LP2I – Lycée Pilote
Innovant International

EUCYS

A mysterious cup

Project presented by :

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With the support of our partners :

FONDATION CGENIAL

Sciences à l'École

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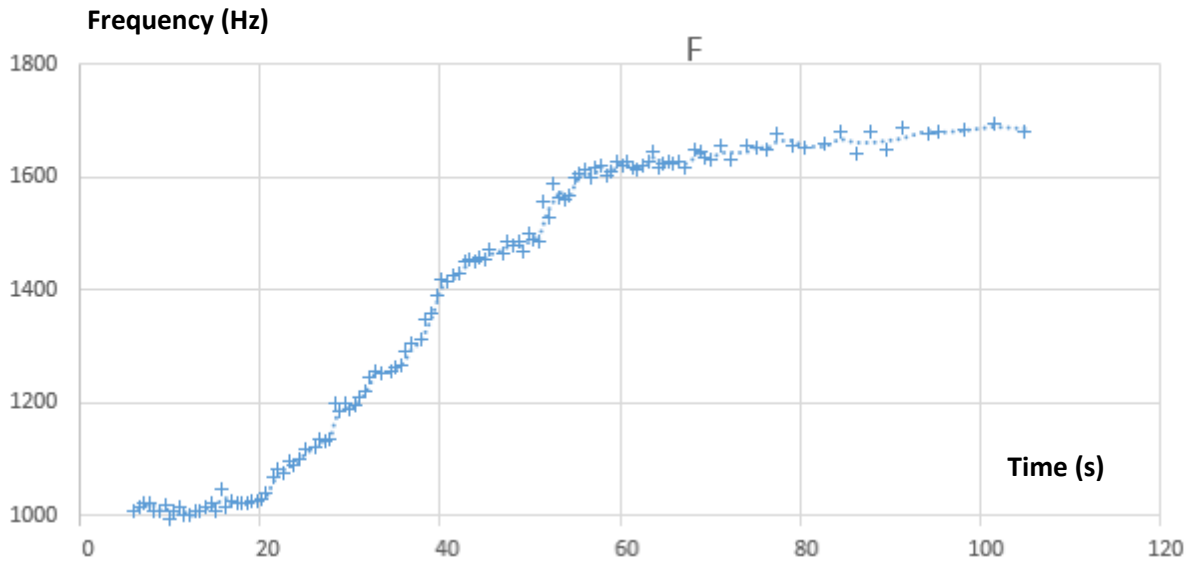
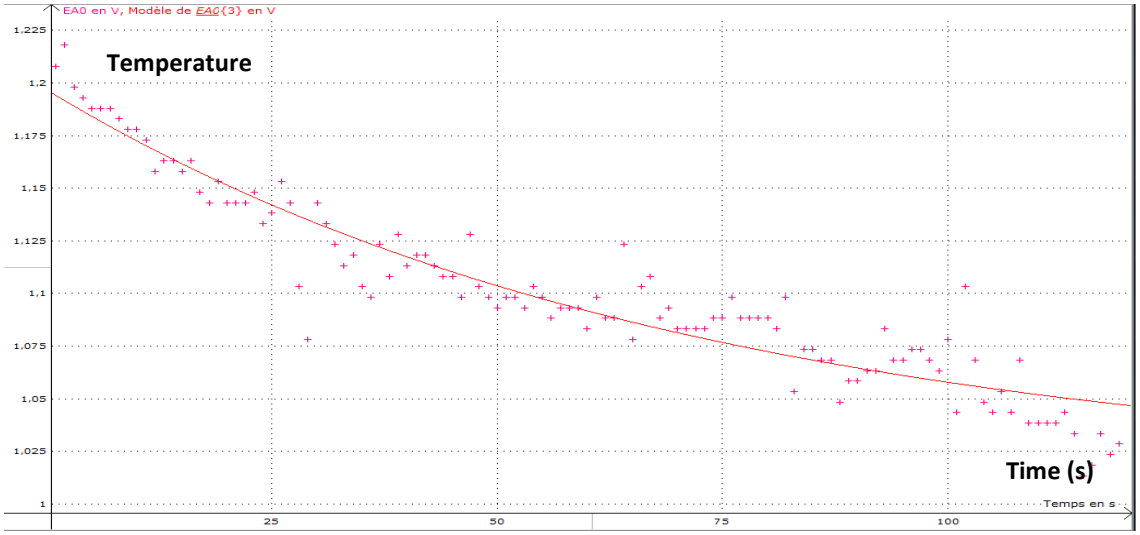
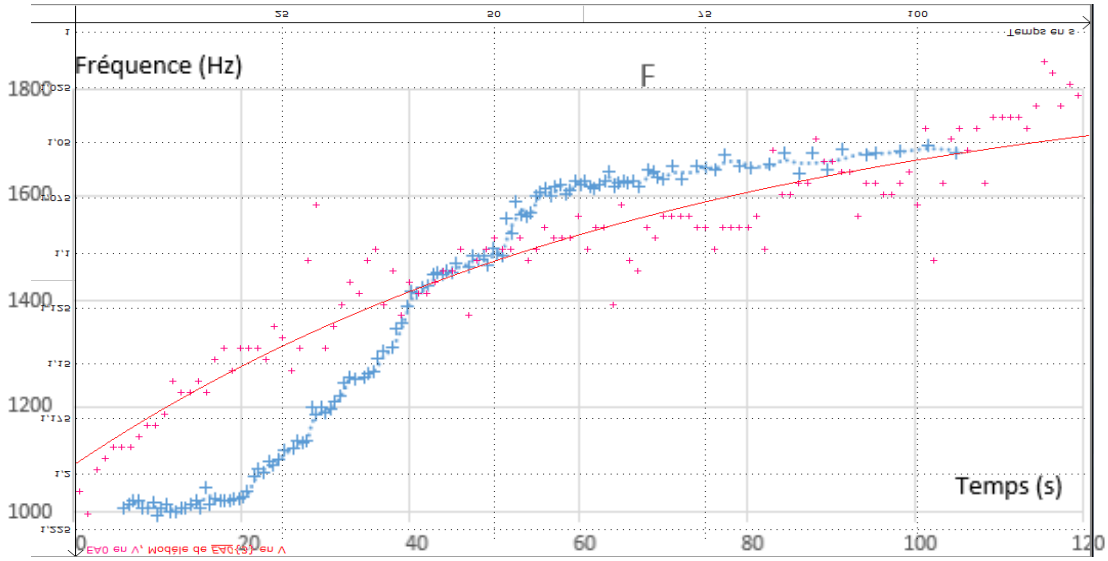


