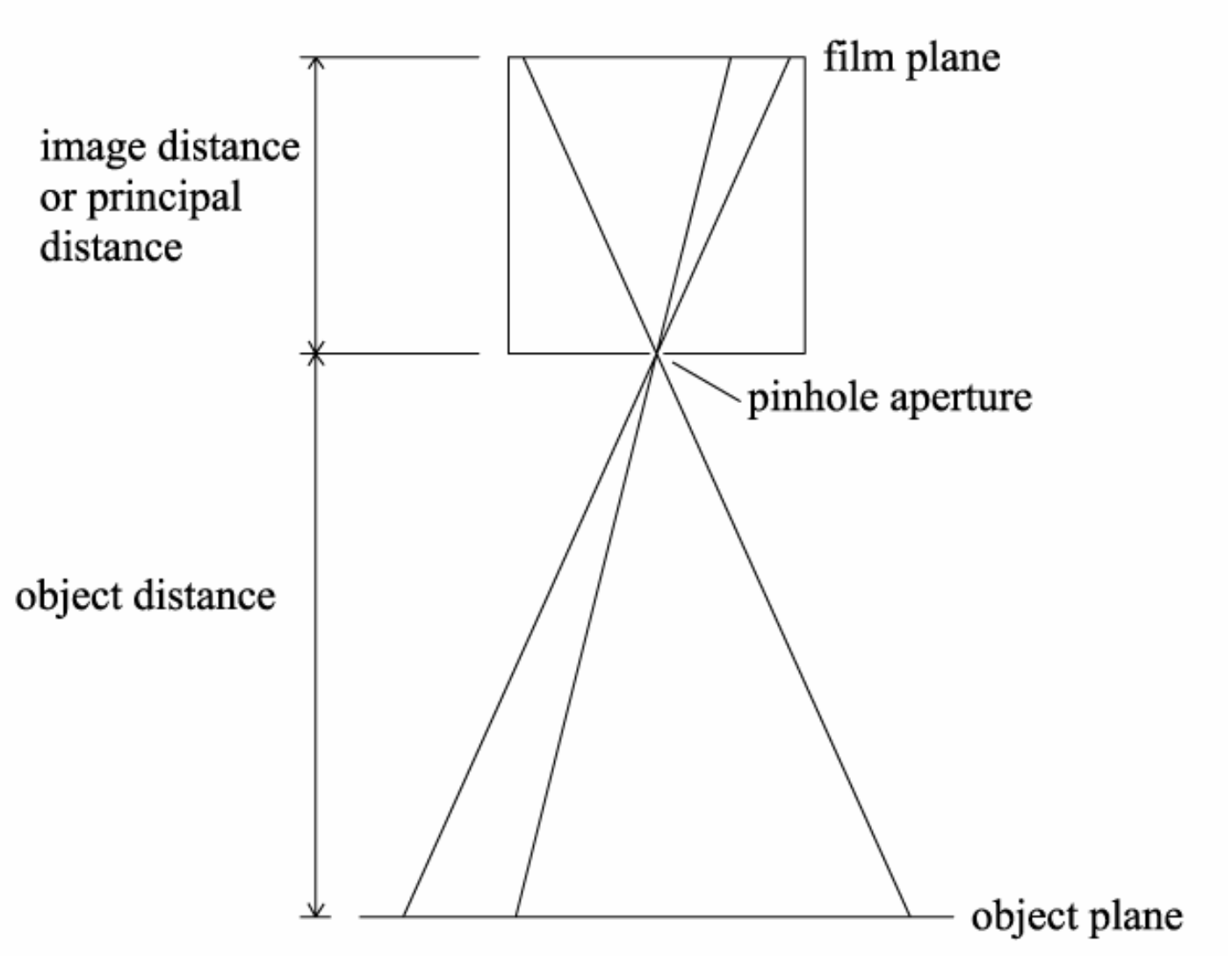
