

INTRODUCTION

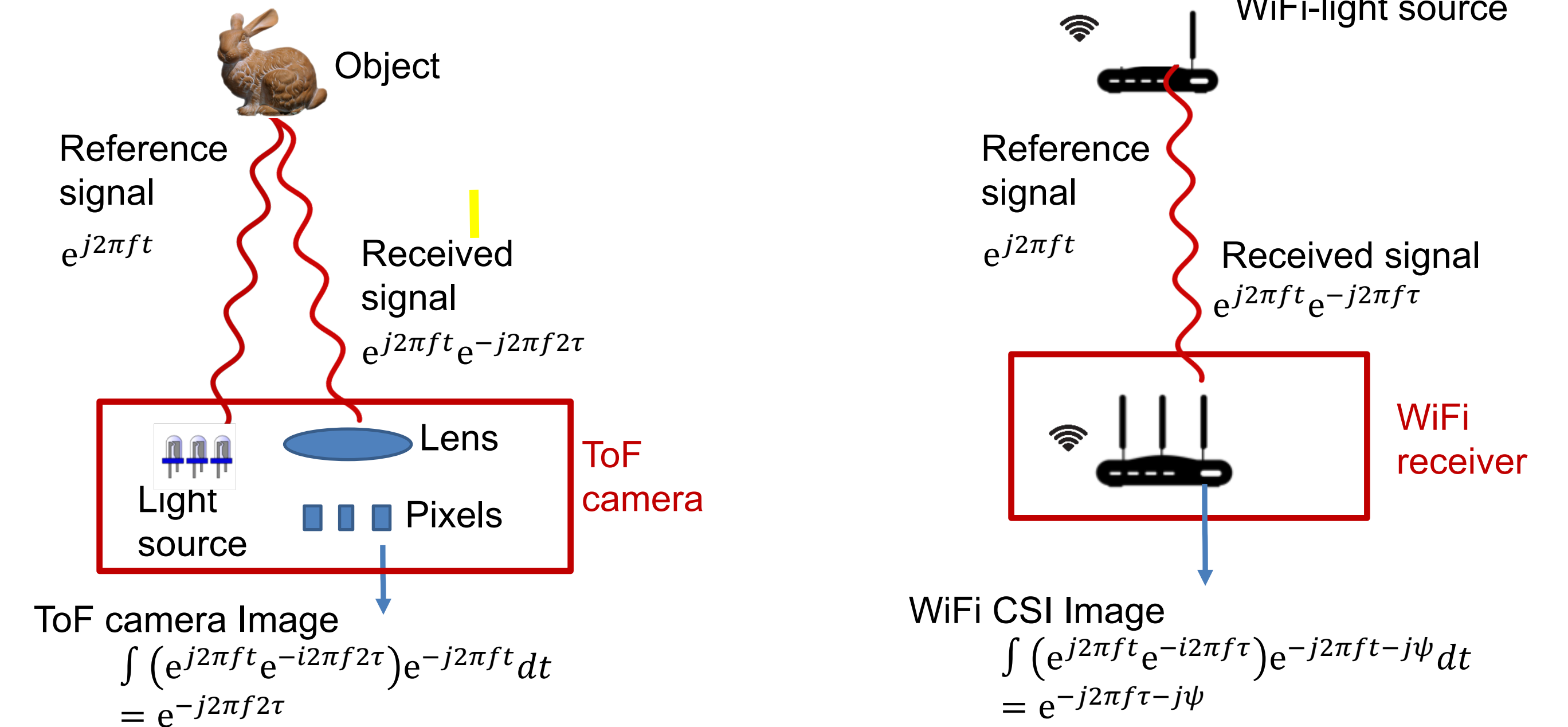
- Position tracking is a major hurdle to **widespread VR adoption**



- Potential solution: **WiFi**
- No specialized hardware, occlusion resistant, enables whole-home experience

