

# VFX Project #3: MatchMove

Digital Visual Effects, Spring 2015

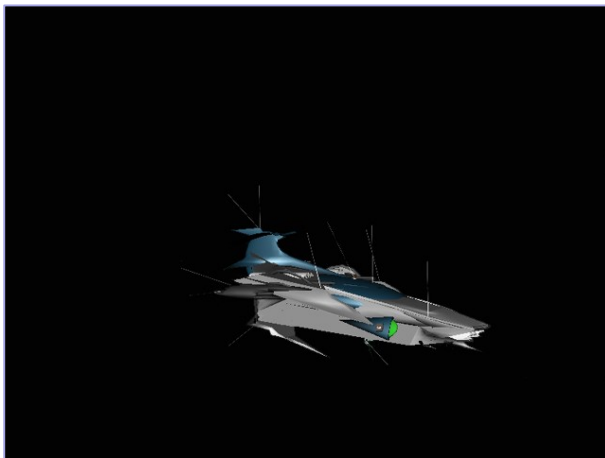
2015/4/29

# Overview

## Input



Video



CGI Animation

**Matchmove** is a technique of estimating camera parameters from an input video sequence so that computer generated imagery (CGI) could be seamlessly inserted into the sequence.

## Example

## Output



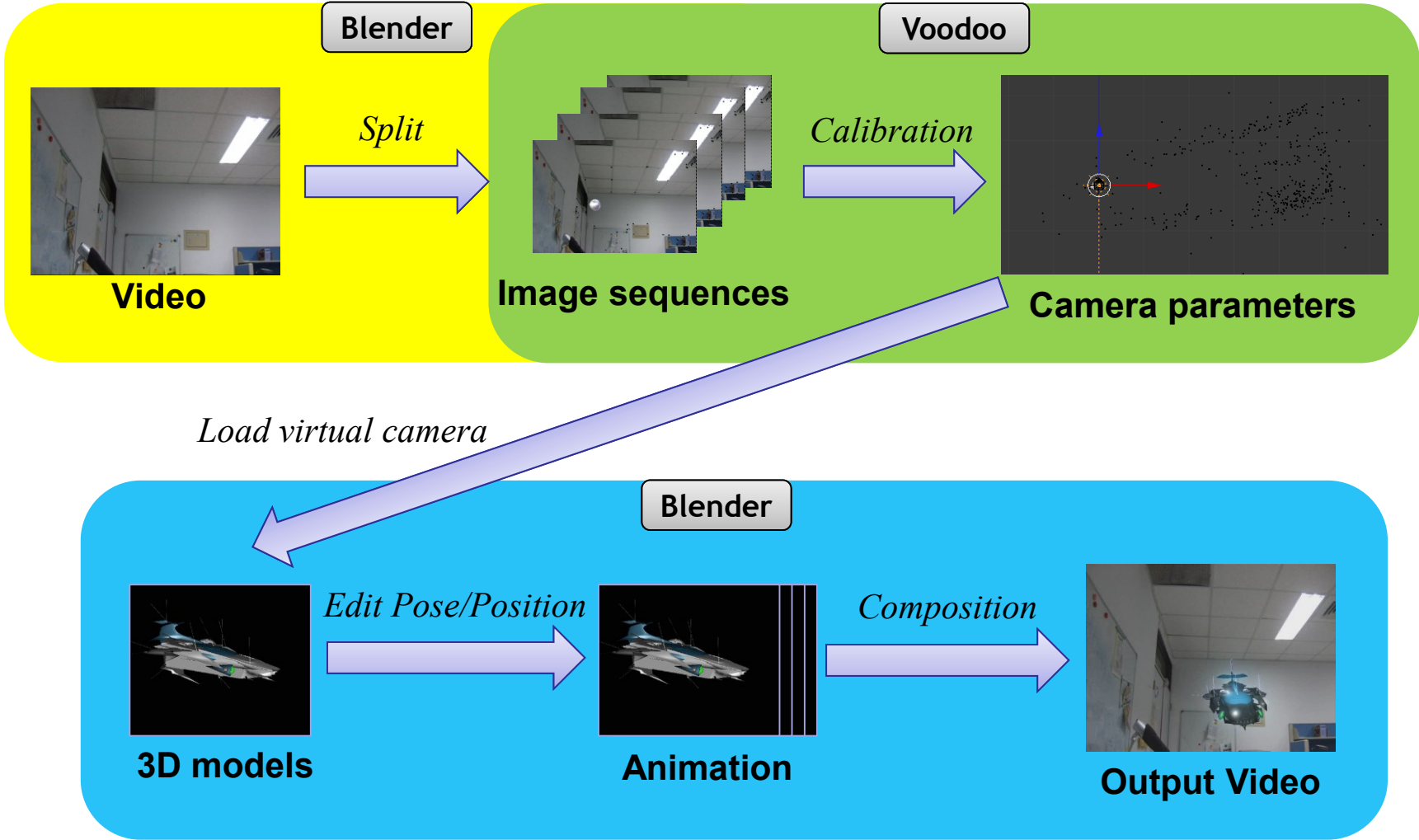
Composite Video

# Environment Setting

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- Blender
  - Version **2.6.2** <http://download.blender.org/release/Blender2.62/>
  - Using version higher than 2.6.6 might get error while running voodoo python scripts
- Voodoo
  - Version 1.2.0 <http://www.viscoda.com/en/voodoo-download>
- Other options
  - Free: Blender + ICARUS
  - Pay: boujou + 3D Max, boujou + Maya, ...
- 3D models
  - \*.obj, \*.3ds...

# Flowchart

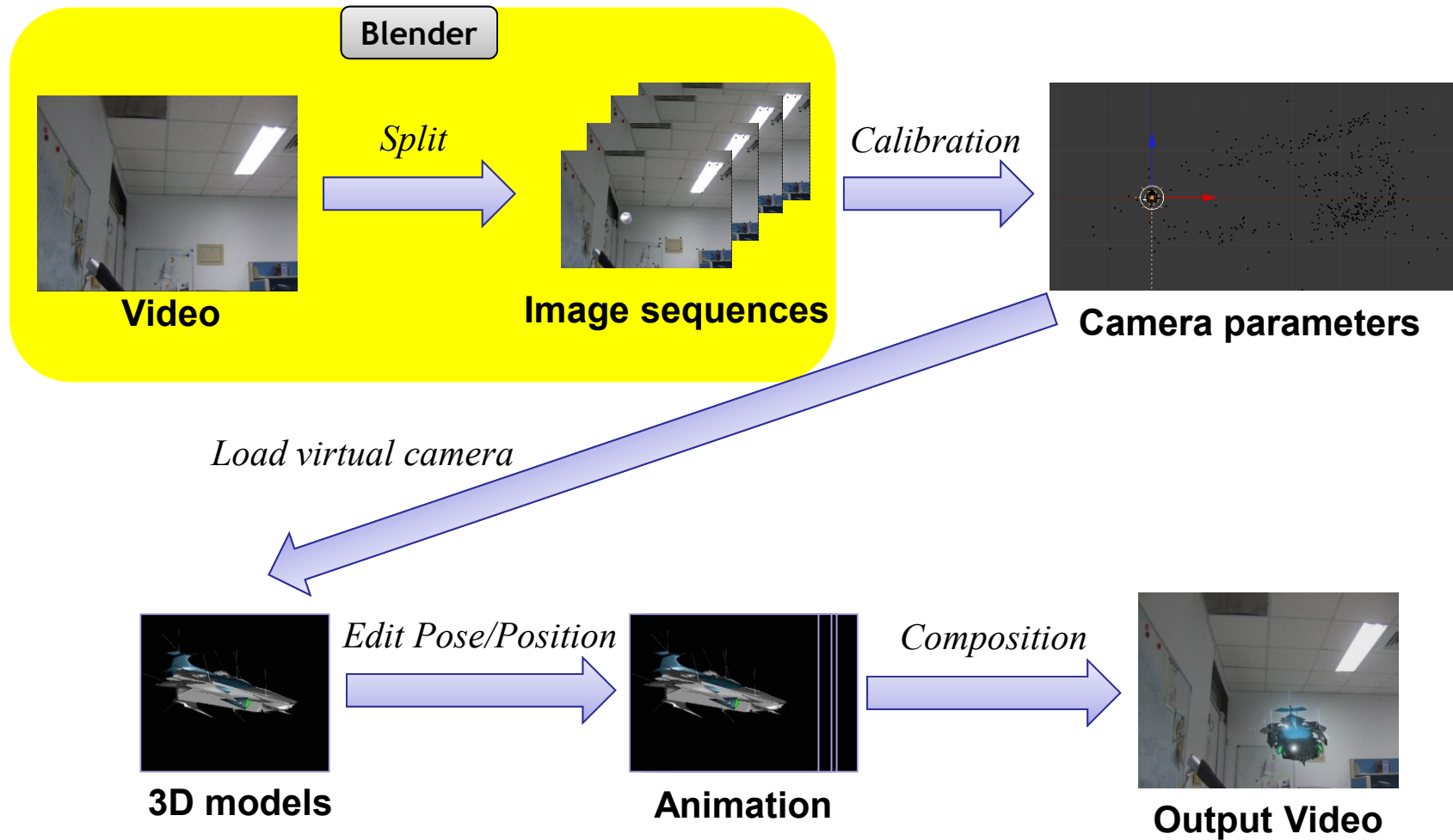


# Flowchart (detailed)

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- Three main stages:
  - 1. In Blender: Split video into image sequences**
    - Input: video
    - Output: image sequence (\*.tga)
  - 2. In Voodoo: Camera calibration/tracking**
    - Input: image sequence (\*.tga)
    - Output: voodoo python script (\*.py)
  - 3. In Blender: Combine video and 3D model**
    - Input: 3D model, video, voodoo python script (\*.py)
    - Output: video with 3D model
  4. (Option) Edit your video with other software (ex. Adobe After Effects, VideoStudio, PowerDirector, Final Cut)

# Stage 1: Get Image Sequence

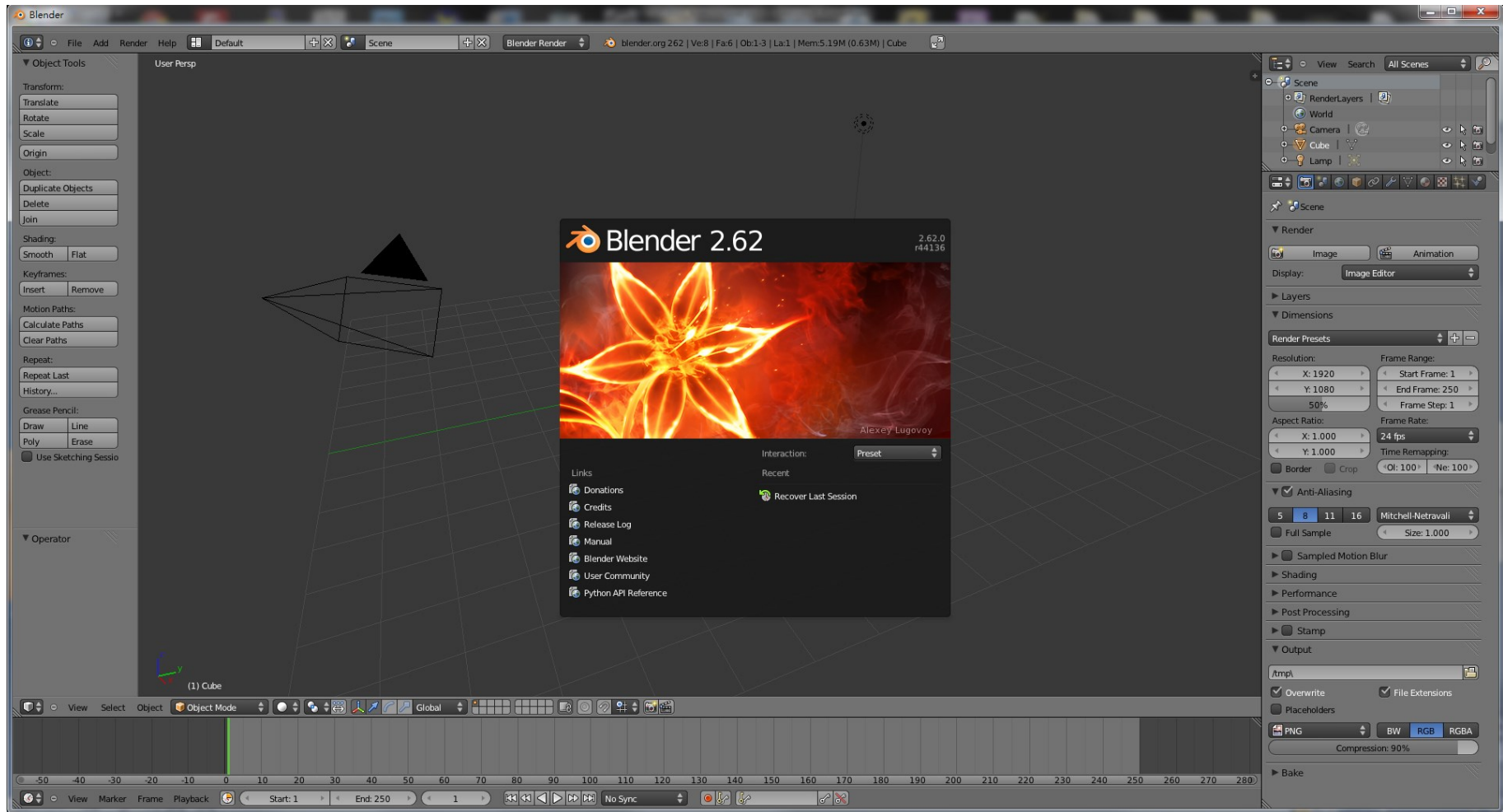


# Stage 1: Get Image Sequence

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1. Open Blender
2. Load video file:
  - Change window type to “Video Sequence Editor”
  - Select Add →Movie
  - Put the strip in Layer 1
3. Do sequence:
  - Frame
    - Set number of frames and resolution of frames
    - Choose output file type (**Targa, \*.tga**)
  - Time interval: select start and end of the sequence
  - Choose output location
4. Click “Animation” button

