



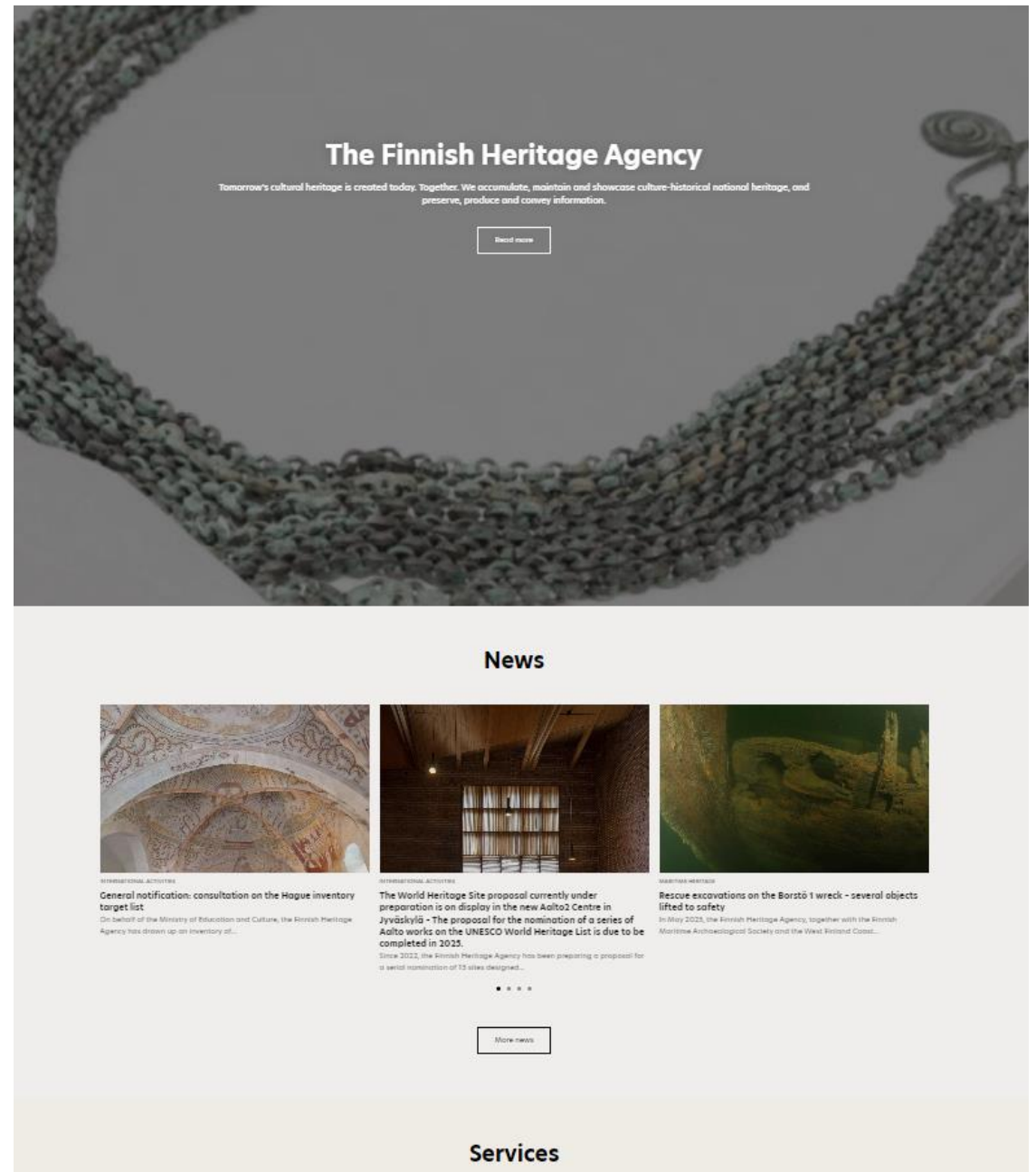
Being digital, being standard. Guidelines for digitisation of cultural heritage

EUREKA3D 27th October 2023

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# Quality in 2D – why?

