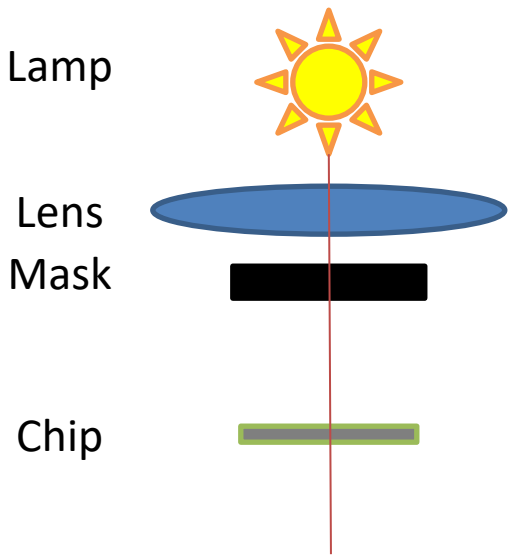
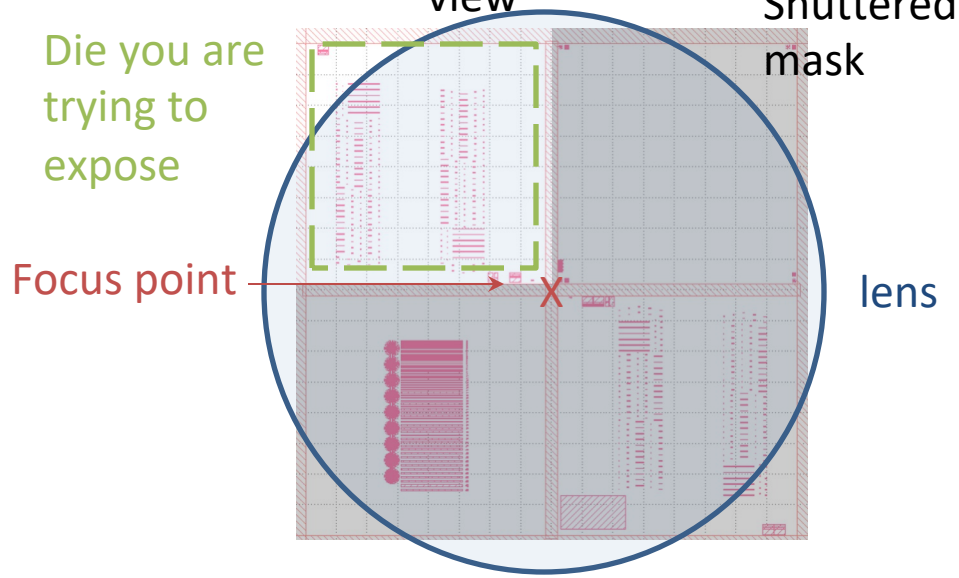
How the stepper focuses

Side view



Autofocus axis:
right on the center of the lens and mask plate
Optics probably don't go through center of mask plate, but they are aligned to the center of it. There is no way you can change this in your program

