UNIVERSIDAD POLITECNICA DE VALENCIA

ESCUELA POLITECNICA SUPERIOR DE GANDIA

Grado en Ing. Sist. de Telecom., Sonido e Imagen

"El desarrollo de la postproducción a lo largo del tiempo.
Beneficios de trabajar con flujos 4k. "

TRABAJO FINAL DE GRADO

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I. INTRODUCTION

ABSTRACT

Nowadays the technological revolution is booming, as new ways in which any type of audiovisual material is produced and consumed are often brought to market. These new ways of recording and viewing the image are far from the old television formats, as portable devices are increasingly used with large screens or larger TVs. This different resolution in all types of screens requires for the viewer a better quality in the image. This has caused the appearance of the 4k format, which increases the number of pixels per frame. The aim of this survey is to capture the importance of postproduction, in particular non-linear editing, and the benefits of working in this 4k video format. So it will be done a tutorial of basic notions of video editing in 4k using the editing software Adobe Premiere Pro.

KEY WORDS: Postproduction, video editing, 4k, tutorial, Adobe Premiere Pro.

RESUMEN (Valencià)

Hui dia la revolució tecnològica està en auge, ja que sovint apareixent al mercat noves vies per les quals es produeix i es consumeix tot tipus de material audiovisual. Aquestes noves maneres de gravar i visualitzar la imatge s'allunya dels antics formats de televisió, ja que cada vegada s'usen dispositius portàtils amb pantalles considerables o televisor cada volta més grans. Aquesta diferencia en la resolució requereix una millor qualitat d'imatge per l'espectador. Açò ha provocat l'aparició del format 4k, que augmenta el nombre de píxels per frame. L'objectiu d'aquest estudi es plasmar la importància de la postproducció, concretament l'edició de vídeo, i els beneficis que aporta el treballar amb aquest nou format de vídeo 4k. Per a portar a terme aquesta demostració es realitzarà un tutorial on s'explicarà nocions bàsiques de l'edició de vídeo amb 4k amb l'ús del programari d'edició Adobe Premiere Pro.

PARAULES CLAU: Postproducció, edició de vídeo, 4k, tutorial, Adobe Premiere Pro.

RESUMEN (Castellano)

Hoy en día la revolución tecnológica está en auge, ya que a menudo salen al mercado nuevas vías por las cuales se produce y se consume cualquier tipo de material audiovisual. Estas nuevas formas de grabar y visualiza la imagen, distan mucho de los antiguos formatos de televisión, ya que cada vez se usan dispositivos portátiles con pantallas considerables o televisores más grandes. Esta diferente resolución en todo tipo de pantallas requiere para el espectador una mejor calidad en la imagen. Esto ha provocado la aparición del formato 4k, que aumenta el número de pixeles por frame. El objetivo de este estudio es plasmar la importancia de la postproducción de video, en concreto la edición no lineal, y los beneficios que aporta trabajar en este nuevo formato de vídeo 4k. Para ello se realizará un tutorial de nociones básicas de la edición de video en 4k utilizando el programa Adobe Premiere Pro.

PALABRAS CLAVE: Postproducción, edición de video, 4k, tutorial, Adobe Premiere Pro.

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II. CONTENT

1. PERSONAL MOTIVATION

The film industry has been always present in my life and my attention. As every child I really enjoy watching films and TV, I was very curious about how all this image could be in the screen. At the time that I was in the high school and we had to opt for a specialty, I chose technical sciences, without being sure of what will be my university studies, but everyone in my surrounding said that this field could open more doors in the professional world.

In our student plan, once the obligatory studies are finished for continuing studying and enter to the university it is needed to do another two years of preparation for doing the exam that could let in to the university. These two years are focused in very specific subjects depending on the bachelor that the student is thinking of doing. In my case I continued with the technical sciences, the subjects thought for then doing engineering without the consent of some professors that doubt about my studying capacity.

During all these two years I wasn't decided about what degree I should choose. My last year and the graduations were near and this decision should have been done. So I thought about where I will like to be working in 10 years, and that answer was in television or film industry. In that moment I discovered that my professional life was going to be related to the audiovisual world. This industry is plenty of different jobs, but I looked for the technical part and I found the Bachelor's Degree in Telecommunications Systems, Sound and Image Engineering in the *Universitat Politècnica de València, Escola Superior de Gandia*. So in 2012 I started to study this degree that provided me much technological engineering knowledge. As it is engineering, it has to cover several fields of telecommunication without making emphasis in the image; the aspect of the bachelor that I was most interested on.

So for doing the internship I chose a local TV, there I worked in different positions and I discovered that I was right and in the future I will want to work in audiovisual industry.

Accordingly to that when I had the chance to study one semester abroad I chose a university that could offer me to learn about the image aspects that are not possible to learn in my home university. I was looking for a production department and the Hochschule Düsseldorf has it.

Therefore, with the arrival to the HSD I had to decide the topic that would passion me for doing the bachelor thesis, then I decided that it had to be related to the cutting and the editing video, due to it was a topic that more or less, before getting into I knew something about it. With the process of decision of the thesis topic I had the opportunity to work with different editing software and discover all the 4k hardware and how to work with this files. This make me realized all the benefits that 4k material can provide while the shooting of a film or series.

Also I've seen that 4k is the present of the resolution and besides most of the audiovisual world is working with it, in a near future it will be the standard of the semiprofessional video makers and all of the common houses. For all these reasons I decided to get into 4k benefits in editing.

Finally, here is my work, I hope you like.

2. OBJECTIVE AND ORGANISATION OF THE RESEARCH

2.1 RESEARCH QUESTION

In the conversion of the time-base standards from Full HD quality video to 4k video:

Has editing in 4k such an amount of advantages that it can be considered useful to film and edit in 4k instead of filming and editing in the actual standard of Full HD quality video?

2.2. RESEARCH DESIGN

This project is a semi-experimental research, because there are explained all the benefits that can provide 4k in a theoretical way, and then it is shown with images, the practical part and how to use such benefits.

2.2.1. SECONDARY RESEARCH

- Analysis and compilation of the following sources.
- Technical literature.
- Technical specification.
- Whitepapers.
- Technical videotutorials.

2.2.2. PRIMARY RESEARCH

- Test series in different editing systems.
- Development of tutorials with the advantages of the workflow in 4k production.

2.3. RESEARCH OBJECTIVES

The objective of the research is to explain the advantages that 4k resolution can provide. Besides the purpose of the project, is to show the importance of editing in the production of a movie, series or any type of audiovisual material. And also find out about the best workflow in 4k video production shown in the tutorial specially produced for this bachelor thesis.

2.4. LIMITATIONS

To whom is this BA-thesis done?

1. Target Group: People doing an education in film editing (students, trainees, etc.)
2. Target Group: semiprofessional & amateur filmmakers

The reason for this limitation is at first the available time for this Bachelor thesis. Due to that the project does not show a practical comparison of all the professional editing software as Avid Media Composer or Final Cut Pro as it will be advisable.

This tutorial is aimed to be used as a guide for people that people that is starting in the editing world, with some basic knowledge of Adobe Premiere Pro since it's the editing software that will be used in the current project. The target of this project are amateurs editors that want to improve the quality of their image or save filming time due to the fact that with 4k is only need one shot for making more than one different scene. There aren't any compact tutorial that show to the viewer the real technical advantages of 4k format that can provide more image quality

3. VIDEO STANDARDS AND VIDEO EDTING

3.1 HISTORY OF EDITING

In Europe the first cinema screening was done in the basement of Grand Café Paris by the Lumiere Brothers[1] in December, 28th 1895 where they recorded with a cinematograph animated images that showed how the train was arriving to a city the known as *Le Train Arriveé a la Ciotat*[2] or The workers leaving the factory.

In one of this screening was invited a young theater director called *Georges Méliès*[3] who was interested in buying a cinematograph machine from *Lumiere* Brothers. Later, they noticed a potential competence on him so they decided to refuse his offer. On face *Méliès* who had been also a mechanic of an English device called Animatograph reversed the mechanics and created his own camera. He used this machine for recording his own moving images and showing them in his theater exhibition.

In the Fall of 1896 *Méliès* there was shooting in Paris where a bus coming up from a tunnel and suddenly his camera stopped working in the middle of the take. When the camera worked again the bus was gone and placed by a hearse. When *Méliès* developed the film he discovered that the bus turned into the hearse right in the screen, something that now it is called "jump cut", he also discovered fade in and fade out, stop motion photography and overlapping dissolves He used right away that discover for appearing and disappearing things and creating illusionism projections [8].

At the same time in America a man named Edwin S. Porter[4], that was working as a head of production in the Edison Skylight Studio, tried to make his own production with the influence of *Méliès* work, producing *Life of an American Fireman*[5] in 1903 which combines footage from the Edison library and stage scenes for creating a fictional narrative, in the film Porter constructed each shot as a complete scene, letting the viewer see the same action in two different perspective. Even so in the end of the same year Porter developed the film *The Great Train Robbery*[6], in this film the director was more decisive with the cutting, although each scene was one master take, and the cut were straight between scenes without using fades or dissolves and without letting the scene reach its logical end.

After Porter's discovery, D.W. Griffith developed the concept of transparent montage; the goal was to make the audience think that the event appeared successively creating "The Birth of the Nation" in 1915 and "Intolerance" one year later[8].

The technique used in the beginning of editing it was based in some steps; the first one was testing the good parts with a positive tape, then when the order of the film was stabilized it proceeded to make the film into negative and it was numbered. Once the film was numbered it continued with cutting manually for then make positive the frames chose, finally these chosen frames were pasted for making a perfect sequence.

With the appearance of machinery and the development of the industry, the tapes were produced, and using machines that were able to montage these new tapes was built up the magnetosope which is a video tape recorder (VTR).

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[1] Lumiere Brothers: cinematograph inventors
[2] Le Train Arriveé a la Ciotat: [13]
[3] Georges Méliès : French filmmaker
[4] Edwin S. Porter: American film director
[5] *Life of an American Fireman*[14]
[6] *The Great Train Robbery* [15]

3.1.1.　KULESHOV EFFECT[7]

The consolidation of the importance of editing in the cinema was confirmed when the soviethic film director in the 20's. The experiment has three parts, the first one it screened an image of a table with a plate of soup then a short shot of Iván Mozzhujin actor. The second one was a shot of little child playing with a teddy bear and after the same picture of the actor's face seen before. And finally the third one was the image of a coffin and then the shot of Iván Mozzhujin. This experiment proved that the same face expression could mean different feelings, with the soup the audience perceived desire, with the child happiness and with the coffin sadness.

3.2. FILM STANDARDS

3.2.1.　35mm

The standard gauge for professional filmmakers, and the standard mainstream film format used for theatrical releases. It has a width of 35 mm and four holes between each the frame, with this width it can be fill in one meter of tape 52 frames. In the beginning the aspect ratio was for letting space to the sound, but it wasn't reliable for the viewers so it changed to 1:1.33. It was manufactured in 1892 by William Dickson and Thomas Edison [11].

3.2.2.　16mm

The frame is one-fourth the size of a 35 mm frame and has a 1.33:1 television aspect ratio, that means the proportional size between the horizontal and vertical side of the screen The film can have perforations on both sides or on just one side. It was developed by the Eastman Kodak company in 1923 [11].

Figure 1. http://www.cinedecartelera.es/cultura-cinematografica/diferencias-entre-8-16-y-35mm/

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[7] Kuleshov Effect [9]

3.3. VIDEO STANDARDS

3.3.1. ANALOGUE STANDARDS

3.3.1.1. <u>SD</u>

The Standard Definition it is used for referring to the PAL, NTSC or SECAM analogue television signals since the beginning of the 1960 with the first color broadcast. In PAL and SECAM were formats with 576 actives lines and 25 frames interlaced and NTSC 480 active lines with 30 interlaced, so the aspect ratio of SD analogue is 4:3.

This professional broadcast format was recorded with different types of tapes, but the most important were the appearance of the U-MATIC and BETACAM SP.

The first one was U-Matic, it was developed by Sony in 1969 and introduced to the market on 1971. It is based on U-wrap tape lacing system which specifies a video drum diameter of 11cm giving a tape writing speed of 8.54 meters per second U-matic video cassette and rotating in the same direction. The second one is BetaCam SP (Superior Performance) that was released in 1986 and increased the horizontal resolution to 340 lines largely due to new metal formulated tapes. Betacam SP equipment received many reliability and feature upgrades and larger 90 minute tapes became available.

3.3.2. DIGITAL STANDARD

3.3.2.1. <u>SD</u>

In 1995 with the appearance of the DVD and the digitalization of the Standard Definition is the resolutions remain with the PAL and NTSC system. The PAL System worked with around 625 lines which 576 of them are active. And NTSC system worked in 480 active lines on the total of 525. Both systems work in 720x480 [5]. The differentiation with the analogue SD is that digital SD allows 3:4 and 16:9 resolutions.

This broadcast format was recorded professional in Digital Betacam. Digital betacam records component video with 10-bit YUV 4:2:2 compressions. PAL resolution is 720 x 576, NTSC resolution is 720x480. The bitrate is 90 Mbit/s. There are 5 audio channels — 4 main channels (uncompressed 48KHz PCM) and 1 cue track.

3.3.2.2. <u>HD</u>

High Definition format was developed for increasing the quality of television image, improving the resolution 1920x1080 or 1280x720, having to scan progressive or interlace, also increasing the frames per second and aspect ratio of 16:9 [5].

HD is stored in many several different formats, but the professional principal ones are P2, SxS and xQD.

P2 is the card developed by Panasonic, it records for DV, DVCPRO, DVCPRO25, DVCPRO50, DVCPRO-HD, or AVC-Intra streams on a solid-state flash memory [23]. The specifications of the card are the following, the file format is MXF, the maximum datarate is

1.2Gbit/s, available sizes are 2GB, 4GB, 8GB, 16GB, 32GB and 64GB, and the form factor is PC card (PCMCIA) type II.

SxS is a flash memory standard compliant to the Sony and SanDisk-created *ExpressCard* standard. According to *Sandisk* and Sony, the cards have transfer rates of 800 Mbit/s and burst transfer rate of up to 2.5 Gbit/s. Sony uses these cards as the storage medium for their XDCAM EX line of professional video cameras.

The Interface of the card is *ExpressCard*/34; transfer speed 800Mbps; input voltage DC 3.3 V ±10% / DC 1.5 V ±10%; power consumption 1.2W, Max approx. 1.8W; capacity 8GB (SBP-8), 16GB (SBP-16) and 32 GB (SBP-32); actual user capacity approx.7.2GB (SBP-8), 14.9GB (SBP-16) and 29.8 GB (SBP-32); shock resistance 1,500G; vibration resistance 15G.

xQD, is a flash memory developed by Sony that uses PCI Express interface for Nikon camera. It uses XAVC Intra codec, MXF, 60 pixels of frame rate, 222Mbps and 223Mbps of bit rate.

3.3.2.3. 2k and 4k

2K is defined as 2048x1556 pixels, this size represents the entire size of the 35mm film between the both side bars. The film undergoes photochemical and mechanical processes before the image reaches the screen. The other common size attributed to 2K is 2048x1080; this is the standard to which digital cinema currently adheres. However in the digital era most cinema projectors have this 2048x1080 image size as a supported resolution and in many cases, as a maximum resolution [7].

4k standard in the beginning was defined by the Digital Cinema Initiative organization as a new cinema format, it represented 4096x2160 resolution, 24 frames per second and a color depth of 8 bits. Although the broadcasting and TV industry adopted the format, but with some modifications like changing the resolution into 3890x2190 for adjusting with the 16:9 aspect ratio, also 50 or 60 frames per second and 12 bits of color depth; with this adjustments it was named the UHD (Ultra High Definition). Both standards increase to more than four times the definition of the image with a best appreciation of the details and more sharpness, also the format can get more quality in a fast recording and provide more visualization in the screening area.

The problem of the format is the distribution of the material due to the high quality of the image, all the transporting or showing devices have to be able of support a heavy audiovisual material; furthermore the editing software has to have such of amount of system requirements for being able to make the postproduction of 4k material [4].

3.3.2.4. 5k, 6k and 8k

In despite of the use of 4k format is not standardized in every corner of the audiovisual industry. It has been thought with 5k, 6k and 8k. The first one is more though for display's screen not for filming as the other ones, 5k provide resolution of 5120x2880 pixels, it was used by *APPLE* in 2014 with the 27" Retina 5K display [31]. On the other hand 6k format that has 6144x3160 pixels of resolutions has been used by Netflix in their master files as the third season of *House of Cards* [32].

