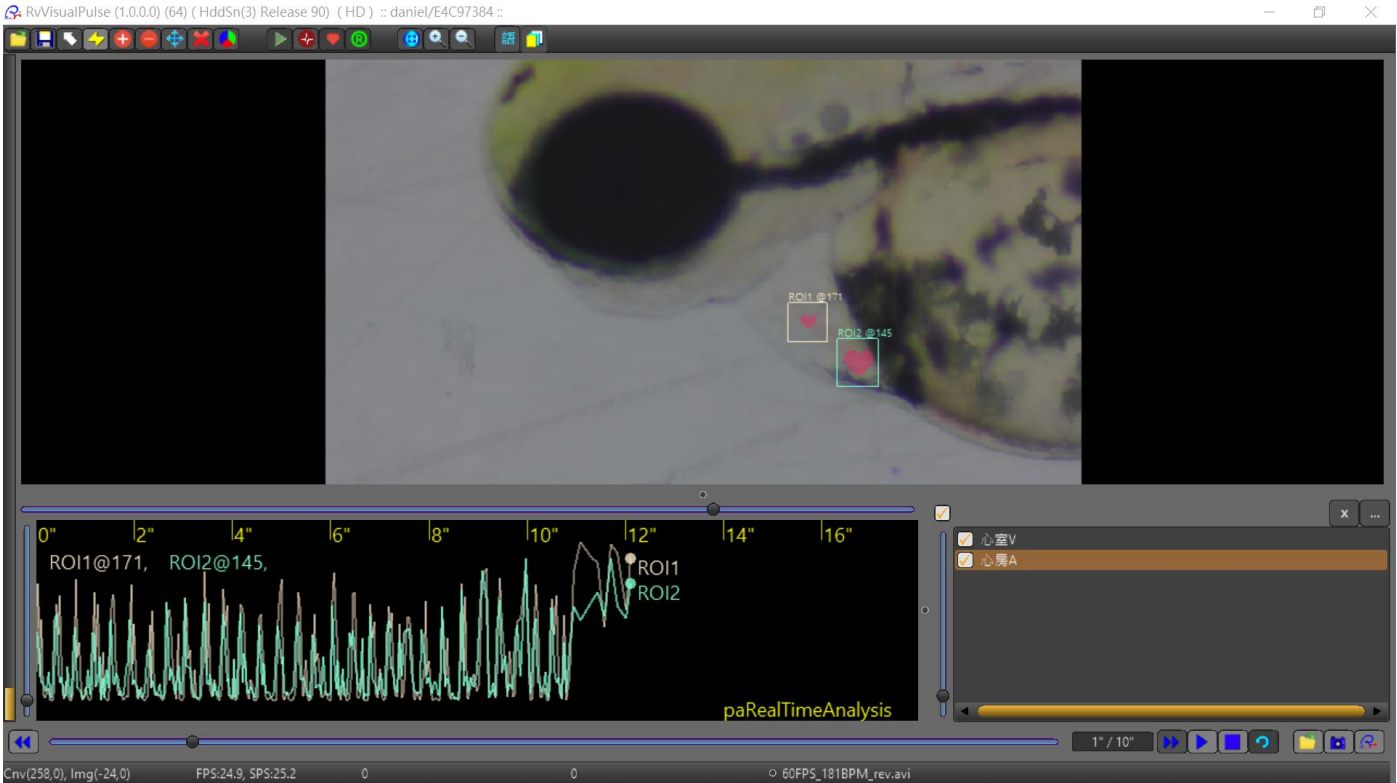


RvVisualPulse Users Manual

2019/10/17

[RasVector Technology](http://www.RasVector.url.tw/)



Content

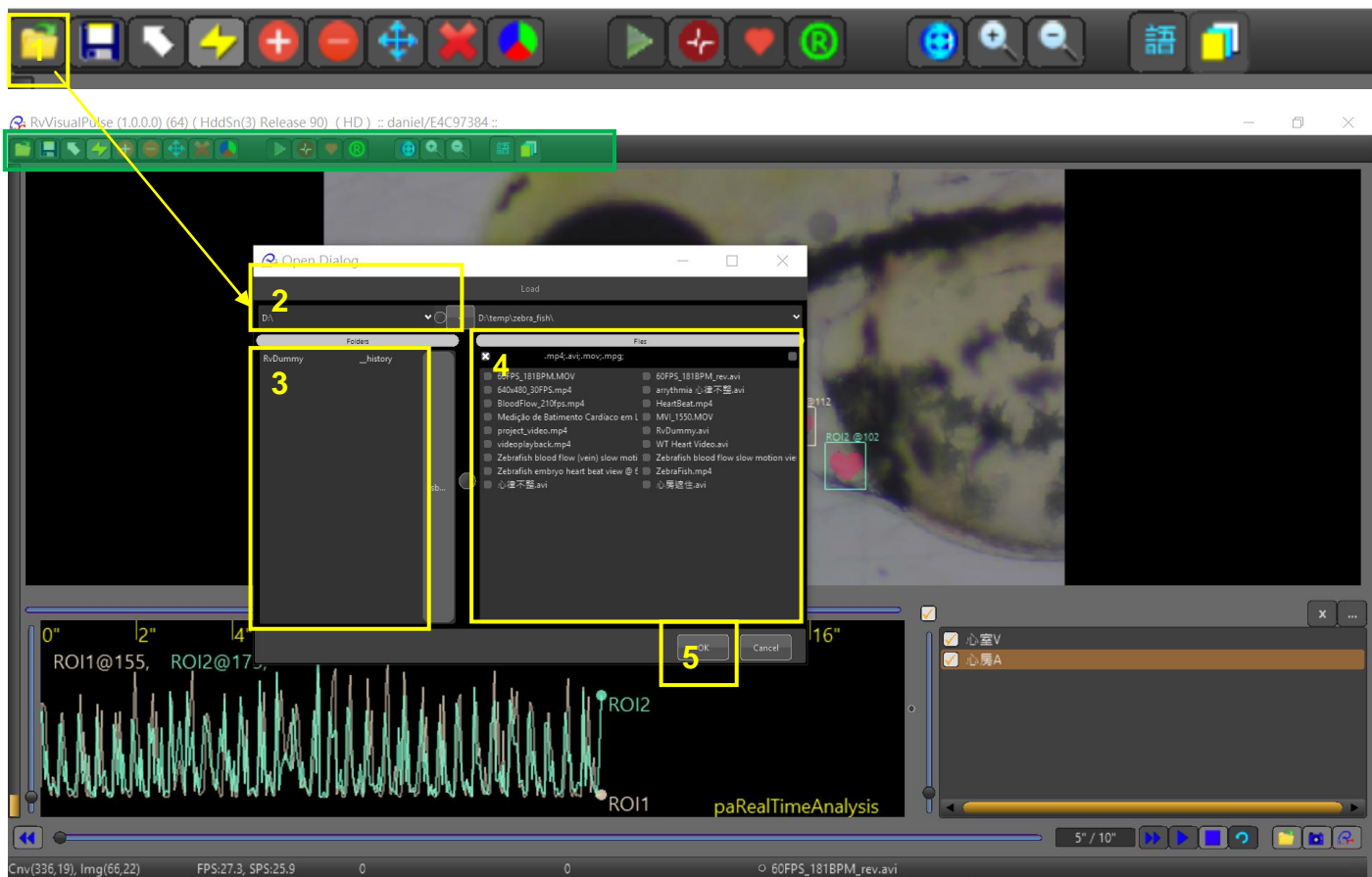
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Quick Start

