

Technical Recommendation

CST - RT – 021 – C - 2012 – v1.0

*Digital files for exchanging and operating
cinematographic works, known as
« Mezzanine Files »*

Publication date: July 15th 2012

PRELIMINARY STATEMENT

In order to stimulate the whole field and to allow everyone to access diverse cultural content, using all current and future means of screening, arrangements to accompany beneficiaries in the digitisation of cinematographic works are implemented jointly by the General Commissioner for Investments and the Treasury Bank within the framework of « investments for the future » on the one hand and by the National Film and Animation Centre (CNC) on the other hand.

The essential question of digital formats for exchanging and screening cinematographic works must be examined prior to implementing these arrangements. In this context, in February 2011, the CNC asked the CST to draft specific recommendations that are coherent with international work on the subject and which guarantee perennial access to cinematographic works in all relevant types of digital broadcast.

To achieve this, the Higher Technical Commission for Image and Sound (CST) based its development on a working group set up for this purpose by the CNC, bringing together:

- The CNC;
- the CST;
- the Film, Audiovisual and Multimedia Industries Federation (FICAM)

PURPOSE

The purpose of this technical recommendation, drafted by the CST, is to define the formats for exchanging and screening cinematographic works with the aim of broadcasting them using all types of equipment.

The technical recommendation defines two fields:

- File formats for digitised image and sound elements
- The format of the container to exchange such digitised programmes.

The “container” format must be selected so that it does not alter the content files in any way and will therefore be able to receive all levels of quality (interoperability) and it remains coherent with international work carried out on this subject.

The founding principle of this recommendation concerning the digitisation of works is that such digitisation must be carried out in a manner such that it guarantees the preservation of the technical and artistic qualities of the original elements.

FIELD OF USE

This technical recommendation describes the digitisation file formats and the exchange file formats in order to facilitate the exchange of digital files between beneficiaries, distributors, broadcasters and theatre operators, as well as the perennial use of these files in all types of digital broadcast.

To achieve this, the aim of this recommendation is to enlighten - not only the CNC, the General Commissioner for Investments and the Treasury Bank with regard to the implementation of their arrangements for digitising cinematographic works – but also private holders who are liable to digitise part of their library independently of these arrangements.

In no way is it intended to be used for describing a file format for long-term archiving.

TECHNICAL RECOMMENDATION

PROGRAMME TYPES

The programmes in question are feature-length and short cinematographic works.

TECHNICAL EQUIPMENT

The equipment used will preferably be derived from the elements validated by the film production (grading).

These works may be derived from the following image media:

- 70 mm positive photochemical film
- 65 mm negative photochemical film
- 35 mm positive photochemical film
- 35 mm negative photochemical film
- 16 mm positive photochemical film
- 16 mm negative photochemical film
- Other photochemical media formats
- Analogue video medium
- Digital video medium
- Digital film medium

These works may be derived from the following sound media:

- Analogue photochemical media, all formats
- Magnetic media, all formats
- Non-encrypted digital media

VERSIONS OF WORKS DERIVED FROM PHOTOCHEMICAL MEDIA POST-PRODUCED USING PHOTOCHEMICAL TECHNIQUES

For the digitisation, the original medium which has the best quality will be used, i.e. original, edited negatives for image and sound positives or magnetic sound tapes.

If these elements are not available, the inter-negatives or inter-positives used for the preparation and manufacture of prints will be used.

If none of these elements are available, a screening copy may be used.

Whatever the source medium used, the photochemical grading data must be preserved (FCC files or perforated tapes).

VERSIONS OF WORKS DERIVED FROM DIGITAL POST-PRODUCTION TECHNIQUES

The versions of these programmes are primarily the DCDM versions from the digital post-production cycle, used to manufacture the DCPs. The DSM files (non-assembled sound and image) used for the manufacture of the DCDMs may also be used.

If this DCDM is not available, the first transfer to top quality film will be used.

VERSIONS OF WORKS DERIVED FROM THE VIDEO MEDIUM

The versions of works used will be primarily the inter-negatives or screening copies.

