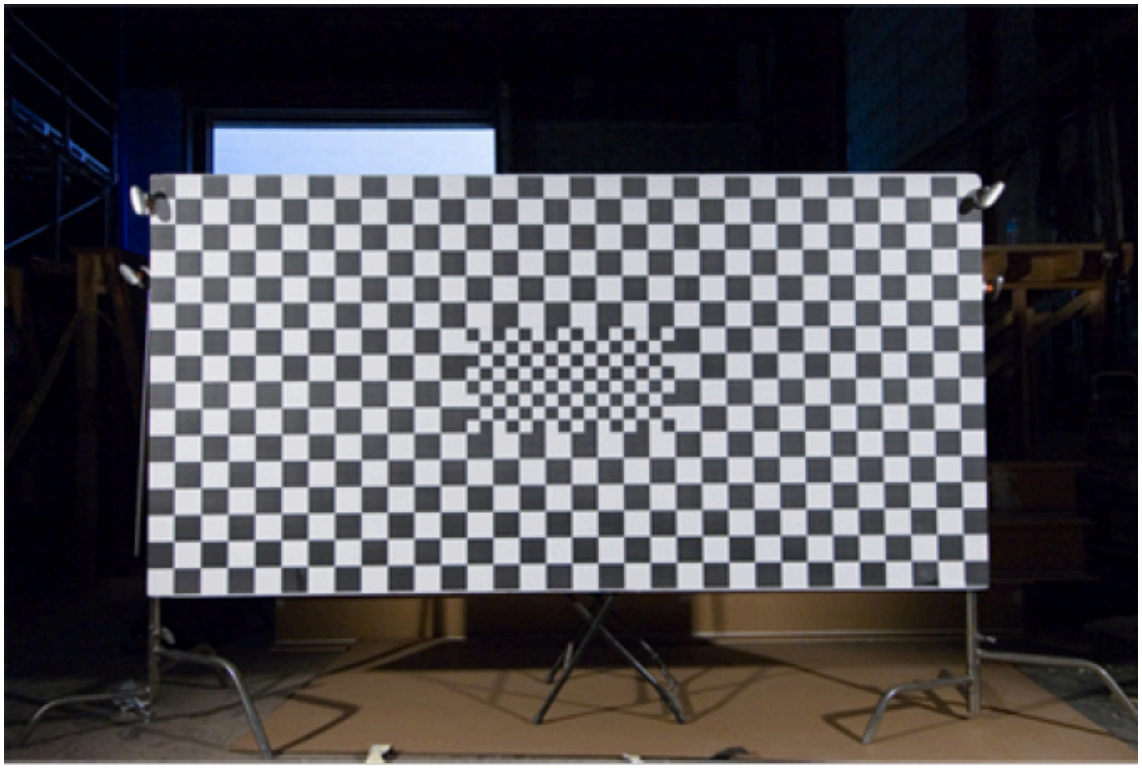
Mapping Lenses

Each lens has its own unique refractive index and distortion characteristics. How to properly shoot lens grids with motion picture lenses: Accuracy is a crucial part of this process. Not just how the camera is set up and how the grid is framed, but the slate, measurements and specifically, the noting of the focus distance and lens identification.



Manufacturing the Grid

The 8'x4' grid should be printed on paper and measured for accuracy (squareness). It will need to be mounted flat onto a smooth surface such as foam core board. Care must be taken to not allow any bubbles/ creases while mounting. The foam core board must then be affixed to a sturdier backing such as plywood board. The board should have some cross-braces on the back to ensure that it cannot warp convex or concave and bend under its own weight.

Setting up the Grid and Camera

The grid must be set up so that it is plumb and the face is flat to the camera. The camera should also be level with no tilt or roll. Set up the camera as perpendicular to the grid as possible and at a height that puts the center of the grid in the center of frame. Have the camera rigged on a dolly track to make moving it through positions easier. 5218 rated at 500 ISO is the preferred stock. Light the grid evenly with tungsten light and take care to ensure there are neither flare nor shadows. Have enough light to expose at f22 at the camera's slowest shooting speed.