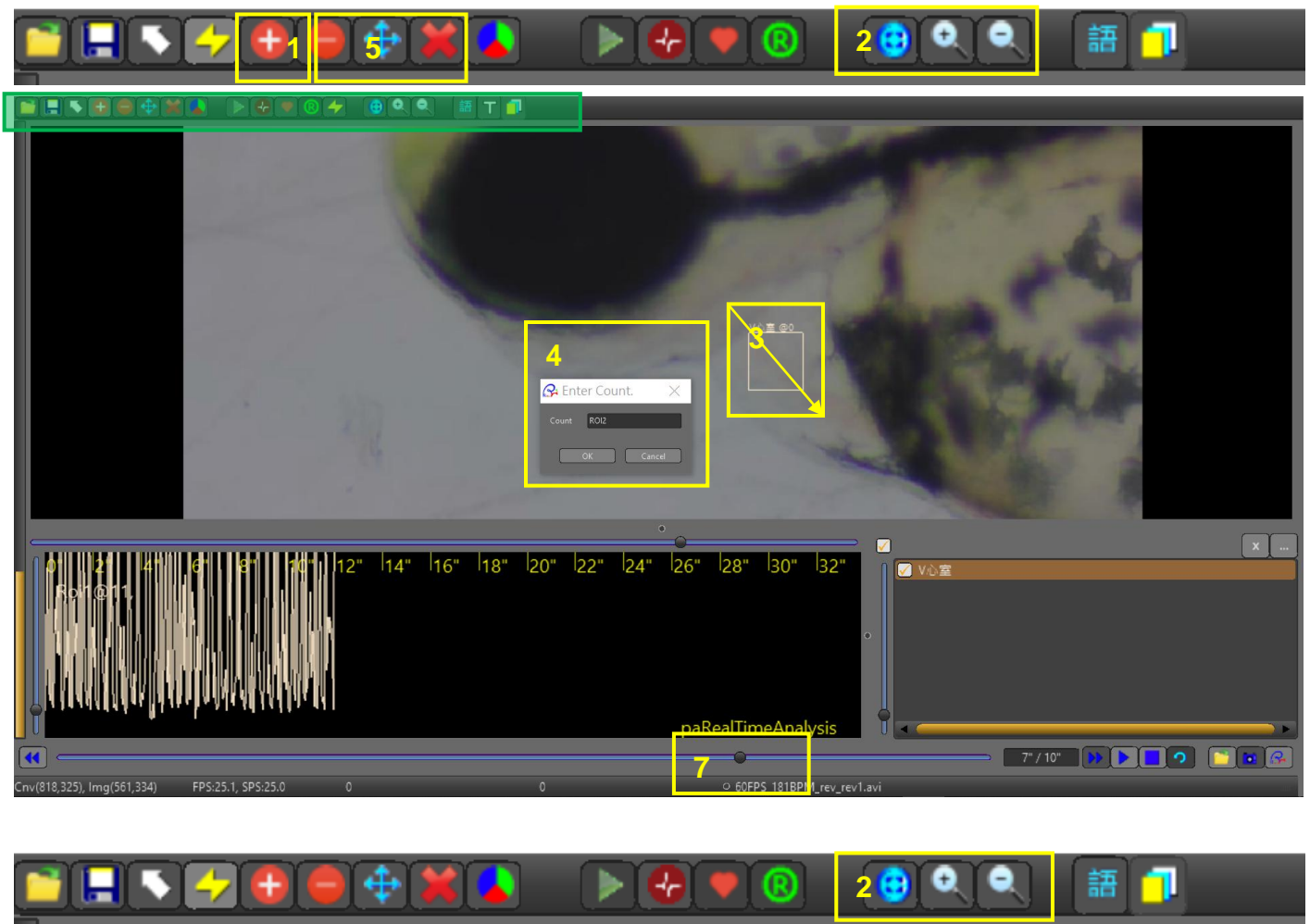
Step 1 : Import a video file

- 1 : Press [Import] Button.
- 2 : Select HDD Path.
- 3 : Navigate to the folder where video files stored.
- 4 : Select the video file.
- 5 : Press OK.

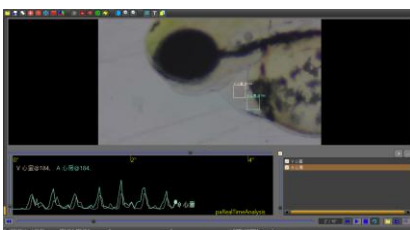


Step 2 : Add ROI

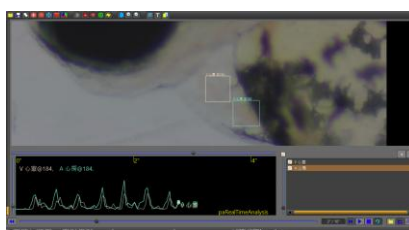
- 1 : Press [Add] button.
- 2 : Press Zoom Buttons to Zoom In/Out/Home the video, In addition, Mouse Right-Down also can be used to move view.
- 3 : Drag a ROI box to cover the detection area in video.
- 4 : Enter the ROI name and press [OK].
- 5 : You can also use [Delete], [Move] to edit the ROIs or [Clear All] to clear all ROIs.
- 6 : Repeat step 1 to 5 to add more ROIs where you want to detect.
- 7 : Adjust the time of playing video to a static image will be helpful while defining ROI.



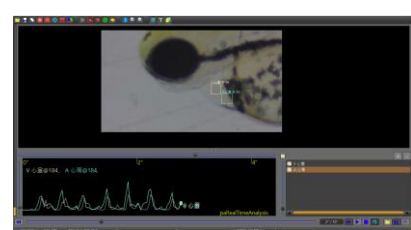
Home View



Zoom In



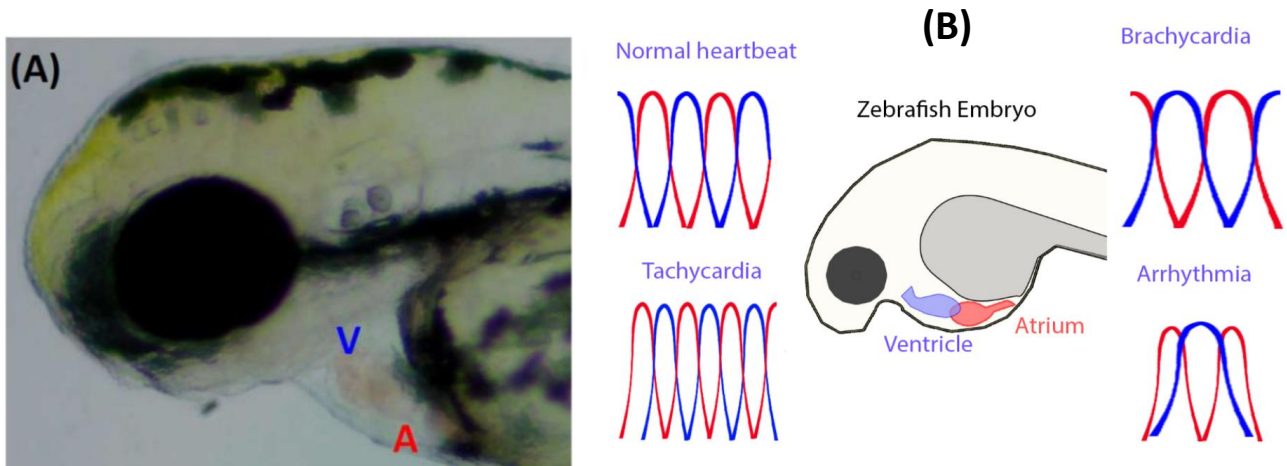
Zoom Out



Note the results of pulse-analysis will be slightly different depend on how you define the ROIs.

