Federal Agencies
Digital Guidelines Initiative

Guidelines for IRENE System Products for Long Term Retention

Deliverable Packages for Imaged Audio Systems

April 15, 2024

The FADGI Audio-Visual Working Group

http://www.digitizationguidelines.gov/audio-visual/

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By the Federal Agencies Digital Guidelines Initiative (FADGI) Audio-Visual Working Group
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Change Log

(To come with revisions)

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1. What is This Document?

This guideline outlines the final package for audio content digitized through an imaged audio system. These are the files resultant at the end of the process, often handed off to the client. This document does not cover all files created or used during the process but rather the final results which should be maintained for the long term.

While much of this guideline is specific to the Project IRENE (Image, Reconstruct, Erase Noise, Etc.) system, the guideline can be applicable to other imaged audio systems as well.

For example, while the IRENE System produces a BigTIFF image file as a primary file deliverable, not all imaged audio systems do. If an imaged audio system does not produce an image file as part of its output, then the guidelines for the image file do not apply.

It's a similar situation for raw data and log files. The guidelines advocate for the availability for process history and log files as part of provenance and transparency. The names of the specific files may be different in other systems but their usefulness is the same: to document how the deliverables were made, with what tools and with what actions both machine and human generated.

For more about IRENE, see Project IRENE (project website from Lawrence Berkeley National Laboratory), Audio Preservation with IRENE (resources from NEDCC, Northeast Document Conservation Center) and Observing the Slightest Motion: Using Visual Tools to Preserve Sound | Guardians of Memory (blog post from the Library of Congress).

1.1. Scope of Guidelines for Imaged Audio Systems

Does this guideline endorse the IRENE System over other imaged audio systems?

No. FADGI's responsibility is first and foremost to federal agencies. This work was identified as a need by FADGI members who use the IRENE System but FADGI does not endorse IRENE over other systems. This guideline does not imply that the IRENE System is "better" than other imaged audio systems. This guideline is simply meeting a need identified by FADGI member institutions, some of which also use other imaged audio systems alongside the IRENE System.

Does this project compare/contrast the systems for imaged audio to one another?

No. The project will not compare and contrast various imaged audio systems to one another, nor will it specify when one system might be better than another. Each has a place in the digitization landscape and they have different approaches for different reasons.

Will FADGI assess the performance of imaged audio systems for specific content types?

FADGI has no opinion about which system performs better with specific content. This project will describe, if you are going to use imaged audio in your preservation workflow, THESE are

the things you will want to receive and understand what they are and here's why they are important.

Does FADGI endorse imaged audio over other options for digitization?

FADGI also does not encourage the use of imaged audio over other digitization options, including stylus-based options. That's really for each institution to decide what works for their content, financial budget, staff experience levels and more.

1.2. Definition of "Imaged Audio"

FADGI's definition of imaged audio is "audio information reconstructed using non-contact optical scanning of grooved audio carriers." Comments welcome to feddigitization@loc.gov.

1.3. Inclusive Language and Terminology

According to the FADGI glossary, "in alignment with terminology changes in the wider software, technology and the GLAM communities,[1] FADGI states that the term primary is an acceptable substitute for master and the two convey the same intentions and meanings." This guideline uses the term "primary" instead of "master" to convey that the file presents the best copy produced by a digitizing organization, with best defined as meeting the objectives of a particular project or program.

1.4. FADGI Levels of Recommendation

FADGI develops guidelines and models of good practice but it is not a formal standards-making organization. Therefore, it does not have the authority to declare that conformance is required or mandatory. FADGI's documents include a tiered approach to adherence.

1.4.1. **Strongly recommended**

If the Working Group had the authority to do so, these would be "required."

1.4.2. **Recommended**

Important information to capture and retain but not essential

1.4.3. **Optional**

Good to retain if there are tools and use cases to support

[1] IETF: https://www.ietf.org/archive/id/draft-knodel-terminology-09.html; GitHub: https://github.com/github/renaming; SMPTE: https://www.smpte.org/blog/engineering-documents-smpte-will-replace-offensive-terminology-alternative-language; WIRED: https://www.wired.com/story/tech-confronts-use-labels-master-slave/

1.5. File Creation Options

Imaged audio systems create many different types of files in one of three ways:

1.5.1. Manual

Requires an action outside of the imaged audio system, such as photographing the disc label on an audio carrier with an external camera. These files are always an optional package component.

1.5.2. User-enabled

File can be generated by the imaged audio system if enabled by technicians

1.5.3. System-generated

File is automatically generated by the imaged audio system without additional action by technicians

2. Defining the Package of Deliverables

2.1. What to Make, Keep and Why

As with all digitization and reformatting projects, regardless of format, consider the goals of the project alongside allocated resources and infrastructure. For a list of common discussion topics before deciding on the contents of the package deliverable, including 2D vs 3D image capture, see Appendix A: Factors to Consider for Imaged Audio Workflows.

For imaged audio processes, it is the image file that is considered the most direct "descendant" of the original carrier. The image file can be used to produce new audio files as long as it is preserved, but one cannot work backwards from the audio to produce the image. Similarly, the image files can be reprocessed with other or adapted plugins to create different configurations of audio files. In digital preservation terms, this means that the image files are considered the archival or preservation primary file and should be retained for the long term without loss of essential features.

Audio files are the secondary output after the image files are processed with specialized software. In the case of IRENE, this is the Weaver software. The audio files would be considered primary files for production. These audio files can be regenerated from the BigTIFF primary image files and adjusted by changing the settings and plugins in Weaver.

It’s good practice to create and maintain audio files at the same technical profile(s) for production and access as other audio reformatting projects within the institution.

Equally as important as the image and audio files are the log files that document the process history of how the image and audio files were created. All these files combined create the deliverable package.

2.2. File Naming

Many institutions have rules for the creation and standardization of file names, especially for complex projects with many interrelated files and file names for imaged audio projects should follow these rules when they exist.

There are widely adopted good practice protocols for file naming. See for example, the advice in the FADGI Technical Guidelines for Digitizing Cultural Heritage Materials section 9.1 which spells out some of the recommended characteristics of file names including uniqueness, consistency, well-defined, persistent and observant of any technical restrictions (such as special characters or spaces).

Because imaged audio projects have many individual files as part of the deliverable package, it is essential to be able to associate all the files together. One way to do this is using a consistent file name for all components in the project with additional information appended to the file name as well as the file extension providing more context. For example, a partial package might include files such as

- filename.tif - Primary image file
- filename.wav - Audio output
- filename-scr.png - Screenshot of capture software
- filename-label.png - Images of the disc label

The key point is to create a consistent naming structure that identifies the file in a useful way for the organization and that ties it back to other components of the project.