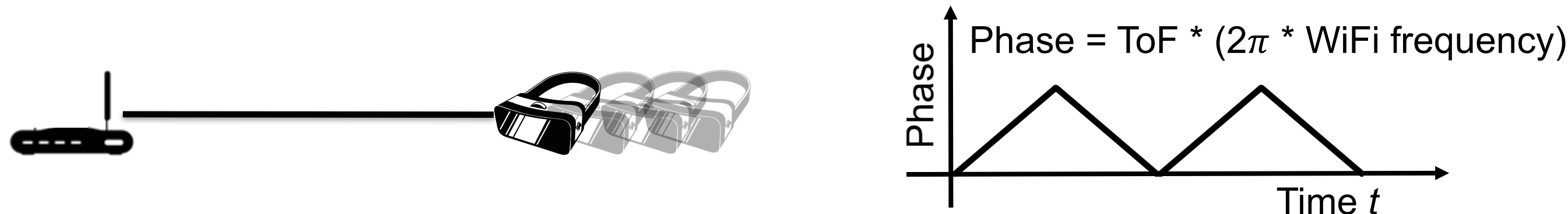
HOW DOES IT WORK?

- WiFi as ToF camera**



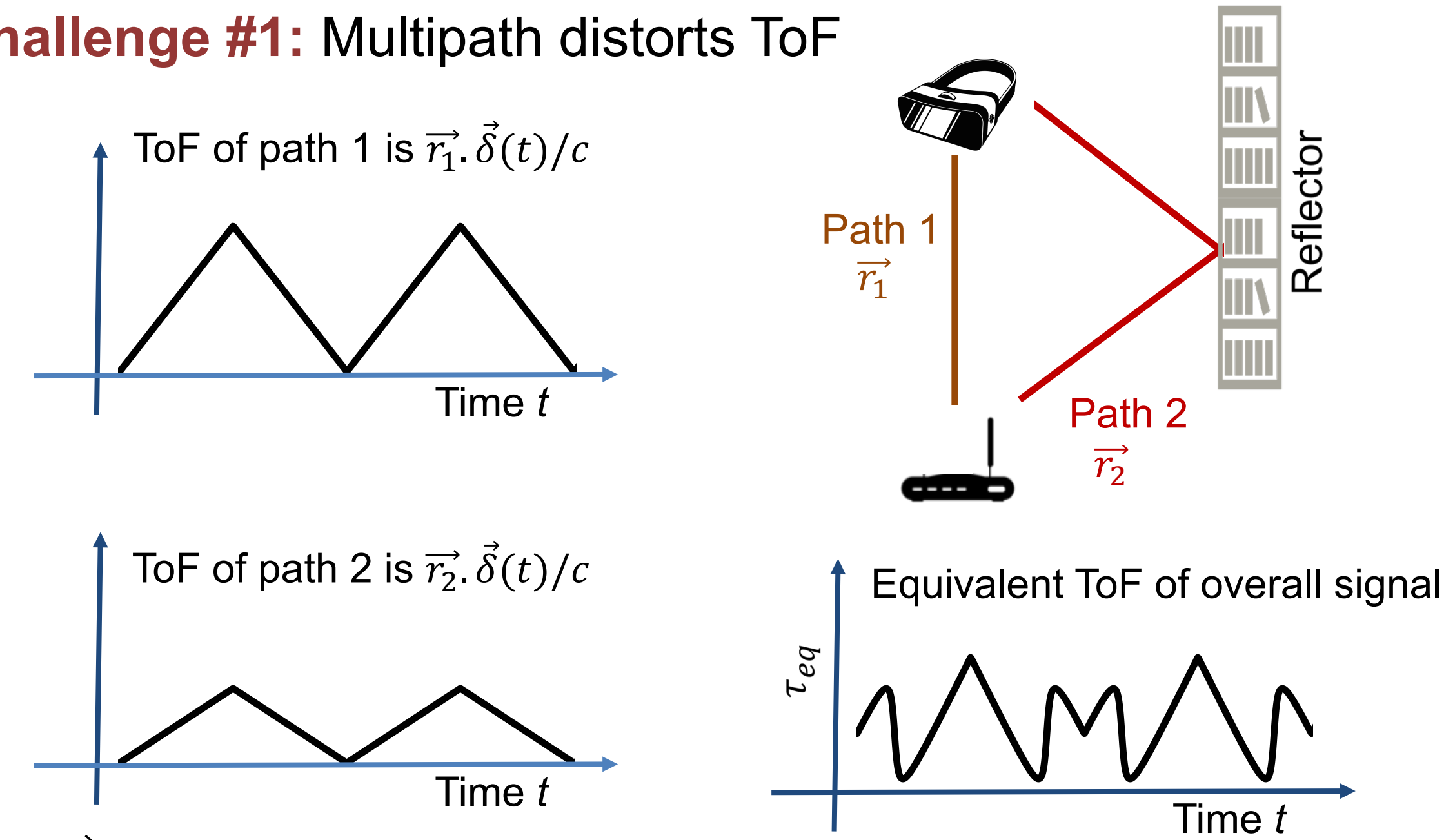
- Even **mm-level motion** creates **measurable** phase change

- For example, consider a VR headset, equipped with a 5 GHz WiFi chip, that is moving back-and-forth at constant speed.