Select ROI

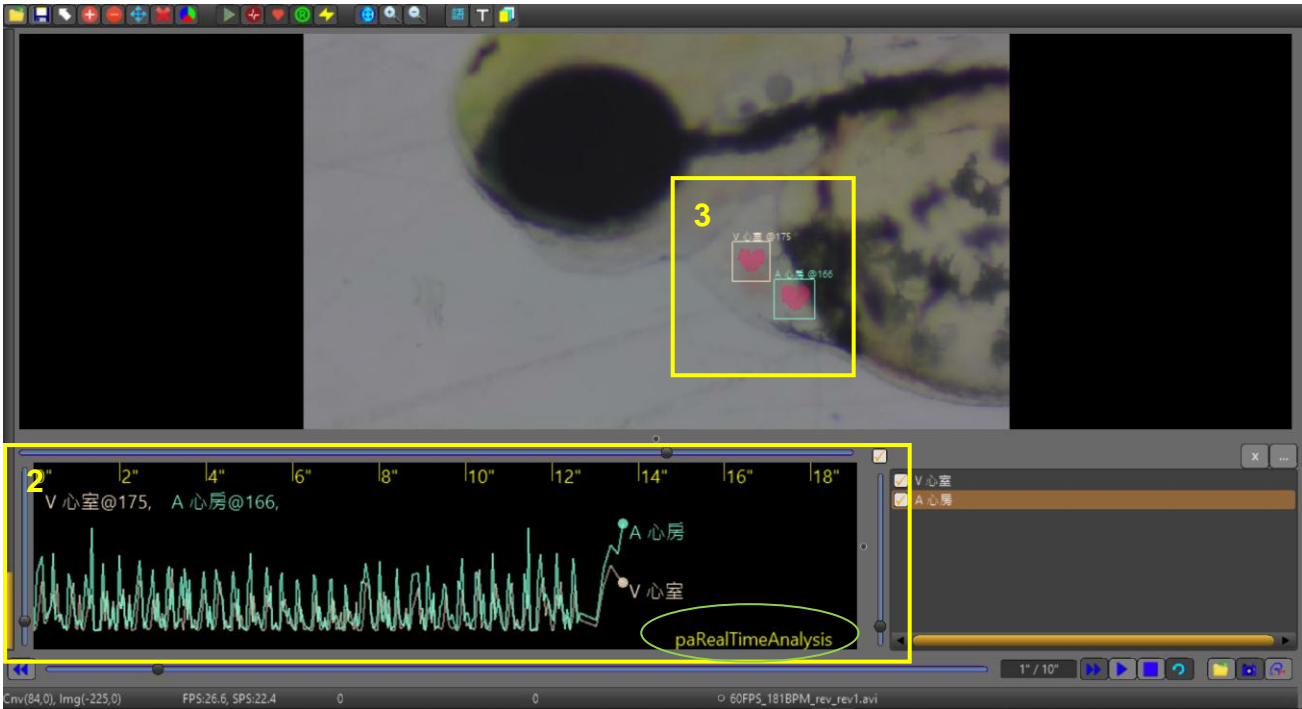
In this case, we would like to see the pulse of zebrafish heart. To see the heart performances, we pick up 2 ROIs to determine the atrium and the ventricle of zebrafish. The part of atrium and ventricle could be seen in Figure A (below). Figure B also showed the detail part of atrium and ventricle in zebrafish embryo. In addition, it also showed the scheme of heart alteration.



Step 3 : Run Pulse Analysis

1. Press [Run] to start Pulse-Analysis. You will then see the Pulse-Waves Shown below.
2. Show / Hide Pulse Waves.
3. Show / Hide Heart-Beat Animation. (Note : This may affect the result of pulse-analysis.)
4. Since Real-Time Pulse-Analysis result may depend on the power of CPU. You can also choose to do analysis offline by pressing [R] button to switch between two modes, Real-Time and Off-line Analysis.





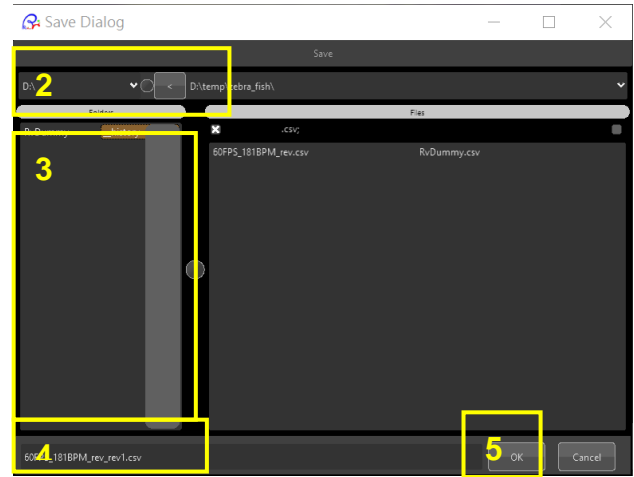
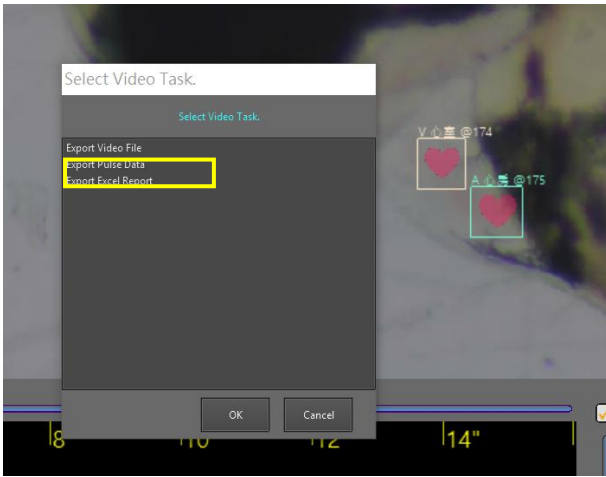
Note : No 4 will show what mode is being analyzed. It is highly recommended to do Off-line Analysis after Real Time Analysis, because Real Time Analysis might got some bias due to the busy on data calculation.



Step 4 : Export Pulse Data.

1. Press [Export] button, to show a dialog below. Select **“Export Pulse Data”** and press [OK].
2. Select file path.
3. Navigate to the folder you want to save the pulse data file.
4. Input the file name.
5. Press [OK].





60FPS_181BPM_rev_rev1.csv

A1 // RasVector Technology RvVisualPulse() Pulse Data*										
	A	B	C	D	E	F	G	H	I	J
4	// YouTube: www.youtube.com/dan59314*									
5	// Email: dan59314@gmail.com*									
6	// Date: 2019/10/2 上午 11:08:39*									
7	// FileName: C:\Users\USER\Documents\RvVisualPulse\60FPS_181BPM_rev_rev1.csv*									
8	// RvKeyID: -1*									
9	PulseRoiN	2								
10	PulseRoi	1	V 心室							
11	RoiMinMa	487	237	529	282					
12	PulseValu	598								
13	PulseValu	1								
14	PulseValu	164								
15	LastMaxP	403								
16	LastMinP	1								
17	LastMean	403								
18	BPM	174								
19	PulseData	299								
20	//Commar	TimeMSe	Value	IsPeak						
21	P	0	825	0						
22	P	34	340	0						
23	P	67	1104	0						
24	P	100	0	0						
25	P	134	7	0						