Note that the IRENE System does not have a filename dependency other than that the filenames of all the processing files need to have the same name (with the appropriate extension). Other imaged audio systems may treat filename dependency differently if specific filenames need to be retained for further processing.

If filenames are removed during processing, such as being stripped after being pulled out of a DAM, they can often be reinstated or resolved through consulting log data or embedded metadata.

2.3. Packaging Files

Imaged audio projects create a variety of digital files including image, audio, log, process and other associated content. How these files are delivered at the end of the digitization process and maintained by the institution can vary depending on other technological processes. Some workflows have a strong reliance on filenames to relate files to one another, others may choose

to keep the files together in one bundle, while still others decouple the files from one another and manage the relationships and interfile dependencies in other ways in digital asset management systems or DAMs. It is up to each institution to decide which approach works best for them.

2.3.1. Recommended: Bundling Project Files Together in ZIP, Bags or Another Aggregating Format

FADGI recommends using an aggregating format (or archive format) such as ZIP. tar or RAR to bundle the project deliverables together into one package at the end of the project. The deliverable package may be split up later but until it makes its way to a stable and managed storage solution, this keeps the files together.

A bundling approach using an aggregate or archival format has several advantages:

- Some DAMs (digital asset management systems) remove file names during ingestion and do not restore the file names when files are pulled back out from the DAM. If the files are packaged in an aggregate format, the files retain their filenames throughout.
- Aggregating formats often allow for some compression to save storage space.
- These formats include the option for creating a hash or checksum value (also known as fixity) for checking file integrity over time.

Another option is using the BagIt specification as defined in IETF RFC 8493: The BagIt File Packaging Format (V1.0). The BagIt specification defines “a set of hierarchical file layout conventions for storage and transfer of arbitrary digital content. A "bag" has just enough structure to enclose descriptive metadata "tags" and a file "payload" but does not require knowledge of the payload's internal semantics. This BagIt format is suitable for reliable storage and transfer.”

Two of the key components of a BagIt bag is that all the files are together in one logical package along with a payload manifest (formatted as a bag-info.txt file) that explains what is within the bag in a structured way as well as ties it to fixity or checksum data which assure the unchanged nature of the content over time. For more information about using BagIt, see the 2019 blog post on The Signal, BagIt at the Library of Congress.

2.3.2. Directory Structures: Nested and Flat

Some institutions may prefer a **nested directory structure** in which files may be organized into a folder tree with, for example, all primary files together in one folder and all log files together in another. Another nested structure may be files organized into folders by date or identifiers or even replicate the logical organization of the originals being scanned.

Another organizational approach is a **flat directory structure**. A flat structure means just that - there are no nested folders. All the files are at the same level of hierarchy. This may be preferred for ingestion into some DAM systems which processes content at the individual item level.

In each of these cases, documenting the relationships of the files that comprise the complete delivery package should be carefully thought through. Relying on maintaining the filenames may not be robust enough over time so systems should be in place to track all the files in the delivery package and how they work together.

2.3.3. Strongly Recommended: Manifest and Fixity Checking

However the files are bundled together for delivery, FADGI strongly recommends including the following to help with provenance and completeness:

- **manifest** to declare the structure of the packaged content in whatever form it is in, such as a nested or flat directory
- **fixity checking** (checksums or other hash algorithms) at key points of transfer.

3. Guidelines for Technical Components

3.1. Scanned Image Output: 2D and 3D Data Capture from a Camera (Archival or Preservation Primary Files)

Criteria	Value	Obligation	Rationale
Primary File Format	BigTIFF	Strongly recommended	In the IRENE System, each pass or rotation is stored as a separate page in a multipage BigTIFF file. This keeps the related and adjacent images together for processing and creation of the audio file. For more information about the structure of multipage TIFF/BigTIFF files, see Multi Page / Multi Image TIFF. BigTIFF has extended file size so is strongly recommended as the default primary file because the camera files are often very large. A secondary set of TIFF files could also be maintained but the file size may exceed the 4 GB file size limit for a compliant TIFF file. FADGI does not recommend TIFF as the default primary file but recognizes that some institutions have a need for TIFF so includes it as optional. For more information about BigTIFF and TIFF, see Appendix B:TIFF vs BigTIFF as Primary File Format
	TIFF	Optional	

Criteria	Value	Obligation	Rationale
Bit Depth/Bits Per Sample	8 (2D)	Strongly recommended	For 2D, 8 bits are brightness; for 3D, 16 bits is depth
	16 (3D)		
Color Mode	Untagged RGB or untagged grayscale	Strongly recommended	Some software may try to assign a color profile if tagged so must be specifically untagged.
Embedded metadata	See Appendix C: TIFF Tags for use in imaged audio projects for specific tags to implement.	Recommended	Some of this data is also captured in Process history (scan setting data) log files. Structured embedded TIFF Tags are well used in the imaging community with many options for export and editing. Many of the specified tags contain auto-generated information so do not unduly burden existing workflows.

3.2. Audio Files

3.2.1. Primary Production Files Created from Processed Scanned Images

The chart below defines the deliverables for the primary production audio files created from the scanned BigTIFF images after processing.

Additional files for access and distribution may also be created according to institutional guidelines. These may be MP3 files or the like. FADGI has no recommendations for the technical structure or composition of these files as they are not maintained for long term purposes and are dependent on requirements from individual systems.

Criteria	Value	Obligation	Rationale
Sampling Rate	96 kHz or higher	Strongly recommended	IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects recommends a minimum of 48 kHz with the acknowledgement that “higher sampling rates are readily available and may be advantageous for many content types.” FADGI strongly recommends 96 kHz.
	48 kHz	Optional	

Criteria	Value	Obligation	Rationale
			See IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects: Key Digital Principles.
Bit Depth	24 bit	Strongly recommended	IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects recommends an encoding rate of at least 24 bit to capture all analogue materials. See IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects: Key Digital Principles.
	32 bit float	Optional	According to Hawkins and Roe in IRENE audio preservation at the Northeast Document Conservation Center: Developing workflows and standards for preservation projects that use innovative technology, "Due to the nature of historical audio recording, [imaged audio] files may contain content that was originally recorded at a very low volume, overlaid with extremely high amplitude noise spikes from damage and wear. In a fixed-point file, these large noise spikes will distort or 'clip' wherever the recorded sound's amplitude exceeds the maximum value of the fixed-point word… The significantly increased 'headroom' of 32-bit floating-point makes it possible to capture the full dynamic range of the recording, without creating files that obscure already difficult to understand content."
Sound Field	Mono (One or Two Channel Mono or Vertical/Horizontal) Stereo (Left/Right)	Recommended	Options depend on original carrier