In Japan it has been investigating about the possibility of the appearance of ULTRA HD 8k. 8k will double the number of pixels of 4k format being 7.680 x 4.320 (Seen Figure 2), increasing the size of the screen of 145 inches (3.7 m) and frame rate of 60 frames per second [30]. This format has been standardized by the ITU[8], and has been proved for broadcasting the Olympics Games of Japan in 2020. In additions thanks to the alliance of Marvel Studios and the manufacturer factory of cameras REC, the new movie of the Guardians of the Galaxy Vol. 2 is going to be filmed n 8k [29].

Figure 2. Video standards. <http://www.cinedigital.tv/4k-2k-2-5k-hd-ultrahd-que-es-todo-esto/>

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[8] ITU: International Telecommunication Union

3.4. EDITING SOFTWARES

3.4.1. FINAL CUT PRO X

Final Cut Pro[9] is the main professional *APPLE*[10] cutting software; it is used by the professional film makers. This software was created by *APPLE* company and *Macromedia* with the purpose of encouraging the use of QuickTime and for competing with Adobe Premiere. In the first time it was created two versions of Final Cut, one for MAC and another for Windows, but the software for Windows didn't.

The minimum system requirements are OS X v10.10.4 or later, 4GB of RAM (8GB recommended for 4K editing and 3D titles), OpenCL-capable graphics card or Intel HD Graphics 3000 or later, 256MB of VRAM (1GB recommended for 4K editing and 3D titles) and 4.15GB of disk space

The principal specifications of this software are divided in eight parts, the features have been extracted from source [1].

Application: the program allows external monitoring of video and audio with third-party Thunderbolt and PCIe devices, or via HDMI on MAC, it takes advantages of the 4GB of RAM with 64-bit architecture and rendering using GPU and CPU, management color pipeline ColorSync and it renders in linear light color space with high precision floating point.
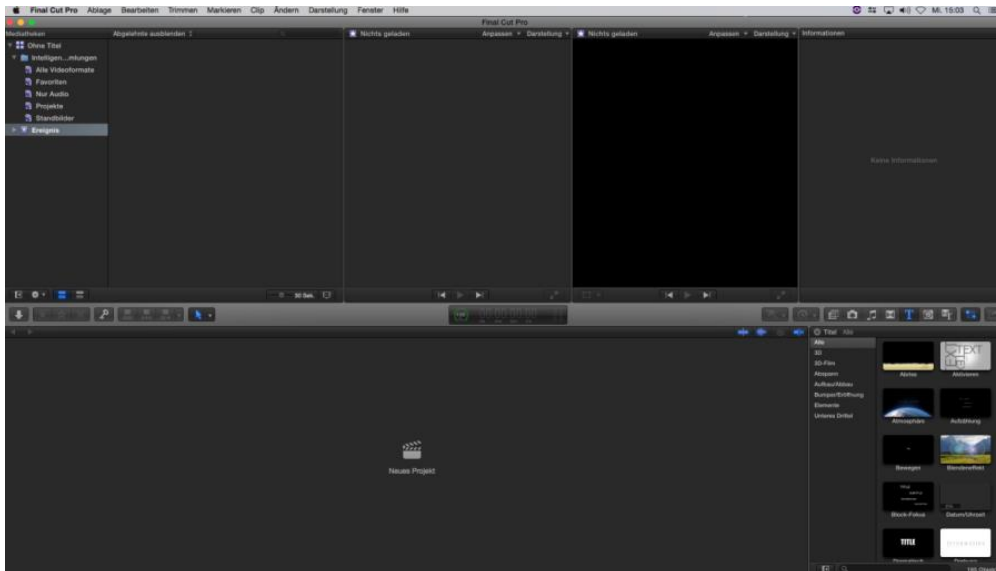

Figure 3. Final Cut Pro X interface

Editing and timeline: Multicam editing with automatic sync and support for mixed formats, mixed frame rates, and up to 64 camera angles, the magnetic timeline automatically keeps material in sync, prevents clip collisions, and eliminates gaps. The clip connections keep secondary material in sync while trimming and moving the Primary Storyline. Also connected clips stationary while slipping, sliding, or moving clips in the Primary Storyline (see Figure 3), otherwise compound clips allow complex compositions to be simplified into a single clip. About auditions combine multiple clips into a single clip to see alternative takes, color grades, or effects in context.

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[9] Final Cut Pro Source [1]
[10] APPLE [1]

Final Cut is able to edit while importing media in the background from multiple sources, also can visualize material in Filmstrip or list view with a mini-filmstrip and metadata columns. One of the best features of the software is the Skimming functionality that enables fast viewing of large amounts of material. Dual viewers for matching action between source material and edited timeline direct access to other *APPLE* softwares *iTunes*, *iMovie*, *iPhoto*, and *Aperture* through media browsers timeline index for timeline navigation and the selection of items based on text searches and other important metadata.

Final Cut has plenty of different tools, one of them is the position tool that it is used for moving and deleting media in the timeline and leaving a gap. Another tools is the clip markers that include to-do items that can be checked off when tasks are completed Snapping to playhead, skimmer, clips, and markers. All command for adding edits High-quality, real-time vectorscopes, waveforms, and histograms for both viewer and event viewer, the vertical placement of scopes below viewers optimizes onscreen space. Organize, view, mute, and export based on automatically assigned or custom roles metadata.
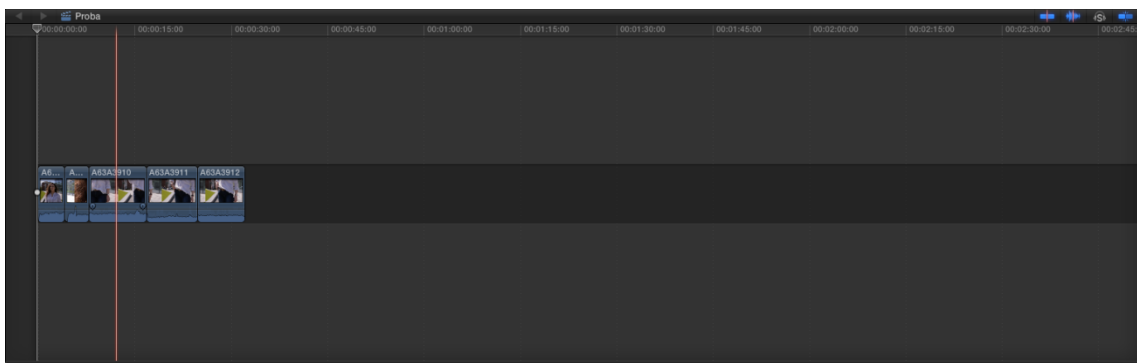

Figure 4. Timeline

Trimming: Inline Precision Editor allows skimming of used and unused media around edit point, plus trimming to Skimmer with a single click trim tool for advanced timeline trimming functions as seen in Figure 4.
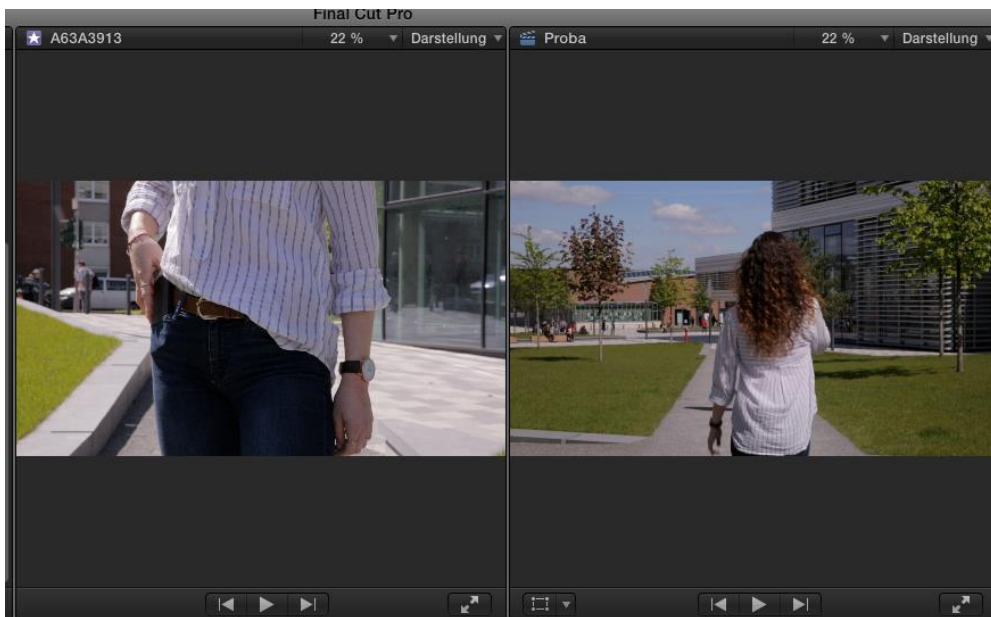

Figure 5 . Final Cut Pro X Trimming

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Effects: it incorporates animated and easily customizable 3D titles with combinations of materials, lighting, and edges, cinematic 3D title templates with built-in backgrounds, animations and 3D text styles. It has an advanced chroma keying controls for color sampling, edge adjustments, and light wrap, the drop shadow includes intuitive onscreen controls and automatic orientation adjustment, it also allows multistream real-time effects in SD and HD formats. (See Figure 5 and 6)

Moreover, for fixing the movement problems while the film was recorded, final cut incorporates a stabilization effect in real time after background analysis, intelligent image stabilization with Inertiacam and tripod mode, rolling shutter correction to improve DSLR video and spatial conform to make different aspect ratios fit into a project seamlessly.
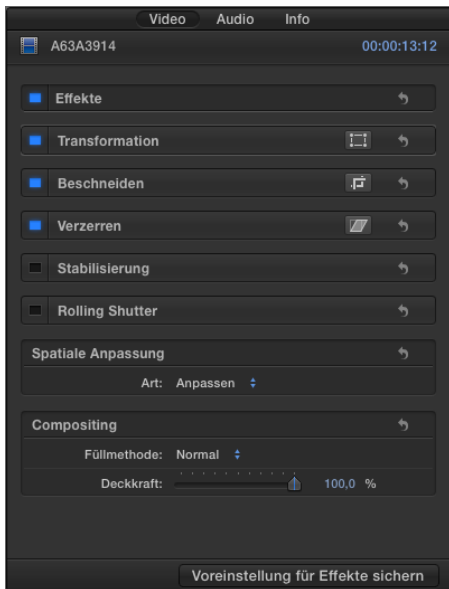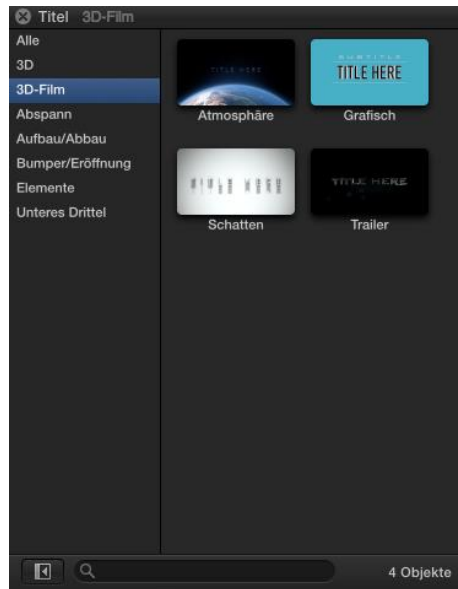

Figure 7. Effects Window

Figure 6. Tittle Window

Audio: Multichannel audio editing for adjusting individual audio channels in the timeline, with ability to assign roles to channels, it supports audio samples up to 192kHz, 64-bit third-party Audio Units plug-ins. It Adjusts audio filters in real time during playback, it has 5.1 surround monitoring and keyframe control for panning. It incorporates also professional audio effects (See Figure 7), 10- or 31-parameter EQ built into each audio clip, audio enhancements for volume normalization, background noise removal, and hum removal for both 50Hz and 60Hz, audio pan controls, disable and solo controls, audio waveform display in viewer and timeline, logarithmic audio fades and VU meters that expand as needed.
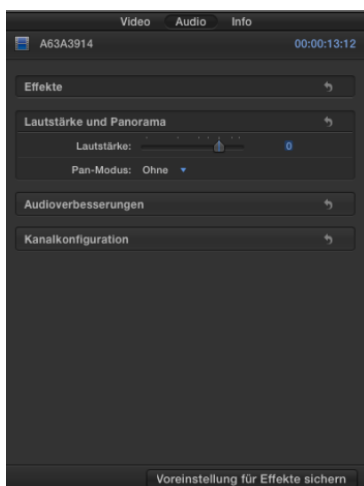

Figure 8. Effects

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Color correction: Final Cut has several variety of tools for doing a color grading, different examples of that are: an unique color board with controls for saturation, exposure and color; match color for precise shot matching in one click; balance color instantly improves skin tones, removes color casts, and expands dynamic range of bright and dark regions of the image; keyframe masks with size, rotation, and softness adjustments. The software adjust the interaction style between masks with add, subtract, or intersect settings and inside or outside of color mask. It supports real-time Look Up Tables (LUTs) from the latest pro cameras from ARRI, Canon, Blackmagic Design, and Sony.

Supported Formats: Final cut pro x supports plenty of different formats whether Apple or not (See Figure 8).

The program create projects with custom frame sizes Mix frame sizes, frame rates, and formats in the same timeline up to 5K in real time Edit at 23.976, 24, 25, 29.97, 30, 50, 59.94, or 60 fps.

Video formats: Apple animation codec, Apple intermediate codec, Apple ProRes , AVCHD (included AVCCAM, AVCHD Lite y NXCAM), AVC-ULTRA (included AVC-LongG y AVC-Intra Class 50/100/200/4:4:4), DV (included DVCAM, DVCPRO y DVCPRO50), DVCPRO HD, H.264, HDV, iFrame, Motion JPEG (only OpenDML), MPEG IMX (D-10), QuickTime formats,QT Avid DnxHD, REDCODE RAW (R3D), 4:2:2 de 8 bits uncompressed, 4:2:2 de 10 bits uncompressed, XAVC (included XAVC-S), XDCAM HD/EX/HD422 and XF-AVC.

Audio formats: AAC, AIFF, BWF, CAF, MP3, MP4 and WAV.

Still images formats: BMP, GIF, JPEG, PNG, PSD (static and in layers), RAW, TGA and TIFF.

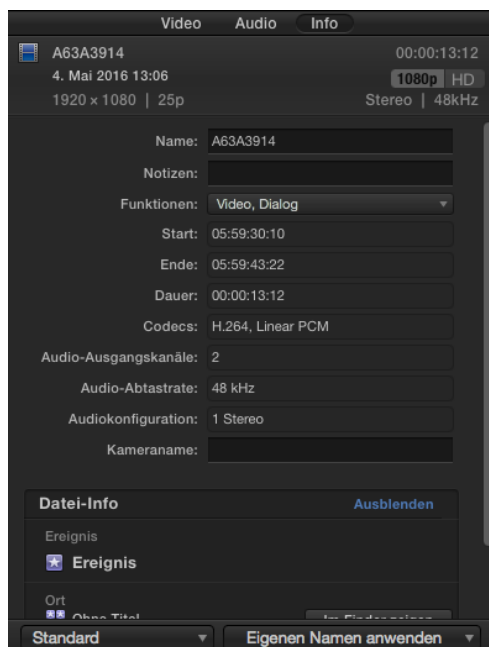Storage formats: 3GP, AVI, MOV (QuickTime), MP4, MTS/M2TS, MXF.

Figure 9. Formats Window.

3.4.2. ADOBE PREMIERE PRO

Adobe Premiere Pro is the editing software developed for Adobe Systems Incorporated. An American company founded in 1982 by John Warnock and Charles Geschke that is involved in the creation of professional software for managing digital contents. Graphic design software (Adobe Photoshop, Adobe Lightroom, Adobe InDesign, Adobe Illustrator, Adobe Fireworks, Adobe Acrobat), Web design programs (Adobe Dreamweaver, Adobe Contribute, Adobe Muse, Adobe Flash Builder, Adobe Flash Catalyst, Adobe Flash, and Adobe Edge),Video editing and visual effects (Adobe Premiere Pro, Adobe After Effects, Adobe Prelude, Adobe Voice), Audio editing software (Adobe Audition, Adobe Soundbooth), eLearning software (Adobe Captivate Adobe Presenter Video Express), Digital Marketing Management Software (Adobe Marketing Cloud, Adobe Experience Manager (AEM 6.0), Mixamo), Server software (Adobe ColdFusion, Adobe Content Server and Adobe LiveCycle Enterprise Suite, Adobe Blaze DS), Formats (Portable Document Format (PDF), PDF's predecessor PostScript, ActionScript, Shockwave Flash (SWF), Flash Video (FLV), and Filmstrip), Web-hosted services (Adobe Color, Photoshop Express, and Acrobat.com).

