

音響信号による屋内測位技術

杉本 雅則

北海道大学

sugi@ist.hokudai.ac.jp

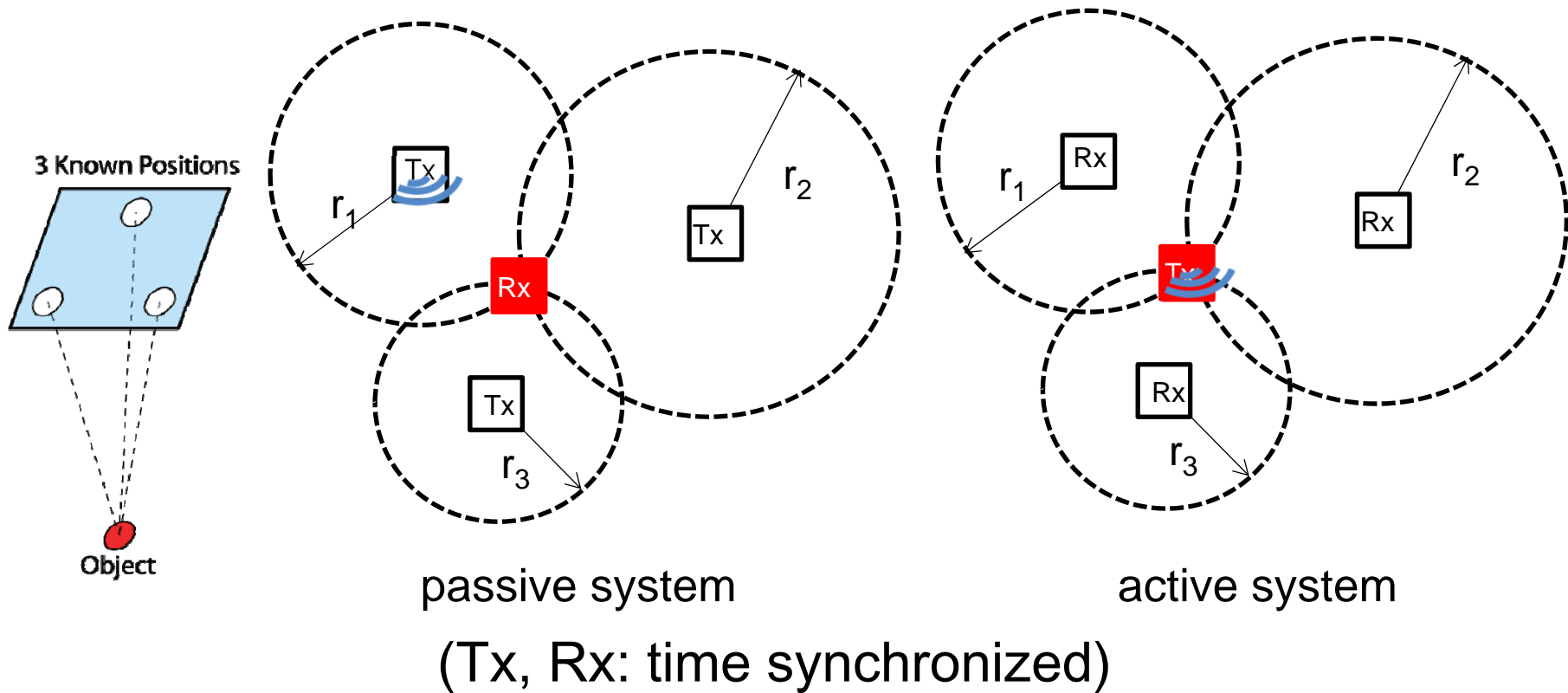
橋爪 宏達

国立情報学研究所

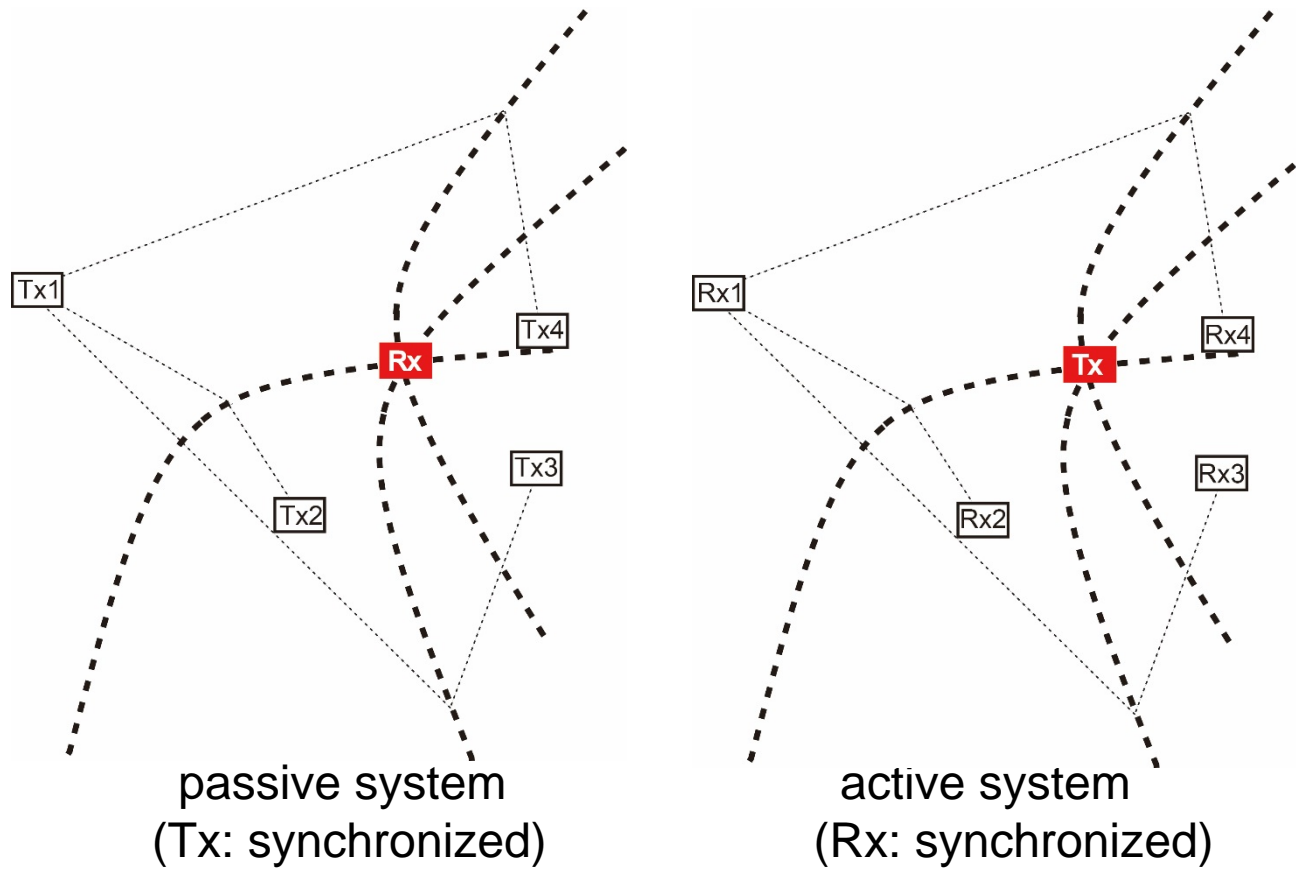
has@nii.ac.jp

ToA Trilateration

Trilateration: finding a position of a target using measured distances between beacons and the target



