



International
Centre for
Radio
Astronomy
Research

Organisation and Exploration of Very Large Imagery Data in the SKA

JT Malarecki

Supervisors: Slava Kitaeff, Andreas Wicenec, Lister Staveley-Smith
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THE UNIVERSITY OF
WESTERN AUSTRALIA



Data Organisation

Big data

The first phase of the Square Kilometre Array is expected to produce data sets on the order of one to ten petabytes.

Need a new approach for visually exploring data

- storage vs visualisation
- JPEG2000 can complement existing methodologies



JPEG2000

JPEG2000

- designed to effectively handle enormous images through complex encoding mechanisms
 - offers random access and processing
 - Adaptive and progressive transfer
- both lossless and lossy compression

JPEG2000 Interactive Protocol (JPIP)

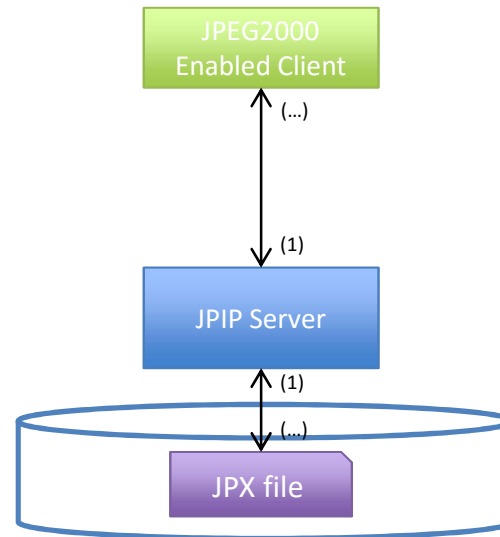
- ensures efficiency when working remotely

JPEG2000 + JPIP

- work with data as soon as they are produced

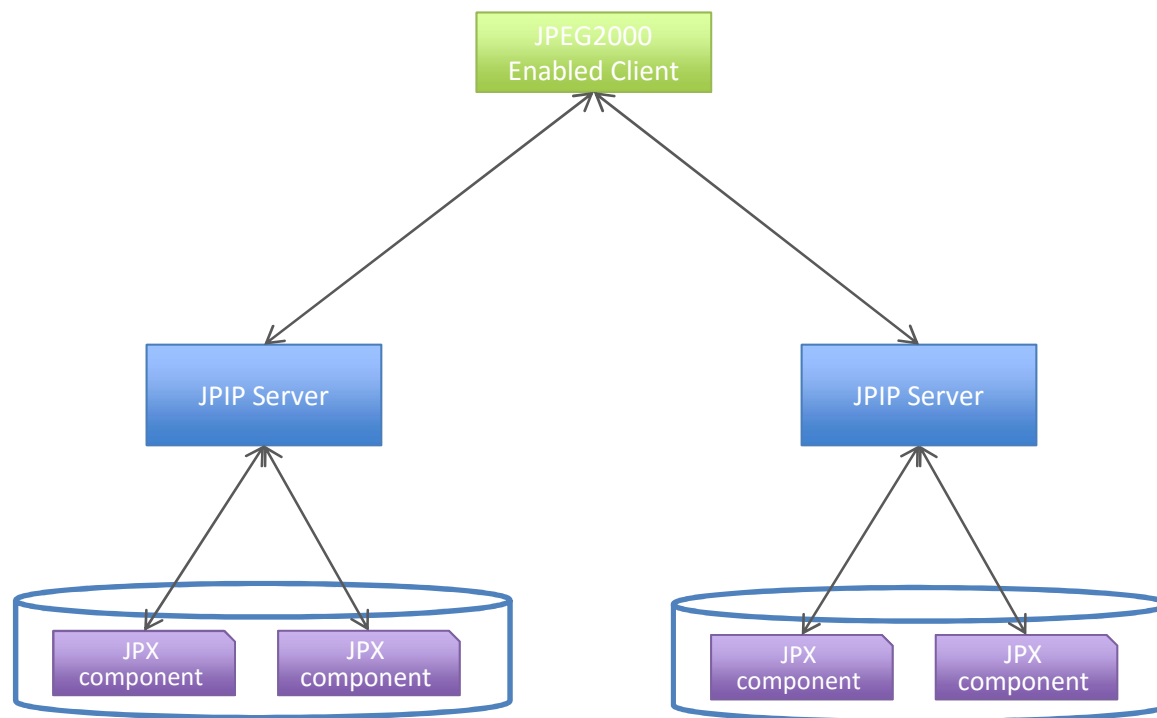


JPIP Client-Server



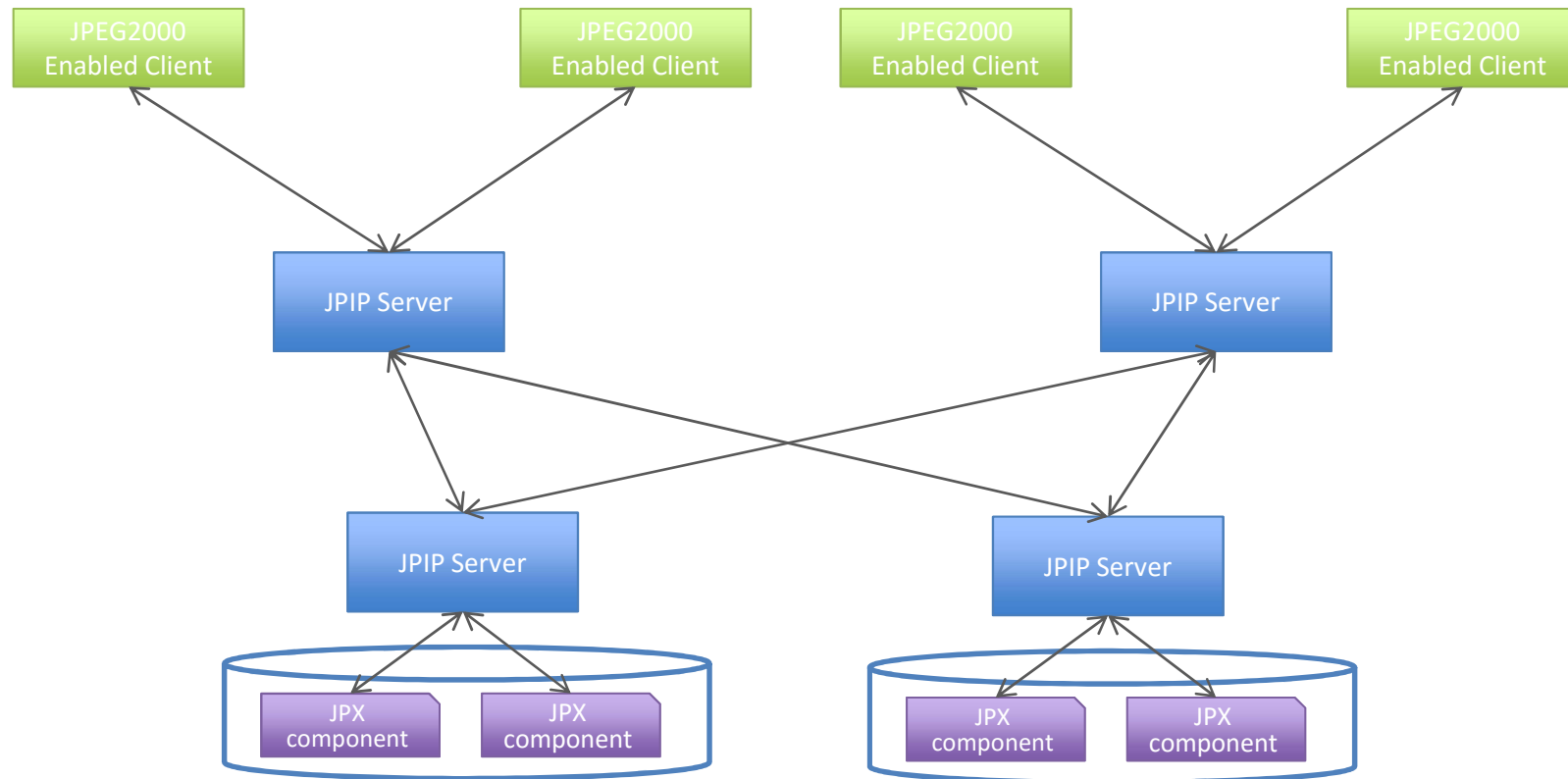


JPIP Client-Server



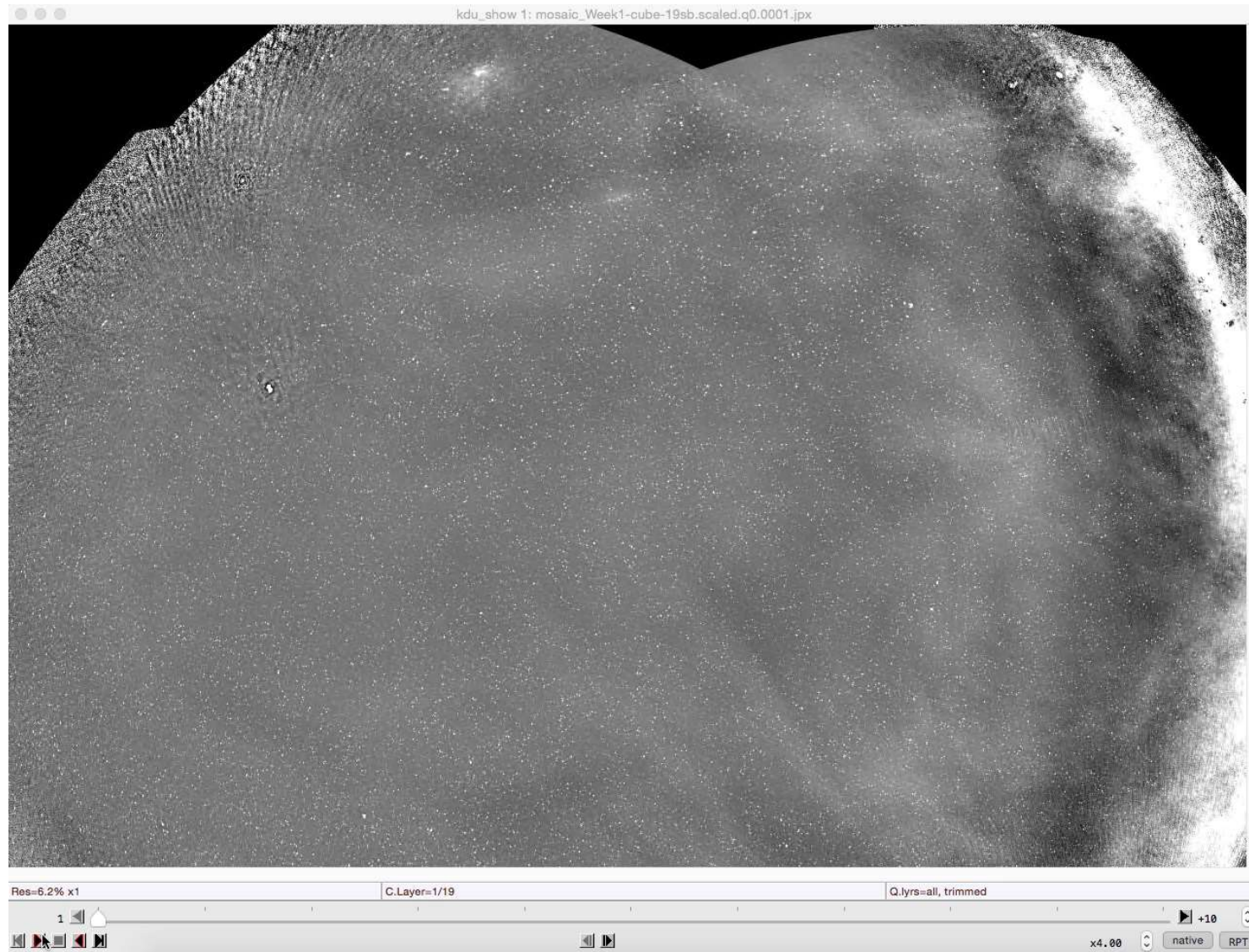


JPIP Client-Server





Interactive





Visualisation Mechanisms

Quality layers

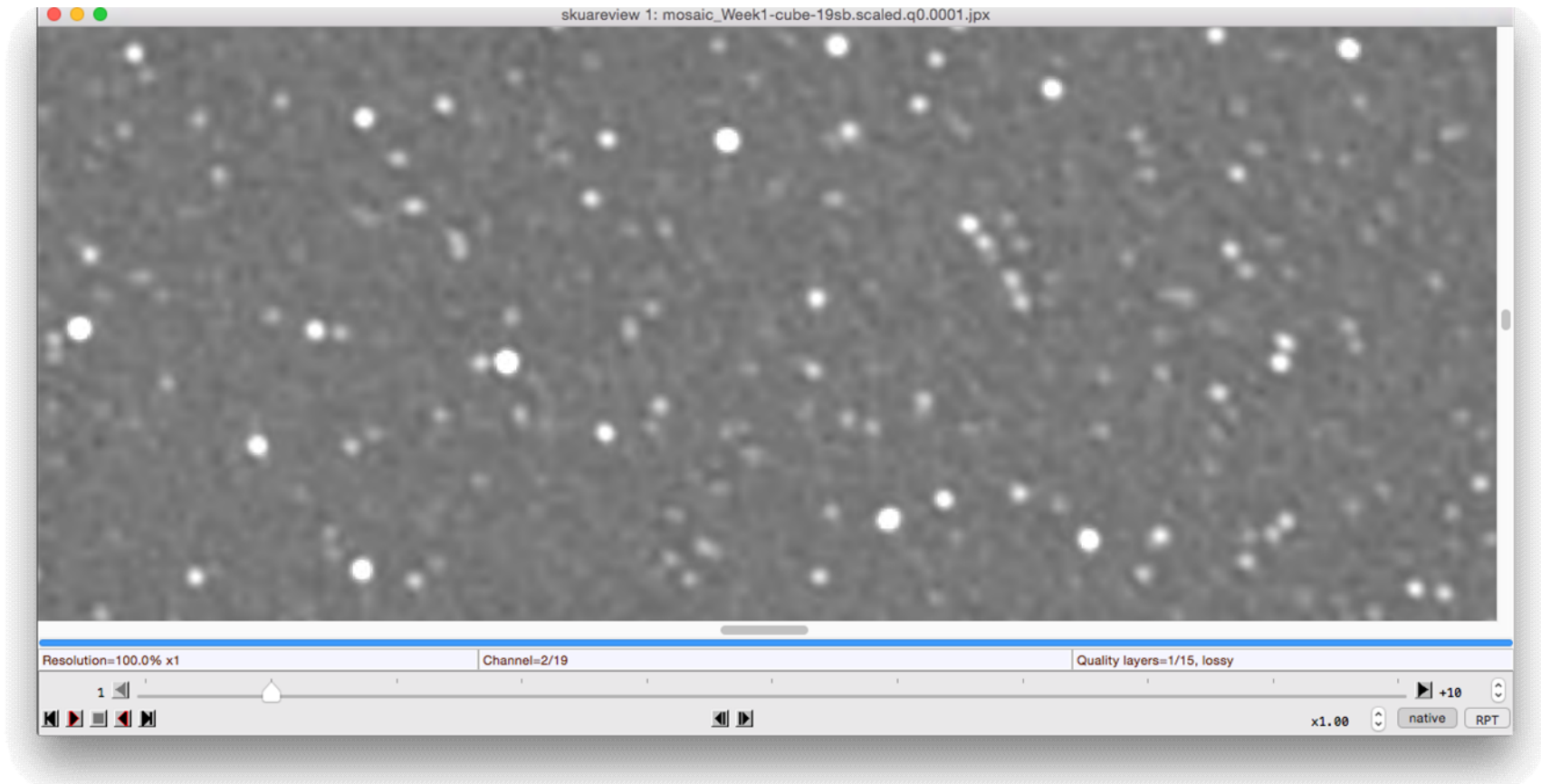
- increase efficiency without compromising visual integrity
- owes to complex encoding mechanisms
- changing quality has no perceivable cost
- effectively filters some noise
- visually lossless

Scaling

- suboptimal method of reducing data transfer



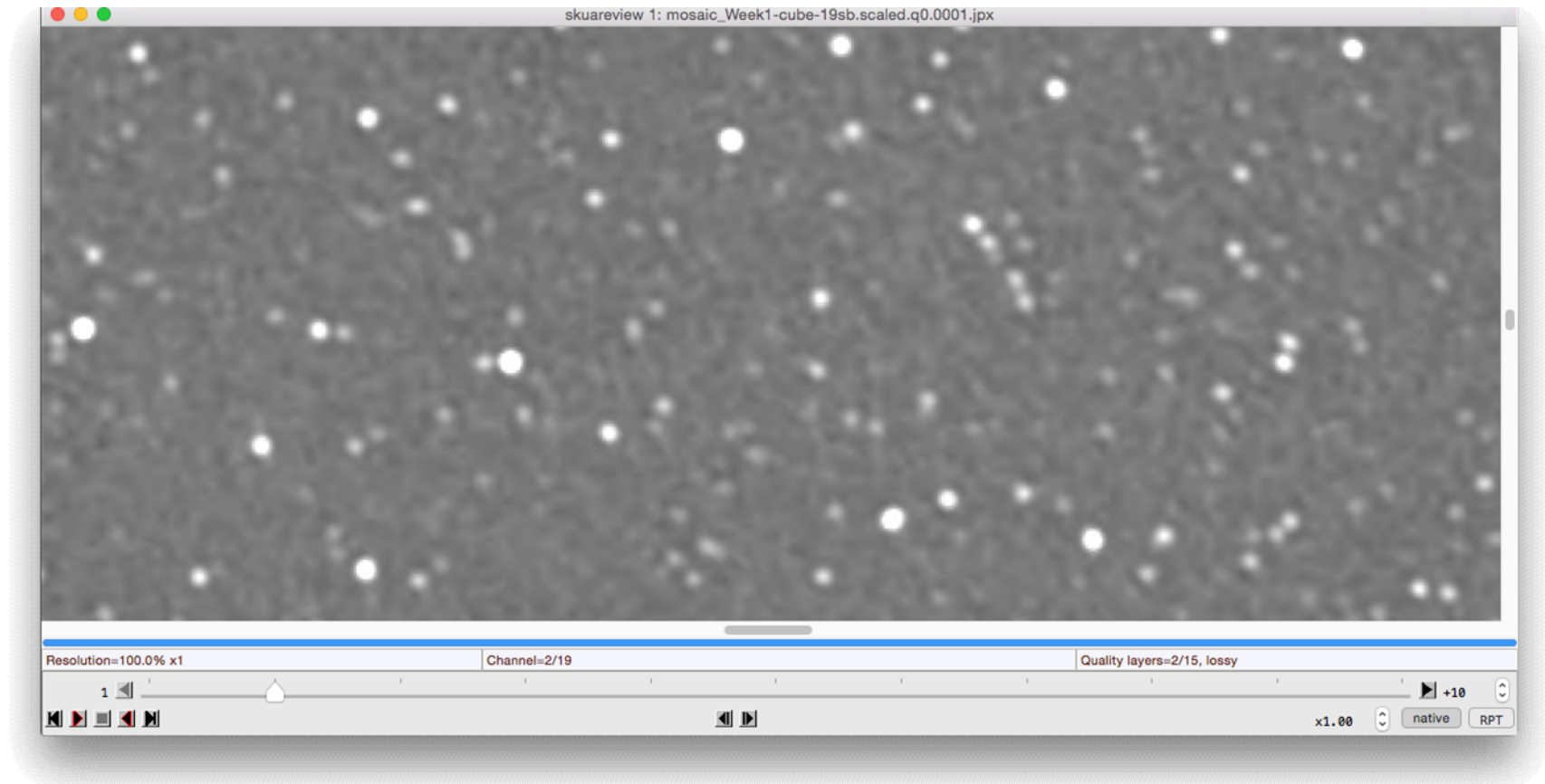
Quality Layers (GLEAM)



