



BIOACOUSTICS  
RESEARCH IN  
LATIN AMERICA  
2015



**“An underwater acoustic camera for  
marine mammal vocalization interaction  
studies”**

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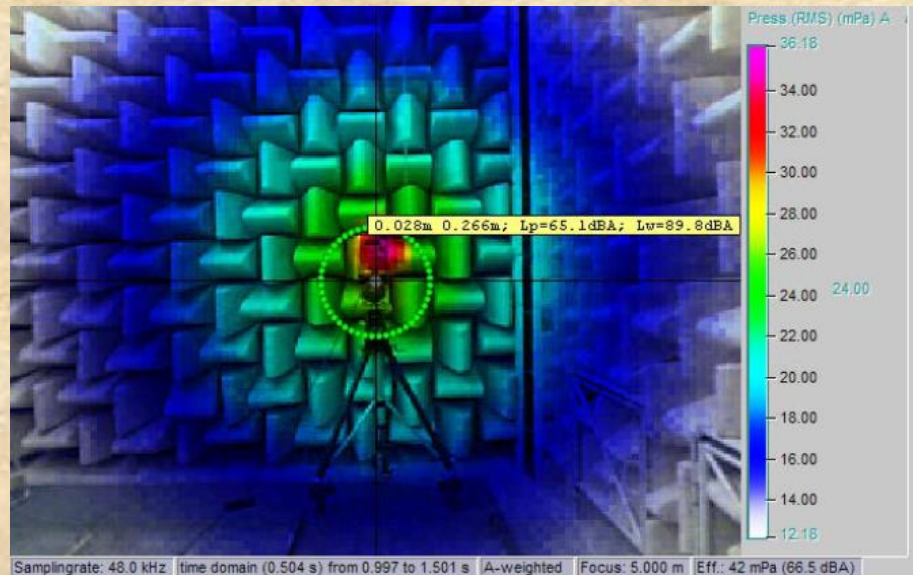
***SERGIO GARCÍA BERISTAIN***



# ACOUSTIC CAMERA



Gfai Tech, GmbH, (2014)

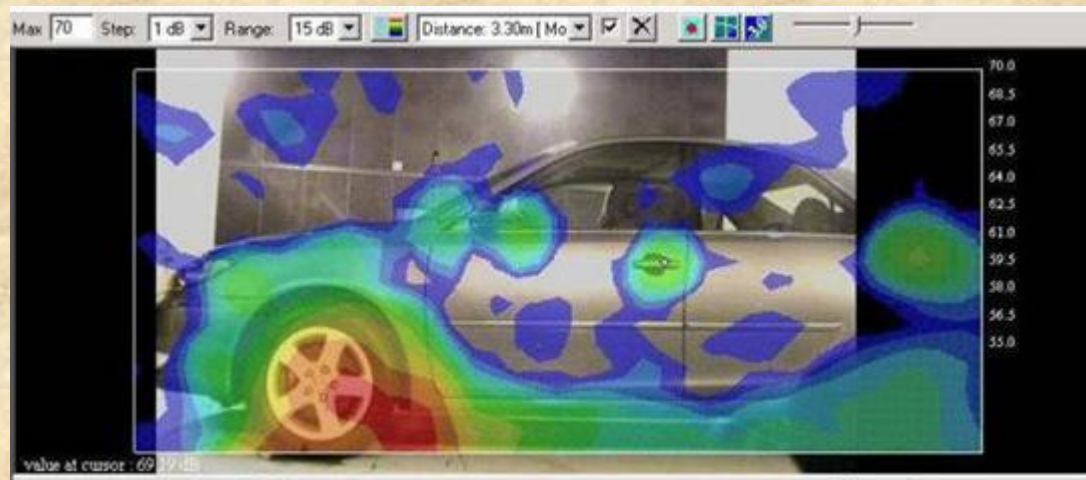


Gfai Tech, GmbH, (2014)

- ❖ Sound source localization system that uses an array of microphones, conventional beam-forming algorithm technic and a video camera to visually pinpoint particular sound sources in a clouded sound environment

# APPLICATIONS

- ❖ The range of usage is nearly unlimited. Automotive, wind energy, environmental, transportation, aerospace