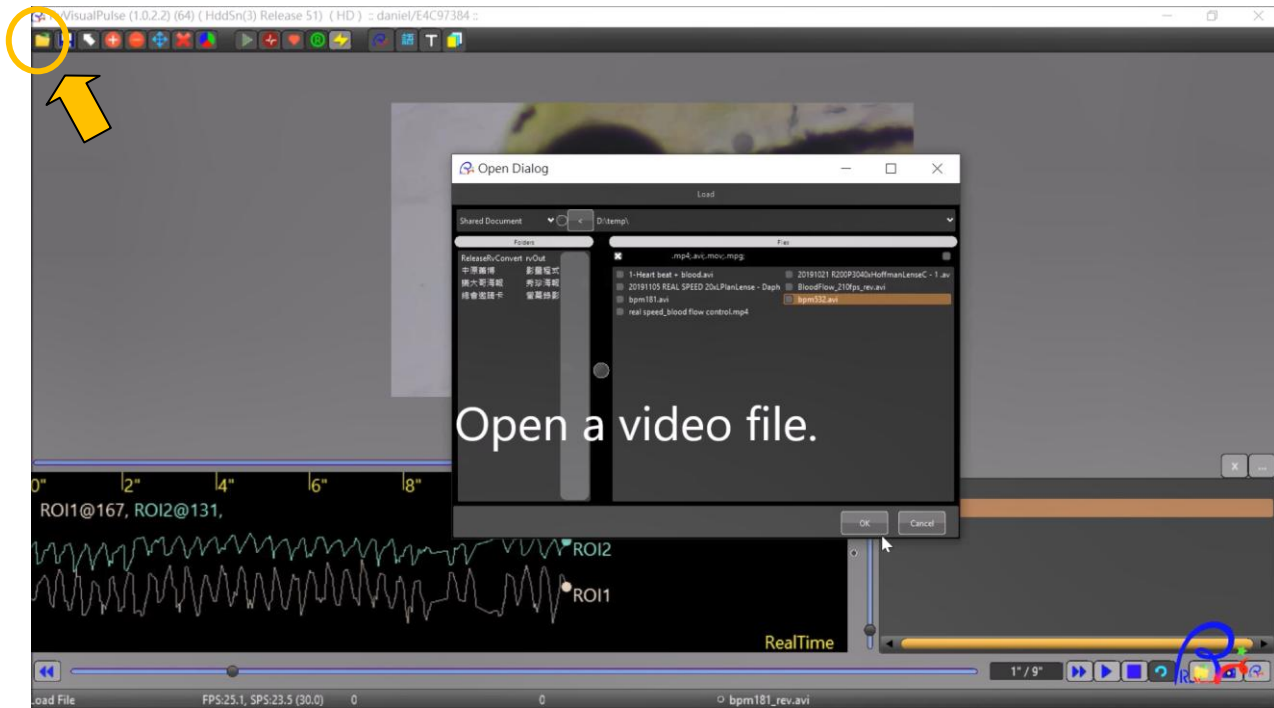
60FPS_181BPM_rev_rev1 就緒

The saved pulse data will look like the picture below.

