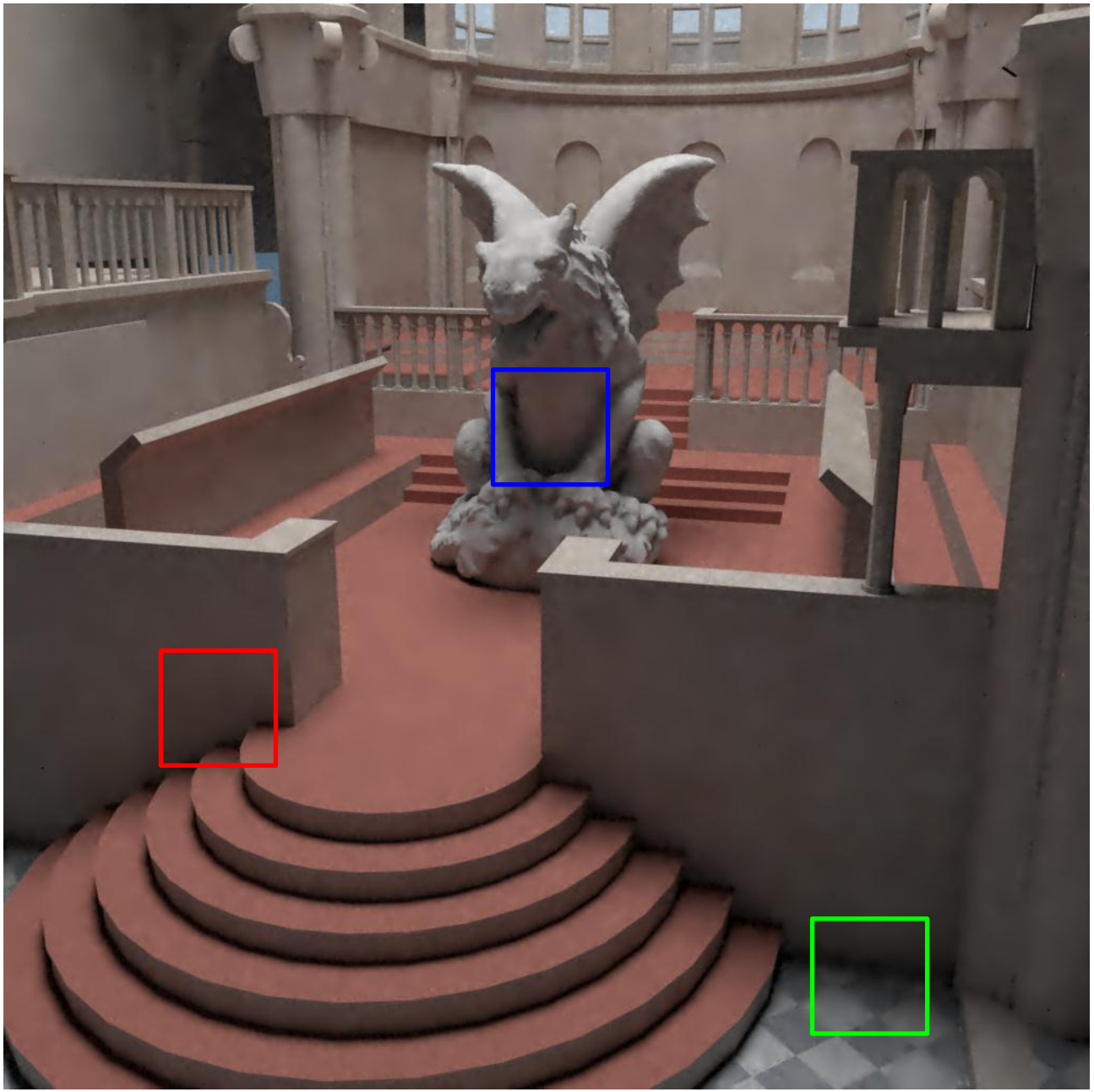
GARGOYLE

Equal-time Monte Carlo, 56 spp, 161.7 sec.



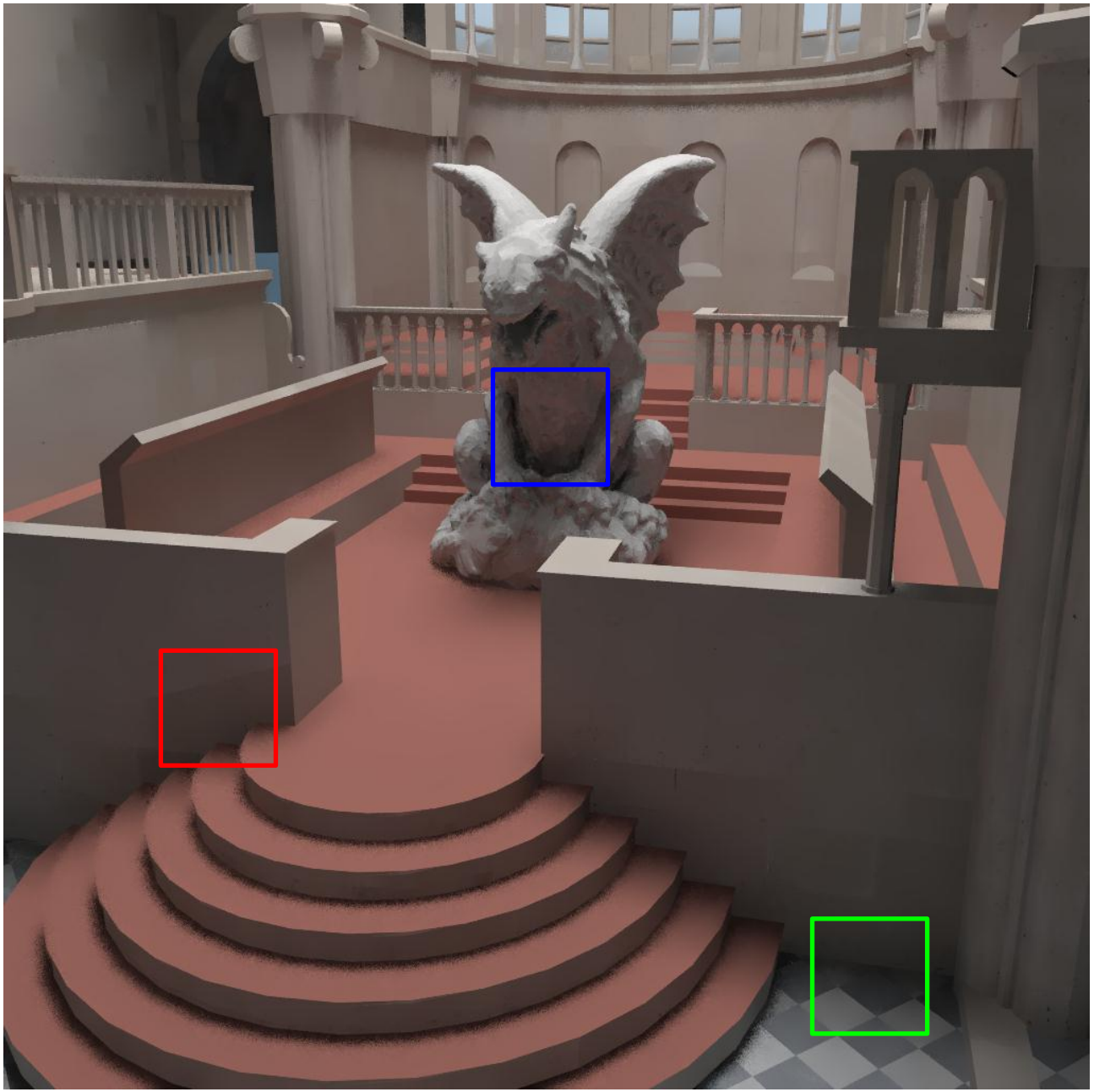
GARGOYLE

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 43.92 spp, 167.4 sec.



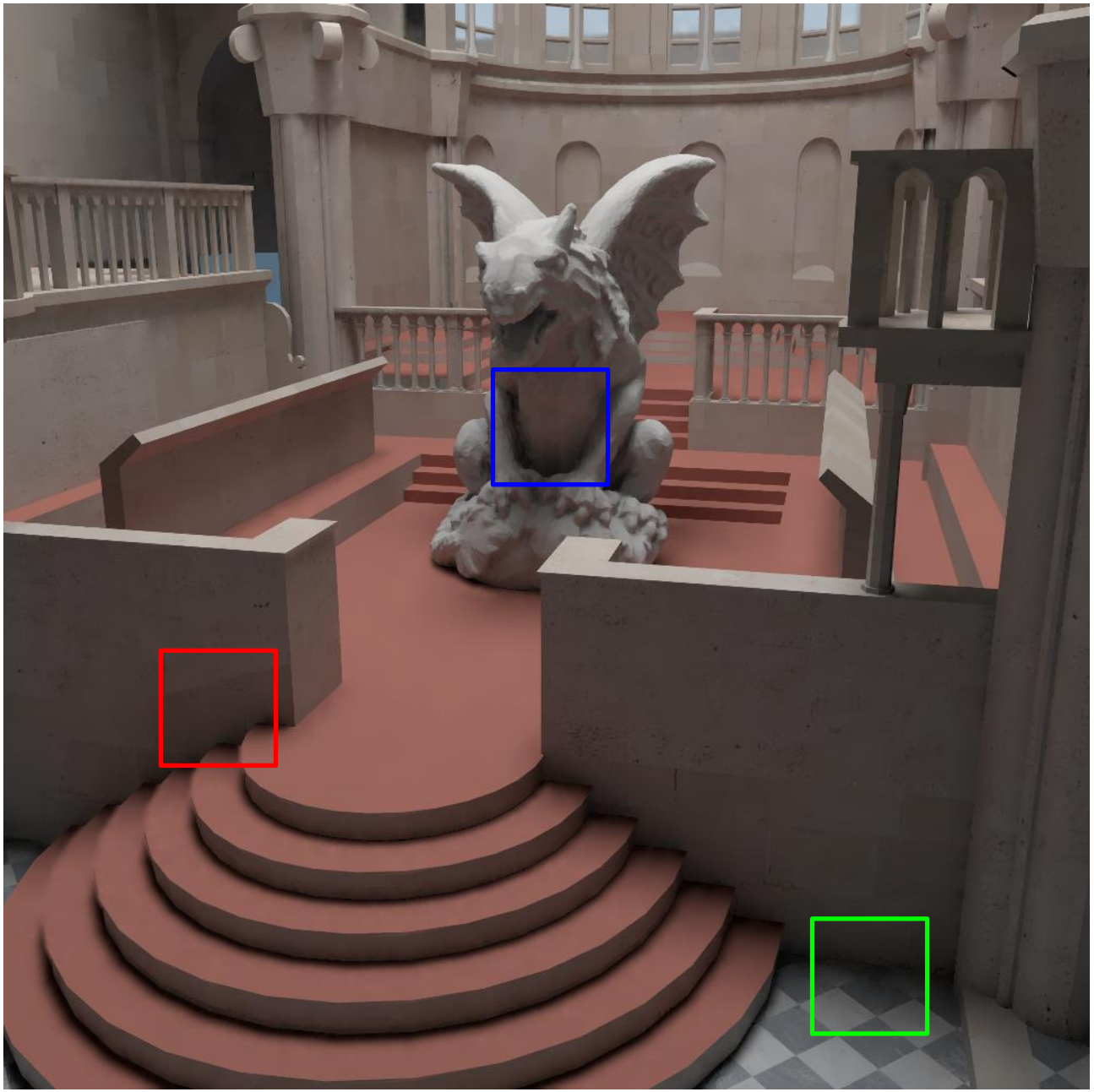
GARGOYLE

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 608.3 sec.



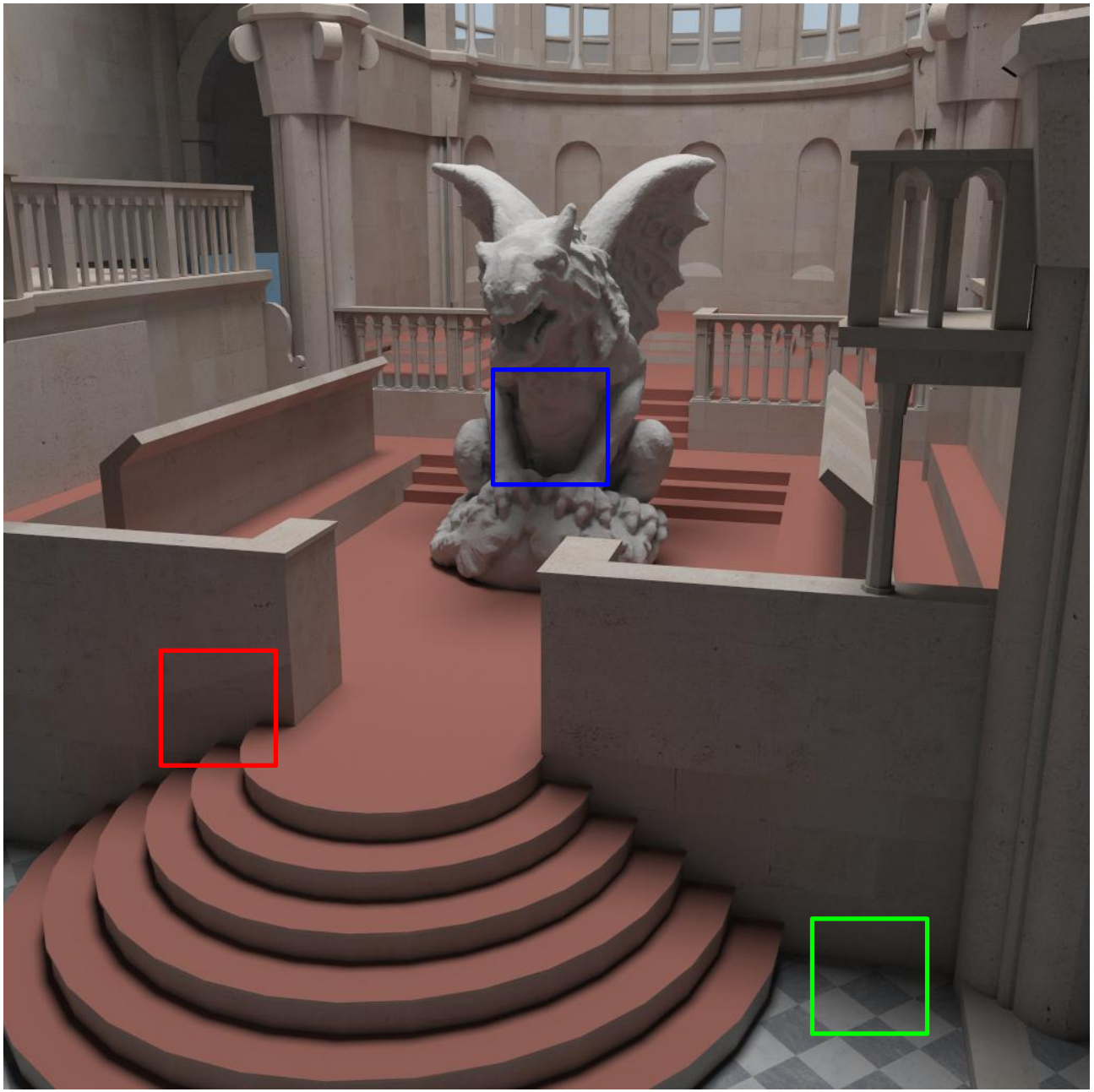
GARGOYLE

SURE-based Optimization (Our Approach), 30.90 spp, 160.0 sec.