Criteria	Value	Obligation	Rationale
Channels	Laterally recorded sources are typically output as: 1. Left/Right groove sides in a two channel file 2. Summed mono in a two channel file	Recommended	Options depend on original carrier
	Vertically recorded sources are typically output as: 1. Mono signal in a one channel file 2. Vertical/Horizontal in a two channel file		
Encoding	Linear Pulse Code Modulation (LPCM)	Strongly recommended	LPCM is preferred by IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects: Key Digital Principles. For more information about the encoding, see Linear Pulse Code Modulated Audio (LPCM)
Wrapper	Broadcast Wave	Strongly recommended	Broadcast Wave is preferred by IASA-TC 04 Guidelines on the Production and Preservation of Digital Audio Objects: Key Digital Principles. For more information about the format, see Broadcast WAVE Audio File Format, Version 2

Criteria	Value	Obligation	Rationale
Embedded metadata	See FADGI's Embedding Metadata in Broadcast WAVE Files for specifics including use of the bext and cue chunks	Recommended	FADGI has guidelines for embedded metadata in Broadcast Wave (defined by EBU Tech 3285) including use of the CodingHistory element to document the digitization process and signal chain. These are supported by the BWF MetaEdit open source application. Example of CodingHistory data for an imaged audio project: A=ANALOGUE,M=mono,T=IRENE3D; LacquerDisc;78RPM A=PCM,W=32,M=dual-mono,T=Weaver;Asus;Windows10 A=PCM,F=96000,W=32,M=dual-mono,T=iZotopeRX8;Asus;Windows10

3.2.2. Access and Distribution Copies

Additional files for access and distribution may also be created according to institutional guidelines. These may be MP3 files or the like. FADGI has no recommendations for the technical structure or composition of these files as they are not maintained for long term purposes and are dependent on requirements from individual systems. However, these files should be valid and workable, and sufficient to render the perceived resolution of data present in the primary file(s).

3.3. Process History Documentation and Log Files

While imaged audio systems may have different specific documentation and log file outputs, the goal for this section is to define the type and scope of information that should be delivered and maintained as part of the project provenance.

The overall intent of this section is to document the process history of the file, including physical condition of the original carrier (to a reasonable extent), all machine and user actions in its creation and processing as well as record the use of specific plugins and their settings. Most of these log files are system generated, may not be easily readable by humans and should be retained in case further analysis or reprocessing is needed in the future.

3.3.1. 2D and 3D Scan Process and Log Files

File purpose	Sample file name with extension	Obligation	File Creation Method	Rationale
Screenshot of capture software interface immediately before scan starts	filename-scr.jpg or filename-scr.png	Recom-mended	System-generated	This serves as a summary or overview of capture settings for provenance history. Note: FADGI does not feel strongly if the data should be stored as a JPG or PNG file but try to use the same file type for all the images for the process documentation to simplify file management.
Images of the disc label captured by a camera	filename-label.jpg or filename-label.png	Recom-mended (if present)	Manual	This serves to capture label information and graphics from the original source object if labels are present. This data may be also captured in external metadata systems but the image captures the information in situ. Note: FADGI does not feel strongly if the data should be stored as a JPG or PNG file but try to use the same file type for all the images for the process documentation to simplify file management.
Process history / Scan setting data	filename.xml	Strongly Recom-mended	System-generated	Captures summary of process history actions including settings for the scan capture. See Appendix D: Sample Process History Data This data is also included in the “Image Description” TIFF tag #270.
Camera focus data	filename.tab	Recom-mended	System-generated	Log output of camera image focus data. This is an ASCII text file which can be opened in a text editor (such as Notepad)

File purpose	Sample file name with extension	Obligation	File Creation Method	Rationale
				See Appendix E: Sample Camera Focus Data (filename.tab)
Plugin and settings log	filename.plg	Strongly Recom-mended	System-generated	List of all plugins and applied settings used in processing the image file, creating audio file and associated file management (save location etc). ASCII text file which can be opened in a text editor (such as Notepad). See Appendix F: Sample Plugin Log (filename.plg)
Plugin tracking data	filename.trk	Recom-mended (if specific plugins are used)	System-generated	Tracking data saved by a plugin with a manual tracking mode. This data is helpful as a record of which plugins were used if reprocessing is needed. Output with .trk extension but is structured XML which can be read in any text editor (such as Notepad). Files can be very long. See Appendix G: Sample Tracking Data (filename.trk)
BLOB data file	identifier.blb	Recom-mended (if MoveRegio n" or "FillRegion" plugins are used)	System-generated	Contains data produced by the "MoveRegion" or "FillRegion" plugins. This data is helpful if reprocessing is needed. Output with .blb extension but is structured XML which can be read in any text editor (such as Notepad). See Appendix H: Sample BLOB Data File (indentifer.blb)

File purpose	Sample file name with extension	Obligation	File Creation Method	Rationale
ManualCracks Plugin tracking data	filename.crk	Recommended (if specific plugins are used)	System-generated	Contains data created and used by specific plugins that generally assist with tracking across areas of damage. These contain information that is specific to the image and plugin chain used for processing, and are often more labor intensive to create. This data is integral if reprocessing is needed or for any analysis of the file's creation. See Appendix I: Sample Manual Cracks Plugin Tracking Data (filename.crk)

3.3.2. 3D Scan Only Process and Log Files

Some process logs are appropriate only for material scanned in 3D. These are in addition to the documentation in section 3.3.1: 2D and 3D Scan Process and Log Files

File purpose	Sample file name with extension	Obligation	File Creation Method	Rationale
User actions log	filename-log.txt	Optional	System-generated	Records scan setup operations that occurred in the process (such as Take Dark, FindZ, ScanCalc). It also logs the X position of each pass in a scan. This data is helpful if there are QA/QC issues, such as a focus issue, which allows the technician to step back to a specific point in the process. See Appendix J: Sample User Action Log (filename-log.txt)
Raw brightness information from	filename.bri.tif	Recommended	User-enabled	Records the brightness of light at each measurement. If a .tif (BigTIFF) file is created for the scan, then the brightness data will

File purpose	Sample file name with extension	Obligation	File Creation Method	Rationale
camera probe				be written out as “filename.bri.tif” and will be the same size as the BigTIFF file. This data is helpful for some processing operations, such as processing a z stack.
3D Position Data	filename.dat	Recom-mended	User-enabled	Every time the camera acquires a line of data in a 3D scan, the position of the rotation stage, X stage (radial position) and Z stage (focus height) are saved in this file in a three column format. For many scans the camera is moving vertically to maintain focus. This data records the ups and downs required to maintain that focus and also records the angle where each line was acquired which can be compared to the expected angle to make sure everything is working as expected. This information is useful in analyzing the spacing between samples and diagnosing incorrect motor movement. These files can be very long and large. See Appendix K: Sample 3D Positioning Data File (filename.dat)