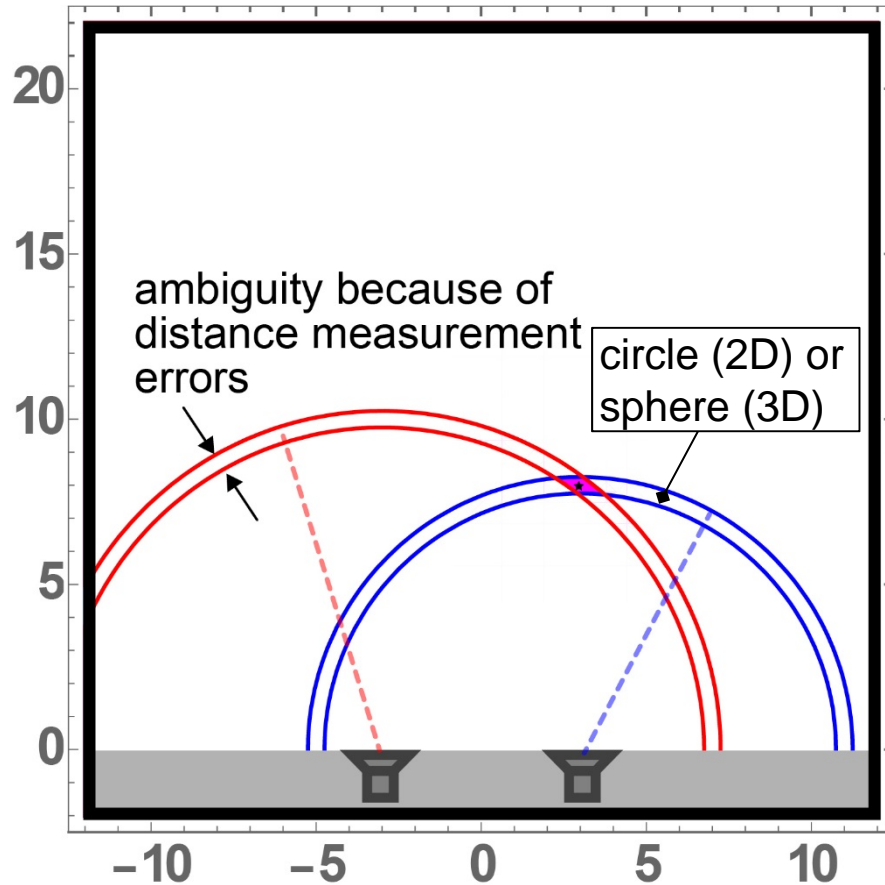
TDoA Trilateration



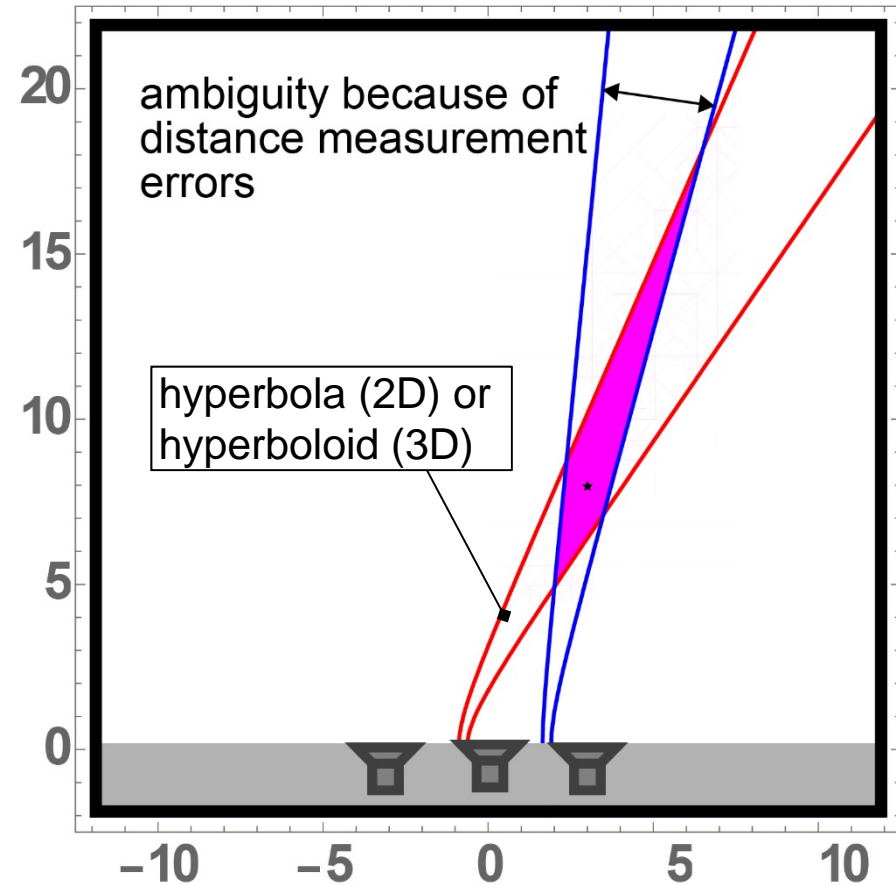
$$d_i - d_1 = c \cdot (t_{ri} - t_{r1}) \quad (i = 2, 3, 4)$$