CHALLENGES

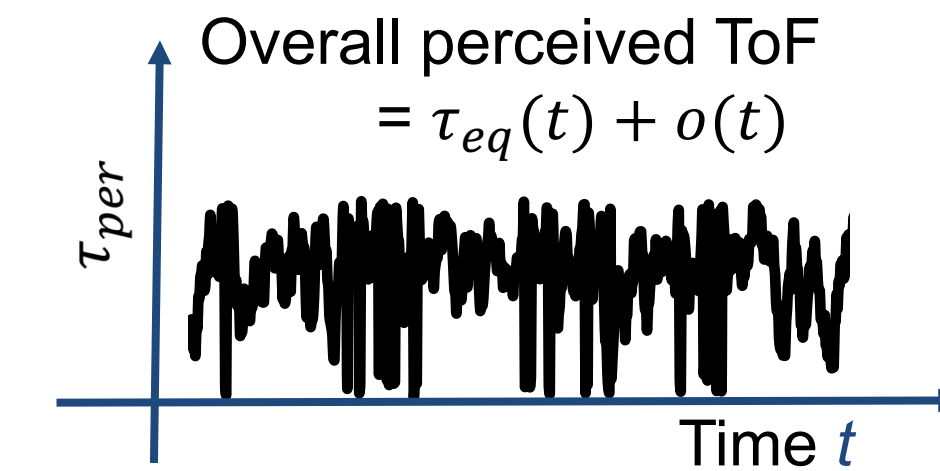
- Challenge #1:** Multipath distorts ToF



Here, $\vec{\delta}(t)$ is the headset's trajectory

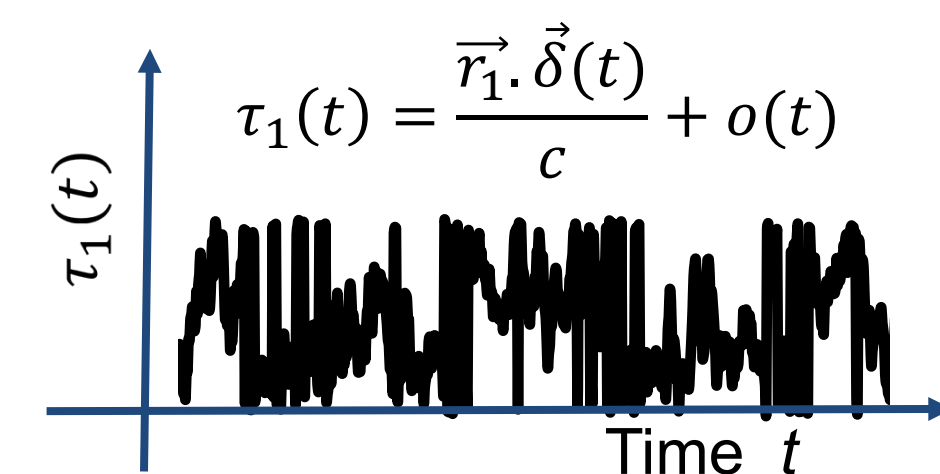
- Challenge #2:** Source and receiver have different clocks

Typical change in clock offset $o(t)$ is
1000X
the ToF change due to typical motion