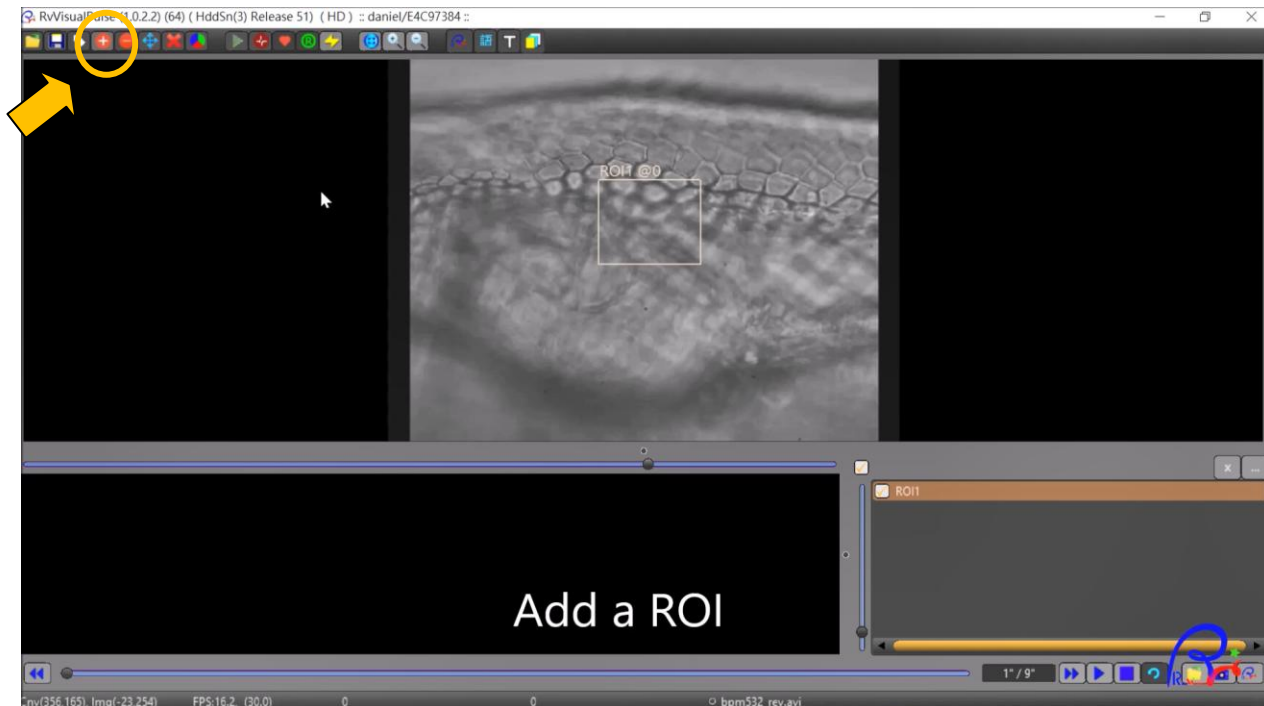
Examples

Daphnia heartbeat

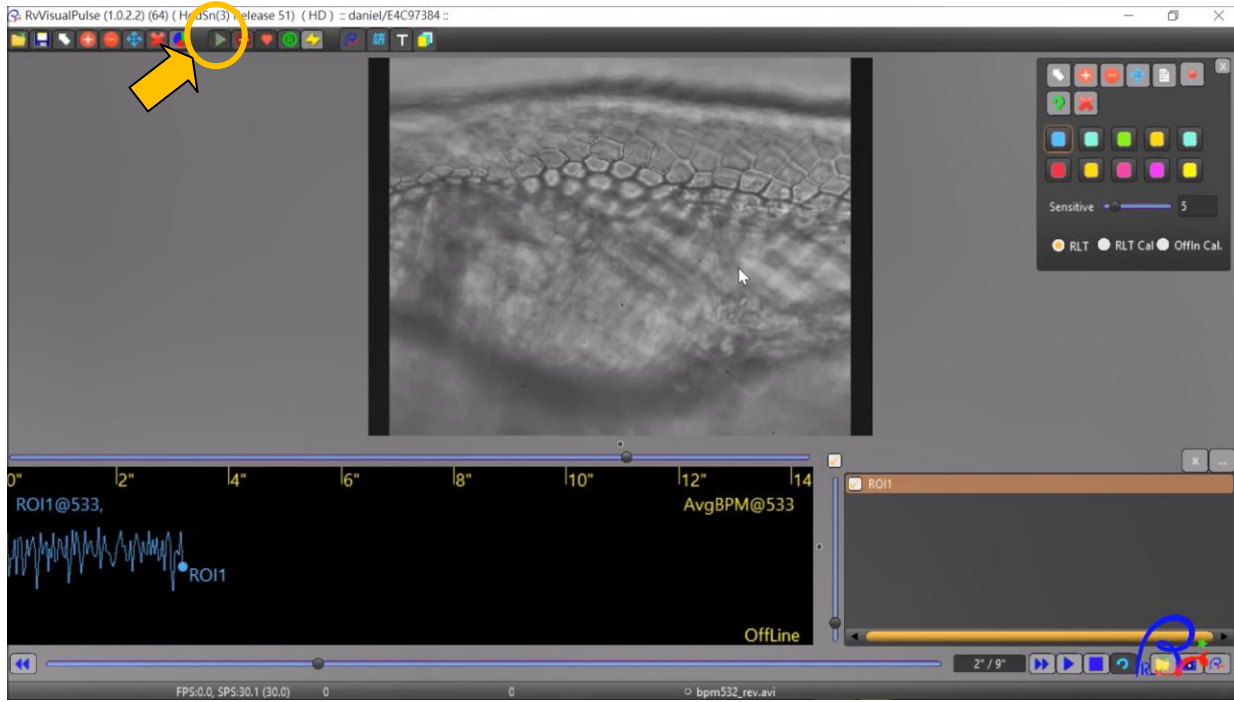
Step 1 : Import a video file



Step 2 : Add a ROI



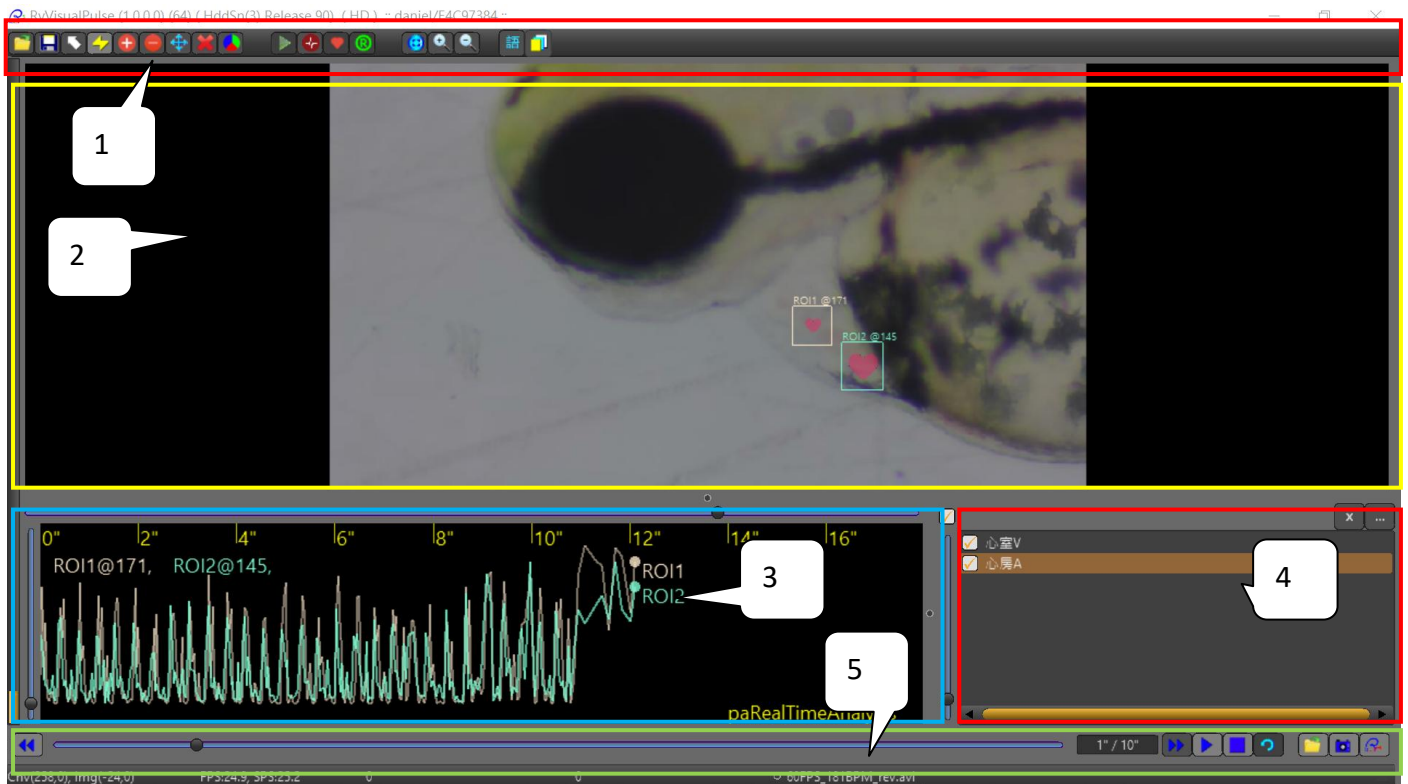
Step 3 : Run Pulse Analysis



Step 4 : Export Pulse Data.

Interface

1. Function Tools.
2. Render Box.
3. Pulse PaintBox
4. Pulse ROI List.
5. Media Play Functions.



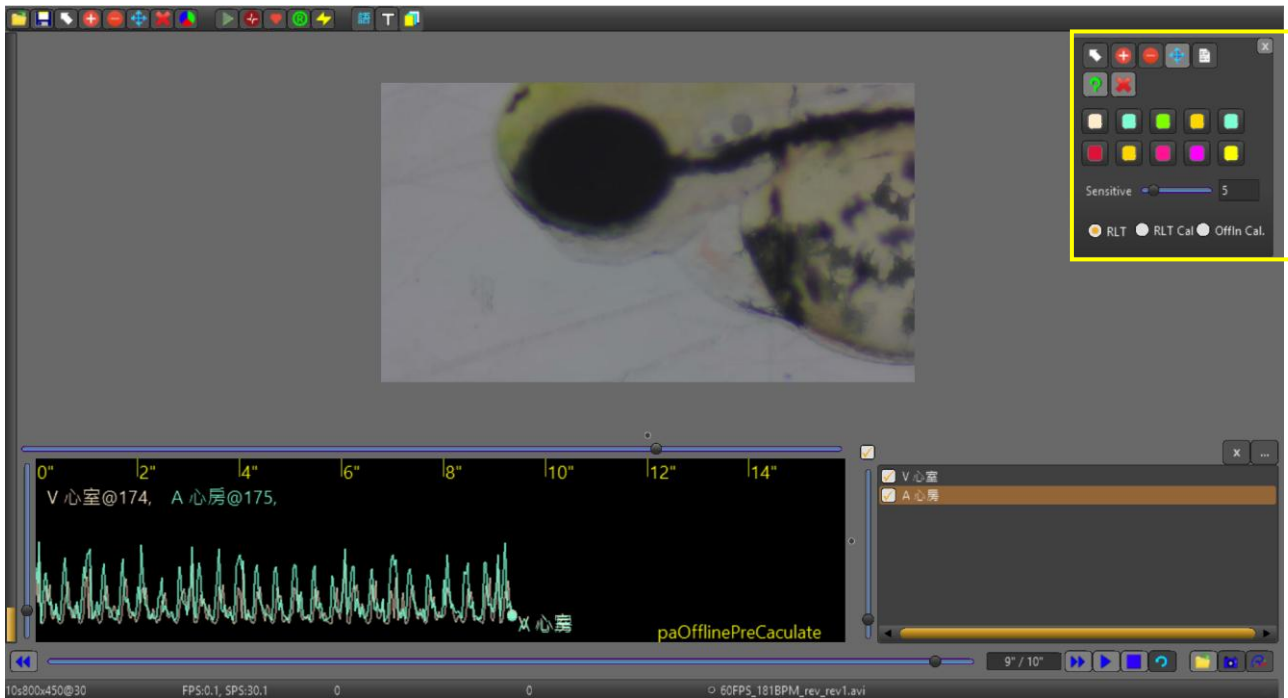
Function Tools.