Appendix A: Factors to Consider for Imaged Audio Workflows

Imaged audio projects are complex with many points for the curatorial and technical staff to discuss. This is a list of topics to consider but there may be others. The important takeaway is to communicate openly about the goals, expectations and budgets,

1. What are your original carriers?
    a. While all carriers can be imaged with 2D or 3D workflows, the groove depth of lacquer and shellac discs may be a good fit for 2D scans.
2. What condition are the original carriers in?
    a. Fragile or damaged carriers may justify higher capture workflows as a default due to their potentially limited life span.
    b. Carriers with cracked, broken, have mold ridden substrates, or warped surfaces are more fragile and might be considered for higher capture workflows (i.e., 3D and/or 96/24)
3. Discuss with operators which original carriers would be best captured by 2D or 3D scans. 2D or 3D IRENE imaging technology can be applied to extract the best audio depending on the material type and condition of the object.
    a. 2D: Lacquer instantaneous discs and shellac discs
        i. 3D capture is more time consuming to perform and results in larger files. But it is a cost-benefit analysis for the user to determine if the additional investment is worth it.
    b. 3D: Recommended for all carriers for maximum data capture
        i. While 3D is optional for some carriers (for example, lacquer instantaneous discs and shellac discs because the grooves are ~75 microns deep), it is the best option for most other audio carriers including plastic and aluminum transcription discs and wax cylinders where the grooves are ~5-10 microns.
4. Do you have pre-existing capture/output specifications for image or audio projects that these should align with?
    a. For example, are all other digitized audio files 96/24?
5. Is file size and ongoing file maintenance a concern?
    a. 3D scanning produces a wider variety of files, often quite large files.
    b. Higher bit depths and sampling frequency rates create larger audio files
6. There is a relationship between the amount of data collection (i.e., higher technical specs for capture), time and money.
    a. Scanning at 96/24 takes longer to do than 48/24 or 44.1/16. The higher the sampling rate and bit depth, the longer it takes to collect the data in the scan and, therefore, the more expensive it is to scan each object. This could have budget implications because less objects could be scanned per budget allotment.

Appendix B: TIFF vs BigTIFF as Primary File Format

As described in the BigTIFF entry on the Sustainability of Digital Formats, BigTIFF is the variant of the TIFF format that uses 64-bit offsets thereby supporting files up to 18,000 petabytes in size, vastly transcending TIFF's normal 4 GB limit. Since the format also supports all of the normal features and header tags of TIFF_6 and the extended metadata offered by GeoTIFF, it provides good service in the GIS domain, medical imaging, and other applications that employ large scanners or cameras. This falls in line with the workflows and products from imaged audio systems, especially IRENE.

As described in the 2008 article, Use and Export BigTIFF Files, BigTIFF files "in the standard TIFF format, [the] offset is specified by a 32-bit integer (4 bytes). The largest offset that can be specified is thus 232 bytes, or 4 GB." The post BigTIFF - Exceeding the 4 GB Limit from 2018 adds that "most desktop computers had about 2-4 MBytes of RAM at that time so a 4 GB limit seemed to have plenty of head room." But this 4 GB maximum file size limit is a hindrance when dealing with detailed, complex or large images. In 2004, BigTIFF was founded which changed the offset value as a 64-bit integer (8 bytes) which extends the theoretical maximum file size to 18,000 PB (petabytes).

The BigTIFF file format specification is available from Aware Systems: https://www.awaresystems.be/imaging/tiff/bigtiff.html.

For more information see TIFF, Revision 6.0 and BigTIFF on the Sustainability of Digital Formats.

Appendix C: TIFF Tags for Use in Imaged Audio Projects

TIFF tags are widely used TIFF files declare and describe their content by means of tags embedded in the header and in Image File Directories within the file. Tags can indicate the basic geometry of the image, define how the image data is arranged, and indicate such facts as whether one or another image compression option has been used. TIFF tags defined by the 1992 TIFF 6.0 specification fall in the first two source categories listed below: baseline and extended. The TIFF specification requires that tags be encoded in numerical order and that is the sequence used in the table below.

For general information about TIFF Tags, see TIFF tags on the Sustainability of Digital Formats.

TIFF Tags are defined in TIFF Revision 6.0 Final — June 3, 1992, https://www.itu.int/itudoc/itu-t/com16/tiff-fx/docs/tiff6.pdf

Tag #	Name	TIFF Standard Description	FADGI Use compared to TIFF Standard Use	FADGI Obligation	Sample Values	Implementation Notes	Baseline or Extended; Manual, System-generated, User-enabled
256	Image Width	The number of pixels per row	Same	Strongly recommended	4096	Typical scanner size	Baseline; System-generated
257	ImageLength	The number of rows of pixels in the image	Same	Strongly recommended	80,000	Typical scanner size	Baseline; System-generated
258	BitsPerSample	Number of bits per component	Same	Strongly recommended	8	Grayscale	Baseline; System-generated
259	Compression	Compression scheme used on image data	Same	Strongly recommended	1 = Uncompressed 4 = CCITT Group 4		Baseline; System-generated

Tag #	Name	TIFF Standard Description	FADGI Use compared to TIFF Standard Use	FADGI Obligation	Sample Values	Implementation Notes	Baseline or Extended; Manual, System-generated, User-enabled
262	PhotometricInterpretation	The color space of the image data	Same	Strongly recommended	0 = WhiteIsZero. 1 = BlackIsZero. 2 = RGB.	Additional color spaces are possible: CMYK (5), YCbCr (6), CIE L*a*b* (8), and others	Baseline; System-generated
271	Make	The scanner manufacturer	Same	Strongly recommended	Sinar	Simple ASCII text string	Baseline; System-generated
272	Model	The scanner model name or number	Same	Strongly recommended	54H	Simple ASCII text string	Baseline; System-generated
277	SamplesPerPixel	The number of components per pixel	Same	Strongly recommended	1 3	Grayscale 24-bit RGB color	Baseline; System-generated
305	Software	Name and version number of the software package(s) used to create the image	Same	Strongly recommended	LabVIEW 2013: labview_3D_P	Simple ASCII text string	Baseline; System-generated
306	DateTime	Date and time of image creation.	Same	Strongly recommended	2024-03-07T13:52:00-05:00 (translates to March 7, 2024 at	FADGI recommends using ISO 8601 datetime format with offset from UTC to	Baseline; System-generated