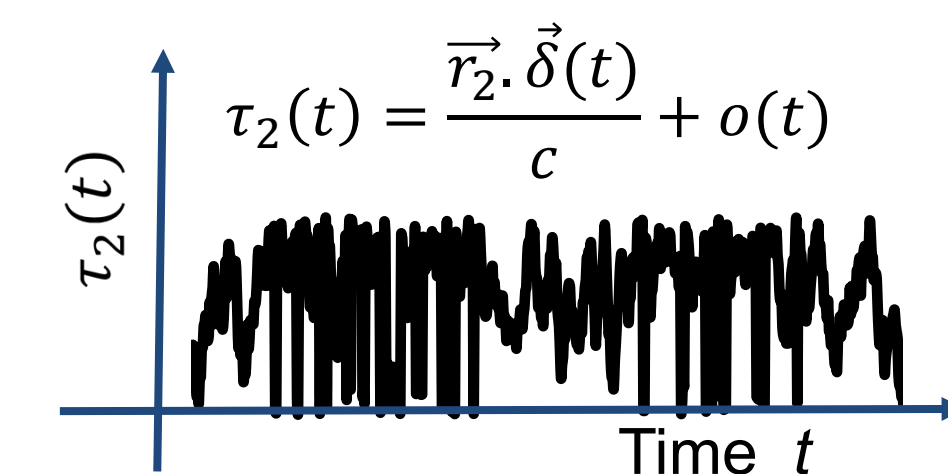


OUR SOLUTION

- Challenge #1:** Use multiple antennas to disentangle the overall signal and obtain signal from each of the paths