Total transfer: 0.05 MB



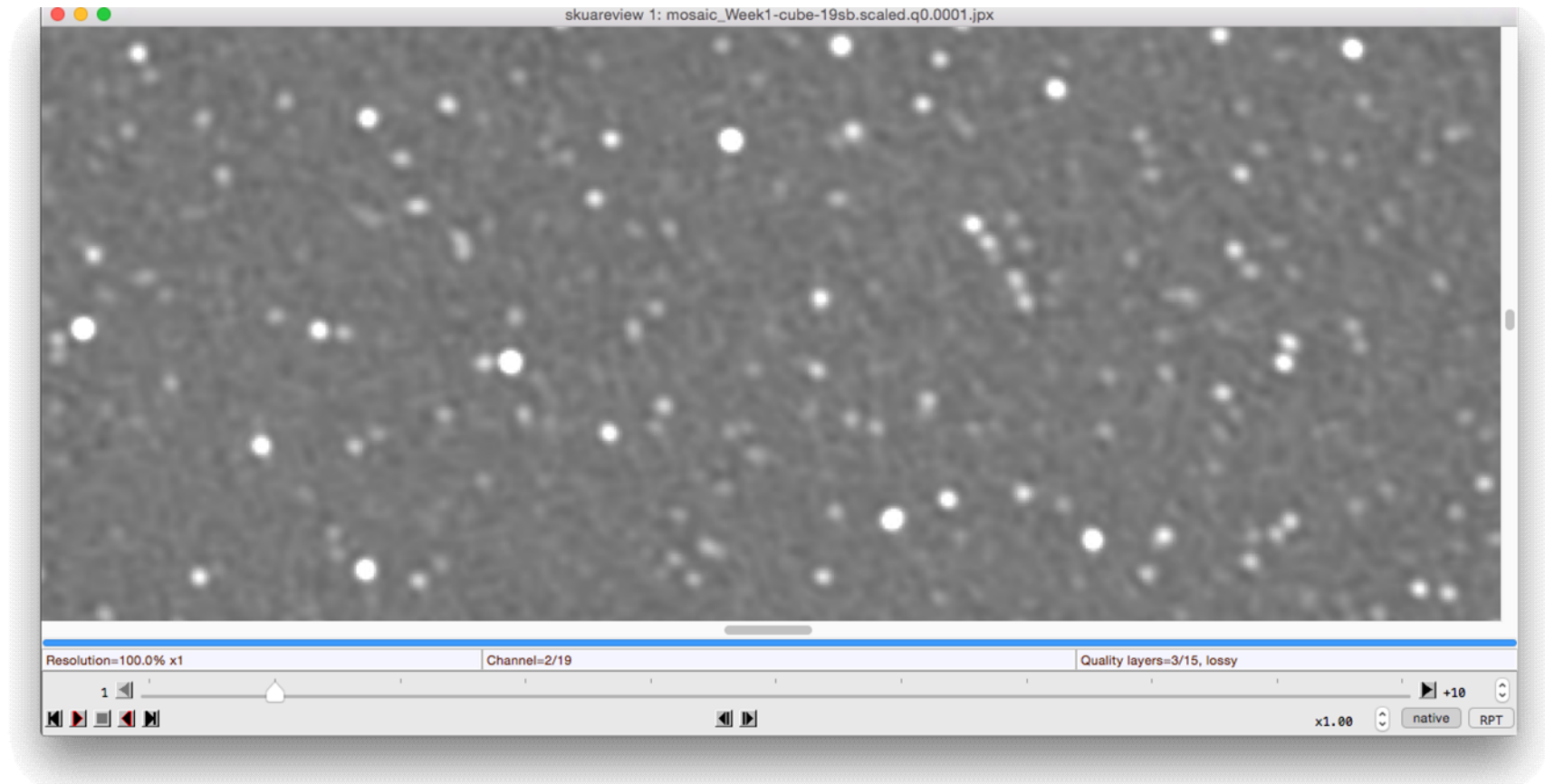
Quality Layers (GLEAM)



Total transfer: 0.06 MB



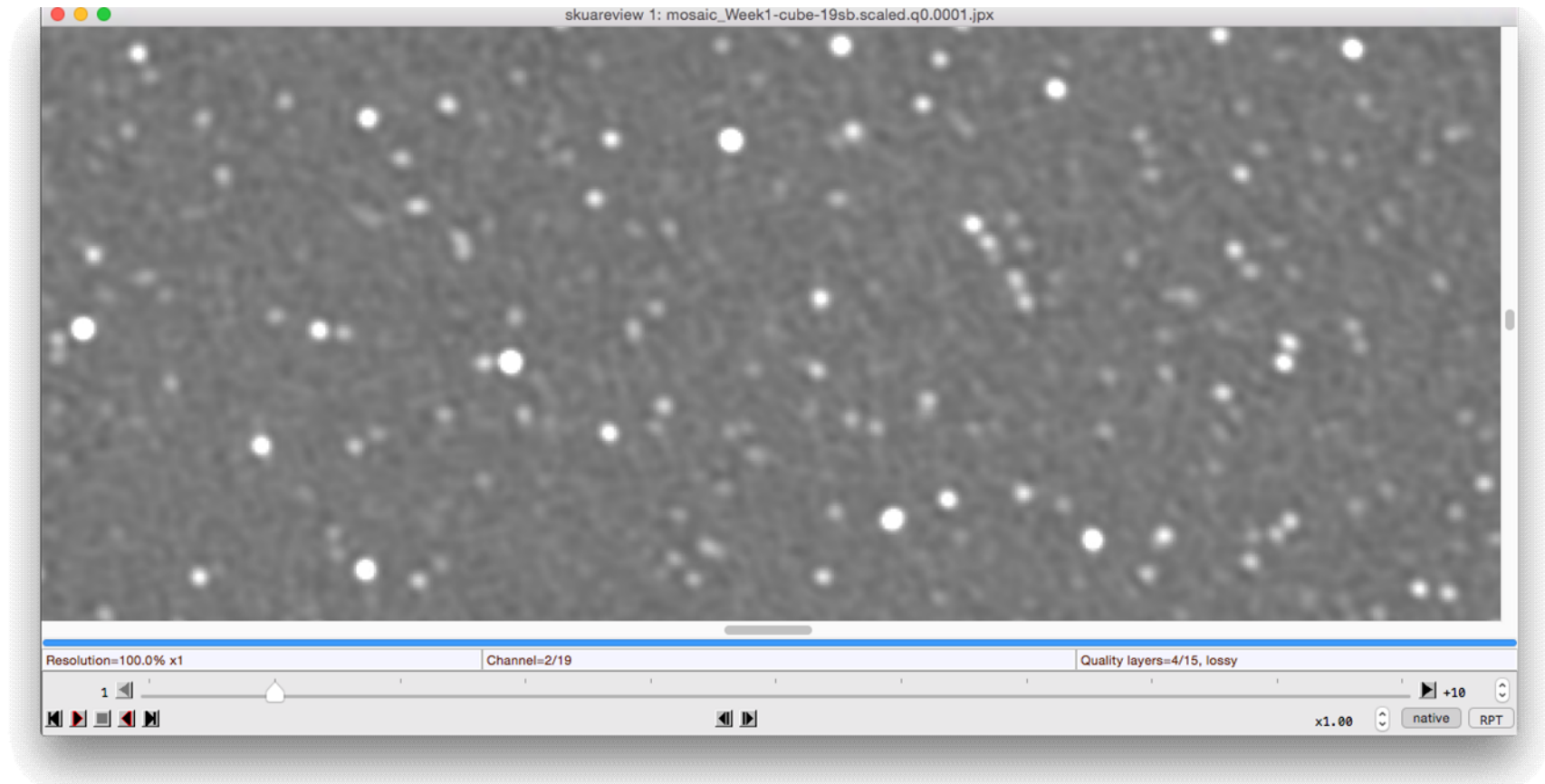
Quality Layers (GLEAM)



Total transfer: 0.09 MB



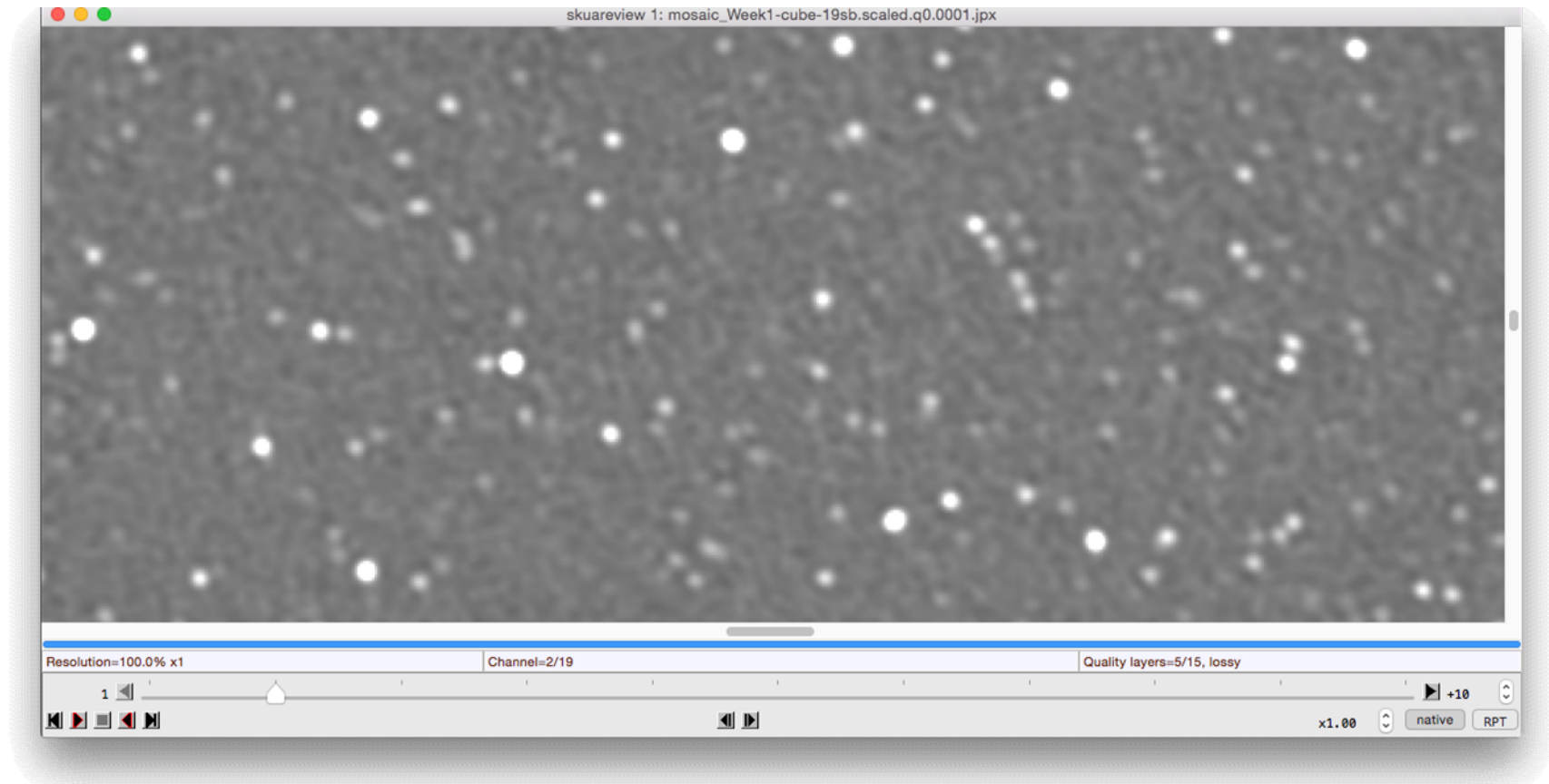
Quality Layers (GLEAM)



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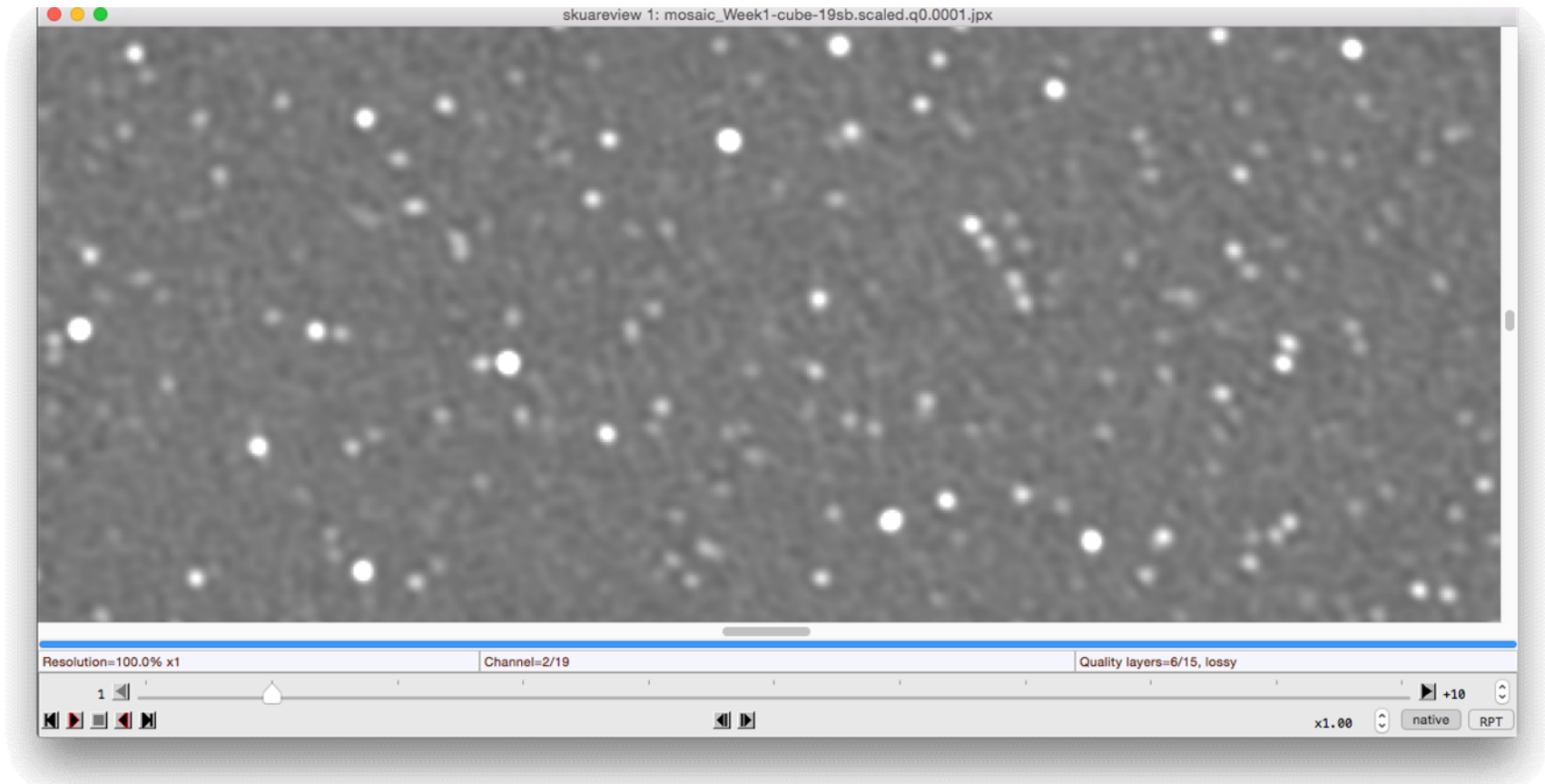
Quality Layers (GLEAM)



