

Co-funded by the Erasmus+ Programme of the European Union



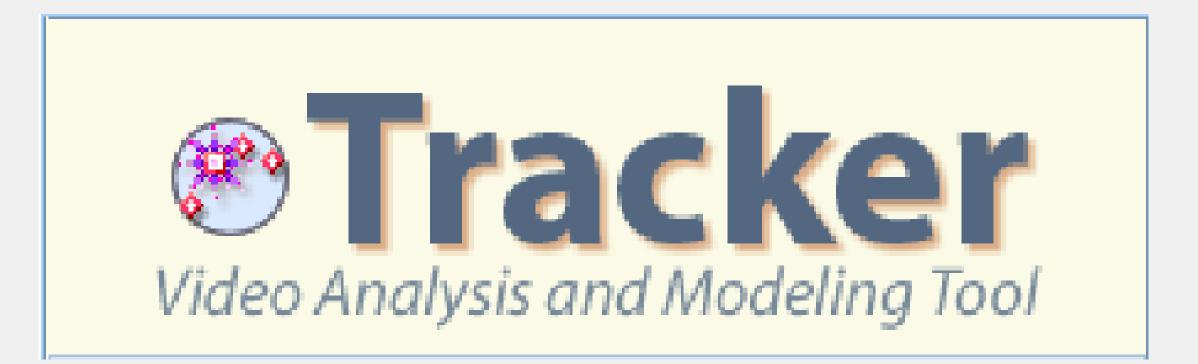
How to model objects with Tracker and GeoGebra

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HOW TO DOWNLOAD TRACKER

Tracker (Video Analysis and Modeling Tools for Physics Education) is available in the following link



https://physlets.org/tracker/







PROBLEM

"Determine the maximum height that a ball reaches when we throw it into the air"

MODELLING THE TRAJECTORY

- Recording a video of the physical phenomenon. ullet
- Obtaining mathematical information from the video using the Tracker program. ${}^{\bullet}$
- Finding the curve equation that describes the movement. ullet

Thus, Tracker allows obtaining measurements and equations just with a video

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RECORDING A VIDEO WITH METRIC REFERENCES TO IMPORT IT INTO THE TRACKER

In this case, we will employ the following video that you can find in Google (tallertracker2023@gmail.com; tracker2023\$)



Aspects to be considered

- Record the video with good contrast and background ullet
- Record from the parallel plane and perpendicular focus ullet
- Have a reference object that we can measure ullet

Drive









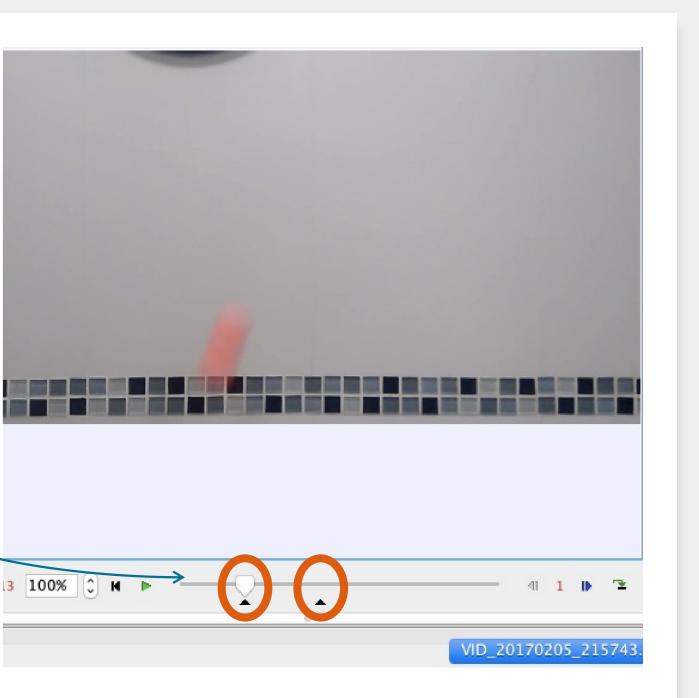
TRACKER INTERFACE AND VIDEO LOADING, ADJUSTING THE DESIRED START AND END WITH THE SLIDERS