Failing this, the Master versions used for the manufacture of the inter-negatives or prints will be used.

LEVELS OF DIGITISATION OF IMAGES

The files in question are the ones resulting from the digitisation of photochemical media by means of a scan or the digital conformation of video and/or digital sources.

The quality of the digitisation will allow for observing *a minima* the requirements for files defined below :

- **File types:** .tiff - .dpx - .exr or equivalent

- **Minimum resolution:** the scan of photochemical images will be carried out using at least a 2K type film scanner. The resulting resolutions will be as follows, depending on the performance of the scanner used:
 - ✓ In the case of a 2K type scan, the analysis window is 2048 x 1536, i.e. a 1.33 full frame ratio. The scan of film elements must allow the use of the largest possible area of this analysis window depending on the image ratio.
 - ✓ In the case of a 4K type scan, the analysis window is 4096 x 3072, i.e. a 1.33 full frame ratio. The scan of film elements must allow the use of the largest possible area of this analysis window depending on the image ratio.
 - ✓ In the case of a 6K type scan, the analysis window is 6144 x 4608, i.e. a 1.33 full frame ratio. The scan of film elements must allow the use of the largest possible area of this analysis window depending on the image ratio.
 - ✓ In the case of an 8K type scan, the analysis window is 8192 x 6144, i.e. a 1.33 full frame ratio. The scan of film elements must allow the use of the largest possible area of this analysis window depending on the image ratio.

- **Colour Space for the colorimetric analysis**

The colorimetric analysis must use the RGB primaries as a reference along with reference white as defined in « ISO 26 428 – 1 – D-Cinema Distribution Master – Part 1 Image characteristics » (REC 709 not accepted).

- **Depth of the colorimetric analysis:**

The digitisation will be carried out according to the following analysis:

- ✓ Linear analysis: ≥ 16 bytes for 4 :4 :4

The encryption of these digitisation files may be carried out either in a linear or a logarithmic manner according to the following minimum criteria:

- ✓ Logarithmic encryption: ≥ 10 bytes for 4 :4 :4
- ✓ Linear encryption: ≥ 16 bytes for 4 :4 :4

- **Pixel ratio:** free. Whatever the original medium, the original pixel ratio will be maintained and the image ratio will be entered.

- **Density ratio:** the tool used must allow the density ranges in the original element to be preserved

LEVELS OF DIGITISATION OF SOUND

- **Files:** « pcm - .wav »
- **Quantification :** minimum 24 bytes
- **Sampling:** minimum 48 kHz
- **Encryption:** no encryption at this stage

RESTORATION ACTIONS

This technical recommendation does not deal with any aspect of the restoration of damaged works. Restoration operations generally take place in between the digitisation (scan) and the delivery of the exchange files.

MASTER SCREENING FILE (MEZZANINE FILE)

This is the file that results from the digitisation process and a configuration integrating – in particular – the restoration and the grading, for transposition to the following format:

- **JPEG 2000 compression** profile 2, mathematically lossless
- **Colorimetric space:** X'Y'Z' without RCT (Reverse Color Transform) including 2.6 gamma encryption as defined in « ISO 26 428 – 1 – D-Cinema Distribution Master – Part 1 Image characteristics »
- **Multichannel mapping:** type « ISO 26 428 – 3 – D-Cinema Distribution Master – Part 3 Audio channel mapping & channel labelling”
- **Image speed:** Whatever method is used to screen digitised films at a later date, the original speed of the digitised elements must be preserved in the broadcast metadata

The information concerning the speed is contained in an xml file by means of the specification of a numerator and and denominator in the SampleRate element. For example, this gives 24/1 and 25/1 for the traditional speeds and 16/1, 200/11, 20/1, 240/11 for archive speeds.

IMF TYPE EXCHANGE FORMAT – IMF APPLICATION FOR CINEMA

The IMF exchange format is the one selected, in principle, for this recommendation.

IMF : Interoperable Master Format. This exchange format is described in a specifications pamphlet drafted by the ETC (Entertainment Technology Center).