Total transfer: 0.13 MB



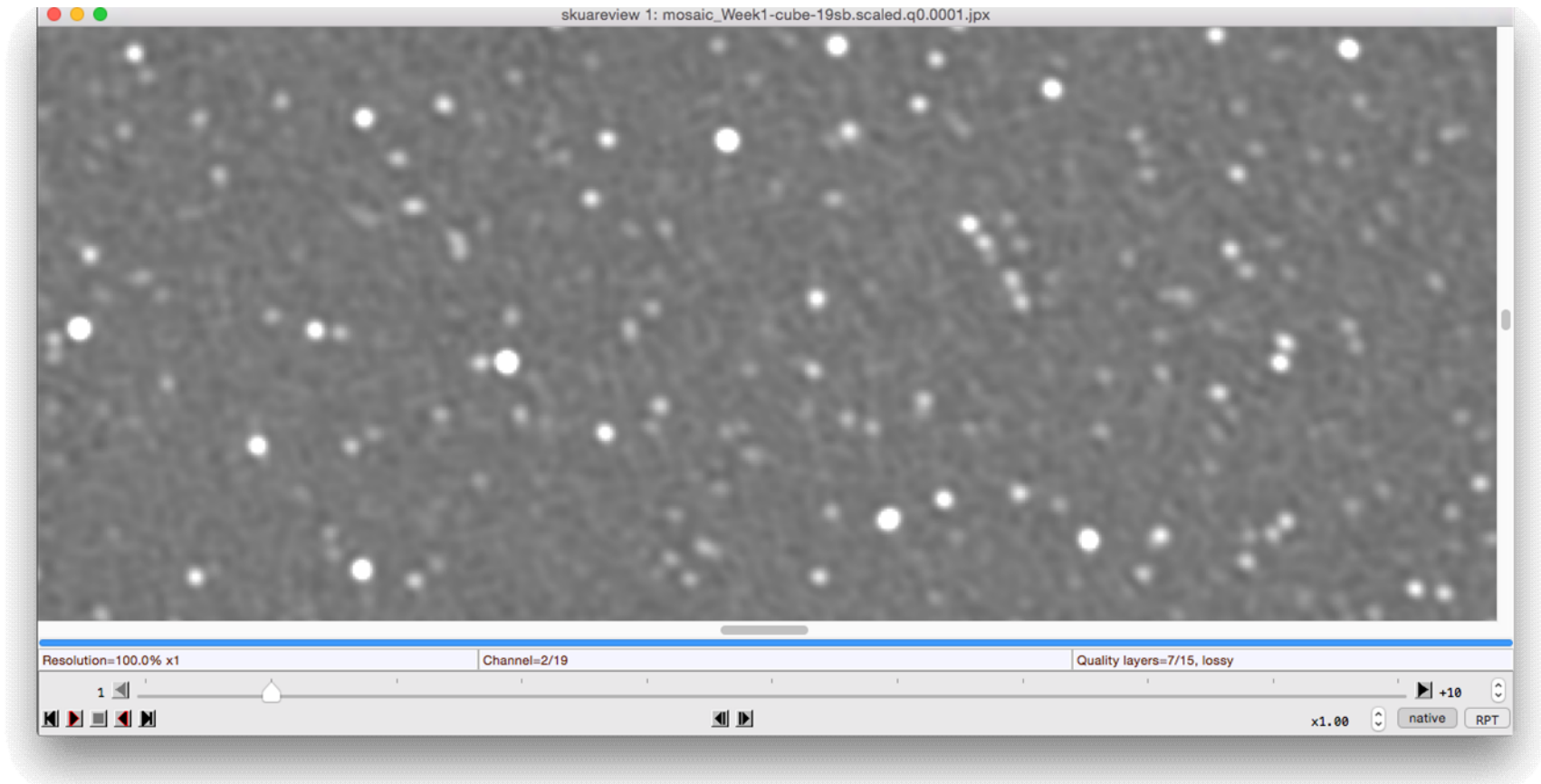
Quality Layers (GLEAM)



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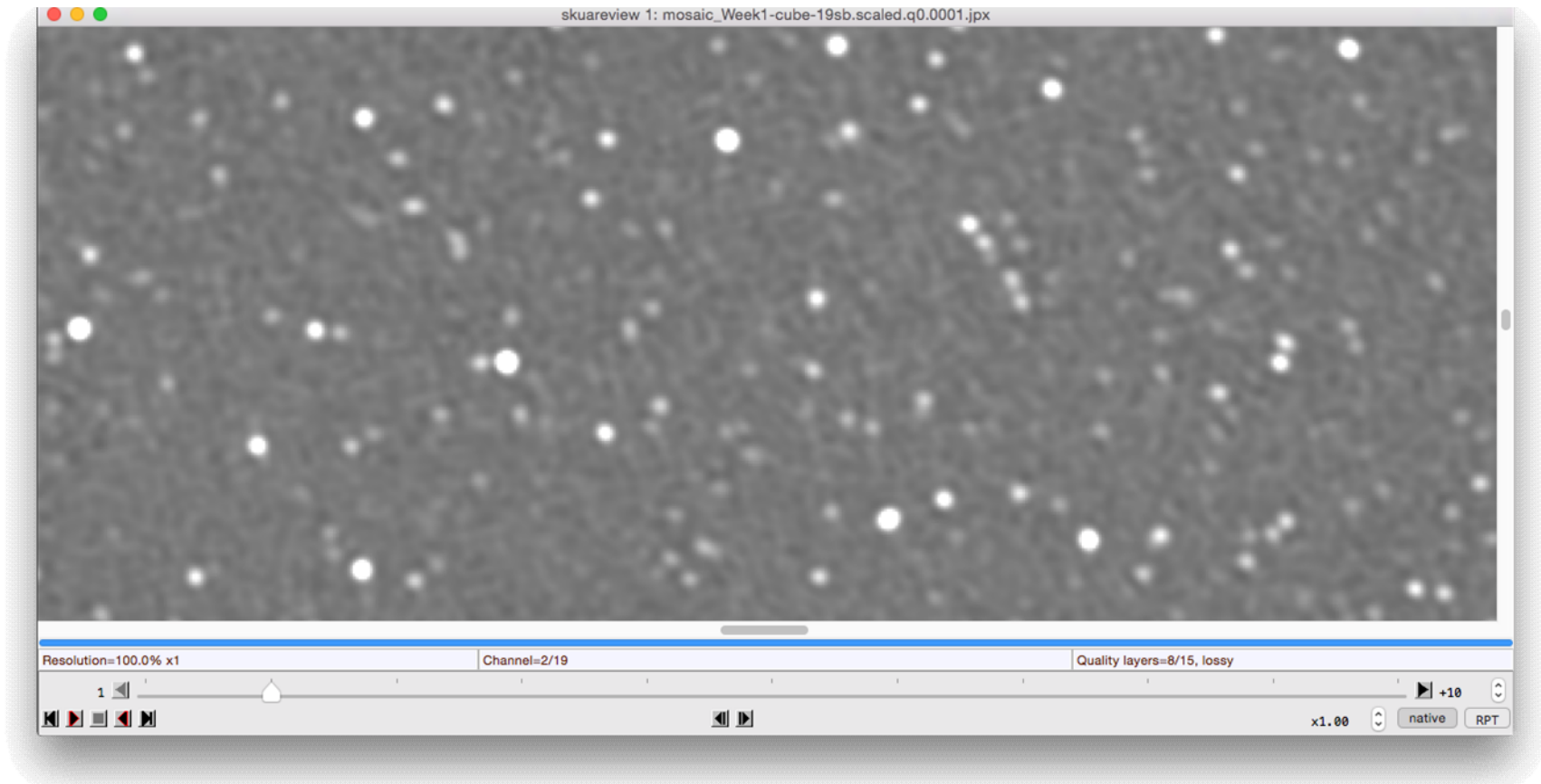
Quality Layers (GLEAM)



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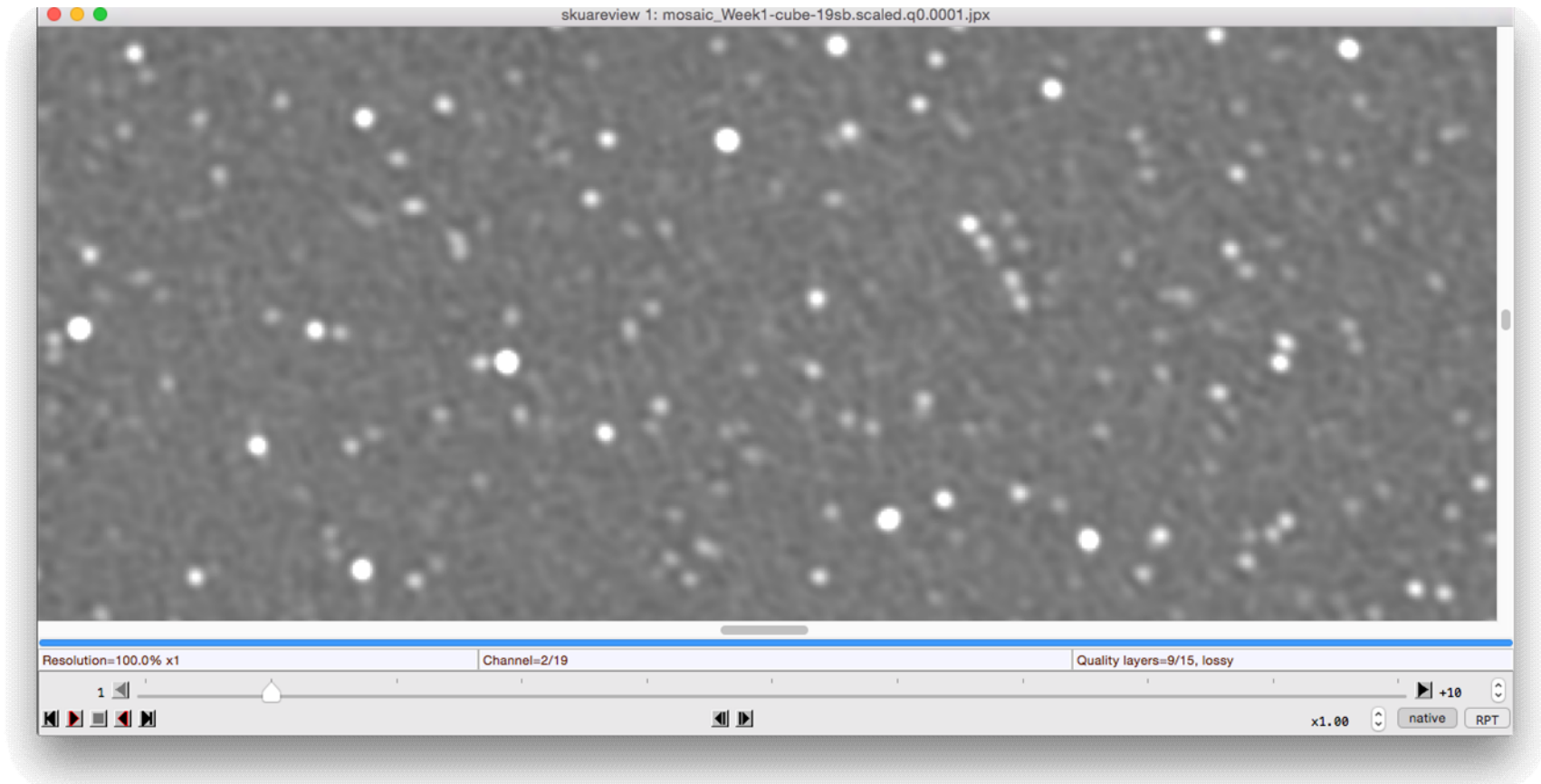
Quality Layers (GLEAM)



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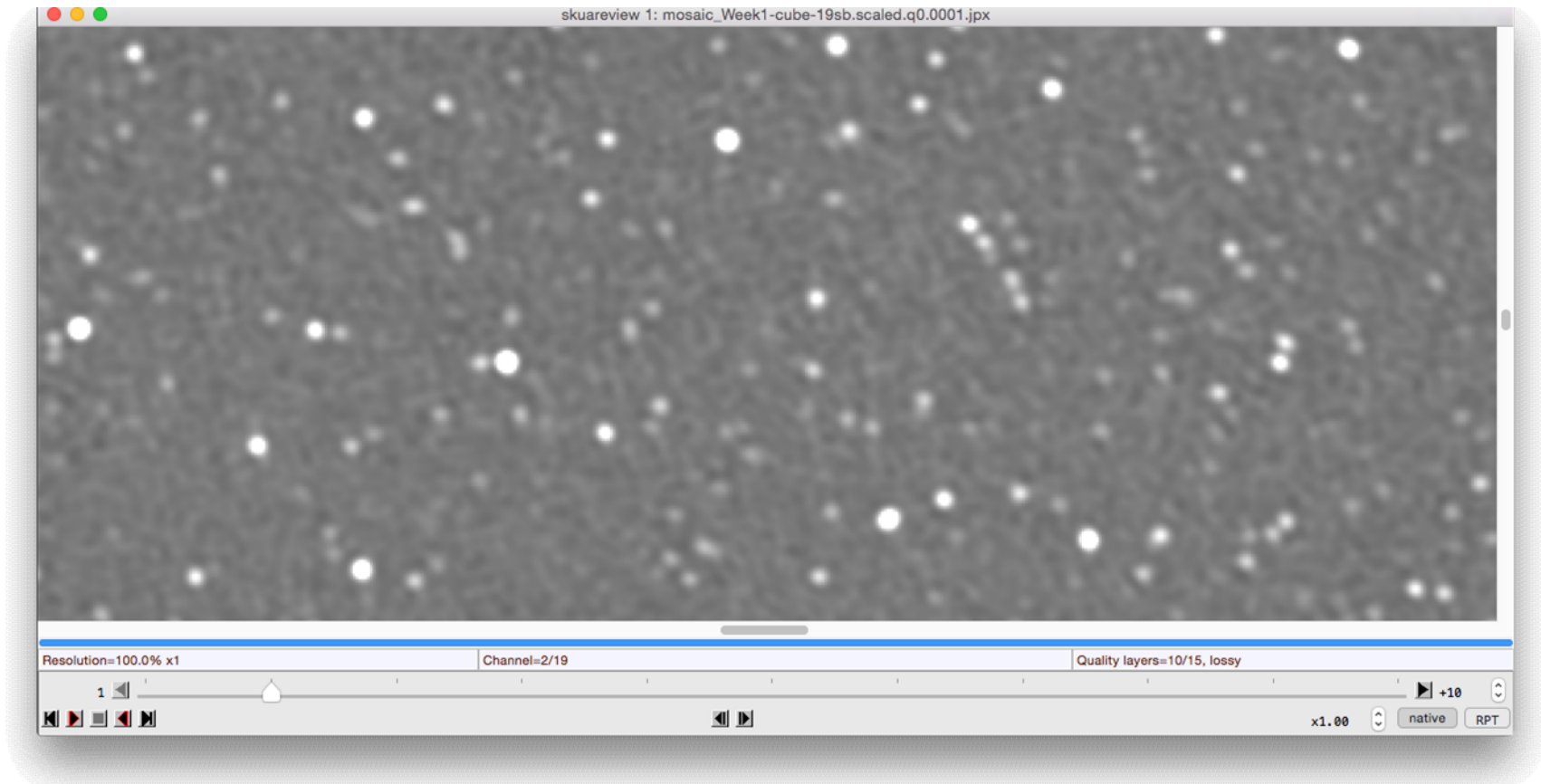
Quality Layers (GLEAM)



Total transfer: 0.42 MB



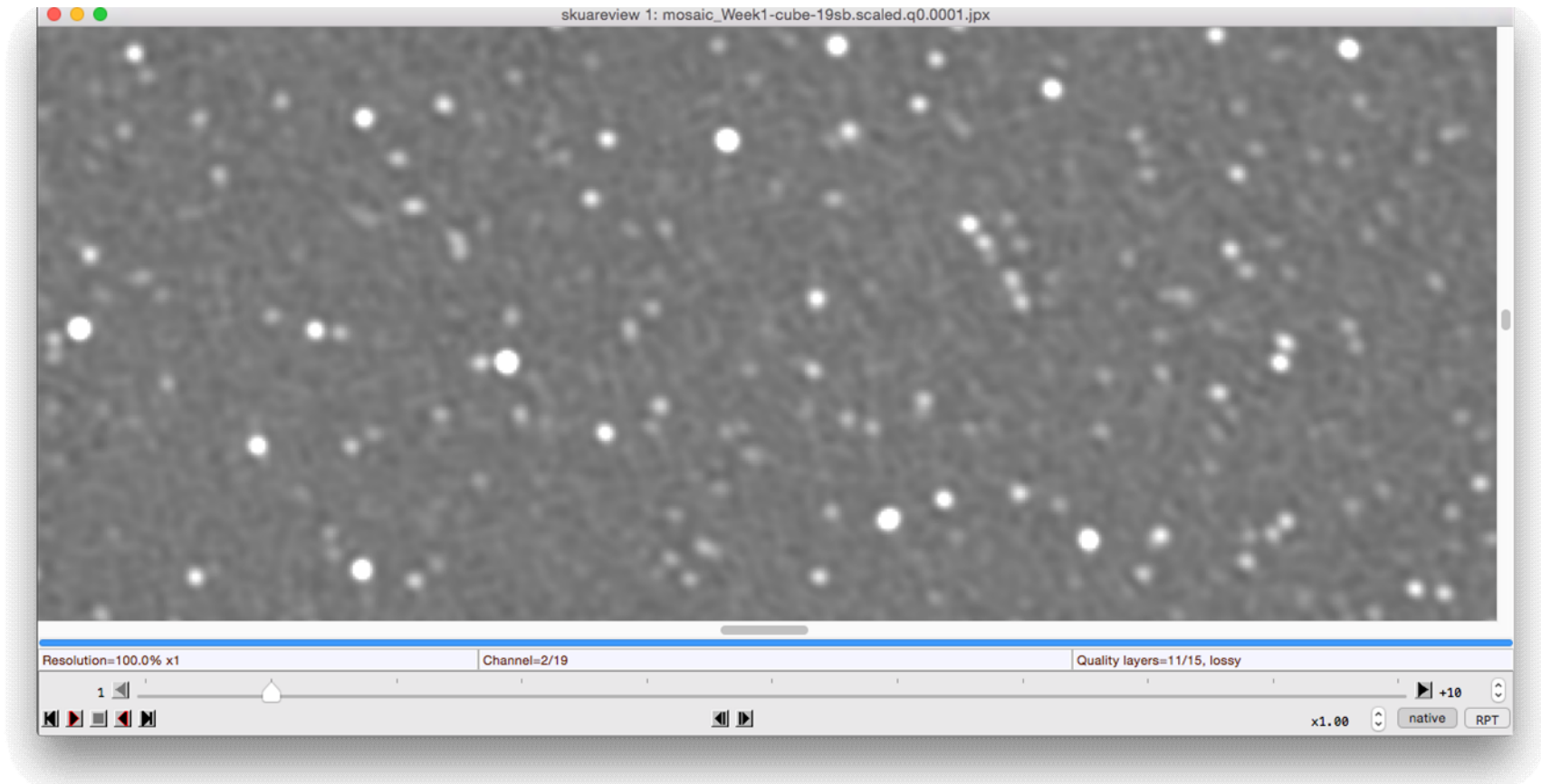
Quality Layers (GLEAM)