GARGOYLE

Reference, 4096 spp



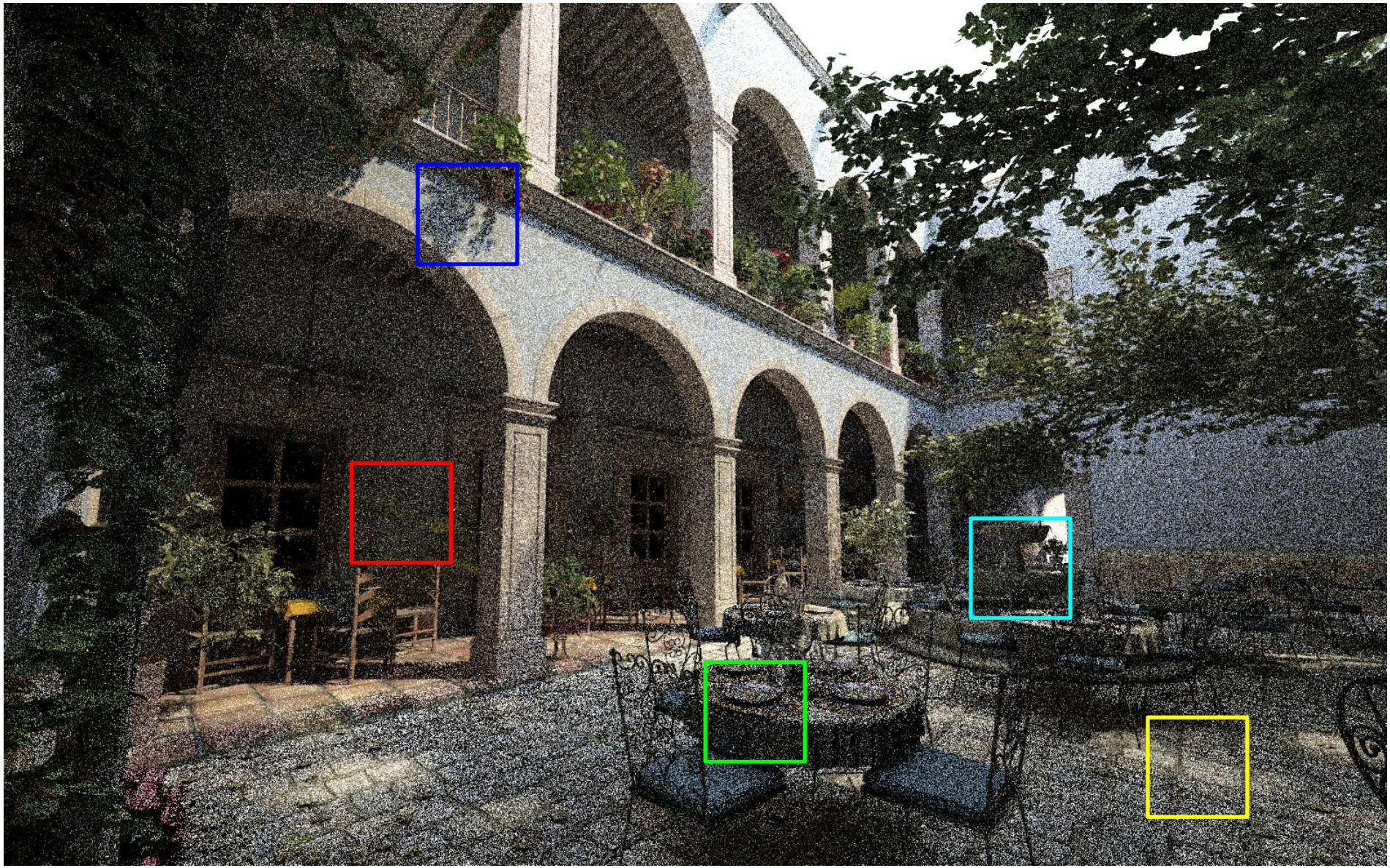
SANMIGUEL

Global Illumination (Path Tracing)

1580 x 986

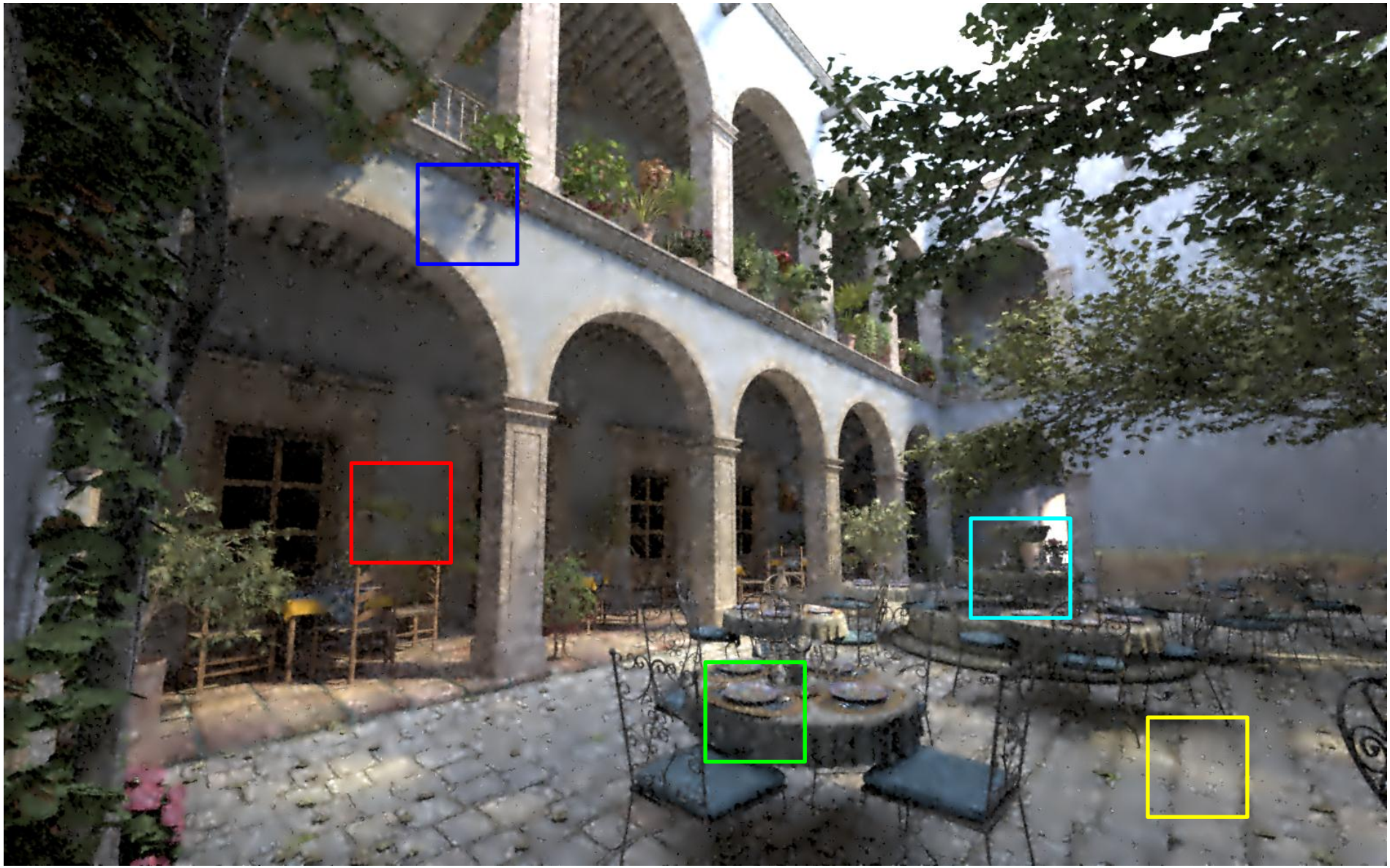
SANMIGUEL

Equal-time Monte Carlo, 70 spp, 1209.4 sec.



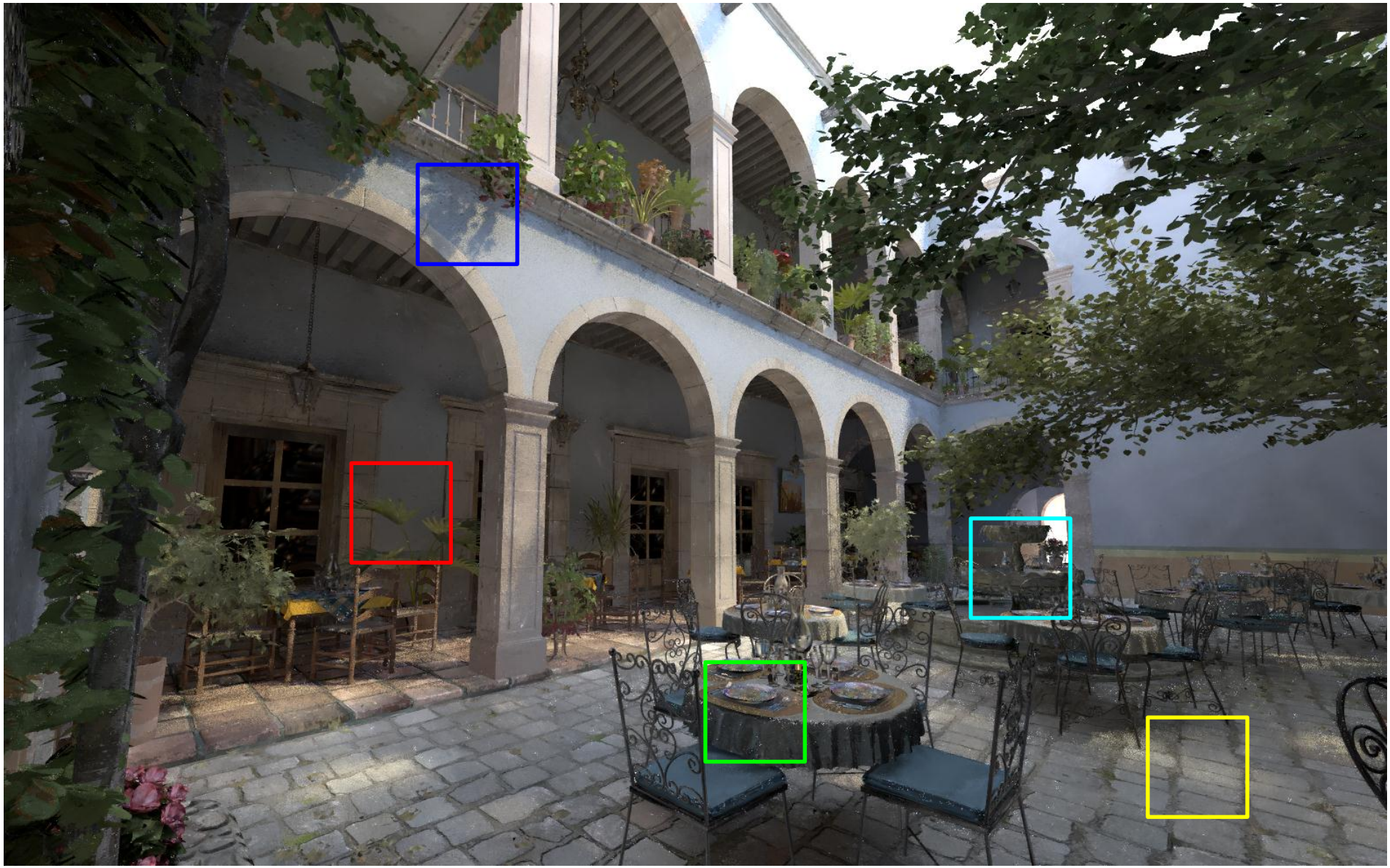
SANMIGUEL

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 63.59 spp, 1239.9 sec.



