

No.03 Scattering Tomography Using Ellipsoidal Mirror

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●Abstract

Optical tomography provides visual images of the interior of objects. When scattering is strong, light paths are scattered and a large field of view is required to observe all of the scattered light. We propose a method based on computed tomography which employs large field of view and observes the scattered light efficiently. We implement a projector-camera system that can send light and receive scattered light from all fields of view.

●Contribution

- Estimate cross-sectional image from scattered light.
- Efficiently observe the scattered light by large FoV.
- Implemented large FoV system by using ellipsoidal mirror.

●Motivation

Food contamination is serious problem.
Contaminant detection is required.

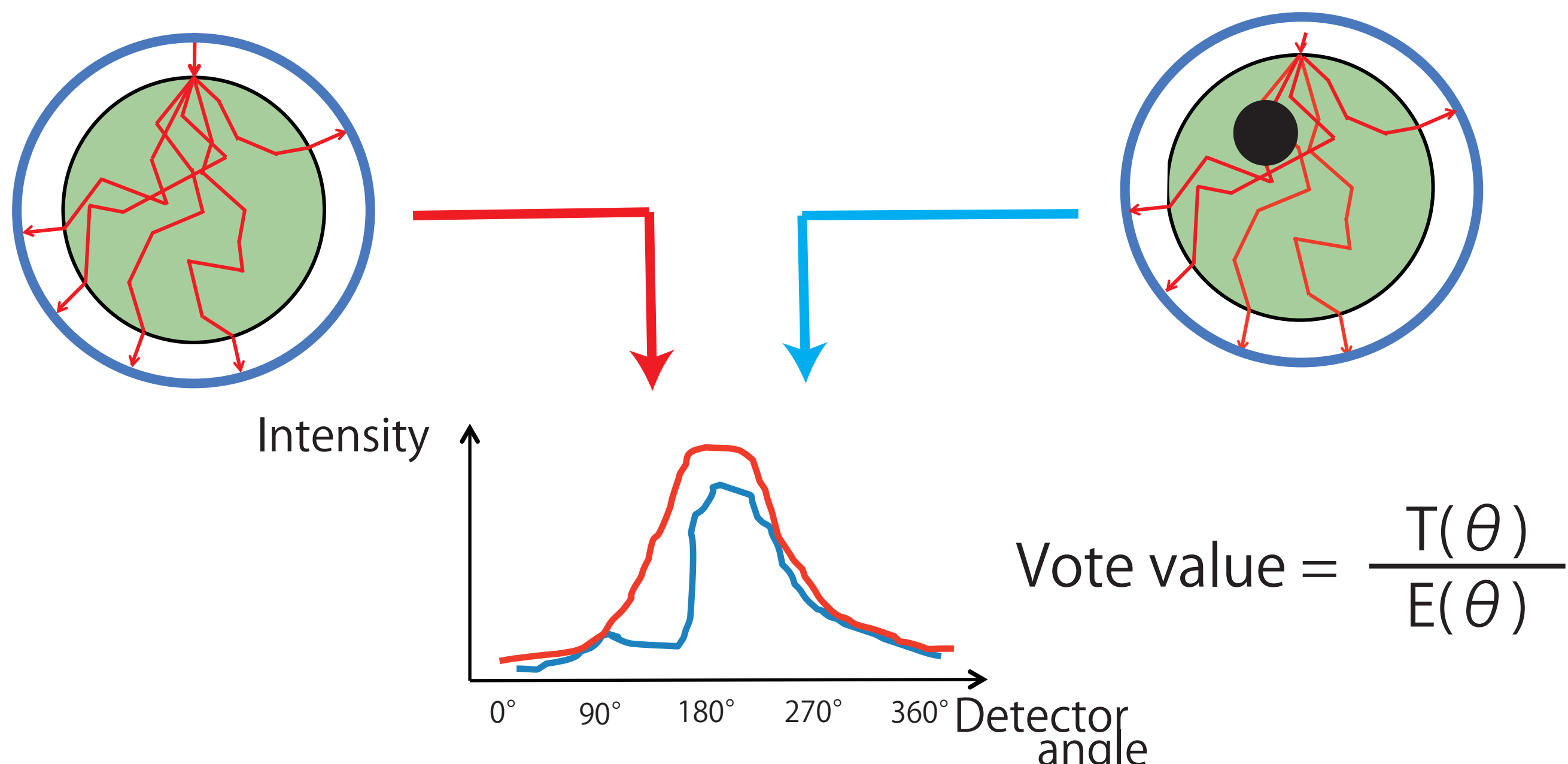


Contaminant in jelly

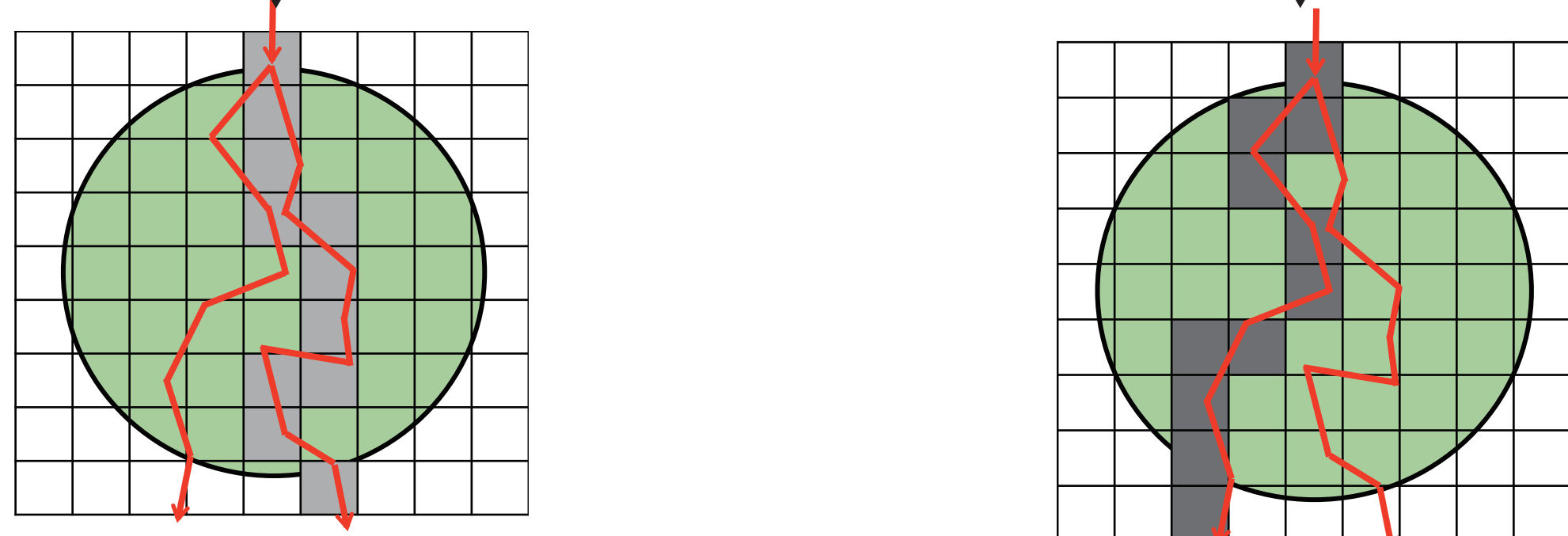
●Estimation of Cross-sectional Image

Simulated scattered light by Monte Carlo ray tracing. ($E(\theta)$)

Observed scattered light ($T(\theta)$)