Total transfer: 0.46 MB



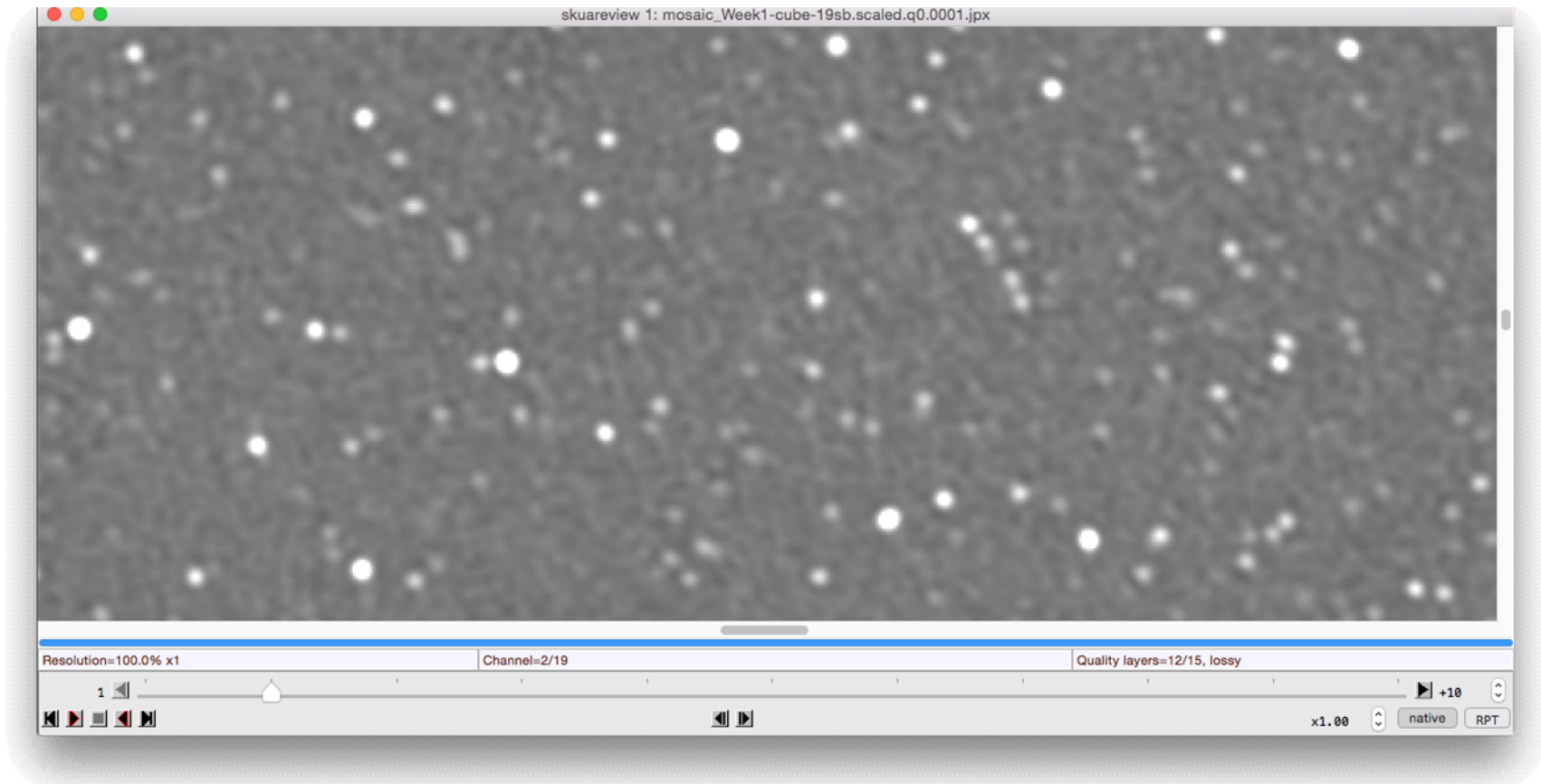
Quality Layers (GLEAM)



Total transfer: 0.59 MB



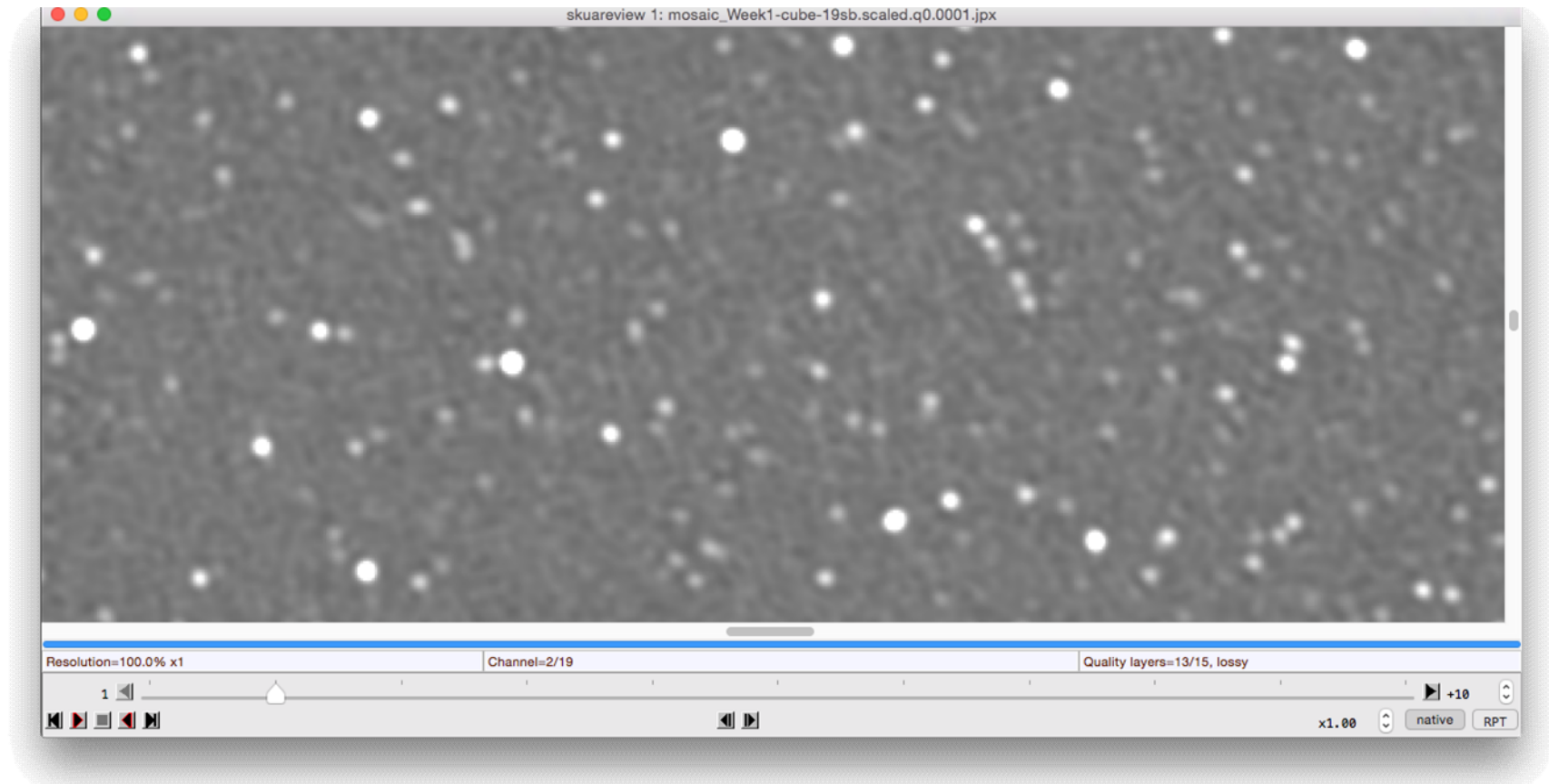
Quality Layers (GLEAM)



Total transfer: 0.63 MB



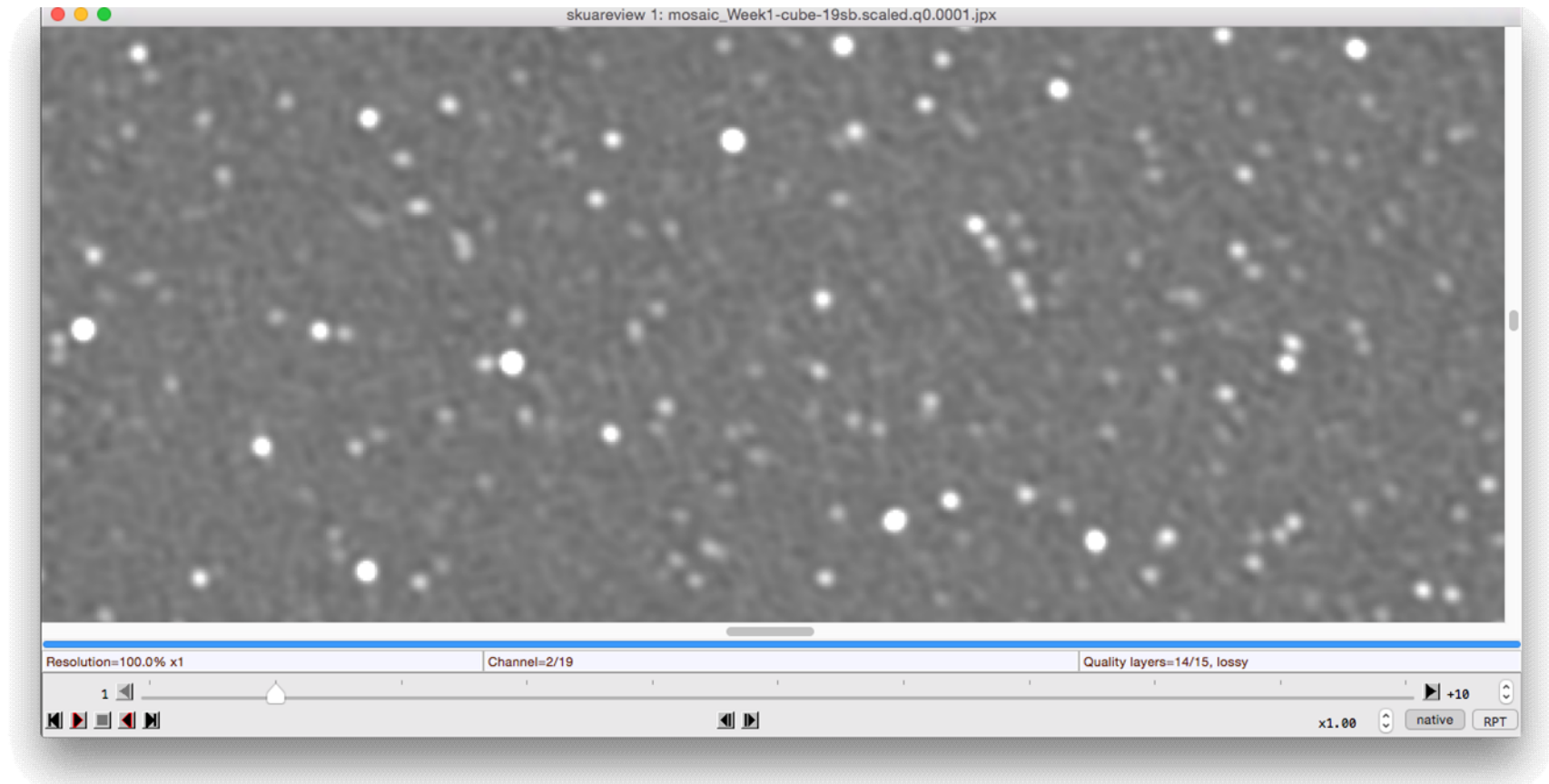
Quality Layers (GLEAM)



Total transfer: 0.78 MB



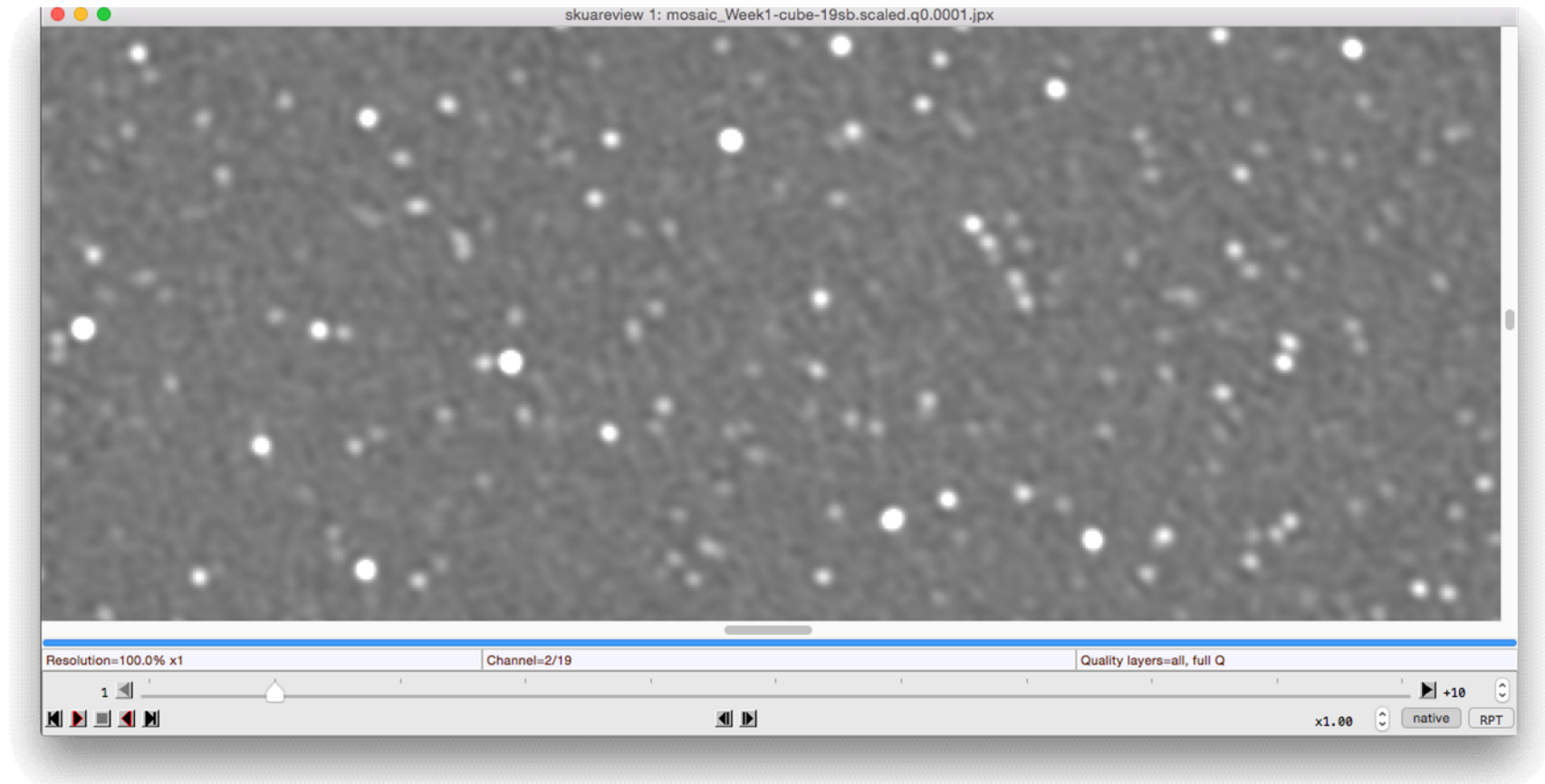
Quality Layers (GLEAM)



Total transfer: 1.02 MB



Quality Layers (GLEAM)