As at the date this recommendation is drafted, it is undergoing the standardisation process at the SMPTE. Every update of the SMPTE IMF format implies an update (version change) of the present recommendation.

The IMF exchange format was designed to contain all the profiles resulting from digitisation, including those concerning quality and it is therefore the largest computer file. It is designed to be non-proprietary, readable by all, internationally and to contain the metadata allowing all screening files to be produced (digital cinema, return to film, DVD, VoD etc.)

The choice of the IMF profile or the IMF Application must allow the preservation of the quality of the file derived from the digitisation process.

The IMF application selected is based on that initially described in the « ETC IMF_Specification_v1.0» (19/02/2011) document, in the amended version currently undergoing the SMPTE validation process (final publication Autumn 2012, communication at the Bristol congress, July 9th 2012 and the Geneva Congress, September 2012) entitled « Application-2 ». This application-2 defines all the criteria for the IMF packaging by specifying a "Broadcast" content in the Rec 709 space and a resolution of 1920x1080.

The present recommendation contains all the criteria defined in the abovementioned document with the exception of the following criteria: colorimetric space and resolution. These criteria will be the subject of an amendment to the corresponding SMPTE standard.

This type of exchange file accepts files that have undergone encryption, digital signature and digital watermarking processes.

Discussions are taking place between the CST and the SMPTE regarding the integration, into the IMF standard, of a complement to the current standard, integrating image files in digital format, along the lines defined in the present recommendation, CST RT 021 V1.0

Until the new version of the IMF is published, we recommend that image files be encrypted using JPEG 2000 profile 2 format and preserved without wrapping, as they come.

The files will be kept either in pcm format or in .wav format.

Regarding a future wrapping solution, the disposals of the draft SMPTE 2067-5:201X may be used as basis of work.

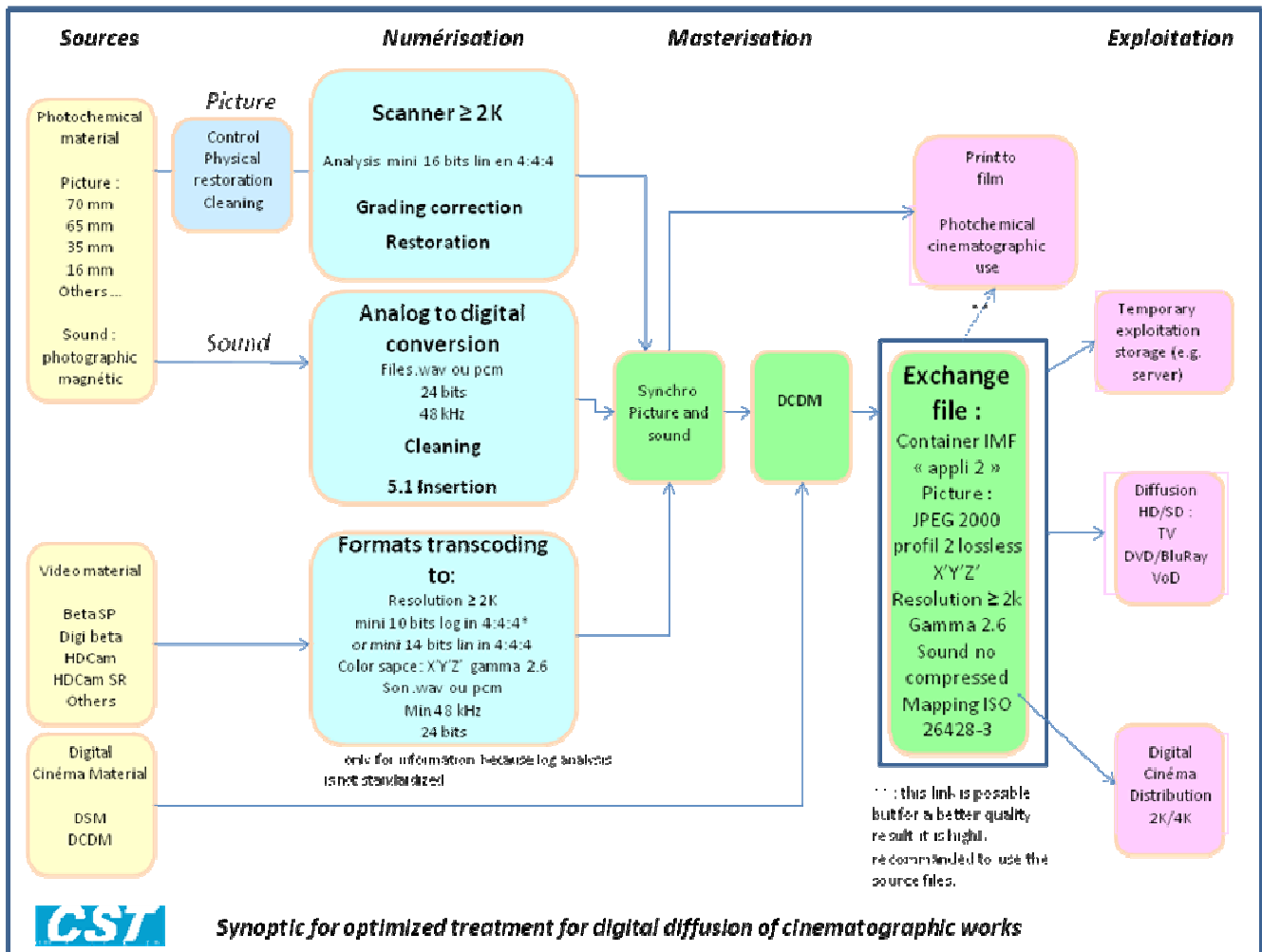
A technical appendix to this recommendation will be developed as the SMPTE work and the CST/Ficam work progresses.