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TRACKER INTERFACE AND VIDEO LOADING, ADJUSTING THE DESIRED START AND END WITH THE SLIDERS

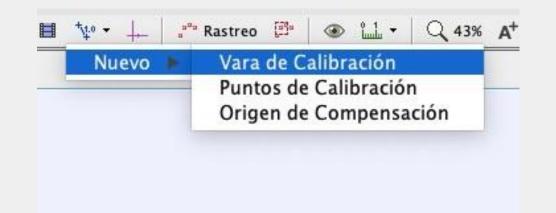
Adjusting the beginning and the end







CALIBRATION ROD, TO GIVE METRIC SCALE TO THE VIDEO



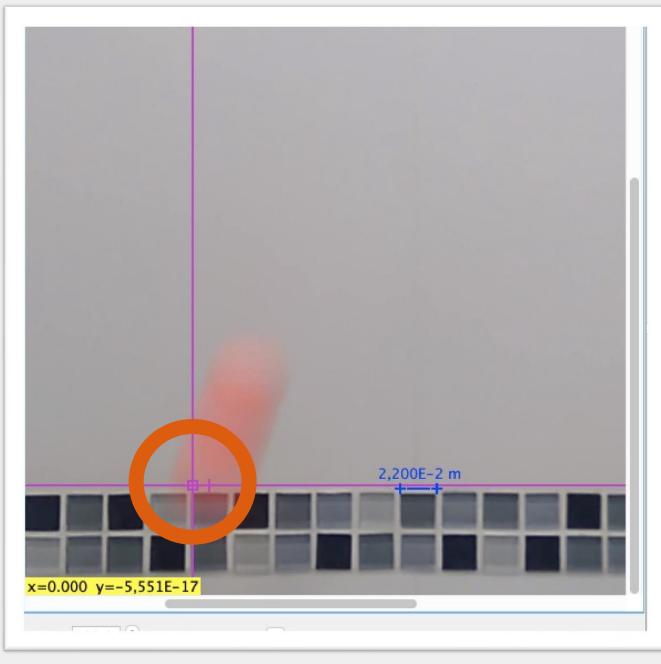






COORDINATE AXES, TO LEAVE THE ORIGIN AND THE X AND Y AXES ORIENTED

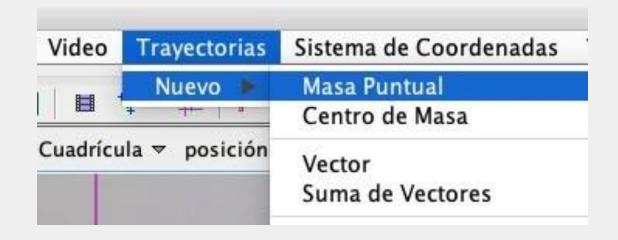
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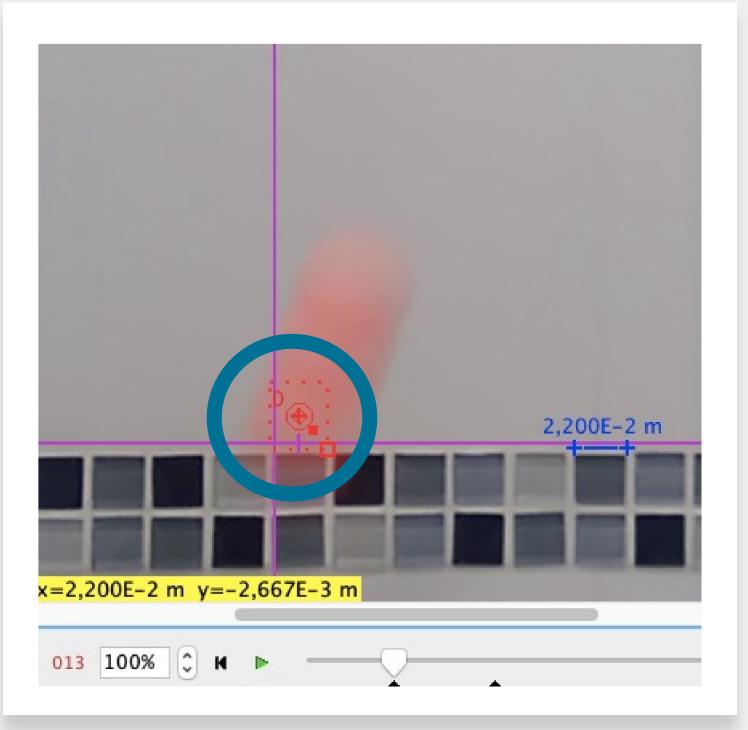