Total transfer: 1.47 MB



Quality Layers



Total transfer: 0.00 MB



Quality Layers



Total transfer: 0.00 MB



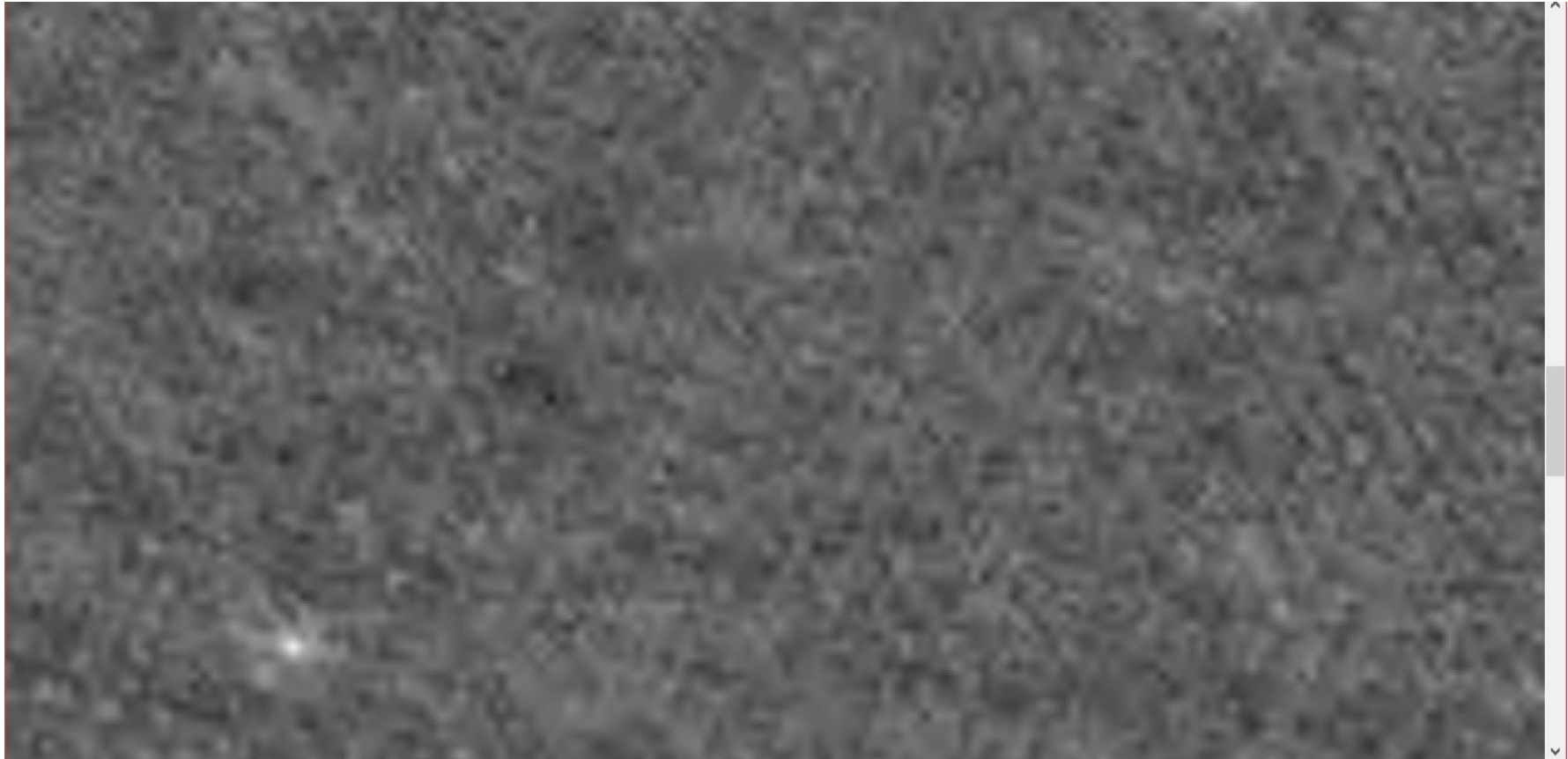
Quality Layers



Total transfer: 0.01 MB



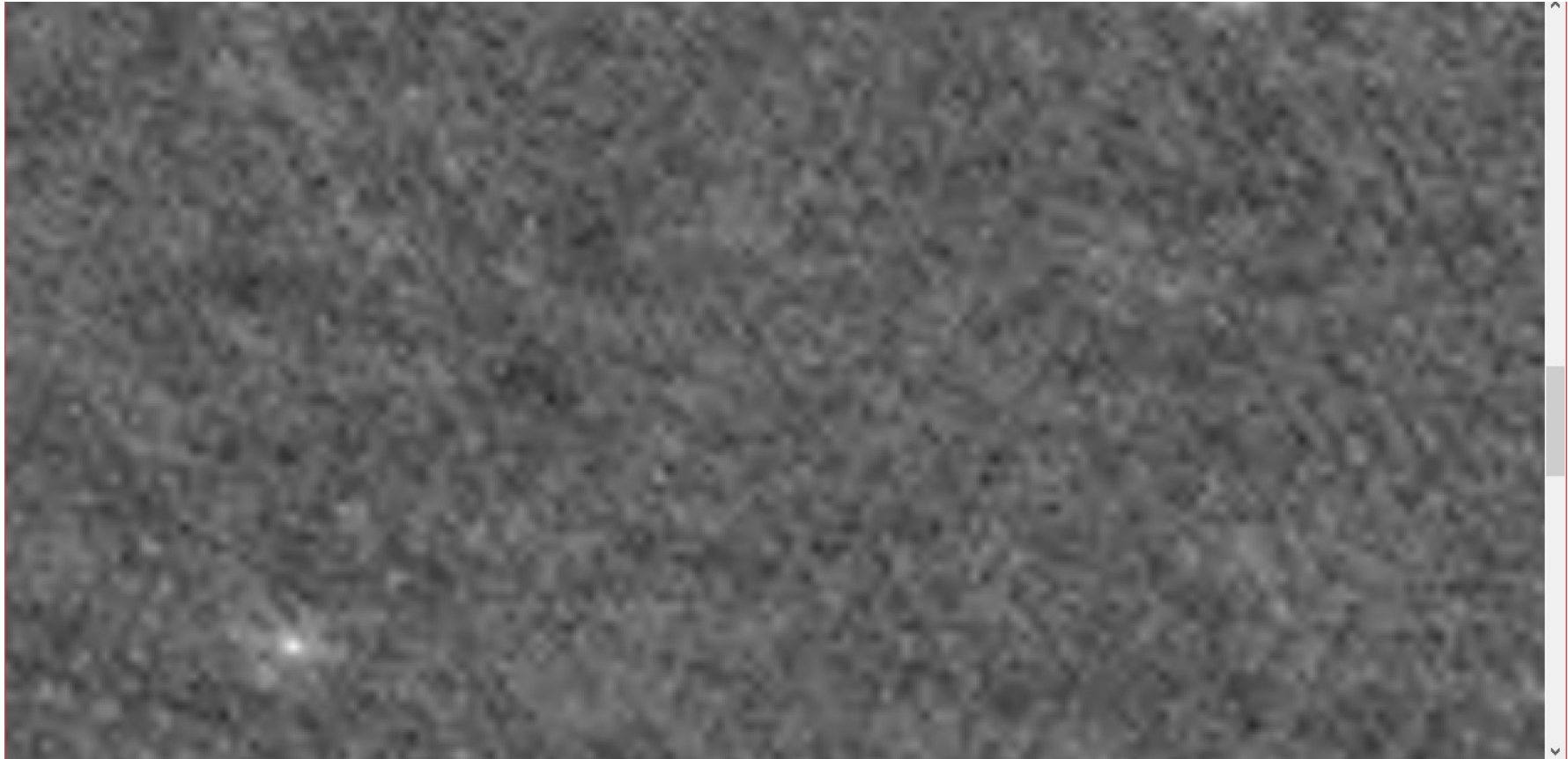
Quality Layers



Total transfer: 0.02 MB



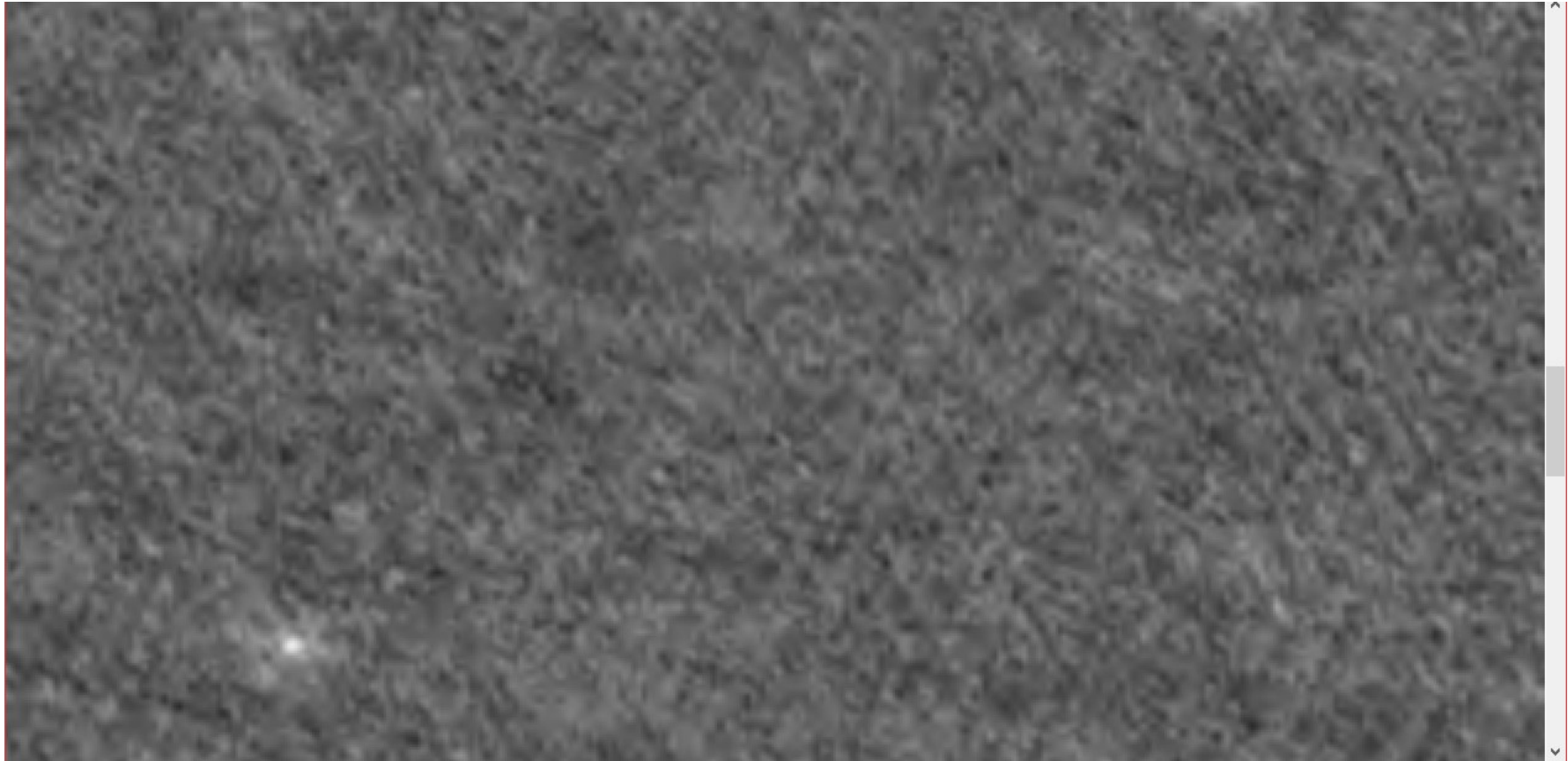
Quality Layers



Total transfer: 0.03 MB



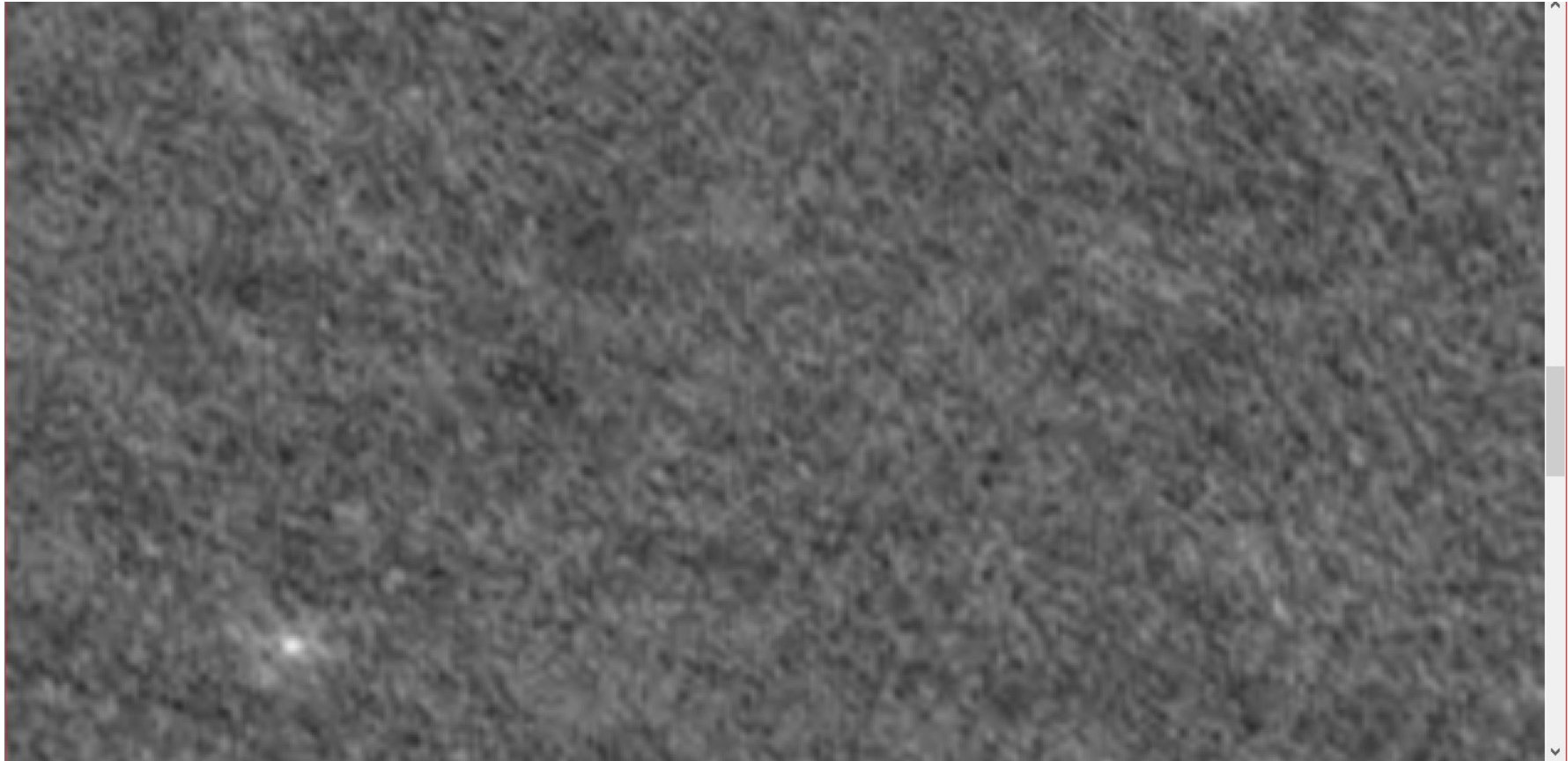
Quality Layers



Total transfer: 0.04 MB



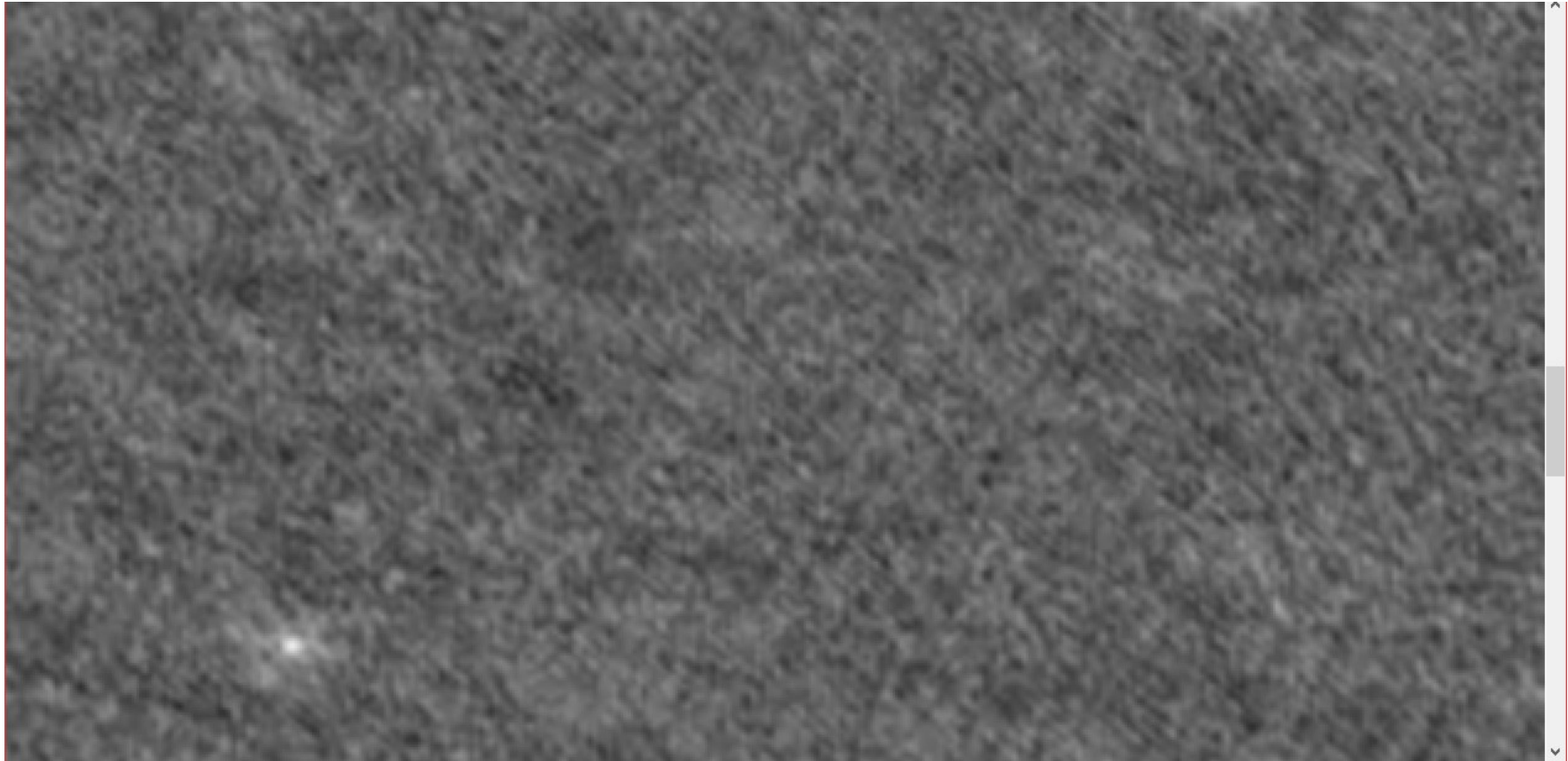
Quality Layers



Total transfer: 0.05 MB



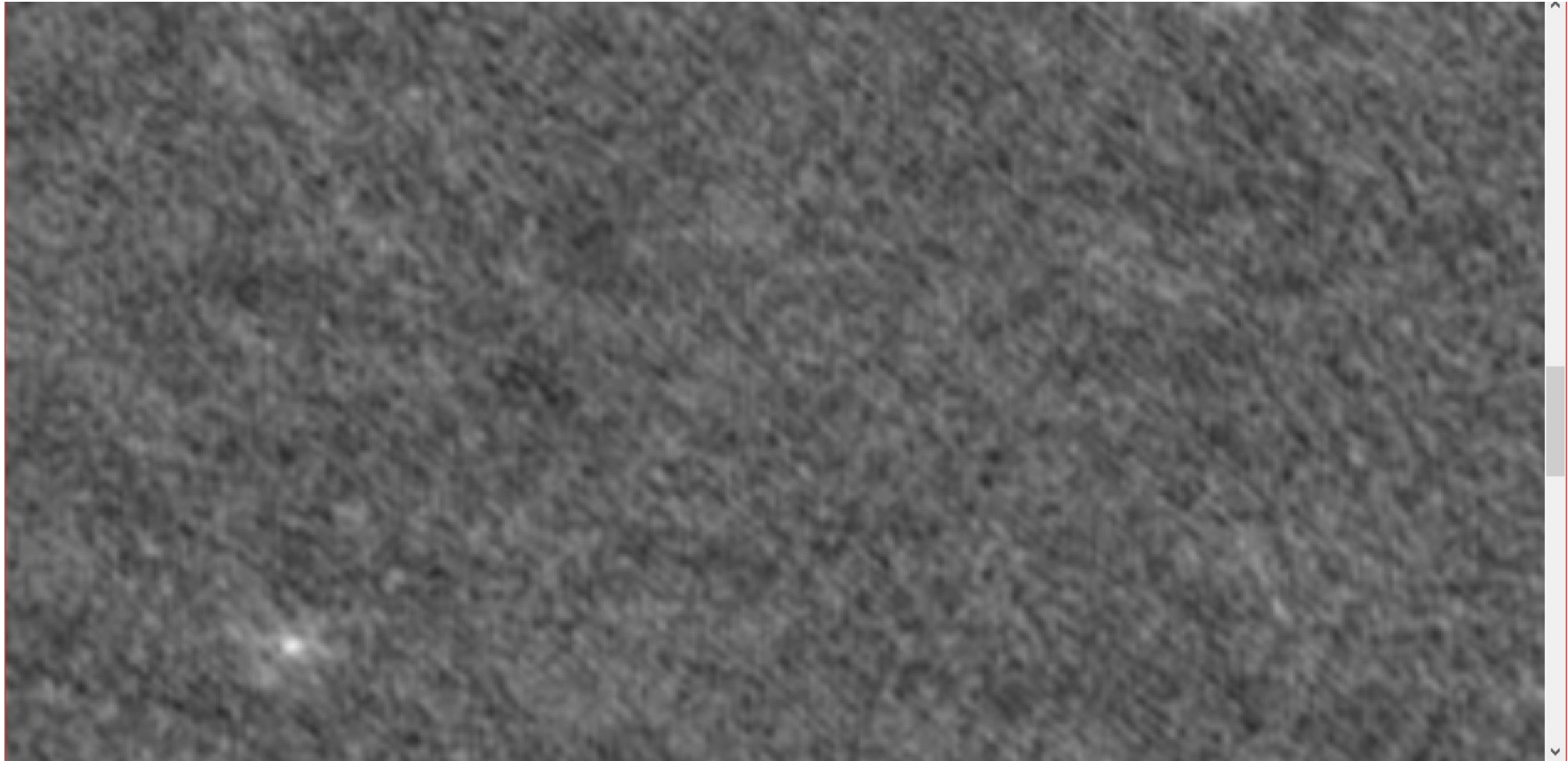
Quality Layers



Total transfer: 0.06 MB