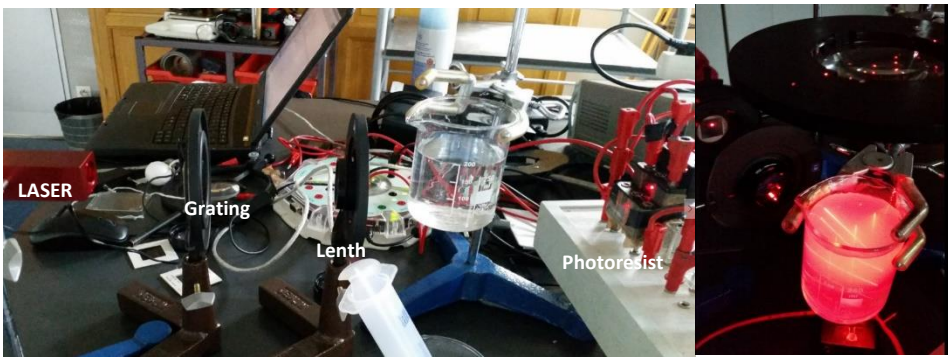
Picture 1 : Evolution vibration frequency versus time, with bubble inside water at the beginning, that disappear over time.

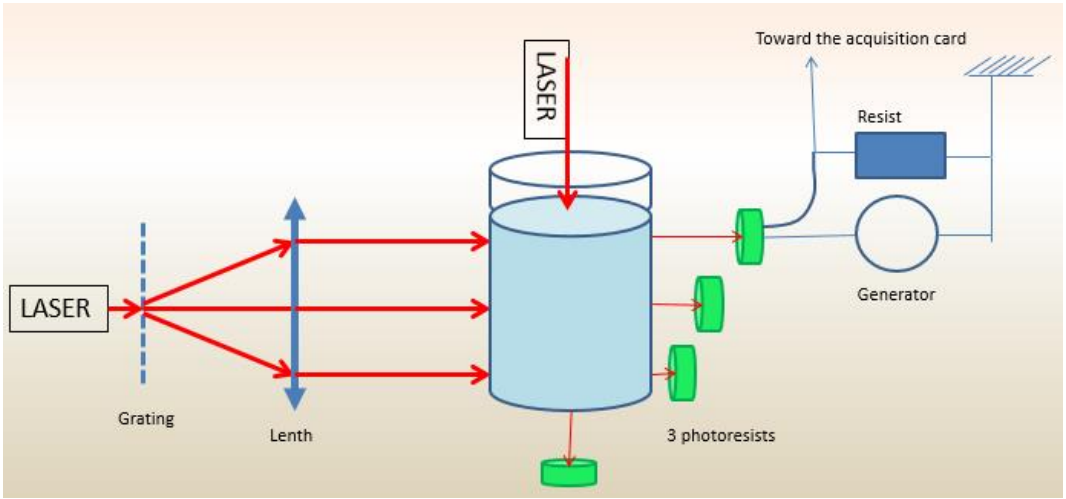


Picture 2 : Evolution of the water temperature during the disappearance of the bubble.