STORAGE MEDIUM

This recommendation does not specify a specific medium for storage nor that to be used for the exchanges. Whatever storage medium is used, procedures that will guarantee the non-alteration of files and clear identification must be implemented.

APPENDIX

SYNOPTIC TABLE REPRESENTING THE DIGITISATION PROCESS



REFERENCES

- IMF_Specification_v1.0 (19/02/2011)
- Iso/IEC 15444-1 :2004 Information technology – JPEG 2000 image encryption system
- ISO/IEC 15444-1:2004/Amd 2:2009 – Extended profiles for cinema and video production and archive applications
- ISO/IEC 15444-1:2004/Amd 3:2010 - Profiles for broadcast applications
- ISO/IEC 15444-1:2004/Amd 1:2006 - Profiles for digital cinema applications

GLOSSARY

DCDM	Digital Cinema Distribution Master : master file for the digital distribution of films, ISO standard
Scanner	Process used for converting photochemical images into digital data
JPEG	Joint Photographic Expert Group
JPEG 2000	Image compression standard, derived from the JPEG group and standardised as reference ISO 15444-1
Lossy	Visually without loss, mathematically with loss
Lossless	Mathematically without loss
XYZ	Colorimetric container defined in publication 1931 CIE Publication 15 :2004, Colorimetry, 3rd édition
RVB	Primary colour space
Mapping	Assignment of audio channels according to a wiring and distribution plan of the tracks in a multichannel programme
Wrapping	Packaging in a single file (.mxf or .zip type or others) of several files (e.g. a succession of images)
.wav	Audio container: Waveform Audio File Format, developed by Microsoft and IBM for storing audio files
.pcm	Non-compressed audio file (raw type)
.tiff	Image container: tag infrastructure file format
.exr	Image container defined by Open EXR for Lucas Digital
.dpx	Image container developed by Kodak and standardised by the SMPTE (268M-2003) Digital Picture Exchange (DPX)
IMF	Interoperable Master Format : technical specifications for an exchange file format, developed by ETC
ETC	Entertainment Technology Center
SMPTE	Society Of Motion Picture and Television Engineers (USA)
ISO	International Standards Organisation
CST	Higher Technical Commission for Image and Sound (Commission Supérieure Technique de l'Image et du Son - France)
Ficam	Cinema, Audiovisual and Multimedia Industries Federation (Fédération des industries du cinéma, de l'audiovisuel et du multimedia)