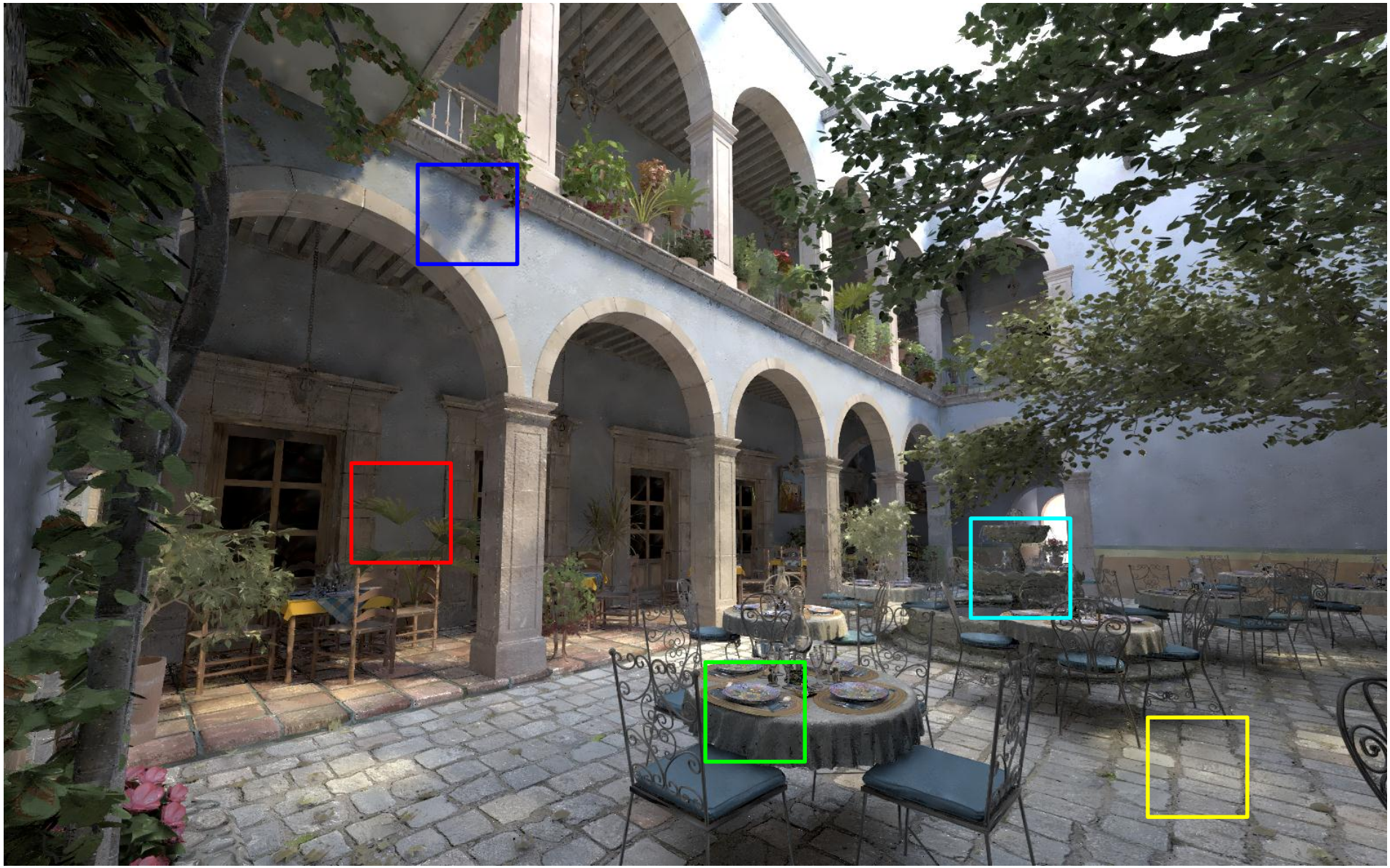
SANMIGUEL

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 16 spp, 2617.9 sec.



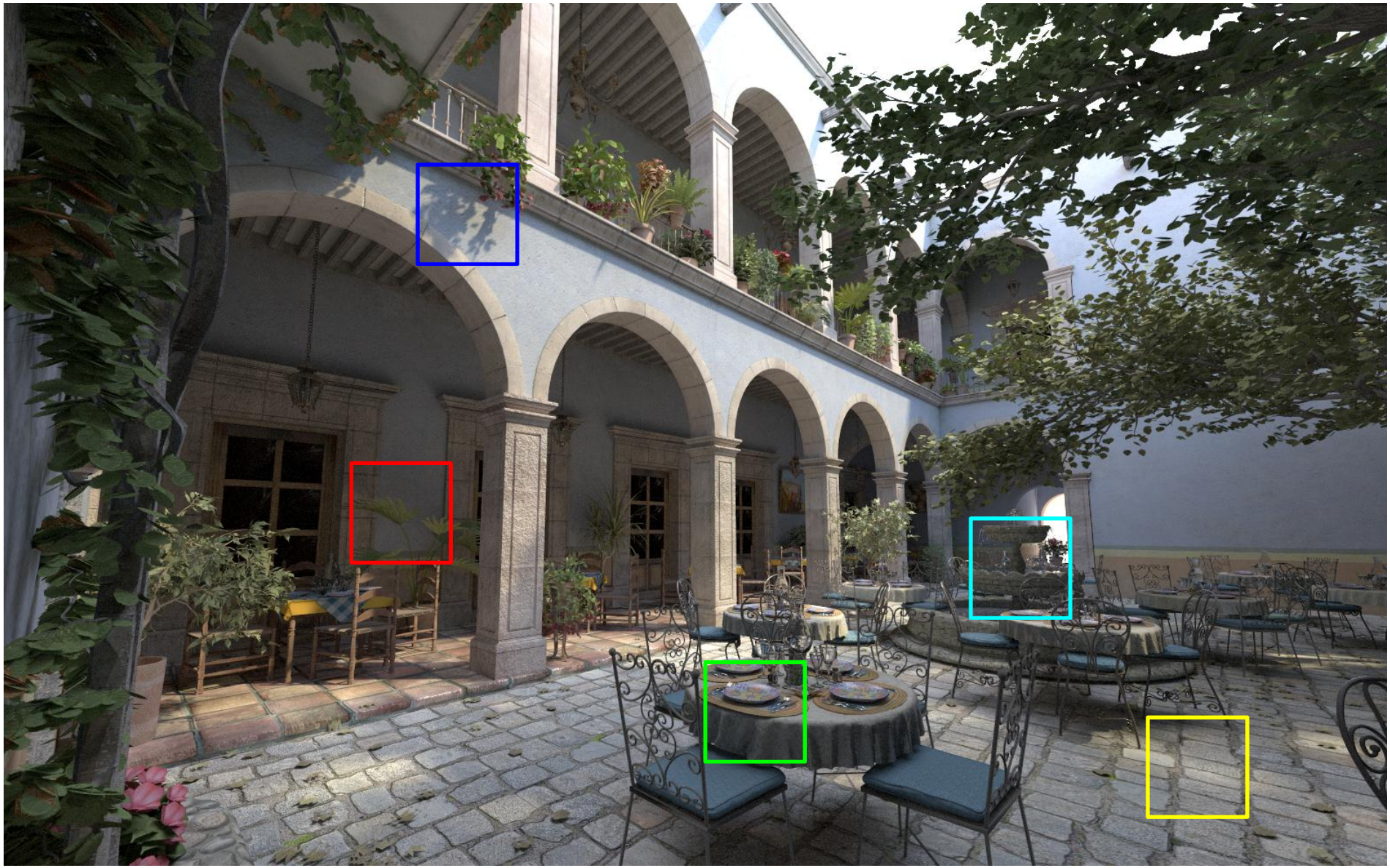
SANMIGUEL

SURE-based Optimization (Our Approach), 61.69 spp, 1228.9 sec.



SANMIGUEL

Reference, 8192 spp



PART II
Equal-Sample Comparison

Compared Methods:

- **Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011]**
- **Random Parameter Filtering [Sen and Darabi, ACMTOG 2012]**
- **SURE-based Optimization (our approach, using cross bilateral filters)**

SPONZA

Global Illumination (Path Tracing)
Motion Blur

1600 x 1200

SPONZA

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 16 spp, 210.0 sec.

SPONZA

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 16 spp, 1676.1 sec.

SPONZA

SURE-based Optimization (Our Approach), 16 spp, 273.3 sec.

SPONZA

Reference, 8192 spp

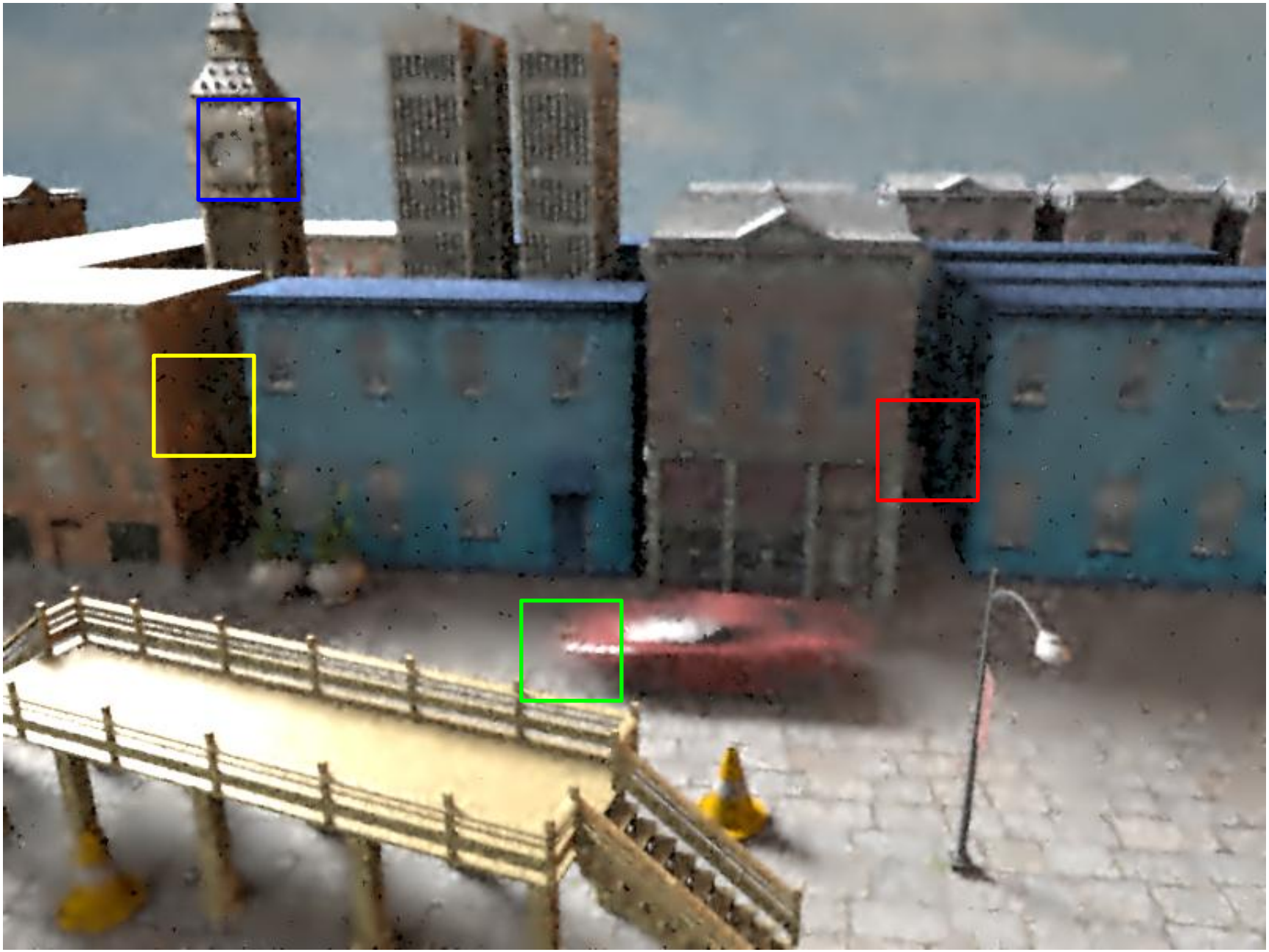
TOWN

Environment Lighting
Area Lighting
Motion Blur

800 x 600

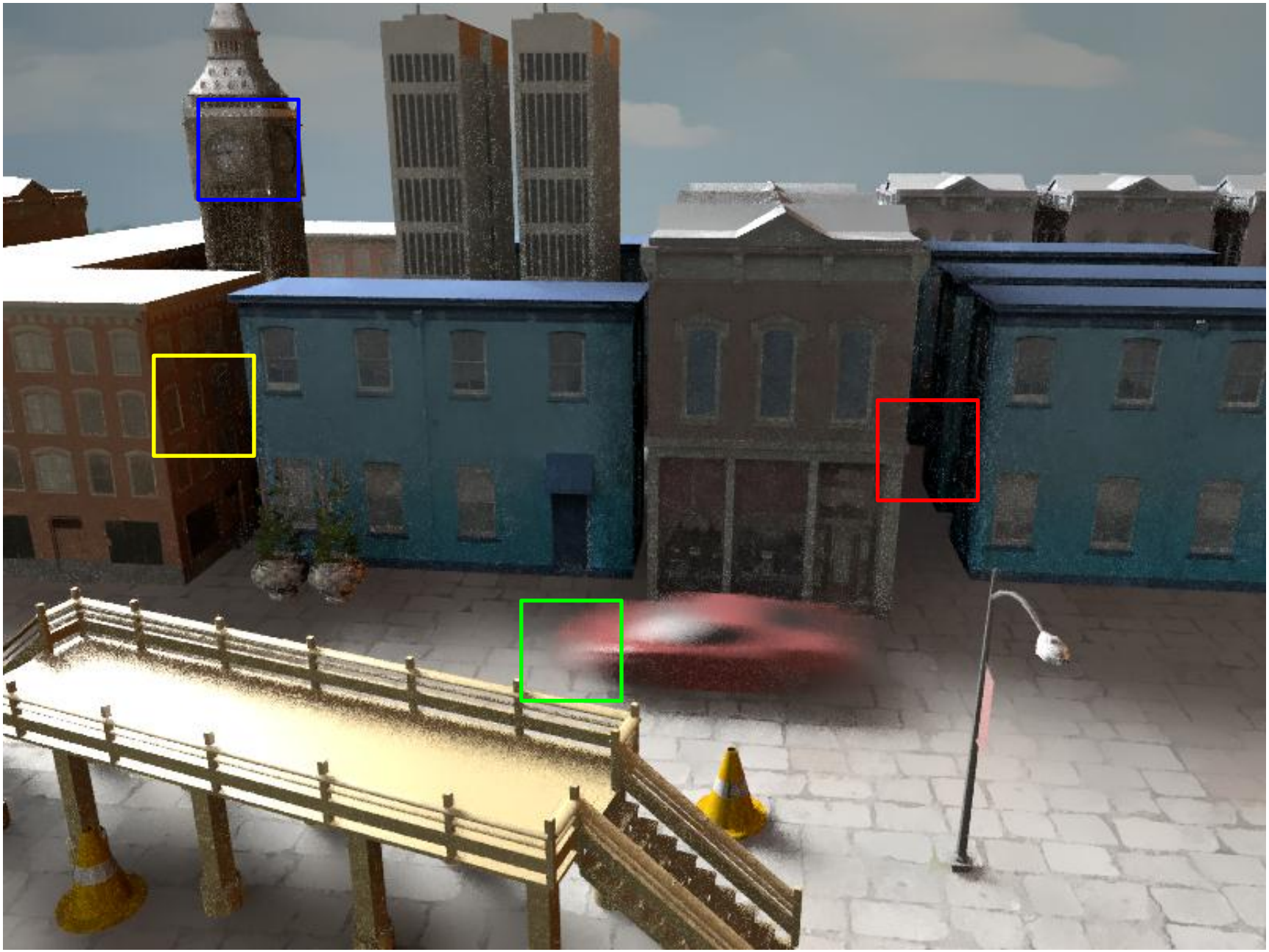
TOWN

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 8 spp, 9.4 sec.