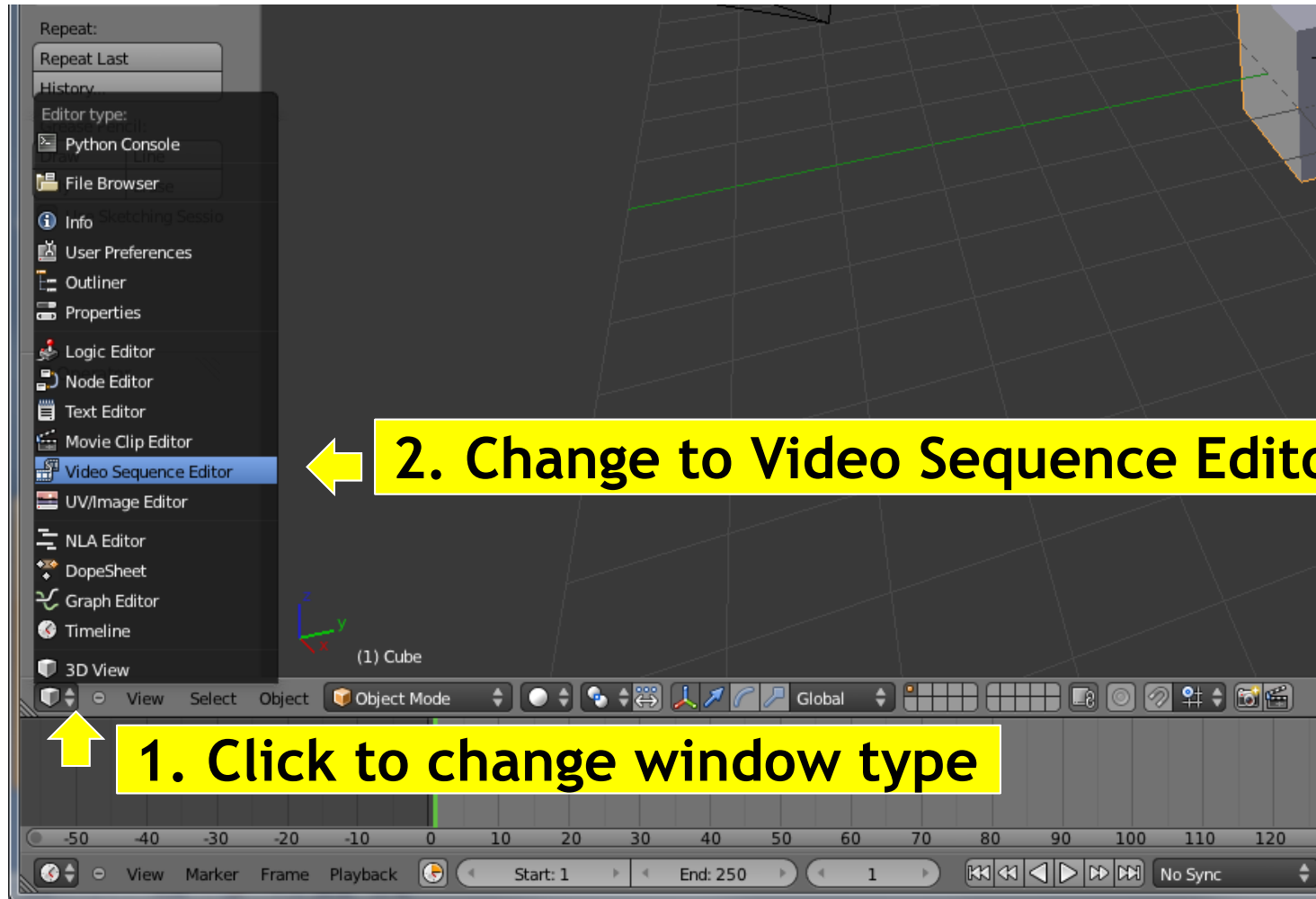
# Stage 1: Get Image Sequence



**Start up Blender**

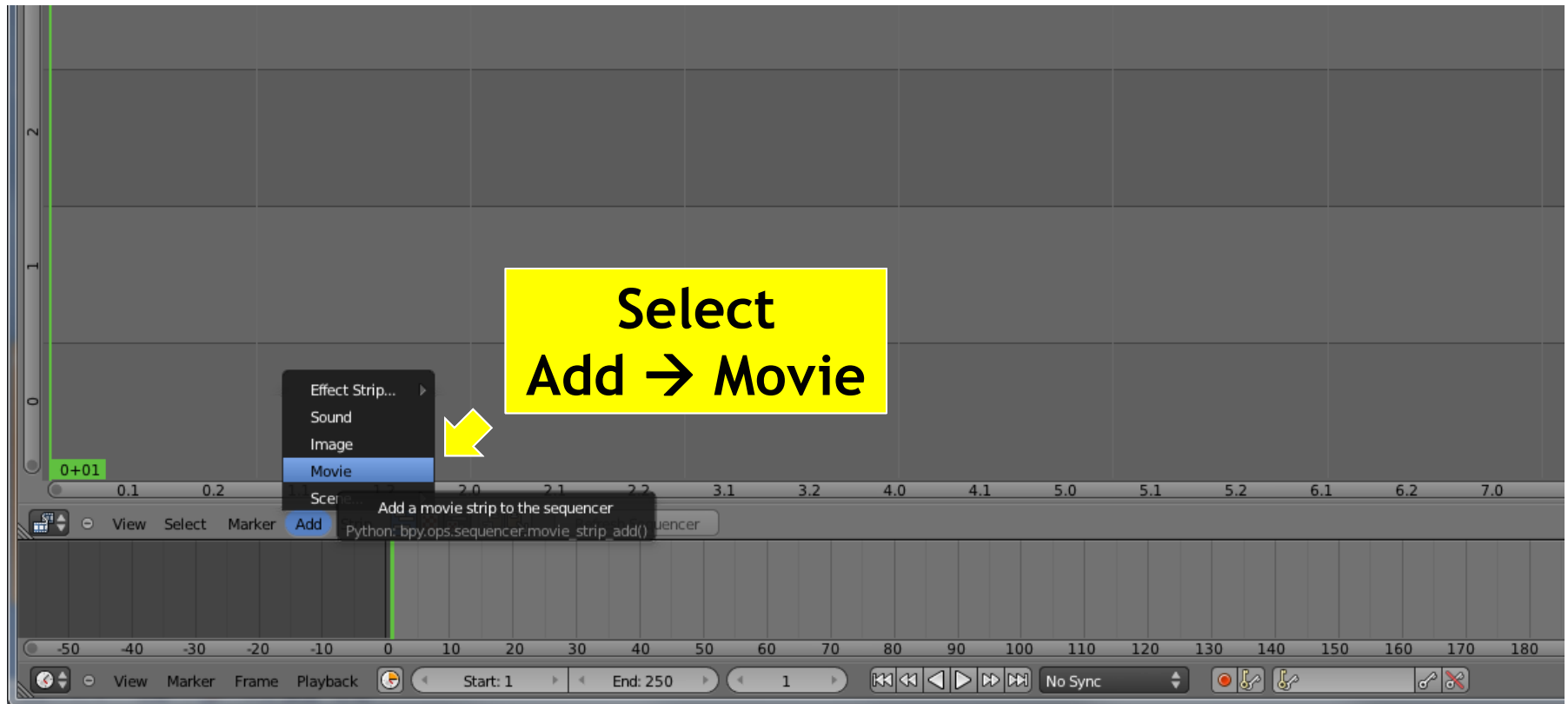


# Stage 1: Get Image Sequence



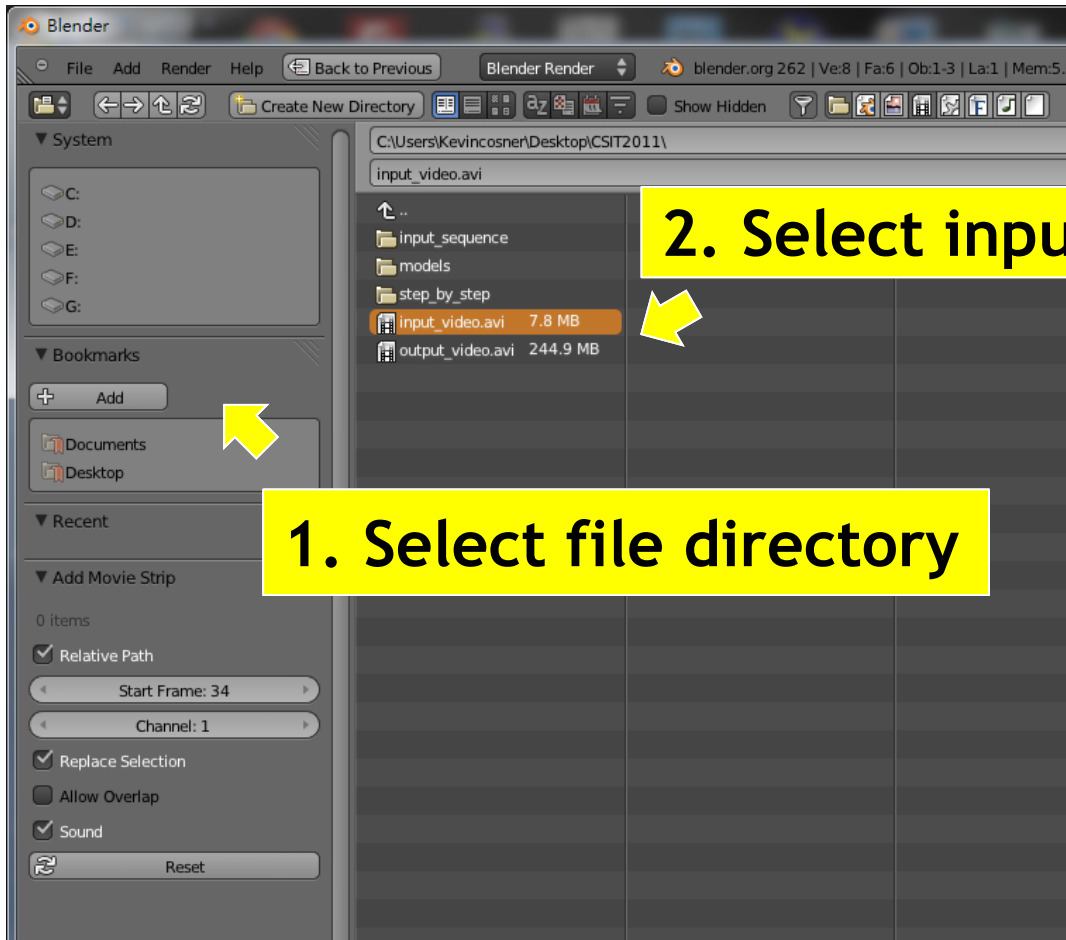
**Change window type**

# Stage 1: Get Image Sequence



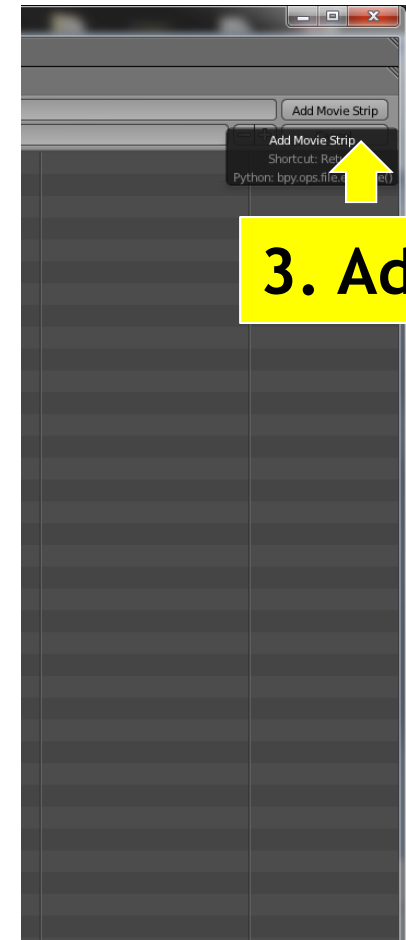
**Add video**

# Stage 1: Get Image Sequence



1. Select file directory

2. Select input file

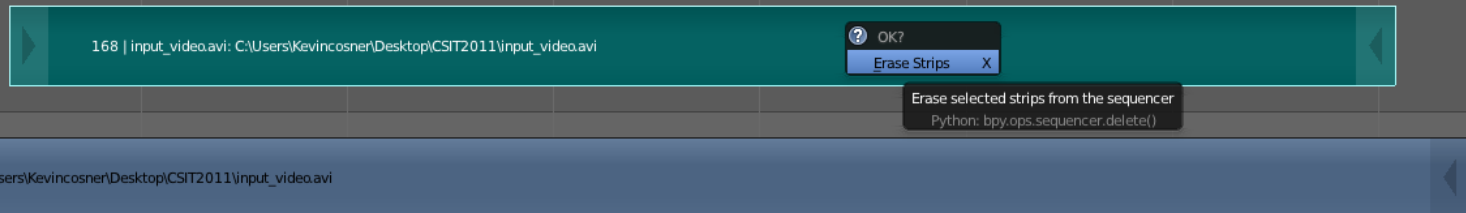


3. Add

Select input video

# Stage 1: Get Image Sequence

1. Delete unnecessary layer (audio)



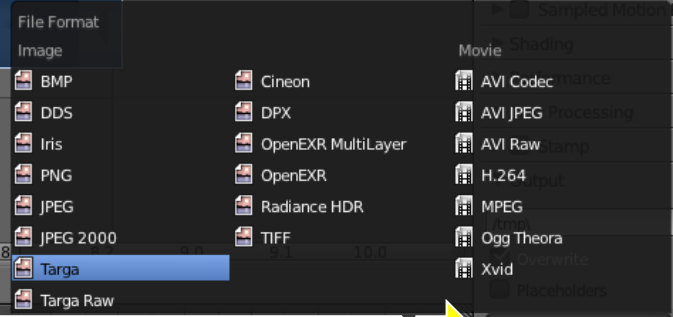
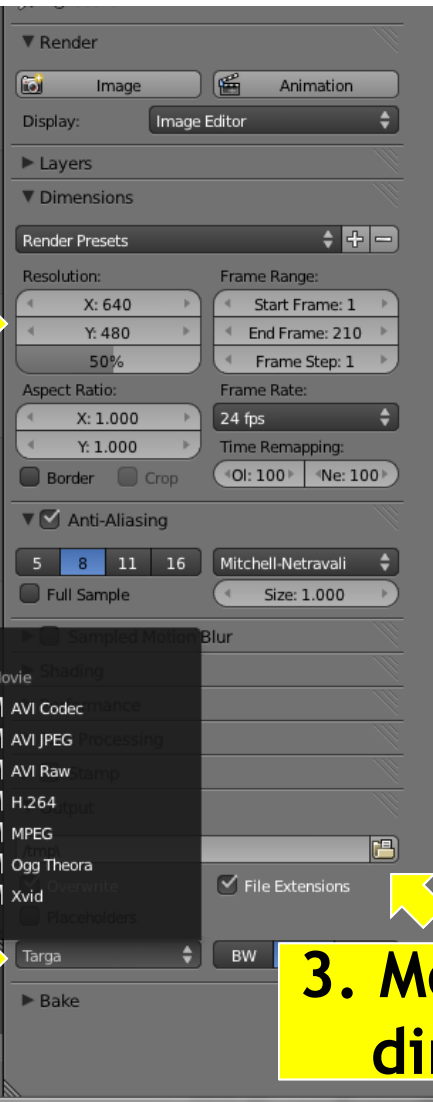
2. Right-click to drag the strip to the “1<sup>st</sup> Frame” in Layer 1



Edit layers (Right click and drag, left click to set)

# Stage 1: Get Image Sequence

1. Set  
a. Resolution  
b. Start/End Frame



2. Set file types to Targa(TGA)



3. Modify output directory

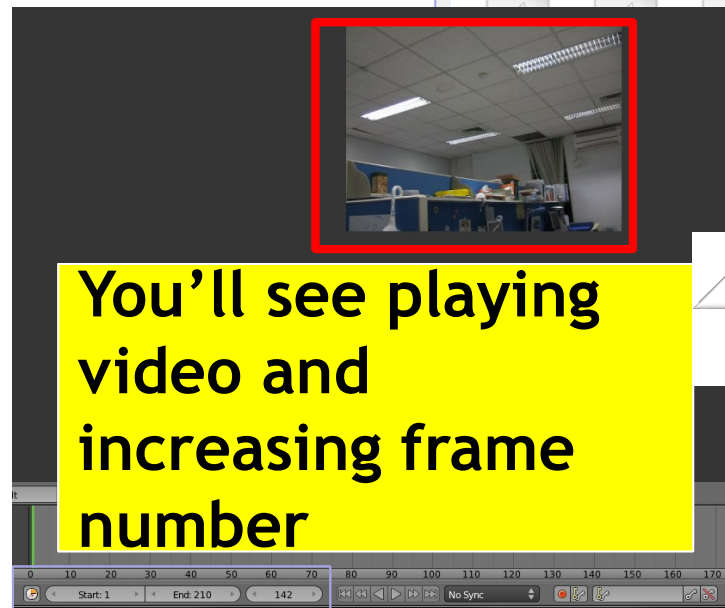
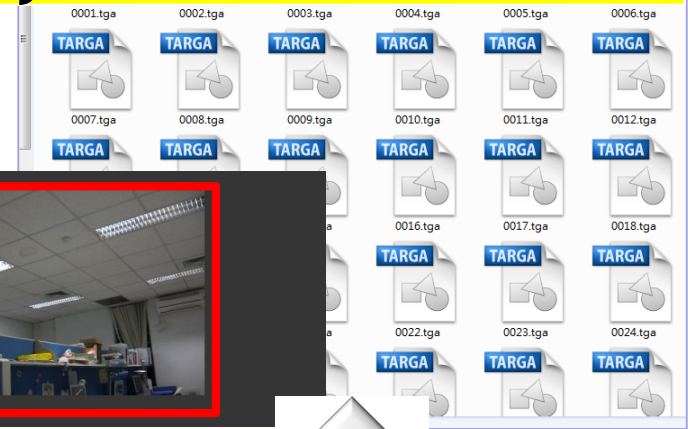
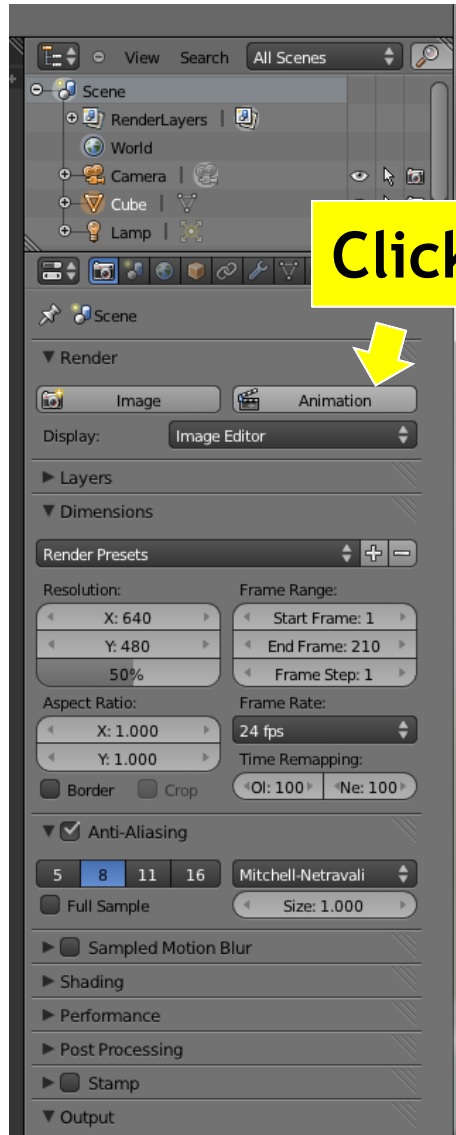


Do video setting

# Stage 1: Get Image Sequence

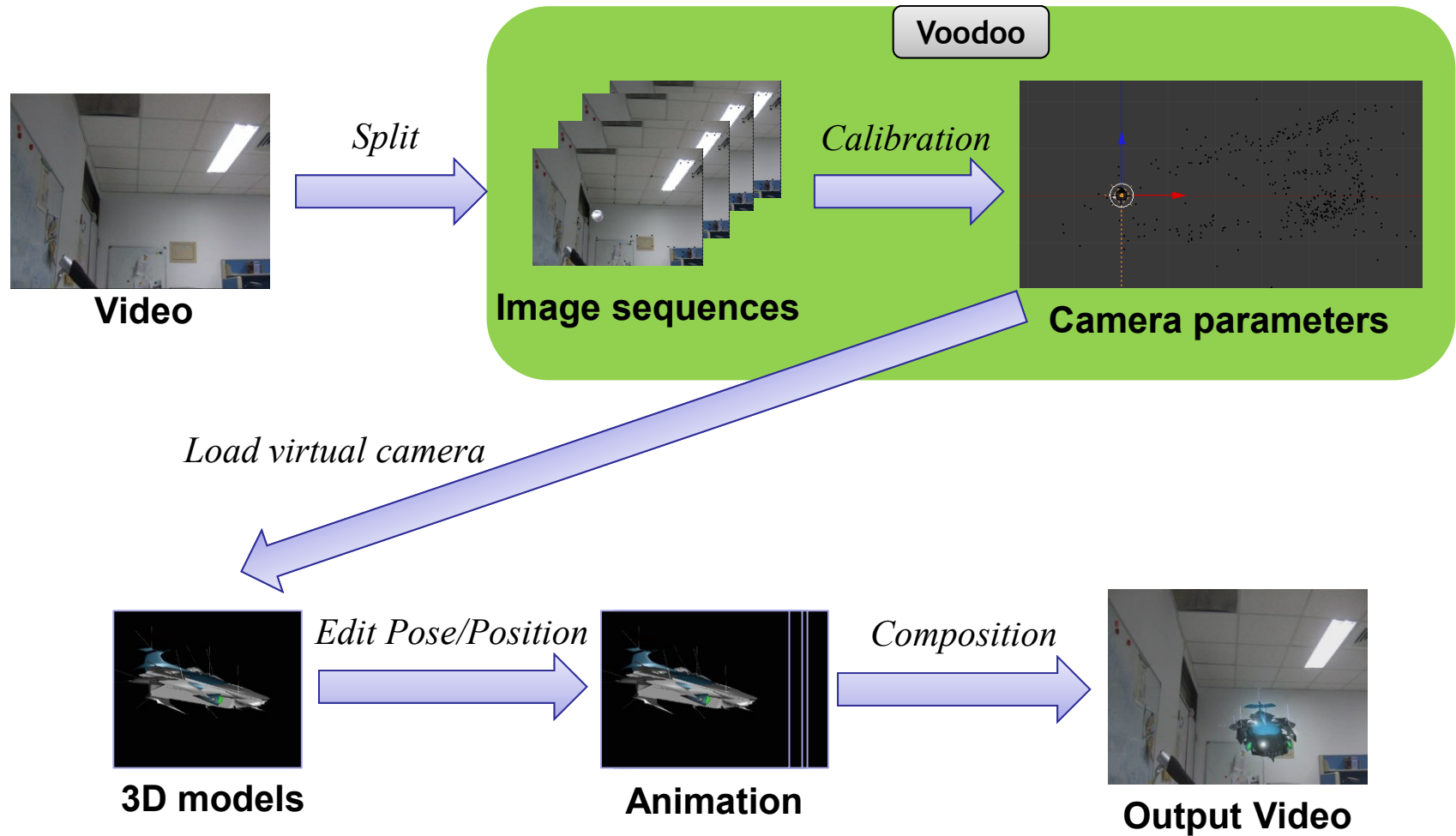
**Finish!**  
You can find the image sequences in  
output directory

**Click Animation**



**Render image sequence**

# Stage 2: Camera Calibration



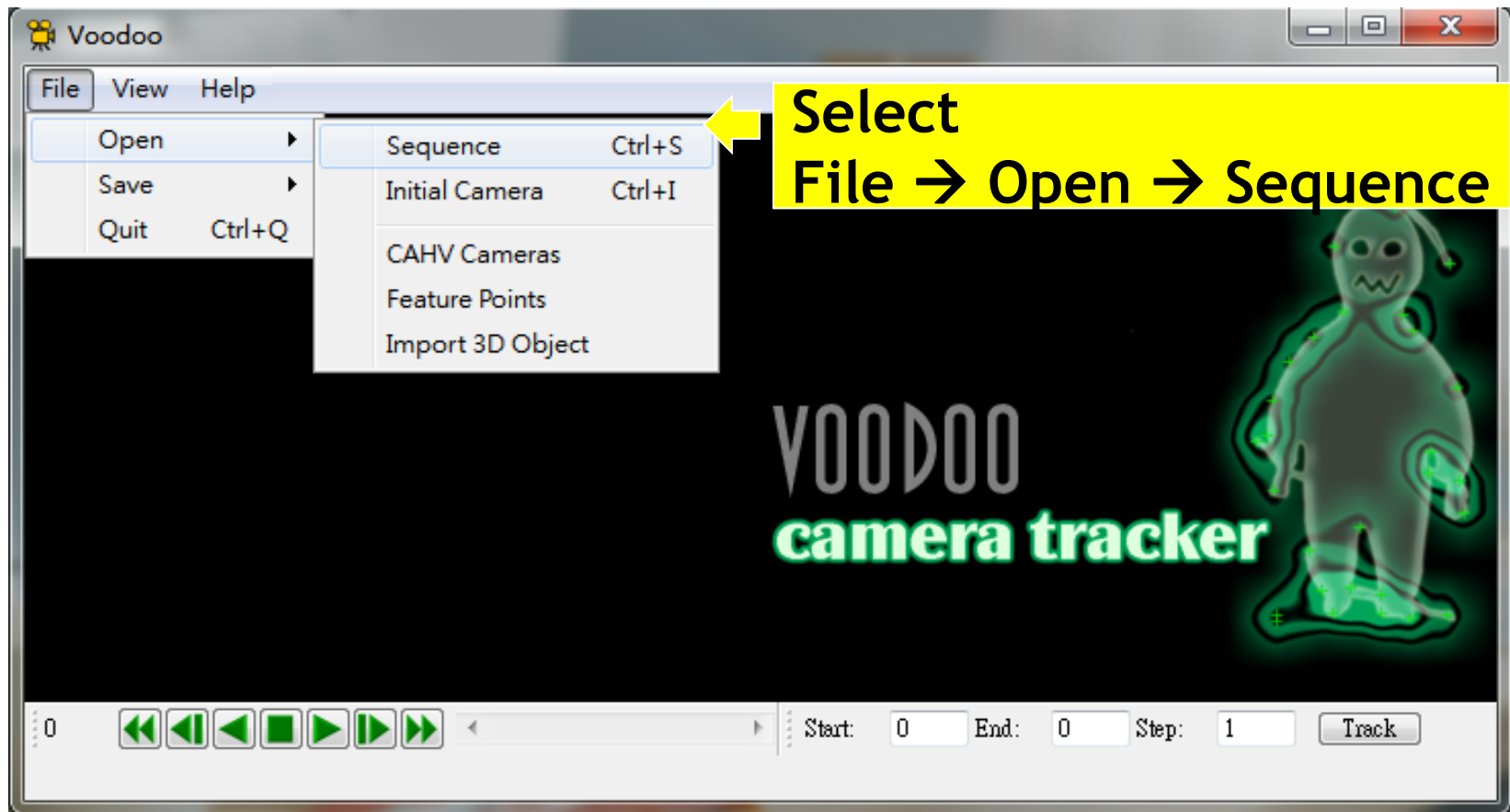
# Stage 2: Camera Calibration

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1. Open Voodoo
2. Open image sequence:
  - Select File → Open → Sequence
  - Select the first frame
  - Set Move Type to “**free move**”
3. Track:
  - Click Track button
4. Export Python script:
  - Select File → Save → Blender Python Script
  - Save .py file (Blender 2.5x and higher)
  - Export all