1. Background
2. Quality and standards
3. Quality project at the Finnish Heritage Agency
4. Results
5. Connection to 3D



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# Technical quality / visual quality



Mrs. Grönberg, glass plate. Atelier Nyblin, Helsinki 1918.  
HK19321130:706-1918



Eetu Isto, Attack 1899. National Museum of Finland



# Some existing standards and guidelines

## 1. Quality

Metamorphose <https://www.metamorfoze.nl/english/digitization>

FADGI [FADGI Technical Guidelines for Digitizing Cultural Heritage Materials\\_3rd Edition\\_05092023.pdf](#)  
([digitizationguidelines.gov](http://digitizationguidelines.gov))

ISO <https://www.iso.org/standard/52391.html>

## 2. Guidelines for digitalisation

NEMO (Network of European Museum organisations)

[NEMO\\_Report\\_Working\\_Group\\_Digitalisation-and-IPR\\_Digital\\_Basic-Cataloguing\\_12.22.pdf](#) (ne-mo.org)

National and local archives in different countries, e.g.

<https://www.parliament.uk/globalassets/documents/upload/digitisation-guidelines.pdf>





# Quality management

- What is quality?
- Project funded by the Ministry of Education and Culture in Finland 2022 - 2023

## Objectives

- Support Finnish Museums in the digital transformation by creating a solid and understandable quality guidelines for digitization
- Quality = image quality and correspondence to original
- A model for managing digitization quality management



Before you start

Read this

Planning

Selection

Digitization

Digitization Process

Preparation

Capturing

Hardware devices

Scanners

Camera-photo

Audio Capture

Video Capture

Archiving

Preparation for publication

Publishing online

Data management

# Camera-photo

## Intro

Digital cameras have been a standard for years. The technology is in constant development which means that some models are cheaper for the quality they have. Recommended type of camera is a DSLR with changeable objectives. There are a lot of DSLR sets for a decent price. What does DSLR mean? It is a digital single-lens reflex camera. Which means that you can use old objectives also. More about DSLR camera check this decent Wikipedia article [LINK](#).

## Use

First and foremost, use it with a stand. That gives a stability and relaxed workflow. Capturing a photo can be done directly from the camera, pressing a button, or using a remote switch (check the camera producer) or using a USB connection to handle the camera on the computer.

Recommendation is not to touch the camera while taking a photo.

There are FLOSS softwares that can be used for this purpose.

For Linux use Entangle, it is available in most Linux Distro or use a flatpak with this command `flatpak install org.entangle_photo.Manager`. List of supported camera is available here <http://www.gphoto.org/doc/remote/>

For Windows the best results give DigiCamControl, connect a camera via USB and open the program. The list of supported cameras is available here <https://digicamcontrol.com/cameras> to download the program <https://digicamcontrol.com/download>

Digital camera can be used for many different purposes:



# A Model for Managing Digitization Quality Guidelines



# Outputs of the Museum Digitization Quality Management Project

- Selection and Localization of the Standard/Guideline
  - Library of Congress: FADGI Guidance
- Survey on Digitization Quality Management in the Museum Field
- Digitizers have varying educational, skill, and work experience backgrounds.
- Similarly, there are differences in space and equipment resources.
- The quality of digitization is assessed visually/subjectively.
- Transition of the museum field from the subjective assessment of digitization quality to standardized and programmatic evaluation.
- [Link to the Survey on Digitization in Museums](#)
- Wiki website for guidelines: digitointilaatu.fi
- PDF publication for the guidelines: [Link to PDF](#)
- Presentations and training events for introducing the guidelines in the museum field (Vimeo)





# National Level Collaborative Network

- **Museum Association (Museoliitto):** Provides information about digitization in the museum field within the collaborative network. Plays a role as a project partner. Collaborates in planning and implementing digitization quality management training.
- **National Archives (Kansallisarkisto):** Has developed quality criteria for archive sector in Finland. Contributes expertise to the collaborative network in creating and maintaining national quality management guidelines. Also, brings expertise in the digitization processes and quality management of two-dimensional materials.
- **CSC - IT Center for Science:** Incorporates guidance on national preservable file formats.
- **Finnish Standards Association (Suomen Standardisoimisliitto - SFS):** Expertise in ISO standards and a supporting role.
- **XAMK (South-Eastern Finland University of Applied Sciences):** Provider of training for becoming an expert in digitization.
- **Museum Organizations:** National Gallery, Museum of Photography, Satakunta Museum, and Turku Museum Center form the core group.