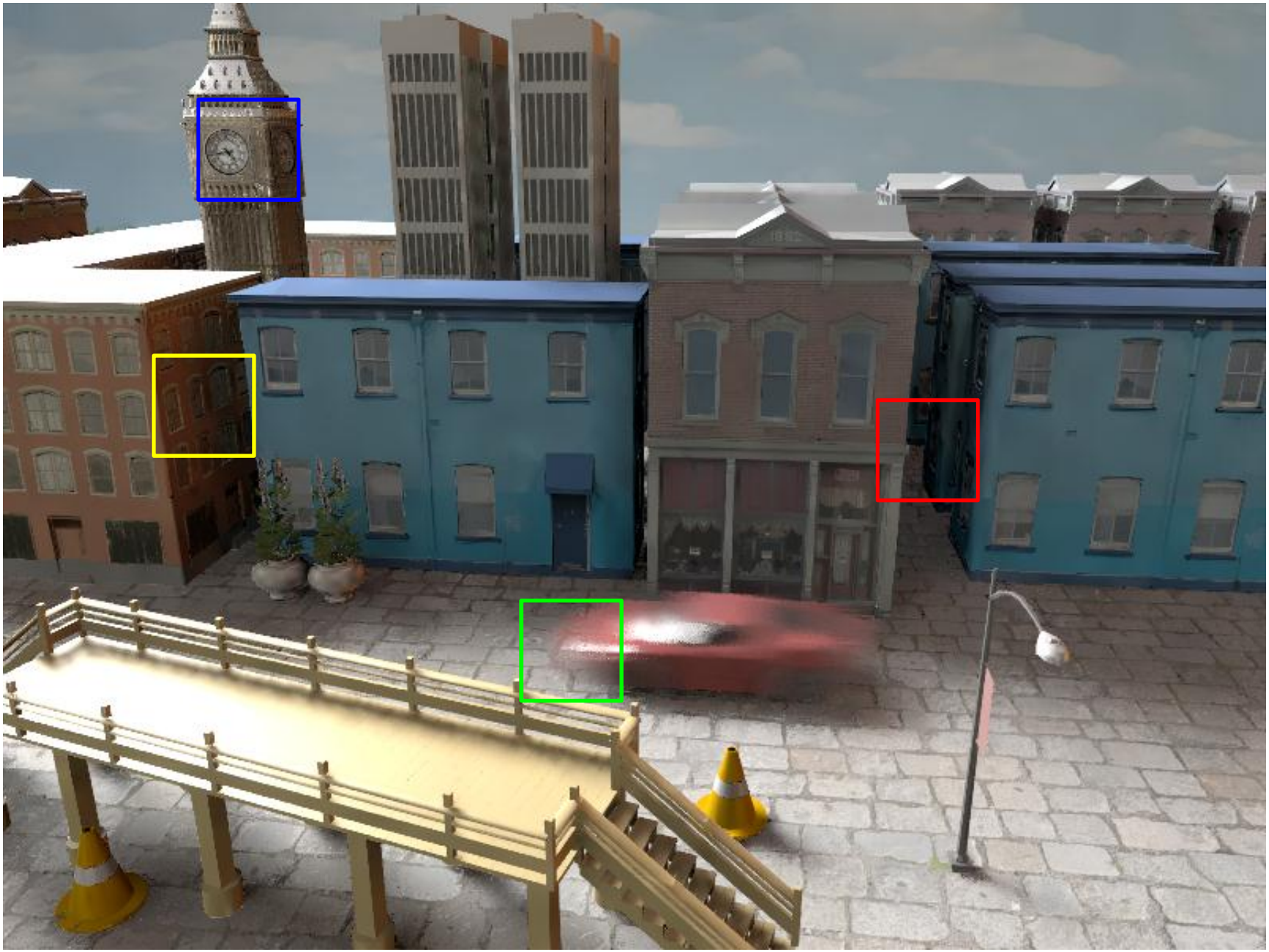
TOWN

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 272.4 sec.



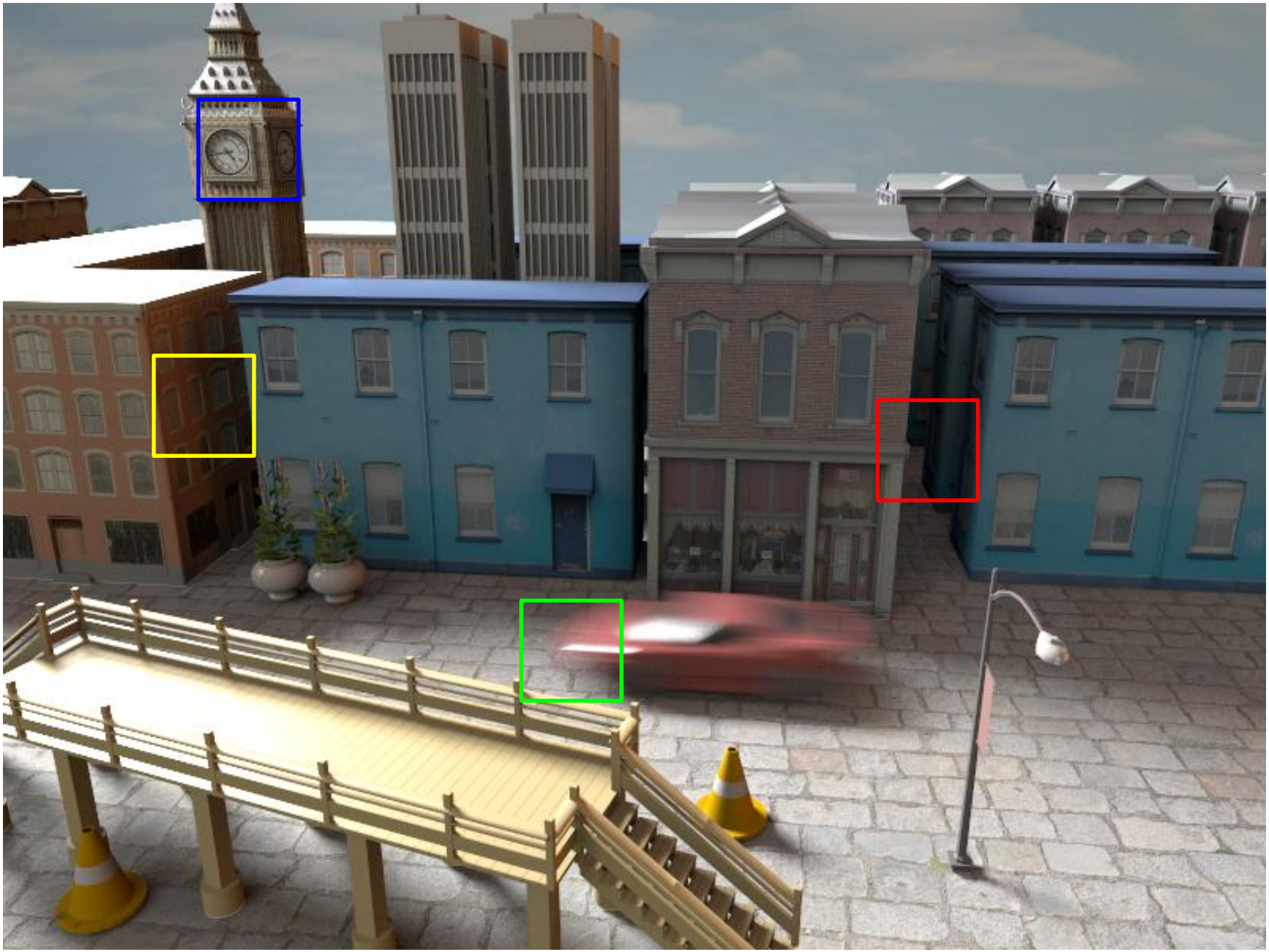
TOWN

SURE-based Optimization (Our Approach), 8 spp, 20.0 sec.



TOWN

Reference, 4096 spp



SIBENIK

Global Illumination (One-Bounce Path Tracing)
Depth of Field

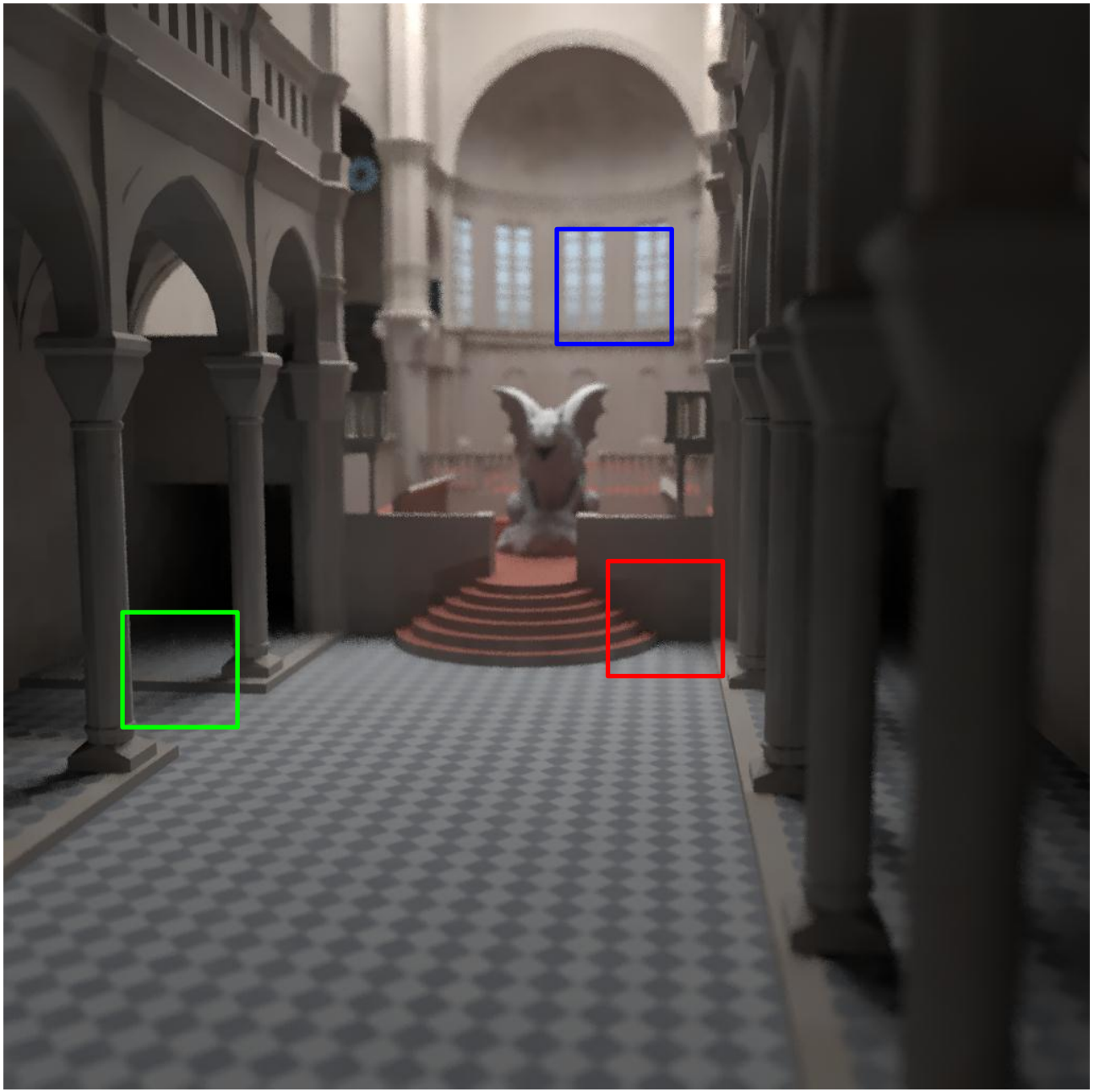
1024 x 1024

SIBENIK

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 8 spp, 27.6 sec.

SIBENIK

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 363.0 sec.