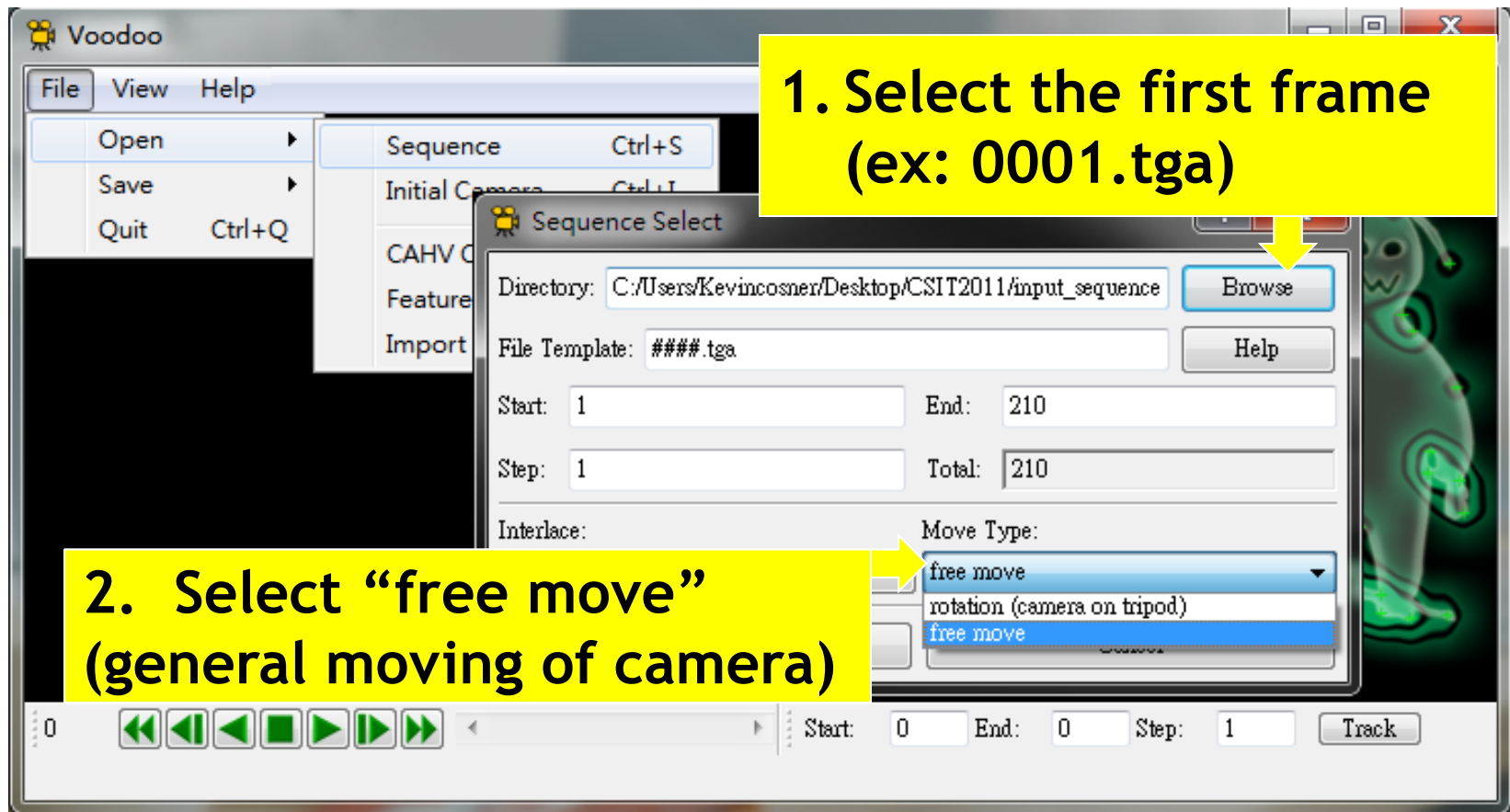


# Stage 2: Camera Calibration



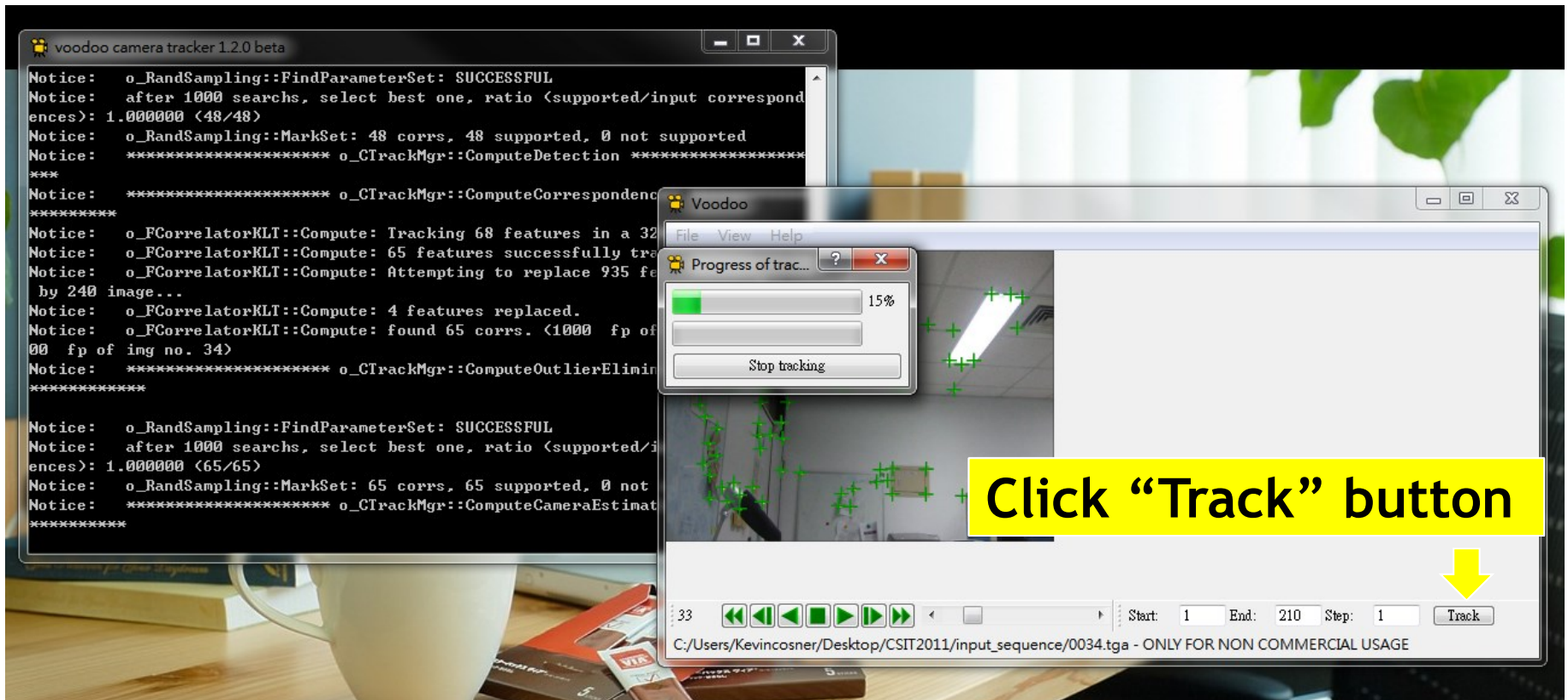
Use Voodoo to load image sequence

# Stage 2: Camera Calibration



**Choose and set sequence**

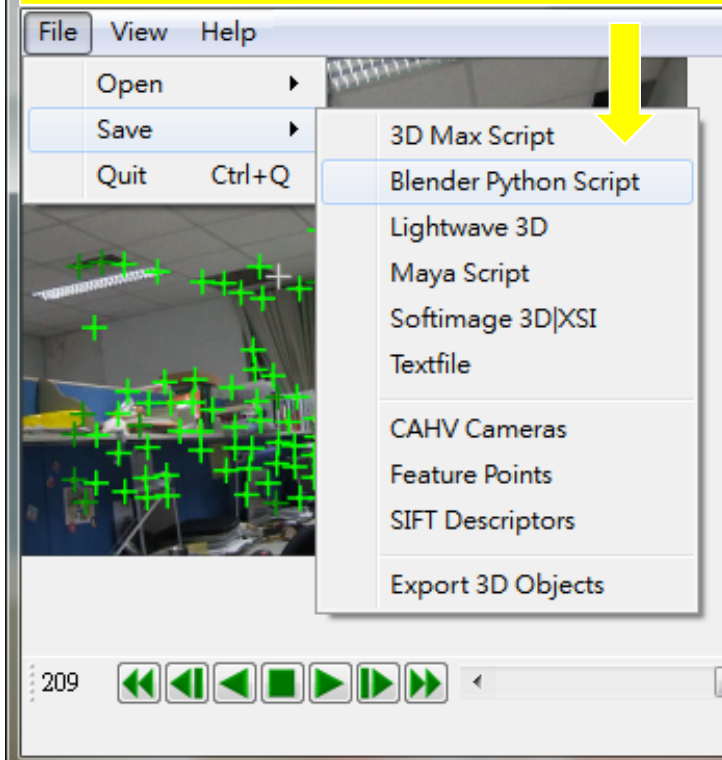
# Stage 2: Camera Calibration



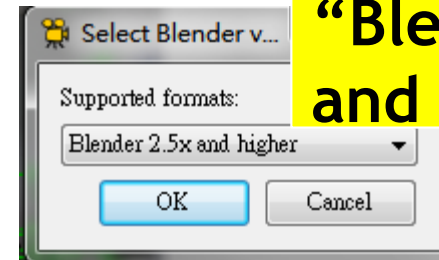
Tracking features

# Stage 2: Camera Calibration

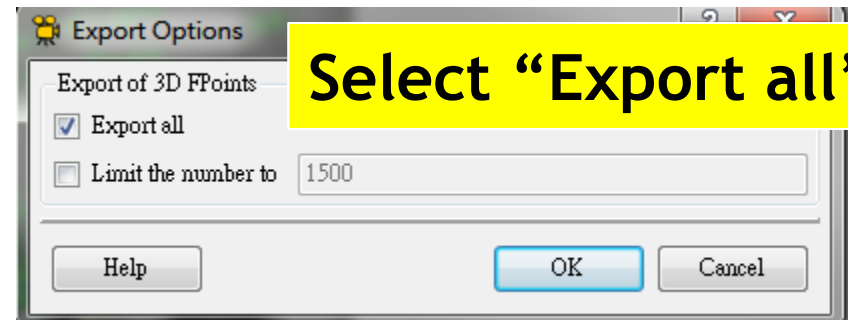
Select  
File → Save → Blender Python Script



Select  
“Blender 2.5x  
and higher”

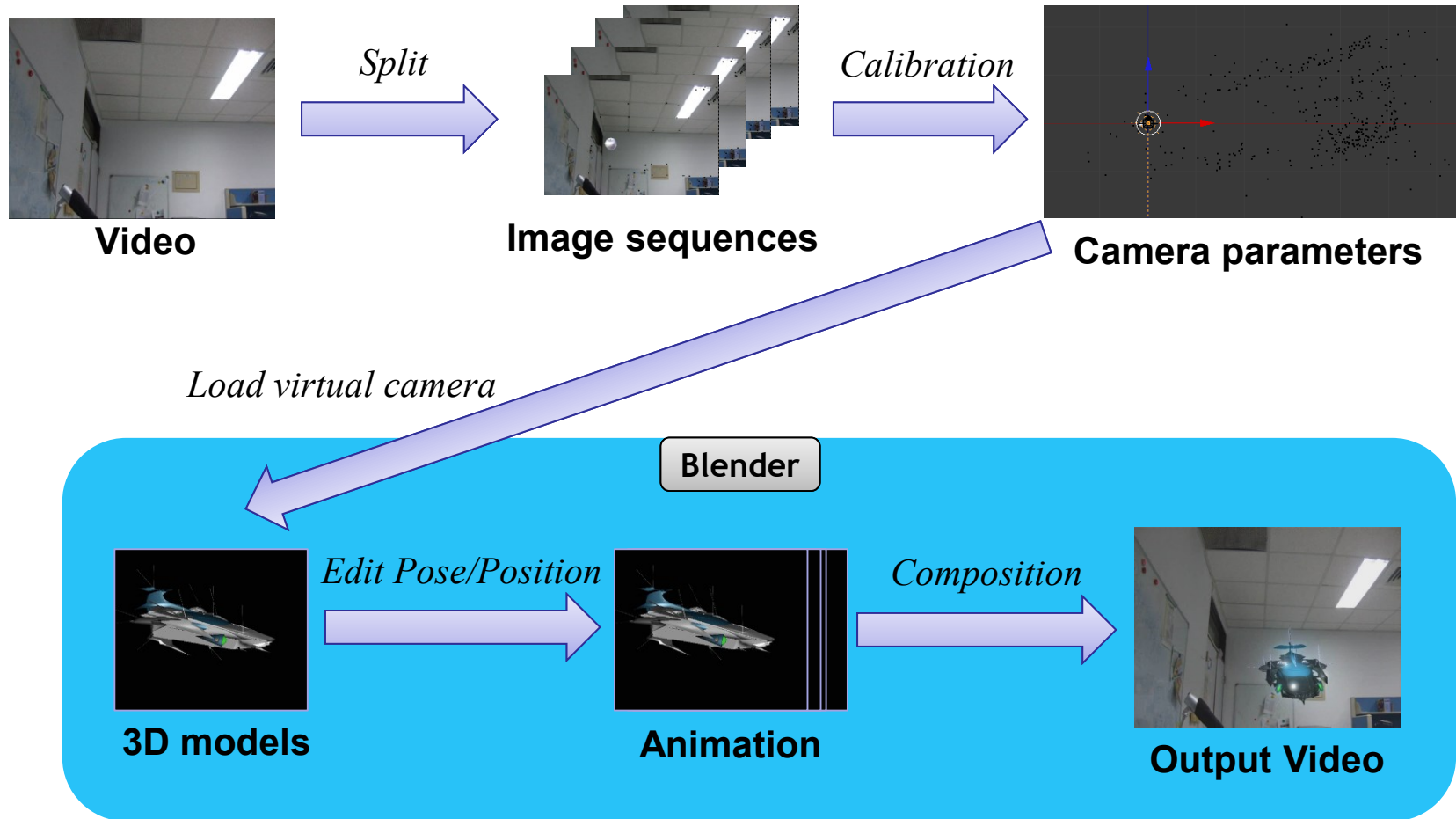


Select “Export all”



Save results to “Blender Python Script”

# Stage 3: Combine Video and 3D Model

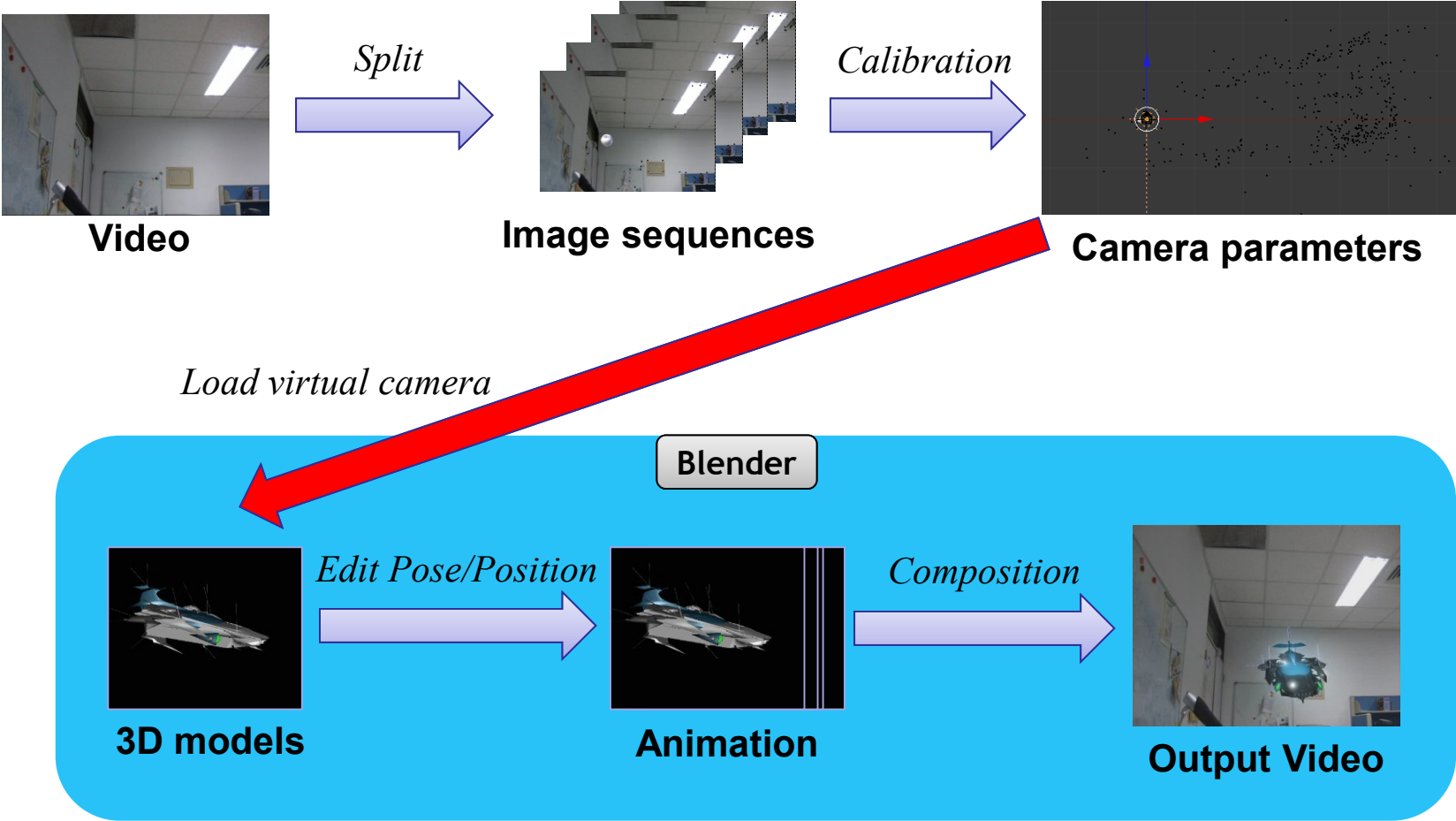


## Stage 3: Combine Video and 3D Model

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- Stage 3-1: Load virtual camera (python script from voodoo)
- Stage 3-2: Show background images
- Stage 3-3: Load 3D model
- Stage 3-4: Set model animation
- Stage 3-5: Render video

# Stage 3: Combine Video and 3D Model



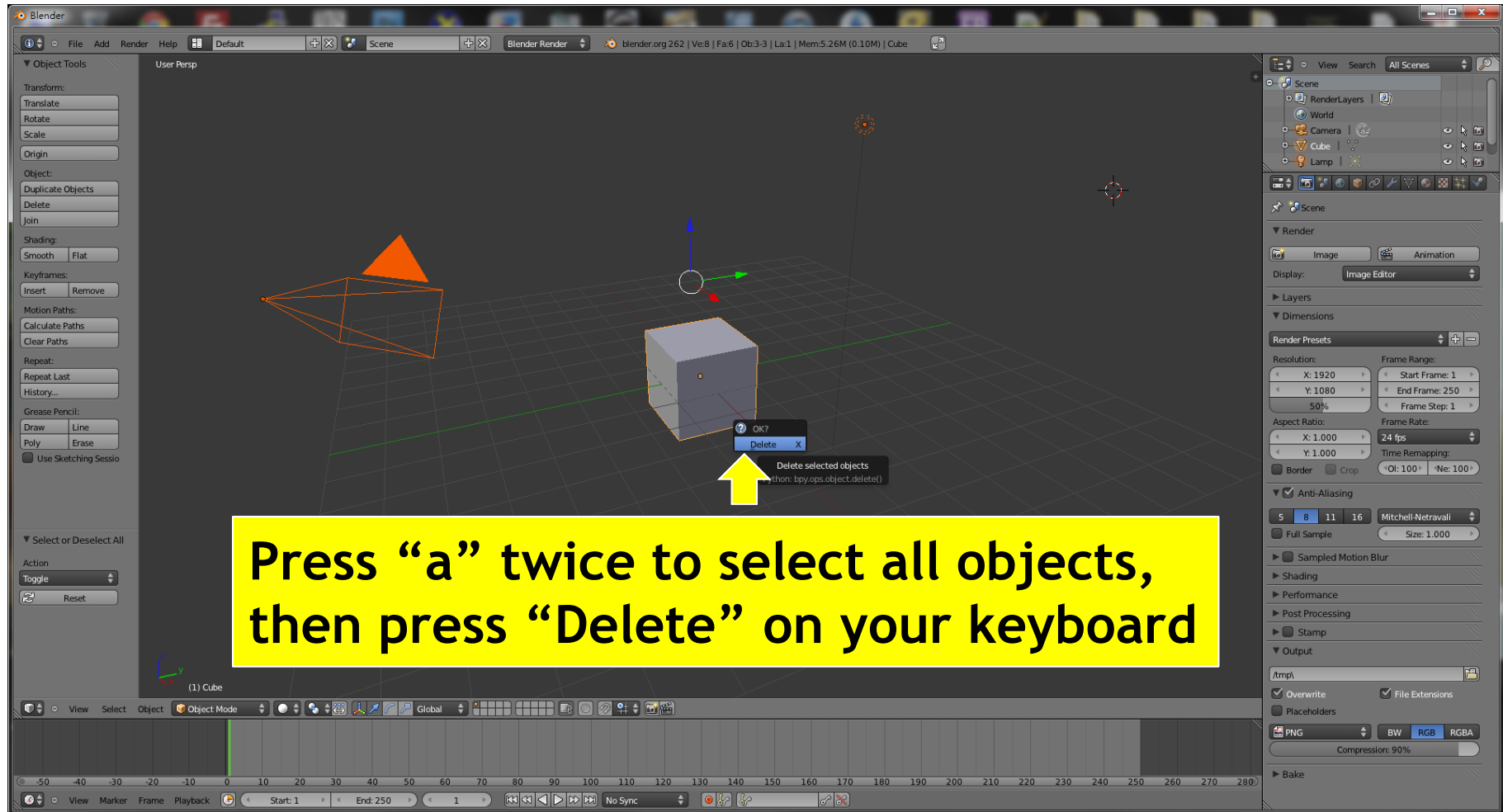
# Stage 3-1 ~ 3-2

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1. Open Blender
2. Delete default objects
3. Load Python Script
  - Change Window Type to “**Text Editor**”
  - Select Text → Open Text Block
  - Select the \*.py file (exported from Voodoo)
  - Click “**Run Script**”
4. Load Background Images
  - Change window type to “**3D View**”
  - Select View → Cameras → Set Active Object as Active Camera
  - Load background images
  - Set the parameters of background images

