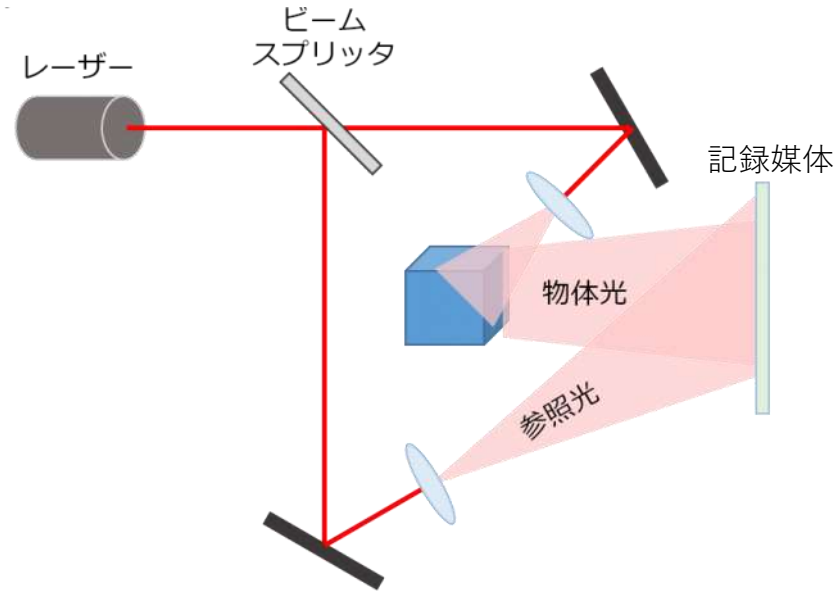
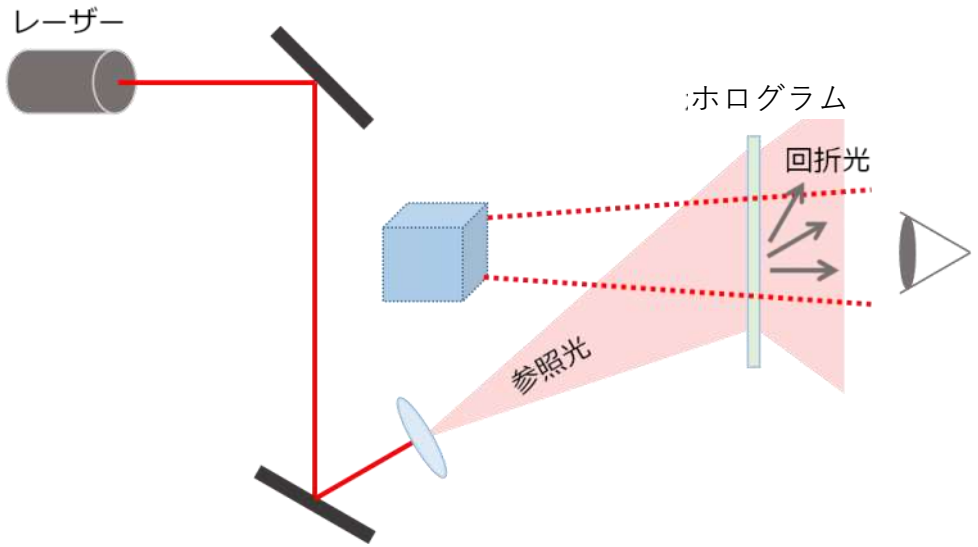
What is holography

Holography is a technique for recording a three-dimensional image of an object on a recording medium and reconstructing a three-dimensional image of the object.

Recording



Reconstruction



- Recording the interference fringes of the object beam and the reference beam on a recording medium.
- A recording medium on which interference fringes are recorded is called a hologram.

※Laser light is split by a beam splitter to generate object and reference beams.

- Illuminate the hologram with the reference beam.
- The amplitude and phase information of the recorded interference fringes are added to the diffracted beam of the reference beam.
- To an observer, an object appears to exist even though it does not exist. .