ToF obtained for first path



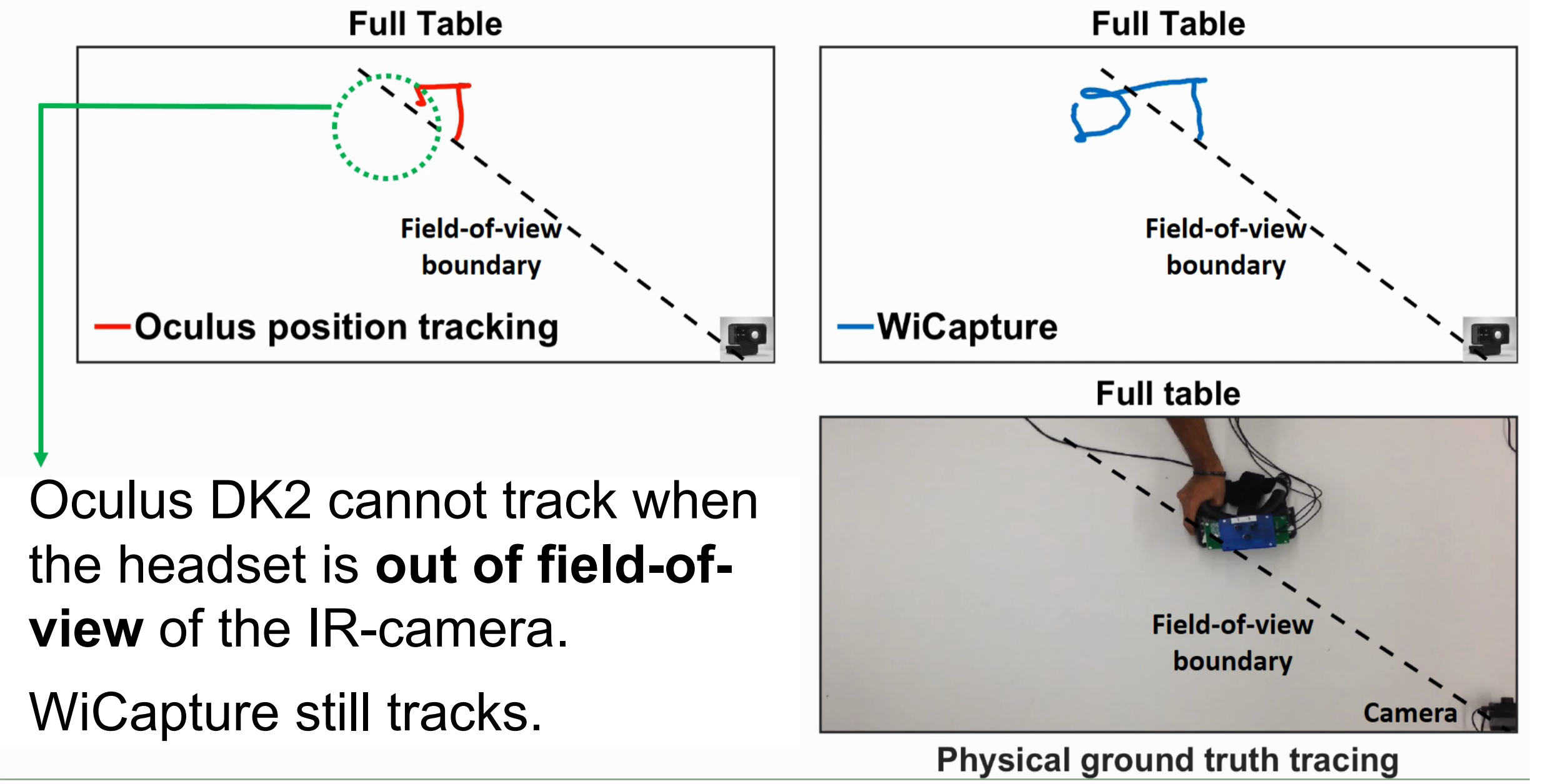
ToF obtained for second path

- Challenge #2:** Use multipath to eliminate the clock offset $o(t)$

$$\tau_2(t) - \tau_1(t) = (\vec{r}_2 - \vec{r}_1) \cdot \vec{\delta}(t)/c$$