This paper will be focused in the video editing program, Adobe Premiere Pro CC, the last version of the 21 that the company has developed for both MAC and Windows PC.

Main Features of Premiere Pro CC

The next specifications have been extracted from the text source [2]

For guarantee the proper functionality of the program the computer has to have a few previous system requirements, for Windows PC it is necessary to have multicore processor with 64-bit support, Microsoft Windows 7 with Service Pack 1 (64 bit) or Windows 8 (64 bit), or Windows 10, 8GB of RAM (16GB recommended), 8GB of available hard-disk space for installation; additional free space required during installation (cannot install on removable flash storage devices), 1280x800 display, sound card compatible with ASIO protocol or Microsoft Windows Driver Model.

Workspace and workflows: Premiere workspace is set of panels (such as Project, Metadata, and Timeline), that is available to move and group panels in the same way across products. The default workspace shows the main window of a program which is the application window, then below of it appears the timeline panel, at the left top site the project window and at under-left the media browser and effects as seen in Figure 9. Premiere allows changing all the windows as easier will be for the consumer.
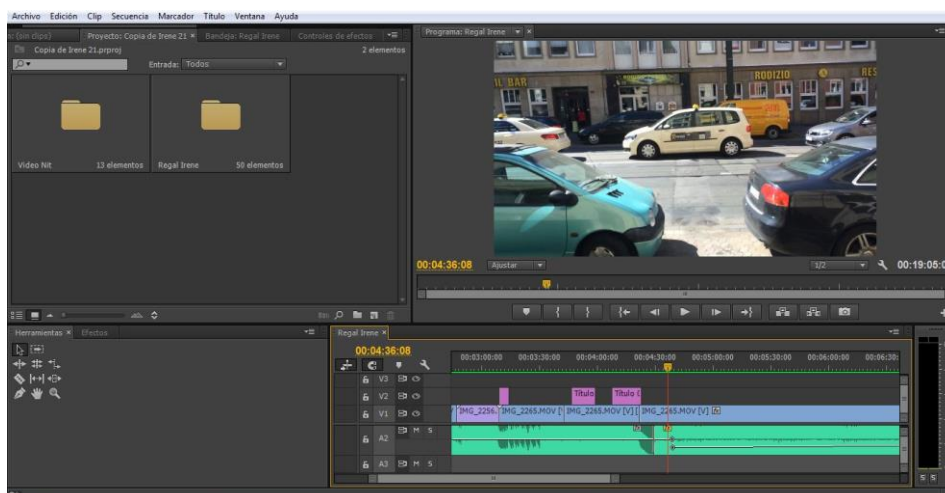

Figure 10. **Workflow.**

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Project setup: A project file stores information about sequences and assets, such as settings for capture, transitions, and audio mixing (See Figure 11). Also, the project file contains the data from all of the editing decisions, such as the In and Out points for trimmed clips and the parameters for each effect. Premiere Pro creates a folder on the hard disk at the start of each new project as seen Figure 10. By default, this is where it stores the files it captures the preview and conformed audio files it creates, and the project file itself.

Premiere Pro doesn't store video, audio, or still image files in the project file—it stores only a reference to each of these files, a clip, which is based on the filename and location of the file at the time it is imported it.

By default, every project includes a single Project panel. This acts as a storage area for all clips used in the project.
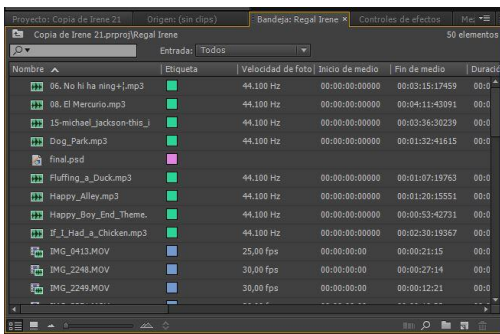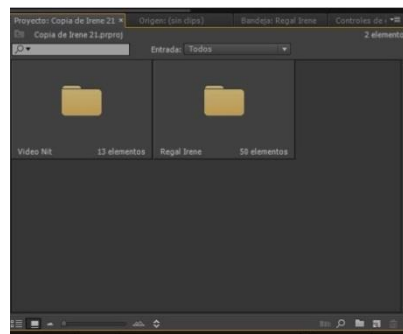

Figure 12. Project

Figure 11. Project Window

Importing footage: HEVC (H.265 8K UHD media with resolutions up to 8192×4320 in MXF), H.264 AVC, DNxHR (DNxHR LB, DNxHR SQ, DNxHR TR, DNxHR HQ, DNxHR HQX and QT Avid DnxHD for HD; OpenEXR (Files in .EXR, .MXR, and .SXR formats), 3GP, 3G2 (.3gp) , Apple ProRes 64-bit, AVI (DV-AVI, Microsoft AVI Type 1 and Type 2),DV (Raw DV stream, a QuickTime format),DNxHD (Supported in native MXF and QuickTime wrappers), F4V (Import only), GIF, M1V (MPEG-1 Video File), M2T (Sony HDV), M2TS (Blu-ray BDAV MPEG-2 Transport Stream, AVCHD), M4V (MPEG-4 Video File), MOV (QuickTime Movie format),MP4 (QuickTime Movie, XDCAM EX), MPEG, MPE, MPG (MPEG-1, MPEG-2),M2V (DVD-compliant MPEG-2), MTS   (AVCHD), MXF, Native MJPEGs (1DC), VOB and WMV.

Apart of all this formats, Premiere supports native camera formats of ARRI AMIRA camera, Canon XF, Canon RAW, Cinema DNG, Panasonic AVC, P2 cameras, Phantom Cine media, RED support and Sony cameras.

Managing assets: Premier Pro has many different ways for managing the project. After import all the files from the media browser to the project is possible to create bins for collecting the different point of views of the camera or different types of files. The software also allows changing colors of the files for a better visualization of the sequence, and choosing the aspect ratio of the image depending on the export file which the editor needs.

Montoring assets: the main windows in an editing project are the source monitor and program monitor. The Source Monitor plays back individual clips. It prepares clips that there will be adding to a sequence, by setting In points and Out points, and specifying the clip's source tracks (audio or video). It is also able to insert clip markers and add clips to a sequence in a Timeline panel.

The Program Monitor plays back the sequence of clips that is assembling. It's the view of the active sequence in a Timeline panel. It is possible to set sequence markers and specify sequence In points and Out points. Sequence In points and Out points define where frames are added or removed from the sequence.

Each monitor contains both a time ruler and controls to play back and cue the current frame of a source clip or sequence. Set In and Out points, go to In and Out points, and set markers. Insert and Overwrite buttons are available in the Source Monitor, and Lift and Extract buttons are available in the Program Monitor, by default. Each monitor also contains an Export Frame button for creating a still from a single frame of video.

Editing: as all the editing software, Premiere has a bank of tools that makes as create and change sequences, edit from sequences loaded into the Source monitor, rearrange clips in a sequence, find, select, and group clips in a sequence and rendering and previewing sequences (See Figure 12).
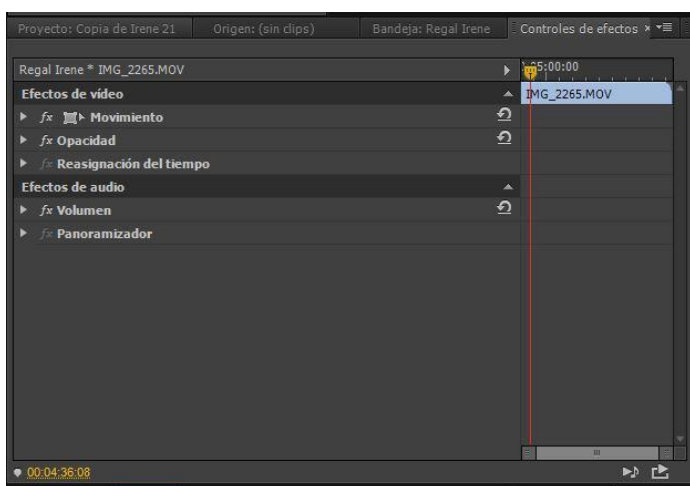

Figure 13. Effects Control

Audio: Mapping the audio channels in clips determines the type and number of audio tracks in which they appear in a sequence. Also, mapping channels determines the destination channels within the master track, and therefore in the final output file.

By default, clip audio channels are mapped to the master track when they are captured or imported into a project. It can specify how Premiere Pro maps them by selecting a Default Track Format in the Source Channel Mapping pane of the Audio Preferences dialog box. It is possible to change how clip audio channels are mapped after importing them into a project. Moreover, the editor can specify which output channels Premiere Pro uses to monitor each audio channel and set this default in the Audio Output Mapping Preferences dialog box (See Figure 13).
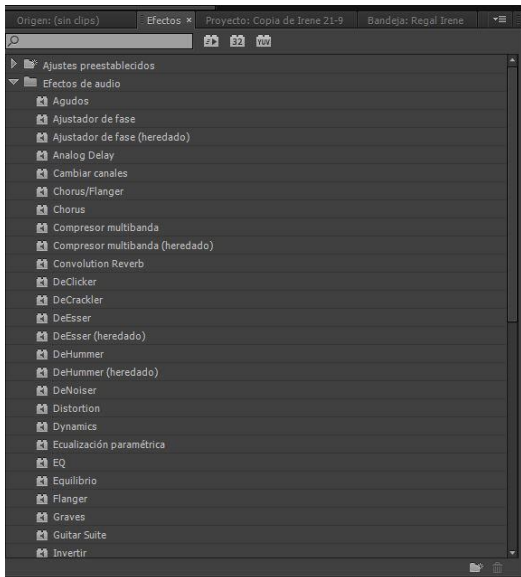
Figure 14. Audio Effect

Titles: The Titler is a versatile tool enabling that creates titles and credits, but animated composites as well as seen in Figure 14.

The Titler is a collection of related panels. It is possible to close the panels within the Titler without closing the Titler, dock the panels to each other or to other parts of the interface. When the panels are not docked to the main workspace, they appear over the other panels, or float.

Also it allows loading more than one title into the Titler, choosing the title to view by choosing its name in the Title tab menu, reopening a title to change it or to duplicate it and basing a new version on it.
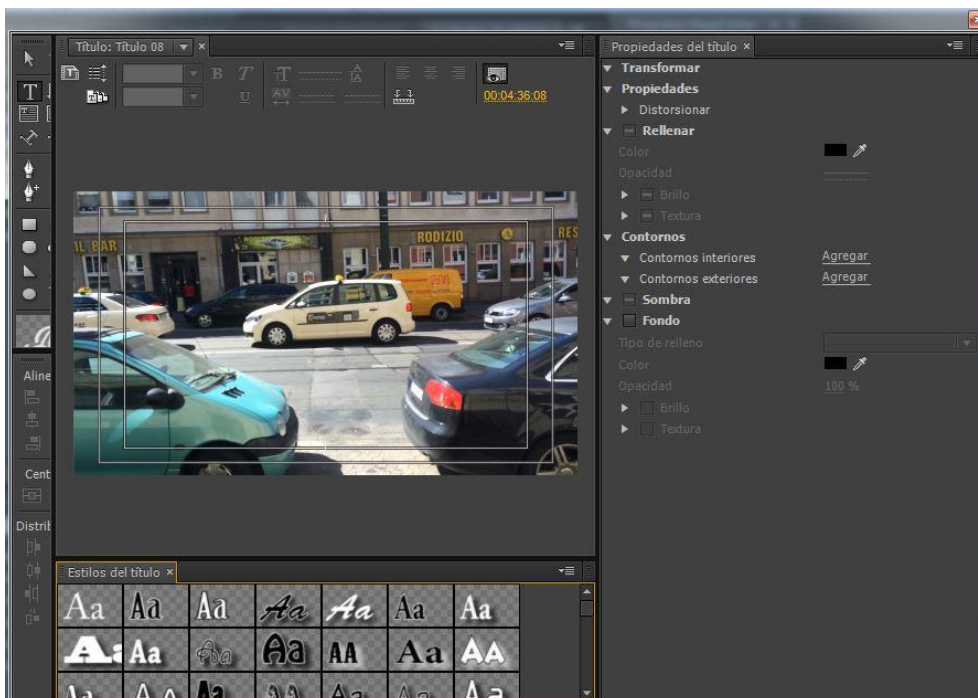

Figure 15. Titler Window

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Effects and transitions: Premiere Pro includes a variety of audio and video effects that apply to clips in the video program as seen in Figure 16. An effect can add a special visual or audio characteristic or provide an unusual feature attribute. For example, an effect can alter the exposure or color of footage, manipulate sound, distort images, or add artistic effects (See Figure 15). Also it is possible to add effects to rotate and animate a clip or adjust its size and position within the frame. The editor can control the intensity of an effect by the values that you set for it, and animate the controls for most effects using keyframes in the Effect Controls panel or in a Timeline panel.

For personalize the work of an editor with Premiere, the maker can create and apply presets for all effects and add more plugins.
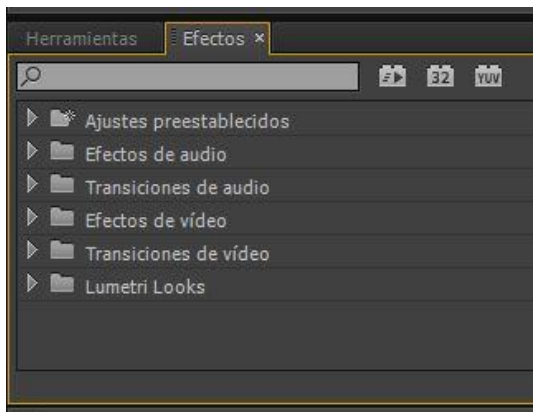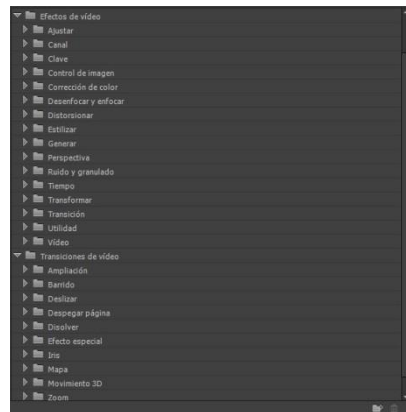

Figure 17. Effects Window

Figure 16. Video Effects.

Animation and keyframes: the software can make animations, which means to move a digital object across the screen. It can be possible using the keyframes. A keyframe marks the point in time where it is specified a value, such as spatial position, opacity, or audio volume. Values between keyframes are interpolated. When it is used keyframes to create a change over time, you typically use at least two keyframes—one for the state at the beginning of the change, and one for the new state at the end of the change of the video.

Exporting: There are a few ways to export video from Premiere. Exporting files for further editing, editable movie or audio files for previewing the work with effects and transitions fully rendered. Furthermore, is possible to export a still-image sequence or still image from a single frame of video for use in a title or graphic.

Exporting Adobe Premiere is complemented with Adobe Media Encoder that can choose whether to render an asset immediately, or to add it to a render queue.

The second type of exporting is for taping, it means that the output file is supported camcorder or VTR. This type of export is used for archiving a master tape, or for delivering rough edits for screening from VTRs. The next way for exporting is the one for using the file in other systems, import AAF files into various third-party editing systems for finishing. The last type of exporting is for various devices and web sites, using the Adobe Media Encoder, it is able to export video in formats suitable for devices ranging from professional tape decks to DVD players to video-sharing web sites to mobile phones to portable media players to standard- and high-definition TV sets.

3.4.3. AVID MEDIA COMPOSER

Avid Media Composer[11] is the editing video software of Avid Technology, Inc Company[12] that is the creator of video and audio non-linear systems. Avid software is used by the professionals for creating audiovisual material in the film and music industry, because it incorporates the option that is able to work in team with the same project in different location or in the same network but different station. The Avid software and plug-in incorporates some hardware that complements the work of Avid programs.