Brüel & Kjær , (2015)

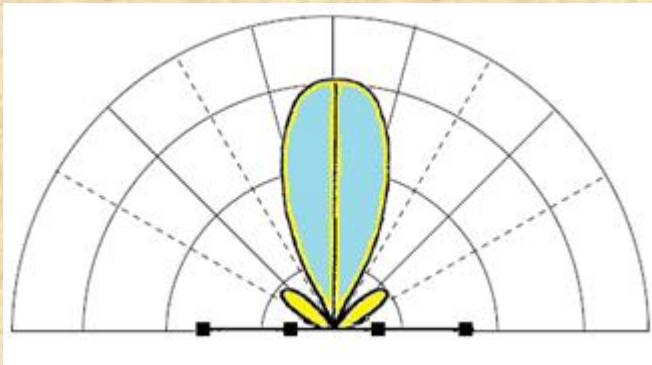


# BIOACOUSTIC APPLICATIONS

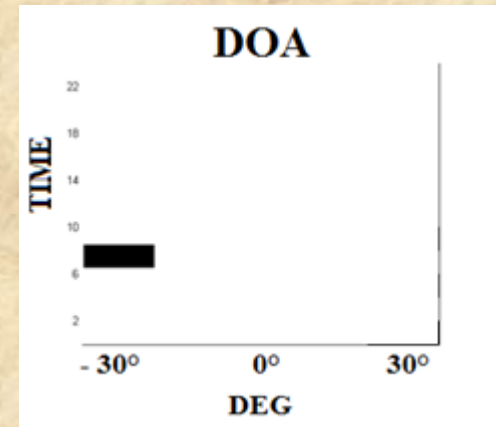


# ACOUSTIC CAMERA REQUIREMENTS

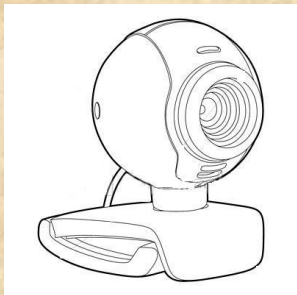
## 1 – LINEAR ARRAY



## 3 – SIGNAL PROCESSING



## 2 – DIGITAL CAMERA



- DATA ACQUISITION
- BEAMFORMING
- DIRECTION OF ARRIVAL
- SUPERPOSITION

# ACOUSTIC CAMERA DESIGN

# AIR SETTINGS

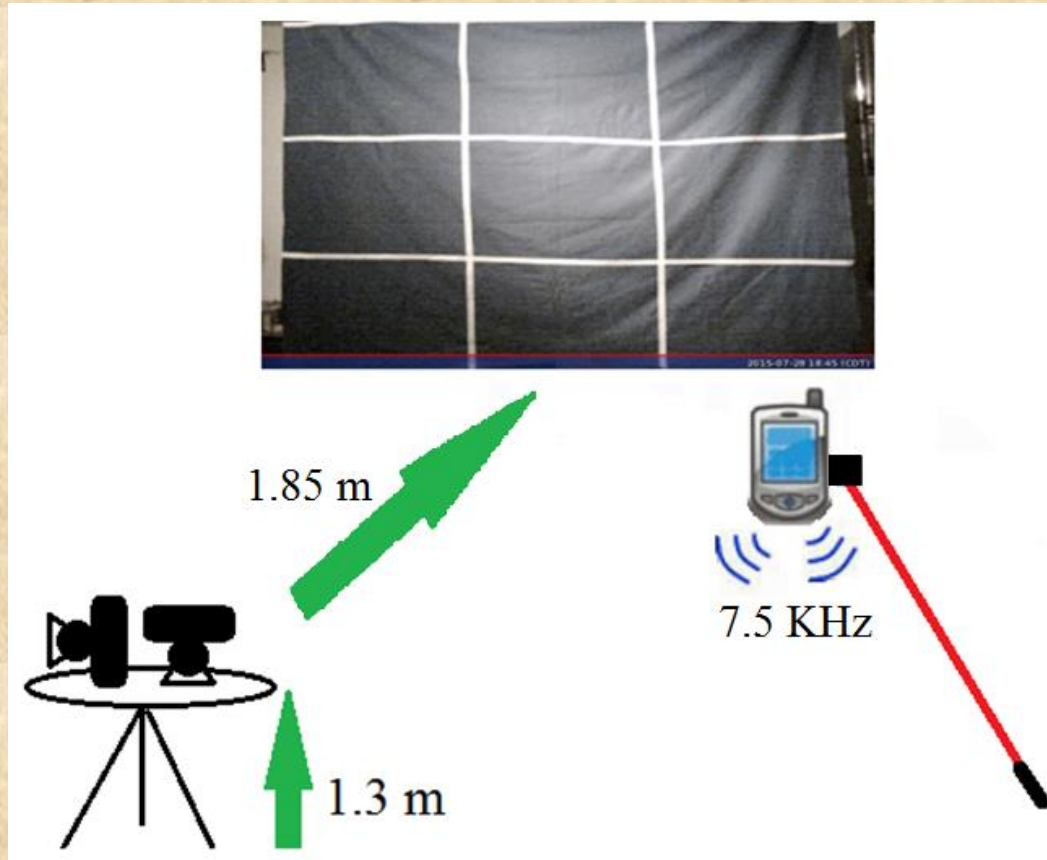
## MICROPHONES



### ❖ Sony PS3 Eye Camera

#### Features

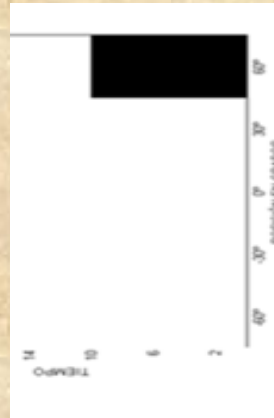
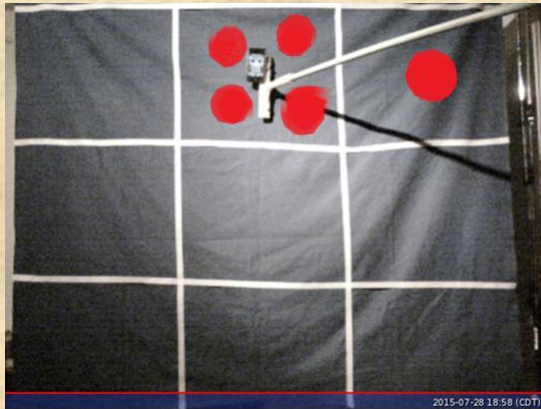
- 16 KHz sampling rate
- 16 bits resolution
- USB connector



### ❖ RASPBERRY PI

Credit card-sized single-board computers

# RESULTS



❖ RESULTING IMAGE FROM THE ACOUSTIC CAMERA



# UNDERWATER ACOUSTIC CAMERA

# FIELD TEST SETTINGS

## ❖ LOW-COST LINEAR ARRAY OF HYDROPHONES



F = 2 KHz  
L = 1.125 m.  
BW = 30 °  
Deep = 2 m

*Design and field test of a low-cost-portable linear array for marine mammal localization*  
Omar A. Bustamante, Eduardo Romero Vivas and Sergio Beristain  
*J. Acoust. Soc. Am.* 133, 3257 (2013);  
<http://dx.doi.org/10.1121/1.4805256>

## ❖ UNDERWATER CAMERA



Viewing angle:  
83° horizontal  
60° vertical



❖ Zoom H4N  
48 kHz  
4 channels  
Shielded case

# STUDY AREA

## ❖ Bahía de La Paz in the Gulf of California



## ❖ La Lobera



➤ Sea Lions colony  
underwater social interactions studies  
Calls with no bubble emissions  
revisar AU  
explicar la importancia....

# RESULTS





# CONCLUSIONS

- ❖ The results shows that an underwater acoustic camera built around a low-cost open source linear array of hydrophones and a fishing underwater camera is affordable
- ❖ This prototype allows deepen different concepts of visual-acoustic sound source localization, advantage and limitations.
- ❖ Bioacoustic conclusion

# FUTURE WORK

- ❖ Real time processing
- ❖ Underwater acoustic camera in 2 dimensions

# Acknowledgments

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