# Guidelines for Digitizing Cultural Heritage Materials for the Finnish Museums

- Informative Recommendation – Not a Regulatory Requirement!
- Useful for digitizing two-dimensional materials
- Both in the planning of digitization and as part of daily digitization work
- Based on the international FADGI recommendation (Library of Congress), localized with national specifications and guidelines
- published in 2023 along with the quality management website <https://digitointilaatu.fi/>

## Includes:

- Introduction to quality management
- Technical quality criterias for different object types and practical recommendations for digitizing different object types
- Recommendations for workspaces, equipment, and accessories
- Recommendations for resolution, color spaces, and image processing
- Recommendations for file formats and metadata
- Frameworks for workflow planning



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Image: Finnish Heritage Agency



# The Quality Levels

- The quality levels are based on FADGI Star System
- The FADGI recommendation classifies the quality and performance goals of digitization into four different quality levels, expressed in stars.
- A four-level system: Levels 1-4 stars, where 1 star represents the lowest level, and 4 stars represent the highest image quality.
- Quality levels are based on qualitative measures / image analysis.
- Quality levels are determined using reference targets designed for testing the quality of digital images, as well as analysis software.
- The achievement of quality levels can be measured using various reference objects or targets and compatible softwares (both free and paid).



# Quality Levels of Digitization Guidelines

## ★ One-Star Quality Level

- Suitable for only reference use, i.e., to illustrate the object when the purpose is to refer to the original information and/or location, or when digitizing at a higher quality level is not possible.
- Does not meet the requirements of ISO 19264 standard.
- Comparable to a screen capture or low-resolution quality.
- The starting point for digitization based on the recommendation when achieving a higher quality level does not have the necessary support, resources, and/or experience.

## ★ ★ Two-Star Quality Level

- The minimum acceptable quality level in professional museum digitization.
- However, not suitable for the original information's intact preservation and long-term storage of the digitized material.
- Appropriate if achieving a three-star quality level is not possible or if the purpose of digital image use does not require a three-star quality.



# Quality Levels of Digitization Guidelines

## ★ ★ ★ Three-Star Quality Level

- Digitization at the three-star quality level produces an exceptionally high-quality professional digital image suitable for most purposes.
- In principle, in the long term, the three-star quality level should be the target level for professional museum digitization if the available resources make it possible.
- The international FADGI recommendation does not recommend digitization below the three-star quality level to avoid the need for re-digitizing materials in the future.

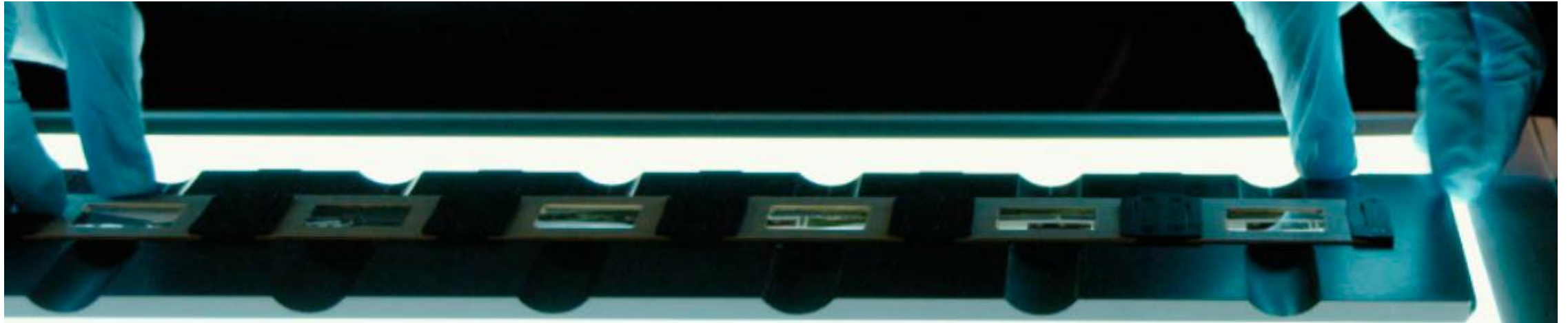
## ★ ★ ★ ★ Four-Star Quality Level

- High-quality, often referred to as "the best possible" quality.
- The four-star quality level represents the pinnacle of museum digitization. It is recommended, especially when digitizing the culturally most valuable parts of collections.





# Quality Levels of Digitization Guidelines



Digital Transitions, The DT Film Scanning Kit

- It is crucial to define, at the organizational level, the target quality levels for different materials and/or collections, as well as their components, and to document this as part of digitization plans and/or collection policies and/or metadata.
- The target level can also vary, depending on factors such as different parts of collections, different types of objects, different projects and initiatives, and, for example, based on the intended use (illustrative screen captures vs. digitization of rare materials).