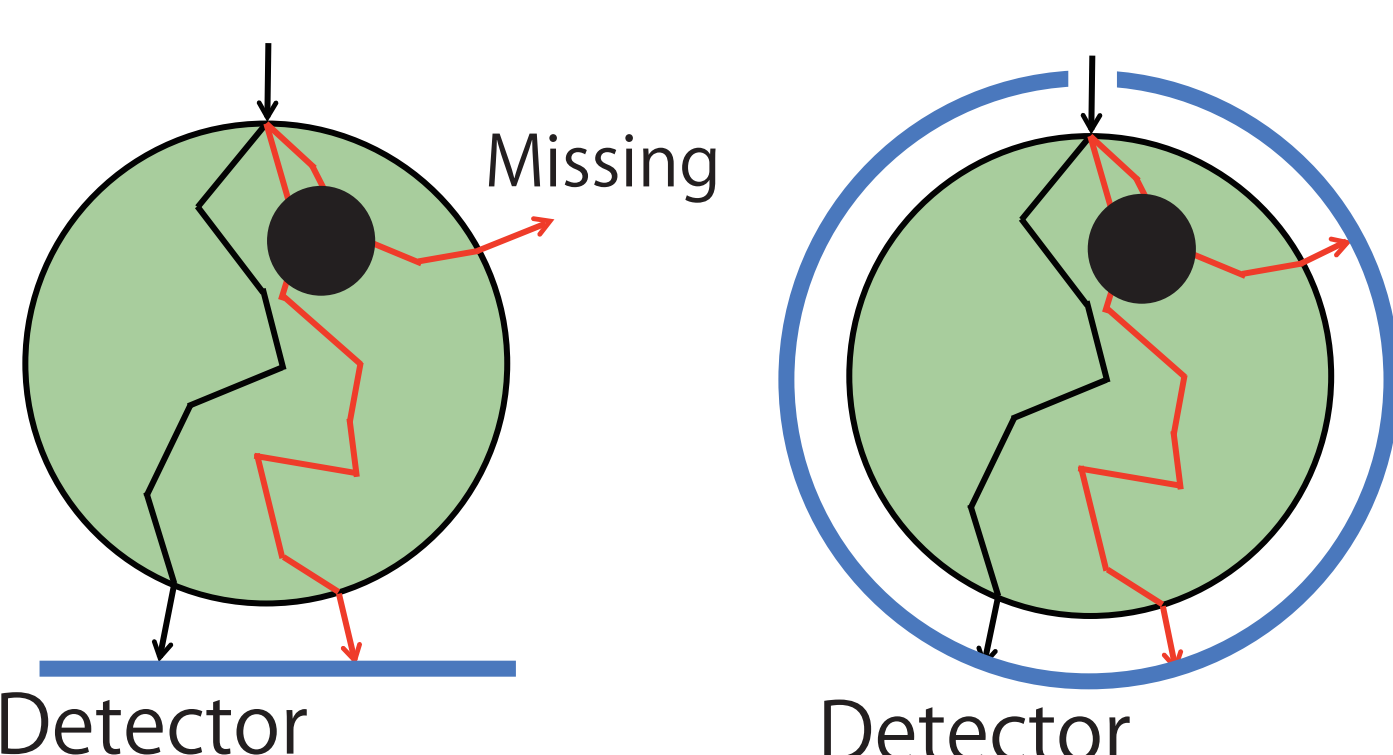


Vote ratio of intensity



●Merit of Large FoV

Efficient observation of scattered light.

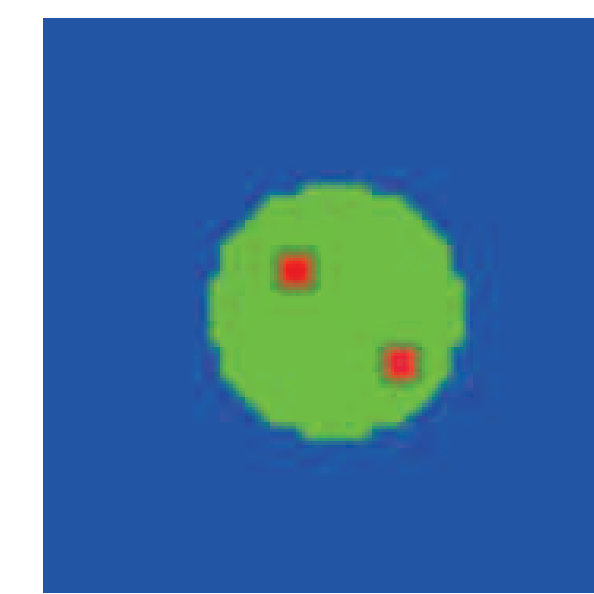


Observe almost all scattered light.

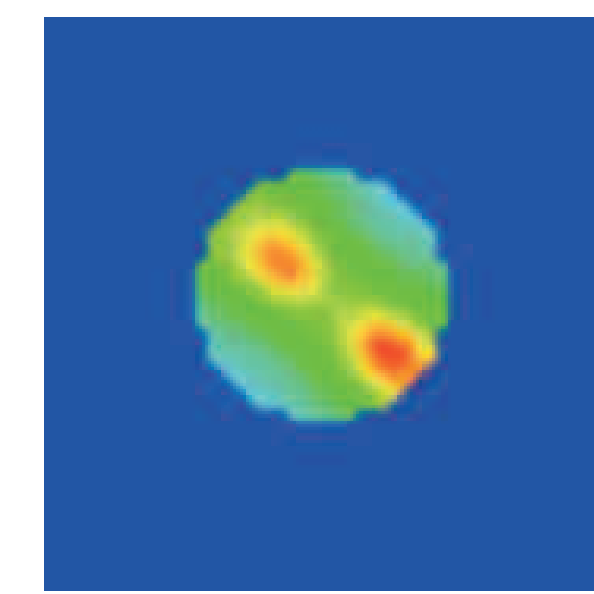
Observe weakly attenuated light by the target object.