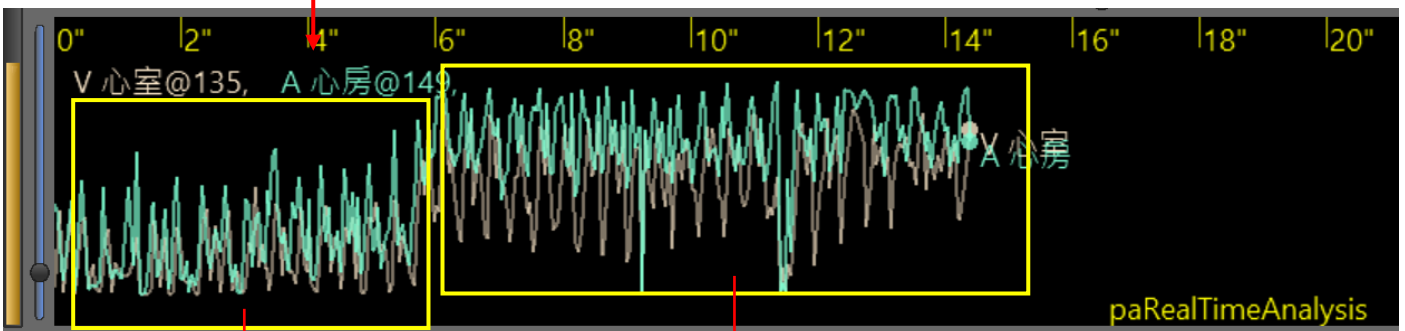
Button functions listed from left to right.

1. File Import : Import kinds of file format.
2. File Export : Export kinds of file format.
3. Free Mode : Exit active editing action.
4. Reset All : Reset all current pulse data.
5. Add ROI : Define and add ROI (Region of Interest).
6. Delete ROI : Click to delete ROI on paint box.
7. Move ROI : Move ROI on paint box.
8. Clear All ROI : Clear all current ROIs.
9. Settings : Settings for pulse-analysis.
10. Run Analysis : Start running task of pulse-analysis.
11. Pulse Display : Show / Hide Pulse waves figure.
12. Heartbeat Animation : Show/Hide Heartbeat animation.
13. Analysis Mode : Switch between Real-Time and Off-Line calculation mode.
14. Home View : View whole video.
15. Zoom In : Zoom In video image.
16. Zoom Out : Zoom out video image.
17. Language : Select language.
18. Icon Size : Enlarge/Reduce Icon size.

Settings



- Free Mode / Add ROI / Delete ROI / Move ROI / Rename ROI
- Query ROI / Clear All ROIs
- ROI Colors (Click color box to change)
- Pulse Sensitivity. Reduce the value is recommended if the pulse is not shown obviously.

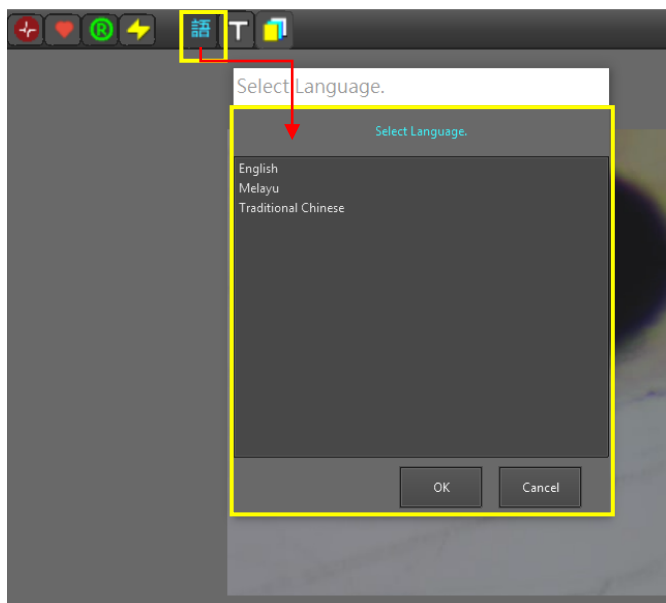


Pulse Sensitivity = 5

Pulse Sensitivity = 2

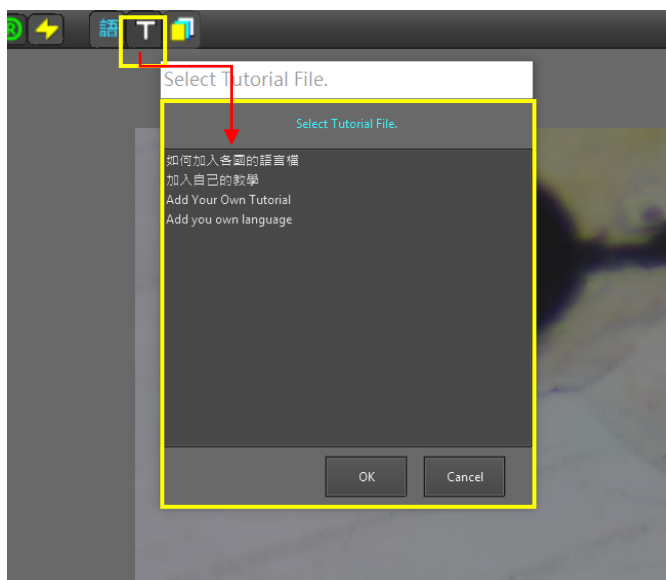
Language

Press [Language] button and select your language.

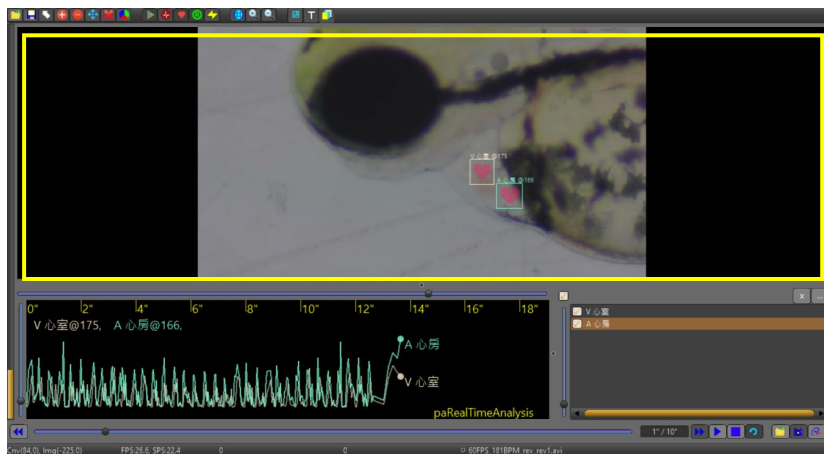


Tutorials

Press [T] button, and select the tutorial documents, videos, images... and so on that stored in "Tutorial" folder.

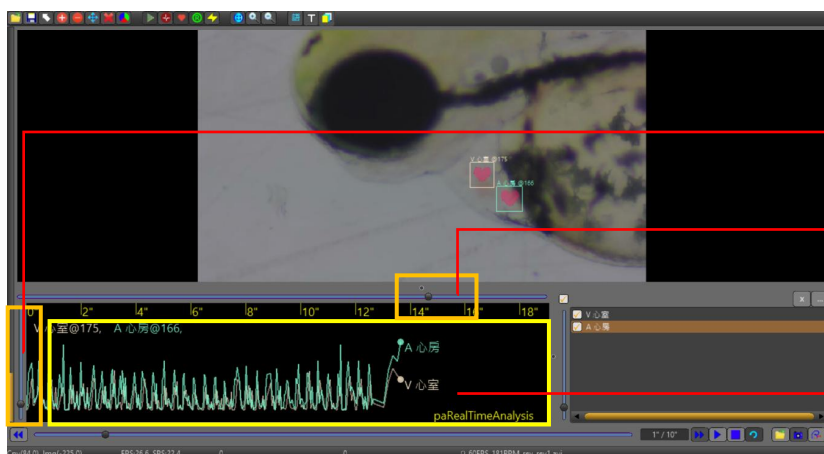


Render Box.