The next specifications have been extracted from the text source [3]

System requirements: for Windows is necessary an Avid-qualified Windows-based computery: 8GB minimum, 16GB (or more) recommended, Windows OS compatibility grid and PC's with more than 48 cores (including hyper threading) are not supported at this time.

And for Apple Mac, it is recommended Avid qualified Apple Computer with at least operating system: MAC OS X 10.9.5 OR 10.10.x or 10.11.x (with Media Composer 8.5), memory RAM 8 GB minimum, 16 GB (or more) and for working with UHD, large projects and interplay environment 24 GB or more.
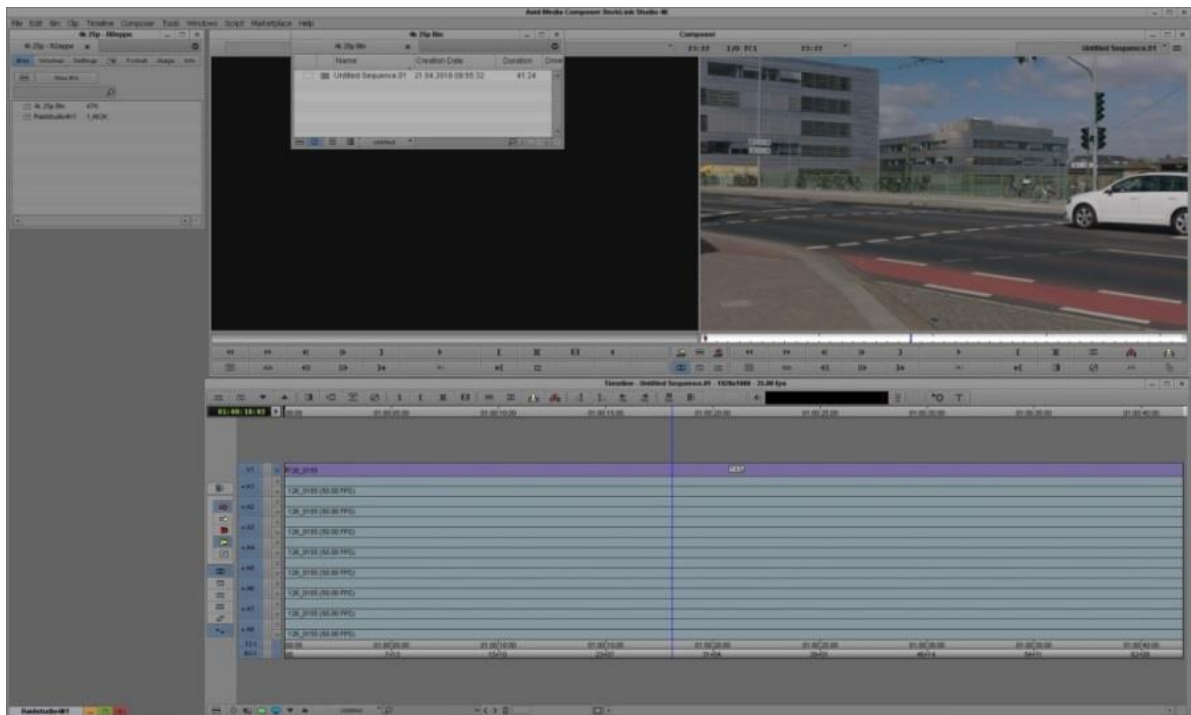

Figure 18. Media Composer Workflow

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[11] AVID Media Composer [3]
[12] Avid Technology, Inc Company :www.avid.com/

Workflow: Media Composer's Workflow is based in personalize windows that the editor can modify, but by default the main windows are the program and preview monitor, at left side there is the project management, and below the timeline as seen in Figure 18.
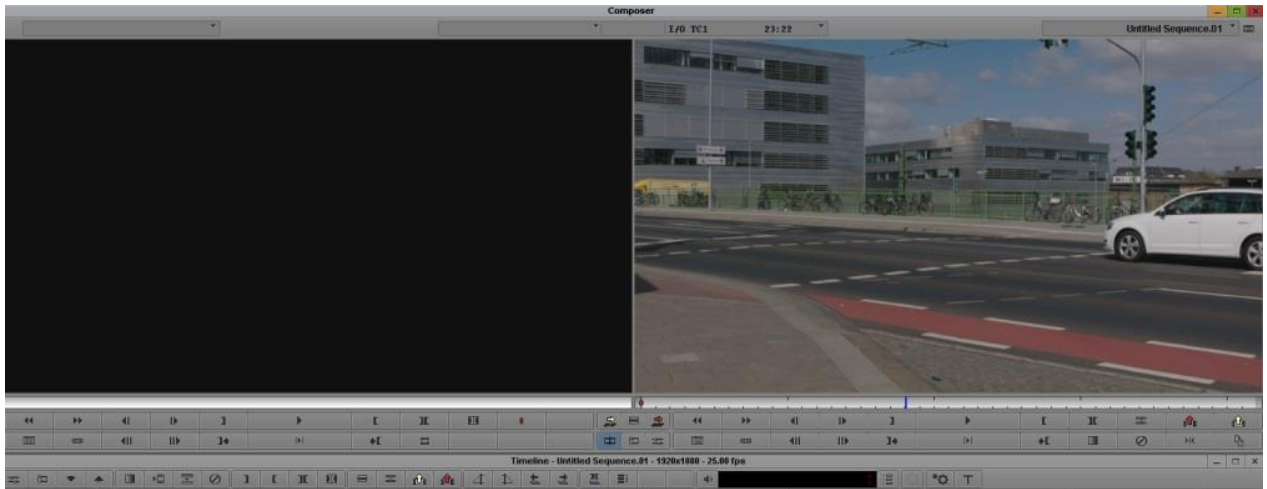
Figure 19. **Screening**

Supporting import files: device formats such as, Canon, Ikegami, JVC, OHCI, Panasonic, RED, Sony and XDCAM cameras. Application-generated formats, Quicktime, AVI, MXF, MPEG, JPG, PNG, TIFF and PSD.
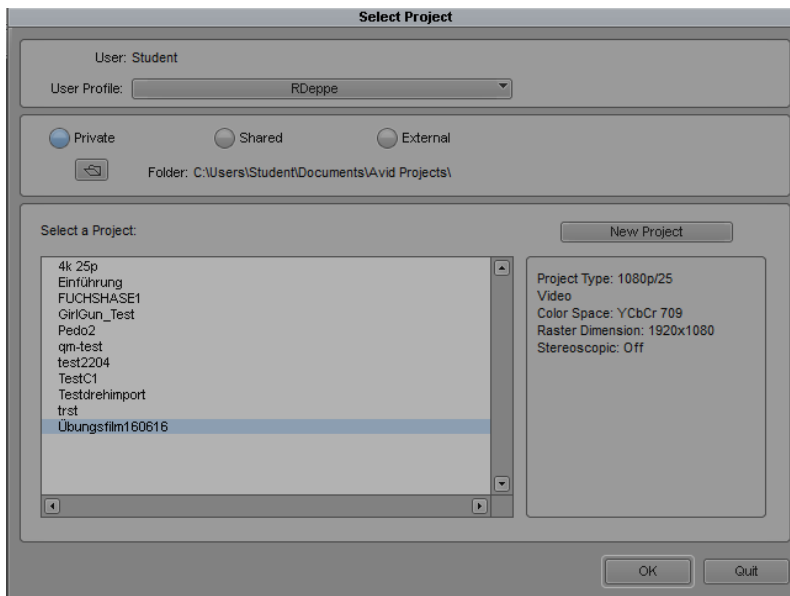

Figure 20. **Project Managing**

Managing media: there are two ways of collecting the media inside of the software, to link or to import. When importing a file, the software converts this file in an avid media composer proper file and then is available for editing (See Figure 20).

When linking the media, the program just used the file as the original format and at the end of cutting it is transformed into the Media Composer file, for linking is needed the appropriate AMA plug-in installed.

Editing: Avid Media Composer used approve ACE tools, so it makes a personalize tool panel that allows mix and match media formats, frame rates, resolutions, and more in the same timeline without rendering. The software works with 3D media editing stereoscopic 3D material as quickly and easily as 2D footage; capturing, editing, and managing the complete 3D end-to-end workflow; Mixing and match 2D and stereoscopic 3D clips on the same track.

Color correction: Media Composer uses Natural Match for making the color grading shot to shot, also it gets fine animated color correction and fast with Artist Color controls.
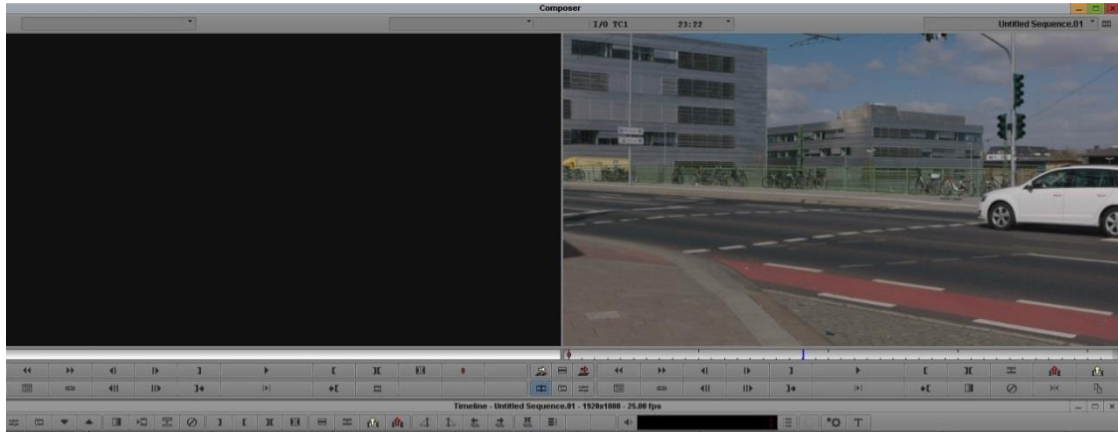

Figure 21. Timeline

Audio: multichannel audio tools, recording voiceovers, ADR and foley. Media Composer is able to edit and mix in up to 7.1 surround sound, polish sounds with high-quality AAX audio effects (the plug-ins that comes with Pro Tools), and expand the sound with the industry's best compressors, reverbs, and other sound processing plug-ins, many of which can be purchased directly within Media Composer.

Exporting: exists two ways for exporting files, for a physical device or create a movie file. The first one is for being tape in to a device directly and the second one is just for keeping it in memory devices.

Avid Media Composer supports the following video formats (See Figure 23), all Quicktime codecs, HDV, XDCAM, MXF OP1a, DV, AVI and Windows Media. Still images formats, BMP, JPEG, Framestore, PNG, TIFF, Pixar, Targa, Softimage, SGI, Wavefront, YUV and Cineon. And for audio WAV and AIFF.
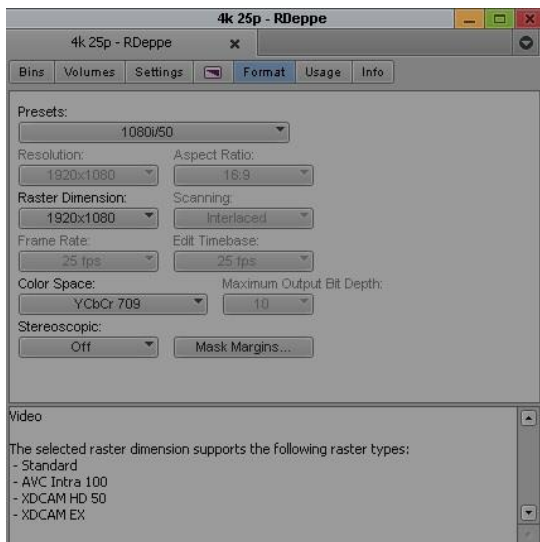

Figure 22. Formats

3.4.4. COMPARISON AND PROBLEMS

At the present time the editing software this most commonly used in the film industry is Adobe Premiere Pro due to its simple workflow, the intuitive design of the program, the price and the compatibility with the other adobe software. In the other hand is the Final Cut Pro X that also has an easy design that makes the work with it more reliable, it can match with the audio editor Pro Tools, but it only works with APPLE hardware. Finally it was explained the editor Avid Media Composer, the one that is now used in film big productions because it has the option that the editors can be working around the world, it means that it is possible to edit one single project in different stations and workflows, so allows to the editors to not be in the same computer. The projects can be opened and modified in PC on the same network or completely different even not in the same country. This professionally might be a problem because this software is not easily to work with, it is needed a good training for working with Avid Media Composer.

	Adobe Premiere Pro	Final Cut Pro X	AVID Media Composer
Price (license 1 year)	19.99$/month	299$/year	49.99$/month
Operating systems	Windows+Mac	Mac	Windows+Mac
Design	Intuitive	Intuitive	Advanced
Media Management	Dynamic Media Folders speed workflow	Range-based tag searches from metadata.	Dynamic Media Folders /Mute and Power
Importable Video Codecs	15	15	12
Dynamic Media Folders or Bins	✓	✓	✓
Comprehensive Camera Compatibility	✓	✓	✓
Multicam Support	✓	✓	✓
Automatic Content Analyzer	✓	✓	
Automatic Audio and Video sync	✓	✓	
Render Time	Mercury Playback Engine GPU Engagement		Without Avid native format (DNxHD)
Save/Undo	32 recent changes	Saves 99 keystrokes (but defaults to only 10)	100 keystroke history. Nearly infinitive With Avid Atic
Editing Tools			
Enhanced Timeline	✓	✓	✓
Precision Trimming	✓	✓	✓
Sequence Nesting	✓	✓	✓
Effects and Transitions	✓	✓	✓
Keyframing Tools	✓	✓	✓

Title Designer	✔	✔	✔
Masking	✔	✔	✔
Chroma Key	✔	✔	✔
Video Stabilizer	✔	✔	✔
Export and Production			
Video Codecs	✔	✔	✔
Audio Codecs	✔	✔	✔
Export for other app	✔	✔	✔
DVD and Blu-ray Authoring	✔	✔	
Export to Web and Mobile Devices.	✔	✔	
Interface Files Families	.omf, .asf, .avi, .dv, .m1v, .m2t, .m4v, .mov, .mp4, .mpeg, .mts, .mxf, .r3d, .sfw, .vob, .wmv	ProRes, avchd, dv, dvcpro, h.264, hdv, iframe, mojpeg, mprg, r3d, xavc, xdcm, aac, aiff, bwf,caf, mp3, mp4, wav, bmp, gif png, psd, 3gp, avi, mts, mxf, tga, tiff,	.omf, .aaf, .mxf, .ale, .r3d, .edl, .afe,.avx, .avv, .avc, .avb,.avs, .stl
Native File Support	Able to handling without transcoding	ProRes 422	Avid Media Access (AMA) with transcoding in the background
Color Grading	16-bit, truncated to 10-bit, Look Up Tab (LUTs) pre-sets	10-bit with cool tools: Auto-analysis, Match-Color and Masks	10-bit;Look Up Tables(LUTs) speed process
Audio	Tunnel with Adobe Audition	Subframe editing, f handles and Logic "lite" plugs.	Cached Waveforms / ProTools Interoperability / Clip Gain / Multiple Mixes
UHD+Stereoscopic 3D	2k/4K/ 5K+ (incl. RED raw)	4k	2k/4k/5k Frar Flex HD

Table 1. Comparison of editing software

Anyway, the three of the software are able to make any good postproduction and have perfect results.

4. ADVANTAGES OF 4k AGAINST HD

4.1. SYSTEM REQUIREMENTS

- Processor CPU

The processor complementing the graphic card are the most important part of all the hardware for editing, because is the component that provides the program with a faster and more fluent performance. Nowadays there are in the market, mainly, 2 types of processors: the ones from AMD and the others from INTEL. About the power, the INTEL processors is in average at 10% more powerful than AMD CPU, the powerful this means that the efficiency of the INTEL is superior with minimum of the AMD. Anyway for editing in fluently HD quality is recommendable a processor that minimum 4 cores and 2,8GHz of timeclock. [16]

In the case of 4k the processor has to be more powerful and sophisticated, so a few examples of that are the following CPUs: family of Intel® Core™ processors of 4.ª (CPU based in Intel Haswell) - (Intel® Iris™ Pro Graphics 5200 / Intel® Iris™ Graphics 5100, Intel® HD Graphics 5000 / 4600 / 4400 / 4200) and of AMD processors the A10-7800 APU model (Reference 19).