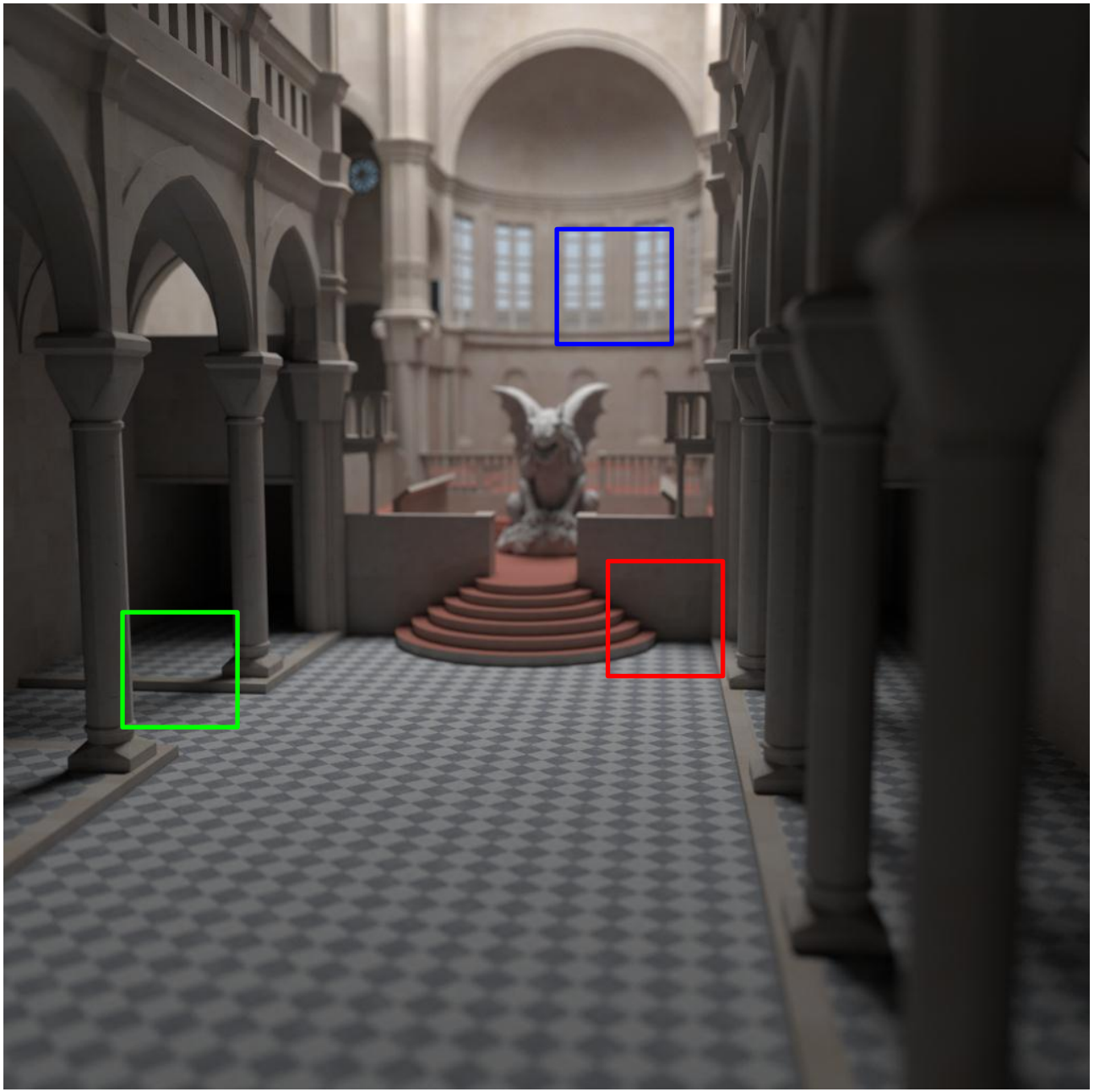


SIBENIK

SURE-based Optimization (Our Approach), 8 spp, 64.2 sec.

SIBENIK

Reference, 4096 spp



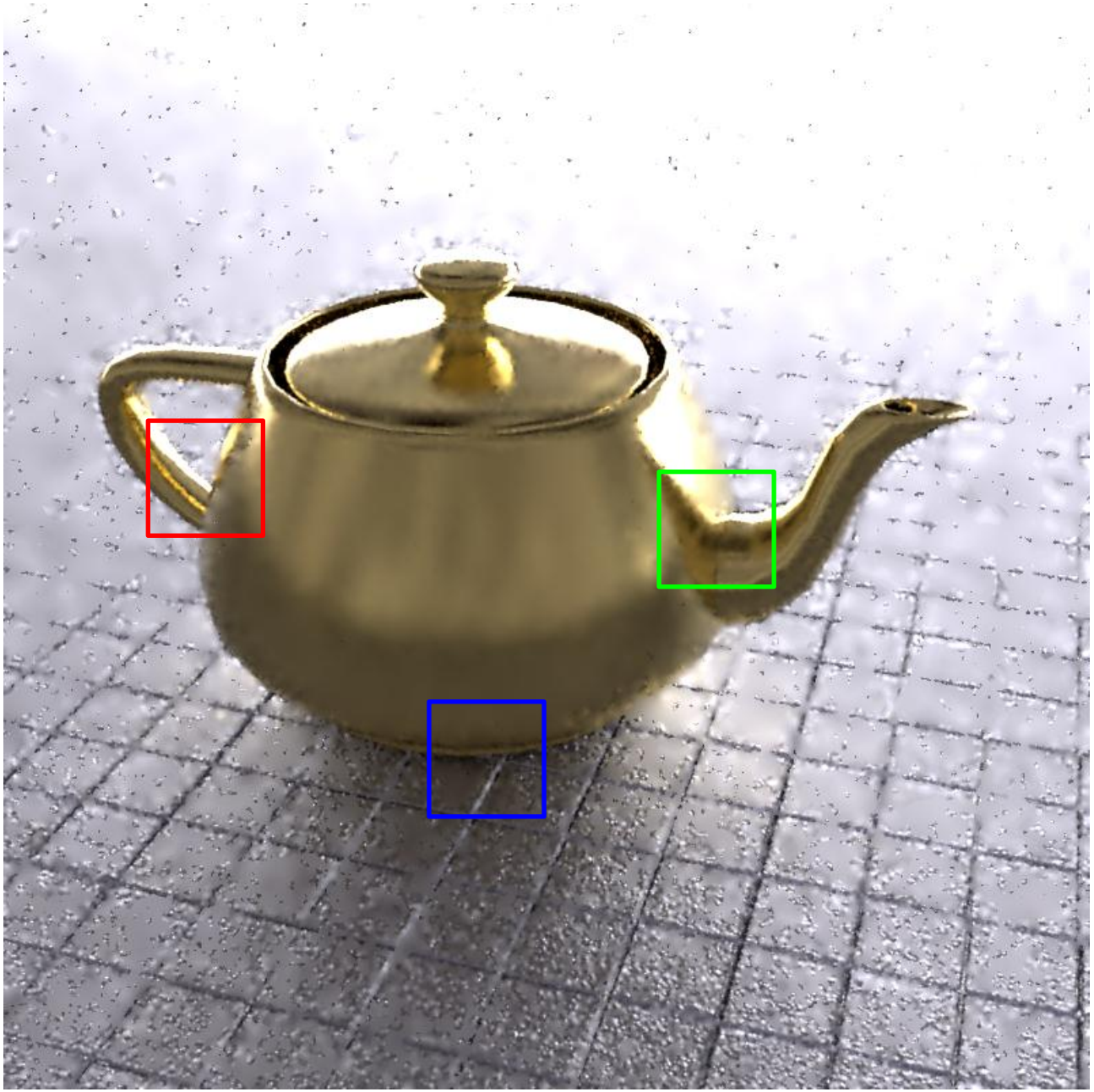
TEAPOT

Environment Lighting
Glossy Reflection

800 x 800

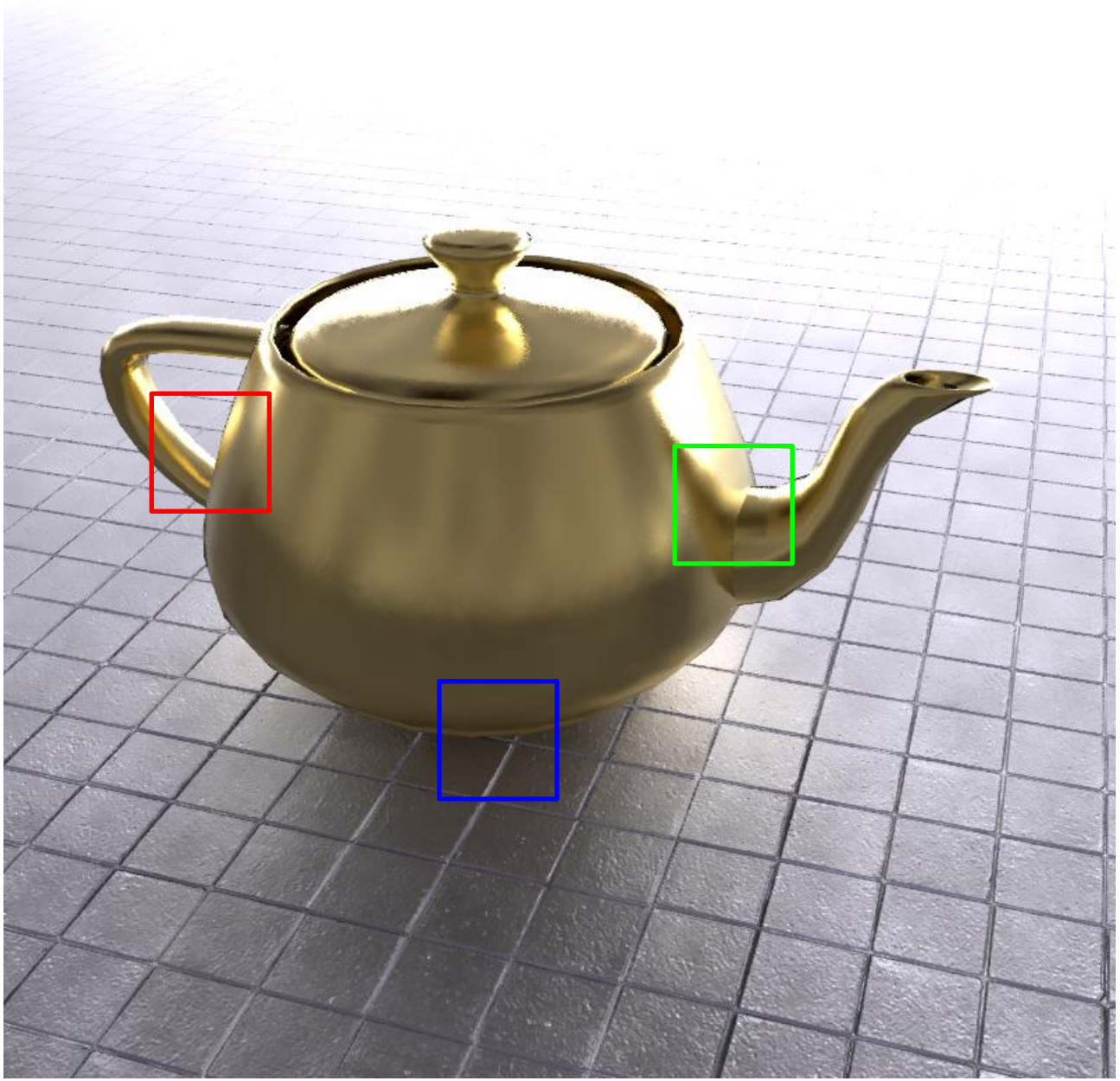
TEAPOT

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 8 spp, 14.1 sec.



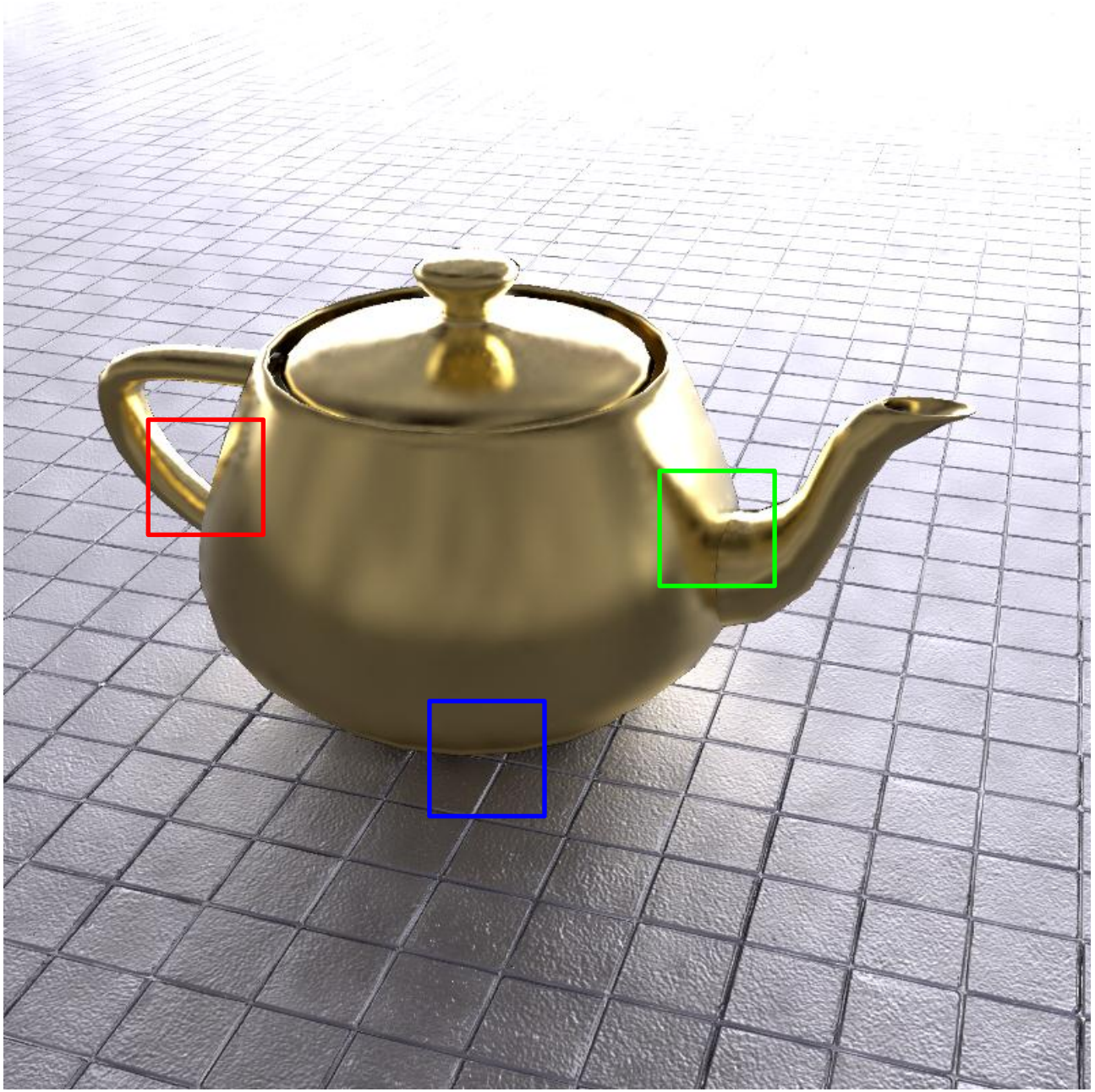
TEAPOT

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 374.4 sec.