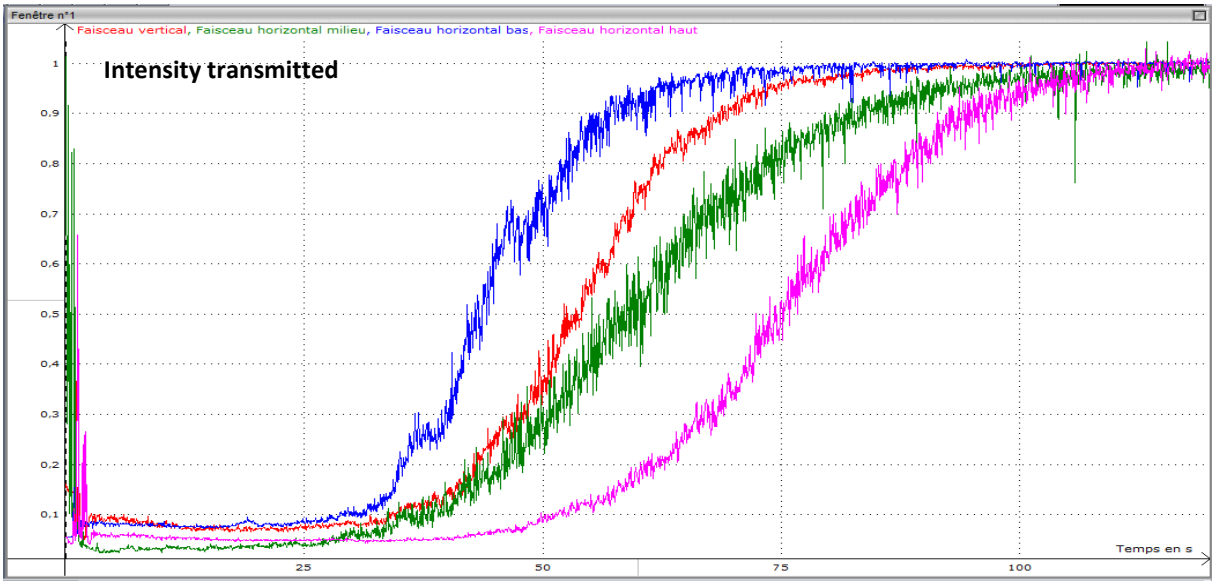


Picture 3 : Comparison between the temperature (red curve) and the frequency (blue curve) of the cup vibration.

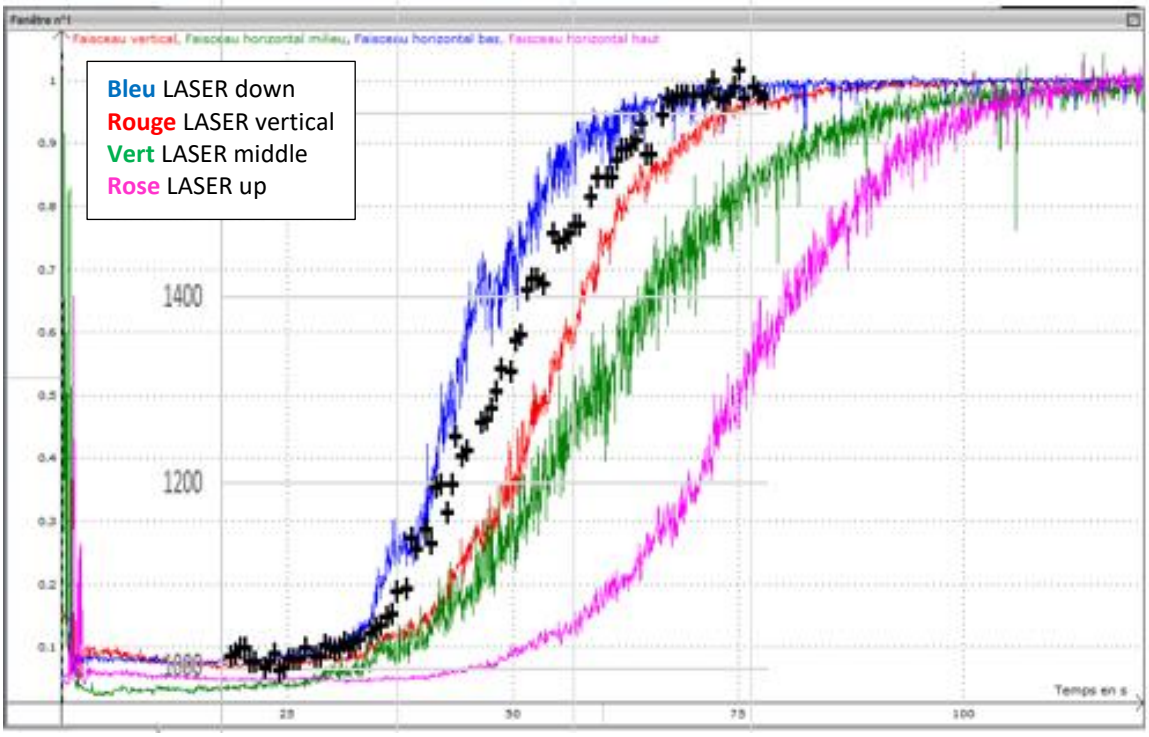




Picture 4 –Experimental design to follow the evolution of the bubble concentration in water.