●Simulation Result

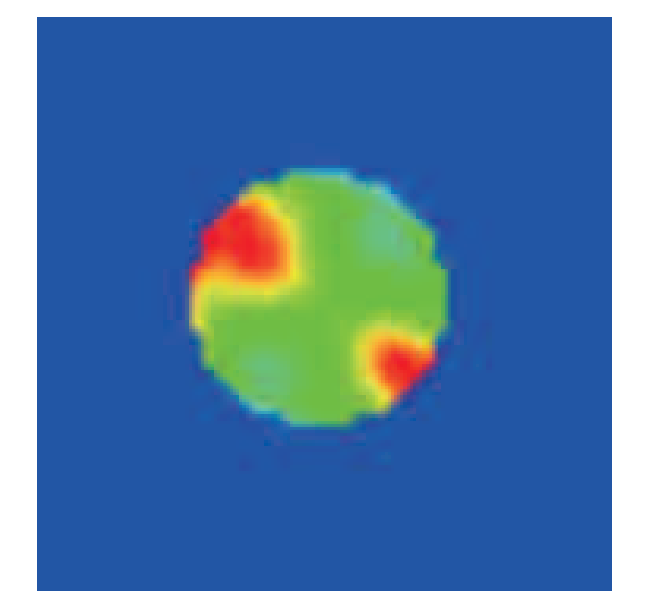
At the boundary area, obstacle's distribution is estimated accurately.