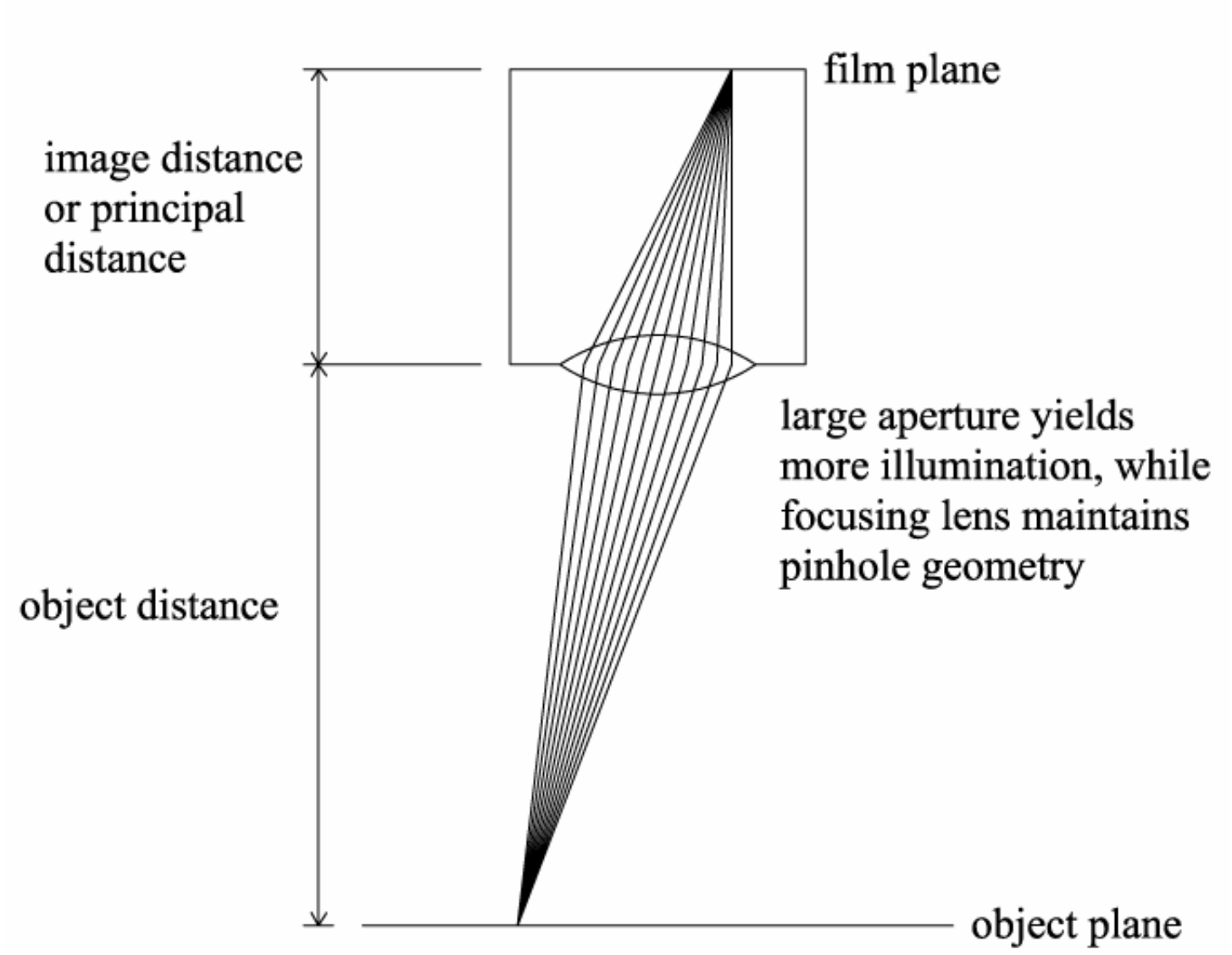