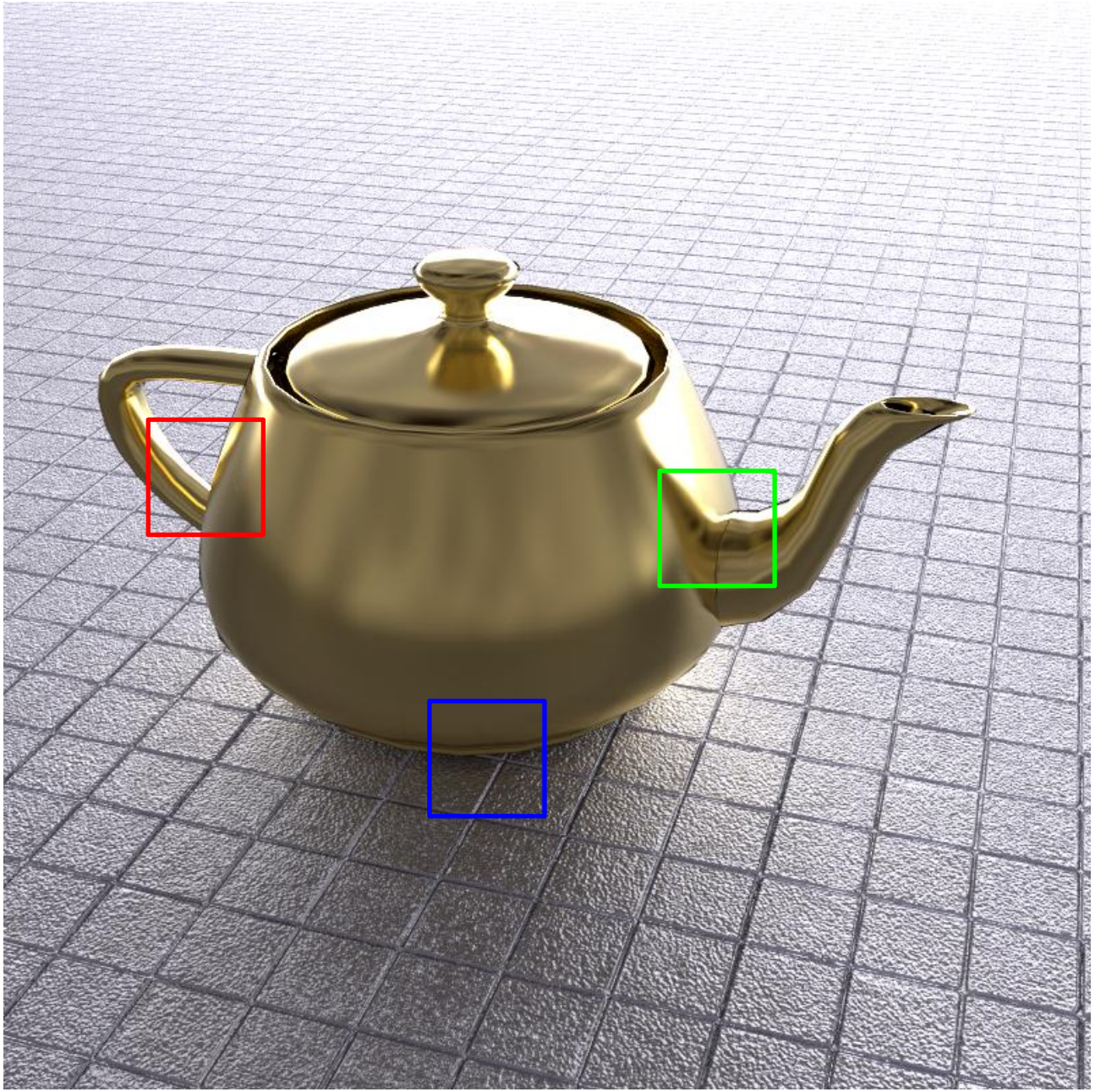
TEAPOT

SURE-based Optimization (Our Approach), 8 spp, 40.4 sec.



TEAPOT

Reference, 4096 spp



GARGOYLE

Global Illumination (One-Bounce Path Tracing)

1024 x 1024

GARGOYLE

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 8 spp, 28.6 sec.

GARGOYLE

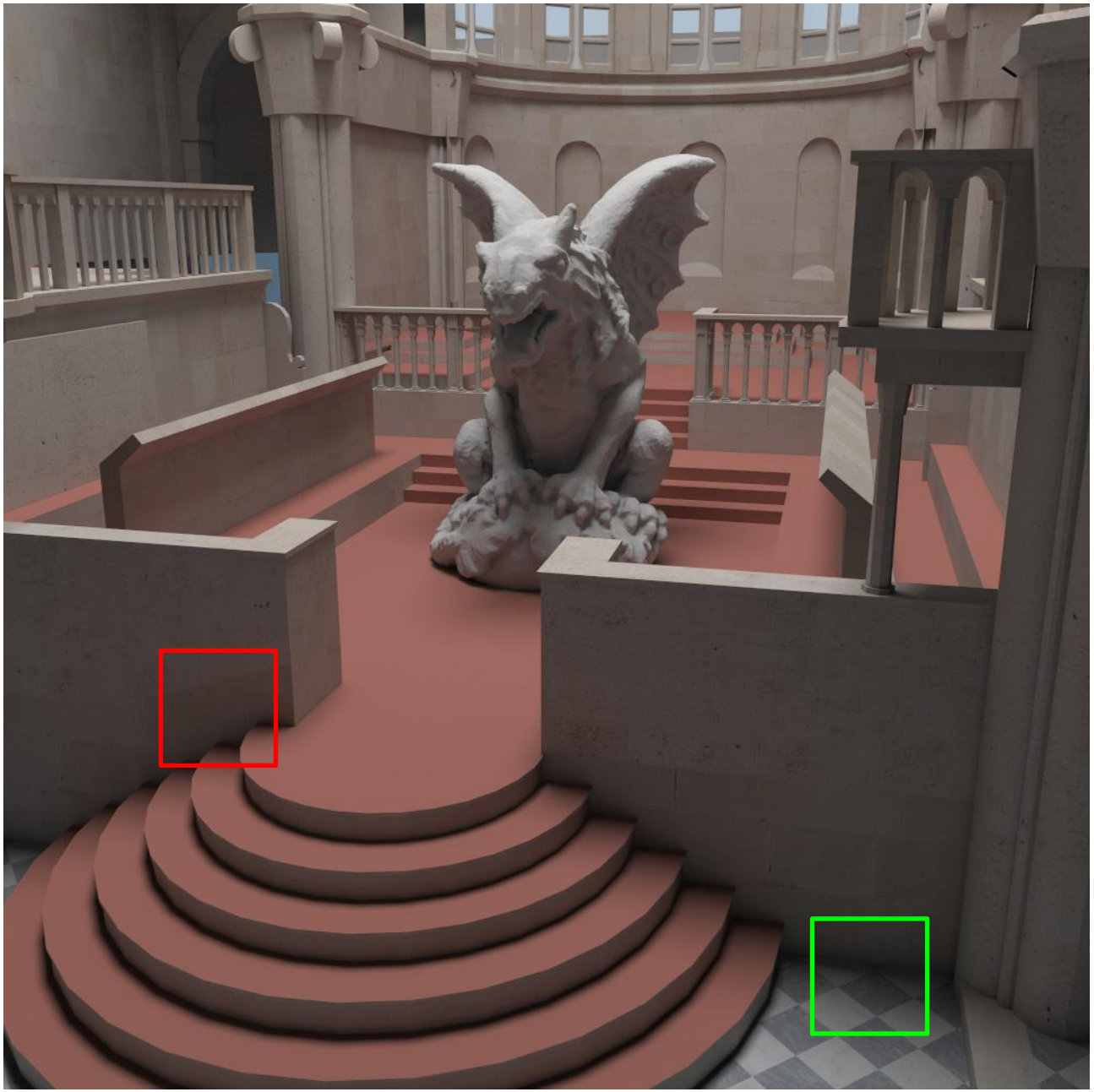
Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 8 spp, 608.3 sec.

GARGOYLE

SURE-based Optimization (Our Approach), 8 spp, 68.3 sec.

GARGOYLE

Reference, 4096 spp



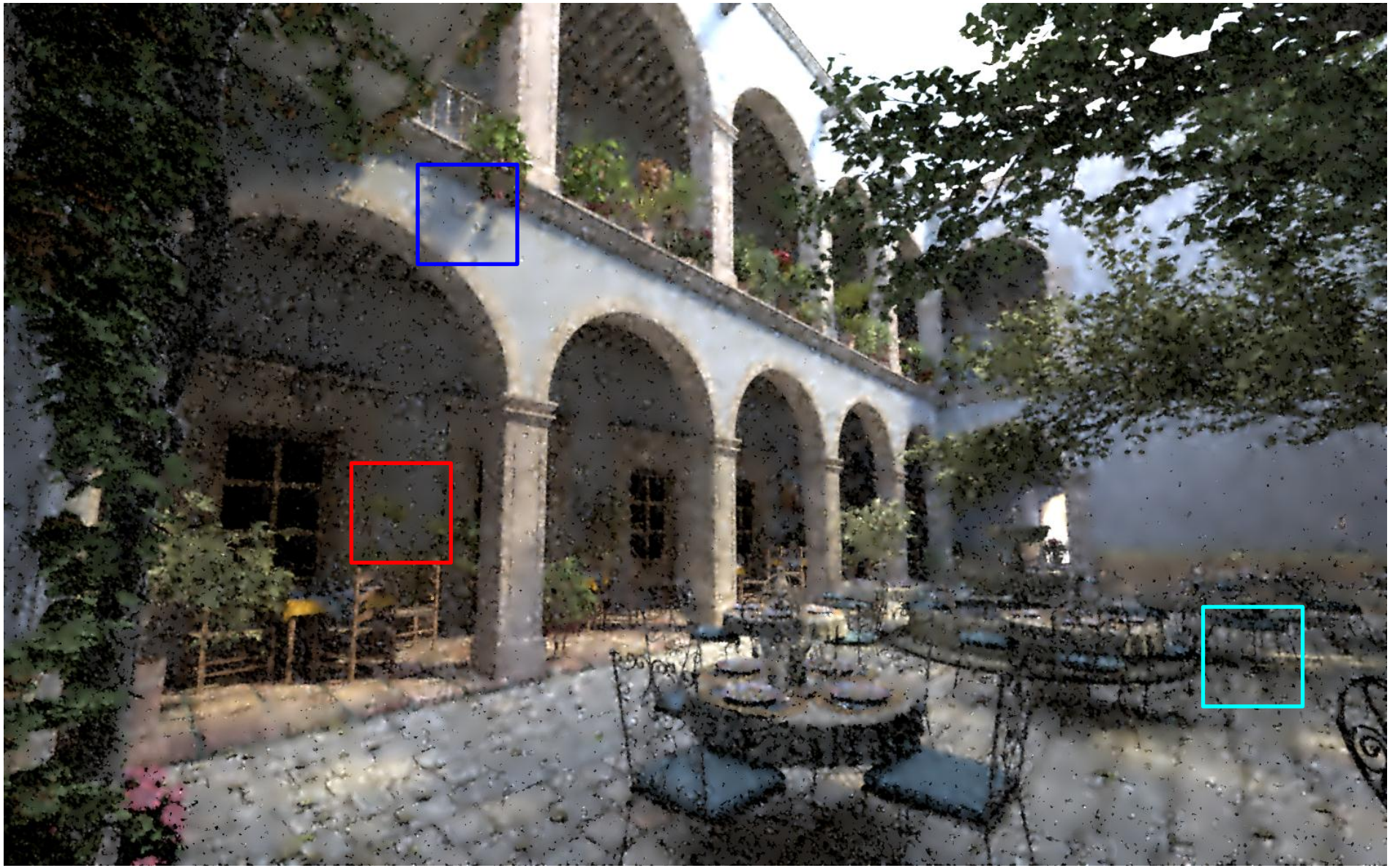
SANMIGUEL

Global Illumination (Path Tracing)

1580 x 986

SANMIGUEL

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011], 16 spp, 304.4 sec.



SANMIGUEL

Random Parameter Filtering [Sen and Darabi, ACMTOG 2012], 16 spp, 2617.9 sec.

SANMIGUEL

SURE-based Optimization (Our Approach), 16 spp, 336.3 sec.