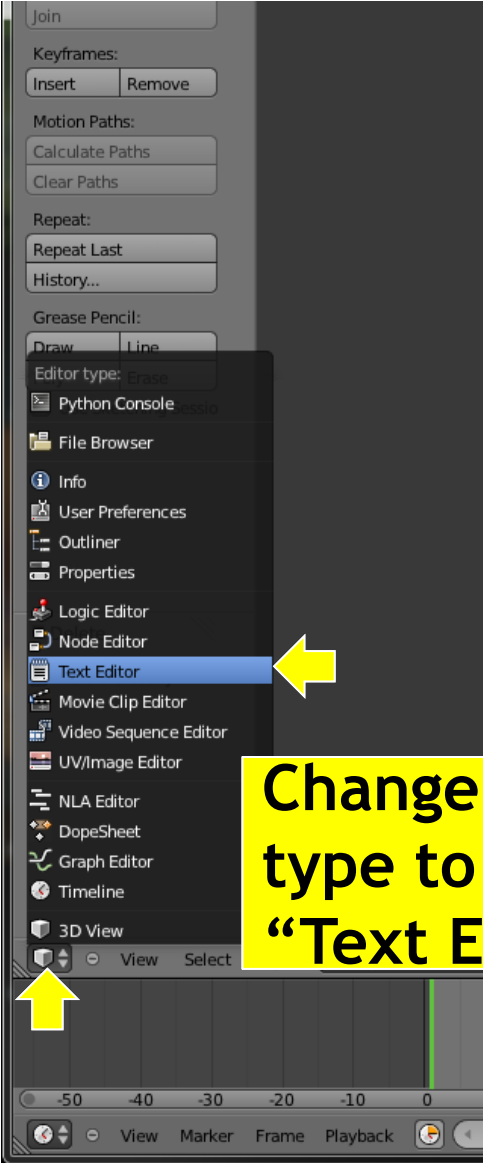


# Stage 3-1: Load Virtual Camera

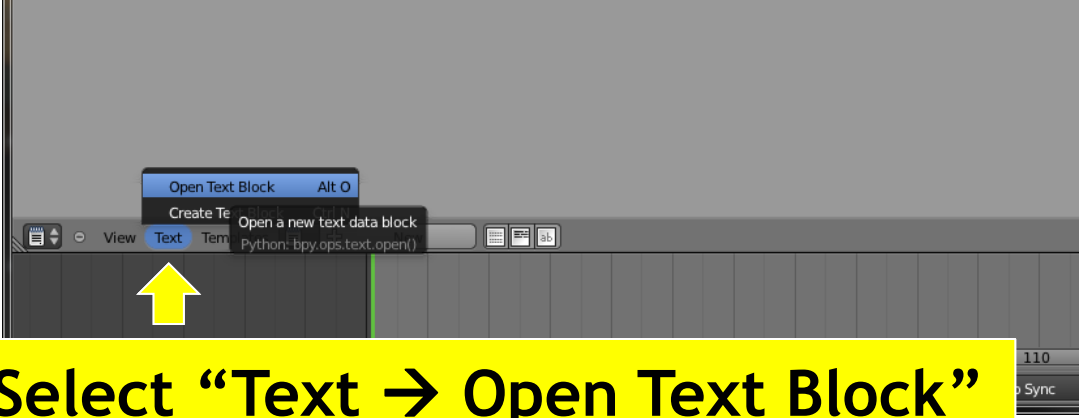


**Delete default objects**

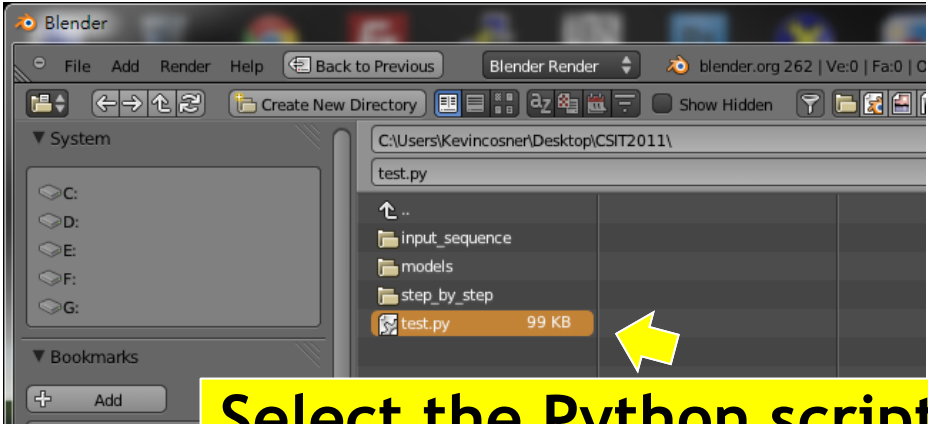
# Stage 3-1: Load Virtual Camera



**Change window type to "Text Editor"**



**Select "Text → Open Text Block"**



**Select the Python script exported by Voodoo**

**Load python script**

# Stage 3-1: Load Virtual Camera

The screenshot shows the Blender 2.5x interface with a Python script loaded in the Text Editor. The script defines a scene, a camera, and a mesh. The 'Run Script' button is highlighted with a yellow callout box labeled '1. Press "Run Script"'. The '3D Viewport' is highlighted with a yellow callout box labeled '2. Return to "3D View"'. The script content is as follows:

```

blender export (blender version 2.5x and higher)
# created by voodoo camera tracker - www.digitlab.uni-hannover.de
# Creation date: Thu May 31 00:38:03 2012
# USAGE: load this python script into Blender's text editor and execute the script with ALT-P
# use the 'voodoo_render_cam' for rendering your scene
# use the helper object 'voodoo_scene' to rotate, translate and scale the scene

import bpy
import mathutils
import string
import math
scene = bpy.context.scene
dummy = bpy.data.objects.new('voodoo_scene', None)
dummy.location = (0.0, 0.0, 0.0)
dummy.rotation_euler = (-3.141593/2, 0.0, 0.0)
dummy.scale = (0.2, 0.2, 0.2)
scene.objects.link(dummy)
data = bpy.data.cameras.new('voodoo_render_cam')
data.lens.unit = 'DEGREES'
vcam = bpy.data.objects.new('voodoo_render_cam', data)
vcam.location = (0.0, 0.0, 0.0)
vcam.rotation_euler = (0.0, 0.0, 0.0)
vcam.scale = (1.0, 1.0, 1.0)
data.lens = 35.0
data.shift.x = 0.0
data.shift.y = 0.0
data.dof.distance = 0.0
data.clip.start = 0.1
data.clip.end = 1000.0
data.draw.size = 0.5
scene.objects.link(vcam)
vcam.parent = dummy
data = bpy.data.meshes.new('voodoo_FP3D_cloud')
mesh = bpy.data.objects.new('voodoo_FP3D_cloud', data)
mesh.location = (0.0, 0.0, 0.0)
mesh.rotation_euler = (0.0, 0.0, 0.0)
mesh.scale = (1.0, 1.0, 1.0)
scene.objects.link(mesh)
mesh.parent = dummy

#Camera Parameters
scene.frame_current = 1
vcam.data.lens = 54.088324
vcam.matrix_world = (((0.999989, -0.000551, 0.004552, 0.000000), [-0.000416, -0.999563, -0.029551, 0.000000]), [0.004566, 0.029549, -0.999553, 0.000000]), [0.062943, -0.024483, -0.433771, 1.000000]))
vcam.keyframe.insert('location')
vcam.keyframe.insert('scale')
vcam.keyframe.insert('rotation_euler')
vcam.data.keyframe.insert('lens')

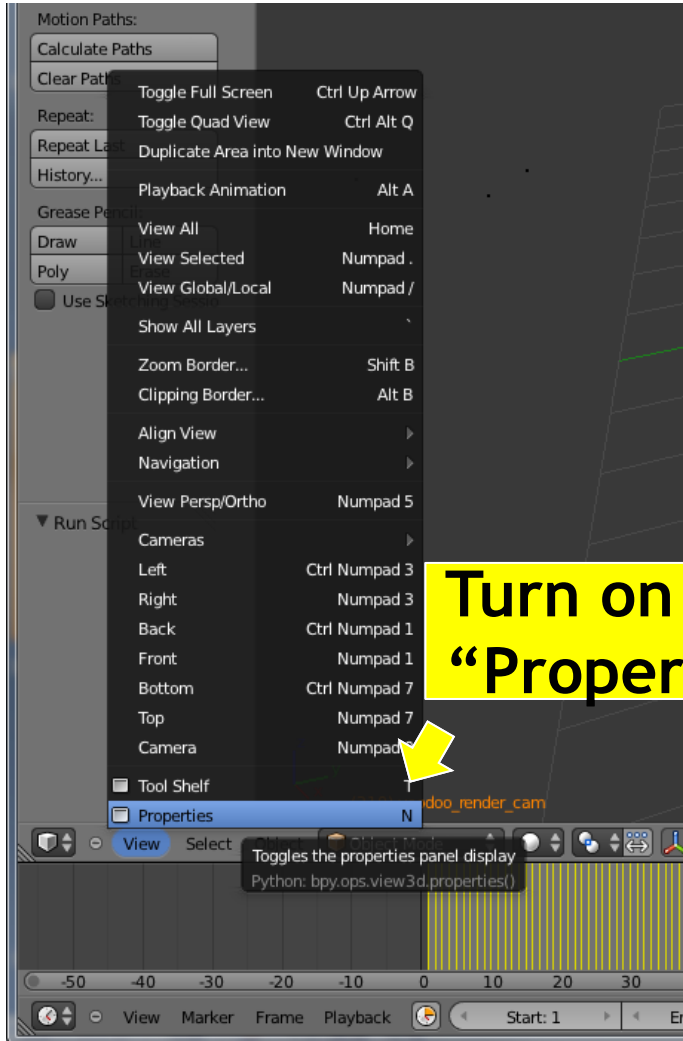
scene.frame_current = 2
vcam.data.lens = 54.088324
vcam.matrix_world = (((0.999988, -0.000251, 0.004864, 0.000000), [-0.000107, -0.999562, -0.029604, 0.000000]), [0.004870, 0.029603, -0.999550, 0.000000]), [0.064143, -0.024497, -0.438955, 1.000000]))
vcam.keyframe.insert('scale')
vcam.keyframe.insert('rotation_euler')
vcam.data.keyframe.insert('lens')

scene.frame_current = 4
vcam.data.lens = 54.088324
vcam.matrix_world = (((0.999990, -0.000268, 0.004483, 0.000000), [-0.000137, -0.999571, -0.029271, 0.000000]), [0.004483, 0.029271, -0.999559, 0.000000]), [0.061696, -0.025573, -0.429861, 1.000000]))