# Evaluation Parameters

- Resolution, Sampling Frequency
- Lightness uniformity
- Color accuracy
- Color Channel misregistration
- SFR / Spatial Frequency Response
- Reproduction Scale Accuracy
- Sharpening
- Gain Modulation
- Skew and Rotation
- Geometric Distortion (Partially implemented)
- Field artifacts (Future implementation)
- Highlight/shadow, tolerance
- Tone response, OECF
- White balance error
- Dynamic Range
- Noise



# Object types

- Photographs, Printed Materials, and Prints
- Slides: 35mm - 9 x 12 cm, Larger than 9 x 12 cm
- Negatives: 35mm - 9 x 12 cm, Larger than 9 x 12 cm
- Paintings and Other Two-Dimensional Art (excluding printed materials and prints)
- Oversized Objects: Maps, Posters, and Other Materials
- Bound Materials: General, Rare, and Special Materials
- Documents (Unbound): General Collections, Modern Text-based Materials, Manuscripts, Other Rare and Special Materials
- Newspapers
- Microfilms and Microfiche
- X-ray Films (Radiography Images)



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# Evaluation Criteria Values for Specific Object Types

- In the quality management guidelines, each object type is provided with the technical evaluation criteria related to its digitization quality, the target thresholds for each quality metric associated with each quality level.
- Additionally, the recommendation includes, for each object type:
  - Recommended digitization techniques
  - Various practical recommendations for digitization and post-processing (localization)
  - Other noteworthy considerations (localization)



Laatutaso	1 tähti	2 tähteä	3 tähteä	4 tähteä
Arkistotallenteiden tiedostomuodot	DNG, TIFF, JPEG2000	DNG, TIFF, JPEG2000	DNG, TIFF, JPEG2000	DNG, TIFF, JPEG2000
Käyttötallenteiden tiedostomuodot	<a href="#">Säilytyskelpoiset tiedostomuodot</a> (PAS-palveluiden määrittelyt)	<a href="#">Säilytyskelpoiset tiedostomuodot</a> (PAS-palveluiden määrittelyt)	<a href="#">Säilytyskelpoiset tiedostomuodot</a> (PAS-palveluiden määrittelyt)	<a href="#">Säilytyskelpoiset tiedostomuodot</a> (PAS-palveluiden määrittelyt)
Resoluutio eli näytteenottotaajuus (pikseliä tuumalle, ppi)	200 ppi	250ppi	400 ppi	600 ppi
Bittisyvyys	8	8	8 tai 16	16
Väriavaruus	Gray Gamma 2.2 SRGB Adobe 1998 ProPhoto ECIRGB_v2	Gray Gamma 2.2 SRGB Adobe 1998 ProPhoto ECIRGB_v2	Adobe 1998 ProPhoto, ECIRGB_v2	Adobe 1998 ProPhoto, ECIRGB_v2
Väritila	Harmaasävy tai väri	Harmaasävy tai väri	Väri	Väri

Tone Response (OECF) L* (Units Colorimetric $\Delta L_{2000}^*$ ) for any given gray patch	$\leq 6$	$\leq 4.5$	$\leq 3$	$\leq 1.5$
Gain Modulation Highlight Patches (average L* between 95 and 85)	Gain between 0.5 and 1.4	Gain between 0.6 and 1.3	Gain between 0.7 and 1.2	Gain between 0.8 and 1.1
Gain Modulation all other patches	Gain between 0.25 and 1.7	Gain between 0.3 and 1.6	Gain between 0.6 and 1.4	Gain between 0.7 and 1.3
White Balance (Units Colorimetric $\Delta E(a^*b^*)$ ) for any given gray patch	$\leq 8$	$\leq 6$	$\leq 4$	$\leq 2$
Lightness Uniformity (Units Colorimetric – Standard Deviation Divided by Mean)	$\leq 8\%$	$\leq 5\%$	$\leq 3\%$	$\leq 1\%$