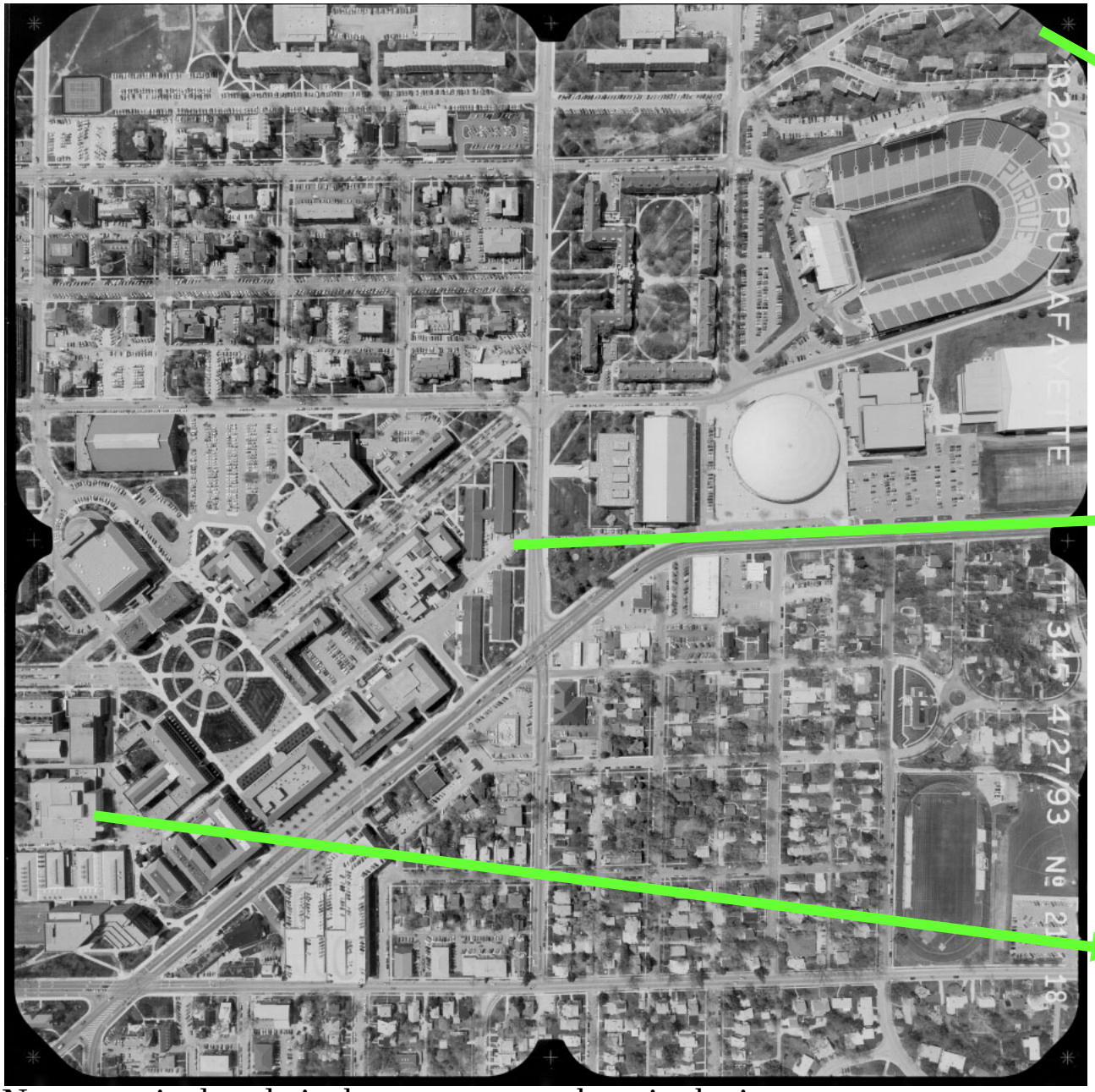
Pinhole / Frame Geometry