```

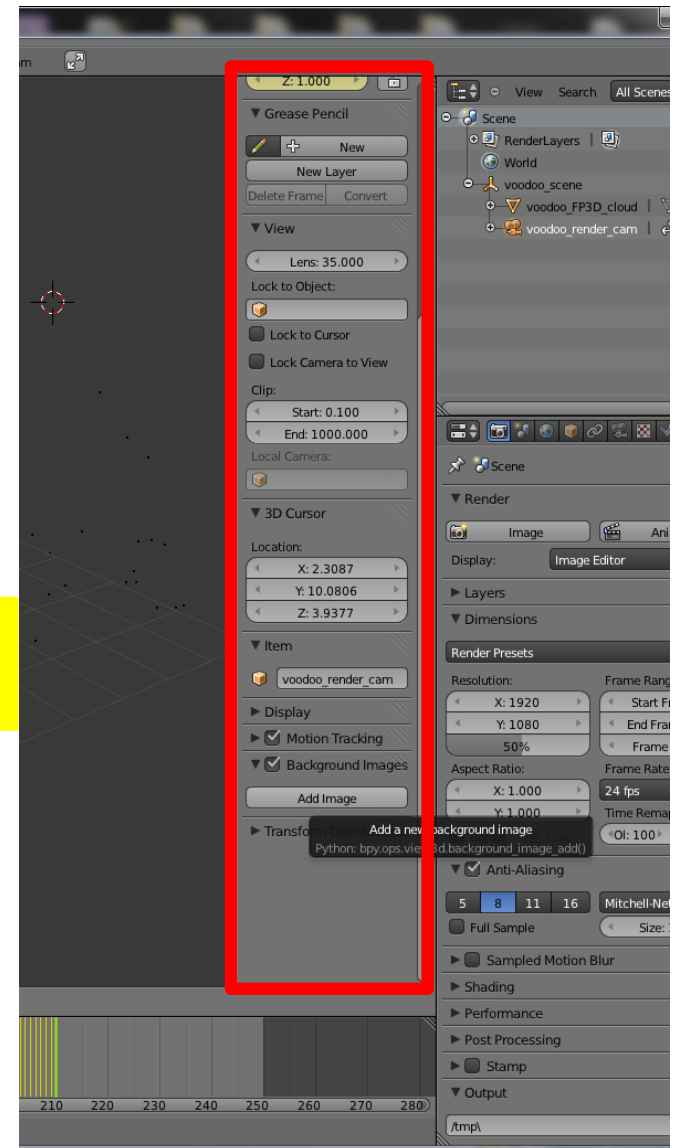
Run script

# Stage 3-2: Show Background Images

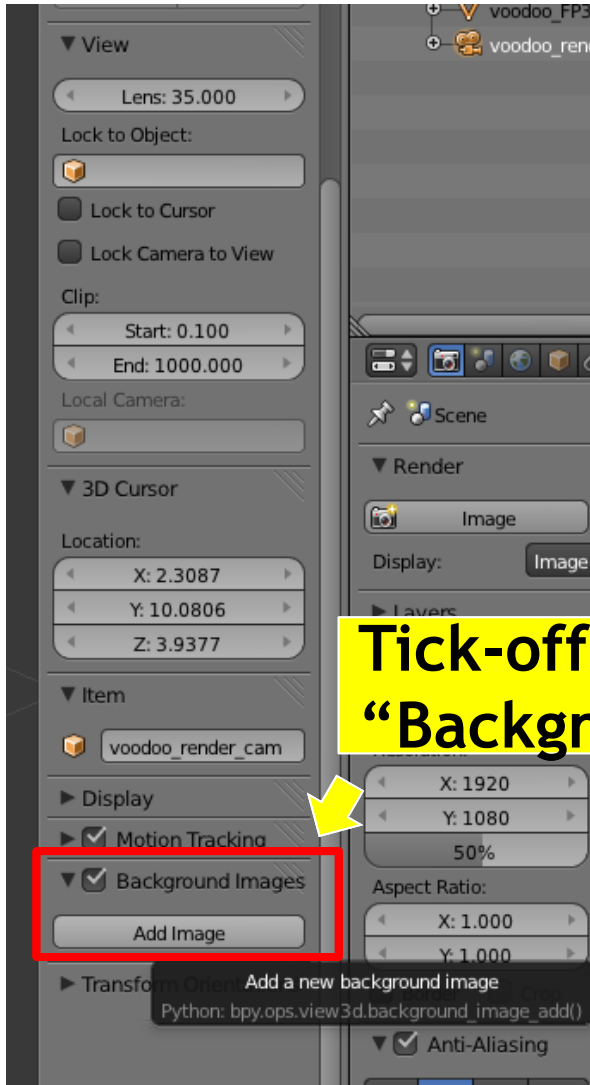


Turn on  
"Properties" Panel

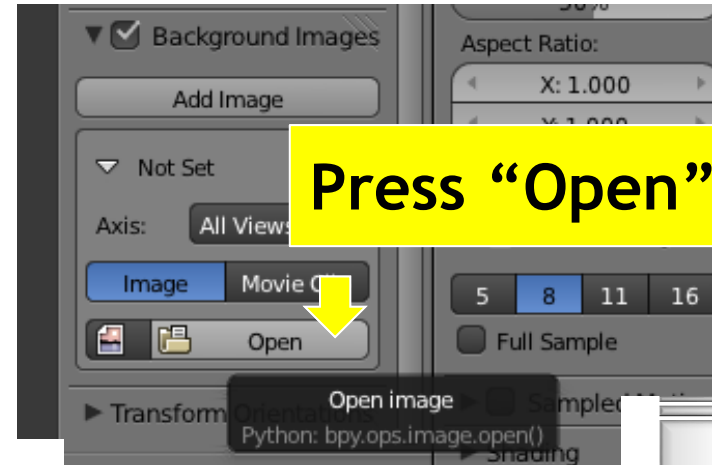
Show Property Panel



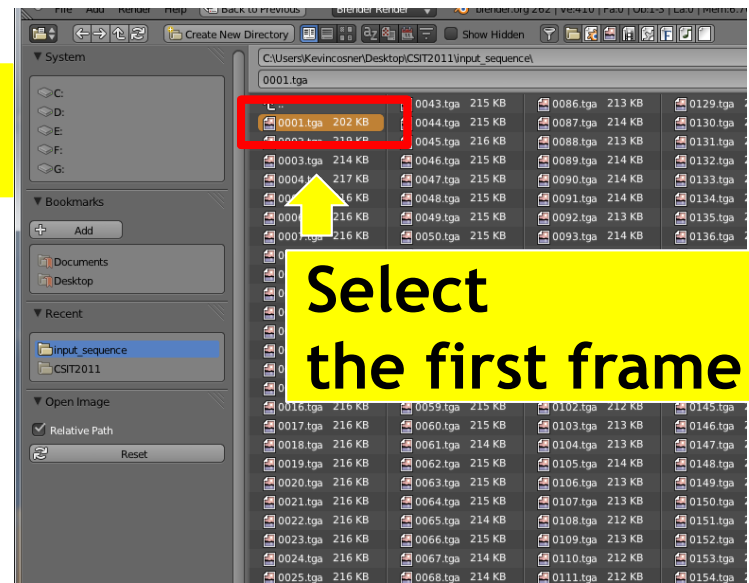
# Stage 3-2: Show Background Images



**Tick-off  
“Background Images”**

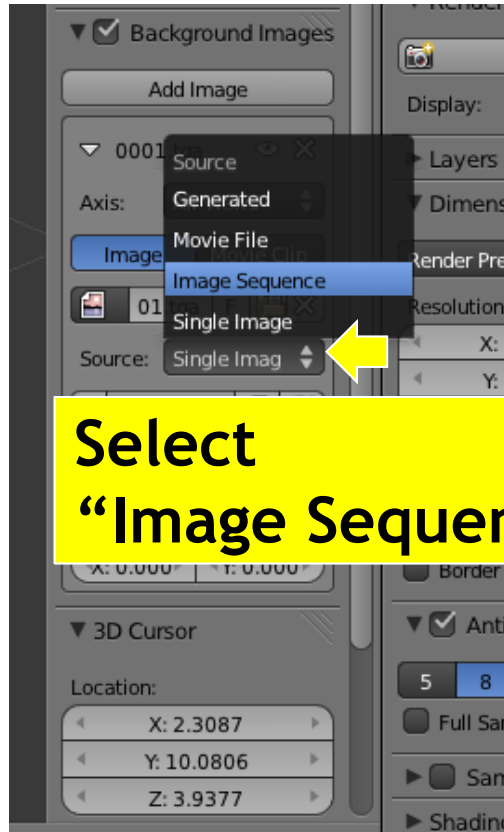


**Press “Open”**

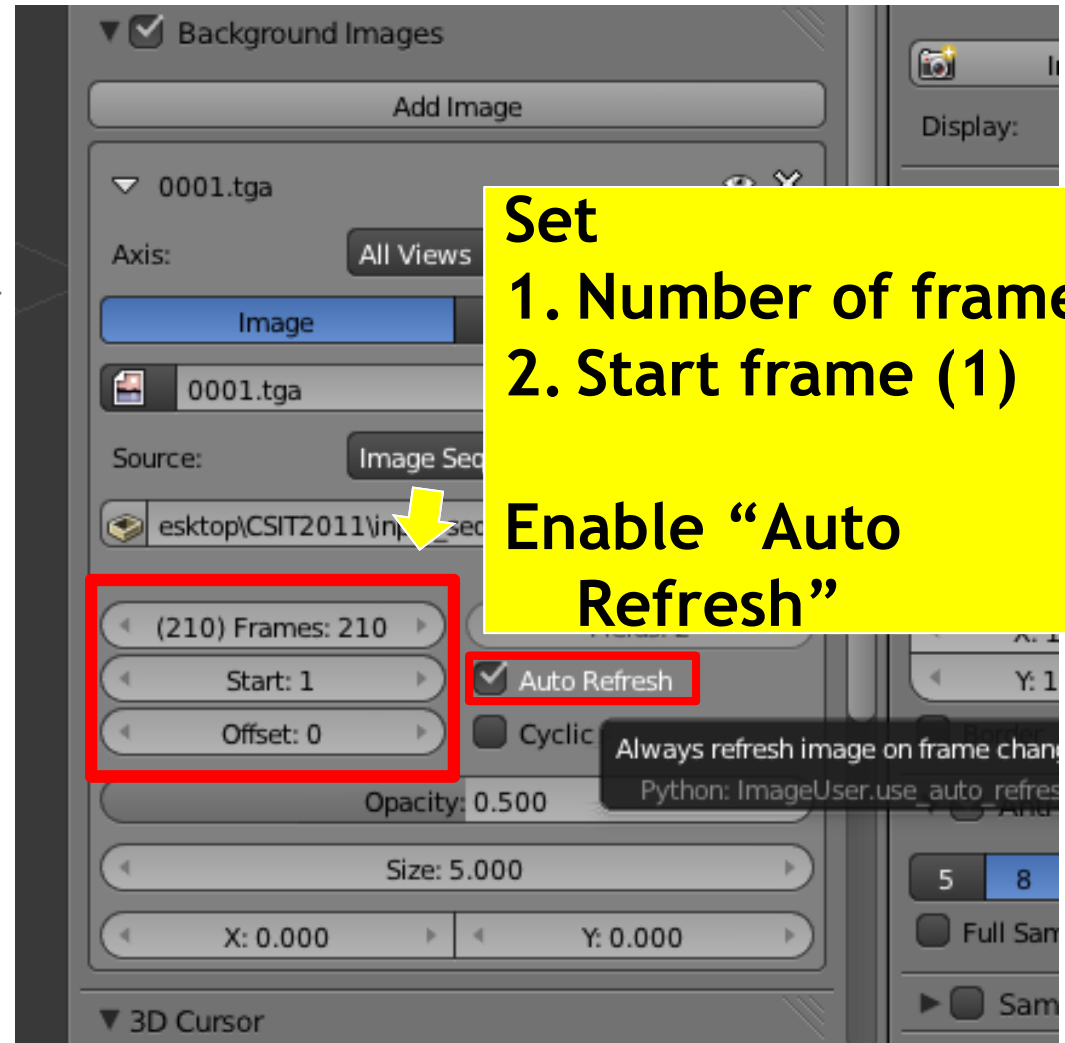


**Select  
the first frame**

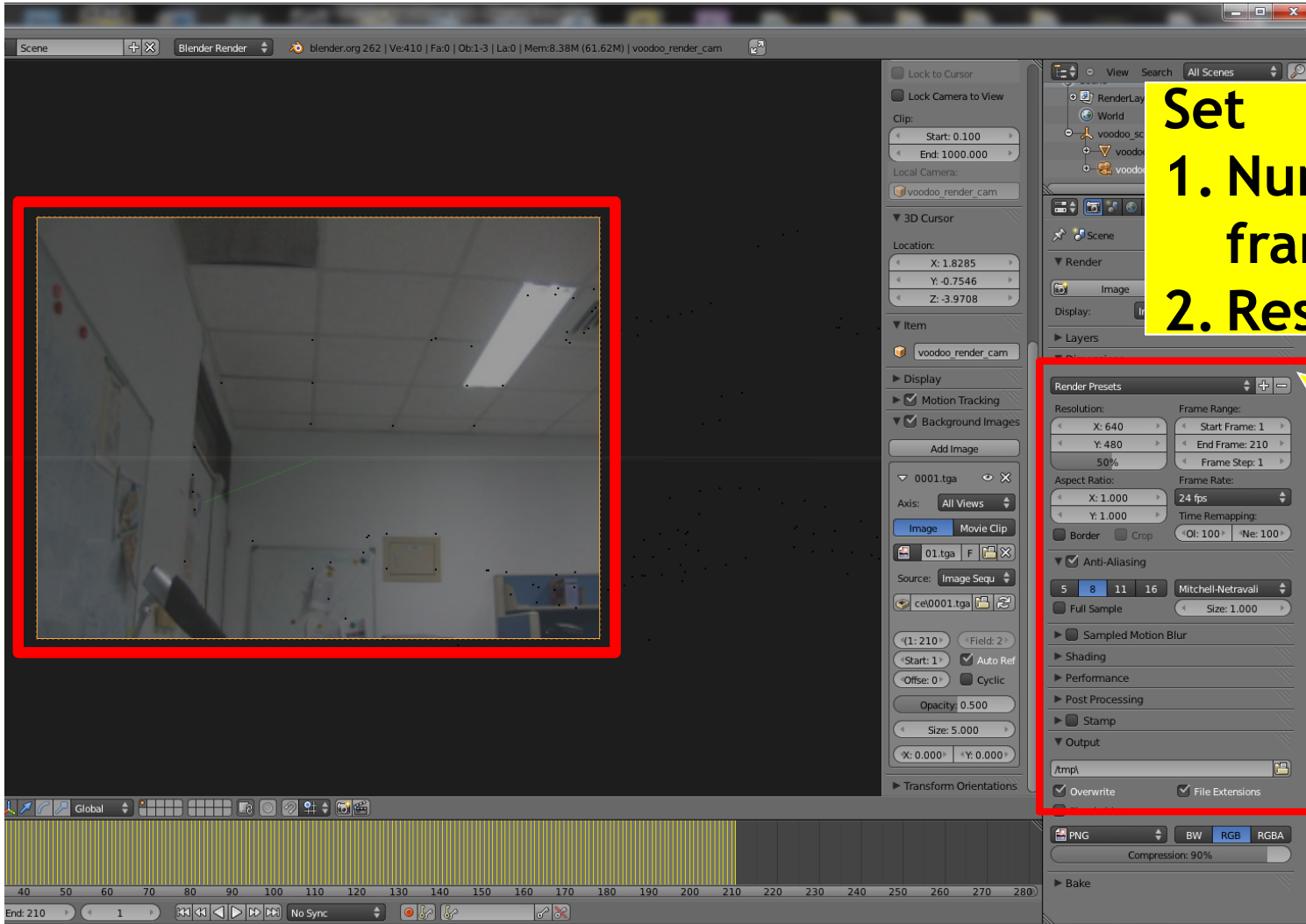
# Stage 3-2: Show Background Images



**Change  
background type**



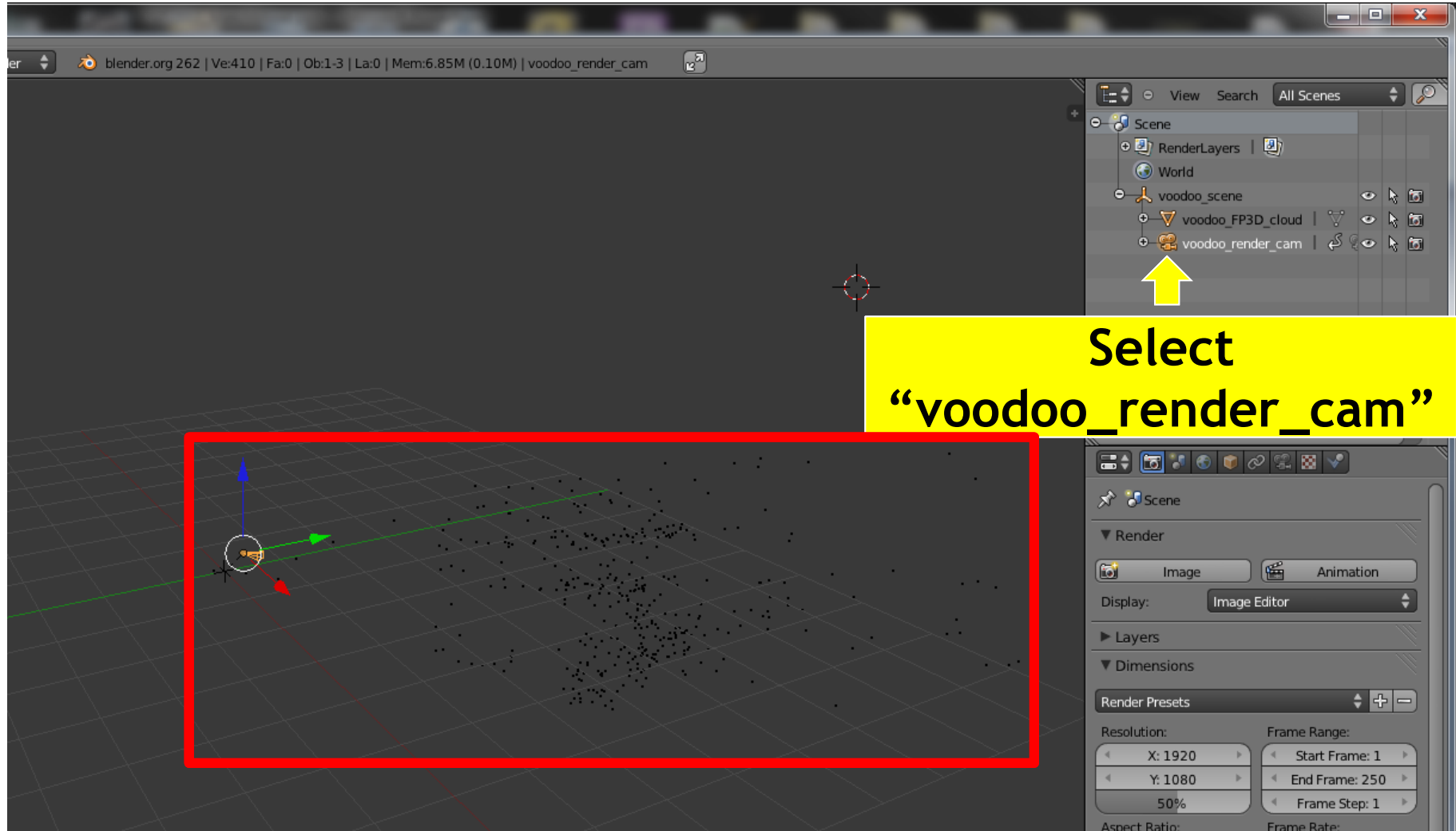
# Stage 3-2: Show Background Images



**Set**  
**1. Number of frames**  
**2. Resolution**

**Set resolution**

# Stage 3-2: Show Background Images

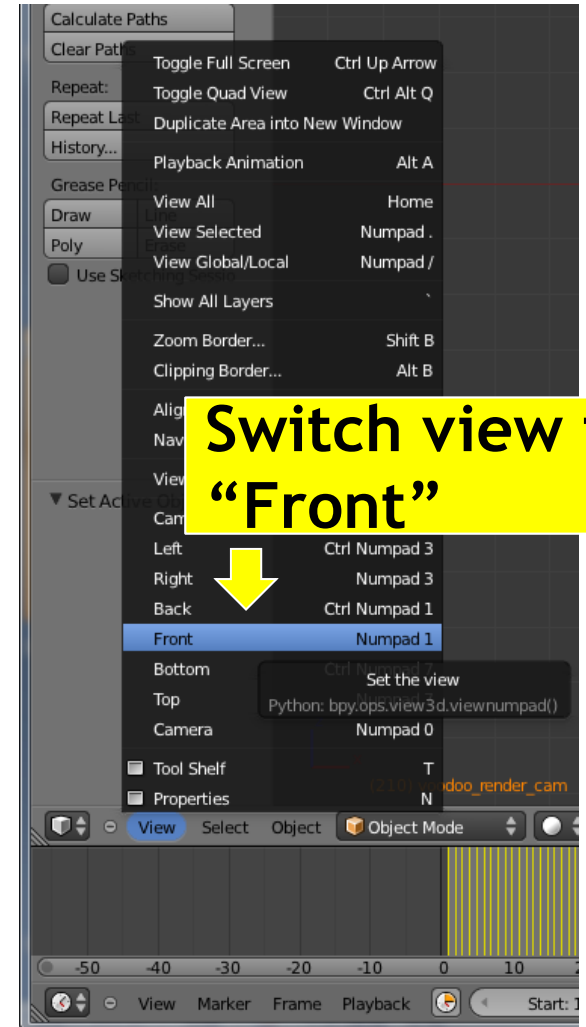
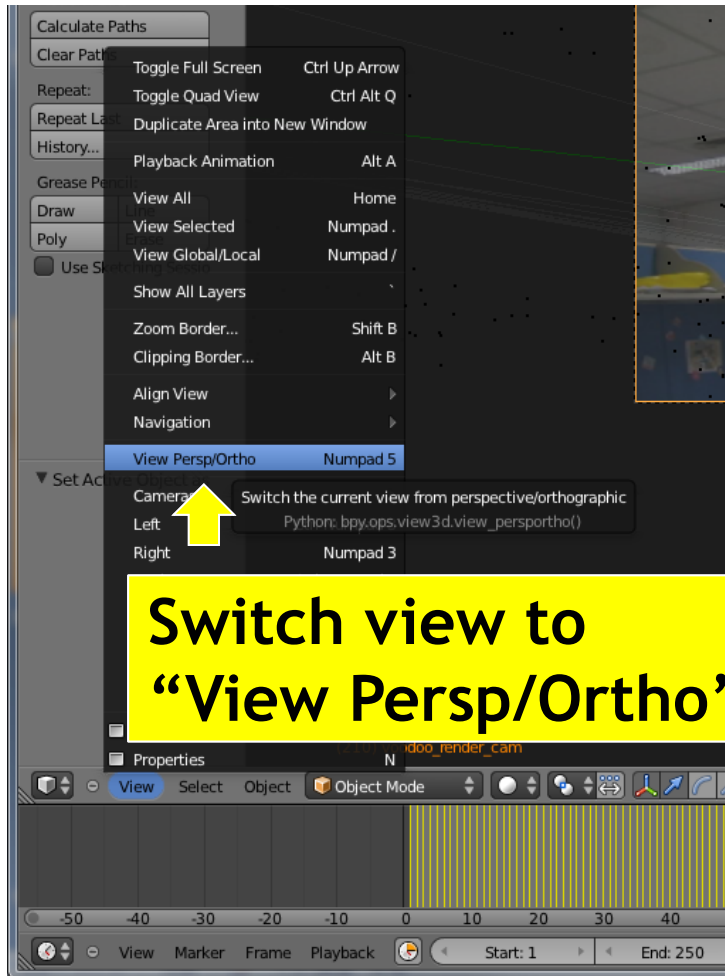


Select  
"voodoo\_render\_cam"

Select Voodoo camera

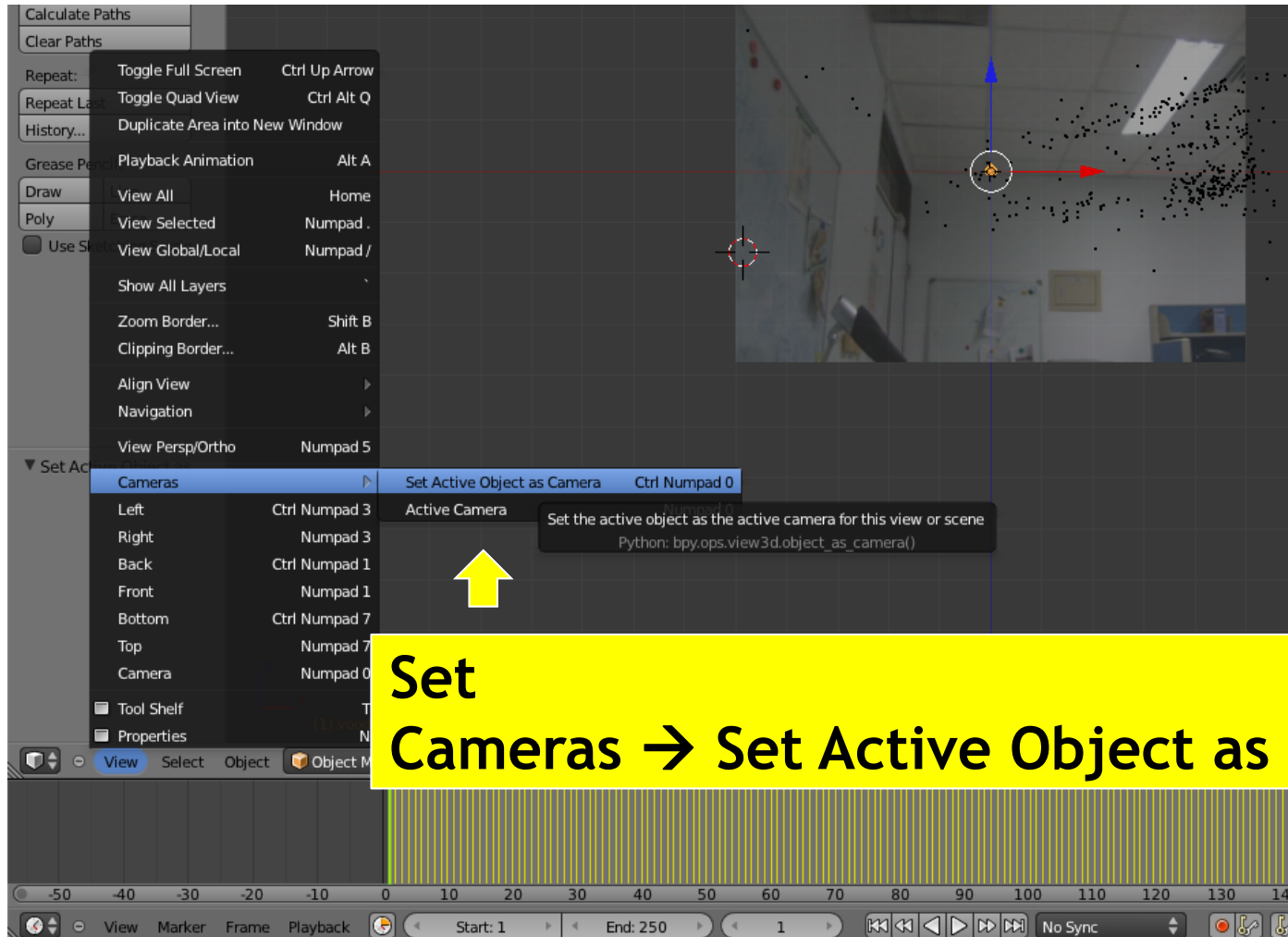


# Stage 3-2: Show Background Images



Set view

# Stage 3-2: Show Background Images



**Set  
Cameras → Set Active Object as Camera**

**Set active camera**

# Stage 3-2: Show Background Images

**Make sure "voodoo\_render\_cam" is selected**

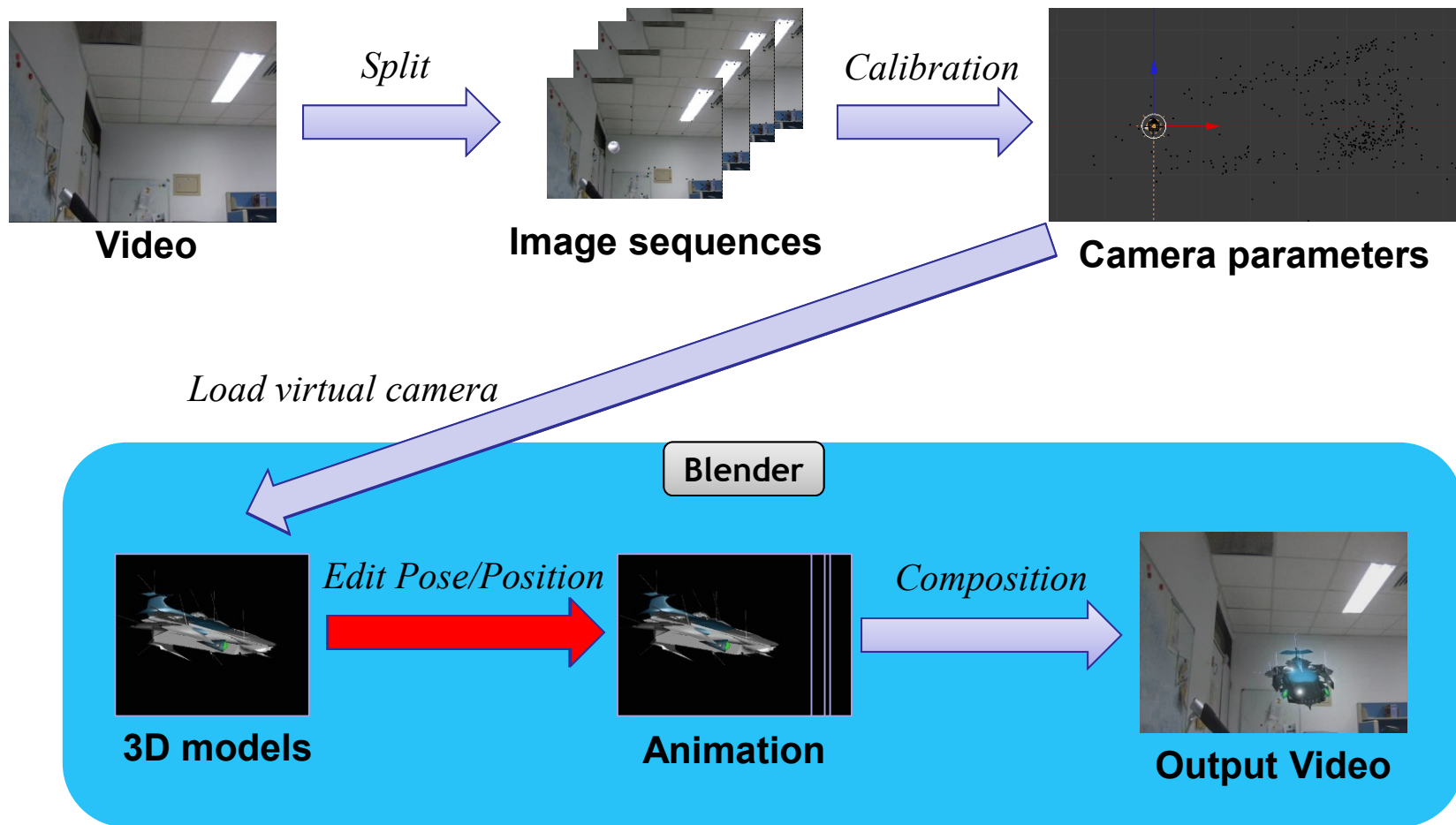
**You can drag here to see the camera motions**

**Check background**

The image shows the Blender 2.79 interface. The central 3D viewport displays a scene with a camera. A red box highlights the camera's motion path in the 3D space. Another red box highlights the 'voodoo\_render\_cam' object in the Outliner panel on the right. The Properties panel on the right shows the 'Background Images' section, where an image sequence is loaded. The Timeline at the bottom shows the current frame at 79. A yellow arrow points to the timeline area.