Tag #	Name	TIFF Standard Description	FADGI Use compared to TIFF Standard Use	FADGI Obligation	Sample Values	Implementation Notes	Baseline or Extended; Manual, System-generated, User-enabled
					1:52pm EST)	unambiguously declare time zone: YYYY-MM-DDThh:mm:ssTZD	
315	Artist	Person who created the image.	Institutional or organizational image producer, not individual person	Optional	Library of Congress;Contractor or Unit Name Library of Congress; PRTD (PRTD = Preservation Research and Testing Division) LC;DSD CDD (DSD CDD = Digital Services Directorate/ Collections Digitization Division)	Institutional image producer, not individual person including, if possible, institution and unit or contractor company name. Do not include personal names. US government users may consider using a standard abbreviation of entity names such as those found in the Guide to Government Acronyms & Abbreviations. If an entity is not on this list, use a familiar	Baseline; Manual

Tag #	Name	TIFF Standard Description	FADGI Use compared to TIFF Standard Use	FADGI Obligation	Sample Values	Implementation Notes	Baseline or Extended; Manual, System-generated, User-enabled
						abbreviation.	
269	DocumentName	The name of the document from which this image was scanned.	This tag contains the principal identifier or the "best" identifier which uniquely differentiates one object from another, preferably at the file level.	Optional		This can be a record number or catalog number or any other meaningful identifier that points to other resources for more information including finding aids.	Extended; Manual
33432	Copyright	Copyright notice of the person or organization that claims the copyright to the image. The complete copyright statement should be listed in this field including any dates and statements of claims. For example,	Same	Optional	Copyright notice; Publication and other forms of distribution may be restricted. For details, contact the Recorded Sound Section of the Library of Congress.	Copyright notice if known.	Baseline; Manual

Tag #	Name	TIFF Standard Description	FADGI Use compared to TIFF Standard Use	FADGI Obligation	Sample Values	Implementation Notes	Baseline or Extended; Manual, System-generated, User-enabled
		"Copyright, John Smith, 19xx. All rights reserved."					
270	Image Description	A string that describes the subject of the image. For example, a user may wish to attach a comment such as "1988 company picnic" to an image.	This is the same data included in the Process history / Scan setting data XML file	Optional	See Appendix D: Sample Process History Data (filename.xml)		Baseline; Manual

Appendix D: Sample Process History Data (filename.xml)


```
<Cluster>
<Name></Name>
<NumElts>6</NumElts>
<Cluster>
<Name>Settings</Name>
<NumElts>10</NumElts>
<DBL>
<Name>Begin (mm)</Name>
<Val>144.00000000000000</Val>
</DBL>
<DBL>
<Name>Setup (mm)</Name>
<Val>135.00000000000000</Val>
</DBL>
<DBL>
<Name>Delta (mm)</Name>
<Val>2.00000000000000</Val>
</DBL>
<I32>
<Name>Intensity (0-100)</Name>
<Val>10</Val>
</I32>
<I32>
<Name>Exposure (90-900)</Name>
<Val>200</Val>
</I32>
<U16>
<Name>10k Lines per Rev</Name>
<Val>20</Val>
</U16>
<Boolean>
<Name>2pass (cracks)</Name>
<Val>0</Val>
</Boolean>
<I32>
<Name>Z Num</Name>
<Val>3</Val>
</I32>
<DBL>
<Name>Z delta </Name>
<Val>0.10000000000000</Val>
</DBL>
```

<DBL>
<Name>End (mm)</Name>
<Val>130.00000000000000</Val>
</DBL>
</Cluster>
<Cluster>
<Name>Settings 2</Name>
<NumElts>8</NumElts>
<DBL>
<Name>R start</Name>
<Val>144.00000000000000</Val>
</DBL>
<DBL>
<Name>R end</Name>
<Val>130.00000000000000</Val>
</DBL>
<DBL>
<Name>Delta R</Name>
<Val>2.00000000000000</Val>
</DBL>
<DBL>
<Name>Exposure Time</Name>
<Val>200.00000000000000</Val>
</DBL>
<DBL>
<Name>Sampling Freq</Name>
<Val>200000.00000000000000</Val>
</DBL>
<DBL>
<Name>Illumination</Name>
<Val>10.00000000000000</Val>
</DBL>
<DBL>
<Name>Aperture</Name>
<Val>2.00000000000000</Val>
</DBL>
<U16>
<Name>10k Samples per Rev</Name>
<Val>20</Val>
</U16>
</Cluster>
<Cluster>
<Name>Disk</Name>
<NumElts>9</NumElts>

<String>
<Name>Other Number</Name>
<Val></Val>
</String>
<String>
<Name>Rack No. / Label</Name>
<Val>IDB 45697</Val>
</String>
<String>
<Name>Mavis Number</Name>
<Val></Val>
</String>
<String>
<Name>Broken Disk Box # / Label #</Name>
<Val></Val>
</String>
<String>
<Name>Title</Name>
<Val>Capricorn Concerto_Barber</Val>
</String>
<String>
<Name>Artist</Name>
<Val></Val>
</String>
<Path>
<Name>Path</Name>
<Val>E:\data\Barber</Val>
</Path>
<String>
<Name>Filename</Name>
<Val>IDB 45697A_z3</Val>
</String>
<Boolean>
<Name>Save TIF</Name>
<Val>1</Val>
</Boolean>
</Cluster>
<Cluster>
<Name>Operator</Name>
<NumElts>21</NumElts>
<String>
<Name>Operator ID</Name>
<Val>personX</Val>
</String>

<EL>
<Name>Visual Condition I
nspection</Name>
<Choice>Excellent</Choice>
<Choice>Good</Choice>
<Choice>Fair</Choice>
<Choice>Poor</Choice>
<Choice>Damaged</Choice>
<Choice>Not Selected</Choice>
<Val>4</Val>
</EL>
<Boolean>
<Name>Fingerprints</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Exudation</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Stains</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Scratched</Name>
<Val>1</Val>
</Boolean>
<Boolean>
<Name>Cracked</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Scuffed</Name>
<Val>1</Val>
</Boolean>
<Boolean>
<Name>Broken</Name>
<Val>0</Val>
</Boolean>
<String>
<Name>Cond-Other</Name>
<Val>dented, pocked</Val>
</String>
<Boolean>

<Name>Warped</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Off-Center</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Other</Name>
<Val>1</Val>
</Boolean>
<EL>
<Name>Start</Name>
<Choice>Outside</Choice>
<Choice>Inside</Choice>
<Choice>Not Selected</Choice>
<Val>0</Val>
</EL>
<Boolean>
<Name>Delaminating</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Chipped</Name>
<Val>1</Val>
</Boolean>
<DBL>
<Name>Disk Size</Name>
<Val>12.00000000000000</Val>
</DBL>
<String>
<Name>Disc Type</Name>
<Val>aluminum based lacquer</Val>
</String>
<Boolean>
<Name>Crazed</Name>
<Val>0</Val>
</Boolean>
<Boolean>
<Name>Bubbling</Name>
<Val>0</Val>
</Boolean>
<DBL>
<Name>Num Bands</Name>