Ground truth

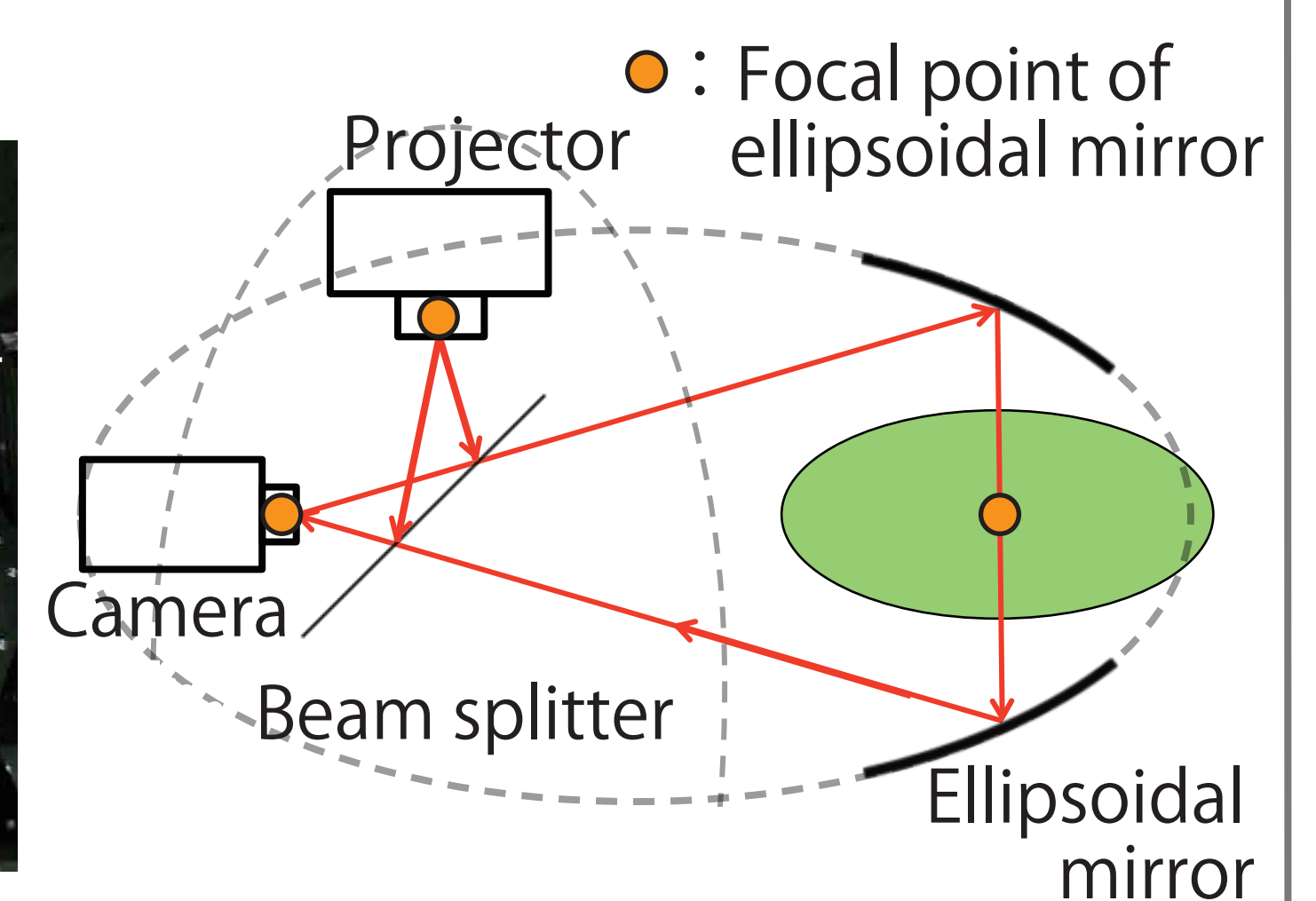
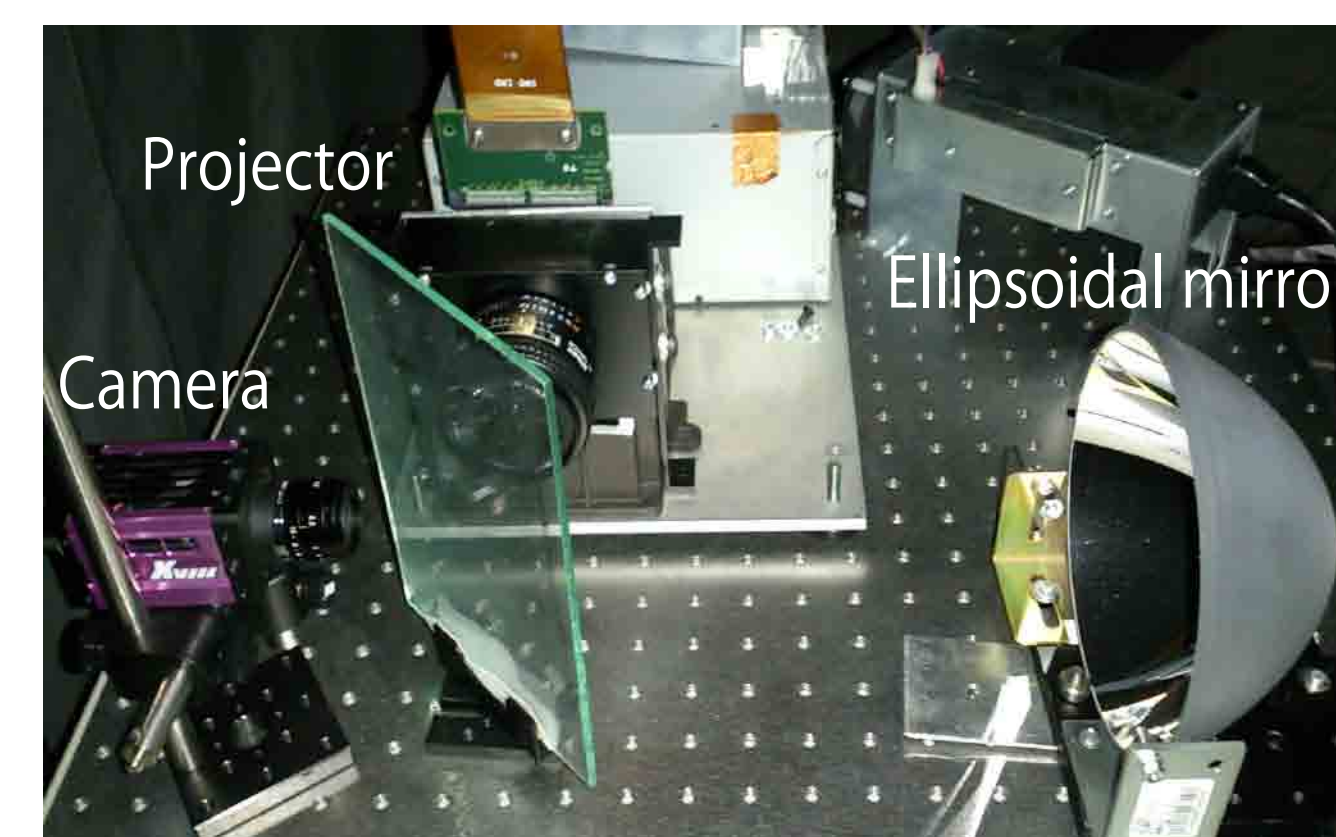