**Check background**

# Stage 3: Combine Video and 3D Model

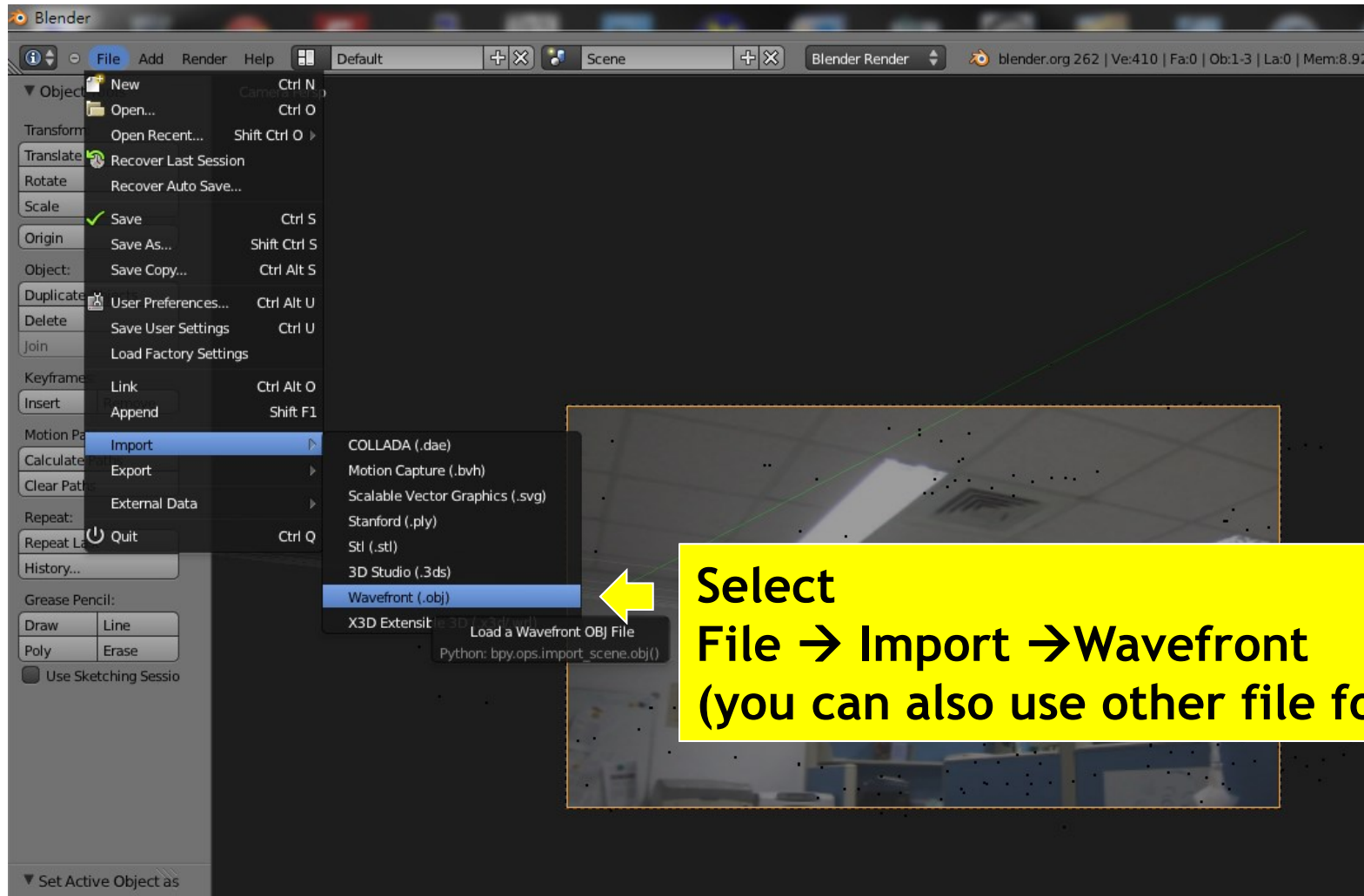


# Stage 3-3 ~ 3-4

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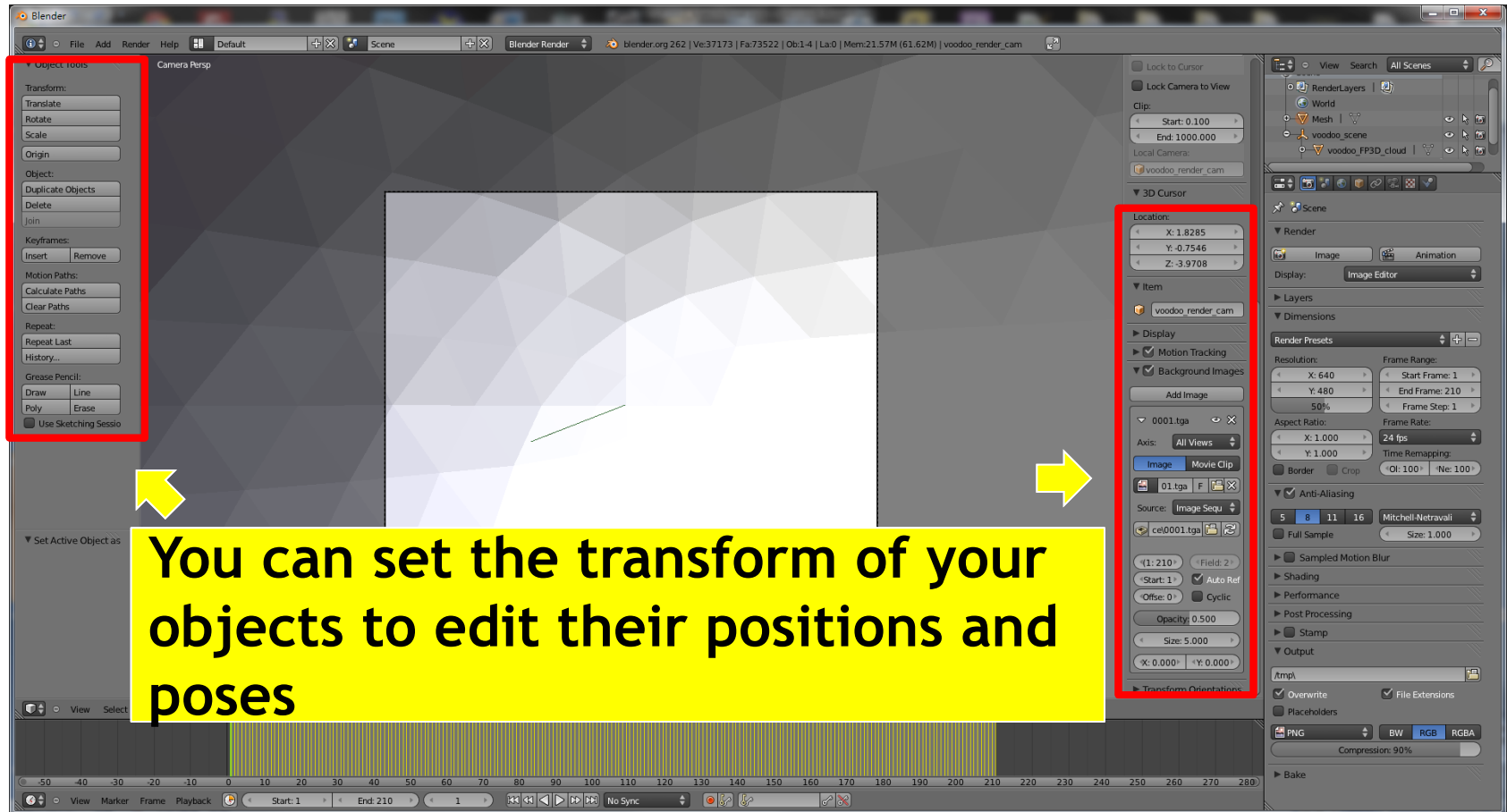
- Load models
  - File → Import → \*.obj
- Edit model poses/motions in the video
  - Object → Animation → Insert keyframe (or press “I”)
  - Fine tuning

# Stage 3-3: Load 3D Model



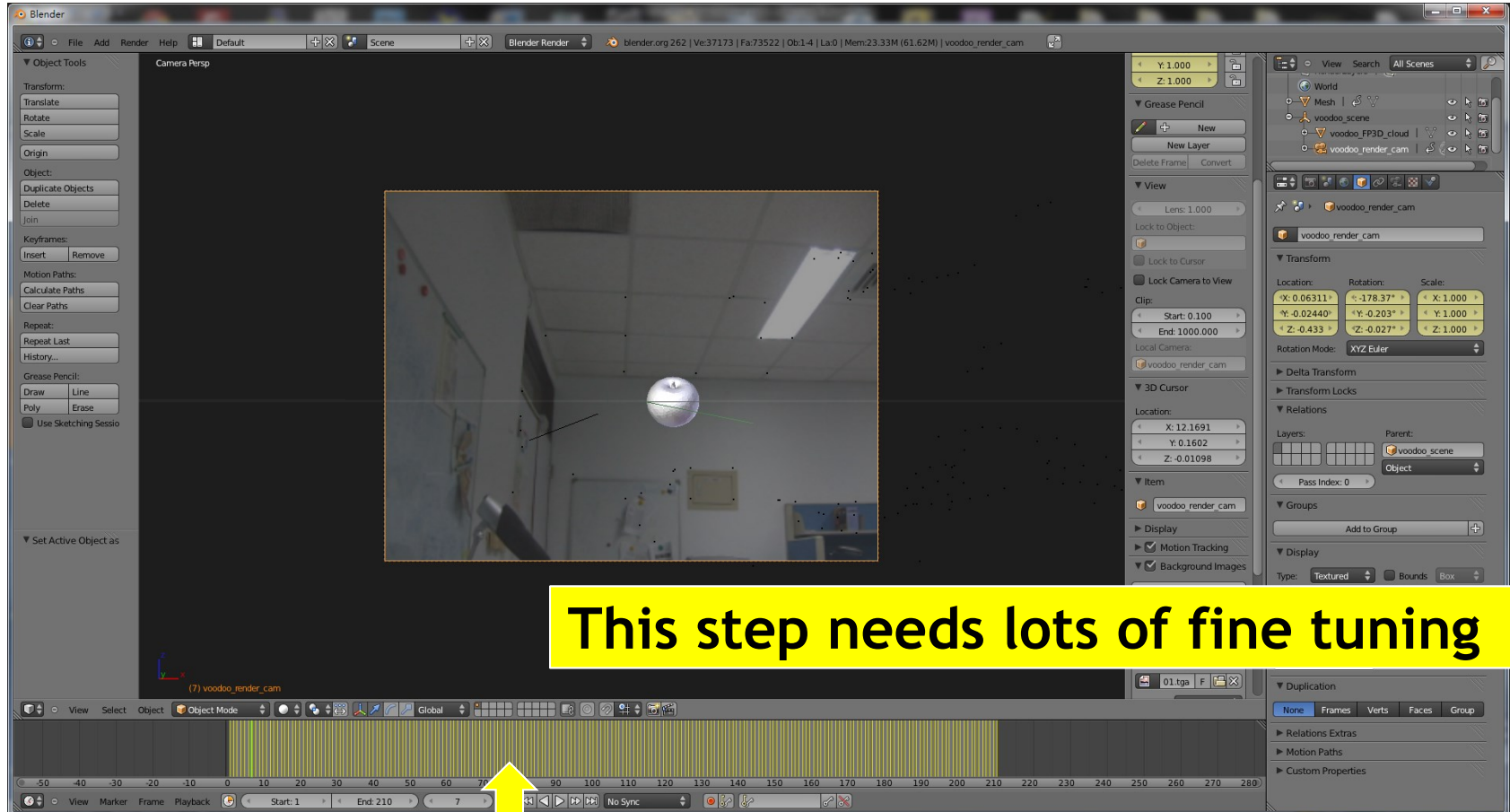
**Load models**

# Stage 3-3: Load 3D Model



**Set poses / positions for models**

# Stage 3-3: Load 3D Model

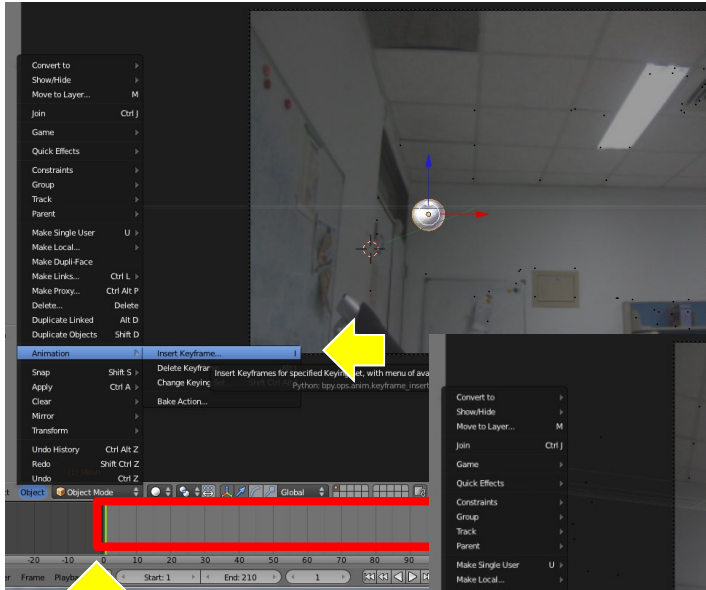


**Fine tuning** You can drag here to see whether your tuning is correct or not (is the object located at the correct position?)

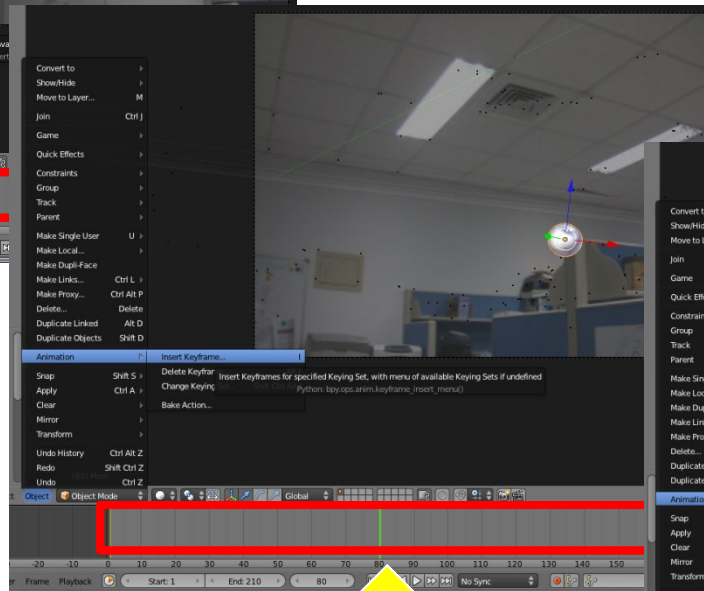


# Stage 3-4: Set Model Animation

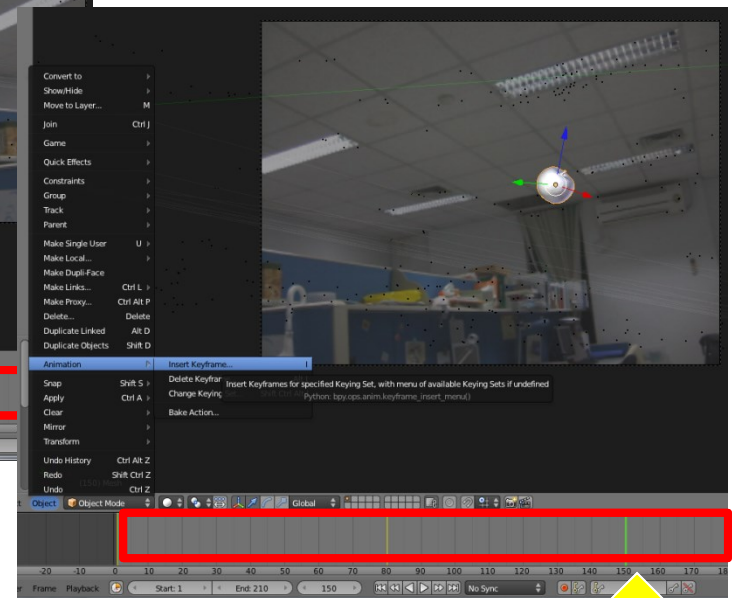
1. Select the frame that you want to insert a key frame
2. Select Object → Animation → Insert Keyframe..
3. Repeat multiple times



Frame 1



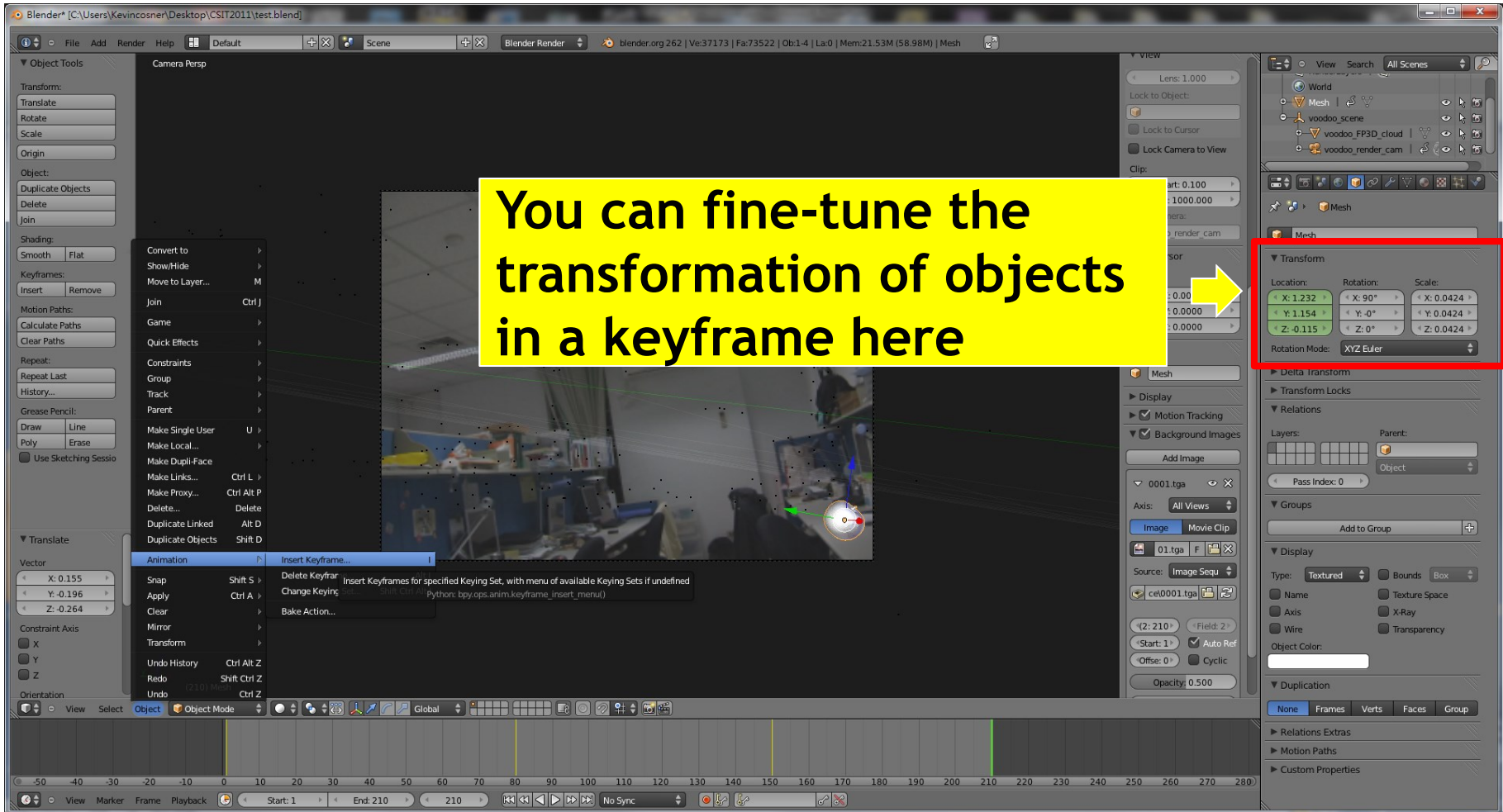
Frame 80



Frame 150

Set keyframes

# Stage 3-4: Set Model Animation



Fine tuning

# Stage 3: Combine Video and 3D Model



Video

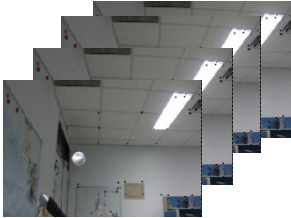
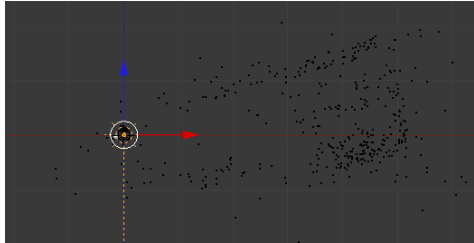
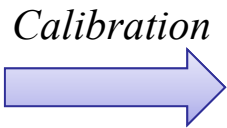
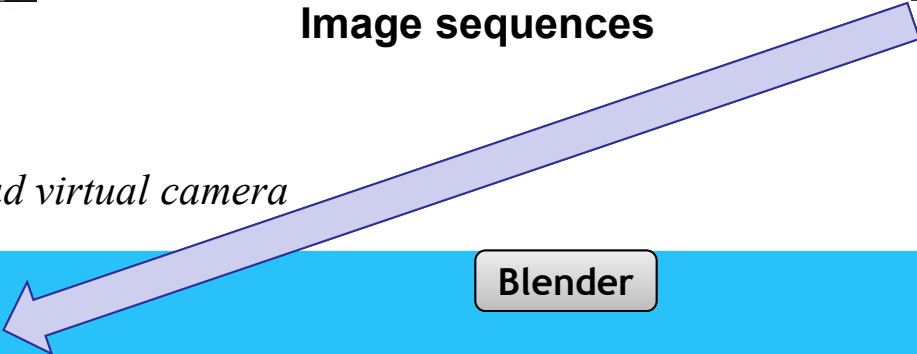