- Graphic Card

The graphic card is the complement of the processor because it helps the CPU to show the procedure done. The two major brands of graphics cards are NVIDIA and ATI, due to the fact that are the responsible for making the own chips for the graphics, the key aspects are the memory (minimum 1GB) and the number of microprocessors.

To choose the graphic card is always advisable to know first the editing software that the editor is going to use. In the case that the program chose was Adobe Premiere Pro as it is in this project the graphic card that is more suitable for the software is the NVIDIA ones.

For HD an example of a suitable graphic card is ATI Radeon HD Serie 3000 or superior with 512 MB VRAM, and for 4k it is needed VRAM at least 4GB. Instead than 4k that the AMD options are AMD Radeon™ HD serie 7000 or superior, or AMD Firepro (AMD FirePro™ W9100, AMD FirePro™ W8100, AMD FirePro™ W7000 and AMD FirePro™ W5000) [33].

 By the other hand wth Nvidia the options are Nvidia GeForce: GeForce® GTX™ 970, GeForce® GTX™ 980, GeForce® GTX™ TITAN Z, GeForce® GTX™ TITAN Black , GeForce® GTX™ TITAN, GeForce® GTX™ 780 y 780 Ti, GeForce® GTX™ 770, GeForce® GTX™ 760 y 760 Ti, GeForce® GTX™ 750 y 750 Ti and GeForce® GTX™ 690, 680, 670, 660, 660 Ti, 650, 650 Ti BOOST, 650 Ti. Or the Nvida Quatro range: Quadro P6000, Quadro P5000, Quadro M6000, Quadro M5000, Quadro M4000, Quadro M2000, Quadro K1200, Quadro K620 and Quadro K420 [34].

- RAM Memory

The RAM memory is the capacity of immediate response of the PC, so when more RAM less problems for editing and fluent process video. The memory RAMs are classified in three types depending on the generation that they belong to: DDR1, DDR2 or DDR3, the third one is the modern one and the most reliable. At least it is recommendable to have a 4GB RAM memory divided in slots, depending on the budget or the conditions of the PC, the best one will be at least two slots of 4GB of memory.

In the case of Avid Media Composer it is recommended as minimum of 8GB, 16GB or more while normally work in HD. But when the workflow is working in UHD, large projects or interplay environment is better to have at least 24 GB of RAM.

- Motherboard

The motherboard is the central of the PC, it has to be chosen according to the other components of the computer, as known there are different brands for the processors, INTEL and AMD, so these brands will specify which motherboard for the CPU elected. It is advisable to put at least two ports of 3.0 USB.

- Harddisk

Usually it is recommended to have at least two hard drives in the system, one for the operating system and another to edit. As for the disk for the operating system, a great option is SSDs, which are virtually solid state memory that achieves a very high speed and make the system work very quickly, so they are generally used only for the operating system and applications, and traditional hard drives are used for editing. Traditional hard drives are available in both 5400 rpm (revolutions per minute) and 7200 rpm, due to the large size of the video files, it is important to have drives of 7200 rpm.

Although there is no difference in these third last features between editing HD or 4k, due to the only thing that 4k needs more that HD is memory. Moreover all the requirements of the hardware for editing such in full HD or 4k has to be accord of the software used for editing, in the case of the project the chosen program has been Adobe Premiere Pro, so all the specify requirements of the last version of the software that allows to work in 4k is the third chapter (See Chapters 3.4.2.).

4.2. ADVANTAGES OF 4k EDITING

The 4k standard is called like that due to the 4000 pixels of resolutions used in cinema, television and devices.

There are differences between the standard for cinema and for television. In the case of cinema the resolution of the screening is 4096x2160, 24 frames per second and 8 bits of color depth. And in the case of television the resolution 3840x2160, 25, 50 or 60 frames per second and 12 bits color depth, this last one is the most used in terms of recording.

The basic advantage of 4k standard is that provides more resolution and sharpness to the image, which allows the viewer to see any video with more quality and perceive all the details of the video, in bigger displays. However this improvement the 4k standard has several problems that time to time and with the growing up of its used they are solving. The first one, with the increase of image quality causes a problem in the storage and processing this material; the computers that work with 4k must have a higher system requirements (See chapter 4.1) ;as an example a the first 4k film takes up 160 GB. This is also a problem in broadcasting because at least is need 25Mbps of bandwidth for transfer a normal 4k video, thing that not all the companies can afford the infrastructure, also it is needed for receiving 4k broadcasting material at least a VDSL of 30Mbytes connection. This memory problem does that there aren't so many 4k productions, fact that has already been overcome with the appearance of the compression standard H.265 o HEV, which is able to compress with a double ratio than its predecessor H.264.

In this last paragraph it has explained the benefits of 4k for displaying the material, but this project is focused in filming for then editing in 4k and having a Full HD result. These benefits will be structured in four facts: zooming, panning, tilting and stabilization [18].

Figure 23. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/can videocamaras/ventajas-del-video-4K.html

- ZOOMING

To make zoom is the movement that the camera does for changing the distance between the camera and the object being filmed, and rapidly move from a wide-angle shot to a telephoto shot in one continuous movement; this camera technique makes an object in the frame appear larger; movement towards a subject to magnify it is known as zoom in or forward zoom, or reversed to reduce its size is known as zoom out/back or backward zoom. [20].

In the case of a normal HD film, when there is done in any shot a zoom movement, the quality of the image decrease hardly making the image seen pixelated. With 4k, the zooming movement doesn't lose any image quality (See Figure 24 and 25) so with just one shot, it can be made different scenes [19].

Figure 24. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/can videocamaras/ventajas-del-video-4K.html

Figure 25. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/can videocamaras/ventajas-del-video-4K.html

- PANNING

The panning shot is the abbreviation for panorama shot; refers to the horizontal scan, movement, rotation or turning of the camera in one direction (to the right or left) around a fixed axis while filming; a variation is the swish pan (also known as flash pan, flick pan, zip pan, blur pan, or whip pan), in which the camera is purposely panned in either direction at a very fast pace, creating the impression of a fast-moving horizontal blurring of images across the screen; often confused with a dolly or tracking shot [20].

As in the zoom movement, the panning allows to convert a single shot in a stationary one without losing any quality and screening the footage in Full HD as seen in Figure 26 [19].

Figure 26. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/can videocamaras/ventajas-del-video-4K.html

- TILTING

The movement does when the camera tilted up or down on a diagonal along a vertical axis; a vertical camera movement from a fixed position often used to suggest an imbalance, or strangeness, or to emphasize size, power or menace; also known as tilt pan, tilt up or tilt down (or reveal), or vertical pan, although not technically the same as "pan up" or "pan down", similar to a moving close-up; a dutch angle is filmed at an extreme diagonal tilt [20].

The tilting problem can appear while recording the scenes, because the floor is not plane or has some slopes that make the images filmed are not always as straight as they have to be. So 4k let to tilt the footage to level the composition as seen in Figure 27 [19].

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Figure 27. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/camaras-y-videocamaras/ventajas-del-video-4K.html

- STABILISATION

The stabilization is the process that makes to move the camera lens or the sensor in the opposite site that the camera is moving, in order that if the cameraman moves a little bit the camera the image continues to be motionless. Also the stabilization erases the little vibrations that the own human body does.

There are different techniques for doing the stabilization in conventional Full HD. Otherwise in 4k all these shaky and unstable video of fast-moving objects are covered up, due to the big amount of pixels, these movements are enhanced and stabilized (See Figure 28) [20].

Figure 28. https://www.panasonic.com/es/consumer/camaras-y-videocamaras-aprender/can videocamaras/ventajas-del-video-4K.html
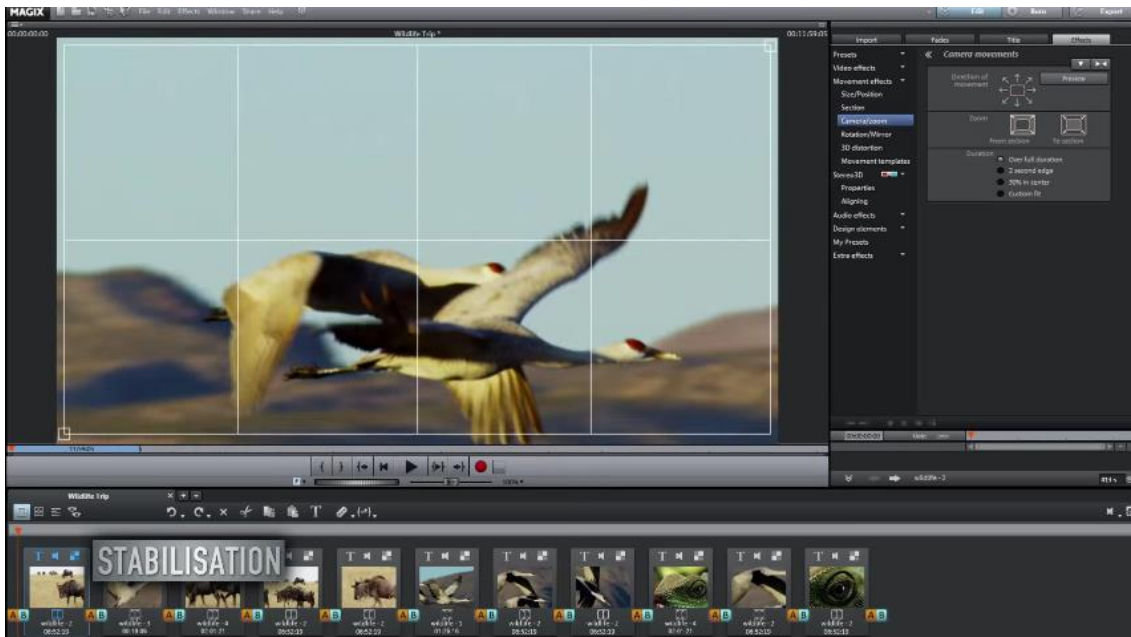
- CHROMA KEYING

Chroma keying is a technique used for combining two frames or images by replacing a color or a color range in one frame with that from the another frame.

It is often used in film industry to replace a scene's background by using a blue or green screen as the initial background and placing the actor in the foreground. The principle behind chroma keying is that the color blue is the opposite color of skin tone, so a distinction between the two is very clear, making it easier to select the color without worrying about any part of the actor being included in the selection. The whole blue selection is then replaced with another frame as the background. While doing chroma keying in 4k, the quality of the images increases, so the image in front of the blue or green is screen, has shown more clear [25].

- COLOR GRADING

Color grading allows the video editor to control the image. A video clip conveys more than the content it contains. A varied and intentional color palette in video can inform the audience in a multitude of ways. The mood of a narrative is enhanced by the use of color grading [26]. In the case of 4k format, is it used the Rec. 2020 instead of its predecessor the Rec. 709, this new recommendation can show ¾ parts of the visible color spectrum as seen in Figure 29. Rec. 2020 uses progressive scanning, and frequencies of 120p, 119.88p, 100p, 60p, 59.94p, 50p, 30p, 29.97p, 25p, 24p, 23.976p.

Bit depth of 10 or 12 bit per sample; The 10 bits per sample uses video levels where the black level is defined with code 64 and the nominal peak is defined with code 940. Codes 0-3 and 1,020-1,023 are used for the timing reference. Codes 4 through 63 provide video data below the black level, while codes 941 through 1019 provide video data above the nominal peak. The 12-bits per sample of Rec.2020 uses video levels where the black level is defined with the 256 code and the nominal peak is defined with the code 3760. The codes 0-15 and 4,080-4,095 are used for the timing reference. Codes 16 through 255 provide video data below the black level while codes 3761 through 4079 provide video data above the nominal peak.

The wavelength of the primary colors of Rec.2020 is 630 nm for the primary red color, 532 nm for the primary green color and 467 nm for the primary blue color.

Rec.2020 allows RGB and YcbCr signal formats with 4: 4: 4, 4: 2: 2, and 4: 2: 0 Chroma sub-sampling. Rec.2020 specifies that if a Luma signal (Y ') is made from a signal R'G'B', then it uses the coefficients 0.2627 for red, 0.6780 for green and 0.0593 for blue. [27]

UHDTV vs HDTV Color Gamuts

Figure 29. https://calibracionhd.com/informacion-complementaria/todo-sobre-el-espa color-bt-2020-utilizado-en-el-contenido-de-video-4k-y-8k/
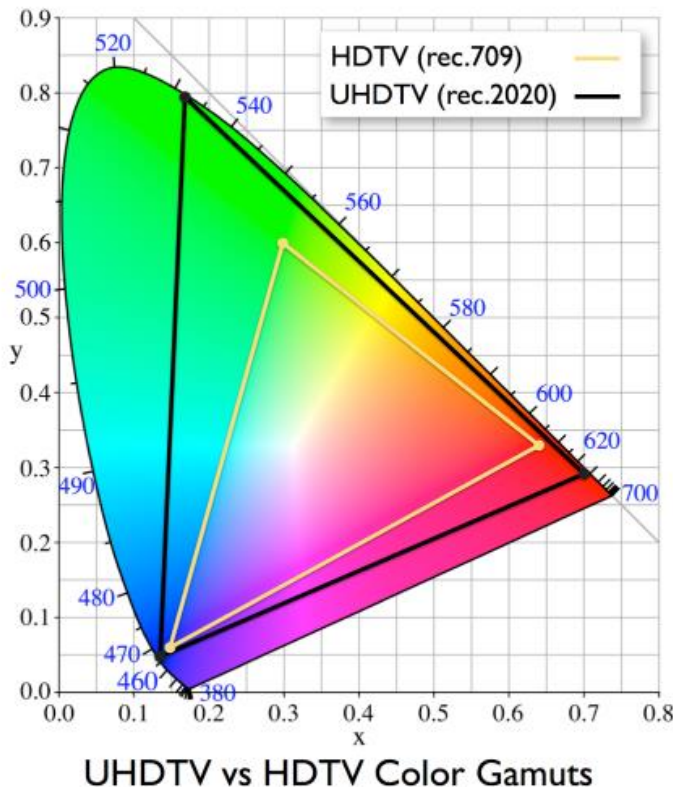
5. PRODUCTION PROCCESS OF THE TUTORIAL

5.1. IDEA AND PURPOSE

The tutorial is thought for showing the basic features that editing in 4k can provide to improve the image of amateur filmmakers. The idea of it is that the editors that known already how to use Adobe Premiere Pro, get into the 4k video and learn the differences of editing in 4k against HD, and the advantages that 4k can provide if there is any problem while the footage is shooting.

5.2. DESIGN

For the design of the tutorial, first it was made an illustrative storyboard to show more or less how is going to be the video tutorial as is going to be explained below, and what screens of the software are going to be in it.

To show the benefits of editing in 4k, it is going to be used the *Adobe Premiere Pro*, because although it is known that nowadays the editing software used in professional audiovisual world is the *Avid Media Composer*. This project is not focused in professional editor if not to amateurs that want to improve the quality in their audiovisual material. In addition Adobe Premiere Pro, has an intuitive workspace that allows the beginner to learn how to cut more easily.

The tutorial is going to be divided in two parts, first it will be presented an animated explanation of the principle advantages of editing in 4k as it has seen in Chapter 4.2. Then it will show how to apply practically with the software these benefits, in six parts. Below it will be explained the steps that is going to show in the video.

As it said before the user of this tutorial has to have some basic knowledge of Adobe Premiere Pro.

ZOOMING, for creating this shot the images have to be moved creating movement with the key frames.