Large FoV



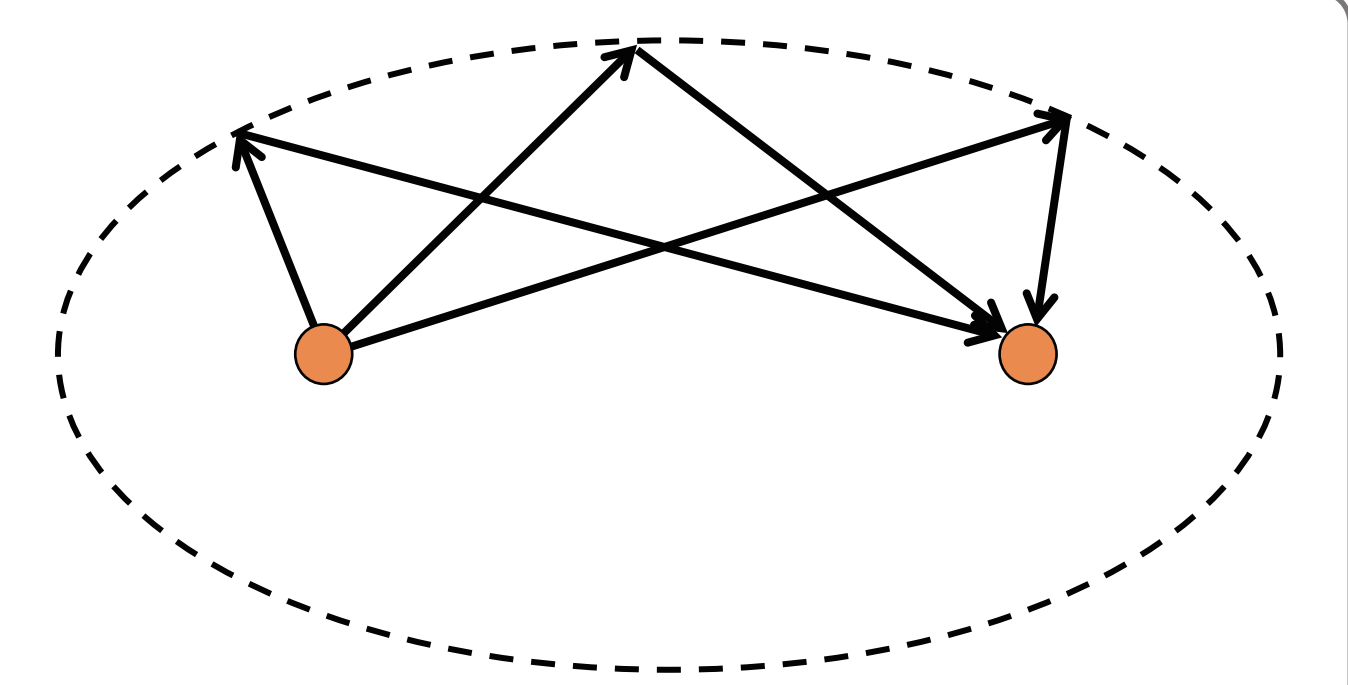
90° FoV

●Large FoV Implementation

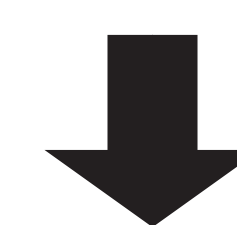


Property of Ellipsoid

Light from a focal point is reflected toward the other focal point.



Not need mechanical motion.



Simple system

Shorten the time for capture



Ellipsoidal mirror

●Experiment of Real Object

We used silicorn with metal wire as a target object.



Silicorn object

When we know the scattering without obstacle, ...

We can estimate distribution of obstacle.



Without obstacle

Result

●Future Work

- Improve the estimation result of real object.
- Consider multiplexing, encoding and compressive sensing.