Image sequences

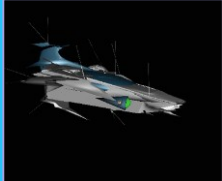


Camera parameters

*Load virtual camera*



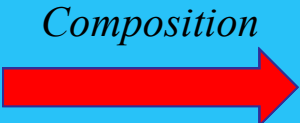
Blender



3D models



Animation



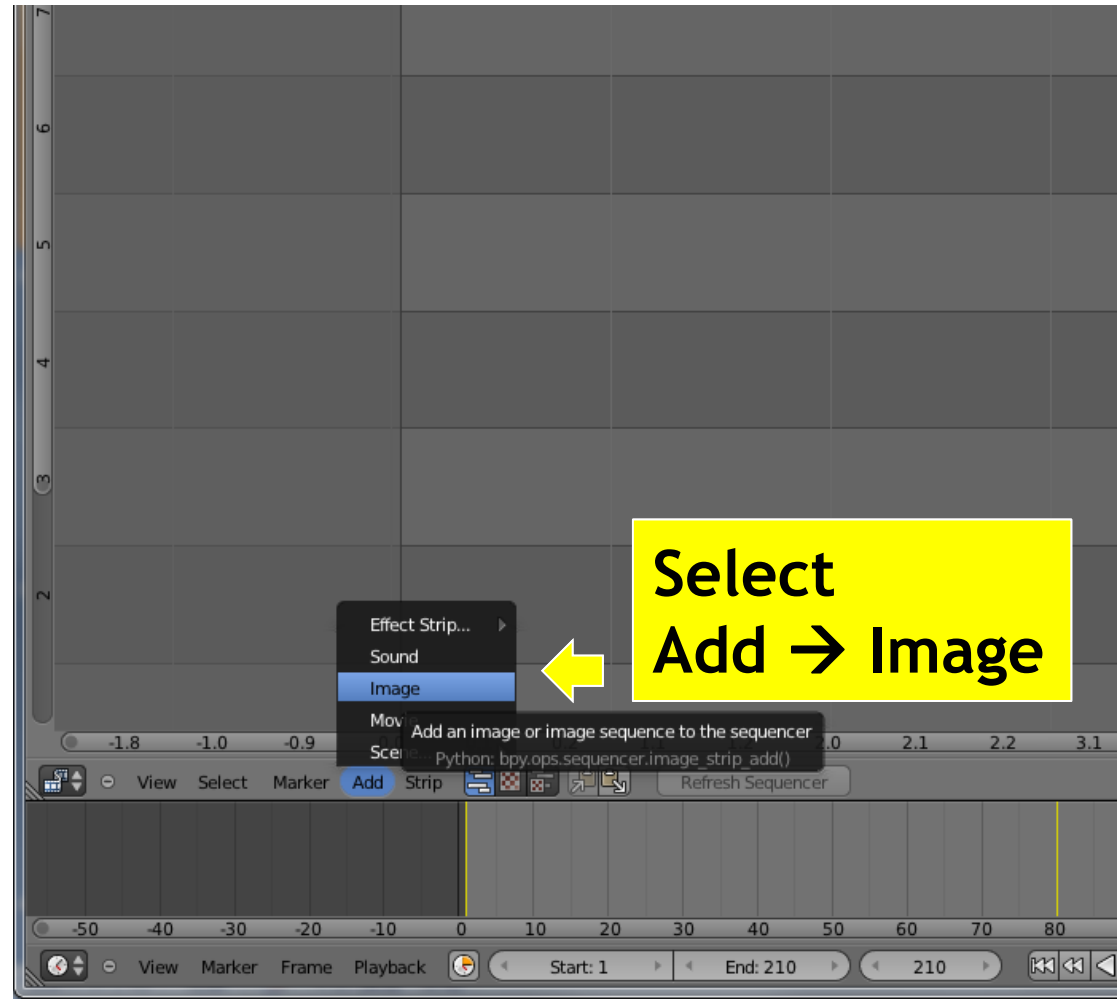
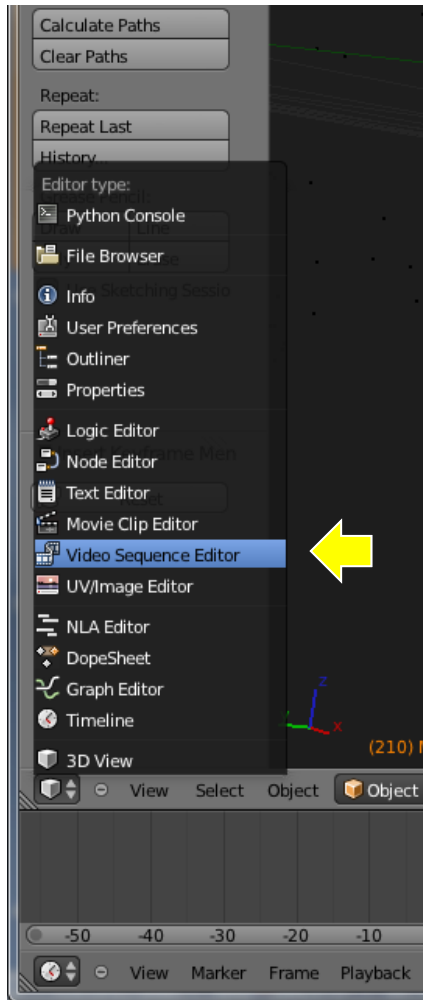
Output Video

# Stage 3-5

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- Add image sequence
  - Change window type to “Video Sequence Editor”
  - Select Add → Images and select all images
  - Drag the strip to the “1<sup>st</sup> Frame” in Layer 1
- Add scene
  - Select Add → Scene
  - Drag the scene strip to the “1<sup>st</sup> Frame” in Layer 2
  - Change scene property to “Alpha Over”
  - Set parameters of output video
- Click “Animation”

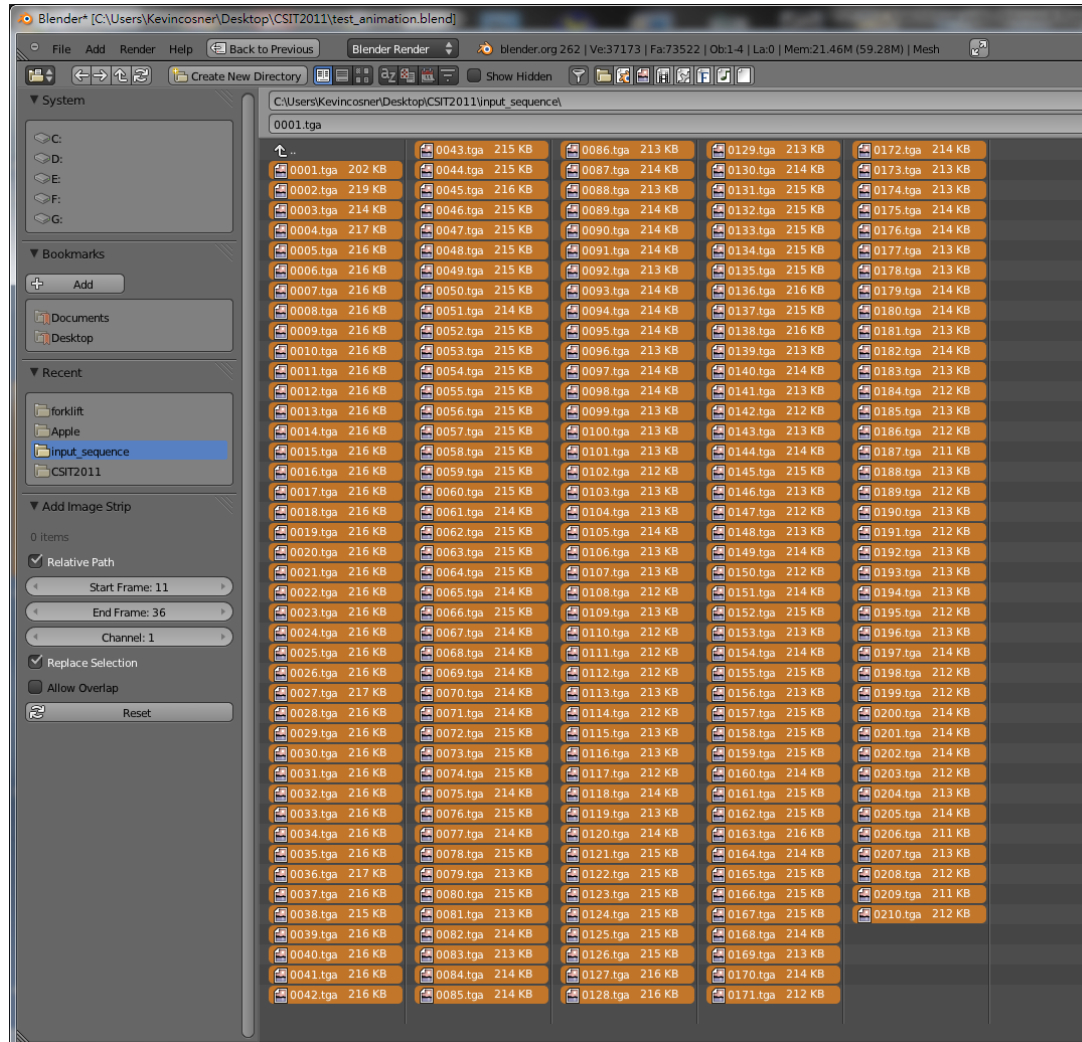
# Stage 3-5: Render Video



**Set to Video Sequence Editor**

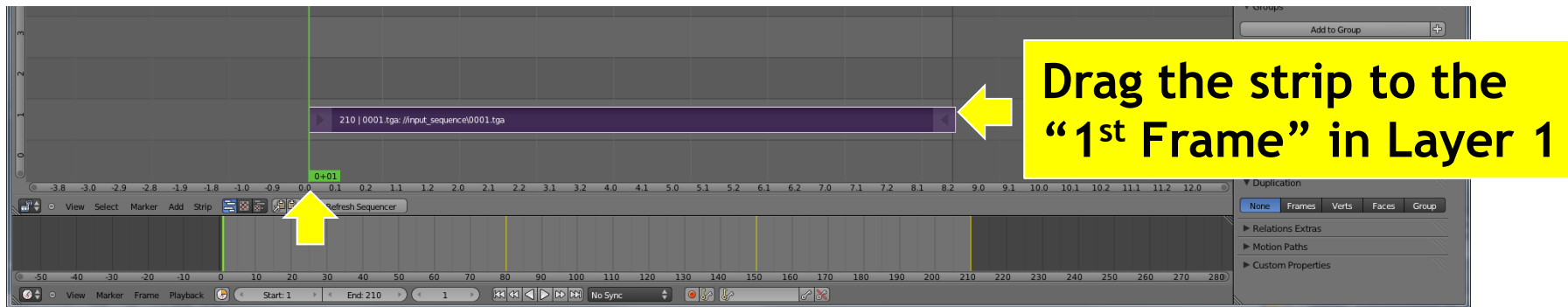
**Add image sequence (Video Channel)**

# Stage 3-5: Render Video



**This time, select all frames (Press A)**

# Stage 3-5: Render Video

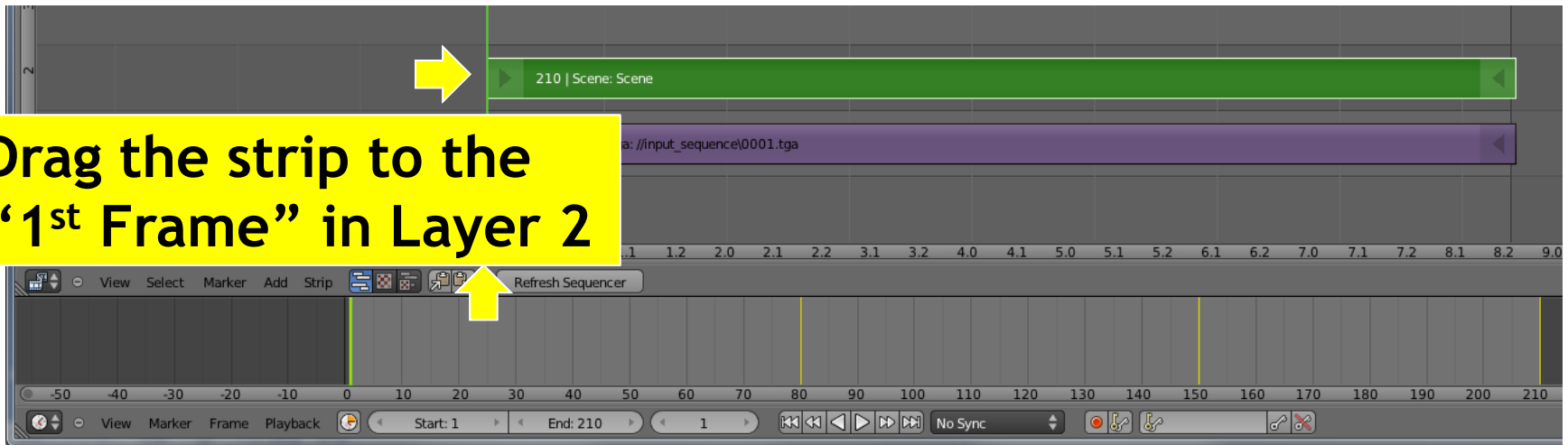


**Edit Video Layer (Right click and drag, left click to set)**

# Stage 3-5: Render Video



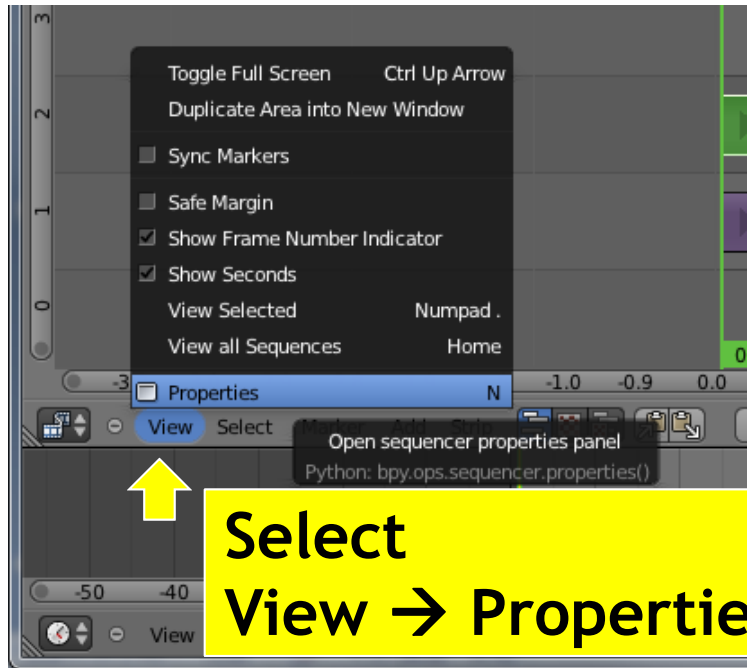
**Add scene layer**



**Edit scene layer (Right click and drag, left click to set)**



# Stage 3-5: Render Video



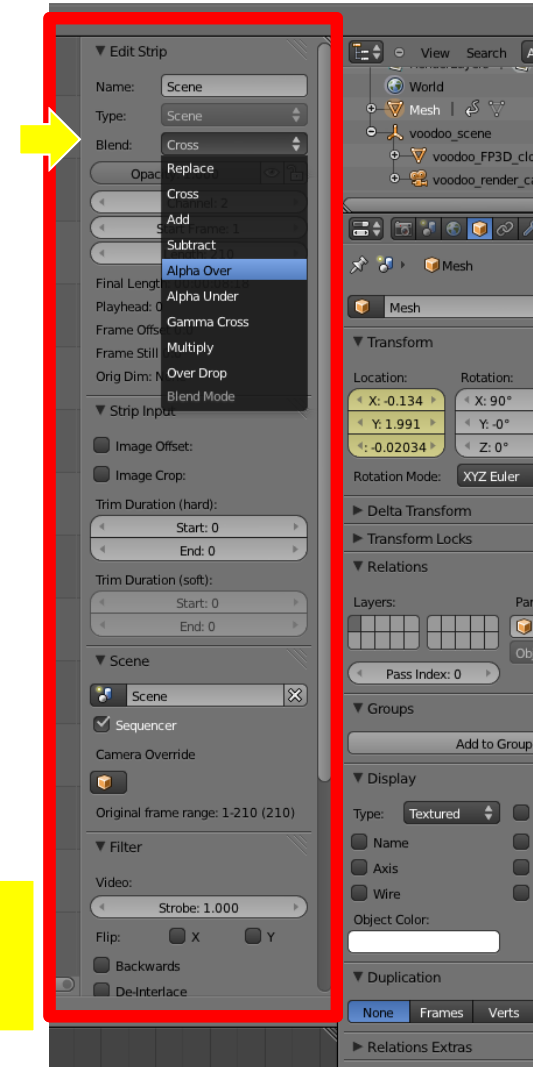
Select  
View → Properties

Show Properties Panel

You will see the Properties Panel



Select  
Blend → Alpha Over



Set Blend Type

# Stage 3-5: Render Video

Frame Offset 0:0  
Frame Still 0:0  
Orig Dim: None

▼ Strip Input

Image Offset:  
 Image Crop:

Trim Duration (hard):  
Start: 0  
End: 0

Trim Duration (soft):  
Start: 0  
End: 0

▼ Scene

Scene

Sequencer

Camera Override

Original frame range: 1-210 (210)

▼ Filter

Video:  
Strobe: 1.000

Flip:  X  Y

Backwards  
 De-Interlace

Colors:  
Saturation: 1.000  
Multiply: 1.000

Premultiply  
 Convert Float  
 Use Color Balance

▼ Proxy / Timecode

Proxy Custom Directory  
 Proxy Custom File

Frame Still 0:0  
Orig Dim: None

▼ Strip Input

Image Offset:  
 Image Crop:

Trim Duration (hard):  
Start: 0  
End: 0

Trim Duration (soft):  
Start: 0  
End: 0

▼ Scene

Scene

Sequencer

Camera Override

voodoo\_render\_cam

▼ Filter

Video:  
Strobe: 1.000

Flip:  X  Y

Backwards  
 De-Interlace

Colors:  
Saturation: 1.000  
Multiply: 1.000

Premultiply  
 Convert Float  
 Use Color Balance

▼ Proxy / Timecode

Proxy Custom Directory  
 Proxy Custom File

World  
Mesh | voodoo\_scene  
voodoo\_FP3D\_cloud | voodoo\_render\_cam

Mesh

▼ Transform

Location: X: -0.134 Y: 1.991 Z: -0.02034  
Rotation: X: 90° Y: -0° Z: 0°  
Scale: X: 0.0424 Y: 0.0424 Z: 0.0424

Rotation Mode: XYZ Euler

► Delta Transform  
► Transform Locks

▼ Relations

Layers: Parent: Object

Pass Index: 0

▼ Groups  
Add to Group

▼ Display

Type: Textured  
Bounds: Box  
 Name  
 Axis  
 Wire  
 Texture Space  
 X-Ray  
 Transparency

Object Color:

▼ Duplication

10.2 11.2

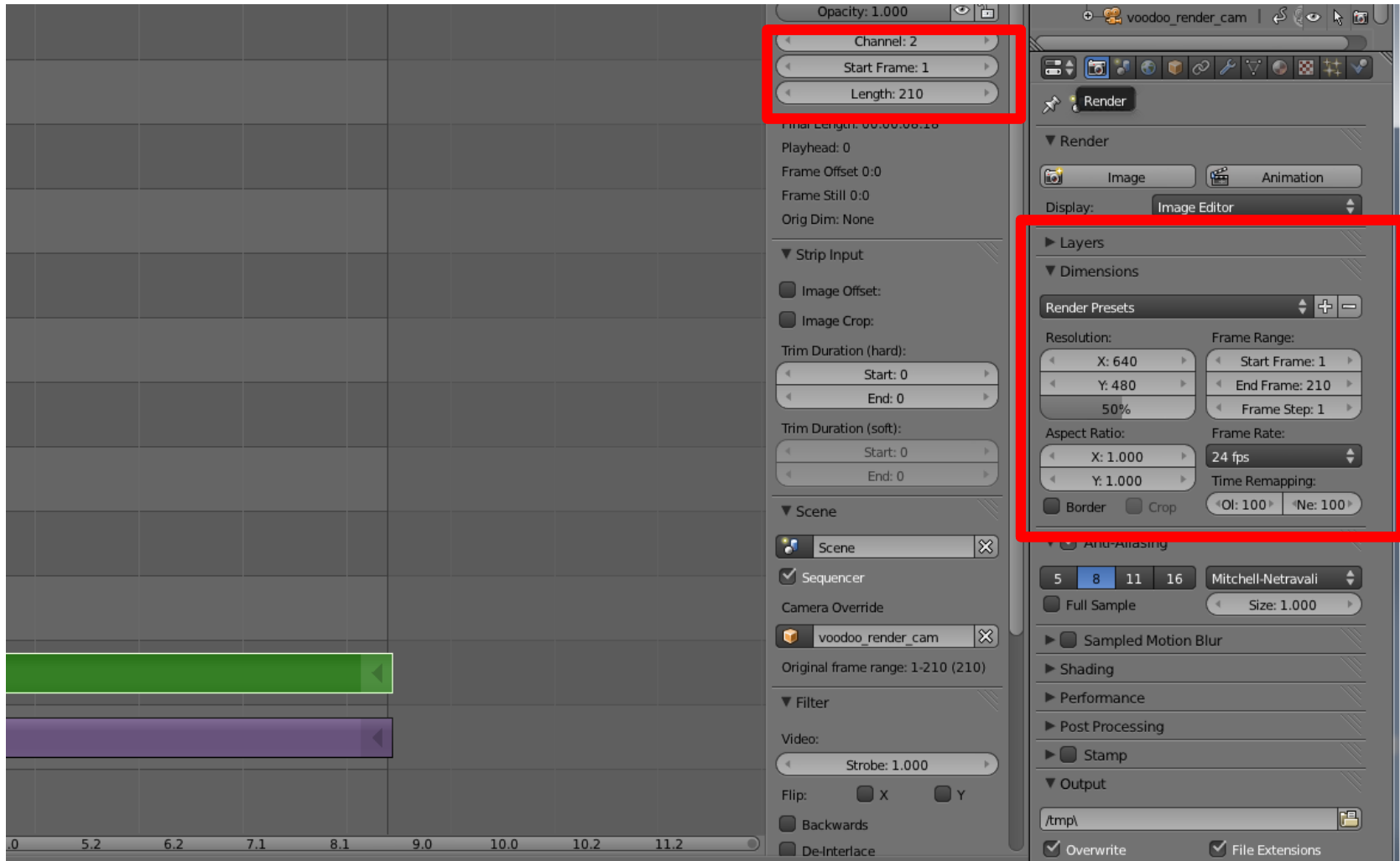
**Set scene camera to "voodoo\_render\_cam"**