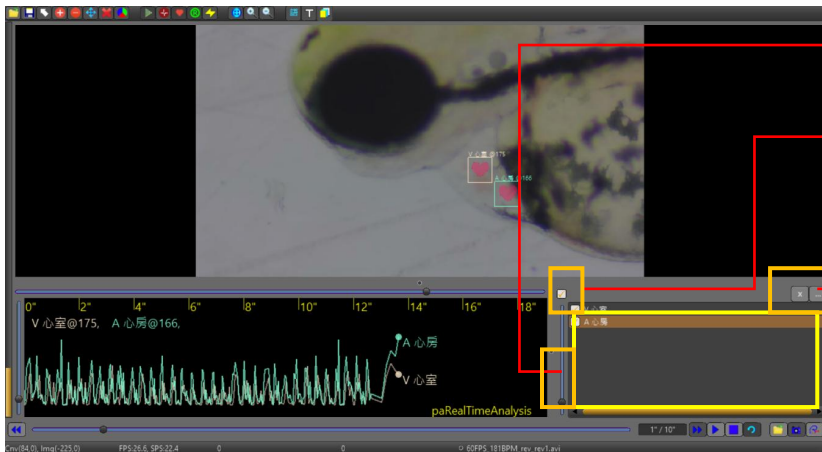
It has function to play the video, heartbeat animation and allow user to edit data. Also you can use mouse keys to do other operations like Left-Click (Zoom in a region), Right-Click (Move view), and Mouse Wheel (Zoom In/Out).

Pulse PaintBox



Here you can adjust the pulse interval or pulse scale to change the figure displayed on pulse paint box.

Pulse ROI List.



Individually Pulse Scale Adjustment.

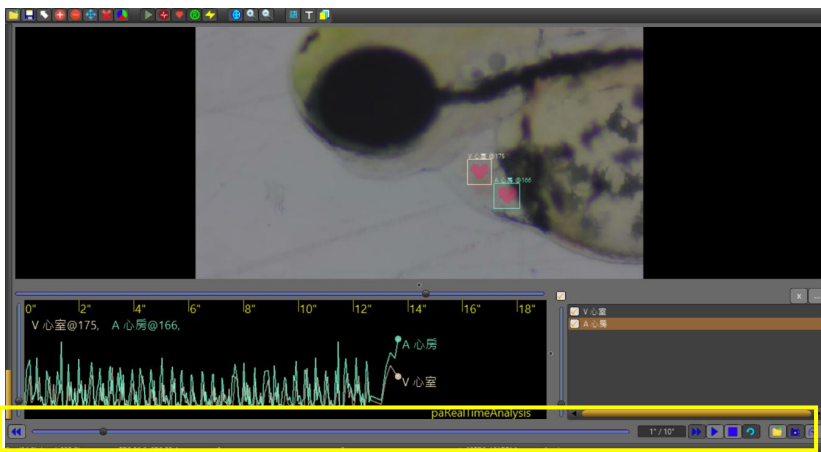
Select/UnSelect All ROIs

Clear Select ROIs.

Popup Functions.

1. Delete Selected ROIs.
2. Reset all ROIs Pulse scale.
3. Rename Selected ROI

Media Play Functions.



Backward few seconds.
Adjust play position.

Play progress.
Forward few seconds.
Play / Pause
Stop
Loop Play

Open Video
Capture and Save Image
Visit RasVector.

Appendix

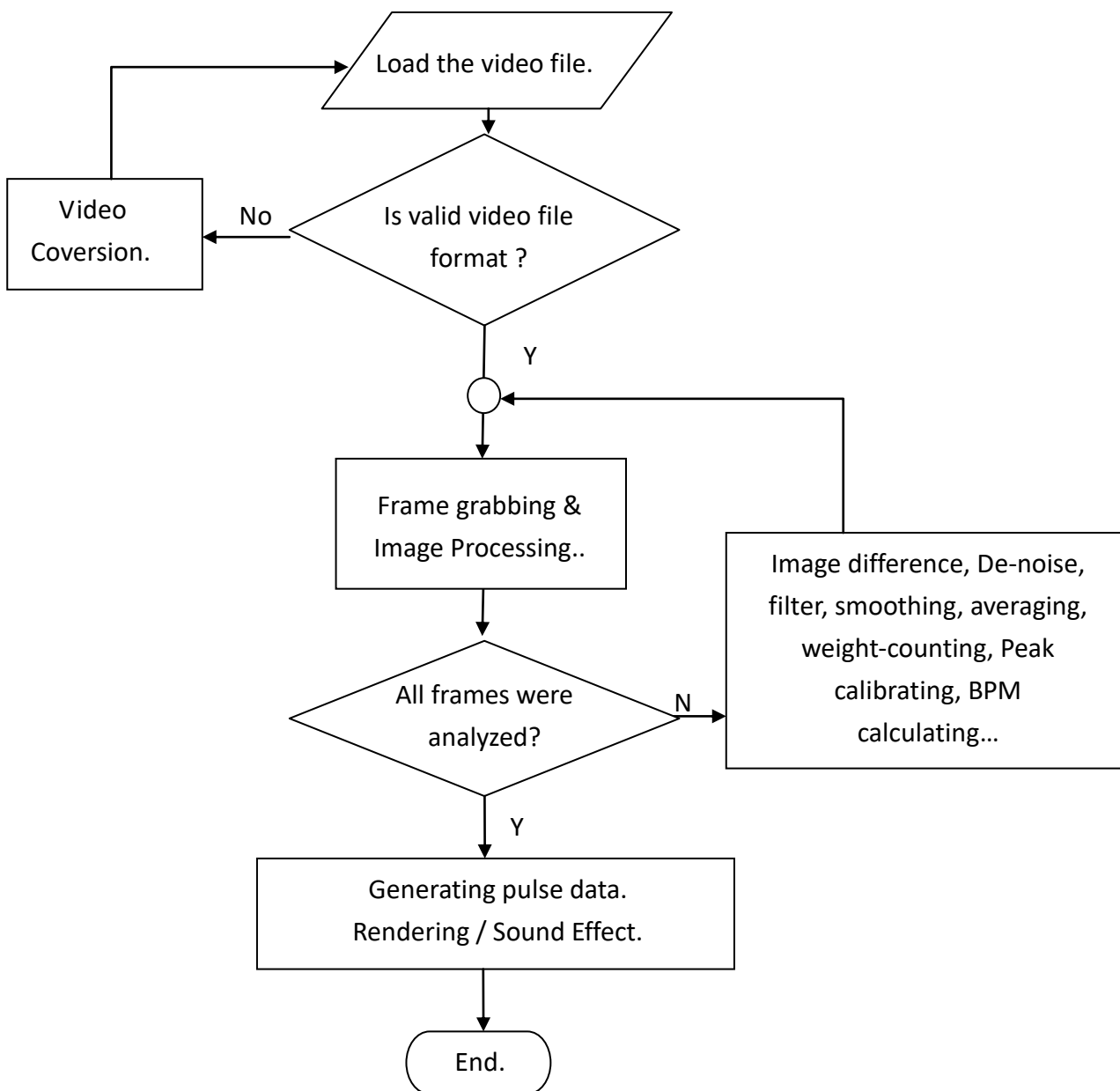
Inside RvVisualPulse

Video Loading and Processing :

FFmpeg : <https://www.ffmpeg.org/>

Image-Processing , Math libraries and Vector Analysis:

RasVector Technology Kernel. Math lib, Raster lib, Vector lib and Rendering library.



