Developing the Optical Fiber Infrasound Sensor at Piñon Flat Observatory

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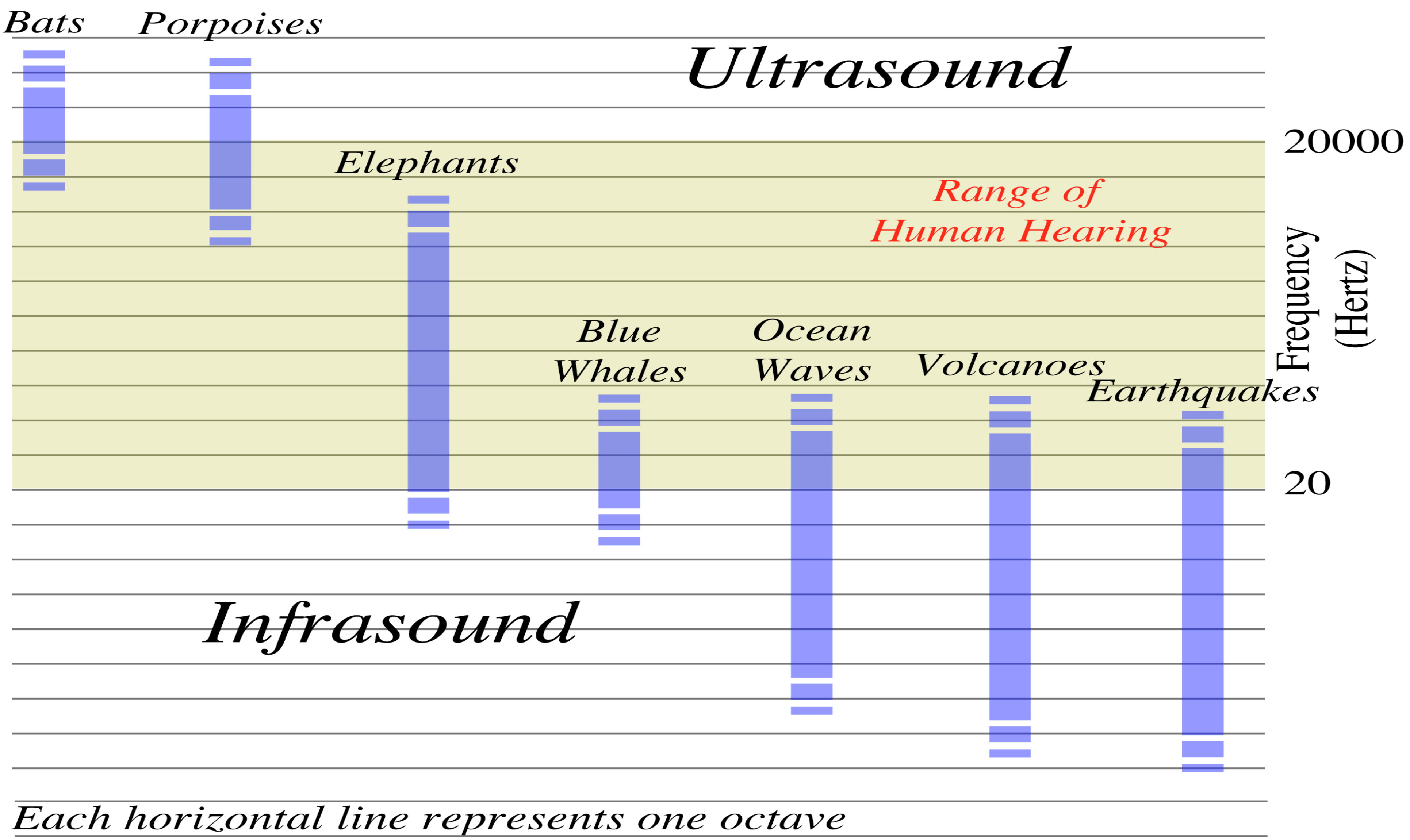
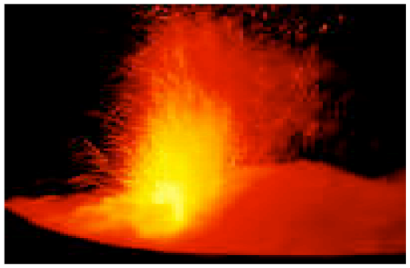
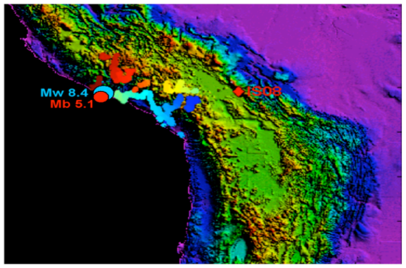
The Acoustic Spectrum