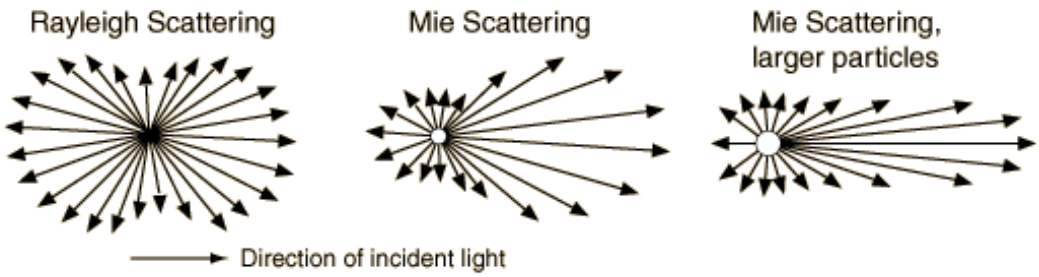


Picture 5 : Evolution of the intensity of light transmitted after passing through water that contain

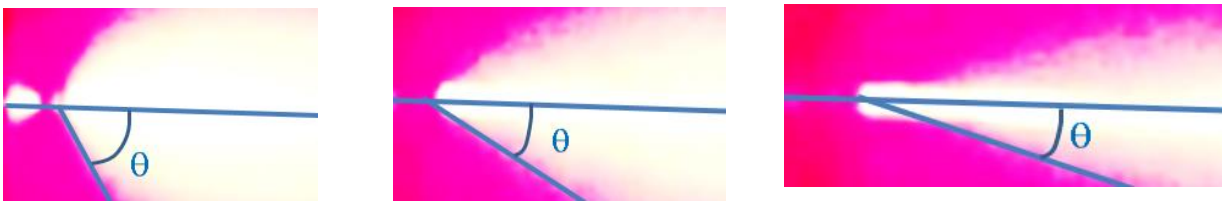


Picture 6 : Comparison between the intensity transmitted and the evolution of the frequency (black curve) of the cup that contain water with bubble.

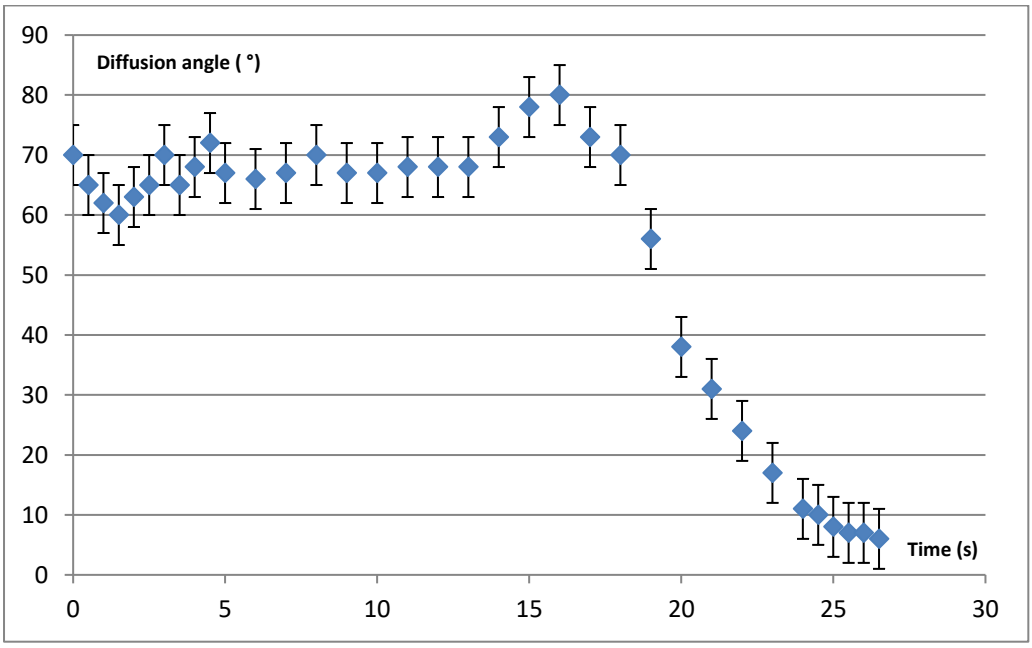
Time (s)