<Val>3.00000000000000</Val>
</DBL>
</Cluster>
<Cluster>
<Name>ue-acq-param</Name>
<NumElts>10</NumElts>
<DBL>
<Name>Exposure time [ms]:</Name>
<Val>20.00000000000000</Val>
</DBL>
<I32>
<Name>No. of profiles [1/s]:</Name>
<Val>100</Val>
</I32>
<Boolean>
<Name>Freeze display</Name>
<Val>0</Val>
</Boolean>
<I32>
<Name>Display every Nth line</Name>
<Val>25</Val>
</I32>
<I32>
<Name>Reflections:</Name>
<Val>4</Val>
</I32>
<I32>
<Name>Value:</Name>
<Val>100</Val>
</I32>
<I32>
<Name>Threshold:</Name>
<Val>0</Val>
</I32>
<I32>
<Name>Measuring field custom</Name>
<Val>0</Val>
</I32>
<U16>
<Name>Measuring field:</Name>
<Val>0</Val>
</U16>
<U16>
<Name>Points per profile:</Name>

<Val>1280</Val>
</U16>
</Cluster>
<Cluster>
<Name>ue-focus-param</Name>
<NumElts>5</NumElts>
<DBL>
<Name>X Offset</Name>
<Val>5.59999999999999</Val>
</DBL>
<DBL>
<Name>Width (mm)</Name>
<Val>3.00000000000000</Val>
</DBL>
<DBL>
<Name>Y Offset</Name>
<Val>32.00000000000000</Val>
</DBL>
<DBL>
<Name>Z Offset</Name>
<Val>60.24000000000006</Val>
</DBL>
<DBL>
<Name>Y Offset 2</Name>
<Val>-1.00000000000000</Val>
</DBL>
</Cluster>
</Cluster>

Appendix E: Sample Camera Focus Data (filename.tab)

```
1467.804        1.535   1.410   1479.828        142.000         4.412   1280.000        57.339 57.335
        57.329 57.324 60.540 57.344 60.566 60.581 60.584 60.576 57.333 57.331 57.333 57.338
        57.347 57.348 57.351 57.353 57.356 57.358 57.356 57.352 57.345 57.335 57.336 57.342
        57.350 57.352 57.349 57.355 57.359 57.356 57.348 57.340 57.331 57.323 57.325 57.334
        57.338 57.336 57.337 57.343 57.346 57.342 57.336 57.331 57.329 57.328 57.328 57.328
        57.333 57.344 57.348 57.348 57.348 57.346 57.336 57.330 57.330 57.329 57.332 57.341
        57.350 57.351 57.350 57.352 57.354 57.354 57.350 57.347 57.350 57.350 57.346 57.349
        57.352 57.349 57.349 57.350 57.348 57.344 57.338 57.338 57.346 57.347 57.344 57.347
        57.349 57.345 57.338 57.334 57.330 57.327 57.337 57.349 57.352 57.349 57.343 57.337
        57.338 57.340 57.341 57.344 57.345 57.344 57.345 57.344 57.338 57.334 57.332 57.332
        57.339 57.342 57.342 57.341 57.344 57.345 60.555 60.559 60.555 60.552 60.553 60.551
        61.435 61.443 61.455 61.509 61.604 61.629 61.649 61.666 61.679 61.690 61.698 61.710
        61.716 61.717 61.718 61.721 61.729 61.735 61.735 61.734 61.737 61.739 61.739 61.742
        61.749 61.749 61.747 61.749 61.751 61.748 61.750 61.756 61.760 61.761 61.763 61.765
        61.764 61.765 61.766 61.769 61.773 61.776 61.779 61.780 61.780 61.779 61.777 61.773
[snip]
```

Appendix F: Sample Plugin Log (filename.plg)

```
Version: 1.1
Weaver.Plugin.Load.LoadBinMultTiff
chkAlwaysPrompt:False
numBinY:5
numBinX:4
lstFilenames:D:\20221213\IDB sample\filename0-0.tif
D:\20221213\IDB sample\filename0-1.tif
D:\20221213\IDB sample\filename0-2.tif
D:\20221213\IDB sample\filename0-3.tif
D:\20221213\IDB sample\filename0-4.tif
D:\20221213\IDB sample\filename0-5.tif
D:\20221213\IDB sample\filename0-6.tif
D:\20221213\IDB sample\filename0-7.tif
numOverlap:1596
cboFrom:-1
chkDisplay:True
cboFrom2:-1
chkGC:False
cboFrom3:-1
numRun:12

Weaver.Plugin.Load.LoadBinMultTiff
chkAlwaysPrompt:False
numBinY:5
numBinX:4
lstFilenames:D:\20221213\IDB sample\filename0-0.tif
D:\20221213\IDB sample\filename0-1.tif
D:\20221213\IDB sample\filename0-2.tif
D:\20221213\IDB sample\filename0-3.tif
D:\20221213\IDB sample\filename0-4.tif
D:\20221213\IDB sample\filename0-5.tif
D:\20221213\IDB sample\filename0-6.tif
D:\20221213\IDB sample\filename0-7.tif
numOverlap:1596
cboFrom:-1
chkDisplay:True
cboFrom2:-1
chkGC:False
cboFrom3:-1
numRun:1

Weaver.Plugin.Image.ImageAdd
```

numRun:1
chkGC:False
cboFrom3:-1
cboFrom2:-1
cboFrom:2
chkDisplay:True

Weaver.Plugin.Image.FillRegion
numAvgY:5
chkDone:True
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:False
numRun:1

Weaver.Plugin.Image.FillRegion
numAvgY:5
chkDone:True
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:True
numRun:1

Weaver.Plugin.Image.FillRegion
numAvgY:5
chkDone:True
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:True
numRun:5

Weaver.Plugin.Image.FillRegion
numAvgY:5
chkDone:True
cboFrom3:-1
cboFrom2:-1
chkDisplay:True
cboFrom:-1

chkGC:True
numRun:1

Weaver.Plugin.Image.ImageSmooth
cboFrom2:-1
chkDisplay:True
cboFrom:-1
cboFrom3:-1
numYSmooth:5
numXSmooth:1
numRun:2
chkGC:True

Weaver.Plugin.Image.ImageSmooth
cboFrom2:-1
chkDisplay:True
cboFrom:-1
cboFrom3:-1
numYSmooth:80
numXSmooth:1
numRun:1
chkGC:True