Average Color Accuracy (Units Colorimetric – Mean $\Delta E_{2000}$ – average deviation of all patches)	$\leq 6.5$	$\leq 5$	$\leq 3.5$	$\leq 2$
Color Accuracy 90 <sup>th</sup> Percentile (Units Colorimetric – $\Delta E_{2000}$ of all patches)	$\leq 13$	$\leq 10$	$\leq 7$	$\leq 4$
Color Channel Misregistration (Units Pixels)	$\leq 1.2$ pixel	$\leq 0.8$ pixel	$\leq 0.5$ pixel	$\leq 0.33$ pixel
SFR10 (Sampling Efficiency) (Measurement is a Ratio %)	$\geq 60\%$	$\geq 70\%$	$\geq 80\%$	$\geq 90\%$
SFR Response at Nyquist Frequency (Units Modulation)	$< 0.5$	$< 0.4$	$< 0.3$	$< 0.2$
SFR50 (50% SFR) (Units Percentage of Half Sampling Frequency) [Lower, Upper]	Percentage of half sampling frequency: [ $>30\%$ , $<95\%$ ]	Percentage of half sampling frequency: [ $>35\%$ , $<85\%$ ]	Percentage of half sampling frequency: [ $>40\%$ , $<75\%$ ]	Percentage of half sampling frequency: [ $>45\%$ , $<65\%$ ]
Reproduction Scale Accuracy (Units % Difference from Header PPI)	$< +/- 3\%$	$< +/- 2.5\%$	$< +/- 2\%$	$< +/- 1\%$
Sharpening (Units Max Modulation)	$< 1.15$	$< 1.1$	$< 1.05$	$\leq 1.02$
Noise (Upper Limit) (Units Std Dev of L*)	$\leq 4$	$\leq 3$	$\leq 2$	$\leq 1$
Noise (Lower Limit) (Units Std Dev of L*) – A warning should be raised if the image doesn't meet this criteria	$\geq 0.25$	$\geq 0.25$	$\geq 0.25$	$\geq 0.25$





# Key Factors Affecting the Quality of Digitization

- Professional competence of the digitization staff
- Use of reference objects, i.e., targets
- Use of analysis software
- Characteristics of the digitization space and management capabilities
- Cleanliness of materials to be digitized
- Digitization based on recommendations, guidelines, standards, and best practices
- Determination of digitization quality level (as part of digitization plans)
- Digitization equipment and its performance
- Planned, documented and tested workflow
- Technical quality management and monitoring (e.g., color management, bit depth, noise, resolution)
- File size, quality, and file formats throughout the lifecycle (PAS preservable file formats)



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Image: Finnish Heritage Agency