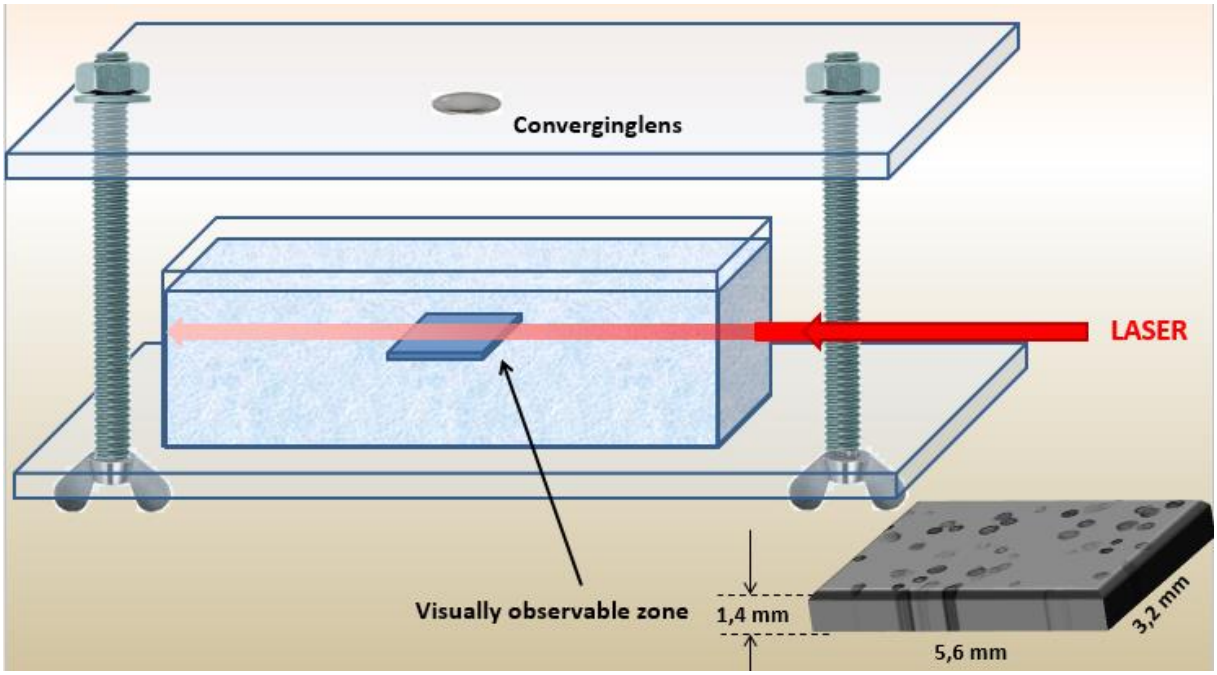
Picture 7 –Rayleigh and Mie diffusion



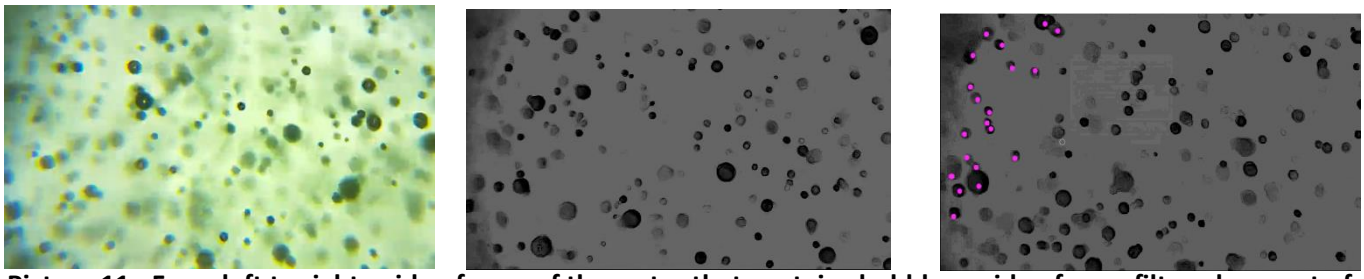
Picture 8 : A few angle values of diffusion over time.



Picture 9 : Evolution of the diffusion angle over time.



Picture 10 : Experimental to count the bubble



Picture 11 : From left to right : video frame of the water that contains bubble. – video frame filtered – count of the bubble by marking them with pink points.