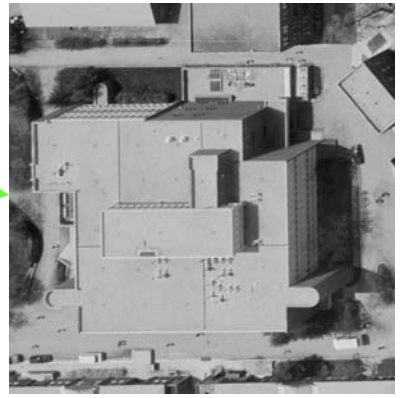


Same Geometry – Large Aperture



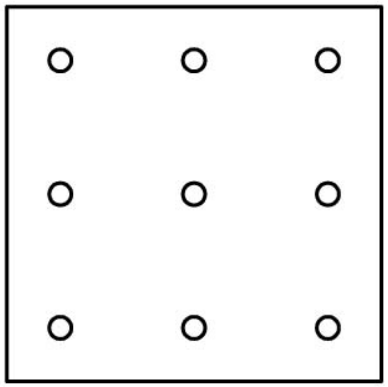


Relief Displacement

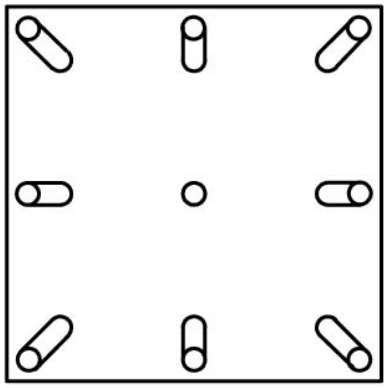


Note: nominal scale is the same everywhere in the image

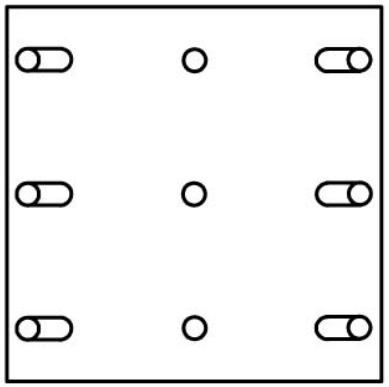
Relief Displacement



Layout of vertically extended objects within an image



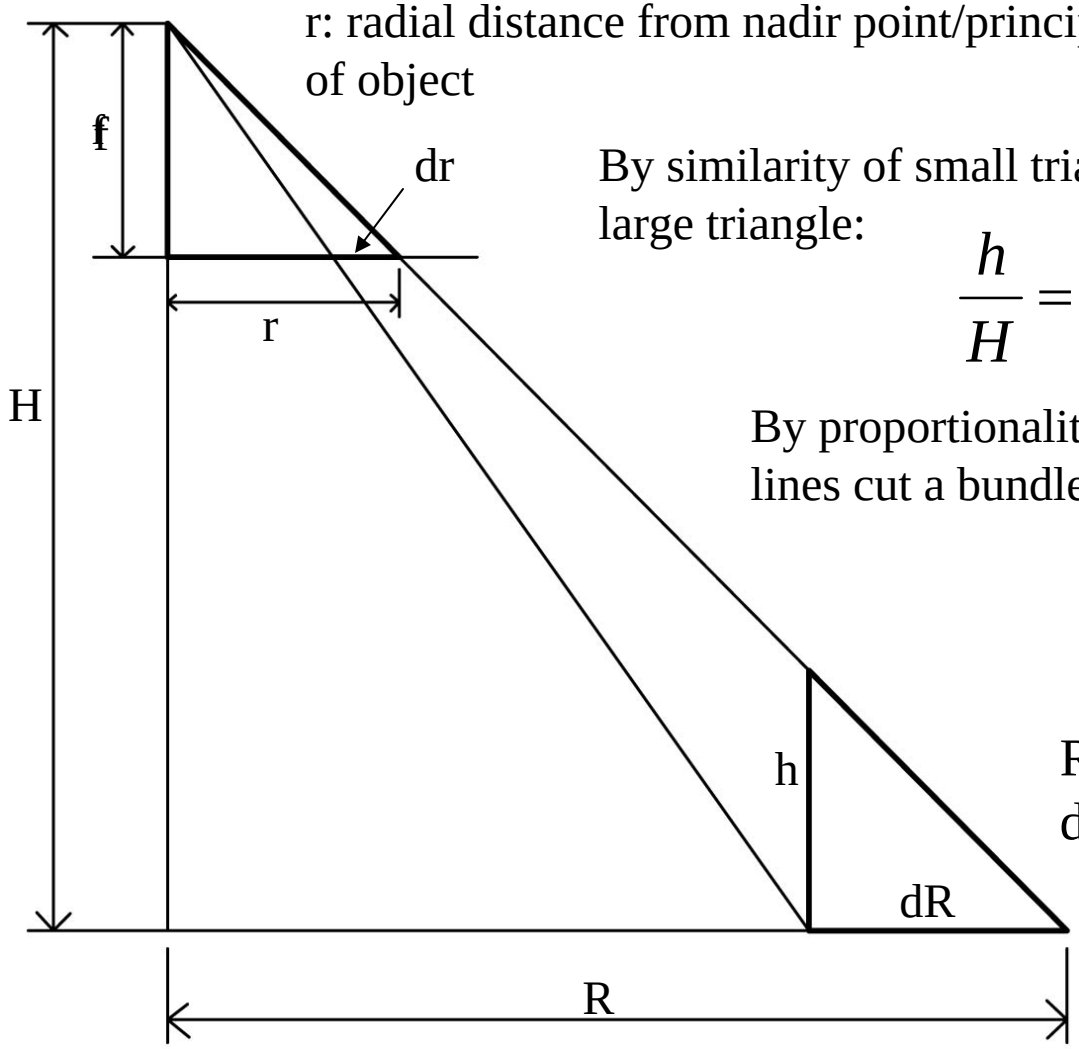
Relief displacement as found in *frame* imagery, entire image captured at same instant, relief displacement is always *radial* with respect to the *nadir point*