One-shot digital holography (DH)

The one-shot DH technique was invented for one-shot recording and accurate reconstruction of object light.

Conventional DH

(Overview)

The interference fringes (hologram) formed by the object beam and the reference beam are recorded as digital data, and the object beam is reconstructed from the hologram by numerical calculation.

(Problem)

In order to accurately obtain the object beam from the hologram, it is necessary to accurately represent the reference beam as digital data.

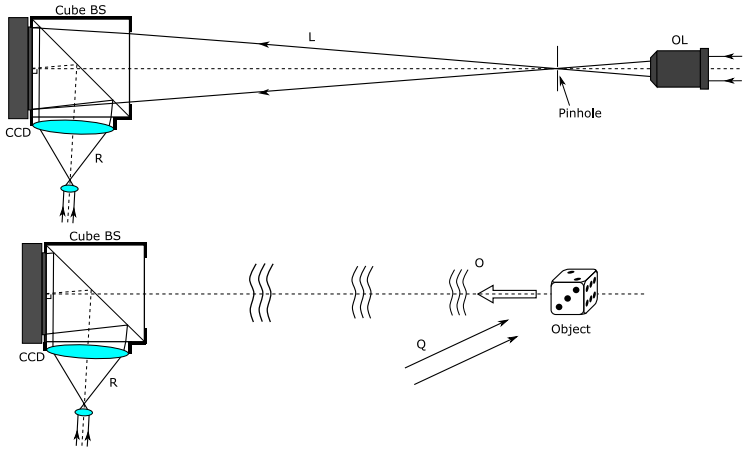
One-shot DH

(Method for solving the problem)

- Using the analytic solution of the wave equation (spherical wave) as the standard beam L, the reference beam R is recorded.
- One-shot recording of object beam O using reference beam R.
- Separate and extract the object beam O from the hologram.
- Describe the object beam O using the analytical solution (plane wave) of the wave equation.
- Calculate the beam propagation and reconstruct the object beam O on the object surface.

(a) Recording of reference beam R using standard beam L

(b) Recording of object beam O using reference beam R

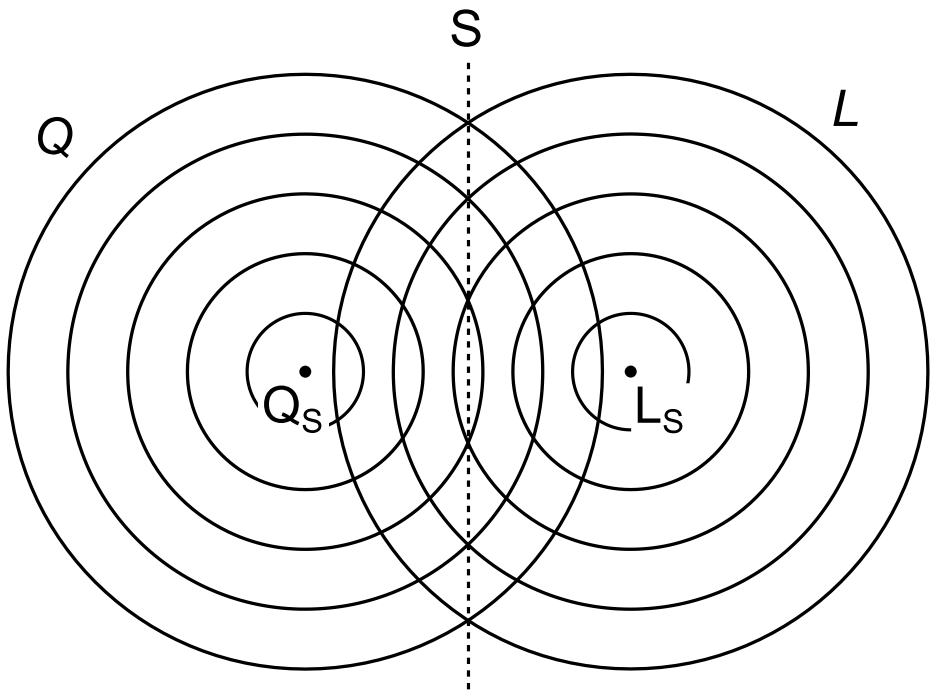


Optical system for one-shot DH

Surface shape measurement using one-shot DH (2-1)