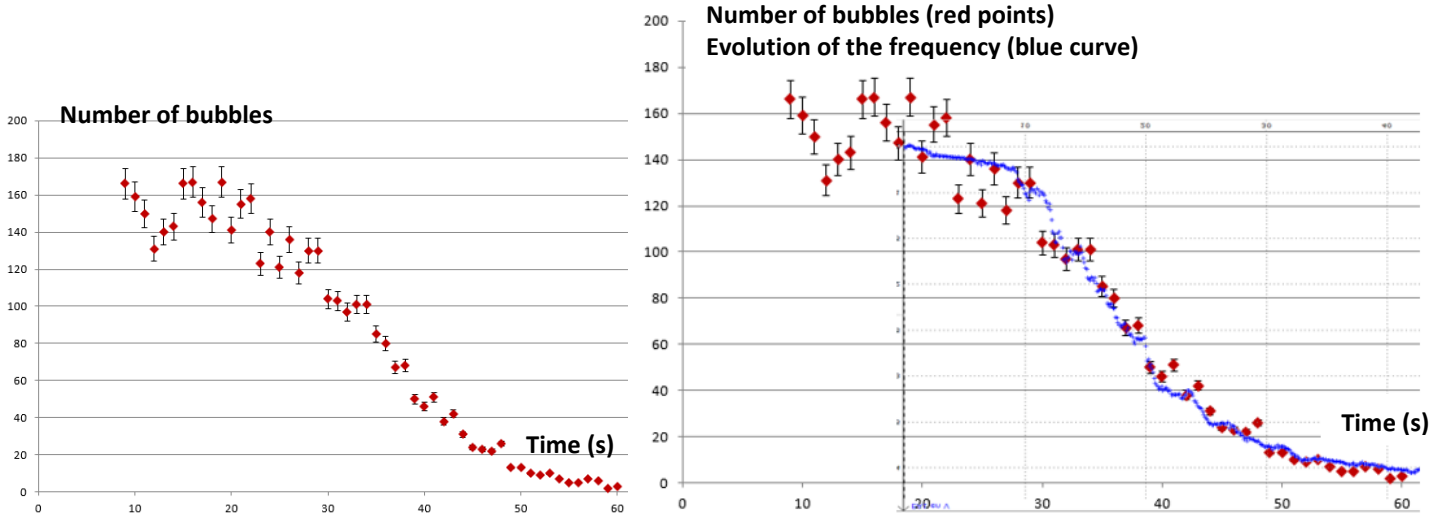


Figure 12 : Left : Evolution of the bubble concentration – Comparison between the evolution of the bubble concentration (red curve) and the evolution of the frequency (the curve is turn over for an easier comparison (blue curve).

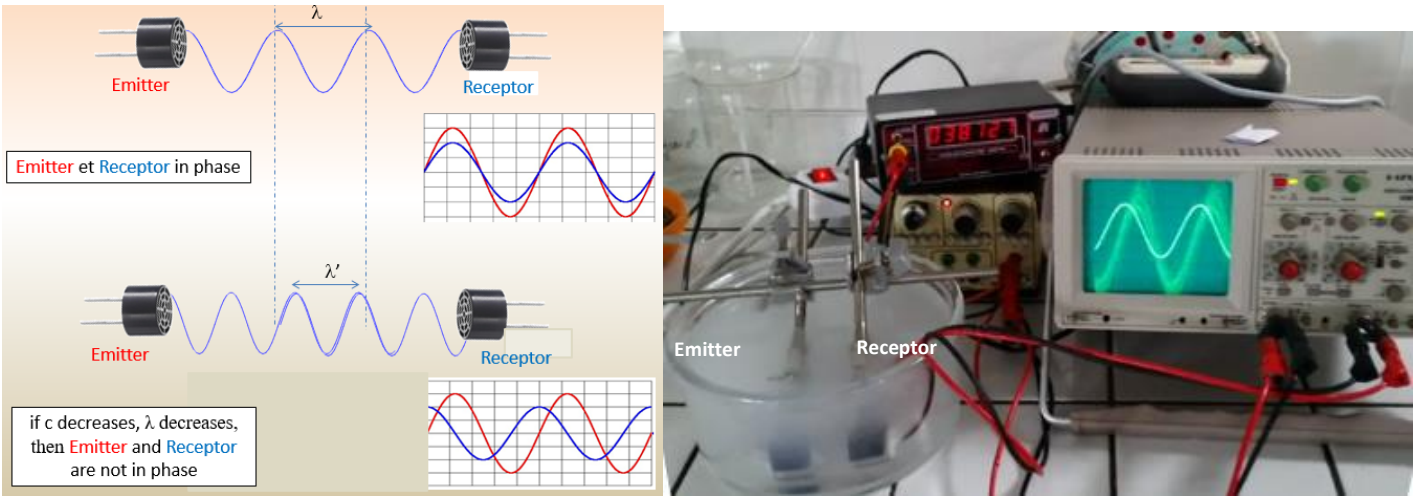
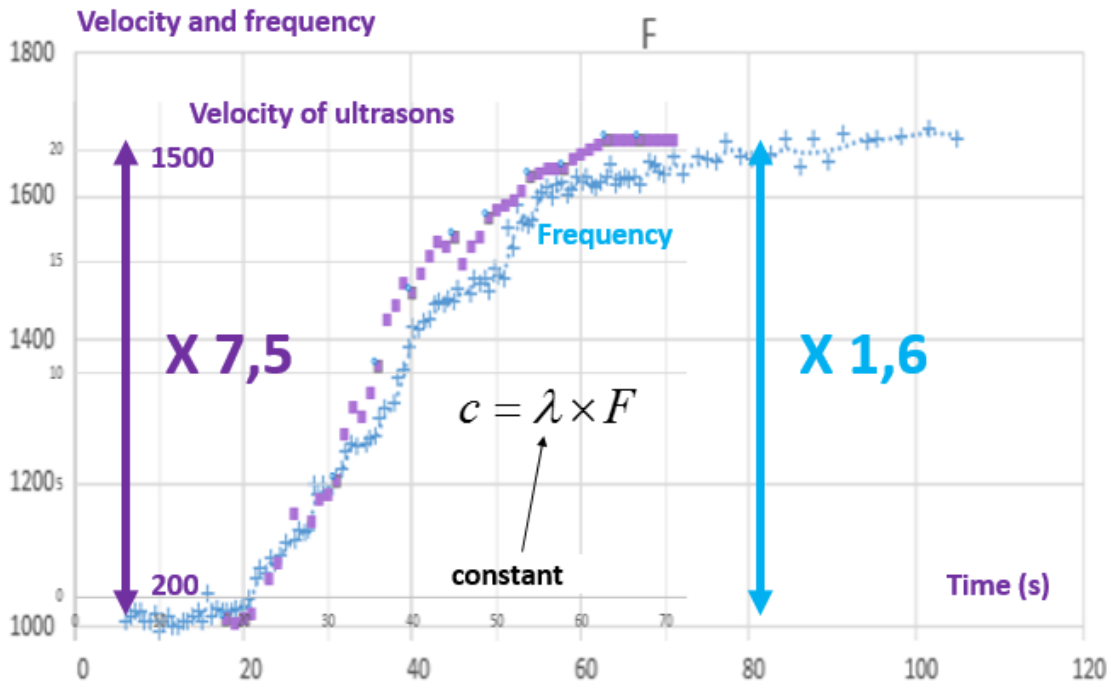
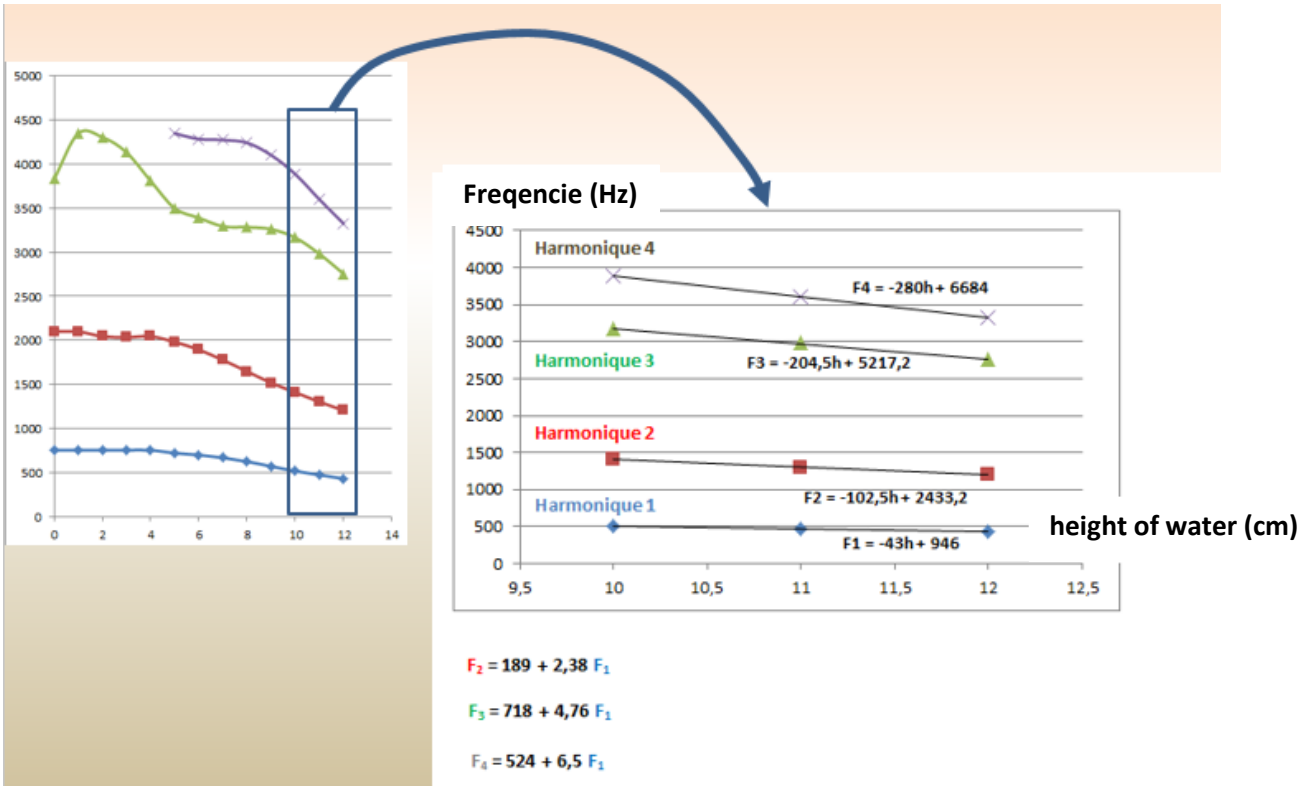