SANMIGUEL

Reference, 8192 spp

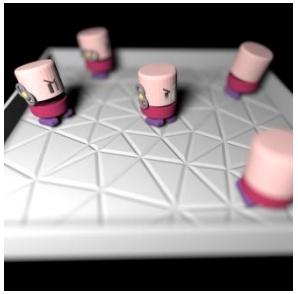
PART III
Equal-Time Comparison for Isotropic Gaussian Filters

Compared Methods:

- **Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011]**
- **SURE-based Optimization (our approach, using isotropic Gaussian filters)**

TOASTERS

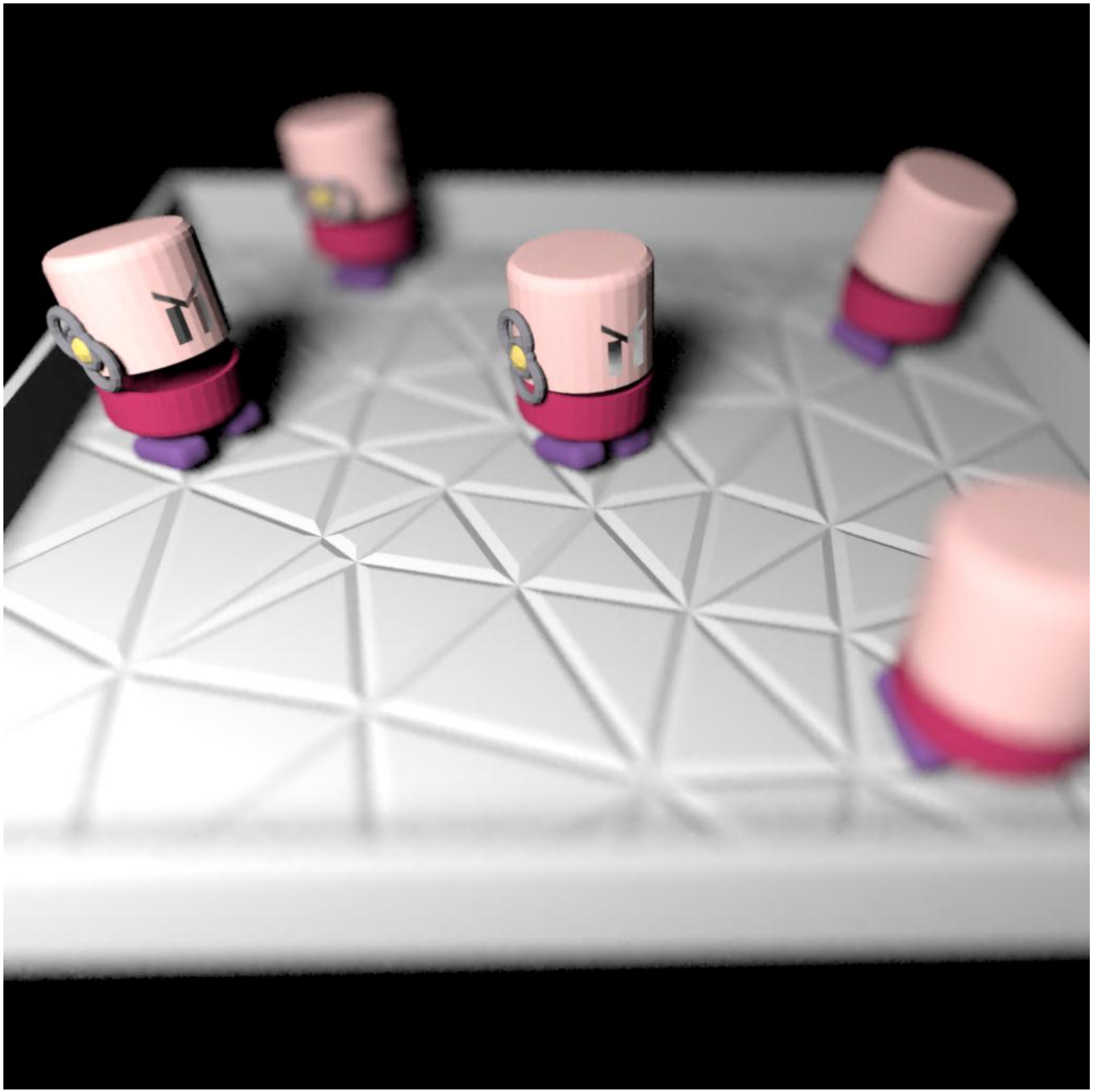
Area Lighting
Depth of Field



1024 x 1024

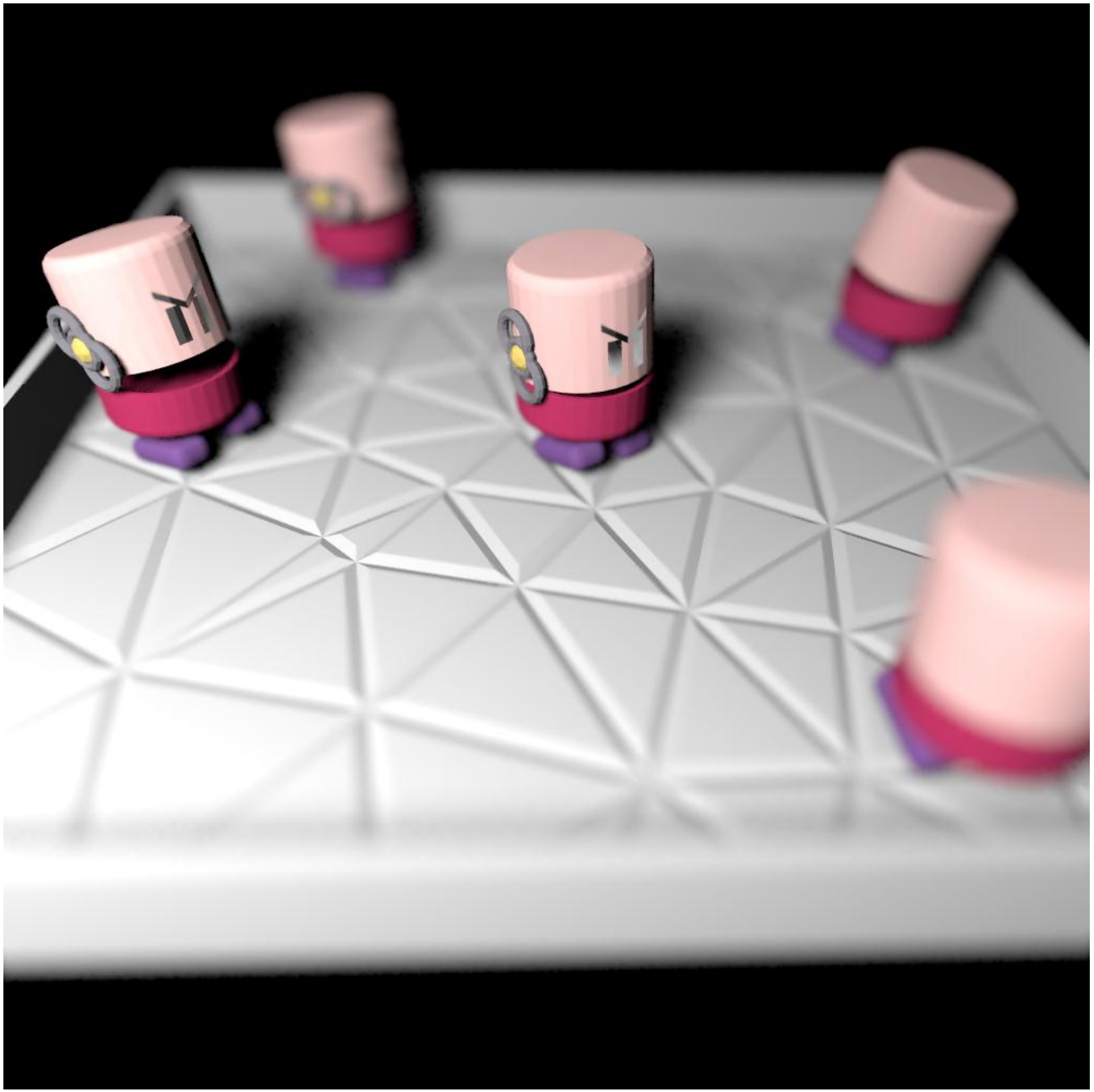
TOASTERS

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011]