Determination of virtual plane using spherical wave phase

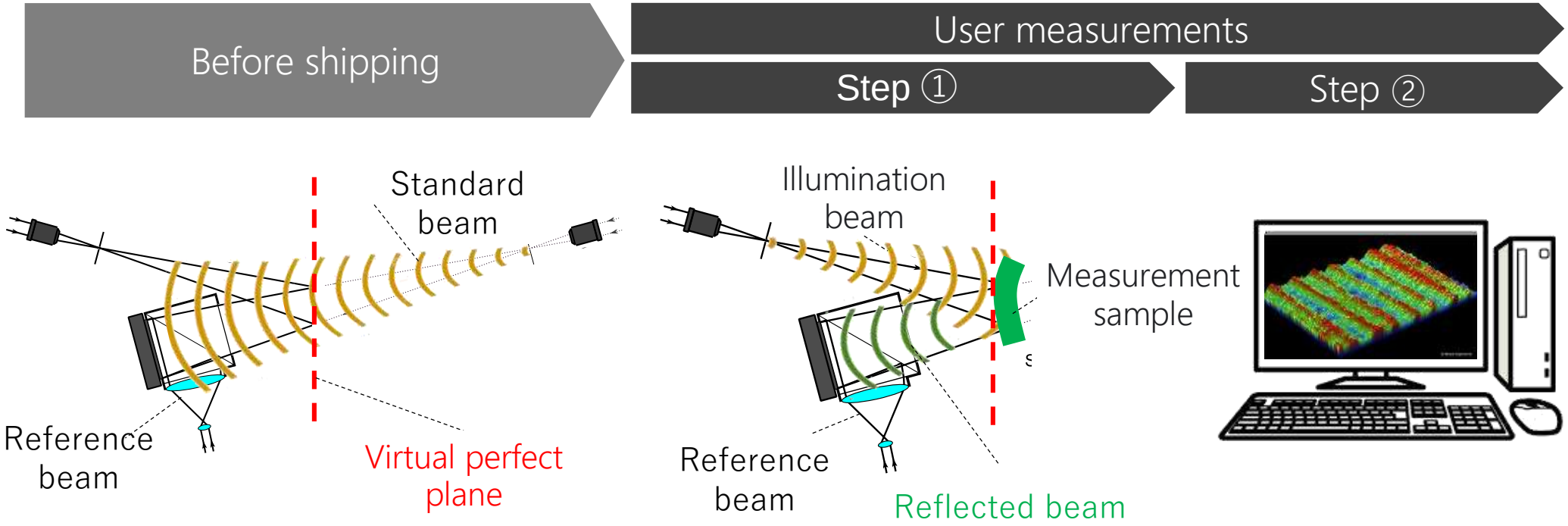
- The plane S where the distances from the two wave sources LS and QS are equal becomes a virtual perfect plane, and the phases of the two spherical waves L and Q agree precisely on the plane S.
- If the surface to be measured is placed on surface S, flatness and surface shape can be measured using the phase difference on the virtual plane (no physical reference plane is required).



Virtual perfect plane S formed by two spherical waves L and Q

Surface shape measurement using one-shot DH (2-2)

The standard beam information on the virtual plane is acquired before the product is shipped, and the user completes the measurement in a simple two-step method.



- Record the interference fringes formed by the standard beam and the reference beam.
- Obtain standard beam information on the virtual (perfect) plane from the recorded interference fringes.

- Record the interference fringes formed by the reflected beam and the reference beam.
- Acquisite reflected beam information on the virtual (perfect) plane from recorded interference fringes.

- Acquire height distribution from phase difference between reflected beam and standard beam.

※Product does not require the standard beam source.