IDENTIFY THE POINT MASS OF THE MOVING OBJECT



We use the key combination: Ctrl + Shift [얇] + Left mouse button

- Circle: search pattern
- Square: search area







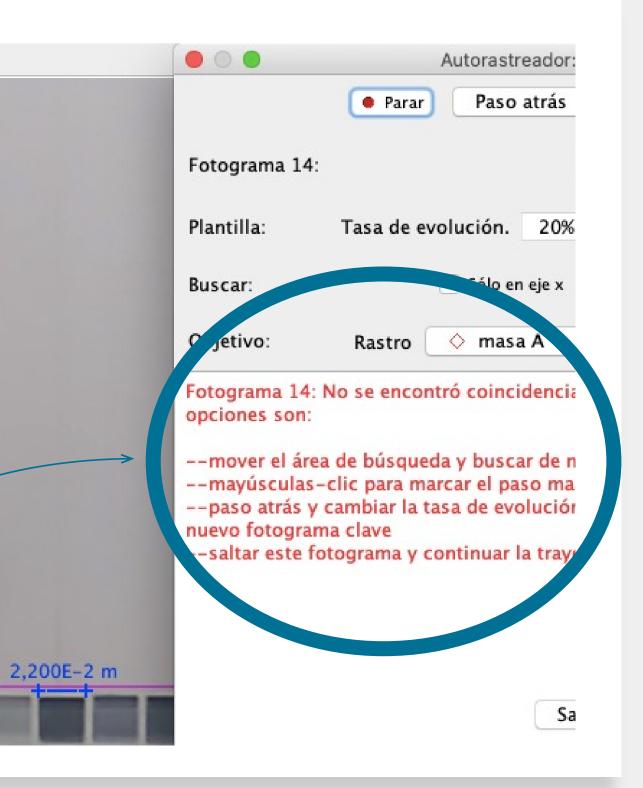
FIND THE TRAJECTORY OF POINTS

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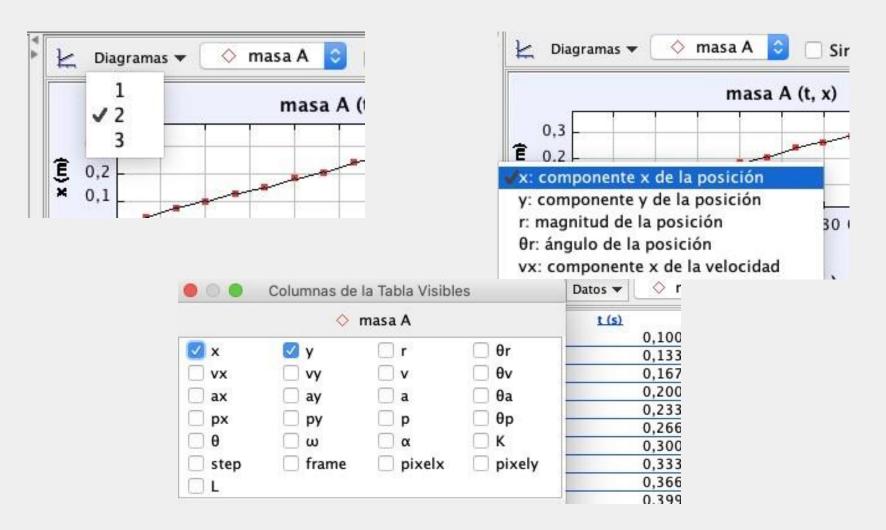
- Find the path of points [Buscar] to generate the points
- It is usually automatic, but if at any time the object is not detected, search for the trajectory with the following:







IDENTIFIED DATA

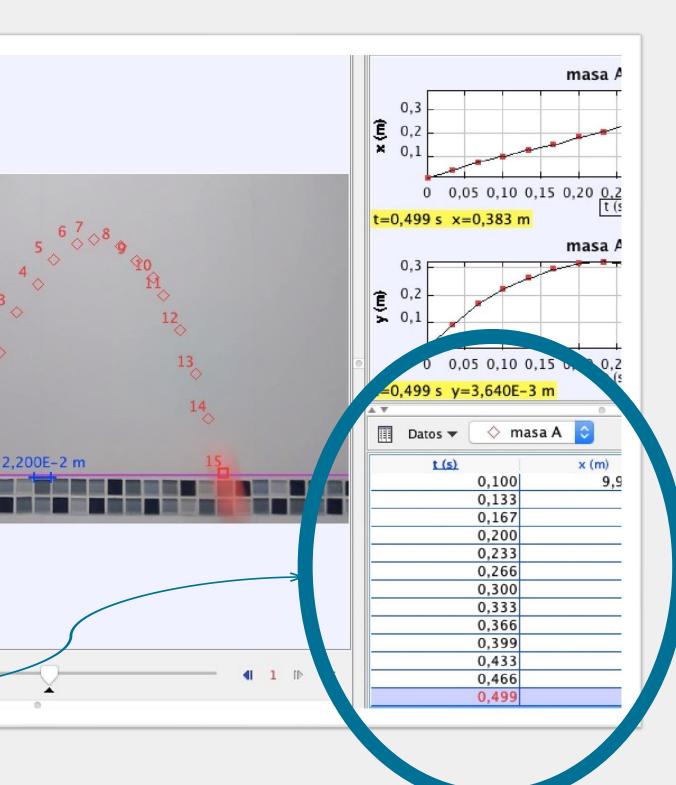


You can identify the points detected in the video frames:

- You can select which data to see
- You can choose which graphs to display

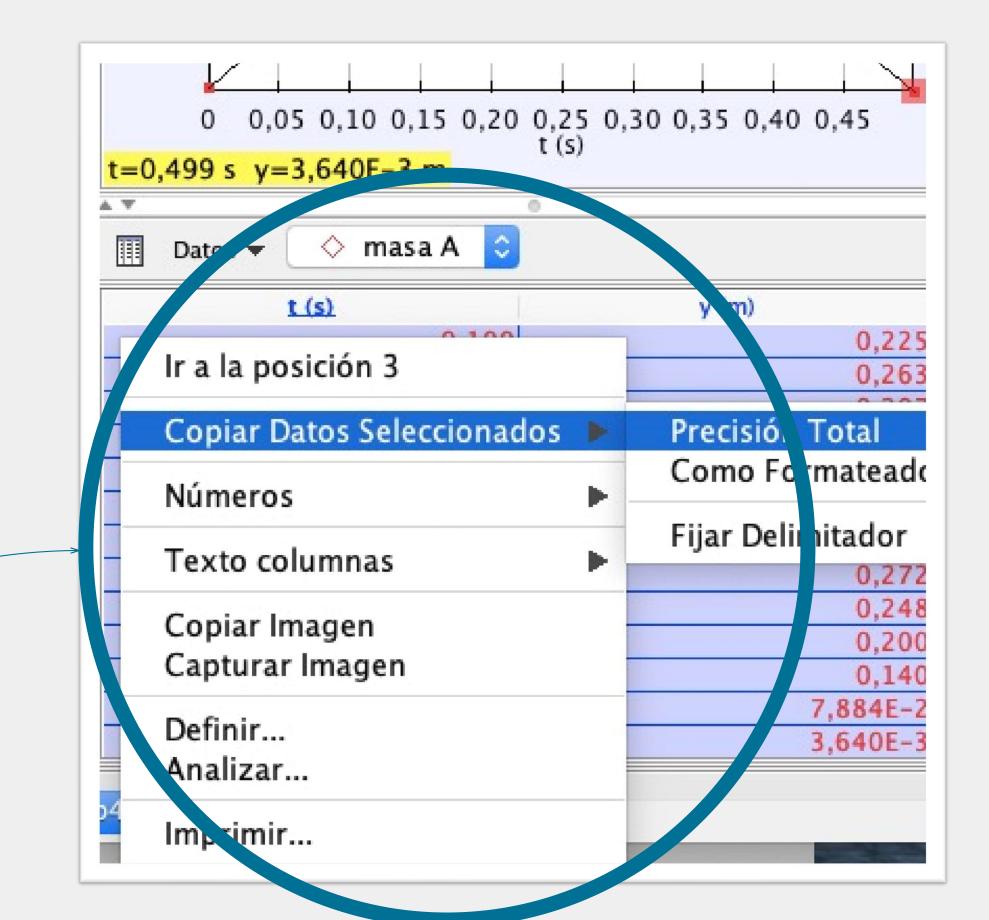






EXPORT DATA

Export the data to Excel or GeoGebra by selecting the data in the spreadsheet and, with the Right Button of the mouse, giving Copy with Total Precision:



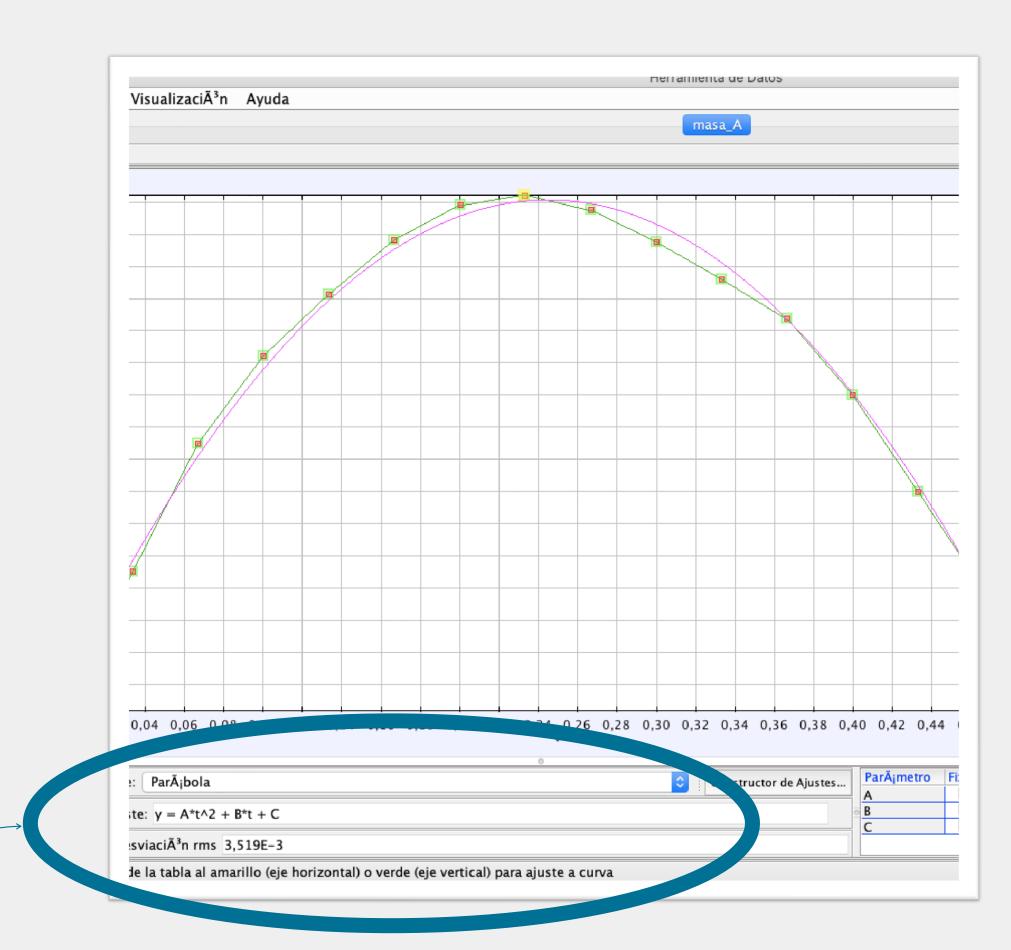


OBTAIN THE CURVE OF THE TRAJECTORY

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☐ Datos ▼ ♦ masa A t (s)	Puntos Seleccionados Puntos no Seleccionados
	' Puntos 3 ' Líneas 7
	Copiar Imagen E Capturar Imagen
C	Comparar con
C	Definir
	Analizar
C	Algoritmos

Mathematical modelling to obtain the curve equation that best fits the trajectory of the object:

 With the right button, we click on the data or a graph and choose "Analyze", selecting the "Type of Adjustment".





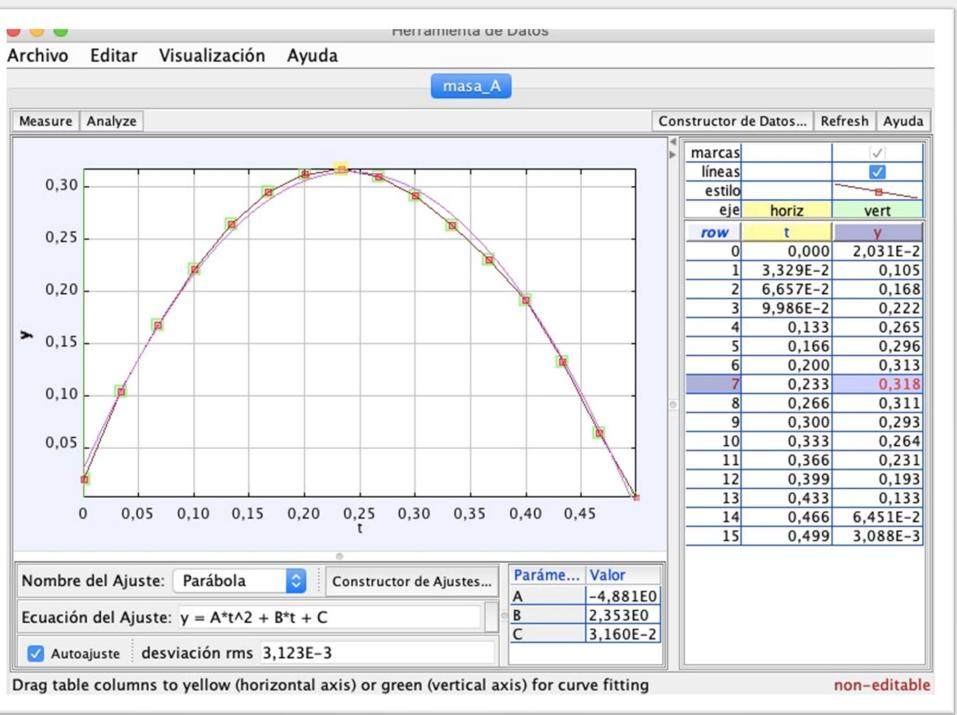
OBTAIN THE CURVE OF THE TRAJECTORY

The parabolic movement, also known as an oblique throw, consists of throwing a body with a speed that forms an angle α with the horizontal. The equation y(t) is:

$$y = y_0 + v_0 \cdot \sin(\alpha) \cdot t - \frac{1}{2} \cdot g \cdot t^2$$

As $g=9.8 \text{ m/s}^2$, the coefficient A of the parabola is expected to be -4.9.