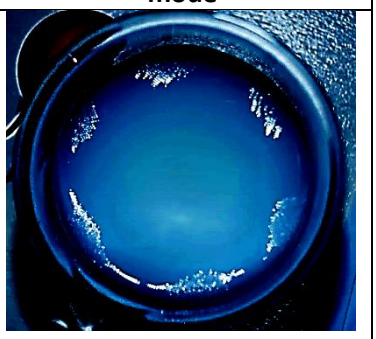
Figure 13 : Experimental design to measure the variation of the velocity of the acoustic waves in water that contains bubble.



Picture 14 : Comparison between the velocity evolution (violet) and the frequency evolution (blue)



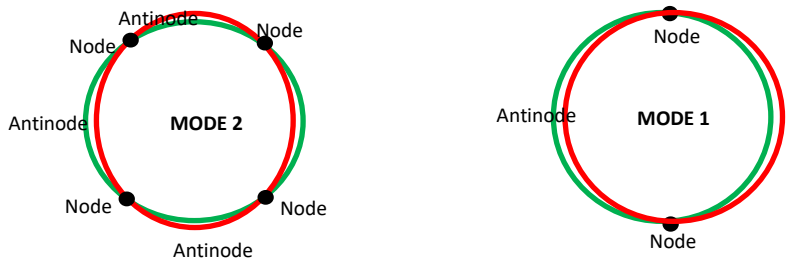
Picture 15 : Different modes of vibration of the cup

first natural vibration mode		second natural vibration mode
	Viewing of the first mode with a powder sprinkled on the surface of the water. 	