Relief displacement as found in *pushbroom* imagery, the image is built up *over time* by the platform motion, relief displacement only exists *within a line*. It is still radial with respect to the nadir point, but there is a different nadir point *for every line*. Therefore the only component of relief displacement is *cross-track*, there is no *along-track* component. (platform motion is up/down)

Relief Displacement for Nadir Imagery

Ideal geometry: nadir imagery, flat terrain



r: radial distance from nadir point/principal point to top of object

By similarity of small triangle at lower right and the large triangle:

$$\frac{h}{H} = \frac{dR}{R}$$

By proportionality of segments when parallel lines cut a bundle of rays:

$$\frac{dr}{r} = \frac{dR}{R}$$

Rearrange for classic relief displacement formula:

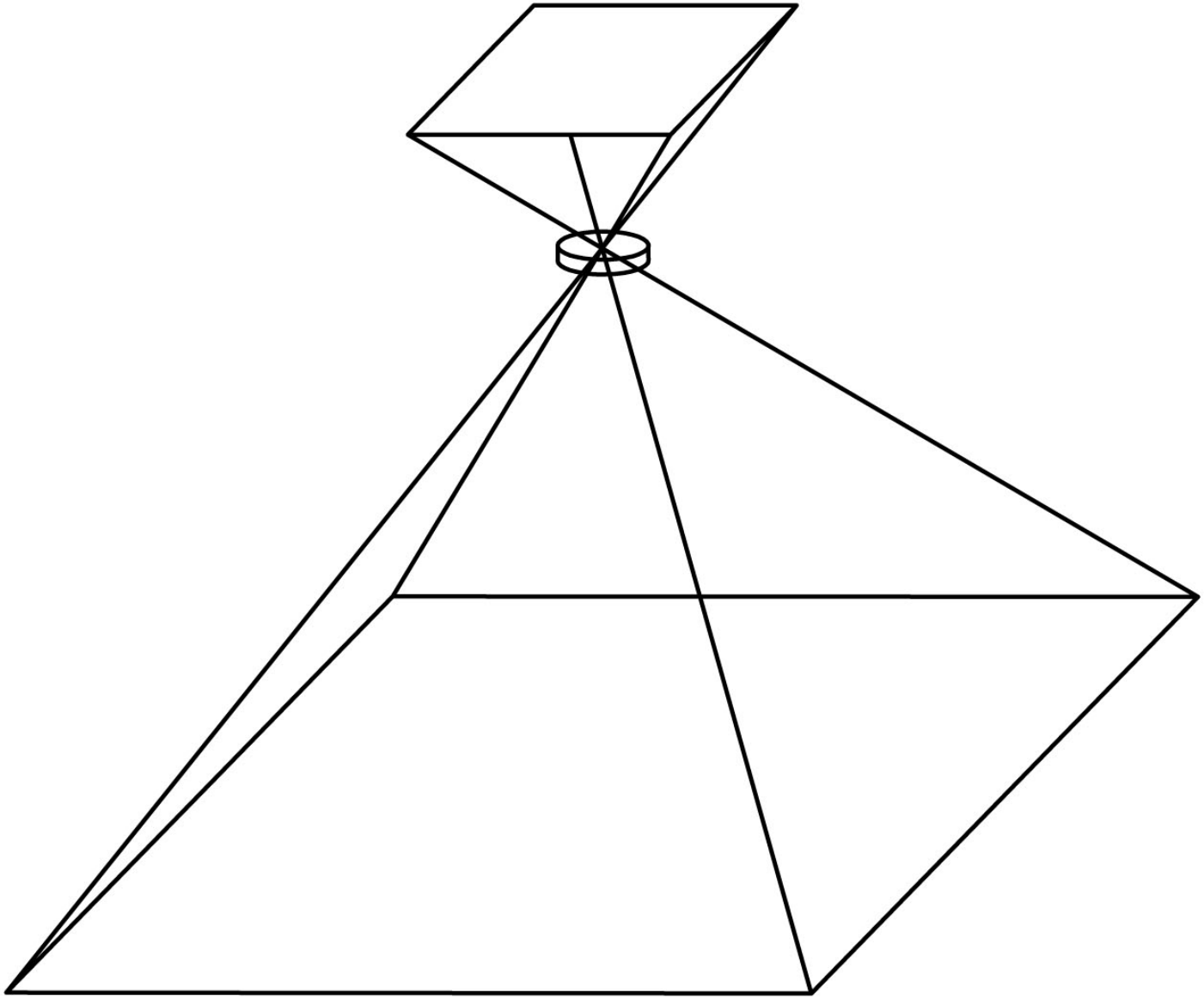
$$h = \frac{\Delta r}{r} H$$

Relief displacement in QB (Satellite Camera) image. Narrow FOV, displacement same throughout the field of view, depends on tilt