**Enable!**

**Select Premultiply**

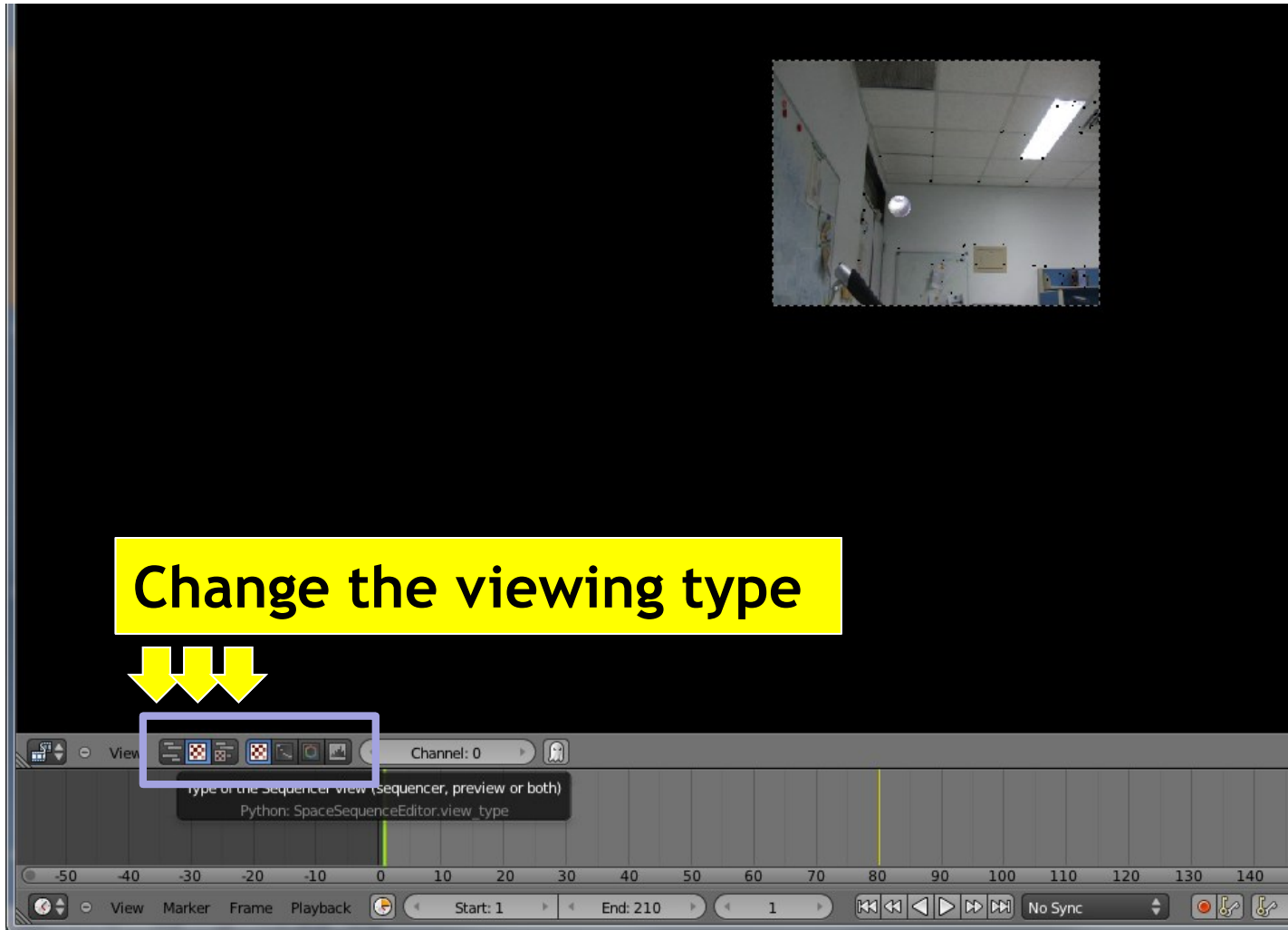
**Set scene camera**

# Stage 3-5: Render Video



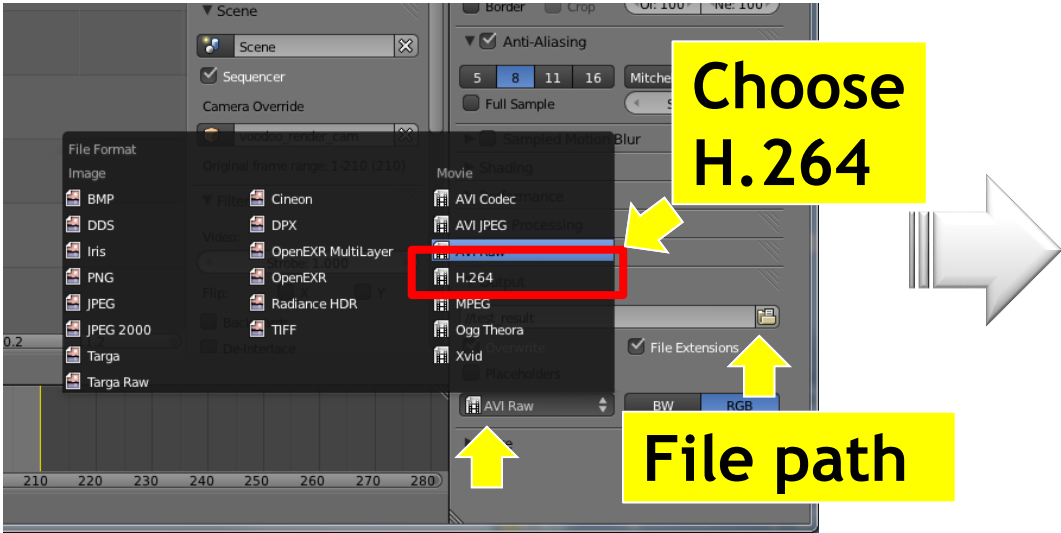
**Check output setting again!**

# Stage 3-5: Render Video

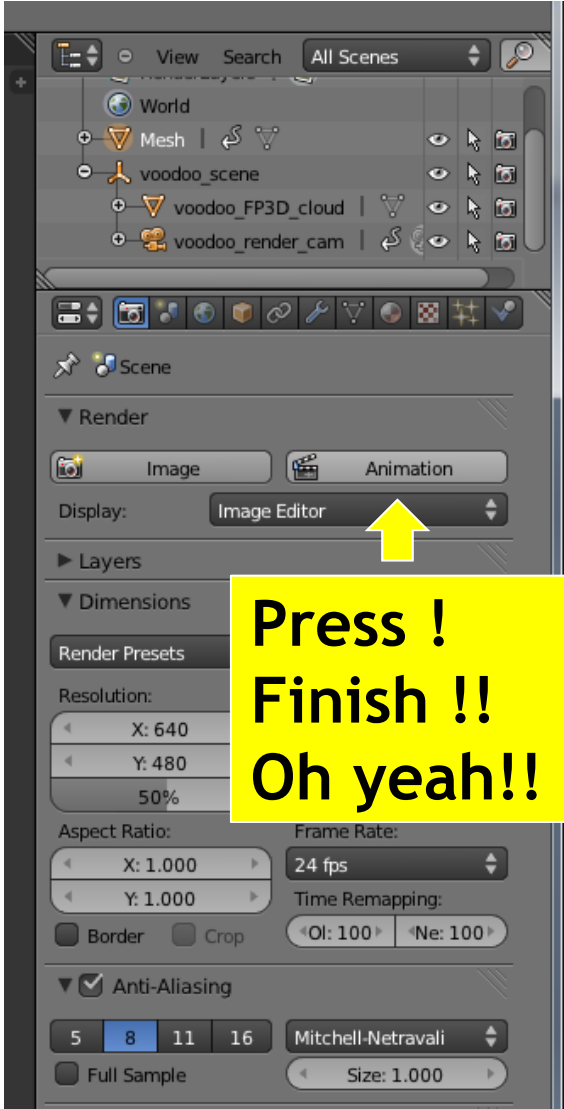


**Preview your video**

# Stage 3-5: Render Video



Select output format



Final Output

# Demo

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- <https://www.youtube.com/watch?v=DzTiVhdxJk0>
- <https://www.youtube.com/watch?v=QU4pPnsqbeM>
- <https://www.youtube.com/watch?v=1f3fMV3v7Xg>
  
- <https://www.youtube.com/watch?v=B8LN9nMM3Wg>
- <https://www.youtube.com/watch?v=BM5EmTMjFy0>
  
- More examples:
  - <http://ntuvfx.csie.org/vfx/2015/>
  - <http://192.168.1.110/vfx/2015/>

# Submission

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- You need to submit:
  1. **Artifact video:** final video with CGI
  2. **Raw video:** video without CGI
  3. **Report** in html/pdf format
- Upload a compressed file (including raw video and report) and your artifact to the submission website.
  - [http://ntuvfx.csie.org/vfx/2015/proj3\\_submit.php](http://ntuvfx.csie.org/vfx/2015/proj3_submit.php)
  - [http://192.168.1.110/vfx/2015/proj3\\_submit.php](http://192.168.1.110/vfx/2015/proj3_submit.php)

# Grading Criterion

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- Camera motion
- Model motion: ex. moving on the ground vs. flying
- Video completeness: ex. story
- Creativity
- Bonus: voting



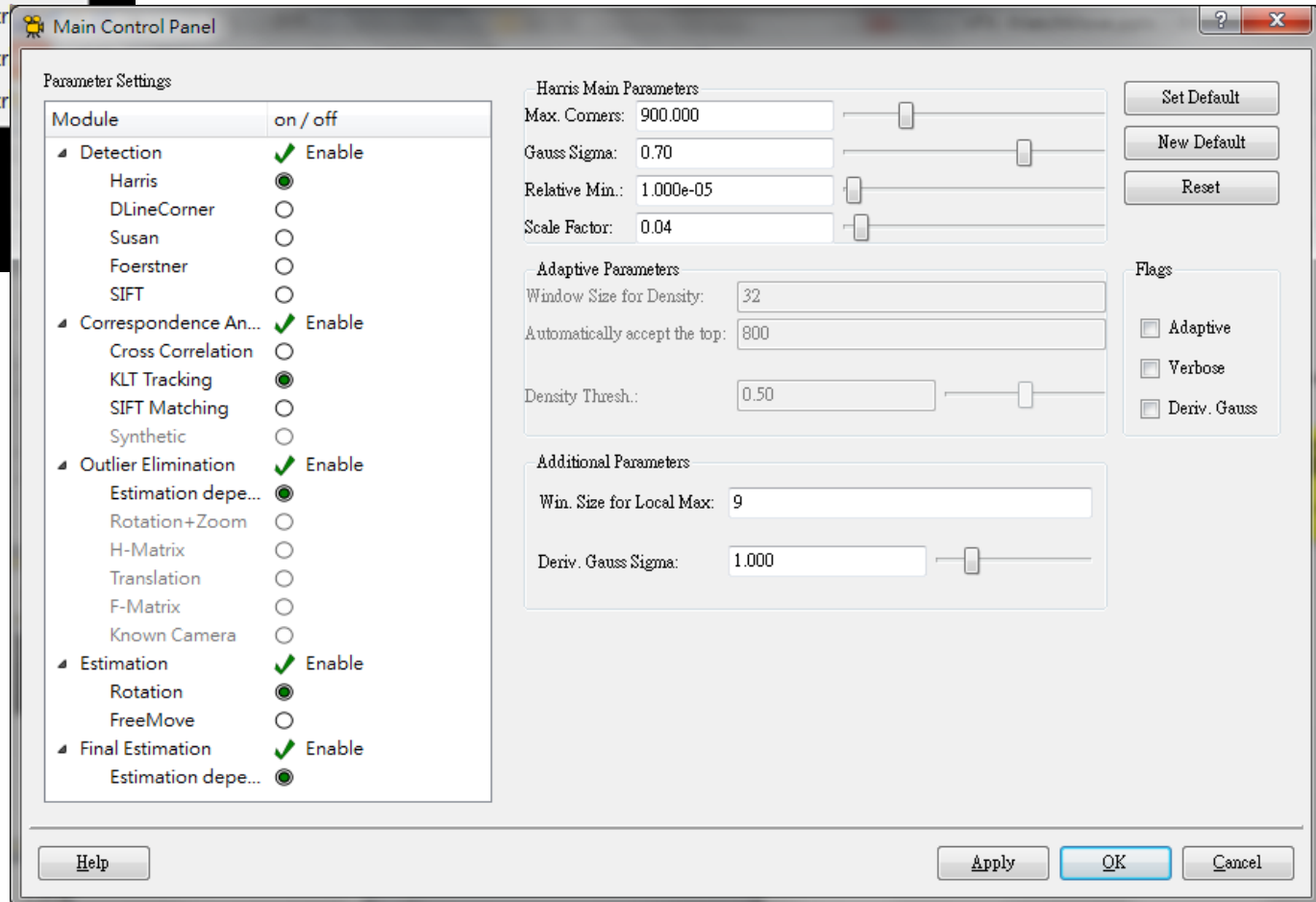
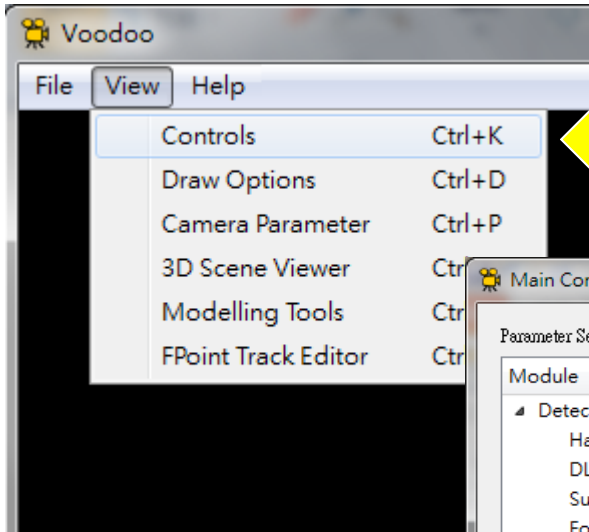
# FAQ

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- Voodoo會當掉！
  - 拍攝的影片內容差異太大
  - 調整tracking的方式
- 為什麼我在Blender中的Background和Feature沒辦法配合？
  - 記得要先選取 voodoo\_render\_cam
  - 設定 **Cameras → Set Active Object as Camera**
- 3D models的位置/動作好難調整...
  - 多利用座標系相對位置以及不同視角會有幫助，不過還是需要一些時間
  - 設定動作時，盡量避免大角度或大範圍的interpolation，**多設一些 key frames**
- 為什麼最後做出來的動畫Model是黑的？
  - 記得在場景裡**加盞燈**
- 我該去哪裡找3D models？
  - 網路上免費資源非常多！
  - 例如：<http://www.3dm3.com/modelsbank/>  
<http://www.sharecg.com/>

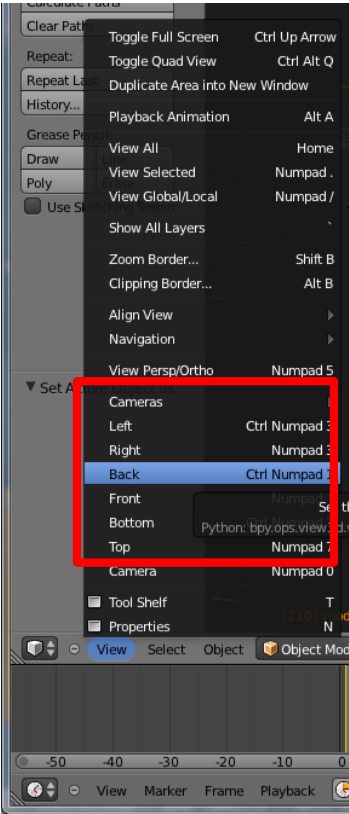
# FAQ

調整設定  
View → controls

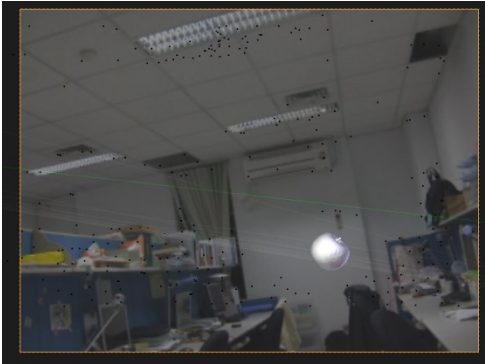


# FAQ

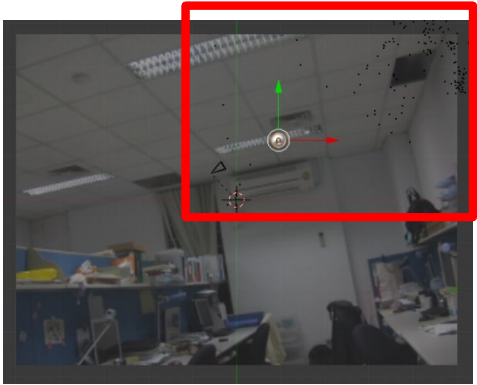
- Use different views to adjust the positions and poses of objects



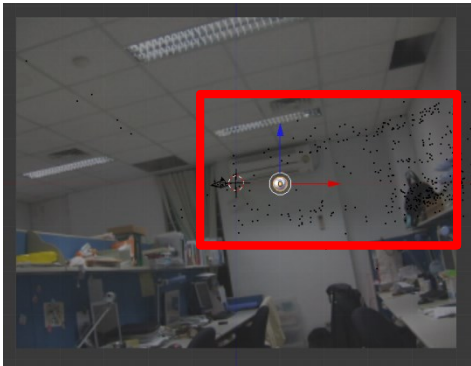
**Set  
view**



**Camera  
view**



**Top  
view**

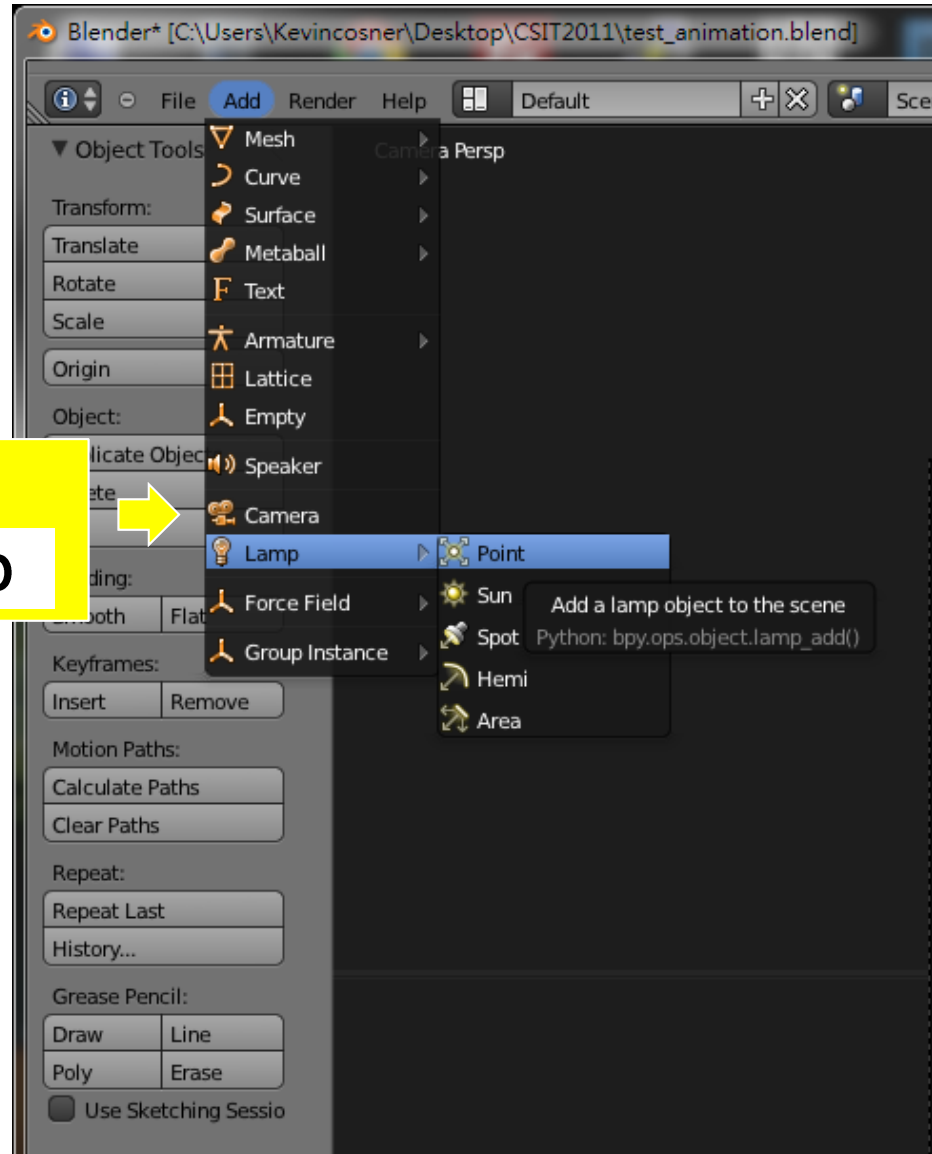


**Front  
view**

# FAQ

- Add lights

記得開燈!  
Add → Lamp



# Document

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- Blender official website
  - <http://www.blender.org/education-help/>
- Voodoo document website
  - <http://www.viscoda.com/index.php/en/voodoo-manual>