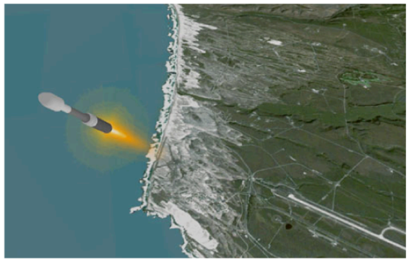


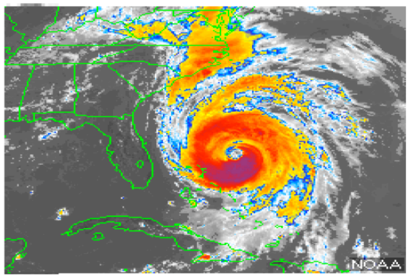
Each horizontal line represents one octave

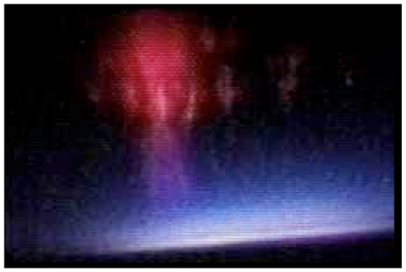
Other Infrasound Sources

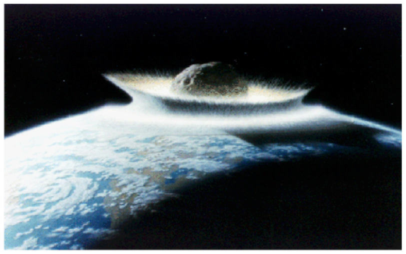








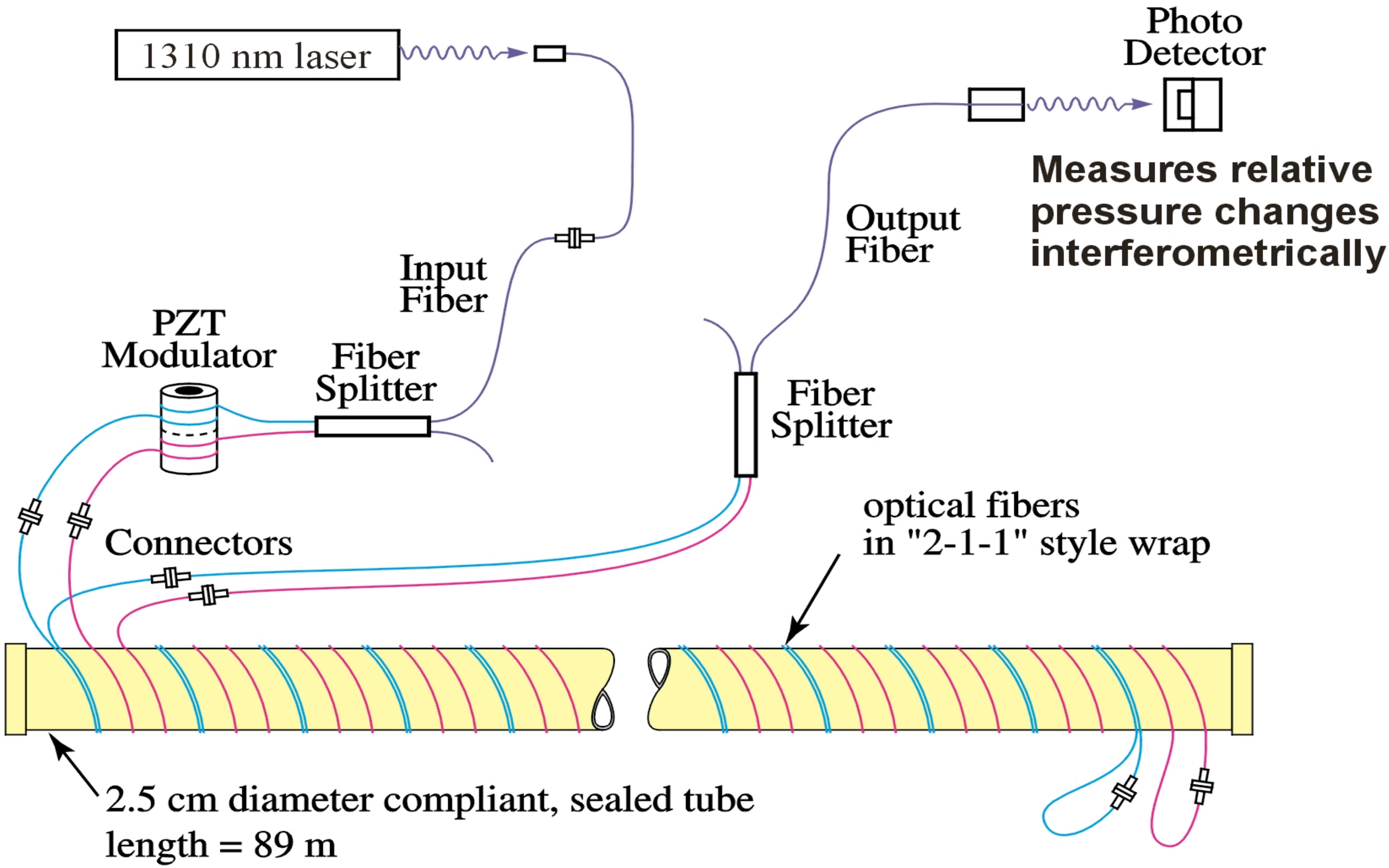




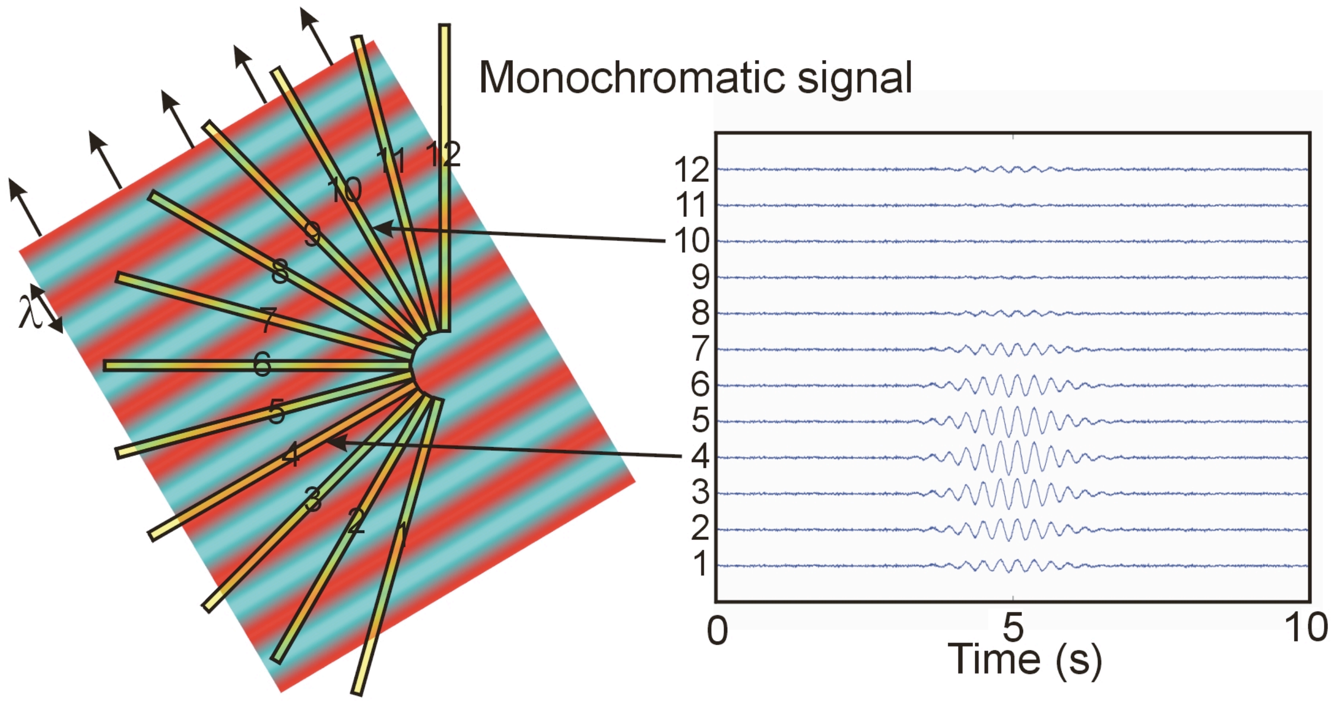
OFIS Development Motivations: Wind Noise and Expense

- Wind noise overwhelms many signals. Target: reduce noise at wind speeds up to 20 mph
- Traditional microphone arrays are relatively expensive to build, maintain, and are intrusive.
- Solution: Average pressure along an inexpensive line of receivers.