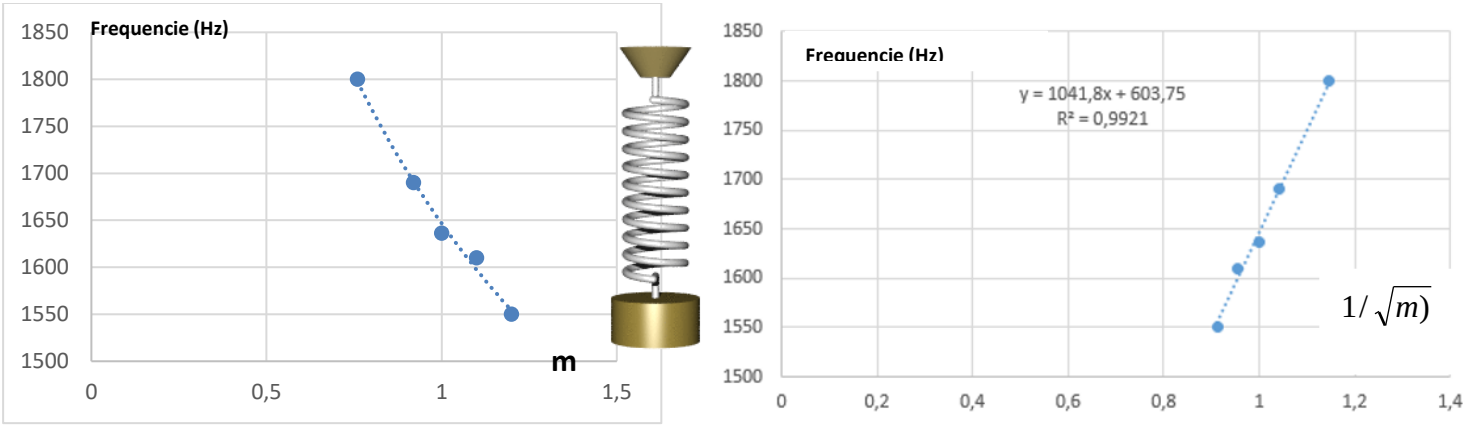
Picture 16 : viewing of the two first natural vibration modes of a cup of water.

Mode	*F(Hz)*	*λ(m)*	velocity (m/s) $v_n = f_n \times \lambda_n$
1			
2	f_2 =590	$\lambda_2 = \frac{2\pi R}{2} = 0{,}12$	71
3	f_3 =1628	$\lambda_3 = \frac{2\pi R}{3} = 0{,}08$	130
4	f_4 =2825	$\lambda_n = \frac{2\pi R}{4} = 0{,}06$	170

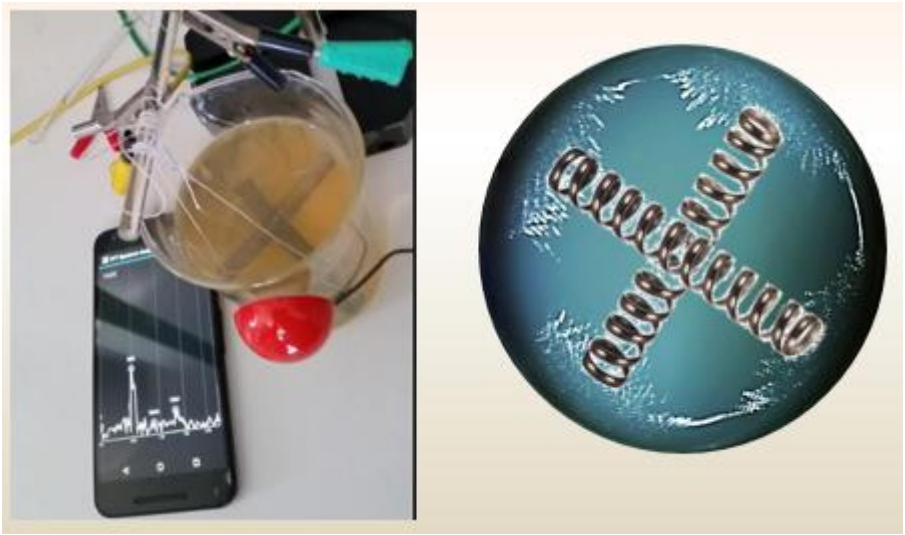
Picture 17 : Natural modes of the vibration of the cup



Picture 18 : Nodes and antinodes in the second mode (left) and the first mode (right).



Picture 19 Solid spring system modelling



Picture 20 : Bubble production by electrolysis

Thanks to our partners, for their support, their collaboration, and for the interest in our work.