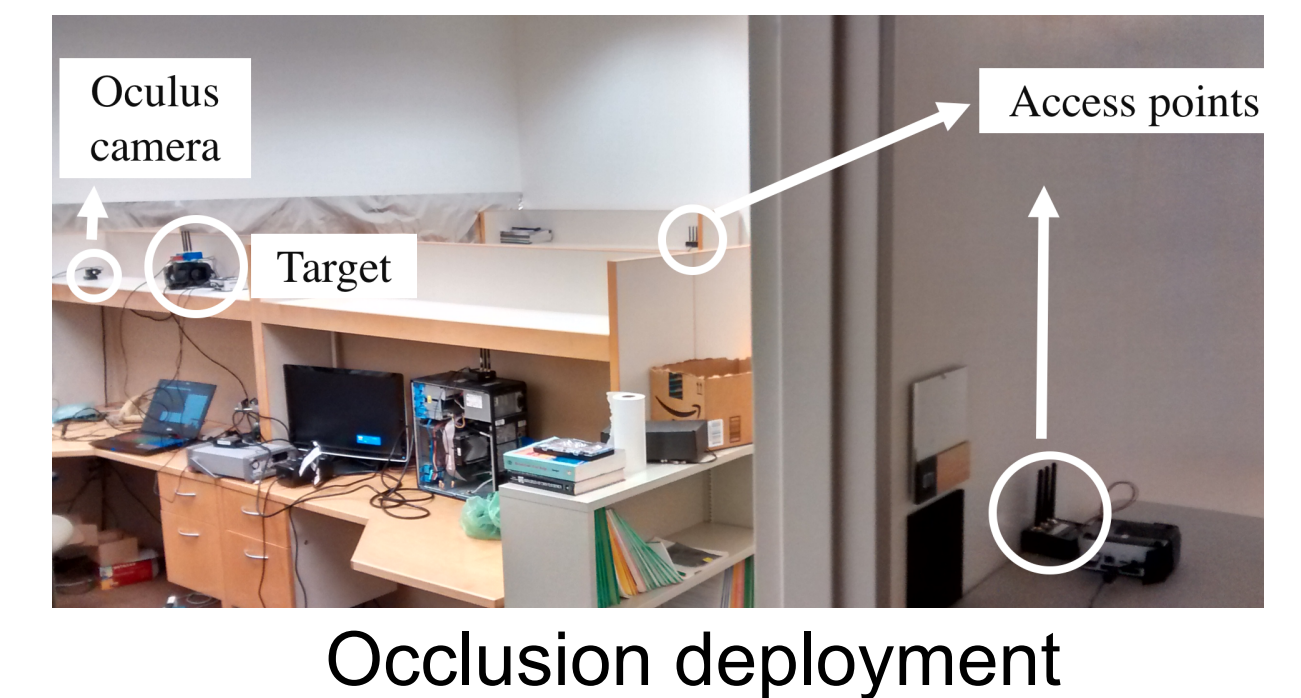
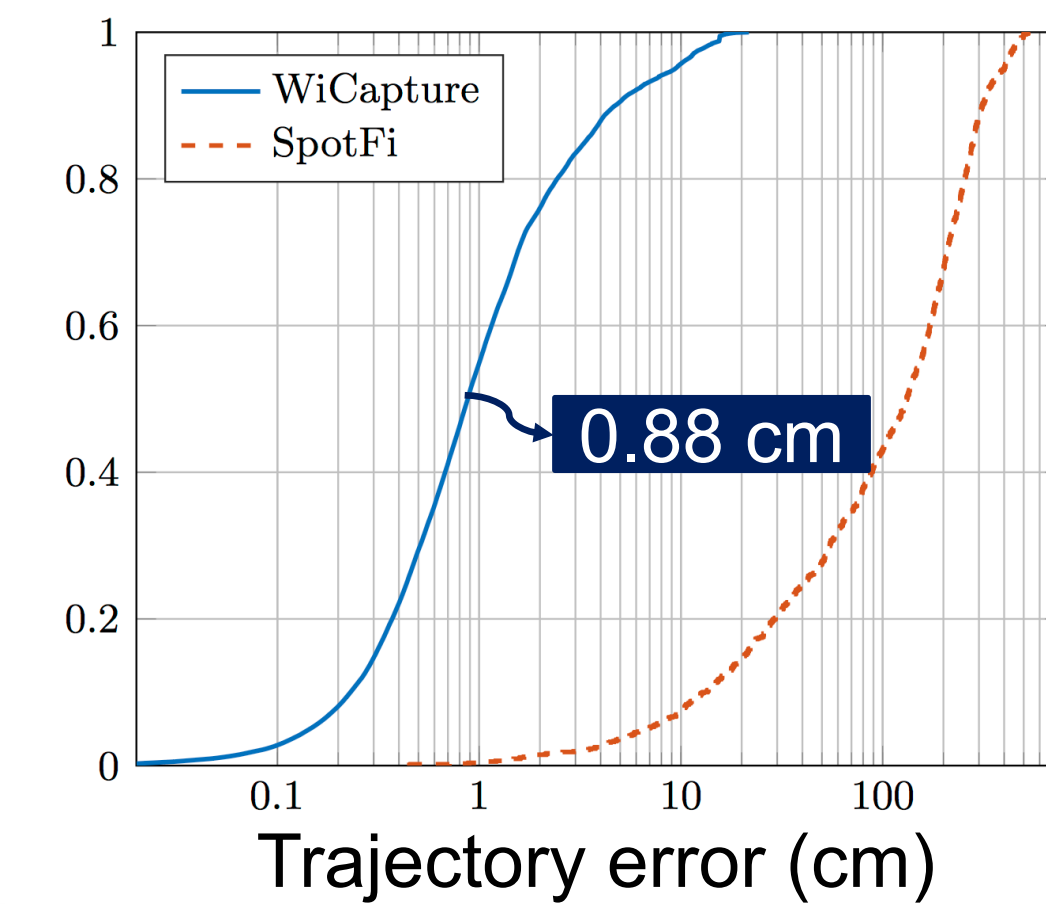
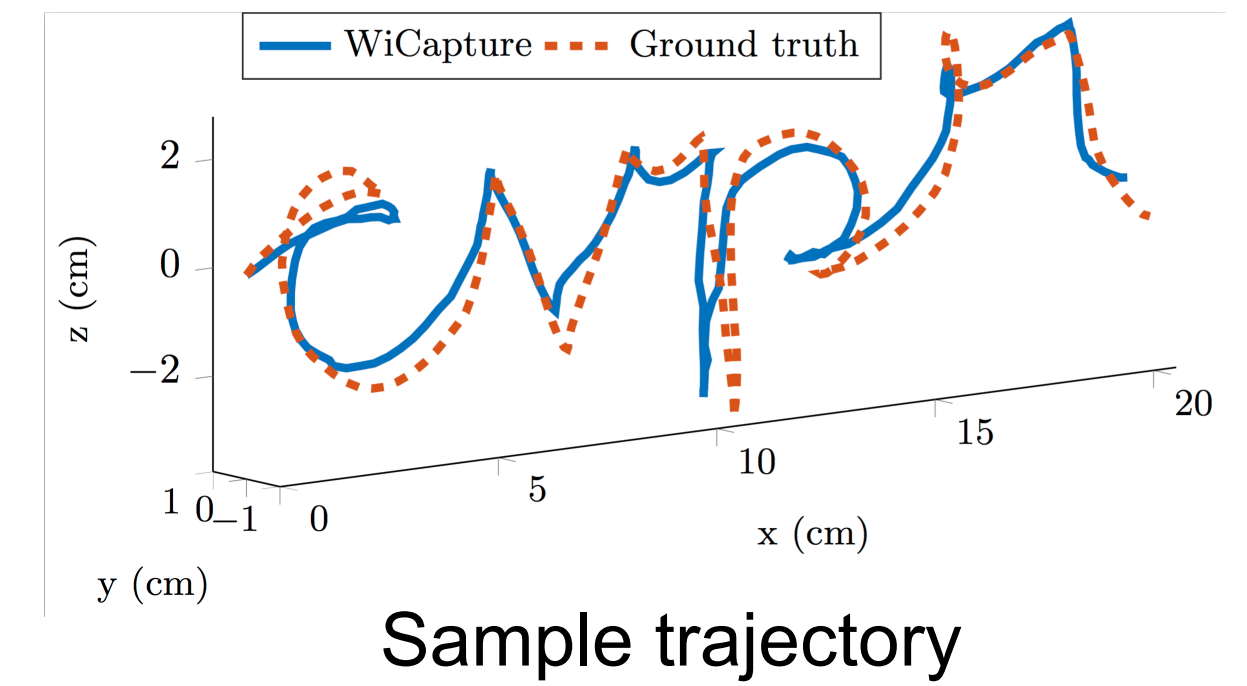
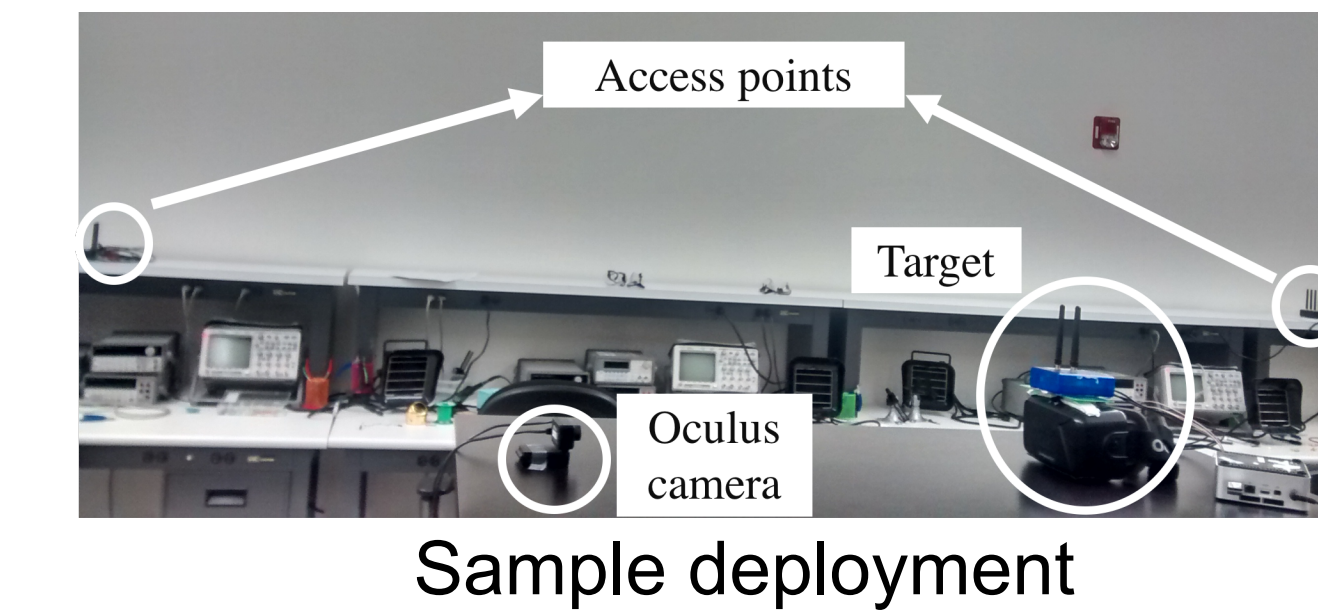
RESULTS

- Demo



- Oculus DK2 cannot track when the headset is **out of field-of-view** of the IR-camera.
- WiCapture still tracks.

- Extensive experiments



ACKNOWLEDGMENTS AND CODE

We thank Stanford Computational Imaging Group for valuable feedback on the paper.



Website