- First the clip has to be loaded.
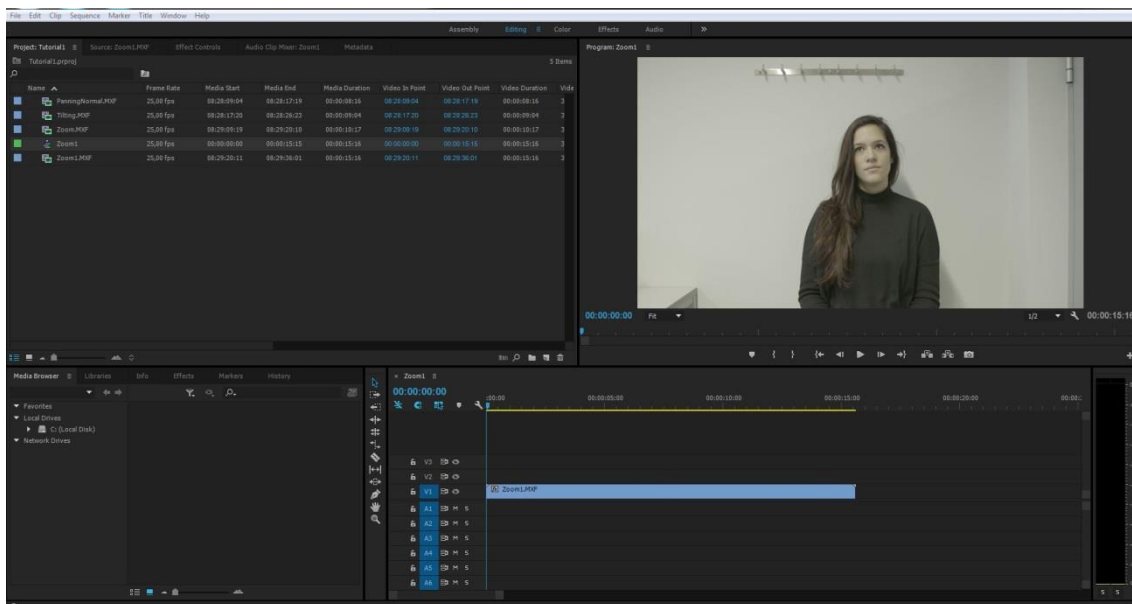
Figure 30. Clip loaded

- Open the Effects Control.
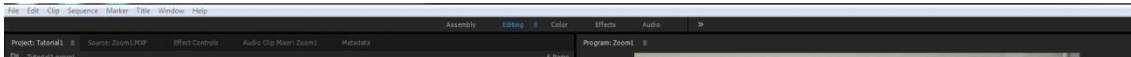
Figure 31. Effect menu

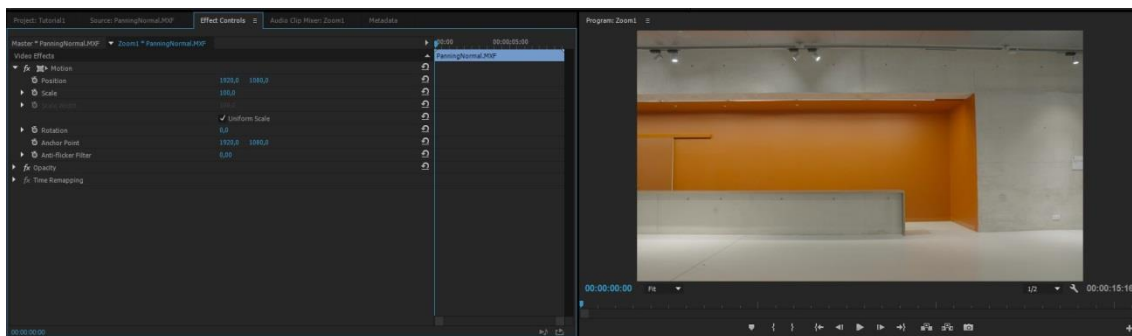- Click the clock that activates the keyframes in scale option.
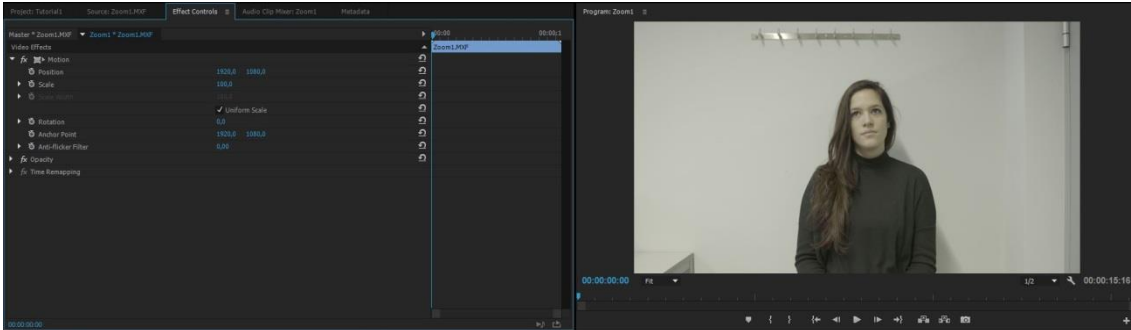
Figure 33. Keyframes option

- Move around the effect timeline to the second chose.
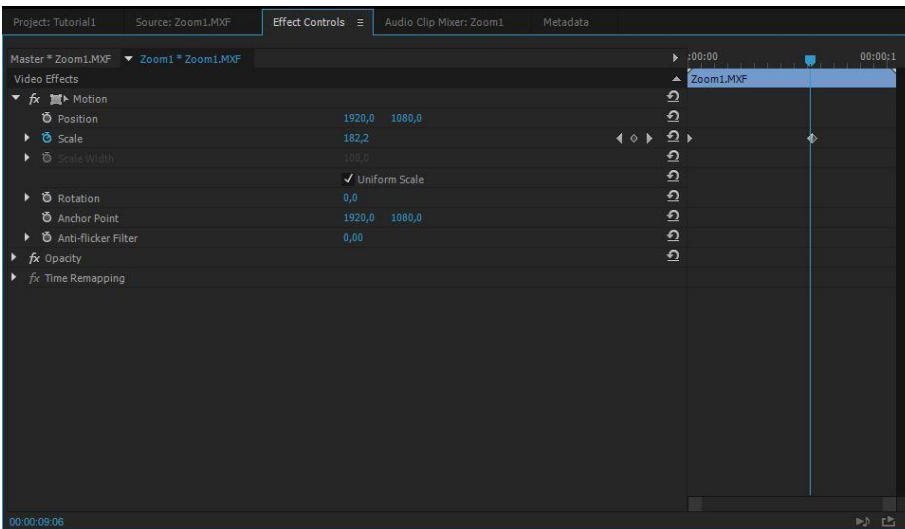
Figure 34. Effects timeline

- Change the size of the image, doing a zoom in to the image in parameter scale.
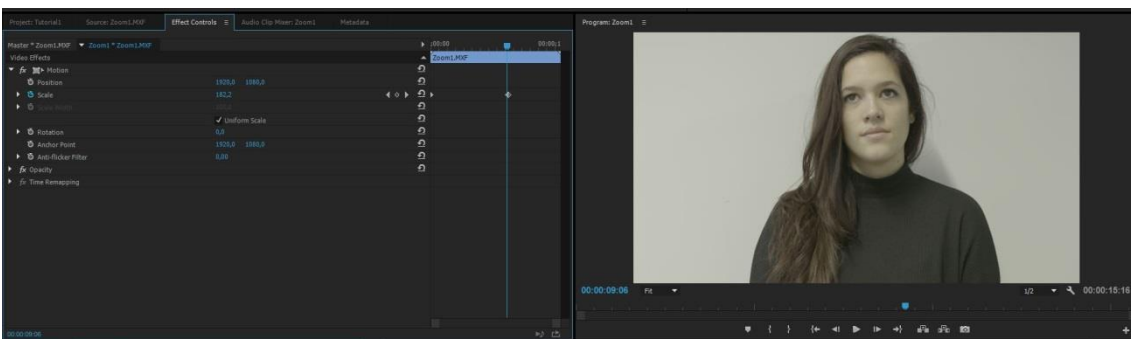
Figure 35. Zoom in

PANNING

- Click the clip.
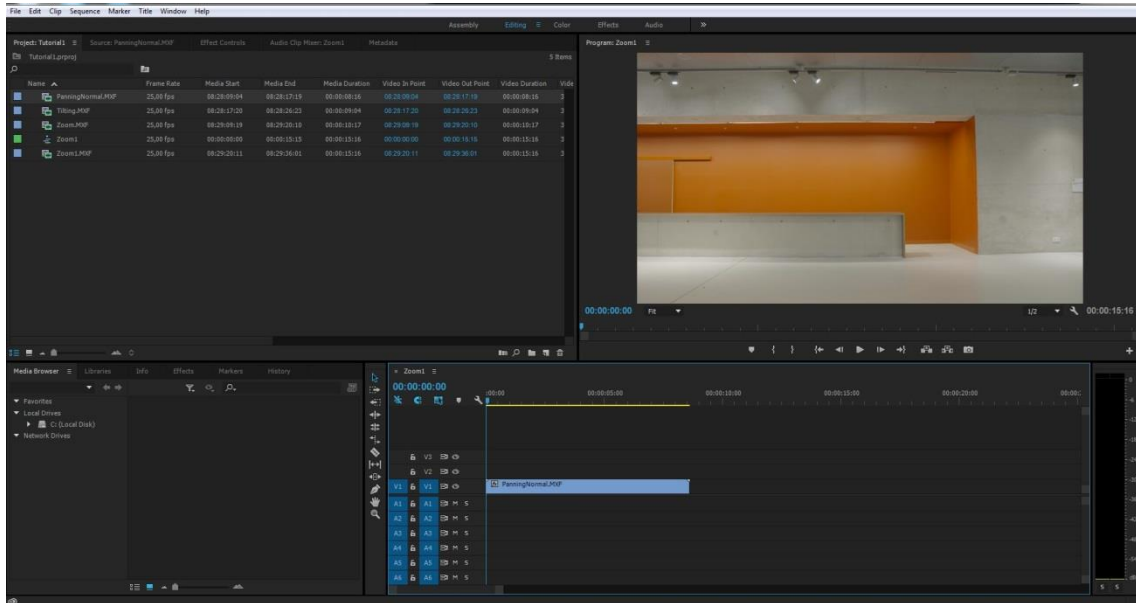
- Open the Effects Control.

Figure 38. Effect menu

- Click the clock that activates the keyframes in position option.

Figure 39. Keyframe option

- Move around the effect timeline to the second chose.
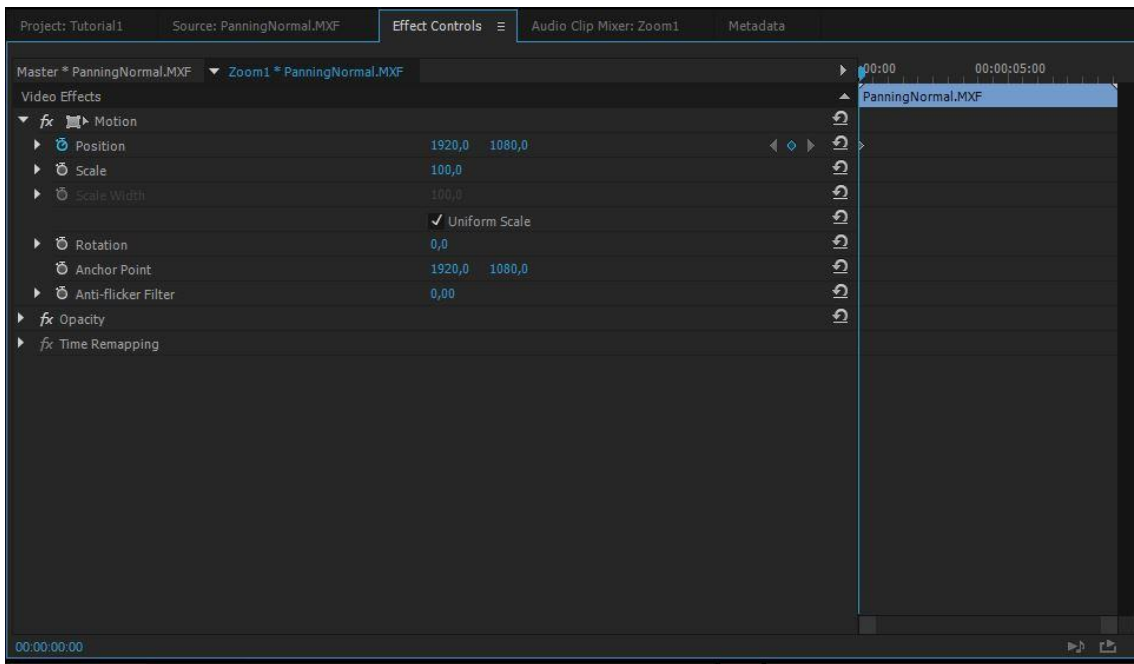
Figure 40. Effects timeline

- Change the position of your clip creating a horizontal movement of the image.
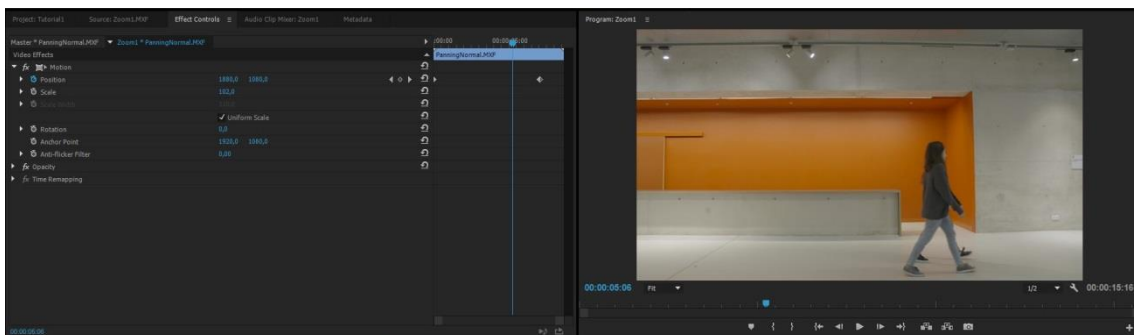
Figure 41. Panning image

TILTING

- Click the clip.
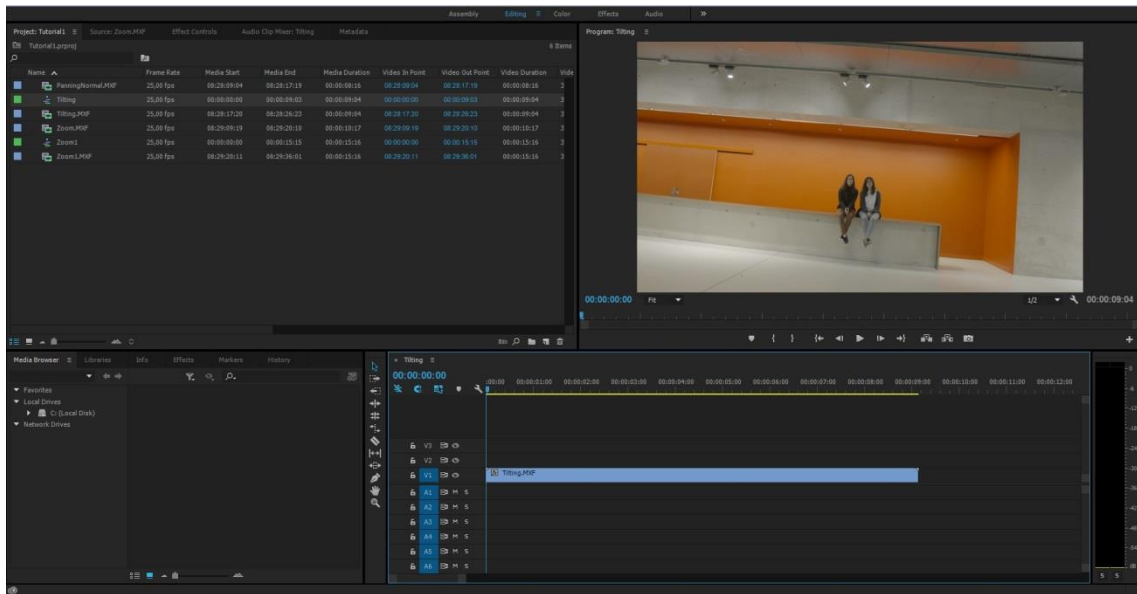
Figure 42. Clip loaded

- Open the Effects Control.
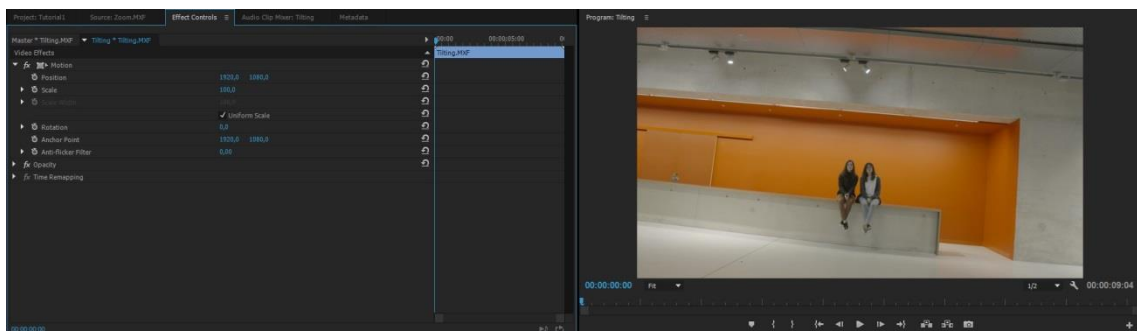
Figure 43. Effects Control Window