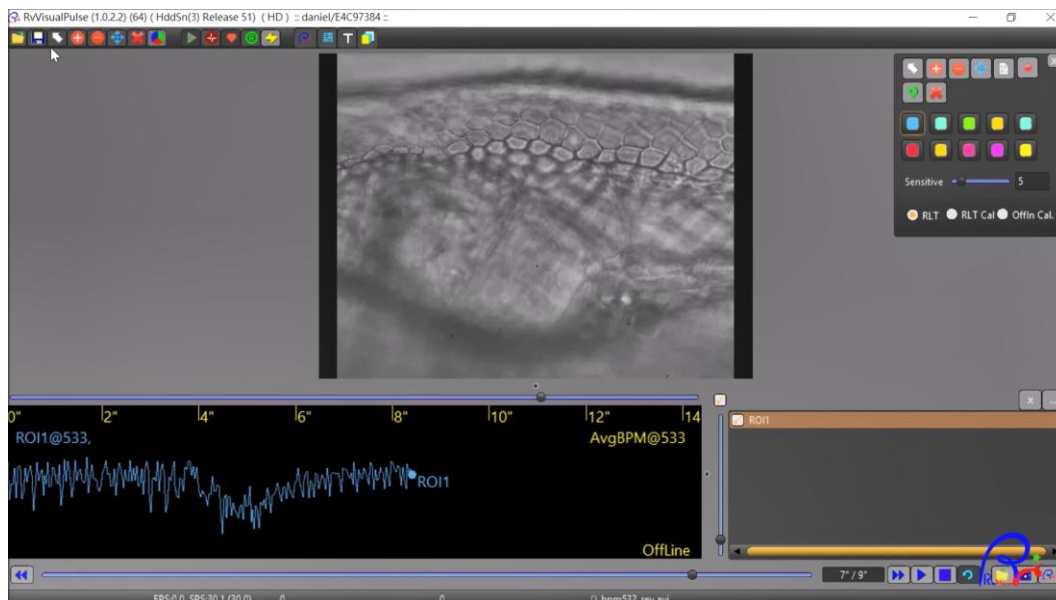
About the video FPS

Since the video files can be in any format and different FPS while exported. RvVisualPulse calculate pulse data from in two modes, Real-time and Off-line. While Real-time mode analysis the video frames every 50~500 milliseconds, depend on the PC CPU power, the Off-line mode will analyze all the frames in the video file. Thus, the higher the Video FPS is, the more that the analysis time will need.

Real-time mode.

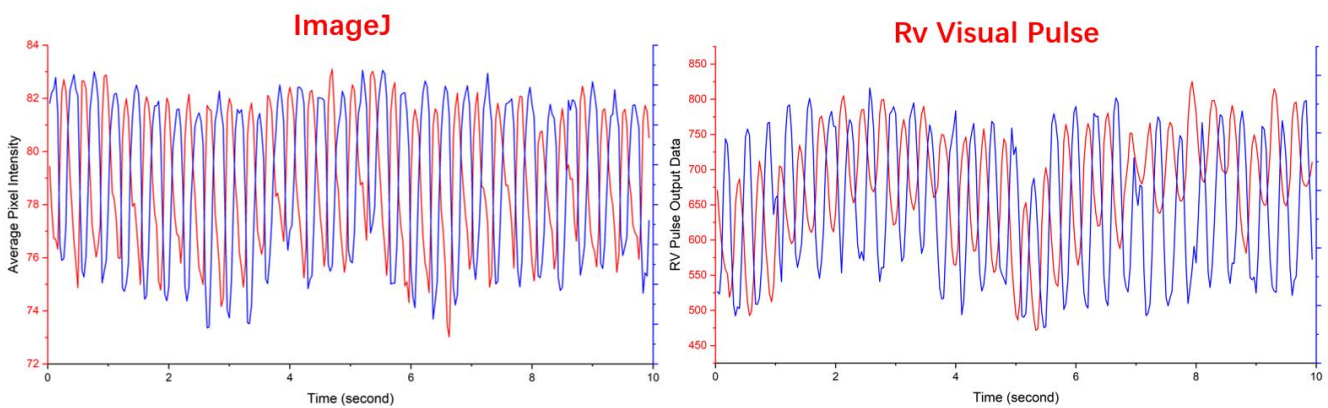


Off-line mode



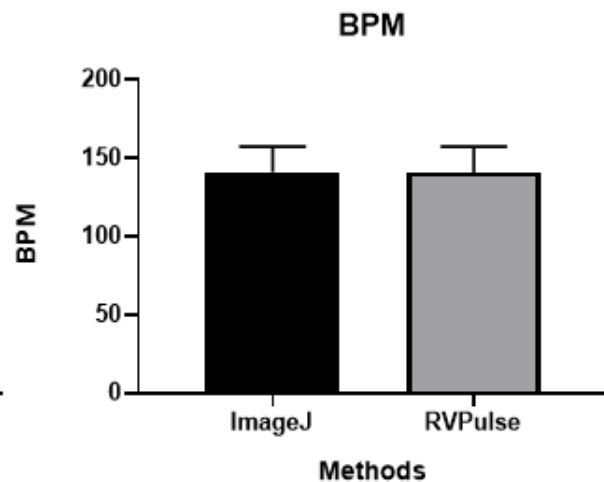
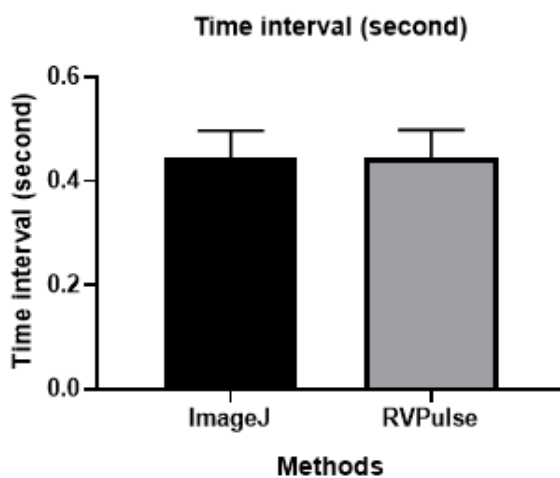
Technical validation:

In order to validate the performance of RvVisualPulse tool, we perform side-by-side comparison of zebrafish heart beat by using ImageJ and RvVisualPulse tools. The ImageJ method has been published by Sampurna et al., (2018) and can be considered as positive control. The heart beat rate (beat per minute) and heart beat interval (sec) data were extracted from videos after conducting either ImageJ and RvVisualPulse algorithm calculation. The following data show the heart beat rate and heart beat interval display high correlation (tested by Pearson correlation) between those two different methods, supporting the utility of RvVisualPulse tool.



Correlation		A	B
Pearson r		ImageJ	RVPulse
1	ImageJ	1.000	1.000
2	RVPulse	1.000	1.000

Correlation		A	B
Pearson r		ImageJ	RVPulse
1	ImageJ	1.000	1.000
2	RVPulse	1.000	1.000



Technical References:

Sampurna BP, Audira G, Juniardi S, Lai YH*, Hsiao CD*. 2018. A Simple ImageJ-Based Method to Measure



Cardiac Rhythm in Zebrafish Embryos. *Inventions*, 3(2), 21.

Sampurna BP, Santoso F, Lee JH, Yu WH, Wu CC, Audira G, Juniardi S, Chen JR, Lin YT*, Hsiao CD*. 2019. Cardiac Rhythm and Molecular Docking Studies of Ion Channel Ligands with Cardiotoxicity in Zebrafish. *Cells*, 8(6), 566