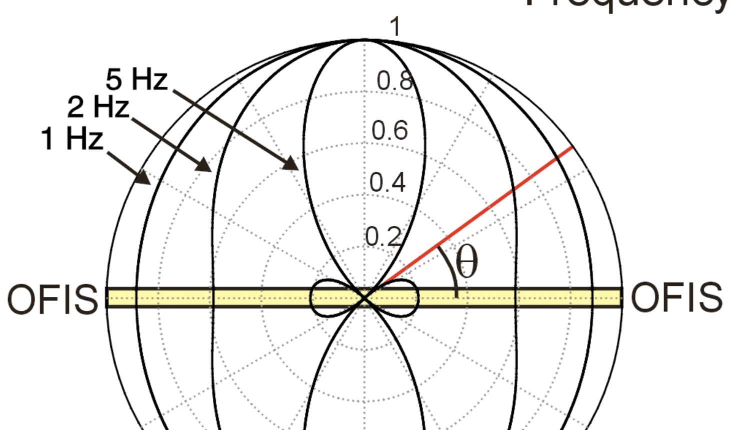
$$\overline{P} = (1/L)\int_0^L P(x)\,dx$$



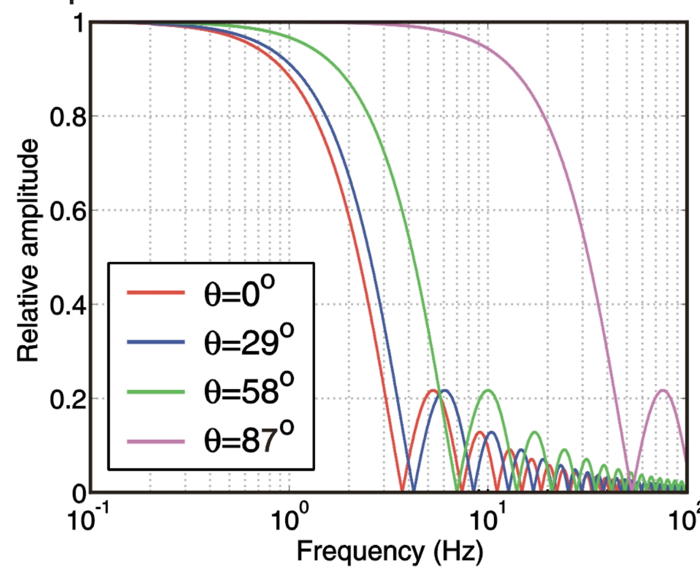

OFIS is a directional microphone



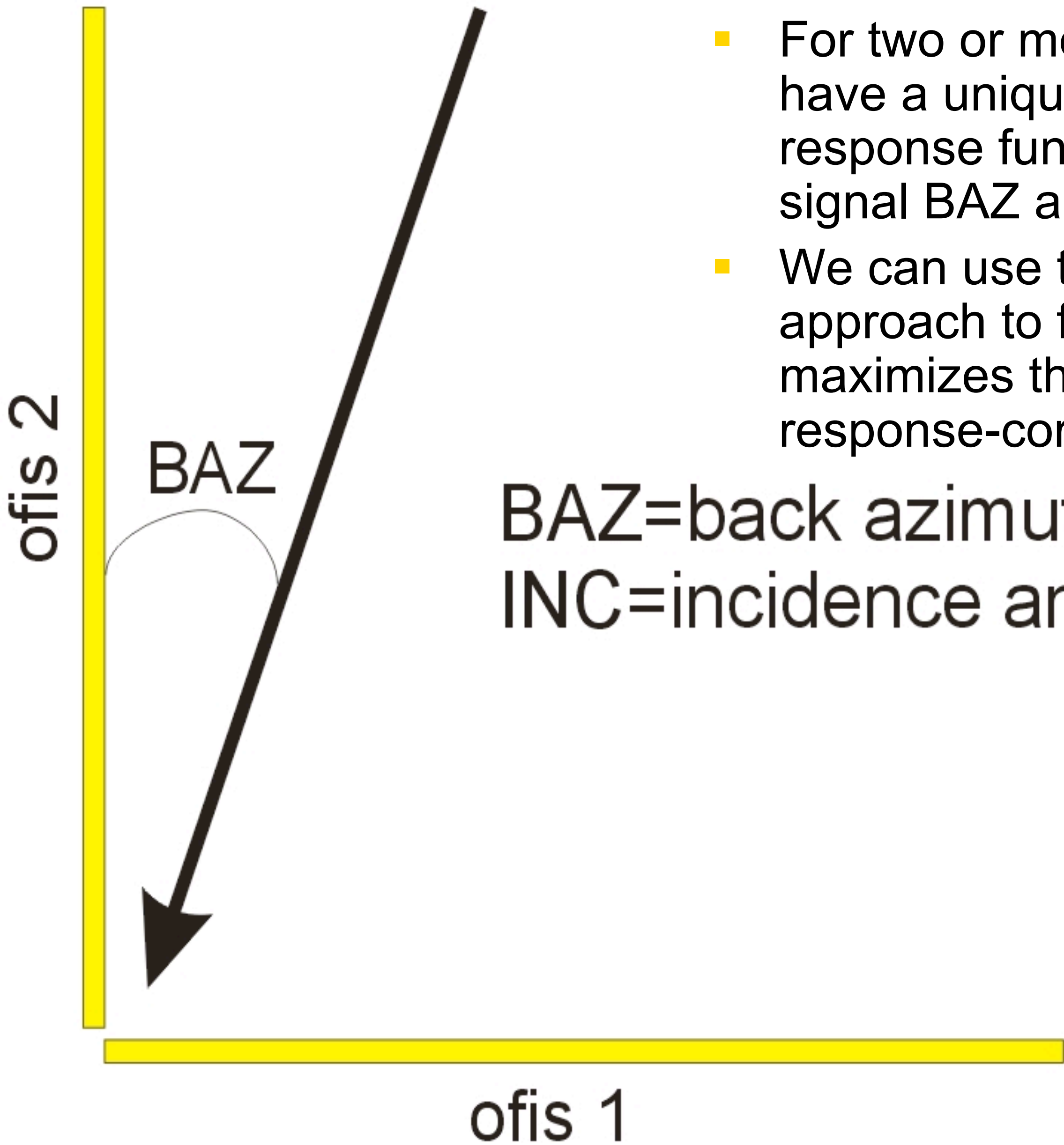
Frequency response



$$R = \left|\mathrm{sinc}\left(\frac{L\pi f}{V_a}\cos(\theta)\right)\right|$$



Determining Back Azimuth



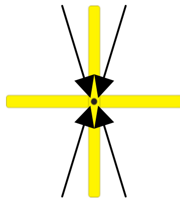
- For two or more OFIS arms, each will have a unique and predictable response function for an incoming signal BAZ and INC.
- We can use this in a trial-and-error approach to find the signal BAZ that maximizes the similarity between the response-corrected signals.

BAZ=back azimuth

INC=incidence angle (90°=horizontal)

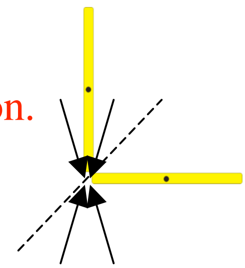
Other Configurations

We get BAZ/INC resolution from two sources: directivity of OFIS and time separation of signals.

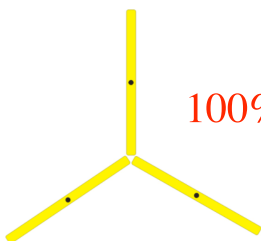


Only resolution within quadrant.

90% resolution.

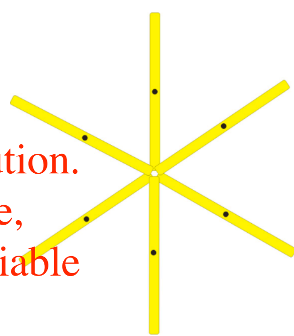


“2-90” config; PFO 2004



100% resolution.

“3-120” config; PFO 2005 (currently)



100% resolution. More precise, accurate, reliable

“6-60” config; maybe Camp Elliot, 2006 (or “5-72”)

Real Signal Example