- Go to Rotation option.
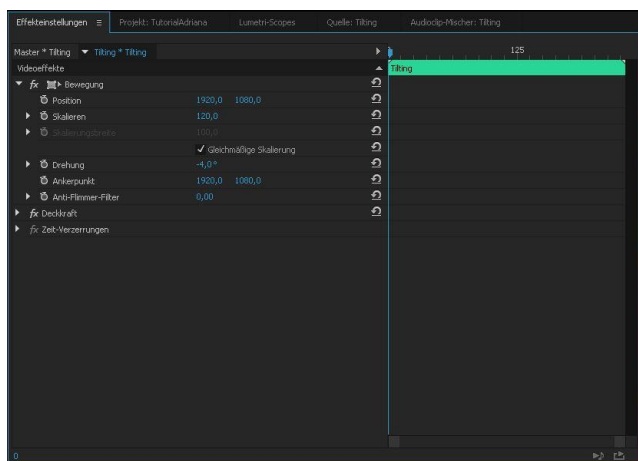
Figure 44. Rotation option

- Choose the angle correct for the tilt image.
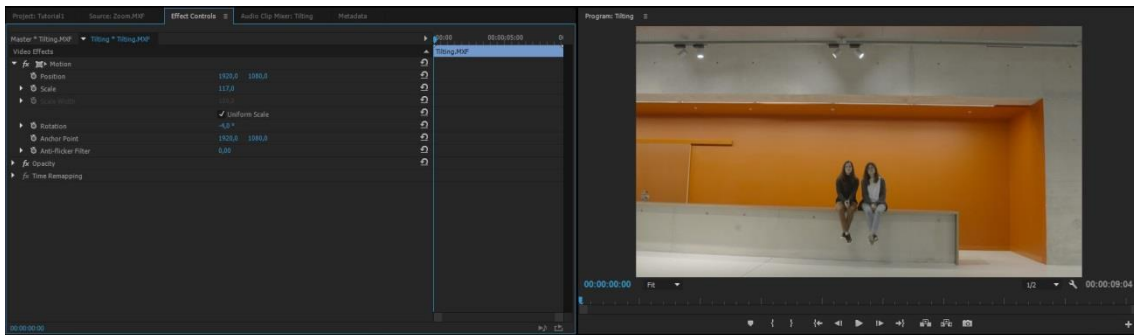
Figure 45. Image without tilting

STABILISATION

- Choose the unbalanced clip.
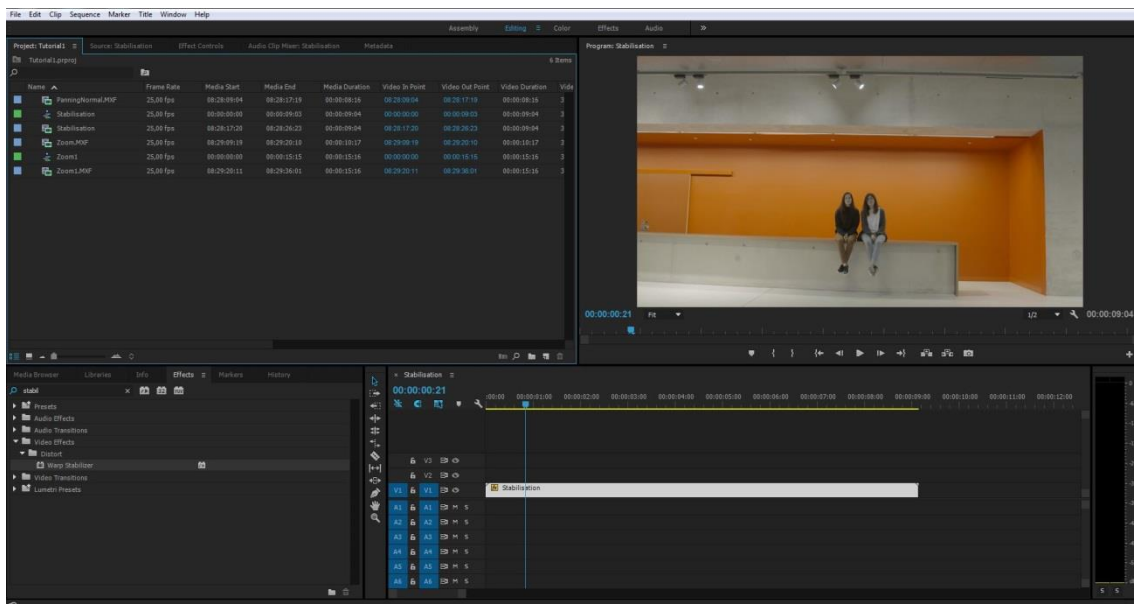
Figure 46. Clip unbalanced

- Go to Video Effects.
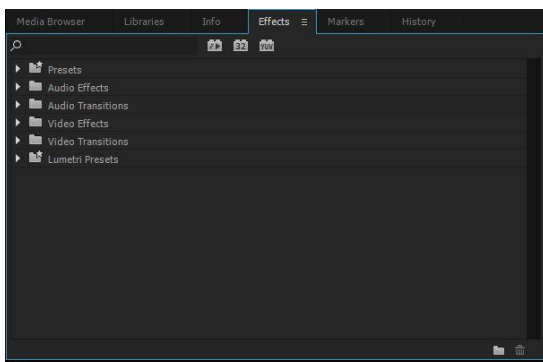
Figure 47. Effects window

- Choose Wrap Stabilizer.
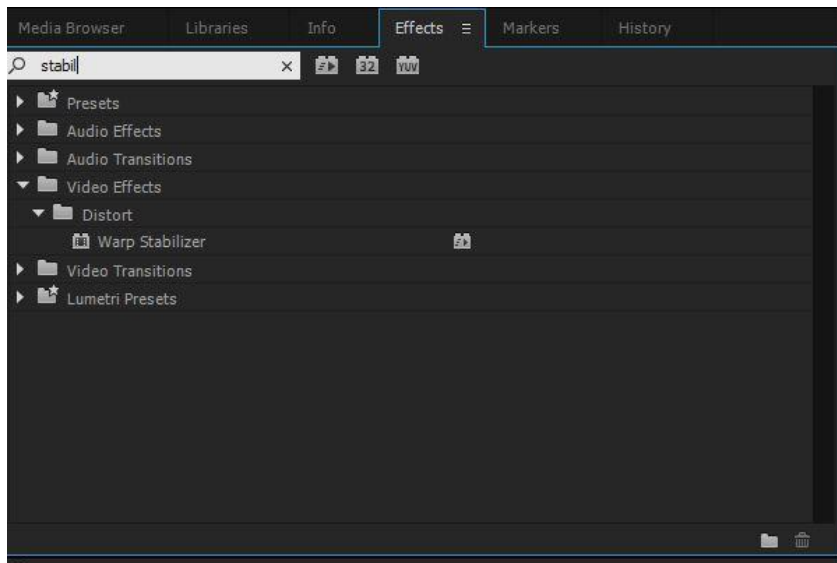
Figure 48. Stabilisation effect

- Put it in the clip and wait until all the frames are analyzed and change the Method option into: Position, Scale and Rotation.
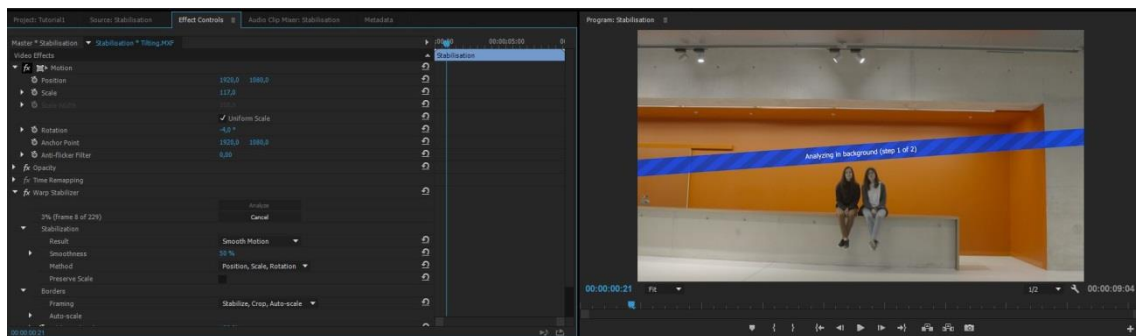
Figure 49. Stabilisation analysis

- In the Stabilization settings, in the Smoothness Method option, change the number until the image will be stabilized. In this case it is 105%
  The stabilization of the image is not perfect; besides 4k material increases the precision of the stabilization, because there were many movements in this shot.
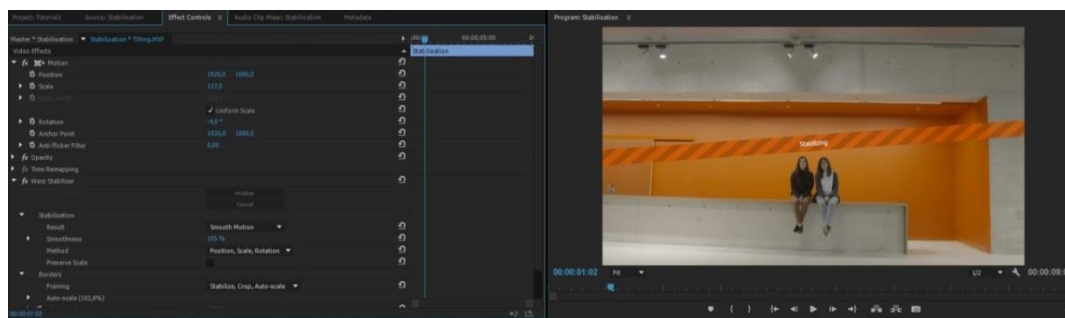
Figure 50. Image stabilized

COLOR GRADING

This option depends on the problem that the image has, the will be to have in mind for doing one process or another. The special case of 4k format is that it provides a large amount of different color codecs; the color grading will be more accurate.
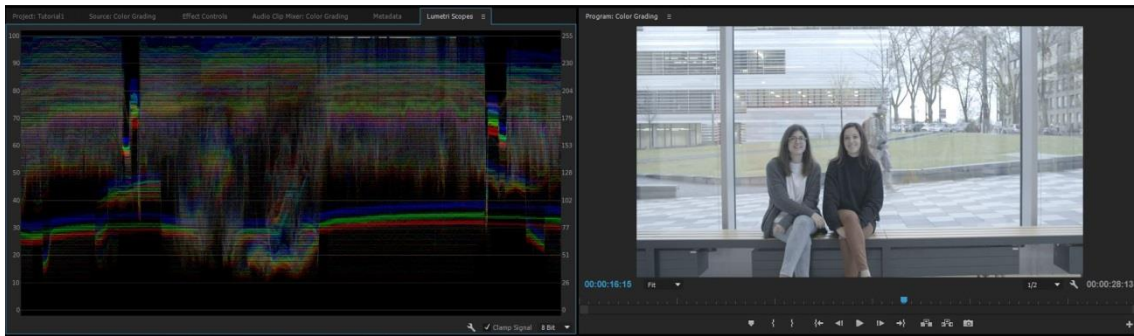
- ¾ Color Spectrum.

Figure 51. Color Spectrum

- Recommendation 2020.

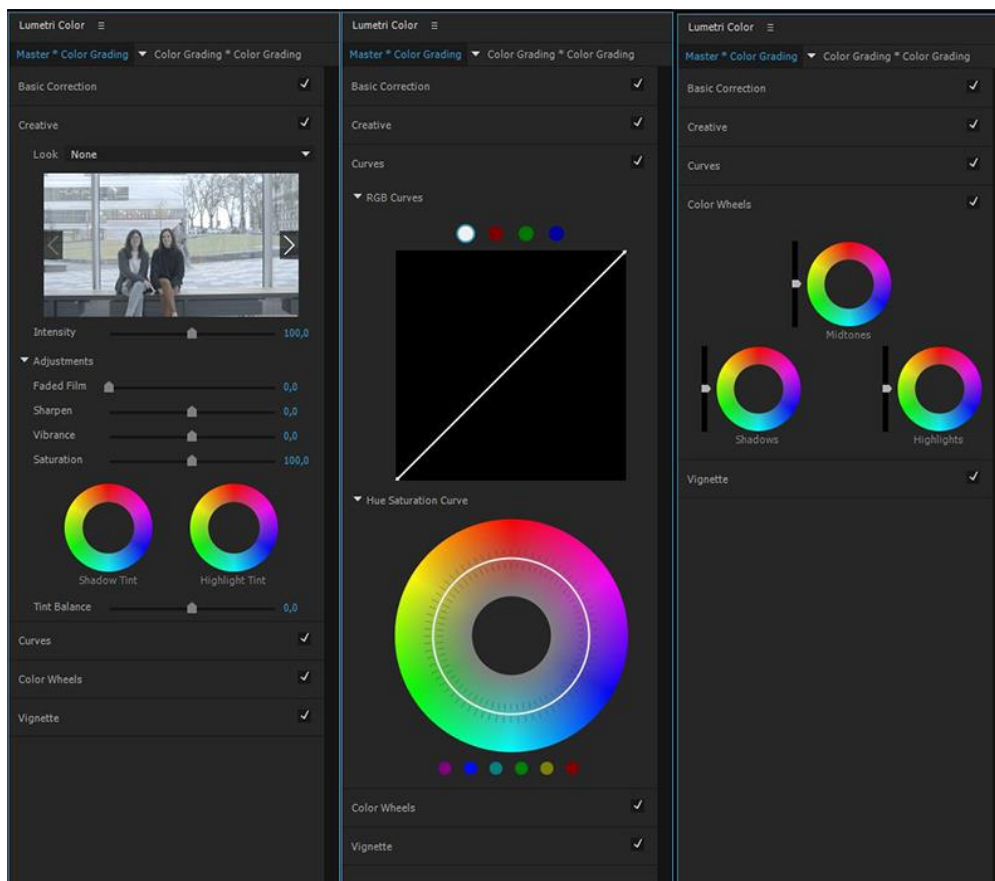**Figure 52.** Color Grading options

CHROMA KEYING

- The process of doing the chroma keying is the same as in normal HD. Selecting Ultra-Key effect, choosing the color of the chroma and changing the brightness and the contrast of the image.