**Targets from left to right:**  
FADGI 19264, ColorChecker Digital SG, ISA Object level target



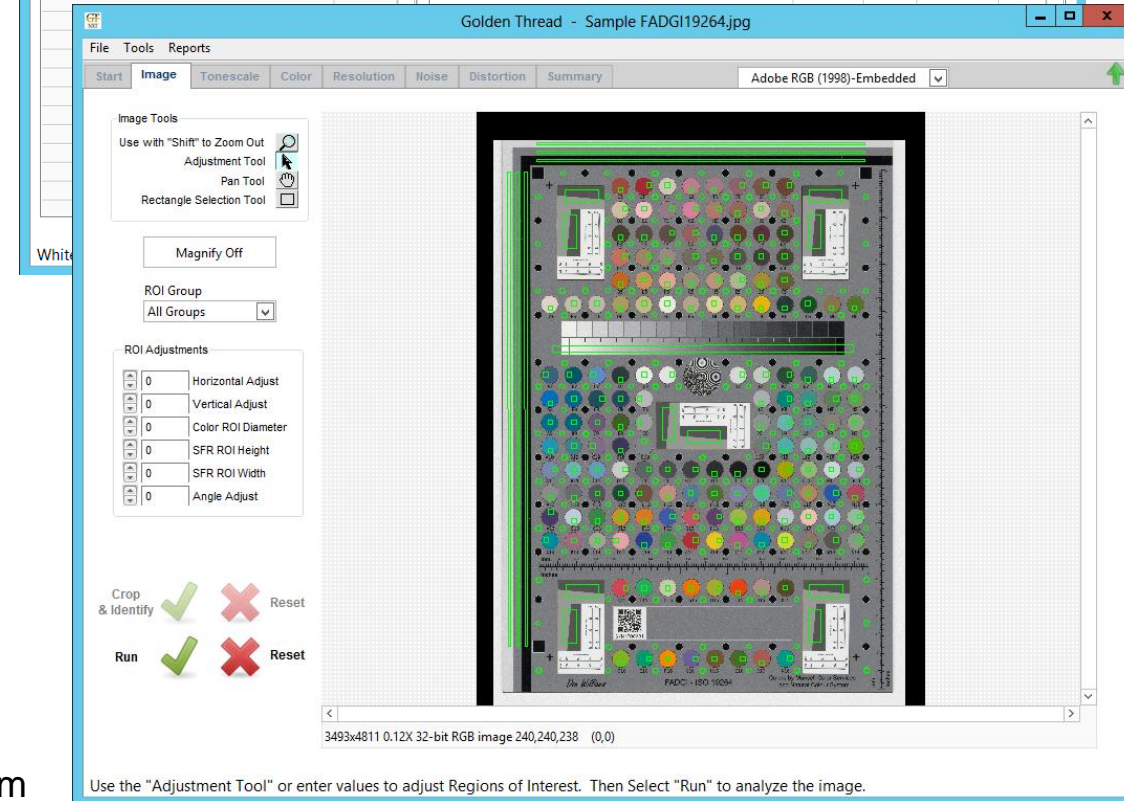
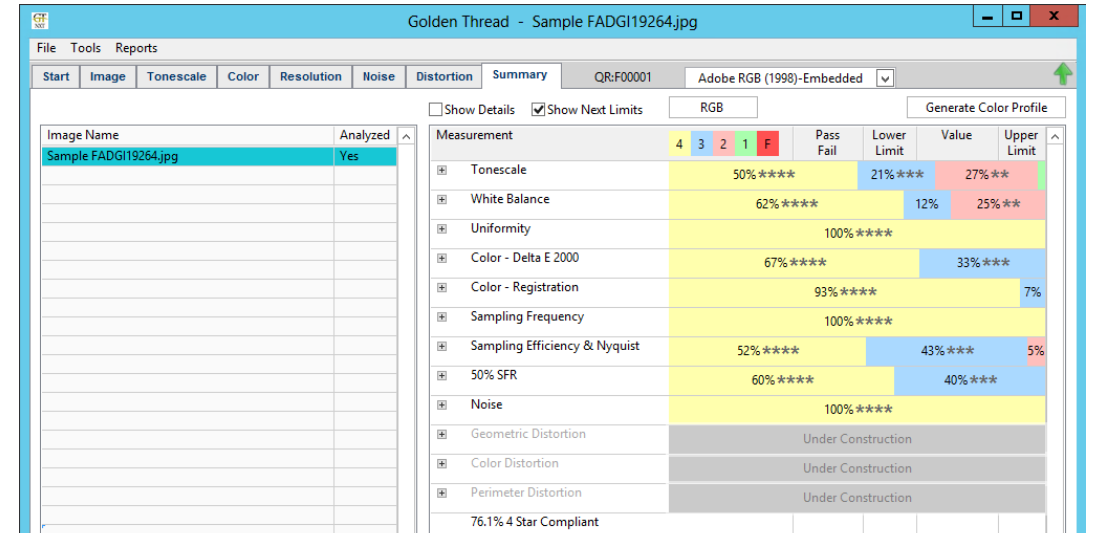
# Analysis Softwares

- The quality of digitization can be measured using various analysis softwares
- Both free and paid options are available.
- Software measures digitized targets and provides information about the performance of digitization equipment and/or the quality of digital images based on them.
- Some software can perform comprehensive analysis but are slow and more demanding to use.
- Others are user-friendly but may be capable of only color analysis and potentially creating ICC profiles.



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Image: Image Science Associates, GoldenThread NXT System



# Key Localizations and Changes to the FADGI Guidelines

- [Museum Cataloging Guidelines 2015](#)
- National Digital Preservation Services, [Recommended and Transferable File Formats](#)
- Resolution Recommendations for Reflective Materials based on the Original Size (National Archives' guidelines and regulations)
- Guidelines for Long-Term Preservation (CSC)
- Guidelines for the Selection and Procurement of Equipment and Accessories (e.g., cameras, lenses, analysis software, and targets)
- Detailed Instructions for Handling Object types
- Separate Layout Work and Rearranging Content, Such as Combining Chapters
- Supplementary Introduction and Presentation of the Quality Project
- Supplementary Illustrations and Visual Aids
- Additions to the Vocabulary



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Image: Finnish Heritage Agency

# Implementation and Monitoring of Digitization Quality Guidelines

- Guideline Update (v1.1) by November 2023
- Implementation in the museum sector
- Monitoring and statistics (e.g., National level Museum Statistics)
- Standardization of quality recommendations in the whole cultural heritage sector
- Centralization of digitization and quality management for cost-effective solutions
- Freeware analysis softwares & solutions for cost-effective reference targets
- Collaborative Education with Universities of Applied Sciences and Other Educational

Institutions



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Image: Finnish Heritage Agency



# Thank You!



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Test target in use during the filming of  
The Umbrellas of Cherbourg in 1963. Image: Agnes Varda