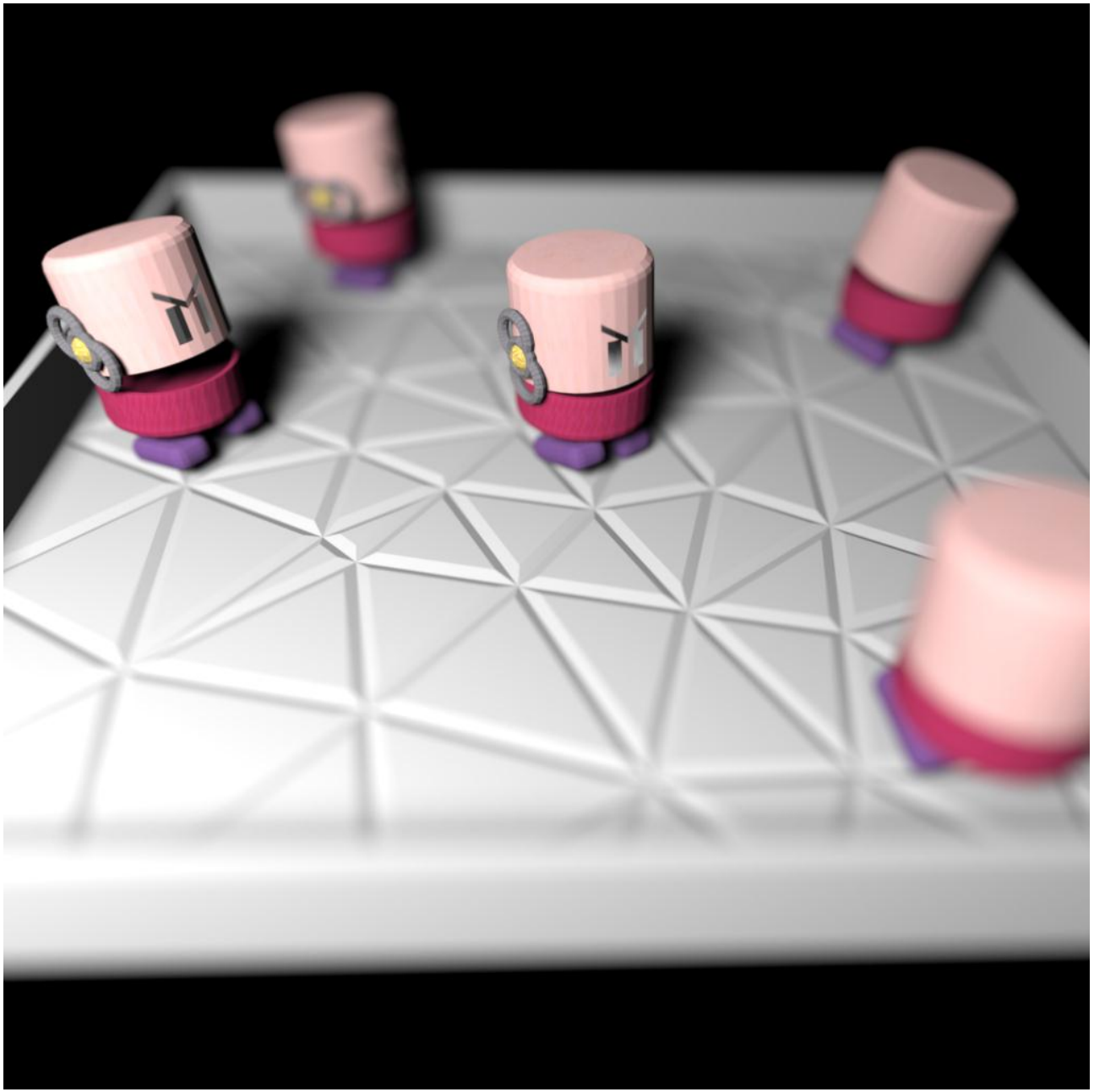
TOASTERS

SURE-based Optimization (Our Approach), using Isotropic Gaussian Filters



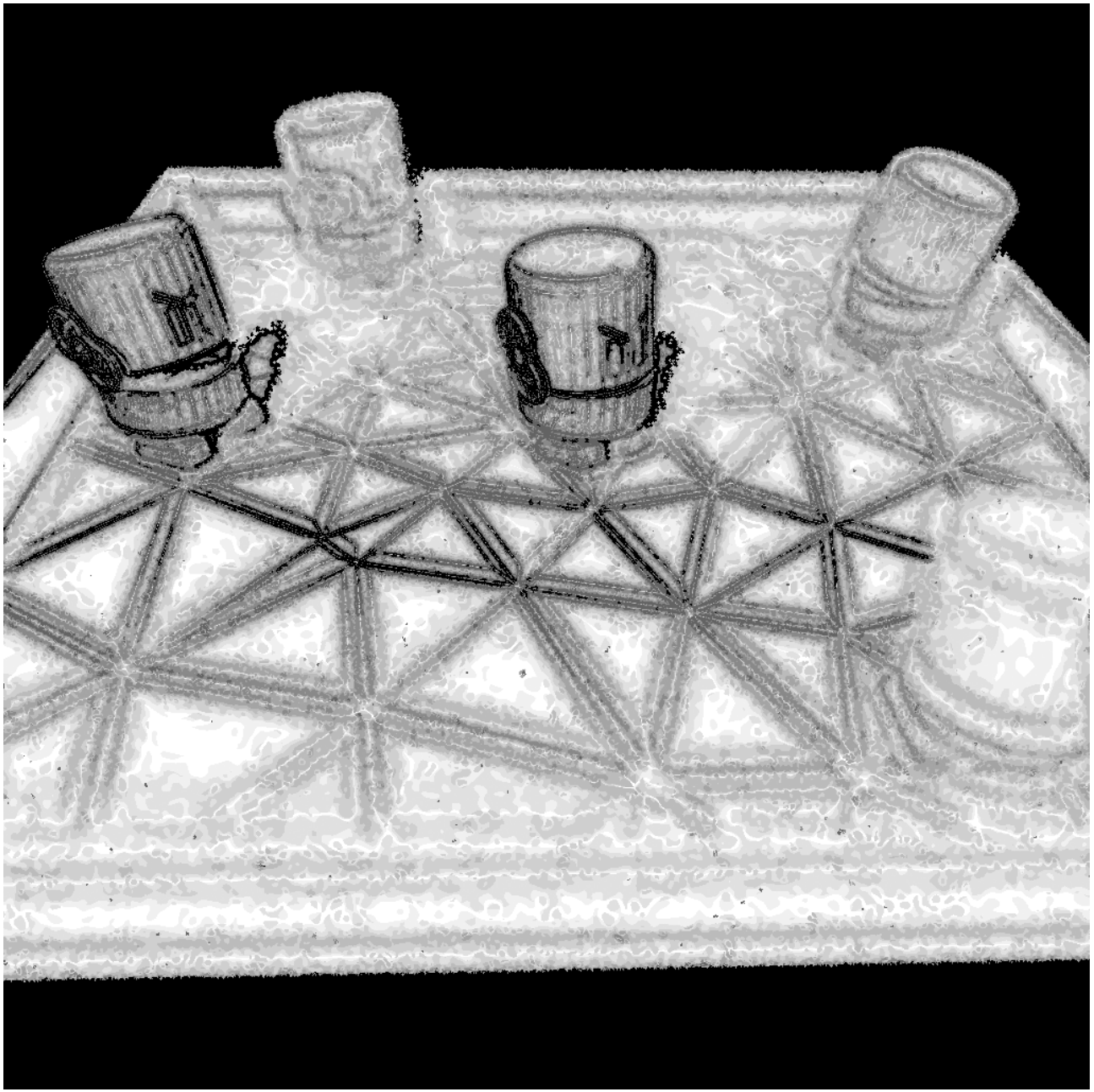
TOASTERS

Reference, 4096 spp



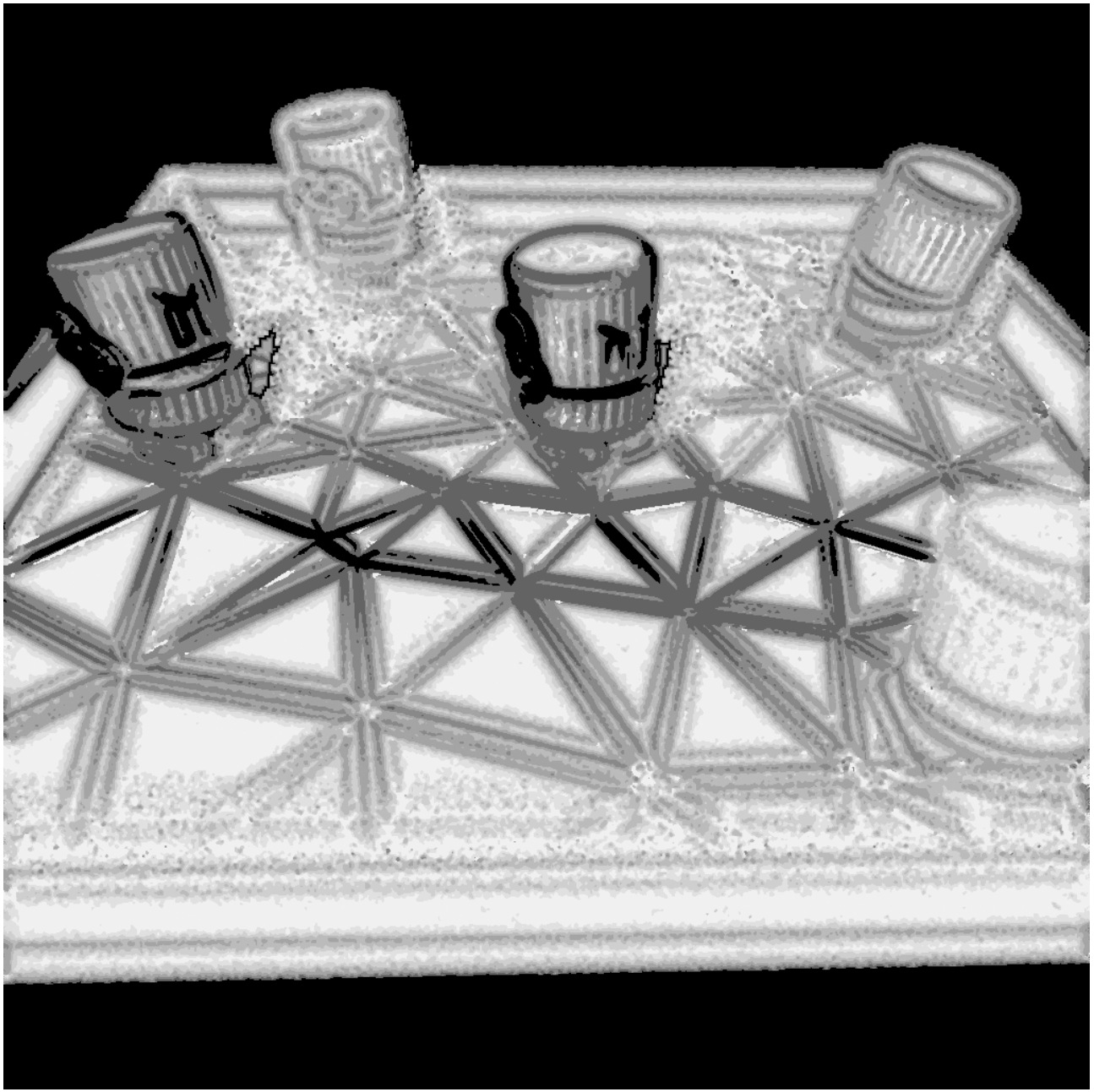
TOASTERS – Scale Selection Map

Greedy Error Minimization [Rousselle et al., SIGGRAPH Asia 2011]



TOASTERS - Scale Selection Map

SURE-based Optimization (Our Approach), using Isotropic Gaussian Filters



PART IV
Equal-Time Comparison for Cross Non-local Means Filters

Compared Methods:

- **Global cross non-local means filters**
- **SURE-based Optimization (our approach, using cross non-local means filters)**

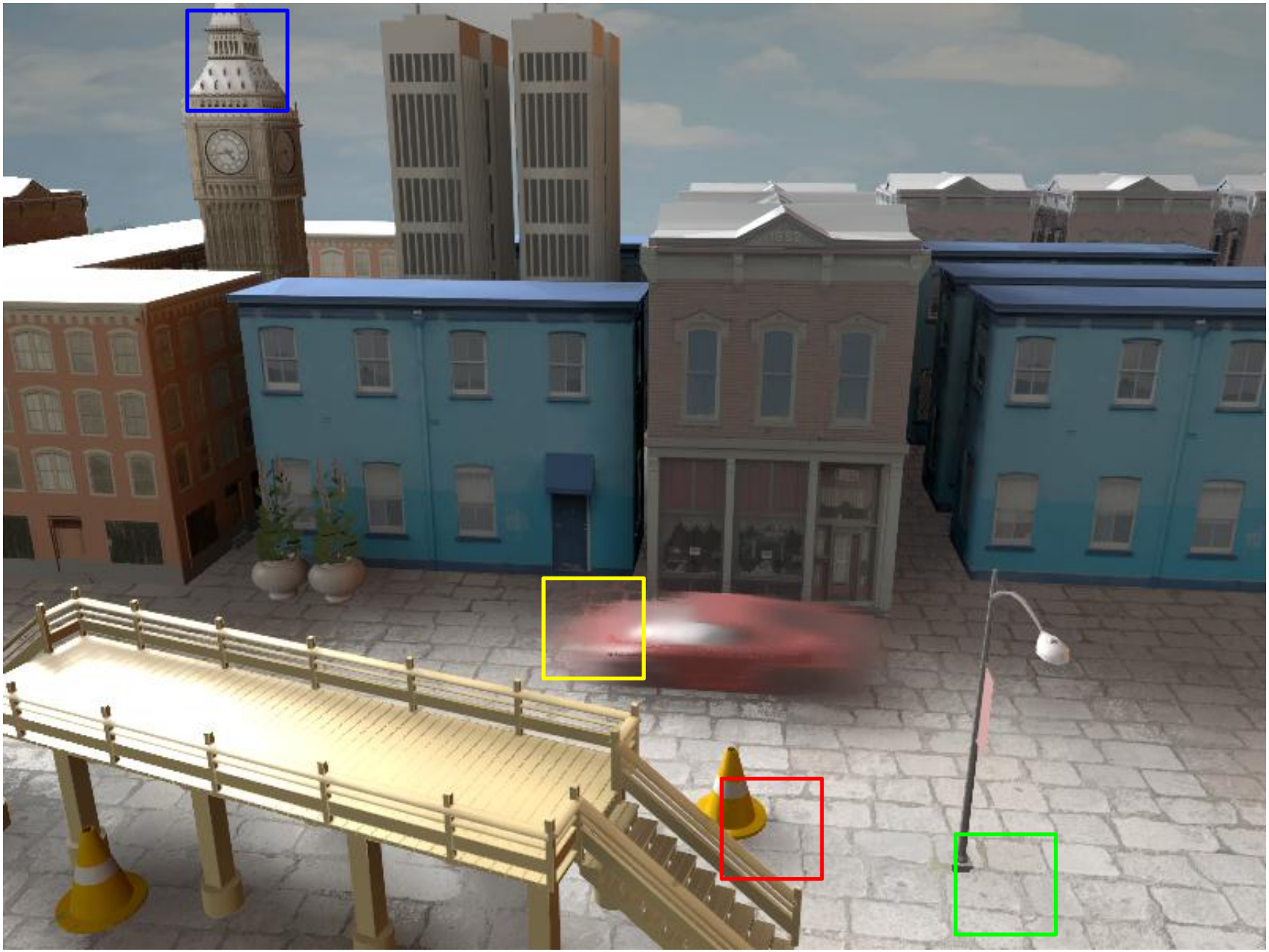
TOWN

Environment Lighting
Area Lighting
Motion Blur

800 x 600

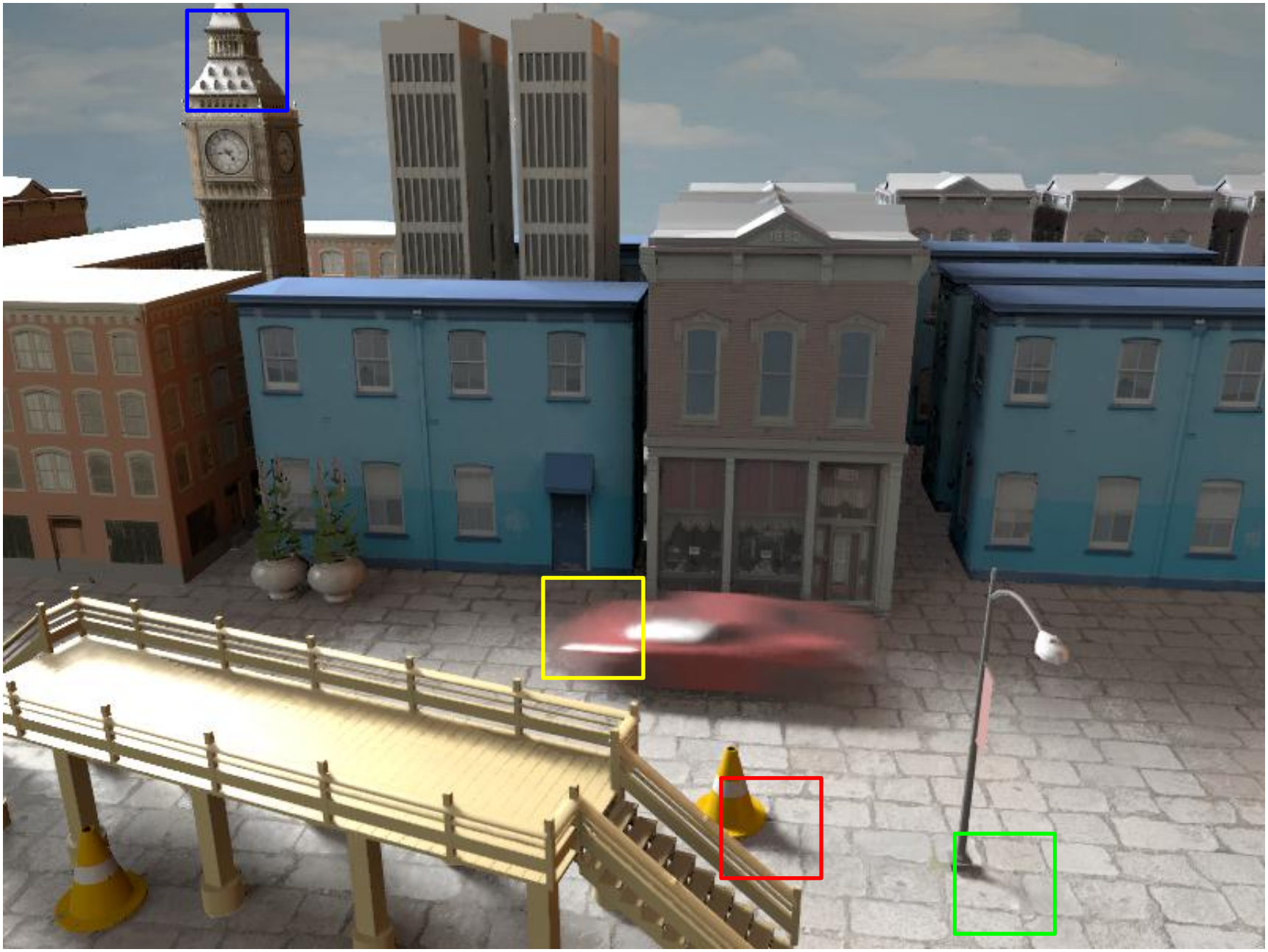
TOWN

Global Non-local Means Filter, 41.2 spp



TOWN

SURE-based Optimization (Our Approach), using Cross Non-local Means Filters, 41.2 spp, 244.7 sec.



TOWN

Reference, 4096 spp