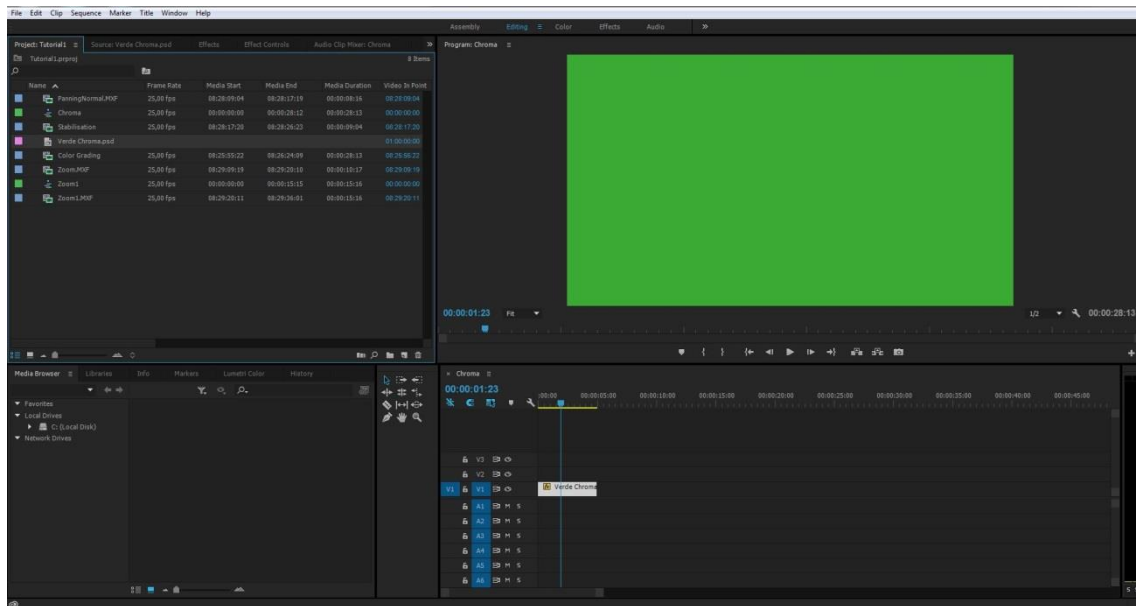- The special aspect of 4k is increasing the definition in the limits between the background and the image over.
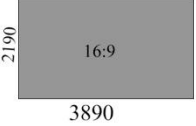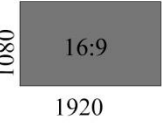

Figure 53. Chrom keying workflow

5.3. STORYBOARD

4k	4k Resolution 2190 / 16:9 / 3890 / 25, 50 or 60 fps / 12 bits	HD Resolution 1080 / 16:9 / 1920 / 25fps / 8 or 10 bits
Benefits of 4k	Increase of quality 	Better quality for bigger displays
More definition in Chroma Keying	3/4 visible color spectrum Rec.2020	Fix movement problems while recording STABILISATION TILTING
Zoom and pan without losing quality		Explanation

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ZOOMING
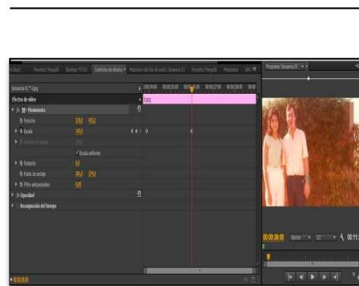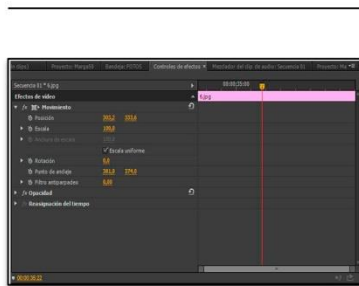
PANNING
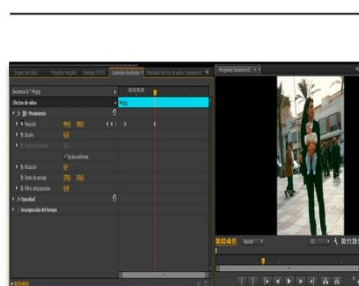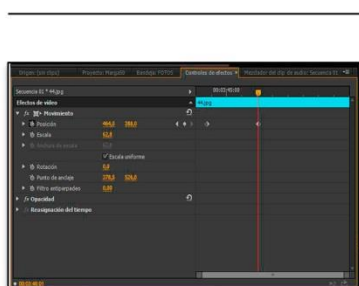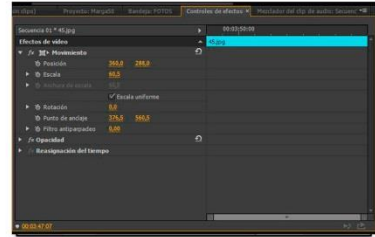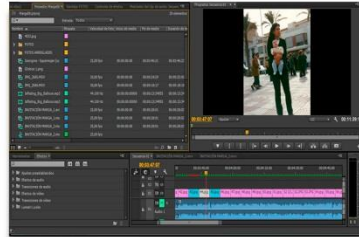
TILTING

STABILISATION

Chroma Keying

Color Grading

Rec. 2020

3/4 parts of the color spectrum
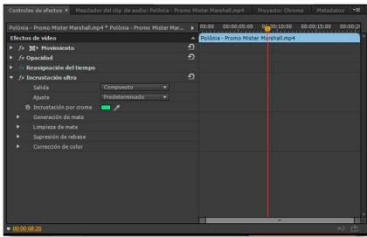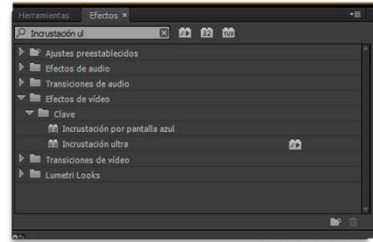
Progressive Scanning
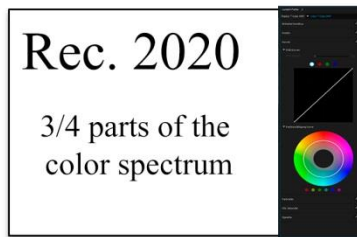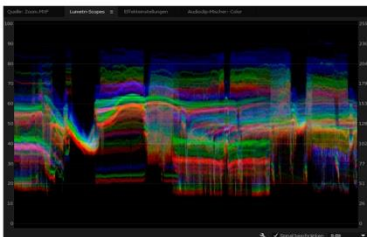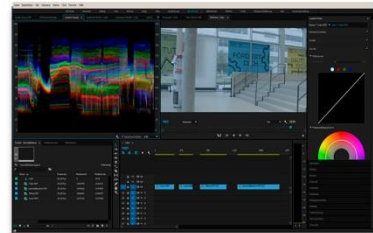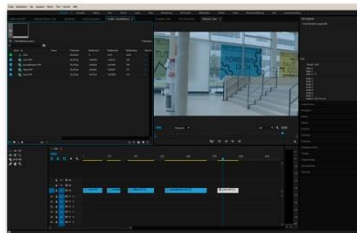
5.4. PRODUCTION PLAN

The process of the production of this video tutorial is divided in three parts, first the filming part, then the design part, that contains the titles explanatories, and finally the editing part in which the tutorial will be define.

- FILMING

The video tutorial is an explanation of how useful is 4k in editing, so for showing these advantages, first it has to record some resource footage in 4k. For filming these images it is used a Sony Camera FS7 configured with 3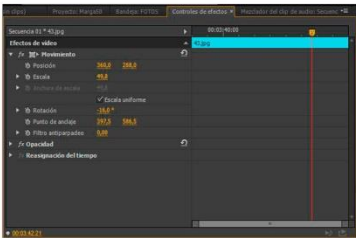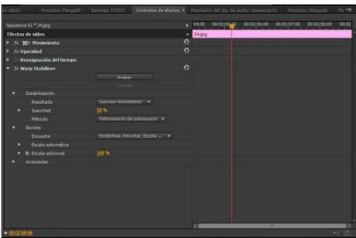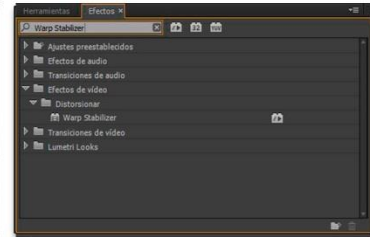840 x 2160 pixels, aspect ratio of 16:9 (it was chose this format because the image were though for televisión), frame rate of 25p, Cine EI, color S-Gamut, XAVC-I codec, and a xQD Series G of 128 GB Card. All these settings are sum up in the following table.

Sony PXW-FS7	
Format	3840 x 2160
Frame Rate	25p
Basic Settings	Cine EI
Color	S-Gamut
Codec	XAVC-I
Card	xQD Series G 128GB

Table 2. Camera specifications

The footage as it was resource it was changed during the shooting due to the climatology, the day chosen it was raining, and so all the images that in the beginning where supposed to do outside, had to be recreated inside. These shots are not relevant for the tutorial, however the images filmed the first day weren't nice so the was needed to do all the images again. This shooting time was around one hour, because it appeared some technical issues like images with no focus that were checked in the dump process.

So due to these issues was planned to do another shooting with the same camera and with an actress.

After the part that was film with the camera, the footage was loaded to Premiere. First it was though that the images of how to do the process in Premiere is going to do by recording the screen of the PC, but after some test, it was decided that the best option will be to do screen shots of the PC and then edit them.

- DESIGN AND EDITING

For doing the design of the tutorial it is used two more Adobe software, After Effects and Photoshop, which is going to complement Premiere. In the beginning of the tutorial it is taught a short explanation of the benefits of 4k, that later are going to be shown. Some of these titles are animated, so they were done with Photoshop and the animated with After Effects.

As the tutorial is a video the font chose for doing the titles is one *Sans Serif*, without trim. The background is a white image with paper texture.

The editing process has been done in Adobe Premiere Pro, first all the images and the result video were imported and ordered, dividing all the six parts that are going to be explained. With each part it is made a new sequence to be able to edit every part separately and sum up all the sequences in one.

The design of how to explain the themes in the tutorial is based in the idea, which all the windows relevant are in the front and the interface of the software appears at background but with some opacity. Then it was though also to put explanation titles in white color, because Premiere workflow is majority black; these titles are short statements that help the viewer to follow the lesson.

The technical aspects of the video aren't 4k ones because the screen are not with such this quality so they are in HD; these settings are going to be resume in the table below.

VIDEOTUTORIAL TECHNICAL ASPECT	
Codec	H.264 (.mp4)
Resolution	1920x1080
Frame Rate	25p
Pixels	Squared
Field order	Progressive
Frame frequency	50
TV Standard	PAL

Table 3. Video Settings

6. CONCLUSION

In the present project has been implemented a video tutorial that shows the improvements that comes from the 4k resolution format compared to previous formats. The set of all the features projected in the tutorial itself has no predecessor, since although we can find tutorials that explain these improvements or how to perform them practically; there aren't any that fully cover all the specifications of the video tutorial.

The use of the 4k format provides more quality with the use of larger screens. Relevant fact, since every time the demand of the audiovisual market, both professional and domestic, is to acquire increasingly large screens. That causes that the professionals of the sector correspond and bit by bit they are incorporating the format in the new issues.

This globalization of the use of 4k resolution is limited due to the problem of storage and broadcasting of audiovisual material. 4k video files increase its size considerably, making it difficult to store and broadcast; as neither the current equipment nor the current television broadcast network would support such a high bandwidth.

However, TV manufacturers have already incorporated the format into all new equipment launched; as well as large companies dedicated to audiovisual production, such as Netflix have incorporated the 4k standard to their recent broadcasts.

Although 4k televisions are booming, tests are already being done to increase the resolution to 6k or 8k, this latter one is being the highest resolution that could be reached duet to the human eye is not able to perceive more resolution. The Asian society is the one that most is investigating in this area, as an example, there are the proofs that were realized in the last Olympic Games of Rio, antecedent so that in 2020 the Olympics of Tokyo already can be emitted in 8k.

Likewise as the 4k resolution, is the present and will be the future of the image, since not only incorporated into televisions, but also to mobile phones, increasingly intelligent and with as many functions as a computer. The 8k resolution is being designed for the retransmission of events with giant screens that can be seen at a distance by the spectators.

Nowadays this consumption of traditional live television is declining, as the television viewing on demand is bursting with force. It is a debacle of the consumption of the television; it causes the appearance of platforms which offers contents on demand. These platforms already offer some type of content with the quality 4k, therefore the television companies will have to offer their content with the same quality to get to compete with them and that the consumer of the audiovisual market, continue using the service.

6.1.   CONCLUSIÓN (Castellano)

En el presente proyecto se ha implementado un video tutorial que muestra las mejoras que proviene el formato de resolución 4k frente a los anteriores formatos. El conjunto de todas las características que se proyectan en el tutorial no tienen en sí misma ningún predecesor. Aunque podemos encontrar tutoriales que explican éstas mejoras o como realizarlas prácticamente, no hay ninguno que abarque por completo todas las especificaciones del video tutorial.

El uso del formato 4k, aporta mucha más calidad con el uso de pantallas mucho más grandes. Esto es hecho relevante, ya que cada vez la demanda del mercado audiovisual, tanto profesional como doméstico, es el de adquirir pantallas cada vez más considerables. Esto provoca que los profesionales del sector correspondan y poco a poco vayan incorporando este formato en las nuevas emisiones.

Esta popularización del uso de la resolución 4k, se limita, debido al problema de almacenamiento y difusión del material audiovisual. Los archivos de video 4k incrementan

considerablemente su tamaño, dificultando su almacenaje y la difusión; puesto que ni los equipos actuales no están preparados para soportar dichos formatos, ni la actual red de emisión por televisión soportaría el ancho de banda requerido.

Sin embargo, los fabricantes de televisores ya han incorporado el formato a todos los equipos nuevos lanzados al mercado; del mismo modo, grandes empresas dedicadas a la producción audiovisual, como *Netflix* han incorporado el estándar 4k a sus emisiones recientes.

Aunque los televisores 4k estén en auge, ya se están realizando pruebas para aumentar la resolución a 6k o 8k. Este último, sería la resolución más alta que se podría alcanzar ya que el ojo humano, no es capaz de percibir más resolución. La sociedad asiática es la que más investiga en este ámbito, como ejemplo, las pruebas que se realizaron en los pasados juegos olímpicos de Rio, antecedente para que en 2020 las olimpiadas de Tokio ya puedan ser emitidas en 8k.

Así mismo, como la resolución 4k, es el presente y será el futuro de la imagen, dado que no sólo se incorporan a los televisores, sino también a los teléfonos móviles, cada vez más inteligentes y con tantas funciones como un ordenador. Por lo tanto, la resolución 8k está siendo pensada para la retransmisión de eventos con pantallas gigantes que puedan ser vistas a distancia por los espectadores.

Actualmente, el consumo de televisión tradicional en directo está en decadencia, ya que la visualización de televisión a la carta, está irrumpiendo con fuerza. Este descenso del consumo de la televisión tradicional provoca, a su vez, la aparición de plataformas de visión de contenido a la carta. Estas plataformas, ya ofrecen algún tipo de contenido con la calidad 4k. Consecuentemente, las empresas televisivas deberán ofrecer su contenido con la misma calidad para llegar a competir con ellas y que el consumidor del mercado audiovisual, siga utilizando el servicio.

6.2. CONCLUSIÓ (Valencià)

En el present projecte s'ha implementat un vídeo tutorial que mostra les millores que aporta el format de resolució 4k front als anteriors. El conjunt de totes aquestes característiques projectades al tutorial no tenen, per elles mateixa, cap predecessor. Tot y que, es pot trobar tutorials que explica les millores o com es poden dur a terme pràcticament, no hi ha ningun que les abasti per complet.

L'ús del format 4k, aporta una millora en la qualitat de la imatge amb la utilització de pantalles molt més grans. Fet rellevant, ja que cada vegada la demanda del mercat audiovisual, tant en l'àmbit domèstic com professional, es el d'adquirir pantalles cada volta més considerables. Això provoca que els professionals del sector corresponguin i poc a poc incorporen el format a les noves emissions.

Aquesta globalització de l'ús de la resolució 4k es limita, a causa del problema d'emmagatzematge i la difusió del material audiovisual. Els arxius de vídeo 4k incrementen considerablement la seu mida dificultant el seu magatzematge y difusió; ja que ni els equips actuals estan preparats per a suportar els formats anomenats, ni la xarxa de televisió actual suportaria el ample de banda necessari.

Malgrat els problemes, els fabricants de televisors ja han incorporat el format a tots els nous equips llançats al mercat; tanmateix grans companyies dedicades a la producció, com Netflix, han incorporat l'estàndard 4k a les emissions immediates.

Encara que els televisors 4k estan en apogeu, ja s'estan realitzant proves per augmentar la resolució a 6k o 8k. Aquest, seria la resolució més ata a la que es podria arribar, ja que l'ull humà no es capaç de percebre més resolució. La societat asiàtica és la que més investiga en aquest àmbit, com a exemple, hi són les proves que es van realitzar en els passats jocs olímpics de Rio, antecedent per a que en 2020 les olimpíades de Tòquio puguin ser retransmeses en 8k.

Així mateix com la resolució 4k, és el present y serà el futur de la imatge, ja que no només s'incorpora a als televisors, sinó també als telèfons mòbils, cada volta més intel•ligents y amb totes les funcions d'un propi ordinador. La resolució 8k està sent pensada per a la retransmissió de esdeveniments amb grans pantalles per a poder ser vistes a distància.

Hui en dia, el consum de televisió tradicional en directe, està en decadència, ja que la visualització de televisió a la carta està irrompent amb força. Aquesta descens del consum de la televisió, provoca l'aparició d'altres plataformes de visionat a la carta. Aquestes darreres plataformes, ja comencen a proveir contingut amb una qualitat 4k, per tant, les empreses televisives hauran de oferir alguna part del seu contingut amb la mateixa qualitat per a competir amb elles y que el consumidor les seguisca utilitzant.

7. GREETINGS

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