Positioning Performance

TOA



TDoA

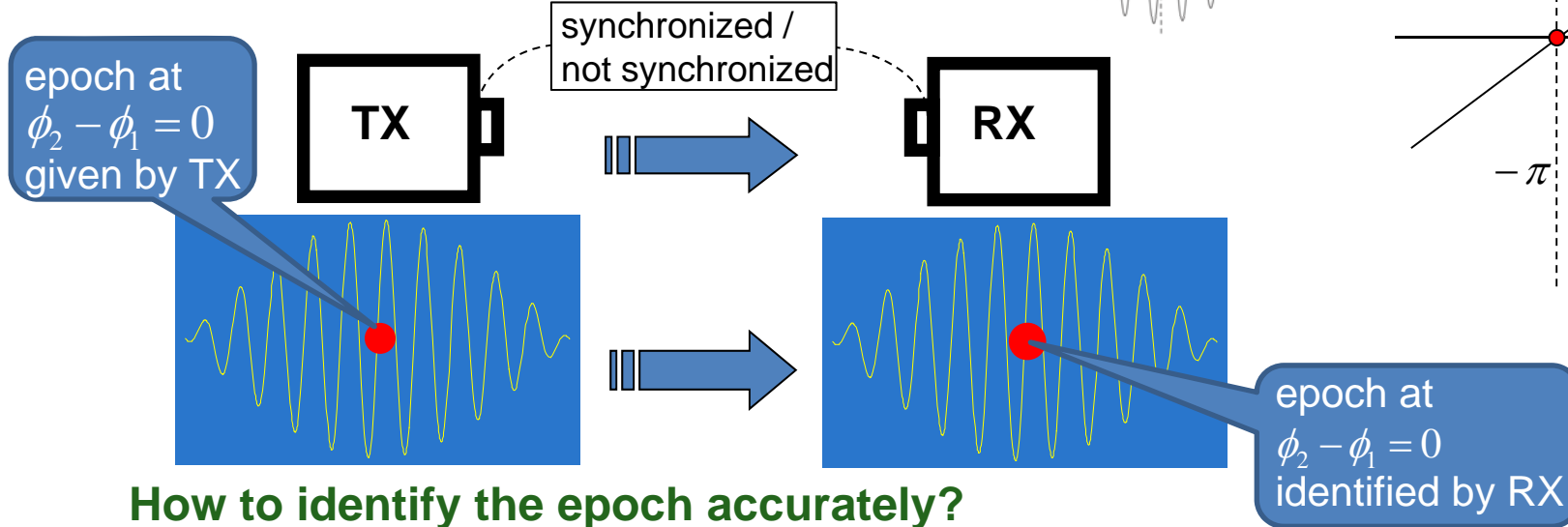
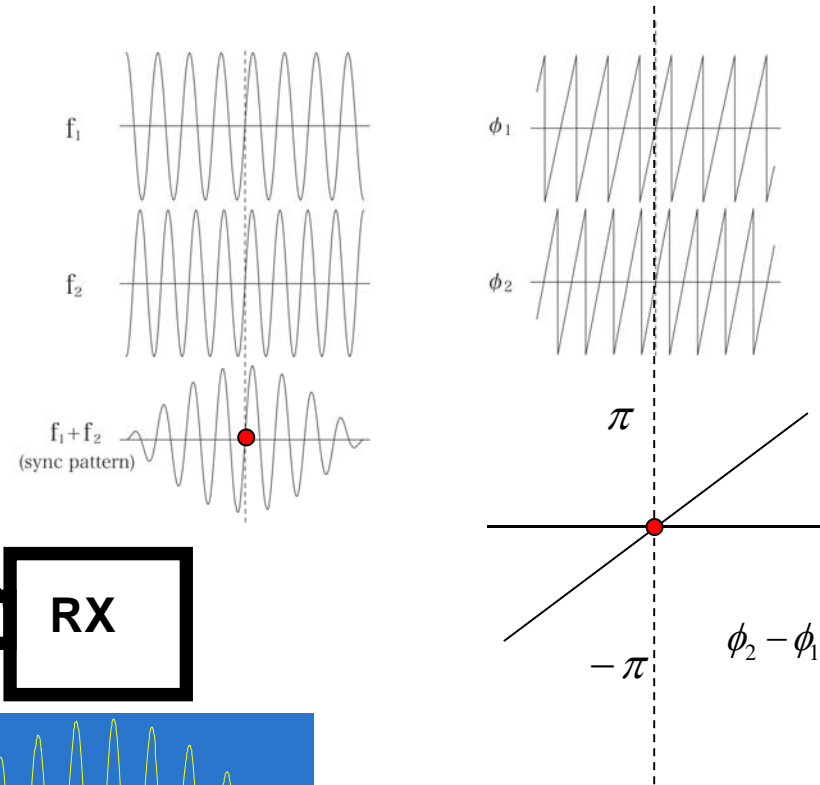


TOA shows better positioning performance than TDoA

Phase Accordance Method (PAM)

Accurate and precise arrival time detection method

- Use multiple (two or more) ultrasonic signals with different frequencies
- Set a reference time as the phases of the multiple signals have the same value \rightarrow *epoch*



How to identify the epoch accurately?

FDM-PAM for Smartphone

Frequency Division Multiplexing (FDM)