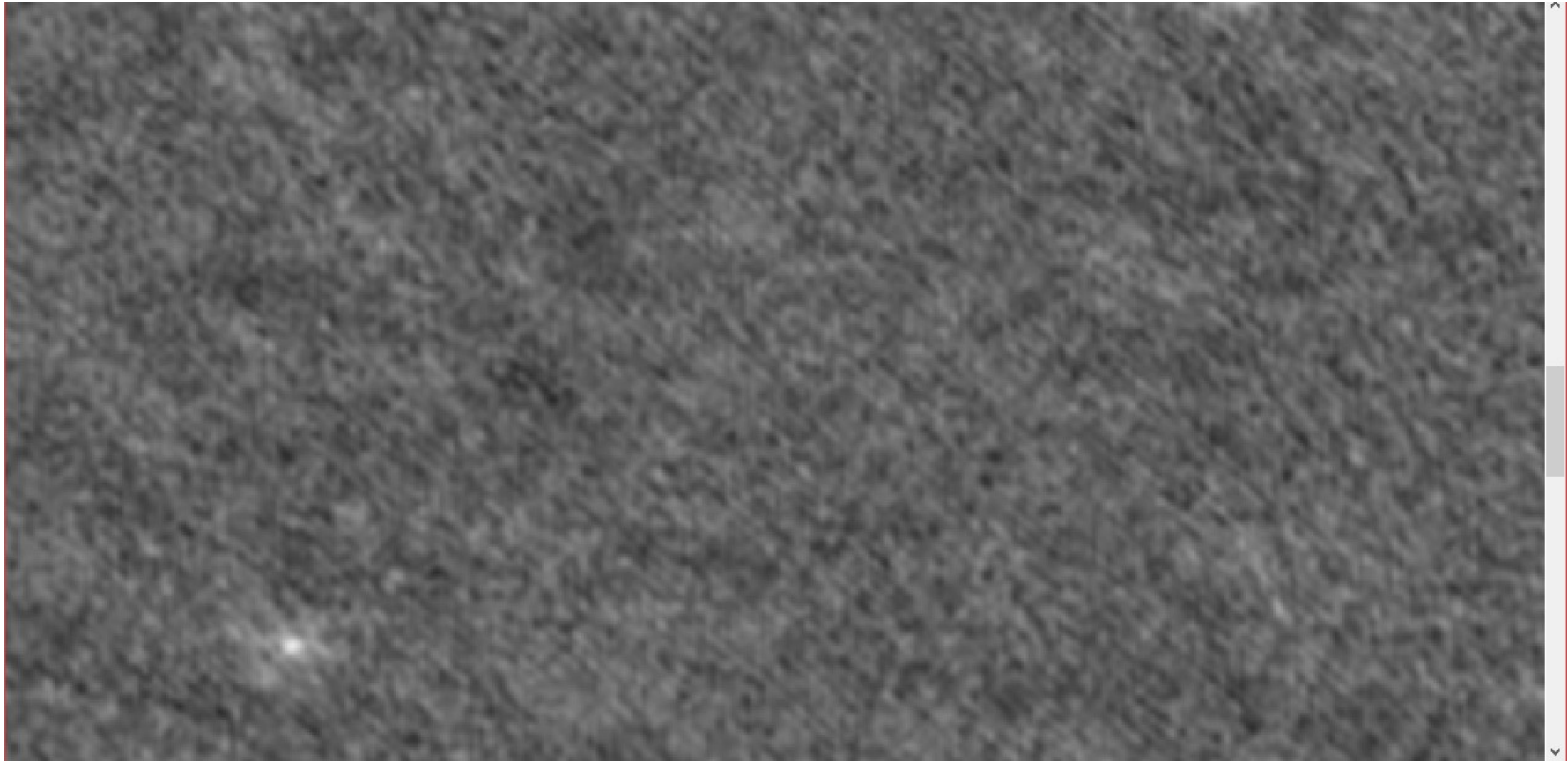
Quality Layers



Total transfer: 0.07 MB



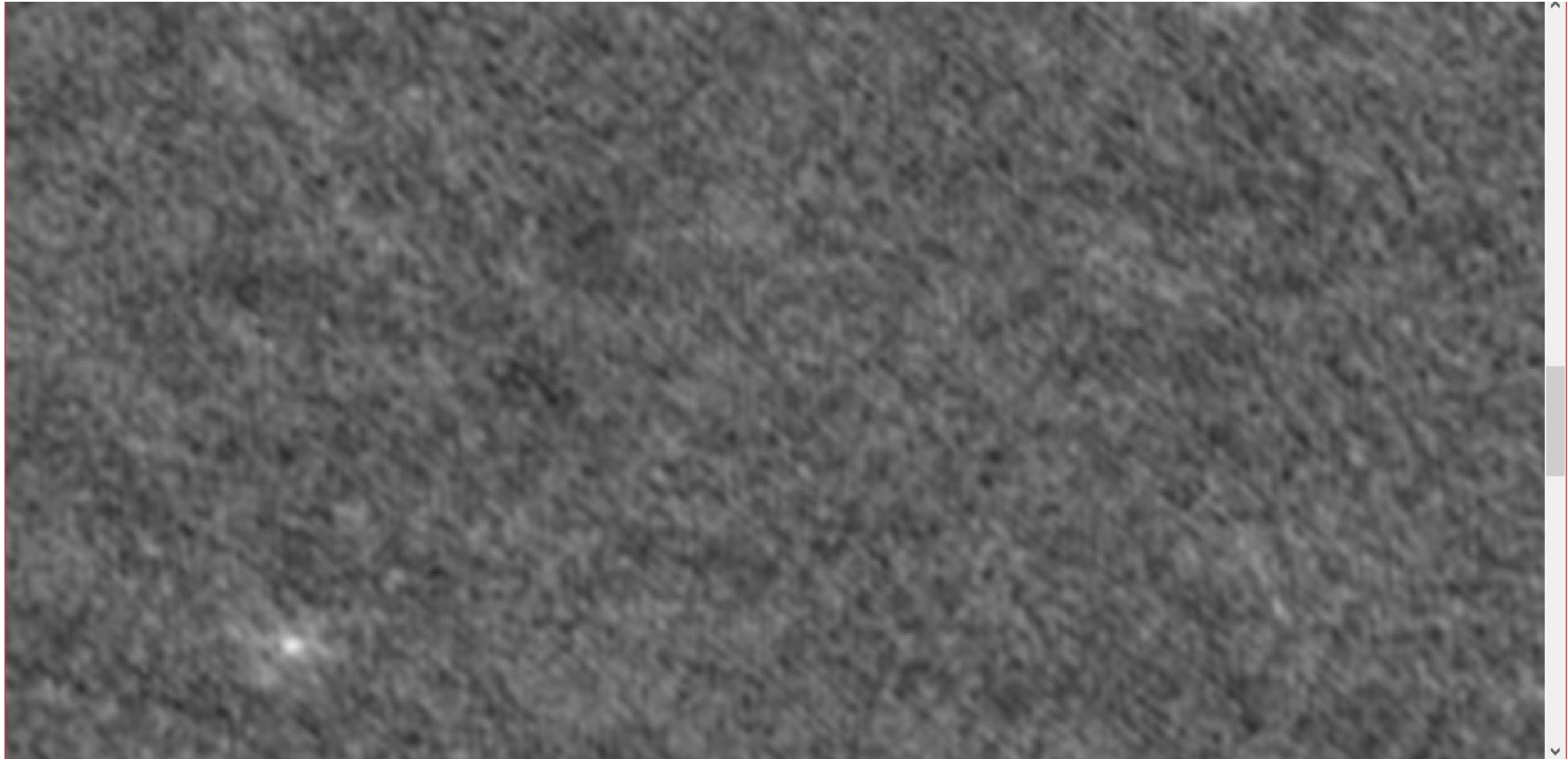
Quality Layers



Total transfer: 0.09 MB



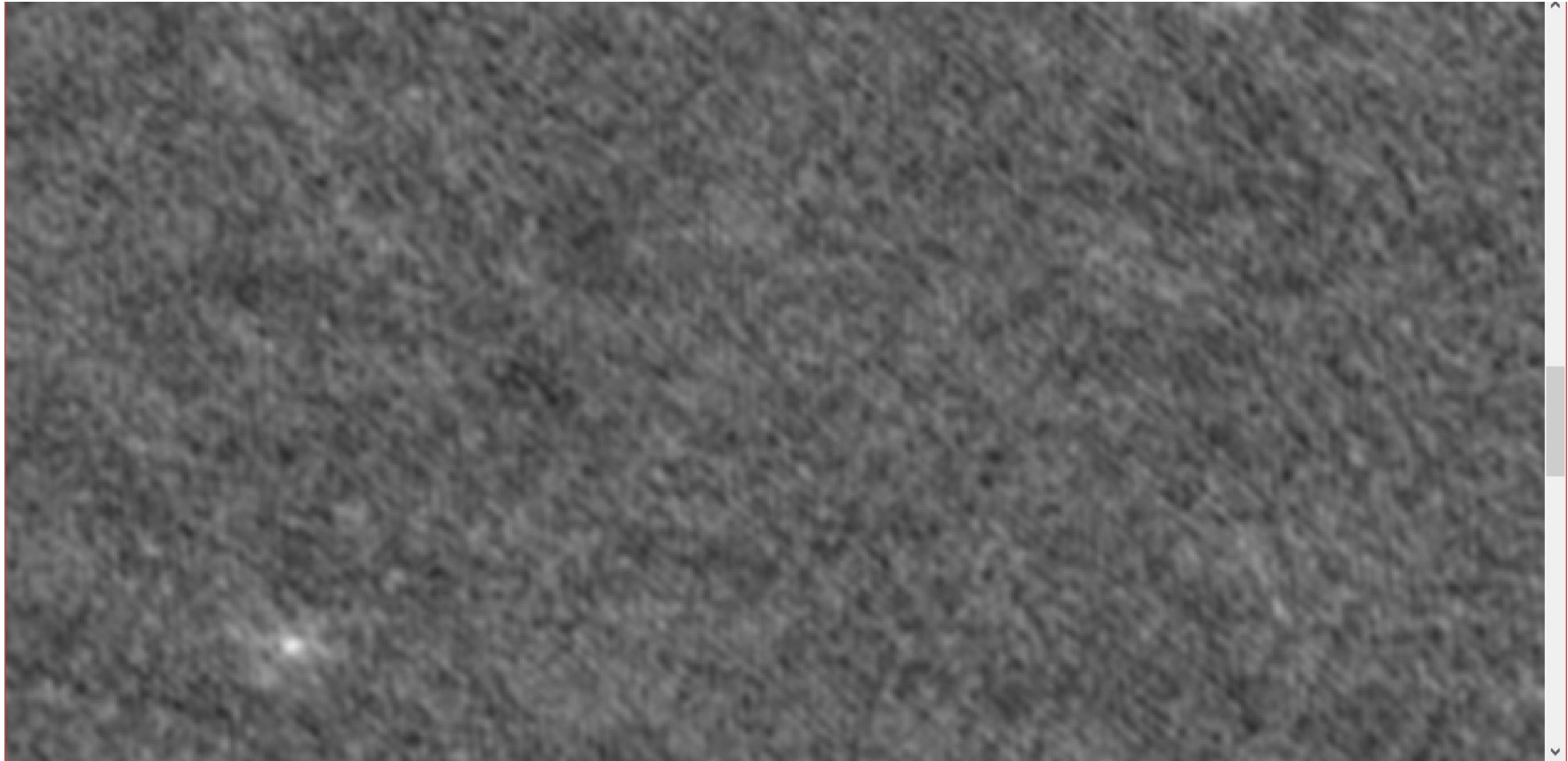
Quality Layers



Total transfer: 0.10 MB



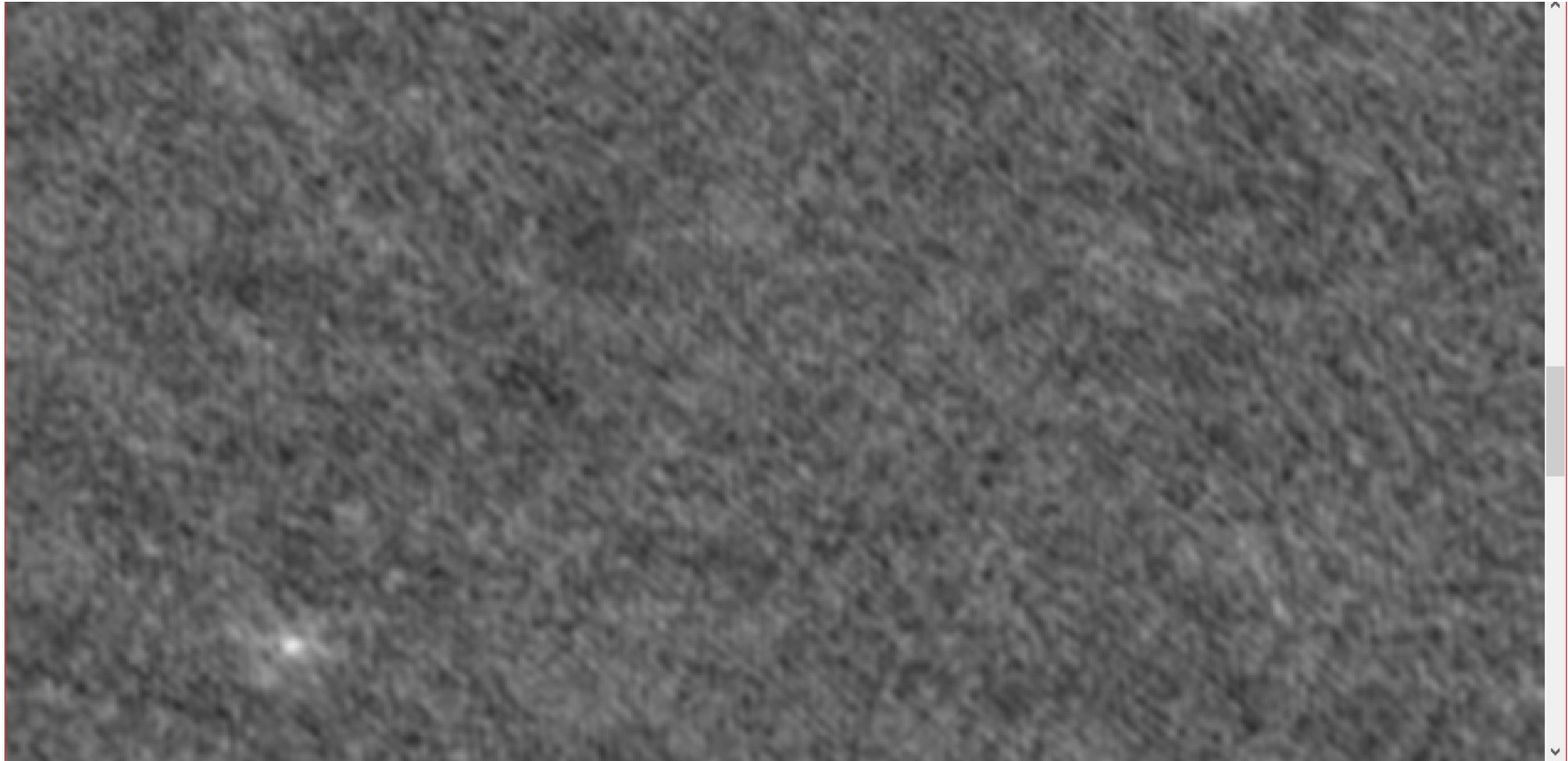
Quality Layers



Total transfer: 0.12 MB



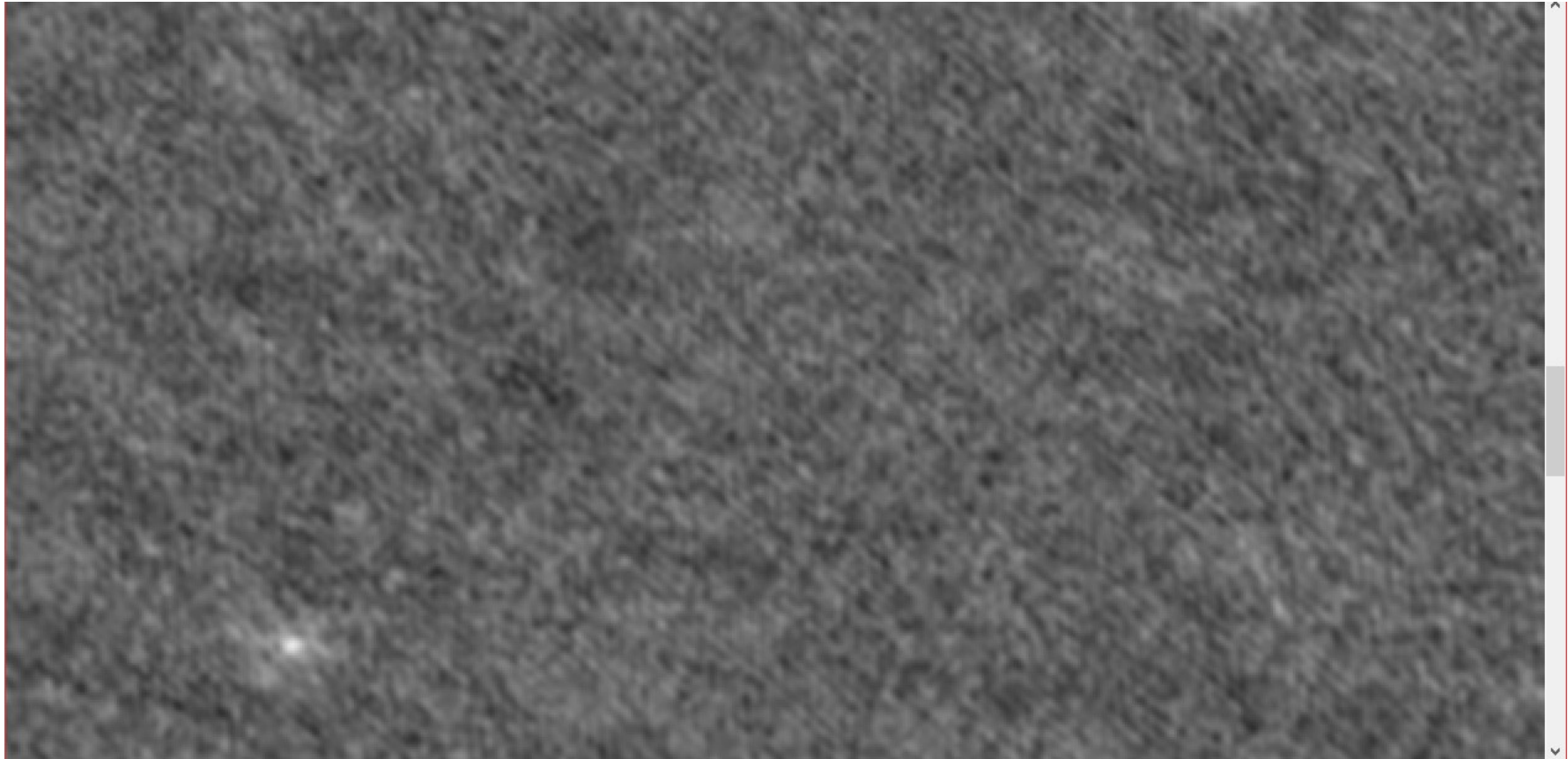
Quality Layers



Total transfer: 0.14 MB



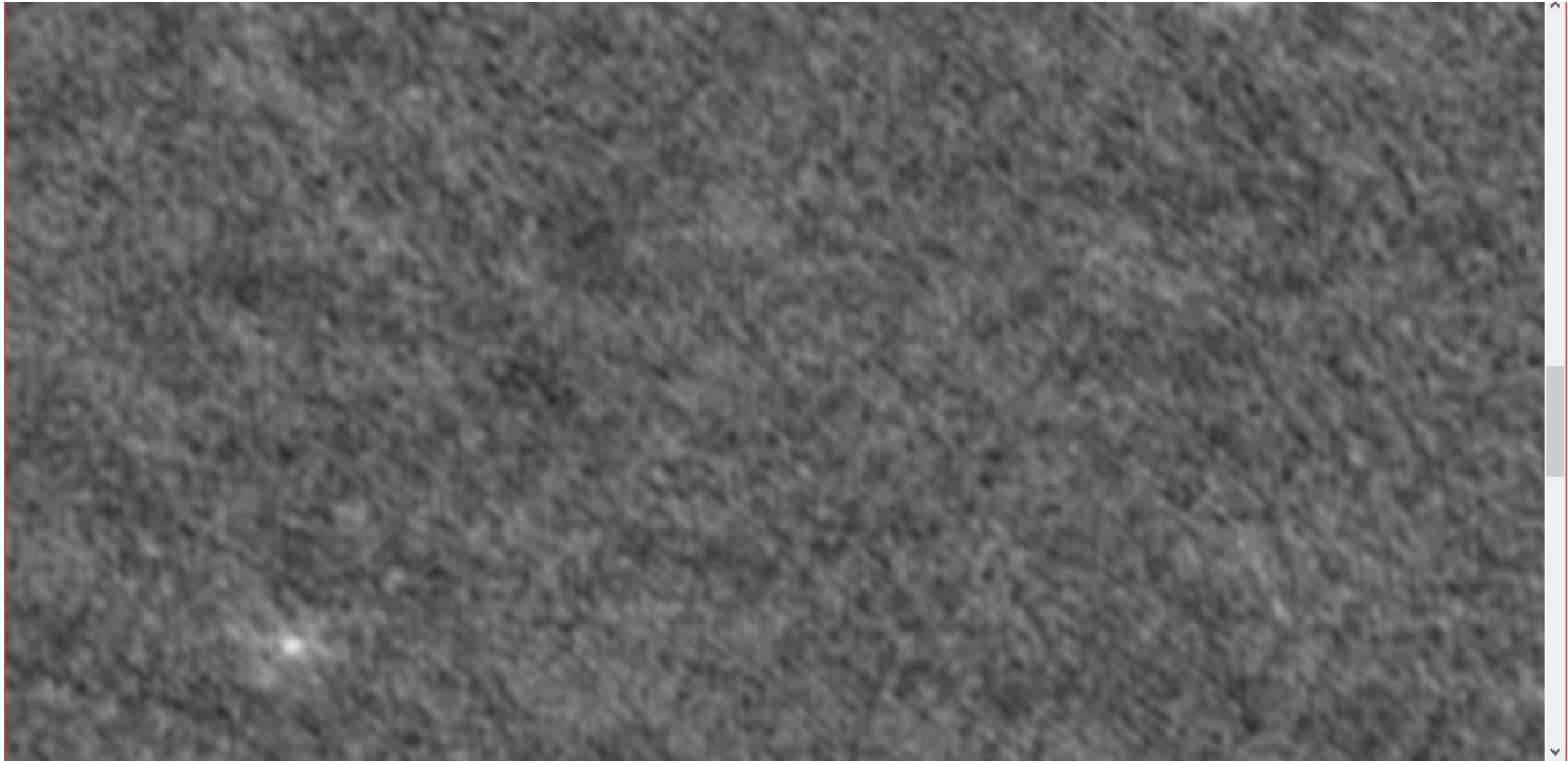
Quality Layers



Total transfer: 0.18 MB



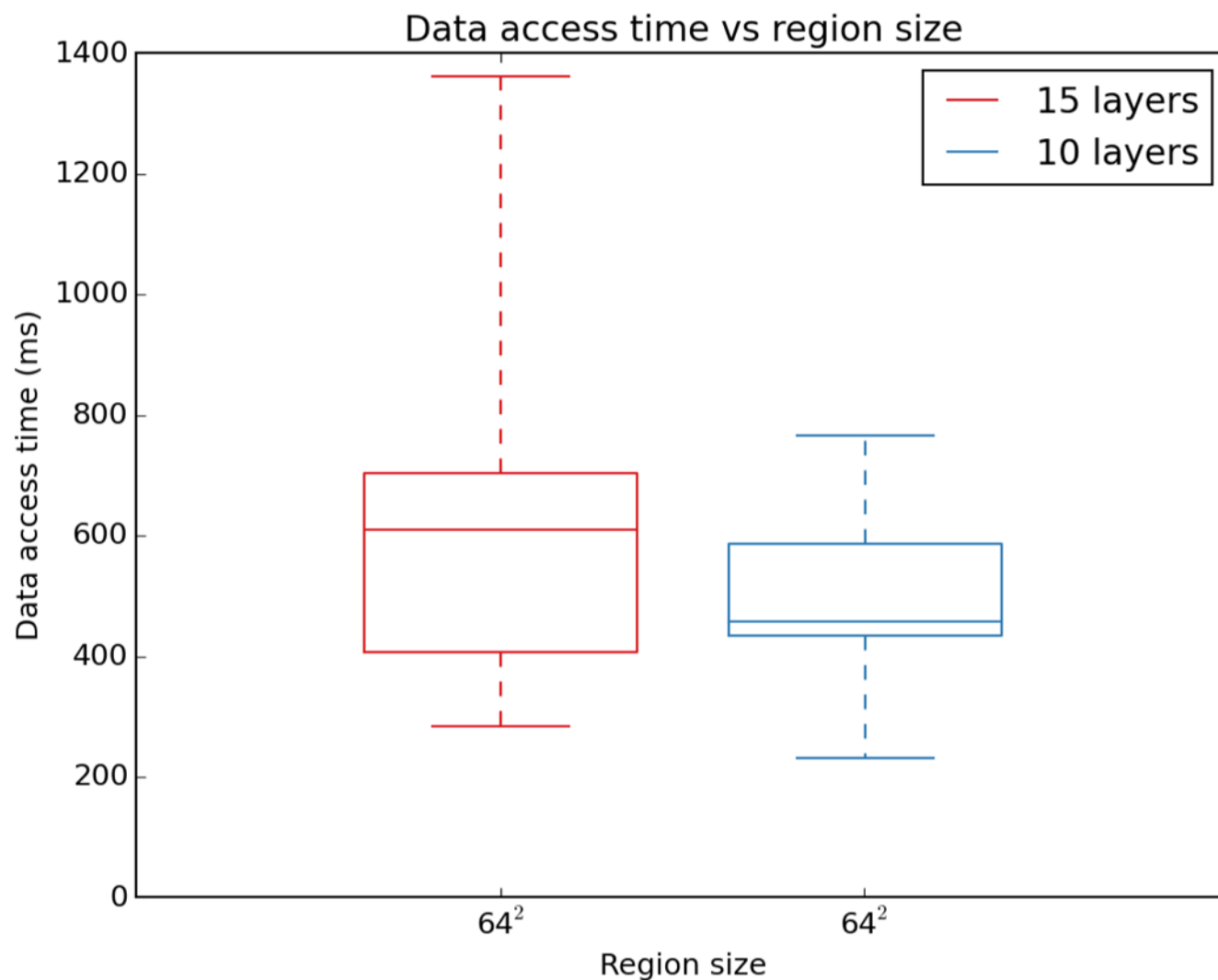
Quality Layers



Total transfer: 0.23 MB

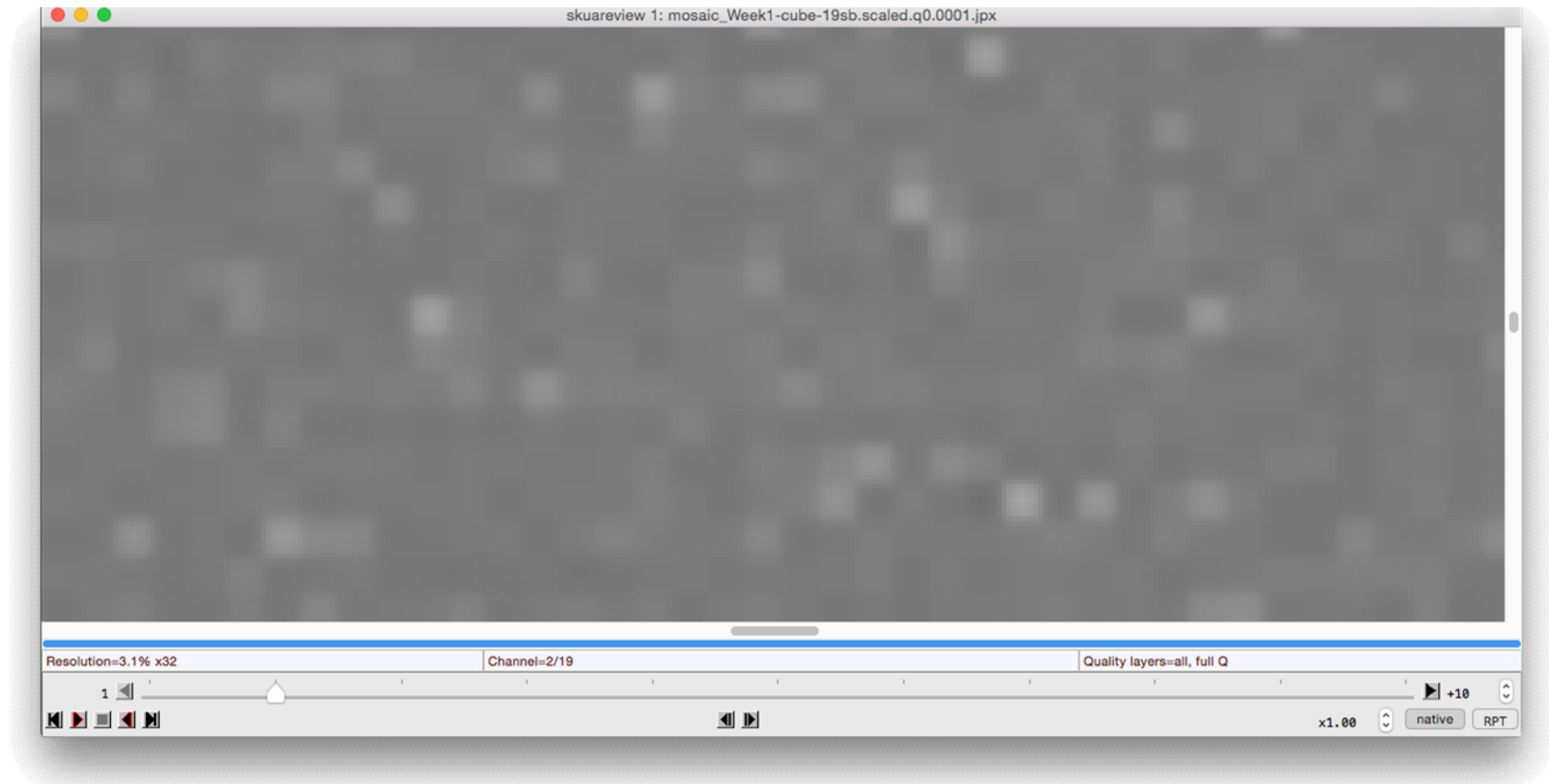


Quality Layers Decode Rate