In our case, A=-4,81

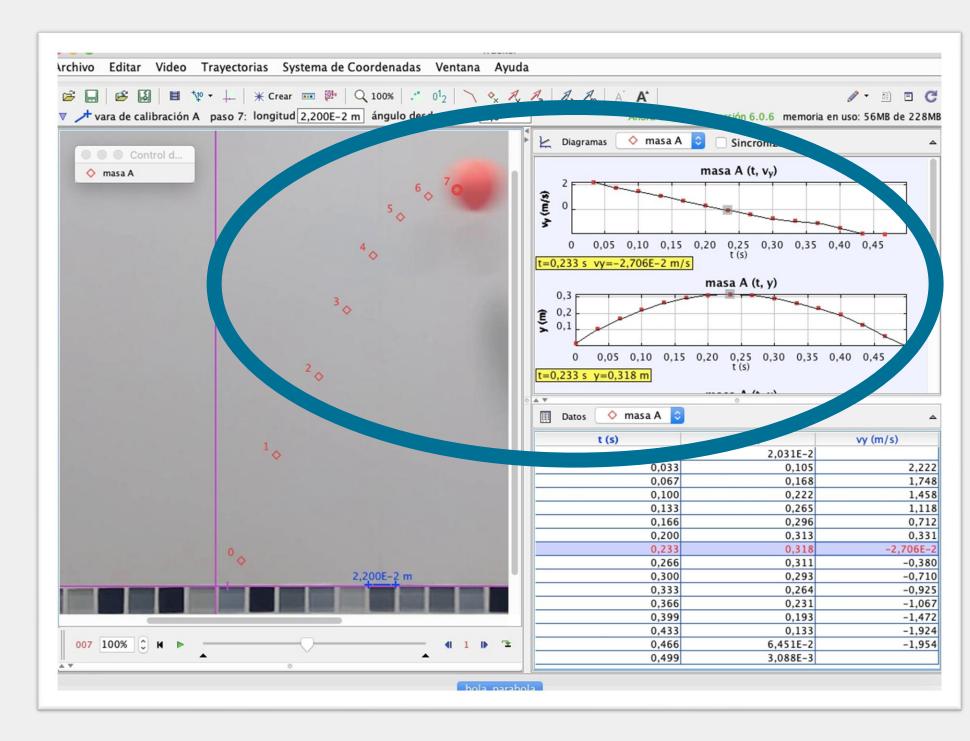






SOLVING OUR INITIAL PROBLEM (OBTAINING THE MAXIMUM HEIGHT)

It can be seen how at the vertex of the parabola, where the maximum height is reached, the v_y component of the velocity is zero (in our case, almost zero -0.02706)





SAVE OUR PROJECT IN TRACKER: CREATION OF A .TRZ FIL

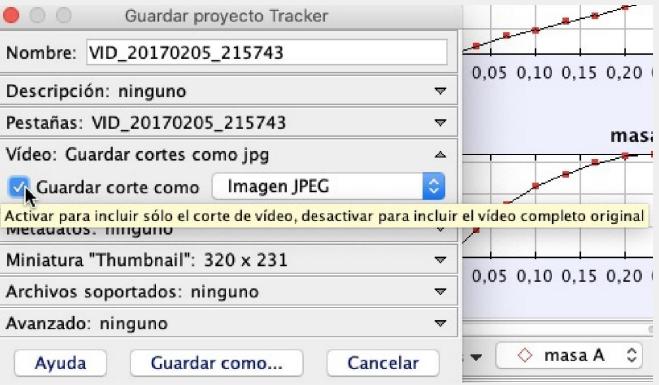
there are many options to save our project, export it, and save the video clip, among others

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Thank you