Shooting the Grid
Most tests will be shot at the camera's slowest shooting speed. Let's call this S. Lights will have already been set so that we get a good exposure for this shooting speed at f22.
NOTE: When slating, hold the slate with a stand so that it does not blur.

FOR PRIMES

Shoot the grid from 3 distances with the different exposures and focus distances described below for each distance. Always get the lens serial number, notate focal length, distance between grid and the filmback of the camera, exposure, and focus distance on the slate (See additional slate info below). Only a few frame are needed so when the camera is speeding, slate, pull the slate, wait a second, and then stop the camera.

FOR ZOOMS
Set the lens to its widest FOV (shortest focal length) and run the fixed local length procedure with one additional test at the D1 position.

DISTANCE # 1 (D1)
This should be as far way as possible while still having the grid fills the full aperture frame (both left, right, top, and bottom).

- Slow focus pull (over 4 seconds) from INFINITY -> NEAREST FOCUS and shoot at f5.6 @ (S*16) fps
- Set focus to INFINITY and shoot at f22 @ (S)fps
- Sharp focus on grid (FOCUS # 1) and mark the focus distance.
- Roll back focus to ! between INFINITY and FOCUS #1 and shoot at f22 @ (S) fps.
- Set the focus to FOCUS #1 and shoot at f22 @ (S) fps.
- Don't forget to change the slate every time the camera rolls!

ADDITIONAL TEST FOR ZOOM LENSES ONLY

D1 ZOOM PULL (for position D1 only)
This zoom pull will allow us to judge the change in distortion as the zoom setting changes with a constant focus setting. The duration of the zoom pull should approximate the lens's zoom ratio (i.e. a 10:1 zoom lens should take about 10 seconds to pull, a 5:1 should take about 5 seconds, etc)...

- Set the focus to FOCUS #1 and shoot at f5.6 @ (S*16)fps
- Start with the zoom at its widest FOV (shortest focal length) and slowly zoom to its narrowest FOV (longest focal length) over a period seconds approximately equivalent to the lens's zoom ratio.
- Don't forget the change the slate!

DISTANCE #2 (D2)
This distance will be half of D1.

- Keep focus set to FOCUS #1 and shoot at f22 @ (S) fps.
- Change the focus so that the grid is sharp (FOCUS #2) and shoot at f22 @ (S) fps.
- Don't forget to change the slate!

DISTANCE #3 (D3)
This distance will be half of D2, one quarter of D1.

- Set focus the FOCUS #1 and shoot at f22 @ (S) fps.
- Set focus the FOCUS #2 and shoot at f22 @ (S) fps.
- Change the focus so that the grid is sharp (FOCUS #3) and shoot at f22 @ (S) fps.
- Don't forget to change the slate!

SLATING
Re-slate for each exposure, focus, and distance change. The following information must be documented and slated in all cases:

- Lens type and serial number.
- Camera body.
- Distance of the camera (Film back) from the grid.
- Focus distance (Keep in mind the focus distance will not always equal the distance from the grid. Most lenses have a meter on them that shows what the focus distance is in feet/meters. If a lens does not have this meter, frame the grid per the instructions above under "shooting Lens Grids". Focus so that the grid is in focus. Measure the distance from the face of the grid to the back of the lens. This distance should be noted as the focus distance. Be sure to make a note on your shoot sheet that you have listed the distance form the grid as your focus distance).

The following is an example of how the slate should read followed by a blank slate to be used as a template.

For prime lenses:

DevLENS_P24mmB_10ft_00in
Lens ID Focus Distance

For zoom lenses: (In the case of a zoom lens, the focal length that the lens is set at must also be noted).
DevLENS_z75-300A at 135mm 10ft 10in
Lens ID Focal Length Focus Distance

NOTE: For motion picture lenses the ID should be the unique serial number.

Thank you.