Weaver.Plugin.Image.ImageAdd
numRun:1
chkGC:False
cboFrom3:-1
cboFrom2:10
cboFrom:9
chkDisplay:True

Weaver.Plugin.Image.ImageSmooth
cboFrom2:-1
chkDisplay:False
cboFrom:-1
cboFrom3:-1
numYSmooth:1
numXSmooth:21
numRun:1
chkGC:False

Weaver.Plugin.Track.TrackDepthMan
numSearchDist:2
chkLoad:True

chkAutoHScroll:True
chkDone:True
numGrooveShift:0
numGrooveWidth:5
numMaxChange:2
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:False
cboFrom3:-1
numRun:1

Weaver.Plugin.Save.SavePlugin
txtAppend:
chkGC:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:2
numRun:1

Weaver.Plugin.Load.LoadTrack
txtFilename:D:\20221213\IDB sample\filename0-0.tif.trk
chkAlwaysPrompt:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:False
numRun:1

Weaver.Plugin.Other.LoopFile
chkPrompt:False
lstFiles:D:\20221213\IDB sample\filename0-0.tif
D:\20221213\IDB sample\filename0-1.tif
D:\20221213\IDB sample\filename0-2.tif
D:\20221213\IDB sample\filename0-3.tif
D:\20221213\IDB sample\filename0-4.tif
D:\20221213\IDB sample\filename0-5.tif
D:\20221213\IDB sample\filename0-6.tif
D:\20221213\IDB sample\filename0-7.tif

chkGC:False
cboFrom3:-1

cboFrom2:-1
chkDisplay:False
cboFrom:-1
numRun:15

Weaver.Plugin.Load.LoadTiff
chkPrompt:False
chkVFlip:False
txtFilename:D:\20221213\IDB sample\filename0-7.tif
txtFilename:1
cboFrom:-1
chkDisplay:False
cboFrom2:-1
numRun:1
chkGC:False
cboFrom3:-1

Weaver.Plugin.Load.LoadTiffRepl
txtReplace:z1-
txtSearch:z0-
chkPrompt:False
txtFilename:D:\20221213\IDB sample\filename0-6.tif
cboFrom:-1
chkDisplay:False
cboFrom2:-1
chkGC:False
cboFrom3:-1
numRun:1

Weaver.Plugin.Image.ImageAdd
numRun:1
chkGC:False
cboFrom3:-1
cboFrom2:-1
cboFrom:17
chkDisplay:True

Weaver.Plugin.Track.TrackFromMult
numRightMargin:30
numLeftMargin:30
numOffset:-2
numWidth:10
chkGC:False
cboFrom2:15

cboFrom3:-1
chkDisplay:False
cboFrom:-1
numRun:1

Weaver.Plugin.Track.LinearInterpolation
numMinNewGrooveVertDist:40
chkGC:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
numRun:1

Weaver.Plugin.Track.TrackSmooth
numSmooth:30
chkGC:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
numRun:1

Weaver.Plugin.Image.XSmDerivSm
numSmooth2:5
numSmooth1:4
cboFrom2:-1
chkDisplay:False
cboFrom:19
numRun:1
chkGC:False
cboFrom3:-1

Weaver.Plugin.Process.DEdgeGauss2
numMaxMove:10.0
numWidthWidth:6.0
numWidthTrack:6.0
numWidthLast:2.0
numFitWidth:7
numMinDeriv:30.0
numExtraWidth:30
numContrastWeight:1
numWidthWeight:200
numFollowTrackWeight:100

numFollowLastWeight:400
chkInvert:False
txtGrooveBottomWidth:10
cboFrom2:22
chkDisplay:True
cboFrom:23
chkGC:False
cboFrom3:-1
numRun:1

Weaver.Plugin.Other.WriteWav
chkReverse:False
chkItop:False
chkDerivative:True
numScale:1.000
cboBits:3
txtAppend:33
chkStereo:True
txtRPM:33.333
cboFrom2:-1
chkDisplay:True
cboFrom:-1
cboFrom3:-1
chkGC:False
numRun:1

Weaver.Plugin.Other.LoopEnd
chkGC:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
numRun:1

Weaver.Plugin.Save.SavePlugin
txtAppend:
chkGC:False
cboFrom3:-1
cboFrom2:-1
chkDisplay:False
cboFrom:-1
numRun:1

Weaver.Plugin.Other.Merge2D

chkReverse:False
chkFavorRightSide:False
txtMask:*.wav
numSamplePerRev:80000
lstMerge:D:\20221213\IDB sample\filename0-1.tif1-1.tif0.tif1-0.tif.trk33.wav 3685 3020
0/6894419
D:\20221213\IDB sample\filename0-2.tif1-2.tif0.tif1-0.tif.trk33.wav 3740 2901 17/24007134
D:\20221213\IDB sample\filename0-3.tif1-3.tif0.tif1-0.tif.trk33.wav 3790 2949 18/25897124
D:\20221213\IDB sample\filename0-4.tif1-4.tif0.tif1-0.tif.trk33.wav 3696 2857 17/24013779
D:\20221213\IDB sample\filename0-5.tif1-5.tif0.tif1-0.tif.trk33.wav 3747 2903 18/25005634
D:\20221213\IDB sample\filename0-6.tif-6.tif0.tif1-0.tif.trk33.wav 3804 2958 18/25897464
numOverlap:2500
cboFrom2:-1
chkDisplay:False
cboFrom:-1
chkGC:False
cboFrom3:-1
numRun:1

Appendix G: Sample Tracking Data (filename.trk)

These files can be very long. This is an abbreviated example.


```
<ArrayOfArrayOfDouble xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ArrayOfDouble>
    <double>5400</double>
    <double>40000</double>
    <double>399</double>
    <double>4096</double>
    <double>8</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38534</double>
    <double>761</double>
    <double>765</double>
    <double>0.35894775390625</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38535</double>
    <double>762</double>
    <double>766</double>
    <double>1.74200439453125</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38536</double>
    <double>763</double>
    <double>767</double>
    <double>3.10565185546875</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38537</double>
    <double>762</double>
    <double>766</double>
    <double>2.02862548828125</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38538</double>
    <double>762</double>
    <double>766</double>
    <double>2.24383544921875</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
```

```
    <double>38539</double>
    <double>761</double>
    <double>765</double>
    <double>1.17431640625</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38540</double>
    <double>760</double>
    <double>764</double>
    <double>1.0489501953125</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38541</double>
    <double>760</double>
    <double>764</double>
    <double>1.04156494140625</double>
  </ArrayOfDouble>
  <ArrayOfDouble>
    <double>38542</double>
    <double>760</double>
    <double>764</double>
    <double>1.01104736328125</double>
  </ArrayOfDouble>
[snip]
</ArrayOfArrayOfDouble>
```