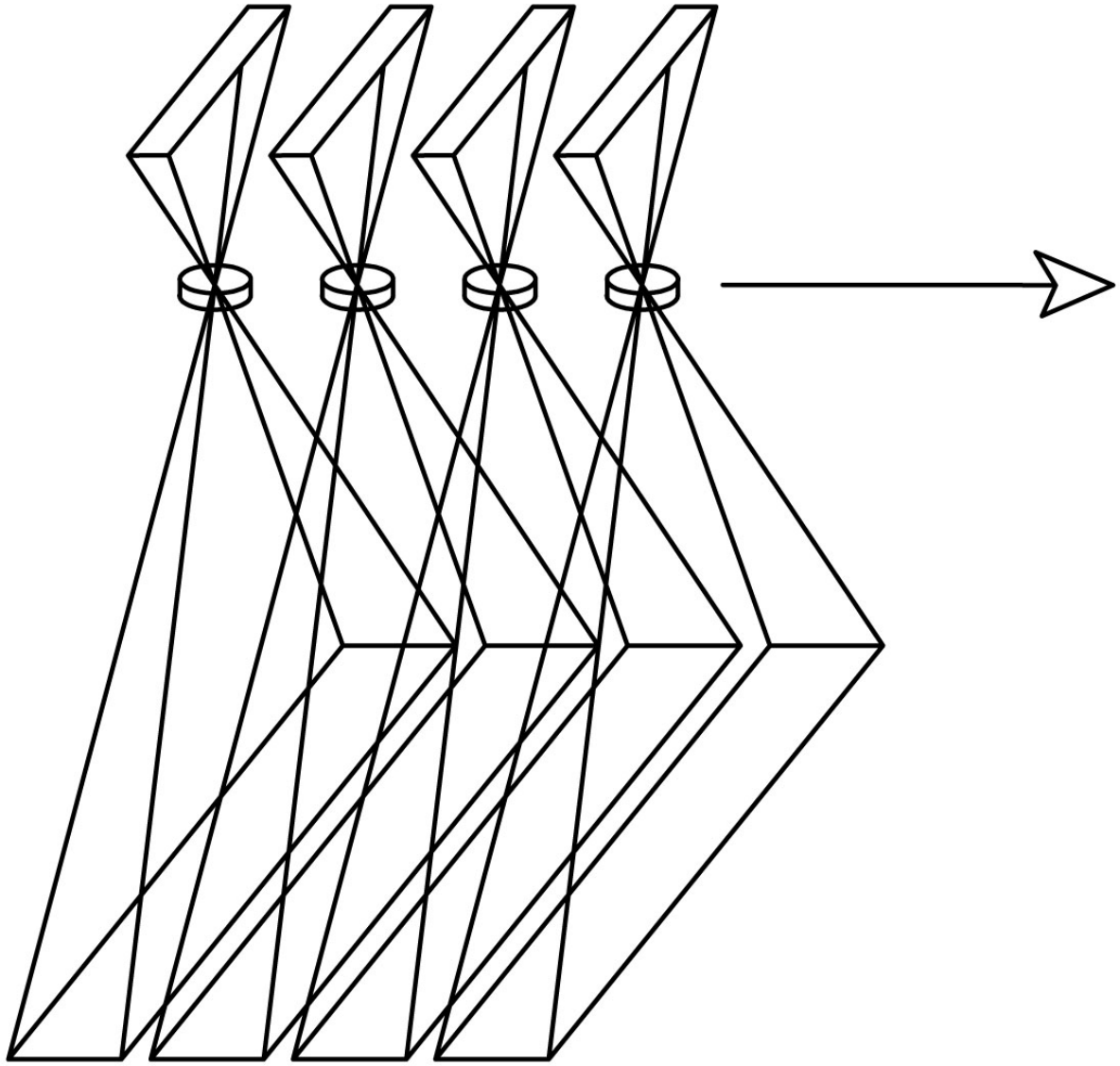
L   R

Relief displacement in images taken at different locations – yields parallax – which in turn yields perception of depth – more on this later.

Frame (Pinhole Camera) Sensor Geometry



Pushbroom Sensor Geometry



Panoramic Sensor Geometry