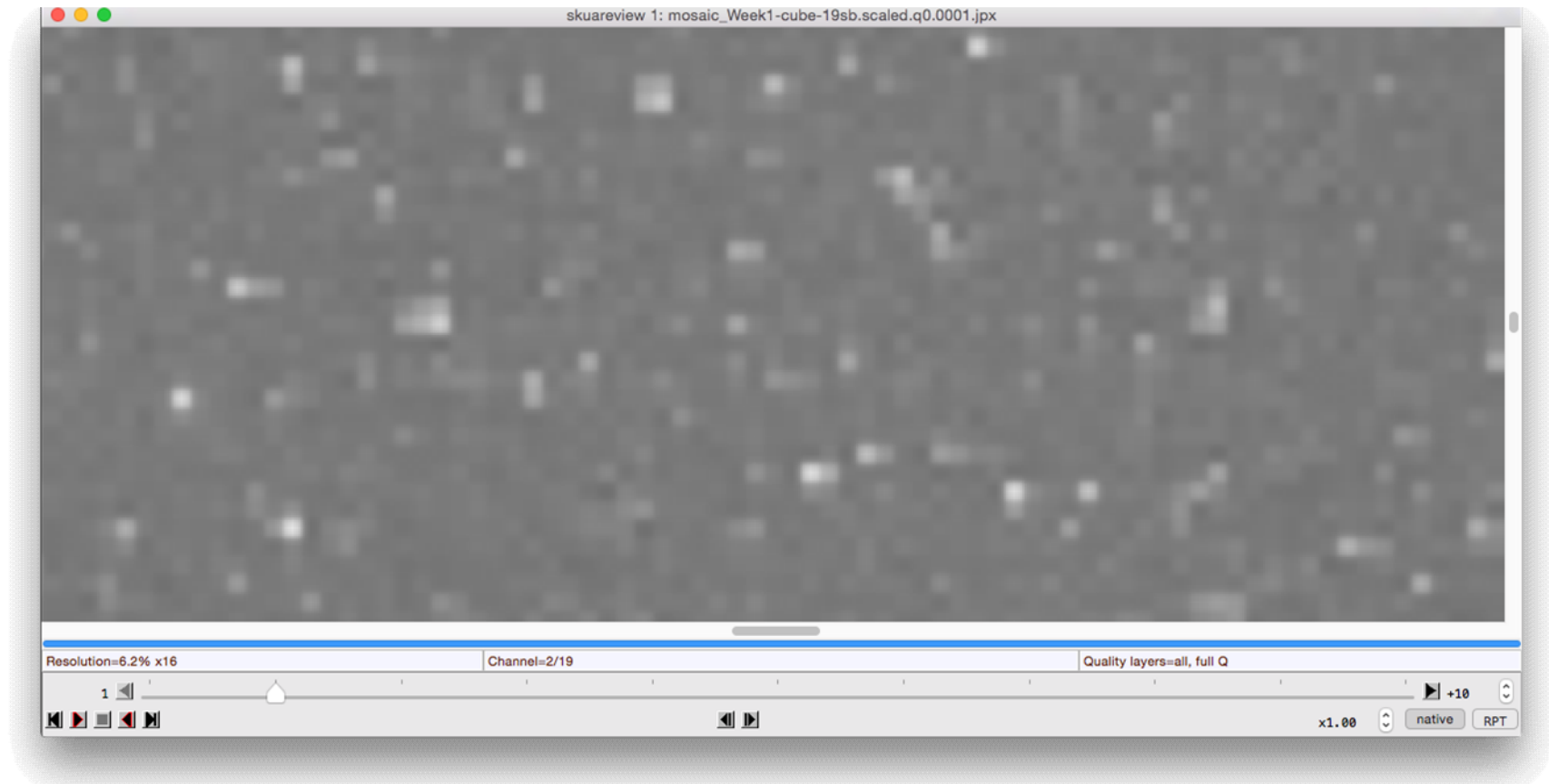
Resolution Scaling



Total transfer: 0.02 MB



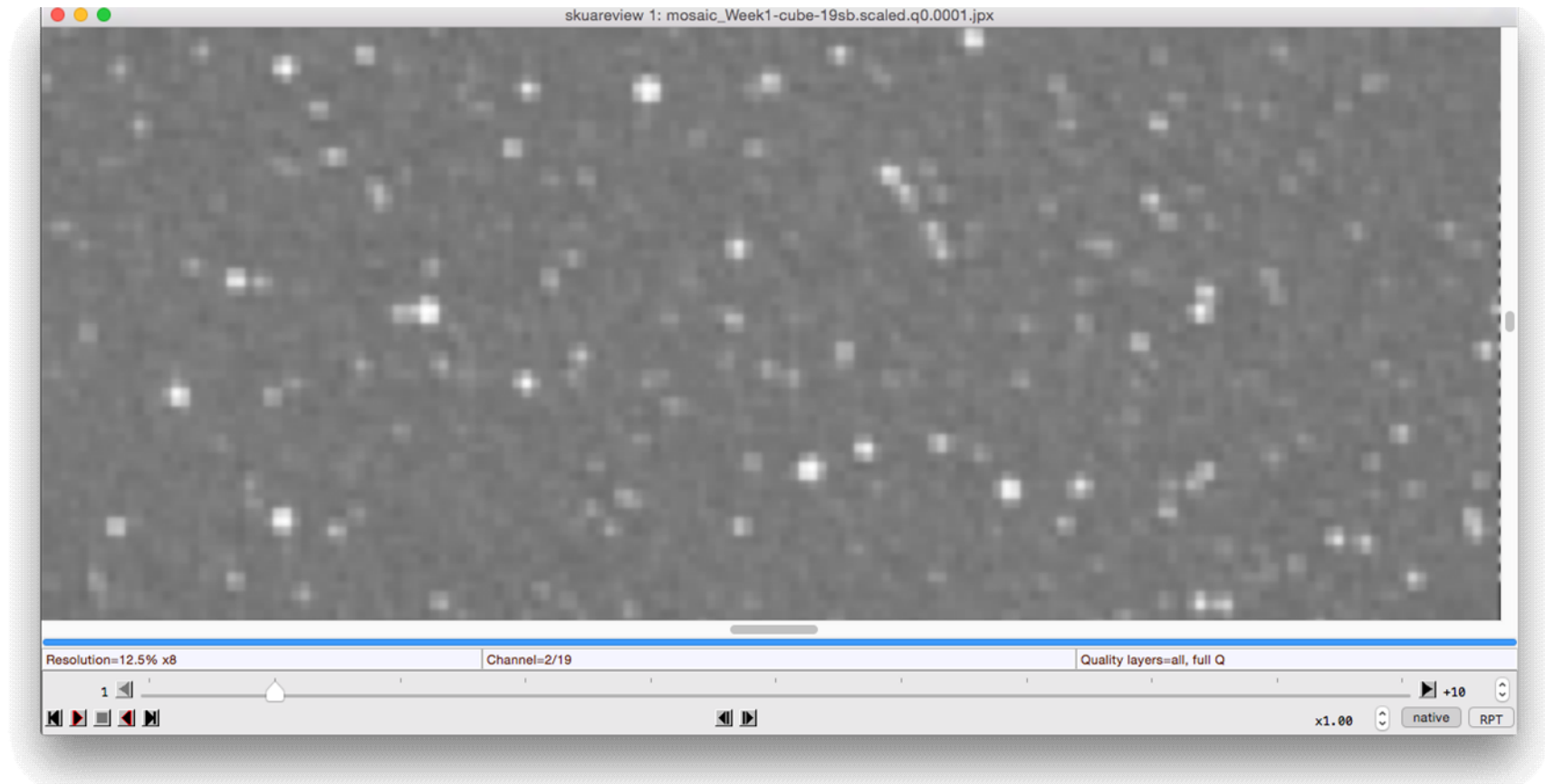
Resolution Scaling



Total transfer: 0.06 MB



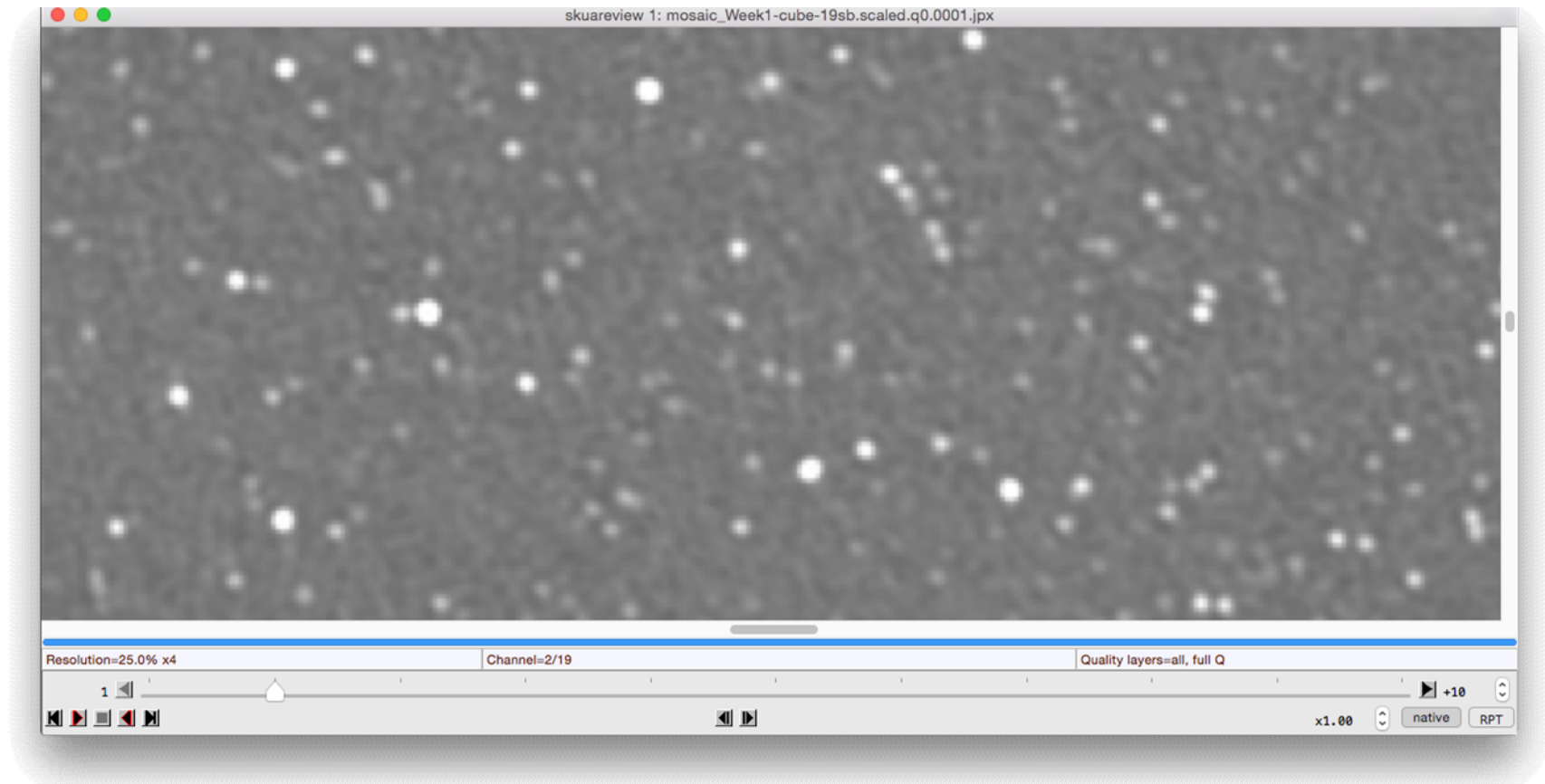
Resolution Scaling



Total transfer: 0.13 MB



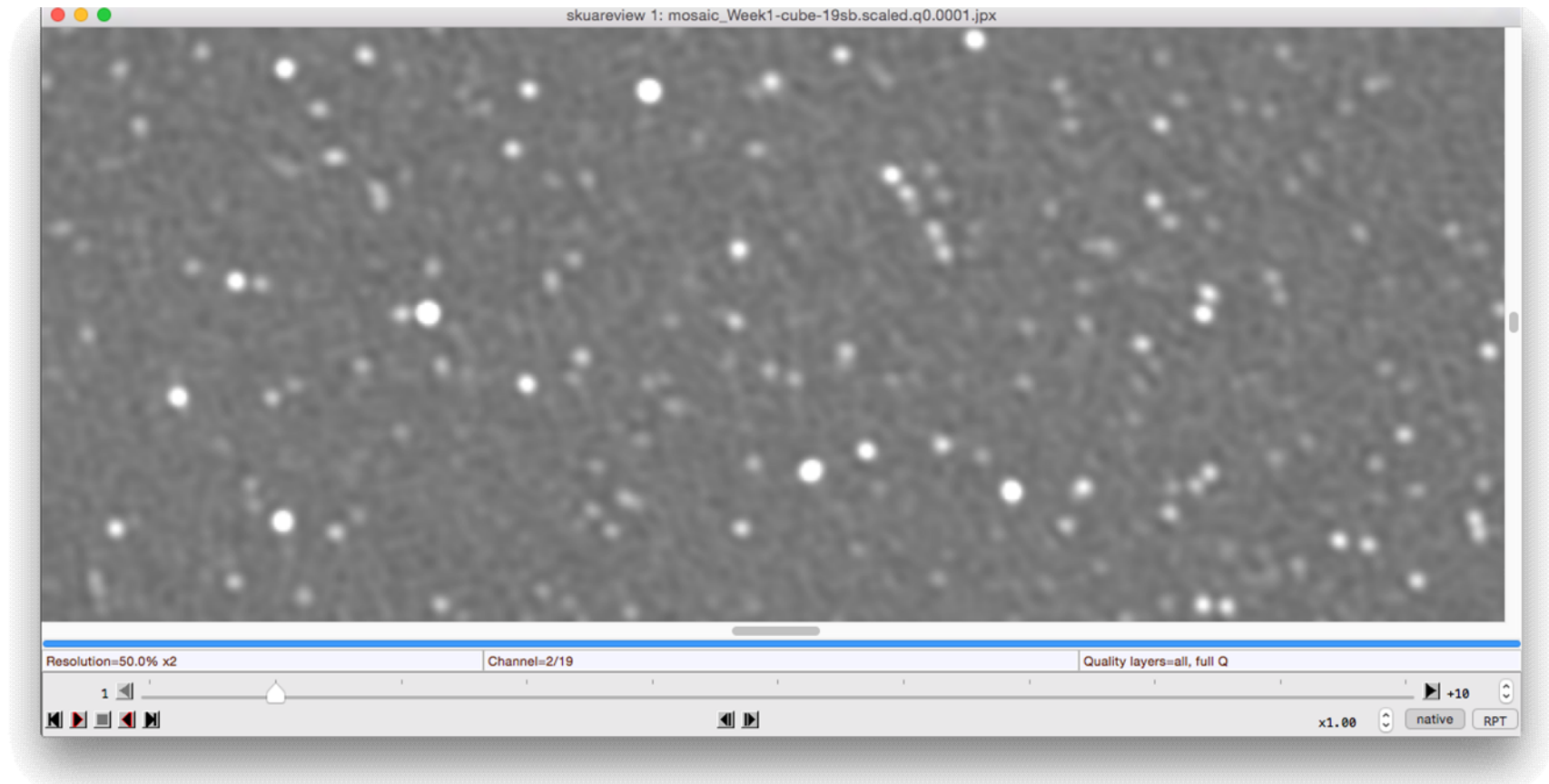
Resolution Scaling



Total transfer: 0.26 MB



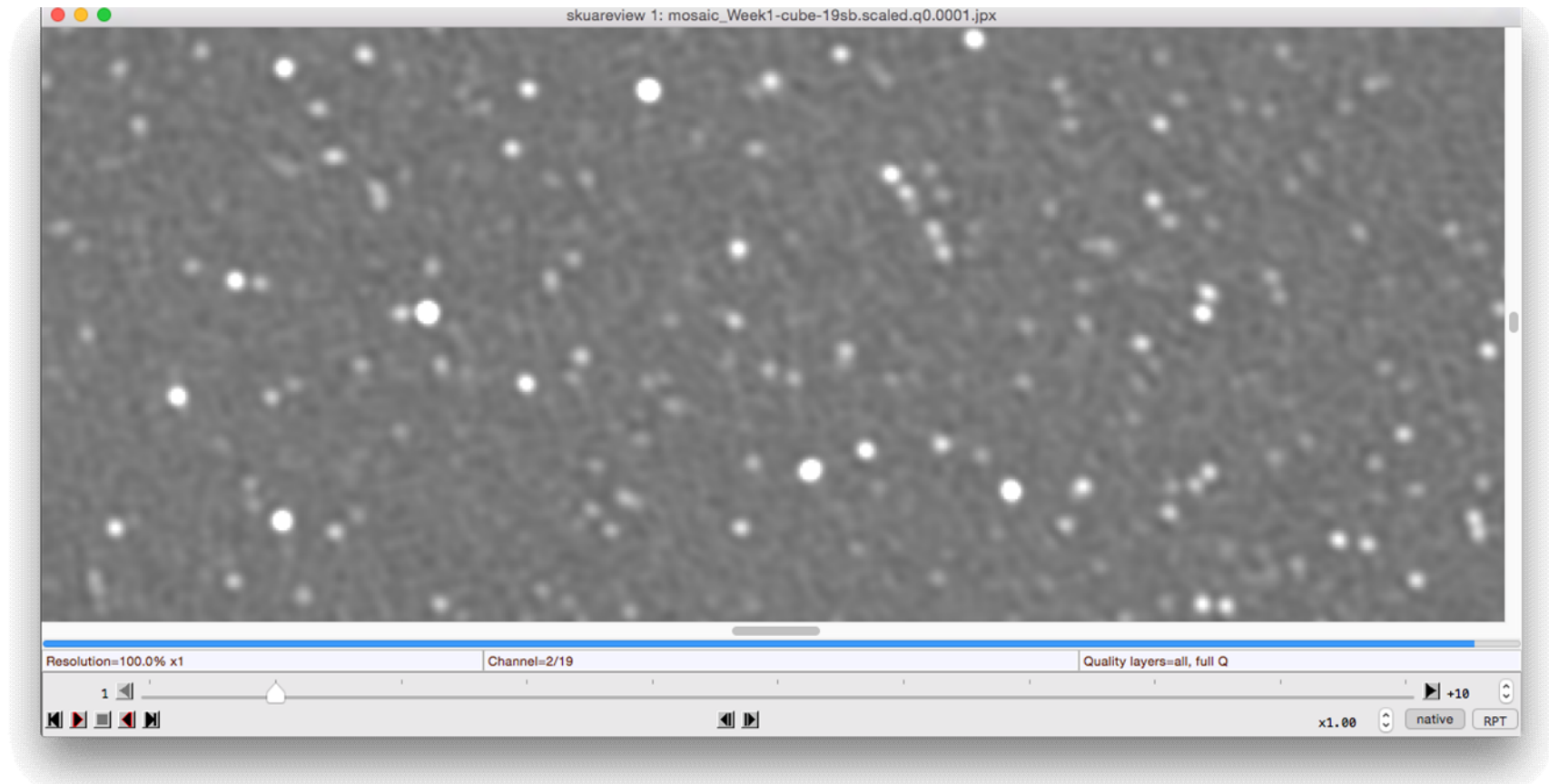
Resolution Scaling



Total transfer: 0.48 MB



Resolution Scaling



Total transfer: 1.42 MB



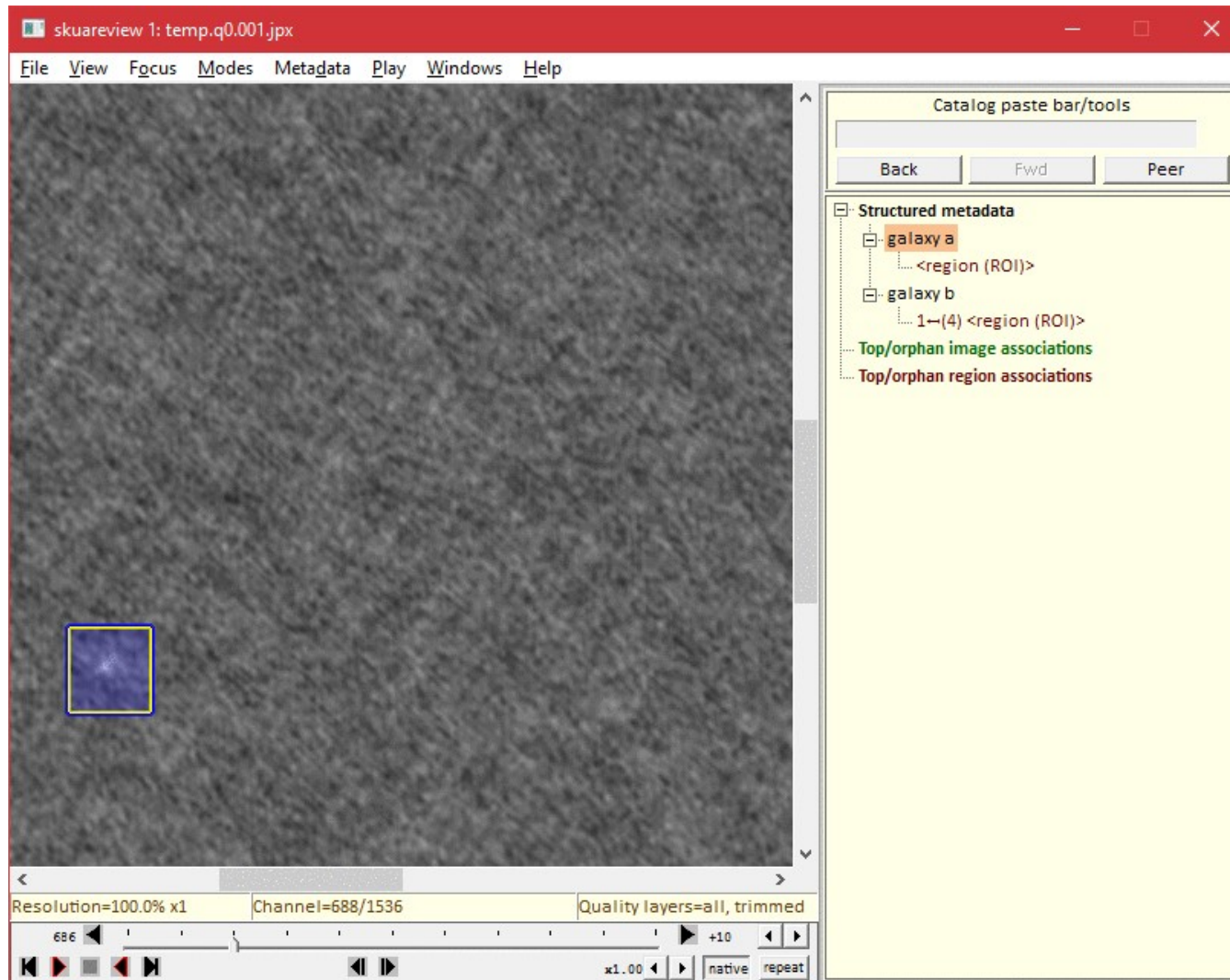
Metadata

Extremely flexible metadata mechanism

- Store existing metadata headers
- Provenance
- Cataloguing
 - Supports complex geometries
 - Comments/labels/links to other files



Metadata





Summary

JPEG2000 + JPIP can complement other formats and provide very fast access to data

Provides access to different representations of the data

- Select most appropriate for application
- Negligible overheads in accessing different representations

Flexible metadata offers a richer interactive experience



Software

SkuareView (Encoder / Decoder)

- FITS $\rightleftharpoons$ JPEG2000
- github.com/ICRAR/SkuareView

SkuareView-Client

- github.com/ICRAR/SkuareView-Client

Kakadu JPEG2000 library

- Free for research/academia
- kakadusoftware.com