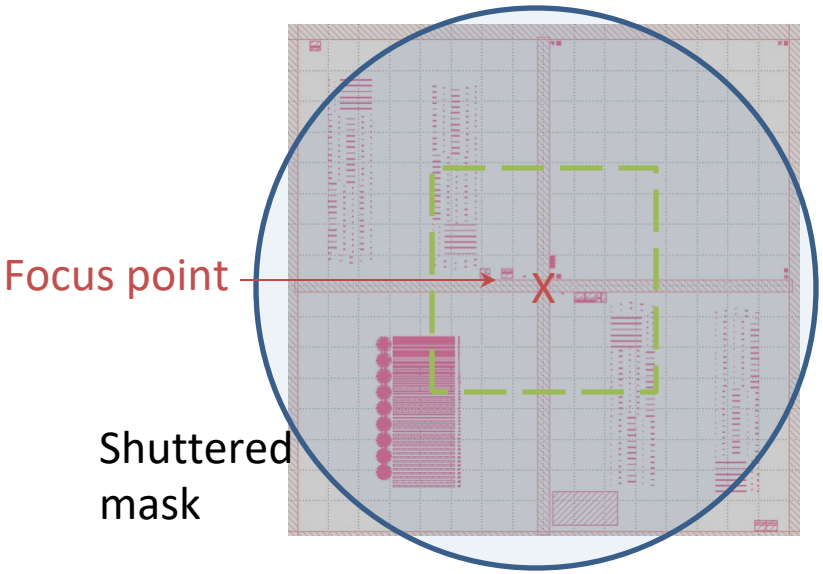
Top view



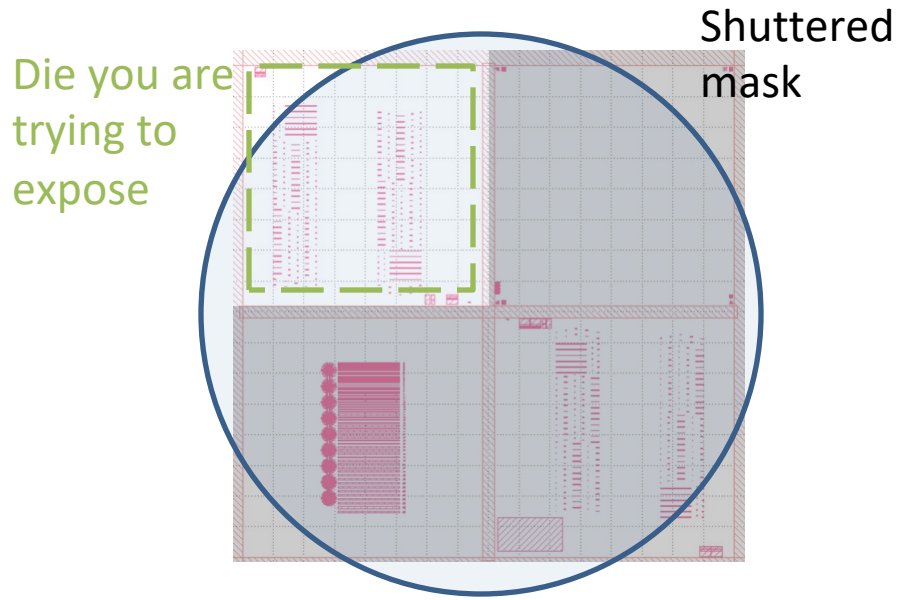
- If you have four layers on the mask, the stepper will try to focus on a spot that isn't even on your die. This may be a problem.
- This powerpoint explains how to make the stepper focus on the center of your die, regardless of where it is on your mask
- If you have 1 layer per plate, this will not help you

Big picture

Calibration pass



Exposure pass



No autofocus!

- 2 step procedure:
  - 1) Calibration of focus w/ dummy exposure
  - 2) Use calibration values for real exposure, overriding autofocus

Program setup

1) Set up your program normally. Add a dummy die that is not on your wafer so that autofocus is guaranteed to fail.
    1) The die should be the first one exposed, so in the upper left if you do not use mapping, and either the lower right or left if you do, depending on how many rows you have. You can add as many extra dies as you want to guarantee autofocus fails on the first attempt, but this can get really tedious.
2) Add another exposure pass. If your normal exposure pass has a pass shift, the pass shift for this pass should be 0. If your normal exposure pass does not have a shift, and you expose the upper left quadrant (like in the previous slide) it should be +4.1 +4.1, so that your die is moved to the center of the lens during this pass
3) Set the exposure time to several seconds, find a mostly-dark mask, and figure out how to shutter it so that no actual features are exposed
    1) I have one of these, it is called Ge/Si WGPD plate 1, shutter positions are 23 and 70 depending on which quadrant it's in
4) If you use matching, make sure your match program runs every 1 wafer
5) If you use mapping, your mapping pass should be set up like normal. Make sure to drop out all the dummy dies you added in step 1

Running an exposure

1) Make sure focus is in auto mode (on the black box near the left of the alignment screen, the green LED should be lit)
2) Make sure you have a pen and paper handy
3) Type EXPO\JOBNAME,CAL,EXP
    1) Or MAP\JOBNAME,MAP,CAL,EXP
4) At the prompts, enter the appropriate floors for both masks. The focus offset should go on the calibration pass, anything you put on the exposure pass will be ignored
5) Align your mask as normal, hit expose
6) The calibration mask will load and the pass will run. The first die will have an autofocus failure, hit enter through all of these. If it does not, abort immediately and edit your program so that the first die is even farther from the wafer.
7) When the voltage on the black box starts reading normal-seeming numbers (close to what you saw during AWLT, not zero), write them down in the appropriate place on your paper. I'm pretty sure the calibration and exposure passes expose the same dies in the same order, but pay attention to be safe. The screen on top of the stepper shows you where on the wafer you are. The blue boxes show up AFTER a die has been exposed.
8) The exposure mask will load. If you use matching, the matching routine will run. Wait for the first autofocus failure before you do anything
9) When autofocus fails on your dummy die, turn the bottom black knob to MANUAL (red LED). Change the voltage to whatever you recorded for your first die, then hit enter.
10) The stepper will expose your first die, but it will also return an autofocus fail. Change the voltage to what you recorded for your second die, and hit enter. Continue until the whole wafer is exposed.

Some notes

- 40 mV on the focus meter corresponds to 2µm, or one depth-of-focus:
  - You don't need to get the last digit right when entering numbers back in, but you should probably be correct within 10mV
  - It's substantially less painful to do an exposure array manually than with the program
- If you touch the chuck during alignment (due to theta issues), you should re-start your program so the auto-level runs with the moved chuck.
- If it is a non-critical feature, you can run AWLT, record the voltage left on the voltmeter at the end, and then use that to expose all your dies.
  - If you touch the chuck after running AWLT, run it again to get an updated voltage
- Don't use CEM when doing this for the first time