Appendix H: Sample BLOB Data File (filename.blb)

```
<?xml version="1.0" encoding="utf-8"?>
<ArrayOfBlob xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <Blob>
    <area>0</area>
    <perim>0</perim>
    <x>0</x>
    <y>0</y>
    <w>0</w>
    <h>0</h>
    <num>0</num>
    <pts>
      <Point>
        <X>795</X>
        <Y>29448</Y>
      </Point>
      <Point>
        <X>970</X>
        <Y>29464</Y>
      </Point>
      <Point>
        <X>1144</X>
        <Y>29408</Y>
      </Point>
      <Point>
        <X>1324</X>
        <Y>29448</Y>
      </Point>
      <Point>
        <X>1504</X>
        <Y>29416</Y>
      </Point>
      <Point>
        <X>1681</X>
        <Y>29416</Y>
      </Point>
      <Point>
        <X>1861</X>
        <Y>29384</Y>
      </Point>
      <Point>
```

```
        <X>803</X>
        <Y>29920</Y>
      </Point>
      <Point>
        <X>977</X>
        <Y>29936</Y>
      </Point>
      <Point>
        <X>1147</X>
        <Y>29896</Y>
      </Point>
      <Point>
        <X>1323</X>
        <Y>29960</Y>
      </Point>
      <Point>
        <X>1501</X>
        <Y>29968</Y>
      </Point>
      <Point>
        <X>1681</X>
        <Y>29904</Y>
      </Point>
      <Point>
        <X>1855</X>
        <Y>29880</Y>
      </Point>
    </pts>
    <width>5400</width>
    <height>40000</height>
    <multOverlap>399</multOverlap>
    <subWidth>4096</subWidth>
    <imgCount>8</imgCount>
  </Blob>
</ArrayOfBlob>
```

Appendix I: Sample Manual Cracks Plugin Tracking Data (filename.crk)

```
<?xml version="1.0" encoding="utf-8"?>
<ArrayOfArrayOfPoint xmlns:xsd="http://www.w3.org/2001/XMLSchema"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
  <ArrayOfPoint>
    <Point>
      <X>20</X>
      <Y>2915</Y>
    </Point>
    <Point>
      <X>939</X>
      <Y>2920</Y>
    </Point>
    <Point>
      <X>1674</X>
      <Y>2923</Y>
    </Point>
    <Point>
      <X>3053</X>
      <Y>2923</Y>
    </Point>
    <Point>
      <X>3813</X>
      <Y>2922</Y>
    </Point>
    <Point>
      <X>4893</X>
      <Y>2921</Y>
    </Point>
    <Point>
      <X>6421</X>
      <Y>2920</Y>
    </Point>
    <Point>
      <X>7078</X>
      <Y>2918</Y>
    </Point>
    <Point>
      <X>8098</X>
      <Y>2916</Y>
```

```
    </Point>
    <Point>
      <X>9238</X>
      <Y>2917</Y>
    </Point>
    <Point>
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      <Y>2916</Y>
    </Point>
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      <Y>2920</Y>
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    <Point>
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    <Point>
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      <Y>11373</Y>
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    <Point>
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    <Y>11367</Y>
   </Point>
   <Point>
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    <Y>11355</Y>
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    <Y>11356</Y>
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    <X>8750</X>
    <Y>11321</Y>
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    <Y>11292</Y>
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```

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  <ArrayOfPoint>
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      <Y>11275</Y>
    </Point>
    <Point>
      <X>11087</X>
      <Y>11269</Y>
    </Point>
    <Point>
      <X>12139</X>
      <Y>11256</Y>
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      <Y>11211</Y>
    </Point>
  </ArrayOfPoint>
</ArrayOfArrayOfPoint>
```

Appendix J: Sample User Action Log (filename-log.txt)

2023-11-28_13-21-01, Scan Calc
2023-11-28_13-21-11, Scan Calc Done
2023-11-28_13-22-06, Dark
2023-11-28_13-22-25, Dark Done
2023-11-28_13-22-34, Scan Calc
2023-11-28_13-22-44, Scan Calc Done
2023-11-28_13-22-44, FindZ2
2023-11-28_13-22-55, FindZ2 Done
2023-11-28_13-23-12, Viewer
2023-11-28_14-16-33, Viewer Done
2023-11-28_14-16-59, Scan Calc
2023-11-28_14-17-09, Scan Calc Done
2023-11-28_14-17-09, FindZ2
2023-11-28_14-17-21, FindZ2 Done
2023-11-28_14-17-27, Viewer
2023-11-28_14-18-16, Viewer Done
2023-11-28_14-21-05, Dark
2023-11-28_14-21-23, Dark Done
2023-11-28_14-21-31, Scan Calc
2023-11-28_14-21-41, Scan Calc Done
2023-11-28_14-21-41, FindZ2
2023-11-28_14-21-53, FindZ2 Done
2023-11-28_14-22-05, Scan Calc
2023-11-28_14-22-15, Scan Calc Done
2023-11-28_14-22-15, Scan
X end / ADC1128.000000, -0.000610
X end / ADC1128.880000, -0.001220
X end / ADC1129.760000, -0.000915
X end / ADC1130.640000, -0.000610
X end / ADC1131.520000, -0.000610
2023-11-28_14-46-54, Scan Done

Appendix K: Sample 3D Positioning Data File (filename.dat)

Summary of file data:

The file starts with:

0.000125 0 0

Group3.Pos.ExternalLatchPosition | Group1.Pos.ExternalLatchPosition | Group2.Pos.ExternalLatchPosition

-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422
-61.9851	146.0001	-6.422

At line 31028 it repeats the same information for the next pass:

0.000125 0 0

Group3.Pos.ExternalLatchPosition | Group1.Pos.ExternalLatchPosition | Group2.Pos.ExternalLatchPosition

0.00525	146.0034	-6.44
0.01725	146.0034	-6.44
0.02925	146.0034	-6.44
0.04125	146.0034	-6.44
0.05325	146.0034	-6.44
0.06525	146.0034	-6.44
0.07725	146.0034	-6.44
0.08925	146.0034	-6.44
0.1014	146.0034	-6.44

0.11325 146.0034 -6.44

Extended Data

0.000125 0 0

Group3.Pos.ExternalLatchPosition	Group1.Pos.ExternalLatchPosition	Group2.Pos.ExternalLatchPosition
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.9851146.0001	-6.422	
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422

-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422
-61.98495	146.0001	-6.422

<snip at line 30 of 61754 lines>

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